

FCC

EMC

TEST REPORT

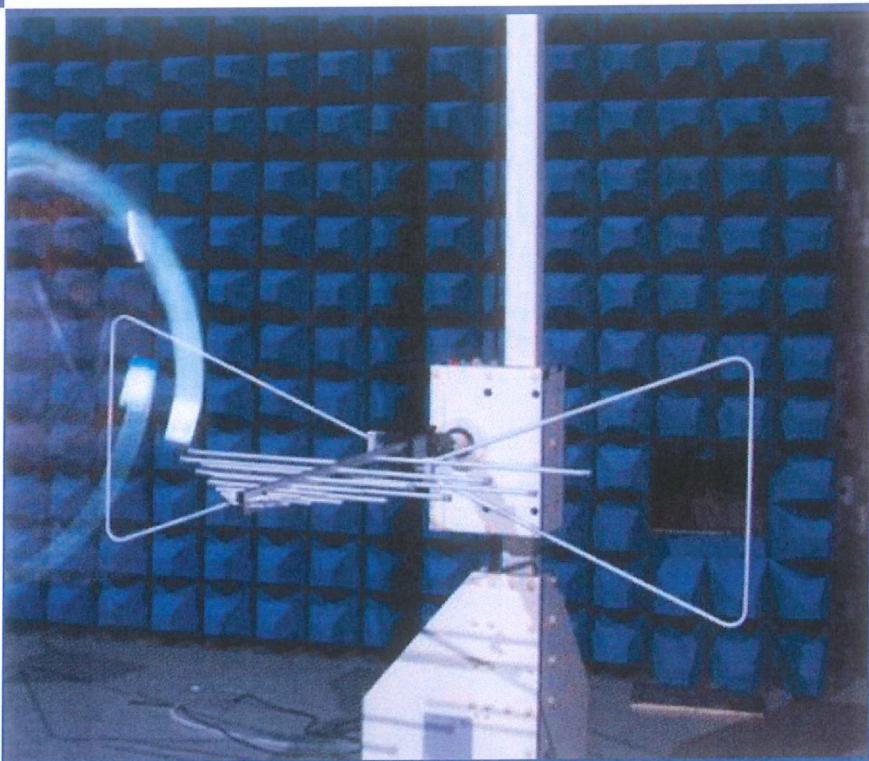
ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



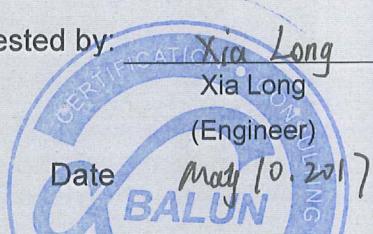
FOR
GPS tracker

ISSUED TO
WayRay SA

Avenue de Gratta-Paille 1-2, CH - 1018 Lausanne, Switzerland



Tested by:



Xia Long

Xia Long

(Engineer)

Date

May 10, 2017

Approved by:

Wei Yanquan

(Chief Engineer)

Date

May 10, 2017

Report No.: BL-SZ1730218-402

EUT Name: GPS tracker

Model Name: Model A

Brand Name: WAYRAY

Test Standard: 47 CFR Part 15 Subpart B

FCC ID: 2AHNW-3010

Test Conclusion: Pass

Test Date: Apr. 25, 2017 ~ Apr. 28, 2017

Date of Issue: May 10, 2017

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Revision History

Version	Issue Date	Revisions Content
<u>Rev. 01</u>	<u>May 10, 2017</u>	<u>Initial Issue</u>

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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

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
Accreditation Certificate	The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1. The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are 832625. The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.
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°C~25°C
Ambient Relative Humidity	45% - 55%
Ambient Pressure	100 kPa - 102 kPa

1.4 Announce

- (1) The test report reference to the report template version v6.4.
- (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.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	WayRay SA
Address	Avenue de Gratta-Paille 1-2, CH - 1018 Lausanne, Switzerland

2.2 Manufacturer Information

Manufacturer	WayRay SA
Address	Avenue de Gratta-Paille 1-2, CH - 1018 Lausanne, Switzerland

2.3 Factory Information

Factory	WayRay SA
Address	Avenue de Gratta-Paille 1-2, CH - 1018 Lausanne, Switzerland

2.4 General Description for Equipment under Test (EUT)

EUT Name	GPS tracker
Model Name Under Test	Model A
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	8.0
Software Version	E2.0.29
Random-access Memory	4G
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A
Network and Wireless connectivity	2G Network GPRS 850/1900MHz 3G Network WCDMA/HSDPA Band 2/5 Bluetooth, GPS

2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	40230
	Serial No.	N/A
	Capacitance	370 mAh
	Rated Voltage	3.7 V
	Limit Charge Voltage	4.2 V
Ancillary Equipment 2	Connection line	
	Length(Approx.)	85 cm

2.6 Technical Information

Note: Not applicable.

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	FCC 47 CFR Part 15 Subpart B (10-1-15 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

Note : Because of the EUT and the test sample (which in the test report No. is BL-SZ1730218-401, and it issued by Shenzhen BALUN Technology Co., Ltd. On May 10, 2017) just have the different Random-access Memory. The other hardware circuit all the same. So all of the test items please refer to the report BL-SZ1730218-401 (issued by Shenzhen BALUN Technology Co., Ltd. On May 10, 2017 and only evaluated Radiated Emission below 1GHz).

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)	3.23 dB
Radiated emissions (30 MHz-1 GHz)	4.30 dB
Radiated emissions (1 GHz-18 GHz)	4.81 dB
Radiated emissions (18 GHz-40 GHz)	5.71 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~26°C	DC 14V	50%-55%	100 to 102 kPa

4.2 Test Equipment List

Radiated Emission Test For Frequency Below 1 GHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWA RZ	ESRP	101036	2016.07.05	2017.07.04	<input checked="" type="checkbox"/>
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-977	2016.07.19	2018.07.18	<input checked="" type="checkbox"/>
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1600	2016.07.12	2018.07.11	<input type="checkbox"/>
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60 *7.35m	N/A	2016.08.09	2018.08.08	<input checked="" type="checkbox"/>

Radiated Emission Test For Frequency Above 1 GHz						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	KEYSIGHT	N9038A	MY53220118	2016.09.09	2017.09.08	<input type="checkbox"/>
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-624	2015.07.22	2017.07.21	<input type="checkbox"/>
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1148	2015.07.22	2017.07.21	<input type="checkbox"/>
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2019.02.20	<input type="checkbox"/>

Conducted Emission Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWA RZ	ESRP	101036	2016.07.05	2017.07.04	<input type="checkbox"/>
LISN	SCHWARZBECK	NSLK 8127	8127-687	2016.07.05	2017.07.04	<input type="checkbox"/>
LISN	SCHWARZBECK	NNLK 8129	8129-462	2016.09.14	2017.09.13	<input type="checkbox"/>
AMN	SCHWARZBECK	NNBM8124	8124-509	2016.07.05	2017.07.04	<input type="checkbox"/>
AMN	SCHWARZBECK	NNBM8124	8124-510	2016.07.05	2017.07.04	<input type="checkbox"/>
ISN	TESEQ	ISN T800	34449	2016.07.05	2017.07.04	<input type="checkbox"/>
Shielded Enclosure	ChangNing	CN-130701	130703	N/A	N/A	<input type="checkbox"/>

4.3 Test Enclosure list

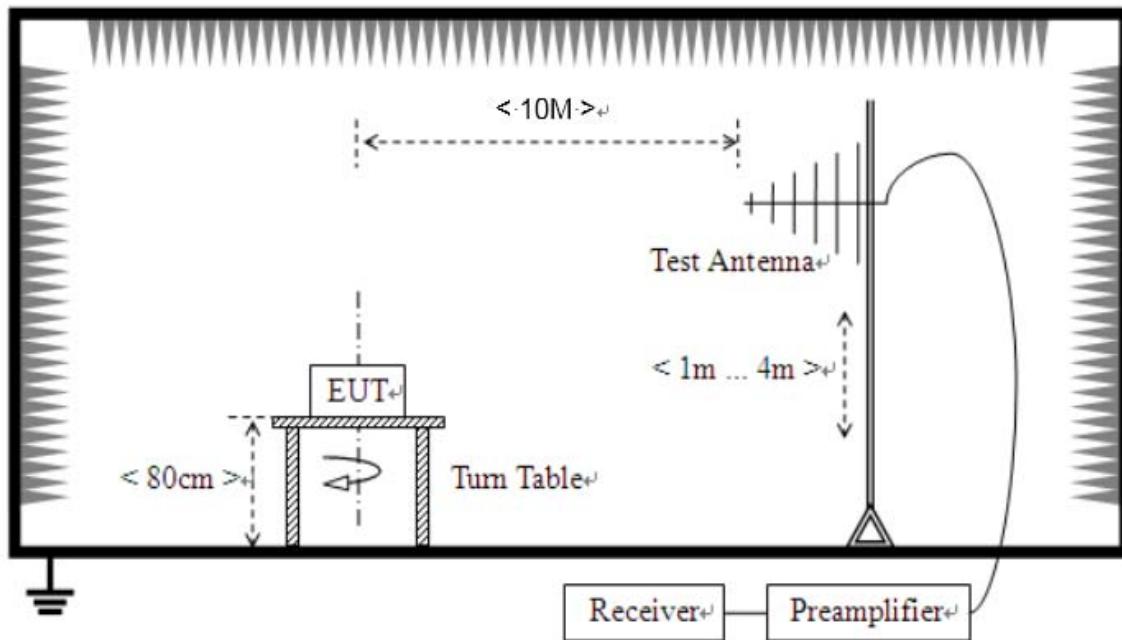
Description	Manufacturer	Model	Serial No.	Length	Description	Use
PC	Dell	015K3N	N/A	N/A	Special Handled	<input type="checkbox"/>
Laptop	Apple	A1465	N/A	N/A	N/A	<input checked="" type="checkbox"/>
Printer	HP	DESKJET 1000	N/A	N/A	N/A	<input type="checkbox"/>
Keyboard	Logitech	Y-BP62a	N/A	N/A	N/A	<input type="checkbox"/>
Mouse	Logitech	M100	N/A	N/A	N/A	<input type="checkbox"/>
USB disk	Kingston	N/A	N/A	N/A	N/A	<input type="checkbox"/>
TF Card	Kingston	N/A	N/A	N/A	N/A	<input type="checkbox"/>
VGA Cable	N/A	N/A	N/A	1.5 m	Shielded with core	<input type="checkbox"/>
HDMI Cable	N/A	N/A	N/A	1.5 m	Shielded with core	<input type="checkbox"/>
DVI Cable	N/A	N/A	N/A	1.5 m	Shielded with core	<input type="checkbox"/>
Coaxial video cable	N/A	N/A	N/A	2.0 m	Shielded with core	<input type="checkbox"/>
iPhone	Apple	A1586	N/A	N/A	N/A	<input type="checkbox"/>
Phone	MI	M4	N/A	N/A	N/A	<input type="checkbox"/>
Bluetooth Earphone	SAMSUNG	Gear Circle	N/A	N/A	N/A	<input checked="" type="checkbox"/>
GPS/GLONAS S Vector signal generator	R&S	N5172B EXG	N/A	N/A	N/A	<input checked="" type="checkbox"/>
WIFI Router	TP-LINK	TL-WDR7500	N/A	N/A	N/A	<input type="checkbox"/>
Earphone	N/A	OPPO	N/A	1.1 m	N/A	<input type="checkbox"/>
Car Battery	Camel	55530	N/A	N/A	12 V/55 Ah	<input type="checkbox"/>
Artificial load	N/A	N/A	N/A	N/A	2.5 Ω/100 W	<input type="checkbox"/>
Artificial load	N/A	N/A	N/A	N/A	5 Ω/100 W	<input type="checkbox"/>
Electronic Load	ITECH	IT8511	N/A	N/A	N/A	<input type="checkbox"/>
USB Cable	N/A	N/A	N/A	1.5 m	Shielded with core	<input type="checkbox"/>
DC Power Supply	ITECH	IT6863A	60001401068 7210006	N/A	N/A	<input checked="" type="checkbox"/>
LCD Monitor	SAMSUNG	UA32C4000P	N/A	N/A	N/A	<input type="checkbox"/>
LCD Monitor	Dell	U241HB	N/A	N/A	N/A	<input type="checkbox"/>
Control Line	N/A	N/A	N/A	N/A	N/A	<input checked="" type="checkbox"/>
RJ45 Cable	N/A	N/A	N/A	1.5 m	Shielded with core	<input type="checkbox"/>

4.4 Test Configurations

Test Configurations (TC) No.	Description
Traffic Test Mode	
TC01	<u>The GPRS 850 MHz Test Mode</u> GPRS 850 MHz Link + Battery + Connection line + Control Line + Laptop + GPS + BT Link + DC Power Supply
TC02	<u>The GPRS 1900 MHz Test Mode</u> GPRS 1900 MHz Link + Battery + Connection line + Control Line + Laptop + GPS + BT Link + DC Power Supply
TC03	<u>The WCDMA 850 MHz Mode</u> WCDMA 850 MHz Link + Battery + Connection line + Control Line + Laptop + GPS + BT Link + DC Power Supply
TC04	<u>The WCDMA 1900 MHz Mode</u> WCDMA 1900 MHz Link + Battery + Connection line + Control Line + Laptop + GPS + BT Link + DC Power Supply
TC05	<u>The Idle Test Mode</u> GPRS 850(Idle) + Battery + Earphone + DC Power Supply
Amusement Test Mode	
TC06	<u>The USB Test Mode</u> EUT + Battery + Connection line + Control Line + Laptop + GPS + BT Link + DC Power Supply

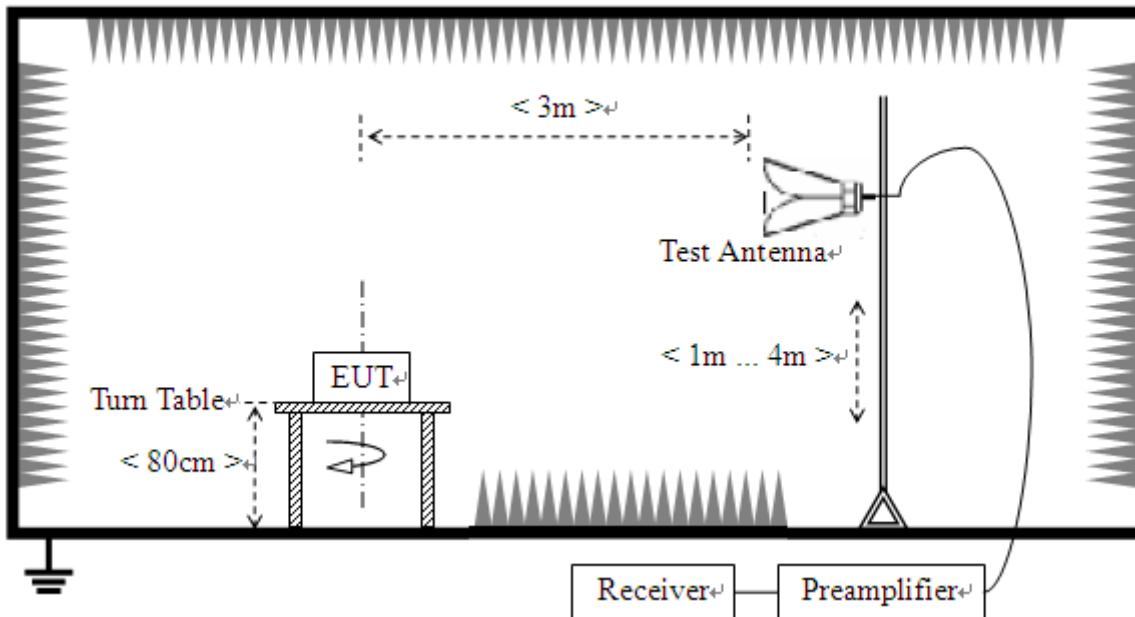
4.5 Test Setups

Test Setup 1

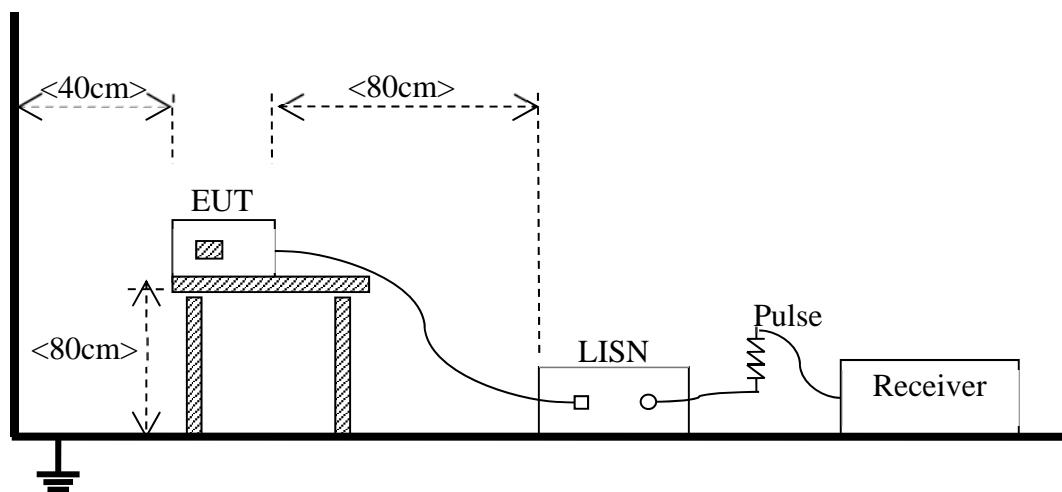


(For Radiated Emission Test (30 MHz-1 GHz))

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
	Test Configuration	TC01~TC06 <small>Note</small>
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 USB test 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

Frequency range (MHz)	Class B (at 10 m)		Class A (at 10 m)	
	Field Strength (μ V/m)	Field Strength (dB μ V/m)	Field Strength (μ V/m)	Field Strength (dB μ V/m)
30 - 88	100	30	90	39
88 - 216	150	33.5	150	43.5
216 - 960	200	36	210	46.4
Above 960	500	44	300	49.5

NOTE:

- 1) Field Strength (dB μ V/m) = 20*log [Field Strength (μ V/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.

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.

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.

ANNEX A TEST RESULTS

A.1 Radiated Emission

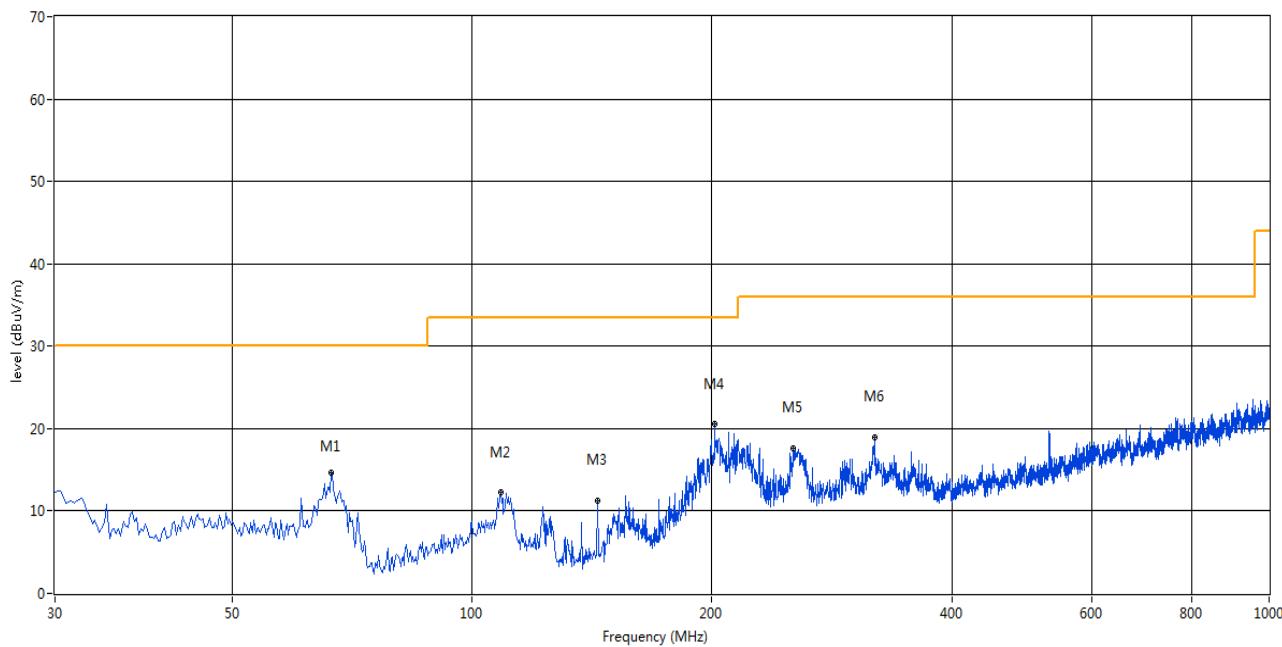
Note 1: The symbol of “--” in the table which means not application.

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

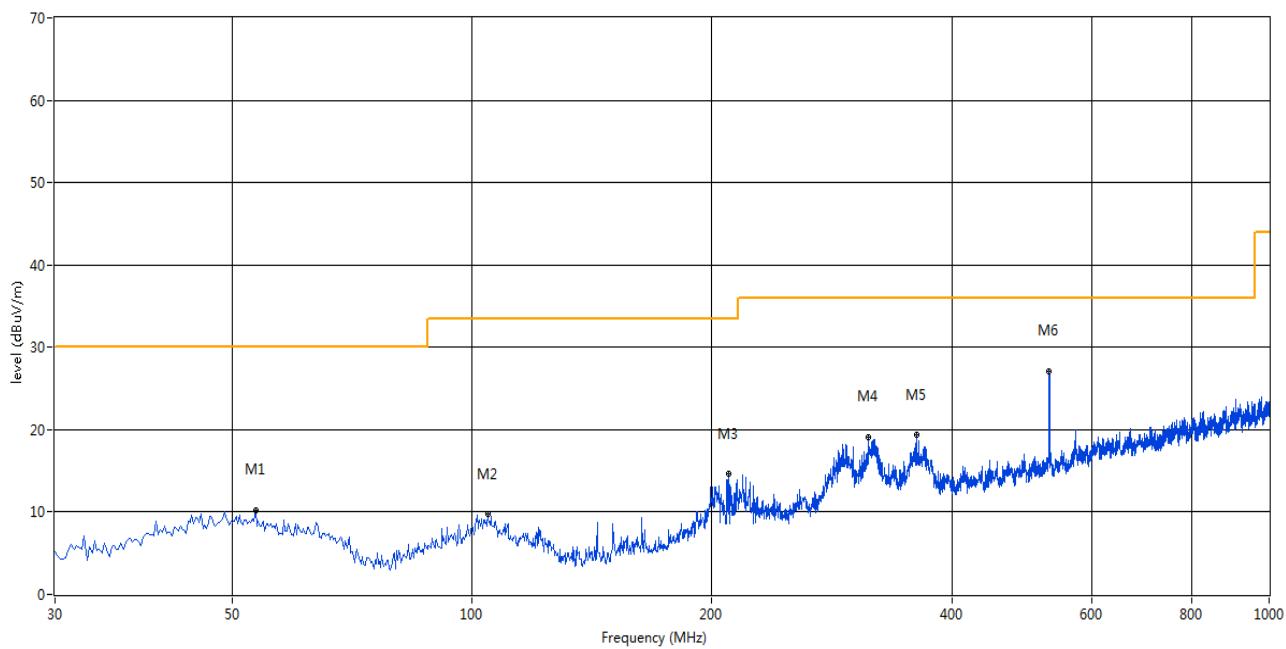
The USB Test Mode

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



No.	Frequency (MHz)	Results (dB _{UV} /m)	Factor (dB)	Limit (dB _{UV} /m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	66.608	14.70	-16.20	30.0	15.30	Peak	162.00	300	Vertical	Pass
2	108.793	12.23	-15.30	33.5	21.27	Peak	183.00	100	Vertical	Pass
3	143.947	11.28	-19.01	33.5	22.22	Peak	46.00	200	Vertical	Pass
4	201.647	20.52	-15.03	33.5	12.98	Peak	172.00	100	Vertical	Pass
5	253.287	17.58	-13.43	36.0	18.42	Peak	190.00	200	Vertical	Pass
6	319.715	18.96	-11.78	36.0	17.04	Peak	237.00	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 (o)	Height (cm)	ANT	Verdict
1	53.517	10.18	-13.45	30.0	19.82	Peak	352.00	100	Horizontal	Pass
2	104.671	9.71	-15.03	33.5	23.79	Peak	8.00	200	Horizontal	Pass
3	209.890	14.61	-15.19	33.5	18.89	Peak	304.00	300	Horizontal	Pass
4	314.624	19.14	-11.89	36.0	16.86	Peak	345.00	300	Horizontal	Pass
5	361.172	19.34	-10.56	36.0	16.66	Peak	137.00	300	Horizontal	Pass
6	529.910	27.14	-7.10	36.0	8.86	Peak	220.00	200	Horizontal	Pass

Test Data and Plots (Above 1 GHz)

Note: Test Data and Plots (Above 1 GHz) result reference from original test report: BL-SZ1730218-401 (issued by Shenzhen BALUN Technology Co., Ltd. On May 10, 2017) A.1.3 Test Antenna Vertical, 1 GHz - 6 GHz & A.1.4 Test Antenna Horizontal, 1 GHz - 6 GHz.

A.2 Conducted Emission

Note: Test Data and Plots (Above 1 GHz) result reference from original test report: BL-SZ1730218-401 (issued by Shenzhen BALUN Technology Co., Ltd. On May 10, 2017) A.2. Conducted Emission

ANNEX B TEST SETUP PHOTOS

Please refer the document "BL-SZ1730218-AE.PDF".

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document "BL-SZ1730218-AW.PDF".

ANNEX D EUT INTERNAL PHOTOS

Please refer the document "BL-SZ1730218-AI.PDF".

--END OF REPORT--