





QUICK START GUIDE cnWave<sup>™</sup> 5G Fixed Release 4.2



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# Introduction

On purchasing the **cnWave<sup>™</sup> 5G Fixed** platform of products from Cambium Networks, a Quick Start Guide is provided to assist operators. The guide helps in acquiring a high-level understanding of the cnWave<sup>™</sup> 5G Fixed platform of products, required hardware, installation methods, initial login procedures, and safety or warranty information.

Similar to other products of Cambium Networks, the cnWave<sup>™</sup> 5G Fixed system supports a long-life cycle with new features. These new features are introduced to the market through firmware updates and hardware upgrades.

# Product Description

The cnWave<sup>™</sup> 5G Fixed platform of products (from Cambium Networks) are high-end Point-to-Multipoint (PMP) systems. These systems provide easy, fast, and cost-effective wireless Gigabit connectivity for edge access solutions at a significantly lower cost than fiber infrastructure.

With the cnWave<sup>™</sup> 5G Fixed platform of products, operators and service providers can have access to Gigabit for business and residential connectivity and backhaul for Wi-Fi access. These products enable carriers and service providers to offer high-speed broadband connectivity to subscribers, even in areas not reachable through full-fiber networks.

For more information about the product description and installation (including frequency bands and hardware requirements), refer to the *cnWave™* 5G Fixed Planning and Installation Guide.

## **Overview of the cnWave™ 5G Fixed platform of products**

The cnWave<sup>™</sup> 5G Fixed platform of products are radio products that operate in the 24 to 30 GHz licensed bands (with various frequency ranges covered by these products, as shown in Table 12).

The cnWave<sup>™</sup> 5G Fixed platform of products consists of a B1000 Base Transceiver Station (BTS), which serves one or more cnWave<sup>™</sup> 5G Fixed C100 Customer Premises Equipment (CPE). Each CPE can be located at multiple locations within a sector.

A B1000 BTS is available as an integrated unit with a flat panel 90° sector antenna. A C100 CPE is available as an integrated unit connected to an external dish antenna (as shown in Figure 3). Figure 1, Figure 2, and Figure 3 are the images of radios - B1000 BTS, C100 CPE, and C100 CPE dish antenna, respectively.

Figure 1: cnWave<sup>™</sup> 5G Fixed B1000 BTS



### Figure 2: cnWave™ 5G Fixed C100 CPE



Figure 3: C100 CPE Dish antenna (assembled)



For information about the technical specifications of the cnWave™ 5G Fixed platform of products, refer to the <u>System Technical Specifications</u> section.

# Product Safety Information

This section provides guidelines specific to the product's safety.



### Warning

To prevent a loss of life or any physical injury, consider the safety guidelines listed in this section. For any such events, Cambium Networks shall not be liable to any injury or damage caused during the installation of cnWave<sup>™</sup> 5G Fixed radio nodes. Ensure that only qualified personnel install the cnWave<sup>™</sup> 5G Fixed radios.

Consider the following product safety guidelines:

- Ensure that B1000 BTS and C100 CPE products are capable of withstanding the maximum wind speeds at the proposed site.
- Ensure that the equipment is not powered during installation. Disconnect the equipment always from its power source before servicing.
- Note that harmful levels of Radio Frequency (RF) radiation are present close to the antenna when the transmitter is ON.
- Observe the minimum safe distance limit.
- Ensure that the equipment is installed in a position that prevents any radiation hazard to humans.
- Exercise extreme care when working at heights. Consider the national regulations for working at heights. Use the trained competent staff.
- Exercise extreme care when working near power lines.
- Always use a qualified electrician to install cables.
- The cnWave<sup>™</sup> 5G Fixed equipment must be grounded, properly (in accordance with installation guidance).
- Always use the specified cnWave<sup>™</sup> 5G Fixed equipment's Power Supply Units (PSU) to power the equipment. Failure to use the specified or supplied power equipment (by Cambium Networks) might result in equipment damage and cause a safety hazard.
- Deploy power injectors only with outdoor approvals in an outdoor environment.
- Structures, equipment, and people must be protected against electrostatic discharge by:
  - Siting the equipment in a lightning protection zone.
  - Installing appropriate lightning conductors to conduct the surge current to ground through a separate preferential solid path.
  - Using the recommended ground bonding and transient voltage surge suppression. You must use the surge suppressors specified by Cambium Networks.
- Use outdoor-rated cables for connections that are exposed to the outdoor environment. Install cables recommended by Cambium Networks.

- B1000 BTS and C100 CPE operate at a maximum ambient temperature of +60°C (maximum +50°C ambient under solar loading conditions). If the deployment site is an area with restricted access, confirm that the ambient temperature never exceeds 55°C.
- During operation, the surfaces of B1000 BTS and C100 CPE might be warm. Take care before handling or touching them.



### Caution

In a lab setting, the B1000 BTS heatsink requires adequate airflow to prevent overheating, therefore, it is recommended to expose the B1000 BTS heatsink to the ambient air when placing it on a table. It is also recommended to leave the unit mounted vertically on a purpose-built stand.

# Hardware Overview

This section provides an overview of the cnWave™ 5G Fixed hardware components. This section covers the following topics:

- Package contents
- B1000 BTS
- <u>C100 CPE</u>
- cnWave<sup>™</sup> 5G Fixed power supply and accessories

## Package contents

Table 1 lists the package contents of the cnWave<sup>™</sup> 5G Fixed platform of products:

Table 1: cnWave™ 5G Fixed platform package contents

Product name	Package contents
B1000 BTS	A B1000 BTS package box contains the following items:
	<ul> <li>One cnWave<sup>™</sup> 5G Fixed B1000 BTS</li> </ul>
	One 28 GHz BTS Radio
	One 28 GHz BTS mounting bracket
	One DC power connector kit 18AWG, which contains:
	One connector, plug housing, cable mounted, 4-pin, MiniFitJR, required crimp terminals, a connector and a crimp terminal, 18AWG, MiniFitJR, and a tin-plated copper tape of 3M 1345 and 1/4 inch (6.35mm) wide
	<ul> <li>One cable gland - M25, Cat5E, EMC, environmental seal, silver body black cap</li> </ul>
C100 CPE	A C100 CPE package box contains the following items:
	<ul> <li>One cnWave<sup>™</sup> 5G Fixed CPE</li> </ul>
	<ul> <li>One screw/bolt, flange head cap W/socket, M6x1x28mm</li> </ul>
	One cable gland, M25, ID10.0mm, plastic with O-Ring
	One product leaflet

## **B1000 BTS**

B1000 BTS is based on the latest 5G New Radio (NR) technology. It is fitted with a Global Navigation Satellite System (GNSS) Receiver System (as shown in Figure 4) and heatsinks for efficient thermal management under specified ambient conditions.

This release supports a standard Ethernet port. Maximum number of CPEs per BTS supported are:

- 120 for 100 and 112 MHz channel size and
- 60 for 50 and 56 MHz channel size.

Figure 4: cnWave<sup>™</sup> 5G Fixed B1000 BTS



Figure 5 shows location and description of interface ports on B1000 BTS.

### Figure 5: B1000 BTS interface ports



Table 2: Function and cabling details of B1000 BTS Interface ports

Interface	Function	Connector/Cabling
PSU	Power – Use the PSU brick supplied by Cambium Networks (refer to – 56V 240W PSU)	56V 240W
MAIN	Data port	RJ45
SFP+1	Fiber data port - 1GE optical only	Fiber
SFP+2	Fiber data port - 10GE optical only	Fiber
Ground Lug	Unit chassis ground - For details, refer to the Installation section in the <i>cnWave™ 5G Fixed Planning and Installation Guide</i> .	10 AWG copper wire



### Note

In the later sections of this guide, the term BTS is used to refer to B1000 BTS and the term CPE to refer to C100 CPE.

## An overview of BTS antenna

The cnWave<sup>™</sup> 5G Fixed BTS is a multi-user multi-input-multi-output (MU-MIMO) platform available in a single, 90° sector - all integrated antenna. The antenna arrays in the BTS can be configured electrically to be either Horizontal (H) or Vertical (V) polarized.



Note

Only the single sector variant is included in Release 4.1.

Table 3 provides high-level specifications of the antennas required for various configurations.

Table 3: Antenna specifications for BTS

Antenna type	Columns per sector	Azimuth beamwidth	Elevation beamwidth
Single sector	8	90°	10°

## Time Division Duplexing (TDD) synchronization

The cnWave<sup>™</sup> 5G Fixed system supports a network-wide synchronization of its TDD structure to avoid network self-interference.

The reference signal required at BTS for TDD synchronization is either:

- a one pulse per second (PPS) signal provided by onboard GPS,
- a one PPS signal over the Cambium Networks Sync-Over-Power interface, or
- derived from an onboard IEEE1588v2 Slave Clock.



## Note

Currently, Cambium Networks does not offer any Sync-Over-Power injectors but recommends a third-party equipment on request. For more details, contact Cambium Networks Sales.

Figure 6 shows the location of a GPS antenna on BTS.

Figure 6: Top side handle on BTS



GPS for Synchronization

For more information about the TDD Synchronization, refer to the *cnWave™ 5G Fixed Planning and Installation Guide*.

## **C100 CPE**

The current release supports up to 60 CPEs per BTS sector for 50 MHz and 56 MHz channel sizes, and 120 CPEs per BTS sector for 100 MHZ and 112 MHZ channel sizes.

The maximum Effective Isotropic Radiated Power (EIRP) per CPE is 52 dBm. Figure 7 shows back and front views of the CPE.

Figure 7: Back and front views of C100 CPE



Figure 8 shows interface ports of CPE.

Figure 8: CPE Interface ports



Table 4 provides function and cabling details of CPE interface port.

Table 4: Details of CPE interface ports

Interface	Function	Connector/Cabling
Main/Power Port	IEEE 802.3at (42.5 - 58 V), 10/100/1000Base- T Ethernet, and no Canopy Sync-over- power.	RJ45/CAT5E/CAT6/CAT6E
Audio Port	Used for the sound tones to align radio.	Two lines. one for the 3.5 mm connector and one for the SIM card. 3.5 mm TRRS audio or standard Headphones or custom sync + nano SIM card.

## An overview of CPE antenna

The CPE uses a high gain dish antenna. As per the BTS, the CPE can be configured to dynamically operate in either vertical or horizontal polarization. The overall antenna gain is made up of a combination of the dish gain and the antenna array used as its source.

Table 5 provides high-level specifications of the antennas required for the CPE configuration.

Table 5: Antenna specifications for CPE

Antenna type	Gain	Elevation beamwidth
450 mm diameter dish	36 dBi	~2.0 <sup>°</sup>



Note

Only the 450 mm diameter dish is included in Release 4.1.

## cnWave<sup>™</sup> 5G Fixed power supply and accessories

Details of all the accessories and how they are connected to the cnWave<sup>M</sup> 5G Fixed radios are described in the *cnWave<sup>M</sup>* 5G Fixed Planning and Installation Guide.

You can order the following accessories (from Cambium Networks) that are compatible with the cnWave<sup>™</sup> 5G Fixed platform of products:

## **BTS Power supply and accessories**

The various power supply and accessories required for BTS are as follows:

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Accessory	Part number	Key attributes
DC Power supply	N00000L054B	Main power supply, 54V 240W PSU, IP65

Accessory	Part number	Key attributes
Crimp tool for Molex MiniFitJr	N00000T001A	Tool to apply crimps for DC power connectors
Crimp extractor tool	N00000T002A	Manual tool to extract crimps from the connector
Connector and Crimps	N00000L123A and N000000L124A	DC Power Connector kit package that contains 10 connectors, 50 crimps, 18 AWG or 16 AWG, respectively (sold as spares kit)
Cable	<ul> <li>N00000L116A: Four conductor 1 mm x 2 DC cable - 100 m</li> <li>N000000L117A: Four conductor 0.75 mm x 2 DC cable - 300 m</li> <li>N00000L118A: Four conductor 1 mm x 2 DC cable - 300 m</li> </ul>	0.75 mm x 2 or 1 mm x 2 Four conductor cables sold in 100 m or 300 m reels
<b>10G Ethernet LPU for the data cable</b> (recommended by Cambium Networks)	TBD	Surge protector for the data cable

Accessory	Part number	Key attributes
DC LPU for the power cable	C00000L114A	DC Surge Suppressor (DC LPU Kit) with 2 x four pin power connectors

Cambium Networks provides accessories (on ordering) for BTS such as DC LPU Grounding Kit and SFP module kit (optional accessory). For more information about the BTS accessories and installation, refer to the *cnWave™ 5G Fixed Planning and Installation Guide*.

## **CPE** Power supply and accessories

The various accessories required for CPE are as follows:

Table 7: Details of power supply and accessories for CPE

Accessory	Part number	Key attributes
EEE802.3at 30W Power brick	N00000L034B	PoE, 30.5W, 56V, GbE DC Injector, Indoor, Energy Level 6 Supply, accepts C5 connector
1G Ethernet LPU (recommended by Cambium Networks)	TBD	Ethernet LPU for the CPEs
Scope Mount for cnWave™ 5G Fixed	N000500L001A	An optical scope mount
		<b>Note</b> : You can use this Scope Mount to attach a telescope, which is used to align CPEs with the BTS.

Cambium Networks provides accessories (on ordering) for CPE such as **1G Ethernet Surge Protector** and **Scope Mount** kit. To order a **Scope Mount**, contact Cambium Networks Support. For more information

about the CPE radio accessories and installation, refer to the *cnWave™* 5G Fixed Planning and Installation Guide.

# Installing the cnWave™ 5G Fixed Products

Installation and operation of the cnWave<sup>™</sup> 5G Fixed platform of products are complex. Cambium Networks recommends professional installation and management of the system to ensure the operation compliance with regulations of a region (where the product is installed).

Follow the instructions provided in this guide. Further guidance on the cnWave<sup>M</sup> 5G Fixed installation and operation is available in the *cnWave<sup>M</sup>* 5G Fixed Planning and Installation Guide, *cnWave<sup>M</sup>* 5G Fixed Configuration Guide, and other training materials available on the Cambium Networks website (check here).

You must have sufficient skills, knowledge, and experience to perform the installation tasks. An installer must have:

- Familiarity with current applicable national regulations, including radio regulations, electrical installation regulations, surge protection regulations, and regulations specific to working at heights.
- Knowledge to install by following instructions given by Cambium Networks.
- Responsibility to confirm the compliance of the equipment settings with national or regional regulations.
- Familiarity with training materials available on the Cambium Networks website (check here).

Update the cnWave<sup>™</sup> 5G Fixed series equipment with the latest software code. The required software is available on the Cambium Networks Support site.

## Installing and connecting the products

Review national regulations and ensure that all appropriate regulatory licenses are obtained prior to deployment. Before installing, plan the location of BTS carefully to ensure good radio coverage and to minimize interference. Installation and commissioning of equipment must be carried out by trained personnel.



### Warning

Always use an appropriately rated and approved AC supply cord that is set in accordance with regulations of a country.



#### Attention

As the PSU is not waterproof, keep it away from sources of moisture. Place it either in the equipment building or in a ventilated moisture-proof enclosure. Do not locate the PSU in a position where it might exceed its temperature rating.



### Attention

Do not plug any device other than the cnWave<sup>™</sup> 5G Fixed BTS into the ODU port of the PSU. There might be damage to other devices due to the non-standard techniques employed for injecting the DC power into the Ethernet connection between the PSU and the BTS.

Do not plug any device other than the cnWave<sup>™</sup> 5G Fixed PSU into the PSU port of the BTS. Plugging any other device into the PSU port of BTS might damage the BTS and the device.

Installing and connecting the cnWave<sup>™</sup> 5G Fixed platform of products involve the following processes:

- Assembling the cnWave<sup>™</sup> 5G Fixed products
- Connecting the cnWave<sup>™</sup> 5G Fixed products

## Assembling the cnWave<sup>™</sup> 5G Fixed products

To assemble and connect the cnWave<sup>™</sup> 5G Fixed platform of products, perform the following tasks:

- Assembling the mounting bracket for BTS
- Assembling the CPE dish and a precision bracket
- Attaching the dish to the CPE

Detailed information on how to prepare for installation is available in the *cnWave™ 5G Fixed Planning and Installation Guide*.

### Assembling the mounting bracket for BTS

The tilt bracket (as shown in Figure 9) is provided with the BTS and can be used to provide elevation adjustments when it is mounted on a pole or mast. The tilt bracket works with poles with diameters ranging from 25 mm to 80 mm (0.98 inch to 3.14 inches). The tilt bracket assembly can be used with third-party band clamps to mount the ODU on larger poles with a diameter ranging from 90 mm to 230 mm (3.54 inches to 9.05 inches).

#### Figure 9: BTS Tilt bracket components



B1000 Tilt Bracket Components

For more information on how to assemble and connect the mounting bracket for BTS, refer to the Assembling the tilt mounting bracket for BTS section in the *cnWave™ 5G Fixed Planning and Installation Guide*.

### Assembling the CPE dish and a precision bracket

This section explains how to assemble the 400 mm CPE dish and a precision bracket.

### Assembling the 450 mm CPE dish

In Release 4.1, the CPE is connected to a 450 mm dish.

CPE Dishes are packed in a box of four dishes. Each dish has the following components (as shown in Figure 10):

- 1 x Metal Dish 450 mm white
- 1 x Sub Reflectors
- 4 x Washer, M4 Crinkle, Stainless Steel
- 4 x Screws, Pan Head Torx, M6 x 12 mm
- 4 x Washers, M6 plain
- 4 x Nuts, M4

### Figure 10: CPE Dish components



To assemble the CPE dish, perform the following steps:

1. Insert the sub-reflector into the corresponding four small holes of the antenna dish, as shown in Figure 11.

Figure 11: Inserting the sub-reflector



2. Secure the sub-reflector from the back of the dish using the M4 washers and M4 nuts, as shown in Figure 12.

You must use a spanner to tighten the screws.

Figure 12: Securing the sub reflector



3. Use the remaining M6 screws and M6 washers to attach the dish assembly to the mounting bracket of the CPE (as described in the <u>Assembling the precision bracket for CPE</u> section).



Figure 13: Attaching the dish assembly to the bracket

Figure 14 shows an assembled image of the CPE dish.

Figure 14: An assembled CPE dish



### Assembling the precision bracket for CPE

The fine adjustment or precision bracket (as shown in Figure 15) is used to mount the CPE with a 450 mm external dish antenna on a vertical pole, with a diameter ranging from 25 mm to 80 mm (0.98 inch to 3.14 inches). The precision bracket supports fine adjustments up to 18° in azimuth and +/-30° in elevation for an accurate alignment of the CPE.

You must first assemble the fine adjustment bracket using a 13 mm (0.511 inch) wrench with a maximum torque of 5 Nm. Unpack the box that contains the precision bracket components.

Figure 15 shows the precision brackets components and an assembled precision bracket.

Figure 15: Fine adjustment bracket (precision bracket)



For more information on steps to assemble and connect the mounting bracket for CPE, refer to the Assembling the precision bracket for CPE section in the  $cnWave^{M}$  5G Fixed Planning and Installation Guide.

### Attaching the dish to the CPE

To attach the dish to the CPE, perform the following steps:

- 1. Connect the CPE to the dish using the four screws provided with the CPE box.
- 2. Place the CPE and ensure that the radome is aligned with a hole inside the dish and the four screws in a secure way.

Figure 16 shows a side and rear views of an assembled CPE and dish.

Figure 16: Views of assembled CPE and dish



Figure 17 shows the back and right side views of the CPE with an external antenna and a precision bracket.

Figure 17: Back and right side views of CPE



## **Connecting the cnWave™ 5G Fixed products**

After assembling the cnWave<sup>™</sup> 5G Fixed platform of products, perform the following tasks to complete installation and connection of the products:

- 1. Connecting the CPE
- 2. Installing BTS on a mast and connecting BTS to power
- 3. Connecting the BTS to AC/DC PSU

### **Connecting the CPE**

To connect the CPE to the 30W DC power injector, perform the following steps:

1. Connect the input side of the 30W DC power injector (as shown in Figure 18) to the AC power line (line cord).

Figure 18: 30W DC Power injector



- 2. Connect the 5 GbE LAN port of the power injector to a network equipment.
- 3. Connect the 30W 56V 5 GbE Power over Ethernet (PoE) port of the power injector to the ODU drop cable.

Figure 19 shows how the CPE is connected to the power Injector.

Figure 19: CPE Connection



For more details, refer to the cnWave™ 5G Fixed Planning and Installation Guide.

### Installing BTS on a mast and connecting BTS to power

To install the BTS on a mast and connect the BTS to power, perform the following steps:

1. Ensure that structures, equipment, and people are protected from power surges (typically, caused by lightning) by conducting the surge power to the ground through a separate preferential solid path.

It is recommended to use a DC LPU to protect BTS from potential lightning surge damages. For more details, refer to the DC LPU Installation guide.

The actual degree of protection required depends on local conditions and applicable local regulations. To adequately protect an installation, both ground bonding and transient voltage surge suppression are required.

2. Follow your best practices for grounding and lightning protection.

With the best practices, network operators can minimize network outages and reduce the associated costs of tower climbs and equipment repair or replacement.

- 3. Review national regulations and ensure that all appropriate regulatory licenses are obtained prior to deployment.
- 4. Before installing, plan the location of BTS carefully to ensure good radio coverage and to minimize interference.

Trained personnel must carry out installation and commissioning of the equipment.

- 5. Ensure that the BTS is powered through an AC power injector installed at the bottom of the tower.
- 6. Consider DC LPUs (as shown in Figure 20) and grounding guidelines to power up the BTS.
- 7. Connect the ground at multiple points on the mast, as shown in Figure 20.

Figure 20: A sample design of BTS and DC LPU connections





### Note

You can improve the lightning-prone installations by performing the following tasks:

- Install a lightning protection device near the Outdoor Unit (ODU).
- Ground the ODU to the pole.
- Lower the installation of the ODU below the highest point of the pole. It must not be the highest metallic object.

### Connecting the BTS to AC/DC PSU

To connect the BTS to AC/DC PSU, perform the following steps:

1. Connect the output of the AC/DC PSU through a connector to the BTS PSU port.

For information on preparing the cables, refer to the *cnWave™* 5G Fixed Planning and Installation Guide.

2. Connect the Input side of the AC/DC PSU (as shown in Figure 21) to the AC power line (line cord).

Figure 21: BTS AC/DC PSU

	MW PERMICENT	HLG-240H-54A(x+x) LEDECHAR	
	S-N: EAJ	100-246V- 4.8A 50'60Hz (W-) 277V- 1.2A 50'60Hz (W-) 277V- 1.2A 50'60Hz	(BLACK R) Vo-
ACL (BROWN 41     ACN (BLUE #)	BRY AL BRADE BUT	And As (2779-107 North America biny)	A THE SELV
		Baltable for sortin Jrg. Dang and And Locations	

Figure 22 shows an image of the power cable connector.

Figure 22: BTS AC/DC PSU connector



Figure 23 shows an image of the BTS with cables connected to the ports (PSU and MAIN).

Figure 23: B1000 BTS interface connections





### Note

Both short and long glands can be used to connect the BTS AC/DC to an indoor PSU. For more information on steps to attach the BTS AC/DC PSU, refer to the Powering up the BTS section in the  $cnWave^{m}$  5G Fixed Planning and Installation Guide.

# Configuring the cnWave™ 5G Fixed Products

This section provides information about the user interface (UI) of BTS and CPE. It also lists UI controls required to start the configuration tasks.

## **UI Controls**

Before configuring the UI of B1000 (BTS) and C100 (CPE), familiarize yourself with the UI controls (as described in Table 8). These UI controls are required for managing BTS and CPE configurations.

UI Control	UI Control name	Description
8	Dashboard	To open the main dashboard page of the required product.
		Applicable to both B1000 and C100 UIs.
	System	To configure the required system settings for BTS and CPE.
		For BTS:
		• General
		Management
		• Radio
		Interface
		SFP Modules
		CPE Provisioning
*		Synchronisation
		• Syslog
		For CPE:
		• General
		Management
		• Radio
		Interface
		Session
		RADIUS Authentication
		Applicable to both B1000 and C100 UIs.
8	Subscribers	To view (read-only) all the data related to subscribers (CPEs).

Table 8: List of UI controls

UI Control	UI Control name	Description
		Applicable only to the B1000 UI.
*	Tools	To update firmware and reboot the unit, test network connectivity, and access the unit remotely.
		Applicable to both B1000 and C100 UIs.
A	Setup Wizard	To configure the CPE (for example, frequencies, power, polarisation, and other configurations).
		Applicable only to the C100 UI.
Other common L	Il controls:	
	Expand or collapse	To expand or collapse the options on the left navigation column of the dashboard.
~	Expand	To expand the parameters of a section.
^	Collapse	To collapse the parameters of a section.
B	Table	To view the parameters in a column format.
5	Undo	To undo the changes.
•	Save	To save the changes.
С С	Power	To restart or reboot the system from the UI.
2	Admin	To change the password of the UI and log out from the UI.

To configure the cnWave<sup>™</sup> 5G Fixed platform of products, perform the following tasks:

- <u>Configuring BTS</u>
- Configuring CPE

## **Configuring BTS**

This section provides information about the B1000 UI. It explains how to log on to the B1000 UI and configure the required settings for BTS.

For detailed information on the B1000 UI configuration, refer to the *cnWave™ 5G Fixed Configuration Guide*.

## Accessing the B1000 UI

To access the B1000 UI, perform the following steps:

- 1. Use the default IP address (169.254.1.1) to connect to the BTS setup.
- 2. Ensure that your PC is set up to communicate with the required range of IP addresses.

3. Open a web browser and type the URL - http://169.254.1.1 - to access the B1000 UI.

The **Sign In** page appears, as shown in Figure 24.

Figure 24: The Sign In page of B1000 UI



4. Type an appropriate username and password.

Default username: admin

Default password: admin

You can use the show-password eye icon ((?)) to view the password characters.

5. Click Sign In.

The **Profile** page appears, as shown in Figure 25. This page allows you to change the password.



### Note

There is no need to change the password every time when the **Profile** page appears. You must change the password only when it is required.

You can also access the **Profile** page by selecting **Profile** from the **admin** drop-down list on the top right side of the B1000 UI.

Figure 25: The Profile page - B1000 UI

	Cam	nbium Networks │ cn <b>Wave</b> ™ 5	iG Fixed   B1000			Undo 🍤 Save 🖬	🖒 Admi	nistrator	🚨 admin 👻
-14		Profile							
•		Change Passphrase		~ ⊞	Options				~ ⊞
<b>•</b>			admin			Highlight Changes			
•		Account Name	The current passphrase for this account is expired and should be changed immediately.		Preferences	Login Page Background Image			
*		Current Passphrase	Current Passphrase	8					
		New Passphrase	New Passphrase	8					
		New Passphrase Confirm	New Passphrase Confirm	8					
			Change Passphrase						

Table 9 lists and describes the parameters available on the **Profile** page.

Table	9. List	of	narameters	in f	the	Profile	nade
TUDIC	J. LIJU		parameters				puge

Parameter	Description					
Change Passphrase						
Account Name	The default name of the user account required for accessing the B1000 UI.					
	This is read-only parameter.					
	The default password used for the first time log in or for the previous access.					
Current Passphrase	Default password: admin					
	Enter the current password in the text box.					
New Decembrace	Enter a new password in the text box.					
New Passphrase	<b>Note</b> : The maximum character limit for the password is eight.					
New Passphrase Confirm	Reenter the new password in the text box to confirm.					
Change Dassabrase	An option to change the current password.					
Change Passpillase	Click on <b>Change Passphrase</b> to change the current password.					
Options Used for the engineerin	ng purpose.					
	An option to set your preferences in the UI.					
	Following options are supported:					
Preferences	<ul> <li>Highlight Change: Use this option to easily identify the new changes, which are highlighted in light yellow color on UI pages. These highlighted values help you in quickly monitoring the system changes. Example: The System &gt; Interface UI page displays the highlighted values in light yellow color.</li> </ul>					
	• Login Page Background Image: Use this option to set the background image on the Sign In page of UI (as shown in Figure 24).					
	Select the check boxes, if required.					

6. On changing the password, log on to the B1000 UI using admin (username) and the new password (which you set on the **Profile** page).

The **Profile** page appears, as shown in Figure 25.

7. To view the main B1000 dashboard, click the **1** icon (Dashboard) icon on the left navigation pane.

The **Dashboard** page appears. For more information about the B1000 dashboard page, refer to the B1000 Dashboard section.



### Note

To log out from the UI, select **Logout** from the **admin** drop-down list at the top right side of the UI.

You can now use the required UI controls (as described in Table 8) for configuring and managing BTS.

## B1000 Dashboard

The B1000 dashboard provides a simple representation of the number of CPEs registered with BTS, along with status of the connection with CPEs. Example: Figure 26 shows the B1000 dashboard, indicating the number of CPEs that are registered and connected with BTS.

### Note

Currently, the B1000 BTS device can support up to:

- 120 CPEs for 100 and 112 MHz channel size and
- 60 CPEs for 50 and 56 MHz channel size.

When you log on to the B1000 UI (by using appropriate URL and login credentials), the main B1000 dashboard page appears as shown in Figure 26.

Figure 26: The main B1000 dashboard page

Ca	mbium Networks	cn <b>Wave</b> ™ 5G Fixe	ed   B1000					C obnU	Save 🔒	Φ	Administrator	💄 admin 👻
H	General Device	Radio GNSS										
:	Device		Sessions									
•	000456700188 ESN	8d 17h 47m Uptime	8 Connected CPEs	8 Registered CPEs								
<b>4</b>	Device Summary			~ E	B Netw	ork						~ ⊞
14	B Product Name	cnWave (	G Fixed Base Transceiver Station (BTS		<b>0</b> M	AC	00:04:56:70:01:88					
×	Release Name	4.1b2			IP	Address	169.254.3.99					
	System Description	Cambium	Networks cnWave 5G Fixed Base Trans	ceiver Station (BTS) 4.0b2 aarch64	I Pr	efix	24					
	Custom Name	GNU/Lini	IX		0 De	fault Gateway	169.254.3.253					
	System Name	POU-Rig	_1 5.1 Sollwale		-							
	System Contact	vassine			VLA							
	System Time	2024-05-	24.06:26:18		0 Ma	anagement VID	1					
	NTP Synchronized				0 M	AN Enabled	U					
	cnMaestro Connection	Status Connecte	d			in O Ether Type	0v8100					
						ing caler type	0.0100					
	Subscribers			✓ E	Radi	o						~ ⊞
	Connected CPEs	8			6 Ca	libration Status	Calibrated					
	8 Registered CPEs	8					Tx Enabled					
					Тх	State	Transmit control o	werridden by E	ngineering ke	y		

The main B1000 dashboard page contains the following tabs:

- **General**: Provides a summary of the connected devices. It also displays the subscriber status and other system related details. Example: Firmware and current operational software release number, including system contact details.
- **Device**: Displays information about the system reboot, antenna orientation, and the boot loader, as shown in Figure 27.

### Figure 27: The Device page

ambium Networks   cn <b>Wa</b>	<b>/e</b> ™ 5G Fixed   B1000				Undo 🍤 S	ave 🖬 😃 Administrator	💄 admin 👻
General Device Radio	GNSS						
Device Identifier		~ ⊞	Power Supply				~ ⊞
0 MSN	V5YA02QT3091		1 Input Current	4.12 A			
0 ESN	000456700183		<ol> <li>Input Voltage</li> </ol>	52.6 V			
0 SKU	C280500A101A						
			Boot				~ ⊞
Location		~ ⊞	<ol> <li>Startup Reason</li> </ol>	Long Powe	er Cycle		
1 Latitude	50.52305 DD		<ol> <li>Startup Count</li> </ol>	40			
1 Longitude	-3.74034 DD						
1 Altitude	88.6 m		Shutdown				~ ⊞
			History	Reason	<ol> <li>Date</li> </ol>	O Detail	
Antenna Orientation		~ ⊞	1	Power Loss	0000-00-00 00:00:00	Boot after long power cycle	
O Antenna Azimuth	90.0 °		2	Power Loss	0000-00-00 00:00:00	Boot after long power cycle	
<ol> <li>Antenna Tilt</li> </ol>	-1.0 °		3	Power Loss	0000-00-00 00:00:00	Boot after long power cycle	
			4	Power Loss	0000-00-00 00:00:00	Boot after long power cycle	
Boot Loader		× 🖽	5	Power Loss	0000-00-00 00:00:00	Boot after long power cycle	
<ol> <li>Git Tag</li> </ol>	develop/6/18		6	Firmware Upgrade	2024-11-08 13:30:07	cnMaestro upgrade	
Build Name	BOOTLOADER 18/2024-03-22 (W) 11:46:53 -0500		7	Configuration Change	2024-10-11 13:07:00	Radio configuration change	ed
			8	Configuration Change	2024-10-11 12:22:46	Radio configuration change	ed
Hardware		× 🖪					
Hardware Version	Digits P9.0 RF 6.0						
0 RFID	X60570000202						
	Ambium Networks     CnWax       General     Device     Radio       Device Identifier     0     MSN       0     ESN     0       0     SKU     Location       0     Latitude     0       0     Longitude     0       0     Antenna Orientation     0       0     Antenna Azimuth     0       0     Antenna Tilt     Boot Loader       0     Git Tag     0       0     Build Name       Hardware     0       0     Hardware Version       0     RFID	ambium Networks       I CrtWave* 5G Fixed   B1000         General       Device         Radio       GNSS         Device Identifier       0         MSN       V5YA02QT3091         ESN       000456700183         SKU       C280500A101A         Location       0         Latitude       50 52305 DD         Longitude       -3.74034 DD         Atteinde       68.6 m         Antenna Orientation       0         Antenna Azimuth       90.0 °         Antenna Tilt       -1.0 °         Boot Loader       0         G Git Tag       develop/6/18         Build Name       BOOTLOADER 18/2024-03-22 (W) 11.46:53 -0500         Hardware       Upits P9.0 RF 6.0         0       RHD       X80570000202	Bamblum Networks       I CnWave" 5G Fixed   B1000         General       Device       Radio       GNSS         Device Identifier       VE       If       If         Image: Strain Str	Bamblum Networks       I CrWave* 5G Fixed   Bl0OO         General       Device       Radio       GNSS         Device Identifier       Y III       Power Supply         0 MSN       V5YA02013091       0 Input Current         0 ESN       000495700183       0 Input Voltage         0 SKU       C280500A101A       Boot         Location       Y III       Boot         0 Latitude       50 52305 DD       Startup Reason         0 Latitude       50 52305 DD       Startup Count         1 Antenna Orientation       Y III       1         0 Antenna Azimuth       90 0*       1       2         0 Antenna Trit       -1.0*       I       2       3         Boot Loader       Y III       3       4       5       6       7       8         Hardware       Y III       20 0 FI 6.0       Miss 3-0500       IIII       8       8       9       9       90 0 FI 6.0       9       9       9       9       9       9       9       9       9       9       9 <th>Ambium Networks I cnWave* 5G Fixed I B1000     General Device   Radio GNSS     Device Identifier      <ul> <li>MSN</li> <li>V5YA02013091</li> <li>ESN</li> <li>000456700183</li> <li>C280500A101A</li> </ul>    Location  <ul> <li>Boot</li> <li>Startup Reason</li> <li>Long Power</li> <li>Startup Reason</li> <li>Continuate</li> <li>Attenna Crientation</li> <li>Antenna Tritt</li> <li>4.0.°</li> </ul>    Antenna Crientation  <ul> <li>Boot</li> <li>Continuate</li> <li>Attenna Azimuth</li> <li>90.0°</li> <li>Antenna Tritt</li> <li>4.0°</li> </ul>    Boot Loader  <ul> <li>General</li> <li>Built Name</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>Bo</li></ul></th> <th>Construit         Construit         <thconstruit< th=""> <thconstruit< th=""> <thc< th=""><th>Buttour Networks       CreWee* SG Fixed 18000       Out of Miss       Out of Miss       Out of Miss         General       Device       Radio       GINSS       Impair Control       Impair Contro       Impair Control       Impair Control</th></thc<></thconstruit<></thconstruit<></th>	Ambium Networks I cnWave* 5G Fixed I B1000     General Device   Radio GNSS     Device Identifier <ul> <li>MSN</li> <li>V5YA02013091</li> <li>ESN</li> <li>000456700183</li> <li>C280500A101A</li> </ul> Location <ul> <li>Boot</li> <li>Startup Reason</li> <li>Long Power</li> <li>Startup Reason</li> <li>Continuate</li> <li>Attenna Crientation</li> <li>Antenna Tritt</li> <li>4.0.°</li> </ul> Antenna Crientation <ul> <li>Boot</li> <li>Continuate</li> <li>Attenna Azimuth</li> <li>90.0°</li> <li>Antenna Tritt</li> <li>4.0°</li> </ul> Boot Loader <ul> <li>General</li> <li>Built Name</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>BootLoader</li> <li>Bo</li></ul>	Construit         Construit <thconstruit< th=""> <thconstruit< th=""> <thc< th=""><th>Buttour Networks       CreWee* SG Fixed 18000       Out of Miss       Out of Miss       Out of Miss         General       Device       Radio       GINSS       Impair Control       Impair Contro       Impair Control       Impair Control</th></thc<></thconstruit<></thconstruit<>	Buttour Networks       CreWee* SG Fixed 18000       Out of Miss       Out of Miss       Out of Miss         General       Device       Radio       GINSS       Impair Control       Impair Contro       Impair Control       Impair Control

• Radio: Displays information about the key radio settings (as shown in Figure 28) configured using the System > Radio page.

Figure 28: The Radio page

	ambium Networks │cn <b>Wave</b> ™	5G Fixed   B1000							Un	do 🔊 S	ave 🖬	đ Ad	ministrator	💄 admin 👻
÷H	General Device Radio G	NSS												
•	Status		~ ⊞	MU-MIMO	Group U	tilisation Cha	art							~
-	I Frequency	27000.000 MHz		100										
0	Max EIRP	25.0 dBm		90										
	O Polarisation	Horizontal		80										
2	B Link Symmetry	5:2		70										
10	Bandwidth	112 MHz		60										
2	0 UL Target Rx Power	-60 dBm		⇒ 50										
	0 UL Tx Power Initial Adjust	Enabled		40										
	0 UL Tx Power Continuous Adjust	Enabled		40										
	MUMIMO Control	Enabled		30										
	Radio Resource Control	40	× 🖽	10										
	RX RACH Counts	16		0	DI	DI	DI	DI						
	Ry SPB Messages	96			sec	min	hr	24hr		sec	m	in	hr	24hr
	• It one messages			MUMIMO	Group Uti	ilisation Deta	uls							× m
		Reset RACH Counts		Interval	oroup ou	inoution Dett	DL sec	DI min	DI br	DL 24br	LIL SOC	LIL min	LII. br	UL 24br
				G Idle (%)			11	45.8	97.1	99.6	23.5	57.6	96.4	98.4
	MU-MIMO Group Size Configuration	on	~ ⊞		ned (%)		0.0	0.1	0.3	0.2	76.4	42.3	3.4	15
	0 DL MUMIMO Max Group Size	6		Groups	of 2 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	UL MUMIMO Max Group Size	6		0 Groups	of 3 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0 Groups	of 4 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				0 Groups	of 5 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Groups	of 6 (%)		98.8	54.0	2.4	0.1	0.0	0.0	0.0	0.0
				Groups	of 7 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				6 Groups	of 8 (%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Avg			6.0	6.0	5.4	2.4	1.0	1.0	1.0	1.0
				6 Max			6	6	6	6	1	1	5	5

In Figure 28, the DL MUMIMO utilisation in groups of six is shown as an example. The utilisation is expressed as the percentage of the available link capacity that has been utilised by the downlink scheduler. The measurement is updated every minute and shows the utilisation for the last second, one minute, one hour, and day (24 hours).

• **GNSS**: Displays satellite information (read-only) for the BTS device such as number of satellites that are in use, sky view details, and sky map (location of satellites in different directions).

Using this information (as shown in Figure 29), you can monitor the satellites and ensure the BTS installation in a clear sky for optimal GPS synchronisation.



You can configure GNSS using the **System** > **Synchronisation** page of the B1000 UI. For more information, refer to the *cnWave 5G Fixed Configuration Guide*.

For information on checking the BTS installation using satellite details, refer to the *cnWave 5G Fixed Planning and Installation Guide*.



Note





### Note

For information about each parameter in **General**, **Device**, Radio, and **GNSS** pages, refer to the *cnWave™ 5G Fixed Configuration Guide*.

When you modify any parameters for either BTS or CPE in the B1000 dashboard page, click **Save** (located at the top right corner of the UI page) to apply the changes.



#### Consider the following settings to configure the BTS:

### System settings

To access most of the configuration parameters for BTS, select the **System** (2) icon on the left navigation column in the main B1000 dashboard page. When you select the **System** icon, the **System** page appears with the following tabs:

General: Allows you to configure generic system settings such as system name, its location, contact details, IP, cnMaestro X, VLAN, and other network-related settings (as shown in Figure 30). You can also enable or disable IPv6. For information about configuring VLAN, cnMaestro X, and other system settings, refer to the cnWave<sup>™</sup> 5G Fixed Configuration Guide.

🜔 Ca	ambium Networks │ Cn <b>Wave</b> ™ 5	5G Fixed   B1000		Undo 🖒 Save 🖬 Ů Administrator 🔮 admin 👻
÷H	General Management Radio	Interfaces SFP Module CPE Provisioning Synchronisation Sy	slog	
;	System	× 🖽	VLAN Configuration	✓ ■
	System Name	POC-RIG_1 3.1 Software	0	Activate saved VLAN configuration
	System Location	D1 Lab	Management VID	1
H	System Contact	yassine	Management VID Priority	0
~	Timezone	GMT (+00:00) \$	VLAN Enabled	O Disabled O Enabled
	Antenna Orientation	✓ ⊞	Q-in-Q Ether Type	○ 0x88a8
	<ol> <li>Antenna Azimuth</li> </ol>	• 0.0	cnMaestro	✓ ⊞
	Antenna Tilt	-2.0 °	Remote Management	
			Connection Status	Connected
	Network Configuration	~ B	Address	qa.cloud.cambiumnetworks.com
	IP Address	169.254.3.99	Account ID	28GHZ_CNWAVE_PLATFORM_SIT
	1 Prefix	24	Cambium ID	Cambium ID
	0 Default Gateway	169.254.3.253	Onboarding Key	Onboarding Key 🗞
	1 IPv6 Enabled	ල් 🖸	Validate Server Certificate	
	1 IPv6 Address		L	
		64		
	IPv6 Prefix	• This setting will apply when the device next boots.		
		fec0::1		
	IPv6 Default Gateway	This setting will apply when the device next boots.		
	1 Primary DNS Server	8.8.8.8		
	Secondary DNS Server	10.130.12.111		
	Primary IPv6 DNS Server			
	1 DNS Domain Name	DNS Domain Name		
	Forward Unknown Unicast Packets	0		

Figure 30: The System settings page

• Management: Allows you to set protocol, user roles, user access passwords and permissions, and SNMP configuration related information. You can add or delete the required user roles and their details, as shown in Figure 31.

You can also download the SNMP MIB file and access the VLAN or QoS attributes of the device. You can also set the SNMP trap and information notifications for the required user roles. For more information, refer to the  $cnWave^{m}$  5G Fixed Configuration Guide.

#### Figure 31: The Management page

General	Management Radio Interfaces	SFP Module CPE Provisioning Synchronic	isation Syslog			
Web Server (	Configuration					
		HTTPS with HTTP redirect	¢ \$			
Protocols		A valid Server Certification	ate is not installed so this device will serve a se	If-signed TLS certificate.		
Certificate	File	Choose File No file chosen	n			
		Install Certificate				
User Account	ts					
<b>(</b> )	<ol> <li>Account Name</li> </ol>	Description	8 Role	Web Access Enable	O Web Passphrase	
<b>1</b>	support	Description	Support 🔶		Web Passphrase	
P	engineer	engineer	Engineer \$		Web Passphrase	
3	Account Namo	Description	Guest			
×	Account Name	Description	•			
12	admin	Description	Administrator 🖕		Web Passphrase	
SNMP Config	Juration					
O Versions		U v2c				
		□ v3				
Engine ID		0x800045310300045670018	8			
-						
SNMP Iraps			Notice Free			
U Enable		Cold Start/Warm Start/Autrier	nication Error			
SNMP Trap F	Receivers					
Notificat	ion Type	<ol> <li>IP Address</li> </ol>	<ol> <li>Port</li> </ol>	Comit	munity	
SNMPv20	Trap 🖕	10.130.150.129	10162		* * * *	
SNMPv3 Acc	ounts					
Account Na	ime		<ol> <li>Access Enable</li> </ol>			
support						

• **Radio**: Provides options to configure transmit control and the key radio settings (as shown in Figure 32). You can also enable or disable Multi-user Multiple Input Multiple Output (MU-MIMO) and Extended Range parameters.

Figure 32: The Radio page

	ambium N	etworks   cn	Nave™	5G Fixed	B1000						Undo 🖒	Save 🖬	ወ	Administrator	💄 admin 👻
-14	General	Management	Radio	Interfaces	SFP Module	CPE Provisioning	Synchronisa	ation	Syslog						
:	Transmit	Control					~ ⊞	MU	IMIMO						~ ⊞
-	Tx Stat	e	0	Active 🔿 Mu	uted			0	DL MUMIMO Max Group Size	8					
								0	UL MUMIMO Max Group Size	8					
<b>A</b> .	Configura	ation					~ ⊞		. To obligat						
12	6 Freque	ncy	3	27000.000		MHz		La	biesting						× 🖽
<b>\$</b>								0	Near Field Corr	0					
	Max Ell	RP	2	24.0		dBm		0	Near Field Corr Active	0					
	1 Polaris	ation	0	Horizontal	Vertical										
	Link Sy	vmmetry		6:1 🧿 5:2 (	4:3										
	<ul> <li>Bandwi</li> </ul>	idth		56 MHz 🗿 1	12 MHz 🔿 50	MHz 🔘 100 MHz									
	0 UL Targ	get Rx Power	ŀ	60		dBm									
	0 UL Tx F	Power Initial Adjust		Disabled 🧿	Enabled										
	0 UL Tx F	Power Continuous A	Adjust 🔾	Disabled 🔾	Enabled										
	0 MUMIM	IO Control		Disabled 🗿	Enabled										
	Extend	ed Range	0	Disabled 🔘	Enabled										

You can make changes to the radio settings and click **Save** to apply the settings to the system. For more information about each parameter on the **Radio** page, refer to the *cnWave™* 5G Fixed Configuration Guide.



### Note

CPE scans frequency and attaches to BTS if the RF frequency range for BTS is set in the **Radio Scan Frequencies** field in the C100 UI. For more details, refer to the <u>CPE</u> Frequency Scan Feature section.

You can also modify the polarization settings for BTS. When you save the polarization settings (by clicking **Save**), CPE connects to BTS using a similar polarization scan feature implemented in the cnWave<sup>M</sup> 5G Fixed system. For more details on the CPE's polarization feature, refer to the *cnWave<sup>M</sup>* 5G Fixed Configuration Guide.

• Interfaces: Provides statistical information on all the BTS interfaces (for example, Wireless, MainEth, and Small form-factor pluggable (SFP) ports), as shown in Figure 33. This page also allows you to select a combination of GNSS satellite constellation for the location of the BTS device.





- SFP Module: Using the SFP Module page, you can retrieve and view the information of Small Form-Factor Pluggable (SFP) module fitted in the BTS device. This SFP module information helps you to monitor performance, analyze speed efficiency, and read other network related settings. For more details, refer to the cnWave<sup>™</sup> 5G Fixed Configuration Guide.
- **CPE Provisioning**: Provides options to configure the RADIUS server and DHCP Option 28 parameters, as shown in Figure 34. If you select **None** in the **Mode** field, then any CPE can connect to BTS without authentication. Therefore, user data traffic is bridged unconditionally. You can also manage CPE IP configuration through DHCP and view the authentication logs.

Figure 34: The CPE Provisioning page

<b>()</b> c	ambium Ne	tworks   cn	<b>Vave</b> ™ 5	G Fixed   I	B1000					Undo 🕽 Save 🖬 😃 Adm	ninistrator 🙎 admin 👻
÷H-	General	Management	Radio	Interfaces	SFP Module	CPE Provisioning	Synchronisation	Syslog			
i	Authentica	tion						~ ⊞	DHCP Option 82 Configuration		× 🖽
-				None O RADIUS AAA					OHCP Option 82 Enabled		
후 삼	1 Mode			▲ Any C User	CPE may connect to data traffic will be bri	this BTS without authenti dged unconditionally.	cation.		Authentication Logs	315633044.083136: 315633044.083138: v0 hostapd: RA	ADIUS Receive
≫	RADIUS Authentication Server Status			15	~ E					315633044.083148: RADIUS message: code=2 (Access-A 315633044.083167: 315633044.083169: v0_hostapd: ST	Accept) iden1 TA 00:00:00:0
	0 Auth Se	rver Reachable								315633044.083179: CAMBIUM: Received RADIUS ACCESS- 315633044.083189: RADIUS ALARM: received access ac	-ACCEPI (2) ccept
	Network 0	Network Configuration					~ ⊞	authentication.log 🛓	315633044.083199: Radius message does not contain 315633044.083210: IEEE 802.1X: Could not find matc	User Name at ching station	
	O CPE IP	From DHCP		🔿 True 🤇	False					315633044.083227: 315633044.083228: v0_hostapd: ST 315633644.083462: 315633644.083467: v0_hostapd: RA	TA 00:00:00:0 ADIUS Sending 🔻
											• 1

For more details about the RADIUS Server settings, refer to the <u>RADIUS Server configuration</u> section.

• **Synchronisation**: Displays parameters required to manage the TDD synchronization by using either an internal GPS or an external GPS source (as shown in Figure 35). The BTS device can be synchronised to a one pulse per second (PPS) source. The synchronisation process involves detecting of a valid one PPS reference signal, acquiring frequency lock, and then acquiring and maintaining time lock. When a PPS is detected, the frequency is locked and the TDD is synchronized (which is indicated by the **Time Locked** state).

#### Figure 35: The Synchronisation page

	Cambium Ne	etworks   cn	<b>Wave</b> ™ 50	G Fixed   E	31000							Undo 🏷 Save 🖬	Φ	Administrator	💄 admin 👻
-	General	Management	Radio	Interfaces	SFP Module	CPE Provisioning	Synchronisation	Sys	log						
•	TDD Cont	iguration						~ ⊞	NTF	•					~ ⊞
-	Control		0	Disabled	Best Effort	In Sync Only					1 Address		O Port		
\$	3 Source			Internal Gf	NSS 🔿 Sync C	ver Power			2		169.254.3.253		123		
Ø	TDD State	21							3		pool.ntp.org		123		
×	0 State		1	Time Locked					4		pool.ntp.org		123		
	TDD State	5						~ ⊞	5		pool.ntp.org		123		
	0 Relock	Counts	1	1											

• **Syslog**: Allows you to allocate a lowest syslog severity level and enable the remote syslog specific parameters for the BTS device. The syslog configuration helps you to record and view all events of the BTS device. Example: CPE connected or BTS connected to cnMaestro.

For detailed information about the **System** settings, refer to the *cnWave™ 5G Fixed Configuration Guide*.

### **Subscriber list**

You can access the CPE subscriber list by selecting the **Subscribers** ((2)) icon on the left navigation column in the main B1000 dashboard page. Figure 36 shows how the CPE subscriber details appear on the B1000 UI.

#### Figure 36: CPE Subscriber details

·	Networks	cn <b>Wave</b> ™ 5G E	ived   B1000					Lind		(b) Admin	istrator • odmin -
ampium	Networks		ixed + Biooo					ond		C Admin	
CPE S	tatus CPE	Device CPE Radio	Status CPE Cfg	CPE QoS	CPE Wireless F	Port Stats	CPE Ethernet Port	Stats			
Summ	ary										× 🖽
Cor	nected CPEs		8								
<ol> <li>Reg</li> </ol>	istered CPEs		8								
1 NTF	Synchronized		<b>Z</b>	l							
CPE S	tatus										~ ⊞
Sys Na	me 🕕 C-RNTI	<ol> <li>Registration State</li> </ol>	<ol> <li>Registration Count</li> </ol>	Link Uptime	<ol> <li>IP Address</li> </ol>	IDL Rx Po (dBm)	wer 🕕 DL MCS	1 DL EVM (dB)	UL Rx Power (dBm)	1 UL MCS	1 UL EVM (dB)
CPE 6	47	Registered	1	6d 14h 7m	169.254.3.6	-41	23	-31.7	-61	19	-32.0
CPE 4	50	Registered	1	6d 14h 6m	169.254.3.4	-39	23	-31.3	-56	23	-28.7
CPE 2	93	Registered	5	20h 42m 9s	169.254.3.2	-40	23	-32.6	-61	23	-28.6
CPE 7	95	Registered	5	19h 33m 20s	169.254.3.7	-40	23	-30.5	-63	18	-28.2
CPE 1	101	Registered	11	17h 49m 57s	169.254.3.1	-45	23	-33.3	-62	19	-28.8
CPE 8	109	Registered	4	17h 48m 13s	169.254.3.8	-41	23	-31.0	-61	19	-28.4
CPE 5	110	Registered	4	17h 47m 46s	169.254.3.5	-41	23	-32.1	-57	23	-28.9
CPE 3	111	Registered	5	17h 47m 41s	169.254.3.3	-38	23	-31.3	-65	16	-27.1

The CPE subscriber information includes the number of CPEs registered with BTS, along with the connection status of CPEs.

When you modify any attributes for either BTS or CPE in the dashboard, click Save to apply the changes.

#### **Radio link information**

The B1000 UI supports the Radio link page, as shown in Figure 37. To view the **CPE Radio Status** page, you must use the **Subscribers** (1) icon. This page allows you to troubleshoot issues (if any) with the Radio link related parameters at a deployment site. The detailed description of each parameter and the other tabs are available in the *cnWave<sup>TM</sup> 5G Fixed Configuration Guide*.

Figure 37: Radio link characteristics of CPEs

C ca	ambium	Networks	cn <b>W</b> a	<b>ave</b> ™ 5G	Fixed   B	1000									C obnU	Save 🔒	ර Adminis	strator 💄 admin 👻
÷I	CPE St	atus CP	E Device	CPE Ra	dio Status	CPE Cfg	CPE QoS CP	E Wireless Port	Stats	CPE Ethernet P	ort Stats							
:	CPE Radio Status																	~ ⊞
•	Sys Name	OL Rx Power (dBm)	DL EVM (dB)	IDL MCS	DL Backoff (dB)	IDL Spatial Frequency	IDL Channel Distortion (dB)	DL Sounding State	<ol> <li>Curre EIRP (dBm</li> </ol>	ent () UL Rx Power I) (dBm)	OUL EVM (dB)	O UL MCS	UL Backoff (dB)	UL Spatial Frequency	<ul> <li>UL Channel Distortion (dB)</li> </ul>	UL Sounding State	Range (km)	<ol> <li>Alignment Active</li> </ol>
	CPE 6	-41	-33.1	23	13	692	-17.3	Tracking	30	-61	-29.1	19	0	687	-17.4	Tracking	0.01	
	CPE 4	-39	-31.8	23	13	958	-19.4	Tracking	48	-55	-29.3	23	4	957	-22.4	Tracking	0.01	
¥	CPE 2	-40	-32.7	23	13	212	-18.7	Tracking	18	-61	-28.7	22	0	213	-18.9	Tracking	0.02	
	CPE 7	-40	-32.9	23	13	568	-17.1	Tracking	48	-62	-28.2	18	0	567	-18.3	Tracking	0.01	
	CPE 1	-45	-32.6	23	13	327	-15.6	Tracking	48	-62	-28.5	19	0	331	-22.8	Tracking	0.02	
	CPE 8	-40	-30.5	23	13	446	-17.0	Tracking	18	-61	-27.9	19	0	449	-18.3	Tracking	0.02	
	CPE 5	-41	-33.3	23	13	822	-18.6	Tracking	48	-58	-28.8	23	1	818	-17.8	Tracking	0.01	
	CPE 3	-38	-30.6	23	13	91	-18.4	Tracking	49	-65	-26.8	16	0	91	-21.3	Tracking	0.01	

For detailed information about each parameter in the **Subscriber** page, refer to the *cnWave™ 5G Fixed Configuration Guide*.

### **Tools**

The **Tools** ( $\bigotimes$ ) icon allows you to upload a new firmware (software) or reboot the unit. In addition, there are a set of tools, such as **Link Capacity Test** and **Engineering**, which help to troubleshoot the radio links (as shown in Figure 38).

Ca	mbium Net	works   cnW	<b>ave</b> ™ 5G Fixed	B1000						Undo 🍤 🛛 Save 🔒	ዕ Ac	iministrator 🛛 🚨 admin	•
				_									_
	Firmware	Configuration	Link Capacity Test	Network Test	MAC Learning Tables	Engineering	Logs						
i	Device Info	rmation										~ 8	Ð
	Product N	ame			cnWave 5G Fixed	Base Transceiver S	ation (BTS)						
*	Release N	ame			4.1b2								
숨	Image Uplo	ad										× 8	B
*	6 Source				Local File (	Remote Serve	r						_
	1 Local File				Choose File No	file chosen							
	O Destination	n			O Image 1 ⊂	Image 2							
					Start Upload								
	Upgrade St	atus										× 8	8
	Upload Prog	ess											
	Install Progr	SS											
	Reboot											× 8	
	Cashie D	heat											
	U Enable R	boot			1 A reboot w	II be required to inst	all a firmware image						
													J
	Installable	mages										× 8	B
			Status		Descript	tion							
	Image 1		Valid Image		cnWave	5G Fixed (BTS) 4.0t	2	Eras	e	Install			
	Image 2		Valid Image		cnWave §	iG Fixed (BTS) 4.1b	2	Eras	e	Install			
	· · · · · · · · · · · · · · · · · · ·												_

Figure 38: The Firmware page for software upgrade or downgrade

### Link Capacity Test

The **Link Capacity Test** page allows you to test the links (uplink, downlink, or both) and analyze the link performance for a subscriber (CPE). The test summary and statistics help in managing the traffic and troubleshooting the links for the subscriber. When you run the test, this page displays the performance of BTS (as shown in Figure 39).

Figure 39 is an example of a link capacity test done for IMSIs with the following settings, where:

- MU MIMO Control is set to Disabled in the System > Radio page of the B1000 UI.
- Traffic Direction is set to Bidirectional in the Tools > Link Capacity Test page of the B1000 UI

Figure 39: Link capacity test with MU MIMO disa
---

Firmware Configuration Link Capacity Test Network Test MAC Le	aming Tables Engineering Logs
Test Settings	× 1
Registered CPEs	8
0 Traffic Direction	O Downlink O Uplink O Bidirectional
0 CPE Under Test	888901007406841,888901007406348,888901007406344,888901007406574,888901007406869,888901007406429,888901007406893,8889010
0 Mode	● Single-Shot ○ Free Running
Traffic Duration	100 s
	Start Test
Test Summary	vi) Vi
CPE Under Test	888901007406841,888901007406348,888901007406344,888901007406574,888901007406869,888901007406429,888901007406893,888901007407454
DL Throughput	315.58 Mbit/s
UL Throughput	127.21 Mbit/s
Aggregate Throughput	442.79 Mbit/s
DL Utilisation	98 %
0 UL Utilisation	99 %
Traffic Duration	100 s
Time	2024-02-07 07:11:24
Detailed Test Statistics	~ E
CPE Under Test	DL Throughput (Mbit/s) UL Throughput (Mbit/s)
169.254.3.6	39.44 15.89
169.254.3.7	39.44 15.91
169.254.3.2	39.45 15.90
169.254.3.5	39.44 15.90
169.254.3.4	39.45 15.91
169.254.3.8	39.46 15.90
169.254.3.3	39.45 15.89
169.254.3.1	39.45 15.91
Test History	
Time     CPE Under Test	Total DL     Total UL     Total UL     DL Utilisation     Throughput     (%)     (Mbit/s)     (Mbit/s)
2024-02- 888901007406841,888901007406348,888901007406344,88890 07 07 11:24	007406674,888901007406869,888901007406429,888901007406683,888901007407454 315.58 127.21 98 99
2024-02- 888901007406841,888901007406348,888901007406344,888901 07 07:07:44	007406574,888901007406869,888901007406429,888901007406893,888901007407454 1495.84 0.11 98 76

Figure 40 is an example of a link capacity test done for the same IMSIs with the following settings, where:

- MU MIMO Control is set to Enabled in the System > Radio page of the B1000 UI.
- Traffic Direction is set to Downlink in the Tools > Link Capacity Test page of the B1000 UI.

est Settings		× !
Registered CPEs	8	
Traffic Direction	🧿 Downlink 🔿 Uplink 🔿 Bidirectional	
CPE Under Test	888901007406841,888901007406348,888901007	406344,888901007406574,888901007406869,888901007406429,888901007406893,8889010
Mode	Single-Shot C Free Running	
Traffic Duration	100 s	
	Start Test	
est Summary		~ I
CPE Under Test	888901007406841,888901007406348,888901007406344,88	8901007406574,888901007406869,888901007406429,888901007406893,888901007407454
DL Throughput	1495.84 Mbit/s	
UL Throughput	0.11 Mbit/s	
Aggregate Throughput	1495.95 Mbit/s	
DL Utilisation	98 %	
UL Utilisation	76 %	
Traffic Duration	100 s	
Time	2024-02-07 07:07:44	
etailed Test Statistics		✓ 1
CPE Under Test	DL Throughput (Mbit/s)	UL Throughput (Mbit/s)
69.254.3.6	248.67	0.01
69.254.3.7	190.27	0.01
69.254.3.2	151.58	0.01
69.254.3.5	248.48	0.01
69.254.3.4	254.62	0.01
69.254.3.8	102.71	0.01
69.254.3.3	197.35	0.01
69.254.3.1	102.14	0.01
est History		× 1
Time O CPE Under Test		Total DL     Throughput     Throughput     Throughput     (%)     (%)

#### Figure 40: Link capacity test with MU MIMO enabled

For detailed information about parameters and other tools (such as Configuration, Network Test, Engineering, and Logs, refer to the *cnWave™ 5G Fixed Configuration Guide*.

## **Configuring CPE**

This section provides information about the C100 UI. It explains how to log on to the C100 UI and configure the required settings for CPE.

For detailed information on the C100 UI configuration, refer to the *cnWave™ 5G Fixed Configuration Guide*.

## Accessing the C100 UI

To access the C100 UI, perform the following steps:

- 1. Use the default IP address (169.254.1.1) to connect to the CPE setup.
- 2. Ensure that your PC is set up to communicate with the required range of IP addresses.
- 3. Open a web browser and type the URL http://169.254.1.2 to access the C100 UI.

The Sign In page appears, as shown in Figure 41.

Figure 41: The Sign In page for C100 UI (CPE)

Cambium Networks I cnWave® 5G Fixed I Cr00	
	CnWave" 5G Fixed

4. Type an appropriate username and password.

Default username: admin

Default password: admin

You can use the show-password eye icon ((?)) to view the password characters.

5. Click Sign In.

The **Profile** page appears. This page allows you to change the password.

When you click on the **Dashboard** icon on the left navigation pane, the main C100 dashboard page appears (as shown in Figure 42).

You can now use the required UI controls (as described in Table 8) for configuring and managing CPEs.



### Note

To log out from the UI, select **Logout** from the **admin** drop-down list on the top right side of the UI.

To change the password, select **Profile** from the **admin** drop-down list at the top right side of the UI. For more information on changing the password and setting preferences, refer to Table 9.

## C100 Dashboard

The C100 dashboard provides comprehensive information about the link status, radio parameters, RADIUS session settings, and other network details. Example: Figure 42 shows that the CPE is up for more than 1500 seconds and that the Receive Power is -46 dBm.

For detailed information on the C100 UI configuration, refer to the *cnWave™* 5G Fixed Configuration Guide.

When you log on to the C100 UI (using appropriate URL and login credentials), the main C100 dashboard page appears as shown in Figure 42.

#### Figure 42: The main C100 dashboard page

mbium Networks	cnWave <sup>™</sup> 5G Fixed   C	C100					Save 🖬 🙂	Administrator	admin 🙎
General Device	Radio Session								
Device		IMSI		Session		Radio			
0004567104F9 ESN	6d 14h 44m Uptime	888901007406841		Registered Registration State	18h 44m 24s Link Uptime	-44 dBm Rx Power		-32.7 dB ≣∨м	
Device Summary			~ ⊞	Session					~ 1
1 Product Name	cnWave 5G Fixed	d Consumer Premises Equipment (CPE)		8 Registration State	Registered				
8 Release Name	4.1b2			<ol> <li>Registration Count</li> </ol>	11				
System Description	Cambium Networ	rks cnWave 5G Fixed Consumer Premises Equipment (CPE) 4.0	b2	1 Link Uptime	18h 44m 24s				
	armv7l GNU/Linu	IX		<ol> <li>Auth Mode</li> </ol>	RADIUS AAA				
System Name	CPE 1								
System Location	D1 Lab			Network					× 8
<ol> <li>System Contact</li> </ol>	Yassine Poc Rig	1		1 MAC	00:04:56:71:04:19				
System Time	2024-05-30 05:56	5:30		IP Address	169.254.3.1				
Radio			<b>v</b> m	O Prefix	24				
	07000.000 MI I=		• •	O Default Gateway	169.254.3.99				
Current Frequency     Rx Power	-45 dBm			VIAN					× 00
0 EVM	-33.0 dB			A VI AN Configured By F					
0 DL MCS	23			VLAN Configured by P	Management VID		1	[from PADTUS]	
DL Backoff	13 dB				Management VID Pr	iority:	0	[11:00 KADIO2]	
UL MCS	17				Allow Frame Types		Tagged Frames	[from RADIUS]	
0 UL Backoff	0 dB				CPE Management VI	es: ) Pass-through	: Disabled	[from RADIUS]	
Calibration Status	Calibrated			Active VLAN Configure	ation VLAN Enabled:		Enabled	[From BTS]	
	Tx Enabled				Q-in-Q Ether Type VLAN Port Type:		Q 0X8100	[From BIS]	
Tx State		control overridden by Engineering key			Default Port VID: Default Port VID I Dynamic Learning:	Priority:	50 0 Enabled	[from RADIUS] [from RADIUS]	
					VLAN Aging Timeout		25	[from RADIUS]	

The main C100 dashboard page contains the following tabs:

- **General**: Provides summary (read-only) of the connected devices. It displays other system related details (as shown in Figure 42) such as firmware and current operational software release number, including optional system contact details. It also provides information specific to radio links, sessions, and Ethernet.
- Device: Provides information (read-only) about reboot and boot loader of the CPE system.
- **Radio**: Displays parameters (read-only) such as operating frequency, receive power levels, EIRP, and the range (distance) to BTS. Figure 43 shows the radio settings. To access and configure the **Radio** page, select the **System** () icon on the left navigation column in the main C100 dashboard page.

Figure 43: The Radio page

Ca	ambium Networks   cn	Wave™ 5G Fixed   C100			Undo 🍤	Save 🖬	ወ	Administrator	💄 admin 👻
-H	General Device Rad	dio Session							
:	Summary		~ ⊞	Downlink Details					~ ⊞
-	Current Frequency	27000.000 MHz		1 Rx Power	-45 dBm				
10	Scan State	Tracking		1 DL MCS	23				
	Current EIRP	33.0 dBm		1 DL Backoff	13 dB				
$\mathbf{x}$	Current Polarisation	Horizontal		Spatial Frequency	513				
1	<ol> <li>Bandwidth</li> </ol>	112 MHz		IDL Channel Distortion	-17.2 dB				
A	Extended Range	Disabled		1 DL Multipath Distortion	-26.8 dB				
	<ol> <li>Range</li> </ol>	0.01 km							
				Uplink Details					~ ⊞
				Max EIRP	52.0 dBm				
				<ol> <li>Current EIRP</li> </ol>	33.0 dBm				
				1 UL MCS	23				
				UL Backoff	5 dB				

• Session: Provides information (read-only) about registration state of CPEs, registration count of CPEs, quality of services (QoS), and the RADIUS session details.

For more information about each tab in the C100 dashboard page, refer to the *cnWave™* 5G Fixed Configuration Guide.

When you modify any parameters for CPE in the C100 dashboard page, click **Save** (located at top right corner of the UI page) to apply the changes.

You can also monitor the CPE dashboard to ensure that a connection has been authenticated and established with the desired BTS.



## Note The Power icon () is also available to allow you to restart (reboot) CPE from the C100 UI.

**CPE Frequency scan feature** 

CPE provides a frequency scan feature to operators. Using this feature, operators can enable a set of licensed frequency points that they want to use for an installation.

If you have enabled the BTS RF frequency from a list of frequencies in the C100 UI, then the CPE actively scans for these frequency points and locks onto the BTS frequency to resume link and service. Example: Figure 44 shows how the CPE is using the frequency 27000 MHz and horizontal polarization. The supported radio scan frequency resolution is 250 kHz.

Ca	mbium N	etworks	l cn <b>Wave</b> ™ 5	5G Fixed	d   C100					C obnU	Save 🖥	ወ	Administrator	💄 admin 🔻
-14	General	VLAN	Management	Radio	Interfaces	Session	RADIUS Authenticat	tion	Syslog					
•	Radio Co	onfiguratio	on				~ ⊞	R	adio Scan Advanced					~ ⊞
	1 Max El	RP	52.0	)		dBm		•	Rescan Delay	15		s		
s and a second s	1 Polaris	ation	⊖ Ho	Horizontal Vertical      Auto Detect				R	adio Scan Status					~ ⊞
<i>~</i>	0 UL Tx F	Power Initia	I Adjust 🛛 Dis	sabled 🧿	Enabled			0	Current Frequency	27000.000 MHz				
A I	(	_						1 0	Current Polarisation	Horizontal				
_	Radio Sc	an Freque	encies				~ =		Scan State	Tracking				
	Enable		I F Mi	MHz					adio Stats					~ ⊞
									Rx Power	-45 dBm				
			27	000.000		MHz			Rx Power (SI-RNTI)	-43 dBm				
			26	26500.000 MHz			z		Rx Power PSS	-58 dBm				
									PSS SNR	16 dB				
			29	450.000		MHz			DLMCS	23				
L L				-					ULMCS	23				
			MI	ΠZ					DL Backoff	13 dB				
			M	Ηz					Range	4 0D				
	MHz								Current EIRP	24.0 dBm				
									Max EIRP Boost	0.0 dB				
			M	Ηz					EVM	-27.0 dB				
			M	Hz				•	DL Channel Distortion	-17.4 dB				
									DL Multipath Distortion	-25.9 dB				

### Figure 44: The Frequency Scan feature

To access the radio scan frequency feature elements, select the **System** (2) icon on the left navigation column in the main C100 dashboard page.

To enable the radio scan frequency feature, perform the following steps:

- 1. Select the **Enable** check box (as shown in red box in Figure 44) and enter the required frequency in MHz.
- 2. Click Save on the top right corner in the C100 dashboard page.
- 3. Monitor the dashboard, as shown in Figure 42. After a few minutes, the link between CPE and BTS is authenticated and established.
- 4. Ensure that the BTS frequency is set to one of the frequencies listed in the **Radio Scan Frequencies** section.

For detailed information about each parameter in the System settings for CPEs, refer to the  $cnWave^{TM} 5G$ Fixed Configuration Guide.

### **Tools**

Similar to the B1000 dashboard, the **Tools** icon (in the C100 dashboard) allows you to upload a new firmware or reboot the unit. In addition, there are a set of tools, such as **Link Capacity Test**, which helps to troubleshoot the radio links.

For detailed information about each parameter in the **Tools** page, refer to the *cnWave™ 5G Fixed Configuration Guide*.

### **RADIUS Server configuration**

A RADIUS server is used for provisioning, remote authentication, and configuration of users (CPEs).

The cnWave<sup>™</sup> 5G Fixed BTS application software supports up to three RADIUS authentication servers. You must configure the RADIUS authentication server for CPEs in the B1000 dashboard.

Figure 45 shows the **CPE Provisioning** page in the B1000 dashboard for the RADIUS server authentication settings.

Figure 45: RADIUS Server settings in the B1000 dashboard

General Management Radio Interfaces SFP Module CPE Provisioning Syn	chronisation Syslog			
Authentication	× 🖽	Network Configuration		
Mode     None     RADIUS AAA		CPE IP From DHCP	🔵 True 🧿 False	
PADIUS Configuration	~ •	CPE Use Local VLAN Confi	g 🔵 True 💿 False	
Accounting     S	• •	CPE Use Local QoS Config	🔿 True 🝳 False	
		DHCP Option 82 Configuration		× 🖽
RADIUS Authentication Server	~ ⊞	1 DHCP Option 82 Enabled		
Role     Inet Address     Port     Secret	t			
Primary ◆         169.254.2.253         1812	•••••	Authentication Logs		✓ ■
None			1690374547.906038: 1690374547.906047: 1690374547.906056: 1690374547.906055:	Value: 79b3b80ac7154 Attribute 1 (User-Name) Value: '888901007407 Attribute 8 (Framed-IP-,
RADIUS Accounting Server	~ ⊞	authentication.log 📩	1690374547.906075: 1690374547.906084:	Value: 169.254.2.13 Attribute 9 (?Unknown?)
Role     Inet Address     Port     Secret	t		1690374547.906094:	Attribute 26 (Vendor-Sp
Primary         \$         10.10.254         1813	•••••		1690374547.906108:	Attribute 26 (Vendor-Sp
None 🗢				·

To configure the RADIUS Server settings, perform the following steps:

- 1. In the B1000 dashboard, select the **System** (<sup>(2)</sup>) icon on the left navigation column. The **System** page appears with multiple tabs.
- 2. Select the CPE Provisioning tab on the B1000 dashboard.

The **CPE Provisioning** page appears.

3. In the Mode field, select RADIUS AAA for the CPE.

For more information about the CPE Provisioning settings, refer to the Configuring BTS section.

Table 10 lists and describes parameters available on the **CPE Provisioning** page for RADIUS server settings.

Parameter	Description	
Authentication		
	Determines the connection mode of CPEs.	
	This parameter supports the following options:	
Mode	<ul> <li>None: In this mode, any CPE can connect to BTS without authentication. Therefore, user data traffic is bridged unconditionally. By default, this option is selected.</li> </ul>	
	<ul> <li>RADIUS AAA: In this mode, CPEs are authenticated by a RADIUS Server (back-end server). User traffic is not bridged until the CPEs are authenticated.</li> </ul>	
	Choose the required mode.	
	You can use <sup>5</sup> to revert to <b>None</b> from the <b>RADIUS AAA</b> mode.	
Network Configuration		
	Determines whether the CPE's IP network configuration is supplied by a DHCP server.	
	Following options are supported:	
	<ul> <li>True: If enabled, the DHCP server supplies the CPE's IP network configuration.</li> </ul>	
	False: If disabled and the Authentication Mode is	
	<ul> <li>RADIUS AAA, the configured RADIUS server supplies the CPE's IP network configuration.</li> </ul>	
	If disabled and the Authentication Mode is None, the CPE's IP network configuration is set locally at each	
	CPE.	
	Select an appropriate option.	
CPE Use Local VLAN Config	Determines whether the CPE uses the local VLAN configuration or the RADIUS-supplied VLAN settings.	

Parameter	Description		
	The following options are supported:		
	<ul> <li>True: The CPE uses the local VLAN configuration. This control is applicable when the Authentication Mode is None and this control has no effect as CPEs always install their local VLAN configuration.</li> </ul>		
	<ul> <li>False: The CPE installs the RADIUS-supplied VLAN settings. This control is applicable when the Authentication Mode is RADIUS AAA.</li> </ul>		
	Select the required option.		
	Determines whether the CPE uses the local QoS configuration or the RADIUS-supplied QoS settings.		
	The following options are supported:		
CPE Use Local QoS Config	<ul> <li>True: The CPE uses the local QoS configuration. This control is applicable when the Authentication Mode is None and this control has no effect as CPEs always install their local QoS configuration.</li> </ul>		
	<ul> <li>False: The CPE installs the RADIUS-supplied QoS settings. This control is applicable when the Authentication Mode is RADIUS AAA.</li> </ul>		
	Select the required option.		
Authentication Logs			
authentication.log	An option to view and download the authentication logs from the UI.		
	Click the 📥 icon to download the authentication logs.		
Following parameters appear only	when you select the <b>RADIUS AAA</b> mode.		
RADIUS Configuration			
	Used for billing purposes.		
	When the CPE authentication mode is set to <b>RADIUS AAA</b> , this RADIUS accounting-specific parameters are enabled in the <b>RADIUS Accounting Server</b> section (as shown in Figure 45).		
Accounting	When you select the check box, the <b>RADIUS Accounting Server</b> section appears with accounting related parameters. You must set these RADIUS accounting-specific parameters with appropriate values by configuring with at least one primary accounting server (as shown in Figure 45). For more details on these parameters, refer to the $cnWave^{TM}$ 5G Fixed Configuration Guide.		
RADIUS Authentication Server			

Parameter	Description
	Used for designating one RADIUS server as primary and the others (if required) as secondary authentication servers.
	This parameter supports the following options:
Role	Primary
	• Secondary
	• None
	Select the required value from the drop-down lists.
Inet Address	The IPv4 address of the RADIUS server used for identifying in standard dot notion.
	Type an appropriate value in the text box.
Port	The destination port used by the device for RADIUS communication, authorization, and configuration.
	Default value: 1812
	The shared secret must contain up to 32 ASCII printable characters, which are used to authenticate transactions between the BTS and the RADIUS authentication server.
Secret	The shared secret(s) must match with those shared secret(s) configured in the RADIUS server(s) clients.conf file. For more information about the clients.conf file settings, refer to the <u>An</u> example of configuring an authentication server section.
	Provide an appropriate value in the text box.

### An example of configuring an authentication server

This section explains an example of configuring FreeRADIUS 3.0 as an authentication server.

Use the clients.conf file to configure the credentials required for enabling the RADIUS server to authenticate the data flow from BTS to CPE or CPE to BTS. The default location of the file is /etc/freeradius/3.0/ (in a Linux-based PC).

Following is an example of a configuration that matches with the **System** configuration (as described in <u>System settings</u>) in the B1000 dashboard:

```
client hawking-auth {
```

ipaddr = 10.10.10.150/24
secret = phn\_shared\_secret
shortname = hawking\_auth

### dictionary

Each dictionary file contains a list of Vendor Specific Attribute (VSAs) and values. The RADIUS server uses these VSAs and values to map descriptive names and on-the-wire data.

Default location of directories: /etc/freeradius/3.0/

To add dictionary.canopy and dictionary.hawking, add the following to the default dictionary file:

\$INCLUDE dictionary.canopy

\$INCLUDE dictionary.hawking

Ensure that all dictionaries are available in the default location.

#### authorize

The authorize file within a FreeRADIUS server determines the network access and configuration for each user (CPE).

Default location of the authorize file: /etc/freeradius/3.0/mods-config/files/

Figure 46 is a screenshot of a section taken from an authorize file for a CPE (with an IMSI - 208920007405736).

Figure 46: A sample configuration for a RADIUS Server

# CPE	ls 1				
# Fix	ked IMSIs				
20892	20007405736	Cl	eartext-Passw	or	d := "networks"
E	Tramed-IP-Address	=	"192.168.192.	31	l", # Assigned CPE Management IP Address
F	Tramed-IP-Netmask	=	255.255.255.0	),	# Assigned Management Netmask
C	Cambium-Canopy-Gateway	=	10.10.10.254,		# The IP address acting as a gateway
C	Cambium-Canopy-VLMGVID	=	1,		# VLAN Management VLAN ID
C	Cambium-Canopy-VLSMMGPASS	=	Ο,	#	VLAN SM Management Passthrough
				#	Enable(1=enable,0=disable)
C	Cambium-Canopy-HPENABLE	=	Ο,	#	High Priority Channel Enable (1=enable,0=disable)
C	Cambium-Canopy-ULBR	=	3072,	#	Uplink Bit Rate/Sustained Uplink Rate (kbps)
C	Cambium-Canopy-ULBL	=	6144,	#	Uplink Bit Limit/Uplink Burst Allocation (kbps)
C	Cambium-Canopy-DLBR	=	30720,	#	Downlink Bit Rate/Sustained Downlink Rate (kbps)
C	Cambium-Canopy-DLBL	=	61440,	#	Downlink Bit Limit/Downlink Burst Allocation kbps)
C	Cambium-Canopy-BCASTMIR	=	100,	#	Broadcast Traffic Maximum Information Rate (kbps)
C	Cambium-Canopy-ULMB	=	6144,	#	Max Burst Uplink Rate (kbps)
C	Cambium-Canopy-DLMB	=	61440,	#	Max Burst Downlink Rate (kbps)
C	Cambium-Canopy-LPULCIR	=	1000,	#	Low Priority uplink CIR (kbps)
C	Cambium-Canopy-HPULCIR	=	100,	#	High Priority uplink CIR (kbps)
C	Cambium-Canopy-LPDLCIR	=	6000,	#	Low Priority downlink CIR (kbps)
C	Cambium-Canopy-HPDLCIR	=	100,	#	High Priority downlink CIR (kbps)
C	Cambium-Canopy-VLLEARNEN	=	Ο,	#	VLAN Learning Enable (1=enable, 0=disable)
C	Cambium-Canopy-VLIGVID	=	50,	#	VLAN Ingress VLAN ID
C	Cambium-Canopy-VLFRAMES	=	1,	#	Frames Types allowed(0=all/1=Tagged/2=Untagged)
C	Cambium-Canopy-VLIDSET	=	103,	#	VLAN Membership (1-4094)
C	Cambium-Canopy-VLIDSET	=	203	#	VLAN Membership (1-4094)

Figure 47 shows various fields that indicate how the CPE uses RADIUS authentication to communicate with BTS.

RADIUS Session	
1 Phase	Authenticated
Connection	Connected
1 IP Address	169.254.3.1
1 IP Netmask	255.255.255.0
Prefix	24
1 Default Gateway	169.254.3.99
VLMGVID	1
CPE Management VID Pass- through	Disabled
1 ULBR	0 kbps
1 ULBL	0 kbits
1 DLBR	0 kbps
1 DLBL	0 kbits
1 LPULCIR	0 kbps
MPULCIR	0 kbps
1 HPULCIR	0 kbps
1 UHPULCIR	0 kbps
1 LPDLCIR	0 kbps
1 MPDLCIR	0 kbps
1 HPDLCIR	0 kbps
1 UHPDLCIR	0 kbps
VLLEARNEN	Enabled
I VLAGETO	25
VLIGVID	50
ULFRAMES	Tagged Frames
Primary DNS Server	0.0.0.0
Secondary DNS Server	0.0.0.0
DNS Domain Name	
Bts_version	4-0-0-0

Figure 47: RADIUS authentication values in the C100 UI

For detailed information about each parameter specific to the RADIUS authentication, refer to the *cnWave™ 5G Fixed Configuration Guide*.

# Appendix 1: System Technical Specifications

This release focuses specifically on the execution of Proof of Concept (POCs), with limited number of customers.

Table 11: System technical specifications

Feature	Release details
5G Core Network	Integrated
Authentication and Authorization	RADIUS
Beamforming modes	Directed and Sector
Channel bandwidth	50, 56, 100, 112 MHz
Connectivity	Ethernet (Layer2)
CPE SIM support	Emulated
Downlink MU-MIMO	8 x 8 using 50 MHz and 56 MHz (8 streams and max CPE grouping size = 8)
Uplink MU-MIMO	Yes
	3200 Mbps maximum aggregate
Max BTS Data Rate	2200 Mbps maximum downlink (112 MHz, 6:1)
	1400 Mbps maximum uplink (112 MHz, 4:3)
Max Cell size	Up to 10 Km
Max CPE Data Rate	Up to 400 Mbps
May CDEs por BTS	120 for 100 and 112 MHz Channel size
	60 for 50 and 56 MHz Channel size
Max EIRP - BTS	44 dBm
Max EIRP – CPE	52 dBm
Modulation Dange	QPSK to 256 QAM
	( MCS 6 to 23)
Operating frequencies	Licensed bands, 24.250 to 29.50 GHz
QoS Levels	4
TDD period	1 ms
TDD structure, downlink slots; uplink slots	6.1, 5.2, and 4:3
TDD sync	Integrated GPS
Тороlоду	PMP

The cnWave<sup>™</sup> 5G Fixed platform of products supports the 28 GHz band (as indicated in the product's name). It also covers 24, 26, and 28 GHz bands (as shown in Table 12).

Table 12 lists the 3GPP standard 5G NR frequency bands. The exact frequency limits are from 24.250 GHz to 29.500 GHz.

Та	ble	12:	5G	NR	Bands
1 4	DIC.	1 diana	50	1417	Durius

5G NR Band	Bands Limits (GHz)
n257	26.50 to 29.50 GHz
n258	24.25 to 27.50 GHz
n261	27.50 to 28.35 GHz

# Appendix 2: Acronyms and Abbreviations

Table 13 lists the terms used in this guide.

Table 13:	List of	acronyms	and	abbreviations
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Term	Definition
5G NR	5G New Radio (From Release 15, the 3GPP consortium refers to the air interface as 5G New Radio)
BTS	Base Transceiver Station
C-RNTI	Call-Radio Network Temporary Identifier
CIR	Committed information rate
CPE	Customer Premise Equipment
dBm	Decibel relative to a milliwatt
DNS	Domain Name System
DL	Downlink
EIRP	Effective Isotropic Radiated Power
ESN	Electronic Serial Number
EVM	Error Vector Magnitude
FQDN	Fully qualified domain name
GbE	Gigabit Ethernet
GHz	gigahertz
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
LoS	Line of Sight
LPU	Lightning Protection Unit
MAC	Media access control
MCS	Modulation and Coding Scheme
MHz	megahertz
MU-MIMO	Multi-user multi-input-multi-output (MU-MIMO)
mm	millimeters
ms	millisecond
MSN	Manufacturer Serial Number
Nm	Newton-metre

Term	Definition
NR	New Radio
NTP	Network Time Protocol
OFDMA	Orthogonal Frequency Division Multiple Access
ODU	Outdoor Unit
PC	Personal computer
PDSCH	Physical Downlink Shared Channel
PDCCH	Physical Downlink Control Channel
PMP	Point-to-MultiPoint
POC	Proof of Concept
PoE	Power over Ethernet
PPS	Pulse Per Second
PSS	Primary Synchronization Signal
PSU	Power Supply Unit
PUSCH	Physical Uplink Shared Channel
PUCCH	Physical Uplink Control Channel
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RACH	Random Access Channel
RADIUS	Remote Authentication Dial-In Service
RSSI	Receiver Signal Strength Indication
SFP	Small form-factor pluggable (transceiver)
SIM	Subscriber Identification Module
SI-RNTI	System Information-Radio Network Temporary Identifier
SNR	Signal-to-Noise Ratio
SKU	Stock Keeping Unit
SNMP	Simple Network Management Protocol
TDD	Time Division Duplexing
UI	User Interface
UL	Uplink
VLAN	Virtual Local Area Network

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Sales enquiries	solutions@cambiumnetworks.com
Warranty	https://www.cambiumnetworks.com/support/standard-warranty/
Telephone number list to contact	http://www.cambiumnetworks.com/contact-us/
Address	Cambium Networks Limited, Unit B2, Linhay Business Park, Eastern Road, Ashburton, Devon, TQ13 7UP United Kingdom

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