Transmit Power graph

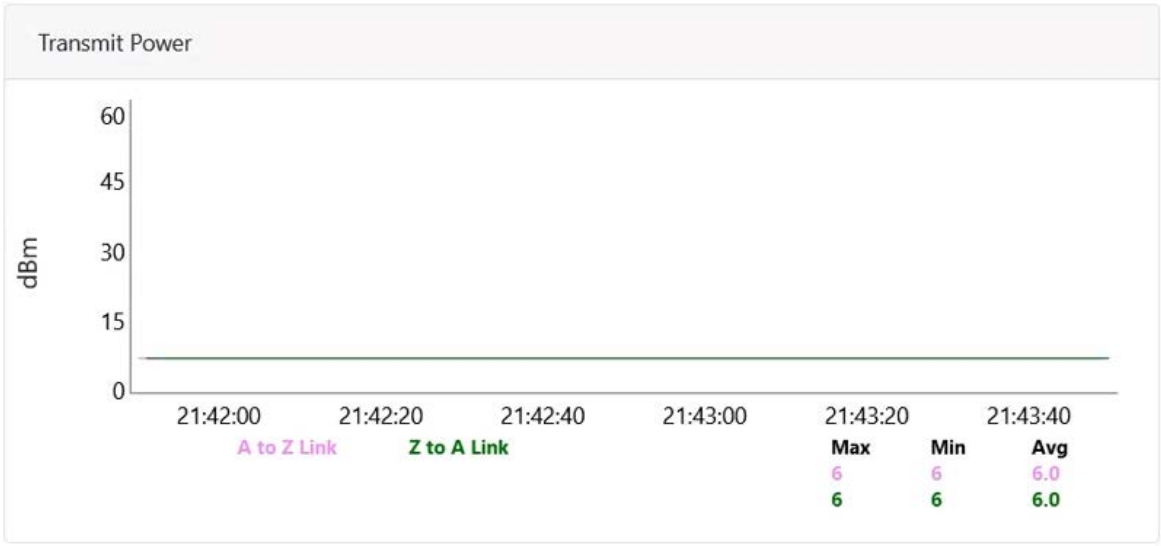


Figure 9 : *Transmit Power graph*

SNR graph

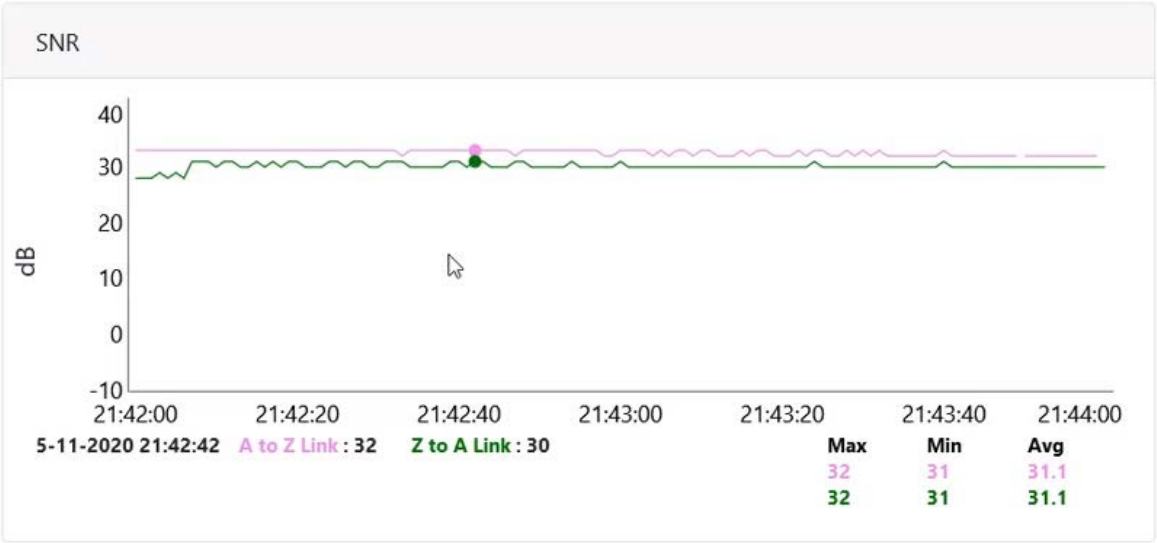


Figure 10 : *SNR graph*

MCS Index graph

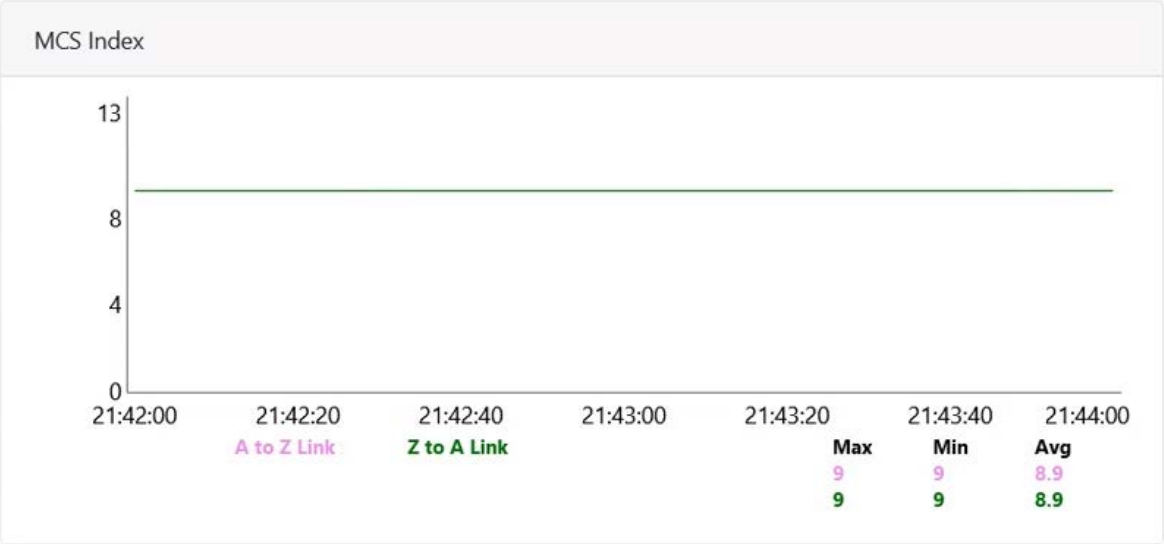


Figure 11 : *MCS Index graph*

Packet Error Ratio graph

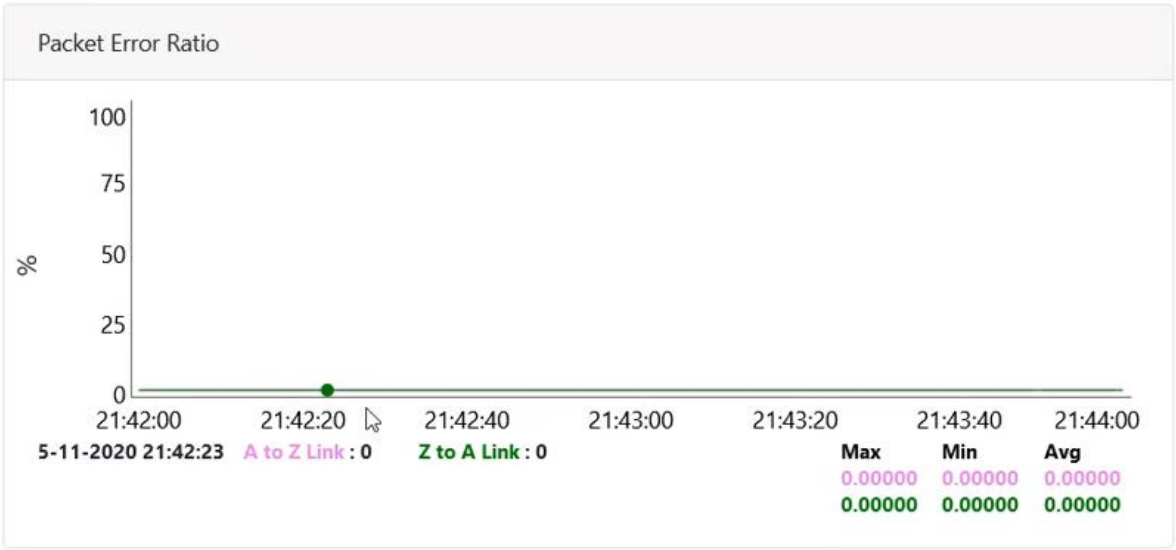


Figure 12 : *Packet Error Ratio graph*

Received Frames graph

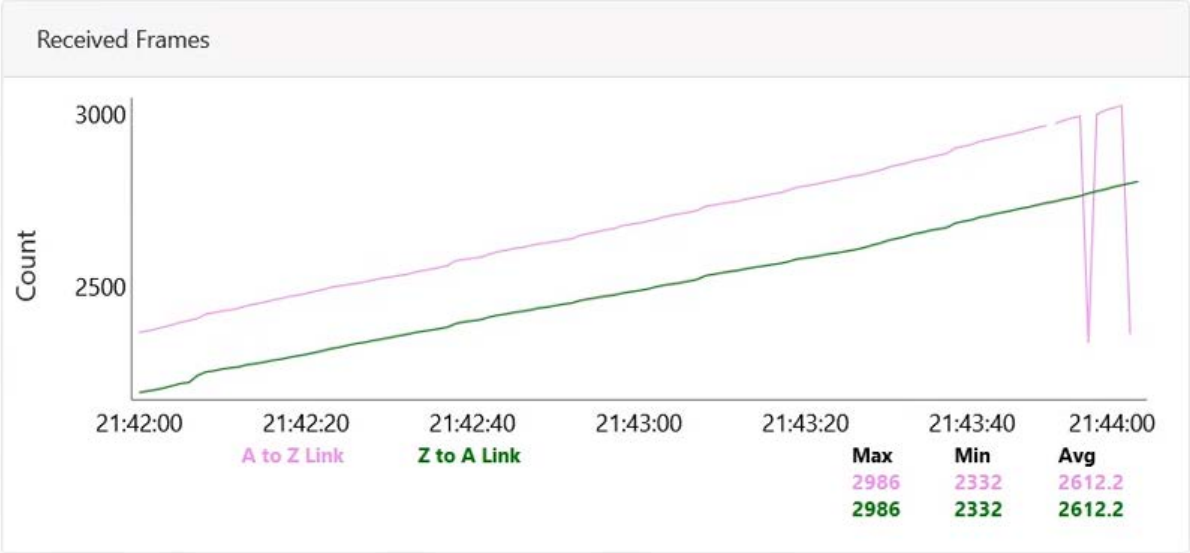


Figure 13 : *Received Frames graph*

Transferred Frames graph

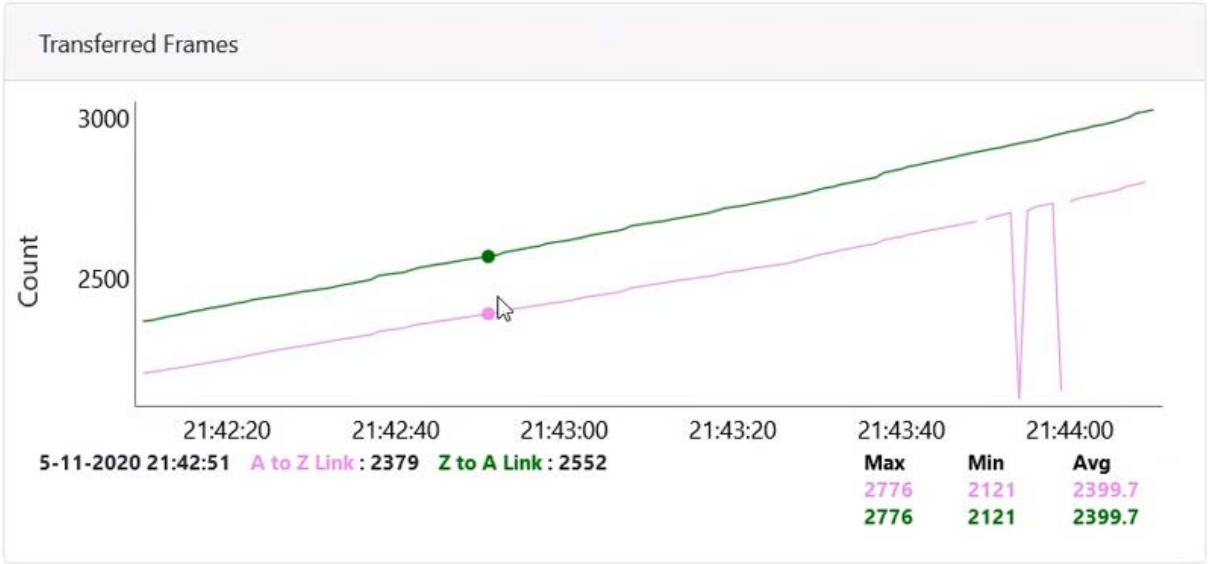
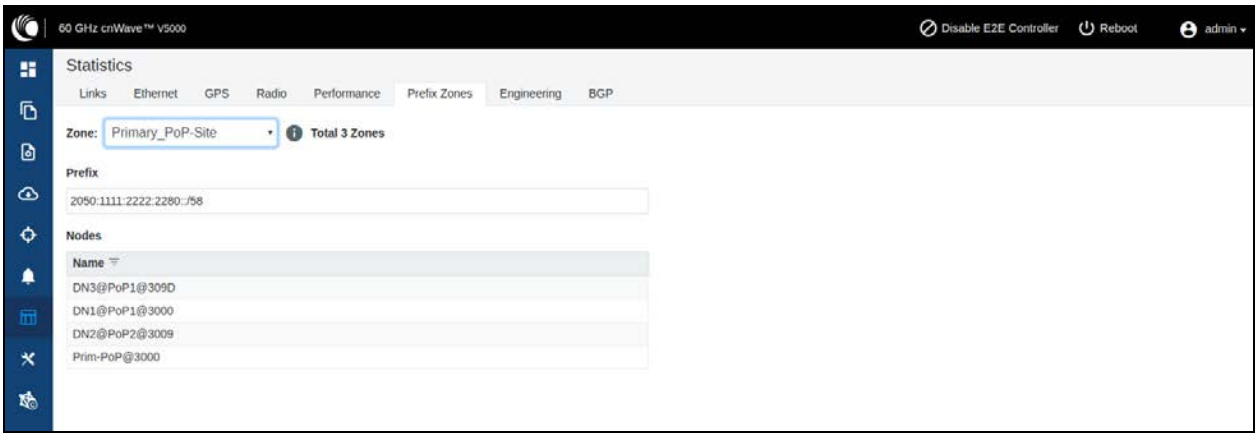


Figure 14 : *Transferred Frames graph*

Prefix Zone Statistics

When **Deterministic prefix** is enabled and in the Multi PoP deployments, the mesh is divided into prefix zones. Prefix Zone statistics are available in **Statistics > Prefix Zone** page.



Engineering

Engineering page displays the engineering information of system and sector.

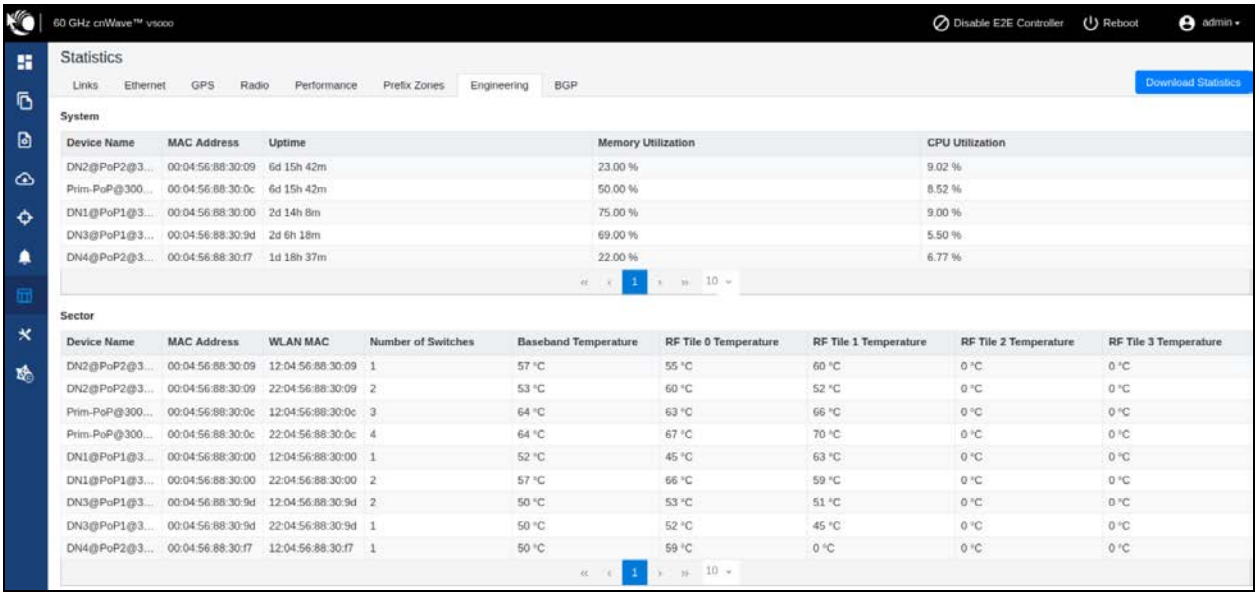
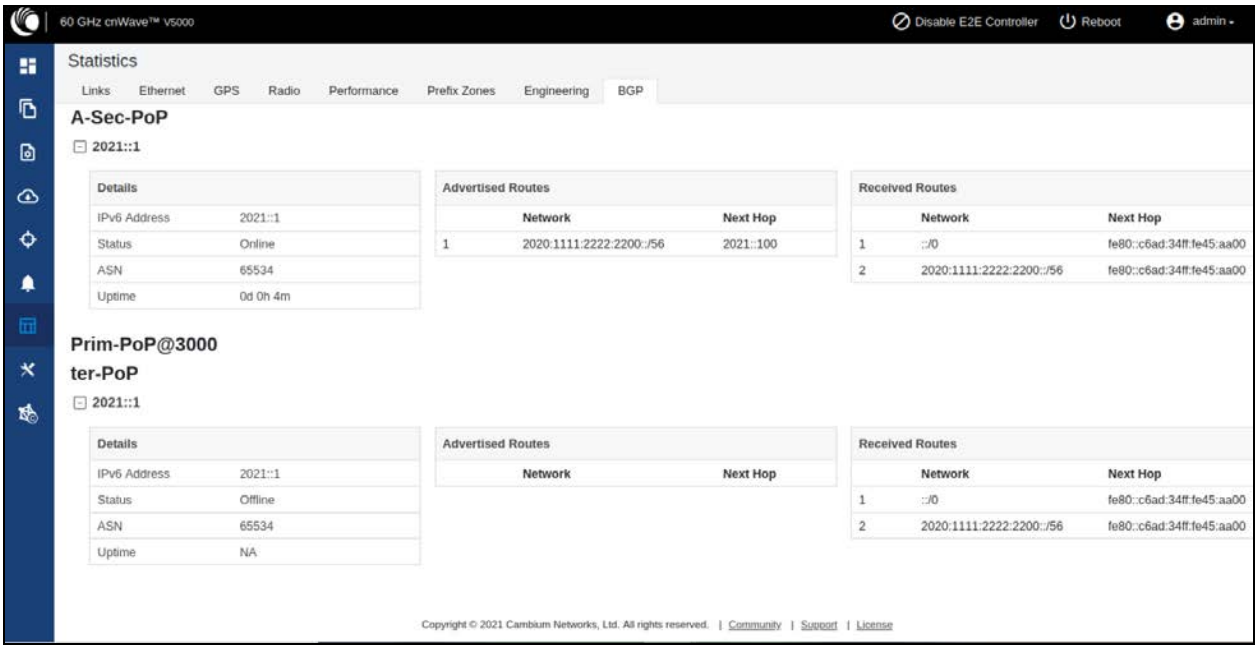


Figure 15 : *Engineering tab*

Border Gateway Protocol (BGP)

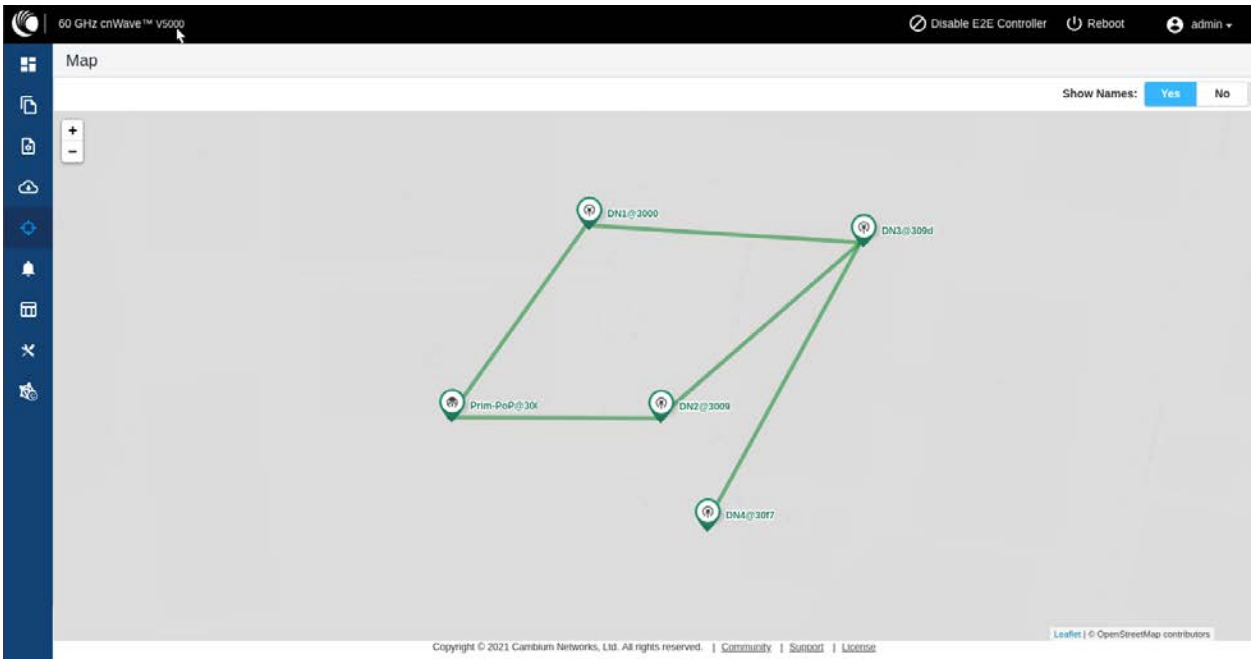
The BGP is the protocol used throughout the Internet to exchange routing information between networks. It is the language spoken by routers on the Internet to determine how packets can be sent from one router to another to reach their final destination. BGP has worked extremely well and continues to the be protocol that makes the Internet work.

To configure BGP, navigate to **Statistics** and select **BGP** tab.



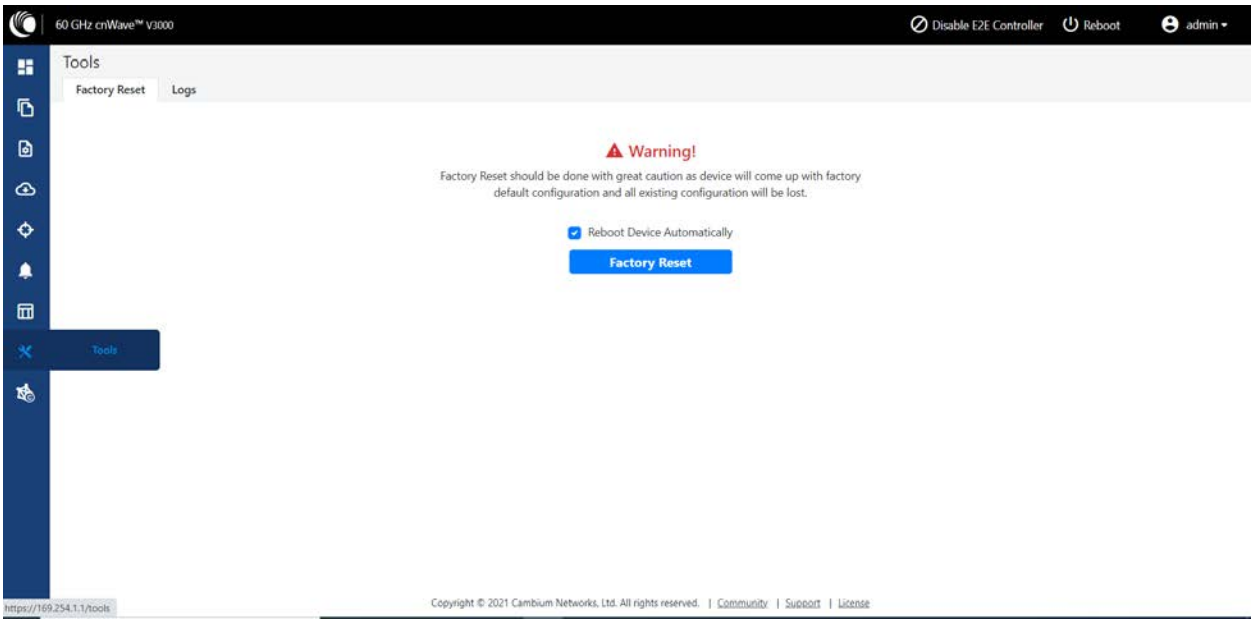
Maps

Map displays the topology and location/sites of the deployed nodes in the cnWave network. Click **Maps** icon on the left panel to display the nodes.



Tools

Tools menu contains **Factory Reset** and **Logs** options. Factory Reset is used to set the default settings.



.

Figure 16 : *Tools menu*

Logs tab is used to view and download the error logs. To download the error logs select the node from the drop-down and click **Download Logs**.

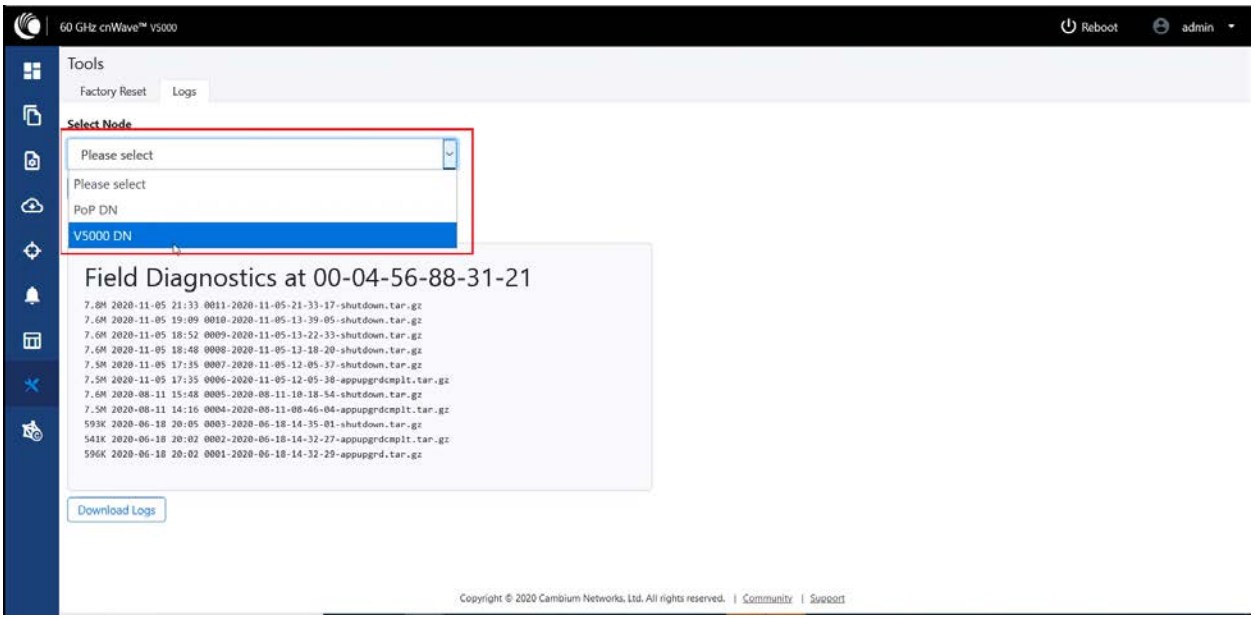


Figure 17 : *Logs tab*

After clicking **Download Logs**, downloading status is displayed.

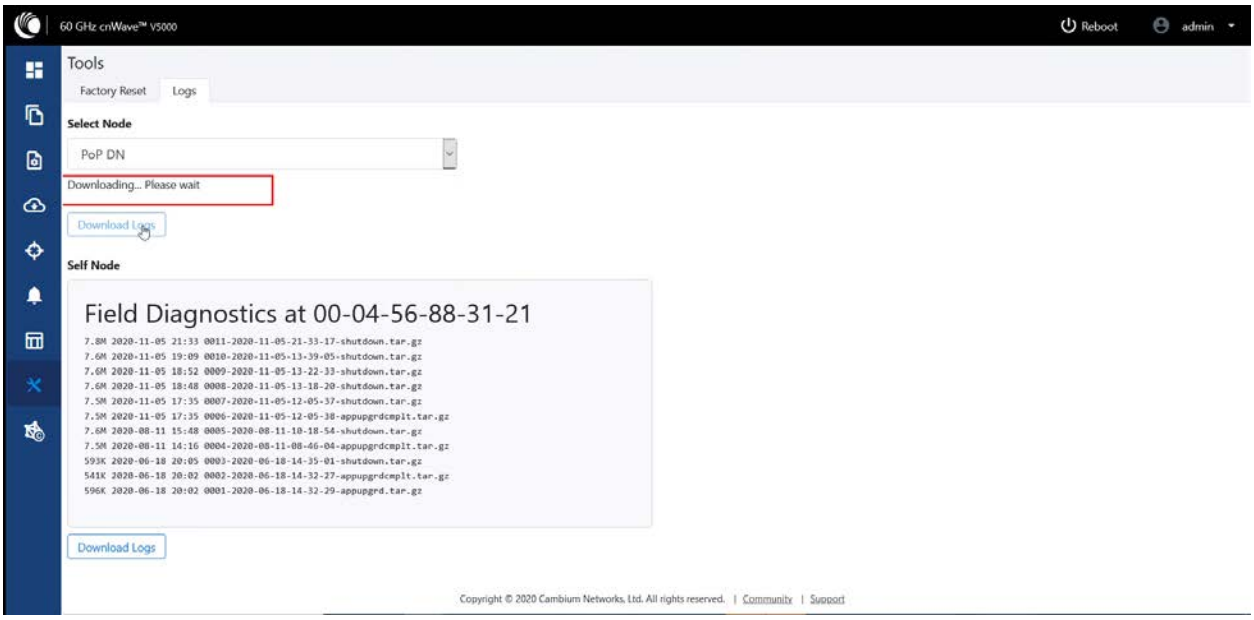


Figure 18 : *Download status*

To download the logs for self node, click **Download Logs** at the bottom and save the log file.

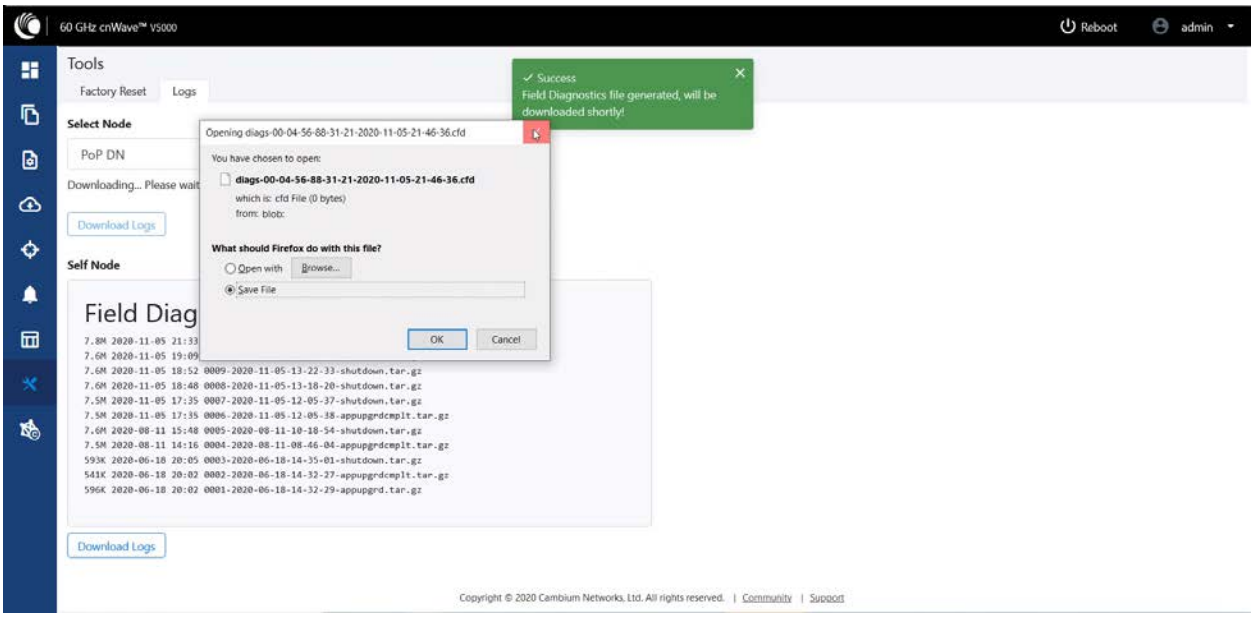
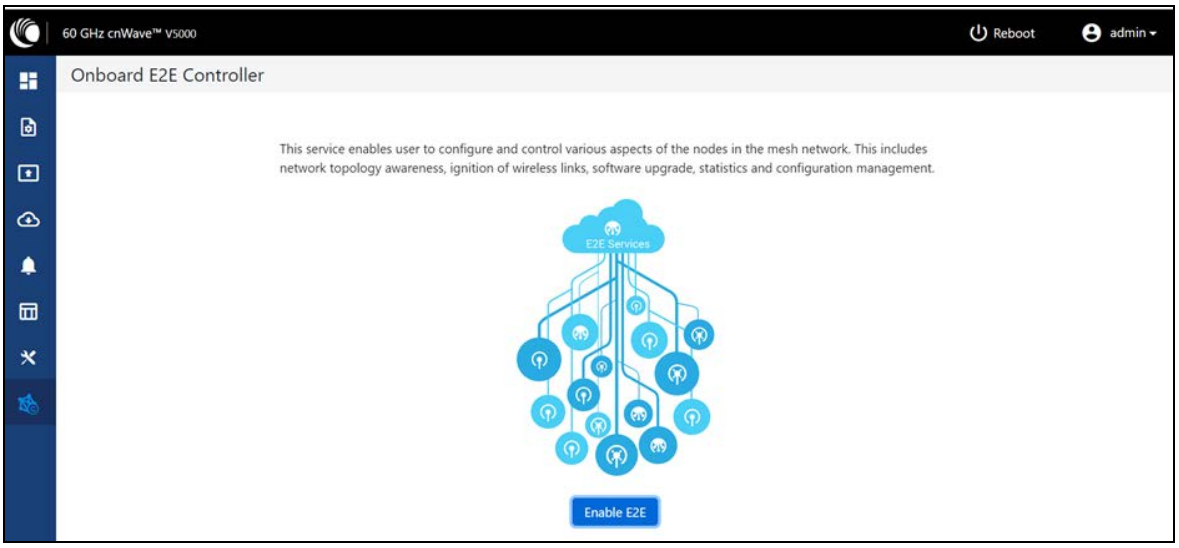


Figure 19 : *Saving log file*

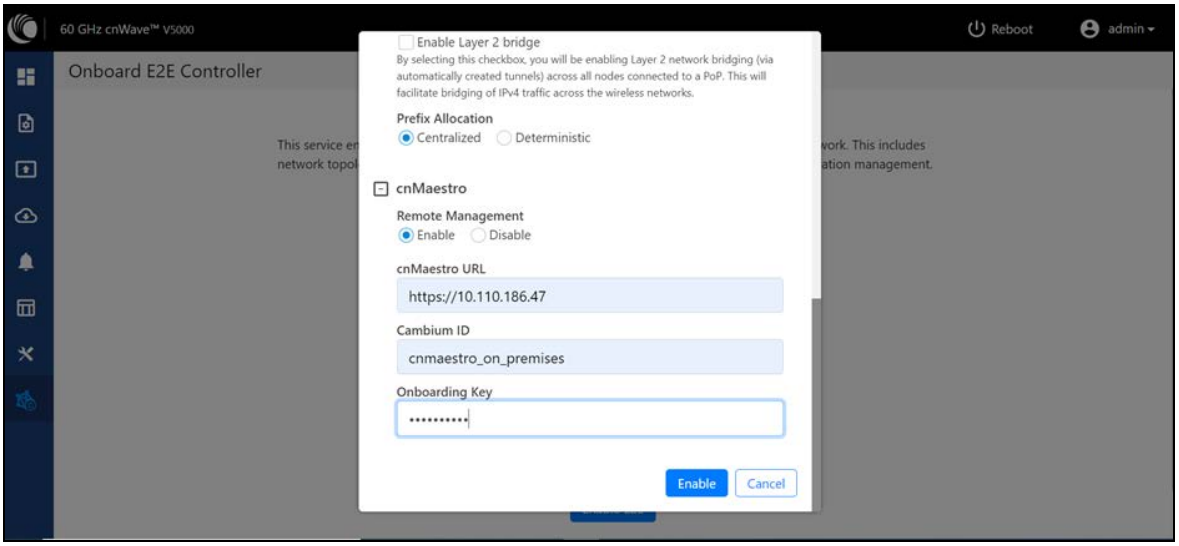
cnMaestro support for Onboard Controller

From System Release 1.0.1 onwards, Onboard E2E controller can be managed by cnMaestro 2.5.0 (on-premises) for network management.

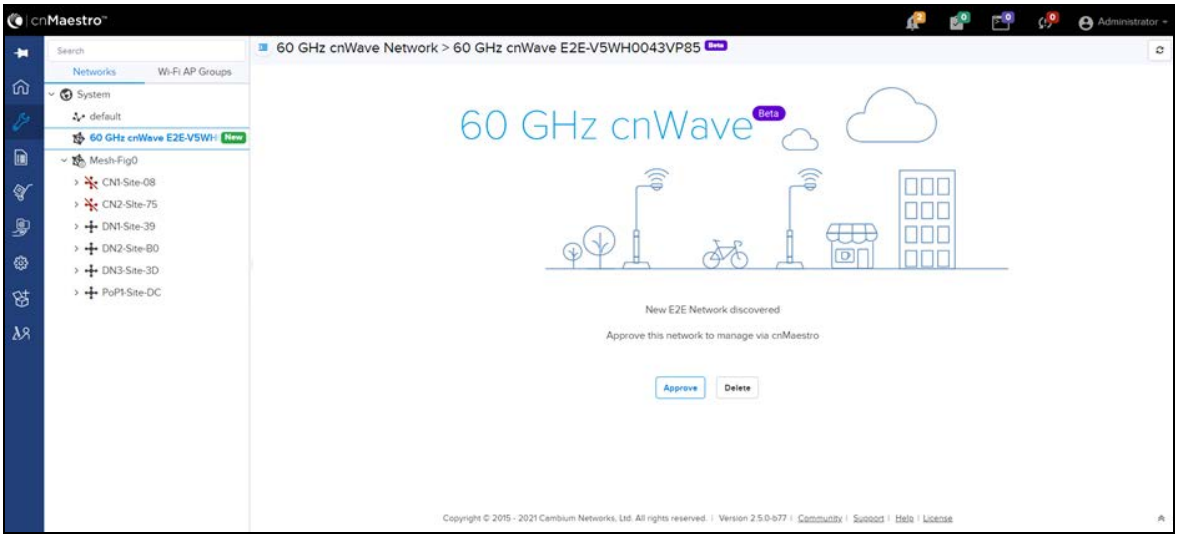
1. Once Onboard E2E controller is enabled from device GUI, enter cnMaestro URL. If **Cambium ID based authentication** option is enabled in cnMaestro, then enter cambium ID and onboarding key.
2. Click **Enable E2E** on **Onboard E2E Controller** in device GUI.



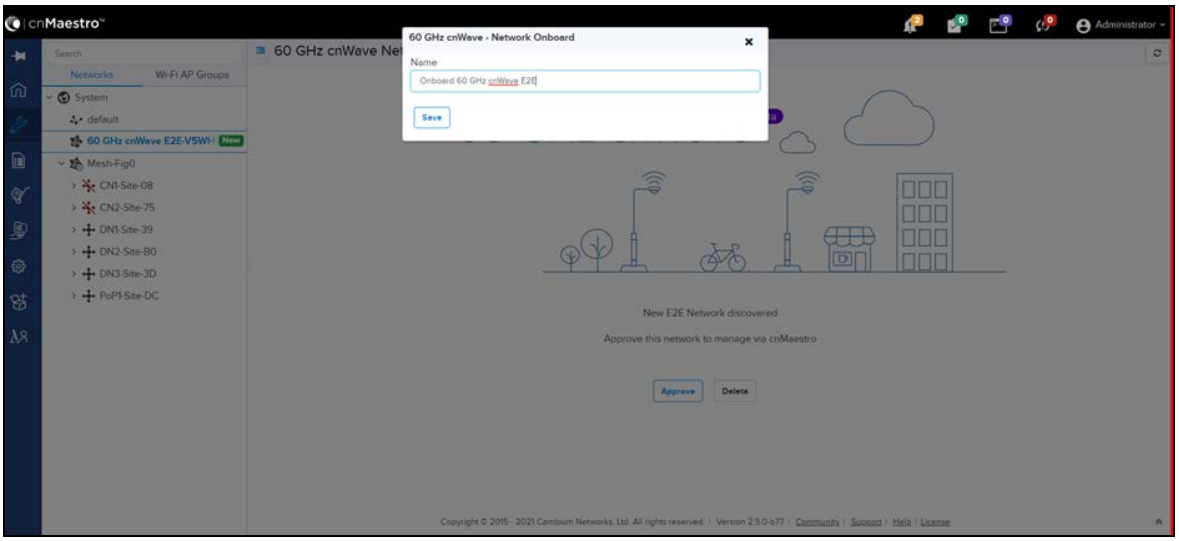
3. Enter cnMaestro management configuration information.
   - Remote Management - Select the required remote management option
   - cnMaestro URL - cnMaestro address
   - Cambium ID - Cambium ID of the device
   - Onboarding key - Password to onboard the device



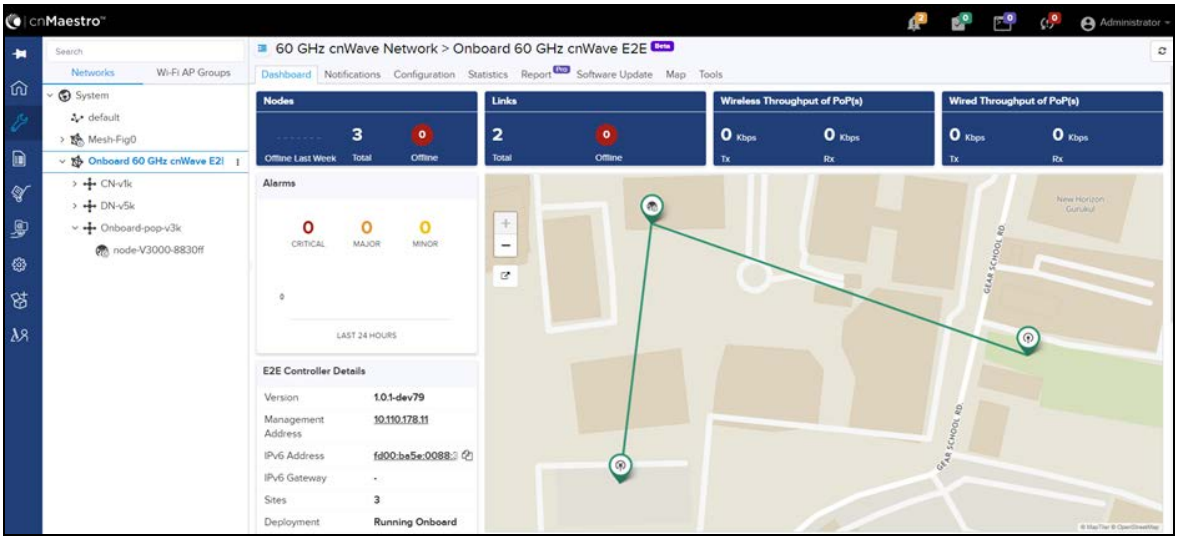
4. Click **Enable**.
5. New E2E Network appears in cnMaestro. Click **Approve** to manage it.



6. The **Network Onboard** window appears and provides option to edit network name.
7. Click **Save**.



After the successful onboarding of E2E Network, it can be managed through cnMaestro.


cnMaestro
Administrator
Search
Networks
Wi-Fi AP Groups
System
default
Mesh-Fig0
Onboard 60 GHz cnWave E2I
CN-v1k
DN-v5k
Onboard-pop-v3k
node-V3000-8830ff
60 GHz cnWave Network > Onboard 60 GHz cnWave E2E
Beta
Dashboard
Notifications
Configuration
Statistics
Report
Software Update
Map
Tools
Nodes
3
Offline Last Week
Total
0
Offline
Links
2
Total
0
Offline
Wireless Throughput of PoP(s)
0 Kbps
Tx
0 Kbps
Rx
Wired Throughput of PoP(s)
0 Kbps
Tx
0 Kbps
Rx
Alarms
0
CRITICAL
0
MAJOR
0
MINOR
LAST 24 HOURS
E2E Controller Details
Version
1.0.1-dev79
Management Address
10.110.178.11
IPv6 Address
fd00:ba5e:0088:
IPv6 Gateway
-
Sites
3
Deployment
Running Onboard
GEAR SCHOOL RD
GEAR SCHOOL RD

Chapter 8: Regulatory Information

This chapter provides regulatory notifications.

Caution

Intentional or unintentional changes or modifications to the equipment must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty.

Attention

Les changements ou modifications intentionnels ou non intentionnels à l'équipement ne doivent pas être effectués sauf avec le consentement exprès de la partie responsable de la conformité. De telles modifications pourraient annuler l'autorisation de l'utilisateur à faire fonctionner l'équipement et annulera la garantie du fabricant.

The following topics are described in this chapter:

- Compliance with safety standards lists the safety specifications against which the 60 GHz cnWave™ Family of ODUs has been tested and certified. It also describes how to keep RF exposure within safe limits.
- Compliance with radio regulations describes how the 60 GHz cnWave™ Family of ODUs complies with the radio regulations that are in force in various countries

Compliance with safety standards

This section lists the safety specifications against which the 60 GHz cnWave™ Platform Family has been tested and certified. It also describes how to keep RF exposure within safe limits.

Electrical safety compliance

The 60 GHz cnWave™ Platform Family hardware has been tested for compliance to the electrical safety specifications listed in following Safety compliance specifications table.

Table 27 : Safety compliance specifications

Region	Specification
USA	UL 62368-1, UL 60950-22
Canada	CSA C22.2 No.62368-1, CSA C22.2 No. 60950-22
Europe	EN 62368-1, EN 60950-22
International	CB certified IEC 62368-1 Edition 2 IEC 60950 -22

Electromagnetic compatibility (EMC) compliance

The EMC specification type approvals that have been granted for 60 GHz cnWave™ Platform Family are listed in following table.

Table 28 :EMC compliance

Region	Specification
USA	FCC Part 15 Class B
Canada	RSS Gen
Europe/International	EN 301 489-1 V2.1.1, EN 301 489-17 V3.1.1

Human exposure to radio frequency energy

Relevant standards (USA and EC) applicable when working with RF equipment are:

- ANSI IEEE C95.1-2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
- Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC) and respective national regulations
- *Directive 2013/35/EU - electromagnetic fields* of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and repealing Directive 2004/40/EC.
- US FCC limits for the general population. See the FCC web site at http://www.fcc.gov, and the policies, guidelines, and requirements in Part 1 of Title 47 of the Code of Federal Regulations, as well as the guidelines and suggestions for evaluating compliance in FCC OET Bulletin 65
- Health Canada limits for the general population. See the Health Canada web site at https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/limits-human-exposure-radiofrequency-electromagnetic-energy-frequency-range-3-300.html and Safety Code 6
- EN 62232: 2017 Determination of RF field strength, power density and SAR in the vicinity of radiocommunication base stations for the purpose of evaluating human exposure (IEC 62232:2017)
- EN 50385:2017 Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when placed on the market
- ICNIRP (International Commission on Non-Ionizing Radiation Protection) guidelines for the general public. See the ICNIRP web site at https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf and Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields.

Power density exposure limit

Install the radios for the 60 GHz cnWave™ Platform Family of wireless solutions so as to provide and maintain the minimum separation distances from all persons.

The applicable FCC power density exposure limit for RF energy in the 57 – 66 GHz frequency bands is 10 W/m^2. For more information, see Human exposure to radio frequency energy.

Calculation of power density

The following calculation is based on the ANSI IEEE C95.1-1991 method, as that provides a worst case analysis.

Peak power density in the far field of a radio frequency point source is calculated as follows:

$$S = \frac{P.G}{4\pi d2}$$

Where:

S: power density in W/m^2

p: maximum average transmit power capability of the radio, in W

G: total Tx gain as a factor, converted from dB

d: distance from point source, in m

Rearranging terms to solve for distance yields:

$$d = \sqrt{P.G/4\pi S}$$

Calculated distances and power compliance margins

The following tables show calculated recommended separation distances, for the 60 GHz cnWave™ for Europe the USA and Canada. These are conservative distances that include compliance margins.

Note

Les tableaux suivants indiquent les distances de séparation recommandées calculées pour le cnWave ™ 60 GHz pour l'Europe, les États-Unis et le Canada. Ce sont des distances prudentes qui incluent des marges de conformité.

At these and greater separation distances, the power density from the RF field is below generally accepted limits for the general population.

Note

À ces distances de séparation et à des distances supérieures, la densité de puissance du champ RF est inférieure aux limites généralement acceptées pour la population générale.

60 GHz cnWave™ Platform Family ODU adheres to all applicable EIRP limits for transmit power when operating in MIMO mode. Separation distances and compliance margins include compensation for the antenna configuration of each product.

Note

L'ODU de la famille de plates-formes cnWave ™ 60 GHz respecte toutes les limites EIRP applicables pour la puissance de transmission lors d'un fonctionnement en mode MIMO. Les distances de séparation et les marges de conformité incluent la compensation de la configuration d'antenne de chaque produit.

Table 29 :Calculated distances and power compliance margins

Product	Countries	EIRP (dBm)	EIRP (W)	Maximum power density (W/m^2)	Compliance distance (m)
V1000	USA, Canada, EU	38	6.3	10	0.22
V3000	USA, Canada	60.5	1122	10	3.0
V3000	EU	55	316.2	10	1.6
V5000	USA, Canada, EU	38	6.3	10	0.22

Note

The regulations require that the power used for the calculations is the maximum power in the transmit burst subject to allowance for source-based time-averaging.

The calculations above are based upon platform maximum EIRP and worst case 100% duty cycle.

Remarque

Les réglementations exigent que la puissance utilisée pour les calculs soit la puissance maximale de la rafale d'émission sous réserve de la moyenne temporelle basée sur la source.

Les calculs ci-dessus sont basés sur la PIRE maximale de la plate-forme et le pire des cas, un cycle de service de 100%.

Compliance with radio regulations

This section describes how the 60 GHz cnWave™ Platform Family complies with the radio regulations that are in force in various countries.

Caution

Where necessary, the end user is responsible for obtaining any National licenses required to operate this product and these must be obtained before using the product in any particular country. Contact the appropriate national administrations for details of the conditions of use for the bands in question and any exceptions that might apply.

Attention

Le cas échéant, l'utilisateur final est responsable de l'obtention des licences nationales nécessaires pour faire fonctionner ce produit. Celles-ci doivent être obtenus avant d'utiliser le produit dans un pays particulier. Contactez les administrations nationales concernées pour les détails des conditions d'utilisation des bandes en question, et toutes les exceptions qui pourraient s'appliquer.

Caution

Changes or modifications not expressly approved by Cambium Networks could void the user's authority to operate the system.

Attention

Les changements ou modifications non expressément approuvés par les réseaux de Cambium pourraient annuler l'autorité de l'utilisateur à faire fonctionner le système.

Type approvals

The system has been tested against various local technical regulations and found to comply. Radio specifications section list the radio specification type approvals that have been granted for the 60GHz cnWave products.

Some of the frequency bands in which the system operates are “license exempt” and the system is allowed to be used provided it does not cause interference. In these bands, the licensing authority does not guarantee protection against interference from other products and installations.

Region	Regulatory approvals	FCC ID	IC ID
USA	Part 15C	QWP-60V1000 QWP-60V3000 QWP-60V5000	
Canada	ISED RSS-210		109AO-60V1000 109AO-60V3000 109AO-60V5000

FCC compliance

The 60 GHz cnWave™ V1000, V3000 and V5000 comply with the regulations that are in force in the USA.

Caution

If this equipment does cause interference to radio or television reception.

FCC notification

This device complies with part 15C of the US FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

ISEDC compliance

The 60 GHz cnWave™ V1000, V3000 and V5000 comply with the regulations that are in force in the Canada.

Caution

If this equipment does cause interference to radio or television reception.

Attention

Si cet équipement cause des interférences à la réception radio ou télévision.

60 GHz cnWave™ example product labels

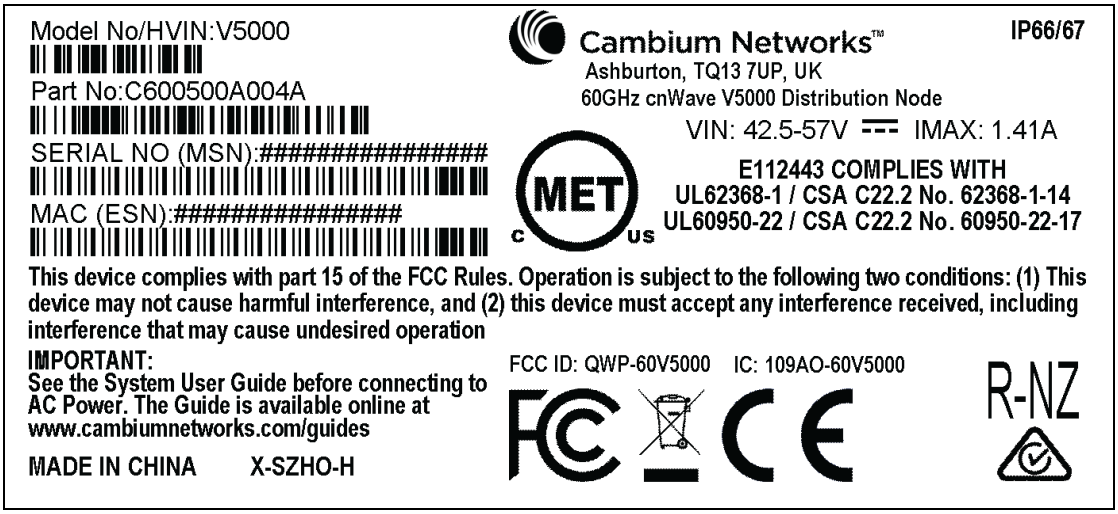


Figure 1 : *60 GHz cnWave™ V5000 Distribution Node*

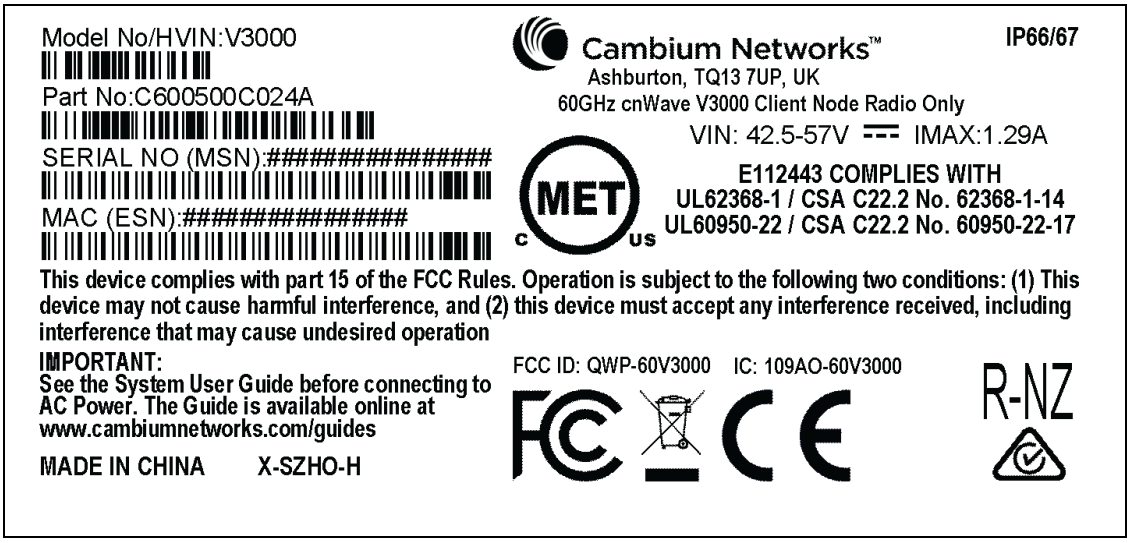


Figure 2 : *60 GHz cnWave™ V3000 Client Node Radio only*

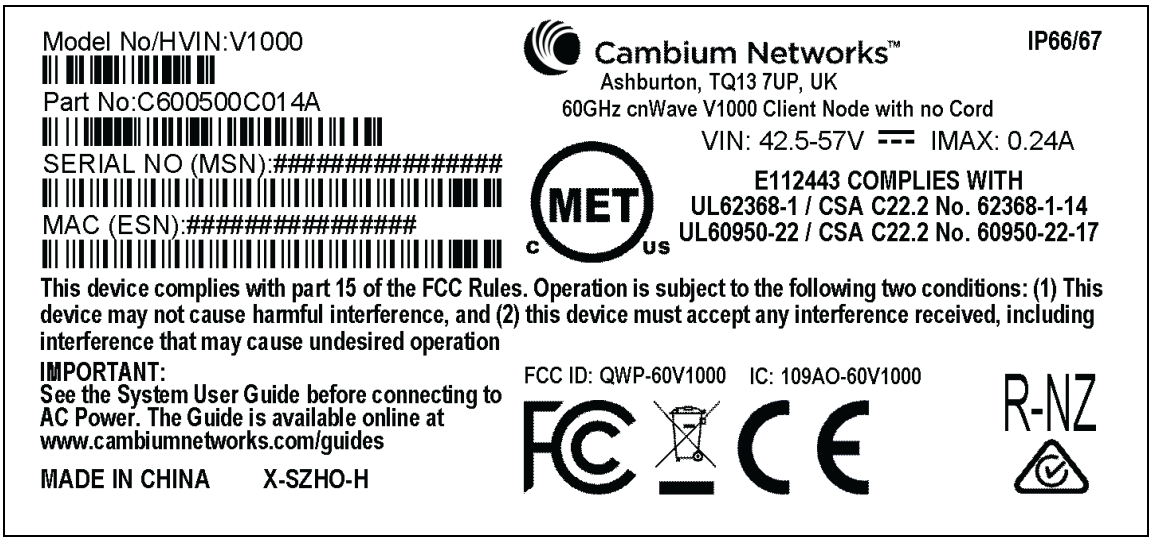


Figure 3 : *60 GHz cnWave™ V1000 Client Node with no cord*

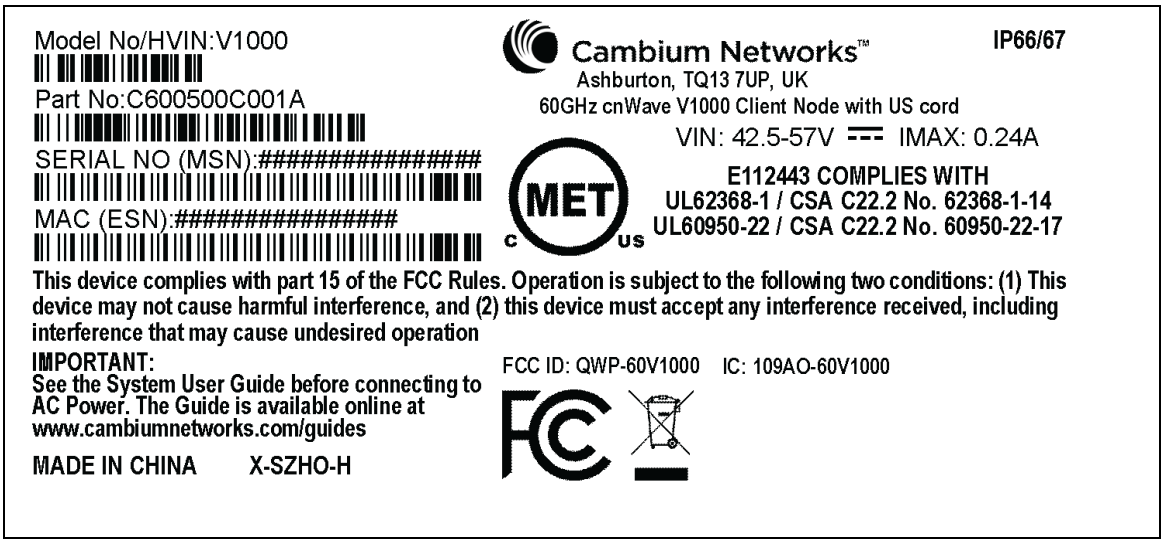


Figure 4 : *60 GHz cnWave™ V1000 with US cord*

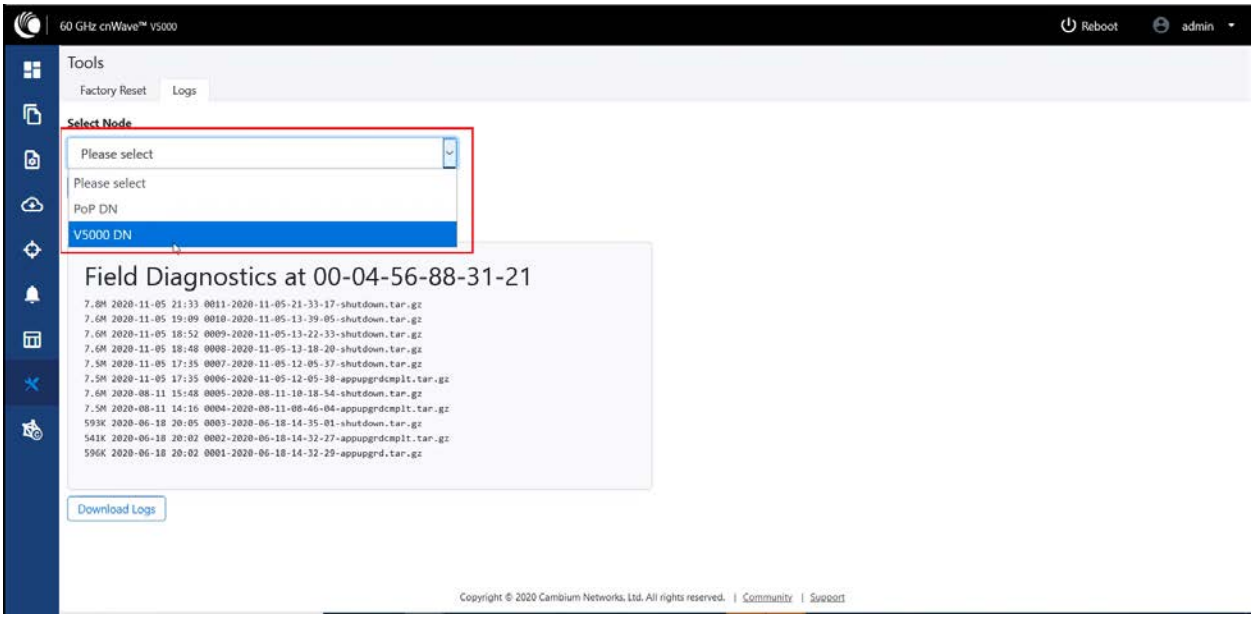
Accessory	Radio nodes	Cambium Part Number
60 GHz cnWave™ V5000 Distribution Node	V5000	C6000500A004A
60 GHz cnWave™ V3000 Client Node Radio only	V3000	C600500C024A
60 GHz cnWave™ V1000 Client Node with no cord	V1000	C600500C14A
60 GHz cnWave™ V1000 with US cord	V1000	C600500C001A

Chapter 9: Troubleshooting

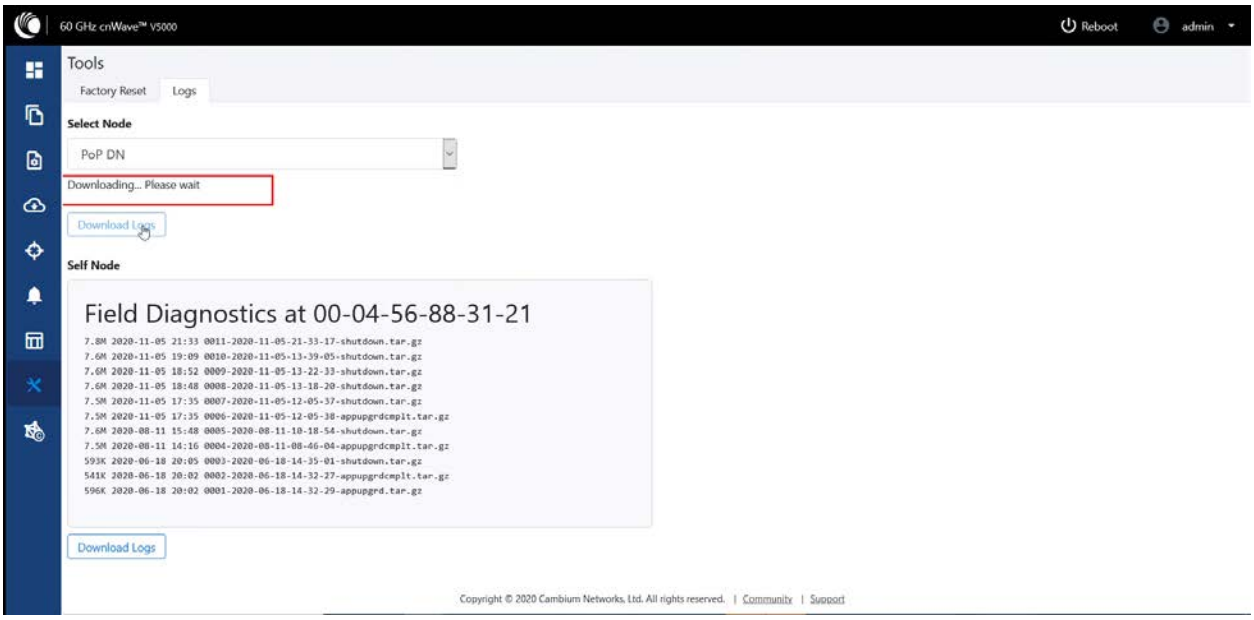
This section describes the troubleshooting steps and addresses frequently asked questions related to 60 GHz product deployment.

Field diagnostics logs

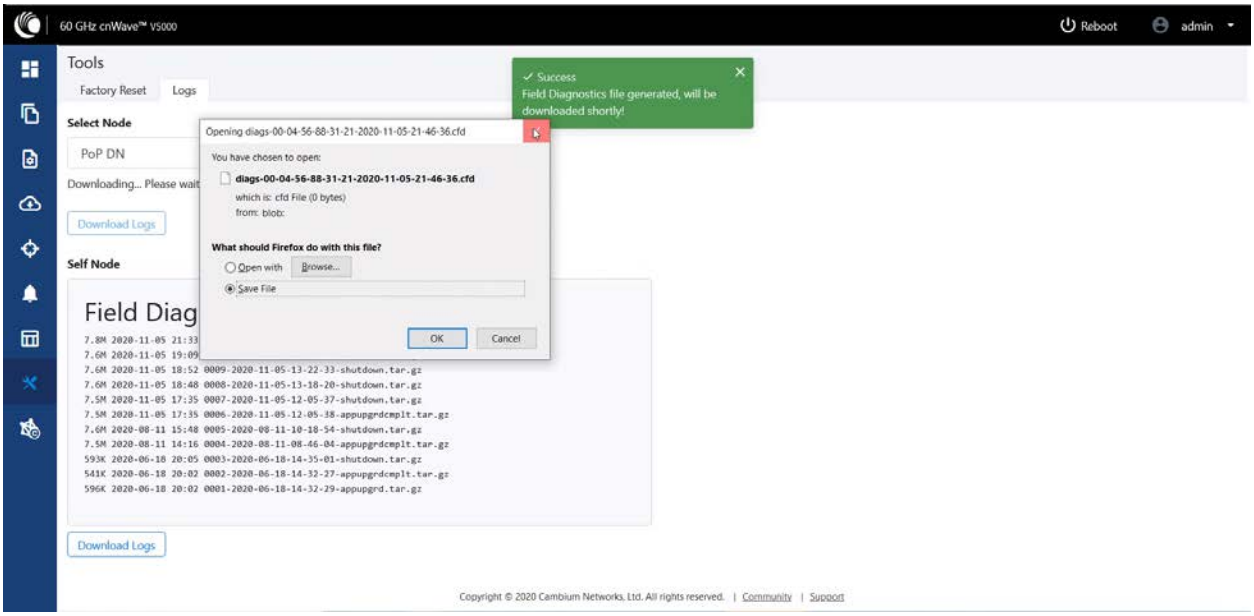
Download the logs to view more information about the error. To download the error logs select the node from the drop-down and click **Download Logs**.



After clicking **Download Logs**, downloading status is displayed.



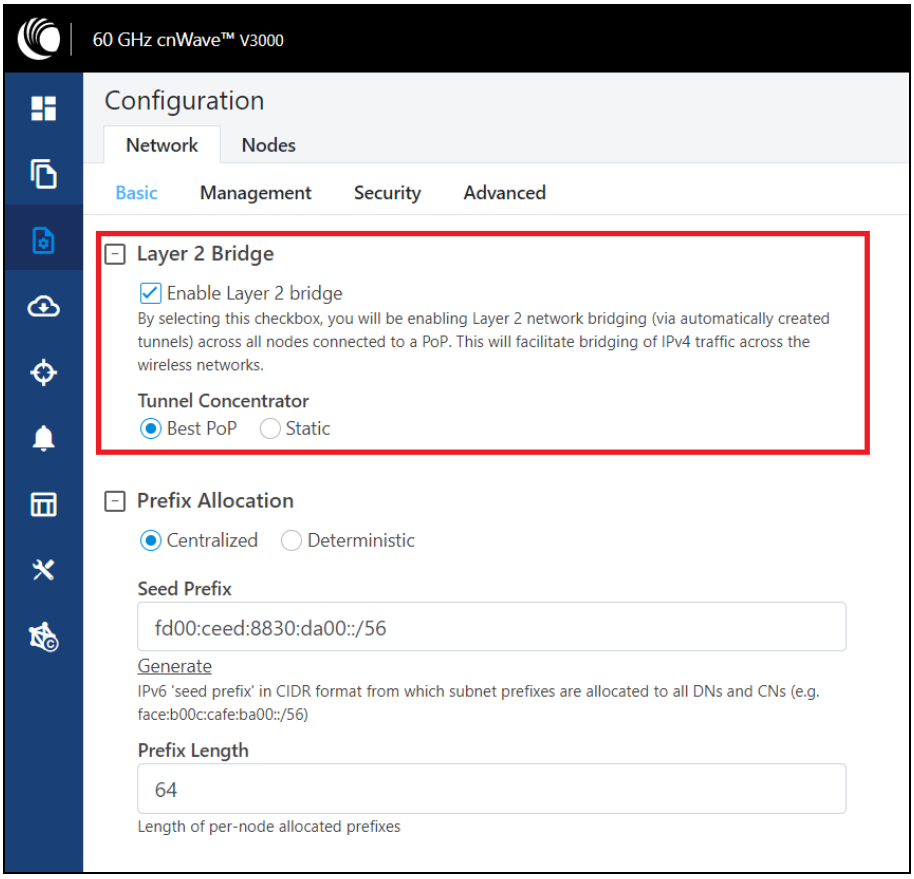
To download the logs for self node, click **Download Logs** at the bottom and save the log file.



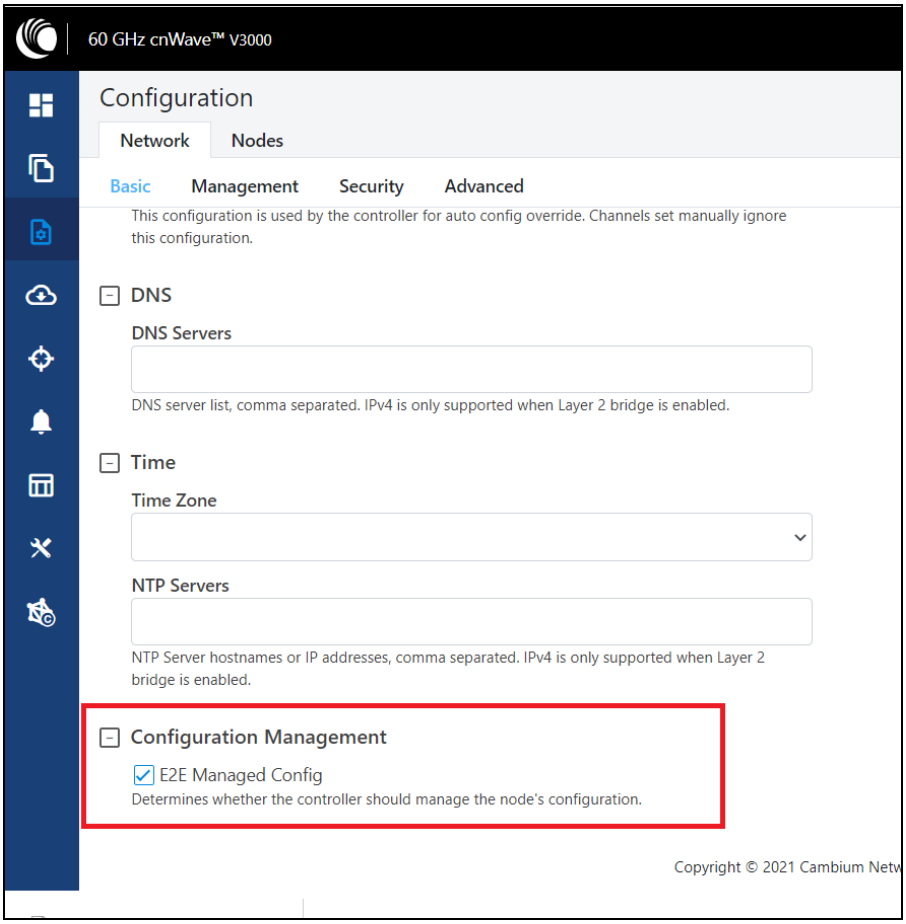
Setup issues in IPv4 tunneling

In IPv4 tunneling, if setup issues occurs then perform the below steps:

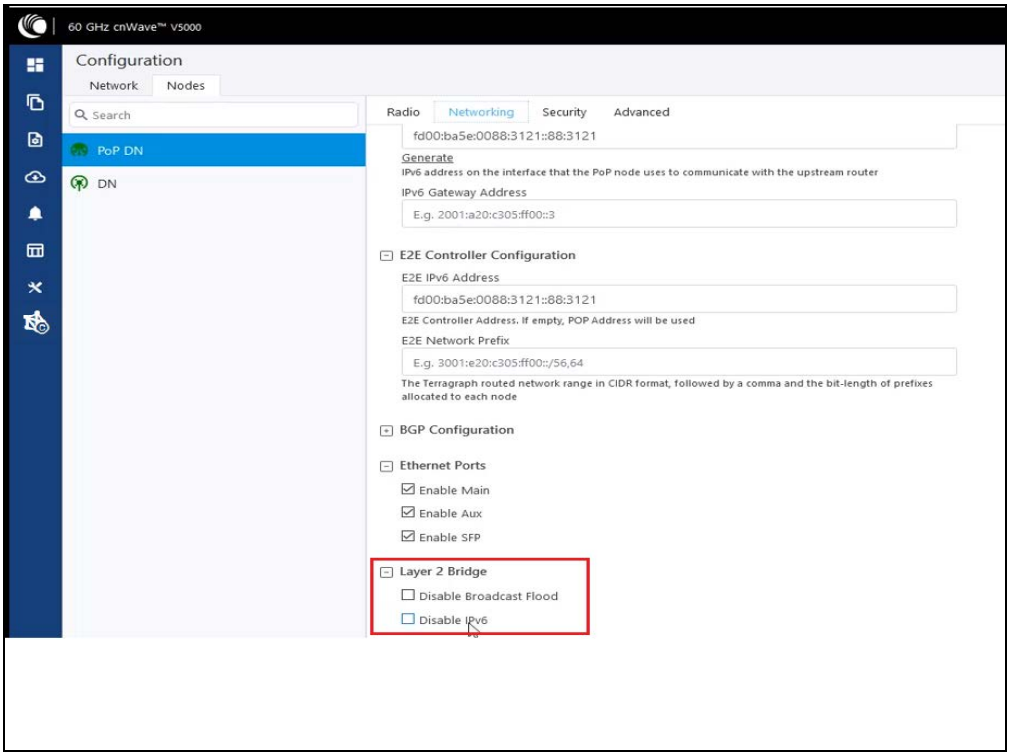
1. Click **Configuration** on the left pane, navigate to **Network** > **Basic** > **Layer 2 Bridge** and verify **Enable Layer 2 bridge** is selected.


60 GHz cnWave™ V3000
Configuration
Network
Nodes
Basic
Management
Security
Advanced
Layer 2 Bridge
Enable Layer 2 bridge
By selecting this checkbox, you will be enabling Layer 2 network bridging (via automatically created tunnels) across all nodes connected to a PoP. This will facilitate bridging of IPv4 traffic across the wireless networks.
Tunnel Concentrator
Best PoP
Static
Prefix Allocation
Centralized
Deterministic
Seed Prefix
fd00:ceed:8830:da00::/56
Generate
IPv6 'seed prefix' in CIDR format from which subnet prefixes are allocated to all DNs and CNs (e.g. face:b00c:cafe:ba00::/56)
Prefix Length
64
Length of per-node allocated prefixes

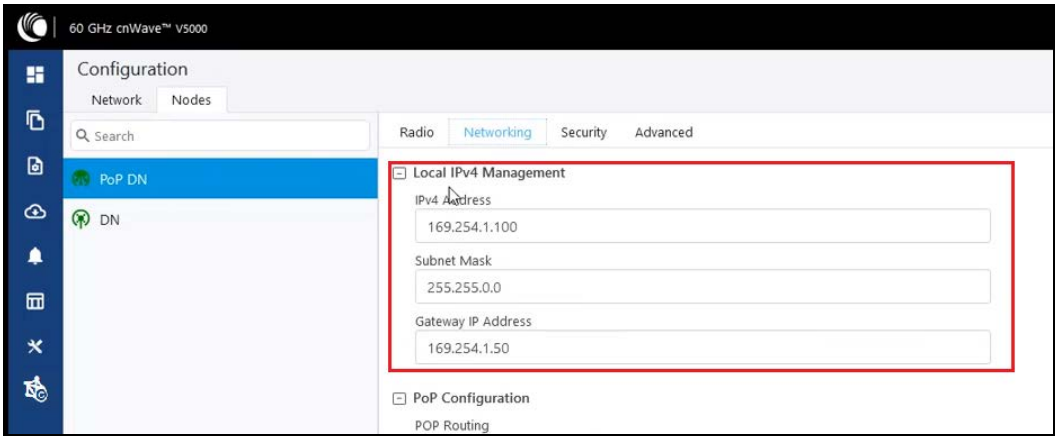
2. On the same page under **Configuration Management**, verify **E2E Managed Config** is selected.

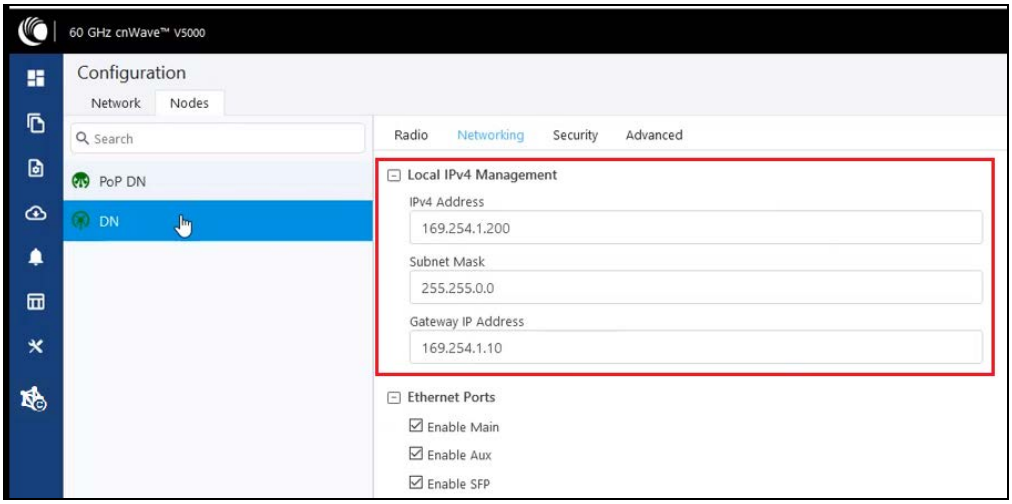


3. Click **Configuration** > **Nodes** > **PoP DN** > **Networking** > **Layer 2 Bridge** and verify **Disable Broadcast Flood** and **Disable IPv6** are disabled.



4. Ensure that PoP DN and DNs are in the same subnet and verify gateway is correct.

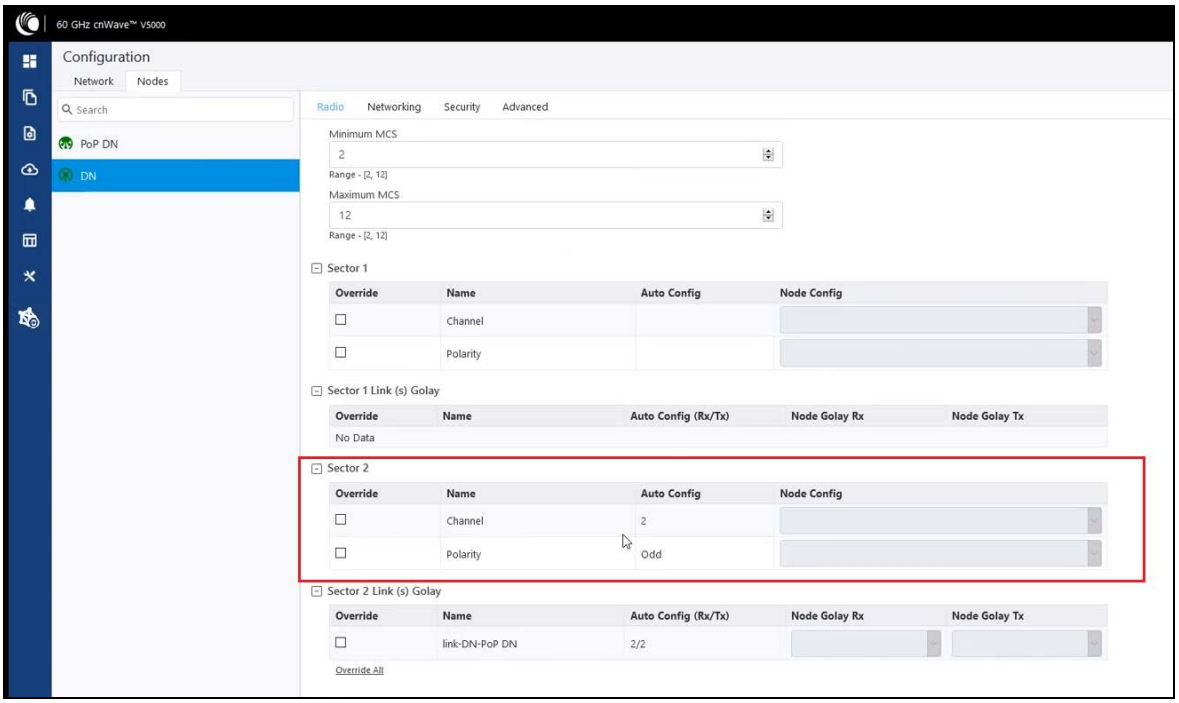




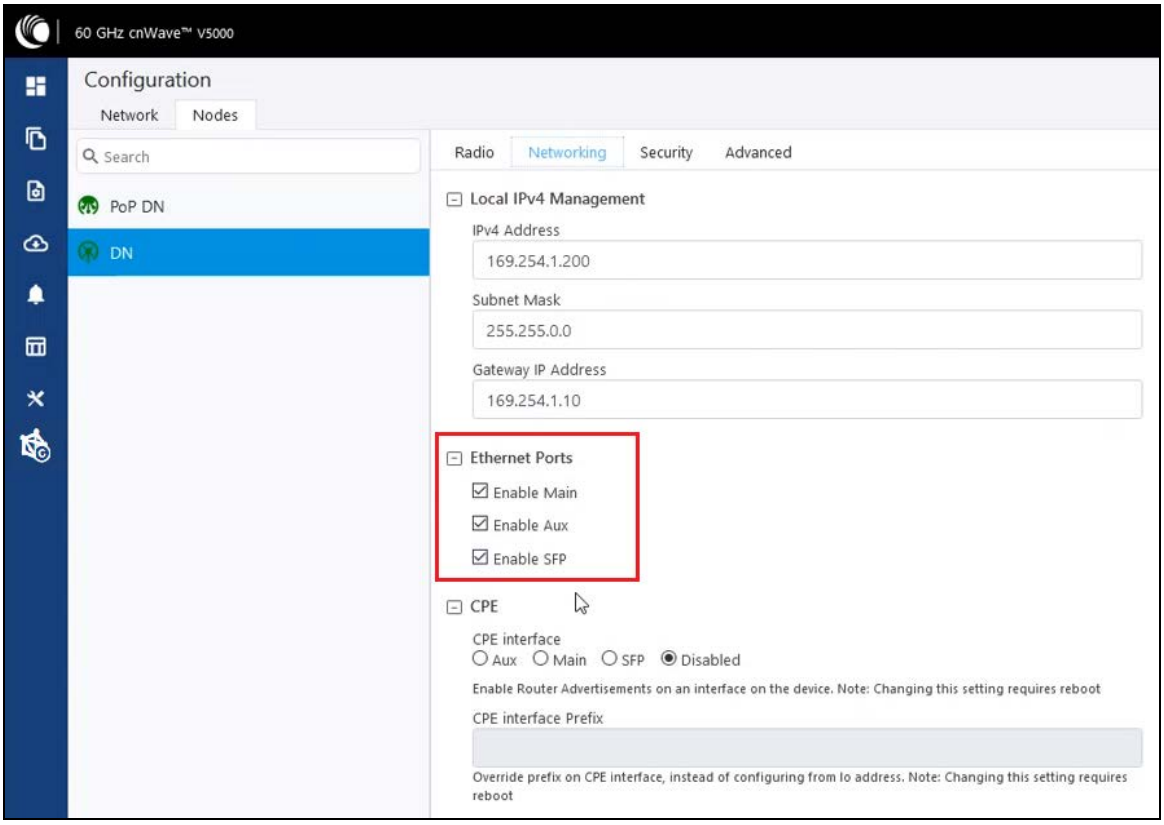
Link is not established

If link is not established between the nodes, then verify the below options:

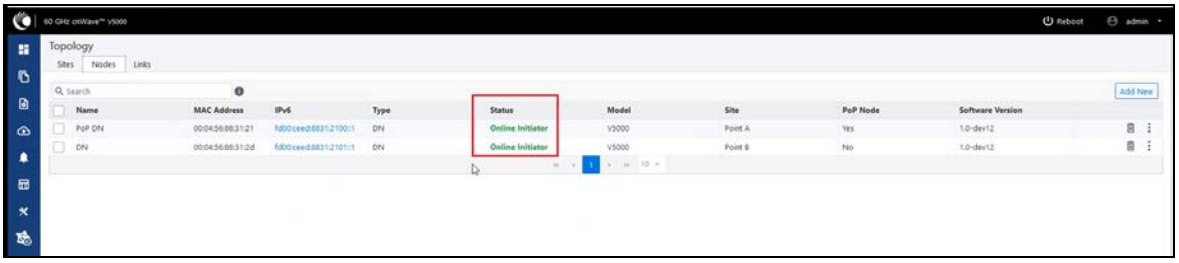
1. Click **Configuration** on the left panel, go to **Nodes** > **Radio** and verify Sector 2 PoP DN and DN's polarities, frequency and Golay codes.



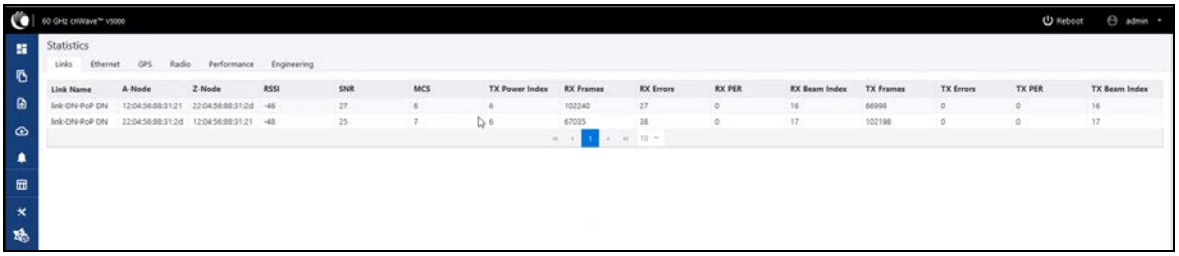
2. Select **DN** > **Networking** > **Ethernet Ports**, and ensure that specific Ethernet ports are enabled.



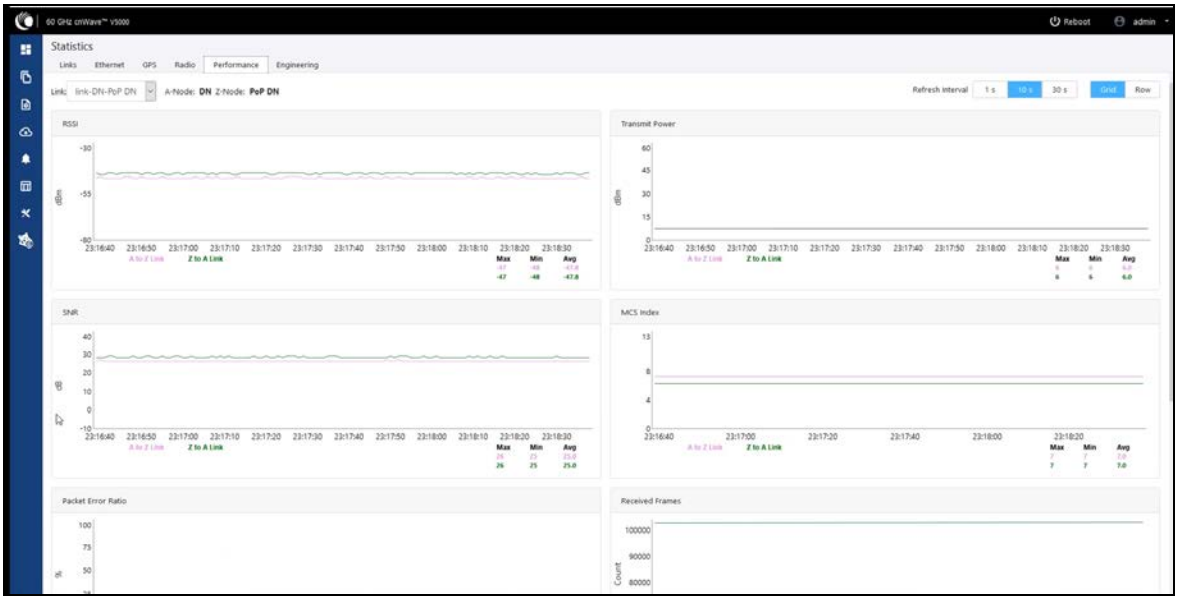
3. Click **Topology** on left pane, go to **Nodes** and verify Status is **Online Initiator**.



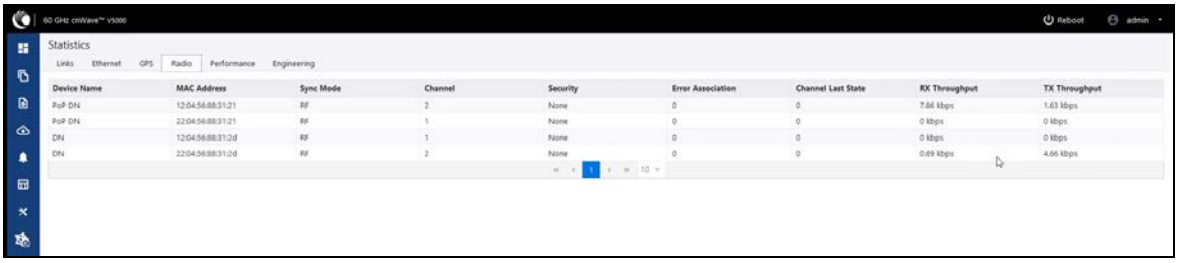
4. Click **Statistics** on left pane, go to **Links** and verify **RSSI**, **MCS**, **TX Power Index**.



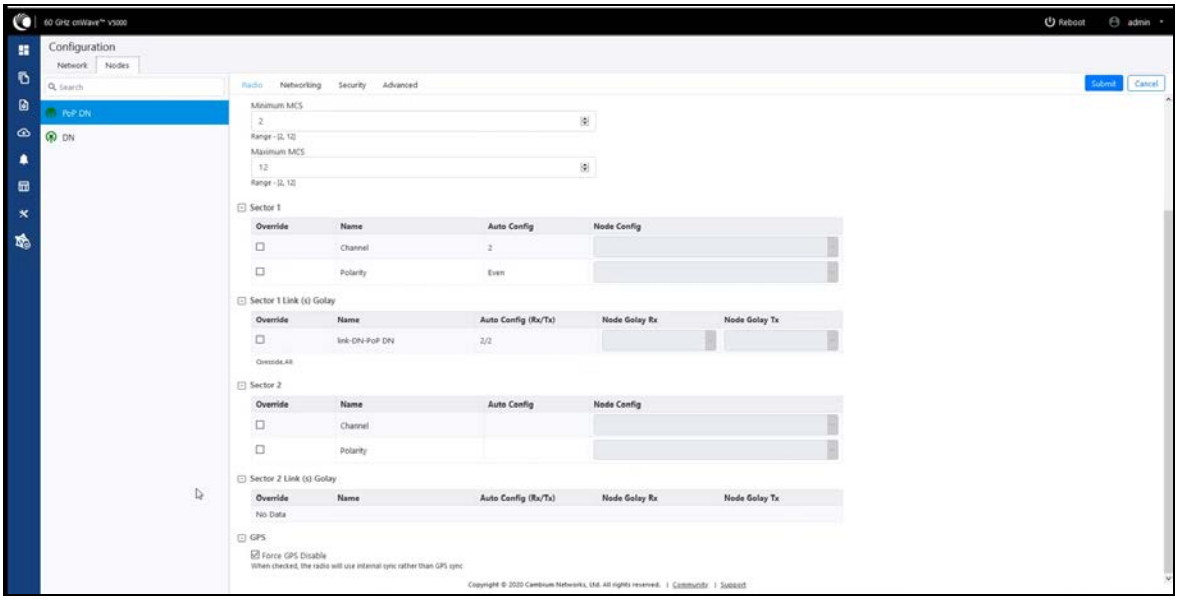
5. Go to **Performance** and verify the graphs.



6. Go to **Radio** and monitor the throughput capacity.



7. If internal GPS is used, then verify **Configuration** > **Nodes** > **Radio** > **GPS** > **Force GPS Disable** is enabled.



PoP not online from E2E/cnMaetro GUI

This usually means that the PoP node is not able to talk to the E2E controller. Ensure that the PoP node has the E2E IPv6 configured properly. Also ensure that there is a route between the E2E controller and the PoP node, if they are not in the same VLAN. Try to ping the E2E from the PoP node (login to ssh).

Link not coming up

1. Ensure that the two ends of the radios can see each other (clear line of sight in between). If the link is using V3000, ensure that they are properly aligned.
2. Ensure that MAC address of the radios are configured correctly in the E2E Controller.
3. Ensure that GPS sync is not enabled if indoor and ensure that GPS sync is enabled if outdoor.
4. Ensure that both ends of the link has the same software version.
5. Ensure to configure country code on the E2E GUI.
6. Ensure that the two ends of the link use opposite polarity and Golay codes that matches each other.
7. Ensure that the remote ends can reach the E2E Controller – IPv6 configuration (if beamforming is successful but the remote end cannot reach back to the E2E, the E2E/cnMaestro GUI displays link status as up but the remote radio is offline).
8. If you already have experience setting up a link and you are trying to setup a daisy chain, ensure that there is not any interference caused by the existing link. For example, make sure that the two neighboring link use different Golay code.

Link does not come up after some configuration change

There is a possibility that the remote unit could be in a state that it uses different channel/Golay code/polarity from the near-end unit. Try to factory default the remote radio if possible.

On the E2E Controller/cnMaestro, it shows that the link is up, but the remote radio is NOT online - This means that link is established but the remote end radio cannot reply back to the E2E controller. Check the E2E configuration to make sure that the IPv6 default gateway is configured correctly to allow a route between the E2E controller and the remote radio.

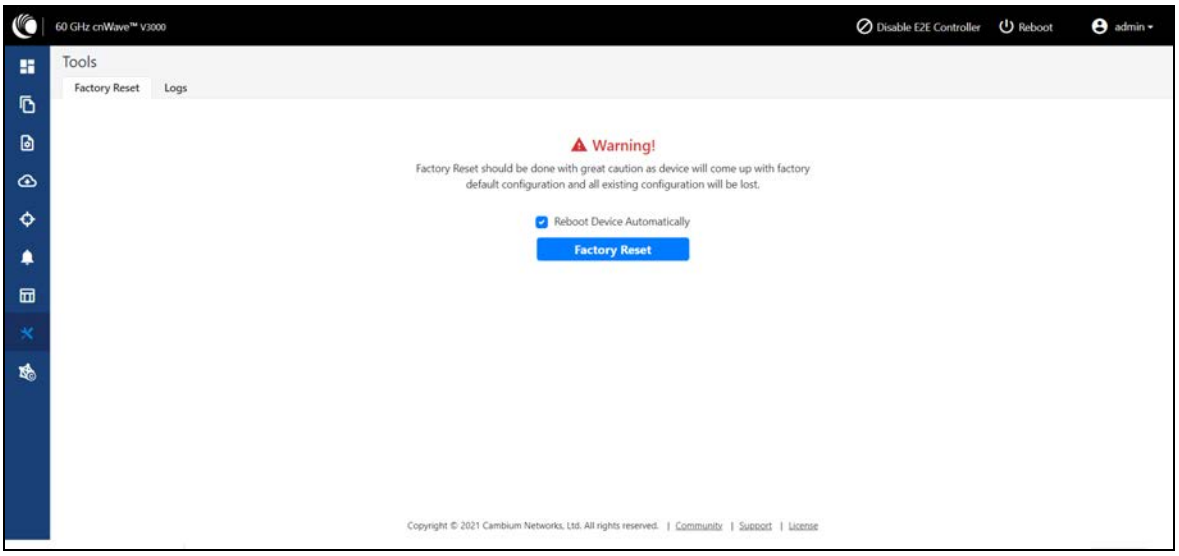
Link not having expected throughput performance

- Check the radio GUI to ensure that the link is running as the expected MCS mode when user data is passing through.
- Check to ensure that the Ethernet ports of the radios and the testing devices are negotiated to expected data rate (10Gbps).
- Ensure that your testing devices are capable of handling the throughput – run data throughput test by bypassing the radio link.
- Do not use radio internal iperf tool to test throughput.

Factory reset

Recovery mode is used to reset the configuration to the factory settings. To reset the configuration, perform the following steps:

1. Go to **Tools** menu and click **Factory Reset**.



Pop-up appears. Confirm to reset the device to factory reset

2. Click **Yes** to reboot.
3. After the reboot, access the device using IP address **169.254.1.1**.

Note

After factory reset, all configuration set to default mode.

Cambium Networks

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