

TEST REPORT

Reference No...... : WTS17S0477106-1E
FCC ID : Y18V88
Applicant..... : OMEGA TECHNOLOGY INC.
Address..... : 6F, NO. 87, Sec. 3, Chung-Yang Rd., Tu-Cheng Dist, New Taipei
City, Taiwan
Manufacturer : The same as above
Address..... : The same as above
Product Name..... : Wireless Ergonomic Optical Mouse
Model No..... : V88
Standards : FCC CFR Title 47 Chapter I Subchapter A Part 15 Subpart C Section
15.249 :2016
Date of Receipt sample : Apr. 21, 2017
Date of Test : Apr. 21 – Apr. 28, 2017
Date of Issue..... : May. 05, 2017
Test Result..... : Pass

Remarks:

The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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2 Contents

	Page
1 COVER PAGE.....	1
2 CONTENTS	2
3 REVISION HISTORY	3
4 GENERAL INFORMATION.....	4
4.1 GENERAL DESCRIPTION OF E.U.T.....	4
4.2 DETAILS OF E.U.T.....	4
4.3 CHANNEL LIST	4
4.4 TEST FACILITY	5
4.5 TEST MODE	5
5 EQUIPMENT USED DURING TEST	6
5.1 EQUIPMENTS LIST	6
5.2 MEASUREMENT UNCERTAINTY.....	6
5.3 TEST EQUIPMENT CALIBRATION.....	7
6 TEST SUMMARY	8
7 CONDUCTED EMISSION TEST	9
7.1 E.U.T. OPERATION.....	9
7.2 EUT SETUP	9
7.3 MEASUREMENT DESCRIPTION	9
7.4 CONDUCTED EMISSION TEST RESULT	10
8 RADIATION EMISSION TEST	12
8.1 EUT OPERATION	12
8.2 TEST SETUP	13
8.3 SPECTRUM ANALYZER SETUP.....	14
8.4 TEST PROCEDURE.....	15
8.5 TEST RESULT	16
9 OUTSIDE OF BAND EMISSION.....	19
9.1 TEST PROCEDURE.....	19
9.2 TEST RESULT	19
10 BANDWIDTH MEASUREMENT	21
10.1 TEST PROCEDURE.....	21
10.2 TEST RESULT	21
11 ANTENNA REQUIREMENT	23
12 PHOTOGRAPHS- MODEL V88 TEST SETUP PHOTOS.....	24
12.1 PHOTOGRAPH - RADIATION EMISSION	24
12.2 PHOTOGRAPH – CONDUCTED EMISSION	26
13 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS.....	27
13.1 PHOTOGRAPHS –MODEL V88 EXTERNAL PHOTOS	27
13.2 PHOTOGRAPHS – MODEL V88 INTERNAL PHOTOS	31

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0477106-1E	Apr. 21, 2017	Apr. 21– Apr. 28, 2017	May. 05, 2017	original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name	: Wireless Ergonomic Optical Mouse
Model No.	: V88
Model Differences	:N/A
Type of Modulation	:GFSK
Frequency Range	:2402MHz-2480MHz, 40 Channels in total
The Lowest Oscillator	:16MHz
Antenna installation	:PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 3.7V, 300mAh by battery; Charging: DC 5V by USB from PC
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4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	11	2422	21	2442	31	2462
2	2404	12	2424	22	2444	32	2464
3	2406	13	2426	23	2446	33	2466
4	2408	14	2428	24	2448	34	2468
5	2410	15	2430	25	2450	35	2470
6	2412	16	2432	26	2452	36	2472
7	2414	17	2434	27	2454	37	2474
8	2416	18	2436	28	2456	38	2476
9	2418	19	2438	29	2458	39	2478
10	2420	20	2440	30	2460	40	2480

4.4 Test Facility

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

- **IC – Registration No.:7760A-1**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A-1, Oct 15, 2015.

- **FCC Test Site – Registration No.: 328995**

Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Table 1 Tests carried out under FCC part 15.249

Test mode	Low channel	Middle channel	High channel
Transmitting	2402MHz	2440MHz	2480MHz

Table 2 Tests carried out under FCC part 15.209 and FCC Part 15.207

Test Item	Test Mode
Conducted Emissions Test	Charging + Transmitting
Radiation Emissions Test	Charging + Transmitting

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions at Mains Terminals Disturbance Voltage						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI Test Receiver	R&S	ESCI	100947	Sep.12, 2016	Sep.11, 2017
2	LISN	R&S	ENV216	100115	Sep.12, 2016	Sep.11, 2017
3	Cable	Top	TYPE16(3.5M)	-	Sep.12, 2016	Sep.11, 2017
3m Semi-anechoic Chamber for Radiation						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	Apr. 07, 2017	Apr. 06, 2018
2	Amplifier	Agilent	8447D	2944A10178	Jan. 12, 2017	Jan. 11, 2018
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	0703	Oct. 17, 2016	Oct. 16, 2017
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr. 07, 2017	Apr. 06, 2018
5	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.12, 2016	Sep.11, 2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr. 07, 2017	Apr. 06, 2018
7	SHF-EHF Horn, 15-40GHz	SCHWARZBECK	BBHA 9170	BBHA9170582	Aug. 13, 2016	Aug. 12, 2017
8	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr. 07, 2017	Apr. 06, 2018
9	Broadband Preamplifier	SCHWARZBECK	BBV 9719	18-26.5GHz	Aug. 13, 2016	Aug. 12, 2017
10	Coaxial Cable (above 1GHz)	Top	1GHz-26.5GHz	EW02014-7	Apr. 07, 2017	Apr. 06, 2018
11	Test Receiver	R&S	ESCI	101296	Apr. 07, 2017	Apr. 06, 2018
12	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr. 07, 2017	Apr. 06, 2018
13	Amplifier	ANRITSU	MH648A	M43381	Apr. 07, 2017	Apr. 06, 2018
14	Cable	HUBER+SUHNER	CBL2	525178	Apr. 07, 2017	Apr. 06, 2018

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	C
Radiated Emission	15.249(a) 15.209 15.205(a)	C
Outside of Band Emission	15.249 15.205 15.209	C
20dB Bandwidth	15:215(c)	C
Antenna Requirement	15.203	C
Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable		

7 Conducted Emission Test

Test Requirement:	FCC CFR Title 47 Chapter I Subchapter A Part 15 Subpart C Section 15.207
Test Method:	ANSI C63.10:2013&ANSI C63.4:2014
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment :

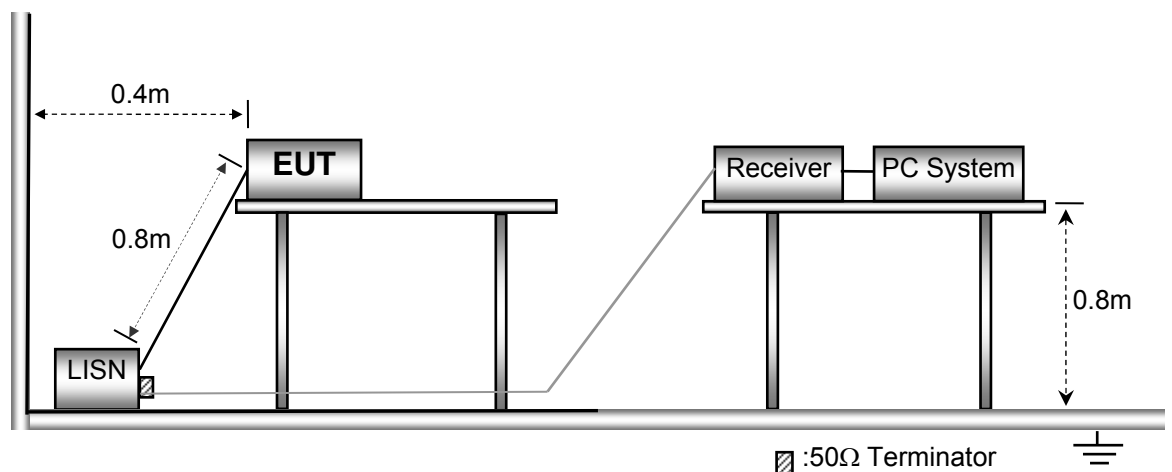
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

Refer to section 4.5.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.

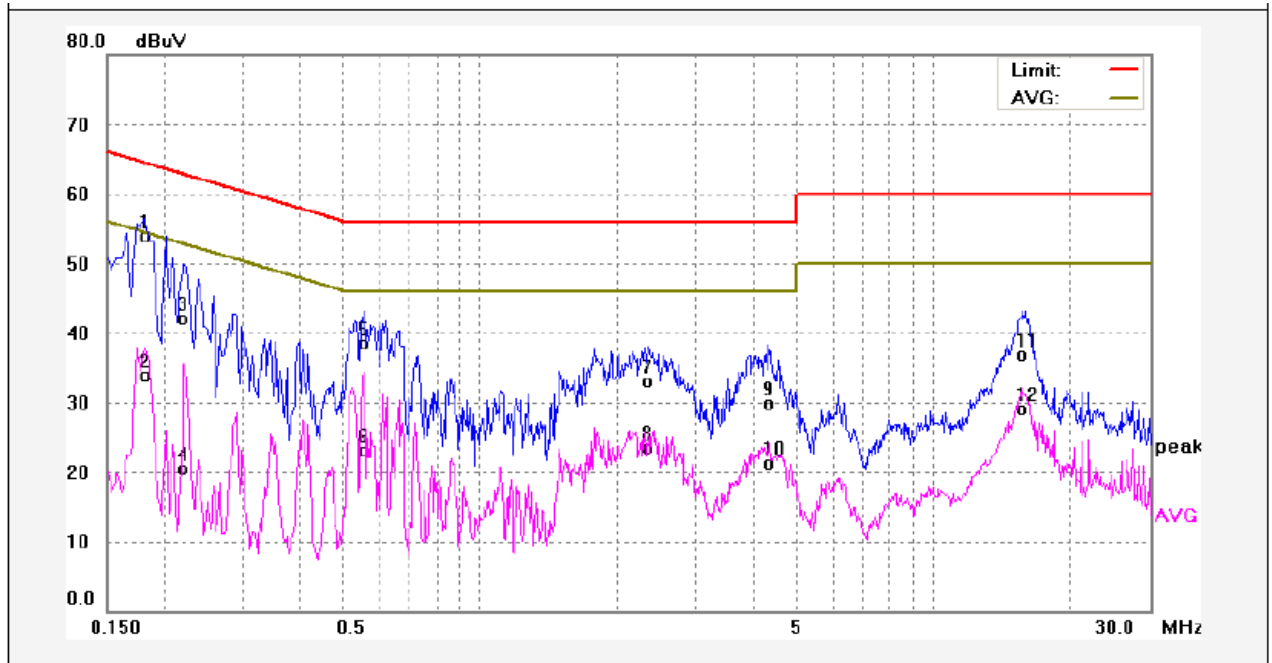


7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

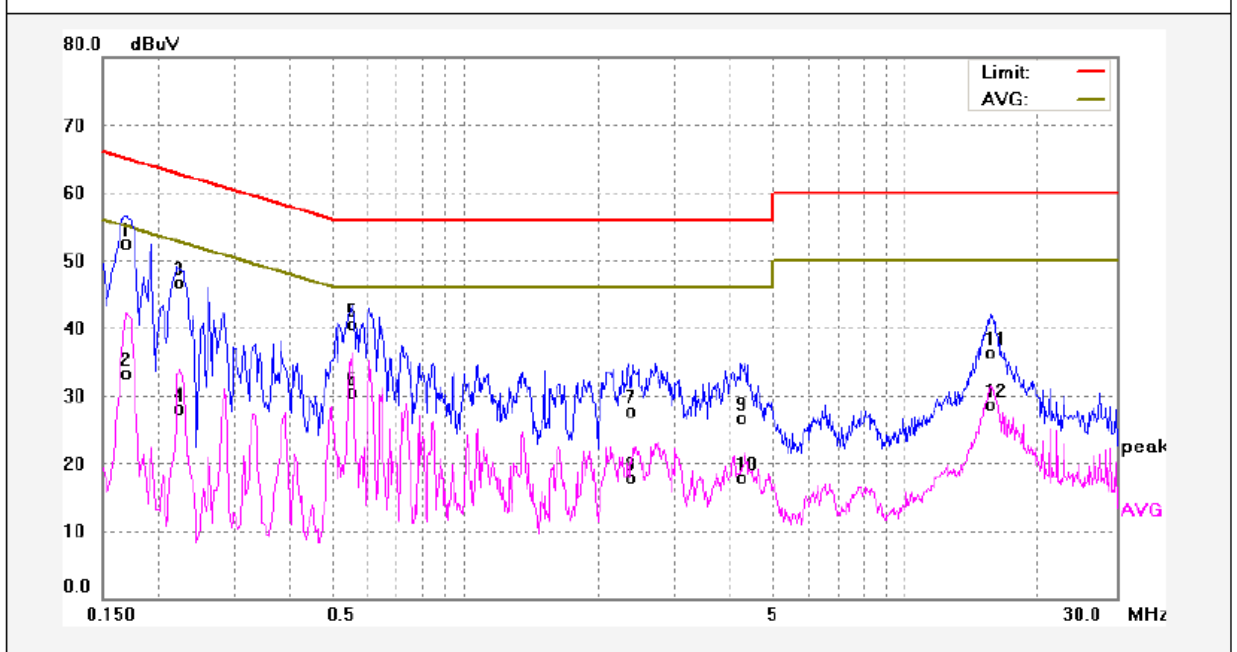
7.4 Conducted Emission Test Result

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1819	44.36	9.63	53.99	64.39	-10.40	QP	
2	0.1819	24.33	9.63	33.96	54.39	-20.43	AVG	
3	0.2220	32.51	9.63	42.14	62.74	-20.60	QP	
4	0.2220	10.91	9.63	20.54	52.74	-32.20	AVG	
5	0.5540	28.89	9.69	38.58	56.00	-17.42	QP	
6	0.5540	13.39	9.69	23.08	46.00	-22.92	AVG	
7	2.3380	23.20	9.94	33.14	56.00	-22.86	QP	
8	2.3380	13.53	9.94	23.47	46.00	-22.53	AVG	
9	4.3340	20.02	9.98	30.00	56.00	-26.00	QP	
10	4.3340	11.29	9.98	21.27	46.00	-24.73	AVG	
11	15.9260	26.61	10.26	36.87	60.00	-23.13	QP	
12	15.9260	18.79	10.26	29.05	50.00	-20.95	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1712	42.79	9.64	52.43	64.90	-12.47	QP	
2	0.1712	23.88	9.64	33.32	54.90	-21.58	AVG	
3	0.2220	37.06	9.63	46.69	62.74	-16.05	QP	
4	0.2220	18.56	9.63	28.19	52.74	-24.55	AVG	
5	0.5540	30.77	9.69	40.46	56.00	-15.54	QP	
6	0.5540	20.88	9.69	30.57	46.00	-15.43	AVG	
7	2.3460	17.84	9.94	27.78	56.00	-28.22	QP	
8	2.3460	7.97	9.94	17.91	46.00	-28.09	AVG	
9	4.2140	16.77	9.96	26.73	56.00	-29.27	QP	
10	4.2140	7.94	9.96	17.90	46.00	-28.10	AVG	
11	15.4980	25.96	10.25	36.21	60.00	-23.79	QP	
12	15.4980	18.47	10.25	28.72	50.00	-21.28	AVG	

8 Radiation Emission Test

Test Requirement: FCC CFR Title 47 Chapter I Subchapter A Part 15 Subpart C
Section 15.205&15.209&15.249

Test Method: ANSI C63.10: 2013;ANSI C63.4: 2014

Measurement Distance: 3m

Test Result: PASS

15.249(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	20log ^{(2400/F(kHz))} + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log ^{(24000/F(kHz))} + 40
1.705 ~ 30	30	30	100 * 30	20log ⁽³⁰⁾ + 40
30 ~ 88	100	3	100	20log ⁽¹⁰⁰⁾
88 ~ 216	150	3	150	20log ⁽¹⁵⁰⁾
216 ~ 960	200	3	200	20log ⁽²⁰⁰⁾
Above 960	500	3	500	20log ⁽⁵⁰⁰⁾

Note: RF Voltage(dBuV)=20 log₁₀ RF Voltage(uV)

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

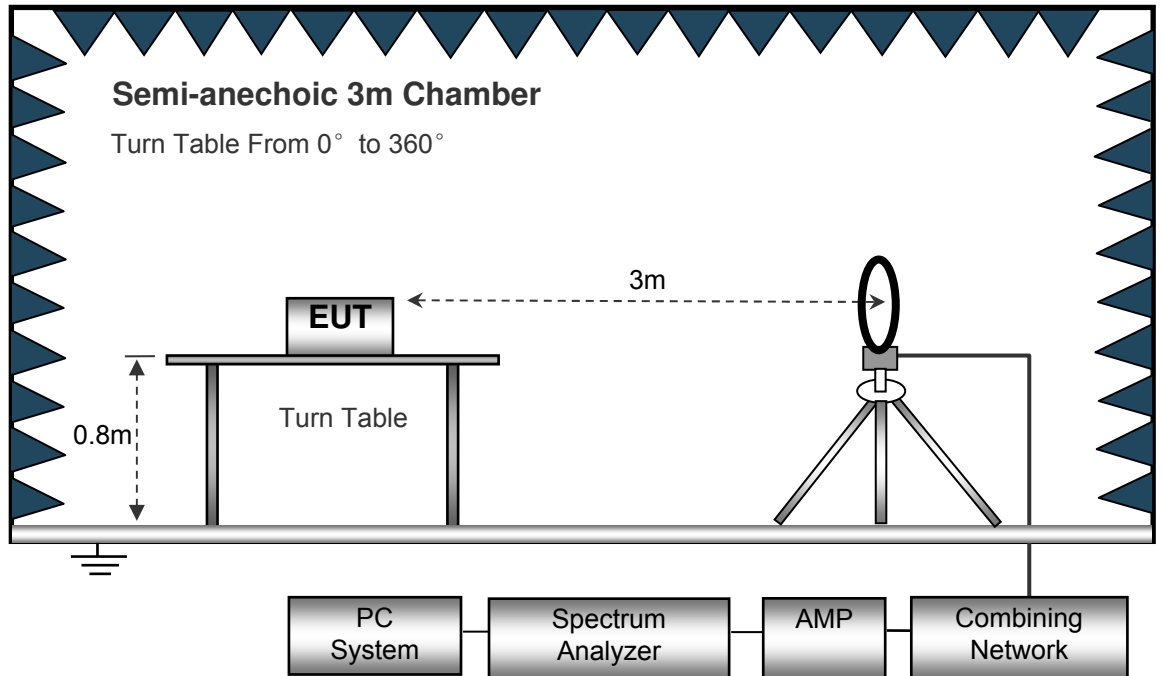
EUT Operation :

Refer to section 4.5.

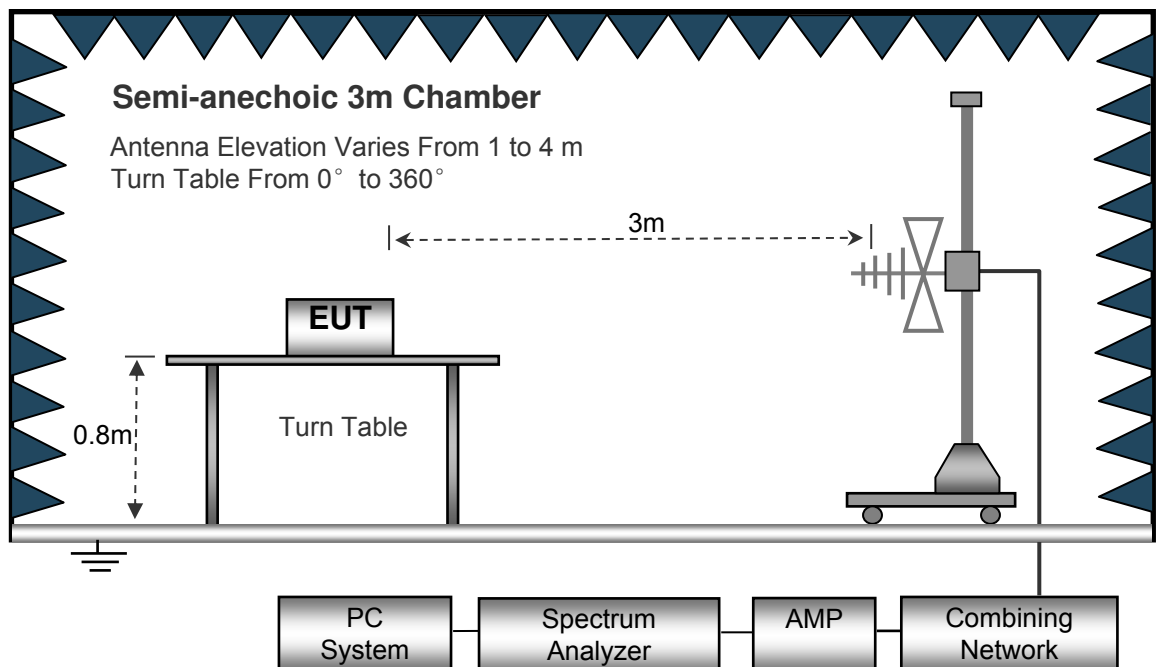
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10: 2013.

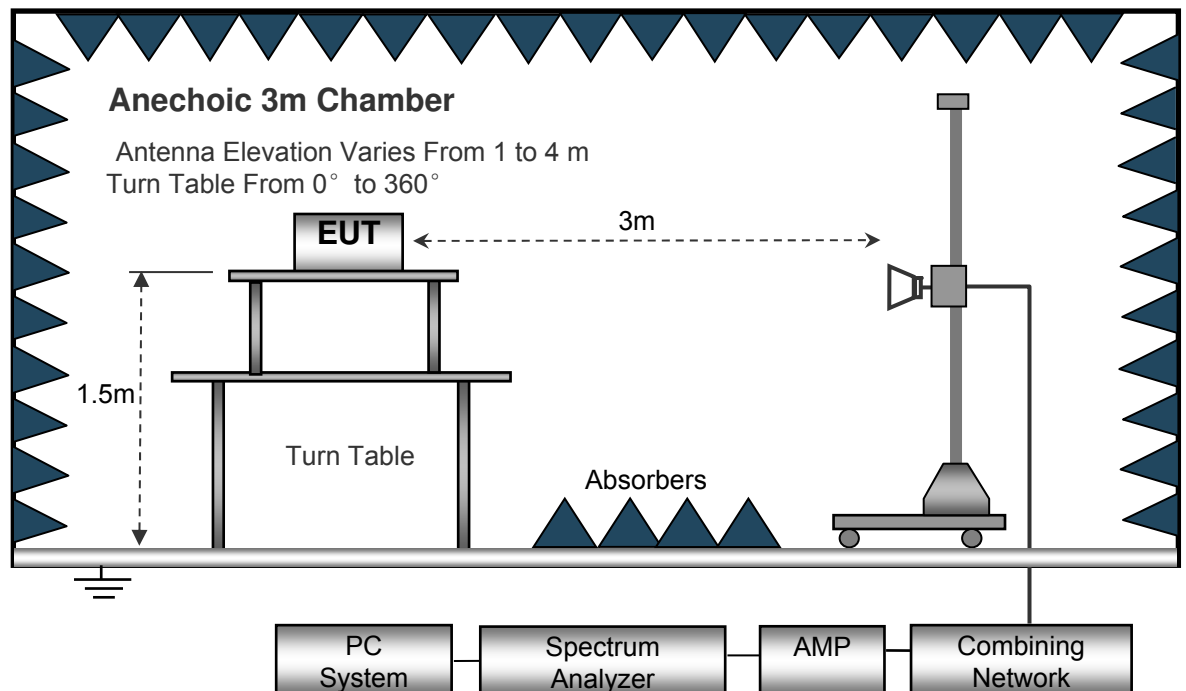
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth.....10kHz
 Video Bandwidth10kHz
 Resolution Bandwidth10kHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....100kHz
 Video Bandwidth300kHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....1MHz
 Video Bandwidth3MHz
 DetectorAve.
 Resolution Bandwidth.....1MHz
 Video Bandwidth10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above 1GHz, the EUT is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8.5 Test Result

Test Frequency: 9 KHz ~ 30 MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Low Channel									
*268.32	35.23	QP	140	1.4	H	-13.35	21.88	46.00	-24.12
*268.32	40.45	QP	196	1.8	V	-13.35	27.10	46.00	-18.90
2402.00	96.70	PK	15	1.8	V	-11.87	84.83	114.00	-29.17
2402.00	86.15	Ave	15	1.8	V	-11.87	74.28	94.00	-19.72
*4804.00	46.15	PK	72	1.9	V	-1.06	45.09	74.00	-28.91
*4804.00	43.52	Ave	72	1.9	V	-1.06	42.46	54.00	-11.54
7206.00	40.62	PK	283	1.5	H	1.33	41.95	74.00	-32.05
7206.00	35.37	Ave	283	1.5	H	1.33	36.70	54.00	-17.30
*2313.45	46.95	PK	305	1.4	V	-13.19	33.76	74.00	-40.24
*2313.45	39.62	Ave	305	1.4	V	-13.19	26.43	54.00	-27.57
*2354.17	44.46	PK	176	1.5	H	-13.14	31.32	74.00	-42.68
*2354.17	37.63	Ave	176	1.5	H	-13.14	24.49	54.00	-29.51
*2489.78	44.10	PK	101	2.0	V	-13.08	31.02	74.00	-42.98
*2489.78	36.17	Ave	101	2.0	V	-13.08	23.09	54.00	-30.91
Note: * Restricted bands of operation.									

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK Middle Channel									
*268.32	34.78	QP	64	1.3	H	-13.35	21.43	46.00	-24.57
*268.32	39.22	QP	194	2.0	V	-13.35	25.87	46.00	-20.13
2440.00	94.97	PK	136	1.4	V	-11.73	83.24	114.00	-30.76
2440.00	84.67	Ave	136	1.4	V	-11.73	72.94	94.00	-21.06
*4880.00	45.11	PK	269	1.5	V	-0.62	44.49	74.00	-29.51
*4880.00	44.91	Ave	269	1.5	V	-0.62	44.29	54.00	-9.71
*7320.00	41.47	PK	222	1.8	H	2.21	43.68	74.00	-30.32
*7320.00	33.91	Ave	222	1.8	H	2.21	36.12	54.00	-17.88
*2325.91	45.96	PK	175	1.0	V	-13.19	32.77	74.00	-41.23
*2325.91	38.00	Ave	175	1.0	V	-13.19	24.81	54.00	-29.19
*2375.73	44.94	PK	147	1.6	H	-13.14	31.80	74.00	-42.20
*2375.73	36.79	Ave	147	1.6	H	-13.14	23.65	54.00	-30.35
*2499.63	43.82	PK	52	1.5	V	-13.08	30.74	74.00	-43.26
*2499.63	37.26	Ave	52	1.5	V	-13.08	24.18	54.00	-29.82
Note: * Restricted bands of operation.									

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
GFSK High Channel									
*268.32	34.78	QP	284	1.9	H	-13.35	21.43	46.00	-24.57
*268.32	39.39	QP	77	1.8	V	-13.35	26.04	46.00	-19.96
2480.00	95.61	PK	138	1.3	V	-11.58	84.03	114.00	-29.97
2480.00	85.98	Ave	138	1.3	V	-11.58	74.38	94.00	-19.62
*4960.00	45.72	PK	175	1.9	V	-0.24	45.48	74.00	-28.52
*4960.00	44.03	Ave	175	1.9	V	-0.24	43.79	54.00	-10.21
*7440.00	40.68	PK	302	1.0	H	2.84	43.52	74.00	-30.48
*7440.00	35.40	Ave	302	1.0	H	2.84	38.24	54.00	-15.76
*2321.68	46.98	PK	208	1.1	V	-13.19	33.79	74.00	-40.21
*2321.68	37.02	Ave	208	1.1	V	-13.19	23.83	54.00	-30.17
*2351.56	44.06	PK	339	1.7	H	-13.14	30.92	74.00	-43.08
*2351.56	37.08	Ave	339	1.7	H	-13.14	23.94	54.00	-30.06
*2483.54	44.83	PK	85	1.7	V	-13.08	31.75	74.00	-42.25
*2483.54	38.03	Ave	85	1.7	V	-13.08	24.95	54.00	-29.05
Note: * Restricted bands of operation.									

Test Frequency: From 18GHz to 25GHz

The measurements were more than 20 dB below the limit and not reported.

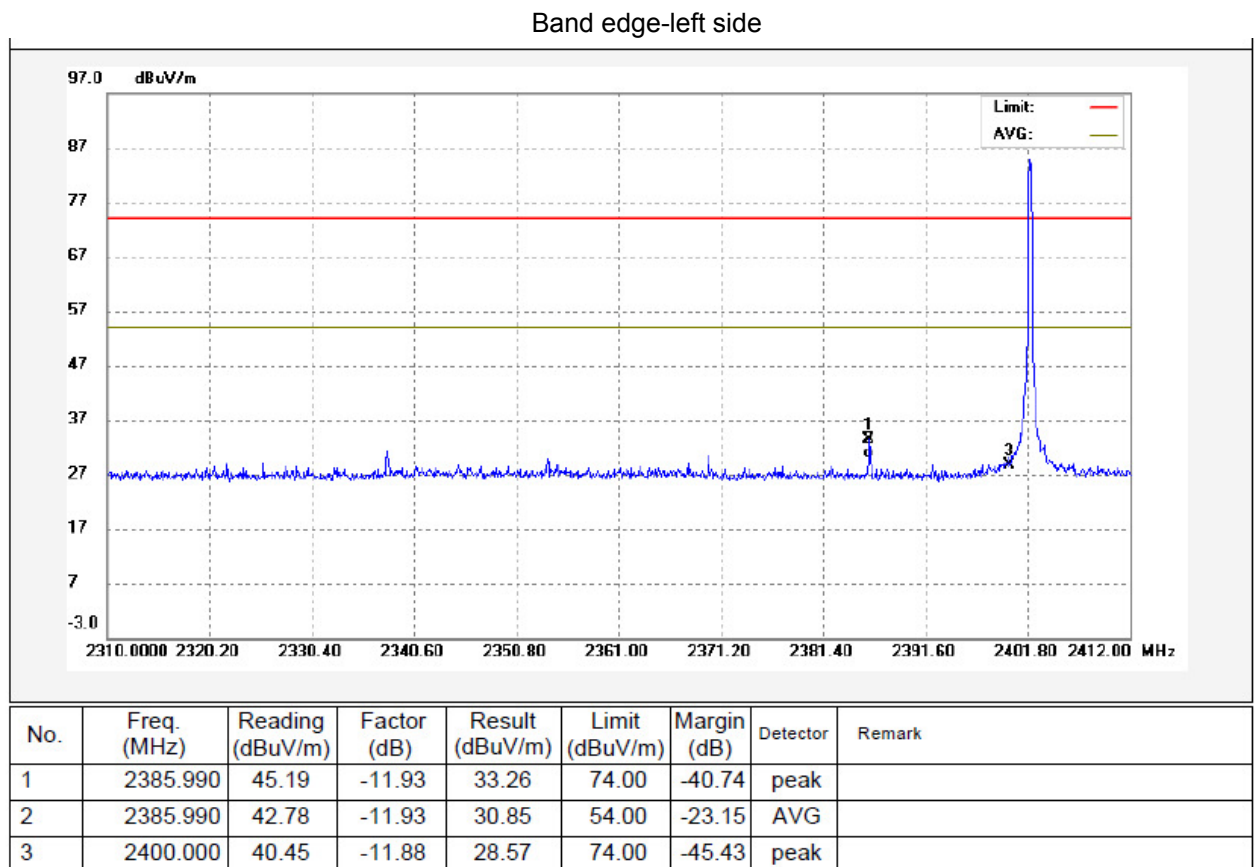
9 Outside of Band Emission

Test Requirement:	15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.10:2013
Test Mode:	Transmitting

9.1 Test Procedure

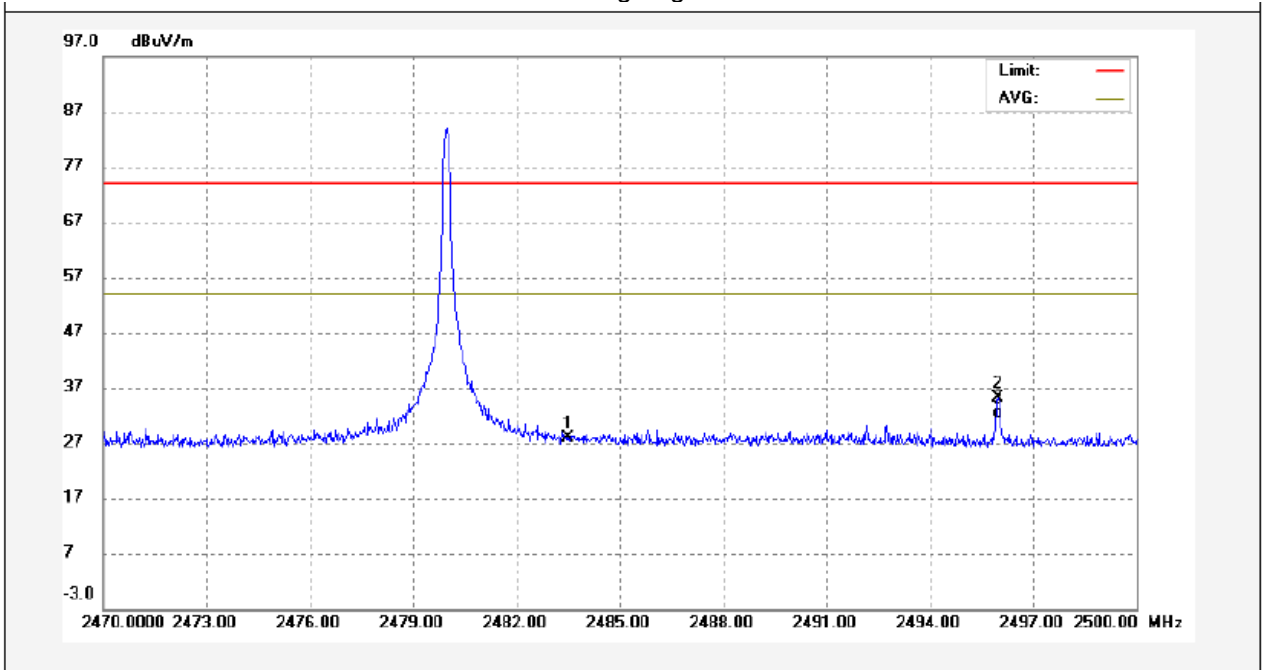
Refer to section 8.4 of this test report.

9.2 Test Result



Remark: The worst case (Vertical) was recorded.

Band edge-right side



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2483.500	39.33	-11.56	27.77	74.00	-46.23	peak	
2	2495.980	46.75	-11.51	35.24	74.00	-38.76	peak	
3	2495.980	43.98	-11.51	32.47	54.00	-21.53	AVG	

Remark: The worst case (Vertical) was recoded.

10 Bandwidth Measurement

Test Requirement: FCC CFR Title 47 Chapter I Subchapter A Part 15 Subpart C Section 15.215(c)

Test Method: ANSI C63.10:2013

Test Mode: Transmitting

10.1 Test Procedure

Refer to section 8.4 of this test report.

10.2 Test Result

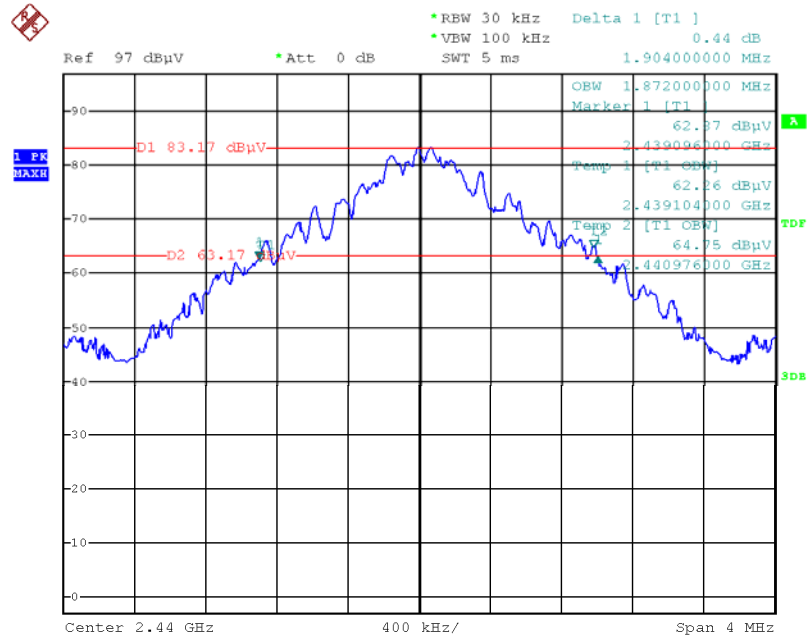
Operation mode	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low channel	1.872	1.820
Middle channel	1.904	1.872
High channel	1.912	1.896

Test result plot as follows:

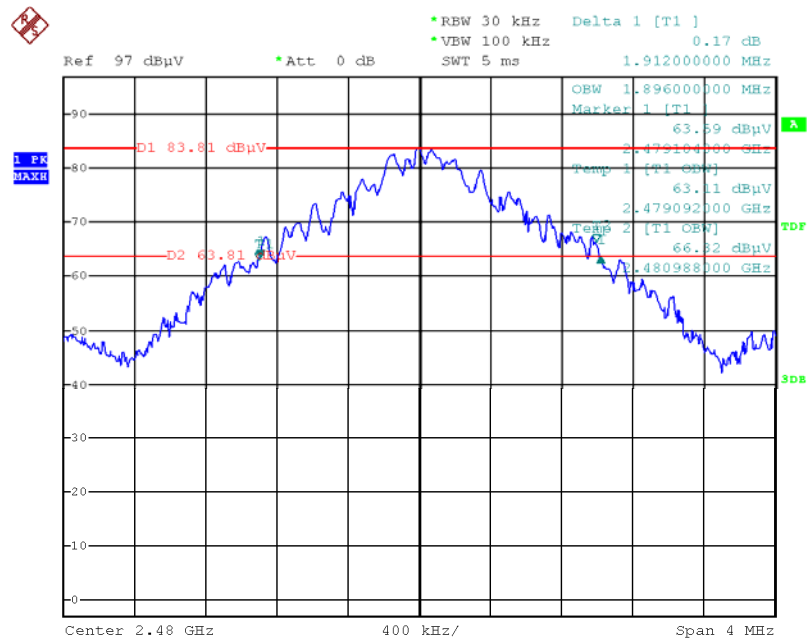
Mode: Low channel



Mode: Middle channel



Mode: High channel



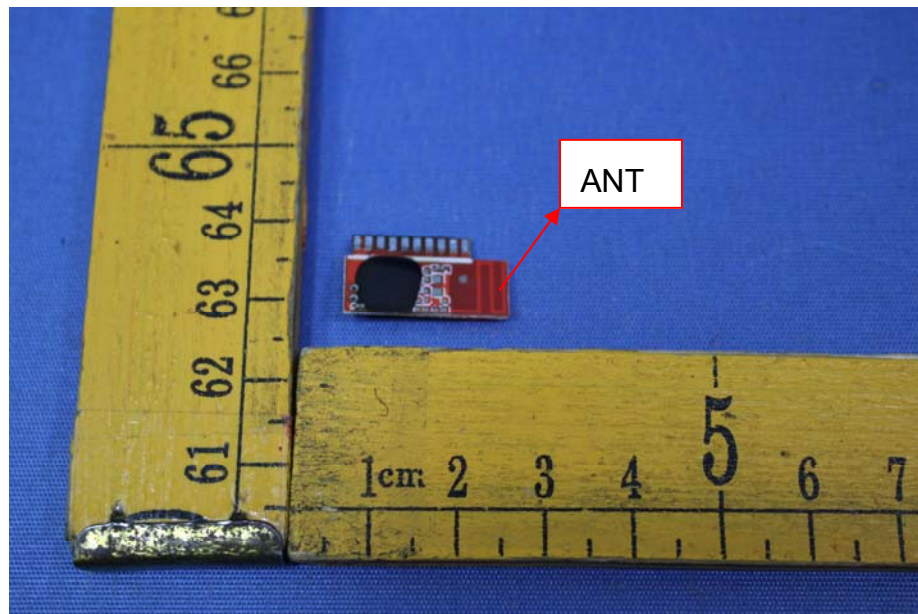
11 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC CFR Title 47 Chapter I Subchapter A Part 15 Subpart C Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Result:

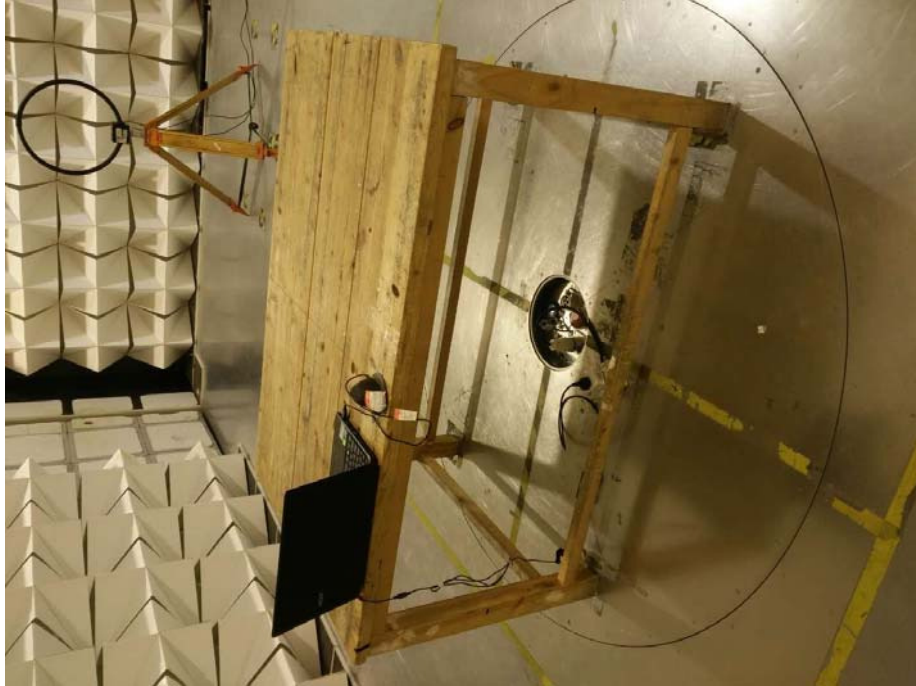
The EUT has one PCB Printed Antenna, the gain is -1.52 dBi. meets the requirements of FCC 15.203.



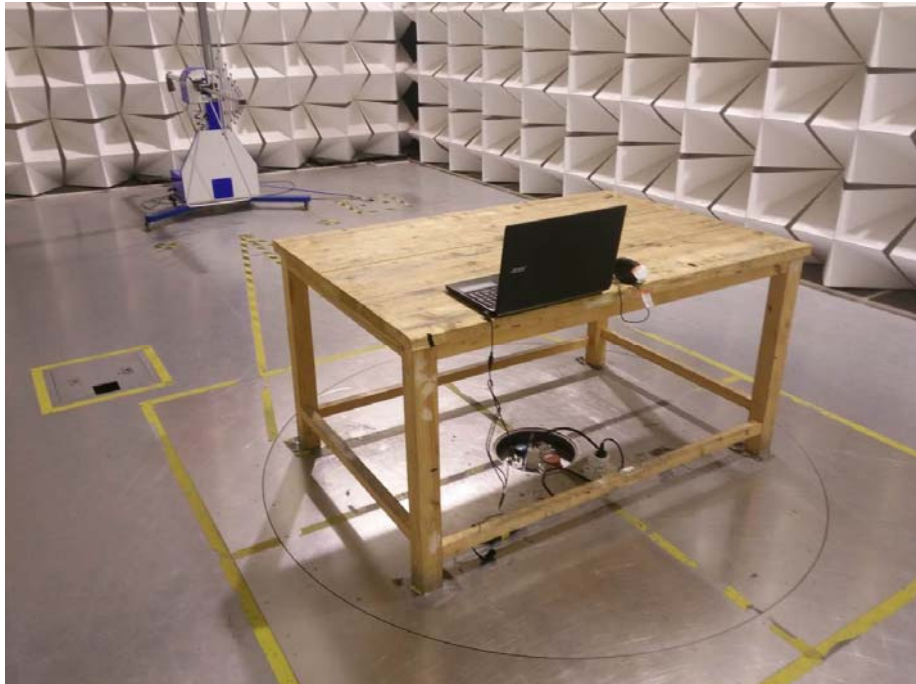
12 Photographs- Model V88 Test Setup Photos

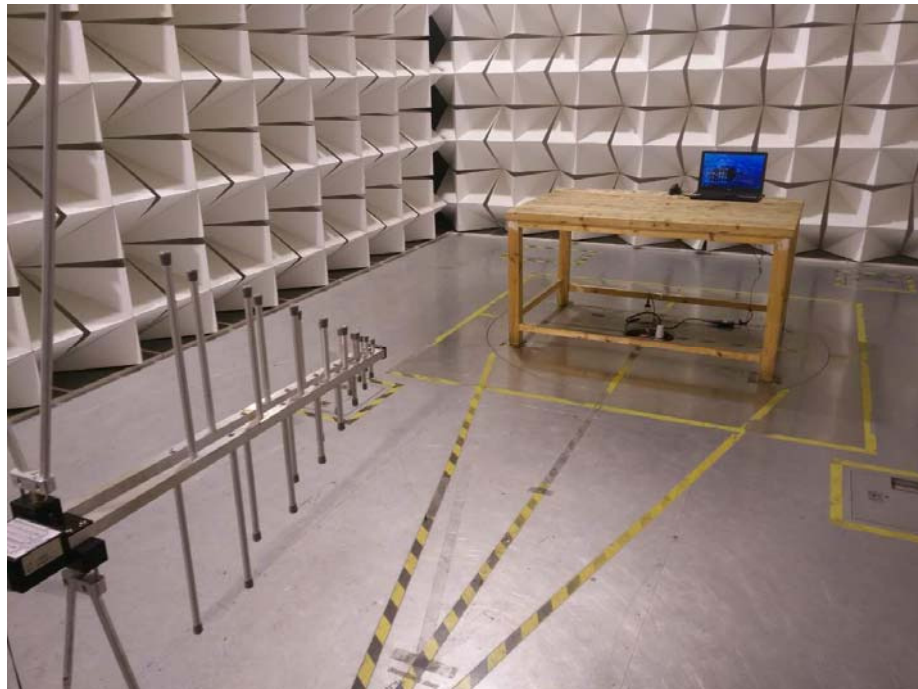
12.1 Photograph - Radiation Emission

Test frequency from 9 KHz to 30MHz

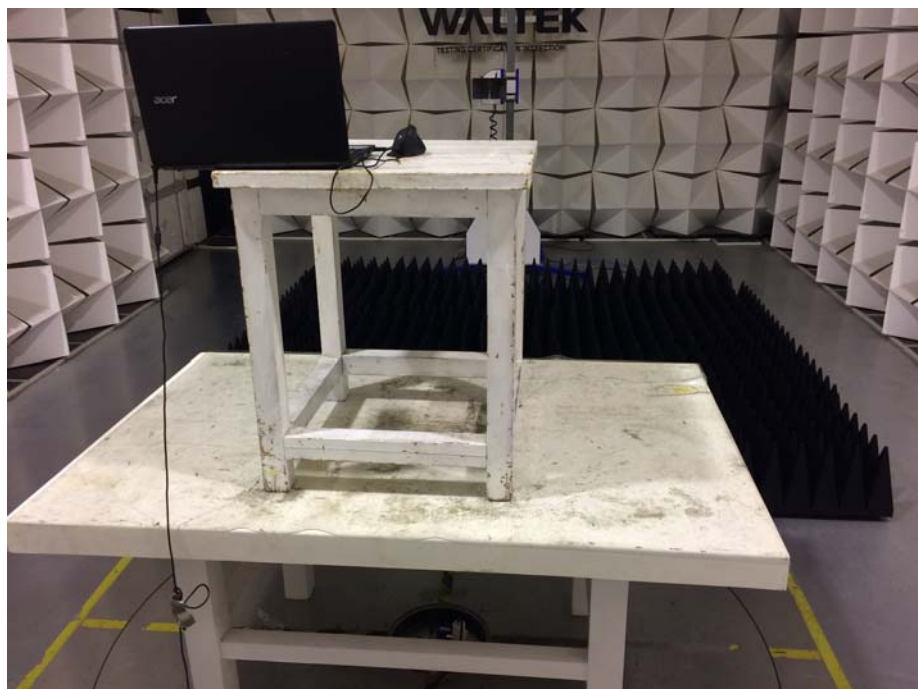


Test frequency from 30MHz to 1GHz





Test frequency above 1GHz



12.2 Photograph – Conducted Emission



13 Photographs - Constructional Details

13.1 Photographs –Model V88 External Photos

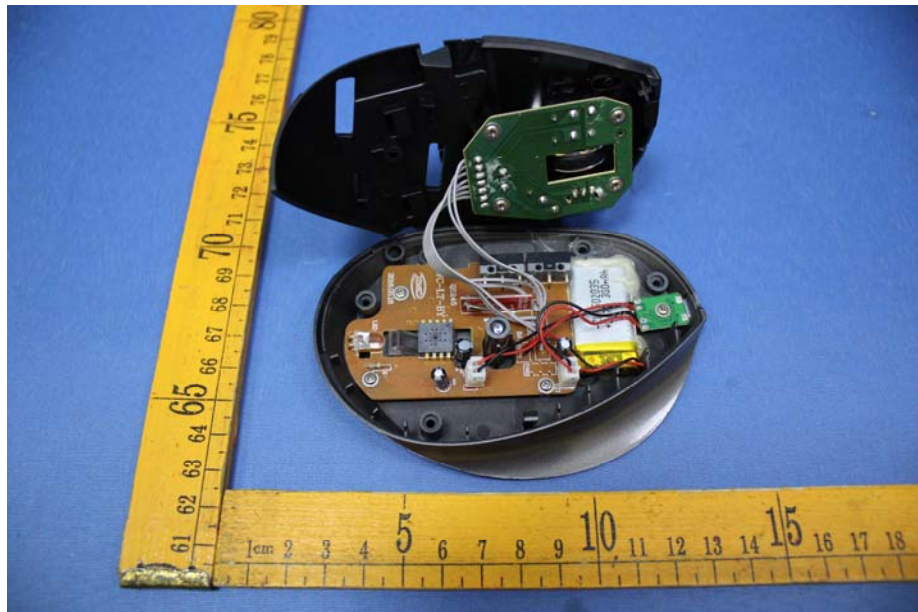


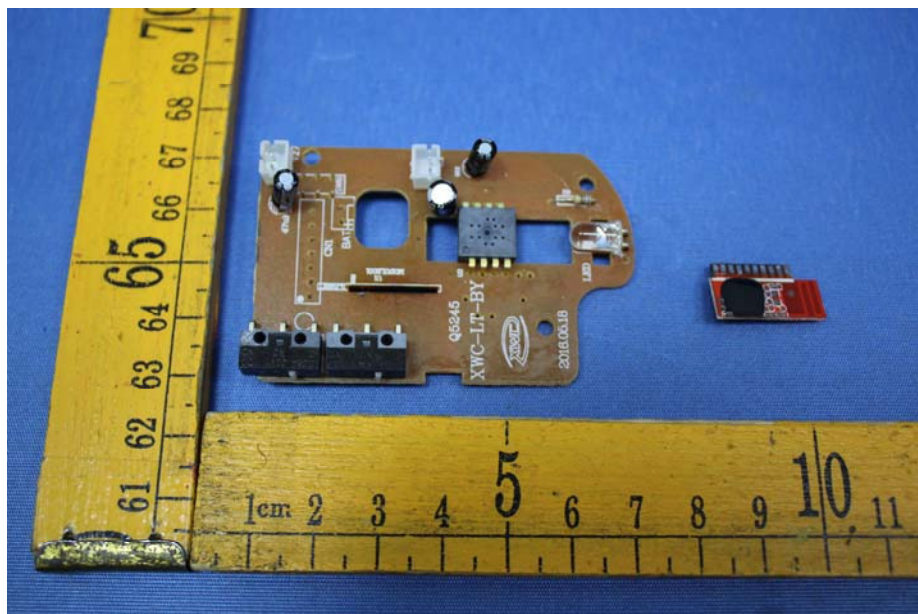
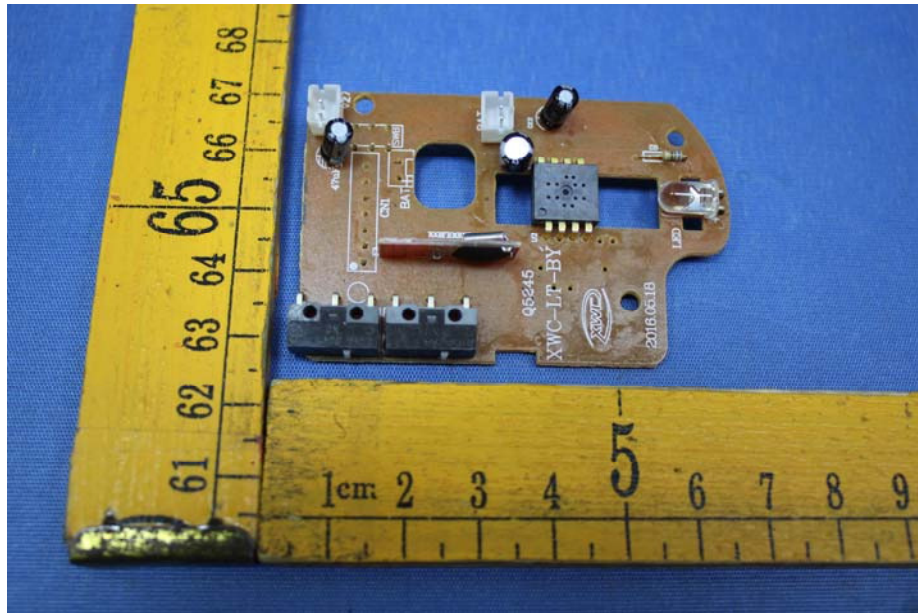


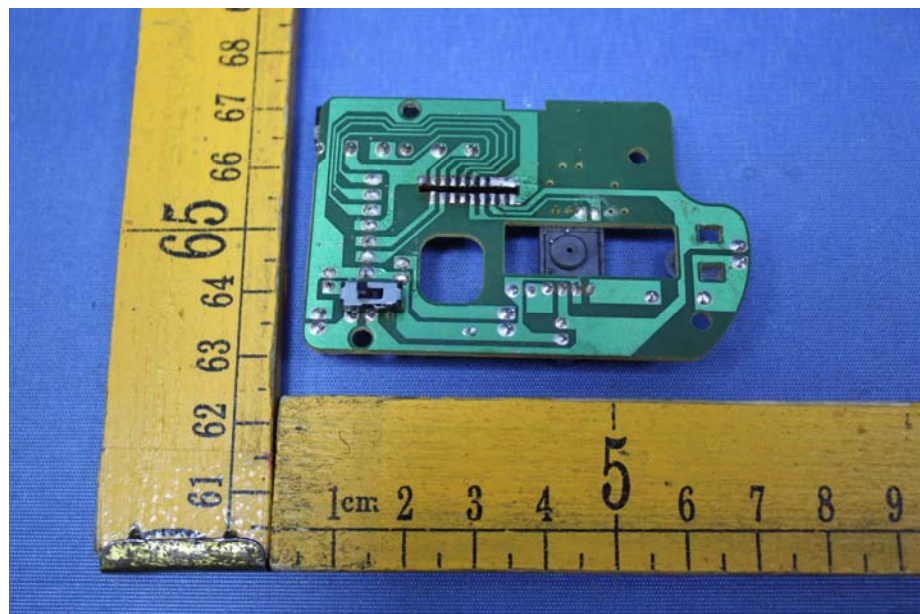
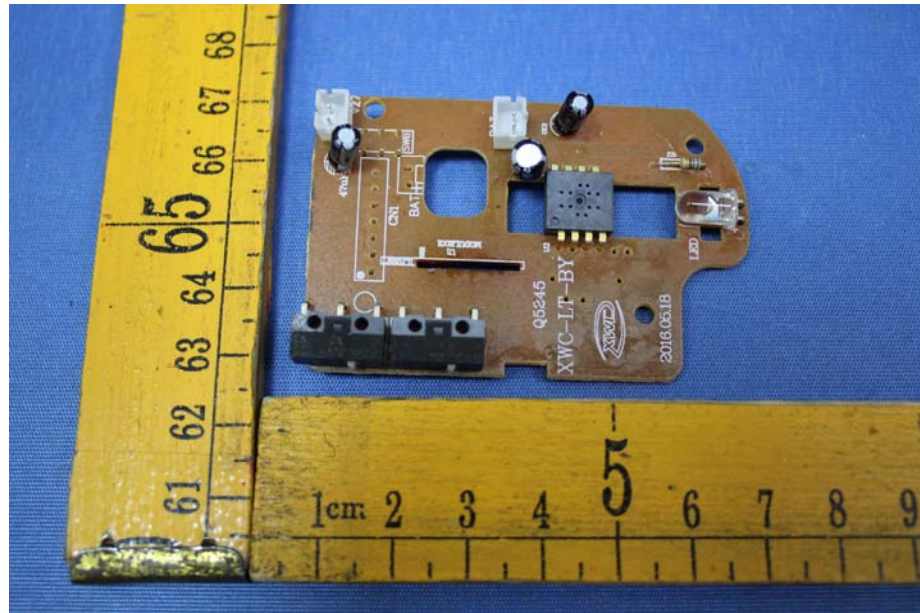


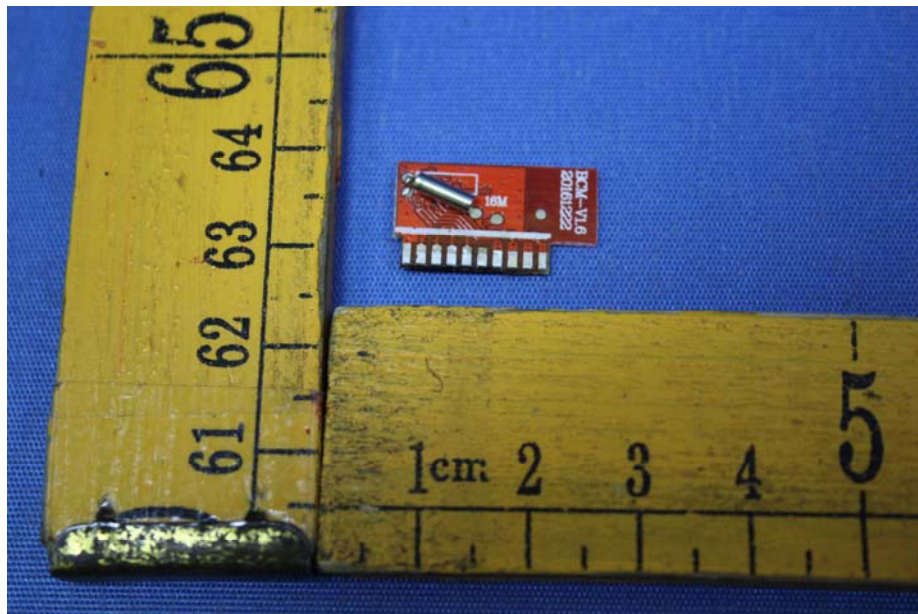
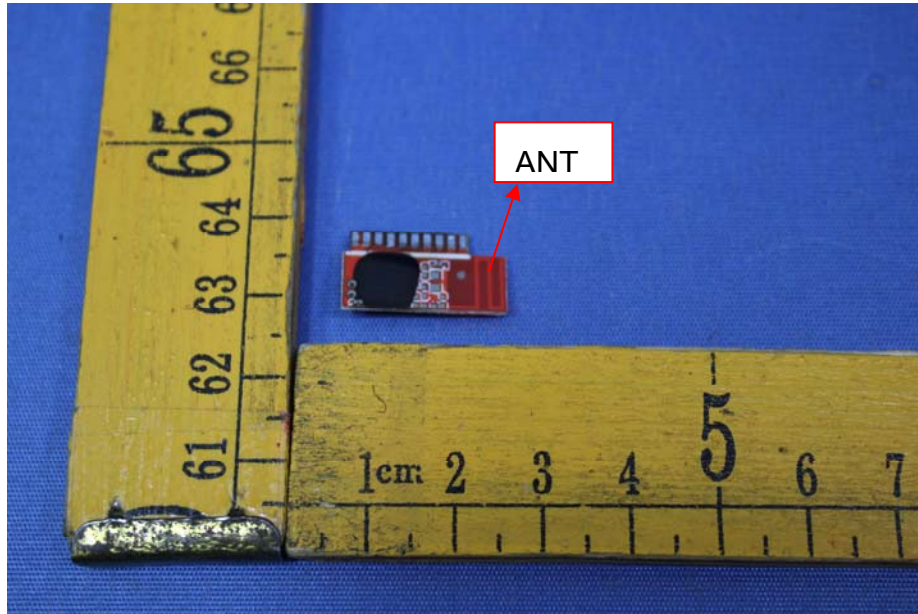


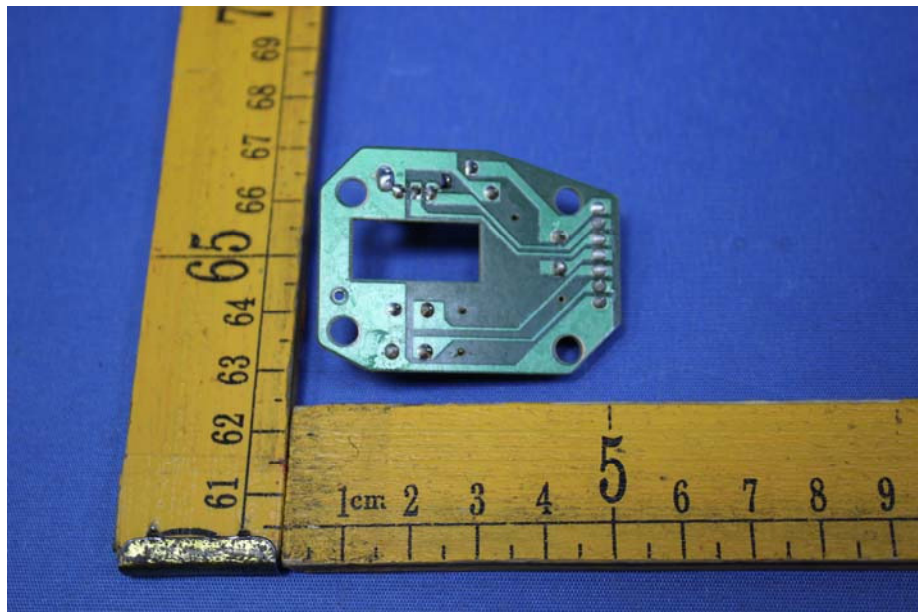
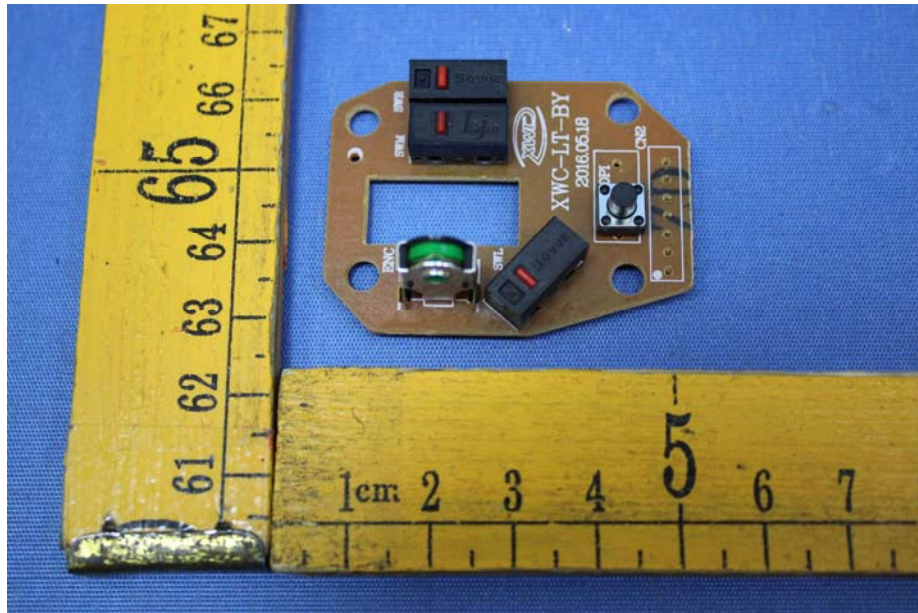
13.2 Photographs – Model V88 Internal Photos

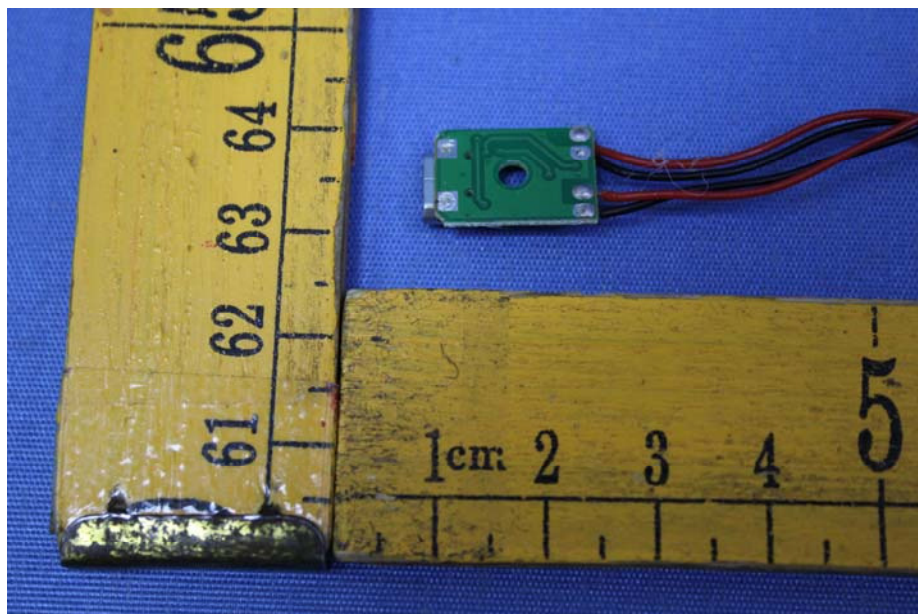
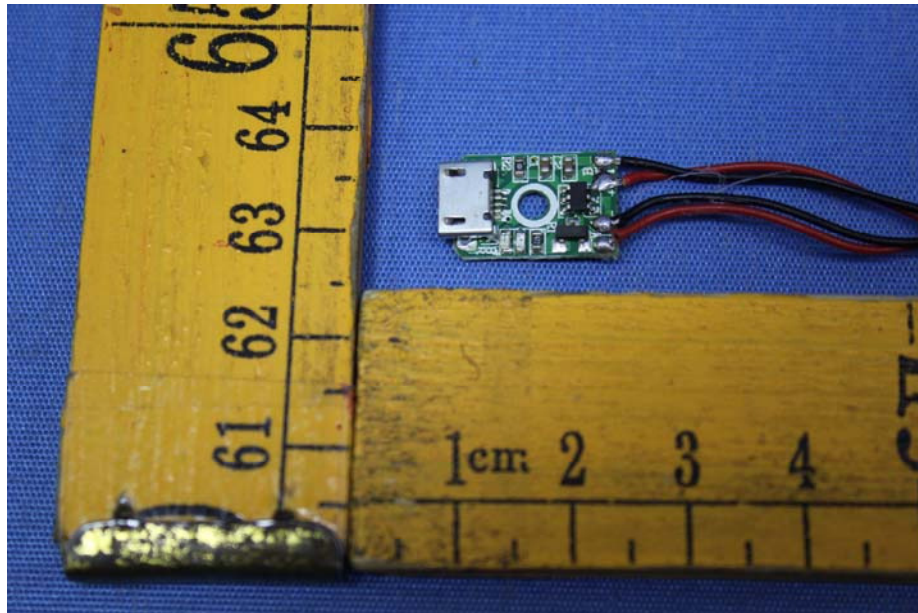


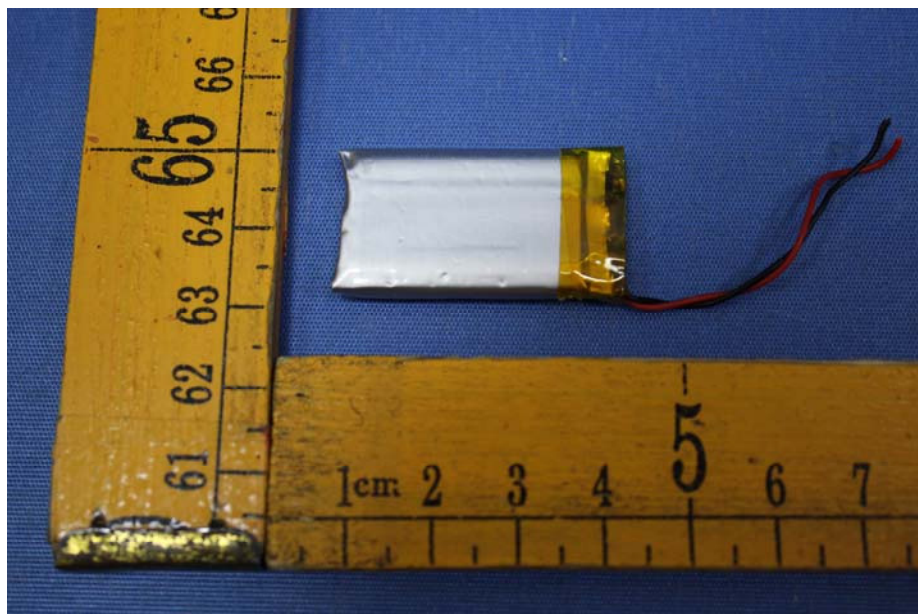
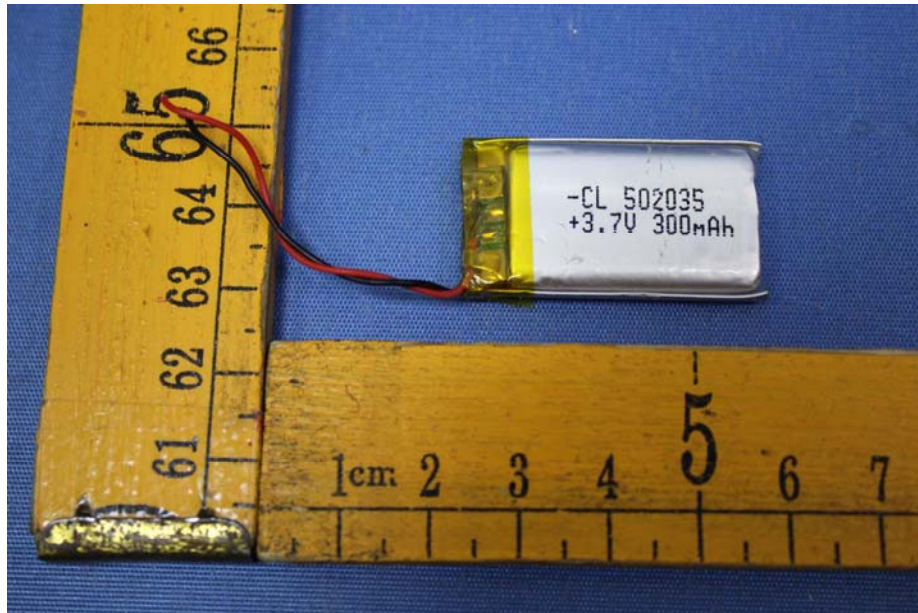












====End of Report====