

FCC TEST REPORT
for
Hobbico Inc

Tactic TTX850 8-Channel 2.4GHz Computer Transmitter
Model No.: TACJ2850

Prepared for : Hobbico Inc
Address : 2904 Research Road, Champaign, IL 61821 USA

Prepared By : Shenzhen Anbotek Compliance Laboratory Limited
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Report Number : R011509071I
Date of Test : Sept. 02~ Dec. 31, 2015
Date of Report : Jan. 05, 2016

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TEST REPORT

Applicant : Hobbico Inc
Manufacturer : Shanghai Nine Eagles Electronic Technology Co., Ltd.
EUT : Tactic TTX850 8-Channel 2.4GHz Computer Transmitter
Model No. : TACJ2850
Serial No. : N.A.
Trade Mark : N.A.
Rating : DC 4.2-6.0V, 15mA Max.

Measurement Procedure Used:

FCC Part15 Subpart C 2015, Paragraph 15.207, 15.247 & 15.209

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 : Sept. 02~ Dec. 31, 2015

Prepared by :

(Tested Engineer / Kebo Zhang)

Reviewer :

(Project Manager / Amy Ding)

Approved & Authorized Signer :

(Manager / Tom Chen)

1. GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT : Tactic TTX850 8-Channel 2.4GHz Computer Transmitter

Model Number : TACJ2850

Test Power Supply : AC 120V, 60Hz for Adatper (with DC 4.8V battery inside)/
AC 240V, 60Hz for adapter (with DC 4.8V battery inside)

Frequency : 2403-2479MHz

Channel Space 1MHz

No. of Channels : 77

Antenna Specification : Integrated Antenna: 0 dBi

Applicant : Hobbico Inc
Address : 2904 Research Road, Champaign, IL 61821 USA

Manufacturer : Shanghai Nine Eagles Electronic Technology Co., Ltd.
Address : No. 818, Feng Rao Road, Ma Lu Town, Jiading District, Shanghai,
201801 PR. China

Factory : Shanghai Nine Eagles Electronic Technology Co., Ltd.
Address : No. 818, Feng Rao Road, Ma Lu Town, Jiading District, Shanghai,
201801 PR. China

Date of receipt : Sept. 02, 2015

Date of Test : Sept. 02~ Dec. 31, 2015

1.2 Auxiliary Equipment Used during Test

N/A

1.3 Description of Test Facility

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

FCC-Registration No.: 752021

Shenzhen Anbotek Compliance Laboratory Limited, 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 752021, July 10, 2013.

IC-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

Test Location

All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC
Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong,
China

1.4 Measurement Uncertainty

Radiation Uncertainty	:	Ur = 4.1 dB (Horizontal) Ur = 4.3 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4dB

2. Test Procedure

GENERAL: This report shall NOT be reproduced except in full without the written approval of Shenzhen Anbotek Compliance Laboratory Limited. The EUT was transmitting a test signal during the testing.

RADIATION INTERFERENCE: The test procedure used was ANSI STANDARD C63.10-2013 using a spectrum analyzer with a pre-selector. The analyzer was calibrated in dB above a microvolt at the output of the antenna. The resolution bandwidth was 100KHz and the video bandwidth was 300KHz up to 1.0GHz and 1.0MHz with a video BW of 3.0MHz above 1.0GHz. The ambient temperature of the EUT was 74.3oF with a humidity of 69%.

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 dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Preselector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

Freq (MHz) METER READING + ACF = FS
20 dBuV + 10.36 dB = 30.36 dBuV/m @ 3m

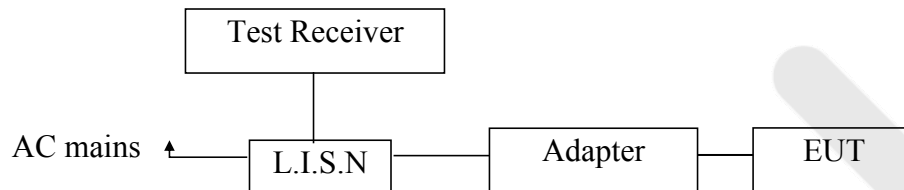
ANSI STANDARD C63.10-2013 10.1.7 MEASUREMENT PROCEDURES: The EUT was placed on a table 80 cm high and with dimensions of 1m by 1.5m. The EUT was placed in the center of the table (1.5m side). The table used for radiated measurements is capable of continuous rotation.

When an emission was found, the table was rotated to produce the maximum signal strength. At this point, the antenna was raised and lowered from 1m to 4m. The antenna was placed in both the horizontal and vertical planes.

3. Conducted Emission

3.1 Block Diagram of Test Setup

3.1.1. Block diagram of connection between the EUT and simulators



3.2 Power Line Conducted Emission Measurement Limits (15.207)

Frequency MHz	Limits dB(μV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66 ~ 56*	56 ~ 46*
0.50 ~ 5.00	56	46
5.00 ~ 30.00	60	50

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

3.3 Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4 Operating Condition of EUT

- 3.4.1. Setup the EUT and simulator as shown as Section 3.1.
- 3.4.2. Turn on the power of all equipment.
- 3.4.3. Let the EUT work in test mode (Charging and On) and measure it.

3.5 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.

The test results are reported on Section 3.6.

Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Two-Line V-network	Rohde & Schwarz	ENV216	100055	Apr. 17, 2015	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Apr. 17, 2015	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Apr. 17, 2015	1 Year

3.6 Power Line Conducted Emission Measurement Results

PASS.

The frequency range from 150KHz to 30 MHz is investigated.

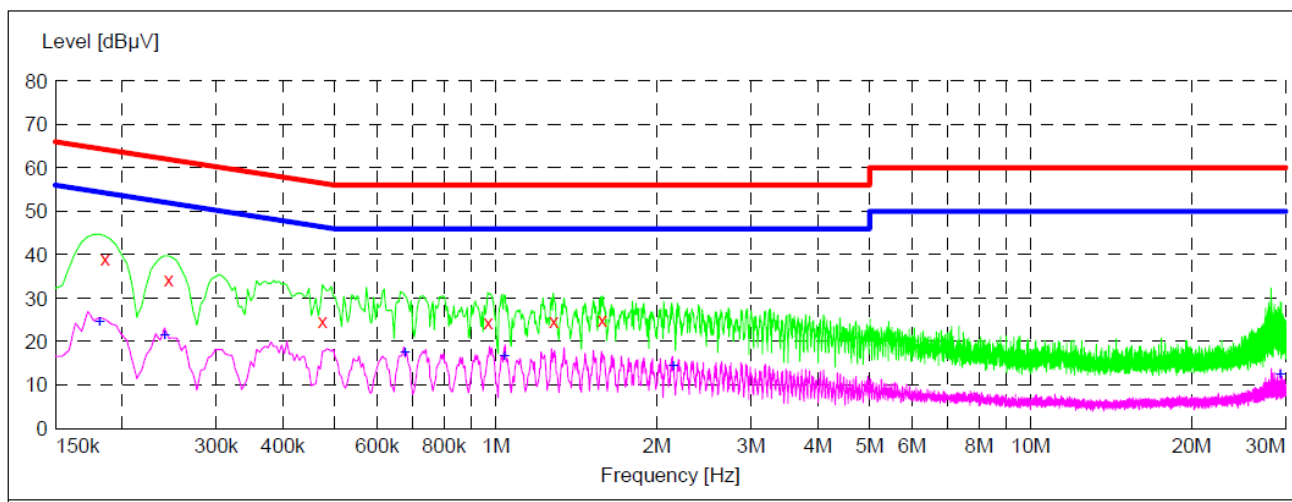
Please refer the following pages.

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charging and On
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Tem.:25°C Hum.:50%

SCAN TABLE: "Voltage (150K~30M) FIN"

Short Description: 150K-30M Disturbance Voltages



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.186000	39.20	20.1	64	25.0	QP	L1	GND
0.244500	34.30	20.1	62	27.6	QP	L1	GND
0.474000	24.80	20.1	56	31.6	QP	L1	GND
0.969000	24.60	20.2	56	31.4	QP	L1	GND
1.283500	24.70	20.2	56	31.3	QP	L1	GND
1.580500	25.10	20.3	56	30.9	QP	L1	GND

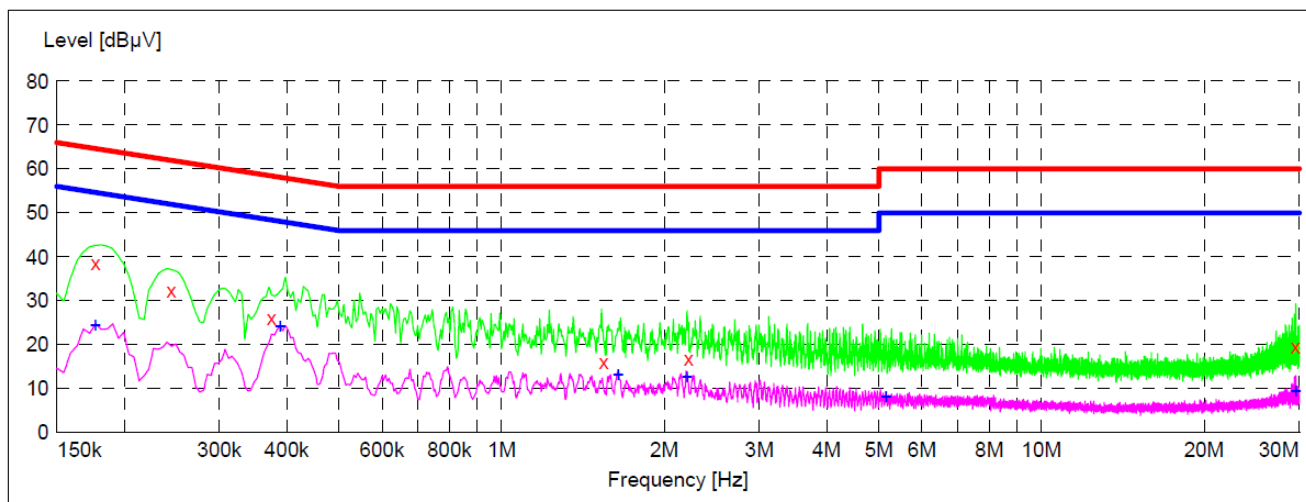
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.181500	24.50	20.1	54	29.9	AV	L1	GND
0.240000	21.40	20.1	52	30.7	AV	L1	GND
0.676500	17.50	20.1	46	28.5	AV	L1	GND
1.036000	16.80	20.2	46	29.2	AV	L1	GND
2.147500	14.30	20.3	46	31.7	AV	L1	GND
29.305000	12.40	20.9	50	37.6	AV	L1	GND

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charging and On
Test Specification: AC 120V, 60Hz for adapter
Comment: Neutral Line
Tem.:25°C Hum.:50%

SCAN TABLE: "Voltage (150K~30M) FIN"

Short Description: 150K-30M Disturbance Voltages



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.177000	38.50	20.1	65	26.1	QP	N	GND
0.244500	32.40	20.1	62	29.5	QP	N	GND
0.375000	26.00	20.1	58	32.4	QP	N	GND
1.544500	16.00	20.3	56	40.0	QP	N	GND
2.219500	16.90	20.3	56	39.1	QP	N	GND
29.561500	19.60	20.9	60	40.4	QP	N	GND

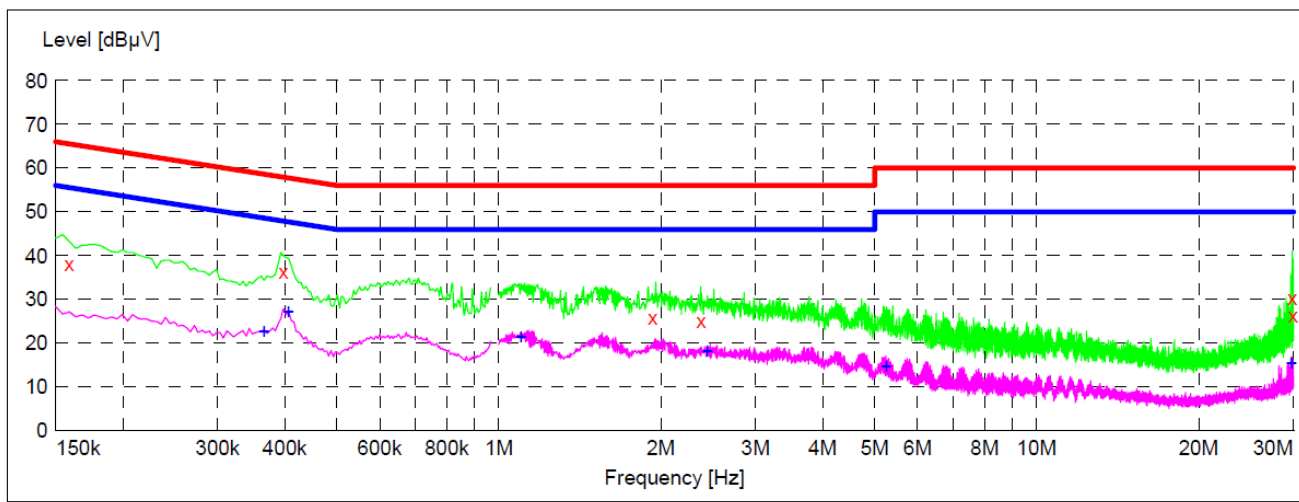
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.177000	24.50	20.1	55	30.1	AV	N	GND
0.388500	24.40	20.1	48	23.7	AV	N	GND
1.643500	13.20	20.3	46	32.8	AV	N	GND
2.206000	12.80	20.3	46	33.2	AV	N	GND
5.153500	8.40	20.5	50	41.6	AV	N	GND
29.561500	9.70	20.9	50	40.3	AV	N	GND

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charging and On
Test Specification: AC 240V, 60Hz for adapter
Comment: Live Line
Tem.:25°C Hum.:50%

SCAN TABLE: "Voltage (150K~30M) FIN"

Short Description: 150K-30M Disturbance Voltages



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.159000	38.10	20.1	66	27.4	QP	L1	GND
0.397500	36.40	20.1	58	21.5	QP	L1	GND
1.931500	25.80	20.3	56	30.2	QP	L1	GND
2.377000	25.10	20.3	56	30.9	QP	L1	GND
29.876500	30.30	20.9	60	29.7	QP	L1	GND
29.939500	26.40	20.9	60	33.6	QP	L1	GND

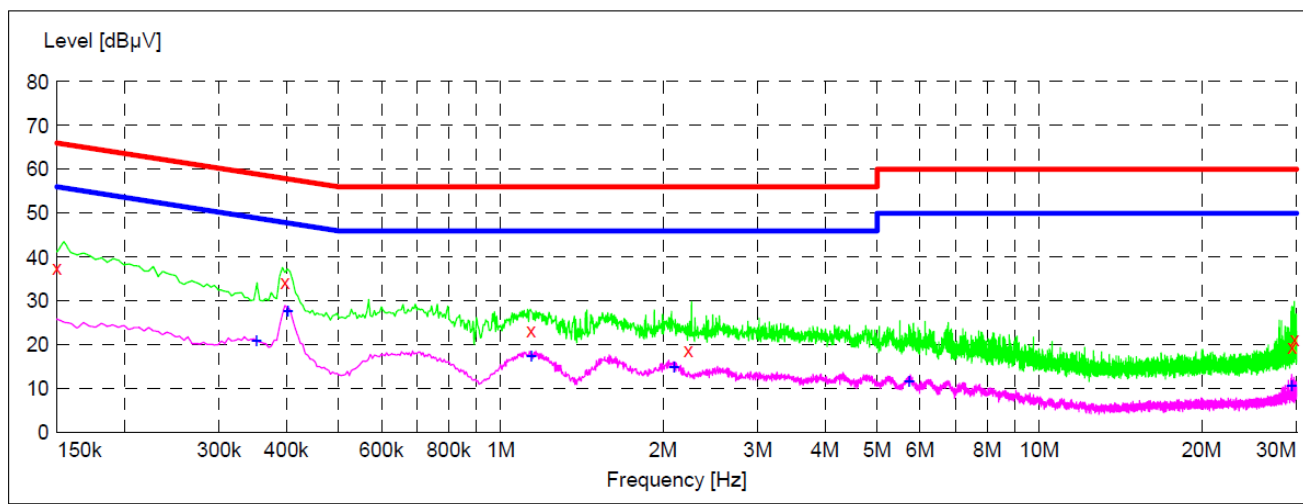
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.366000	22.80	20.1	49	25.8	AV	L1	GND
0.406500	27.30	20.1	48	20.4	AV	L1	GND
1.099000	21.70	20.2	46	24.3	AV	L1	GND
2.440000	18.30	20.3	46	27.7	AV	L1	GND
5.252500	14.90	20.5	50	35.1	AV	L1	GND
29.750500	15.60	20.9	50	34.4	AV	L1	GND

CONDUCTED EMISSION TEST DATA

Test Site: 1# Shielded Room
Operating Condition: Charging and On
Test Specification: AC 240V, 60Hz for adapter
Comment: Neutral Line
Tem.:25°C Hum.:50%

SCAN TABLE: "Voltage (150K~30M) FIN"

Short Description: 150K-30M Disturbance Voltages



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	37.70	20.1	66	28.3	QP	N	GND
0.397500	34.40	20.1	58	23.5	QP	N	GND
1.139500	23.30	20.2	56	32.7	QP	N	GND
2.228500	18.80	20.3	56	37.2	QP	N	GND
29.435500	19.50	20.9	60	40.5	QP	N	GND
29.755000	21.40	20.9	60	38.6	QP	N	GND

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.352500	21.10	20.1	49	27.8	AV	N	GND
0.402000	27.90	20.1	48	19.9	AV	N	GND
1.139500	17.70	20.2	46	28.3	AV	N	GND
2.098000	15.10	20.3	46	30.9	AV	N	GND
5.725000	11.80	20.5	50	38.2	AV	N	GND
29.368000	10.90	20.9	50	39.1	AV	N	GND

4. Radiation Interference

4.1 Requirements (15.247, 15.209):

4.1.1. Test Limits (< 30 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

4.1.2. Test Limits (≥ 30 MHz)

FIELD STRENGTH of Fundamental: @3M	FIELD STRENGTH of Harmonics	S15.209 30 - 88 MHz	40 dBuV/m
902-928 MHz		88 - 216 MHz	43.5
2.4-2.4835 GHz		216 - 960 MHz	46
94 dBuV/m @3m	54 dBuV/m @3m	ABOVE 960 MHz	54dBuV/m

For range 9KHz~30MHz, The measured value is really too low to be recorded.

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.

4.2 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 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 =3MHz,
Detector= Peak

Trace mode= Max hold.
Sweep- auto couple.

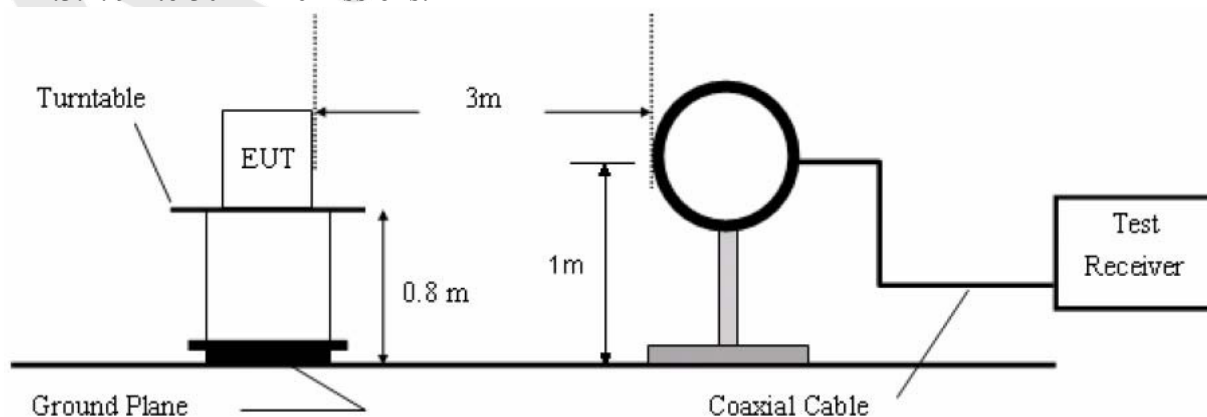
Set the spectrum analyzer as:
RBW =1MHz, VBW =10Hz
Detector= Average
Trace mode= Max hold.
Sweep- auto couple.

Test Equipment

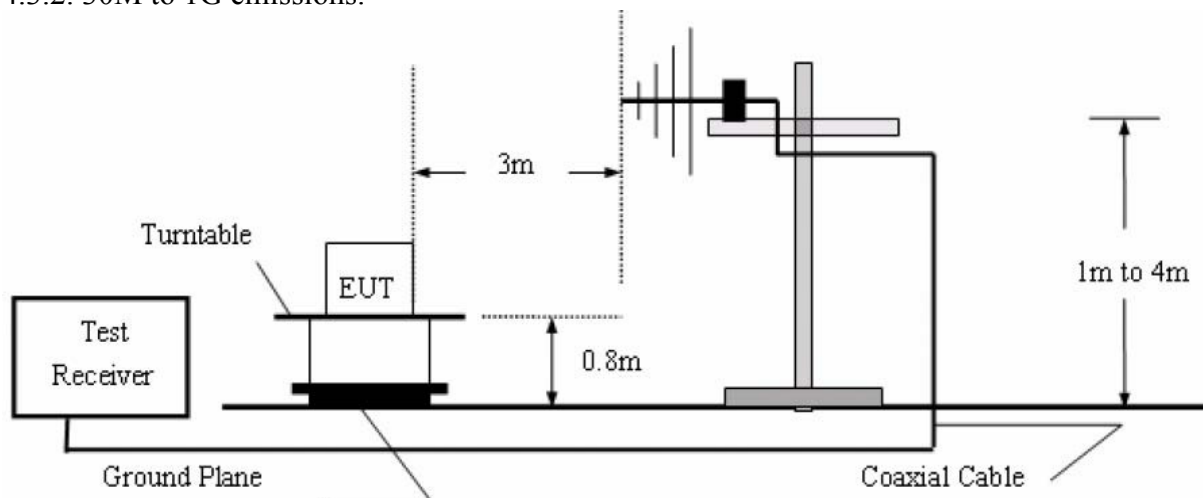
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 17, 2015	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 17, 2015	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 17, 2015	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 20, 2015	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 20, 2015	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 17, 2015	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006 W	15I00041SN046	Jun 30, 2015	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2015	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2015	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2015	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2015	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar 16, 2015	1 Year

4.3 Test Configuration

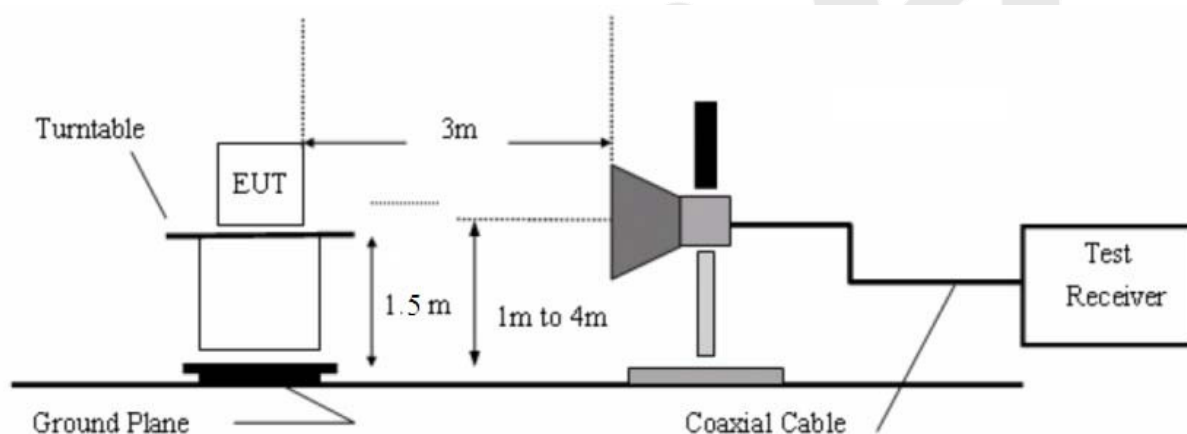
4.3.1. 9k to 30MHz emissions:



4.3.2. 30M to 1G emissions:



4.3.3. 1G to 40G emissions:



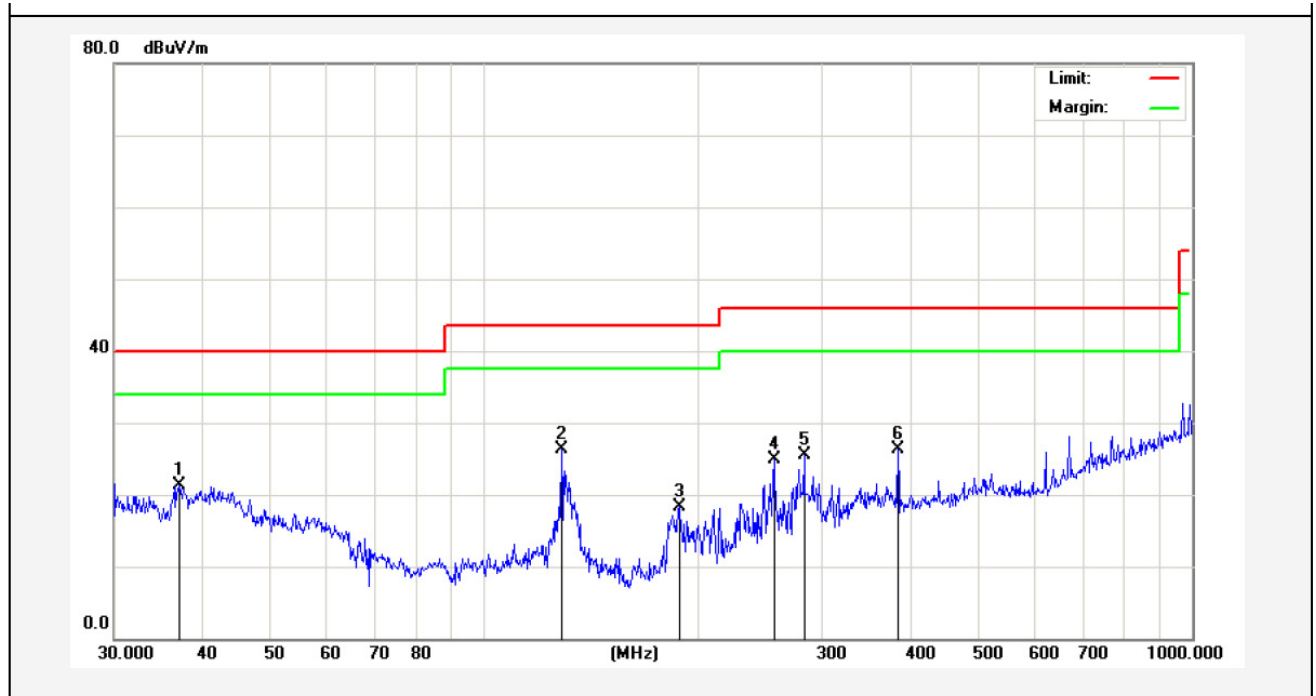
4.4 Test Results

PASS.

Please refer the following pages. Only the worst case (x orientation).

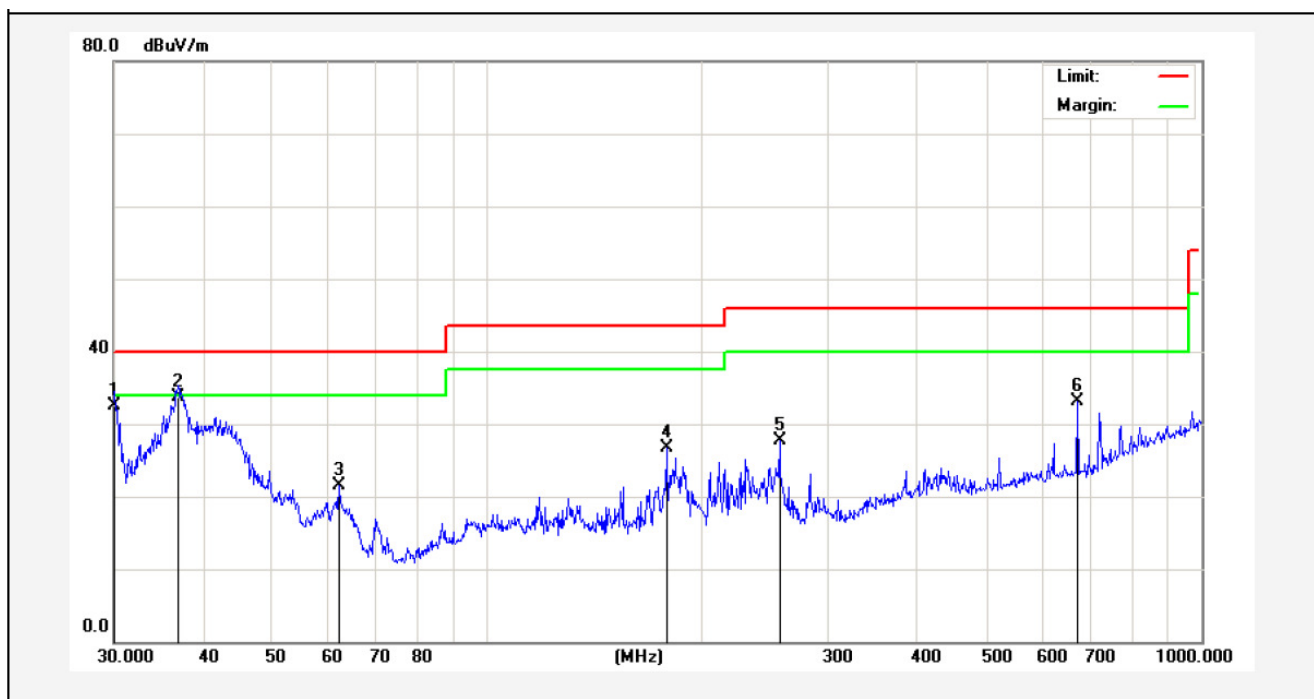
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	0115090711	Plarization:	Horizontal
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Test Mode:	Charging and On	Distance:	3m



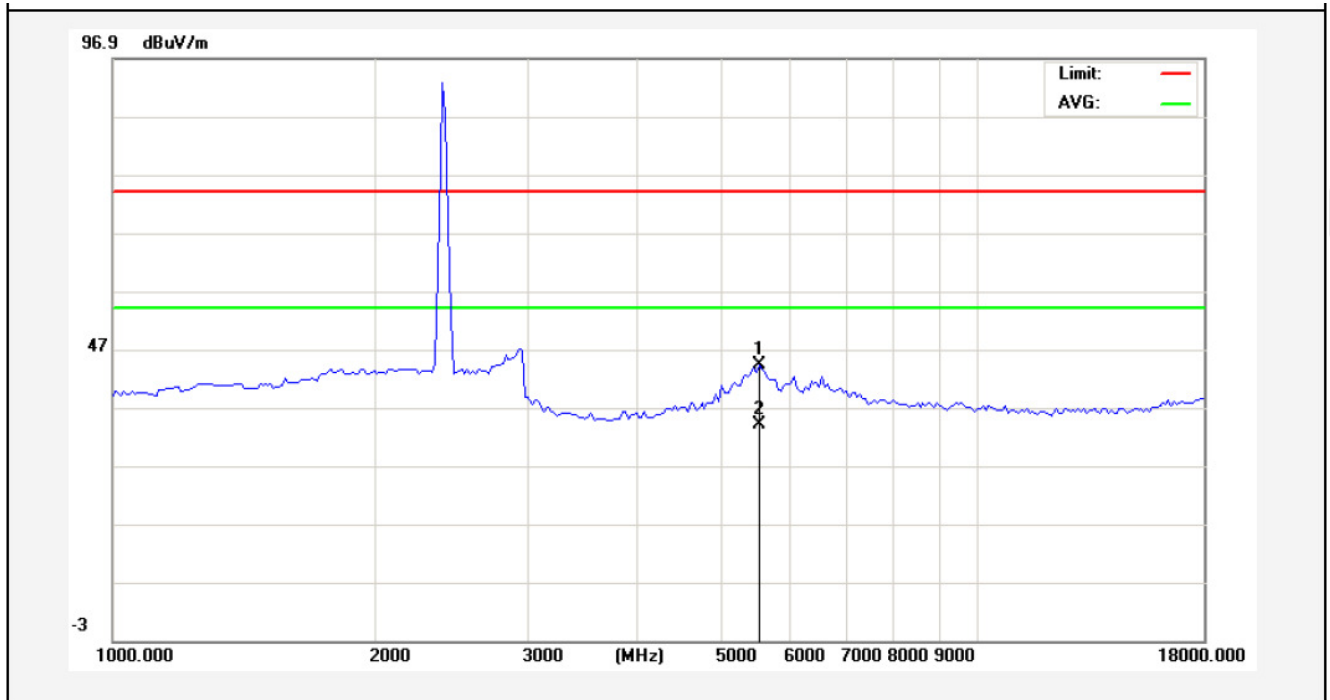
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	37.1550	33.83	-12.60	21.23	40.00	-18.77	peak			
2	128.5630	48.95	-22.60	26.35	43.50	-17.15	peak			
3	188.4125	39.34	-21.07	18.27	43.50	-25.23	peak			
4	256.5211	43.82	-18.84	24.98	46.00	-21.02	peak			
5	282.9852	43.59	-18.15	25.44	46.00	-20.56	peak			
6	383.9318	39.54	-13.19	26.35	46.00	-19.65	peak			

Job No.:	0115090711	Plarization:	Vertical
Standard:	(RE)FCC PART 15C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test (30~1000MHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Test Mode:	Charging and On	Distance:	3m



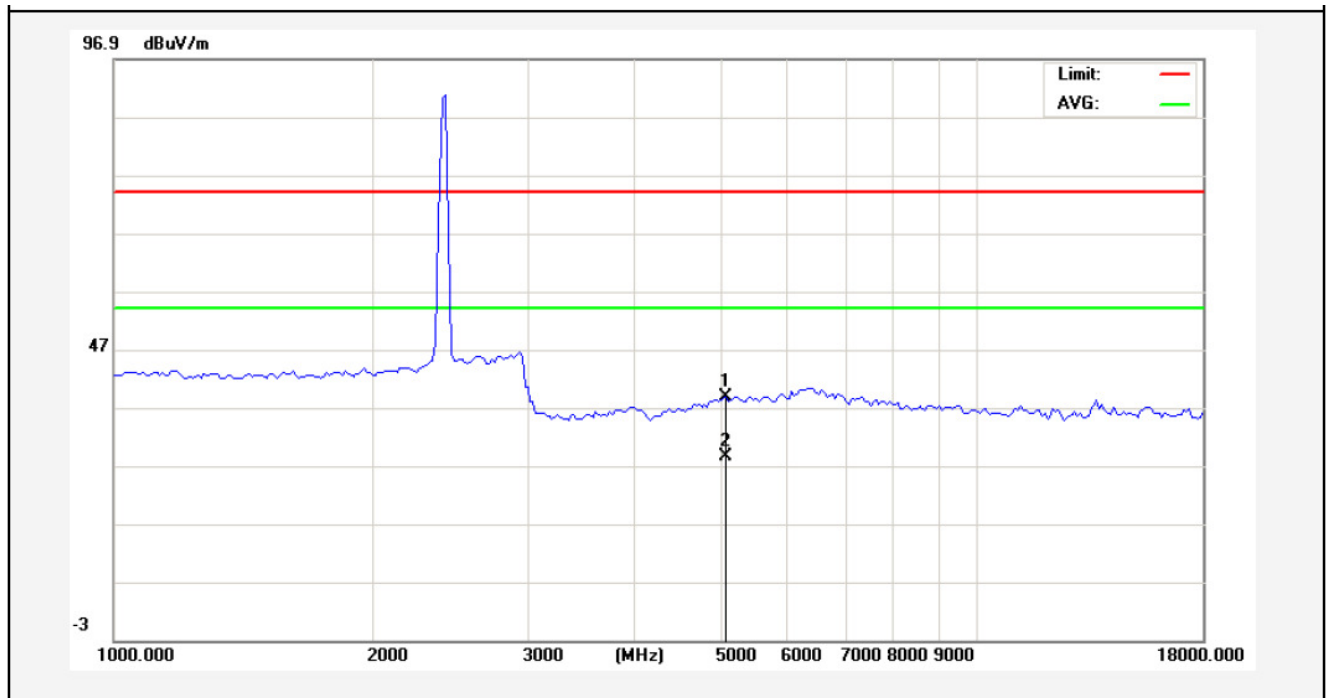
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	30.0000	49.44	-16.95	32.49	40.00	-7.51	QP	100	360	
2	36.8953	46.55	-12.79	33.76	40.00	-6.24	QP	100	0	
3	61.9951	37.64	-16.22	21.42	40.00	-18.58	peak			
4	178.1327	43.66	-16.98	26.68	43.50	-16.82	peak			
5	256.5211	41.77	-14.01	27.76	46.00	-18.24	peak			
6	670.4893	41.77	-8.70	33.07	46.00	-12.93	peak			

Job No.:	011509071I	Plarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2403 MHz)	Distance:	3m



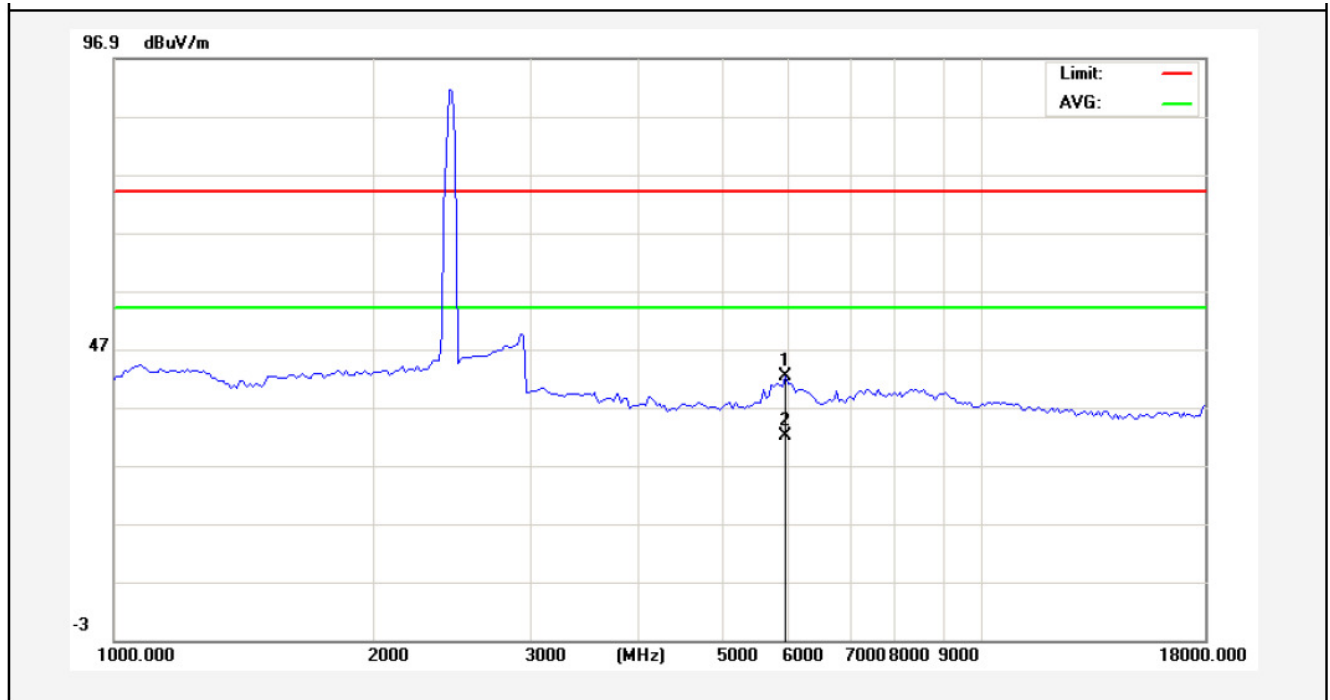
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	5547.500	40.08	4.26	44.34	74.00	-29.66	peak			
2	5547.500	29.88	4.26	34.14	54.00	-19.86	AVG			

Job No.:	011509071I	Plarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2403 MHz)	Distance:	3m



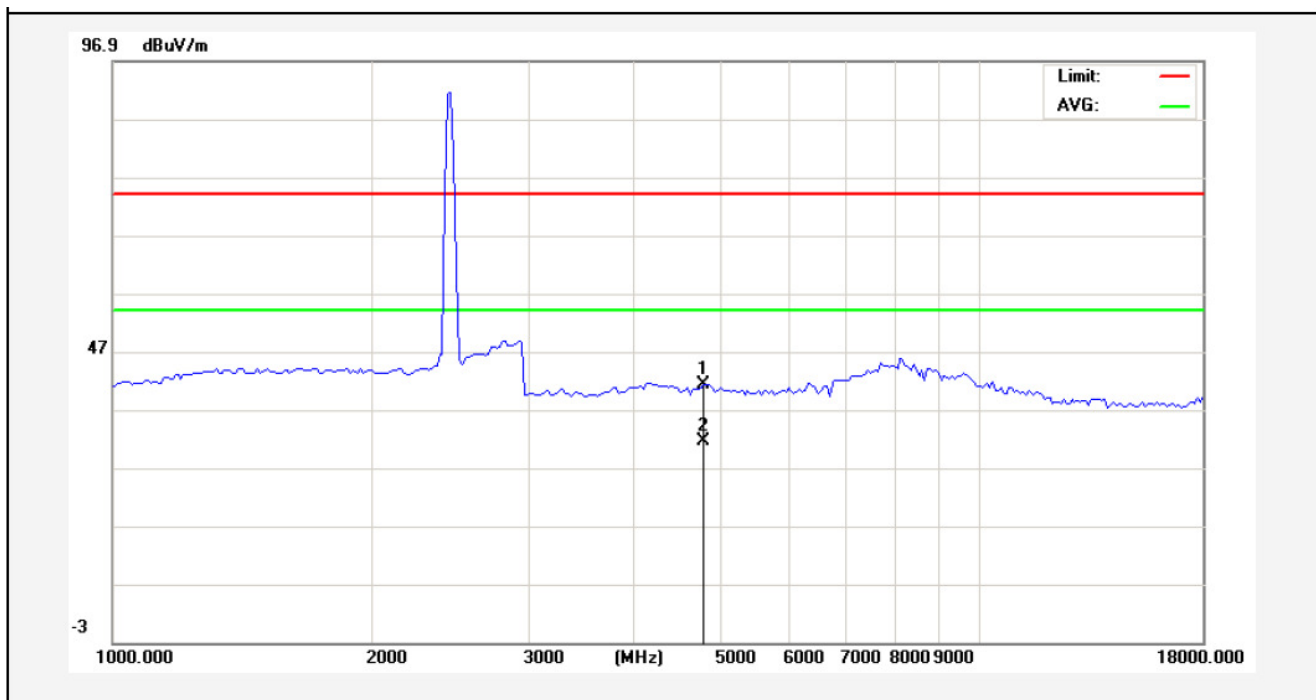
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	5082.657	35.17	3.70	38.87	74.00	-35.13	peak			
2	5082.657	24.93	3.70	28.63	54.00	-25.37	AVG			

Job No.:	011509071I	Plarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2447 MHz)	Distance:	3m



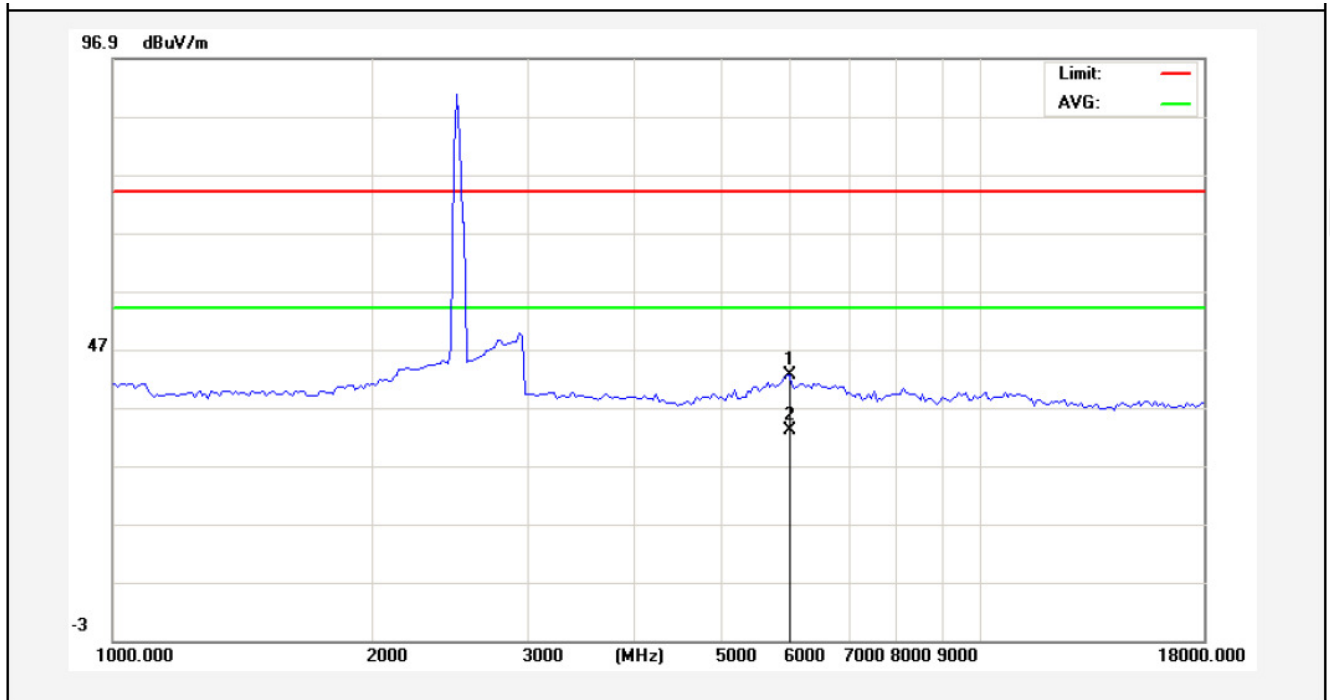
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	5930.000	35.61	6.69	42.30	74.00	-31.70	peak			
2	5930.000	25.38	6.69	32.07	54.00	-21.93	AVG			

Job No.:	011509071I	Plarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2447 MHz)	Distance:	3m



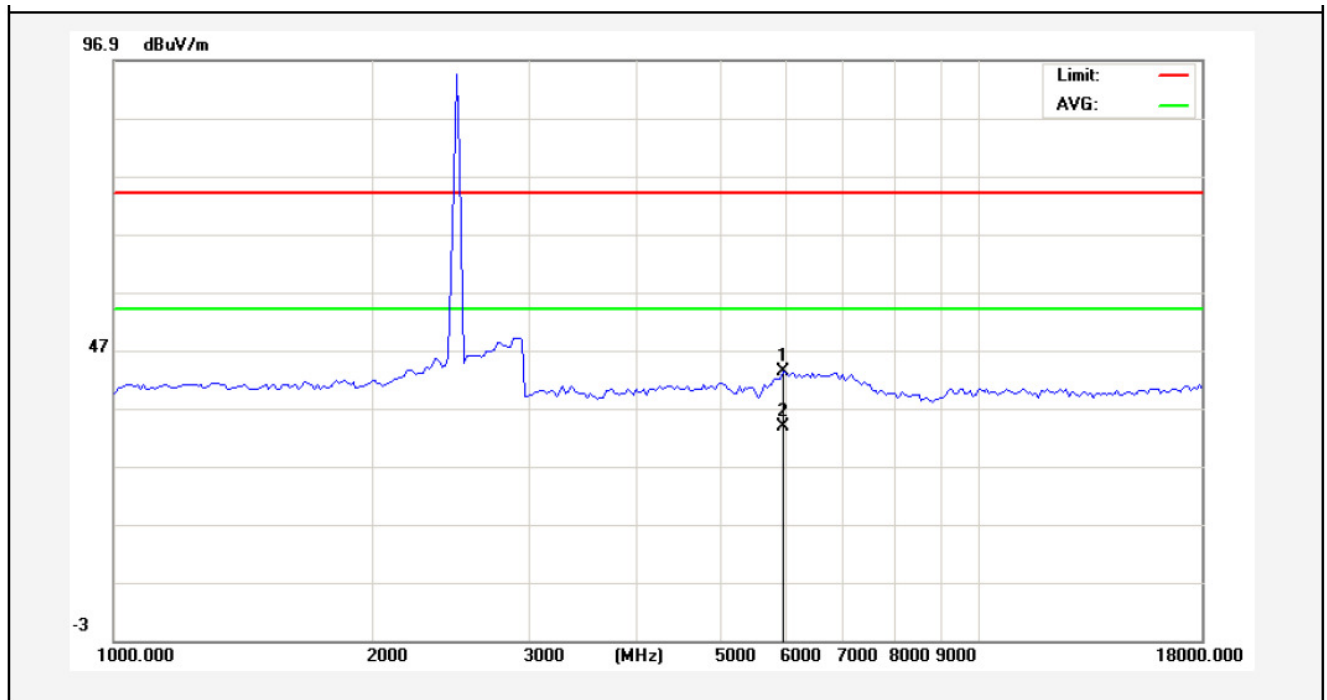
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	38.01	3.34	41.35	74.00	-32.65	peak			
2	4825.000	28.18	3.34	31.52	54.00	-22.48	AVG			

Job No.:	011509071I	Plarization:	Horizontal
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2479 MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	6015.000	35.50	7.14	42.64	74.00	-31.36	peak			
2	6015.000	25.77	7.14	32.91	54.00	-21.09	AVG			

Job No.:	011509071I	Plarization:	Vertical
Standard:	(RE)FCC PART 15C_Class B_3m	Power Source:	DC 4.8V
Test item:	Radiation Test (Above 1GHz)	Temp.(C)/Hum.(%RH):	24.3(C)/55%RH
Test Mode:	TX(2479 MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	5930.000	36.59	6.69	43.28	74.00	-30.72	peak			
2	5930.000	27.02	6.69	33.71	54.00	-20.29	AVG			

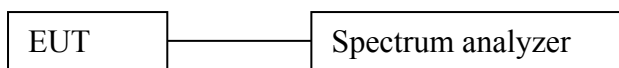
5. CHANNEL SEPARATION TEST

5.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer settings:

1. Span= Wide enough to capture the peaks of two adjacent channels
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

5.2 Test SET-UP



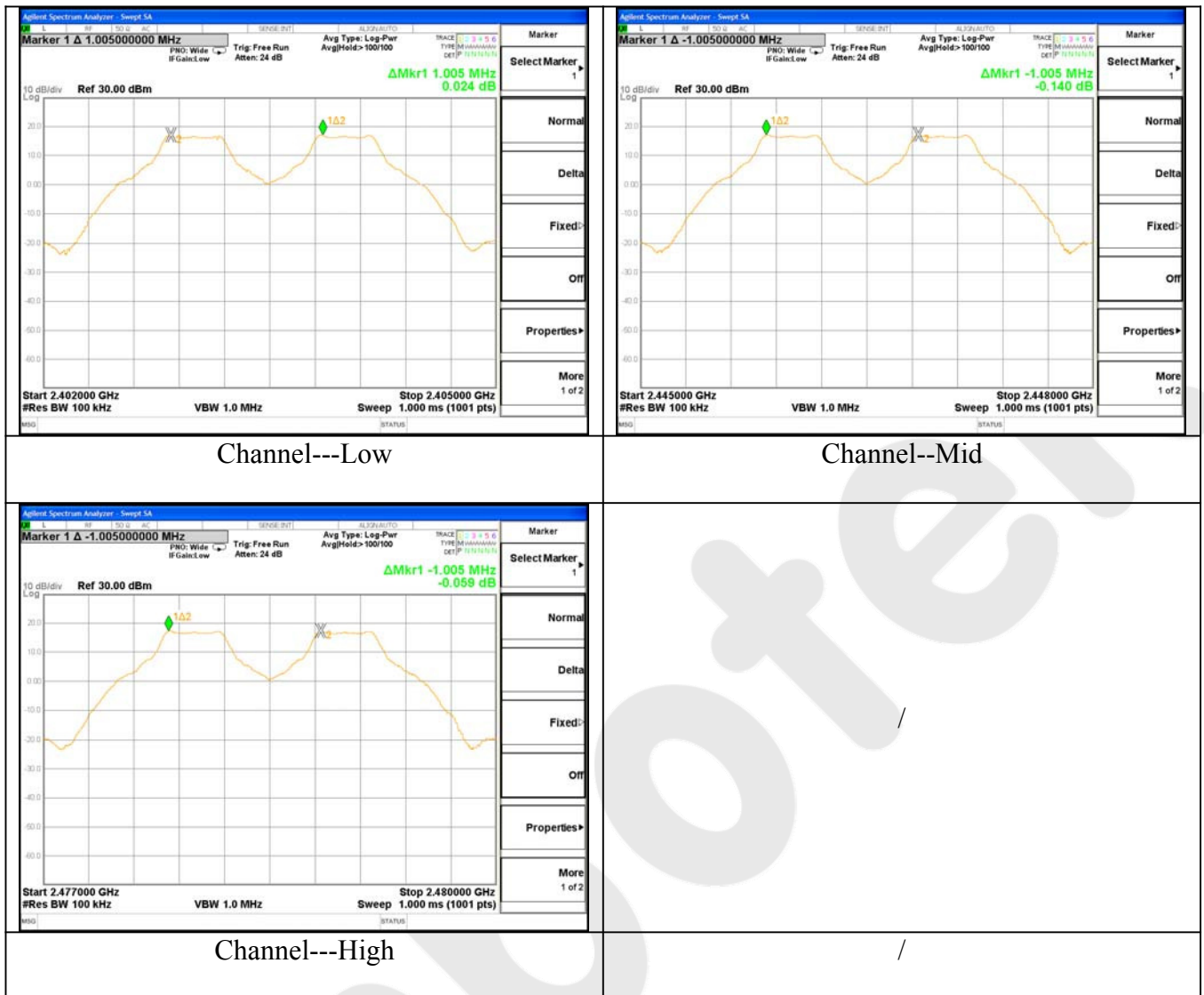
5.3 Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 17, 2015	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 17, 2015	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 17, 2015	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 20, 2015	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 20, 2015	1 Year
6.	Pre-amplifier	SONOMA	310N	186860	Apr. 17, 2015	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8	Power Sensor	DAER	RPR3006W	15I00041SN046	Jun 30, 2015	1 Year
9	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2015	1 Year
10	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2015	1 Year
11	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2015	1 Year
12	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2015	1 Year
13	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-150M8	SE-0137	Mar 16, 2015	1 Year

5.4 Test Results

Test Item : Frequency Separation Test Mode : CH Low ~ CH High
Test Voltage : DC 4.8V Temperature : 24°C
Test Result : PASS Humidity : 55%RH

Channel	Frequency (MHz)	Separation Read Value (kHz)	Limit (kHz)	Result
Low	2403	1005	927.4	Pass
Mid	2447	1005	928.9	Pass
High	2479	1005	931.4	Pass



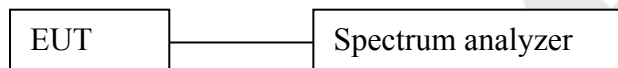
6. 20DB BANDWIDTH TEST

6.1 Measurement Procedure

Using the following spectrum analyzer settings:

1. Span= approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel.
2. Set the RBW = 30 kHz.
3. Set the VBW = 100 kHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

6.2 Test SET-UP



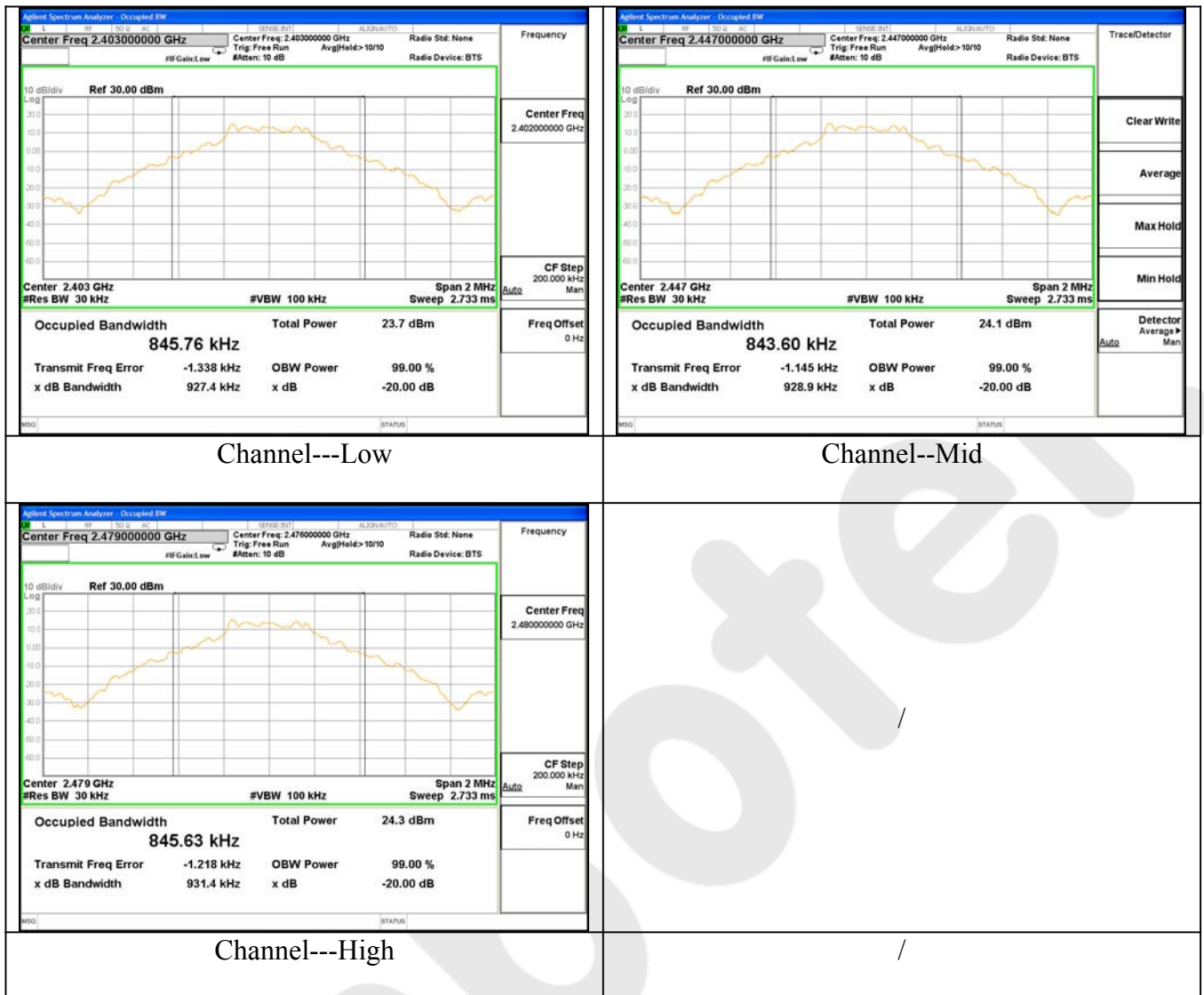
6.3 Test Equipment

Same as the equipment listed in 5.3.

6.4 Test Results

Test Item	: 20dB BW	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 4.8V	Temperature	: 24°C
Test Result	: PASS	Humidity	: 55%RH

Channel	Frequency (MHz)	20dB Down BW(kHz)	Result
Low	2403	927.4	Pass
Mid	2447	928.9	Pass
High	2479	931.4	Pass



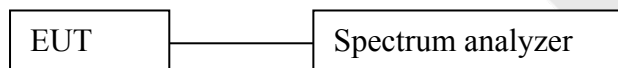
7. QUANTITY OF HOPPING CHANNEL TEST

7.1 Measurement Procedure

The EUT must have its hopping function enabled. Using the following spectrum analyzer setting:

1. Span= the frequency band of operation
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = auto couple.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

7.2 Test SET-UP



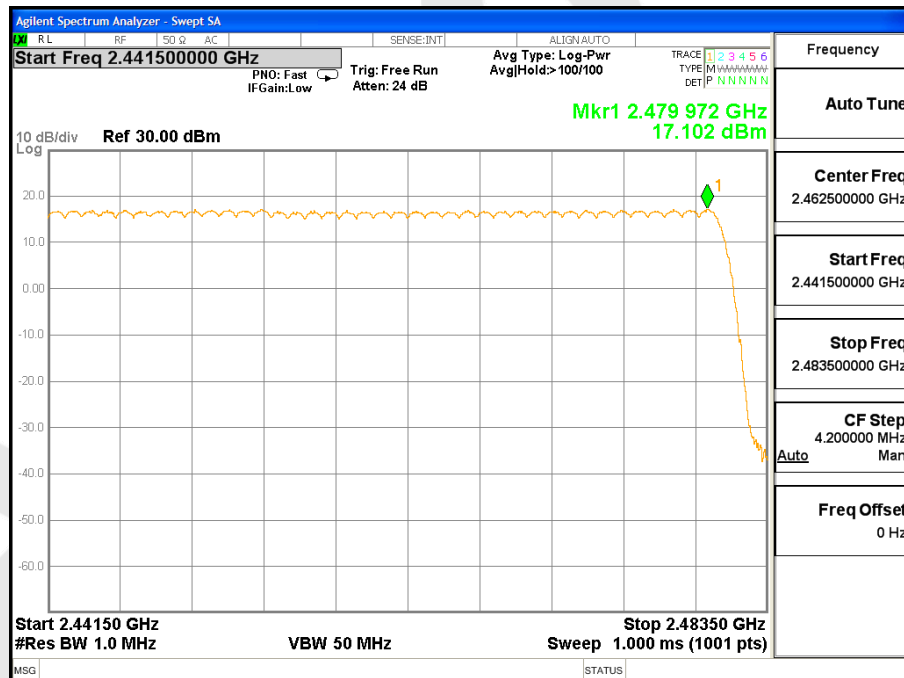
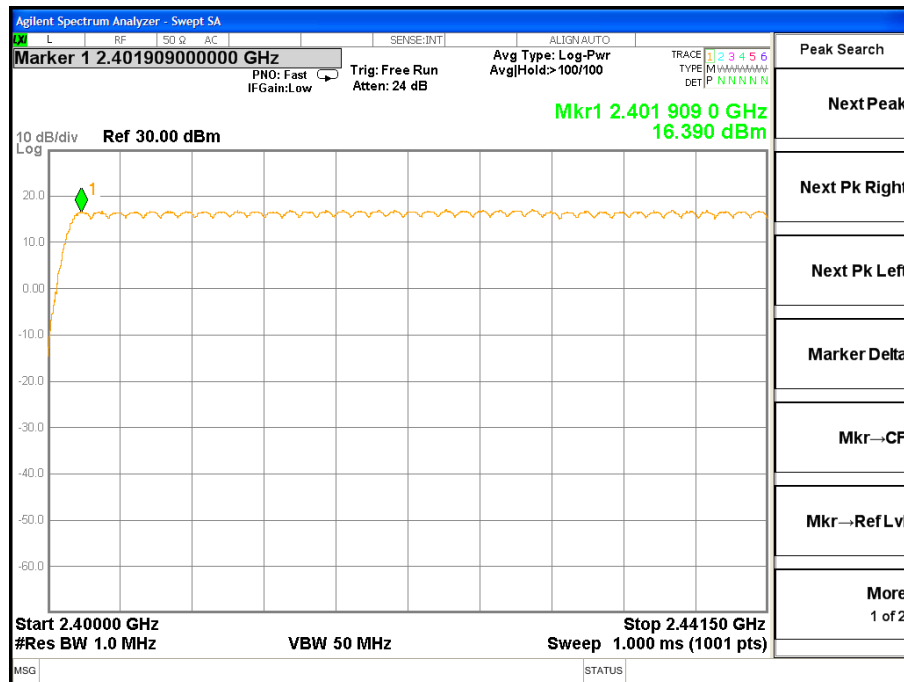
7.3 Test Equipment

Same as the equipment listed in 5.3.

7.4 Test Results

Test Item	: Number of Hopping Frequency	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 4.8V	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
2403-2479	77	> 15



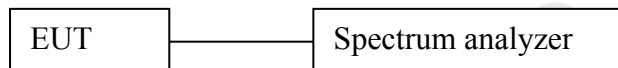
8. DWELL TIME TEST

8.1 Measurement Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span= zero span, centered on a hopping channel
2. Set the RBW = 1 MHz.
3. Set the VBW = 1 MHz.
4. Sweep time = as necessary to capture the entire dwell time per hopping channel.
5. Detector function = peak.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

8.2 Test SET-UP



8.3 Test Equipment

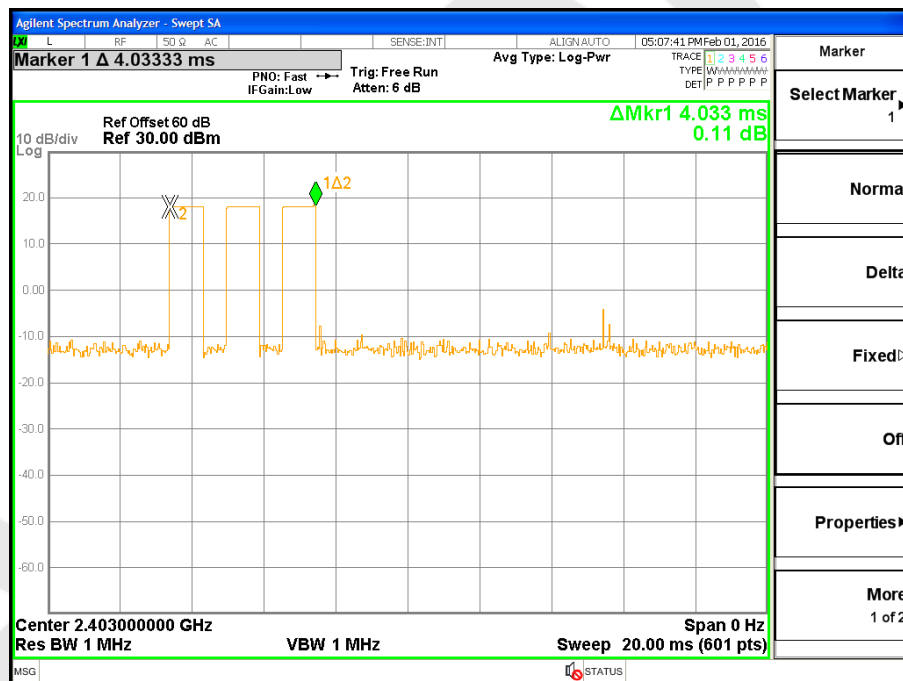
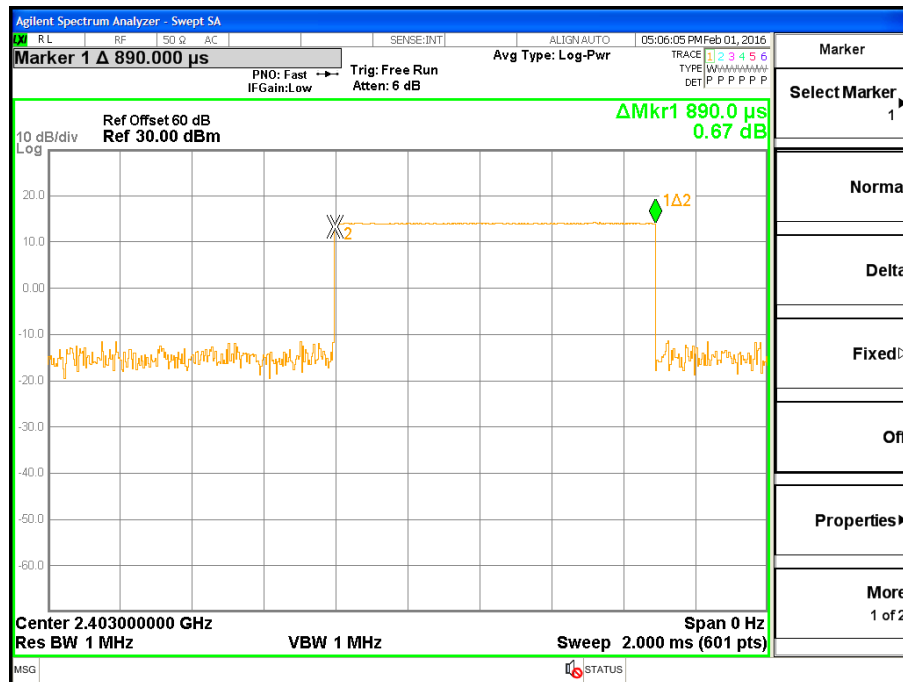
Same as the equipment listed in 5.3.

8.4 Test Results

Test Item	:	Time of Occupancy	Test Mode	:	CH Low ~ CH High
Test Voltage	:	DC 4.8V	Temperature	:	24°C
Test Result	:	PASS	Humidity	:	55%RH

Frequency (MHz)	Pulse width (ms)	Time slot length(ms)	Dwell time (ms)	Limit (s)
2403	0.89	Pulse width*3/20* (0.4*77)	4.11	0.4

Note: Dwell time = Pulse Time (ms) × number of hops on spectrum analyzer ÷ analyzer sweep time × 77 × 0.4



9. MAXIMUM PEAK OUTPUT POWER TEST

9.1 Measurement Procedure

- Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

Using the following spectrum analyzer settings:

- Span= approximately 5 times the 20dB bandwidth, centered on a hopping channel
- Set the RBW = 3 MHz.
- Set the VBW = 3 MHz.
- Sweep time = auto couple.
- Detector function = peak.
- Trace mode = max hold.
- Allow trace to fully stabilize.

9.2 Test SET-UP



9.3 Test Equipment

Same as the equipment listed in 5.3.

9.4 Test Results

Test Item	: Max. peak output power	Test Mode	: CH Low ~ CH High
Test Voltage	: DC 4.8V	Temperature	: 24℃
Test Result	: PASS	Humidity	: 55%RH

Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Results
2403	43.873	16.422	1000	PASS
2447	46.387	16.664	1000	PASS
2479	45.856	16.614	1000	PASS



10. BAND EDGE TEST

10.1 Measurement Procedure

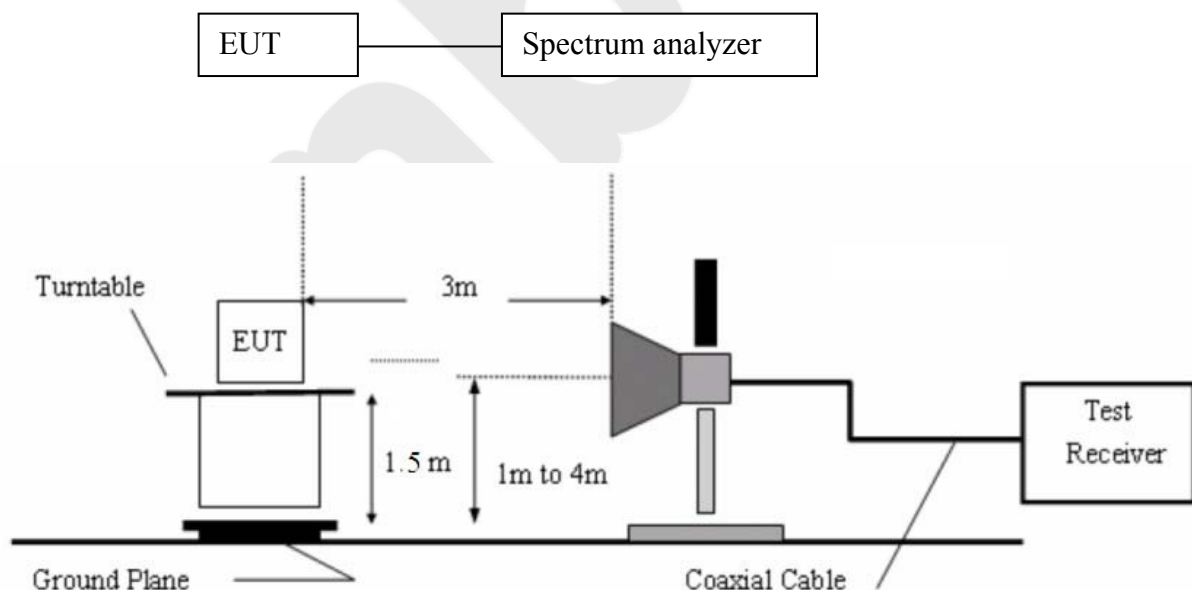
A) Conducted Emission method:

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measurement the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Report above procedures until all measured frequencies were complete.

B) Radiated Emission method:

The EUT is placed on a turn table which is 1.5 meter high above the ground. 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. for Radiated emissions restricted band RBW= 1 MHz, VBW= 3 MHz.

10.2 Test SET-UP



10.3 Test Equipment

Same as the equipment listed in 5.3.

10.4 Test Results

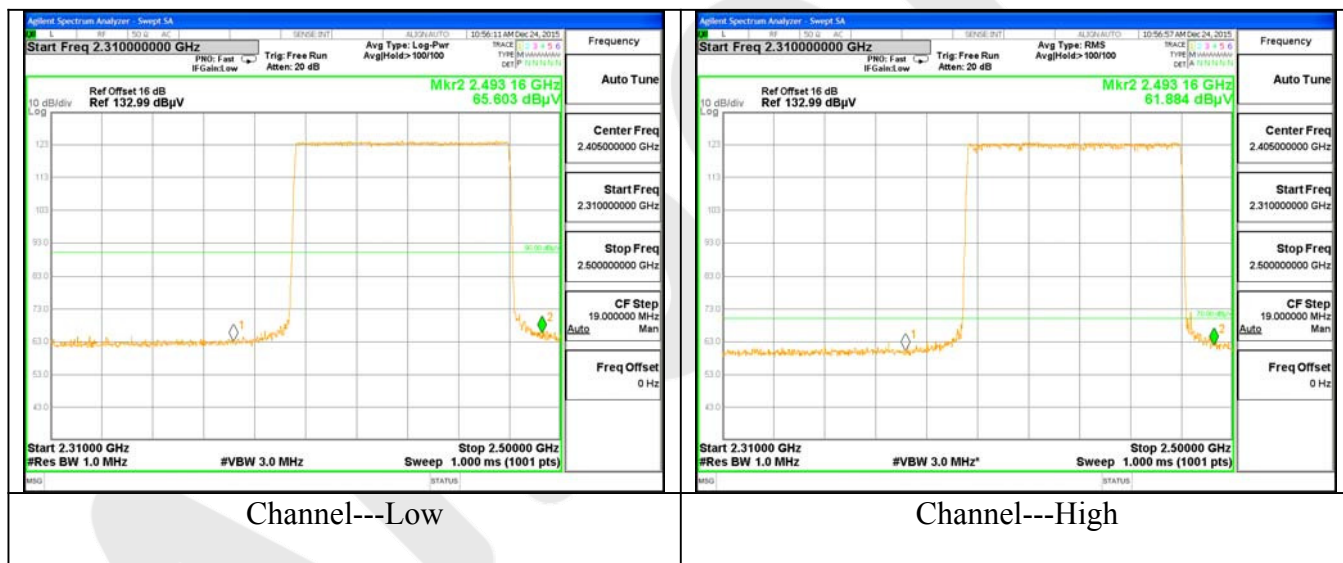
Pass.

Please refer the following data.

Test Item : Band edge
Test Voltage : DC 4.8V
Test Result : PASS

Test Mode : CH Low ~ CH High
Temperature : 24°C
Humidity : 55%RH

For Hopping Mode:



Test Item : Band edge
Test Voltage : DC 4.8V
Test Result : PASS

Test Mode : CH Low ~ CH High
Temperature : 24°C
Humidity : 55%RH

For Non-Hopping Mode:

1. Conducted Test

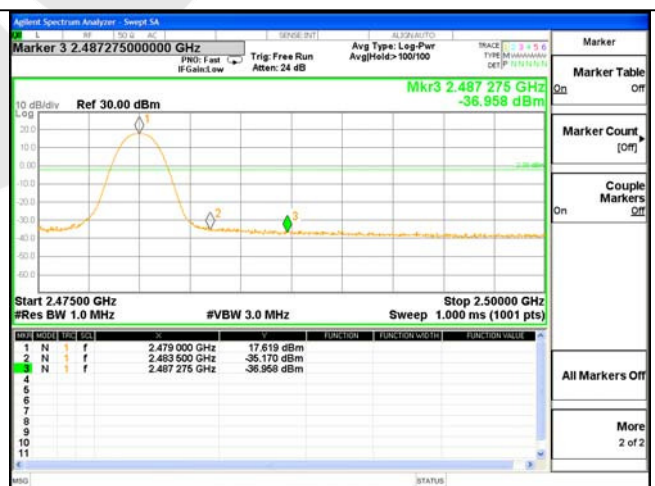
Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)	Results
<2400	17.329	-22.033	39.362	>20dBc	PASS
>2483.5	17.619	-35.170	52.789	>20dBc	PASS

2. Radiated emission Test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Results
		PK	AV	PK	AV	
<2400	V	56.71	44.49	74.00	54.00	PASS
>2483.5	V	55.45	43.63	74.00	54.00	PASS



Channel---Low



Channel---High

11. ANTENNA APPLICATION

11.1 Antenna requirement

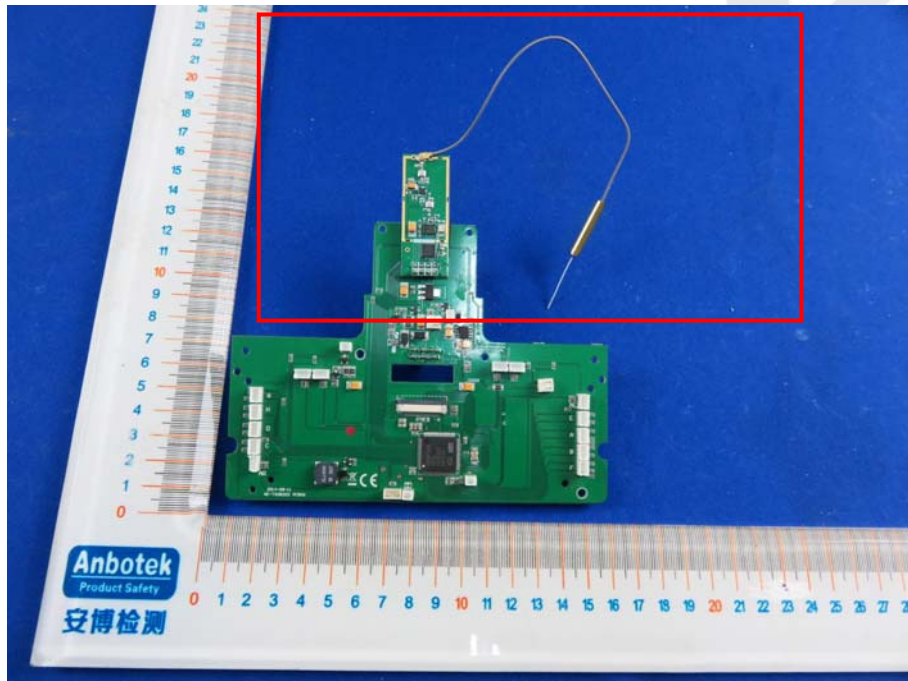
The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:

Systems operating in the 2402-2479MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

11.2 Result

The EUT's antenna used a Integrated Antenna, The antenna's gain is 0dBi and meets the requirement.

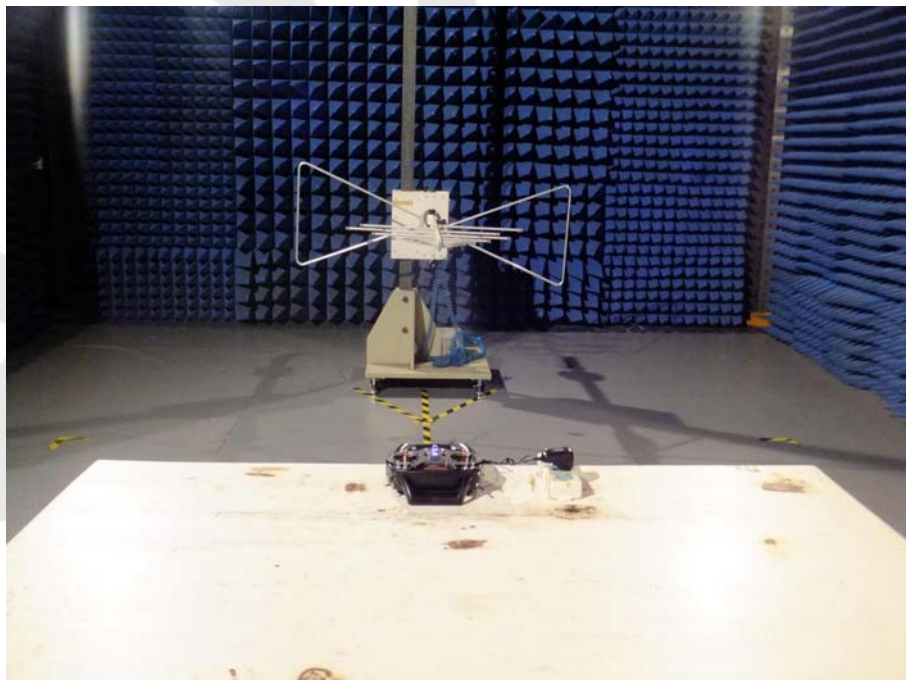


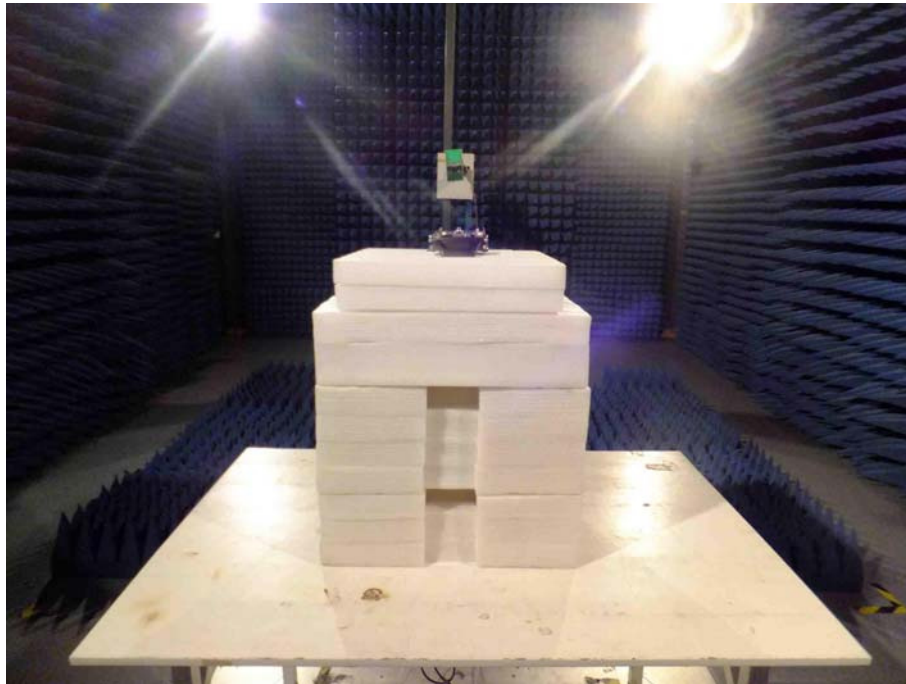
12. PHOTOGRAPH

12.1 Photo of Power Line Conducted Emission Measurement



12.2 Photo of Radiation Emission Test





APPENDIX I (EXTERNAL PHOTOS)

Figure 1
The EUT-Overall View



Figure 2
The EUT-Top View



Figure 3
The EUT-Bottom View



Figure 4
The EUT-Front View



Figure 5
The EUT-Back View

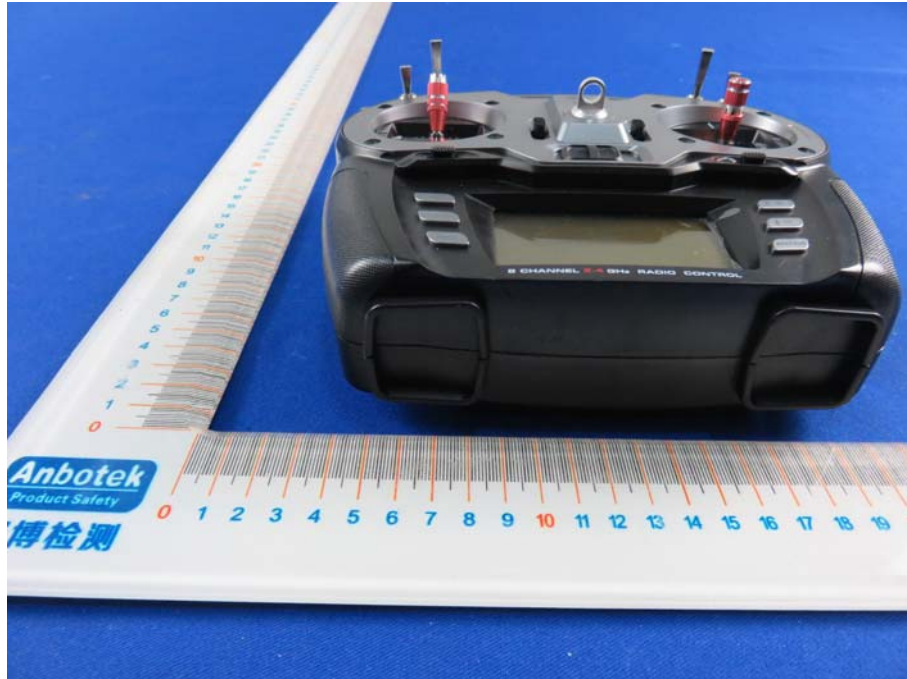


Figure 6
The EUT-Right View



Figure 7
The EUT-Left View



APPENDIX II (INTERNAL PHOTOS)

Figure 8
The EUT-Inside View

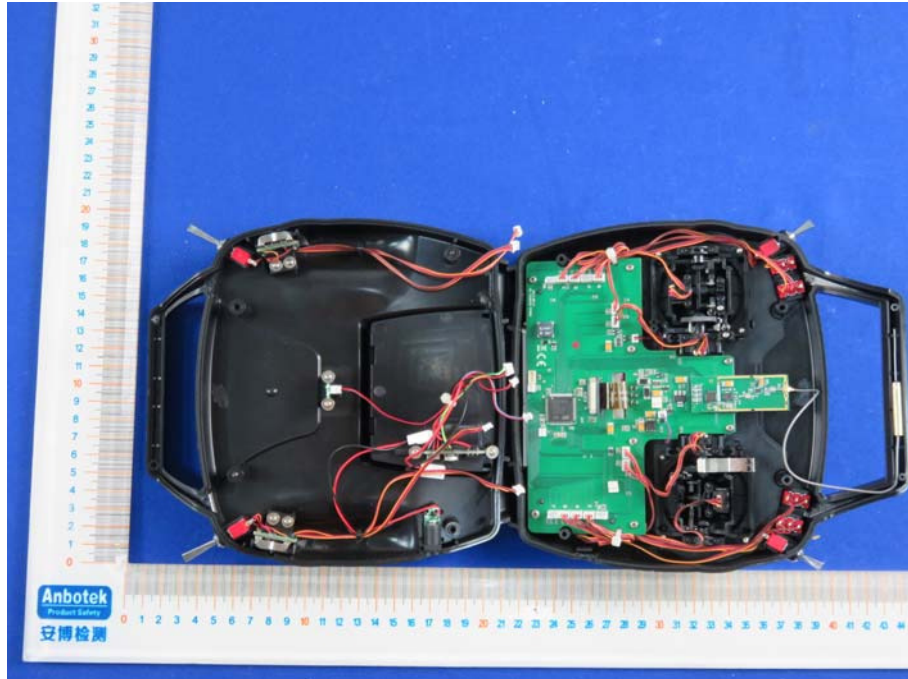


Figure 9
PCB of the EUT-Front View

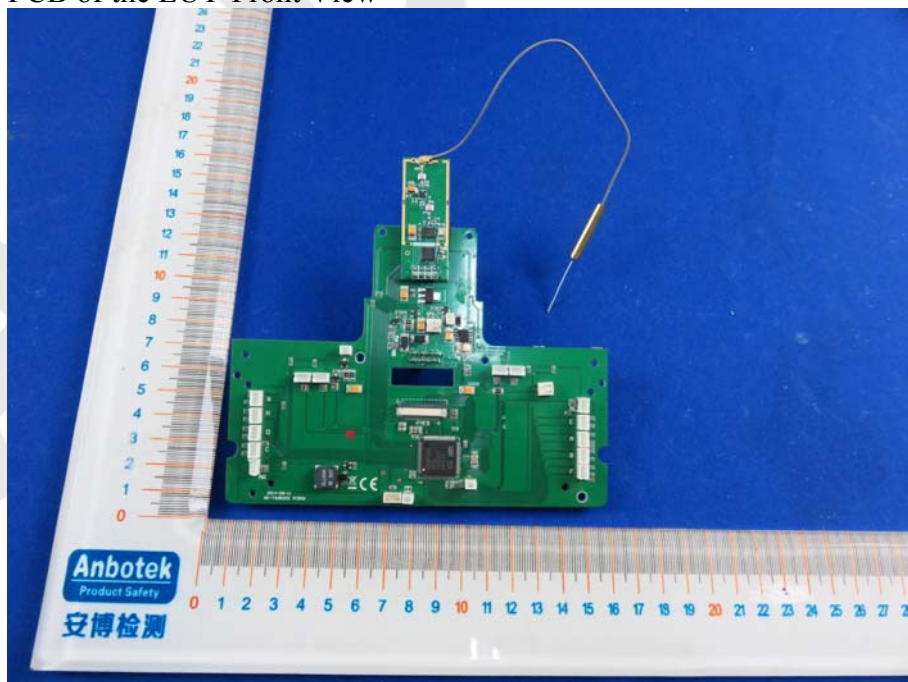


Figure 10
PCB of the EUT-Back View

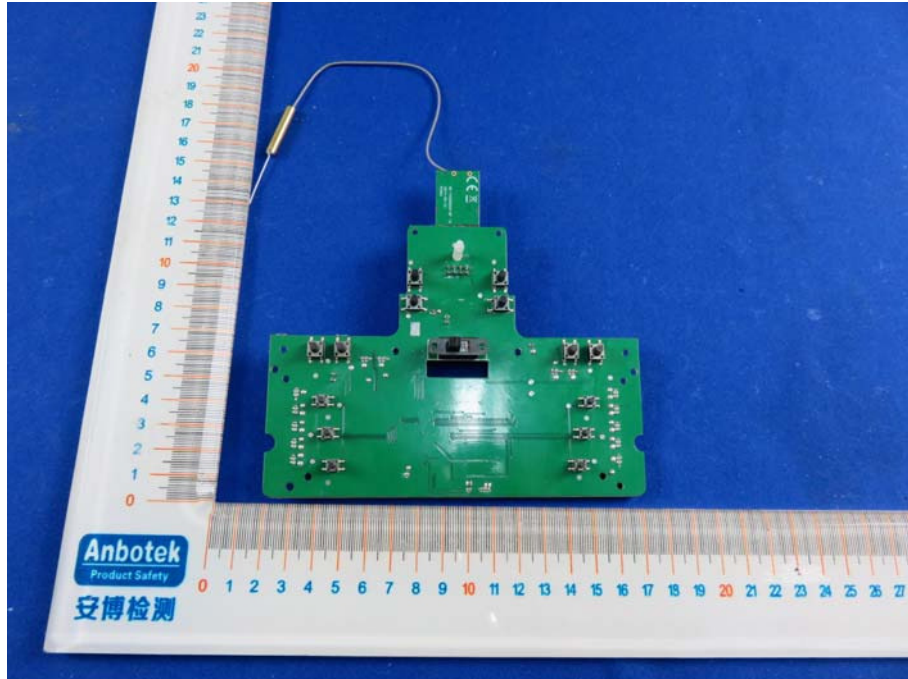


Figure 11
PCB of the EUT-Front View

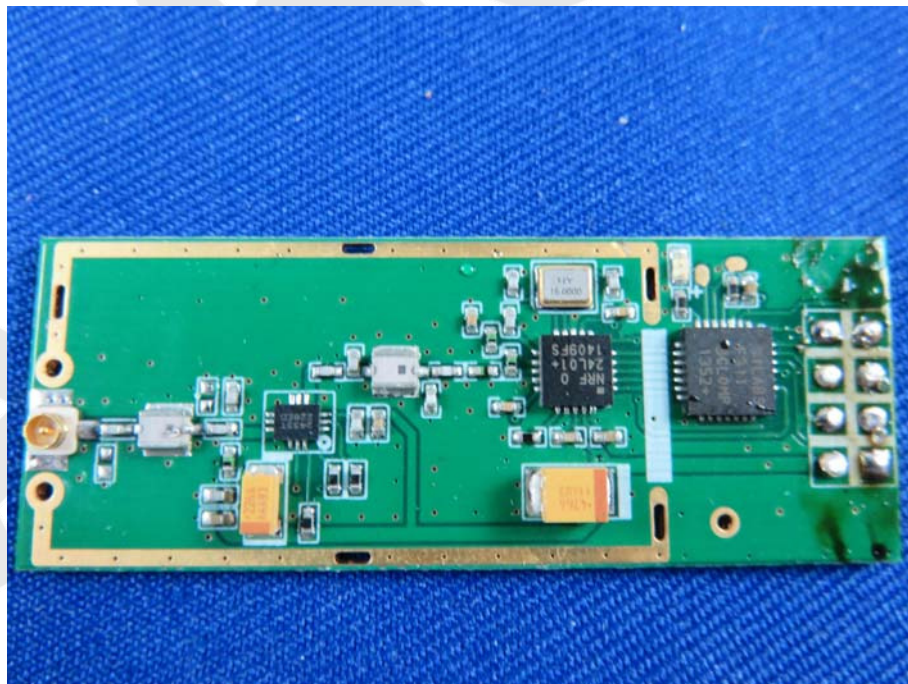


Figure 12
PCB of the EUT-Front View

