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Project No: CB10511180

Maximum Permissible Exposure Report

Applicant's company	Ubiquiti Networks, Inc.
Applicant Address	2580 Orchard Parkway San Jose, CA 95131
FCC ID	SWX-UAPACHD
Manufacturer's company	Ubiquiti Networks, Inc.
Manufacturer Address	2580 Orchard Parkway San Jose, CA 95131

Product Name	UniFi Access Point
Brand Name	UBIQUITI
Model Name	UAP-AC-SHD, UAP-AC-HD
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Jun. 21, 2016
Final Test Date	Nov. 04, 2016
Submission Type	Class II Change



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SPORTON INTERNATIONAL INC.



Table of Contents

1. GENERAL DESCRIPTION.....	1
1.1. EUT General Information	1
1.2. Table for Multiple Listing.....	1
1.3. Table for Class II Change	1
1.4. Testing Location.....	1
2. MAXIMUM PERMISSIBLE EXPOSURE.....	2
2.1. Limit of Maximum Permissible Exposure	2
2.2. MPE Calculation Method	2
2.3. Calculated Result and Limit.....	3

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA661623-03	Rev. 01	Initial issue of report	Nov. 21, 2016
FA661623-03	Rev. 02	Removing 80+80 MHz Mode	Feb. 08, 2017

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 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)
Bluetooth	2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK) LE: DSSS (GFSK)

1.2. Table for Multiple Listing

The model names as below

Brand Name	Model Name	2.4GHz/5GHz WLAN function	2.4GHz/5GHz RX function	Bluetooth function
UBIQUITI	UAP-AC-SHD	O	O	O
	UAP-AC-HD	O	X	X

Note: The Model UAP-AC-SHD was selected to test and recorded in the report.

1.3. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FA661623-02

Below is the table for the change of the product with respect to the original one.

Modifications	Performance Checking
1. Adding 5 GHz Band 2 and Band 3 (5250~5350 MHz, 5470~5725 MHz) for this device.	Maximum Permissible Exposure

Note: Maximum Permissible Exposure of 2.4GHz WLAN, 5GHz WLAN band 1 + Band 4 and bluetooth are based on original test report.

1.4. 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 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

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

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 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 23.18 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)			
20	2437	9.02	7.9810	23.18	207.8346	0.3301	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 9.02 \text{dBi}.$

Band 1+Band 4

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 23.82 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)			
20	5230	10.02	10.0475	23.82	240.8842	0.4817	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 10.02 \text{dBi}.$

Band 2+Band 3

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT80): 17.89 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)			
20	5530	10.02	10.0475	17.89	61.4900	0.1229	1	Complies

Note: $DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 10.02 \text{dBi.}$

For Bluetooth:

Antenna Type : PIFA Antenna

Conducted Power for Bluetooth 2DH5: 7.28 dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power		Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
				(dBm)	(mW)			
20	2480	1.00	1.2589	7.2800	5.3456	0.0013	1.00	Complies

Conclusion:

Both of the WLAN 2.4GHz Band , WLAN 5GHz Band and Bluetooth 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 $0.3301 / 1 + 0.4817 / 1 + 0.0013 / 1 = 0.8131$, which is less than "1".

This confirmed that the device complies.