### 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.

	60 GHz criWave to V5000	
-	Statistics	
<b>F</b>	Links Ethernet GPS Radio Performance Prefix Zones Engineering	BGP
	Zone: Primary_PoP-Site • 1 Total 3 Zones	
6	Prefix	
٢	2050:1111:2222:2280::/58	
φ	Nodes	
	Name =	
1	DN3@PoP1@309D	
	DN1@PoP1@3000	
1002	DN2@P0P2@3009	
*	Prim-PoP@3000	
动		
10078-0		

### Engineering

Engineering page displays the engineering information of system and sector.

10	60 GHz cnWave™ vtc	900							Disable E2E Controller	U Reboot	🔒 admin-
	Statistics										
-	Links Etherne	st GPS Rad	lio Performance	Prefix Zones	Engineering	BGP				D	wnload Statistics
D	System										
٥	Device Name	MAC Address	Uptime			Memory L	Itilization	0	PU Utilization		
	DN2@PoP2@3	00:04:56:88:30:09	6d 15h 42m			23.00 %		9	.02 %		
•	Prim-PoP@300	00:04:56:88:30:0c	6d 15h 42m			50.00 %		8	52 %		
¢.	DN1@PoP1@3	00:04:56:88:30:00	2d 14h 8m			75.00 %		9	.00 %		
	DN3@PoP1@3	00:04:56:88:30:9d	2d 6h 18m			69.00 %		5	50 %		
	DN4@PoP2@3	00:04:56:88:30:17	1d 18h 37m			22.00 %		6	77 %		
						et 8 1	а на 10 на				
	Sector										
*	Device Name	MAC Address	WLAN MAC	Number of Switch	es Bas	eband Temperature	RF Tile 0 Temperature	RF Tile 1 Temperature	RF Tile 2 Temperature	RF Tile 3	Temperature
14	DN2@PoP2@3	00:04 56:88:30:09	12:04 56:88:30:09	1	57 %	5	55 °C	60 °C	0 °C	0°C	
40	DN2@PoP2@3	00:04:56:88:30:09	22:04:56:88:30:09	2	53 %	5	60 °C	52 °C	0°C	0 °C	
	Prim-PoP@300	00:04:56:88:30:0c	12:04:56:88:30:0c	3	64 *	5	63 °C	66 °C	0 °C	0 °C	
	Prim-PoP@300	00:04:56:88:30:0c	22:04:56:88:30:0c	4	64 *	D.	67 °C	70 °C	0 °C	0 °C	
	DN1@PoP1@3	00:04:56:88:30:00	12:04:56:88:30:00	1	52 *	p	45 °C	63 °C	0 °C	0 °C	
	DN1@PoP1@3	00:04:56:88:30:00	22:04:56:88:30:00	2	57.9	5	66 °C	59 °C	0 °C	0 °C	
	DN3@PoP1@3	00:04:56:88:30:9d	12:04:56:88:30:9d	2	50 %	5	53 °C	51 °C	0 °C	0 °C	
	DN3@PoP1@3	00:04:56:88:30:9d	22:04:56:88:30:9d	1	50 *	0	52 °C	45 °C	0 °C	0 °C	
	DN4@PoP2@3	00:04:56:88:30:17	12:04:56:88:30:17	1	50 %	5	59 °C	0 °C	0 °C	0°C	
						st (c 1	у н 10 т				

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.

00	GHZ chwave - vsoou					21	O Disable E2E Controller	Reboot 🕒 admin -
Ş	Statistics							
	Links Ethernet	GPS Radio Performance	Prefix Zone:	s Engineering BGP				
	A-Sec-PoP							
2	2021::1							
	Details		Advertis	ed Routes		Recei	ved Routes	
	IPv6 Address	2021::1		Network	Next Hop		Network	Next Hop
		Online	1	2020:1111:2222:2200:/56	2021::100	1	::/0	fe80::c6ad:34ff:fe45:aa00
	Status							
	ASN Uptime Prim-PoP@300	65534 Od Oh 4m				2	2020:1111:2222:2200::/56	fe80::c6ad:34ff:fe45:aa00
	Status           ASN           Uptime           Prim-PoP@300           ter-PoP          2021::1           Details	65534 0d 0h 4m	Advertis	ed Routes		2 Recei	2020:1111:2222:2200://56	fe80:::c6ad:34ff:fe45:aa00
	Status ASN Uptime Prim-PoP@300 ter-PoP 2021::1 Details IPv6 Address	65534 0d 0h 4m 00	Advertis	ed Routes Network	Next Hop	2 Receiv	2020:1111:2222:2200://56	ree0:::c6ad:34ff:fe45:aa00
	Status ASN Uptime Prim-PoP@300 ter-PoP 2021::1 Details IPv6 Address Status	65534 0d 0h 4m 00	Advertis	ed Routes Network	Next Hop	2 Received	2020:1111:2222:2200::/56	fe80::c6ad:34ff:fe45:aa00
	Status ASN Uptime  Prim-PoP@300 ter-PoP  2021::1  Details IPv6 Address Status ASN	65534 0d 0h 4m 00 2021::1 0ffline 65534	Advertis	ed Routes Network	Next Hop	2 Received	2020:1111:2222:2200::/56	fe80::c6ad:34ff;fe45:aa00 Next Hop fe80::c6ad:34ff;fe45:aa00 fe80::c6ad:34ff;fe45:aa00

# 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**.

	60 GHz cnWave <sup>w</sup> vsooo	U Reboot	🖯 admin 🔹
-	Tools		
Б	Factory Reset Logs		
	Select Node		
۵	Please select		
	Please select		
œ	PoP DN		
÷	V5000 DN		
	Field Diagnostics at 00-04-56-88-31-21		
	7.8M 2020-11-05 21:33 0011-2020-11-05-21-33-17-shutdown.tar.gz 7.6M 2020-11-05 19:09 0010-2020-11-05-13-39-05-shutdown.tar.gz		
	7.6M 2020-11-05 18:52 0009-2020-11-05-13-22-33-shutdown.tar.gz 7.6M 2020-11-05 18:40 0008-2020-11-05-13-18-20-shutdown.tar.gz		
	7.5M 2020-11-05 17:35 0007-2020-11-05-12-05-37-shutdown.tar.gz 7.5M 2020-11-05 17:35 0006-2020-11-05-12-05-38-appupgrdcmplt.tar.gz		
	7.6M 2020-08-11 15:48 0005-2020-08-11-10-18-54-shutdown.tar.gz 7.5M 2020-08-11 14:16 0004-2020-08-11-08-46-04-appupgrdcmplt.tar.gz		
10	593K 2020-06-18 20:05 0003-2020-06-18-14-35-01-shutdown.tar.gz 541K 2020-06-18 20:02 0002-2020-06-18-14-32-27-appupgrdcmplt.tar.gz		
	596K 2020-06-18 20:02 0001-2020-06-18-14-32-29-appupgrd.tar.gz		
	Download Logs		
	Copyright © 2020 Cambium Networks, Ltd. All rights reserved.   Community   Support		

Figure 17 : Logs tab

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

	60 GHz criWøve <sup>tta</sup> V5000	U Reboot	🕒 admin 🝷
	Tools Factory Reset Logs		
D	Select Node		
۵	PoP DN ~		
⊛	Downloading_Please wait Download tags		
¢	Self Node		
<u> </u>	Field Diagnostics at 00-04-56-88-31-21		
	7.8M 2020-11-05 21:33 0011-2020-11-05-21-33-17-thutdown.tar.gz 7.0M 2020-11-05 19:09 0010-2020-11-05-13-39-05-thutdown.tar.gz 7.6M 2020-11-05 19:09 0010-2020-11-05-13-39-05-thutdown.tar.gz		
*	7.6# 2020-11-05 18:48 0008-2020-11-05-13-18-20-shutdown.tar.gz 7.5# 2020-11-05 17:35 0007-2020-11-05-12-05-37-shutdown.tar.gz		
1	7.58 2202-11-05 17:35 0006-2020-11-05-12-05-38 appuggtemplt.tar.gr 7.68 2202-08-11 15:48 0056-2020-08:11-18-18:45-shuthem.ter.gr 7.58 2202-08-11 17:16 0006-2020-08:11-08-46-04-appuggtemplt.tar.gr 59K 2202-06-18 20:05 0003-2020-06-18-14-53-27-appuggtemplt.tar.gr 54K 2020-06-18 20:02 0003-2020-06-18-14-32-29-appuggtemplt.tar.gr		
	Download Logs		
	Copyright @ 2020 Cambium Networks, Ltd. All rights reserved.   Community   Support		

Figure 18 : Download status

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

	60 GHz cnWave™ V5000		( Reboot	🕒 admin 🔹
	Tools Factory Reset Logs	✓ Success × Field Diagnostics file generated, will be downloaded shortb/		
.0	Select Node	Opening diags-00-04-56-88-31-21-2020-11-05-21-46-36.ctd		
٦	PoP DN	You have chosen to open:		
٩	Downloading Please wait	C dlags-00-04-56-88-31-21-2020-11-05-21-46-36.cfd which is: cfd File (0 bytes) from: blob:		
¢	Self Node	What should Firefox do with this file?		
•	Field Diag	@ Save File		
	7.8M 2020-11-05 21:33	OK Cancel		
*	7.6M 2020-11-05 19:09 7.6M 2020-11-05 18:52 7.6M 2020-11-05 18:52 7.6M 2020-11-05 18:48 7.5M 2020-11-05 17:35 7.5M 2020-11-05 17:35	0009-2020-11-05-13-3-shutdown,tar.gz 0005-2020-11-05-13-8-20-shutdown,tar.gz 0007-2020-11-05-12-05-37-shutdown,tar.gz 0006-2020-11-05-12-05-38-appugmenplt.tar.gz		
10	7.64 2020-08-11 15:48 7.5M 2020-08-11 14:16 593% 2020-06-18 20:05 541% 2020-06-18 20:02 596K 2020-06-18 20:02	0005-2020-06-11-10-10-55-shutdown,tar.gz 0002-2020-06-110-36-40-4-appografemplt.tar.gz 0002-2020-06-110-14-35-01-shutdown.tar.gz 0002-2020-06-18-14-32-27-appuggrd.mplt.tar.gz 00021-2020-06-18-14-32-27-appuggrd.tar.gz		
	Download Logs	Copyright © 2020 Cambium Networks, Ltd. All rights reserved.   <u>Commutility</u>   Support		

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

	60 GHz cnWave <sup>™</sup> V5000		Enable Layer 2 bridge		U Reboot	😝 admin 🗸
-	Onboard E2E Controller		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.			
6		This service er	Prefix Allocation <ul> <li>Centralized</li> <li>Deterministic</li> </ul>	vork. This includes		
Ð		network topol	- cnMaestro	ation management.		
④			Remote Management Enable Disable			
۰			cnMaestro URL			
			https://10.110.186.47			
*			Cambium ID cnmaestro_on_premises			
聯			Onboarding Key			
			Enable	r I		
				·		

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

()   c	Maestro	🖉 🧟 🖆	\$1 <b>9</b>	Administrator +
-10	Search	60 GHz cnWave Network > 60 GHz cnWave E2E-V5WH0043VP85		0
~	Networks Wi-Fi AP Groups			
w	~ 🕲 System			
8	A. default	$60 \text{ GHz cn} \text{Mayo}^{\text{Beta}}$		
1.000	60 GHz cnWave E2E-V5WH New			
	~ 🏷 Mesh-Fig0			
ø	> 🔆 CN1-Site-08			
e	> 🔆 CN2-Site-75			
9	> 🕂 DN1-Site-39			
573	> 🕂 DN2-Site-B0			
693	> 🕂 DN3-Site-3D			
醫	> 🕂 PoPI-Site-DC			
		New EZE Network discovered		
78		Approve this network to manage via cnMaestro		
		Approve Delete		
		Copyright © 2015 - 2021 Cambium Networks, Ltd. All rights reserved.   Version 2.5:0-677   Cammunity   Suspart   Hala   License		A

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

() cr	Maestro						P	0	2	61,9	e Administrator -
▲ ∩ / ■ 《 學 ◎ 청 XX	Securit         Weikrick         Wi-Fr, AP Groups           * System         Ar default         Securit           * Son GHz cr/Wave E2E-V5WH         Securit	60 GHz cnWave Net 60 GHZ cn	60 GHz criffere - Network Or Name Deboard 60 GHz <u>criffere</u> E2( Exe Seve	nboard	EZE Network discov enywork to manage v enywork to enywork to eny	ered we criticestro					▲ Animatical Control = 1

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

399101	60 GHz cnl	Wave Network	> Onboard 60 GH	Iz cnWave E2E 📖				
Networks Wi-Fi AP Groups	Dashboard Notif	ications Configura	ition Statistics Report	Software Update Map	o Tools			
~ 😨 System	Nodes		Links		Wireless Thro	ughput of PoP(s)	Wired Through	hput of PoP(s)
<ul> <li>default</li> <li>Mesh-Fig0</li> </ul>		3 🧿	2	0	O Kbps	O Kbps	O Khps	O Kbps
Onboard 60 GHz cnWave E21 1	Alarma	iosa Onine	IOSA	Chille	. IX	RX	IX	KX
> + DN-v5k								New Horizon
<ul> <li>✓</li></ul>	0	0 0	+	X			2	
node-V3000-8830ff	CRITICAL	MAJOR MINOR					700	
			2				9	
	0						667	
	LA	ST 24 HOURS						0
	E2E Controller Det	ST 24 HOURS						9
	E2E Controller Det	tails 1.0.1-dev79						9
	LA E2E Controller De Version Management Address	st 24 HOURS tails 1.0.1-dev79 10.110.178.11					Or NOOK	9
	LA E2E Controller De Version Management Address IPv6 Address	tails 1.0.1-dev79 10.110.178.11 fd00-ba5e:00	88.2 C				An SCHOOL RD	
	E2E Controller De Version Management Address IPv6 Address IPv6 Gateway	tells 1.0.1-dev79 10.110.178.11 fd00:ba5e:00 -	88:2 C	0			Case School and	9
	E2E Controller Der Version Management Address IPV6 Address IPV6 Gateway Sites	tails 1.0.1-dev79 10.110.178.11 fd00:ba5e:00 - 3	880 2	©			General and	0

# 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<sup>™</sup> 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<sup>™</sup> Platform Family hardware has been tested for compliance to the electrical safety specifications listed in following <u>Safety compliance specifications</u> 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 (O 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 <a href="http://www.fcc.gov">http://www.fcc.gov</a>, 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
   <a href="https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/limits-human-exposure-radiofrequency-electromagnetic-energy-frequency-range-3-300.html">https://www.canada.ca/en/health-canada/services/environmental-workplace-health/consultations/limits-human-exposure-radiofrequency-electromagnetic-energy-frequency-range-3-300.html</a> 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 <u>https://www.icnirp.org/cms/upload/publications/ICNIRPemfgdl.pdf</u> 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<sup>™</sup> 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:

$$d = \sqrt[1]{P.G/4\pi S}$$

### 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<sup>™</sup> 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 <sup>2</sup> )	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<sup>™</sup> 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. <u>Radio</u> <u>specifications</u> 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<sup>™</sup> 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<sup>™</sup> example product labels



Figure 1: 60 GHz cnWave™ V5000 Distribution Node



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

Model No/HVIN:V1000	Cambium Networks <sup>™</sup> Ashburton, TQ13 7UP, UK	IP66/67
	60GHz cnWave V1000 Client Node with no Co	rd X: 0.044
SERIAL NO (MSN):####################################		X. U.24A
	(MFT) UL62368-1 / CSA C22 2 No.	VIIH 62368-1-14
MAC (ESN):####################################	UL60950-22 / CSA C22.2 No.	60950-22-17
III III III III III III III III III II	on Operation is subject to the following two conditions	tione: (1) This
device may not cause harmful interference, and (	2) this device must accept any interference receive	ed, including
interference that may cause undesired operation		
See the System User Guide before connecting to	FCC ID: QWP-60V1000 IC: 109AO-60V1000	$P_N7$
AC Power. The Guide is available online at www.cambiumnetworks.com/guides		
MADE IN CHINA X-SZHO-H		Ø

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
- Setup IPv4 tunneling
- Link is not established
- <u>Recovery mode</u>

# **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.

	60 GHz cnWave® V5000	U Reboot	\varTheta admin 🝷
	Tools Factory Reset Logs		
D	Select Node		
۵	PoP DN v		
٢	DownloadingPlease wait		
¢	Self Node		
<ul><li></li><li></li><li></li><li>×</li></ul>	Field Diagnostics at 00-04-56-88-31-21 7.68 2026-11-69 21:33 0011-2020-11-05-21-33-17-ibntdom.tar.gr 7.69 2020-11-69 19:09 0001-2020-11-01-13-19-05-ibntdom.tar.gr 7.69 2020-11-69 18:52 0009-2020-11-95-13-22-33-shutdom.tar.gr 7.69 2020-11-69 18:52 0009-2020-11-95-13-22-33-shutdom.tar.gr 7.69 2020-11-69 18:54 0008-2020-11-95-13-28-20-shutdom.tar.gr		
Ø	7.38 2020-11-05 17/35 0000-2020-11-05-12-05-19-appuggrdmplt.tar.gr 7.08 2020-01-11 15-48 0006-2020 0-11-10-11-01-15-45-01-01-0000 tar.gr 7.58 2020-00-11 12-15-0000-2020-06-10-10-15-45-01-01-0000 tar.gr 7.58 2020-06-11 20:05 0000-2020-06-10-14-30-01-01-0000 tar.gr 558 2020-06-11 20:05 0000-2020-06-10-14-30-01-01-0000 tar.gr 558 2020-06-11 20:02 0000-2020-06-18-14-30-27-appuggrdmplt.tar.gr		
	Copyright © 2020 Cambium Networks, Ltd. All rights reserved.   <u>Community</u>   Support		

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:

 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		
88	Configuration		
_	Network Nodes		
D	Basic Management Security Advanced		
٥	□ Layer 2 Bridge		
œ	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.		
¢	Best PoP Static		
	Prefix Allocation		
	Centralized Oeterministic		
∗	Seed Prefix		
<b>K</b>	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.

	60 GHz cnWave™ V3000
	Configuration
_	Network Nodes
D	Basic Management Security Advanced
ø	This configuration is used by the controller for auto config override. Channels set manually ignore this configuration.
Ð	DNS
¢	DNS Servers
۹	DNS server list, comma separated. IPv4 is only supported when Layer 2 bridge is enabled.
	Time Time Zone
×	~
	NTP Servers
×.	
	NTP Server hostnames or IP addresses, comma separated. IPv4 is only supported when Layer 2 bridge is enabled.
	Configuration Management
	E2E Managed Config Determines whether the controller should manage the node's configuration.
	Copyright © 2021 Cambium Netw

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

	60 GHz cnWave∾ vsooo Configuration Network Nodes	
C @ () . E × 🛱	Q. Search       POP DN       PO       DN	Radio       Networking       Security       Advanced         fd00:ba5e:0088:3121:88:3121       Generate       Pre-address on the interface that the PoP node uses to communicate with the upstream router         IPv6 address       E.g. 2001:a20:c305:ff00:3         CED Controller Configuration       E2E Pre-Address         E.g. 2001:a20:c305:ff00:3         E2E Controller Configuration         E2E Controller Address. If empty, POP Address will be used         E2E Network Prefix         E.g. 3001:a20:c305:ff00:/56,64         The Terragraph routed network range in CIDR format, followed by a comma and the bit-length of prefixes allocated to each node         BGP Configuration         Ethernet Ports         Enable Main         Enable SFP         Layer 2 Bridge         Disable Broadcast Flood         Disable Broadcast Flood
		,

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

	60 GHz cnWave™ V5000		
	Configuration Network Nodes		
יט	Q Search	Radio Networking Security Advanced	
٥	💮 PoP DN	Local IPv4 Management     The set of th	٦
(	R DN	IPv4 Avdtress 169.254.1.100	
		Subnet Mask	
		255.255.0.0	
		Gateway IP Address	
*		169.254.1.50	
t		PoP Configuration	
		POP Routing	

	60 GHz cnWave <sup>™</sup> ∨5000	
	Configuration Network Nodes	
D	Q Search	Radio Networking Security Advanced
٦	R PoP DN	Local IPv4 Management
٢	🖗 DN 🔚	IPv4 Address 169.254.1.200
۰		Subnet Mask
		255.255.0.0
*		Gateway IP Address 169.254.1.10
1		Ethernet Ports
		Enable Main
		Enable Aux
		☑ Enable SFP

# 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.

Configuration						
Network Nodes						
Q Search	Radio Networki	ng Security Advanced				
PoP DN	Minimum MCS					
tor bit	2			<b>+</b>		
ON DN	Range - [2, 12]					
	Maximum MCS			100		
	12			•		
	Kange - [2, 12]					
	- Sector 1					
	Override	Name	Auto Config	Node Config		
		Channel				4
		Polarity				
	- Sector 1 Link (s)	Golay				
	Override	Name	Auto Config (Rx/Tx)	Node Golay Rx	Node Golay Tx	
	No Data					
	- Sector 2					
	Quarrida	Namo	Auto Config	Node Config		
	override	Name	Auto Conng	Node Conng		-
		Channel	2			20
		Polarity	Ug Odd			4
	<ul> <li>Sector 2 Link (s)</li> </ul>	Golay				
	Override	Name	Auto Config (Rx/Tx)	Node Golay Rx	Node Golay Tx	
		link-DN-PoP DN	2/2			4
	Override All					

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

	Configuration Network Nodes	
טי	Q Search	Radio Networking Security Advanced
6	Pop DN	Local IPv4 Management
٢	🛞 DN	169.254.1.200
٩		Subnet Mask
		255.255.0.0
×		Gateway IP Address 169.254.1.10
1		Ethernet Ports Enable Main Enable Aux Enable SFP CPE CPE  CPE interface Aux O Main O SFP O Disabled Enable Router Advertisements on an interface on the device. Note: Changing this setting requires reboot CPE interface Prefix Override prefix on CPE interface, instead of configuring from to address. Note: Changing this setting requires reboot

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

()	60 GHz criWave** V5000								( <sup>1</sup> ) Reboot	🖯 admin •
	Topology									
6	Sites Nodes Links									
	Q, Search	0								Add New
6	Name	MAC Address	IPv6	Туре	Status	Model	Site	PoP Node	Software Version	
۵	POP DN	00.04.56(88(31:21	M00xeed:8831:2100:1	DN	Online Initiator	V5000	Point A	Yes	1.0-dev12	8 :
	DN DN	00:04:56:88:31:2d	fd00.ceed.8831/2101:1	DN	Online Initiator	V5000	Point B	No	1.0-dev12	8 :
					D	1 5 # 10 5				
<b>a</b>										
*										
10										

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

0	60 GHz criWave** v5	000												(Ú) Re	toot 🖯 admin •
	Statistics				<b>1</b>										
6	Links Ethern	et GPS Radi	o Performance	Engineering											
	Link Name	A-Node	Z-Node	RSSI	SNR	MCS	TX Power Index	RX Frames	RX Errors	RX PER	RX Beam Index	TX Frames	TX Errors	TX PER	TX Beam Index
	link-DN-PoP DN	12:04:56:88:31:21	22:04:56:88:31:2d	-46	27	6	6	102240	27	0	.16	66998	0	0	16
٥	link-DN-PoP DN	22:04:56:88:31:2d	12:04:56:88:31:21	-40	25	1	D; e	67035	36 ++ 10	0	17	102198	0	0	17
٠															
* 10															

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

Italistics Links Ethernet OPS Radio Performance Engineering	
ink DN-PoP DN C Antode: DN 2/Node: PoP DN	Ratresh interval 1.5 10.8 30.5 Gold P
R59	Transmit Power
-10 	231630 45 5 231640 231650 231700 231720 231730 231740 231750 231800 231800 231800 231800 331800 4107 410 210 210 210 210 210 201700 23170 23170 23170 23170 23170 2318000 2318000000000000000000000000000000000000
98	MCS Index
ар 30 8 10 1231сво 221150 2211700 2211710 2211720 2211750 2211500 221180000000000	2:1620 22:1640 22:1700 22:1720 22:1740 22:1800 22:1800 Max May Arg
24 25 Paciet from Ratio	25.0 7 7 7.0 Remind Frames
100 73 gl. 50	100000 80000 80000

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

0	60 GHz cnWave** v5000								😃 Reboot  😁 admin 🔸
	Statistics								
Ð	Unks Ethernet G	PS Radio Performance	Engineering			201200200			
	Device Name	MAC Address	Sync Mode	Channel	Security	Error Association	Channel Last State	RX Throughput	TX Throughput
	PoP DN	12:04:56:88:31:21	N	2	None	0	0	7.66 kbps	1.63 kbps
-	PoP DN	22:04:56:88:31:21	R5	1	None	0	0	0 kbps	0 kbps
•	DN	1204568831.2d	85	1	None	0	0	0 kbps	0 kbps
	DN	22:04:56:88/31/2d	85	2.	None	0	0	0.69 kbps	4.66 kbps
-					at t 1 5 a	10 -		-P	
	-								
*									
16									

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

0	60 GHz criWave* v5000									🙂 Reboot	⊖ adm	n •
	Configuration Network Nodes											
0	Q. Search		Rado Networkie	ig Security Advanced							Submt Ca	ncel
۵	m rep on		Minimum MCS			*						
	P DN		Range - (2, 12) Maximum MCS									
			12 8									
•			Hange - (2, 12)									
			Sector 1									
16			Override	Name	Auto Config	Node Config		-				
40				Channel	2			100				
				Polarity	Even			1				
			Sector 1 Link (c)	Solay								
			Override	Name	Auto Config (Rx/Tx)	Node Golay Rx	Node Golay Tx					
			•	link-DN-PoP DN	2/2			1				
			Override, All									
			Sector 2									
			Override	Name	Auto Config	Node Config						
				Channel								
			D	Polarity								
			Sector 2 Link (s)	Golay								
		D	Override	Name	Auto Config (Rx/Tx)	Node Golay Rx	Node Golay Tx					
			No Data									
			GPS									
			Force GPS Disa When checked, the r	ble adio will use internal sync rather than GP	5 apric							
					Copyright @ 2020 Cambrum Netw	ronka, U.d. All rights reserved. I <u>Cam</u>	munity 1 Subsect					

# 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

Cambium Networks provides professional grade fixed wireless broadband and microwave solutions for customers around the world. Our solutions are deployed in thousands of networks in over 153 countries, with our innovative technologies providing reliable, secure, cost-effective connectivity that's easy to deploy and proven to deliver outstanding performance.

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Support enquiries	https://support.cambiumnetworks.com
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