

TEST REPORT

FCC ID: 2AL2L915MHZM

Product: Modem 915MHz v4.95

Model No.: 915MHz

Trade mark: N/A

Report No.: TCT170720E007

Issued Date: Aug. 30, 2017

Issued for:

Marvelmind Robotics

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

Issued By:

Shenzhen Tongce Testing Lab

**1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District,
Shenzhen, Guangdong, China**

TEL: +86-755-27673339

FAX: +86-755-27673332

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1. Test Certification

Product:	Modem 915MHz v4.95
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:	Aug. 28, 2017 ~ Aug. 30, 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

Date:

Aug. 30, 2017

Jerry

Check By:

Joe Zhou

Date:

Aug. 30, 2017

Joe Zhou

Approved By:

Tomsin

Date:

Aug. 30, 2017

Tomsin

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:	Modem 915MHz v4.95
Model No.:	915MHz
Product Parameter:	Input: DC 5.0 V
AC Mains:	☐ Shielded ☐ Unshielded, ☐ Detachable ☐ Un-detachable ☒ Not applicable ☐ Length:
DC Line:	☐ Shielded ☐ Unshielded, ☐ Detachable ☐ Un-detachable ☒ Not applicable ☐ Length:
Control Line:	☐ Shielded ☐ Unshielded, ☐ Detachable ☐ Un-detachable ☒ Not applicable ☐ 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

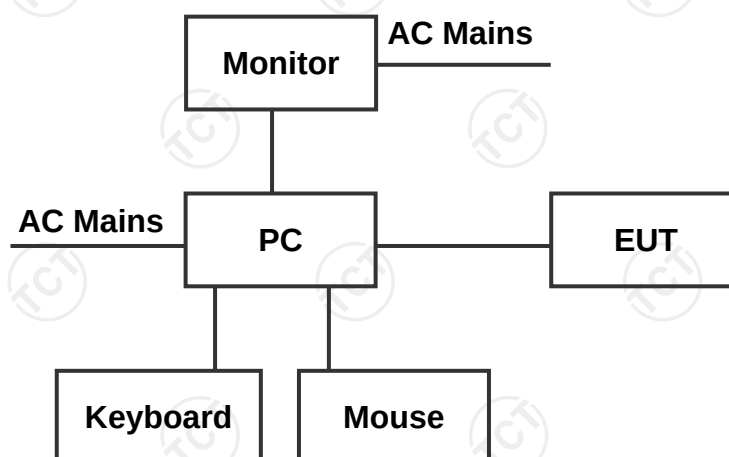
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
PC	Inspiron 3668	CN-04T4P2-C1332-26C-0013	/	Dell
Monitor	SE1918HV	CN-0YVJCX-FCC00-75D-AUAB-A00	/	Dell
Mouse	MS116p	CN-009NK2-73826-74M-0QI9	/	Dell
Keyboard	KB216t	CN-0RKR0N-71616-75I-0CYQ-A03	/	Dell

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: Modem 915MHz v4.95)

6. Facilities and Accreditations

6.1. Facilities

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

Test Firm Registration Number: 645098

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	$\pm 4.28 \text{ dB}$

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 B dB(μV)	
	Quasi-peak	Average
0.15 - 0.5	66 – 56 ^a	56 – 46 ^a
0.50 - 5.0	56	46
5.0 - 30.0	60	50

a. Decreases with the logarithm of the frequency

7.1.3. Test Instruments

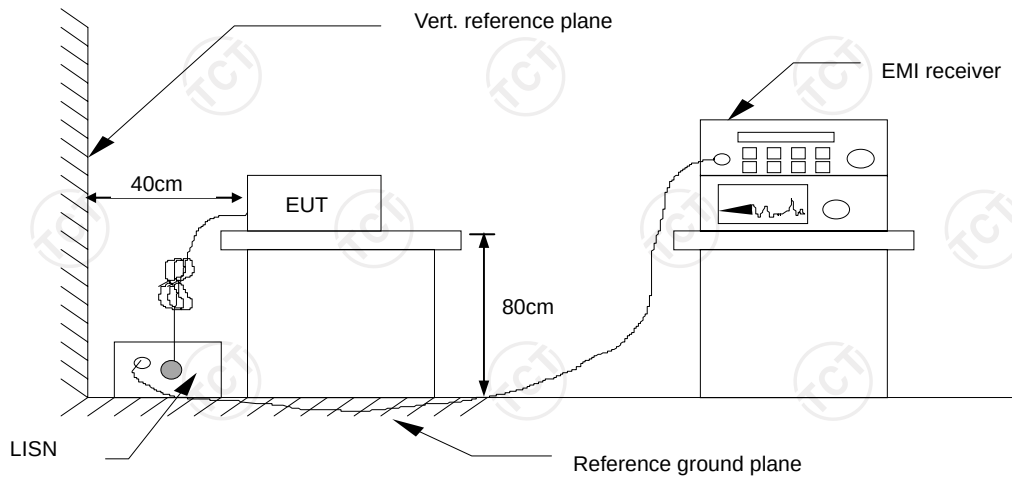
Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCS30	100139	Oct. 13, 2017
LISN	Schwarzbeck	NSLK 8126	8126453	Oct. 13, 2017

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

7.1.4. 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.: 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:

L1 = Live Line / N = Neutral Line

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Correct Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

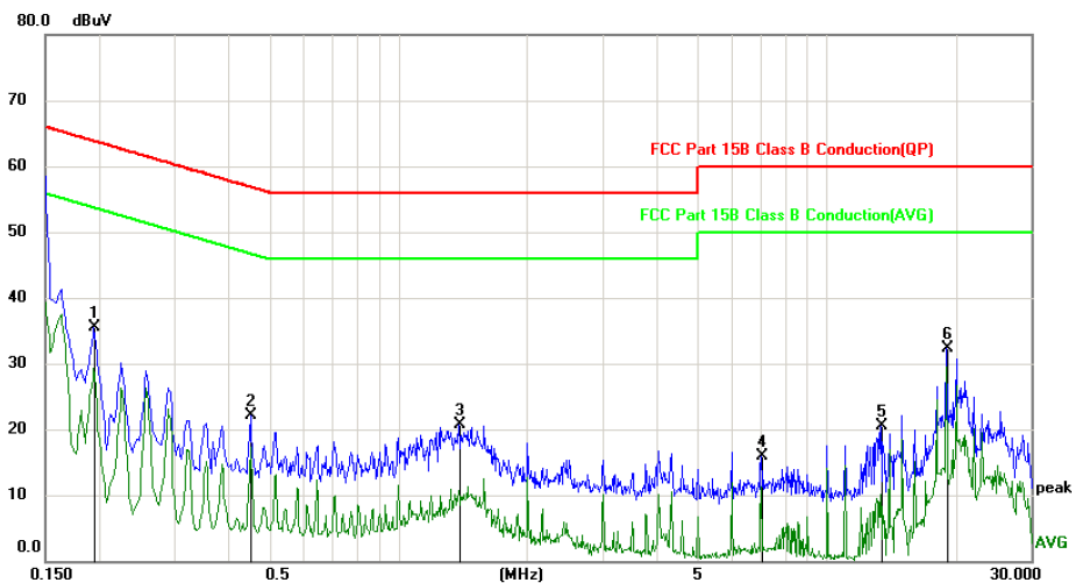
Limit (dBμV) = Limit stated in standard

Margin (dB) = Measurement (dBμV) – Limits (dBμV)

Q.P. =Quasi-Peak AVG =average

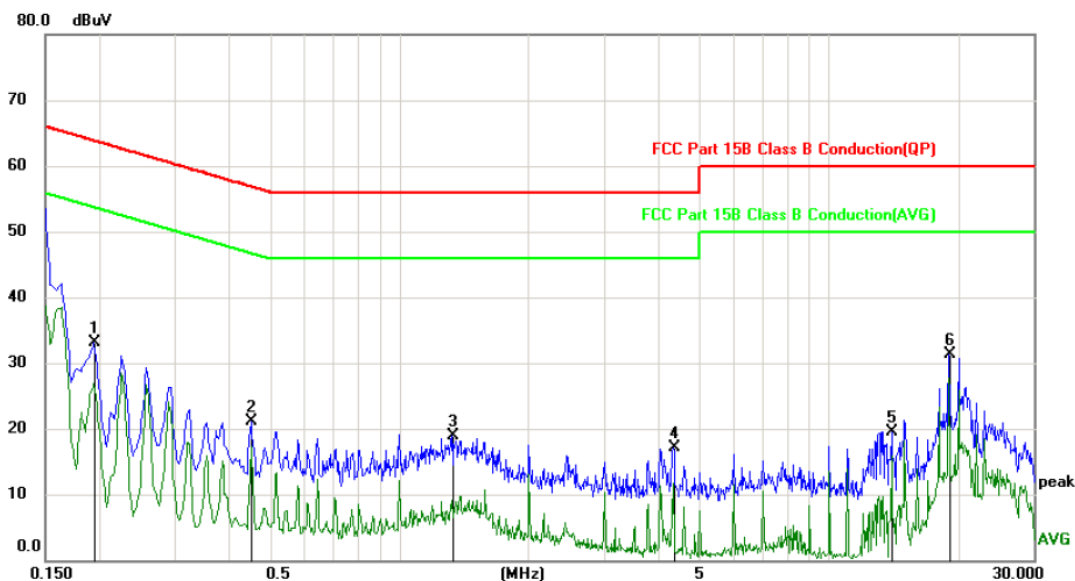
* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

Please refer to following diagram for individual



Site: Phase: **L1** Temperature: 25
 Limit: FCC Part 15B Class B Conduction(QP) Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.1949	34.09	1.45	35.54	63.83	-28.29	peak	
2	0.4515	20.87	1.32	22.19	56.85	-34.66	peak	
3	1.3875	19.27	1.38	20.65	56.00	-35.35	peak	
4	7.0260	15.06	0.92	15.98	60.00	-44.02	peak	
5	13.3935	19.03	1.50	20.53	60.00	-39.47	peak	
6 *	19.0725	31.46	0.76	32.22	60.00	-27.78	peak	



Site: Phase: **N** Temperature: 25
 Limit: FCC Part 15B Class B Conduction(QP) Power:
 Mode: Updating Humidity: 55 %
 Note: DC 5V(PC Input AC 120V/60Hz)

No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over		
	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	0.1949	31.66	1.45	33.11	63.83	-30.72	peak	
2	0.4515	19.72	1.32	21.04	56.85	-35.81	peak	
3	1.3245	17.50	1.36	18.86	56.00	-37.14	peak	
4	4.3395	16.21	0.85	17.06	56.00	-38.94	peak	
5	14.0595	17.88	1.58	19.46	60.00	-40.54	peak	
6 *	19.0815	30.47	0.76	31.23	60.00	-28.77	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 6000 MHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical

7.2.2. Limits

Below 1 GHz

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

Above 1 GHz

Frequency (MHz)	Peak Value (at 3m)	Average (at 3m)
	dBuV/m	dBuV/m
Above 1GHz	74.0	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

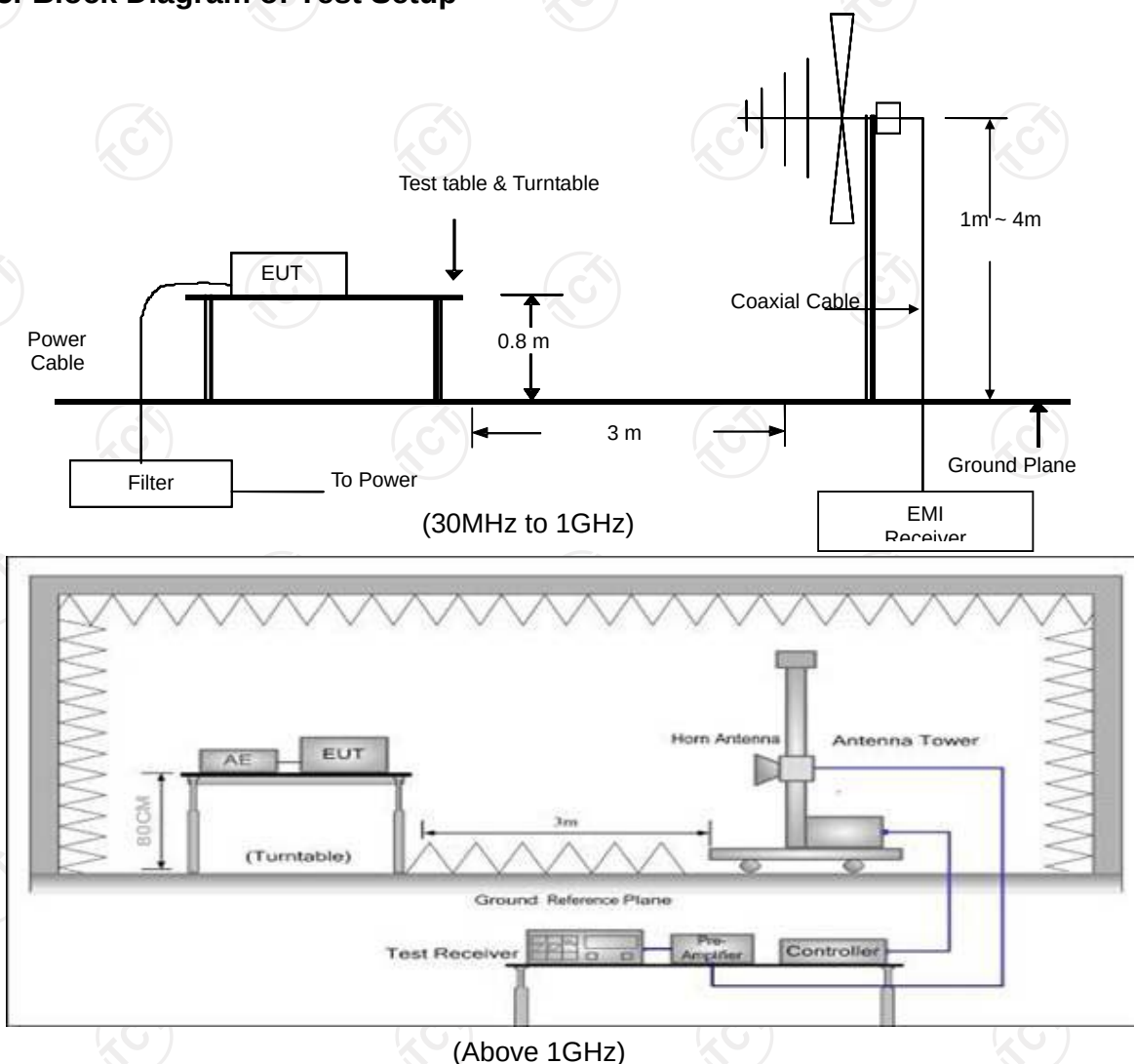
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESVD	100008	Oct. 13, 2017
Spectrum Analyzer	R&S	FSEM	848597-001	Oct. 13, 2017
Amplifier	HP	8447D	2727A05017	Oct. 13, 2017
Amplifier	EM	EM30265	07032613	Oct. 13, 2017
Broadband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

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

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

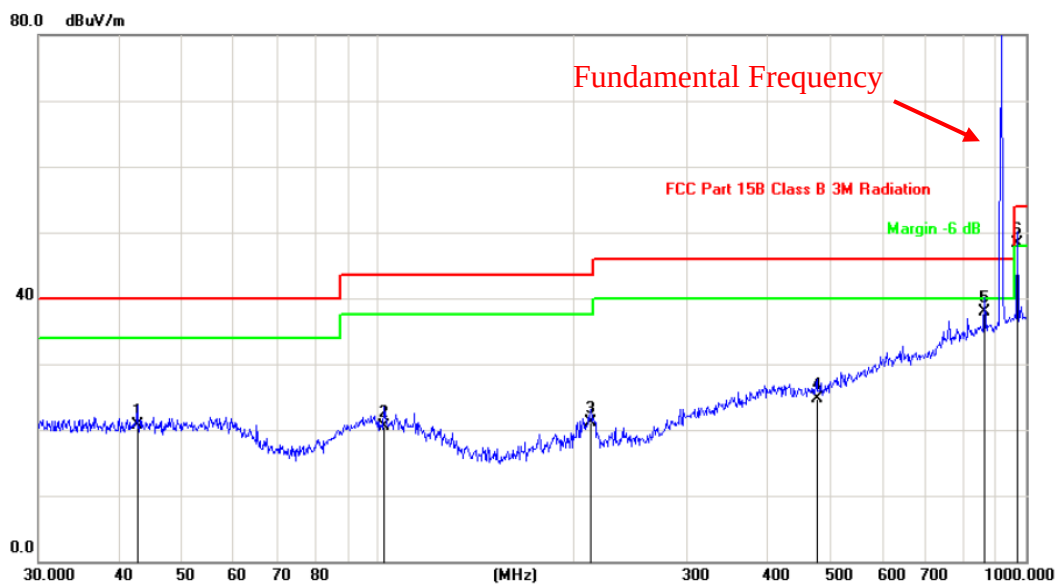
Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

Margin (dB) = Measurement (dBμV) – Limits (dBμV)

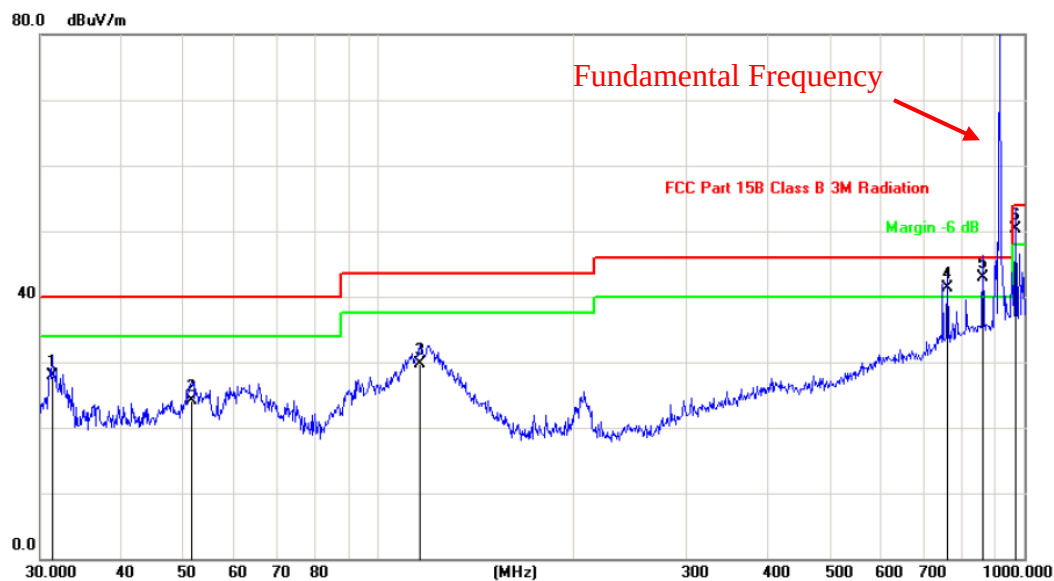
* is meaning the worst frequency has been tested in the test frequency range

Please refer to following diagram for individual



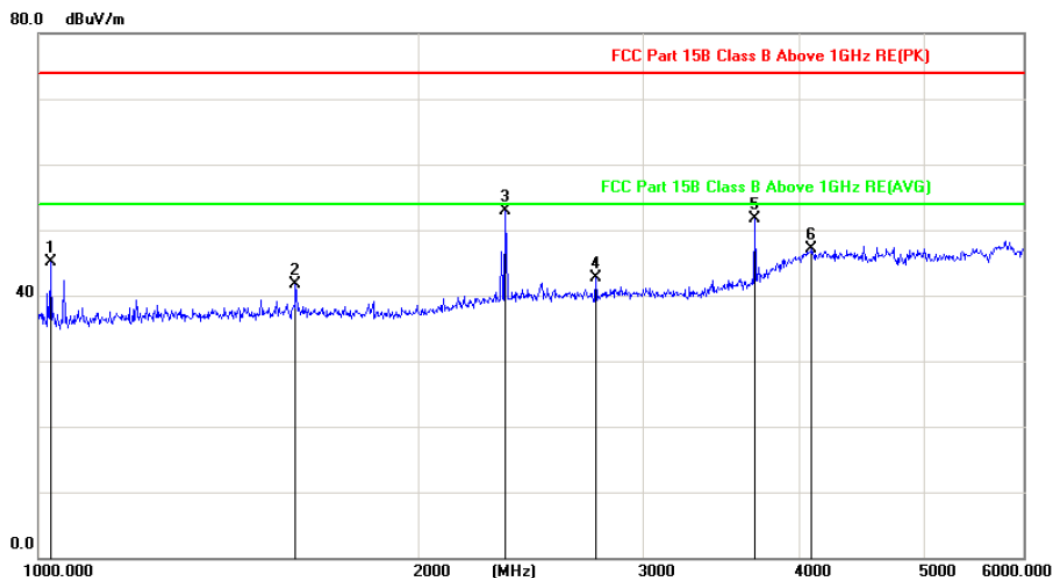
Site: Polarization: **Horizontal** Temperature: 25
 Limit: FCC Part 15B Class B 3M Radiation Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree	Comment
1		42.6000	27.60	-6.96	20.64	40.00	-19.36	QP		
2		102.3597	27.10	-6.61	20.49	43.50	-23.01	QP		
3		213.0149	30.20	-9.07	21.13	43.50	-22.37	QP		
4		475.4990	26.20	-1.45	24.75	46.00	-21.25	QP		
5		863.0562	30.90	7.08	37.98	46.00	-8.02	QP		
6	*	968.9338	39.50	8.73	48.23	54.00	-5.77	QP		



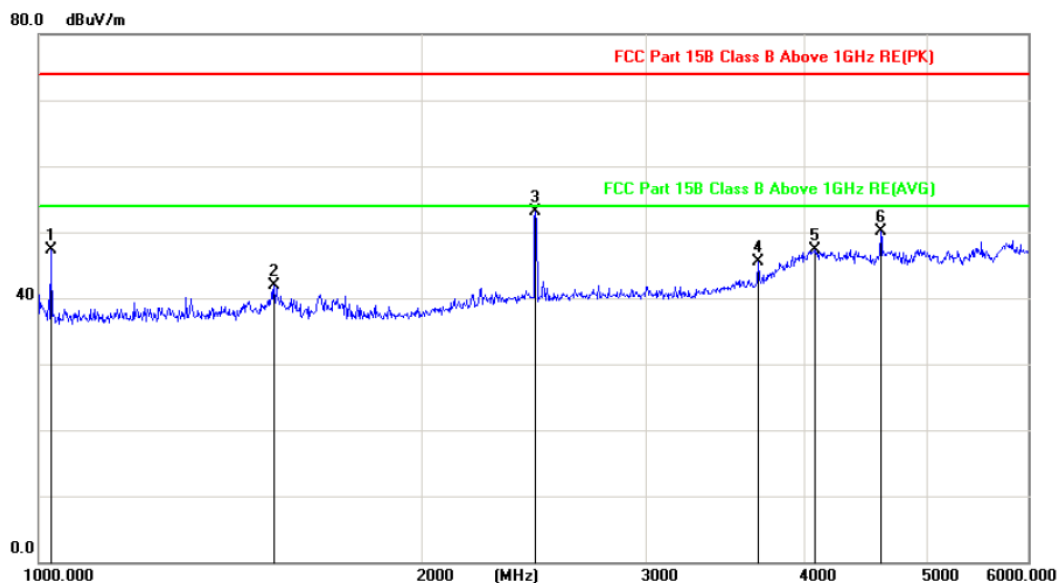
Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15B Class B 3M Radiation Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree	Comment
1		31.2893	35.80	-7.89	27.91	40.00	-12.09	QP		
2		51.4806	30.90	-6.86	24.04	40.00	-15.96	QP		
3		116.1320	38.10	-8.39	29.71	43.50	-13.79	QP		
4	!	760.7036	35.80	5.47	41.27	46.00	-4.73	QP		
5	*	863.0562	35.80	7.08	42.88	46.00	-3.12	QP		
6	!	968.9338	41.60	8.73	50.33	54.00	-3.67	QP		



Site: Polarization: **Horizontal** Temperature: 25
 Limit: FCC Part 15B Class B Above 1GHz RE(PK) Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree	Detector	Comment
1		1021.734	57.67	-12.62	45.05	74.00	-28.95			peak	
2		1596.237	53.59	-11.90	41.69	74.00	-32.31			peak	
3	*	2337.996	62.94	-10.08	52.86	74.00	-21.14			peak	
4		2756.980	51.92	-9.29	42.63	74.00	-31.37			peak	
5		3678.883	57.85	-6.06	51.79	74.00	-22.21			peak	
6		4081.772	49.58	-2.50	47.08	74.00	-26.92			peak	



Site: Polarization: **Vertical** Temperature: 25
 Limit: FCC Part 15B Class B Above 1GHz RE(PK) Power: Humidity: 55 %
 Mode: Updating
 Note: DC 5V(PC Input AC 120V/60Hz)

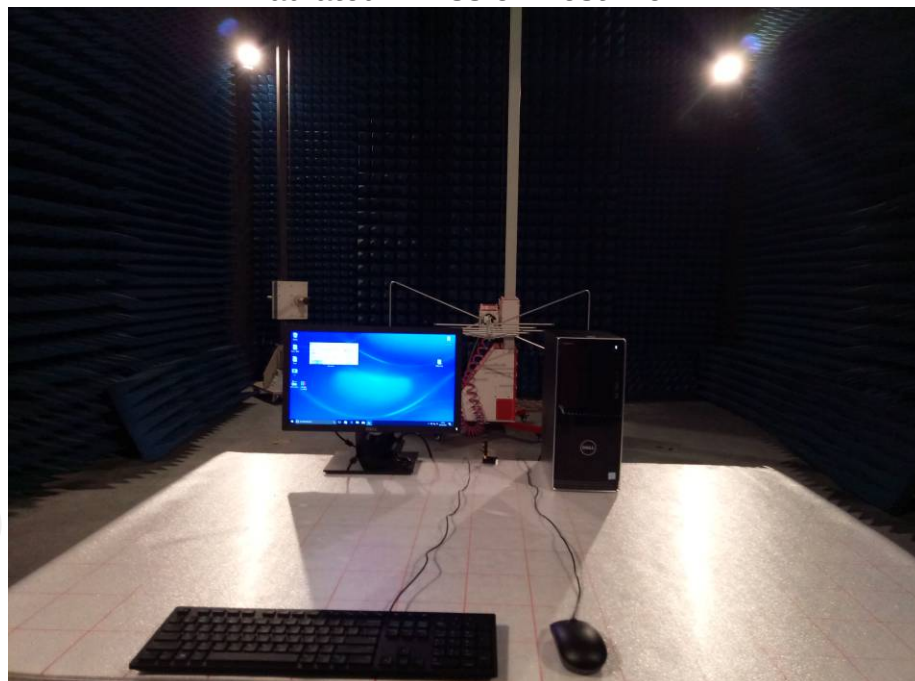
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree	Comment
1		1021.734	59.94	-12.62	47.32	74.00	-26.68	peak		
2		1531.793	53.62	-11.79	41.83	74.00	-32.17	peak		
3	*	2458.283	62.55	-9.54	53.01	74.00	-20.99	peak		
4		3678.883	51.48	-6.06	45.42	74.00	-28.58	peak		
5		4081.772	49.72	-2.50	47.22	74.00	-26.78	peak		
6		4594.166	52.46	-2.28	50.18	74.00	-23.82	peak		

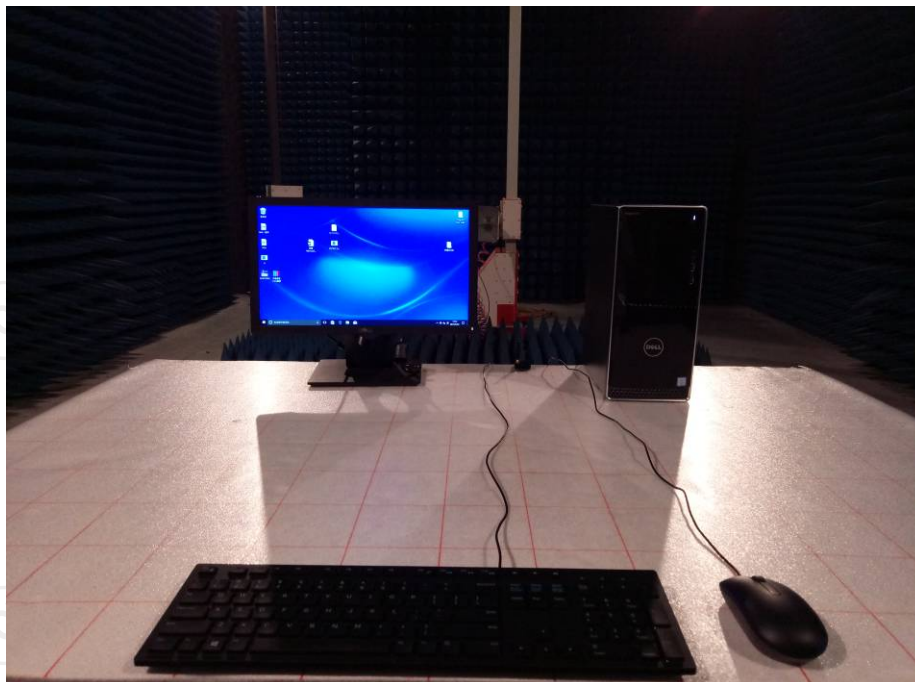
8. Photographs of Test Configuration

Conducted Emission Test View

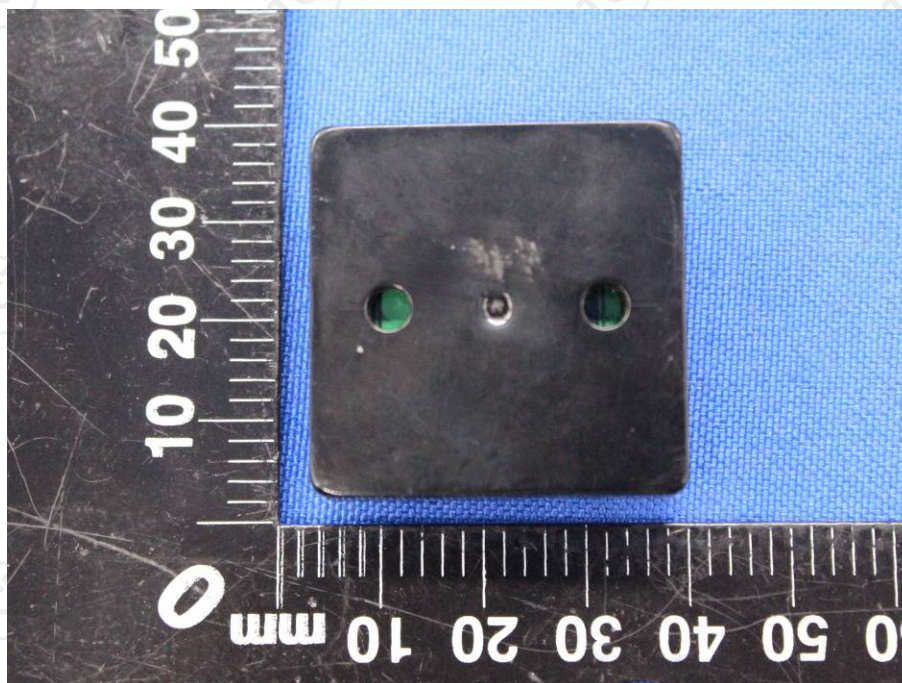
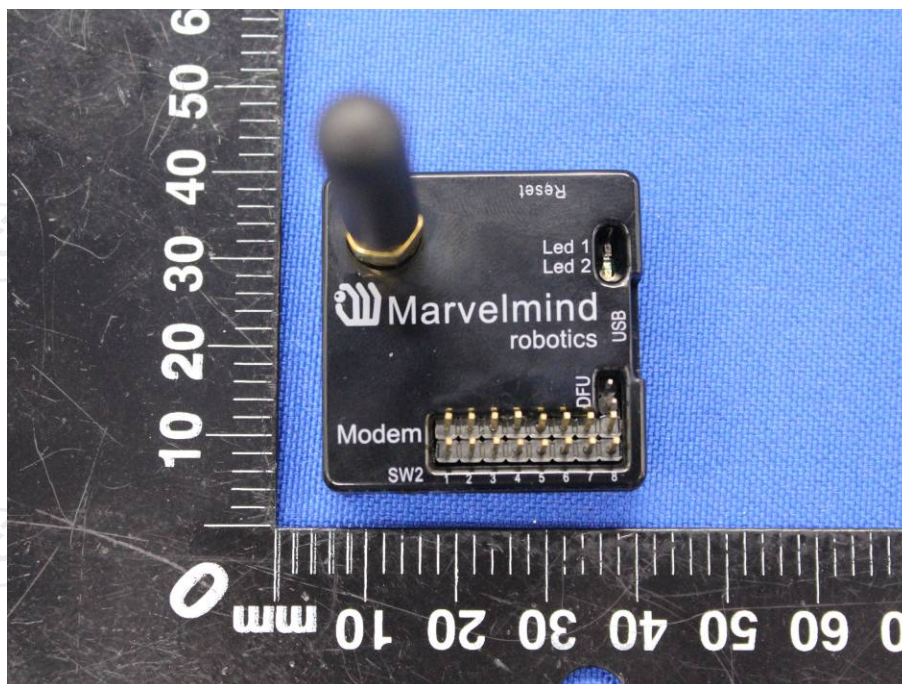


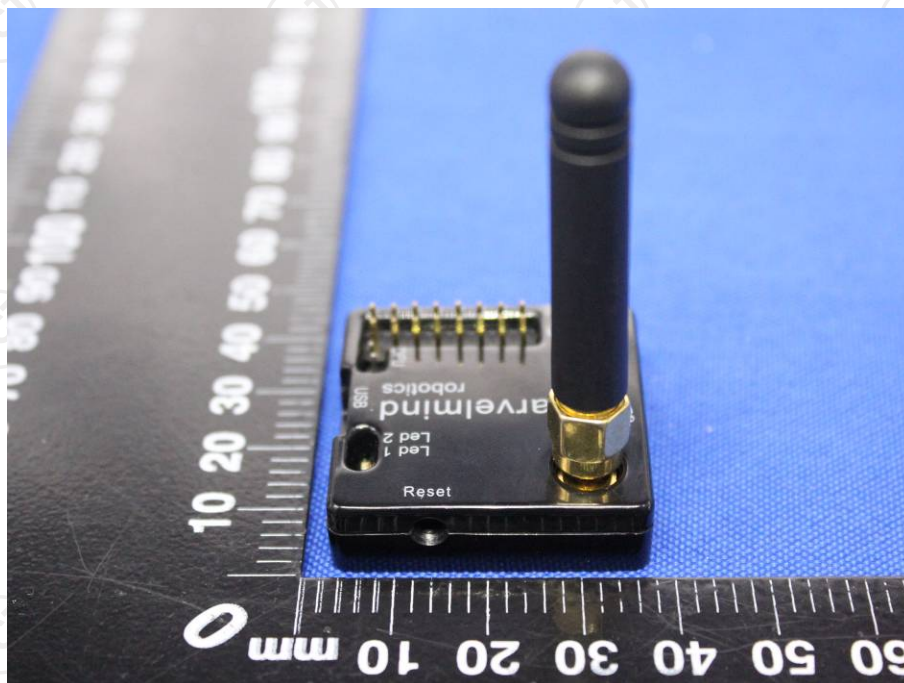
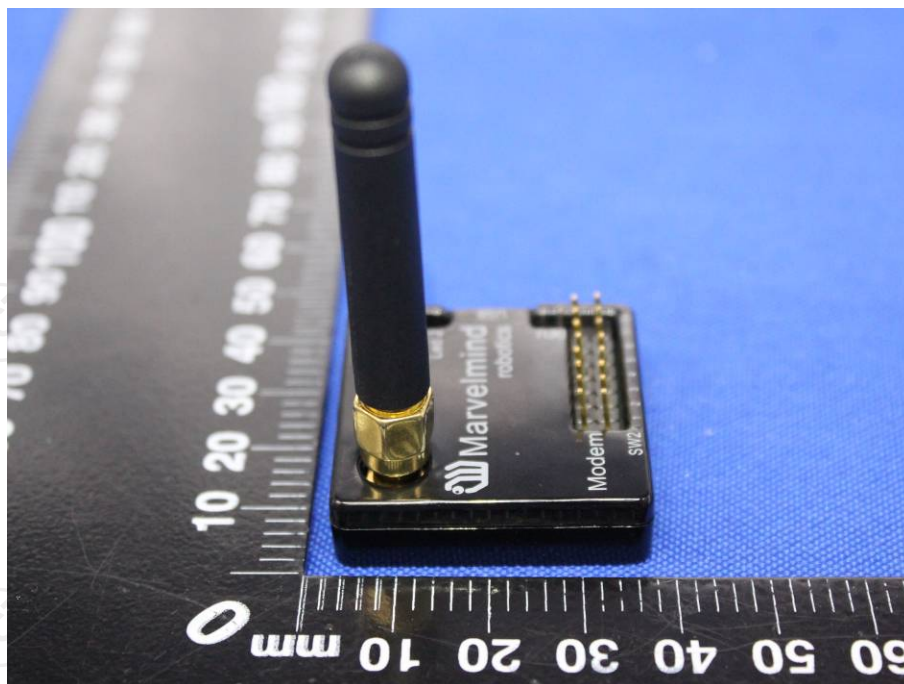
Radiated Emission Test View

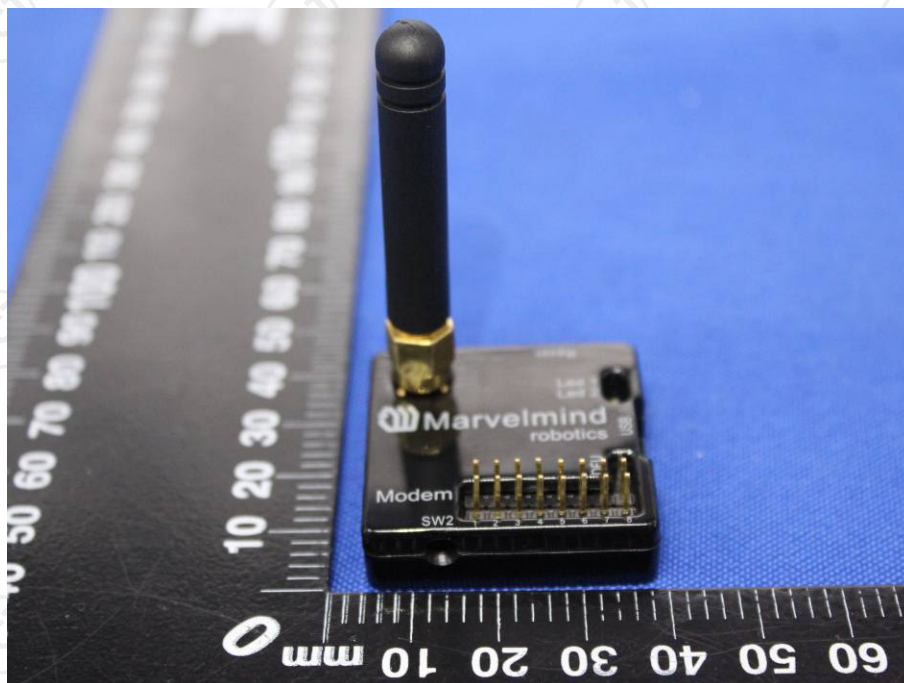
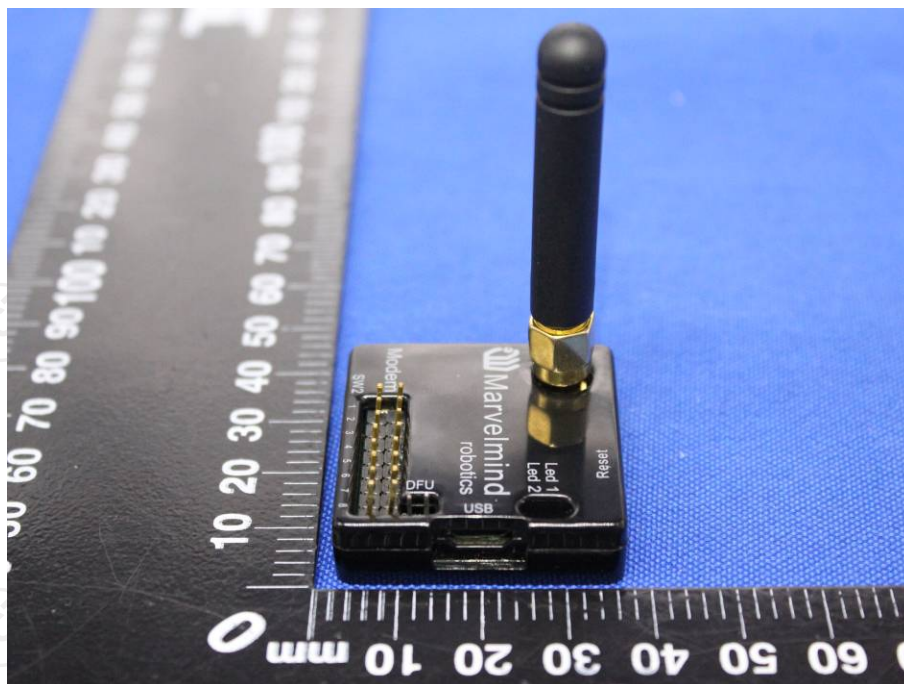


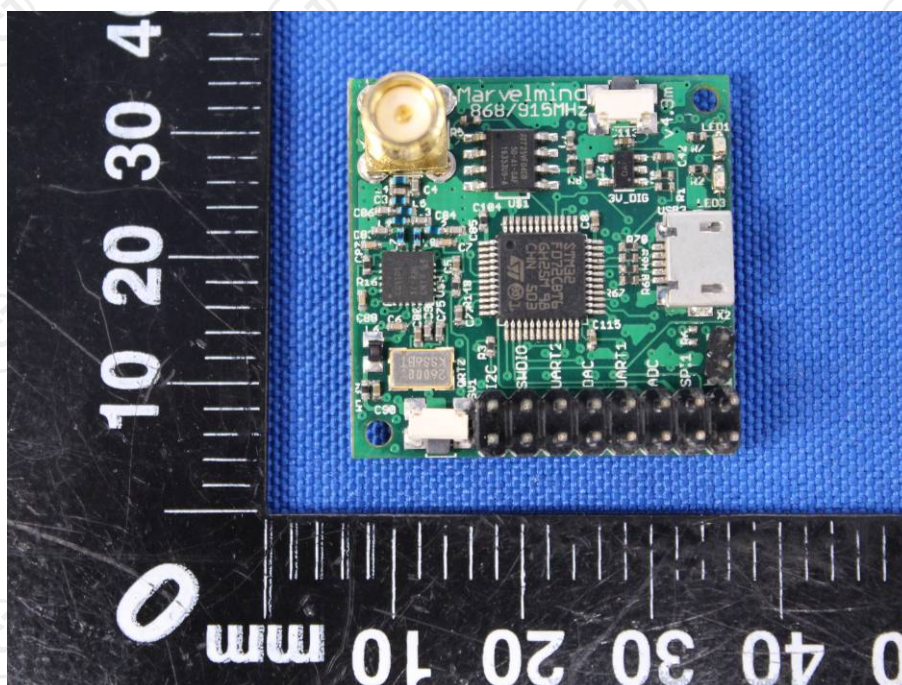
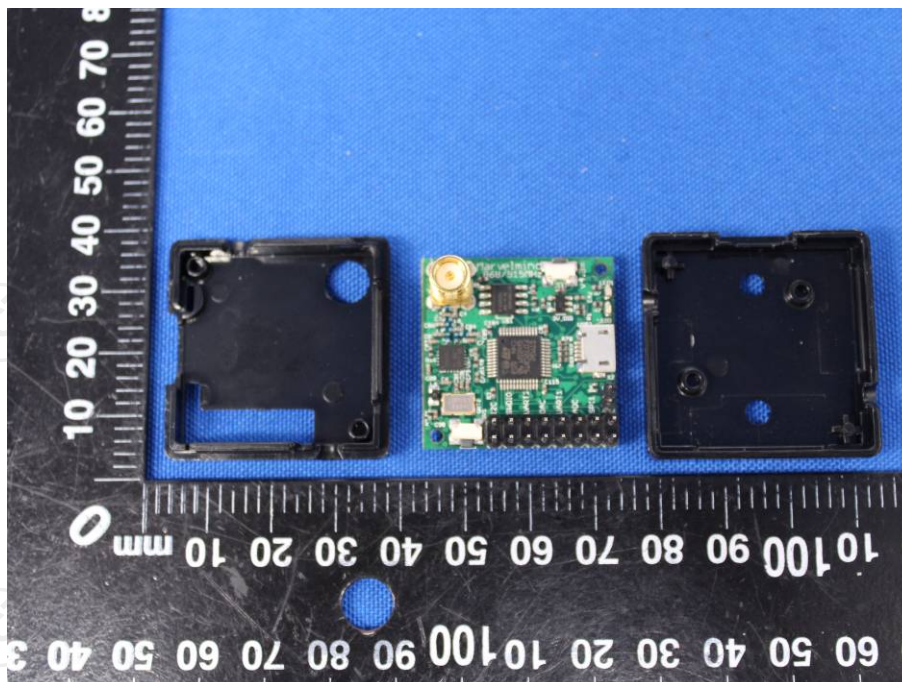


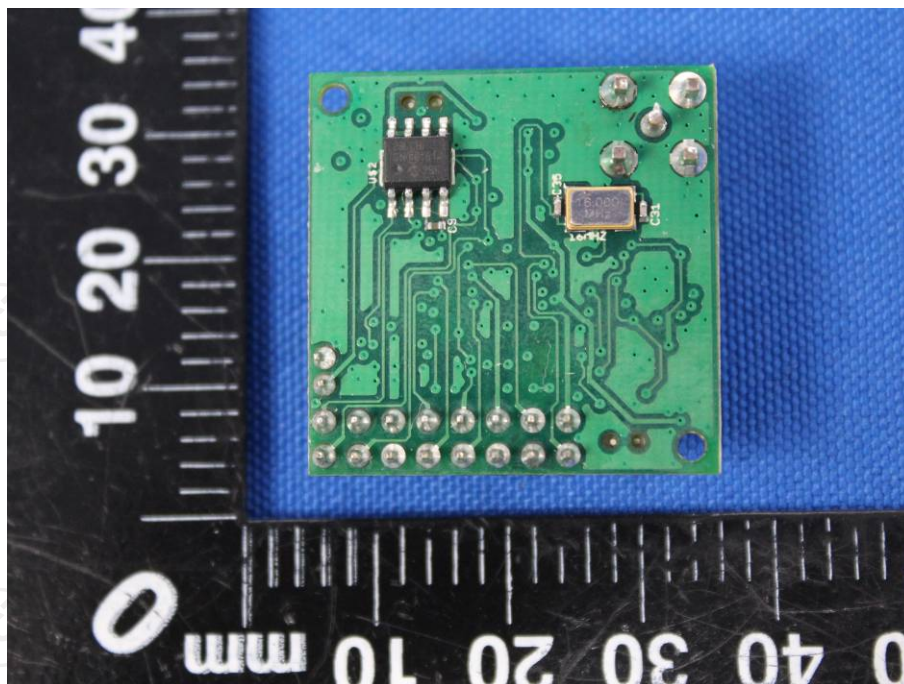
9. Photographs of EUT











*****END OF REPORT*****