

Radio Exposure Evaluation Report

FCC ID : TVE-240602

Equipment : Secured Wireless Access Point

Brand Name : FORTINET

Model Name : FortiAP 241Kxxxxxxxxxx, FAP-241Kxxxxxxxxxx,
FORTIAP-241Kxxxxxxxxxx (Where "x" can be used as
"A-Z", or "0-9", or "-", or blank for software changes
or marketing purposes only)

Applicant : Fortinet, Inc.
909 Kifer Road, Sunnyvale, CA 94086, USA

Manufacturer : Fortinet, Inc.
909 Kifer Road, Sunnyvale, CA 94086, USA

Standard : 47 CFR FCC Part 2 Subpart J, section 2.1091

The product was received on Apr. 23, 2024, and testing was started from May 28, 2024 and completed on Jun. 11, 2024. 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

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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: Barry Hsiao

Report Producer: Amber Chiu

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) VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850 5850-5895	5180-5240 5260-5320 5500-5720 5745-5825 5845-5885	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
6GHz WLAN	5925-7125	5955-7115	802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) 802.11be: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM, 4096QAM)
Bluetooth	2400-2483.5	2402-2480	LE: DSSS (GFSK)
ZigBee	2400-2483.5	2405-2480	DSSS (O-QPSK)

1.1.2 Antenna Information

Ant.	Port	Brand	Model Name	Antenna Type	Connector	Support
1	1	EnRack	7102A1242000	PIFA	I-PEX	2.4G+5G+5.9G
2	2	EnRack	7102A1241000	PIFA	I-PEX	2.4G+5G+5.9G
3	1	EnRack	7102A1244000	PIFA	I-PEX	2.4G+5G+5.9G +6G
4	2	EnRack	7102A1243000	PIFA	I-PEX	2.4G+5G+5.9G +6G
5	1	AWAN	7102A1240000	Alford Loop	I-PEX	6G
6	2	AWAN	7102A1240000	Alford Loop	I-PEX	6G
7	1	AWAN	7102A1240000	Dipole	I-PEX	BT+Zigbee

Ant.	Port	Gain (dBi)						Remark	
		2.4G	5G	5.9G	6G	BT	Zigbee		
1	1	5.11	5.22	5.11	-	-	-	Radio1 2.4G only 2*2	Radio2 5G/5.9G 2*2
2	2	5.19	5.32	4.79	-	-	-		
3	1	4.97	5.35	5.40	5.48	-	-	Radio3 (Scan radio) 2.4G/5G/5.9G/6G 2*2	
4	2	4.69	5.43	5.13	5.37	-	-		
5	1	-	-	-	5.53	-	-	Radio2 6G 2*2	
6	2	-	-	-	5.58	-	-		
7	1	-	-	-	-	5.00	5.00	-	

Note 1: The EUT has seven antennas.

Note 2: Directional gain information

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

**For 2.4GHz function:****< Radio 1 >**

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

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

< Radio 3 > < Scan >

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

Ant.3 (port 1), Ant.4 (port 2) can be used as receiving.

For 5GHz function:**< Radio 2 >**

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

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

< Radio 3 > < Scan >

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

Ant.3 (port 1), Ant.4 (port 2) can be used as receiving.

For 6GHz function:**< Radio 2 >**

For IEEE 802.11ax/be mode (2TX/2RX)

Ant.5 (port 1), Ant.6 (port 2) could transmit/receive simultaneously.

< Radio 3 > < Scan >

For IEEE 802.11ax mode (2RX)

Ant.3 (port 1), Ant.4 (port 2) can be used as receiving.

For Bluetooth function:

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

Only Ant.7 can be used as transmitting/receiving.

For Zigbee function:

For IEEE 802.15.4 Zigbee mode (1TX/1RX)

Only Ant.7 can be used as transmitting/receiving.

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 241Kxxxxxxxxx, FAP-241Kxxxxxxxxx, FORTIAP-241Kxxxxxxxxx (Where "x" can be used as "A-Z", or "0-9", or "-", or blank for software changes or marketing purposes only)	All the models are identical, the difference model served as marketing strategy.

From the above models, model: FAP-241K was selected as representative model for the test and its data was recorded in this report.



1.1.4 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA411229
Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
Frequency bands U-NII-2A and U-NII-2C were added	All

1.1.5 Accessories

Accessories				
BRACKET,METAL CLIP CEILING,RVAQ-AP43	Brand Name	WNC	Model Name	6B.SRVAQ.00N
BRACKET,CEILING RAIL 1	Brand Name	WNC	Model Name	3S.005AL.111
BRACKET,CEILING RAIL 2	Brand Name	WNC	Model Name	3S.005AK.111

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

1.2 Applicable Standards

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

- ♦ 47 CFR FCC Part 2 Subpart J, section 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

1.3 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 2_6E + Bluetooth
2. Radio 1_2.4G + Radio 2_5G + Radio 2_6E + Zigbee

2.2 RF Exposure Exempt Measurement

Option	Refer Std.	Exemption Exposure Thresholds (TL)
A	§1.1307(b)(3)(i)(A)	Available maximum time-averaged power is no more than 1 mW
B	§1.1307(b)(3)(i)(B)	$P_{th}(mW) = \begin{cases} ERP_{20cm} (d / 20cm)^x \rightarrow d \leq 20cm \\ ERP_{20cm} \rightarrow 20cm < d \leq 40cm \end{cases}$ $x = -\log_{10} \left(\frac{60}{ERP_{20cm} \sqrt{f}} \right) \text{ and } f \text{ is in GHz}$ $\begin{cases} ERP_{20cm} : 0.3GHz \leq f < 1.5GHz \rightarrow 2040 f (mW) \\ ERP_{20cm} : 1.5GHz \leq f \leq 6GHz \rightarrow 3060 (mW) \end{cases}$
C	§1.1307(b)(3)(i)(C)	$\begin{cases} 0.3 \sim 1.34MHz \rightarrow ERP(W) = 1920R^2 \\ 1.34 \sim 30MHz \rightarrow ERP(W) = 3450R^2 / f^2 \\ 30 \sim 300MHz \rightarrow ERP(W) = 3.83R^2 \\ 300 \sim 1500MHz \rightarrow ERP(W) = 0.0128R^2 f \\ 1500 \sim 100000MHz \rightarrow ERP(W) = 19.2R^2 \end{cases}$ f is in MHz; R is in m; $R > \lambda / 2\pi$

2.3 Multiple RF Sources Exposure

Refer Std.	Exemption Exposure Thresholds (TL)
§1.1307(b)(3)(ii)(A)	The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required)
§1.1307(b)(3)(ii)(B)	$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{ExposureLimit_k} \leq 1$ a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P , including existing exempt transmitters and those being added. b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added. c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters. P_i = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source i at a distance between 0.5 cm and 40 cm (inclusive). P_{th,i} = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source i. ERP_j = the ERP of fixed, mobile, or portable RF source j. ERP_{th,j} = exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section. Evaluated_k = the maximum reported SAR or MPE of fixed, mobile, or portable RF source k either in the device or at the transmitter site from an existing evaluation at the location of exposure. Evaluated Limit_k = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source k, as applicable from § 1.1310 of this chapter.

2.4 MPE Calculation Method

The MPE was calculated at 44 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

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



2.5 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

Radio 1 2.4G Non-Beamforming

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;G1D	5.19	25.35	30.54	0.50	774.66	44	C	3717.120	0.20840
2.4G;D1D	5.19	25.52	30.71	0.50	805.58	44	C	3717.120	0.21672

Radio 2 5G Non-Beamforming

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
5.2G;D1D	5.32	26.12	31.44	0.50	953.04	44	C	3717.120	0.25639
5.3G;D1D	5.32	23.89	29.21	0.50	570.31	44	C	3717.120	0.15343
5.6G;D1D	5.32	23.96	29.28	0.50	579.58	44	C	3717.120	0.15592
5.8G;D1D	5.32	25.94	31.26	0.50	914.34	44	C	3717.120	0.24598
5.81G;D1D	5.11	25.58	30.69	0.50	801.88	44	C	3717.120	0.21573

Radio 2 6E Non-Beamforming

Mode	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	21.77	0.50	102.83	44	C	3717.120	0.02766
6.4G;D1D	22.10	0.50	110.95	44	C	3717.120	0.02985
6.7G;D1D	22.83	0.50	131.25	44	C	3717.120	0.03531
7.0G;D1D	22.86	0.50	132.16	44	C	3717.120	0.03556

**Radio 1 2.4G Beamforming**

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	8.16	25.35	33.51	0.50	1535.01	44	C	3717.120	0.41295

Radio 2 5G Beamforming

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
5.2G;D1D	8.28	26.03	34.31	0.50	1845.48	44	C	3717.120	0.49648
5.3G;D1D	8.28	21.13	29.41	0.50	597.19	44	C	3717.120	0.16066
5.6G;D1D	8.28	21.21	29.49	0.50	608.29	44	C	3717.120	0.16365
5.8G;D1D	8.28	25.82	34.10	0.50	1758.37	44	C	3717.120	0.47305
5.81G;D1D	7.96	25.55	33.51	0.50	1535.01	44	C	3717.120	0.41296

Radio 2 6E Beamforming

Mode	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
6.2G;D1D	21.83	0.50	104.26	44	C	3717.120	0.02805
6.4G;D1D	21.16	0.50	89.35	44	C	3717.120	0.02404
6.7G;D1D	23.26	0.50	144.91	44	C	3717.120	0.03899
7.0G;D1D	24.35	0.50	186.26	44	C	3717.120	0.05011

Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;BT-LE	5.00	18.30	23.30	0.50	146.25	44	C	3717.120	0.03935

Zigbee

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;Zigbee	5.00	18.42	23.42	0.50	150.35	44	C	3717.120	0.04045

Note 1: Option A, B and C refer as clause 2.2

Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)

Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)



Simultaneous Transmission Analysis Mode:

Radio 1 2.4G + Radio 2 5G + Radio 2 6E + Bluetooth

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	8.16	25.35	33.51	0.50	1535.01	44	C	3717.120	0.41295
5.2G;D1D	8.28	26.03	34.31	0.50	1845.48	44	C	3717.120	0.49648
7.0G;D1D	-	-	24.35	0.50	186.26	44	C	3717.120	0.05011
2.4G;BT-LE	5.00	18.30	23.30	0.50	146.25	44	C	3717.120	0.03935
Sum Ratio	0.99889								
Ratio Limit	1.00000								

Radio 1 2.4G + Radio 2 5G + Radio 2 6E + Zigbee

Mode	DG (dBi)	Power (dBm)	EIRP (dBm)	Tolerance (dB)	Tune-up ERP (mW)	Distance (cm)	Option	TL ERP (mW)	TL Ratio
2.4G;D1D	8.16	25.35	33.51	0.50	1535.01	44	C	3717.120	0.41295
5.2G;D1D	8.28	26.03	34.31	0.50	1845.48	44	C	3717.120	0.49648
7.0G;D1D	-	-	24.35	0.50	186.26	44	C	3717.120	0.05011
2.4G;Zigbee	5.00	18.42	23.42	0.50	150.35	44	C	3717.120	0.04045
Sum Ratio	0.99999								
Ratio Limit	1.00000								

Note 1: Option A, B and C refer as clause 2.2

Note 2: For option B, Pth(mW) convert to TL ERP(mW); For option C, ERP(W) convert to TL ERP(mW)

Note 3: TL Ratio=Tune-up ERP(mW)/TL ERP(mW)

Note 4: Refer as clause 2.3 Multiple RF Sources Exposure. Please follow below option and sum TL ration table.

Option	Sum TL Ratio_B	Option	Sum TL Ratio_C	Option	Sum TL Ratio_E
B	$\sum_{i=1}^a \frac{P_i}{P_{th,i}}$	C	$\sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}}$	E	$\sum_{k=1}^c \frac{Evaluated_k}{ExposureLimit_k}$

Note: The above antenna gain was declared by manufacturer.

————THE END————