RF Exposure Evaluation Report

APPLICANT	:	Quectel Wireless Solutions Co., Ltd.
EQUIPMENT	:	Wi-Fi & Bluetooth Module
BRAND NAME	:	Quectel
MODEL NAME	:	FCE863R
FCC ID	:	XMR2024FCE863R
STANDARD	:	47 CFR Part 2.1091

The product evaluation date was started from Apr. 28, 2024 and completed on Apr. 28, 2024. We, Sporton International Inc. (Kunshan), would like to declare that the device has been evaluated in accordance with 47 CFR Part 2.1091 and FCC KDB 447498 D01 v06, and pass the limit. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China

Table of Contents

1. ADMINISTRATION DATA 4
1.1. Testing Laboratory 4
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) 5
3. MAXIMUM RF AVERAGE OUTPUT TUNE UP POWER AMONG PRODUCTION UNITS 6
4. RF EXPOSURE LIMIT INTRODUCTION 8
5. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION 9
5.1. Standalone Power Density Calculation 9
5.2. Collocated Power Density Calculation 9

Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA430102	Rev. 01	Initial issue of report.	May 06, 2024

1. Administration Data

1.1. Testing Laboratory

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Testing Laboratory			
Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR01-KS	CN1257	314309

Applicant	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

Manufacturer	
Company Name	Quectel Wireless Solutions Co., Ltd.
Address	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China

2. Description of Equipment Under Test (EUT)

Product Feature & Specification	
EUT Type	Wi-Fi & Bluetooth Module
Brand Name	Quectel
Model Name	FCE863R
FCC ID	XMR2024FCE863R
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	WLAN 2.4GHz 802.11b/g WLAN 2.4GHz 802.11n HT20/HT40 WLAN 2.4GHz 802.11ac VHT20/VHT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a WLAN 5GHz 802.11n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 WLAN 5GHz 802.11ax HE20/HE40/HE80 Bluetooth BR/EDR/LE
Antenna Type	Dipole antenna
HW Version	R1.0
SW Version	NA
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. WLAN2.4GHz /WLAN5GHz all support SISO and MIMO mode, we chose MIMO tune up power to perform MPE calculation conservatively.

Comments and Explanations:
1. The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification. 2. The maximum RF output tune up power, antenna gain also the safe distance used for evaluate RF exposure were declared by manufacturer.

Antenna Gain:

WLAN	Ant.1	Ant.2
WLAN2.4GHz	0.2	0.2
WLAN5.2GHz	-0.7	-0.7
WLAN5.3GHz	-0.8	-0.8
WLAN5.5GHz	-1.2	-1.2
WLAN5.8GHz	-1.5	-1.5
BT	**Ant.0**	**Ant.1**
Bluetooth	0.2	0.2

3. Maximum RF average output tune up power among production units

<Bluetooth>

Mode	Maximum Average Power (dBm)	
	Ant.0	Ant.1
Bluetooth BR/EDR	8.00	10.00
Bluetooth LE	8.00	9.00

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
2.4GHz	802.11b	22.00
	802.11g	22.00
	802.11n-HT20	23.00
	802.11n-HT40	16.00
	802.11ac-VHT20	23.00
	802.11ac-VHT40	16.00
	802.11ax-HE20	18.00
	802.11ax-HE40	18.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)
		Ant.1+2
5.2GHz	802.11a	19.00
	802.11n-HT20	20.00
	802.11n-HT40	22.00
	802.11ac-VHT20	20.00
	802.11ac-VHT40	22.00
	802.11ac-VHT80	23.00
	802.11ax-HE20	20.00
	802.11ax-HE40	23.00
	802.11ax-HE80	23.00
5.3GHz	802.11a	23.00
	802.11n-HT20	22.00
	802.11n-HT40	23.00
	802.11ac-VHT20	22.00
	802.11ac-VHT40	23.00
	802.11ac-VHT80	23.00
	802.11ax-HE20	22.00
	802.11ax-HE40	23.00
	802.11ax-HE80	23.00
5.5GHz	802.11a	23.00
	802.11n-HT20	22.00
	802.11n-HT40	23.00
	802.11ac-VHT20	22.00
	802.11ac-VHT40	23.00

	802.11ac-VHT80	24.00
	802.11ax-HE20	22.00
	802.11ax-HE40	23.00
	802.11ax-HE80	24.00
5.8GHz	802.11a	21.00
	802.11n-HT20	21.50
	802.11n-HT40	22.00
	802.11ac-VHT20	21.50
	802.11ac-VHT40	22.00
	802.11ac-VHT80	24.00
	802.11ax-HE20	22.00
	802.11ax-HE40	22.00
	802.11ax-HE80	24.00

Note: WLAN2.4GHz /WLAN5GHz all support SISO/MIMO mode, we only chose MIMO tune up power to perform MPE calculation conservatively for MIMO power is higher.

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^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

5. Radio Frequency Radiation Exposure Evaluation

5.1. Standalone Power Density Calculation

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Average EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)	Power Density / Limit
2.4GHz WLAN	2412.0	0.20	23.00	23.200	208.930	0.042	1.000	**0.042**
5.2GHz WLAN	5180.0	-0.70	23.00	22.300	169.824	0.034	1.000	0.034
5.3GHz WLAN	5260.0	-0.80	23.00	22.200	165.959	0.033	1.000	0.033
5.5GHz WLAN	5500.0	-1.20	24.00	22.800	190.546	0.038	1.000	**0.038**
5.8GHz WLAN	5745.0	-1.50	24.00	22.500	177.828	0.035	1.000	0.035
Bluetooth	2402.0	0.20	10.00	10.200	10.471	0.002	1.000	**0.002**

Note:
1. For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
2. WLAN2.4GHz and WLAN5GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.
3. Chose the maximum power to do MPE analysis.
4. Chose the maximum RF output tune up power of all antennas among same frequency BT band and the maximum antenna gain to perform MPE calculation conservatively.

5.2. Collocated Power Density Calculation

Bluetooth Power Density / Limit	WLAN 5GHz Power Density / Limit	Σ(Power Density / Limit) of Bluetooth + WLAN 5GHz
0.002	0.038	0.040

Bluetooth Power Density / Limit	WLAN 2.4GHz Power Density / Limit	Σ(Power Density / Limit) of Bluetooth + WLAN 2.4GHz
0.002	0.042	0.044

Note:
1. According to the EUT characteristic, two Bluetooth antennas cannot transmit simultaneously.
2. According to the EUT characteristic, WLAN 2.4GHz and WLAN5GHz cannot transmit simultaneously.
3. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for Bluetooth +WLAN5GHz, Bluetooth + WLAN2.4GHz.
4. Considering all transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1.

Conclusion:

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

------THE END------