

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: VL110C (refer to section 2.3)
Brand Name: JimiIoT
FCC ID: 2AMLF-VL110
Test Standard: 47 CFR Part 15 Subpart B
ANSI C63.4-2014
Sample Arrival Date: Sep. 20, 2024
Test Date: Sep. 26, 2024
Date of Issue: Nov. 08, 2024

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Qiu Yongjing **Checked by:** Liu Zhenxiang **Approved by:** Tolan Tu
(Testing Director)



Revision History		
Version	Issue Date	Revisions
<u>Rev. 01</u>	<u>Nov. 08, 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, Dashu 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, Dashu 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	VL110C
Series Model Name	VL110, C410
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 applicant)
Hardware Version	VL110_MB_V1.0
Software Version	VL110_VL110C_WABI_LA_V1.3_241015.2128
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Ancillary Equipment

Note: Not applicable.

2.5 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/1900 MHz 4G Network LTE FDD Band 2/4/5/7
Classification of equipment	Class B
The highest internal frequency of EUT	2689.9MHz

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B	Unintentional Radiators
2	ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

3.2 Verdict

No.	Description	FCC Rule	Test Verdict	Remark
1	Radiated Emission	15.109	Pass	--
2	Conducted Emission, AC Ports	15.107	N/A	Note
Note: The EUT has no AC port So the Conducted Emission, AC Port test is not applicable.				

3.3 Test Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Radiated emissions (30 MHz-1 GHz)-966#2	4.4 dB
Radiated emissions (1 GHz-18 GHz)-966#2	5.0 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Enclosure List

Description	Manufacturer	Model	Serial No.	Length	Description	Use
Vehicle battery	CAMEL	6-QWLZ-45(370)	N/A	N/A	N/A	☒
Clamp line	N/A	N/A	N/A	0.8m	N/A	☒

4.2 Test Configurations

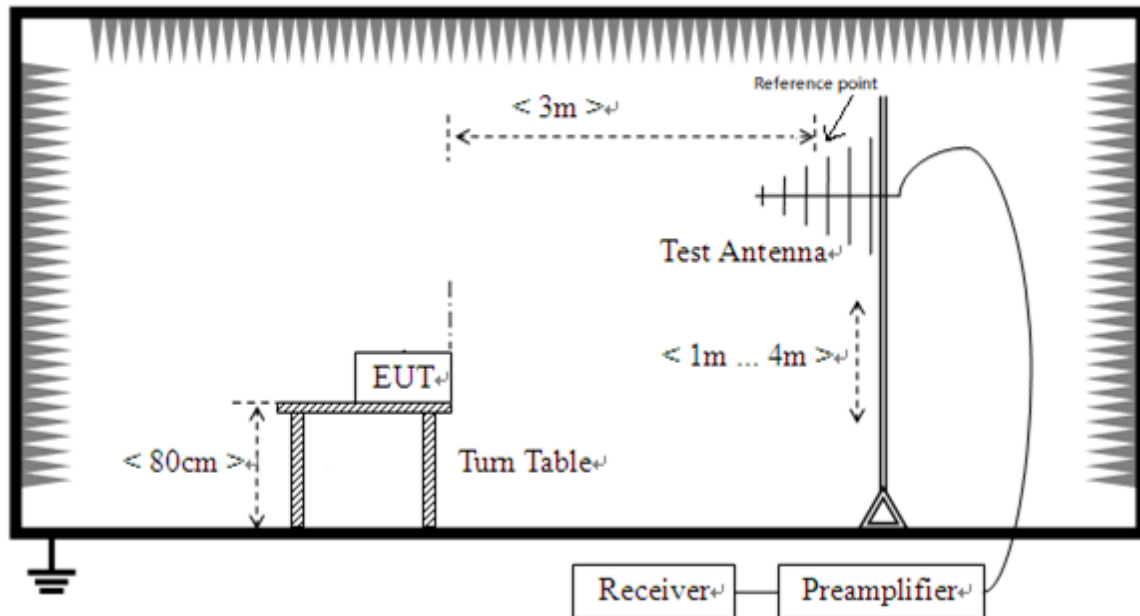
All test modes of EUT are listed in the table below.

Test Mode Configuration	Description
Mode 1	<u>The Standby Test Mode</u> EUT + Clamp line + Vehicle Battery
Mode 2	<u>The Normal Operating Test Mode</u> EUT + Clamp line + Vehicle Battery+SIM Card

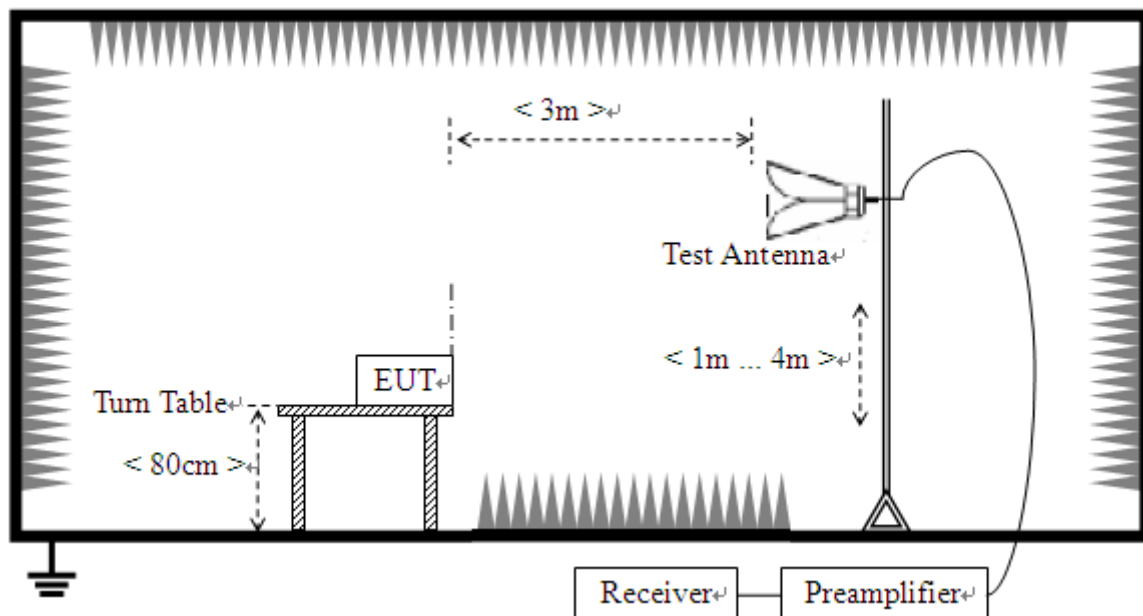
Test Case	Test Mode Configuration	Worst Mode
Radiated Emission	Mode 1~Mode 2	1
Note: All operation modes were tested, but only test data of the worst mode was presented in this report.		

4.3 Test Setups

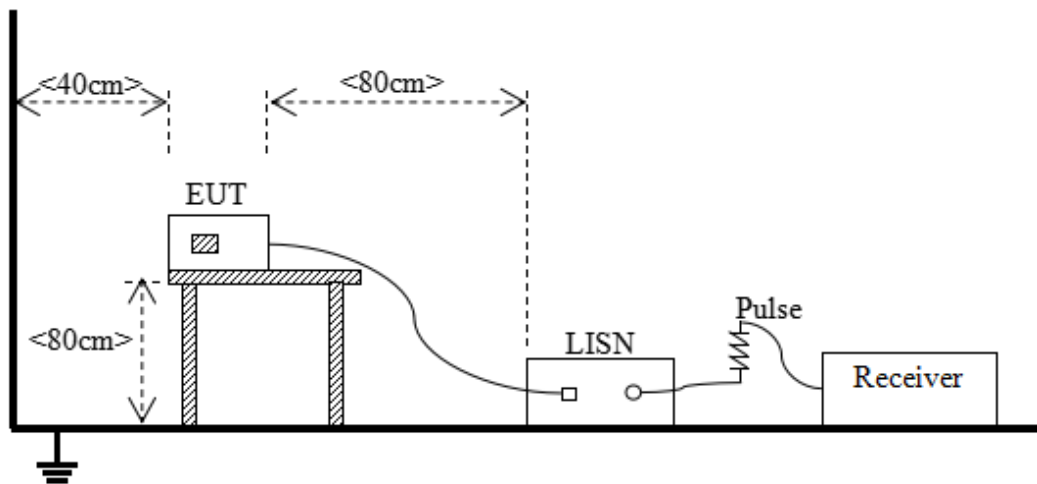
Test Setup 1



Radiated Emission (30 MHz-1 GHz)



Radiated Emission (above 1 GHz)

Test Setup 2

Conducted Emissions, AC Ports

5 TEST ITEMS

5.1 Emission Tests

5.1.1 Radiated Emission

5.1.1.1 Limit

Frequency range (MHz)	Class B (at 3 m)		Class A (at 3 m)
	Field Strength ($\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)
30 - 88	100	40	49.5
88 - 216	150	43.5	54
216 - 960	200	46	56.9
Above 960	500	54	60

NOTE:

- 1) Field Strength (dB $\mu\text{V/m}$) = $20 \cdot \log [\text{Field Strength } (\mu\text{V/m})]$.
- 2) In the emission tables above, the tighter limit applies at the band edges.
- 3) For 30 MHz to 1000 MHz, the CISPR quasi-peak is employed.

For above 1000 MHz, according to the requirements of FCC 15.35, unless otherwise specified, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

Frequency range (GHz)	Class B (at 3 m)			Class A (at 3 m)	
	Field Strength ($\mu\text{V/m}$)	Field Strength Average (dB $\mu\text{V/m}$)	Field Strength Peak (dB $\mu\text{V/m}$)	Field Strength Average (dB $\mu\text{V/m}$)	Field Strength Peak (dB $\mu\text{V/m}$)
1 - F_M	500	54	74	60	80

Note 1: The highest measurement frequency, F_M , in GHz, shall be determined as next Table.

Note 2: Average Class A limit at 3m L_{3m} is determined by the following conversion formula:

$$L_{3m} = L_{10m} + 20 \cdot \log(d_{10m}/d_{3m})$$
Where:
 L_{3m} is Average Class A limit at 3m;
 L_{10m} is Average Class A limit at 10m;
 d_{10m} is Measurement distance in 10m;
 d_{3m} is Measurement distance in 3m.
For this case: $L_{3m} = 49.5 + 20 \cdot \log(10/3) = 60$ (dB $\mu\text{V/m}$).

Highest internal frequency (F_X)	Highest measurement frequency (F_M)
$F_X \leq 108 \text{ MHz}$	1 GHz
$108 \text{ MHz} \leq F_X \leq 500 \text{ MHz}$	2 GHz
$500 \text{ MHz} \leq F_X \leq 1 \text{ GHz}$	5 GHz
$F_X \geq 1 \text{ GHz}$	$5 * F_X$ or 40 GHz, whichever is lower.
Note: F_X is Highest frequency generated or used in the device or on which the device operates or tunes.	

5.1.1.2 Test Setup

Refer to 4.3 section (test setup 1) for radiated emission test, the photo of test setup please refer to ANNEX B.

5.1.1.3 Test Procedure

All Radiated Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

An initial pre-scan was performed in the chamber using the EMI Receiver in peak detection mode. Quasi-peak measurements were conducted based on the peak sweep graph. The EUT was measured by Bi-Log antenna with 2 orthogonal polarities.

The measurement frequency range is from 30 MHz to the 5th harmonic of the maximum frequency of the EUT internal source. The Turn Table is actuated to turn from 0° to 360° , and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1 \text{ GHz}$, 100 kHz for $f < 1 \text{ GHz}$

VBW $\geq$ RBW

Sweep = auto

Detector function = peak for $f < 1 \text{ GHz}$, peak & RMS Average for $f \geq 1 \text{ GHz}$

Trace = max hold

5.1.1.4 Test Result and Test Equipment List

Please refer to ANNEX A.1.

NOTE:

1. Results (dB μ V/m) = Reading (dB μ V) + Factor (dB/m)

The reading level is calculated by software which is not shown in the sheet

2. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain (dB)

3. Margin = Limit - Results

5.1.2 Conducted Emission, AC Ports

5.1.2.1 Test Limit

Frequency range (MHz)	Class A	
	Quasi-peak (dB μ V)	Average (dB μ V)
0.15 - 0.50	79	66
0.50 - 30	73	60

Frequency range (MHz)	Class B	
	Quasi-peak (dB μ V)	Average (dB μ V)
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- 1) The lower limit shall apply at the band edges.
- 2) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

5.1.2.2 Test Setup

Refer to 4.3 section test (test setup 2) for conducted emission, the photo of test setup please refer to ANNEX B.

5.1.2.3 Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω /50 μ H of coupling impedance for the measuring instrument. The test frequency range is from 150 kHz to 30 MHz. The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels that are more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

Use the following spectrum analyzer settings:

RBW = 9 kHz

VBW $\geq$ RBW

Sweep = 10ms

Detector function = peak & Average

Trace = max hold

5.1.2.4 Test Result and Test Equipment List

Please refer to ANNEX A.2.

NOTE:

1. Results (dB μ V) = Reading (dB μ V) + Factor (dB)

The reading level is calculated by software which is not shown in the sheet

2. Factor = Insertion loss + Cable loss

3. Margin = Limit - Results

ANNEX A TEST RESULTS

A.1 Radiated Emission

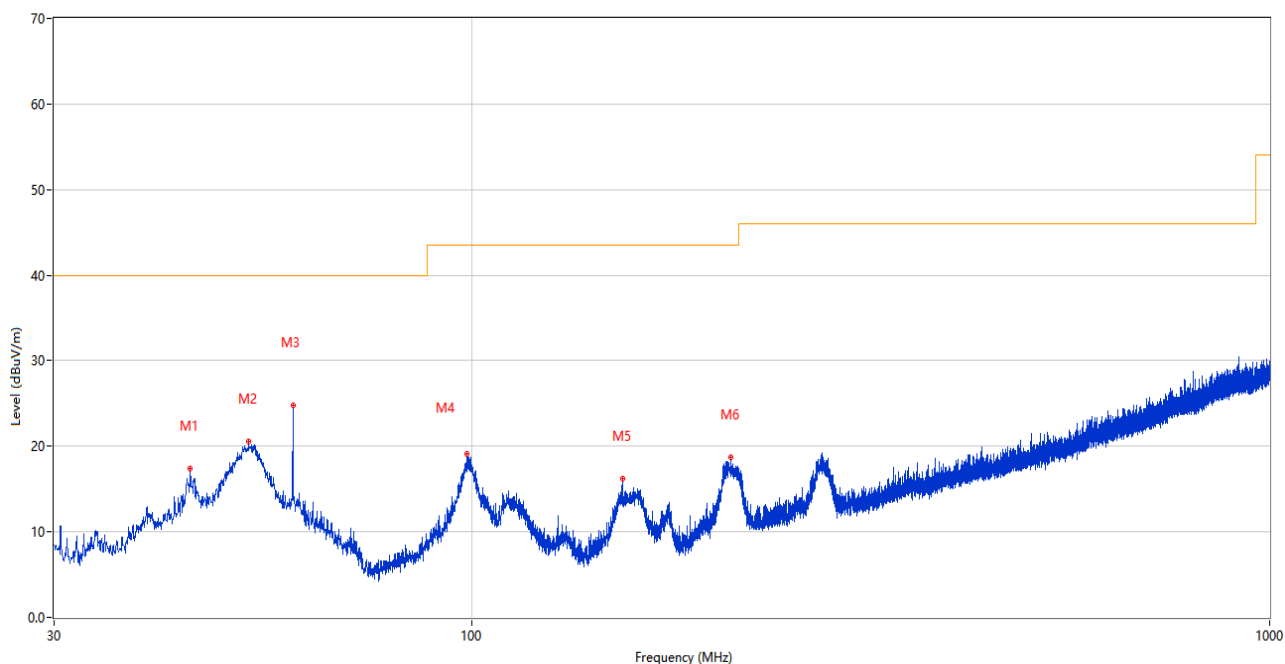
Note 1: The symbol of "--" in the table which means not application.

Note 2: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Sample No.	S04	Temperature	22.7℃
Humidity	39%RH	Pressure	101kPa
Test Engineer	He Shichang	Test Date	2024.09.26

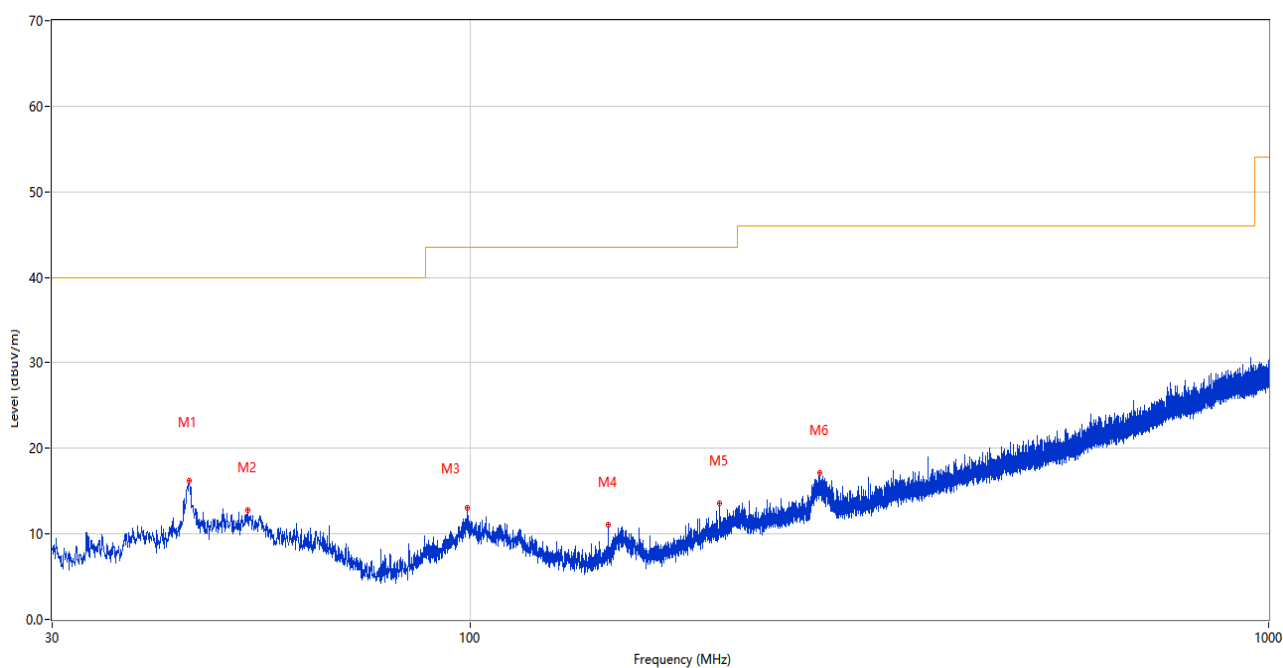
Test Mode 1

1) Test Antenna Vertical, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	44.404	17.40	-25.71	40.0	22.60	Peak	73.00	100	Vertical	Pass
2	52.601	20.52	-25.48	40.0	19.48	Peak	219.00	100	Vertical	Pass
3	59.779	24.73	-26.82	40.0	15.27	Peak	71.00	100	Vertical	Pass
4	98.676	19.08	-26.99	43.5	24.42	Peak	235.00	100	Vertical	Pass
5	154.500	16.21	-29.89	43.5	27.29	Peak	282.00	100	Vertical	Pass
6	211.148	18.72	-26.64	43.5	24.78	Peak	115.00	100	Vertical	Pass

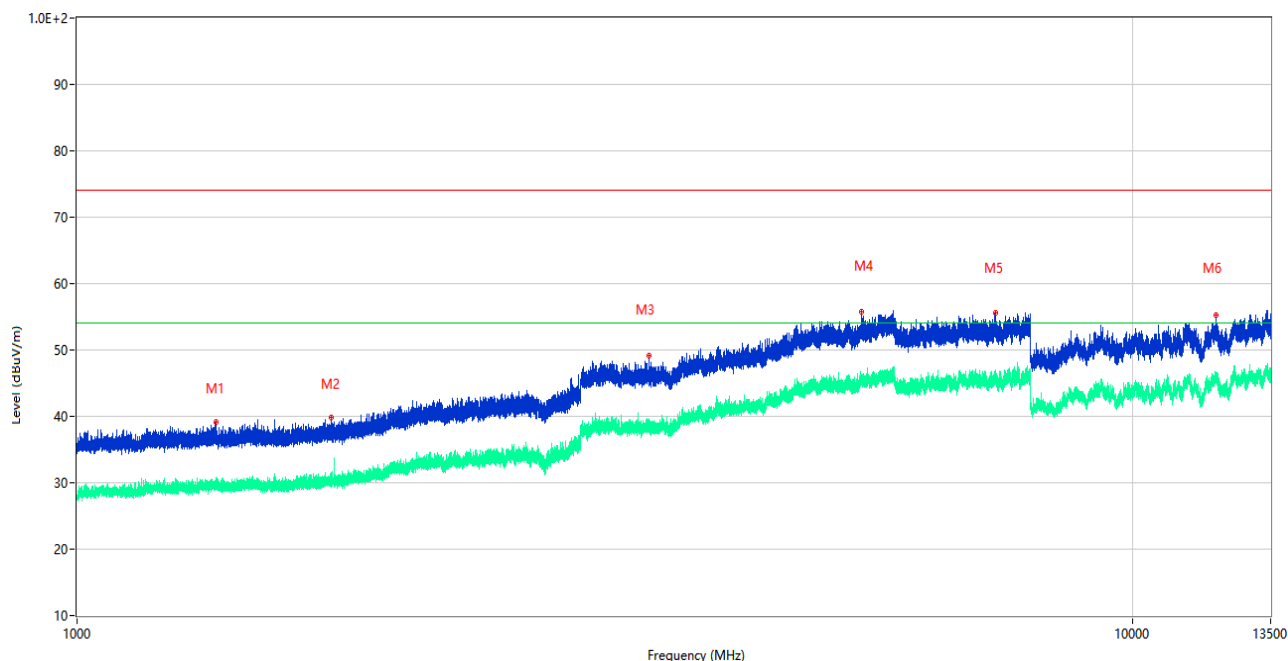
2) Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	44.502	16.24	-25.68	40.0	23.76	Peak	102.00	100	Horizontal	Pass
2	52.746	12.75	-25.49	40.0	27.25	Peak	91.00	100	Horizontal	Pass
3	99.161	13.07	-26.86	43.5	30.43	Peak	326.00	200	Horizontal	Pass
4	149.068	11.09	-30.05	43.5	32.41	Peak	70.00	200	Horizontal	Pass
5	205.279	13.59	-26.65	43.5	29.91	Peak	112.00	200	Horizontal	Pass
6	274.246	17.09	-24.41	46.0	28.91	Peak	10.00	200	Horizontal	Pass

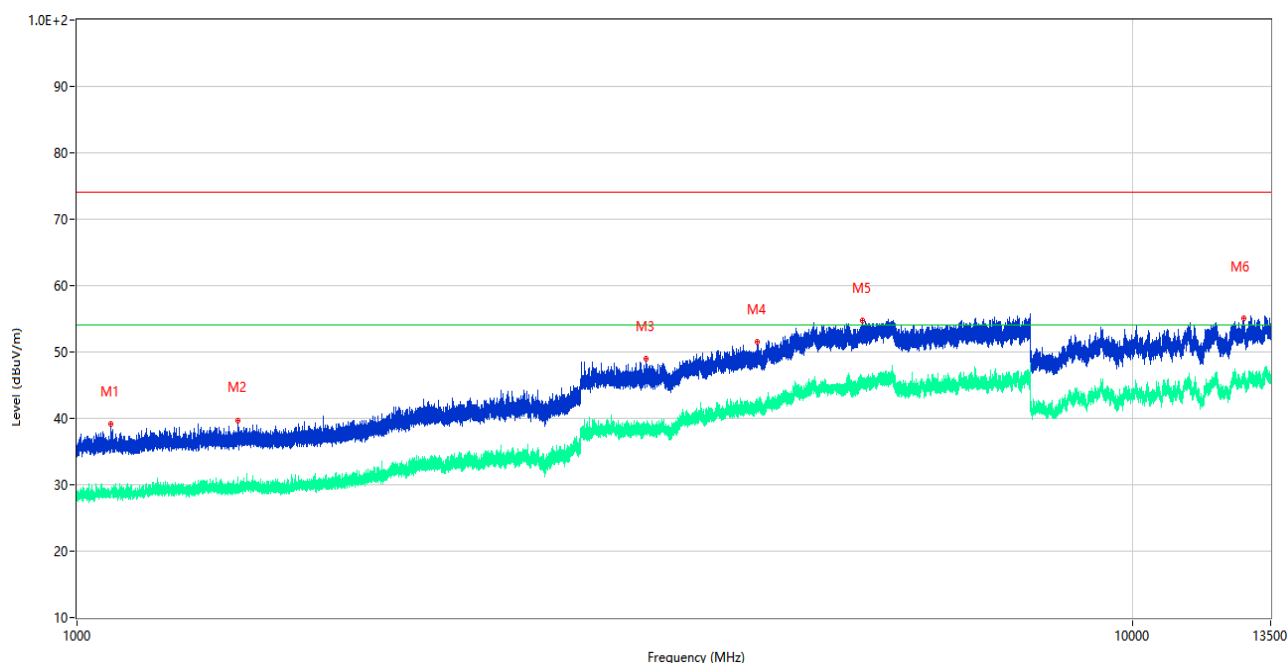
Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
Frequency Below 1 GHz						
EMI Receiver	Keysight	N9038A	MY55330120	2024.08.01	2025.07.31	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2017119081	2023.12.05	2024.12.04	☒
Test Antenna- Bi-Log	SCHWARZB ECK	VULB 9168	9168-00867	2022.04.12	2025.04.11	☒
Anechoic Chamber (#2)	YiHeng	9m*6m*6m	142	2024.07.21	2027.07.20	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

3) Test Antenna Vertical, 1 GHz – 13.5 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1353.500	39.23	-16.01	74.0	34.77	Peak	284.00	100	Vertical	Pass
1**	1353.500	29.61	-16.01	54.0	24.39	AV	284.00	100	Vertical	Pass
2	1739.100	39.83	-15.82	74.0	34.17	Peak	168.00	100	Vertical	Pass
2**	1739.100	30.10	-15.82	54.0	23.90	AV	168.00	100	Vertical	Pass
3	3480.500	49.19	-3.65	74.0	24.81	Peak	184.00	100	Vertical	Pass
3**	3480.500	37.99	-3.65	54.0	16.01	AV	184.00	100	Vertical	Pass
4	5529.750	55.78	2.11	74.0	18.22	Peak	149.00	100	Vertical	Pass
4**	5529.750	45.40	2.11	54.0	8.60	AV	149.00	100	Vertical	Pass
5	7416.000	55.62	3.01	74.0	18.38	Peak	43.00	100	Vertical	Pass
5**	7416.000	45.08	3.01	54.0	8.92	AV	43.00	100	Vertical	Pass
6	11990.500	55.33	2.63	74.0	18.67	Peak	51.00	100	Vertical	Pass
6**	11990.500	46.18	2.63	54.0	7.82	AV	51.00	100	Vertical	Pass

4) Test Antenna Horizontal, 1 GHz – 13.5 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1077.500	39.10	-16.47	74.0	34.90	Peak	260.00	100	Horizontal	Pass
1**	1077.500	28.83	-16.47	54.0	25.17	AV	260.00	100	Horizontal	Pass
2	1418.900	39.72	-16.00	74.0	34.28	Peak	82.00	100	Horizontal	Pass
2**	1418.900	29.34	-16.00	54.0	24.66	AV	82.00	100	Horizontal	Pass
3	3458.250	48.96	-4.38	74.0	25.04	Peak	204.00	100	Horizontal	Pass
3**	3458.250	38.74	-4.38	54.0	15.26	AV	204.00	100	Horizontal	Pass
4	4402.750	51.52	-0.18	74.0	22.48	Peak	360.00	100	Horizontal	Pass
4**	4402.750	42.06	-0.18	54.0	11.94	AV	360.00	100	Horizontal	Pass
5	5548.000	54.75	2.16	74.0	19.25	Peak	232.00	100	Horizontal	Pass
5**	5548.000	45.33	2.16	54.0	8.67	AV	232.00	100	Horizontal	Pass
6	12723.500	55.15	3.39	74.0	18.85	Peak	203.00	100	Horizontal	Pass
6**	12723.500	46.62	3.39	54.0	7.38	AV	203.00	100	Horizontal	Pass

Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
Frequency Above 1 GHz						
EMI Receiver	Keysight	N9038A	MY55330120	2024.08.01	2025.07.31	☒
Amplifier (1-12GHz)	Advanced Microwave	WLA652A	1740103	2023.12.05	2024.12.04	☒
Amplifier (0.8-21GHz)	Mini-Circuits	ZVA-213-S+	225321316	2023.12.05	2024.12.04	☒
Test Antenna- Horn	SCHWARZB ECK	BBHA 9120D	01917	2022.06.09	2025.06.08	☒
Anechoic Chamber (#2)	YiHeng	9m*6m*6m	142	2024.07.21	2027.07.20	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

A.2 Conducted Emission, AC Ports

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2490757-AE.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2490757-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2490757-AI.PDF”.

Statement

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--END OF REPORT--