Chapter 7: Configuration

This chapter describes how to use the web interface to configure the 450 Platform link. This chapter contains the following topics:

Preparing for configuration

This section describes the checks to be performed before proceeding with unit configuration and antenna alignment.

Safety precautions

All national and local safety standards must be followed while configuring the units and aligning the antennas.

Warning

Ensure that personnel are not exposed to unsafe levels of RF energy. The units start to radiate RF energy as soon as they are powered up. Respect the safety standards defined in Compliance with safety standards on page 4-22, in particular the minimum separation distances.

Observe the following guidelines:

- Never work in front of the antenna when the ODU is powered.
- Always power down the PSU before connecting or disconnecting the drop cable from the PSU, ODU or LPU.

Regulatory compliance

All applicable radio regulations must be followed while configuring the units and aligning the antennas. For more information, refer to Compliance with radio regulations on page 4-31.

Caution

If the system designer has provided a list of channels to be barred for TDWR radar avoidance, the affected channels must be barred before the units are allowed to radiate on site, otherwise the regulations will be infringed.

Attention

Si le concepteur du système a fourni une liste de canaux à interdire pour éviter les radars TDWR, les cannaux concernées doivent être interdits avant que les unités sont autorisées à émettre sur le site, sinon la réglementation peut être enfreinte.

Connecting to the unit

This section describes how to connect the unit to a management PC and power it up.

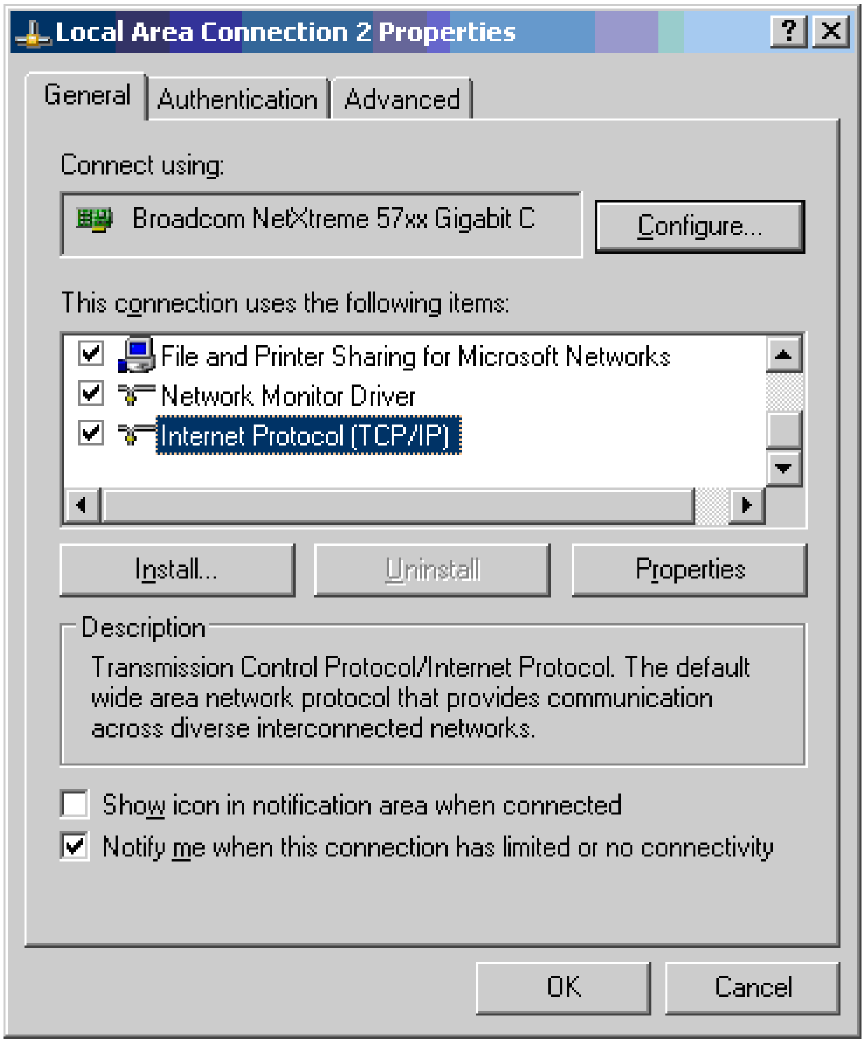
Configuring the management PC

Use this procedure to configure the local management PC to communicate with the 450 Platform ODU.

Procedure 9 Configuring the management PC

1 Select **Properties** for the Ethernet port. In Windows 7 this is found in **Control Panel > Network and Internet > Network Connections > Local Area Connection**.

2 Select **Internet Protocol (TCP/IP)**:



Connect using:

Broadcom NetXtreme 57xx Gigabit C

This connection uses the following items:

☑ File and Printer Sharing for Microsoft Networks
☑ Network Monitor Driver
☑ Internet Protocol (TCP/IP)

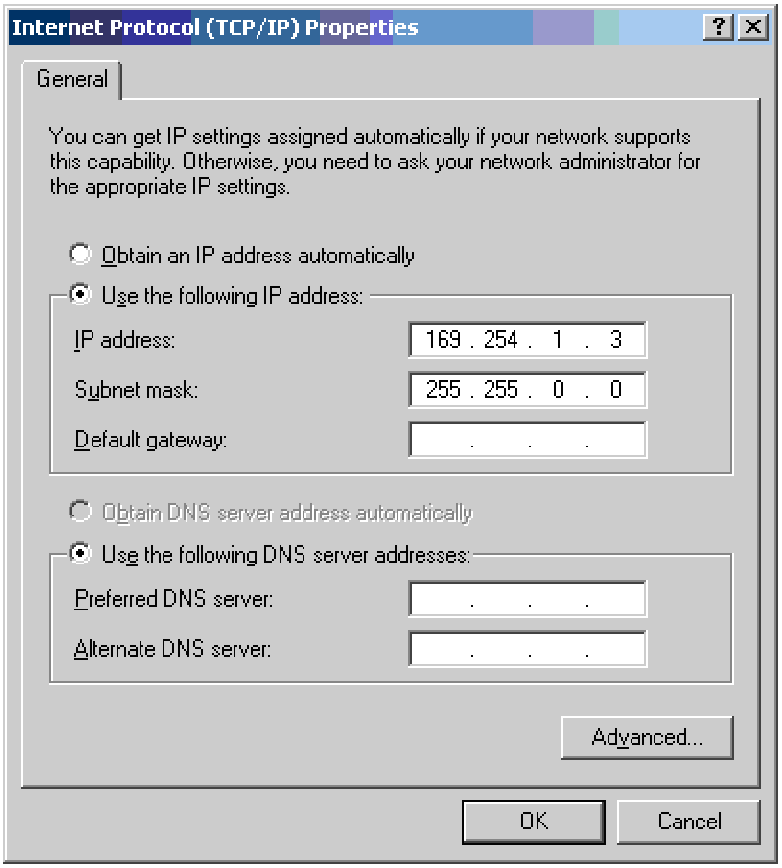
Description

Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.

☐ Show icon in notification area when connected
☑ Notify me when this connection has limited or no connectivity

3 Click **Properties**.

4 Enter an IP address that is valid for the 169.254.X.X network, avoiding 169.254.0.0 and 169.254.1.1. A good example is 169.254.1.3:



Internet Protocol (TCP/IP) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

○ Obtain an IP address automatically

● Use the following IP address:

IP address:	169 . 254 . 1 . 3
Subnet mask:	255 . 255 . 0 . 0
Default gateway:	. . .

○ Obtain DNS server address automatically

● Use the following DNS server addresses:

Preferred DNS server:	. . .
Alternate DNS server:	. . .

5 Enter a subnet mask of 255.255.0.0. Leave the default gateway blank.

Connecting to the PC and powering up

Use this procedure to connect a management PC and power up the 450 platform ODU.

Procedure 10 Connecting to the PC and powering up

1 Check that the ODU and PSU are correctly connected.

2 Connect the PC Ethernet port to the LAN port of the PSU using a standard (not crossed) Ethernet cable.

3 Apply mains or battery power to the PSU. The green Power LED should illuminate continuously.

4 After about several seconds, check that the orange Ethernet LED starts with 10 slow flashes.

5 Check that the Ethernet LED then illuminates continuously.

Using the web interface

This section describes how to log into the 450 Platform Family web interface and use its menus.

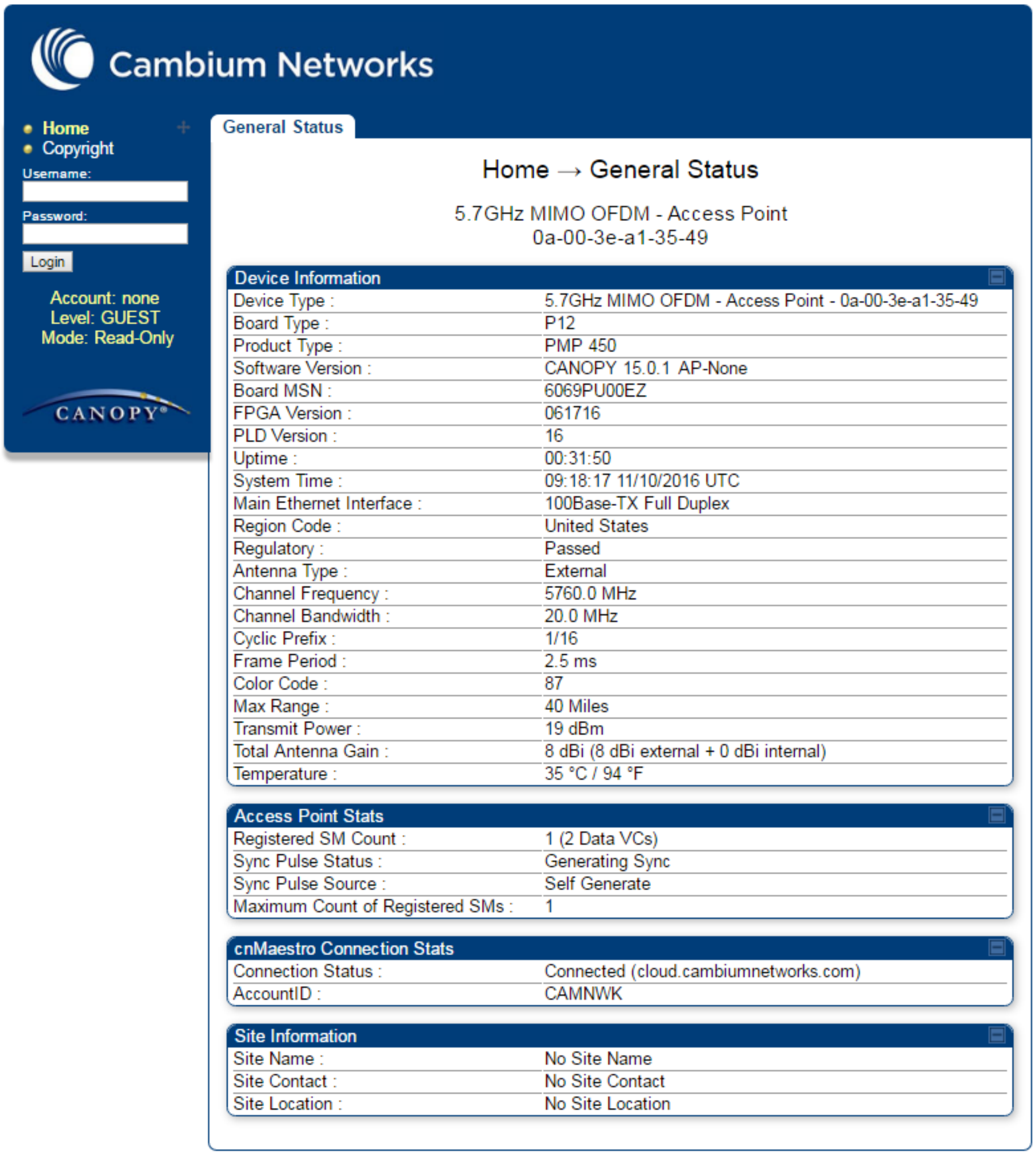
Logging into the web interface

Use this procedure to log into the web interface as a system administrator.

Procedure 11 Logging into the web interface

1 Start the web browser from the management PC.

2 Type the IP address of the unit into the address bar. The factory default IP address is **169.254.1.1**. Press ENTER. The web interface menu and System Summary page are displayed:



Account: none
Level: GUEST
Mode: Read-Only

Home → General Status

5.7GHz MIMO OFDM - Access Point
0a-00-3e-a1-35-49

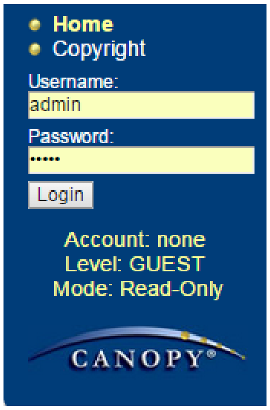
Device Information	
Device Type :	5.7GHz MIMO OFDM - Access Point - 0a-00-3e-a1-35-49
Board Type :	P12
Product Type :	PMP 450
Software Version :	CANOPY 15.0.1 AP-None
Board MSN :	6069PU00EZ
FPGA Version :	061716
PLD Version :	16
Uptime :	00:31:50
System Time :	09:18:17 11/10/2016 UTC
Main Ethernet Interface :	100Base-TX Full Duplex
Region Code :	United States
Regulatory :	Passed
Antenna Type :	External
Channel Frequency :	5760.0 MHz
Channel Bandwidth :	20.0 MHz
Cyclic Prefix :	1/16
Frame Period :	2.5 ms
Color Code :	87
Max Range :	40 Miles
Transmit Power :	19 dBm
Total Antenna Gain :	8 dBi (8 dBi external + 0 dBi internal)
Temperature :	35 °C / 94 °F

Access Point Stats	
Registered SM Count :	1 (2 Data VCs)
Sync Pulse Status :	Generating Sync
Sync Pulse Source :	Self Generate
Maximum Count of Registered SMs :	1

cnMaestro Connection Stats	
Connection Status :	Connected (cloud.cambiumnetworks.com)
AccountID :	CAMNWK

Site Information	
Site Name :	No Site Name
Site Contact :	No Site Contact
Site Location :	No Site Location

3 On left hand side of home page, the login information is displayed:



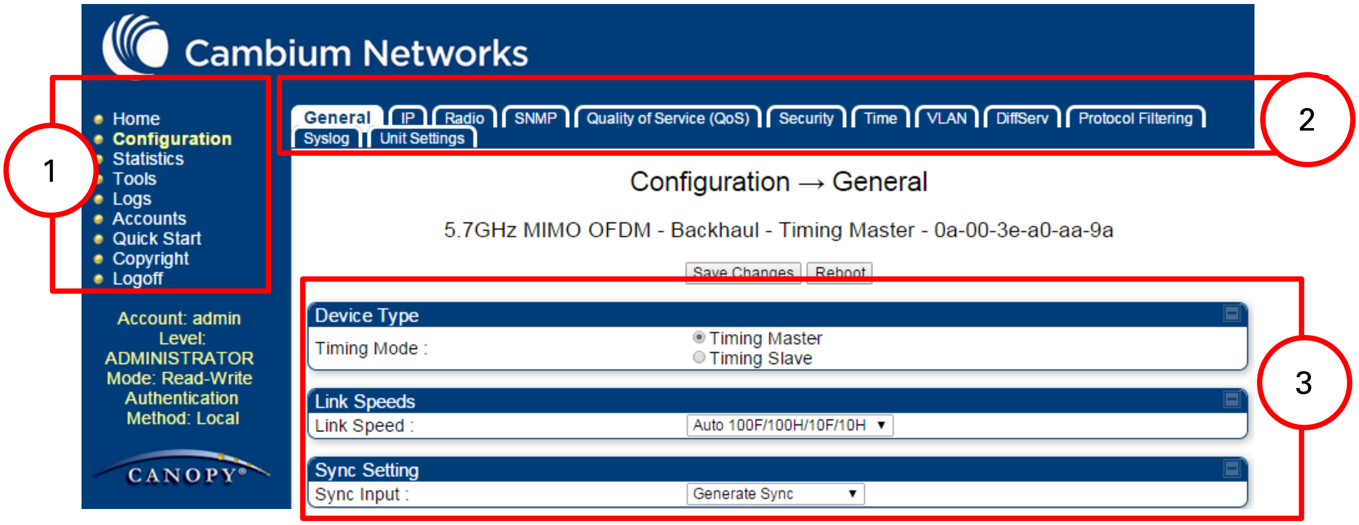
Username: admin

Password: •••••

Account: none
Level: GUEST
Mode: Read-Only

4 Enter Username (factory default username is *admin*) and Password (factory default password is *admin*) and click **Login**.

Web GUI



Account: admin
Level: ADMINISTRATOR
Mode: Read-Write
Authentication Method: Local

Configuration → General

5.7GHz MIMO OFDM - Backhaul - Timing Master - 0a-00-3e-a0-aa-9a

Device Type

Timing Mode : ● Timing Master ○ Timing Slave

Link Speeds

Link Speed : Auto 100F/100H/10F/10H ▼

Sync Setting

Sync Input : Generate Sync ▼

Field Name	Description
Main Manu	Click an option in side navigation bar (area marked as “1”). Multiple options in sub-navigation bars appear
Menu Option	Click top sub-navigation bar to choose one configuration page (area marked as “2”)
Parameter	To configure the parameters (e.g. area marked as “3”)
Save Changes	Press "Save Changes" to confirm and save the changes
Reboot	To reboot the ODU

Using the menu options

Use the menu navigation bar in the left panel to navigate to each web page. Some of the menu options are only displayed for specific system configurations. Use Table 82 to locate information about using each web page.

Table 82 Menu options and web pages

Main menu	Menu options	Applicable module	Description
● Home			
	General Status	All	Viewing General Status on page 9-2
	Session Status	AP, BHM	Viewing Session Status on page 9-20
	Event Log	All	Interpreting messages in the Event Log on page 9-27
	Network Interface	AP, BHM	Viewing the Network Interface on page 9-29
	Layer 2 Neighbors	All	Viewing the Layer 2 Neighbors on page 9-30
● Configuration			
	General	All	General configuration on page 7-140
	IP	All	Configuring IP and Ethernet interfaces on page 7-93
	Radio	All	Configuring radio parameters on page 7-193
	SNMP	All	Setting up SNMP agent on page 7-238
	cnMaestro	All	Configuring cnMaestroTM Connectivity on page 7-277
	Quality of Service (QoS)	All	Configuring quality of service on page 7-255
	Security	All	Configuring security on page 7-165
	Time	AP, BHM	Setting up time and date Time page of 450 Platform Family - AP/BHM on page 7-161

Main menu	Menu options	Applicable module	Description
	VLAN	All	VLAN configuration for PMP on page 7-115 VLAN configuration for PTP on page 7-125
	DiffServ	All	IPv4 and IPv6 Prioritization on page 7-132
	Protocol Filtering	All	Filtering protocols and ports on page 7-133
	Syslog	All	Configuring syslog on page 7-245
	Unit Setting	All	Configuring Unit Settings page on page 7-157
● Statistics			
	Scheduler	All	Viewing the Scheduler statistics on page 9-31
	Registration Failures	AP, BHM	Viewing list of Registration Failures statistics on page 9-33
	Bridge Control Block	All	Interpreting Bridge Control Block statistics on page 9-59
	Bridging Table	All	Interpreting Bridging Table statistics on page 9-34
	Ethernet	All	Interpreting Ethernet statistics on page 9-36
	Radio	All	Interpreting RF Control Block statistics on page 9-39
	VLAN	All	Interpreting VLAN statistics on page 9-41
	Data VC	All	Interpreting Data VC statistics on page 9-43
	Throughput	AP, BHM	Interpreting Throughput statistics on page 9-45
	Filter	SM	Interpreting Filter statistics on page 9-52
	ARP	SM	Viewing ARP statistics on page 9-53
	Overload	All	Interpreting Overload statistics on page 9-48

Main menu	Menu options	Applicable module	Description
	Syslog Statistics	All	Interpreting syslog statistics on page 9-65
	Translation Table	SM	Interpreting Translation Table statistics on page 9-35
	DHCP Relay	SM	Interpreting DHCP Relay statistics on page 9-50
	NAT Stats	SM	Viewing NAT statistics on page 9-53
	NAT DHCP	SM	Viewing NAT DHCP Statistics on page 9-55
	Pass Through Statistics	AP	Interpreting Pass Through Statistics on page 9-62
	Sync Status	AP	Interpreting Sync Status statistics on page 9-56
	PPPoE	SM	Interpreting PPPoE Statistics for Customer Activities on page 9-57
	SNMPv3 Statistics	All	Interpreting SNMPv3 Statistics on page 9-63
	Frame Utilization		Interpreting SNMPv3 Statistics on page 9-63
● Tools			
	Link Capacity Test	All	Using the Link Capacity Test tool on page 8-21
	Spectrum Analyzer	All	Spectrum Analyzer tool on page 8-3
	Remote Spectrum Analyzer	All	Remote Spectrum Analyzer tool on page 8-12
	AP/BHM Evaluation	SM, BHS	Using AP Evaluation tool on page 8-30 Using BHM Evaluation tool on page 8-34
	Subscriber Configuration	AP	Using the Subscriber Configuration tool on page 8-43
	OFDM Frame Calculator	AP, BHM	Using the OFDM Frame Calculator tool on page 8-38
	BER results	SM	Using BER Results tool on page 8-49
	Alignment Tool	SM, BHS	Using the Alignment Tool on page 8-15

Main menu	Menu options	Applicable module	Description
	Link Status	AP	Using the Link Status tool on page 8-44
	Sessions	AP	Using the Sessions tool on page 8-50
● Logs			
● Accounts			
	Change User Setting		Changing a User Setting on page 7-167
	Add user		Adding a User for Access to a module on page 7-166
	Delete User		Deleting a User from Access to a module on page 7-167
	User		Users account on page 7-168
● Quick Start			
	Quick Start	AP, BHM	Quick link setup on page 7-82
	Region Settings	AP, BHM	Quick link setup on page 7-82
	Radio Carrier Frequency	AP, BHM	Quick link setup on page 7-82
	Synchronization	AP, BHM	Quick link setup on page 7-82
	LAN IP Address	AP, BHM	Quick link setup on page 7-82
	Review and Save Configuration	AP, BHM	Quick link setup on page 7-82
● PDA			
	Quick Status	SM	The PDA web-page includes 320 x 240 pixel formatted displays of information important to installation and alignment for installers using legacy PDA devices. All device web pages are compatible with touch devices such as smart phones and tablets.
	Spectrum Results (PDA)	SM	
	Information	SM	
	BHM Evaluation	SM	
	AIM	SM	
● Copyright			

Main menu	Menu options	Applicable module	Description
	Copyright Notices	All	The Copyright web-page displays pertinent device copyright information.
Logoff		All	

Quick link setup

This section describes how to use the Quick Start Wizard to complete the essential system configuration tasks that must be performed on a PMP/PTP configuration.

Note

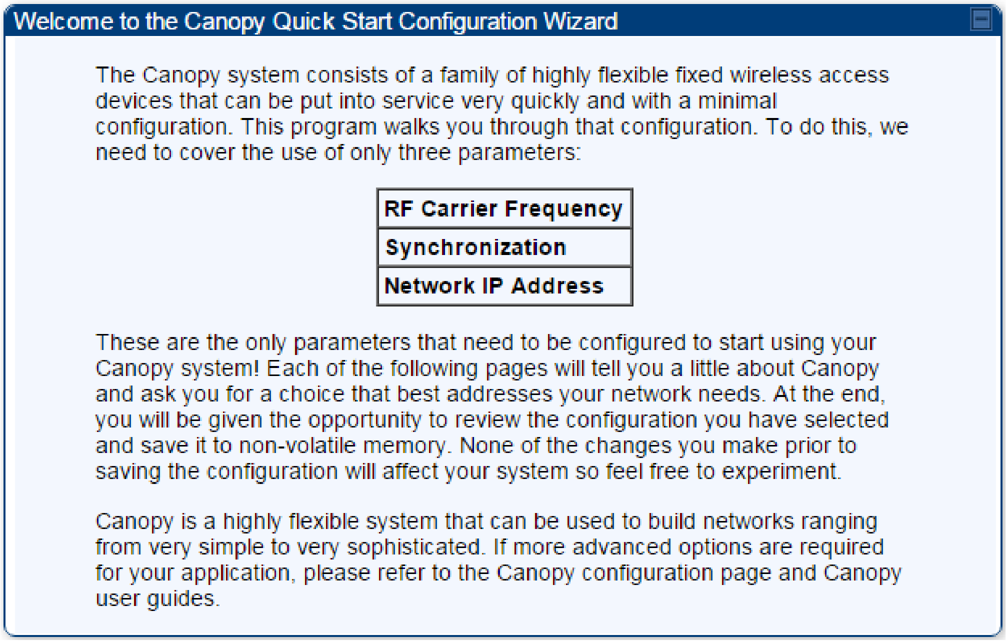
If the IP address of the AP or BHM is not known, See Radio recovery mode on page 1-24.

Initiating Quick Start Wizard

Applicable products	PMP : ☑	AP	PTP: ☑	BHM

To start with Quick Start Wizard: after logging into the web management interface click the **Quick Start** button on the left side of main menu bar. The AP/BHM responds by opening the Quick Start page.

Figure 99 Disarm Installation page (top and bottom of page shown)



Welcome to the Canopy Quick Start Configuration Wizard

The Canopy system consists of a family of highly flexible fixed wireless access devices that can be put into service very quickly and with a minimal configuration. This program walks you through that configuration. To do this, we need to cover the use of only three parameters:

RF Carrier Frequency
Synchronization
Network IP Address

These are the only parameters that need to be configured to start using your Canopy system! Each of the following pages will tell you a little about Canopy and ask you for a choice that best addresses your network needs. At the end, you will be given the opportunity to review the configuration you have selected and save it to non-volatile memory. None of the changes you make prior to saving the configuration will affect your system so feel free to experiment.

Canopy is a highly flexible system that can be used to build networks ranging from very simple to very sophisticated. If more advanced options are required for your application, please refer to the Canopy configuration page and Canopy user guides.

Quick Start is a wizard that helps you to perform a basic configuration that places an AP/BHM into service. Only the following parameters must be configured:

- Region Code
- RF Carrier Frequency
- Synchronization
- LAN (Network) IP Address

In each Quick Start page, you can

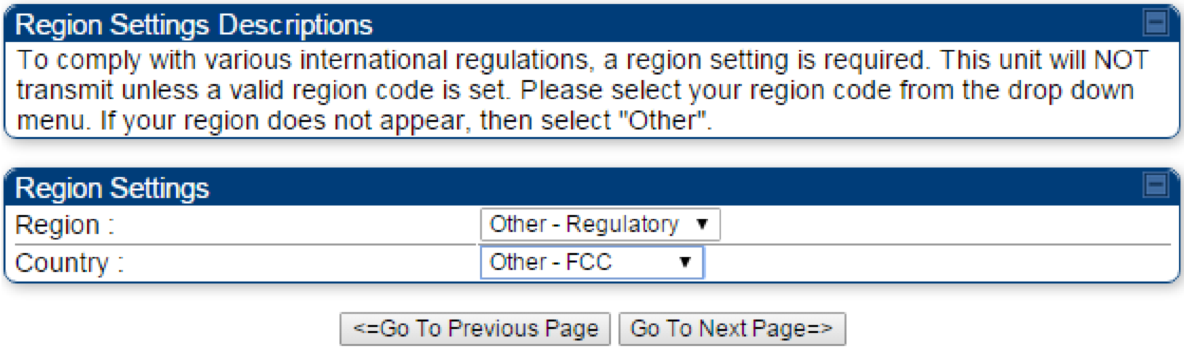
- specify the settings to satisfy the requirements of the network.
- review the configuration selected.
- save the configuration to non-volatile memory.

Procedure 12 Quick start wizard

1 At the bottom of the Quick Start tab, click the **Go To Next Page** button.

2 From the pull-down menu, select the region in which the AP will operate.

Figure 100 Regional Settings tab of AP/BHM



Region Settings Descriptions

To comply with various international regulations, a region setting is required. This unit will NOT transmit unless a valid region code is set. Please select your region code from the drop down menu. If your region does not appear, then select "Other".

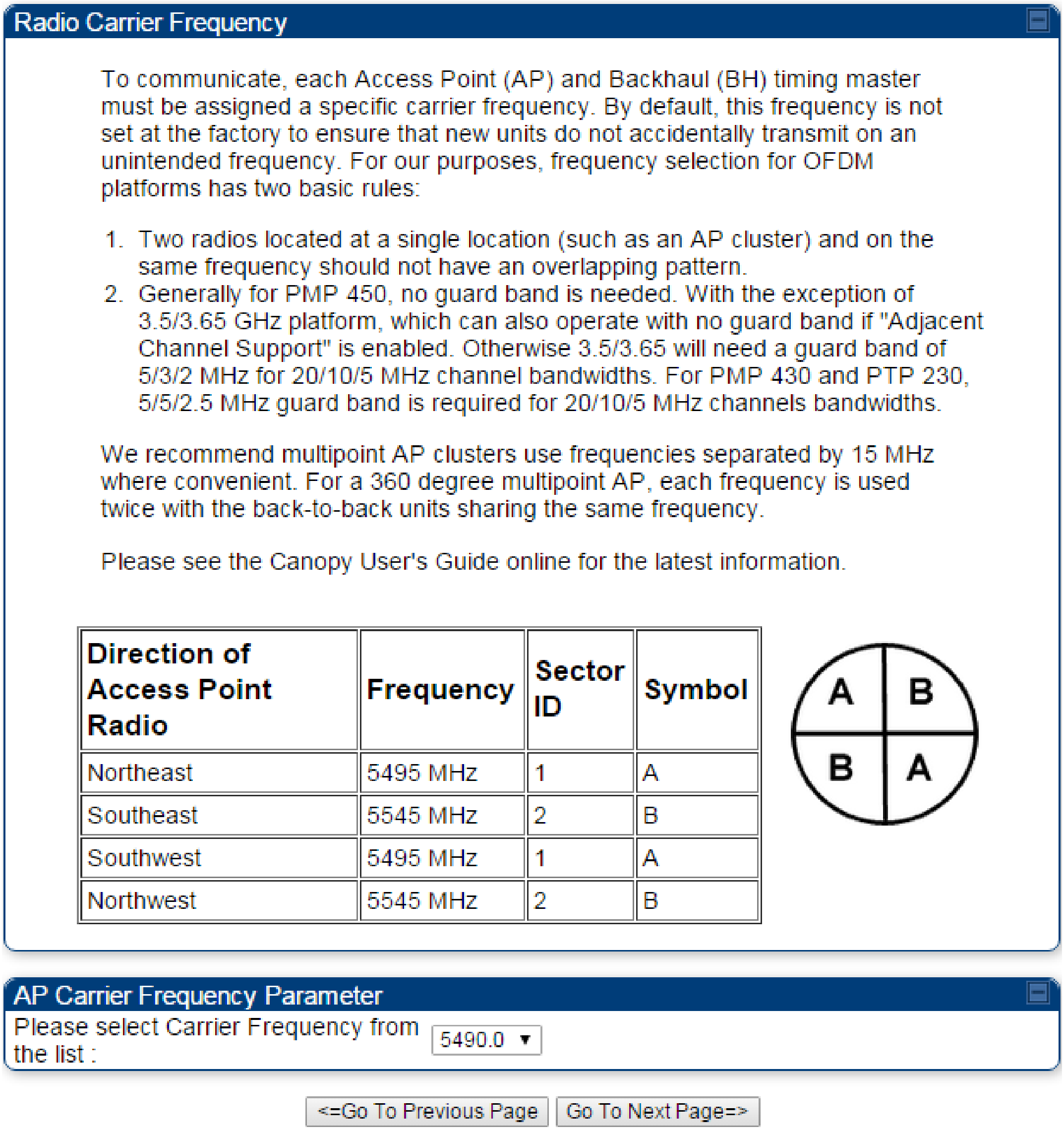
Region Settings

Region :	Other - Regulatory ▼
Country :	Other - FCC ▼

3 Click the **Go To Next Page** button.

4 From the pull-down menu, select a frequency for the test.

Figure 101 Radio Carrier Frequency tab of AP/BHM



Radio Carrier Frequency

To communicate, each Access Point (AP) and Backhaul (BH) timing master must be assigned a specific carrier frequency. By default, this frequency is not set at the factory to ensure that new units do not accidentally transmit on an unintended frequency. For our purposes, frequency selection for OFDM platforms has two basic rules:

1. Two radios located at a single location (such as an AP cluster) and on the same frequency should not have an overlapping pattern.
2. Generally for PMP 450, no guard band is needed. With the exception of 3.5/3.65 GHz platform, which can also operate with no guard band if "Adjacent Channel Support" is enabled. Otherwise 3.5/3.65 will need a guard band of 5/3/2 MHz for 20/10/5 MHz channel bandwidths. For PMP 430 and PTP 230, 5/5/2.5 MHz guard band is required for 20/10/5 MHz channels bandwidths.

We recommend multipoint AP clusters use frequencies separated by 15 MHz where convenient. For a 360 degree multipoint AP, each frequency is used twice with the back-to-back units sharing the same frequency.

Please see the Canopy User's Guide online for the latest information.

Direction of Access Point Radio	Frequency	Sector ID	Symbol
Northeast	5495 MHz	1	A
Southeast	5545 MHz	2	B
Southwest	5495 MHz	1	A
Northwest	5545 MHz	2	B

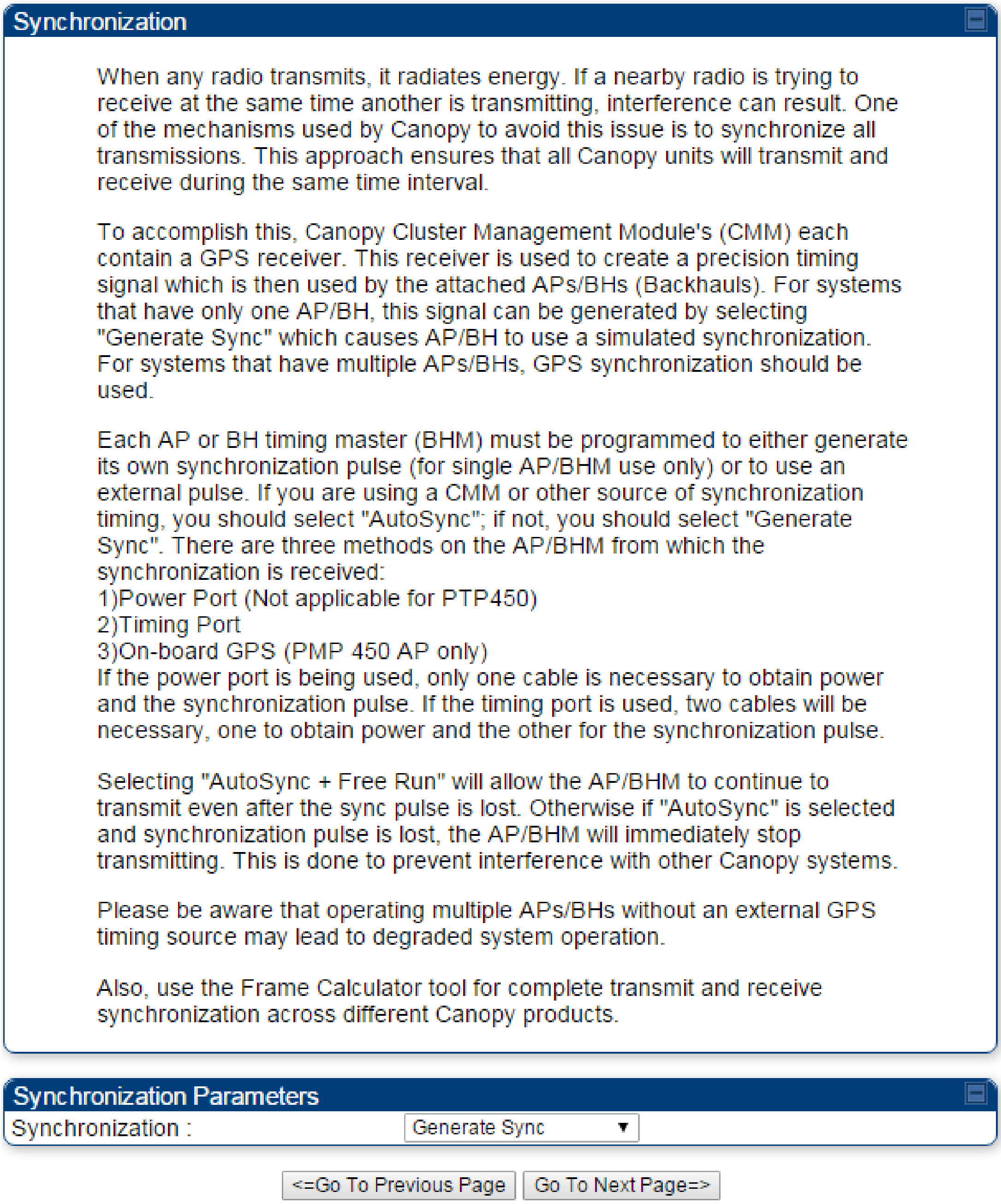
AP Carrier Frequency Parameter

Please select Carrier Frequency from the list : 5490.0

5 Click the **Go To Next Page** button.

6 At the bottom of this tab, select **Generate Sync Signal**.

Figure 102 Synchronization tab of AP/BHM



Synchronization

When any radio transmits, it radiates energy. If a nearby radio is trying to receive at the same time another is transmitting, interference can result. One of the mechanisms used by Canopy to avoid this issue is to synchronize all transmissions. This approach ensures that all Canopy units will transmit and receive during the same time interval.

To accomplish this, Canopy Cluster Management Module's (CMM) each contain a GPS receiver. This receiver is used to create a precision timing signal which is then used by the attached APs/BHs (Backhauls). For systems that have only one AP/BH, this signal can be generated by selecting "Generate Sync" which causes AP/BH to use a simulated synchronization. For systems that have multiple APs/BHs, GPS synchronization should be used.

Each AP or BH timing master (BHM) must be programmed to either generate its own synchronization pulse (for single AP/BHM use only) or to use an external pulse. If you are using a CMM or other source of synchronization timing, you should select "AutoSync"; if not, you should select "Generate Sync". There are three methods on the AP/BHM from which the synchronization is received:
1)Power Port (Not applicable for PTP450)
2)Timing Port
3)On-board GPS (PMP 450 AP only)
If the power port is being used, only one cable is necessary to obtain power and the synchronization pulse. If the timing port is used, two cables will be necessary, one to obtain power and the other for the synchronization pulse.

Selecting "AutoSync + Free Run" will allow the AP/BHM to continue to transmit even after the sync pulse is lost. Otherwise if "AutoSync" is selected and synchronization pulse is lost, the AP/BHM will immediately stop transmitting. This is done to prevent interference with other Canopy systems.

Please be aware that operating multiple APs/BHs without an external GPS timing source may lead to degraded system operation.

Also, use the Frame Calculator tool for complete transmit and receive synchronization across different Canopy products.

Synchronization Parameters

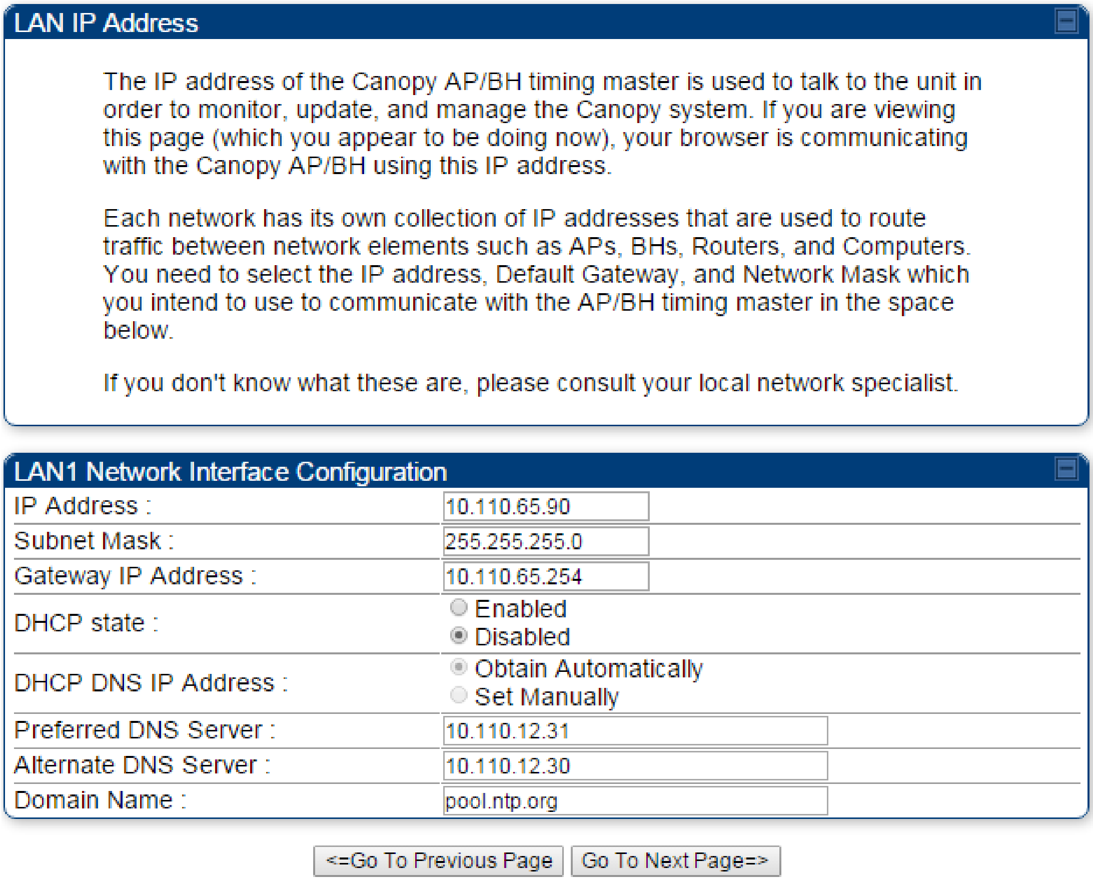
Synchronization :	Generate Sync ▼

7 Click the **Go To Next Page** button.

8 At the bottom of the IP address configuration tab, either

- specify an **IP Address**, a **Subnet Mask**, and a **Gateway IP Address** for management of the AP and leave the **DHCP state** set to **Disabled**.
- set the **DHCP state** to **Enabled** to have the IP address, subnet mask, and gateway IP address automatically configured by a domain name server (DNS).

Figure 103 LAN IP Address tab of the AP/BHM



LAN IP Address

The IP address of the Canopy AP/BH timing master is used to talk to the unit in order to monitor, update, and manage the Canopy system. If you are viewing this page (which you appear to be doing now), your browser is communicating with the Canopy AP/BH using this IP address.

Each network has its own collection of IP addresses that are used to route traffic between network elements such as APs, BHs, Routers, and Computers. You need to select the IP address, Default Gateway, and Network Mask which you intend to use to communicate with the AP/BH timing master in the space below.

If you don't know what these are, please consult your local network specialist.

LAN1 Network Interface Configuration

IP Address :	10.110.65.90
Subnet Mask :	255.255.255.0
Gateway IP Address :	10.110.65.254
DHCP state :	○ Enabled ● Disabled
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	10.110.12.31
Alternate DNS Server :	10.110.12.30
Domain Name :	pool.ntp.org

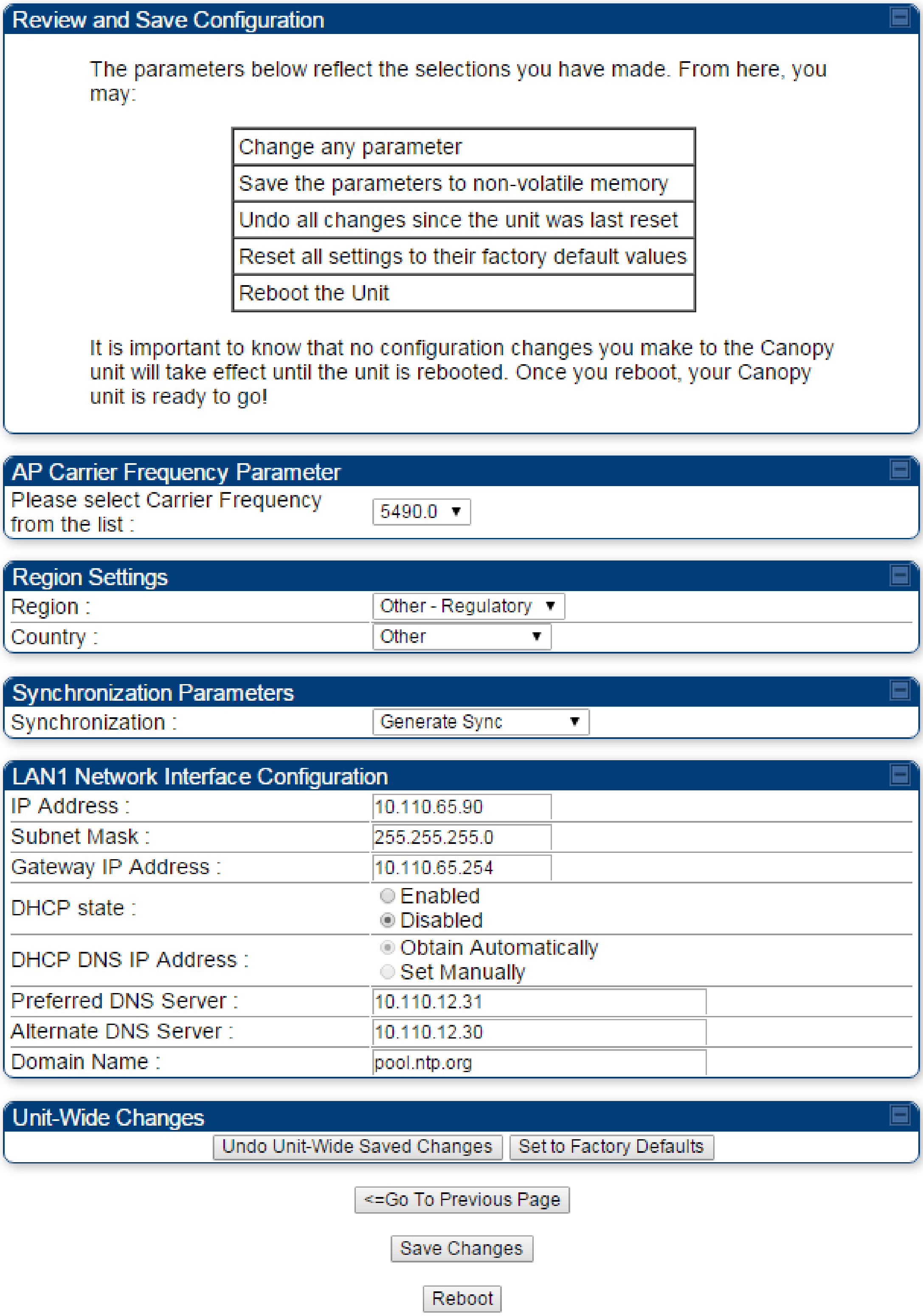
Note

Cambium encourages you to experiment with the interface. Unless you save a configuration and reboot the AP after you save the configuration, none of the changes are affected.

9 Click the **Go To Next Page =>** button.

10 Ensure that the initial parameters for the AP are set as you intended.

Figure 104 Review and Save Configuration tab of the AP/BHM



Review and Save Configuration

The parameters below reflect the selections you have made. From here, you may:

Change any parameter
Save the parameters to non-volatile memory
Undo all changes since the unit was last reset
Reset all settings to their factory default values
Reboot the Unit

It is important to know that no configuration changes you make to the Canopy unit will take effect until the unit is rebooted. Once you reboot, your Canopy unit is ready to go!

AP Carrier Frequency Parameter

Please select Carrier Frequency from the list :	5490.0 ▼

Region Settings

Region :	Other - Regulatory ▼
Country :	Other ▼

Synchronization Parameters

Synchronization :	Generate Sync ▼

LAN1 Network Interface Configuration

IP Address :	10.110.65.90
Subnet Mask :	255.255.255.0
Gateway IP Address :	10.110.65.254
DHCP state :	○ Enabled ● Disabled
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	10.110.12.31
Alternate DNS Server :	10.110.12.30
Domain Name :	pool.ntp.org

Unit-Wide Changes

11 Click the **Save Changes** button.

12 Click the **Reboot** button.
RESULT: The AP responds with the message **Reboot Has Been Initiated…**

13 Wait until the indicator LEDs are not red.

14 Trigger your browser to refresh the page until the AP redisplays the General Status tab.

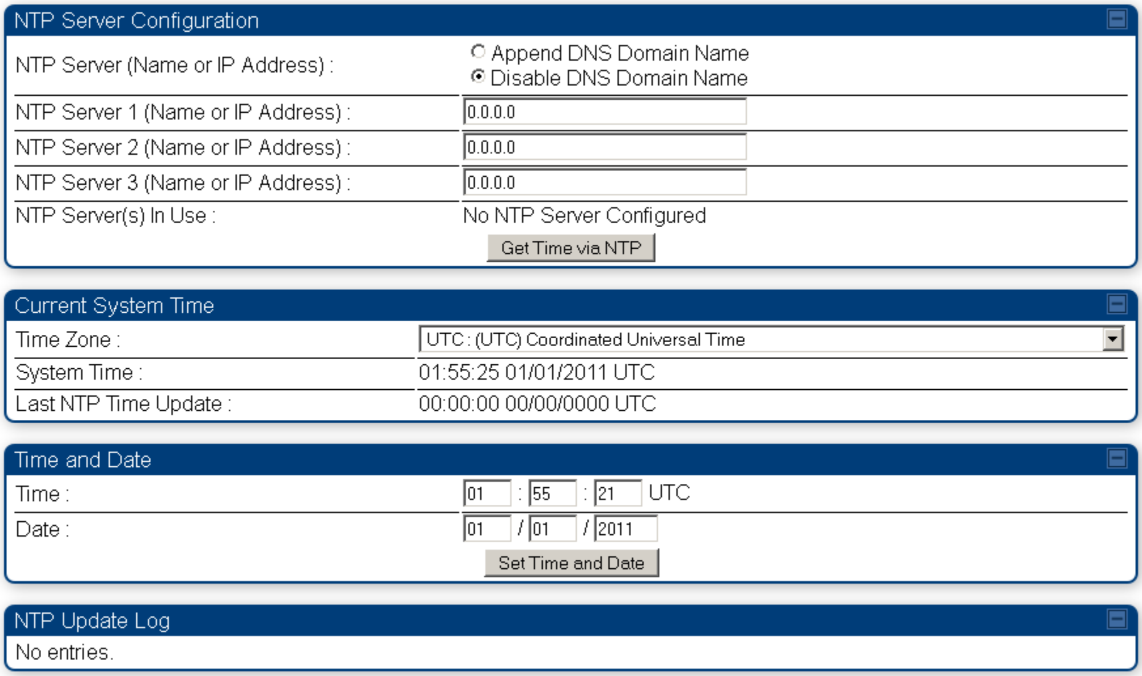
15 Wait until the red indicator LEDs are not lit.

Configuring time settings

Applicable products	PMP :	☑	AP	PTP:	☑	BHM

To proceed with the test setup, click the **Configuration** link on the left side of the General Status page. When the AP responds by opening the Configuration page to the General page, click the Time tab.

Figure 105 Time tab of the AP/BHM



NTP Server Configuration

NTP Server (Name or IP Address) :	○ Append DNS Domain Name ● Disable DNS Domain Name
NTP Server 1 (Name or IP Address) :	0.0.0.0
NTP Server 2 (Name or IP Address) :	0.0.0.0
NTP Server 3 (Name or IP Address) :	0.0.0.0
NTP Server(s) In Use :	No NTP Server Configured

Current System Time

Time Zone :	UTC : (UTC) Coordinated Universal Time
System Time :	01:55:25 01/01/2011 UTC
Last NTP Time Update :	00:00:00 00/00/0000 UTC

Time and Date

Time :	01 : 55 : 21 UTC
Date :	01 / 01 / 2011

NTP Update Log

No entries.

To have each log in the AP/BHM correlated to a meaningful time and date, either a reliable network element must pass time and date to the AP/BHM or you must set the time and date whenever a power cycle of the AP/BHM has occurred. A network element passes time and date in any of the following scenarios:

- A connected CMM4 passes time and date (GPS time and date, if received).
- A separate NTP server is addressable from the AP/BHM.

If the AP/BHM should obtain time and date from a CMM4, or a separate NTP server, enter the IP address of the CMM4 or NTP server on this tab. To force the AP/BHM to obtain time and date before the first (or next) 15-minute interval query of the NTP server, click **Get Time through NTP**.

If you enter a time and date, the format for entry is

Figure 106 Time and date entry formats

Time : *hh* / *mm* / *ss*

Date : *MM* / *dd* / *yyyy*

where

hh represents the two-digit hour in the range 00 to 24
mm represents the two-digit minute
ss represents the two-digit second
MM represents the two-digit month
dd represents the two-digit day
yyyy represents the four-digit year

Proceed with the time setup as follows.

Procedure 13 Entering AP/BHM time setup information

1 Enter the appropriate information in the format shown above.

2 Then click the **Set Time and Date** button.

> **Note**
> The time displayed at the top of this page is static unless your browser is set to automatically refresh

Powering the SM/BHS for test

Procedure 14 Powering the SM/BHS for test

1 In one hand, securely hold the top (larger shell) of the SM/BHS. With the other hand, depress the lever in the back of the base cover (smaller shell). Remove the base cover.

2 Plug one end of a CAT 5 Ethernet cable into the SM PSU port

3 Plug the other end of the Ethernet cable into the jack in the pig tail that hangs from the power supply

4 Roughly aim the SM/BHS toward the AP/BHM

5 Plug the power supply into an electrical outlet

> **Warning**
> From this point until you remove power from the AP/BHM, stay at least as far from the AP/BHM as the minimum separation distance specified in Calculated distances and power compliance margins.

6 Repeat the foregoing steps for each SM/BHS that you wish to include in the test.

Viewing the Session Status of the AP/BHM to determine test registration

Once the SMs/BHS under test are powered on, return to the computing device to determine if the SM/BHS units have registered to the AP/BHM.

Note

In order for accurate power level readings to be displayed, traffic must be present on the radio link.

The Session Status tab provides information about each SM/BHS that has registered to the AP/BHM. This information is useful for managing and troubleshooting a system.
All information that you have entered in the **Site Name** field of the SM/BHS displays in the Session Status tab of the linked AP/BHM.

The Session Status tab also includes the current active values on each SM(or BHS) (LUID) for MIR, and VLAN, as well as the source of these values (representing the SM/BHS itself, Authentication Server, or the AP/BHM and cap, if any—for example, APCAP as shown above).. As an SM/BHS registers to the AP/BHM, the configuration source that this page displays for the associated LUID may change. After registration, however, the displayed source is stable and can be trusted.

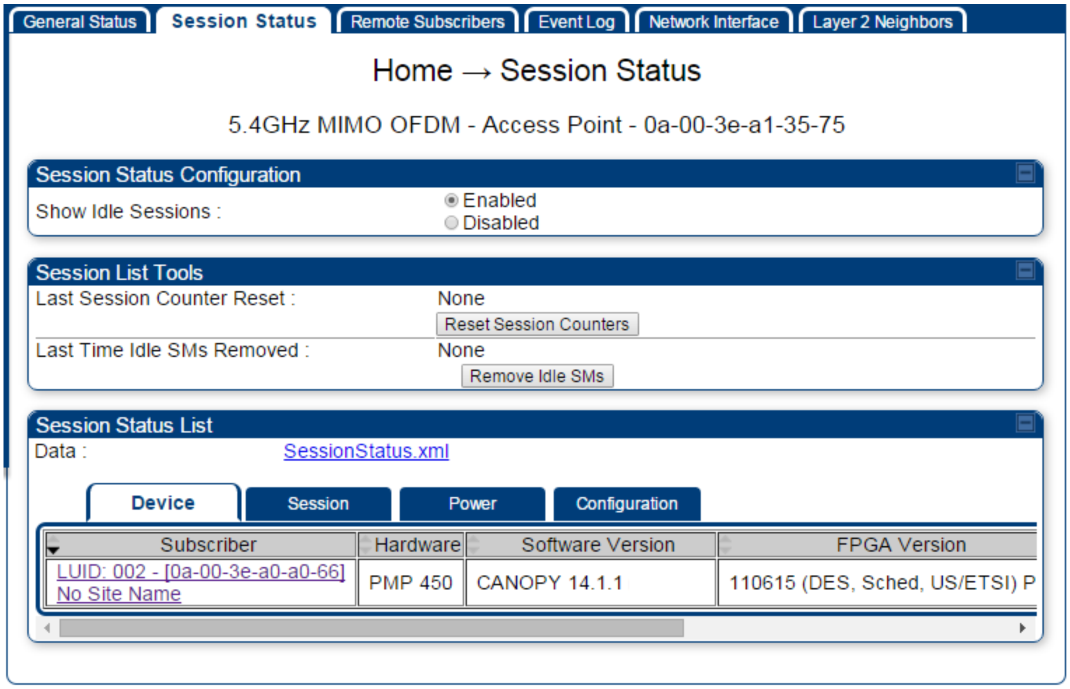
Idle subscribers may be included or removed from the session status display by enabling or disabling, respectively, the **Show Idle Sessions** parameter. Enabling or disabling this parameter only affects the GUI display of subscribers, not the registration status.

The SessionStatus.xml hyperlink allows user to export session status page from web management interface of AP/BHM. The session status page will be exported in xml file.

Procedure 15 Viewing the AP Session Status page

1 On the AP web management GUI, navigate to **Home, Session Status**:

Figure 107 Session Status tab of AP



Home → Session Status

5.4GHz MIMO OFDM - Access Point - 0a-00-3e-a1-35-75

Session Status Configuration

Show Idle Sessions : ● Enabled ○ Disabled

Session List Tools

Last Session Counter Reset : None

Last Time Idle SMs Removed : None

Session Status List

Data : SessionStatus.xml

Subscriber	Hardware	Software Version	FPGA Version
LUID: 002 - [0a-00-3e-a0-a0-66] No Site Name	PMP 450	CANOPY 14.1.1	110615 (DES, Sched, US/ETSI) P

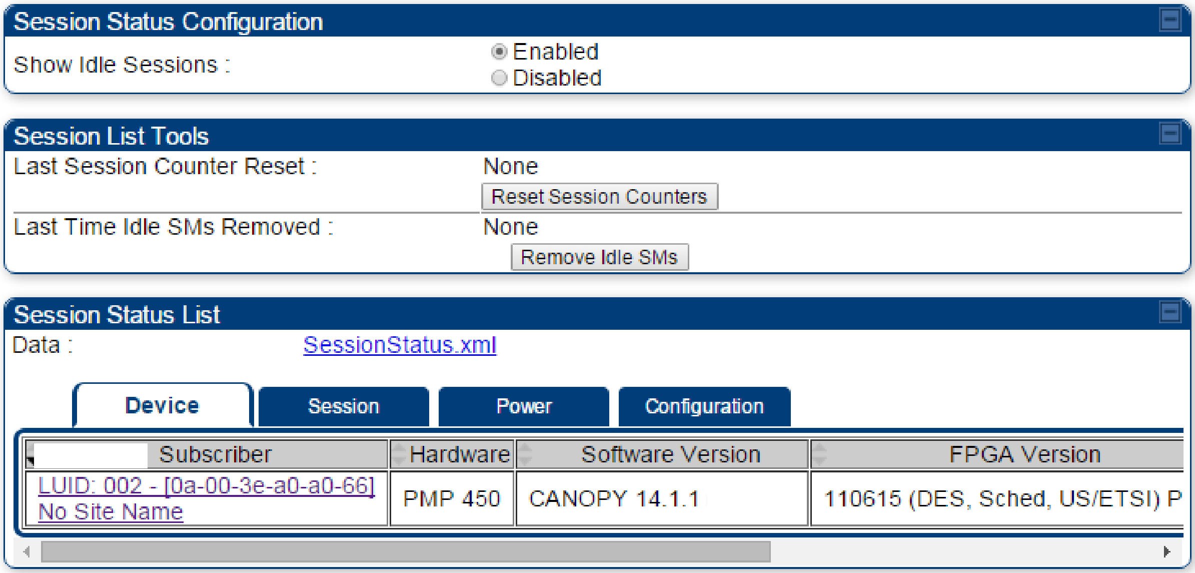
Note

Session status page for BHM is same as AP.

2 Verify that for each SM (or BHS) MAC address (printed on the SM/BHS housing) the AP/BHM has established a registered session by verifying the “State” status of each entry.

The Session Status page of the AP/BHM is explained in Table 83.

Table 83 Session Status Attributes – AP



Session Status Configuration

Show Idle Sessions : ● Enabled ○ Disabled

Session List Tools

Last Session Counter Reset : None

Reset Session Counters

Last Time Idle SMs Removed : None

Remove Idle SMs

Session Status List

Data : SessionStatus.xml

Subscriber	Hardware	Software Version	FPGA Version
LUID: 002 - [0a-00-3e-a0-a0-66] No Site Name	PMP 450	CANOPY 14.1.1	110615 (DES, Sched, US/ETSI) P

Attribute	Meaning
Show Idle Sessions	Idle subscribers may be included or removed from the session status display by enabling or disabling, respectively, the **Show Idle Sessions** parameter. Enabling or disabling this parameter only affects the GUI display of subscribers, not the registration status.
Last Session Counter Reset	This field displays date and time stamp of last session counter reset.
Last Time Idle SMs Removed	This field displays date and time stamp of last Idle SMs Removed. On click of “Remove Idle SMs” button, all the SMs which are in Idle state are flushed out.
Data	See Exporting Session Status page of AP/BHM on page 7-266
Device tab	See Device tab on page 9-20
Session tab	See Session tab on page 9-21
Power tab	See Power tab on page 9-23
Configuration tab	See Configuration tab on page 9-24

Configuring IP and Ethernet interfaces

This task consists of the following sections:

- Configuring the IP interface on page 7-94
- Auxiliary port on page 7-97
- NAT, DHCP Server, DHCP Client and DMZ on page 7-98
- IP interface with NAT disabled on page 7-103
- IP interface with NAT enabled on page
- NAT tab with NAT disabled on page 7-106
- NAT tab with NAT enabled on page 7-109
- NAT DNS Considerations on page 7-114
- DHCP – BHS on page 7-115
- VLAN configuration for PMP on page 7-115
- VLAN page of AP on page 7-118
- VLAN page of SM on page 7-121
- VLAN Membership tab of SM on page 7-125
- VLAN configuration for PTP on page 7-125
- NAT Port Mapping tab - SM on page 7-114

Configuring the IP interface

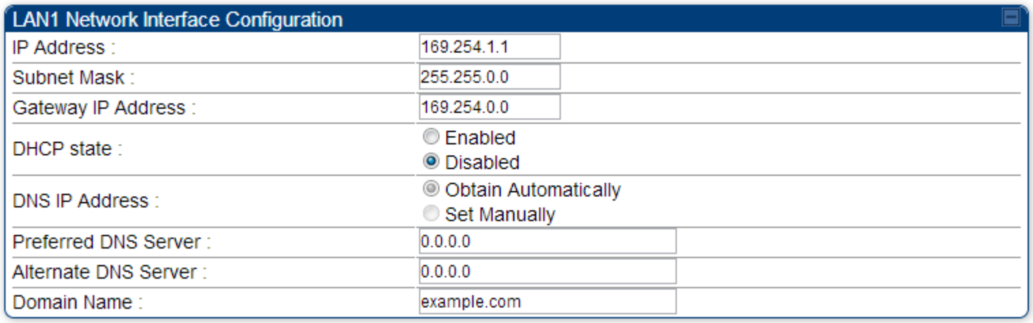
The IP interface allows users to connect to the 450 Platform Family web interface, either from a locally connected computer or from a management network.

Applicable products	**PMP :**	☑	AP	☑	SM	**PTP:**	☑	BHM	☑ BMS

To configure the IP interface, follow these instructions:

Procedure 16 Configuring the AP/BHM IP interface

1 Select menu option **Configuration** > **IP**. The LAN configuration page is displayed:



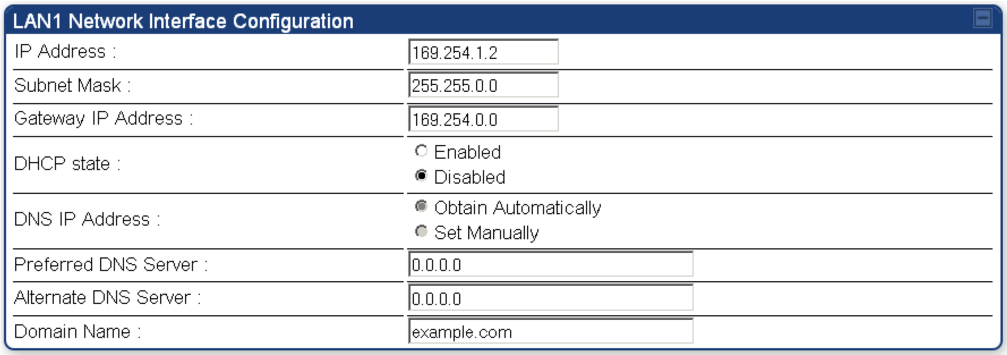
LAN1 Network Interface Configuration

IP Address :	169.254.1.1
Subnet Mask :	255.255.0.0
Gateway IP Address :	169.254.0.0
DHCP state :	○ Enabled ● Disabled
DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

2 Update IP Address, Subnet Mask and Gateway IP Address to meet network requirements (as specified by the network administrator).

3 Review the other IP interface attributes and update them, if necessary (see Table 84 IP interface attributes).

4 Click **Save**. "Reboot Required" message is displayed:



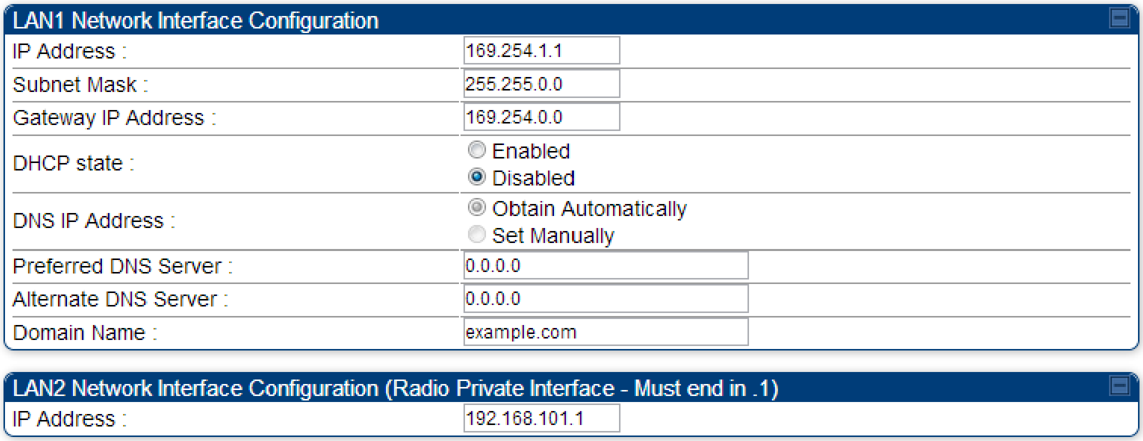
LAN1 Network Interface Configuration

IP Address :	169.254.1.2
Subnet Mask :	255.255.0.0
Gateway IP Address :	169.254.0.0
DHCP state :	○ Enabled ● Disabled
DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

5 Click **Reboot**.

The IP page of AP/SM/BHM/BHS is explained in Table 84.

Table 84 IP interface attributes



LAN1 Network Interface Configuration

IP Address :	169.254.1.1
Subnet Mask :	255.255.0.0
Gateway IP Address :	169.254.0.0
DHCP state :	○ Enabled ● Disabled
DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

LAN2 Network Interface Configuration (Radio Private Interface - Must end in .1)

IP Address :	192.168.101.1

Attribute	Meaning
IP Address	Internet Protocol (IP) address. This address is used by family of Internet protocols to uniquely identify this unit on a network.
Subnet Mask	Defines the address range of the connected IP network.
	The IP address of a computer on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
DHCP state	If **Enabled** is selected, the DHCP server automatically assigns the IP configuration (IP address, subnet mask, and gateway IP address) and the values of those individual parameters (above) are not used. The setting of this DHCP state parameter is also viewable (read only), in the Network Interface tab of the Home page.
DNS IP Address	Canopy devices allow for configuration of a preferred and alternate DNS server IP address either automatically or manually. Devices must set DNS server IP address manually when DHCP is disabled for the management interface of the device. DNS servers may be configured automatically from the DHCP response when DHCP is enabled for the management interface of the device. Optionally devices may be configured to set the DNS server IP address manually when DHCP is enabled for the management interface. The default DNS IP addresses are 0.0.0.0 when configured manually.
Preferred DNS Server	The first address used for DNS resolution.
Alternate DNS Server	If the Preferred DNS server cannot be reached, the Alternate DNS Server is used.
Domain Name	The operator’s management domain name may be configured for DNS. The domain name configuration can be used for configuration of the servers in the operator’s network. The default domain name is example.com, and is only used if configured as such.

<table>
<tr>
<td>LAN2 Network Interface Configuration (Radio Private Interface) – IP Address</td>
<td>It is recommended not to change this parameter from the default AP/BHM private IP address of 192.168.101.1. A /24 CIDR subnet is used to communicate with each of the SMs/BHS that are registered. The AP/BHM uses a combination of the private IP and the LUID (logical unit ID) of the SM/BHS.
It is only displayed for AP and BHM.
<b>Table 85</b> SM/BHS private IP and LUID
<table>
<tr><th>SM/BHS</th><th>LUID</th><th>Private IP</th></tr>
<tr><td>First SM/BHS registered</td><td>2</td><td>192.168.101.2</td></tr>
<tr><td>Second SM/BHS registered</td><td>3</td><td>192.168.101.3</td></tr>
</table>
</td>
</tr>
</table>

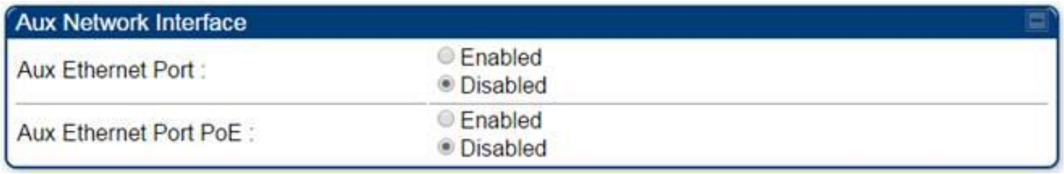
Auxiliary port

An additional Ethernet port labeled “Aux” for Auxiliary port is implemented for downstream traffic. This feature is supported only for PTP/PMP 450i ODUs.

To enable the Aux port, follow these instructions:

Procedure 17 Enabling Aux port interface

1 Select menu option **Configuration > IP > Aux Network Interface** tab.:



Aux Network Interface

Aux Ethernet Port : ○ Enabled ● Disabled

Aux Ethernet Port PoE : ○ Enabled ● Disabled

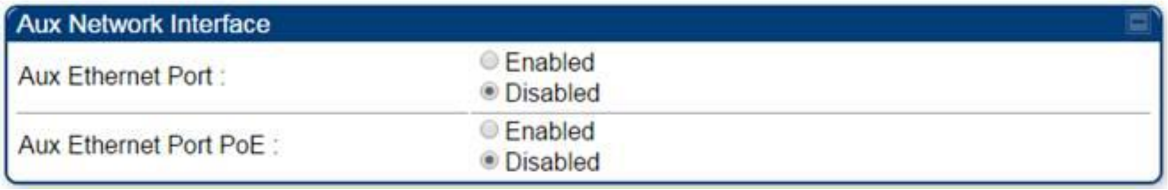
2 Click Enable button of Aux Ethernet Port parameter to enable Aux Ethernet port

3 Click Enable button of Aux Ethernet Port PoE parameter to enable Aux port PoE out.

4 Click **Save.** “Reboot Required” message is displayed.

5 Click **Reboot**.

Table 86 Aux port attributes



Aux Network Interface

Aux Ethernet Port : ○ Enabled ● Disabled

Aux Ethernet Port PoE : ○ Enabled ● Disabled

Attribute	Meaning
Aux Ethernet Port	Enabled: Data is enabled for Auxiliary port Disabled: Data is disabled for Auxiliary port
Aux Ethernet Port PoE	Enabled: PoE out is enable for Auxiliary port Disabled: PoE out is disabled for Auxiliary port

By disabling this feature, the data at the Auxiliary port will be disabled.

NAT, DHCP Server, DHCP Client and DMZ

Applicable products	**PMP :**	☑	SM

The system provides NAT (Network Address Translation) for SMs in the following combinations of NAT and DHCP (Dynamic Host Configuration Protocol):

- NAT Disabled
- NAT with DHCP Client (**DHCP** selected as the **Connection Type** of the WAN interface) and DHCP Server
- NAT with DHCP Client(**DHCP** selected as the **Connection Type** of the WAN interface)
- NAT with DHCP Server
- NAT without DHCP

NAT

NAT isolates devices connected to the Ethernet or wired side of a SM from being seen directly from the wireless side of the SM. With NAT enabled, the SM has an IP address for transport traffic (separate from its address for management), terminates transport traffic and allows you to assign a range of IP addresses to devices that are connected to the Ethernet or wired side of the SM.

In the Cambium system, NAT supports many protocols, including HTTP, ICMP (Internet Control Message Protocols), and FTP (File Transfer Protocol). For virtual private network (VPN) implementation, L2TP over IPSec (Level 2 Tunneling Protocol over IP Security) and PPTP (Point to Point Tunneling Protocol) are supported.

Note

When NAT is enabled, a reduction in throughput is introduced in the system (due to processing overhead).

DHCP

DHCP enables a device to be assigned a new IP address and TCP/IP parameters, including a default gateway, whenever the device reboots. Thus DHCP reduces configuration time, conserves IP addresses, and allows modules to be moved to a different network within the Cambium system.

In conjunction with the NAT features, each SM provides the following:

- A DHCP server that assigns IP addresses to computers connected to the SM by Ethernet protocol.
- A DHCP client that receives an IP address for the SM from a network DHCP server.

DMZ

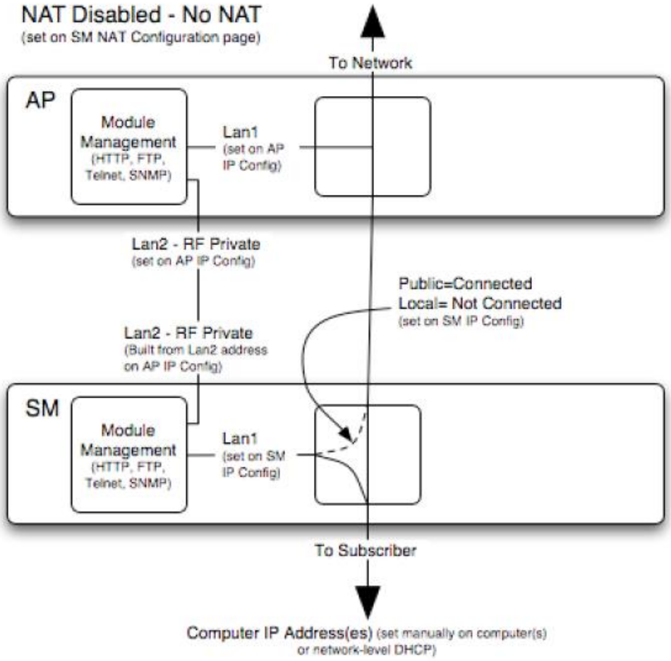
In conjunction with the NAT features, a DMZ (Demilitarized Zone) allows the allotment of one IP address behind the SM for a device to logically exist outside the firewall and receive network traffic. The first three octets of this IP address must be identical to the first three octets of the NAT private IP address.

- A DHCP server that assigns IP addresses to computers connected to the SM by Ethernet protocol.
- A DHCP client that receives an IP address for the SM from a network DHCP server.

NAT Disabled

The NAT Disabled implementation is illustrated in Figure 108.

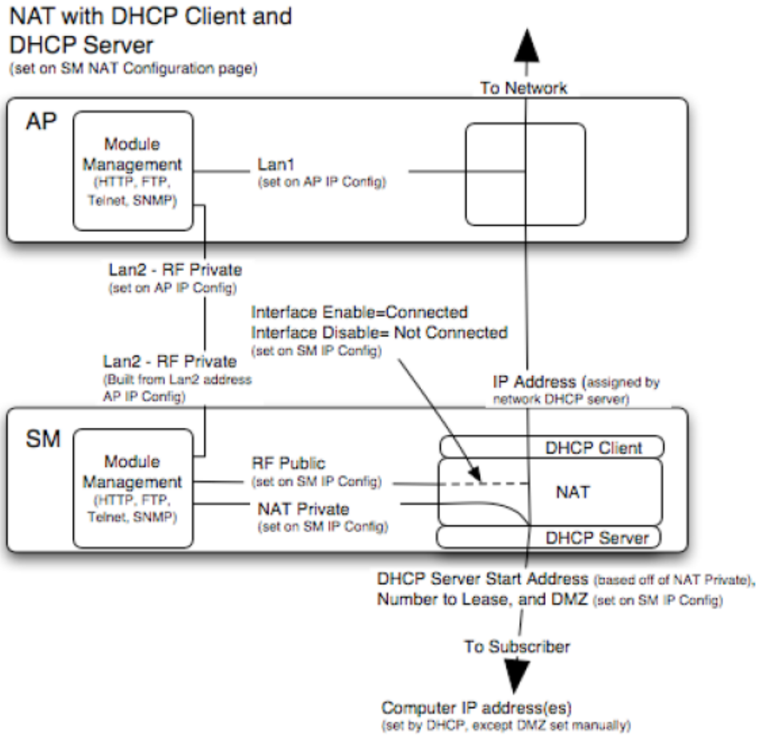
Figure 108 NAT disabled implementation


NAT Disabled - No NAT
(set on SM NAT Configuration page)
To Network
AP
Module Management (HTTP, FTP, Telnet, SNMP)
Lan1 (set on AP IP Config)
Lan2 - RF Private (set on AP IP Config)
Public=Connected
Local= Not Connected
(set on SM IP Config)
Lan2 - RF Private (Built from Lan2 address on AP IP Config)
SM
Module Management (HTTP, FTP, Telnet, SNMP)
Lan1 (set on SM IP Config)
To Subscriber
Computer IP Address(es) (set manually on computer(s) or network-level DHCP)

NAT with DHCP Client and DHCP Server

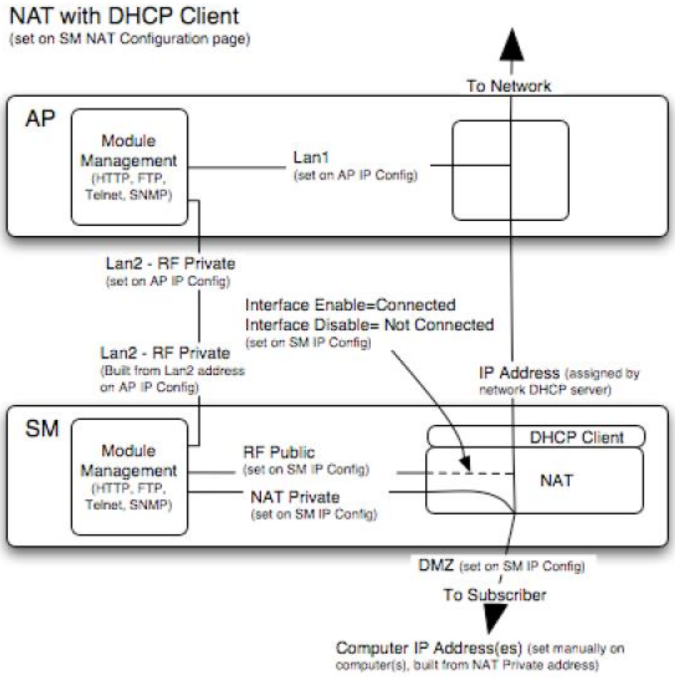
The NAT with DHCP Client and DHCP server is illustrated in Figure 109.

Figure 109 NAT with DHCP client and DHCP server implementation



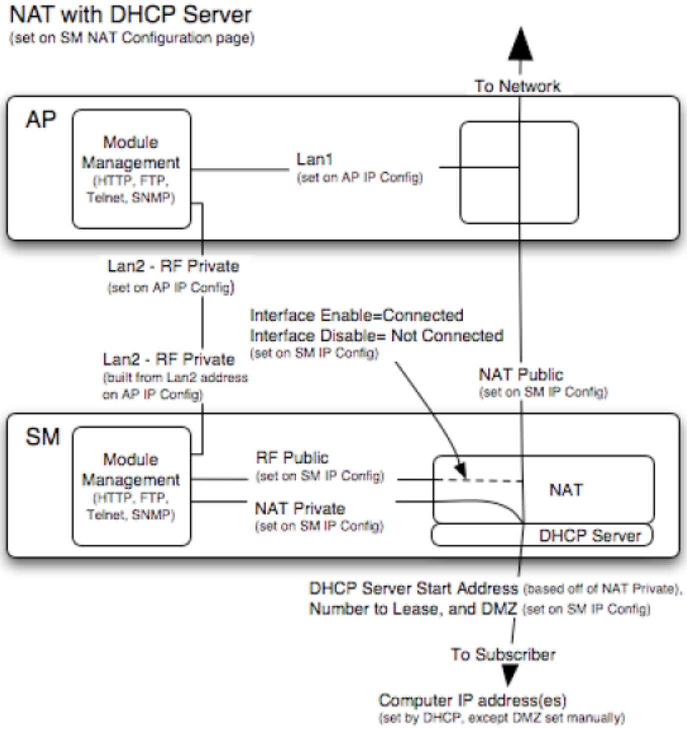
NAT with DHCP Client

Figure 110 NAT with DHCP client implementation



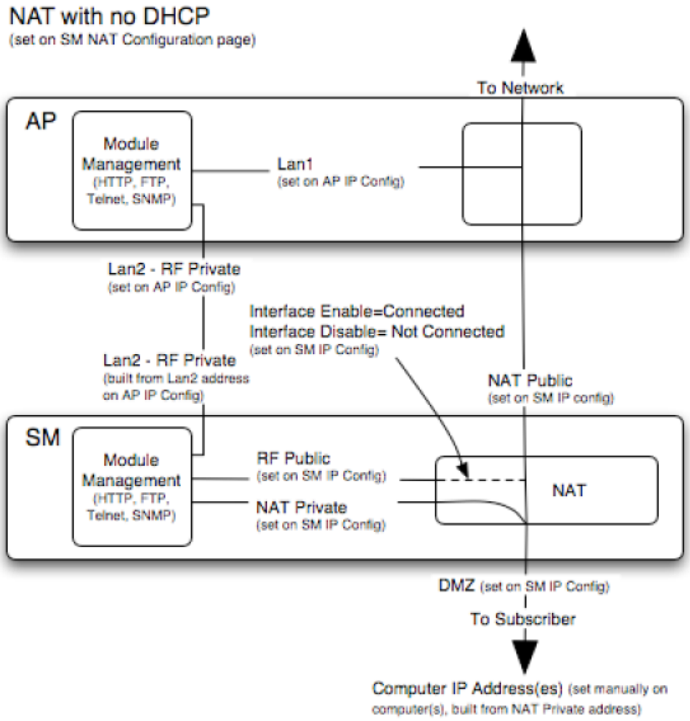
NAT with DHCP Server

Figure 111 NAT with DHCP server implementation


NAT with DHCP Server
(set on SM NAT Configuration page)
To Network
AP
Module Management (HTTP, FTP, Telnet, SNMP)
Lan1
(set on AP IP Config)
Lan2 - RF Private
(set on AP IP Config)
Interface Enable=Connected
Interface Disable= Not Connected
(set on SM IP Config)
Lan2 - RF Private
(built from Lan2 address on AP IP Config)
NAT Public
(set on SM IP Config)
SM
Module Management (HTTP, FTP, Telnet, SNMP)
RF Public
(set on SM IP Config)
NAT Private
(set on SM IP Config)
NAT
DHCP Server
DHCP Server Start Address (based off of NAT Private),
Number to Lease, and DMZ (set on SM IP Config)
To Subscriber
Computer IP address(es)
(set by DHCP, except DMZ set manually)

NAT without DHCP

Figure 112 NAT without DHCP implementation


NAT with no DHCP
(set on SM NAT Configuration page)
To Network
AP
Module Management (HTTP, FTP, Telnet, SNMP)
Lan1
(set on AP IP Config)
Lan2 - RF Private
(set on AP IP Config)
Interface Enable=Connected
Interface Disable= Not Connected
(set on SM IP Config)
Lan2 - RF Private
(built from Lan2 address on AP IP Config)
NAT Public
(set on SM IP config)
SM
Module Management (HTTP, FTP, Telnet, SNMP)
RF Public
(set on SM IP Config)
NAT Private
(set on SM IP Config)
NAT
DMZ (set on SM IP Config)
To Subscriber
Computer IP Address(es) (set manually on computer(s), built from NAT Private address)

NAT and VPNs

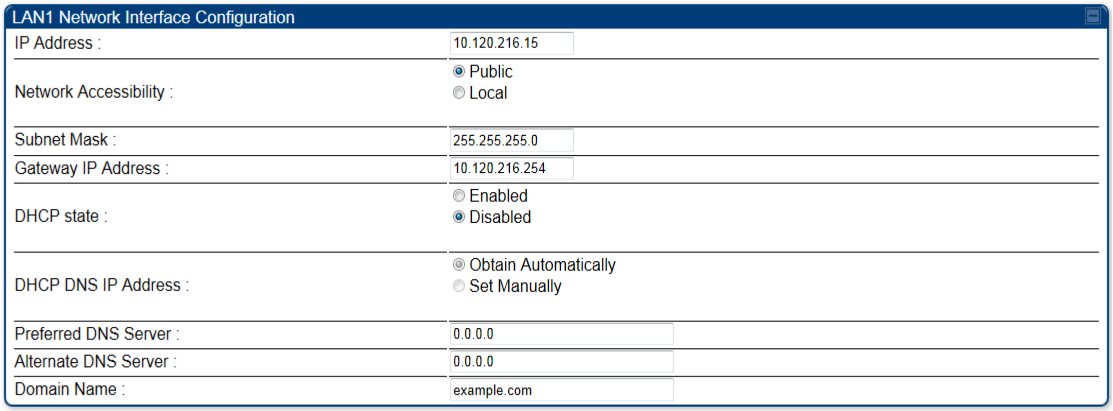
VPN technology provides the benefits of a private network during communication over a public network. One typical use of a VPN is to connect employees remotely (who are at home or in a different city), with their corporate network through a public Internet. Any of several VPN implementation schemes is possible. By design, NAT translates or changes addresses, and thus interferes with a VPN that is not specifically supported by a given NAT implementation.

With NAT enabled, SM supports L2TP over IPSec (Level 2 Tunneling Protocol over IP Security) VPNs and PPTP (Point to Point Tunneling Protocol) VPNs. With NAT disabled, SM supports all types of VPNs.

IP interface with NAT disabled - SM

The IP page of SM with NAT disabled is explained in Table 87.

Table 87 IP attributes - SM with NAT disabled



LAN1 Network Interface Configuration

IP Address :	10.120.216.15
Network Accessibility :	● Public ○ Local
Subnet Mask :	255.255.255.0
Gateway IP Address :	10.120.216.254
DHCP state :	○ Enabled ● Disabled
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

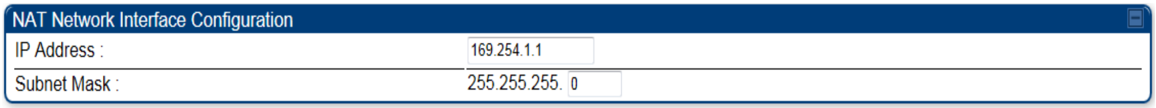
Attribute	Meaning
IP Address	Enter the non-routable IP address to associate with the Ethernet connection on this SM. (The default IP address from the factory is 169.254.1.1.) If you forget this parameter, you must both: • physically access the module. • use recovery mode to access the module configuration parameters at 169.254.1.1. See Radio recovery mode on page 1-24 **Note** Note or print the IP settings from this page. Ensure that you can readily associate these IP settings both with the module and with the other data that you store about the module.
Network Accessibility	Specify whether the IP address of the SM must be visible to only a device connected to the SM by Ethernet (**Local**) or be visible to the AP/BHM as well (**Public**).
Subnet Mask	Enter an appropriate subnet mask for the SM to communicate on the network. The default subnet mask is 255.255.0.0.
Gateway IP Address	Enter the appropriate gateway for the SM to communicate with the network. The default gateway is 169.254.0.0.
DHCP state	If you select **Enabled**, the DHCP server automatically assigns the IP configuration (IP address, subnet mask, and gateway IP address) and the values of those individual parameters (above) are not used. The setting of this DHCP state parameter is also viewable, but not settable, in the Network Interface tab of the Home page.

	In this tab, DHCP State is settable only if the **Network Accessibility** parameter in the IP tab is set to **Public**. This parameter is also settable in the NAT tab of the Configuration web page, but only when NAT is enabled. If the **DHCP state** parameter is set to **Enabled** in the **Configuration > IP** sub-menu of the SM/BHS, do not check the **BootpClient** option for **Packet Filter Types** in its Protocol Filtering tab, because doing so can block the DHCP request. (Filters apply to all packets that leave the SM via its RF interface, including those that the SM itself generates.) If you want to keep DHCP enabled and avoid the blocking scenario, select the **Bootp Server** option instead. This will result in responses being appropriately filtered and discarded.
DHCP DNS IP Address	Canopy devices allow for configuration of a preferred and alternate DNS server IP address either automatically or manually. Devices must set DNS server IP address manually when DHCP is disabled for the management interface of the device. DNS servers may be configured automatically from the DHCP response when DHCP is enabled for the management interface of the device. Optionally devices may be configured to set the DNS server IP address manually when DHCP is enabled for the management interface. The default DNS IP addresses are 0.0.0.0 when configured manually.
Preferred DNS Server	The first DNS server used for DNS resolution.
Alternate DNS Server	The second DNS server used for DNS resolution.
Domain Name	The operator’s management domain name may be configured for DNS. The domain name configuration can be used for configuration of the servers in the operator’s network. The default domain name is example.com, and is only used if configured as such.

IP interface with NAT enabled - SM

The IP page of SM with NAT enabled is explained in Table 88.

Table 88 IP attributes - SM with NAT enabled



NAT Network Interface Configuration

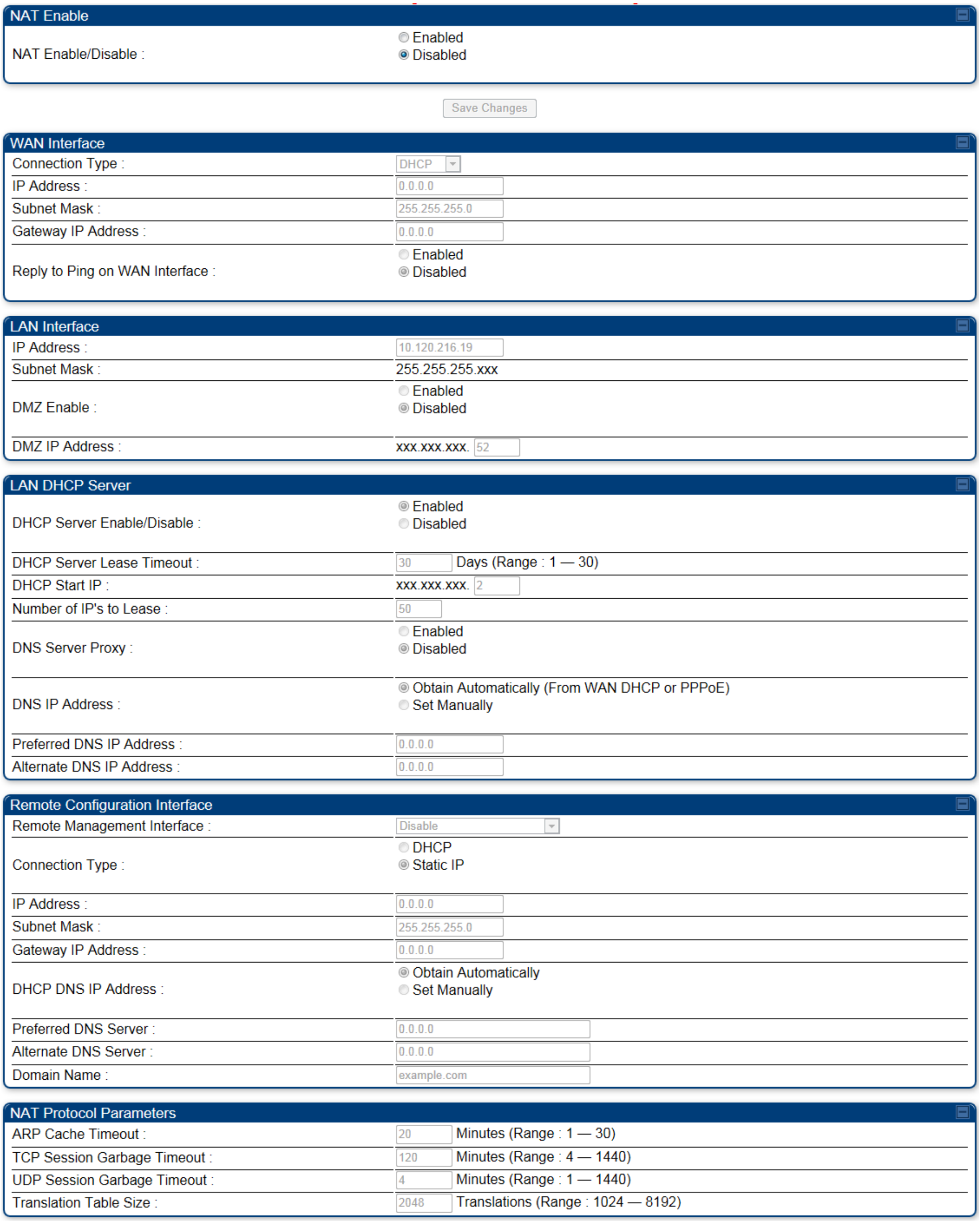
IP Address :	169.254.1.1
Subnet Mask :	255.255.255. 0

Attribute	Meaning
IP Address	Assign an IP address for SM/BHS management through Ethernet access to the SM/BHS. Set only the first three bytes. The last byte is permanently set to 1. This address becomes the base for the range of DHCP-assigned addresses.
Subnet Mask	Assign a subnet mask of 255.255.255.0 or a more restrictive subnet mask. Set only the last byte of this subnet mask. Each of the first three bytes is permanently set to 255.

NAT tab with NAT disabled - SM

The NAT tab of SM with NAT disabled is explained in Table 89.

Table 89 NAT attributes - SM with NAT disabled



NAT Enable

NAT Enable/Disable :	○ Enabled ● Disabled

Save Changes

WAN Interface

Connection Type :	DHCP
IP Address :	0.0.0.0
Subnet Mask :	255.255.255.0
Gateway IP Address :	0.0.0.0
Reply to Ping on WAN Interface :	○ Enabled ● Disabled

LAN Interface

IP Address :	10.120.216.19
Subnet Mask :	255.255.255.xxx
DMZ Enable :	○ Enabled ● Disabled
DMZ IP Address :	xxx.xxx.xxx. 52

LAN DHCP Server

DHCP Server Enable/Disable :	● Enabled ○ Disabled
DHCP Server Lease Timeout :	30 Days (Range : 1 — 30)
DHCP Start IP :	xxx.xxx.xxx. 2
Number of IP's to Lease :	50
DNS Server Proxy :	○ Enabled ● Disabled
DNS IP Address :	● Obtain Automatically (From WAN DHCP or PPPoE) ○ Set Manually
Preferred DNS IP Address :	0.0.0.0
Alternate DNS IP Address :	0.0.0.0

Remote Configuration Interface

Remote Management Interface :	Disable
Connection Type :	○ DHCP ● Static IP
IP Address :	0.0.0.0
Subnet Mask :	255.255.255.0
Gateway IP Address :	0.0.0.0
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

NAT Protocol Parameters

ARP Cache Timeout :	20 Minutes (Range : 1 — 30)
TCP Session Garbage Timeout :	120 Minutes (Range : 4 — 1440)
UDP Session Garbage Timeout :	4 Minutes (Range : 1 — 1440)
Translation Table Size :	2048 Translations (Range : 1024 — 8192)

Attribute	Meaning
NAT Enable/Disable	This parameter enables or disables the Network Address Translation (NAT) feature for the SM. NAT isolates devices connected to the Ethernet or wired side of a SM from being seen directly from the wireless side of the SM. With NAT enabled, the SM has an IP address for transport traffic separate from its address for management, terminates transport traffic, and allows you to assign a range of IP addresses to devices that are connected to the Ethernet or wired side of the SM. When NAT is enabled, VLANs are not supported on the wired side of that SM. You can enable NAT in SMs within a sector where VLAN is enabled in the AP/BHM, but this may constrain network design.
IP Address	This field displays the IP address for the SM. DHCP Server *will not* automatically assign this address when NAT is disabled.
Subnet Mask	This field displays the subnet mask for the SM. DHCP Server *will not* automatically assign this address when NAT is disabled.
Gateway IP Address	This field displays the gateway IP address for the SM. DHCP Server *will not* automatically assign this address when NAT is disabled.
ARP Cache Timeout	If a router upstream has an ARP cache of longer duration (as some use 30 minutes), enter a value of longer duration than the router ARP cache. The default value of this field is 20 minutes.
TCP Session Garbage Timeout	Where a large network exists behind the SM, you can set this parameter to lower than the default value of 120 minutes. This action makes additional resources available for greater traffic than the default value accommodates.
UDP Session Garbage Timeout	You may adjust this parameter in the range of 1 to 1440 minutes, based on network performance. The default value of this parameter is 4 minutes.
Translation Table Size	Total number of minutes that have elapsed since the last packet transfer between the connected device and the SM/BHS.

Note

When NAT is disabled, the following parameters are not required to be configurable:

WAN Inter face > Connection Type, IP Address, Subnet Mask, Gateway IP address

LAN Interface > IP Address

LAN DHCP Server > DHCP Server Enable/Disable, DHCP Server Lease Timeout, Number of IP’s to Lease, DNS Server Proxy, DNS IP Address, Preferred DNS IP address, Alternate DNS IP address

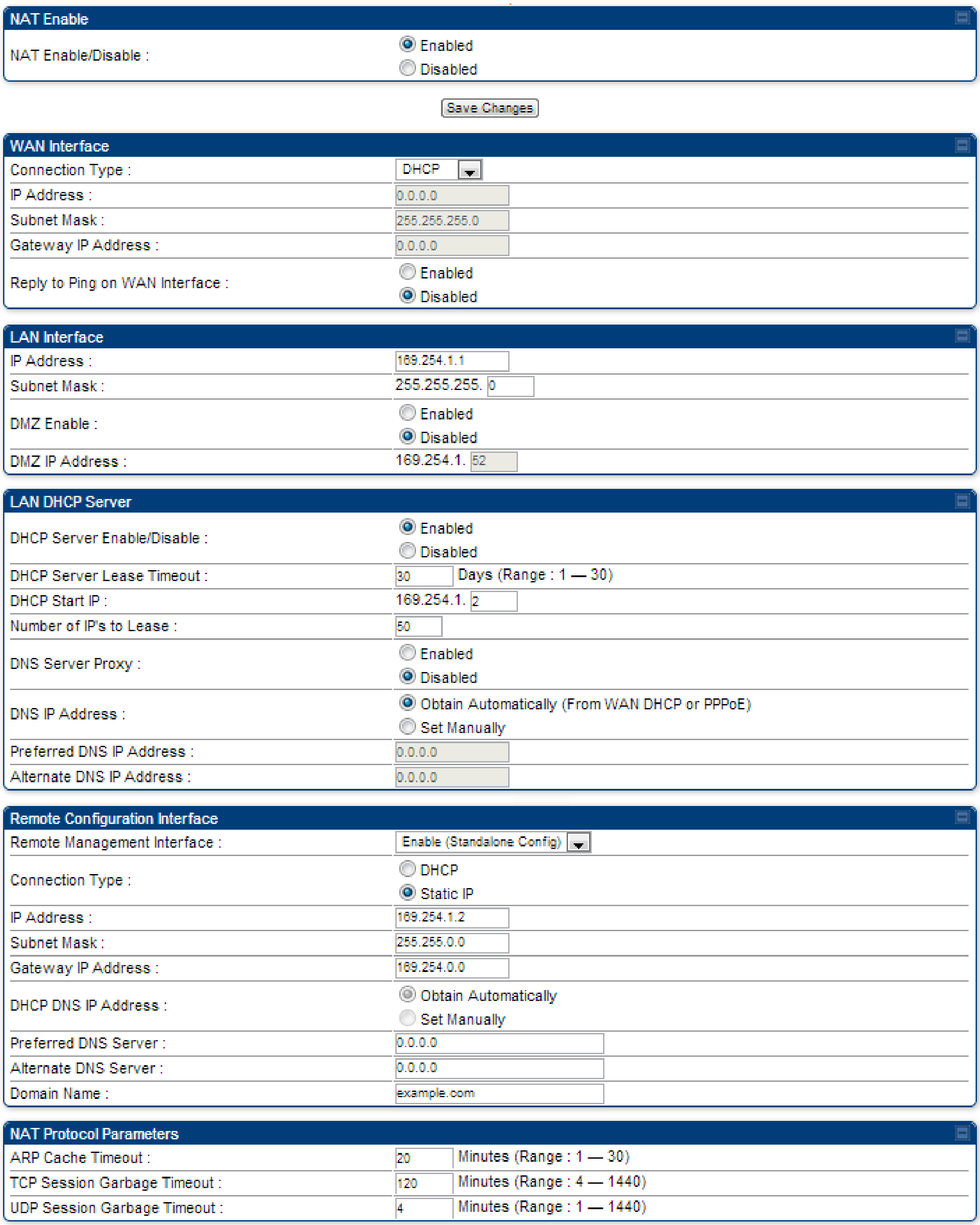
Remote Management Interface > Remote Management Interface, IP address, Subnet Mask, DHCP DNS IP Address, Preferred DNS Server, Alternate DNS Server, Domain Name

NAT Protocol Parameters > ARP Cache Timeout, TCP Session Garbage Timeout, UDP Session Garbage Timeout, Translation Table Size

NAT tab with NAT enabled - SM

The NAT tab of SM with NAT enabled is explained in Table 90.

Table 90 NAT attributes - SM with NAT enabled



NAT Enable	
NAT Enable/Disable :	● Enabled ○ Disabled

WAN Interface	
Connection Type :	DHCP
IP Address :	0.0.0.0
Subnet Mask :	255.255.255.0
Gateway IP Address :	0.0.0.0
Reply to Ping on WAN Interface :	○ Enabled ● Disabled

LAN Interface	
IP Address :	169.254.1.1
Subnet Mask :	255.255.255. 0
DMZ Enable :	○ Enabled ● Disabled
DMZ IP Address :	169.254.1. 52

LAN DHCP Server	
DHCP Server Enable/Disable :	● Enabled ○ Disabled
DHCP Server Lease Timeout :	30 Days (Range : 1 — 30)
DHCP Start IP :	169.254.1. 2
Number of IP's to Lease :	50
DNS Server Proxy :	○ Enabled ● Disabled
DNS IP Address :	● Obtain Automatically (From WAN DHCP or PPPoE) ○ Set Manually
Preferred DNS IP Address :	0.0.0.0
Alternate DNS IP Address :	0.0.0.0

Remote Configuration Interface	
Remote Management Interface :	Enable (Standalone Config)
Connection Type :	○ DHCP ● Static IP
IP Address :	169.254.1.2
Subnet Mask :	255.255.0.0
Gateway IP Address :	169.254.0.0
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	0.0.0.0
Alternate DNS Server :	0.0.0.0
Domain Name :	example.com

NAT Protocol Parameters	
ARP Cache Timeout :	20 Minutes (Range : 1 — 30)
TCP Session Garbage Timeout :	120 Minutes (Range : 4 — 1440)
UDP Session Garbage Timeout :	4 Minutes (Range : 1 — 1440)

Attribute	Meaning
NAT Enable/Disable	This parameter enables or disabled the Network Address Translation (NAT) feature for the SM. NAT isolates devices connected to the Ethernet or wired side of a SM from being seen directly from the wireless side of the SM. With NAT enabled, the SM has an IP address for transport traffic separate from its address for management, terminates transport traffic, and allows you to assign a range of IP addresses to devices that are connected to the Ethernet or wired side of the SM. When NAT is enabled, VLANs are not supported on the wired side of that SM. You can enable NAT in SMs within a sector where VLAN is enabled in the AP, but this may constrain network design.
WAN Interface	The WAN interface is the RF-side address for transport traffic.
Connection Type	This parameter may be set to **Static IP**—when this is the selection, all three parameters (**IP Address**, **Subnet Mask**, and **Gateway IP Address**) must be properly populated. **DHCP**—when this is the selection, the information from the DHCP server configures the interface. **PPPoE**—when this is the selection, the information from the PPPoE server configures the interface.
Subnet Mask	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the subnet mask of the SM for RF transport traffic.
Gateway IP Address	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the gateway IP address for the SM for RF transport traffic.
Reply to Ping on WAN Interface	By default, the radio interface *does not* respond to pings. If you use a management system (such as WM) that will occasionally ping the SM, set this parameter to **Enabled**.
LAN Interface	The LAN interface is both the management access through the Ethernet port and the Ethernet-side address for transport traffic. When NAT is enabled, this interface is redundantly shown as the **NAT Network Interface Configuration** on the IP tab of the Configuration web page in the SM.
IP Address	Assign an IP address for SM/BHS management through Ethernet access to the SM. This address becomes the base for the range of DHCP-assigned addresses.
Subnet Mask	Assign a subnet mask of 255.255.255.0 or a more restrictive subnet mask. Set only the last byte of this subnet mask. Each of the first three bytes is permanently set to 255.
DMZ Enable	Either enable or disable DMZ for this SM/BHS.

DMZ IP Address	If you enable DMZ in the parameter above, set the last byte of the DMZ host IP address to use for this SM when DMZ is enabled. Only one such address is allowed. The first three bytes are identical to those of the NAT private IP address. Ensure that the device that receives network traffic behind this SM is assigned this address. The system provides a warning if you enter an address within the range that DHCP can assign.
DHCP Server	This is the server (in the SM) that provides an IP address to the device connected to the Ethernet port of the SM.
DHCP Server Enable/Disable	Select either **Enabled** or **Disabled**. **Enable** to: • Allow this SM to assign IP addresses, subnet masks, and gateway IP addresses to attached devices. • Assign a start address for DHCP. • Designate how many IP addresses may be temporarily used (leased). **Disable** to: • Restrict SM/BHS from assigning addresses to attached devices.
DHCP Server Lease Timeout	Based on network performance, enter the number of days between when the DHCP server assigns an IP address and when that address expires. The range of values for this parameter is 1 to 30 days. The default value is 30 days.
DHCP Start IP	If you enable DHCP Server below, set the last byte of the starting IP address that the DHCP server assigns. The first three bytes are identical to those of the NAT private IP address.
Number of IPs to Lease	Enter how many IP addresses the DHCP server is allowed to assign. The default value is 50 addresses.
DNS Server Proxy	This parameter enables or disables advertisement of the SM/BHS as the DNS server. On initial boot up of a SM with the NAT WAN interface configured as DHCP or PPPoE, the SM module will not have DNS information immediately. With **DNS Server Proxy** disabled, the clients will renew their lease about every minute until the SM has the DNS information to give out. At this point the SM will go to the full configured lease time period which is 30 days by default. With **DNS Server Proxy** enabled, the SM will give out full term leases with its NAT LAN IP as the DNS server.
DNS IP Address	Select either: **Obtain Automatically** to allow the system to set the IP address of the DNS server *or* **Set Manually** to enable yourself to set both a preferred and an alternate DNS IP address.
Preferred DNS IP Address	Enter the preferred DNS IP address to use when the **DNS IP Address** parameter is set to **Set Manually**.

Alternate DNS IP Address	Enter the DNS IP address to use when the **DNS IP Address** parameter is set to **Set Manually** and no response is received from the preferred DNS IP address.
Remote Management Interface	To offer greater flexibility in IP address management, the NAT-enabled SM's configured WAN Interface IP address may now be used as the device Remote Management Interface (unless the SM's PPPoE client is set to Enabled) **Disable**: When this interface is set to "Disable", the SM is not directly accessible by IP address. Management access is only possible through either the LAN (Ethernet) interface or a link from an AP web page into the WAN (RF-side) interface. **Enable (Standalone Config)**: When this interface is set to "Enable (Standalone Config)", to manage the SM/BHS the device must be accessed by the IP addressing information provided in the Remote Configuration Interface section. **Note** When configuring PPPoE over the link, use this configuration option (PPPoE traffic is routed via the IP addressing specified in section Remote Configuration Interface). **Enable (Use WAN Interface)**: When this interface is set to "Enable (Use WAN Interface)", the Remote Configuration Interface information is greyed out, and the SM is managed via the IP addressing specified in section WAN Interface). **Note** When using this configuration, the ports defined in section Configuration, Port Configuration are consumed by the device. For example, if **FTP Port** is configured as 21 by the SM, an FTP server situated below the SM must use a port other than 21. This also applies to DMZ devices; any ports specified in section Configuration, Port Configuration will not be translated through the NAT, they is consumed by the device's network stack for management.
Connection Type	This parameter can be set to: **Static IP**—when this is the selection, all three parameters (**IP Address**, **Subnet Mask**, and **Gateway IP Address**) must be properly populated. **DHCP**—when this is the selection, the information from the DHCP server configures the interface.
IP Address	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the IP address of the SM for RF management traffic.
Subnet Mask	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the subnet mask of the SM for RF management traffic.

Gateway IP Address	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the gateway IP address for the SM for RF management traffic. Note or print the IP settings from this page. Ensure that you can readily associate these IP settings both with the module and with the other data that you store about the module.
DHCP DNS IP Address	Select either: **Obtain Automatically** to allow the system to set the IP address of the DNS server. *or* **Set Manually** to enable yourself to set both a preferred and an alternate DNS IP address.
Preferred DNS Server	Enter the preferred DNS IP address to use when the **DNS IP Address** parameter is set to **Set Manually**.
Alternate DNS Server	Enter the DNS IP address to use when the **DNS IP Address** parameter is set to **Set Manually** and no response is received from the preferred DNS IP address.
Domain Name	Domain Name to use for management DNS configuration. This domain name may be concatenated to DNS names used configured for the remote configuration interface.
ARP Cache Timeout	If a router upstream has an ARP cache of longer duration (as some use 30 minutes), enter a value of longer duration than the router ARP cache. The default value of this field is *20* (minutes).
TCP Session Garbage Timeout	Where a large network exists behind the SM, you can set this parameter to lower than the default value of *120* (minutes). This action makes additional resources available for greater traffic than the default value accommodates.
UDP Session Garbage Timeout	You may adjust this parameter in the range of 1 to 1440 minutes, based on network performance. The default value of this parameter is *4* (minutes).

NAT DNS Considerations - SM

SM DNS behavior is different depending on the accessibility of the SM. When NAT is enabled the DNS configuration that is discussed in this document is tied to the RF Remote Configuration Interface, which must be enabled to utilize DNS Client functionality. Note that the WAN DNS settings when NAT is enabled are unchanged with the addition of the management DNS feature discussed in this document.

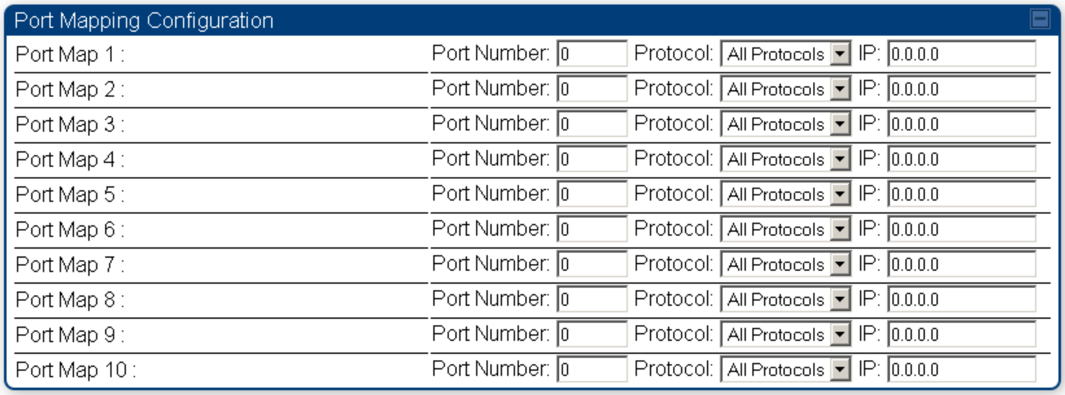
Table 91 SM DNS Options with NAT Enabled

NAT Configuration	Management Interface Accessibility	DHCP Status	DNS Status
NAT Enabled	RF Remote Management Interface Disabled	N/A	DNS Disabled
	RF Remote Management Interface Enabled	DHCP Disabled	DNS Static Configuration
		DHCP Enabled	DNS from DHCP or DNS Static Configuration

NAT Port Mapping tab - SM

The NAT Port Mapping tab of the SM is explained in Table 92.

Table 92 NAT Port Mapping attributes - SM



Port Mapping Configuration

Port Map 1 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 2 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 3 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 4 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 5 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 6 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 7 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 8 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 9 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0
Port Map 10 :	Port Number: 0	Protocol: All Protocols	IP: 0.0.0.0

Attribute	Meaning
Port Map *1 to 10*	Separate parameters allow you to distinguish NAT ports from each other by assigning a unique combination of port number, protocol for traffic through the port, and IP address for access to the port

DHCP – BHS

Applicable products	PTP: ☑ BHM

DHCP enables a device to be assigned a new IP address and TCP/IP parameters, including a default gateway, whenever the device reboots. Thus DHCP reduces configuration time, conserves IP addresses, and allows modules to be moved to a different network within the Cambium system.

In conjunction with the NAT features, each BHS provides:

- A DHCP server that assigns IP addresses to computers connected to the BHS by Ethernet protocol.
- A DHCP client that receives an IP address for the BHS from a network DHCP server.

Reconnecting to the management PC

If the IP Address, Subnet Mask and Gateway IP Address of the unit have been updated to meet network requirements, then reconfigure the local management PC to use an IP address that is valid for the network. See Configuring the management PC on page 7-73.

Once the unit reboots, log in using the new IP address. See Logging into the web interface on page 7-75.

VLAN configuration for PMP

Applicable products	PMP : ☑ AP ☑ SM

VLAN Remarking

VLAN Remarking feature allows the user to change the VLAN ID and priority of both upstream and downstream packets at the Ethernet Interface. The remarking configuration is available for:

1. VLAN ID re-marking
2. 802.1p priority re-marking

Note

For Q-in-Q VLAN tagged frame, re-marking is performed on the outer tag.

VLAN ID Remarking

SM supports the ability to re-mark the VLAN ID on both upstream and downstream VLAN frames at the Ethernet interface. For instance, a configuration can be added to re-mark VLAN ID 'x' to VLAN ID 'y' as shown in Table 93. AP does not support VLAN ID remarking.

Table 93 VLAN Remarking Example

VLAN frame direction	Remarking
Upstream	SM receives VLAN ID 'x' frame at the Ethernet interface, checks the configuration and re-marks to VLAN ID 'y'. So VLAN ID 'y' frame comes out of AP's Ethernet interface. When SM re-marks, a dynamic entry in VLAN membership table for 'y' is added to allow reception of VLAN ID 'y' downstream packet.
Downstream	AP receives VLAN ID 'y' frame at the Ethernet interface and sends to SM. SM accepts the frame as it has an entry in the membership table and re-marks to VLAN ID 'x'. This reverse re- marking is necessary because the downstream devices do not know of re-marking and are expecting VLAN 'x' frames. This remarking is done just before sending the packet out on Ethernet interface.

802.1P Remarking

AP/BHM and SM/BHS allow re-marking of 802.1p priority bits for the frames received at the Ethernet interface. Priority bits are not re-marked for the packets sent out of Ethernet interface (reverse direction).

Configuration must be added at SM/BHS for upstream frames and at AP/BHM for downstream frames.

VLAN Priority Bits configuration

VLAN Priority Bits Configuration feature allows the user to configure the three 802.1p bits upon assigning VLAN to an ingress packet. The priority bits configuration is available for:

- Default Port VID
- Provider VID
- MAC Address mapped Port VID
- Management VID

Default Port VID

This VID is used for untagged frames and will correspond to the Q-Tag for 802.1Q frames (if VLAN Port Type is Q), or the C-Tag for 802.1ad frames (if the VLAN Port Type is QinQ).

The priority bits used in the Q-tag/C-tag are configurable.

The configuration can be:

- **Promote IPv4/IPv6 priority** – The priority in the IP header is copied to the Q-tag/C-tag.
- **Define priority** – Specify the priority in the range of 0 to 7. This value is used as priority in the Q-tag/C-tag.

MAC Address Mapped VID

If a packet arrives at the SM/BHS that is sourced from a device whose MAC address is in the table, then the corresponding VID is used for that frame's Q-tag (Q port) or C-tag (QinQ port). The priority bits used in the Q-tag/C-tag are configurable similar to default port VID.

Provider VID

The provider VID is used for the S-tag. The priority bits used in the S-tag are configurable similar to default port VID. Provider VID has an extra priority configuration:

- **Copy inner tag 802.1p priority** – The priority in the C-tag is copied to the S-tag.

Management VID

This VID is used to communicate with AP/BHM and SM/BHS for management purposes. The priority bits used in the Q-tag are configurable similar to default port VID.

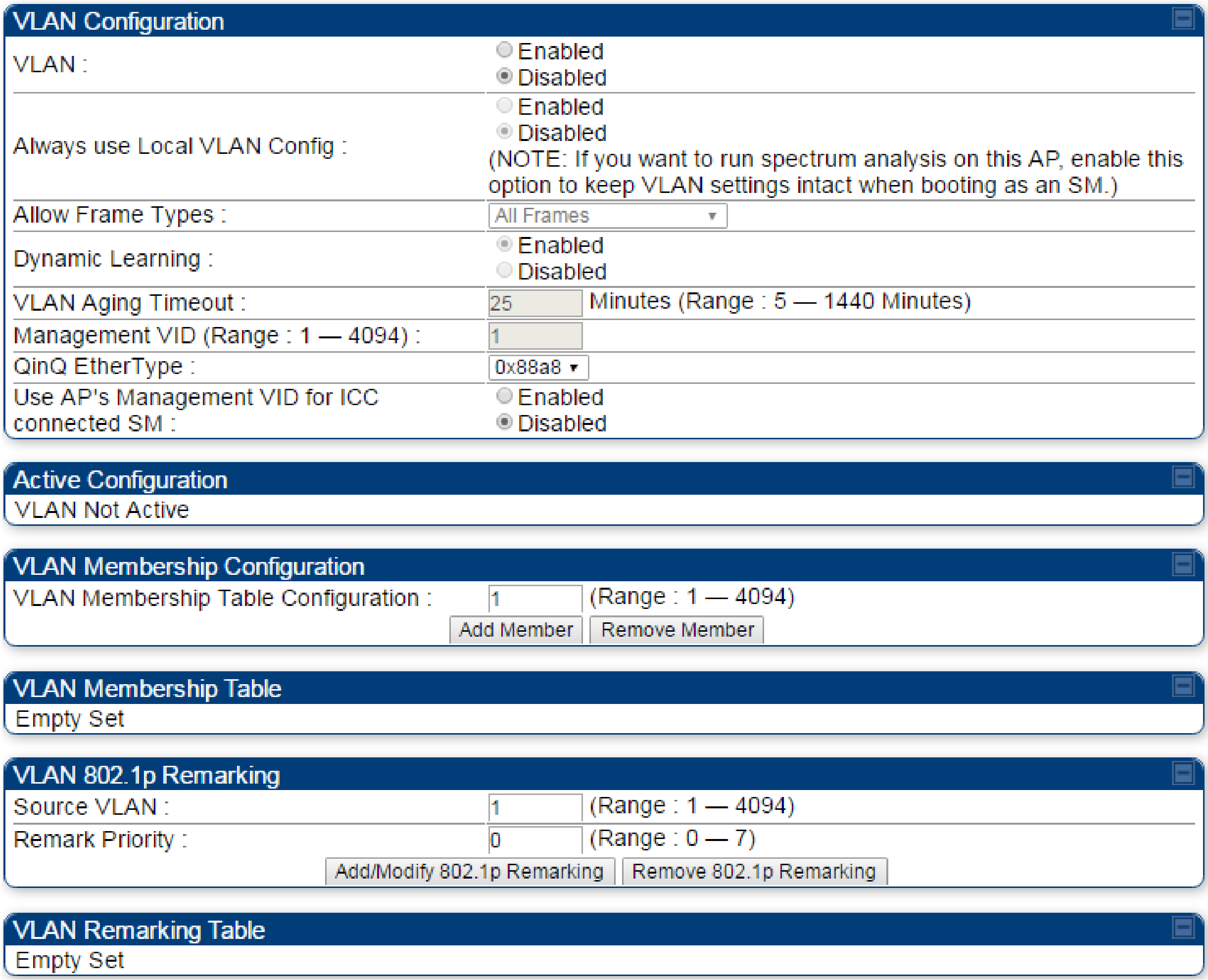
Use AP's Management VID for ICC connected SM

This feature allows the SM to use the AP's management VLAN ID when the SM is registered to the AP via ICC. This feature is useful for the customer who uses a different management VID for the SM and AP and Zero Touch feature is enabled for configuration. This parameter may be accessed via the **Configuration > VLAN** page on the AP's web management interface.

VLAN page of AP

The **VLAN** tab of the AP/BHM is explained in Table 94.

Table 94 AP/BHM VLAN tab attributes



VLAN Configuration

VLAN :	○ Enabled ● Disabled
Always use Local VLAN Config :	○ Enabled ● Disabled (NOTE: If you want to run spectrum analysis on this AP, enable this option to keep VLAN settings intact when booting as an SM.)
Allow Frame Types :	All Frames ▾
Dynamic Learning :	● Enabled ○ Disabled
VLAN Aging Timeout :	25 Minutes (Range : 5 — 1440 Minutes)
Management VID (Range : 1 — 4094) :	1
QinQ EtherType :	0x88a8 ▾
Use AP's Management VID for ICC connected SM :	○ Enabled ● Disabled

Active Configuration

VLAN Not Active

VLAN Membership Configuration

VLAN Membership Table Configuration : 1 (Range : 1 — 4094)

Add Member | Remove Member

VLAN Membership Table

Empty Set

VLAN 802.1p Remarking

Source VLAN :	1 (Range : 1 — 4094)
Remark Priority :	0 (Range : 0 — 7)

Add/Modify 802.1p Remarking | Remove 802.1p Remarking

VLAN Remarking Table

Empty Set

Attribute	Meaning
VLAN	Specify whether VLAN functionality for the AP and all linked SMs must (**Enabled**) or may not (**Disabled**) be allowed. The default value is **Disabled**.
Always use Local VLAN Config	Enable this option before you reboot this AP as a SM to use it to perform spectrum analysis. Once the spectrum analysis completes, disable this option before you reboot the module as an AP,
Allow Frame Types	Select the type of arriving frames that the AP must tag, using the VID that is stored in the **Untagged Ingress VID** parameter. The default value is **All Frames**.
Dynamic Learning	Specify whether the AP must (**Enabled**) or not (**Disabled**) add the VLAN IDs (VIDs) of upstream frames to the VID table. (The AP passes frames with VIDs that are stored in the table both upstream and downstream.). The default value is **Enabled**.

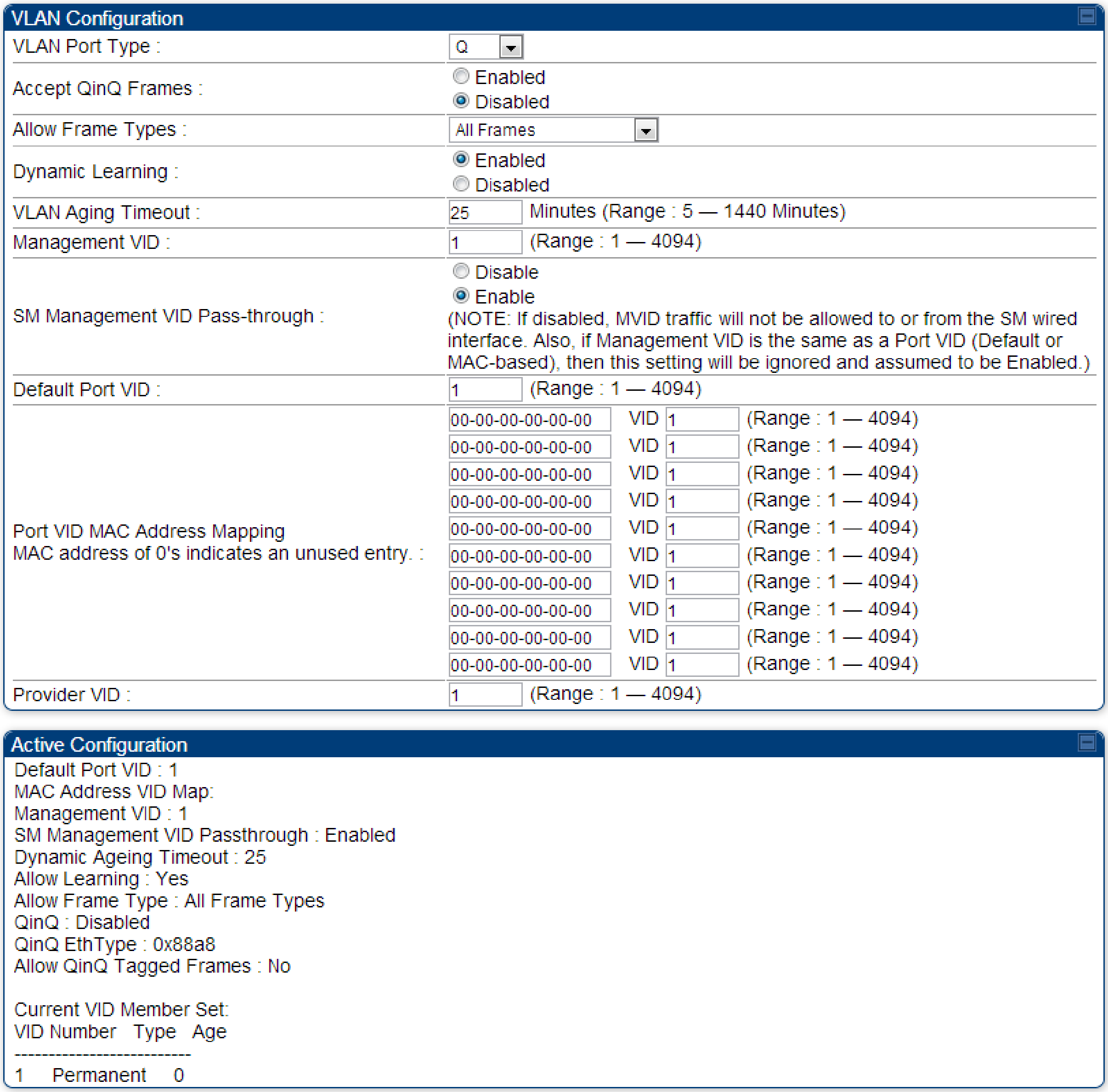
<table>
<tr><td>VLAN Aging Timeout</td><td>Specify how long the AP must keep dynamically learned VIDs. The range of values is 5 to <em>1440</em> (minutes). The default value is <em>25</em> (minutes).
<strong>Note</strong>
VIDs that you enter for the Management VID and VLAN Membership parameters do not time out.</td></tr>
<tr><td>Management VID</td><td>Enter the VID that the operator wishes to use to communicate with the module manager. The range of values is 1 to 4095. The default value is <strong>1.</strong></td></tr>
<tr><td>QinQ EtherType</td><td>Modules can be configured with 802.1ad Q-in-Q DVLAN (Double-VLAN) tagging which is a way for an operator to put an 802.1Q VLAN inside of an 802.1ad VLAN. A nested VLAN, which is the original 802.1Q tag and a new second 802.1ad tag, allows for bridging of VLAN traffic across a network and segregates the broadcast domains of 802.1Q VLANs. Q-in-Q can be used with PPPoE and/or NAT.
The 802.1ad standard defines the S-VLAN as the Service Provider VLAN and the C-VLAN as the customer VLAN. The radio software does 2 layer Q-in-Q whereby the C-VLAN is the 802.1Q tag and the S-VLAN is the second layer Q tag as shown below:
<strong>Table 95</strong> Q-in-Q Ethernet frame
<table><tr><td>Ethernet Header</td><td>S-VLAN EthType 0x88a8</td><td>C-VLAN EthType 0x8100</td><td>IP Data EthType 0x0800</td></tr></table>
The 802.1ad S-VLAN is the outer VLAN that is configurable on the <strong>Configuration > VLAN</strong> web page of the AP. The Q-in-Q EtherType parameter is configured with a default EtherType of 0x88a8 in addition to four alternate EtherTypes that can be configured to aid in interoperability with existing networks that use a different EtherType than the default.
The C-VLAN is the inner VLAN tag, which is the same as 802.1Q. As a top level concept, this operates on the outermost tag at any given time, either “pushing” a tag on or “popping” a tag off. This means packets will at most transition from an 802.1Q frame to an 801.ad frame (with a tag “pushed” on) or an untagged 802.1 frame (with the tag “popped” off. Similarly, for an 802.1ad frame, this can only transition from an 802.1ad frame to an 802.1Q frame (with the tag “popped” off) since the radio software only supports 2 levels of tags</td></tr>
<tr><td>Use AP's Management VID for ICC connected SM</td><td>This field allows the SM to use the AP’s management VLAN ID when the SM is registered to the AP via ICC.</td></tr>
</table>

VLAN Not Active	When VLAN is enabled in the AP, the Active Configuration block provides the following details as read-only information in this tab. In the Cambium fixed wireless broadband IP network, each device of any type is automatically a permanent member of VID 1. This facilitates deployment of devices that have VLAN enabled with those that do not.
VLAN Membership Table Configuration	For each VLAN in which you want the AP to be a member, enter the VLAN ID and then click the **Add Member** button. Similarly, for any VLAN in which you want the AP to no longer be a member, enter the VLAN ID and then click the **Remove Member** button.
VLAN Membership table	This field lists the VLANs that an AP is a member of. As the user adds a number between 1 and 4094, this number is populated here.
Source VLAN (Range: 1-4094)	Enter the VID for which the operator wishes to remark the 802.1p priority for the downstream packets. The range of values is 1 to 4094. The default value is 1.
Remark Priority (Range 0-7)	This is the priority you can assign to the VLAN Tagged packet. Priority of 0 is the highest.
VLAN Remarking table	As the user enters a VLAN and a Remarking priority, this information is added in this table.

VLAN page of SM

The **VLAN** tab of SM/BHS is explained in Table 96.

Table 96 SM VLAN attributes



VLAN Configuration

VLAN Port Type :	Q
Accept QinQ Frames :	○ Enabled ● Disabled
Allow Frame Types :	All Frames
Dynamic Learning :	● Enabled ○ Disabled
VLAN Aging Timeout :	25 Minutes (Range : 5 — 1440 Minutes)
Management VID :	1 (Range : 1 — 4094)
SM Management VID Pass-through :	○ Disable ● Enable (NOTE: If disabled, MVID traffic will not be allowed to or from the SM wired interface. Also, if Management VID is the same as a Port VID (Default or MAC-based), then this setting will be ignored and assumed to be Enabled.)
Default Port VID :	1 (Range : 1 — 4094)
Port VID MAC Address Mapping MAC address of 0's indicates an unused entry. :	00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094) 00-00-00-00-00-00 VID 1 (Range : 1 — 4094)
Provider VID :	1 (Range : 1 — 4094)

Active Configuration

```
Default Port VID : 1
MAC Address VID Map:
Management VID : 1
SM Management VID Passthrough : Enabled
Dynamic Ageing Timeout : 25
Allow Learning : Yes
Allow Frame Type : All Frame Types
QinQ : Disabled
QinQ EthType : 0x88a8
Allow QinQ Tagged Frames : No

Current VID Member Set:
VID Number   Type   Age
---------------------------
1     Permanent     0
```

Attribute	Meaning
VLAN Port Type	By default this is Q, indicating that it is to operate in the existing manner. The other option is Q-in-Q, which indicates that it must be adding and removing the S-Tag, and adding a C-Tag if necessary for untagged packets. The VLAN Port type corresponds to the Ethernet port of the SM/BHS. Currently, the internal management interfaces will always operate as Q ports.

Accept QinQ Frames	This option is valid for the Q-in-Q port so that the user may force blocking of existing 802.1ad Q-in-Q frames. This way, only untagged or single tagged packets will come in and out of the Ethernet interface. If a Q-in-Q frame is about ingress or egress the Ethernet interface and this is disabled, it is dropped and a filter entry will show up on the VLAN Statistics page as DVLAN Egress or DVLAN Ingress.
Allow Frame Types	Select the type of arriving frames that the SM must tag, using the VID that is stored in the **Untagged Ingress VID** parameter. The default value is **All Frames**. **Tagged Frames Only**: The SM only tags incoming VLAN-tagged frames **Untagged Frames Only**: The SM will only tag incoming untagged frames
Dynamic Learning	Specify whether the SM must (**Enable**) or not (**Disable**) add the VIDs of upstream frames (that enter the SM through the wired Ethernet interface) to the VID table. The default value is **Enable**.
VLAN Aging Timeout	Specify how long the SM/BHS must keep dynamically learned VIDs. The range of values is 5 to 1440 (minutes). The default value is *25* (minutes). **Note** VIDs that you enter for the Untagged Ingress VID and Management VID parameters do not time out.
Management VID	Enter the VID that the SM/BHS must share with the AP/BHM. The range of values is 1 to 4095. The default value is **1**.
SM Management VID Pass-through	Specify whether to allow the SM/BHS (**Enabled**) or the AP/RADIUS (**Disabled**) to control the VLAN settings of this SM. The default value is **Enabled**. When VLAN is enabled in the AP to whom this SM is registered, the Active Configuration block provides the following details as read-only information in this tab. In the Cambium fixed wireless broadband IP network, each device of any type is automatically a permanent member of VID 1. This facilitates deployment of devices that have VLAN enabled with those that do not. If disabled, MVID traffic is not allowed to or from the SM wired interface. Also, if Management VID is the same as a Port VID (Default or MAC-based), then this setting is ignored and assumed to be Enabled.
Default Port VID	This is the VID that is used for untagged frames and will correspond to the Q-Tag for 802.1Q frames (if VLAN Port Type is Q), or the C-Tag for 802.1ad frames (if the VLAN Port Type is Q-in- Q).

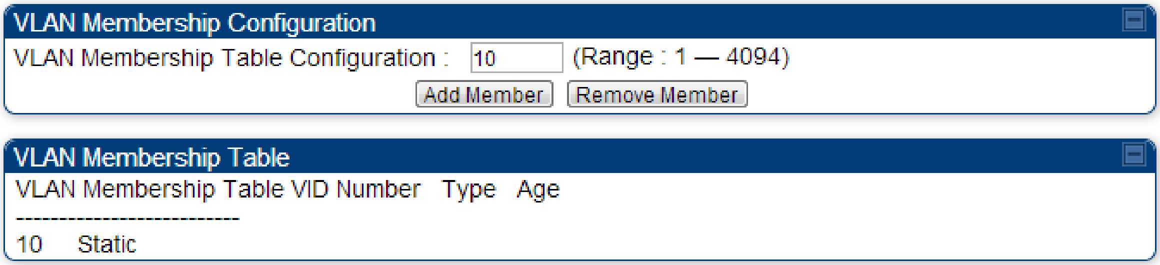
Port VID MAC Address Mapping	These parameters allow operators to place specific devices onto different VLANs (802.1Q tag or 802.1ad C-tag) based on the source MAC address of the packet. If the MAC address entry is 00-00-00-00-00-00 then that entry is not used. If a packet arrives at the SM that is sourced from a device whose MAC address is in the table, then the corresponding VID is used for that frame's Q-tag (Q port) or C-tag (Q-in-Q port). If there is no match, then the Default Port VID is used. This table is also used in the downstream direction for removal of the tag based on the destination MAC address so that an untagged (for Q port) or Q-Tagged (for Q-in-Q port) frame is delivered to the end device. You may use wildcards for the non-OUI (Organizationally Unique Identifier) portion of the MAC address, which is the last 3 bytes. MAC addresses contain 6 bytes, the first 3 of which are the OUI of the vendor that manufactured the device and the last 3 are unique to that vendor OUI. If you want to cover all devices from a known vendor's OUI, you have to specify 0xFF for the remaining 3 bytes. So, for example, if you wanted all devices from a specific vendor with an OUI of 00-95-5b (which is a Netgear OUI) to be on the same VID of 800, you have to specify an entry with MAC address 00-95-5b-ff-ff-ff. Then, any device underneath of the SM with MAC addresses starting with 00-95-5b is put on VLAN 800.
Provider VID	The provider VID is used for the S-tag. It is only used if the **Port Type** is **Q-in-Q** and will always be used for the S-tag. If an existing 802.1Q frame arrives, the **Provider VID** is what is used for adding and removing of the outer S-tag. If an untagged frame arrives to a Q-in-Q port, then the **Provider VID** is the S-tag and the **Default Port VID** (or **Port VID MAC Address Mapping**, if valid) is used for the C-tag.
Active Configuration, Default Port VID	This is the value of the parameter of the same name, configured above.
Active Configuration, MAC Address VID Map	This is the listing of the MAC address VIDs configured in **Port VID MAC Address Mapping**.
Active Configuration, Management VID	This is the value of the parameter of the same name, configured above.
Active Configuration, SM Management VID Pass-Through	This is the value of the parameter of the same name, configured above.
Active Configuration, Dynamic Aging Timeout	This is the value of the **VLAN Aging Timeout** parameter configured above.
Active Configuration, Allow Learning	**Yes** is displayed if the value of the **Dynamic Learning** parameter above is **Enabled**. No is displayed if the value of **Dynamic Learning** is **Disabled**.

Active Configuration, Allow Frame Type	This displays the selection that was made from the drop-down list at the **Allow Frame Types** parameter above.
Active Configuration, QinQ	This is set to **Enabled** if **VLAN Port Type is** set to **QinQ**, and is set to **Disabled** if **VLAN Port Type** is set to **Q**.
Active Configuration, QinQ EthType	This is the value of the QinQ EtherType configured in the AP.
Active Configuration, Allow QinQ Tagged Frames	This is the value of **Accept QinQ Frames**, configured above.
Active Configuration, Current VID Member Set, VID Number	This column lists the ID numbers of the VLANs in which this module is a member, whether through assignment or through dynamic learning.
Active Configuration, Current VID Member Set, Type	For each VID number in the first column, the entry in this column correlates the way in which the module became and continues to be a member: **Permanent**—This indicates that the module was assigned the VID number through direct configuration by the operator. **Dynamic**—This indicates that the module adopted the VID number through enabled dynamic learning, when a tagged packet from a SM behind it in the network or from a customer equipment that is behind the SM in this case, was read.
Active Configuration, Current VID Member Set, Age	For each VID number in the first column of the table, the entry in this column reflects whether or when the VID number will time out: **Permanent** type - Number never times out and this is indicated by the digit 0. **Dynamic** type - **Age** reflects what is configured in the **VLAN Aging Timeout** parameter in the **Configuration** => **VLAN** tab of the AP or reflects a fewer number of minutes that represents the difference between what was configured and what has elapsed since the VID was learned. Each minute, the Age decreases by one until, at zero, the AP deletes the learned VID, but can it again from packets sent by elements that are beneath it in the network. **Note** Values in this Active Configuration block can differ from attempted values in configurations: The AP can override the value that the SM has configured for SM Management VID Pass-Through.

VLAN Membership tab of SM

The **Configuration > VLAN > VLAN Membership** tab is explained in Table 97.

Table 97 SM VLAN Membership attributes



VLAN Membership Configuration

VLAN Membership Table Configuration : 10 (Range : 1 — 4094)

Add Member | Remove Member

VLAN Membership Table

```
VLAN Membership Table VID Number   Type   Age
---------------------------
10    Static
```

Attribute	Meaning
VLAN Membership Table Configuration	For each VLAN in which you want the AP to be a member, enter the VLAN ID and then click the **Add Member** button. Similarly, for any VLAN in which you want the AP to no longer be a member, enter the VLAN ID and then click the **Remove Member** button.

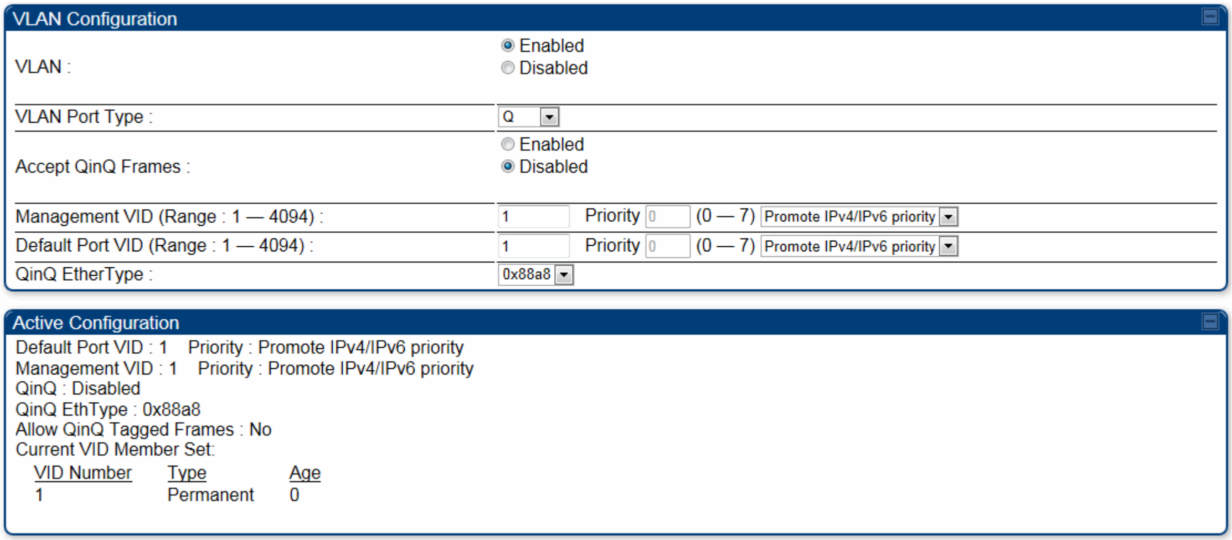
VLAN configuration for PTP

Applicable products	PTP: ☑ BHM ☑ BMS

VLAN page of BHM

The VLAN tab of BHS is explained in Table 98.

Table 98 BHM VLAN page attributs



VLAN Configuration

VLAN :	● Enabled ○ Disabled
VLAN Port Type :	Q
Accept QinQ Frames :	○ Enabled ● Disabled
Management VID (Range : 1 — 4094) :	1 Priority 0 (0 — 7) Promote IPv4/IPv6 priority
Default Port VID (Range : 1 — 4094) :	1 Priority 0 (0 — 7) Promote IPv4/IPv6 priority
QinQ EtherType :	0x88a8

Active Configuration

```
Default Port VID : 1    Priority : Promote IPv4/IPv6 priority
Management VID : 1    Priority : Promote IPv4/IPv6 priority
QinQ : Disabled
QinQ EthType : 0x88a8
Allow QinQ Tagged Frames : No
Current VID Member Set:
    VID Number      Type          Age
    1               Permanent     0
```

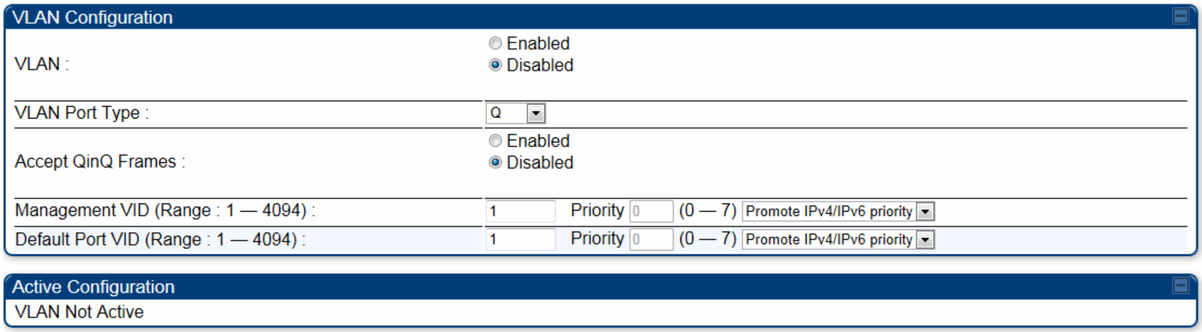
<table>
<tr><th>Attribute</th><th>Meaning</th></tr>
<tr><td>VLAN</td><td>Specify whether VLAN functionality for the BHM and all linked BHS must be (**Enabled**) or may not (**Disabled**) be allowed. The default value is **Disabled**.</td></tr>
<tr><td>VLAN Port Type</td><td>By default this is Q, indicating that it is to operate in the existing manner. The other option is Q-in-Q, which indicates that it must be adding and removing the S-Tag, and adding a C-Tag if necessary for untagged packets. The VLAN Port type corresponds to the Ethernet port of the BHS. Currently, the internal management interfaces will always operate as Q ports.</td></tr>
<tr><td>Accept QinQ Frames</td><td>This option is valid for the Q-in-Q port so that the user may force blocking of existing 802.1ad Q-in-Q frames. This way, only untagged or single tagged packets will come in and out of the Ethernet interface. If a Q-in-Q frame is about ingress or egress the Ethernet interface and this is disabled, it is dropped and a filter entry will show up on the VLAN Statistics page as DVLAN Egress or DVLAN Ingress.</td></tr>
<tr><td>Management VID
(Range 1-4094)</td><td>Enter the VID that the BHS must share with the BHM. The range of values is 1 to 4095. The default value is **1**.</td></tr>
<tr><td>Default Port VID
(Range 1-4094)</td><td>This is the VID that is used for untagged frames and corresponds to the Q-Tag for 802.1Q frames (if VLAN Port Type is Q), or the C-Tag for 802.1ad frames (if the VLAN Port Type is Q-in- Q).</td></tr>
<tr><td>QinQ Ether Type</td><td>Modules can be configured with 802.1ad Q-in-Q DVLAN (Double-VLAN) tagging which is a way for an operator to put an 802.1Q VLAN inside of an 802.1ad VLAN. A nested VLAN, which is the original 802.1Q tag and a new second 802.1ad tag, allows for bridging of VLAN traffic across a network and segregates the broadcast domains of 802.1Q VLANs. Q-in-Q can be used with PPPoE and/or NAT.
The 802.1ad standard defines the S-VLAN as the Service Provider VLAN and the C-VLAN as the customer VLAN. The radio software does 2 layer Q-in-Q whereby the C-VLAN is the 802.1Q tag and the S-VLAN is the second layer Q tag as shown below:
<table>
<tr><td>Ethernet Header</td><td>S-VLAN EthType 0x88a8</td><td>C-VLAN EthType 0x8100</td><td>IP Data EthType 0x0800</td></tr>
</table>
The 802.1ad S-VLAN is the outer VLAN that is configurable on the **Configuration > VLAN** web page of the BHM. The Q-in-Q EtherType parameter is configured with a default EtherType of 0x88a8 in addition to four alternate EtherTypes that can be configured to aid in interoperability with existing networks that use a different EtherType than the default.</td></tr>
</table>

	The C-VLAN is the inner VLAN tag, which is the same as 802.1Q. As a top level concept, this operates on the outermost tag at any given time, either “pushing” a tag on or “popping” a tag off. This means packets will at most transition from an 802.1Q frame to an 801.ad frame (with a tag “pushed” on) or an untagged 802.1 frame (with the tag “popped” off. Similarly, for an 802.1ad frame, this can only transition from an 802.1ad frame to an 802.1Q frame (with the tag “popped” off) since the radio software only supports 2 levels of tags.
VLAN Not Active	When VLAN is enabled in the BHM, the Active Configuration block provides the following details as read-only information in this tab. In the Cambium fixed wireless broadband IP network, each device of any type is automatically a permanent member of VID 1. This facilitates deployment of devices that have VLAN enabled with those that do not.

VLAN page of BHS

The VLAN tab of BHS is explained in Table 99.

Table 99 BHS VLAN page attributes



VLAN Configuration

VLAN :	○ Enabled ● Disabled
VLAN Port Type :	Q
Accept QinQ Frames :	○ Enabled ● Disabled
Management VID (Range : 1 — 4094) :	1 Priority 0 (0 — 7) Promote IPv4/IPv6 priority
Default Port VID (Range : 1 — 4094) :	1 Priority 0 (0 — 7) Promote IPv4/IPv6 priority

Active Configuration

VLAN Not Active

Attribute	Meaning
VLAN	Specify whether VLAN functionality for the BHM and all linked BHS must be (Enabled) or may not (Disabled) be allowed. The default value is Disabled.
VLAN Port Type	By default this is Q, indicating that it is to operate in the existing manner. The other option is Q-in-Q, which indicates that it must be adding and removing the S-Tag, and adding a C-Tag if necessary for untagged packets. The VLAN Port type corresponds to the Ethernet port of the BHS. Currently, the internal management interfaces will always operate as Q ports.
Accept QinQ Frames	This option is valid for the Q-in-Q port so that the user may force blocking of existing 802.1ad Q-in-Q frames. This way, only untagged or single tagged packets will come in and out of the Ethernet interface. If a Q-in-Q frame is about ingress or egress the Ethernet interface and this is disabled, it is dropped and a filter entry will show up on the VLAN Statistics page as DVLAN Egress or DVLAN Ingress.
Management VID (Range 1-4094)	Enter the VID that the BHS must share with the BHM. The range of values is 1 to 4095. The default value is 1.
Default Port VID (Range 1-4094)	This is the VID that is used for untagged frames and corresponds to the Q-Tag for 802.1Q frames (if VLAN Port Type is Q), or the C-Tag for 802.1ad frames (if the VLAN Port Type is Q-in- Q).
VLAN Not Active	When VLAN is enabled in the BHM, the Active Configuration block provides the following details as read-only information in this tab. In the Cambium fixed wireless broadband IP network, each device of any type is automatically a permanent member of VID 1. This facilitates deployment of devices that have VLAN enabled with those that do not.

PPPoE page of SM

Applicable products	**PMP :**	☑	SM

Point-to-Point Protocol over Ethernet (PPPoE) is a protocol that encapsulates PPP frames inside Ethernet frames (at Ethernet speeds). Benefits to the network operator may include

- Access control
- Service monitoring
- Generation of statistics about activities of the customer
- Re-use of infrastructure and operational practices by operators who already use PPP for other networks

PPPoE options are configurable for the SM only, and the AP indicates whether or not PPPoE is enabled for a specific subscriber.

When PPPoE is enabled, once the RF session comes up between the SM and the AP, the SM will immediately attempt to connect to the PPPoE Server. You can monitor the status of this by viewing the PPPoE Session Log in the Logs section (Administrator only). Every time the RF session comes up, the SM will check the status of the link and if it is down, the SM will attempt to redial the link if necessary depending on the Timer Type. Also, on the Configuration page, the user may 'Connect' or 'Disconnect' the session manually. This can be used to override the session to force a manual disconnect and/or reconnect if there is a problem with the session.

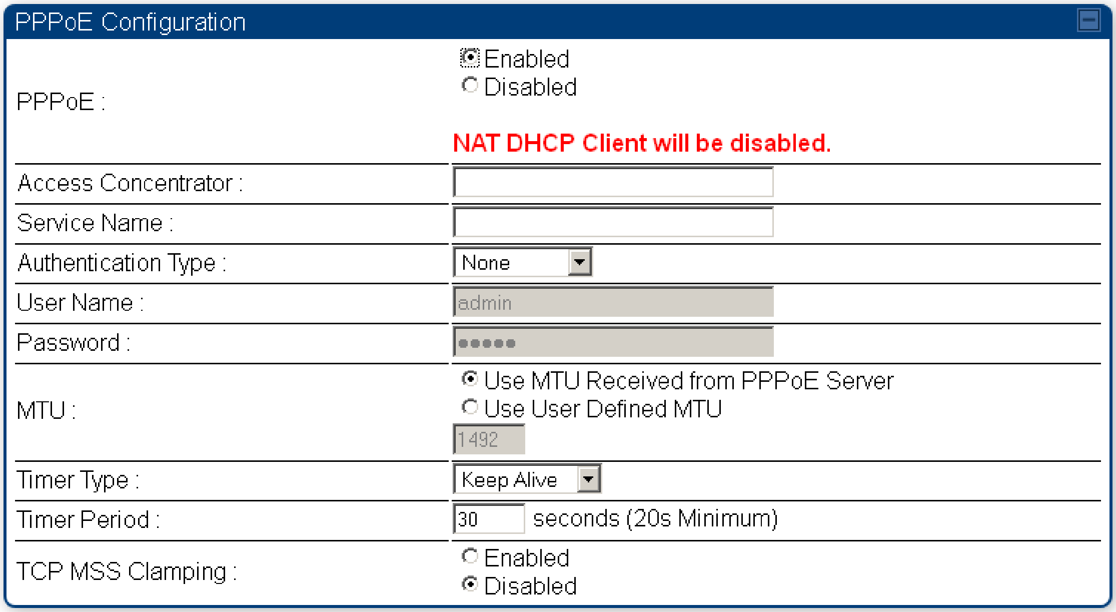
In order to enable PPPoE, NAT MUST be enabled on the SM and Translation Bridging MUST be disabled on the AP. These items is strictly enforced for you when you are trying to enable PPPoE. A message will indicate any prerequisites not being met. Also, the NAT Public IP DHCP client cannot be enabled, because the NAT Public IP is received through the IPCP process of the PPPoE discovery stages.

The pre-requisites are:

- NAT MUST be enabled on the SM
  - NAT DHCP Client is disabled automatically. The NAT public IP is received from the PPPoE Server.
  - NAT Public Network Interface Configuration will not be used and must be left to defaults. Also NAT Public IP DHCP is disabled if it is enabled.
- Translation Bridging MUST be DISABLED on the AP
  - This will only be determined if the SM is in session since the SM won't know the AP configuration otherwise. If the SM is not in session, PPPoE can be enabled but if the SM goes into session to a Translation Bridge-enabled AP, then PPPoE will not be enabled.

The PPPoE configuration parameters are explained in Table 100.

Table 100 SM PPPoE attributes



PPPoE Configuration

PPPoE :	● Enabled ○ Disabled NAT DHCP Client will be disabled.
Access Concentrator :	
Service Name :	
Authentication Type :	None
User Name :	admin
Password :	●●●●●
MTU :	● Use MTU Received from PPPoE Server ○ Use User Defined MTU 1492
Timer Type :	Keep Alive
Timer Period :	30 seconds (20s Minimum)
TCP MSS Clamping :	○ Enabled ● Disabled

Attribute	Meaning
Access Concentrator	An optional entry to set a specific access concentrator to connect to for the PPPoE session. If this is blank, the SM will accept the first access concentrator which matches the service name (if specified). This is limited to 32 characters.
Service Name	An optional entry to set a specific service name to connect to for the PPPoE session. If this is left blank the SM will accept the first service option that comes back from the access concentrator specified above, if any. This is limited to 32 characters.
Authentication Type	**None** means that no PPPoE authentication is implemented **CHAP/PAP** means that CHAP authentication is attempted first, then PAP authentication. The same password is used for both types.
User Name	This is the CHAP/PAP user name that is used if CHAP/PAP authentication is selected. If **None** is selected for authentication then this field is unused. This is limited to 32 characters.
Password	This is the CHAP/PAP password that is used if PAP authentication is selected. If **None** is selected for authentication then this field is unused. This is limited to 32 characters.
MTU	**Use MTU Received from PPPoE Server** causes the SM to use the MRU of the PPPoE server received in LCP as the MTU for the PPPoE link.

	Use User Defined MTU allows the operator to specify an MTU value to use to override any MTU that may be determined in the LCP phase of PPPoE session setup. If this is selected, the user is able to enter an MTU value up to 1492. However, if the MTU determined in LCP negotiations is less than this user-specified value, the SM will use the smaller value as its MTU for the PPPoE link.
Timer Type	**Keep Alive** is the default timer type. This timer will enable a keepalive that will check the status of the link periodically. The user can set a keepalive period. If no data is seen from the PPPoE server for that period, the link is taken down and a reconnection attempt is started. For marginal links, the keep alive timer can be useful so that the session will stay alive over periodic dropouts. The keepalive timer must be set such that the session can outlast any session drop. Some PPPoE servers will have a session check timer of their own so that the timeouts of the server and the SM are in sync, to ensure one side does not drop the session prematurely. **Idle Timeout** enables an idle timer that checks the usage of the link from the customer side. If there is no data seen from the customer for the idle timeout period, the PPPoE session is dropped. Once data starts flowing from the customer again, the session is started up again. This timer is useful for users who may not be using the connection frequently. If the session is idle for long periods of time, this timer will allow the resources used by the session to be returned to the server. Once the connection is used again by the customer, the link is reestablished automatically.
Timer Period	The length in seconds of the PPPoE keepalive timer.
TCP MSS Clamping	If this is enabled, then the SM will alter TCP SYN and SYN-ACK packets by changing the Maximum Segment Size to be compatible with the current MTU of the PPPoE link. This way, the user does not have to worry about MTU on the client side for TCP packets. The MSS is set to the current MTU – 40 (20 bytes for IP headers and 20 bytes for TCP headers). This will cause the application on the client side to not send any TCP packets larger than the MTU. If the network is exhibiting large packet loss, try enabling this option. This may not be an option on the PPPoE server itself. The SM will NOT reassemble IP fragments, so if the MTUs are incorrect on the end stations, then MSS clamping will solve the problem for TCP connections.

IP4 and IPv6

Applicable products	PMP :	☑	AP	☑	SM	PTP:	☑	BHM	☑	BMS

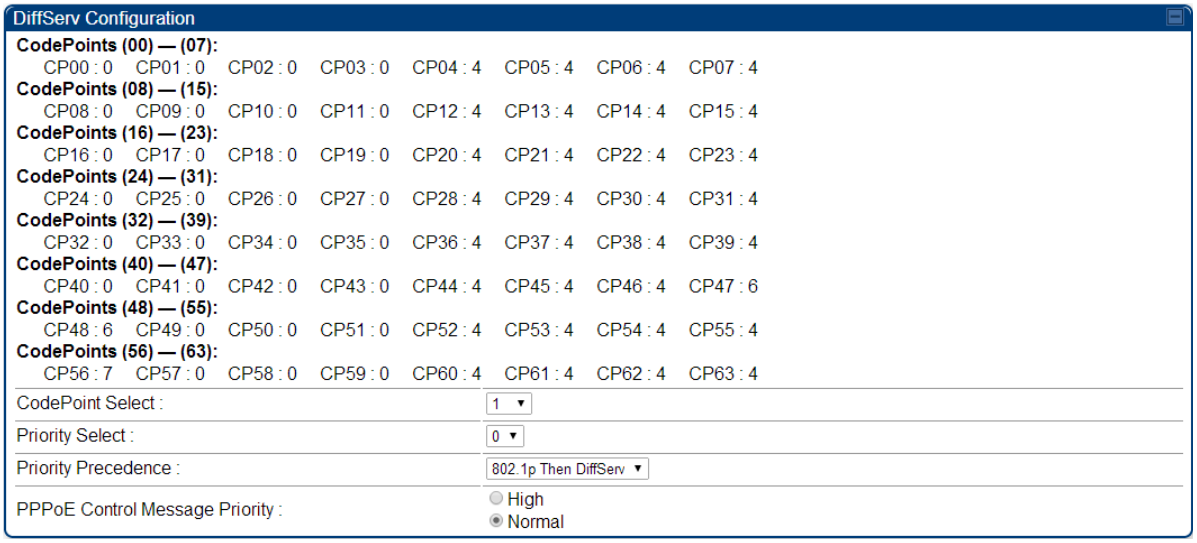
IPv4 and IPv6 Prioritization

450 Platform Family provides operators the ability to prioritize IPv6 traffic in addition to IPv4 traffic. IPv6/IPv4 prioritization can be configured by selecting a CodePoint and the corresponding priority from the GUI of the AP/BHM and the IPv6/IPv4 packet is set up accordingly. There is no GUI option for selecting IPv6 or IPv4 priority. Once the priority is set, it is set for IPv4 and IPv6 packets.

Configuring IPv4 and IPv6 Priority

IPv4 and IPv6 prioritization is set using the DiffServ tab on the AP/BHM and SM/BHS (located at **Configuration > DiffServ**). A priority set to a specific CodePoint will apply to both IPv4 and IPv6 traffic.

Table 101 DiffServ attributes – AP/BHM



DiffServ Configuration

CodePoints (00) — (07):
CP00 : 0 CP01 : 0 CP02 : 0 CP03 : 0 CP04 : 4 CP05 : 4 CP06 : 4 CP07 : 4
CodePoints (08) — (15):
CP08 : 0 CP09 : 0 CP10 : 0 CP11 : 0 CP12 : 4 CP13 : 4 CP14 : 4 CP15 : 4
CodePoints (16) — (23):
CP16 : 0 CP17 : 0 CP18 : 0 CP19 : 0 CP20 : 4 CP21 : 4 CP22 : 4 CP23 : 4
CodePoints (24) — (31):
CP24 : 0 CP25 : 0 CP26 : 0 CP27 : 0 CP28 : 4 CP29 : 4 CP30 : 4 CP31 : 4
CodePoints (32) — (39):
CP32 : 0 CP33 : 0 CP34 : 0 CP35 : 0 CP36 : 4 CP37 : 4 CP38 : 4 CP39 : 4
CodePoints (40) — (47):
CP40 : 0 CP41 : 0 CP42 : 0 CP43 : 0 CP44 : 4 CP45 : 4 CP46 : 4 CP47 : 6
CodePoints (48) — (55):
CP48 : 6 CP49 : 0 CP50 : 0 CP51 : 0 CP52 : 4 CP53 : 4 CP54 : 4 CP55 : 4
CodePoints (56) — (63):
CP56 : 7 CP57 : 0 CP58 : 0 CP59 : 0 CP60 : 4 CP61 : 4 CP62 : 4 CP63 : 4

CodePoint Select :	1 ▾
Priority Select :	0 ▾
Priority Precedence :	802.1p Then DiffServ ▾
PPPoE Control Message Priority :	○ High ● Normal

Attribute	Meaning
CodePoint 1 through CodePoint 47	Priorities of 0 through 3 map to the low-priority channel; 4 through 7 to the high- priority channel. The mappings are the same as 802.1p VLAN priorities.
CodePoint 49 through CodePoint 55	Consistent with RFC 2474 CodePoint 0 is predefined to a fixed priority value of 0 (low-priority channel).
CodePoint 57 through CodePoint 63	CodePoint 48 is predefined to a fixed priority value of 6 (high-priority channel). CodePoint 56 is predefined to a fixed priority value of 7 (high-priority channel).

	Operator cannot change any of these three fixed priority values. Among the settable parameters, the priority values (and therefore the handling of packets in the high or low priority channel) are set in the AP/BHM for all downlinks within the sector and in the SM/BHS for each uplink.
CodePoint Select	This represents the CodePoint Selection to be modified via Priority Select
Priority Select	The priority setting input for the CodePoint selected in CodePoint Select
Priority Precedence	Allows operator to decide if 802.1p or DiffServ priority bits must be used first when making priority decisions.
PPPoE Control Message Priority	Operators may configure the AP/BHM to utilize the high priority channel for PPPoE control messages. Configuring the AP/BHM in this fashion can benefit the continuity of PPPoE connections when there are issues with PPPoE sessions being dropped in the network. This prioritization may be configured in the DiffServ tab in the Configuration menu of the AP/BHM.

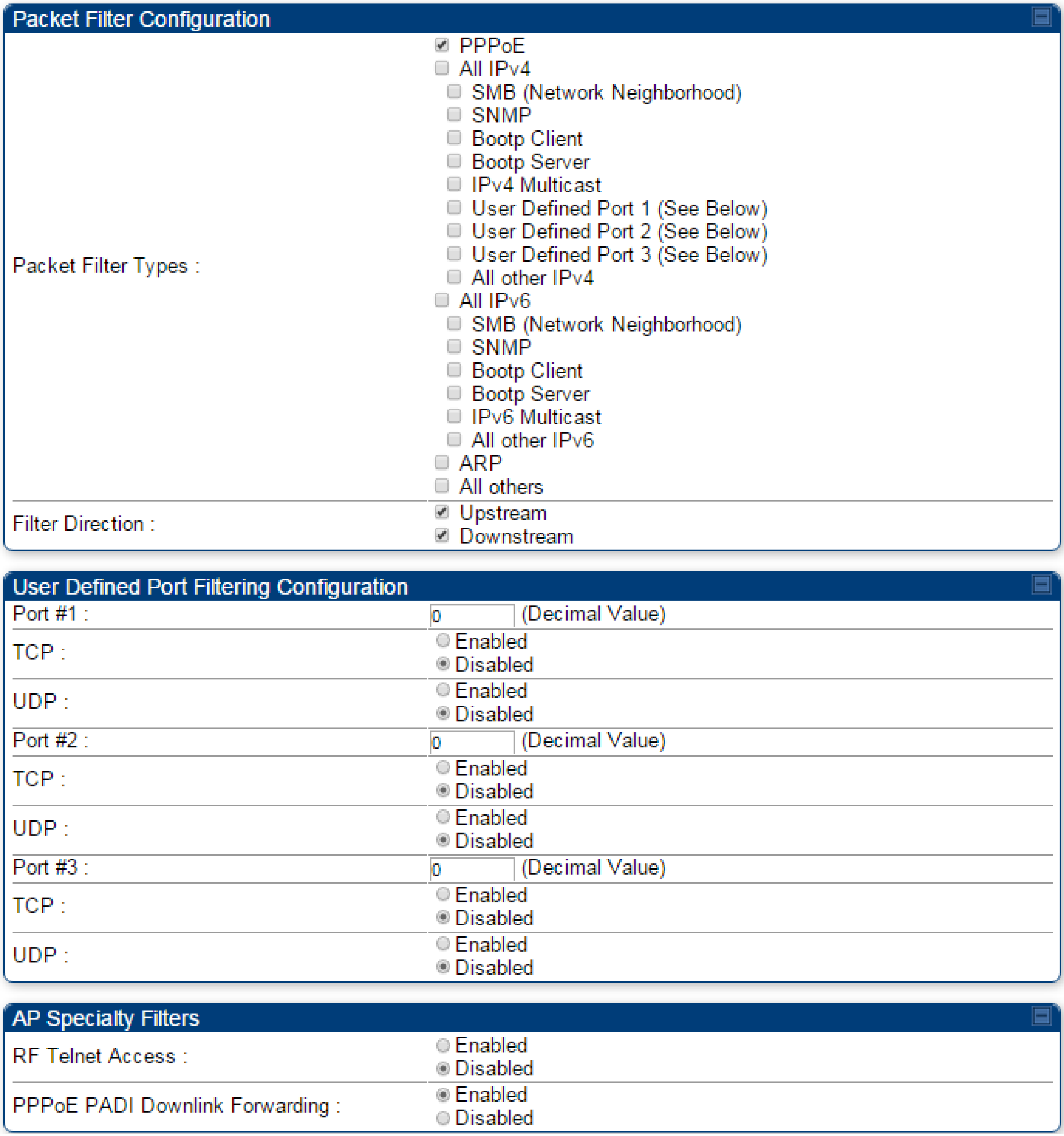
IPv4 and IPv6 Filtering

The operator can filter (block) specified IPv6 protocols including IPv4 and ports from leaving the AP/BHM and SM/BHS and entering the network. This protects the network from both intended and inadvertent packet loading or probing by network users. By keeping the specified protocols or ports off the network, this feature also provides a level of protection to users from each other.

Configuring IPv4 and IPv6 Filtering

IPv6 filters are set using the Protocol Filtering tab on the AP/BHM and SM/BHS (at **Configuration > Protocol Filtering**). Once a filter is set for a packet type, those packets will not be sent over the RF interface depending on “Filter Direction” setting.

Table 102 Packet Filter Configuration attributes



Packet Filter Configuration

Packet Filter Types :	☑ PPPoE □ All IPv4 □ SMB (Network Neighborhood) □ SNMP □ Bootp Client □ Bootp Server □ IPv4 Multicast □ User Defined Port 1 (See Below) □ User Defined Port 2 (See Below) □ User Defined Port 3 (See Below) □ All other IPv4 □ All IPv6 □ SMB (Network Neighborhood) □ SNMP □ Bootp Client □ Bootp Server □ IPv6 Multicast □ All other IPv6 □ ARP □ All others
Filter Direction :	☑ Upstream ☑ Downstream

User Defined Port Filtering Configuration

Port #1 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #2 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #3 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled

AP Specialty Filters

RF Telnet Access :	○ Enabled ● Disabled
PPPoE PADI Downlink Forwarding :	● Enabled ○ Disabled

Attribute	Meaning
Packet Filter Types	For any box selected, the Protocol and Port Filtering feature blocks the associated protocol type. To filter packets in any of the user-defined ports, you must do all of the following: • Check the box for **User Defined Port *n* (See Below)** in the **Packet Filter Types** section of this tab. • Provide a port number at **Port #*n***. in the **User Defined Port Filtering** Configuration section of this tab

	- Enable **TCP** and/or **UDP** by clicking the associated radio button
Filter Direction	Operators may choose to filter upstream (uplink) RF packets or downstream (downlink) RF packets.
User Defined Port Filtering Configuration	You can specify ports for which to block subscriber access, regardless of whether NAT is enabled.

Upgrading the software version and using CNUT

This section consists of the following procedures:

- Checking the installed software version on page 7-136
- Upgrading to a new software version on page 7-136

Caution

If the link is operational, ensure that the remote end of the link is upgraded first using the wireless connection, and then the local end can be upgraded. Otherwise, the remote end may not be accessible.

Use CNUT 4.10.4 or later version and always refer to the software release notes before upgrading system software. The release notes are available at:

https://support.cambiumnetworks.com/files/pmp450

https://support.cambiumnetworks.com/files/ptp450

Checking the installed software version

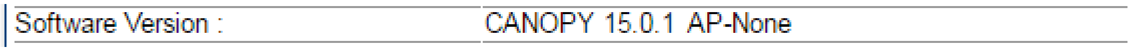
To check the installed software version, follow these instructions:

Procedure 18 Checking the installed software version

1 Click on **General** tab under **Home** menu.

2 Note the installed Software Version (under Device Information):

PMP/PTP 450/450i/450m



Software Version : CANOPY 15.0.1 AP-None

3 Go to the support website (see Contacting Cambium Networks on page 1) and find Point-to-Multipoint software updates. Check that the latest 450 Platform Family software version is the same as the installed Software Version.

4 To upgrade software to the latest version, see Upgrading to a new software version on page 7-136.

Upgrading to a new software version

All 450 platform modules are upgraded using the Canopy Network Updater Tool. The Canopy Network Updater Tool (CNUT) manages and automates the software upgrade process for a Canopy radio, or CMM4 (but not its 14-port switch) across the network. This eliminates the need for an administrator to visit each radio in the network (or each AP/BHM while using the Autoupdate feature) to upgrade the modules.

Note

Please ensure that you have the most up-to-date version of CNUT by browsing to the Customer Support Web Page located: http://www.cambiumnetworks.com/support/management-tools/cnut

This section includes an example of updating a single unit before deployment. System-wide upgrading procedures may be found in the *CNUT Online Help* manual, which can be found on the Cambium support website (see Contacting Cambium Networks on page 1).

CNUT functions

The Canopy Network Updater tool has the following functions:

- Automatically discovers all network elements
- Executes a UDP command that initiates and terminates the Auto-update mode within APs/BHMs. This command is both secure and convenient:
    - For security, the AP/BHM accepts this command from only the IP address that you specify in the Configuration page of the AP/BHM.
    - For convenience, Network Updater automatically sets this Configuration parameter in the APs/BHMs to the IP address of the Network Updater server when the server performs any of the update commands.
- CNUT supports HTTP and HTTPS
- Allows you to choose the following among updating:
    - Your entire network.
    - Only elements that you select.
    - Only network branches that you select.
- Provides a Script Engine that you can use with any script that:
    - You define.
    - Cambium supplies.
- Configurability of any of the following to be the file server for image files:
    - The AP/BHM, for traditional file serving via UDP commands and monitoring via UDP messaging
    - CNUT HTTP/HTTPS Server, for upgrading via SNMP commands and monitoring via SNMP messaging. This also supports an option to either set the image order specifically for this file server or to allow the AP to determine the order.
    - Local TFTP Server, for traditional file serving via UDP commands and monitoring via UDP messaging. This supports setting the number of simultaneous image transfers per AP/BHM
- The capability to launch a test of connectivity and operational status of the local HTTP, HTTPS and TFTP file servers
- An interface that supports efficient specification of the proper IP address for the local file server(s) where Network Updater resides on a multi-homed computer
- An md5 checksum calculator utility for identifying corruption of downloaded image files before Network Updater is set to apply them.

Network element groups

With the Canopy Network Updater Tool, you can identify element groups composed of network elements that you select. Identifying these element groups does the following:

- Organizes the display of elements (for example, by region or by AP/BHM cluster).
- Allows to:
  - Perform an operation on all elements in the group simultaneously.
  - Set group-level defaults for ftp password access and SNMP Community String (defaults that can be overridden in an individual element when necessary).

Network layers

A typical network contains multiple layers of elements, with each layer farther from the Point of Presence. For example, SMs (or BHS) are behind an AP/BHM and thus, in this context, at a lower layer than the AP/BHM. Correctly portraying these layers in Network Updater is essential so that Network Updater can perform radio and AP/BHM cluster upgrades in an appropriate order.

Script engine

Script Engine is the capability in Network Updater that executes any user-defined script against any network element or element group. This capability is useful for network management, especially for scripts that you repetitively execute across your network.

The Autodiscovery capability in Network Updater finds all of your network elements.
This comprehensive discovery:

- Ensures that, when you intend to execute a script against *all* elements, the script is indeed executed against *all* elements.
- Maintains master lists of elements (element groups) against which you selectively execute scripts.

The following scripts are included with CNUT:

- Gather Customer Support Information
- Set Access Point Authentication Mode
- Set Autoupdate Address on APs/BHMs
- Set SNMP Accessibility
- Reset Unit

Software dependencies for CNUT

CNUT functionality requires

- one of the following operating systems
  - Windows® 2000
  - Windows Server 2003
  - Windows 7 and Windows 8
  - Windows XP or XP Professional
  - Red Hat Enterprise Linux (32-bit) Version 4 or 5
- Java™ Runtime Version 2.0 or later (installed by the CNUT installation tool)

CNUT download

CNUT can be downloaded together with each system release that supports CNUT. Software for these system releases is available from http://www.cambiumnetworks.com/support/management-tools/cnut/, as either:

- A `.zip` file for use without the CNUT application.
- A `.pkg` file that the CNUT application can open.

Upgrading a module prior to deployment

To upgrade to a new software version, follow this:

Procedure 19 Upgrading a module prior to deployment

1. Go to the support website (see Contacting Cambium Networks on page 1) and find Point-to-Multipoint software updates. Download and save the required software image.
2. Start CNUT
3. If you don't start up with a blank new network file in CNUT, then open a new network file with the **New Network Archive** operation (located at **File > New Network**).
4. Enter a new network element to the empty network tree5-9 using the **Add Elements to Network Root** operation (located at **Edit > Add Elements to Network Root**).
5. In the **Add Elements** dialogue, select a type of **Access Point** or **Subscriber Module** and enter the IP address of **169.254.1.1**.
6. Make sure that the proper Installation Package is active with the **Package Manager** dialogue (located at **Update > Manage Packages**).
7. To verify connectivity with the radio, perform a **Refresh**, **Discover Entire Network** operation (located at **View > Refresh/Discover Entire Network**). You must see the details columns for the new element filled in with ESN and software version information.
8. Initiate the upgrade of the radio using **Update Entire Network Root** operation (located at **Update > Update Entire Network Root**). When this operation finishes, the radio is done being upgraded.

General configuration

The **Configuration > General** page of the AP/BMH or BHM/BHS contains many of the configurable parameters that define how the ratio's operate in sector or backhaul.

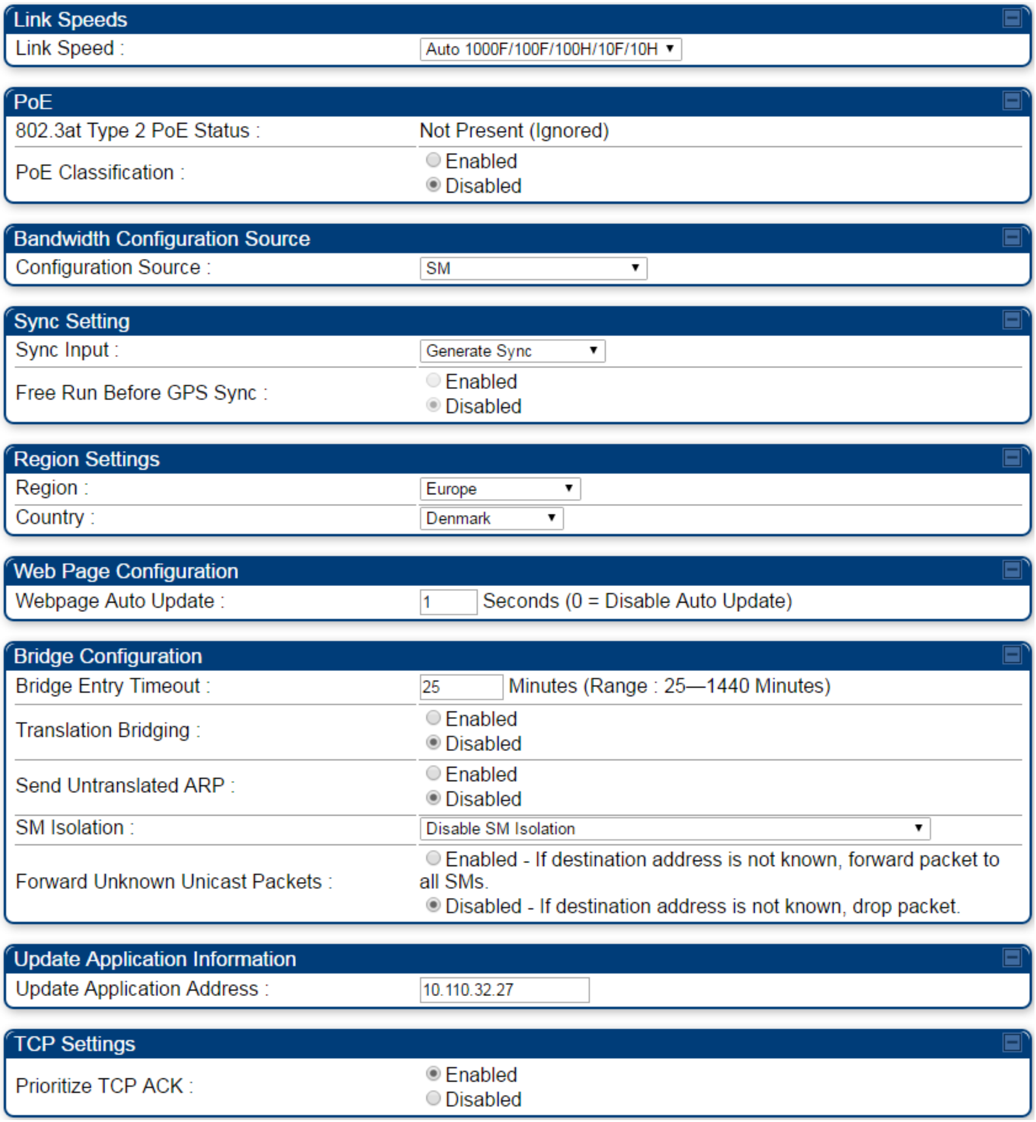
Applicable products	**PMP :**	☑ AP	☑ SM	**PTP:**	☑ BHM	☑ BMS

PMP 450m and PMP/PTP 450i Series

General page - PMP 450m AP / PMP 450i AP

The General page of AP is explained in Table 103. The General page of PMP 450 SM looks same as PMP 450i AP.

Table 103 General page attributes – PMP 450i AP / PMP 450m AP



Link Speeds	
Link Speed :	Auto 1000F/100F/100H/10F/10H ▾

PoE	
802.3at Type 2 PoE Status :	Not Present (Ignored)
PoE Classification :	○ Enabled ● Disabled

Bandwidth Configuration Source	
Configuration Source :	SM ▾

Sync Setting	
Sync Input :	Generate Sync ▾
Free Run Before GPS Sync :	○ Enabled ● Disabled

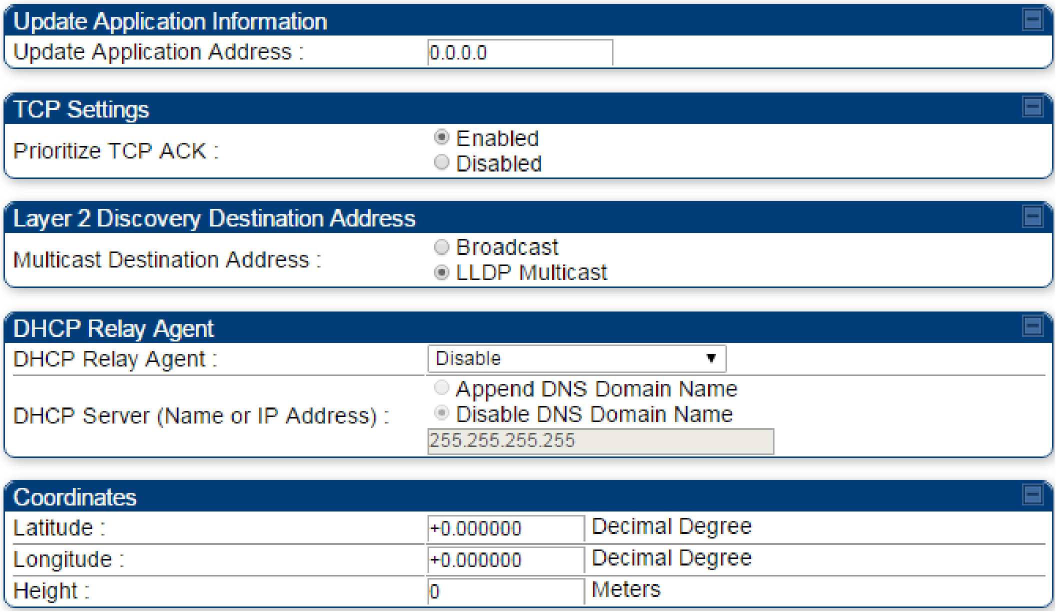
Region Settings	
Region :	Europe ▾
Country :	Denmark ▾

Web Page Configuration	
Webpage Auto Update :	1 Seconds (0 = Disable Auto Update)

Bridge Configuration	
Bridge Entry Timeout :	25 Minutes (Range : 25—1440 Minutes)
Translation Bridging :	○ Enabled ● Disabled
Send Untranslated ARP :	○ Enabled ● Disabled
SM Isolation :	Disable SM Isolation ▾
Forward Unknown Unicast Packets :	○ Enabled - If destination address is not known, forward packet to all SMs. ● Disabled - If destination address is not known, drop packet.

Update Application Information	
Update Application Address :	10.110.32.27

TCP Settings	
Prioritize TCP ACK :	● Enabled ○ Disabled



Update Application Information

Update Application Address : 0.0.0.0

TCP Settings

Prioritize TCP ACK : ● Enabled ○ Disabled

Layer 2 Discovery Destination Address

Multicast Destination Address : ○ Broadcast ● LLDP Multicast

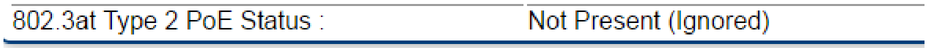
DHCP Relay Agent

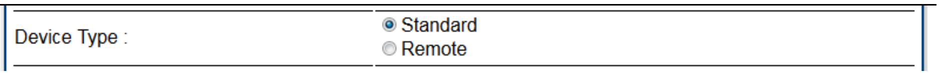
DHCP Relay Agent : Disable

DHCP Server (Name or IP Address) : ○ Append DNS Domain Name ● Disable DNS Domain Name 255.255.255.255

Coordinates

Latitude :	+0.000000	Decimal Degree
Longitude :	+0.000000	Decimal Degree
Height :	0	Meters

Attribute	Meaning
Link Speeds	From the drop-down list of options, select the type of link speed for the Ethernet connection. The default for this parameter is that all speeds are selected: **Auto 100F/100H/10F/10H**. In this setting, the two ends of the link automatically negotiate with each other whether the speed that they will use is 10 Mbps or 100 Mbps and whether the Ethernet traffic is full duplex or half duplex. However,137 Ethernet links work best when either: • both ends are set to the same forced selection • both ends are set to auto-negotiate and both have capability in least one common speed and traffic type combination.
802.3at Type 2 PoE Status and PoE Classification (PMP 450i Series only)	When the PoE Classification functionality is enabled and if Type 2 power is not present, the PAs do not power up and draw too much power. By default, the PoE Classification feature is disabled and the PAs will power up regardless of the classification presented by the power source. This is supported only on 450i series devices. PoE Classification configuration status also can be check under home > General > Device Information tab:  802.3at Type 2 PoE Status : Not Present (Ignored)
Configuration Source	See Setting the Configuration Source on page 7-260.
Sync Input	See Configuring synchronization on page 7-163
Device Type	**Standard**: The Autosync mechanism will source GPS synchronization from the AP's RJ-11 port, the AP's power port, or from the device on-board GPS module. **Remote**: The Autosync mechanism will source GPS synchronization from the AP's RJ-11 port or from the device on-board GPS module.

	 Device Type : ● Standard ○ Remote
Region	From the drop-down list, select the region in which the radio is operating.
Country	From the drop-down list, select the country in which the radio is operating. Unlike selections in other parameters, your **Country** selection requires a **Save Changes** and a **Reboot** cycle before it will force the context-sensitive GUI to display related options (for example, **Alternate Frequency Carrier** ***1 and 2*** in the **Configuration** > **Radio** tab). PMP 450i Series ODUs shipped to the United States is locked to a Region Code setting of "United States". Units shipped to regions other than the United States must be configured with the corresponding Region Code to comply with local regulatory requirements. Country Code settings affect the radios in the following ways: • Maximum transmit power limiting (based on radio transmitter power plus configured antenna gain) • DFS operation is enabled based on the configured region code, if applicable For more information on how transmit power limiting and DFS is implemented for each country, see the *PMP 450 Planning Guide*.
Webpage Auto Update	Enter the frequency (in seconds) for the web browser to automatically refresh the web-based interface. The default setting is 0. The 0 setting causes the web-based interface to never be automatically refreshed.
Bridge Entry Timeout	Specify the appropriate bridge timeout for correct network operation with the existing network infrastructure. The Bridge Entry Timeout must be a longer period than the ARP (Address Resolution Protocol) cache timeout of the router that feeds the network. **Caution** An inappropriately low Bridge Entry Timeout setting may lead to temporary loss of communication with some end users.
Translation Bridging	Optionally, you can configure the AP to change the source MAC address in every packet it receives from its SMs to the MAC address of the SM that bridged the packet, before forwarding the packet toward the public network. If you do, then: Not more than 10 IP devices at any time are valid to send data to the AP from behind the SM. SM populates the Translation Table tab of its Statistics web page, displaying the MAC address and IP address of all the valid connected devices.

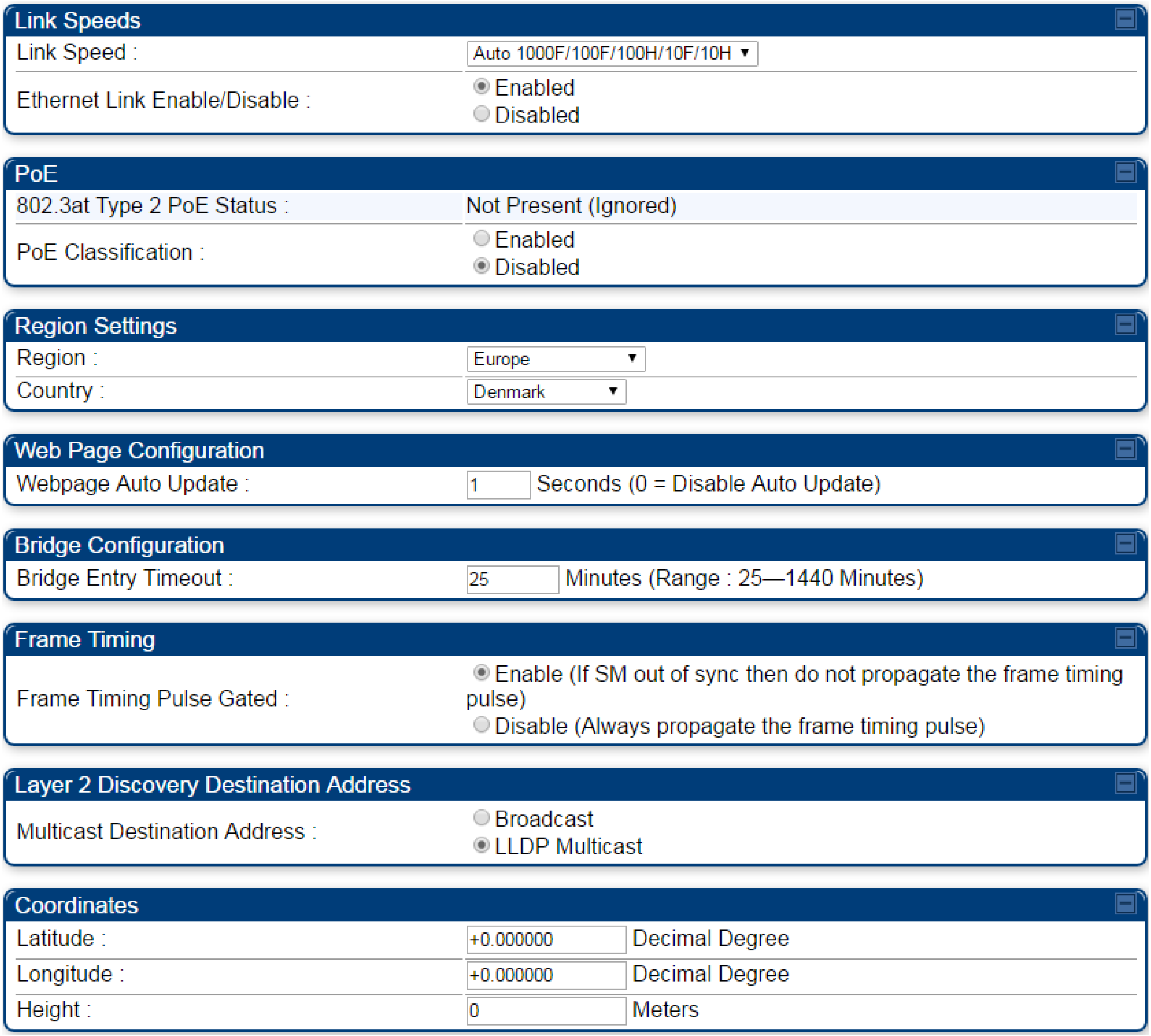
	Each entry in the Translation Table is associated with the number of minutes that have elapsed since the last packet transfer between the connected device and the SM. If 10 are connected and another attempts to connect: If no Translation Table entry is older than 255 minutes, the attempt is ignored. If an entry is older than 255 minutes, the oldest entry is removed and the attempt is successful. the Send Untranslated ARP parameter in the General tab of the Configuration page can be: Disabled, so that the AP overwrites the MAC address in Address Resolution Protocol (ARP) packets before forwarding them. Enabled, so that the AP forwards ARP packets regardless of whether it has overwritten the MAC address. When this feature is disabled, the setting of the **Send Untranslated ARP** parameter has no effect, because all packets are forwarded untranslated (with the source MAC address intact).
Send Untranslated ARP	If the **Translation Bridging** parameter is set to **Enabled**, then the **Send Untranslated ARP** parameter can be: **Disabled -** so that the AP will overwrite the MAC address in Address Resolution Protocol (ARP) packets before forwarding them. **Enabled -** so that the AP will forward ARP packets regardless of whether it has overwritten the MAC address. If the **Translation Bridging** parameter is set to **Disabled**, then the **Send Untranslated ARP** parameter has no effect.
SM Isolation	Prevent or allow SM-to-SM communication by selecting from the following drop-down menu items: **Disable SM Isolation** (the default selection). This allows full communication between SMs. **Block SM Packets from being forwarded**. This prevents both multicast/broadcast and unicast SM-to-SM communication. **Block and Forward SM Packets to Backbone**. This not only prevents multicast/broadcast and unicast SM-to-SM communication but also sends the packets, which otherwise are handled SM to SM, through the Ethernet port of the AP.
Forward Unknown Unicast Packets	**Enabled**: All unknown Unicast packets (no entry in the AP's bridge table) received via the AP's Ethernet LAN interface are forwarded to registered SMs. If the target device is situated beneath a particular SM, when the device responds the SM and AP will learn and add the device to their bridge tables so that subsequent packets to that device is bridged to the proper SM. **Disabled**: All unknown Unicast packets (no entry in the AP's bridge table) received via the AP's Ethernet LAN interface are discarded at the AP.

Update Application Address	Enter the address of the server to access for software updates on this AP and registered SMs.
Prioritize TCP ACK	To reduce the likelihood of TCP acknowledgement packets being dropped, set this parameter to **Enabled**. This can improve throughput that the end user perceives during transient periods of congestion on the link that is carrying acknowledgements. This parameter, when enabled, can be particularly useful when running bi-direction FTP sessions over the link. If a link is primarily used for video surveillance, it is recommended to set this parameter to **Disable**.
Multicast Destination Address	Using Link Layer Discovery Protocol (LLDP), a module exchanges multicast addresses with the device to which it is wired on the Ethernet interface. Although some switches (CMM4, for example) do not pass LLDP addresses upward in the network, a radio can pass it as the value of the **Multicast Destination Address** parameter value in the connected device that has it populated.
DHCP Relay Agent	The AP may act as a DHCP relay for SMs and CPEs underneath it. The AP will make use of the DHCP Option 82 (DHCP Relay Agent Information) from RFC 3046 when performing relay functions. The AP offers two types of DHCP relay functionality: **Full Relay Information**. Configuring the DHCP Full Relay Operation will take broadcast DHCP packets and send them to a Unicast server in unicast mode. This way the DHCP requests and replies can be routed like any other UDP packet. **Only Insert Option 82**. This option leaves the DHCP request on its broadcast domain as opposed to DHCP Full Relay Operation which will turn it into a unicast packet. In order to accommodate setting up pools or classes for different VLANs, the Option 82 field will include information to tell the server what VLAN the client is on.
DHCP Server (Name or IP Address)	The DHCP relay server may be either a DNS name or a static IP address in dotted decimal notation. Additionally the management DNS domain name may be toggled such that the name of the DHCP relay server only needs to be specified and the DNS domain name is automatically appended to that name. The default DHCP relay server addresses is 255.255.255.255 with the appending of the DNS domain name disabled.
Latitude Longitude Height	Physical radio location data may be configured via the **Latitude**, **Longitude** and **Height** fields. Latitude and Longitude is measured in *Decimal Degree* while the Height is calculated in *Meters.*

General page - PMP 450i SM

The General page of PMP 450i SM is explained in Table 104. The General page of PMP 450 SM looks same as PMP 450i SM.

Table 104 General page attributes – PMP 450i SM



Link Speeds

Link Speed : Auto 1000F/100F/100H/10F/10H ▾

Ethernet Link Enable/Disable : ● Enabled ○ Disabled

PoE

802.3at Type 2 PoE Status : Not Present (Ignored)

PoE Classification : ○ Enabled ● Disabled

Region Settings

Region : Europe ▾

Country : Denmark ▾

Web Page Configuration

Webpage Auto Update : 1 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout : 25 Minutes (Range : 25—1440 Minutes)

Frame Timing

Frame Timing Pulse Gated : ● Enable (If SM out of sync then do not propagate the frame timing pulse) ○ Disable (Always propagate the frame timing pulse)

Layer 2 Discovery Destination Address

Multicast Destination Address : ○ Broadcast ● LLDP Multicast

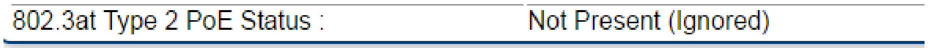
Coordinates

Latitude : +0.000000 Decimal Degree

Longitude : +0.000000 Decimal Degree

Height : 0 Meters

Attribute	Meaning
Link Speeds	From the drop-down list of options, select the type of link speed for the Ethernet connection. The default for this parameter is that all speeds are selected. The recommended setting is a single speed selection for all APs and SMs in the operator network.
802.3at Type 2 PoE Status and PoE Classification	When the PoE Classification functionality is enabled and if Type 2 power is not present, the PAs do not power up and draw too much power. By default, the PoE Classification feature is disabled and the PAs will power up regardless of the classification presented by the power source. This is supported only on 450i series ODUs.

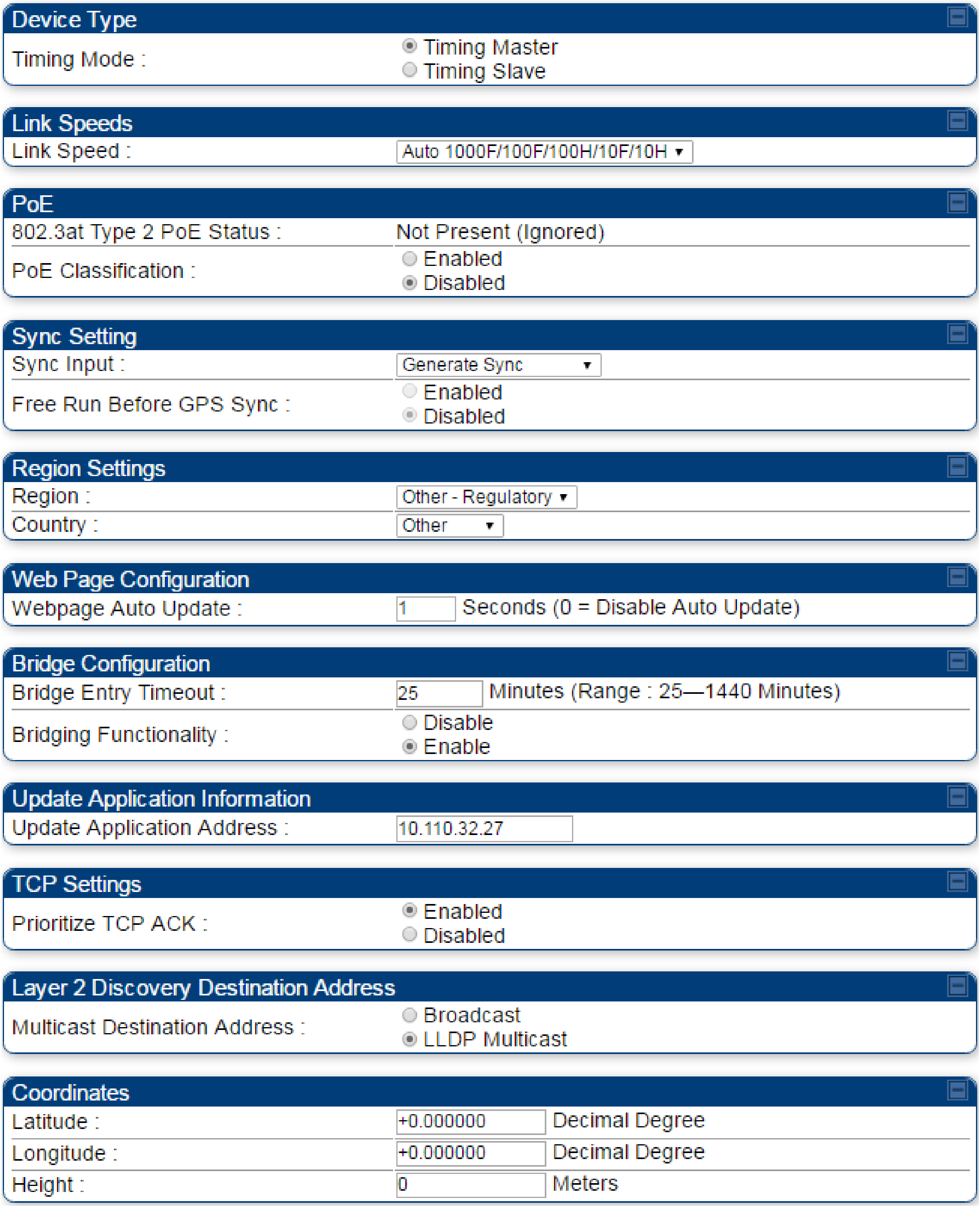
	PoE Classification configuration status also can be check under home > General > Device Information tab:  802.3at Type 2 PoE Status : Not Present (Ignored)
Ethernet Link Enable/Disable	Specify whether to enable or disable Ethernet/802.3 connectivity on the wired port of the SM. This parameter has no effect on the wireless link. When you select **Enable**, this feature allows traffic on the Ethernet/802.3 port. This is the factory default state of the port. When you select **Disable**, this feature prevents traffic on the port. Typical cases of when you may want to select **Disable** include: The subscriber is delinquent with payment(s). You suspect that the subscriber is sending or flooding undesired broadcast packets into the network, such as when • a virus is present in the subscriber's computing device. • the subscriber's home router is improperly configured.
Region	This parameter allows you to set the region in which the radio will operate. The SM radio automatically inherits the Region type of the master. This behavior ignores the value of the **Region** parameter in the SM, even when the value is **None**. Nevertheless, since future system software releases may read the value in order to configure some other region-sensitive feature(s), this parameter must be always set to the value that corresponds to the local region.
Country	This parameter allows you to set the country in which the radio will operate. The SM radio automatically inherits the Country Code type of the master. This behavior ignores the value of the **Country** parameter in the SM, even when the value is **None**. Nevertheless, since future system software releases may read the value in order to configure some other region-sensitive feature(s), this parameter must be always set to the value that corresponds to the local region. PMP/PTP 450i Series ODU shipped to the United States is locked to a Region Code setting of “United States”. Units shipped to regions other than the United States must be configured with the corresponding Region Code to comply with local regulatory requirements.
Webpage Auto Update	See Table 103 General page attributes – PMP 450i AP on page 7-140
Bridge Entry Timeout	Specify the appropriate bridge timeout for correct network operation with the existing network infrastructure. Timeout occurs when the AP encounters no activity with the SM (whose MAC address is the bridge entry) within the interval that this parameter specifies. The Bridge Entry Timeout must be a longer period than the ARP (Address Resolution Protocol) cache timeout of the router that feeds the network.

	Caution This parameter governs the timeout interval, even if a router in the system has a longer timeout interval. The default value of this field is *25* (minutes). An inappropriately low Bridge Entry Timeout setting may lead to temporary loss of communication with some end users.
Frame Timing Pulse Gated	If this SM extends the sync pulse to a BH master or an AP, select either **Enable**—If this SM loses sync from the AP, then *do not* propagate a sync pulse to the BH timing master or other AP. This setting prevents interference in the event that the SM loses sync. **Disable**—If this SM loses sync from the AP, then propagate the sync pulse to the BH timing master or other AP.
Multicast Destination Address	Using Link Layer Discovery Protocol (LLDP), a module exchanges multicast addresses with the device to which it is wired on the Ethernet interface. Although some switches (CMM4, for example) do not pass LLDP addresses upward in the network, a radio can pass it as the value of the **Multicast Destination Address** parameter value in the connected device that has it populated.
Coordinates	Physical radio location data may be configured via the **Latitude**, **Longitude** and **Height** fields.

General page - PTP 450i BHM

The General page of BHM is explained in Table 105. The General page of PTP 450 BHM looks same as PTP 450i BHM.

Table 105 General page attributes – PTP 450i BHM



Device Type

Timing Mode :	● Timing Master ○ Timing Slave

Link Speeds

Link Speed :	Auto 1000F/100F/100H/10F/10H ▾

PoE

802.3at Type 2 PoE Status :	Not Present (Ignored)
PoE Classification :	○ Enabled ● Disabled

Sync Setting

Sync Input :	Generate Sync ▾
Free Run Before GPS Sync :	○ Enabled ● Disabled

Region Settings

Region :	Other - Regulatory ▾
Country :	Other ▾

Web Page Configuration

Webpage Auto Update :	1 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout :	25 Minutes (Range : 25—1440 Minutes)
Bridging Functionality :	○ Disable ● Enable

Update Application Information

Update Application Address :	10.110.32.27

TCP Settings

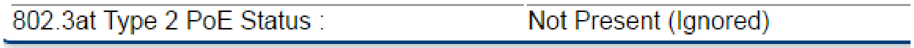
Prioritize TCP ACK :	● Enabled ○ Disabled

Layer 2 Discovery Destination Address

Multicast Destination Address :	○ Broadcast ● LLDP Multicast

Coordinates

Latitude :	+0.000000 Decimal Degree
Longitude :	+0.000000 Decimal Degree
Height :	0 Meters

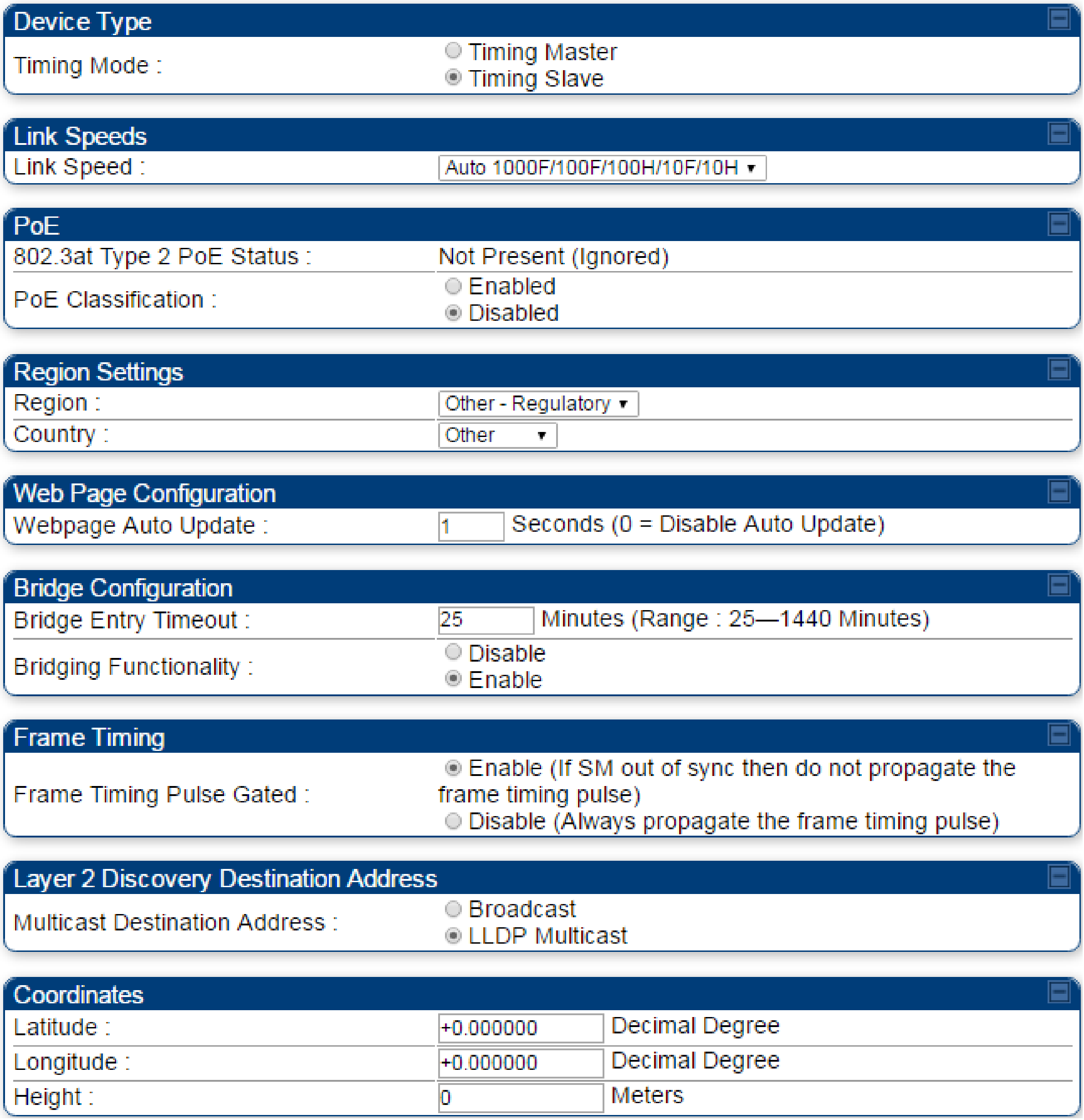
Attribute	Meaning
Timing Mode	Allows the user to choose the mode between Timing Master and Timing Slave.
Link Speed	See Table 103 General page attributes – PMP 450i AP on page 7-140
802.3at Type 2 PoE Status and PoE Classification	When the PoE Classification functionality is enabled and if Type 2 power is not present, the PAs do not power up and draw too much power. By default, the PoE Classification feature is disabled and the PAs will power up regardless of the classification presented by the power source. This is supported only on 450i Series ODUs. PoE Classification configuration status also can be check under home > General > Device Information tab:  802.3at Type 2 PoE Status : Not Present (Ignored)
Sync Input	See Configuring synchronization on page 7-163
Region	See Table 103 General page attributes – PMP 450i AP on page 7-140
Country	
Webpage Auto Update	
Bridge Entry Timeout	
Bridging Functionality	Select whether you want bridge table filtering active (**Enable**) or not (**Disable**) on this BH. **Disable:** allows user to use redundant BHs without causing network addressing problems. Through a spanning tree protocol, this reduces the convergence time from 25 minutes to few seconds. However, you must disable bridge table filtering as only a deliberate part of your overall network design since disabling it allows unwanted traffic across the wireless interface. **Enable**: Allows user to enable bridge functionality. **Note** Specify the appropriate bridge timeout for correct network operation with the existing network infrastructure. The Bridge Entry Timeout must be a longer period than the ARP (Address Resolution Protocol) cache timeout of the router that feeds the network.
Prioritize TCP ACK	See Table 103 General page attributes – PMP 450i AP on page 7-140
Multicast Destination Address	

Latitude
Longitude
Height

General page - PTP 450i BHS

The General page of PTP 450i BHS is explained in Table 106. The General page of PTP 450 BHS looks same as PTP 450i BHS.

Table 106 General page attributes – PTP 450i BHS



Device Type

Timing Mode : ○ Timing Master ● Timing Slave

Link Speeds

Link Speed : Auto 1000F/100F/100H/10F/10H ▾

PoE

802.3at Type 2 PoE Status : Not Present (Ignored)

PoE Classification : ○ Enabled ● Disabled

Region Settings

Region : Other - Regulatory ▾

Country : Other ▾

Web Page Configuration

Webpage Auto Update : 1 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout : 25 Minutes (Range : 25—1440 Minutes)

Bridging Functionality : ○ Disable ● Enable

Frame Timing

Frame Timing Pulse Gated : ● Enable (If SM out of sync then do not propagate the frame timing pulse) ○ Disable (Always propagate the frame timing pulse)

Layer 2 Discovery Destination Address

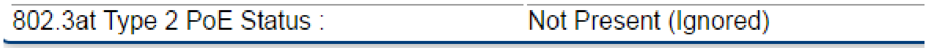
Multicast Destination Address : ○ Broadcast ● LLDP Multicast

Coordinates

Latitude : +0.000000 Decimal Degree

Longitude : +0.000000 Decimal Degree

Height : 0 Meters

Attribute	Meaning
Timing Mode	Allows the user to choose the mode between Timing Master and Timing Slave.
Link Speed	From the drop-down list of options, select the type of link speed for the Ethernet connection. The default for this parameter is that all speeds are selected. The recommended setting is a single speed selection for all BHMs and BHSs in the operator network.
802.3at Type 2 PoE Status and PoE Classification	When the PoE Classification functionality is enabled and if Type 2 power is not present, the PAs do not power up and draw too much power. By default, the PoE Classification feature is disabled and the PAs will power up regardless of the classification presented by the power source. This is supported only on 450i Series ODUs. PoE Classification configuration status also can be check under home > General > Device Information tab:  802.3at Type 2 PoE Status : Not Present (Ignored)
Region	This parameter allows you to set the region in which the radio will operate. The BHS radio automatically inherits the Region type of the master. This behavior ignores the value of the **Region** parameter in the BHS, even when the value is **None**. Nevertheless, since future system software releases may read the value in order to configure some other region-sensitive feature(s), this parameter must be always set to the value that corresponds to the local region.
Country	This parameter allows you to set the country in which the radio will operate. The BHS radio automatically inherits the Country Code type of the master. This behavior ignores the value of the **Country** parameter in the BHS, even when the value is **None**. Nevertheless, since future system software releases may read the value in order to configure some other region-sensitive feature(s), this parameter must be always set to the value that corresponds to the local region. PMP/PTP 450i Series ODU shipped to the United States is locked to a Region Code setting of "United States". Units shipped to regions other than the United States must be configured with the corresponding Region Code to comply with local regulatory requirements.
Webpage Auto Update	See Table 103 General page attributes – PMP 450i AP on page 7-140
Bridge Entry Timeout	Specify the appropriate bridge timeout for correct network operation with the existing network infrastructure. Timeout occurs when the BHM encounters no activity with the BHS (whose MAC address is the bridge entry) within the interval that this parameter specifies. The Bridge Entry Timeout must be a longer period than the ARP (Address Resolution Protocol) cache timeout of the router that feeds the network.

	Caution This parameter governs the timeout interval, even if a router in the system has a longer timeout interval. The default value of this field is *25* (minutes). An inappropriately low Bridge Entry Timeout setting may lead to temporary loss of communication with some end users.
Bridging Functionality	See Table 103 General page attributes – PMP 450i AP on page 7-140
Frame Timing Pulse Gated	If this BHS extends the sync pulse to a BH master or an BHM, select either **Enable**—If this BHS loses sync from the BHM, then *do not* propagate a sync pulse to the BH timing master or other BHM. This setting prevents interference in the event that the BHS loses sync. **Disable**—If this BHS loses sync from the BHM, then propagate the sync pulse to the BH timing master or other BHM.
Multicast Destination Address	See Table 103 General page attributes – PMP 450i AP on page 7-140
Latitude Longitude Height	See Table 103 General page attributes – PMP 450i AP on page 7-140

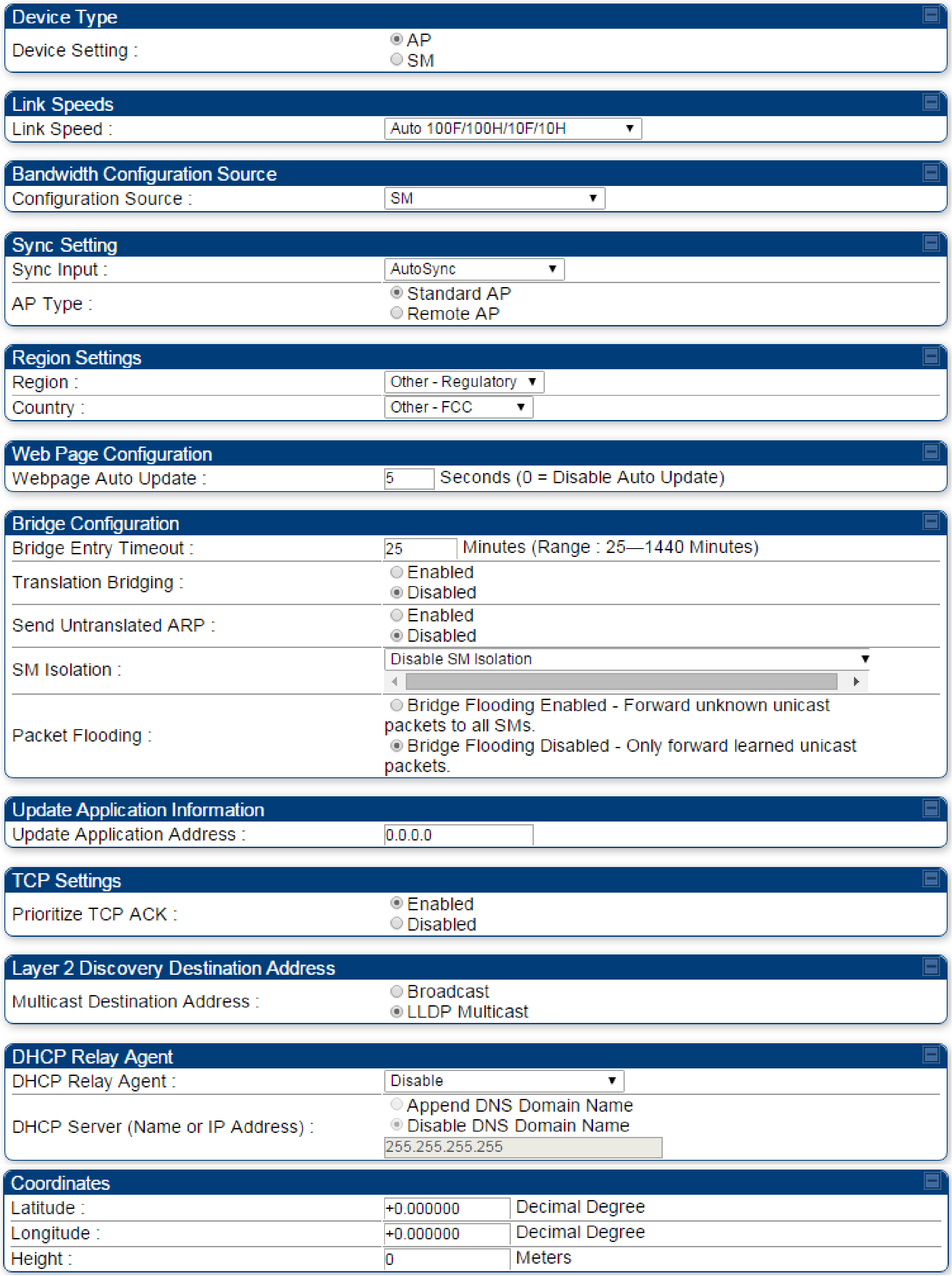
PMP/PTP 450 Series

Note

Refer Table 103 and Table 104 for PMP 450 AP/SM General page parameters details.

General page - PMP 450 AP

Figure 113 General page attributes - PMP 450 AP



Device Type

Device Setting : ● AP ○ SM

Link Speeds

Link Speed : Auto 100F/100H/10F/10H ▾

Bandwidth Configuration Source

Configuration Source : SM ▾

Sync Setting

Sync Input : AutoSync ▾

AP Type : ● Standard AP ○ Remote AP

Region Settings

Region : Other - Regulatory ▾

Country : Other - FCC ▾

Web Page Configuration

Webpage Auto Update : 5 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout : 25 Minutes (Range : 25—1440 Minutes)

Translation Bridging : ○ Enabled ● Disabled

Send Untranslated ARP : ○ Enabled ● Disabled

SM Isolation : Disable SM Isolation ▾

Packet Flooding : ○ Bridge Flooding Enabled - Forward unknown unicast packets to all SMs. ● Bridge Flooding Disabled - Only forward learned unicast packets.

Update Application Information

Update Application Address : 0.0.0.0

TCP Settings

Prioritize TCP ACK : ● Enabled ○ Disabled

Layer 2 Discovery Destination Address

Multicast Destination Address : ○ Broadcast ● LLDP Multicast

DHCP Relay Agent

DHCP Relay Agent : Disable ▾

DHCP Server (Name or IP Address) : ○ Append DNS Domain Name ● Disable DNS Domain Name 255.255.255.255

Coordinates

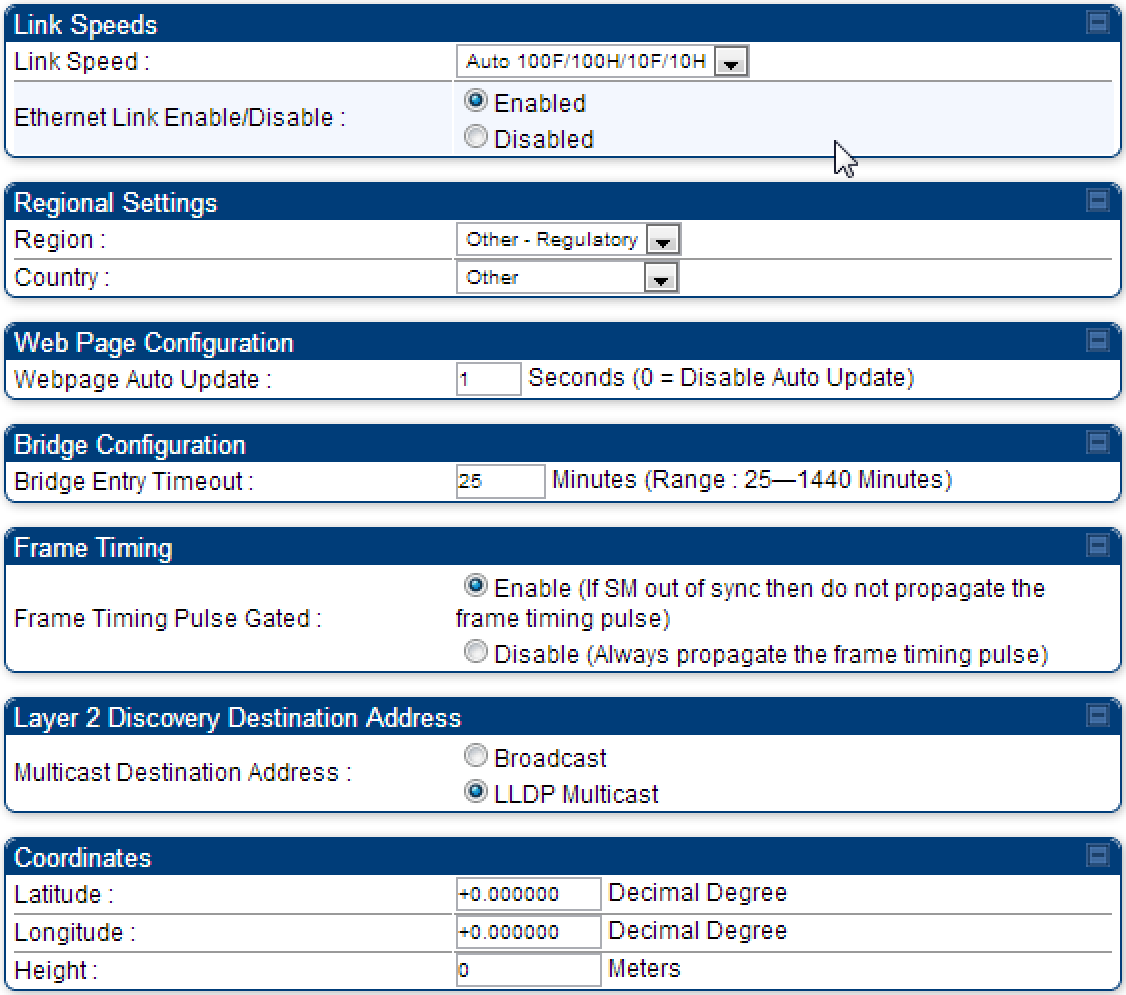
Latitude : +0.000000 Decimal Degree

Longitude : +0.000000 Decimal Degree

Height : 0 Meters

General page - PMP 450 SM

Figure 114 General page attributes - PMP 450 SM



Link Speeds

Link Speed :	Auto 100F/100H/10F/10H
Ethernet Link Enable/Disable :	● Enabled ○ Disabled

Regional Settings

Region :	Other - Regulatory
Country :	Other

Web Page Configuration

Webpage Auto Update :	1 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout :	25 Minutes (Range : 25—1440 Minutes)

Frame Timing

Frame Timing Pulse Gated :	● Enable (If SM out of sync then do not propagate the frame timing pulse) ○ Disable (Always propagate the frame timing pulse)

Layer 2 Discovery Destination Address

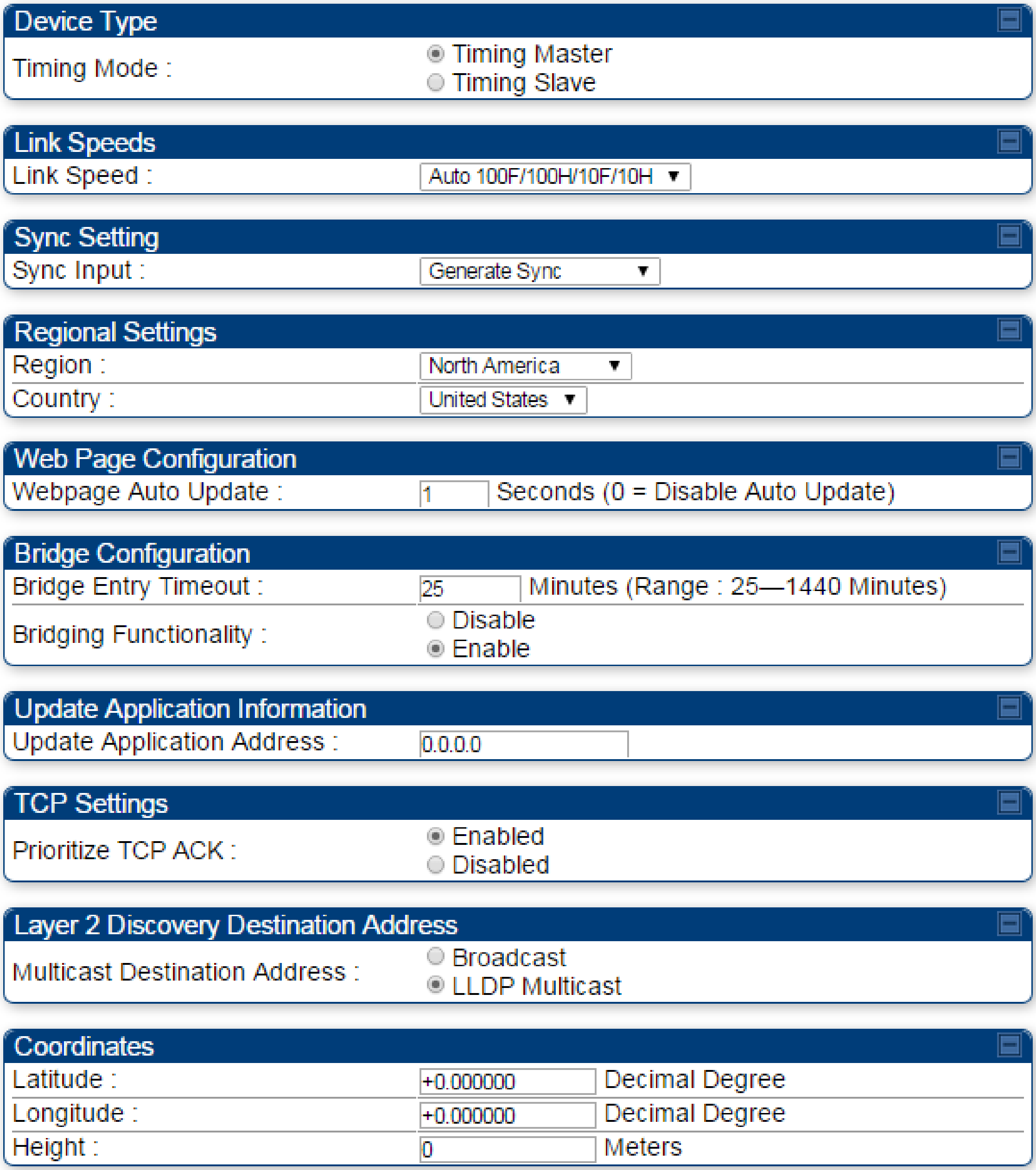
Multicast Destination Address :	○ Broadcast ● LLDP Multicast

Coordinates

Latitude :	+0.000000 Decimal Degree
Longitude :	+0.000000 Decimal Degree
Height :	0 Meters

General page – PTP 450 BHM

Figure 115 General page attributes - PTP 450 BHM



Device Type

Timing Mode :	● Timing Master ○ Timing Slave

Link Speeds

Link Speed :	Auto 100F/100H/10F/10H ▼

Sync Setting

Sync Input :	Generate Sync ▼

Regional Settings

Region :	North America ▼
Country :	United States ▼

Web Page Configuration

Webpage Auto Update :	1 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout :	25 Minutes (Range : 25—1440 Minutes)
Bridging Functionality :	○ Disable ● Enable

Update Application Information

Update Application Address :	0.0.0.0

TCP Settings

Prioritize TCP ACK :	● Enabled ○ Disabled

Layer 2 Discovery Destination Address

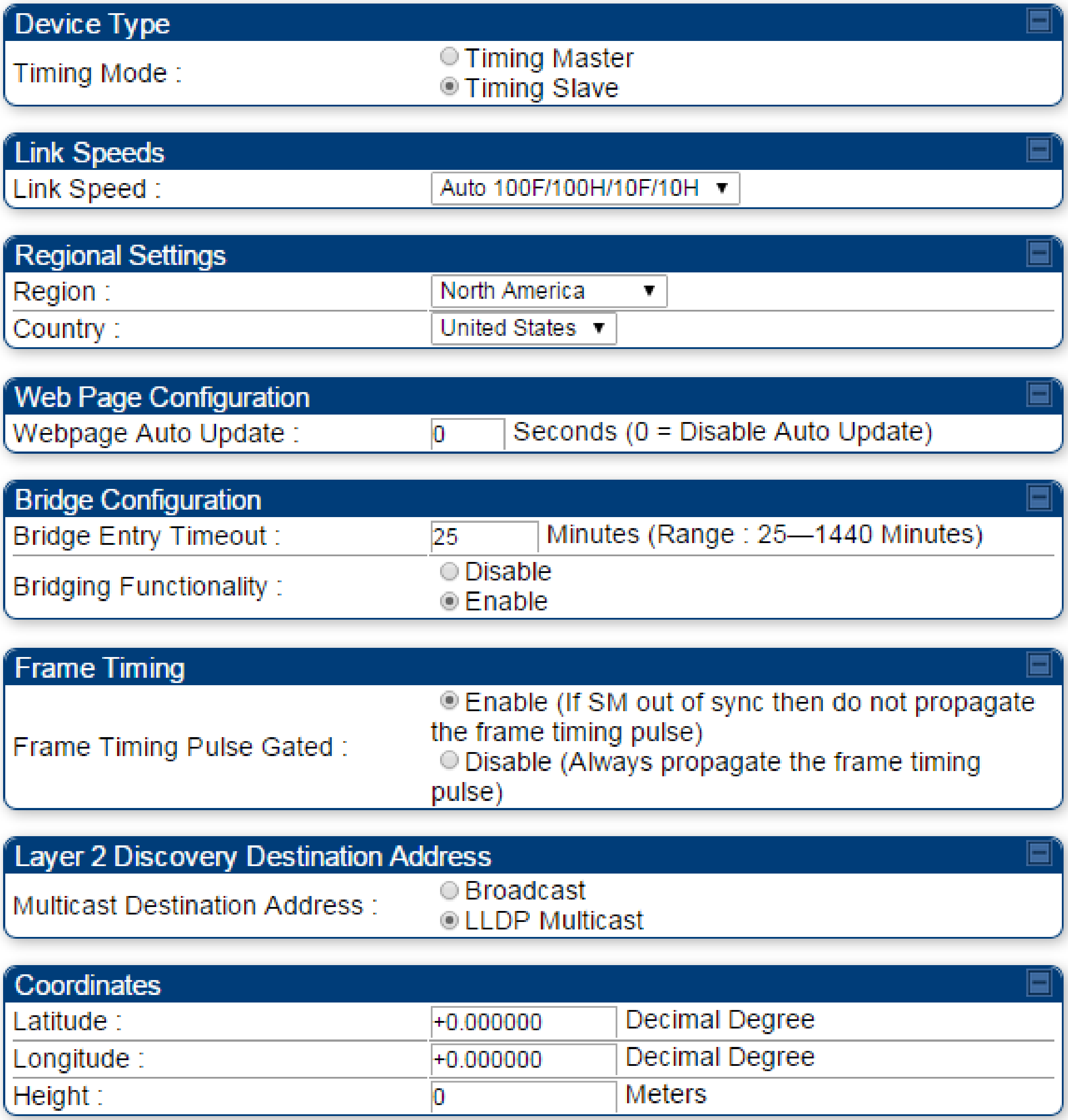
Multicast Destination Address :	○ Broadcast ● LLDP Multicast

Coordinates

Latitude :	+0.000000 Decimal Degree
Longitude :	+0.000000 Decimal Degree
Height :	0 Meters

General page – PTP 450 BHS

Figure 116 General page attributes - PTP 450 BHS



Device Type

Timing Mode :	○ Timing Master ● Timing Slave

Link Speeds

Link Speed :	Auto 100F/100H/10F/10H ▼

Regional Settings

Region :	North America ▼
Country :	United States ▼

Web Page Configuration

Webpage Auto Update :	0 Seconds (0 = Disable Auto Update)

Bridge Configuration

Bridge Entry Timeout :	25 Minutes (Range : 25—1440 Minutes)
Bridging Functionality :	○ Disable ● Enable

Frame Timing

Frame Timing Pulse Gated :	● Enable (If SM out of sync then do not propagate the frame timing pulse) ○ Disable (Always propagate the frame timing pulse)

Layer 2 Discovery Destination Address

Multicast Destination Address :	○ Broadcast ● LLDP Multicast

Coordinates

Latitude :	+0.000000 Decimal Degree
Longitude :	+0.000000 Decimal Degree
Height :	0 Meters

Configuring Unit Settings page

Applicable products	PMP :	☑	AP	☑	SM	PTP:	☑	BHM	☑	BMS

The **Unit Settings** page of the 450 Platform Family contains following options:

- Unit-Wide Changes
- Download Configuration File
- Upload and Apply Configuration File (for AP and BHM)
- LED Panel Settings (for SM and BHS)

Note

LED Panel setting is applicable for SM and BHS only.

Upload and Apply Configuration File attributes are not supported for SM and BHS.

The 450 Platform Family also supports import and export of configuration from the AP/BHM/SM/BHS as a text file. The configuration file is in JSON format. The logged in user must be an ADMINISTRATOR in order to export or import the configuration file.

The exported configuration file contains the complete configuration including all the default values. To keep a backup of the current configuration, the file can be saved as-is and imported later.

The configuration file supports encrypted password. The exported configuration file will contain encrypted password. The import of configuration can have either encrypted or plain text password in Configuration fie. A new tab Encrypt the Password is added under Encrypted Password tab to generate encrypted password for a given password.

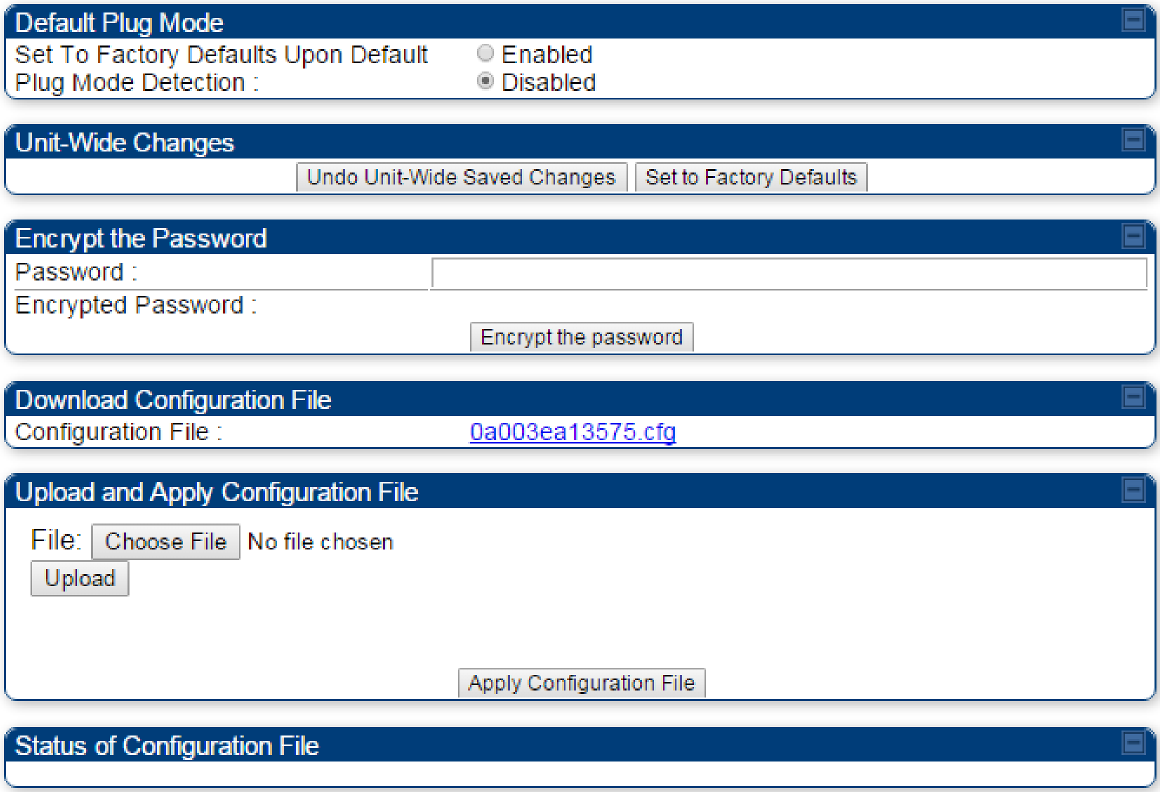
The Import and Export procedure of configuration file is described in Import and Export of config file on page 7-275.

LED Panel Mode has options select Revised mode and Legacy mode. The Legacy mode configures the radio to operate with standard LED behavior.

Unit Settings page of 450 Platform Family - AP/BHM

The Unit Setting page of AP/BHM is explained in Table 107.

Table 107 Unit Settings attributes – 450 Platform Family AP/BHM



Default Plug Mode

Set To Factory Defaults Upon Default Plug Mode Detection : ○ Enabled ● Disabled

Unit-Wide Changes

Encrypt the Password

Password :

Encrypted Password :

Download Configuration File

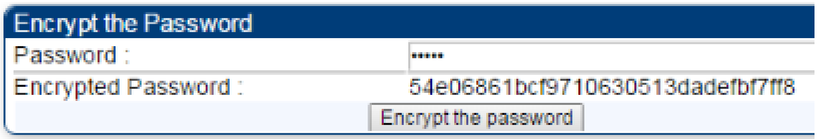
Configuration File : 0a003ea13575.cfg

Upload and Apply Configuration File

File: Choose File No file chosen

Status of Configuration File

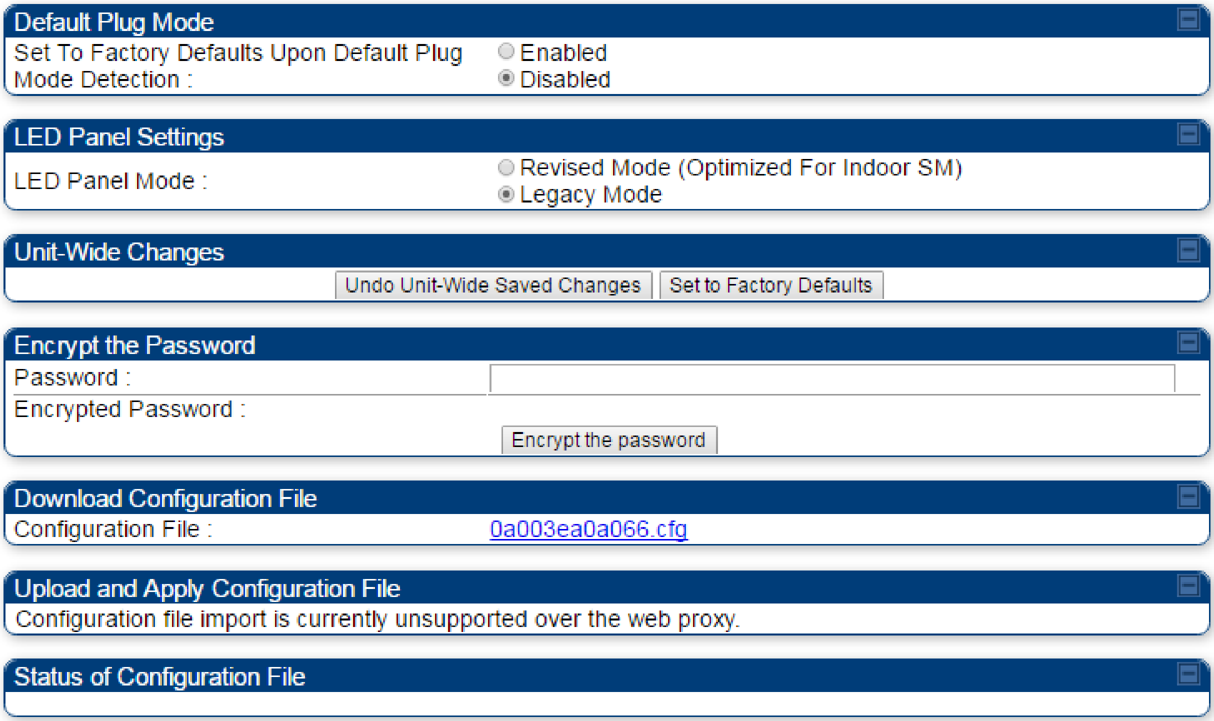
Attribute	Meaning
Set to Factory Defaults Upon Default Mode Detection	If **Enabled** is checked, then the default mode functions is enabled. When the module is rebooted with Default mode enabled, it can be accessed at the IP address 169.254.1.1 and no password, and all parameter values are reset to defaults. A subscriber, technician, or other person who gains physical access to the module and uses an override *cannot* see or learn the settings that were previously configured in it. If **Disabled** is checked, then the default mode functions is disabled. See Radio recovery mode on page 1-24 ⚠ Caution When **Set to Factory Defaults Upon Default Mode** is set to **Enable**, the radio does not select all of the frequencies for Radio Frequency Scan Selection List. It needs to be selected manually.
Undo Unit-Wide Saved Changes	When you click this button, any changes that you made in any tab but did not commit by a reboot of the module are undone.

Set to Factory Defaults	When you click this button, *all configurable parameters on all tabs* are reset to the factory settings. **Note** This can be reverted by selecting "Undo Unit-Wide Saved Changes", *before* rebooting the radio, though this is not recommended.
Password	This allows to provide encrypted password for a given password. On click of ‘Encrypt the password’ button, the Encrypted Password field will display encrypted value of entered plain text password in ‘Password’ field.  Encrypt the Password Password : ••••• Encrypted Password : 54e06861bcf9710630513dadefbf7ff8
Configuration File	This allows to download the configuration file of the radio. This configuration file contains the complete configuration including all the default values. The configuration file is highlighted as downloadable link and the naming convention is “<mac address of AP>.cfg”.
Apply Configuration File	This allows to import and apply configuration to the AP. **Chose File**: Select the file to upload the configuration. The configuration file is named as “<file name>.cfg”. **Upload**: Import the configuration to the AP. **Apply Configuration File**: Apply the imported configuration file to the AP. The imported configuration file may either contain a full device configuration or a partial device configuration. If a partial configuration file is imported, only the items contained in the file will be updated, the rest of the device configuration parameters will remain the same. Operators may also include a special flag in the configure file to instruct the device to first revert to factory defaults then to apply the imported configuration.
Status of Configuration file	This section shows the results of the upload.

Unit Settings page of PMP/PTP 450i SM/BHS

The Unit Settings page of PMP/PTP 450i SM/BHS is explained in Table 108.

Table 108 SM Unit Settings attributes



Default Plug Mode

Set To Factory Defaults Upon Default Plug Mode Detection : ○ Enabled ● Disabled

LED Panel Settings

LED Panel Mode : ○ Revised Mode (Optimized For Indoor SM) ● Legacy Mode

Unit-Wide Changes

Encrypt the Password

Password :

Encrypted Password :

Download Configuration File

Configuration File : 0a003ea0a066.cfg

Upload and Apply Configuration File

Configuration file import is currently unsupported over the web proxy.

Status of Configuration File

Attribute	Meaning
Set to Factory Defaults Upon Default Plug Detection	See Table 107 Unit Settings attributes – 450 Platform Family AP/BHM on page 7-158
LED Panel Settings	Legacy Mode configures the radio to operate with standard LED behavior.
Undo Unit-Wide Saved Changes	See Table 107 Unit Settings attributes – 450 Platform Family AP/BHM on page 7-158
Password	
Set to Factory Defaults	
Configuration File	
Status of Configuration file	

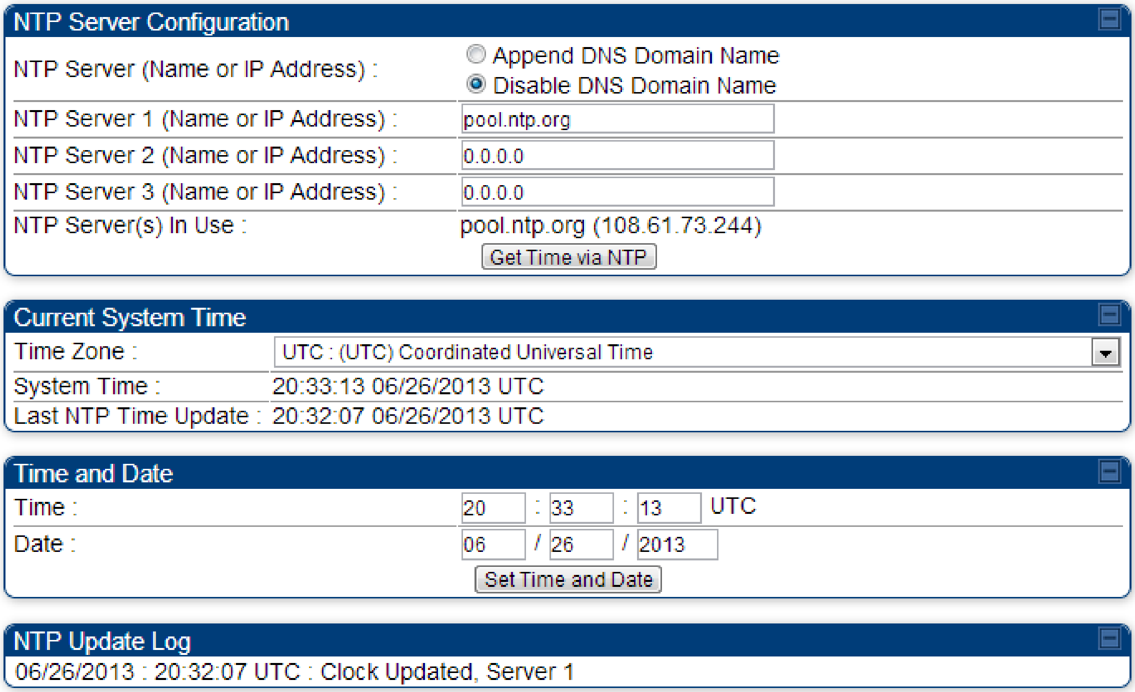
Setting up time and date

Time page of 450 Platform Family - AP/BHM

Applicable products	**PMP :**	☑ AP	**PTP:**	☑ BHM

The Time page of 450 Platform Family AP/BHM is explained in Table 109.

Table 109 450 Platform Family - AP/BHM Time attributes



NTP Server Configuration

NTP Server (Name or IP Address) : ○ Append DNS Domain Name ● Disable DNS Domain Name

NTP Server 1 (Name or IP Address) : pool.ntp.org

NTP Server 2 (Name or IP Address) : 0.0.0.0

NTP Server 3 (Name or IP Address) : 0.0.0.0

NTP Server(s) In Use : pool.ntp.org (108.61.73.244)

Current System Time

Time Zone : UTC : (UTC) Coordinated Universal Time

System Time : 20:33:13 06/26/2013 UTC

Last NTP Time Update : 20:32:07 06/26/2013 UTC

Time and Date

Time : 20 : 33 : 13 UTC

Date : 06 / 26 / 2013

NTP Update Log

06/26/2013 : 20:32:07 UTC : Clock Updated, Server 1

Attribute	Meaning
NTP Server (Name or IP Address)	The management DNS domain name may be toggled such that the name of the NTP server only needs to be specified and the DNS domain name is automatically appended to that name.
NTP Server 1 (Name or IP Address) NTP Server 2 (Name or IP Address) NTP Server 3 (Name or IP Address)	To have each log in the AP/BHM correlated to a meaningful time and date, either a reliable network element must pass time and date to the AP/BHM or must set the time and date whenever a power cycle of the AP/BHM has occurred. A network element passes time and date in any of the following scenarios: • A connected CMM4 passes time and date (GPS time and date, if received). • A connected CMM4 passes the time and date (GPS time and date, if received), but only if both the CMMr is operating on CMMr Release 2.1 or later release. (These releases include NTP server functionality.)

	• A separate NTP server (including APs/BHMs receiving NTP data) is addressable from the AP/BHM. If the AP/BHM needs to obtain time and date from a CMM4, or a separate NTP server, enter the IP address or DNS name of the CMM4 or NTP server on this tab. To force the AP/BHM to obtain time and date before the first (or next) 15-minute interval query of the NTP server, click **Get Time via NTP**. The polling of the NTP servers is done in a sequential fashion, and the polling status of each server is displayed in the NTP Update Log section of the Time Configuration page. An entry of 0.0.0.0 in any of the NTP Server fields indicates an unused server configuration.
NTP Server(s) in Use	Lists the IP addresses of servers used for NTP retrieval.
Time Zone	The Time Zone option may be used to offset the received NTP time to match the operator's local time zone. When set on the AP/BHM, the offset is set for the entire sector SMs (or BHS) are notified of the current Time Zone upon initial registration). If a Time Zone change is applied, the SMs(or BHS) is notified of the change in a best effort fashion, meaning some SMs//BHSs may not pick up the change until the next re-registration. Time Zone changes are noted in the Event Log of the AP/BHM and SM/BHS.
System Time	The current time used by the system.
Last NTP Time Update	The last time that the system time was set via NTP.
Time	This field may be used to manually set the system time of the radio.
Date	This field may be used to manually set the system date of the radio.
NTP Update Log	This field shows NTP clock update log. It includes NTP clock update Date and Time stamp along with server name.

Configuring synchronization

Applicable products	PMP : ☑ AP	PTP: ☑ BHM

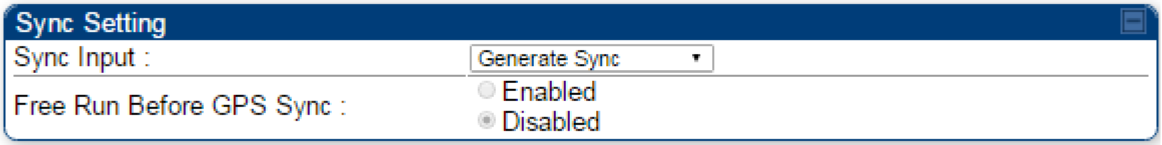
This section describe synchronization options for PMP and PTP configuration.

This **Sync Input** parameter can be configured under Sync Setting tab of **Configure > General** page (see General configuration on page 7-140).

PMP/PTP 450i Series has following synchronization options:

- AutoSync
- AutoSync + Free Run
- Generate Sync
- Free Run Before GPS Sync

Figure 117 Sync Setting configuration



Sync Setting

Sync Input : Generate Sync

Free Run Before GPS Sync : ○ Enabled ● Disabled

AutoSync

For PTP, the BHM automatically receives sync from one of the following sources:

- GPS Sync over Timing Port (UGPS, co-located AP GPS sync output, or “Remote ” Device feed from a registered SM’s GPS sync output)
- GPS Sync over Power Port (CMM4)

Upon AP/BM power on, the AP/BHM does not transmit until a valid synchronization pulse is received from one of the sources above. If there is a loss of GPS synchronization pulse, within two seconds the AP/BHM automatically attempts to source GPS signaling from another source.

In case of PMP, when there are synchronization sources on both the timing port and the power port, the power port GPS source is chosen first.

If no valid GPS signal is received, the AP/BHM ceases transmission and SM/BHS registration is lost until a valid GPS signal is received again on the AP or BHM.

AutoSync + Free Run

This mode operates similarly to mode “AutoSync”, but if a previously received synchronization signal is lost and no GPS signaling alternative is achieved, the AP/BHM automatically changes to synchronization mode “Generate Sync”. While SM registration ins maintained, in this mode there is no synchronization of APs/BHMs that can “hear” each other; the AP/BHM will only generate a sync signal for the local AP/BHM and its associated SMs/BHS. Once a valid GPS signal is obtained again, the AP/BHM automatically switches to receiving synchronization via the GPS source and SM/BHS registration is maintained.

When the Sync Input field is set to Autosync or Autosync + Free Run, other options become available to be set e.g. UGPS Power and other fields. This is true on APs and BHMs.

Note

In mode AutoSync + Free Run, if a GPS signal is never achieved initially, the system will not switch to “Free Run” mode, and SMs/BHS will not register to the AP/BHM. A valid GPS signal must be present initially for the AP to switch into “Free Run” mode (and to begin self-generating a synchronization pulse).

Also, When an AP/BHM is operating in “Free Run” mode, over a short time it will no longer be synchronized with co-located or nearby APs/BHMs (within radio range). Due to this lack of transmit and receive synchronization across APs/BHMs or across systems, performance while in “Free Run” mode may be degraded until the APs/BHMs operating in “Free Run” mode regain a external GPS synchronization source. Careful attention is required to ensure that all systems are properly receiving an external GPS synchronization pulse, and please consider “Free Run” mode as an emergency option.

Generate Sync (factory default)

This option may be used when the AP/BHM is not receiving GPS synchronization pulses from either a CMM4 or UGPS module, and there are no other APs/BHMs active within the link range. Using this option will not synchronize transmission of APs/BHMs that can “hear” each other; it will only generate a sync signal for the local AP/BHM and its associated SMs/BHS.

Note

When an AP/BHM has its "Regional Code" set to "None", The radio will not provide valid Sync Pulse Information.

There is a RED warning that the radio will not transmit, but the user might expect to see a valid sync if the radio is connected to a working CMM4 or UGPS.

Configuring security

Perform this task to configure the 450 Platform system in accordance with the network operator's security policy. Choose from the following procedures:

- Managing module access by password on page 7-166: to configure the unit access password and access level
- Isolating from the internet on page 7-169: to ensure that APs are properly secured from external networks
- Encrypting radio transmissions on page 7-169: to configure the unit to operate with AES or DES wireless link security
- Requiring SM Authentication on page 7-170: to set up the AP to require SMs to authenticate via the AP, WM, or RADIUS server
- Filtering protocols and ports on page 7-171: to filter (block) specified protocols and ports from leaving the system
- Encrypting downlink broadcasts on page 7-174: to encrypt downlink broadcast transmissions
- Isolating SMs on page 7-174: to prevent SMs in the same sector from directly communicating with each other
- Filtering management through Ethernet on page 7-175: to prevent management access to the SM via the radio's Ethernet port
- Allowing management only from specified IP addresses on page 7-175: to only allow radio management interface access from specified IP addresses
- Restricting radio Telnet access over the RF interface on page 7-175: to restrict Telnet access to the AP
- Configuring SNMP Access on page 7-178
- Configuring Security on page 7-180

Managing module access by password

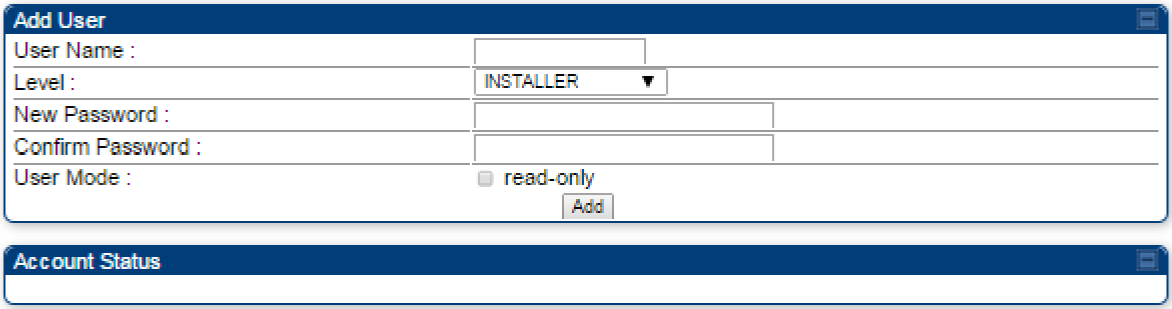
Applicable products	PMP :	☑ AP	☑ SM	PTP:	☑ BHM	☑ BMS

See Managing module access by passwords on page 3-38.

Adding a User for Access to a module

The **Account > Add User** page allows to create a new user for accessing 450 Platform Family - AP/SM/BHM/BHS. The Add User page is explained in Table 110.

Table 110 Add User page of account page - AP/ SM/BH



Add User

User Name :	
Level :	INSTALLER ▼
New Password :	
Confirm Password :	
User Mode :	□ read-only

Account Status

Attribute	Meaning
User Name	User Account name.
Level	Select appropriate level for new account. It can be INSTALLER, ADMINISTRATOR or TECHNICIAN. See Managing module access by passwords on page 3-38.
New Password	Assign the password for new user account
Confirm Password	This new password must be confirmed in the "**Confirm Password**" field.
User Mode	User Mode is used to create an account which are mainly used for viewing the configurations. The local and remote Read-Only user account can be created by "Admin", "Installer" or "Tech" logins. To create a Read-Only user, the "read-only" check box needs to be checked.

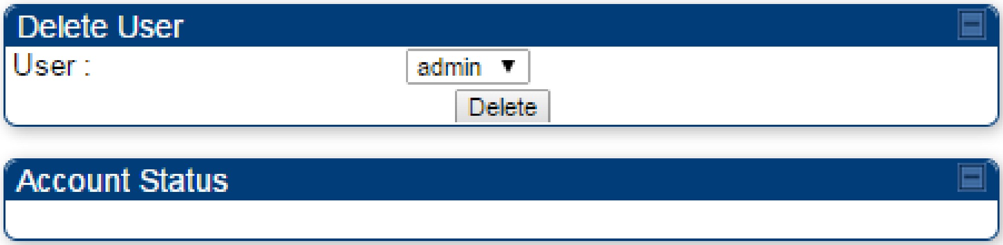
Note

The Read-Only user cannot perform any service impacting operations like creating read-only accounts, editing and viewing read-only user accounts, changes in login page, read-only user login, Telnet access, SNMP, RADIUS and upgrade/downgrade.

Deleting a User from Access to a module

The **Account > Delete User** page provides a drop down list of configured users from which to select the user you want to delete. The Delele User page is explained in Table 111.

Table 111 Delete User page - 450 Platform Family - AP/ SM/BH



Delete User

User : admin ▼

Delete

Account Status

Attribute	Meaning
User	Select a user from drop down list which has to be deleted and click **Delete** button. Accounts that cannot be deleted are • the current user's own account. • the last remaining account of ADMINISTRATOR level.

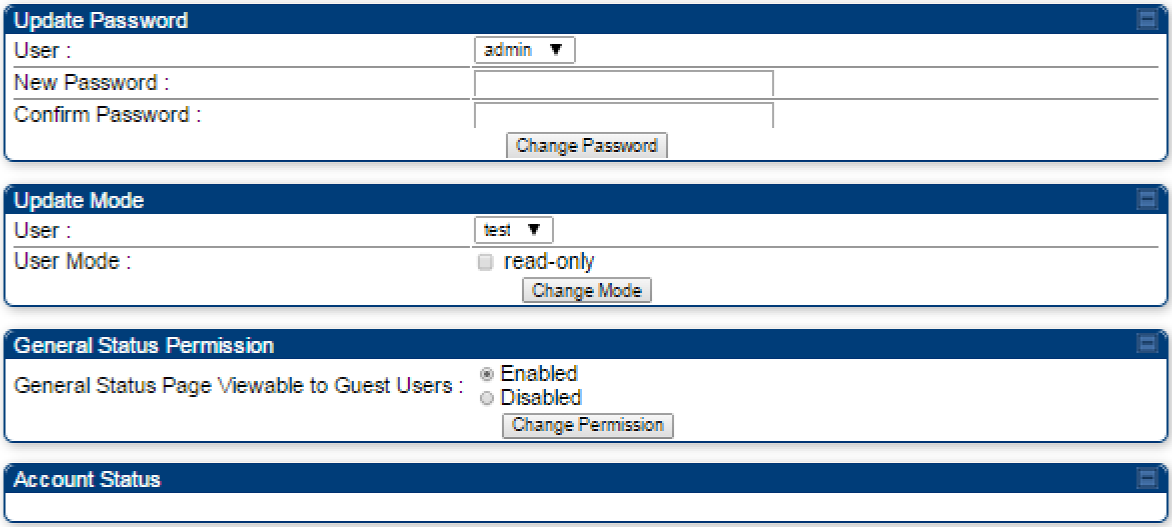
Changing a User Setting

The **Account > Change User Setting** page allows to update password, mode update and general status permission for a user.

From the factory default state, configure passwords for both the root and admin account at the ADMINISTRATOR permission level, using **Update Password** tab of Change Users Setting page.

The Change User Setting page is explained in Table 112.

Table 112 Change User Setting page - 450 Platform Family AP/ SM/BH



Update Password

User : admin ▼

New Password :

Confirm Password :

Change Password

Update Mode

User : test ▼

User Mode : □ read-only

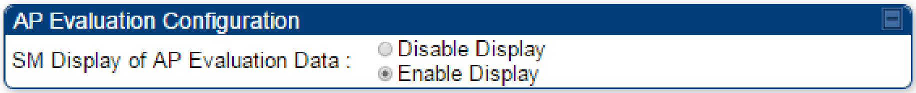
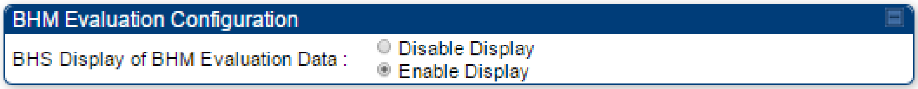
Change Mode

General Status Permission

General Status Page Viewable to Guest Users : ● Enabled ○ Disabled

Change Permission

Account Status

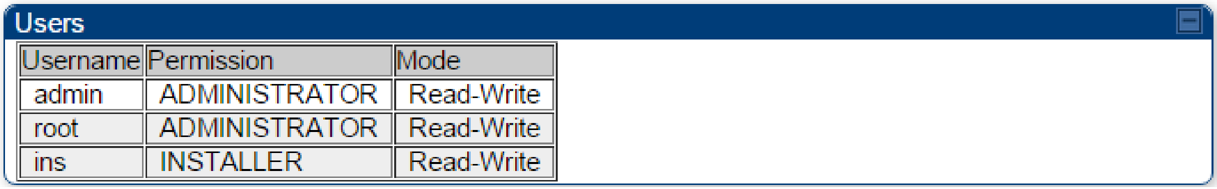
Attribute	Meaning
Update Password tab	This tab provides a drop down list of configured users from which a user is selected to change password.
Update Mode tab	This tab facilitates to convert a configured user to a Read-Only user.
General Status Permission tab	This tab enables and disables visibility of **General Status Page** for all Guest user. To display of Radio data on SMs/BHS main Login page for Guest login, it can be enabled or disabled in Security tab of Configuration page. **Figure 118** AP Evaluation Configuration parameter of Security tab for PMP  AP Evaluation Configuration SM Display of AP Evaluation Data : ○ Disable Display ● Enable Display **Figure 119** BHM Evaluation Configuration parameter of Security tab for PTP  BHM Evaluation Configuration BHS Display of BHM Evaluation Data : ○ Disable Display ● Enable Display

Users account

The **Account > Users** page allows to view all configured users account for accessing the module.

The Users page is explained in Table 113.

Table 113 User page –450 Platform Family AP/SM/BH



Users

Username	Permission	Mode
admin	ADMINISTRATOR	Read-Write
root	ADMINISTRATOR	Read-Write
ins	INSTALLER	Read-Write

Attribute	Meaning
Username	User access account name
Permission	Permission of configured user – INSTALLER, ADMINISTRATOR or TECHNICIAN
Mode	This field indicate access mode of user – Read-Write or Read-Only.

Overriding Forgotten IP Addresses or Passwords on AP and SM

See Radio recovery mode on page 1-24

Isolating from the internet – APs/BHMs

Applicable products	PMP :	☑	AP	PTP:	☑	BHM

See Isolating AP/BHM from the Internet on page 3-36.

Encrypting radio transmissions

Applicable products	PMP :	☑	AP	☑	SM	PTP:	☑	BHM	☑	BMS

See Encrypting radio transmissions on page 3-36.

Requiring SM Authentication

Applicable products	PMP : ☑ AP ☑ SM

Through the use of a shared AP key, or an external RADIUS (Remote Authentication Dial In User Service) server, it enhances network security by requiring SMs to authenticate when they register.

For descriptions of each of the configurable security parameters on the AP, see Configuring Security on page 7-180. For descriptions of each of the configurable security parameters on the SM, see Security on page 7-185.

Operators may use the AP's **Authentication Mode** field to select from among the following authentication modes:

- **Disabled**—the AP requires no SMs to authenticate (factory default setting).
- **Authentication Server** —the AP requires any SM that attempts registration to be authenticated in Wireless Manager before registration
- **AP PreShared Key** - The AP acts as the authentication server to its SMs and will make use of a user-configurable pre-shared authentication key. The operator enters this key on both the AP and all SMs desired to register to that AP. There is also an option of leaving the AP and SMs at their default setting of using the "Default Key". Due to the nature of the authentication operation, if you want to set a specific authentication key, then you MUST configure the key on all of the SMs and reboot them BEFORE enabling the key and option on the AP. Otherwise, if you configure the AP first, none of the SMs is able to register.
- **RADIUS AAA** - When RADIUS AAA is selected, up to 3 Authentication Server (RADIUS Server) IP addresses and Shared Secrets can be configured. The IP address(s) configured here must match the IP address(s) of the RADIUS server(s). The shared secret(s) configured here must match the shared secret(s) configured in the RADIUS server(s). Servers 2 and 3 are meant for backup and reliability, not for splitting the database. If Server 1 doesn't respond, Server 2 is tried, and then server 3. If Server 1 rejects authentication, the SM is denied entry to the network, and does not progress trying the other servers.

  For more information on configuring the PMP 450 Platform network to utilize a RADIUS server, see Configuring a RADIUS server on page 7-283.

Filtering protocols and ports

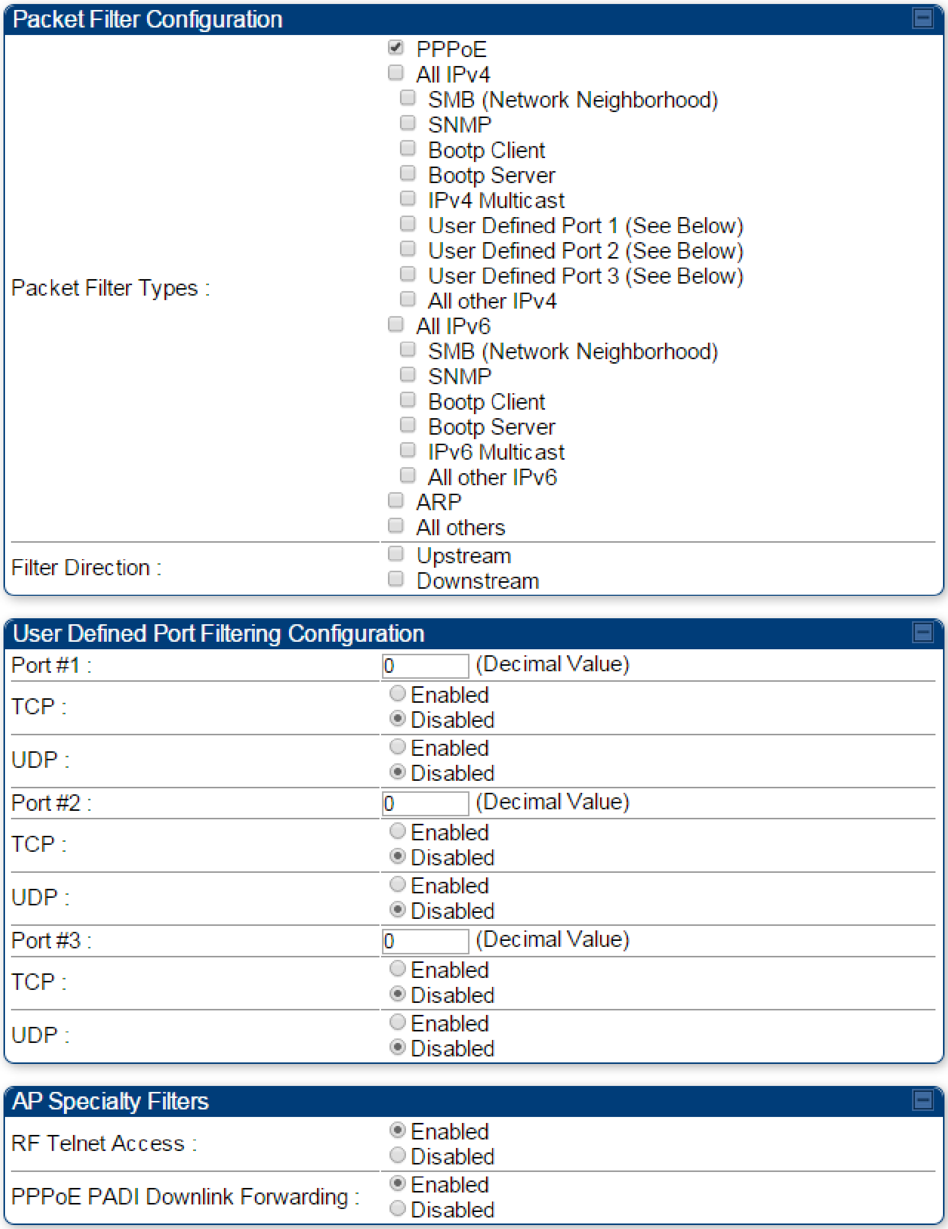
Applicable products	**PMP :**	☑	AP	☑	SM	**PTP:**	☑	BHM	☑	BMS

The filtering protocols and ports allows to configure filters for specified protocols and ports from leaving the AP/SM/BHM/BHS and entering the network. See Filtering protocols and ports on page 3-39.

Protocol filtering page of 450 Platform Family AP/BHM

The Protocol Filtering page of 450 Platform Family - AP/BHM is explained in Table 114.

Table 114 AP/BHM Protocol Filtering attributes



Packet Filter Configuration

Packet Filter Types :
☑ PPPoE
□ All IPv4
□ SMB (Network Neighborhood)
□ SNMP
□ Bootp Client
□ Bootp Server
□ IPv4 Multicast
□ User Defined Port 1 (See Below)
□ User Defined Port 2 (See Below)
□ User Defined Port 3 (See Below)
□ All other IPv4
□ All IPv6
□ SMB (Network Neighborhood)
□ SNMP
□ Bootp Client
□ Bootp Server
□ IPv6 Multicast
□ All other IPv6
□ ARP
□ All others

Filter Direction :
□ Upstream
□ Downstream

User Defined Port Filtering Configuration

Port #1 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #2 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #3 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled

AP Specialty Filters

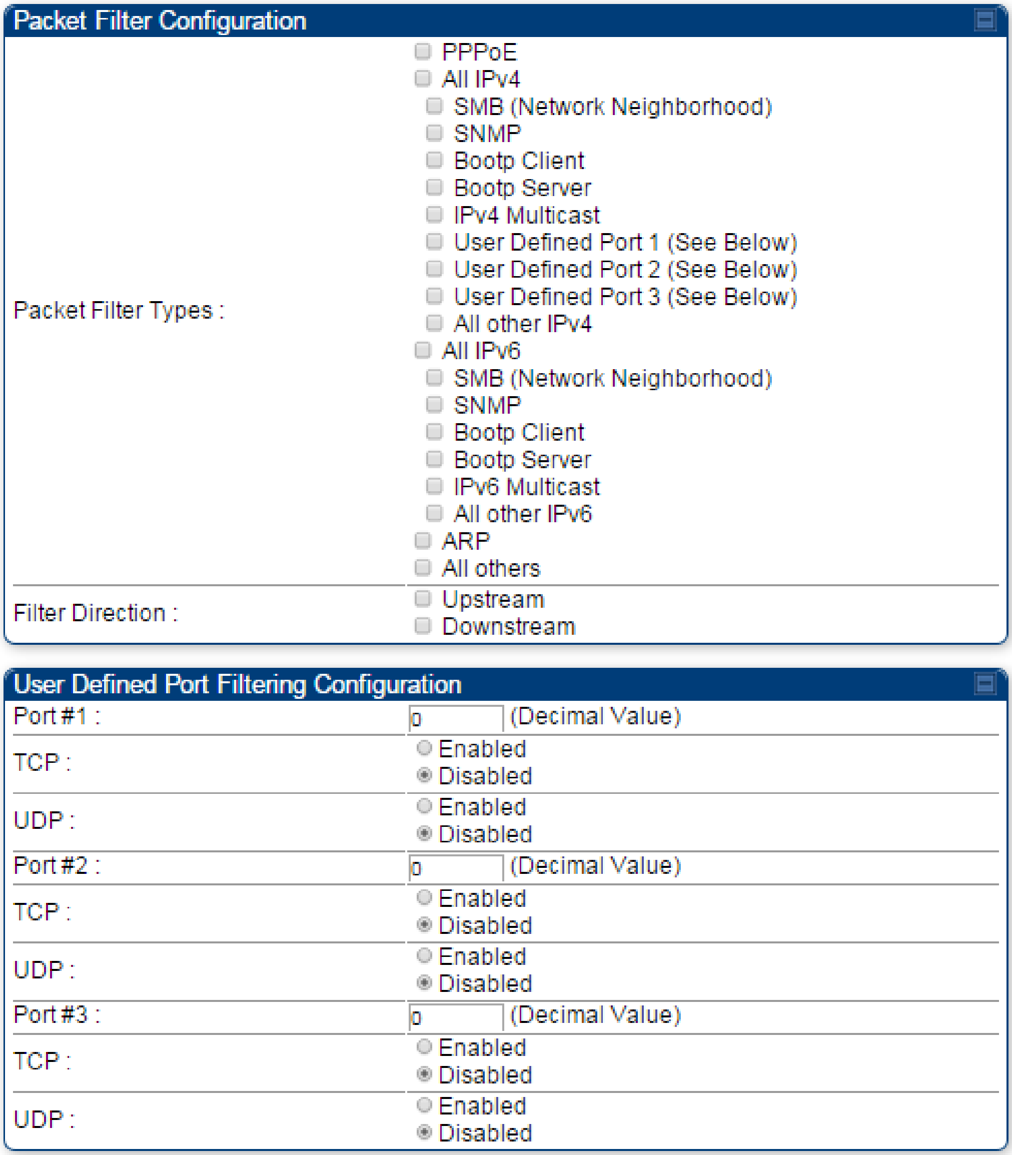
RF Telnet Access :	● Enabled ○ Disabled
PPPoE PADI Downlink Forwarding :	● Enabled ○ Disabled

Attribute	Meaning
Packet Filter Types	For any box selected, the Protocol and Port Filtering feature blocks the associated protocol type. To filter packets in any of the user-defined ports, must do all of the following: Check the box for **User Defined Port *n* (See Below)** in the **Packet Filter Types** section of this tab. In the **User Defined Port Filtering Configuration** section of this tab: • provide a port number at **Port #*n***. • enable **TCP** and/or **UDP** by clicking the associated radio button
Filter Direction	Operators may choose to filter upstream (uplink) RF packets or downstream (downlink) RF packets.
User Defined Port Filtering Configuration	You can specify ports for which to block subscriber access, regardless of whether NAT is enabled.
RF Telnet Access	RF Telnet Access restricts Telnet access to the AP/BHM from a device situated below a network SM/BHS (downstream from the AP/BHM). This is a security enhancement to restrict RF-interface sourced AP access specifically to the LAN1 IP address and LAN2 IP address (Radio Private Address, typically 192.168.101.[LUID]). This restriction disallows unauthorized users from running Telnet commands on the AP/BHM that can change AP/BHM configuration or modifying network-critical components such as routing and ARP tables.
PPPoE PADI Downlink Forwarding	**Enabled**: the AP/BHM allows downstream and upstream transmission of PPPoE PADI packets. By default, PPPoE PADI Downlink Forwarding is set to “Enabled”. **Disabled**: the AP/BHM disallows PPPoE PADI packets from entering the Ethernet interface and exiting the RF interface (downstream to the SM/BHS). PPPoE PADI packets are still allowed to enter the AP’s RF interface and exit the AP’s /BHM’s Ethernet interface (upstream).

Protocol filtering page of SM/BHS

The Protocol Filtering page of SM/BHS is explained in Table 115.

Table 115 SM/BHS Protocol Filtering attributes



Packet Filter Configuration

Packet Filter Types :	☐ PPPoE ☐ All IPv4 ☐ SMB (Network Neighborhood) ☐ SNMP ☐ Bootp Client ☐ Bootp Server ☐ IPv4 Multicast ☐ User Defined Port 1 (See Below) ☐ User Defined Port 2 (See Below) ☐ User Defined Port 3 (See Below) ☐ All other IPv4 ☐ All IPv6 ☐ SMB (Network Neighborhood) ☐ SNMP ☐ Bootp Client ☐ Bootp Server ☐ IPv6 Multicast ☐ All other IPv6 ☐ ARP ☐ All others
Filter Direction :	☐ Upstream ☐ Downstream

User Defined Port Filtering Configuration

Port #1 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #2 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled
Port #3 :	0 (Decimal Value)
TCP :	○ Enabled ● Disabled
UDP :	○ Enabled ● Disabled

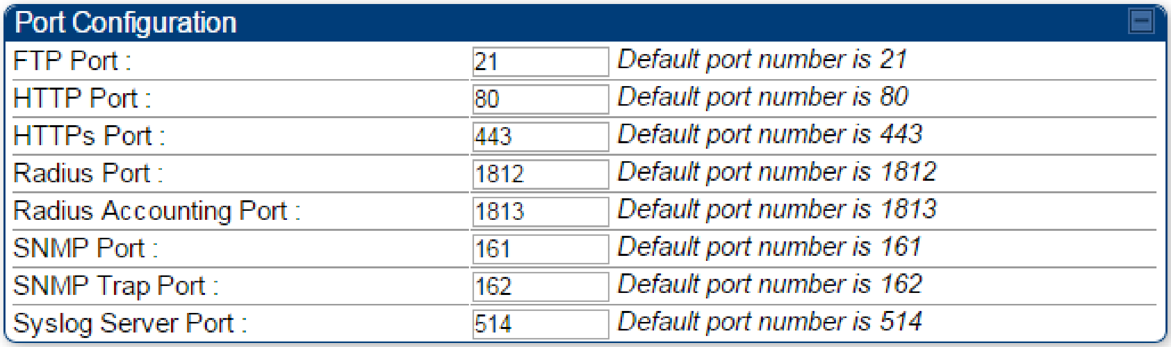
Attribute	Meaning
Packet Filter Configuration tab	See Table 114 AP/BHM Protocol Filtering attributes on page 7-171
User Defined Port Filtering Configuration tab	See Table 114 AP/BHM Protocol Filtering attributes on page 7-171

Port configuration

450 Platform Family ODUs support access to various communication protocols and only the ports required for these protocols are available for access by external entities. Operators may change the port numbers for these protocols via the radio GUI or SNMP.

The **Port Configuration** page of the AP/SM/BHM/BHS is explained in Table 116.

Table 116 Port Configuration attributes – AP/SM/BHM/BMS



Port Configuration

FTP Port :	21	*Default port number is 21*
HTTP Port :	80	*Default port number is 80*
HTTPs Port :	443	*Default port number is 443*
Radius Port :	1812	*Default port number is 1812*
Radius Accounting Port :	1813	*Default port number is 1813*
SNMP Port :	161	*Default port number is 161*
SNMP Trap Port :	162	*Default port number is 162*
Syslog Server Port :	514	*Default port number is 514*

Attribute	Meaning
FTP Port	The listen port on the device used for FTP communication.
HTTP Port	The listen port on the device used for HTTP communication.
HTTPS Port	The listen port on the device used for HTTPS communication
Radius Port	The destination port used by the device for RADIUS communication.
Radius Accounting Port	The destination port used by the device for RADIUS accounting communication.
SNMP Port	The listen port on the device used for SNMP communication.
SNMP Trap Port	The destination port used by the device to which SNMP traps are sent.
Syslog Server Port	The destination port used by the device to which Syslog messaging is sent.

Encrypting downlink broadcasts

See Encrypting downlink broadcasts on page 3-43.

Isolating SMs

See Isolating SMs in PMP on page 3-43.

Filtering management through Ethernet

See Filtering management through Ethernet on page 3-43.

Allowing management only from specified IP addresses

See Allowing management from only specified IP addresses on page 3-44.

Restricting radio Telnet access over the RF interface

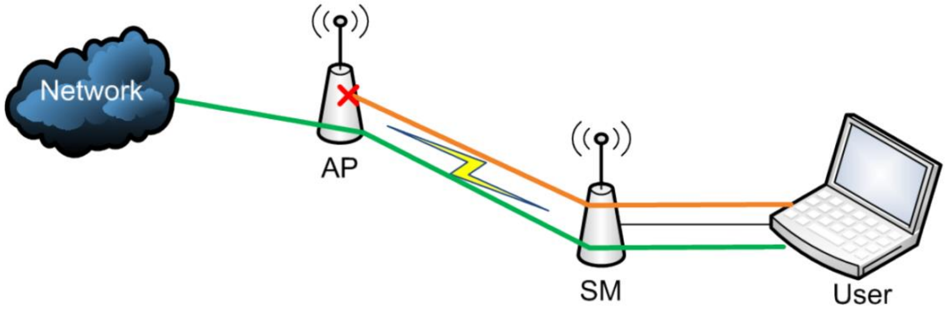
RF Telnet Access restricts Telnet access to the AP from a device situated below a network SM (downstream from the AP). This is a security enhancement to restrict RF-interface sourced AP access specifically to the LAN1 IP address and LAN2 IP address (Radio Private Address, typically 192.168.101. [LUID]). This restriction disallows unauthorized users from running Telnet commands on the AP that can change AP configuration or modifying network-critical components such as routing and ARP tables.

The RF Telnet Access may be configured via the AP GUI or via SNMP commands, and RF Telnet Access is set to “Enabled” by default. Once RF Telnet Access is set to “Disabled”, if there is a Telnet session attempt to the AP originating from a device situated below the SM (or any downstream device), the attempt is dropped. This also includes Telnet session attempts originated from the SM’s management interface (if a user has initiated a Telnet session to a SM and attempts to Telnet from the SM to the AP). In addition, if there are any active Telnet connections to the AP originating from a device situated below the SM (or any downstream device), the connection is dropped. This behavior must be considered if system administrators use Telnet downstream from an AP (from a registered SM) to modify system parameters.

Setting RF Telnet Access to “Disabled” does not affect devices situated above the AP from accessing the AP via Telnet, including servers running the CNUT (Canopy Network Updater tool) application. Also, setting RF Telnet Access to “Disabled” does not affect any Telnet access into upstream devices (situated above or adjacent to the AP) through the AP (see Figure 120).

The figure below depicts a user attempting two telnet sessions. One is targeted for the AP (orange) and one is targeted for the network upstream from the AP (green). If RF Telnet Access is set to “Disabled” (factory default setting), the Telnet attempt from the user to the AP is blocked, but the attempt from the user to Network is allowed to pass through the Cambium network.

Figure 120 RF Telnet Access Restrictions (orange) and Flow through (green)



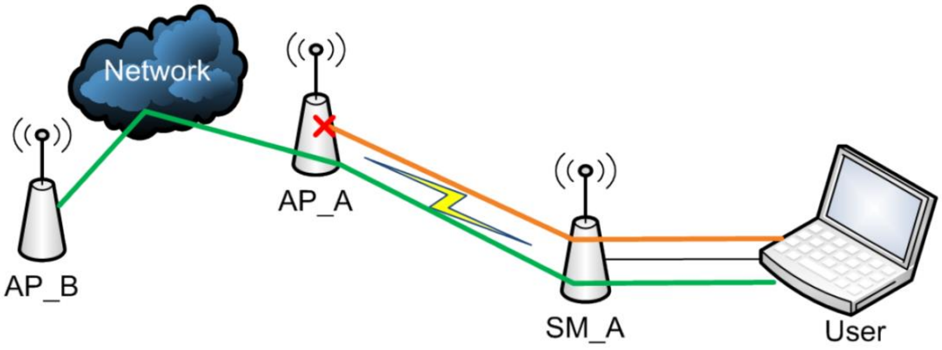
Key Security Considerations when using the RF Telnet Access Feature

To ensure that the network is fully protected from unauthorized AP Telnet sessions, the following topics must be considered:

Securing AP Clusters

When working with a cluster of AP units, to eliminate potential security holes allowing Telnet access, ensure that the RF Telnet Access parameter is set to “Disabled” for every AP in the cluster. In addition, since users situated below the AP are able to pass Telnet sessions up through the SM and AP to the upstream network (while AP RF Telnet Access is set to “Disabled”), ensure that all CMM4 or other networking equipment is secured with strong passwords. Otherwise, users may Telnet to the CMM4 or other networking equipment, and subsequently access network APs (see Figure 121) via their Ethernet interfaces (since RF Telnet Access only prevents Telnet sessions originating from the AP’s wireless interface).

Figure 121 RF Telnet Access Restriction (orange) and Potential Security Hole (green)



As a common practice, AP administrator usernames and passwords must be secured with strong, non-default passwords.

Restricting AP RF Telnet Access

AP Telnet access via the RF interface may be configured in two ways – the AP GUI and SNMP.

Controlling RF Telnet Access via the AP GUI

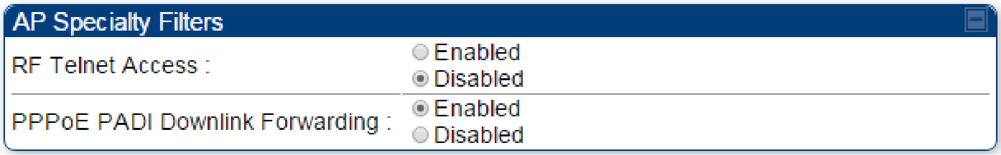
To restrict all Telnet access to the AP via the RF interface from downstream devices, follow these instructions using the AP GUI:

Procedure 20 Restricting RF Telnet access

1 Log into the AP GUI using administrator credentials

2 On the AP GUI, navigate to **Configuration > Protocol Filtering**

3 Under GUI heading “Telnet Access over RF Interface”, set **RF Telnet Access** to **Disabled**



AP Specialty Filters

RF Telnet Access : ○ Enabled ● Disabled

PPPoE PADI Downlink Forwarding : ● Enabled ○ Disabled

4 Click the **Save** button

5 Once the **Save** button is clicked, all RF Telnet Access to the AP from devices situated below the AP is blocked.

Note

The factory default setting for RF Telnet Access is disabled and PPPoE PADI Downlink Forwarding is enabled.

Configuring SNMP Access

The SNMPv3 interface provides a more secure method to perform SNMP operations. This standard provides services for authentication, data integrity and message encryption over SNMP. Refer to Planning for SNMPv3 operation on page 3-37 for details.

Note

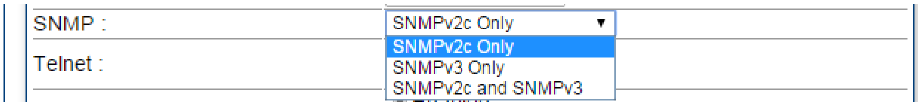
The factory default setting for SNMP is "SNMPv2c Only".

Procedure 21 Configuring SNMPv3

1 Log into the AP GUI using administrator credentials

2 On the AP/SM GUI, navigate to **Configuration > Security Page**

3 Under GUI heading "Security Mode", set **SNMP** to **SNMPv3 Only**



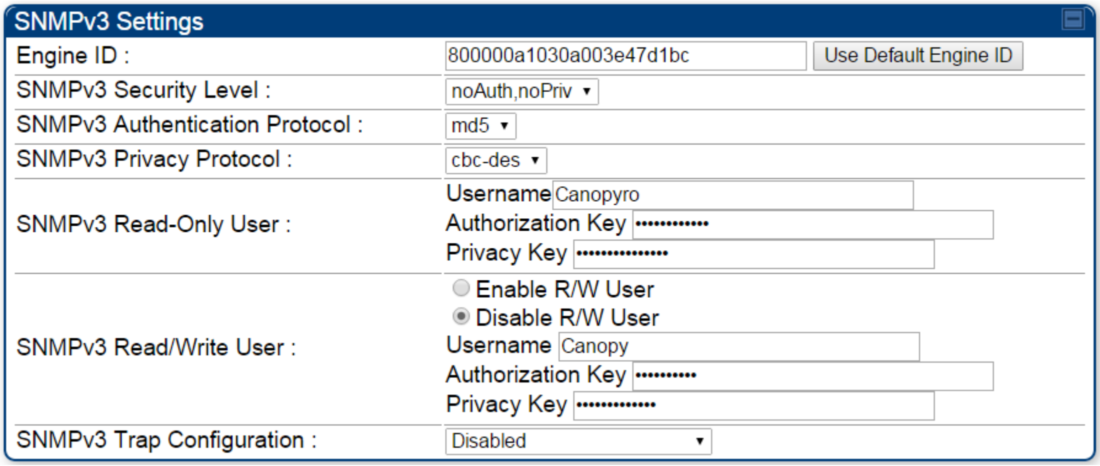
SNMP : SNMPv2c Only

Telnet :

4 Click the **Save Changes** button

5 Go to **Configuration > SNMP Page**

6 Under GUI heading "SNMPv3 setting", set **Engine ID, SNMPv3 Security Level, SNMPv3 Authentication Protocol, SNMPv3 Privacy Protocol, SNMPv3 Read-Only User, SNMPv3 Read/Write User, SNMPv3 Trap Configuration** parameters:



SNMPv3 Settings

Engine ID :	800000a1030a003e47d1bc
SNMPv3 Security Level :	noAuth,noPriv
SNMPv3 Authentication Protocol :	md5
SNMPv3 Privacy Protocol :	cbc-des
SNMPv3 Read-Only User :	Username Canopyro Authorization Key •••••••••••• Privacy Key •••••••••••••••
SNMPv3 Read/Write User :	○ Enable R/W User ● Disable R/W User Username Canopy Authorization Key •••••••••• Privacy Key •••••••••••••
SNMPv3 Trap Configuration :	Disabled

Engine ID :

Each radio (AP/SM/BHM/BHS) has a distinct SNMP authoritative engine identified by a unique Engine ID. While the Engine ID is configurable to the operator it is expected that the operator follow the guidelines of the SNMPEngineID defined in the SNMP-FRAMEWORK-MIB (RFC 3411). The default Engine ID is the MAC address of the device.

SNMPv3 security level, Authentication and Privacy Protocol

The authentication allows authentication of SNMPv3 user and privacy allows for encryption of SNMPv3 message. 450 Platform Family supports MD5 authentication and CBC-DES privacy protocols.

SNMPv3 Read-Only and Read/Write User

The user can defined by configurable attributes. The attributes and default values are:

- Read-only user
  - Username = Canopyro
  - Authentication Password = authCanopyro
  - Privacy Password = privacyCanopyro
- Read-write user (by default read-write user is disabled)
  - Username = Canopy
  - Authentication Password = authCanopy
  - Privacy Password = privacyCanopy

SNMPv3 Trap Configuration

The traps may be sent from radios in SNMPv3 format based on parameter settings. It can be configured for Disabled, Enabled for Read-Only User, Enable for Read/Write User.

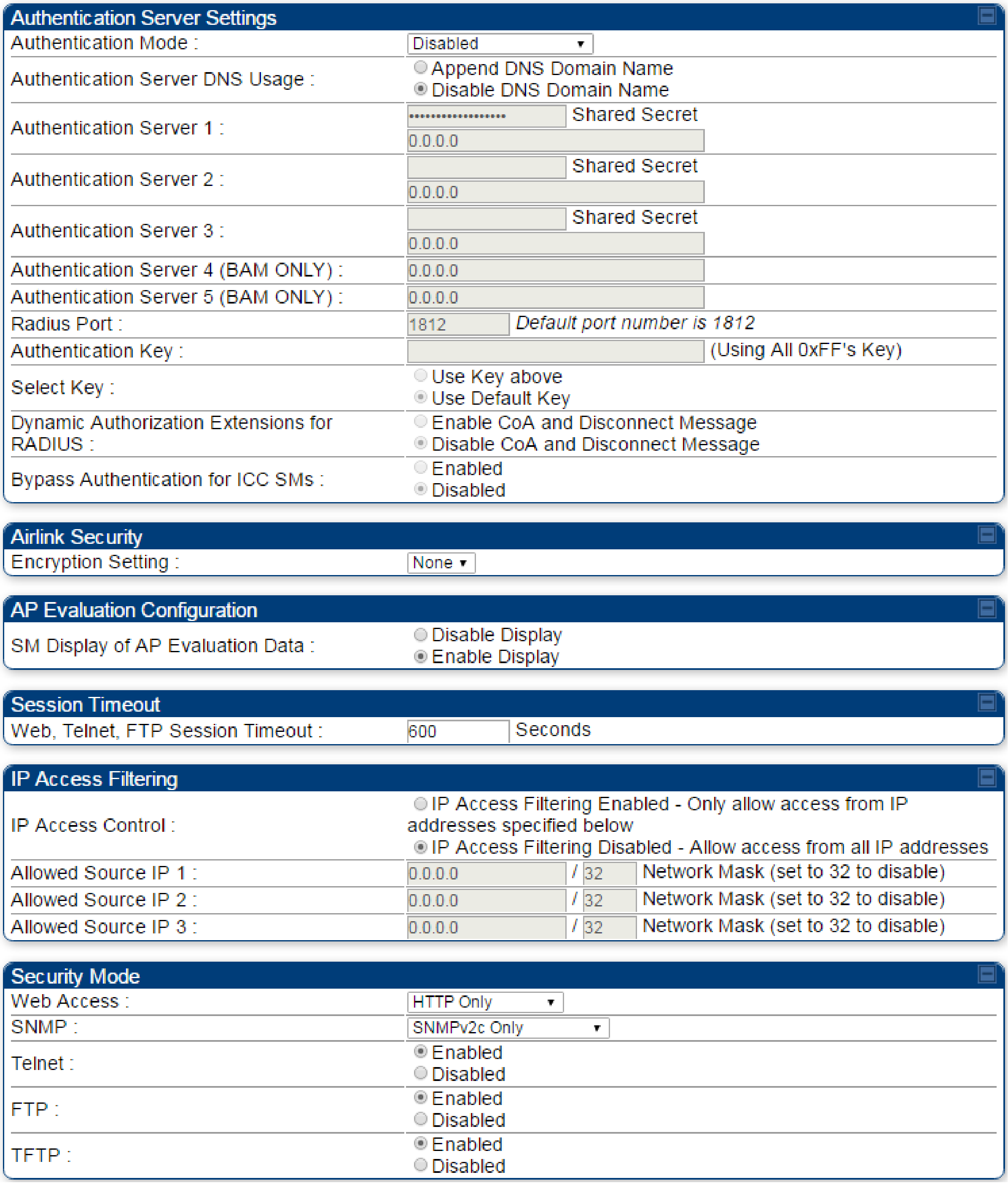
Configuring Security

Applicable products	**PMP :**	☑	AP	☑	SM	**PTP:**	☑	BHM	☑ BMS

Security page – 450 Platform Family AP/BHM

The security page of AP/BHM is explained in Table 117.

Table 117 Security attributes –450 Platform Family AP



Authentication Server Settings

Authentication Mode :	Disabled ▾
Authentication Server DNS Usage :	○ Append DNS Domain Name ● Disable DNS Domain Name
Authentication Server 1 :	•••••••••••••••••• Shared Secret 0.0.0.0
Authentication Server 2 :	Shared Secret 0.0.0.0
Authentication Server 3 :	Shared Secret 0.0.0.0
Authentication Server 4 (BAM ONLY) :	0.0.0.0
Authentication Server 5 (BAM ONLY) :	0.0.0.0
Radius Port :	1812 *Default port number is 1812*
Authentication Key :	(Using All 0xFF's Key)
Select Key :	○ Use Key above ● Use Default Key
Dynamic Authorization Extensions for RADIUS :	○ Enable CoA and Disconnect Message ● Disable CoA and Disconnect Message
Bypass Authentication for ICC SMs :	○ Enabled ● Disabled

Airlink Security

Encryption Setting :	None ▾

AP Evaluation Configuration

SM Display of AP Evaluation Data :	○ Disable Display ● Enable Display

Session Timeout

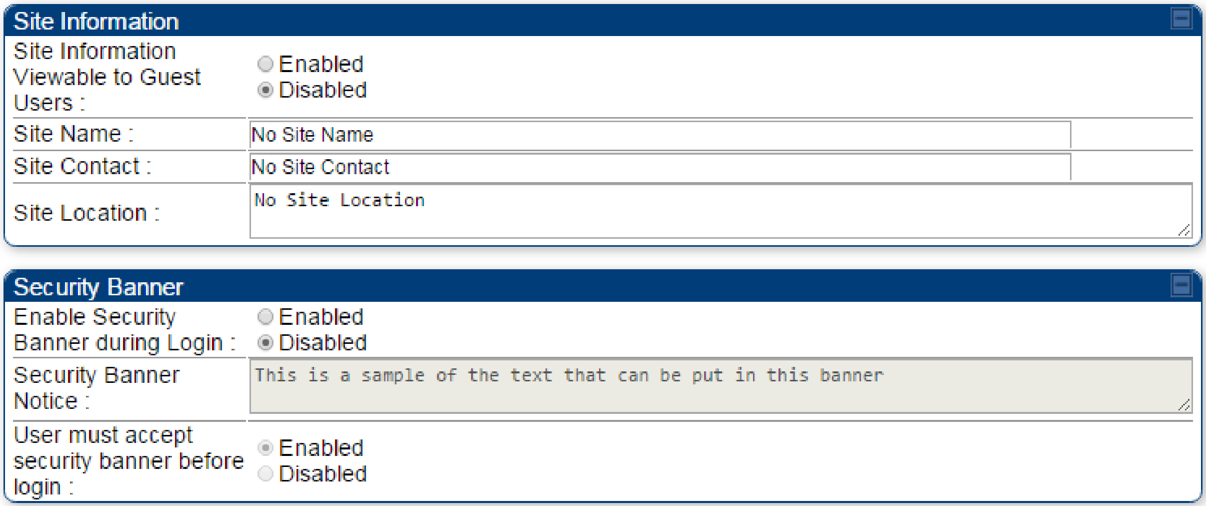
Web, Telnet, FTP Session Timeout :	600 Seconds

IP Access Filtering

IP Access Control :	○ IP Access Filtering Enabled - Only allow access from IP addresses specified below ● IP Access Filtering Disabled - Allow access from all IP addresses
Allowed Source IP 1 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 2 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 3 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)

Security Mode

Web Access :	HTTP Only ▾
SNMP :	SNMPv2c Only ▾
Telnet :	● Enabled ○ Disabled
FTP :	● Enabled ○ Disabled
TFTP :	● Enabled ○ Disabled



Site Information

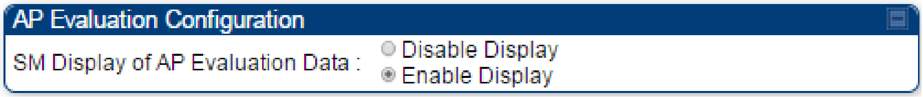
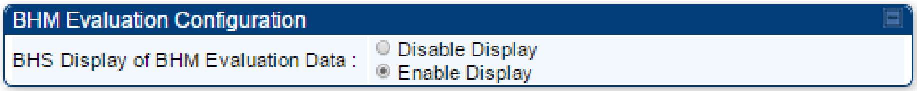
Site Information Viewable to Guest Users :	○ Enabled ● Disabled
Site Name :	No Site Name
Site Contact :	No Site Contact
Site Location :	No Site Location

Security Banner

Enable Security Banner during Login :	○ Enabled ● Disabled
Security Banner Notice :	This is a sample of the text that can be put in this banner
User must accept security banner before login :	● Enabled ○ Disabled

Attribute	Meaning
Authentication Mode	Operators may use this field to select from among the following authentication modes: **Disabled**—the AP/BHM requires no SMs/BHS to authenticate. (Factory default). **Authentication Server** —the AP/BHM requires any SM/BHS that attempts registration to be authenticated in Wireless Manager before registration. **AP PreShared Key** - The AP/BHM acts as the authentication server to its SMs/BHS and will make use of a user-configurable pre-shared authentication key. The operator enters this key on both the AP/BHM and all SMs/BHS desired to register to that AP/BHM. There is also an option of leaving the AP/BHM and SMs/BHS at their default setting of using the “Default Key”. Due to the nature of the authentication operation, if you want to set a specific authentication key, then you MUST configure the key on all of the SMs/BHS and reboot them BEFORE enabling the key and option on the AP/BHM. Otherwise, if you configure the AP/BHM first, none of the SMs/BHS is able to register. **RADIUS AAA** - When RADIUS AAA is selected, up to 3 Authentication Server (RADIUS Server) IP addresses and Shared Secrets can be configured. The IP address(s) configured here must match the IP address(s) of the RADIUS server(s). The shared secret(s) configured here must match the shared secret(s) configured in the RADIUS server(s). Servers 2 and 3 are meant for backup and reliability, not for splitting the database. If Server 1 doesn’t respond, Server 2 is tried, and then server 3. If Server 1 rejects authentication, the SM is denied entry to the network, and does not progress trying the other servers. **Note** This parameter is applicable to BHM.

Authentication Server DNS Usage	The management DNS domain name may be toggled such that the name of the authentication server only needs to be specified and the DNS domain name is automatically appended to that name. **Note** This parameter is applicable to BHM.
Authentication Server *1 to 5*	Enter the IP address or server name of the authentication server (RADIUS or WM) and the Shared Secret configured in the authentication server. When **Authentication Mode RADIUS AAA** is selected, the default value of **Shared Secret** is "CanopySharedSecret". The **Shared Secret** may consist of up to 32 ASCII characters. **Note** This parameter is applicable to BHM.
Radius Port	This field allows the operator to configure a custom port for RADIUS server communication. The default value is *1812*. **Note** This parameter is applicable to BHM.
Authentication Key	The authentication key is a 32-character hexadecimal string used when **Authentication Mode** is set to **AP PreShared Key**. By default, this key is set to 0xFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF. **Note** This parameter is applicable to BHM.
Select Key	This option allows operators to choose which authentication key is used: **Use Key above** means that the key specified in **Authentication Key** is used for authentication **Use Default Key** means that a default key (based off of the SM's MAC address) is used for authentication **Note** This parameter is applicable to BHM.
Dynamic Authorization Extensions for RADIUS	**Enable CoA and Disconnect Message**: Allows to control configuration parameters of SM using RADIUS CoA and Disconnect Message feature. **Disable CoA and Disconnect Message**: Disables RADIUS CoA and Disconnect Message feature. To enable CoA and Disconnect feature, the Authentication Mode should be set to RADIUS AAA.
Bypass Authentication for ICC SMs	**Enabled**: SM authentication is disabled when SM connects via ICC (Installation Color Code). **Disabled**: SM authentication is enabled.
Encryption Setting	Specify the type of airlink security to apply to this AP. The encryption setting must match the encryption setting of the SMs.

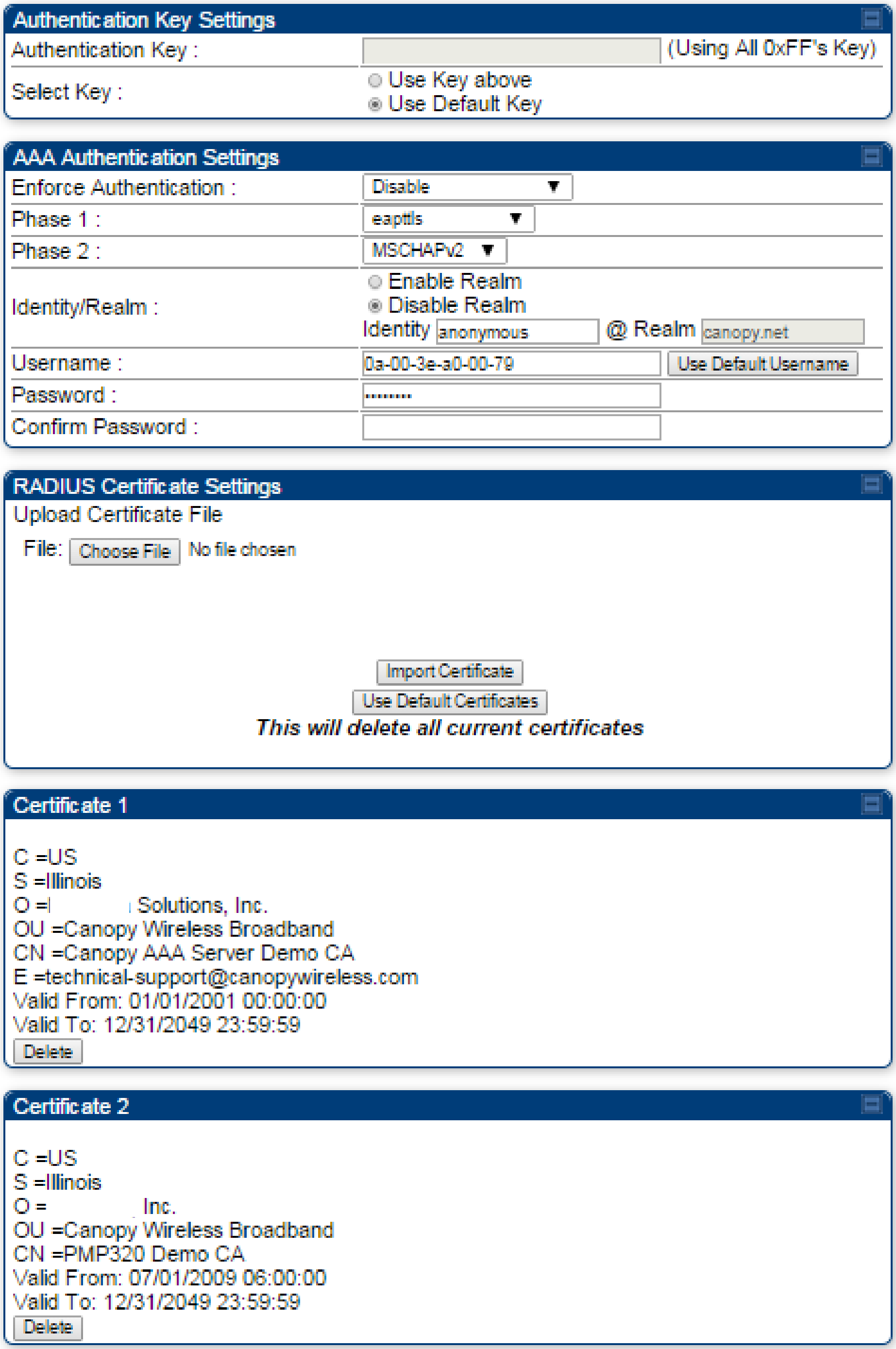
	None provides no encryption on the air link. **DES** (Data Encryption Standard): An over-the-air link encryption option that uses secret 56-bit keys and 8 parity bits. DES performs a series of bit permutations, substitutions, and recombination operations on blocks of data. DES encryption does not affect the performance or throughput of the system. **AES** (Advanced Encryption Standard)**:** An over-the-air link encryption option that uses the Rijndael algorithm and 128-bit keys to establish a higher level of security than DES. AES products are certified as compliant with the Federal Information Processing Standards (FIPS 197) in the U.S.A. Note This parameter is applicable to BHM.
SM Display of AP Evaluation Data Or BHS Display of BHM Evaluation Data	Allows operators to suppress the display of data about this AP/BHM on the AP/BHM Evaluation tab of the Tools page in all SMs/BHS that register. The factory default setting for SM Display of AP Evaluation Data or BHS Display of BHM Evaluation Data is enabled display. PMP 450/450i Series – SM display of AP Evaluation Data parameter  AP Evaluation Configuration SM Display of AP Evaluation Data : ○ Disable Display ● Enable Display PTP 450/450i Series – BHS display of BHM Evaluation Data parameter  BHM Evaluation Configuration BHS Display of BHM Evaluation Data : ○ Disable Display ● Enable Display
Web, Telnet, FTP Session Timeout	Enter the expiry in seconds for remote management sessions via **HTTP**, **telnet**, or **ftp** access to the AP/BHM.
IP Access Control	You can permit access to the AP/BHM from any IP address (**IP Access Filtering Disabled**) or limit it to access from only one, two, or three IP addresses that you specify (**IP Access Filtering Enabled**). If you select **IP Access Filtering Enabled**, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted from any IP address
Allowed Source IP *1 to 3*	If you selected **IP Access Filtering Enabled** for the **IP Access Control** parameter, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted to the AP from any IP address. You may populate as many as all three. If you selected **IP Access Filtering Disabled** for the **IP Access Control** parameter, then no entries in this parameter are read, and access from all IP addresses is permitted.

Web Access	The Radio supports secured and non-secured web access protocols. Select suitable web access from drop down list: • **HTTP Only** – provides non-secured web access. The radio to be accessed via http://<IP of Radio>. • **HTTPS Only** – provides a secured web access. The radio to be accessed via https://<IP of Radio>. • **HTTP and HTTPS** – If enabled, the radio can be accessed via both http and https.
SNMP	This option allows to configure SNMP agent communication version. It can be selected from drop down list : • **SNMPv2c Only** – Enables SNMP v2 community protocol. • **SNMPv3 Only** – Enables SNMP v3 protocol. It is a secured communication protocol. • **SNMPv2c and SNMPv3** – It enables both the protocols.
Telnet	This option allows to **Enable** and **Disable** Telnet access to the Radio.
FTP	This option allows to **Enable** and **Disable** FTP access to the Radio.
TFTP	This option allows to **Enable** and **Disable** TFTP access to the Radio.

Security page - 450 Platform Family SM

The security page of 450 Platform Family SM is explained in Table 118.

Table 118 Security attributes –450 Platform Family SM



Authentication Key Settings

Authentication Key : (Using All 0xFF's Key)

Select Key : ○ Use Key above ● Use Default Key

AAA Authentication Settings

Enforce Authentication : Disable

Phase 1 : eapttls

Phase 2 : MSCHAPv2

Identity/Realm : ○ Enable Realm ● Disable Realm
Identity anonymous @ Realm canopy.net

Username : 0a-00-3e-a0-00-79 Use Default Username

Password : •••••••••

Confirm Password :

RADIUS Certificate Settings

Upload Certificate File

File: Choose File No file chosen

Import Certificate

Use Default Certificates

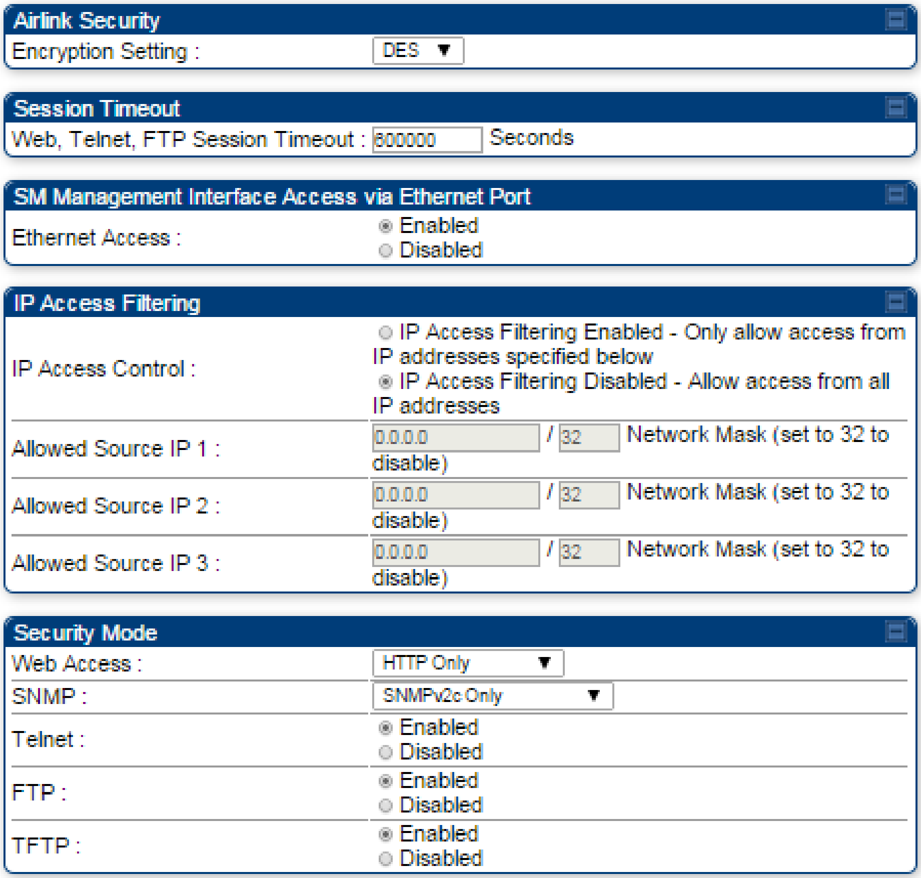
This will delete all current certificates

Certificate 1

C =US
S =Illinois
O =I Solutions, Inc.
OU =Canopy Wireless Broadband
CN =Canopy AAA Server Demo CA
E =technical-support@canopywireless.com
Valid From: 01/01/2001 00:00:00
Valid To: 12/31/2049 23:59:59
Delete

Certificate 2

C =US
S =Illinois
O = Inc.
OU =Canopy Wireless Broadband
CN =PMP320 Demo CA
Valid From: 07/01/2009 06:00:00
Valid To: 12/31/2049 23:59:59
Delete



Airlink Security

Encryption Setting :	DES ▼

Session Timeout

Web, Telnet, FTP Session Timeout :	600000 Seconds

SM Management Interface Access via Ethernet Port

Ethernet Access :	● Enabled ○ Disabled

IP Access Filtering

IP Access Control :	○ IP Access Filtering Enabled - Only allow access from IP addresses specified below ● IP Access Filtering Disabled - Allow access from all IP addresses
Allowed Source IP 1 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 2 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 3 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)

Security Mode

Web Access :	HTTP Only ▼
SNMP :	SNMPv2c Only ▼
Telnet :	● Enabled ○ Disabled
FTP :	● Enabled ○ Disabled
TFTP :	● Enabled ○ Disabled

Attribute	Meaning
Authentication Key	Only if the AP to which this SM will register requires authentication, specify the key that the SM will use when authenticating. For alpha characters in this hex key, use only upper case.
Select Key	The **Use Default Key** selection specifies the predetermined key for authentication in Wireless Manager The **Use Key above** selection specifies the 32-digit hexadecimal key that is permanently stored on both the SM and the WM
Enforce Authentication	The SM may enforce authentication types of **AAA** and **AP Pre-sharedKey**. The SM will not finish the registration process if the AP is not using the configured authentication method (and the SM locks out the AP for 15 minutes).
Phase 1	The protocols supported for the **Phase 1** (Outside Identity) phase of authentication are EAPTTLS (Extensible Authentication Protocol Tunneled Transport Layer Security) or MSCHAPv2 (Microsoft Challenge-Handshake Authentication Protocol version 2).

Phase 2	Select the desired **Phase 2** (Inside Identity) authentication protocol from the **Phase 2** options of **PAP** (Password Authentication Protocol), **CHAP** (Challenge Handshake Authentication Protocol), and **MSCHAP (**Microsoft's version of CHAP, version 2 is used). The protocol must be consistent with the authentication protocol configured on the RADIUS server.
Identity/Realm	If Realms are being used, select **Enable Realm** and configure an outer identity in the **Identity** field and a Realm in the **Realm** field. These must match the Phase 1/Outer Identity and Realm configured in the RADIUS server. The default **Identity** is "anonymous". The **Identity** can be up to 128 non-special (no diacritical markings) alphanumeric characters. The default **Realm** is "canopy.net". The **Realm** can also be up to 128 non-special alphanumeric characters. Configure an outer Identity in the **Username** field. This must match the Phase 1/Outer Identity username configured in the RADIUS server. The default Phase 1/Outer Identity **Username** is "anonymous". The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters.
Username	Enter a **Username** for the SM. This must match the username configured for the SM on the RADIUS server. The default **Username** is the SM's MAC address. The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters.
Password	Enter the desired password for the SM in the **Password** and **Confirm Password** fields. The **Password** must match the password configured for the SM on the RADIUS server. The default **Password** is "password". The **Password** can be up to 128 non-special (no diacritical markings) alphanumeric characters
Upload Certificate File	To upload a certificate manually to a SM, first load it in a known place on your PC or network drive, then click on a **Delete** button on one of the Certificate description blocks to delete a certificate to provide space for your certificate. Click on **Choose File,** browse to the location of the certificate, and click the **Import Certificate** button, and then reboot the radio to use the new certificate. When a certificate is in use, after the SM successfully registers to an AP, an indication of **In Use** will appear in the description block of the certificate being used. The public certificates installed on the SMs are used with the private certificate on the RADIUS server to provide a public/private key encryption system. Up to 2 certificates can be resident on a SM. An installed certificate can be deleted by clicking the **Delete** button in the certificate's description block on the Configuration > Security tab. To restore the 2 default certificates, click the **Use Default Certificates** button in the **RADIUS Certificate Settings** parameter block and reboot the radio.

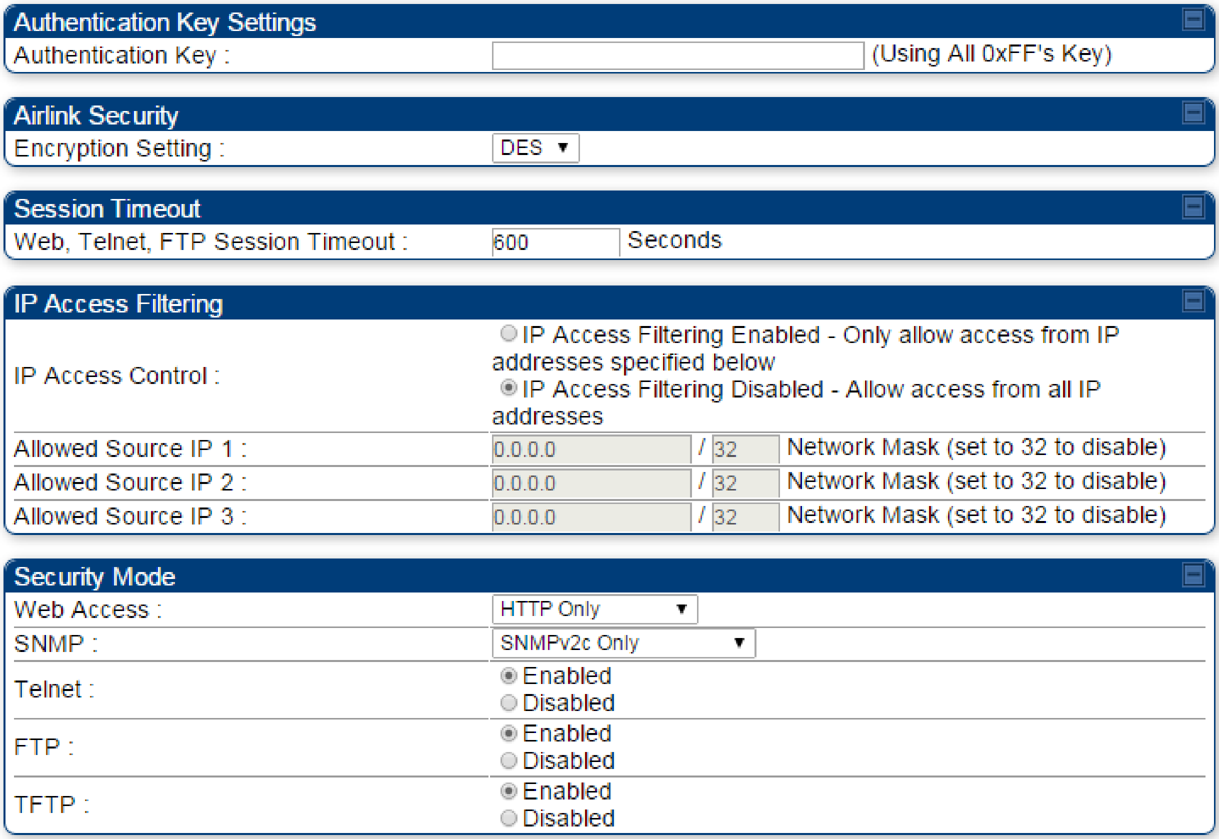
Encryption Setting	Specify the type of airlink security to apply to this SM. The encryption setting must match the encryption setting of the AP. **None** provides no encryption on the air link. **DES** (Data Encryption Standard): An over-the-air link encryption option that uses secret 56-bit keys and 8 parity bits. DES performs a series of bit permutations, substitutions, and recombination operations on blocks of data. DES encryption does not affect the performance or throughput of the system. **AES** (Advanced Encryption Standard)**:** An over-the-air link encryption option that uses the Rijndael algorithm and 128-bit keys to establish a higher level of security than DES. AES products are certified as compliant with the Federal Information Processing Standards (FIPS 197) in the U.S.A.
Web, Telnet, FTP Session Timeout	Enter the expiry in seconds for remote management sessions via HTTP, telnet, or FTP access to the SM.
Ethernet Access	If you want to prevent any device that is connected to the Ethernet port of the SM from accessing the management interface of the SM, select **Ethernet Access Disabled**. This selection disables access through this port to via HTTP (the GUI), SNMP, telnet, FTP, and TFTP. With this selection, management access is available through only the RF interface via either an IP address (if **Network Accessibility** is set to **Public** on the SM) or the Session Status or Remote Subscribers tab of the AP. **Note** This setting does not prevent a device connected to the Ethernet port from accessing the management interface of other SMs in the network. To prevent this, use the IP Access Filtering Enabled selection in the IP Access Control parameter of the SMs in the network. See IP Access Control below. If you want to allow management access through the Ethernet port, select **Ethernet Access Enabled**. This is the factory default setting for this parameter.
IP Access Control	You can permit access to the SM from any IP address (**IP Access Filtering Disabled**) or limit it to access from only one, two, or three IP addresses that you specify (**IP Access Filtering Enabled**). If you select **IP Access Filtering Enabled**, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted from any IP address
Allowed Source IP *1 to 3*	If you selected **IP Access Filtering Enabled** for the **IP Access Control** parameter, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted to the SM from any IP address. You may populate as many as all three.

	If you selected **IP Access Filtering Disabled** for the **IP Access Control** parameter, then no entries in this parameter are read, and access from all IP addresses is permitted. A subnet mask may be defined for each entry to allow for filtering control based on a range of IP addresses.
Web Access	The Radio supports secured and non-secured web access protocols. Select suitable web access from drop down list: • **HTTP Only** – provides non-secured web access. The radio to be accessed via http://<IP of Radio>. • **HTTPS Only** – provides a secured web access. The radio to be accessed via https://<IP of Radio>. • **HTTP and HTTPS** – If enabled, the radio can be accessed via both http and https.
SNMP	This option allows to configure SNMP agent communication version. It can be selected from drop down list : • **SNMPv2c Only** – Enables SNMP v2 community protocol. • **SNMPv3 Only** – Enables SNMP v3 protocol. It is secured communication protocol. • **SNMPv2c and SNMPv3** – It enables both the protocols.
Telnet	This option allows to **Enable** and **Disable** Telnet access to the Radio.
FTP	This option allows to **Enable** and **Disable** FTP access to the Radio.
TFTP	This option allows to **Enable** and **Disable** TFTP access to the Radio.
Site Name	Specify a string to associate with the physical module.
Site Contact	Enter contact information for the module administrator.
Site Location	Enter information about the physical location of the module.
Enable Security Banner during Login	**Enable**: The Security Banner Notice will be displayed before login. **Disable**: The Security Banner Notice will not be displayed before login.
Security Banner Notice	User can enter ASCII (0-9a-zA-Z newline, line-feed are allowed) text up-to 1300 characters.
User must accept security banner before login	**Enable**: login area (username and password) will be disabled unless user accepts the security banner. **Disable**: User can't login to radio without accepting security banner.

Security page –450 Platform Family BHS

The Security page of 450 Platform Family BHS is explained in Table 119.

Table 119 Security attributes - 450 Platform Family BHS



Authentication Key Settings

Authentication Key : (Using All 0xFF's Key)

Airlink Security

Encryption Setting : DES

Session Timeout

Web, Telnet, FTP Session Timeout : 600 Seconds

IP Access Filtering

IP Access Control :
○ IP Access Filtering Enabled - Only allow access from IP addresses specified below
● IP Access Filtering Disabled - Allow access from all IP addresses

Allowed Source IP 1 : 0.0.0.0 / 32 Network Mask (set to 32 to disable)

Allowed Source IP 2 : 0.0.0.0 / 32 Network Mask (set to 32 to disable)

Allowed Source IP 3 : 0.0.0.0 / 32 Network Mask (set to 32 to disable)

Security Mode

Web Access : HTTP Only

SNMP : SNMPv2c Only

Telnet : ● Enabled ○ Disabled

FTP : ● Enabled ○ Disabled

TFTP : ● Enabled ○ Disabled

Attribute	Meaning
Authentication Key	Only if the BHM to which this BHS registers requires an authentication, specify the key that the BHS will use when authenticating. For alpha characters in this hex key, use only upper case.
Encryption Setting	Specify the type of airlink security to apply to this BHS. The encryption setting must match the encryption setting of the BHM. **None** provides no encryption on the air link. **DES** (Data Encryption Standard): An over-the-air link encryption option that uses secret 56-bit keys and 8 parity bits. DES performs a series of bit permutations, substitutions, and recombination operations on blocks of data. DES encryption does not affect the performance or throughput of the system. It is factory default setting. **AES** (Advanced Encryption Standard)**:** An over-the-air link encryption option that uses the Rijndael algorithm and 128-bit keys to establish a higher level of security than DES. AES products are certified as compliant with the Federal Information Processing Standards (FIPS 197) in the U.S.A.

Web, Telnet, FTP Session Timeout	Enter the expiry in seconds for remote management sessions via HTTP, telnet, or FTP access to the BHS.
IP Access Control	You can permit access to the BHS from any IP address (**IP Access Filtering Disabled**) or limit it to access from only one, two, or three IP addresses that you specify (**IP Access Filtering Enabled**). If you select **IP Access Filtering Enabled**, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted from any IP address
Allowed Source IP *1 to 3*	If you selected **IP Access Filtering Enabled** for the **IP Access Control** parameter, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted to the BHS from any IP address. You may populate as many as all three. If you selected **IP Access Filtering Disabled** for the **IP Access Control** parameter, then no entries in this parameter are read, and access from all IP addresses is permitted. A subnet mask may be defined for each entry to allow for filtering control based on a range of IP addresses.
Web Access	The Radio supports secured and non-secured web access protocols. Select suitable web access from drop down list: • **HTTP Only** – provides non-secured web access. The radio to be accessed via http://<IP of Radio>. • **HTTPS Only** – provides a secured web access. The radio to be accessed via https://<IP of Radio>. • **HTTP and HTTPS** – If enabled, the radio can be accessed via both http and https.
SNMP	This option allows to configure SNMP agent communication version. It can be selected from drop down list : • **SNMPv2c Only** – Enables SNMP v2 community protocol. • **SNMPv3 Only** – Enables SNMP v3 protocol. It is secured communication protocol. • **SNMPv2c and SNMPv3** – It enables both the protocols.
Telnet	This option allows to **Enable** and **Disable** Telnet access to the Radio.
FTP	This option allows to **Enable** and **Disable** FTP access to the Radio.
TFTP	This option allows to **Enable** and **Disable** TFTP access to the Radio.

Configuring radio parameters

PMP 450m Series – Configuring radio

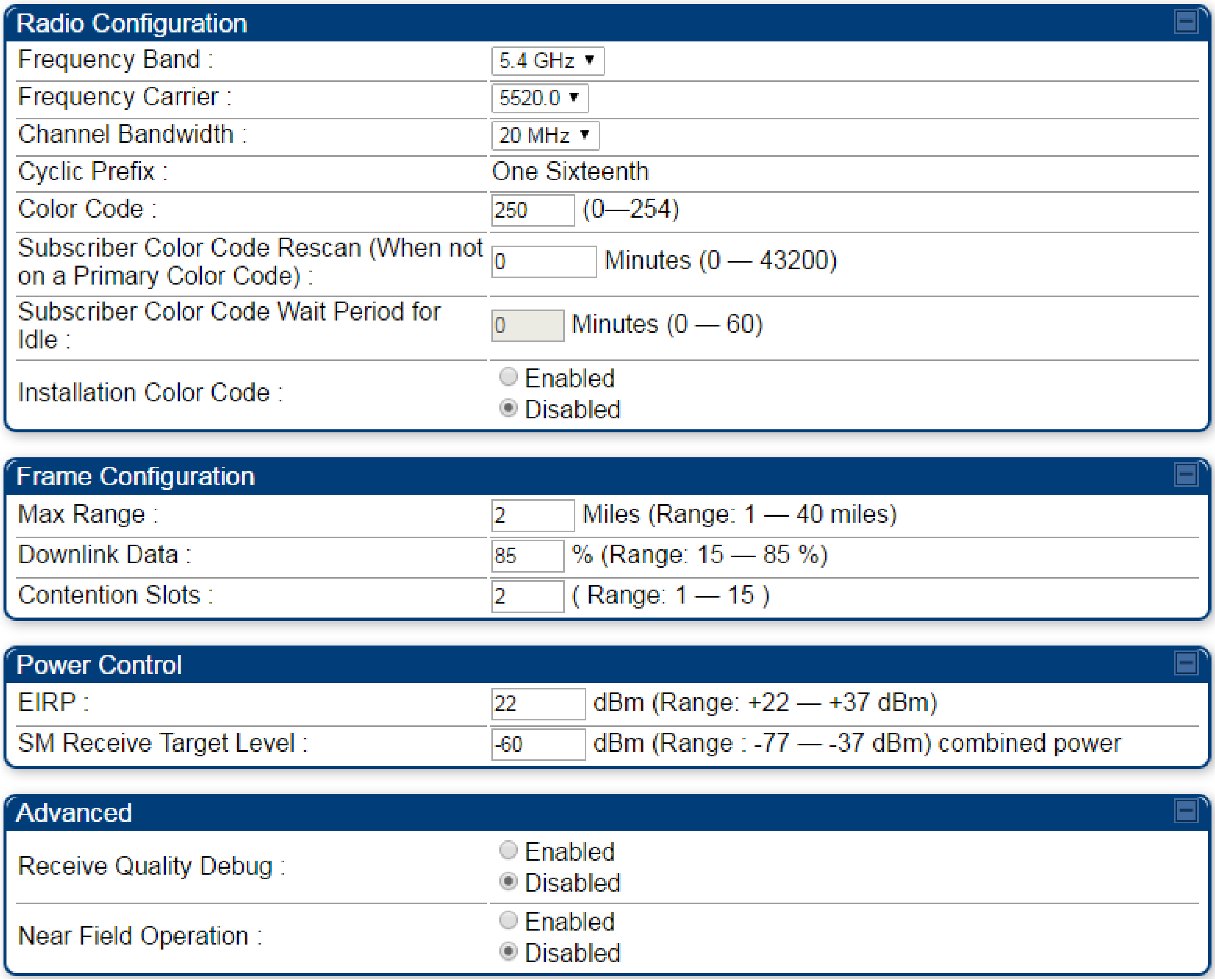
Radio page - PMP 450m AP 5 GHz

The **Radio** tab of the PMP 450m AP contains some of the configurable parameters that define how an AP operates.

Note

Only the frequencies available for your region and the selected Channel bandwidth are displayed.

Table 120 PMP 450m AP Radio attributes - 5 GHz



Radio Configuration

Frequency Band :	5.4 GHz ▾
Frequency Carrier :	5520.0 ▾
Channel Bandwidth :	20 MHz ▾
Cyclic Prefix :	One Sixteenth
Color Code :	250 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Frame Configuration

Max Range :	2 Miles (Range: 1 — 40 miles)
Downlink Data :	85 % (Range: 15 — 85 %)
Contention Slots :	2 (Range: 1 — 15)

Power Control

EIRP :	22 dBm (Range: +22 — +37 dBm)
SM Receive Target Level :	-60 dBm (Range : -77 — -37 dBm) combined power

Advanced

Receive Quality Debug :	○ Enabled ● Disabled
Near Field Operation :	○ Enabled ● Disabled

Attribute	Meaning
Frequency Band	Select the desired operating frequency band.
Frequency Carrier	Specify the frequency for the module to transmit. The default for this parameter is **None**. For a list of channels in the band, see the drop-down list on the radio GUI.
Channel Bandwidth	The channel size used by the radio for RF transmission. The setting for the channel bandwidth must match between the AP and the SM. The supported Channel Bandwidth is 20 MHz.
Cyclic Prefix	OFDM technology uses a cyclic prefix, where a portion of the end of a symbol (slot) is repeated at the beginning of the symbol to allow multi-pathing to settle before receiving the desired data. A 1/16 cyclic prefix means that for every 16 bits of throughput data transmitted, an additional bit is used.
Color Code	Specify a value from 0 to 254. For registration to occur, the color code of the SM and the AP *must* match. Color code is not a security feature. Instead, color code is a management feature, typically for assigning each sector a different color code. Color code allows you to force a SM to register to only a specific AP, even where the SM can communicate with multiple APs. The default setting for the color code value is 0. This value matches only the color code of 0 (*not* all 255 color codes).
Subscriber Color Code Rescan (When not on a Primary Color Code)	This timer may be utilized to initiate SM rescans in order to register to an AP configured with the SM's primary color code. The time (in minutes) for a subscriber to rescan (if this AP is not configured with the SM's primary color code). This timer will only fire once – if the **Subscriber Color Code Wait Period for Idle** timer is configured with a nonzero value and the **Subscriber Color Code Rescan** expires, the **Subscriber Color Code Wait Period for Idle** is started. If the **Subscriber Color Code Wait Period for Idle** timer is configured with a zero value and the **Subscriber Color Code Rescan** timer expires, the SM will immediately go into rescan mode
Subscriber Color Code Wait Period for Idle	The time (in minutes) for a subscriber to rescan while idle (if this AP is not configured with the SM's primary color code). This timer will fire periodic events. The fired event determines if any RF unicast traffic (either inbound or outbound) has occurred since the last event. If the results of the event determine that no RF unicast traffic has occurred (SM is idle), then the subscriber will rescan.

Installation Color Code	With this feature enabled on the AP and SM, operators may install and remotely configure SMs without having to configure matching color codes between the modules. While the SM is accessible for configuration from above the AP (for remote provisioning) and below the SM (for local site provisioning), no user data is passed over the radio link. When using the Installation Color Code feature, ensure that the SM is configured with the factory default Color Code configuration (Color Code 1 is “0”, Color Code 2-10 set to “0” and “Disable”). The status of the Installation Color Code can be viewed on the AP Eval web GUI page, and when the SM is registered using the Installation Color Code the message “SM is registered via ICC – Bridging Disabled!” is displayed in red on every SM GUI page. The Installation Color Code parameter is configurable without a radio reboot for both the AP and SM. If a SM is registered via Installation Color Code and the feature is then disabled, operators will need to reboot the SM or force it to reregister (i.e. using Rescan APs functionality on the AP Eval page).
Max Range	Enter a number of miles (or kilometers divided by 1.61, then rounded to an integer) for the furthest distance from which a SM is allowed to register to this AP. Do not set the distance to any greater number of miles. A greater distance • does not increase the power of transmission from the AP. • can reduce aggregate throughput. Regardless of this distance, the SM must meet the minimum requirements for an acceptable link. If the AP is in cluster, then you *must* set this parameter on all other APs in the cluster exactly the same, except as described in the Downlink Data NOTE admonition below. The default value of this parameter is 2 miles (3.2 km).
Downlink Data	Specify the percentage of the aggregate throughput for the downlink (frames transmitted from the AP to the subscriber). For example, if the aggregate (uplink and downlink total) throughput on the AP is 90 Mb, then 75% specified for this parameter allocates 67.5 Mb for the downlink and 22.5 Mb for the uplink. The default for this parameter is 75%. This parameter must be set in the range of 15% - 85%, otherwise the invalid input will not be accepted and the previously-entered valid setting is used. **Note** In order to prevent self-interference, the frame configuration needs to align which includes Downlink Data, Max Range and Contention slots. For North America Region, the maximum Downlink % for a 5.4 GHz radio is 75% only..
Contention Slots (a.k.a. Control Slots)	This field indicates the number of (reserved) Contention slots configured by the operator. The SM uses reserved Contention slots and unused data slots for bandwidth requests. See Contention slots on page 7-234.

EIRP	This field indicates the combined power level at which the AP will transmit, based on the Country Code. It also includes the antenna gain and array gain.
SM Receive Target Level	Each SM's Transmitter Output Power is automatically set by the AP. The AP monitors the received power from each SM, and adjusts each SM's Transmitter Output Power so that the received power at the AP from that SM is not greater what is set in this field. This value represents the transmitted and received power (combined power) perceived on the SM.
Receive Quality Debug	To aid in link performance monitoring, the AP and SM now report the number of fragments received per modulation (i.e. QPSK, 16-QAM, 64-QAM and 256-QAM) and per channel (polarization). **Note** Due to CPU load, this will slightly degrade packet per second processing.
Near Field Operation	This parameter is enabled by the Near Field Operation control. This is only available when the EIRP is set to 22 dBm or below. When Near Field Operation is enabled, the Near Field Range is used to apply compensation to the unit's calibration to support operation in the near field.

Note

The following features are not supported on PMP 450m in current release:

- Multicast VC
- Broadcast Repeat Count

PMP/PTP 450i Series – configuring radio

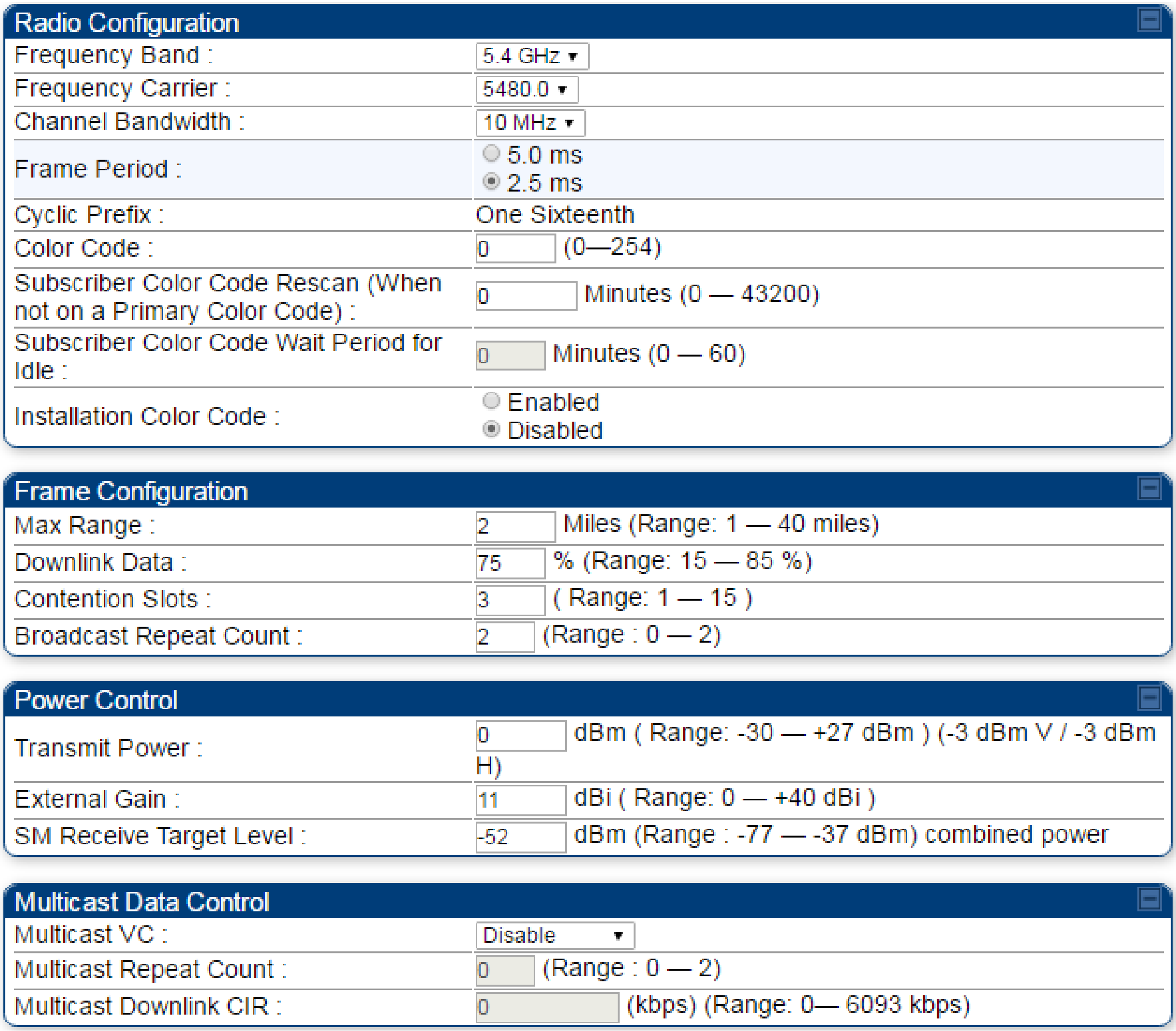
Radio page - PMP 450i AP 5 GHz

The **Radio** tab of the PMP 450i AP contains some of the configurable parameters that define how an AP operates.

Note

Only the frequencies available for your region and the selected Channel bandwidth are displayed.

Table 121 PMP 450i AP Radio attributes - 5 GHz



Radio Configuration

Frequency Band :	5.4 GHz ▾
Frequency Carrier :	5480.0 ▾
Channel Bandwidth :	10 MHz ▾
Frame Period :	○ 5.0 ms ● 2.5 ms
Cyclic Prefix :	One Sixteenth
Color Code :	0 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Frame Configuration

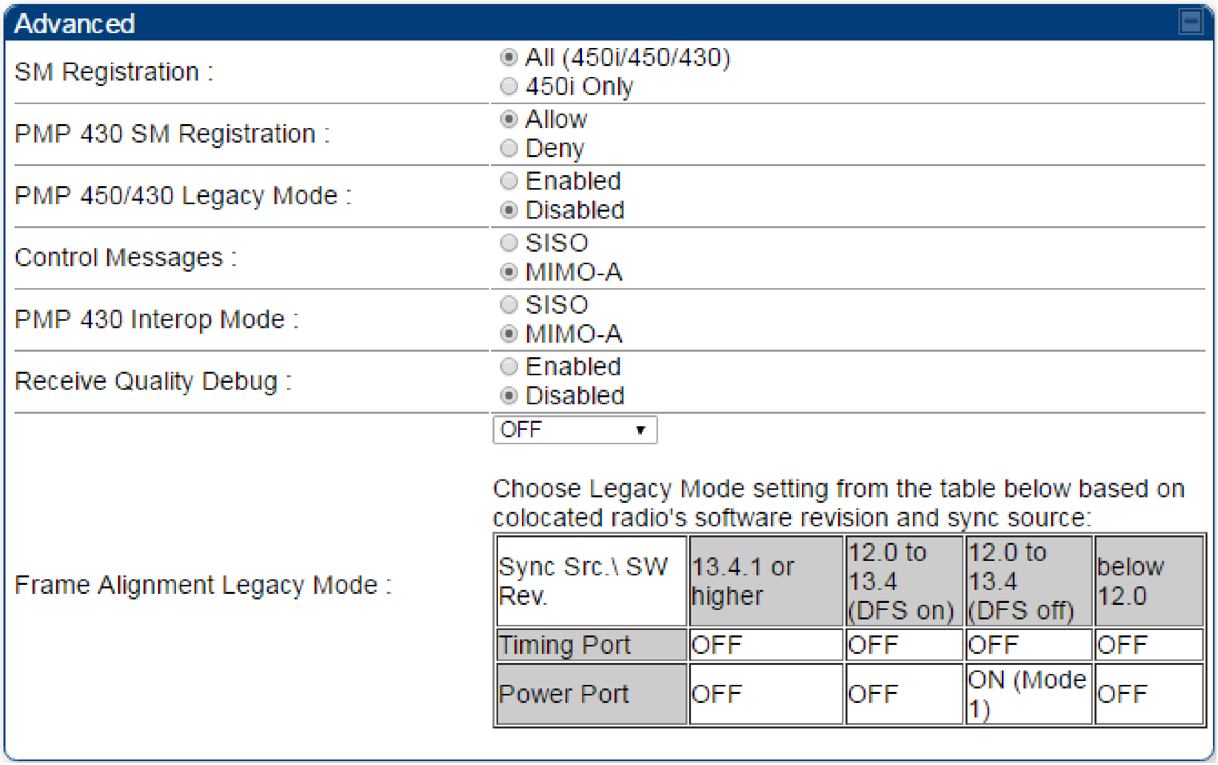
Max Range :	2 Miles (Range: 1 — 40 miles)
Downlink Data :	75 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	0 dBm (Range: -30 — +27 dBm) (-3 dBm V / -3 dBm H)
External Gain :	11 dBi (Range: 0 — +40 dBi)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power

Multicast Data Control

Multicast VC :	Disable ▾
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 6093 kbps)



Advanced

SM Registration :	● All (450i/450/430) ○ 450i Only
PMP 430 SM Registration :	● Allow ○ Deny
PMP 450/430 Legacy Mode :	○ Enabled ● Disabled
Control Messages :	○ SISO ● MIMO-A
PMP 430 Interop Mode :	○ SISO ● MIMO-A
Receive Quality Debug :	○ Enabled ● Disabled
Frame Alignment Legacy Mode :	OFF ▾ Choose Legacy Mode setting from the table below based on colocated radio's software revision and sync source:

Sync Src.\ SW Rev.	13.4.1 or higher	12.0 to 13.4 (DFS on)	12.0 to 13.4 (DFS off)	below 12.0
Timing Port	OFF	OFF	OFF	OFF
Power Port	OFF	OFF	ON (Mode 1)	OFF

Attribute	Meaning
Frequency Band	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193
Frequency Carrier	
Alternate Frequency Carrier 1 and 2	These parameters are displayed based on Regional Settings. Refer Country on page 7-142
Channel Bandwidth	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193
Cyclic Prefix	
Frame Period	
Color Code	
Subscriber Color Code Rescan (When not on a Primary Color Code)	
Subscriber Color Code Wait Period for Idle	
Installation Color Code	
Max Range	
Downlink Data	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193

Contention Slots (a.k.a. Control Slots)	This field indicates the number of (reserved) Contention slots configured by the operator. The SM uses reserved Contention slots and unused data slots for bandwidth requests. See Contention slots on page7-234.
Broadcast Repeat Count	The default is 2 repeats (in addition to the original broadcast packet, for a total of 3 packets sent for every one needed), and is settable to 1 or 0 repeats (2 or 1 packets for every broadcast). ARQ (Automatic Repeat reQuest) is not present in downlink broadcast packets, since it can cause unnecessary uplink traffic from every SM for each broadcast packet. For successful transport without ARQ, the AP repeats downlink broadcast packets. The SMs filter out all repeated broadcast packets and, thus, do not transport further. The default of 2 repeats is optimum for typical uses of the network as an internet access system. In applications with heavy download broadcast such as video distribution, overall throughput is significantly improved by setting the repeat count to 1 or 0. This avoids flooding the downlink with repeat broadcast packets.
Transmitter Output Power	This value represents the combined power of the AP's two transmitters. Nations and regions may regulate transmitter output power. For example • 900 MHz, 5.4 GHz and 5.8 GHz modules are available as connectorized radios, which require the operator to adjust power to ensure regulatory compliance. The professional installer of the equipment has the responsibility to • maintain awareness of applicable regulations. • calculate the permissible transmitter output power for the module. • confirm that the initial power setting is compliant with national or regional regulations. • confirm that the power setting is compliant following any reset of the module to factory defaults.
External Gain	This value needs to correspond to the published gain of the antenna used to ensure the radio will meet regulatory requirements.
SM Receive Target Level	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193
Multicast VC Data Rate	This pull down menu of the Multicast Data Control screen helps in configuring multicast packets to be transmitted over a dedicated channel at a configurable rate of 1X, 2X, 4X or 6X. The default value is "Disable". If set to the default value, all multicast packets are transmitted over the Broadcast VC data path. This feature is available only for the PMP 450 Series and is not backward compatible with PMP 430 series of radios.

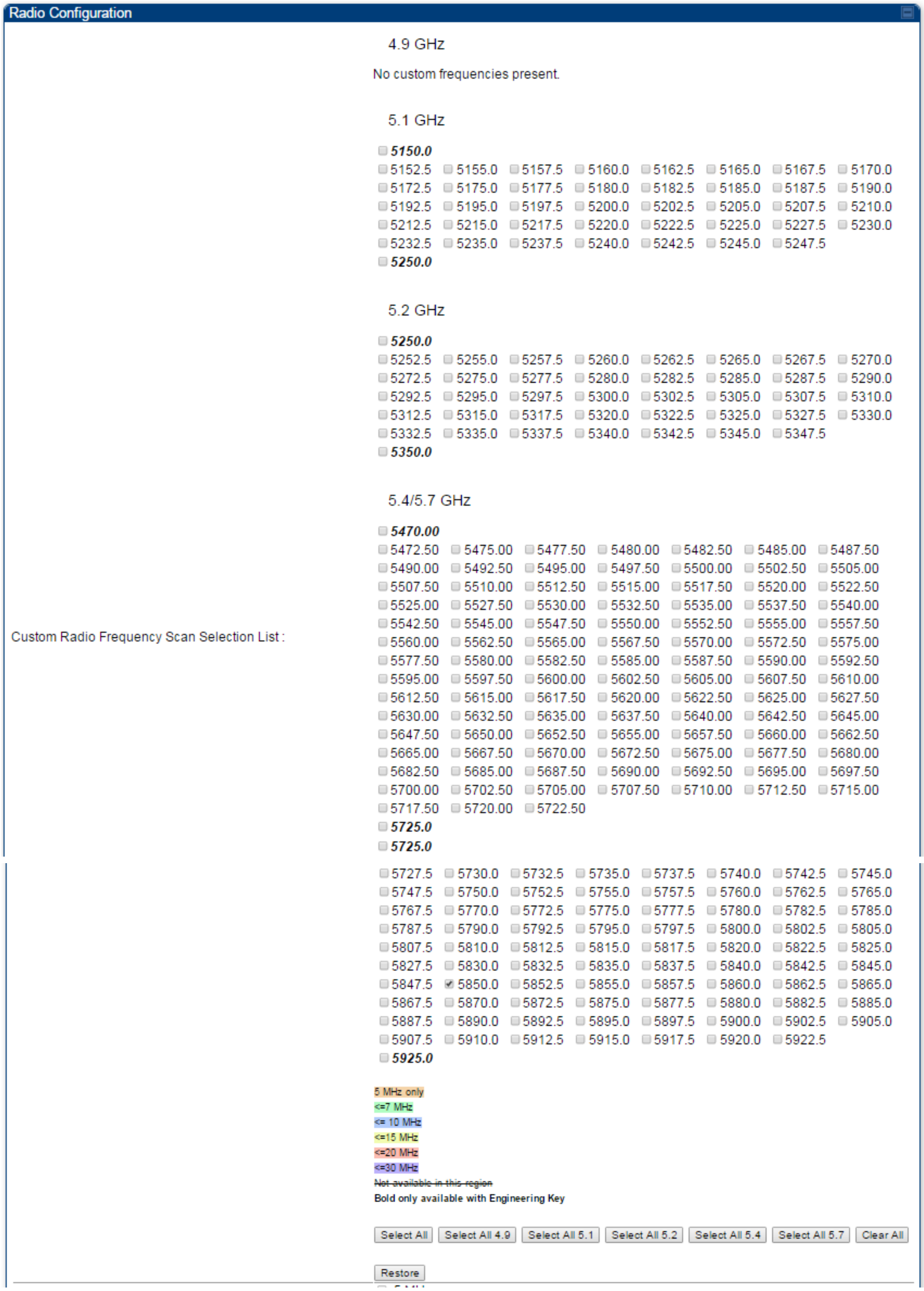
Multicast Repeat Count	This value is the number of packets that are repeated for every multicast VC packet received on the AP (located under **Radio** tab of **Configuration**). Multicast (like Broadcast) packets go over a VC that is shared by all SMs, so there is no guaranteed delivery. The repeat count is an attempt to improve the odds of the packets getting over the link. If the user has issues with packets getting dropped, they can use this parameter to improve the performance at the cost of the overall throughput possible on that channel. The default value is *0*.
Multicast Downlink CIR	This value is the committed information rate for the multicast downlink VC (located under the **Radio** tab of **Configuration**). The default value is *0* kbps. The range of this parameter is based on the number of repeat counts. The higher the repeat count, the lower the range for the multicast downlink CIR.
SM Registration All	This field allows to control registration of all type 450 Platform Family SM including 430 Series SM(450i/450/430) or 450i Series SM only.
PMP 430 SM Registration	This field allows to control of PMP 430 SMs whether PMP 430 SMs are allowed to register to PMP 450i APs. By default, it is enabled and PMP 430 SM registrations are accepted. When this field is set to disabled, PMP 430 SM's registrations fail with reject reason 8. This will cause SMs to lock out the AP for 15 minutes. **Note** This option is not displayed if the Frame Period is set to 5 ms. This option applies only to PMP 450/450i Series APs - 5 GHz.
Control Message	Controls whether the control messages are sent in MIMO-B or MIMO-A mode. MIMO-A is recommended. However, if an AP on 13.2 is attempting to connect to an SM on 13.1.3 or before, changing to MIMO-B may aid in getting the SM registered.
PMP 450/430 Legacy mode	Disabled: It is factory default setting. It allows to operate in 450i Series capabilities. Enabled: It allows to operate radio in Legacy mode PMP 450 or 430.
PMP 430 Interop Mode	For n-1 compatibility, In SISO mode this forces the AP to only send Control and Beacons over one of the RF paths.
Receive Quality Debug	To aid in link performance monitoring, the AP and SM now report the number of fragments received per modulation (i.e. QPSK, 16-QAM, 64-QAM) and per channel (polarization). **Note** Due to CPU load, this will slightly degrade packet per second processing.

	Mode	Behavior (non-900 MHz radios)	Behavior (FSK 900 MHz radios)
Frame Alignment Legacy Mode	OFF	By default frame start is aligned with devices with Timing Port synchronization If the synchronization source changes (due to Autosync or otherwise) the radio will dynamically adjust its frame start to maintain alignment with the default frame start timing	By default frame start is aligned with FSK 900 MHz devices with Timing Port synchronization If the synchronization source changes (due to Autosync or otherwise) the radio will dynamically adjust its frame start to maintain alignment with the default frame start timing
	ON (Mode 1)	The radio will align with devices running software versions from 12.0 to 13.4.	The radio will align with FSK 900 MHz devices running software versions from 12.0 to 13.4.
	ON (Mode 2)	N/A	The radio will align with FSK 900 MHz devices with software versions 11.2 or older.

Radio page – PMP 450i SM 5 GHz

The **Radio** page of PMP 450i SM is explained in Table 122.

Table 122 PMP 450i SM Radio attributes – 5 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

4.9 GHz

No custom frequencies present.

5.1 GHz

□ ***5150.0***
□ 5152.5 □ 5155.0 □ 5157.5 □ 5160.0 □ 5162.5 □ 5165.0 □ 5167.5 □ 5170.0
□ 5172.5 □ 5175.0 □ 5177.5 □ 5180.0 □ 5182.5 □ 5185.0 □ 5187.5 □ 5190.0
□ 5192.5 □ 5195.0 □ 5197.5 □ 5200.0 □ 5202.5 □ 5205.0 □ 5207.5 □ 5210.0
□ 5212.5 □ 5215.0 □ 5217.5 □ 5220.0 □ 5222.5 □ 5225.0 □ 5227.5 □ 5230.0
□ 5232.5 □ 5235.0 □ 5237.5 □ 5240.0 □ 5242.5 □ 5245.0 □ 5247.5
□ ***5250.0***

5.2 GHz

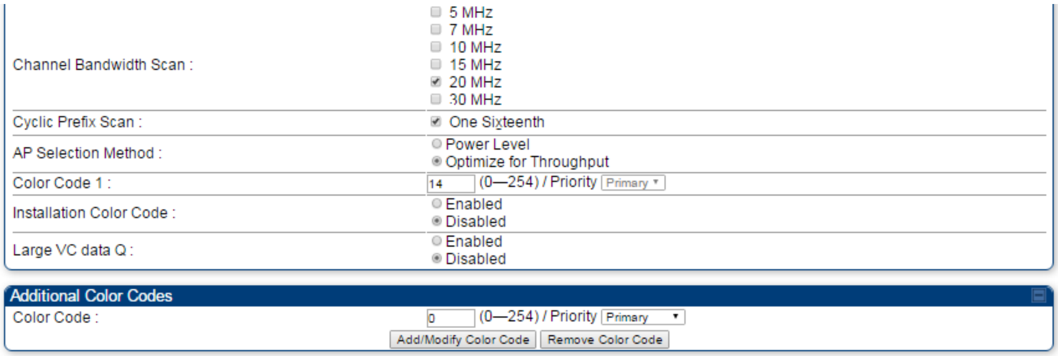
□ ***5250.0***
□ 5252.5 □ 5255.0 □ 5257.5 □ 5260.0 □ 5262.5 □ 5265.0 □ 5267.5 □ 5270.0
□ 5272.5 □ 5275.0 □ 5277.5 □ 5280.0 □ 5282.5 □ 5285.0 □ 5287.5 □ 5290.0
□ 5292.5 □ 5295.0 □ 5297.5 □ 5300.0 □ 5302.5 □ 5305.0 □ 5307.5 □ 5310.0
□ 5312.5 □ 5315.0 □ 5317.5 □ 5320.0 □ 5322.5 □ 5325.0 □ 5327.5 □ 5330.0
□ 5332.5 □ 5335.0 □ 5337.5 □ 5340.0 □ 5342.5 □ 5345.0 □ 5347.5
□ ***5350.0***

5.4/5.7 GHz

□ ***5470.00***
□ 5472.50 □ 5475.00 □ 5477.50 □ 5480.00 □ 5482.50 □ 5485.00 □ 5487.50
□ 5490.00 □ 5492.50 □ 5495.00 □ 5497.50 □ 5500.00 □ 5502.50 □ 5505.00
□ 5507.50 □ 5510.00 □ 5512.50 □ 5515.00 □ 5517.50 □ 5520.00 □ 5522.50
□ 5525.00 □ 5527.50 □ 5530.00 □ 5532.50 □ 5535.00 □ 5537.50 □ 5540.00
□ 5542.50 □ 5545.00 □ 5547.50 □ 5550.00 □ 5552.50 □ 5555.00 □ 5557.50
□ 5560.00 □ 5562.50 □ 5565.00 □ 5567.50 □ 5570.00 □ 5572.50 □ 5575.00
□ 5577.50 □ 5580.00 □ 5582.50 □ 5585.00 □ 5587.50 □ 5590.00 □ 5592.50
□ 5595.00 □ 5597.50 □ 5600.00 □ 5602.50 □ 5605.00 □ 5607.50 □ 5610.00
□ 5612.50 □ 5615.00 □ 5617.50 □ 5620.00 □ 5622.50 □ 5625.00 □ 5627.50
□ 5630.00 □ 5632.50 □ 5635.00 □ 5637.50 □ 5640.00 □ 5642.50 □ 5645.00
□ 5647.50 □ 5650.00 □ 5652.50 □ 5655.00 □ 5657.50 □ 5660.00 □ 5662.50
□ 5665.00 □ 5667.50 □ 5670.00 □ 5672.50 □ 5675.00 □ 5677.50 □ 5680.00
□ 5682.50 □ 5685.00 □ 5687.50 □ 5690.00 □ 5692.50 □ 5695.00 □ 5697.50
□ 5700.00 □ 5702.50 □ 5705.00 □ 5707.50 □ 5710.00 □ 5712.50 □ 5715.00
□ 5717.50 □ 5720.00 □ 5722.50
□ ***5725.0***
□ ***5725.0***

□ 5727.5 □ 5730.0 □ 5732.5 □ 5735.0 □ 5737.5 □ 5740.0 □ 5742.5 □ 5745.0
□ 5747.5 □ 5750.0 □ 5752.5 □ 5755.0 □ 5757.5 □ 5760.0 □ 5762.5 □ 5765.0
□ 5767.5 □ 5770.0 □ 5772.5 □ 5775.0 □ 5777.5 □ 5780.0 □ 5782.5 □ 5785.0
□ 5787.5 □ 5790.0 □ 5792.5 □ 5795.0 □ 5797.5 □ 5800.0 □ 5802.5 □ 5805.0
□ 5807.5 □ 5810.0 □ 5812.5 □ 5815.0 □ 5817.5 □ 5820.0 □ 5822.5 □ 5825.0
□ 5827.5 □ 5830.0 □ 5832.5 □ 5835.0 □ 5837.5 □ 5840.0 □ 5842.5 □ 5845.0
□ 5847.5 ☑ 5850.0 □ 5852.5 □ 5855.0 □ 5857.5 □ 5860.0 □ 5862.5 □ 5865.0
□ 5867.5 □ 5870.0 □ 5872.5 □ 5875.0 □ 5877.5 □ 5880.0 □ 5882.5 □ 5885.0
□ 5887.5 □ 5890.0 □ 5892.5 □ 5895.0 □ 5897.5 □ 5900.0 □ 5902.5 □ 5905.0
□ 5907.5 □ 5910.0 □ 5912.5 □ 5915.0 □ 5917.5 □ 5920.0 □ 5922.5
□ ***5925.0***

5 MHz only
<=7 MHz
<= 10 MHz
<=15 MHz
<=20 MHz
<=30 MHz
~~Not available in this region~~
Bold only available with Engineering Key



Channel Bandwidth Scan :	□ 5 MHz □ 7 MHz □ 10 MHz □ 15 MHz ☑ 20 MHz □ 30 MHz
Cyclic Prefix Scan :	☑ One Sixteenth
AP Selection Method :	○ Power Level ● Optimize for Throughput
Color Code 1 :	14 (0—254) / Priority Primary
Installation Color Code :	○ Enabled ● Disabled
Large VC data Q :	○ Enabled ● Disabled

Additional Color Codes

Color Code :	0 (0—254) / Priority Primary

Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check the frequencies that SM has to scan for AP transmissions. See Radio Frequency Scan Selection List on page 7-227.
Channel Bandwidth Scan	The channel size used by the radio for RF transmission. **Note** Selecting multiple channel bandwidths will increase registration and re-registration times.
Cyclic Prefix Scan	The cyclic prefix for which AP scanning is executed.
AP Selection Method	Operators may configure the method by which a scanning SM selects an AP. By default, AP Selection Method is set to "Optimize for Throughput", which has been the mode of operation in releases prior to 12.0.3.1. **Power Level**: AP selection based solely on power level *or* **Optimize for Throughput**: AP selection based on throughput optimization – the selection decision is based on power level (which affects the modulation state), channel bandwidth (which affects throughput) and number of SM registrations to the AP (which affects system contention performance).
Color Code 1	Color code allows you to force the SM to register to only a specific AP, even where the SM can communicate with multiple APs. For registration to occur, the color code of the SM and the AP *must* match. Specify a value from 0 to 254. Color code is not a security feature. Instead, color code is a management feature, typically for assigning each sector a different color code. The default setting for the color code value is 0. This value matches only the color code of 0 (*not* all 255 color codes).

	SMs may be configured with up to 20 color codes. These color codes can be tagged as **Primary**, **Secondary**, or **Tertiary**, or **Disable**. When the SM is scanning for APs, it will first attempt to register to an AP that matches one of the SM's primary color codes. Failing that, the SM will continue scanning and attempt to register to an AP that matches one of the SM's secondary color codes. Failing that, the SM will continue scanning and attempt to register to an AP that matches one of the SM's tertiary color codes. This is all done in the scanning mode of the SM and will repeat until a registration has occurred. Color codes in the same priority group are treated equally. For example, all APs matching one of the SM's primary color codes are analyzed equally. Likewise, this evaluation is done for the secondary and tertiary groups in order. The analysis for selecting an AP within a priority group is based on various inputs, including signal strength and number of SMs already registered to each AP. The first color code in the configuration is the pre-Release 9.5 color code. Thus, it is always a primary color code for legacy reasons. The color codes can be disabled, with the exception of the first color code.
Installation Color Code	With this feature enabled on the AP and SM, operators may install and remotely configure SMs without having to configure matching color codes between the modules. When using the Installation Color Code feature, ensure that the SM is configured with the factory default Color Code configuration (Color Code 1 is "0", Color Code 2-10 set to "0" and "Disable"). The status of the Installation Color Code can be viewed on the AP Eval web GUI page, and when the SM is registered using the Installation Color Code the message "SM is registered via ICC – Bridging Disabled!" is displayed in red on every SM GUI page. The Installation Color Code parameter is configurable without a radio reboot for both the AP and SM.
External Gain	This value represents the antenna gain. For ODUs with integrated antenna, this is set at the correct value in the factory. For Connectorized ODUs with external antenna, the user must set this value to the overall antenna gain, including any RF cable loss between the ODU and the antenna.
Large VC data Queue	AP and BH have a configurable option used to prevent packet loss in the uplink due to bursting IP traffic. This is designed for IP burst traffic particular to video surveillance applications.
Receive Quality Debug	To aid in link performance monitoring, the AP and SM now report the number of fragments received per modulation (i.e. QPSK, 16-QAM, 64-QAM) and per channel (polarization).

Note

Due to CPU load, this will slightly degrade packet per second processing.

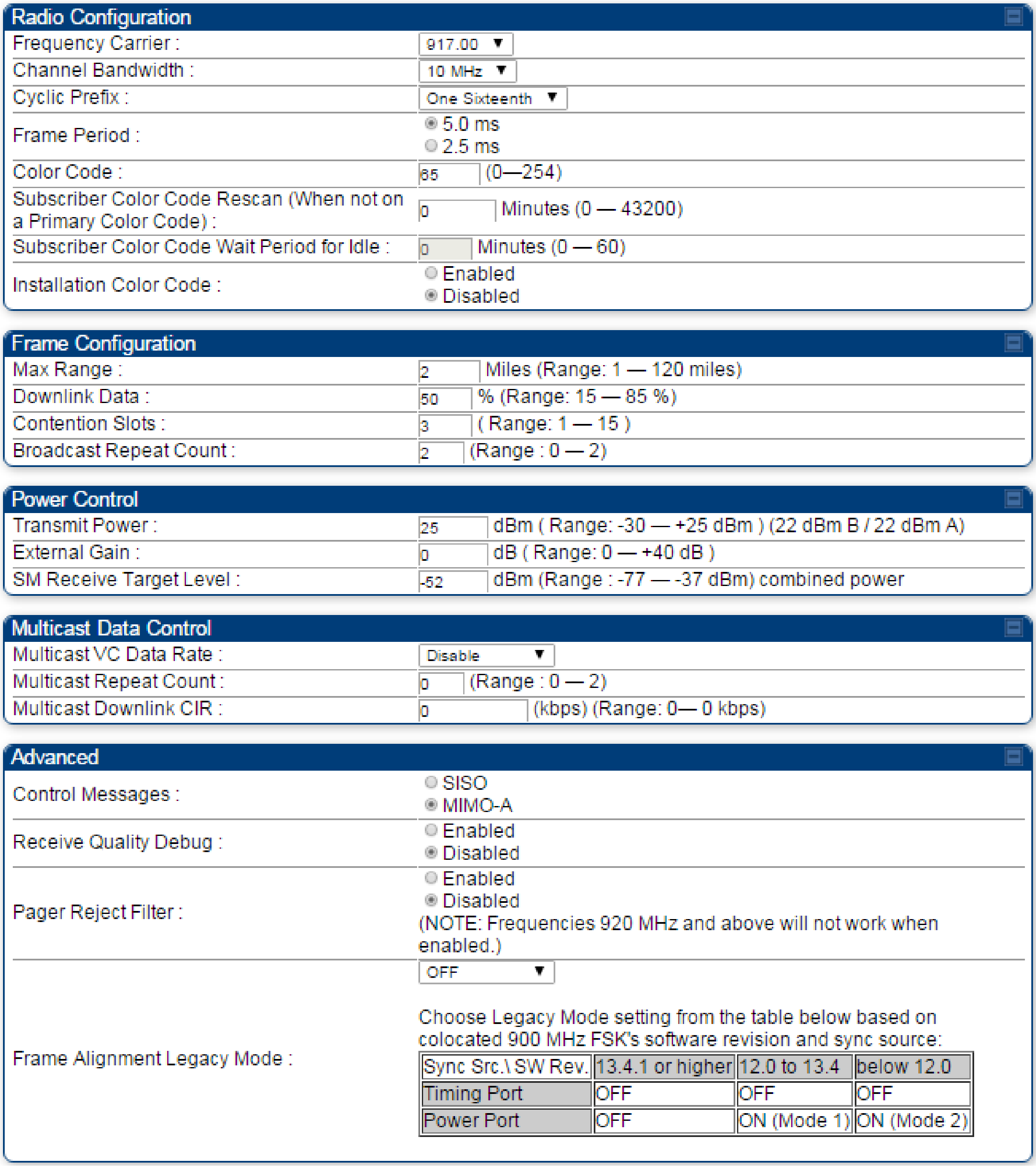
Note

The frequencies that a user can select are controlled by the country or a region and the Channel Bandwidth selected. There can be a case where a user adds a custom frequency (from the Custom Frequencies page on page 7-230) and cannot see it in the pull down menu.

Radio page - PMP 450i AP 900 MHz

The Radio tab of the PMP 450i AP 900 MHz is described in below table Table 123.

Table 123 PMP 450i AP Radio attributes - 900 MHz



Radio Configuration

Frequency Carrier :	917.00 ▼
Channel Bandwidth :	10 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	● 5.0 ms ○ 2.5 ms
Color Code :	65 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Frame Configuration

Max Range :	2 Miles (Range: 1 — 120 miles)
Downlink Data :	50 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	25 dBm (Range: -30 — +25 dBm) (22 dBm B / 22 dBm A)
External Gain :	0 dB (Range: 0 — +40 dB)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power

Multicast Data Control

Multicast VC Data Rate :	Disable ▼
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 0 kbps)

Advanced

Control Messages :	○ SISO ● MIMO-A
Receive Quality Debug :	○ Enabled ● Disabled
Pager Reject Filter :	○ Enabled ● Disabled (NOTE: Frequencies 920 MHz and above will not work when enabled.)
Frame Alignment Legacy Mode :	OFF ▼ Choose Legacy Mode setting from the table below based on colocated 900 MHz FSK's software revision and sync source:

Sync Src.\ SW Rev.	13.4.1 or higher	12.0 to 13.4	below 12.0
Timing Port	OFF	OFF	OFF
Power Port	OFF	ON (Mode 1)	ON (Mode 2)

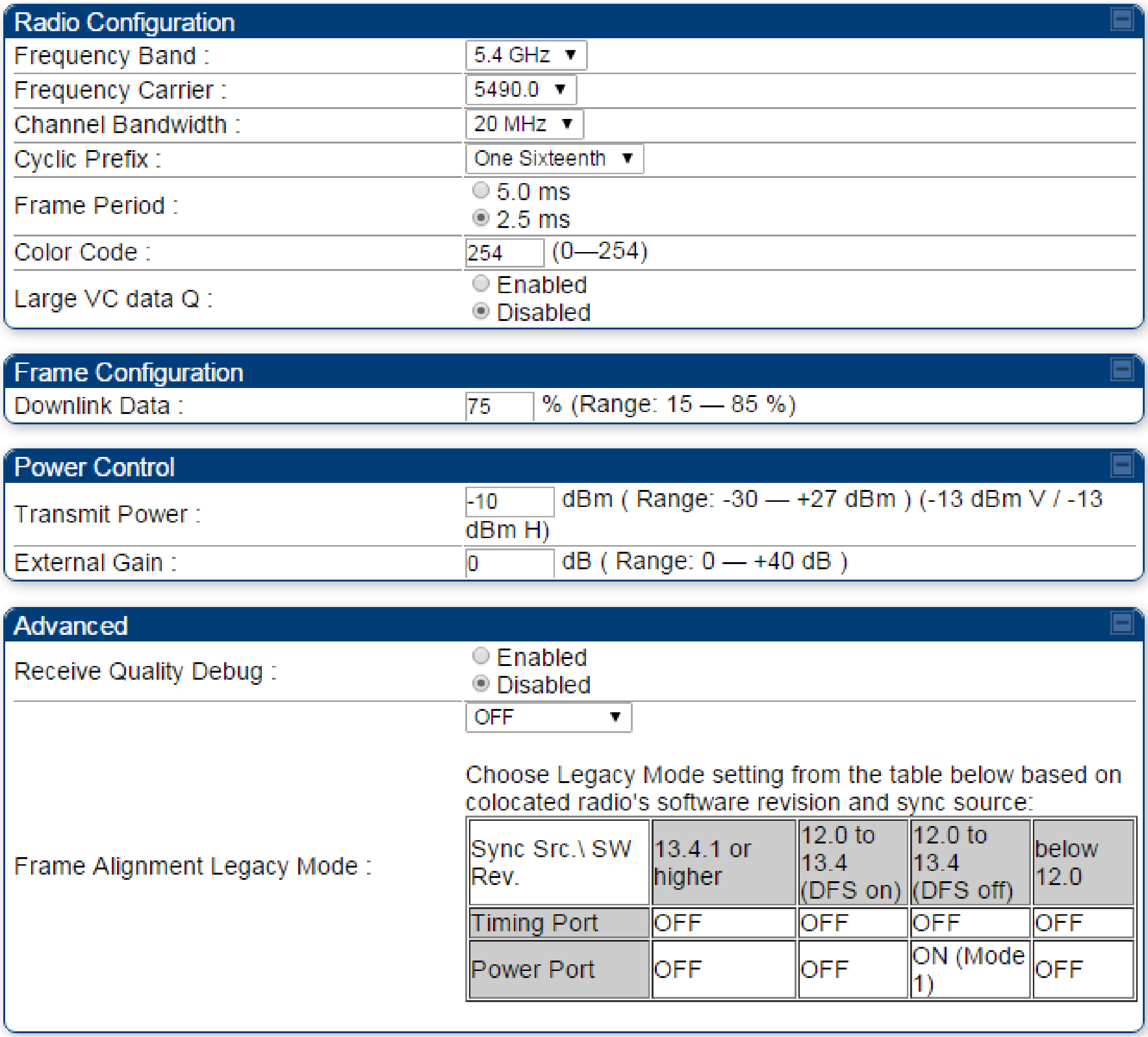
Attribute	Meaning
Frequency Carrier	Specify the frequency for the module to transmit. The default for this parameter is **None**. For a list of channels in the band, see the drop-down list on the radio GUI.
Channel Bandwidth	The channel size used by the radio for RF transmission. The setting for the channel bandwidth must match between the AP and the SM. The supported Channel Bandwidths are 5, 7, 10 and 20 MHz.
Cyclic Prefix	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193.
Frame Period	
Color Code	
Subscriber Color Code Rescan (When not on a Primary Color Code)	
Subscriber Color Code Wait Period for Idle	
Installation Color Code	
Max Range	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193.
Downlink Data	
Contention Slots (a.k.a. Control Slots)	
Broadcast Repeat Count	
Transmitter Output Power	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.
External Gain	
SM Receive Target Level	See Table 120 PMP 450m AP Radio attributes - 5 GHz on page 7-193
Multicast VC Data Rate	
Multicast Repeat Count	
Multicast Downlink CIR	
Control Message	
Receive Quality Debug	
Pager Reject Filter	In 900 MHz, Pager Reject filter is placed on the AP to block Pager signals which could cause interference to the whole band. The Pager signals typically operate in the 928-930 frequency range. When the filter is enabled, the signals of 920 MHz and above are attenuated which enables better reception of signals in the rest of the band. Note that the AP/SM should not be configured on the frequencies of 920 MHz and above when this filter is enabled.

Frame Alignment Legacy Mode	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.

Radio page - PTP 450i BHM 5 GHz

The **Radio** page of PTP 450i BHM is explained in Table 124.

Table 124 PTP 450i BHM Radio page attributes – 5 GHz



Radio Configuration

Frequency Band :	5.4 GHz ▼
Frequency Carrier :	5490.0 ▼
Channel Bandwidth :	20 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	254 (0—254)
Large VC data Q :	○ Enabled ● Disabled

Frame Configuration

Downlink Data :	75 % (Range: 15 — 85 %)

Power Control

Transmit Power :	-10 dBm (Range: -30 — +27 dBm) (-13 dBm V / -13 dBm H)
External Gain :	0 dB (Range: 0 — +40 dB)

Advanced

Receive Quality Debug :	○ Enabled ● Disabled
Frame Alignment Legacy Mode :	OFF ▼ Choose Legacy Mode setting from the table below based on colocated radio's software revision and sync source:

Sync Src.\ SW Rev.	13.4.1 or higher	12.0 to 13.4 (DFS on)	12.0 to 13.4 (DFS off)	below 12.0
Timing Port	OFF	OFF	OFF	OFF
Power Port	OFF	OFF	ON (Mode 1)	OFF

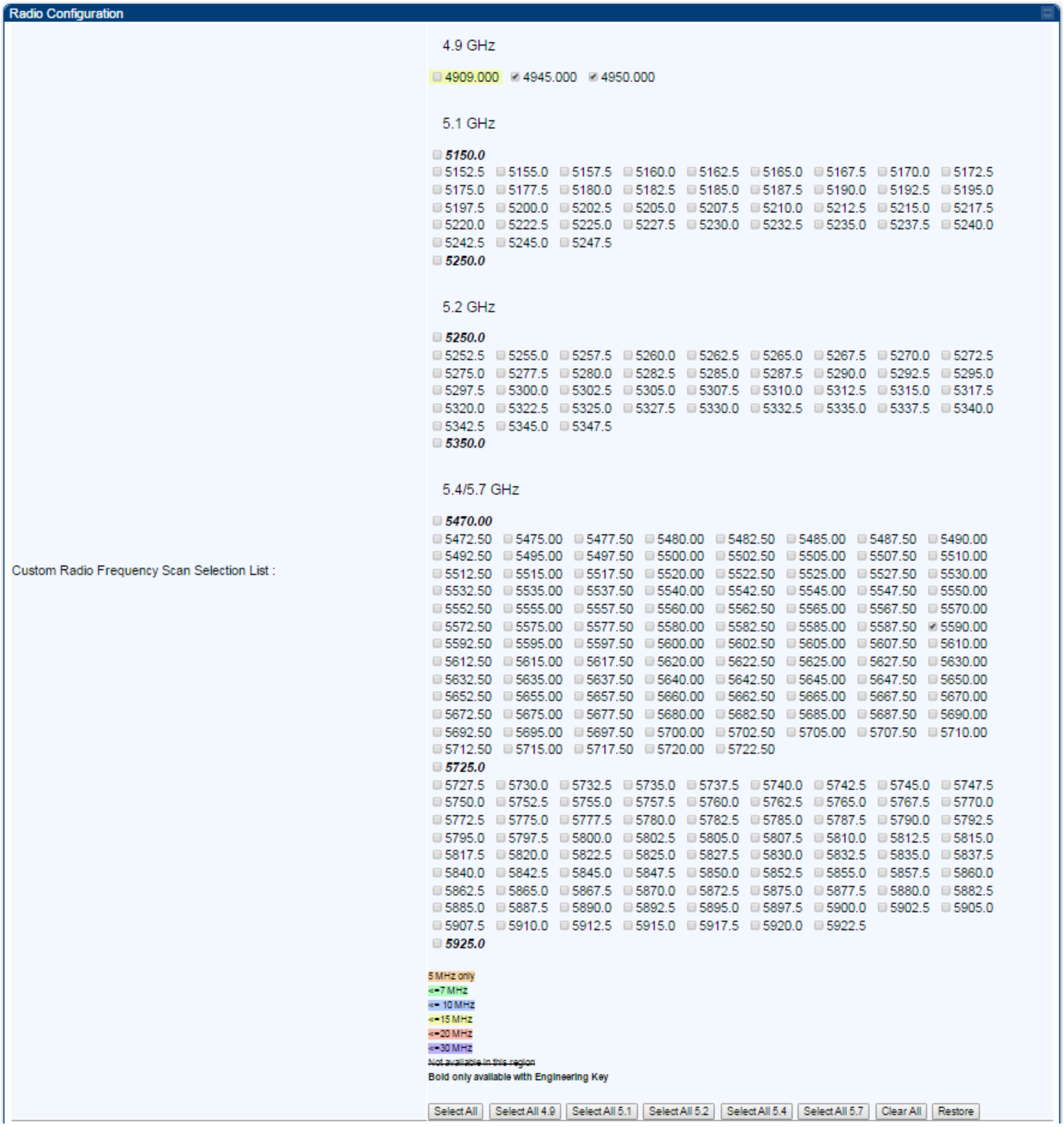
Attribute	Meaning
Frequency Band	Select the operating frequency band of the radio. The supported bands are 4.9 GHz, 5.4 GHz and 5.7 GHz.
Frequency Carrier	Specify the frequency for the module to transmit. The default for this parameter is **None**. For a list of channels in the band, see the drop-down list on the radio GUI.
Channel Bandwidth	The channel size used by the radio for RF transmission. The setting for the channel bandwidth must match between the BHM and the BHS.
Cyclic Prefix	OFDM technology uses a cyclic prefix, where a portion of the end of a symbol (slot) is repeated at the beginning of the symbol to allow multi-pathing to settle before receiving the desired data. A 1/16 cyclic prefix means that for every 16 bits of throughput data transmitted, an additional bit is used.
Frame Period	Select the Frame Period of the radio. The support Frame Periods are : 5 ms and 2.5 ms.
Color Code	Specify a value from 0 to 254. For registration to occur, the color code of the BHM and the BHS must match. Color code is not a security feature. Instead, color code is a management feature, typically for assigning each link a different color code. Color code allows you to force a BHS to register to only a specific BHM. The default setting for the color code value is 0. This value matches only the color code of 0 (not all 255 color codes).
Large VC data Q	**Enable** Large VC Q for applications that burst data high rates. Large Qs may decrease effective throughput for TCP application. **Disable** Large VC Q if application need not handle bursts of data. Large Qs may decrease effective throughput for TCP application.
Downlink Data	Specify the percentage of the aggregate throughput for the downlink (frames transmitted from the BHM to the subscriber). For example, if the aggregate (uplink and downlink total) throughput on the BHM is 132 Mbps, then 75% specified for this parameter allocates 99 Mbps for the downlink and 33 Mbps for the uplink. The default for this parameter is 50%. This parameter must be set in the range of 15% - 85%, otherwise the invalid input will not be accepted and the previously-entered valid setting is used. **Note** In order to prevent self-interference, the frame configuration needs to align. This includes Downlink Data, Max Range and Contention slots.
Transmit Power	This value represents the combined power of the BHM's two transmitters. Nations and regions may regulate transmit power. For example

	• PTP 450i Series modules are available as connectorized radios, which require the operator to adjust power to ensure regulatory compliance. The professional installer of the equipment has the responsibility to: • Maintain awareness of applicable regulations. • Calculate the permissible transmitter output power for the module. • Confirm that the initial power setting is compliant with national or regional regulations. Confirm that the power setting is compliant following any reset of the module to factory defaults.
External Gain	This value needs to correspond to the published gain of the antenna used to ensure the radio will meet regulatory requirements.
Receive Quality Debug	To aid in link performance monitoring, the BHM and BHS now report the number of fragments received per modulation (i.e. QPSK, 16-QAM, 64-QAM and 256-QAM) and per channel (polarization). **Note** Due to CPU load, this slightly degrades the packet during per second processing.
Frame Alignment Legacy Mode	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.

Radio page – PTP 450i BHS 5 GHz

The **Radio** page of PTP 450i BHS is explained in Table 125.

Table 125 PTP 450i BHS Radio attributes – 5 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

4.9 GHz

□ 4909.000 ☑ 4945.000 ☑ 4950.000

5.1 GHz

□ ***5150.0***
□ 5152.5 □ 5155.0 □ 5157.5 □ 5160.0 □ 5162.5 □ 5165.0 □ 5167.5 □ 5170.0 □ 5172.5
□ 5175.0 □ 5177.5 □ 5180.0 □ 5182.5 □ 5185.0 □ 5187.5 □ 5190.0 □ 5192.5 □ 5195.0
□ 5197.5 □ 5200.0 □ 5202.5 □ 5205.0 □ 5207.5 □ 5210.0 □ 5212.5 □ 5215.0 □ 5217.5
□ 5220.0 □ 5222.5 □ 5225.0 □ 5227.5 □ 5230.0 □ 5232.5 □ 5235.0 □ 5237.5 □ 5240.0
□ 5242.5 □ 5245.0 □ 5247.5
□ ***5250.0***

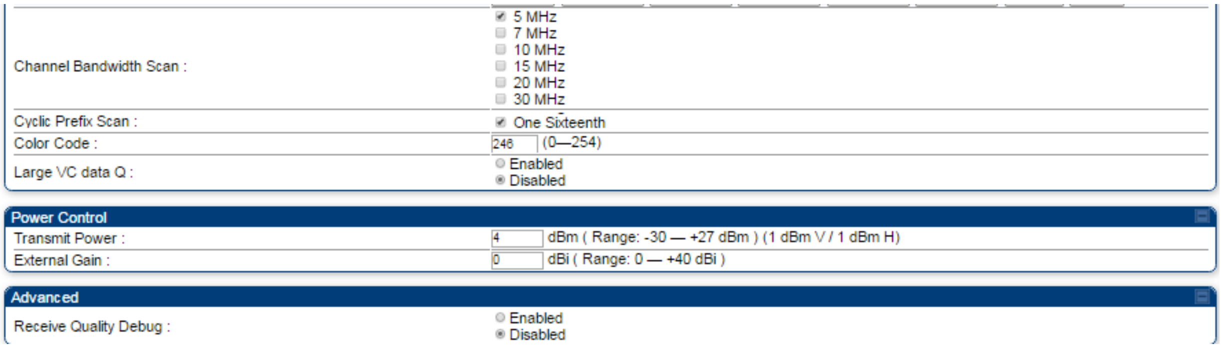
5.2 GHz

□ ***5250.0***
□ 5252.5 □ 5255.0 □ 5257.5 □ 5260.0 □ 5262.5 □ 5265.0 □ 5267.5 □ 5270.0 □ 5272.5
□ 5275.0 □ 5277.5 □ 5280.0 □ 5282.5 □ 5285.0 □ 5287.5 □ 5290.0 □ 5292.5 □ 5295.0
□ 5297.5 □ 5300.0 □ 5302.5 □ 5305.0 □ 5307.5 □ 5310.0 □ 5312.5 □ 5315.0 □ 5317.5
□ 5320.0 □ 5322.5 □ 5325.0 □ 5327.5 □ 5330.0 □ 5332.5 □ 5335.0 □ 5337.5 □ 5340.0
□ 5342.5 □ 5345.0 □ 5347.5
□ ***5350.0***

5.4/5.7 GHz

□ ***5470.00***
□ 5472.50 □ 5475.00 □ 5477.50 □ 5480.00 □ 5482.50 □ 5485.00 □ 5487.50 □ 5490.00
□ 5492.50 □ 5495.00 □ 5497.50 □ 5500.00 □ 5502.50 □ 5505.00 □ 5507.50 □ 5510.00
□ 5512.50 □ 5515.00 □ 5517.50 □ 5520.00 □ 5522.50 □ 5525.00 □ 5527.50 □ 5530.00
□ 5532.50 □ 5535.00 □ 5537.50 □ 5540.00 □ 5542.50 □ 5545.00 □ 5547.50 □ 5550.00
□ 5552.50 □ 5555.00 □ 5557.50 □ 5560.00 □ 5562.50 □ 5565.00 □ 5567.50 □ 5570.00
□ 5572.50 □ 5575.00 □ 5577.50 □ 5580.00 □ 5582.50 □ 5585.00 □ 5587.50 ☑ 5590.00
□ 5592.50 □ 5595.00 □ 5597.50 □ 5600.00 □ 5602.50 □ 5605.00 □ 5607.50 □ 5610.00
□ 5612.50 □ 5615.00 □ 5617.50 □ 5620.00 □ 5622.50 □ 5625.00 □ 5627.50 □ 5630.00
□ 5632.50 □ 5635.00 □ 5637.50 □ 5640.00 □ 5642.50 □ 5645.00 □ 5647.50 □ 5650.00
□ 5652.50 □ 5655.00 □ 5657.50 □ 5660.00 □ 5662.50 □ 5665.00 □ 5667.50 □ 5670.00
□ 5672.50 □ 5675.00 □ 5677.50 □ 5680.00 □ 5682.50 □ 5685.00 □ 5687.50 □ 5690.00
□ 5692.50 □ 5695.00 □ 5697.50 □ 5700.00 □ 5702.50 □ 5705.00 □ 5707.50 □ 5710.00
□ 5712.50 □ 5715.00 □ 5717.50 □ 5720.00 □ 5722.50
□ ***5725.0***
□ 5727.5 □ 5730.0 □ 5732.5 □ 5735.0 □ 5737.5 □ 5740.0 □ 5742.5 □ 5745.0 □ 5747.5
□ 5750.0 □ 5752.5 □ 5755.0 □ 5757.5 □ 5760.0 □ 5762.5 □ 5765.0 □ 5767.5 □ 5770.0
□ 5772.5 □ 5775.0 □ 5777.5 □ 5780.0 □ 5782.5 □ 5785.0 □ 5787.5 □ 5790.0 □ 5792.5
□ 5795.0 □ 5797.5 □ 5800.0 □ 5802.5 □ 5805.0 □ 5807.5 □ 5810.0 □ 5812.5 □ 5815.0
□ 5817.5 □ 5820.0 □ 5822.5 □ 5825.0 □ 5827.5 □ 5830.0 □ 5832.5 □ 5835.0 □ 5837.5
□ 5840.0 □ 5842.5 □ 5845.0 □ 5847.5 □ 5850.0 □ 5852.5 □ 5855.0 □ 5857.5 □ 5860.0
□ 5862.5 □ 5865.0 □ 5867.5 □ 5870.0 □ 5872.5 □ 5875.0 □ 5877.5 □ 5880.0 □ 5882.5
□ 5885.0 □ 5887.5 □ 5890.0 □ 5892.5 □ 5895.0 □ 5897.5 □ 5900.0 □ 5902.5 □ 5905.0
□ 5907.5 □ 5910.0 □ 5912.5 □ 5915.0 □ 5917.5 □ 5920.0 □ 5922.5
□ ***5925.0***

5 MHz only
<=7 MHz
<= 10 MHz
<=15 MHz
<=20 MHz
<=30 MHz
~~Not available in this region~~
Bold only available with Engineering Key



Channel Bandwidth Scan :	☑ 5 MHz □ 7 MHz □ 10 MHz □ 15 MHz □ 20 MHz □ 30 MHz
Cyclic Prefix Scan :	☑ One Sixteenth
Color Code :	246 (0—254)
Large VC data Q :	○ Enabled ● Disabled
Power Control	
Transmit Power :	4 dBm (Range: -30 — +27 dBm) (1 dBm V / 1 dBm H)
External Gain :	0 dBi (Range: 0 — +40 dBi)
Advanced	
Receive Quality Debug :	○ Enabled ● Disabled

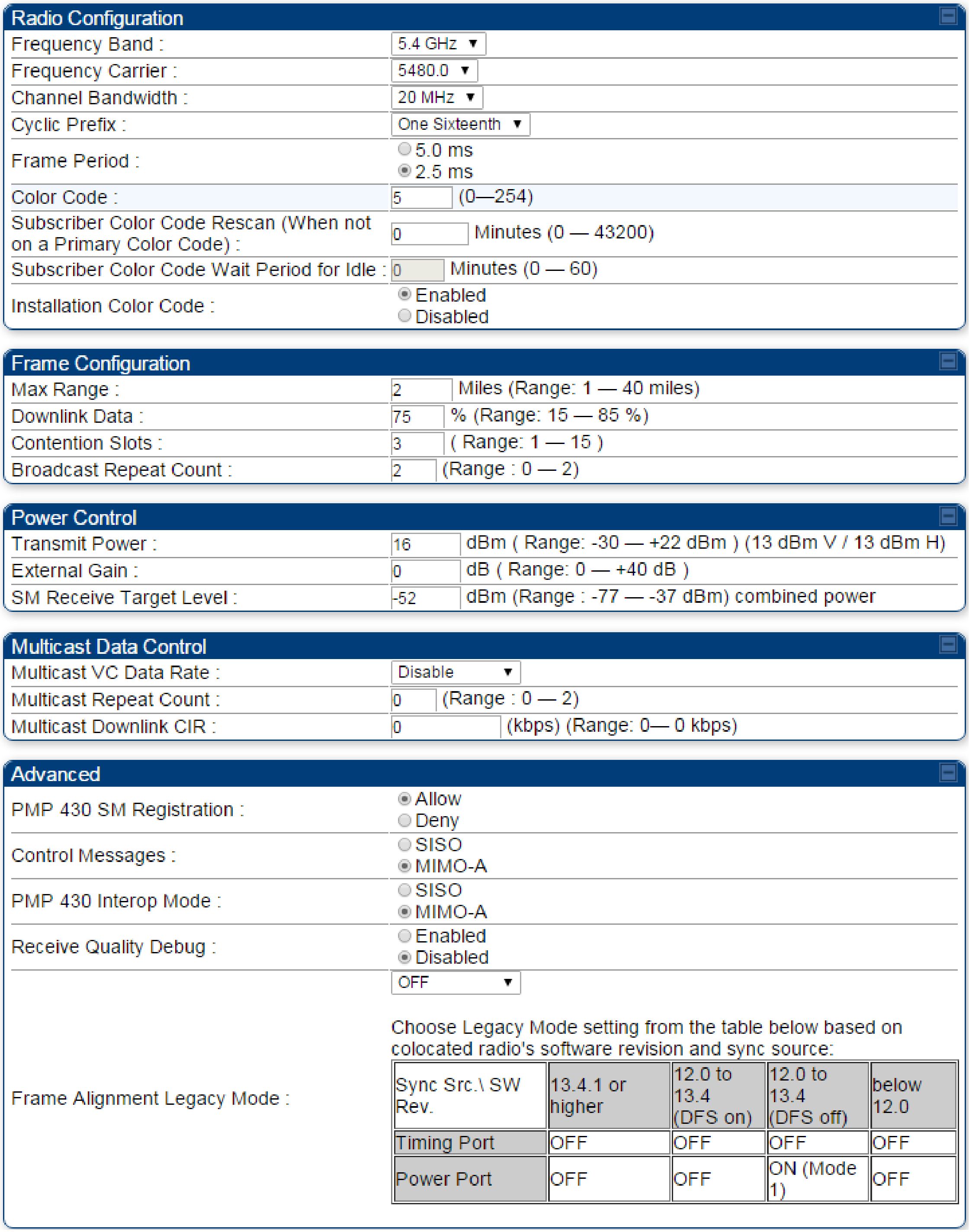
Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check any frequency that you want the BHS to scan for BHM transmissions. See Radio Frequency Scan Selection List on page 7-227.
Channel Bandwidth Scan	The channel size used by the radio for RF transmission. **Note** Selecting multiple channel bandwidths will increase registration and re-registration times.
Cyclic Prefix Scan	The cyclic prefix for which BHM scanning is executed.
Color Code	Color code allows to force the BHS to register to only a specific BHM, even where the BHS can communicate with multiple BHMs. For registration to occur, the color code of the BHS and the BHM *must* match. Specify a value from 0 to 254. The color codes can be disabled, with the exception of the first color code.
Large VC data Q	BHM and BHS have a configurable option used to prevent packet loss in the uplink due to bursting IP traffic. This is designed for IP burst traffic particular to video surveillance applications.
Transmit Power	Refer Table 124 PTP 450i BHM Radio page attributes – 5 GHz on page 7-208
External Gain	
Receive Quality Debug	

PMP/PTP 450 Series – configuring radio

Radio page - PMP 450 AP 5 GHz

The **Radio** tab of the AP for 5 GHz is as shown in.Table 126.

Table 126 PMP 450 AP Radio attributes - 5 GHz



Radio Configuration

Frequency Band :	5.4 GHz ▾
Frequency Carrier :	5480.0 ▾
Channel Bandwidth :	20 MHz ▾
Cyclic Prefix :	One Sixteenth ▾
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	5 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	● Enabled ○ Disabled

Frame Configuration

Max Range :	2 Miles (Range: 1 — 40 miles)
Downlink Data :	75 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	16 dBm (Range: -30 — +22 dBm) (13 dBm V / 13 dBm H)
External Gain :	0 dB (Range: 0 — +40 dB)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power

Multicast Data Control

Multicast VC Data Rate :	Disable ▾
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 0 kbps)

Advanced

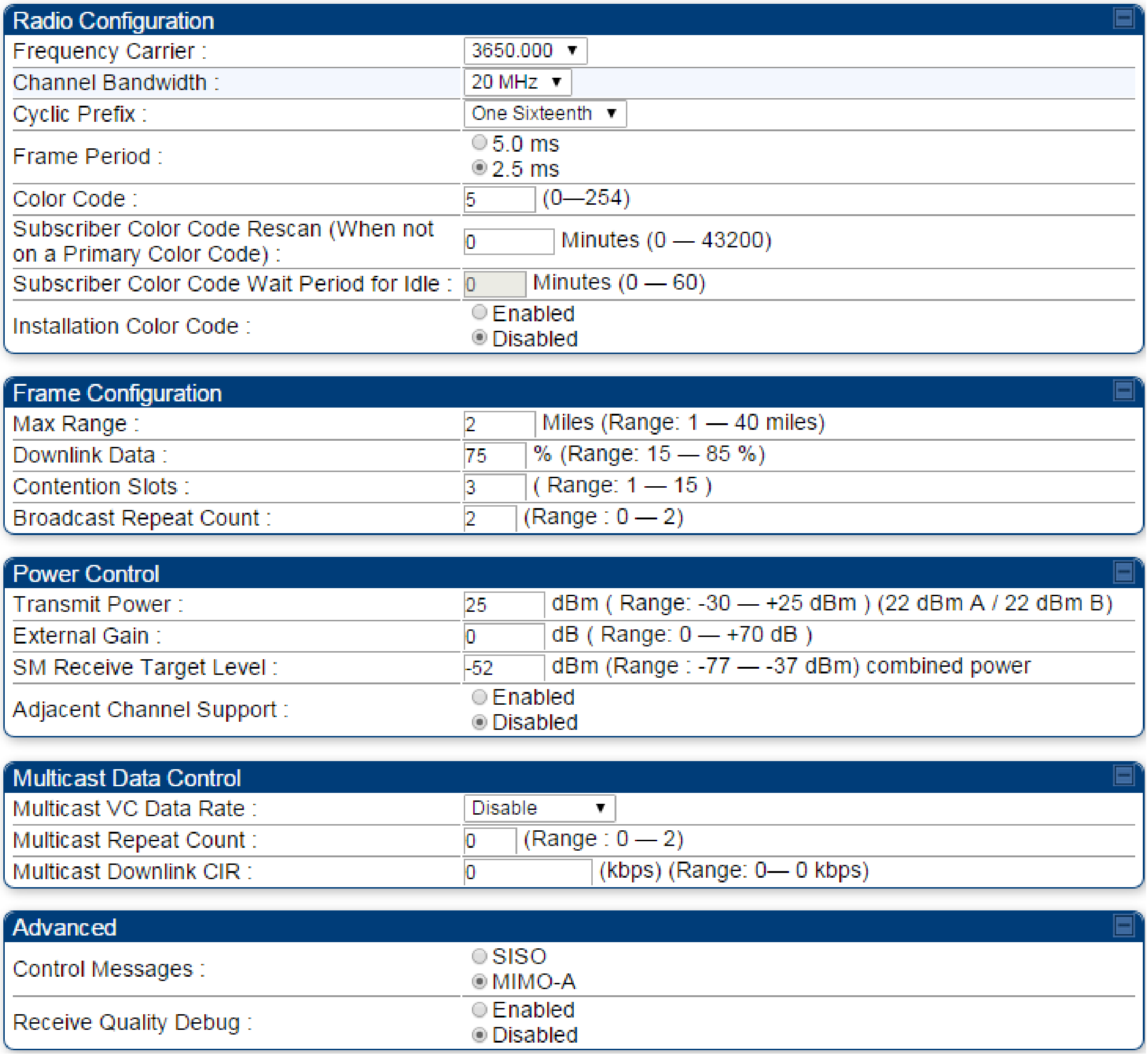
PMP 430 SM Registration :	● Allow ○ Deny
Control Messages :	○ SISO ● MIMO-A
PMP 430 Interop Mode :	○ SISO ● MIMO-A
Receive Quality Debug :	○ Enabled ● Disabled
Frame Alignment Legacy Mode :	OFF ▾ Choose Legacy Mode setting from the table below based on colocated radio's software revision and sync source:

Sync Src.\ SW Rev.	13.4.1 or higher	12.0 to 13.4 (DFS on)	12.0 to 13.4 (DFS off)	below 12.0
Timing Port	OFF	OFF	OFF	OFF
Power Port	OFF	OFF	ON (Mode 1)	OFF

Attribute	Meaning
Radio Configuration, Frame Configuration, Power Control, Multicast Data Control and Advance tab	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.
PMP 430 SM Registration	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.
PMP 450/430 Legacy Mode	
Control Messages	
PMP 430 Interop Mode	
Receive Quality Debug	
Frame Alignment Legacy Mode	

Radio page - PMP 450 AP 3.65 GHz

Table 127 PMP 450 AP Radio attributes - 3.65 GHz



Radio Configuration

Frequency Carrier :	3650.000 ▼
Channel Bandwidth :	20 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	5 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Frame Configuration

Max Range :	2 Miles (Range: 1 — 40 miles)
Downlink Data :	75 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	25 dBm (Range: -30 — +25 dBm) (22 dBm A / 22 dBm B)
External Gain :	0 dB (Range: 0 — +70 dB)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power
Adjacent Channel Support :	○ Enabled ● Disabled

Multicast Data Control

Multicast VC Data Rate :	Disable ▼
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 0 kbps)

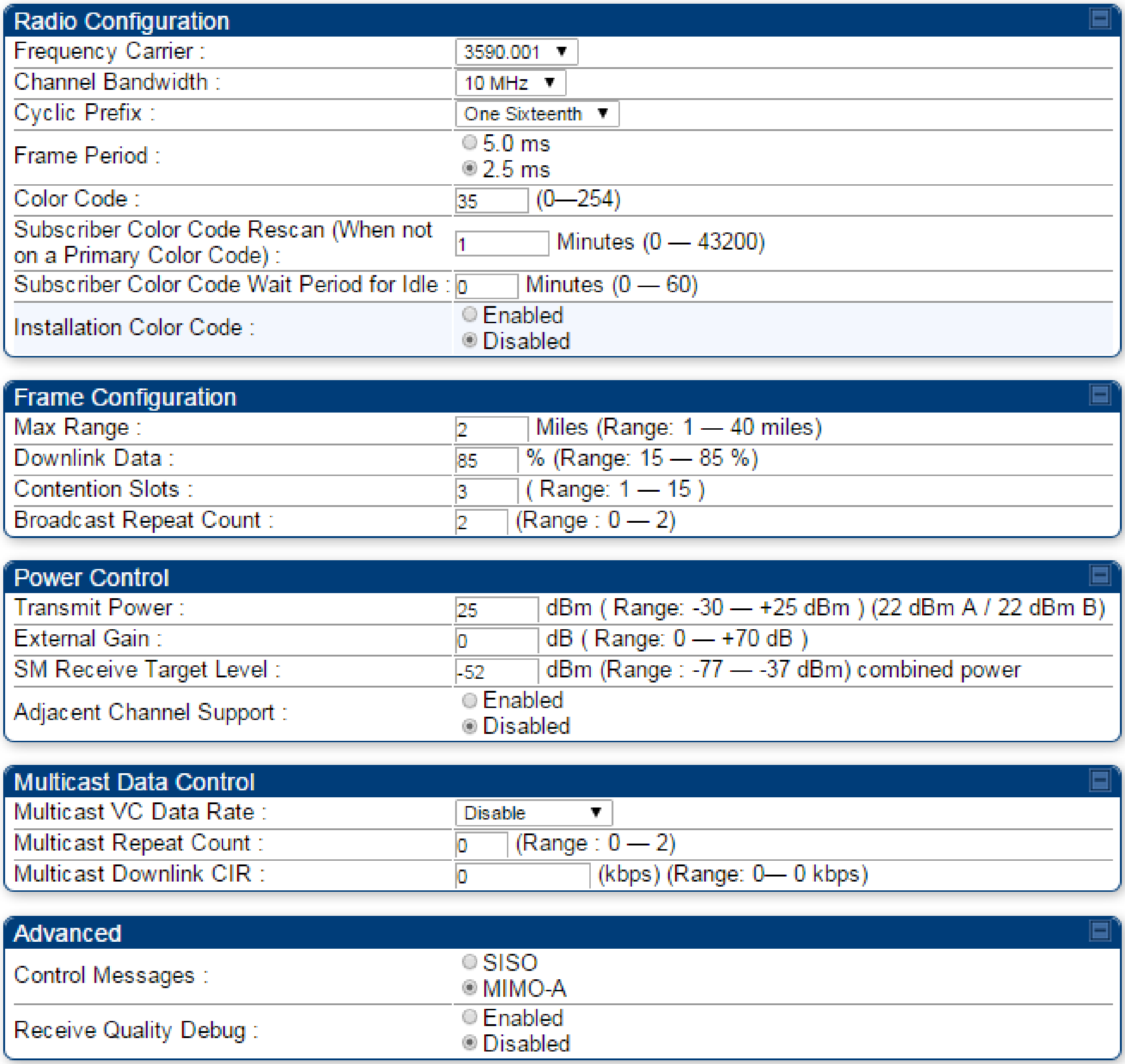
Advanced

Control Messages :	○ SISO ● MIMO-A
Receive Quality Debug :	○ Enabled ● Disabled

Attribute	Meaning
Radio Configuration, Frame Configuration, Power Control, Multicast Data Control and Advance tab	See Table 121 PMP 450i AP Radio attributes - 5 **GHz** on page 7-197.

Radio page - PMP 450 AP 3.5 GHz

Table 128 PMP 450 AP Radio attributes - 3.5 GHz



Radio Configuration

Frequency Carrier :	3590.001 ▼
Channel Bandwidth :	10 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	35 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	1 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Frame Configuration

Max Range :	2 Miles (Range: 1 — 40 miles)
Downlink Data :	85 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	25 dBm (Range: -30 — +25 dBm) (22 dBm A / 22 dBm B)
External Gain :	0 dB (Range: 0 — +70 dB)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power
Adjacent Channel Support :	○ Enabled ● Disabled

Multicast Data Control

Multicast VC Data Rate :	Disable ▼
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 0 kbps)

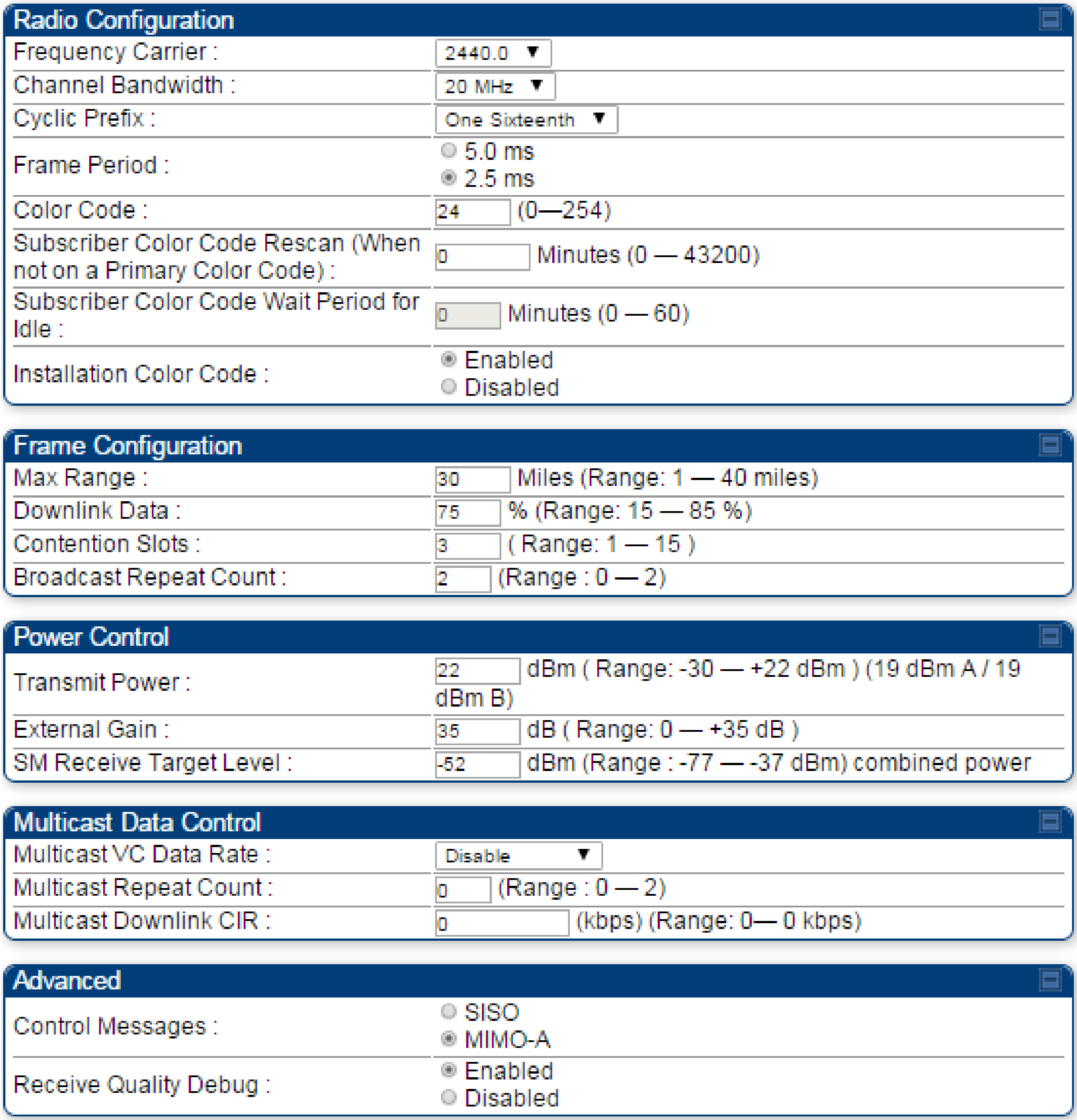
Advanced

Control Messages :	○ SISO ● MIMO-A
Receive Quality Debug :	○ Enabled ● Disabled

Attribute	Meaning
Radio Configuration, Frame Configuration, Power Control, Multicast Data Control and Advance tab	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.

Radio page - PMP 450 AP 2.4 GHz

Table 129 PMP 450 AP Radio attributes - 2.4 GHz



Radio Configuration

Frequency Carrier :	2440.0 ▼
Channel Bandwidth :	20 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	24 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	● Enabled ○ Disabled

Frame Configuration

Max Range :	30 Miles (Range: 1 — 40 miles)
Downlink Data :	75 % (Range: 15 — 85 %)
Contention Slots :	3 (Range: 1 — 15)
Broadcast Repeat Count :	2 (Range : 0 — 2)

Power Control

Transmit Power :	22 dBm (Range: -30 — +22 dBm) (19 dBm A / 19 dBm B)
External Gain :	35 dB (Range: 0 — +35 dB)
SM Receive Target Level :	-52 dBm (Range : -77 — -37 dBm) combined power

Multicast Data Control

Multicast VC Data Rate :	Disable ▼
Multicast Repeat Count :	0 (Range : 0 — 2)
Multicast Downlink CIR :	0 (kbps) (Range: 0— 0 kbps)

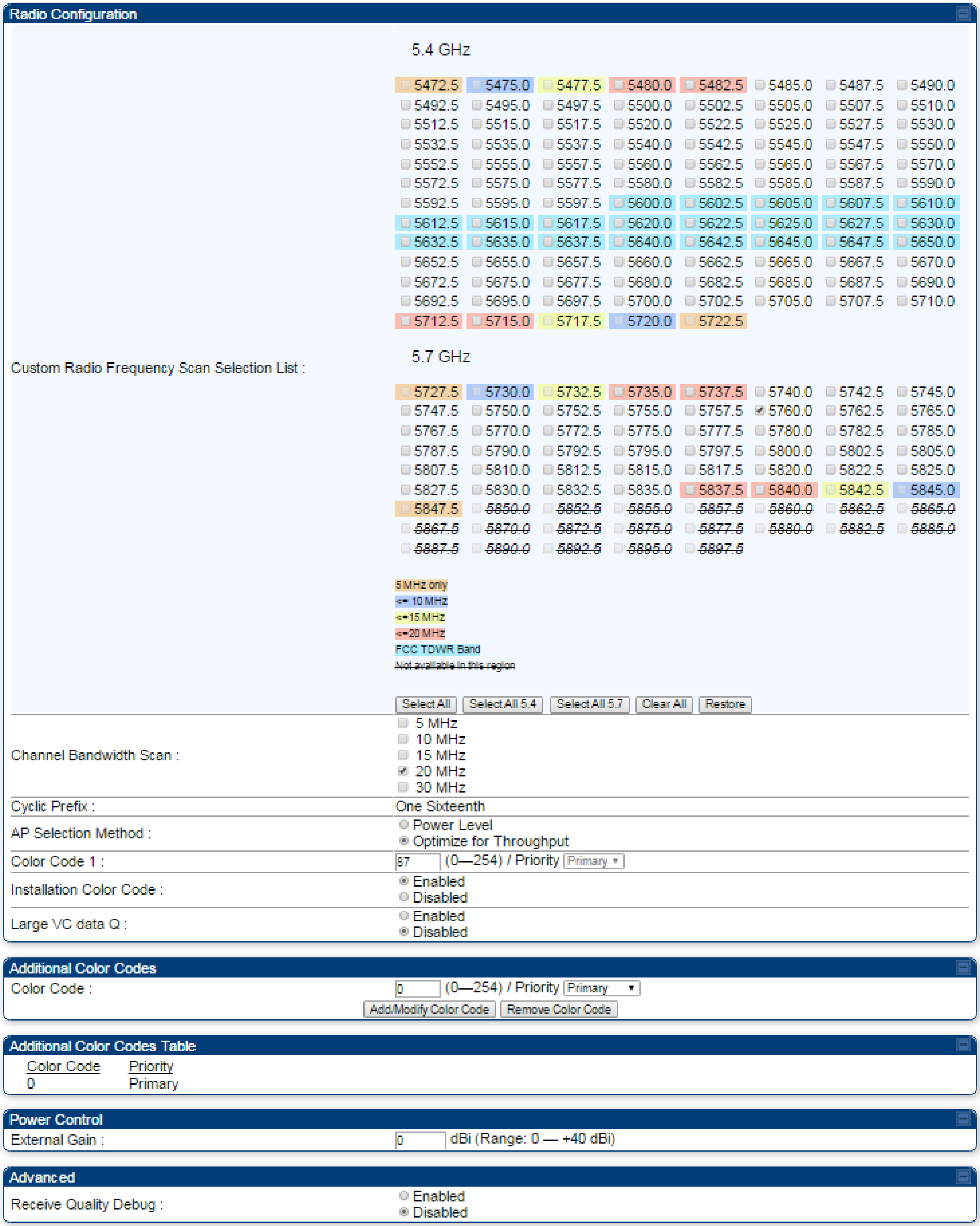
Advanced

Control Messages :	○ SISO ● MIMO-A
Receive Quality Debug :	● Enabled ○ Disabled

Attribute	Meaning
Radio Configuration, Frame Configuration, Power Control, Multicast Data Control and Advance tab	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.

Radio page - PMP 450 SM 5 GHz

Table 130 PMP 450 SM Radio attributes – 5 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

5.4 GHz

□ 5472.5	□ 5475.0	□ 5477.5	□ 5480.0	□ 5482.5	□ 5485.0	□ 5487.5	□ 5490.0
□ 5492.5	□ 5495.0	□ 5497.5	□ 5500.0	□ 5502.5	□ 5505.0	□ 5507.5	□ 5510.0
□ 5512.5	□ 5515.0	□ 5517.5	□ 5520.0	□ 5522.5	□ 5525.0	□ 5527.5	□ 5530.0
□ 5532.5	□ 5535.0	□ 5537.5	□ 5540.0	□ 5542.5	□ 5545.0	□ 5547.5	□ 5550.0
□ 5552.5	□ 5555.0	□ 5557.5	□ 5560.0	□ 5562.5	□ 5565.0	□ 5567.5	□ 5570.0
□ 5572.5	□ 5575.0	□ 5577.5	□ 5580.0	□ 5582.5	□ 5585.0	□ 5587.5	□ 5590.0
□ 5592.5	□ 5595.0	□ 5597.5	□ 5600.0	□ 5602.5	□ 5605.0	□ 5607.5	□ 5610.0
□ 5612.5	□ 5615.0	□ 5617.5	□ 5620.0	□ 5622.5	□ 5625.0	□ 5627.5	□ 5630.0
□ 5632.5	□ 5635.0	□ 5637.5	□ 5640.0	□ 5642.5	□ 5645.0	□ 5647.5	□ 5650.0
□ 5652.5	□ 5655.0	□ 5657.5	□ 5660.0	□ 5662.5	□ 5665.0	□ 5667.5	□ 5670.0
□ 5672.5	□ 5675.0	□ 5677.5	□ 5680.0	□ 5682.5	□ 5685.0	□ 5687.5	□ 5690.0
□ 5692.5	□ 5695.0	□ 5697.5	□ 5700.0	□ 5702.5	□ 5705.0	□ 5707.5	□ 5710.0
□ 5712.5	□ 5715.0	□ 5717.5	□ 5720.0	□ 5722.5			

5.7 GHz

□ 5727.5	□ 5730.0	□ 5732.5	□ 5735.0	□ 5737.5	□ 5740.0	□ 5742.5	□ 5745.0
□ 5747.5	□ 5750.0	□ 5752.5	□ 5755.0	□ 5757.5	☑ 5760.0	□ 5762.5	□ 5765.0
□ 5767.5	□ 5770.0	□ 5772.5	□ 5775.0	□ 5777.5	□ 5780.0	□ 5782.5	□ 5785.0
□ 5787.5	□ 5790.0	□ 5792.5	□ 5795.0	□ 5797.5	□ 5800.0	□ 5802.5	□ 5805.0
□ 5807.5	□ 5810.0	□ 5812.5	□ 5815.0	□ 5817.5	□ 5820.0	□ 5822.5	□ 5825.0
□ 5827.5	□ 5830.0	□ 5832.5	□ 5835.0	□ 5837.5	□ 5840.0	□ 5842.5	□ 5845.0
□ 5847.5	□ ~~5850.0~~	□ ~~5852.5~~	□ ~~5855.0~~	□ ~~5857.5~~	□ ~~5860.0~~	□ ~~5862.5~~	□ ~~5865.0~~
□ ~~5867.5~~	□ ~~5870.0~~	□ ~~5872.5~~	□ ~~5875.0~~	□ ~~5877.5~~	□ ~~5880.0~~	□ ~~5882.5~~	□ ~~5885.0~~
□ ~~5887.5~~	□ ~~5890.0~~	□ ~~5892.5~~	□ ~~5895.0~~	□ ~~5897.5~~			

5 MHz only
<= 10 MHz
<=15 MHz
<=20 MHz
FCC TDWR Band
~~Not available in this region~~

Channel Bandwidth Scan : □ 5 MHz □ 10 MHz □ 15 MHz ☑ 20 MHz □ 30 MHz

Cyclic Prefix : One Sixteenth

AP Selection Method : ○ Power Level ● Optimize for Throughput

Color Code 1 : 87 (0—254) / Priority Primary

Installation Color Code : ● Enabled ○ Disabled

Large VC data Q : ○ Enabled ● Disabled

Additional Color Codes

Color Code : 0 (0—254) / Priority Primary

Additional Color Codes Table

Color Code	Priority
0	Primary

Power Control

External Gain : 0 dBi (Range: 0 — +40 dBi)

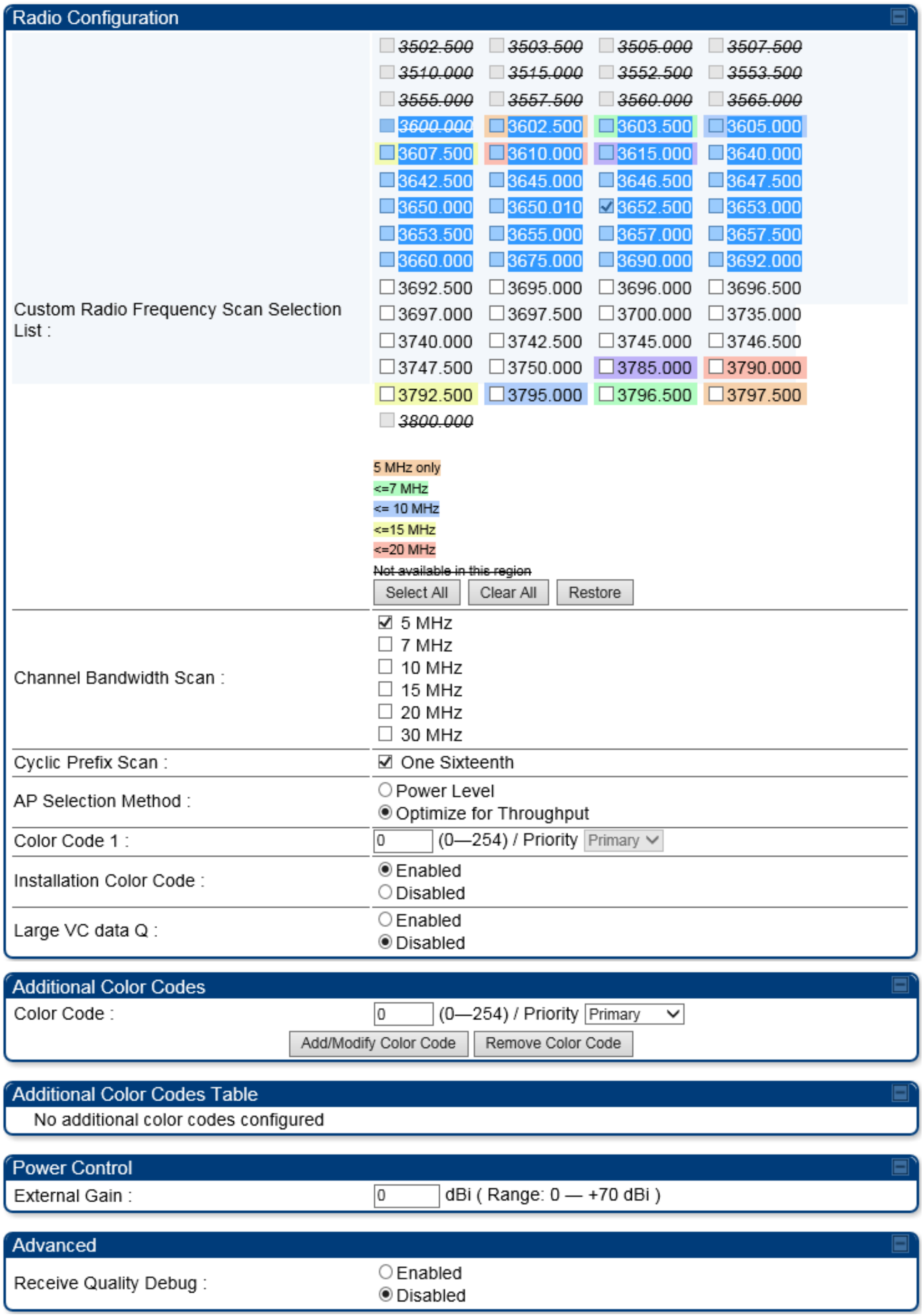
Advanced

Receive Quality Debug : ○ Enabled ● Disabled

Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check the frequencies that SM has to scan for AP transmissions. See Radio Frequency Scan Selection List on page 7-227.
See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.	

Radio page - PMP 450 SM 3.65 GHz

Table 131 PMP 450 SM Radio attributes – 3.65 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

□ ~~3502.500~~	□ ~~3503.500~~	□ ~~3505.000~~	□ ~~3507.500~~
□ ~~3510.000~~	□ ~~3515.000~~	□ ~~3552.500~~	□ ~~3553.500~~
□ ~~3555.000~~	□ ~~3557.500~~	□ ~~3560.000~~	□ ~~3565.000~~
□ ~~3600.000~~	□ 3602.500	□ 3603.500	□ 3605.000
□ 3607.500	□ 3610.000	□ 3615.000	□ 3640.000
□ 3642.500	□ 3645.000	□ 3646.500	□ 3647.500
□ 3650.000	□ 3650.010	☑ 3652.500	□ 3653.000
□ 3653.500	□ 3655.000	□ 3657.000	□ 3657.500
□ 3660.000	□ 3675.000	□ 3690.000	□ 3692.000
□ 3692.500	□ 3695.000	□ 3696.000	□ 3696.500
□ 3697.000	□ 3697.500	□ 3700.000	□ 3735.000
□ 3740.000	□ 3742.500	□ 3745.000	□ 3746.500
□ 3747.500	□ 3750.000	□ 3785.000	□ 3790.000
□ 3792.500	□ 3795.000	□ 3796.500	□ 3797.500
□ ~~3800.000~~			

5 MHz only
<=7 MHz
<= 10 MHz
<=15 MHz
<=20 MHz
~~Not available in this region~~

Channel Bandwidth Scan :	☑ 5 MHz □ 7 MHz □ 10 MHz □ 15 MHz □ 20 MHz □ 30 MHz
Cyclic Prefix Scan :	☑ One Sixteenth
AP Selection Method :	○ Power Level ● Optimize for Throughput
Color Code 1 :	0 (0—254) / Priority Primary
Installation Color Code :	● Enabled ○ Disabled
Large VC data Q :	○ Enabled ● Disabled

Additional Color Codes

Color Code :	0 (0—254) / Priority Primary

Additional Color Codes Table

No additional color codes configured

Power Control

External Gain :	0 dBi (Range: 0 — +70 dBi)

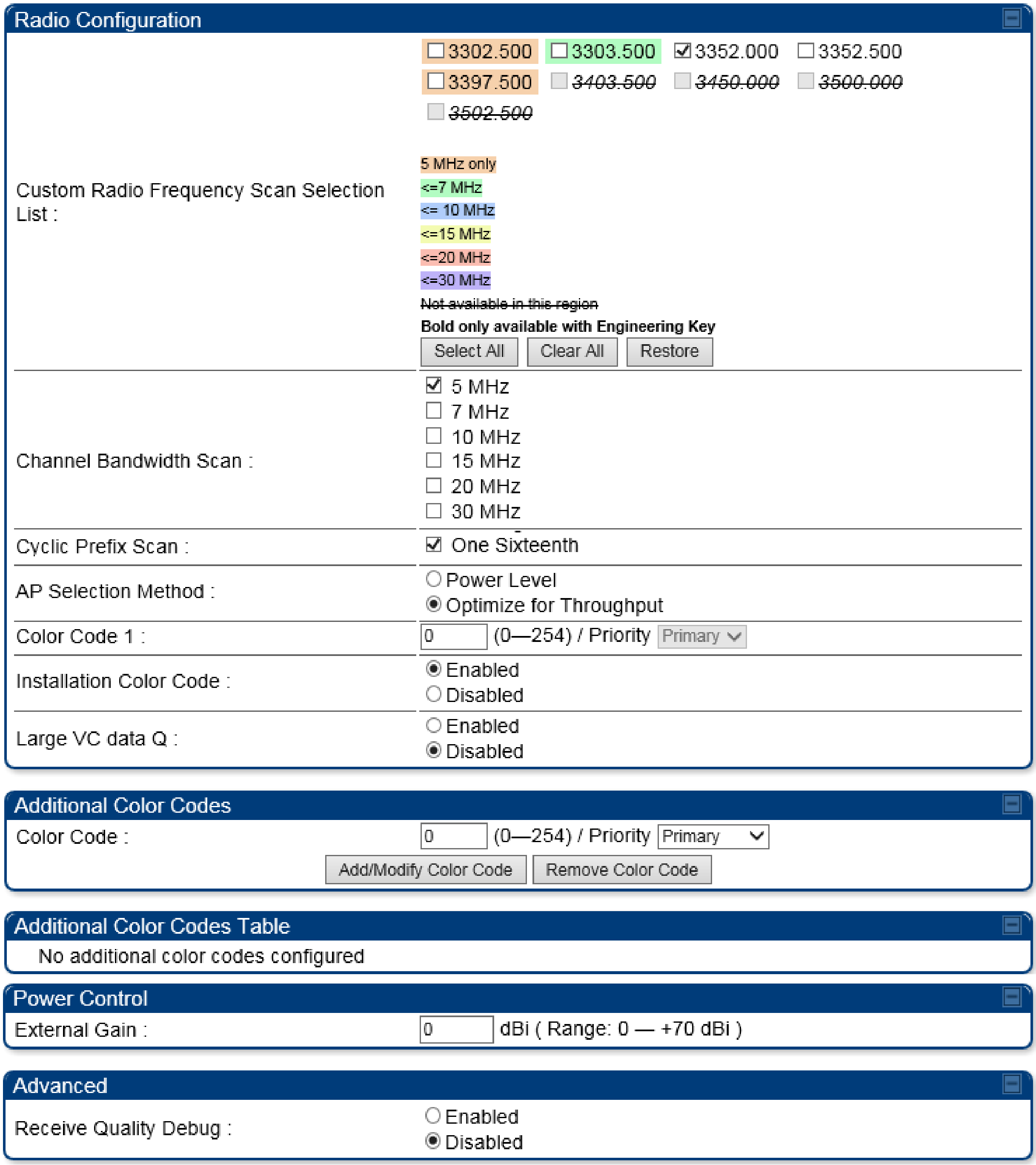
Advanced

Receive Quality Debug :	○ Enabled ● Disabled

Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check the frequencies that SM has to scan for AP transmissions. See Radio Frequency Scan Selection List on page 7-227.
See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.	

Radio page - PMP 450 SM 3.5 GHz

Table 132 PMP 450 SM Radio attributes – 3.5 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

☐3302.500 ☐3303.500 ☑3352.000 ☐3352.500
☐3397.500 ☐~~3403.500~~ ☐~~3450.000~~ ☐~~3500.000~~
☐~~3502.500~~

5 MHz only
<=7 MHz
<= 10 MHz
<=15 MHz
<=20 MHz
<=30 MHz
~~Not available in this region~~
Bold only available with Engineering Key

Channel Bandwidth Scan :
☑ 5 MHz
☐ 7 MHz
☐ 10 MHz
☐ 15 MHz
☐ 20 MHz
☐ 30 MHz

Cyclic Prefix Scan : ☑ One Sixteenth

AP Selection Method : ○ Power Level ● Optimize for Throughput

Color Code 1 : 0 (0—254) / Priority Primary

Installation Color Code : ● Enabled ○ Disabled

Large VC data Q : ○ Enabled ● Disabled

Additional Color Codes

Color Code : 0 (0—254) / Priority Primary

Additional Color Codes Table

No additional color codes configured

Power Control

External Gain : 0 dBi (Range: 0 — +70 dBi)

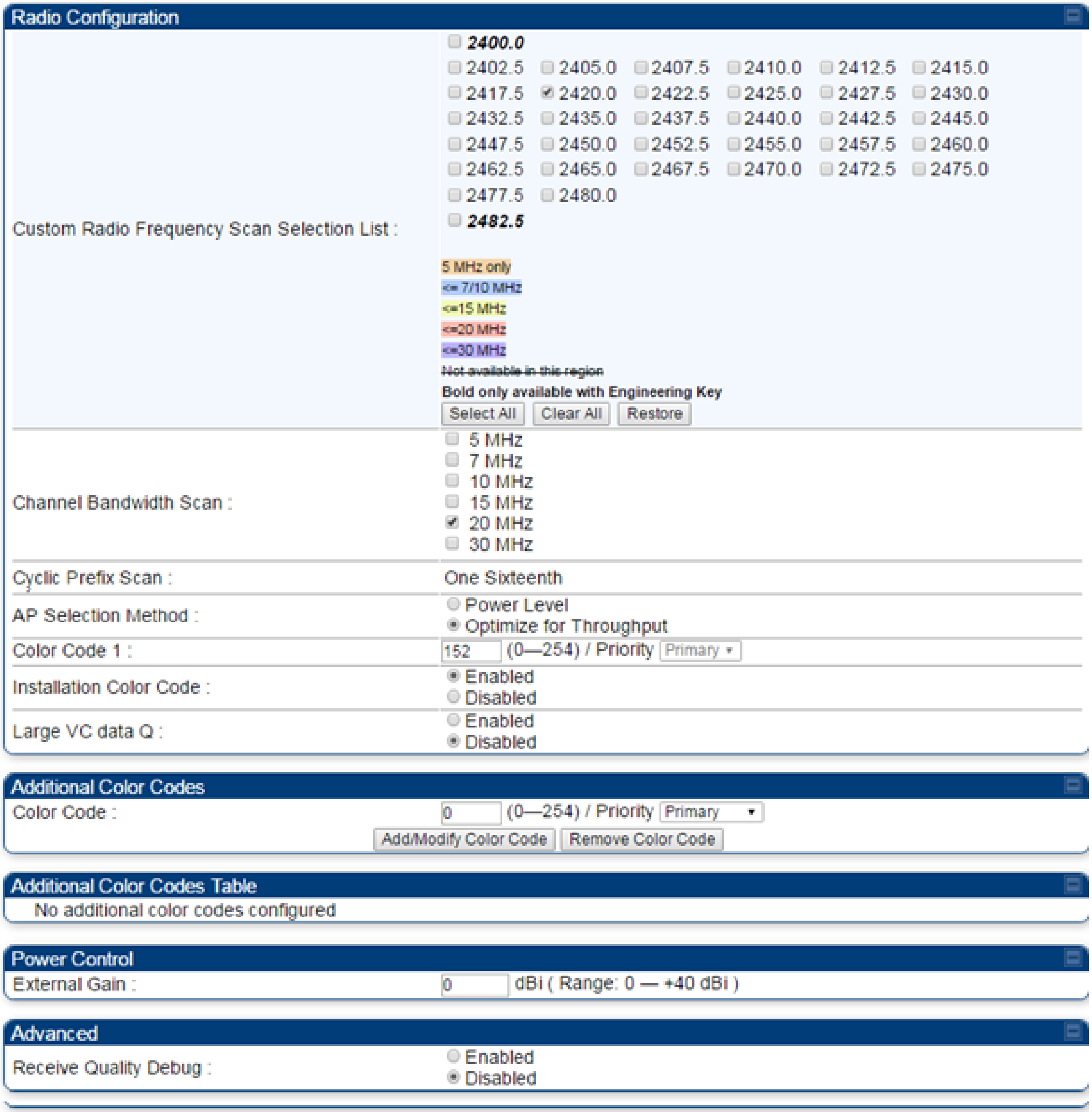
Advanced

Receive Quality Debug : ○ Enabled ● Disabled

Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check the frequencies that SM has to scan for AP transmissions. See Radio Frequency Scan Selection List on page 7-227.
See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.	

Radio page - PMP 450 SM 2.4 GHz

Table 133 PMP 450 SM Radio attributes – 2.4 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

□ ***2400.0***

□ 2402.5	□ 2405.0	□ 2407.5	□ 2410.0	□ 2412.5	□ 2415.0
□ 2417.5	☑ 2420.0	□ 2422.5	□ 2425.0	□ 2427.5	□ 2430.0
□ 2432.5	□ 2435.0	□ 2437.5	□ 2440.0	□ 2442.5	□ 2445.0
□ 2447.5	□ 2450.0	□ 2452.5	□ 2455.0	□ 2457.5	□ 2460.0
□ 2462.5	□ 2465.0	□ 2467.5	□ 2470.0	□ 2472.5	□ 2475.0
□ 2477.5	□ 2480.0				

□ ***2482.5***

5 MHz only
<= 7/10 MHz
<=15 MHz
<=20 MHz
<=30 MHz
~~Not available in this region~~
Bold only available with Engineering Key

Channel Bandwidth Scan :
□ 5 MHz
□ 7 MHz
□ 10 MHz
□ 15 MHz
☑ 20 MHz
□ 30 MHz

Cyclic Prefix Scan : One Sixteenth

AP Selection Method :
○ Power Level
● Optimize for Throughput

Color Code 1 : 152 (0—254) / Priority Primary

Installation Color Code :
● Enabled
○ Disabled

Large VC data Q :
○ Enabled
● Disabled

Additional Color Codes

Color Code : 0 (0—254) / Priority Primary

Additional Color Codes Table

No additional color codes configured

Power Control

External Gain : 0 dBi (Range: 0 — +40 dBi)

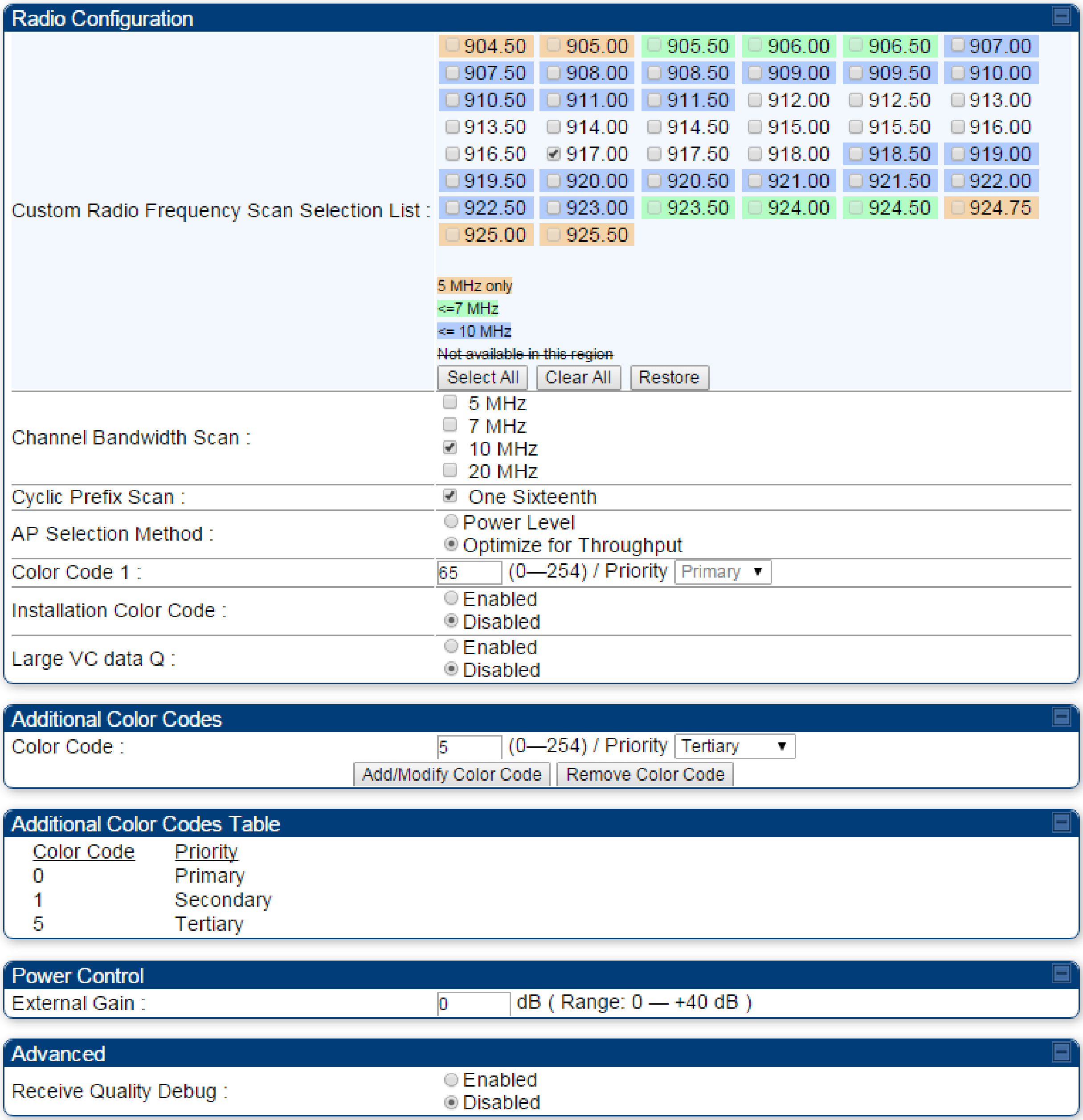
Advanced

Receive Quality Debug :
○ Enabled
● Disabled

Attribute	Meaning
Custom Radio Frequency Scan Selection List	Check the frequencies that SM has to scan for AP transmissions. See Radio Frequency Scan Selection List on page 7-227.
See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.	

Radio page - PMP 450 SM 900 MHz

Table 134 PMP 450 SM Radio attributes –900 MHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

□ 904.50	□ 905.00	□ 905.50	□ 906.00	□ 906.50	□ 907.00
□ 907.50	□ 908.00	□ 908.50	□ 909.00	□ 909.50	□ 910.00
□ 910.50	□ 911.00	□ 911.50	□ 912.00	□ 912.50	□ 913.00
□ 913.50	□ 914.00	□ 914.50	□ 915.00	□ 915.50	□ 916.00
□ 916.50	☑ 917.00	□ 917.50	□ 918.00	□ 918.50	□ 919.00
□ 919.50	□ 920.00	□ 920.50	□ 921.00	□ 921.50	□ 922.00
□ 922.50	□ 923.00	□ 923.50	□ 924.00	□ 924.50	□ 924.75
□ 925.00	□ 925.50				

5 MHz only
<=7 MHz
<= 10 MHz
~~Not available in this region~~

Channel Bandwidth Scan : □ 5 MHz □ 7 MHz ☑ 10 MHz □ 20 MHz

Cyclic Prefix Scan : ☑ One Sixteenth

AP Selection Method : ○ Power Level ● Optimize for Throughput

Color Code 1 : 65 (0—254) / Priority Primary

Installation Color Code : ○ Enabled ● Disabled

Large VC data Q : ○ Enabled ● Disabled

Additional Color Codes

Color Code : 5 (0—254) / Priority Tertiary

Additional Color Codes Table

Color Code	Priority
0	Primary
1	Secondary
5	Tertiary

Power Control

External Gain : 0 dB (Range: 0 — +40 dB)

Advanced

Receive Quality Debug : ○ Enabled ● Disabled

Attribute	Meaning
Custom Radio Frequency Scan Selection List	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.
Channel Bandwidth Scan	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.
Cyclic Prefix Scan	
AP Selection Method	

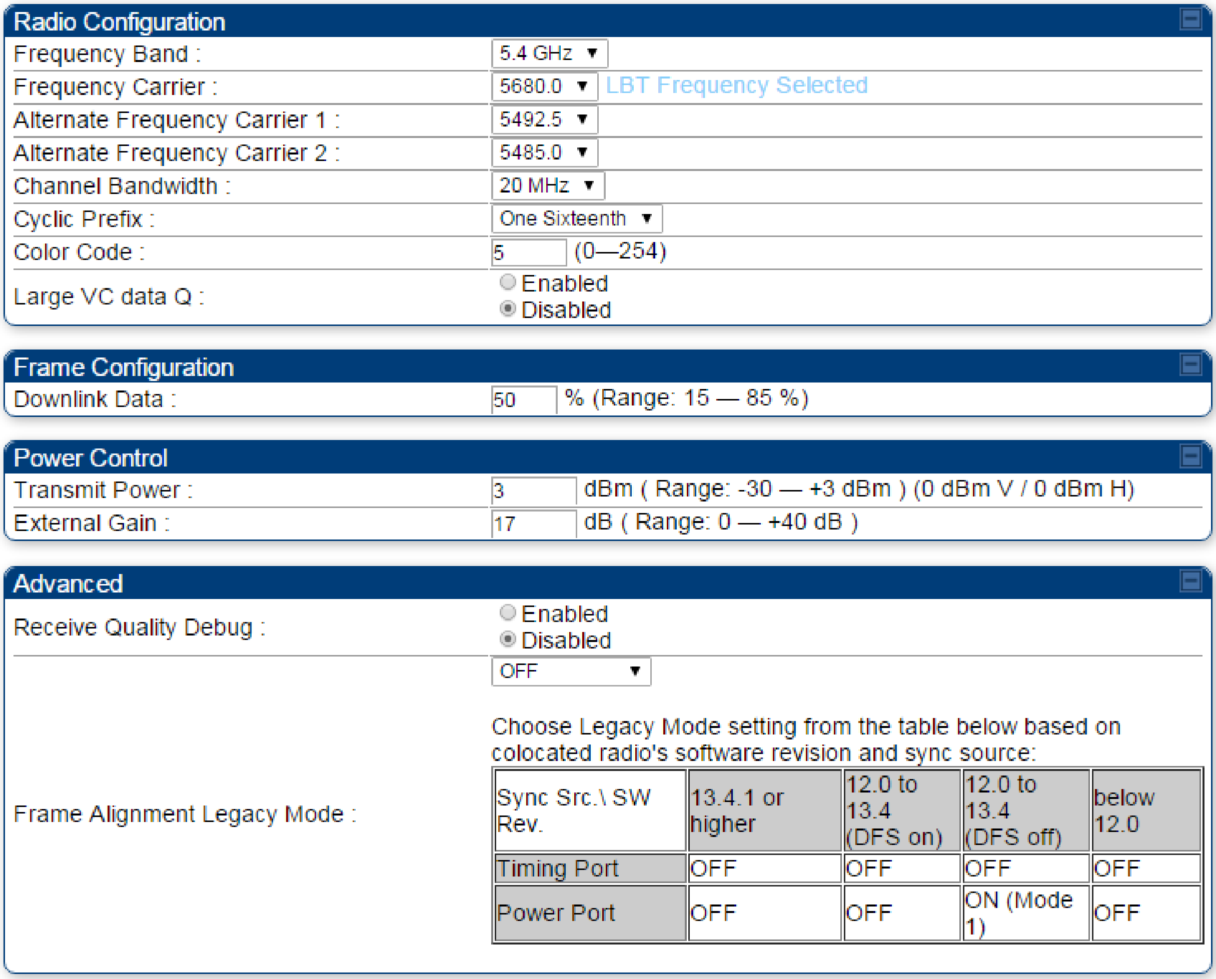
Color Code 1	
Installation Color Code	
Large VC data Queue	
Color Code	
External Gain	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197
Receive Quality Debug	See Table 121 PMP 450i AP Radio attributes - 5 GHz on page 7-197.

Note

The frequencies that a user can select are controlled by the country or a region and the Channel Bandwidth selected. There can be a case where a user adds a custom frequency (from the Custom Frequencies page on page 7-230) and cannot see it in the pull down menu.

Radio page - PTP 450 BHM 5 GHz

Table 135 PTP 450 BHM Radio attributes –5 GHz



Radio Configuration

Frequency Band :	5.4 GHz ▼
Frequency Carrier :	5680.0 ▼ LBT Frequency Selected
Alternate Frequency Carrier 1 :	5492.5 ▼
Alternate Frequency Carrier 2 :	5485.0 ▼
Channel Bandwidth :	20 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Color Code :	5 (0—254)
Large VC data Q :	○ Enabled ● Disabled

Frame Configuration

Downlink Data :	50 % (Range: 15 — 85 %)

Power Control

Transmit Power :	3 dBm (Range: -30 — +3 dBm) (0 dBm V / 0 dBm H)
External Gain :	17 dB (Range: 0 — +40 dB)

Advanced

Receive Quality Debug :	○ Enabled ● Disabled
Frame Alignment Legacy Mode :	OFF ▼

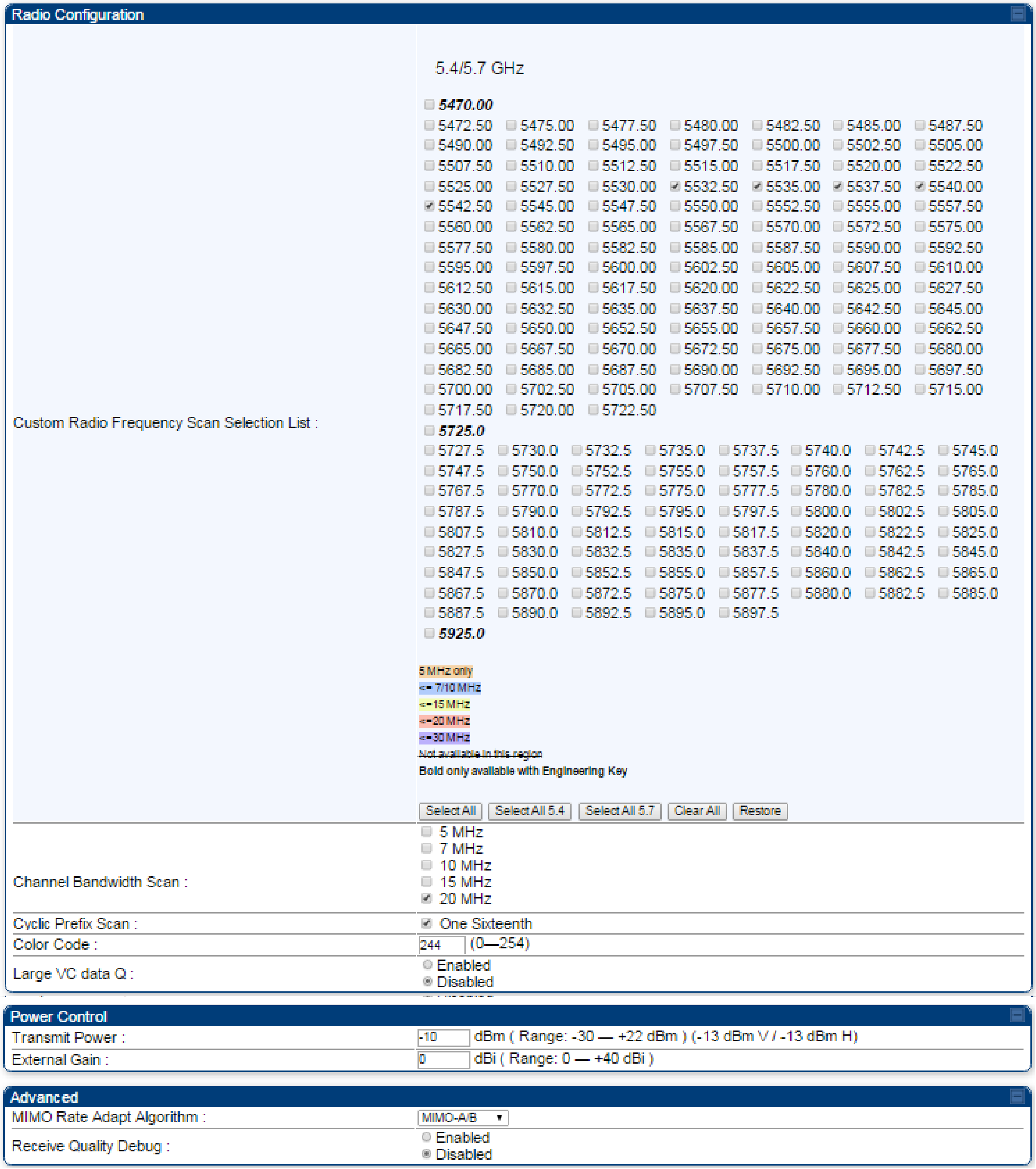
Choose Legacy Mode setting from the table below based on colocated radio's software revision and sync source:

Sync Src.\ SW Rev.	13.4.1 or higher	12.0 to 13.4 (DFS on)	12.0 to 13.4 (DFS off)	below 12.0
Timing Port	OFF	OFF	OFF	OFF
Power Port	OFF	OFF	ON (Mode 1)	OFF

Attribute	Meaning
Refer Table 124 PTP 450i BHM Radio page attributes – 5 GHz on page 7-208 for all parameters details.	

Radio page - PTP 450 BHS 5 GHz

Table 136 PTP 450 BHM Radio attributes –5 GHz



Radio Configuration

Custom Radio Frequency Scan Selection List :

5.4/5.7 GHz

□ ***5470.00***
□ 5472.50 □ 5475.00 □ 5477.50 □ 5480.00 □ 5482.50 □ 5485.00 □ 5487.50
□ 5490.00 □ 5492.50 □ 5495.00 □ 5497.50 □ 5500.00 □ 5502.50 □ 5505.00
□ 5507.50 □ 5510.00 □ 5512.50 □ 5515.00 □ 5517.50 □ 5520.00 □ 5522.50
□ 5525.00 □ 5527.50 □ 5530.00 ☑ 5532.50 ☑ 5535.00 ☑ 5537.50 ☑ 5540.00
☑ 5542.50 □ 5545.00 □ 5547.50 □ 5550.00 □ 5552.50 □ 5555.00 □ 5557.50
□ 5560.00 □ 5562.50 □ 5565.00 □ 5567.50 □ 5570.00 □ 5572.50 □ 5575.00
□ 5577.50 □ 5580.00 □ 5582.50 □ 5585.00 □ 5587.50 □ 5590.00 □ 5592.50
□ 5595.00 □ 5597.50 □ 5600.00 □ 5602.50 □ 5605.00 □ 5607.50 □ 5610.00
□ 5612.50 □ 5615.00 □ 5617.50 □ 5620.00 □ 5622.50 □ 5625.00 □ 5627.50
□ 5630.00 □ 5632.50 □ 5635.00 □ 5637.50 □ 5640.00 □ 5642.50 □ 5645.00
□ 5647.50 □ 5650.00 □ 5652.50 □ 5655.00 □ 5657.50 □ 5660.00 □ 5662.50
□ 5665.00 □ 5667.50 □ 5670.00 □ 5672.50 □ 5675.00 □ 5677.50 □ 5680.00
□ 5682.50 □ 5685.00 □ 5687.50 □ 5690.00 □ 5692.50 □ 5695.00 □ 5697.50
□ 5700.00 □ 5702.50 □ 5705.00 □ 5707.50 □ 5710.00 □ 5712.50 □ 5715.00
□ 5717.50 □ 5720.00 □ 5722.50
□ ***5725.0***
□ 5727.5 □ 5730.0 □ 5732.5 □ 5735.0 □ 5737.5 □ 5740.0 □ 5742.5 □ 5745.0
□ 5747.5 □ 5750.0 □ 5752.5 □ 5755.0 □ 5757.5 □ 5760.0 □ 5762.5 □ 5765.0
□ 5767.5 □ 5770.0 □ 5772.5 □ 5775.0 □ 5777.5 □ 5780.0 □ 5782.5 □ 5785.0
□ 5787.5 □ 5790.0 □ 5792.5 □ 5795.0 □ 5797.5 □ 5800.0 □ 5802.5 □ 5805.0
□ 5807.5 □ 5810.0 □ 5812.5 □ 5815.0 □ 5817.5 □ 5820.0 □ 5822.5 □ 5825.0
□ 5827.5 □ 5830.0 □ 5832.5 □ 5835.0 □ 5837.5 □ 5840.0 □ 5842.5 □ 5845.0
□ 5847.5 □ 5850.0 □ 5852.5 □ 5855.0 □ 5857.5 □ 5860.0 □ 5862.5 □ 5865.0
□ 5867.5 □ 5870.0 □ 5872.5 □ 5875.0 □ 5877.5 □ 5880.0 □ 5882.5 □ 5885.0
□ 5887.5 □ 5890.0 □ 5892.5 □ 5895.0 □ 5897.5
□ ***5925.0***

5 MHz only
<= 7/10 MHz
<=15 MHz
<=20 MHz
<=30 MHz
~~Not available in this region~~
Bold only available with Engineering Key

Channel Bandwidth Scan : □ 5 MHz □ 7 MHz □ 10 MHz □ 15 MHz ☑ 20 MHz

Cyclic Prefix Scan : ☑ One Sixteenth

Color Code : 244 (0—254)

Large VC data Q : ○ Enabled ● Disabled

Power Control

Transmit Power : -10 dBm (Range: -30 — +22 dBm) (-13 dBm V / -13 dBm H)

External Gain : 0 dBi (Range: 0 — +40 dBi)

Advanced

MIMO Rate Adapt Algorithm : MIMO-A/B

Receive Quality Debug : ○ Enabled ● Disabled

Attribute	Meaning
Refer Table 125 PTP 450i BHS Radio attributes – 5 GHz on page 7-211 for all parameters details.	

Radio Frequency Scan Selection List

The SM or BHS scans complete spectrum as per Full Spectrum Band Scan feature. SMs or BHS first boot into the smallest selected channel bandwidth (10 MHz, if selected) and scan all selected frequencies across both the 5.4 GHz and 5.7 GHz frequency bands.

After this scan, if a wider channel bandwidth is selected (20 MHz), the SM/BHS automatically changes to 20 MHz channel bandwidth and then scans for APs/BHSs. After the SM/BHS finishes this final scan it will evaluate the best AP/BHM with which to register. If required for registration, the SM/BHS changes its channel bandwidth back to 10 MHz to match the best AP/BHM.

The SM/BHS will attempt to connect to an AP/BHM based on power level (which affects the modulation state), channel bandwidth (which affects throughput) and number of SM/BHS registrations to the AP/BHM (which affects system contention performance).

If it is desired to prioritize a certain AP/BHM over other available APs/BHMs, operators may use the Color Code Priority feature on the SM/BHS. Utilization of the Color Code feature on the AP/BHM is recommended to further constrain the AP selection.

If the SM does not find any suitable APs/BHMs for registration after scanning all channel bandwidths, the SM restarts the scanning process beginning with the smallest configured channel bandwidth.

Selecting multiple frequencies and multiple channel bandwidths impacts the SM/BHS scanning time. The biggest consumption of time is in the changing of the SM/BHS channel bandwidth setting.

The worst case scanning time is approximately two minutes after boot up (SM/BHS with all frequencies and channel bandwidths selected and registering to an AP/BHM at 10 MHz). If only one channel bandwidth is selected the time to scan all the available frequencies and register to an AP/BHM is approximately one minute after boot up.

Other scanning features such as Color Code, Installation Color Code, and RADIUS authentication are unaffected by the Full Band Scan feature.

Dedicated Multicast Virtual Circuit (VC)

A Multicast VC allows to configure multicast packets to be transmitted over a dedicated channel at a configurable rate of 1X, 2X, 4X or 8X. This feature is available only for the PMP 450 and PMP 450i and is not backward compatible with PMP 430 series of radios.

To configure Multicast VC, the AP must have this enabled. This can be enabled in the “Multicast Data Control” section (under **Configuration > Radio** page). The default value is “Disable”. If set to the *default* value, all multicast packets are transmitted over the Broadcast VC data path. To enable, select the data rate that is desired for the Multicast VC Data Rate parameter and click **Save Changes** button. The radio requires no reboot after any changes to this parameter.

The multicast VC allows three different parameters to be configured on the AP. These can be changed on the fly and are saved on the flash memory.

Note

If the Multicast VC Data Rate is set to a modulation that the radio is not currently capable of or operates in non-permitted channel conditions, multicast data is sent but not received.

Ex: If Multicast VC Data Rate is set to 6x and the channel conditions only permit 4x mode of operation, then multicast data is sent at 6x modulation but the SM will not receive the data.

Note

The PMP 450 AP supports up to 119 VCs (instead of 238 VCs) when configured for 30 MHz channel bandwidth or 5 ms Frame Period. This limitation is not applicable for PMP 450i Series.

Note

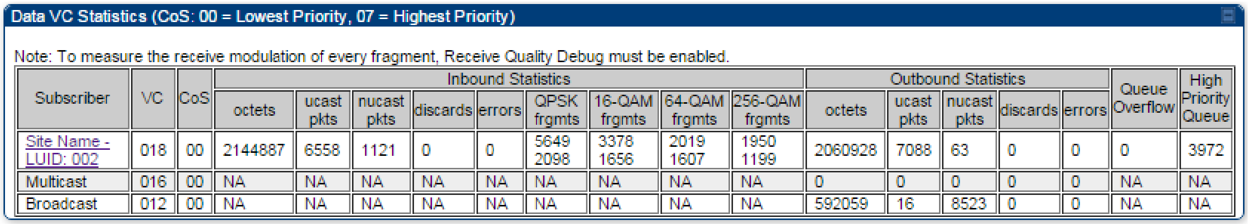
- Actual Multicast CIR honored by the AP = Configured Multicast CINR/ (Multicast Repeat Count + 1).
- Increasing the Multicast data rate has no impact on the Unicast data rate.
- For multicast and unicast traffic mix scenario examples, see Table 137.

Table 137 Example for mix of multicast and unicast traffic scenarios

Repeat Count	Multicast Data Rate (Mbps)	Unicast Data Rate (Mbps)	Aggregate DL Data Rate (Mbps)
0	10	40	50
1	5	40	45
2	3.33	40	43.33

The statistics have been added to the **Data VC** page (under **Statistics > Data VC**). The table displays the multicast row on the PMP 450 Platform Family AP. The SM displays the multicast row if it is a PMP 450 Platform Family.

Figure 122 Multicast VC statistics



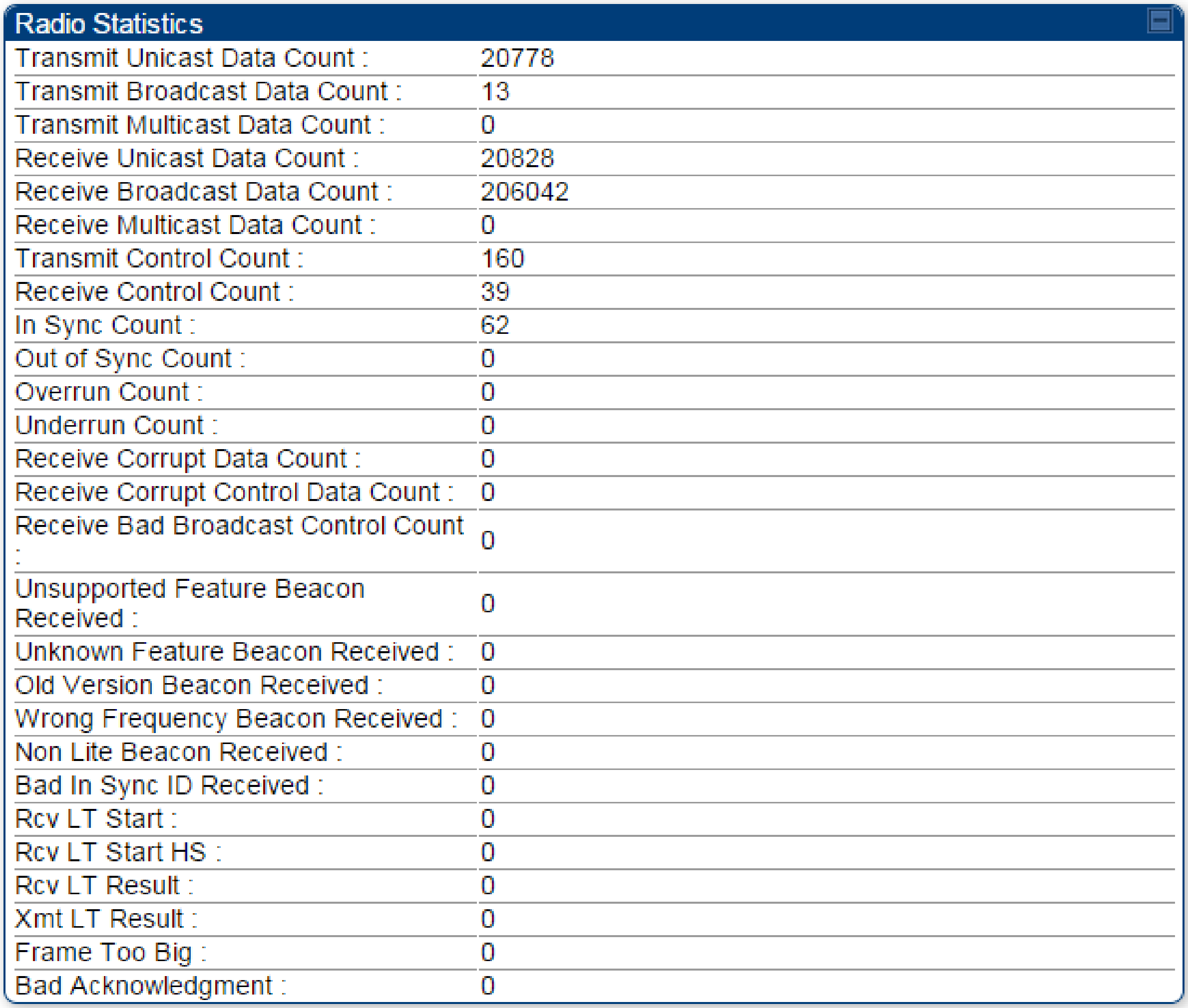
Data VC Statistics (CoS: 00 = Lowest Priority, 07 = Highest Priority)

Note: To measure the receive modulation of every fragment, Receive Quality Debug must be enabled.

Subscriber	VC	CoS	Inbound Statistics									Outbound Statistics					Queue Overflow	High Priority Queue
			octets	ucast pkts	nucast pkts	discards	errors	QPSK frgmts	16-QAM frgmts	64-QAM frgmts	256-QAM frgmts	octets	ucast pkts	nucast pkts	discards	errors		
Site Name - LUID: 002	018	00	2144887	6558	1121	0	0	5649 2098	3378 1656	2019 1607	1950 1199	2060928	7088	63	0	0	0	3972
Multicast	016	00	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	NA	NA
Broadcast	012	00	NA	NA	NA	NA	NA	NA	NA	NA	NA	592059	16	8523	0	0	NA	NA

The AP and SM display Transmit and Receive Multicast Data Count (under the **Statistics > Scheduler** page), as shown in Figure 123.

Figure 123 Multicast scheduler statistics



Radio Statistics

Transmit Unicast Data Count :	20778
Transmit Broadcast Data Count :	13
Transmit Multicast Data Count :	0
Receive Unicast Data Count :	20828
Receive Broadcast Data Count :	206042
Receive Multicast Data Count :	0
Transmit Control Count :	160
Receive Control Count :	39
In Sync Count :	62
Out of Sync Count :	0
Overrun Count :	0
Underrun Count :	0
Receive Corrupt Data Count :	0
Receive Corrupt Control Data Count :	0
Receive Bad Broadcast Control Count :	0
Unsupported Feature Beacon Received :	0
Unknown Feature Beacon Received :	0
Old Version Beacon Received :	0
Wrong Frequency Beacon Received :	0
Non Lite Beacon Received :	0
Bad In Sync ID Received :	0
Rcv LT Start :	0
Rcv LT Start HS :	0
Rcv LT Result :	0
Xmt LT Result :	0
Frame Too Big :	0
Bad Acknowledgment :	0

Custom Frequencies page

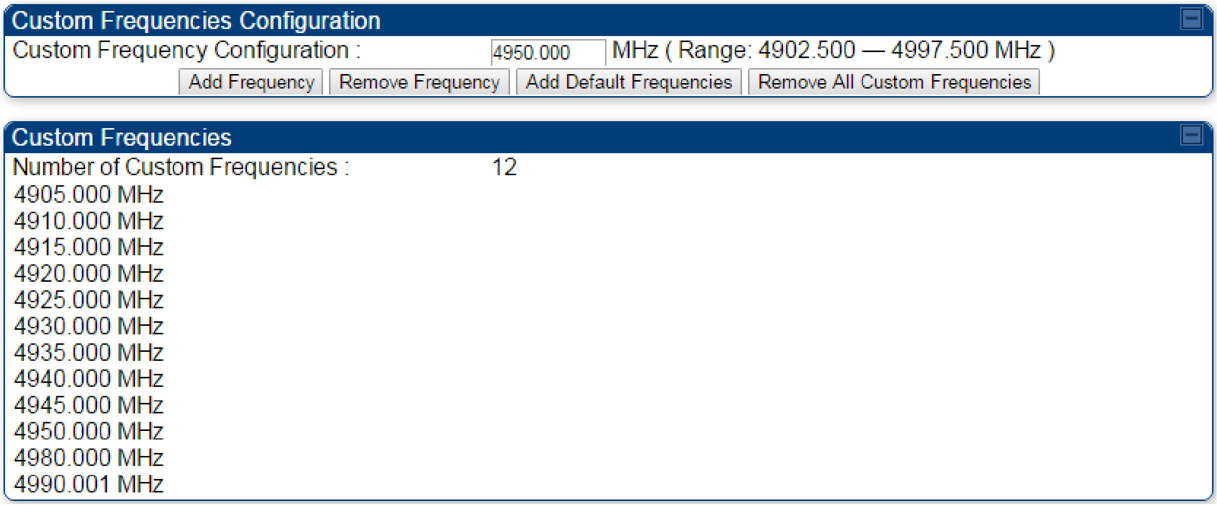
In addition to the **Radio** tab, AP/SM/BH has another tab called **Custom Frequencies** as shown in Table 138.

The custom frequency tab allows to configure custom frequency at 1 KHz raster. It means that the custom frequencies can be at granularity of 1 KHz e.g. 4910.123 MHz, 4922.333 MHz, 4933.421 MHz etc.

Note

Ensure that a customer frequency exists before using SNMP to set the radio to a Custom Frequency.

Table 138 450 Platform Family AP/SM/BH Custom Frequencies page – 5 GHz



Custom Frequencies Configuration

Custom Frequency Configuration : 4950.000 MHz (Range: 4902.500 — 4997.500 MHz)

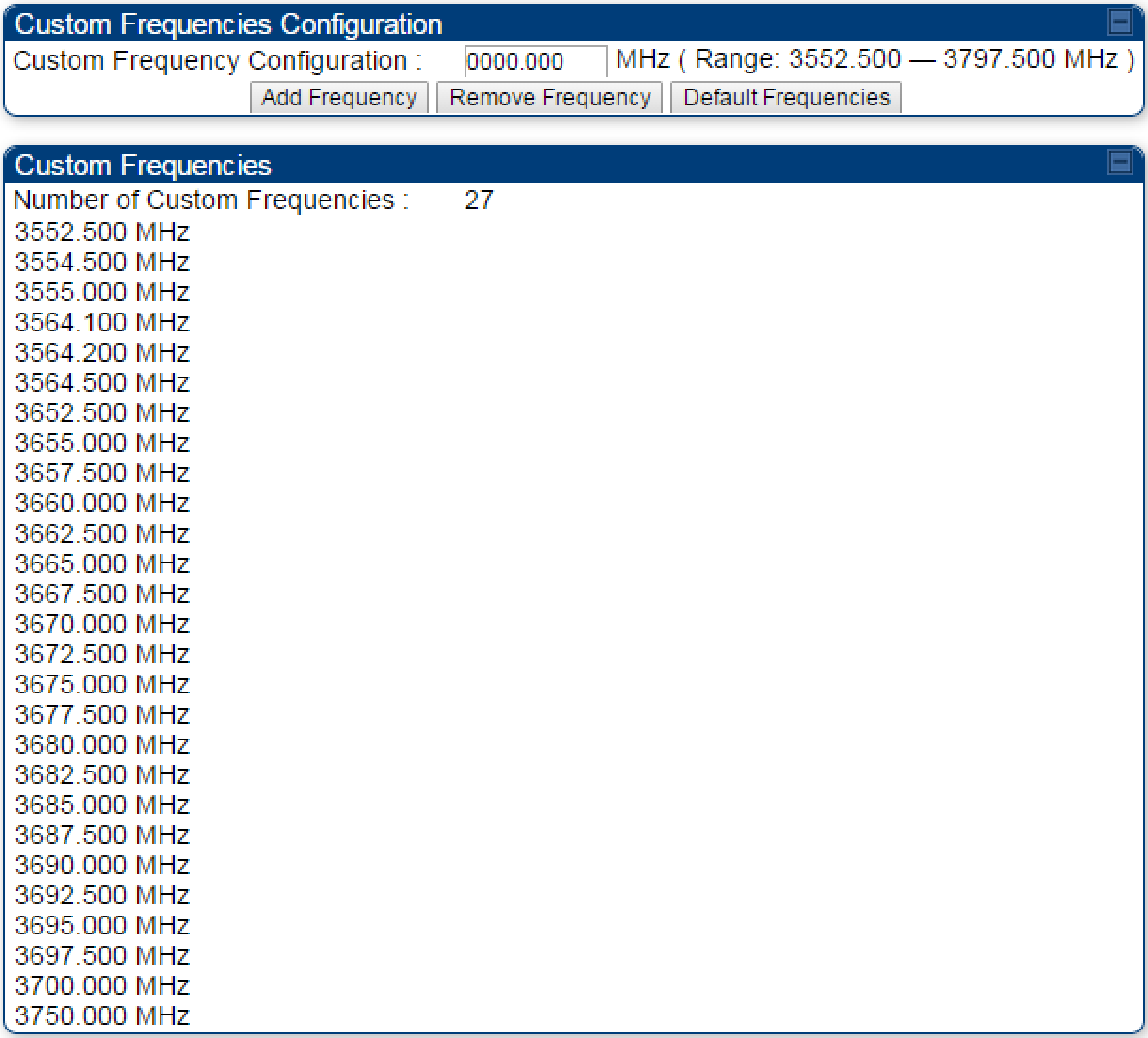
Custom Frequencies

Number of Custom Frequencies : 12

4905.000 MHz
4910.000 MHz
4915.000 MHz
4920.000 MHz
4925.000 MHz
4930.000 MHz
4935.000 MHz
4940.000 MHz
4945.000 MHz
4950.000 MHz
4980.000 MHz
4990.001 MHz

Attribute	Meaning
Custom Frequency Configuration	Custom frequencies with a channel raster of 1 KHz can be added from the available range by keying in the frequency and then clicking the **Add Frequency** button. Click **Remove Frequency** button to delete a specific frequency keyed in the text box. Click **Default Frequencies** button to add a pre-defined list of frequencies that can be used in this band. This list can be reduced or increased by manually removing or adding other custom frequencies.
Custom Frequencies	Displays the complete list of user configured custom frequencies.

Table 139 PMP/PTP 450 SM/BH Custom Frequencies page – 3.65 GHz



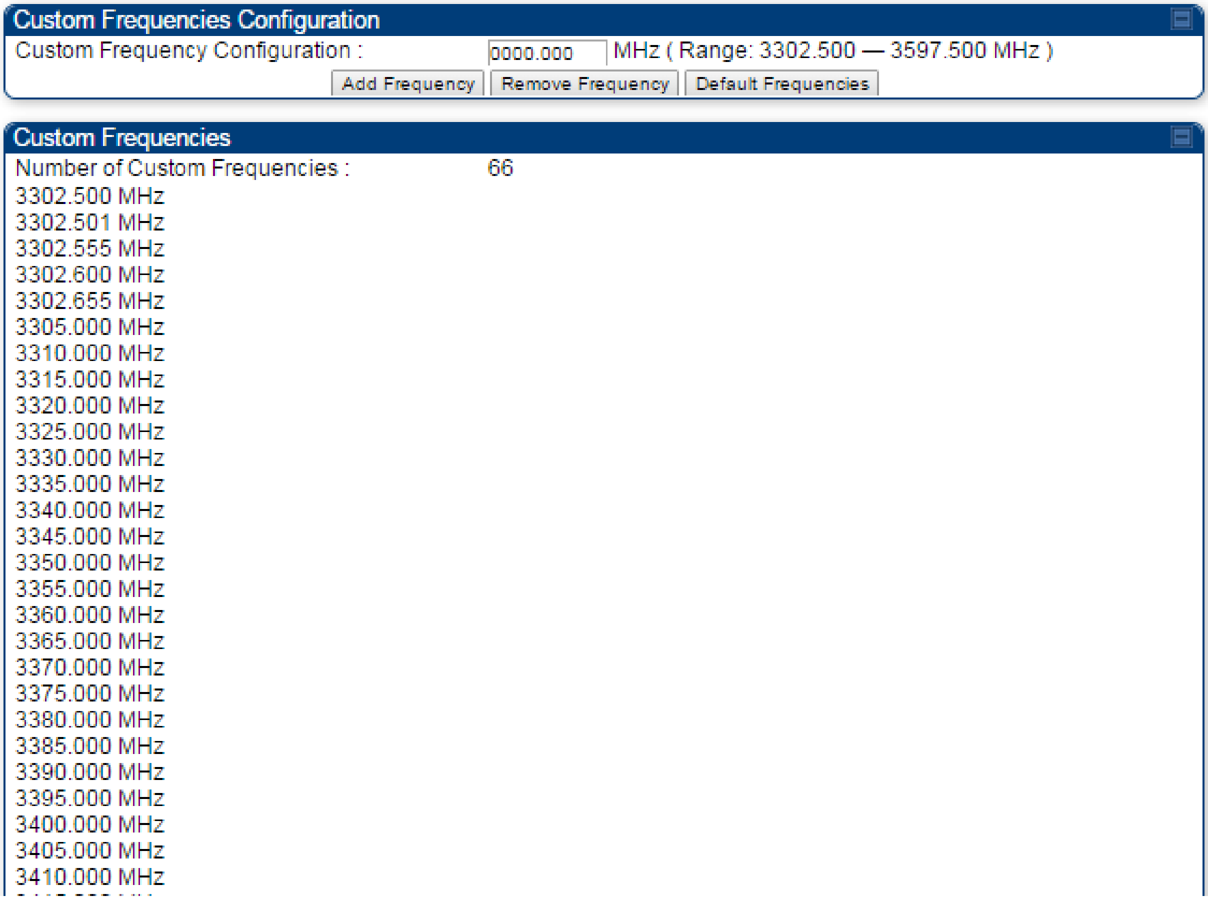
Custom Frequency Configuration : 0000.000 MHz (Range: 3552.500 — 3797.500 MHz)

Number of Custom Frequencies : 27

3552.500 MHz
3554.500 MHz
3555.000 MHz
3564.100 MHz
3564.200 MHz
3564.500 MHz
3652.500 MHz
3655.000 MHz
3657.500 MHz
3660.000 MHz
3662.500 MHz
3665.000 MHz
3667.500 MHz
3670.000 MHz
3672.500 MHz
3675.000 MHz
3677.500 MHz
3680.000 MHz
3682.500 MHz
3685.000 MHz
3687.500 MHz
3690.000 MHz
3692.500 MHz
3695.000 MHz
3697.500 MHz
3700.000 MHz
3750.000 MHz

Attribute	Meaning
Custom Frequency Configuration	Custom frequencies with a channel raster of 1 KHz can be added from the available range by keying in the frequency and then clicking the **Add Frequency** button. Click **Remove Frequency** button to delete a specific frequency keyed in the text box. Click **Default Frequencies** button to add a pre-defined list of frequencies that can be used in this band. This list can be reduced or increased by manually removing or adding other custom frequencies.
Custom Frequencies	Displays the complete list of user configured custom frequencies.

Table 140 PMP/PTP 450 SM/BH Custom Frequencies page – 3.5 GHz



Custom Frequencies Configuration

Custom Frequency Configuration : 0000.000 MHz (Range: 3302.500 — 3597.500 MHz)

Custom Frequencies

Number of Custom Frequencies : 66

3302.500 MHz
3302.501 MHz
3302.555 MHz
3302.600 MHz
3302.655 MHz
3305.000 MHz
3310.000 MHz
3315.000 MHz
3320.000 MHz
3325.000 MHz
3330.000 MHz
3335.000 MHz
3340.000 MHz
3345.000 MHz
3350.000 MHz
3355.000 MHz
3360.000 MHz
3365.000 MHz
3370.000 MHz
3375.000 MHz
3380.000 MHz
3385.000 MHz
3390.000 MHz
3395.000 MHz
3400.000 MHz
3405.000 MHz
3410.000 MHz

Attribute	Meaning
Custom Frequency Configuration	Custom frequencies with a channel raster of 1 KHz can be added from the available range by keying in the frequency and then clicking the **Add Frequency** button. Click **Remove Frequency** button to delete a specific frequency keyed in the text box. Click **Default Frequencies** button to add a pre-defined list of frequencies that can be used in this band. This list can be reduced or increased by manually removing or adding other custom frequencies.

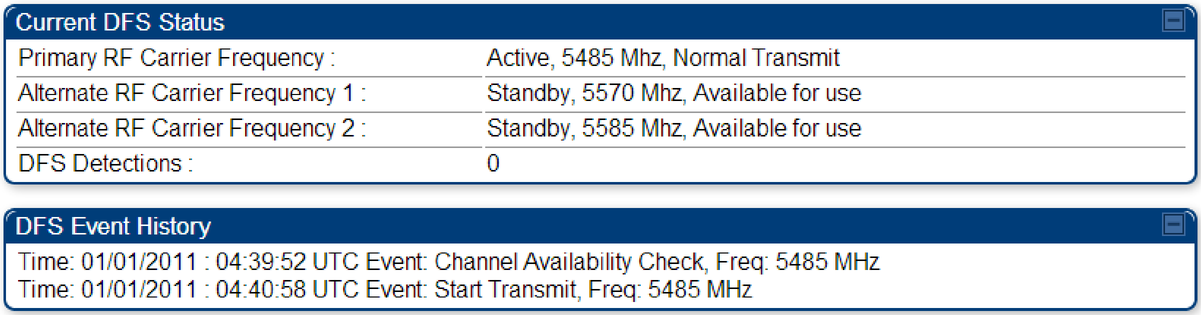
DFS for 5 GHz Radios

Dynamic Frequency Selection (DFS) is a requirement in several countries and regions for 5 GHz unlicensed systems to detect radar systems and avoid co-channel operation. DFS and other regulatory requirements drive the settings for the following parameters, as discussed in this section:

- Country Code
- Primary Frequency
- Alternate 1 and Alternate 2 Frequencies
- External Antenna Gain

On the AP, the **Home > DFS Status** page shows current DFS status of all three frequencies and a DFS log of past DFS events.

Figure 124 AP DFS Status



Current DFS Status

Primary RF Carrier Frequency :	Active, 5485 Mhz, Normal Transmit
Alternate RF Carrier Frequency 1 :	Standby, 5570 Mhz, Available for use
Alternate RF Carrier Frequency 2 :	Standby, 5585 Mhz, Available for use
DFS Detections :	0

DFS Event History

```
Time: 01/01/2011 : 04:39:52 UTC Event: Channel Availability Check, Freq: 5485 MHz
Time: 01/01/2011 : 04:40:58 UTC Event: Start Transmit, Freq: 5485 MHz
```

DFS operation

The ODUs use region-specific DFS based on the **Country Code** selected on the module's Configuration, General page. By directing installers and technicians to set the Country Code correctly, the operator gains confidence the module is operating according to national or regional regulations without having to deal with the details for each region.

The details of DFS operation for each Country Code, including whether DFS is active on the AP, SM, and which DFS regulations apply is shown in Table 231 on page 10-37.

Contention slots

The SM uses reserved Contention slots and unused data slots for bandwidth requests.

Uplink Data Slots are used first for data. If they are not needed for data in a given frame, the remaining data slots can be used by the SMs for bandwidth requests. This allows SMs in sectors with a small number of Contention slots configured to still successfully transmit bandwidth requests using unused data slots.

A higher number of Contention slots give higher probability that a SM's bandwidth request is correctly received when the system is heavily loaded, but with the tradeoff that sector capacity is reduced, so there is less capacity to handle the request. The sector capacity reduction is about 200 kbps for each Contention slot configured in a 20 MHz channel at QPSK MIMO-A modulation. The reduction in sector capacity is proportionally higher at MIMO-B modulations (2 times at QPSK MIMO-B, 4 times at 16 QAM MIMO-B, 6 times at 64 QAM MIMO-B and 8 times at 256 QAM MIMO-B). If very few reserved Contention slots are specified, then latency increases in high traffic periods. If too many are specified, then the maximum capacity is unnecessarily reduced.

The suggested Contention slot settings as a function of the number of active VCs in the sector are shown in the table below.

Table 141 Contention slots and number of VCs

Number of VCs	Recommended Number of Contention slots
1 to 10	3
11 to 50	4
51 to 150	6
151 and above	8

Note that each SM uses one or two VCs. All SMs have a Low Priority Channel that uses one VC; if the High Priority Channel is enabled for the SM, then the SM uses a second VC. Therefore the number of active VCs in a sector is greater than or equal to the number of SMs registered to the AP in the sector. For example, a network including 20 SMs with High Priority Channel disabled and 20 SMs with High Priority Channel enabled has 60 active VCs and may be configured with 6 Contention slots.

In a typical cluster, each AP must be set to the same number of Contention slots to assure proper timing in the send and receive cycles. However, where high incidence of small packets exists, as in a sector that serves several VoIP streams, additional Contention slots may provide better results. For APs in a cluster of mismatched Contention slots setting, or where PMP 450/450i Series is collocated with radios using different technologies, like PMP 430 or FSK, in the same frequency band, use the frame calculator. To download the PMP 450 Contention Slots Paper, see

http://www.cambiumnetworks.com/solution-papers/pmp-450-contention-slots.

MIMO-A mode of operation

450 Platform Family supports MIMO-B mode using the following modulation levels: QPSK, 16-QAM, 64-QAM and 256-QAM. System Release 13.2 introduces MIMO-A mode of operation using the same modulation levels as the MIMO-B mode. With MIMO-B, the radio sends different streams of data over the two antennas whereas with MIMO-A, the radio uses a scheme that tries to optimize coverage by transmitting the same data over both antennas. This redundancy improves the signal to noise ratio at the receiver making it more robust, at the cost of throughput.

In addition to introducing MIMO-A modes, improvements have been made to the existing rate adapt algorithm to switch between MIMO-A and MIMO-B seamlessly without any intervention or added configuration by the operator. The various modulation levels used by the 450 Platform Family are shown in Table 142.

Table 142 450 Platform Family Modulation levels

Rate	MIMO-B	MIMO-A
QPSK	2X MIMO-B	1X MIMO-A
16-QAM	4X MIMO-B	2X MIMO-A
64-QAM	6X MIMO-B	3X MIMO-A
265-QAM	8X MIMO-B	4X MIMO-A

System Performance

For System Performance details of all the 450 Platform Family ODUs please refer below tools:

- Link Capacity Planner for PMP/PTP 450 and 450i:

https://support.cambiumnetworks.com/files/capacityplanner/

- Link planner for PMP/PTP 450/450i and PMP 450m:

https://support.cambiumnetworks.com/files/linkplanner/

Table 143 Co-channel Interference per (CCI) MCS

MCS of Victim	MCS of Interferer	Channel BW (MHz)	CCI
1X (QPSK SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	10 dB
2X (16-QAM SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	17 dB
3X (64-QAM SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	25 dB
1X (QPSK MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	7 dB
2X (16-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	14 dB
3X (64-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	22 dB
4X (256-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	30 dB
2X (QPSK MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	10 dB
4X (16-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	17 dB
6X (64-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	25 dB
8X (256-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	33 dB

Table 144 Adjacent Channel Interference (ACI) per MCS

MCS of Victim	MCS of Interferer	Channel BW (MHz)	ACI	Guard Band
1X (QPSK SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
2X (16-QAM SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
3X (64-QAM SISO)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
1X (QPSK MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-13 dB	None
2X (16-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-13 dB	None
3X (64-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-13 dB	None
4X (256-QAM MIMO-A)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-10 dB	None
2X (QPSK MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
4X (16-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
6X (64-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-16 dB	None
8X (256-QAM MIMO-B)	6X (64-QAM MIMO-B)	5, 7, 10, 15, 20 or 30	-10 dB	None

Guard Band

When synchronized, no Guard Bands are needed for the 450[*] and 450i Series.

[*] For PMP 450 AP 3.6 GHz, Configuration -> Radio -> Power Control -> Adjacent Channel Support must be enabled.

Improved PPS performance of 450 Platform Family

The 450m and 450i Series provides improved packets per second (PPS) performance compared to 450 Series.

Through hardware and software enhancements, the PPS performance of the PMP 450i Series AP has been improved to 40k packets/second, measured through a standard RFC2544 test using 64 bytes packets. With this enhancement, operators are able to provide higher bandwidth including better VoIP and video services to end customers using existing SM deployments.

PMP 450m supports 100k packets/second.

Setting up SNMP agent

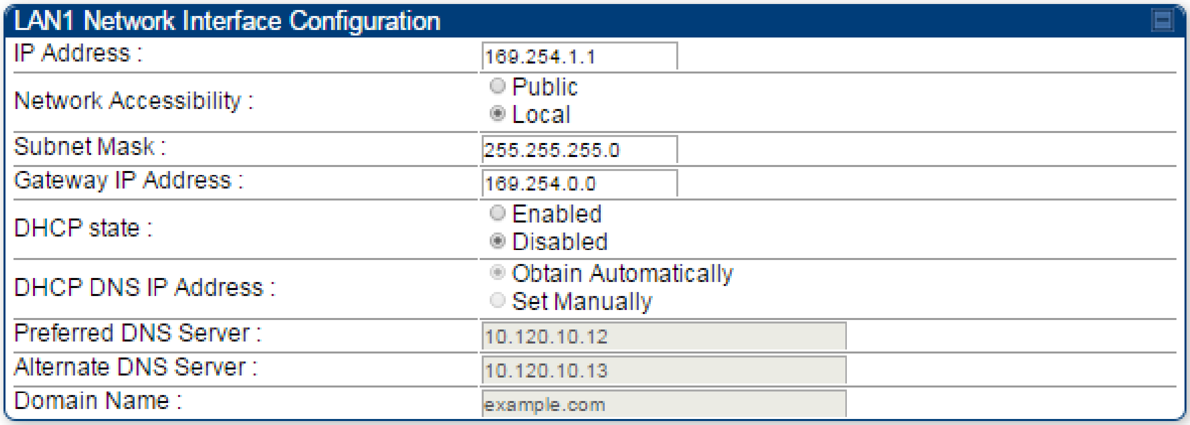
Operators may use SNMP commands to set configuration parameters and retrieve data from the AP and SM modules. Also, if enabled, when an event occurs, the SNMP agent on the 450 Platform Family sends a trap to whatever SNMP trap receivers configured in the management network.

- SNMPv2c
- SNMPv3

Configuring SM/BHS's IP over-the-air access

To access the SM/BHS management interface from a device situated above the AP, the SM/BHS's **Network Accessibility** parameter (under the web GUI at **Configuration > IP**) may be set to **Public**.

Table 145 LAN1 Network Interface Configuration tab of IP page attributes



LAN1 Network Interface Configuration

IP Address :	169.254.1.1
Network Accessibility :	○ Public ● Local
Subnet Mask :	255.255.255.0
Gateway IP Address :	169.254.0.0
DHCP state :	○ Enabled ● Disabled
DHCP DNS IP Address :	● Obtain Automatically ○ Set Manually
Preferred DNS Server :	10.120.10.12
Alternate DNS Server :	10.120.10.13
Domain Name :	example.com

Attribute	Meaning
IP Address	Internet Protocol (IP) address. This address is used by family of Internet protocols to uniquely identify this unit on a network.
Network Accessibility	Specify whether the IP address of the SM/BHS must be visible to only a device connected to the SM/BHS by Ethernet (**Local**) or be visible to the AP/BHM as well (**Public**).
Subnet Mask	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the subnet mask of the SM/BHS for RF management traffic.
Gateway IP Address	If **Static IP** is set as the **Connection Type** of the WAN interface, then this parameter configures the gateway IP address for the SM/BHS for RF management traffic.
DHCP state	If **Enabled** is selected, the DHCP server automatically assigns the IP configuration (IP address, subnet mask, and gateway IP address) and the values of those individual parameters (above) are not used. The setting of this DHCP state parameter is also viewable (read only), in the Network Interface tab of the Home page.
DNS IP Address	Canopy devices allow for configuration of a preferred and alternate DNS server IP address either automatically or manually. Devices must set DNS server IP address manually when DHCP is disabled for the management interface of the device. The default DNS IP addresses are 0.0.0.0 when configured manually.
Preferred DNS Server	The first address used for DNS resolution.

Alternate DNS Server	If the Preferred DNS server cannot be reached, the Alternate DNS Server is used.
Domain Name	The operator’s management domain name may be configured for DNS. The domain name configuration can be used for configuration of the servers in the operator’s network. The default domain name is example.com, and is only used if configured as such.

Configuring SNMP

The SNMP page configuration is explained below.

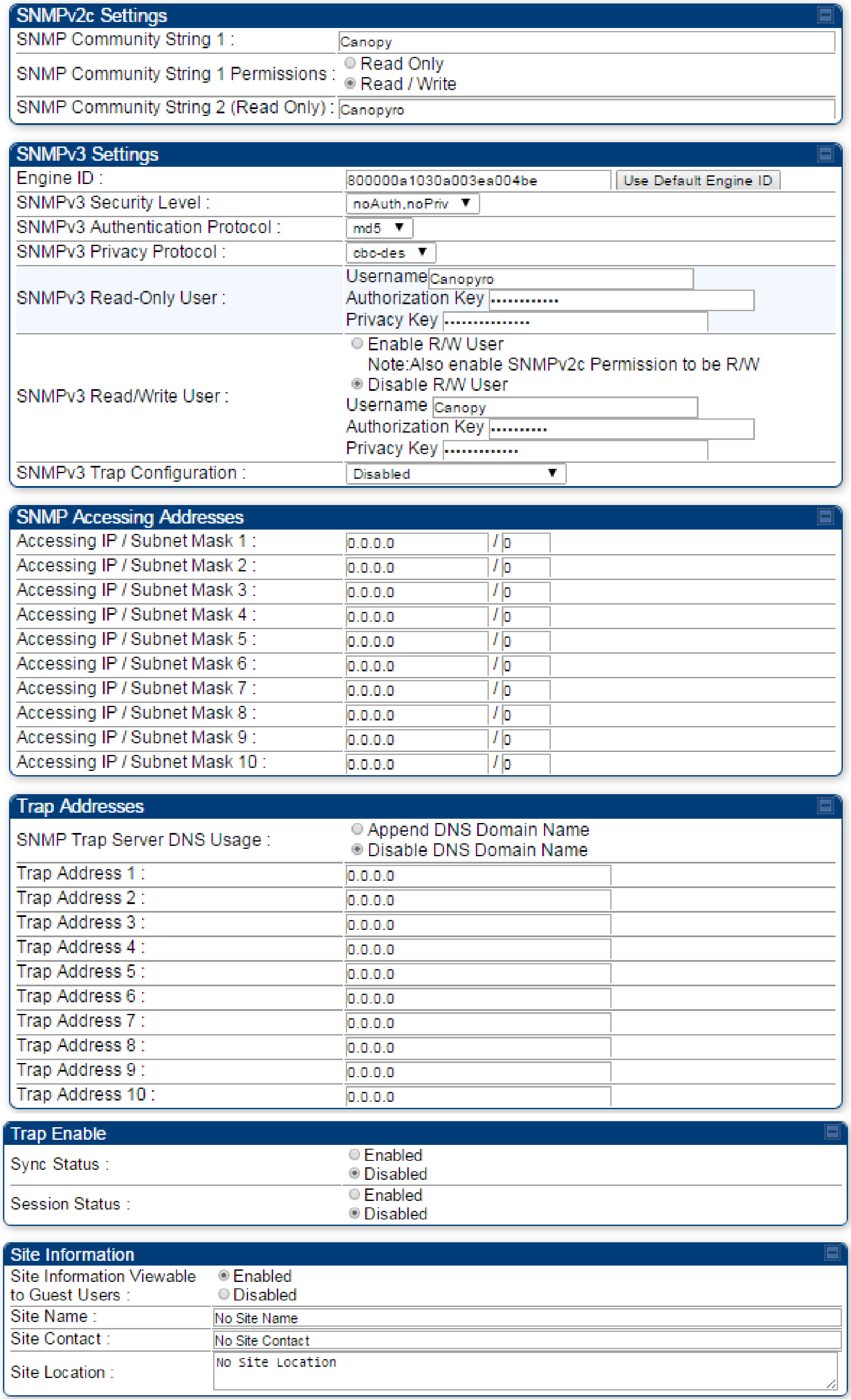
Note

The SNMP page for AP, SM, BHM and BHS has the same parameter attributes.

SNMP page – AP/SM/BHM/BHS

The SNMP page is explained in Table 146.

Table 146 SNMP page attributes



SNMPv2c Settings

SNMP Community String 1 :	Canopy
SNMP Community String 1 Permissions :	○ Read Only ● Read / Write
SNMP Community String 2 (Read Only) :	Canopyro

SNMPv3 Settings

Engine ID :	800000a1030a003ea004be [Use Default Engine ID]
SNMPv3 Security Level :	noAuth,noPriv ▼
SNMPv3 Authentication Protocol :	md5 ▼
SNMPv3 Privacy Protocol :	cbc-des ▼
SNMPv3 Read-Only User :	Username Canopyro Authorization Key .... Privacy Key ....
SNMPv3 Read/Write User :	○ Enable R/W User Note:Also enable SNMPv2c Permission to be R/W ● Disable R/W User Username Canopy Authorization Key .... Privacy Key ....
SNMPv3 Trap Configuration :	Disabled ▼

SNMP Accessing Addresses

Accessing IP / Subnet Mask 1 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 2 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 3 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 4 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 5 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 6 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 7 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 8 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 9 :	0.0.0.0 / 0
Accessing IP / Subnet Mask 10 :	0.0.0.0 / 0

Trap Addresses

SNMP Trap Server DNS Usage :	○ Append DNS Domain Name ● Disable DNS Domain Name
Trap Address 1 :	0.0.0.0
Trap Address 2 :	0.0.0.0
Trap Address 3 :	0.0.0.0
Trap Address 4 :	0.0.0.0
Trap Address 5 :	0.0.0.0
Trap Address 6 :	0.0.0.0
Trap Address 7 :	0.0.0.0
Trap Address 8 :	0.0.0.0
Trap Address 9 :	0.0.0.0
Trap Address 10 :	0.0.0.0

Trap Enable

Sync Status :	○ Enabled ● Disabled
Session Status :	○ Enabled ● Disabled

Site Information

Site Information Viewable to Guest Users :	● Enabled ○ Disabled
Site Name :	No Site Name
Site Contact :	No Site Contact
Site Location :	No Site Location

Attribute	Meaning
SNMP Community String 1	Specify a control string that can allow a Network Management Station (NMS) to access SNMP information. No spaces are allowed in this string. The default string is **Canopy**.
SNMP Community String 1 Permissions	You can designate the **SNMP Community String 1** to be the password for WM, for example, to have **Read / Write** access to the module via SNMP or for all SNMP access to the module to be **Read Only**.
SNMP Community String 2 (Read Only)	Specify an additional control string that can allow a Network Management Station (NMS) to read SNMP information. No spaces are allowed in this string. The default string is **Canopyro**. This password will never authenticate a user or an NMS to read/write access. The **Community String** value is clear text and is readable by a packet monitor. Additional security derives from the configuration of the **Accessing Subnet**, **Trap Address**, and **Permission** parameters.
Engine ID	The Engine ID may be between 5 and 32 hex characters. The hex character input is driven by RFC 3411 recommendations on the Engine ID. The default Engine ID is the MAC address of the device
SNMPv3 Security Level	Specify security model where users are defined and authenticated before granting access to any SNMP service. Each device can configure the security level of SNMPv3 to No authentication/No privacy, Authentication/No privacy, or Authentication/Privacy.
SNMPv3 Authentication Protocol	Currently, the SNMPv3 authentication protocol **MD5** is supported.
SNMPv3 Privacy Protocol	Currently, the SNMPv3 privacy protocol **CBC-DES** is supported.
SNMPv3 Read-Only User	This filed allows for a read-only user per devices. The default values for the Read-Only users is: • Username = Canopyro • Authentication Password = authCanopyro • Privacy Password = privacyCanopyro
SNMPv3 Read/Write User	Read-write user by default is disabled. The default values for the Read/Write users is : • Username = Canopy • Authentication Password = authCanopy • Privacy Password = privacyCanopy
SNMPv3 Trap Configuration	When enabling transmission of SNMPv3 traps the read-only or read-write user credentials must be used and selected properly in order for the SNMP manager to correctly interpret the traps. By default transmission of SNMPv3 traps is disabled and all traps sent from the radios are in SNMPv2c format.

Accessing IP / Subnet Mask *1 to 10*	Specify the addresses that are allowed to send SNMP requests to this AP. The NMS has an address that is among these addresses (this subnet). You must enter both • The network IP address in the form xxx.xxx.xxx.xxx • The CIDR (Classless Interdomain Routing) prefix length in the form /xx For example: • the /16 in 198.32.0.0/16 specifies a subnet mask of 255.255.0.0 (the first 16 bits in the address range are identical among all members of the subnet). • 192.168.102.0 specifies that any device whose IP address is in the range 192.168.102.0 to 192.168.102.254 can send SNMP requests to the AP, presuming that the device supplies the correct **Community String** value. The default treatment is to allow all networks access. For more information on CIDR, execute an Internet search on “Classless Interdomain Routing.” You are allowed to specify as many as 10 different accessing IP address, subnet mask combinations. **RECOMMENDATION:** The subscriber can access the SM/BHS by changing the subscriber device to the accessing subnet. This hazard exists because the **Community String** and **Accessing Subnet** are both visible parameters. To avoid this hazard, configure the SM/BHS to filter (block) SNMP requests.
SNMP Trap Server DNS Usage	The management DNS domain name may be toggled such that the name of the trap server only needs to be specified and the DNS domain name is automatically appended to that name. The default SNMP trap server addresses for all 10 available servers is 0.0.0.0 with the appending of the DNS domain name disabled.
Trap Address *1 to 10*	Specify ten or fewer IP addresses (xxx.xxx.xxx.xxx) or DNS names to which SNMP traps must be sent. Traps inform Wireless Manager or an NMS that something has occurred. For example, trap information is sent • after a reboot of the module. • when an NMS attempts to access agent information but either • supplied an inappropriate community string or SNMP version number. • is associated with a subnet to which access is disallowed.
Trap Enable, Sync Status	If the sync status traps (sync lost and sync regained) have to be sent to Wireless Manager or an NMS, select **Enabled**. If these traps have to be suppressed, select **Disabled**.
Trap Enable, Session Status	If you want session status traps sent to Wireless Manager or an NMS, select **Enabled**.

Site Information Viewable to Guest Users	Operators can enable or disable site information from appearing when a user is in GUEST account mode.
Site Name	Specify a string to associate with the physical module. This parameter is written into the *sysName* SNMP MIB-II object and can be polled by Wireless Manager or an NMS. The buffer size for this field is 128 characters.
Site Contact	Enter contact information for the module administrator. This parameter is written into the *sysContact* SNMP MIB-II object and can be polled by Wireless Manager or an NMS. The buffer size for this field is 128 characters.
Site Location	Enter information about the physical location of the module. This parameter is written into the *sysLocation* SNMP MIB-II object and can be polled by Wireless Manager or an NMS. The buffer size for this field is 128 characters.

Configuring syslog

450 Platform Family includes:

- Syslog event logging
- Configuring system logging

Syslog event logging

Following events are logged in syslog as explained in Table 147.

Table 147 Syslog parameters

Attribute	Meaning
Timestamp	All syslog messages captured from the radio have a timestamp.
Configuration Changes	This includes any device setting that has changed and includes the old or new parameter value, including the device reboots.
User Login and Logout	Syslog records each user login and logout, with username.
Add or Delete of user accounts through GUI and SNMP	Syslog captures any user accounts that are added or deleted.
Spectrum Analysis	Syslog records a message every time Spectrum Analysis runs. **Note** Since the AP/BHM must be set to a SM/BHS for Spectrum Analysis, syslog messages are not reported from the radio until the scan is done and the radio mode is switched back to AP/BHM.
Link Test	Syslog records a message every time a Link Test is run.
Clear Statistics	Syslog sends a message when Statistics are cleared. This is done individually for each statistics page that is cleared.
SM Register or De-register	Syslog records a message when a SM registers or deregisters.
BHS Connect or Disconnect	Syslog records a message when a BHS connects or disconnects.

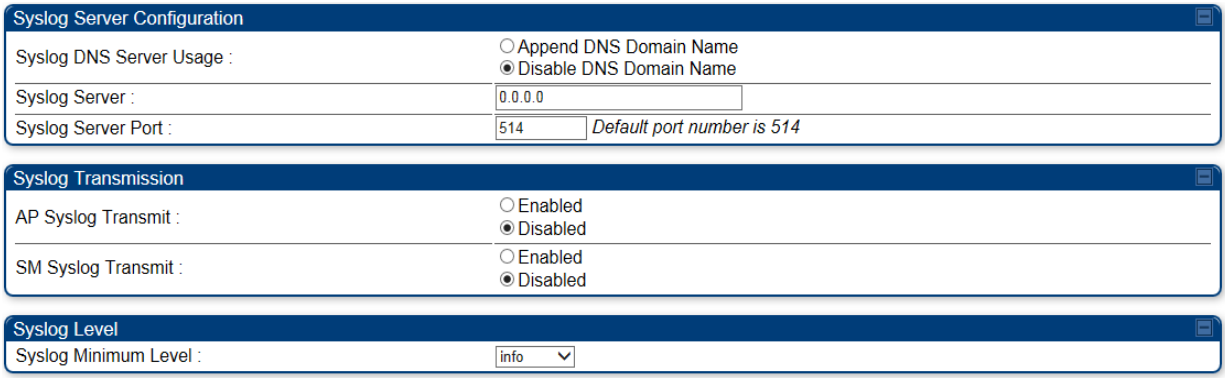
Configuring system logging

To configure system logging, select the menu option **Configuration > Syslog**.

Syslog page of AP/BHM

The Syslog Configuration page for AP/BHM is shown in Table 148.

Table 148 Syslog Configuration attributes - AP



Syslog Server Configuration

Syslog DNS Server Usage :	○ Append DNS Domain Name ● Disable DNS Domain Name
Syslog Server :	0.0.0.0
Syslog Server Port :	514 *Default port number is 514*

Syslog Transmission

AP Syslog Transmit :	○ Enabled ● Disabled
SM Syslog Transmit :	○ Enabled ● Disabled

Syslog Level

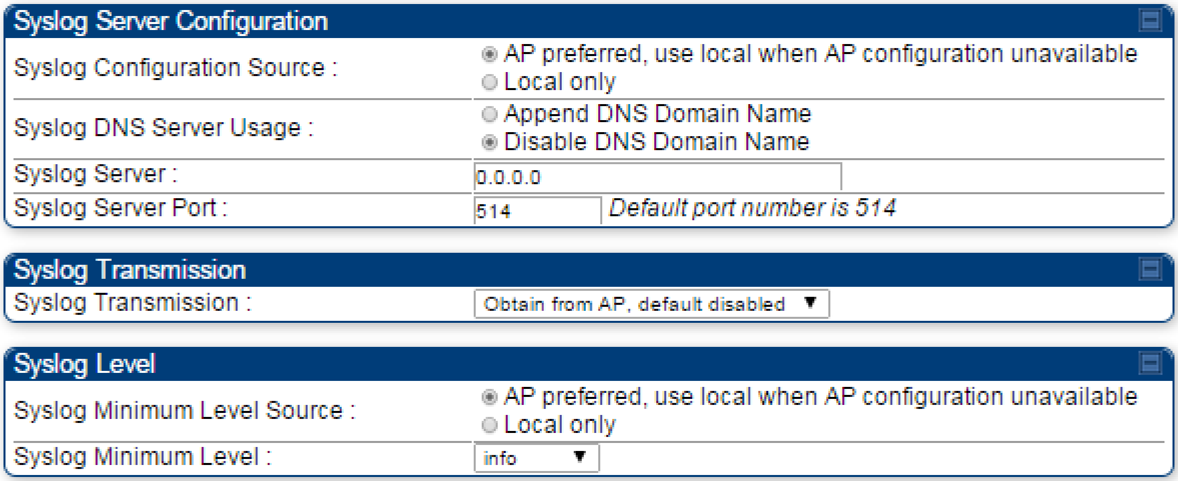
Syslog Minimum Level :	info

Attribute	Meaning
Syslog DNS Server Usage	To configure the AP/BHM to append or not append the DNS server name to the syslog server name.
Syslog Server	The dotted decimal or DNS name of the syslog server address.
Syslog Server Port	The syslog server port (default 514) to which syslog messaging is sent.
AP Syslog Transmit Or BHM Syslog Transmit	When enabled, syslog messages are sent from the AP/BHM.
SM Syslog Transmit Or BHS Syslog Transmit	When enabled, syslog messages are sent from all the registered SMs/BHS, unless they are individually set to override this.
Syslog Minimum Level	This provides a selection for the minimum syslog message severity that is sent to the syslog server. Values range from fatal (highest severity and least verbose) to info (lowest severity, maximum verbosity). For example: If the Syslog Minimum Level is set to notice, then only messages with severity notice and above are sent.

Syslog page of SM

To configure system logging, select the menu option **Configuration > Syslog**. The Syslog Configuration page is shown in Table 149.

Table 149 Syslog Configuration attributes - SM



Syslog Server Configuration

Syslog Configuration Source : ● AP preferred, use local when AP configuration unavailable ○ Local only

Syslog DNS Server Usage : ○ Append DNS Domain Name ● Disable DNS Domain Name

Syslog Server : 0.0.0.0

Syslog Server Port : 514 *Default port number is 514*

Syslog Transmission

Syslog Transmission : Obtain from AP, default disabled ▼

Syslog Level

Syslog Minimum Level Source : ● AP preferred, use local when AP configuration unavailable ○ Local only

Syslog Minimum Level : info ▼

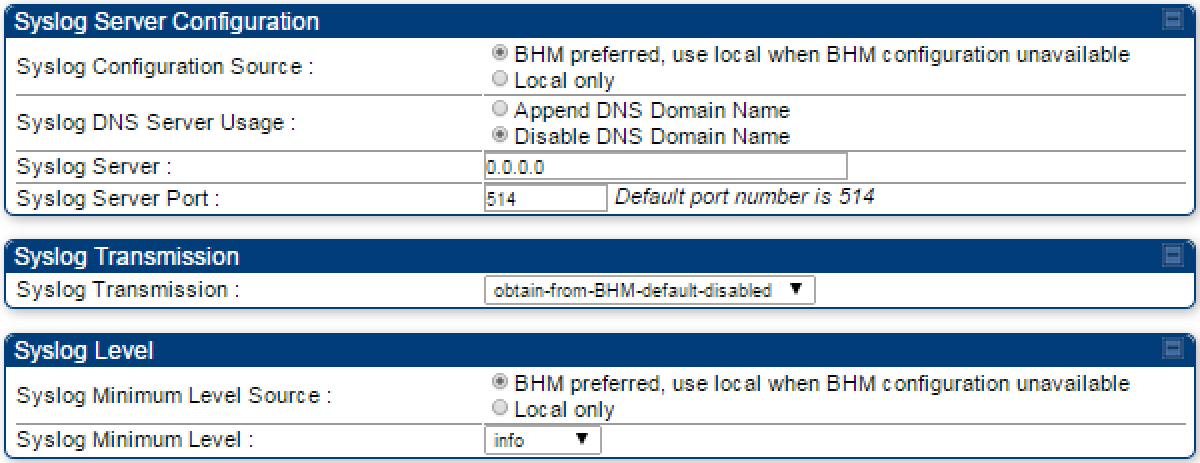
Attribute	Meaning
Syslog Configuration Source	This control determines whether the SM will attempt to use the syslog server definition from the AP, or whether it will use a local server definition. When set to **AP preferred, use local when AP configuration unavailable**, and if the SM can register with an AP, then it uses the syslog server defined on that AP. If the SM cannot register then it will syslog to its locally defined syslog server through its wired connection, if any. When set to **Local only** the SM ignores the AP’s definition of the syslog server and allows the syslog server to be configured individually for each SM.
Syslog DNS Server Usage	To configure the SM to append or not the DNS server name to the syslog server name.
Syslog Server	The dotted decimal or DNS name of the syslog server address.
Syslog Server Port	The syslog server port (default 514) to which syslog messaging is sent.
Syslog Transmission	Controls the SMs ability to transmit syslog messages. When set to “Learn from AP” the AP will control whether this SM transmits syslog messages. When set to “enable” or “disable” the SM will control whether it sends syslog messages. This allows an operator to override the AP settings for individual SMs in a sector.
Syslog Minimum Level Source	This control determines whether the SM attempts to use the minimum syslog level defined by the AP, or whether it uses a local defined value using the “Syslog Minimum Level” parameter. When set to “AP preferred, use local when AP configuration unavailable”, and if the SM can register with an AP, then it uses the Syslog Minimum Level defined on that AP. If the SM cannot register then it uses its own Syslog Minimum Level setting. When set to “Local only” the SM will always use its own Syslog Minimum Level setting and ignores the AP’s setting.

Syslog Minimum Level	This provides a selection for the minimum syslog message severity that is sent to the syslog server. Values range from fatal (highest severity and least verbose) to info (lowest severity, maximum verbosity). For example: If the Syslog Minimum Level is set to notice, then only messages with severity notice and above are sent.

Syslog page of BHS

The Syslog Configuration page is shown in Table 150.

Table 150 Syslog Configuration attributes - BHS



Syslog Server Configuration

Syslog Configuration Source : ● BHM preferred, use local when BHM configuration unavailable ○ Local only

Syslog DNS Server Usage : ○ Append DNS Domain Name ● Disable DNS Domain Name

Syslog Server : 0.0.0.0

Syslog Server Port : 514 *Default port number is 514*

Syslog Transmission

Syslog Transmission : obtain-from-BHM-default-disabled ▼

Syslog Level

Syslog Minimum Level Source : ● BHM preferred, use local when BHM configuration unavailable ○ Local only

Syslog Minimum Level : info ▼

Attribute	Meaning
Syslog Configuration Source	This control determines whether the BHS will attempt to use the syslog server definition from the BHM, or whether it will use a local server definition. • When set to **BHM preferred, use local when BHM configuration unavailable**, and if the BHS can register with a BHM, then it uses the syslog server defined on that BHM. If the BHS cannot register then it will syslog to its locally defined syslog server through its wired connection, if any. • When set to **Local only** the BHS ignores the BHM's definition of the syslog server and allows the syslog server to be configured individually for each BHS.
Syslog DNS Server Usage	To configure the BHS to append or not to append the DNS server name to the syslog server name.
Syslog Server	The dotted decimal or DNS name of the syslog server address.
Syslog Server Port	The syslog server port (default 514) to which syslog messaging is sent.
Syslog Transmission	Controls the BHSs ability to transmit syslog messages. When set to **Learn from BHM** the BHM will control whether this BHS transmits syslog messages. When set to **enable** or **disable** the BHS will control

	whether it sends syslog messages. This allows an operator to override the BHM settings for individual BHSs in a sector.
Syslog Minimum Level Source	This control determines whether the BHS attempts to use the minimum syslog level defined by the BHM, or whether it uses a local defined value using the **Syslog Minimum Level** parameter. • When set to **BHM preferred, use local when BHM configuration unavailable**, and if the BHS can register with a BHM, then it uses the Syslog Minimum Level defined on that BHM. If the BHS cannot register then it uses its own Syslog Minimum Level setting. When set to **Local only** the BHS will always use its own Syslog Minimum Level setting and ignores the BHM's setting.
Syslog Minimum Level	This provides a selection for the minimum syslog message severity that is sent to the syslog server. Values range from fatal (highest severity and least verbose) to info (lowest severity, maximum verbosity). For example: If the Syslog Minimum Level is set to notice, then only messages with severity notice and above are sent.

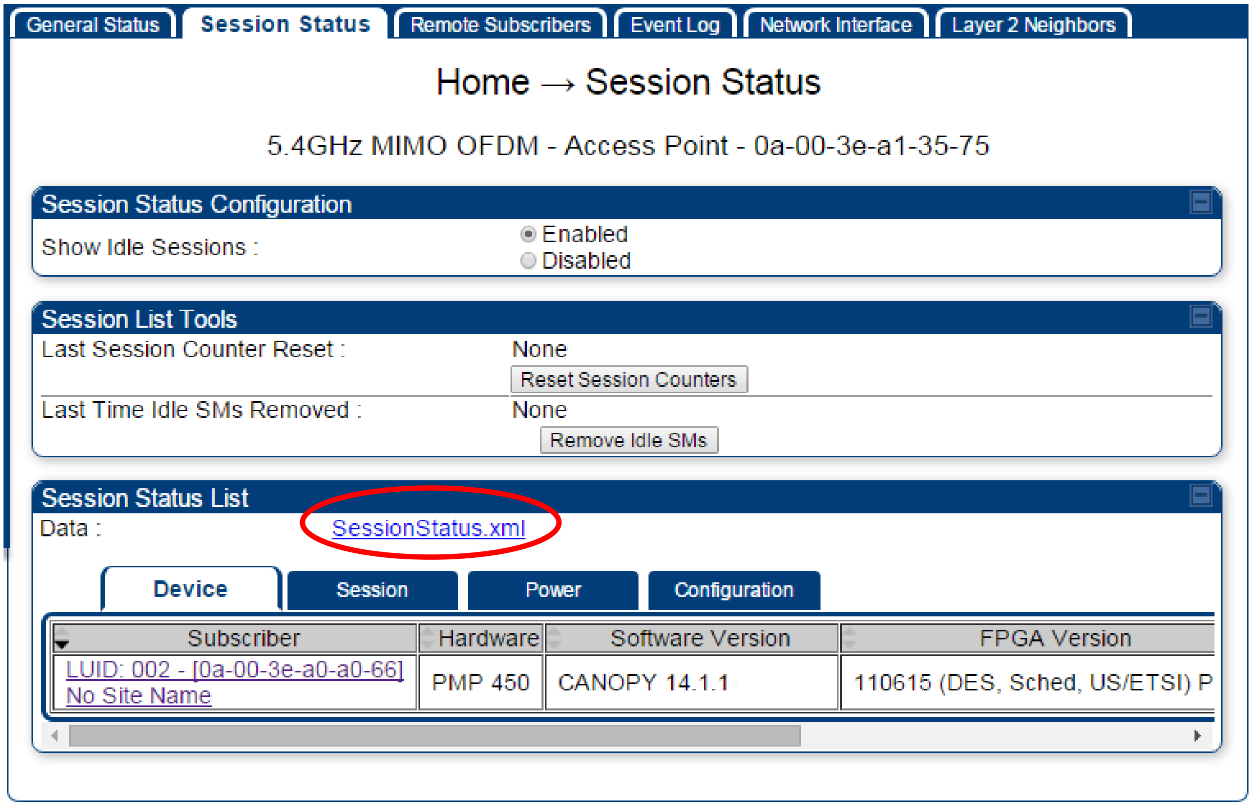
Configuring remote access

Accessing SM/BHS over-the-air by Web Proxy

The SM/BHS may be accessed via the AP/BHM management GUI by navigating to **Home > Session Status** (or **Home** > **Remote Subscribers** for AP only) and clicking on the SM's hyperlink.

For example, to access one of the SMs, click **LUID: 002 – [0a-00-3e-37-b9-fd]**, as shown in Figure 125.

Figure 125 AP Session Status page



Home → Session Status

5.4GHz MIMO OFDM - Access Point - 0a-00-3e-a1-35-75

Session Status Configuration

Show Idle Sessions : ● Enabled ○ Disabled

Session List Tools

Last Session Counter Reset : None

Last Time Idle SMs Removed : None

Session Status List

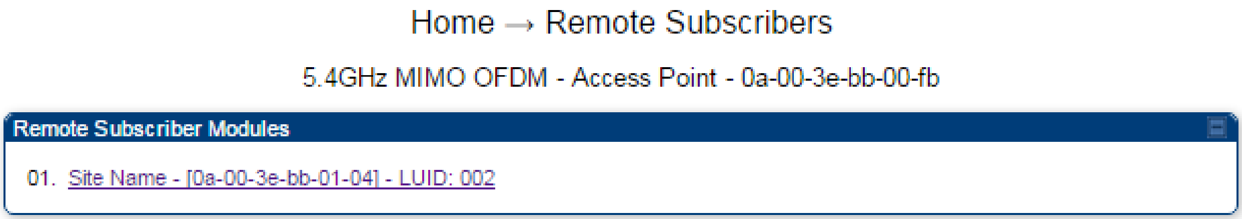
Data : SessionStatus.xml

Subscriber	Hardware	Software Version	FPGA Version
LUID: 002 - [0a-00-3e-a0-a0-66] No Site Name	PMP 450	CANOPY 14.1.1	110615 (DES, Sched, US/ETSI) P

The **SessionStatus.xml** hyper link allows user to export all displayed SM data in Session Status table into an xml file.

To access any one of the SMs, click 450 Platform Family - SM hyperlink, as shown in Figure 126.

Figure 126 AP Remote Subscribers page



Home → Remote Subscribers

5.4GHz MIMO OFDM - Access Point - 0a-00-3e-bb-00-fb

Remote Subscriber Modules

01. Site Name - [0a-00-3e-bb-01-04] - LUID: 002

Monitoring the Link

Link monitoring procedure

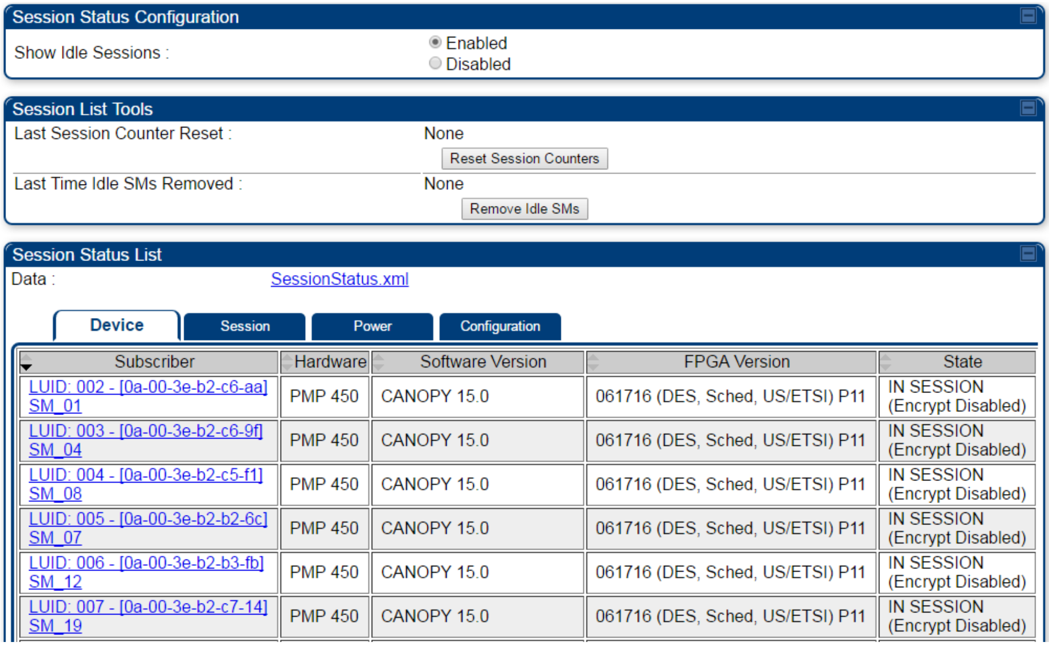
After configuring the link, either an operator in the network office or the SM/BHS INSTALLER user in the field (if read access to the AP/BHM is available to the INSTALLER) must perform the following procedure. Who is authorized and able to do this depends on local operator password policy, management VLAN setup and operational practices.

To monitor the link for performance, follow these instructions:

Procedure 22 Monitoring the AP-SM link

1. Access the web interface of the AP/BHM
2. In the left-side menu of the AP/BHM interface, select **Home**.
3. Click the **Session Status** tab.

   Figure 127 Session Status page



Session Status Configuration

Show Idle Sessions : ● Enabled ○ Disabled

Session List Tools

Last Session Counter Reset : None

Last Time Idle SMs Removed : None

Session Status List

Data : SessionStatus.xml

Subscriber	Hardware	Software Version	FPGA Version	State
LUID: 002 - [0a-00-3e-b2-c6-aa] SM_01	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)
LUID: 003 - [0a-00-3e-b2-c6-9f] SM_04	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)
LUID: 004 - [0a-00-3e-b2-c5-f1] SM_08	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)
LUID: 005 - [0a-00-3e-b2-b2-6c] SM_07	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)
LUID: 006 - [0a-00-3e-b2-b3-fb] SM_12	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)
LUID: 007 - [0a-00-3e-b2-c7-14] SM_19	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)

4. The **Device** tab of Session Status List display all displayed SMs – MAC address, PMP/PTP Hardware, Software Version, FPGA Version and State

5 Click **Session Count** tab of Session Status List to display values for **Session Count**, **Reg Count**, and **Re-Reg Count**.

- **Session Count**: This field displays how many sessions the SM/BHS has had with the AP/BHM. Typically, this is the sum of Reg Count and Re-Reg Count. However, the result of internal calculation may display here as a value that slightly differs from the sum.
- **Reg Count**: When a SM/BHS makes a Registration Request, the AP/BHM checks its local session database to see whether it was registered earlier. If the AP/BHM concludes that the SM/BHS is not currently in session database and it is valid Registration Request, then the request increments the value of this field.
- **Re-Reg Count**: When a SM/BHS makes a Registration Request, the AP/BHM checks its local session database to see whether it was registered earlier. If the AP/BHM concludes that the SM/BHS is currently in session database, then the request increments the value of this field.
- Typically, a Re-Reg is the case where both
  - SM/BHS attempts to reregister for having lost communication with the AP/BHM.
  - AP/BHM has not yet observed the link to the SM/BHS as being down.

See Session tab on page 9-21

6 Click **Power** tab of Session Status list to display Downlink Rate, AP Rx Power (dBm), Signal Strength Radio (dB) for Uplink and Signal to Noise Radio (dB) for Uplink.

See Power tab on page 9-23

7 Click **Configuration** tab of Session Status list to get QoS configuration details:

- Sustained Data Rate (kbps)
- Burst Allocation (kbit)
- Max Burst Rate (kbit)
- Low Priority CIR (kbps)

See Configuration tab on page 9-24

8 Briefly monitor these values, occasionally refreshing this page by clicking another tab and then the Session Status tab again.

9 If these values are low (for example, 1, 1, and 0, respectively, meaning that the SM/BHS registered and started a stable session once) and are not changing:

- Consider the installation successful.
- Monitor these values from the network office over the next several hours and days.

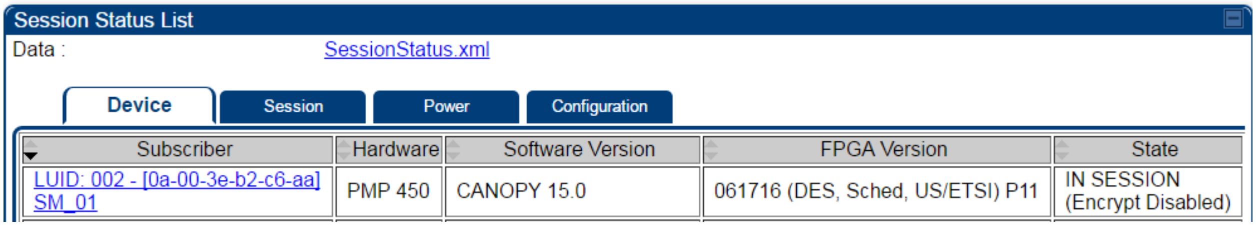
If these values are greater than 1, 1, and 0, or they increase while you are monitoring them, troubleshoot the link. (For example, Use **Receive Power Level** for aiming and then use Link Tests to confirm alignment).

Refer Viewing Session Status on page 9-20 for more details.

Exporting Session Status page of AP/BHM

The SessionStatus.xml hyper link allows user to export all displayed SMs or BHS data in Session Status table into an xml file.

Figure 128 Exporting Session Status page of PMP 450m AP



Session Status List

Data : SessionStatus.xml

Subscriber	Hardware	Software Version	FPGA Version	State
LUID: 002 - [0a-00-3e-b2-c6-aa] SM_01	PMP 450	CANOPY 15.0	061716 (DES, Sched, US/ETSI) P11	IN SESSION (Encrypt Disabled)

In case of PMP, if the session status page does not list any SM, the SessionStatus.xml will still be visible but the file would be empty. The file will contain data from all of the 5 different tables.

Export from command line

The scripts users can also get this file from command line, you have to authenticate successfully in order to download the file.

Wget

http://169.254.1.1/SessionStatus.xml?CanopyUsername=test&CanopyPassword=test

Configuring quality of service

Maximum Information Rate (MIR) Parameters

Point-to-multipoint links use the following MIR parameters for bandwidth management:

- Sustained Uplink Data Rate (kbps)
- Uplink Burst Allocation (kb)
- Sustained Downlink Data Rate (kbps)
- Downlink Burst Allocation (kb)
- Max Burst Downlink Data Rate (kbps)
- Max Burst Uplink Data Rate (kbps)

Set each of these parameters per AP or per SM independently.

Note

You can refer below whitepaper for 450 Platform Family Max Burst MIR:

http://www.cambiumnetworks.com/resources/pmp-450-maxburst/

Token Bucket Algorithm

The software uses a *token bucket* algorithm that has the following features:

- Stores credits (tokens) for the SM to spend on bandwidth for reception or transmission.
- Drains tokens during reception or transmission.
- Refills with tokens at the sustained rate set by the network operator.

For each token, the SM can send toward the network in the uplink (or the AP can send toward the SM in the downlink) an equivalent number of kilobits. Two buckets determine the permitted throughput: one in the SM for uplink and one in the AP for downlink.

The applicable set of **Uplink Burst Allocation** and **Downlink Burst Allocation** parameters determine the *number* of tokens that can fill each bucket. When the SM transmits (or the AP transmits) a packet, the equivalent number of tokens is removed from the uplink (or downlink) bucket.

Except when full, the bucket is continuously being refilled with tokens at *rates* that the applicable set of **Sustained Uplink Data Rate** and **Sustained Downlink Data Rate** parameters specify. The bucket often drains at a rate that is much faster than the sustained data rate but can refill at only the sustained data rate. Thus, the effects of the allocation and rate parameters on packet delay are as follows:

- The burst allocation affects how many kilobits are processed before packet delay is imposed.
- The sustained data rate affects the packet delay that is imposed.

MIR Data Entry Checking

Uplink and downlink MIR is enforced as shown in Figure 129.

Note

In these figures, *entry* refers to the setting in the data rate parameter, not the burst allocation parameter.

Figure 129 Uplink and downlink rate caps adjusted to apply aggregate cap

$$\text{uplink cap enforced} = \frac{\text{uplink entry} \times \text{aggregate cap for the SM}}{\text{uplink entry} + \text{downlink entry}}$$

$$\text{downlink cap enforced} = \frac{\text{downlink entry} \times \text{aggregate cap for the SM}}{\text{uplink entry} + \text{downlink entry}}$$

For example, in the SM, if you set the **Sustained Uplink Data Rate** parameter to 2,000 kbps and the **Sustained Downlink Data Rate** parameter to 10,000 kbps, then the uplink and downlink MIR that is enforced for the SM can be calculated as shown in Figure 130.

Figure 130 Uplink and downlink rate cap adjustment example

$$\text{uplink cap enforced} = \frac{2{,}000\text{ kbps} \times 7{,}000\text{ kbps}}{2{,}000\text{ kbps} + 10{,}000\text{ kbps}} = 1{,}167\text{ kbps}$$

$$\text{downlink cap enforced} = \frac{10{,}000\text{ kbps} \times 7{,}000\text{ kbps}}{2{,}000\text{ kbps} + 10{,}000\text{ kbps}} = 5{,}833\text{ kbps}$$

In this example case, the derived 1,167-kbps uplink and 5,833-kbps downlink MIR sum to the fixed 7,000-kbps aggregate cap of the SM.

Committed Information Rate (CIR)

The Committed Information Rate (CIR) capability feature enables the service provider to guarantee to any subscriber that bandwidth will never decrease to below a specified minimum unless CIR is oversubscribed or RF conditions are degraded. CIR is oversubscribed when there is not enough available bandwidth to support CIR configuration for all subscribers. In this condition, SMs which are configured with a nonzero CIR will all operate at the maximum data rate supported by the link (subject to Maximum Information Rate and Burst Rate/Allocations). SMs which are configured with a CIR of 0 kbps will not transmit until CIR-configured SMs have completed transmission. CIR may be configured independently for high priority traffic and for low priority traffic.

CIR parameters may be configured in the following ways:

- Web-based management GUI
- SNMP
- Authentication Server (RADIUS) - when a SM successfully registers and authenticates, CIR information is retrieved from the RADIUS server.

Active CIR configuration can be verified via the AP’s **Home > Session Status** page.

Bandwidth from the SM Perspective

In the SM, normal web browsing, e-mail, small file transfers and short streaming video are rarely rate limited with practical bandwidth management (QoS) settings. When the SM processes large downloads such as software upgrades and long streaming video or a series of medium-size downloads, the bucket rapidly drains, the burst limit is reached, and some packets are delayed. The subscriber experience is more affected in cases where the traffic is more latency sensitive.

Interaction of Burst Allocation and Sustained Data Rate Settings

If the Burst Allocation is set to 1200 kb and the Sustained Data Rate is set to 128 kbps, a data burst of 1000 kb is transmitted at full speed because the Burst Allocation is set high enough. After the burst, the bucket experiences a significant refill at the Sustained Data Rate. This configuration uses the advantage of the settable Burst Allocation.

If both the Burst Allocation and the Sustained Data Rate are set to 128 kb, a burst is limited to the Burst Allocation value. This configuration does not take advantage of the settable Burst Allocation.

If the Burst Allocation is set to 128 kb and the Sustained Data Rate is set to 256 kbps, the actual rate is the burst allocation (but in kbps). As above, this configuration does not take advantage of the settable Burst Allocation.

High-priority Bandwidth

To support low-latency traffic such as VoIP (Voice over IP) or video, the system implements a high-priority channel. This channel does not affect the inherent latencies in the system but allows high-priority traffic to be immediately served. The high-priority pipe separates low-latency traffic from traffic that is latency tolerant, such as standard web traffic and file downloads.

The number of channels available on the AP is reduced by the number of SMs configured for the high-priority channel (each SM operating with high-priority enabled uses two channels (virtual circuits) instead of one).

A module prioritizes traffic by

- reading the Low Latency bit (Bit 3) in the IPv4 Type of Service (ToS) byte in a received packet. Bit 3 is set by a device outside the system.
- reading the 802.1p field of the 802.1Q header in a received packet, where VLAN is enabled on the module.
- comparing the 6-bit Differentiated Services Code Point (DSCP) field in the ToS byte of a received packet to a corresponding value in the **Diffserv** tab of the Configuration page of the module. A packet contains no flag that indicates whether the encoding is for the Low Latency bit or the DSCP field. For this reason, you must ensure that all elements in your trusted domain, including routers and endpoints, set and read the ToS byte with the same scheme.

Modules monitor ToS bytes with DSCP fields, but with the following differences:

- The 6-bit length of the field allows it to specify one of 64 service differentiations.

- These correlate to 64 individual (**CodePoint**) parameters in the **Diffserv** tab of the Configuration page.
- Per RFC 2474, 3 of these 64 are preset and cannot be changed. (See http://www.faqs.org/rfcs/rfc1902.html.)
- For any or all of the remaining 61 CodePoint parameters, you can specify a value of
  - 0 through 3 for low-priority handling.
  - 4 through 7 for high-priority handling.

Note

Ensure that your Differentiated Services domain boundary nodes mark any entering packet, as needed, so that it specifies the appropriate Code Point for that traffic and domain. This prevents theft of service level.

An example of the **Diffserv** page in the Configuration menu and parameter descriptions are provided under DiffServ attributes – AP/BHM on page 7-132. This tab and its rules are identical from module type to module type. However, any of the 61 configurable Code Points can be set to a different value from module to module, thus defining unique per-hop behavior for some traffic.

This tab in the AP sets the priorities for the various packets in the downstream (sent from the public network). This tab in the SM sets the priorities for the various packets in the upstream (sent to the public network).

Typically, some SMs attach to older devices that use the ToS byte as originally formatted, and others to newer devices that use the DSCP field. The *default* values in the **Diffserv** page allow your modules to prioritize traffic from the older devices roughly the same as they traditionally have. However, these default values may result in more high-priority traffic as DSCP fields from the newer devices are read and handled. So, after making changes in the **Diffserv** page, carefully monitor the high-priority channel for high packet rates

- in SMs that you have identified as those to initially set and watch.
- across your network when you have broadly implemented Code Point values, such as via SNMP.

Traffic Scheduling

The characteristics of traffic scheduling in a sector are summarized in Table 151.

Table 151 Characteristics of traffic scheduling

Category	Factor	Treatment
Throughput	Aggregate throughput, less additional overhead	132 Mbps
Latency	Number of frames required for the scheduling process	1
	Round-trip latency	≈ 6 ms
	AP broadcast the download schedule	No
High-priority Channel	Allocation for *uplink* high-priority traffic on amount of high-priority traffic	Dynamic, based on amount of high-priority traffic
	Allocation for *downlink* high-priority traffic on amount of high-priority traffic	Dynamic, based on amount of high-priority traffic
	Order of transmission	CIR high-priority CIR low-priority Other high-priority Other low-priority

⚠ **Caution**

Power requirements affect the recommended maximums for power cord length feeding the CMM4. See the dedicated user guide that supports the CMM that you are deploying.

Packets that have a priority of 4 to 7 in either the DSCP or a VLAN 802.1p tag are automatically sent on the high-priority channel, but only where the high-priority channel is enabled.

Setting the Configuration Source

The AP includes a **Configuration Source** parameter, which sets where SMs that register to the AP are controlled for MIR, CIR, VLAN, and the high-priority channel as follows. The **Configuration Source** parameter affects the source of:

- all MIR settings:
  - Sustained Uplink Data Rate
  - Uplink Burst Allocation
  - Max Burst Uplink Data Rate
  - Sustained Downlink Data Rate
  - Downlink Burst Allocation
  - Max Burst Downlink Data Rate
- all CIR settings:
  - Low Priority Uplink CIR
  - Low Priority Downlink CIR
  - Hi Priority Uplink CIR
  - Hi Priority Downlink CIR
- all SM VLAN settings
  - Dynamic Learning
  - Allow Only Tagged Frames
  - VLAN Aging Timeout
  - Untagged Ingress VID
  - Management VID
  - VLAN Membership
- the Hi Priority Channel setting

Table 152 Recommended combined settings for typical operations

Most operators who use…	must set this parameter…	in this web page/tab…	in the AP to…
no authentication server	**Authentication Mode**	Configuration/ Security	**Disabled**
	Configuration Source	Configuration/ General	**SM**
Wireless Manager (Authentication Server)	**Authentication Mode**	Configuration/ Security	**Authentication Server**
	Configuration Source	Configuration/ General	**Authentication Server**
RADIUS AAA server	**Authentication Mode**	Configuration/ Security	**RADIUS AAA**
	Configuration Source	Configuration/ General	**Authentication Server**

Table 153 Where feature values are obtained for a SM with authentication required

Configuration Source Setting in the AP	Values are obtained from		
	MIR Values	VLAN Values	High Priority Channel State
Authentication Server	Authentication Server	Authentication Server	Authentication Server
SM	SM	SM	SM
Authentication Server+SM	Authentication Server	Authentication Server, then SM	Authentication Server, then SM

Note

HPC represents the Hi Priority Channel (enable or disable).

Where Authentication Server, then SM is the indication, parameters for which Authentication Server does not send values are obtained from the SM. This is the case where the Authentication Server is operating on an Authentication Server release that did not support the feature. This is also the case where the feature enable/disable flag in Authentication Server is set to disabled. The values are those previously set or, if none ever were, then the default values.

Where Authentication Server is the indication, values in the SM are disregarded.

Where SM is the indication, values that Authentication Server sends for the SM are disregarded.

For any SM whose **Authentication Mode** parameter *is not* set to 'Authentication Required', the listed settings are derived as shown in Table 154.

Table 154 MIR, VLAN, HPC, and CIR Configuration Sources, Authentication Disabled

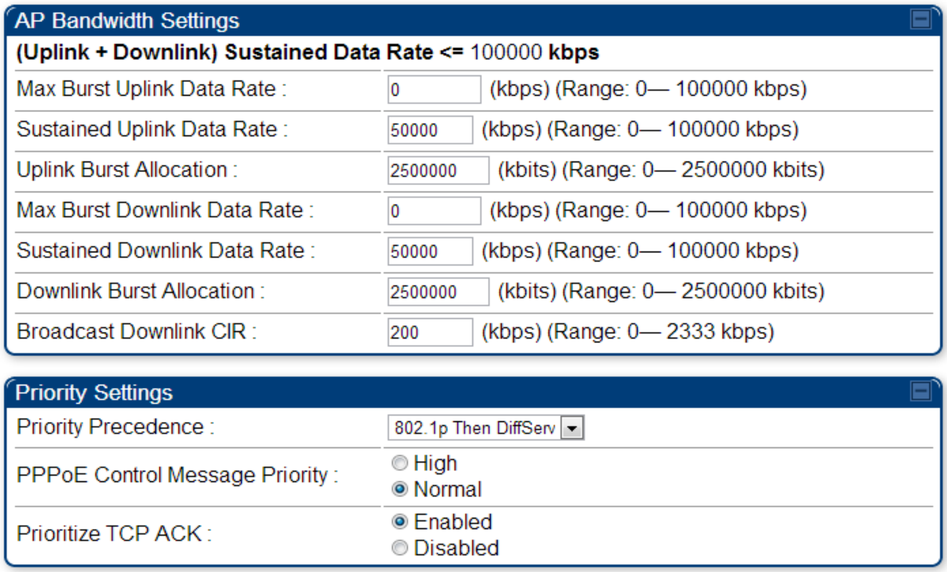
Configuration Source Setting in the AP	Values are obtained from			
	MIR Values	VLAN Values	High Priority Channel State	CIR Values
Authentication Server	AP	AP	AP	AP
SM	SM	SM	SM	SM
Authentication Server+SM	SM	SM	SM	SM

Configuring Quality of Service (QoS)

Quality of Service (QoS) page of AP

The QoS page of AP is explained in Table 155.

Table 155 QoS page attributes - AP



AP Bandwidth Settings

(Uplink + Downlink) Sustained Data Rate <= 100000 **kbps**

Max Burst Uplink Data Rate :	0 (kbps) (Range: 0— 100000 kbps)
Sustained Uplink Data Rate :	50000 (kbps) (Range: 0— 100000 kbps)
Uplink Burst Allocation :	2500000 (kbits) (Range: 0— 2500000 kbits)
Max Burst Downlink Data Rate :	0 (kbps) (Range: 0— 100000 kbps)
Sustained Downlink Data Rate :	50000 (kbps) (Range: 0— 100000 kbps)
Downlink Burst Allocation :	2500000 (kbits) (Range: 0— 2500000 kbits)
Broadcast Downlink CIR :	200 (kbps) (Range: 0— 2333 kbps)

Priority Settings

Priority Precedence :	802.1p Then DiffServ
PPPoE Control Message Priority :	○ High ● Normal
Prioritize TCP ACK :	● Enabled ○ Disabled

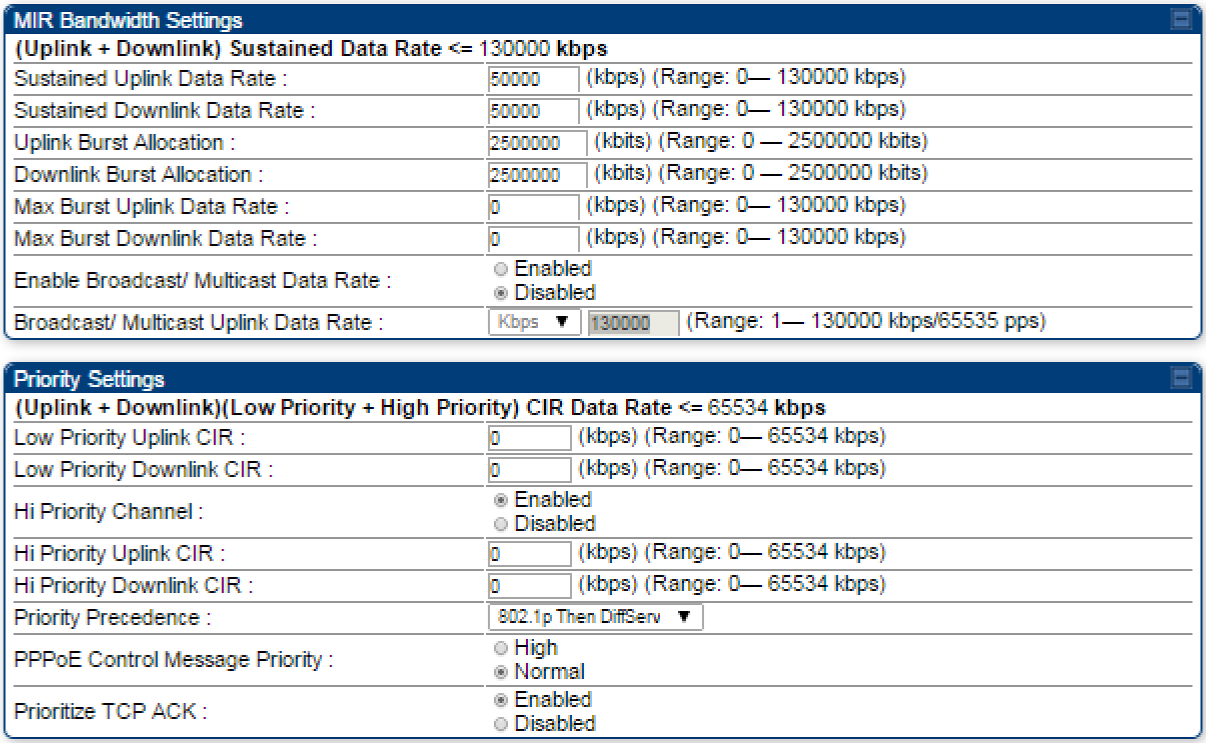
Attribute	Meaning
Max Burst Uplink Data Rate	These parameters allow operators to specify the data rate at which a SM is allowed to transmit (until burst allocation limit is reached) before being recharged at the **Sustained Uplink Data Rate** with credits to transit more. When set to 0 (default), the burst rate is unlimited.
Sustained Uplink Data Rate	Specify the rate that each SM registered to this AP is replenished with credits for transmission. This default imposes no restriction on the uplink. See • Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Uplink Burst Allocation	Specify the maximum amount of data to allow each SM to transmit before being recharged at the **Sustained Uplink Data Rate** with credits to transmit more. See Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141

Max Burst Downlink Data Rate	These parameters allow operators to specify the data rate at which a SM is allowed to transmit (until burst allocation limit is reached) before being recharged at the **Sustained Downlink Data Rate** with credits to transit more. When set to 0 (default), the burst rate is unlimited.
Sustained Downlink Data Rate	Specify the rate at which the AP is replenished with credits (tokens) for transmission to each of the SMs in its sector. This default imposes no restriction on the uplink. See Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Downlink Burst Allocation	Specify the maximum amount of data to allow the AP to transmit to any registered SM before the AP is replenished with transmission credits at the **Sustained Downlink Data Rate**. See • Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Broadcast Downlink CIR	Broadcast Downlink CIR (Committed Information Rate, a minimum) supports system designs where downlink broadcast is desired to have higher priority than other traffic. For many other system designs, especially typical internet access networks, leave the Broadcast Downlink CIR at the default. Broadcast Downlink CIR is closely related to the Broadcast Repeat Count parameter, which is settable in the Radio tab of the Configuration page in the AP: when the Broadcast Repeat Count is changed, the total of available bandwidth is also changed, since packets are being sent one, two, or three times, according to the setting in the Broadcast Repeat Count parameter.
Priority Precedence	Allows operator to decide if 802.1p or DiffServ priority bits must be used first when making priority decisions.
PPPoE Control Message Priority	Operators may configure the SM to utilize the high priority channel for PPPoE control messages. Configuring the SM in this fashion can benefit the continuity of PPPoE connections when there are issues with PPPoE sessions being dropped in the network. This prioritization may be configured in the DiffServ tab in the Configuration menu of the SM.
Prioritize TCP ACK	To reduce the likelihood of TCP acknowledgement packets being dropped, set this parameter to **Enabled**. This can improve throughput that the end user perceives during transient periods of congestion on the link that is carrying acknowledgements.

Quality of Service (QoS) page of SM

The QoS page of SM is explained in Table 156.

Table 156 QoS page attributes - SM



MIR Bandwidth Settings

(Uplink + Downlink) Sustained Data Rate <= 130000 kbps

Sustained Uplink Data Rate :	50000 (kbps) (Range: 0— 130000 kbps)
Sustained Downlink Data Rate :	50000 (kbps) (Range: 0— 130000 kbps)
Uplink Burst Allocation :	2500000 (kbits) (Range: 0 — 2500000 kbits)
Downlink Burst Allocation :	2500000 (kbits) (Range: 0 — 2500000 kbits)
Max Burst Uplink Data Rate :	0 (kbps) (Range: 0— 130000 kbps)
Max Burst Downlink Data Rate :	0 (kbps) (Range: 0— 130000 kbps)
Enable Broadcast/ Multicast Data Rate :	○ Enabled ● Disabled
Broadcast/ Multicast Uplink Data Rate :	Kbps ▼ 130000 (Range: 1— 130000 kbps/65535 pps)

Priority Settings

(Uplink + Downlink)(Low Priority + High Priority) CIR Data Rate <= 65534 kbps

Low Priority Uplink CIR :	0 (kbps) (Range: 0— 65534 kbps)
Low Priority Downlink CIR :	0 (kbps) (Range: 0— 65534 kbps)
Hi Priority Channel :	● Enabled ○ Disabled
Hi Priority Uplink CIR :	0 (kbps) (Range: 0— 65534 kbps)
Hi Priority Downlink CIR :	0 (kbps) (Range: 0— 65534 kbps)
Priority Precedence :	802.1p Then DiffServ ▼
PPPoE Control Message Priority :	○ High ● Normal
Prioritize TCP ACK :	● Enabled ○ Disabled

Attribute	Meaning
Sustained Uplink Data Rate	Specify the rate that this SM is replenished with credits for transmission. This default imposes no restriction on the uplink. See Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Sustained Downlink Data Rate	Specify the rate at which the AP is replenished with credits (tokens) for transmission to this SM. This default imposes no restriction on the uplink. See Maximum Information Rate (MIR) Parameters on Page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Uplink Burst Allocation	Specify the maximum amount of data to allow this SM to transmit before being recharged at the **Sustained Uplink Data Rate** with credits to transmit more. See Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257

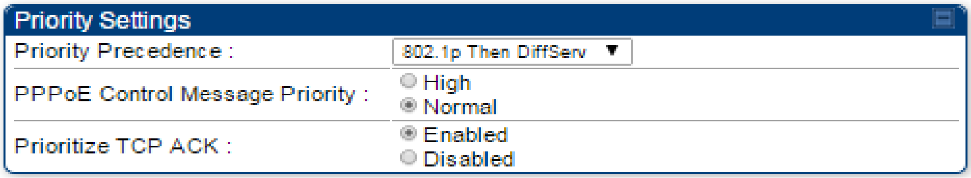
	• Configuration Source on page 7-141
Downlink Burst Allocation	Specify the maximum amount of data to allow the AP to transmit to this SM before the AP is replenished at the **Sustained Downlink Data Rate** with transmission credits. See Maximum Information Rate (MIR) Parameters on page 7-255 • Interaction of Burst Allocation and Sustained Data Rate Settings on page 7-257 • Configuration Source on page 7-141
Max Burst Uplink Data Rate	These parameters allow operators to specify the data rate at which a SM is allowed to transmit (until burst allocation limit is reached) before being recharged at the **Sustained Uplink Data Rate** with credits to transit more. When set to 0 (default), the burst rate is unlimited.
Max Burst Downlink Data Rate	These parameters allow operators to specify the data rate at which a SM is allowed to transmit (until burst allocation limit is reached) before being recharged at the **Sustained Downlink Data Rate** with credits to transit more. When set to 0 (default), the burst rate is unlimited.
Enable Broadcast / Multicast Data Rate	This parameter allows the operator to specify if Broadcast and Multicast data is rate-limited. This data rate can be entered in Kbps or PPS (Packets Per Second).
Broadcast / Multicast Data Rate	This parameter allows the operator to specify a data rate at which Broadcast and Multicast traffic is sent via the radio link.
Low Priority Uplink CIR	This field indicates the minimum rate at which low priority traffic is sent over the uplink (unless CIR is oversubscribed or RF link quality is degraded). • Committed Information Rate (CIR) on page 7-256 • Setting the Configuration Source on page 7-260
Low Priority Downlink CIR	This field indicates the minimum rate at which low priority traffic is sent over the downlink (unless CIR is oversubscribed or RF link quality is degraded). • Committed Information Rate (CIR) on page 7-256 • Setting the Configuration Source on page 7-260
Hi Priority Channel	See • High-priority Bandwidth on page 7-257 • Configuration Source on page 7-141
Hi Priority Uplink CIR	This field indicates the minimum rate at which high priority traffic is sent over the uplink (unless CIR is oversubscribed or RF link quality is degraded). • Committed Information Rate (CIR) on page 7-256 • Setting the Configuration Source on page 7-260

Hi Priority Downlink CIR	This field indicates the minimum rate at which high priority traffic is sent over the downlink (unless CIR is oversubscribed or RF link quality is degraded). • Committed Information Rate (CIR) on page 7-256 • Setting the Configuration Source on page 7-260
Priority Precedence	Allows operator to decide if 802.1p or DiffServ priority bits must be used first when making priority decisions.
PPPoE Control Message Priority	Operators may configure the SM to utilize the high priority channel for PPPoE control messages. Configuring the SM in this fashion can benefit the continuity of PPPoE connections when there are issues with PPPoE sessions being dropped in the network. This prioritization may be configured in the DiffServ tab in the Configuration menu of the SM.
Prioritize TCP ACK	To reduce the likelihood of TCP acknowledgement packets being dropped, set this parameter to Enabled. This can improve throughput that the end user perceives during transient periods of congestion on the link that is carrying acknowledgements. This parameter, when enabled, can be particularly useful when running bi-direction FTP sessions over the link. If a link is primarily used for video surveillance, it is recommended to configure this parameter to **Disabled**.

Quality of Service (QoS) page of BHM

The QoS page of BHM is explained in Table 157.

Table 157 QoS page attributes - BHM



Priority Settings

Priority Precedence : 802.1p Then DiffServ

PPPoE Control Message Priority : ○ High ● Normal

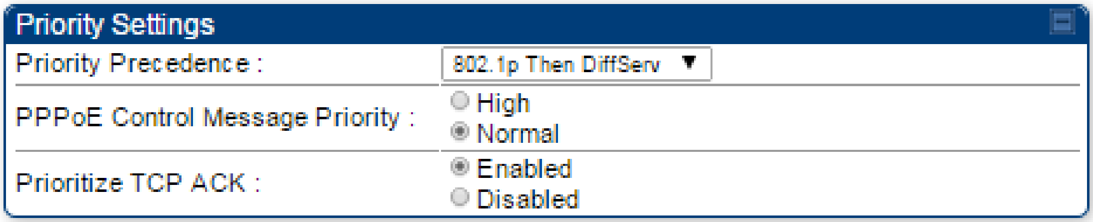
Prioritize TCP ACK : ● Enabled ○ Disabled

Attribute	Meaning
PPPoE Control Message Priority	Operators may configure the BHM to utilize the high priority channel for PPPoE control messages. Configuring the BHM in this fashion can benefit the continuity of PPPoE connections when there are issues with PPPoE sessions being dropped in the network. This prioritization may be configured in the DiffServ tab in the Configuration menu of the BHS.
Prioritize TCP ACK	To reduce the likelihood of TCP acknowledgement packets being dropped, set this parameter to Enabled. This can improve throughput that the end user perceives during transient periods of congestion on the link that is carrying acknowledgements. This parameter, when enabled, can be particularly useful when running bi-direction FTP sessions over the link. If a link is primarily used for video surveillance, it is recommended to configure this parameter to **Disabled**.

Quality of Service (QoS) page of BHS

The QoS page of BHS is explained in Table 158.

Table 158 QoS page attributes - BHS



Priority Settings

Priority Precedence : 802.1p Then DiffServ ▼

PPPoE Control Message Priority : ○ High ● Normal

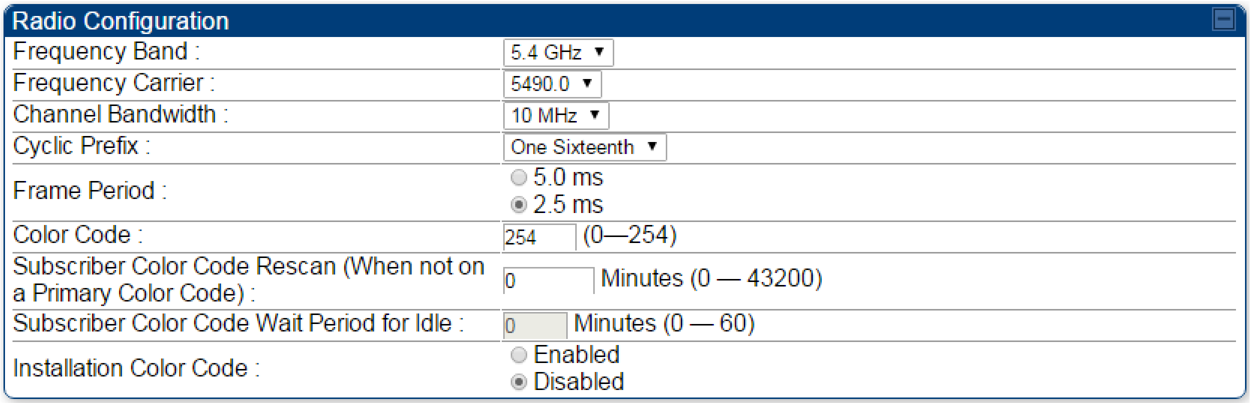
Prioritize TCP ACK : ● Enabled ○ Disabled

Attribute	Meaning
PPPoE Control Message Priority	Operators may configure the BHS to utilize the high priority channel for PPPoE control messages. Configuring the BHS in this fashion can benefit the continuity of PPPoE connections when there are issues with PPPoE sessions being dropped in the network. This prioritization may be configured in the DiffServ tab in the Configuration menu of the BHS.
Prioritize TCP ACK	To reduce the likelihood of TCP acknowledgement packets being dropped, set this parameter to Enabled. This can improve throughput that the end user perceives during transient periods of congestion on the link that is carrying acknowledgements. This parameter, when enabled, can be particularly useful when running bi-direction FTP sessions over the link. If a link is primarily used for video surveillance, it is recommended to configure this parameter to **Disabled**.

Installation Color Code

With this feature enabled on the AP and SM, operators may install and remotely configure SMs without having to configure matching color codes between the modules. While the SM is accessible for configuration from above the AP (for remote provisioning) and below the SM (for local site provisioning), no user data is passed over the radio link. When using the Installation Color Code feature, ensure that the SM is configured with the factory default Color Code configuration (Color Code 1 is “0”, Color Code 2-10 set to “0” and “Disable”). The status of the Installation Color Code can be viewed on the AP Eval web GUI page, and when the SM is registered using the Installation Color Code the message “SM is registered via ICC – Bridging Disabled!” is displayed in red on every SM GUI page. The Installation Color Code parameter is configurable without a radio reboot for both the AP and SM. If an SM is registered via Installation Color Code and the feature is then disabled, operators will need to reboot the SM or force it to reregister (i.e. using the **Rescan APs** functionality on the AP Eval page).

Figure 131 Installation Color Code of AP



Radio Configuration

Frequency Band :	5.4 GHz ▼
Frequency Carrier :	5490.0 ▼
Channel Bandwidth :	10 MHz ▼
Cyclic Prefix :	One Sixteenth ▼
Frame Period :	○ 5.0 ms ● 2.5 ms
Color Code :	254 (0—254)
Subscriber Color Code Rescan (When not on a Primary Color Code) :	0 Minutes (0 — 43200)
Subscriber Color Code Wait Period for Idle :	0 Minutes (0 — 60)
Installation Color Code :	○ Enabled ● Disabled

Zero Touch Configuration Using DHCP Option 66

This feature allows an SM to get its configuration via DHCP option 66. This can be used for the initial configuration of an SM as well as managing the configuration of SMs on an ongoing basis. Here is how it works in brief:

- When the SM boots up, if it is set to use DHCP client, it will send out a DHCP Discover packet which includes a request for DHCP Option 66.
- In case of a brand new SM out of the box, the DHCP Discover packet is sent out if the SM connects to an AP using Installation Color Code (ICC), even though DHCP client is not enabled in factory default config.
- An appropriately configured DHCP server will respond with a DHCP Offer and include a URL in response to the Option 66 request. The URL should point to the configuration file.
- The device will download the configuration file and apply it. The device will reboot automatically if needed. (Note: this requires “rebootIfRequired” flag to be added to the config file. See Creating a Golden config file on page 7-270.

Configuration Steps

Procedure 23 Zero Touch Configuration steps

1. Create the golden config file(s)
2. Host it on an TFTP/FTP/HTTP/HTTPS server
3. Configure the DHCP server to return the URL of the golden config file in option 66

When the SM boots up, it will get the URL for the golden config from the DHCP server via option 66, download it and apply it.

If all the SMs are configured exactly the same, then you can create just new golden config file that can be used with all SMs.

If the SMs are not configured the same, see if it is possible to group the SMs such that SMs with the same configuration are served by the same DHCP pool. User can then create multiple golden config files and configure the DHCP server to use the appropriate config file for each pool.

User can also create one config file per SM. This provides the most flexibility, but is practical only if you have a software tool/script to generate the config files for each MAC address. The files should be named <mac>.cfg where <mac> is the MAC address of the SM, and stored in the same directory on the file server. The DHCP server should be configured to return the directory name ending with a ‘/’ in option 66. The SM will automatically add “<mac>.cfg” to the path and get its config file.

If some configuration is unique per SM, but rest of the configuration is common, the SMs can be staged with the unique part, and use option 66 to manage the common part. For example, if each SM needs to have its coordinates set, don’t include the coordinates in the golden config file. Instead, configure the coordinates for each SM manually. Manage the rest of the configuration using DHCP option 66.

Creating a Golden config file

The easiest way to create the golden config file is to configure an SM, export its configuration and edit it. To export the configuration file from the GUI of the SM, go to “Configuration > Unit Settings” tab, go to the “Download Configuration File” section and click on the “<mac>.cfg” link. This will give you a text file in JSON format. You can edit this file in a text editor but it’s easier to use a JSON editor like https://www.jsoneditoronline.org/.

Strip down the config file to remove sections and entries that don’t care about, and keep only the items that require changes. If there are many required changes, it can easily get confusing. To identify the exact items changes, first reset the SM to factory default, export the config file, make the necessary changes, export a second config file, then use a tool like WinMerge (http://winmerge.org/) to identify the differences.

The config file contains the following informational entries at the top level.

```
 "cfgUtcTimestamp": "cfgUtcTimestamp",
 "swVersion": "CANOPY 13.3 (Build 15)  SM-AES",
 "cfgFileString": "Canopy configuration file",
 "srcMacAddress": "0a-00-3e-a2-c2-74",
 "deviceType": "5.4/5.7GHz MIMO OFDM - Subscriber Module",
 "cfgFileVersion": "1.0"
```

The “cfgUtcTimestamp”, “swVersion”, “srcMacAddress” and “deviceType” lines can be deleted. Do not delete the “cfgFileString” and “cfgFileVersion” entries.

Next, create an object named “configFileParameters” at the top level. Under that, add a parameter called “rebootIfRequired” and set it to true. This tells the SM to reboot automatically if a reboot is needed to apply the new configuration.

A sample configuration file that has been edited for use via DHCP option 66 is given below.

```
{
  "userParameters": {
    "smNetworkConfig": {
      "networkAccess": 1
    },
    "location": {
      "siteName": "Test site"
    },
    "smRadioConfig": {
      "frequencyScanList": [
        5475000,
        5480000
      ],
      "colorCodeList": [
        {
          "colorCode": 42,
          "priority": 1
        }
      ]
    },
    "networkConfig": {
      "lanDhcpState": 1
    }
  },
  "cfgFileVersion": "1.0",
  "cfgFileString": "Canopy configuration file",
  "configFileParameters": {
    "rebootIfRequired": true
  }
}
```

When configuration is imported, only the items that exist in the configuration file are modified. Parameters that are not in the imported file are not changed. If user wish to revert those settings to their factory default values, please add a “setToDefaults” item under “configFileParameters” section with a value of true.

```
  "cfgFileVersion": "1.0",
  "cfgFileString": "Canopy configuration file",
  "configFileParameters": {
    "rebootIfRequired": true,
    "setToDefaults": true
  }
```

In case, the SM needs to fetch the configuration file on each boot up even when not connecting to AP via ICC, set “Network Accessibility” to “Public” and “DHCP State” to “Enabled” in the “Configuration > IP” page before exporting the configuration.

Hosting the config file

Copy the golden configuration file to an FTP, TFTP, HTTP or HTTPS server. This location can be password protected; you just have to include the user name and password in the URL.

DHCP server configuration

Configure DHCP server to return the full URL to the golden config file as the value of DHCP option 66.

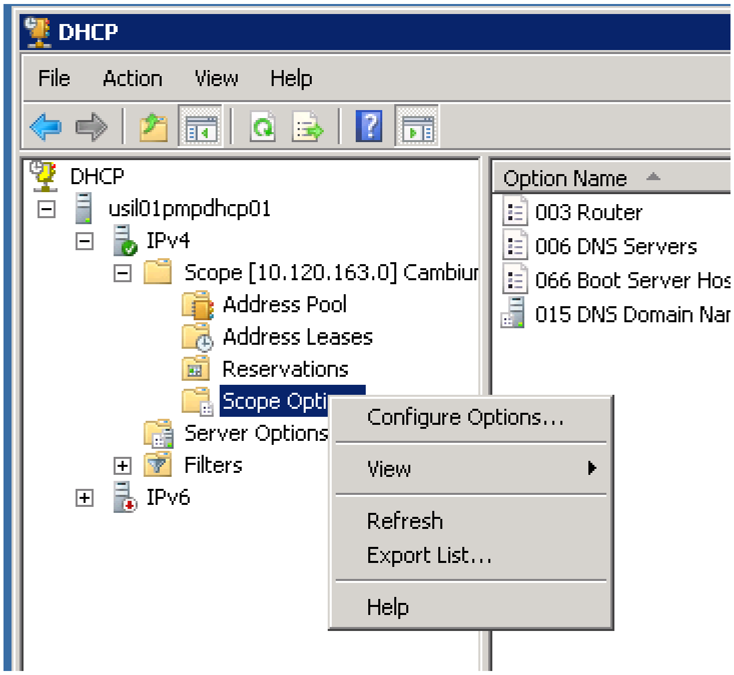
The following example explains how to make the change for Windows Server 2008. Adapt it to your specific DHCP server.

Procedure 24 DHCP server configuration

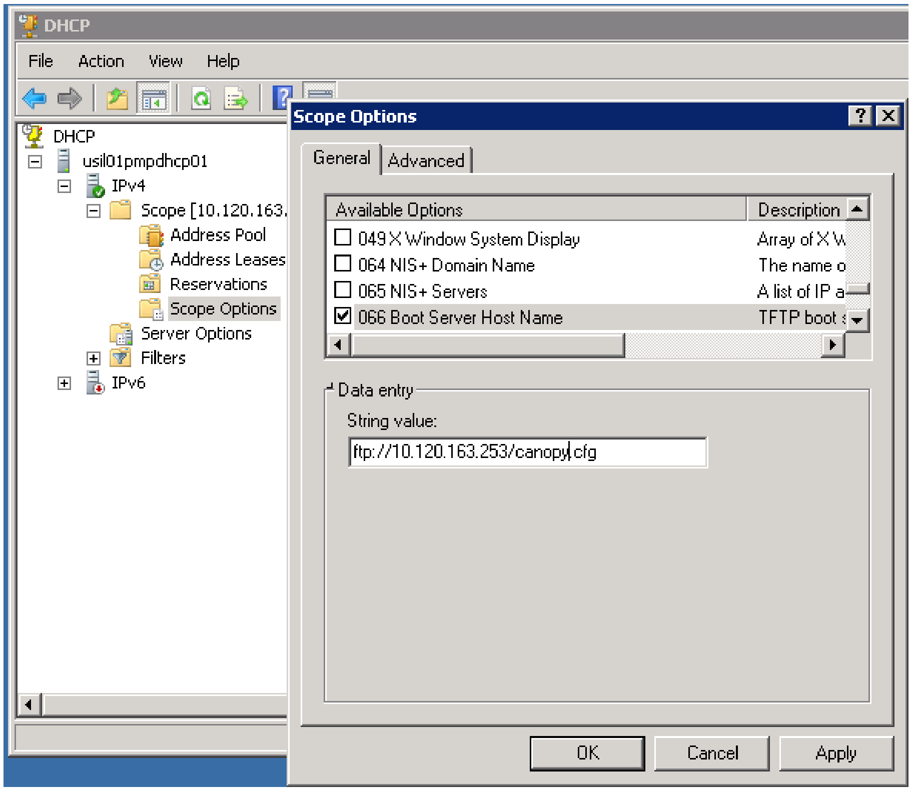
1 Click "Start > Administrative Tools > DHCP"

2 If you have multiple "Scopes" defined, identify the correct "Scope" that will serve IP addresses for the SMs

3 Right click on "Scope Option" under the correct "Scope" and select "Configure Options"



4 In the “Scope Options” dialog, scroll down to “066 Boot Server Host Name”, select the checkbox and enter the full URL to the golden config file as the “String value”. Then click “OK”.



Available Options	Description
☐ 049 X Window System Display	Array of X W
☐ 064 NIS+ Domain Name	The name o
☐ 065 NIS+ Servers	A list of IP a
☑ 066 Boot Server Host Name	TFTP boot s

Data entry

String value: ftp://10.120.163.253/canopy.cfg

5 In the DHCP snap-in window, right click and “Refresh” to see the DHCP option 66 in the list of DHCP options

Supported URL Formats

FTP, TFTP, HTTP and HTTPS URLs are supported. Some examples are given below.

- ftp://10.120.163.253/canopy.cfg
- ftp://admin:admin123@10.120.163.253/canopy.cfg (login as admin with password admin123)
- tftp://10.120.163.253/canopy.cfg
- http://10.120.163.253/golden-config.cfg
- https://10.120.163.253/smconfig/golden-config.cfg

User can also specify the URL pointing to a directory and not a specific file. Terminate the URL with a ‘/’ to indicate that it is a directory and not a file. Use this format when each SM has its own individual config file. The directory should contain files named “<mac>.cfg”, one for each SM.

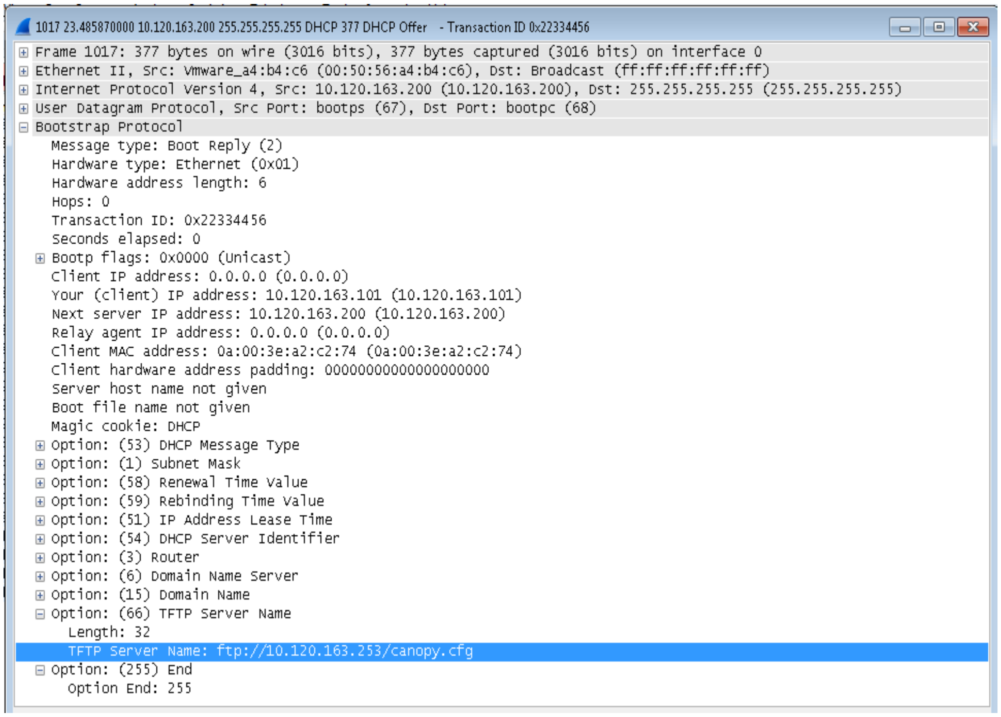
For example:

ftp://10.120.163.253/smconfig/

In this case, the SM will append “<mac>.cfg” to the path and try to get that file. For example, if the SM’s MAC address is 0a-00-3e-a2-c2-74, it will request for ftp://10.120.163.253/smconfig/0a003ea2c274.cfg. This mechanism can be used to serve individual config file for each SM.

Troubleshooting

1. Ensure that the___14 SM is running 13.3 or newer version of software.
2. If the SM has factory default config, confirm ICC is enabled on the AP, so the SM can connect to it.
3. If the SM is connecting to the AP using a color code other than ICC, make sure the SM has “Network Accessibility” set to “Public” and “DHCP State” set to “Enabled” in the “Configuration > IP” page.
4. Make sure the golden config file does not turn off “Network Accessibility” or “DHCP State”. If it does, the SM will no longer request the config file when it is rebooted.
5. Check the event log of the SM to see the status of the configuration file import including any errors that prevented it from importing the file.
6. Capture the DHCP Offer packet from the DHCP server to the SM and verify that Option 66 has the expected URL.



```
1017 23.485870000 10.120.163.200 255.255.255.255 DHCP 377 DHCP Offer   - Transaction ID 0x22334456
⊞ Frame 1017: 377 bytes on wire (3016 bits), 377 bytes captured (3016 bits) on interface 0
⊞ Ethernet II, Src: Vmware_a4:b4:c6 (00:50:56:a4:b4:c6), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
⊞ Internet Protocol Version 4, Src: 10.120.163.200 (10.120.163.200), Dst: 255.255.255.255 (255.255.255.255)
⊞ User Datagram Protocol, Src Port: bootps (67), Dst Port: bootpc (68)
⊟ Bootstrap Protocol
    Message type: Boot Reply (2)
    Hardware type: Ethernet (0x01)
    Hardware address length: 6
    Hops: 0
    Transaction ID: 0x22334456
    Seconds elapsed: 0
  ⊞ Bootp flags: 0x0000 (Unicast)
    Client IP address: 0.0.0.0 (0.0.0.0)
    Your (client) IP address: 10.120.163.101 (10.120.163.101)
    Next server IP address: 10.120.163.200 (10.120.163.200)
    Relay agent IP address: 0.0.0.0 (0.0.0.0)
    Client MAC address: 0a:00:3e:a2:c2:74 (0a:00:3e:a2:c2:74)
    Client hardware address padding: 00000000000000000000
    Server host name not given
    Boot file name not given
    Magic cookie: DHCP
  ⊞ Option: (53) DHCP Message Type
  ⊞ Option: (1) Subnet Mask
  ⊞ Option: (58) Renewal Time Value
  ⊞ Option: (59) Rebinding Time Value
  ⊞ Option: (51) IP Address Lease Time
  ⊞ Option: (54) DHCP Server Identifier
  ⊞ Option: (3) Router
  ⊞ Option: (6) Domain Name Server
  ⊞ Option: (15) Domain Name
  ⊟ Option: (66) TFTP Server Name
      Length: 32
      TFTP Server Name: ftp://10.120.163.253/canopy.cfg
  ⊟ Option: (255) End
      Option End: 255
```

Configuring Radio via config file

The 450 Platform Family supports export and import of a configuration file from the AP or SM as a text file. The configuration file is in JSON format.

To export or import the configuration file, the logged in user needs to be an ADMINISTRATOR and it must not be a “read-only” account.

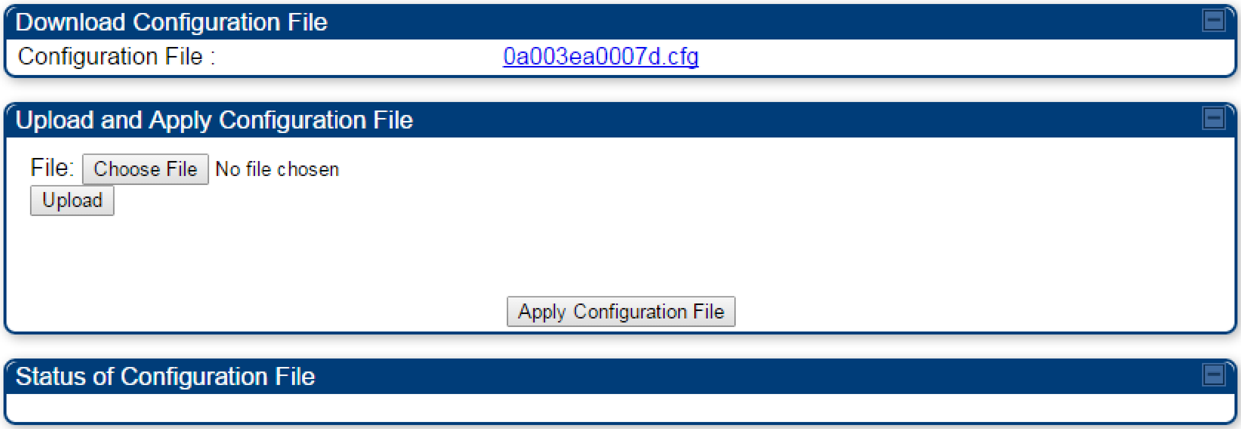
The exported configuration file contains the complete configuration including all the default values. To keep a backup of the current configuration, the file can be saved as-is and imported later.

While importing a configuration file, it can be either imported the full configuration or a sparse configuration containing only the items that need to be changed. If a sparse configuration file is imported, only the items in the file will be imported. Other configuration will remain unchanged. There could also be used a special flag in the configuration file to tell the device to apply the configuration starting from factory default (Refer Special Headers for configuration file on page 7-276).

Import and Export of config file

The config file import and export is supported in **Configuration > Unit Settings** page. The procedure for importing and exporting config file is explained below.

Figure 132 Configuration File upload and download page



Download Configuration File

Configuration File : 0a003ea0007d.cfg

Upload and Apply Configuration File

File: Choose File No file chosen

Status of Configuration File

The DHCP server configuration procedure is as follows:

Procedure 25 DHCP server configuration

1. Login to the GUI and go to **Configuration** > **Unit Settings.**
2. Under Download Configuration File tab, click on the “<mac>.cfg” link, where <mac> is the MAC address of the device (for example, “01003ea2c274.cfg”).
3. Save the file to the local disk.

The below procedure is to be followed for Importing a config file

Procedure 26 Import the configuration from the GUI

1. Login to the GUI and go to Configuration → Unit Settings.
2. Click on “Browse” button under “Upload and Apply Configuration File” tab and select the configuration file from disk.
3. Click “Upload” followed by “Apply Configuration File” button click.
4. The “Status of Configuration File” section will show the results of the upload.
5. Review it to make sure there are no errors. Then click on “Reboot” to reboot with the imported configuration

The special headers for config file is explained below:

Procedure 27 Special Headers for configuration file

1. A "configFileParameters" section can be added to the header to control the behavior of the device when importing configuration.
2. The "**setToDefaults**" when set to "true" tell the device to reset to factory default configuration and apply the configuration in the file on top of that. So any attribute not in the configuration file will be set to its factory default value. By default, the configuration in the file is merged with the existing configuration on the device.

   The "r**ebootIfRequired**" flag when set to "true" tell the device to reboot automatically if needed to apply the configuration change. By default, the device will not reboot automatically.

   ```
   {
     "cfgFileString": "Canopy configuration file",
     "cfgFileVersion": "1.0",
     "configFileParameters": {
       "setToDefaults":true,
       "rebootIfRequired":true,
     }
   }
   ```

Configuring cnMaestro^{TM} Connectivity

450 Platform Family network can be onboarded, configured and managed using cnMaestro™ Cloud or On Premises Server.

Note

cnMaestro is not currently supported on 450m.

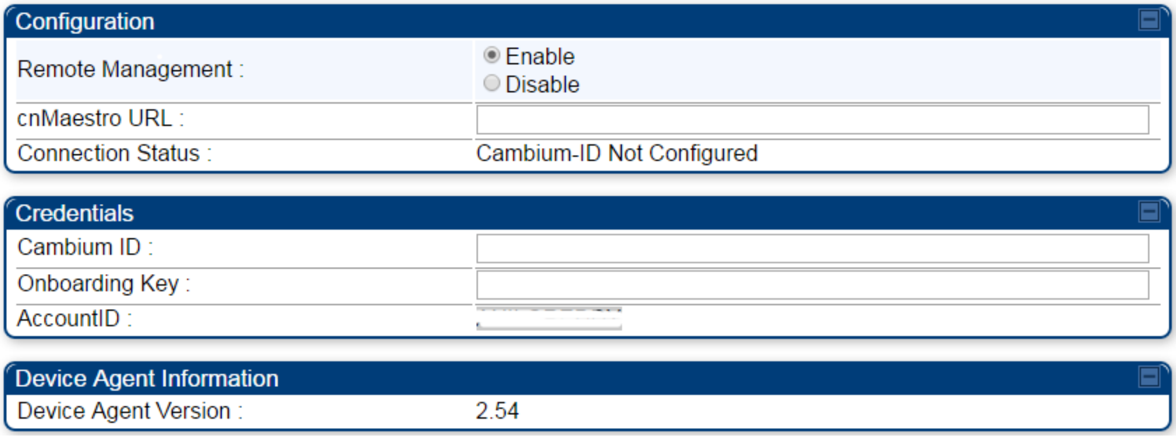
Onboarding

Onboarding can be done in one of several ways:

- Using Cambium ID and Onboarding key
- Using Manufacturer's Serial Number (Only if it starts with an "M" and is 12 characters long)
- On Premises Zero Touch onboarding of AP/SM using DHCP option 43 and 15
- PMP SM Zero touch onboarding to the cnMaestro server where PMP AP is onboarded.

To configure the PMP devices, enable Remote Management under Configuration->cnMaestro as shown in Table 159.

Table 159 Configuring cnMaestro



Configuration

Remote Management :	● Enable ○ Disable
cnMaestro URL :	
Connection Status :	Cambium-ID Not Configured

Credentials

Cambium ID :	
Onboarding Key :	
AccountID :	

Device Agent Information

Device Agent Version :	2.54

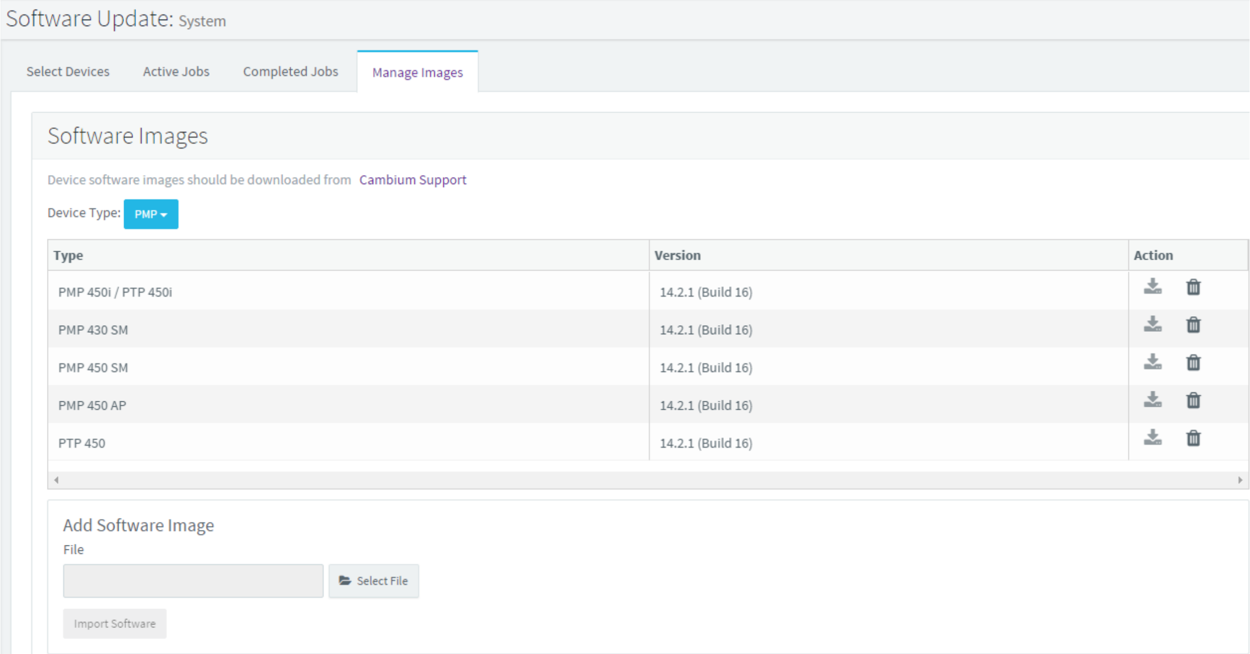
Attribute	Meaning
Remote Management	This field enables/disables remote management of 450 Platform Family products.
cnMaestro URL	This field allows to enter cnMaestro URL e.g. https://cloud.cambiumnetworks.com Or cnMaestro on premises URL
Connection Status	This field indicates cnMaestro connectivity status.
Cambium ID	This field allows to enter Cambium ID for onboarding 450 Platform devices.
Onboarding Key	This field allows to enter Onboarding Key for onboarding.

AccountID	This field indicates Account ID of the customer.
Device Agent Version	This field shows device agent version.

Prerequisites for onboarding to cnMaestro™

- Devices types must be PMP 450m Series, PMP/PTP 450 Series, PMP/PTP 450i Series or PMP 430 Series SMs (interoperability mode only).
- Minimum required software version of 14.2.1. Device software images can be downloaded from http://support.cambiumnetworks.com or from the On Premises cnMaestro server by navigating to Operate >Software Update->Manage Images. Select
- Device type to display the available images and then click the download icon as shown in Figure 133.

Figure 133 Software Upgrade from cnMaestro™



Software Images

Device software images should be downloaded from Cambium Support

Device Type: PMP

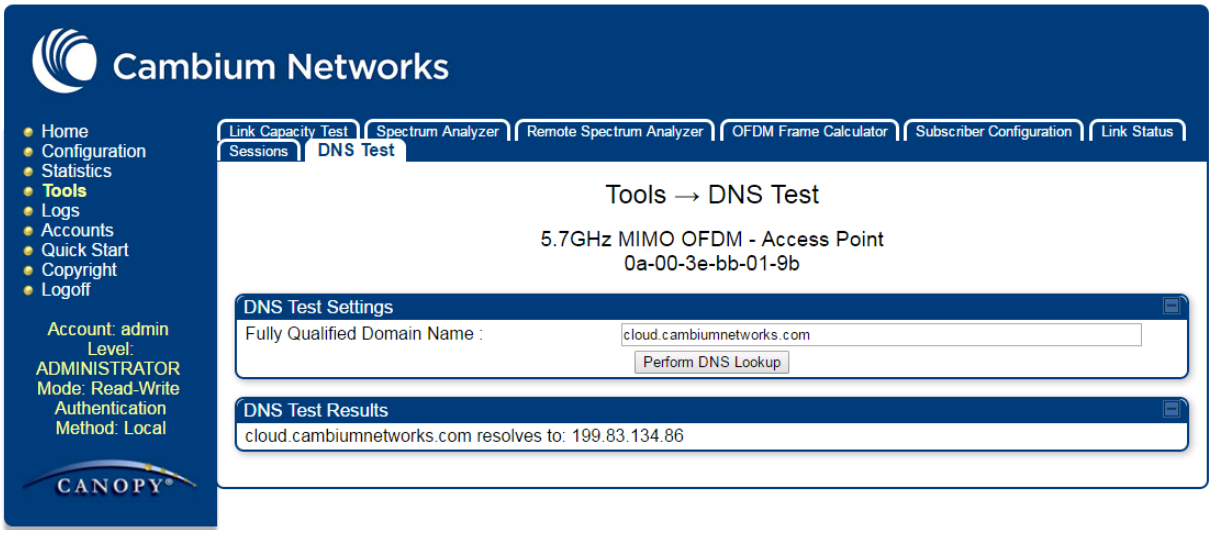
Type	Version	Action
PMP 450i / PTP 450i	14.2.1 (Build 16)	⬇ 🗑
PMP 430 SM	14.2.1 (Build 16)	⬇ 🗑
PMP 450 SM	14.2.1 (Build 16)	⬇ 🗑
PMP 450 AP	14.2.1 (Build 16)	⬇ 🗑
PTP 450	14.2.1 (Build 16)	⬇ 🗑

Add Software Image

File

- IP connectivity between PMP Device and the cnMaestro server is established. Ensure Port 443 is open in the firewall as this port is used for secure communication between the PMP device and the cnMaestro server through web sockets. In addition, if the PMP device and cnMaestro™ server are on different subnets, proper routes should be established for communication.
- For PMP AP, a valid DNS setting is required so that the AP will be able to resolve the cnMaestro URL. DNS settings can be verified by performing a DNS lookup under Tools->DNS Test on the AP as shown in Figure 134.

Figure 134 DNS Test for cnMaestro™ connectivity



Account: admin Level: ADMINISTRATOR Mode: Read-Write Authentication Method: Local

Tools → DNS Test

5.7GHz MIMO OFDM - Access Point
0a-00-3e-bb-01-9b

DNS Test Settings

Fully Qualified Domain Name : cloud.cambiumnetworks.com

DNS Test Results

cloud.cambiumnetworks.com resolves to: 199.83.134.86

- If the SM is in Bridge mode, then LAN1 must have public accessbility with a public IP assigned and corresponding DNS setting.
- If the SM is in NAT mode, then Remote Management should be enabled with the standalone configuration option and DNS settings.

Knowledge Based articles for onboarding

For onboarding the devices to cloud server and troubleshooting the onboarding issues in cloud server please see the following link:

http://community.cambiumnetworks.com/t5/cnMaestro/Device-On-boarding/td-p/51484

For onboarding the devices to on Premises server and configuring the DHCP server options for on boarding please see the following link:

http://community.cambiumnetworks.com/t5/cnMaestro/Device-Onboarding-and-Linux-DHCP-Options-for-cnMaestro-On/m-p/55187#U55187

Order of Device Onboarding

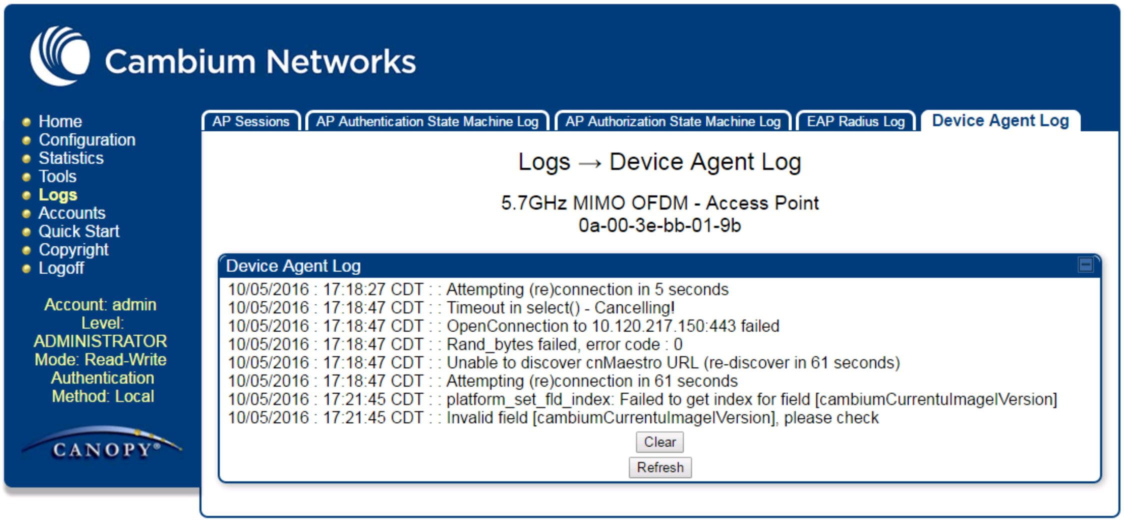
The device discovery order is as follows in On Permises cnMaestro™ Server. If any of the options is not configured, the discovery method will fallback to the next option:

1. Static cnMaestro URL
2. Zero Touch token (on boarding of PMP SMs when the corresponding AP is on boarded)
3. DHCP Option 43
4. DHCP Option 15
5. https://cloud.cambiumnetworks.com

Device Agent Logs

For debugging any onboarding issues please check the device agent logs by navigating to Logs->Device Agent Logs on the PMP device GUI as shown in Figure 135. In addition, a tech support dump can for the PMP device can be obtained from cnMaestro™ by navigating to Monitor->Tools menu after selecting the particular PMP device in the tree and clicking the tech support file icon. This can be send to Cambium support for further troubleshooting.

Figure 135 Device Agent Logs



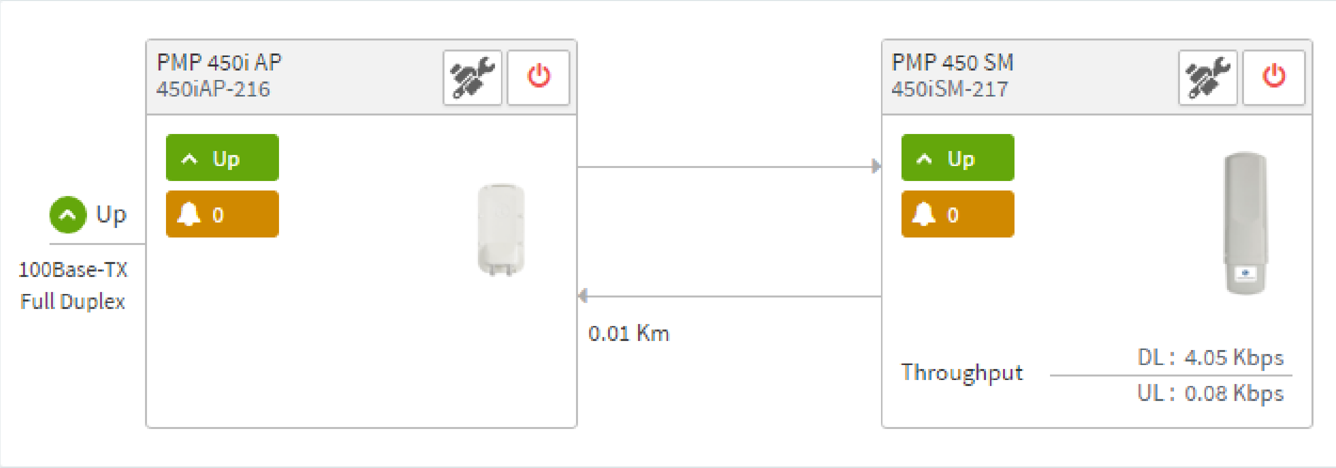
```
10/05/2016 : 17:18:27 CDT : : Attempting (re)connection in 5 seconds
10/05/2016 : 17:18:47 CDT : : Timeout in select() - Cancelling!
10/05/2016 : 17:18:47 CDT : : OpenConnection to 10.120.217.150:443 failed
10/05/2016 : 17:18:47 CDT : : Rand_bytes failed, error code : 0
10/05/2016 : 17:18:47 CDT : : Unable to discover cnMaestro URL (re-discover in 61 seconds)
10/05/2016 : 17:18:47 CDT : : Attempting (re)connection in 61 seconds
10/05/2016 : 17:21:45 CDT : : platform_set_fld_index: Failed to get index for field [cambiumCurrentuImageIVersion]
10/05/2016 : 17:21:45 CDT : : Invalid field [cambiumCurrentuImageIVersion], please check
```

Monitoring Tools for PMP Devices on cnMaestro™

cnMaestro™ as of this release offers several debugging tools for PMP devices. Some examples are:

- Pictorial view of network hierarchy
- Device status
- Tech support file
- Throughput
- Alarms
- Reboot
- Debug Logs
- Network connectivity – ping and DNS lookup

Figure 136 Example cnMaestro™ screenshot



For more information on these tools please see http://community.cambiumnetworks.com/t5/cnMaestro/How-to-use-the-cnMaestro-Tools-for-Troubleshooting-Device-or/m-p/54503#U54503

Zero Touch on boarding of the PMP SMs when the corresponding AP is on boarded

First a link should be established between the PMP AP and SM either by configuring manually or using the ICC. Once the AP and SM link is established, the AP must be onboarded to cnMaestro™ using one of several ways detailed above under the Onboarding section. Once the AP is onboarded to cnMaestro™ Cloud or On premises cnMaestro™ server, the SMs under the AP will automatically onboard to cnMaestro™ using a Zero touch token that is communicated between the AP and SMs. This is applicable to existing SMs registered to the AP as well as new SMs registering to the AP for the first time. The SMs appear on the onboarding queue of cnMaestro™ and the operator must “Approve” the devices in order to manage them.

The following operations for PMP Devices are available on cnMaestro™

- Monitor the device details in the Dashboard page by navigating to the **Monitor >Dashboard** menu and selecting the PMP AP/SM in the tree.
- Monitor notifications related to the PMP AP/SM by navigating to the **Monitor >Notifications** Menu and selecting the PMP AP/SM in the tree.
- Monitor device statistics on the statistics page by navigating to the **Monitor >Statistics** menu and selecting the PMP AP/SM in the tree, then selecting the PMP AP or PMP SM in the Device type dropdown.
- Monitor Performance graphs related to the PMP AP/SM by navigating to the **Monitor >Performance** menu and selecting the required performance graph (i.e Throughput, SMs, Modulation) and selecting the PMP AP/SM in the tree.
- Troubleshoot the device on the Troubleshooting page by navigating to the **Monitor >Tools** menu and selecting the PMP AP/SM in the tree.

- Configure the devices by navigating to the **Configure >Devices** menu and selecting the PMP AP/SM in the tree and selecting the config template that needs to be pushed to the device. Configuration templates need to be created before the configuration can be pushed to the device. The template can be created by copying the existing configuration from the view device configuration link provided in the same page and then modifying the template as needed and then pushing to the same device or other similar devices. Template needs to be properly reviewed for IP Address and other critical parameters to avoid stranding SMs (resulting in a truck roll) by pushing an incorrect configuration. Configuration templates can be created by navigating to the Configure->Templates page and selecting the PMP device type while creating the template.
- Once on 14.2.1, PMP devices can be upgraded to future supported versions from cnMaestro™ by navigating to the **Operate > Software Update** page and selecting the "PMP Sectors" option from the device type drop down and the version to which the device needs to be upgraded. It is recommended to upgrade the AP first, then the SMs.
- PMP Device Inventory details can be reviewed by navigating to the **Monitor >Inventory** page.

Configuring a RADIUS server

Configuring a RADIUS server in a PMP 450 Platform network is optional, but can provide added security, increase ease of network management and provide usage-based billing data.

Understanding RADIUS for PMP 450 Platform Family

PMP 450 Platform modules include support for the RADIUS (Remote Authentication Dial In User Service) protocol supporting Authentication and Accounting.

RADIUS Functions

RADIUS protocol support provides the following functions:

- **SM Authentication** allows only known SMs onto the network (blocking "rogue" SMs), and can be configured to ensure SMs are connecting to a known network (preventing SMs from connecting to "rogue" APs). RADIUS authentication is used for SMs, but is not used for APs.
- **SM Configuration:** Configures authenticated SMs with MIR (Maximum Information Rate), CIR (Committed Information Rate), High Priority, and VLAN (Virtual LAN) parameters from the RADIUS server when a SM registers to an AP.
- **SM Accounting provides** support for RADIUS accounting messages for usage-based billing. This accounting includes indications for subscriber session establishment, subscriber session disconnection, and bandwidth usage per session for each SM that connects to the AP.
- **Centralized AP and SM user name and password management** allows AP and SM usernames and access levels (Administrator, Installer, Technician) to be centrally administered in the RADIUS server instead of on each radio and tracks access events (logon/logoff) for each username on the RADIUS server. This accounting does *not* track and report specific configuration actions performed on radios or pull statistics such as bit counts from the radios. Such functions require an Element Management System (EMS) such as Cambium Networks Wireless Manager. This accounting is *not* the ability to perform accounting functions on the subscriber/end user/customer account.
- **Framed IP** allows operators to use a RADIUS server to assign management IP addressing to SM modules (framed IP address).

Tested RADIUS Servers

The Canopy RADIUS implementation has been tested and is supported on

- FreeRADIUS, Version 2.1.8
- Aradial RADIUS, Version 5.1.12
- Microsoft RADIUS (Windows Server 2012 R2 version)
- Cisco ACS, Version 5.7.0.15

Note

Aradial 5.3 has a bug that prevents "remote device login", so doesn't support the user name and password management feature.

Choosing Authentication Mode and Configuring for Authentication Servers - AP

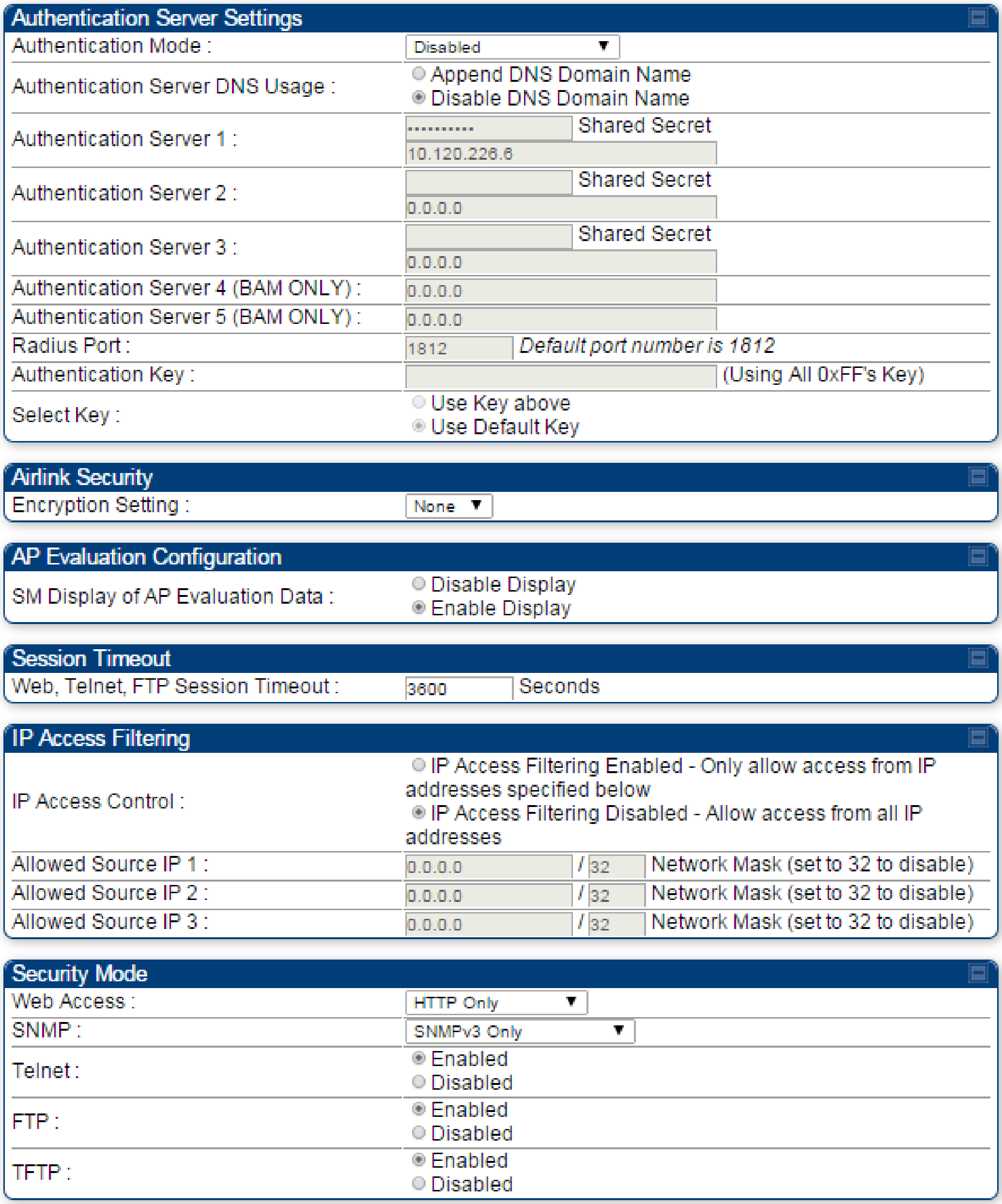
On the AP's **Configuration > Security** tab, select the **RADIUS AAA Authentication Mode**. The following describes the other **Authentication Mode** options for reference, and then the **RADIUS AAA** option.

- **Disabled:** Requires no authentication. Any SM (except a SM that itself has been configured to *require* RADIUS authentication by enabling Enforce Authentication as described below) is allowed to register to the AP.
- **Authentication Server:** Authentication Server in this instance refers to Wireless Manager in BAM-only mode. Authentication is required for a SM to register to the AP. Only SMs listed by MAC address in the Wireless Manager database is allowed to register to the AP.
- **AP Pre-Shared Key:** Canopy offers a pre-shared key authentication option. In this case, an identical key must be entered in the Authentication Key field on the AP's Configuration > Security tab and in the Authentication Key field on each desired SM's Configuration > Security tab.
- **RADIUS AAA:** To support RADIUS authentication of SMs, on the AP's Configuration > Security tab select RADIUS AAA. Only properly configured SMs with a valid certificate is allowed to register to the AP.

When RADIUS AAA is selected, up to 3 Authentication Server (RADIUS Server) IP addresses and Shared Secrets can be configured. The IP address(s) configured here must match the IP address(s) of the RADIUS server(s). The shared secret(s) configured here must match the shared secret(s) configured in the RADIUS server(s). Servers 2 and 3 are meant for backup and reliability, not splitting the database. If Server 1 doesn't respond, Server 2 is tried, and then server 3. If Server 1 rejects authentication, the SM is denied entry to the network, and does not progress trying the other servers.

The default IP address is 0.0.0.0. The default Shared Secret is "CanopySharedSecret". The Shared Secret can be up to 32 ASCII characters (no diacritical marks or ligatures, for example).

Table 160 Security tab attributes



Authentication Server Settings

Authentication Mode :	Disabled ▼
Authentication Server DNS Usage :	○ Append DNS Domain Name ● Disable DNS Domain Name
Authentication Server 1 :	•••••••••• Shared Secret 10.120.226.6
Authentication Server 2 :	Shared Secret 0.0.0.0
Authentication Server 3 :	Shared Secret 0.0.0.0
Authentication Server 4 (BAM ONLY) :	0.0.0.0
Authentication Server 5 (BAM ONLY) :	0.0.0.0
Radius Port :	1812 *Default port number is 1812*
Authentication Key :	(Using All 0xFF's Key)
Select Key :	○ Use Key above ● Use Default Key

Airlink Security

Encryption Setting :	None ▼

AP Evaluation Configuration

SM Display of AP Evaluation Data :	○ Disable Display ● Enable Display

Session Timeout

Web, Telnet, FTP Session Timeout :	3600 Seconds

IP Access Filtering

IP Access Control :	○ IP Access Filtering Enabled - Only allow access from IP addresses specified below ● IP Access Filtering Disabled - Allow access from all IP addresses
Allowed Source IP 1 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 2 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 3 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)

Security Mode

Web Access :	HTTP Only ▼
SNMP :	SNMPv3 Only ▼
Telnet :	● Enabled ○ Disabled
FTP :	● Enabled ○ Disabled
TFTP :	● Enabled ○ Disabled

Attribute	Meaning
Authentication Mode	Operators may use this field to select the following authentication modes: **Disabled**—the AP requires no SMs to authenticate. **Authentication Server** —the AP requires any SM that attempts registration to be authenticated in Wireless Manager before registration. **AP PreShared Key** - The AP acts as the authentication server to its SMs and will make use of a user-configurable pre-shared authentication key. The operator enters this key on both the AP and all SMs desired to register to that AP. There is also an option of leaving the AP and SMs at their default setting of using the "Default Key". Due to the nature of the authentication operation, if you want to set a specific authentication key, then you MUST configure the key on all of the SMs and reboot them BEFORE enabling the key and option on the AP. Otherwise, if you configure the AP first, none of the SMs is able to register. **RADIUS AAA** - When RADIUS AAA is selected, up to 3 Authentication Server (RADIUS Server) IP addresses and Shared Secrets can be configured. The IP address(s) configured here must match the IP address(s) of the RADIUS server(s). The shared secret(s) configured here must match the shared secret(s) configured in the RADIUS server(s). Servers 2 and 3 are meant for backup and reliability, not for splitting the database. If Server 1 doesn't respond, Server 2 is tried, and then server 3. If Server 1 rejects authentication, the SM is denied entry to the network and does not progress trying the other servers.
Authentication Server DNS Usage	The management DNS domain name may be toggled such that the name of the authentication server only needs to be specified and the DNS domain name is automatically appended to that name.
Authentication Server 1	Enter the IP address or server name of the authentication server (RADIUS or WM) and the Shared Secret configured in the authentication server. When **Authentication Mode RADIUS AAA** is selected, the default value of **Shared Secret** is "CanopySharedSecret". The **Shared Secret** may consist of up to 32 ASCII characters.
Authentication Server 2	
Authentication Server 3	
Authentication Server 4 (BAM Only)	
Authentication Server 5 (BAM Only)	
Radius Port	This field allows the operator to configure a custom port for RADIUS server communication. The default value is *1812*.
Authentication Key	The authentication key is a 32-character hexadecimal string used when **Authentication Mode** is set to **AP Pre-Shared Key**. By default, this key is set to 0xFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF.

Selection Key	This option allows operators to choose which authentication key is used: **Use Key above** means that the key specified in **Authentication Key** is used for authentication **Use Default Key** means that a default key (based off of the SM's MAC address) is used for authentication
Encryption Key	Specify the type of airlink security to apply to this AP. The encryption setting must match the encryption setting of the SMs. **None** provides no encryption on the air link. **DES** (Data Encryption Standard): An over-the-air link encryption option that uses secret 56-bit keys and 8 parity bits. DES performs a series of bit permutations, substitutions, and recombination operations on blocks of data. DES encryption does not affect the performance or throughput of the system. **AES** (Advanced Encryption Standard)**:** An over-the-air link encryption option that uses the Rijndael algorithm and 128-bit keys to establish a higher level of security than DES. AES products are certified as compliant with the Federal Information Processing Standards (FIPS 197) in the U.S.A.
SM Display of AP Evaluation Data	You can use this field to suppress the display of data about this AP on the AP Evaluation tab of the Tools page in all SMs that register.
Web, Telnet, FTP Session Timeout	Enter the expiry in seconds for remote management sessions via HTTP, telnet, or ftp access to the AP.
IP Access Control	You can permit access to the AP from any IP address (**IP Access Filtering Disabled**) or limit it to access from only one, two, or three IP addresses that you specify (**IP Access Filtering Enabled**). If you select **IP Access Filtering Enabled**, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted from any IP address
Allowed Source IP 1	If you selected **IP Access Filtering Enabled** for the **IP Access Control** parameter, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted to the AP from any IP address. You may populate as many as all three.
Allowed Source IP 2	If you selected **IP Access Filtering Disabled** for the **IP Access Control** parameter, then no entries in this parameter are read, and access from all IP addresses is permitted.
Allowed Source IP 3	
Web Access	The Radio supports secured and non-secured web access protocols. Select suitable web access from drop down list: • **HTTP Only** – provides non-secured web access. The radio to be accessed via http://<IP of Radio>. • **HTTPS Only** – provides a secured web access. The radio to be accessed via https1://<IP of Radio>.

	• **HTTP and HTTPS** – If enabled, the radio can be accessed via both http and https.
SNMP	This option allows to configure SNMP agent communication version. It can be selected from drop down list : • **SNMPv2c Only** – Enables SNMP v2 community protocol. • **SNMPv3 Only** – Enables SNMP v3 protocol. It is secured communication protocol. • **SNMPv2c and SNMPv3** – It enables both the protocols.
Telnet	This option allows to **Enable** and **Disable** Telnet access to the Radio.
FTP	This option allows to **Enable** and **Disable** FTP access to the Radio.
TFTP	This option allows to **Enable** and **Disable** TFTP access to the Radio.

SM Authentication Mode – Require RADIUS or Follow AP

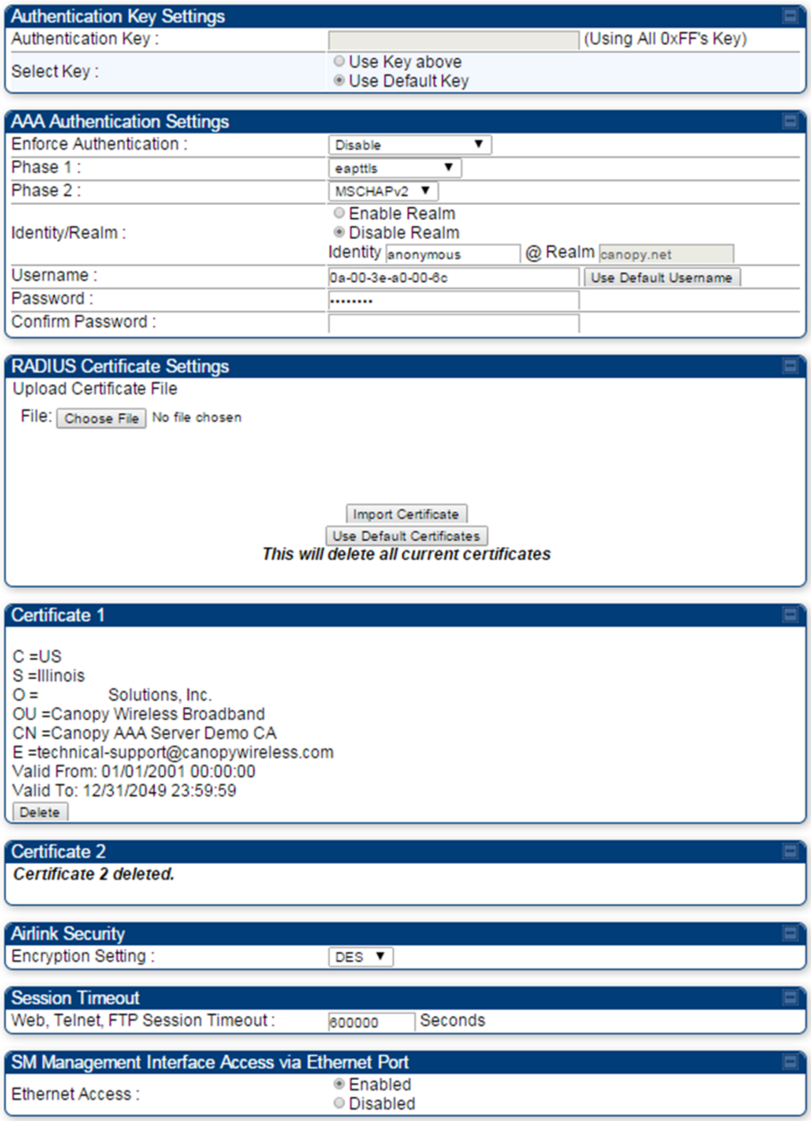
If it is desired that a SM will only authenticate to an AP that is using RADIUS, on the SM's Configuration Security tab set **Enforce Authentication** to **AAA**. With this enabled, SM does not register to an AP that has any **Authentication Mode** other than **RADIUS AAA** selected**.**

If it is desired that a SM use the authentication method configured on the AP it is registering to, set **Enforce Authentication** to **Disabled.** With **Enforce Authentication** disabled, a SM will attempt to register using whichever **Authentication Mode** is configured on the AP it is attempting to register to.

Note

Having SMs to use RADIUS by enabling **Enforce Authentication** avoids the security issue of SMs possibly registering to "rogue" APs, which have authentication disabled.

Table 161 SM Security tab attributes



Authentication Key Settings

Authentication Key :	(Using All 0xFF's Key)
Select Key :	○ Use Key above ● Use Default Key

AAA Authentication Settings

Enforce Authentication :	Disable ▼
Phase 1 :	eapttls ▼
Phase 2 :	MSCHAPv2 ▼
Identity/Realm :	○ Enable Realm ● Disable Realm Identity anonymous @ Realm canopy.net
Username :	0a-00-3e-a0-00-6c Use Default Username
Password :	·········
Confirm Password :	

RADIUS Certificate Settings

Upload Certificate File

File: Choose File No file chosen

Import Certificate

Use Default Certificates

This will delete all current certificates

Certificate 1

C =US
S =Illinois
O = Solutions, Inc.
OU =Canopy Wireless Broadband
CN =Canopy AAA Server Demo CA
E =technical-support@canopywireless.com
Valid From: 01/01/2001 00:00:00
Valid To: 12/31/2049 23:59:59
Delete

Certificate 2

Certificate 2 deleted.

Airlink Security

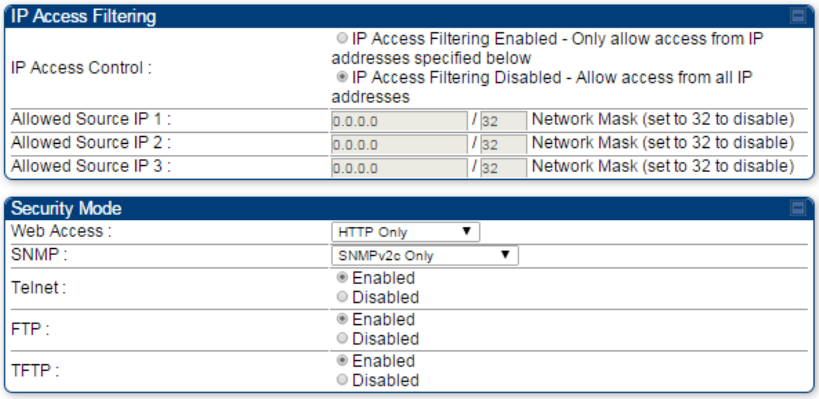
Encryption Setting :	DES ▼

Session Timeout

Web, Telnet, FTP Session Timeout :	600000 Seconds

SM Management Interface Access via Ethernet Port

Ethernet Access :	● Enabled ○ Disabled



IP Access Filtering

IP Access Control :	○ IP Access Filtering Enabled - Only allow access from IP addresses specified below ● IP Access Filtering Disabled - Allow access from all IP addresses
Allowed Source IP 1 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 2 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)
Allowed Source IP 3 :	0.0.0.0 / 32 Network Mask (set to 32 to disable)

Security Mode

Web Access :	HTTP Only ▼
SNMP :	SNMPv2c Only ▼
Telnet :	● Enabled ○ Disabled
FTP :	● Enabled ○ Disabled
TFTP :	● Enabled ○ Disabled

Attribute	Meaning
Authentication Key	The authentication key is a 32-character hexadecimal string used when **Authentication Mode** is set to **AP PreShared Key**. By default, this key is set to 0xFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF.
Select Key	This option allows operators to choose which authentication key is used: **Use Key above** means that the key specified in **Authentication Key** is used for authentication **Use Default Key** means that a default key (based off of the SM's MAC address) is used for authentication
Enforce Authentication	The SM may enforce authentication types of **AAA** and **AP Pre-sharedKey**. The SM will not finish the registration process if the AP is not using the configured authentication method (and the SM locks out the AP for 15 minutes). Enforce Authentication default setting is **Disable.**
Phase 1	The protocols supported for the **Phase 1** (Outside Identity) phase of authentication are EAPTTLS (Extensible Authentication Protocol Tunneled Transport Layer Security) or MSCHAPv2 (Microsoft Challenge-Handshake Authentication Protocol version 2).
Phase 2	Select the desired **Phase 2** (Inside Identity) authentication protocol from the **Phase 2** options of **PAP** (Password Authentication Protocol), **CHAP** (Challenge Handshake Authentication Protocol), and **MSCHAP** (Microsoft's version of CHAP, version 2 is used). The protocol must be consistent with the authentication protocol configured on the RADIUS server.

Identity/Realm	If Realms are being used, select **Enable Realm** and configure an outer identity in the **Identity** field and a Realm in the **Realm** field. These must match the Phase 1/Outer Identity and Realm configured in the RADIUS server. The default **Identity** is “anonymous”. The **Identity** can be up to 128 non-special (no diacritical markings) alphanumeric characters. The default **Realm** is “canopy.net”. The **Realm** can also be up to 128 non-special alphanumeric characters. Configure an outer Identity in the **Username** field. This must match the Phase 1/Outer Identity username configured in the RADIUS server. The default Phase 1/Outer Identity **Username** is “anonymous”. The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters.
Username	Enter a **Username** for the SM. This must match the username configured for the SM on the RADIUS server. The default **Username** is the SM’s MAC address. The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters.
Password	Enter the desired password for the SM in the **Password** and **Confirm Password** fields. The **Password** must match the password configured for the SM on the RADIUS server. The default **Password** is “password”. The **Password** can be up to 128 non-special (no diacritical markings) alphanumeric characters.
Confirm Password	
Upload Certificate File	To upload a certificate manually to a SM, first load it in a known place on your PC or network drive, then click on a **Delete** button on one of the Certificate description blocks to delete a certificate to provide space for your certificate. Click on **Choose File,** browse to the location of the certificate, and click the **Import Certificate** button, and then reboot the radio to use the new certificate. When a certificate is in use, after the SM successfully registers to an AP, an indication of **In Use** will appear in the description block of the certificate being used. The public certificates installed on the SMs are used with the private certificate on the RADIUS server to provide a public/private key encryption system. Up to 2 certificates can be resident on a SM. An installed certificate can be deleted by clicking the **Delete** button in the certificate’s description block on the Configuration > Security tab. To restore the 2 default certificates, click the **Use Default Certificates** button in the **RADIUS Certificate Settings** parameter block and reboot the radio.

Encryption Setting	Specify the type of airlink security to apply to this AP. The encryption setting must match the encryption setting of the SMs. **None** provides no encryption on the air link. **DES** (Data Encryption Standard): An over-the-air link encryption option that uses secret 56-bit keys and 8 parity bits. DES performs a series of bit permutations, substitutions, and recombination operations on blocks of data. DES encryption does not affect the performance or throughput of the system. **AES** (Advanced Encryption Standard)**:** An over-the-air link encryption option that uses the Rijndael algorithm and 128-bit keys to establish a higher level of security than DES. AES products are certified as compliant with the Federal Information Processing Standards (FIPS 197) in the U.S.A.
Web, Telnet, FTP Session Timeout	Enter the expiry in seconds for remote management sessions via HTTP, telnet or ftp access to the AP.
Ethernet Access	If you want to prevent any device that is connected to the Ethernet port of the SM from accessing the management interface of the SM, select **Ethernet Access Disabled**. This selection disables access through this port to via HTTP (the GUI), SNMP, telnet, FTP, and TFTP. With this selection, management access is available through only the RF interface via either an IP address (if **Network Accessibility** is set to **Public** on the SM) or the Session Status or Remote Subscribers tab of the AP. See **IP Access Control** below. If you want to allow management access through the Ethernet port, select **Ethernet Access Enabled**. This is the factory default setting for this parameter.
IP Access Control	You can permit access to the AP from any IP address (**IP Access Filtering Disabled**) or limit it to access from only one, two, or three IP addresses that you specify (**IP Access Filtering Enabled**). If you select **IP Access Filtering Enabled**, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted from any IP address
Allowed Source IP 1	If you selected **IP Access Filtering Enabled** for the **IP Access Control** parameter, then you must populate at least one of the three **Allowed Source IP** parameters or have no access permitted to the AP from any IP address. You may populate as many as all three. If you selected **IP Access Filtering Disabled** for the **IP Access Control** parameter, then no entries in this parameter are read, and access from all IP addresses is permitted.
Allowed Source IP 2	
Allowed Source IP 3	
Web Access	The Radio supports secured and non-secured web access protocols. Select suitable web access from drop down list: • **HTTP Only** – provides non-secured web access. The radio to be accessed via http://<IP of Radio>.

	• **HTTPS Only** – provides a secured web access. The radio to be accessed via https://<IP of Radio>. • **HTTP and HTTPS** – If enabled, the radio can be accessed via both http and https.
SNMP	This option allows to configure SNMP agent communication version. It can be selected from drop down list : • **SNMPv2c Only** – Enables SNMP v2 community protocol. • **SNMPv3 Only** – Enables SNMP v3 protocol. It is secured communication protocol. • **SNMPv2c and SNMPv3** – It enables both the protocols.
Telnet	This option allows to **Enable** and **Disable** Telnet access to the Radio.
FTP	This option allows to **Enable** and **Disable** FTP access to the Radio.
TFTP	This option allows to **Enable** and **Disable** TFTP access to the Radio.

SM - Phase 1 (Outside Identity) parameters and settings

The protocols supported for the **Phase 1** (Outside Identity) phase of authentication are

eapttls (Extensible Authentication Protocol Tunneled Transport Layer Security) and **eapMSChapV2** (Extensible Authentication Protocol – Microsoft Challenge-Handshake Authentication Protocol).

Configure an outer Identity in the **Username** field. This must match the Phase 1/Outer Identity username configured in the RADIUS server. The default Phase 1/Outer Identity **Username** is "anonymous". The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters. If Realms are being used in the RADIUS system (**eapttls** only), select **Enable Realm** and configure an outer identity in the **Identity** field and a Realm in the **Realm** field. These must match the Phase 1/Outer Identity and Realm configured in the RADIUS server. The default **Identity** is "anonymous". The **Identity** can be up to 128 non-special (no diacritical markings) alphanumeric characters. The default **Realm** is "canopy.net". The **Realm** can also be up to 128 non-special alphanumeric characters.

SM - Phase 2 (Inside Identity) parameters and settings

If using **eapttls** for Phase 1 authentication, select the desired **Phase 2** (Inside Identity) authentication protocol from the **Phase 2** options of **PAP** (Password Authentication Protocol), **CHAP** (Challenge Handshake Authentication Protocol), and **MSCHAPv2 (**Microsoft's version of CHAP). The protocol must be consistent with the authentication protocol configured on the RADIUS server. Enter a **Username** for the SM. This must match the username configured for the SM on the RADIUS server. The default **Username** is the SM's MAC address. The **Username** can be up to 128 non-special (no diacritical markings) alphanumeric characters.

Enter the desired password for the SM in the **Password** and **Confirm Password** fields. The **Password** must match the password configured for the SM on the RADIUS server. The default **Password** is "password". The **Password** can be up to 128 non-special (no diacritical markings) alphanumeric characters.

Handling Certificates

Managing SM Certificates via the SM GUI

The default public Canopy certificates are loaded into SMs upon factory software installation. The default certificates are not secure and are intended for use during lab and field trials as part of gaining experience with the RADIUS functionalities or as an option during debug. For secure operation, an operator will want to create or procure their own certificates. Resetting a SM to its factory defaults will remove the current certificates and restore the default certificates.

Up to two certificates can be resident on a SM. An installed certificate can be deleted by clicking the **Delete** button in the certificate's description block on the Configuration > Security tab. To restore the 2 default certificates, click the **Use Default Certificates** button in the **RADIUS Certificate Settings** parameter block and reboot the radio.

To upload a certificate manually to a SM, first load it in a known place on your PC or network drive, then click on a **Delete** button on one of the Certificate description blocks to delete a certificate to provide space for your certificate. Click on **Choose File,** browse to the location of the certificate, and click the **Import Certificate** button, and then reboot the radio to use the new certificate.

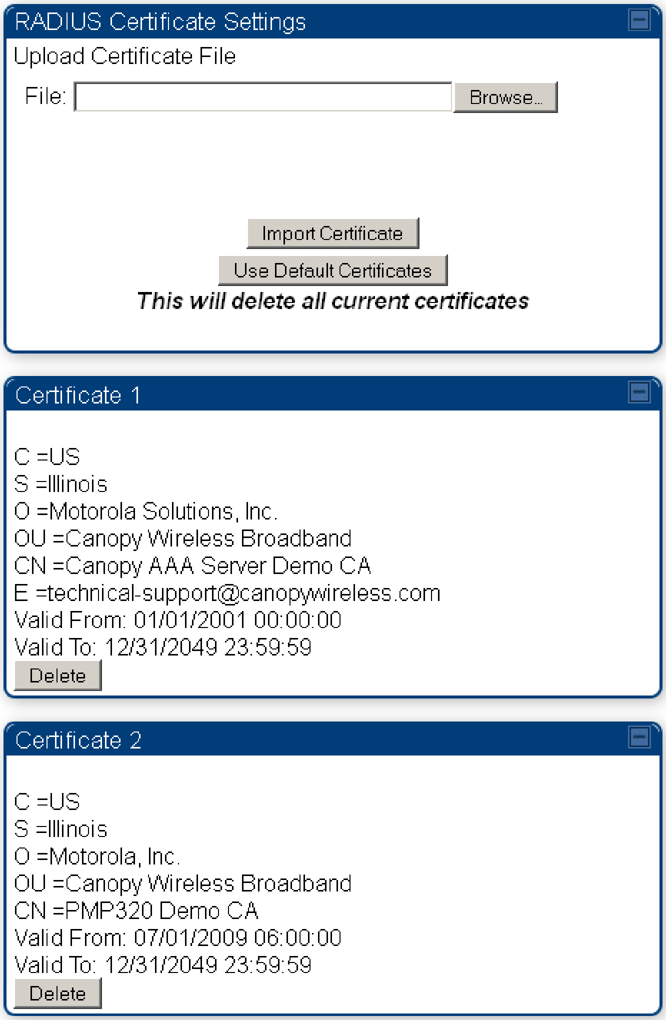
When a certificate is in use, after the SM successfully registers to an AP, an indication of **In Use** will appear in the description block of the certificate being used.

The public certificates installed on the SMs are used with the private certificate on the RADIUS server to provide a public/private key encryption system.

Note

Root certificates of more than one level (Example - a certificate from someone who received their CA from Verisign) fails. Certificates must be either root or self-signed.

Figure 137 SM Certificate Management



This will delete all current certificates

C =US
S =Illinois
O =Motorola Solutions, Inc.
OU =Canopy Wireless Broadband
CN =Canopy AAA Server Demo CA
E =technical-support@canopywireless.com
Valid From: 01/01/2001 00:00:00
Valid To: 12/31/2049 23:59:59

C =US
S =Illinois
O =Motorola, Inc.
OU =Canopy Wireless Broadband
CN =PMP320 Demo CA
Valid From: 07/01/2009 06:00:00
Valid To: 12/31/2049 23:59:59

Configuring RADIUS servers for SM authentication

Your RADIUS server must be configured to use the following:

- EAPTTLS or MSCHAPv2 as the Phase 1/Outer Identity protocol.
- If **Enable Realm** is selected on the SM's **Configuration** > **Security** tab, then the same Realm appears there (or access to it).
- The same Phase 2 (Inner Identity) protocol as configured on the SM's **Configuration** > **Security** tab under Phase 2 options.
- The username and password for each SM configured on each SM's **Configuration > Security** tab.
- An IP address and NAS shared secret that is the same as the IP address and **Shared Secret** configured on the AP's **Configuration > Security** tab for that RADIUS server.

- A server private certificate, server key, and CA certificate that complement the public certificates distributed to the SMs, as well as the Canopy dictionary file that defines Vendor Specific Attributes (VSAa). Default certificate files and the dictionary file are available from the software site: https://support.cambiumnetworks.com/files/pmp450 after entering your name, email address, and either Customer Contract Number or the MAC address of a module covered under the 12 month warranty.

Optionally, operators may configure the RADIUS server response messages (Accept or Reject) so that the user has information as to why they have been rejected. The AP displays the RADIUS Authentication Reply message strings in the Session Status list as part of each SM's information. The SM will show this string (listed as Authentication Response on the SM GUI) on the main Status page in the Subscriber Module Stats section.

Note

Aradial AAA servers only support operator-configurable Authentication Accept responses, not Authentication Reject responses.

Assigning SM management IP addressing via RADIUS

Operators may use a RADIUS AAA server to assign management IP addressing to SM modules (framed IP address). SMs now interpret attributes Framed-IP-Address, Framed-IP-Netmask, and Cambium-Canopy-Gateway from RADIUS. The RADIUS dictionary file has been updated to include the Cambium-Canopy-Gateway attribute and is available on the Cambium Software Support website.

In order for these attributes to be assigned and used by the SM, the following must be true:

- The system is configured for AAA authentication
- The SM is *not* configured for DHCP on its management interface. If DHCP is enabled and these attributes are configured in the RADIUS server, the attributes is ignored by the SM.
- The SM management interface must be configured to be publically accessible. If the SM is configured to have local accessibility, the management interface will still be assigned the framed addressing, and the SM iscome publicly accessible via the assigned framed IP addressing.
- When using these attributes, for the addressing to be implemented by the SM operators must configure Framed-IP-Address in RADIUS. If Framed-IP-Address is not configured but Framed-IP-Netmask and/or Cambium-Canopy-Gateway is configured, the attributes is ignored. In the case where only the Framed-IP-Address is configured, Framed-IP-Netmask defaults to 255.255.0.0 (NAT disabled) / 255.255.255.0 (NAT enabled) and Cambium-Canopy-Gateway defaults to 0.0.0.0.

Configuring RADIUS server for SM configuration

Canopy Vendor Specific Attributes (VSAs) along with VSA numbers and other details are listed in Table 162. The associated SM GUI page, tab and parameter are listed to aid cross-referencing and understanding of the VSAs.

A RADIUS dictionary file is available from the software site:

https://support.cambiumnetworks.com/files/pmp450

The RADIUS dictionary file defines the VSAs and their values and is usually imported into the RADIUS server as part of server and database setup.

Note

Beginning with System Release 12.0.2, two RADIUS dictionary files are available on the Cambium website – “RADIUS Dictionary file – Cambium” and “RADIUS Dictionary file – Motorola”.

In addition to a renaming of attributes, the Cambium-branded dictionary file contains two new VSAs for controlling uplink and downlink Maximum Burst Data Rate (these VSAs are listed below in Table 162).

If you are transitioning from the Motorola-branded dictionary file to the Cambium-branded dictionary file, ensure that all RADIUS profiles containing Motorola-Canopy attribute references are updated to include Cambium-Canopy attribute references (for all applicable VSAs listed in Table 162). Also, ensure that all RADIUS configuration files reference the new dictionary file (as an alternative, operators may rename the Cambium-branded dictionary file to the filename currently in use by the RADIUS server). Once the profiles are updated and the new Cambium-branded dictionary file is installed on the RADIUS server, restart the RADIUS server to ensure that the new VSAs and attribute names are enabled.

Table 162 RADIUS Vendor Specific Attributes (VSAs)

Name	Number	Type	Required	Value	
MS-MPPE-Send-Key*	26.311.16	-	Y	-	
-				-	-
MS-MPPE-Recv-Key*	26.311.17	-	Y	-	
-				-	-
Cambium-Canopy-LPULCIR	26.161.1	integer	N	0-65535 kbps	
Configuration > Quality of Service > Low Priority Uplink CIR				0 kbps	32 bits
Cambium-Canopy-LPDLCIR	26.161.2	integer	N	0-65535 kbps	
Configuration > Quality of Service > Low Priority Downlink CIR				0 kbps	32 bits
Cambium-Canopy-HPULCIR	26.161.3	integer	N	0-65535 kbps	
Configuration > Quality of Service > Hi Priority Uplink CIR				0 kbps	32 bits
Cambium-Canopy-HPDLCIR	26.161.4	integer	N	0-65535 kbps	
Configuration > Quality of Service > Hi Priority Uplink CIR				0 kbps	32 bits
Cambium-Canopy-HPENABLE	26.161.5	integer	N	0-disable, 1-enable	
Configuration > Quality of Service > Hi Priority Channel Enable/Disable				0	32 bits
26.161.6		integer	N	0-100000 kbps	

Configuration > Quality of Service > Sustained Uplink Data Rate				dependent on radio feature set	32 bits
Cambium-Canopy-ULBL	26.161.7	integer	N	0-2500000 kbps	
Configuration > Quality of Service > Uplink Burst Allocation				dependent on radio feature set	32 bits
Cambium-Canopy-DLBR	26.161.8	integer	N	0-100000 kbps	
Configuration > Quality of Service > Sustained Downlink Data Rate				dependent on radio feature set	32 bits
Cambium-Canopy-DLBL	26.161.9	integer	N	0-2500000 kbps	
Configuration > Quality of Service > Downlink Burst Allocation				dependent on radio feature set	32 bits
Cambium-Canopy-VLLEARNEN	26.161.14	integer	N	0-disable, 1-enable	
Configuration > VLAN > Dynamic Learning				1	32 bits
Cambium-Canopy-VLFRAMES	26.161.15	integer	N	0-all, 1-tagged, 2-untagged	
Configuration > VLAN > Allow Frame Types				0	32 bits
Cambium-Canopy-VLIDSET	26.161.16	integer	N	VLAN Membership (1-4094)	
Configuration > VLAN Membership				0	32 bits
Cambium-Canopy-VLAGETO	26.161.20	integer	N	5 - 1440 minutes	
Configuration > VLAN > VLAN Aging Timeout				25 mins	32 bits
Cambium-Canopy-VLIGVID	26.161.21	integer	N	1 – 4094	
Configuration > VLAN > Default Port VID				1	32 bits
Cambium-Canopy-VLMGVID	26.161.22	integer	N	1 – 4094	
Configuration > VLAN > Management VID				1	32 bits
Cambium-Canopy-VLSMMGPASS	26.161.23	integer	N	0-disable, 1-enable	
Configuration > VLAN > SM Management VID Pass-through				1	32 bits
Cambium-Canopy-BCASTMIR	26.161.24	integer	N	0-100000 kbps, 0=disabled	
Configuration > Quality of Service > Broadcast/Multicast Uplink Data Rate				dependent on radio feature set	32 bits
Cambium-Canopy-Gateway	26.161.25	ipaddr	N	-	
Configuration > IP > Gateway IP Address				0.0.0.0	-

Cambium-Canopy-ULMB	26.161.26	integer	N	0-100000 kbps	
Configuration > Quality of Service > Max Burst Uplink Data Rate				0	32 bits
Cambium-Canopy-DLMB	26.161.27	integer	N	0-100000 kbps	
Configuration > Quality of Service > Max Burst Downlink Data Rate				0	32 bits
Cambium-Canopy-UserLevel	26.161.50	integer	N	1-Technician, 2-Installer, 3-Administrator	
Account > Add User > Level				0	32 bits
Cambium-Canopy-DHCP-State	26.161.31	integer	N	1-Enable	
Configuration > IP > DHCP state				1	32 bits
Cambium-Canopy-BCASTMIRUNITS	26.161.28	integer	N		
Configuration > QoS > Broadcast Downlink CIR				0	32 bits
Cambium-Canopy-ConfigFileImportUrl	26.161.29	string	N		
Configuration > Unit Settings				0	32 bits
Cambium-Canopy-ConfigFileExportUrl	26.161.30	string	N		
Configuration > Unit Settings				0	32 bits
Cambium-Canopy-UserMode	26.161.51	integer	N	1=Read-Only 0=Read-Write	
Account > Add User > User Mode				0	32 bits

(*) Contains key for encrypting packets sent by the NAS to the remote host (for Microsoft Point-to-Point Encryption Protocol).

Note

VSA numbering:

26 connotes Vendor Specific Attribute, per RFC 2865

26.311 is Microsoft Vendor Code, per IANA

Configuring RADIUS server for SM configuration using Zero Touch feature

The RADIUS VSA (Vendor Specific Attributes) is updated for Zero Touch feature. This feature enables the ability for a SM to get its configuration via RADIUS VSA. The RADIUS VSA is updated for an URL which points to the configuration file of SM (see Table 162 for list of VSA).

The RADIUS will push the vendor specific attribute to SM after successful authentication. The VSA contains URL of config file which will redirect SM to download configuration. If there is any change in SM confirmation, the SM will reboot automatically after applying the configuration.

The RADIUS VSA attributes concerning Zero Touch are as follows:

```
VSA                                     Type       String


Cambium-Canopy-ConfigFileImportUrl (29) string  Maximum Length 127
characters.
Cambium-Canopy-ConfigFileExportUrl (30) string  Maximum Length 127
characters.
```

The updated RADIUS dictionary can be downloaded from below link:

https://support.cambiumnetworks.com/files/pmp450/

Note

The feature is not applicable to the AP.

Using RADIUS for centralized AP and SM user name and password management

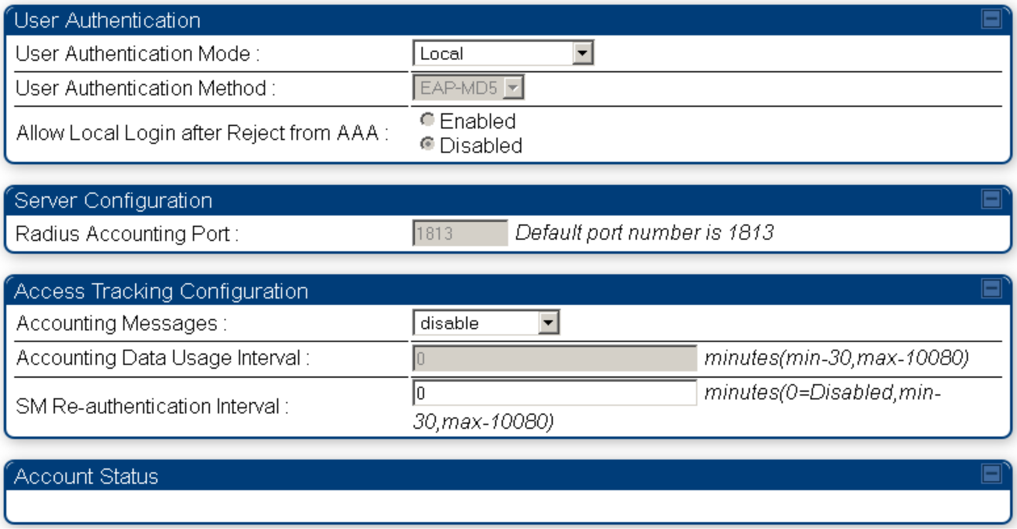
AP – Technician/Installer/Administrator Authentication

To control technician, installer, and administrator access to the AP from a centralized RADIUS server:

Procedure 28 Centralized user name and password management for AP

1. Set **Authentication Mode** on the AP's Configuration > Security tab to **RADIUS AAA**
2. Set **User Authentication Mode** on the AP's Account > User Authentication tab (the tab only appears after the AP is set to RADIUS authentication) to **Remote** or **Remote then Local**.
   - **Local**: The local SM is checked for accounts. No centralized RADIUS accounting (access control) is performed.
   - **Remote**: Authentication by the centralized RADIUS server is required to gain access to the SM if the SM is registered to an AP that has **RADIUS AAA Authentication Mode** selected. For up to 2 minutes a test pattern is displayed until the server responds or times out.
   - **Remote then Local**: Authentication using the centralized RADIUS server is attempted. If the server sends a reject message, then the setting of **Allow Local Login after Reject from AAA** determines if the local user database is checked or not. If the configured servers do not respond within 2 minutes, then the local user database is used. The successful login method is displayed in the navigation column of the SM.

Figure 138 User Authentication and Access Tracking tab of the AP



User Authentication

User Authentication Mode : Local

User Authentication Method : EAP-MD5

Allow Local Login after Reject from AAA : ○ Enabled ● Disabled

Server Configuration

Radius Accounting Port : 1813 *Default port number is 1813*

Access Tracking Configuration

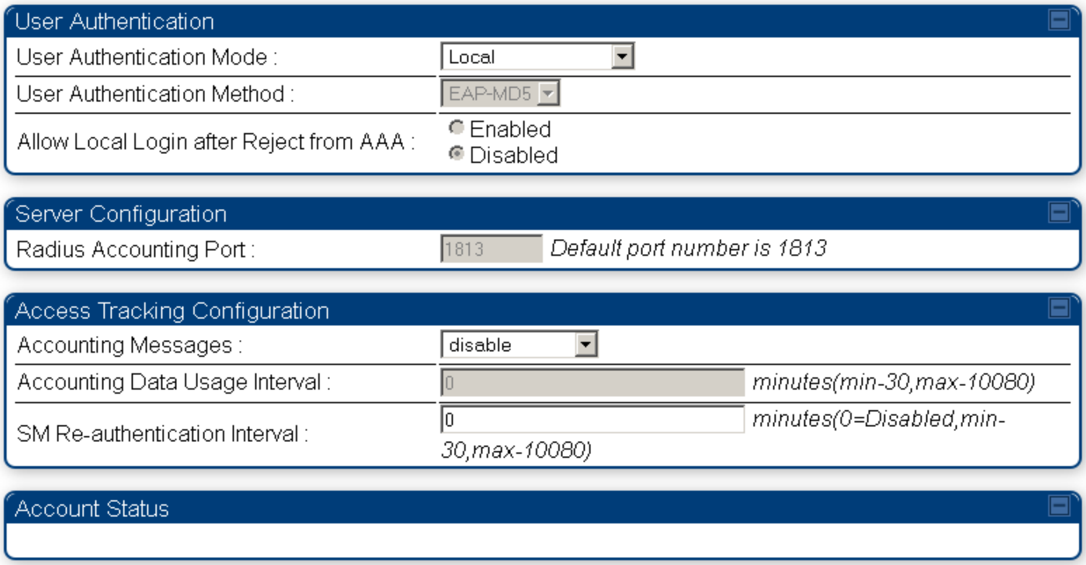
Accounting Messages : disable

Accounting Data Usage Interval : 0 *minutes(min-30,max-10080)*

SM Re-authentication Interval : 0 *minutes(0=Disabled,min-30,max-10080)*

Account Status

Table 163 AP User Authentication and Access Tracking attributes



User Authentication

User Authentication Mode : Local

User Authentication Method : EAP-MD5

Allow Local Login after Reject from AAA : ○ Enabled ● Disabled

Server Configuration

Radius Accounting Port : 1813 *Default port number is 1813*

Access Tracking Configuration

Accounting Messages : disable

Accounting Data Usage Interval : 0 *minutes(min-30,max-10080)*

SM Re-authentication Interval : 0 *minutes(0=Disabled,min-30,max-10080)*

Account Status

Attribute	Meaning
User Authentication Mode	• **Local**: The local SM is checked for accounts. No centralized RADIUS accounting (access control) is performed. • **Remote**: Authentication by the centralized RADIUS server is required to gain access to the AP. For up to 2 minutes a test pattern is displayed until the server responds or times out. • **Remote then Local**: Authentication using the centralized RADIUS server is attempted. If the server sends a reject message, then the setting of **Allow Local Login after Reject from AAA** determines if the local user database is checked or not. If the configured servers do not respond within 2 minutes, then the local user database is used. The successful login method is displayed in the navigation column of the AP.
User Authentication Method	The user authentication method employed by the radios is EAP-MD5.
Allow Local Login after Reject from AAA	If a user authentication is rejected from the AAA server, the user is allowed to login locally to the radio's management interface.
Radius Accounting Port	The destination port on the AAA server used for Radius accounting communication.
Accounting Messages	disable – no accounting messages are sent to the RADIUS server deviceAccess – accounting messages are sent to the RADIUS server regarding device access (see Table 165). dataUsage – accounting messages are sent to the RADIUS server regarding data usage (see Table 165).
Accounting Data Usage Interval	The interval for which accounting data messages are sent from the radio to the RADIUS server. If 0 is configured for this parameter, no data usage messages are sent.

SM Re-authentication Interval	The interval for which the SM will re-authenticate to the RADIUS server.

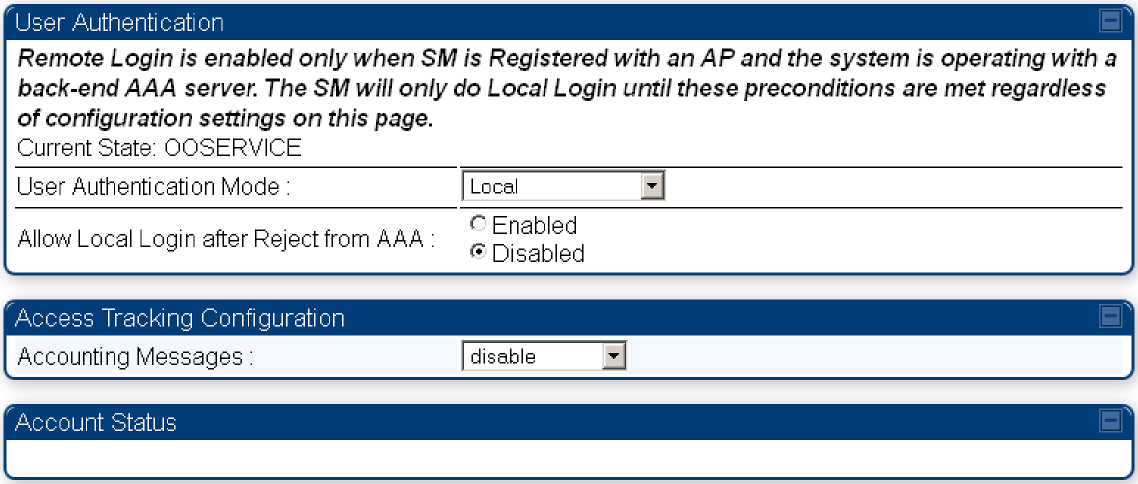
SM – Technician/Installer/Administrator Authentication

The centralized user name and password management for SM is same as AP. Follow AP – Technician/Installer/Administrator Authentication on page 7-302 procedure.

Note

Remote access control is enabled only after the SM registers to an AP that has **Authentication Mode** set to **RADIUS AAA**. Local access control will always be used before registration and is used after registration if the AP is not configured for RADIUS.

Figure 139 User Authentication and Access Tracking tab of the SM



User Authentication

Remote Login is enabled only when SM is Registered with an AP and the system is operating with a back-end AAA server. The SM will only do Local Login until these preconditions are met regardless of configuration settings on this page.

Current State: OOSERVICE

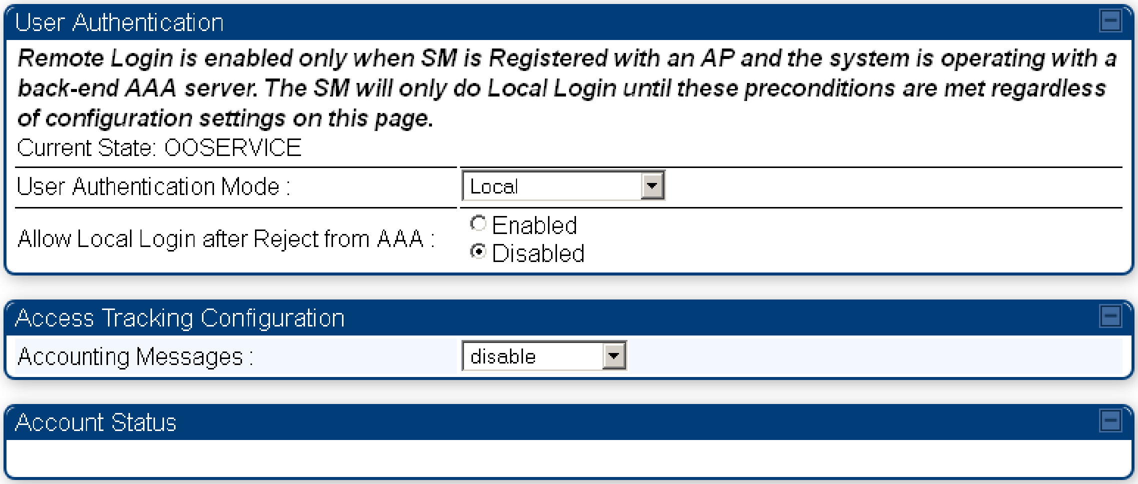
User Authentication Mode :	Local
Allow Local Login after Reject from AAA :	○ Enabled ● Disabled

Access Tracking Configuration

Accounting Messages :	disable

Account Status

Table 164 SM User Authentication and Access Tracking attributes



User Authentication

Remote Login is enabled only when SM is Registered with an AP and the system is operating with a back-end AAA server. The SM will only do Local Login until these preconditions are met regardless of configuration settings on this page.

Current State: OOSERVICE

User Authentication Mode :	Local
Allow Local Login after Reject from AAA :	○ Enabled ● Disabled

Access Tracking Configuration

Accounting Messages :	disable

Account Status

Attribute	Meaning
User Authentication Mode	• **Local**: The local SM is checked for accounts. No centralized RADIUS accounting (access control) is performed. • **Remote**: Authentication by the centralized RADIUS server is required to gain access to the SM if the SM is registered to an AP that has **RADIUS AAA Authentication Mode** selected. For up to 2 minutes a test pattern is displayed until the server responds or times out. • **Remote then Local**: Authentication using the centralized RADIUS server is attempted. If the server sends a reject message, then the setting of **Allow Local Login after Reject from AAA** determines if the local user database is checked or not. If the configured servers do not respond within 2 minutes, then the local user database is used. The successful login method is displayed in the navigation column of the SM.
Allow Local Login after Reject from AAA	If a user authentication is rejected from the AAA server, the user is allowed to login locally to the radio’s management interface. It is applicable ONLY when the **User Authentication Mode** is set to “**Remote then Local**”. **Note** When the radio User Authentication Mode is set to “Local” or “Remote”, the Allow Local Login after Reject from AAA does not any effect.
Accounting Messages	• disable – no accounting messages are sent to the RADIUS server • deviceAccess – accounting messages are sent to the RADIUS server regarding device access (see Table 165).

Access Tracking

To track logon and logoff times on individual radios by technicians, installers, and administrators, on the AP or SM's **Account** > **User Authentication and Access Tracking** tab under **Accounting** (Access Tracking) set **Accounting Messages** to "deviceAccess".

Device Access Tracking is enabled separately from **User Authentication Mode**. A given AP or SM can be configured for both, either, or neither.

RADIUS Device Data Accounting

PMP 450 Platform systems include support for RADIUS accounting messages for usage-based billing. This accounting includes indications for subscriber session establishment, subscriber session disconnection, and bandwidth usage per session for each SM that connects to the AP. The attributes included in the RADIUS accounting messages are shown in the table below.

Table 165 Device data accounting RADIUS attributes

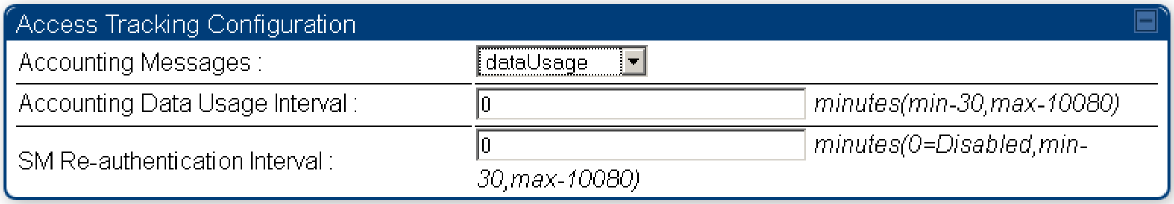
Sender	Message	Attribute	Value	Description
AP	Accounting-Request	Acct-Status-Type	1 - Start	This message is sent every time a SM registers with an AP, and after the SM stats are cleared.
		Acct-Session-Id	Unique per AP session. Initial value is SM MAC, and increments after every start message sent of an in session SM.	
		Event-Timestamp	UTC time the event occurred on the AP	
AP	Accounting-Request	Acct-Status-Type	2 - Stop	This message is sent every time a SM becomes unregistered with an AP, and when the SM stats are cleared.
		Acct-Session-Id	Unique per AP session. Initial value is SM MAC, and increments after every start message sent of an in session SM.	
		Acct-Input-Octets	Sum of the input octets received at the SM over regular data VC and the high priority data VC (if enabled). Will not include broadcast.	
		Acct-Output-Octets	Sum of the output octets sent from the SM over regular data VC and the high priority data VC (if enabled).	

Sender	Message	Attribute	Value	Description
		Acct-Input-Gigawords	Number of times the Acct-Input-Octets counter has wrapped around 2^32 over the course of the session	
		Acct-Output-Gigawords	Number of times the Acct-Output-Octets counter has wrapped around 2^32 over the course of the session	
		Acct-Input-Packets	Sum of unicast and multicast packets that are sent to a particular SM over the regular data VC and the high priority data VC (if enabled). It will not include broadcast.	
		Acct-Output-Packets	Sum of unicast and multicast packets that are sent from a particular SM over the regular data VC and the high priority data VC (if enabled).	
		Acct-Session-Time	Uptime of the SM session.	
		Acct-Terminate-Cause	Reason code for session termination	
AP	Accounting-Request	Acct-Status-Type	3 - Interim-Update	This message is sent periodically per the operator configuration on the AP in seconds. Interim update counts are cumulative over the course of the session
		Acct-Session-Id	Unique per AP session. Initial value is SM MAC, and increments after every start message sent of an in session SM.	
		Acct-Input-Octets	Sum of the input octets sent to the SM over regular data VC and the high priority data VC (if enabled). Will not include broadcast.	
		Acct-Output-Octets	Sum of the output octets set from the SM over regular data VC and the high priority data VC (if enabled).	

Sender	Message	Attribute	Value	Description
		Acct-Input-Gigawords	Number of times the Acct-Input-Octets counter has wrapped around 2^32 over the course of the session	
		Acct-Output-Gigawords	Number of times the Acct-Output-Octets counter has wrapped around 2^32 over the course of the session	
		Acct-Session-Time	Uptime of the SM session.	
		Acct-Input-Packets	Sum of unicast and multicast packets that are sent to a particular SM over the regular data VC and the high priority data VC (if enabled). It will not include broadcast.	
		Acct-Output-Packets	Sum of unicast and multicast packets that are sent from a particular SM over the regular data VC and the high priority data VC (if enabled).	

The data accounting configuration is located on the AP's **Accounts** > **User Authentication and Access Tracking** GUI menu, and the AP's **Authentication Mode** must be set to **Radius AAA** for the menu to appear. The accounting may be configured via the AP GUI as shown in the figures below. By default accounting messages are not sent and the operator has the choice of configuring to send only Device Access accounting messages (when a user logs in or out of the radio), only Data Usage messages, or both. When Data Accounting is enabled, the operator must specify the interval of when the data accounting messages are sent (0 – disabled, or in the range of 30-10080 minutes). The default interval is 30 minutes.

Figure 140 RADIUS accounting messages configuration



Access Tracking Configuration

Accounting Messages :	dataUsage
Accounting Data Usage Interval :	0 minutes(min-30,max-10080)
SM Re-authentication Interval :	0 minutes(0=Disabled,min-30,max-10080)

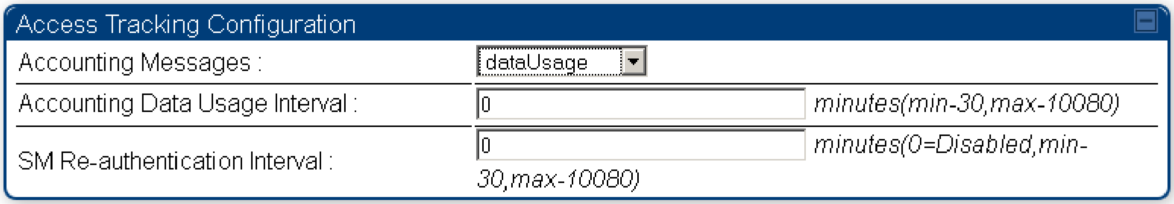
The data accounting message data is based on the SM statistics that the AP maintains, and these statistics may be cleared on the AP by an operator. If an operator clears these messages and data accounting is enabled, an accounting stop message is sent followed by an accounting start message to notify the AAA of the change.

If an operator clears the VC statistics on the device through the management GUI, a RADIUS stop message and data start message is issued for each device affected. The start and stop messages will only be sent once every 5 minutes, so if an operator clears these statistics multiple times within 5 minutes, only one set of data stop/start messages is sent. This may result in inaccurate data accumulation results.

RADIUS Device Re-authentication

PMP 450 Platform systems include support for periodic SM re-authentication in a network without requiring the SM to re-register (and drop the session). The re-authentication may be configured to occur in the range of every 30 minutes to weekly.

Figure 141 Device re-authentication configuration



Access Tracking Configuration

Accounting Messages :	dataUsage
Accounting Data Usage Interval :	0 *minutes(min-30,max-10080)*
SM Re-authentication Interval :	0 *minutes(0=Disabled,min-30,max-10080)*

The re-authentication interval is only configurable on the AP. When this feature is enabled, each SM that enters the network will re-authenticate each the interval time has expired without dropping the session. The response that the SM receives from the AAA server upon re-authentication is one of the following:

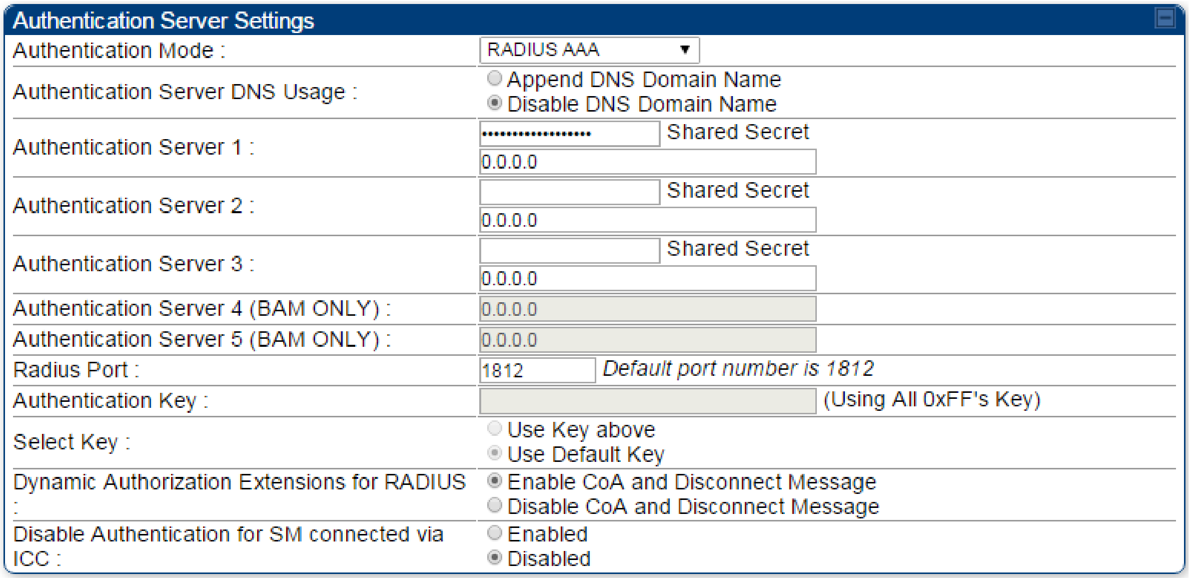
- **Success**: The SM continues normal operation
- **Reject**: The SM de-registers and will attempt network entry again after 1 minute and then if rejected will attempt re-entry every 15 minutes
- **Timeout or other error**: The SM remains in session and attempt 5 times to re-authenticate with the RADIUS-REQUEST message. If these attempts fail, then the SM will go out of session and proceed to re-authenticate after 5 minutes, then every 15 minutes.

Although re-authentication is an independent feature, it was designed to work alongside with the RADIUS data usage accounting messages. If a user is over their data usage limit the network operator can reject the user from staying in the network. Operators may configure the RADIUS ‘Reply-Message’ attribute with an applicable message (i.e. “Data Usage Limit Reached”) that is sent to the subscriber module and displayed on the general page.

RADIUS Change of Authorization and Disconnect Message

Prior to this feature, SM will get configuration parameters from a RADIUS server during authentication process. This feature allows an administrator to control configuration parameters in the SM while SM is in session. The configuration changes in SM are done using RADIUS Change of Authorization method (RFC 3576) on the existing RADIUS authentication framework for AP and SM. A typical use case could be changing the QOS parameters after a certain amount of bandwidth usage by a SM.

Figure 142 RADIUS CoA configuration for AP



Authentication Server Settings

Authentication Mode :	RADIUS AAA ▼
Authentication Server DNS Usage :	○ Append DNS Domain Name ● Disable DNS Domain Name
Authentication Server 1 :	•••••••••••••••••• Shared Secret 0.0.0.0
Authentication Server 2 :	Shared Secret 0.0.0.0
Authentication Server 3 :	Shared Secret 0.0.0.0
Authentication Server 4 (BAM ONLY) :	0.0.0.0
Authentication Server 5 (BAM ONLY) :	0.0.0.0
Radius Port :	1812 *Default port number is 1812*
Authentication Key :	(Using All 0xFF's Key)
Select Key :	○ Use Key above ● Use Default Key
Dynamic Authorization Extensions for RADIUS :	● Enable CoA and Disconnect Message ○ Disable CoA and Disconnect Message
Disable Authentication for SM connected via ICC :	○ Enabled ● Disabled

The RADIUS CoA feature enables initiating a bi-directional communication from the RADIUS server(s) to the AP and SM.

The AP listens on UDP port 3799 and accepts CoA requests from the configured RADIUS servers. This CoA request should contain SM MAC address in 'User-Name' attribute as identifier and all other attributes which control the SM config parameters. For security reasons, a timestamp also needs to be added as 'Event-Timestamp' attribute. Hence the time should also be synchronized between the RADIUS server(s) and the AP to fit within a window of 300 seconds.

Once the configuration changes are applied on the SM, CoA-ACK message is sent back to RADIUS server. If the validation fails, the AP sends a CoA-NACK response to the RADIUS server with proper error code.

A **Disconnect-Message** is sent by the RADIUS server to NAS in order to terminate a user session on a NAS and discard all associated session context. It is used when the authentication AAA server wants to disconnect the user after the session has been accepted by the RADIUS.

In response of Disconnect-Request from RADIUS server, the NAS sends a Disconnect-ACK if all associated session context is discarded, or a Disconnect-NACK, if the NAS is unable to disconnect the session.

Note

The RADIUS CoA feature will only enabled if Authentication mode is set to RADIUS AAA.