

TEST REPORT

Applicant: SHENZHEN INVISPOWER TECHNOLOGY CO., LTD.
Address: 13B, Xu Sheng building, 4004 Baoan Avenue, Baoan District, Shenzhen, China
Equipment Type: WLC_ECU
Model Name: WLC_ECU
Brand Name: VINFAST
FCC ID: 2AR4XYGKJ-VFE34S
Test Standard: 47 CFR Part 15 Subpart B
ANSI C63.4-2014
Sample Arrival Date: Apr. 07, 2023
Test Date: Apr. 12, 2023
Date of Issue: Jul. 03, 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 Content</u>
<u>Rev. 01</u>	<u>Jun.15, 2023</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Jul. 03, 2023</u>	<u>Delete standards and data for ICES-001, Add work frequency description and delete Radiated Emission (1-18G) data.</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. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	SHENZHEN INVISPOWER TECHNOLOGY CO., LTD.
Address	13B, Xu Sheng building, 4004 Baoan Avenue, Baoan District, Shenzhen, China

2.2 Manufacturer Information

Manufacturer	SHENZHEN INVISPOWER TECHNOLOGY CO., LTD.
Address	13B, Xu Sheng building, 4004 Baoan Avenue, Baoan District, Shenzhen, China

2.3 Factory Information

Factory	Jiangsu InvisPower Co., Ltd
Address	No.100, Xinning Road, Chongchuan District, Nantong City, Jiangsu Province, P.R.China

2.4 General Description for Equipment under Test (EUT)

EUT Name	WLC_ECU
Model Name Under Test	WLC_ECU
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	Qi
The EUT is used in vehicle environment.	

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

Operating frequency range	117kHz~137 kHz
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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, DC Ports	15.107	N/A	Annex A .2

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	21.3°C	56%	101kPa	Apr. 12, 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	Keysight	N9038A	MY55330120	2022.09.09	2023.09.08	<input checked="" type="checkbox"/>
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2017119081	2022.12.07	2023.12.06	<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	142	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

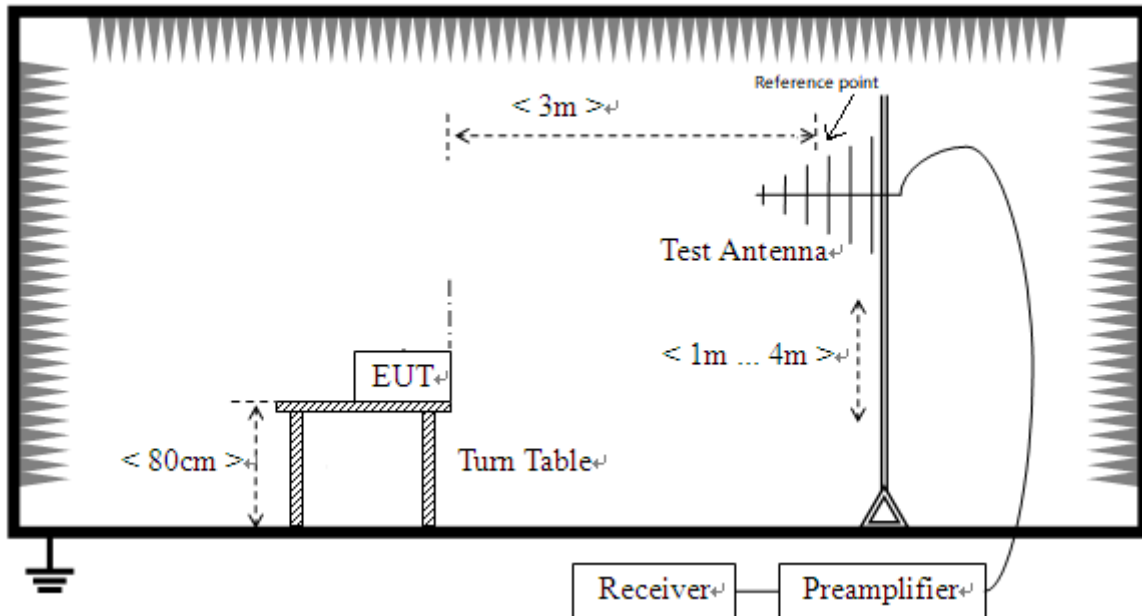
Description	Manufacturer	Model	Serial No.	Length	Description	Use
Vehicle Battery	N/A	N/A	127801	N/A	N/A	<input checked="" type="checkbox"/>
Clip Wire	N/A	N/A	N/A	N/A	N/A	<input checked="" type="checkbox"/>
Wireless charging load	N/A	N/A	N/A	N/A	N/A	<input checked="" type="checkbox"/>

4.4 Test Configurations

Test Configurations (TC) No.	Description
TC01	<u>The Standby mode</u> EUT + Vehicle Battery + Clip Wire
TC02	<u>The Load Test Mode</u> EUT + Vehicle Battery + Clip Wire + Load

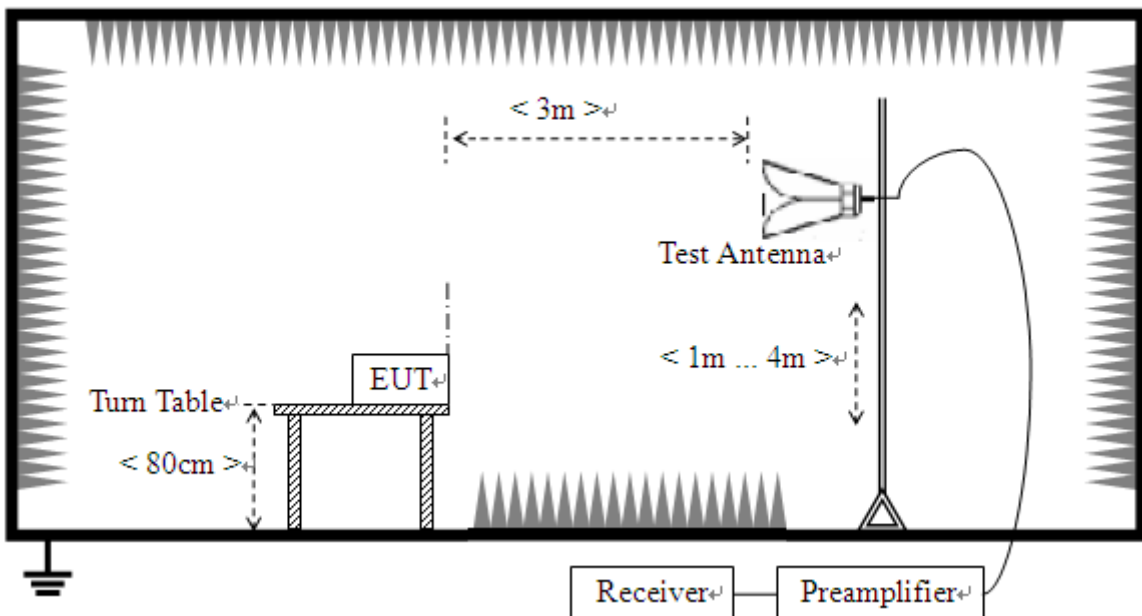
4.5 Test Setups

Test Setup 1



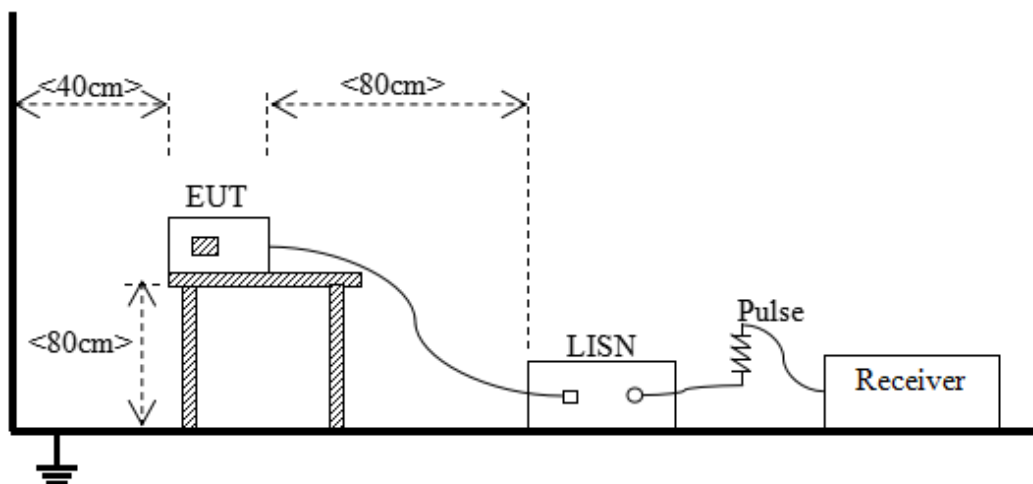
(For Radiated Emission Test (30 MHz-1 GHz))

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
	Test Configuration	TC01-TC02 ^{Note}
Note: Based on client request, all normal using modes of the normal function were tested but only the worst test data of the worst mode is reported by this report. The Standby mode is the worst mode in this report.		

5 TEST ITEMS

5.1 Emission Tests

5.1.1 Radiated Emission

5.1.1.1 Limit

FCC:

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.
- 3) The limits using ANSI C63.4.

Highest internal frequency (F_X)	Highest measurement frequency (F_M)
$F_X \leq 108 \text{ MHz}$	1GHz
$108 \text{ MHz} \leq F_X \leq 500 \text{ MHz}$	2GHz
$500 \text{ MHz} \leq F_X \leq 1 \text{ GHz}$	5GHz
$F_X \geq 1 \text{ GHz}$	$5 \cdot F_X$ up to a maximum of 40 GHz

Note: F_X is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.

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

The test employing the methods of measurement described in the publication referenced in Section 3(b) (ANSI C63.4);

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.
- 3) The limit using ANSI C63.4.

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 test employing the methods of measurement described in the publication referenced in Section 3(b) (ANSI C63.4);

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

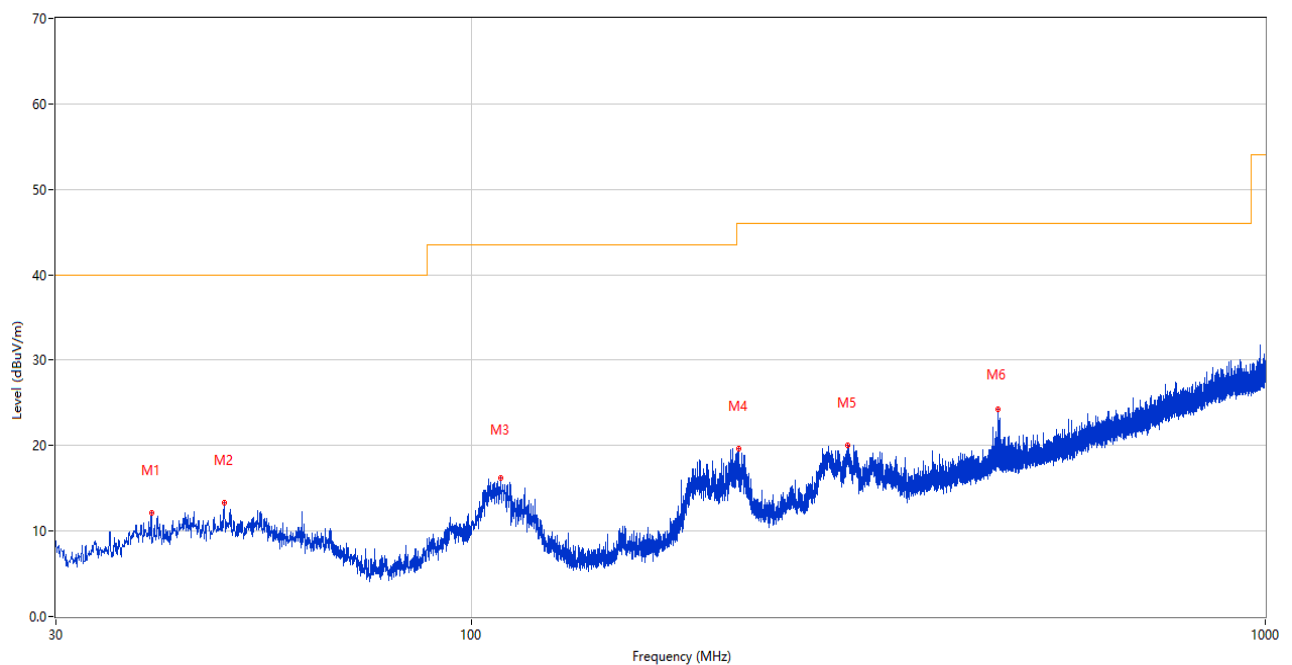
Note 1: The symbol of "--" in the table which means not application.

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.

Test Data and Plots

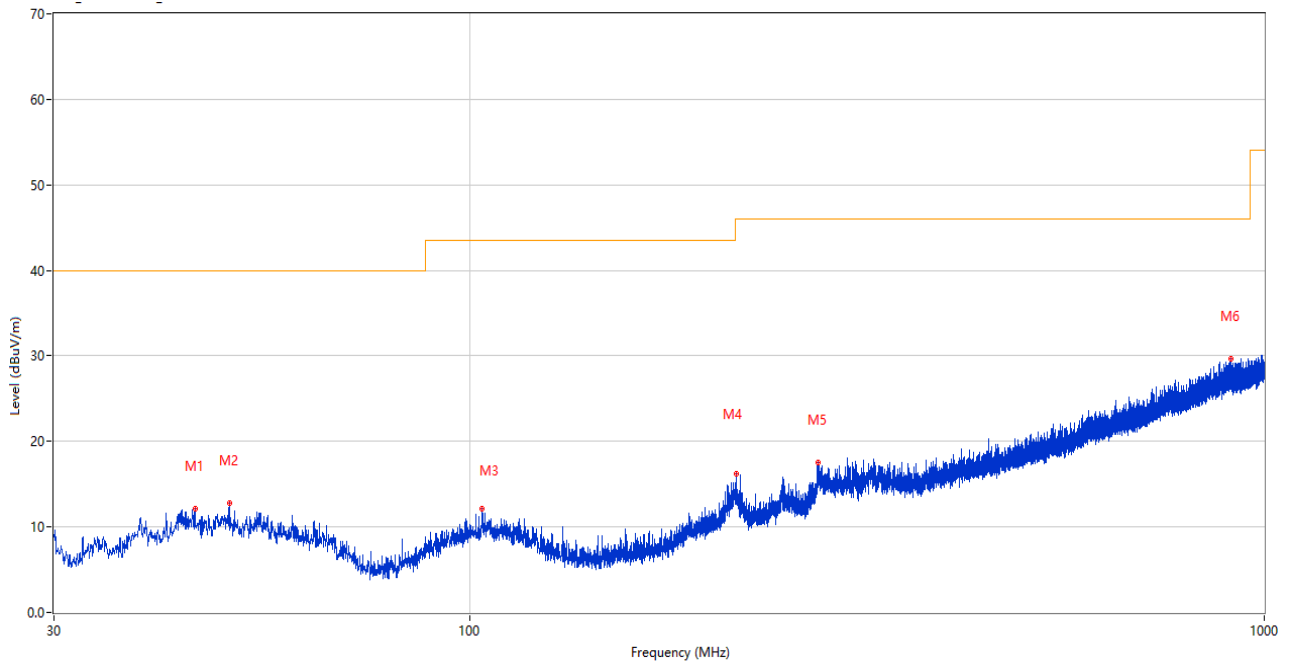
The Standby mode

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	39.554	12.09	-26.84	40.0	27.91	Peak	360.00	100	Vertical	Pass
2	48.867	13.33	-25.37	40.0	26.67	Peak	278.00	200	Vertical	Pass
3	108.910	16.19	-26.66	43.5	27.31	Peak	3.00	100	Vertical	Pass
4	216.968	19.66	-26.32	46.0	26.34	Peak	299.00	200	Vertical	Pass
5	298.399	20.02	-23.82	46.0	25.98	Peak	323.00	200	Vertical	Pass
6	460.243	24.24	-19.65	46.0	21.76	Peak	0.00	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	45.132	12.11	-25.52	40.0	27.89	Peak	249.00	200	Horizontal	Pass
2	49.837	12.81	-25.57	40.0	27.19	Peak	336.00	200	Horizontal	Pass
3	103.672	12.10	-26.47	43.5	31.40	Peak	360.00	200	Horizontal	Pass
4	216.337	16.24	-26.37	46.0	29.76	Peak	314.00	200	Horizontal	Pass
5	274.780	17.55	-24.39	46.0	28.45	Peak	207.00	200	Horizontal	Pass
6	907.219	29.66	-9.78	46.0	16.34	Peak	9.00	100	Horizontal	Pass

A.2 Conducted Emission

Note: Not applicable.

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2340120-AE-1.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2340120-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2340120-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--