

# RF EVALUATION TEST REPORT

Applicant.....: Hysolis LLC

Address.....: 350 Pauma Place Escondido CA 92029 USA

Manufacturer.....: Seasun New Energy Co., Ltd.

Address.....: No. 215 Jincheng Rd Jintan Changzhou Jiangsu PRC 213200

Factory .....: Foshan SNAT Energy Electrical Technology Co., Ltd.

Address .....: Unit 101-501, Building 27, Wan Yang, Chuangzhi Park, No. 82, Wuxing section,  
Xiaotang Industrial Avenue, Nanhai District, Foshan, Guangdong

Product Name.....: Power Station

Brand Name.....: N/A

Model No. ....: Apollo 5K

FCC ID.....: 2BDZ4-APL2401

Measurement Standard.....: 47 CFR PART 2, Section 2, 1.1091  
47 CFR PART 2, Section 1, 1.1310

Receipt Date of Samples.....: November 28, 2023

Date of Tested.....: December 06, 2023 to January 22, 2024

Date of Report.....: February 01, 2024

This report shows that above equipment is technically compliant with the requirements of the standards above. All test results in this report apply only to the tested sample(s). Without prior written approval of Dongguan Nore Testing Center Co., Ltd, this report shall not be reproduced except in full.



Prepared by

Julie Xiao / Project Engineer



Iori Fan / Authorized Signatory

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Revision History

Report Number	Description	Issued Date
NTC2311421F01	Initial Issue	2024-02-01

## 1. General Description of EUT

Product Information	
Product name:	Power Station
Main Model Name:	Apollo 5K
Additional Model Name:	N/A
Model Difference:	N/A
S/N:	2311-5977
Brand Name:	N/A
Hardware version:	V1.0
Software version:	V1.0
Rating:	AC output: AC 120V, 60Hz (Max. 25A, 3000W) DC output: DC 12V/10A*1, DC 12V/30A*1, DC 12V/2A*2 2*USB output: QC 3.0 5V/9V/12V (Max. 18W) Type-C output: 5V/9V/12V PD 18W Type-C output: 5V/9V/12V/15V/20V PD 100W Solar input: DC 60-500V AC input: AC 120V, 60Hz (Max. 30A) DC input: 12V/24V (Max. 10A) Capacity: DC 51.2V 105Ah, 5376Whs Wireless charging: 5W, 7.5W, 10W, 15WS
Typical Arrangement:	Floor-standing
I/O Port:	Refer to user manual
Accessories Information	
Adapter:	N/A
Cable:	N/A
Additional information	
Note:	N/A
Remark:	All the information above are provided by the manufacturer. More detailed feature of the EUT please refers to the user manual.

Technical Specification	
Frequency Range:	110.5-205KHz
Modulation Type:	FSK
Antenna Type:	Coil antenna
Output power for each coil:	5W, 7.5W, 10W, 15W

Technical Specification (2.4G WLAN)	
Frequency Range:	2412-2462MHz for IEEE 802.11b/g/n(HT20) 2422-2452MHz for IEEE 802.11n(HT40)
Modulation Technology:	DSSS, OFDM
Modulation Type:	CCK, DQPSK, DBPSK, QPSK, BPSK, 16-QAM, 64-QAM,
Number of Channel:	11 for IEEE 802.11b/g/n(HT20) 7 for IEEE 802.11n(HT40)
Channel Space:	5MHz
Antenna Type:	PCB antenna
Antenna Gain:	2.87dBi (Declared by the manufacturer)

Technical Specification (BLE ESP32)	
Bluetooth Version:	V5.2
Frequency Range:	2402-2480MHz
Modulation Type:	GFSK
Number of Channel:	40 (refer to following channel list for details)
Channel Space:	2MHz
Antenna Type:	PCB antenna
Number of Antenna	1
Antenna Gain:	2.87dBi (Declared by the manufacturer)
RF PHY Support:	1Mbps, 2Mbps
Technical Specification (BLE PB-03F)	
Bluetooth Version:	V5.2
Frequency Range:	2402-2480MHz
Modulation Type:	GFSK
Number of Channel:	40 (refer to following channel list for details)
Channel Space:	2MHz
Antenna Type:	PCB antenna
Number of Antenna	1
Antenna Gain:	3.14dBi (Declared by the manufacturer)
RF PHY Support:	1Mbps, 2Mbps

## 2. Test Facility and Location

Test Site	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)
Accreditations and Authorizations	:	<p>The Laboratory has been assessed and proved to be in compliance with CNAS/CL01</p> <p>Listed by CNAS, August 13, 2018</p> <p>The Certificate Registration Number is L5795.</p> <p>The Certificate is valid until August 13, 2024</p> <p>The Laboratory has been assessed and proved to be in compliance with ISO17025</p> <p>Listed by A2LA, November 01, 2017</p> <p>The Certificate Registration Number is 4429.01</p> <p>Listed by FCC, November 06, 2017</p> <p>Test Firm Registration Number: 907417</p> <p>Listed by Industry Canada, June 08, 2017</p> <p>The Certificate Registration Number. Is 46405-9743A</p>
Test Site Location	:	Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong Province, China

### 3. Applicable Standards and References

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

**Test Standards:**

47 CFR Part 1, 1.1307 & 1.1310

47 CFR Part 2, 2.1091

KDB 447498 D04 v01



#### 4. Maximum Permissible Exposure Limit

According to 47 CFR Part 1, 1.1307, for single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if: 47 CFR Part 1, 1.1307

(A) The available maximum time- averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time- averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold  $P_{th}$  (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive).  $P_{th}$  is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where,

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

And,

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$d$  = the minimum separation distance (cm) in any direction from any part of the device antenna(s) or radiating structure(s) to the body of the device user.

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least  $\lambda/2\pi$ , where  $\lambda$  is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the

available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of  $\lambda/4$  or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R <sup>2</sup> .
1.34-30	3,450 R <sup>2</sup> /f <sup>2</sup> .
30-300	3.83 R <sup>2</sup> .
300-1500	0.0128 R <sup>2</sup> f.
1500-100000	19.2R <sup>2</sup> .

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time- averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters be-tween any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

Where,

$a$  = number of fixed, mobile, or portable RF sources claiming exemption using para-graph (b)(3)(i)(B) of this section for  $P_{th}$ , including existing exempt transmitters and those being added.

$b$  = number of fixed, mobile, or portable RF sources claiming exemption using para-graph (b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

$c$  = number of existing fixed, mobile, or port-able RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$P_i$  = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source  $i$  at a distance between 0.5 cm and 40 cm (inclusive).

$P_{th,i}$  = the exemption threshold power ( $P_{th}$ ) according to paragraph (b)(3)(i)(B) of this section for fixed, mobile, or portable RF source  $i$ .

$ERP_j$  = the ERP of fixed, mobile, or portable RF source  $j$ .

$ERP_{th,j}$  = exemption threshold ERP for fixed, mobile, or portable RF source  $j$ , at a distance of at least  $\lambda/2\pi$  according to the applicable formula of paragraph (b)(3)(i)(C) of this section.

$Evaluated_k$  = the maximum reported SAR or MPE of fixed, mobile, or portable RF source  $k$  either in the device or at the transmitter site from an existing evaluation at the location of exposure.

$Exposure Limit_k$  = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source  $k$ , as applicable from §1.1310 of this chapter.

### **§ 1.1310 Radiofrequency radiation exposure limits.**

(a) Specific absorption rate (SAR) shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in § 1.1307(b) of this part within the frequency range of 100 kHz to 6 GHz (inclusive).

(b) The SAR limits for occupational/controlled exposure are 0.4 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 8 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit for occupational/controlled exposure is 20 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be

averaged over a time period not to exceed 6 minutes to determine compliance with occupational/controlled SAR limits.

(c) The SAR limits for general population/uncontrolled exposure are 0.08 W/kg, as averaged over the whole body, and a peak spatial-average SAR of 1.6 W/kg, averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the parts of the human body treated as extremities, such as hands, wrists, feet, ankles, and pinnae, where the peak spatial-average SAR limit is 4 W/kg, averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). Exposure may be averaged over a time period not to exceed 30 minutes to determine compliance with general population/uncontrolled SAR limits.

(d) (1) Evaluation with respect to the SAR limits in this section must demonstrate compliance with both the whole-body and peak spatial-average limits using technically supported measurement or computational methods and exposure conditions in advance of authorization (licensing or equipment certification) and in a manner that facilitates independent assessment and, if appropriate, enforcement. Numerical computation of SAR must be supported by adequate documentation showing that the numerical method as implemented in the computational software has been fully validated; in addition, the equipment under test and exposure conditions must be modeled according to protocols established by FCC-accepted numerical computation standards or available FCC procedures for the specific computational method.

(2) For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

(3) At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part.

(4) Both the MPE limits listed in Table 1 in paragraph (e)(1) of this section and the SAR limits as set forth in paragraphs (a) through (c) of this section are for continuous exposure, that is, for indefinite time periods. Exposure levels higher than the limits are permitted for shorter exposure times, as long as the average exposure over a period not more than the specified averaging time in Table 1 in paragraph (e)(1) is less than (or equal to) the exposure limits. Detailed information on our policies regarding procedures for evaluating compliance with all of these exposure limits can be found in the most recent edition of FCC's *OET Bulletin 65*, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," and its supplements, all available at the FCC's internet website: <https://www.fcc.gov/general/oet-bulletins-line>, and in the Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB)

(e)(1) Table 1 to § 1.1310(e)(1) sets forth limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

Table 1 to § 1.1310(e)(1)—Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(i) Limits for Occupational/Controlled Exposure</b>				
0.3–3.0	614	1.63	*(100)	≤6
3.0–30	1842/f	4.89/f	*(900/f <sup>2</sup> )	<6
30–300	61.4	0.163	1.0	<6
300–1,500	-	-	f/300	<6
1,500–100,000	-	-	5	<6
<b>(ii) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34	614	1.63	*(100)	<30
1.34–30	824/f	2.19/f	*(180/f <sup>2</sup> )	<30
30–300	27.5	0.073	0.2	<30
300–1,500	-	-	f/1500	<30
1,500–100,000	-	-	1.0	<30
<p>Note:</p> <p>f = frequency in MHz.</p> <p>* = Plane-wave equivalent power density.</p>				

Power density (S) is calculated by the following formula:

$$S = (P * G) / 4\pi R^2$$

Where, S = Power density(mW/cm<sup>2</sup>)

P = Output power to antenna (mW)

R = Distance between radiating structure and observation point (cm)

R= 20cm

G = Gain of antenna in numeric

$\pi = 3.1416$

## 5. RF Exposure Evaluation Results

Single RF Source					
Mode	Frequency (KHz)	Mobile Measured field strength (A/m)	Antenna Gain (dBi)	Electric field strength Limits (A/m)	Ratio
FSK	110.5-205	0.22	0	1.63	0.13497

Wi-Fi & Bluetooth Module:

Single RF Source									
Mode	Frequency (MHz)	Max. Conducted Power (dBm)	Antenna Gain (dBi)	Max. EIRP (dBm)	Max. ERP (dBm)	Max. ERP (mW)	Power density at 20cm (mW/ cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )	Ratio
2.4G WLAN (ESP32-MINI- 1-N4)	2462	20.93	2.87	23.80	21.65	146.22	0.02464	1.0	0.02464
BLE (ESP32-MINI- 1-N4)	2402	-0.42	2.87	2.45	0.30	1.07	0.00181	1.0	0.00181
BLE (PB-03F) -A	2402	-0.28	3.14	2.86	0.71	1.18	0.00187	1.0	0.00187
BLE (PB-03F) -B	2402	-0.24	3.14	2.90	0.75	1.19	0.00188	1.0	0.00188

Multiple RF Source (Simultaneous Transmission)						
Maximum Bluetooth Ratio			Maximum WPT Ratio	Maximum 2.4G WLAN Ratio	Max. Total Ratio	Limit
BLE (ESP32-MINI-1-N4)	BLE (PB-03F) -A	BLE (PB-03F) -B				
0.00181	0.00187	0.00188	0.13497	0.02464	0.16517	1

### Conclusion:

According to 47 CFR §1.1310 (b)(c)(d)(e)(1), the RF exposure analysis concludes that the product is compliant with the FCC RF exposure requirements in mobile exposure condition.

---End---