

Radio Exposure Evaluation Report

Equipment : Secured Wireless Access Point
Brand Name : FORTINET
Model Name : FAP-831F
Applicant : 英屬蓋曼群島商防特網股份有限公司台灣分公司
台北市內湖區行愛路 176 號 2 樓
Manufacturer : Fortinet, Inc.
899 Kifer Road, Sunnyvale, CA 94086, USA
Standard : LP0002 Section 6.20.2 (2020-07-01)

The product was received on Jan. 26, 2021, and testing was started from Feb. 05, 2021 and completed on Aug. 20, 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 LP0002 Section 6.20.2 (2020-07-01) 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





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: Debby Hung

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: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5700 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: 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	5718A0607300	PIFA	I-Pex
2	Senao	5718A0608300	PIFA	I-Pex
3	Senao	5718A0609300	PIFA	I-Pex
4	Senao	5718A0610300	PIFA	I-Pex
5	Senao	5718A0611300	PIFA	I-Pex
6	Senao	5718A0612300	PIFA	I-Pex
7	Senao	5718A0613300	PIFA	I-Pex
8	Senao	5718A0614300	PIFA	I-Pex
9	Senao	5718A0611300	PIFA	I-Pex
10	Senao	5718A0612300	PIFA	I-Pex
11	Senao	5718A0613300	PIFA	I-Pex
12	Senao	5718A0614300	PIFA	I-Pex
13	Senao	5718A0615300	PIFA	I-Pex
14	Senao	5718A0616300	Dipole	I-Pex

Ant.	2.4GHz		5GHz			BT LE Zigbee	Remark		
	Max. Peak Gain(dBi)	Correlated Gain(dBi)	Max. Peak Gain(dBi)	Correlated Gain(dBi)		Antenna Gain(dBi)			
1	4.4	6.7	-	-		-	Radio 2, 4*4		
2	4.49	6.7					Radio 2, 4*4		
3	4.32	6.7					Radio 2, 4*4		
4	4.14	6.7					Radio 2, 4*4		
5	-	-	6.10	Band1:9.52 Band2:9.01 Band3:7.95 Band4:7.84	Band1:7.23 Band2:7.18	-	Radio 1 8*8 mode	Radio 1 4*4 mode Low Band mode	
6			6.21						
7			6.11						
8			6.12						
9			6.24	Band3:6.09 Band4:7.44	-		Radio 1 4*4 mode Hi Band mode		
10			6.20						
11			6.27						
12			6.13						
13	4.69	-	4.60	-		-		Radio 3	
14	-	-	-			5.20		BT+ Zigbee	

For 2.4 GHz function:

Radio 2

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

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

Radio 3(Scan radio)

For IEEE 802.11b/g/n mode (1TX/1RX)

Only Ant.13 can be used as transmitting/receiving.

For 5 GHz function:

Radio 1

For IEEE 802.11a/n/ac/ax mode (8TX/8RX)

Ant.5, Ant.6, Ant.7, Ant.8, Ant.9, Ant.10, Ant.11 and Ant.12 could transmit/receive simultaneously.

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

Ant.5, Ant.6, Ant.7, and Ant.8 could transmit/receive simultaneously.

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

Ant.9, Ant.10, Ant.11 and Ant.12 could transmit/receive simultaneously.

Radio 3(Scan radio)

For IEEE 802.11a/n/ac mode (1TX/1RX)

Only Ant.13 can be used as transmitting/receiving.

For Bluetooth function:

For Bluetooth mode (1TX/1RX)

Only Ant.14 can be used as transmitting/receiving.

For Zigbee function:

For Zigbee mode (1TX/1RX)

Only Ant.14 can be used as transmitting/receiving.

1.1.3 Accessories

Accessories				
Bracket ceiling mount 1	Brand Name	Senao Networks, Inc.	Model Name	CLIP CEILING 9/16 LFP
Bracket ceiling mount 2	Brand Name	Senao Networks, Inc.	Model Name	CLIP CEILING 15/16 LFP

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	
☐	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	

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 21 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 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Wi-Fi 2.4G Function - Radio 2 (Non-Beamforming)

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;G1D	4.49	27.13	31.62	0.00	31.62	1.45211	20	0.28889	1.00000
2.4G;D1D	4.49	26.95	31.44	0.00	31.44	1.39316	20	0.27716	1.00000

Wi-Fi 2.4G Function - Radio 2 (Beamforming)

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	6.70	24.90	31.60	0.00	31.60	1.44544	20	0.28756	1.00000

Wi-Fi 2.4G Function - Radio 3

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;G1D	4.69	21.68	26.37	0.00	26.37	0.43351	20	0.08624	0.00
2.4G;D1D	4.69	21.36	26.05	0.00	26.05	0.40272	20	0.08012	0.00

Wi-Fi 5G Function - Radio 1 4TX (Non-Beamforming)

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)
5.2G;D1D	6.21	25.46	31.67	0.00	31.67	1.46893	20	0.29223	1.00000
5.3G;D1D	6.21	23.24	29.45	0.00	29.45	0.88105	20	0.17528	1.00000
5.6G;D1D	6.27	23.22	29.49	0.00	29.49	0.88920	20	0.17690	1.00000
5.8G;D1D	6.27	25.85	32.12	0.00	32.12	1.62930	20	0.32414	1.00000

Wi-Fi 5G Function - Radio 1 4TX (Beamforming)

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)
5.2G;D1D	7.23	24.14	31.37	0.00	31.37	1.37088	20	0.27273	1.00000
5.3G;D1D	7.18	22.27	29.45	0.00	29.45	0.88105	20	0.17528	1.00000
5.6G;D1D	6.09	23.40	29.49	0.00	29.49	0.88920	20	0.17690	1.00000
5.8G;D1D	7.44	24.13	31.57	0.00	31.57	1.43549	20	0.28558	1.00000

Wi-Fi 5G Function - Radio 1 8TX (Non-Beamforming)

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)
5.2G;D1D	9.27	26.13	35.40	0.00	35.40	3.46737	20	0.68981	1.00000
5.3G;D1D	9.27	20.18	29.45	0.00	29.45	0.88105	20	0.17528	1.00000
5.6G;D1D	9.27	20.05	29.32	0.00	29.32	0.85507	20	0.17011	1.00000
5.8G;D1D	9.27	26.06	35.33	0.00	35.33	3.41193	20	0.67878	1.00000

Wi-Fi 5G Function - Radio 1 8TX (Beamforming)

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)
5.2G;D1D	9.52	25.86	35.38	0.00	35.38	3.45144	20	0.68664	1.00000
5.3G;D1D	9.01	20.44	29.45	0.00	29.45	0.88105	20	0.17528	1.00000
5.6G;D1D	7.95	21.37	29.32	0.00	29.32	0.85507	20	0.17011	1.00000
5.8G;D1D	7.84	25.99	33.83	0.00	33.83	2.41546	20	0.48054	1.00000

Wi-Fi 5G Function - Radio 3

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)
5.2G;D1D	4.60	19.81	24.41	0.00	24.41	0.27606	20	0.05492	1.00000
5.3G;D1D	4.60	20.73	25.33	0.00	25.33	0.34119	20	0.06788	1.00000
5.6G;D1D	4.60	21.75	26.35	0.00	26.35	0.43152	20	0.08585	1.00000
5.8G;D1D	4.60	20.98	25.58	0.00	25.58	0.36141	20	0.07190	1.00000

Bluetooth Function

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;BT-LE	5.20	7.10	12.30	0.00	12.30	0.01698	20	0.00338	1.00000

Zigbee Function

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;G1D	5.20	5.54	10.74	0.00	10.74	0.01186	20	0.00236	1.00000

—————THE END—————