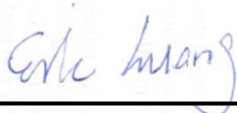


# RF Exposure Evaluation Report

APPLICANT : Zebra Technologies Corporation  
EQUIPMENT : Vehicle Computer  
BRAND NAME : Zebra  
MODEL NAME : VC80x  
FCC ID : UZ7VC80X  
STANDARD : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC., would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091, and pass the limit. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.



Reviewed by: Eric Huang / Manager



Approved by: Jones Tsai / Manager



## SPORTON INTERNATIONAL INC.

No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.)



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## 1. Administration Data

### 1.1. Testing Laboratory

Testing Laboratory	
Test Site	SPORTON INTERNATIONAL INC.
Test Site Location	No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978

Applicant	
Company Name	Zebra Technologies Corporation
Address	1 Zebra Plaza, Holtsville, NY 11742-1300, USA

Manufacturer	
Company Name	Zebra Technologies Corporation
Address	1 Zebra Plaza, Holtsville, NY 11742-1300, USA

## 2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Vehicle Computer
Brand Name	Zebra
Model Name	VC80x
FCC ID	UZ7VC80X
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
HW Version	EV
SW Version	91-15-01.7-MN-00
FW Version	FUSION_BA_2_00.0.0.033_M
EUT Stage	Identical Prototype

**Remark:**

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This device had four kinds of antennas, the detail information as following table.



Antenna No.	Chain No.	Model	Antenna Type	Antenna Gain (dBi) Exclude Cable loss	Internal Cable loss (dB)	External Cable loss (dB)	Antenna Gain (dBi) Include Cable loss	Frequency (GHz)
1	Int. Chain 0	AN000097A01	Patch	2.80	N/A	N/A	2.80	2.4~2.4835 – WLAN CH01
				3.32	N/A	N/A	3.32	2.4~2.4835 – WLAN CH03
				3.68	N/A	N/A	3.68	2.4~2.4835 – WLAN CH07
				3.96	N/A	N/A	3.96	2.4~2.4835 – WLAN CH11
				3.96	N/A	N/A	3.96	2.4~2.4835 – WLAN CH13
				3.96	N/A	N/A	3.96	2.4~2.4835 – BT/BLE
	Int. Chain 1			5	N/A	N/A	5	5.15~5.85
				3.40	N/A	N/A	3.40	2.4~2.4835 – WLAN CH01
				3.69	N/A	N/A	3.69	2.4~2.4835 – WLAN CH03
				3.54	N/A	N/A	3.54	2.4~2.4835 – WLAN CH07
				3.32	N/A	N/A	3.32	2.4~2.4835 – WLAN CH11
				3.26	N/A	N/A	3.26	2.4~2.4835 – WLAN CH13
				5	N/A	N/A	5	5.15~5.85
2	Ext. Chain 0	AN2010	Monopole	2	0.6	1.8	-0.4	2.4~2.4835
	Ext. Chain 1			2	0.9	2.6	-1.5	5.15~5.85
				2	0.6	1.8	-0.4	2.4~2.4835
				2	0.9	2.6	-1.5	5.15~5.85
3	Ext. Chain 0	AN2020	Monopole	5	0.6	1.8	2.6	2.4~2.4835
	Ext. Chain 1			5	0.6	1.8	2.6	2.4~2.4835
4	Ext. Chain 0	AN2030	Dipole	2	0.6	N/A	1.4	2.4~2.4835
				3.7	0.9	N/A	2.8	5.15~5.85
	Ext. Chain 1			2	0.6	N/A	1.4	2.4~2.4835
				3.7	0.9	N/A	2.8	5.15~5.85



**3. Maximum RF average output power among production units**

**<Non-Beamforming Mode>**

Mode	Maximum Average Power (dBm)		
	Chain 0	Chain 1	Chain 0+1
2.4GHz WLAN	20.5	21.0	22.0
5GHz WLAN	18.5	19.5	21.5
Bluetooth BR/EDR	3.0		
Bluetooth LE	2.5		

**<Beamforming Mode>**

Mode	Maximum Average Power (dBm)		
	Chain 0	Chain 1	Chain 0+1
2.4GHz WLAN			23.0
5GHz WLAN			23.0



### 4. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

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:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna



## 5. Radio Frequency Radiation Exposure Evaluation

### 5.1. Standalone Power Density Calculation

**<Non-Beamforming Mode>**

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Power Density / Limit
2.4GHz WLAN Chain 0	2412.0	3.96	20.50	24.460	0.279	279.254	0.056	1.000	0.056
2.4GHz WLAN Chain 1	2412.0	3.69	21.00	24.690	0.294	294.442	0.059	1.000	0.059
2.4GHz WLAN Chain 0+1	2412.0	3.96	22.00	25.960	0.394	394.457	0.079	1.000	0.079
5GHz WLAN Chain 0	5180.0	5.00	18.50	23.500	0.224	223.872	0.045	1.000	0.045
5GHz WLAN Chain 1	5180.0	5.00	19.50	24.500	0.282	281.838	0.056	1.000	0.056
5GHz WLAN Chain 0+1	5180.0	5.00	21.50	26.500	0.447	446.684	0.089	1.000	0.089
Bluetooth	2402.0	3.96	3.00	6.960	0.005	4.966	0.001	1.000	0.001

**Note:**

1. For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.
2. In the above table have assessed Bluetooth, WLAN2.4GHz and WLAN 5GHz by referring to their maximum antenna gain and maximum power.

**<Beamforming Mode>**

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	Power Density / Limit
2.4GHz WLAN Chain 0+1	2412.0	5.13	23.00	28.130	0.650	650.130	0.129	1.000	0.129
5GHz WLAN Chain 0+1	5180.0	6.17	23.00	29.170	0.826	826.038	0.164	1.000	0.164

**Note:**

1. In the above table have assessed WLAN2.4GHz and WLAN 5GHz by referring to their maximum power.
2. This device support Beamforming for 2.4GHz and 5GHz WLAN; therefore, in the table above which consider maximum directional Gain 5.13dBi for 2.4GHz WLAN and 6.17dBi for 5GHz WLAN Beamforming mode.

### 5.2. Collocated Power Density Calculation

Maximum WLAN Power Density / Limit	Maximum Bluetooth Power Density / Limit	Σ(Power Density / Limit) of WLAN+Bluetooth
0.164	0.001	0.165

**Note:**

1. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for all radio transmitter.
2. Considering all antenna collocation of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of all collocated transmitters is compliant

## Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.