

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 OBDII GNSS Tracker
Model Name: VL502 (refer to section 2.4)
Brand Name: Jimi
FCC ID: 2AMLF-VL502
Test Standard: 47 CFR Part 15 Subpart B
ANSI C63.4-2014
Sample Arrival Date: Jun. 15, 2023
Test Date: Jun. 21, 2023 - Aug. 04, 2023
Date of Issue: Aug. 04, 2023

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Zhang Guoxi

Checked by: Xia Long

Approved by: Liao Jianming
(Technical Director)

Zhang Guoxi

Xia Long

Liao Jianming

Revision History		
<u>Version</u>	<u>Issue Date</u>	<u>Revisions</u>
<u>Rev. 01</u>	<u>Jul. 24, 2023</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Aug. 04, 2023</u>	<u>Updated Section 4.4 Test Mode and updated the test results in Annex A</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	<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 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 Factory Information

Factory	Huizhou Newthinking Electronics Co., Ltd.
Address	The third&sixth floor, 1&2 Factory Buildings, Jimi Industrial Park, No.101 Jinfu Road, Xiaojinkou street, Huicheng District, Huizhou

2.4 General Description for Equipment under Test (EUT)

EUT Name	LTE OBDII GNSS Tracker
Model Name Under Test	VL502
Series Model Name	VL502(A), VL502_A, VL04NA, VL04(NA), VL502A
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	VL04NA_MB_V1.0, VL04NA_SUB_V1.0
Software Version	VL04NA_VL04NA_WAAH_V1.0_230223.1012
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	4G Network FDD LTE Band 2/4/5/12/13 Bluetooth, GPS
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The requirement for the following technical information of the EUT was tested in this report:

The highest internal frequency of EUT	2483.5MHz
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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	Result
1	Radiated Emission	15.109	Pass	Annex A .1
2	Conducted Emission, AC Ports	15.107	N/A	Annex A .2

Note: The EUT is only used in vehicle environment. 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
Conducted emissions (9 kHz-30 MHz)	3.22 dB
Radiated emissions (30 MHz-1 GHz)-10m	4.80 dB
Radiated emissions (30 MHz-1 GHz)-3m	4.76 dB
Radiated emissions (1 GHz-18 GHz)-3m	4.88 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments, Test Date and Test Engineer

Test items	Voltage	Temperature	Relative Humidity	Ambient Pressure	Test Date	Test Engineer
Radiated Emission	DC 12V, DC 24V	22.8℃	50%	101kPa	Aug. 04, 2023	Tian Hengzhao

4.2 Test Equipment List

Radiated Emission Test For Frequency Below 1 GHz (3m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Agilent	N9038A	MY55330120	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2017119081	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-00867	2022.04.12	2025.04.11	<input checked="" type="checkbox"/>
Anechoic Chamber	YiHeng	9m*6m*6m	966#2	2021.08.19	2024.08.18	<input checked="" type="checkbox"/>
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		<input checked="" type="checkbox"/>

Radiated Emission Test For Frequency Above 1 GHz (3m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	Agilent	N9038A	MY55330120	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Amplifier (1-12GHz)	Advanced Microwave	WLA652A	1740103	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Amplifier (0.8-21GHz)	Mini-Circuits	ZVA-213-S+	225321316	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Amplifier (18-40GHz)	COM-MV	KA_LNA18-40G-01	18050001	2022.09.09	2023.09.08	<input type="checkbox"/>
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	1917	2022.06.09	2025.06.08	<input checked="" type="checkbox"/>
Anechoic Chamber	YiHeng	9m*6m*6m	966#2	2021.08.19	2024.08.18	<input checked="" type="checkbox"/>
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		<input checked="" type="checkbox"/>

4.3 Test Enclosure list

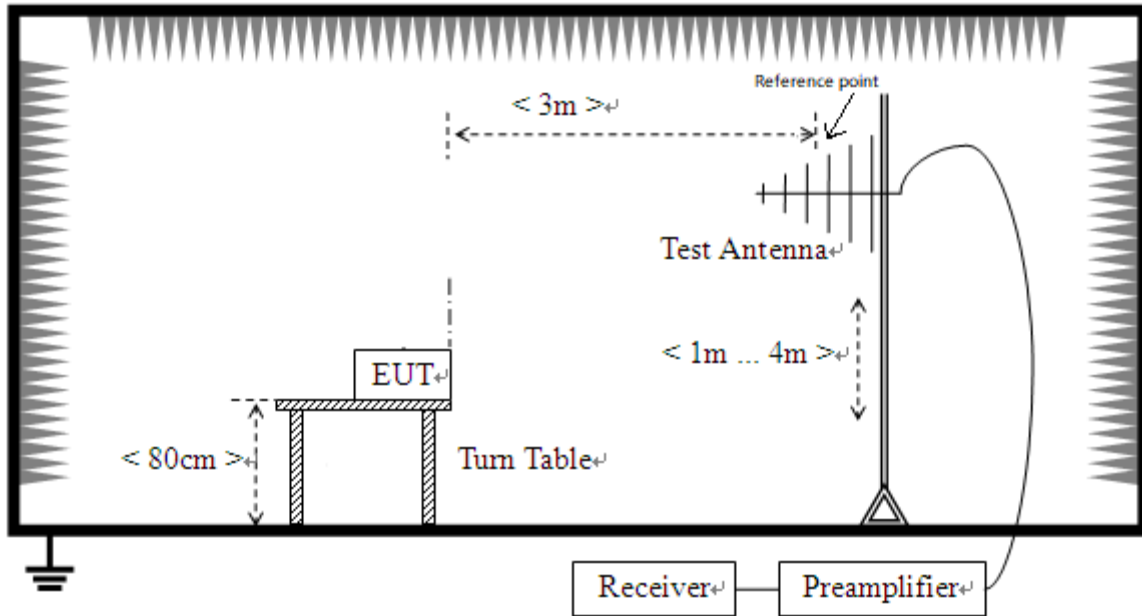
Description	Manufacturer	Model	Serial No.	Length	Description	Use
Vehicle Battery	Camel	55530	N/A	N/A	N/A	<input checked="" type="checkbox"/>
Clamp wire	N/A	N/A	N/A	N/A	N/A	<input checked="" type="checkbox"/>

4.4 Test Configurations

Test Configurations (TC) No.	Description
TC01	<u>The Standby Test Mode</u> EUT + Vehicle Battery + Clip line

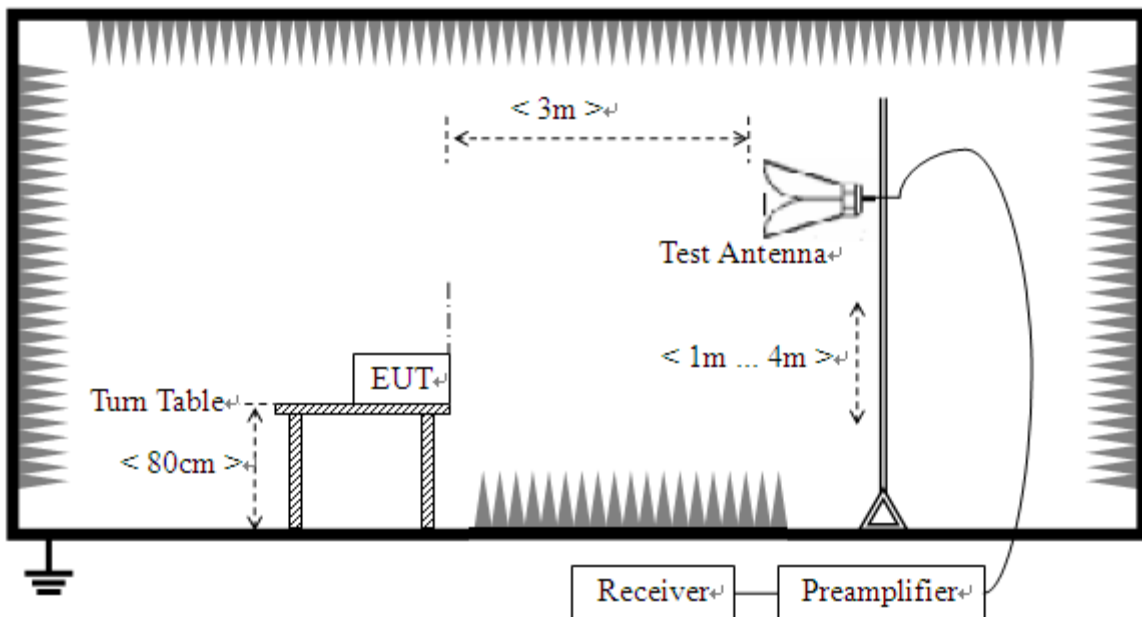
4.5 Test Setups

Test Setup 1



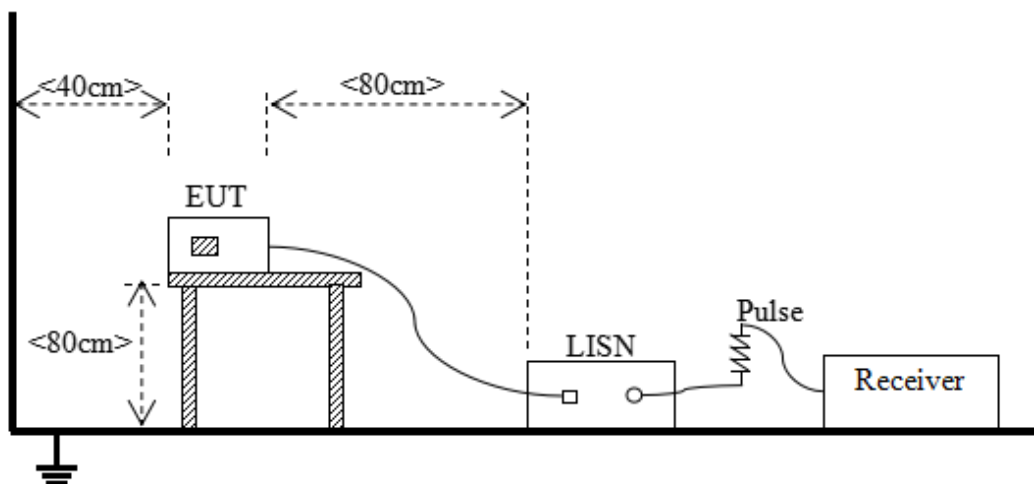
(For Radiated Emission Test (30 MHz-1 GHz))

Test Setup 2



(For Radiated Emission Test (above 1 GHz))

Test Setup 3



(For Conducted Emission, AC Ports Test)

4.6 Test Conditions

Test Case	Test Conditions	
Radiated Emission	Test Setup	Test Setup 1&2
	Test Configuration	TC01

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 B (at 10 m)	Class A (at 10 m)	
	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)
30 - 88	100	40	30	90	39
88 - 216	150	43.5	33.5	150	43.5
216 - 960	200	46	36	210	46.4
Above 960	500	54	44	300	49.5

NOTE:

- 1) Field Strength ($\text{dB}\mu\text{V/m}$) = $20 \cdot \log$ [Field Strength ($\mu\text{V/m}$)].
- 2) In the emission tables above, the tighter limit applies at the band edges.

5.1.1.2 Test Setup

Refer to 4.5 section (test setup 1 to test setup 2) for radiated emission test, the photo of test setup please refer to ANNEX B.

5.1.1.3 Test Procedure

All Spurious 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 $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

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

Trace = max hold

5.1.1.4 Test Result

Please refer to ANNEX A.1.

NOTE:

1. Results (dB μ V/m) = Reading (dB μ V/m) + 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. Over limit = Results – Limit.

5.1.2 Conducted Emission

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 4.5 section test (test setup 3) 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

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. Over limit = Results – Limit.

ANNEX A TEST RESULTS

A.1 Radiated Emission

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

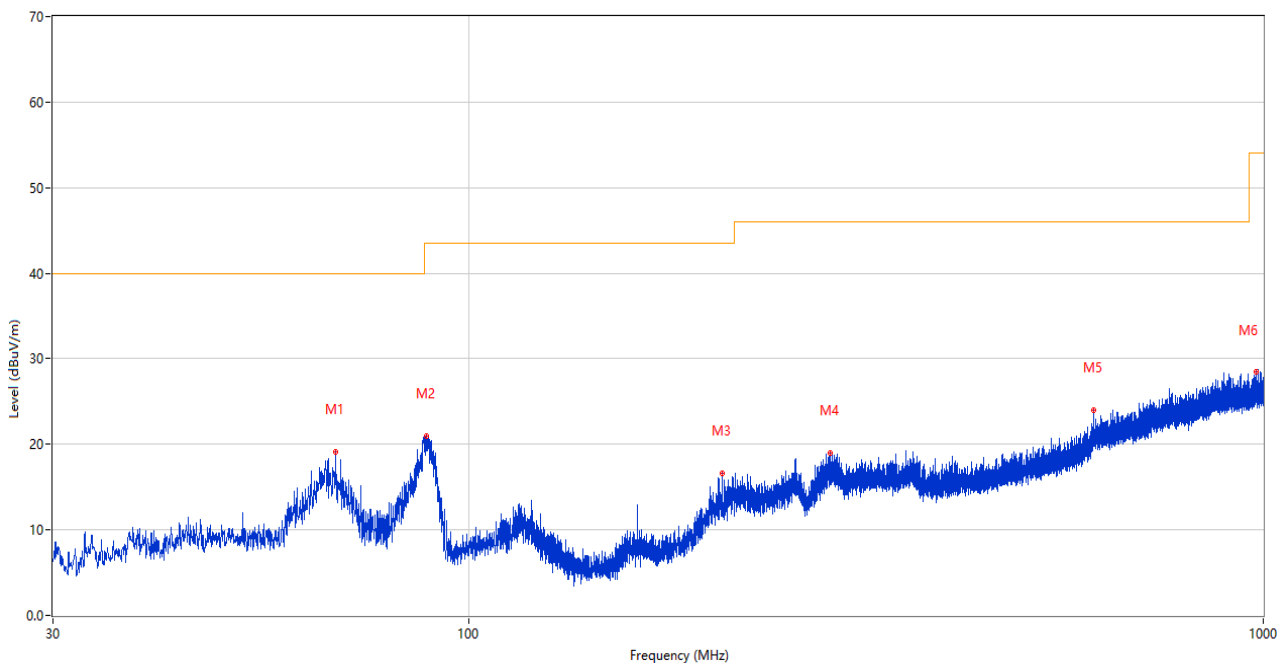
Note 2: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note 3: All the configurations were pre tested, only the worst configuration has been reported in this report.

Test Data and Plots

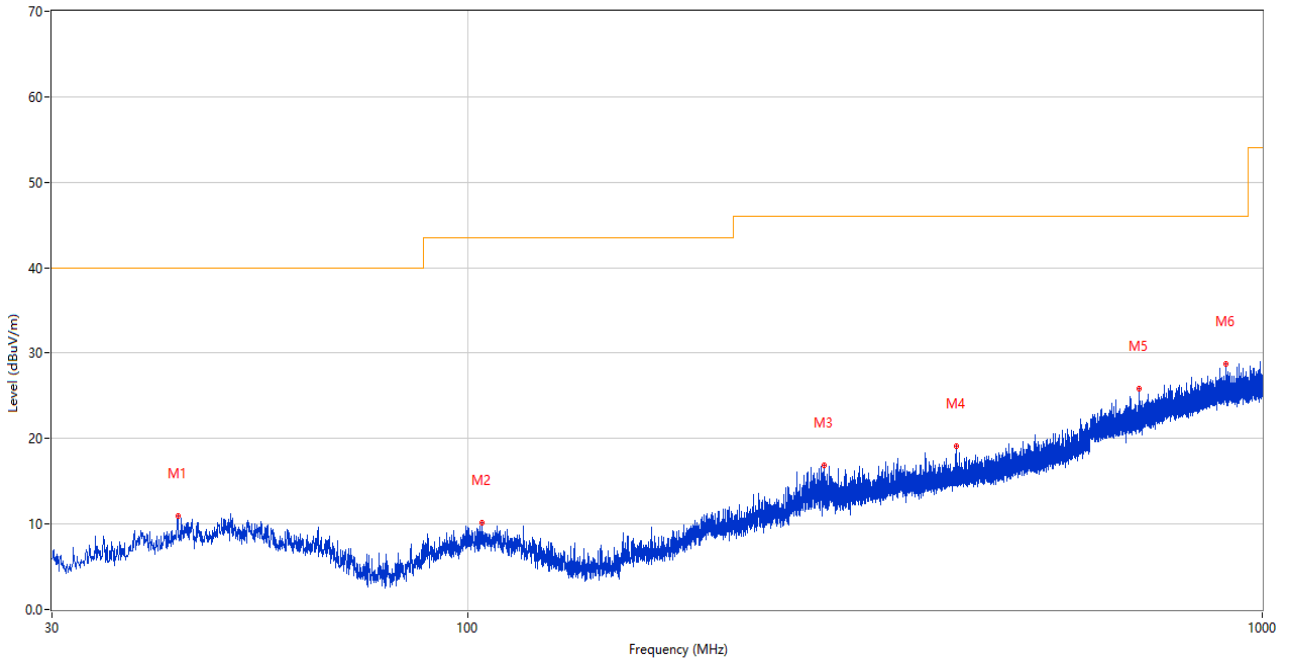
The Standby Test Mode

A.1.1 Test Antenna Vertical, 30 MHz – 1 GHz



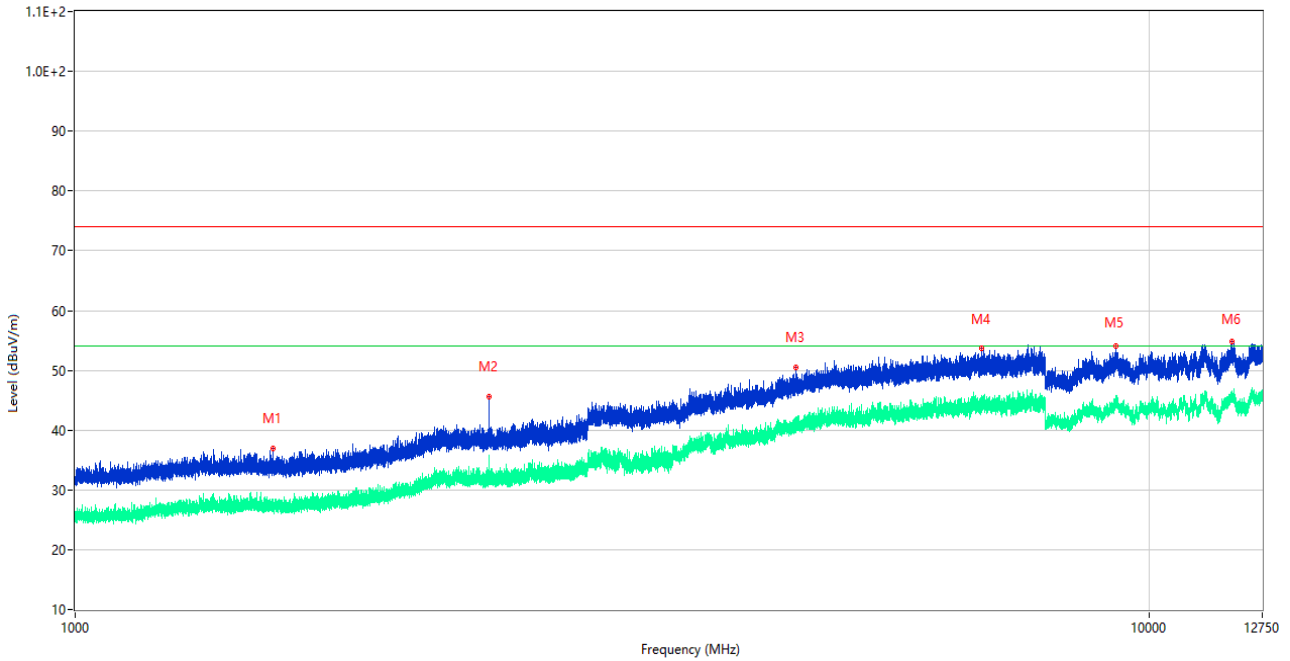
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	68.073	19.13	-28.56	40.0	20.87	Peak	54.00	100	Vertical	Pass
2	88.588	20.96	-28.95	43.5	22.54	Peak	71.00	100	Vertical	Pass
3	208.334	16.65	-26.64	43.5	26.85	Peak	252.00	100	Vertical	Pass
4	285.304	18.99	-24.01	46.0	27.01	Peak	108.00	100	Vertical	Pass
5	611.175	24.01	-15.58	46.0	21.99	Peak	181.00	100	Vertical	Pass
6	980.164	28.53	-8.62	54.0	25.47	Peak	5.00	100	Vertical	Pass

A.1.2 Test Antenna Horizontal, 30 MHz – 1 GHz



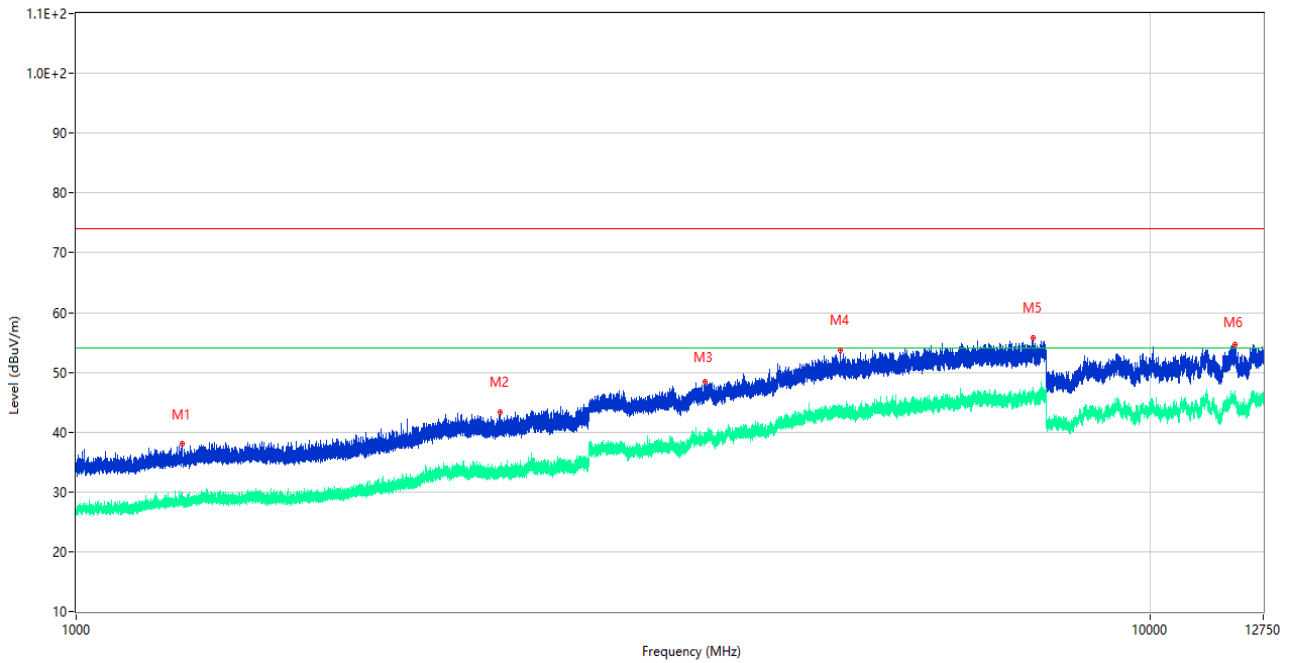
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	43.192	10.91	-25.78	40.0	29.09	Peak	279.00	100	Horizontal	Pass
2	104.302	10.20	-26.50	43.5	33.30	Peak	360.00	100	Horizontal	Pass
3	280.648	16.84	-24.10	46.0	29.16	Peak	196.00	200	Horizontal	Pass
4	412.228	19.09	-20.53	46.0	26.91	Peak	58.00	200	Horizontal	Pass
5	699.688	25.79	-14.08	46.0	20.21	Peak	184.00	200	Horizontal	Pass
6	901.157	28.73	-9.86	46.0	17.27	Peak	159.00	200	Horizontal	Pass

A.1.3 Test Antenna Vertical, 1 GHz – 12.75 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1529.100	36.94	-16.75	74.0	37.06	Peak	359.00	100	Vertical	Pass
1**	1529.100	27.23	-16.75	54.0	26.77	AV	359.00	100	Vertical	Pass
2	2429.400	45.65	-11.64	74.0	28.35	Peak	287.00	100	Vertical	Pass
2**	2429.400	31.86	-11.64	54.0	22.14	AV	287.00	100	Vertical	Pass
3	4688.750	50.56	-0.30	74.0	23.44	Peak	78.00	100	Vertical	Pass
3**	4688.750	40.19	-0.30	54.0	13.81	AV	78.00	100	Vertical	Pass
4	6982.750	53.77	1.41	74.0	20.23	Peak	227.00	100	Vertical	Pass
4**	6982.750	44.46	1.41	54.0	9.54	AV	227.00	100	Vertical	Pass
5	9318.000	54.01	2.18	74.0	19.99	Peak	167.00	100	Vertical	Pass
5**	9318.000	44.25	2.18	54.0	9.75	AV	167.00	100	Vertical	Pass
6	11958.000	54.79	2.64	74.0	19.21	Peak	81.00	100	Vertical	Pass
6**	11958.000	45.18	2.64	54.0	8.82	AV	81.00	100	Vertical	Pass

A.1.4 Test Antenna Horizontal, 1 GHz – 18 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1		38.01	-16.88	74.0	35.99	Peak	127.00	100	Horizontal	Pass
1**	1254.900	28.72	-16.88	54.0	25.28	AV	127.00	100	Horizontal	Pass
2	2483.000	43.42	-10.54	74.0	30.58	Peak	97.00	100	Horizontal	Pass
2**	2483.000	33.83	-10.54	54.0	20.17	AV	97.00	100	Horizontal	Pass
3	3854.250	48.44	-3.16	74.0	25.56	Peak	323.00	100	Horizontal	Pass
3**	3854.250	38.94	-3.16	54.0	15.06	AV	323.00	100	Horizontal	Pass
4	5145.000	53.71	-0.09	74.0	20.29	Peak	260.00	100	Horizontal	Pass
4**	5145.000	43.63	-0.09	54.0	10.37	AV	260.00	100	Horizontal	Pass
5	7787.000	55.85	3.18	74.0	18.15	Peak	335.00	100	Horizontal	Pass
5**	7787.000	46.48	3.18	54.0	7.52	AV	335.00	100	Horizontal	Pass
6	12000.500	54.56	2.62	74.0	19.44	Peak	278.00	100	Horizontal	Pass
6**	12000.500	45.87	2.62	54.0	8.13	AV	278.00	100	Horizontal	Pass

A.2 Conducted Emission

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2360686-AE.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2360686-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2360686-AI.PDF”.

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.
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--END OF REPORT--