

TEST REPORT

Reference No..... : WTD14S0110459E
FCC ID : 2ABOZ TSM-5009
Applicant..... : TOPSUN (CHINA) INDUSTRY CO.,LTD.
Address..... : 2nd Floor 2nd Bldg The First Fuqiao Industrial Zone Qiaotou Village,
Fuyong Town, Shenzhen,Guangdong
Manufacturer : The same as above.
Address..... : The same as above.
Product Name..... : 2.4G wireless mouse
Model No. : TSM-5001, TSM-5002, TSM-5003, TSM-5004, TSM-5005,
TSM-5006, TSM-5007, TSM-5008, TSM-5009, TSM-5010,
TSM-5011, TSM-5012, TSM-5013, TSM-5014, TSM-5015,
TSM-5016, TSM-5017, TSM-5018, TSM-5019, TSM-5020
Standards..... : FCC CFR47 Part 15 Section 15.249: 2012
Date of Receipt sample : Jan.06,2014
Date of Test..... : Jan.13~16, 2014
Date of Issue..... : Feb.20,2014
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:

Waltek Services (Shenzhen) Co., Ltd.

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Testing location: The same as above

Tel :+86-755-83551033

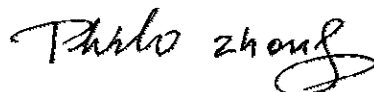
Fax:+86-755-83552400

Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Outside of Band Emission	15.249	PASS
	15.205	
	15.209	
20dB Bandwidth	15:215(c)	PASS
Conducted Emissions	15.207	N/A
Radiated Emission	15.249(a)	PASS
	15.209	
	15.205(a)	
Antenna Requirement	15.203	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: 2.4G wireless mouse
Model No.	: TSM-5001, TSM-5002, TSM-5003, TSM-5004, TSM-5005, TSM-5006, TSM-5007, TSM-5008, TSM-5009, TSM-5010, TSM-5011, TSM-5012, TSM-5013, TSM-5014, TSM-5015, TSM-5016, TSM-5017, TSM-5018, TSM-5019, TSM-5020
Model Differences	: Only the model No. is different. The model TSM-5009 is tested sample.
Type of Modulation	: FSK
Frequency Range	: 2409-2476MHz
Oscillator	: 16MHz
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 2*1.5V Powered by lithium battery
Adapter	: N/A

4.3 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, July 12, 2012.

- **FCC – Registration No.: 880581**

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 880581, May 26, 2011.

4.4 Test Location

All Emissions tests were performed at:-

1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, Guangdong, China.

4.4.1 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.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	2409MHz	2440MHz	2476MHz

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY4511494 3	Sep.18,2013	Sep.17,2014
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.18,2013	Sep.17,2014
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.20,2013	Apr.19,2014
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.18,2013	Sep.17,2014
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.20,2013	Apr.19,2014
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.20,2013	Apr.19,2014
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
8	Coaxial Cable (above 1GHz)	Top	25MHz-18GHz	EW02014-7	Apr.20,2013	Apr.19,2014

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 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249
 Test Method: ANSI 63.4: 2003
 Measurement Distance: 3m
 Detector: Peak for pre-scan (120kHz resolution bandwidth)
 Quasi-Peak if maximised peak within 6dB of limit
 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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note: RF Voltage(dBuV)= $20 \log_{10}$ RF Voltage(uV)

6.1 EUT Operation:

Operating Environment:

Temperature: 22 °C
 Humidity: 52% RH
 Atmospheric Pressure: 101.5 kPa

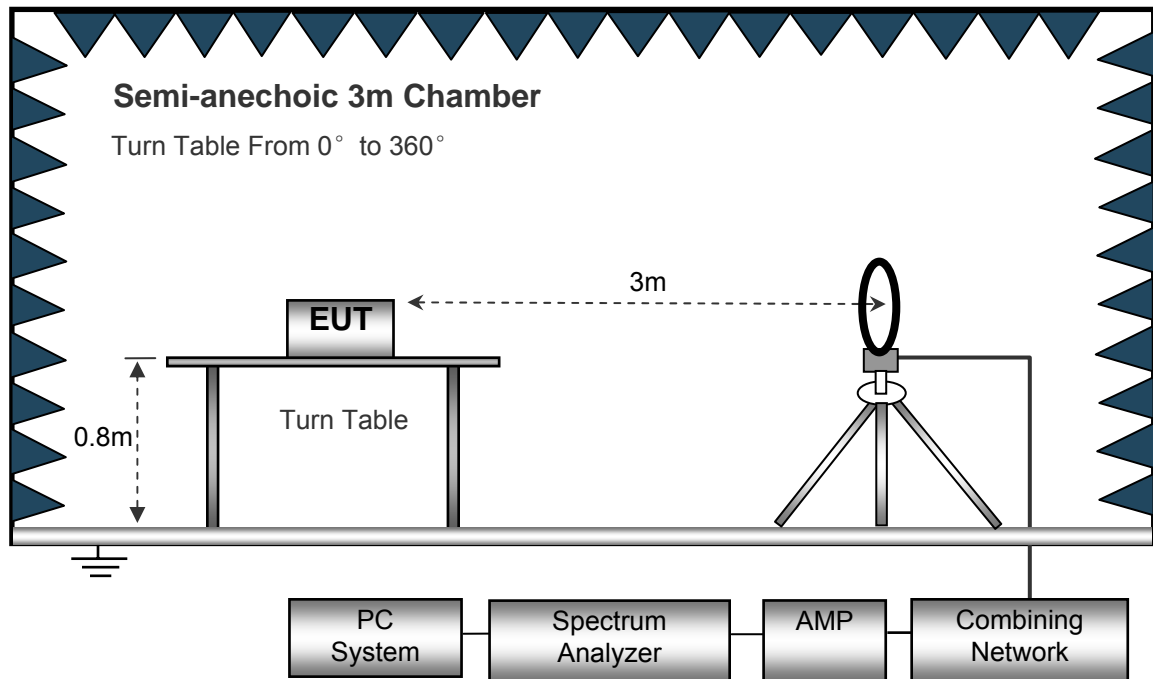
Operation Mode:

The EUT was tested in transmitting mode, and the test data were shown as follow.

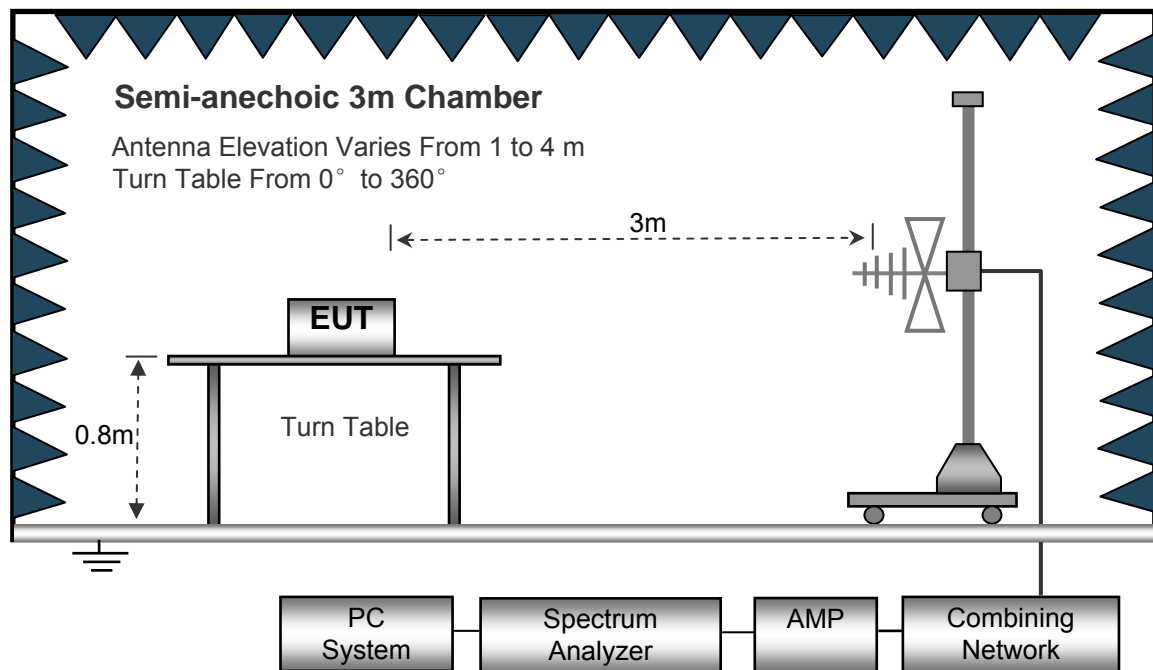
6.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

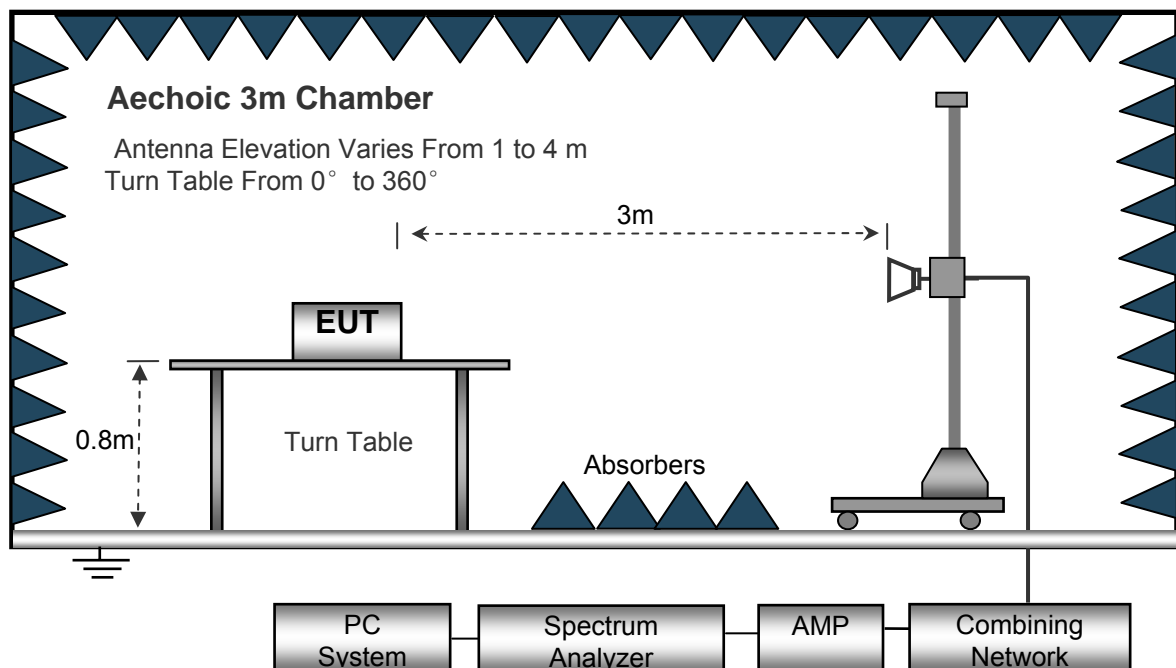
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 16MHz to 25GHz.

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth10kHz
 Video Bandwidth10kHz
 Resolution Bandwidth10kHz

30MHz ~ 1GHz

Sweep Speed Auto
 IF Bandwidth120 KHz
 Video Bandwidth100KHz
 Quasi-Peak Adapter Bandwidth120 KHz
 Quasi-Peak Adapter ModeNormal
 Resolution Bandwidth100KHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth1MHz
 Video Bandwidth3MHz
 DetectorAve.
 Resolution Bandwidth1MHz
 Video Bandwidth10Hz

6.4 Test Procedure

1. This is a handheld device, The radiation emission should be 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.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
3. All data was recorded in the peak and average detection mode.
4. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

6.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB μ V means the emission is 7dB μ V below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

6.6 Radiated Emissions Test Result

Formula of conversion factors: the field strength at 3m was established by adding
The meter reading of the spectrum analyzer (which is set to read in units of dB μ V/m)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stated in terms of dB. The gain of the pressletor was accounted
For in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading + ACF = FS

33 20dB μ V + 10.36dB = 30.36dB μ V/m @3m

6.7 Radiated Emission Data

Test Frequency :Below 30MHz

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

Test Frequency: 30MHz ~ 18GHz

Test Mode: Transmitting

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Low Channel 2409MHz									
345.32	12.32	PK	221	1.2	H	17.25	29.57	40.00	-10.43
324.50	10.08	PK	205	1.5	V	17.25	27.33	40.00	-12.67
2409.00	97.57	PK	360	1.6	H	-13.02	84.55	114.00	-29.45
2409.00	92.53	Ave	81	1.8	H	-13.02	79.51	94.00	-14.49
4818.00	56.32	PK	271	1.2	H	-1.06	55.26	74.00	-18.74
4818.00	44.56	Ave	271	1.2	H	-1.06	43.50	54.00	-10.50
7227.00	45.62	PK	66	1.1	H	1.33	46.95	74.00	-27.05
7227.00	37.85	Ave	66	1.1	H	1.33	39.18	54.00	-14.82
2313.59	45.96	PK	176	2.0	V	-13.19	32.77	74.00	-41.23
2313.59	38.08	Ave	176	2.0	V	-13.19	24.89	54.00	-29.11
2387.24	44.92	PK	103	1.6	H	-13.14	31.78	74.00	-42.22
2387.24	36.41	Ave	103	1.6	H	-13.14	23.27	54.00	-30.73
2486.81	42.66	PK	197	1.7	V	-13.08	29.58	74.00	-44.42
2486.81	38.17	Ave	197	1.7	V	-13.08	25.09	54.00	-28.91

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
Middle Channel 2440MHz									
345.32	12.41	PK	219	1.7	H	17.25	29.66	40.00	-10.34
324.50	10.14	PK	223	1.2	V	17.25	27.39	40.00	-12.61
2440.00	98.71	PK	141	1.2	H	-13.05	85.66	114.00	-28.34
2440.00	93.24	Ave	341	1.5	H	-13.05	80.19	94.00	-13.81
4880.00	57.06	PK	323	1.3	H	-0.62	56.44	74.00	-17.56
4880.00	45.32	Ave	323	1.3	H	-0.62	44.70	54.00	-9.30
7320.00	44.96	PK	195	1.5	H	2.21	47.17	74.00	-26.83
7320.00	38.05	Ave	195	1.5	H	2.21	40.26	54.00	-13.74
2322.58	46.43	PK	215	1.9	V	-13.19	33.24	74.00	-40.76
2322.58	38.88	Ave	215	1.9	V	-13.19	25.69	54.00	-28.31
2380.61	43.82	PK	262	1.3	H	-13.14	30.68	74.00	-43.32
2380.61	37.17	Ave	262	1.3	H	-13.14	24.03	54.00	-29.97
2499.59	43.75	PK	155	1.4	V	-13.08	30.67	74.00	-43.33
2499.59	38.64	Ave	155	1.4	V	-13.08	25.56	54.00	-28.44

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
High Channel 2476MHz									
345.32	12.71	PK	10	1.1	H	17.25	29.96	40.00	-10.04
324.50	10.36	PK	22	1.5	V	17.25	27.61	40.00	-12.39
2476.00	98.16	PK	171	1.0	H	-13.06	85.10	114.00	-28.90
2476.00	93.33	Ave	32	1.4	H	-13.06	80.27	94.00	-13.73
4952.00	56.81	PK	17	1.1	H	-0.24	56.57	74.00	-17.43
4952.00	45.72	Ave	17	1.1	H	-0.24	45.48	54.00	-8.52
7428.00	45.84	PK	189	1.1	H	2.84	48.68	74.00	-25.32
7428.00	37.82	Ave	189	1.1	H	2.84	40.66	54.00	-13.34
2312.13	46.57	PK	306	1.7	V	-13.19	33.38	74.00	-40.62
2312.13	37.29	Ave	306	1.7	V	-13.19	24.10	54.00	-29.90
2362.72	44.81	PK	77	1.8	H	-13.14	31.67	74.00	-42.33
2362.72	36.88	Ave	77	1.8	H	-13.14	23.74	54.00	-30.26
2489.53	44.18	PK	259	1.2	V	-13.08	31.10	74.00	-42.90
2489.53	38.73	Ave	259	1.2	V	-13.08	25.65	54.00	-28.35

Test Frequency :From 18GHz to 25GHz

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

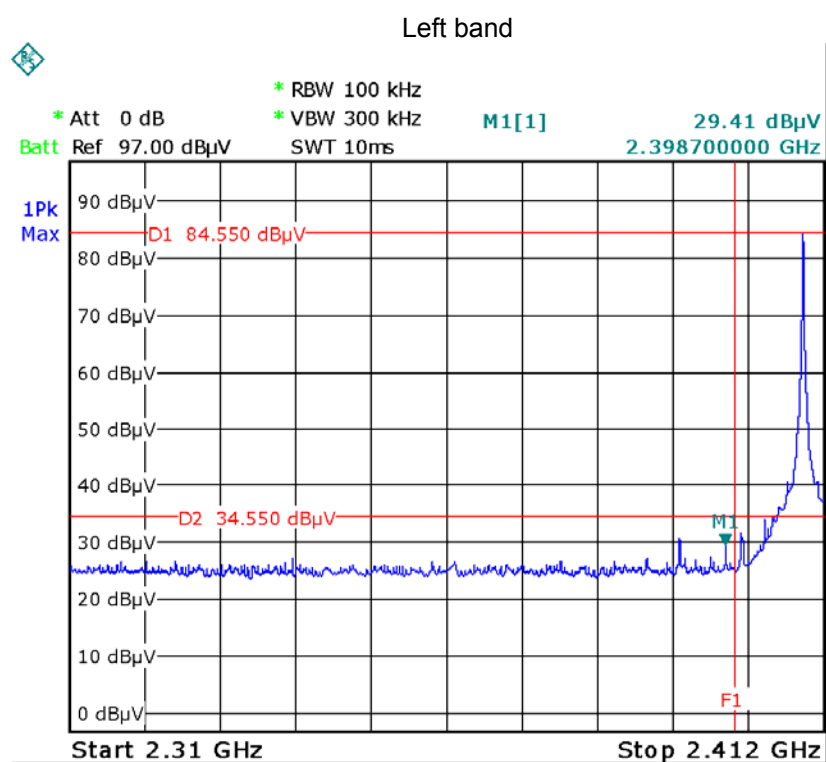
7 Outside of Band Emission

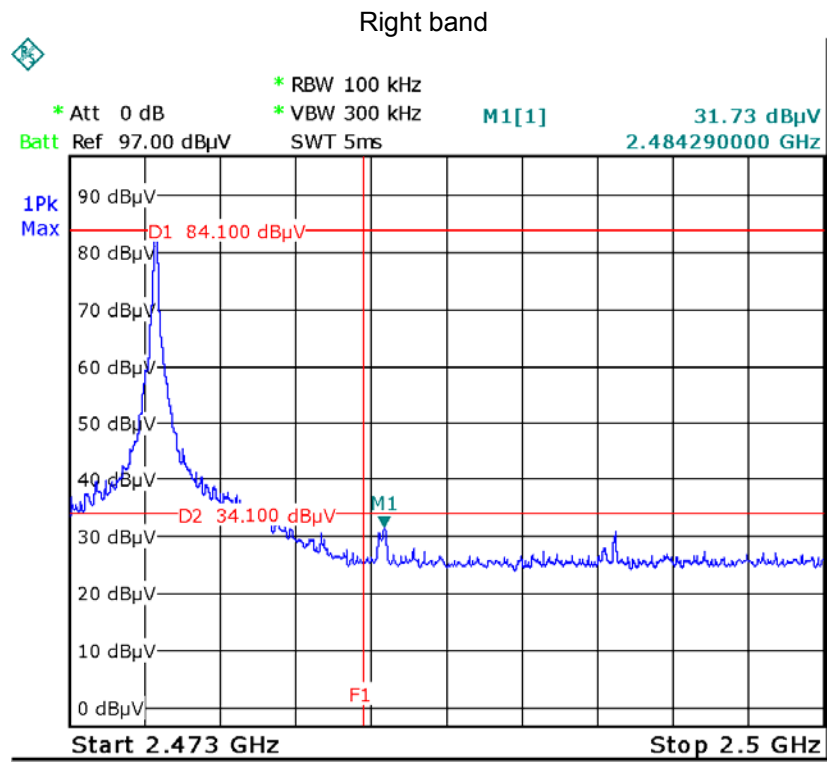
Test Requirement: 15.249(d):Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Test Method: ANSI C63.4:2003

Test Result: PASS

Test result plots shown as follows:





8 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.215(c)
 Test Method: ANSI C63.4:2003
 Test Mode: Transmitting

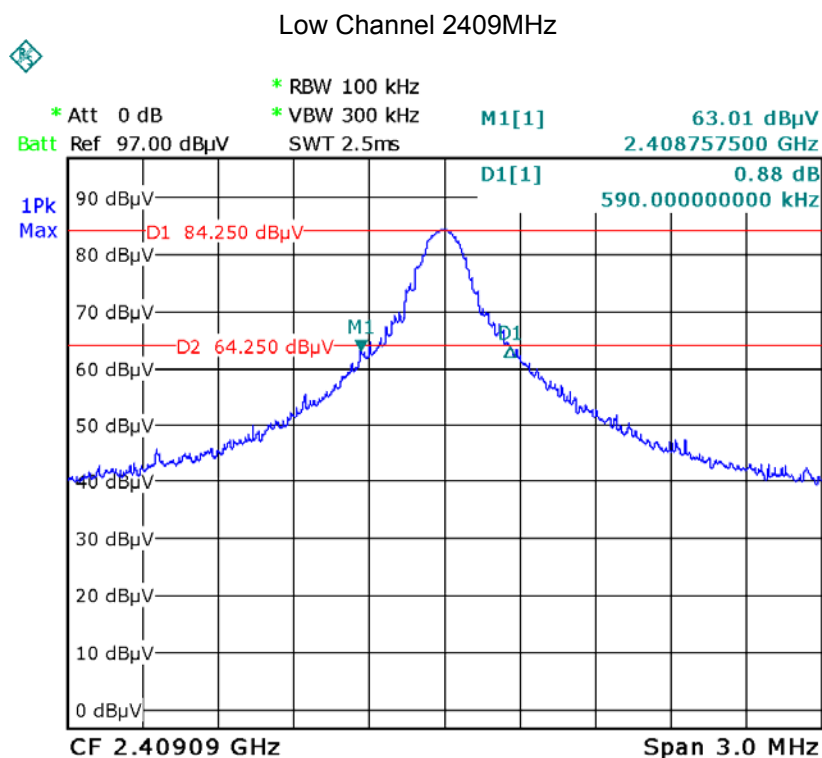
8.1 Test Procedure:

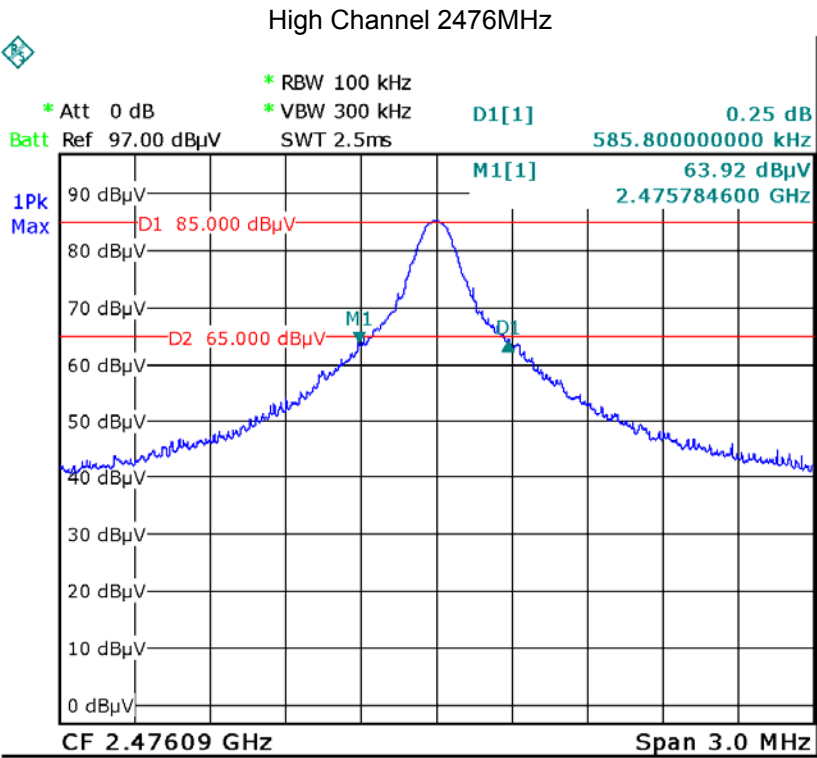
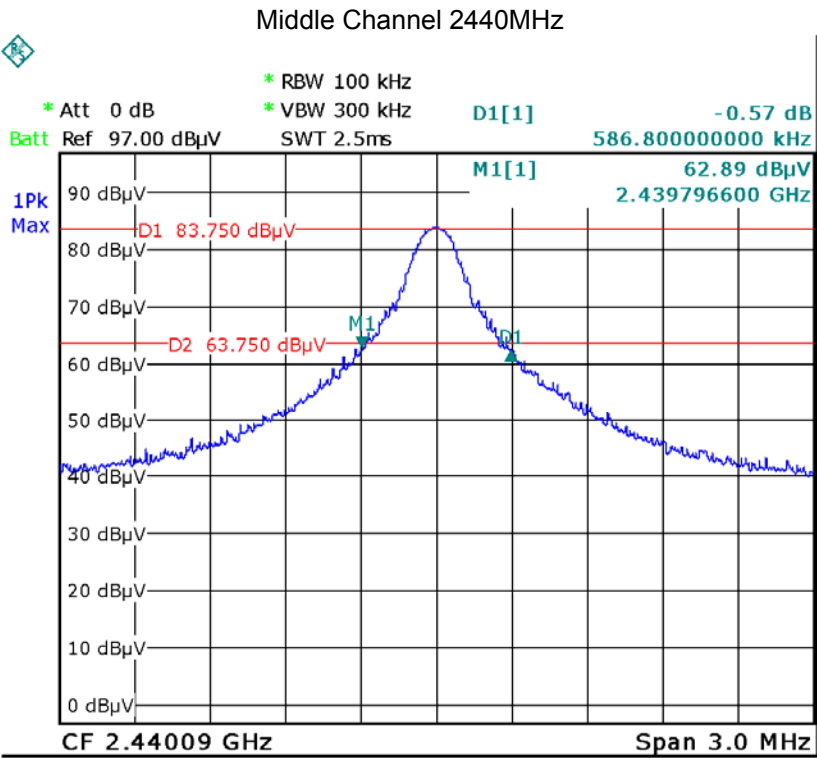
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

8.2 Test Result:

Test Channel	Bandwidth
2409MHz	590.0kHz
2440MHz	586.8kHz
2476MHz	585.8 kHz

Test result plot as follows:





9 Antenna Requirement

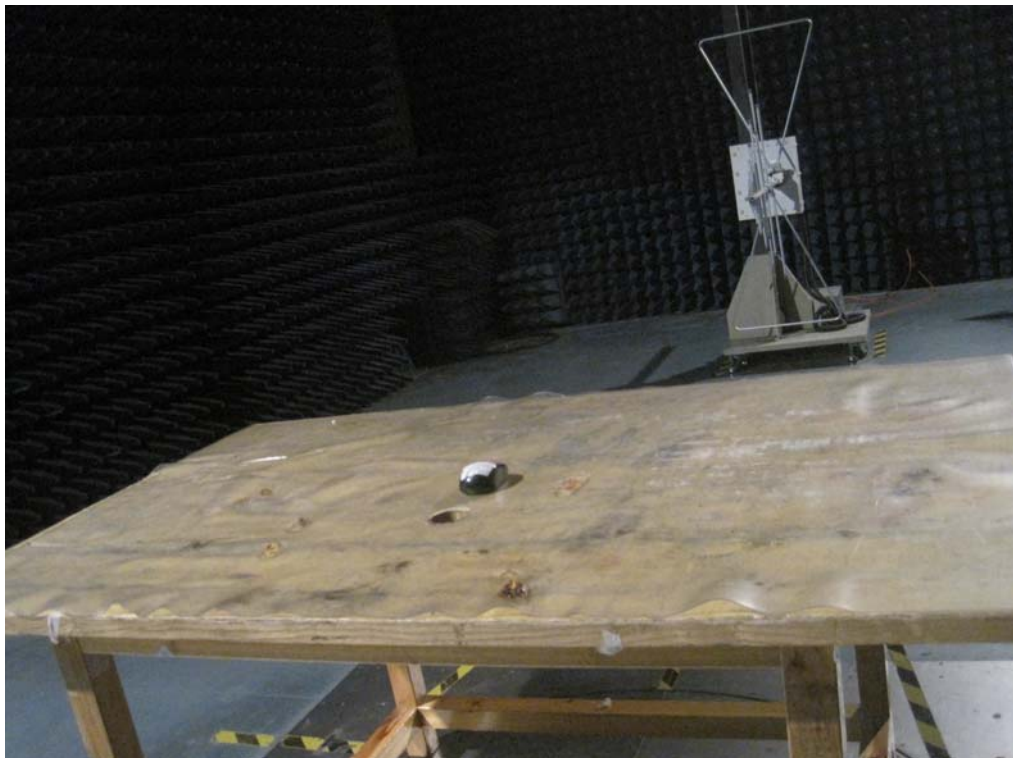
According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a PCB printed, fulfil the requirement of this section.

10 Photographs of Testing

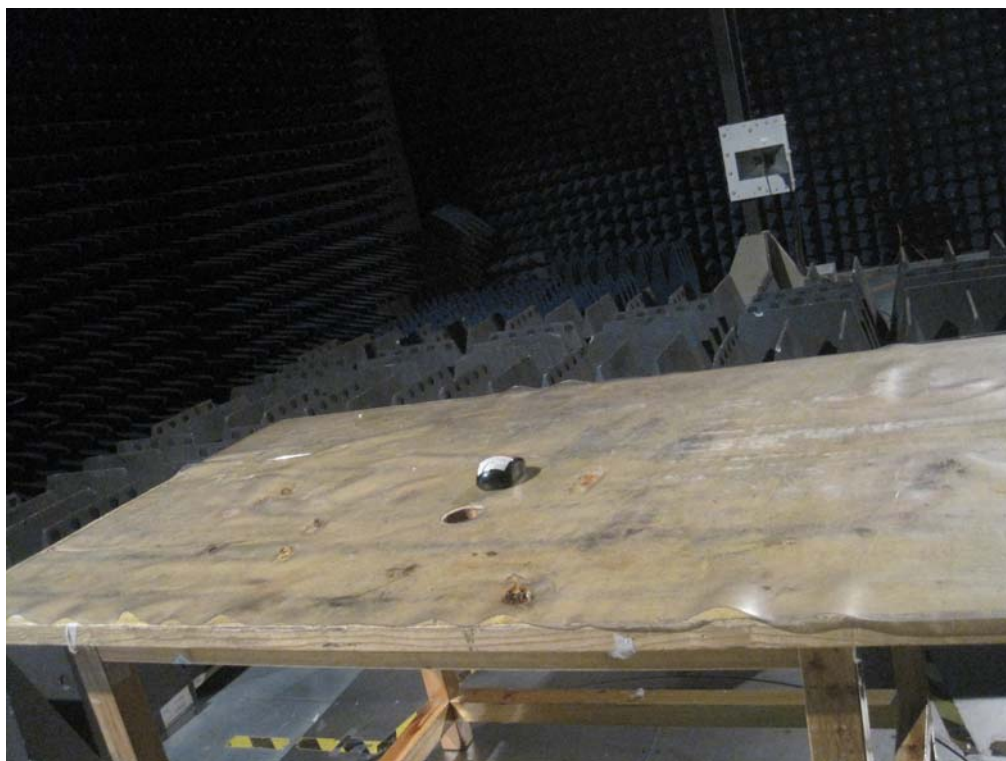
10.1 Radiation Emission below 30MHz



10.2 Radiation Emission From 30MHz-1GHz



10.3 Radiation Emission Above 1GHz



11 Photographs - Constructional Details

11.1 EUT - Appearance View

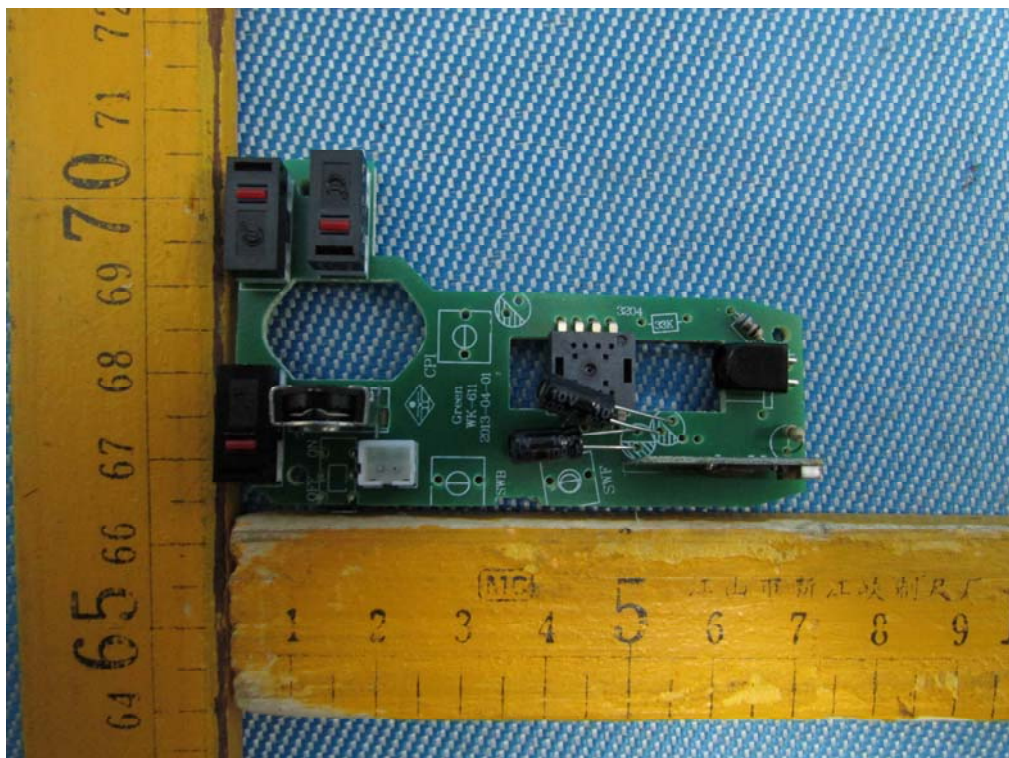


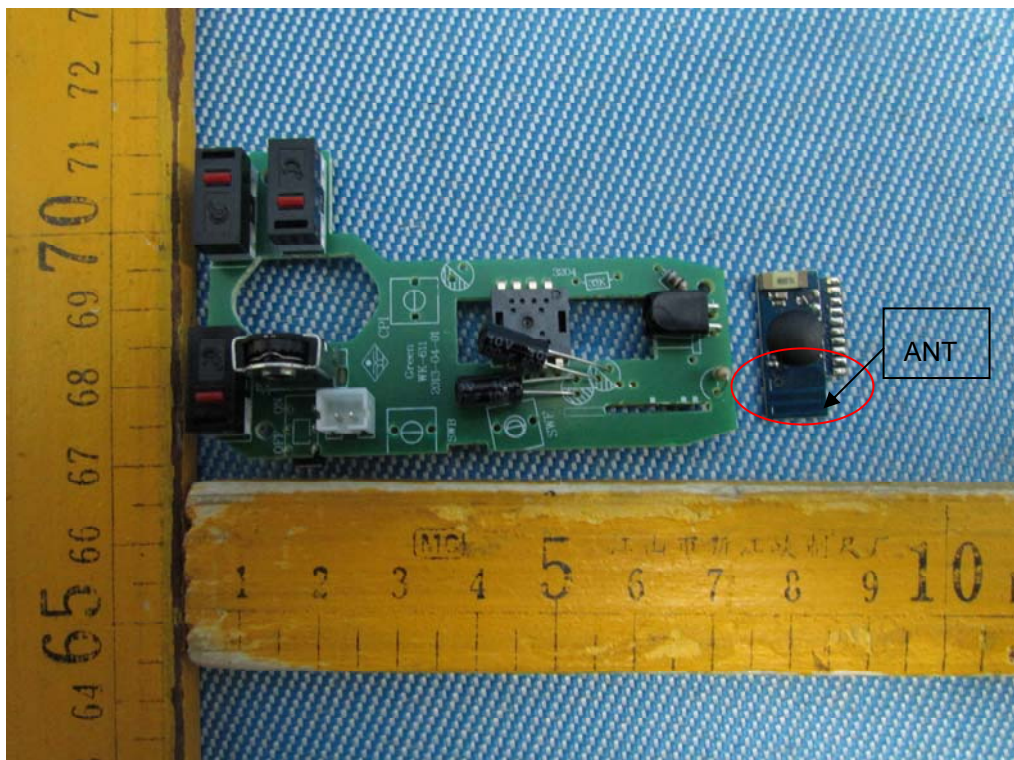
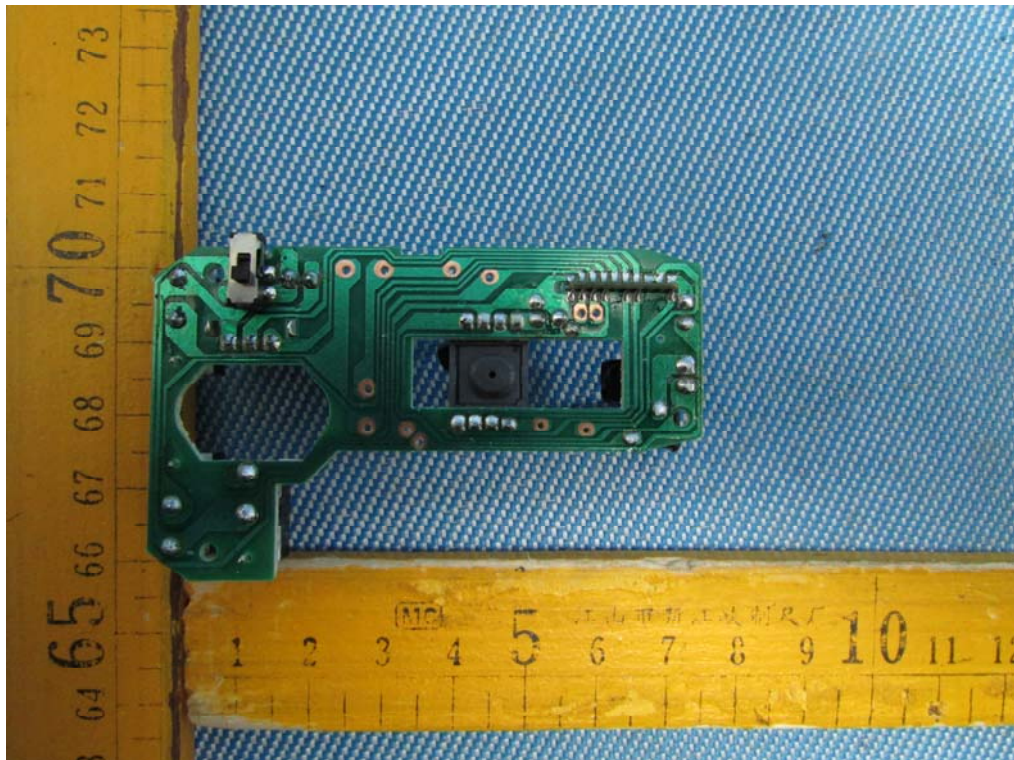






11.2 EUT - Open View





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