

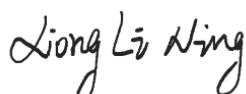
TEST REPORT

Applicant: Shenzhen SEI Robotics Co., Ltd.
Address: 4th Floor, Productivity Building D, #5 Hi-Tech Middle 2nd Road, Shenzhen Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China
Equipment Type: Set Top Box
Model Name: SEI800 (refer to section 2.3)
Brand Name: WOW
FCC ID: 2AOVU-SX6BLGN
Test Standard: 47 CFR Part 2.1091
KDB 447498 D04 v01
Sample Arrival Date: Apr. 19, 2024
Test Date: Apr. 29, 2024 - May 10, 2024
Date of Issue: Jun. 07, 2024

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Lining



Checked by: Xu Rui



Approved by: Tolan Tu
(Testing Director)



Revision History		
Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>May 21, 2024</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Jun. 07, 2024</u>	<u>Updated the Model Name</u>

TABLE OF CONTENTS

1	GENERAL INFORMATION	3
1.1	Test Laboratory	3
1.2	Test Location.....	3
2	PRODUCT INFORMATION.....	4
2.1	Applicant Information.....	4
2.2	Manufacturer Information	4
2.3	General Description for Equipment under Test (EUT)	4
2.4	Technical Information	5
3	SUMMARY OF TEST RESULT	6
3.1	Test Standards	6
4	DEVICE CATEGORY AND LEVELS LIMITS	7
5	ASSESSMENT RESULT	9
5.1	Output Power	9
5.2	Tune-up power	10
5.3	RF Exposure Evaluation Result	11
5.4	Collocated Power Calculation	12
5.5	Conclusion.....	12

1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	<input checked="" type="checkbox"/> Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	<input type="checkbox"/> 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Shenzhen SEI Robotics Co., Ltd.
Address	4th Floor, Productivity Building D, #5 Hi-Tech Middle 2nd Road, Shenzhen Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China

2.2 Manufacturer Information

Manufacturer	Shenzhen SEI Robotics Co., Ltd.
Address	4th Floor, Productivity Building D, #5 Hi-Tech Middle 2nd Road, Shenzhen Hi-Tech Industrial Park, Nanshan District, Shenzhen, Guangdong, China

2.3 General Description for Equipment under Test (EUT)

EUT Name	Set Top Box
Model Name Under Test	SEI800
Series Model Name	SX6BLGX (X:A-Z)
Description of Model name differentiation	The circuit, PCB layout, electrical components and appearance of the above model are exactly the same as the basic model, except the model names are different due to different market and customer needs. (this information provided by the applicant)
Hardware Version	SMB.280.08E
Software Version	SEI800WOW_v12.8.4833
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac and 802.11ax U-NII-1/3/5/6
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WLAN, Bluetooth	
Frequency Range	802.11b/g	2412 ~ 2462 MHz
	802.11n(HT20)/ax(HE20)	2412 ~ 2462 MHz
	802.11a	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
		5925 ~ 6425 MHz
		6425 ~ 6525 MHz
	802.11n(HT20/HT40)	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
		5925 ~ 6425 MHz
		6425 ~ 6525 MHz
	802.11 ac(VHT20/VHT40/VHT80)	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
		5925 ~ 6425 MHz
		6425 ~ 6525 MHz
802.11 ax(HE20/HE40/HE80)	5150 ~ 5250 MHz	
	5725 ~ 5850 MHz	
	5925 ~ 6425 MHz	
	6425 ~ 6525 MHz	
Bluetooth	2400 ~ 2483.5 MHz	
Antenna Type	WLAN	PIFA Antenna
	Bluetooth	PCB Antenna
Exposure Category	General Population/Uncontrolled Exposure	
Product Type	Mobile Device	

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D04 v01	447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Devices:

CFR Title 47 §2.1091(b)

(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.

FCC KDB 447498 D04 General RF Exposure Guidance v01 Limit

For 300MHz to 6000Mhz

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP_{20cm} in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (\text{B.1})$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i. e., without consideration of ERP only 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.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad \text{(B.2)}$$

where

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

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1). The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
	5	10	15	20	25	30	35	40	45	50	
300	39	65	88	110	129	148	166	184	201	217	
450	22	44	67	89	112	135	158	180	203	226	
835	9	25	44	66	90	116	145	175	207	240	
1900	3	12	26	44	66	92	122	157	195	236	
2450	3	10	22	38	59	83	111	143	179	219	
3600	2	8	18	32	49	71	96	125	158	195	
5800	1	6	14	25	40	58	80	106	136	169	

For 6000MHz to 10000Mhz

Frequencies above 300 kHz but at distances $R > \lambda/2\pi$, R is the antenna-person separation distance. λ =wavelength of transmitted signal.

Can calculate from the frequency of operation using $v=f*\lambda$

v =speed of light= $3*10^8$ m/s

f =frequency(Hz)

Primarily an MPE-based exclusion but also SAR-based where $\lambda/2\pi$ is < 20 cm.

TABLE B.1—THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	$1,920 R^2$
1.34	–	30	35.6 m	–	1.6 m	$3,450 R^2/f^2$
30	–	300	1.6 m	–	159 mm	$3.83 R^2$
300	–	1,500	159 mm	–	31.8 mm	$0.0128 R^2 f$
1,500	–	100,000	31.8 mm	–	0.5 mm	$19.2 R^2$

Subscripts L and H are low and high; λ is wavelength.
From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.

5 ASSESSMENT RESULT

5.1 Output Power

Mode	Bluetooth	
	BR+EDR	BLE
Conducted Power (dBm)	0.30	0.48
Antenna Gain (dBi)	2.08	2.08
EIRP (dBm)	2.38	2.56

Note: This report listed the worst case conducted power value, please refer to BL-SZ2440954-601~602 report for more details.

Mode	2.4G WIFI		
	Antenna 1	Antenna 2	MIMO
Conducted Power (dBm)	19.38	18.53	18.44
Antenna Gain (dBi)	3.45	3.98	3.72
EIRP (dBm)	22.83	22.51	22.16

Note: This report listed the worst case conducted power value, please refer to BL-SZ2440954-603 report for more details.

Mode	5G WIFI					
	U-NII-1			U-NII-3		
	Antenna 1	Antenna 2	MIMO	Antenna 1	Antenna 2	MIMO
Conducted Power (dBm)	16.42	14.87	15.53	16.40	14.83	15.65
Antenna Gain (dBi)	3.61	3.92	3.78	3.13	3.92	3.53
EIRP (dBm)	20.03	18.79	19.31	19.53	18.75	19.18

Note: This report listed the worst case conducted power value, please refer to BL-SZ2440954-604 report for more details.

Mode	6G WIFI					
	U-NII-5			U-NII-6		
	Antenna 1	Antenna 2	MIMO	Antenna 1	Antenna 2	MIMO
Conducted Power (dBm)	16.87	15.00	15.00	16.62	15.00	14.96
Antenna Gain (dBi)	3.98	3.99	3.99	3.69	3.57	3.63
EIRP (dBm)	20.85	18.99	18.99	20.31	18.57	18.59

Note: This report listed the worst case conducted power value, please refer to BL-SZ2440954-604 report for more details.

5.2 Tune-up power

Mode		Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
Bluetooth		[-1.00, 1.00]	[1.08, 3.08]	[-1.07, 0.93]
2.4G WIFI	Antenna 1	[18.00, 20.00]	[21.45, 23.45]	[19.30, 21.30]
	Antenna 2	[18.00, 20.00]	[21.98, 23.98]	[19.83, 21.83]
	MIMO	[18.00, 20.00]	[21.72, 23.72]	[19.57, 21.57]
5G WIFI (U-NII-1)	Antenna 1	[15.00, 17.00]	[18.61, 20.61]	[16.46, 18.46]
	Antenna 2	[14.00, 16.00]	[17.92, 19.92]	[15.77, 17.77]
	MIMO	[14.00, 16.00]	[17.78, 19.78]	[15.63, 17.63]
5G WIFI (U-NII-3)	Antenna 1	[15.00, 17.00]	[18.13, 20.13]	[15.98, 17.98]
	Antenna 2	[14.00, 16.00]	[17.92, 19.92]	[15.77, 17.77]
	MIMO	[14.00, 16.00]	[17.53, 19.53]	[15.38, 17.38]
6G WIFI (U-NII-5)	Antenna 1	[15.00, 17.00]	[18.98, 20.98]	[16.83, 18.83]
	Antenna 2	[14.00, 16.00]	[17.99, 19.99]	[15.84, 17.84]
	MIMO	[14.00, 16.00]	[17.99, 19.99]	[15.84, 17.84]
6G WIFI (U-NII-6)	Antenna 1	[15.00, 17.00]	[18.69, 20.69]	[16.54, 18.54]
	Antenna 2	[14.00, 16.00]	[17.57, 19.57]	[15.42, 17.42]
	MIMO	[14.00, 16.00]	[17.63, 19.63]	[15.48, 17.48]

Note1: ERP= EIRP -2.15dB.

Note2: According KDB 447498 D04, used the greater of maximum conducted power and ERP to compare with the threshold value Pth.

5.3 RF Exposure Evaluation Result

For 300MHz to 6000MHz

Evolution Mode		Maximum power (dBm)	Maximum power (mw)	Distance (cm)	Threshold Power (mW)	Power / Limit	Verdict
Bluetooth		1.00	1.26	20	3060.00	0.0004	Pass
2.4G WIFI	Antenna 1	21.30	134.90	20	3060.00	0.0441	Pass
	Antenna 2	21.83	152.41	20	3060.00	0.0498	Pass
	MIMO	21.57	143.55	20	3060.00	0.0469	Pass
5G WIFI	Antenna 1	18.46	70.15	20	3060.00	0.0229	Pass
	Antenna 2	17.77	59.84	20	3060.00	0.0196	Pass
	MIMO	17.63	57.94	20	3060.00	0.0189	Pass

For 6000MHz to 10000MHz

Evolution Mode		Frequency (MHz)	Distance (cm)	$\lambda / 2 \pi$ (m)	$\lambda / 2 \pi$ (cm)	$R > \lambda / 2 \pi$
6G WIFI	Antenna 1	6425	20	0.007	0.700	Yes
	Antenna 2	6425	20	0.007	0.700	Yes
	MIMO	6425	20	0.007	0.700	Yes

Evolution Mode		Frequency (MHz)	Threshold Power (W)	Maximum power (dBm)	Maximum power (W)	Power / Limit	Verdict
6G WIFI	Antenna 1	6425	76.800	18.83	0.076	0.0010	Pass
	Antenna 2	6425	76.800	17.84	0.061	0.0008	Pass
	MIMO	6425	76.800	17.84	0.061	0.0008	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency (MHz)	Power /Limit	Σ (Power / Limit) of Bluetooth + 2.4G WIFI Antenna 2 + 5G WIFI Antenna 2 + 6G WIFI Antenna 1	Verdict
BT	2480	0.0004	0.0741	Pass
MAX WLAN 2.4G	2462	0.0498		
MAX WLAN 5G	5250	0.0229		
MAX WLAN 6G	6425	0.0010		

Note:

- Σ (Power / Limit): This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for Bluetooth + 2.4G WIFI Antenna 2 + 5G WIFI Antenna 2 + 6G WIFI Antenna 1.
- Both of the 2.4GHz/5GHz/6GHz can transmit simultaneously, the formula of calculated the Power is $CP1 / LP1 + CP2 / LP2 + \dots$ etc. < 1
 CP = Calculation power
 LP = Limit of power
- Both of the 5.2GHz WIFI and 5.8GHz WIFI can't transmit simultaneously at same time.
- The worst-case situation is 0.0741, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
- The DUT work frequency range used is 2400 MHz ~ 2483.5 MHz, 5150 MHz~ 5250 MHz, 5725 MHz ~ 5850 MHz and 6425 MHz ~ 6525 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.
- More power list please refer to BL-SZ2440954-601~604 test report.

5.5 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

Statement

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--END OF REPORT--