

Radio Exposure Evaluation Report

FCC ID : TVE-240602
Equipment : Secured Wireless Access Point
Brand Name : FORTINET
Model Name : FortiAP 243Kxxxxxxxxxx, FAP-243Kxxxxxxxxxx,
FORTIAP-243Kxxxxxxxxxx (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 May 24, 2024, and testing was started from Jun. 17, 2024 and completed on Aug. 05, 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 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
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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: Barry Hsiao

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: 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	5180-5240 5260-5320 5500-5720 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) 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

Group	Ant.	Brand	Model Name	Antenna Type	Connector	Support
A	1	AWAN	7102A0668000	Dipole	Reverse SMA	2.4G+5G
	2	AWAN	7102A0668000	Dipole	Reverse SMA	2.4G+5G
	3	AWAN	7102A0669000	Dipole	Reverse SMA	2.4G+5G+6G
	4	AWAN	7102A0669000	Dipole	Reverse SMA	2.4G+5G+6G
	5	AWAN	7102A0667000	Dipole	Reverse SMA	6G
	6	AWAN	7102A0667000	Dipole	Reverse SMA	6G
-	7	Enrack	7102A1239000	PIFA	I-Pex	BT+Zigbee
B	8	Master Wave	7102A1334000	Dipole	Reverse SMA	2.4G+5G
	9	Master Wave	7102A1334000	Dipole	Reverse SMA	2.4G+5G
	10	Master Wave	7102A1335000	Dipole	Reverse SMA	2.4G+5G+6G
	11	Master Wave	7102A1335000	Dipole	Reverse SMA	2.4G+5G+6G
	12	Master Wave	7102A1333000	Dipole	Reverse SMA	6G
	13	Master Wave	7102A1333000	Dipole	Reverse SMA	6G

Ant.	Port	Gain (dBi)					Remark	
		2.4G	5G	6G	BT	Zigbee		
1	1	3.53	5.51	-	-	-	Radio 1 2.4G only 2*2	Radio 2 5G 2*2
2	2	3.40	5.34	-	-	-		
3	1	3.27	5.21	5.32	-	-	Radio 3 (Scan radio) 2.4G/5G/6G 2*2	
4	2	3.47	5.05	5.10	-	-		
5	1	-	-	5.20	-	-	Radio 2 6G 2*2	
6	2	-	-	5.03	-	-		
7	1	-	-	-	4.82	4.82	-	
8	3	3.19	5.14	-	-	-	Radio 1 2.4G only 2*2	Radio 2 5G 2*2
9	4	3.27	5.13	-	-	-		
10	3	3.13	5.03	4.66	-	-	Radio 3 (Scan radio) 2.4G/5G/6G 2*2	
11	4	3.03	5.03	4.82	-	-		
12	3	-	-	5.01	-	-	Radio 2 6G 2*2	
13	4	-	-	4.89	-	-		

Note 1: The EUT has thirteen antennas.

Note 2: EUT can match with above antennas for using. Higher gain in each group of antennas was used to perform the worst configuration and result of that was recorded as the final test result.

Note 3: 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	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} E_{j,k} \right\}^2}{N_{ANT}} \right]$
BF	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} E_{j,k} \right\}^2}{N_{ANT}} \right]$	$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{ANT}} \left\{ \sum_{k=1}^{N_{ANT}} E_{j,k} \right\}^2}{N_{ANT}} \right]$

For 2.4GHz function:

< Radio 1>

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

Ant. 1 (port 1) and Ant. 2 (port 2) or Ant. 8 (port 3) and Ant. 9 (port 4) could transmit/receive simultaneously.



< Radio 3><Scan>

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

Ant. 3 (port 1) and Ant. 4 (port 2) or Ant. 10 (port 3) and Ant. 11 (port 4) can be used as receiving.

For 5GHz function:

< Radio 2>

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

Ant. 1 (port 1) and Ant. 2 (port 2) or Ant. 8 (port 3) and Ant. 9 (port 4) could transmit/receive simultaneously.

< Radio 3><Scan>

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

Ant. 3 (port 1) and Ant. 4 (port 2) or Ant. 10 (port 3) and Ant. 11 (port 4) can be used as receiving.

For 6GHz function:

< Radio 2>

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

Ant. 5 (port 1) and Ant. 6 (port 2) or Ant. 12 (port 3) and Ant. 14 (port 4) could transmit/receive simultaneously.

< Radio 3><Scan>

For IEEE 802.11 ax mode (2RX)

Ant. 3 (port 1) and Ant. 4 (port 2) or Ant. 10 (port 3) and Ant. 11 (port 4) 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 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 243Kxxxxxxxxx, FAP-243Kxxxxxxxxx, FORTIAP-243Kxxxxxxxxx (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 for difference brand served as marketing strategy.

From the above models, model: FAP-243K was selected as representative model for the test and its data was recorded in this report.

1.1.4 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
Antenna 1 for 2/5GHz*2	Brand Name	AWAN	Model Name	7102A0668000
Antenna 1 for 2/5/6GHz*2	Brand Name	AWAN	Model Name	7102A0669000
Antenna 1 for 6GHz*2	Brand Name	AWAN	Model Name	7102A0667000
Antenna 2 for 2/5GHz*2	Brand Name	Master Wave	Model Name	7102A1334000
Antenna 2 for 2/5/6GHz*2	Brand Name	Master Wave	Model Name	7102A1335000
Antenna 2.for 6GHz*2	Brand Name	Master Wave	Model Name	7102A1333000

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		
<input checked="" type="checkbox"/> 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.		

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+Bluetooth
2. Radio 1_2.4G+ Radio 2_5G+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)	$\begin{cases} 0.3 \sim 1.34MHz \rightarrow ERP(W) = 1920R^2 \\ 1.34 \sim 30MHz \rightarrow ERP(W) = 3450R^2 / f^2 \\ 30 \sim 300MHz \rightarrow ERP(W) = 3.83R^2 \\ 300 \sim 1500MHz \rightarrow ERP(W) = 0.0128R^2 f \\ 1500 \sim 100000MHz \rightarrow ERP(W) = 19.2R^2 \end{cases}$ <p>f is in MHz; R is in m; $R > \lambda / 2\pi$</p>

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)	$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{ExposureLimit_k} \leq 1$ <p>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.</p> <p>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.</p> <p>c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.</p> <p>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> <p>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.</p> <p>ERP_j = the ERP of fixed, mobile, or portable RF source j.</p> <p>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.</p> <p>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.</p> <p>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.</p>



2.4 MPE Calculation Method

The MPE was calculated at 20 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

2.4GHz WLAN 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	3.53	24.96	28.49	0.50	483.059	20	B	3060.000	0.15790
2.4G;D1D	3.53	25.15	28.68	0.50	504.661	20	B	3060.000	0.16496

2.4GHz WLAN 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	6.48	24.91	31.39	0.50	941.890	20	B	3060.000	0.30789

5GHz WLAN 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	5.51	25.14	30.65	0.50	794.328	20	B	3060.000	0.25965
5.3G;D1D	5.51	23.86	29.37	0.50	591.711	20	B	3060.000	0.19337
5.6G;D1D	5.51	23.94	29.45	0.50	601.174	20	B	3060.000	0.19651
5.8G;D1D	5.51	25.02	30.53	0.50	772.681	20	B	3060.000	0.25257

5GHz WLAN 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	8.44	24.92	33.36	0.50	1482.518	20	B	3060.000	0.48461
5.3G;D1D	8.44	21.03	29.47	0.50	605.341	20	B	3060.000	0.19787
5.6G;D1D	8.44	20.92	29.36	0.50	590.201	20	B	3060.000	0.19293
5.8G;D1D	8.44	24.80	33.24	0.50	1442.115	20	B	3060.000	0.47140

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	4.82	17.89	22.71	0.50	127.644	20	B	3060.000	0.04172

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	4.82	17.80	22.62	0.50	125.026	20	B	3060.000	0.04087

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+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	6.48	24.91	31.39	0.50	941.890	20	B	3060.000	0.30789
5.2G;D1D	8.44	24.92	33.36	0.50	1482.518	20	B	3060.000	0.48461
2.4G;BT-LE	4.82	17.89	22.71	0.50	127.644	20	B	3060.000	0.04172
Sum Ratio	0.83422								
Ratio Limit	1.00000								

Radio 1_2.4G+ Radio 2_5G+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	6.48	24.91	31.39	0.50	941.890	20	B	3060.000	0.30789
5.2G;D1D	8.44	24.92	33.36	0.50	1482.518	20	B	3060.000	0.48461
2.4G;Zigbee	4.82	17.80	22.62	0.50	125.026	20	B	3060.000	0.04087
Sum Ratio	0.83337								
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————