RF EXPOSURE EVALUATION REPORT

FCC ID	:	UZ7FXR9001
Equipment	:	Industrial Fixed RFID Reader
Brand Name	:	ZEBRA
Model Name	:	FXR9001
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 this product in accordance with 47 CFR Part2.1091 and it complies with applicable limit.

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC evaluation.

The results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. Laboratory, the test report shall not be reproduced except in full

Approved by: Cona Huang / Deputy Manager

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

Table of Contents

1. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) 4
2. MAXIMUM RF AVERAGE OUTPUT POWER AMONG PRODUCTION UNITS 7
3. RF EXPOSURE LIMIT INTRODUCTION 10
4. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION 11
4.1. Collocated Power Density Calculation 11

History of this test report

Report No.	Version	Description	Issued Date
FA381616	Rev. 01	Initial issue of report	Nov. 01, 2023

1. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Industrial Fixed RFID Reader
Brand Name	ZEBRA
Model Name	FXR9001
FCC ID	UZ7FXR9001
Wireless Technology and Frequency Range	WLAN 2.4 GHz Band: 2400 MHz ~ 2483.5 MHz WLAN 5.2 GHz Band: 5150 MHz ~ 5250 MHz WLAN 5.3 GHz Band: 5250 MHz ~ 5350 MHz WLAN 5.6 GHz Band: 5470 MHz ~ 5725 MHz WLAN 5.8 GHz Band: 5725 MHz ~ 5850 MHz Bluetooth: 2400 MHz ~ 2483.5 MHz RFID : 902.75 MHz ~ 927.25 MHz
Mode	WLAN: 802.11a/b/g/n/ac/ax HT20/HT40/VHT20/VHT40/VHT80/HE20/HE40/HE80 Bluetooth BR/EDR/LE RFID: ASK
HW Version	EV2
SW Version	0.4.11
MFD	1-Aug-23
EUT Stage	Identical Prototype

Reviewed by: Jason Wang

Report Producer: Daisy Peng

WLAN Antenna information				
BT/WiFi 1 (Left) (Internal Antenna)	Ant. Type	PIFA		
	Model No.	A92777-30	Brand Name	Auden
	Peak Gain (dBi)			
	2400~2483.5MHz	4.02	5470~5725MHz	4.95
	5150~5250MHz	5.51	5725~5850MHz	4.94
	5250~5350MHz	5.05		
WiFi 1 (Right) (Internal Antenna)	Ant. Type	PIFA		
	Model No.	A92774-30	Brand Name	Auden
	Peak Gain (dBi)			
	2400~2483.5MHz	5.42	5470~5725MHz	6.52
	5150~5250MHz	6.30	5725~5850MHz	5.95
	5250~5350MHz	6.39		
BT/WiFi (Left/Right) (External Antenna 1)	Ant. Type	Dipole		
	Model No.	ST0228-30-502-A	Brand Name	Amphenol
	Peak Gain (dBi)			
	2400~2483.5MHz	2.98	5470~5725MHz	4.15
	5150~5250MHz	4.22	5725~5850MHz	4.15
	5250~5350MHz	4.37		
BT/WiFi (Left/Right) (External Antenna 2)	Ant. Type	Dipole		
	Model No.	ZB511A-02-001-C	Brand Name	Amphenol
	Peak Gain (dBi)			
	2400~2483.5MHz	3.59	5470~5725MHz	3.70
	5150~5250MHz	2.60	5725~5850MHz	4.03
	5250~5350MHz	3.09		

RFID Antenna information				
RFID (Internal Antenna)	Ant. Type	Patch		
	Model No.	L000213-01	Brand Name	TE
	Peak Gain (dBi)			
	865-868MHz	6.5		
	902-928MHz	7.2		
RFID (External Antenna)	Ant. Type	Patch		
	Model No.	AN650	Brand Name	ZEBRA
	Peak Gain (dBi)			
	865-868MHz	6		
	902-928MHz	6		
RFID (External Antenna)	Ant. Type	Patch		
	Model No.	AN480	Brand Name	ZEBRA
	Peak Gain (dBi)			
	865-868MHz	6		
	902-928MHz	6		
RFID (External Antenna)	Ant. Type	Patch		
	Model No.	SR5502	Brand Name	ZEBRA
	Peak Gain (dBi)			
	865-868MHz	2.0		
	902-928MHz	6.7		

Support Unit for Test				
Cable, 3-way USB Splitter	Brand Name	ZEBRA	Model Name	ADP-USB0010-M12
Cable, USB-C Host, 5ft.	Brand Name	ZEBRA	Model Name	CBL-USBCHST015-M12
Cable, USB-C Host, 15ft.	Brand Name	ZEBRA	Model Name	CBL-USBCHST035-M12
Cable, USB-C Client, 5ft.	Brand Name	ZEBRA	Model Name	CBL-USBCCLT015-M12
Cable, USB-C Client, 15ft.	Brand Name	ZEBRA	Model Name	CBL-USBCCLT035-M12
Cable, USB-A Client, 5ft.	Brand Name	ZEBRA	Model Name	CBL-USBACLT015-M12
Cable, USB-A Client, 15ft.	Brand Name	ZEBRA	Model Name	CBL-USBACLT035-M12
Cable, GPIO	Brand Name	ZEBRA	Model Name	CBL-GP0050-M12M12A
Cable, 12V (Cigarette Lighter) Power Adapter, 3.5 meter	Brand Name	ZEBRA	Model Name	CBL-PWRD035-M12CL
Cable, DC Power Cord (Flying Leads), 3.5m	Brand Name	ZEBRA	Model Name	CBL-PWRD035-M1200
Cable, DC Power Cord (Flying Leads), 10m	Brand Name	ZEBRA	Model Name	CBL-PWRD100-M1200
Cable, Power Supply Output Adapter, 3.5m	Brand Name	ZEBRA	Model Name	CBL-PWRD035-M12M12
Cable, Power Supply Output Adapter, 10m	Brand Name	ZEBRA	Model Name	CBL-PWRD100-M12M12
Cable, DC-DC Power Supply Input	Brand Name	ZEBRA	Model Name	CBL-PWRD150-M12M00
Cable, AC-DC Power Supply Input (Flying Leads)	Brand Name	ZEBRA	Model Name	CBL-PWRA150-M1200
Cable, AC-DC Power Supply Input (IEC plug)	Brand Name	ZEBRA	Model Name	CBL-PWRA035-M12IEC
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 68", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-3B4000680R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 180", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-3B4001800R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 240", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-3B4002400R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 360", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-3B4003600R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 68", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-1B4000680R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 180", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-1B4001800R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 240", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-1B4002400R
CBL: RF, N STR PLUG TO RP-TNC STR PLUG ON LMR-240, 360", IP67 Sealed	Brand Name	ZEBRA	Model Name	CBLRD-1B4003600R
CHIMERA ETHERNET CABLE 5M	Brand Name	ZEBRA	Model Name	CBL-ENT00500-M1200
CHIMERA ETHERNET CABLE 15M	Brand Name	ZEBRA	Model Name	CBL-ENT01500-M1200
Outdoor AC-DC PSU	Brand Name	ZEBRA	Model Name	PWR-BGA24V90W0WW (Spec PD-007875-01)
Forklift DC-DC PSU	Brand Name	ZEBRA	Model Name	PWR-BGA24V90W1WW (Spec PD-007876-01)
Indoor AC-DC PSU	Brand Name	ZEBRA	Model Name	PWR-BGA24V78W3WW (Spec PD-007877-01)
PoE adaptor	Brand Name	ZEBRA	Model Name	PD-9001GR/AT/AC
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN480
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN650
External RFID Antenna	Brand Name	ZEBRA	Model Name	SR5502
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN510
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN520
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN610
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN620
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN720
External RFID Antenna	Brand Name	ZEBRA	Model Name	AN440
External RFID Antenna	Brand Name	ZEBRA	Model Name	SP5504
BT/WLAN_External Antenna	Brand Name	Amphenol	Model Name	ST0228-30-502-A
BT/WLAN_External Antenna	Brand Name	Amphenol	Model Name	ZB511A-02-001-C
AN650 Antenna cable(5ft/1524mm)	Brand Name	ZEBRA	Model Name	CBLRD-1C4000600R
AN650 Antenna cable(20ft/6096mm)	Brand Name	ZEBRA	Model Name	CBLRD-1C4002400R
AN650 Antenna cable(15ft/4572mm)	Brand Name	ZEBRA	Model Name	CBLRD-1C4001800R
AN650 Antenna cable(30ft/9144mm)	Brand Name	ZEBRA	Model Name	CBLRD-1C4003600R
AN650 Antenna cable(10ft/3048mm)	Brand Name	ZEBRA	Model Name	CBLRD-1C4001200R

2. Maximum RF average output power among production units

<WLAN 2.4GHz>

	Mod.	Data Rate	CH.	Freq. (MHz)	Ant1 tune up	Ant2 tune up
2.4GHz WLAN	11b	1Mbps	1	2412	9.50	10.00
	11b	1Mbps	6	2437	9.50	9.50
	11b	1Mbps	11	2462	10.00	9.50
	11g	6Mbps	1	2412	10.00	9.50
	11g	6Mbps	6	2437	10.00	10.00
	11g	6Mbps	11	2462	9.50	9.00
	HT20	MCS0	1	2412	8.00	8.00
	HT20	MCS0	6	2437	12.50	14.00
	HT20	MCS0	11	2462	7.50	7.00
	HT40	MCS0	3	2422	6.00	6.00
	HT40	MCS0	6	2437	10.00	10.50
	HT40	MCS0	9	2452	5.00	5.50
	VHT20	MCS0	1	2412	8.00	8.00
	VHT20	MCS0	6	2437	12.50	14.00
	VHT20	MCS0	11	2462	7.50	7.00
	VHT40	MCS0	3	2422	6.00	6.00
	VHT40	MCS0	6	2437	10.00	10.50
	VHT40	MCS0	9	2452	5.00	5.50

<WLAN 5GHz>

	Mod.	Data Rate	CH.	Freq. (MHz)	Ant1 tune up	Ant2 tune up
5GHz WLAN B1	11a	6Mbps	36	5180	15.00	15.00
	11a	6Mbps	44	5220	14.50	14.50
	11a	6Mbps	48	5240	15.00	14.50
	HT20	MCS0	36	5180	12.50	12.00
	HT20	MCS0	44	5220	12.50	12.00
	HT20	MCS0	48	5240	12.50	11.50
	HT40	MCS0	38	5190	12.50	12.00
	HT40	MCS0	46	5230	12.50	12.00
	VHT20	MCS0	36	5180	12.50	12.00
	VHT20	MCS0	44	5220	12.50	12.00
	VHT20	MCS0	48	5240	12.50	11.50
	VHT40	MCS0	38	5190	12.50	12.00
	VHT40	MCS0	46	5230	12.50	12.00
	VHT80	MCS0	42	5210	8.00	8.00

	Mod.	Data Rate	CH.	Freq. (MHz)	Ant1 tune up	Ant2 tune up
5GHz WLAN B2	11a	6Mbps	52	5260	14.50	15.00
	11a	6Mbps	60	5300	14.50	14.50
	11a	6Mbps	64	5320	15.00	14.50
	HT20	MCS0	52	5260	12.50	11.50
	HT20	MCS0	60	5300	13.00	12.00
	HT20	MCS0	64	5320	13.00	11.00
	HT40	MCS0	54	5270	12.50	11.50
	HT40	MCS0	62	5310	12.50	11.00
	VHT20	MCS0	52	5260	12.50	11.50
	VHT20	MCS0	60	5300	13.00	12.00
	VHT20	MCS0	64	5320	13.00	11.00
	VHT40	MCS0	54	5270	12.50	11.50
	VHT40	MCS0	62	5310	12.50	11.00
	VHT80	MCS0	58	5290	8.50	7.50

	Mod.	Data Rate	CH.	Freq. (MHz)	Ant1 tune up	Ant2 tune up
5GHz WLAN B3	11a	6Mbps	100	5500	15.00	15.00
	11a	6Mbps	116	5580	15.00	15.00
	11a	6Mbps	140	5700	15.00	15.00
	HT20	MCS0	100	5500	12.50	11.50
	HT20	MCS0	116	5580	12.00	12.00
	HT20	MCS0	140	5700	12.50	12.00
	HT40	MCS0	102	5510	13.00	11.50
	HT40	MCS0	110	5550	13.00	12.00
	HT40	MCS0	134	5670	12.00	12.00
	VHT20	MCS0	100	5500	12.50	11.50
	VHT20	MCS0	116	5580	12.00	12.00
	VHT20	MCS0	140	5700	12.50	12.00
	VHT40	MCS0	102	5510	13.00	11.50
	VHT40	MCS0	110	5550	13.00	12.00
	VHT40	MCS0	134	5670	12.00	12.00
	VHT80	MCS0	106	5530	9.00	7.50
	VHT80	MCS0	122	5610	8.50	8.00

	Mod.	Data Rate	CH.	Freq. (MHz)	Ant1 tune up	Ant2 tune up
5GHz WLAN B4	HE20	MCS0	149	5745	12.80	11.30
	HE20	MCS0	157	5785	12.90	10.90
	HE20	MCS0	165	5825	12.40	10.10
	HE40	MCS0	151	5755	12.90	10.50
	HE40	MCS0	159	5795	12.30	10.20
	HE80	MCS0	155	5775	8.30	6.40

<RFID>

Frequacy(MHz)	Data Rate
	RFID
902.75 MHz	27.00
914.75 MHz	27.00
927.25 MHz	27.00

<Bluetooth>

Mode	Average power (dBm)				
	BR / EDR			LE	
	1Mbps	2Mbps	3Mbps	1Mbps	2Mbps
Tune-up Limit	10.00	7.50	7.50	8.50	8.50

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^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f2)	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				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f2)	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. Collocated Power Density Calculation

Band	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
WLAN2.4GHz Band	5.42	14.00	19.42	0.09	87.50	0.017	1.000	0.017
WLAN5GHz Band	6.52	15.00	21.52	0.14	141.91	0.028	1.000	0.028
Bluetooth	4.02	10.00	14.02	0.03	25.23	0.005	1.000	0.005
RFID	7.20	27.00	34.20	2.63	2630.27	0.524	0.601	0.871

RFID Power Density / Limit	WLAN Power Density / Limit	Bluetooth Power Density / Limit	∑(Power Density / Limit) of RFID+WLAN+Bluetooth
0.871	0.028	0.005	0.904

Note:

1. ∑(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for RFID + WLAN + Bluetooth.
2. Considering the WLAN module collocation with the RFID and Bluetooth transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 3 collocated transmitters is compliant

Conclusion:

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