



QUICK START GUIDE

cnWave™ 5G Fixed

Release 3.3



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Contents

- Contents** **3**
- Introduction** **5**
- Product Description** **6**
 - Overview of the cnWave™ 5G Fixed platform of products 6
- Product Safety Information** **8**
- Hardware Overview** **10**
 - Package contents 10
 - B1000 BTS 11
 - An overview of BTS antenna 12
 - Time Division Duplexing (TDD) synchronization 13
 - C100 CPE 13
 - An overview of CPE antenna 15
 - cnWave™ 5G Fixed power supply and accessories 15
 - BTS Power supply and accessories 15
 - CPE Power supply and accessories 18
- Installing the cnWave™ 5G Fixed Products** **19**
 - Installing and connecting the products 19
 - Assembling the cnWave™ 5G Fixed products 20
 - Connecting the cnWave™ 5G Fixed products 26
- Configuring the cnWave™ 5G Fixed Products** **31**
 - UI Controls 31
 - Configuring BTS 32
 - Accessing the B1000 UI 32
 - B1000 Dashboard 34
 - Configuring CPE 44
 - Accessing the C100 UI 44
 - C100 Dashboard 45
 - RADIUS Server configuration 48
- Appendix 1: System Technical Specifications** **54**

| | |
|---|-----------|
| Appendix 2: Acronyms and Abbreviations | 56 |
| Cambium Networks | 58 |

Introduction

On purchasing the **cnWave™ 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™ 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™ 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™ 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™ 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™ 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™ 5G Fixed platform of products consists of a B1000 Base Transceiver Station (BTS), which serves one or more cnWave™ 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™ 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 [System Technical Specifications](#) 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™ 5G Fixed radio nodes. Ensure that only qualified personnel install the cnWave™ 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™ 5G Fixed equipment must be grounded, properly (in accordance with installation guidance).
- Always use the specified cnWave™ 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](#)
- [C100 CPE](#)
- [cnWave™ 5G Fixed power supply and accessories](#)

Package contents

Table 1 lists the package contents of the cnWave™ 5G Fixed platform of products:

Table 1: cnWave™ 5G Fixed platform package contents

| Product name | Package contents |
|--------------|--|
| B1000 BTS | <p>A B1000 BTS package box contains the following items:</p> <ul style="list-style-type: none">• One cnWave™ 5G Fixed B1000 BTS• 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• One cable gland - M25, Cat5E, EMC, environmental seal, silver body black cap |
| C100 CPE | <p>A C100 CPE package box contains the following items:</p> <ul style="list-style-type: none">• One cnWave™ 5G Fixed CPE• One screw/bolt, flange head cap W/socket, M6x1x28mm• One cable gland, M25, ID10.0mm, plastic with O-Ring• One product leaflet |

B1000 BTS

B1000 BTS is equipped with 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 up to 120 CPEs and a standard Ethernet port.

Figure 4: cnWave™ 5G Fixed B1000 BTS

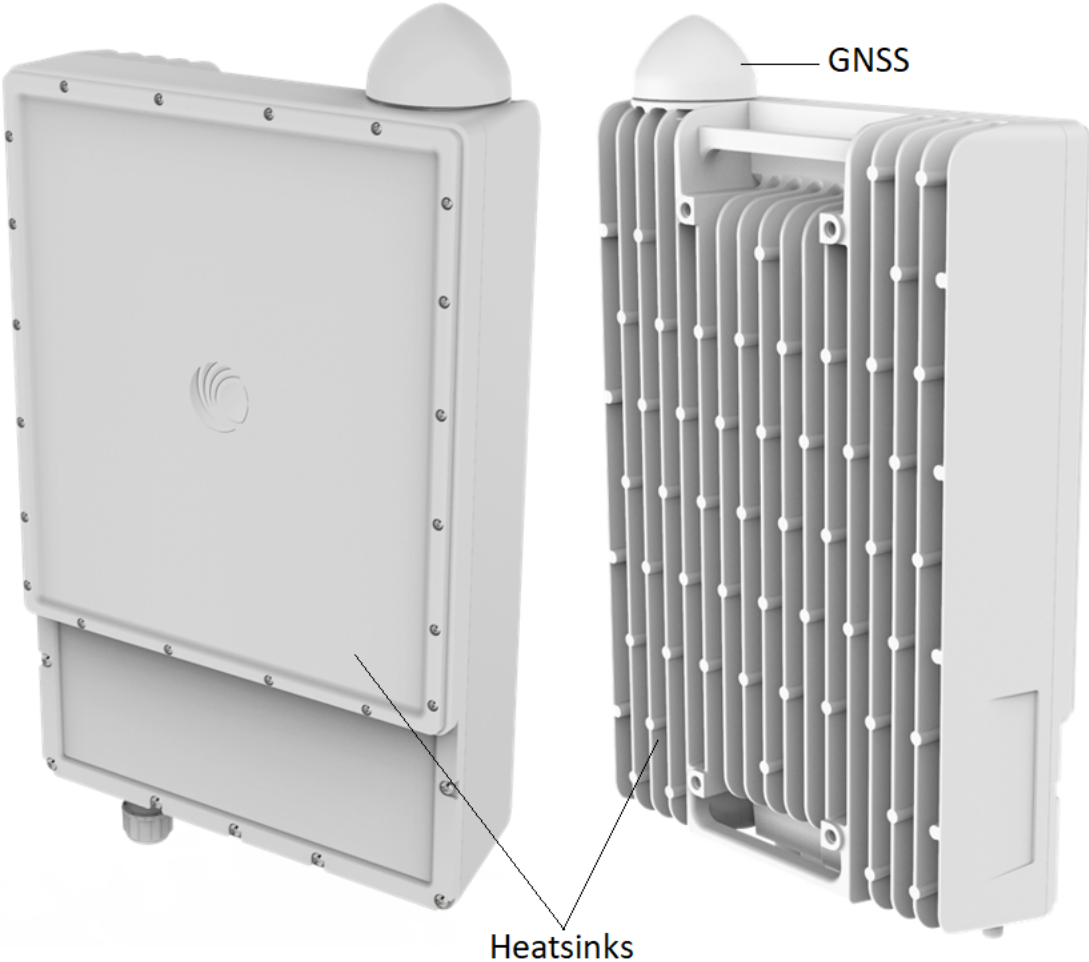


Figure 5 shows location and description of interface ports on B1000 BTS.

Figure 5: B1000 BTS interface ports

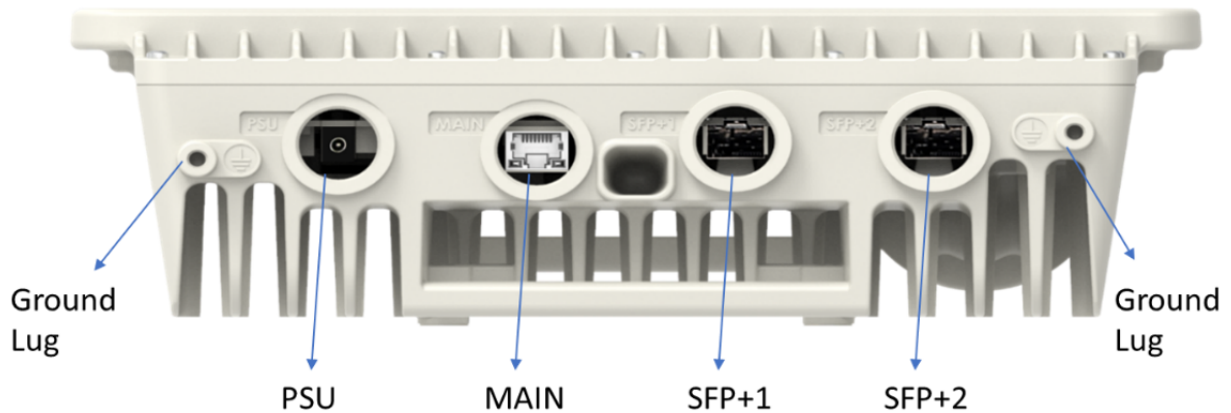


Table 2: Function and cabling details of B1000 BTS Interface ports

| 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™ 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 3.3.

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™ 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.

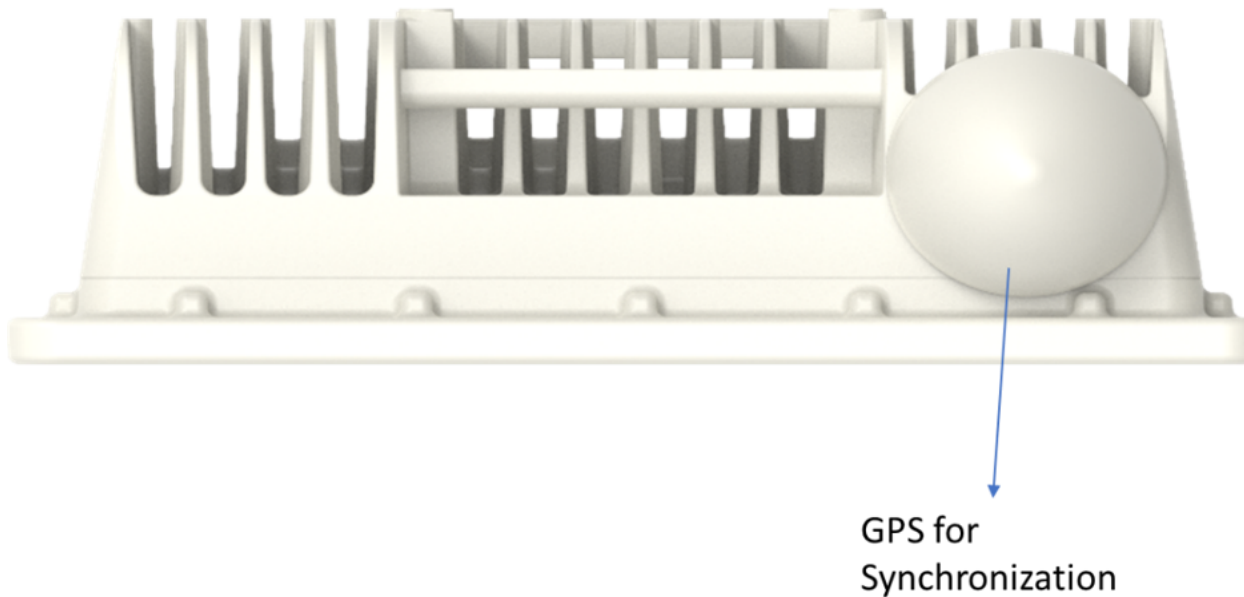


Note

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



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 120 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 48 dBm. Figure 7 shows back and front views of the CPE.

Figure 7: Back and front views of C100 CPE

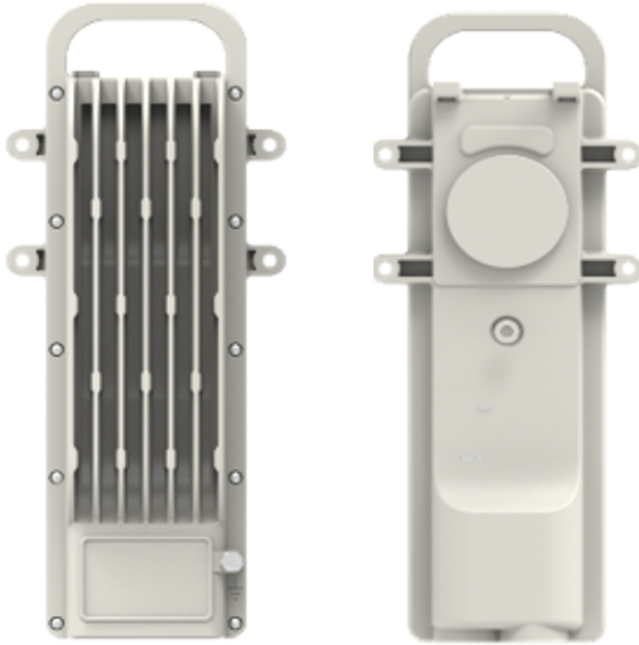


Figure 8 shows interface ports of CPE.

Figure 8: CPE Interface ports

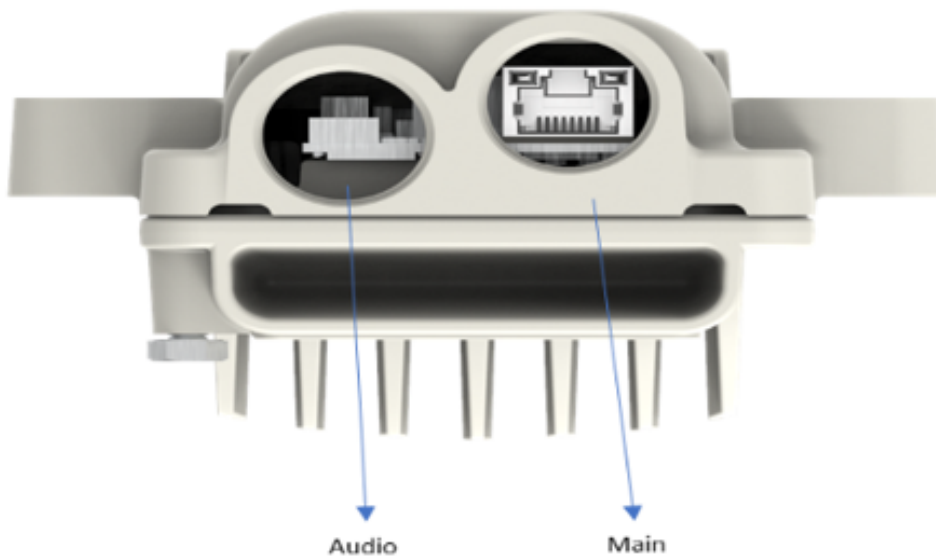


Table 4 provides function and cabling details of CPE interface ports.

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 |
|----------------------|--------|---------------------|
| 400 mm diameter dish | 36 dBi | ~2.0° |



Note

Only the 400 mm diameter dish is included in Release 3.3.

cnWave™ 5G Fixed power supply and accessories


Details of all the accessories and how they are connected to the cnWave™ 5G Fixed radios are described in the *cnWave™ 5G Fixed Planning and Installation Guide*.






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


BTS Power supply and accessories

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

Table 6: Details of power supply and accessories for BTS

| Accessory | Part number | Key attributes |
|---|--------------|---------------------------------------|
|  | N000000L054B | Main power supply, 54V 240W PSU, IP65 |
| Crimp tool for Molex MiniFitJr | N000000T001A | Tool to apply crimps for DC power |

| Accessory | Part number | Key attributes |
|---|---|--|
|  | | connectors |
| Crimp extractor tool  | N000000T002A | Manual tool to extract crimps from the connector |
| Connector and Crimps  | N000000L123A 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 style="list-style-type: none"> • N000000L116A: Four conductor 1 mm x 2 DC cable - 100 m • N000000L117A: Four conductor 0.75 mm x 2 DC cable - 300 m • N000000L118A: Four conductor 1 mm x 2 DC cable - 300 m | 0.75 mm x 2 or 1 mm x 2 Four conductor cables sold in 100 m or 300 m reels |
| 10G Ethernet LPU for the data cable (recommended by Cambium Networks)  | TBD | Surge protector for the data cable |
| DC LPU for the power cable | C000000L114A | DC Surge Suppressor (DC LPU Kit) with 2 x four pin power connectors |



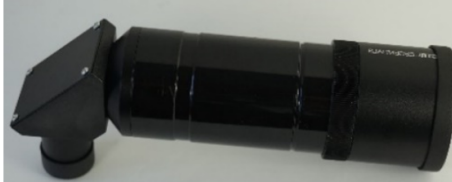
| Accessory | Part number | Key attributes |
|---|-------------|----------------|
|  | | |

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  | N000000L034B | 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 |
| Optical alignment tool  | C000000L139A | A tool to align CPEs with the BTS |

Cambium Networks provides accessories (on ordering) for CPE such as **1G Ethernet Surge Protector** and **Optional alignment tool**. 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™ 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™ 5G Fixed installation and operation is available in the *cnWave™ 5G Fixed Planning and Installation Guide*, *cnWave™ 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™ 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™ 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™ 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™ 5G Fixed platform of products involve the following processes:

- [Assembling the cnWave™ 5G Fixed products](#)
- [Connecting the cnWave™ 5G Fixed products](#)

Assembling the cnWave™ 5G Fixed products

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

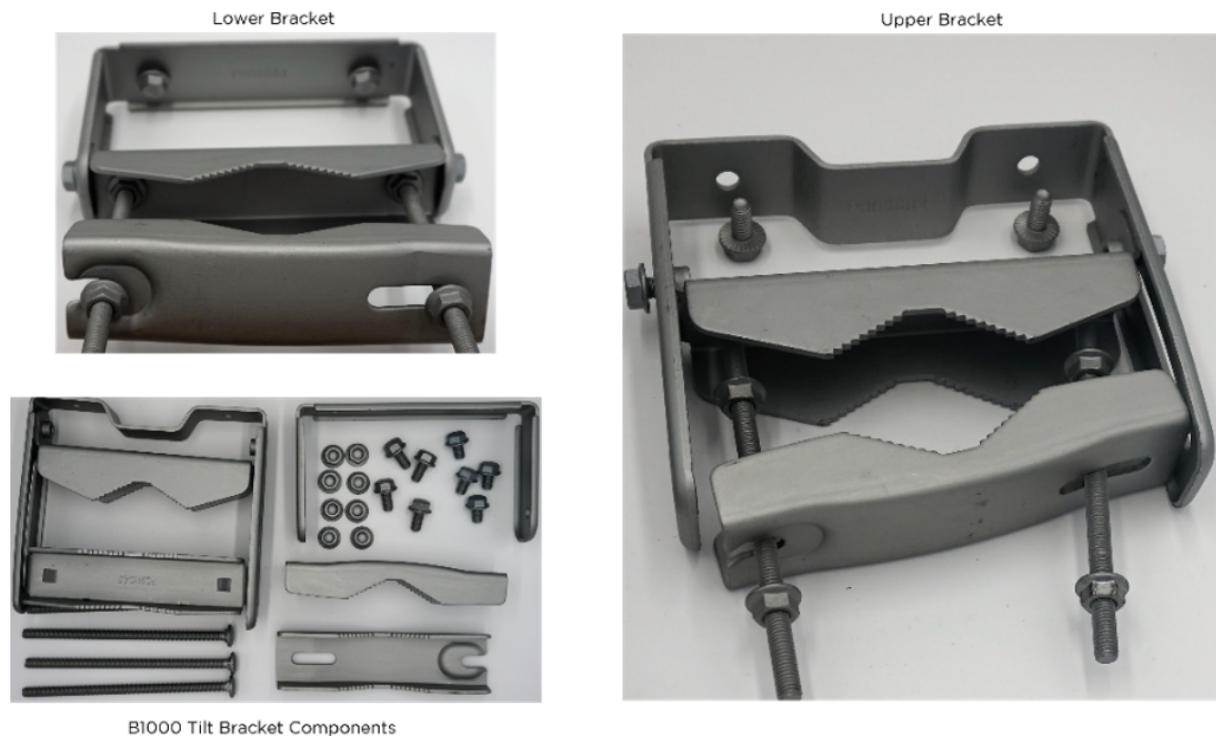
- [Assembling the mounting bracket for BTS](#)
- [Assembling the CPE dish and a precision bracket](#)
- [Attaching the dish to the CPE](#)

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



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 400 mm CPE Dish

In Release 3.3, the CPE is connected to a 400 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 400 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 [Assembling the precision bracket for CPE](#) 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



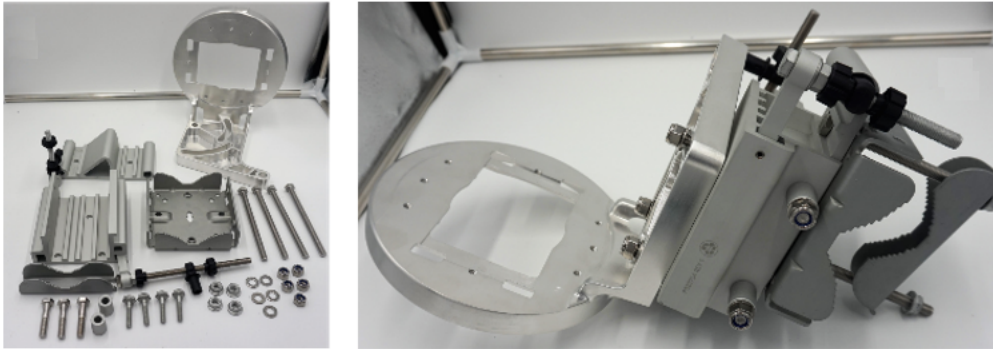
Assembling the precision bracket for CPE

The fine adjustment or precision bracket (as shown in [Figure 15](#)) is used to mount the CPE with a 400 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™ 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

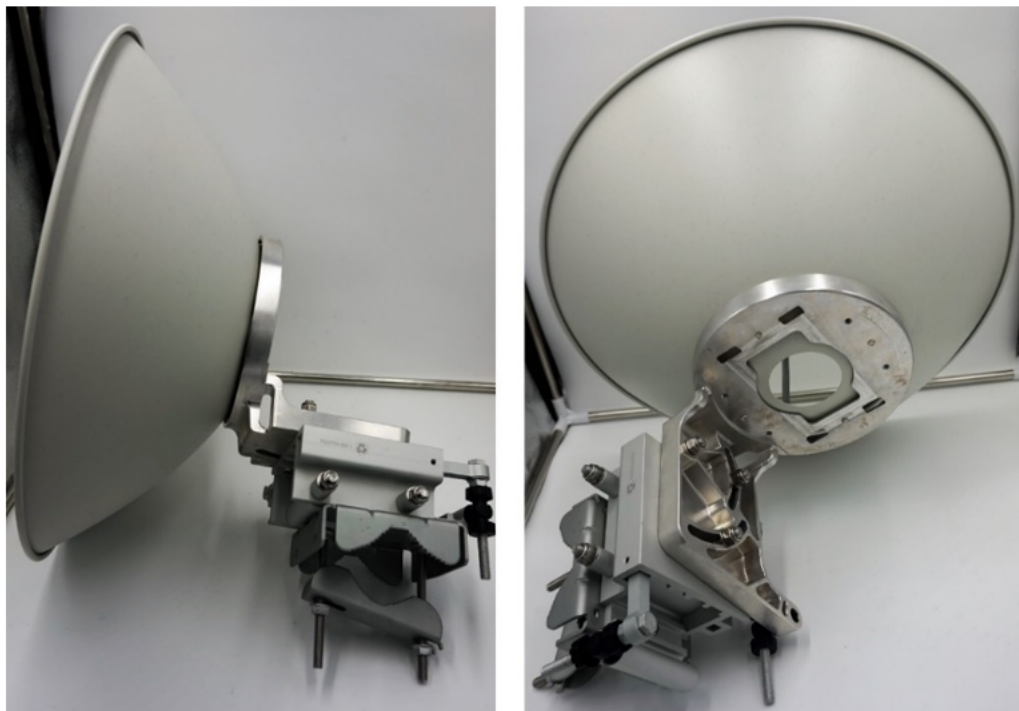
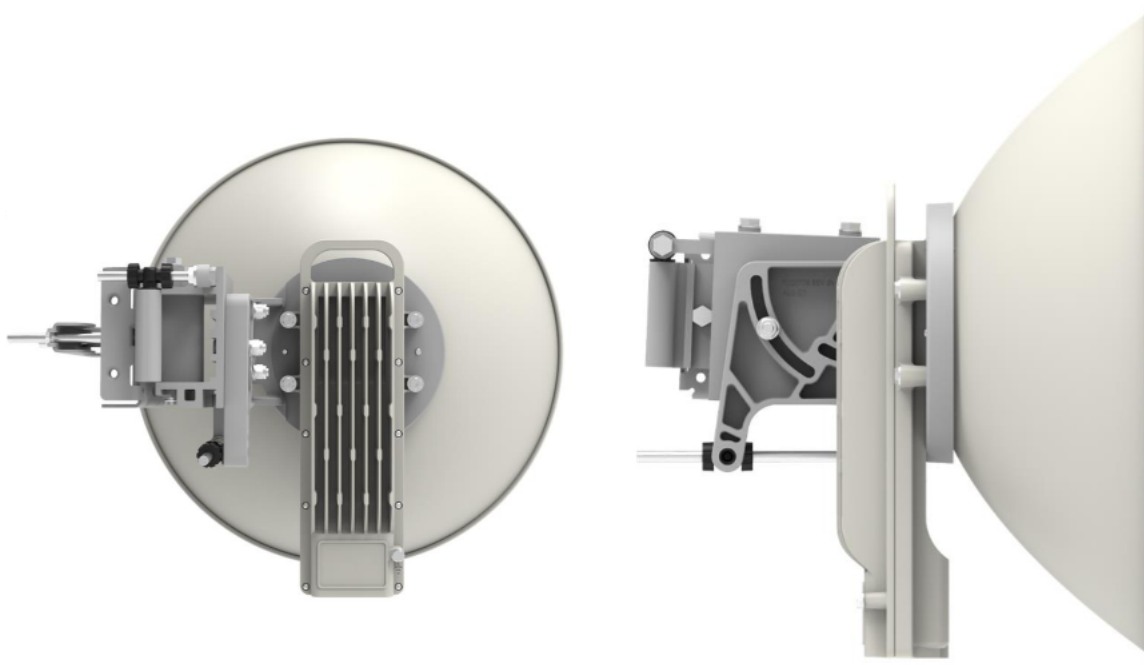


Figure 17 shows the back and right side views of the CPE with an external antenna and a precision bracket.

Figure 17: Back and right side views of CPE



Connecting the cnWave™ 5G Fixed products

After assembling the cnWave™ 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.

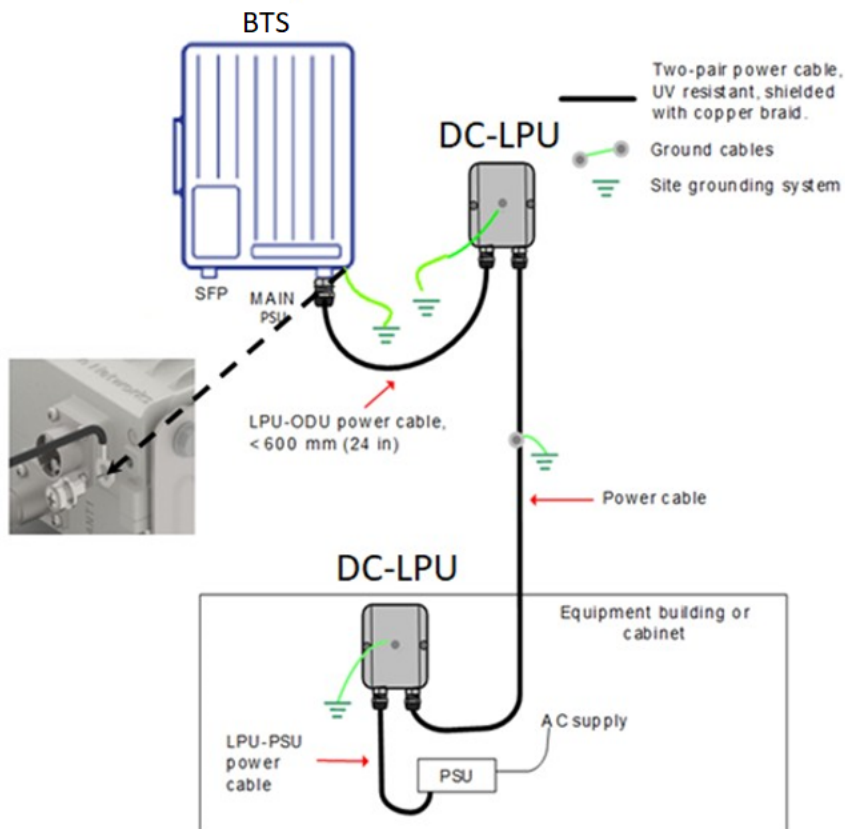
The actual degree of protection required depends on local conditions and applicable local regulations. To adequately protect an installation, both ground bonding and transient voltage surge suppression are required.

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



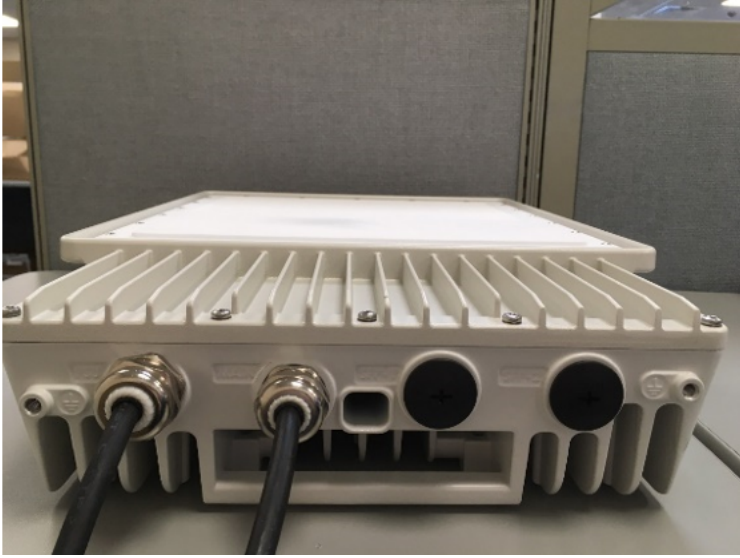
[Figure 22](#) shows an image of the power cable connector.

[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™ 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.

Table 8: List of UI controls

| UI Control | UI Control name | Description |
|---|-----------------|---|
|  | 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: <ul style="list-style-type: none"> • General • Management • Radio • Interface • CPE Provisioning • Synchronisation For CPE: <ul style="list-style-type: none"> • General • Management • Radio • Interface • Session • RADIUS Authentication Applicable to both B1000 and C100 UIs. |
|  | Subscribers | To view (read-only) all the data related to subscribers (CPEs). Applicable only to the B1000 UI. |
|  | Tools | To update firmware and reboot the unit. Applicable to both B1000 and C100 UIs. |
|  | Setup Wizard | To configure the CPE (for example, frequencies, power, polarisation, and other configurations). |

| UI Control | UI Control name | Description |
|---|--------------------|---|
| | | Applicable only to the C100 UI. |
| Other common UI 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. |
|  | Table | To view the parameters in a column format. |
|  | Undo | To undo the changes. |
|  | Save | To save the changes. |
|  | Power | To restart or reboot the system from the UI. |
|  | Admin | To change the password of the UI and log out from the UI. |

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

- [Configuring BTS](#)
- [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

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

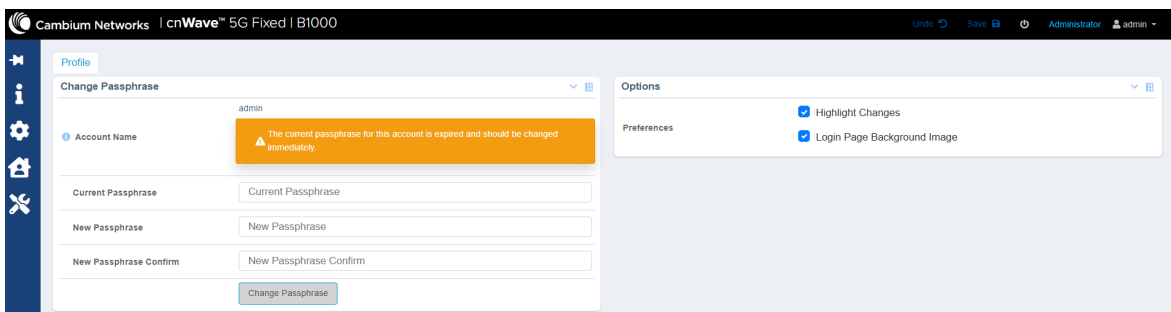


Table 9 lists and describes the parameters available on the **Profile** page.

Table 9: List of parameters in the Profile page

| Parameter | Description |
|-------------------|-------------|
| Change Passphrase | |

| Parameter | Description |
|--|---|
| Account Name | The default name of the user account required for accessing the B1000 UI. This is read-only parameter. |
| Current Passphrase | The default password used for the first time log in or for the previous access. Default password: admin Enter the current password in the text box. |
| New Passphrase | Enter a new password in the text box. Note: The maximum character limit for the password is eight. |
| New Passphrase Confirm | Reenter the new password in the text box to confirm. |
| Change Passphrase | An option to change the current password. Click on Change Passphrase to change the current password. |
| Options Used for the engineering purpose. | |
| Preferences | An option to set your preferences in the UI. Following options are supported: <ul style="list-style-type: none"> • 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 > Interface UI page displays the highlighted values in light yellow color. • 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  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.

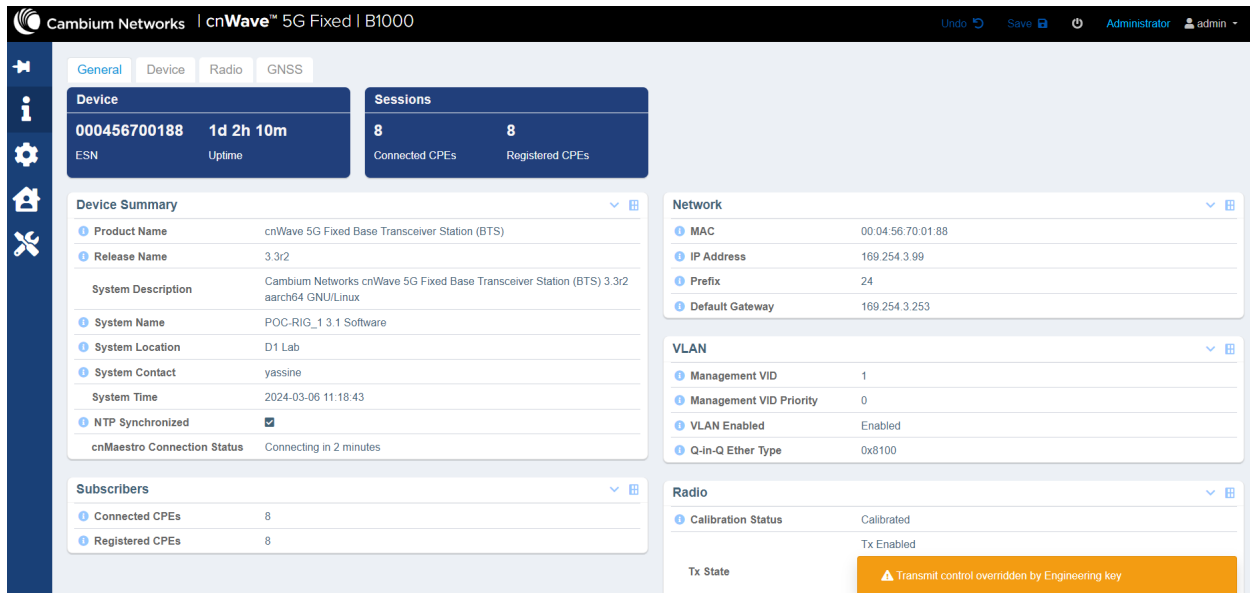


Note

Currently, the B1000 BTS device can support up to 120 CPE connections.

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](#).

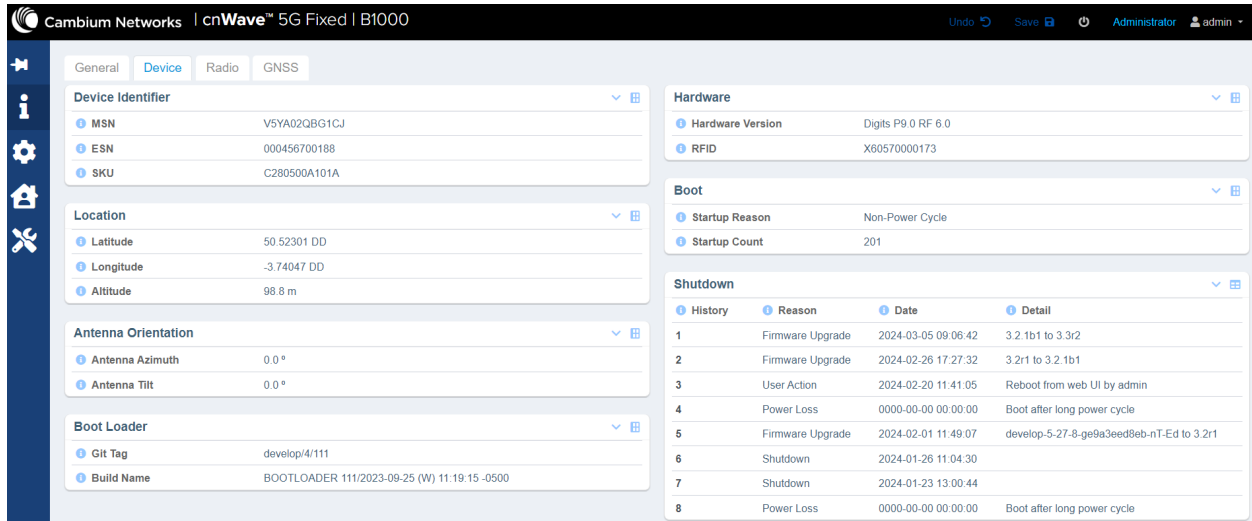
Figure 26: The main B1000 dashboard page



The main B1000 dashboard page contains the following tabs:

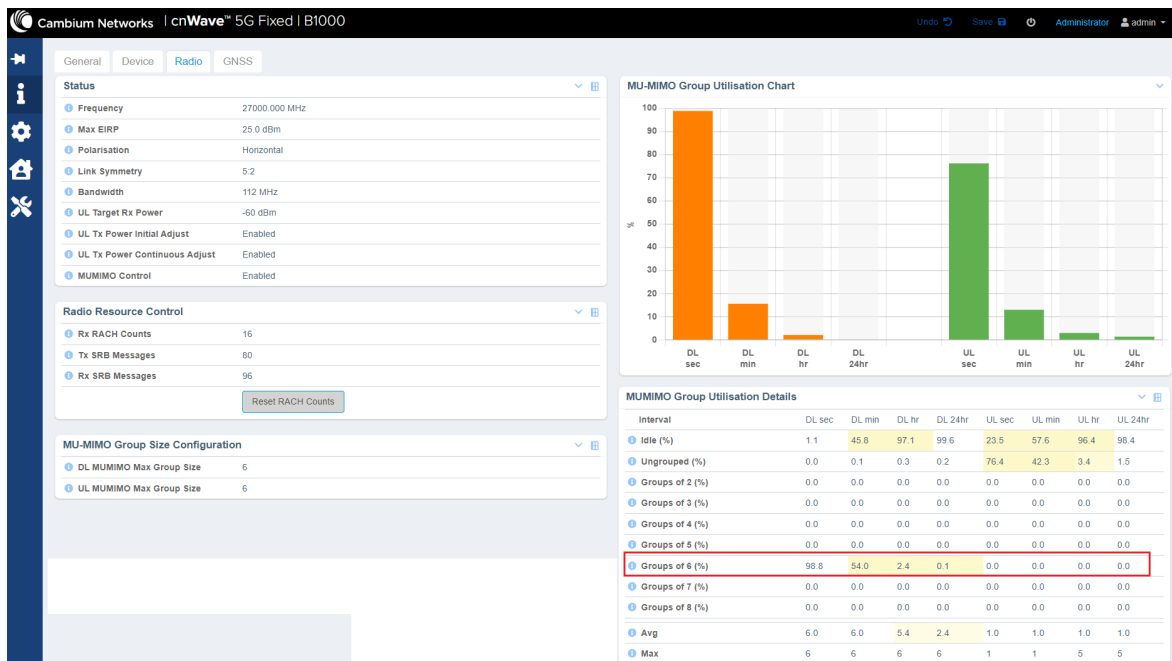
- **General:** Provides a summary of the connected devices. It also displays the subscriber status and other system related details. Example: Firmware and current operational software release number, including system contact details.
- **Device:** Displays information about the system reboot, antenna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

Figure 27: The Device page



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

Figure 28: The Radio page



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.

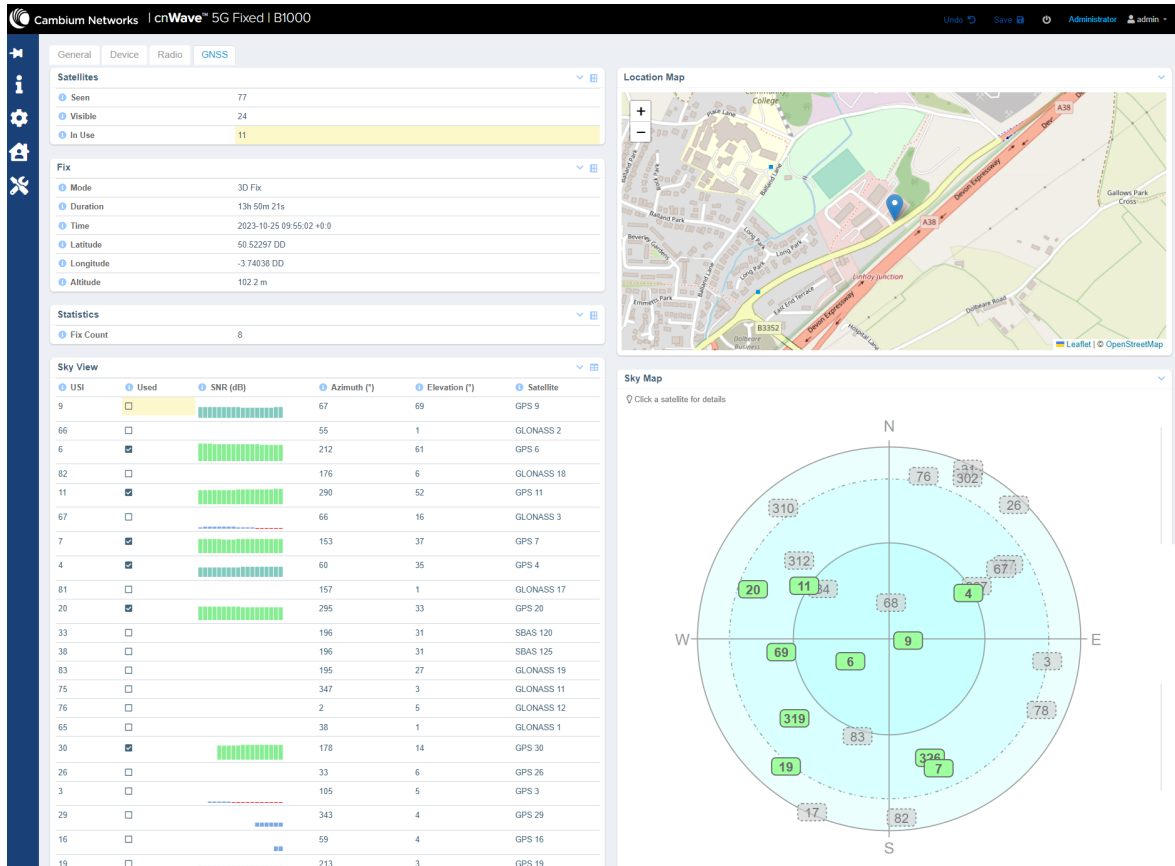


Note

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*.

Figure 29: The GNSS page




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.



Note

The Power icon () is also available to allow you to restart (reboot) the system from the UI.

Consider the following settings to configure the BTS:

System settings

To access most of the configuration parameters for BTS, select the **System** (⚙️) 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](#)). For information about configuring VLAN, cnMaestro X, and other system settings, refer to the *cnWave™ 5G Fixed Configuration Guide*.

Figure 30: The System settings page

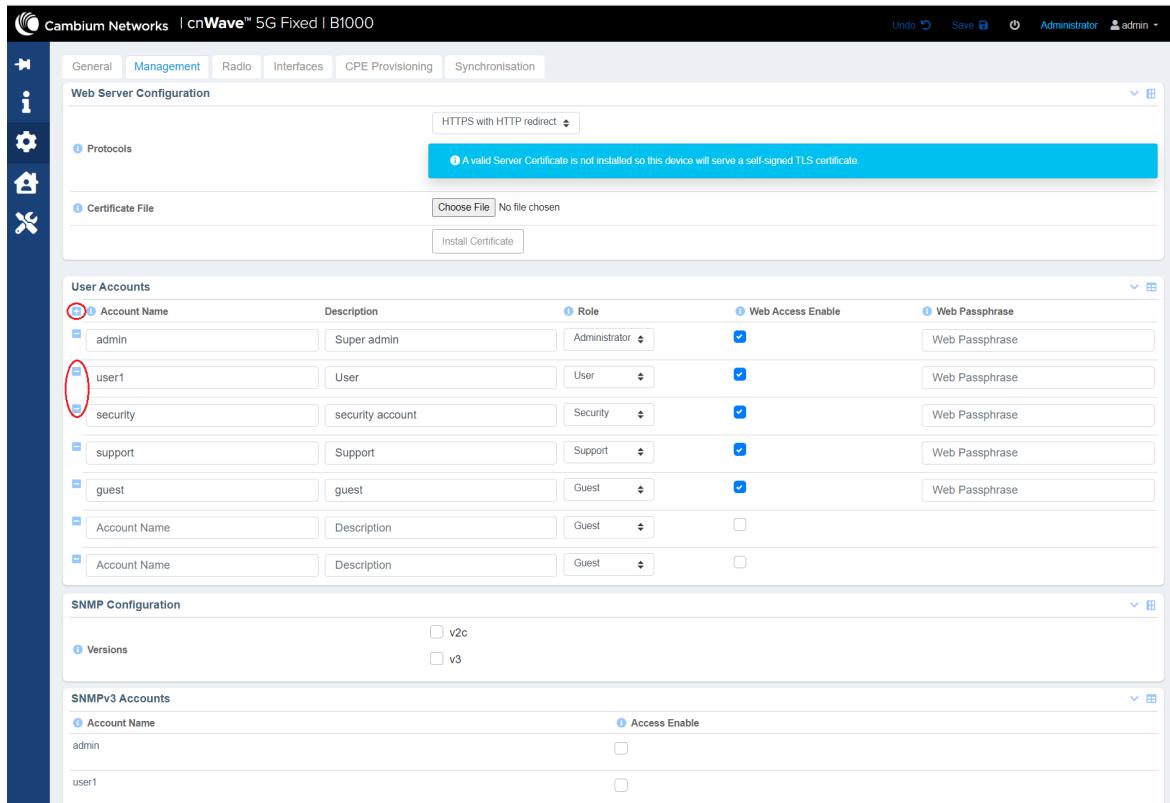
The screenshot shows the 'System' configuration page in the Cambium Networks cnWave™ 5G Fixed B1000 interface. The page is organized into several sections:

- System:** Fields for System Name (POC-RIG_13.1 Software), System Location (D1 Lab), System Contact (yassine), and Timezone (GMT (+00:00)).
- Antenna Orientation:** Fields for Antenna Azimuth (0.0) and Antenna Tilt (0.0).
- Network Configuration:** Fields for IP Address (169.254.3.99), Prefix (24), Default Gateway (169.254.3.253), Primary DNS Server (8.8.8.8), Secondary DNS Server (10.130.12.111), DNS Domain Name (DNS Domain Name), and Forward Unknown Unicast Packets (unchecked).
- VLAN Configuration:** Fields for Management VID (1), Management VID Priority (0), VLAN Enabled (Enabled), and Q-in-Q Ether Type (0x8100).
- cnMaestro:** Fields for Remote Management (checked), Connection Status (Connected), Address (qa.cloud.cambiumnetworks.com), Account ID (28GHZ_CNWAVE_PLATFORM_SIT), Cambium ID (Cambium ID), Onboarding Key (Onboarding Key), and Validate Server Certificate (unchecked).

- **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](#).

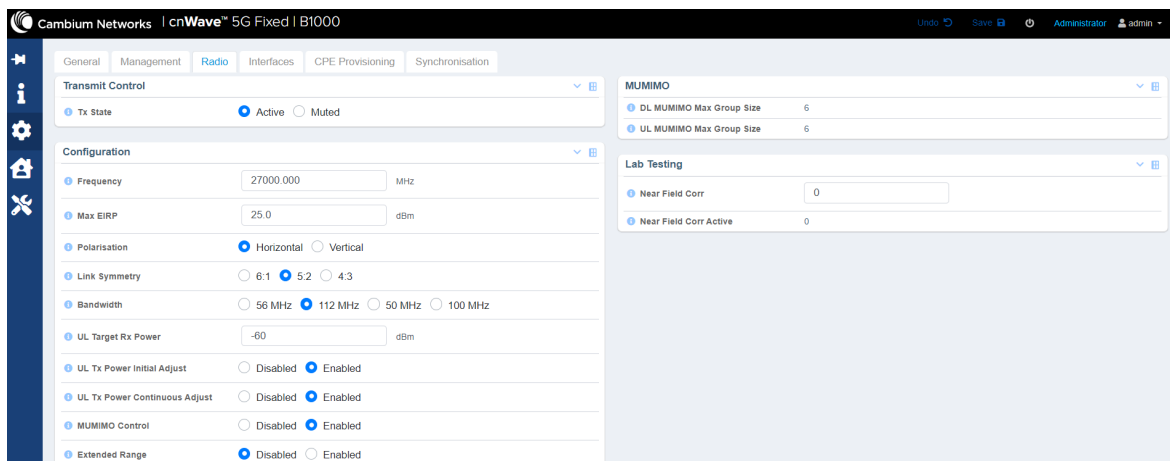
You can also download the SNMP MIB file and access the VLAN or QoS attributes of the device. For more information on downloading the MIB file, refer to the *cnWave™ 5G Fixed Configuration Guide*.

Figure 31: The Management page



- **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



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 [CPE 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™ 5G Fixed* system. For more details on the CPE's polarization feature, refer to the *cnWave™ 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.

Figure 33: The Interfaces page

The screenshot shows the 'Interfaces' configuration page. On the left, there are tabs for General, Management, Radio, Interfaces, CPE Provisioning, and Synchronisation. The 'Interfaces' tab is active. Under 'Configuration', SFP1 Speed is set to 'Autoneg 1000BASE-X' and SFP2 Speed is set to 'Autoneg 10GBASE-R'. The 'Physical Port Status' table shows: Wireless (Up), MainEth (Down), SFP1 (Not Present), and SFP2 (Up). The 'Counters' section has a 'Reset Confirmation' checkbox. On the right, there are two tables: 'Tx Rx Counters' and 'Tx Rx Errors'. The 'Tx Rx Counters' table shows statistics for Wireless, MainEth, SFP1, and SFP2. The 'Tx Rx Errors' table shows error counts for the same interfaces. At the bottom, the 'GNSS Configuration' section has a 'Constellations' dropdown set to 'GPS + Galileo + GLONASS'.

- **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

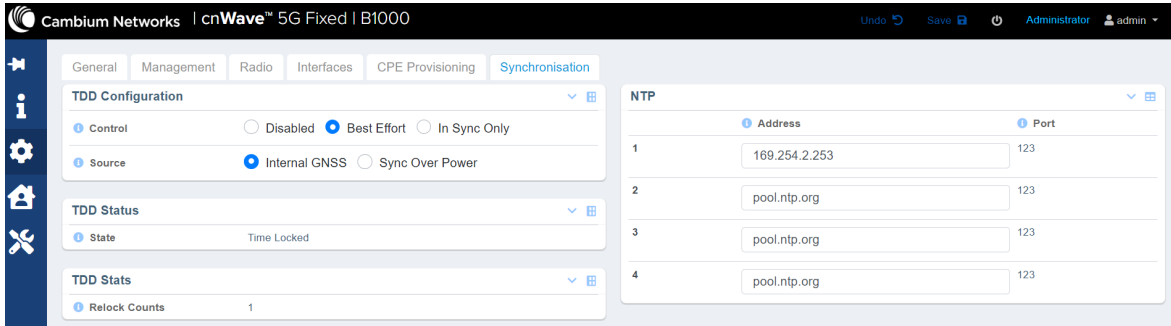
The screenshot shows the 'CPE Provisioning' configuration page. The 'Authentication' section has 'Mode' set to 'None'. A yellow warning box states: 'Any CPE may connect to this BTS without authentication. User data traffic will be bridged unconditionally.' The 'Network Configuration' section has 'CPE IP From DHCP' set to 'True'. The 'DHCP Option 82 Configuration' section has 'DHCP Option 82 Enabled' checked. On the right, the 'Authentication Logs' section shows a list of log entries with details like IP addresses, message lengths, and user names.

For more details about the RADIUS Server settings, refer to the [RADIUS Server configuration](#) 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

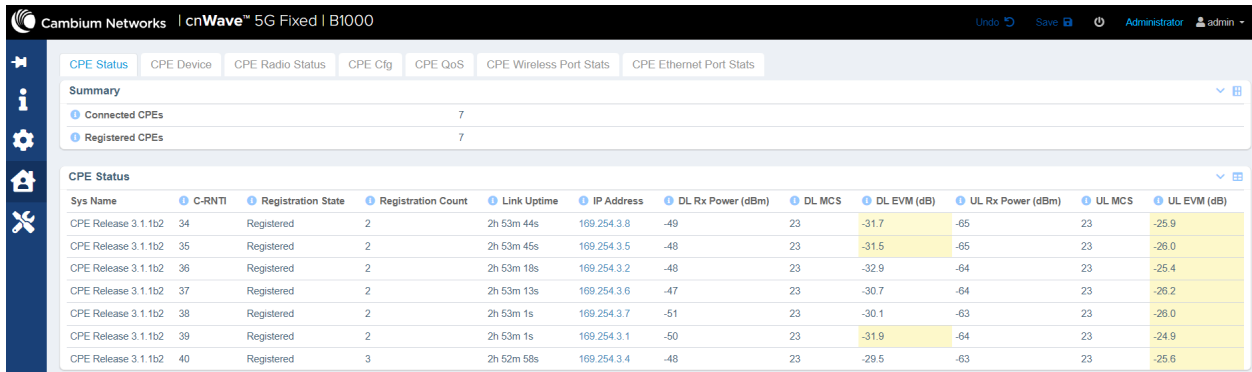


For detailed information about each parameter in the **System** page, refer to the *cnWave™ 5G Fixed Configuration Guide*.

Subscriber list

You can access the CPE subscriber list by selecting the **Subscribers** (👤) 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



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** (👤) 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™ 5G Fixed Configuration Guide*.

Figure 37: Radio link characteristics of CPEs

| Sys Name | DL Rx Power (dBm) | DL EVM (dB) | DL MCS | DL Backoff (dB) | DL Spatial Frequency | DL Channel Distortion (dB) | DL Sounding State | Current EIRP (dBm) | UL Rx Power (dBm) | UL EVM (dB) | UL MCS | UL Backoff (dB) | UL Spatial Frequency | UL Channel Distortion (dB) | UL Sounding State | Range (km) | Alignment Active |
|---------------------|-------------------|-------------|--------|-----------------|----------------------|----------------------------|-------------------|--------------------|-------------------|-------------|--------|-----------------|----------------------|----------------------------|-------------------|------------|--------------------------|
| CPE Release 3.1.1b2 | -49 | -28.1 | 23 | 10 | 517 | -15.1 | Tracking | 15 | -65 | -25.5 | 23 | 4 | 514 | -18.7 | Tracking | 0.01 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -48 | -32.5 | 23 | 11 | 891 | -16.4 | Tracking | 14 | -65 | -25.7 | 23 | 3 | 892 | -16.9 | Tracking | 0.02 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -48 | -31.8 | 23 | 11 | 277 | -16.3 | Tracking | 17 | -64 | -25.3 | 23 | 5 | 280 | -17.4 | Tracking | 0.02 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -47 | -31.9 | 23 | 10 | 759 | -18.2 | Tracking | 18 | -64 | -25.7 | 23 | 5 | 757 | -20.7 | Tracking | 0.02 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -51 | -32.4 | 23 | 8 | 636 | -15.2 | Tracking | 18 | -63 | -25.6 | 23 | 5 | 633 | -19.7 | Tracking | 0.01 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -50 | -31.5 | 23 | 9 | 395 | -17.4 | Tracking | 18 | -64 | -26.0 | 23 | 4 | 397 | -18.0 | Tracking | 0.02 | <input type="checkbox"/> |
| CPE Release 3.1.1b2 | -48 | -30.4 | 23 | 11 | 1020 | -16.9 | Tracking | 12 | -63 | -25.8 | 23 | 5 | 1020 | -19.7 | Tracking | 0.01 | <input type="checkbox"/> |

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

Tools

The **Tools** (🔧) 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](#)).

Figure 38: The Firmware page for software upgrade or downgrade

Device Information

- Product Name: cnWave 5G Fixed Base Transceiver Station (BTS)
- Release Name: 3.3r2

Image Upload

- Source: Local File Remote Server
- Local File: No file chosen
- Destination: Image 1 Image 2
-

Upgrade Status

- Upload Progress
- Install Progress

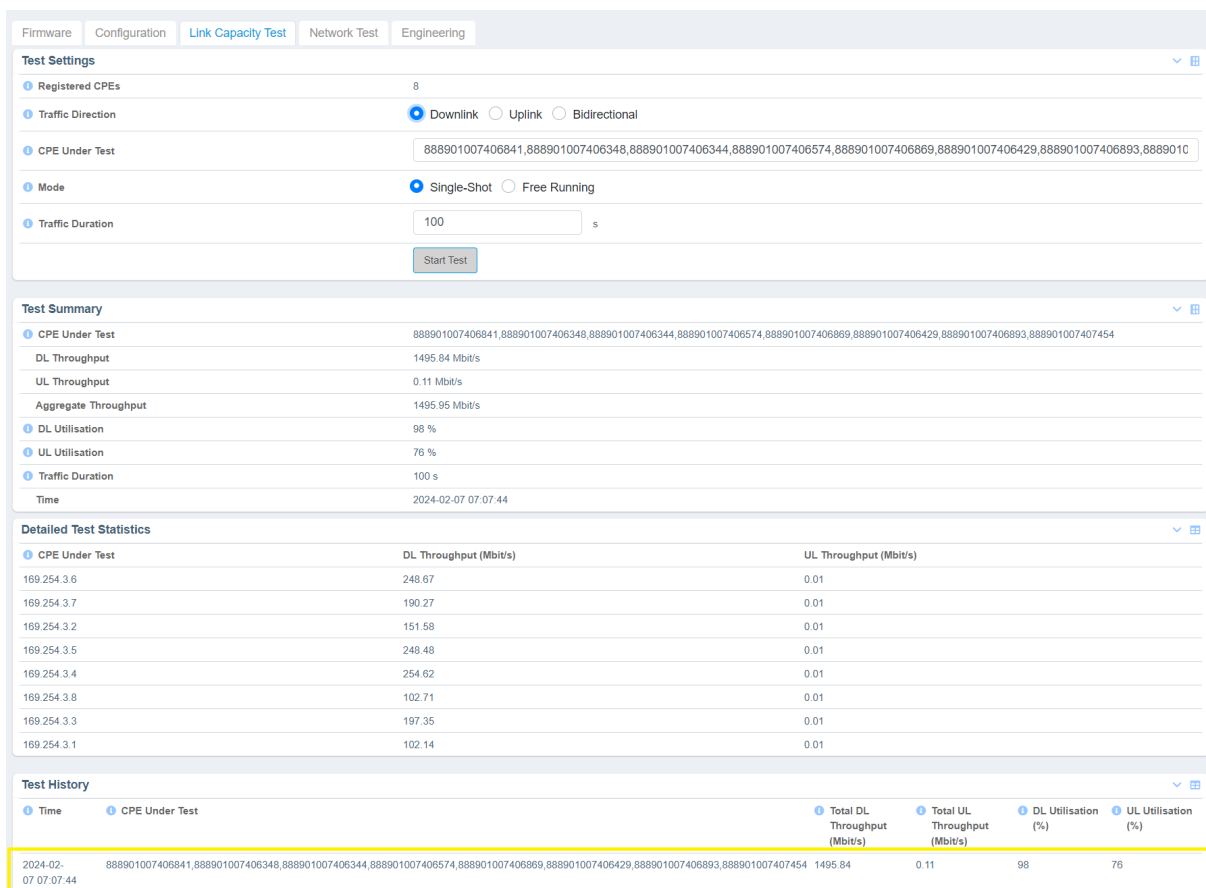
Reboot

- Enable Reboot
- A reboot will be required to install a firmware image

Installable Images

| Image | Status | Description | Eraser | Installer |
|---------|-------------|-----------------------------|--------------------------------------|--|
| Image 1 | Valid Image | cnWave 5G Fixed (BTS) 3.3r2 | <input type="button" value="Erase"/> | <input type="button" value="Install"/> |
| Image 2 | Valid Image | cnWave 5G Fixed (BTS) 3.2r1 | <input type="button" value="Erase"/> | <input type="button" value="Install"/> |

Figure 40: Link capacity test with MU MIMO enabled



For detailed information about parameters and other tools (such as Configuration, Network Test, and Engineering, 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*.

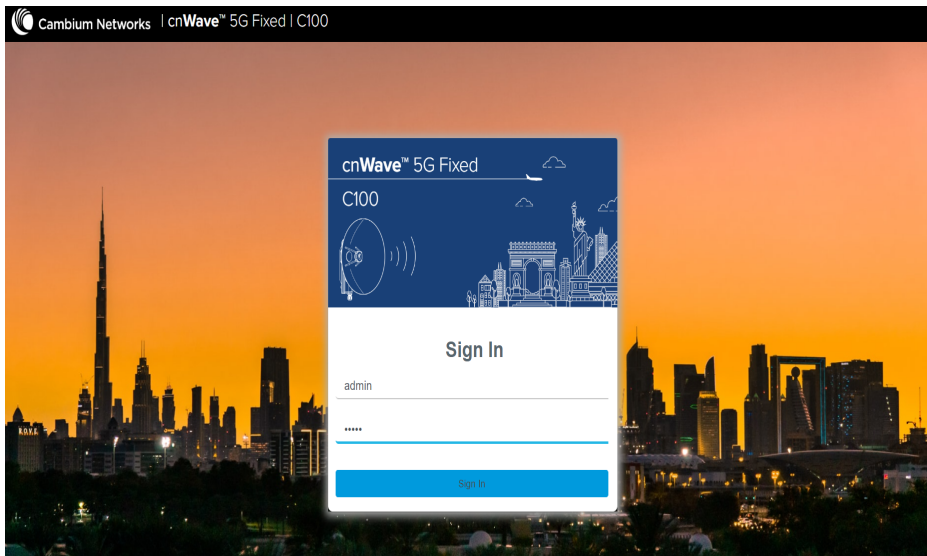
Accessing the C100 UI

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)



4. Type an appropriate username and password.

Default username: admin

Default password: admin

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](#).

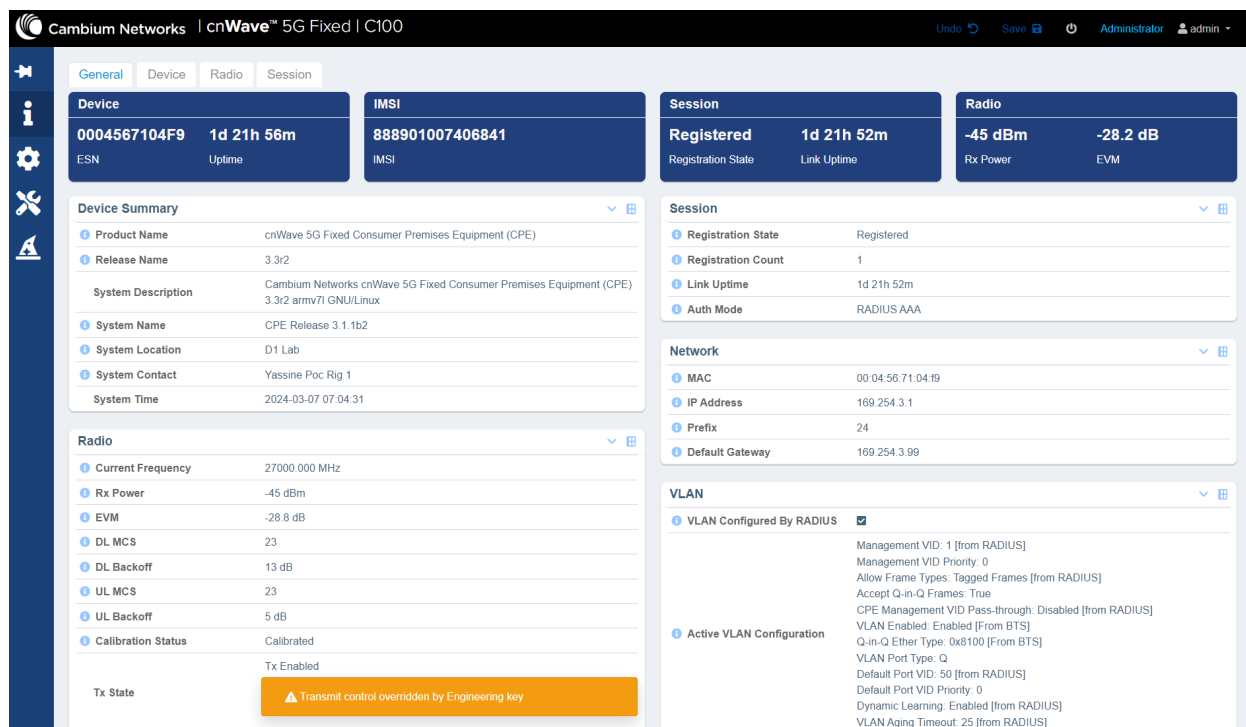
C100 Dashboard

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](#).

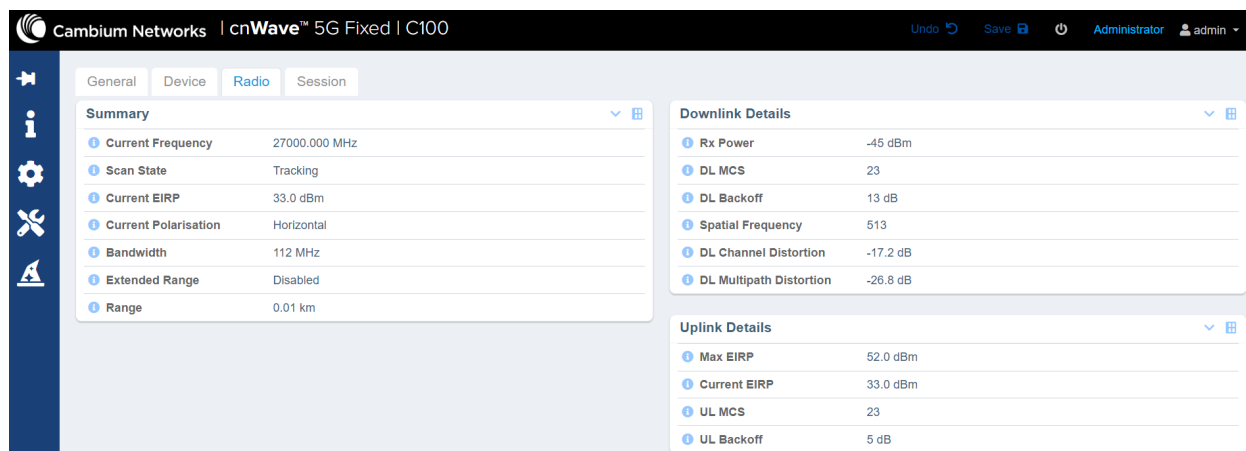
Figure 42: The main C100 dashboard page



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



- **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

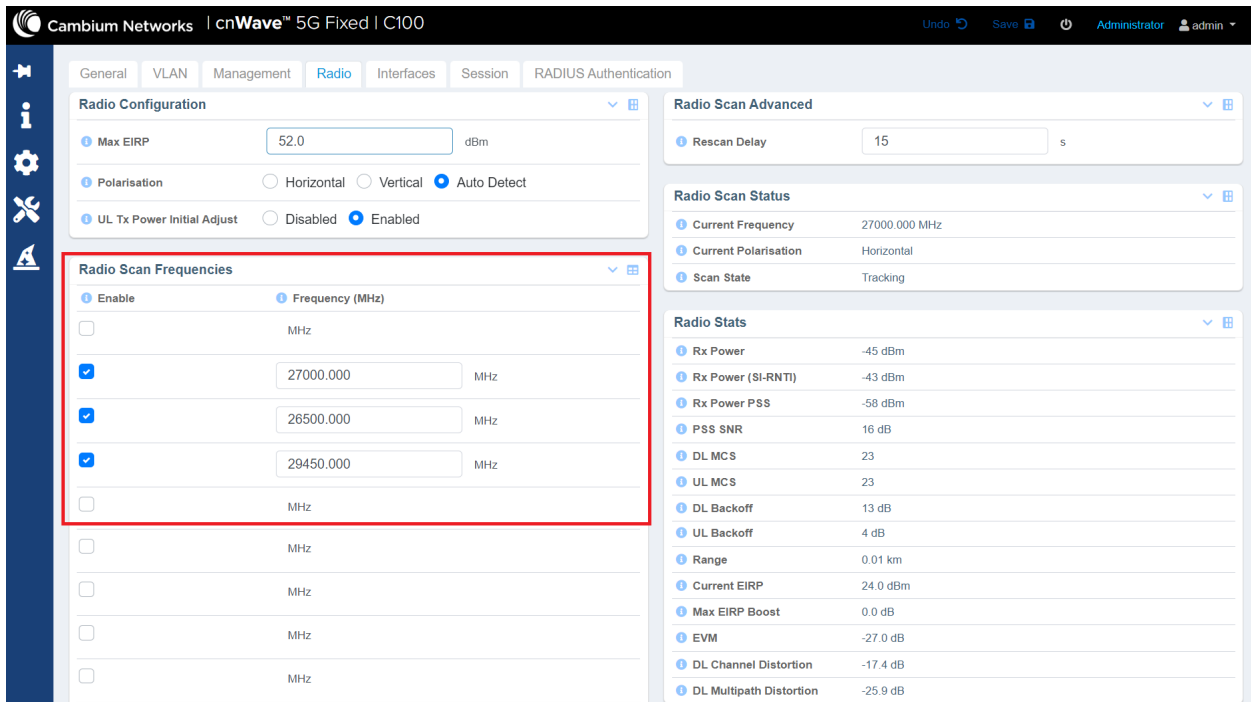
The Power icon (🔌) is also available to allow you to restart (reboot) CPE from the C100 UI.

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.

Figure 44: The Frequency Scan feature



To access the radio scan frequency feature elements, select the **System** (🔌) 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™ 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™ 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

The screenshot displays the 'CPE Provisioning' configuration page in the B1000 dashboard. The page is divided into several sections:

- Authentication:** Mode is set to RADIUS AAA.
- RADIUS Configuration:** Accounting is enabled.
- RADIUS Authentication Server:**
 - Role: Primary
 - Inet Address: 169.254.2.253
 - Port: 1812
 - Secret: [Redacted]
- RADIUS Accounting Server:**
 - Role: Primary
 - Inet Address: 10.10.10.254
 - Port: 1813
 - Secret: [Redacted]
- Network Configuration:**
 - CPE IP From DHCP: False
 - CPE Use Local VLAN Config: False
 - CPE Use Local QoS Config: False
- DHCP Option 82 Configuration:** DHCP Option 82 Enabled: [Unchecked]
- Authentication Logs:** A log viewer showing entries from 'authentication.log' with details like IP addresses, timestamps, and RADIUS attributes (e.g., User-Name, Framed-IP-Address, Vendor-Specific).

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


1. In the B1000 dashboard, select the **System** (⚙️) 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.

Table 10: Parameters for RADIUS server settings

| Parameter | Description |
|------------------------------|---|
| Authentication | |
| Mode | <p>Determines the connection mode of CPEs.</p> <p>This parameter supports the following options:</p> <ul style="list-style-type: none"> • 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. • 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. <p>Choose the required mode.</p> <p>You can use  to revert to None from the RADIUS AAA mode.</p> |
| Network Configuration | |
| CPE IP From DHCP | <p>Determines whether the CPE's IP network configuration is supplied by a DHCP server.</p> <p>Following options are supported:</p> <ul style="list-style-type: none"> • True: If enabled, the DHCP server supplies the CPE's IP network configuration. • False: If disabled and the Authentication Mode is • RADIUS AAA, the configured RADIUS server supplies the CPE's IP network configuration. <p>If disabled and the Authentication Mode is None, the CPE's IP network configuration is set locally at each CPE.</p> <p>Select an appropriate option.</p> |
| CPE Use Local VLAN Config | <p>Determines whether the CPE uses the local VLAN configuration or the RADIUS-supplied VLAN settings.</p> <p>The following options are supported:</p> <ul style="list-style-type: none"> • 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. • False: The CPE installs the RADIUS-supplied VLAN settings. This control is applicable when the Authentication Mode is RADIUS AAA. <p>Select the required option.</p> |

| Parameter | Description |
|--|--|
| CPE Use Local QoS Config | <p>Determines whether the CPE uses the local QoS configuration or the RADIUS-supplied QoS settings.</p> <p>The following options are supported:</p> <ul style="list-style-type: none"> • 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. • False: The CPE installs the RADIUS-supplied QoS settings. This control is applicable when the Authentication Mode is RADIUS AAA. <p>Select the required option.</p> |
| Authentication Logs | |
| authentication.log | <p>An option to view and download the authentication logs from the UI.</p> <p>Click the  icon to download the authentication logs.</p> |
| Following parameters appear only when you select the RADIUS AAA mode. | |
| RADIUS Configuration | |
| Accounting | <p>Used for billing purposes.</p> <p>When the CPE authentication mode is set to RADIUS AAA, this RADIUS accounting-specific parameters are enabled in the RADIUS Accounting Server section (as shown in Figure 45).</p> <p>When you select the check box, the RADIUS Accounting Server 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 <i>cnWave™ 5G Fixed Configuration Guide</i>.</p> |
| RADIUS Authentication Server | |
| Role | <p>Used for designating one RADIUS server as primary and the others (if required) as secondary authentication servers.</p> <p>This parameter supports the following options:</p> <ul style="list-style-type: none"> • Primary • Secondary • None <p>Select the required value from the drop-down lists.</p> |
| Inet Address | <p>The IPv4 address of the RADIUS server used for identifying in standard dot notation.</p> <p>Type an appropriate value in the text box.</p> |
| Port | <p>The destination port used by the device for RADIUS communication, authorization, and configuration.</p> <p>Default value: 1812</p> |

| Parameter | Description |
|-----------|--|
| Secret | <p>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.</p> <p>The shared secret(s) must match with those shared secret(s) configured in the RADIUS server(s) <code>clients.conf</code> file. For more information about the <code>clients.conf</code> file settings, refer to the An example of configuring an authentication server section.</p> <p>Provide an appropriate value in the text box.</p> |

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 [System settings](#)) 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

```
# CPEs 1
# Fixed IMSIs
208920007405736          Cleartext-Password := "networks"
    Framed-IP-Address      = "192.168.192.31",    # Assigned CPE Management IP Address
    Framed-IP-Netmask      = 255.255.255.0,      # Assigned Management Netmask
    Cambium-Canopy-Gateway = 10.10.10.254,      # The IP address acting as a gateway
    Cambium-Canopy-VLMGVID = 1,                # VLAN Management VLAN ID
    Cambium-Canopy-VLSMMGPASS = 0,              # VLAN SM Management Passthrough
                                                # Enable(1=enable,0=disable)
    Cambium-Canopy-HPENABLE = 0,                # High Priority Channel Enable (1=enable,0=disable)
    Cambium-Canopy-ULBR    = 3072,              # Uplink Bit Rate/Sustained Uplink Rate (kbps)
    Cambium-Canopy-ULBL    = 6144,              # Uplink Bit Limit/Uplink Burst Allocation (kbps)
    Cambium-Canopy-DLBR    = 30720,            # Downlink Bit Rate/Sustained Downlink Rate (kbps)
    Cambium-Canopy-DLBL    = 61440,            # Downlink Bit Limit/Downlink Burst Allocation kbps)
    Cambium-Canopy-BCASTMIR = 100,             # Broadcast Traffic Maximum Information Rate (kbps)
    Cambium-Canopy-ULMB    = 6144,              # Max Burst Uplink Rate (kbps)
    Cambium-Canopy-DLMB    = 61440,            # Max Burst Downlink Rate (kbps)
    Cambium-Canopy-LPULCIR = 1000,             # Low Priority uplink CIR (kbps)
    Cambium-Canopy-HPULCIR = 100,              # High Priority uplink CIR (kbps)
    Cambium-Canopy-LPDLCIR = 6000,             # Low Priority downlink CIR (kbps)
    Cambium-Canopy-HPDLCIR = 100,              # High Priority downlink CIR (kbps)
    Cambium-Canopy-VLLEARNEN = 0,              # VLAN Learning Enable (1=enable, 0=disable)
    Cambium-Canopy-VLIGVID = 50,               # VLAN Ingress VLAN ID
    Cambium-Canopy-VLFRAMES = 1,               # Frames Types allowed(0=all/1=Tagged/2=Untagged)
    Cambium-Canopy-VLIDSET = 103,              # VLAN Membership (1-4094)
    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.

Figure 47: RADIUS authentication values in the C100 UI

| RADIUS Session ▼ ☰ | |
|---|---------------|
| Phase | Authenticated |
| Connection | Connected |
| IP Address | 169.254.2.13 |
| IP Netmask | 255.255.255.0 |
| Prefix | 24 |
| Default Gateway | 169.254.2.88 |
| VLMGVID | 1 |
| CPE Management VID Pass-through | Disabled |
| ULBR | 0 kbps |
| ULBL | 226144 kbits |
| DLBR | 0 kbps |
| DLBL | 2261440 kbits |
| LPULCIR | 0 kbps |
| MPULCIR | 0 kbps |
| HPULCIR | 0 kbps |
| UHPULCIR | 0 kbps |
| LPDLCIR | 0 kbps |
| MPDLCIR | 0 kbps |
| HPDLCIR | 0 kbps |
| UHPDLCIR | 0 kbps |
| VLLEARNEN | Enabled |
| VLGETO | 25 |
| VLIGVID | 50 |
| VLFRAMES | Tagged Frames |
| Bts_version | 3-1-0-0 |

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 |
| 5G NR Chipset based Cambium CPE | No |
| 5G Third Party CPE | No |
| 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 | <ul style="list-style-type: none"> 8 x 8 using 50 MHz and 56 MHz (8 streams and max CPE grouping size = 8) 6 x 6 using 100 MHz and 112 MHz |
| Downlink OFDMA | 1 group/slot |
| Max BTS Data Rate | 1.8 Gbps DL and 600 Mbps UL |
| Max Cell size | Up to 10 Km |
| Max CPE Data Rate | Up to 400 Mbps |
| Max CPEs per 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 | 48 dBm |
| Modulation Range | 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 |
| Topology | PMP |
| Uplink OFDMA | No |
| Uplink MU-MIMO | Yes |

| Feature | Release details |
|------------------------|-----------------|
| Vertical Beam Steering | Static |

The cnWave™ 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.

Table 12: 5G NR Bands

| 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

| 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 | Cell-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 |
| NR | New Radio |

| Term | Definition |
|-------------|---|
| 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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| | |
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| Installation and Configuration Guides | http://www.cambiumnetworks.com/guides |
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| Warranty | https://www.cambiumnetworks.com/support/standard-warranty/ |
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