FCC TEST REPORT

For

COMAT ELECTRONIC (SHENZHEN) CO., LTD

2.4G wireless optical mouse

Model No.: CRC1235205, CRC1235206

Prepared For	:	COMAT ELECTRONIC (SHENZHEN) CO., LTD
Address	:	4th Industry Park,ShangXiaWei Zone ShaSan Village,ShaJin Town,Baoan, ShenZhen, China

Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
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Date of Receipt	:	Jul. 19, 2018
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Date of Report	:	Aug. 01, 2018

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TEST REPORT

Applicant	:	COMAT ELECTRONIC (SHENZHEN) CO., LTD
Manufacturer	:	COMAT ELECTRONIC (SHENZHEN) CO., LTD
Product Name	:	2.4G wireless optical mouse
Model No.	:	CRC1235205, CRC1235206
Trade Mark	:	Power zone
Rating(s)	:	Input: DC 3V 30mA by "AAA"*2 battery inside

Test Standard(s)	**:**	**FCC Part15 Subpart C, Paragraph 15.203, 15.207, 15.249, 15.215(c), 15.249(c)**
Test Method(s)	**:**	**ANSI C63.10: 2013**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited 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 FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test Jul. 19~Aug. 01, 2018

Prepared By

Reviewer

(Supervisor / Calvin Liu)

Approved & Authorized Signer

(Manager / Tom Chen)

1. General Information

1.1. Client Information

Applicant	:	COMAT ELECTRONIC (SHENZHEN) CO., LTD
Address	:	4th Industry Park,ShangXiaWei Zone ShaSan Village,ShaJin Town,Baoan, ShenZhen, China
Manufacturer	:	COMAT ELECTRONIC (SHENZHEN) CO., LTD
Address	:	4th Industry Park,ShangXiaWei Zone ShaSan Village,ShaJin Town,Baoan, ShenZhen, China

1.2. Description of Device (EUT)

Product Name	:	2.4G wireless optical mouse	
Model No.	:	CRC1235205, CRC1235206 (Note: All samples are the same except the model colour and appearance, so we prepare "CRC1235205" for test only.)	
Trade Mark	:	Power zone	
Test Power Supply	:	DC 3V Battery inside	
Test Sample No.	:	S1, S2	
Product Description	:	Operation Frequency:	2408-2474MHz
		Number of Channel:	34 Channels
		Modulation Type:	GFSK
		Antenna Type:	PCB Antenna
		Antenna Gain(Peak):	-2 dBi
Remark: 1)For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.			

1.3. Auxiliary Equipment Used During Test

N/A		

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	Keeping TX mode
Mode 2	CH01
Mode 3	CH17
Mode 4	CH34

For Radiated Emission	
Final Test Mode	Description
Mode 1	Keeping TX mode
Mode 2	CH01
Mode 3	CH17
Mode 4	CH34

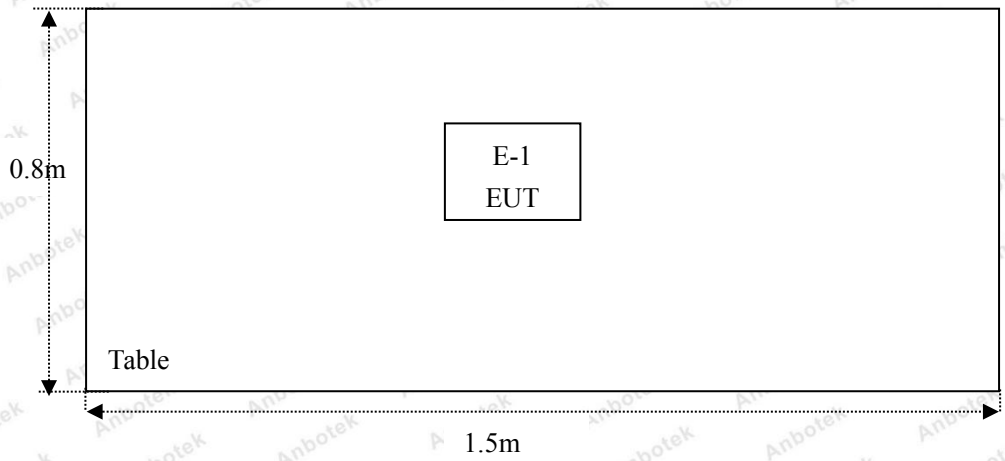
Note:
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.
2. EUT built-in battery-powered, fully-charged battery use of the test battery.

1.5. List of Channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2408	10	2426	19	2444	28	2462
2	2410	11	2428	20	2446	29	2464
3	2412	12	2430	21	2448	30	2466
4	2414	13	2432	22	2450	31	2468
5	2416	14	2434	23	2452	32	2470
6	2418	15	2436	24	2454	33	2472
7	2420	16	2438	25	2456	34	2474
8	2422	17	2440	26	2458		
9	2424	18	2442	27	2460		

1.6. Description of Test Setup

RE



1.7. Test Equipment List

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 17, 2017	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Nov. 17, 2017	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 17, 2017	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 17, 2017	1 Year
5.	Spectrum Analysis	Agilent	N9038A	MY53227295	Nov. 17, 2017	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 17, 2017	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Nov. 17, 2017	1 Year
8.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2017	1 Year
9.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 20, 2017	1 Year
10.	Loop Antenna	Schwarzbeck	HFH2-Z2	100047	Nov. 17, 2017	1 Year
11.	Horn Antenna	Schewarzbeck	BBHA9170	9170-375	Nov. 17, 2017	1 Year
12.	Pre-amplifier	SONOMA	310N	186860	Nov. 17, 2017	1 Year
13.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
14.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 18, 2017	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 17, 2017	1 Year
16.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 17, 2017	1 Year
17.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 18, 2017	1 Year
18.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 18, 2017	1 Year
19.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 18, 2017	1 Year
20.	DC Power Supply	LW	TPR-6410D	349315	Nov. 01, 2017	1 Year
21.	Constant Temperature Humidity Chamber	Sertep	ZJ-HWHS80B	ZJ-17042804	Nov. 01, 2017	1 Year

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4 dB

1.9. Description of Test Facility

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

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed 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 No. 184111, July 31, 2017.

ISED-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, June 13, 2016.

Test Location

All Emissions tests were performed at Shenzhen Anbotek Compliance Laboratory Limited.
at 1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

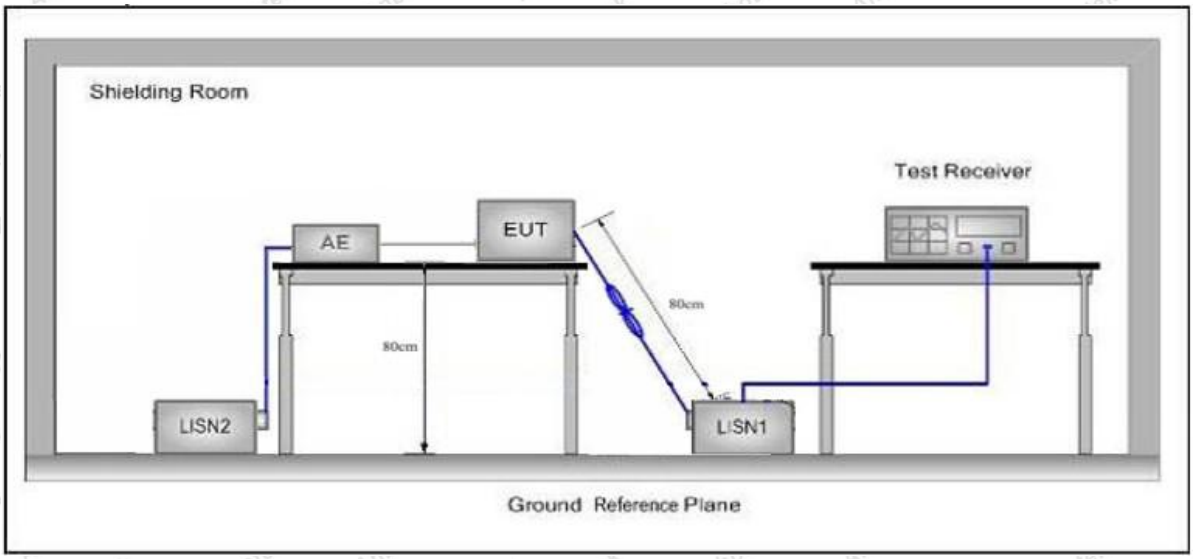
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.249	Radiated Emission	PASS
15.215(c)	20dB Bandwidth	PASS
15.249(c)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.207		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50
Remark: (1) *Decreasing linearly with logarithm of the frequency. (2) The lower limit shall apply at the transition frequency.			

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

The EUT is powered by DC 3V Battery inside, so there is no need to conduct this test.

4. Radiated Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:
(1)The lower limit shall apply at the transition frequency.
(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Test Standard	FCC Part15 C Section 15.249					
Test Limit	Frequency (MHz)	Field Strength of fundamental ((millivolts /meter)	Field Strength of Harmonics (microvolts/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	2400~2483.5	50	-	114.0	Peak	3
	2400~2483.5	50	-	94.0	Average	3
	2400~2483.5	-	500	74.0	Peak	3
	2400~2483.5	-	500	54.0	Average	3

Remark:
(1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

4.2. Test Setup

Figure 1. Below 30MHz

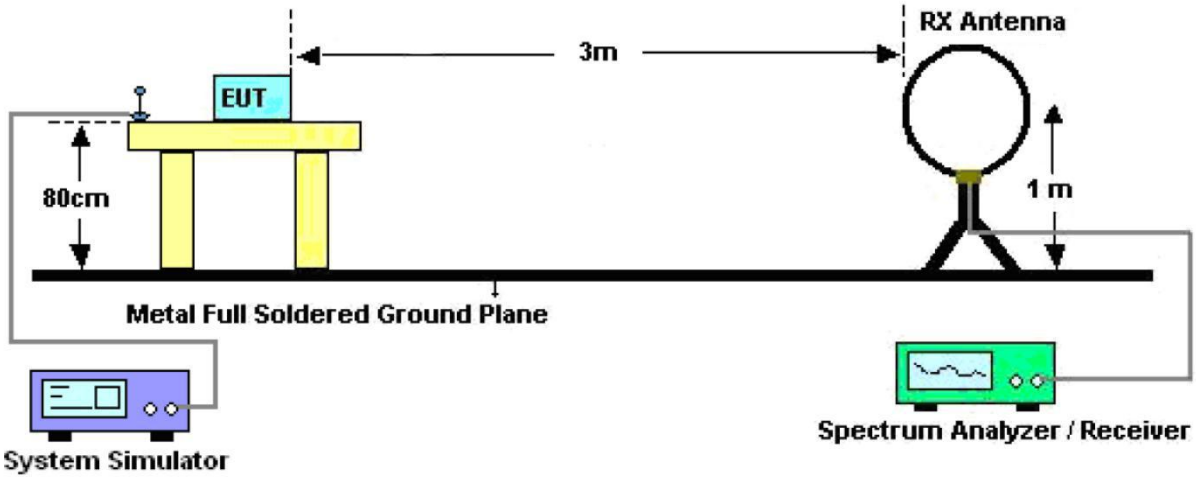


Figure 2. 30MHz to 1GHz

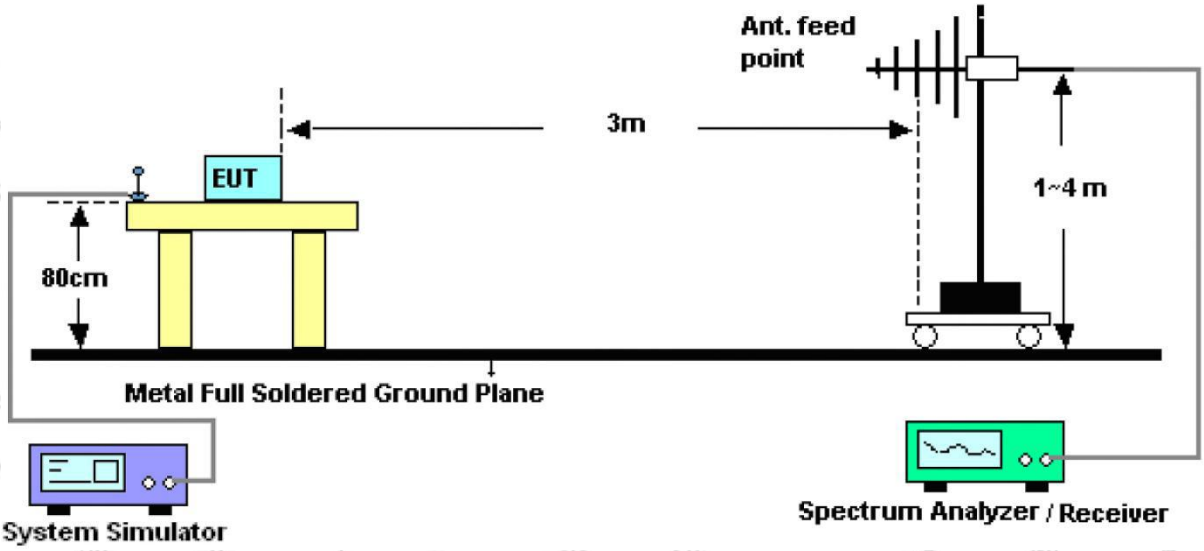
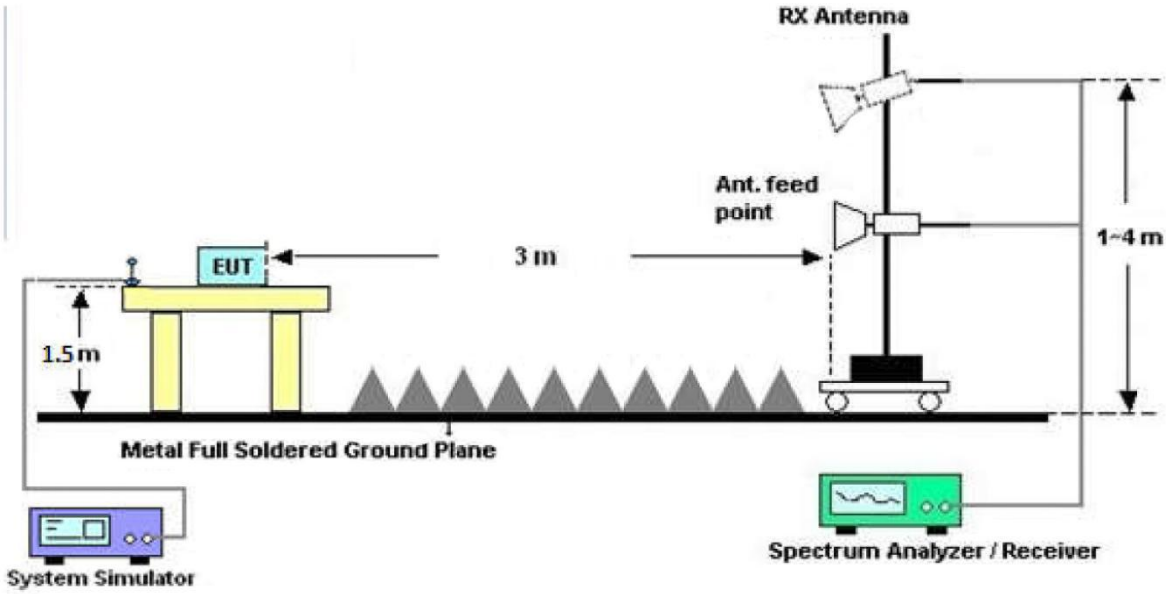


Figure 3. Above 1 GHz



4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.
.
For above 1GHz,Set the spectrum analyzer as:
RBW =1MHz, VBW =1MHz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.
RBW =1MHz, VBW =10Hz, Detector= Average, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

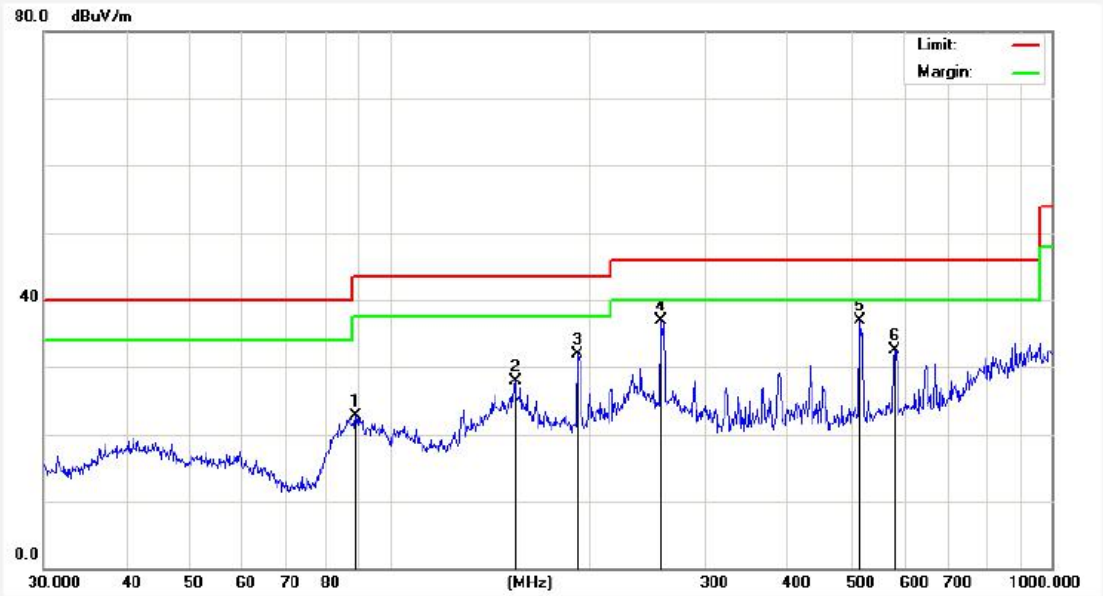
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

During the test, pre-scan all the mode, and found the Middle channel which is the worst case, only the worst case is recorded in the report

Test Results (30~1000MHz)

Job No.:	SZAWW180719004-01	Temp.(℃)/Hum.(%RH):	24.3℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 3V Battery inside
Test Mode:	Mode 3	Polarization:	Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	88.9639	45.60	-22.80	22.80	43.50	-20.70	QP	300	0	
2	154.8204	48.94	-21.11	27.83	43.50	-15.67	QP	300	45	
3	192.4186	51.66	-19.67	31.99	43.50	-11.51	QP	300	114	
4	256.5211	55.33	-18.40	36.93	46.00	-9.07	QP	300	165	
5	513.6331	47.84	-10.99	36.85	46.00	-9.15	QP	300	277	
6	580.7026	43.76	-11.19	32.57	46.00	-13.43	QP	300	360	

Test Results (30~1000MHz)

Job No.:	SZAWW180719004-01	Temp.(℃)/Hum.(%RH):	24.3℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 3V Battery inside
Test Mode:	Mode 3	Polarization:	Vertical

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	84.1100	43.04	-18.27	24.77	40.00	-15.23	QP	300	0	
2	142.8243	48.32	-17.45	30.87	43.50	-12.63	QP	300	96	
3	385.2805	44.40	-12.16	32.24	46.00	-13.76	QP	300	114	
4	449.5558	44.87	-11.63	33.24	46.00	-12.76	QP	300	175	
5	513.6331	44.28	-10.72	33.56	46.00	-12.44	QP	300	256	
6	668.1423	42.86	-8.71	34.15	46.00	-11.85	QP	300	360	

Test Results (1GHz-25GHz)

Test Mode: CH01 (Low channel)									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
2408.0000	96.75	31.12	2.18	35.33	94.72	114.00	-19.28	V	Peak
2408.0000	82.78	31.12	2.18	35.33	80.75	94.00	-13.25	V	AVG
4816.0000	47.15	34.01	2.58	34.65	49.09	74.00	-24.91	V	Peak
4816.0000	41.96	34.01	2.58	34.65	43.90	54.00	-10.10	V	AVG
7224.0000	46.94	36.16	2.97	35.07	51.00	74.00	-23.00	V	Peak
7224.0000	38.03	36.16	2.97	35.07	42.09	54.00	-11.91	V	AVG
9632.0000	*								
12040.0000	*								
14448.0000	*								
16856.0000	*								
2408.0000	93.79	31.12	2.18	35.33	91.76	114.00	-22.24	H	Peak
2408.0000	83.03	31.12	2.18	35.33	81.00	94.00	-13.00	H	AVG
4816.0000	47.84	34.01	2.58	34.65	49.78	74.00	-24.22	H	Peak
4816.0000	39.25	34.01	2.58	34.65	41.19	54.00	-12.81	H	AVG
7224.0000	47.37	36.16	2.97	35.07	51.43	74.00	-22.57	H	Peak
7224.0000	37.85	36.16	2.97	35.07	41.91	54.00	-12.09	H	AVG
9632.0000	*								
12040.0000	*								
14448.0000	*								
16856.0000	*								

Note:

1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Test Mode: CH17 (Middle channel)									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
2440.0000	93.88	31.12	2.20	34.51	92.69	114.00	-21.31	V	Peak
2440.0000	82.41	31.22	2.20	34.51	81.32	94.00	-12.68	V	AVG
4880.0000	47.47	34.98	2.49	34.14	50.80	74.00	-23.20	V	Peak
4880.0000	40.51	34.98	2.49	34.14	43.84	54.00	-10.16	V	AVG
7320.0000	45.57	36.01	3.01	34.56	50.03	74.00	-23.97	V	Peak
7320.0000	38.97	36.01	3.01	34.56	43.43	54.00	-10.57	V	AVG
9760.0000	*								
12200.0000	*								
14640.0000	*								
17080.0000	*								
2440.0000	94.23	31.12	2.20	34.51	93.04	114.00	-20.96	H	Peak
2440.0000	83.87	31.12	2.20	34.51	82.68	94.00	-11.32	H	AVG
4880.0000	48.47	34.98	2.49	34.14	51.80	74.00	-22.20	H	Peak
4880.0000	39.46	34.98	2.49	34.14	42.79	54.00	-11.21	H	AVG
7320.0000	46.59	36.01	3.01	34.56	51.05	74.00	-22.95	H	Peak
7320.0000	36.35	36.01	3.01	34.56	40.81	54.00	-13.19	H	AVG
9760.0000	*								
12200.0000	*								
14640.0000	*								
17080.0000	*								

Note:

1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Test Mode: CH34 (High channel)									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Pol.	Detector
2474.0000	94.72	31.65	2.23	36.07	92.53	114.00	-21.47	V	Peak
2474.0000	85.31	31.65	2.23	36.07	83.12	94.00	-10.88	V	AVG
4948.0000	49.37	35.06	2.60	34.93	52.10	74.00	-21.90	V	Peak
4948.0000	39.31	35.06	2.60	34.93	42.04	54.00	-11.96	V	AVG
7422.0000	47.94	36.19	3.12	35.11	52.14	74.00	-21.86	V	Peak
7422.0000	37.36	36.19	3.12	35.11	41.56	54.00	-12.44	V	AVG
9896.0000	*								
12370.0000	*								
14844.0000	*								
17318.0000	*								
2474.0000	93.37	31.65	2.23	36.07	91.18	114.00	-22.82	H	Peak
2474.0000	84.24	31.65	2.23	36.07	82.05	94.00	-11.95	H	AVG
4948.0000	50.30	35.06	2.60	34.93	53.03	74.00	-20.97	H	Peak
4948.0000	40.46	35.06	2.60	34.93	43.19	54.00	-10.81	H	AVG
7422.0000	47.27	36.19	3.12	35.11	51.47	74.00	-22.53	H	Peak
7422.0000	37.78	36.19	3.12	35.11	41.98	54.00	-12.02	H	AVG
9896.0000	*								
12370.0000	*								
14844.0000	*								
17318.0000	*								

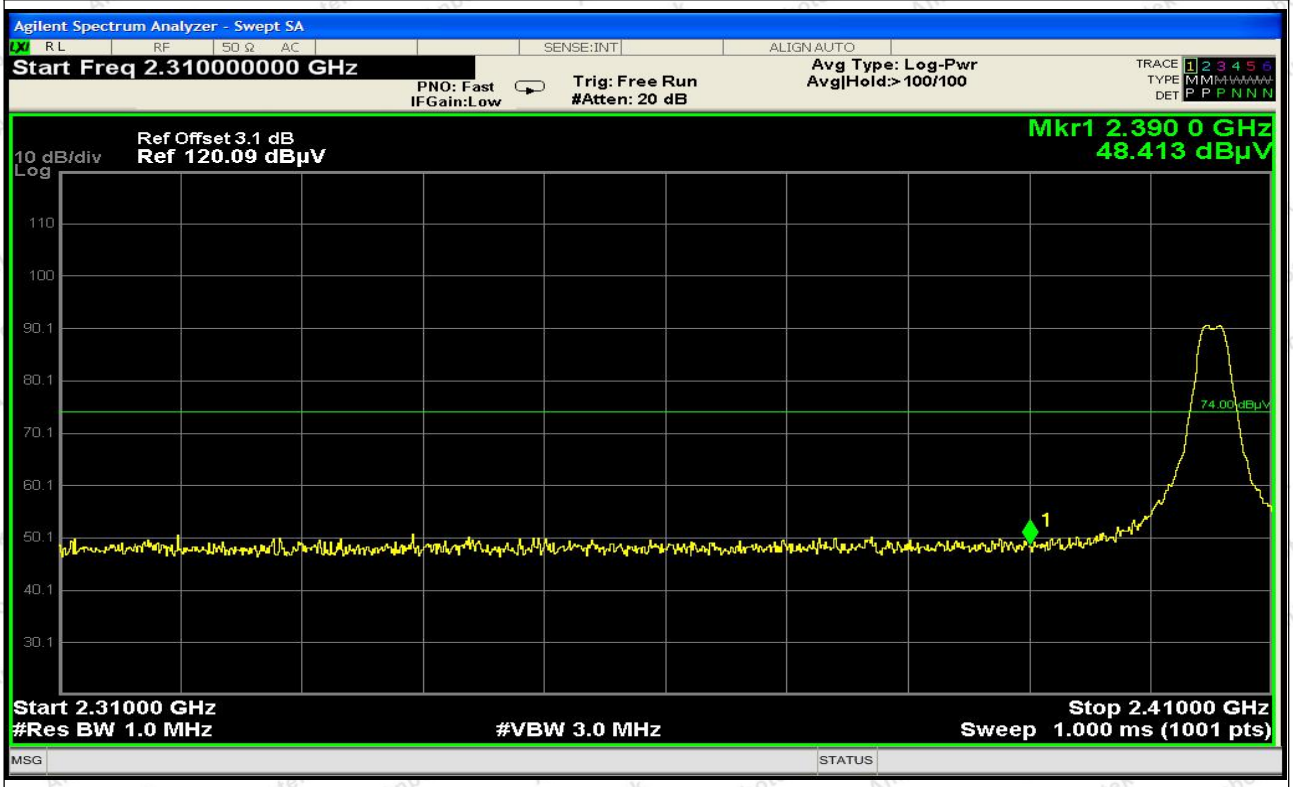
Note:

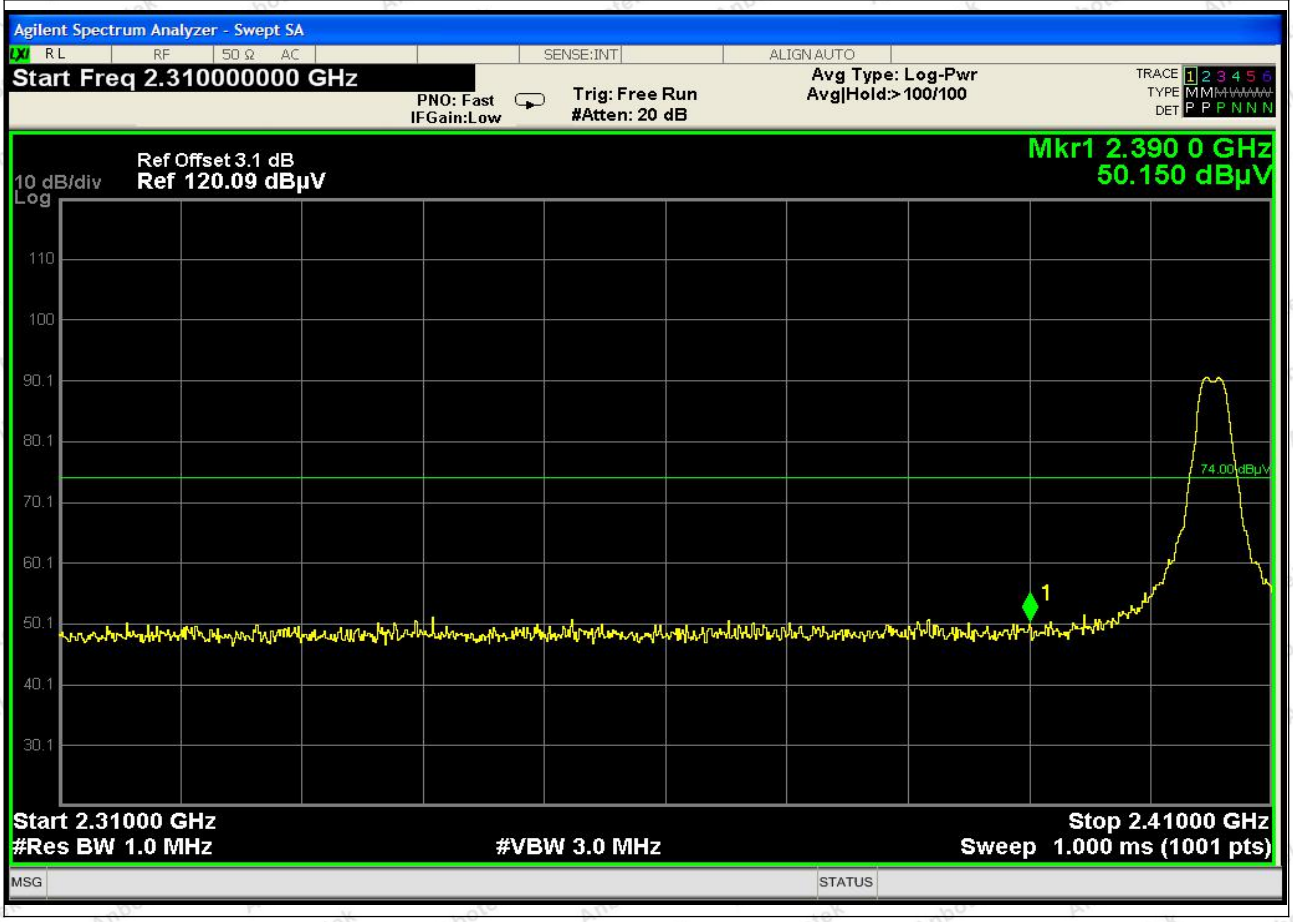
1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. "*" means the test results were attenuated more than 20dB below the permissible limits, so the results don't record in the report.

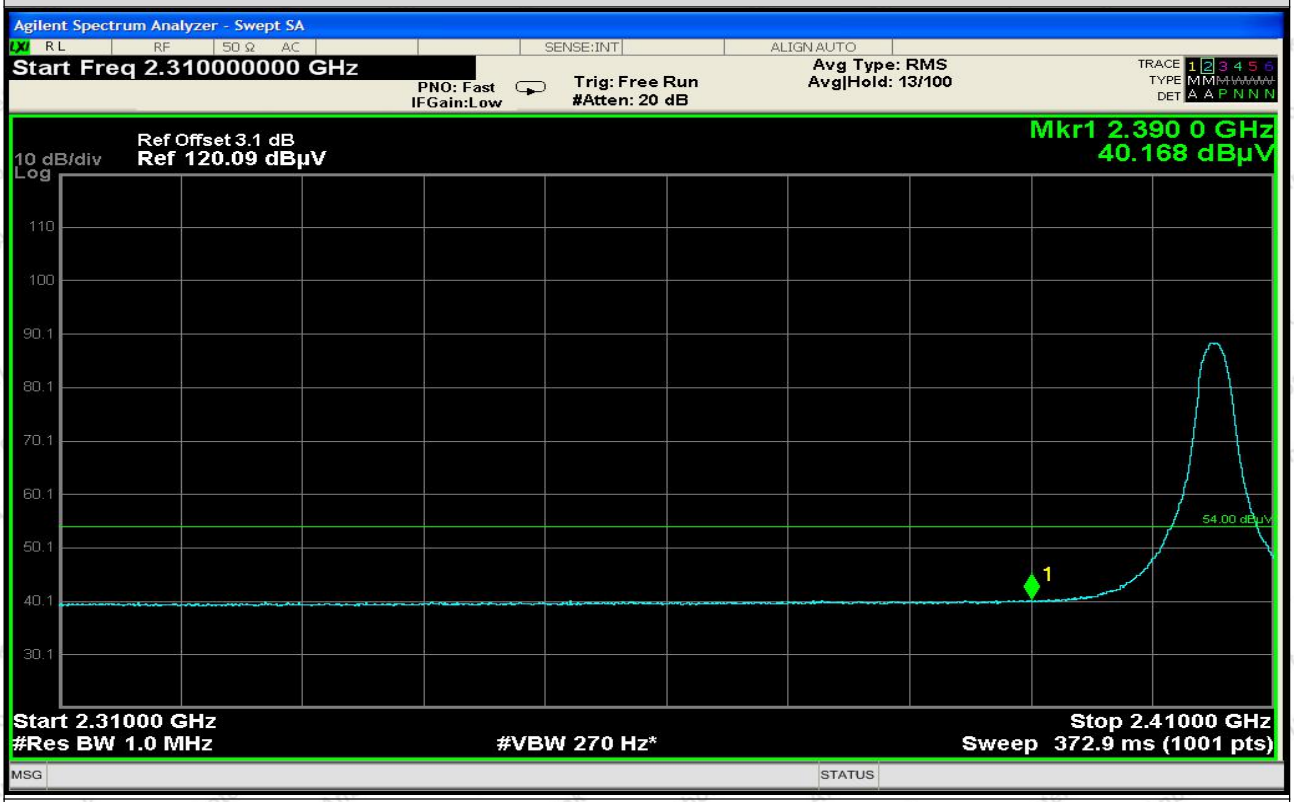
Radiated Band Edge:

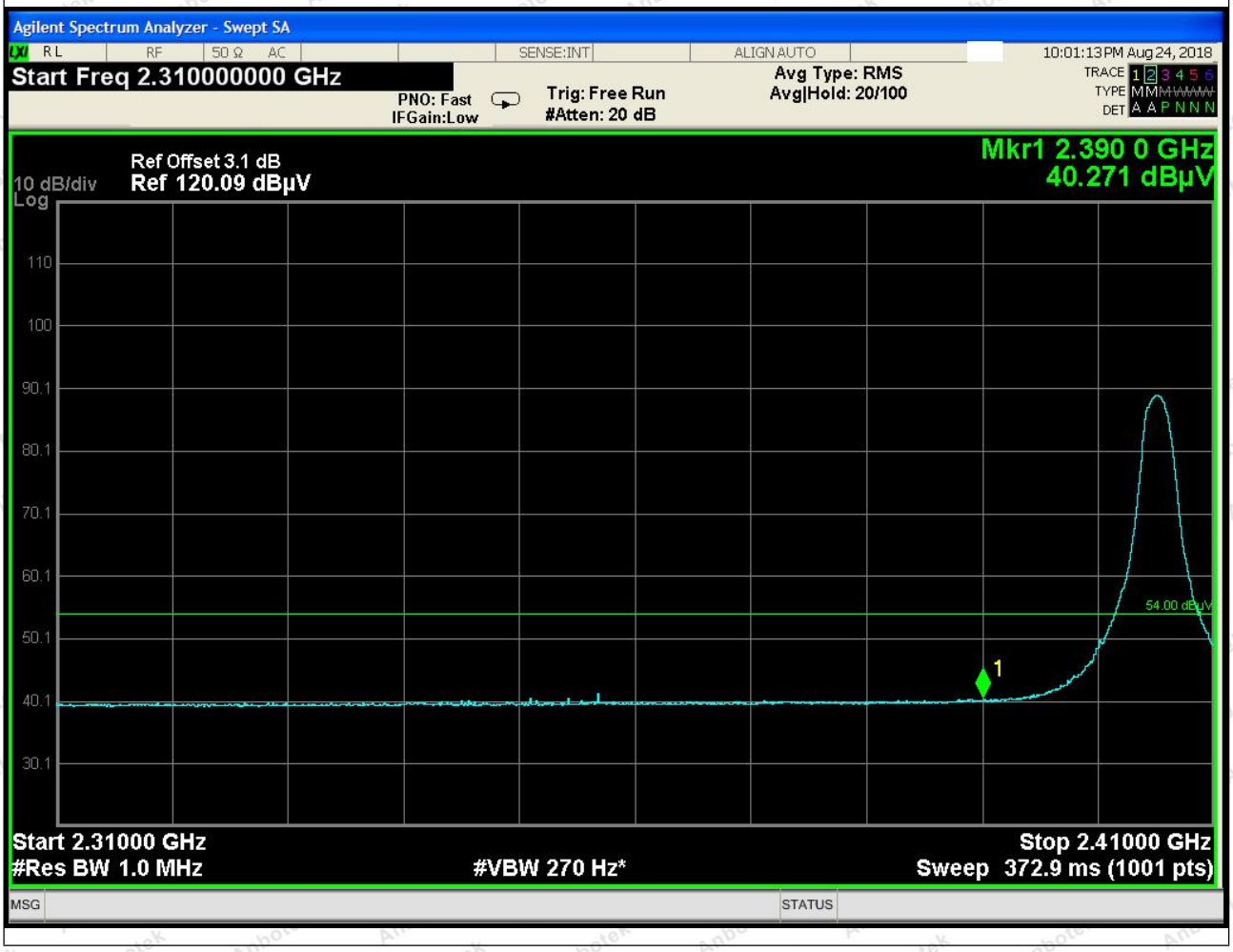
Test Mode: CH01	Test channel: Lowest
Peak Value	



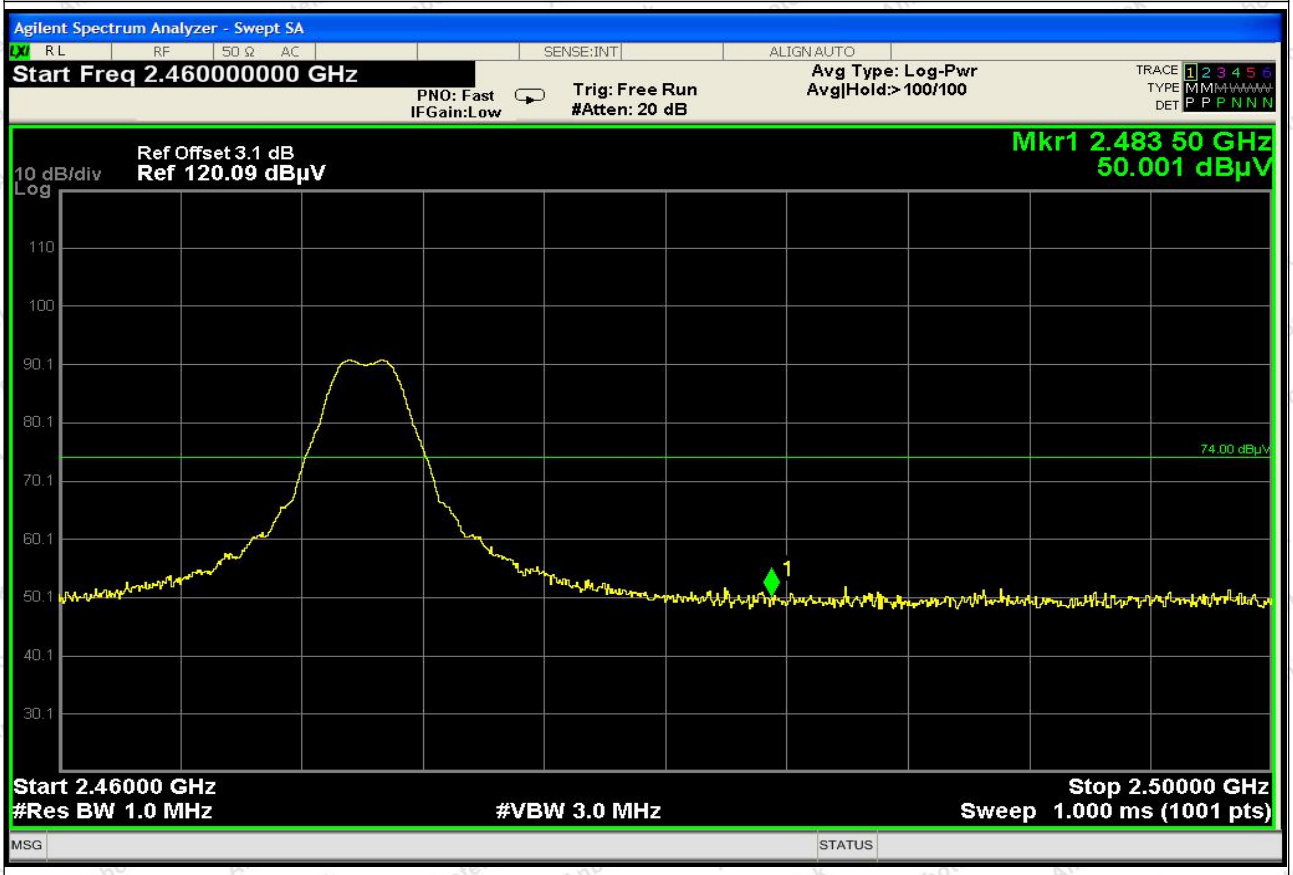


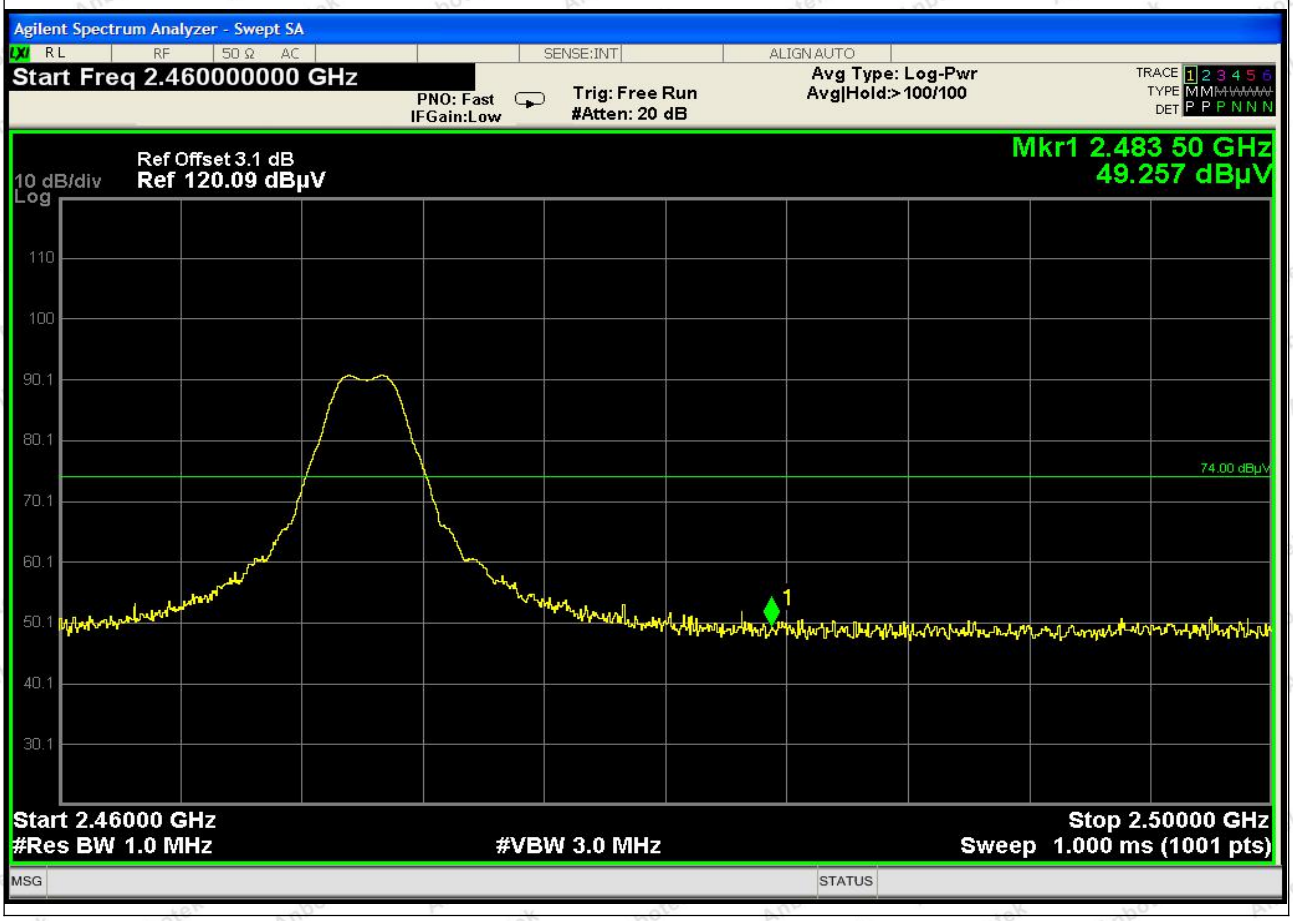
Average Value





Test Mode: CH34	Test channel: Highest
Peak Value	





Average Value

Remark:

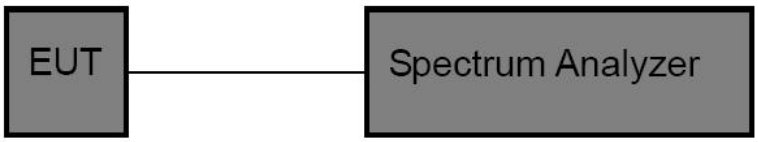
1. Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

5. 20dB Bandwidth Test

5.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.249

5.2. Test Setup



5.3. Test Procedure

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:

RBW = 30kHz, VBW≥3*RBW =100kHz,

Detector= Average

Trace mode= Max hold.

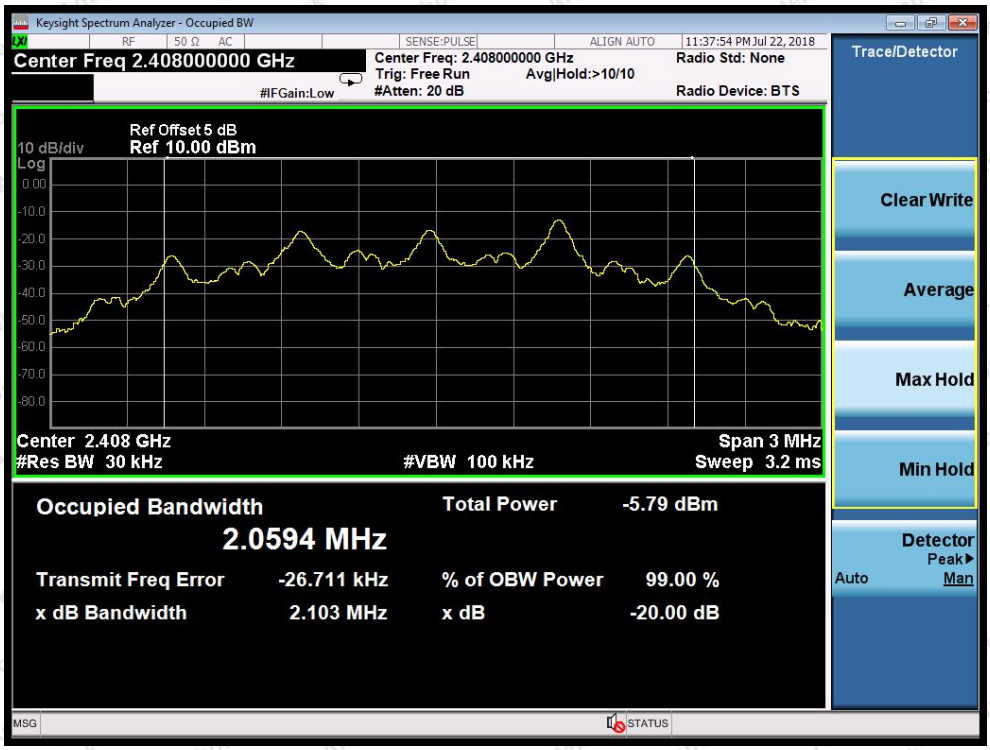
Sweep- auto couple.

4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

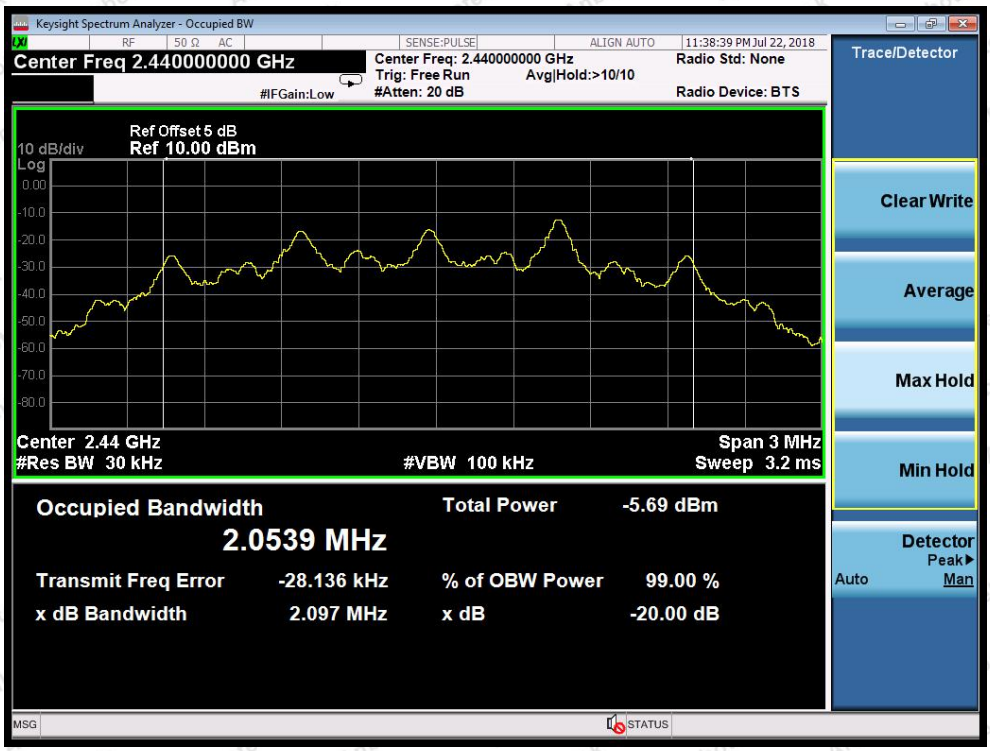
5.4. Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	Mode 1
Test Voltage	:	DC 3V Battery inside	Temperature	:	24℃
Test Result	:	PASS	Humidity	:	55%RH

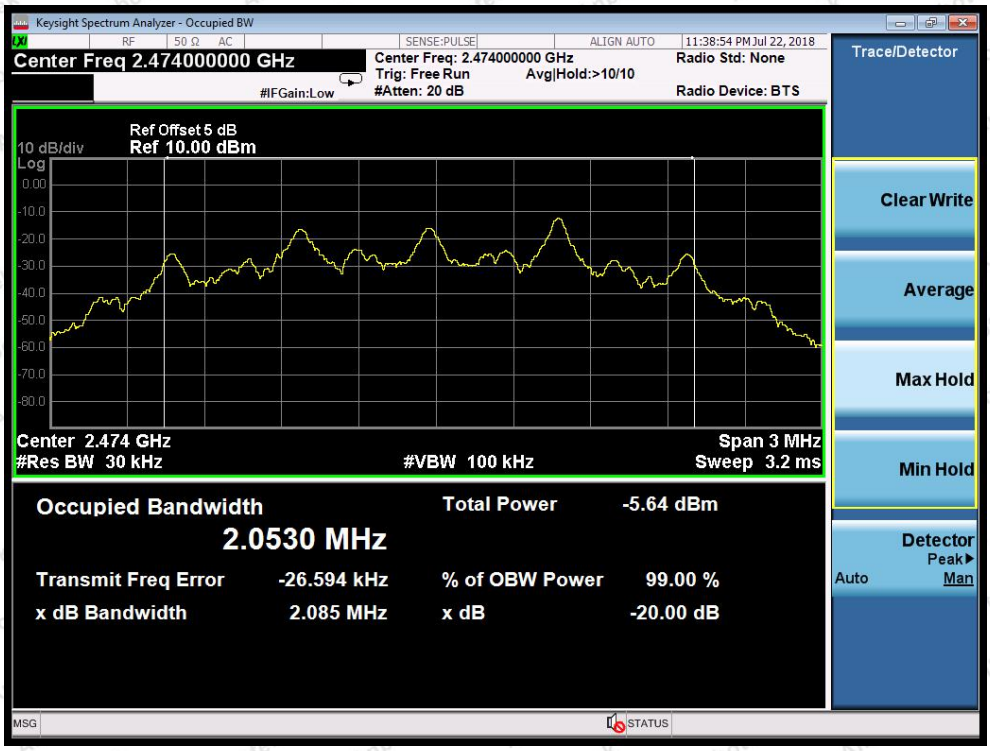
Frequency (MHz)	Bandwidth (kHz)	Result
2408MHZ	2103	PASS
2440MHZ	2097	PASS
2474MHZ	2085	PASS



Test Mode: Low



Test Mode: Middle



Test Mode: High

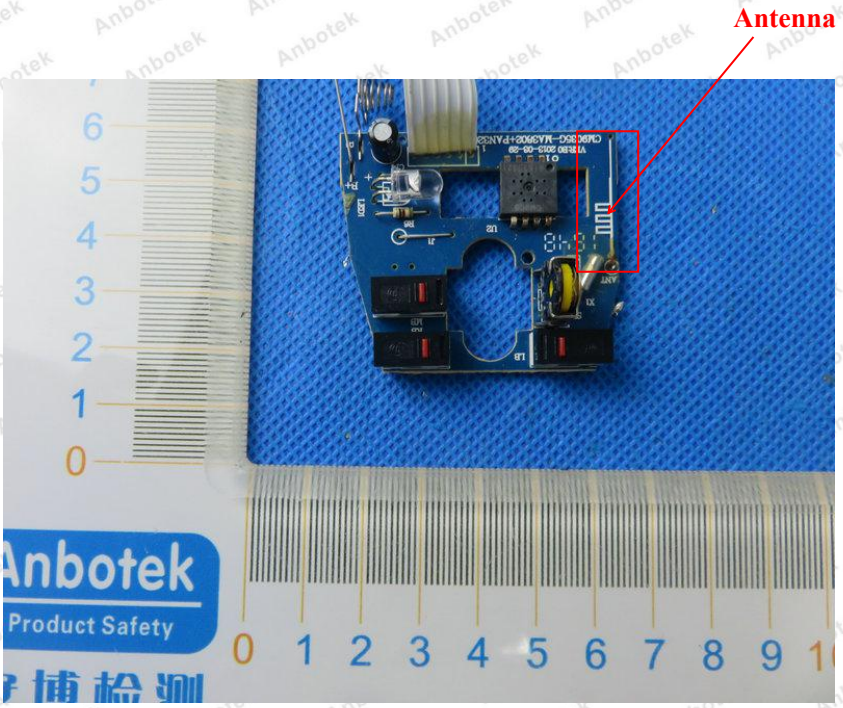
6. Antenna Requirement

6.1. Test Standard and Requirement

Test Standard	FCC Part15 Section 15.203
Requirement	1) 15.203 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, 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.

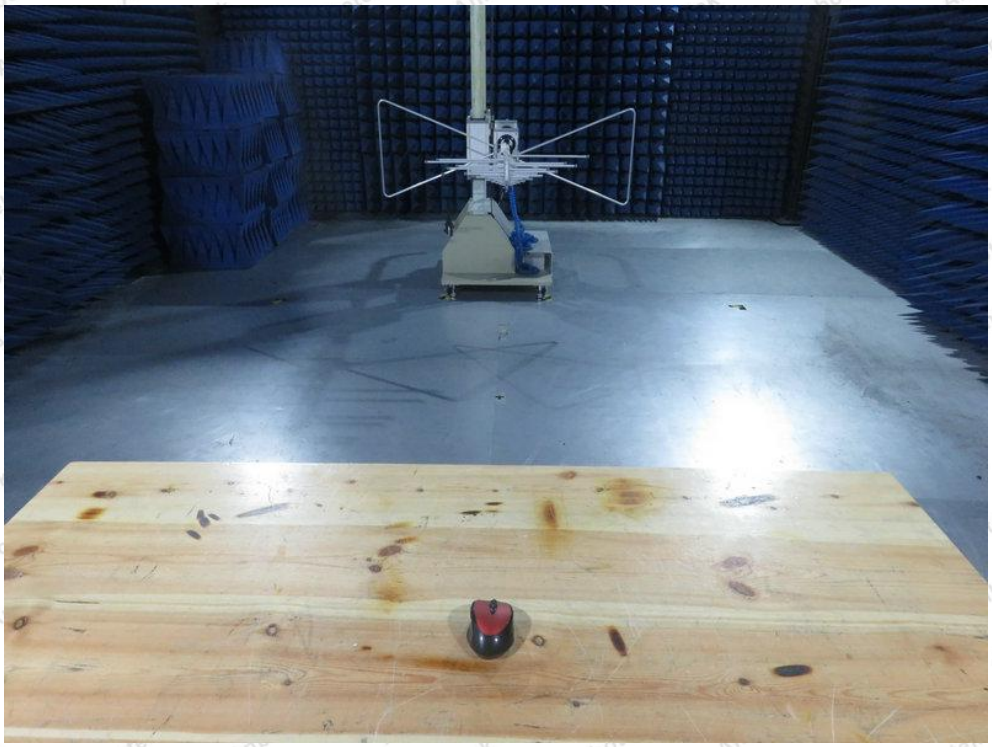
6.2. Antenna Connected Construction

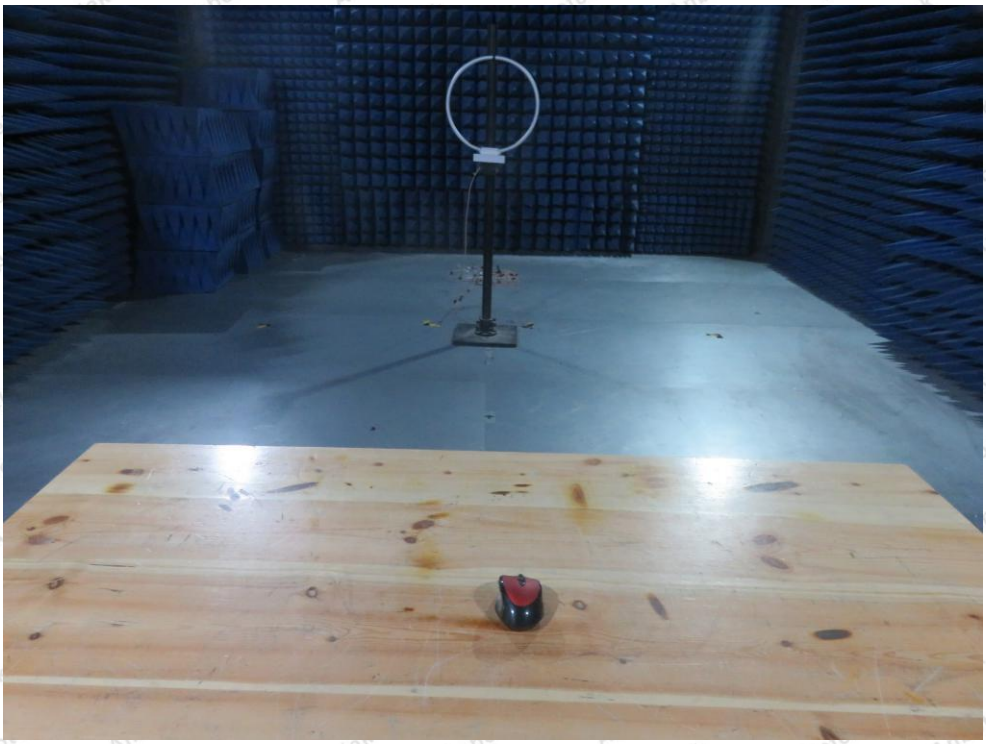
The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is -2 dBi. It complies with the standard requirement.



APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Radiation Emission Test



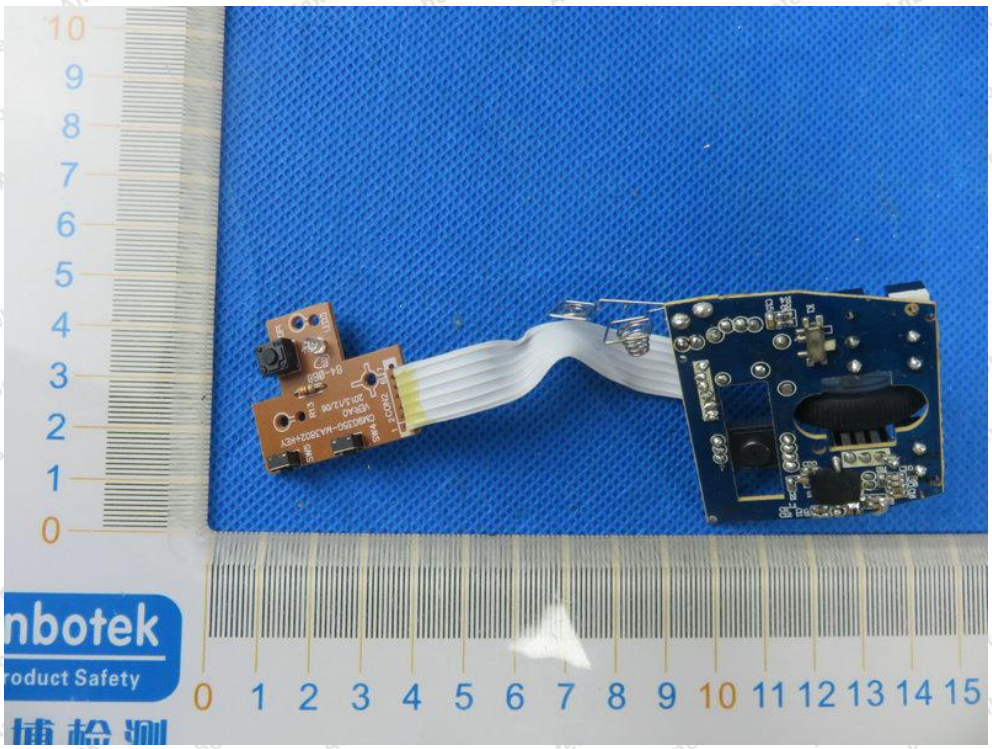


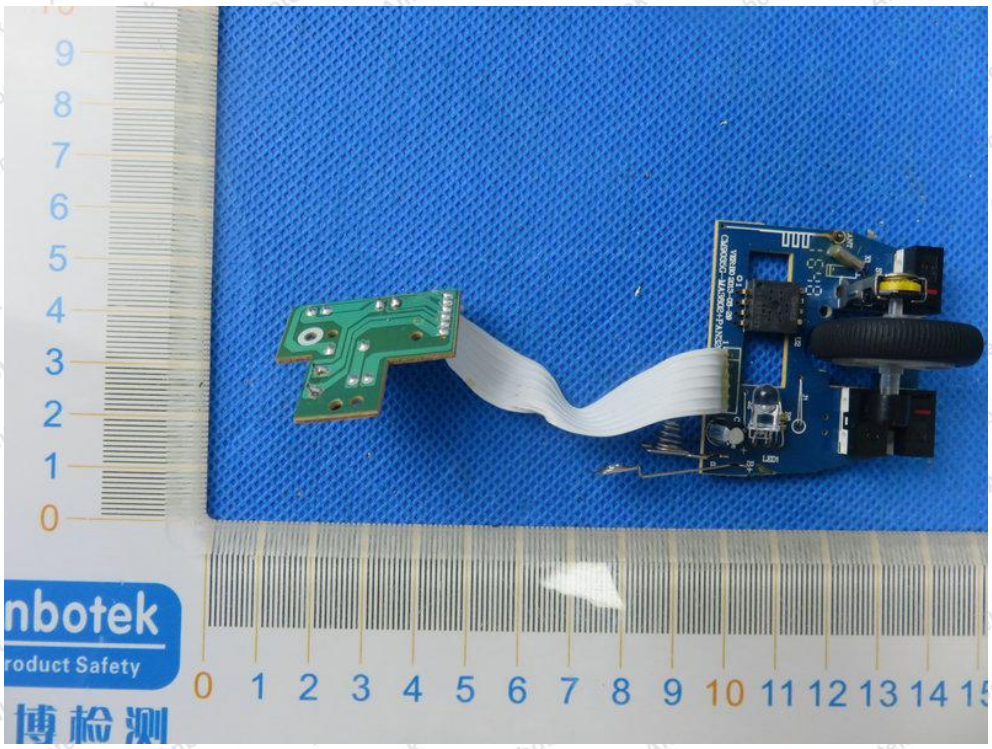
APPENDIX II -- EXTERNAL PHOTOGRAPH

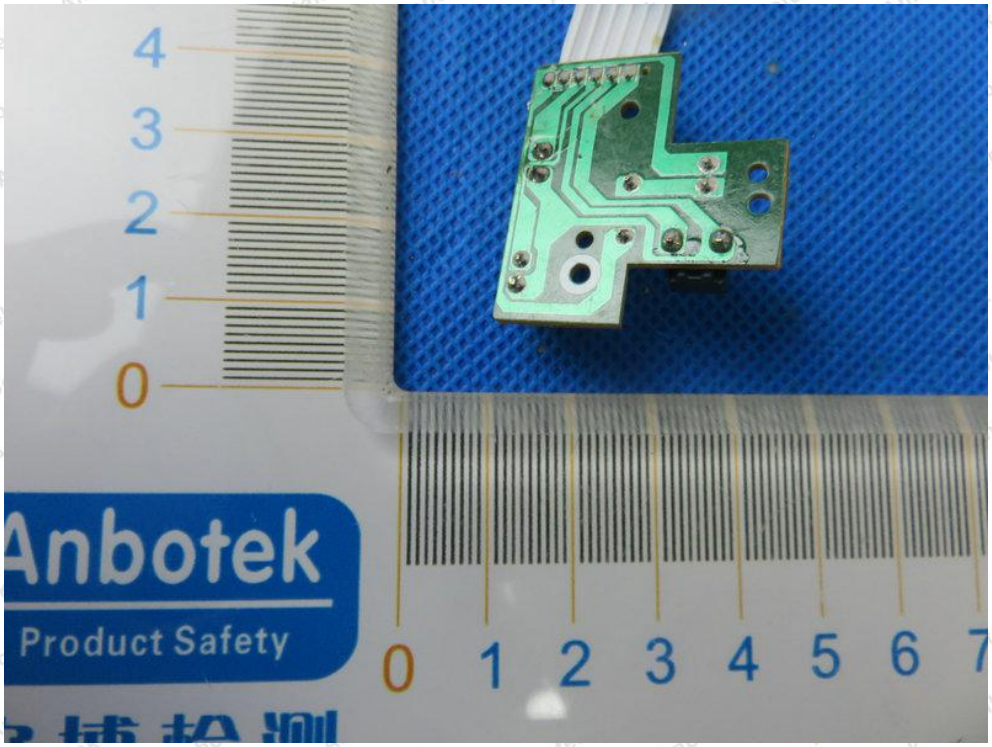
Anbotek
Product Safety
安博检测

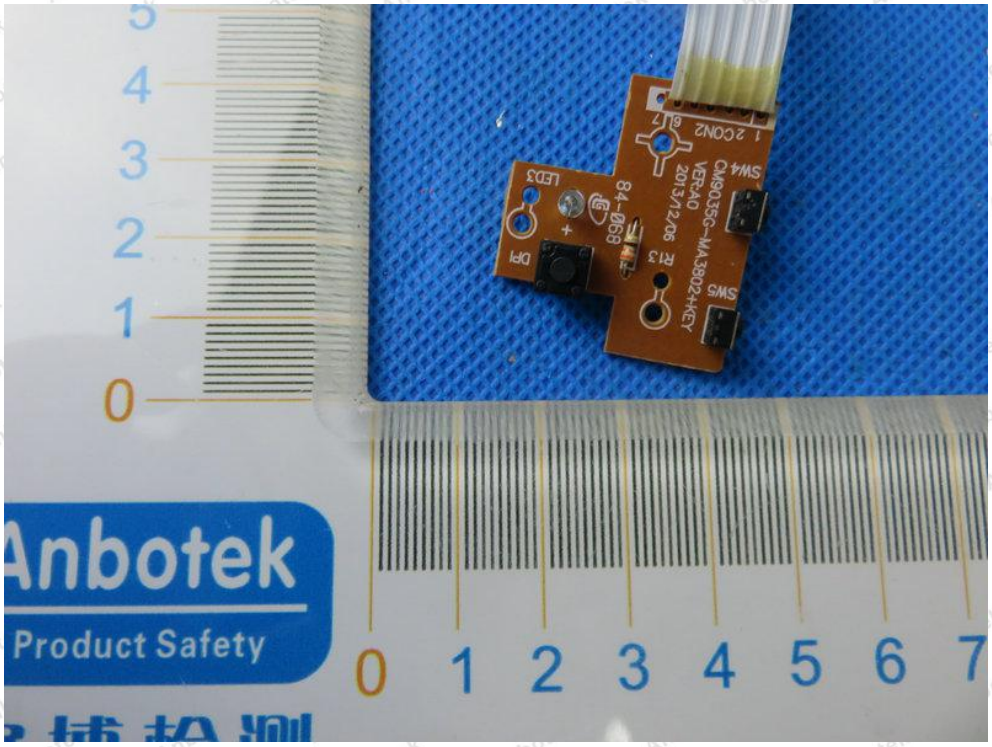
Anbotek
Product Safety
0 1 2 3 4 5 6 7 8 9

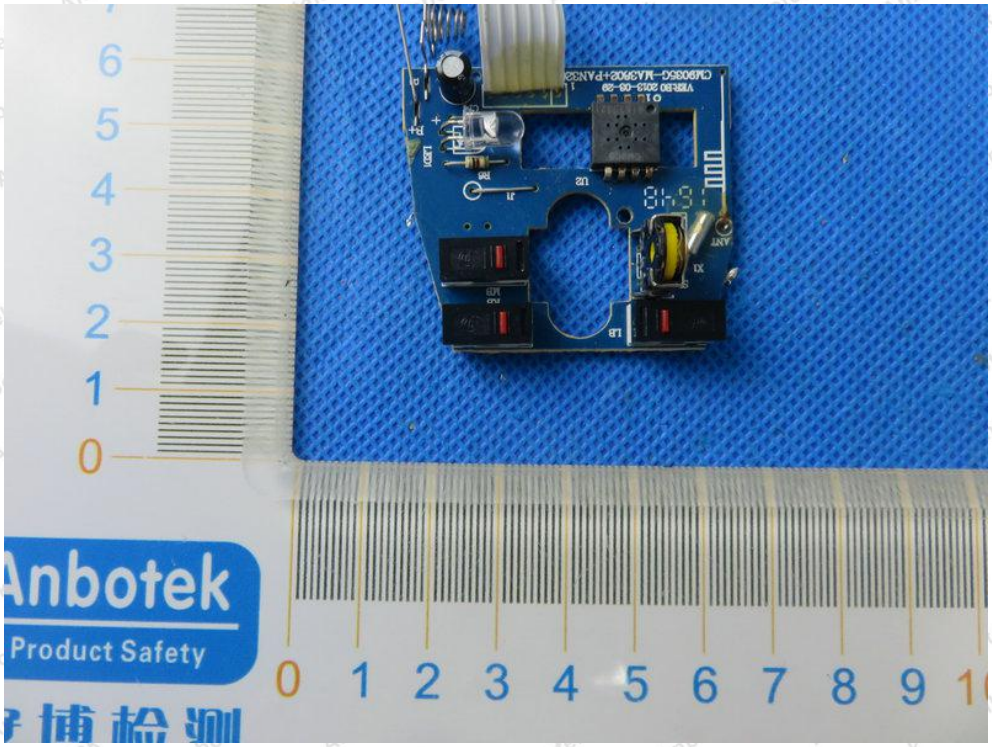
APPENDIX III -- INTERNAL PHOTOGRAPH

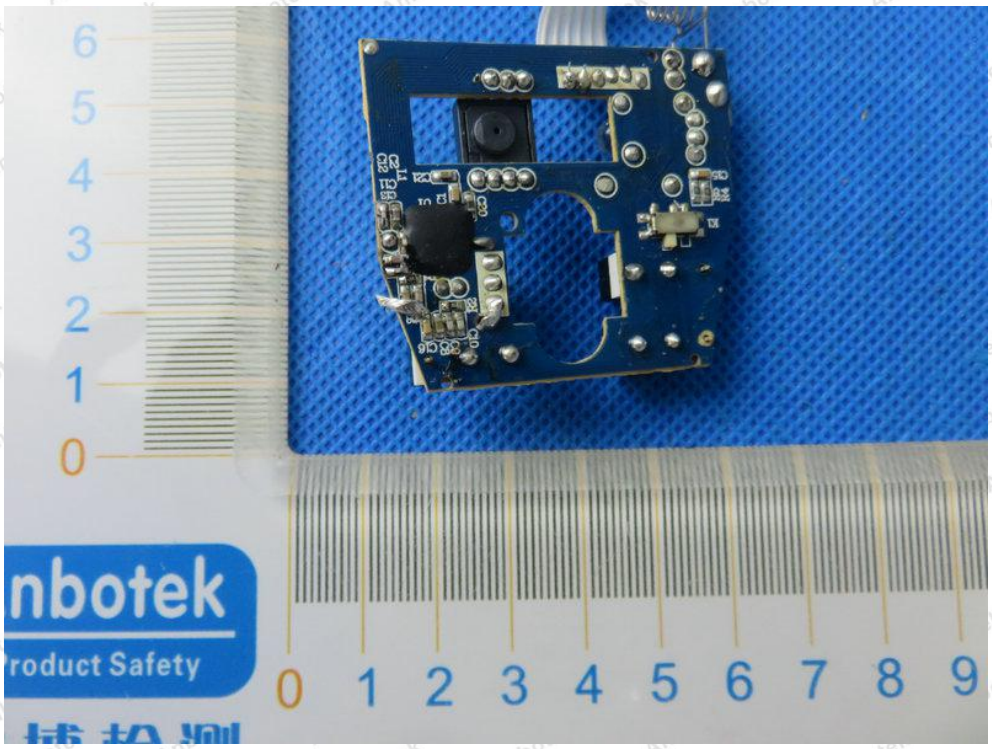


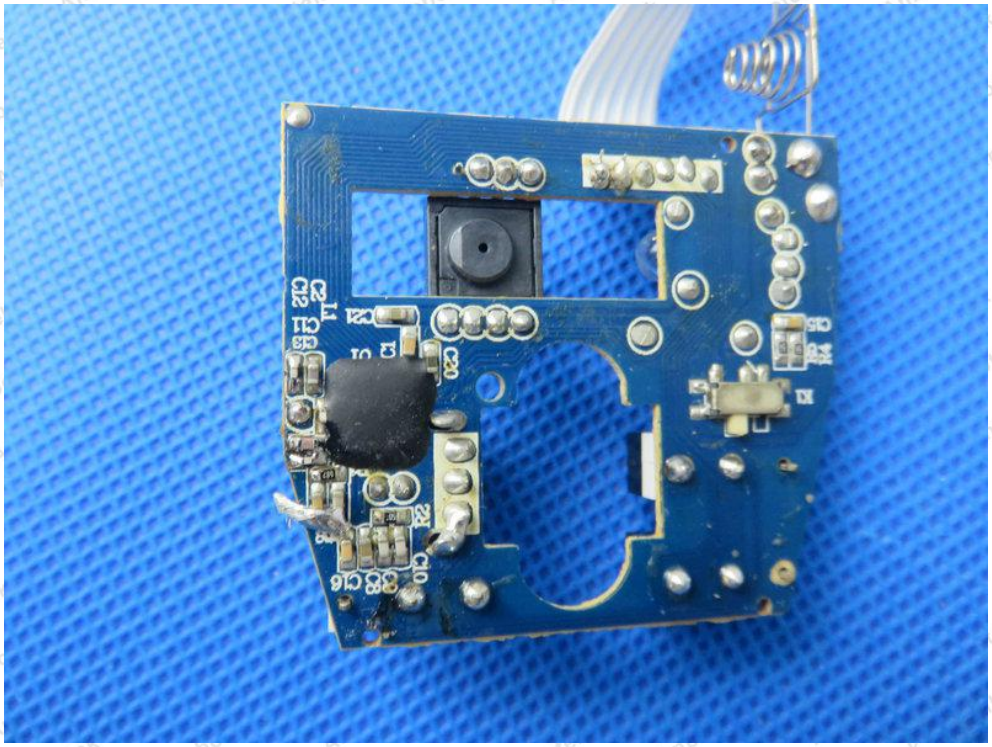



4
3
2
1
0
Anbotek
Product Safety
0 1 2 3 4 5 6 7


4
3
2
1
0
Anbotek
Product Safety
0 1 2 3 4 5 6 7







---------- End of Report ----------