Radio Exposure Evaluation Report

FCC ID	:	**TVE-3111BB056**
Equipment	:	**Secured Wireless Access Point**
Brand Name	:	**FORTINET**
Model Name	:	**FortiAP U431Fxxxxxx, FAP-U431Fxxxxxx, FORTIAP-U431Fxxxxxx , FortiAP U433Fxxxxxx, FAP-U433Fxxxxxx, FORTIAP-U433Fxxxxxx** **(where "x" can be used as "A-Z", or "0-9", or "-", or blank for software changes or marketing purposes only)**
Applicant	:	**Fortinet, Inc.** **899 Kifer Road, Sunnyvale, CA 94086, USA**
Manufacturer	:	**Universal Global Scientific Industrial Co., Ltd** **141, Lane 351, Sec. 1, Taiping Road, Tsaotuen, Nantou 54261, Taiwan**
Standard	:	**47 CFR FCC Part 2 Subpart J, section 2.1091**

The product was received on Dec. 06, 2021, and testing was started from Dec. 11, 2021 and completed on Dec. 25, 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 variant 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: Jackson Tsai

SPORTON INTERNATIONAL INC. Hsinhua Laboratory
No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan (R.O.C.)

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Photographs of EUT V01

History of this test report

Report No.	Version	Description	Issued Date
FA931106-09	01	Initial issue of report	Apr. 01, 2022

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: Ben Tseng

Report Producer: Jenny Yang

1 General Description

1.1 Information

1.1.1 EUT General Information

The EUT has three radio chip.

Function	Radio 1	Radio 2	Radio 3
WiFi 2.4G	X	V	V
WiFi 5G	V	V	V (Only RX)
Bluetooth	X	X	V

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)
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: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)
Bluetooth	2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / π/4-DQPSK / 8DPSK) LE: DSSS (GFSK)

1.1.2 Antenna Information

Model: FAP-U433F

Ant.	Radio	Brand	Model Name	Antenna Type	Connector
1-4	1	ARISTOTLE	RFA-05-C53-U-B32C255	Dipole Antenna	Reversed-SMA
5-8	2	ARISTOTLE	RFA-25-C53-U-B32C255	Dipole Antenna	Reversed-SMA
9-10	3	ARISTOTLE	RFA-25-C53-U-B32C255	Dipole Antenna	Reversed-SMA
11	3	ARISTOTLE	RFA-BT-G402-79-200	PIFA Antenna	IPEX
12	1 & 2	ventev	FANT-08ABGN-1213-D-R	Directional Dipole Antenna	Reversed-SMA

Ant.	Gain (dBi)					
	Radio 1	Radio 2		Radio 3		
	5G	2.4G	5G	2.4G	5G	BT
1-4	4.3	-	-	-	-	-
5-8	-	3.5	5.0	-	-	-
9-10	-	-	-	3.5	5.0	-
11	-	-	-	-	-	3.0
12	13	12	13	-	-	-

Model: FAP-U431F

Ant.	Radio	Brand	Model Name	Antenna Type	Connector
1-4	1	ARISTOTLE	RFA-9953	PIFA Antenna	IPEX
5-8	2	ARISTOTLE	RFA-9953	PIFA Antenna	IPEX
9-10	3	ARISTOTLE	RFA-9953	PIFA Antenna	IPEX
11	3	ARISTOTLE	RFA-BT-G402-79-200	PIFA Antenna	IPEX

Ant.	Gain (dBi)					
	Radio 1	Radio 2		Radio 3		
	5G	2.4G	5G	2.4G	5G	BT
1-4	6.0	-	-	-	-	-
5-8	-	4.0	6.0	-	-	-
9-10	-	-	-	4.0	6.0	-
11	-	-	-	-	-	3.0

Ant.	BF Gain (dBi)
	Radio 1 & 2
-	6.02

Directional gain = $G_{ANT\ MAX}$ + 10 log(N_{ANT}/N_{SS}) dBi, where N_{SS} = the number of independent spatial streams of data and $G_{ANT\ MAX}$ is.the gain of the antenna having the highest gain (in dBi).

For 2.4GHz function:

For IEEE 802.11 b/g/n/VHT/ax mode

Radio 2: Ant. 5 to Ant. 8 could transmit/receive simultaneously. (4TX/4RX)

Radio 2: Ant. 12 could transmit/receive simultaneously. (4TX/4RX)

Radio 3: Ant. 9 and Ant. 10 could transmit/receive simultaneously. (2TX/2RX)

For 5GHz function:

For IEEE 802.11 a/n/ac/ax mode

Radio 1: Ant. 1 to Ant. 4 could transmit/receive simultaneously. (4TX/4RX)

Radio 1: Ant. 12 could transmit/receive simultaneously. (4TX/4RX)

Radio 2: Ant. 5 to Ant. 8 could transmit/receive simultaneously. (4TX/4RX)

Radio 2: Ant. 12 could transmit/receive simultaneously. (4TX/4RX)

Radio 3: Ant. 9 and Ant. 10 could transmit/receive simultaneously. (2RX)

For Bluetooth function:

For IEEE 802.15.1 Bluetooth mode

Radio 3: Ant. 11 could transmit/receive simultaneously. (1TX/1RX)

1.1.3 Table for Multiple Listing

Brand Name	Model Name	Description
FORTINET	FortiAP U431Fxxxxxx	Internal Antenna
	FAP-U431Fxxxxxx	
	FORTIAP-U431Fxxxxxx	
	FortiAP U433Fxxxxxx	External Antenna
	FAP-U433Fxxxxxx	
	FORTIAP-U433Fxxxxxx	

Note: All the models are electrically identical, difference model names for marketing purpose.

1.1.4 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA931106-01.
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
The Antenna 12 was added for FAP-U433F	MPE was evaluated.

1.1.5 Accessories

Accessories				
AC Adapter	Brand Name	APD	Model Name	WA-30J12R
	Power Rating	I/P: 100 - 240Vac, 0.9 A, O/P: 12 Vdc, 2.5 A		
	Power Cord	1.50 meter, non-shielded cable, w/o ferrite core		

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.	

Laboratory number TAF 3785 is a spin-off from the original Laboratory number TAF 1190.

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/ cm²)	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/ cm²)	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: WLAN 5GHz(Radio1)+WLAN 5GHz(Radio2)+WLAN 2.4GHz(Radio2)+WLAN 2.4GHz(Radio3)+Bluetooth

2.2 MPE Calculation Method

The MPE was calculated at 32 cm to show compliance with the power density limit.
The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

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

WLAN 5GHz(Radio1)+WLAN 5GHz(Radio2)+WLAN 2.4GHz(Radio2)+WLAN 2.4GHz(Radio3)+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)
5.2G;D1D	19.02	16.47	35.49	0.50	35.99	3.97192	32	0.30867	1.00000	0.30867
5.8G;D1D	13	22.42	35.42	0.50	35.92	3.90841	32	0.30373	1.00000	0.30373
2.4G;D1D	18.02	17.42	35.44	0.50	35.94	3.92645	32	0.30513	1.00000	0.30513
2.4G;G1D	3.5	25.39	28.89	0.50	29.39	0.86896	32	0.06753	1.00000	0.06753
2.4G;BT-BR	3	11.96	14.96	0.50	15.46	0.03516	32	0.00273	1.00000	0.00273
									Sum Ratio	0.98779
									Ratio Limit	1

———THE END———