

TEST REPORT

FCC ID: 2AL2L915MHz

Product: Beacon HW v4.9

Model No.: 915MHz

Trade mark: N/A

Report No.: TCT170505E008

Issued Date: May 22, 2017

Issued for:

Marvelmind Robotics

**Lugovaya str., 4 bld 5 room 17, Skolkovo Innovation Center, Moscow,
143026, Russian Federation**

Issued By:

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1. Test Certification

Product:	Beacon HW v4.9
Model No.:	915MHz
Applicant:	Marvelmind Robotics
Address:	Lugovaya str., 4 bld 5 room 17, Skolkovo Innovation Center, Moscow, 143026, Russian Federation
Manufacturer:	Marvelmind Robotics
Address:	Lugovaya str., 4 bld 5 room 17, Skolkovo Innovation Center, Moscow, 143026, Russian Federation
Test Voltage:	DC 5 V (PC Input AC 120 V/ 60 Hz)
Date of Test:	May 17, 2017 ~ May 19, 2017
Applicable Standards:	47 CFR FCC Part 15 Subpart B: 2016 ANSI C63.4: 2014

The above equipment has been tested by Shenzhen Tongce Testing Lab and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Jerry
Jerry

Date: May 19, 2017

Check By: Joe Zhou
Joe Zhou

Date: May 22, 2017

Approved By: Tomsin
Tomsin

Date: May 22, 2017

2. Test Result Summary

Emission		
Test Method	Item	Result
FCC 47 CFR Part 15 Subpart B	Conducted Emission at Mains Terminals	Pass
	Radiated Emission	Pass

Note:

1. Pass: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.
5. The information of measurement uncertainty is available upon the customer's request.

3. EUT Description

Product Name:	Beacon HW v4.9
Model No.:	915MHz
Product Parameter:	Rechargeable Li-ion Battery DC 3.7V
AC Mains:	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:
DC Line:	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:
Control Line:	<input type="checkbox"/> Shielded <input type="checkbox"/> Unshielded, <input type="checkbox"/> Detachable <input type="checkbox"/> Un-detachable <input checked="" type="checkbox"/> Not applicable <input type="checkbox"/> Length:

4. Test Methodology

4.1. Decision of Final Test Mode

The EUT was tested together with the thereafter additional components, and a configuration, which produced the worst emission levels, was selected and recorded in this report.

The following test mode(s) were assessed:

Test Mode
Mode 1: Updating

4.2. EUT System Operation

1. Set up EUT with the support equipments.
2. Make sure the EUT work normally during the test.

5. Setup of Equipment under Test

5.1. Description of Support Units

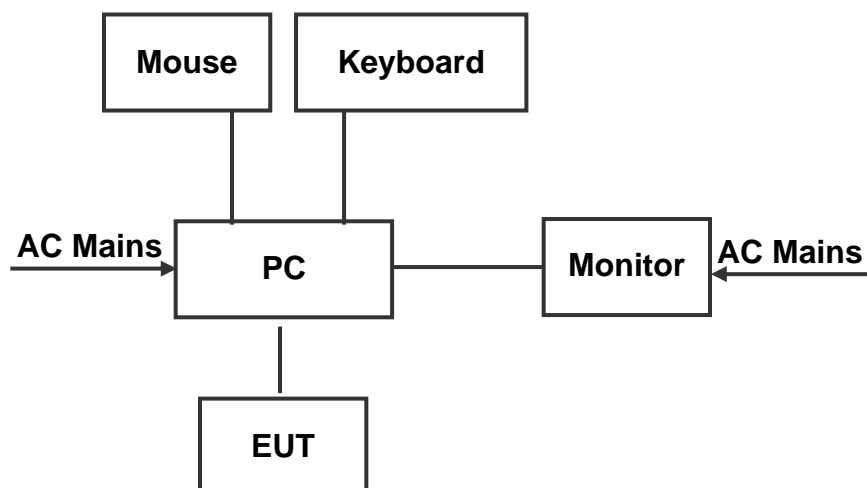
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
Keyboard	PK1100U	04G10418003 9DP	/	ASUS
Mouse	MOBTUO	04G12561017 0DP	/	ASUS
PC	BM6620	D1PFCG0008 HP	/	ASUS
Monitor	19PFL3120/T3	AU2A1241000 762	/	PHILIPS

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

5.2. Configuration of System Under Test



(EUT: Beacon HW v4.9)

6. Facilities and Accreditations

6.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 32. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

No.	Item	MU
1.	Temperature	$\pm 0.1^{\circ}\text{C}$
2.	Humidity	$\pm 1.0 \%$
3.	Spurious Emissions, Conducted	$\pm 2.56 \text{ dB}$
4.	All Emissions, Radiated	$\pm 4.50 \text{ dB}$

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of $k=2$.

7. Emission Test

7.1. Conducted Emission at Mains Terminals

7.1.1. Test Specification

Test Requirement:	FCC 47 CFR Part 15 Subpart B
Test Method:	ANSI C63.4: 2014
Frequency Range:	150 kHz to 30 MHz

7.1.2. Limits

Frequency (MHz)	Class A dB(uV)		Class B dB(uV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 – 56 ^a	56 – 46 ^a
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

a. Decreases with the logarithm of the frequency

7.1.3. Test Instruments

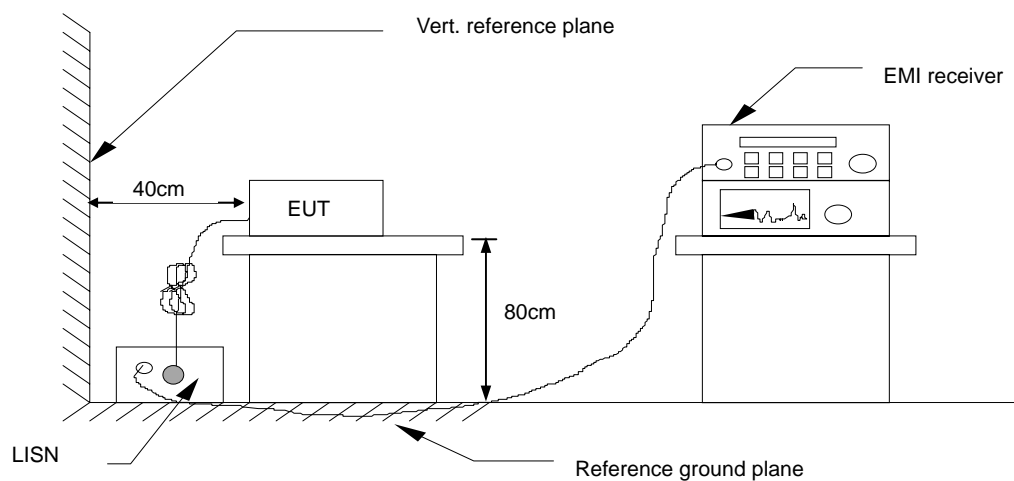
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	100139	Aug. 11, 2017
LISN	Schwarzbeck	NSLK 8126	8126453	Aug. 16, 2017

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.1.4. Test Method

The AMN was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN

7.1.5. Block Diagram of Test Setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.1.6. Test Results

Test Environment:	Temp.: 26 °C	Humid.: 60 %	Press.: 96 kPa
Test Mode:	Mode 1		
Test Voltage:	DC 5 V (PC Input AC 120 V/ 60 Hz)		
Test Result:	Pass		

Note:

L1 = Live Line / N = Neutral Line

“---” denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.

Freq. = Emission frequency in MHz

Reading level dB(μV) = Receiver reading

Corr. Factor (dB) = Attenuator factor + Cable loss

Level dB(μV) = Reading level dB(μV) + Corr. Factor (dB)

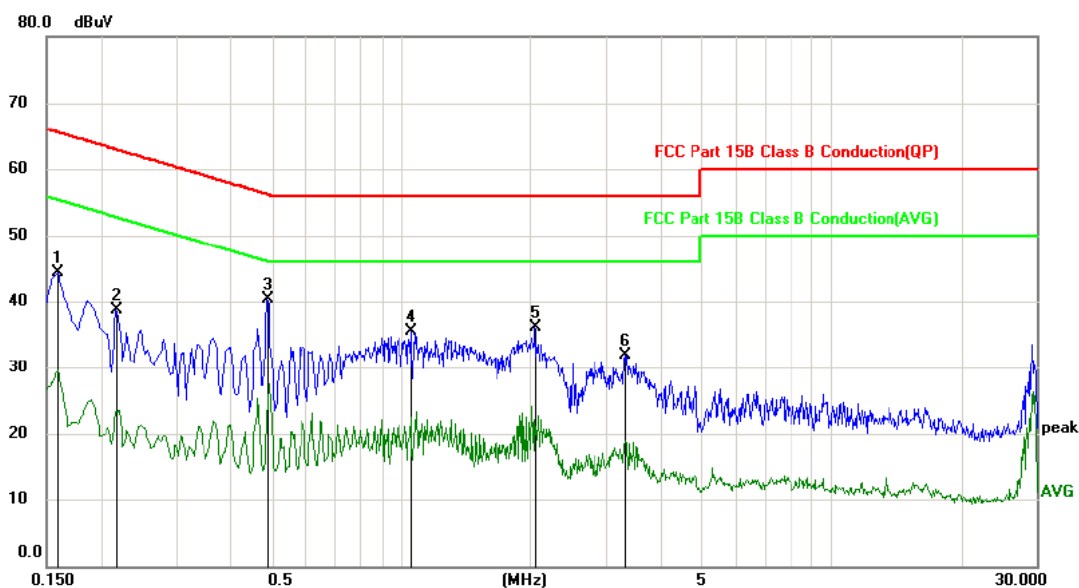
Limit dB(μV) = Limit stated in standard

Margin (dB) = Level dB(μV) – Limits dB(μV)

Q.P. =Quasi-Peak

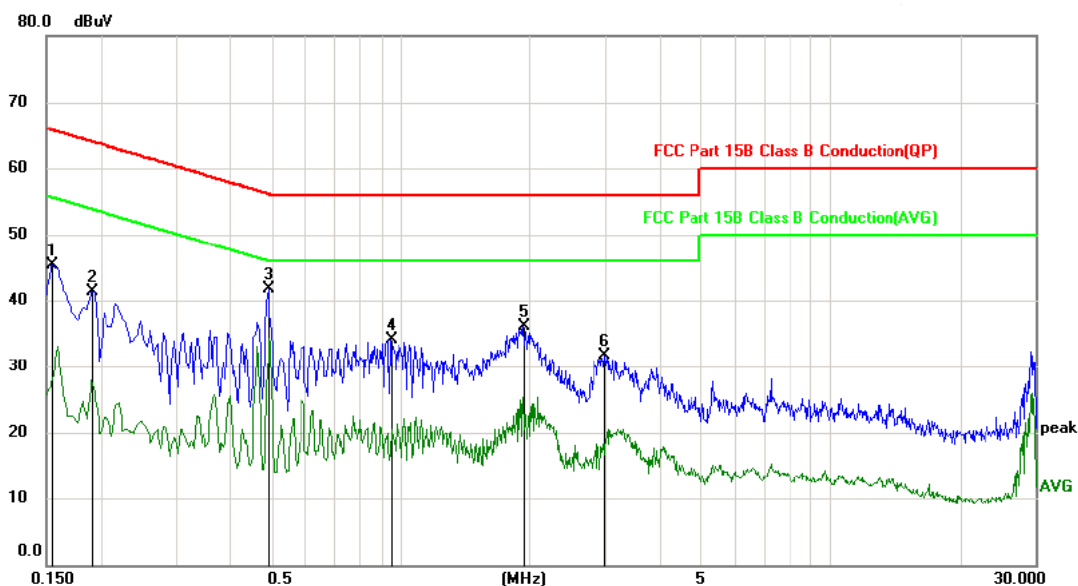
AVG=Average

Please refer to following diagram for individual



Site: Phase: **L1** Temperature: 26
 Limit: FCC Part 15B Class B Conduction(QP) Power:
 Mode: Updating Humidity: 60 %
 Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1590	32.77	11.47	44.24	65.52	-21.28	peak	
2		0.2175	27.25	11.44	38.69	62.91	-24.22	peak	
3	*	0.4875	29.02	11.31	40.33	56.21	-15.88	peak	
4		1.0590	24.29	11.23	35.52	56.00	-20.48	peak	
5		2.0535	24.49	11.67	36.16	56.00	-19.84	peak	
6		3.3270	20.72	11.21	31.93	56.00	-24.07	peak	



Site: Phase: **N** Temperature: 26
 Limit: FCC Part 15B Class B Conduction(QP) Power: Humidity: 60 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1545	33.88	11.47	45.35	65.75	-20.40	peak	
2		0.1905	29.88	11.45	41.33	64.01	-22.68	peak	
3	*	0.4920	30.38	11.30	41.68	56.13	-14.45	peak	
4		0.9465	22.80	11.21	34.01	56.00	-21.99	peak	
5		1.9320	24.48	11.65	36.13	56.00	-19.87	peak	
6		2.9849	20.29	11.34	31.63	56.00	-24.37	peak	

7.2. Radiated Emission

7.2.1. Test Specification

Test Requirement:	FCC 47 CFR Part 15 Subpart B
Test Method:	ANSI C63.4: 2014
Frequency Range:	30 MHz to 1000 MHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical

7.2.2. Limits

Frequency (MHz)	Class A (at 3m)	Class B (at 3m)
	dBuV/m	dBuV/m
30 ~ 88	49.0	40.0
88 ~ 216	53.5	43.5
216 ~ 960	56.4	46.0
960 ~ 1000	59.5	54.0

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level $\text{dB}(\mu\text{V/m}) = 20 \log \text{Emission level } (\mu\text{V/m})$.

7.2.3. Test Instruments

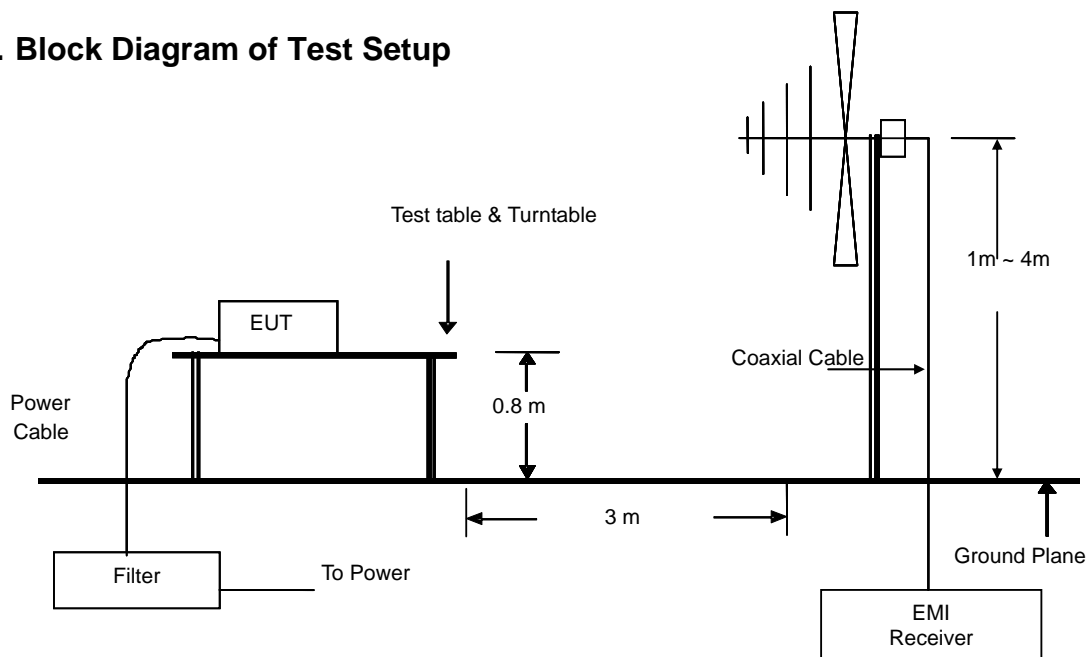
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESVD	100008	Aug. 11, 2017
Spectrum Analyzer	R&S	FSEM	848597-001	Aug. 11, 2017
Amplifier	HP	8447D	2727A05017	Aug. 11, 2017
Amplifier	EM	EM30265	07032613	Aug. 11, 2017
Broadband Antenna	Schwarzbeck	VULB9163	340	Aug. 13, 2017
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Aug. 13, 2017

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

7.2.4. Test Method

Measurements were made in a 3-meter semi-anechoic chamber or Open Area Test Site that complies to CISPR 16. Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements (quasi-peak) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable. Block Diagram of Test Setup.

7.2.5. Block Diagram of Test Setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration

7.2.6. Test Results

Test Environment:	Temp.: 25 °C	Humid.: 55 %	Press.: 96 kPa
Test Mode:	Mode 1		
Test Voltage:	DC 5 V (PC Input AC 120 V/ 60 Hz)		
Test Result:	Pass		

Note:

Freq. = Emission frequency in MHz

Reading level dB(μV) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss

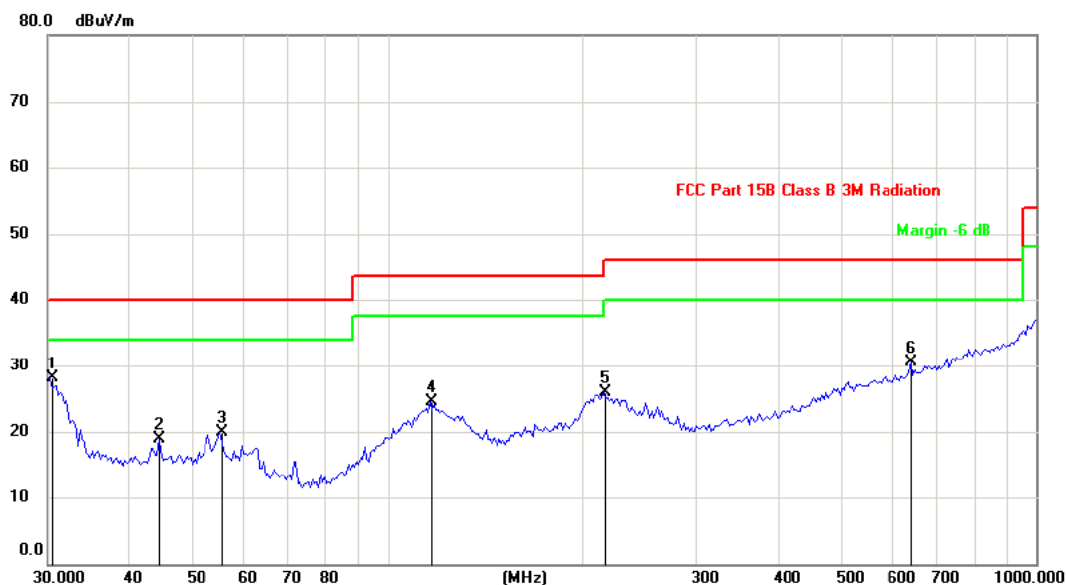
Measurement dB(μV/m) = Reading level dB(μV) + Corr. Factor (dB)

Limit dB(μV/m) = Limit stated in standard

Margin (dB) = Measurement dB(μV/m) – Limits dB(μV/m)

Q.P. =Quasi-Peak

Please refer to following diagram for individual



Site

Polarization: **Horizontal**

Temperature: 25

Limit: FCC Part 15B Class B 3M Radiation

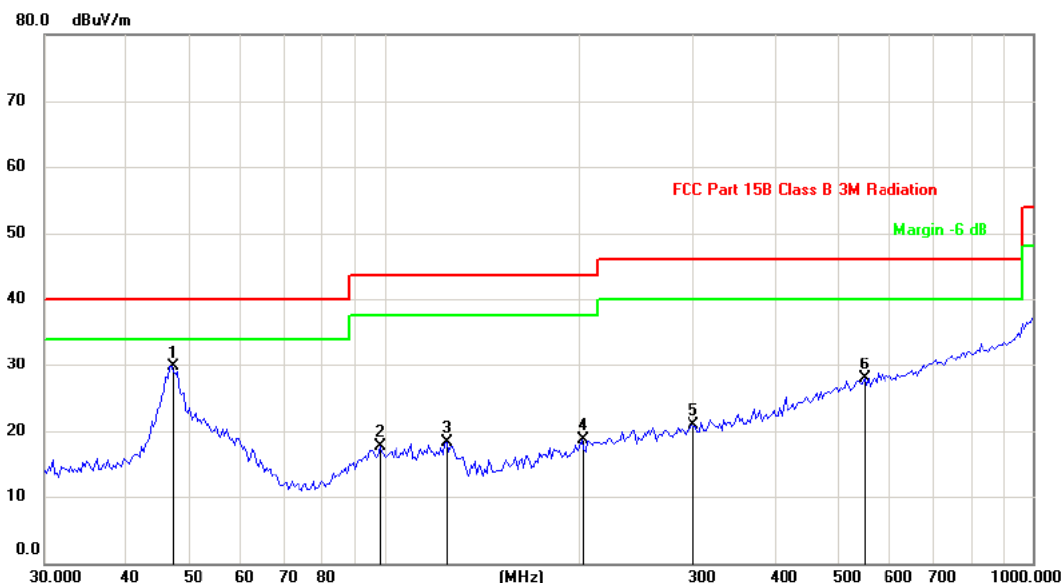
Power:

Humidity: 55 %

Mode: Updating

Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	30.2116	41.78	-13.69	28.09	40.00	-11.91	peak		
2		44.4657	31.21	-12.28	18.93	40.00	-21.07	peak		
3		55.2883	32.31	-12.45	19.86	40.00	-20.14	peak		
4		116.4476	37.56	-13.06	24.50	43.50	-19.00	peak		
5		216.1197	36.98	-11.12	25.86	46.00	-20.14	peak		
6		642.2923	31.56	-1.06	30.50	46.00	-15.50	peak		



Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15B Class B 3M Radiation Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

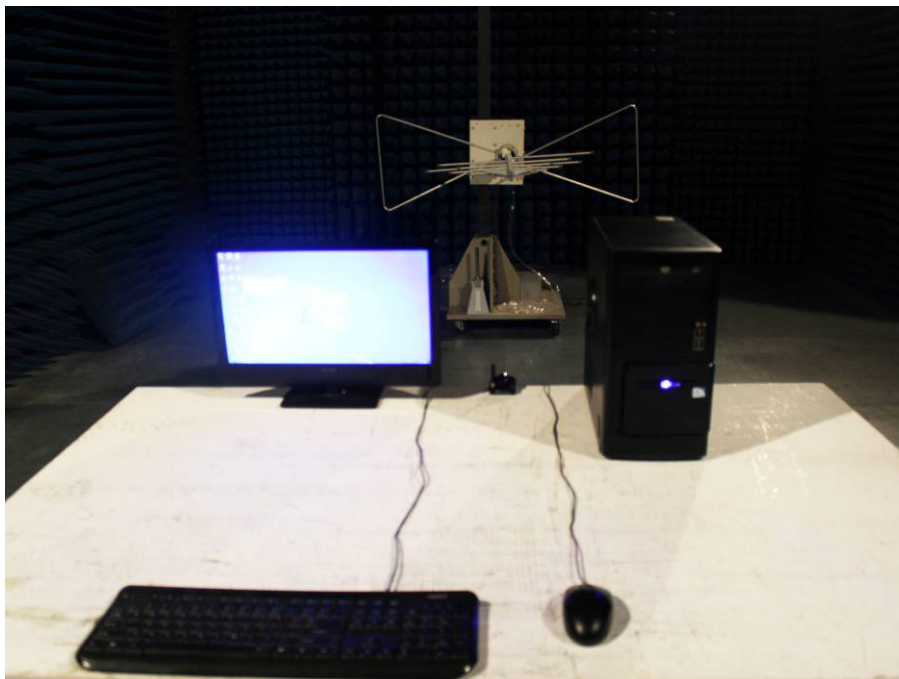
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	47.0371	41.93	-12.16	29.77	40.00	-10.23	peak		
2		98.3752	29.41	-11.68	17.73	43.50	-25.77	peak		
3		124.9249	32.55	-14.33	18.22	43.50	-25.28	peak		
4		201.4539	30.34	-11.63	18.71	43.50	-24.79	peak		
5		298.5932	29.23	-8.29	20.94	46.00	-25.06	peak		
6		550.2902	30.38	-2.45	27.93	46.00	-18.07	peak		

8. Photographs of Test Configuration

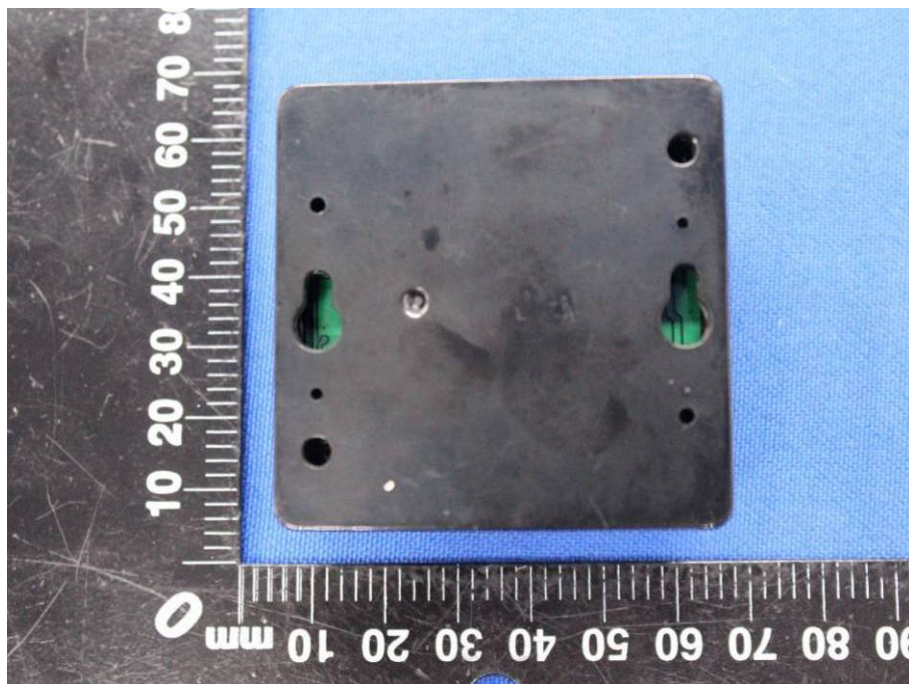
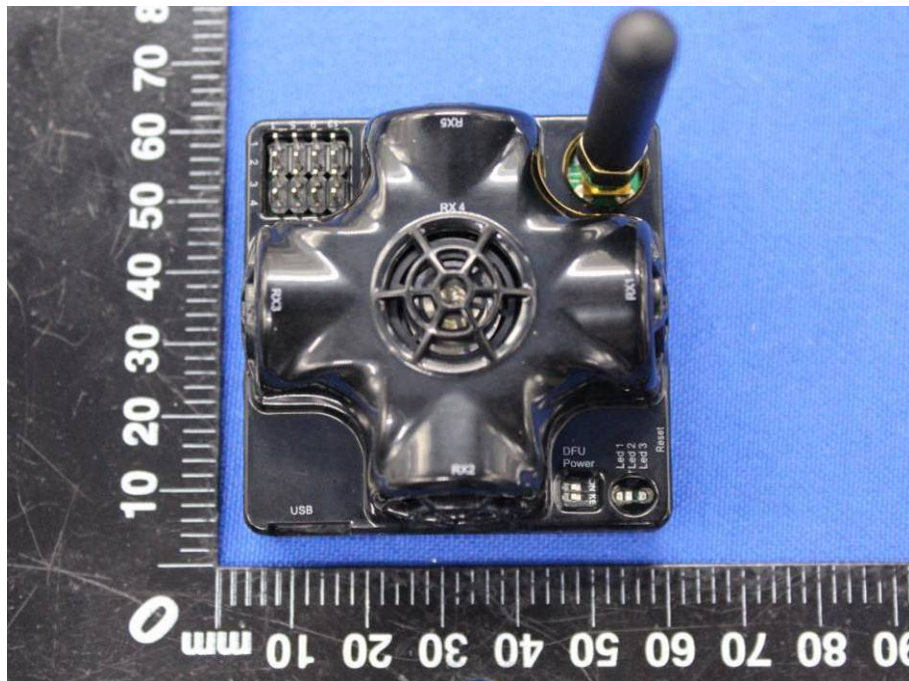
Conducted Emission Test View

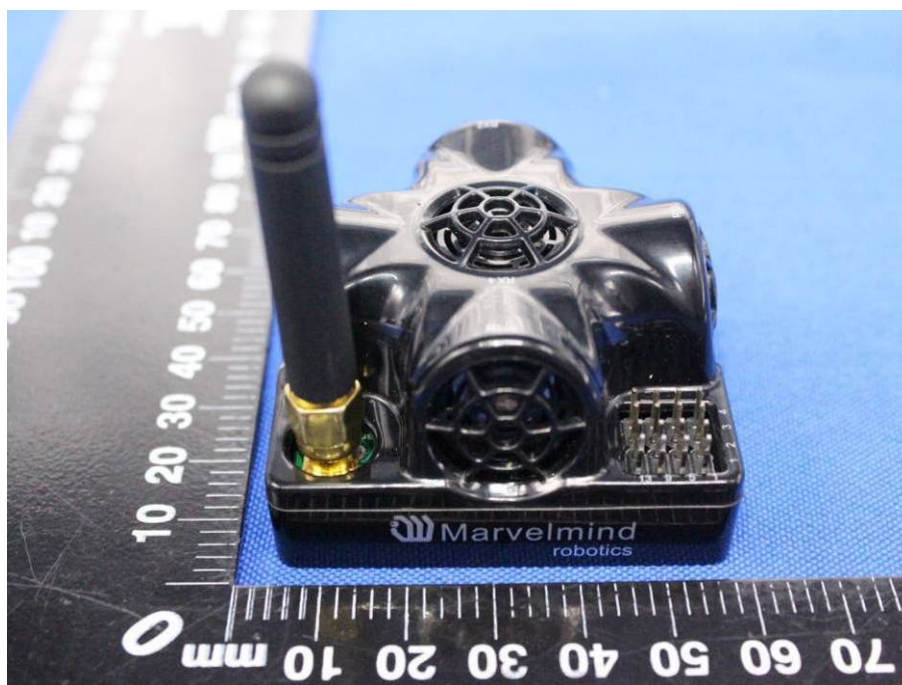


Radiated Emission Test View

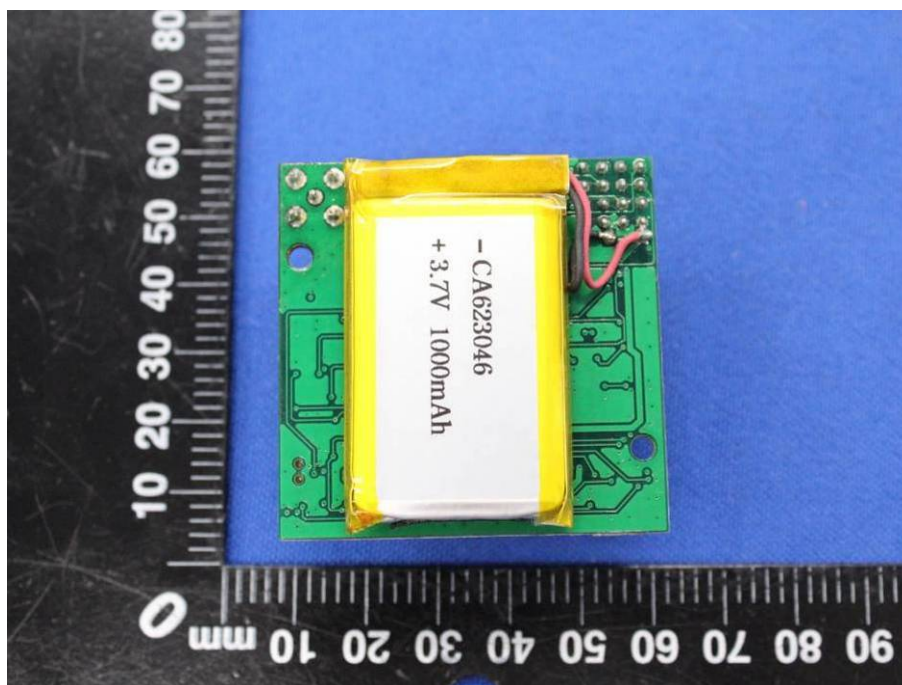
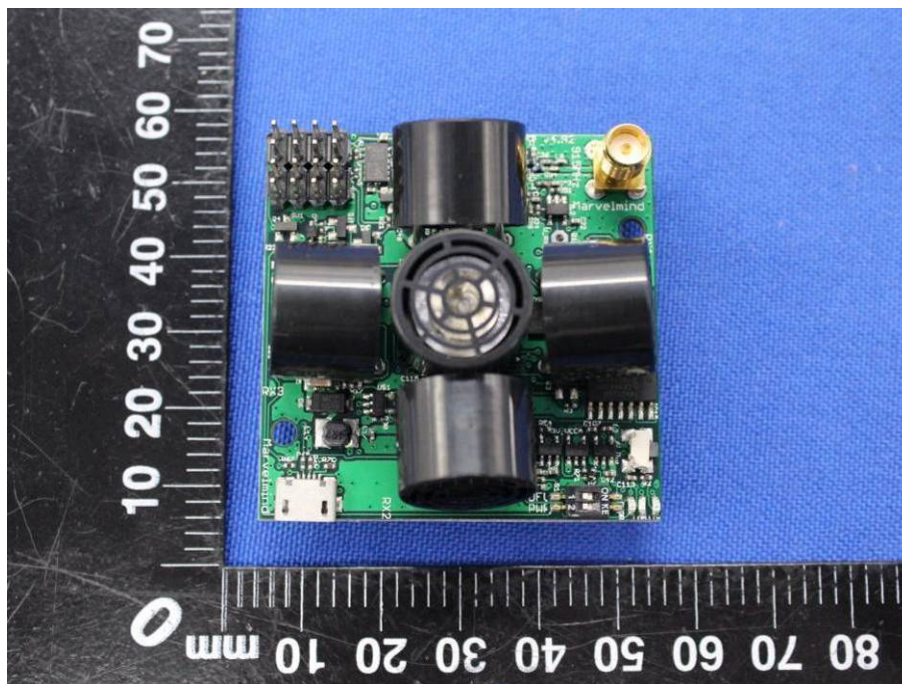


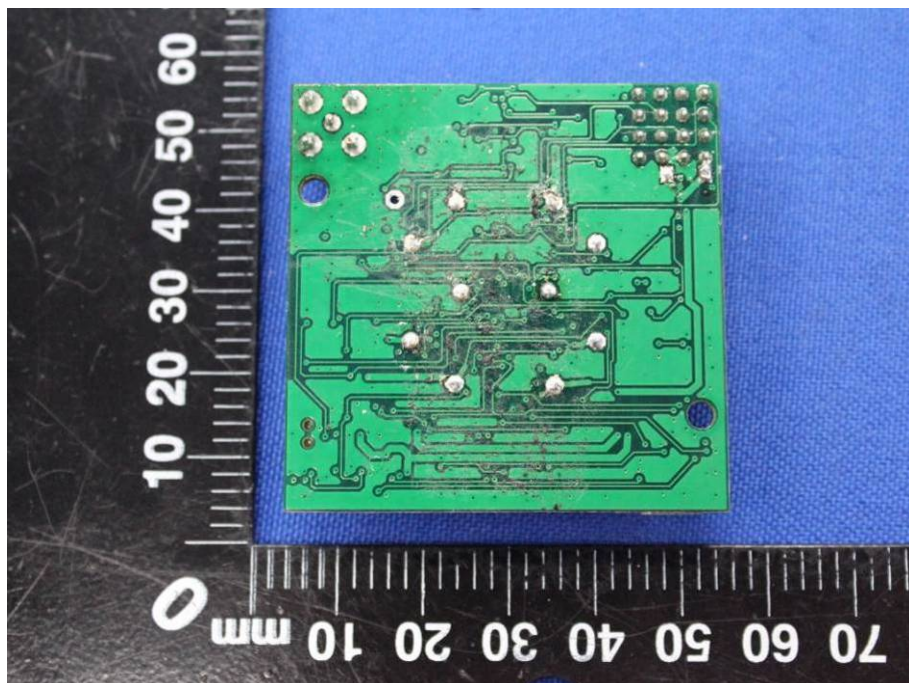
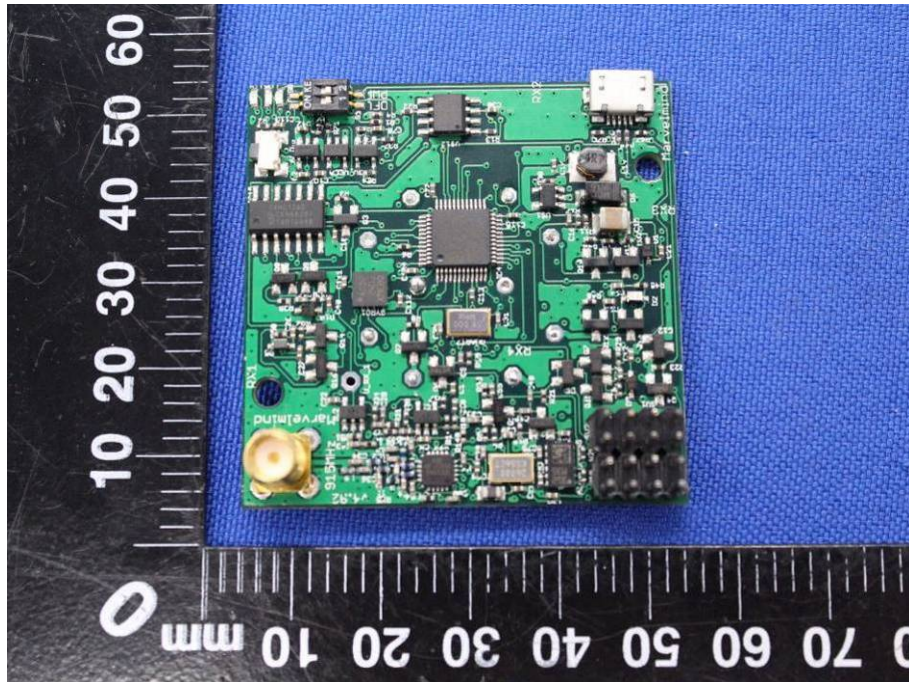
9. Photographs of EUT

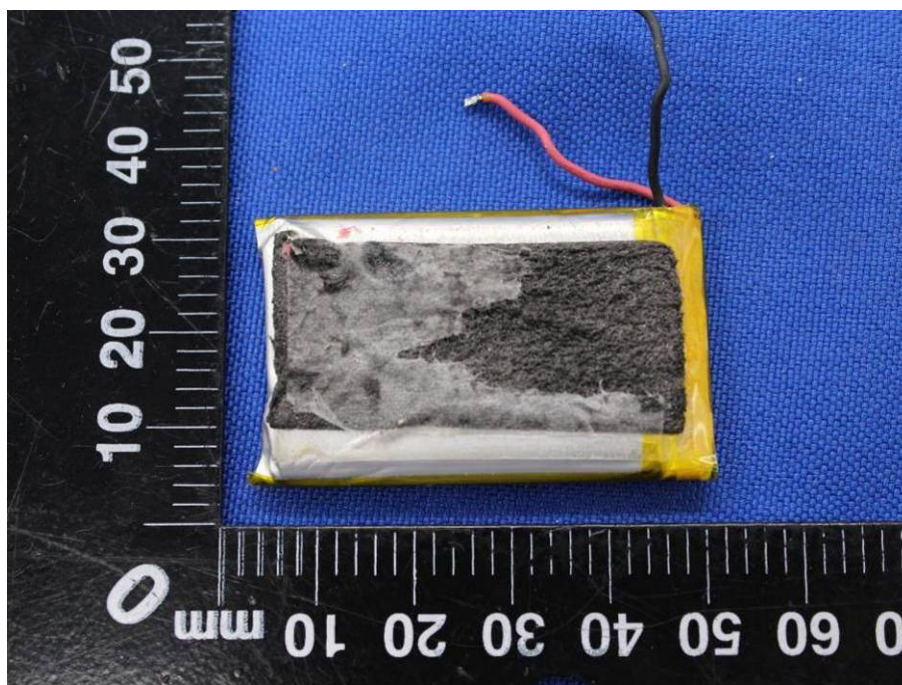
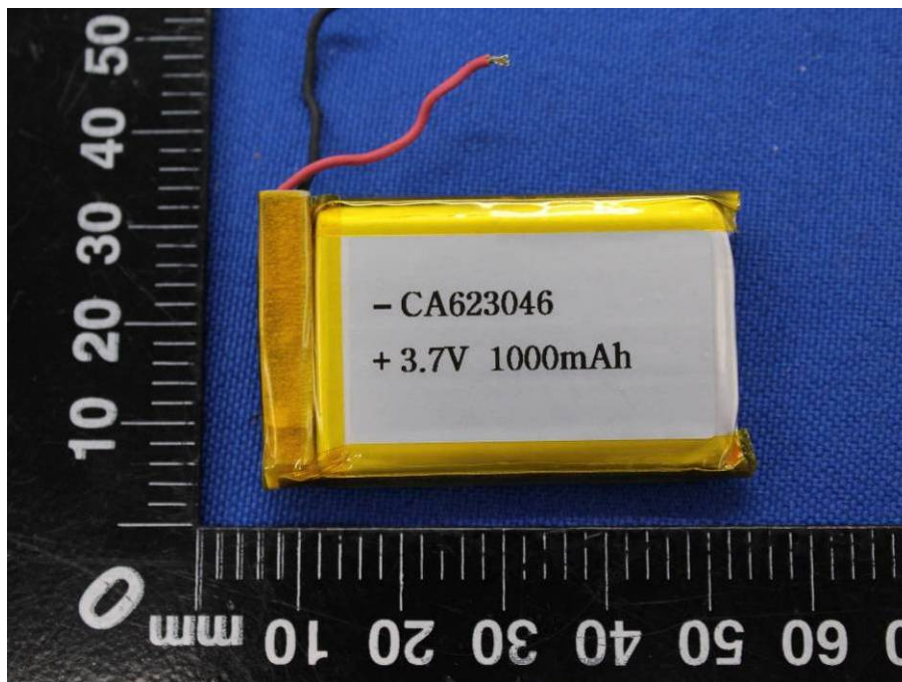












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