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, 518000, China
Equipment Type:	4K Stick
Model Name:	IPA3102HDW (refer section 2.4)
Brand Name:	N/A
FCC ID:	2AOVU-IPA3102HDW
Test Standard:	47 CFR Part 2.1091 KDB 447498 D04 v01
Test Date:	Sep. 15, 2022 - Sep. 23, 2022
Date of Issue:	Oct. 28, 2022

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Julie Zhu **Checked by:** Xiong Lining **Approved by:** Wei Yanquan (Chief Engineer)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Oct. 28, 2022	Initial Issue

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 Factory Information 4

2.4 General Description for Equipment under Test (EUT) 4

2.5 Ancillary Equipment 4

2.6 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 Turn-up power 10

5.3 RF Exposure Evaluation Result 11

5.4 Collocated Power Calculation 11

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	☑ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☐ 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, 518000, 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, 518000, China

2.3 Factory Information

Factory	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, 518000, China

2.4 General Description for Equipment under Test (EUT)

EUT Name	4K Stick
Model Name Under Test	IPA3102HDW
Series Model Name	SN8BKJA, SN8BKJX(X=A~Z), SEI700L, FUSE4K, SEI700
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name. (this information provided by the customer)
Hardware Version	SMB.308.04
Software Version	transmitter KEY 1.4
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	Bluetooth (BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n, 802.11ac and 802.11ax U-NII-1/3

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	2.4G WLAN, 5G WLAN, Bluetooth	
Frequency Range	802.11b/g/n(HT20/HT40)	2412 MHz ~ 2462 MHz
	802.11a/n(HT20/HT40) /ac(VHT20/VHT40/VHT80)	5150 MHz ~ 5250 MHz
		5725 MHz ~ 5850 MHz
	Bluetooth	2402 MHz ~ 2480 MHz
Antenna Type	PCB Antenna	
Hotspot Function	N/A	
Exposure Category	General Population/Uncontrolled Exposure	
EUT Stage	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	447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Device:

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

Evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP20cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

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

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 λ/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 Pth (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). Pth is given by Formula (B.2).

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

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

5 ASSESSMENT RESULT

5.1 Output Power

Bluetooth			
Mode	GFSK (BLE 1Mbps)		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	**5.78**	5.39	4.93
Antenna Gain (dBi)	6.35		
EIRP (dBm)	12.13	11.74	11.28
Note: This report listed the maximal case power value, please refer to Report No. BL-SZ2290469-601 for more details.			

WLAN 2.4G Main Antenna			
Mode	802.11 n20/n40		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	19.58	19.50	**19.63**
Antenna Gain (dBi)	4.65		
EIRP (dBm)	24.23	24.15	24.28
Note: This table listed the worst case power value, please refer to BL-SZ2290469-602 report for more details.			

WLAN 2.4G Aux. Antenna			
Mode	802.11 n20/n40		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	**19.52**	19.40	19.23
Antenna Gain (dBi)	6.35		
EIRP (dBm)	25.87	25.75	25.58
Note: This table listed the worst case power value, please refer to BL-SZ2290469-602 report for more details.			

WLAN 5.1G Main Antenna	
Mode	802.11a/HT20/HT40/VHT20/VHT40/VHT80
	U-NII-1
Conducted Power (dBm)	**13.97**
Antenna Gain (dBi)	8.10
EIRP (dBm)	22.07
Note: This table listed the worst case power value, please refer to BL-SZ2290469-603 report for more details.	

WLAN 5.8G Main Antenna	
Mode	802.11a/HT20/HT40/VHT20/VHT40/VHT80
	U-NII-3
Conducted Power (dBm)	**13.94**
Antenna Gain (dBi)	7.58
EIRP (dBm)	21.52
Note: This table listed the worst case power value, please refer to BL-SZ2290469-603 report for more details.	

WLAN 5.1G Aux. Antenna	
Mode	802.11a/HT20/HT40/VHT20/VHT40/VHT80
	U-NII-1
Conducted Power (dBm)	**13.94**
Antenna Gain (dBi)	4.28
EIRP (dBm)	18.22
Note: This table listed the worst case power value, please refer to BL-SZ2290469-603 report for more details.	

WLAN 5.8G Aux. Antenna	
Mode	802.11a/HT20/HT40/VHT20/VHT40/VHT80
	U-NII-3
Conducted Power (dBm)	**13.95**
Antenna Gain (dBi)	4.81
EIRP (dBm)	18.76
Note: This table listed the worst case power value, please refer to BL-SZ2290469-603 report for more details.	

5.2 Turn-up power

Mode	Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
Bluetooth	4.00-6.00	11.00-12.50	8.85-10.35
WLAN 2.4G Main Antenna	19.00-20.00	24.00-25.00	21.85-22.85
WLAN 2.4G Aux. Antenna	19.00-20.00	25.00-26.00	22.85-23.85
WLAN 5.1G Main Antenna	13.00-14.00	22.00-22.50	19.85-20.35
WLAN 5.8G Main Antenna	13.00-14.00	21.00-22.00	18.85-19.85
WLAN 5.1G Aux. Antenna	13.00-14.00	18.00-19.00	15.85-16.85
WLAN 5.8G Aux. Antenna	13.00-14.00	18.00-19.00	15.85-16.85
Note1: ERP= EIRP -2.15dB Note2: According KDB 447498 D04, used the greater of maximun conducted power and ERP to compare with the threshold value Pth.			

5.3 RF Exposure Evaluation Result

Evolution mode	Maximum power (dBm)	Maximum power (mw)	Distance (cm)	Threshold Power (mW)	Power / Limit	Verdict
Bluetooth	10.35	10.84	20	3060.00	0.004	Pass
WLAN 2.4G Main Antenna	22.85	192.75	20	3060.00	0.063	Pass
WLAN 2.4G Aux. Antenna	23.85	242.66	20	3060.00	0.079	Pass
WLAN 5.1G Main Antenna	20.35	108.39	20	3060.00	0.035	Pass
WLAN 5.8G Main Antenna	19.85	96.61	20	3060.00	0.032	Pass
WLAN 5.1G Aux. Antenna	16.85	48.42	20	3060.00	0.016	Pass
WLAN 5.8G Aux. Antenna	16.85	48.42	20	3060.00	0.016	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency(MHz)	Power /Limit	Σ(Power / Limit) of WIFI 2.4G	Verdict
WLAN 2.4G Main Antenna	2.412	0.063	**0.142**	Pass
WLAN 2.4G Aux. Antenna	2.412	0.079		

Evolution mode	Frequency(MHz)	Power /Limit	Σ(Power / Limit) of WIFI 5G	Verdict
WLAN 5G Main Antenna	5.150	0.035	**0.051**	Pass
WLAN 5G Aux. Antenna	5.150	0.016		

Evolution mode	Frequency(MHz)	Power /Limit	Σ(Power / Limit) of WIFI 2.4G+ Bluetooth	Verdict
Bluetooth	2.402	0.004	**0.067**	Pass
WLAN 2.4G Main Antenna	2.412	0.063		

Evolution mode	Frequency(MHz)	Power /Limit	Σ(Power / Limit) of WIFI 5G+ Bluetooth	Verdict
Bluetooth	2.402	0.004	**0.039**	Pass
WLAN 5G Main Antenna	5.150	0.035		

Note:

1. Σ(Power / Limit): This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for Bluetooth + WIFI 5G and WIFI 2.4G + WLAN 5G.

2. Both of the 2.4GHz/5GHz can transmit simultaneously, the formula of calculated the Power is
   CP1 / LP1 + CP2 / LP2 + ……etc. < 1
   CP = Calculation power
   LP = Limit of power
3. Both of the 2.4G WIFI and 5G WIFI can't transmit simultaneously at same time.
4. The worst-case situation is 0.142, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
5. The DUT work frequency range used is 2400 MHz ~ 2483.5 MHz, 5150 MHz~ 5250 MHz and 5725 MHz ~ 5850 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.
6. More power list please refer to RF 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

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
3. For the report with CNAS mark or A2LA mark, the items marked with "☆" are not within the accredited scope.
4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the “inspection and testing dedicated stamp” or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--