

# FCC Report

**Applicant:** Firelands Group,LLC

**Address of Applicant:** 1214 Dorchester Dr, 2919 Crossing Court, Suite 2, Champaign, IL 61822, United States

## Equipment Under Test (EUT)

**Product Name:** Mini quadcopter

**Model No.:** Neon X Plus

**Trade Mark:** Ares

**FCC ID:** 2AEIGNEONXP

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.247:2015

**Date of sample receipt:** October 14, 2016

**Date of Test:** October 14-25, 2016

**Date of report issued:** October 25, 2016

**Test Result :** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

A handwritten signature of 'Robinson Lo' is written over a circular blue official seal. The seal contains the text 'GTS' in the center, surrounded by 'GLOBAL TECHNOLOGY SERVICES' and 'TESTING CO.' The date '10/25/16' is also visible on the seal.

Robinson Lo

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of GTS or testing done by GTS in connection with, distribution or use of the product described in this report must be approved by GTS in writing.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

## 2 Version

Version No.	Date	Description
00	October 25, 2016	Original

**Prepared By:**

*Edward Pan*

**Date:**

October 25, 2016

**Project Engineer**

*Andy Wu*

**Check By:**

**Date:**

October 25, 2016

**Reviewer**

### 3 Contents

	Page
1 COVER PAGE .....	1
2 VERSION .....	2
3 CONTENTS .....	3
4 TEST SUMMARY .....	4
4.1 MEASUREMENT UNCERTAINTY .....	4
5 GENERAL INFORMATION .....	5
5.1 CLIENT INFORMATION .....	5
5.2 GENERAL DESCRIPTION OF EUT .....	5
5.3 TEST MODE .....	8
5.4 TEST FACILITY .....	8
5.5 TEST LOCATION .....	8
5.6 OTHER INFORMATION REQUESTED BY THE CUSTOMER .....	8
5.7 DESCRIPTION OF SUPPORT UNITS .....	8
5.8 TEST INSTRUMENTS LIST .....	9
6 TEST RESULTS AND MEASUREMENT DATA .....	11
6.1 ANTENNA REQUIREMENT .....	11
6.2 CONDUCTED PEAK OUTPUT POWER .....	12
6.3 20dB EMISSION BANDWIDTH .....	14
6.4 CARRIER FREQUENCIES SEPARATION .....	16
6.5 HOPPING CHANNEL NUMBER .....	19
6.6 DWELL TIME .....	21
6.7 PSEUDORANDOM FREQUENCY HOPPING SEQUENCE .....	25
6.8 BAND EDGE .....	26
6.8.1 Conducted Emission Method .....	26
6.8.2 Radiated Emission Method .....	28
6.9 SPURIOUS EMISSION .....	30
6.9.1 Conducted Emission Method .....	30
6.9.2 Radiated Emission Method .....	32
7 TEST SETUP PHOTO .....	39
8 EUT CONSTRUCTIONAL DETAILS .....	40

## 4 Test Summary

Test Item	Section	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	N/A
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

N/A: Not applicable

Remark: Test according to ANSI C63.10: 2013.

### 4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

## 5 General Information

### 5.1 Client Information

Applicant:	Firelands Group,LLC
Address of Applicant:	1214 Dorchester Dr, 2919 Crossing Court, Suite 2, Champaign, IL 61822, United States
Manufacturer:	LANDBOW INDUSTRY CO., LIMITED
Address of Manufacturer:	UNIT 04, 7/F BRIGHT WAY TOWER NO. 33 MONG KOK RD, KL HK
Factory:	LANDBOW INDUSTRY CO., LIMITED
Address of Factory:	2/F Huatai Road, Chenghai, Shantou, Guangdong, China

### 5.2 General Description of EUT

Product Name:	Mini quadcopter
Model No.:	Neon X Plus
Operation Frequency:	2405~2475MHz
Channel numbers:	71
Modulation technology:	GFSK
Antenna Type:	Integral antenna
Antenna Gain:	0dBi (declare by Applicant)
Power Supply:	TX:DC 3.V 2*AAA Size Battery

Remark: The system works in the frequency range of 2405MHz to 2475MHz. This band has been divided to 71 independent channels. Each radio system uses 25 different channels, the minimum channel separation is 1MHz. By using various switch-on times, hopping scheme and channel frequencies, the system can guarantee a jamming free radio transmission.

<b>Operation Frequency each of channel</b>							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405.00	19	2423.00	37	2441.00	55	2459.00
2	2406.00	20	2424.00	38	2442.00	56	2460.00
3	2407.00	21	2425.00	39	2443.00	57	2461.00
4	2408.00	22	2426.00	40	2444.00	58	2462.00
5	2409.00	23	2427.00	41	2445.00	59	2463.00
6	2410.00	24	2428.00	42	2446.00	60	2464.00
7	2411.00	25	2429.00	43	2447.00	61	2465.00
8	2412.00	26	2430.00	44	2448.00	62	2466.00
9	2413.00	27	2431.00	45	2449.00	63	2467.00
10	2414.00	28	2432.00	46	2450.00	64	2468.00
11	2415.00	29	2433.00	47	2451.00	65	2469.00
12	2416.00	30	2434.00	48	2452.00	66	2470.00
13	2417.00	31	2435.00	49	2453.00	67	2471.00
14	2418.00	32	2436.00	50	2454.00	68	2472.00
15	2419.00	33	2437.00	51	2455.00	69	2473.00
16	2420.00	34	2438.00	52	2456.00	70	2474.00
17	2421.00	35	2439.00	53	2457.00	71	2475.00
18	2422.00	36	2440.00	54	2458.00		

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2405.0MHz
The middle channel	2445.0MHz
The Highest channel	2475.0MHz

## 5.3 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
-------------------	------------------------------------

## 5.4 Test Facility

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

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 600491, June 22, 2016.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

## 5.5 Test Location

All other tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

## 5.6 Other Information Requested by the Customer

None.
-------

## 5.7 Description of Support Units

None.
-------

## 5.8 Test Instruments list

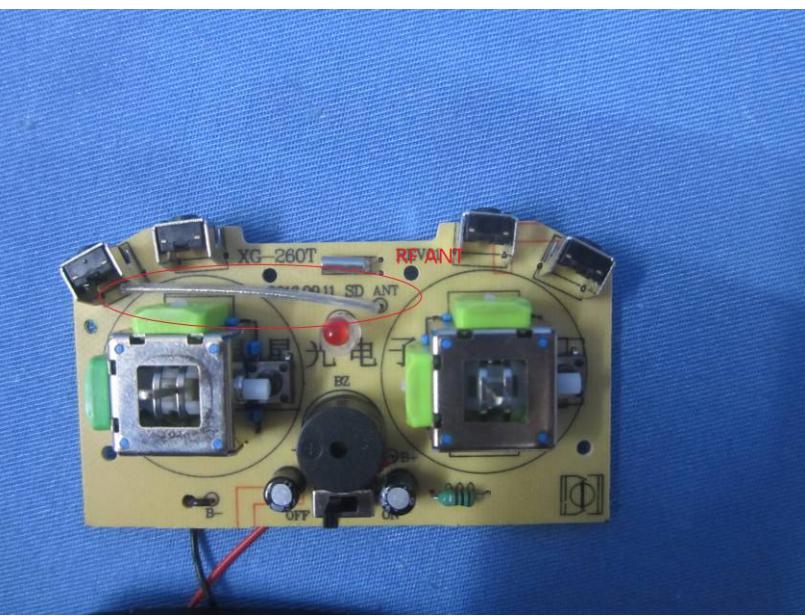
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 29 2016	June. 28 2017
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 29 2016	June. 28 2017
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June. 29 2016	June. 28 2017
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 29 2016	June. 28 2017
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 29 2016	June. 28 2017
9	Coaxial Cable	GTS	N/A	GTS211	June. 29 2016	June. 28 2017
10	Coaxial cable	GTS	N/A	GTS210	June. 29 2016	June. 28 2017
11	Coaxial Cable	GTS	N/A	GTS212	June. 29 2016	June. 28 2017
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 29 2016	June. 28 2017
13	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June. 29 2016	June. 28 2017
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 29 2016	June. 28 2017
15	Band filter	Amindeon	82346	GTS219	June. 29 2016	June. 28 2017
16	Constant temperature and humidity box	Oregon Scientific	BA-888	GTS248	June. 29 2016	June. 28 2017
17	D.C. Power Supply	Insteek	PS-3030	GTS232	June. 29 2016	June. 28 2017
18	Splitter	Agilent	11636B	GTS237	June. 29 2016	June. 28 2017

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.0(L)x3.0(W)x3.0(H)	GTS264	May.16 2014	May.15 2019
2	EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	June 29 2016	June 28 2017
3	10dB Pulse Limita	Rohde & Schwarz	N/A	GTS224	June 29 2016	June 28 2017
4	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 29 2016	June 28 2017
5	LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	GTS226	June 29 2016	June 28 2017
6	Coaxial Cable	GTS	N/A	GTS227	June 29 2016	June 28 2017
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A

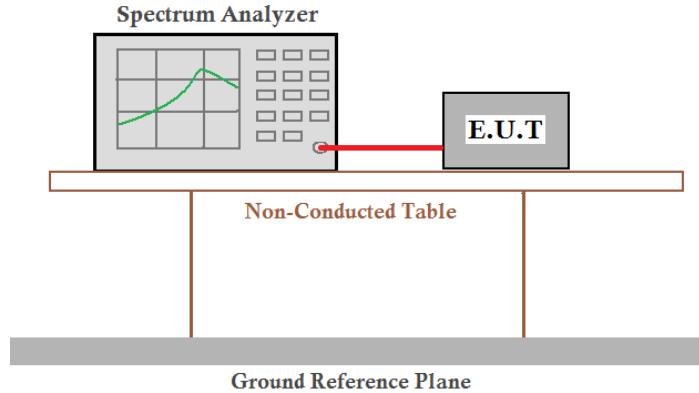
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 29 2016	June 28 2017

## 6 Test results and Measurement Data

### 6.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<b>15.203 requirement:</b>	
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.	
<b>15.247(c) (1)(i) requirement:</b>	
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
<b>EUT Antenna:</b>	
<i>The antenna is integral Antenna, the best case gain of the antenna is 0dBi</i>	
	

## 6.2 Conducted Peak Output Power

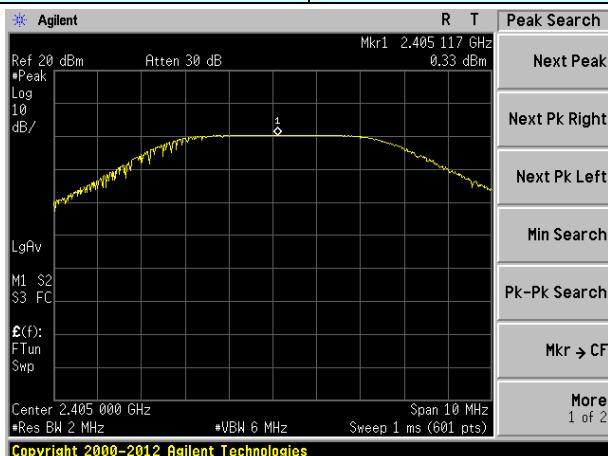
Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	DA 00-705, ANSI C63.10:2013
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup for conducted peak output power. A Spectrum Analyzer is connected to the E.U.T (Equipment Under Test) via a coaxial cable. The E.U.T is placed on a Non-Conducted Table. The entire setup is positioned above a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

### Measurement Data

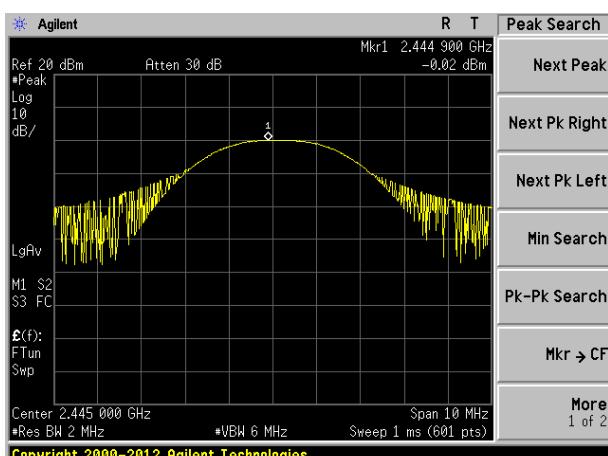
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.33	30	Pass
Middle	-0.02		
Highest	0.88		

**Test plot as follows:**

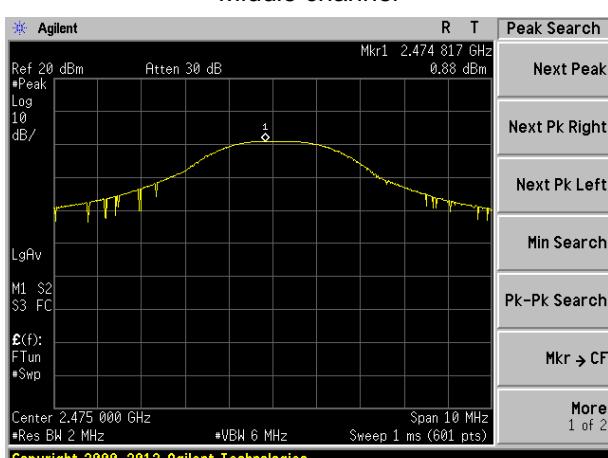
		Antenna:	Antenna 1
--	--	----------	-----------



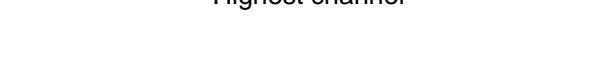
Lowest channel



Lowest channel

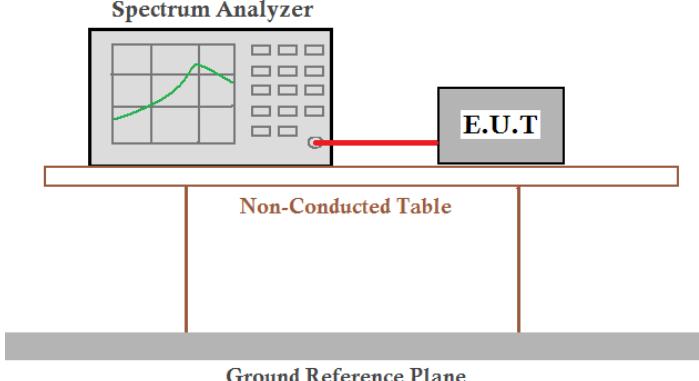


Middle channel



Highest channel

### 6.3 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	DA 00-705, ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

#### Measurement Data

Test channel	20dB Emission Bandwidth (MHz)	Result
Lowest	1.436	Pass
Middle	1.073	
Highest	1.133	

**Test plot as follows:**

--	--	--	--



Lowest channel

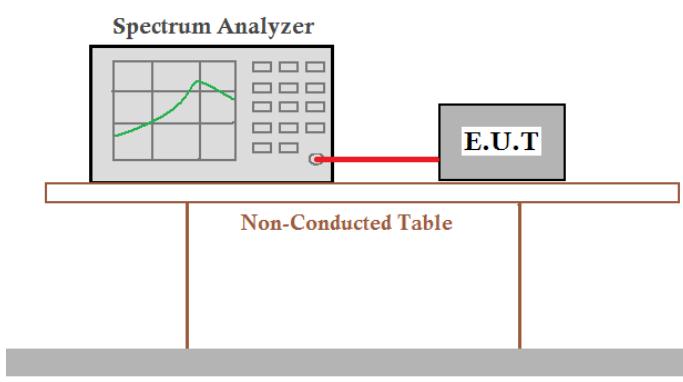


Middle channel



Highest channel

## 6.4 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	<p style="text-align: center;"><b>Spectrum Analyzer</b></p> 
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

**Measurement Data**

Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	3008	957.33	Pass
Middle	1000	957.33	Pass
Highest	3025	957.33	Pass

*Note: According to section 6.3*

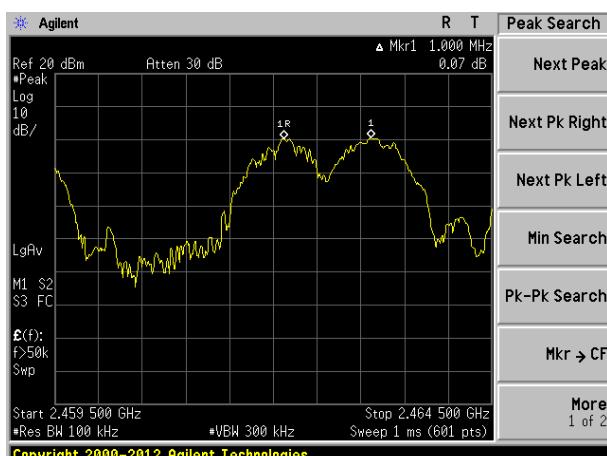
Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	1436.00	957.33

**Test plot as follows:**

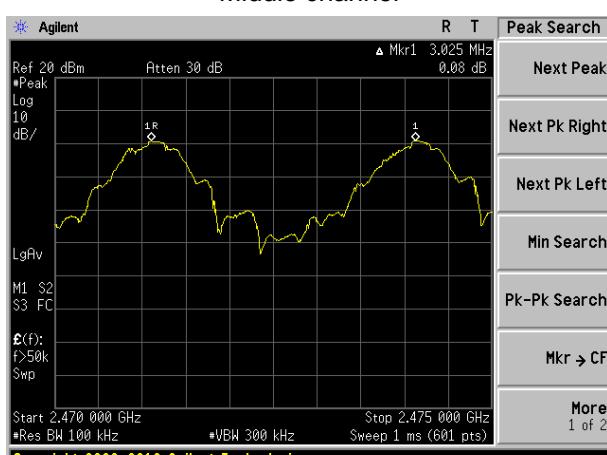
--	--	--	--



Lowest channel

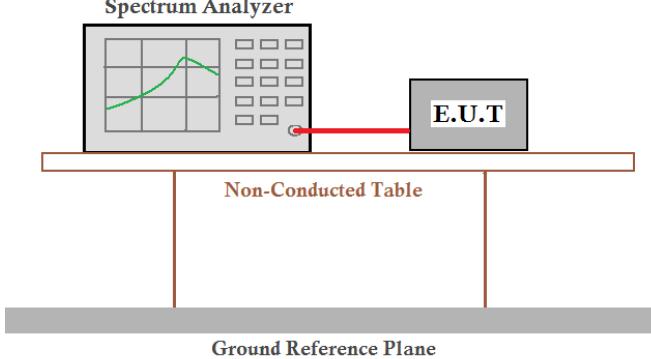


Middle channel



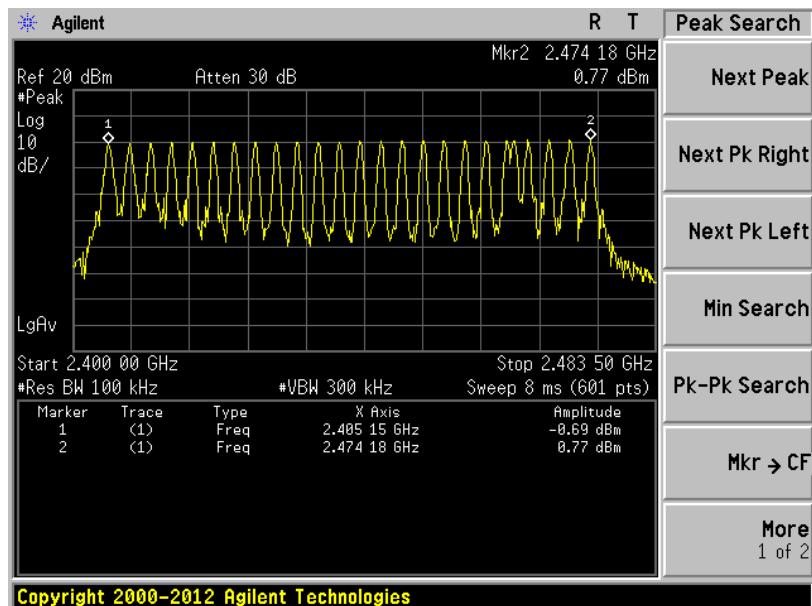
Highest channel

## 6.5 Hopping Channel Number

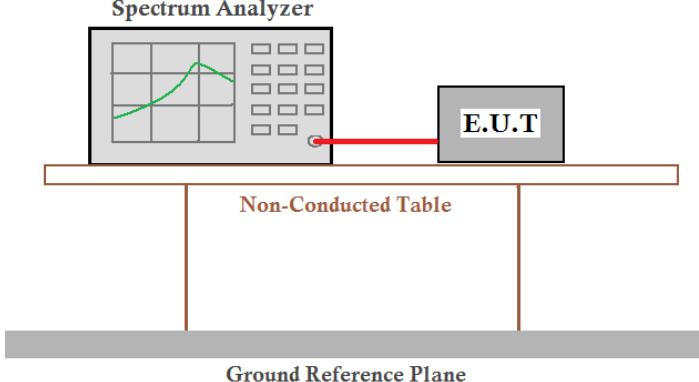
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

**Measurement Data:**

Hopping channel numbers	Limit	Result
25	15	Pass



## 6.6 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	<p style="text-align: center;"><b>Spectrum Analyzer</b></p>  <p style="text-align: center;">Non-Conducted Table</p> <p style="text-align: center;">Ground Reference Plane</p>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

## Measurement Data

Frequency	Ton (ms)	Dwell time(ms)	Limit(ms)	Result
2.405GHz	0.440	17.60	400	Pass
2.445GHz	0.440	17.60	400	Pass
2.475GHz	0.435	17.40	400	Pass

The formula as below:

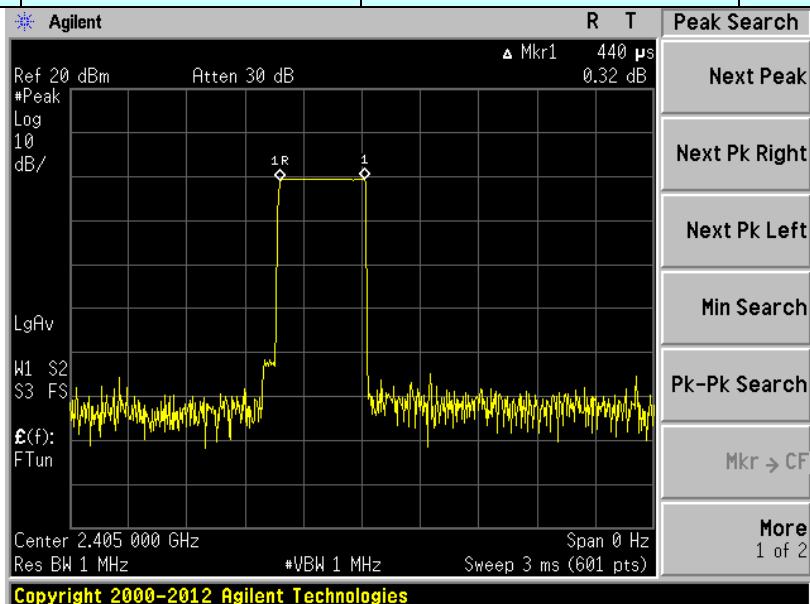
2405MHz: Dwell time = Ton \* Ton times in 1s \* 0.4s \* channel numbers=0.440ms\*4\*0.4\*25=17.60ms

2445MHz: Dwell time = Ton \* Ton times in 1s \* 0.4s \* channel numbers=0.440ms\*4\*0.4\*25=17.60ms

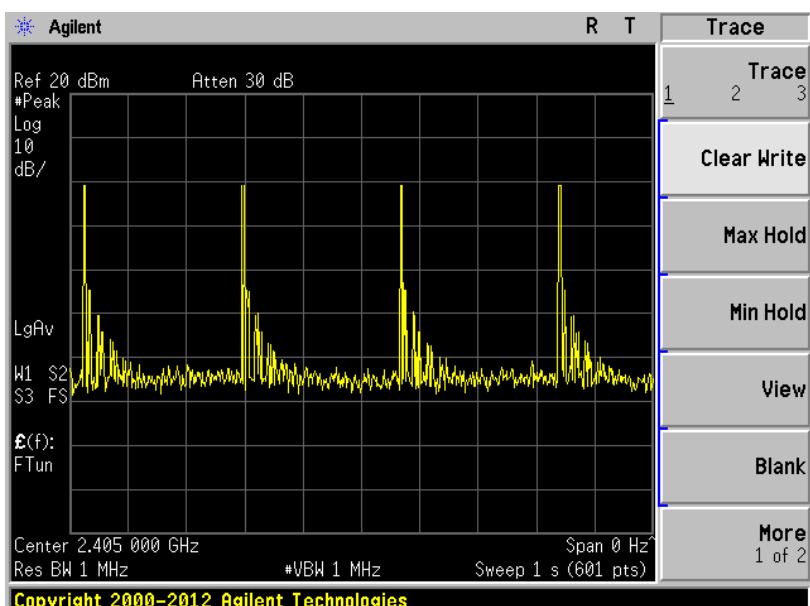
2475MHz: Dwell time = Ton \* Ton times in 1s \* 0.4s \* channel numbers=0.435ms\*4\*0.4\*25=17.40ms

Test plot as follows:

Frequency:	2405MHz		
------------	---------	--	--

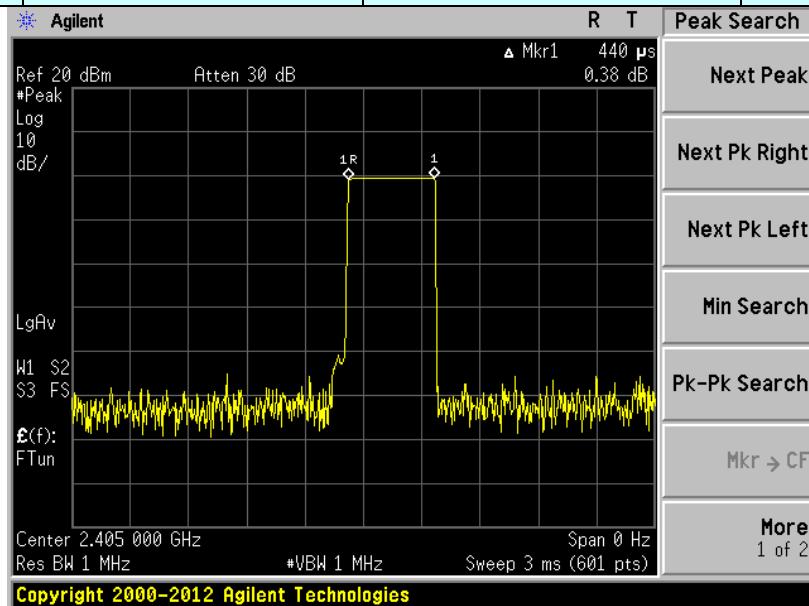


Ton

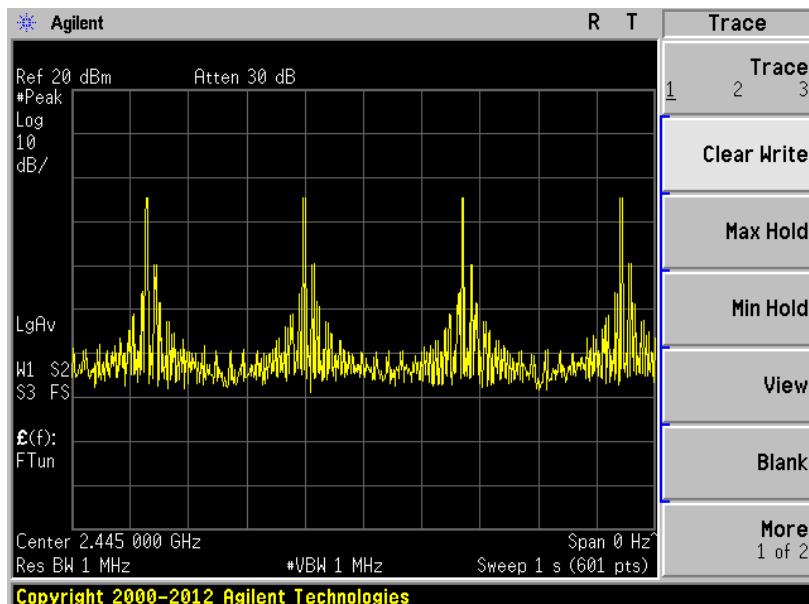


Ton times in 1s

Frequency:	2445MHz		
------------	---------	--	--

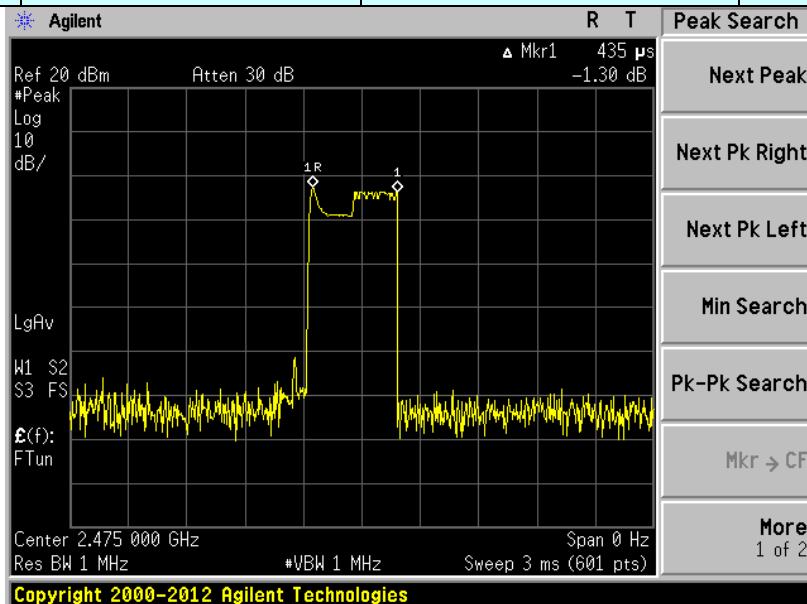


Ton

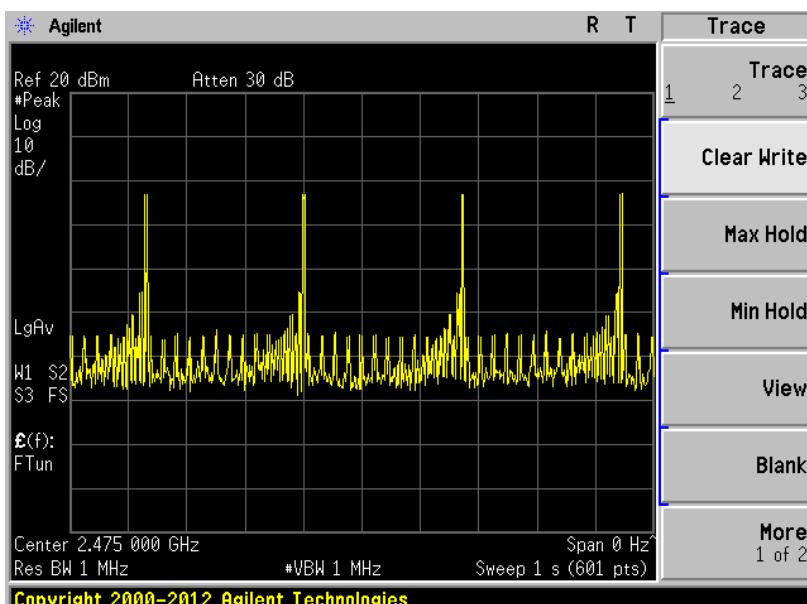


Ton times in 1s

Frequency:	2475MHz		
------------	---------	--	--



Ton



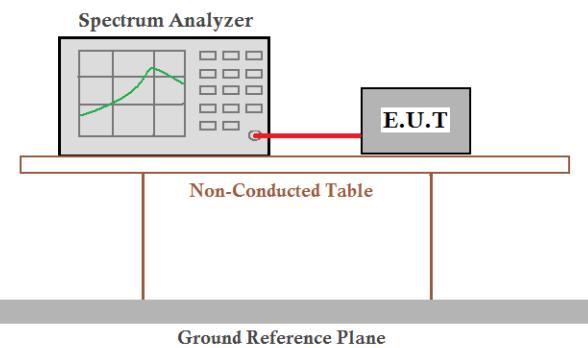
Ton times in 1s

## 6.7 Pseudorandom Frequency Hopping Sequence

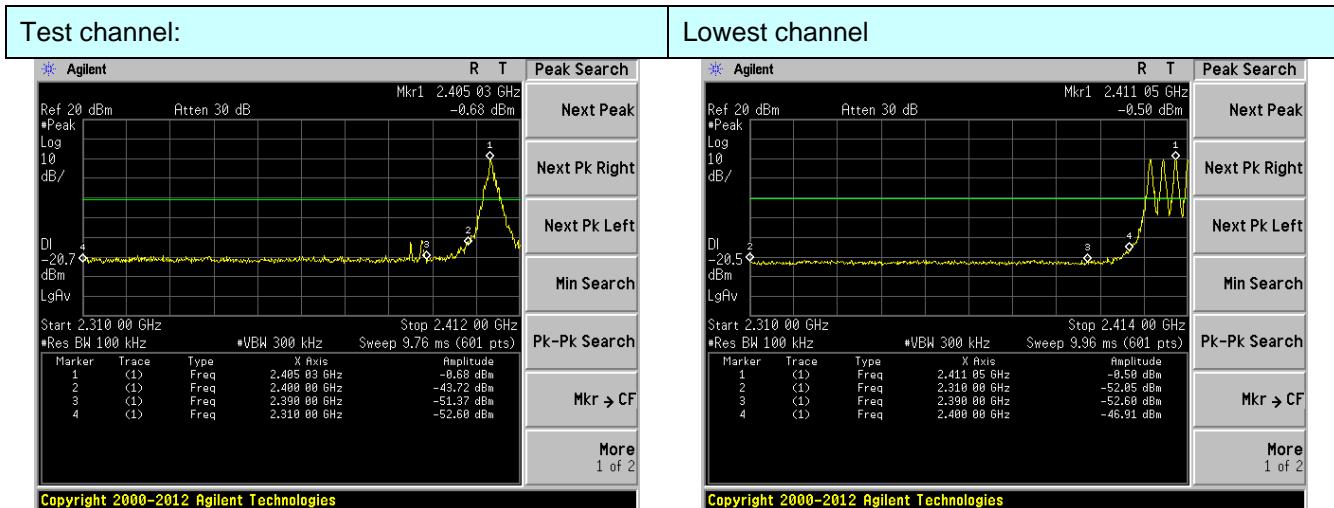
Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:
	<p><i>Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.</i></p> <p><i>Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.</i></p>
<b>EUT Pseudorandom Frequency Hopping Sequence</b>	
<p><i>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.</i></p> <ul style="list-style-type: none"> <li>• Number of shift register stages: 9</li> <li>• Length of pseudo-random sequence: <math>2^9 - 1 = 511</math> bits</li> <li>• Longest sequence of zeros: 8 (non-inverted signal)</li> </ul> <div style="text-align: center; border: 1px solid black; padding: 10px; margin: 10px 0;"> <pre> graph LR     S1[ ] --&gt; S2[ ]     S2 --&gt; S3[ ]     S3 --&gt; S4[ ]     S4 --&gt; S5[ ]     S5 --&gt; S6[ ]     S6 --&gt; S7[ ]     S7 --&gt; S8[ ]     S8 --&gt; S9[ ]     S9 --&gt; S1     S5 --&gt; Add(( ))     S9 --&gt; Add     Add --&gt; S1     style Add fill:none,stroke:none     Add +&gt; S1   </pre> </div> <p><i>Linear Feedback Shift Register for Generation of the PRBS sequence</i></p> <p><i>Each frequency used equally on the average by each transmitter.</i></p> <p><i>The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</i></p>	

## 6.8 Band Edge

### 6.8.1 Conducted Emission Method

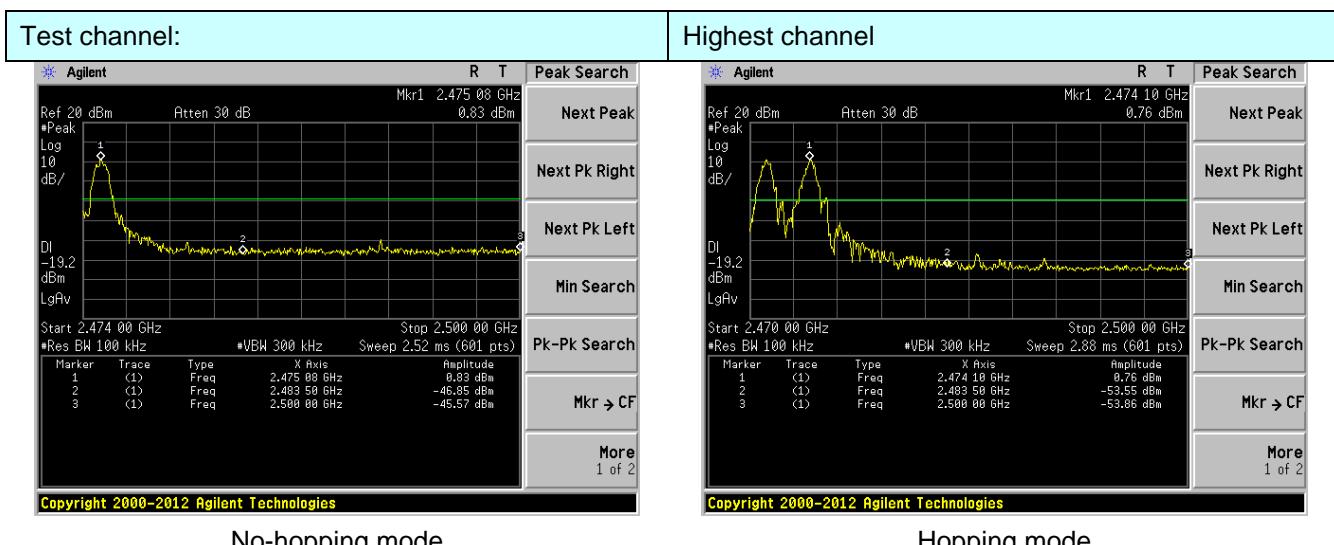
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

**Test plot as follows:**



No-hopping mode

Hopping mode



No-hopping mode

Hopping mode

## 6.8.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205								
Test Method:	ANSI C63.10:2013								
Test Frequency Range:	All restriction band have been tested, and 2.3GHz to 2.5GHz band is the worse case								
Test site:	Measurement Distance: 3m								
Receiver setup:	Frequency	Detector	RBW	VBW	Remark				
	Above 1GHz	Peak	1MHz	3MHz	Peak Value				
		Peak	1MHz	10Hz	Average Value				
Limit:	Frequency	Limit (dBuV/m @3m)		Remark					
	Above 1GHz	54.00		Average Value					
		74.00		Peak Value					
Test setup:									
Test Procedure:	<ol style="list-style-type: none"> <li>The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>								
Test Instruments:	Refer to section 5.8 for details								
Test mode:	Refer to section 5.3 for details								
Test results:	Pass								

Remark:

- Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Test channel:				Lowest				
---------------	--	--	--	--------	--	--	--	--

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	47.50	27.91	5.30	30.37	50.34	74.00	-23.66	Vertical
2390.00	47.13	27.59	5.38	30.18	49.92	74.00	-24.08	Vertical
2400.00	48.28	27.58	5.39	30.18	51.07	74.00	-22.93	Vertical
2310.00	44.89	27.91	5.30	30.37	47.73	74.00	-26.27	Horizontal
2390.00	47.75	27.59	5.38	30.18	50.54	74.00	-23.46	Horizontal
2400.00	46.02	27.58	5.39	30.18	48.81	74.00	-25.19	Horizontal

**Average value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	34.88	27.91	5.30	30.37	37.72	54.00	-16.28	Vertical
2390.00	34.74	27.59	5.38	30.18	37.53	54.00	-16.47	Vertical
2400.00	37.23	27.58	5.39	30.18	40.02	54.00	-13.98	Vertical
2310.00	34.80	27.91	5.30	30.37	37.64	54.00	-16.36	Horizontal
2390.00	35.36	27.59	5.38	30.18	38.15	54.00	-15.85	Horizontal
2400.00	35.60	27.58	5.39	30.18	38.39	54.00	-15.61	Horizontal

Test channel:				Highest				
---------------	--	--	--	---------	--	--	--	--

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	47.09	27.53	5.47	29.93	50.16	74.00	-23.84	Vertical
2500.00	44.39	27.55	5.49	29.93	47.50	74.00	-26.50	Vertical
2483.50	48.44	27.53	5.47	29.93	51.51	74.00	-22.49	Horizontal
2500.00	44.64	27.55	5.49	29.93	47.75	74.00	-26.25	Horizontal

**Average value:**

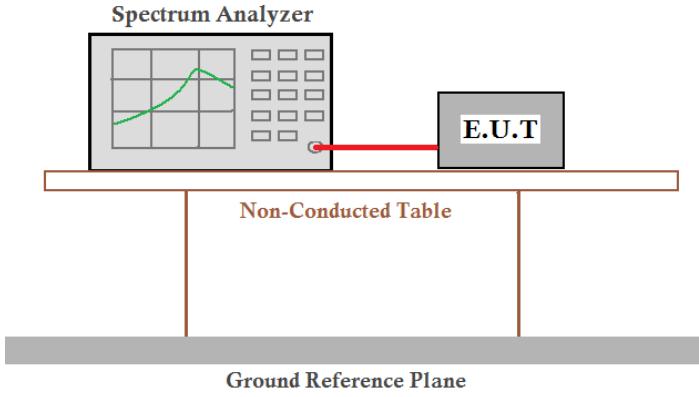
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	33.98	27.53	5.47	29.93	37.05	54.00	-16.95	Vertical
2500.00	34.08	27.55	5.49	29.93	37.19	54.00	-16.81	Vertical
2483.50	33.53	27.53	5.47	29.93	36.60	54.00	-17.40	Horizontal
2500.00	34.12	27.55	5.49	29.93	37.23	54.00	-16.77	Horizontal

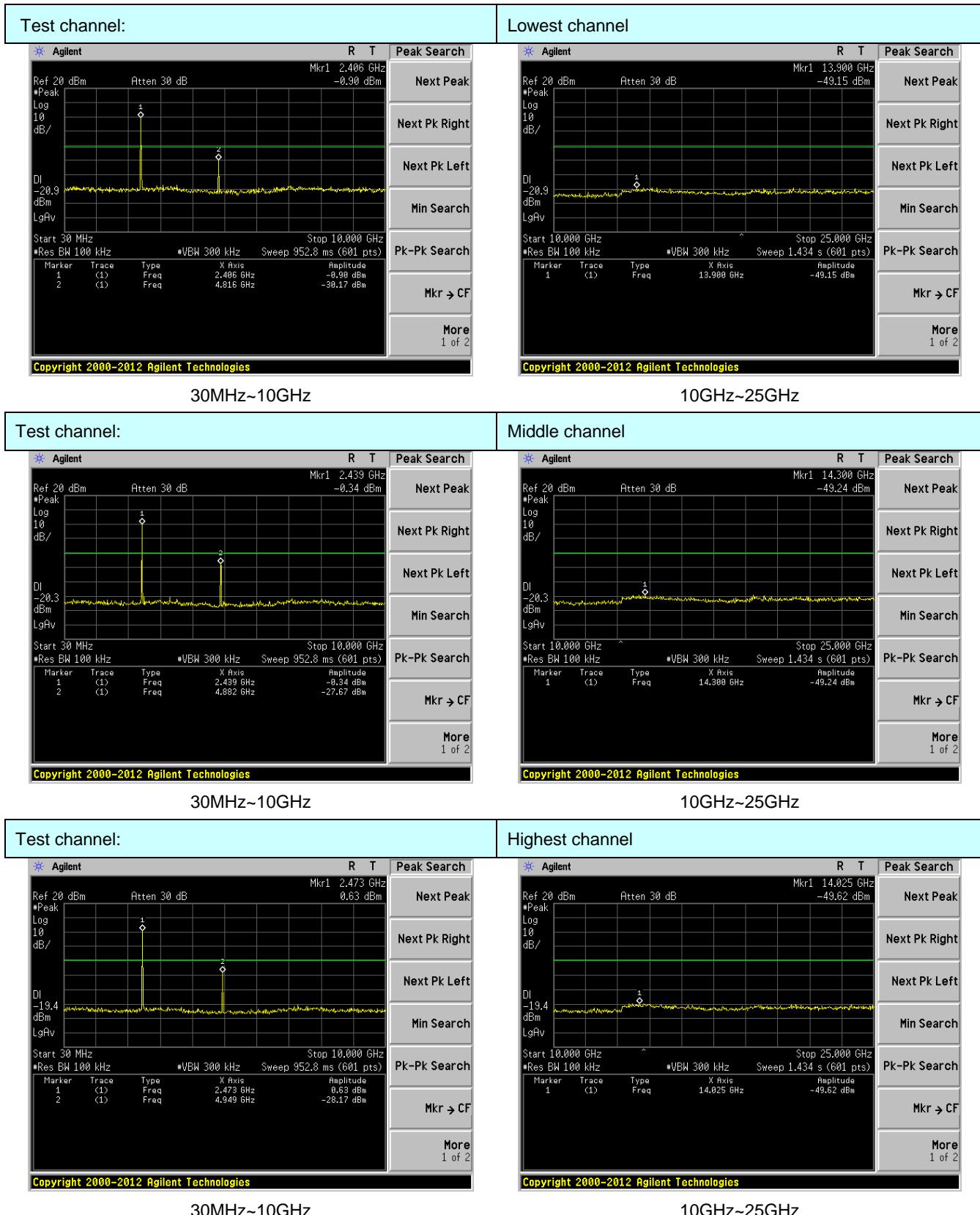
**Remark:**

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- The emission levels of other frequencies are very lower than the limit and not show in test report.

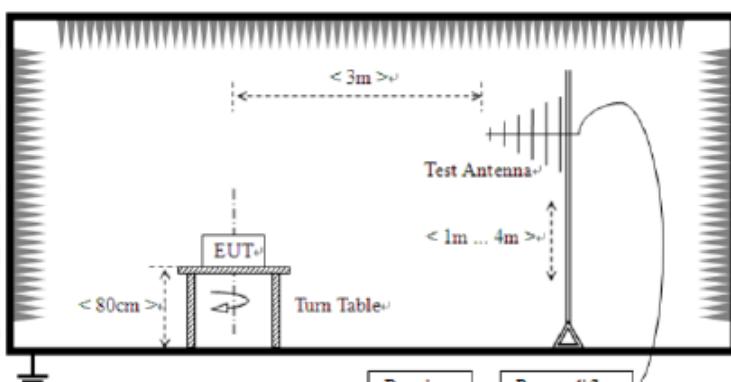
## 6.9 Spurious Emission

### 6.9.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass



## 6.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209						
Test Method:	ANSI C63.10:2013						
Test Frequency Range:	9kHz to 25GHz						
Test site:	Measurement Distance: 3m						
Receiver setup:	Frequency	Detector	RBW	VBW	Value		
	9KHz-10KHz	Quasi-peak	200Hz	600Hz	Quasi-peak		
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak		
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak		
	Above 1GHz	Peak	1MHz	3MHz	Peak		
	Above 1GHz	Peak	1MHz	10Hz	Average		
Limit: (Spurious Emissions)	Frequency	Limit (uV/m)	Value	Measurement Distance			
	0.009MHz-0.490MHz	2400/F(KHz)	QP	300m			
	0.490MHz-1.705MHz	24000/F(KHz)	QP	300m			
	1.705MHz-30MHz	30	QP	30m			
	30MHz-88MHz	100	QP				
	88MHz-216MHz	150	QP				
	216MHz-960MHz	200	QP				
	960MHz-1GHz	500	QP				
	Above 1GHz	500	Average	3m			
	Above 1GHz	5000	Peak				
Test setup:	Below 1GHz						
							
	Above 1GHz						

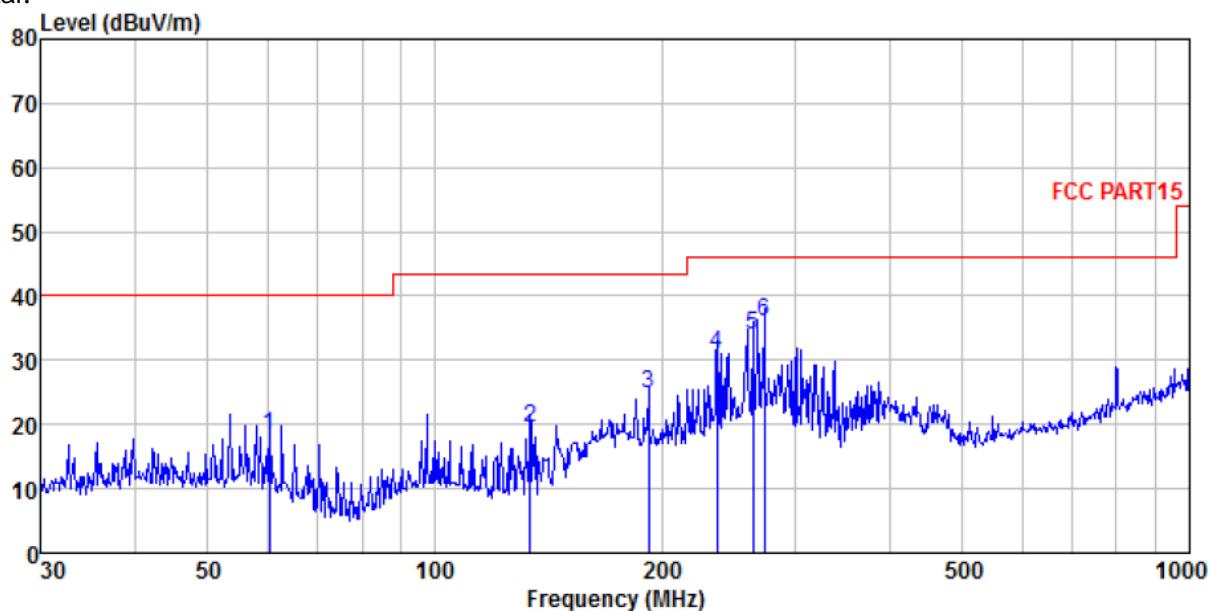
Test Procedure:	<ol style="list-style-type: none"> <li>1. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

*Remark:*

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.
2. The measured filed strength at frequencies below 30MHz are lower than the limit over 30dB. So the data isn't reported.

**Measurement data:**
**■ 30MHz ~ 1GHz**
**ANT 2:**

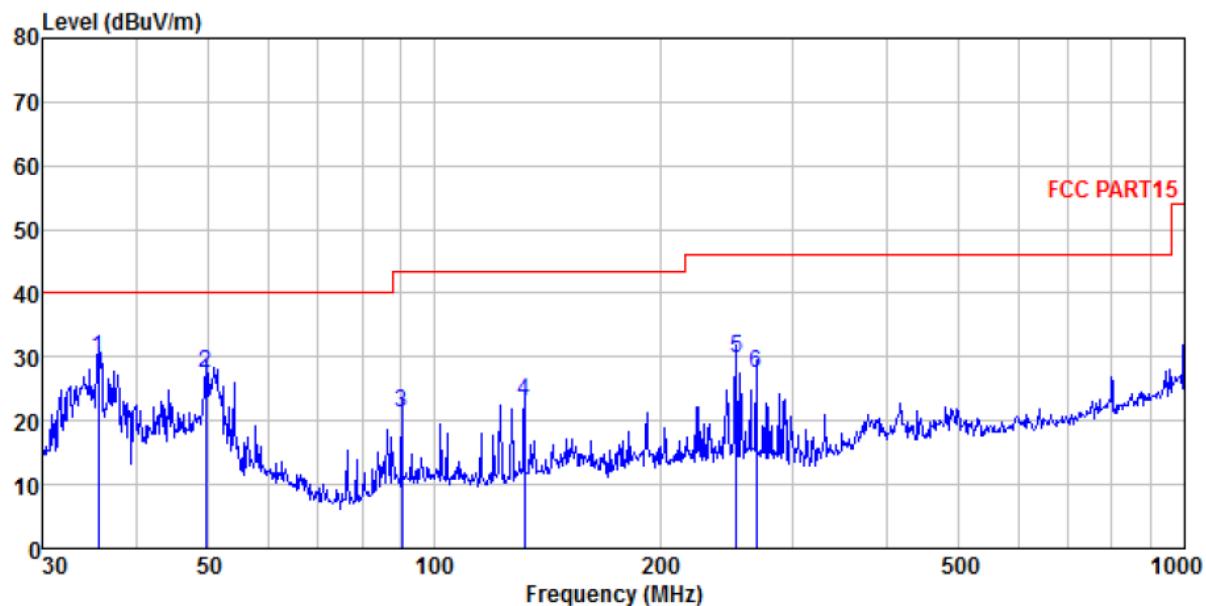
Horizontal:



Site : 3m chamber  
 Condition : FCC PART15 3m HORIZONTAL  
 Job No. : 109  
 Test Mode : Transmitting mode  
 Test Engineer: Sky

	Read	Antenna	Cable	Preamp	Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	60.280	32.68	14.69	0.86	29.92	18.31	40.00	-21.69 QP
2	133.619	36.80	10.67	1.46	29.49	19.44	43.50	-24.06 QP
3	191.745	39.63	12.56	1.80	29.23	24.76	43.50	-18.74 QP
4	236.645	44.60	13.93	2.05	29.54	31.04	46.00	-14.96 QP
5	263.819	47.30	14.17	2.19	29.75	33.91	46.00	-12.09 QP
6	273.234	49.14	14.46	2.24	29.82	36.02	46.00	-9.98 QP

Vertical:



Site : 3m chamber  
 Condition : FCC PART15 3m VERTICAL  
 Job No. : 109  
 Test Mode : Transmitting mode  
 Test Engineer: Sky

Freq	ReadAntenna		Cable		Preamp	Limit	Over	Remark
	Level	Factor	Loss	Factor	Level			
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	35.624	44.66	14.49	0.62	30.07	29.70	40.00	-10.30 QP
2	49.533	41.48	15.28	0.77	30.00	27.53	40.00	-12.47 QP
3	90.537	35.90	14.07	1.11	29.74	21.34	43.50	-22.16 QP
4	131.758	40.12	10.82	1.45	29.50	22.89	43.50	-20.61 QP
5	252.948	43.25	14.06	2.14	29.66	29.79	46.00	-16.21 QP
6	268.485	40.69	14.34	2.21	29.79	27.45	46.00	-18.55 QP

## ■ Above 1GHz

Test channel:	Lowest
---------------	--------

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4810.00	55.10	31.78	8.60	32.09	63.39	74.00	-10.61	Vertical
7215.00	40.30	36.15	11.66	31.99	56.12	74.00	-17.88	Vertical
9620.00	31.93	38.01	14.14	31.60	52.48	74.00	-21.52	Vertical
12025.00	*					74.00		Vertical
14430.00	*					74.00		Vertical
4810.00	51.96	31.78	8.60	32.09	60.25	74.00	-13.75	Horizontal
7215.00	33.00	36.15	11.66	31.99	48.82	74.00	-25.19	Horizontal
9620.00	30.13	38.01	14.14	31.60	50.68	74.00	-23.32	Horizontal
12025.00	*					74.00		Horizontal
14430.00	*					74.00		Horizontal

**Average value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4810.00	39.31	31.78	8.60	32.09	47.60	54.00	-6.40	Vertical
7215.00	28.94	36.15	11.66	31.99	44.76	54.00	-9.24	Vertical
9620.00	19.36	38.01	14.14	31.60	39.91	54.00	-14.09	Vertical
12025.00	*					54.00		Vertical
14430.00	*					54.00		Vertical
4810.00	36.76	31.78	8.60	32.09	45.05	54.00	-8.95	Horizontal
7215.00	24.49	36.15	11.66	31.99	40.31	54.00	-13.70	Horizontal
9620.00	19.83	38.01	14.14	31.60	40.38	54.00	-13.62	Horizontal
12025.00	*					54.00		Horizontal
14430.00	*					54.00		Horizontal

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*\*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel:	Middle
---------------	--------

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4890.00	53.83	31.86	8.67	32.13	62.23	74.00	-11.77	Vertical
7335.00	30.86	36.41	11.72	31.88	47.11	74.00	-26.89	Vertical
9780.00	28.88	38.43	14.27	31.62	49.96	74.00	-24.04	Vertical
12225.00	*					74.00		Vertical
14670.00	*					74.00		Vertical
4890.00	51.79	31.86	8.67	32.13	60.19	74.00	-13.81	Horizontal
7335.00	29.37	36.41	11.72	31.88	45.62	74.00	-28.38	Horizontal
9780.00	28.41	38.43	14.27	31.62	49.49	74.00	-24.51	Horizontal
12225.00	*					74.00		Horizontal
14670.00	*					74.00		Horizontal

**Average value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4890.00	27.40	31.86	8.67	32.13	35.80	54.00	-18.20	Vertical
7335.00	21.61	36.41	11.72	31.88	37.86	54.00	-16.14	Vertical
9780.00	18.93	38.43	14.27	31.62	40.01	54.00	-13.99	Vertical
12225.00	*					54.00		Vertical
14670.00	*					54.00		Vertical
4890.00	22.46	31.86	8.67	32.13	30.86	54.00	-23.14	Horizontal
7335.00	21.31	36.41	11.72	31.88	37.56	54.00	-16.44	Horizontal
9780.00	18.75	38.43	14.27	31.62	39.83	54.00	-14.17	Horizontal
12225.00	*					54.00		Horizontal
14670.00	*					54.00		Horizontal

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*\*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

Test channel:	Highest
---------------	---------

**Peak value:**

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4950.00	48.84	31.91	8.71	32.16	57.30	74.00	-16.70	Vertical
7425.00	35.20	36.56	11.79	31.80	51.75	74.00	-22.25	Vertical
9900.00	29.75	39.12	14.45	32.06	51.26	74.00	-22.74	Vertical
12375.00	*					74.00		Vertical
14850.00	*					74.00		Vertical
4950.00	49.85	31.91	8.71	32.16	58.31	74.00	-15.69	Horizontal
7425.00	33.47	36.56	11.79	31.80	50.02	74.00	-23.98	Horizontal
9900.00	31.04	39.12	14.35	32.06	52.45	74.00	-21.55	Horizontal
12375.00	*					74.00		Horizontal
14850.00	*					74.00		Horizontal

**Average value:**

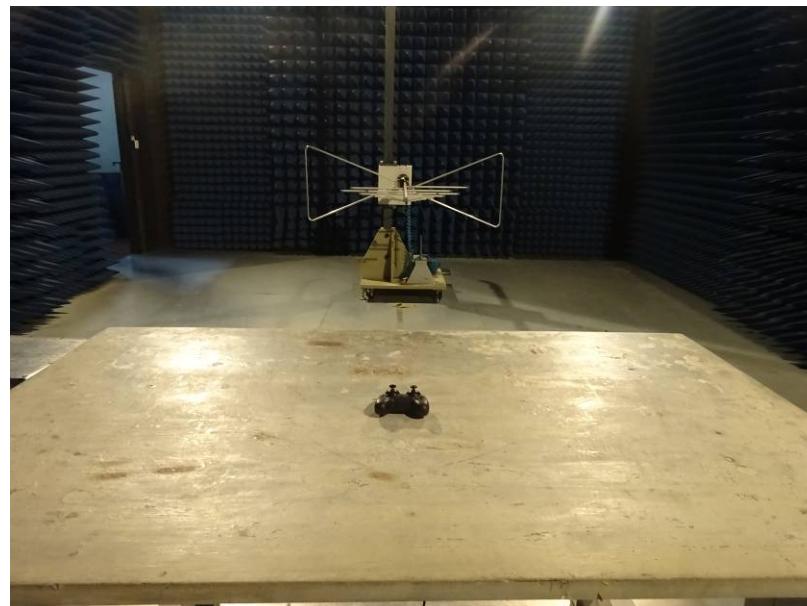
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4950.00	36.98	31.91	8.71	32.16	45.44	54.00	-8.56	Vertical
7425.00	24.33	36.56	11.79	31.80	40.88	54.00	-13.12	Vertical
9900.00	19.45	39.12	14.45	32.06	40.96	54.00	-13.04	Vertical
12375.00	*					54.00		Vertical
14850.00	*					54.00		Vertical
4950.00	35.86	31.91	8.71	32.16	44.32	54.00	-9.68	Horizontal
7425.00	24.53	36.56	11.79	31.80	41.08	54.00	-12.92	Horizontal
9900.00	20.05	39.12	14.35	32.06	41.46	54.00	-12.54	Horizontal
12375.00	*					54.00		Horizontal
14850.00	*					54.00		Horizontal

**Remark:**

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*\*”, means this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

## 7 Test Setup Photo

Radiated Emission



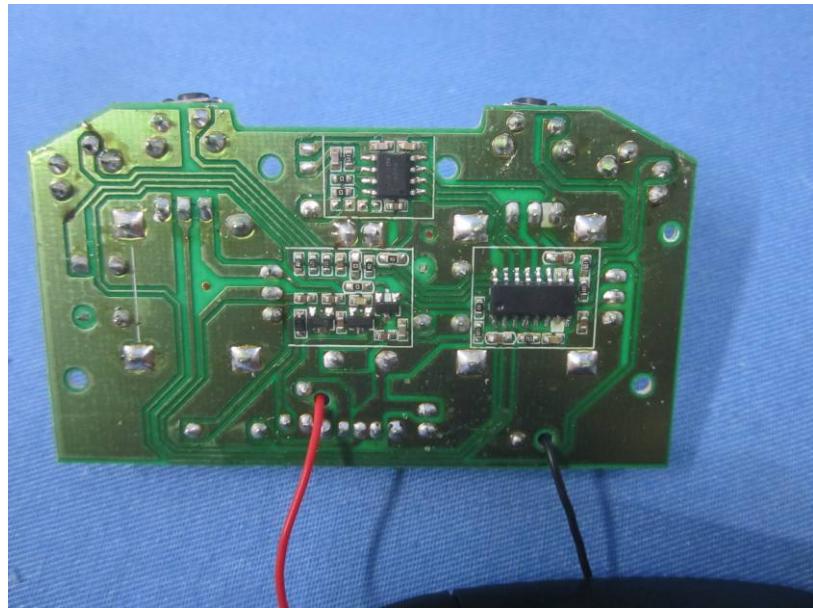
## 8 EUT Constructional Details













---End---