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 C ANSI C63.10-2020
Sample Arrival Date:	Apr. 07, 2023
Test Date:	Apr. 12, 2023 - Apr. 18, 2023
Date of Issue:	Jul. 06, 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

Revision History

Version	Issue Date	Revisions
Rev. 01	Jun. 15, 2023	Initial Issue
Rev. 02	Jul. 06, 2023	Section 2.6, update the working frequency of the product and change the product type to fixed position.

TABLE OF CONTENTS

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 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	117~137 kHz
Fix Location	☐ Mobile ☐ Portable ☒ Fix Location
Antenna Type	Coil Antenna
About Product	The EUT support the Qi and PMA technology, and they have the same operating frequency.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Intentional Radiators
2	ANSI C63.10-2020	American National Standard for Testing Unlicensed Wireless Devices

3.2 Verdict

No.	Description	FCC Rule	Test Verdict	Result
1	Antenna Requirement	15.203	Pass Note	--
2	Radiated Emission	15.209,15.215(b)	Pass	Annex A.1
3	Conducted Emission, DC Ports	15.207	N/A	Annex A.2
4	20 dB Bandwidth	15.215(c)	Pass	Annex A.3
Note: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.				

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)	4.28 dB
Radiated 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

Relative Humidity	30% to 60%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+22℃ to +25℃
Working Voltage of the EUT	NV (Normal Voltage)	12V

4.2 Test Equipment List

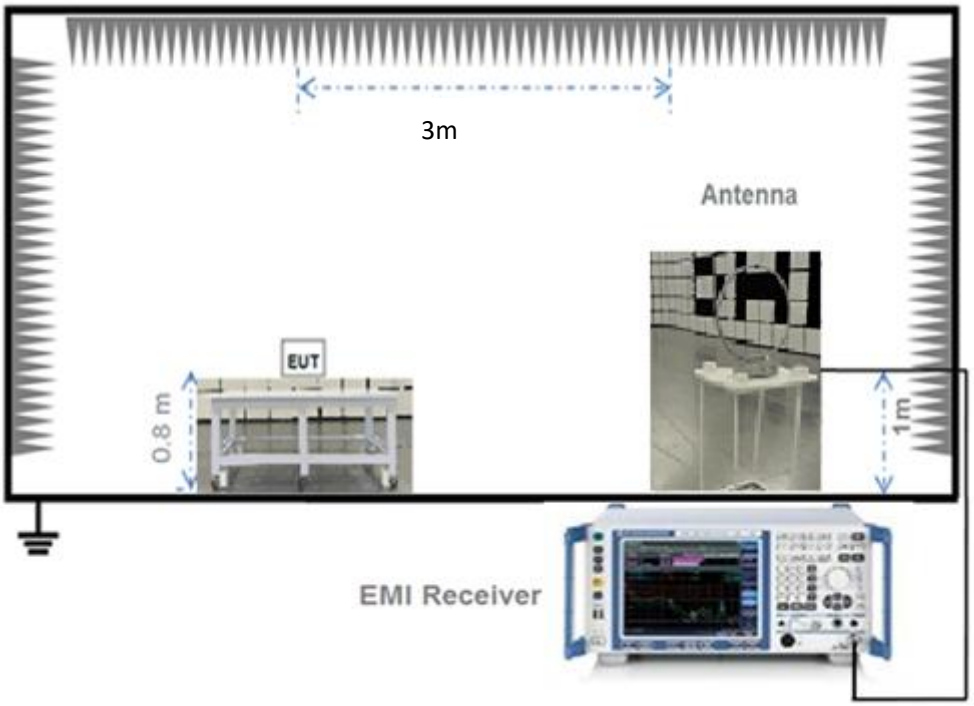
Transmitter Spurious Emission < 30 MHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2022.09.09	2023.09.08	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2018054558	2022.12.07	2023.12.06	☐
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2021.04.16	2024.04.15	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-01162	2020.08.12	2023.08.11	☐
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	130	2021.08.15	2024.08.14	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		☒

Transmitter Spurious Emission > 30 MHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2022.09.09	2023.09.08	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2018054558	2022.12.07	2023.12.06	☒
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2021.04.16	2024.04.15	☐
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-01162	2020.08.12	2023.08.11	☒
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	130	2021.08.15	2024.08.14	☒
Description	Manufacturer	Name		Version		Use
Test Software	BALUN	BL410-E		V22.930		☒

Emission Bandwidth						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2022.09.09	2023.09.08	☒
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2021.04.16	2024.04.15	☒
Anechoic Chamber	EMC TECHNOLOGY LTD	20.1m*11.6m *7.35m	130	2021.08.15	2024.08.14	☒

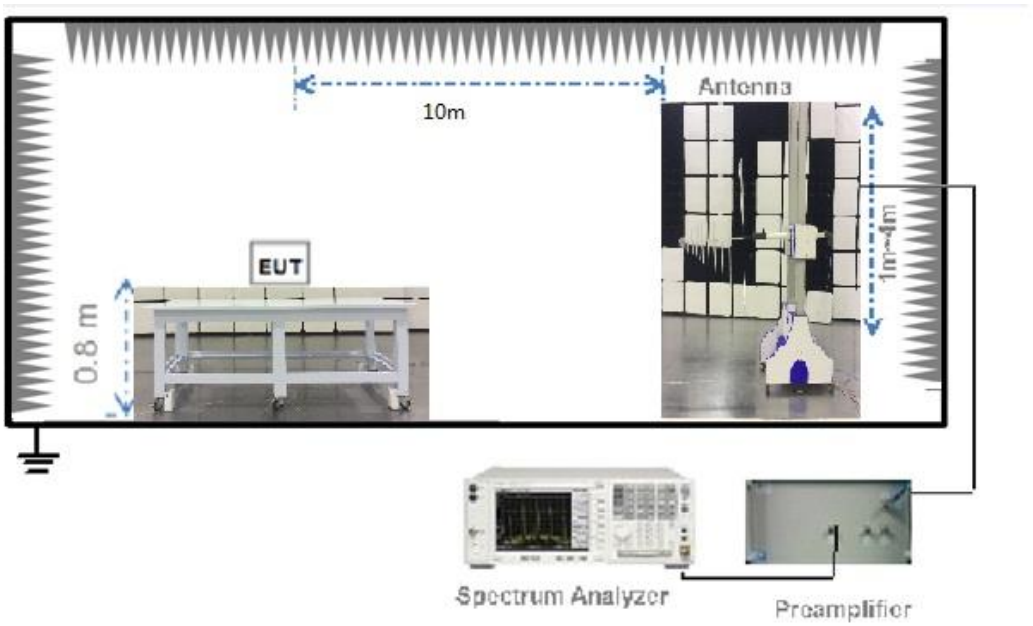
4.3 Test Setups

Test Setup 1



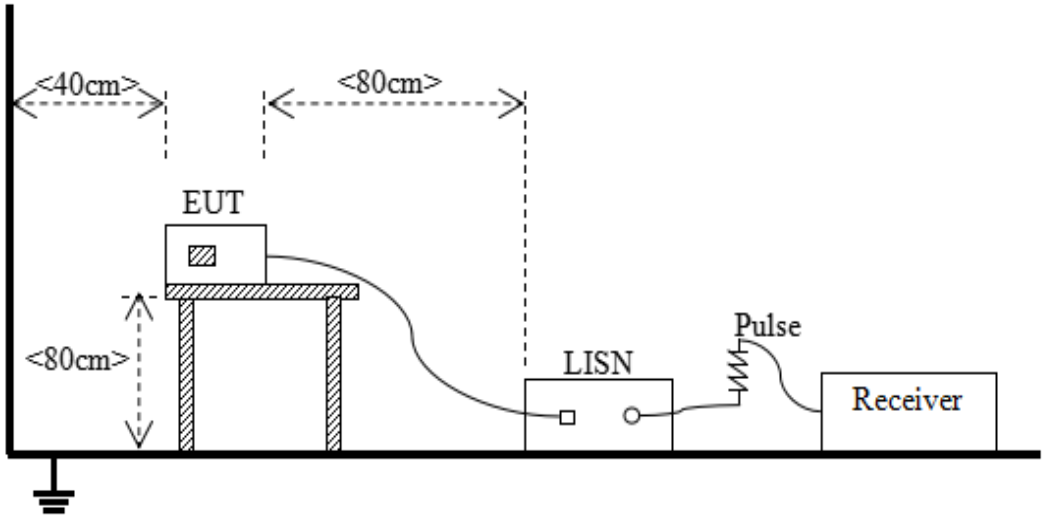
For Radiated Emission Test (Below 30 MHz))

Test Setup 2



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

Test Setup 3



(For Conducted Emission, DC Ports Test)

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	An embedded-in antenna design is used.

Reference Documents	Item
Photo	Please refer EUT internal photos.

5.2 Emission Tests

5.2.1 Radiated Emission

5.2.1.1 Limit

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

NOTE:

1) Field Strength (dBμV/m) = 20*log [Field Strength (μV/m)].

2) In the emission tables above, the tighter limit applies at the band edges.

3) For above 1000 MHz, limit field strength of harmonics: 54 dBμV/m@3 m (AV) and 74 dBμV/m@3 m (PK)

4) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). For example, at the frequency 9 kHz, limit @10m = 20*log (2400/f) + 40log (dlimit/dmeasure) where limit = 300m, dmeasure=10m. limit @10m = 20*log (2400/9) + 40log (300/10) = 107.5 (dBμV/m).

5) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided, When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements). For example, at the frequency 30 MHz, limit @10m = 20*log (100) + 20log (dlimit/dmeasure) where limit = 3m, dmeasure=10m. limit @10m = 20*log (100) + 20log (3/10) = 29.5 (dBμV/m).

5.2.1.2 Test Setup

Refer to 4.3 section (test setup 1 to test setup 2) for radiated emission test, the photo of test setup please refer to ANNEX B.

5.2.1.3 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.

5.2.1.4 Test Result

Please refer to ANNEX A.1.

NOTE:

1. Results (dBμV/m) = Reading (dBμV/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.

5.2.2 Conducted Emission

5.2.2.1 Test Limit

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

1) The limit is applicable to Class B ITE.
2) The lower limit shall apply at the band edges.
3) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50 MHz.

5.2.2.2 Test Setup

Refer to 4.3 section test (test setup 3) for conducted emission, the photo of test setup please refer to ANNEX B.

5.2.2.3 Test Procedure

The EUT is connected to the power mains through a LISN which provides 50 Ω/50 μH 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.

5.2.2.4 Test Result

Please refer to ANNEX A.2.

NOTE**:**

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

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.

5.2.3 20 dB Bandwidth

5.2.3.1 Limit

FCC §15.215(c)

The 20 dB bandwidth is known as the 99% emission bandwidth, or 20 dB bandwidth (10*log1%=20 dB) taking the total RF output power.

5.2.3.2 Test Setup

Refer to 4.3 section test (test setup 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3.3 Test Procedure

Use the following spectrum analyzer settings:

Span = between 2 and 5 times the OBW

RBW = 1%~5% of the OBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

5.2.3.4 Test Result

Please refer to ANNEX A.3.

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.

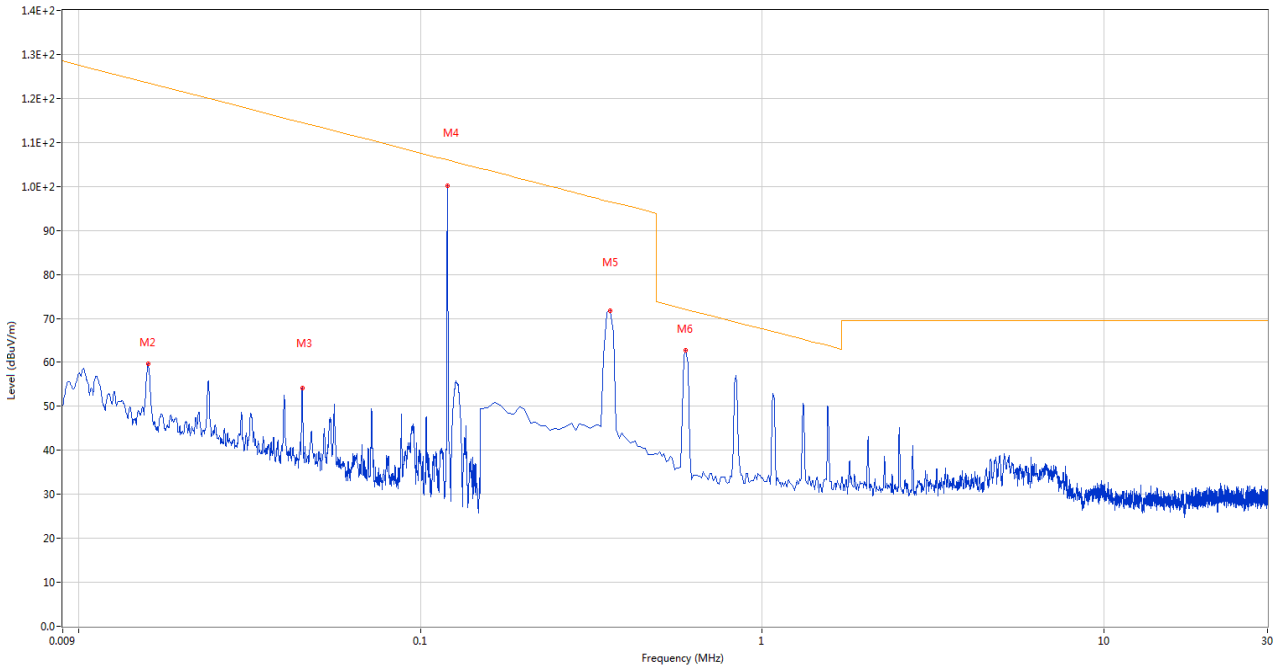
Note [3]: All Radiated Emissions tests were performed in X, Y, Z axis direction of EUT. And only the worst axis test condition was recorded in this test report.

Note [4]: This frequency which near 0.129 MHz with circle should be ignored because they are Qi carrier frequencies.

Qi Test Data and Plots

The Standby mode

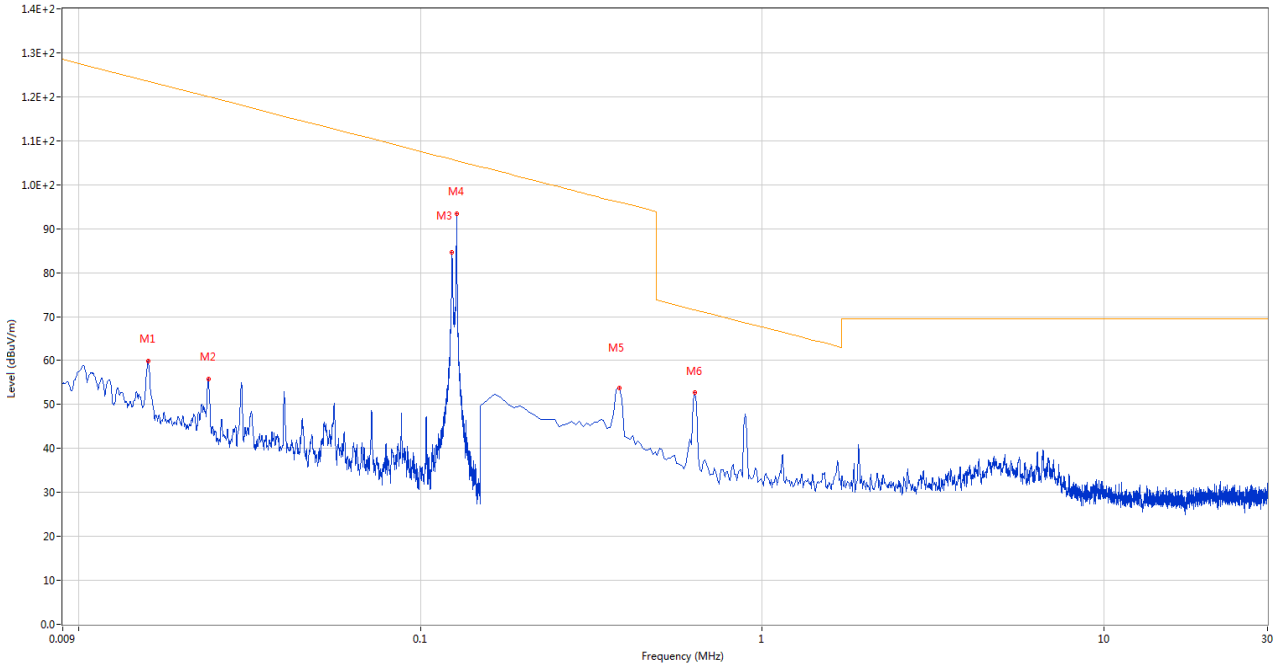
A.1.1 Test Antenna LOOP, EUT X axis, 9 kHz –30 MHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.113	32.29	20.17	106.5	74.21	Peak	262.00	100	Vertical	Pass
2	0.016	59.60	20.13	123.5	63.90	Peak	148.00	100	Vertical	Pass
3	0.045	54.12	20.25	114.5	60.38	Peak	0.00	100	Vertical	Pass
4	0.120	100.11	20.16	106.0	5.89	Peak	0.00	100	Vertical	Pass
5	0.359	71.74	20.16	96.5	24.76	Peak	326.00	100	Vertical	Pass
6	0.598	62.68	20.33	72.1	9.42	Peak	326.00	100	Vertical	Pass

The Load Test Mode

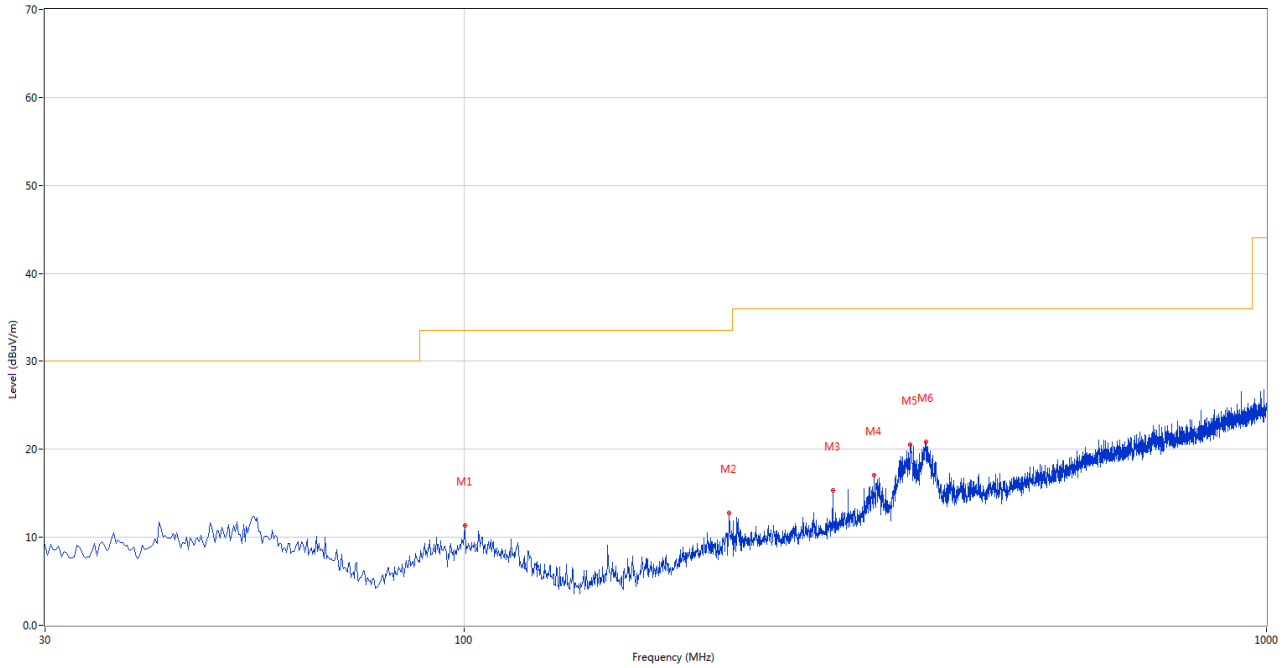
A.1.2 Test Antenna LOOP, EUT X axis, 9 kHz –30 MHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.016	59.79	20.13	123.5	63.71	Peak	52.00	100	Vertical	Pass
2	0.024	55.78	20.23	120.0	64.22	Peak	0.00	100	Vertical	Pass
3	0.124	84.63	20.16	105.8	21.17	Peak	80.00	100	Vertical	Pass
4	0.128	93.47	20.15	105.5	12.03	Peak	102.00	100	Vertical	Pass
5	0.381	53.77	20.17	96.0	42.23	Peak	300.00	100	Vertical	Pass
6	0.635	52.72	20.35	71.5	18.78	Peak	295.00	100	Vertical	Pass

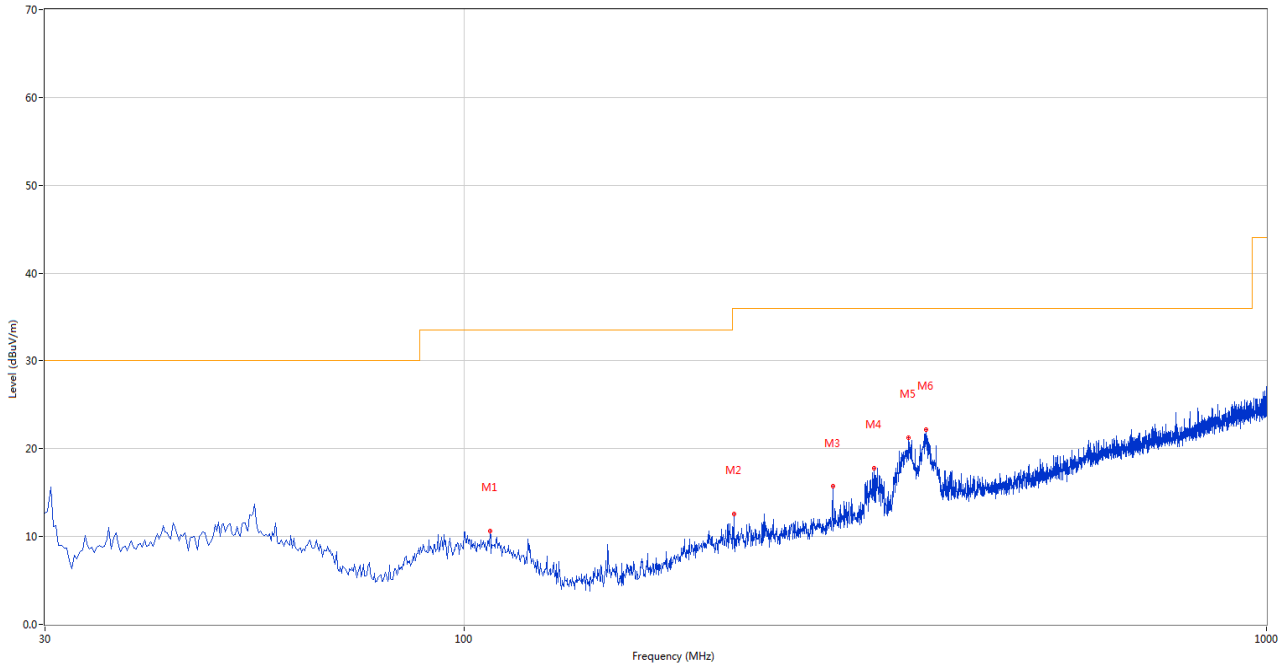
The Standby mode

A.1.3 Test Antenna Vertical, EUT X axis, 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	100.065	11.31	-27.96	33.5	22.19	Peak	34.00	100	Vertical	Pass
2	214.011	12.76	-27.89	33.5	20.74	Peak	275.00	100	Vertical	Pass
3	287.956	15.37	-25.19	36.0	20.63	Peak	341.00	100	Vertical	Pass
4	323.837	17.05	-24.45	36.0	18.95	Peak	160.00	200	Vertical	Pass
5	359.475	20.53	-23.35	36.0	15.47	Peak	336.00	100	Vertical	Pass
6	376.446	20.82	-23.10	36.0	15.18	Peak	336.00	100	Vertical	Pass

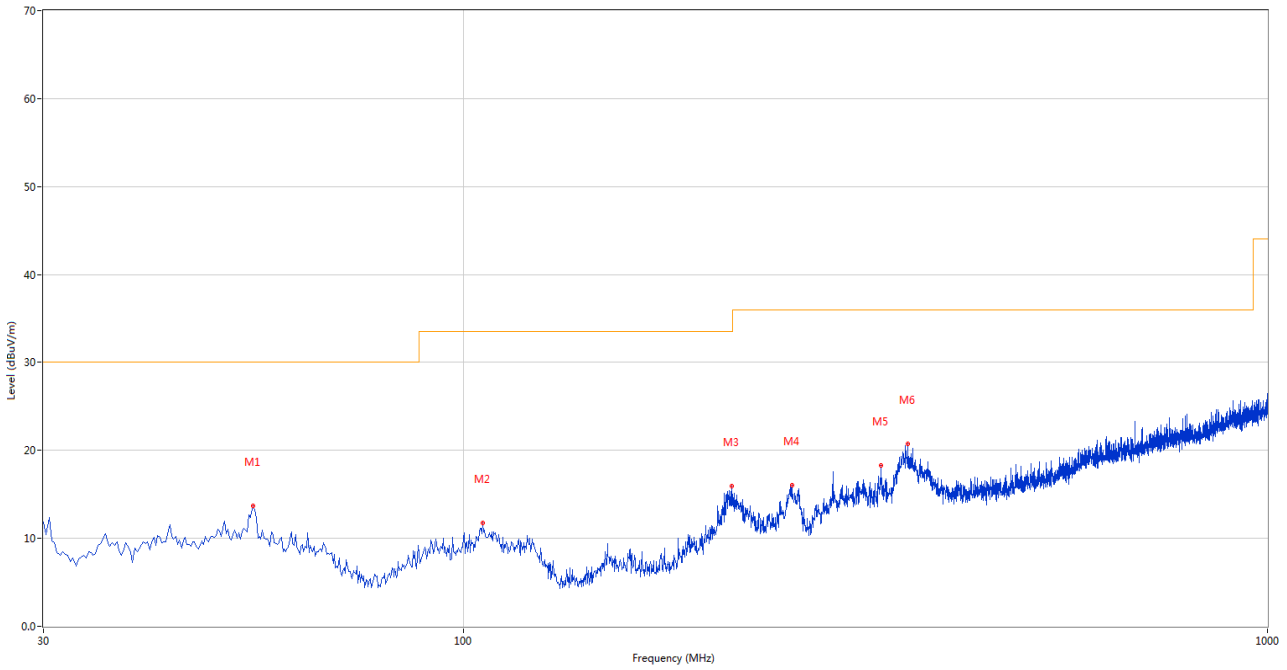
A.1.4 Test Antenna Horizontal, EUT X axis, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	107.581	10.60	-27.88	33.5	22.90	Peak	304.00	100	Horizontal	Pass
2	216.921	12.58	-27.79	36.0	23.42	Peak	154.00	100	Horizontal	Pass
3	287.956	15.69	-25.19	36.0	20.31	Peak	0.00	100	Horizontal	Pass
4	324.564	17.77	-24.46	36.0	18.23	Peak	149.00	200	Horizontal	Pass
5	357.778	21.21	-23.34	36.0	14.79	Peak	247.00	100	Horizontal	Pass
6	375.961	22.17	-23.14	36.0	13.83	Peak	0.00	200	Horizontal	Pass

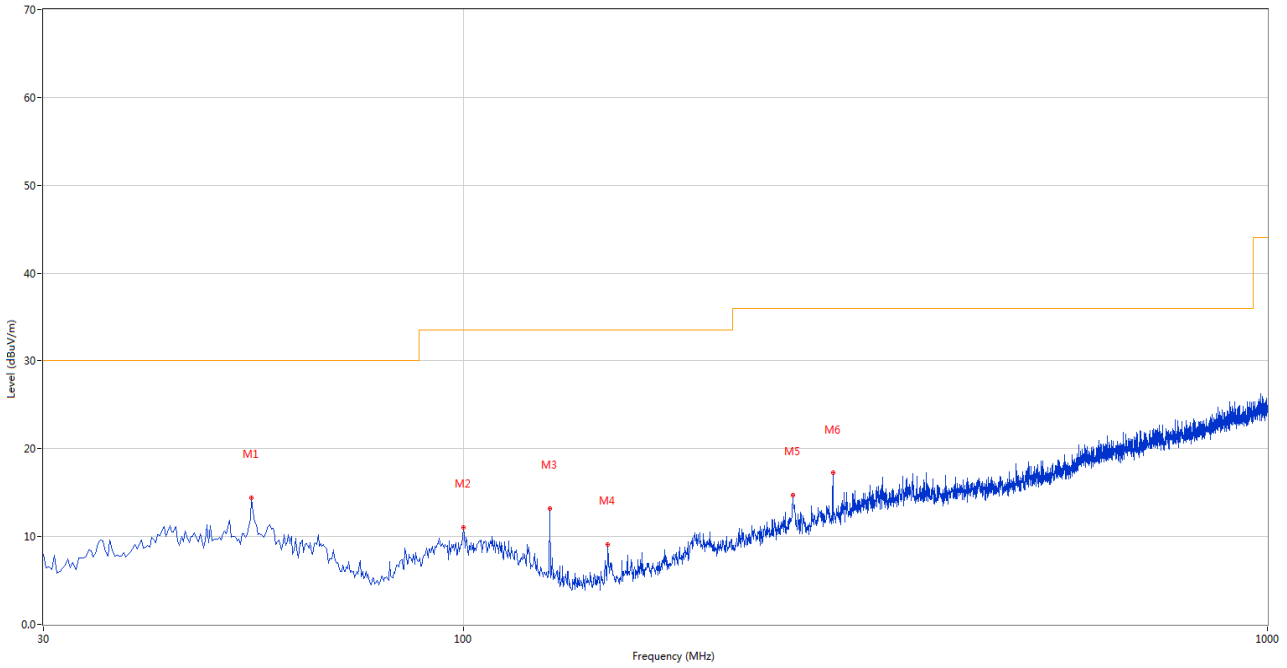
The Load Test Mode

A.1.5 Test Antenna Vertical, EUT X axis, 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	54.729	13.67	-26.56	30.0	16.33	Peak	84.00	200	Vertical	Pass
2	105.641	11.75	-27.83	33.5	21.75	Peak	285.00	100	Vertical	Pass
3	215.466	15.92	-27.84	33.5	17.58	Peak	202.00	100	Vertical	Pass
4	255.954	16.01	-26.07	36.0	19.99	Peak	103.00	100	Vertical	Pass
5	330.382	18.29	-24.16	36.0	17.71	Peak	140.00	100	Vertical	Pass
6	357.293	20.78	-23.33	36.0	15.22	Peak	282.00	100	Vertical	Pass

A.1.6 Test Antenna Horizontal, EUT X axis, 30 MHz – 1 GHz



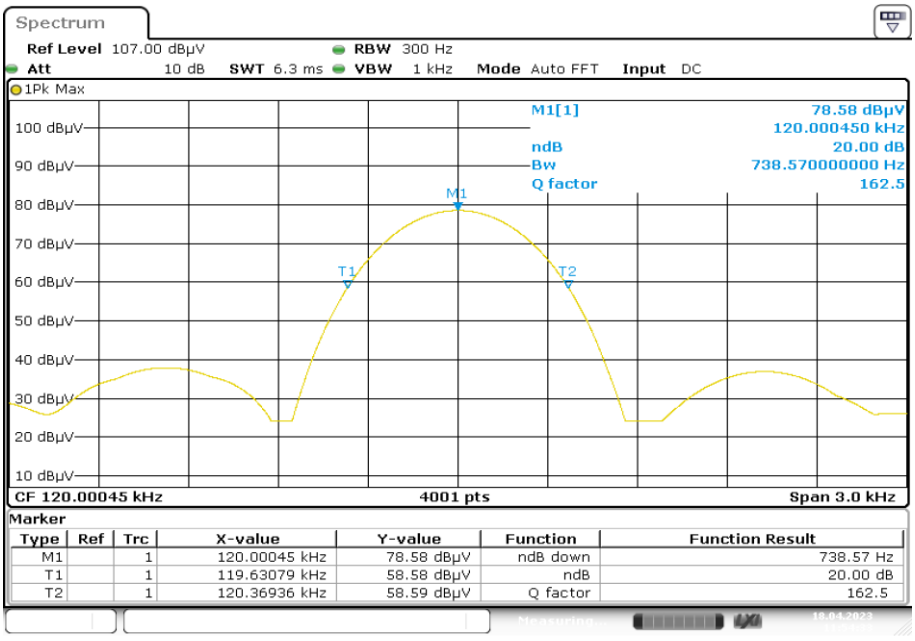
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.486	14.44	-26.52	30.0	15.56	Peak	118.00	200	Horizontal	Pass
2	99.823	11.00	-27.98	33.5	22.50	Peak	149.00	100	Horizontal	Pass
3	127.946	13.17	-31.06	33.5	20.33	Peak	0.00	200	Horizontal	Pass
4	151.220	9.14	-31.32	33.5	24.36	Peak	0.00	200	Horizontal	Pass
5	256.681	14.76	-26.00	36.0	21.24	Peak	143.00	200	Horizontal	Pass
6	287.956	17.23	-25.19	36.0	18.77	Peak	143.00	200	Horizontal	Pass

A.2 Conducted Emission

Note: Not applicable.

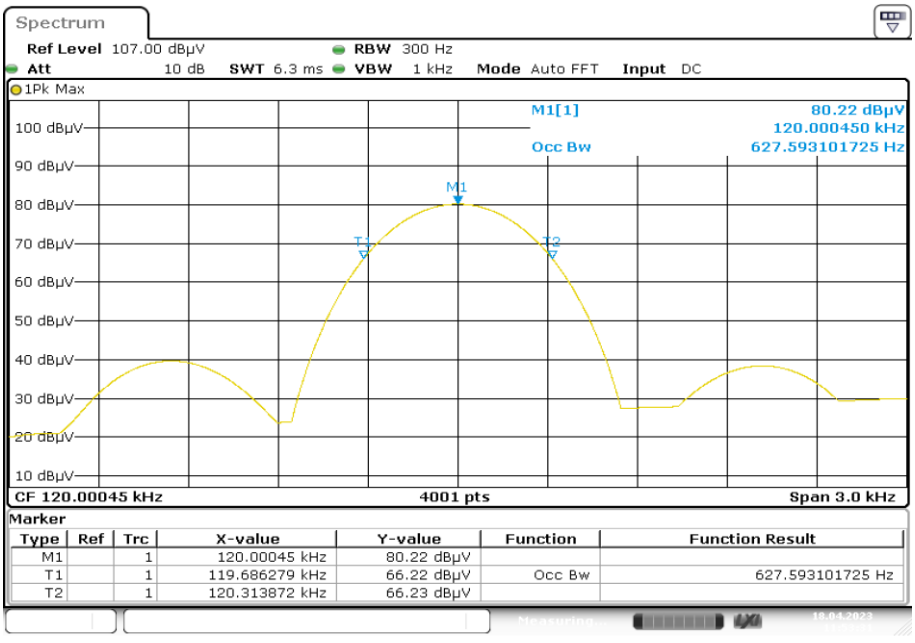
A.3 20 dB Bandwidth

Qi Test Data and Plots



99% Occupied Bandwidth

Qi Test Data and Plots



ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2340120-AE-2.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.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
3. For the report with CNAS mark or A2LA mark, the items marked with "☆" are not within the accredited scope.
4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the “inspection and testing dedicated stamp” or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
6. This report shall not be partially reproduced without the written permission of the laboratory.
7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

--END OF REPORT--