

RF Exposure Evaluation Report

APPLICANT : Quectel Wireless Solutions Co., Ltd.
EQUIPMENT : Wi-Fi & Bluetooth Module
BRAND NAME : Quectel
MODEL NAME : FCE860L
FCC ID : XMR2023FCE860L
STANDARD : 47 CFR Part 2.1091

The product evaluation date was started from Dec. 15, 2023 and completed on Dec. 15, 2023. 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.



Approved by: Si Zhang

Sporton International Inc. (Kunshan)

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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Revision History

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FA352903	Rev. 01	Initial issue of report.	Dec. 22, 2023



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	FCE860L
FCC ID	XMR2023FCE860L
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/n HT20/HT40 WLAN 2.4GHz 802.11ax HE20/HE40 WLAN 5GHz 802.11a/n 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, and MIMO mode is only for WLAN 2.4GHz 802.11n/ax HT20/HT40 /HE20/HE40/ and WLAN 5GHz 802.11n/ac/ax HT20/HT40/VHT20/VHT40/VHT80 /HE20/HE40/HE80.
3. Chose the maximum RF output tune up power of all antennas among same frequency WLAN bands and the maximum antenna gain 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.0	Ant.1
WLAN2.4GHz	0.73	0.73
WLAN5.2GHz	1.14	1.14
WLAN5.3GHz	1.00	1.00
WLAN5.5GHz	0.60	0.60
WLAN5.8GHz	0.95	0.95
Bluetooth	0.73	/



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

<Bluetooth>

Mode		Maximum Average power(dBm)
Bluetooth	BR/EDR	9.00
	LE	9.00

<2.4GHz WLAN >

Mode		Maximum Average Power (dBm)		
		Ant.0	Ant.1	Ant.0+1
2.4GHz	802.11b	23.50	20.50	/
	802.11g	18.00	20.00	/
	802.11n-HT20	13.50	13.50	16.50
	802.11n-HT40	16.00	16.00	19.00
	802.11ax-HE20	13.50	13.50	16.50
	802.11ax-HE40	16.00	16.00	19.00

<5GHz WLAN >

Mode		Maximum Average Power (dBm)		
		Ant.0	Ant.1	Ant.0+1
5.2GHz	802.11a	15.50	15.50	/
	802.11n-HT20	15.50	15.50	18.50
	802.11n-HT40	14.50	14.50	17.50
	802.11ac-VHT20	15.50	15.50	18.50
	802.11ac-VHT40	14.50	14.50	17.50
	802.11ac-VHT80	13.00	13.00	16.00
	802.11ax-HE20	15.50	15.50	18.50
	802.11ax-HE40	14.50	14.50	17.50
	802.11ax-HE80	13.00	13.00	16.00
5.3GHz	802.11a	15.00	15.00	/
	802.11n-HT20	15.50	15.50	18.50
	802.11n-HT40	14.50	14.50	17.50
	802.11ac-VHT20	15.50	15.50	18.50
	802.11ac-VHT40	14.50	14.50	17.50
	802.11ac-VHT80	13.00	13.00	16.00
	802.11ax-HE20	15.50	15.50	18.50
	802.11ax-HE40	14.50	14.50	17.50
	802.11ax-HE80	13.00	13.00	16.00
5.5GHz	802.11a	16.00	16.00	/
	802.11n-HT20	16.00	16.00	19.00
	802.11n-HT40	15.00	15.00	18.00
	802.11ac-VHT20	16.00	16.00	19.00
	802.11ac-VHT40	15.00	15.00	18.00
	802.11ac-VHT80	14.00	14.00	17.00
	802.11ax-HE20	16.00	16.00	19.00
	802.11ax-HE40	15.00	15.00	18.00



	802.11ax-HE80	14.00	14.00	17.00
5.8GHz	802.11a	16.00	16.00	/
	802.11n-HT20	16.00	16.00	19.00
	802.11n-HT40	15.00	15.00	18.00
	802.11ac-VHT20	16.00	16.00	19.00
	802.11ac-VHT40	15.00	15.00	18.00
	802.11ac-VHT80	14.00	14.00	17.00
	802.11ax-HE20	16.00	16.00	19.00
	802.11ax-HE40	15.00	15.00	18.00
	802.11ax-HE80	14.00	14.00	17.00

Note: WLAN2.4GHz 802.11n/ax/WLAN5GHz 802.11n/ac/ax all support SISO/MIMO mode, chose the maximum RF output tune up power of all antennas among same frequency WLAN bands and the maximum antenna gain to perform MPE calculation conservatively.

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/f ²)	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/f ²)	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	0.73	23.50	24.230	264.850	0.053	1.000	0.053
5.2GHz WLAN	5180.0	1.14	18.50	19.640	92.045	0.018	1.000	0.018
5.3GHz WLAN	5260.0	1.00	18.50	19.500	89.125	0.018	1.000	0.018
5.5GHz WLAN	5500.0	0.60	19.00	19.600	91.201	0.018	1.000	0.018
5.8GHz WLAN	5745.0	0.95	19.00	19.950	98.855	0.020	1.000	0.020
Bluetooth	2402.0	0.73	9.00	9.730	9.397	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.
- WLAN2.4GHz and WLAN5GHz chose the higher SISO gain as MIMO gain to perform MPE calculation.
- Chose the maximum power to do MPE analysis.

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	0.020	0.022

Bluetooth Power Density / Limit	WLAN 2.4GHz Power Density / Limit	Σ (Power Density / Limit) of Bluetooth + WLAN 2.4GHz
0.002	0.053	0.055

Note:

- According to the EUT characteristic, WLAN 2.4GHz and WLAN5GHz cannot transmit simultaneously.
- 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.
- 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-----