TEST REPORT

Applicant:	Cavli Inc.
Address:	99 South Almaden Blvd., Suite 600, San Jose, CA 95113 United States
Equipment Type:	LTE MODEM
Model Name:	C42GM (refer to section 2.3)
Brand Name:	CAVLI WIRELESS
FCC ID:	2BB64C42GM
Test Standard:	47 CFR Part 15 Subpart B ANSI C63.4-2014
Sample Arrival Date:	May 31, 2023
Test Date:	Oct. 13, 2023
Date of Issue:	Dec. 26, 2023

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Zhenxiang Liu **Checked by:** Liyao Zong **Approved by:** Liao Jianming (Technical Director)

Zhenxiang.Liu Liyao.Zong

Revision History

Version	Issue Date	Revisions
Rev. 01	Dec. 26, 2023	Initial Issue

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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	Cavli Inc.
Address	99 South Almaden Blvd., Suite 600, San Jose, CA 95113 United States

2.2 Manufacturer Information

Manufacturer	Cavli Inc
Address	99 South Almaden Blvd., Suite 600, San Jose, CA 95113 United States

2.3 General Description for Equipment under Test (EUT)

EUT Name	LTE MODEM
Model Name Under Test	C42GM
Series Model Name	C42GM-N16S0N, C42GM-N16S0H, C42GM-N16GNN, C42GM-N16GNH, C42GM-M16S0N, C42GM-M16S0H, C42GM-M16GNN, C42GM-M16GNH, C42GM-N32S0N, C42GM-N32S0H, C42GM-N32GNN, C42GM-N32GNH, C42GM-M32S0N, C42GM-M32S0H, C42GM-M32GNN, C42GM-M32GNH
Description of Model name differentiation	The difference between the series models is whether they support GNSS or not, with different memory (16MB or 32MB) and internal sim variant will have additional eSim. The circuit schematic and PCB layout are exactly the same. (this information provided by the customer)
Hardware Version	C42GM_V3.4(2410)
Software Version	V1.2.1
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Ancillary Equipment

Note: Not applicable.

2.5 Technical Information

Network and Wireless connectivity	4G Network FDD LTE-M1 Band 2/4/5/12/13/14/17/18/19/25/26/66/71/85 FDD NB-IoT Band 2/4/5/12/13/14/17/18/19/25/26/66/71/85 BDS, GPS, SBAS, GLONASS, Galileo, QZSS
Classification of equipment	Class B
The highest internal frequency of EUT	5850 MHz

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)-3m	4.8 dB
Radiated emissions (1 GHz-18 GHz)-3m	4.9 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Enclosure List

Description	Manufacturer	Model	Serial No.	Length	Description	Use
Adapter	N/A	N/A	N/A	N/A	N/A	☒
USB Cable	N/A	N/A	N/A	N/A	N/A	☒
Antenna	N/A	N/A	N/A	N/A	N/A	☒
RF Cable	N/A	N/A	N/A	N/A	N/A	☒
Development Board	N/A	N/A	N/A	N/A	N/A	☒

4.2 Test Configurations

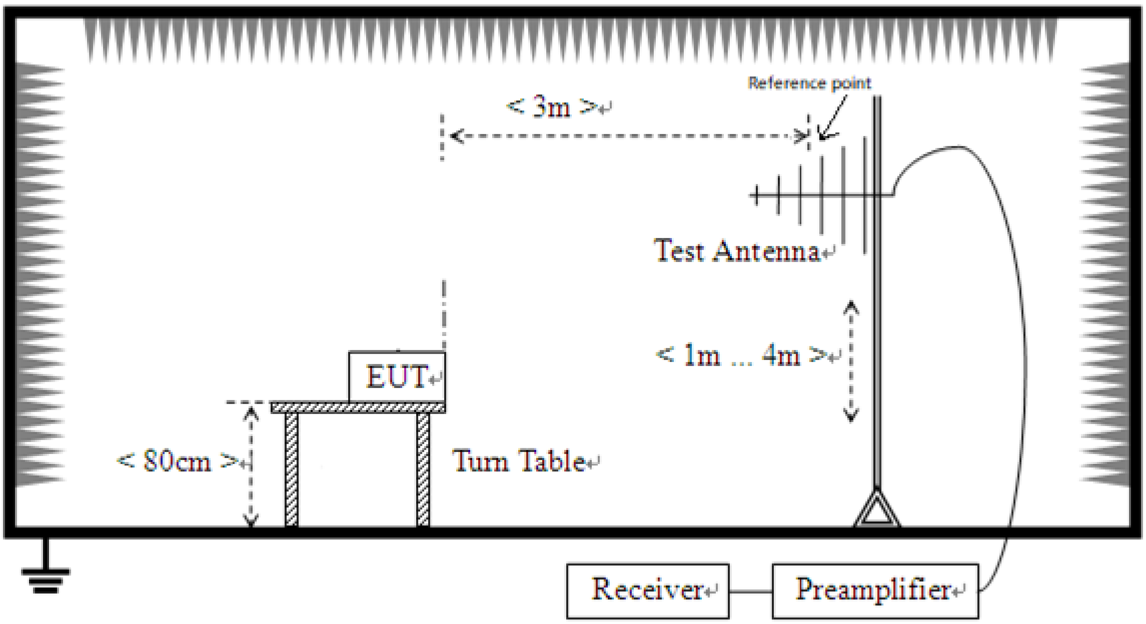
All test modes of EUT are listed in the table below.

Test Mode Configuration	Description
Mode 1	The Normal Test Mode EUT + Adapter + USB Cable + RF Cable + Antenna + Development Board

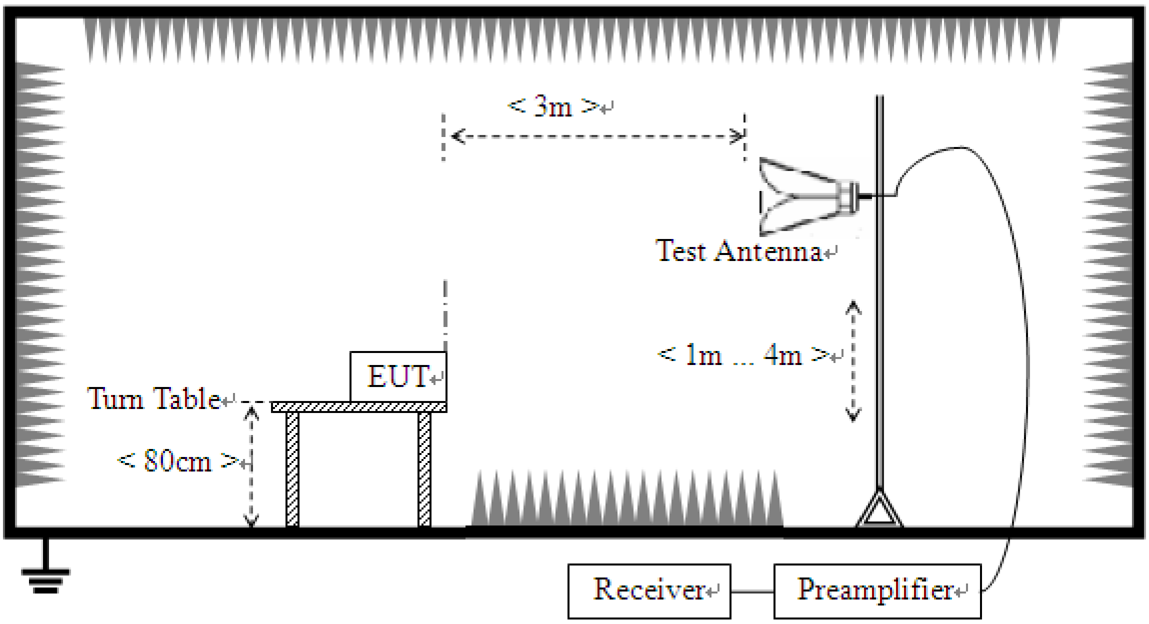
Test Case	Test Mode Configuration	Worst Mode
Radiated Emission	Mode 1	1
Conducted Emission, AC Ports	Mode 1	1

4.3 Test Setups

Test Setup 1

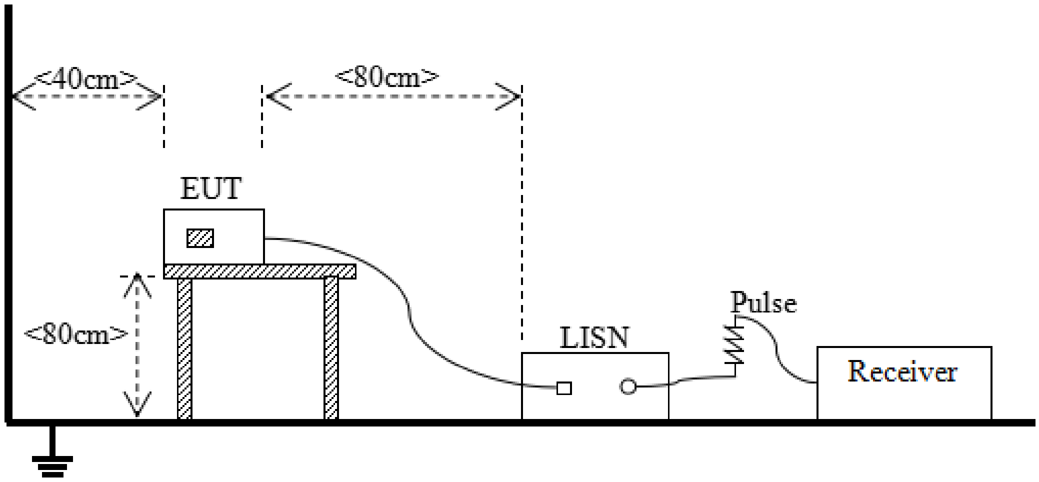


Radiated Emission (30 MHz-1 GHz)



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 (μV/m)	Field Strength (dBμV/m)	Field Strength (dBμV/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 (dBμV/m) = 20*log [Field Strength (μV/m)].
2) In the emission tables above, the tighter limit applies at the band edges.
3) The limits using ANSI C63.4.
4) 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

Highest internal frequency (F_X)	Highest measurement frequency (F_M)
$F_X \geq 1$ 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 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 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/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. 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 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 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.

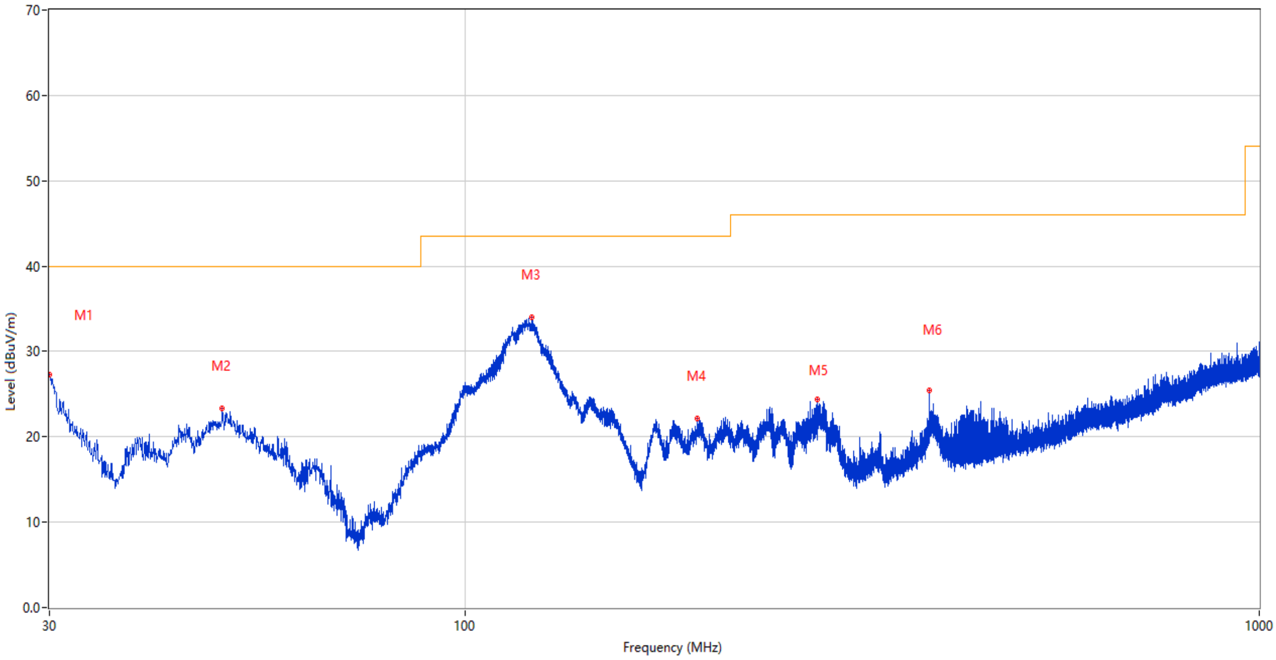
Note 3: When the EUT is on, it will automatically emit Bluetooth signal and cannot be turned off. So the marked spikes near 2400 MHz with circle should be ignored because they are Bluetooth carrier frequencies.

Note 4: The Radiated Emission is required to be investigated to the upper frequency of 5th harmonic of the highest internal frequency of EUT or 40 GHz, whichever is lower. The test results above 18GHz are only noise and are not recorded in the report.

Sample No.	S08	Temperature	23.9℃
Humidity	43%RH	Pressure	101kPa
Test Engineer	Xiao Tangqi	Test Date	2023.10.13

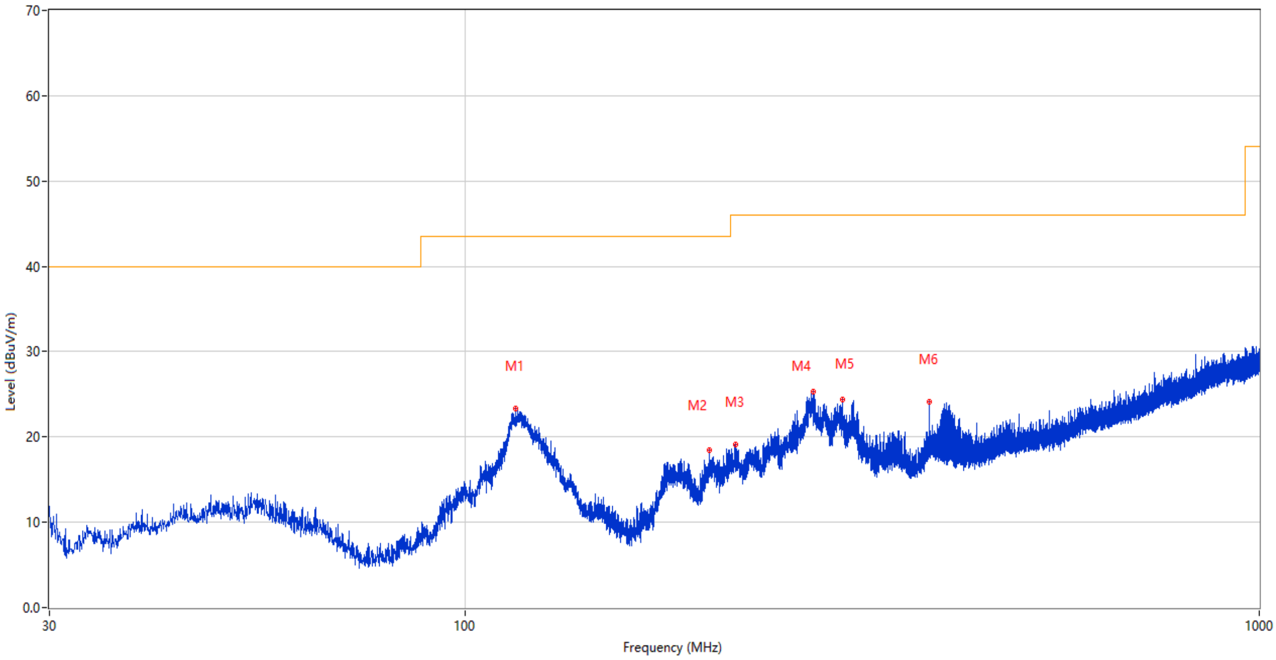
Test Mode 1

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	30.000	27.29	-28.82	40.0	12.71	Peak	192.00	100	Vertical	Pass
2	49.497	23.32	-25.52	40.0	16.68	Peak	248.00	100	Vertical	Pass
3	121.374	34.07	-28.70	43.5	9.43	Peak	192.00	100	Vertical	Pass
4	196.258	22.13	-26.80	43.5	21.37	Peak	106.00	100	Vertical	Pass
5	278.029	24.44	-24.23	46.0	21.56	Peak	0.00	100	Vertical	Pass
6	384.002	25.51	-21.41	46.0	20.49	Peak	210.00	200	Vertical	Pass

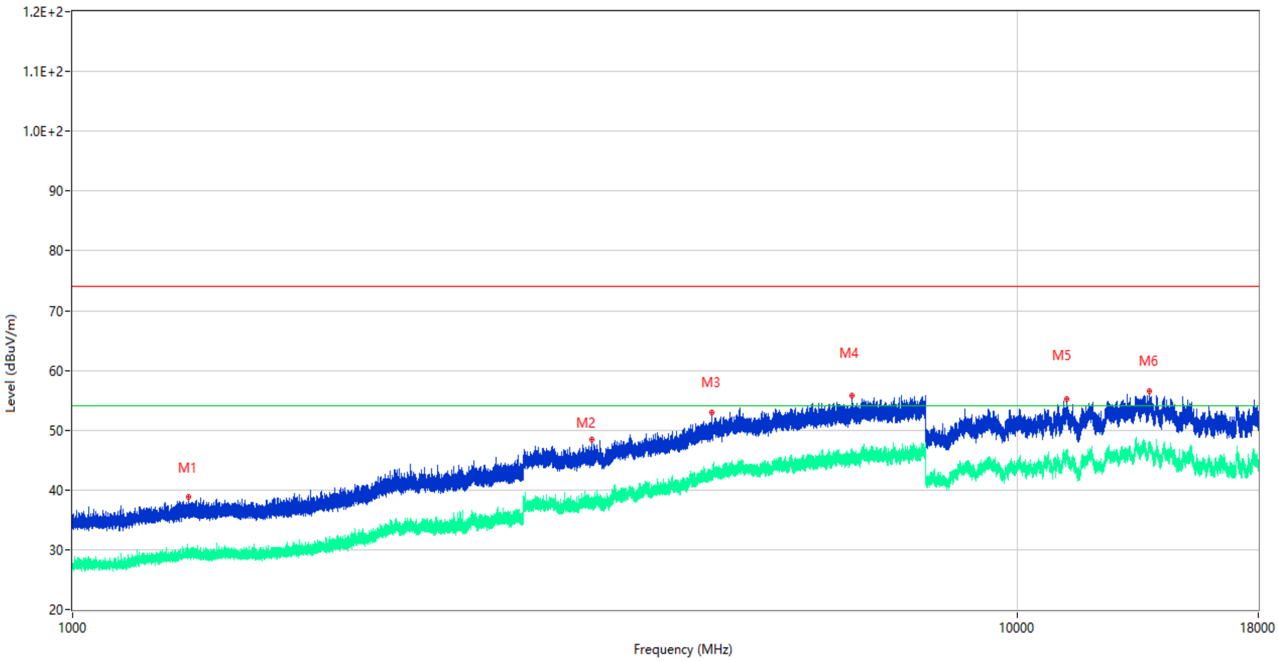
2) Test Antenna Horizontal, 30 MHz – 1 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	115.797	23.39	-27.59	43.5	20.11	Peak	108.00	200	Horizontal	Pass
2	203.339	18.49	-26.47	43.5	25.01	Peak	205.00	100	Horizontal	Pass
3	219.102	19.15	-26.25	46.0	26.85	Peak	208.00	200	Horizontal	Pass
4	274.634	25.30	-24.38	46.0	20.70	Peak	39.00	100	Horizontal	Pass
5	299.030	24.43	-23.73	46.0	21.57	Peak	198.00	100	Horizontal	Pass
6	384.002	24.17	-21.41	46.0	21.83	Peak	69.00	100	Horizontal	Pass

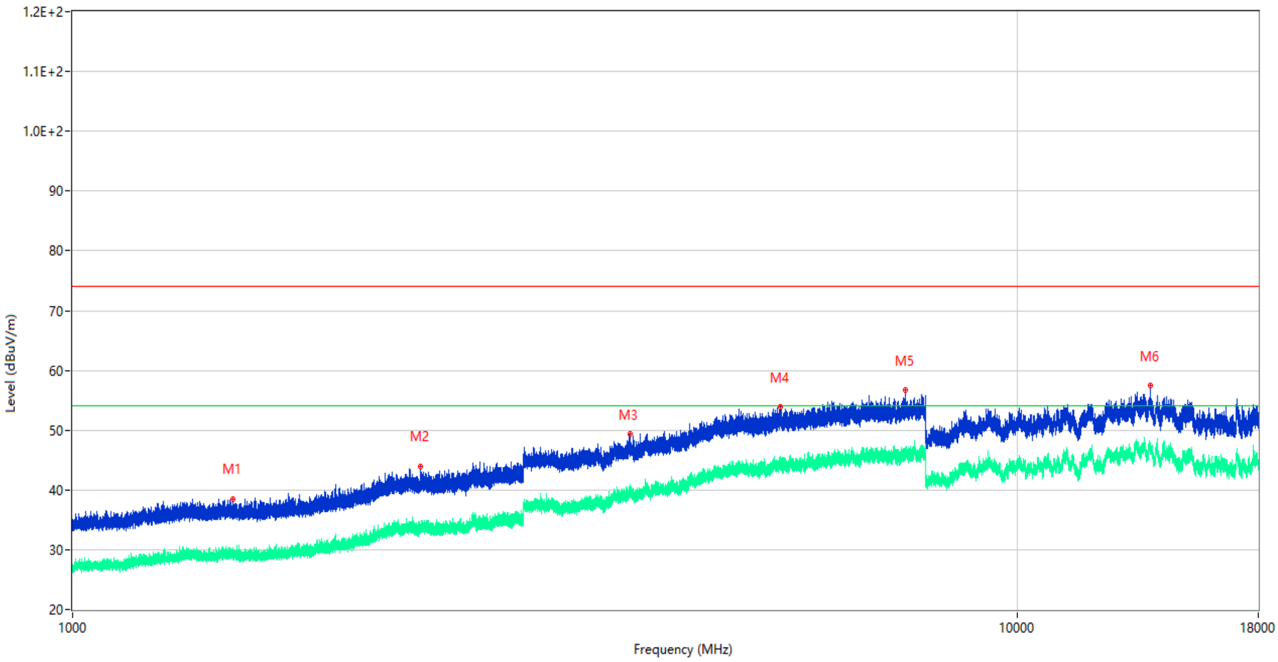
Equipment Information						
Equipment Name	Supplier	Model	Serial No.	Cal. Date	Cal. Due	Use
Frequency Below 1 GHz						
EMI Receiver	Keysight	N9038A	MY55330120	2023.09.05	2024.09.04	☒
Amplifier (30-1GHz)	COM-MV	ZT30-1000M	B2017119081	2022.12.07	2023.12.06	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-00867	2022.04.12	2025.04.11	☒
Anechoic Chamber（#2）	YiHeng	9m*6m*6m	142	2021.08.19	2024.08.18	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

3) Test Antenna Vertical, 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	1327.200	38.75	-16.65	74.0	35.25	Peak	12.00	100	Vertical	Pass
1**	1327.200	30.17	-16.65	54.0	23.83	AV	12.00	100	Vertical	Pass
2	3545.750	48.40	-4.93	74.0	25.60	Peak	27.00	100	Vertical	Pass
2**	3545.750	37.06	-4.93	54.0	16.94	AV	27.00	100	Vertical	Pass
3	4745.250	52.88	-0.66	74.0	21.12	Peak	102.00	100	Vertical	Pass
3**	4745.250	43.05	-0.66	54.0	10.95	AV	102.00	100	Vertical	Pass
4	6693.000	55.77	1.61	74.0	18.23	Peak	178.00	100	Vertical	Pass
4**	6693.000	46.77	1.61	54.0	7.23	AV	178.00	100	Vertical	Pass
5	11290.500	55.28	2.28	74.0	18.72	Peak	148.00	100	Vertical	Pass
5**	11290.500	45.44	2.28	54.0	8.56	AV	148.00	100	Vertical	Pass
6	13796.000	56.56	5.63	74.0	17.44	Peak	161.00	100	Vertical	Pass
6**	13796.000	47.60	5.63	54.0	6.40	AV	161.00	100	Vertical	Pass

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	1479.000	38.47	-16.73	74.0	35.53	Peak	255.00	100	Horizontal	Pass
1**	1479.000	29.02	-16.73	54.0	24.98	AV	255.00	100	Horizontal	Pass
2	2334.500	43.99	-11.72	74.0	30.01	Peak	282.00	100	Horizontal	Pass
2**	2334.500	33.45	-11.72	54.0	20.55	AV	282.00	100	Horizontal	Pass
3	3897.250	49.33	-2.21	74.0	24.67	Peak	100.00	100	Horizontal	Pass
3**	3897.250	39.63	-2.21	54.0	14.37	AV	100.00	100	Horizontal	Pass
4	5611.250	53.85	0.75	74.0	20.15	Peak	175.00	100	Horizontal	Pass
4**	5611.250	44.14	0.75	54.0	9.86	AV	175.00	100	Horizontal	Pass
5	7617.250	56.66	2.17	74.0	17.34	Peak	286.00	100	Horizontal	Pass
5**	7617.250	45.42	2.17	54.0	8.58	AV	286.00	100	Horizontal	Pass
6	13821.500	57.41	5.54	74.0	16.59	Peak	309.00	100	Horizontal	Pass
6**	13821.500	47.46	5.54	54.0	6.54	AV	309.00	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	2023.09.05	2024.09.04	☒
Amplifier (1-12GHz)	Advanced Microwave	WLA652A	1740103	2022.12.07	2023.12.06	☒
Amplifier （0.8-21GHz）	Mini-Circuits	ZVA-213-S+	225321316	2022.12.07	2023.12.06	☒
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	01917	2022.06.09	2025.06.08	☒
Anechoic Chamber（#2）	YiHeng	9m*6m*6m	142	2021.08.19	2024.08.18	☒
Description	Supplier	Name	Version	/		Use
Test Software	BALUN	BL410-E	V22.930	/		☒

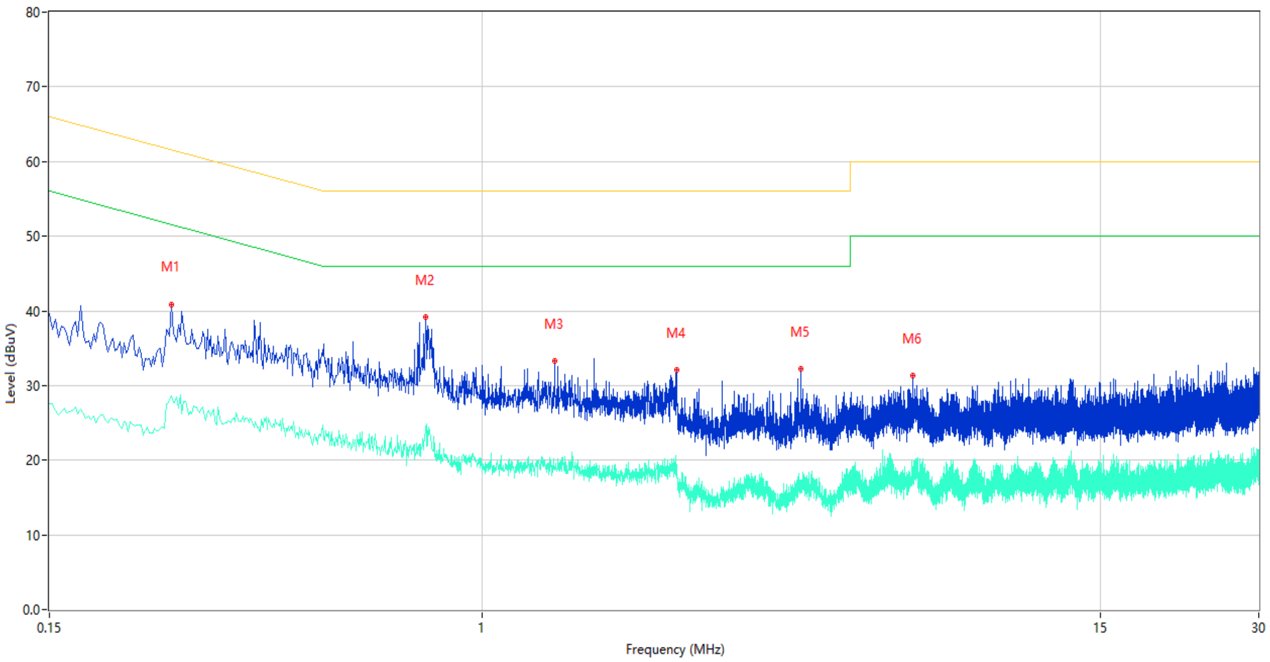
A.2 Conducted Emission, AC Ports

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.	S08	Temperature	23.9℃
Humidity	43%RH	Pressure	101kPa
Test Engineer	Yang yang	Test Date	2023.10.13

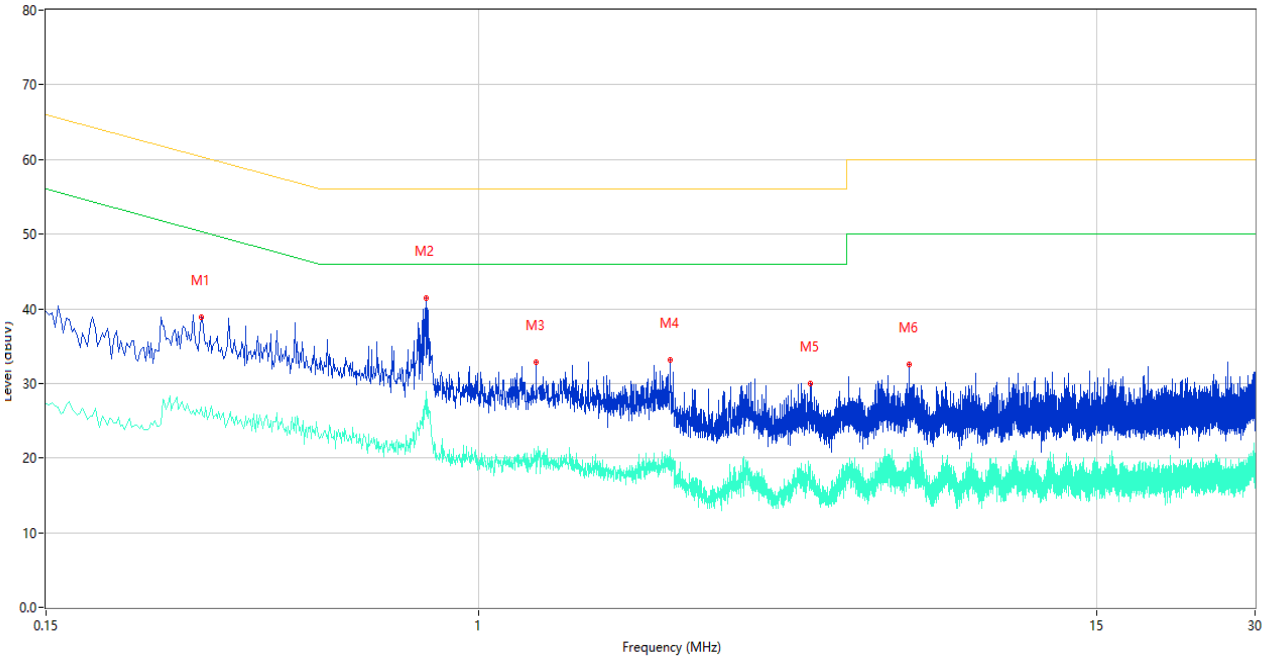
Test Mode 1

1) AC Ports - L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.256	40.89	9.79	61.56	20.67	Peak	L	Pass
1**	0.256	28.69	9.79	51.56	22.87	AV	L	Pass
2	0.778	39.11	9.61	56.00	16.89	Peak	L	Pass
2**	0.778	24.59	9.61	46.00	21.41	AV	L	Pass
3	1.372	33.32	10.38	56.00	22.68	Peak	L	Pass
3**	1.372	19.05	10.38	46.00	26.95	AV	L	Pass
4	2.346	32.12	10.20	56.00	23.88	Peak	L	Pass
4**	2.346	19.38	10.20	46.00	26.62	AV	L	Pass
5	4.038	32.18	10.21	56.00	23.82	Peak	L	Pass
5**	4.038	17.02	10.21	46.00	28.98	AV	L	Pass
6	6.602	31.30	10.20	60.00	28.70	Peak	L	Pass
6**	6.602	19.03	10.20	50.00	30.97	AV	L	Pass

2) AC Ports - N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.296	38.80	9.80	60.35	21.55	Peak	N	Pass
1**	0.296	26.76	9.80	50.35	23.59	AV	N	Pass
2	0.792	41.37	9.54	56.00	14.63	Peak	N	Pass
2**	0.792	28.89	9.54	46.00	17.11	AV	N	Pass
3	1.284	32.79	10.06	56.00	23.21	Peak	N	Pass
3**	1.284	20.87	10.06	46.00	25.13	AV	N	Pass
4	2.312	33.19	10.27	56.00	22.81	Peak	N	Pass
4**	2.312	20.07	10.27	46.00	25.93	AV	N	Pass
5	4.276	30.00	10.09	56.00	26.00	Peak	N	Pass
5**	4.276	18.37	10.09	46.00	27.63	AV	N	Pass
6	6.586	32.55	10.17	60.00	27.45	Peak	N	Pass
6**	6.586	17.52	10.17	50.00	32.48	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	2023.05.16	2024.05.15	☒
ISN	TESEQ	ISN T800	34449	2022.11.11	2023.11.10	☐
ISN	TESEQ	ISN T8-Cat6	53561	2023.04.23	2024.04.22	☐
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-SZ2370129-AE.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2370129-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2370129-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.
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--END OF REPORT--