FCC TEST REPORT

Client Name	:	SHENZHEN SUOAI ELECTRONICS TECHNOLOGY CO.,LTD
Address	:	8FL, A Block, huayuan Industrial area, Fuyong No.1 industrial zone, Baoan, Shenzhen, Guangdong, China
Product Name	:	Wireless keyboard
Date	:	Mar. 12, 2019

Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant	:	SHENZHEN SUOAI ELECTRONICS TECHNOLOGY CO.,LTD
Manufacturer	:	DONGGUAN SUOAI ELECTRONICS CO.,LTD
Product Name	:	Wireless keyboard
Model No.	:	SPK6314, SPK6324
Trade Mark	:	PHILIPS
Rating(s)	:	Input: DC 1.5V, 5mA by "AAA" battery*1 inside

Test Standard(s)	**:**	**FCC Part15 Subpart C, Paragraph 15.249**
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 Receipt	Feb. 25, 2019
Date of Test	Feb. 25~Mar. 12, 2019

Prepared by _____
(Engineer / Dolly Mo)

Reviewer _____
(Supervisor / Snowy Meng)

Approved & Authorized Signer _____
(Manager / Sally Zhang)

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Hotline 400-003-0500 www.anbotek.com

1. General Information

1.1. Client Information

Applicant	:	SHENZHEN SUOAI ELECTRONICS TECHNOLOGY CO.,LTD
Address	:	8FL, A Block, huayuan Industrial area, Fuyong No.1 industrial zone, Baoan, Shenzhen, Guangdong, China
Manufacturer	:	DONGGUAN SUOAI ELECTRONICS CO.,LTD
Address	:	No.3, Huayu Street, Changlong Village, Huangjiang Town, Dongguan, China
Factory	:	DONGGUAN SUOAI ELECTRONICS CO.,LTD
Address	:	No.3, Huayu Street, Changlong Village, Huangjiang Town, Dongguan, China

1.2. Description of Device (EUT)

Product Name	:	Wireless keyboard	
Model No.	:	SPK6314, SPK6324 (Note: All samples are the same except the appearance, so we prepare "SPK6314" for test only.)	
Trade Mark	:	PHILIPS	
Test Power Supply	:	DC 1.5V Battery inside	
Test Sample No.	:	S1(Normal Sample), S2(Engineering Sample)	
Product Description	:	Operation Frequency:	2402~2480MHz
		Number of Channel:	40 Channels
		Modulation Type:	GFSK
		Antenna Type:	PCB Antenna
		Antenna Gain(Peak):	0 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	CH01
Mode 2	CH20
Mode 3	CH40

For Radiated Emission	
Final Test Mode	Description
Mode 1	CH01
Mode 2	CH20
Mode 3	CH40

Note:

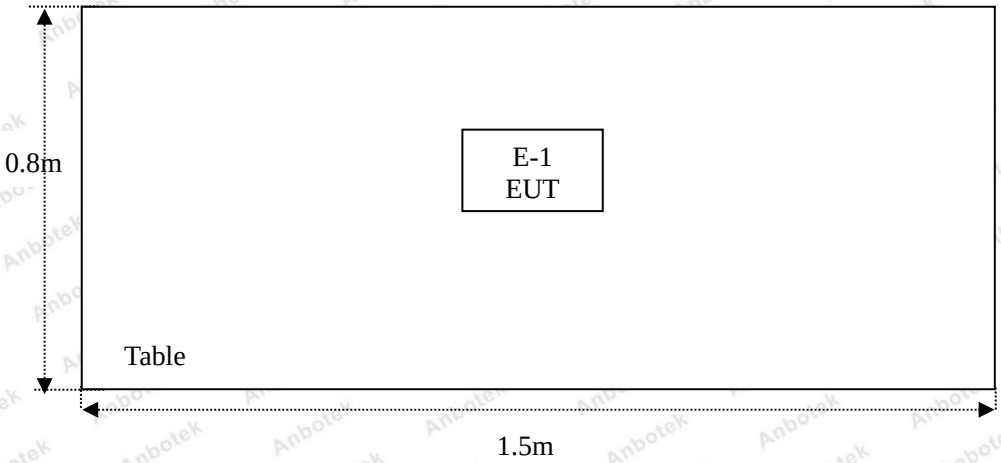
1. The engineering test program was provided and the EUT was programmed to be in continuously transmitting mode.

1.5. List of Channels

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
01	2402	10	2420	19	2438	28	2456	37	2474
02	2404	11	2422	20	2440	29	2458	38	2476
03	2406	12	2424	21	2442	30	2460	39	2478
04	2408	13	2426	22	2444	31	2462	40	2480
05	2410	14	2428	23	2446	32	2464		
05	2412	15	2430	24	2448	33	2466		
07	2414	16	2432	25	2450	34	2468		
08	2416	17	2434	26	2452	35	2470		
09	2418	18	2436	27	2454	36	2472		

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. 05, 2018	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESPI3	101604	Nov. 05, 2018	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 05, 2018	1 Year
4.	Spectrum Analysis	Agilent	E4407B	US39390582	Nov. 05, 2018	1 Year
5.	MAX Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
6.	Preamplifier	SKET Electronic	BK1G18G30D	KD17503	Nov. 05, 2018	1 Year
7.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Nov. 20, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 19, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB1519B	00053	Nov. 20, 2018	1 Year
10.	Horn Antenna	A-INFO	LB-180400-KF	J211060628	Nov. 20, 2018	1 Year
11.	Pre-amplifier	SONOMA	310N	186860	Nov. 05, 2018	1 Year
12.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
13.	RF Test Control System	YIHENG	YH3000	2017430	Nov. 05, 2018	1 Year
14.	Power Sensor	DAER	RPR3006W	15I00041SN045	Nov. 05, 2018	1 Year
15.	Power Sensor	DAER	RPR3006W	15I00041SN046	Nov. 05, 2018	1 Year
16.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Nov. 05, 2018	1 Year
17.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Nov. 05, 2018	1 Year
18.	Signal Generator	Agilent	E4421B	MY41000743	Nov. 05, 2018	1 Year
19.	DC Power Supply	IVYTECH	IV3605	1804D360510	Apr. 02, 2018	1 Year
20.	Constant Temperature Humidity Chamber	ZHONGJIAN	ZJ-KHWS80B	N/A	Nov. 01, 2018	1 Year

1.8. 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

Shenzhen Anbotek Compliance Laboratory Limited.
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

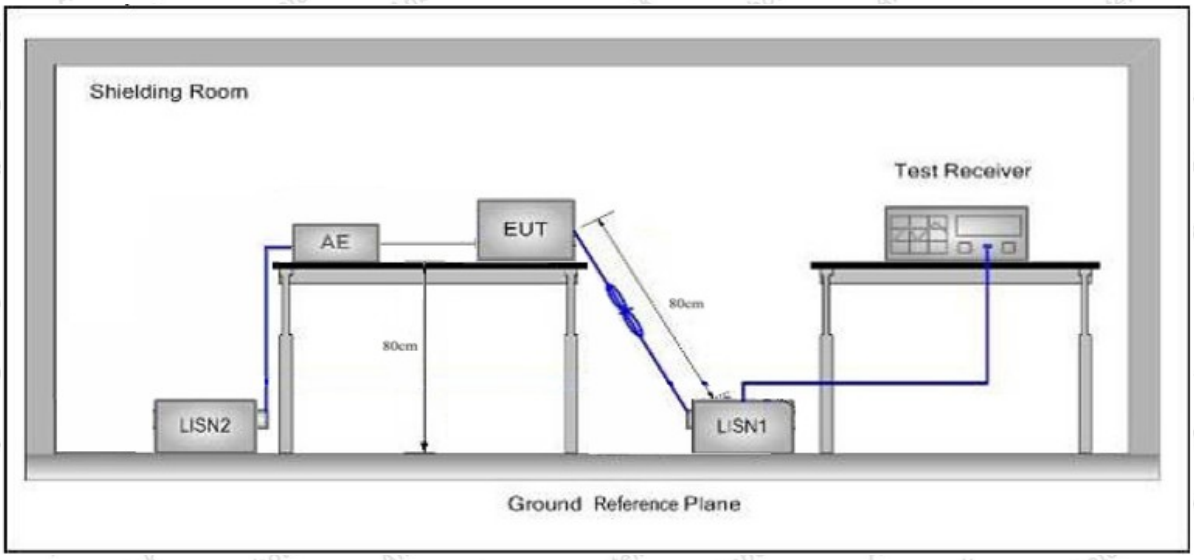
Standard Section	Test Item	Result
15.203	Antenna Requirement	PASS
15.207	Conducted Emission	N/A
15.249	Radiated Emission	PASS
15.215(c)	20dB Bandwidth	PASS
15.249(c)	Band Edge	PASS
Remark: "N/A" is an abbreviation for Not Applicable.		

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 1.5V 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

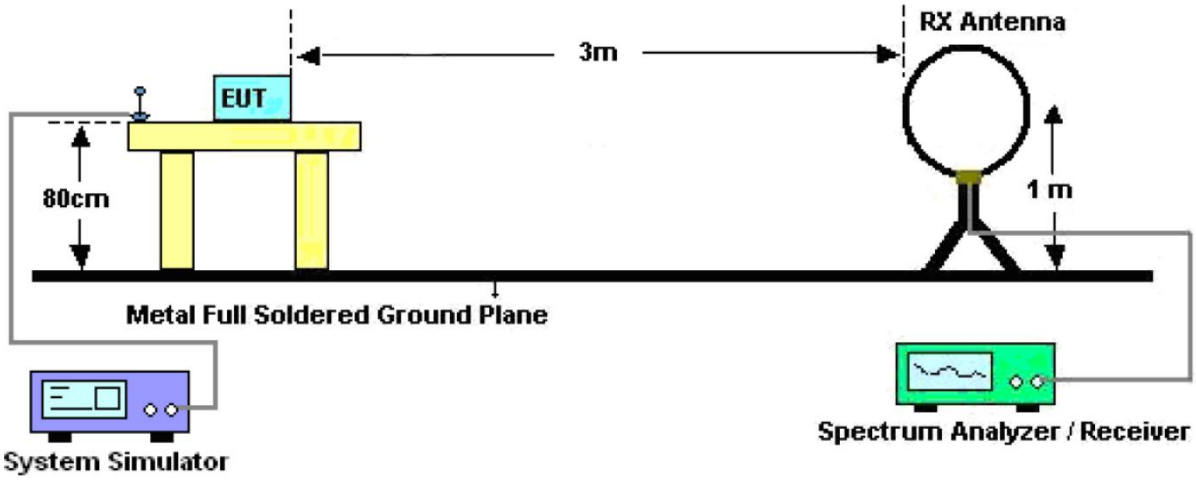


Figure 2. 30MHz to 1GHz

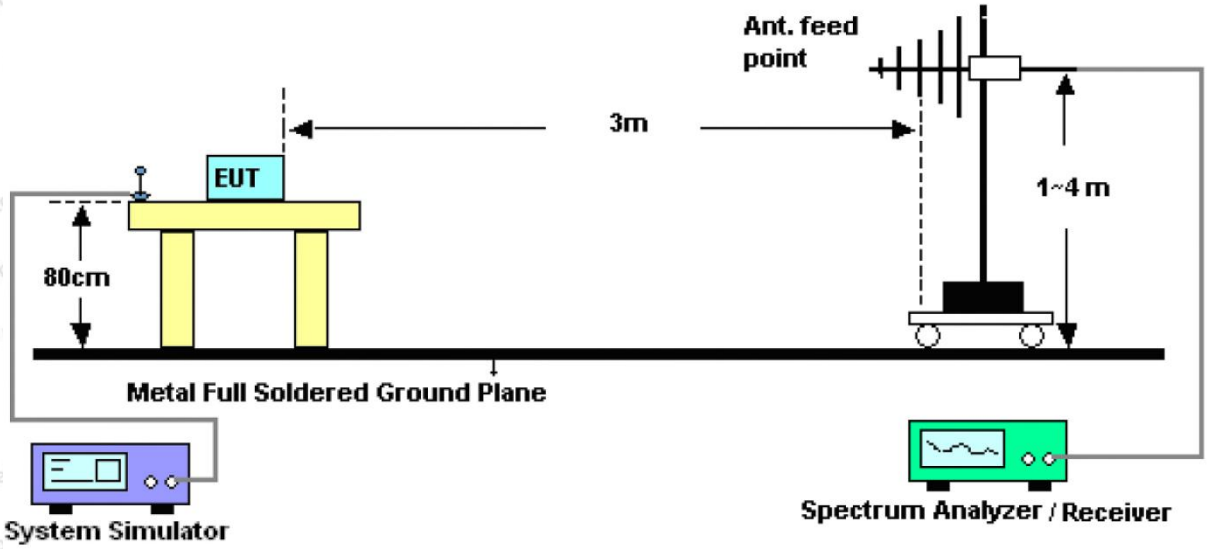
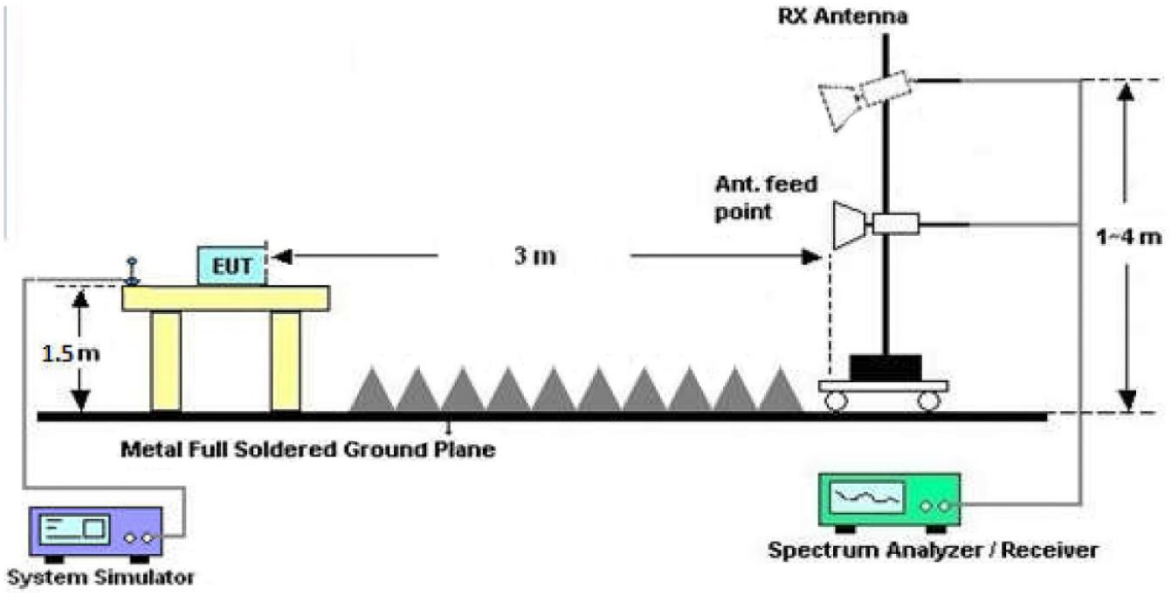


Figure 3. Above 1 GHz



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

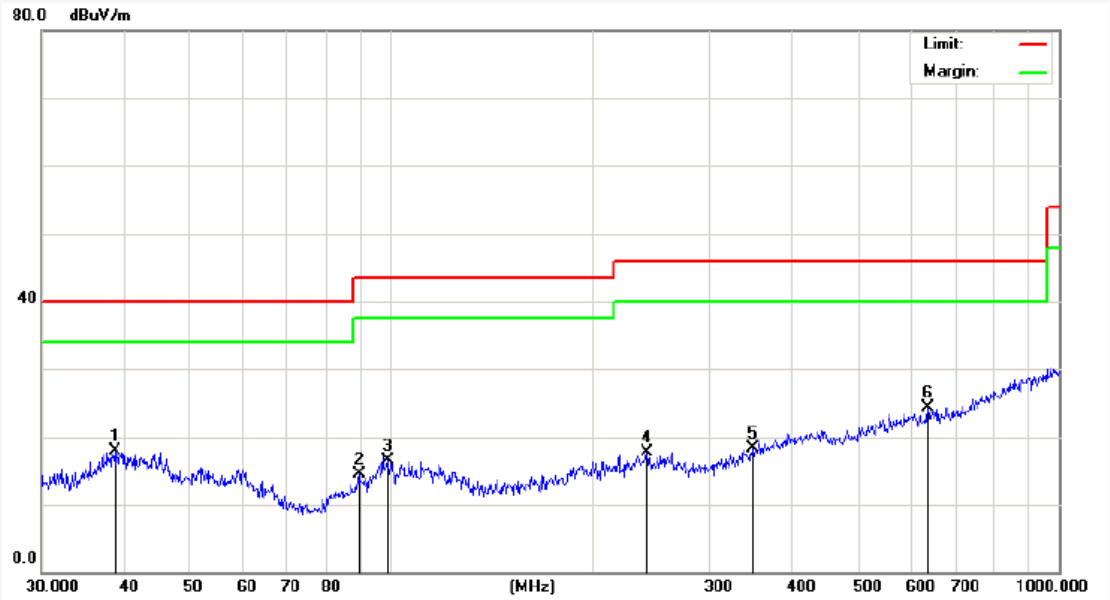
During the test, Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis is the worst case.

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)

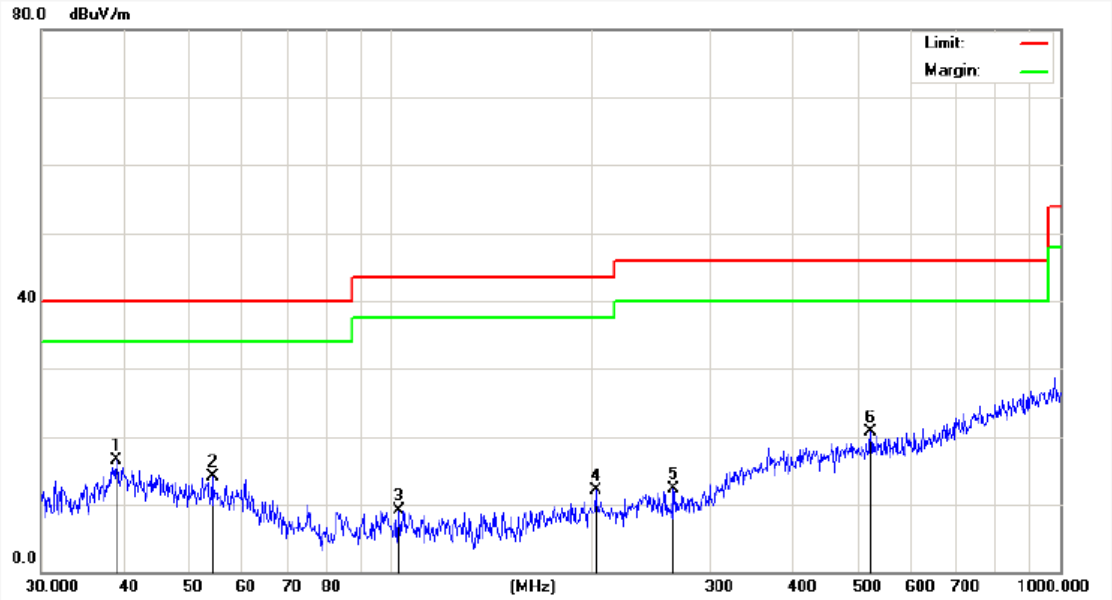
Job No.:	SZAWW190225005-01	Temp.(℃)/Hum.(%RH):	21.6℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 1.5V battery inside
Test Mode:	Mode 2	Polarization:	Horizontal



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	38.6160	33.02	-15.12	17.90	40.00	-22.10	QP	300	0	
2	89.5899	38.54	-24.09	14.45	43.50	-29.05	QP	300	77	
3	99.1797	38.29	-21.84	16.45	43.50	-27.05	QP	300	125	
4	241.6763	36.33	-18.58	17.75	46.00	-28.25	QP	300	255	
5	348.0274	32.88	-14.57	18.31	46.00	-27.69	QP	300	269	
6	636.1340	34.60	-10.24	24.36	46.00	-21.64	QP	300	360	

Test Results (30~1000MHz)

Job No.:	SZAWW190225005-01	Temp.(℃)/Hum.(%RH):	21.6℃/55%RH
Standard:	FCC PART 15C	Power Source:	DC 1.5V battery inside
Test Mode:	Mode 2	Polarization:	Vertical



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	38.8878	30.42	-13.97	16.45	40.00	-23.55	QP	300	0	
2	54.0711	30.77	-16.71	14.06	40.00	-25.94	QP	300	52	
3	102.7192	24.90	-15.73	9.17	43.50	-34.33	QP	300	121	
4	202.1005	27.87	-15.81	12.06	43.50	-31.44	QP	300	222	
5	263.8190	27.10	-14.86	12.24	46.00	-33.76	QP	300	233	
6	520.8882	31.27	-10.59	20.68	46.00	-25.32	QP	300	360	

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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
2402.0000	94.53	31.12	2.18	35.33	92.50	114.00	-21.50	V	Peak
2402.0000	84.93	31.12	2.18	35.33	82.90	94.00	-11.10	V	AVG
4804.0000	48.20	34.01	2.58	34.65	50.14	74.00	-23.86	V	Peak
4804.0000	41.71	34.01	2.58	34.65	43.65	54.00	-10.35	V	AVG
7206.0000	48.58	36.16	2.97	35.07	52.64	74.00	-21.36	V	Peak
7206.0000	38.16	36.16	2.97	35.07	42.22	54.00	-11.78	V	AVG
9608.0000	*								
12010.0000	*								
14412.0000	*								
16814.0000	*								
2402.0000	95.48	31.12	2.18	35.33	93.45	114.00	-20.55	H	Peak
2402.0000	85.15	31.12	2.18	35.33	83.12	94.00	-10.88	H	AVG
4804.0000	49.49	34.01	2.58	34.65	51.43	74.00	-22.57	H	Peak
4804.0000	38.57	34.01	2.58	34.65	40.51	54.00	-13.49	H	AVG
7206.0000	48.15	36.16	2.97	35.07	52.21	74.00	-21.79	H	Peak
7206.0000	38.76	36.16	2.97	35.07	42.82	54.00	-11.18	H	AVG
9608.0000	*								
12010.0000	*								
14412.0000	*								
16814.0000	*								

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.

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Test Mode: CH20 (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	94.46	31.12	2.20	34.51	93.27	114.00	-20.73	V	Peak
2440.0000	82.39	31.22	2.20	34.51	81.30	94.00	-12.70	V	AVG
4880.0000	47.87	34.98	2.49	34.14	51.20	74.00	-22.80	V	Peak
4880.0000	39.49	34.98	2.49	34.14	42.82	54.00	-11.18	V	AVG
7320.0000	45.45	36.01	3.01	34.56	49.91	74.00	-24.09	V	Peak
7320.0000	36.76	36.01	3.01	34.56	41.22	54.00	-12.78	V	AVG
9760.0000	*								
12200.0000	*								
14640.0000	*								
17080.0000	*								
2440.0000	94.27	31.12	2.20	34.51	93.08	114.00	-20.92	H	Peak
2440.0000	82.05	31.12	2.20	34.51	80.86	94.00	-13.14	H	AVG
4880.0000	49.82	34.98	2.49	34.14	53.15	74.00	-20.85	H	Peak
4880.0000	41.24	34.98	2.49	34.14	44.57	54.00	-9.43	H	AVG
7320.0000	48.06	36.01	3.01	34.56	52.52	74.00	-21.48	H	Peak
7320.0000	36.20	36.01	3.01	34.56	40.66	54.00	-13.34	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.

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Test Mode: CH40 (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
2480.0000	94.23	31.65	2.23	36.07	92.04	114.00	-21.96	V	Peak
2480.0000	84.24	31.65	2.23	36.07	82.05	94.00	-11.95	V	AVG
4960.0000	50.93	35.06	2.60	34.93	53.66	74.00	-20.34	V	Peak
4960.0000	38.49	35.06	2.60	34.93	41.22	54.00	-12.78	V	AVG
7440.0000	45.75	36.19	3.12	35.11	49.95	74.00	-24.05	V	Peak
7440.0000	37.87	36.19	3.12	35.11	42.07	54.00	-11.93	V	AVG
9920.0000	*								
12400.0000	*								
14880.0000	*								
17360.0000	*								
2480.0000	94.40	31.65	2.23	36.07	92.21	114.00	-21.79	H	Peak
2480.0000	84.92	31.65	2.23	36.07	82.73	94.00	-11.27	H	AVG
4960.0000	48.80	35.06	2.60	34.93	51.53	74.00	-22.47	H	Peak
4960.0000	38.68	35.06	2.60	34.93	41.41	54.00	-12.59	H	AVG
7440.0000	47.64	36.19	3.12	35.11	51.84	74.00	-22.16	H	Peak
7440.0000	37.06	36.19	3.12	35.11	41.26	54.00	-12.74	H	AVG
9920.0000	*								
12400.0000	*								
14880.0000	*								
17360.0000	*								

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.

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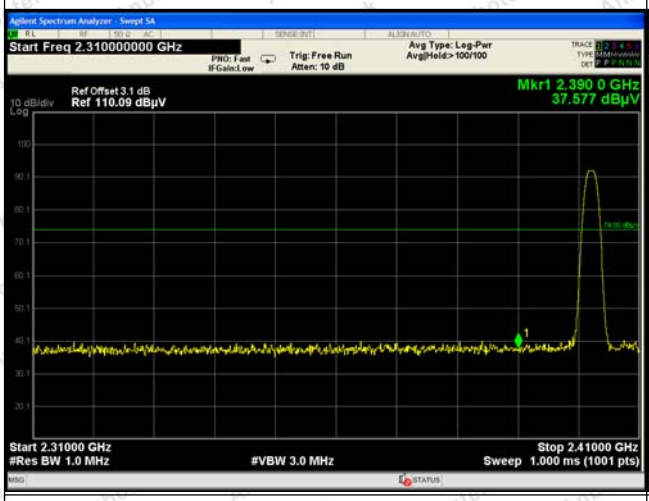
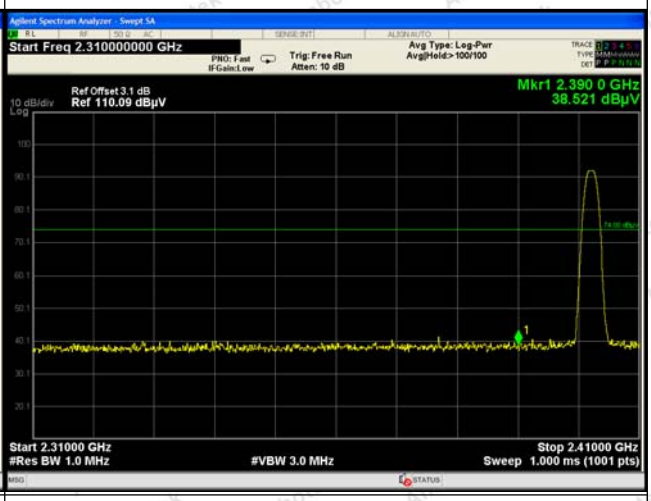
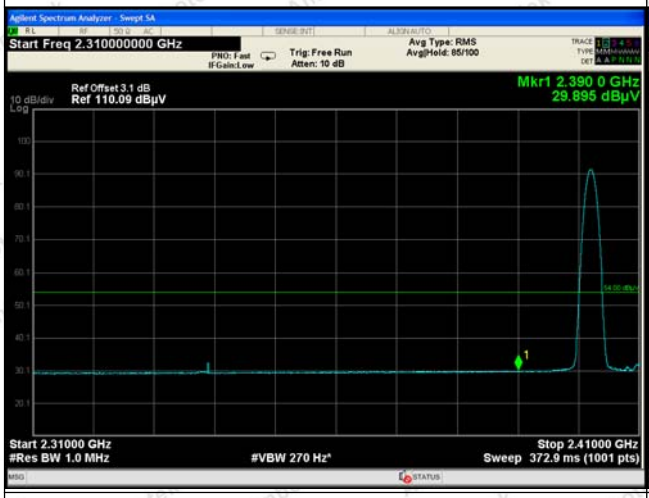
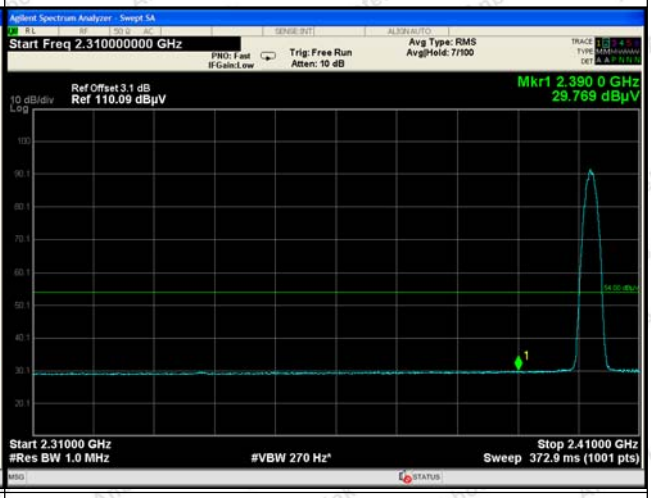
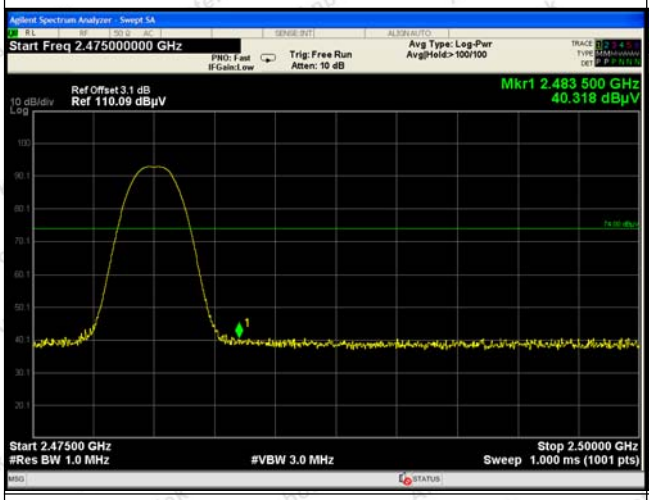
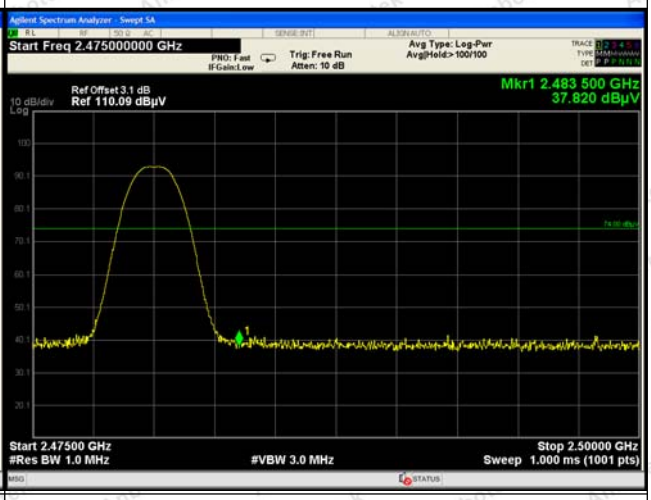
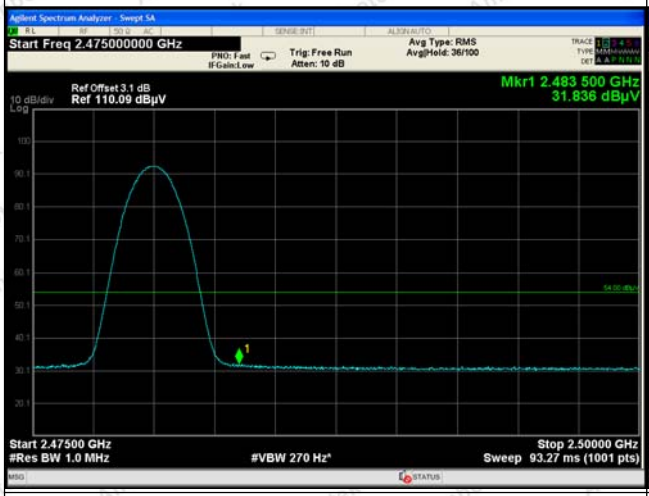
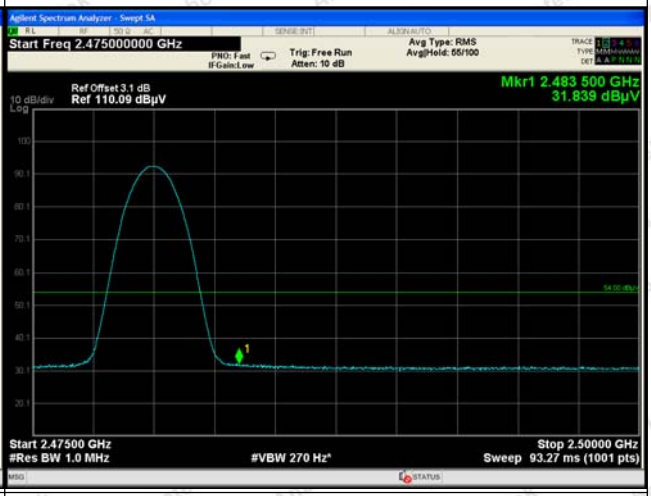
Radiated Band Edge:

Test Mode: CH01	Test channel: Lowest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

Test Mode: CH40	Test channel: Highest
	
Peak Value(Vertical)	Peak Value(Horizontal)
	
Average Value(Vertical)	Average Value(Horizontal)

Remark:

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

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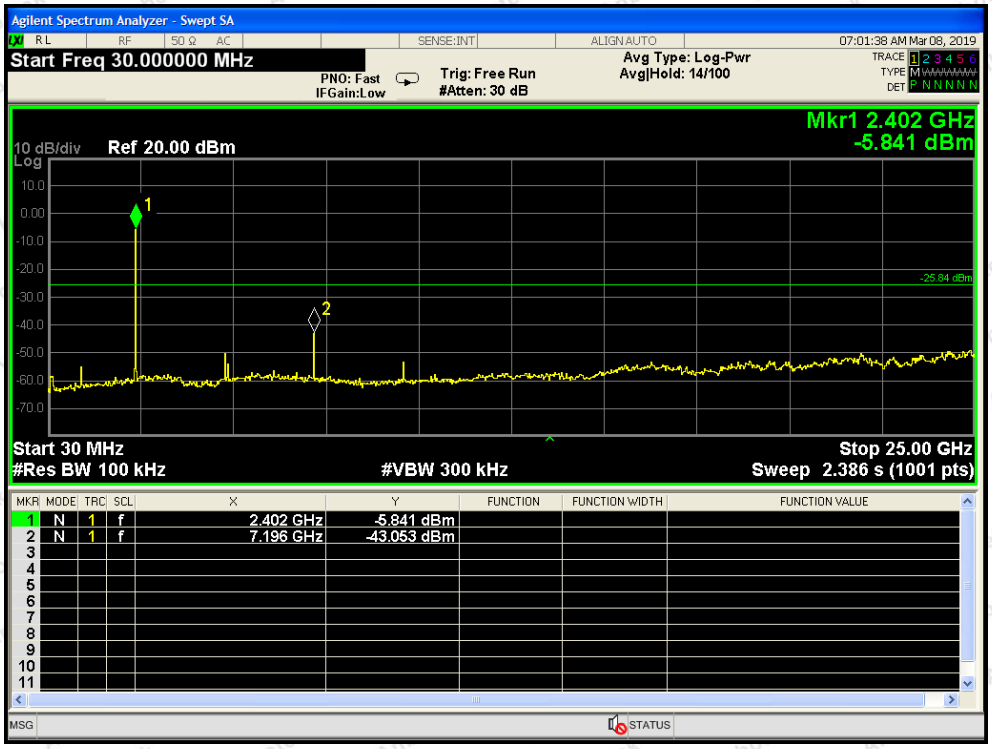
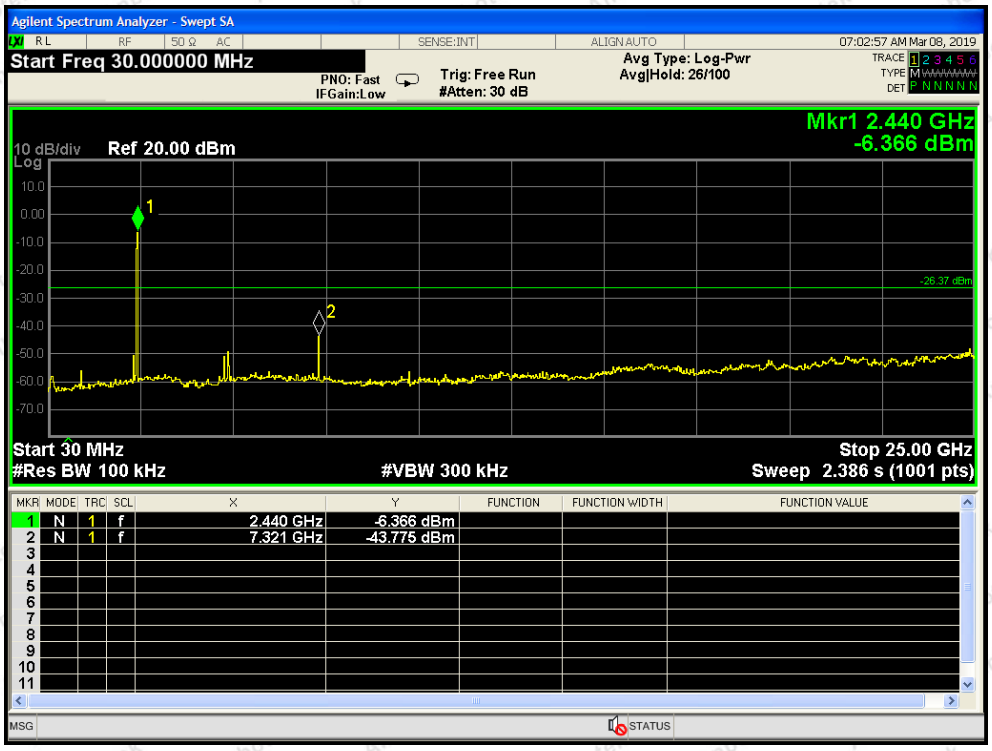
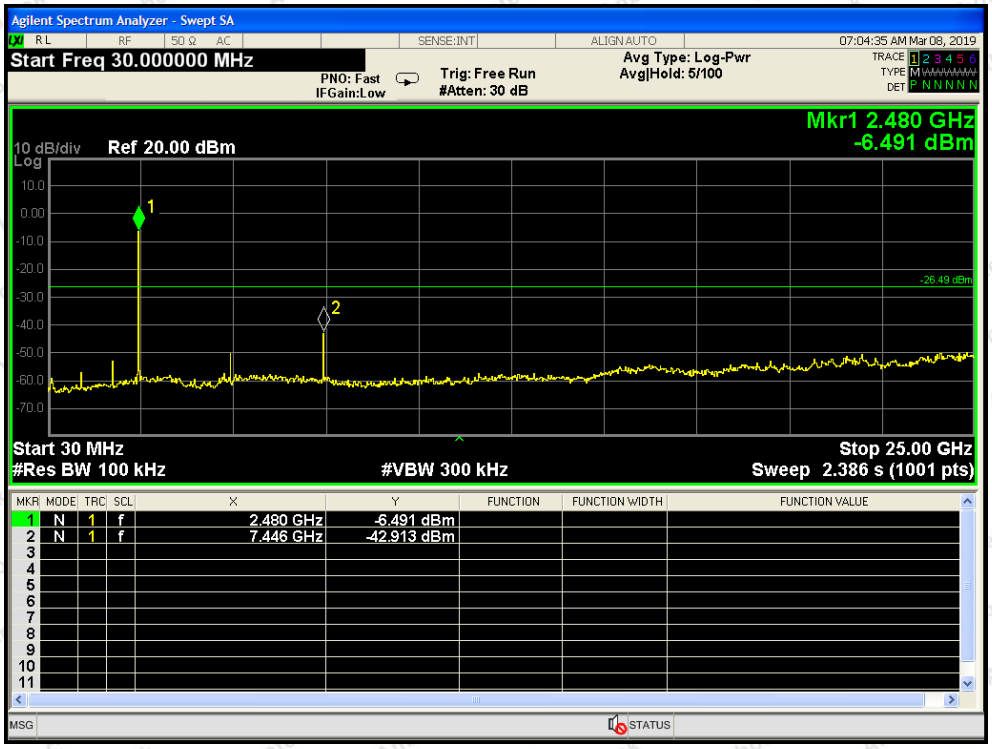
Conducted Emission Method



CH: Low



CH: Middle


Agilent Spectrum Analyzer - Swept SA
Start Freq 30.000000 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 5/100
07:04:35 AM Mar 08, 2019
Mkr1 2.480 GHz
-6.491 dBm
10 dB/div Ref 20.00 dBm
Log
-26.49 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.386 s (1001 pts)
1 N 1 f 2.480 GHz -6.491 dBm
2 N 1 f 7.446 GHz -42.913 dBm

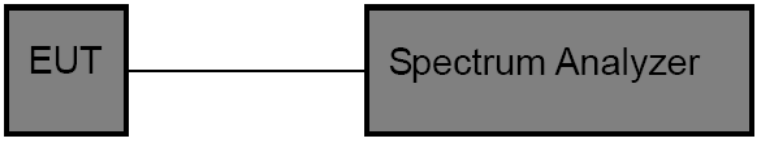
CH: High

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.

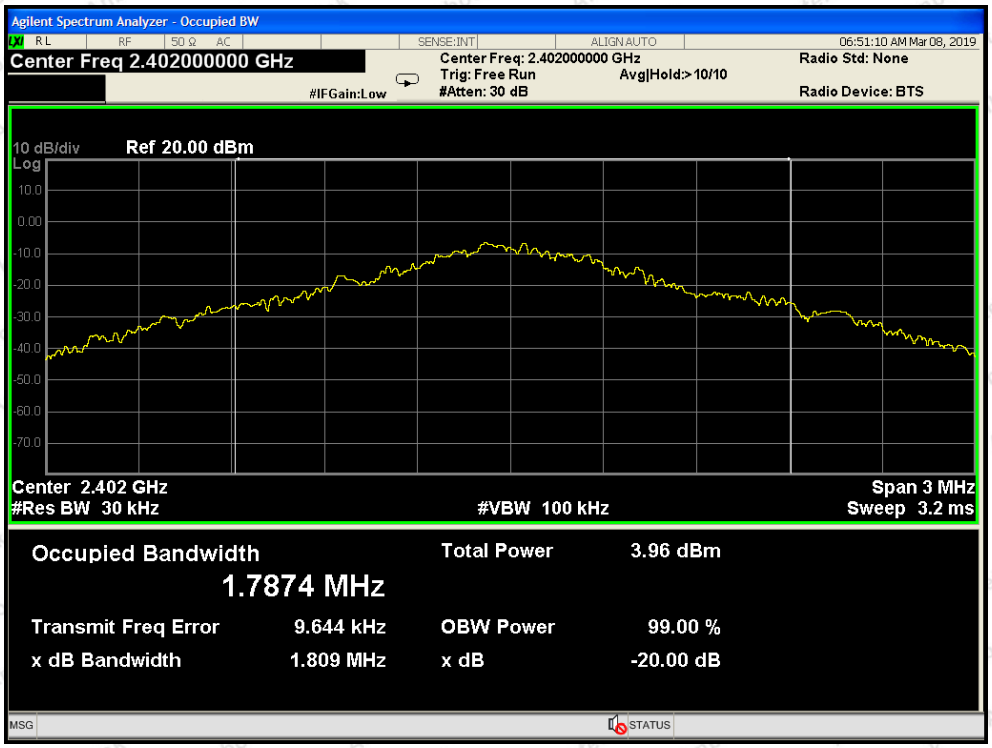
Sweep- auto couple.

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

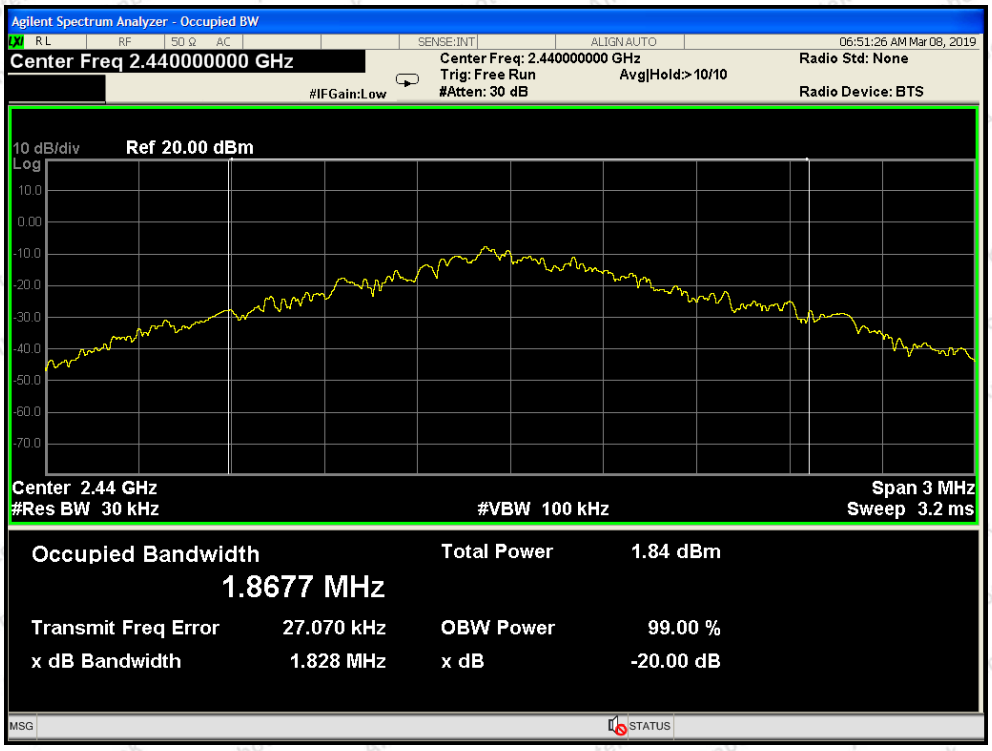
5.4. Test Data

Test Item	:	20dB Bandwidth	Test Mode	:	Mode 1
Test Voltage	:	DC 1.5V battery inside	Temperature	:	22.7℃
Test Result	:	PASS	Humidity	:	53%RH

Frequency (MHz)	Bandwidth (kHz)	Result
2402MHZ	1809	PASS
2440MHZ	1828	PASS
2480MHZ	1890	PASS



Test Mode: Low



Test Mode: Middle

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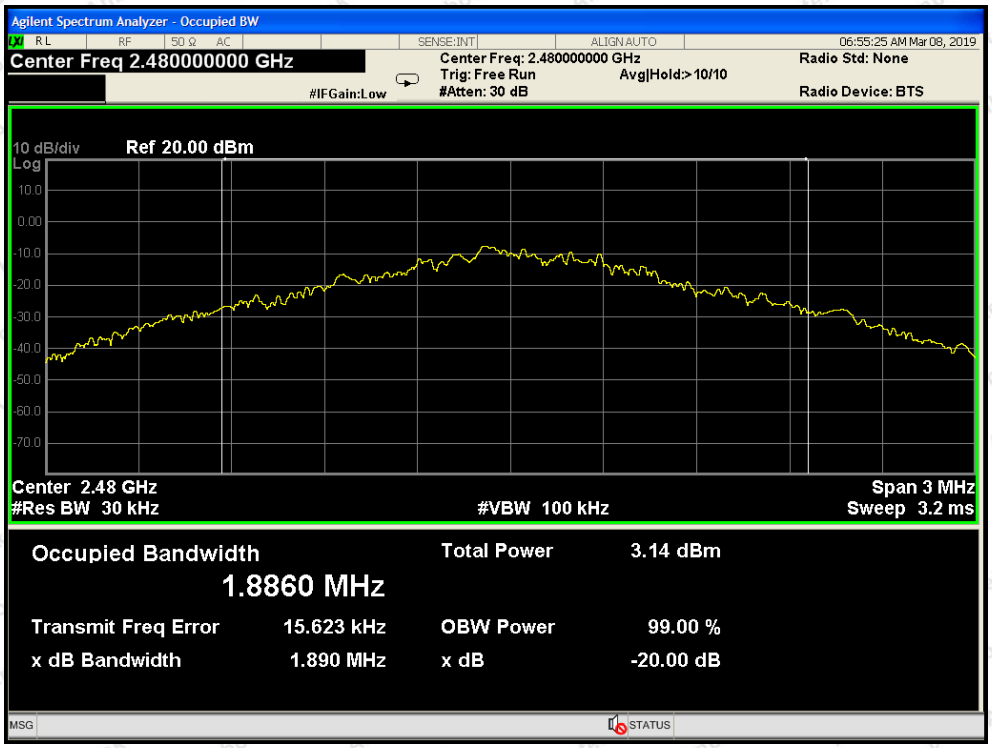


Test Mode: High

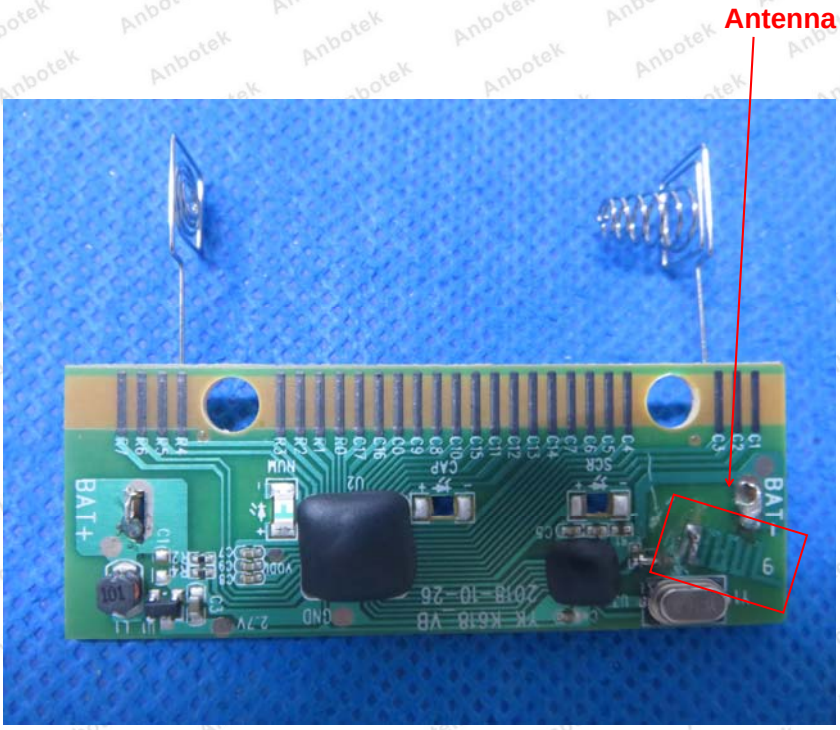
6. Antenna Requirement

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.

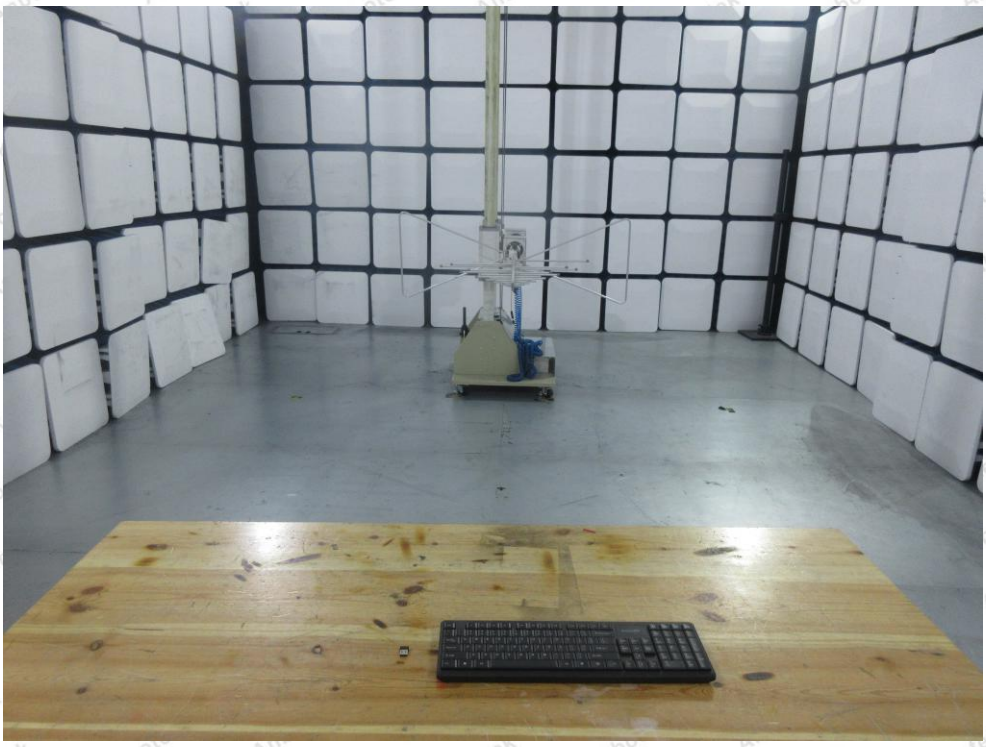
6.2. Antenna Connected Construction

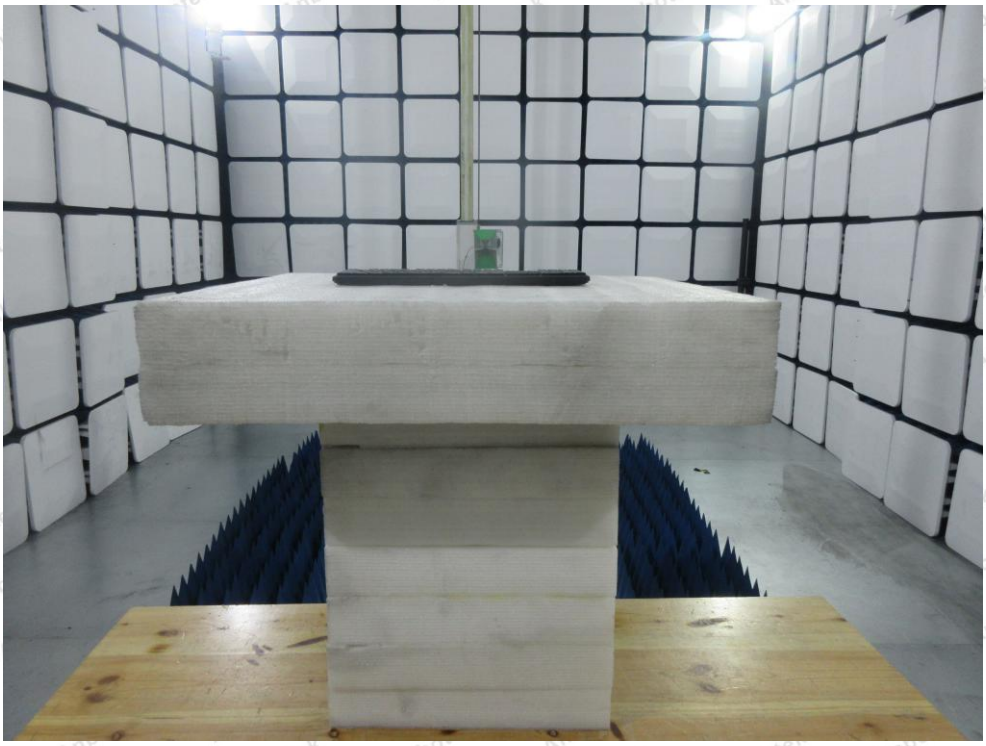
The antenna is a PCB Antenna which permanently attached, and the best case gain of the antenna is 0 dBi. It complies with the standard requirement.



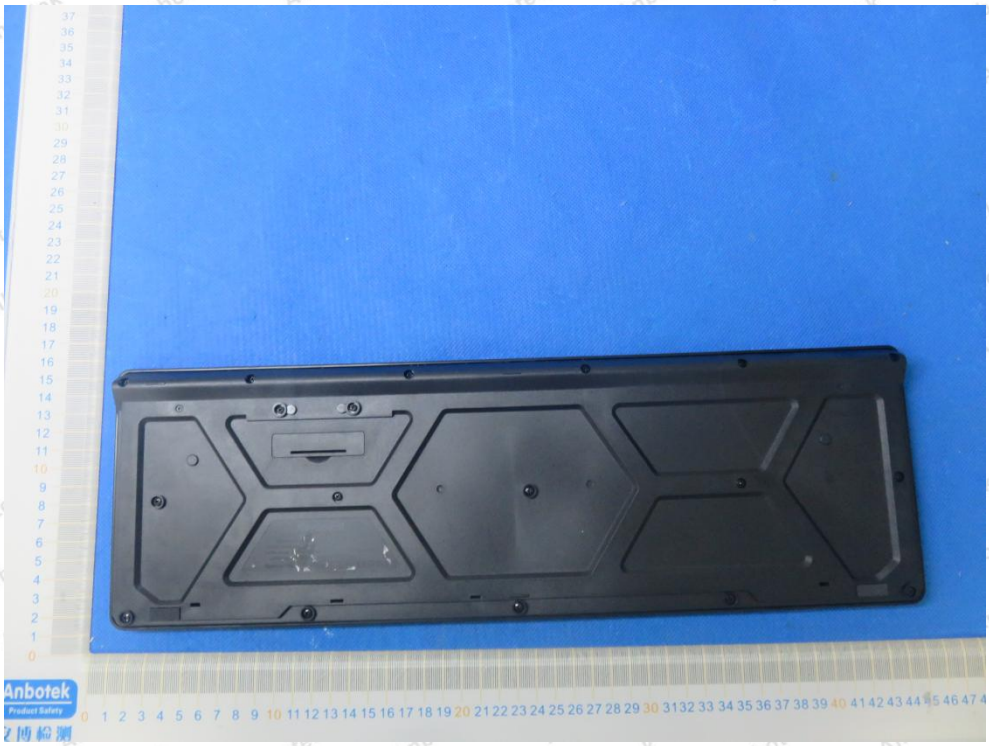
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Radiation Emission Test





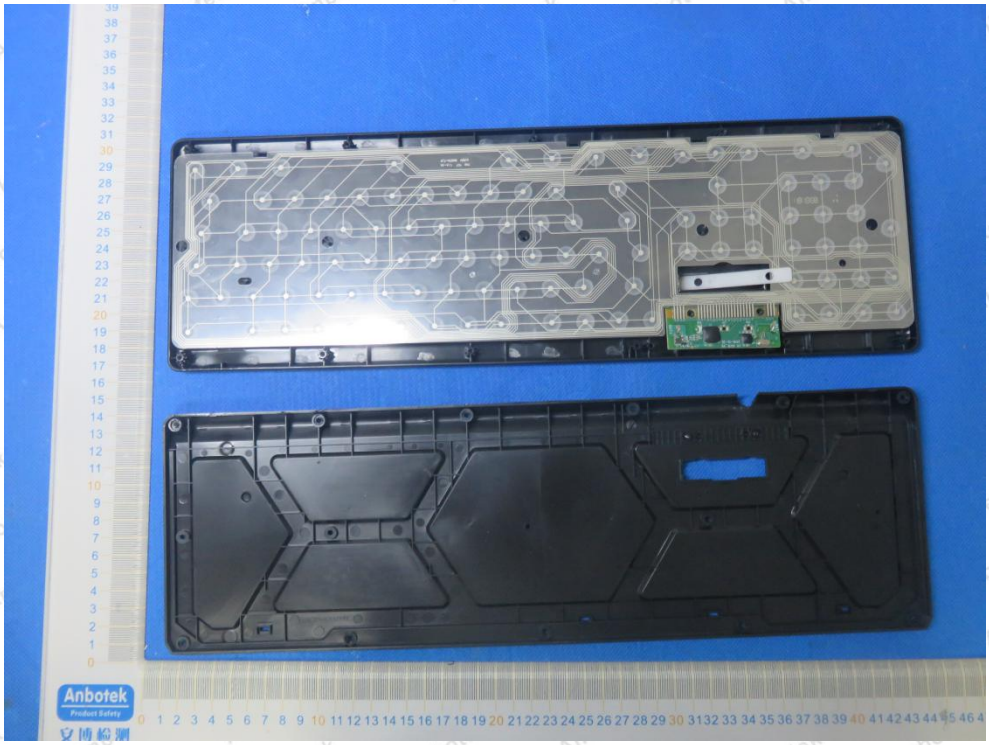
APPENDIX II -- EXTERNAL PHOTOGRAPH

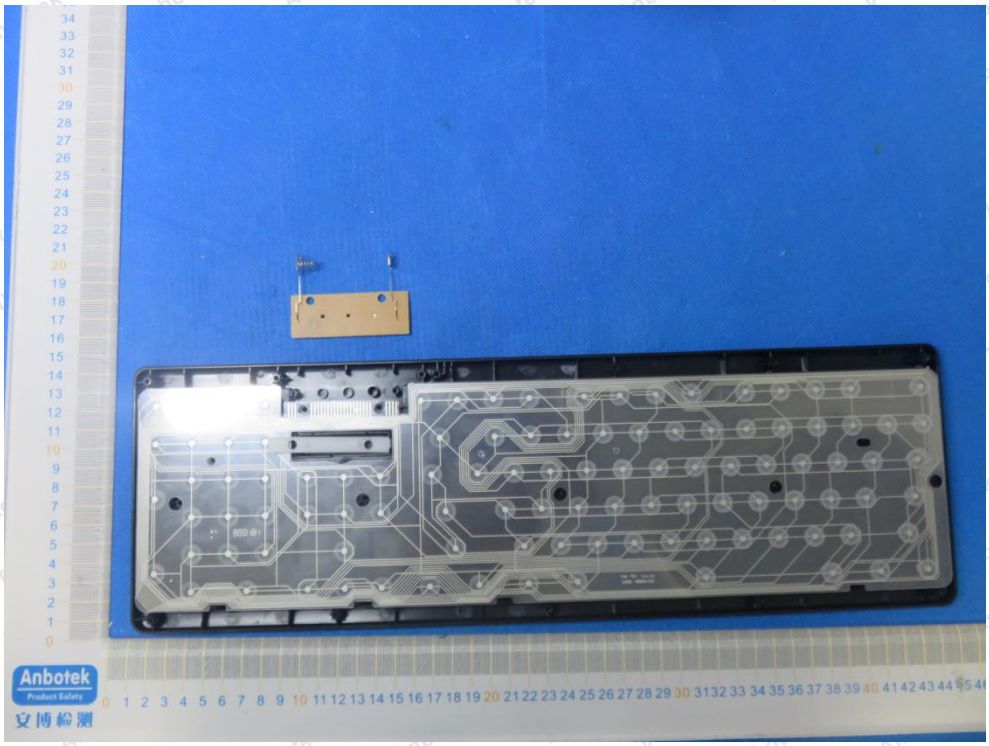


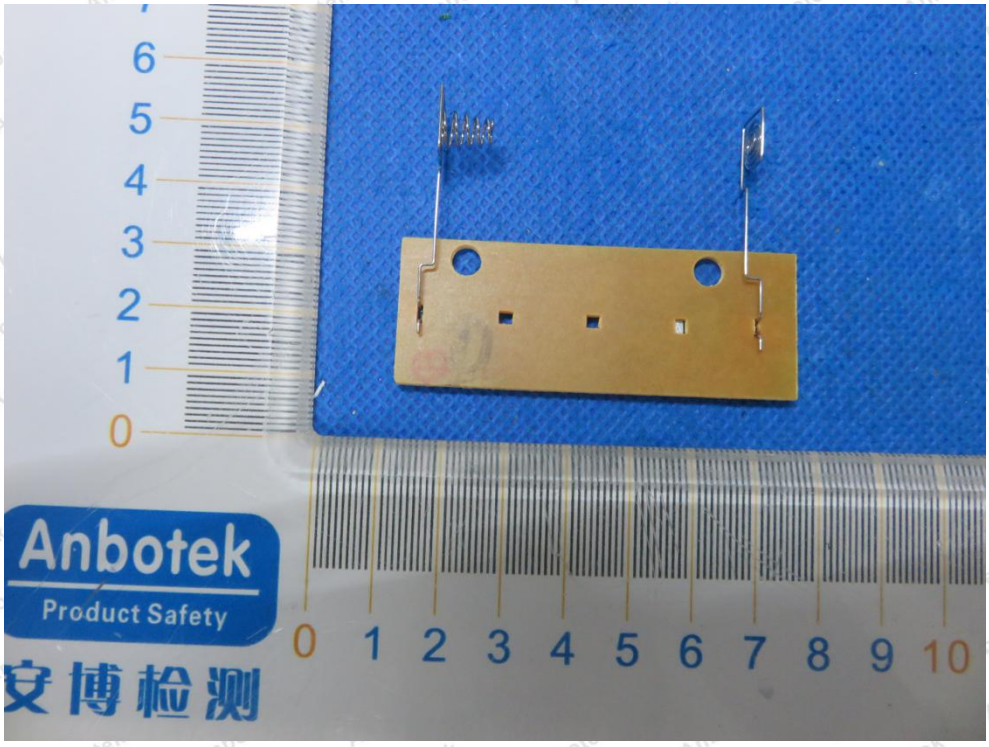
PHILIPS

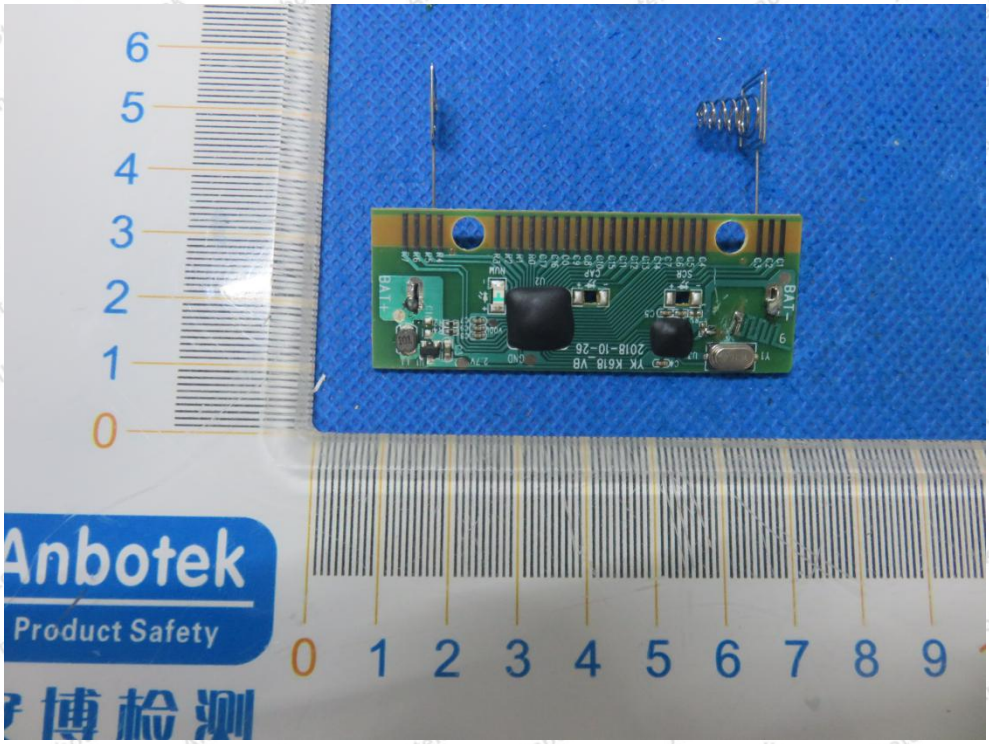
PHILIPS

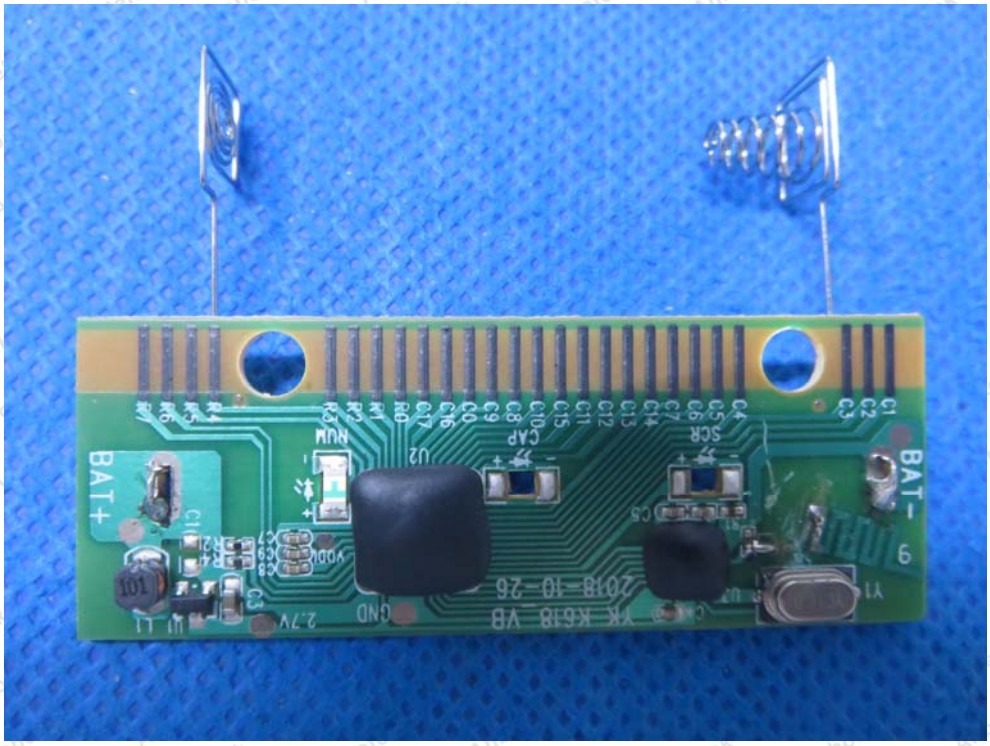
APPENDIX III -- INTERNAL PHOTOGRAPH

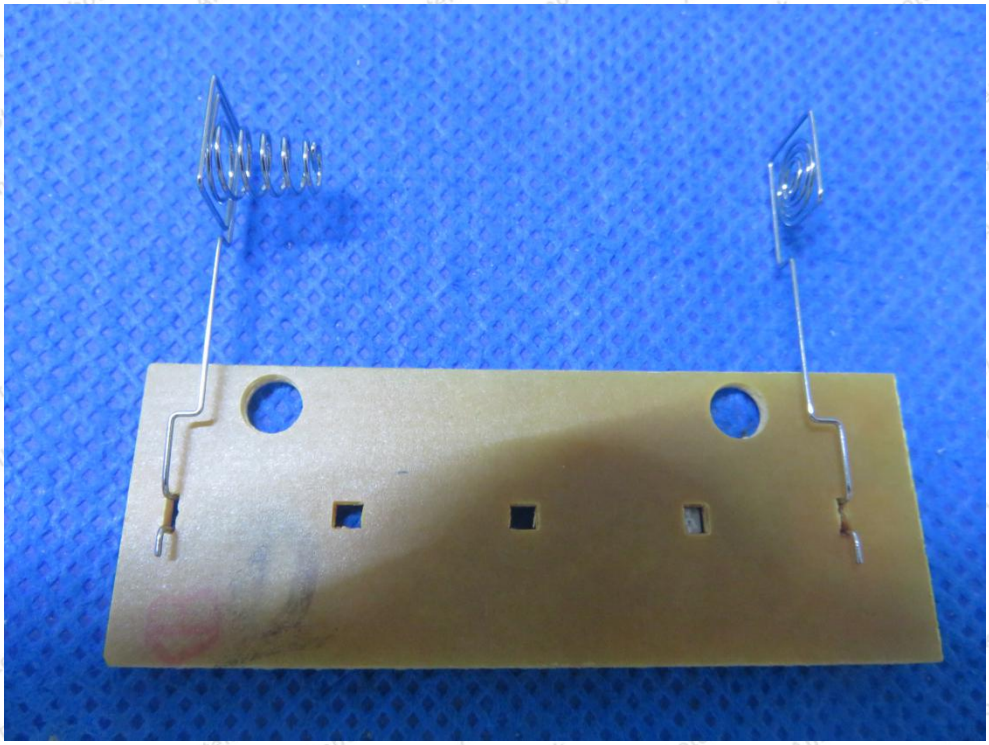












---------- End of Report ----------

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