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Project No: CB10408170

Maximum Permissible Exposure Report

Applicant's company	Symbol Technologies, Inc.
Applicant Address	One Zebra Plaza Holtsville, NY 11742 USA
FCC ID	UZ7AP7532
Manufacturer's company	Wistron NeWeb Corporation
Manufacturer Address	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan, R.O.C.

Product Name	Birch External (3x3 MIMO)
Brand Name	Symbol
Model Name	AP-7532
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Apr. 15, 2014
Final Test Date	Sep. 08, 2015
Submission Type	Class II Change

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Testing Laboratory
1190

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History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA441804-21	Rev. 01	Initial issue of report	Oct. 08, 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) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
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) 802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)

1.2. Table for Class II Change

This product is an extension of original one reported under Sporton project number: FA441804-02 and 06
Below is the table for the change of the product with respect to the original one.

Modifications	
1. Changing Applicant to "Symbol Technologies, Inc." from "Motorola Solutions, Inc." 2. Changing Applicant address to "One Zebra Plaza Holtsville, NY 11742 USA" from "One Motorola Plaza Holtsville, NY 11742 USA". 3. Changing brand name to "Symbol" from "MOTOROLA"	
Modifications	Performance Checking
4. Adding 3 antennas. (Ant. 5-Model name: ML-2452-PNL9M3-N36) (Ant. 6-Model name: ML-2452-PTA3M3-036) (Ant. 7-Model name: ML-2452-VMM5M3-N72)	1. MPE (2.4G / 5G B1-B4)
5. Ant. 4 (Model name: ML-2452-PNA5-01R) applies to indoor use only in the original filing and it applies to both indoor/outdoor uses now.	1. MPE (5G B1)

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 5GHz Band (NII):

Antenna Type : Polarized Panel

Conducted Power for IEEE 802.11a (3TX): 23.01 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	5785	12.92	19.5816	23.0108	200.0216	0.346492	1	Complies

Note:

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 12.92 \text{ dBi}$$

For 2.4GHz Band:

Antenna Type : Polarized Panel

Conducted Power for IEEE 802.11g (3TX): 22.70 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	13.22	20.9821	22.7043	186.3924	0.345975	1	Complies

Note:

$$Directional\ Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right] = 13.22 \text{ dBi}$$

Conclusion:

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

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

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.345975 / 1 + 0.346492 / 1 = 0.692467$, which is less than "1". This confirmed that the device complies.