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Project No: CB10410117

Maximum Permissible Exposure Report

Applicant's company	Lite-On Technology Corp.
Applicant Address	Bldg. C, 90, Chien 1 Road, Chung Ho, New Taipei City 23585, Taiwan, R.O.C
FCC ID	PPQ-WCBN4506R
Manufacturer's company	LITE-ON TECHNOLOGY (Changzhou) CO., LTD
Manufacturer Address	A9 Building, No.88 Yanghu Road, Wujin Hi-Tech Industrial Development Zone, Changzhou City, Jiangsu Province 213100 China

Product Name	WLAN + BT Combo Module
Brand Name	LITE-ON
Model Name	WCBN4506R
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Sep. 08, 2015
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Submission Type	Original Equipment

Sam Chen

SPORTON INTERNATIONAL INC.



Testing Laboratory
1190



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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA590501	Rev. 01	Initial issue of report	Nov. 04, 2015

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)
5GHz WLAN	5150-5250 5250-5350 5470-5725 5725-5850	5180-5240 5260-5320 5500-5700 5745-5825	802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)
Bluetooth	2400-2483.5	2402-2480	BR / EDR: FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK) LE: DSSS (GFSK)

Note: WLAN 2.4G supports 20MHz only.

1.2. Table for Multiple List

The brand/model names in the following table are all refer to the identical product.

EUT	Model Name	WiFi Antenna (Internal)	WiFi Antenna (External)	BT Antenna (External)
1	WCBN4506R	X	V	V
2		V	X	V

1.3. Testing Location

Testing Location		
<input type="checkbox"/>	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
<input checked="" type="checkbox"/>	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:

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

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 5GHz Band:

Antenna Type : Dipole Antenna

Conducted Power for IEEE 802.11n MCS0 HT20: 24.91dBm

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	5785	2.70	1.8621	24.9054	309.4169	0.114682	1	Complies

For 2.4GHz Band:

Antenna Type : Dipole Antenna

Conducted Power for IEEE 802.11n MCS0 HT20: 23.87 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	2.06	1.6069	23.8664	243.5784	0.077909	1	Complies

For Bluetooth Function:

Antenna Type : Dipole Antenna

Conducted Power for BR (GFSK) 1 Mbps: 8.52 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	2402	1.61	1.4488	8.5200	7.1121	0.002051	1	Complies

Conclusion:

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

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

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.077909 / 1 + 0.002051 / 1 = 0.079960$, which is less than "1". This confirmed that the device complies.

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

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

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.114682 / 1 + 0.002051 / 1 = 0.116733$, which is less than "1". This confirmed that the device complies.

For EUT 2:

For 5GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11n MCS0 HT20: 24.88 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	5825	1.80	1.5136	24.8754	307.2820	0.092574	1	Complies

For 2.4GHz Band:

Antenna Type : PIFA Antenna

Conducted Power for IEEE 802.11g: 27.25 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	0.71	1.1776	27.2503	530.9267	0.124447	1	Complies

For Bluetooth Function:

Antenna Type : Dipole Antenna

Conducted Power for BR (GFSK) 1 Mbps: 8.52 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	2402	1.61	1.4488	8.5200	7.1121	0.002051	1	Complies

Conclusion:

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

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

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.124447 / 1 + 0.002051 / 1 = 0.126498$, which is less than "1". This confirmed that the device complies.

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

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

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.092574 / 1 + 0.002051 / 1 = 0.094625$, which is less than "1". This confirmed that the device complies.