


# RF EXPOSURE EVALUATION REPORT

FCC ID : UZ7VC8300  
Equipment : Vehicle Computer  
Brand Name : Zebra  
Model Name : VC8300  
Applicant : Zebra Technologies Corporation  
1 Zebra Plaza, Holtsville, NY 11742  
Manufacturer : Zebra Technologies Corporation  
1 Zebra Plaza, Holtsville, NY 11742  
Standard : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated in accordance with 47 CFR Part 2.1091 for the device and pass the limit.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

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Approved by: Cona Huang / Deputy Manager

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## History of this test report

Report No.	Version	Description	Issued Date
FA8N0846-03	Rev. 01	Initial issue of report	May 06, 2019

**1. Description of Equipment Under Test (EUT)**

Product Feature & Specification	
EUT Type	Vehicle Computer
Brand Name	Zebra
Model Name	VC8300
FCC ID	UZ7VC8300
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	EVT1
SW Version	Zebra/VC8300/VC8310:8.1.0/01-14-12-00-ON-U00-PRD/266:eng/release-keys
FW Version	01-14-12.00-ON-U00-PRD
MFD	03Nov18
EUT Stage	Identical Prototype
<b>Remark:</b>	
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 is a variant report by adding TXBF Mode.	

**Reviewed by: Jason Wang****Report Producer: Wan Liu**

## 2. Maximum RF average output power among production units

<Non-beamforming mode>

Band / Mode	Average Power (dBm)			
	BR / EDR			LE
	1M	2M	3M	GFSK
Bluetooth	4	1	1	1.5

	Mode	Channel	Frequency (MHz)	SISO ANT 1	SISO ANT 2	MIMO
				Tune-Up Limit	Tune-Up Limit	Tune-Up Limit
2.4GHz WLAN	802.11b	1	2412	20.50	21.00	23.50
		6	2437	21.50	21.50	22.50
		11	2462	21.50	18.00	21.50
	802.11g	1	2412	13.00	15.50	15.00
		6	2437	23.00	23.00	25.00
		11	2462	14.00	15.50	17.00
	802.11n-HT20	1	2412	11.00	14.00	14.00
		6	2437	22.50	22.00	24.50
		11	2462	13.50	14.50	15.50
	802.11n-HT40	3	2422	11.00	14.00	13.00
		6	2437	13.00	19.00	17.00
		9	2452	13.00	14.50	13.00
	802.11ac-VHT20	1	2412	11.00	14.00	14.00
		6	2437	22.50	22.00	24.50
		11	2462	13.50	14.50	15.50
	802.11ac-VHT40	3	2422	11.00	14.00	13.00
		6	2437	13.00	19.00	17.00
		9	2452	12.50	14.50	13.00

5.2GHz WLAN	Mode	Channel	Frequency (MHz)	SISO ANT 1 Tune-Up Limit	SISO ANT 2 Tune-Up Limit	MIMO Tune-Up Limit
	802.11a	36	5180	21.00	19.50	20.00
		40	5200	21.00	21.00	20.00
		44	5220	21.50	21.00	20.00
		48	5240	21.50	21.50	19.50
	802.11n-HT20	36	5180	21.00	19.50	20.00
		40	5200	21.00	21.50	20.00
		44	5220	21.50	21.50	20.00
		48	5240	21.50	21.50	20.00
	802.11n-HT40	38	5190	17.50	15.50	19.50
		46	5230	21.00	20.00	22.50
	802.11ac-VHT20	36	5180	21.00	19.00	20.00
		40	5200	21.00	21.50	20.00
		44	5220	21.50	21.50	20.00
		48	5240	21.50	21.50	20.00
	802.11ac-VHT40	38	5190	17.00	16.00	19.50
		46	5230	21.00	20.00	22.50
	802.11ac-VHT80	42	5210	16.50	15.50	17.00



5.3GHz WLAN	Mode	Channel	Frequency (MHz)	SISO ANT 1 Tune-Up Limit	SISO ANT 2 Tune-Up Limit	MIMO Tune-Up Limit
	802.11a	52	5260	21.50	21.50	19.50
		56	5280	21.50	21.50	19.50
		60	5300	21.50	18.50	19.50
		64	5320	21.50	21.00	19.50
	802.11n-HT20	52	5260	21.50	22.00	20.00
		56	5280	21.50	22.00	20.00
		60	5300	21.50	18.00	20.00
		64	5320	22.00	21.00	21.00
	802.11n-HT40	54	5270	22.00	17.00	22.00
		62	5310	17.50	16.50	18.50
	802.11ac-VHT20	52	5260	21.50	21.00	20.00
		56	5280	21.50	22.00	20.00
		60	5300	21.50	18.00	20.00
		64	5320	22.00	21.00	21.00
	802.11ac-VHT40	54	5270	22.00	17.00	22.00
		62	5310	17.50	16.00	18.50
	802.11ac-VHT80	58	5290	16.00	13.50	13.00

	Mode	Channel	Frequency (MHz)	SISO ANT 1 Tune-Up Limit	SISO ANT 2 Tune-Up Limit	MIMO Tune-Up Limit
5.5GHz WLAN	802.11a	100	5500	19.00	21.00	19.50
		116	5580	21.00	21.00	20.50
		124	5620	21.00	21.00	20.50
		132	5660	14.00	21.00	20.50
		140	5700	14.00	19.50	20.00
		144	5720	21.00	21.00	19.00
	802.11n-HT20	100	5500	18.50	20.00	19.00
		116	5580	21.00	21.00	21.00
		124	5620	21.00	21.00	21.00
		132	5660	21.00	21.00	21.00
		140	5700	16.50	19.00	16.50
		144	5720	19.50	21.50	19.50
	802.11n-HT40	102	5510	18.00	16.50	20.50
		110	5550	22.00	22.50	22.50
		126	5630	22.00	22.50	20.50
		134	5670	20.50	18.00	20.50
		142	5710	21.00	23.00	22.50
	802.11ac-VHT20	100	5500	18.50	20.00	19.00
		116	5580	21.00	21.00	21.00
		124	5620	21.00	21.00	21.00
		132	5660	21.00	21.00	21.00
		140	5700	16.50	19.00	16.50
		144	5720	19.50	21.00	19.50
	802.11ac-VHT40	102	5510	18.00	16.50	20.50
		110	5550	22.00	22.50	22.50
		126	5630	22.00	22.50	22.50
		134	5670	20.50	18.00	20.50
		142	5710	21.00	23.00	22.00
	802.11ac-VHT80	106	5530	17.50	17.00	20.00
		122	5610	21.50	21.00	22.50
		138	5690	22.00	21.50	23.50



5.8GHz WLAN	Mode	Channel	Frequency (MHz)	SISO ANT 1 Tune-Up Limit	SISO ANT 2 Tune-Up Limit	MIMO Tune-Up Limit
	802.11a	149	5745	21.00	24.00	24.00
		157	5785	23.00	23.50	24.00
		165	5825	23.50	23.00	26.00
	802.11n-HT20	149	5745	21.00	24.00	24.50
		157	5785	20.50	23.50	24.50
		165	5825	24.00	23.00	26.00
	802.11n-HT40	151	5755	24.50	24.00	27.00
		159	5795	23.50	24.00	26.50
	802.11ac-VHT20	149	5745	21.00	24.00	24.50
		157	5785	20.00	23.50	24.50
		165	5825	24.00	23.00	26.00
	802.11ac-VHT40	151	5755	24.00	24.00	27.00
		159	5795	23.50	24.00	26.50
	802.11ac-VHT80	155	5775	22.50	21.50	20.00

**<Beamforming mode>**

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	MIMO Tune-Up Limit
	802.11ac-VHT20	1	2412	17.00
		6	2437	22.00
		11	2462	14.00
	802.11ac- MCS0	3	2422	14.00
		6	2437	16.00
		9	2452	9.00

5.2GHz WLAN	Mode	Channel	Frequency (MHz)	MIMO Tune-Up Limit
	802.11ac-VHT20	36	5180	19.50
		40	5200	19.50
		44	5220	19.50
		48	5240	19.50
	802.11ac-VHT40	38	5190	17.00
		46	5230	22.50
	802.11ac-VHT80	42	5210	17.00

5.3GHz WLAN	Mode	Channel	Frequency (MHz)	MIMO Tune-Up Limit
	802.11ac-VHT20	52	5260	19.50
		56	5280	19.50
		60	5300	19.50
		64	5320	21.00
	802.11ac-VHT40	54	5270	22.00
		62	5310	13.50
	802.11ac-VHT80	58	5290	13.00

5.5GHz WLAN	Mode	Channel	Frequency (MHz)	MIMO Tune-Up Limit
	802.11ac-VHT20	100	5500	15.50
		116	5580	21.00
		124	5620	21.00
		132	5660	21.00
		140	5700	16.00
		144	5720	19.00
	802.11ac-VHT40	102	5510	20.50
		110	5550	22.00
		126	5630	22.00
		134	5670	20.50
		142	5710	22.00
	802.11ac-VHT80	106	5530	19.50
		122	5610	22.00
		138	5690	22.50

5.8GHz WLAN	Mode	Channel	Frequency (MHz)	MIMO Tune-Up Limit
	802.11ac-VHT20	149	5745	21.50
		157	5785	22.00
		165	5825	22.00
	802.11ac-VHT40	151	5755	22.00
		159	5795	22.50
	802.11ac-VHT80	155	5775	20.00

### **3. 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

## **4. Radio Frequency Radiation Exposure Evaluation**

### **4.1. 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	2412.0	4.00	25.00	29.000	0.794	794.328	0.158	1.000	0.158
5GHz WLAN	5180.0	5.00	27.00	32.000	1.585	1584.893	0.315	1.000	0.315
Bluetooth	2402.0	4.00	4.00	8.000	0.006	6.310	0.001	1.000	0.001

**Note:** For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band

<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	2412.0	0.36	22.00	22.360	0.172	172.187	0.034	1.000	0.034
5GHz WLAN	5180.0	-11.59	22.50	10.910	0.012	12.331	0.002	1.000	0.002

**Note:** For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band

### **4.2. Collocated Power Density Calculation**

WLAN Power Density / Limit	Bluetooth Power Density / Limit	$\Sigma$ (Power Density / Limit) of WLAN+Bluetooth
0.315	0.001	0.316

**Note:**

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

## **Conclusion:**

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