



# SOFTWARE USER GUIDE

## ePMP

Release 5.10.2



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# About This Guide

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This guide describes the planning, installation, configuration, and operation of the Cambium ePMP Series of point-to-multipoint and point-to-point wireless Ethernet systems. It is intended for use by the system designer, system installer, and system administrator.

## Precautionary statements

This section explains the precautionary statements used in this document.

### Warning

Precautionary statements with the Warning tag precede instructions that contain potentially hazardous situations. Warnings are used to alert the reader to possible hazards that could cause loss of life or physical injury. A warning has the following format:



#### Warning

Text and consequence for not following the instructions in the warning.

## Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.



#### Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.



## IMPORTANT NOTE

### FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 30 cm between the radiator and your body.

## IC Interference Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

*Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes:*

*(1) Cet appareil ne doit pas provoquer d'interférences.*

*(2) Cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.*

IC MPE distance: 20 cm



### Warning

Devices shall not be used for control of or communications with unmanned aircraft systems.  
Les appareils ne doivent pas être utilisés pour contrôler ou communiquer avec des systèmes d'aéronefs sans pilote.



### Warning

Operation on oil platforms, automobiles, trains, maritime vessels and aircraft shall be prohibited.  
L'exploitation sur les plates-formes pétrolières, les automobiles, les trains, les navires maritimes et les aéronefs est interdite.



### Warning

The antenna height shall be determined by the installer or operator of the standard-power access point or fixed client device, or by automatic means. This information shall be stored internally in the device. Provision of accurate device information is mandatory.  
La hauteur de l'antenne doit être déterminée par l'installateur ou l'opérateur du point d'accès à puissance standard ou de l'appareil client fixe, ou par des moyens automatiques. Ces informations doivent être stockées en interne dans l'appareil. La fourniture d'informations précises sur l'appareil est obligatoire.



## IMPORTANT NOTE

### IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

*Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.*

## Attention

Precautionary statements with the Attention tag precede instructions that are used when there is a possibility of damage to systems, software, or individual items of equipment within a system. However, this damage presents no danger to personnel. An attention statement has the following format:



### Attention

Text and consequence for not following the instructions.

## Note

Precautionary statements with the Note tag indicate the possibility of an undesirable situation or provide additional information to help the reader understand a topic or concept. A note has the following format:



### Note

Text.

# Compatibility Matrix

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This Release 5.10.2 is applicable to the following products:

- ePMP 4600
- ePMP 4500
- ePMP 4500L
- ePMP 4500C
- ePMP 4600L
- Force 4625
- Force 4525
- Force 4525L
- Force 4600C
- ePMP 3000x
- Force 300-xx

## Backward Compatibility Matrix

A backward compatibility matrix for 5.x.x shows how newer software versions work with older hardware, software, or system components. It helps users determine which older systems are compatible with updates, ensuring smooth upgrades and minimizing potential issues.

Model	Software Version 4.x.x	Software Version 5.x.x
<b>AC Platform</b>		
ePMP 3000	Supported	Supported
Force 300-16	Supported	Supported
ePMP 3000L	Supported	Supported
Force 300	Supported	Supported
Force 300-13	Supported	Supported
Force 300-19	Supported	Supported
Force 300-19R	Supported	Supported
ePMP Client MAXrP	Supported	Supported
Force 300-25	Supported	Supported
Force 300-25L	Supported	Supported
Force 300 CSML	Supported	Supported

Model	Software Version 4.x.x	Software Version 5.x.x
Force 300-13L	Supported	Supported
<b>AX Platform</b>		
ePMP 4600	-	Supported
ePMP 4500	-	Supported
ePMP 4500C	-	Supported
ePMP 4600L	-	Supported
ePMP 4500L	-	Supported
Force 425	-	Supported
Force 400C	-	Supported
Force 4600C	-	Supported
Force 4518	-	Supported
Force 4525	-	Supported
Force 4525L	-	Supported
Force 4625	-	Supported

## MU-MIMO

The ePMP MU-MIMO AP is equipped either with a sector antenna array or a pseudo-omni antenna. Antenna diversity allows simultaneous DL transmissions for two subscriber modules for MU-MIMO. As such, the ePMP 4600 AP's DL throughput capacity is significantly increased versus the ePMP 1000/2000 APs.

This is a contrast to a traditional wireless system, where two subscribers cannot communicate on the same channel to the same AP at the same time without causing significant self-interference and degrading the overall wireless network performance.

## OFDM and channel bandwidth

ePMP transmits using Orthogonal Frequency Division Multiplexing (OFDM). This wideband signal consists of many equally spaced sub-carriers. Although each subcarrier is modulated at a low rate using conventional modulation schemes, the resultant data rate from all the sub-carriers is high.

The channel bandwidth of the OFDM signal is 20 MHz, 40 MHz, or 80 MHz, based on operator configuration. For 6 GHz, 160 MHz bandwidth is also supported.

Each channel is offset in center frequency from its neighboring channel by 5 MHz.

# Using the Device Management Interface

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This section describes all configuration and alignment tasks that are performed while deploying the ePMP system.

Perform the following tasks while configuring the ePMP devices:

- [Preparing for configuration](#)
- [Connecting to the unit](#)
- [Using the web interface](#)
- [Using the installation wizard - Access Point](#)
- [Using the installation wizard - Subscriber Module](#)
- [Using the menu options](#)

## Preparing for configuration

This section describes the actions to be performed before proceeding with the unit configuration. It has the following topics:

- [Safety precautions](#)
- [Regulatory compliance](#)

## Safety precautions

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



### Warning

Ensure that personnel is not exposed to unsafe levels of RF energy. The units start to radiate as soon as they are powered up. Respect the safety standards defined in [Compliance with safety standards](#), in particular, the minimum separation distances.

Observe the following guidelines:

- Never work in front of the antenna when the device is powered on.
- Always switch off the power supply before connecting or disconnecting the Ethernet cable from the module.

## Regulatory compliance

All applicable radio regulations must be followed while configuring the units and aligning the antennas. For more information, refer to [Compliance with safety standards](#) section.

## GPS functionality and privacy notice

This section explains whether Cambium Networks ePMP devices clearly describe any external sensing features that may affect user or subscriber privacy. These features can include microphones, cameras, biometric scanners, or other sensors that collect personal or environmental data.

Cambium ePMP devices do not include microphones, cameras, or biometric scanners. However, some models have built-in GPS modules, which are a type of external sensor and may raise privacy concerns.

The ePMP user documentation includes the following information about GPS functionality:

- **Synchronization:** GPS is used on sync-capable ePMP devices to keep accurate time across the network. This allows to reduce interference and better use of the wireless spectrum.
- **Geo-Location:** The GPS module detects the geographic location of the device. This location data is visible in the device's user interface as well as in the cnMaestro network management system.
- **AFC Support:** In countries that follow FCC rules, GPS location data is needed to support Automated Frequency Coordination (AFC), which ensures legal use of wireless frequencies.

## Connecting to the unit

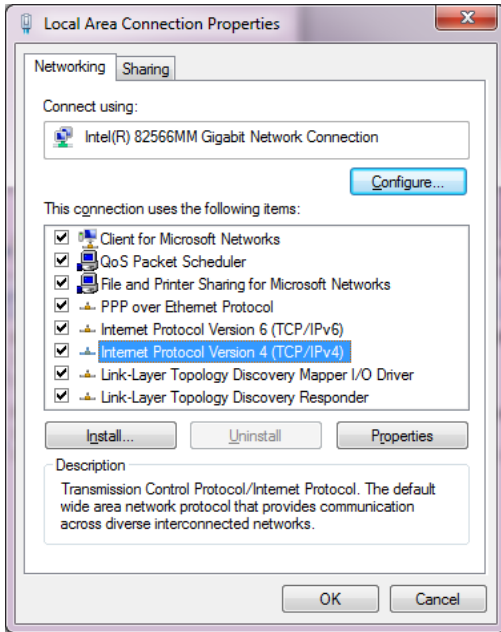
To connect the unit to management PC, perform the following procedures:

- [Configuring the management PC](#)
- [Connecting to the a PC and powering up](#)

## Configuring the management PC

Perform the following steps to configure the local management PC to communicate with the ePMP module:

1. Select **Properties** for the Ethernet port.  
For Windows 7, navigate to **Control Panel > Network and Internet > Network Connections > Local Area Connection**.
2. Select the **Internet Protocol (TCP/IP)** option.
3. Click **Properties**.



4. Enter an IP address that is valid for the 169.254.1.x network, avoiding 169.254.1.1. For example, 169.254.1.100.
5. Enter a subnet mask of **255.255.255.0**.  
Leave the default gateway blank.
6. Click **OK** and then click **Close**.

## Connecting to a PC and powering up

Connect a management PC directly to the ePMP device to configure, align, and to power up the ePMP device. To connect the PC to the device, perform the following steps:

1. Verify that the device and power supply are connected correctly (the device Ethernet port is connected to the power supply Ethernet power port (**Gigabit Data+Power** or **10/100Mbit Data+Power**)).
2. Connect the PC Ethernet port to the LAN ( **Gigabit Data** or **10/100Mbit Data**) port of the power supply using a standard (not crossed) Ethernet cable.
3. Apply main or battery power to the power supply. The Green power LED must blink continuously.



### Note

If the power and Ethernet LEDs do not blink continuously, refer to [Testing hardware](#) section to troubleshoot.

## Using the web interface

This section describes the usage of ePMP web interfaces.

- [Logging into the web interface](#)

## Logging into the web interface

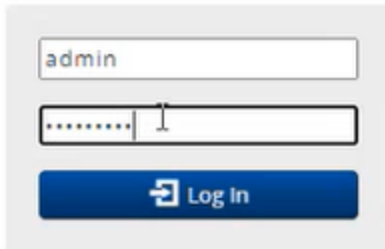
Perform the following procedure to login into the web interface as a system administrator.

### Equipment and tools

- ePMP device connected to the power supply by Ethernet cable.
- PC is connected to the power supply by Ethernet cable.
- Power supply powered up.
- Minimum supported browser versions: Chrome v29, Firefox v24, Internet Explorer 10, Safari v5.

### Procedure

1. Verify that the device and power supply are connected correctly (the device Ethernet port is connected to the power supply Ethernet power port (**Gigabit Data+Power** or **10/100Mbit Data+Power**)).
2. Configure the host machine with an IP address in the 169.254.1.x subnet (excluding 169.254.1.1).
3. Configure the host machine with an IP address in the 169.254.1.x subnet (excluding 169.254.1.1).
4. Connect the power supply to power mains.
5. From the browser, navigate to the device's default IP address **169.254.1.1**.



6. Log in with **admin** username and **admin** password.



#### Note

If **Device IP address Mode** is set to **DHCP** and the device is unable to retrieve IP address information via DHCP, the device management IP is set to 192.168.0.1 (AP Mode), 192.168.0.2 (SM mode), or the previously-configured static Device IP Address. Units may always be accessed via the Ethernet port at 169.254.1.1.



#### Attention

All the new ePMP devices contain default username and password configurations. It is recommended to change the password configurations immediately. These passwords is configured in the management UI section **Configuration > System > Account Management**.

## Using the installation wizard – Access Point

ePMP device provides a guided configuration mechanism for configuring key parameters for the link operation.

This setup can be accessed from the **Installation** page by clicking on the **Start Setup** button.

Click **Finish Setup** to commit the changes to the device.

## Step 1: Main system parameters

Figure 1 shows the Main system parameters page.

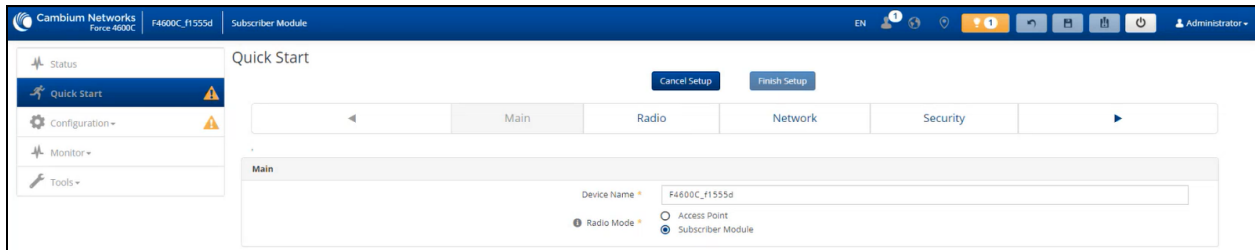


Figure 1: Quick Start page

Attribute	Description
<b>Main</b>	
Device Name	The configured identifier used in NMS such as cnMaestro.
Radio Mode	<b>Access Point:</b> Select if the radio is an access point. <b>Subscriber Module:</b> Select if the radio is a subscriber module.

## Step 2: Radio parameters

Figure 2 shows the Radio parameters page.

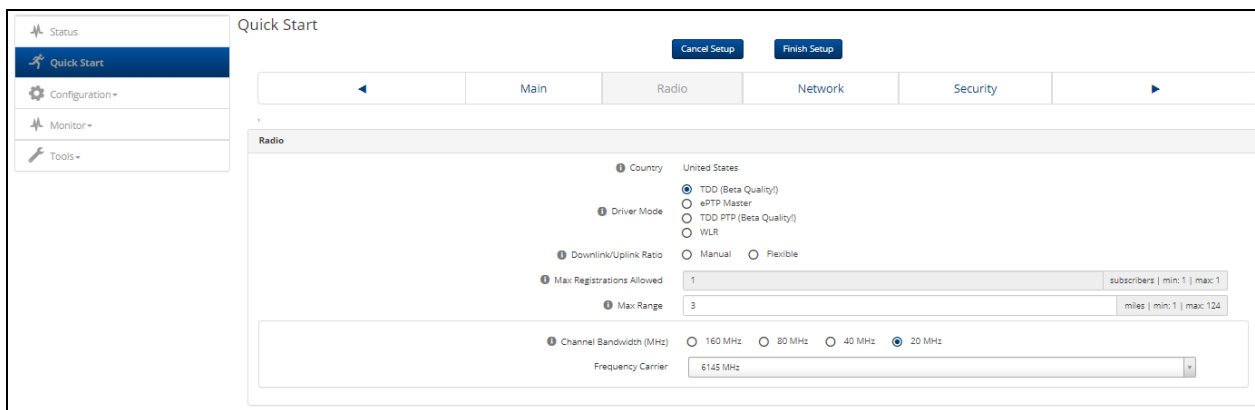


Figure 2: Radio parameters page

Attribute	Description
<b>Radio</b>	

Attribute	Description
Country	Defines the country code that is used by the device. The country code of the Subscriber Module follows the country code of the associated AP unless it is an FCC SKU in which case the country code is the United States or Canada. Country code defines the regulatory rules in use for the device.
Driver Mode	<p><b>TDD:</b> The device is operating in point-to-multipoint (PMP) mode using TDD scheduling. The AP can GPS synchronize in this mode.</p> <p><b>ePTP Master:</b> The AP is operating as a Master in point-to-point mode. The AP does not support GPS Synchronization in this mode but can provide significantly lower latency than other modes. QoS (MIR and traffic priority) capability and Link Quality/Capacity indicators are not available in this mode.</p> <p><b>TDD PTP:</b> The AP is operating in point-to-point (PTP) mode using TDD scheduling. The AP can GPS synchronize in this mode.</p>
Downlink/Uplink Ratio	The schedule of downlink traffic to uplink traffic on the radio link. The three options, <b>75/25</b> , <b>50/50</b> , and <b>30/70</b> , allow the radio to operate in a fixed ratio on every frame. In other words, this ratio represents the amount of the total radio link's aggregate throughput that will be used for downlink resources, and the amount of the total radio link's aggregate throughput that will be used for uplink resources.
Max Range	This parameter represents the cell coverage radius. Subscriber Modules outside the configured radius does not able to connect. It is recommended to configure Max Range to match the actual physical distance of the farthest subscriber.
Channel Bandwidth	Configure the channel size used by the radio for RF transmission.
Frequency Carrier	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the <b>Country</b> parameter. Ensure that a thorough spectrum analysis is completed before configuring this parameter.

### Step 3: Network parameters

Figure 3 shows the Network parameters page.

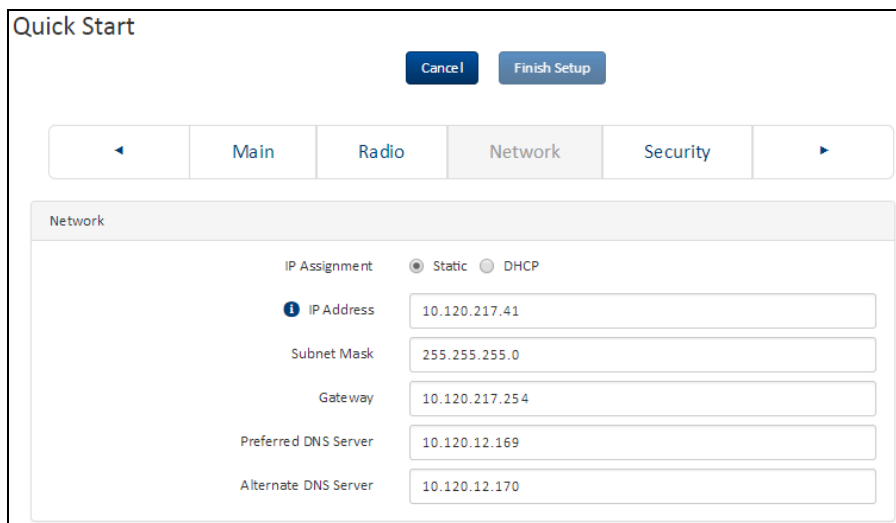


Figure 3: Network parameters page

Attribute	Description
<b>Network</b>	
IP Assignment	<p><b>Static:</b> Device management IP addressing is configured manually in fields <b>IP Address</b>, <b>Subnet Mask</b>, <b>Gateway</b>, <b>Preferred DNS Server</b>, and <b>Alternate DNS Server</b>.</p> <p><b>DHCP:</b> Device management IP addressing (<b>IP address</b>, <b>Subnet Mask</b>, <b>Gateway</b>, and <b>DNS Server</b>) is assigned via a network DHCP server, and parameters <b>IP Address</b>, <b>Subnet Mask</b>, <b>Gateway</b>, <b>Preferred DNS Server</b>, and <b>Alternate DNS Server</b> are not configurable.</p>
IP Address	<p>Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.</p> <p>If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (AP) or 192.168.0.2 (SM).</p>
Subnet Mask	<p>Defines the address range of the connected IP network. For example, if the <b>IP Address</b> is configured to <b>192.168.2.1</b> and <b>Subnet Mask</b> is configured to <b>255.255.255.0</b>, the device will belong to subnet <b>192.168.2.X</b>.</p>
Gateway	<p>Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.</p>
Preferred DNS Server	<p>Configure the primary IP address of the server used for DNS resolution.</p>
Alternate DNS Server	<p>Configure the secondary IP address of the server used for DNS resolution.</p>

## Step 4: Security parameters

Figure 4 shows the Security parameters page.

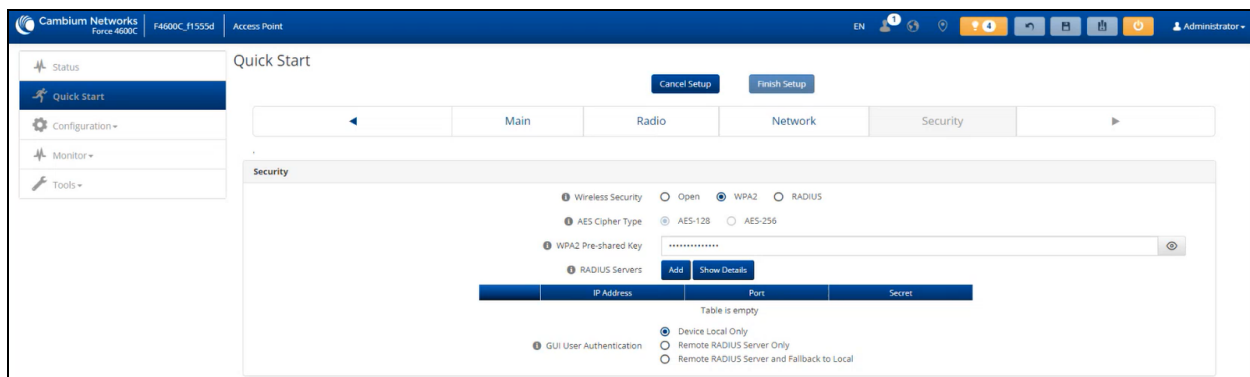



Figure 4: Security parameters page

Attribute	Description
<b>Network</b>	
Wireless Security	<p><b>Open:</b> All Subscriber Module devices requesting network entry are allowed registration.</p> <p><b>WPA2:</b> The WPA2 mechanism provides AES radio link encryption and Subscriber Module network entry authentication. When enabled, the Subscriber Module must register using the Authentication Pre-shared Key configured on the AP and Subscriber Module.</p> <p><b>RADIUS:</b> Enables Subscriber Module authentication through a pre-configured Radius server.</p>
AES Cipher Type	<p><b>AES-128:</b> A symmetric encryption algorithm that uses a 128-bit key to convert plain text into Cipher.</p> <p><b>AES-256:</b> A symmetric encryption algorithm that uses a 256-bit key to convert plain text into Cipher.</p>
WPA2 Pre-shared Key	Configure this key on the AP, then configure the Subscriber Module with this key to complete the authentication configuration. This key must be between 8 to 128 symbols.
RADIUS Servers	<p>Up to three RADIUS servers can be configured on the device with the following attributes:</p> <p><b>IP Address:</b> IP Address of the RADIUS server on the network.</p> <p><b>Port:</b> The RADIUS server port. The default is 1812.</p> <p><b>Secret:</b> Secret key that is used to communicate with the RADIUS server.</p>
GUI User Authentication	<p>This parameter applies to both the AP and its registered SMs.</p> <p><b>Device Local Only:</b> The device GUI authentication is local to the device using one of the accounts configured under <b>Configuration &gt; System &gt; Account Management</b>.</p> <p><b>Remote RADIUS Server Only:</b> The device GUI authentication is performed using a RADIUS server.</p>

Attribute	Description
	<b>Remote RADIUS Server and Fallback to Local:</b> The device GUI authentication is performed using a RADIUS server. Upon failure of authentication through a RADIUS server, the authentication falls back to one of the local accounts configured under <b>Configuration &gt; System &gt; Account Management</b> .

## Using the installation wizard – Subscriber Module

The ePMP device features the guided configuration mechanism for configuring key parameters for link operation.

This setup is accessed on the **Installation** page by clicking on the **Start Setup**  button.

Click **Finish Setup** to commit the changes to the device.

### Step 1: Main system parameters

Figure 5 shows the Main system parameters page.

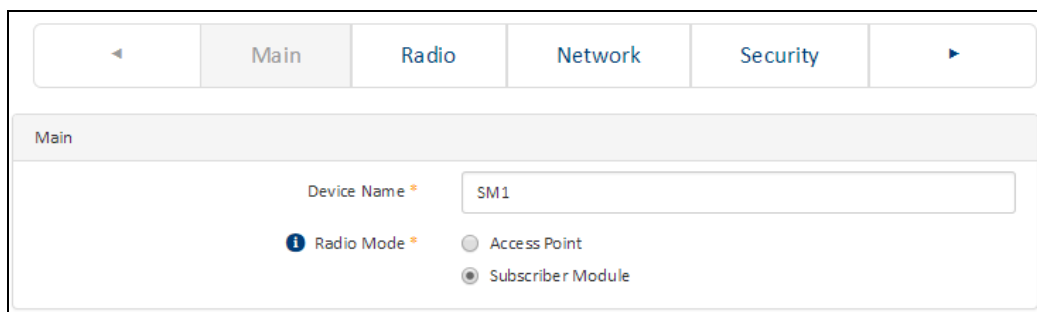


Figure 5: Main system parameters page

Attribute	Description
<b>Main</b>	
Device Name	The configured identifier used in NMS such as cnMaestro.
Radio Mode	This parameter controls the function of the device – All ePMP devices are configured to operate as an <b>Access Point</b> (AP) or a <b>Subscriber Module</b> (SM).

### Step 2: Radio parameters

Figure 6 shows the Radio parameters page.

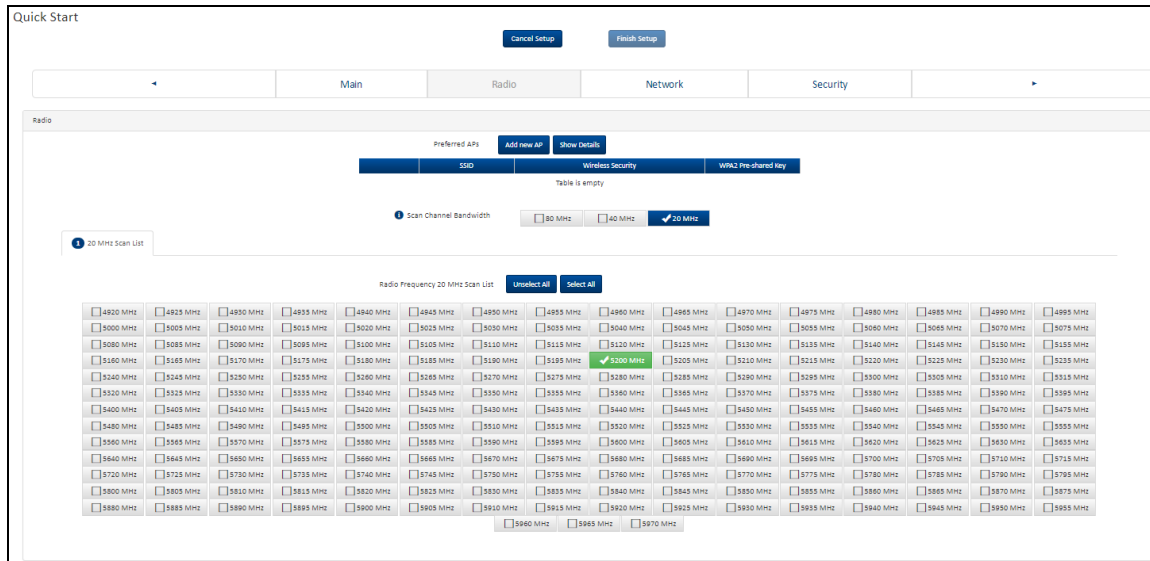


Figure 6: Radio parameters page

Attribute	Description
<b>Radio</b>	
<b>Preferred APs</b>	
SSID	The <b>Preferred Access Points SSID</b> defines the AP SSID to which the Subscriber Module (SM) device attempts the registration.
Wireless Security	<b>Open:</b> The SM device attempts the registration to preferred APs SSID with no security mechanism.  <b>WPA2:</b> The WPA2 mechanism provides AES radio link encryption and SM network entry authentication. When enabled, the SM must register using the Authentication Pre-shared Key configured on the AP and SM.
WPA2 Pre-shared Key	The <b>Preferred Access Points WPA2 Pre-shared Key</b> must be configured on the SM device to match the pre-shared key configured on the Access Point for registration with WPA2 security.
Scan Channel Bandwidth	Configure the channel size used by the radio for RF transmission.
Radio Frequency Scan List	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the <b>Country</b> parameter. Ensure that a thorough spectrum analysis is completed before configuring this parameter.

### Step 3: Network parameters

Figure 7 shows the Network parameters page.

The screenshot shows the 'Network' configuration page. At the top, there are navigation tabs: Main, Radio, Network (selected), and Security. Below the tabs, the 'Network' section is visible. It includes a 'Network Mode' section with radio buttons for NAT, Bridge (selected), and Router. Below that is an 'IP Assignment' section with radio buttons for Static (selected) and DHCP. The 'Static' assignment is further configured with the following fields: IP Address (10.120.223.110), Subnet Mask (255.255.255.0), Gateway (10.120.223.254), Preferred DNS Server (10.120.12.169), and Alternate DNS Server (10.120.12.170).

Figure 7: Network parameters page

Attribute	Description
<b>Network</b>	
Network Mode	<p><b>NAT:</b> The SM acts as a router and packets are forwarded or filtered based on their IP header (source or destination).</p> <p><b>Bridge:</b> The SM acts as a switch and packets are forwarded or filtered based on their MAC destination address.</p> <p><b>Router:</b> The SM acts as a router and packets are forwarded or filtered based on their IP header (source or destination) using specific static routes and IP aliases configured by the operator.</p>
IP Assignment	<p><b>Static:</b> Device management IP addressing is configured manually in fields <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server</b>.</p> <p><b>DHCP:</b> Device management IP addressing (<b>IP address, Subnet Mask, Gateway, and DNS Server</b>) is assigned via a network DHCP server, and parameters <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server</b> are not configurable.</p>
IP Address	<p>Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.</p> <p>If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information through DHCP, the device management IP is set to fallback IP 192.168.0.1 (AP) or 192.168.0.2 (SM).</p>
Subnet Mask	<p>Defines the address range of the connected IP network. For example, if the <b>IP Address</b> is configured to <b>192.168.2.1</b> and <b>Subnet Mask</b> is configured to <b>255.255.255.0</b>, the device belongs to subnet <b>192.168.2.X</b>.</p>
Gateway	<p>Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.</p>
Preferred DNS Server	<p>Configure the primary IP address of the server used for DNS resolution.</p>
Alternate DNS Server	<p>Configure the secondary IP address of the server used for DNS resolution.</p>

## Step 4: Security parameters

Figure 8 shows the Security parameters page.

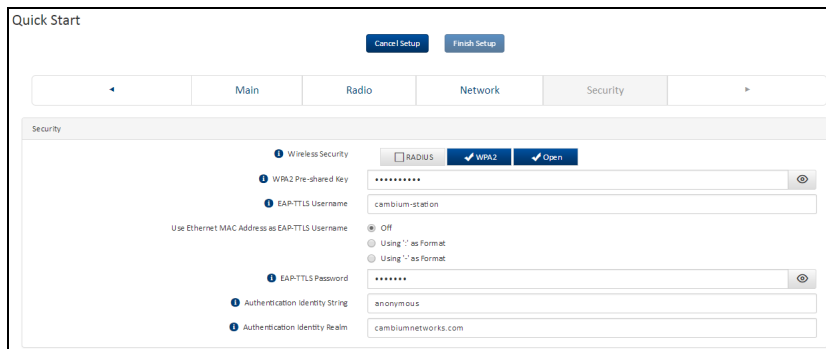


Figure 8: Security parameters page

Attribute	Description
<b>Network</b>	
EAP-TTLS Username	Configure the EAP-TTLS Username to match the credentials on the RADIUS server being used for the network.
Use Ethernet MAC Address at EAP-TTLS Username	The device MAC Address can be used as the EAP-TTLS Username in either “:” or “-” delimited format.
EAP-TTLS Password	Configure the EAP-TTLS Password to match the credentials on the RADIUS server being used for the network.
Authentication Identity String	Configure this identity string to match the credentials on the RADIUS server being used for the network. The default value for this parameter is <b>anonymous</b> .
Authentication Identity Realm	Configure this identity string to match the credentials on the RADIUS server being used for the network. The default value for this parameter is <b>cambiumnetworks.com</b> .

## Using the menu options

Use the menu navigation bar in the left panel to navigate to the web pages. Some of the menu options are only displayed for specific system configurations. Refer to [Table 1](#) to locate information about each web page.

Table 1: Menu options and web pages

Main menu	Menu option	Web page information
Status		<a href="#">Status page</a>
Installation		<a href="#">Installation page</a>

Main menu	Menu option	Web page information
Configuration		<a href="#">Configuration menu</a>
	Radio	<a href="#">Configuration &gt; Radio page</a>
	System	<a href="#">Configuration &gt; System page</a>
	Network	<a href="#">Configuration &gt; Network page</a>
	Security	<a href="#">Configuration &gt; Security page</a>
Monitor		<a href="#">Monitor menu</a>
	Performance	<a href="#">Monitor &gt; Performance page</a>
	System	<a href="#">Monitor &gt; System page</a>
	Wireless	<a href="#">Monitor &gt; Wireless page</a>
	Throughput Chart	<a href="#">Monitor &gt; Throughput Chart page</a>
	GPS	<a href="#">Monitor &gt; GPS page (Access Point mode)</a>
	Network	<a href="#">Monitor &gt; Network page</a>
	System Log	<a href="#">Monitor &gt; System Log page</a>
Tools		<a href="#">Tools menu</a>
	Software Upgrade	<a href="#">Tools &gt; Software Upgrade page</a>
	Backup / Restore	<a href="#">Tools &gt; Backup/Restore page</a>
	License Management	<a href="#">Tools &gt; License Management page (Access Point Mode)</a>
	Spectrum Analyzer	<a href="#">Tools &gt; Spectrum Analyzer page</a>
	eAlign (For SM only)	<a href="#">Tools &gt; eAlign page</a>
	Wireless Link Test	<a href="#">Tools &gt; Wireless Link Test page</a>
	Watchdog	<a href="#">Tools &gt; Watchdog page</a>
	Ping	<a href="#">Tools &gt; Ping page</a>
	Traceroute	<a href="#">Tools &gt; Traceroute page</a>

## Status page

The status page describes the status information of the QoE device. Figure 9 shows the Status page.

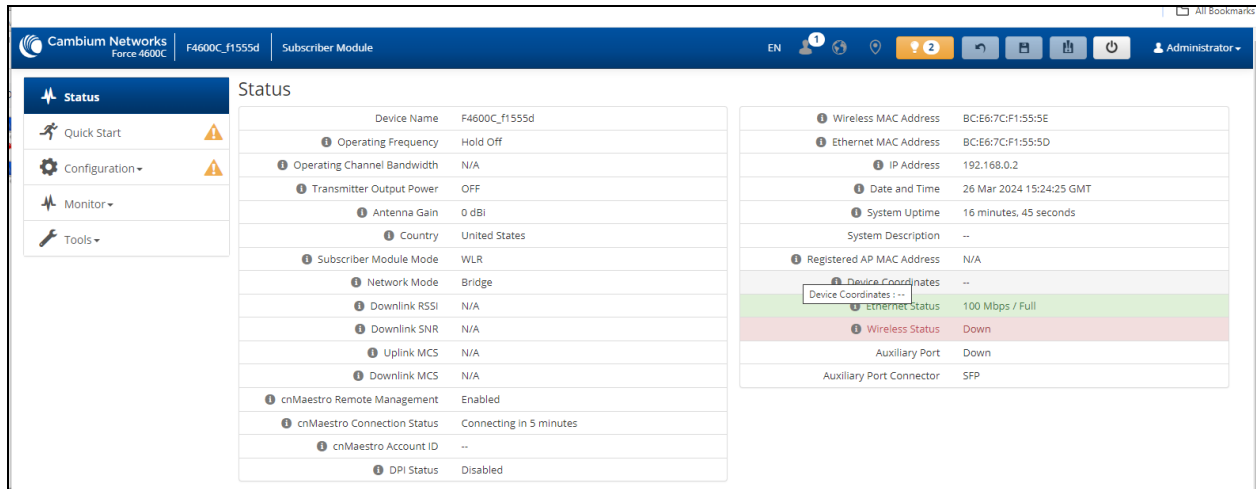


Figure 9: Status page

Table 132 Status page attributes

Attribute	Description
Device Name	The configured device name of the AP, used for identifying the device in an NMS such as the Cambium Network Services Server (CNSS).
SSID	The current configured name/SSID of the AP.
Operating Frequency	The current frequency carrier used for radio transmission, based on the configuration of the <b>Frequency Carrier</b> parameter (in DFS regions, if radar has been detected, this field may display either <b>DFS Alternate Frequency Carrier 1</b> or <b>DFS Alternate Frequency Carrier 2</b> ).
Operating Channel Bandwidth	The current channel bandwidth used for radio transmission, based on the configuration of the <b>Channel Bandwidth</b> parameter.
Transmitter Output Power	The current operating transmit power of the AP.
Antenna Gain	The configured gain of the external antenna.
Country	The current configured country code, which has an effect on DFS operation and transmits power restrictions. Registered Subscriber Modules will inherit this country code when registration is complete (unless SM is locked to the US region).
Access Point Mode	<b>TDD</b> : The Access Point is operating in point-to-multipoint (PMP) mode using TDD scheduling. The AP can GPS synchronize in this mode (except when in Flexible mode).

Attribute	Description
	<p><b>ePTP Master:</b> The Access Point is operating as a Master in point-to-point mode. The AP does not support GPS Synchronization in this mode but can provide <b>significantly lower latency</b> than other modes. QoS (MIR and traffic priority) capability and Link Quality/Capacity indicators are not available in this mode.</p> <p><b>PTP:</b> The Access Point is operating in point-to-point (PTP) mode using TDD scheduling. The AP can GPS synchronize in this mode (except when in Flexible mode).</p>
Downlink/Uplink Frame Ratio	The current configured schedule of downlink traffic to uplink traffic on the radio link. In other words, this ratio represents the amount of the total radio link's aggregate throughput that will be used for downlink resources and the amount of the total radio link's aggregate throughput that will be used for uplink resources.
Wireless Security	Currently configured authentication type used for radio link encryption as well as SM authentication.
cnMaestro Remote Management	Indicates whether the device is currently configured to be managed by the Cambium cloud management system - cnMaestro™.
cnMaestro Connection Status	The current management status of the device concerning the Cambium Cloud Server. When Enabled under <b>Configuration &gt; System</b> , the device will be managed by the Cambium Remote Management System, which allows all Cambium devices to be managed from the Cambium Cloud Server.
cnMaestro Account ID	The ID that the device is currently using to be managed by the Cambium Cloud Server.
Wireless MAC Address	The MAC address of the device wireless interface.
Ethernet MAC Address	The MAC address of the device Ethernet (LAN) interface.
SFP Port MAC Address	The MAC address of the device SFP interface.
IP Address	The currently configured device IP address (LAN) is used for management access.
IPv6 Link Local Address	A link-local address is required for the IPv6-enabled interface (applications may rely on the link-local address even when there is no IPv6 routing). The IPv6 link-local address is comparable to the auto-configured IPv4 address 169.254.0.0/16.
IPv6 Address	The IPv6 address for device management.
Date and Time	The current date and time on the device, subject to the configuration of the parameter <b>Time Zone</b> .
System Uptime	The total uptime of the radio since the last reset.
System Description	The current configured system description.
Sync Source Status	Displays the current status of sync timing for the AP.

Attribute	Description
Device Coordinates	The current configured Latitude and Longitude coordinates in decimal format.
DFS Status	<p><b>N/A:</b> DFS operation is not required for the region configured in parameter <b>Country Code</b>.</p> <p><b>Channel Availability Check:</b> Before transmitting, the device must check the configured <b>Frequency Carrier</b> for radar pulses for 60 seconds). If no radar pulses are detected, the device transitions to state <b>In-Service Monitoring</b>.</p> <p><b>In-Service Monitoring:</b> Radio is transmitting and receiving normally while monitoring for radar pulses that require a channel move.</p> <p><b>Radar Signal Detected:</b> The receiver has detected a valid radar pulse and is carrying out detect-and-avoid mechanisms (moving to an alternate channel).</p> <p><b>In-Service Monitoring at Alternative Channel:</b> The radio has detected a radar pulse and has moved the operation to a frequency configured in <b>DFS Alternative Frequency Carrier 1</b> or <b>DFS Alternative Frequency Carrier 2</b>.</p> <p><b>System Not In Service due to DFS:</b> The radio has detected a Radar pulse and has failed channel availability checks on all alternative frequencies. The non-occupancy time for the radio frequencies in which Radar detected is 30 minutes.</p>
Ethernet Status	<p><b>Up:</b> The Ethernet (LAN) interface is functioning properly. This also displays the current port speed and duplex mode to which the Ethernet port has auto negotiated to or configured.</p> <p><b>Down:</b> The Ethernet (LAN) interface is either disconnected or has encountered an error and is not servicing traffic.</p>
Wireless Status	<p><b>Up:</b> The radio (WAN) interface is functioning properly</p> <p><b>Down:</b> The radio (WAN) interface has encountered an error and is not servicing traffic.</p>
SFP Port	Displays the current port speed and duplex mode to which the SFP port has auto-negotiated or displays the current port speed and duplex mode that have been configured manually.
SFP Port Type	Displays the type of SFP module connected to the device.
Registered Subscriber Modules	The total number of SMs currently registered to the AP.
Registered Elevate Subscriber Modules	The total number of ePMP Elevate (third-party software solution) subscribers registered to the AP.

## Installation page

For more information on the installation page, refer to [Using the installation wizard – Access Point](#) and [Using the installation wizard – Subscriber Module](#) sections.

## Configuration menu

Use the **Configuration** menu to access all applicable device configuration parameters.

### Configuration > Radio page

Figure 10 and Figure 11 shows the Radio pages (AP mode and SM mode).

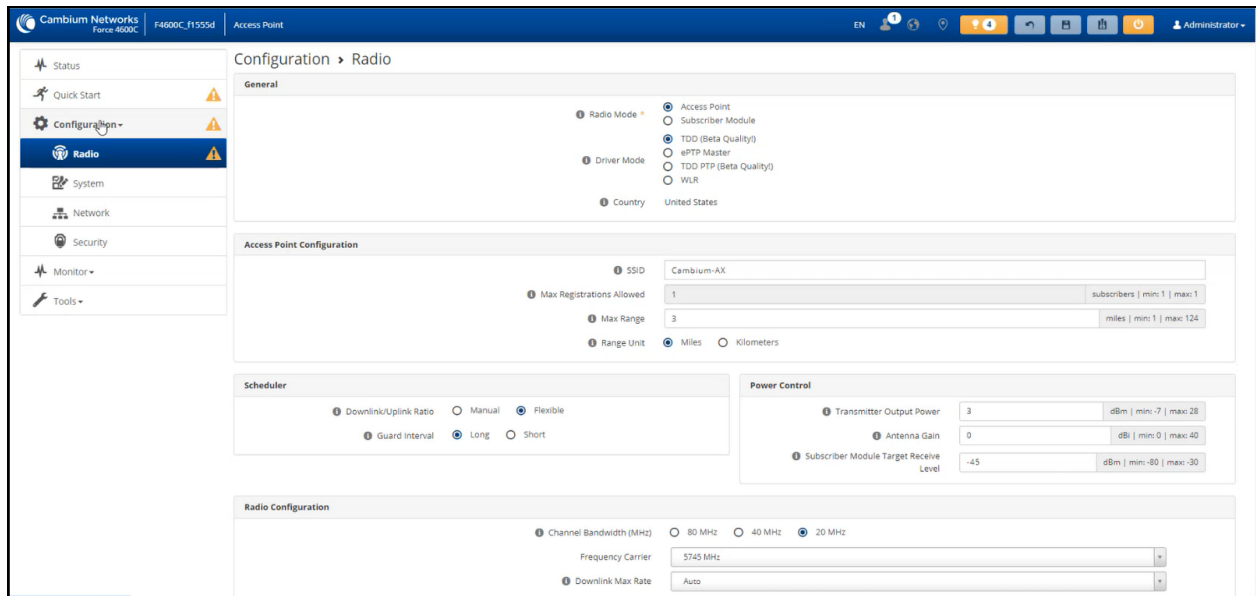


Figure 10: Configuration > Radio page (AP mode)



#### Note

The **Trial Configuration** allows you to try a configuration change without applying the configuration.

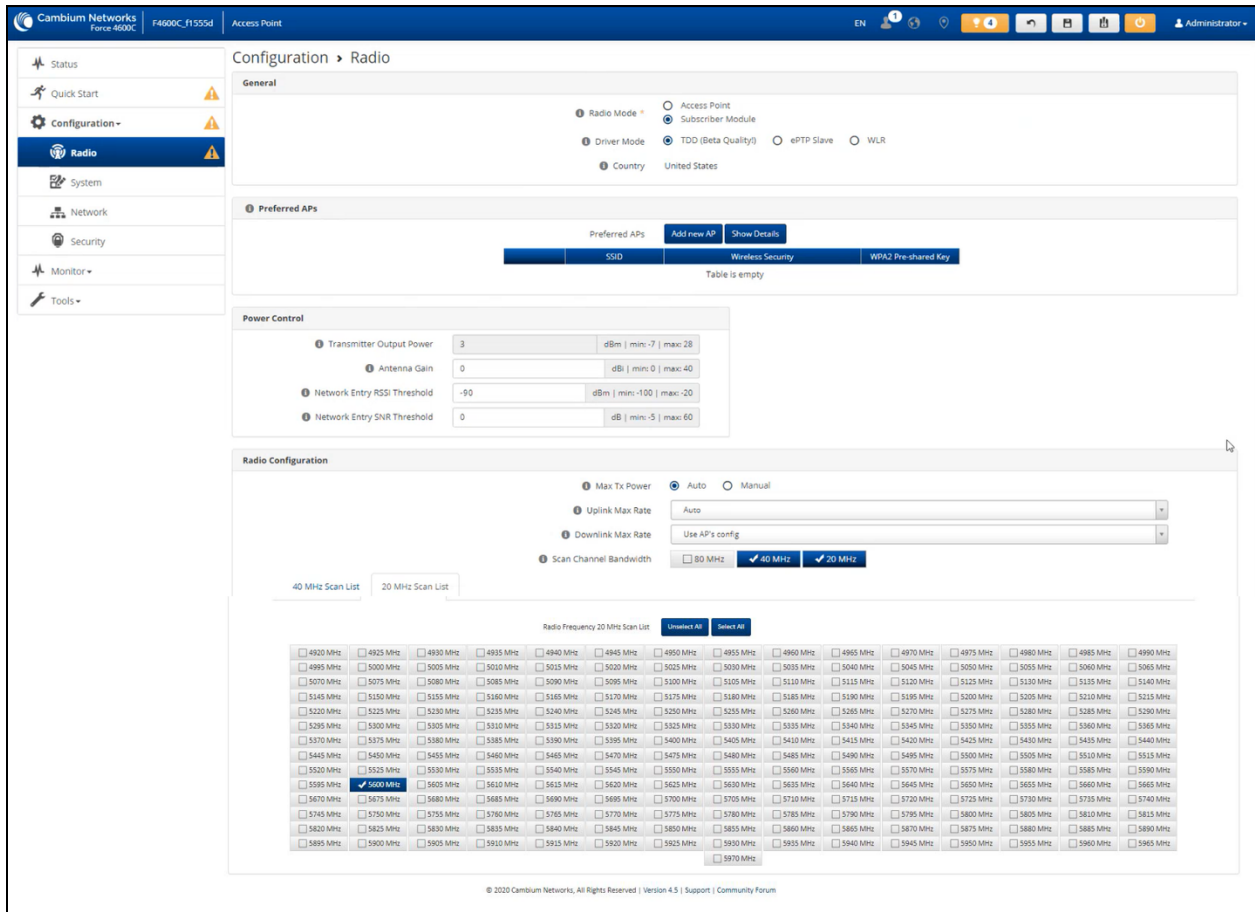


Figure 11: Configuration > Radio page (SM mode)

Table 133 Configuration > Radio page attributes


Attribute	Description
<b>General</b>	
Driver Mode	<p><b>TDD:</b> The device is operating in Point-to-Multipoint (PMP) mode using TDD scheduling. The AP can GPS synchronize in this mode.</p> <p><b>ePTP Slave:</b> The SM is operating as a Slave in point-to-point mode. The AP and the system do not support GPS Synchronization in this mode but can provide significantly lower latency than other modes. QoS (MIR and traffic priority) capability and Link Quality/Capacity indicators are not available in this mode.</p> <p><b>TDD PTP:</b> The Access Point is operating in point-to-point (PTP) mode using TDD scheduling. The AP can GPS synchronize in this mode.</p>
Radio Mode	<p><b>Access Point:</b> The unit controls the point-to-point link and its maintenance. On start-up, the Access Point transmits until a link with the Subscriber Module is made.</p>


Attribute	Description
	<b>Subscriber Module:</b> The unit listens for its peer and only transmits when the peer has been identified.
Backward Compatibility (Access Point Mode)	<b>Enabled:</b> 802.11n ePMP subscribers can register to the AP (requires subscriber software upgrade). <b>Disabled:</b> 802.11n ePMP subscribers are not able to register to the AP.
Country (Access Point Mode)	Defines the country code being used by the device. The country code of the Subscriber Module follows the country code of the associated Access Point unless it is an FCC SKU in which case the country code is the United States or Canada. Country code defines the regulatory rules in use for the device.
Range Unit (Access Point Mode)	Units of measurement on the device are displayed in either miles (m) or kilometers (km).
<b>Access Point Configuration (AP mode)</b>	
Antenna (Access Point Mode)	<b>Sector:</b> Panel, 90° or Dual-Horn, 60° <b>Omni:</b> KP-5QSOMNI-13
SSID (Access Point Mode)	SSID is a unique identifier for a wireless LAN which is specified in the AP's beacon. (AP mode). SSID must be the same at both ends and different from the site name.
Max Registrations Allowed (Access Point Mode)	Based on a sector/network planning and subscriber service level implementations, this parameter allows setting the maximum number of subscribers that are allowed to register/gain network entry. The maximum number of subscribers allowed for each channel bandwidth is as follows: <ul style="list-style-type: none"> <li>• <b>20/40 MHz:</b> 120 subscribers</li> <li>• <b>10 MHz:</b> 60 subscribers</li> <li>• <b>5 MHz:</b> 30 subscribers</li> </ul> <p>The maximum registrations allowed depending on the channel bandwidth of the current operating frequency which can be the primary <b>Frequency Carrier</b> or one of the alternate Frequency Carriers.</p> <p>For DFS regions, the maximum number of subscribers is based on the channel bandwidth of the current operating channel. That is <b>Frequency Carrier, Alternate Frequency Carrier 1, or Alternate Frequency Carrier 2.</b></p> <p>The number of elevate devices that are allowed to register is specified by the applied license.</p>
Max Range (Access Point Mode)	This parameter represents the cell coverage radius. Subscriber Modules outside the configured radius does not able to connect. It is recommended to configure Max Range to match the actual physical distance of the farthest subscriber.

Attribute	Description
Channel Bandwidth (Access Point Mode)	Configure the channel size used by the radio for RF transmission.
Frequency Carrier (Access Point Mode)	Configure the frequency carrier for RF transmission. This list is dynamically adjusted to the regional restrictions based on the setting of the <b>Country</b> parameter. Ensure that a thorough spectrum analysis has been completed before configuring this parameter.
Frequency Reuse (Access Point Mode)	<p>The <b>Frequency Reuse</b> parameter allows operators to define which APs are co-located (or within radio range) with other APs. This definition results in an automatic radio network modification such that self-interference is reduced amongst the co-located sectors.</p> <p>A network in which two frequencies <b>F1</b> and <b>F2</b> are reused throughout the installation is shown in <a href="#">Figure 11</a>.</p> <p>Note that CMM3 and CMM4 devices cannot be used as synchronization sources for ePMP 3000, the parameter setting suggestions below serve as a guideline for mixed 802.11n and 802.11ac networks.</p> <div data-bbox="527 829 1274 1281" data-label="Diagram"> </div> <p><b>Figure 12: Frequency reuse installation</b></p> <p>The set of APs to configure the <b>Frequency Reuse</b> option is dependent on the GPS synchronization sources in the whole network, CMM3, CMM4, CMM5, or GPS.</p> <p>OBOBThe GPS sync source is the same on all APs or is a combination of “GPS”, “CMM4”, “CMM5”</p> <p>In this configuration the GPS synchronization source in the whole network is one of the following:</p> <ul style="list-style-type: none"> <li>• GPS</li> <li>• CMM4</li> <li>• CMM5</li> </ul>

Attribute	Description
	<p>The rules in selecting the APs to enable the <b>Frequency Reuse</b> in this installation are:</p> <p>Only ONE of the APs on the same tower configured with the same frequency must be configured with the <b>Frequency Reuse Mode</b> parameter set to <b>Back Sector</b>; the other AP must be configured with <b>Frequency Reuse</b> set to <b>Front Sector</b>.</p> <p>Also, APs on different towers facing each other with overlapped coverage must be configured with <b>Frequency Reuse</b> set to <b>Back Sector</b>.</p> <p>1B1B The GPS sync source is a mixture of all types (“CMM3”, “CMM4”, “CMM5” or “GPS”)</p> <p>In this configuration the GPS sync source in the whole network is one of the following:</p> <ul style="list-style-type: none"> <li>• (CMM3 and GPS) or</li> <li>• (CMM3 and CMM4 / CMM5) or</li> <li>• (CMM3 and CMM4 / CMM5 and GPS)</li> </ul> <p>The rules in selecting the APs to configure <b>Frequency Reuse</b> to <b>Frequency Reuse</b> to <b>Front Sector</b> or <b>Back Sector</b> in a mixture of sync sources installations are:</p> <p>Only ONE of the APs on the same tower configured with the same frequency must have <b>Frequency Reuse</b> set to <b>Back Sector</b> if the sync source of both APs is the same or the sync is a combination of GPS and CMM4 / CMM5; the other AP has the <b>Front Sector</b> ON.</p> <p>For the APs on different towers facing each other with overlapped coverage:</p> <ul style="list-style-type: none"> <li>• If both APs have the same sync source, then only ONE of them must have the <b>Back Sector</b> ON; the other AP shall have the <b>Front Sector</b> ON.</li> <li>• If one AP has GPS as sync source and the other one has CMM4 / CMM5 then only ONE of them must have <b>Back Sector</b> ON; the other AP shall have <b>Front Sector</b> ON.</li> <li>• If one AP has GPS or CMM4 / CMM5 as sync source and the other one has CMM3.</li> <li>• If the AP with CMM3 sync source has <b>Back Sector</b> ON, then the other AP (with GPS or CMM4 / CMM5 sync source) must have the <b>Back Sector</b> ON.</li> <li>• If the AP with CMM3 sync source has <b>Frequency Reuse</b> set to <b>Off</b>, then the other AP (with GPS or CMM4 CMM5 sync source) must have <b>Frequency Reuse</b> set to <b>OFF</b>.</li> </ul>

Attribute	Description
<b>Power Control</b>	
Transmitter Output Power (Access Point Mode)	<b>Transmitter Output Power</b> is the total transmit power of the device. The device has four transmit chains and total transmit power sums the power from all chains. This does not include antenna gain. Transmitter Output Power may be limited by regulatory rules for the country in use.
Antenna Gain	The total gain of the antenna is being uses by the device.
Subscriber Module Target Receive Level (Access Point Mode)	Defines the desired received power level at the AP from the registered Subscriber Module. APs use this parameter to control the transmission power of the Subscriber Module to reduce system self-interference.
Network Entry RSSI Threshold (Subscriber Module Mode)	This defines the Downlink RSSI threshold below which a Subscriber Module does not register to an Access Point.
Network Entry SNR Threshold (Subscriber Module Mode)	This defines the Downlink Signal-to-Noise-Ratio (SNR) threshold below which the Subscriber Module does not register to an Access Point.
<b>Synchronization (AP mode)</b>	
Co-location Mode (Access Point Mode)	<p><b>Disabled:</b> The ePMP device can synchronize only with other ePMP APs.</p> <p><b>Enabled:</b> The ePMP device can be configured to synchronize with PMP 100 or PMP 450 series of radios in addition to other ePMP APs. Refer to <a href="#">ePMP and PMP 100 Co-location and Migration Recommendations Guide</a> for guidance on synchronizing ePMP and PMP 100. Verify that frame size (ms) is configured equally across the co-located installations.</p>
Synchronization Source (Access Point Mode)	<p><b>GPS:</b> Synchronization timing is received through the AP's connected GPS antenna. Co-located or in-range APs receiving synchronization via GPS or CMM transmits and receive at the same time, thereby reducing self-interference.</p> <p><b>CMM5:</b> Synchronization timing is received through the AP's Ethernet port through a connected Cambium Cluster Management Module 5 (CMM5). Co-located or in-range APs receiving synchronization through GPS or CMMI transmits and receive at the same time, thereby reducing self-interference. For more information on CMM configuration, refer to <i>PMP Synchronization Solutions User Guide</i>.</p> <p>If CMM is used, verify that the cables from the CMM to the network switch are at most 30 ft (shielded) or 10 ft (unshielded) and that the network switch is not PoE (802.3af).</p> <p><b>Internal:</b> Synchronization timing is generated by the AP and the timing is not based on GPS pulses.</p> <p>APs using synchronization source of <b>Internal</b> does not transmit and receive in sync with other co-located or in-range APs, which introduces self-interference into the system.</p>

Attribute	Description
Synchronization Holdoff Time (Access Point Mode)	The <b>Synchronization Holdoff Time</b> is designed to gracefully handle fluctuations/losses in the GPS synchronization signaling. After the AP has received a reliable synchronization pulse for at least 60 seconds, if there is a loss of synchronization signal, the <b>Synchronization Holdoff</b> timer is started. During the holdoff interval, all SM registrations are maintained. If a valid GPS synchronization pulse is regained during the holdoff interval, then the AP continues to operate normally. If a valid synchronization pulse is not regained from the GPS source during the holdoff interval, then the AP ceases radio transmission. The default is <b>30 seconds</b> .
<b>Preferred Access Points (SM mode)</b>	
Preferred Access Points list (Subscriber Module Mode)	The <b>Preferred Access Points List</b> is comprised of a list of up to 16 Access Point devices to which the SM device sequentially attempts registration. For each AP configured, if authentication is required, enter the <b>Wireless Security</b> type and <b>WPA2 Pre-shared Key</b> associated with the configured <b>SSID</b> .
<b>Scheduler (AP mode)</b>	
Downlink/Uplink Ratio (Access Point Mode)	The schedule of downlink traffic to uplink traffic on the radio link. The three options, <b>75/25</b> , <b>50/50</b> , and <b>30/70</b> , allow the radio to operate in a fixed ratio on every frame. In other words, this ratio represents the amount of the total radio link's aggregate throughput that is used for downlink resources, and the amount of the total radio link's aggregate throughput that is used for uplink resources.
Guard interval (Access Point Mode)	The purpose of the guard interval is to introduce immunity to propagation delays, echoes, and reflections, to which digital data is normally very sensitive. Longer guard periods allow more distant echoes to be tolerated. However, longer guard intervals reduce channel efficiency.
Downlink Max Rate (AP mode)	<p>Specifies the maximum downlink MCS value that the Rate Adapt algorithm chooses for Radio 1. If an installation is exhibiting packet loss due to downlink interference, modifying <b>Downlink Max Rate</b> to limit the device's maximum MCS rate may result in more reliable packet delivery. This is especially true in installations among changing and unpredictable interference.</p> <div data-bbox="516 1440 1427 1566" style="border: 1px solid black; padding: 5px;">  <p><b>Note</b> This setting is not available if the AP is set to ePTP Master mode.</p> </div>
<b>Radio Configuration</b>	
Maximum Tx Power (SM mode)	<p><b>Auto:</b> The AP can control, using ATPC (Automatic Transmit Power Control), the TX power of the SM up to the maximum capability of the SM's transmitter (based on regulatory limits).</p> <p><b>Manual:</b> The AP can control the TX power of the SM up to the value configured in the <b>Transmitter Power</b> field.</p>

Attribute	Description
Transmitter Output Power (SM mode)	The total transmit power of the radio interface. The device has four transmit chains for each channel and total transmit power sums the power from all chains. This does not include antenna gain. Transmitter output power may be limited by regulatory rules for the country in use.
Uplink Maximum Rate (SM mode)	Specifies the maximum uplink MCS value that the Rate Adapt algorithm chooses for Radio 1. If an installation is exhibiting packet loss due to uplink interference, modifying <b>Uplink Max Rate</b> to limit the device's maximum MCS rate may result in more reliable packet delivery. This is especially true in installations among changing and unpredictable interference.
	<div style="display: flex; align-items: center;">  <div style="border: 1px solid black; background-color: #e6f2ff; padding: 5px;"> <p><b>Note</b></p> <p>This setting is not available if the SM is set to ePTP Slave mode.</p> </div> </div>
Scan Channel Bandwidth (Subscriber Module Mode)	The selected scan channel bandwidths are scanned by the SM. Any combination can be selected. When bandwidth is selected, a tab for the bandwidth appears and a listing of all available channels is presented once the tab for the bandwidth is selected. Each bandwidth tab contains a number on the left side. This number defines how many channels have been selected for that bandwidth. If no channels are selected for bandwidth, then all the channels are scanned.

## Configuration > Quality of Service (QoS)

### The AP Quality of Service (QoS) page

The ePMP platform supports three QoS priority levels (not available in ePTP Master mode) using air fairness, priority-based starvation avoidance scheduling algorithm.

Ordering of traffic amongst the priority levels is based on a percentage of total link throughput. In other words, all priorities receive some throughput so that low priority traffic is not starved from the transmission. In effect, the greatest amount of throughput is guaranteed to the VOIP priority level, then high, and then low.

Priority Level	ePMP Traffic Priority Label
Highest Priority	VOIP (only utilized when <b>VOIP Enable</b> is set to <b>Enabled</b> )
Medium Priority	High
Lowest Priority	Low

By default, all traffic passed over the air interface is a low priority. The Quality of Service page of AP may be utilized to map traffic to certain priority levels using QoS classification rules. The rules included in the table are enforced starting with the first row of the table.



#### Warning

Each additional traffic classification rule increases device CPU utilization. Careful network traffic planning is required to efficiently use the device processor.

The ePMP platform also supports radio data rate-limiting (Maximum Information Rate, or MIR) based on the configuration of the MIR table. Operators may add up to 16 MIR profiles on the AP, each with unique limits for uplink and downlink data rates. The SM field **MIR Profile Setting** is used to configure the appropriate MIR profile for limiting the SM's data rate. [Figure 13](#) shows the Quality of Service page.

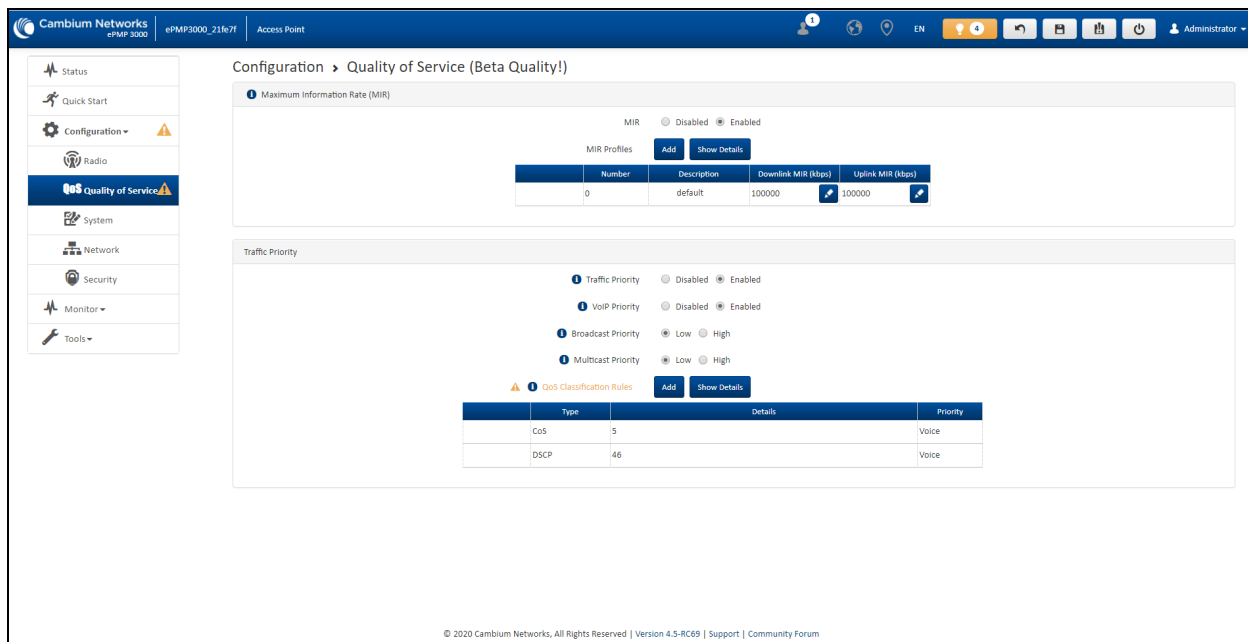


Figure 13: Configuration > AP Quality of Service page

Table 2: AP Radio Configuration attributes

Attribute	Description
<b>Maximum Information Rate (MIR)</b>	
MIR	<b>Disabled:</b> When disabled, RF transmission is only limited by the capacity of the link (and any active QoS classification rules). <b>Enabled:</b> When enabled, all downlink and uplink traffic is limited based on the profiles configured in the MIR table.
MIR Profiles	The MIR (Maximum Information Rate) table is comprised of up to sixteen profiles which, after configured, may be set on the SM to employ a certain service level or data rate.
Number	Assign a profile number to each row in the AP MIR table. This profile number is then set on each SM to limit data transfer rates based on the operator's configuration of the MIR table and its profiles.
Description	Assign a logical description for each service level. For example, a tiered service-level provider may deploy service levels <b>Gold</b> , <b>Silver</b> and <b>Bronze</b> or <b>20 Mbps</b> , <b>10 Mbps</b> and <b>5 Mbps</b> to offer a clear description.
Downlink MIR (kbps)	Specify the downlink rate at which the AP is allowed to transmit for this configured profile.

Attribute	Description
Uplink MIR (kbps)	Specify the uplink rate at which the AP is allowed to transmit for this configured profile.
<b>Traffic Priority</b>	
Traffic Priority	<p><b>Disabled:</b> No traffic prioritization is performed. All traffic is treated with equal priority (low priority).</p> <p><b>Enabled:</b> Traffic prioritization is enabled, and specific types of traffic can be prioritized using the fields below.</p>
VoIP Priority	<p><b>Enabled:</b> When enabled, two entries are automatically added to the first and second rows of the QoS Classification Rules table, one with <b>Rule Type CoS</b> (5) and one with <b>Rule Type DSCP</b> (46). The addition of these rules ensures that VoIP traffic passed over the radio downlink is given the highest priority. The <b>CoS</b> and <b>DSCP</b> values may be modified to accommodate non-standard VoIP equipment.</p> <p><b>Disabled:</b> When disabled, VoIP traffic is scheduled normally along with all other user data.</p>
Broadcast Priority	<p><b>Low Priority:</b> All broadcast traffic sent over the downlink is prioritized as low priority and is delivered to the SM after scheduled high priority and VoIP traffic.</p> <p><b>High Priority:</b> All broadcast traffic sent over the downlink is prioritized as a high priority and is scheduled for delivery to SMs before low priority traffic but after VoIP traffic.</p>
Multicast Priority	<p><b>Low Priority:</b> All multicast traffic sent over the downlink is prioritized as low priority and will be delivered to the SM after scheduled high priority and VoIP traffic.</p> <p><b>High Priority:</b> All multicast traffic sent over the downlink is prioritized as a high priority and is scheduled for delivery to SMs before low priority traffic but after VoIP traffic.</p>
QoS Classification Rules	The QoS Classification Rules table contains all of the rules enforced by the device when passing traffic over the radio downlink. Traffic passed through the device is matched against each rule in the table; when a match is made the traffic is sent over the radio link using the priority defined in <b>Traffic Priority</b> column.
Type	<p><b>CoS:</b> Class of Service; traffic prioritization is based on the 3-bit header present in the 802.1Q VLAN-tagged Ethernet frame header in the packet entering the AP's Ethernet port.</p> <p><b>VLAN ID:</b> Traffic prioritization is based on the VLAN ID of the packet entering the AP's Ethernet port.</p> <p><b>EtherType:</b> Traffic prioritization is based on the two-octet Ethertype field in the Ethernet frame entering the AP's Ethernet port. The Ethertype is used to identify the protocol of the data in the payload of the Ethernet frame.</p> <p><b>IP:</b> Traffic prioritization is based on the source and (or) destination IP address of the packet entering the AP's Ethernet port. A subnet mask may be included to define a range of IP addresses to match.</p>

Attribute	Description
	<b>MAC:</b> Traffic prioritization is based on the source and (or) destination MAC address of the packet entering the AP's Ethernet port. A mask may be included to define a range of MAC addresses to match. The mask is made up of a hex representation of a series of 1s to start the mask and 0s that end the mask. A 1 may not follow a 0. Thus FF:FF:FF:FF:00:00 is allowed, but FF:00:FF:FF:FF:FF is not. The MAC address is combined with the mask to define the range of allowed MAC addresses.
Details	Represents the details of the Class of Service (CoS) present in the packet entering the AP's Ethernet port.
Priority	Represents the QoS classification rule priority.

## The SM Quality of Service page

The ePMP platform supports three QoS priority levels (not available in ePTP Master mode) using air fairness, priority-based starvation avoidance scheduling algorithm.

Ordering of traffic amongst the priority levels is based on a percentage of total link throughput. In other words, all priorities receive some throughput so that low priority traffic is not starved from the transmission. In effect, the greatest amount of throughput is guaranteed to the VOIP priority level, then High, then Low.

Priority Level	ePMP Traffic Priority Label
Highest Priority	VOIP (only utilized when <b>VOIP Enable</b> is set to <b>Enabled</b> )
Medium Priority	High
Lowest Priority	Low

By default, all traffic passed over the air interface is a low priority. The SM's QoS page may be utilized to map traffic to certain priority levels using QoS classification rules. The rules included in the table are enforced starting with the first row of the table.



### Warning

Each additional traffic classification rule increases device CPU utilization. A good network traffic planning is required to efficiently use the device processor.

The ePMP platform also supports radio data rate-limiting (Maximum Information Rate (MIR)) based on the configuration of the MIR table. Operators may add up to 16 MIR profiles on the AP, each with unique limits for uplink and downlink data rates. The SM field **MIR Profile Setting** is used to configure the appropriate MIR profile for limiting the SM's data rate. [Figure 14](#) shows the Quality of Service page.

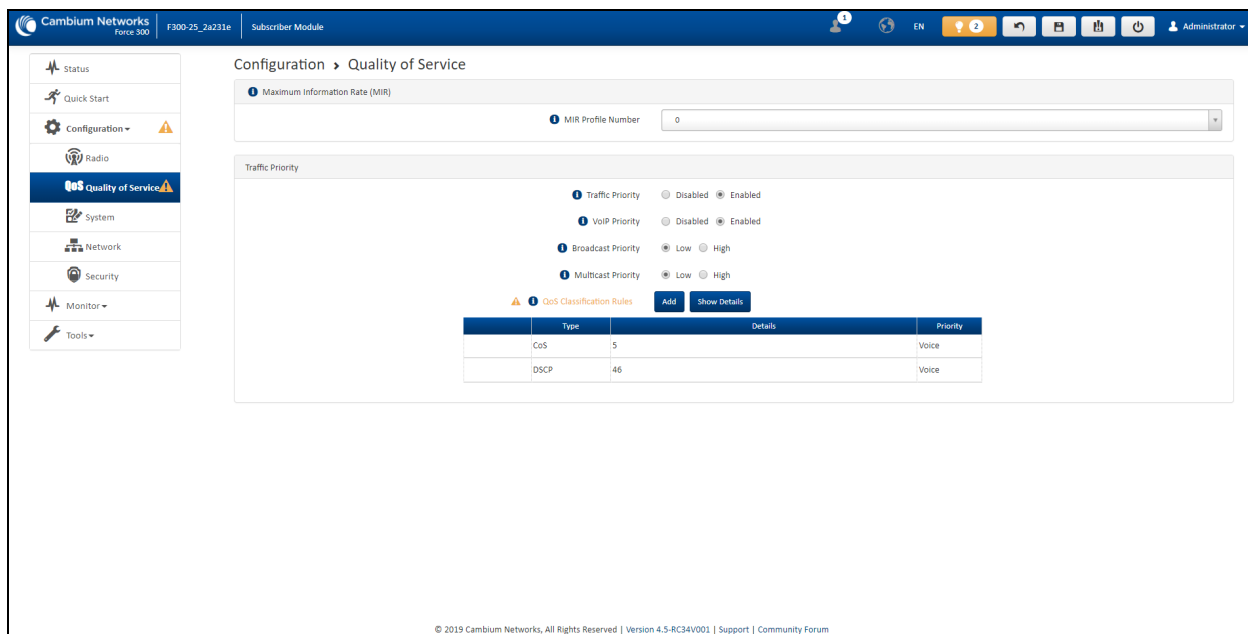


Figure 14: Configuration > SM Quality of Service page

Table 135 SM QoS attributes

Attribute	Description
<b>Maximum Information Rate (MIR)</b>	
MIR Profile Number	Configure the desired MIR (Maximum Information Rate) profile for SM operation. This profile must be configured on the AP else the default profile (0) is used.
Traffic Priority	<p><b>Enabled:</b> The QoS Classification Rules table is editable and is utilized by the device to classify traffic.</p> <p><b>Disabled:</b> The QoS Classification Rules table is greyed out and all traffic is sent at one priority level.</p>
VoIP Priority	<b>Enabled:</b> When enabled, two entries are automatically added to the first and second rows of the QoS Classification Rules table, one with <b>Rule Type CoS (5)</b> and one with <b>Rule Type DSCP (46)</b> . The addition of these rules ensures that VoIP traffic passed over the radio downlink is given the highest priority. The <b>CoS</b> and <b>DSCP</b> values may be modified to accommodate non-standard VoIP equipment.
Broadcast Priority	<p><b>Low Priority:</b> All Broadcast traffic sent over the uplink is prioritized as low priority and is delivered to the AP after scheduled high priority and VoIP traffic.</p> <p><b>High Priority:</b> All Broadcast traffic sent over the uplink is prioritized as a high priority and is scheduled for delivery to the AP before low priority traffic but after VoIP traffic.</p>
Multicast Priority	<p><b>Low Priority:</b> All Multicast traffic sent over the uplink is prioritized as low priority and is delivered to the AP after scheduled high priority and VoIP traffic.</p> <p><b>High Priority:</b> All Multicast traffic sent over the uplink is prioritized as a high priority and is scheduled for delivery to the AP before low priority traffic but after VoIP traffic.</p>

Attribute	Description
Subscriber Module Priority	<p><b>Normal:</b> SM gives priority to the packets as defined in the rules which can be <b>Low</b>, <b>High</b>, or <b>VoIP</b>. <b>Normal</b> priority allows data to be added to the appropriate <b>High</b>, <b>Low</b>, and <b>VoIP</b> queues based on the QoS rules. This is the default setting. If no rule is defined for a packet, then the packet priority is <b>Low</b>.</p> <p><b>High:</b> SM places all data other than VoIP in the <b>High</b> queue. It is given higher priority than SMs configured with <b>Low</b> and <b>Normal</b> when there is contention for bandwidth under the AP.</p> <p><b>Low:</b> <b>Low</b> priority places all data that is not VoIP in the <b>Low</b> priority queue. It will be given lower priority than SMs configured with <b>High</b> when there is contention for bandwidth under the same AP.</p> <p><b>VoIP</b> queue is the highest priority queue followed by the <b>High</b> queue and then by the <b>Low</b> queue. Higher priority queues have preference over lower priority queues, but does not suffer them.</p>
QoS Classification Rules	<p>The QoS Classification Rules table contains all of the rules enforced by the device when passing traffic over the radio downlink. Traffic passed through the device is matched against each rule in the table; when a match is made the traffic is sent over the radio link using the priority defined in column <b>Traffic Priority</b>.</p>
Type	<p><b>DSCP:</b> Differentiated Services Code Point; traffic prioritization is based on the 6-bit differentiated services field in the IP header present in the packet entering the Ethernet port.</p> <p><b>CoS:</b> Class of Service; traffic prioritization is based on the 3-bit header present in the 802.1Q VLAN-tagged Ethernet frame header in the packet entering the SM's Ethernet port.</p> <p><b>VLAN ID:</b> Traffic prioritization is based on the VLAN ID of the packet entering the SM's Ethernet port.</p> <p><b>EtherType:</b> Traffic prioritization is based on a 2 octet Ethertype field in the Ethernet frame entering the SM's Ethernet port. The Ethertype is used to identify the protocol of the data in the payload of the Ethernet frame.</p> <p><b>IP:</b> Traffic prioritization is based on the source and/or destination IP addresses of the packet entering the SM's Ethernet port. A subnet mask may be included to define a range of IP addresses to match.</p> <p><b>MAC:</b> Traffic prioritization is based on the source and/or destination MAC addresses of the packet entering the SM's Ethernet port. A mask may be included to define a range of MAC addresses to match. The mask is made up of a hex representation of a series of 1s to start the mask and 0s that end the mask. A 1 may not follow a 0. Thus, FF:FF:FF:FF:00:00 is allowed, but FF:00:FF:FF:FF:FF is not. The MAC address is combined with the mask to define the range of allowed MAC addresses.</p>
Details	<p>The <b>Rule Details</b> column is used to further configure each classification rule specified in column <b>Rule Type</b>.</p>
Priority	<p><b>High:</b> Traffic entering the SM's Ethernet port is prioritized as <b>high priority</b> for sending over the radio link (traffic will be sent after VOIP-classified traffic but before Low-classified traffic).</p>

Attribute	Description
	<b>Low:</b> Traffic entering the SM's Ethernet port is prioritized as <b>low priority</b> for sending over the radio link (traffic will be sent after VOIP-classified and High-classified traffic is sent).

## Configuration > System page

Figure 15 shows the System page.

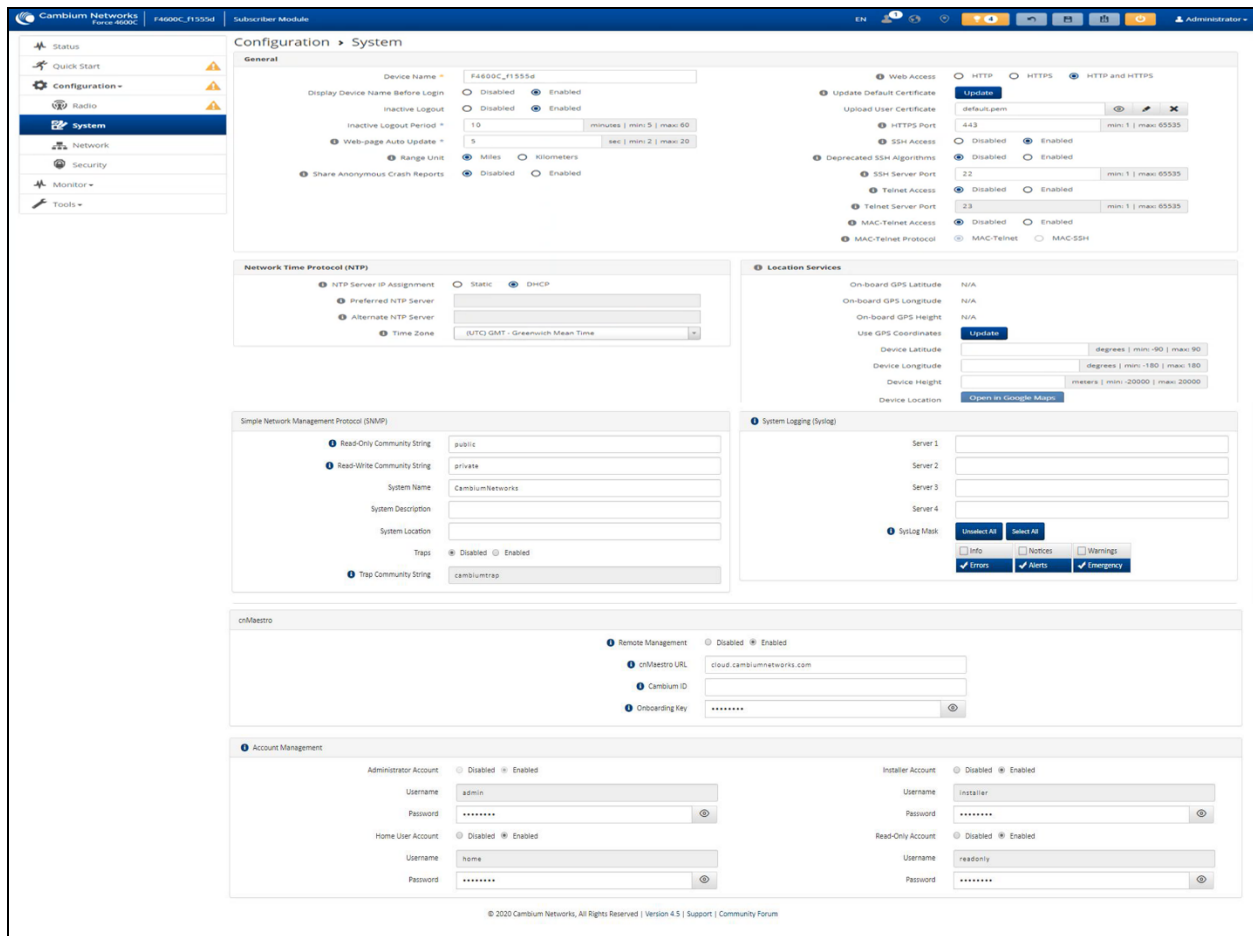






Figure 15: Configuration > System page parameters




Table 136 Configuration > System page attributes

Attribute	Description
<b>General</b>	
Device Name	The configured identifier is used in an NMS such as cnMaestro.
Display Device Name Before Login	<b>Disabled:</b> For security, the configured <b>Device Name</b> is hidden on the device login screen.

Attribute	Description
	<b>Enabled:</b> The configured <b>Device Name</b> is displayed upper-left on the device login screen.
Inactive Logout	<b>Disabled:</b> The device does not automatically log out users after a period of inactivity. <b>Enabled:</b> After the period configured in the <b>Inactive Logout Period</b> has elapsed, the device automatically log out the user.
Inactive Logout Period	Represents the amount of time for which a user remains logged in. After this period has elapsed, the user automatically logged out.
Web-page Auto Update	Configure the interval for which the device retrieves system statistics for display on the management interface. For example, if this setting is configured to 5 seconds, the statistics and status parameters displayed on the management interface is refreshed every 5 seconds (default). <b>Webpage Auto Update</b> is a session-only configuration change. It is updated with the <i>Enter</i> key and is not savable when using the <b>Save</b> button.
Range Unit	Units of measurement on the device are displayed in either miles (m) or kilometers (km).
Web Access	<b>HTTP:</b> The web management interface of the device is accessed through HTTP. <b>HTTPS:</b> The web management interface of the device may only be accessed through secure HTTPS.
HTTP Port	This specifies the TCP/UDP port to be used with HTTP or HTTPS. The default value for HTTP is 80 and HTTPS is 443.
SSH Access	<b>Disabled:</b> Access to the device through SSH is not possible. <b>Enabled:</b> Cambium Networks engineers can access the device through SSH which enables them to log in to the radio and troubleshoot. <b>SSH Access</b> is <b>Enabled</b> by default.
Telnet Access	<b>Disabled:</b> Command Line Interface access through Telnet is not allowed <b>Enabled:</b> Command Line Interface access through Telnet is allowed
<b>Network Time Protocol (NTP)</b>	
NTP Server IP Assignment	<b>Static:</b> The device retrieves NTP time data from the servers configured in fields NTP Server IP Address. <b>DHCP:</b> The device retrieves NTP time data from the server IP issued through a network DHCP server.
Preferred NTP Server	Configure the primary NTP server IP addresses from which the device retrieves time and date information.
Alternate NTP Server	Configure alternate or secondary NTP server IP addresses from which the device retrieves time and date information.

Attribute	Description
Time Zone	The Time Zone option may be used to offset the received NTP time to match the operator's local time zone.
<b>Location Services</b>	
On-board GPS Latitude	GPS-retrieved Latitude information for the device in decimal format.
On-board GPS Longitude	GPS-retrieved Longitude information for the device in decimal format.
On-board GPS Height	GPS-retrieved height information for the device in meters.
Use GPS Coordinates 	Click <b>Update</b> to retrieve device location and height information via the connected GPS source.
Device Latitude	Configure Latitude information for the device in decimal format.
Device Longitude	Configure Longitude information for the device in decimal format.
Device Height	Configure height above sea level for the device in meters.
Device Location 	Hyperlink to display the device location in Google Maps
<b>Simple Network Management Protocol (SNMP)</b>	
Read-Only Community String	Specify a control string that can allow a Network Management Station (NMS) to read SNMP information. No spaces are allowed in this string. This password will never authenticate an SNMP user or an NMS to read/write access.  The <b>Read-only Community String</b> value is clear text and is readable by a packet monitor.
Read-Write Community String	Specify a control string that can allow a Network Management Station (NMS) to access SNMP information. No spaces are allowed in this string.
System Name	Specify a string to associate with the physical module. This parameter can be polled by the NMS. Special characters are supported.
System Description	Specify a description string to associate with the physical module. This parameter can be polled by the NMS. Special characters are supported.
System Location	Specify a description string to associate with the physical location. This parameter can be polled by the NMS. Special characters are supported.
Traps	<b>Disabled:</b> SNMP traps for system events are not sent from the device.  <b>Enabled:</b> SNMP traps for system events are sent to the servers configured in table <b>Trap Servers</b> .

Attribute	Description
Trap Community String	Configure an SNMP Trap Community String which is processed by the servers configured in <b>Trap Servers</b> . This string is used by the trap server to decide whether or not to process the traps incoming from the device. That is, for traps to successfully be received by the trap server, the community string must match.
<b>System Logging (Syslog)</b>	
Server 1-4	Specify up to four Syslog servers to which the device sends Syslog messages.
Syslog Mask	Configure the levels of Syslog messages which the devices send to the servers configured in parameters <b>Server 1-4</b> .  <div style="display: flex; align-items: center;">  <div style="background-color: #f4a460; padding: 5px; border: 1px solid black;"> <p><b>Caution</b></p> <p>Choose only the Syslog levels for the appropriate installation. Excessive logging can cause the device log file to fill and starts overwriting the previous entries.</p> </div> </div>
<b>cnMaestro</b>	
Remote Management	When <b>Enabled</b> , the device is managed by cnMaestro - the Cambium Networks Remote Management System, allows all Cambium Networks devices to be managed in the cloud.
cnMaestro URL	Configure the URL of cnMaestro. The default value is <a href="https://cloud.cambiumnetworks.com">https://cloud.cambiumnetworks.com</a> .
Cambium ID	Configure the Cambium ID that the device uses for onboarding on to cnMaestro.
Onboarding Key	Configure the password/key associated with the <b>Cambium-ID</b> that the device uses for onboarding on to cnMaestro.
<b>Account Management</b>	
Administrator Account	The Administrator account has full read and write permissions for the device.  <b>Disabled:</b> The disabled user is not granted access to the device management interface. The administrator user level cannot be disabled.  <b>Enabled:</b> The user is granted access to the device management interface.
Username	The username associated with the administrator account is used upon device login.
Password	Configure a custom password to secure the device. Only the <b>Administrator</b> account can override this password. The password character display may be toggled using the visibility icon  .
Installer Account	The Installer account has permissions to read and write parameters applicable to unit installation and monitoring.

Attribute	Description
	<p><b>Disabled:</b> The disabled user is not granted access to the device management interface.</p> <p><b>Enabled:</b> The user is granted access to the device management interface.</p>
Username	The username associated with the installer account used upon device login.
Password	Configure a custom password to secure the device. Only the <b>Administrator</b> account can override this password. The password character display may be toggled using the visibility icon  .
Home User Account	<p>The Home User account has permission to access pertinent information for support purposes.</p> <p><b>Disabled:</b> The disabled user is not granted access to the device management interface.</p> <p><b>Enabled:</b> The user is granted access to the device management interface.</p>
Username	The username associated with the home user account is used upon device login.
Password	Configure a custom password to secure the device. Only the <b>Administrator</b> account can override this password. The password character display may be toggled using the visibility icon  .
Read-Only Account	<p>The Read-Only account has permission to view only the <b>Monitor</b> page.</p> <p><b>Disabled:</b> The disabled user is not granted access to the device management interface.</p> <p><b>Enabled:</b> The user is granted access to the device management interface.</p>
Username	The username associated with the read-only account used upon device login.
Password	Configure a custom password to secure the device. Only the <b>Administrator</b> account can override this password. The password character display may be toggled using the visibility icon  .

## Configuration > Network page

Figure 16 shows the Network page (AP mode).

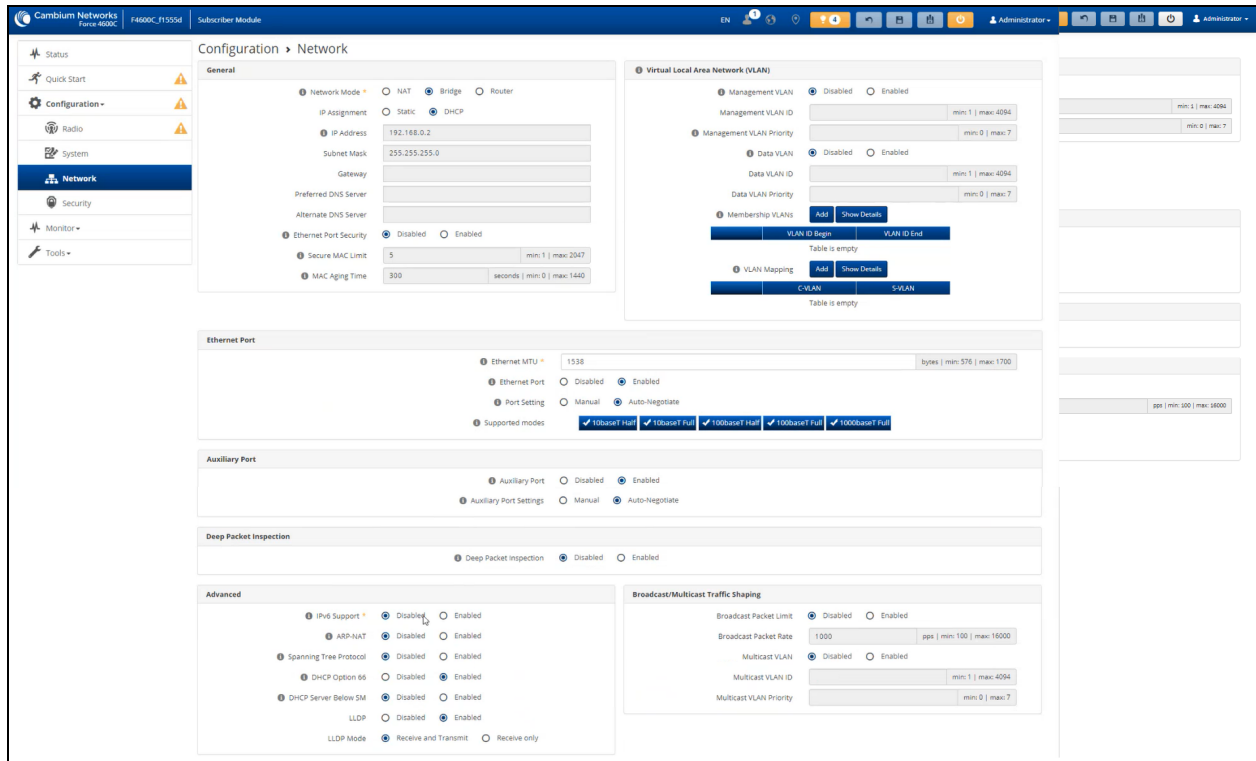


Figure 16: Configuration > Network page (AP mode)

Figure 17 shows the Network page (SM mode, Bridge Network mode).

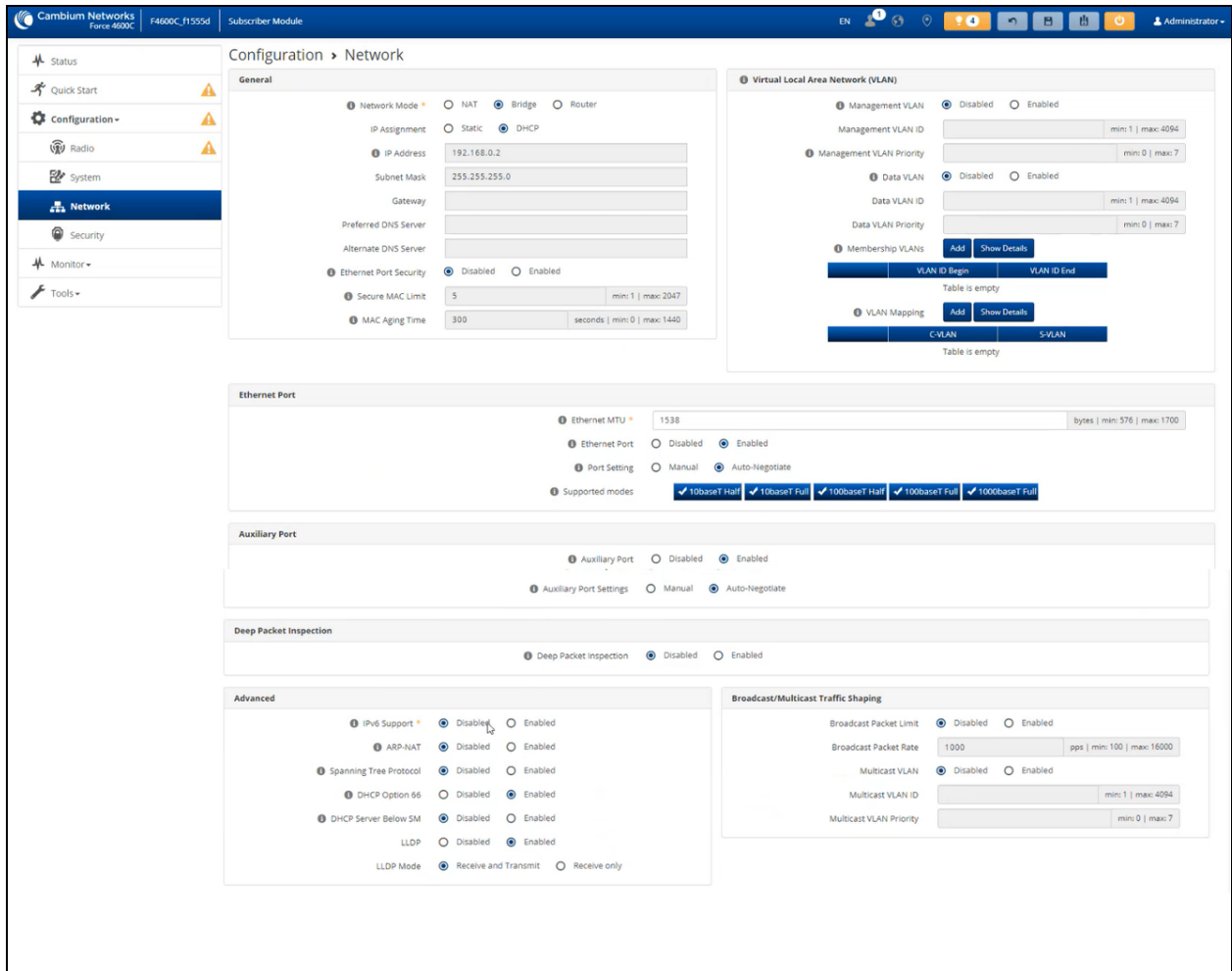


Figure 17: Configuration > Network page (SM mode, Bridge Network mode)

Figure 18 shows the Configuration > Network page (SM mode, NAT Network mode) .

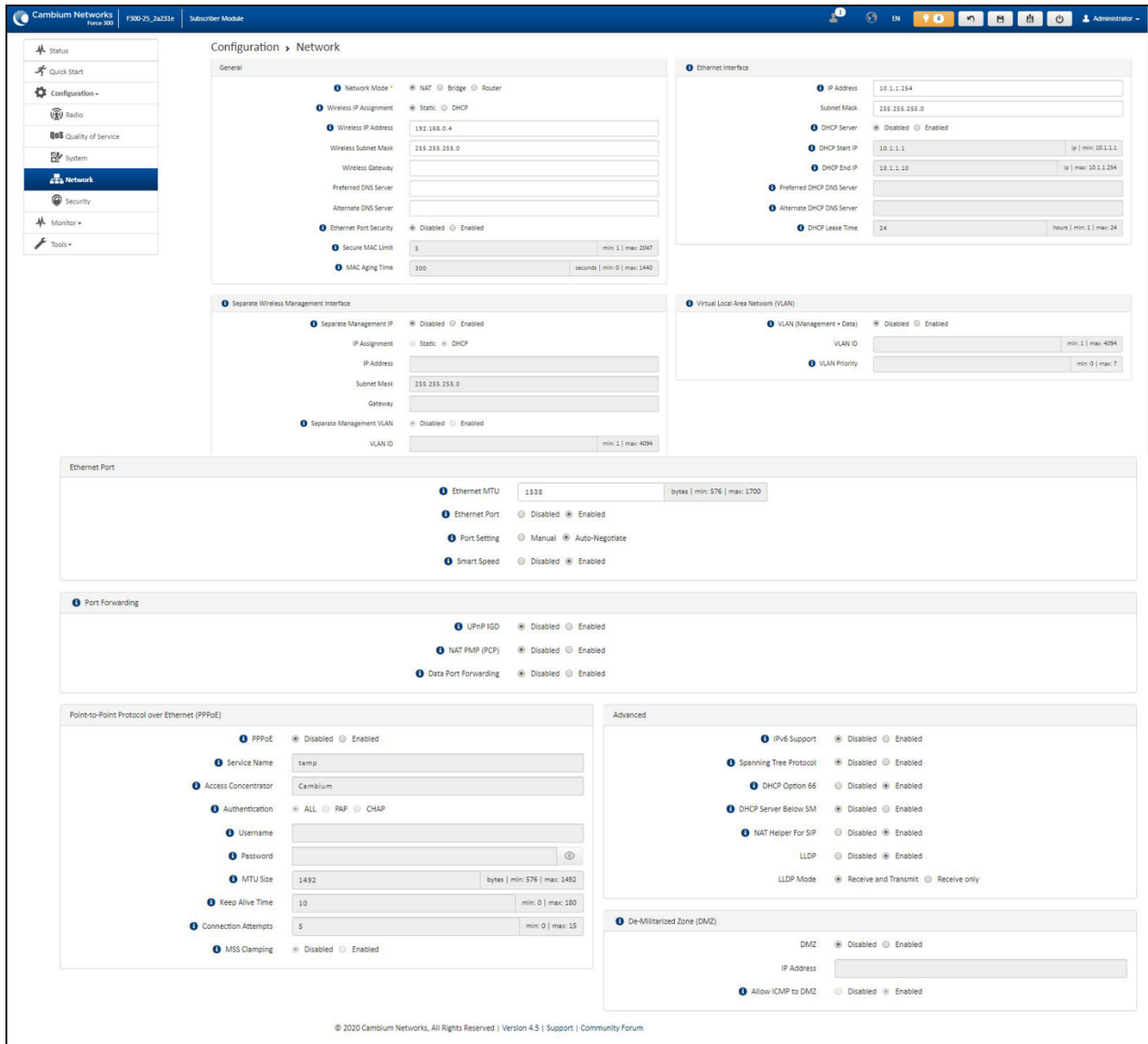


Figure 18: Configuration > Network page (SM mode, NAT Network mode)

Figure 19 shows the Configuration > Network page (SM mode, Router mode).

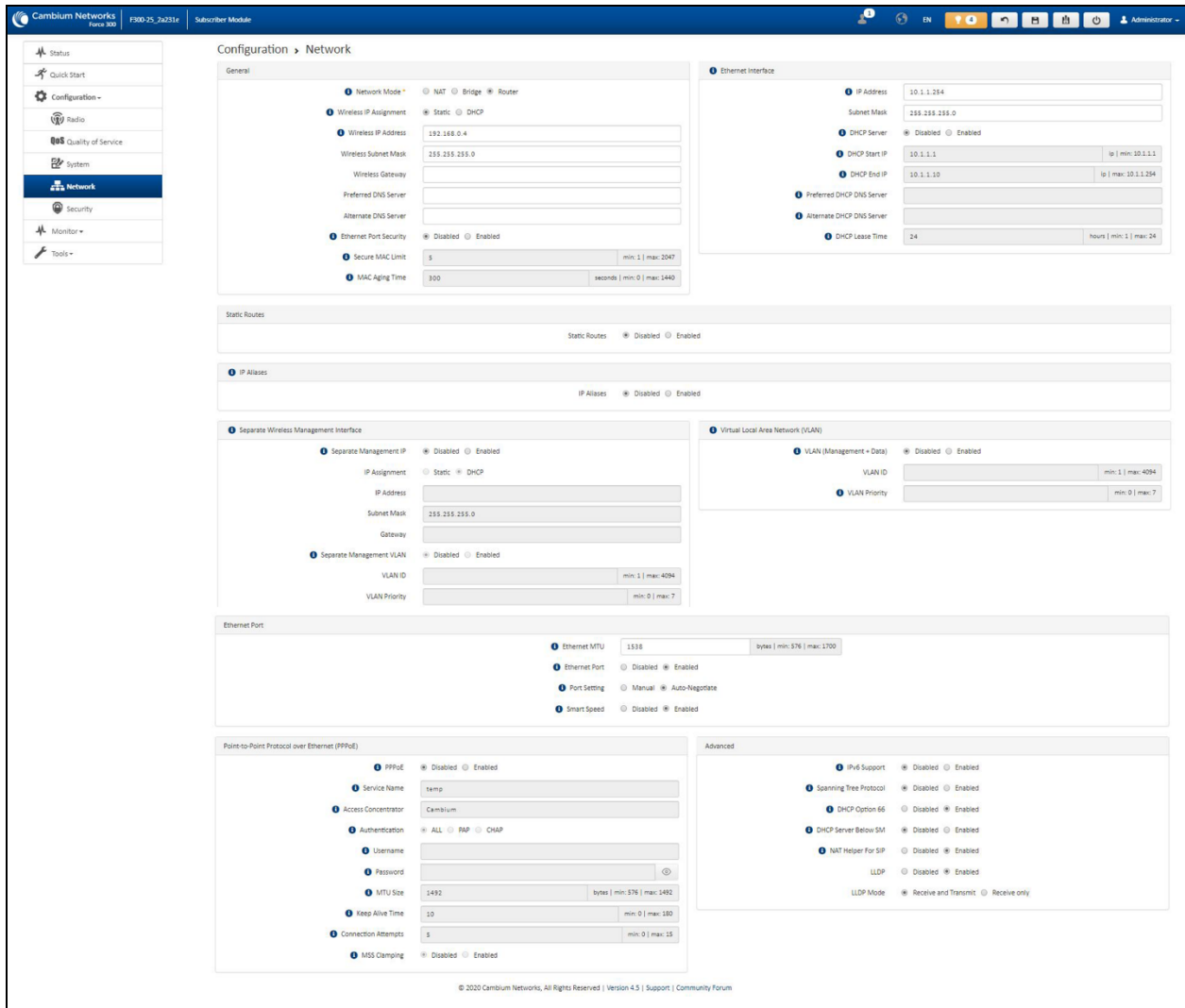


Figure 19: Configuration > Network page (SM mode, Router mode)

Table 137 Configuration > Network page attributes

Attribute	Description
<b>General</b>	
Network Mode	<p><b>NAT:</b> The SM acts as a router and packets are forwarded or filtered based on their IP header (source or destination).</p> <p><b>Bridge:</b> The SM acts as a switch and packets are forwarded or filtered based on their MAC destination address.</p> <p><b>Router:</b> The SM acts as a router and packets are forwarded or filtered based on their IP header (source or destination) using specific static routes and IP aliases configured by the operator.</p>

Attribute	Description
IP Assignment	<p><b>Static:</b> Device management IP addressing is configured manually in fields <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server.</b></p> <p><b>DHCP:</b> Device management IP addressing (<b>IP address, Subnet Mask, Gateway, and DNS Server</b>) is assigned through a network DHCP server, and parameters <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server</b> are not configurable.</p>
Wireless IP Assignment (NAT mode, Router mode)	<p><b>Static:</b> Wireless IP address is configured manually in fields <b>Wireless IP Address, Wireless IP Subnet Mask, Wireless Gateway IP Address, Preferred DNS IP Address, and Alternate DNS IP Address.</b></p> <p><b>DHCP:</b> Device management IP addressing (<b>Wireless IP address, Wireless Subnet mask, Wireless Gateway, and DNS server</b>) is assigned through a network DHCP server.</p>
IP Address Wireless IP Address (NAT mode, Router mode)	<p>Internet Protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.</p> <p>If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information through DHCP, the device management IP is set to fallback IP 192.168.0.1 (Access Point) or 192.168.0.2 (Subscriber Module).</p>
Subnet Mask Wireless IP Address (NAT mode, Router mode)	<p>Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device will belong to subnet 192.168.2.X.</p>
Gateway Wireless Gateway (NAT mode, Router mode)	<p>Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.</p>
Preferred DNS Server	<p>Configure the primary IP address of the server used for DNS resolution.</p>
Alternate DNS Server	<p>Configure the secondary IP address of the server used for DNS resolution.</p>
IPv6 Assignment	<p>IPv6 Assignment specifies how the IPv6 address is obtained.</p> <p><b>Static:</b> Device management IP addressing is configured manually in fields IPv6 Address and IPv6 Gateway.</p> <p><b>DHCPv6:</b> Device management IP addressing (IP address and gateway) is assigned via a network DHCP server, and parameters IPv6 Address and IPv6 Gateway are unused. If the DHCPv6 server is not available previous static IPv6 address will be used as a fallback IPv6 address. If no previous static IPv6 address is available, no IPv6 address will be assigned. DHCPv6 will occur over the wireless interface by default.</p>
IPv6 Address	<p>Internet Protocol version 6 (IPv6) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.</p> <p>IPv6 addresses are represented by eight groups of four hexadecimal digits separated by colons.</p>

Attribute	Description
IPv6 Gateway	Configure the IPv6 address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
Ethernet Port Security (Subscriber Module Mode)	<p><b>Disabled:</b> No MAC address limit/gaining timers are imposed for bridging at the SM device Ethernet port.</p> <p><b>Enabled:</b> By configuring <b>Secure MAC Limit</b> and <b>MAC Aging Time</b>, a limit is imposed on the number and duration of bridged devices connected to the SM Ethernet port.</p>
Secure MAC Limit (SM mode)	Configure the number of simultaneous secure MAC addresses that is allowed at the Ethernet interface of the SM
MAC Aging Time (SM mode)	Configure the time for which the secure MAC addresses should be allowed to age. Once the Aging timer expires for a MAC address, it is removed from the internal table and no longer count as an active MAC. Set the time to 0 to disable aging.
<b>Ethernet Interface (Subscriber Module NAT Mode, Router Mode)</b>	
IP Address (SM NAT mode, Router mode)	Ethernet interface Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.
Subnet Mask (SM NAT mode, Router Mode)	Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device belongs to subnet 192.168.2.X.
DHCP Server (SM NAT mode, Router mode)	<p><b>Disabled:</b> Use this setting when SM is in NAT or Router mode if there is an existing DHCP Server below the SM handing out IP Addresses or if all devices below the SM is configured with static IP Addresses.</p> <p><b>Enabled:</b> Use this setting when SM is in NAT or Router mode, to use the SM's local/onboard DHCP server to hand out IP addresses to its clients.</p>
DHCP Start IP (SM NAT mode, Router mode)	Configure the first address which is issued to a DHCP client. Upon additional DHCP requests, the DHCP Start IP is incremented until the local DHCP End IP is reached.
DHCP End IP (SM NAT mode, Router mode)	Configure the highest IP address in the DHCP pool that can be issued to a DHCP client.
Preferred DHCP DNS Server (SM NAT mode, Router mode)	Configure the primary DNS Server IP address which is used to configure DHCP clients (if local DHCP Server is set to <b>Enabled</b> ).
Alternate DHCP DNS Server (SM NAT Mode, Router mode)	Configure the secondary DNS Server IP address which is used to configure DHCP clients (if local DHCP Server is set to <b>Enabled</b> ).
DHCP Lease Time (SM NAT Mode, Router mode)	Configure the time for which a DHCP IP address is leased. When the lease time expires, the DHCP client must renew IP addresses through DHCP request.

Attribute	Description
PPPoE	<b>Point-to-Point Protocol over Ethernet:</b> Used for encapsulating PPP frames inside Ethernet frames.
Service Name	Optional entry to set a specific service name to connect to for the PPPoE session. If this is left blank the SM accepts the first service option that comes back from the Access Concentrator specified below, if any. This is limited to 32 characters.
Access Concentrator	An optional entry to set a specific Access Concentrator to connect to for the PPPoE session. If this is blank, the SM accepts the first Access Concentrator which matches the service name (if specified). This is limited to 32 characters.
<b>Static Routes (Subscriber Module Router Mode)</b>	
Static Routes (SM Router mode)	<p>When <b>Enabled</b>, it allows the operator to create static routes that apply to both the Wireless and Ethernet interface of the SM.</p> <p>This allows operators to configure a custom table of explicit paths between networks. Static routing is often used as a method to reduce the overhead of processing dynamic routes through a network when the specific path is known (or, it is simpler to define a specific path). Static routing is also used as a backup when dynamic routing protocols fail to complete a route from one network to another.</p> <p>In router mode, the Static Routes table is referenced by the SM to forward/filter packets to a particular destination configured by the user based on the IP addressing information contained in the table.</p> <p>Since static routes do not change with network changes, it is recommended to only use static routes for simple network paths that are not prone to frequent changes (requiring updates to the routes configured on the ePMP SM).</p> <p>It is important to consider each hop in a static route's path to ensure that the routing equipment has been configured to statically or dynamically route packets to the proper destination. Otherwise, network communication fails.</p> <p>Network Address Translation (NAT) is not performed when the SM is in Router mode.</p>
Target Network IP (SM Router mode)	Configure the target subnet/network's IP address to which the SM should route the packets.
Subnet Mask (SM Router mode)	Configure the subnet mask for the <b>Target Network IP</b> address.
Gateway (SM Router mode)	Configure the gateway to which packets that match the <b>Target Network IP Address</b> and <b>Subnet Mask</b> are sent.
Description (SM Router mode)	Provide a description to easily identify the static route and its purpose.

Attribute	Description
<b>IP Aliases (Subscriber Module Router Mode)</b>	
IP Aliases (SM Router mode)	When <b>Enabled</b> , IP aliases allow the operator to associate more than one IP address to the Ethernet interface of the SM.  This configuration of multiple IP addresses for the SM's Ethernet interface allows connections to multiple networks, often used as a mechanism for management access to the device from a convenient networking path.
IP Address (SM Router mode)	Configure the IP address for the alias.
Subnet Mask (SM Router mode)	Configure the subnet mask for the alias.
Description (SM Router mode)	Provide a description to easily identify the IP alias and its purpose/connected network.
<b>Separate Wireless Management Interface (SM NAT mode, Router mode)</b>	
Separate Management IP (SM NAT mode, Router mode)	<b>Disabled:</b> When disabled, the Wireless IP is the management interface for the SM.  <b>Enabled:</b> When enabled, the IP Address below is the management interface for the SM.
IP Assignment (SM NAT mode, Router mode)	<b>Static:</b> Separate Wireless Management Interface is configured manually in fields <b>IP Address, Subnet Mask</b> and <b>Gateway</b> .  <b>DHCP:</b> Management IP addressing ( <b>IP Address, Subnet Mask, Gateway, and DNS Server</b> ) is assigned through a network DHCP server.
IP Address (SM NAT mode, Router mode)	Configure the IP address that is used to access the SM's management interface when in NAT mode. The Wireless IP (public IP) does not allow management access.
Subnet Mask (SM NAT mode, Router mode)	Defines the address range of the connected IP network. For example, if the IP Address is configured to 192.168.2.1 and Subnet Mask is configured to 255.255.255.0, the device wireless interface belongs to the subnet 192.168.2.X.
Gateway (SM NAT mode, Router mode)	Configure 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.
Separate Management VLAN (SM NAT mode, Router mode)	<b>Enabled:</b> A VLAN configuration establishes a logical group within the network. Each computer in the VLAN, regardless of initial or eventual physical location, has access to the same data based on the VLAN architecture. For the network operator, this provides flexibility in network segmentation, simpler management, and enhanced security. When the SM is in NAT mode, the Separate Wireless Management VLAN configuration applies to management data.  <b>Disabled:</b> When disabled, the SM does not have a unique management VLAN.

Attribute	Description
VLAN ID (SM NAT mode, Router mode)	Configure this parameter to include the device's management traffic on a separate VLAN network.
VLAN Priority (SM NAT mode, Router mode)	<p>ePMP radios can prioritize VLAN traffic based on the eight priorities described in the IEEE 802.1p specification. <b>Data VLAN Priority</b> represents the VLAN Priority or Class of Service (CoS). Operators may use this prioritization field to give precedence to the management data of the device.</p> <p>This parameter only takes effect if the Separate Wireless Management VLAN parameter is enabled. Configure this parameter to set the value of the Priority code point field in the 802.1q tag for management traffic on the configured VLAN ID originating from the SM. The default value is 0.</p>
<b>Virtual Local Area Network (VLAN)</b>	
Management VLAN (AP mode)	<p><b>Enabled:</b> The AP management interface can be assigned to a management VLAN to separate management traffic (remote module management via SNMP or HTTP) from user traffic (such as internet browsing, voice, or video). Once the management interface is enabled for a VLAN, an AP's management interface can be accessed only by packets tagged with a VLAN ID matching the management VLAN ID.</p> <p>A VLAN configuration establishes a logical group within the network. Each computer in the VLAN, regardless of initial or eventual physical location, has access to the same data based on the VLAN architecture. For the network operator, this provides flexibility in network segmentation, simpler management, and enhanced security.</p> <p><b>Disabled:</b> When disabled, all IP management traffic is allowed to the device.</p>
VLAN (Management + Data) (SM mode)	<p><b>Enabled:</b> The device management interface can be assigned to a Management VLAN to separate management traffic (remote module management through SNMP or HTTP) from user traffic (such as internet browsing, voice, or video). Once the management interface is enabled for a VLAN, the management interface can be accessed only by packets tagged with a VLAN ID matching the management VLAN ID.</p> <p>A VLAN configuration establishes a logical group within the network. Each computer in the VLAN, regardless of initial or eventual physical location, has access to the same data based on the VLAN architecture. For the network operator, this provides flexibility in network segmentation, simpler management, and enhanced security.</p> <p><b>Disabled:</b> When disabled, all IP management traffic is allowed to the device.</p>
VLAN ID (NAT mode, Router mode)	Configure this parameter to include the device's management traffic on a separate VLAN network.

Attribute	Description
VLAN Priority (NAT mode, Router mode)	<p>ePMP radios can prioritize VLAN traffic based on the eight priorities described in the IEEE 802.1p specification. <b>Data VLAN Priority</b> represents the VLAN Priority or Class of Service (CoS). Operators may use this prioritization field to give precedence to the device management data.</p> <p>This parameter only takes effect if the Separate Wireless Management VLAN parameter is enabled. Configure this parameter to set the value of the Priority code point field in the 802.1q tag for management traffic on the configured VLAN ID originating from the SM. The default value is 0.</p>
Management VLAN ID (AP mode) (SM Bridge mode)	<p>Configure this parameter to include the device's management traffic on a separate VLAN network. For example, if Management VLAN ID is set to 2, UI access is allowed only from frames tagged with VLAN ID 2. This parameter takes effect only if the MGMT VLAN parameter is enabled.</p>
Management VLAN Priority (AP mode) (SM Bridge mode)	<p>ePMP devices can prioritize VLAN traffic based on the eight priorities described in the IEEE 802.1p specification. <b>Management VLAN Priority</b> represents the VLAN Priority or Class of Service (CoS). Operators may use this prioritization field to give precedence to the device management traffic.</p> <p>This parameter only takes effect if the Management VLAN parameter is enabled. Configure this parameter to set the value of the Priority code point field in the 802.1q tag for traffic on the management VLAN originating from the Subscriber Module. The default value is 0.</p>
Data VLAN (SM mode) (Bridge mode)	<p><b>Enabled:</b> A VLAN tag is added to all untagged traffic entering the Salve device LAN port before sending it to the Access Point and remove tags in the opposite direction from traffic (tagged with Data VLAN ID) entering on the SM device WAN port before sending to the SM device LAN port.</p> <p><b>Disabled:</b> When disabled, no changes are made to untagged traffic passing through the SM device.</p>
Data VLAN ID (SM mode) (Bridge mode)	<p>Configure this parameter to include this VLAN tag to all untagged traffic entering on the Subscriber Module device LAN port before sending it to the Access Point device and remove tags in the opposite direction from traffic (tagged with Data VLAN ID) entering on the Subscriber Module device WAN port before sending to the SM device LAN port.</p>
Data VLAN Priority (SM mode) (Bridge mode)	<p>ePMP devices can prioritize VLAN traffic based on the eight priorities described in the IEEE 802.1p specification. <b>Data VLAN Priority</b> represents the VLAN Priority or Class of Service (CoS). Operators may use this prioritization field to give precedence to device user data.</p> <p>This parameter only takes effect if the <b>Data VLAN</b> parameter is enabled. Configure this parameter to set the value of the Priority code point field in the 802.1q tag for traffic on the <b>Data VLAN</b> originating from the SM device. The default value is 0.</p>

Attribute	Description
Membership VLAN (SM Bridge mode)	Configure the <b>Membership VLAN Table</b> to include the SM in one or more VLANs. When the SM receives a packet tagged from either the Ethernet (LAN) or Wireless (WAN) side with a VLAN ID which is contained in the <b>Membership VLAN Table</b> , the packet is forwarded and sent out to the other interface. When the SM receives a packet tagged with a VLAN ID that is not present in the <b>Membership VLAN Table</b> , the frame is dropped (assuming there is at least one VLAN ID present in the Membership VLAN table or configured as a Data VLAN).
VLAN Mapping (SM Bridge mode)	Configure the <b>VLAN Mapping Table</b> to map the C-VLAN of traffic ingressing the Ethernet (LAN) port of the SM to an S-VLAN before being forwarded to the air interface on the UL. In the DL direction, the SM will automatically un-map the S-VLAN to the C-VLAN before forwarding the tagged packets to the Ethernet (LAN) interface of the SM.
C-VLAN (SM Bridge mode)	Configure the C-VLAN ID of the tagged traffic for which the mapping needs to occur.  The C-VLAN ID must be entered in the SM VLAN Membership VLAN table.
S-VLAN (SM Bridge mode)	Configure the S-VLAN ID to which the tagged traffic needs to be mapped.  The S-VLAN ID must be entered in the SM VLAN Membership VLAN table.
<b>Ethernet Port</b>	
Ethernet MTU	Specify the device MTU or Maximum Transmission Unit; the size in bytes of the largest data unit that the device is configured to process. Larger MTU configurations can enable the network to operate with greater efficiency, but in the case of retransmissions due to packet errors, efficiency is reduced since large packets must be resent in the event of an error.
Ethernet Port (SM mode)	<b>Disabled:</b> The primary Ethernet port is disabled (a mechanism for restricting access for non-payment).  <b>Enabled:</b> The primary Ethernet port is enabled.
Port Setting	Allows the Gigabit Ethernet port duplex settings and port speed to be either manually configured or auto-negotiate with the connected Ethernet device on the other end of the link. Guidelines for using <b>Port Setting</b> : <ul style="list-style-type: none"> <li>• If auto-negotiation is turned on, this applies to both <b>Port Speed</b> and <b>Port Duplex Mode</b>.</li> <li>• If the other end of the Ethernet connection supports auto-negotiation, then select <b>Auto-Negotiate</b>.</li> <li>• If the other end of the Ethernet connection does not support auto-negotiation, then select <b>Manual</b> and both ends of the link should manually set the port speed and port duplex mode.</li> </ul>
Port Speed	With <b>Port Setting</b> configured to <b>Manual</b> , the Gigabit Ethernet port speed can be forced to 1000 Mbps, 100 Mbps, or 10 Mbps.

Attribute	Description
Port Duplex mode	With <b>Port Setting</b> configured to <b>Manual</b> , the Gigabit Ethernet port duplex mode can be forced to <b>Full</b> or <b>Half</b> .
<b>Port Forwarding (Subscriber Module Mode) (NAT Mode)</b>	
UPnP IGD (SM mode) (NAT mode)	<p>Universal Plug and Play (UPnP) is a set of networking protocols that permits networked devices, such as personal computers, printers, Internet gateways, Wi-Fi APs, and mobile devices to seamlessly discover each other's presence on the network and establish functional network services for data sharing, communications, and entertainment. UPnP is intended primarily for residential networks without enterprise-class devices. With UPnP IGD and PCP protocols, ePMP supports explicit dynamic port mappings.</p> <p>Enable UPnP IGD (Internet Gateway Device) to allow the ePMP device to use the IGD profile for UPnP support.</p>
NAT PMP (PCP) (SM mode) (NAT mode)	<p>The PCP (Port Control Protocol) allows an IPv6 or IPv4 host to control how incoming IPv6 or IPv4 packets are translated and forwarded by a Network Address Translator (NAT) or simple firewall, and also allows a host to optimize its outgoing NAT keepalive messages. PCP was standardized as a successor to the NAT Port Mapping Protocol (NAT-PMP), with which it shares similar protocol concepts and packet formats.</p> <p>Enable this parameter to allow the ePMP device to use the PCP protocol for UPnP support.</p>
Data Port Forwarding (SM mode) (NAT mode)	The Data Port Forwarding Table is used to define which range of wireless ports are forwarded to a LAN (SM local network) IP address below the SM.
Protocol (SM mode) (NAT mode)	<p><b>UDP:</b> Packet forwarding decisions are based on UDP packets.</p> <p><b>TCP:</b> Packet forwarding decisions are based on TCP packets.</p>
Port Begin (SM mode) (NAT mode)	Configure the beginning of the range of wireless ports to match for forwarding to LAN IP.
Port End (SM mode) (NAT mode)	Configure the end of the range of wireless ports to match for forwarding to LAN IP.
Forwarding IP (SM mode) (NAT mode)	Configure the LAN IP of the device situated below the SM which receives the packets forwarded based on the separate management IP port forwarding table configuration.
Mapped Port (SM mode) (NAT mode)	Configure the port of the device situated below the SM which receives the packets forwarded based on the Data Port Forwarding Table configuration.
<b>Point-to-Point Protocol over Ethernet (PPPoE) (SM mode) (NAT mode, Router mode)</b>	
PPPoE (SM mode) (NAT mode, Router mode)	Point-to-Point Protocol over Ethernet: Used for encapsulating PPP frames inside Ethernet frames.

Attribute	Description
Service Name (SM mode) (NAT mode, Router mode)	Optional entry to set a specific service name to connect to for the PPPoE session. If this is left blank the SM accepts the first service option that comes back from the Access Concentrator specified below, if any. This is limited to 32 characters.
Access Concentrator (SM mode) (NAT mode, Router mode)	Optional entry to set a specific Access Concentrator to connect to for the PPPoE session. If this is blank, the SM accepts the first Access Concentrator which matches the service name (if specified). This is limited to 32 characters.
Authentication (SM mode) (NAT mode, Router mode)	<p><b>ALL:</b> This means that CHAP authentication is attempted first, then PAP authentication. The same password is used for both types.</p> <p><b>CHAP:</b> This means that CHAP authentication is attempted.</p> <p><b>PAP:</b> This means that PAP authentication is attempted.</p>
Username (SM mode) (NAT mode, Router mode)	This is the CHAP/PAP username that is used. This is limited to 32 characters.
Password (SM mode) (NAT mode, Router mode)	This is the CHAP/PAP password that is used. This is limited to 32 characters.
MTU Size (SM mode) (NAT mode, Router mode)	Maximum Transmission Unit; the size in bytes of the largest data unit that the device is configured to process inside the PPPoE tunnel. This field allows the operator to specify the largest MTU value to use in the PPPoE session if PPPoE MSS Clamping is Enabled. 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 uses the smaller value as its MTU for the PPPoE link.
Keep Alive Time (SM mode) (NAT Mode, Router Mode)	Configure the Keep Alive Time to allow the radio to keep the PPPoE session up after establishment. As an example, if this field is set to 5, the PPPoE client sends a keep-alive message to the PPPoE server every 5 seconds. If there is no acknowledgment, it sends the <b>Keep alive</b> message to the server four more times (for a total of five times) before tearing down the PPPoE session. Setting this to 12 means the keep-alive message is sent every 12 seconds and when there is no acknowledgment, the client tries for a total of 12 times every 12 seconds before tearing down the PPPoE session.
MSS Clamping (SM mode) (NAT mode, Router mode)	<b>Disabled:</b> The SM PPPoE session allows any MTU size determined by other devices in the PPPoE session during the LCP negotiations.

Attribute	Description
	<p><b>Enabled:</b> The SM PPPoE session enforces a max MTU size determined by the PPPoE MTU Size setting for all devices in the PPPoE session during the LCP negotiations unless one of the devices enforces an MTU setting that is smaller in value.</p>
<b>SFP Port (Access Point Mode)</b>	
SFP Port (AP mode)	<p><b>Disabled:</b> The SFP port is inactive.</p> <p><b>Enabled:</b> The SFP port is active.</p>
<b>Advanced</b>	
IPv6 Support	System-wide IPv6 Protocol Support. When enabled, appropriate IPv6 modules and services are loaded.
Spanning Tree Protocol	<p><b>Disabled:</b> When disabled, Spanning Tree Protocol (802.1d) functionality is disabled at the Access Point.</p> <p><b>Enabled:</b> When enabled, Spanning Tree Protocol (802.1d) functionality is enabled at the Access Point, allowing for the prevention of Ethernet bridge loops.</p>
DHCP Server Below Subscriber Module (SM mode)	<p><b>Disabled:</b> This blocks DHCP servers connected to the SM device LAN side from handing out IP addresses to DHCP clients above the SM device (wireless side).</p> <p><b>Enabled:</b> This allows DHCP servers connected to the SM device LAN side to assign IP addresses to DHCP clients above the SM device (wireless side). This configuration is typical in PTP links.</p>
Management Access (AP mode)	<p><b>Ethernet:</b> Only allow access to the AP's web management interface through a local Ethernet (LAN) connection. In this configuration, the AP's web management interface may not be accessed from over the air (from a device situated below the SM).</p> <p><b>Ethernet and Wireless:</b> Allow access to the AP's web management interface through a local Ethernet (LAN) connection and from over the air (from a device situated below the SM).</p> <p>APs configured with Management Access Interface set to Ethernet and Ethernet and Wireless are susceptible to unauthorized access.</p>
SM Traffic Isolation (AP mode)	<p><b>Disabled:</b> This is the default mode. When SM isolation is disabled, an SM can communicate with another SM, when both the SMs are associated with the same Access Point (AP).</p> <p><b>Enabled:</b> When the SM Isolation feature is <b>Enabled</b>, an SM is unable to communicate with another SM (peer-to-peer traffic) when both the SMs are associated with the same AP. This feature essentially enables the AP to drop the packets to avoid peer-to-peer traffic scenarios.</p>
DHCP Option 82 (AP mode)	<b>Disabled:</b> The device does not insert the <b>remote-id</b> (option ID 0x2) and the <b>circuit-id</b> (ID 0x01). DHCP Option 82 is 'Disabled' by default.

Attribute	Description
	<p><b>Enabled:</b> The device inserts <b>remote-id</b> (option ID 0x2) to be the SM MAC address and the <b>circuit-id</b> (ID 0x01) to be the AP's MAC address. Those two fields are used to identify the remote device and connection from which the DHCP request was received.</p>
LLDP	<p>The Link Layer Discovery Protocol (LLDP) is a vendor-neutral link layer protocol (as specified in IEEE 802.1AB) used by ePMP for advertising its identity, capabilities, and neighbors on the Ethernet/wired interface.</p> <p><b>Disabled:</b> ePMP does not receive or transmit LLDP packets from/to its neighbors.</p> <p><b>Enabled:</b> ePMP can receive LLDP packets from its neighbors and send LLDP packets to its neighbors, depending on the LLDP Mode configuration below.</p>
LLDP Mode	<p><b>Receive and Transmit:</b> ePMP sends and receives LLDP packets to/from its neighbors on the Ethernet/LAN interface.</p> <p><b>Receive Only:</b> ePMP receives LLDP packets from its neighbors on the Ethernet/LAN interface and discovers them.</p>
PPPoE Intermediate Agent	<p>When enabled, during the PPPoE Discovery phase the AP inserts access loop identification into the PPPoE PADR packets. This mechanism helps the service provider to distinguish between end hosts connected via Ethernet as an access device (typically, home routers situated below an ePMP subscriber device).</p> <p>On the AP, PPPoE Intermediate Agent enables subscriber line identification by tagging Ethernet frames of corresponding users with Vendor-Specific PPPoE Tags <b>Circuit ID</b> (defining AP name, frame, slot, port, and VLAN ID information) and <b>Remote ID</b> (defining user phone number).</p>
<b>Broadcast / Multicast Traffic Shaping (SM mode) (Bridge mode)</b>	
Broadcast Packet Limit (SM mode) (Bridge mode)	<p><b>Enabled:</b> This allows the user to set the <b>Broadcast Packet Rate</b> below. Configure this parameter to limit the number of broadcast packets that will be allowed on the ingress of the radio's Ethernet port. Set the packets per second value to limit the impact of events such as broadcast storms.</p> <p><b>Disabled:</b> There is no limit on the amount of broadcast traffic allowed into the ingress of the radio's Ethernet port.</p>
Broadcast Packet Rate (SM mode) (Bridge mode)	<p>Set the packets per second value to limit the amount of broadcast traffic allowed on the ingress on the radio's Ethernet port. The packets per second limit can be set individually on each ePMP radio. The range is 100 to 16000 packets per second. The default is <b>1000</b>.</p>
Reliable Multicast	<p><b>Enabled:</b> This feature allows ePMP to support IGMP capable devices. Once a multicast group is identified, the AP allows multicast traffic to be sent only to the SMs within the multicast group. The SMs support up to 5 unique multicast groups. Also, when this option is enabled, the multicast traffic is sent to the SMs using the current Downlink MCS rate.</p>

Attribute	Description
	<b>Disabled:</b> ePMP supports IGMP capable devices but the multicast traffic is sent using MCS 1 on the downlink to all SMs, regardless of the multicast group.
Multicast Group Limit (SM mode) (Bridge mode)	Configure the maximum number of simultaneous multicast groups that the SM allows from devices below it. The default is <b>3</b> .
Multicast VLAN (SM mode) (Bridge mode)	<b>Enabled:</b> A VLAN tag is added to all untagged multicast traffic entering the SM's LAN port before sending it to the AP and remove tags in the opposite direction from traffic (tagged with Multicast VLAN ID) entering on the SM's WAN port before sending to the SM's LAN port.  <b>Disabled:</b> When disabled, no changes are made to untagged multicast traffic passing through the SM.
Multicast VLAN ID (SM mode) (Bridge mode)	Configure this parameter to include this VLAN tag to all untagged <b>multicast</b> traffic entering on the SM's LAN port before sending it to the AP and remove tags in the opposite direction from multicast traffic (tagged with Multicast VLAN ID) entering on the SM's WAN port before sending to the SM's LAN port.
Multicast VLAN Priority (SM mode) (Bridge mode)	ePMP radios can prioritize VLAN traffic based on the eight priorities described in the IEEE 802.1p specification. <b>Multicast VLAN Priority</b> represents the VLAN Priority or Class of Service (CoS). Operators may use this prioritization field to give precedence to the device's <b>multicast</b> data.  This parameter only takes effect if the <b>Multicast VLAN</b> parameter is enabled. Configure this parameter to set the value of the Priority code point field in the 802.1p tag for traffic on the <b>Multicast VLAN</b> originating from the SM. The default value is 0.
<b>De-Militarized Zone (Subscriber Module NAT Mode)</b>	
DMZ (SM NAT mode)	<b>Disabled:</b> Packets arriving on the wireless interface destined for the Ethernet side of the network are dropped if a session does not exist between the Source IP (Wireless) and Destination IP (Ethernet). By default, NAT requires the sessions to be initiated from the Ethernet side before a packet is accepted from the Wireless to the Wired side.  <b>Enabled:</b> Any packets with an unknown destination port (not associated with an existing session or not defined in the port forwarding rules) are automatically sent to the device configured with DMZ IP Address.
IP Address (SM NAT mode)	Configure the IP address of an SM-connected device that is allowed to provide network services to the wide-area network.
Allow ICMP to DMZ (SM NAT mode)	<b>Enabled:</b> ICMP packets are forwarded to the DMZ IP  <b>Disabled:</b> SM answers ICMP requests, and SM <b>Wireless IP Address</b> becomes reachable by ping when DMZ is enabled.

## Configuration > Security page

The **Security** page is used to configure system security features including authentication and Layer2/Layer3 Firewall rules. [Figure 20](#) and [Figure 21](#) shows the Security page (AP mode) and Security page (SM mode).



### Attention

If a device firewall rule is added with **Action** set to **Deny** and **Interface** set to **LAN** or **WAN** and no other rule attribute is configured, the device drops all Ethernet or wireless traffic, respectively. Ensure that all firewall rules are specific to the type of traffic which must be denied and that no rules exist in the devices with the only Action set to **Deny** and Interface set to **LAN** or **WAN**. To regain access to the device, perform a factory default.

The screenshot shows the 'Configuration > Security' page for an Access Point (AP) mode device. The interface includes a left-hand navigation menu with options like Status, Quick Start, Configuration, Radio, System, Network, Security (selected), Monitor, and Tools. The main content area is titled 'Configuration > Security' and contains several sections: 'Security Options' with radio buttons for Wireless Security, Open, WPA2 (selected), and RADIUS; 'AES Cipher Type' with radio buttons for AES-128 (selected) and AES-256; 'WPA2' with a 'WPA2 Pre-shared Key' field; 'RADIUS' with 'RADIUS Servers' (a table with columns for IP Address, Port, and Secret), 'Server Retries' (set to 5), 'Server Timeout' (set to 5), and 'GUI User Authentication' options; 'Firewalls' with 'Layer 2 Firewall' and 'Layer 3 Firewall' both set to Disabled; and 'Wireless MAC Address Filtering' with 'Wireless MAC Filter' set to Disabled.

Figure 20: Configuration > Security page (AP mode)

The screenshot shows the 'Configuration > Security' page for a Subscriber Module device. The interface includes a left-hand navigation menu with options like Status, Quick Start, Configuration, Radio, System, Network, Security (selected), Monitor, and Tools. The main content area is titled 'Configuration > Security' and contains several sections: 'Security Options' with radio buttons for Wireless Security, RADIUS (selected), WPA2 (checked), and Open; 'EAP-TTLS Username' (set to cambium-station); 'Use Ethernet MAC Address as EAP-TTLS Username' with radio buttons for OFF (selected), Using ':' as Format, and Using '-' as Format; 'EAP-TTLS Password' (masked); 'Authentication Identity String' (set to anonymous); 'Authentication Identity Realm' (set to cambiumnetworks.com); 'Default Root Certificate' (set to default.crt); 'Canopy Root Certificate' (set to pmp450.crt); 'User Provisioned Root Cert 1' (no certificate added); and 'User Provisioned Root Cert 2' (no certificate added); 'Firewalls' with 'Layer 2 Firewall' and 'Layer 3 Firewall' both set to Disabled.

Figure 21: Configuration > Security page (SM mode)

Table 3: Configuration > Security page attributes

Attribute	Description
<b>Security Options</b>	
Wireless Security (AP mode)	<p>For AP mode devices, select the security mode enforced upon network entry.</p> <p>For SM mode devices, select the security mode utilized upon network entry attempts.</p> <p><b>Open:</b> All SM devices requesting network entry are allowed registration.</p> <p><b>WPA2:</b> The WPA2 mechanism provides AES radio link encryption and SM network entry authentication. When enabled, the SM must register using the authentication pre-shared key configured on the AP and SM.</p> <p><b>RADIUS:</b> Enables SM authentication through a pre-configured Radius server.</p>
<b>WPA2</b>	
WPA2 Pre-shared Key	Configure this key on the AP, then configure the SM with this key to complete the authentication configuration. This key must be between 8 to 128 symbols.
<b>RADIUS (AP mode)</b>	
Servers (AP mode)	<p>For more Radio servers, click <b>Add</b>. Up to three Radius servers can be configured on the device with the following attributes:</p> <ul style="list-style-type: none"> <li>• <b>IP Address:</b> IP Address of the Radius server on the network.</li> <li>• <b>Port:</b> The Radius server port. The default is 1812.</li> <li>• <b>Secret:</b> Secret key that is used to communicate with the RADIUS server.</li> </ul>
Server Retries (AP mode)	The number of times the radio retries authentication with the configured Radius server before it fails authentication of the SM.
Server Timeout (AP mode)	Timeout between each retry with the configured RADIUS server before it fails authentication of the SM.
GUI User Authentication (AP mode)	<p>This applies to both the AP and its registered SMs.</p> <p><b>Device Local Only:</b> The device's GUI authentication is local to the device using one of the accounts configured under <b>Configuration &gt; System &gt; Account Management</b>.</p> <p><b>Remote RADIUS Server Only:</b> The UI authentication of the device is performed using a RADIUS server.</p> <p><b>Remote RADIUS Server and Fallback to Local:</b> The UI authentication of the device is performed using a RADIUS server. Upon failure of authentication through a RADIUS server, the authentication falls back to one of the local accounts configured under <b>Configuration &gt; System &gt; Account Management</b>.</p>
EAP-TTLS Username (SM mode)	Configure the EAP-TTLS Username to match the credentials on the RADIUS server being used for the network.

Attribute	Description
Use Ethernet MAC Address at EAP-TTLS Username (SM mode)	The device MAC Address can be used as the EAP-TTLS Username in either “:” or “-“ delimited format.
EAP-TTLS Password (SM mode)	Configure the EAP-TTLS Password to match the credentials on the RADIUS server being used for the network.
Authentication Identity String (SM mode)	Configure this Identity string to match the credentials on the RADIUS server being used for the network. The default value for this parameter is <b>anonymous</b> .
Authentication Identity Realm (SM mode)	Configure this Identity string to match the credentials on the RADIUS server being used for the network. The default value for this parameter is <b>cambiumnetworks.com</b> .
Default Root Certificate (SM mode)	Default EAP-TTLS root certificate that must match the certificate on the RADIUS server.
Canopy Root Certificate (SM mode)	PMP 450 default EAP-TTLS root certificate to match the certificate on the RADIUS server used with current PMP 450 installations.
User Provisioned Root Cert 1 (SM mode)	Import a user certificate if a certificate different from the default certificates is needed.
User Provisioned Root Cert 2 (SM mode)	Import a second user certificate if a certificate different from the default or 1 <sup>st</sup> user provisioned certificate is needed.
<b>Firewalls</b>	
Layer 2 Firewall	<b>Enabled:</b> Modifications to the Layer 2 Firewall Table are allowed and rules are enforced. <b>Disabled:</b> Modifications to the Layer 2 Firewall Table are not allowed and rules are not enforced.
Layer 2 Firewall Rules	The Layer 2 firewall table may be used to configure rules matching layer 2 (MAC layer) traffic which results in forwarding or dropping the traffic over the radio link or Ethernet interface.
Layer 3 Firewall	<b>Disabled:</b> Modifications to the Layer 3 Firewall Table are not allowed and rules are not enforced. <b>Enabled:</b> Modifications to the Layer 3 Firewall Table are allowed and rules are enforced.
Layer 3 Firewall Rules	The Layer 3 firewall table may be used to configure rules matching layer 3 (IP layer) traffic which results in forwarding or dropping the traffic over the radio link or Ethernet interface.
<b>Wireless MAC Address Filtering (Access Point Mode)</b>	

Attribute	Description
Wireless MAC Filter (AP mode)	<p><b>Disabled:</b> SMs with any MAC Address are allowed to register to the AP.</p> <p><b>Enabled:</b> SMs with specific MAC addresses can be allowed (permit) or denied (prevent) registration with the AP as configured under the <b>MAC Filter List</b>.</p>
Wireless MAC Filter Policy (AP mode)	<p><b>Prevent:</b> All MAC Addresses configured under the MAC Filter List are denied registration to the AP.</p> <p><b>Permit:</b> Only the MAC Addresses configured under the MAC Filter List are allowed to register to the AP.</p>
Wireless MAC Filter List (AP mode)	Configure the SM's MAC addresses that are permitted or prevented from registering to the AP.
MAC Address (AP mode)	MAC Address of the SM.
Description (AP mode)	Friendly description to identify the SM.

## Monitor menu

This section is used to analyze and troubleshoot network performance and operation. Use the **Monitor menu** to access device and network statistics and status information.

### Monitor > Performance page

Figure 23 shows the Performance page.

**Monitor > Performance**

Reset Statistics Time Since Last Reset: 0000:00:30:45 [Reset Stats](#)

**Ethernet Statistics - Transmitted**

- Total Traffic: 5382.5 Kbytes (100%)
- Total Transmitted Packets: 5709 packets (100%)
- Packet Errors: 0 packets
- Packet Drops: 0 packets
- Multicast / Broadcast Traffic: 8.8 Kbytes (0%)
- Broadcast Packets: 0 packets
- Multicast Packets: 61 packets (1%)
- Unicast Packets: 5647 packets (99%)

**Ethernet Statistics - Received**

- Total Traffic: 1024.1 Kbytes (100%)
- Total Received Packets: 3974 packets (100%)
- Packet Errors: 0 packets
- Packet Drops: 0 packets
- Multicast / Broadcast Traffic: 43.5 Kbytes (4%)
- Broadcast Packets: 9 packets (0%)
- Multicast Packets: 218 packets (5%)
- Unicast Packets: 3747 packets (94%)

**Auxiliary Port Statistics - Transmitted**

- Total Traffic: 0 Kbytes
- Total Transmitted Packets: 0 packets
- Packet Errors: 0 packets
- Packet Drops: 0 packets
- Broadcast Packets: 0 packets
- Multicast Packets: 0 packets
- Unicast Packets: 0 packets

**Auxiliary Port Statistics - Received**

- Total Traffic: 0 Kbytes
- Total Received Packets: 0 packets
- Packet Errors: 0 packets
- Packet Drops: 0 packets
- Broadcast Packets: 0 packets
- Multicast Packets: 0 packets
- Unicast Packets: 0 packets

**Wireless Statistics - Downlink**

- Total Traffic: 0 Kbytes
- Total Transmitted Packets: 0 packets
- Error Drop Packets: 0 packets
- Capacity Drop Packets: 0 packets
- Retransmission Packets: N/A
- Multicast / Broadcast Traffic: 0 Kbytes
- Broadcast Packets: 0 packets
- Multicast Packets: 0 packets
- Unicast Packets: 0 packets

**Wireless Statistics - Uplink**

- Total Traffic: 0 Kbytes
- Total Received Packets: 0 packets
- Error Drop Packets: 0 packets
- Multicast / Broadcast Traffic: 0 Kbytes
- Broadcast Packets: 0 packets
- Multicast Packets: 0 packets
- Unicast Packets: 0 packets

**System Statistics**

- Session Drops: 0 sessions
- Network Entry Attempts: 0
- Successful Network Entries: 0
- Network Entry Authentication Failures: 0
- Total Device Reboots: 0 times
- Soft Device Reboots: 0 times
- Watchdog Device Reboots: 0 times
- Hard Device Reboots: 0 times

**Subscriber Module Statistics** [Show Details](#)

MAC Address	IP Address	Device Name	Total Uplink (Bytes)	Total Uplink Packets	Uplink Packet Drops	Total Downlink (Bytes)	Total Downlink Packets	Downlink Packet Drops	Downlink Capacity Packet Drops	Downlink Retransmitted Packets	Downlink Power (dBm)
Table is empty											

**Downlink Packets Per MCS**

SS MCS 13 - 4296-QAM 5/6	0 (0%)	SS MCS 13 - 4296-QAM 5/6	0 (0%)
SS MCS 12 - 4296-QAM 3/4	0 (0%)	SS MCS 12 - 4296-QAM 3/4	0 (0%)
SS MCS 11 - 1024-QAM 5/6	0 (0%)	SS MCS 11 - 1024-QAM 5/6	0 (0%)
SS MCS 10 - 1024-QAM 3/4	0 (0%)	SS MCS 10 - 1024-QAM 3/4	0 (0%)
SS MCS 9 - 256-QAM 5/6	0 (0%)	SS MCS 9 - 256-QAM 5/6	0 (0%)
SS MCS 8 - 256-QAM 3/4	0 (0%)	SS MCS 8 - 256-QAM 3/4	0 (0%)
SS MCS 7 - 64-QAM 5/6	0 (0%)	SS MCS 7 - 64-QAM 5/6	0 (0%)
SS MCS 6 - 64-QAM 3/4	0 (0%)	SS MCS 6 - 64-QAM 3/4	0 (0%)
SS MCS 5 - 64-QAM 2/3	0 (0%)	SS MCS 5 - 64-QAM 2/3	0 (0%)
SS MCS 4 - 16-QAM 3/4	0 (0%)	SS MCS 4 - 16-QAM 3/4	0 (0%)
SS MCS 3 - 16-QAM 1/2	0 (0%)	SS MCS 3 - 16-QAM 1/2	0 (0%)
SS MCS 2 - QPSK 3/4	0 (0%)	SS MCS 2 - QPSK 3/4	0 (0%)
SS MCS 1 - QPSK 1/2	0 (0%)	SS MCS 1 - QPSK 1/2	0 (0%)

**Uplink Packets Per MCS**

SS MCS 13 - 4296-QAM 5/6	0 (0%)	SS MCS 13 - 4296-QAM 5/6	0 (0%)
SS MCS 12 - 4296-QAM 3/4	0 (0%)	SS MCS 12 - 4296-QAM 3/4	0 (0%)
SS MCS 11 - 1024-QAM 5/6	0 (0%)	SS MCS 11 - 1024-QAM 5/6	0 (0%)
SS MCS 10 - 1024-QAM 3/4	0 (0%)	SS MCS 10 - 1024-QAM 3/4	0 (0%)
SS MCS 9 - 256-QAM 5/6	0 (0%)	SS MCS 9 - 256-QAM 5/6	0 (0%)
SS MCS 8 - 256-QAM 3/4	0 (0%)	SS MCS 8 - 256-QAM 3/4	0 (0%)
SS MCS 7 - 64-QAM 5/6	0 (0%)	SS MCS 7 - 64-QAM 5/6	0 (0%)
SS MCS 6 - 64-QAM 3/4	0 (0%)	SS MCS 6 - 64-QAM 3/4	0 (0%)
SS MCS 5 - 64-QAM 2/3	0 (0%)	SS MCS 5 - 64-QAM 2/3	0 (0%)
SS MCS 4 - 16-QAM 3/4	0 (0%)	SS MCS 4 - 16-QAM 3/4	0 (0%)
SS MCS 3 - 16-QAM 1/2	0 (0%)	SS MCS 3 - 16-QAM 1/2	0 (0%)
SS MCS 2 - QPSK 3/4	0 (0%)	SS MCS 2 - QPSK 3/4	0 (0%)
SS MCS 1 - QPSK 1/2	0 (0%)	SS MCS 1 - QPSK 1/2	0 (0%)

**Downlink Frame Time**

Total Frame Time Used: 14% %

Figure 22: Monitor > Performance page (SM mode)

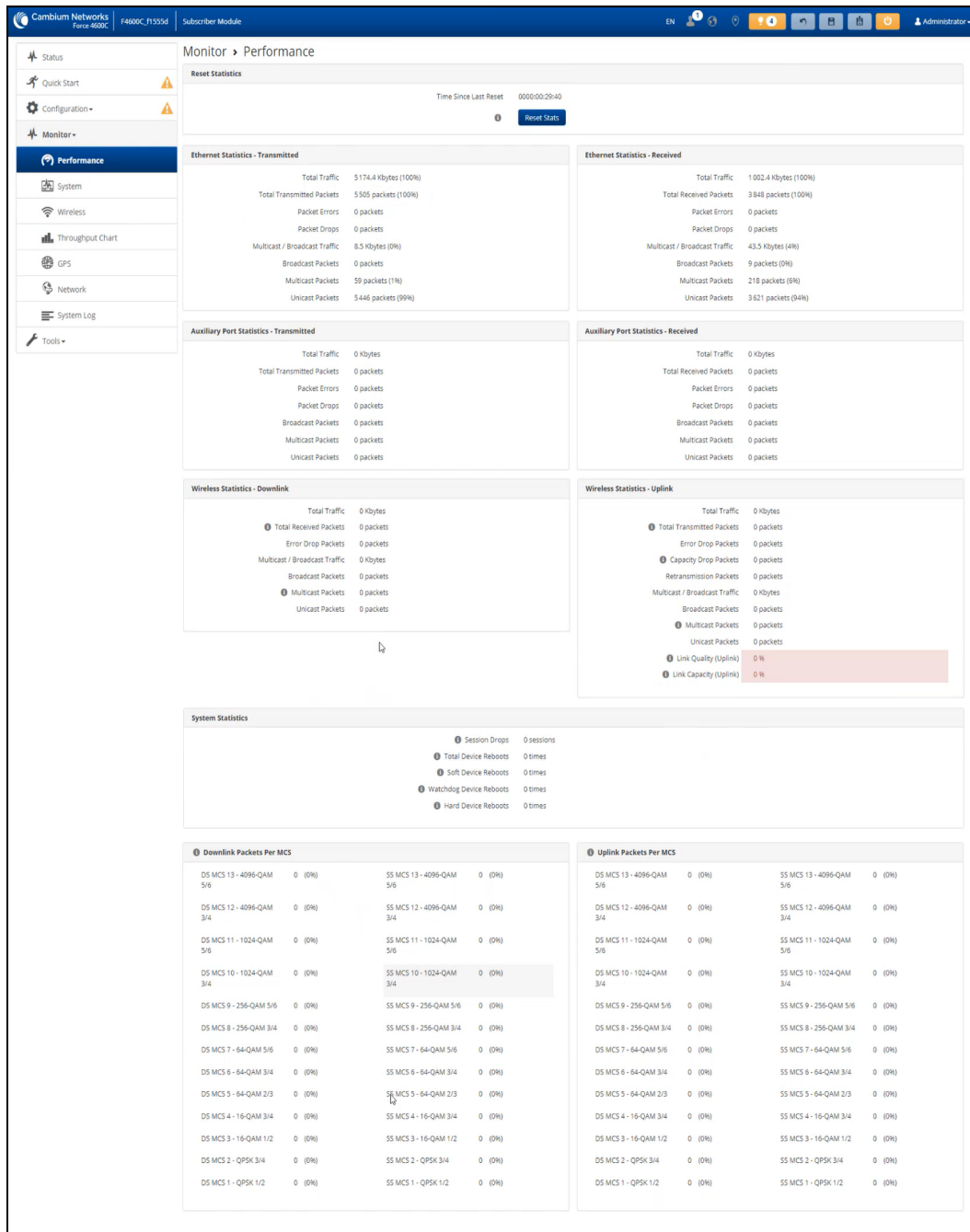


Figure 23: Monitor > Performance page (SM mode)

Table 139 Monitor > Performance page attributes

Attribute	Description
Reset Statistics	

Attribute	Description
Time Since Last Reset	Time since the stats were last reset.
<b>Ethernet Statistics - Transmitted</b>	
Total Traffic	The total amount of traffic in KB transferred from the device Ethernet interface.
Total Packets	The total number of packets transferred from the device Ethernet interface.
Packet Errors	The total number of packets transmitted out of the device Ethernet interface with errors due to collisions, CRC errors, or irregular packet size.
Packet Drops	The total number of packets dropped before sending out from the device's Ethernet interface due to Ethernet setup or filtering issues.
Broadcast Packets	The total number of broadcast packets sent through the device Ethernet interface.
Multicast Packets	The total number of multicast packets sent through the device Ethernet interface.
<b>Ethernet Statistics - Received</b>	
Total Traffic	The total amount of traffic in KB received by the device Ethernet interface.
Total Packets	The total number of packets received by the device Ethernet interface.
Packet Errors	The total number of packets received by the device Ethernet interface with errors due to collisions, CRC errors, or irregular packet size.
Packet Drops	The total number of packets dropped before sending out from the device's wireless interface due to Ethernet setup or filtering issues.
Broadcast Packets	The total number of broadcast packets received through the device Ethernet interface.
Multicast Packets	The total number of multicast packets received through the device Ethernet interface.
<b>SFP Statistics - Transmitted</b>	
Total Traffic	The total amount of traffic in KB transferred from the device SFP interface.
Total Packets	The total number of packets transferred from the device SFP interface.
Packet Errors	The total number of packets transmitted out of the device SFP interface with errors due to collisions, CRC errors, or irregular packet size.
Packet Drops	The total number of packets dropped before sending out from the device's SFP interface due to setup or filtering issues.
Broadcast Packets	The total number of broadcast packets sent through the device SFP interface.
Multicast Packets	The total number of multicast packets sent through the device SFP interface.
<b>SFP Statistics - Received</b>	
Total Traffic	The total amount of traffic in KB received by the device SFP interface.

Attribute	Description
Total Packets	The total number of packets received by the device SFP interface.
Packet Errors	The total number of packets received by the device SFP interface with errors due to collisions, CRC errors, or irregular packet size.
Packet Drops	The total number of packets dropped before sending out of the device wireless interface due to SFP setup or filtering issues.
Broadcast Packets	The total number of broadcast packets received through the device SFP interface.
Multicast Packets	The total number of multicast packets received through the device SFP interface.
<b>Wireless Statistics – Downlink</b>	
Total Traffic	The total amount of traffic transmitted out of the device wireless interface in Kbits.
Total Packets	The total number of packets transmitted out of the device wireless interface.
Error Drop Packets	The total number of packets dropped after transmitting out of the device Wireless interface due to RF errors (No acknowledgment and other RF related packet error).
Capacity Drop Packets (AP mode)	The total number of packets dropped after transmitting out of the device wireless interface due to capacity issues (data buffer/queue overflow or other performance or internal packet errors).
Retransmission Packets (AP mode)	The total number of packets re-transmitted after transmitting out of the device's wireless interface due to the packets not being received by the receiving device.
Multicast / Broadcast Traffic	The total amount of multicast and broadcast traffic transmitted out of the device wireless interface in KB.
Broadcast Packets	The total number of broadcast packets transmitted out of the device wireless interface.
Multicast Packets	The total number of multicast packets transmitted out of the device wireless interface.
<b>Wireless Statistics – Uplink</b>	
Total Traffic	The total amount of traffic received through the device wireless interface in KB.
Total Packets	The total number of packets received through the device wireless interface.
Error Drop Packets	The total number of packets dropped before sending out of the device Ethernet interface due to RF errors (packet integrity error and other RF-related packet error).
Capacity Drop Packets (SM mode)	The total number of packets dropped after transmitting out of the device wireless interface due to capacity issues (data buffer/queue overflow or other performance or internal packet errors).

Attribute	Description
Multicast / Broadcast Traffic	The total amount of multicast and broadcast traffic received on the device wireless interface in KB.
Broadcast Packets	The total number of broadcast packets received on the device wireless interface.
Multicast Packets	The total number of multicast packets received on the device wireless interface.
Link Quality (Uplink) (SM mode)	<p>Defines the Packet Error Rate (PER) in the uplink direction by percentage. A background color corresponds to a percentage range:</p> <ul style="list-style-type: none"> <li>• Blue is between 80 and 100%.</li> <li>• Green is between 50 and 80%.</li> <li>• Yellow is between 30 and 50%.</li> <li>• Red is between 0 and 30%.</li> </ul>
Link Capacity (Uplink) (SM mode)	<p>Defines the capacity of the uplink as defined by MCS. DS MCS 9 provides the greatest capacity. SS MCS 1 provides the least. The capacity of the link is defined as the percentage throughput of the actual link as compared to a link that was always running at DS MCS 9. A background color corresponds to a percentage range:</p> <ul style="list-style-type: none"> <li>• Blue is between 80 and 100%.</li> <li>• Green is between 50 and 80%.</li> <li>• Yellow is between 30 and 50%.</li> <li>• Red is between 0 and 30%.</li> </ul>
<b>System Statistics</b>	
Session Drops	Indicates the total number of Subscriber Module sessions dropped on the AP.
Link Drop Counter	Indicates the total number of times the wireless link was lost.
Total Device Reboots	Indicates the total number of times the device has been rebooted since the statistics were last reset from the <b>GUI, CLI, or SNMP</b> .
Soft Device Reboots	Indicates the number of times the device has been rebooted by the user through <b>GUI, CLI, or SNMP</b> since the statistics were last reset from the <b>GUI, CLI, or SNMP</b> .
Hard Device Reboots	Indicates the number of times the device has been rebooted via power feeding and due to power outage since the statistics were last reset from the <b>GUI, CLI, or SNMP</b> .
Network Entry Attempts (AP mode)	The total number of Network Entry Attempts by Subscriber Module devices.
Successful Network Entries (AP mode)	The total number of successful network entry attempts.

Attribute	Description
Network Entry Authentication Failures (AP mode)	The total number of failed Network Entry Attempts by SM devices.
Radar (DFS) Detections	
<b>Subscriber Module Statistics (AP mode)</b>	
MAC Address	MAC Address of the Subscriber Module connected to the AP.
Total Uplink (KB)	The total amount of traffic received through the AP wireless interface from the Subscriber Module in KB.
Total Uplink Packets	The total number of packets received through the AP wireless interface from this SM.
Uplink Packet Drops	The total number of packets dropped before sending out of the AP Ethernet interface due to RF errors (packet integrity error and other RF-related packet error) from the SM.
Total Downlink (KB)	The total amount of traffic transmitted out of the AP wireless interface in KB.
Total Downlink Packets	The total number of packets transmitted out of the AP wireless interface.
Downlink Packet Drops	The total number of packets dropped after transmitting out of the AP wireless interface due to RF errors (No acknowledgment and other RF-related packet errors).
Downlink Capacity Packet Drops	The total number of packets dropped after transmitting out of the AP Wireless interface due to capacity issues (data buffer/queue overflow or other performance or internal packet errors).
Downlink Retransmitted Packets	The total number of packets re-transmitted after transmitting out of the AP Wireless interface due to the packets not being received by the SM.
Downlink Power (dBm)	The transmit power of the AP for the downlink packets to the SM.
<b>Downlink Packets per MCS</b>	
MCS 1 - MCS 9 DS / SS	The number of packets (and percentage of total packets) transmitted out of the device wireless interface for every modulation mode used by the device transmitter, based on radio conditions.  DS represents dual-stream transmissions and SS represents single-stream transmissions.
<b>Uplink Packets per MCS</b>	
MCS 1 - MCS 9 DS / SS	The number of packets (and percentage of total packets) received on the device wireless interface for every modulation mode, based on radio conditions.

Attribute	Description
	DS represents dual-stream transmissions and SS represents single-stream transmissions.
<b>Downlink Frame Time</b>	
Total Frame Time Used (AP mode)	Percentage of frame time used in the uplink.

## Monitor > System page

Figure 24 shows the System page.

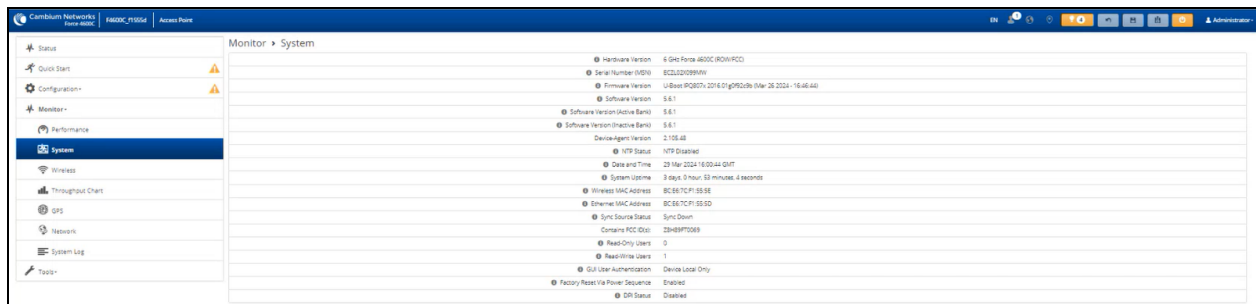


Figure 24: Monitor > System page (AP mode)

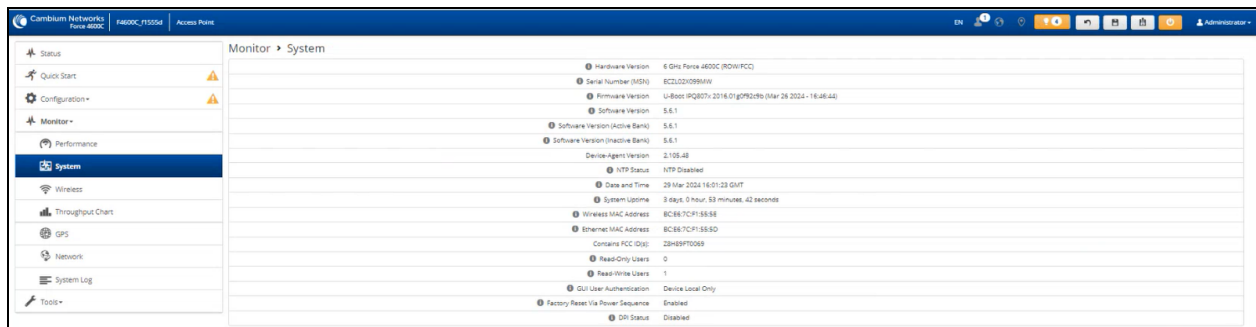


Figure 25: Monitor > System page (SM mode)

Table 140 Monitor > System page attributes

Attribute	Description
Hardware Version	Board hardware version information.
Serial Number (MSN)	Serial Number information.
Firmware Version	U-Boot version information.
Software Version	The currently operating version of software on the device.
Software Version (Active Bank)	The currently operating version of software on the device.

Attribute	Description
Software Version (Inactive Bank)	The backup software version on the device is used upon failure of the active bank. Two software upgrades in sequence updates both the <b>Active Software Bank Version</b> and the <b>Inactive Software Bank Version</b> .
Device-Agent Version	The operating version of the device agent, which is used for communication with cnMaestro.
NTP Status	Indicates whether time and date have been obtained from the NTP server.
Date and Time	Current date and time, subject to time zone offset introduced by the configuration of the device <b>Time Zone</b> parameter. Until a valid NTP server is configured, this field displays the time configured from the factory.
System Uptime	The total system uptime since the last device reset.
Wireless MAC Address	The hardware address of the device's wireless interface.
Ethernet MAC Address	The hardware address of the device LAN (Ethernet) interface.
Read-Only Users	Displays the number of active Read-Only users logged into the radio.
Read-Write Users	Displays the number of active Read-Write users logged into the radio.
GUI User Authentication	The method by which users are authenticated when logging into the device management interface.
Factory Reset Via Power Sequence	<b>Enabled:</b> When Enabled under <b>Tools &gt; Backup/Restore &gt; Reset Via Power Sequence</b> , it is possible to reset the radio's configuration to factory defaults using the power cycle sequence explained under <a href="#">Resetting ePMP to factory defaults by power cycling</a> . <b>Disabled:</b> When disabled, it is not possible to factory default the radio's configuration using the power cycle sequence.
DPI Status	<b>Enabled:</b> DPI Status is enabled. <b>Disabled:</b> DPI Status is disabled.

## Monitor > Wireless page

Figure 26 and Figure 27 shows Wireless page (AP mode) and Wireless page (SM mode).

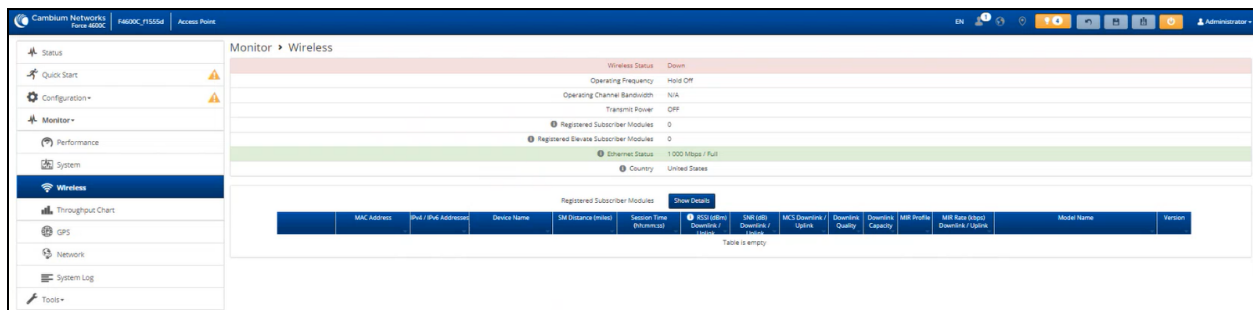


Figure 26: Monitor > Wireless page (AP Mode)

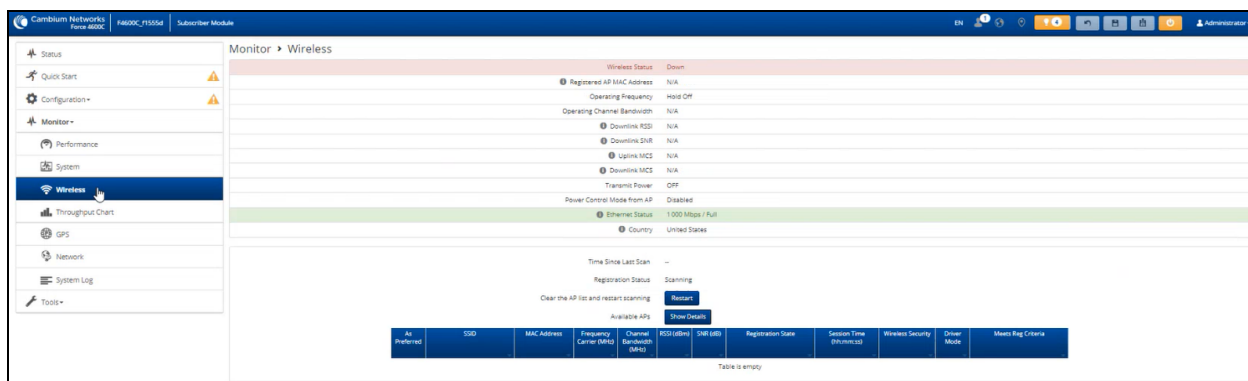



Figure 27: Monitor > Wireless page (SM Mode)

Table 141 Monitor > Wireless page attributes

Attribute	Description
Registered Access Point SSID (SM mode only)	SSID of the AP to which the SM is registered.
Wireless Status (AP mode)	<b>Up:</b> The wireless interface of the device is functioning and sending beacons. <b>Down:</b> The wireless interface of the device has encountered an error disallowing full operation. Reset the device to re-initiate the wireless interface.
Wireless Status (SM mode)	<b>Up:</b> The device wireless interface is functioning and the device has completed network entry. <b>Down:</b> The device's wireless interface has encountered an error disallowing full operation. Evaluate radio and security configuration on the AP and SM device to determine the network entry failure.
Registered AP MAC Address (SM mode)	Wireless MAC address of the AP to which the SM is registered.
Range (SM mode)	The calculated distance from the AP, determined by radio signal propagation delay.
Operating Frequency	The current frequency at which the device is operating.
Operating Channel Bandwidth	The current channel size at which the device is transmitting and receiving.
DFS Status	<b>N/A:</b> DFS operation is not required for the region configured in parameter <b>Country Code</b> . <b>Channel Availability Check:</b> Before transmitting, the device must check the configured <b>Frequency Carrier</b> for radar pulses for 60 seconds). If no radar pulses are detected, the device transitions to state <b>In-Service Monitoring</b> . <b>In-Service Monitoring:</b> Radio is transmitting and receiving normally while monitoring for radar pulses that require a channel move.

Attribute	Description
	<p><b>Radar Signal Detected:</b> The receiver has detected a valid radar pulse and is carrying out detect-and-avoid mechanisms (moving to an alternate channel).</p> <p><b>In-Service Monitoring at Alternative Channel:</b> The radio has detected a radar pulse and has moved the operation to a frequency configured in <b>DFS Alternative Frequency Carrier 1</b> or <b>DFS Alternative Frequency Carrier 2</b>.</p> <p><b>System Not In Service due to DFS:</b> The radio has detected a radar pulse and has failed channel availability checks on all alternative frequencies. The non-occupancy time for the radio frequencies in which radar was detected is 30 minutes.</p>
Downlink SNR (SM mode)	The Signal-to-Noise Ratio of the signal being received from the AP.
Transmitter Power	The current power level at which the device is transmitting.
Uplink MCS (AP mode)	Specifies the current MCS utilized for uplink transmission.
Registered Subscriber Modules (AP mode)	The count of registered AP.
Ethernet Status	The speed and duplex at which the configured LAN port is operating.
Country	Defines the country code being used by the device. The country code of the Subscriber Module follows the country code of the associated Access Point unless it is an FCC SKU in which case the country code is the United States or Canada. Country code defines the regulatory rules in use for the device.
Registered Subscriber Modules (AP mode)	<p>Use the <b>Registered Subscriber Modules</b> table to monitor the registered Subscriber Module device, their key RF status, and statistics information. The Subscriber management interface may also be accessed by clicking the hyperlinks in the <b>IPv4 / IPv6 Addresses</b> and <b>Device Name</b> columns.</p> <p> Click <b>Deregister</b> to disassociate the SM device from the AP.</p>
MAC Address (AP Mode)	The MAC address of the SM wireless interface.
IPv4 / IPv6 Addresses (AP mode)	The IP address of the SM wireless interface.
Device Name (AP mode)	The configured device name of the SM wireless interface.
SM Distance (miles)	Indicates the calculated distance of the SM from the AP.
Session Time (hh:mm:ss) (AP mode)	The time duration for which the SM has been registered and in session with the AP.

Attribute	Description
RSSI (dBm) Downlink / Uplink	Indicates the estimated RSSI of the AP at the SM (first value) and the RSSI of the SM measured at the AP (second value).
SNR (dB) Downlink / Uplink	Indicates the estimated SNR of the AP at the SM (first value) and the SRN of the SM measured at the AP (second value).
MCS Downlink / Uplink (AP mode)	Current MCS at which the downlink (first value) and uplink (second value) are operating.
Downlink Quality (AP mode)	The downlink quality is based on the current MCS and PER (Packet Error Rate) for this SM.
Downlink Capacity (AP mode)	The downlink capacity is based on the current DL MCS for the highest supported MCS (MCS15). The downlink capacity is based on the current DL MCS for the highest supported MCS (MCS15).
MU-MIMO Gain	Indicates if MU-MIMO is supported by the subscriber and the MU-MIMO gain achieved by MU-MIMO capable subscribers.
Model Name	Model of SM.
Add As Preferred (SM mode)	Click <b>Add</b> to add the AP to the <b>Preferred Access Points List</b> under <b>Configuration &gt; Radio</b> .
SSID (SM mode)	The SSID of the visible AP.
MAC Address (SM mode)	The MAC address of the visible AP.
Frequency Carrier (MHz) (SM mode)	The current operating frequency of the visible AP.
Channel Bandwidth (MHz) (SM mode)	The current operating channel bandwidth of the visible AP.
RSSI (dBm) (SM mode)	The current measured Received Signal Strength Indicator at the AP.
SNR (dB) (SM mode)	The current measured Signal-to-Noise Ratio (SNR) of the SM to AP link.
Registration State (SM mode)	The indication of the result of the Subscriber Module device network entry attempt: <ul style="list-style-type: none"> <li>• <b>Successful:</b> The SM registration is successful.</li> <li>• <b>Failed - Out of Range:</b> The SM is out of the Access Point's configured maximum range (<b>Max Range</b> parameter).</li> <li>• <b>Failed- Capacity limit reached at Access Point:</b> The AP is no longer allowing SM network entry due to capacity reached.</li> <li>• <b>Failed - No Allocation on Access Point:</b> The SM to AP handshaking failed due to a misconfigured pre-shared key between the SM and AP.</li> </ul>

Attribute	Description
	<ul style="list-style-type: none"> <li>• <b>Failed - SW Version Incompatibility:</b> The version of software resident on the AP is older than the software version on the SM.</li> <li>• <b>Failed - PTP Mode: ACL Policy:</b> The AP is configured with <b>PTP Access</b> set to <b>MAC Limited</b> and the SM's MAC address is not configured in the AP's <b>PTP MAC Address</b> field.</li> <li>• <b>Failed - Other:</b> The AP does not have the required available memory to allow network entry.</li> </ul>
Session Time (hh:mm:ss) (SM Mode)	This timer indicates the time elapsed since the SM registered to the AP.
Wireless Security (SM mode)	This field indicates the security state of the AP to SM link.
Meets Reg Criteria (SM Mode)	<p><b>Yes:</b> The scanned AP meets the Network Entry criteria defined by the internal Network Algorithm.</p> <p><b>No:</b> The scanned AP does not meet the Network Entry criteria defined by the internal Network Algorithm.</p>

## Monitor > Throughput Chart page

Use the Throughput Chart page to reference a line chart visual representation of system throughput over time. The blue line indicates downlink throughput and the orange line indicates uplink throughput. The X-axis may be configured to display data over seconds, minutes, or hours, and the Y-axis is adjusted automatically based on average throughput. Hover over data points to display details. Figure 28 shows the Throughput Chart page.

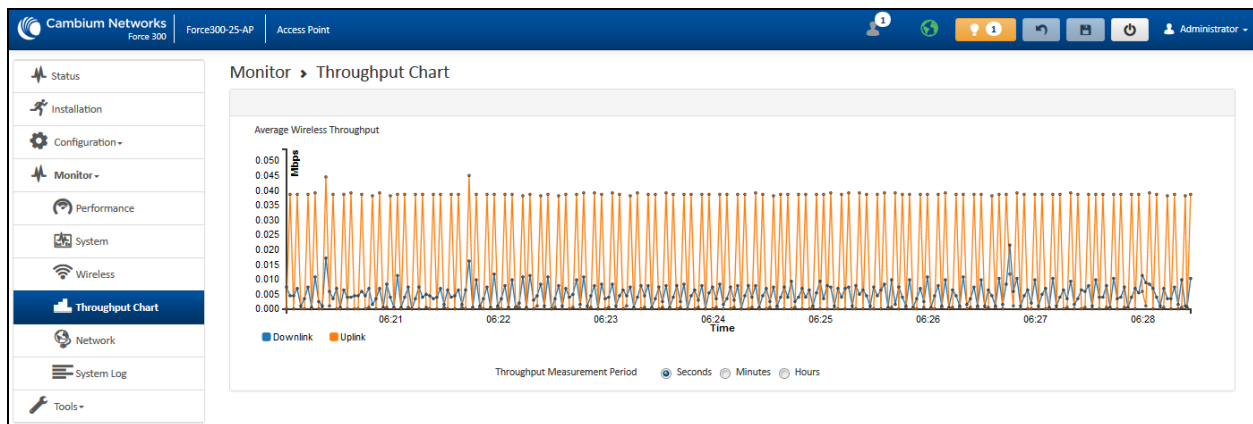


Figure 28: Monitor > Throughput Chart page

Table 142 Monitor > Throughput Chart page attributes

Attribute	Description
Throughput Measurement Period	Adjust the X-axis to display throughput intervals in seconds, minutes, or hours.

## Monitor > GPS page

Use the GPS Status page to reference key information about the device's GPS readings, tracked satellites, and firmware version. Figure 29 shows the GPS page .

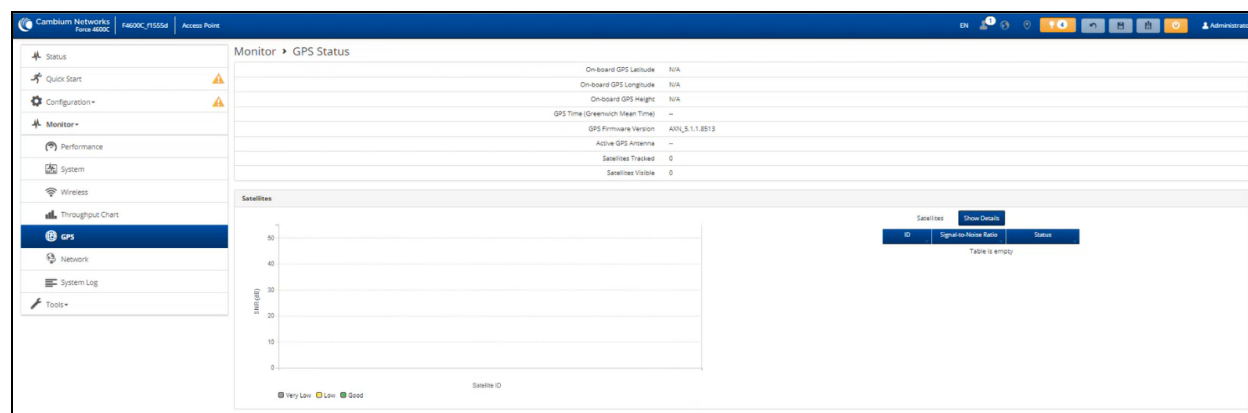


Figure 29: Monitor > GPS page attributes

Table 143 Monitor > GPS page attributes (AP mode)

Attribute	Description
On-board GPS Latitude (AP mode)	On a GPS Synchronized ePMP radio, the field is automatically populated with the Device Latitude information from the on-board GPS chip.
On-board GPS Longitude (AP mode)	On a GPS Synchronized ePMP radio, the field is automatically populated with the Device Longitude information from the on-board GPS chip.
On-board GPS Height (AP mode)	On a GPS Synchronized ePMP radio, the field is automatically populated with the Device height above sea level from the onboard GPS chip.
GPS Time (Greenwich Mean Time) (AP mode)	On a GPS Synchronized ePMP radio, the field is automatically populated with the time from the onboard GPS chip.
GPS Firmware version (AP mode)	On a GPS Synchronized ePMP radio, the field indicates the current firmware version of the onboard GPS chip.
Satellites Tracked (AP mode)	On a GPS Synchronized ePMP radio, the field indicates the number of satellites currently tracked by the onboard GPS chip.
Satellites Visible (AP mode)	On a GPS Synchronized ePMP radio, the field indicates the number of satellites visible to the onboard GPS chip.

Attribute	Description
Satellites (AP mode)	The <b>Satellites</b> table provides information about each satellite that is visible or tracked along with the Satellite ID and Signal to Noise Ratio (SNR) of the satellite.
ID (AP mode)	Represents the Satellite ID.
Signal-to-Noise Ratio (AP mode)	This is an expression of the carrier signal quality concerning signal noise.
Status (AP mode)	Status of each Satellite available.

## Monitor > Network page

Use the Network Status page to reference key information about the device network status. [Figure 30](#) shows the Network page (AP mode).

The screenshot shows the 'Monitor > Network' page for an Access Point (AP) mode. The interface includes a sidebar with navigation options like Status, Configuration, Monitor, Performance, System, Wireless, Throughput Chart, GPS, Network, System Log, and Tools. The main content area is divided into several sections:

- Ethernet Interface:** Displays configuration details such as IP Assignment (DHCP), IP Address (192.168.0.2), Subnet Mask (255.255.255.0), Default Gateway, MTU Size (1536), Ethernet Status (1000 Mbps / Full), Port Speed (1000 Mbps), Port Duplex Mode (Full), Auxiliary Port (Down), Auxiliary Port Speed (N/A), Auxiliary Port Duplex Mode (N/A), Auxiliary Port Connector (SFP), Transceiver Present (Not plugged in), and Auxiliary Module EEPROM Readable (Can't be determined).
- Network Status:** Shows various status indicators including DNS Server IP, DHCP Option 82 (Disabled), NTP Status (NTP Disabled), DHCP Option 84 Status (Disabled), DHCP Option 84 UPL (No Errors), DHCP Option 66 Error (No Errors), and DHCP Option 43 UPL.
- ARP Table:** A table with columns for MAC Address, IP Address, and Interface. It contains one entry: 38:14:2B:3C:EE:53 | 169.254.1.100 | Bridge.
- Bridge Table:** A table with columns for MAC Address, Port, and Interface. It is currently empty.

Figure 30: Monitor > Network page (AP mode)

The screenshot shows the 'Monitor > Network' page for a Subscriber Module. The interface is similar to the AP mode view but includes additional details:

- Ethernet Interface:** Similar to the AP mode view, but with Network Mode set to Bridge.
- Network Status:** Shows Network Mode (Bridge), DNS Server IP, NTP Status (NTP Disabled), DHCP Option 84 Status (Disabled), DHCP Option 84 UPL (No Errors), and DHCP Option 43 UPL.
- ARP Table:** Similar to the AP mode view, with one entry: 38:14:2B:3C:EE:53 | 169.254.1.100 | Bridge.
- Bridge Table:** A table with columns for MAC Address, Port, and Aging Time (sec). It contains three entries:
 

MAC Address	Port	Aging Time (sec)
EC:86:7C:F1:55:5F	Out	0
EC:86:7C:F1:55:5D	Out	0
38:14:2B:3C:EE:53	LAN	0

Figure 31: Monitor > Network page (SM mode)

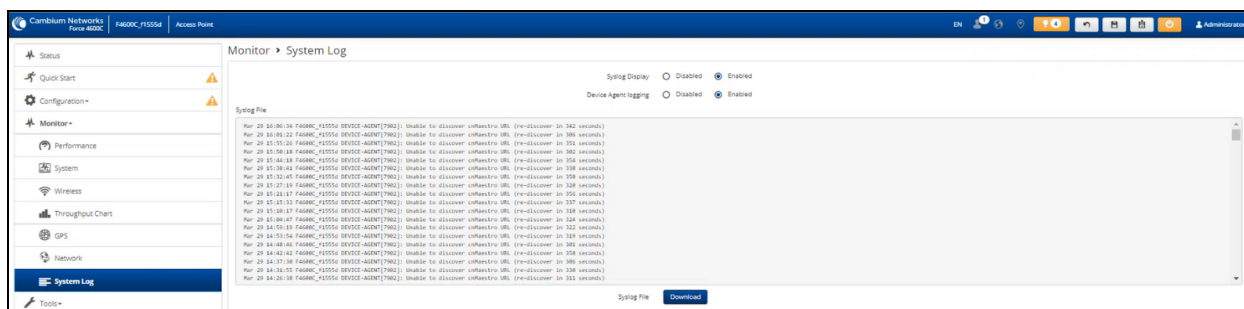
Table 144 Monitor > Network page attributes

Attribute	Description
<b>Ethernet Interface</b>	
IP Assignment	<p><b>Static:</b> Device management IP addressing is configured manually in fields <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server.</b></p> <p><b>DHCP:</b> Device management IP addressing (<b>IP Address, Subnet Mask, Gateway, and DNS Server</b>) is assigned through a network DHCP server, and parameters <b>IP Address, Subnet Mask, Gateway, Preferred DNS Server, and Alternate DNS Server</b> are not configurable.</p>
IP Address	<p>Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.</p> <p>If IP Address Assignment is set to DHCP and the device is unable to retrieve IP address information via DHCP, the device management IP is set to fallback IP 192.168.0.1 (Access Point) or 192.168.0.2 (Subscriber Module).</p>
Subnet Mask	Defines the address range of the connected IP network. For example, if Device IP Address (LAN) is configured to 192.168.2.1 and IP Subnet Mask (LAN) is configured to 255.255.255.0, the device will belong to subnet 192.168.2.X.
Default Gateway	Configure the IP address of the device on the current network that acts as a gateway. A gateway acts as an entrance and exit to packets from and to other networks.
MTU Size	The currently configured <b>Maximum Transmission Unit</b> for the device Ethernet (LAN) interface. Larger MTU configurations can enable the network to operate with greater efficiency, but in the case of retransmissions due to packet errors, efficiency is reduced since large packets must be resent in the event of an error.
Main PSU Port	The speed and duplex at which the configured LAN port is operating.
Port Speed	The speed at which the configured LAN port is operating.
Port Duplex Mode	The duplex at which the configured LAN port is operating.
<b>Network Status</b>	
DNS Server IP	The configured IP address(es) of the network DNS servers.
DHCP Option 82	Status of DHCP Option 82 operation in the network.
NTP Status	Represents the status of NTP retrieval in the network.
<b>ARP Table</b>	
MAC Address	MAC Address of the devices on the bridge.
IP Address	IP Address of the devices on the bridge.
Interface	The interface on which the ePMP identified the devices on.
<b>Bridge Table</b>	

Attribute	Description
MAC Address	The hardware address of the ePMP device.
Port	The port to which the device is connected.
SM MAC	MAC Address for the connected SM device.
Aging Timer (secs)	Time set for the MAC addresses in the Bridge table before renewal.

## Monitor > System Log page

The **System Log** page is used to view the device system log and to download the log file to the accessing PC/device. [Figure 32](#) shows the System Log page.



[Figure 32: Monitor > System Log page](#)

Table 145 Monitor > System Log page attributes

Attribute	Description
Syslog Display	<b>Enabled:</b> The system log file is displayed on the management UI. <b>Disabled:</b> The system log file is hidden on the management UI.
Device Agent logging	<b>Enabled:</b> Device Agent logging is enabled. <b>Disabled:</b> Device Agent logging is disabled.
Download	Used to download the full system log file to a connected PC or device.

## Tools menu

The **Tools** menu provides several options for upgrading device software, configuration backup/restore, managing licenses, analyzing RF spectrum, testing the wireless link, testing network connectivity, and analyzing interferers.

### Tools > Software Upgrade page

The **Software Upgrade** page is used to update the device radio software to take advantage of new software features and improvements. [Figure 33](#) shows the Software Upgrade page.



#### Attention

Refer to **Release Notes** associated with each software release for special notices, feature updates, resolved software issues, and known software issues.

The Release Notes can be found at [Cambium Networks Support Center](#).

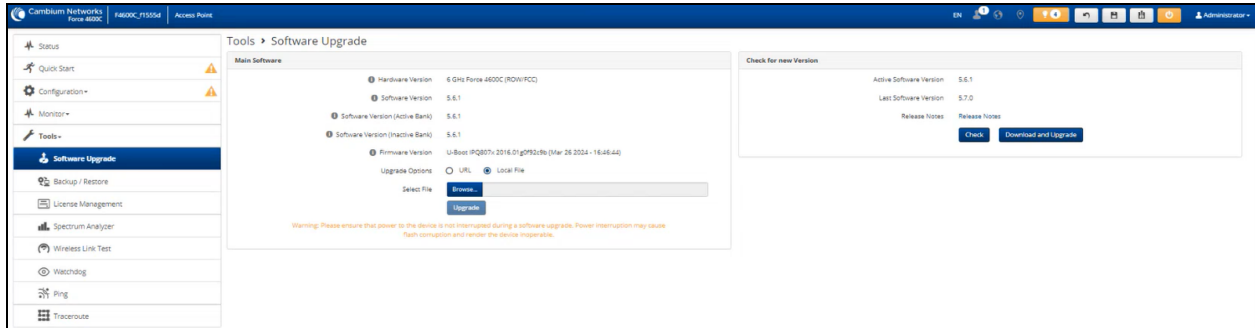


Figure 33: Tools > Software Upgrade page

Table 146 Tools > Software Upgrade page attributes

Attribute	Description
<b>Main Software</b>	
Hardware Version	Defines the board type and frequency band of operation.
Software Version	Defines the current operating software version.
Software Version (Active Bank)	eMPM devices two banks of flash memory which each contain a version of the software. The version of the software last upgraded onto the flash memory is made the active bank. This software is used by the device when rebooted.
Software Version (Inactive Bank)	The version of the software that was the Active Bank is made the Inactive Bank when another version of the software is upgraded onto the Flash memory. The Inactive Bank of the software is used by the device in case the Active Bank cannot be used due to a failure condition.
Firmware Version	The current U-boot version.
Upgrade Options	<p><b>URL:</b> A web server may be used to retrieve software upgrade packages (downloaded to the device through the webserver). For example, if a web server is running at IP address 192.168.2.1 and the software upgrade packages are located in the home directory, an operator may select an option <b>From URL</b> and configure the <b>Software Upgrade Source</b> field to <b>http://192.168.2.1/&lt;software_upgrade_package&gt;</b>.</p> <p><b>Local File:</b> Click <b>Browse</b> to select the local file containing the software upgrade package.</p>
Select File	Click <b>Browse</b> to select a local file (located on the device accessing the web management interface) for upgrading the device software.
Upgrade	<p>Click the <b>Upgrade</b> button to begin the software upgrade process.</p> <p>Ensure that the power to the device is not interrupted during a software upgrade. Power interruption may cause flash corruption and render the device inoperable.</p>

Attribute	Description
<b>Check for new Version</b>	
Active Software Version	The current Firmware of the on-board GPS chip.
Last Software Version	The earlier Firmware of the on-board GPS chip.
Release Notes	Click <b>Release Notes</b> and download the latest Release Notes.

## Tools > Backup/Restore page

The **Backup/Restore** page is used to update the device radio software to take advantage of new software features and improvements. [Figure 34](#) shows the Backup/Restore page.

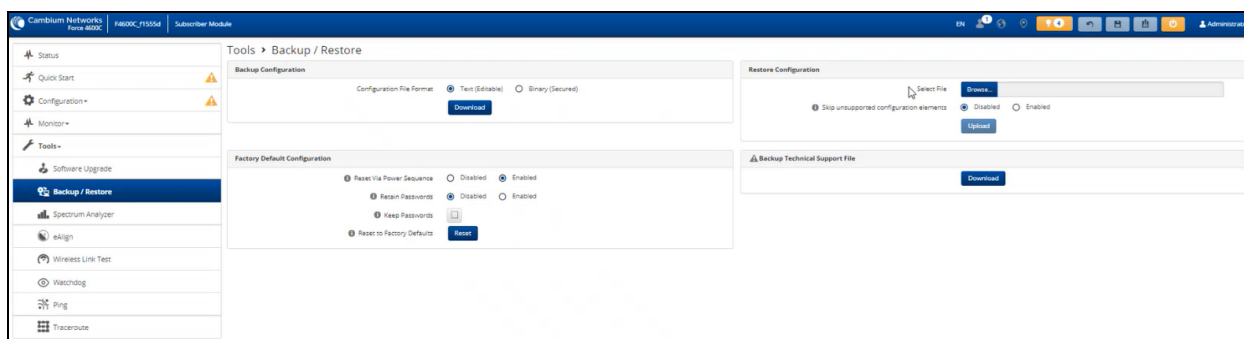


Figure 34: Tools > Backup/Restore page

Table 147 Tools > Backup/Restore page attributes

Attribute	Description
<b>Backup Configuration</b>	
Configuration File Format	<p><b>Text (Editable):</b> This option downloads the configuration file in the .json format and can be viewed and/or edited using a standard text editor.</p> <p><b>Binary (Secured):</b> This option downloads the configuration file in the .bin format, and cannot be viewed and/or edited using an editor. Use this format for a secure backup.</p>
<b>Restore Configuration</b>	
Select File	Click <b>Browse</b> and select a local file (located on the device accessing the web management interface) for restoring the device configuration.
Skip unsupported configuration elements	In the case of configuration incompatibility, the unsupported configuration elements can be ignored and skipped.
<b>Factory Default Configuration</b>	
Reset Via Power Sequence	<b>Enabled:</b> When enabled, it is possible to reset the radio's configuration to factory defaults using the power cycle sequence explained under <a href="#">Resetting ePMP to factory defaults by power cycling</a> .

Attribute	Description
	<b>Disabled:</b> When disabled, it is not possible to factory default the radio's configuration using the power cycle sequence.
Retain Passwords	When set to <b>Enabled</b> , then after a factory default of the radio for any reason, the passwords used for UI and CLI access does not be defaulted and remains unchanged. The default value of this field is <b>Disabled</b> .  If the passwords cannot be retrieved after the factory default, access to the radio will be lost/unrecoverable. This feature prevents unauthorized users from gaining access to the radio for any reason, including theft.
Keep Passwords	When the <b>Keep Passwords</b> checkbox is selected, the passwords used for GUI and CLI access will not be the default and remains unchanged. This is a one-time option, and it does not apply to factory default procedures completed by power cycling (Reset through the Power Sequence).
Reset to Factory Defaults	Use this button to reset the device to its factory default configuration.  A reset to factory default configuration resets all device parameters. With the SM device in the default configuration, it may not be able to register to an AP device configured for your network.
<b>Backup Technical Support File</b>	
Download	The Backup Technical Support File is a compressed archive of the applicable statistics and configuration parameters used by <a href="#">Cambium Networks Support</a> for troubleshooting. This file is downloaded from the ePMP device to the accessing device.

## Tools > License Management page (Access Point mode)

The AP's **License Management** page is used to:

- Install licensing for ePMP Elevate subscriber access allotments
- Convert the AP from Lite (10 subscribers) to Full (120 subscribers)
- Configure the Country Code ETSI-locked devices.

There are two types of ePMP elevate license management mechanisms available on the ePMP device - Flexible and Fixed, described below:

Flexible Licensing

With Flexible Licensing, your licenses are stored in a license server and can be shared among all your Access Points. Each Access Point will only use as many licenses as it has connected subscribers. When a subscriber disconnects, a license is returned to the pool and can be used by any other Access Point.

In order to use Flexible Licensing, your Access Points must:

- be able to make HTTPS requests out to the Internet.
- be running firmware version 3.5 or greater,
- have an accurate NTP time source.

[Use Flexible Licensing →](#)

Fixed Licensing

With Fixed Licensing, you will generate a license key for a specific MAC address, and load that license key into the Access Point. The license key represents the number of Elevate Subscribers that can be supported by that Access Point. The license key may not be transferred to any other Access Point.

You should use Fixed Licensing if your Access Points:

- are unable to make HTTPS requests to the Internet, or
- are running firmware version 3.4.1 or earlier, or
- don't have an accurate NTP time source.

[Use Fixed Licensing →](#)

Figure 35: AP ePMP Elevate license management options



**Note**

Elevate Flexible Licensing is available only for ePMP AP devices with GPS sync.

Country Code configuration for ETSI locked device and Full Capacity Keys for AP Lite devices are available only via Fixed License Management. Elevate is available via Fixed or Flexible License Management. Figure 36 shows the License Management page.



**Note**

To use flexible licensing, the AP must have DNS server access to be able to resolve URLs (and communicate with the license server). Also, the AP must have a valid, accurate time server (NTP) connection.

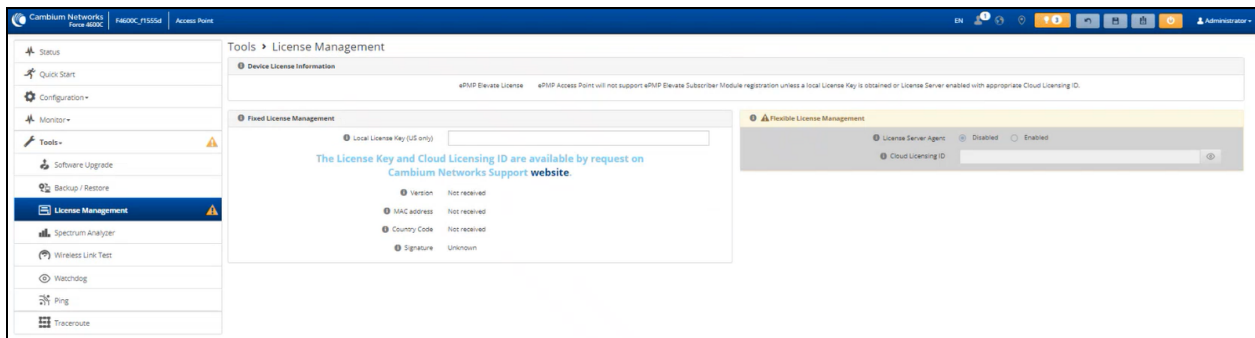


Figure 36: Tools > License Management page

Table 148 Tools > License Management attributes

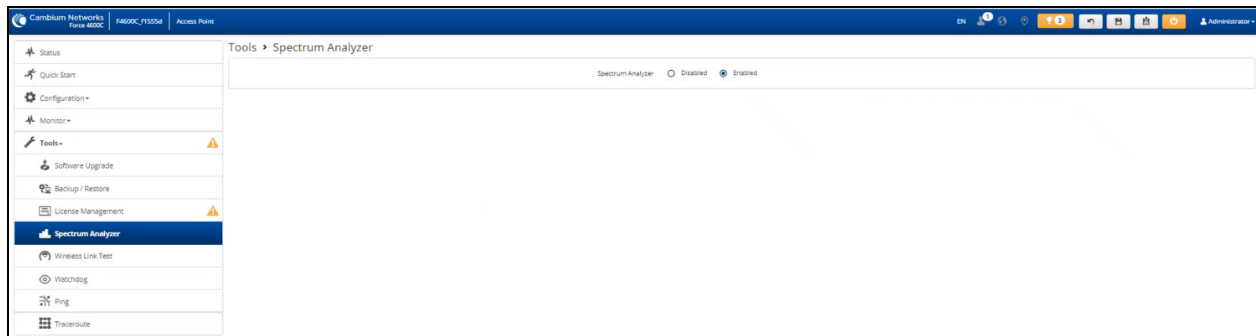
Attribute	Description
<b>Flexible License Management</b>	
License Server Agent	<b>Disabled:</b> No communication with the License Server is established.

Attribute	Description
	<b>Enabled:</b> Enables the <b>License Server</b> functionality to obtain the number of allowed ePMP Elevate SMs to be connected to the AP.
Cloud Licensing ID	This field represents a Cambium Networks customer identification used for AP identification on the License Server. This identifier is generated upon License Entitlement activation at the Cambium Networks web-based Support Center.
Connection Status	The <b>Connection Status</b> displays the License Server process state when the <b>License Server Agent</b> is <b>Enabled</b> . This status may also be referenced on the device <b>Home</b> page.
Enable Proxy	<b>Disabled:</b> The AP must have a valid internet connection to reach the license server. <b>Enabled:</b> A proxy server is specific for the license server access from a private network.
Proxy Server IP Address	Specify the IP address of the proxy server used for internet access from a private network.
Proxy Server Port	Specify the port used on the proxy server for internet access from a private network.
Refresh Requests Failed	The number of failed refresh (polling) requests to the License Server. The <b>ePMP Elevate Subscriber Module Limit</b> resets to 1 after the 3 <sup>rd</sup> failed refresh request.
Update Requests Failed	The number of failed updates (licensing information transfer) requests to the License Server. The <b>ePMP Elevate Subscriber Module Limit</b> resets to 1 after the 5 <sup>th</sup> failed updated request.
NTP Status	Represents whether the current time and date are retrieved from the configured NTP server.
ePMP Elevate Subscriber Module Limit	The number of ePMP Elevate devices allowed to register to the AP.
<b>Flexible License Management</b>	
Local License Key	The <b>License Key</b> is obtained from <a href="#">Cambium Networks Support Site</a> and must be entered into this field to enable additional functionality (registration capacity, ePMP Elevate support) of the ePMP device.
Version	Specifies the licensing version scheme for the license key.
MAC address	The MAC Address is extracted from the license key and must match the MAC Address of this device for the licenses to be enacted.
Country Code	A two-character value representing the licensed country.
Subscriber Module Limit	ePMP Lite / Force 110 devices are limited to 10 SMs in AP TDD mode. <b>SM Limit</b> displays <b>Unlocked</b> if a license is present which allows no limit of SMs to register to the device in AP TDD mode.

Attribute	Description
Signature	A valid license key must have a valid signature included. The status is displayed after a license key is entered and saved. Licenses can only be used if the signature is valid.

## Tools > Spectrum Analyzer page

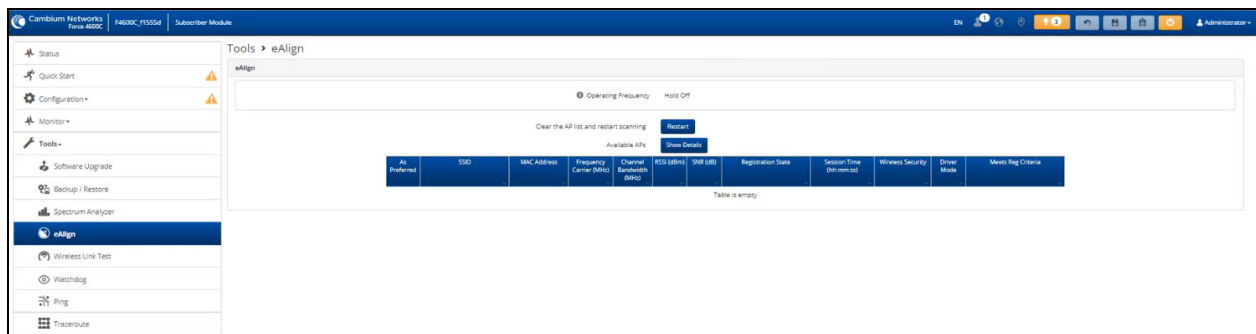
The Spectrum Analyzer page is used to display the spectrum analyzer. [Figure 37](#) shows the Spectrum Analyzer page.



[Figure 37](#): The Spectrum Analyzer page

## Tools > eAlign page (Subscriber Module mode)

The eAlign page is used to aid with subscriber link alignment. [Figure 38](#) shows the eAlign page.



[Figure 38](#): Tools > eAlign page



### Note

A valid link to an SM is required to provide meaningful RSSI measurements.

eMPM supports Automatic Transmit Power Control (ATPC) where the Subscriber Module devices are instructed by the Access Point to adjust their Tx power for the Subscriber Module device signal (UL RSSI) to arrive at the Access Point at a predetermined RSSI level (configurable on the Access Point under **Configuration > Radio > Power Control > Subscriber Module Target Receive Level**). This feature is beneficial to keep the overall noise floor in the sector to an acceptable level. However, the feature negates the purpose of eAlign measurements on the Access Point device since, during the alignment, the Subscriber Module may constantly change its Tx power. It is recommended to turn off ATPC and set the Subscriber Module Tx power to maximum allowable power during alignment.

While aligning the link using eAlign, perform the following steps:

1. On the Subscriber Module, set **Configuration > Radio > Power Control > Max Tx Power** to **Manual**.
2. Set **Configuration > Radio > Power Control > Transmitter Power** to 26 dBm (or maximum value allowed by regulations).
3. Click **Save**.
4. Perform link alignment using eAlign.
5. Once alignment is complete, set **Configuration > Radio > Power Control > Max Tx Power** back to **Auto**.
6. Click **Save**.

## Tools > Wireless Link Test page

The Wireless Link Test page is used to conduct a simple test of wireless throughput. This allows the user to determine the throughput that can be expected on a particular link without having to use external tools. Figure 39 shows the Wireless Link Test page.

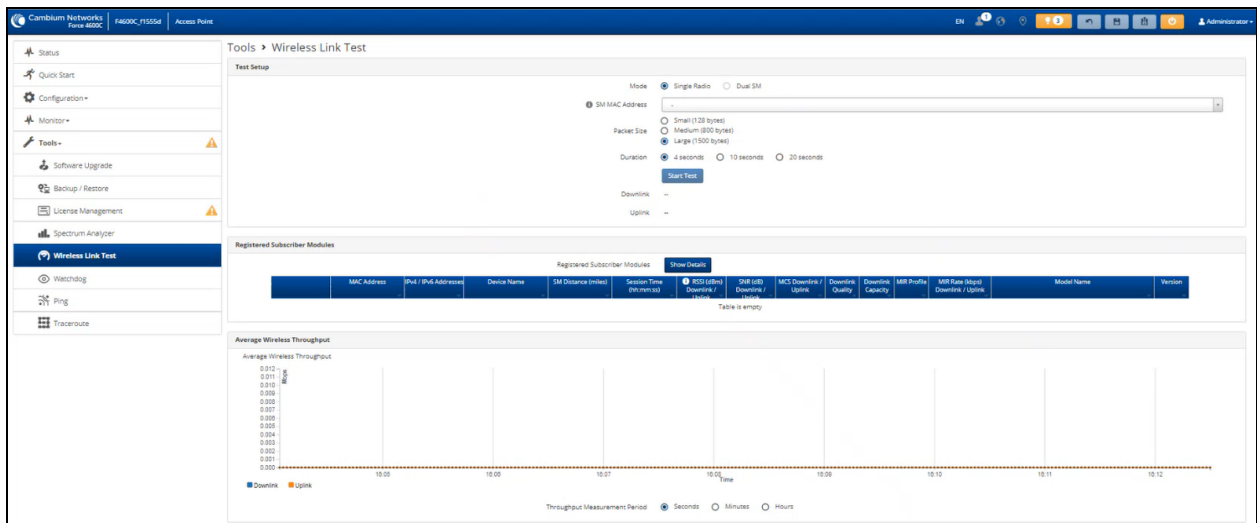


Figure 39: Tools > Wireless Link Test page

Table 149 Tools > Wireless Link Test page attributes

Attribute	Description
<b>Test Setup</b>	
Mode	<b>Single Radio:</b> The link test is conducted between the AP and one SM. <b>Dual SM:</b> The link test is conducted between the AP and two grouped SM (must be operating in MU-MIMO mode).
SM MAC Address	Choose the MAC Address of the SM with which the wireless link test is conducted.
Packet Size	Choose the Packet Size to use for the throughput test.
Duration	Choose the time duration in seconds to use for the throughput test.

Attribute	Description
Downlink	Indicates the result of the throughput test on the downlink, in Mbps.
Uplink	Indicates the result of the throughput test on the uplink, in Mbps.
Average	An auto-adjusting chart displaying the average throughput of the link.
Registered SM	Provides information about the wireless link of each registered SM.

## Tools > Watchdog page

The Watchdog performs ping checks to determine the reachability of a target IP address. If the target IP address is unreachable, a chosen action is performed. [Figure 40](#) shows the Watchdog page.

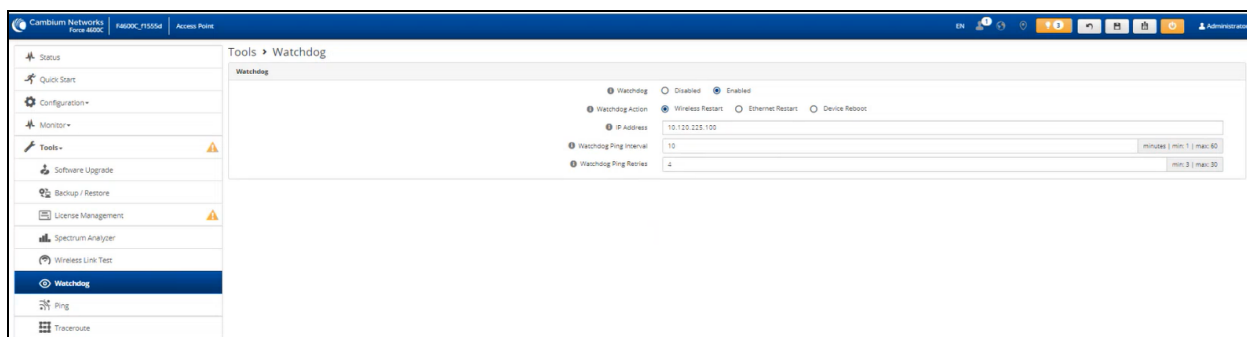


Figure 40: Tools > Watchdog page

Table 150 Tools > Watchdog page attributes

Attribute	Description
<b>Test Setup</b>	
Watchdog	<p><b>Disabled:</b> The device does not ping a specified IP address periodically for verification of connectivity</p> <p><b>Enabled:</b> The device periodically pings the IP address specified. If IP connectivity is lost, the action defined in <b>Watchdog Action</b> is performed.</p>
Watchdog Action	<p><b>Wireless Restart:</b> In case of lost ping connectivity to the specified IP address, the device automatically restarts the wireless interface.</p> <p><b>Ethernet Restart:</b> In case of lost ping connectivity to the specified IP address, the device automatically restarts the Ethernet interface.</p> <p><b>Device Reboot:</b> In case of lost ping connectivity to the specified IP address, the device automatically reboots.</p>
IP Address	Indicates the target IP address for which the device attempts ping connectivity diagnostics.
Watchdog Ping Interval	Indicates the interval in minutes between each ping connectivity diagnostic.
Watchdog Ping Retries	Indicates the number of ping retries executed by the device before considering the test failed (and conducting the action defined in <b>Watchdog Action</b> ).

## Tools > Ping page

The Ping page is used to conduct a simple test of IP connectivity to other devices that are reachable from the network. If no ping response is received or if **Destination Host Unreachable** is reported, the target may be down, there may be no route back to the device, or there may be a failure in the network hardware (DNS server failure).

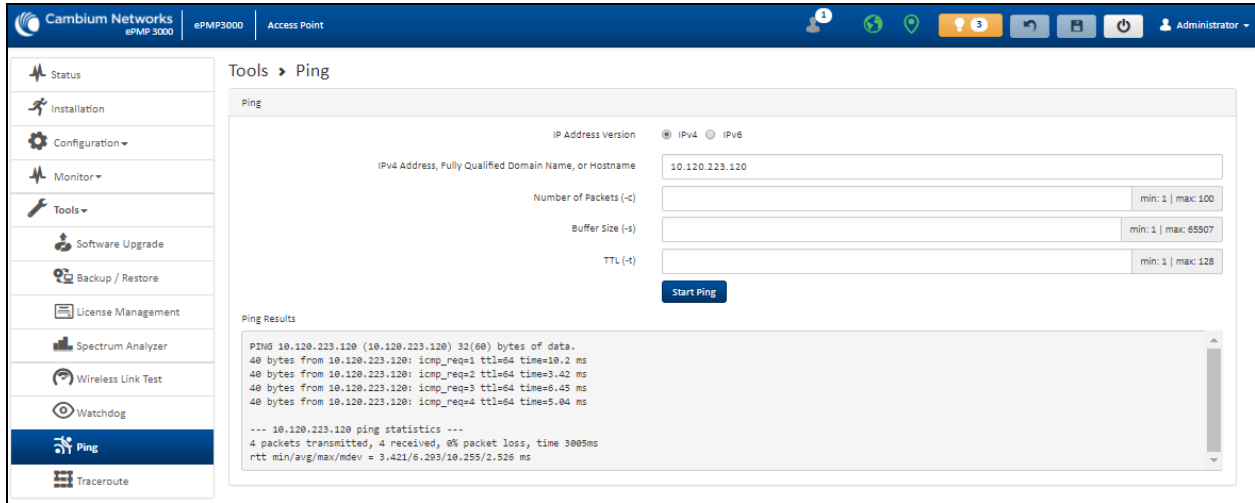


Figure 41: Tools > Ping page

Table 151 Tools > Ping page attributes

Attribute	Description
<b>Ping</b>	
IP Address Version	<b>IPv4:</b> The ping test is conducted via the IPv4 protocol. <b>IPv6:</b> The ping test is conducted via the IPv6 protocol.
IP Address	Enter the IP address of the ping target.
Number of packets (-c)	Enter the total number of ping requests to send to the target.
Buffer size (-s)	Enter the number of data bytes to be sent.
TTL (-t)	Set the IP Time-To-Live (TTL) for multicast packets. This flag applies if the ping target is a multicast address.
Ping results	The results of the ping test are displayed in the box.

## Tools > Traceroute page

The Traceroute page is used to display the route (path) and associated diagnostics for IP connectivity between the device and the destination specified. Figure 42 shows the Traceroute page.

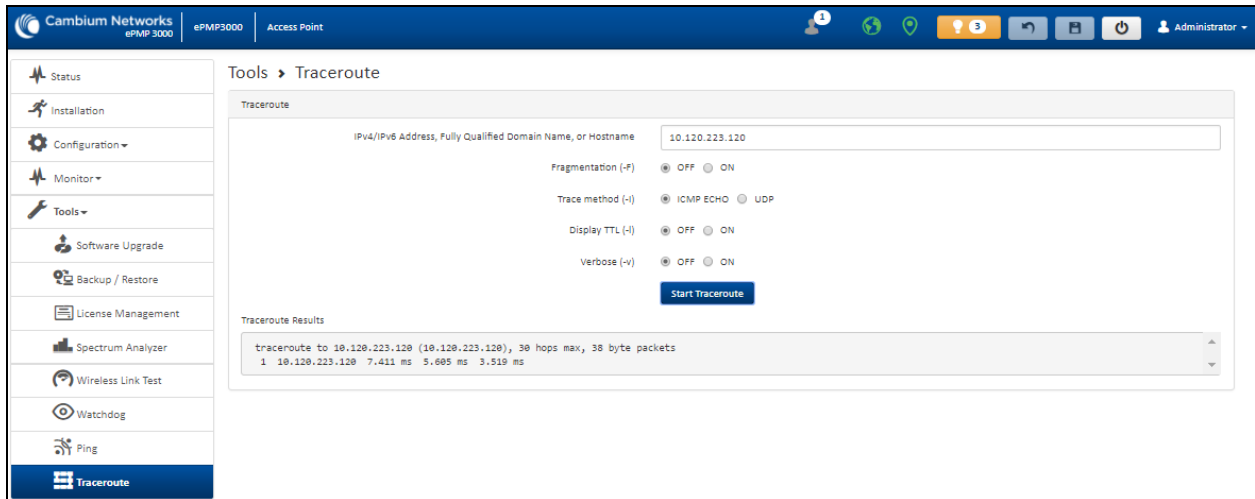


Figure 42: Tools > Traceroute page

Table 152 Tools > Traceroute page attributes

Attribute	Description
Traceroute	
IP Address	Enter the IP address of the target of the traceroute diagnostic.
Fragmentation (-F)	<b>ON:</b> Allow the source and target to fragment probe packets. <b>OFF:</b> Do not fragment probe packets (on the source or target).
Trace method (-I)	<b>ICMP ECHO:</b> Use ICMP ECHO for traceroute probes. <b>UDP:</b> Use UDP for traceroute probes.
Display TTL (-I)	<b>ON:</b> Display TTL values for each hop on the route. <b>OFF:</b> Suppress display of TTL values for each hop on the route.
Verbose (-v)	<b>ON:</b> ICMP packets other than TIME_EXCEEDED and UNREACHABLE are displayed in the output. <b>OFF:</b> Suppress display of extraneous ICMP messaging.
Traceroute Results	Traceroute test results are displayed in the box.

# Operation and Troubleshooting

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This section provides instructions for operators of ePMP networks. The following topics are described in this section:

- [General Planning for troubleshooting](#)
- [Upgrading device software](#)
- [Testing the hardware](#)
- [Troubleshooting the radio link](#)
- [Resetting ePMP to factory defaults by power cycling](#)

## General Planning for troubleshooting

Effective troubleshooting depends in part on measures taken before experiencing the trouble in the network. Cambium Networks recommends the following measures for each site:

- Identify troubleshooting tools that are available at your site (such as a protocol analyzer).
- Identify commands and other sources that can capture baseline data for the site. These include:
  - Ping
  - tracert or traceroute
  - Throughput Test results
  - Throughput data
  - Configure GUI page captures
  - Monitor GUI page captures
  - Session logs
- Start a log for the site, including:
- Operating procedures
  - Site-specific configuration records
  - Network topology
  - Software releases
  - Types of hardware deployed
  - Site-specific troubleshooting process

- Escalation procedures
- GPS latitude/longitude of each network element

## Upgrading device software

To take an advantage of new features and software improvements for the ePMP system, visit Cambium Networks ePMP Software website: <https://support.cambiumnetworks.com/files/epmp>

To upgrade the device software, perform the following steps:

1. Login to the device UI through the management IP.
2. Navigate to page **Tools > Software Upgrade**.
3. Under the **Main Software** section, set the **Upgrade Option** to **URL** to pull the software file from a network software server or select **Local File** to upload a file from the accessing device.  
If **URL** is selected, enter the server IP address, Server Port, and File path.
4. If **Local File** is selected, click **Browse** to launch the file selection dialogue.  
Click **Upgrade**
5. Do not power off the unit in the middle of an upgrade process.
6. Once the software upgrade is complete, click the **Reset** icon.

## Testing the hardware

This section describes the procedure to test the hardware when it fails while starting or during operation.

Before start testing the hardware, verify that all the outdoor cables which connects the device to equipment inside the building, are of the supported type, as defined in [Ethernet cabling](#).

### Checking the power supply LED

When the power supply is connected to the main power supply, the expected LED behavior is:

- The power LED illuminates continuously in Green color.

If the expected LED operation does not occur, or if a fault is suspected in the hardware, check the LED states and choose the correct test procedure.

- [Power LED is OFF](#)
- [Ethernet LED is OFF](#)

### Power LED is OFF

**Meaning:** Either the power supply is not receiving power from the AC/DC outlet, or there is a wiring fault in the unit.

**Action:** Remove the device cable from the PSU and observe the effect on the power LED. If the power LED does not illuminate, confirm that the main power supply is working, for example, check the plug. If the power supply is working, report a suspected power supply fault to Cambium Networks.

## Ethernet LED is OFF

**Meaning:** There is no Ethernet traffic between the device and the power supply.

**Action:** The fault may be in the LAN or device cable:

- Remove the LAN cable from the power supply, examine it, and confirm it is not faulty.
- If the PC connection is working, remove the AP/SM cable from the power supply, examine it, and check that the wiring to pins 1, 2 and 3, 6 are correct and not crossed.

### Test Ethernet packet errors reported by the device

Login to the device and click **Monitor > Performance**. Click **Reset System Counters** at the bottom of the page and wait until LAN RX – Total Packet Counter has reached 1 million. If the counter does not increment or increments too slowly, because for example the ePMP system is newly installed and there is no offered Ethernet traffic, then exit this procedure and consider using the [Test ping packet loss](#) procedure.

Check the **LAN RX – Error Packet Counter** statistic. The test has passed if this is less than 10.

### Test Ethernet packet errors reported by managed switch or router

If the device is connected to a managed Ethernet switch or router, it may be possible to monitor the error rate of Ethernet packets. Refer to *ePMP User Guide* of the managed network equipment. The test has passed if the rate of packet errors reported by the managed Ethernet switch or router is less than ten in one million packets.

### Test ping packet loss

Using a computer, it is possible to generate and monitor packets lost between the power supply and the AP/SM. This can be achieved by executing the Command Prompt application which is supplied as standard with Windows and Mac operating systems.



#### Attention

This procedure disrupts network traffic carried by the device under test.

1. Ensure that the IP address of the computer is configured appropriately for connection to the device under test, and does not conflict with other devices connected to the network.
2. If the power supply is connected to an Ethernet switch or router then connect the computer to a spare port, if available.
3. If it is not possible to connect the computer to a spare port of an Ethernet switch or router, then the power supply must be disconnected from the network in order to execute this test:
  - Disconnect the power supply from the network.
  - Connect the computer directly to the LAN port of the power supply.
4. On the computer, open the Command Prompt application.
5. Send 1000 ping packets of length 1500 bytes. The process takes 1000 seconds, which is approximately 17 minutes.

If the computer is running a Windows operating system, this is achieved by typing (for an IPv6 address, use the **ping6** command):

```
ping -n 1000 -l 1500 <ipaddress>
```

where <ipaddress> is the IP address of the AP or SM under test.

If the computer is running a MAC operating system, this is achieved by typing:

```
ping -c 1000 -s 1492 <ipaddress>
```

where <ipaddress> is the IP address of the AP/SM under test.

6. Record the number of ping packets are lost. This is reported by Command Prompt on completion of the test.

The test has passed if the number of lost packets is less than 2.

## Troubleshooting the radio link

This section describes the process of testing the link when there is no radio communication, when it is unreliable, or when the data throughput rate is too low. It may be necessary to test both ends of the link.

### The module has lost or does not establish radio connectivity

If there is no wireless activity, then perform the following steps:

1. Check that the devices are configured with the same **Frequency Carrier**.
2. Check that the **Channel Bandwidth** is configured the same at both ends of the link.
3. On the AP, verify that the **Max Range** setting is configured to a distance slightly greater than the distance between the Access Point and the other end of the link.
4. Check that the Access Point **Synchronization Source** is configured properly based on the network configuration.
5. Verify the authentication settings on the devices. if **Authentication Type** is set to **WPA2**, verify that the **Pre-shared Key** matches between the AP and the SM **Preferred Access Points List**.
6. Check that the software at each end of the link is the same version.
7. Check that the desired AP SSID is configured in the SM **Preferred Access Points List**.
8. On the SM, check the **DL RSSI** and **DL CINR** values. Verify that for the SM installed distance, that the values are consistent with the values reported by the LINKPlanner tool.
9. Check Tx Power on the devices.
10. Check that the link is not obstructed or misaligned.
11. Check the DFS status page (**Monitor, System Status**) at each end of the link and establish that there is a quiet wireless channel to use.
12. If there are no faults found in the configuration and there is absolutely no wireless signal, retry the installation procedure.
13. If this does not work then report a suspected device fault to Cambium Networks.

## Module exhibiting frequent boots or disconnects

For any Force 300-16 units exhibiting frequent disconnects or reboots, the 4.4 official release must be applied twice to ensure both banks are updated. Once completed, ensure both banks are running 4.4 under **Monitor > System**. In general, this practice can be followed for all 802.11ac models as they support two banks for software storage.

## Link is unreliable or does not achieve the data rates required

If there is some activity, but the link is unreliable or does not achieve the data rates required, then perform the following steps:

1. Check that the interference has not increased by monitoring the uplink and downlink CINR values reported in the Access Point page **Monitor > Wireless Status**.
2. Check that the RSSI values reported at the device are proper based on the distance of the link – the LINKPlanner tool is designed to estimate these values.
3. Check that the path loss is low enough for the communication rates required.
4. Check that the device has not become misaligned.
5. Review the Quality of Service configuration and ensure that traffic is properly classified and prioritized.

## Resetting ePMP to factory defaults by power cycling

Operators may reset an ePMP radio to the default factory configuration by a sequence of power cycling (removing and re-applying power to the device). This procedure allows operators to perform a factory default reset without a tower climb or additional tools. The procedure is depicted in .

1. Remove the Ethernet cable from the PoE jack of the power supply for at least 10 seconds.
2. Reconnect the Ethernet cable to re-supply power to the ePMP device for **3-5 seconds** and disconnect the cable to power off the ePMP device for 3-5 seconds. (1<sup>st</sup> power cycle).
3. Reconnect the Ethernet cable to re-supply power to the ePMP device for **3-5 seconds** and disconnect the cable to power off the ePMP device for 3-5 seconds. (2<sup>nd</sup> power cycle).
4. Reconnect the Ethernet cable to re-supply power to the ePMP device for **3-5 seconds** and disconnect the cable to power off the ePMP device for 3-5 seconds. (3<sup>rd</sup> power cycle).
5. Reconnect the Ethernet cable to re-supply power to the ePMP device for **3-5 seconds** and disconnect the cable to power off the ePMP device for 3-5 seconds. (4<sup>th</sup> power cycle).
6. Reconnect the Ethernet cable to re-supply power to the ePMP device for at least **30 seconds** and allow it to go through the boot-up procedure



### Note

Device goes through an additional reset automatically. This resets the current configuration files to factory default configuration (such as IP addresses, Device mode, and RF configuration). The device can be pinged from a PC to check if boot-up is complete (Successful ping replies indicate boot-up is complete).

7. Access the ePMP device using the default IP address of 192.168.0.1 (AP) or 192.168.0.2 (SM).

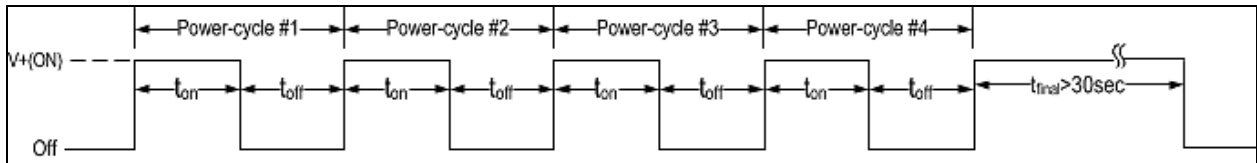


Figure 43: Power cycle timings

Where:	Is:
V+(ON)	Power through PoE has been applied to the device
Off	Power through PoE has been removed from the device
$t_{on}$	The time duration for which the device is powered on. This should be 3-5 seconds.
$t_{off}$	The time duration for which the device is powered off. This should be 3-5 seconds.

# Glossary

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Term	Definition
AES	Advanced Encryption Standard
ANSI	American National Standards Institute
CINR	Carrier to Interference plus Noise Ratio
CMM	Cluster Management Module
DFS	Dynamic Frequency Selection
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
EMD	Electromagnetic Discharge
ETH	Ethernet
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission
FEC	Forward Error Correction
GUI	Graphical User Interface
HTTP	Hypertext Transfer Protocol
IC	Industry Canada
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LoS	Line of Sight
MIMO	Multiple In Multiple Out
MIR	Maximum Information Rate
MU-MIMO	Multi-User Multiple In Multiple Out
MTU	Maximum Transmission Unit
nLOS	Near Line of Sight
NTP	Network Time Protocol
OFDM	Orthogonal Frequency Division Multiplexing
PC	Personal Computer

<b>Term</b>	<b>Definition</b>
PMP	Point to Multipoint
PTP	Point to Point
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keyed
RF	Radio Frequency
RMA	Return Merchandise Authorization
RSSI	Received Signal Strength Indication
RTTT	Road Transport and Traffic Telematics
RX	Receive
SAR	Standard Absorption Rate
SNMP	Simple Network Management Protocol
SW	Software
TDD	Time Division Duplex
TDWR	Terminal Doppler Weather Radar
TX	Transmit
UNII	Unlicensed National Information Infrastructure
URL	Uniform Resource Locator

# Cambium Networks

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Cambium Networks delivers wireless communications that work for businesses, communities, and cities worldwide. Millions of our radios are deployed to connect people, places and things with a unified wireless fabric that spans multiple standards and frequencies of fixed wireless and Wi-Fi, all managed centrally via the cloud. Our multi-gigabit wireless fabric offers a compelling value proposition over traditional fiber and alternative wireless solutions. We work with our Cambium certified ConnectedPartners to deliver purpose-built networks for service provider, enterprise, industrial, and government connectivity solutions in urban, suburban, and rural environments, with wireless that just works.

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