

TEST REPORT

Applicant: Shenzhen Jimi IoT Co., Ltd.
Address: 3-4/F, Block A, Building #7, Shenzhen International Innovation Valley, Dashi 1st Road, Nanshan District, Shenzhen, Guangdong, China
Equipment Type: LTE Vehicle Terminal
Model Name: VL111 (refer to section 2.3)
Brand Name: JimiIoT
FCC ID: 2AMLF-VL111
Test Standard: 47 CFR Part 2.1091
KDB 447498 D04 v01
Sample Arrival Date: Jan. 05, 2024
Test Date: Jan. 15, 2024 - Feb. 23, 2024
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ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xu Rui**Checked by:** Zong Liyao**Approved by:** Tolan Tu
(Testing Director)

Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Apr. 19, 2024</u>	<u>Initial Issue</u>

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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	Shenzhen Jimi IoT Co., Ltd.
Address	3-4/F, Block A, Building #7, Shenzhen International Innovation Valley, Dashi 1st Road, Nanshan District, Shenzhen, Guangdong, China

2.2 Manufacturer Information

Manufacturer	Shenzhen Jimi IoT Co., Ltd.
Address	3-4/F, Block A, Building #7, Shenzhen International Innovation Valley, Dashi 1st Road, Nanshan District, Shenzhen, Guangdong, China

2.3 General Description for Equipment under Test (EUT)

EUT Name	LTE Vehicle Terminal
Model Name Under Test	VL111
Series Model Name	V1411, C45
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	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/1900 MHz 4G Network FDD LTE Band 2/4/5/7 Bluetooth (BR+EDR+BLE)
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	GSM, LTE, Bluetooth		
Frequency Range	GSM 850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM 1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	Bluetooth	2400 ~ 2483.5 MHz	
Antenna Type	WWAN	PIFA	
	Bluetooth	PIFA	
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 v01	447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Mobile Devices:

CFR Title 47 §2.1091(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 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

5 ASSESSMENT RESULT

5.1 Output Power

GSM							
GSM850 Band	Burst Average Power(dBm)			Division Factors	Frame-Averaged power (dBm)		
Channel	128	190	251		128	190	251
GSM (GMSK, 1-Slot)	31.97	32.09	32.20	9.19	22.78	22.90	23.01
GPRS (GMSK, 1-Slot)	31.97	32.06	32.16	9.19	22.78	22.87	22.97
GPRS (GMSK, 2-Slots)	31.65	31.70	31.90	6.13	25.52	25.57	25.77
GPRS (GMSK, 3-Slots)	30.35	30.33	30.62	4.42	25.93	25.91	26.20
GPRS (GMSK, 4-Slots)	28.64	28.63	28.77	3.18	25.46	25.45	25.59
GSM1900 Band	Burst Average Power(dBm)			Division Factors	Frame-Averaged power(dBm)		
Channel	512	661	810		512	661	810
GSM (GMSK, 1-Slot)	29.61	29.29	29.21	9.19	20.42	20.10	20.02
GPRS (GMSK, 1-Slot)	29.57	29.23	29.19	9.19	20.38	20.04	20.00
GPRS (GMSK, 2-Slots)	29.32	29.01	29.00	6.13	23.19	22.88	22.87
GPRS (GMSK, 3-Slots)	28.07	27.79	27.84	4.42	23.65	23.37	23.42
GPRS (GMSK, 4-Slots)	26.09	25.85	25.87	3.18	22.91	22.67	22.69

Note: This table listed the worst case power value, please refer to BL-SZ2410367-501 report for more details.

GSM		
Mode	GSM850	GSM1900
Conducted Power (dBm)	26.2	23.65
Antenna Gain (dBi)	-5.42	-4.27
ERP/EIRP	18.63	19.38

Note: This table listed the worst case power value, please refer to BL-SZ2410367-501 report for more details.

LTE				
Mode	Band 2	Band 4	Band 5	Band 7
Conducted Power (dBm)	19.99	20.9	17.13	22.12
Antenna Gain (dBi)	-4.27	-2.98	-5.42	-2.00
ERP/EIRP	15.72	17.92	9.56	20.12

Note: This table listed the worst case power value, please refer to BL-SZ2410367-501 report for more details.

Mode	Bluetooth
Conducted Power (dBm)	7.15
Antenna Gain (dBi)	-1.13
EIRP (dBm)	6.02

Note: This table listed the worst case power value, please refer to BL-SZ2410367-601 report for more details.

5.2 Tune-up power

Mode	Conducted Power Range (dBm)	EIRP Range (dBm)	ERP Range (dBm)
GSM850	[25.00, 27.00]	/	[17.85, 19.85]
GSM1900	[23.00, 25.00]	[19.00, 21.00]	[16.85, 18.85]
LTE B2	[19.00, 21.00]	[15.00, 17.00]	[12.85, 14.85]
LTE B4	[19.00, 21.00]	[17.00, 19.00]	[14.85, 16.85]
LTE B5	[17.00, 19.00]	/	[8.85, 10.85]
LTE B7	[22.00, 24.00]	[20.00, 22.00]	[17.85, 19.85]
Bluetooth	[6.00, 8.00]	[5.00, 7.00]	[2.85, 4.85]

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

Evolution mode	Maximum power (dBm)	Maximum power (mw)	Distance (mm)	Threshold Power (mW)	Power / Limit	Verdict
GSM850	27.00	501.19	200	1680.96	0.298	Pass
GSM1900	25.00	316.23	200	3060.00	0.103	Pass
LTE B2	21.00	125.89	200	3060.00	0.041	Pass
LTE B4	21.00	125.89	200	3060.00	0.041	Pass
LTE B5	19.00	79.43	200	1680.96	0.047	Pass
LTE B7	24.00	251.19	200	3060.00	0.082	Pass
Bluetooth	8.00	6.31	200	3060.00	0.002	Pass

5.4 Collocated Power Calculation

Evolution mode	Frequency(MHz)	Power /Limit	$\Sigma(\text{Power / Limit})$ of WWAN + BT	Verdict
GSM850	824 ~ 849 MHz	0.298	0.300	Pass
Bluetooth	2400 ~ 2483.5 MHz	0.002		

Note:

1. $\Sigma(\text{Power / Limit})$: This is a summation of [(power for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power limit)], for WWAN/BT.
2. Both of the WWAN/BT can transmit simultaneously, the formula of calculated the Power is

$$CP1 / LP1 + CP2 / LP2 + \dots \text{etc.} < 1$$

CP = Calculation power
LP = Limit of power
3. The worst-case situation is 0.300, which is less than "1". This confirmed that the device comply with FCC KDB 447498 D04 Power limit.
4. The DUT work frequency range used is 2400 MHz ~ 2483.5 MHz, 824 MHz~ 849 MHz the result close to the limit by the above formula, so we select worst case power to calculate the exclusion power threshold.
5. More power list please refer to BL-SZ2410367-501&601 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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