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Project No: CB10412310

Maximum Permissible Exposure Report

Applicant's company	Extreme Networks, Inc.
Applicant Address	9 Northeastern Blvd. Salem, NH 03079 USA
FCC ID	QXO-4411OAC
Manufacturer's company	Senao Networks, Inc.
Manufacturer Address	3F, No. 529, Chung Cheng Rd., Hsintien, Taipei, Taiwan

Product Name	Wireless 802.11a/AC+ b/g/n Access Point
Brand Name	Extreme Networks
Model Name	31016, 31018, 31017, 31019
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Nov. 17, 2015
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Submission Type	Original Equipment

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SPORTON INTERNATIONAL INC.



Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA541521-01	Rev. 01	Initial issue of report	Jan. 06, 2016
FA541521-01	Rev. 02	Adding two model names: 31017, 31019	Jan. 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 model names are identical to each other in all aspects except for the following table:

Equipment	EUT	Product Name	Model Name	Internal Antenna	External Antenna	Equipped Antenna
Wireless 802.11a/AC+ b/g/n Access Point	1	WS-AP3965e-FCC	31018	X	V	Set 1~11
		WS-AP3965e-ROW	31019			
	2	WS-AP3965i-FCC	31016	V	X	Set 12
		WS-AP3965i-ROW	31017			

Note: Different model names for EUT 1 (31018 and 31019) and EUT 2 (31016 and 31017) served as marketing strategy.

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 58 cm for EUT 1 and 25 cm for EUT 2 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 EUT 1

For Non-Beamforming Mode

For 5GHz Band:

Antenna Type : Panel Antenna

Conducted Power for IEEE 802.11a: 19.96dBm

Distance (cm)	Test Freq. (MHz)	Antenna 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)			
58	5785	23.00	199.5262	19.9595	99.0709	0.467843	1	Complies

For 2.4GHz Band:

Antenna Type : Sector Antenna

Conducted Power for IEEE 802.11b: 25.45 dBm

Distance (cm)	Test Freq. (MHz)	Antenna 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)			
58	2437	10.50	11.2202	25.4489	350.6592	0.093119	1	Complies

For Beamforming Mode

For 5GHz Band:

Antenna Type : Panel Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 19.71dBm

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)			
58	5785	26.01	399.0525	19.7143	93.6336	0.884333	1	Complies

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

For 2.4GHz Band:

Antenna Type : Omni Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 24.34dBm

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)			
58	2437	11.52	14.1925	24.3438	271.8811	0.091326	1	Complies

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

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 $0.093119 / 1 + 0.884333 / 1 = 0.977452$, which is less than "1". This confirmed that the device complies.

For EUT 2

For Non-Beamforming Mode

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11a: 22.17dBm

Distance (cm)	Test Freq. (MHz)	Antenna 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)			
25	5785	6.25	4.2170	28.3953	691.0762	0.371241	1	Complies

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 28.63dBm

Distance (cm)	Test Freq. (MHz)	Antenna 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)			
25	2437	6.45	4.4157	28.6295	729.3666	0.410276	1	Complies

For Beamforming Mode

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 23.38dBm

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)			
25	5785	12.09	16.1673	23.5851	228.3024	0.470197	1	Complies

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

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 23.91dBm

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)			
25	2437	12.04	16.0139	23.9127	246.1917	0.502227	1	Complies

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

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 $0.470197 / 1 + 0.502227 / 1 = 0.972424$, which is less than "1". This confirmed that the device complies.