



RADIO EXPOSURE TEST REPORT

FCC ID : Z8H89FT0077
Equipment : XV2-22H Wallplate Wi-Fi 6 Access Point
Brand Name : Cambium Networks
Model Name : XV2-22H
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 Jul. 01, 2022, and testing was started from Jul. 07, 2022 and completed on Nov. 14, 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

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History of this test report

Report No.	Version	Description	Issued Date
FA270109-04	01	Initial issue of report	Feb. 16, 2023



Summary of Test Result

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

Note: Reference to Sporton Project No.:270109-01

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: **Cathy Chiu**



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	5180-5250 5250-5320 5500-5700 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)
Bluetooth	2400-2483.5	2402-2480	LE: GFSK
IEEE802.15.4	2400-2483.5	2405-2480	O-QPSK

1.2 Antenna Information

Ant.	Port			Brand	Model Name	Antenna Type	Connector	Gain (dBi)
	WLAN 2.4GHz	WLAN 5GHz	Bluetooth / Zigbee					
1	1	-	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	Note1
2	2	-	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
3	-	2	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
4	-	1	-	Gemtek	WRTQ-372AX	PIFA	I-Pex	
5	-	-	1	Gemtek	WRTQ-372AX	Dipole	I-Pex	

Note1: Antenna Gain information

Ant.	Port			Antenna Gain (dBi)						
	WLAN 2.4GHz	WLAN 5GHz	Bluetooth / Zigbee	WLAN 2.4GHz	WLAN 5GHz					Bluetooth / Zigbee
					UNII 1	UNII 2A	UNII 2C	UNII 3	UNII 4	
1	1	-	-	4.47	-	-	-	-	-	-
2	2	-	-	4.42	-	-	-	-	-	-
3	-	2	-	-	5.56	5.51	5.53	5.48	5.48	-
4	-	1	-	-	5.45	5.52	5.48	5.51	5.51	-
5	-	-	1	-	-	-	-	-	-	5.18



Note 2: 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	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$

Ex.

Directional Gain (NSS1) formula :

$$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

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

gj,k = $(N_{SS1}(g1,1) + N_{SS1}(g1,2))^2$

DG = $10 \log[(N_{SS1}(g1,1) + N_{SS1}(g1,2))^2 / N_{ANT}] \Rightarrow 10 \log[(10^{G1/20} + 10^{G2/20})^2 / N_{ANT}]$

Where ;

G1 = 10 ; G2 = 10 ;

- 2.4G G1 = 4.47 dBi; G2 = 4.42 dBi ; DG = 7.46 dBi
- 5G UNII1 G1 = 5.56 dBi; G2 = 5.45 dBi; DG = 8.52 dBi
- 5G UNII2A G1 = 5.51 dBi; G2 = 5.52 dBi; DG = 8.53 dBi
- 5G UNII2C G1 = 5.53 dBi; G2 = 5.48 dBi; DG = 8.52 dBi
- 5G UNII3 G1 = 5.48 dBi; G2 = 5.51 dBi; DG = 8.51 dBi
- 5G UNII4 G1 = 5.48 dBi; G2 = 5.51 dBi; DG = 8.51 dBi

Note 3: The above information was declared by manufacturer.

Note 4: The EUT has five antennas.

<WLAN 2.4GHz Function>

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.

<WLAN 5GHz Function>

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.

<Bluetooth/Zigbee function>

Bluetooth/Zigbee (1TX/1RX):

Port 1 can be used as transmitting/receiving antenna.

1.3 Accessories

Others
RJ-45 cable*1: Non-shielded, 0.1m
Wall-mounted rack*1



1.4 Table for EUT supports functions

Function	Supports type	Supports Band
AP	Master	UNII 1, UNII 2A, UNII 2C, UNII 3 and UNII 4
Mesh	Slave without radar detection	UNII 2A and UNII 2C

Note: The above information was declared by manufacturer.

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.

1.7 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA270109-03.

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

Modifications	Performance Checking
1. Remove the Bridge mode. 2. Remove the Mesh mode (master mode). 3. Add the Mesh mode (slave without radar) in UNII 2A and UNII 2C bands.	It does not affect the test.
4. Add the UNII 2A and UNII 2C bands.	Maximum Permissible Exposure.

Note: Maximum Permissible Exposure of 2.4GHz, 5GHz UNII 1 / UNII 3 / UNII 4, Bluetooth and Zigbee are based on original report.



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 41 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

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, <= Pth.

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

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	19.2R 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	7.46	26.17	33.63	0.50	34.13	2.58821	41	0.12252	1.00000
5.2G;D1D	8.52	24.30	32.82	0.50	33.32	2.14783	41	0.10167	1.00000
5.3G;D1D	8.53	21.09	29.62	0.37	29.99	0.99770	41	0.04866	1.00000
5.6G;D1D	8.52	21.24	29.76	0.23	29.99	0.99770	41	0.05026	1.00000
5.8G;D1D	8.51	24.51	33.02	0.50	33.52	2.24905	41	0.10647	1.00000
2.4G;BT-LE	5.18	18.44	23.62	0.50	24.12	0.25823	41	0.01222	1.00000
2.4G;Zigbee	5.18	18.19	23.37	0.50	23.87	0.24378	41	0.01154	1.00000

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm ²)	S Limit (mW/cm ²)	Option	TL EIRP (dBm)	TL Ratio
5.81G;D1D	8.51	24.85	33.36	0.50	33.86	41	0.11514	1.00000	C	37.237	0.4595

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
2437	0.0196	0.41	34.13	31.98	1.578	3.228	Complies
2440(BT)	0.0196		24.12	21.97	0.157	3.228	Complies
2440(Zigbee)	0.0196		23.87	21.72	0.149	3.228	Complies



Simultaneous Transmission Analysis Mode: WLAN 2.4GHz+WLAN 5GHz+Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm2)	Limit (mW/cm2)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	7.46	26.17	33.63	0.50	34.13	41	0.12252	1.00000	C	37.237	0.4890
5.81G;D1D	8.51	24.85	33.36	0.50	33.86	41	0.11514	1.00000	C	37.237	0.4595
2.4G;BT-LE	5.18	18.44	23.62	0.50	24.12	41	0.01222	1.00000	C	37.237	0.0488
Sum TL Ratio_C	0.9973										
Ratio Limit	1										

Simultaneous Transmission Analysis Mode: WLAN 2.4GHz+WLAN 5GHz+Zigbee

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up EIRP (dBm)	Distance (cm)	S (mW/cm2)	Limit (mW/cm2)	Option	TL EIRP (dBm)	TL Ratio
2.4G;D1D	7.46	26.17	33.63	0.50	34.13	41	0.12252	1.00000	C	37.237	0.4890
5.81G;D1D	8.51	24.85	33.36	0.50	33.86	41	0.11514	1.00000	C	37.237	0.4595
2.4G;Zigbee	5.18	18.19	23.37	0.50	23.87	41	0.01154	1.00000	C	37.237	0.0461
Sum TL Ratio_C	0.9946										
Ratio Limit	1										

Note: The above antenna gain was declared by manufacturer.

————THE END————