



FCC Report

Applicant: Firelands Group, LLC

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

Equipment Under Test (EUT)

Product Name: FLDSTX1

Model No.: FLDSTX1

FCC ID: 2AEIGFLDSTX1

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247:2014

Date of sample receipt: October 26, 2015

Date of Test: October 27-28, 2015

Date of report issued: October 29, 2015

Test Result : PASS *

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

Authorized Signature:

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.

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2 Version

Version No.	Date	Description
00	October 29, 2015	Original

Prepared By:

Edward. Pan

Date:

October 29, 2015

Project Engineer

Check By:

Hank. Yan

Date:

October 29, 2015

Reviewer

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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(a)(1)	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.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(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 USA
Manufacturer/Factory:	Firelands Group, LLC
Address of Manufacturer/Factory:	1214 Dorchester Dr, 2919 Crossing Court Suite 2, Champaign, IL 61822 USA

5.2 General Description of EUT

Product Name:	FLDSTX1
Model No.:	FLDSTX1
Operation Frequency:	2409.2MHz~2474.0MHz
Channel numbers:	109
Modulation technology:	GFSK
Antenna Type:	Integral Antenna
Antenna gain:	2dBi
Power supply:	DC 2.0V~3.6V

Remark: The system works in the frequency range of 2409.2MHz to 2474MHz. This band has been divided to 109 independent channels. Each radio system uses 21 different channels, the minimum channel separation is ≥ 1.2 MHz. By using various switch-on times, hopping scheme and channel frequencies, the system can guarantee a jamming free radio transmission. The channel list is below.

Operation Frequency each of channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2409.20	29	2426.00	57	2442.80	85	2459.60
2	2409.80	30	2426.60	58	2443.40	86	2460.20
3	2410.40	31	2427.20	59	2444.00	87	2460.80
4	2411.00	32	2427.80	60	2444.60	88	2461.40
5	2411.60	33	2428.40	61	2445.20	89	2462.00
6	2412.20	34	2429.00	62	2445.80	90	2462.60
7	2412.80	35	2429.60	63	2446.40	91	2463.20
8	2413.40	36	2430.20	64	2447.00	92	2463.80
9	2414.00	37	2430.80	65	2447.60	93	2464.40
10	2414.60	38	2431.40	66	2448.20	94	2465.00
11	2415.20	39	2432.00	67	2448.80	95	2465.60
12	2415.80	40	2432.60	68	2449.40	96	2466.20
13	2416.40	41	2433.20	69	2450.00	97	2466.80
14	2417.00	42	2433.80	70	2450.60	98	2467.40
15	2417.60	43	2434.40	71	2451.20	99	2468.00
16	2418.20	44	2435.00	72	2451.80	100	2468.60
17	2418.80	45	2435.60	73	2452.40	101	2469.20
18	2419.40	46	2436.20	74	2453.00	102	2469.80
19	2420.00	47	2436.80	75	2453.60	103	2470.40
20	2420.60	48	2437.40	76	2454.20	104	2471.00
21	2421.20	49	2438.00	77	2454.80	105	2471.60
22	2421.80	50	2438.60	78	2455.40	106	2472.20
23	2422.40	51	2439.20	79	2456.00	107	2472.80
24	2423.00	52	2439.80	80	2456.60	108	2473.40
25	2423.60	53	2440.40	81	2457.20	109	2474.00
26	2424.20	54	2441.00	82	2457.80		
27	2424.80	55	2441.60	83	2458.40		
28	2425.40	56	2442.20	84	2459.00		

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	2409.2MHz
The middle channel	2441.6MHz
The Highest channel	2474.0MHz

5.3 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
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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 28, 2013.

• **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, June 26, 2013.

5.5 Test Location

All other tests were performed at:

Global United Technology Services Co., Ltd.

Address: Room 301-309, 3th Floor, Block A, Huafeng Jinyuan Business Building, No. 300 Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen 518102

Tel: 0755-27798480

Fax: 0755-27798960

5.6 Other Information Requested by the Customer

None.

5.7 Description of Support Units

Manufacturer	Description	Model	Serial Number	FCC Approval
MEILI	AC-DC Power Source	MCH-305A	N/A	Verification

5.8 Test Instruments list

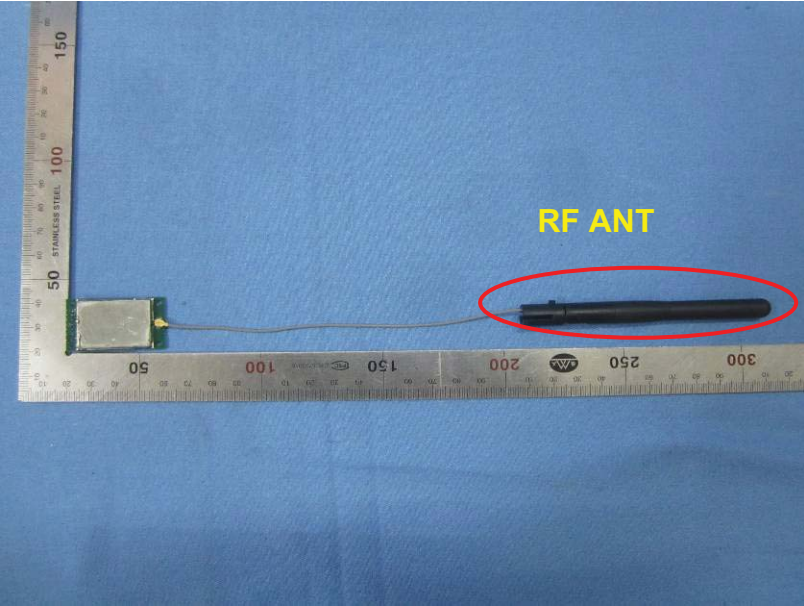
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 28 2015	Mar. 27 2016
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS536	Jul. 04 2015	Jul. 03 2016
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jul. 04 2015	Jul. 03 2016
5	Loop Antenna	ZHINAN	ZN30900A	GTS534	Feb. 22 2015	Feb. 21 2016
6	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Feb. 22 2015	Feb. 21 2016
7	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	Jul. 04 2015	Jul. 03 2016
8	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 28 2015	Mar. 27 2016
9	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
10	Coaxial Cable	GTS	N/A	GTS213	Mar. 28 2015	Mar. 27 2016
11	Coaxial Cable	GTS	N/A	GTS211	Mar. 28 2015	Mar. 27 2016
12	Coaxial cable	GTS	N/A	GTS210	Mar. 28 2015	Mar. 27 2016
13	Coaxial Cable	GTS	N/A	GTS212	Mar. 28 2015	Mar. 27 2016
14	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jul. 04 2015	Jul. 03 2016
15	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jul. 04 2015	Jul. 03 2016
16	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	Jul. 04 2015	Jul. 03 2016
17	Band filter	Amindeon	82346	GTS219	Mar. 28 2015	Mar. 27 2016

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	Sep. 06 2015	Sep. 05 2017
2	EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	June 30 2015	June 29 2016
3	10dB Pulse Limita	Rohde & Schwarz	N/A	GTS224	June 30 2015	June 29 2016
4	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 30 2015	June 29 2016
5	LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	GTS226	June 30 2015	June 29 2016
6	Coaxial Cable	GTS	N/A	GTS227	June 30 2015	June 29 2016
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	July 07 2015	July 06 2016

6 Test results and Measurement Data

6.1 Antenna requirement

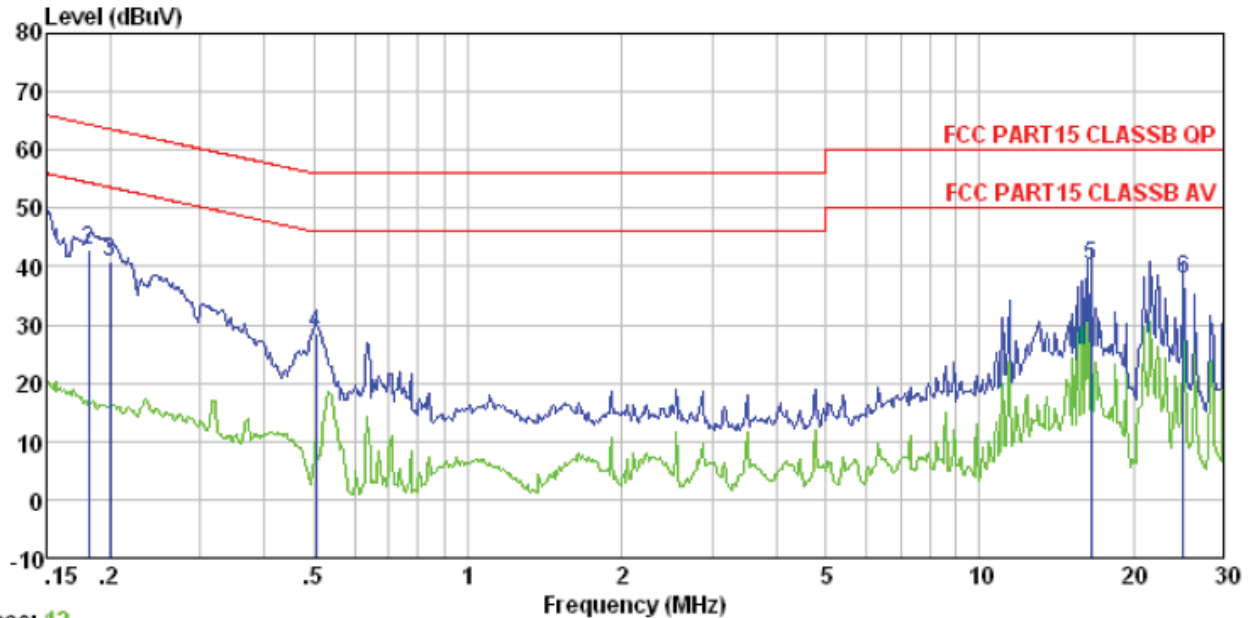
Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<p>15.203 requirement:</p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that 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.</p> <p>15.247(c) (1)(i) requirement:</p> <p>(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.</p>	
EUT Antenna:	
<p><i>The antenna is integral Antenna, the best case gain of the antenna is 2dBi</i></p> 	

6.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.10:2013		
Test Frequency Range:	150KHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test setup:	<div><p style="text-align: center;">Reference Plane</p><p style="text-align: center;">Test table/Insulation plane</p><p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>		
Test procedure:	<div><div>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</div></div>		
Test Instruments:	Refer to section 5.8 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Pass		

Measurement data

Line:



Trace: 12

Condition : FCC PART15 CLASSB QP LISN-2013 LINE

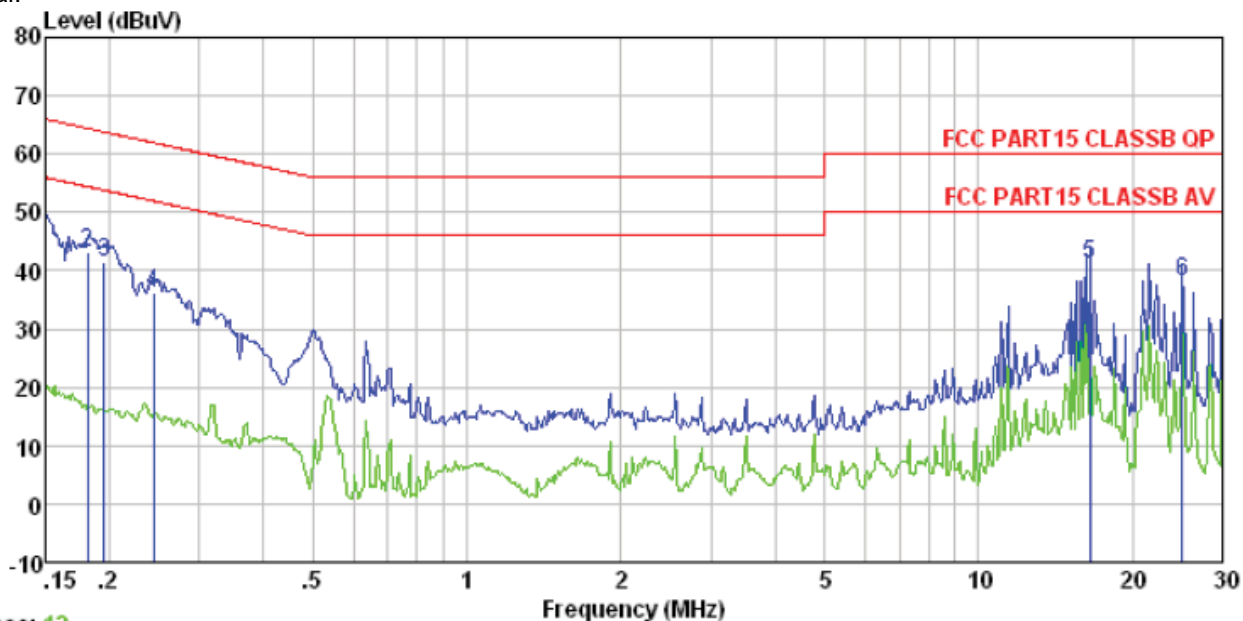
Job No. : 1573RF

Test mode : Transmitting mode

Test Engineer: Joe

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	46.29	0.15	0.12	46.56	66.00	-19.44	QP
2	0.182	42.54	0.14	0.13	42.81	64.42	-21.61	QP
3	0.200	40.67	0.14	0.13	40.94	63.62	-22.68	QP
4	0.505	28.27	0.12	0.11	28.50	56.00	-27.50	QP
5	16.486	39.68	0.39	0.22	40.29	60.00	-19.71	QP
6	25.055	36.33	1.15	0.23	37.71	60.00	-22.29	QP

Neutral:



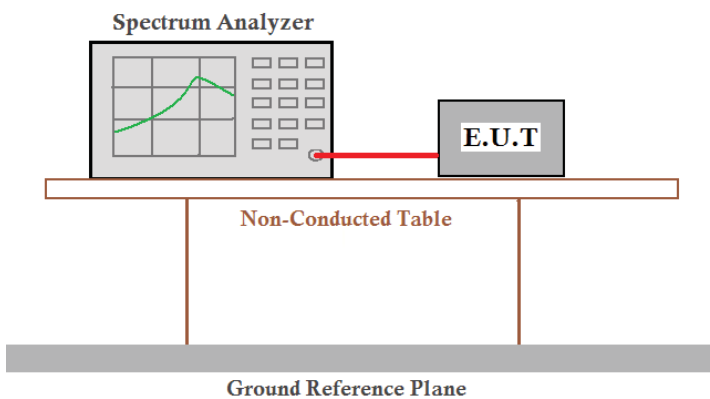
Condition : FCC PART15 CLASSB QP LISN-2013 NEUTRAL
 Job No. : 1573RF
 Test mode : Transmitting mode
 Test Engineer: Joe

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	46.49	0.07	0.12	46.68	66.00	-19.32	QP
2	0.182	42.83	0.07	0.13	43.03	64.42	-21.39	QP
3	0.195	41.26	0.07	0.13	41.46	63.80	-22.34	QP
4	0.244	35.91	0.06	0.11	36.08	61.95	-25.87	QP
5	16.486	40.49	0.37	0.22	41.08	60.00	-18.92	QP
6	25.055	36.95	1.05	0.23	38.23	60.00	-21.77	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

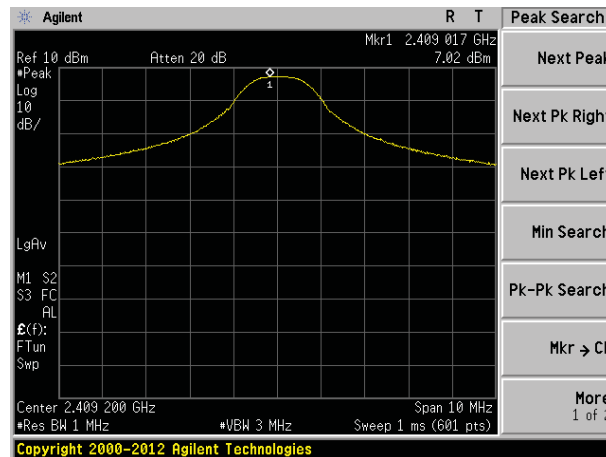
6.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	DA 00-705, ANSI C63.10:2013
Limit:	20.97dBm (125mW)
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is 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

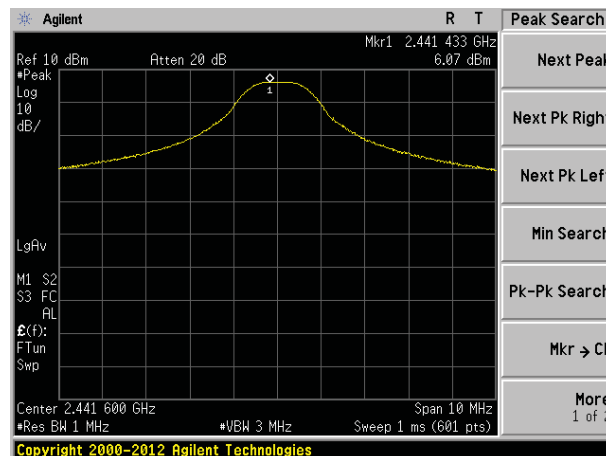
Measurement Data

Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	7.02	20.97	Pass
Middle	6.07		
Highest	5.11		

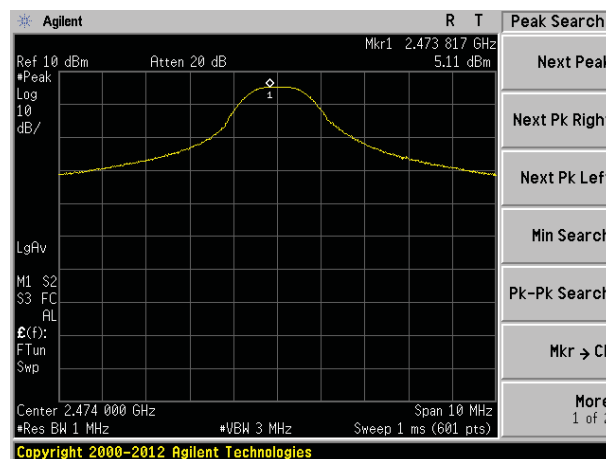
Test plot as follows:



Lowest channel

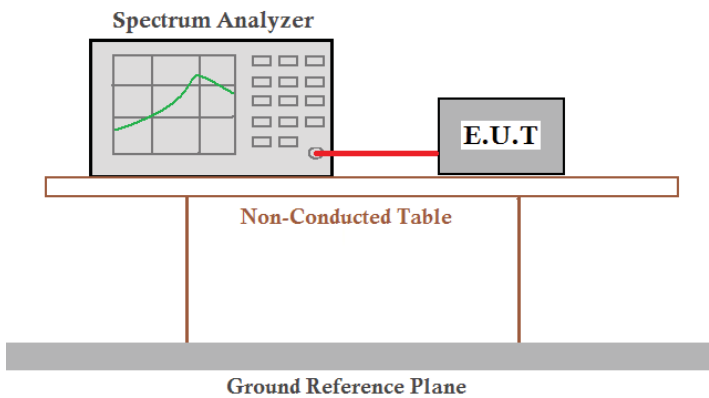


Middle channel



Highest channel

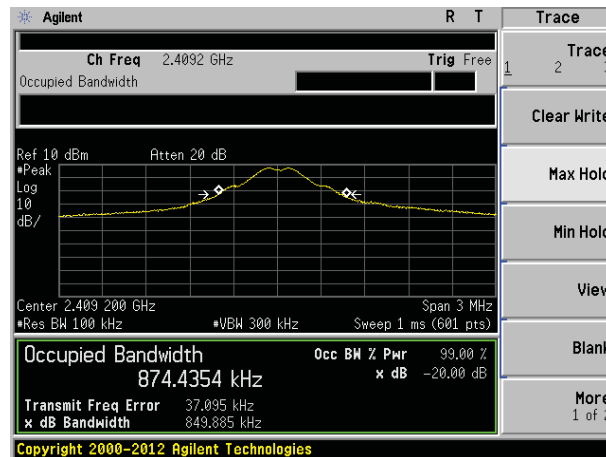
6.4 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	DA 00-705, ANSI C63.10:2013
Limit:	N/A
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is 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

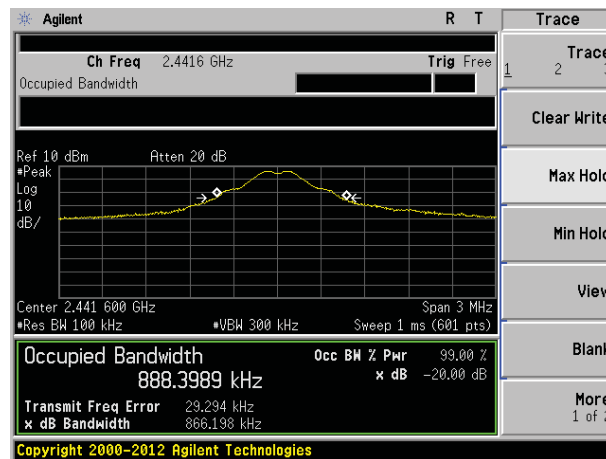
Measurement Data

Test channel	20dB Emission Bandwidth (MHz)	Result
Lowest	0.850	Pass
Middle	0.866	
Highest	0.862	

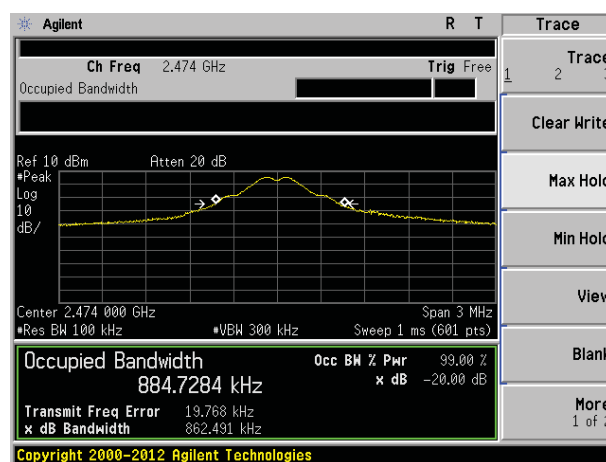
Test plot as follows:



Lowest channel

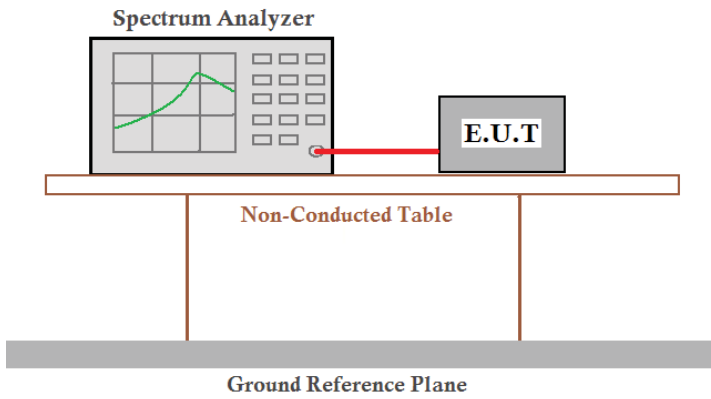


Middle channel



Highest channel

6.5 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>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by 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

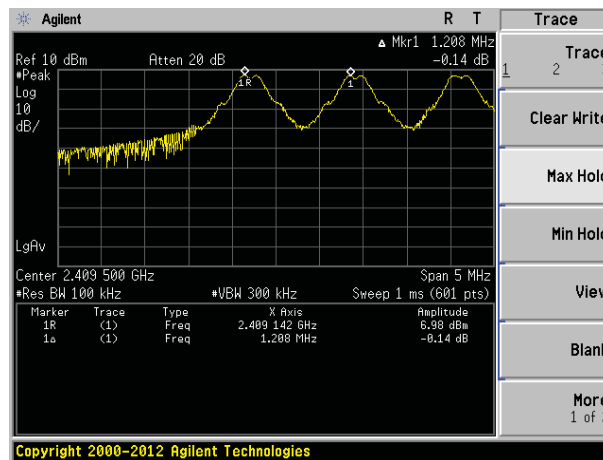
Measurement Data

Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1208	577	Pass
Middle	1808	577	Pass
Highest	5400	577	Pass

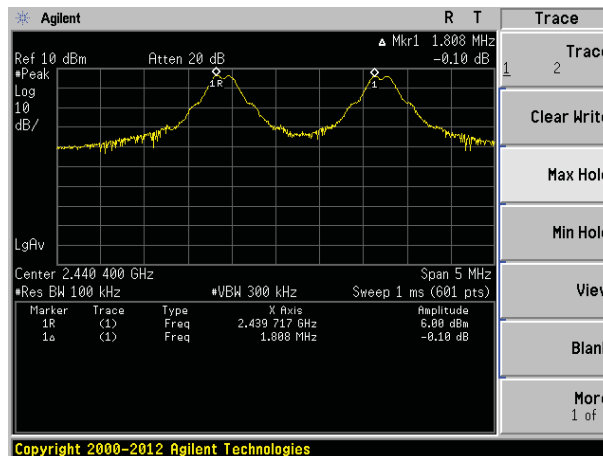
Note: According to section 6.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	866	577

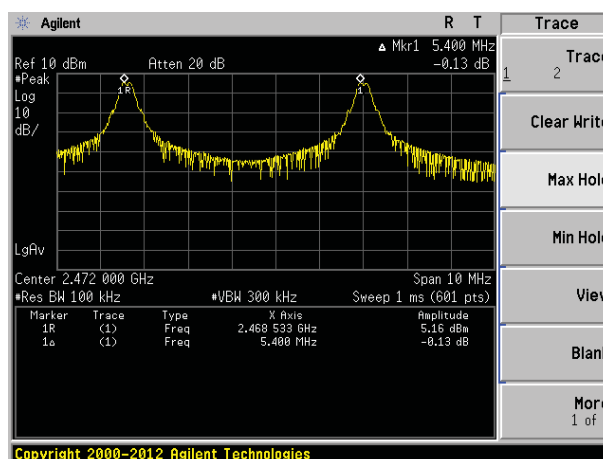
Test plot as follows:



Lowest channel

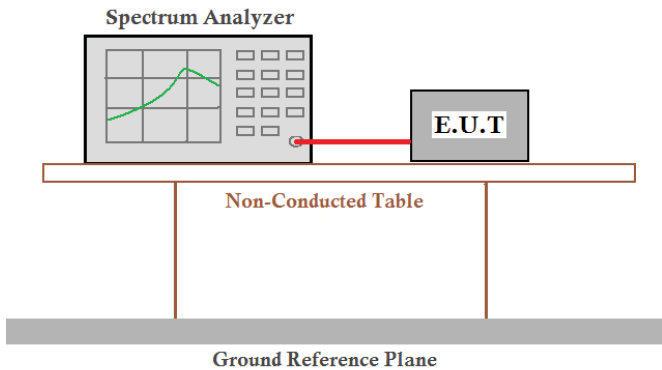


Middle channel



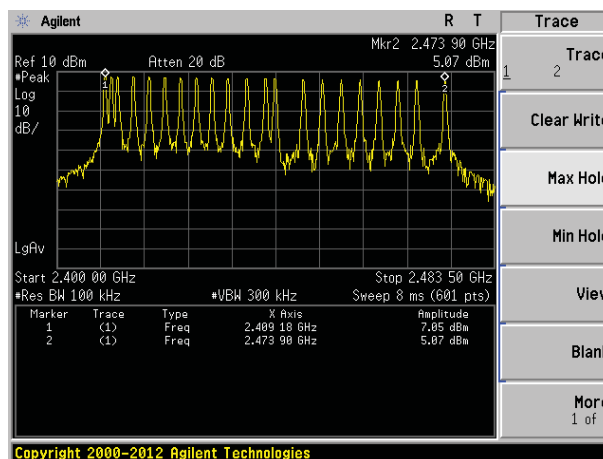
Highest channel

6.6 Hopping Channel Number

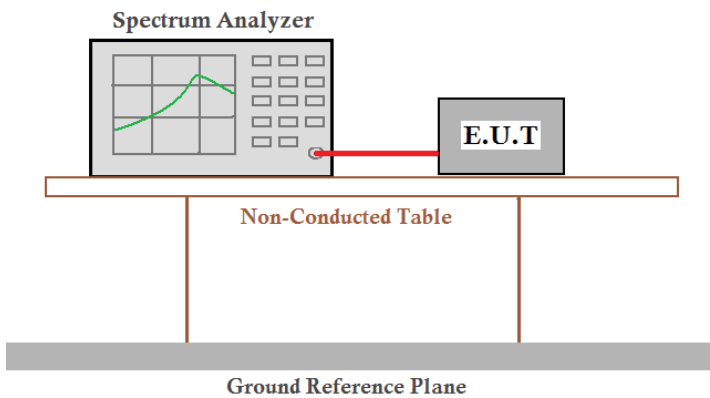
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3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

Measurement Data:

Hopping channel numbers	Limit	Result
21	15	Pass



6.7 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:	
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
2.4092GHz	1.635	31.065	400	Pass
2.4416GHz	1.640	31.160	400	Pass
2.474GHz	1.635	31.065	400	Pass

The formula as below:

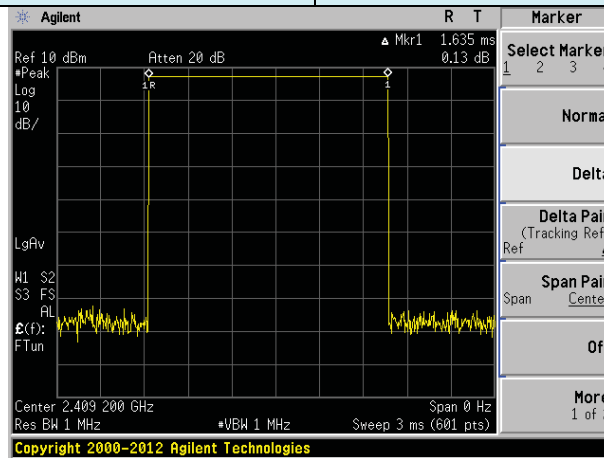
2409.2MHz: Dwell time = Ton * Ton times in 0.4s * channel numbers=1.635ms*19=31.065ms

2441.6MHz: Dwell time = Ton * Ton times in 0.4s * channel numbers=1.64ms*19=31.160ms

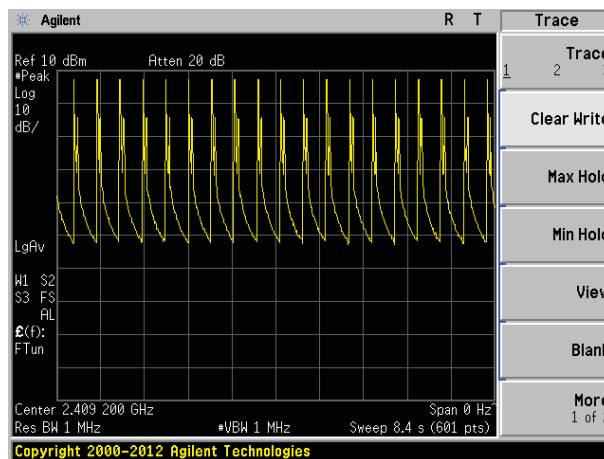
2474.0MHz: Dwell time = Ton * Ton times in 0.4s * channel numbers=1.635ms*19=31.065ms

Test plot as follows:

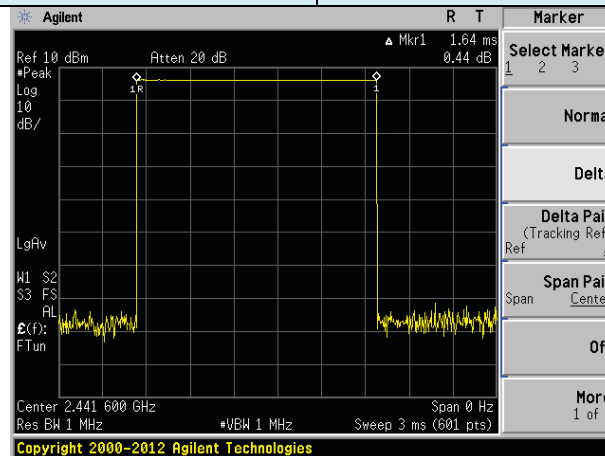
Frequency:	2409.2MHz
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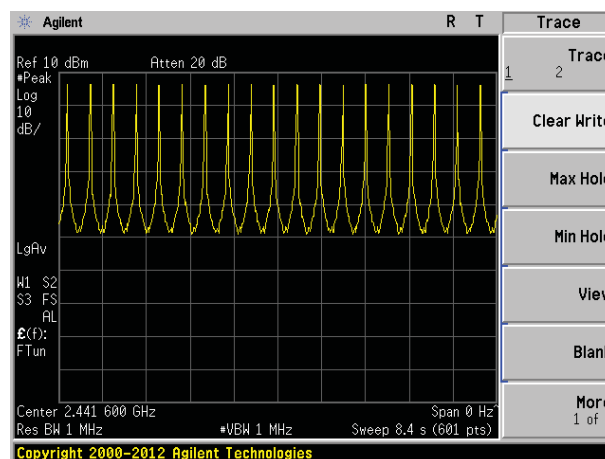
Ton



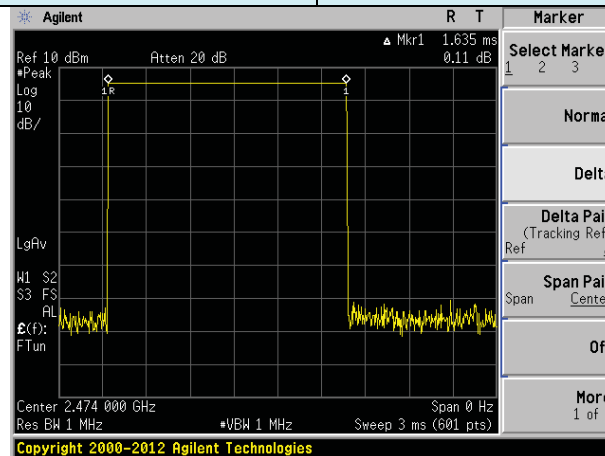
Frequency:	2441.6MHz
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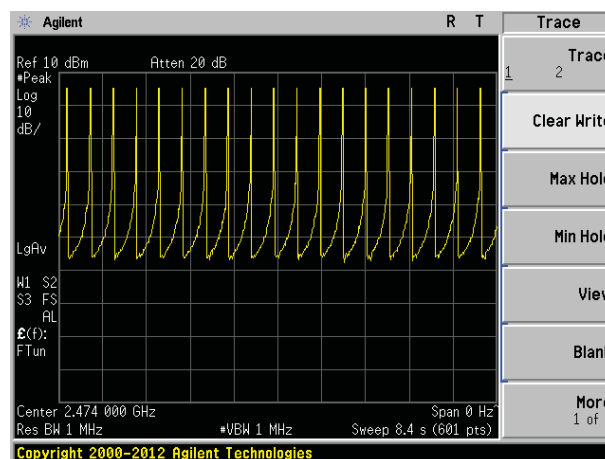
Ton



Frequency:	2474.0MHz
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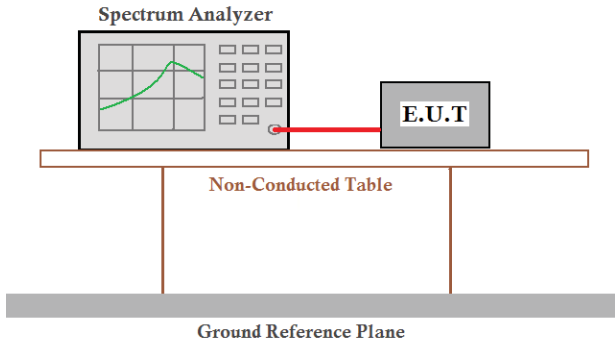


Ton

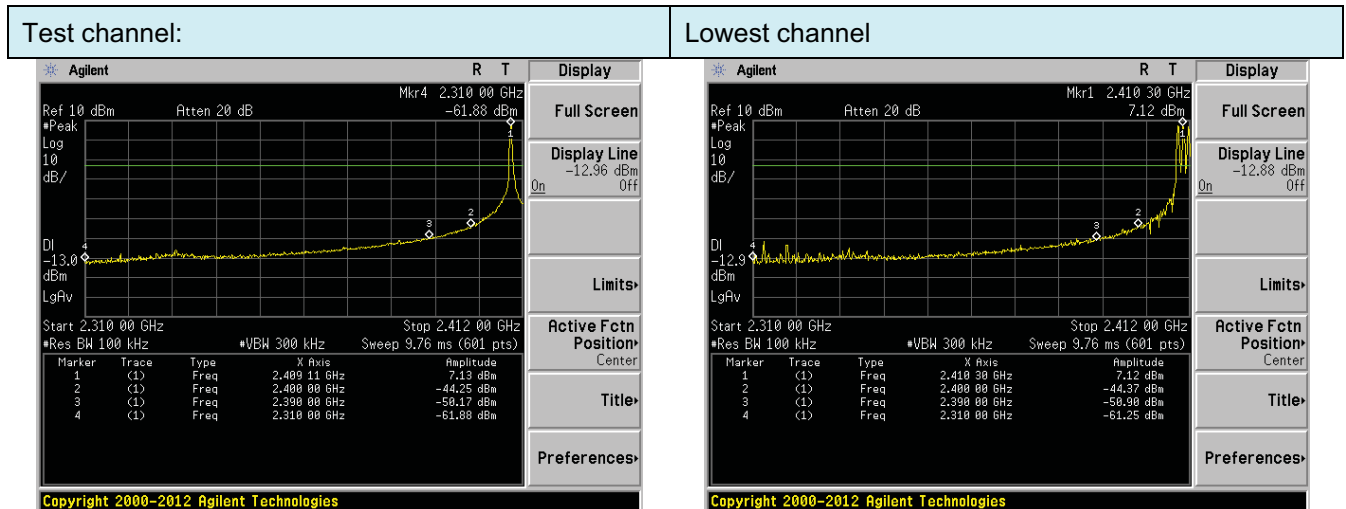


6.8 Band Edge

6.8.1 Conducted Emission Method

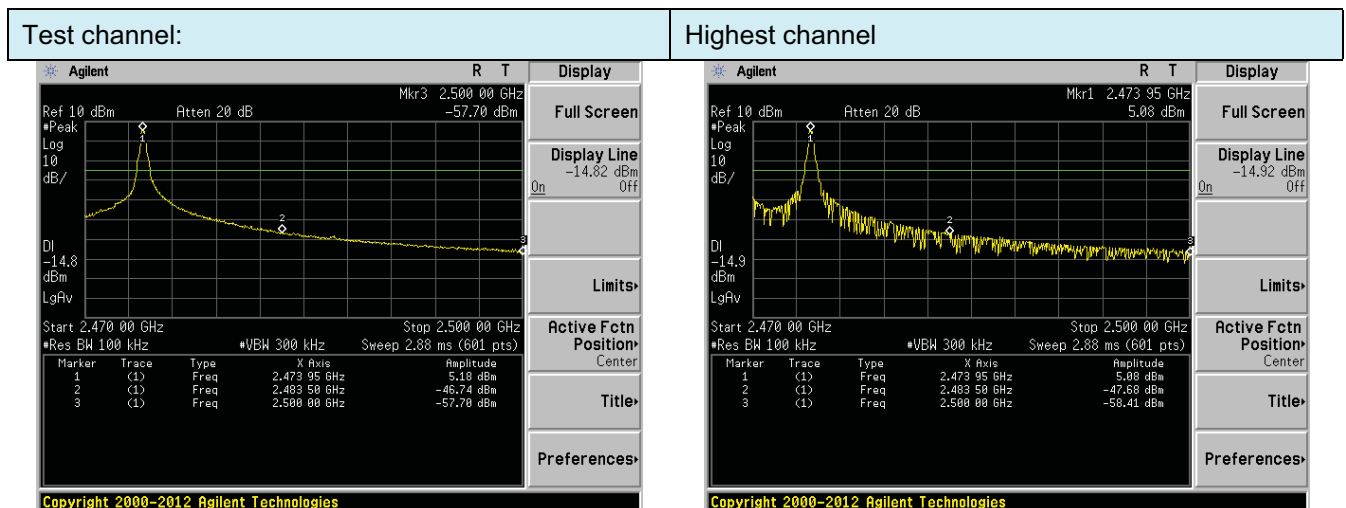
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	DA 00-705, ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is 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:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by 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

Test plot as follows:



No-hopping mode

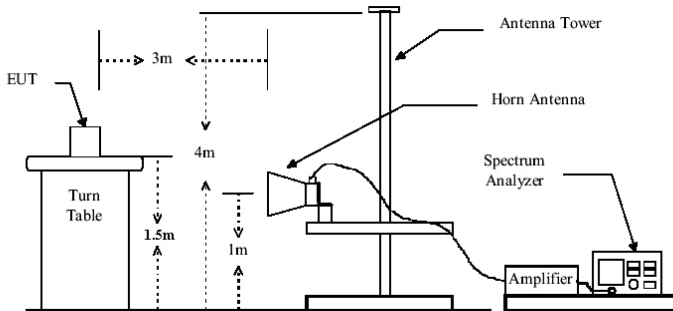
Hopping mode



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:	<div>1. 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.</div> <div>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.</div> <div>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.</div> <div>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.</div> <div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div> <div>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.</div>				
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.

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390.00	56.81	27.59	5.38	30.18	59.60	74.00	-14.40	Vertical
2400.00	65.00	27.58	5.39	30.18	67.79	74.00	-6.21	Vertical
2390.00	45.97	27.59	5.38	30.18	48.76	74.00	-25.24	Horizontal
2400.00	53.19	27.58	5.39	30.18	55.98	74.00	-18.02	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2390.00	33.07	27.59	5.38	30.18	35.86	54.00	-18.14	Vertical
2400.00	34.54	27.58	5.39	30.18	37.33	54.00	-16.67	Vertical
2390.00	32.23	27.59	5.38	30.18	35.02	54.00	-18.98	Horizontal
2400.00	32.58	27.58	5.39	30.18	35.37	54.00	-18.63	Horizontal

Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	63.60	27.53	5.47	29.93	66.67	74.00	-7.33	Vertical
2500.00	51.19	27.55	5.49	29.93	54.30	74.00	-19.70	Vertical
2483.50	46.18	27.53	5.47	29.93	49.25	74.00	-24.75	Horizontal
2500.00	44.11	27.55	5.49	29.93	47.22	74.00	-26.78	Horizontal

Average value:

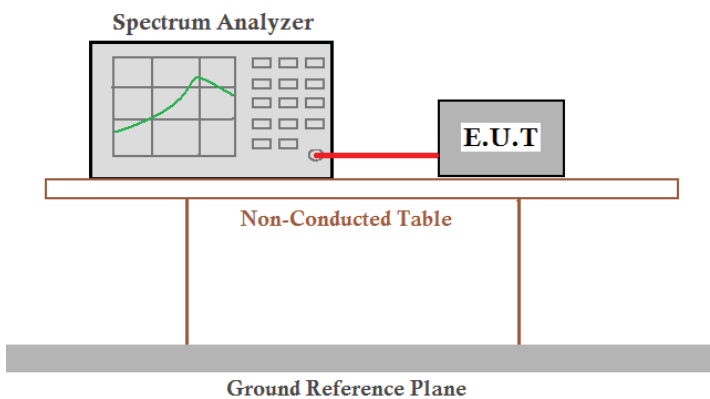
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	34.26	27.53	5.47	29.93	37.33	54.00	-16.67	Vertical
2500.00	33.47	27.55	5.49	29.93	36.58	54.00	-17.42	Vertical
2483.50	33.24	27.53	5.47	29.93	36.31	54.00	-17.69	Horizontal
2500.00	32.81	27.55	5.49	29.93	35.92	54.00	-18.08	Horizontal

Remark:

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

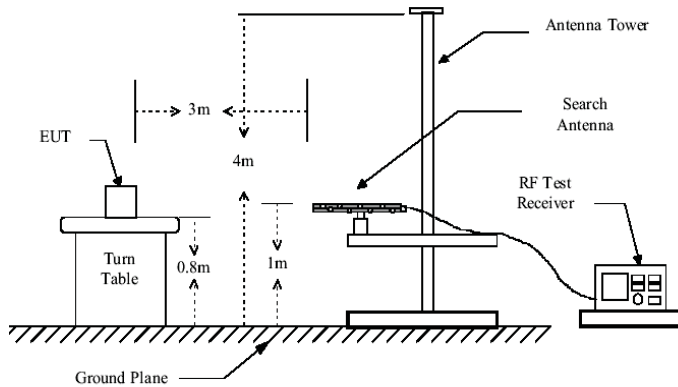
6.9 Spurious Emission

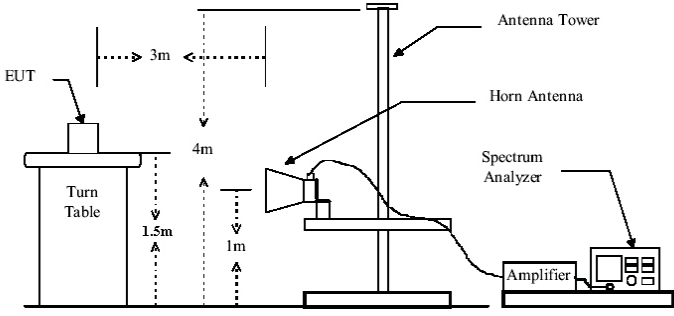
6.9.1 Conducted Emission Method

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:	 <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane, represented by a thick grey bar.</p>
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-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit: (Spurious Emissions)	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz--0.490MHz	2400/F(KHz)	PK,AV,QP	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	30m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Test setup:	Below 1GHz				
	<div></div>				
Test setup:	Above 1GHz				

	
<p>Test Procedure:</p>	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table (0.8m for below 1GHz and 1.5 meters 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. 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. 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. 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. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 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.
<p>Test Instruments:</p>	<p>Refer to section 5.8 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 for details</p>
<p>Test results:</p>	<p>Pass</p>

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.

Measurement data:
■ 30MHz ~ 1GHz

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
50.06	23.66	15.25	0.77	30.00	9.68	40.00	-30.32	Vertical
92.79	24.90	14.41	1.13	29.73	10.71	43.50	-32.79	Vertical
108.65	23.86	14.39	1.27	29.64	9.88	43.50	-33.62	Vertical
236.65	22.27	13.93	2.05	29.54	8.71	46.00	-37.29	Vertical
324.46	22.59	15.53	2.49	29.86	10.75	46.00	-35.25	Vertical
656.53	22.40	20.66	3.94	29.24	17.76	46.00	-28.24	Vertical
55.61	24.23	14.97	0.82	29.95	10.07	40.00	-29.93	Horizontal
95.76	23.06	14.90	1.16	29.72	9.40	43.50	-34.10	Horizontal
113.32	24.45	13.63	1.31	29.61	9.78	43.50	-33.72	Horizontal
194.45	23.30	12.56	1.81	29.22	8.45	43.50	-35.05	Horizontal
325.60	24.46	15.59	2.49	29.85	12.69	46.00	-33.31	Horizontal
654.23	22.75	20.65	3.93	29.24	18.09	46.00	-27.91	Horizontal

■ Above 1GHz

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4818.40	37.90	31.79	8.61	32.09	46.21	74.00	-27.79	Vertical
7227.60	44.05	36.19	11.66	31.99	59.91	74.00	-14.09	Vertical
9636.80	29.35	37.95	14.14	31.62	49.82	74.00	-24.18	Vertical
12046.00	*					74.00		Vertical
14455.20	*					74.00		Vertical
4818.40	33.46	31.79	8.61	32.09	41.77	74.00	-32.23	Horizontal
7227.60	35.33	36.19	11.66	31.99	51.19	74.00	-22.81	Horizontal
9636.80	27.93	37.95	14.14	31.62	48.40	74.00	-25.60	Horizontal
12046.00	*					74.00		Horizontal
14455.20	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4818.40	30.95	31.79	8.61	32.09	39.26	54.00	-14.74	Vertical
7227.60	37.25	36.19	11.66	31.99	53.11	54.00	-0.89	Vertical
9636.80	22.50	37.95	14.14	31.62	42.97	54.00	-11.03	Vertical
12046.00	*					54.00		Vertical
14455.20	*					54.00		Vertical
4818.40	26.06	31.79	8.61	32.09	34.37	54.00	-19.63	Horizontal
7227.60	27.75	36.19	11.66	31.99	43.61	54.00	-10.39	Horizontal
9636.80	20.65	37.95	14.14	31.62	41.12	54.00	-12.88	Horizontal
12046.00	*					54.00		Horizontal
14455.20	*					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
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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
4883.20	45.35	31.85	8.66	32.12	53.74	74.00	-20.26	Vertical
7324.80	48.05	36.37	11.72	31.89	64.25	74.00	-9.75	Vertical
9766.40	33.81	38.35	14.25	31.62	54.79	74.00	-19.21	Vertical
12208.00	*					74.00		Vertical
14649.60	*					74.00		Vertical
4883.20	44.03	31.85	8.66	32.12	52.42	74.00	-21.58	Horizontal
7324.80	42.30	36.37	11.72	31.89	58.50	74.00	-15.50	Horizontal
9766.40	35.19	38.35	14.25	31.62	56.17	74.00	-17.83	Horizontal
12208.00	*					74.00		Horizontal
14649.60	*					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
4883.20	28.91	31.85	8.66	32.12	37.30	54.00	-16.70	Vertical
7324.80	34.82	36.37	11.72	31.89	51.02	54.00	-2.98	Vertical
9766.40	21.18	38.35	14.25	31.62	42.16	54.00	-11.84	Vertical
12208.00	*					54.00		Vertical
14649.60	*					54.00		Vertical
4883.20	25.27	31.85	8.66	32.12	33.66	54.00	-20.34	Horizontal
7324.80	27.44	36.37	11.72	31.89	43.64	54.00	-10.36	Horizontal
9766.40	21.18	38.35	14.25	31.62	42.16	54.00	-11.84	Horizontal
12208.00	*					54.00		Horizontal
14649.60	*					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
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4948.00	45.60	31.91	8.71	32.16	54.06	74.00	-19.94	Vertical
7422.00	49.12	36.56	11.79	31.80	65.67	74.00	-8.33	Vertical
9896.00	33.30	38.81	14.38	31.88	54.61	74.00	-19.39	Vertical
12370.00	*					74.00		Vertical
14844.00	*					74.00		Vertical
4948.00	43.39	31.91	8.71	32.16	51.85	74.00	-22.15	Horizontal
7422.00	44.18	36.56	11.79	31.80	60.73	74.00	-13.27	Horizontal
9896.00	35.48	38.81	14.38	31.88	56.79	74.00	-17.21	Horizontal
12370.00	*					74.00		Horizontal
14844.00	*					74.00		Horizontal

Average value:

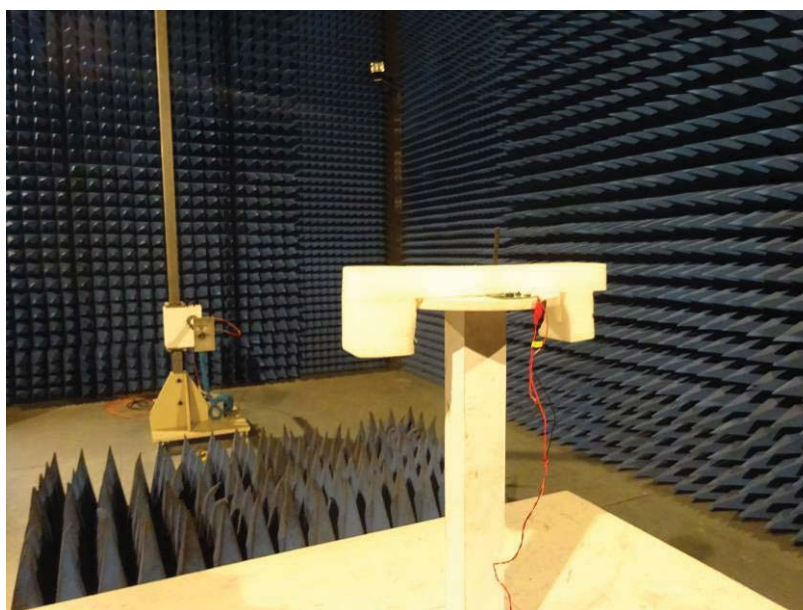
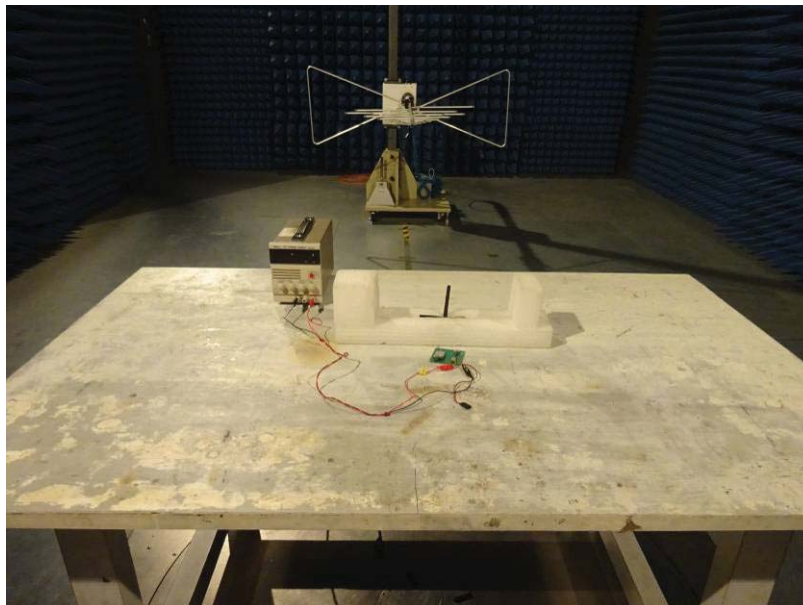
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4948.00	29.99	31.91	8.71	32.16	38.45	54.00	-15.55	Vertical
7422.00	36.52	36.56	11.79	31.80	53.07	54.00	-0.93	Vertical
9896.00	21.27	38.81	14.38	31.88	42.58	54.00	-11.42	Vertical
12370.00	*					54.00		Vertical
14844.00	*					54.00		Vertical
4948.00	25.60	31.91	8.71	32.16	34.06	54.00	-19.94	Horizontal
7422.00	30.03	36.56	11.79	31.80	46.58	54.00	-7.42	Horizontal
9896.00	22.15	38.81	14.38	31.88	43.46	54.00	-10.54	Horizontal
12370.00	*					54.00		Horizontal
14844.00	*					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

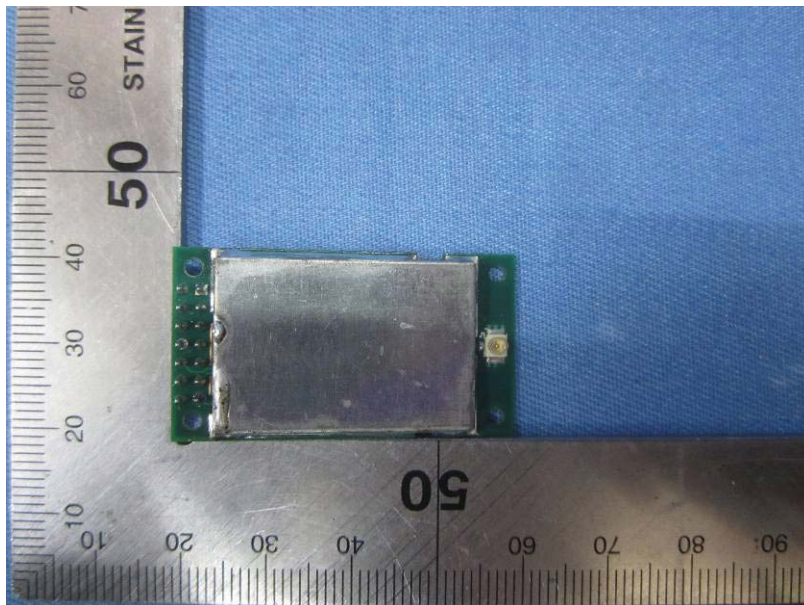
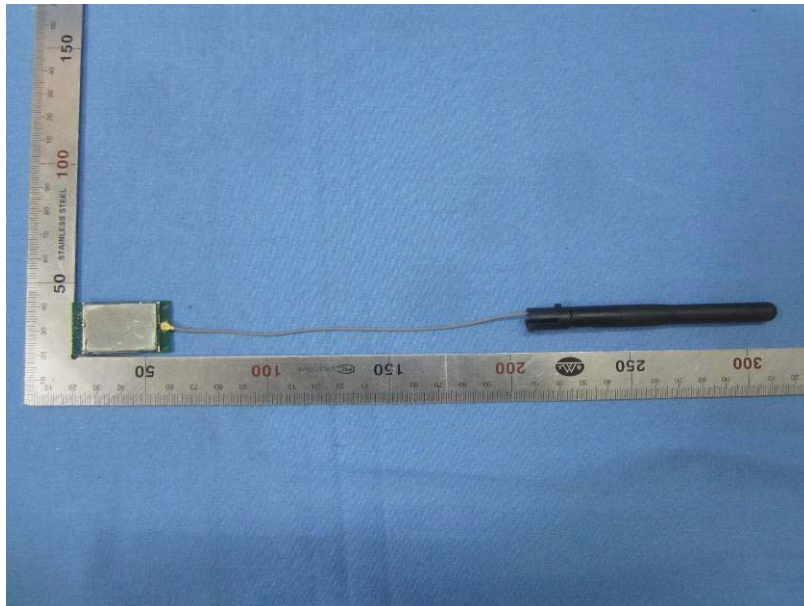
Radiated Emission

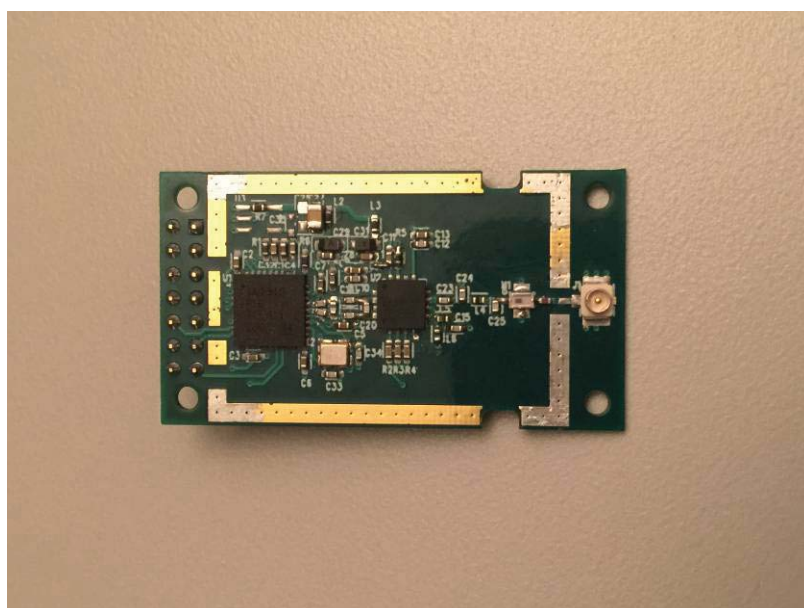
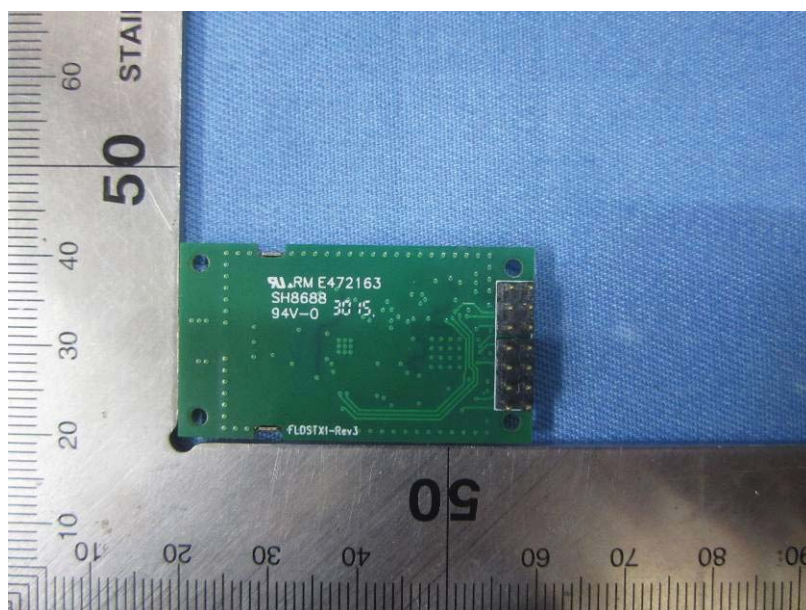


Conducted Emission



8 EUT Constructional Details







---End---