TEST REPORT

Applicant:	Seeed Technology Co., Ltd.
Address:	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C
Equipment Type:	ReSpeaker Lite Voice Assistant Kit
Model Name:	M04
Brand Name:	Seeed Studio
Test Standard:	47 CFR Part 15 Subpart B ANSI C63.4-2014
Sample Arrival Date:	May 17, 2024
Test Date:	May 22, 2024 - May 26, 2024
Date of Issue:	Jun. 13, 2024

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Chong **Checked by:** Xia Long **Approved by:** Liao Jianming (Technical Director)

Revision History

Version	Issue Date	Revisions
Rev. 01	Jun. 13, 2024	Initial Issue

TABLE OF CONTENTS

1 GENERAL INFORMATION 3
1.1 Test Laboratory 3
1.2 Test Location 3
2 PRODUCT INFORMATION 4
2.1 Applicant Information 4
2.2 Manufacturer Information 4
2.3 General Description for Equipment under Test (EUT) 4
2.4 Ancillary Equipment 4
2.5 Technical Information 4
3 SUMMARY OF TEST RESULTS 5
3.1 Test Standards 5
3.2 Verdict 5
3.3 Test Uncertainty 5
4 GENERAL TEST CONFIGURATIONS 6
4.1 Test Enclosure List 6
4.2 Test Configurations 6
4.3 Test Setups 7
5 TEST ITEMS 9
5.1 Emission Tests 9
ANNEX A TEST RESULTS 14
A.1 Radiated Emission 14
A.2 Conducted Emission, AC Ports 21
ANNEX B TEST SETUP PHOTOS 25
ANNEX C EUT EXTERNAL PHOTOS 25

ANNEX D EUT INTERNAL PHOTOS 25

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	Seeed Technology Co., Ltd.
Address	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C

2.2 Manufacturer Information

Manufacturer	Seeed Technology Co., Ltd.
Address	9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C

2.3 General Description for Equipment under Test (EUT)

EUT Name	ReSpeaker Lite Voice Assistant Kit
Model Name Under Test	M04
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	1.0
Software Version	1.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Ancillary Equipment

Ancillary Equipment 1	Antenna

2.5 Technical Information

Network and Wireless connectivity	Bluetooth, WIFI
Classification of equipment	Class B
The highest internal frequency of EUT	2.48 GHz

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	Pass	--

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)	3.2 dB
Radiated emissions (30 MHz-1 GHz)-10m	4.3 dB
Radiated emissions (1 GHz-18 GHz)-966#4	5.0 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Enclosure List

Description	Manufacturer	Model	Serial No.	Length	Description	Use
Laptop	HONOR	KPRC-W10	N/A	N/A	N/A	☒
Laptop	Lenovo	ZHAOYANG K43c-80	N/A	N/A	N/A	☒
Earphone	OPPO	N/A	N/A	1m	N/A	☒
Type-C Cable	N/A	N/A	N/A	1m	Shielded with Core	☒

4.2 Test Configurations

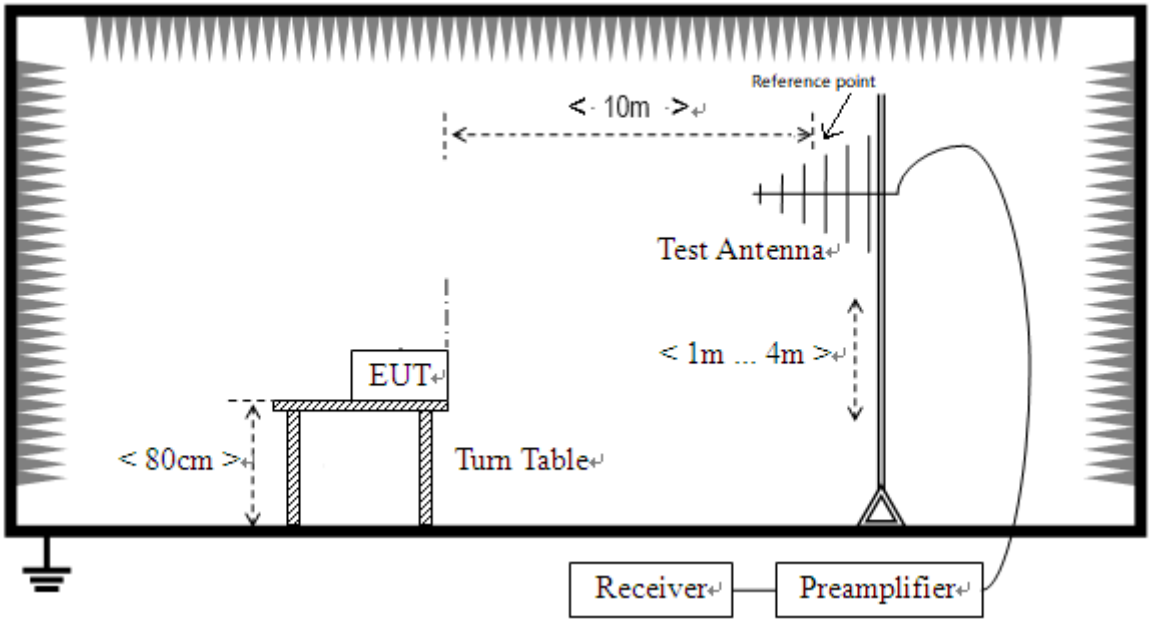
All test modes of EUT are listed in the table below.

Test Mode Configuration	Description
Mode 1	The Audio Playback Test Mode EUT + Antenna + Earphone + Type-C Cable + Laptop
Mode 2	The Sound Recording Test Mode EUT + Antenna + Earphone + Type-C Cable + Laptop

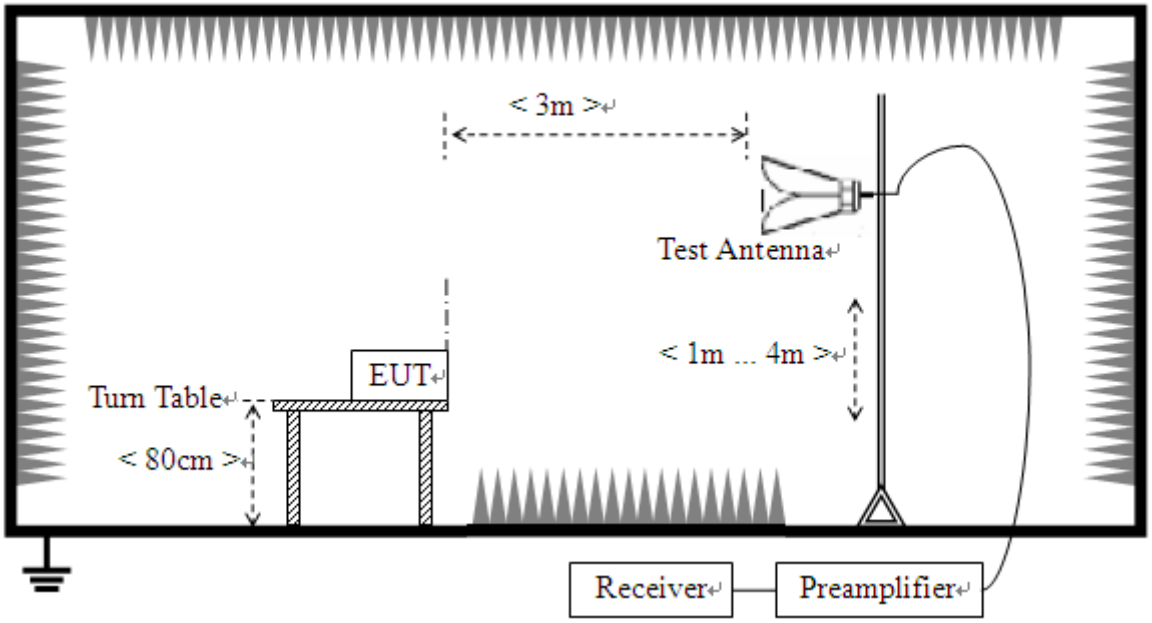
Test Case	Test Mode Configuration	Worst Mode
Radiated Emission	Mode 1~Mode 2	1
Conducted Emission, AC Ports	Mode 1~Mode 2	1
Note: All operation modes were tested, but only test data of the worst mode was presented in this report.		

4.3 Test Setups

Test Setup 1

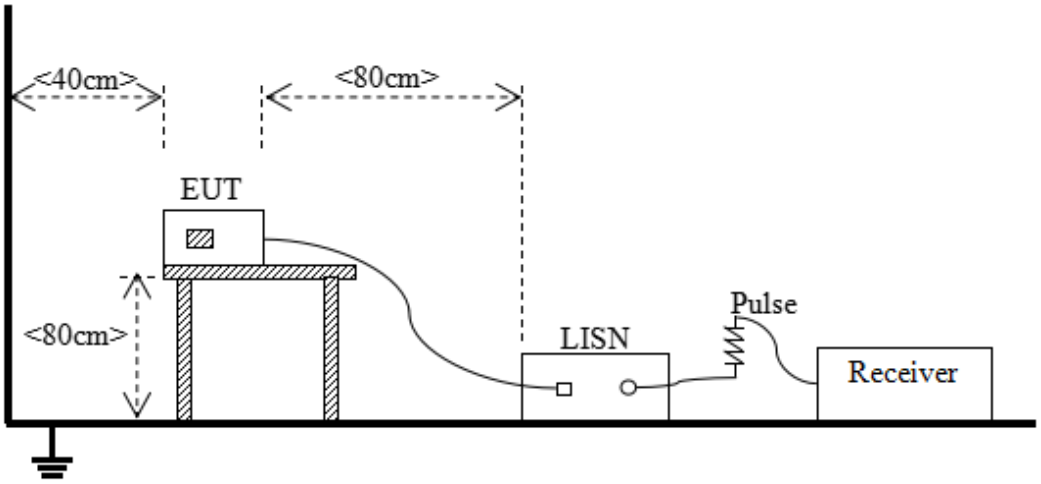


Radiated Emission (30 MHz-1 GHz)



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 A (at 10 m)		Class B (at 10 m)
	Field Strength (μV/m)	Field Strength (dBμV/m)	Field Strength (dBμV/m)
30 - 88	90	39	29.5
88 - 216	150	43.5	33
216 - 960	210	46.4	35.5
Above 960	300	49.5	43.5
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 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 (μV/m)	Field Strength Average (dBμV/m)	Field Strength Peak (dBμV/m)	Field Strength Average (dBμV/m)	Field Strength Peak (dBμV/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: $L_{3m} = L_{10m} + 20*\log(d_{10m}/d_{3m})$ 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*log(10/3)=60 (dBμV/m).					

Highest internal frequency (F_X)	Highest measurement frequency (F_M)
$F_X \leq 108$ MHz	1 GHz
108 MHz $\leq F_X \leq$ 500 MHz	2 GHz
500 MHz $\leq F_X \leq$ 1 GHz	5 GHz
$F_X \geq$ 1 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 ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak for f <1 GHz, peak & RMS Average for f ≥ 1 GHz

Trace = max hold

5.1.1.4 Test Result and Test Equipment List

Please refer to ANNEX A.1.

NOTE:

1. Results (dBμV/m) = Reading (dBμV) + 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 (dBμV)	Average (dBμV)
0.15 - 0.50	79	66
0.50 - 30	73	60

Frequency range (MHz)	Class B	
	Quasi-peak (dBμV)	Average (dBμV)
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 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.

Use the following spectrum analyzer settings:

RBW = 9 kHz

VBW ≥ 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 (dBμV) = Reading (dBμV) + 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

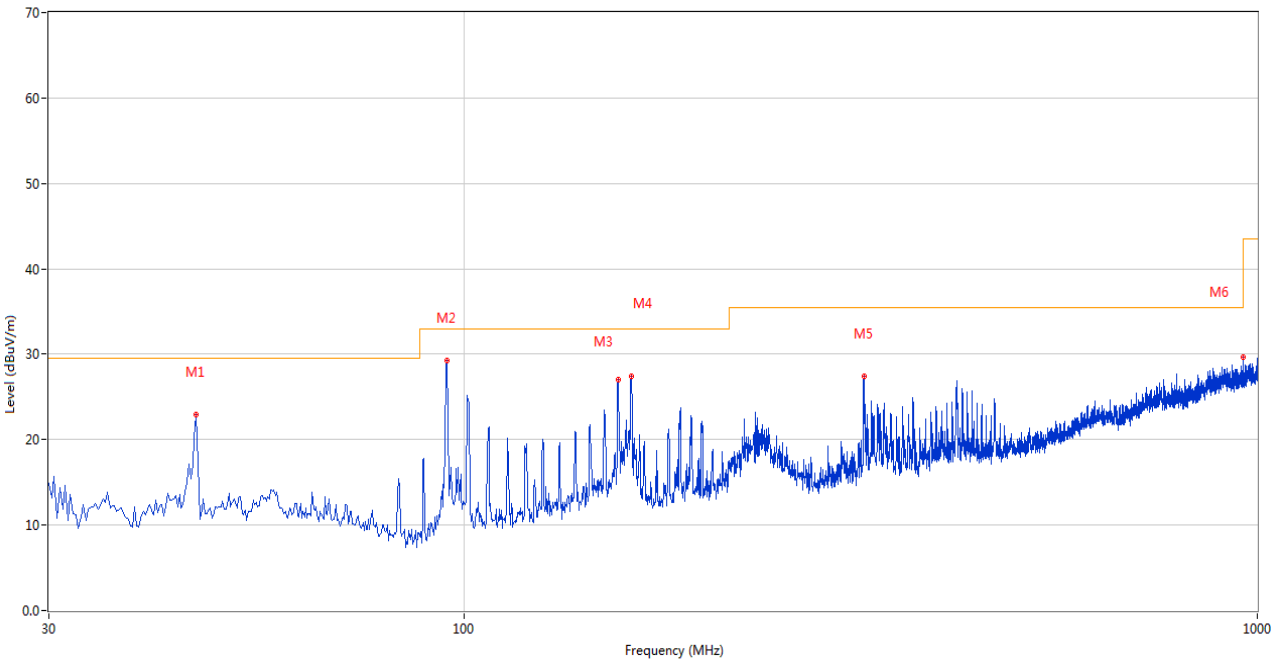
Note 1: The symbol of “--” in the table which means not application.

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.	S01	Temperature	24.8℃ - 25.2℃
Humidity	48%RH - 65%RH	Pressure	101kPa
Test Engineer	Gong Baihua, Huang Xinghong	Test Date	2024.05.22 – 2024.05.25

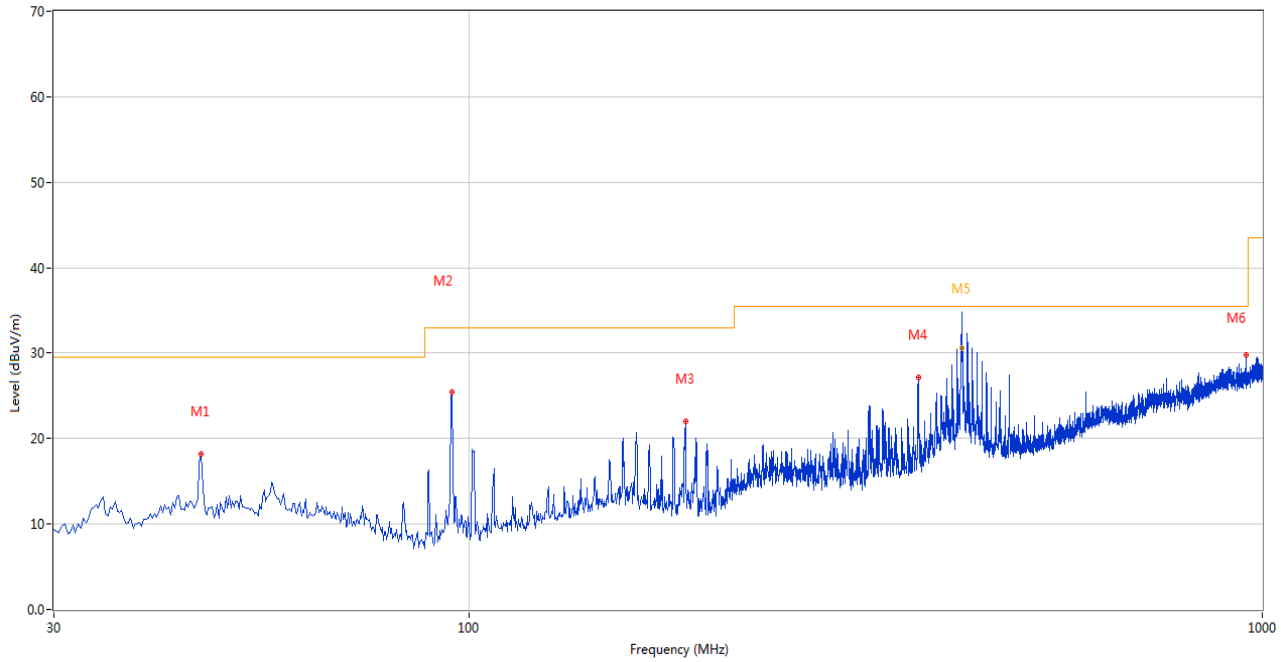
Test Mode 1

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	46.001	22.96	-26.40	29.5	6.54	Peak	93.00	100	Vertical	Pass
2	95.216	29.29	-31.38	33.0	3.71	Peak	130.00	100	Vertical	Pass
3	156.796	26.98	-25.79	33.0	6.02	Peak	105.00	100	Vertical	Pass
4	162.614	27.44	-25.87	33.0	5.56	Peak	74.00	100	Vertical	Pass
5	319.715	27.46	-24.13	35.5	8.04	Peak	208.00	100	Vertical	Pass
6	959.270	29.72	-10.68	35.5	5.78	Peak	146.00	200	Vertical	Pass

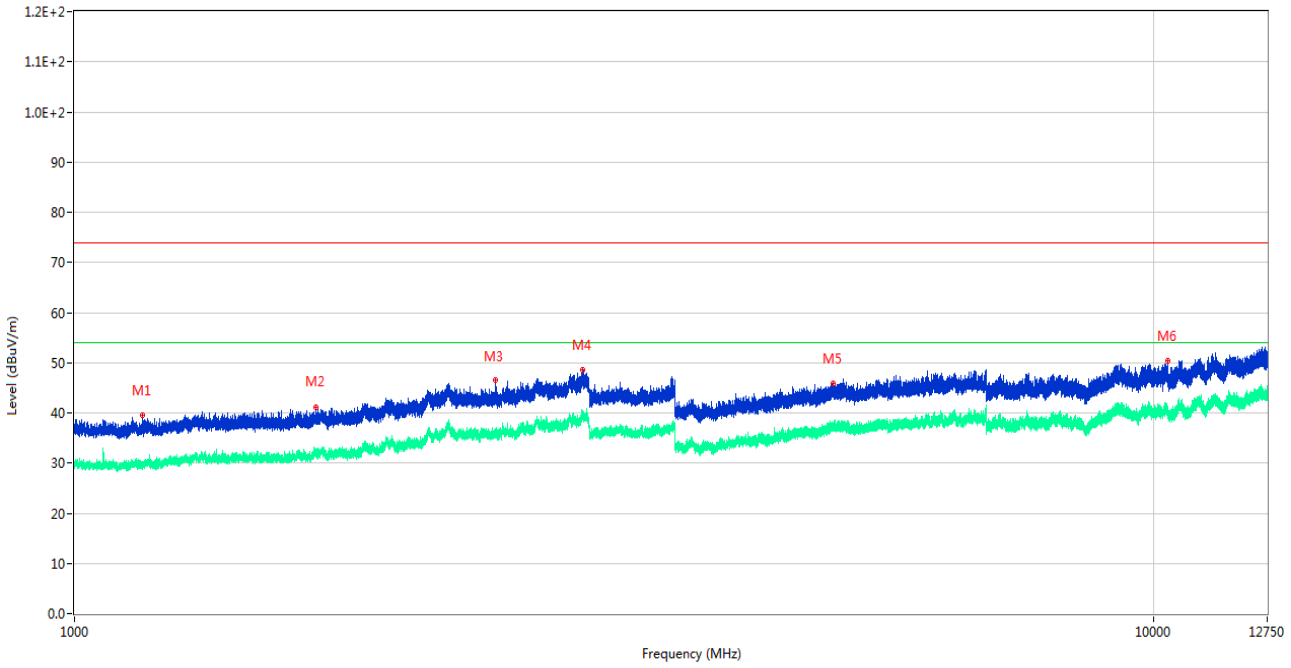
2) Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	46.001	18.20	-26.40	29.5	11.30	Peak	0.00	200	Horizontal	Pass
2	95.216	25.43	-31.38	33.0	7.57	Peak	100.00	200	Horizontal	Pass
3	187.586	21.98	-28.07	33.0	11.02	Peak	112.00	200	Horizontal	Pass
4	368.930	27.17	-23.15	35.5	8.33	Peak	310.00	200	Horizontal	Pass
5	418.195	33.14	-21.89	35.5	2.36	Peak	295.00	198	Horizontal	N/A
5*	418.195	30.60	-21.89	35.5	4.90	QP	295.00	198	Horizontal	Pass
6	953.209	29.81	-10.45	35.5	5.69	Peak	0.00	200	Horizontal	Pass

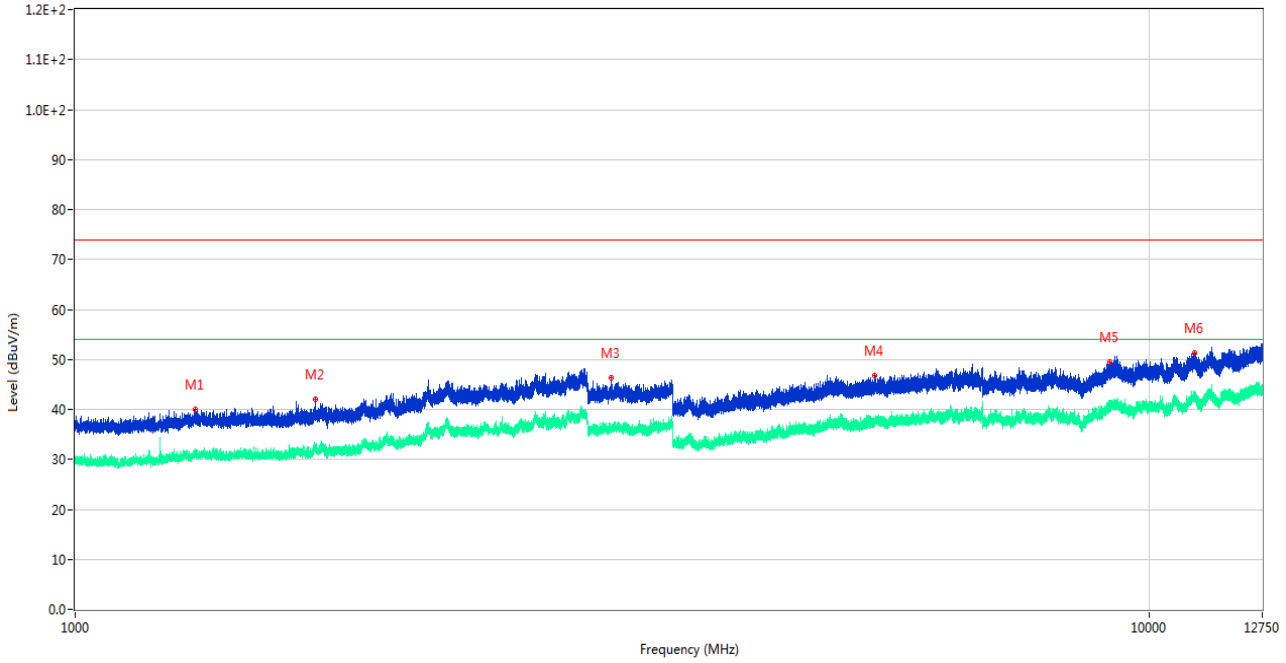
Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
Frequency Below 1 GHz						
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2023.09.05	2024.09.04	☒
Amplifier (30MHz-1GHz)	COM-MV	ZT30-1000M	B2018054558	2023.12.05	2024.12.04	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-01162	2023.08.04	2024.08.03	☒
Anechoic Chamber（10m）	EMC Electronic Co., Ltd	20.10*11.60*7.35m	130	2021.08.15	2024.08.14	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

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	1156.100	39.63	-16.43	74.0	34.37	Peak	237.70	100	Vertical	Pass
1**	1156.100	29.77	-16.43	54.0	24.23	AV	237.70	100	Vertical	Pass
2	1673.000	41.23	-14.05	74.0	32.77	Peak	79.50	200	Vertical	Pass
2**	1673.000	31.77	-14.05	54.0	22.23	AV	79.50	200	Vertical	Pass
3	2440.900	47.45	-8.52	74.0	26.55	Peak	262.70	100	Vertical	N/A
3**	2440.900	35.37	-8.52	54.0	18.63	AV	262.70	100	Vertical	N/A
4	2954.800	48.51	-4.85	74.0	25.49	Peak	161.90	200	Vertical	Pass
4**	2954.800	39.78	-4.85	54.0	14.22	AV	161.90	200	Vertical	Pass
5	5046.200	45.83	-3.46	74.0	28.17	Peak	267.80	100	Vertical	Pass
5**	5046.200	37.20	-3.46	54.0	16.80	AV	267.80	100	Vertical	Pass
6	10305.100	50.39	18.86	74.0	23.61	Peak	292.20	200	Vertical	Pass
6**	10305.100	39.06	18.86	54.0	14.94	AV	292.20	200	Vertical	Pass

4) Test Antenna Horizontal, 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	1293.300	39.95	-14.85	74.0	34.05	Peak	185.20	200	Horizontal	Pass
1**	1293.300	31.32	-14.85	54.0	22.68	AV	185.20	200	Horizontal	Pass
2	1672.300	41.97	-13.99	74.0	32.03	Peak	293.50	100	Horizontal	Pass
2**	1672.300	32.38	-13.99	54.0	21.62	AV	293.50	100	Horizontal	Pass
3	3156.400	46.32	-8.41	74.0	27.68	Peak	237.00	100	Horizontal	Pass
3**	3156.400	36.23	-8.41	54.0	17.77	AV	237.00	100	Horizontal	Pass
4	5553.200	46.78	-3.41	74.0	27.22	Peak	287.30	100	Horizontal	Pass
4**	5553.200	37.61	-3.41	54.0	16.39	AV	287.30	100	Horizontal	Pass
5	9190.750	49.55	18.75	74.0	24.45	Peak	47.00	200	Horizontal	Pass
5**	9190.750	40.62	18.75	54.0	13.38	AV	47.00	200	Horizontal	Pass
6	11019.825	51.25	21.00	74.0	22.75	Peak	16.20	100	Horizontal	Pass
6**	11019.825	41.95	21.00	54.0	12.05	AV	16.20	100	Horizontal	Pass

Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
Frequency Above 1 GHz						
EMI Receiver	Keysight	N9038A	MY53220118	2023.09.05	2024.09.04	☒
Amplifier (1-12GHz)	COM-MV	DLNAB-1000-12000-002	18080279	2023.12.05	2024.12.04	☒
Amplifier （0.8-21GHz）	Mini-Circuits	ZVA-213-S+	619201336	2023.12.05	2024.12.04	☒
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	1148	2022.04.12	2025.04.11	☒
Anechoic Chamber（#4）	ChangNing	9m*6m*6m	101	2023.03.04	2026.03.03	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

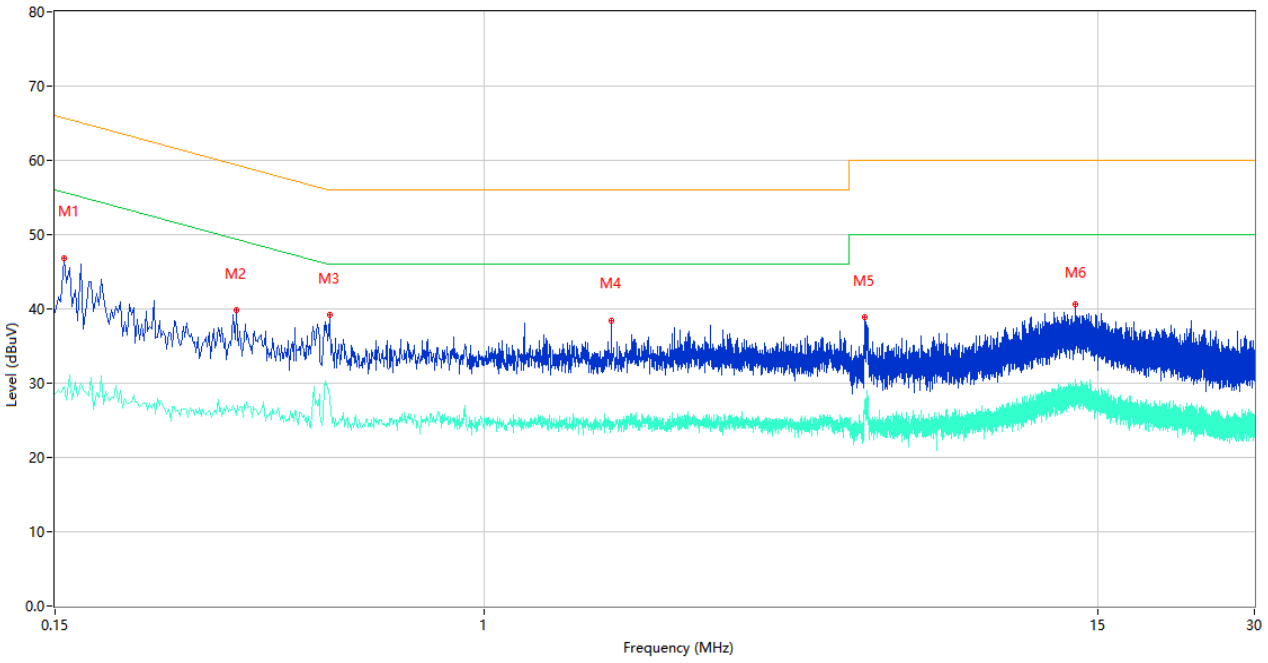
A.2 Conducted Emission, AC Ports

Note: 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. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Sample No.	S01	Temperature	25.1℃
Humidity	59%RH	Pressure	101kPa
Test Engineer	Yang Yang	Test Date	2024.05.26

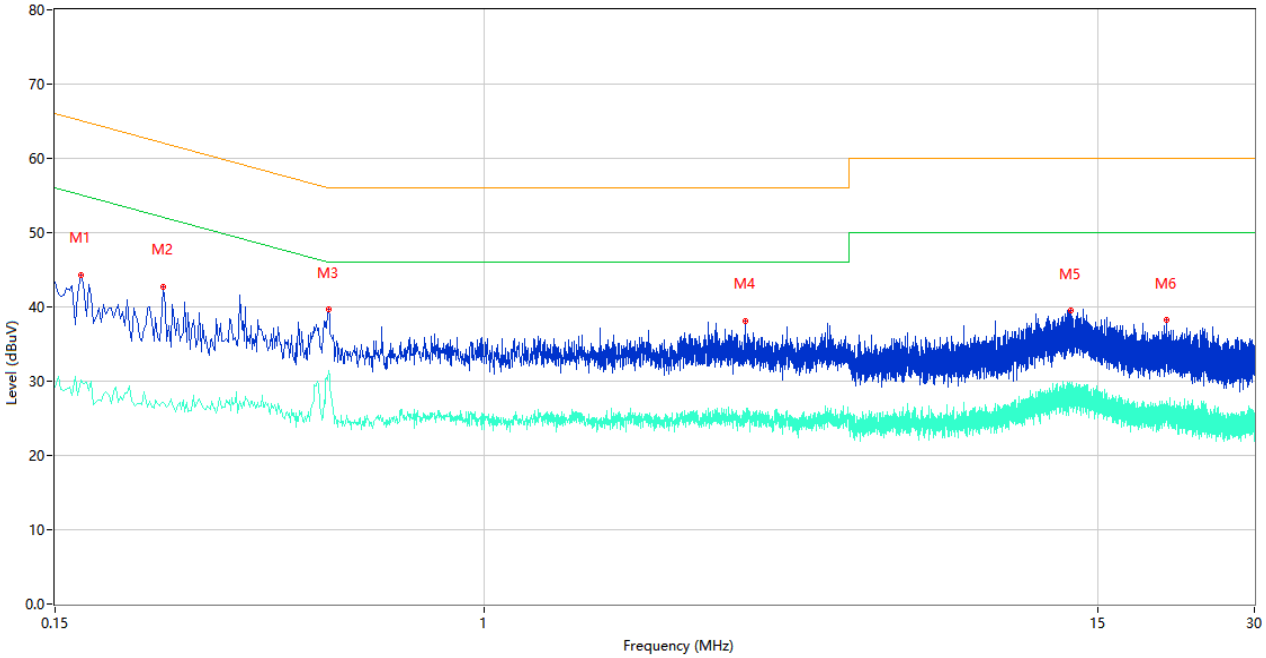
Test Mode 1

1) AC Ports - L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.156	46.86	9.78	65.67	18.81	Peak	L	Pass
1**	0.156	29.58	9.78	55.67	26.09	AV	L	Pass
2	0.334	39.79	10.44	59.35	19.56	Peak	L	Pass
2**	0.334	25.77	10.44	49.35	23.58	AV	L	Pass
3	0.504	39.15	9.98	56.00	16.85	Peak	L	Pass
3**	0.504	27.78	9.98	46.00	18.22	AV	L	Pass
4	1.750	38.47	10.15	56.00	17.53	Peak	L	Pass
4**	1.750	24.70	10.15	46.00	21.30	AV	L	Pass
5	5.366	38.82	10.16	60.00	21.18	Peak	L	Pass
5**	5.366	26.18	10.16	50.00	23.82	AV	L	Pass
6	13.614	40.59	10.57	60.00	19.41	Peak	L	Pass
6**	13.614	30.53	10.57	50.00	19.47	AV	L	Pass

2) AC Ports - N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.168	44.32	9.78	65.06	20.74	Peak	N	Pass
1**	0.168	30.14	9.78	55.06	24.92	AV	N	Pass
2	0.242	42.74	9.77	62.03	19.29	Peak	N	Pass
2**	0.242	27.17	9.77	52.03	24.86	AV	N	Pass
3	0.502	39.64	9.98	56.00	16.36	Peak	N	Pass
3**	0.502	31.36	9.98	46.00	14.64	AV	N	Pass
4	3.162	38.11	10.08	56.00	17.89	Peak	N	Pass
4**	3.162	25.68	10.08	46.00	20.32	AV	N	Pass
5	13.366	39.47	10.69	60.00	20.53	Peak	N	Pass
5**	13.366	29.00	10.69	50.00	21.00	AV	N	Pass
6	20.382	38.18	10.89	60.00	21.82	Peak	N	Pass
6**	20.382	26.35	10.89	50.00	23.65	AV	N	Pass

Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9010B	MY57110309	2023.09.05	2024.09.04	☒
LISN	SCHWARZBECK	NSLK 8127	8127-687	2024.05.09	2025.05.08	☒
Shielded Room	YiHeng Electronic Co., Ltd	3.5m*3.1m*2.8m	112	2022.02.19	2025.02.18	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2450738-AE.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2450738-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document BL-SZ2450738-AI.PDF”.

Statement

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