EMC TEST REPORT

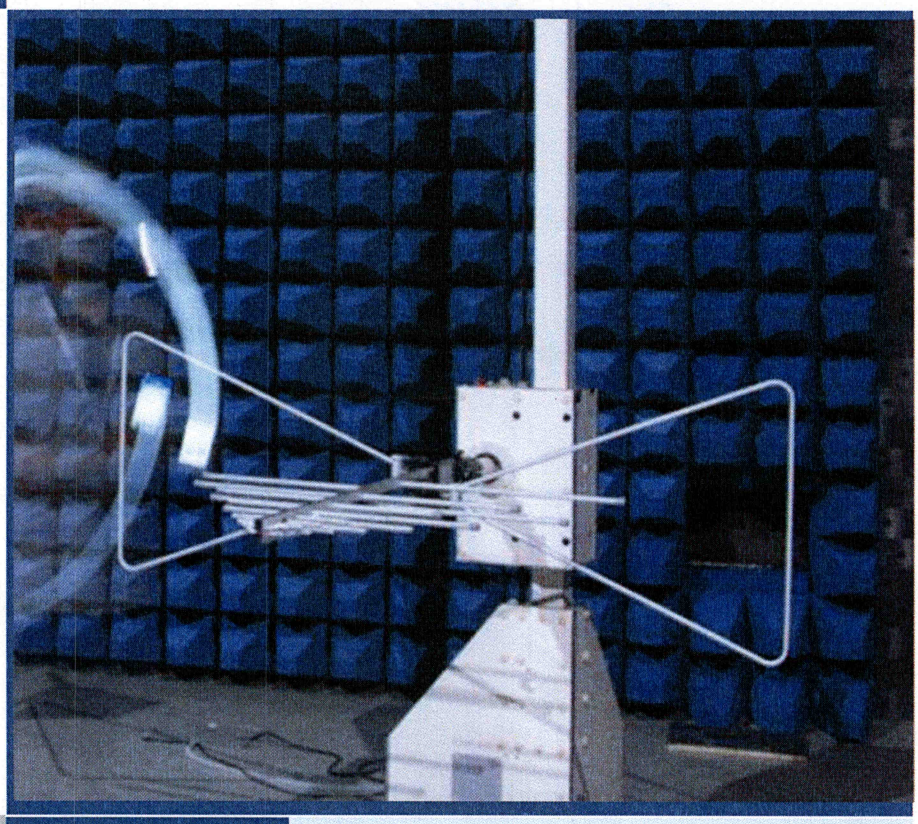
ISSUED BY
Shenzhen BALUN Technology Co., Ltd.

FOR

Industrial Gateway

ISSUED TO
Orbit Irrigation Product Inc.

845N. Overland Rd., North Salt Lake, Utah, United States



Tested by: Xiong Chong
Xiong Chong
Date May 25, 2021

Approved by:
Liao Jianming
(Technical Director)
Date May 25, 2021

Report No.:	BL-SZ2140494-401
EUT Name:	Industrial Gateway
Model Name:	25010-11X
Brand Name:	N/A
Test Standard:	47 CFR Part 15 Subpart B
FCC ID:	ML6-25010-11X
Test Conclusion:	Pass
Test Date:	Apr. 20, 2021 ~ Apr. 30, 2021
Date of Issue:	May 25, 2021

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Revision History

Version	Issue Date	Revisions Content
Rev. 01	May 20, 2021	Initial Issue
Rev. 02	May 25, 2021	Update Conducted Emission Test Mode in section 4.6

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1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co.,Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co.,Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.3 Laboratory Condition

Ambient Temperature	20℃ to 25℃
Ambient Relative Humidity	45% to 55%
Ambient Pressure	100 kPa to 102 kPa

1.4 Announce

(1) The test report refer to the BALUN report mode v7.0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.

(5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.

(6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

(7) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Orbit Irrigation Product Inc.
Address	845N. Overland Rd., North Salt Lake, Utah, United States

2.2 Manufacturer Information

Manufacturer	Shenzhen Guanglianzhitong Tech Co., Ltd
Address	Room 305-306, Skyworth Digital Building , Shiyan Street, Baoan District, Shenzhen, China

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	Industrial Gateway
Model Name Under Test	25010-11X
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V1.1
Software Version	3.104
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Ancillary Equipment 1	Adapter	
	Brand Name	N/A
	Model No.	ICP12-120-1000D
	Serial No.	N/A
	Rated Input	100-240 V~, 0.3 A, 50/60 Hz
	Rated Output	12 V⎓ 1 A
Ancillary Equipment 2	Antenna	

2.6 Technical Information

Network and Wireless connectivity	WIFI

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

The Highest Speed of Processor	650 MHz

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	FCC 47 CFR Part 15 Subpart B (10-1-19 Edition)	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	Pass	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)	2.96 dB
Radiated emissions (30 MHz-1 GHz)	3.67 dB
Radiated emissions (1 GHz-18 GHz)	3.57 dB
Radiated emissions (18 GHz-40 GHz)	5.16 dB

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	23°C to 25°C	AC 120 V/60 Hz or from DC 9 V or DC 35 V	50% to 55%	100 kPa to 102 kPa

4.2 Test Equipment List

Radiated Emission Test For Frequency Below 1 GHz (10 m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2020.06.09	2021.06.08	☒
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9168	9168-0883	2020.05.11	2022.05.10	☒
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60*7.35m	N/A	2018.08.08	2021.08.07	☒
Test Software	BALUN	BL410_E	V19.918	--	--	☒

Radiated Emission Test For Frequency Below 1 GHz (3 m)						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2020.09.18	2021.09.17	☐
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-624	2019.07.02	2021.07.01	☐
Anechoic Chamber	YIHENG	9m*6m*6m	N/A	2018.07.18	2021.07.27	☐
Test Software	BALUN	BL410_E	V19.918	--	--	☐

Radiated Emission Test For Frequency Above 1 GHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2020.09.18	2021.09.17	☒
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1917	2019.07.02	2021.07.01	☒
Anechoic Chamber	YIHENG	9m*6m*6m	N/A	2018.07.18	2021.07.17	☒
Test Software	BALUN	BL410_E	V19.918	--	--	☒

Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9010B	MY57110309	2020.06.08	2021.06.07	☒
LISN	SCHWARZBECK	NSLK 8127	8127-687	2020.06.09	2021.06.08	☒
Shielded Enclosure	YiHeng Electronic Co., Ltd	3.4m*3.1m*2.8m	N/A	2018.08.16	2021.08.15	☒
Test Software	BALUN	BL410_E	V19.918	--	--	☒

4.3 Test Enclosure list

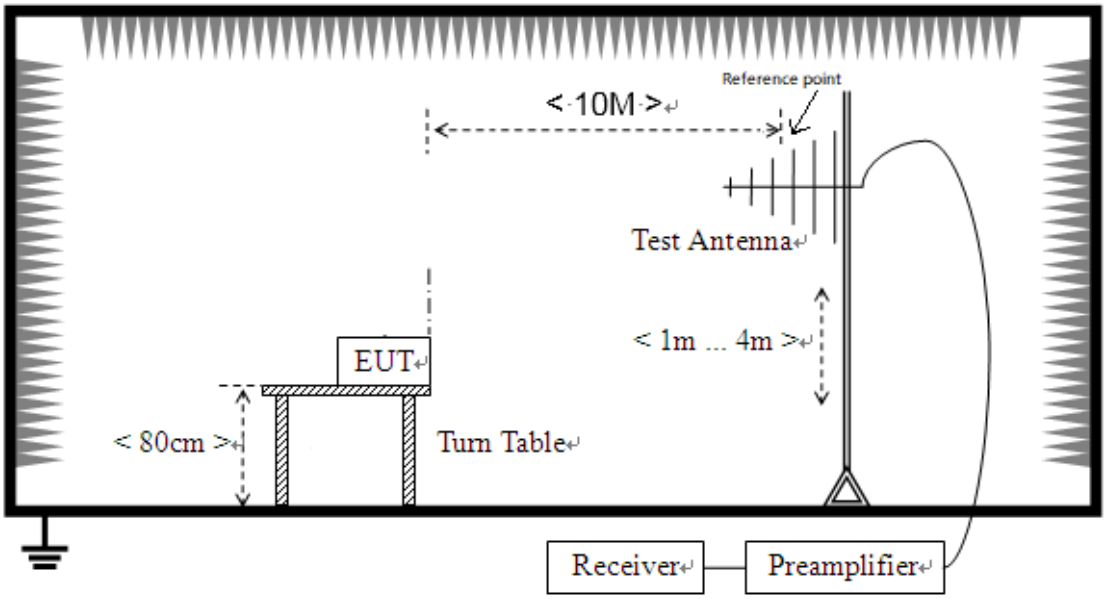
Description	Manufacturer	Model	Serial No.	Length	Description	Use
DC Line	N/A	N/A	N/A	N/A	N/A	☒
Laptop	Lenovo	N/A	N/A	N/A	N/A	☒
DC Source	ITECH	IT6873A	N/A	N/A	N/A	☒
RJ45 Cable	N/A	N/A	N/A	1.5 m	Shielded with core	☒

4.4 Test Configurations

Test Configurations (TC) No.	Description
TC01	The Working Test Mode (Power supply from Adapter) EUT + Antenna + Adapter + RJ45 Cable + Laptop
TC02	The Working Test Mode (Power supply from DC Source) EUT + Antenna + DC Line + DC Source + RJ45 Cable + Laptop

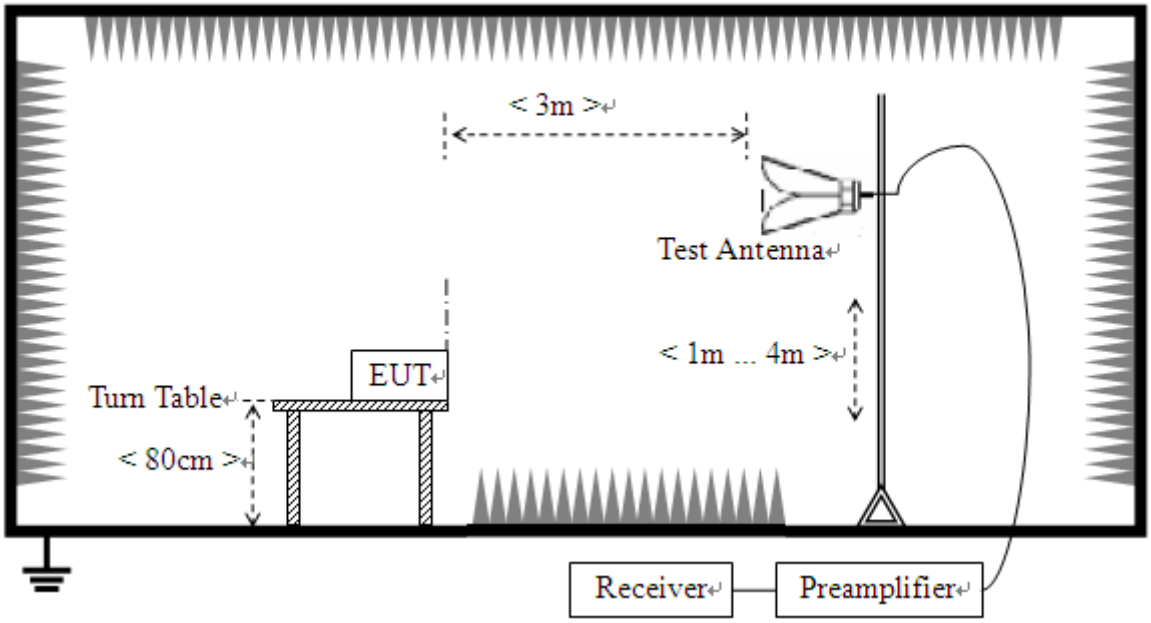
4.5 Test Setups

Test Setup 1



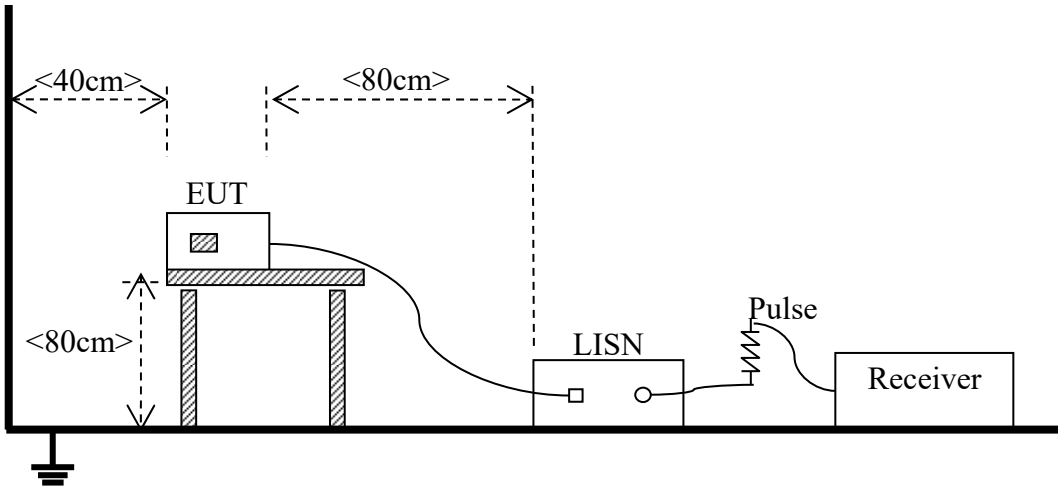
(For Radiated Emission Test (30 MHz-1 GHz))

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 Env.	NTNV
	Test Setup	Test Setup 1&2
	Test Configuration	TC01~TC02 Note
Conducted Emission, AC Ports	Test Env.	NTNV
	Test Setup	Test Setup 3
	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 Working Test Mode (Power supply from DC Source) is the worst mode in this report.		

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

5.1.1.4 Test Result

Please refer to ANNEX A.1.

NOTE:

1. Results (dBuV/m) = Reading (dBuV) + 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 (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 4.5 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 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.

5.1.2.4 Test Result

Please refer to ANNEX A.2.

NOTE:

1. Results (dBuV/m) = Reading (dBuV) + 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.

ANNEX A TEST RESULTS

A.1 Radiated Emission

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

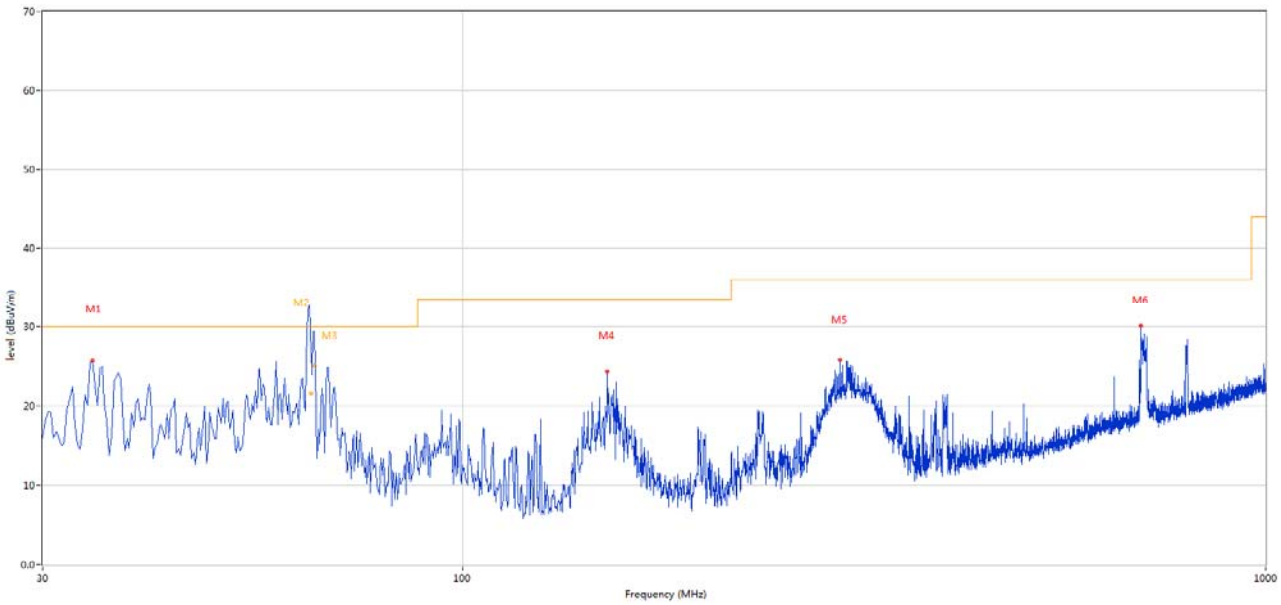
Note 2: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note 3: Three work voltages of AC 120V, DC 9V and DC 35V were tested, but only the worst configuration DC35V shown here.

Test Data and Plots

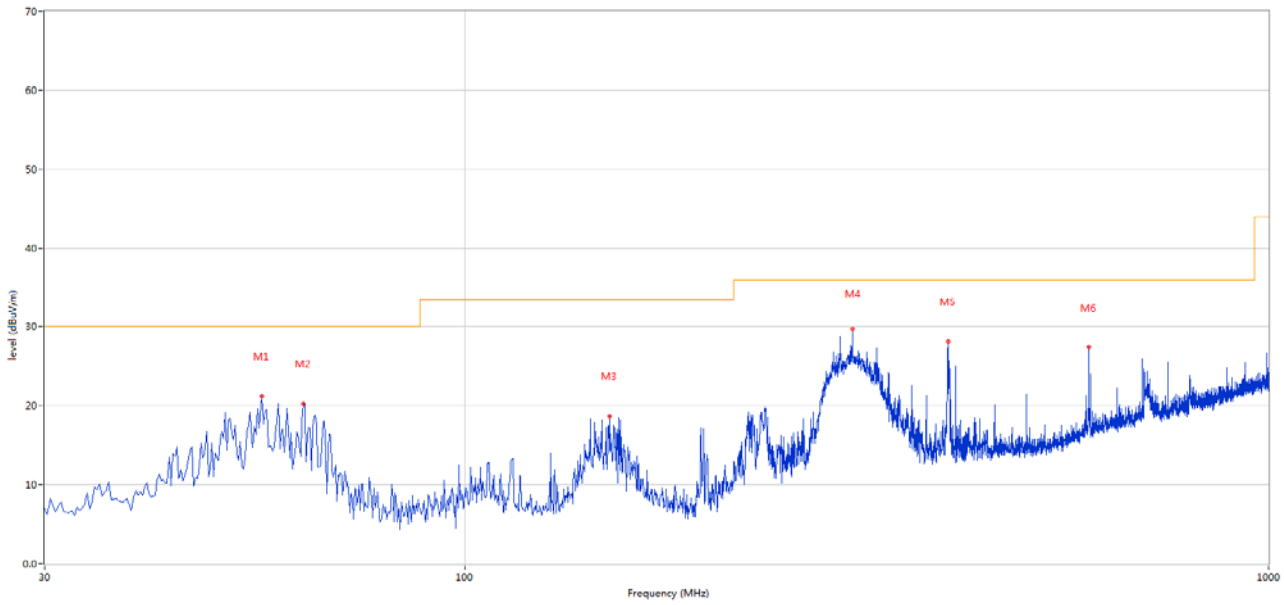
The Working Test Mode (Power supply from DC Source)

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



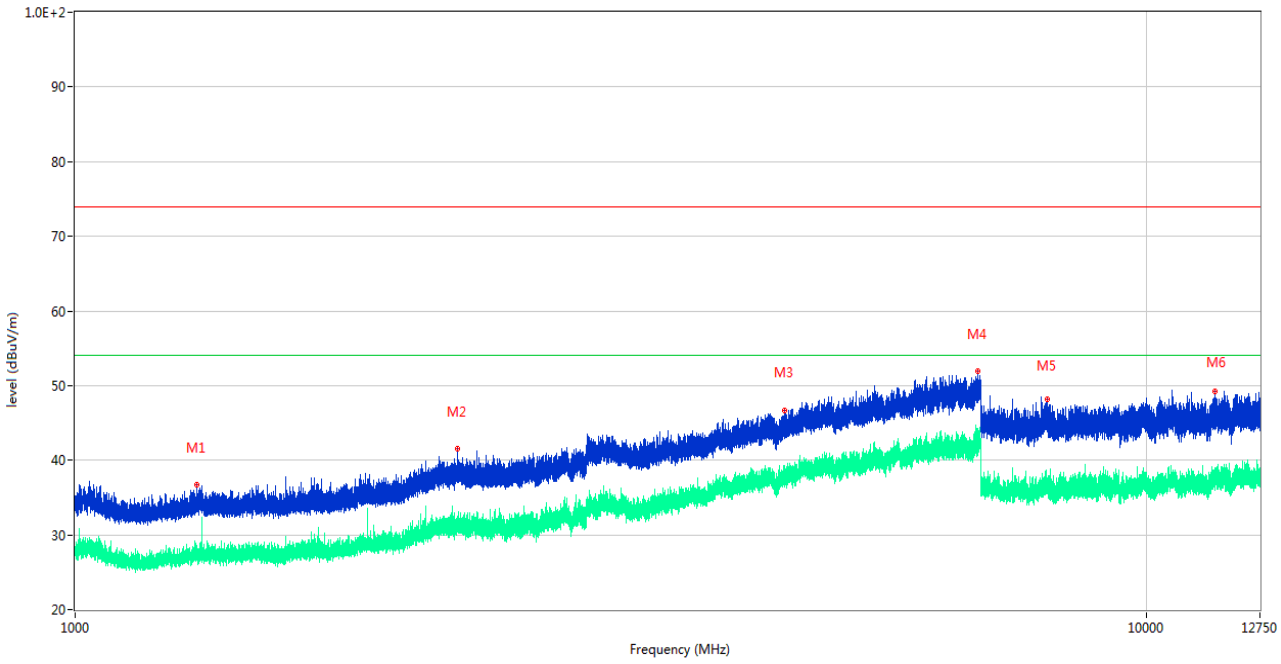
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	34.606	25.66	-27.37	30.0	-4.34	Peak	360.00	200	Vertical	Pass
2	64.773	32.09	-28.69	30.0	2.09	Peak	323.00	100	Vertical	N/A
2*	64.773	21.58	-28.69	30.0	-8.42	QP	323.00	100	Vertical	Pass
3	65.396	29.33	-28.91	30.0	-0.67	Peak	307.00	100	Vertical	N/A
3*	65.396	25.05	-28.91	30.0	-4.95	QP	307.00	100	Vertical	Pass
4	151.462	24.32	-26.01	33.5	-9.18	Peak	90.00	100	Vertical	Pass
5	294.744	25.82	-26.23	36.0	-10.18	Peak	100.00	100	Vertical	Pass
6	699.860	30.12	-16.18	36.0	-5.88	Peak	7.00	200	Vertical	Pass

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



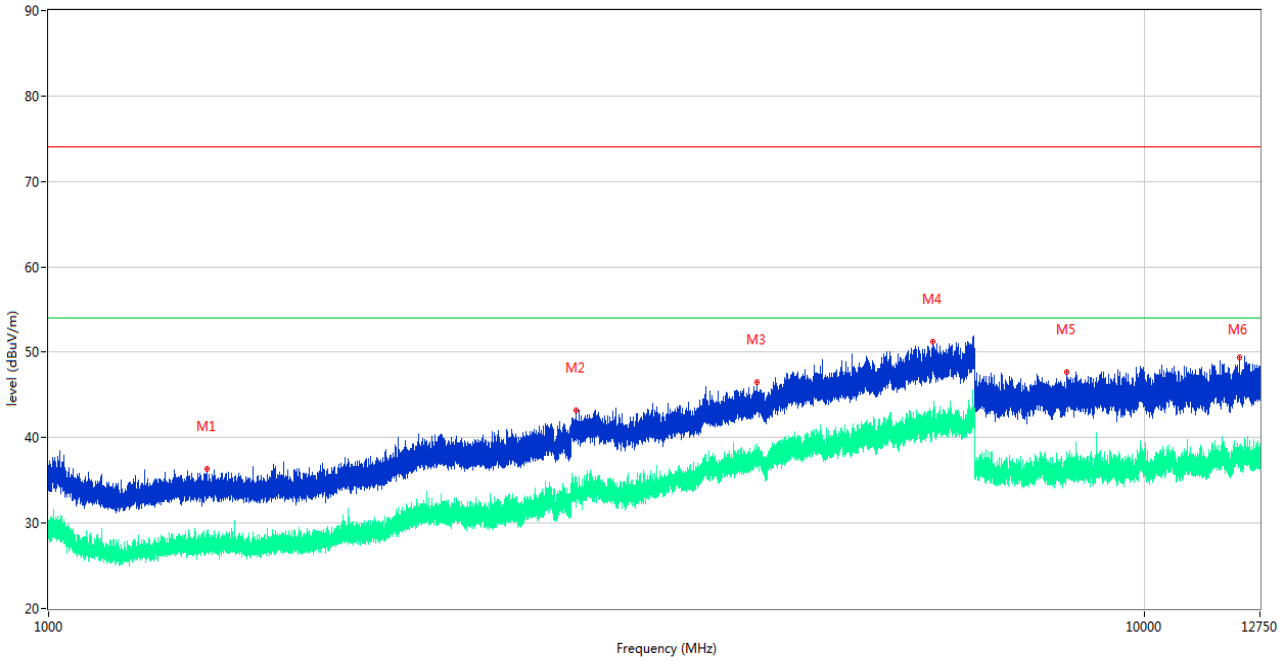
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	55.941	21.18	-27.51	30.0	-8.82	Peak	351.00	400	Horizontal	Pass
2	62.972	20.17	-28.43	30.0	-9.83	Peak	360.00	400	Horizontal	Pass
3	151.462	18.67	-26.01	33.5	-14.83	Peak	48.00	400	Horizontal	Pass
4	303.714	29.64	-25.54	36.0	-6.36	Peak	100.00	300	Horizontal	Pass
5	398.993	28.16	-23.20	36.0	-7.84	Peak	277.00	300	Horizontal	Pass
6	597.551	27.36	-17.77	36.0	-8.64	Peak	179.00	100	Horizontal	Pass

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



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1300.000	36.67	-14.74	74.0	-37.33	Peak	87.00	100	Vertical	Pass
1**	1300.000	27.03	-14.74	54.0	-26.97	AV	87.00	100	Vertical	Pass
2	2273.600	41.50	-10.10	74.0	-32.50	Peak	323.00	100	Vertical	Pass
2**	2273.600	31.79	-10.10	54.0	-22.21	AV	323.00	100	Vertical	Pass
3	4587.000	46.73	-2.38	74.0	-27.27	Peak	136.00	100	Vertical	Pass
3**	4587.000	37.86	-2.38	54.0	-16.14	AV	136.00	100	Vertical	Pass
4	6961.800	51.98	4.80	74.0	-22.02	Peak	16.00	100	Vertical	Pass
4**	6961.800	42.49	4.80	54.0	-11.51	AV	16.00	100	Vertical	Pass
5	8078.413	48.15	18.42	74.0	-25.85	Peak	-2.00	100	Vertical	Pass
5**	8078.413	37.61	18.42	54.0	-16.39	AV	-2.00	100	Vertical	Pass
6	11571.826	49.23	19.84	74.0	-24.77	Peak	133.00	100	Vertical	Pass
6**	11571.826	38.30	19.84	54.0	-15.70	AV	133.00	100	Vertical	Pass

A.1.4 Test Antenna Horizontal, 1 GHz – 12.75 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1394.600	36.32	-14.92	74.0	-37.68	Peak	242.00	100	Horizontal	Pass
1**	1394.600	27.17	-14.92	54.0	-26.83	AV	242.00	100	Horizontal	Pass
2	3026.400	43.25	-6.67	74.0	-30.75	Peak	331.00	100	Horizontal	Pass
2**	3026.400	35.41	-6.67	54.0	-18.59	AV	331.00	100	Horizontal	Pass
3	4434.200	46.56	-2.08	74.0	-27.44	Peak	285.00	100	Horizontal	Pass
3**	4434.200	37.26	-2.08	54.0	-16.74	AV	285.00	100	Horizontal	Pass
4	6408.400	51.18	3.69	74.0	-22.82	Peak	-1.00	100	Horizontal	Pass
4**	6408.400	42.02	3.69	54.0	-11.98	AV	-1.00	100	Horizontal	Pass
5	8493.275	47.67	18.04	74.0	-26.33	Peak	91.00	100	Horizontal	Pass
5**	8493.275	36.08	18.04	54.0	-17.92	AV	91.00	100	Horizontal	Pass
6	12201.162	49.36	20.43	74.0	-24.64	Peak	156.00	100	Horizontal	Pass
6**	12201.162	38.52	20.43	54.0	-15.48	AV	156.00	100	Horizontal	Pass

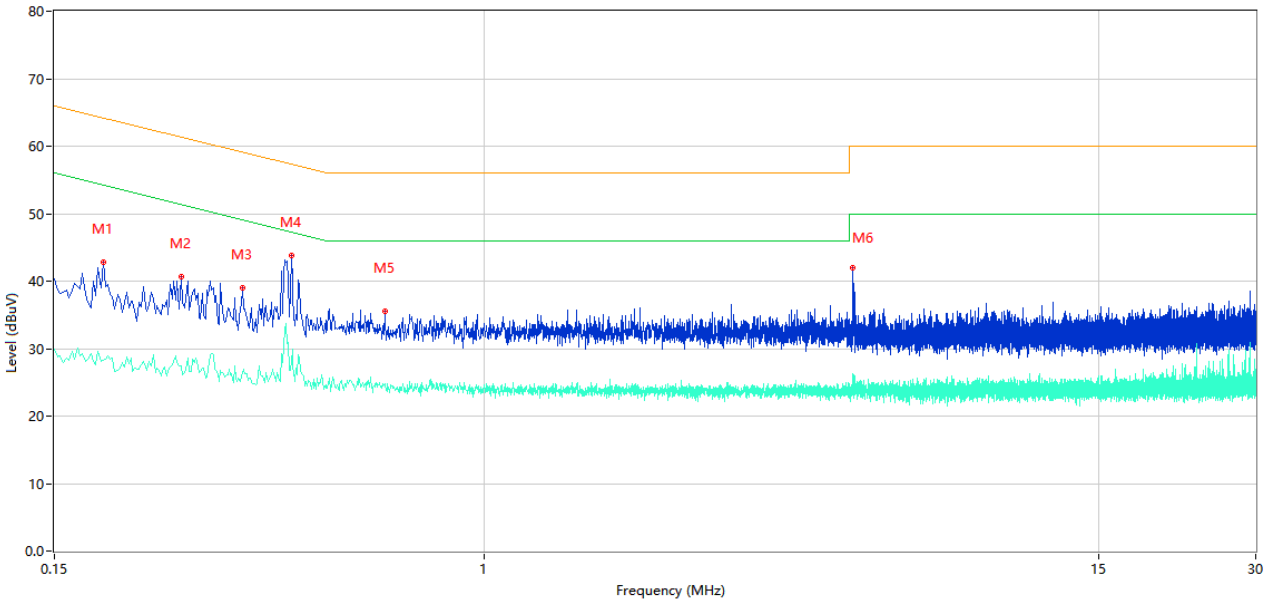
A.2 Conducted Emission

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 and DC 9V and DC 35V) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz and DC 9V and DC 35V were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Test Data and Plots

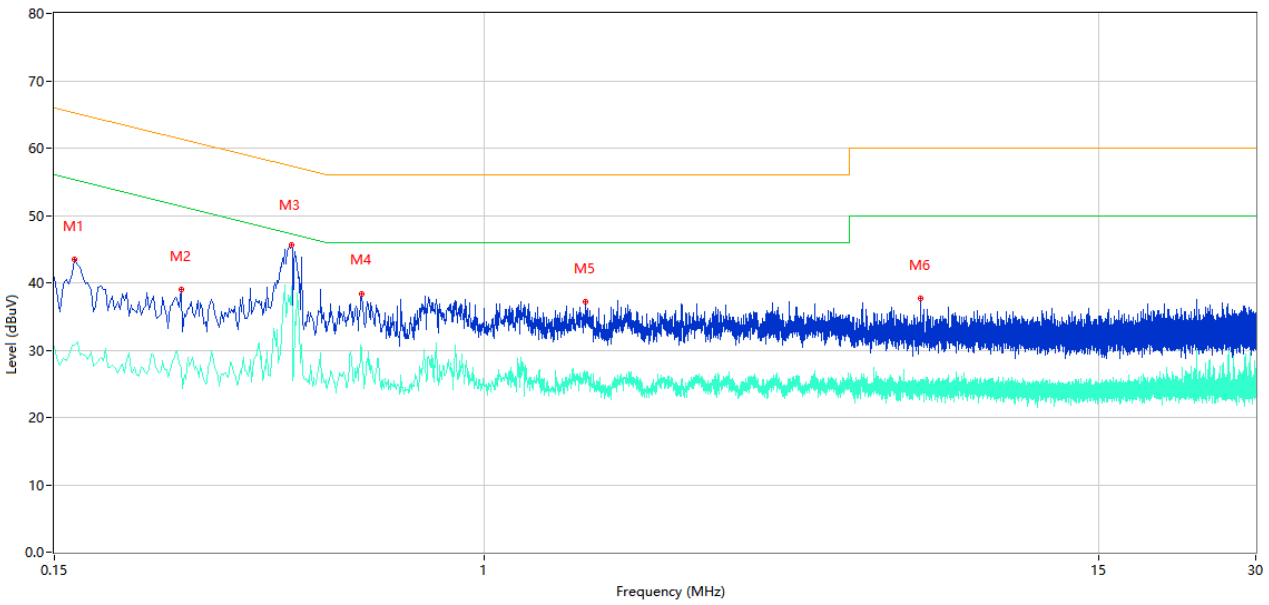
The Working Test Mode (Power supply from Adapter)

A.2.1 L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.186	42.75	10.39	64.21	-21.46	Peak	L	Pass
1**	0.186	28.19	10.39	54.21	-26.02	AV	L	Pass
2	0.262	40.59	10.34	61.37	-20.78	Peak	L	Pass
2**	0.262	27.42	10.34	51.37	-23.95	AV	L	Pass
3	0.344	39.00	10.32	59.11	-20.11	Peak	L	Pass
3**	0.344	26.36	10.32	49.11	-22.75	AV	L	Pass
4	0.426	43.80	10.31	57.33	-13.53	Peak	L	Pass
4**	0.426	28.17	10.31	47.33	-19.16	AV	L	Pass
5	0.644	35.50	10.27	56.00	-20.50	Peak	L	Pass
5**	0.644	24.51	10.27	46.00	-21.49	AV	L	Pass
6	5.078	41.95	10.31	60.00	-18.05	Peak	L	Pass
6**	5.078	26.34	10.31	50.00	-23.66	AV	L	Pass

A.2.2 N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.164	43.42	10.40	65.26	-21.84	Peak	N	Pass
1**	0.164	30.72	10.40	55.26	-24.54	AV	N	Pass
2	0.262	38.98	10.34	61.37	-22.39	Peak	N	Pass
2**	0.262	27.45	10.34	51.37	-23.92	AV	N	Pass
3	0.426	45.64	10.31	57.33	-11.69	Peak	N	Pass
3**	0.426	39.53	10.31	47.33	-7.80	AV	N	Pass
4	0.582	38.40	10.27	56.00	-17.60	Peak	N	Pass
4**	0.582	30.19	10.27	46.00	-15.81	AV	N	Pass
5	1.564	37.17	10.24	56.00	-18.83	Peak	N	Pass
5**	1.564	25.83	10.24	46.00	-20.17	AV	N	Pass
6	6.856	37.60	10.33	60.00	-22.40	Peak	N	Pass
6**	6.856	25.63	10.33	50.00	-24.37	AV	N	Pass

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2140494-AE-1.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2140494-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2140494-AI.PDF”.

--END OF REPORT--