



RADIO EXPOSURE TEST REPORT

FCC ID : Z8H-89FT0067

Equipment : XE3-4 Wi-Fi 6e Indoor Access Point

Brand Name : Cambium Networks

Model Name : XE3-4

Applicant : Cambium Networks Inc.
3800 Golf Road, Suite 360 Rolling Meadows, IL
60008, USA

Manufacturer : Cambium Networks, Ltd.
Ashburton, TQ13 7UP, UK

Standard : 47 CFR Part 2.1091

The product was received on Aug. 13, 2021, and testing was started from Aug. 17, 2021 and completed on Aug. 18, 2022. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

Sporton International Inc. Hsinchu Laboratory

No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)



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History of this test report

TEL : 886-3-656-9065
FAX : 886-3-656-9085
Report Template No.: CB-A1_1 Ver1.1

Page Number : 3 of 12
Issued Date : Sep. 08, 2022
Report Version : 01



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
2	-	Exposure evaluation	PASS	-

Declaration of Conformity:

1. The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to report "Measurement Uncertainty".

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Sam Chen

Report Producer: Penny Kao



1 General Description

1.1 EUT General Information

RF General Information			
Evaluation Mode	Frequency Range (MHz)	Operating Frequency (MHz)	Modulation Type
2.4GHz WLAN	2400-2483.5	2412-2462	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850 5725-5895	5180-5240 5260-5320 5500-5720 5745-5825 5815-5885	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
6GHz	5925-7125	5955-7115	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	LE: GFSK



1.2 Antenna Information

Ant.	Port				Brand	Model Name	Antenna Type	Connector	Gain (dBi)				Remark
	WLAN 2.4GHz	WLAN 5GHz	WLAN 6GHz	Blue-tooth					WLAN 2.4GHz	WLAN 5GHz	WLAN 6GHz	Blue-tooth	
1	2	2	-	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	4.85	5.60	-		Radio 1
2	1	1	-	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	4.85	5.40	-		Radio 1
3	-	4	4	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	-	Note 1	5.84		Radio 2
4	-	2	2	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	-		6.29		Radio 2
5	-	3	3	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	-		6.06		Radio 2
6	-	1	1	-	Accton	EAP9219A-6 E-1120-CAM	PIFA	I-PEX	-		5.99		Radio 2
7	-	-	-	1	Accton	EAP9219A-6 E-1120-CAM	Chip	N/A	-	-	-	3.39	Radio 3

Note1:

Ant.	Port	Antenna Gain (dBi)							Remark
	WLAN 5GHz	UNII 1	UNII 2A	UNII 2C	UNII 3	UNII 4			
						5.85G	5.885G	5.895G	
3	4	2.3	4.22	3.57	5.21	5.49	5.29	5.44	Radio 2
4	2	4.12	4.62	3.15	4.93	5.08	4.77	4.82	Radio 2
5	3	2.91	3.22	2.85	2.81	3.85	3.73	3.9	Radio 2
6	1	3.88	4.46	2.58	4.24	4.6	4.69	4.77	Radio 2

Radio 2 / Directional Gain (dBi)							
Item	WLAN 5GHz UNII 1	WLAN 5GHz UNII 2A	WLAN 5GHz UNII 2C	WLAN 5GHz UNII 3	WLAN 5GHz UNII 4		
					5.85G	5.885G	5.895G
4T1S	4.55	4.78	5.38	5.95	6.84	7.07	7.37

Note2: The above information was declared by manufacturer.

WLAN 2.4GHz, 5GHz (Radio 1), 6GHz: The directional gain is calculated which follows the procedure of KDB 662911 D01.

WLAN 5GHz (Radio 2): The directional gain is measured which follows the procedure of KDB 662911 D03.

For Radio 1:

For 2.4GHz function:

For IEEE 802.11b/g/n/VHT/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For 5GHz function:

For IEEE 802.11a/n/ac/ax (2TX/2RX):

Port 1 and Port 2 can be used as transmitting/receiving antenna.

Port 1 and Port 2 could transmit/receive simultaneously.

For Radio 2:

For 5GHz function:

For IEEE 802.11a/n/ac/ax (4TX/4RX):

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

For 6GHz function:

For IEEE 802.11ax (4TX/4RX):

Port 1, Port 2, Port 3 and Port 4 can be used as transmitting/receiving antenna.

Port 1, Port 2, Port 3 and Port 4 could transmit/receive simultaneously.

For Bluetooth Function:



For Bluetooth mode (1TX/1RX)

Only Port 1 can be use as transmit and receive antenna.

Note3: WLAN 2.4GHz, 5GHz (Radio 1) Directional gain information

Type	Maximum Output Power	Power Spectral Density
Non-BF	Directional gain = Max.gain + array gain. For power measurements on IEEE 802.11 devices Array Gain = 0 dB (i.e., no array gain) for N ANT ≤ 4	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{i,k} \right\}^2}{N_{ANT}} \right]$
BF	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{i,k} \right\}^2}{N_{ANT}} \right]$	$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{i,k} \right\}^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$Directional\ IGain = 10 \cdot \log \left[\frac{\sum_{i=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} g_{i,k} \right\}^2}{N_{ANT}} \right]$$

$$NSS1(g1,1) = 10^{G1/20} ; NSS1(g1,2) = 10^{G2/20}$$

$$g_{j,k} = (NSS1(g1,1) + NSS1(g1,2))^2$$

$$DG = 10 \log[(NSS1(g1,1) + NSS1(g1,2) / N_{ANT}] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$$

Where ;

G1 = Ant 1 Gain ; G2 = Ant 2 Gain

(Radio1)

2.4GHz DG = 7.86 dBi

5 GHz U-NII-1 DG = 8.51 dBi

5 GHz U-NII-2A DG = 8.51 dBi

5 GHz U-NII-2C DG = 8.51 dBi

5 GHz U-NII-3 DG = 8.51 dBi



1.3 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA140924-02.

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Adding UNII 4 (5725-5895 MHz) for Radio 2 of this device.	Maximum Permissible Exposure of UNII 4

Note: Other test results are based on original test report.

1.4 Accessories

Others
Wall Bracket*1

1.5 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310

1.6 Testing Location

Testing Location Information	
Test Lab. : Sporton International Inc. Hsinchu Laboratory	
Hsinchu	ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)
(TAF: 3787)	TEL: 886-3-656-9065 FAX: 886-3-656-9085
	Test site Designation No. TW3787 with FCC.
	Conformity Assessment Body Identifier (CABID) TW3787 with ISED.



2 Maximum Permissible Exposure

2.1 Limit of Maximum Permissible Exposure

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	*(100)	<6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1500	-	-	f/300	<6
1500-100,000	-	-	5	<6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1500	-	-	f/1500	<30
1500-100,000	-	-	1.0	<30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

2.2 MPE Calculation Method

The MPE was calculated at 60 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$



2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= P_{th}.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

R between the person and the antenna / radiating structure, where $R > \lambda / 2 \pi$.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1,920 R^2$
1.34-30	$3,450 R^2 / f^2$
30-300	$3.83 R^2$
300-1,500	$0.0128 R^2 f$
1,500-100,000	$19.2 R^2$
Note: R is in meters, f is in MHz.	



2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Tune-up EIRP (W)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)
2.4G;D1D (Radio 1)	7.86	26.04	33.90	0.50	34.40	2.75423	60	0.06088	1.00000
5.2G;D1D (Radio 1)	8.51	27.39	35.90	0.09	35.99	3.97192	60	0.08780	1.00000
5.3G;D1D (Radio 1)	8.51	21.45	29.96	0.03	29.99	0.99770	60	0.02457	1.00000
5.6G;D1D (Radio 1)	8.51	21.46	29.97	0.02	29.99	0.99770	60	0.02463	1.00000
5.8G;D1D (Radio 1)	8.51	27.42	35.93	0.06	35.99	3.97192	60	0.08780	1.00000
5.2G;D1D (Radio 2)	4.55	27.79	32.34	0.50	32.84	1.92309	60	0.04251	1.00000
5.3G;D1D (Radio 2)	4.78	23.78	28.56	0.50	29.06	0.80538	60	0.01780	1.00000
5.6G;D1D (Radio 2)	5.38	23.83	29.21	0.50	29.71	0.93541	60	0.02068	1.00000
5.8G;D1D (Radio 2)	5.95	29.32	35.27	0.50	35.77	3.77572	60	0.08346	1.00000
5.81G;D1D (Radio 2)	7.37	28.53	35.90	0.09	35.99	3.97192	60	0.08780	1.00000
6.2G;D1D (Radio 2)	6.29	-	23.45	0.50	23.95	0.24831	60	0.02336	1.00000
6.4G;D1D (Radio 2)	6.29	-	22.61	0.50	23.11	0.20464	60	0.01925	1.00000
6.7G;D1D (Radio 2)	6.29	-	22.21	0.50	22.71	0.18664	60	0.01756	1.00000
7.0G;D1D (Radio 2)	6.29	-	21.81	0.50	22.31	0.17022	60	0.01601	1.00000
2.4G;BT-LE (Radio 3)	3.39	8.63	12.02	0.50	12.52	0.01786	60	0.00039	1.00000

MPE Exemption Option C							
Frequency (MHz)	$\lambda/2\pi$ (m)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	MPE Exemption
R1 2437	0.0196	0.6	34.40	32.25	1.679	6.912	Complies
R1 5755	0.0083		35.99	33.84	2.421	6.912	Complies
R2 5835	0.0082		35.99	33.84	2.421	6.912	Complies
R2 6025	0.0079		23.95	21.80	0.151	6.912	Complies
R3 2480	0.0192		12.52	10.37	0.011	6.912	Complies

**Simultaneous Transmission Analysis Mode:**

Radio 1: WLAN 2.4GHz + WLAN 5GHz UNII 1~3 + Radio 2: WLAN 5GHz UNII 1~4 + WLAN 6GHz + Radio 3: Bluetooth

Simultaneous Transmissions Option C							
Frequency (MHz)	R (m)	Tune-up EIRP (dBm)	Tune-up ERP (dBm)	Tune-up ERP (W)	ERP Threshold (W)	Simultaneous Transmissions	Simultaneous Transmissions Limit
R1 2437	0.6	34.40	32.25	1.679	6.912	0.97	<= 1
R1 5755		35.99	33.84	2.421	6.912		
R2 5835		35.99	33.84	2.421	6.912		
R2 6025		23.95	21.80	0.151	6.912		
R3 2480		12.52	10.37	0.011	6.912		

Note: The above antenna gain (except Radio 2 of WLAN 5GHz) was declared by manufacturer.

—————THE END—————