



## **EN301489-1/EN301489-3 TEST REPORT**

On Behalf of

**Cho-Liang Thermal Tech Co.,Ltd**

**2.4GHz Wireless Optical Mouse**

**Model No.: CNE-CMSW1X, CAMW-01X**

Prepared for : Cho-Liang Thermal Tech Co.,Ltd  
Address : 5F-3, NO.14, Lane 609, Sec.5, Chung Hsin Rd., San Chung City,  
Taipei County, Taiwan.R.O.C.

Prepared By : Shenzhen Alpha Product Testing Co., Ltd.  
Address : Building B, East Area of Nanchang Second Industrial Zone,  
Gushu 2nd Road, Bao'anDistrict, Shenzhen 518126,P.R.China

Report Number : T1850408 01  
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# DECLARATION

Applicant : Cho-Liang Thermal Tech Co.,Ltd

Manufacturer : Guangzhou Boda Electronic Equipment Co.,Ltd

Product : 2.4GHz Wireless Optical Mouse

(A) Model No. : CNE-CMSW1X, CAMW-01X

(B) DIFF : All model's the function, software and electric circuit are the same, only the name is different, so all the test were performed on the model CNE-CMSW1X

(C) Trade Name : N/A

(D) Testing supply : DC 3.0V From Battery For Mouse; DC 5V From USB For USB Dongle

### Measurement Procedure Used:

**ETSI EN 301 489-1 V1.9.2: 2011**  
**ETSI EN 301 489-3 V1.6.1: 2013**  
**(EN 55022: 2010; EN55024: 2010)**

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. The measurement results are contained in this test report is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the European Standard ETSI EN 301 489-1 V1.9.2: 2011/EN 301 489-3 V1.6.1: 2013 (EN 55022: 2010; EN 55024: 2010) under R&TTE Directive 1999/5/EC requirement.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....:

Store Chu  
Test Engineer

Approved by (name + signature).....:

Simple Guan  
Project Manager

Date of issue.....

May 07,2015



## 1. General Information

### 1.1. Description of Device (EUT)

EUT Name	:	2.4GHz Wireless Optical Mouse
Trade Name	:	N/A
Model No.	:	CNE-CMSW1X, CAMW-01X
DIFF	:	All model's the function, software and electric circuit are the same, only the appearance is different, so all the test were performed on the model CNE-CMSW1X
Operation frequency	:	CH Low: 2405MHz; CH Middle: 2448MHz; CH High: 2472MHz;
Channel number	:	3
Modulation	:	GFSK
Antenna Type	:	Integral antenna, Maximum Gain: 0dBi
Applicant	:	Cho-Liang Thermal Tech Co.,Ltd
Address	:	5F-3, NO.14, Lane 609, Sec.5, Chung Hsin Rd., San Chung City, Taipei County, Taiwan.R.O.C.
Manufacturer	:	Guangzhou Boda Electronic Equipment Co.,Ltd
Address	:	4 Xiajiyuanyi Road, Xindun Avenue, XinDun Village.Xintang District, GZ, PRC
Sample Type	:	Prototype production

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## 1.2. Test Lab information

### 1.2.1. Laboratory Name

Shenzhen Alpha Product Testing Co., Ltd.

### 1.2.2. Location

Building B, East Area of Nanchang Second Industrial Zone,  
Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China

### 1.2.3. Test facility

August 11, 2014 File on Federal Communication Commission  
Registration Number: 203110

July 18, 2014 Certificated by IC  
Registration Number: 12135A

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## 2. Summary of test

### 2.1. Test Standard description:

ETSI EN 301 489-1 V1.9.2: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements.

ETSI EN 301 489-3 V1.6.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz

EN 55022: 2010: Limits and methods of measurement of radio disturbance characteristics of information technology equipment.

EN 55024: 2010: Information technology equipment-Immunity characteristics limits and methods of measurement.

### 2.2. Summary of test result

Description of Test Item	Standard ETSI EN 301 489-1	Results
<b>EMC Emission</b>		
Radiated emission	Clause 8.2	PASS
Conducted emission(DC power port)	Clause 8.3	N/A
Conducted emission(AC mains port)	Clause 8.4	PASS
Harmonic current emissions	Clause 8.5	N/A
Voltage fluctuation and flicker	Clause 8.6	N/A
Conducted emission(Telecommunication port)	Clause 8.7	N/A
<b>Immunity</b>		
RF electromagnetic field (80MHz to 1GHz and 1.4GHz to 2.7GHz)	Clause 9.2	PASS
Electrostatic discharge	Clause 9.3	PASS
Fast transients common mode(AC mains port and Telecommunication port)	Clause 9.4	N/A

RF common mode 0.15MHz to 80MHz(AC mains port and Telecommunication port)	Clause 9.5	N/A
Transients and surges	Clause 9.6	N/A
Voltage dips and interruptions	Clause 9.7	N/A
Surges, line to line (AC mains port and Telecommunication port)	Clause 9.8	N/A
<p>N/A is an abbreviation for Not Applicable.</p> <p>Note: This device also belong to information technology equipment,and most of EN55022 and EN55024's test intems are same with ETSI EN301 489's.so most of EN55022 and EN55024's tests were performed together with EN301 489's test.</p>		

### 2.3. Assistant equipment used for test

Description	:	Notebook
Manufacturer	:	ACER
Model No.	:	ZQT

### 2.4. Block Diagram of EMC emission test



### 2.5. Block Diagram of Immunity test



## 2.6. Immunity performance assessment criteria

### General performance criteria

During test	After test	Criteria
Operate as intended; Degradation of performance (see note 1); No loss of function.	Operate as intended; No degradation of performance (see note 2); No loss of function.	A
Loss of function (one or more).	Operate as intended; No degradation of performance (see note 2); Functions self-recoverable.	B
Loss of function (one or more).	Operate as intended; No degradation of performance (see note 2); Functions recoverable by the operator.	C
<p>NOTE 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. If the permissible degradation of performance is not specified by the manufacturer, then this may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p> <p>NOTE 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed. If the minimum performance level or the permissible degradation of performance is not specified by the manufacturer, then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.</p>		

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions and voltage dips exceeding a certain period of time.

## 2.7. Test Conditions

All test were performed under the following environmental conditions

Temperature range	:	21-25°C
Humidity range	:	40-75%
Pressure range	:	86-106kPa
Power supply	:	DC 3.0V From Battery For Mouse; DC 5V From USB For USB Dongle

## 2.8. Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	MU	Remark
1	Uncertainty for Conducted Emission Test	2.02dB	
2	Uncertainty for Radiation Emissions	3.44 dB	Polarize: V
		3.96 dB	Polarize: H

## 2.9. Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Cal. Due day	Cal. Interval
Test Receiver	Rohde&Schwarz	ESCI	1166.5950K03-1011	2016.01.19	1 Year
Amplifier	Schwarzbeck	BBV9743	9743-019	2016.01.19	1 Year
Bilog Antenna	Schwarzbeck	VULB 9168	9168-438	2017.01.21	2 Year
Spectrum Analyzer	Agilent	E4407B	MY49510055	2016.01.19	1 Year
Horn Antenna	Schwarzbeck	BBHA 9120 D	BBHA 9120 D(1201)	2017.01.21	2 Year
Cable	Resenberger	SUCOFLEX 104	MY6562/4	2016.01.19	1 Year
Cable	Resenberger	SUCOFLEX 104	309972/4	2016.01.19	1 Year
Cable	Resenberger	SUCOFLEX 104	329112/4	2016.01.19	1 Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2016.01.19	1 Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2016.01.19	1 Year
Amplifier	Quietek	AP-180C	CHM-0602012	2016.01.19	1 Year
Test Receiver	Rohde & Schwarz	ESCI	101202	2016.01.19	1 Year
Pulse Limiter	Schwarzbeck	9516F	9618	2016.01.19	1 Year
ESD Tester	HAEFLY	PESD1610	H310546	2016.01.21	1 Year
Power Meter	Anritsu	ML2487A	6k00003262	2016.01.20	1 Year
Power Sensor	Anritsu	MA2491A	33005	2016.01.20	1 Year
Log-periodic Antenna	A&R	AT1080	16512	NCR	NCR

### 3. Conducted emission

#### 3.1. Limit for AC mains port

Frequency	Quasi-Peak Level dB ( $\mu$ V)	Average Level dB ( $\mu$ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. \* Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

#### 3.2. Limit for Telecommunication ports

Frequency	Quasi-Peak Level dB ( $\mu$ V)	Average Level dB ( $\mu$ V)
150kHz ~ 0.5MHz	84 ~ 74*	74 ~ 64*
0.5MHz ~ 30MHz	74	64

Notes: 1. \* Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

#### 3.3. Test Procedure

For AC Port : The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power connected to the power mains through a line impedance stabilization network (L.I.S.N. 1#). This provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N.2#). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to the EN55022 regulations during conducted emission test.

For Telecommunication Port:

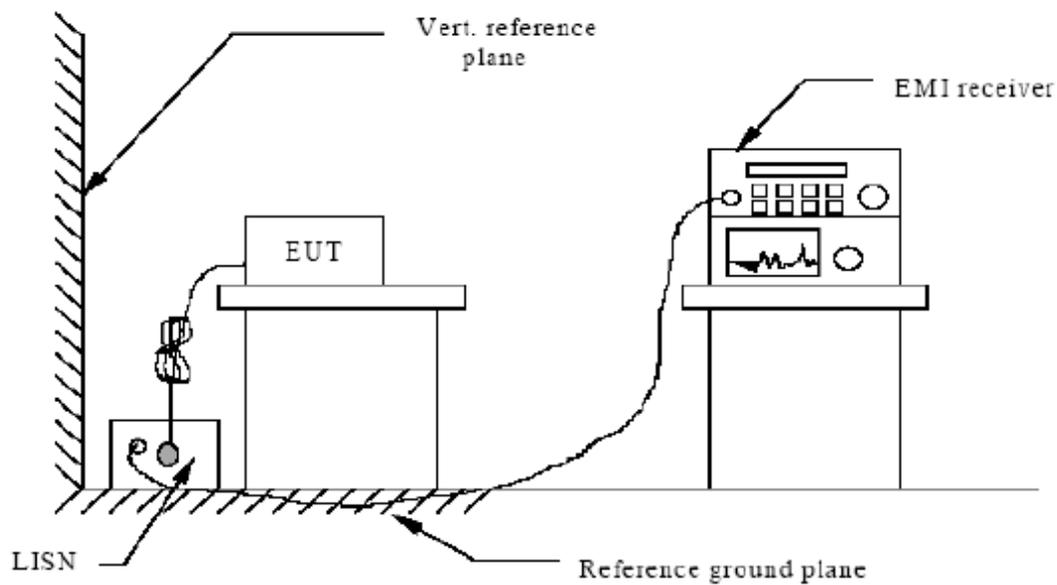
The setup is the same as conduction besides this, connecting between AE and telecommunication port through ISN. Each phase of telecommunication wire is measured to evaluate the maximum conducted emission in accordance with clause 9 of EN 55022.

The LAN utilization in test port was monitored use windows task manager to make LAN utilization excess of 10%.

The bandwidth of the test receiver (R&S Test Receiver ESCI) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked. The test result are reported on Section 3.8.

### 3.4. Test Setup



### 3.5. Operation condition of EUT

- 1, Setup the EUT and the simulators as shown on Section 2.4
- 2, Turned on the power of all equipments.

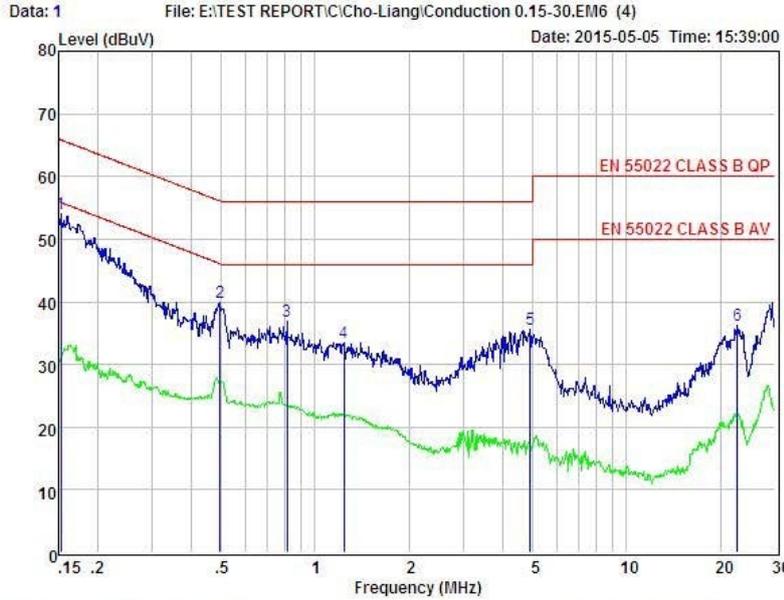
### 3.6. Test Result

**PASS.**

Detailed Information Please refer to the following pages.



Shenzhen Alpha Product Testing Co., Ltd.  
 Building B, East Area of Nanchang Second Industrial Zone,  
 Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China  
 Tel: +86-755-29766001 FAX: +86-755-86375665  
 Website: http://www.a-lab.cn Email: service@a-lab.cn



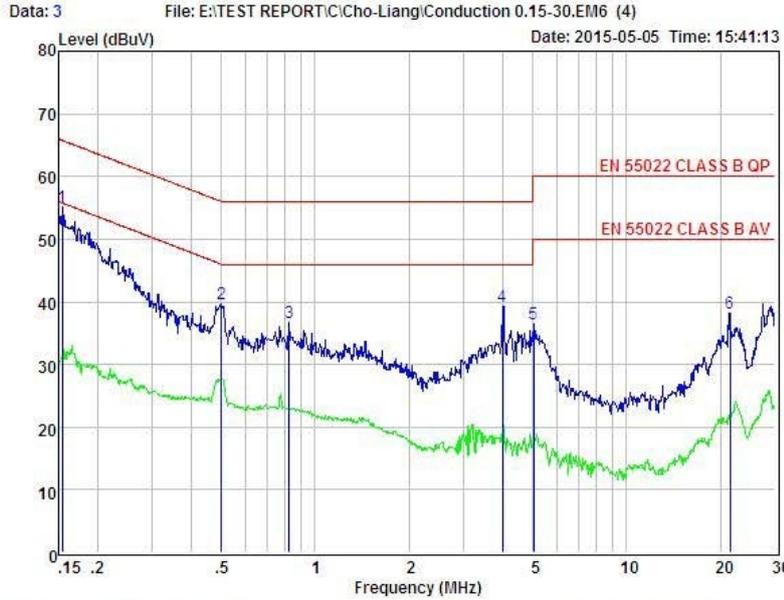
Condition : EN 55022 CLASS B QP POL: NEUTRAL Temp:24.1°C Hum:51 %  
 EUT : 2.4GHz Wireless Optical Mouse  
 Model No : CNE-CMSWLX  
 Test Mode : Link Mode  
 Power : DC 5V from PC with AC 230V/50Hz  
 Test Engineer: Store  
 Remark :

Item	Freq MHz	Read dBuV	LISN Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	0.152	44.20	0.03	-9.72	0.10	54.05	65.87	-11.82	Peak
2	0.494	30.05	0.03	-9.72	0.10	39.90	56.10	-16.20	Peak
3	0.813	26.99	0.02	-9.71	0.10	36.82	56.00	-19.18	Peak
4	1.236	23.68	0.04	-9.71	0.10	33.53	56.00	-22.47	Peak
5	4.900	25.79	0.10	-9.68	0.12	35.69	56.00	-20.31	Peak
6	22.775	25.83	0.41	-9.55	0.42	36.21	60.00	-23.79	Peak

Remarks: Level = Read + LISN Factor - Preamp Factor + Cable loss



Shenzhen Alpha Product Testing Co., Ltd.  
 Building B, East Area of Nanchang Second Industrial Zone,  
 Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China  
 Tel: +86-755-29766001 FAX: +86-755-86375665  
 Website: http://www.a-lab.cn Email: service@a-lab.cn



Condition : EN 55022 CLASS B QP POL: LINE Temp:24.1°C Hum:51 %  
 EUT : 2.4GHz Wireless Optical Mouse  
 Model No : CNE-CMSWLX  
 Test Mode : Link Mode  
 Power : DC 5V from PC with AC 230V/50Hz  
 Test Engineer: Store  
 Remark :

Item	Freq MHz	Read dBuV	LISN Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	0.154	45.32	0.03	-9.72	0.10	55.17	65.78	-10.61	Peak
2	0.499	29.90	0.03	-9.72	0.10	39.75	56.01	-16.26	Peak
3	0.826	26.94	0.02	-9.71	0.10	36.77	56.00	-19.23	Peak
4	4.006	29.28	0.08	-9.69	0.12	39.17	56.00	-16.83	Peak
5	5.031	26.55	0.10	-9.68	0.12	36.45	60.00	-23.55	Peak
6	21.486	27.91	0.36	-9.52	0.38	38.17	60.00	-21.83	Peak

Remarks: Level = Read + LISN Factor - Preamp Factor + Cable loss

## 4. Radiated emission

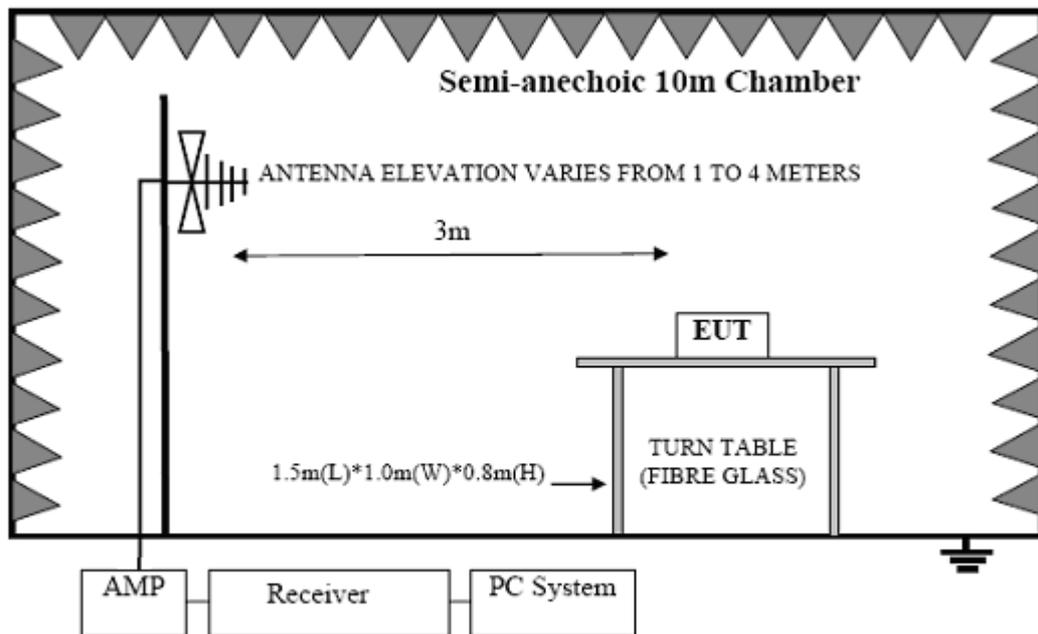
### 4.1. Limit

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMITS (dB $\mu$ V/m)
30 ~ 230	3	40
230 ~ 1000	3	47
1000-3000	3	Average limit:50 Peak limit:70
3000-6000	3	Average limit:54 Peak limit:74

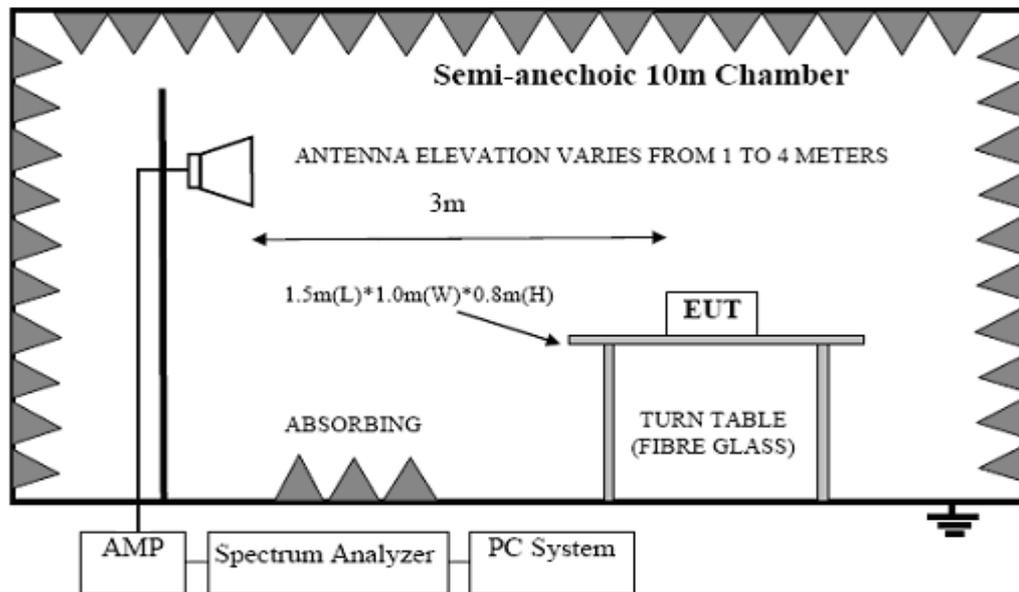
Note: (1)The lower limit shall apply at the transition frequencies.

### 4.2. Test setup

1. In Anechoic Chamber Test Setup Diagram for 30MHz~1000MHz



### 2. In Anechoic (3m) Chamber Test Setup Diagram for 1-6GHz



### 4.3. Test Procedure

The EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber. An antenna was located 10m from the EUT for below 1GHz test and 3m for above 1GHz test on an adjustable mast. A pre-scan was first performed in order to find prominent radiated emissions. For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to EN 55022 Class B on Radiated Disturbance test.

The bandwidth setting on the test receiver (R&S TEST RECEIVER ESVS10) is 120 kHz for below 1GHz test. For emission above 1GHz, The Spectrum's RWB is set 1MHz and VBW 1MHz to measure Peak Level.

### 4.4. Operation condition of EUT

- 1, Setup the EUT and the simulators as shown on Section 2.4
- 2, Turned on the power of all equipments.

Note: Radiated emission test is only applicable to ancillary equipment not incorporated in the radio equipment and intended to be measured on a stand-alone basis, so the wireless function of EUT was closed in this test.

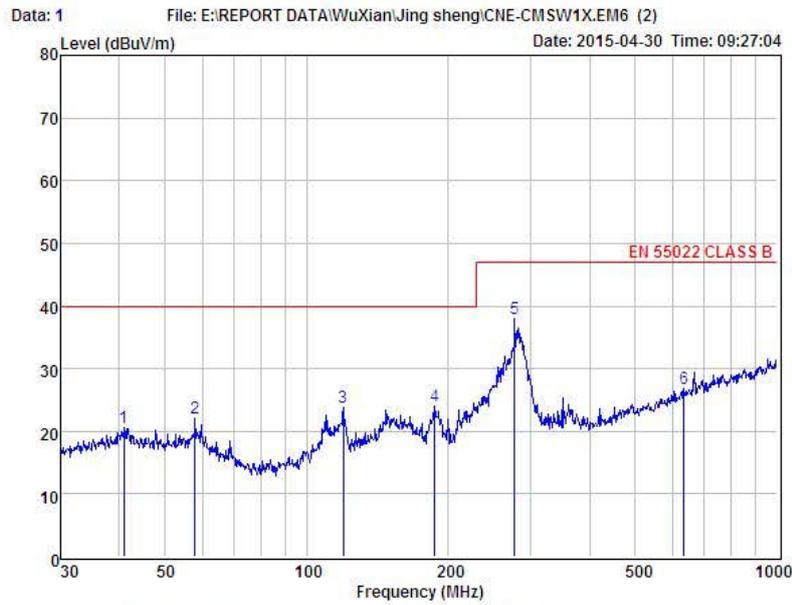
## 4.5. Test result

PASS.

Detailed Information Please refer to the following pages.



Shenzhen Alpha Product Testing Co., Ltd  
 Building B, East Area of Nanchang Second Industrial Zone,  
 Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China  
 Tel: +86-755-29766001 FAX: +86-755-86375565  
 Website: <http://www.a-lab.cn> Email: [service@a-lab.cn](mailto:service@a-lab.cn)



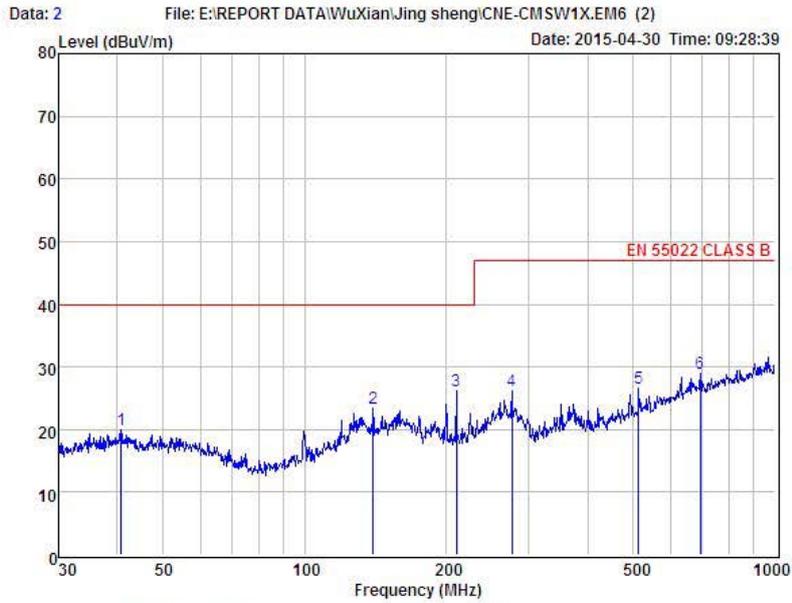
Condition : EN 55022 CLASS B 3m POL: HORIZONTAL  
 EUI : 2.4GHz Wireless Optical Mouse  
 Model No : CNE-CMSW1X  
 Test Mode : Link Mode  
 Power : DC 3.0V From Battery  
 Test Engineer : Store  
 Remark :  
 Temp : 25.2°C  
 Hum : 56%

Item	Freq MHz	Read Level dBuV	Antenna Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	40.84	38.32	13.93	31.87	0.18	20.56	40.00	-19.44	Peak
2	58.00	40.67	12.91	31.77	0.23	22.04	40.00	-17.96	Peak
3	119.86	42.62	12.06	31.31	0.36	23.73	40.00	-16.27	Peak
4	187.10	43.39	10.95	31.00	0.60	23.94	40.00	-16.06	Peak
5	277.09	55.83	12.31	30.65	0.49	37.98	47.00	-9.02	Peak
6	633.91	36.13	18.90	29.37	1.23	26.89	47.00	-20.11	Peak

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss



Shenzhen Alpha Product Testing Co., Ltd  
 Building B, East Area of Nanchang Second Industrial Zone,  
 Gushu 2nd Road, Bao'an District, Shenzhen 518126, P.R. China  
 Tel: +86-755-29766001 FAX: +86-755-86375565  
 Website: http://www.a-lab.cn Email: service@a-lab.cn



Condition : EN 55022 CLASS B 3m POL: VERTICAL  
 EUT : 2.4G Hz Wireless Optical Mouse  
 Model No : CNE-CMSW1X  
 Test Mode : Link Mode  
 Power : DC 3.0V From Battery  
 Test Engineer : Store  
 Remark :  
 Temp : 25.2°C  
 Hum : 56%

Item	Freq MHz	Read Level dBuV	Antenna Factor dB	Preamp Factor dB	Cable Loss dB	Level dBuV	Limit dBuV	Margin dBuV	Remark
1	40.70	37.60	14.07	31.87	0.18	19.98	40.00	-20.02	Peak
2	139.85	40.72	13.51	31.22	0.32	23.33	40.00	-16.67	Peak
3	210.05	46.29	10.07	30.91	0.62	26.07	40.00	-13.93	Peak
4	276.12	43.95	12.26	30.65	0.51	26.07	47.00	-20.93	Peak
5	513.63	38.57	16.75	29.57	0.82	26.57	47.00	-20.43	Peak
6	694.42	37.50	19.60	29.29	1.07	28.88	47.00	-18.12	Peak

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

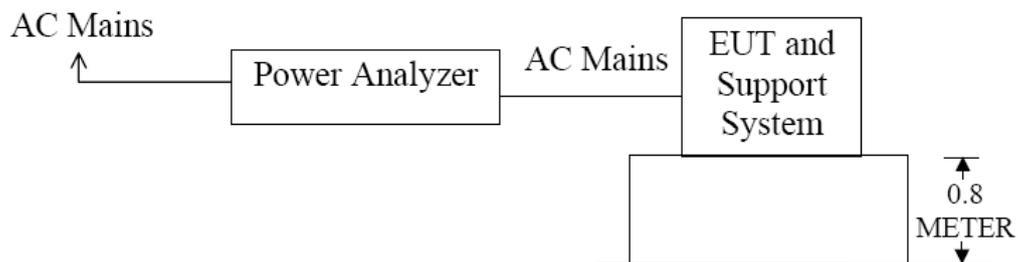
Remark: The test data above 1GHz is too lower than the limit, so not show in this report.

## 5. Harmonic current emissions

### 5.1. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT's Power was connected to the power mains through a power Analyzer, let EUT worked in Tx Mode then measure Harmonic current emissions by power analyzer and recorded data.

### 5.2. Test setup



### 5.3. Test Result

EUT'S Power Supply by DC Battery, So this test is not applicable.

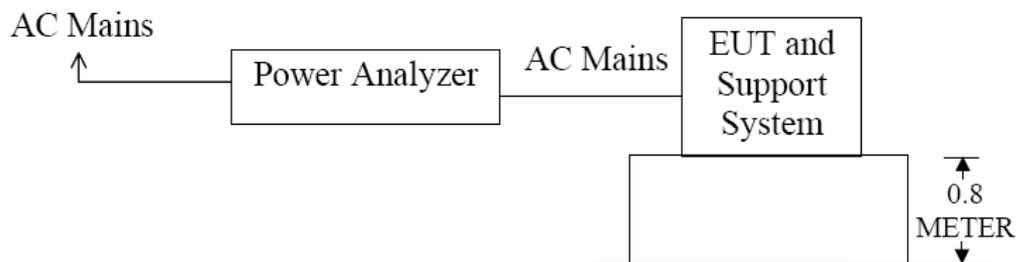
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## 6. Voltage fluctuations and flicker

### 6.1. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT's Power was connected to the power mains through a power Analyzer, let EUT worked in Tx Mode then measure voltage fluctuations and flicker by power analyzer and recorded data.

### 6.2. Test setup



### 6.3. Test Result

EUT'S Power Supply by DC Battery, So this test is not applicable.

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## 7. RF electromagnetic field

### 7.1. Lest levels and Performance Criteria

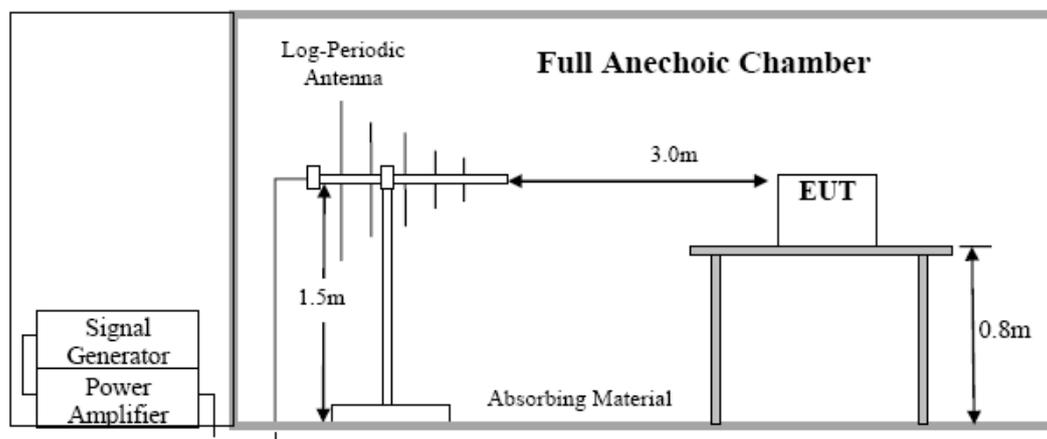
Test Level		Performance Criteria
Frequency	80MHz-1000MHz 1.4GHz-2.7GHz (Note)	<b>A</b>
Field Strength	3V/m measured unmodulated	
Modulation	AM modulated to a depth of 80% by a sinusoidal audio signal of 1KHz	
Step Size	1% increments	
Dwell time	3 Sec.	

### 7.2. Test Procedure

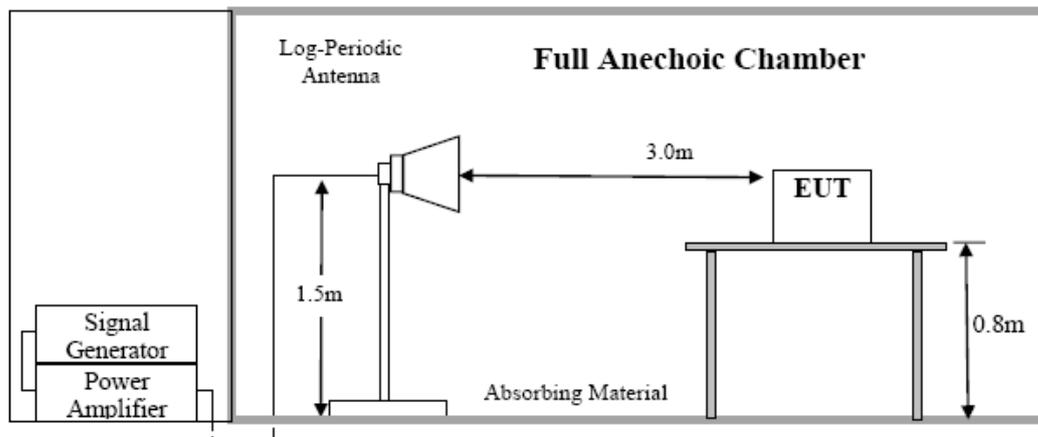
The field sensor is placed on the EUT table (0.8 meter above the ground) which is 3 meters away from the transmitting antenna. Through the signal generator, power amplifier and transmitting antenna to produce a uniformity field strength (3V/m measured by field sensor) around the EUT table from frequency range specified and records the signal generator's output level at the same time for whole measured frequency range. Then, put EUT and its simulators on the EUT turn table and keep them 3 meters away from the transmitting antenna which is mounted on an antenna tower and fixes at 1.5 meter height above the ground. Using the recorded signal generator's output level to measure the EUT from frequency range specified and both horizontal & vertical polarization of antenna must be set and measured. Each of the four sides of EUT must be faced this transmitting antenna and measures individually.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.

### 7.3. Test setup



Frequency For 1.4-2.7GHz



### 7.4. Test Result

EUT: 2.4GHz Wireless Optical Mouse		M/N: CNE-CMSW1X		
Test mode: Link Mode				
Power: DC 3.0V From Battery For Mouse; DC 5V From USB For USB Dongle				
Test conditions: Temperature 24°C Humidity: 52% Pressure 100.6kPa				
Test date: 2015-04-30				
Tested by: Store				
Other: Operation as intend, no loss of function during test and after test; No unintentional transmissions happened in idle mode				
EUT Position	Antenna	Observation	Required	Conclusion
Front	H	A	A	PASS
	V	A	A	PASS
Right	H	A	A	PASS
	V	A	A	PASS
Rear	H	A	A	PASS
	V	A	A	PASS
Left	H	A	A	PASS
	V	A	A	PASS

## 8. Electrostatic discharge

### 8.1. Test level and Performance Criteria

Test Level		Performance Criteria
Air Discharge	$\pm 2\text{kV}$ , $\pm 4\text{kV}$ and $\pm 8\text{kV}$	<b>B</b>
Contact Discharge	$\pm 2\text{kV}$ and $\pm 4\text{kV}$	

### 8.2. Test Procedure

#### **Air discharge:**

The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 20 times for each pre-selected test point. This procedure was repeated until all the air discharge completed

#### **Contact Discharge:**

All the procedure was same as air discharge. except that the generator was re-triggered for a new single discharge and repeated 50 times for each pre-selected test point. The tip of the discharge electrode was touching the EUT before the discharge switch was operated.

#### **Indirect discharge for horizontal coupling plane**

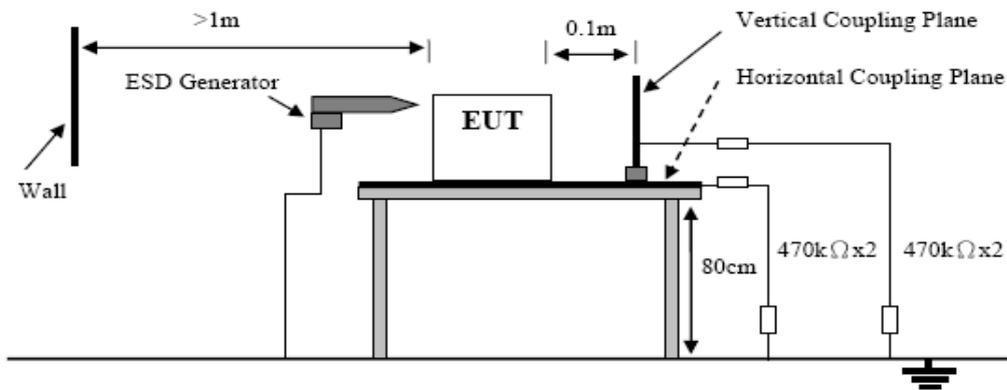
At least 20 single discharges were applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

#### **Indirect discharge for vertical coupling plane**

At least 20 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.

### 8.3. Test setup



### 8.4. Test Result

EUT: 2.4GHz Wireless Optical Mouse		M/N: CNE-CMSW1X			
Test mode: Link Mode					
Power: DC 3.0V From Battery For Mouse; DC 5V From USB For USB Dongle					
Test conditions: Temperature 23°C Humidity: 56% Pressure 100.6kPa					
Test date: 2015-04-30			Tested by: Store		
Other: Operation as intend, no loss of function during test and after test No unintentional transmissions happened in idle mode.					
Discharge Voltage (kV)	Type of discharge	Dischargeable Points	Observation	Require	Conclusion
±2	Air	Slot	A	B	PASS
±4	Air	Slot	A	B	PASS
±8	Air	Slot	A	B	PASS
±2	HCP-Bottom	Edge of the HCP	A	B	PASS
±2	VCP-Front	Center of the VCP	A	B	PASS
±2	VCP-Left	Center of the VCP	A	B	PASS
±2	VCP-Back	Center of the VCP	A	B	PASS
±2	VCP-Right	Center of the VCP	A	B	PASS
±4	HCP-Bottom	Edge of the HCP	A	B	PASS
±4	VCP-Front	Center of the VCP	A	B	PASS
±4	VCP-Left	Center of the VCP	A	B	PASS
±4	VCP-Back	Center of the VCP	A	B	PASS
±4	VCP-Right	Center of the VCP	A	B	PASS

## 9. Fast transients test

### 9.1. Test levels and Performance Criteria

Test Level		Performance Criteria
Test voltage	1KV For AC mains Port	<b>A</b>
	0.5KV for telecommunication ports	
Repetition Frequency	5KHz	
Burst Duration	15ms	
Burst Period	300ms	
Inject Time(s)	60s	
Inject Method	Direct For AC mains port	
	Couple for telecommunication ports	
Inject Line	AC Mains of adapter and telecommunication ports	

### 9.2. Test Procedure

The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m  $\pm$  0.01m thick. The ground reference plane was 1m\*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane was project beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structure, except the ground plane was more than 0.5m. All cables to the EUT was placed on the wood support, cables not subject to EFT/B was routed as far as possible from the cable under test to minimize the coupling between the cables.

The EUT was connected to the power mains by using a coupling device that couples the EFT interference signal to AC power lines. Both positive transients and negative transients of test voltage were applied during compliance test and the duration of the test can't less than 1min.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.



## 10. Injection current test

### 10.1. Test level and Performance Criteria

Test Level		Performance Criteria
Frequency	0.15MHz to 80MHz	<b>A</b>
Field Strength	3V/m measured unmodulated	
Modulation	AM modulated to a depth of 80% by a sinusoidal audio signal of 1KHz	
Step Size	1% increments	
Dwell time	3 Sec.	

### 10.2. Test Procedure

The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).

The disturbance signal described below is injected to EUT through CDN.

The EUT operates within its operational mode(s) under intended climatic conditions after power on.

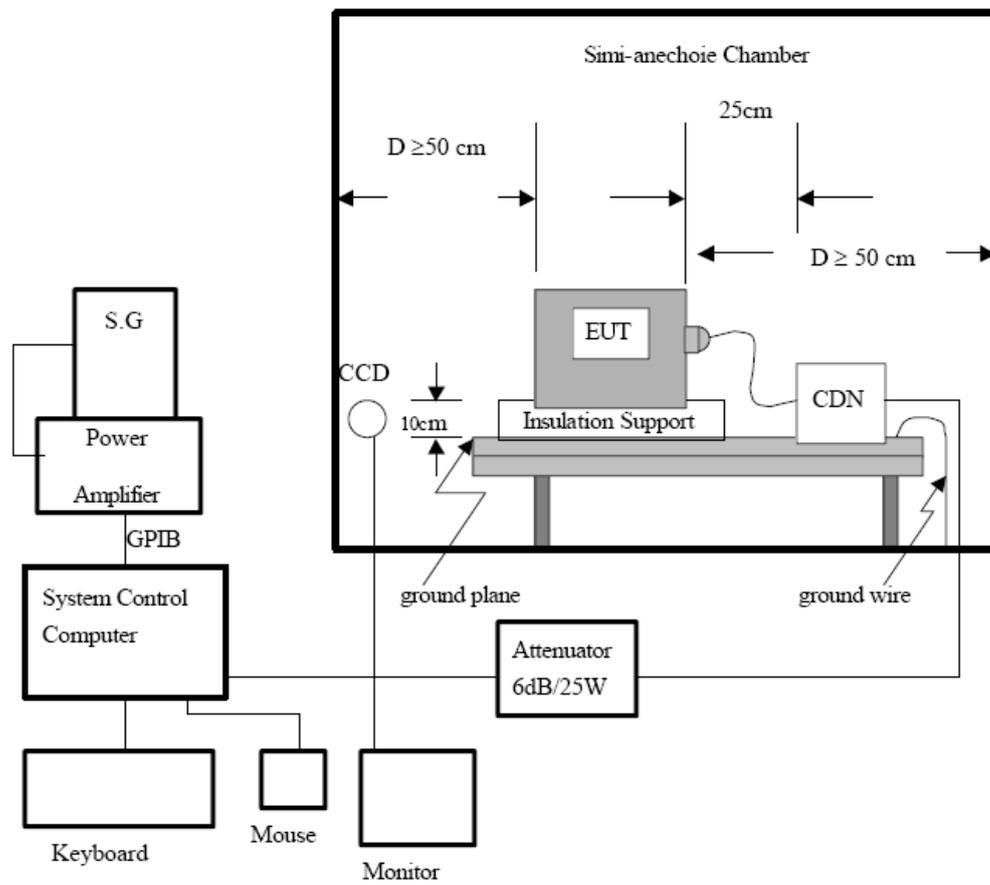
The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 400Hz sine wave.

The rate of sweep shall not exceed  $1.5 \times 10^{-3}$  decades/s. Where the frequency is swept incrementally; the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.

Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.

### 10.3. Test setup



### 10.4. Test result

EUT'S Power Supply by DC Battery, So this test is not applicable.

## 11. Voltage dips and interruptions

### 11.1. Test level and Performance Criteria

Test Level % UT	Duration (in period)	Performance Criterion
0	0.5P	B
0	1P	B
70	25P	B
0	250P	C

### 11.2. Test Procedure

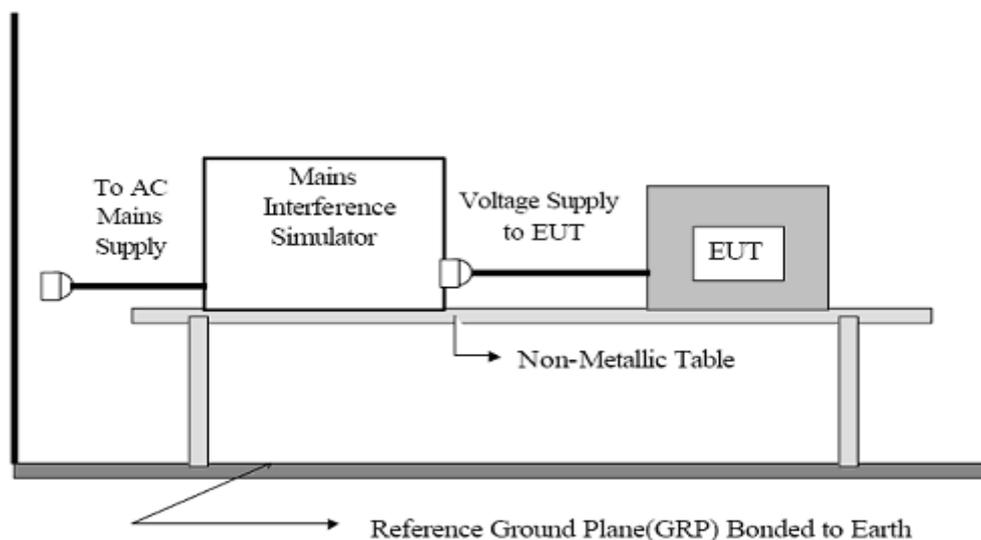
The EUT and test generator were setup as shown on Section 10.3

The interruptions are introduced at selected phase angles with specified duration.

Record any degradation of performance.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.

### 11.3. Test setup



### 11.4. Test Result

EUT'S Power Supply by DC Battery, So this test is not applicable.

## 12. Surge Test

### 12.1. Test level and Performance Criteria

Test level for AC mains ports		Performance Criterion
Line to Line	1KV	B
Line to ground	2KV	B
Test level for telecommunication ports		Performance Criterion
Line to ground	0.5KV	B

### 12.2. Test Procedure

Set up the EUT and test generator as shown on Section 11.2.2.

For line-to-line coupling mode, provide a 1kV 1.2/50us voltage surge (at pen-circuit condition) and 8/20us current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV.

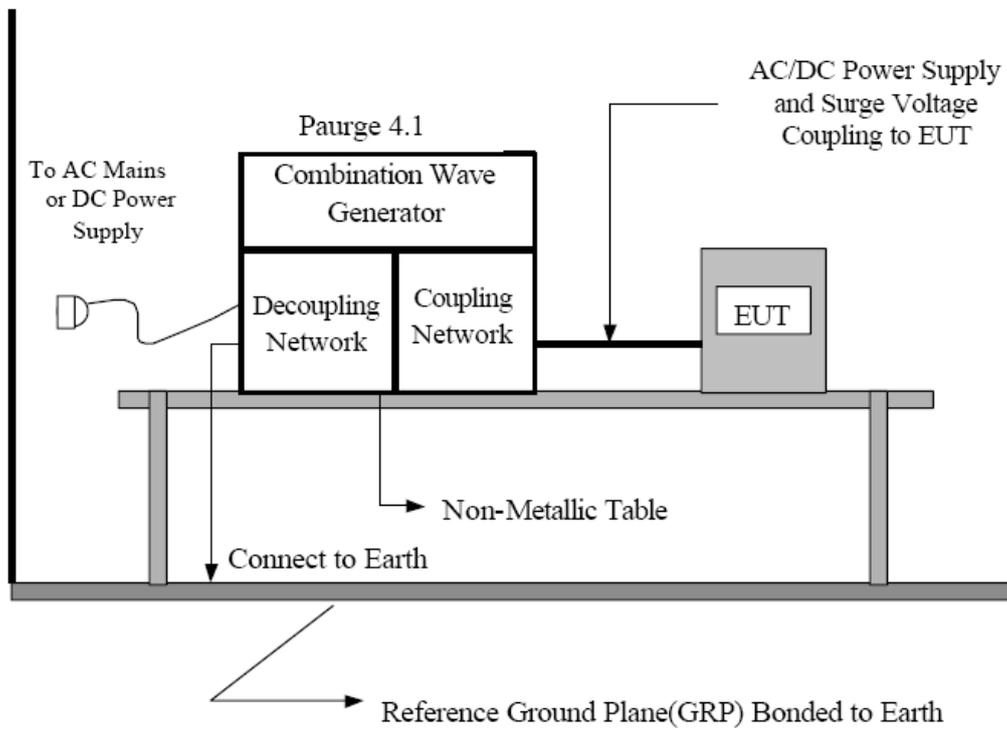
At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test.

Different phase angles are done individually.

Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

Set EUT in idle mode and repeated test with a receive antenna connected to a spectrum analyzer to see if there was unintentional transmissions happened.

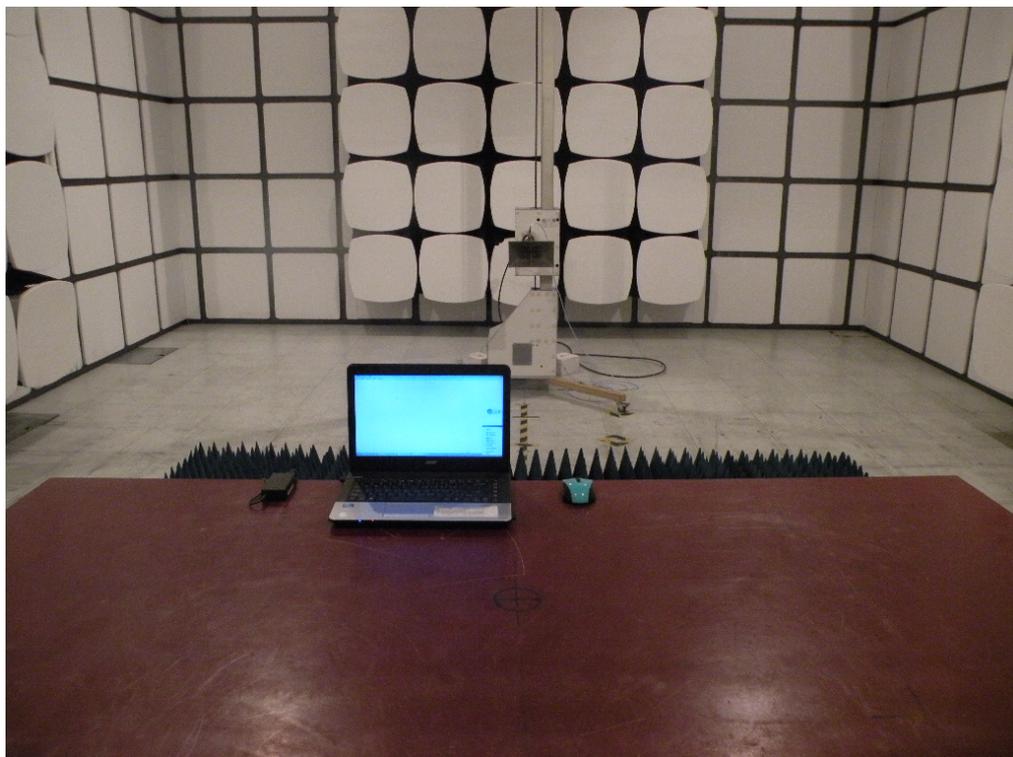
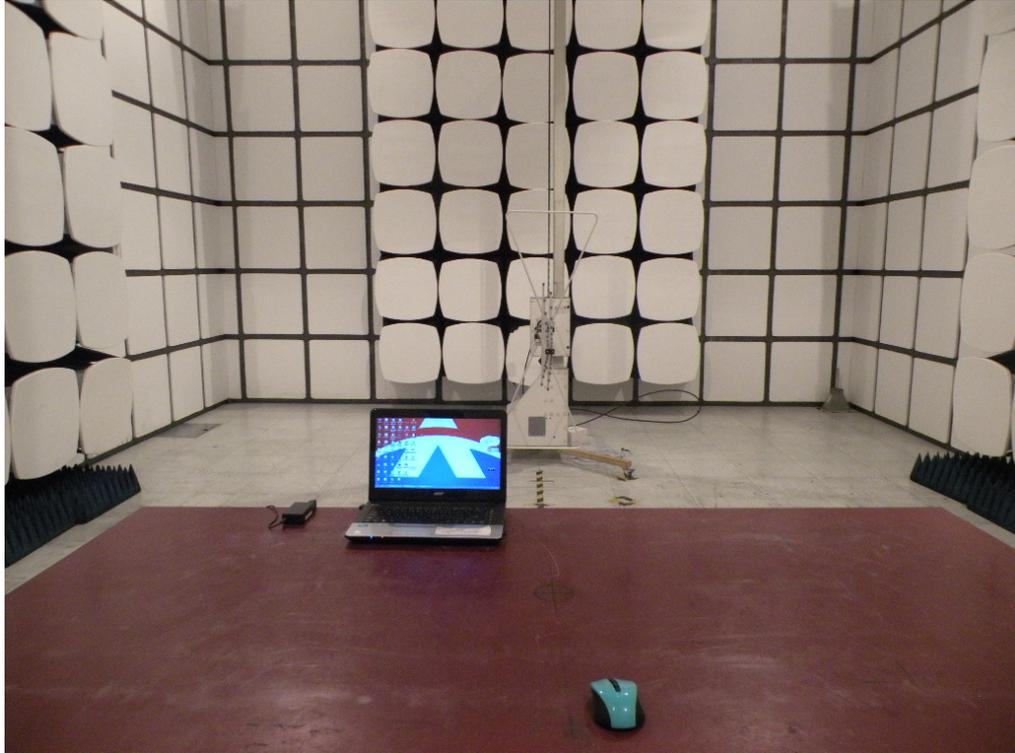
### 12.3. Test setup



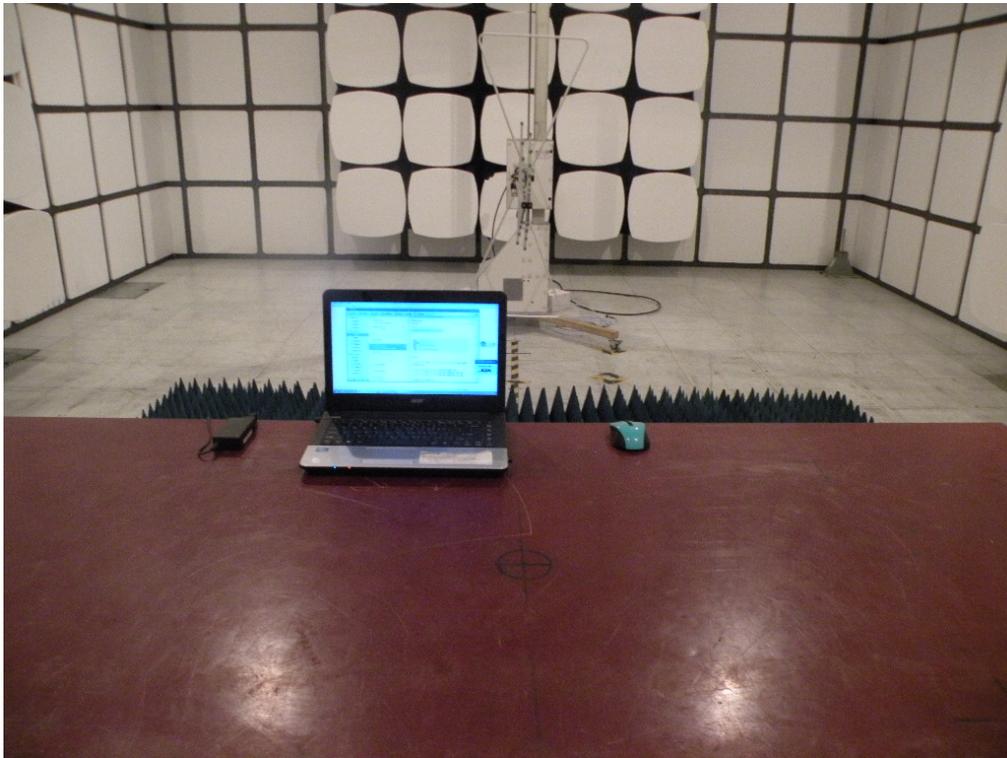
### 12.4. Test Result

### 13. Photos of test setup

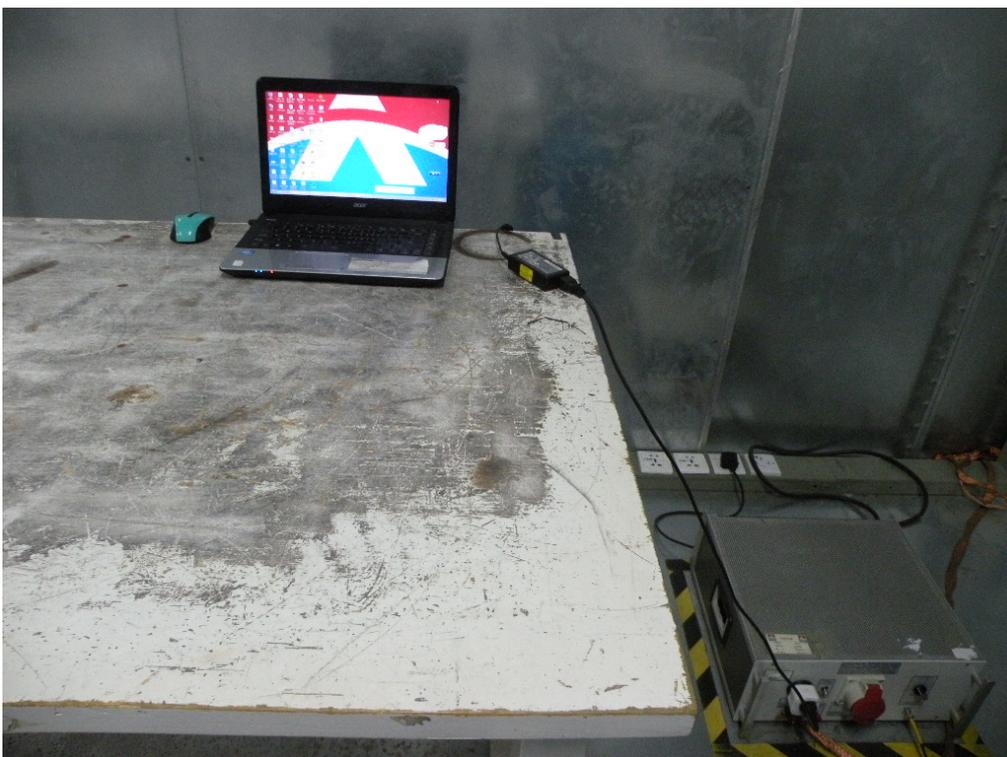
#### 13.1.Photos of Radiated emission test



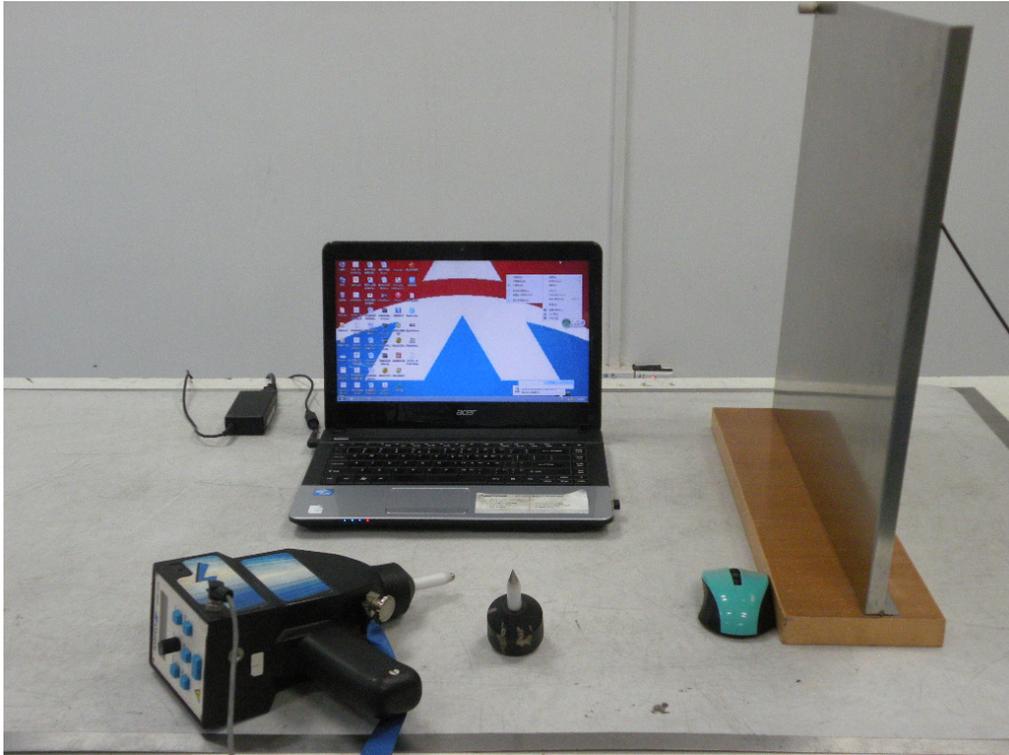
### 13.2.Photos of RF electromagnetic field



### 13.3.Photos of Conducted emission test



### 13.4.Photos of electrostatic discharge test



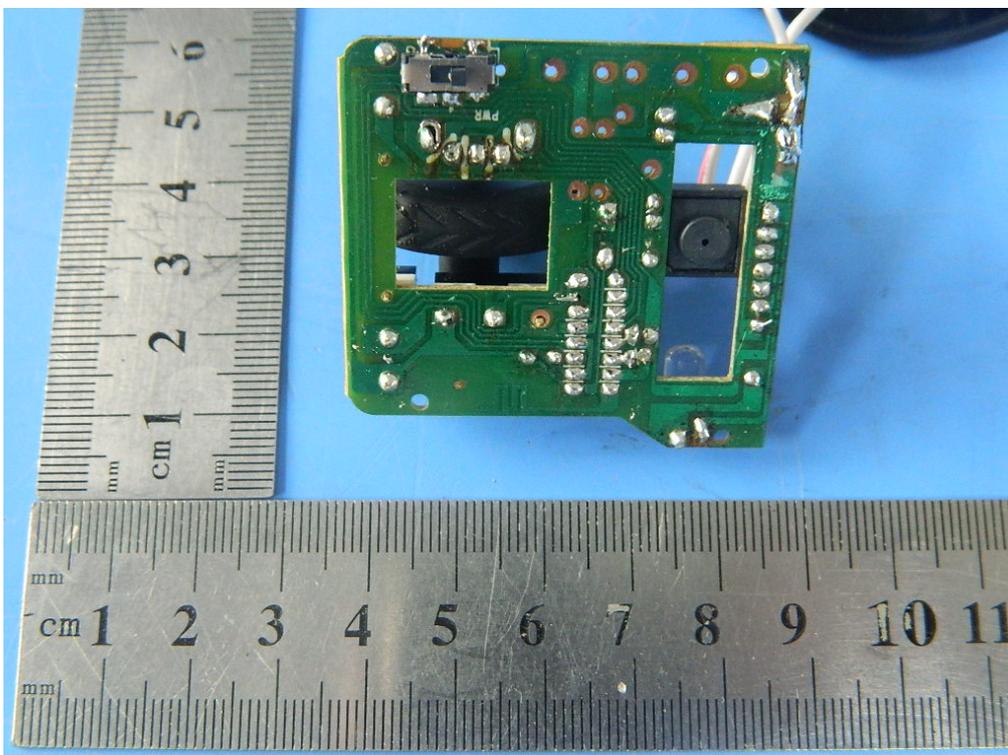
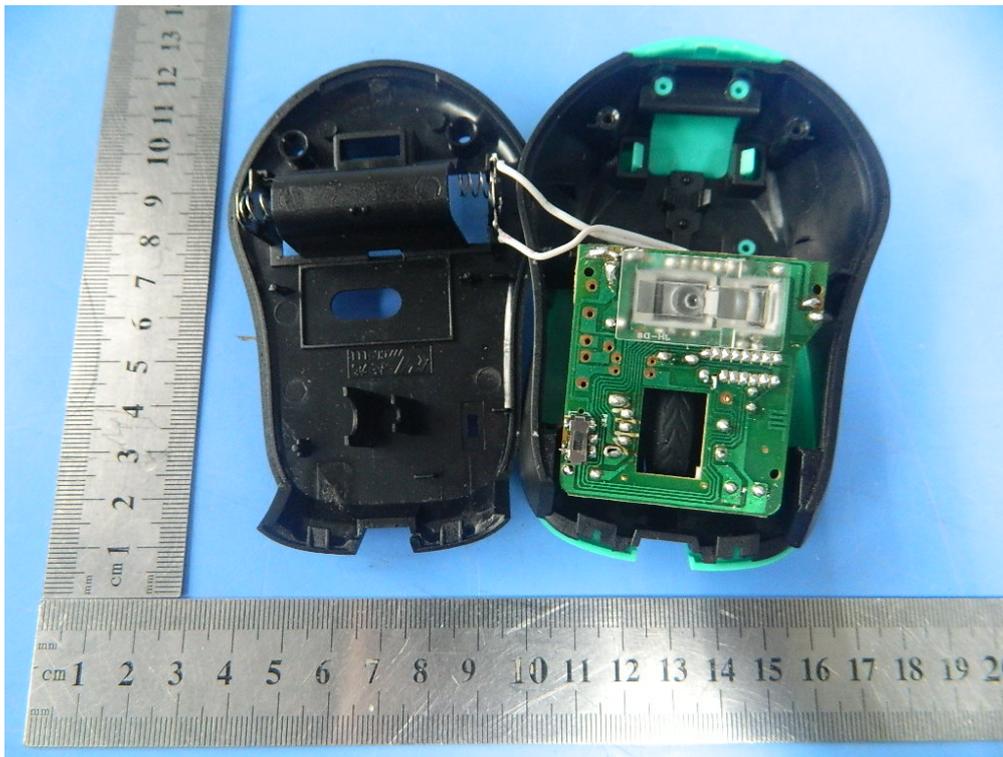
### 14. Photos of EUT

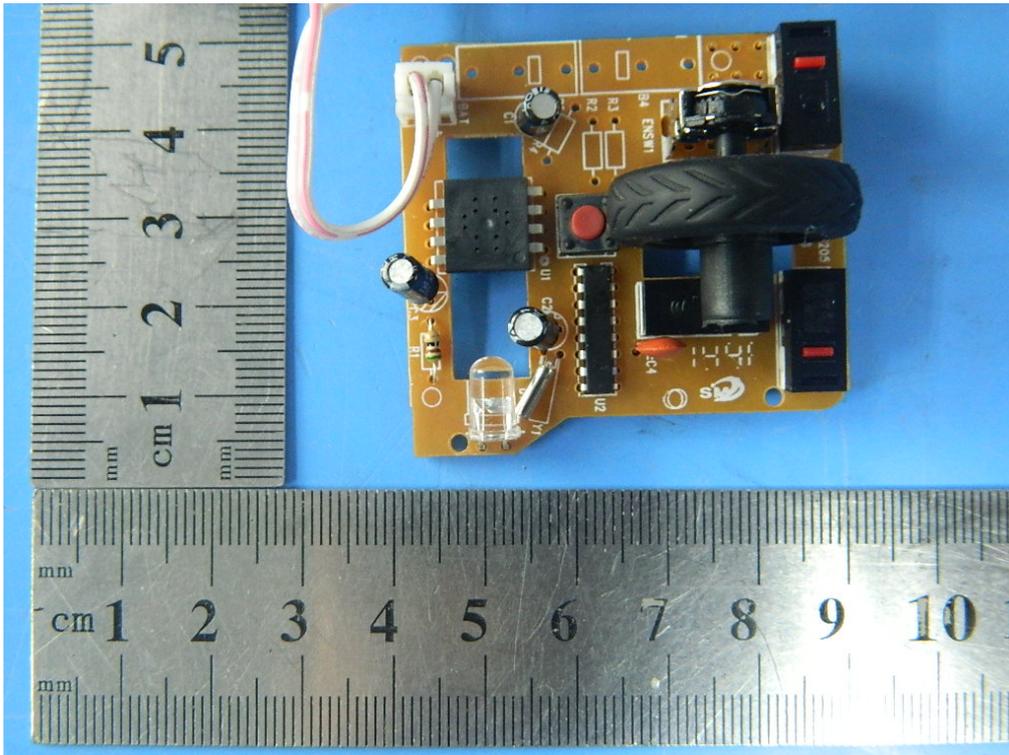












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