TEST REPORT

Applicant:	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Address:	Room 1402, building 1, No. 1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang, China
Equipment Type:	W Series ESP32 IoT Wi-Fi Module
Model Name:	L-WFIWB81-G5PP4 (refer section 2.4)
Brand Name:	Lierda
FCC ID:	2AOFDL-WFIWB81
Test Standard:	47 CFR Part 2.1091 KDB 447498 D04 v01
Sample Arrival Date:	May 11, 2023
Test Date:	May 15, 2023 - May 23, 2023
Date of Issue:	Jun. 01, 2023

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Julie Zhu

Checked by: Xu Rui

Approved by: Tolan Tu

(Testing Director)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Jun. 01, 2023	Initial Issue

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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	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Address	Room 1402, building 1, No. 1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang, China

2.2 Manufacturer Information

Manufacturer	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Address	Room 1402, building 1, No. 1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang, China

2.3 Factory Information

Factory	Zhejiang Lierda Internet of Things Technology Co., Ltd.
Address	Room 1402, building 1, No. 1326, Wenyi West Road, Cangqian street, Yuhang District, Hangzhou, Zhejiang, China

2.4 General Description for Equipment under Test (EUT)

EUT Name	W Series ESP32 IoT Wi-Fi Module
Model Name Under Test	L-WFIWB81-G5PP4
Series Model Name	L-WFIWB81-xxxxx (x stands for 0~9 or a~z or A~Z)
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name which denote selling different consumer (this information provided by the customer)
Hardware Version	01
Software Version	00
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) 2.4G WIFI 802.11b, 802.11g, 802.11n(HT20/HT40)

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

Operating Mode	Bluetooth; 2.4G WLAN	
Frequency Range	Bluetooth	2402 MHz ~ 2480 MHz
	802.11b/g/n(HT20/HT40)	2412 MHz ~ 2462 MHz
Antenna Type	Bluetooth	PCB Antenna
	WLAN	PCB Antenna
Exposure Category	General Population/Uncontrolled Exposure	
EUT 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 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	π/4-DQPSK	8-DPSK	BLE-1Mbps
Conducted Power (dBm)	8.76	8.18	8.70	8.82
Antenna Gain (dBi)	1.48			
EIRP (dBm)	10.24	9.66	10.18	10.30
Note: This report listed the worst case power value, please refer to BL-SZ2350549-601&BL-SZ2350549-602 report for more details.				

WLAN 2.4G				
Mode	802.11b	802.11g	802.11n20	802.11n40
Conducted Power (dBm)	16.80	16.69	16.89	16.79
Antenna Gain (dBi)	1.48			
EIRP (dBm)	18.28	18.17	18.37	18.27
Note: This report listed the worst case power value, please refer to BL-SZ2350549-603 report for more details.				

5.2 Tune-up power

Mode	Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
Bluetooth	[7.00, 9.00]	[8.48, 10.48]	[6.33, 8.33]
WLAN 2.4G	[15.00, 17.00]	[16.48, 18.48]	[14.33, 16.33]
Note 1: ERP= EIRP -2.15dB Note 2: 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

Mode	Distance (mm)	Calculation Frequency (MHz)	Tune-up limit power (dBm)	Tune-up limit power (mW)	Threshold Power (mW)	Verdict
Bluetooth	200	2480	9.00	7.94	3060.00	Pass
WLAN 2.4G	200	2462	17.00	50.12	3060.00	Pass

5.4 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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