

FCC

EMC

TEST REPORT

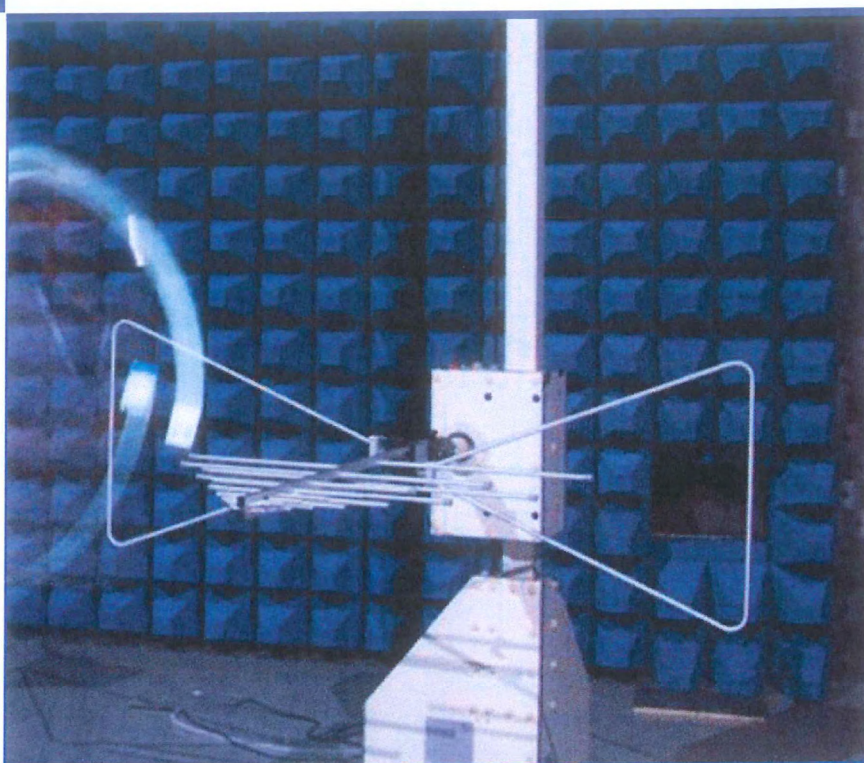
ISSUED BY
Shenzhen BALUN Technology Co., Ltd.



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 Yanguan

Wei Yanguan
(Chief Engineer)

Date: May 10, 2017

Report No.: BL-SZ1730218-401

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

NOTE: This test report can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please visit BALUN website.

Revision History

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

TABLE OF CONTENTS

1	GENERAL INFORMATION	4
1.1	Identification of the Testing Laboratory	4
1.2	Identification of the Responsible Testing Location	4
1.3	Laboratory Condition	4
1.4	Announce	4
2	PRODUCT INFORMATION	5
2.1	Applicant Information	5
2.2	Manufacturer Information	5
2.3	Factory Information	5
2.4	General Description for Equipment under Test (EUT)	5
2.5	Ancillary Equipment	6
2.6	Technical Information	6
3	SUMMARY OF TEST RESULTS	7
3.1	Test Standards	7
3.2	Verdict	7
3.3	Test Uncertainty	7
4	GENERAL TEST CONFIGURATIONS	8
4.1	Test Environments	8
4.2	Test Equipment List	8
4.3	Test Enclosure list	9
4.4	Test Configurations	10
4.5	Test Setups	11
4.6	Test Conditions	13
5	TEST ITEMS	14
5.1	Emission Tests	14
ANNEX A	TEST RESULTS	16

A.1	Radiated Emission	16
A.2	Conducted Emission	20
ANNEX B	TEST SETUP PHOTOS	22
ANNEX C	EUT EXTERNAL PHOTOS	22
ANNEX D	EUT INTERNAL PHOTOS	22

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	8G
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

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	☒
Test Antenna- Bi-Log	SCHWARZBECK	VULB 9163	9163-977	2016.07.19	2018.07.18	☒
Test Antenna- Horn	SCHWARZBECK	BBHA 9120D	9120D-1600	2016.07.12	2018.07.11	☐
Anechoic Chamber	EMC Electronic Co., Ltd	20.10*11.60 *7.35m	N/A	2016.08.09	2018.08.08	☒

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	☒
Test Antenna- Bi-Log	SCHWARZBECK	VULB 9163	9163-624	2015.07.22	2017.07.21	☐
Test Antenna- Horn	SCHWARZBECK	BBHA 9120D	9120D-1148	2015.07.22	2017.07.21	☒
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2019.02.20	☒

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	☒
LISN	SCHWARZBECK	NSLK 8127	8127-687	2016.07.05	2017.07.04	☒
LISN	SCHWARZBECK	NNLK 8129	8129-462	2016.09.14	2017.09.13	☐
AMN	SCHWARZBECK	NNBM8124	8124-509	2016.07.05	2017.07.04	☐
AMN	SCHWARZBECK	NNBM8124	8124-510	2016.07.05	2017.07.04	☐
ISN	TESEQ	ISN T800	34449	2016.07.05	2017.07.04	☐
Shielded Enclosure	ChangNing	CN-130701	130703	N/A	N/A	☒

4.3 Test Enclosure list

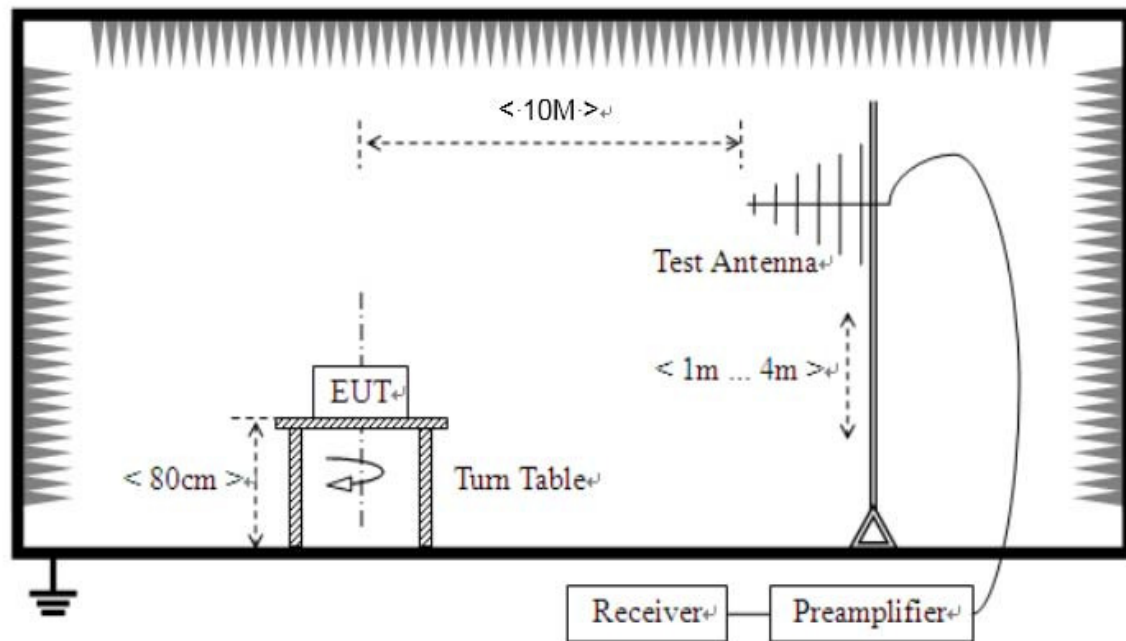
Description	Manufacturer	Model	Serial No.	Length	Description	Use
PC	Dell	015K3N	N/A	N/A	Special Handled	☐
Laptop	Apple	A1465	N/A	N/A	N/A	☒
Printer	HP	DESKJET 1000	N/A	N/A	N/A	☐
Keyboard	Logitech	Y-BP62a	N/A	N/A	N/A	☐
Mouse	Logitech	M100	N/A	N/A	N/A	☐
USB disk	Kingston	N/A	N/A	N/A	N/A	☐
TF Card	Kingston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

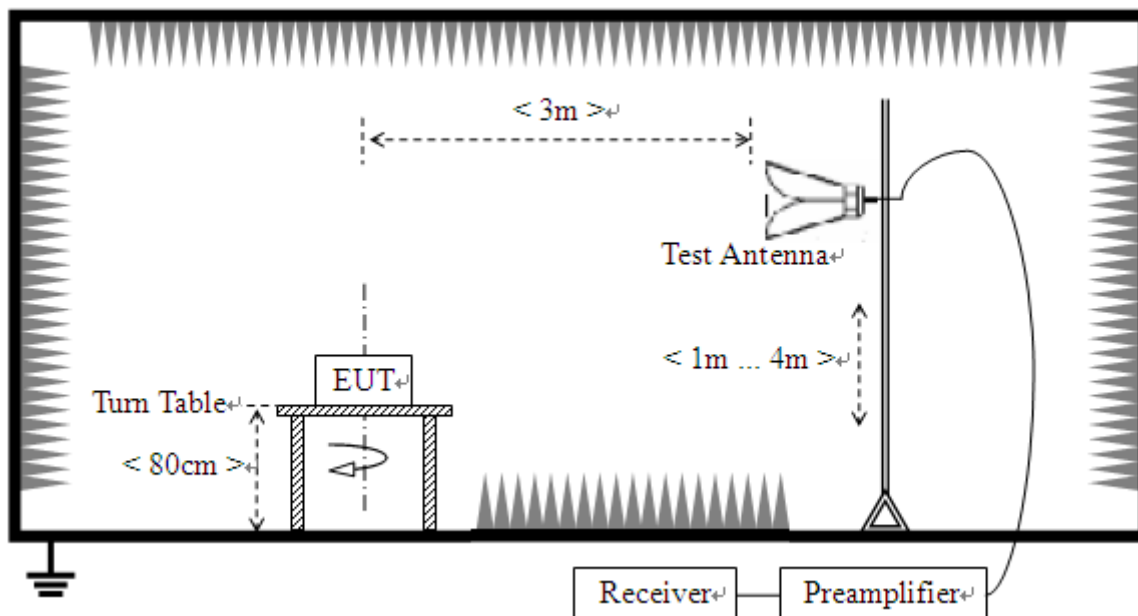
4.5 Test Setups

Test Setup 1



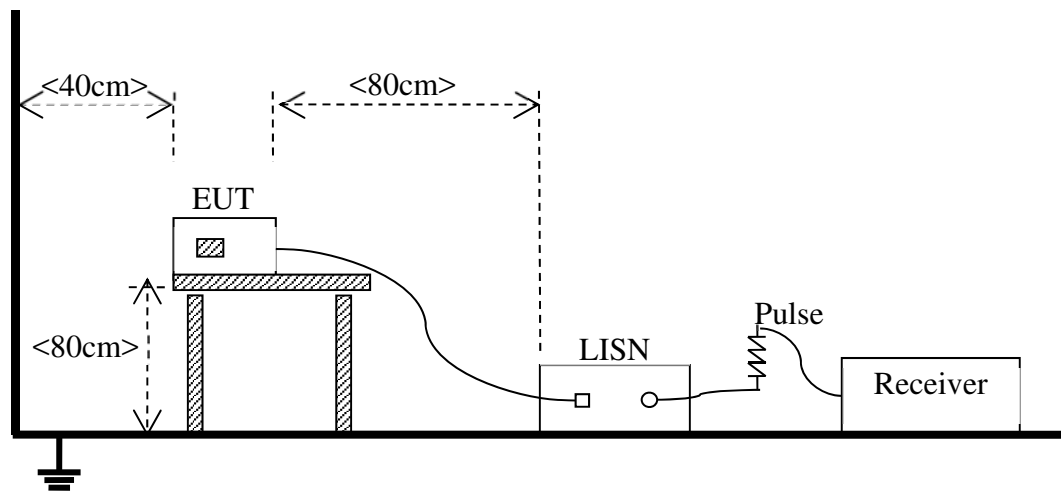
(For Radiated Emission Test (30 MHz-1 GHz))

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&2
	Test Configuration	TC01~TC06 ^{Note}
Conducted Emission, AC Ports	Test Env.	NTNV
	Test Setup	Test Setup 3
	Test Configuration	TC01~TC06 ^{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 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 ($\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)	Field Strength ($\mu\text{V/m}$)	Field Strength (dB $\mu\text{V/m}$)
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 $\mu\text{V/m}$) = $20 \cdot \log [\text{Field Strength } (\mu\text{V/m})]$.
- 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 μ H 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

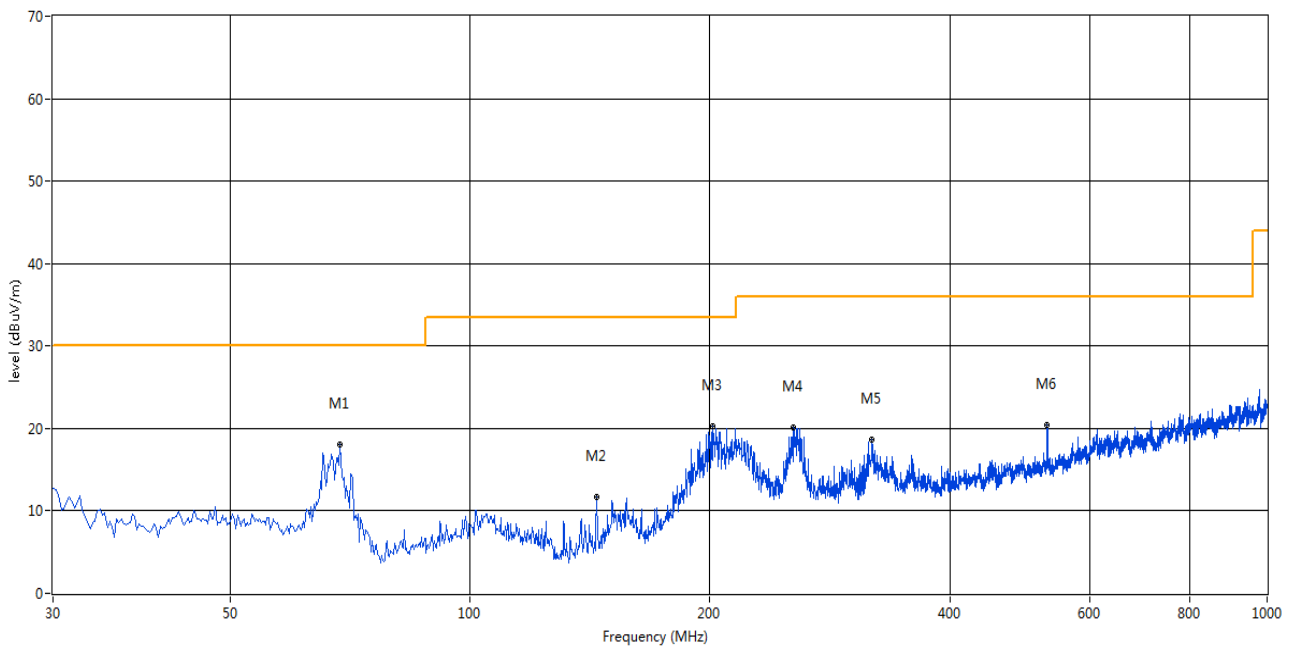
Note 1: The symbol of “--” in the table which means not application.

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

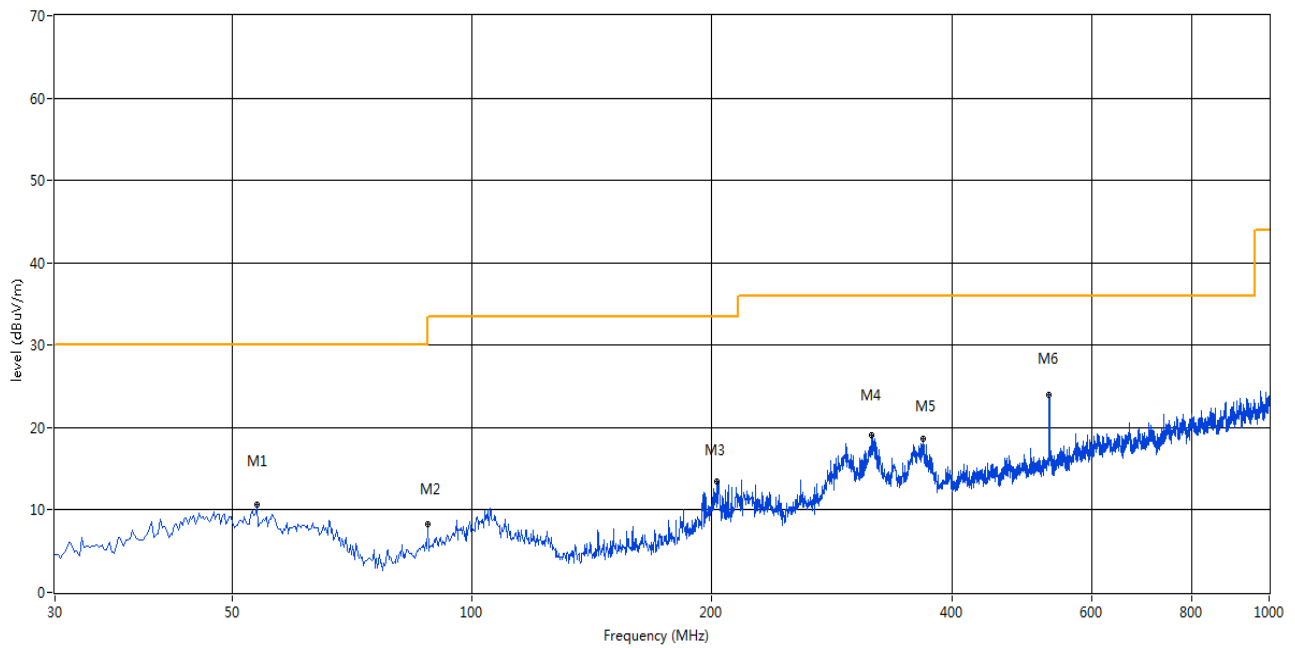
The USB Test Mode

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



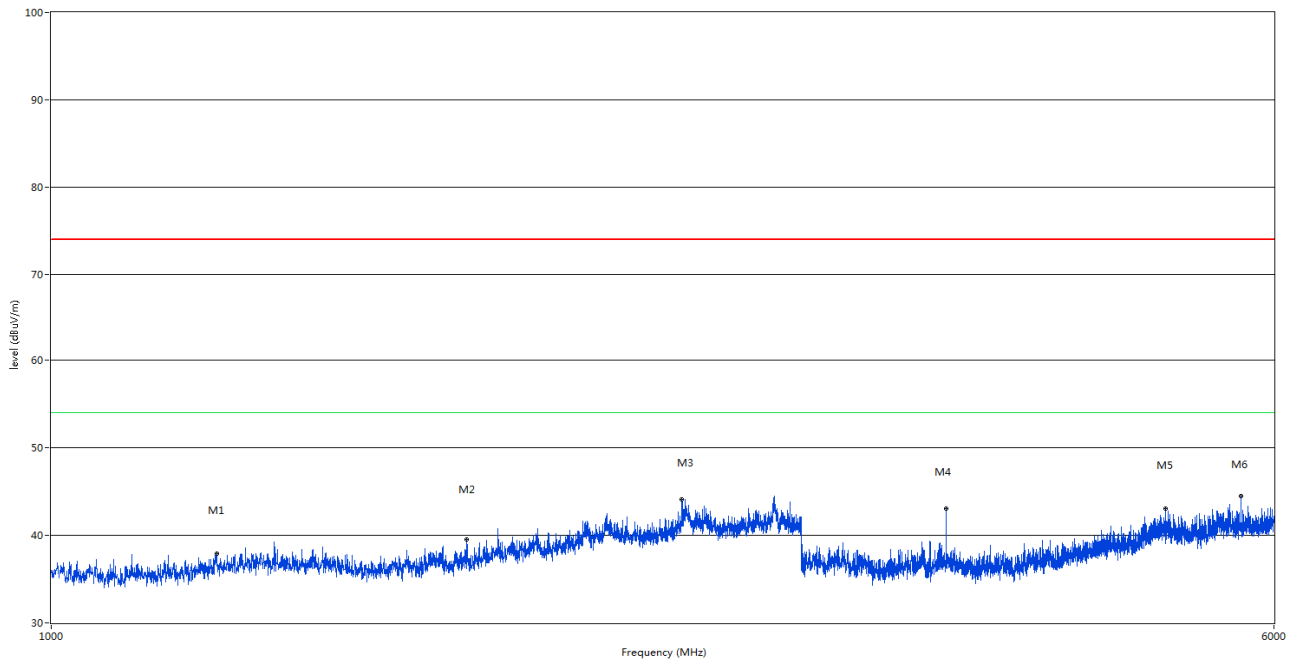
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	68.790	18.04	-16.96	30.0	11.96	Peak	171.00	200	Vertical	Pass
2	144.189	11.74	-19.02	33.5	21.76	Peak	17.00	200	Vertical	Pass
3	201.647	20.23	-15.03	33.5	13.27	Peak	59.00	100	Vertical	Pass
4	254.741	20.16	-13.45	36.0	15.84	Peak	360.00	200	Vertical	Pass
5	319.473	18.62	-11.78	36.0	17.38	Peak	217.00	100	Vertical	Pass
6	529.910	20.44	-7.10	36.0	15.56	Peak	199.00	100	Vertical	Pass

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



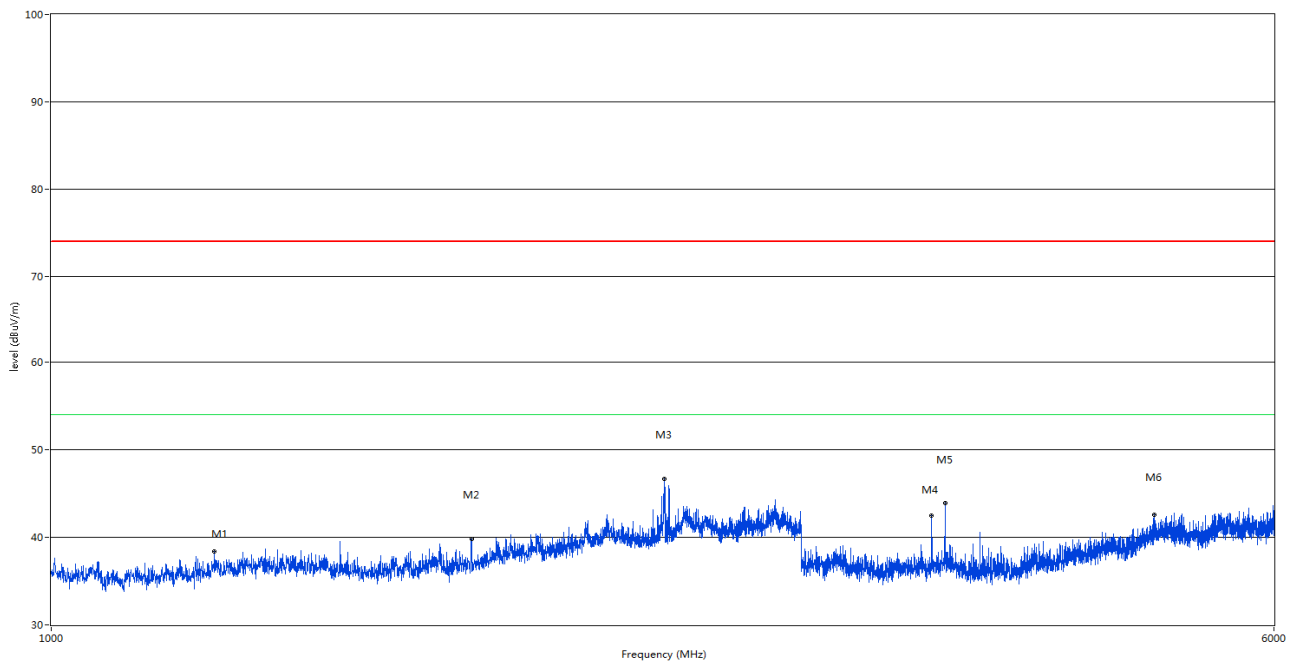
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	53.759	10.60	-13.47	30.0	19.40	Peak	264.00	200	Horizontal	Pass
2	88.185	8.26	-17.58	33.5	25.24	Peak	51.00	300	Horizontal	Pass
3	203.102	13.52	-14.97	33.5	19.98	Peak	360.00	300	Horizontal	Pass
4	317.533	19.09	-11.90	36.0	16.91	Peak	356.00	200	Horizontal	Pass
5	367.961	18.63	-10.54	36.0	17.37	Peak	120.00	300	Horizontal	Pass
6	529.910	24.02	-7.10	36.0	11.98	Peak	210.00	200	Horizontal	Pass

A.1.3 Test Antenna Vertical, 1 GHz – 6 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1274.000	37.87	-3.59	74.0	36.13	Peak	301.90	100	Vertical	Pass
2	1839.000	39.57	-1.76	74.0	34.43	Peak	253.40	100	Vertical	Pass
3	2520.500	44.14	2.89	74.0	29.86	Peak	174.10	100	Vertical	Pass
4	3711.750	43.04	6.77	74.0	30.96	Peak	1.00	100	Vertical	Pass
5	5121.000	43.06	10.34	74.0	30.94	Peak	210.30	100	Vertical	Pass
6	5717.250	44.50	10.50	74.0	29.50	Peak	155.50	100	Vertical	Pass

A.1.4 Test Antenna Horizontal, 1 GHz – 6 GHz



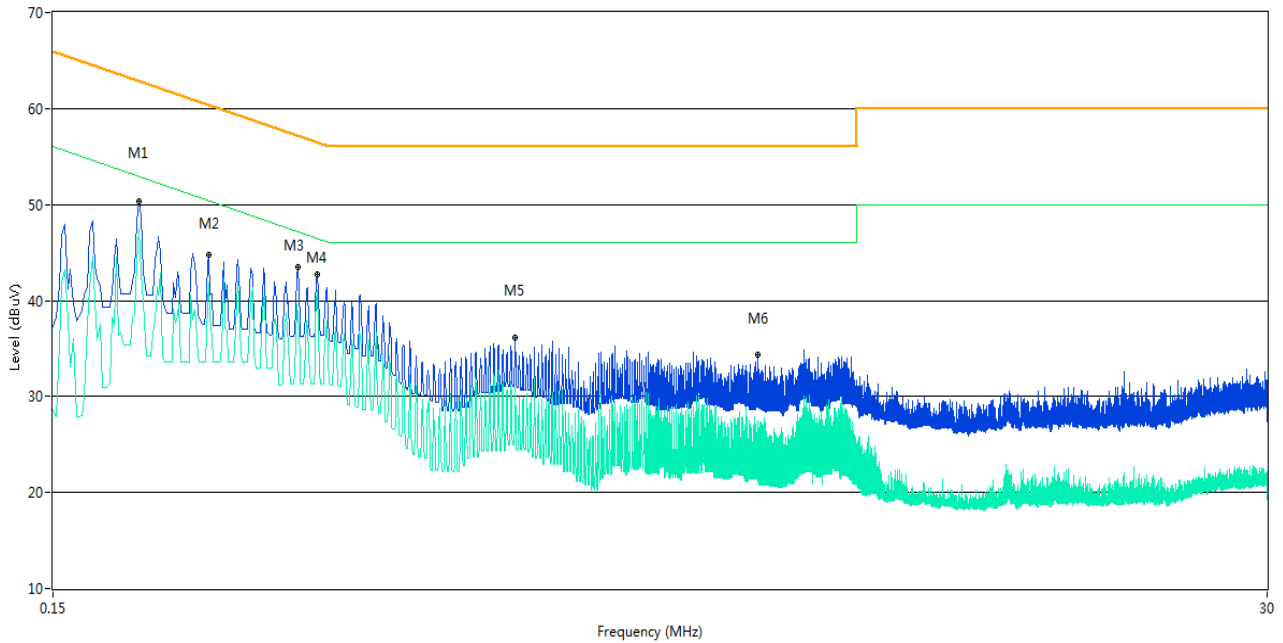
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1270.500	38.42	-3.72	74.0	35.58	Peak	358.40	100	Horizontal	Pass
2	1851.000	39.80	-1.93	74.0	34.20	Peak	308.90	100	Horizontal	Pass
3	2455.500	46.72	1.03	74.0	27.28	Peak	208.60	100	Horizontal	Pass
4	3631.500	42.46	6.44	74.0	31.54	Peak	309.40	100	Horizontal	Pass
5	3705.000	43.89	6.41	74.0	30.11	Peak	282.00	100	Horizontal	Pass
6	5036.250	42.55	10.09	74.0	31.45	Peak	245.30	100	Horizontal	Pass

A.2 Conducted Emission

Test Data and Plots

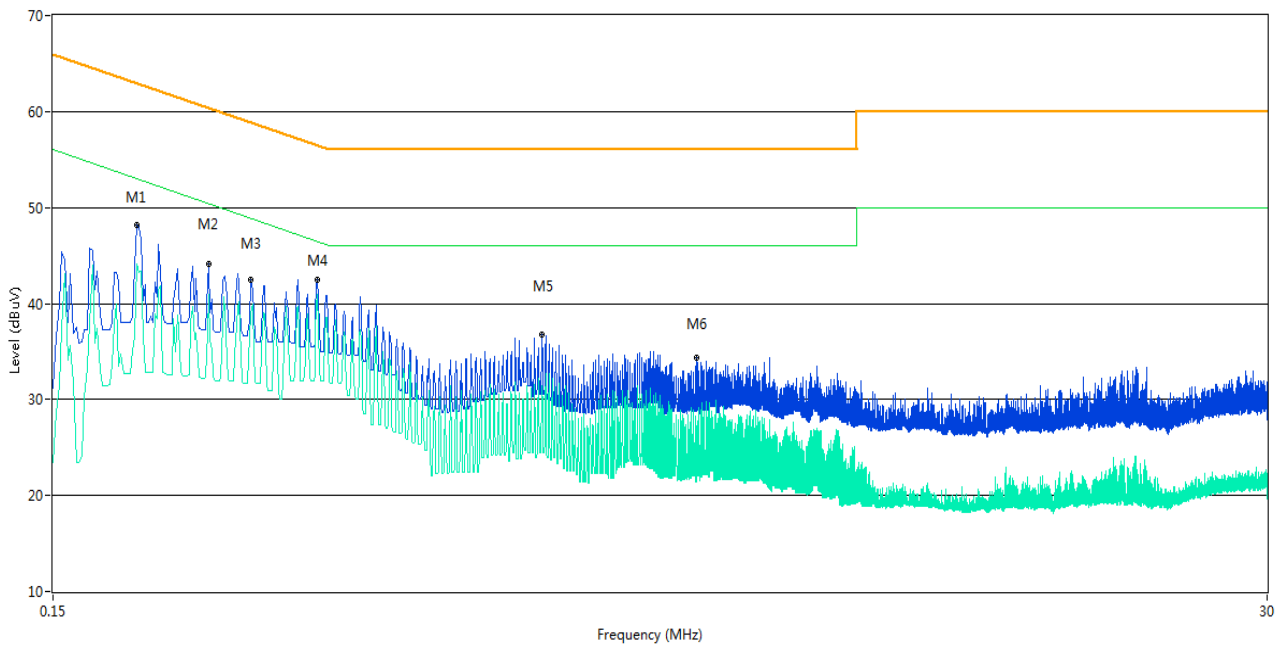
The USB Test Mode

A.2.1 L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.218	50.4	11.34	62.9	12.50	Peak	L Line	Pass
1**	0.218	47.5	11.34	52.9	5.40	AV	L Line	Pass
2	0.296	44.7	9.65	60.4	15.70	Peak	L Line	Pass
2**	0.296	41.9	9.65	50.4	8.50	AV	L Line	Pass
3	0.436	43.5	10.62	57.1	13.60	Peak	L Line	Pass
3**	0.436	38.5	10.62	47.1	8.60	AV	L Line	Pass
4	0.476	42.8	11.04	56.4	13.60	Peak	L Line	Pass
4**	0.476	41.1	11.04	46.4	5.30	AV	L Line	Pass
5	1.128	36.1	10.48	56.0	19.90	Peak	L Line	Pass
5**	1.128	30.9	10.48	46.0	15.10	AV	L Line	Pass
6	3.246	34.3	10.85	56.0	21.70	Peak	L Line	Pass
6**	3.246	27.5	10.85	46.0	18.50	AV	L Line	Pass

A.2.2 N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.216	48.1	10.82	63.0	14.90	Peak	N Line	Pass
1**	0.216	44.1	10.82	53.0	8.90	AV	N Line	Pass
2	0.296	44.1	9.65	60.4	16.30	Peak	N Line	Pass
2**	0.296	41.0	9.65	50.4	9.40	AV	N Line	Pass
3	0.356	42.5	9.29	58.8	16.30	Peak	N Line	Pass
3**	0.356	39.0	9.29	48.8	9.80	AV	N Line	Pass
4	0.476	42.5	11.04	56.4	13.90	Peak	N Line	Pass
4**	0.476	40.9	11.04	46.4	5.50	AV	N Line	Pass
5	1.266	36.8	10.15	56.0	19.20	Peak	N Line	Pass
5**	1.266	30.7	10.15	46.0	15.30	AV	N Line	Pass
6	2.492	34.3	10.80	56.0	21.70	Peak	N Line	Pass
6**	2.492	26.7	10.80	46.0	19.30	AV	N Line	Pass

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--