



RF EXPOSURE Test Report

Report No.: MTi231109003-07E5
Date of issue: 2024-01-18
Applicant: SHENZHEN POWEROAK NEWENER CO., LTD
Product: EMS Controller
Model(s): SEC-G1
FCC ID: 2AYT3-SEC-G1

Shenzhen Microtest Co., Ltd.

<http://www.mtitest.com>

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Test Result Certification	
Applicant:	SHENZHEN POWEROAK NEWENER CO., LTD
Address:	F19, BLD No.1, Kaidaer, Tongsha Rd No.168, Xili Street, Nanshan, Shenzhen, China
Manufacturer:	SHENZHEN POWEROAK NEWENER CO., LTD
Address:	F19, BLD No.1, Kaidaer, Tongsha Rd No.168, Xili Street, Nanshan, Shenzhen, China
Product description	
Product name:	EMS Controller
Trademark:	BLUETTI
Model name:	SEC-G1
Serial Model:	N/A
Standards:	N/A
Test procedure:	KDB 447498 D01 v06
Date of Test	
Date of test:	2024-01-02 to 2024-01-18
Test result:	Pass

Test Engineer :

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RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) Radiation as specified in §1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

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 Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

Friis transmission formula: $P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot R^2)$

Where

P_d = Power density in mW/cm²

P_{out} = output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π = 3.1415926

R = distance between observation point and center of the radiator in cm (20cm)

P_d the limit of MPE, 1mW/cm². If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

Measurement Result

Module 1:

Operation Frequency: 2402-2480MHz

ANT Gain: 3.4 dBi

Power density limited: 1mW/ cm²

BR+EDR:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	8.59	8±1	9	7.943	3.4	2.19	0.0035	1
2441		7.95	8±1	9	7.943	3.4	2.19	0.0035	1
2480		8.86	8±1	9	7.943	3.4	2.19	0.0035	1
2402	π/4-DQPSK	6.88	7±1	8	6.310	3.4	2.19	0.0027	1
2441		7.02	7±1	8	6.310	3.4	2.19	0.0027	1
2480		7.97	7±1	8	6.310	3.4	2.19	0.0027	1
2402	8DPSK	7.19	8±1	9	7.943	3.4	2.19	0.0035	1
2441		7.43	8±1	9	7.943	3.4	2.19	0.0035	1
2480		8.47	8±1	9	7.943	3.4	2.19	0.0035	1

Max MPE ratio: 0.0035

BLE:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK-1M	5.31	6±1	7	5.012	3.4	2.19	0.0022	1
2441		5.72	6±1	7	5.012	3.4	2.19	0.0022	1
2480		6.08	6±1	7	5.012	3.4	2.19	0.0022	1

Max MPE ratio: 0.0022

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,

802.11n HT40: 2422-2452MHz,

ANT Gain: 3.4 dBi

 Power density limited: 1mW/ cm²

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna Gain	Evaluation result at 20cm Power density(mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power				
				(dBm)	(dBm)	(dBm)	(mW)	Numeric
2412	802.11b	21.67	21±1	22	158.489	2.19	0.06898	1
2437		23.83	24±1	25	316.228	2.19	0.13764	1
2462		21.43	21±1	22	158.489	2.19	0.06898	1
2412	802.11g	17.75	18±1	19	79.433	2.19	0.03457	1
2437		22.71	23±1	24	251.189	2.19	0.10933	1
2462		17.67	18±1	19	79.433	2.19	0.03457	1
2412	802.11n H20	18.23	18±1	19	79.433	2.19	0.03457	1
2437		22.95	23±1	24	251.189	2.19	0.10933	1
2462		17.74	18±1	19	79.433	2.19	0.03457	1
2422	802.11n H40	17.72	18±1	19	79.433	2.19	0.03457	1
2437		22.30	22±1	23	199.526	2.19	0.08684	1
2452		15.78	16±1	17	50.119	2.19	0.02181	1

Max MPE ratio: 0.1376

Module 2:

Operation Frequency: 2402-2480MHz

ANT Gain: 2.33 dBi

 Power density limited: 1mW/ cm²

BR+EDR:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK	8.13	8±1	9	7.943	2.33	1.71	0.0027	1
2441		8.36	8±1	9	7.943	2.33	1.71	0.0027	1
2480		9.26	9±1	10	10.000	2.33	1.71	0.0034	1
2402	π/4-DQPSK	7.58	7±1	8	6.310	2.33	1.71	0.0021	1
2441		7.76	7±1	8	6.310	2.33	1.71	0.0021	1
2480		8.67	8±1	9	7.943	2.33	1.71	0.0027	1
2402	8DPSK	7.94	8±1	9	7.943	2.33	1.71	0.0027	1
2441		8.15	8±1	9	7.943	2.33	1.71	0.0027	1
2480		9.29	9±1	10	10.000	2.33	1.71	0.0034	1

Max MPE ratio: 0.0034

BLE:

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
2402	GFSK-1M	5.12	6±1	7	5.012	2.33	1.71	0.0017	1
2441		5.45	6±1	7	5.012	2.33	1.71	0.0017	1
2480		6.05	6±1	7	5.012	2.33	1.71	0.0017	1

Max MPE ratio: 0.0017

2.4G WIFI:

Operation Frequency: WIFI 802.11b/g/n HT20: 2412-2462MHz,

802.11n HT40: 2422-2452MHz,

ANT Gain: 2.33 dBi

 Power density limited: 1mW/ cm²

Channel Freq. (MHz)	modulation	conducted power (dBm)	Tune-up power (dBm)	Max		Antenna Gain	Evaluation result at 20cm Power density(mW/cm ²)	Power density Limits (mW/cm ²)
				tune-up power				
				(dBm)	(dBm)	(dBm)	(mW)	Numeric
2412	802.11b	21.02	21±1	22	158.489	1.71	0.05392	1
2437		23.16	23±1	24	251.189	1.71	0.08545	1
2462		20.94	21±1	22	158.489	1.71	0.05392	1
2412	802.11g	21.42	21±1	22	158.489	1.71	0.05392	1
2437		22.99	23±1	24	251.189	1.71	0.08545	1
2462		20.55	21±1	22	158.489	1.71	0.05392	1
2412	802.11n H20	21.15	21±1	22	158.489	1.71	0.05392	1
2437		23.20	23±1	24	251.189	1.71	0.08545	1
2462		20.60	21±1	22	158.489	1.71	0.05392	1
2422	802.11n H40	20.92	21±1	22	158.489	1.71	0.05392	1
2437		22.27	22±1	23	199.526	1.71	0.06788	1
2452		18.70	19±1	20	100.000	1.71	0.03402	1

Max MPE ratio: 0.0855

5.8G Radar:

Operation Frequency: 5800-5860MHz

ANT Gain: 2 dBi

 Power density limited: 1mW/ cm²

EIRP comes from the following calculations:

9.5 Equations to calculate EIRP

Calculate the EIRP from the radiated field strength in the far field using Equation (22):

$$EIRP = E_{Meas} + 20 \log(d_{Meas}) - 104.7 \quad (22)$$

where

EIRP is the equivalent isotropically radiated power, in dBm
 E_{Meas} is the field strength of the emission at the measurement distance, in dB μ V/m
 d_{Meas} is the measurement distance, in m

NOTE—Because this equation yields the identical result whether the field strength is extrapolated using the default 20 dB/decade of distance extrapolation factor, or the field strength is not extrapolated for distance, this equation can generally be applied directly (with no further correction) to determine EIRP. In some cases, a different distance correction factor may be required; see 9.1.

Channel Freq. (MHz)	modulation	Field strength (dB μ V/m)	EIRP (dBm)	Tune-up power (dBm)	Max		Evaluation result (mW/cm ²)	Power density Limits (mW/cm ²)
					tune-up power (dBm)	(mW)		
5800	CW	91.64	-3.56	(-3) \pm 1	-2	0.631	0.0001	1
5830		91.18	-4.02	(-3) \pm 1	-2	0.631	0.0001	1
5860		91.62	-3.58	(-3) \pm 1	-2	0.631	0.0001	1

Max MPE ratio: 0.0001

Conclusion:
SIMULTANEOUS TRANSMISSIONS

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE. To comply with the MPE, the fraction of the MPE in terms of E2, H2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

Simultaneous transmit:

Module1

Operating Band	The MPE ratio
BR&EDR	0.0035
BLE	0.0022
2.4G WIFI	0.1376

Module2

Operating Band	The MPE ratio
BR&EDR	0.0034
BLE	0.0017
2.4G WIFI	0.0855

Operating Band	The MPE ratio
5.8G Radar	0.0001

The sum of all the MPE ratios result: $0.2340 \leq 1.0$, No SAR is required.

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