TEST REPORT

Reference No. : WTS17S0477106-1E

FCC ID : YI8V88

Applicant.....: OMEGA TECHNOLOGY INC.

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.

Prepared By:

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3 Revision History

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

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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

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

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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

10010 = 10010 0011100 00	rable 2 rests darried out and rest part resizes and rest art resizer						
Test Item	Test Mode						
Conducted Emissions Test	Charging + Transmitting						
Radiation Emissions Test	Charging + Transmitting						

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5 Equipment Used during Test

5.1 Equipments List

Cond	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	Тор	TYPE16(3.5M)	-	Sep.12, 2016	Sep.11, 2017					
3m Se	emi-anechoic Chambe	er 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)	Тор	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	BBHA91705 82	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)	Тор	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	± 1 x 10 ⁻⁶
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
	± 5.03 dB
Radiated Spurious	(Bilog antenna 30M~1000MHz)
Emissions test	± 5.47 dB
	(Horn antenna 1000M~25000MHz)

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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.

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6 Test Summary

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

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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_µV between 0.15MHz & 0.5MHz

 $56~dB\mu V$ between 0.5MHz & 5MHz $60~dB\mu V$ between 5MHz & 30MHz

Detector: Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

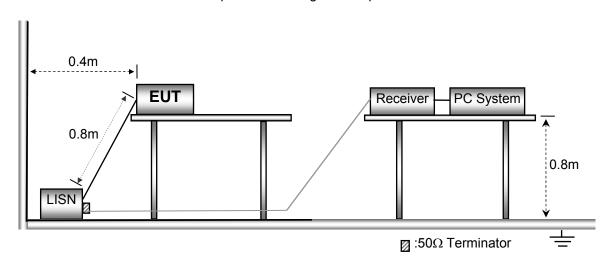
Operating Environment:

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.

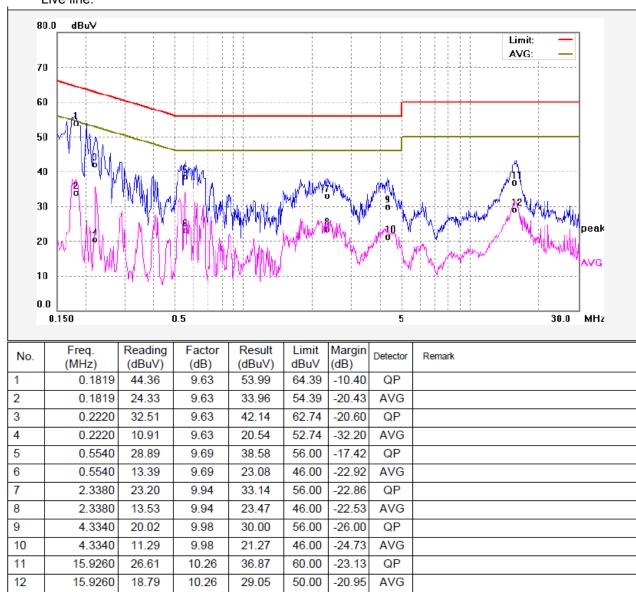


7.3 Measurement Description

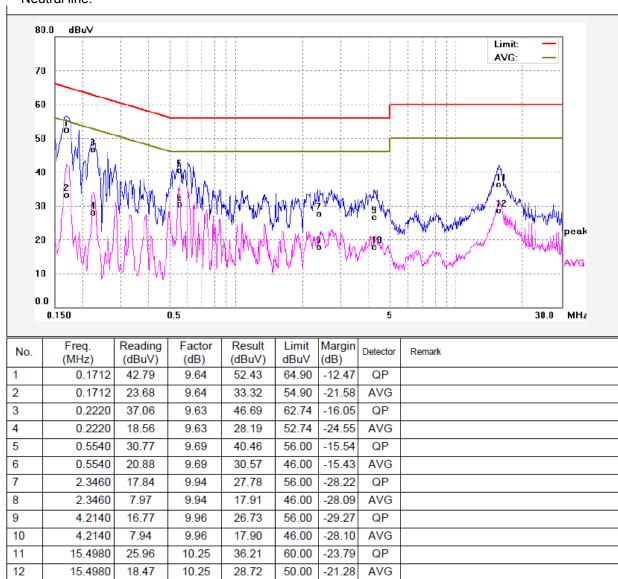
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

Live line:



Neutral line:



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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:

15.209 EIIIIIL.							
_	Field Strei	ngth	Field Strength Limit at 3m Measurement Dist				
Frequency (MHz)	uV/m	uV/m Distance 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:

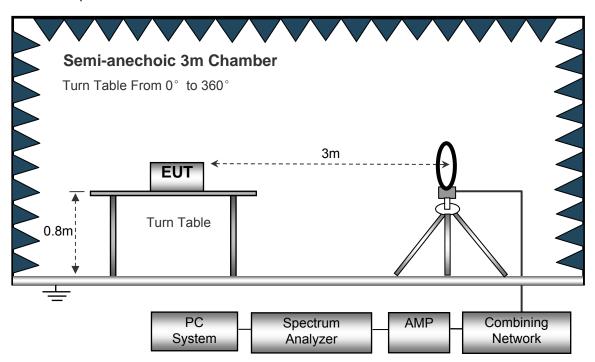
Temperature: 23.5 °C
Humidity: 51.1 % RH
Atmospheric Pressure: 101.2kPa

EUT Operation : Refer to section 4.5.

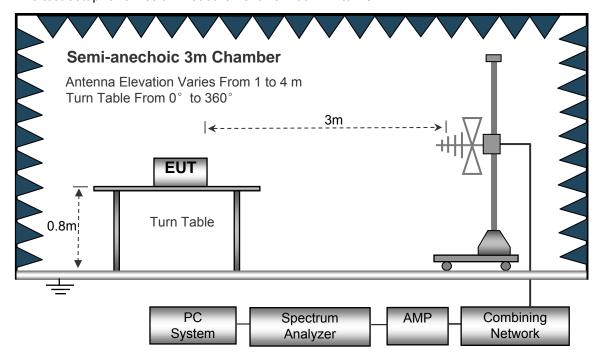
8.2 Test Setup

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.



Anechoic 3m Chamber

Antenna Elevation Varies From 1 to 4 m

Turn Table From 0° to 360°

Turn Table

Absorbers

Spectrum

Analyzer

Combining

Network

AMP

The test setup for emission measurement above 1 GHz.

PC

System

8.3 Spectrum Analyzer Setup

Below 30MHz		
	Sweep Speed	
	Video Bandwidth	
	Resolution Bandwidth	10kHz
30MHz ~ 1GHz	<u>·</u>	
	Sweep Speed	Auto
	Detector	.PK
	Resolution Bandwidth	.100kHz
	Video Bandwidth	.300kHz
Above 1GHz		
	Sweep Speed	.Auto
	Detector	.PK
	Resolution Bandwidth	.1MHz
	Video Bandwidth	.3MHz
	Detector	Ave.
	Resolution Bandwidth	.1MHz
	Video Bandwidth	10Hz

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8.4 Test Procedure

1. 1The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, 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.

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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 An Height	Polar	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
			GF	SK Low	Channel				
*268.32	35.23	QP	140	1.4	Н	-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	Н	1.33	41.95	74.00	-32.05
7206.00	35.37	Ave	283	1.5	Н	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	Н	-13.14	31.32	74.00	-42.68
*2354.17	37.63	Ave	176	1.5	Н	-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: * Resti	ricted bands	of operation.							

Frequency	Receiver Reading	Detector	Turn table Angle	RX An	tenna Polar	Corrected Factor	Corrected Amplitude	Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
GFSK Middle Channel									
*268.32	34.78	QP	64	1.3	Н	-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	Н	2.21	43.68	74.00	-30.32
*7320.00	33.91	Ave	222	1.8	Н	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	Н	-13.14	31.80	74.00	-42.20
*2375.73	36.79	Ave	147	1.6	Н	-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: * Resti	Note: * Restricted bands of operation.								

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected	Corrected		
				Height	Polar	Factor	Amplitude	Limit	Margin
(MHz)	(dBµV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
GFSK High Channel									
*268.32	34.78	QP	284	1.9	Н	-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	Н	2.84	43.52	74.00	-30.48
*7440.00	35.40	Ave	302	1.0	Н	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	Н	-13.14	30.92	74.00	-43.08
*2351.56	37.08	Ave	339	1.7	Н	-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: * Rest	Note: * Restricted bands of operation.								

Test Frequency: From 18GHz to 25GHz

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

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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

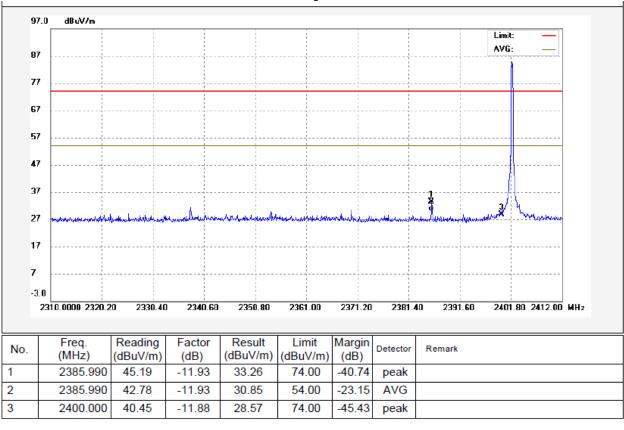
Test Mode: Transmitting

9.1 Test Procedure

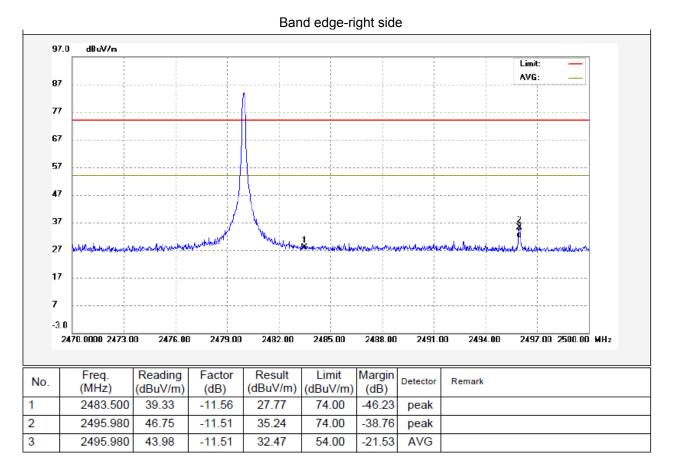
Refer to section 8.4 of this test report.

9.2 Test Result

Band edge-left side



Remark: The worst case (Vertical) was recoded.



Remark: The worst case (Vertical) was recoded.

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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

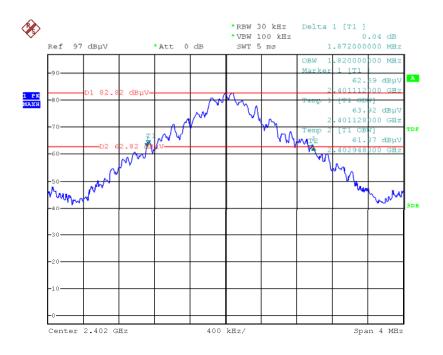
Refer to section 8.4 of this test report.

10.2 Test Result

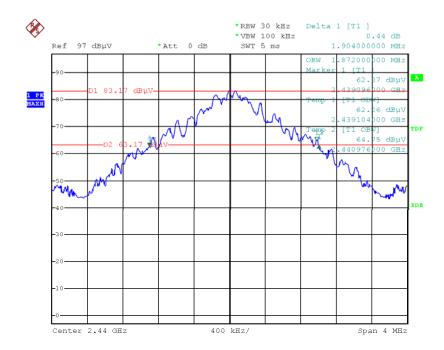
Operation mode	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low channel	1.872	1.820
Middle channel	1.904	1.872
High channel	1.912	1.896

Test result plot as follows:

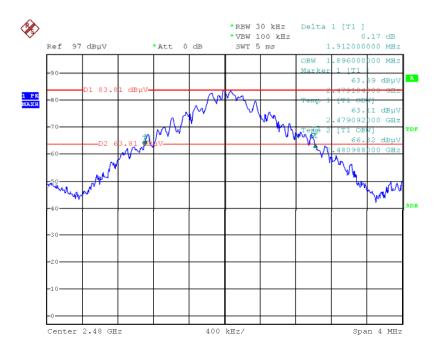
Mode: Low channel



Mode: Middle channel



Mode: High channel



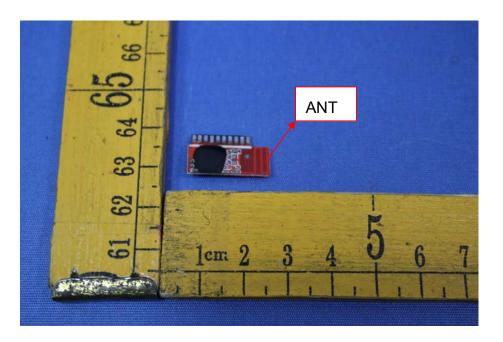
11 Antenna Requirement

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.



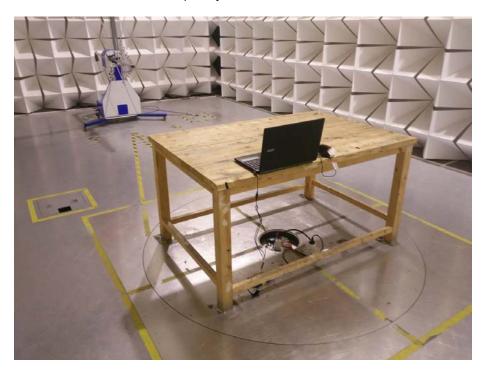
12 Photographs- Model V88 Test Setup Photos

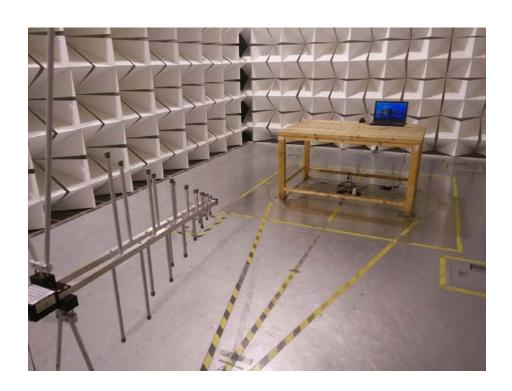
12.1 Photograph - Radiation Emission

Test frequency from 9 KHz to 30MHz



Test frequency from 30MHz to 1GHz





Test frequency above 1GHz



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12.2 Photograph – Conducted Emission



13 Photographs - Constructional Details

13.1 Photographs – Model V88 External Photos





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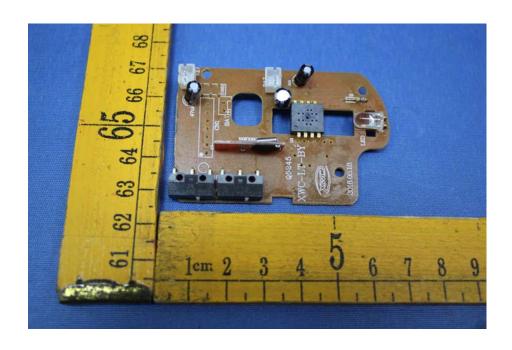
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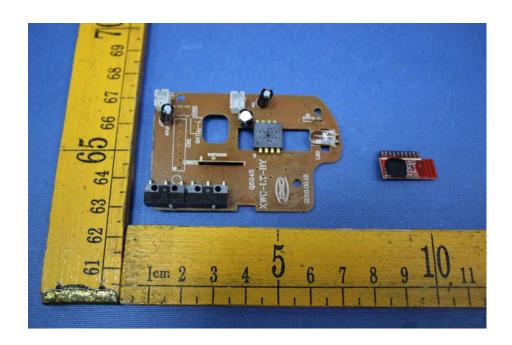
13.2 Photographs – Model V88 Internal Photos



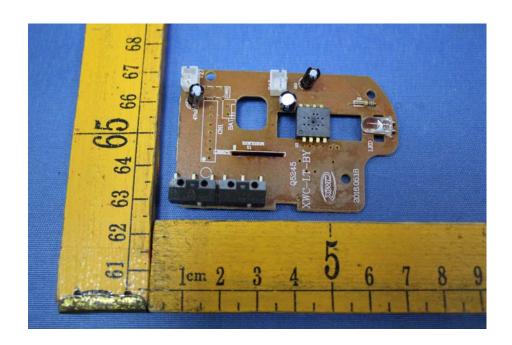


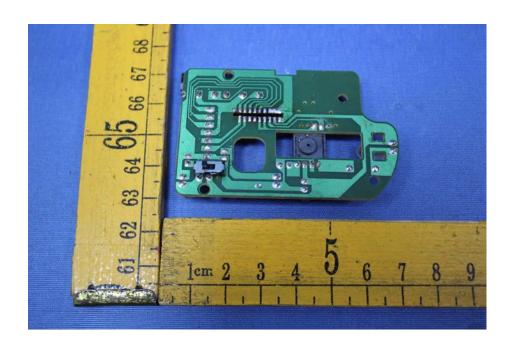
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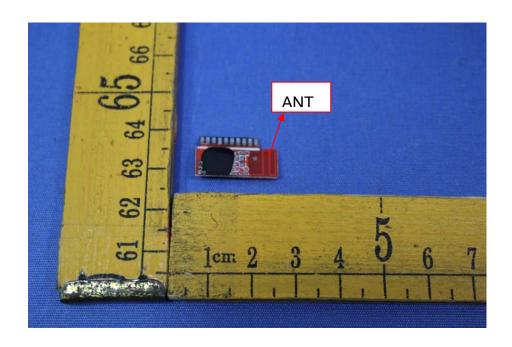


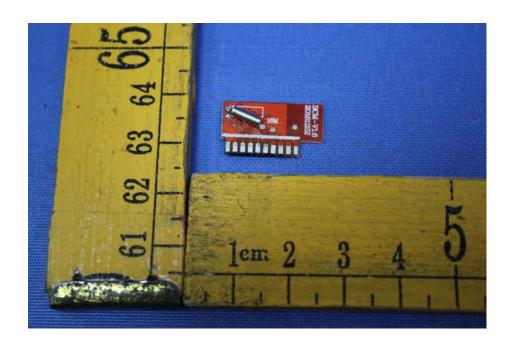
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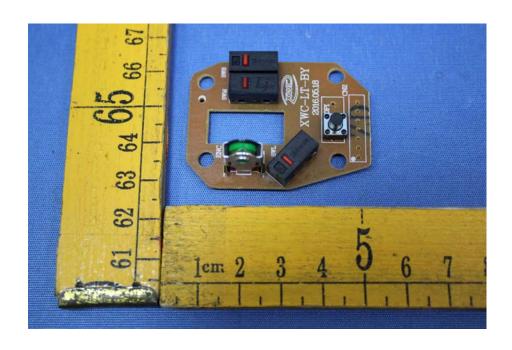


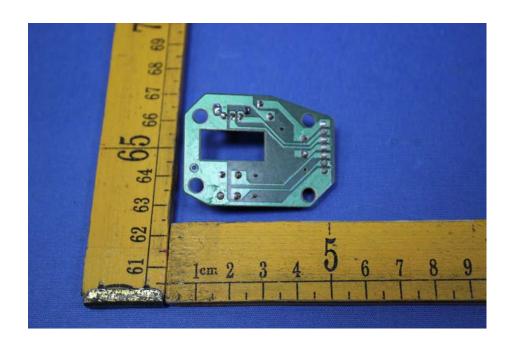
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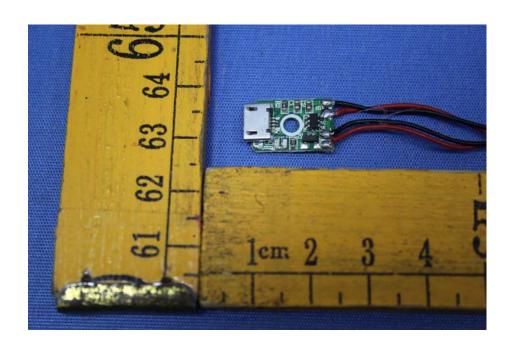


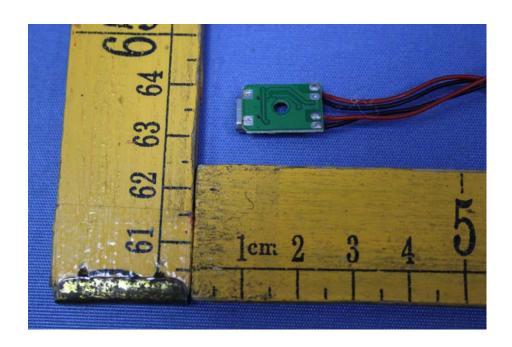
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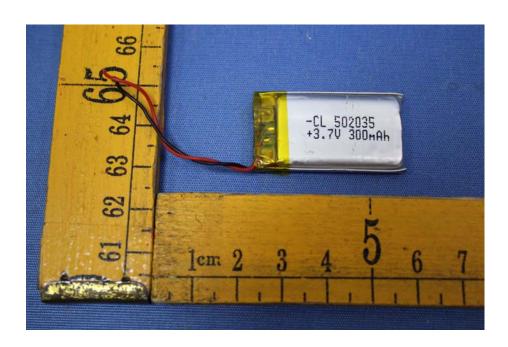


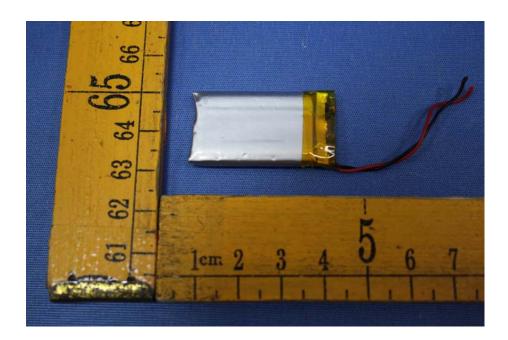


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=====End of Report=====