

Radio Exposure Evaluation Report

FCC ID : TVE-4111BBE0671
Equipment : Secured Wireless Access Point
Brand Name : FORTINET
Model Name : FortiAP U432Fxxxxxx, FAP-U432Fxxxxxx, FORTIAP-U432Fxxxxxx
(where "x" can be "A-Z", or "0-9", or "-", or blank for software purposes or marketing purposes only)
Applicant : Fortinet, Inc.
899 Kifer Road, Sunnyvale, CA 94086, USA
Manufacturer : Fortinet, Inc.
899 Kifer Road, Sunnyvale, CA 94086, USA
Standard : 47 CFR FCC Part 2 Subpart J, section 2.1091

The product was received on Dec. 16, 2020, and testing was started from Dec. 24, 2020 and completed on Apr. 15, 2021. We, SPORTON INTERNATIONAL INC. Hsinhua Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR FCC Part 2 Subpart J, section 2.1091 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Hsinhua Laboratory, the test report shall not be reproduced except in full.



Approved by: Allen Lin

SPORTON INTERNATIONAL INC. Hsinhua Laboratory
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Photographs of EUT V01

History of this test report

[illegible]



Summary of Test Result

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

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

None

Reviewed by: Sam Tsai

Report Producer: Ann Hou

1 General Description

1.1 Information

1.1.1 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/VHT/ax: OFDM (BPSK, QPSK, 16QAM, 64QAM)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac/ax: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	LE: DSSS (GFSK)
ZigBee	2400-2483.5	2405-2480	DSSS (O-QPSK)

1.1.2 Antenna Information

Ant.	Brand	Model Name	Antenna Type	Connector
1	SENAO	5718A0619300	Dipole	N-type
2	SENAO	5718A0619300	Dipole	N-type
3	SENAO	5718A0619300	Dipole	N-type
4	SENAO	5718A0619300	Dipole	N-type
5	SENAO	5718A0620300	Dipole	N-type
6	SENAO	5718A0620300	Dipole	N-type
7	SENAO	5718A0620300	Dipole	N-type
8	SENAO	5718A0620300	Dipole	N-type
9	SENAO	5718A0619300	Dipole	N-type
10	SENAO	5718A0619300	Dipole	N-type
11	SENAO	5718A0618300	Dipole	N-type

Radio	Ant.	Port	Antenna Gain (dBi)				Cable Loss Gain (dBi)			
			2.4G	5G	BT	Zigbee	2.4G	5G	BT	Zigbee
1	1	1	5.5	7.2	-	-	0.6	1	-	-
	2	2	5.5	7.2	-	-	0.6	1	-	-
	3	3	5.5	7.2	-	-	0.5	0.8	-	-
	4	4	5.5	7.2	-	-	0.4	0.7	-	-
2	5	1	-	6.3	-	-	-	1	-	-
	6	2	-	6.3	-	-	-	1.1	-	-
	7	3	-	6.3	-	-	-	0.9	-	-
	8	4	-	6.3	-	-	-	0.9	-	-
3	9	1	5.5	7.2	-	-	0.6	1	-	-
	10	2	5.5	7.2	-	-	0.6	1	-	-
BT+Zigbee	11	1	-	-	4.5	4.5	-	-	0.5	0.5

Note 1: The EUT has eleven antennas.

For 2.4GHz function:

Radio 1

For IEEE 802.11 b/g/n/VHT/ax mode (4TX/4RX)

Ant. 1 (port 1), Ant. 2 (port 2), Ant. 3 (port 3) and Ant. 4 (port 4) could transmit/receive simultaneously.

Radio 3

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

Ant. 9 (port 1) and Ant. 10 (port 2) could transmit/receive simultaneously.

For 5GHz function:

Radio 1

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

Ant. 1 (port 1), Ant. 2 (port 2), Ant. 3 (port 3) and Ant. 4 (port 4) could transmit/receive simultaneously.

Radio 2

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

Ant. 5 (port 1), Ant. 6 (port 2), Ant. 7 (port 3) and Ant. 8 (port 4) could transmit/receive simultaneously.

Radio 3

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

Ant. 9 (port 1) and Ant. 10 (port 2) could transmit/receive simultaneously.

For Bluetooth function:

For IEEE 802.15.1 Bluetooth mode (1TX/1RX)

Only Ant. 11 (port 1) could transmit/receive.

For Zigbee function:

For Zigbee mode (1TX/1RX)

Only Ant. 11 (port 1) could transmit/receive.

1.1.3 Table for Multiple Listing

The brand/model names in the following table are all refer to the identical product.

Brand Name	Model Name	Description
FORTINET	FortiAP U432Fxxxxxx	All the models are identical, the difference model for served as marketing strategy.
	FAP-U432Fxxxxxx	
	FORTIAP-U432Fxxxxxx	

1.1.4 Accessories

Accessories				
PoE Adapter	Brand Name	Senao Inc.	Model Name	PIN060-54PR
	Power Rating	I/P: 100-240Vac, 1.5A, 50-60Hz, O/P: 54Vdc, 1.11A		
AC CORD	Brand Name	I-SHENG	Model Name	AC CORD 600mm
	Signal Line	0.5 meter, shielded cable, w/o ferrite core		
Ground Wire	Brand Name	BO YAO	Model Name	WIRE GEN AWG10 180cm
	Signal Line	1.8 meter, shielded cable, w/o ferrite core		
Bracket wall mount	Brand Name	XIERTEK	Model Name	BRACKET WALL MOUNT
Bracket pole mount	Brand Name	CUN SHENG	Model Name	BRACKET POLE MOUN

Reminder: Regarding to more detail and other information, please refer to user manual.

1.2 Testing Location

Test Lab. : Sporton International Inc. Hsinhua Laboratory			
☒ Hsinhua (TAF: 3785)	ADD: No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)		
	TEL: 886-3-327-3456		FAX: 886-3-327-0973
Test site Designation No. TW3785 with FCC.			
☒ Wen 33rd.St. (TAF: 3785)	ADD: No.14-1, Ln. 19, Wen 33rd St., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)		
	TEL: 886-3-318-0787		FAX: 886-3-318-0287
Test site Designation No. TW0008 with FCC.			

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

Multiple Transmitters Condition

Co-location as simultaneously transmitting (co-transmitting) and the evaluation shall be consider that simultaneous transmissions from co-located devices the individual transmitters are evaluated separately. After sum of the individual value (basic restriction / reference level) are measured/calculated also have to under basic restriction / reference level.

Co-transmitting mode:

1. Radio 1(2.4G)+ Radio 2(5G)+ Radio 3(2.4G)+ Bluetooth
2. Radio 1(5G)+ Radio 2(5G)+ Radio 3(2.4G)+ Bluetooth
3. Radio 1(5G)+ Radio 2(5G)+ Radio 3(5G)+ Bluetooth
4. Radio 1(2.4G)+ Radio 2(5G)+ Radio 3(5G)+ Bluetooth
5. Radio 1(2.4G)+ Radio 2(5G)+ Radio 3(2.4G)+Zigbee
6. Radio 1(5G)+ Radio 2(5G)+ Radio 3(2.4G)+Zigbee
7. Radio 1(5G)+ Radio 2(5G)+ Radio 3(5G)+Zigbee
8. Radio 1(2.4G)+ Radio 2(5G)+ Radio 3(5G)+Zigbee

2.2 MPE Calculation Method

The MPE was calculated at 30 cm to show compliance with the power density limit.
The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

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 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Radio 1(2.4G)+Radio 2(5G)+Radio 3(2.4G)+Bluetooth

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)	Ratio (S/Limit)
2.4G;D1D	11.00	24.84	35.84	0.00	35.84	3.83707	30	0.33927	1.00000	0.33927
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
2.4G;D1D	7.91	25.32	33.23	0.00	33.23	2.10378	30	0.18601	1.00000	0.18601
2.4G;BT-LE	4.00	10.48	14.48	0.00	14.48	0.02805	30	0.00248	1.00000	0.00248
									Sum Ratio	0.87334
									Ratio Limit	1

Radio 1(2.4G)+Radio 2(5G)+Radio 3(2.4G)+Zigbee

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)	Ratio (S/Limit)
2.4G;D1D	11.00	24.84	35.84	0.00	35.84	3.83707	30	0.33927	1.00000	0.33927
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
2.4G;D1D	7.91	25.32	33.23	0.00	33.23	2.10378	30	0.18601	1.00000	0.18601
2.4G;G1D	4.00	10.35	14.35	0.00	14.35	0.02723	30	0.00241	1.00000	0.00241
									Sum Ratio	0.87327
									Ratio Limit	1

**Radio 1(2.4G)+Radio 2(5G)+Radio 3(5G)+Bluetooth**

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)	Ratio (S/Limit)
2.4G;D1D	11.00	24.84	35.84	0.00	35.84	3.83707	30	0.33927	1.00000	0.33927
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
5.8G;D1D	9.21	25.87	35.08	0.00	35.08	3.22107	30	0.28481	1.00000	0.28481
2.4G;BT-LE	4.00	10.48	14.48	0.00	14.48	0.02805	30	0.00248	1.00000	0.00248
									Sum Ratio	0.97214
									Ratio Limit	1

Radio 1(2.4G)+Radio 2(5G)+Radio 3(5G)+Zigbee

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)	Ratio (S/Limit)
2.4G;D1D	11.00	24.84	35.84	0.00	35.84	3.83707	30	0.33927	1.00000	0.33927
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
5.8G;D1D	9.21	25.87	35.08	0.00	35.08	3.22107	30	0.28481	1.00000	0.28481
2.4G;G1D	4.00	10.35	14.35	0.00	14.35	0.02723	30	0.00241	1.00000	0.00241
									Sum Ratio	0.97207
									Ratio Limit	1

Radio 1(5G)+Radio 2(5G)+Radio 3(2.4G)+Bluetooth

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)	Ratio (S/Limit)
5.8G;D1D	12.35	23.60	35.95	0.00	35.95	3.93550	30	0.34797	1.00000	0.34797
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
2.4G;D1D	7.91	25.32	33.23	0.00	33.23	2.10378	30	0.18601	1.00000	0.18601
2.4G;BT-LE	4.00	10.48	14.48	0.00	14.48	0.02805	30	0.00248	1.00000	0.00248
									Sum Ratio	0.88204
									Ratio Limit	1

Radio 1(5G)+Radio 2(5G)+Radio 3(2.4G)+Zigbee

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)	Ratio (S/Limit)
5.8G;D1D	12.35	23.60	35.95	0.00	35.95	3.93550	30	0.34797	1.00000	0.34797
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
2.4G;D1D	7.91	25.32	33.23	0.00	33.23	2.10378	30	0.18601	1.00000	0.18601
2.4G;G1D	4.00	10.35	14.35	0.00	14.35	0.02723	30	0.00241	1.00000	0.00241
									Sum Ratio	0.88197
									Ratio Limit	1

**Radio 1(5G)+Radio 2(5G)+Radio 3(5G)+Bluetooth**

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)	Ratio (S/Limit)
5.8G;D1D	12.35	23.60	35.95	0.00	35.95	3.93550	30	0.34797	1.00000	0.34797
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
5.8G;D1D	9.21	25.87	35.08	0.00	35.08	3.22107	30	0.28481	1.00000	0.28481
2.4G;BT-LE	4.00	10.48	14.48	0.00	14.48	0.02805	30	0.00248	1.00000	0.00248
									Sum Ratio	0.98084
									Ratio Limit	1

Radio 1(5G)+Radio 2(5G)+Radio 3(5G)+Zigbee

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)	Ratio (S/Limit)
5.8G;D1D	12.35	23.60	35.95	0.00	35.95	3.93550	30	0.34797	1.00000	0.34797
5.8G;D1D	11.35	24.57	35.92	0.00	35.92	3.90841	30	0.34558	1.00000	0.34558
5.8G;D1D	9.21	25.87	35.08	0.00	35.08	3.22107	30	0.28481	1.00000	0.28481
2.4G;G1D	4.00	10.35	14.35	0.00	14.35	0.02723	30	0.00241	1.00000	0.00241
									Sum Ratio	0.98077
									Ratio Limit	1

————THE END————