



Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Telephone: +86-755-26648640

Fax: +86-755-26648637

Website: www.cqa-cert.com

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RF Exposure Evaluation Report

Report No. : CQASZ20210500031EX-05

Applicant: SHENZHEN POWEROAK NEWENER CO., LTD

Address of Applicant: Room 701-3, Building B, CADRE Building, Tongsha Road, Nanshan District, Shenzhen City, Guangdong Province, P.R.China

Manufacturer: SHENZHEN POWEROAK NEWENER CO., LTD

Address of Manufacturer: Room 701-3, Building B, CADRE Building, Tongsha Road, Nanshan District, Shenzhen City, Guangdong Province, P.R.China

Equipment Under Test (EUT):

Product: Portable Power Station

All Model No.: EP500

Test Model No.: EP500

Brand Name: /

FCC ID: 2AYT3-EP500

Standards: 47 CFR Part 1.1307

47 CFR Part 1.1310

KDB447498D01 General RF Exposure Guidance v06

Date of Test: May 25, 2021 – Jun. 10, 2021

Date of Issue: Jun. 10, 2021

Test Result : PASS

Tested By: Lewis Zhou
(Lewis Zhou)

Reviewed By: Timo Lei
(Timo Lei)

Approved By: Sheek Luo
(Sheek Luo)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20210500031EX-05	Rev.01	Initial report	Jun. 10, 2021

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3 General Information

3.1 Client Information

Applicant:	SHENZHEN POWEROAK NEWENER CO., LTD
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3.2 General Description of EUT

Product Name:	Portable Power Station
All Model No.:	EP500
Test Model No.:	EP500
Trade Mark:	N/A
Hardware Version:	V1.0
Product Type:	☐ Mobile ☐ Portable ☒ Fix Location
Power Supply:	DC 51.2V from battery 5120Wh 100Ah Input : 100-120VAC 50/60Hz 15A max DC55-145VDC 20AMAX Output: AC*4: 100-120VAC 50/60Hz, 2000W Total Aviation Sockets*1: 12VDC, 30A USB-A*1: 5VDC, 2A, USB-A*1: 5VDC ,1A, USB-A*2: 5VDC, 2A, 9VDC,2A ,12VDC 1.5A USB-C*1: 5V-15VDC 3A 20VDC 5A Cigarette lighter*1: 12VDC, 10A DC 5521*2: 12VDC, 10A Wireless Charging*2: 5/7.5/10/15W Total

3.3 General Description of BT

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	BT-V5.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK
Transfer Rate:	1Mbps/2Mbps/3Mbps
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Antenna Type:	Chip antenna
Antenna Gain	0dBi

3.4 General Description of 2.4G WIFI

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(H40): 2422MHz~2452MHz
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Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels IEEE 802.11n HT40: 7
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g : OFDM IEEE for 802.11n(HT20): OFDM IEEE for 802.11n(HT40): OFDM
Antenna Type	PCB antenna
Antenna Gain	0dBi

4 RF Exposure Evaluation

4.1 RF Exposure Compliance Requirement

4.1.1 Limits

According to FCC Part1.1310: 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 part1.1307(b)

TABLE 1—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 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

F= Frequency in MHz

Friis Formula

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

Where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to

the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

4.1.2 Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.1.3 EUT RF Exposure Evaluation standalone operations

1) For BT

Antenna Gain: 0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

GFSK mode				
Test Channel	Peak Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
			(dBm)	(mW)
Lowest(2402MHz)	4.865	5±1	6	3.981
Middle(2441MHz)	6.037	6±1	7	5.012
Highest(2480MHz)	4.655	5±1	6	3.981
π/4DQPSK mode				
Lowest(2402MHz)	3.907	4±1	5	3.162
Middle(2441MHz)	5.339	5±1	6	3.981
Highest(2480MHz)	3.929	4±1	5	3.162
8DPSK mode				
Lowest(2402MHz)	4.079	4±1	5	3.162
Middle(2441MHz)	5.434	5±1	6	3.981
Highest(2480MHz)	4.109	4±1	5	3.162

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
5.012	0	0.0010	1.0	PASS

Note: 1) Refer to report No. : CQASZ20210500031EX-02 EUT test Max Conducted average Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (5.012 * 1.00) / (4 * 3.1416 * 20^2) = 0.0010 \text{ mW/cm}^2$

3) EUT Bluetooth module is more than 20cm away from the human body

2)For WIFI:

Antenna Gain: 0dBi

Antenna Gain: The maximum Gain measured in fully anechoic chamber is 1.0 in linear scale.

Output Power Into Antenna & RF Exposure Evaluation Distance:

Measurement Data

802.11b mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	6.64	7±1	8	6.310
Middle(2437MHz)	ANT1	7.59	8±1	9	7.943
Highest(2462MHz)	ANT1	7.98	7±1	8	6.310
802.11g mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	7.65	7±1	8	6.310
Middle(2437MHz)	ANT1	8.46	8±1	9	7.943
Highest(2462MHz)	ANT1	6.34	7±1	8	6.310
802.11n(HT20) SISO mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2412MHz)	ANT1	6.98	6±1	7	5.012
Middle(2437MHz)	ANT1	7.67	7±1	8	6.310
Highest(2462MHz)	ANT1	5.42	6±1	7	5.012
802.11n(HT40) SISO mode					
Test channel	Antenna	Output Power (dBm)	Tune up tolerance (dBm)	Maximum tune-up Power	
				(dBm)	(mW)
Lowest(2422MHz)	ANT1	5.96	6±1	7	5.012
Middle(2437MHz)	ANT1	6.35	7±1	8	6.310
Highest(2452MHz)	ANT1	6.59	6±1	7	5.012

Test worst case

Maximum tune-up Power (mW)	Antenna Gain (dBi)	Power Density at R = 20 cm (mW/cm ²)	Limit	Result
7.943	0	0.00158	1.0	PASS

Note: 1) Refer to report No. : CQASZ20210500031EX-02 for EUT test Max Conducted average Output Power value.

2) $P_d = (P_{out} * G) / (4 * \pi * R^2) = (7.943 * 1.00) / (4 * 3.1416 * 20^2) = 0.00158 \text{ mW/cm}^2$

3) EUT wifi2.4G module is more than 20cm away from the human body