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Project No: CB10508071

Maximum Permissible Exposure Report

Applicant's company	Cisco Systems, Inc.
Applicant Address	170 West Tasman Drive San Jose, CA 95134 USA
FCC ID	UDX-60043010
Manufacturer's company	Cisco Systems, Inc.
Manufacturer Address	170 West Tasman Drive San Jose, CA 95134 USA

Product Name	802.11a/b/g/n/ac Wireless Access Point
Brand Name	CISCO
Model Name	MR84-HW
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Jan. 27, 2016
Final Test Date	Jul. 29, 2016
Submission Type	Class III 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 Class III Change.....	1
1.3. 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
FA641615-01	Rev. 01	Initial issue of report	Aug. 18, 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 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)

1.2. Table for Class III Change

This product is an extension of original one reported under Sporton project number: FA641615

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

Modifications	
1.	Add Band 2 and Band 3 (5250~5350 MHz, 5470~5725 MHz) for this device, and it evaluated for Maximum Permissible Exposure.
2.	Add thirteen sets 80+80 Mode also includes the 5150~5250 MHz and 5725~5850 MHz

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
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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 27.5 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 5GHz Band:

For Radio 2 (Band 1+Band4):

Antenna Type : Panel Antenna

Conducted Power for IEEE 802.11a: 25.98 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)			
27.5	5745	10.00	10.0000	25.9846	396.7020	0.417647	1	Complies

For Radio 3 (Band 1+Band4):

Antenna Type : Metal Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 21.46dBm

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)			
27.5	5200	5.40	3.4674	21.4600	139.9587	0.051091	1	Complies

For Radio 2 (Band 2+Band3) :

Antenna Type : Metal Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss2 (VHT80+80): 20.19dBm

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)			
27.5	5210	10.00	10.0000	20.1922	104.5260	0.110045	1	Complies

For Radio 3 (Band 2+Band3):

Antenna Type : Metal Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT20): 21.91dBm

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)			
27.5	5300	5.40	3.4674	21.9100	155.2387	0.056669	1	Complies

For 2.4GHz Band:

For Radio 1:

Antenna Type : Panel Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 (VHT40): 20.07dBm

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)			
27.5	2437	15.92	39.0947	20.0736	101.7093	0.418623	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 Radio 3:

Antenna Type : Metal Antenna

Conducted Power for IEEE 802.11g: 24.92 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)			
27.5	2437	6.30	4.2658	24.9200	310.4560	0.139426	1	Complies

For Bluetooth function:

For Radio 4 :

Antenna Type : Metal Antenna

Conducted Power for Bluetooth 4.0: 3.39 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)			
27.5	2402	7.30	5.3703	3.39	2.1827	0.0012	1	Complies

Conclusion:

Both of the Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth can transmit simultaneously, the formula of calculated the MPE is:

$$\text{CPD1} / \text{LPD1} + \text{CPD2} / \text{LPD2} + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.418623 / 1 + 0.417647 / 1 + 0.139426 / 1 + 0.0012 / 1 = 0.9768$, which is less than "1". This confirmed that the device complies.

Conclusion:

Both of the Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (5GHz WLAN function) + Bluetooth can transmit simultaneously, the formula of calculated the MPE is:

$$\text{CPD1} / \text{LPD1} + \text{CPD2} / \text{LPD2} + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.418623 / 1 + 0.417647 / 1 + 0.051091 / 1 + 0.0012 / 1 = 0.8884$, which is less than "1". This confirmed that the device complies.