SPORTON International Inc.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / www.sporton.com.tw

Project No: CB10502105

Maximum Permissible Exposure Report

Applicant's company	Zebra Technologies, Corp.
Applicant Address	1 Zebra Plaza Holtsville, NY 11742 USA
FCC ID	UZ7AP8432I
Manufacturer's company	Wistron NeWeb Corporation
Manufacturer Address	20 Park Avenue II, Hsinchu Science Park, Hsinchu 308 Taiwan

Product Name	802.11AC MU-MIMO, dual Radio, INT ANT
Brand Name	ZEBRA
Model Name	AP-8432I
Ref. Standard(s)	47 CFR FCC Part 2 Subpart J, section 2.1091
Received Date	Feb. 01, 2016
Final Test Date	Feb. 23, 2016
Submission Type	Original Equipment

TAF
Testing Laboratory
1190

Sam Chen
SPORTON INTERNATIONAL INC.

Table of Contents

1. GENERAL DESCRIPTION 1
1.1. EUT General Information 1
1.2. 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
FA592302-09	Rev. 01	Initial issue of report	Mar. 15, 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)
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 / π/4-DQPSK / 8DPSK) LE: DSSS (GFSK)

1.2. 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/ cm²)	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/ cm²)	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 40 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

E (V/m) = $\frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) = $\frac{E^2}{377}$

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 Radio 3 Bluetooth Function:

For BT2.1+EDR:

Antenna Type : Monopole Antenna

Conducted Power for BR (GFSK) 1 Mbps: 5.43dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
40	2402	7.70	5.8884	5.4282	3.4899	0.001023	1	Complies

For BT4.0:

Antenna Type : Monopole Antenna

Conducted Power: 3.28 dBm

Distance (cm)	Test Freq. (MHz)	Antenna Gain (dBi)	Antenna Gain (numeric)	Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
40	2442	7.70	5.8884	3.2800	2.1281	0.000624	1	Complies

Conclusion:

Both of the Radio 1 (5GHz WLAN function FCC ID: UZ7CDR5G) + Radio 2 (2.4/5GHz WLAN function FCC ID: UZ7CDRDB) + Radio 3 (BT function FCC ID: UZ7AP8432I) can transmit simultaneously, the formula of calculated the MPE is:

For Radio 1 (5GHz WLAN function FCC ID: UZ7CDR5G)

Antenna Type : Monopole antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 4TX (VHT20): 23.40dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
40	5785	12.53	17.8966	23.4013	218.8429	0.194891	1	Complies

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

For Radio 2 (2.4/5GHz WLAN function FCC ID: UZ7CDRDB)

For 5GHz Band:

Antenna Type : Monopole Antenna

Conducted Power for IEEE 802.11ac MCS0/Nss1 3TX (VHT20): 22.66dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
40	5785	10.51	11.2402	22.6632	184.6371	0.103272	1	Complies

Note: $Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =10.51dBi.

For 2.4GHz Band:

Antenna Type : Monopole Antenna

Conducted Power for IEEE 802.11n MCS0 3TX (HT20): 26.28 dBm

Distance (cm)	Test Freq. (MHz)	Directional Gain (dBi)	Antenna Gain (numeric)	The maximum combined Average Output Power		Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)	Test Result
				(dBm)	(mW)			
40	2437	9.07	8.0767	26.2836	424.9752	0.170801	1	Complies

Note: $Directiona\ lGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =9.07dBi.

For Radio 3 (Bluetooth Function FCC ID: UZ7AP8432I)

For BT2.1+EDR:

Antenna Type : Monopole Antenna

Conducted Power for BR (GFSK) 1 Mbps: 5.43dBm

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)			
40	2402	7.70	5.8884	5.4282	3.4899	0.001023	1	Complies

CPD1 / LPD1 + CPD2 / LPD2 + ...etc. < 1

CPD = Calculation power density

LPD = Limit of power density

Mode 1:

Radio 1 (5GHz WLAN function FCC ID: UZ7CDR5G) + Radio 2 (2.4GHz WLAN function FCC ID: UZ7CDRDB) + Radio 3 (BT function FCC ID: UZ7AP8432I)

Therefore, the worst-case situation is 0.194891 / 1 + 0.170801 / 1 + 0.001023 / 1 = 0.366715, which is less than "1". This confirmed that the device complies.

Mode 2:

Radio 1 (5GHz WLAN function FCC ID: UZ7CDR5G) + Radio 2 (5GHz WLAN function FCC ID: UZ7CDRDB) + Radio 3 (BT function FCC ID: UZ7AP8432I)

Therefore, the worst-case situation is 0.194891 / 1 + 0.103272 / 1 + 0.001023 / 1 = 0.299186, which is less than "1". This confirmed that the device complies.