



SPORTON International Inc.

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Project No: CB10505373

Maximum Permissible Exposure Report

Applicant's company	Fortinet Inc.
Applicant Address	899 Kifer Road Sunnyvale, CA 94086, USA
FCC ID	TVE-28166022
Manufacturer's company	Fortinet Inc.
Manufacturer Address	899 Kifer Road Sunnyvale, CA 94086, USA

Product Name	Secured Wireless Access Point
Brand Name	FORTINET
Model Name	FORTIAP-S421Exxxxxx, FortiAP S421Exxxxxx, FAP-S421Exxxxxx, FORTIAP-S423Exxxxxx, FortiAP S423Exxxxxx, FAP-S423Exxxxxx (Please refer to section 1.2 for more detail information)
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Jan. 25, 2016
Final Test Date	Jul. 22, 2016
Submission Type	Original Equipment

Sam Chen

SPORTON INTERNATIONAL INC.



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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA5N2028	Rev. 01	Initial issue of report	Jul. 26, 2016
FA5N2028	Rev. 02	Revising the equation of directional gain	Aug. 12, 2016

1. GENERAL DESCRIPTION

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)
5GHz WLAN	5150-5250 5725-5850	5180-5240 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)

1.2. Table for Multiple List

The EUT has six model numbers which are identical to each other in all aspects except for the following table:

Model No.	Description	Remark
FORTIAP-S421Exxxxxx	Where "x" can be used as "A-Z", or "-0-9", or "-", or blank for software changes or marketing purposes only.	Internal antenna EUT
FortiAP S421Exxxxxx		
FAP-S421Exxxxxx		
FORTIAP-S423Exxxxxx	Where "x" can be used as "A-Z", or "-0-9", or "-", or blank for software changes or marketing purposes only.	External antenna EUT
FortiAP S423Exxxxxx		
FAP-S423Exxxxxx		

1.3. Testing Location

Testing Location		
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C. TEL : 886-3-656-9065 FAX : 886-3-656-9085

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)*	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)*	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 30 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

E = Electric field (V/m)

P = Peak 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

For Internal antenna EUT (Model No.: FortiAP S421E)

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 23.87dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
30	5785	11.86	15.3483	23.87	243.9915	0.3312	1	Complies

Note: Directional Gain = GANT + 10 log(NANT)

For 2.4GHz Band:

Antenna Type : Dipole Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 23.88 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
30	2437	10.00	10.0014	23.88	244.5049	0.2163	1	Complies

Note: Directional Gain = GANT + 10 log(NANT)

Conclusion:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.2163 / 1 + 0.3312 / 1 = 0.5475$, which is less than "1". This confirmed that the device complies.

For External antenna EUT (Model No.: FortiAP S423E)

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 23.87dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
30	5785	9.20	8.3188	23.87	243.9915	0.1795	1	Complies

Note: Directional Gain = GANT + 10 log(NANT)

For 2.4GHz Band:

Antenna Type : Dipole Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 23.88 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
30	2437	10.44	11.0678	23.88	244.5049	0.2393	1	Complies

Note: Directional Gain = GANT + 10 log(NANT)

Conclusion:

Both of the WLAN 2.4GHz Band and WLAN 5GHz Band can transmit simultaneously, the formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.2393 / 1 + 0.1795 / 1 = 0.4188$, which is less than "1". This confirmed that the device complies.