TEST REPORT

for

Eleven Engineering Inc.
Talisa

Model Number: PL5571

FCC ID: OP5PL5571

IC: 3534A-PL5571

Prepared for	:	Eleven Engineering Inc.
Address	:	10150-100 street, Suite 800, Edmonton, Alberta, Canada, T5J 0P6.
Prepared by	:	Keyway Testing Technology Co., Ltd.
Address	:	Building 1, Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China
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Report No.	:	15KWE113251F
Date of Test	:	Nov. 13-18, 2015
Date of Report	:	Nov. 19, 2015

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Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	Eleven Engineering Inc. 10150-100 street, Suite 800, Edmonton, Alberta, Canada, T5J 0P6.		
Manufacturer: **Address:**	Eleven Engineering Inc. 10150-100 street, Suite 800, Edmonton, Alberta, Canada, T5J 0P6.		
E.U.T:	Talisa		
Model Number:	PL5571		
Trade Name:	SKAA	**Serial No.:**	------
Date of Receipt:	Nov.12, 2015	**Date of Test:**	Nov.13-18, 2015
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2014 ANSI C63.10:2013 RSS-247 Issue 1 May 2015 RSS-Gen Issue 4 November 2014		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date:Nov. 19, 2015**		

Tested by:	Reviewed by:	Approved by:
Keven Wu/ Engineer	Mike Xu / Supervisor	Andy Gao / Supervisor

Other Aspects:
None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207/ RSS-Gen §8.8	PASS
Radiated Emissions	15.205(a)/15.209 15.247(d) / RSS-Gen §6.13	PASS
20dB Bandwidth	15.247(a)(1) / RSS-247 §5.1(1) &RSS-Gen§6.6	PASS
99% Bandwidth	RSS-247 §5.1(1) &RSS-Gen§6.6	PASS
Frequency Separation	15.247(a)(1) / RSS-247 §5.1(2)	PASS
Maximum Peak Output Power	15.247(b)(1) / RSS-247§5.4(2) &RSS-Gen§6.12	PASS
Number of Hopping Frequency	15.247(a)(1)(iii) / RSS-247 §5.1(4)	PASS
Dwell time	15.247(a)(1)(iii) / RSS-247 §5.1(4)	PASS
Emissions from out of band	15.247(d) / RSS-247 §5.5	PASS
Antenna Requirement	15.203/ RSS-Gen§8.3	PASS

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

Product Name:	Talisa
Model No.:	PL5571
Operation Frequency:	2403.585MHz~2477.313MHz
Channel numbers:	49 Channels
Modulation technology:	FSK
Antenna Type:	PCB
Antenna gain:	2dBi
Power supply:	DC 5V

2.3. Difference between Model Numbers

N/A

2.4. Product Version

Product SW version	Talisa V1.0
Product HW version	Talisa V1.0
Radio SW version	V1.0
Radio HW version	V1.0
Test SW Version	V1.5.1
RF power setting in TEST SW	18.5dBm(max)

2.5. Independent Operation Modes

The basic operation modes are:

2.5.1. EUT work continues TX mode and frequency as below:

Modulation	Channel	Frequency
FSK	Low	2403.585MHz
	Middle	2438.913MHz
	High	2477.313MHz

2.6. Test Supporting System

None.

2.7. Channel List

Channel List					
Ch Number	Center Frequency (MHz)	Ch Number	Center Frequency (MHz)	Ch #	Center Frequency (MHz)
1	2403.585	18	2429.697	35	2455.809
2	2405.121	19	2431.233	36	2457.345
3	2406.657	20	2432.769	37	2458.881
4	2408.193	21	2434.305	38	2460.417
5	2409.729	22	2435.841	39	2461.953
6	2411.265	23	2437.377	40	2463.489
7	2412.801	24	2438.913	41	2465.025
8	2414.337	25	2440.449	42	2466.561
9	2415.873	26	2441.985	43	2468.097
10	2417.409	27	2443.521	44	2469.633
11	2418.945	28	2445.057	45	2471.169
12	2420.481	29	2446.593	46	2472.705
13	2422.017	30	2448.129	47	2474.241
14	2423.553	31	2449.665	48	2475.777
15	2425.089	32	2451.201	49	2477.313
16	2426.625	33	2452.737		
17	2428.161	34	2454.273		

2.8. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.
Registration No.: UA 50207153
Date of registration: July 13, 2011

Certificated by UL, USA
Registration No.: 100567-237
Date of registration: September 1, 2011

Certificated by Intertek
Registration No.: 2011-RTL-L1-31
Date of registration: October 11, 2011

Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Building 1, Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China

2.9. List of Test and Measurement Instruments

2.9.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,15	Apr. 27,16
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,15	Apr. 27,16
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,15	Apr. 27,16

2.9.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,15	Apr. 27,16
System Simulator	Agilent	E5515C	GB43130245	Apr. 27,15	Apr. 27,16
Power Splitter	Weinschel	1506A	NW425	Apr. 27,15	Apr. 27,16
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 27,15	Apr. 27,16
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,15	Apr. 27,16
Signal Amplifier	SONOMA	310	187016	Apr. 27,15	Apr. 27,16
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,15	Apr. 27,16
RF Cable	IMRO	IMRO-400	966 Cable 1#	N/A	N/A
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna	DAZE	ZN30701	11003	Apr. 27,15	Apr. 27,16
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,15	Apr. 27,16
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,15	Apr. 27,16
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,15	Apr. 27,16
High Pass filter	Micro	HPM50111	324216	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 27,15	Apr. 27,16
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 27,15	Apr. 27,16
DC Power Supply	LongWei	PS-305D	010964729	Apr. 27,15	Apr. 27,16
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 27,15	Apr. 27,16
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	Apr. 27,15	Apr. 27,16
Splitter	Agilent	11636B	0025164	Apr. 27,15	Apr. 27,16

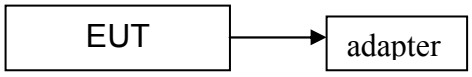
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: Talisa*)*

3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

Adapter:	Manufacturer:Cenique Infotainment Group Limited I/P:AC 100~240V 50/60Hz 0.15A O/P:DC 5V 1A DC Line:Unshielded,detachable 1.2m

3.5. Countermeasures to Achieve EMC Compliance

None.

3.6. Test Environment:

Ambient conditions in the test laboratory:

Items	Actual
Temperature (℃)	21~23
Humidity (%RH)	50~65

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limits

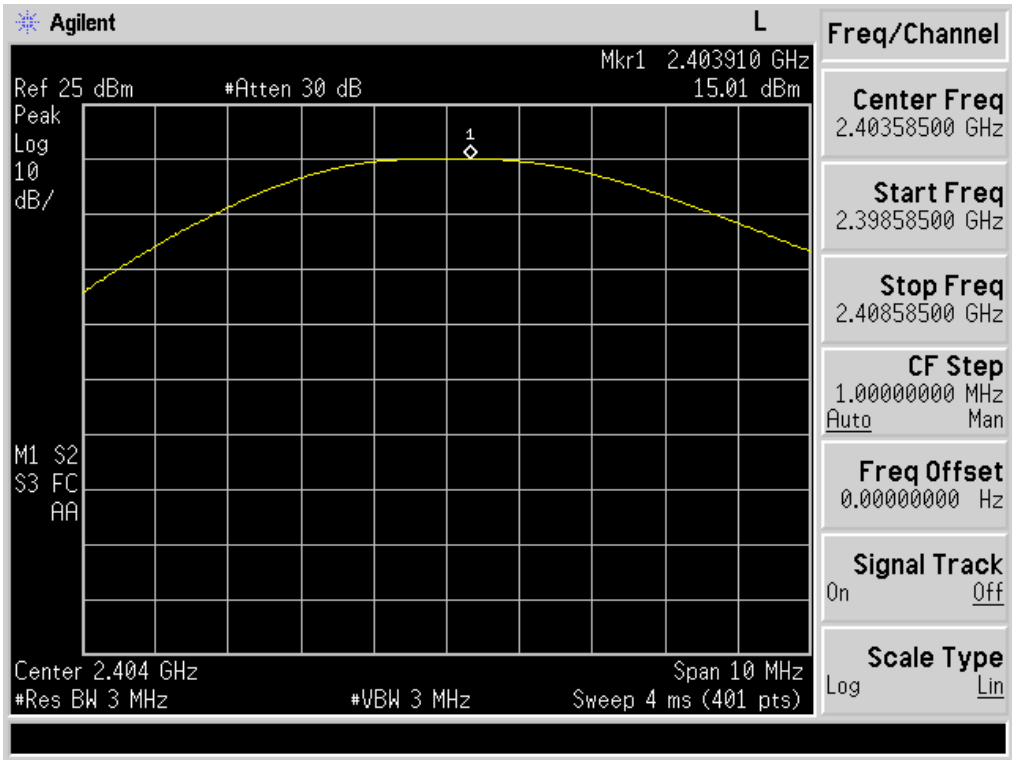
According to FCC Section 15.247(b)(1), For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

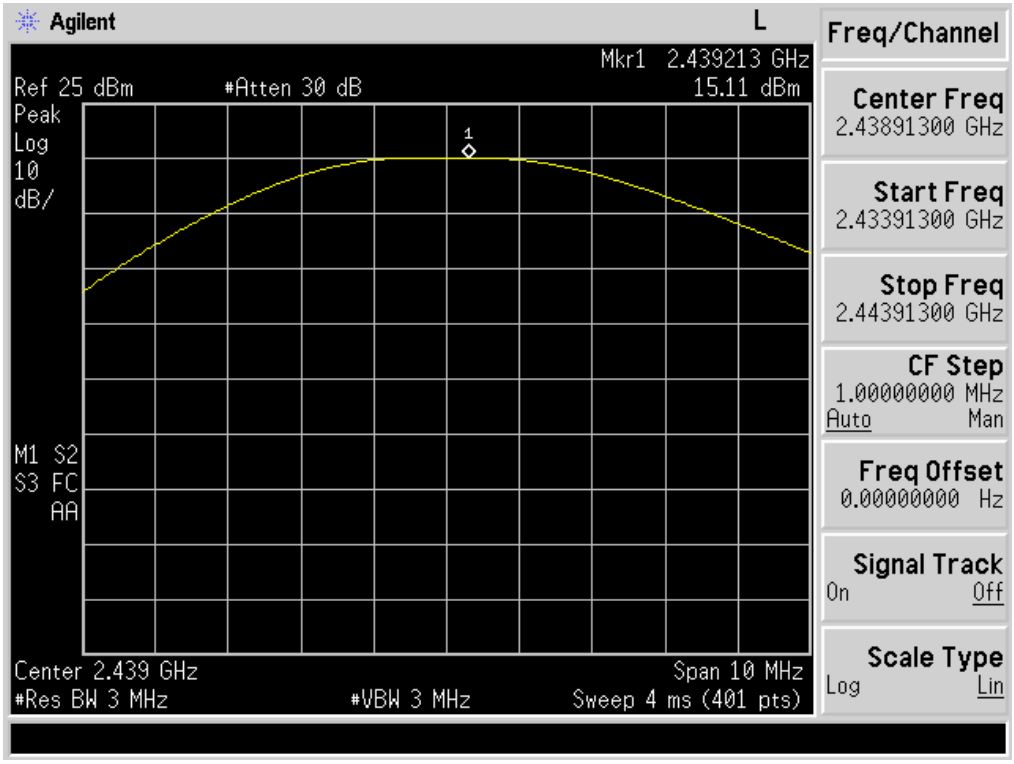
4.2. Test setup

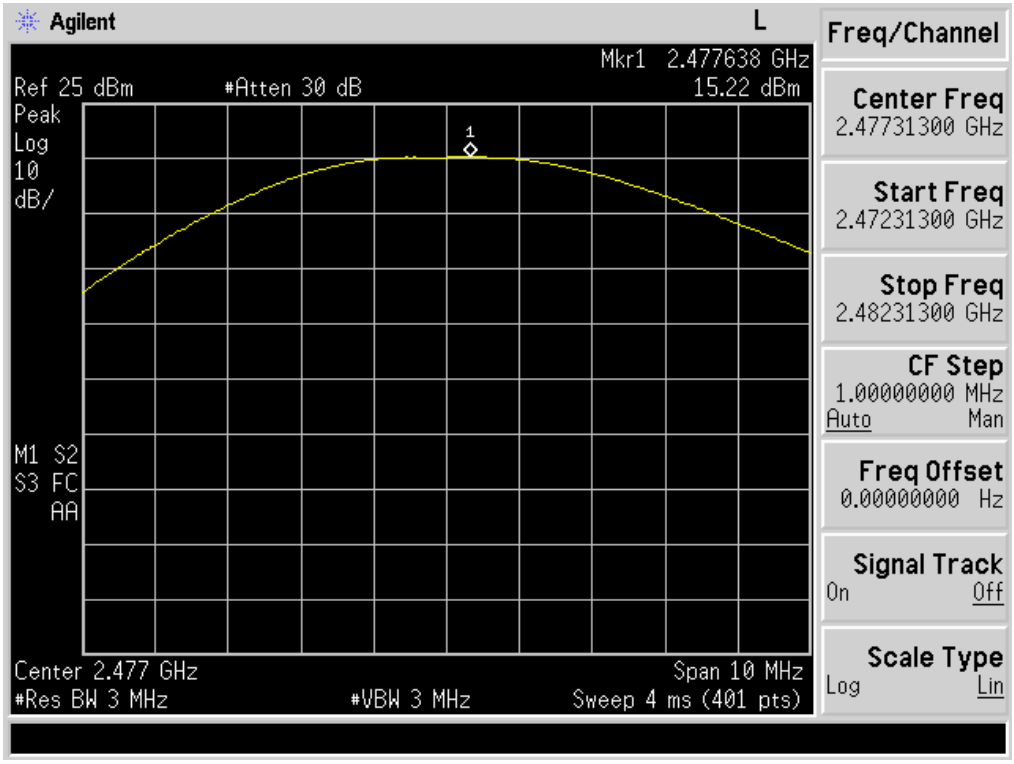
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the power meter, during the measurement, the module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

Test data:

	Channel Frequency (MHz)	Peak output Power dBm	Limit dBm	Result
FSK	2403.585	15.01	21.00	Pass
	2438.913	15.11	21.00	Pass
	2477.313	15.22	21.00	Pass




Agilent
L
Mkr1 2.439213 GHz
Ref 25 dBm
#Atten 30 dB
15.11 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Center 2.439 GHz
Span 10 MHz
#Res BW 3 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Freq/Channel
Center Freq
2.43891300 GHz
Start Freq
2.43391300 GHz
Stop Freq
2.44391300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin


Agilent
L
Mkr1 2.477638 GHz
Ref 25 dBm
#Atten 30 dB
15.22 dBm
Peak
Log
10
dB/
M1 S2
S3 FC
AA
Center 2.477 GHz
Span 10 MHz
#Res BW 3 MHz
#VBW 3 MHz
Sweep 4 ms (401 pts)
Freq/Channel
Center Freq
2.47731300 GHz
Start Freq
2.47231300 GHz
Stop Freq
2.48231300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.207 limits

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

5.1.2. Test Setup

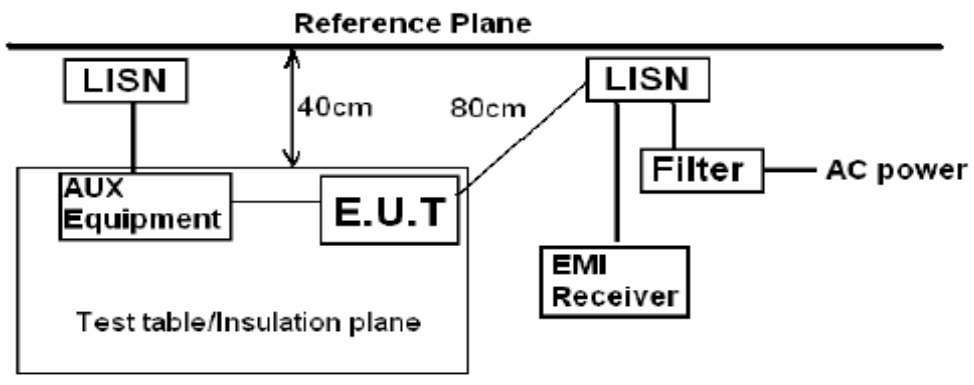
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.



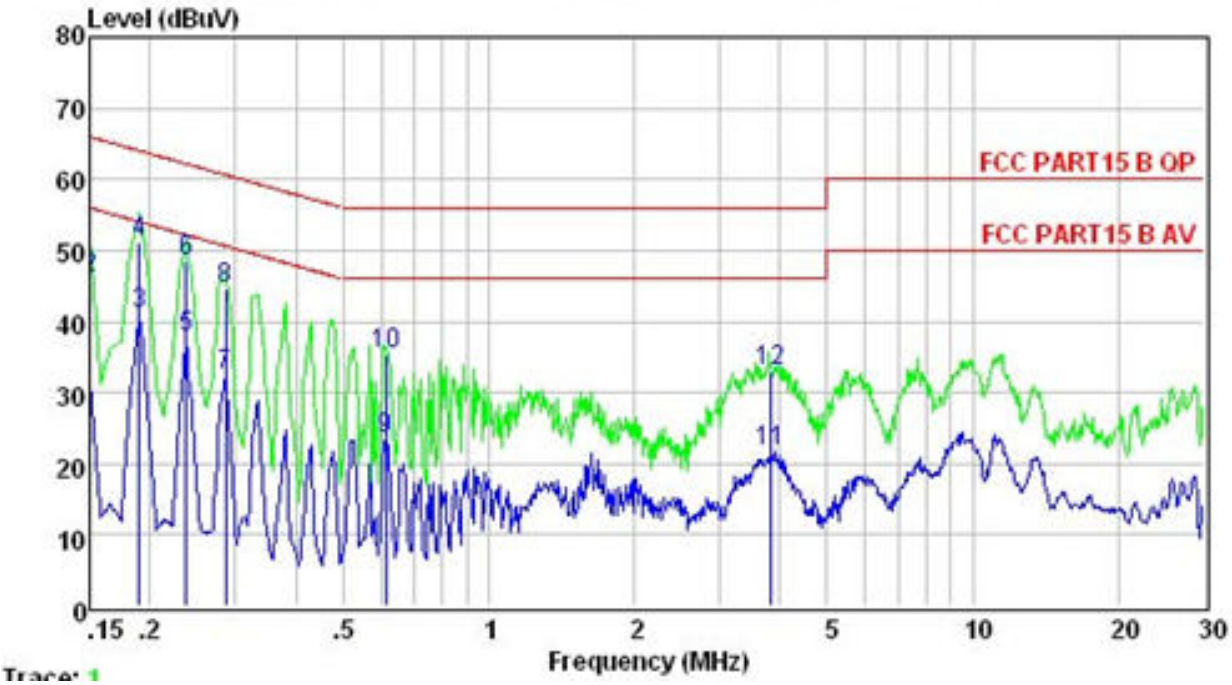
Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

5.1.3. Test Mode

Set EUT in TX mode.

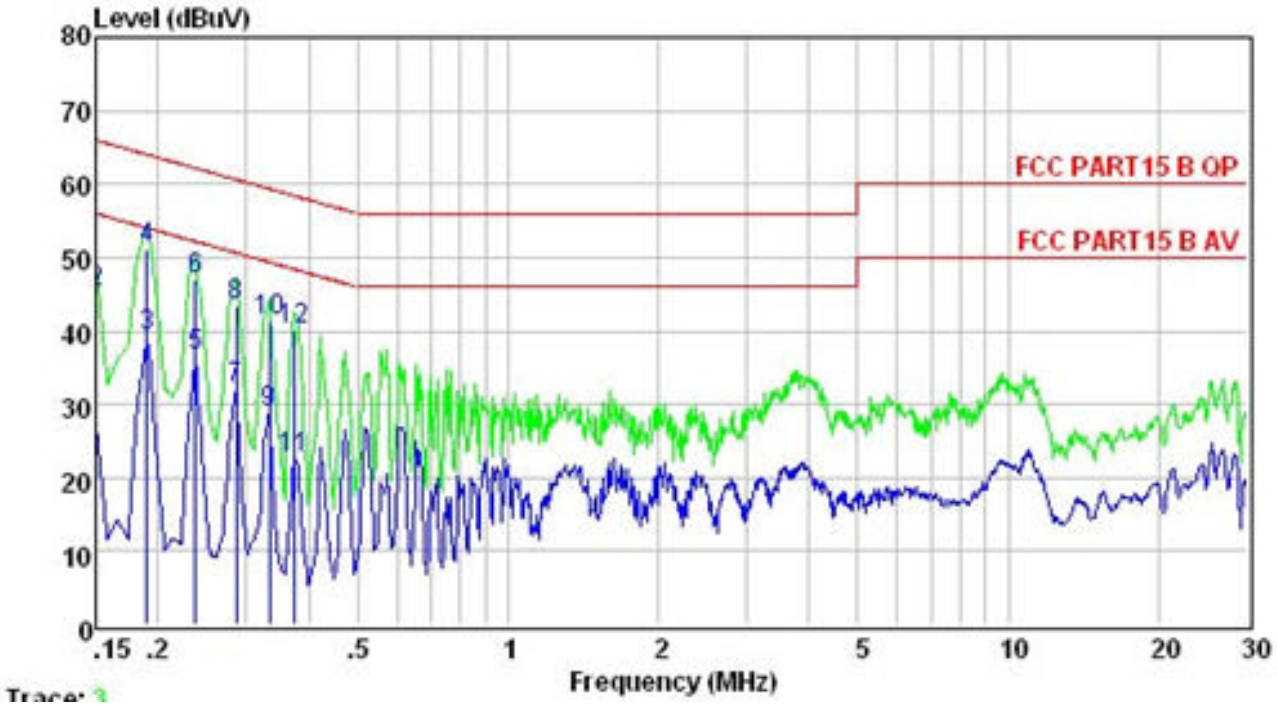
DC 5V from adapter 120V/60Hz

Line:



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	31.28	56.00	-24.72	Average
2	0.150	46.12	66.00	-19.88	QP
3	0.190	40.95	54.02	-13.07	Average
4	0.190	51.24	64.02	-12.78	QP
5	0.238	37.90	52.17	-14.27	Average
6	0.238	48.36	62.17	-13.81	QP
7	0.286	32.38	50.63	-18.25	Average
8	0.286	44.66	60.63	-15.97	QP
9	0.614	23.62	46.00	-22.38	Average
10	0.614	35.40	56.00	-20.60	QP
11	3.820	21.84	46.00	-24.16	Average
12	3.820	33.11	56.00	-22.89	QP

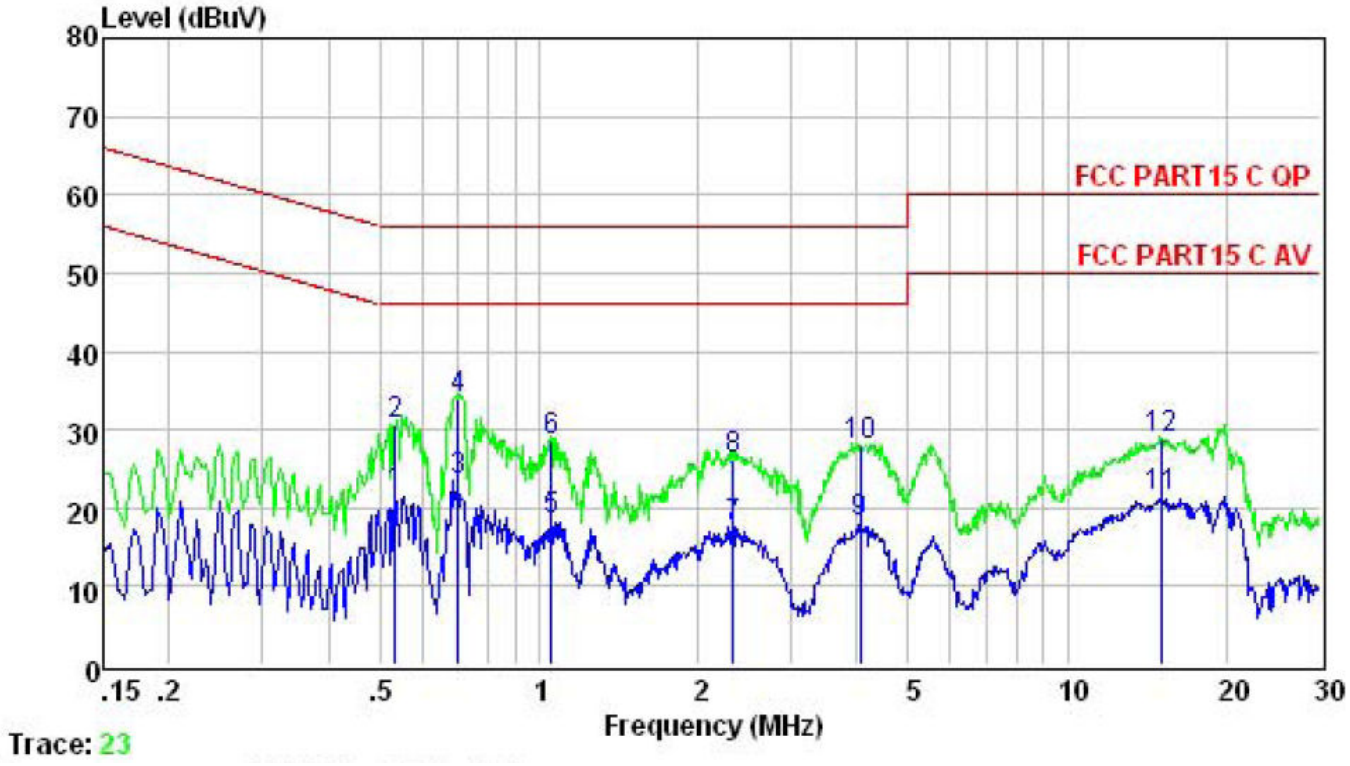
Neutral



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	26.88	56.00	-29.12	Average
2	0.150	45.33	66.00	-20.67	QP
3	0.190	39.13	54.02	-14.89	Average
4	0.190	51.06	64.02	-12.96	QP
5	0.238	36.51	52.17	-15.66	Average
6	0.238	47.12	62.17	-15.05	QP
7	0.286	32.16	50.63	-18.47	Average
8	0.286	43.28	60.63	-17.35	QP
9	0.334	28.94	49.35	-20.41	Average
10	0.334	41.36	59.35	-17.99	QP
11	0.373	22.52	48.43	-25.91	Average
12	0.373	40.22	58.43	-18.21	QP

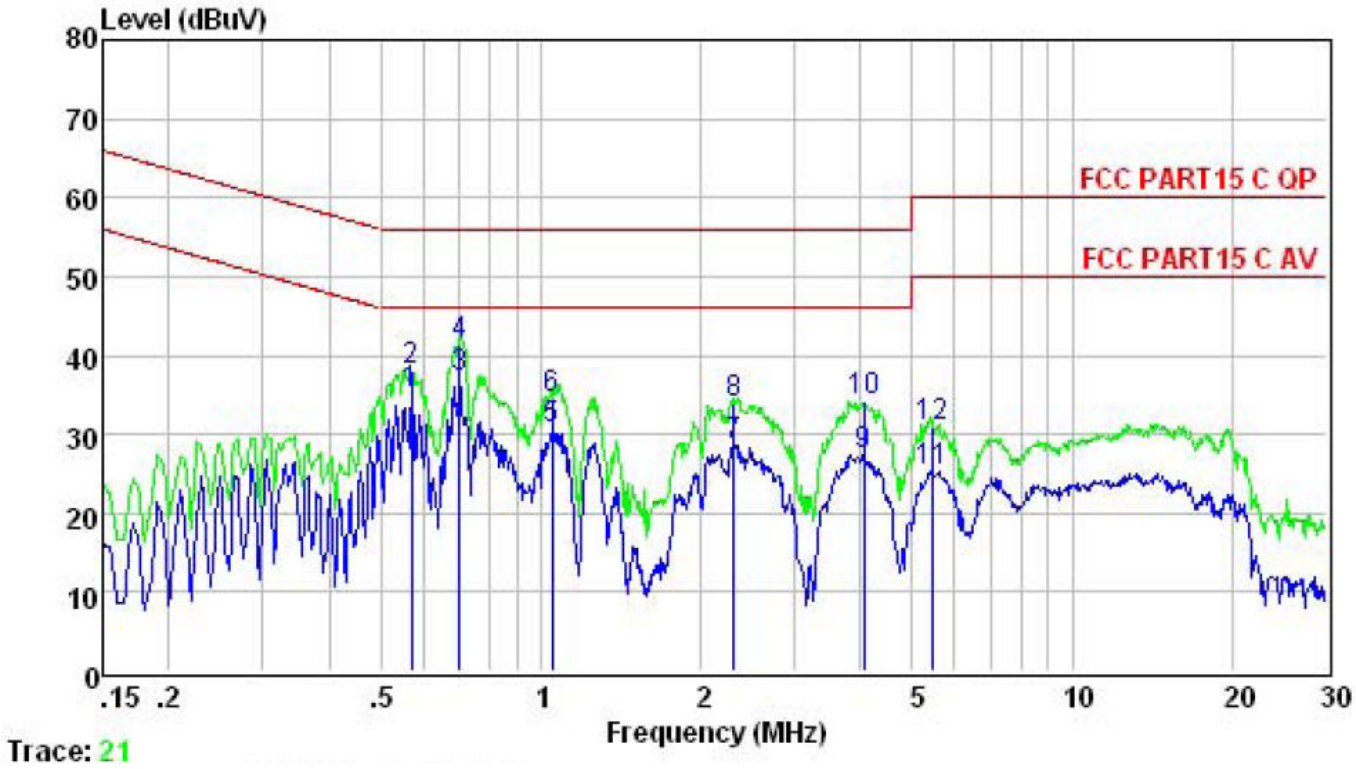
DC 5V from adapter 240V/60Hz

Line



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.535	21.66	56.00	-34.34	Average
2	0.535	30.59	56.00	-25.41	QP
3	0.705	23.47	56.00	-32.53	Average
4	0.705	34.03	56.00	-21.97	QP
5	1.054	18.44	56.00	-37.56	Average
6	1.054	28.69	56.00	-27.31	QP
7	2.334	17.61	56.00	-38.39	Average
8	2.334	26.19	56.00	-29.81	QP
9	4.049	18.04	56.00	-37.96	Average
10	4.049	28.09	56.00	-27.91	QP
11	15.066	21.49	60.00	-38.51	Average
12	15.066	28.94	60.00	-31.06	QP

Neutral



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.570	35.03	56.00	-20.97	Average
2	0.570	38.02	56.00	-17.98	QP
3	0.705	37.22	56.00	-18.78	Average
4	0.705	41.26	56.00	-14.74	QP
5	1.049	30.50	56.00	-25.50	Average
6	1.049	34.52	56.00	-21.48	QP
7	2.309	28.53	56.00	-27.47	Average
8	2.309	34.03	56.00	-21.97	QP
9	4.049	27.49	56.00	-28.51	Average
10	4.049	34.19	56.00	-21.81	QP
11	5.447	25.37	60.00	-34.63	Average
12	5.447	31.06	60.00	-28.94	QP

5.2. Radiated Emission Test

5.2.1. Limit 15.209 limits

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

5.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground below 1G and 1.5m above 1G. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, the EUT was placed on a turn table which was 1.5 m above the ground, for all test, used peak detector.

The frequency range from 30MHz to 10^{th} harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

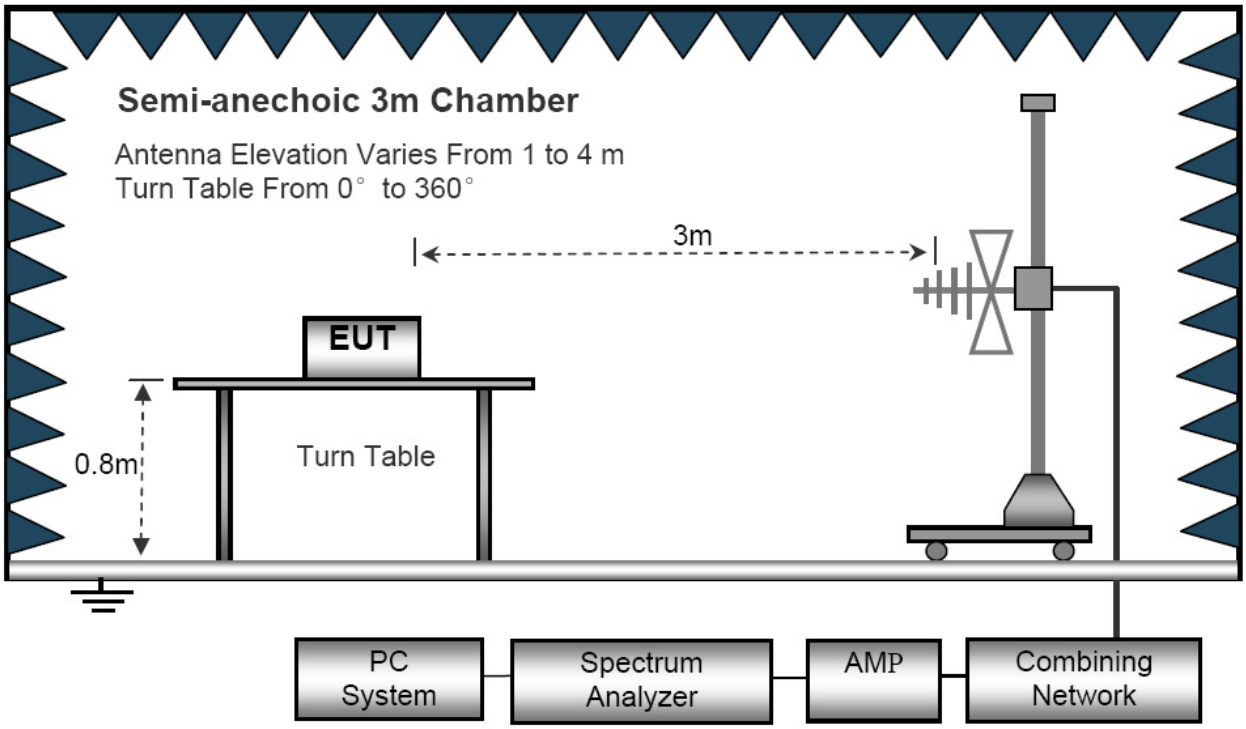
2. Measurement Uncertainty: ±3.2 dB at a level of confidence of 95%.

3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

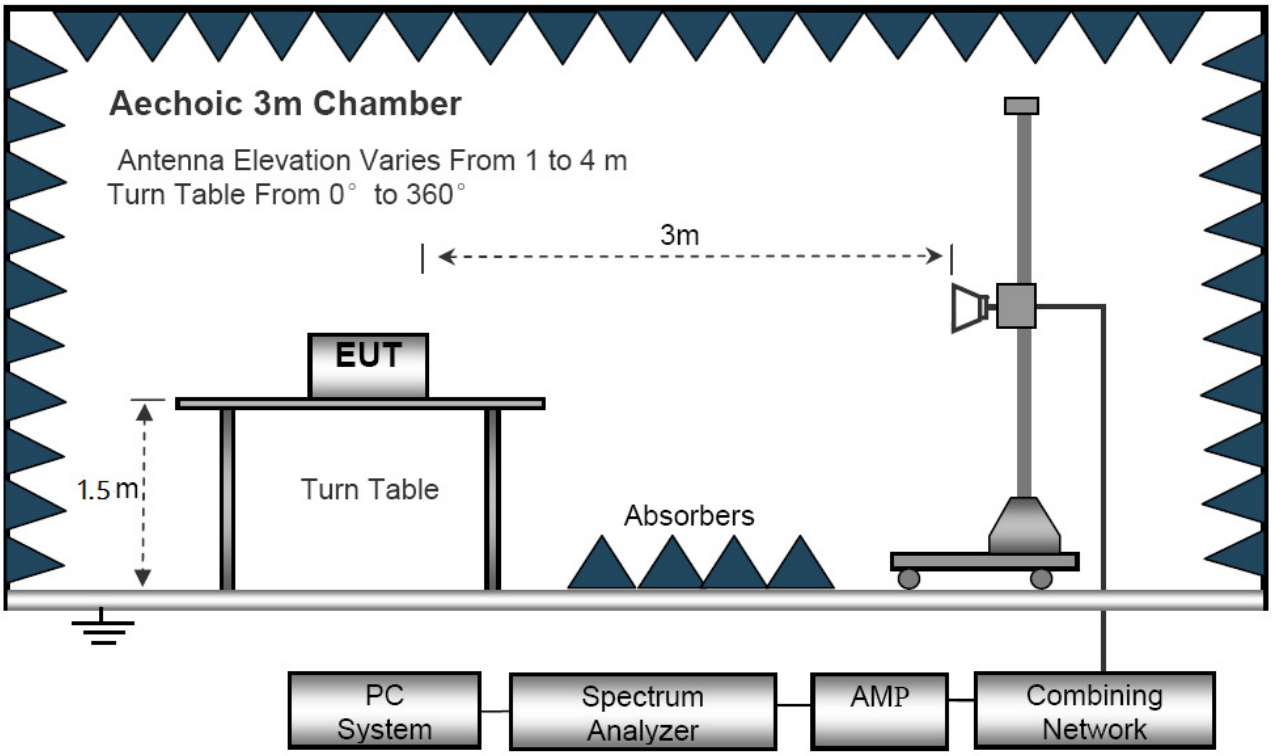
4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.

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

Below 1GHz

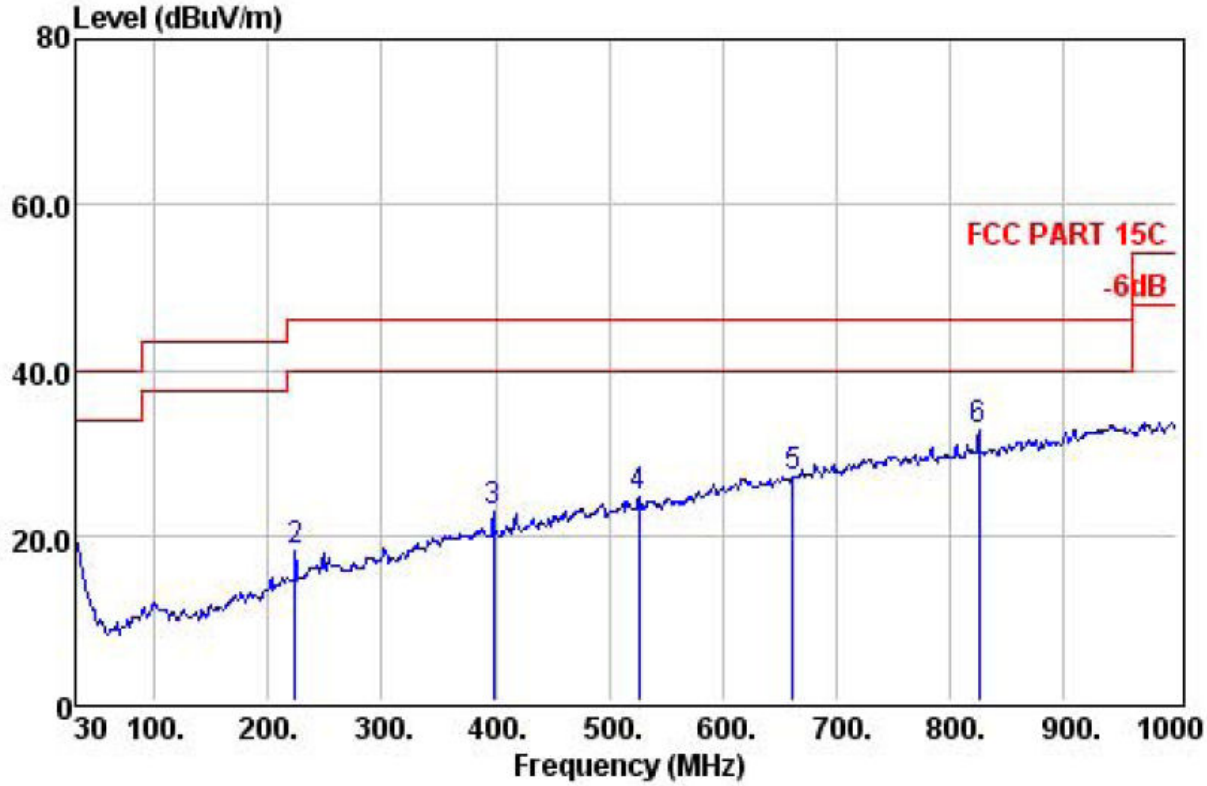


Above 1GHz



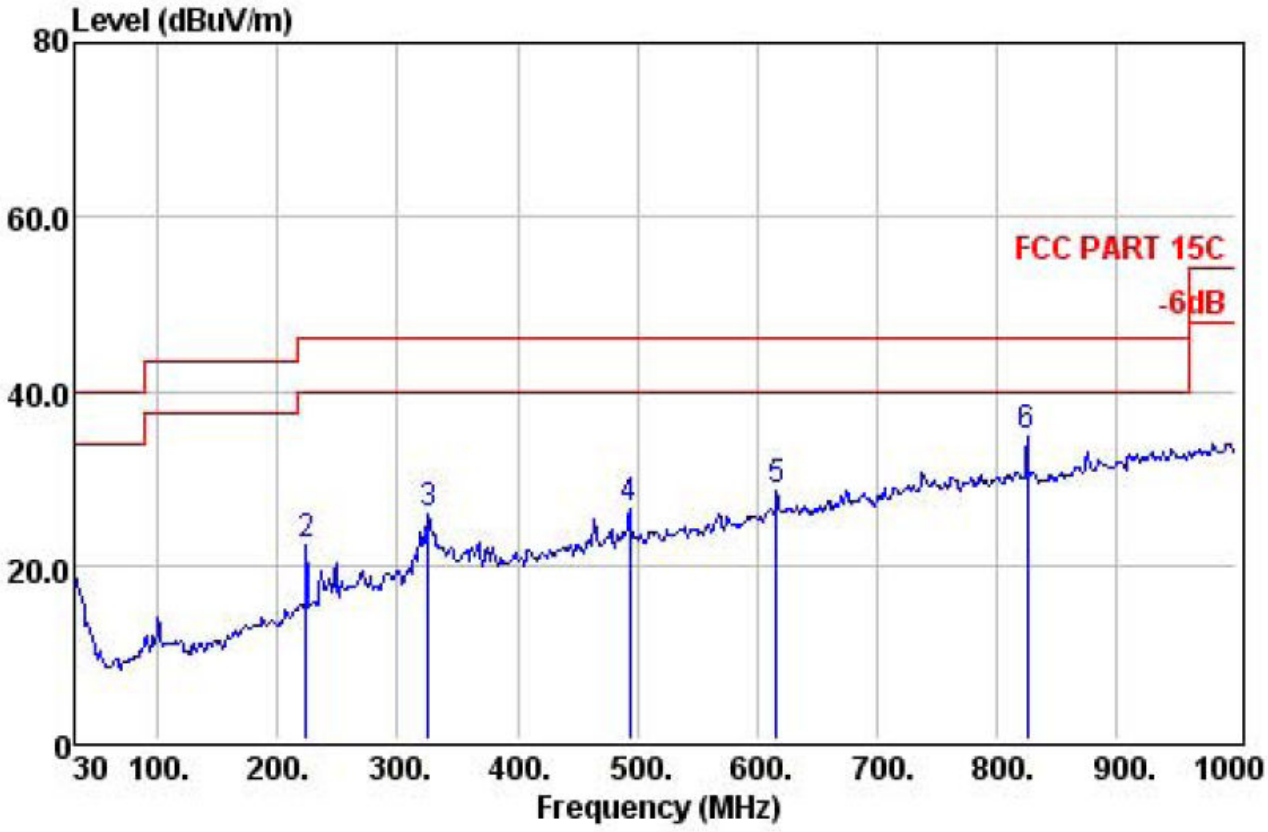
Below 1GHz

Horizontal polarizations



	Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.00	31.41	32.17	0.56	20.12	40.00	-19.88	QP
2	224.00	30.95	35.36	1.53	18.09	46.00	-27.91	QP
3	398.60	30.63	34.73	2.37	22.76	46.00	-23.24	QP
4	526.64	30.72	33.26	2.94	24.70	46.00	-21.30	QP
5	662.44	30.81	32.53	3.69	27.11	46.00	-18.89	QP
6	825.40	30.47	35.56	4.49	32.68	46.00	-13.32	QP

Vertical polarizations



	Freq	Preamp Factor	Read Level	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.00	31.41	32.99	0.56	20.94	40.00	-19.06	QP
2	224.00	30.95	39.50	1.53	22.23	46.00	-23.77	QP
3	325.85	30.81	40.24	2.02	25.98	46.00	-20.02	QP
4	493.66	30.59	35.68	2.77	26.46	46.00	-19.54	QP
5	616.85	30.64	34.74	3.38	28.55	46.00	-17.45	QP
6	825.40	30.47	37.64	4.49	34.76	46.00	-11.24	QP

Above 1GHz

Frequency (MHz)	Reading (dB μ V)	Factor (dB)	Corrected Amplitude (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Remark	Polar (H/V)
low channel(2403.585MHz)							
4807.170	47.11	10.12	57.23	74	-16.77	Pk	Vertical
4807.170	37.47	10.12	47.59	54	-6.41	AV	Vertical
7210.755	44.64	12.05	56.69	74	-17.31	Pk	Vertical
7210.755	32.53	12.05	44.58	54	-9.42	AV	Vertical
4807.170	44.24	10.12	54.36	74	-19.64	Pk	Horizontal
4807.170	35.62	10.12	45.74	54	-8.26	AV	Horizontal
7210.755	45.52	12.05	57.57	74	-16.43	Pk	Horizontal
7210.755	34.25	12.05	46.3	54	-7.7	AV	Horizontal
Middle channel(2438.913MHz)							
4877.826	54.25	10.42	64.67	74	-9.33	Pk	Vertical
4877.826	32.65	10.42	43.07	54	-10.93	AV	Vertical
7316.739	46.63	12.81	59.44	74	-14.56	Pk	Vertical
7316.739	35.23	12.81	48.04	54	-5.96	AV	Vertical
4877.826	55.25	10.42	65.67	74	-8.33	Pk	Horizontal
4877.826	33.63	10.42	44.05	54	-9.95	AV	Horizontal
7316.739	45.25	12.81	58.06	74	-15.94	Pk	Horizontal
7316.739	34.25	12.81	47.06	54	-6.94	AV	Horizontal
High channel(2477.313MHz)							
4954.626	47.35	10.48	57.83	74	-16.17	Pk	Vertical
4954.626	35.12	10.48	45.6	54	-8.4	AV	Vertical
7431.939	43.52	12.87	56.39	74	-17.61	Pk	Vertical
7431.939	35.33	12.87	48.2	54	-5.8	AV	Vertical
4954.626	46.42	10.48	56.9	74	-17.1	Pk	Horizontal
4954.626	36.26	10.48	46.74	54	-7.26	AV	Horizontal
7431.939	45.11	12.87	57.98	74	-16.02	Pk	Horizontal
7431.939	37.46	12.87	50.33	54	-3.67	AV	Horizontal

6. 20DB & 99% OCCUPY BANDWIDTH

6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth(10*log1%=20dB)taking the RF output power

6.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW ≥1% of the 20dB bandwidth

VBW ≥ RBW

Sweep=auto

Detector function=peak

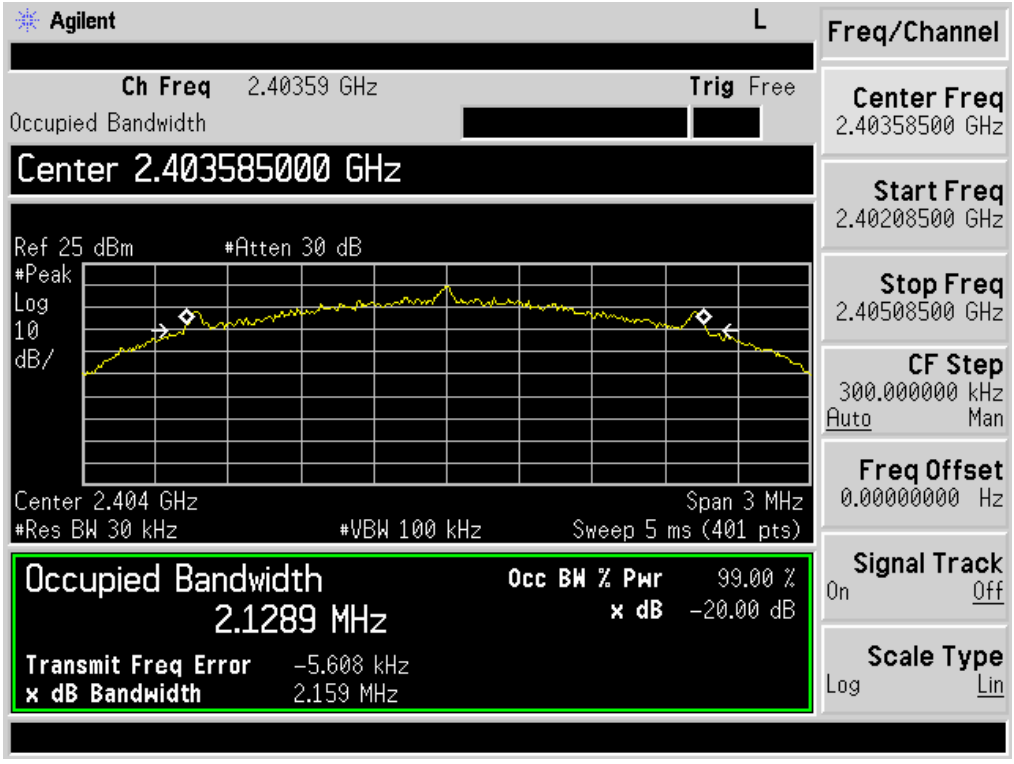
Trace=max hold

Test data:

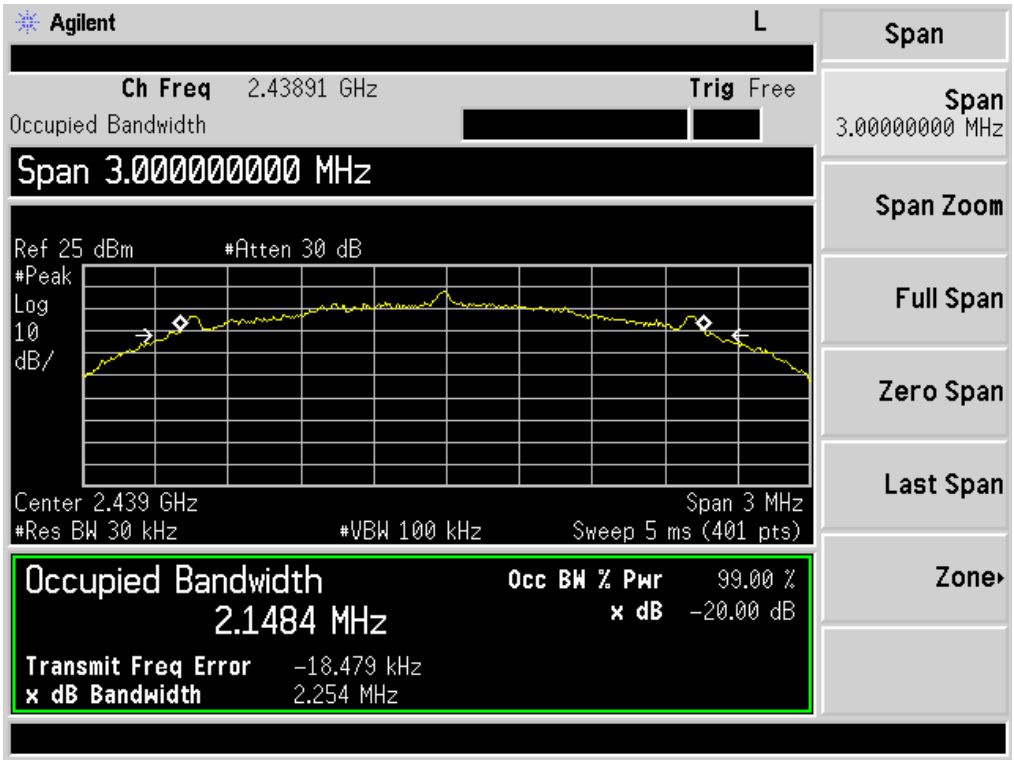
Channel Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2403.585	2.159	2.13	Pass
2438.913	2.254	2.15	Pass
2477.313	2.188	2.15	Pass

Test plot as follows:

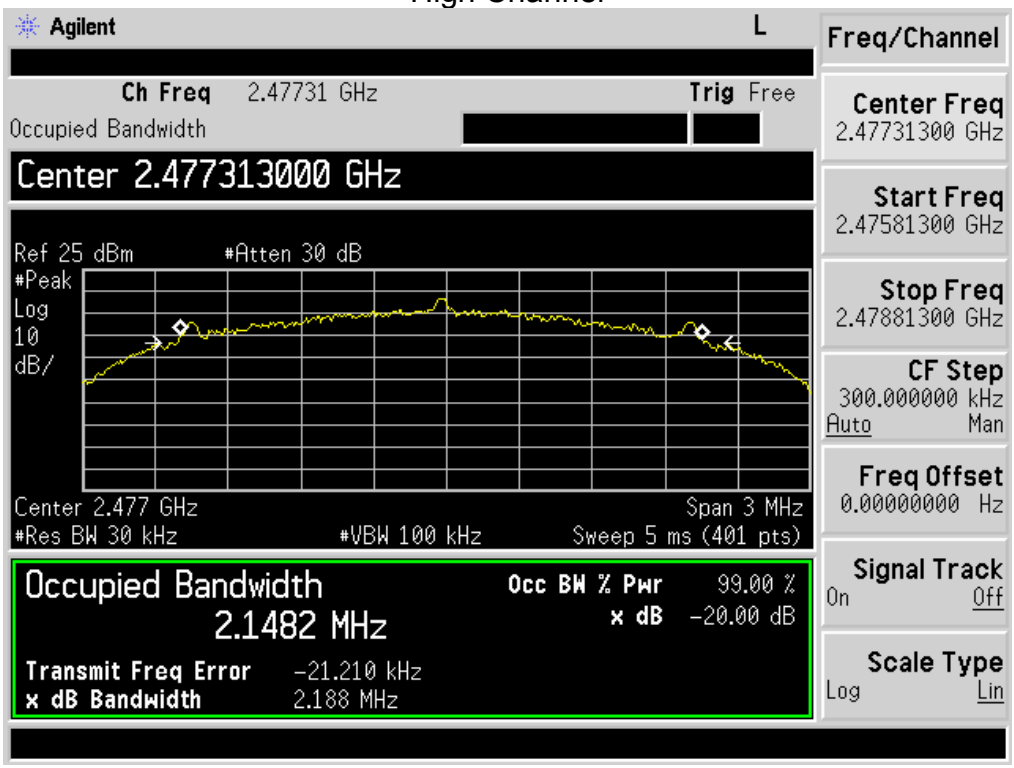
Low Channel



Middle Channel



High Channel



7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

RBW ≥1% of the span

VBW ≥ RBW

Sweep=auto

Detector function=peak

Trace=max hold

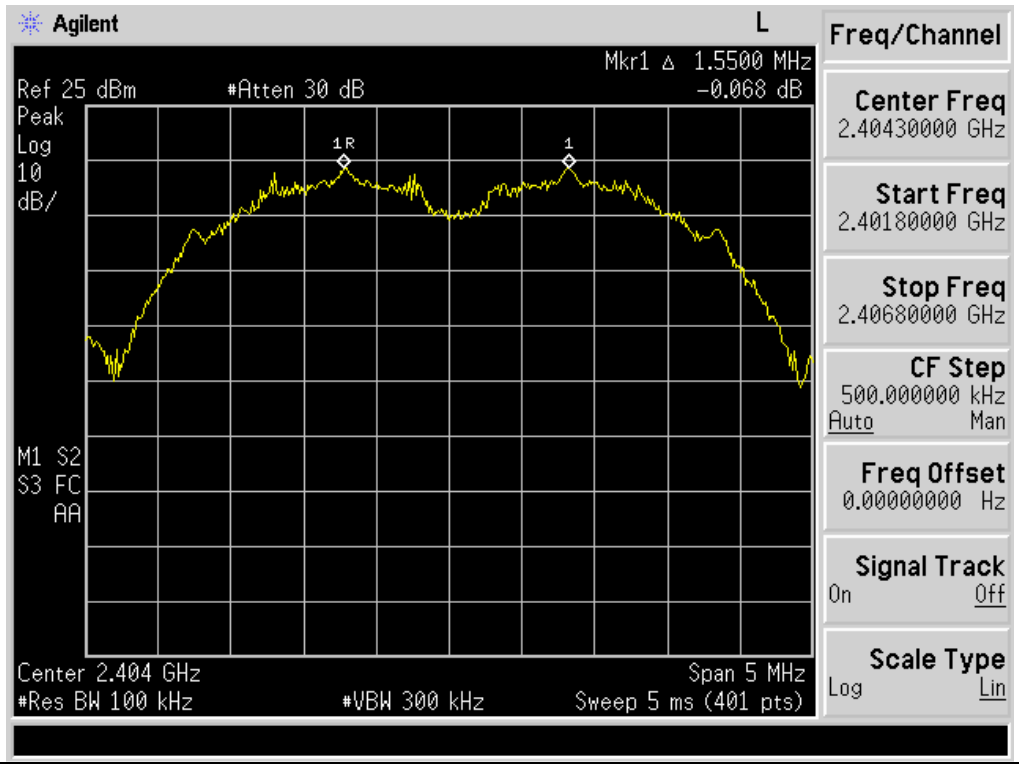
Test data:

Frequency (MHz)	Ch. Separation (MHz)	Result
2403.585	1.55	**Complies**
2438.913	1.55	**Complies**
2477.313	1.55	**Complies**

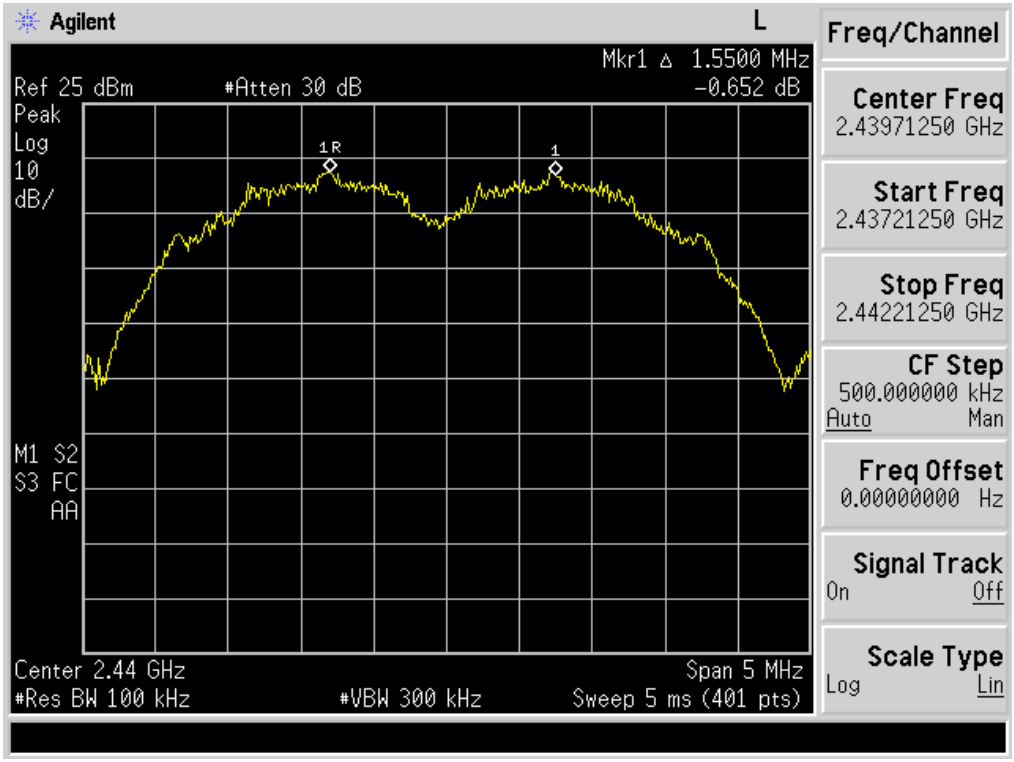
Ch. Separation Limits: >2/3 of 20dB bandwidth

Test plot as follows:

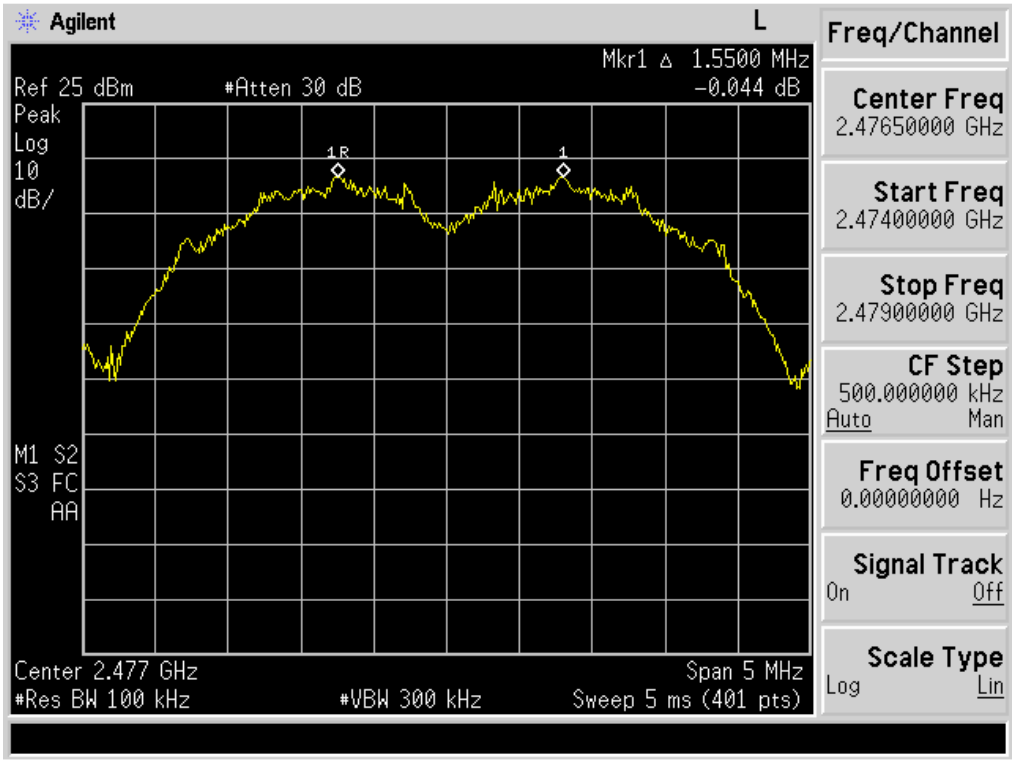
2403.585MHz



2438.913MHz



2477.313MHz



8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting.

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW ≥1% of the span

VBW ≥ RBW

Sweep=auto

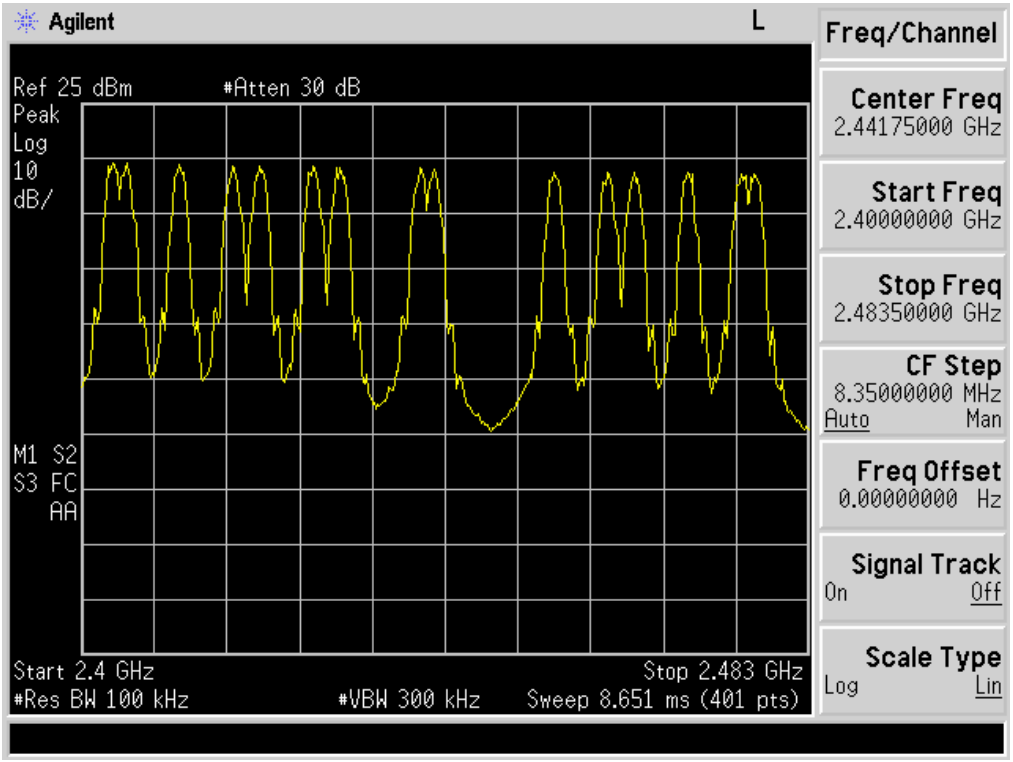
Detector function=peak

Trace=max hold

Test data:

Measured channel numbers	Limit	Result
15	⩾15	PASS

Test plot as follows:



9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting .

2. Set the spectrum analyzer:

Span= 0Hz

RBW =1MHz

VBW = 3MHz

Sweep=auto

Detector function=peak

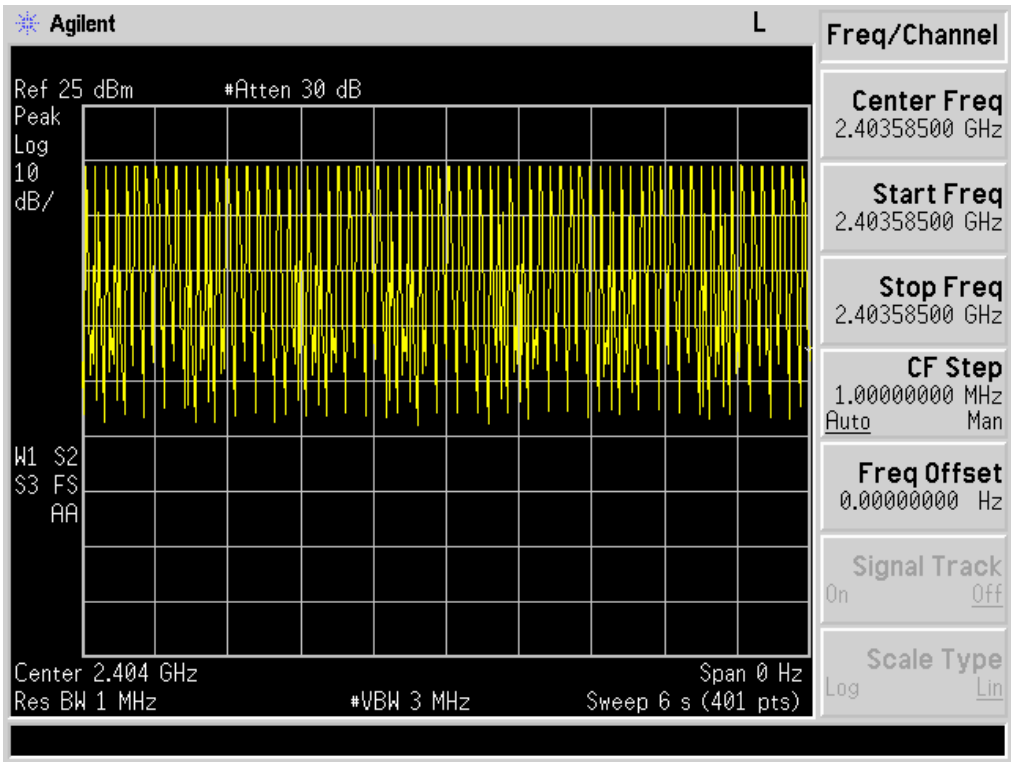
Test data:

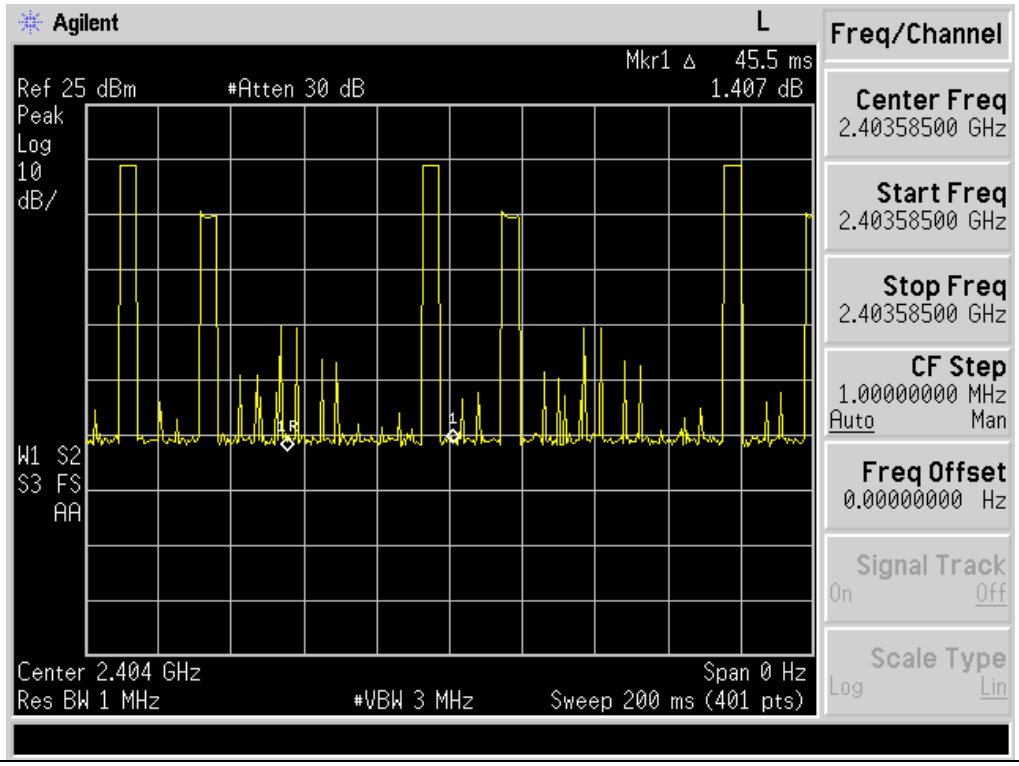
Frequency (MHz)	Pulse Duration	Dwell Time	Limits
	(ms)	(s)	(s)
2403.585	4.55	0.33	0.4
2438.913	4.48	0.32	0.4
2477.313	4.55	0.33	0.4

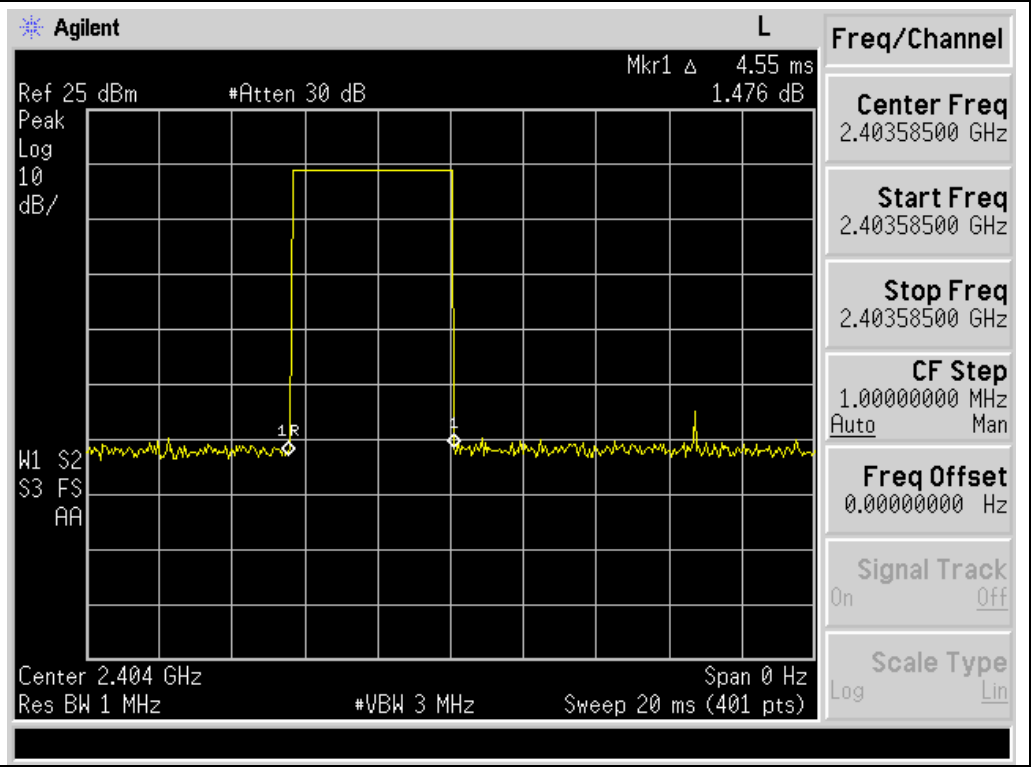
A Period Time = (channel number)*0.4
Dwell Time=72*PulseDuration/1000

Test plot as follows as below:

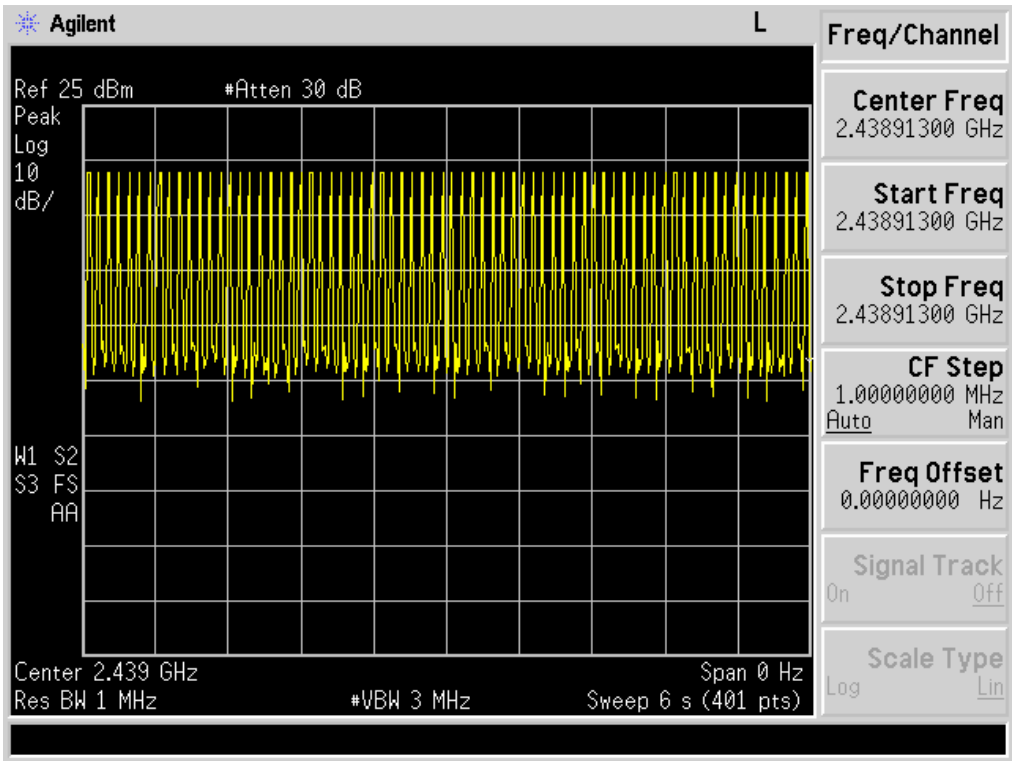
2403.585MHz

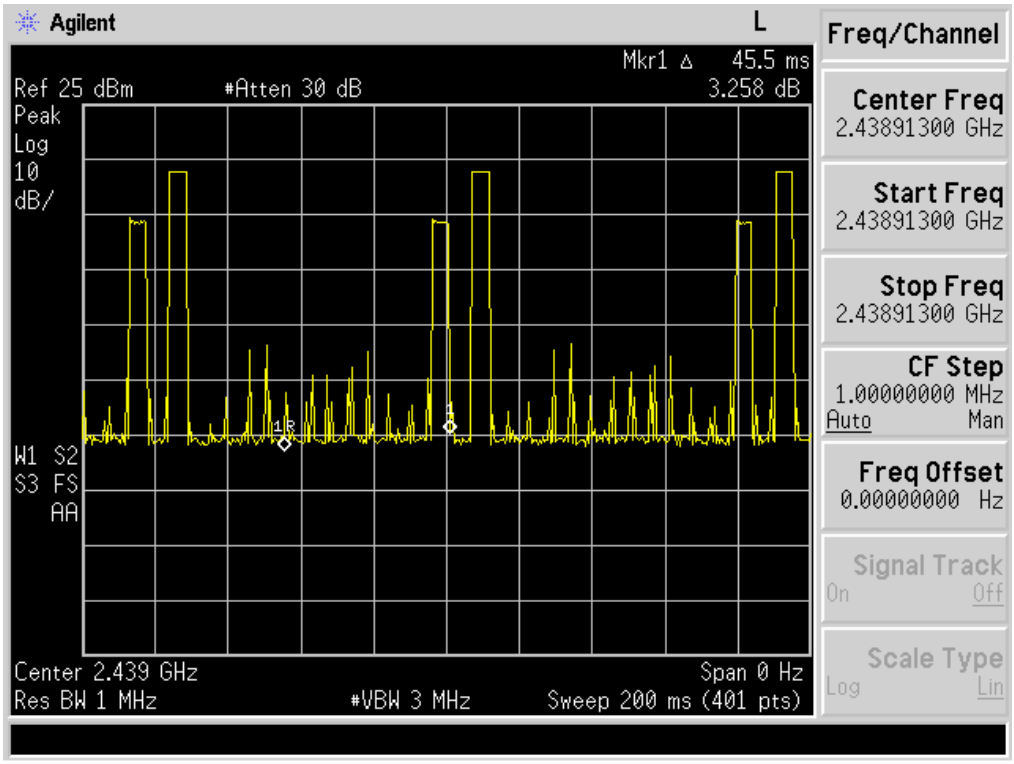


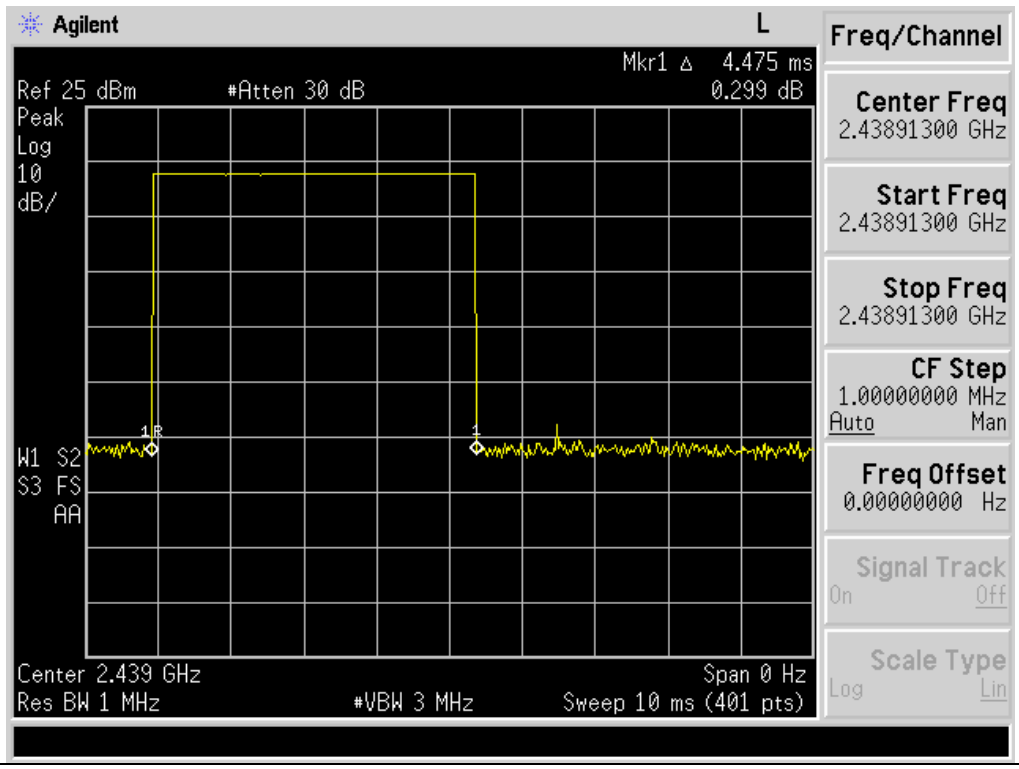

Agilent
L
Mkr1 Δ 45.5 ms
1.407 dB
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.404 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 200 ms (401 pts)
Freq/Channel
Center Freq
2.40358500 GHz
Start Freq
2.40358500 GHz
Stop Freq
2.40358500 GHz
CF Step
1.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin


Agilent
L
Mkr1 Δ 4.55 ms
1.476 dB
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.404 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 20 ms (401 pts)
Freq/Channel
Center Freq
2.40358500 GHz
Start Freq
2.40358500 GHz
Stop Freq
2.40358500 GHz
CF Step
1.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

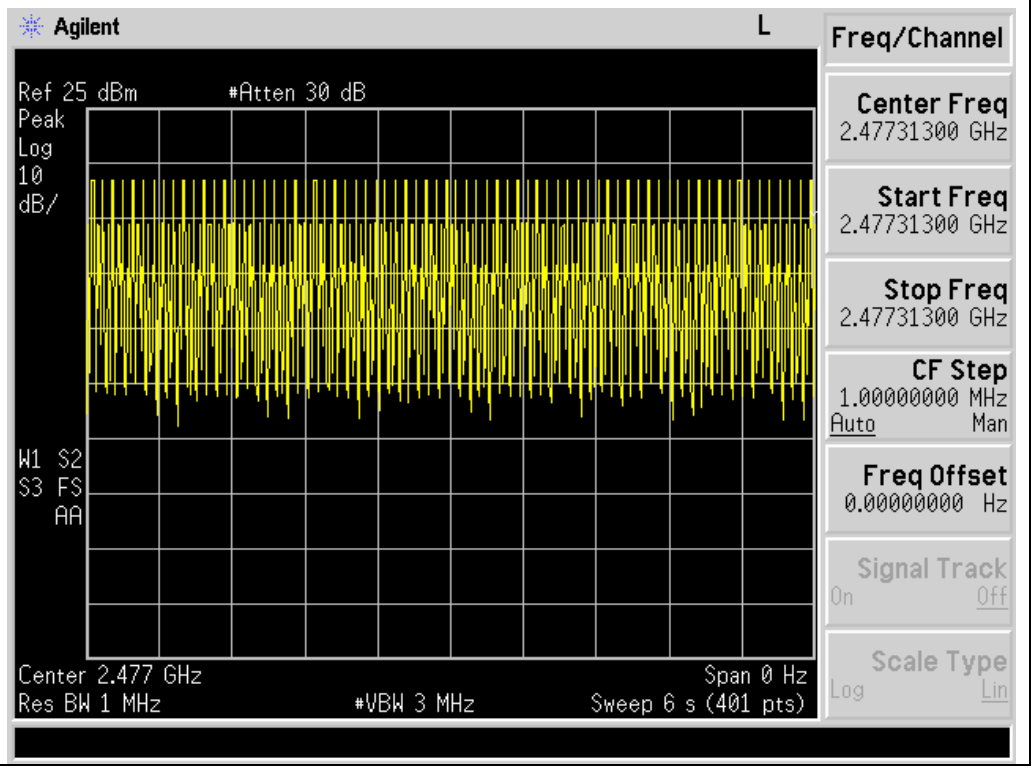
2438.913MHz

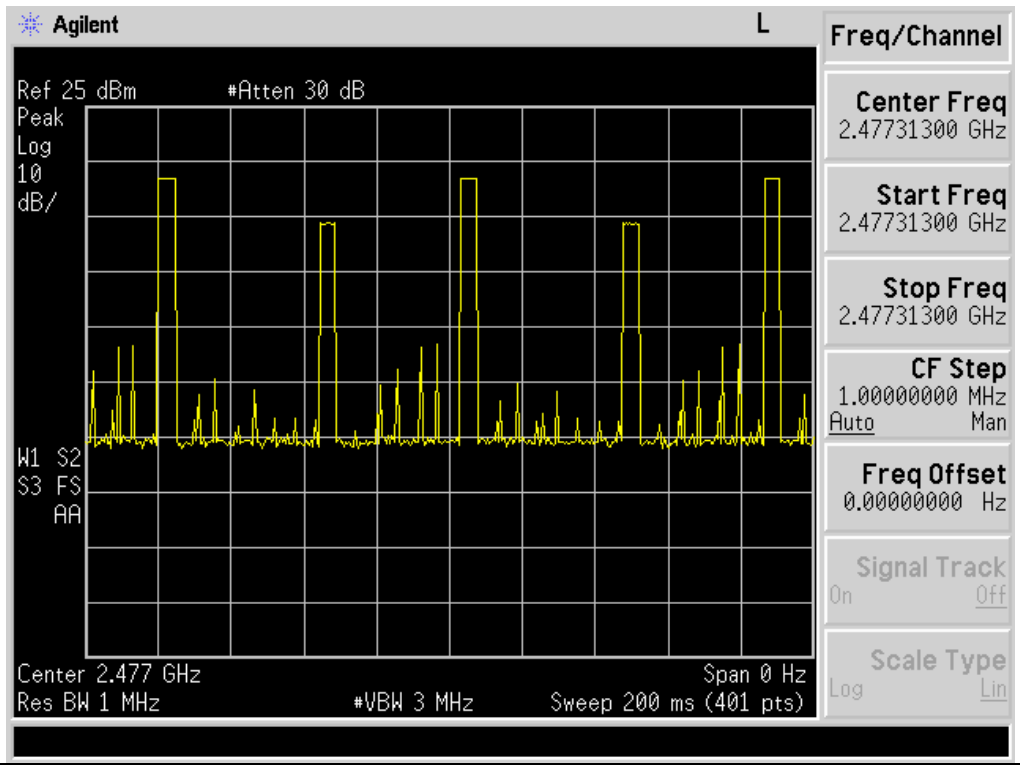

Agilent
L
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.439 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 6 s (401 pts)
Freq/Channel
Center Freq
2.43891300 GHz
Start Freq
2.43891300 GHz
Stop Freq
2.43891300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

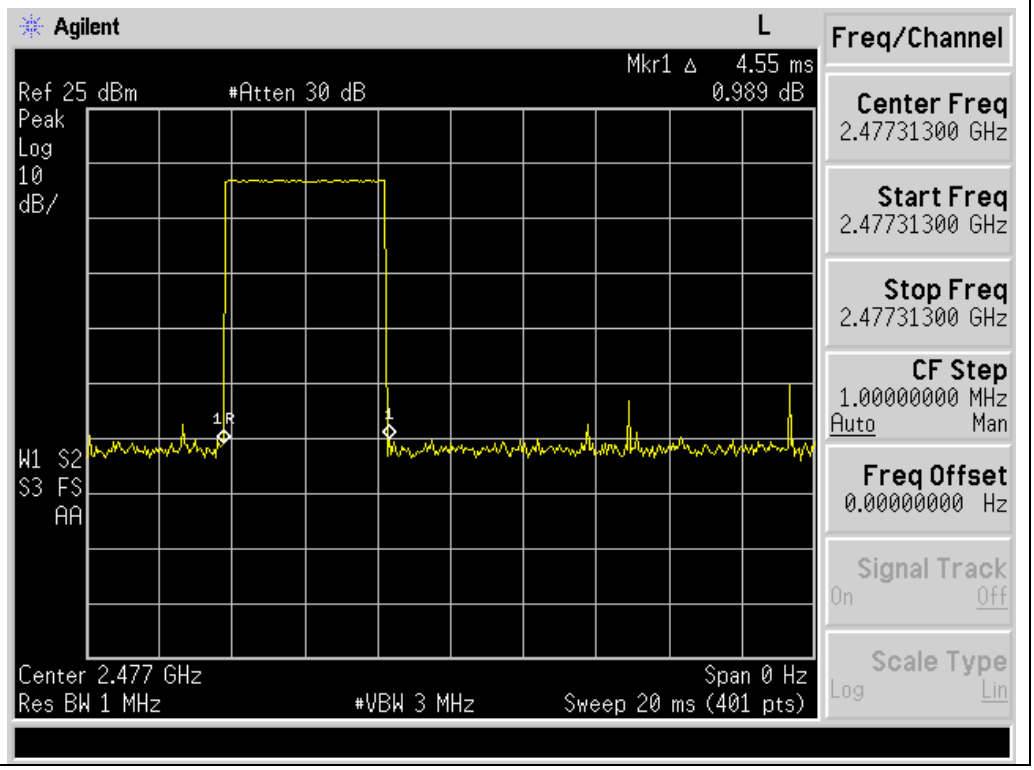

Agilent
L
Mkr1 Δ
45.5 ms
3.258 dB
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.439 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 200 ms (401 pts)
Freq/Channel
Center Freq
2.43891300 GHz
Start Freq
2.43891300 GHz
Stop Freq
2.43891300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin


Agilent
L
Mkr1 Δ 4.475 ms
0.299 dB
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.439 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 10 ms (401 pts)
Freq/Channel
Center Freq
2.43891300 GHz
Start Freq
2.43891300 GHz
Stop Freq
2.43891300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

2477.313MHz


Agilent
L
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.477 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 6 s (401 pts)
Freq/Channel
Center Freq
2.47731300 GHz
Start Freq
2.47731300 GHz
Stop Freq
2.47731300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin


Agilent
L
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
W1 S2
S3 FS
AA
Center 2.477 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 200 ms (401 pts)
Freq/Channel
Center Freq
2.47731300 GHz
Start Freq
2.47731300 GHz
Stop Freq
2.47731300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin


Agilent
L
Mkr1 Δ 4.55 ms
0.989 dB
Ref 25 dBm
#Atten 30 dB
Peak
Log
10
dB/
1R
1
W1 S2
S3 FS
AA
Center 2.477 GHz
Res BW 1 MHz
#VBW 3 MHz
Span 0 Hz
Sweep 20 ms (401 pts)
Freq/Channel
Center Freq
2.47731300 GHz
Start Freq
2.47731300 GHz
Stop Freq
2.47731300 GHz
CF Step
1.00000000 MHz
Auto
Man
Freq Offset
0.00000000 Hz
Signal Track
On
Off
Scale Type
Log
Lin

10. BAND EDGE COMPLIANCE TEST

10.1. Limits

According to FCC Section 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 con-ducted or a radiated measurement

10.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set to span from the lowest frequency generated in the device up to and including the tenth harmonic of the highest fundamental frequency

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure. For all test, used peak detector.

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

Test plot as follows:

For radiated test as follows:

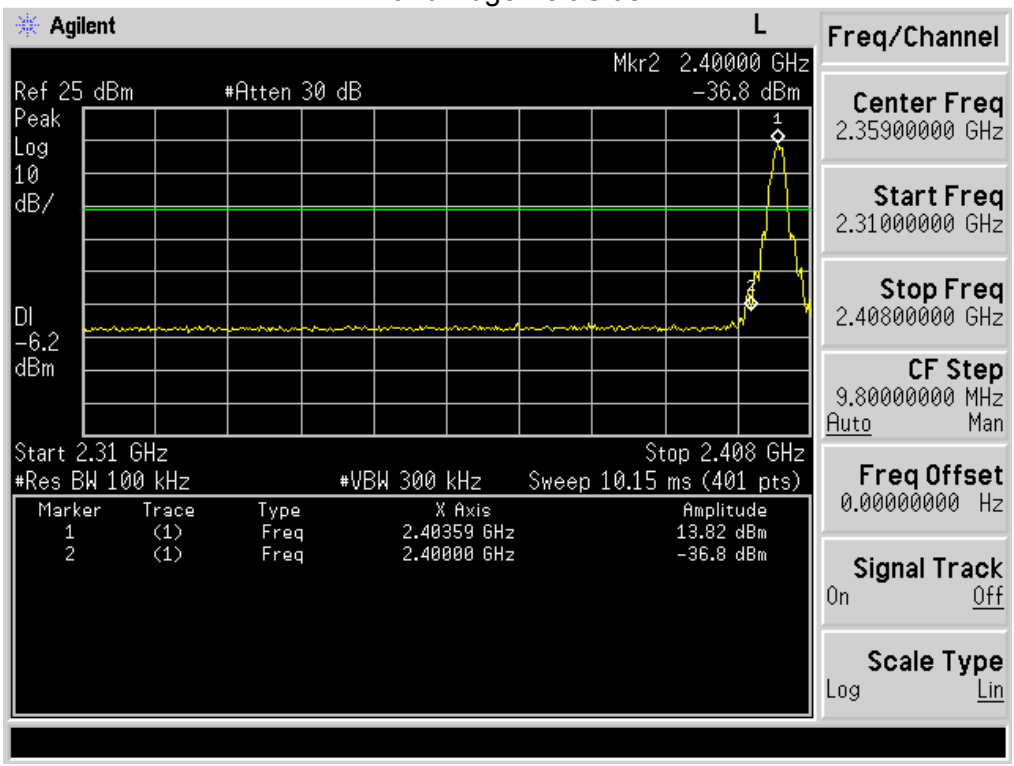
	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
			PK	PK	AV	Pass
Hopping	2400	H	50.24	74.00	54.00	Pass
	2400	V	51.56	74.00	54.00	Pass
	2483.5	H	51.34	74.00	54.00	Pass
	2483.5	V	50.13	74.00	54.00	Pass
Unhopping	2400	H	50.13	74.00	54.00	Pass
	2400	V	50.34	74.00	54.00	Pass
	2483.5	H	50.42	74.00	54.00	Pass
	2483.5	V	50.34	74.00	54.00	Pass

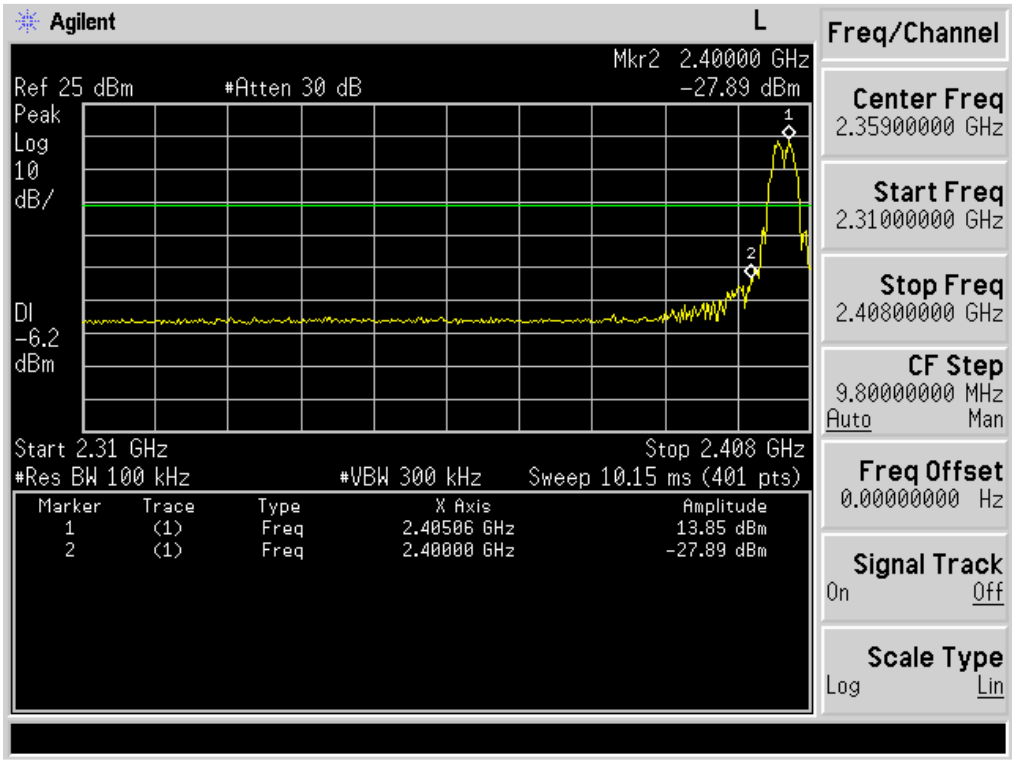
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

For conducted test:

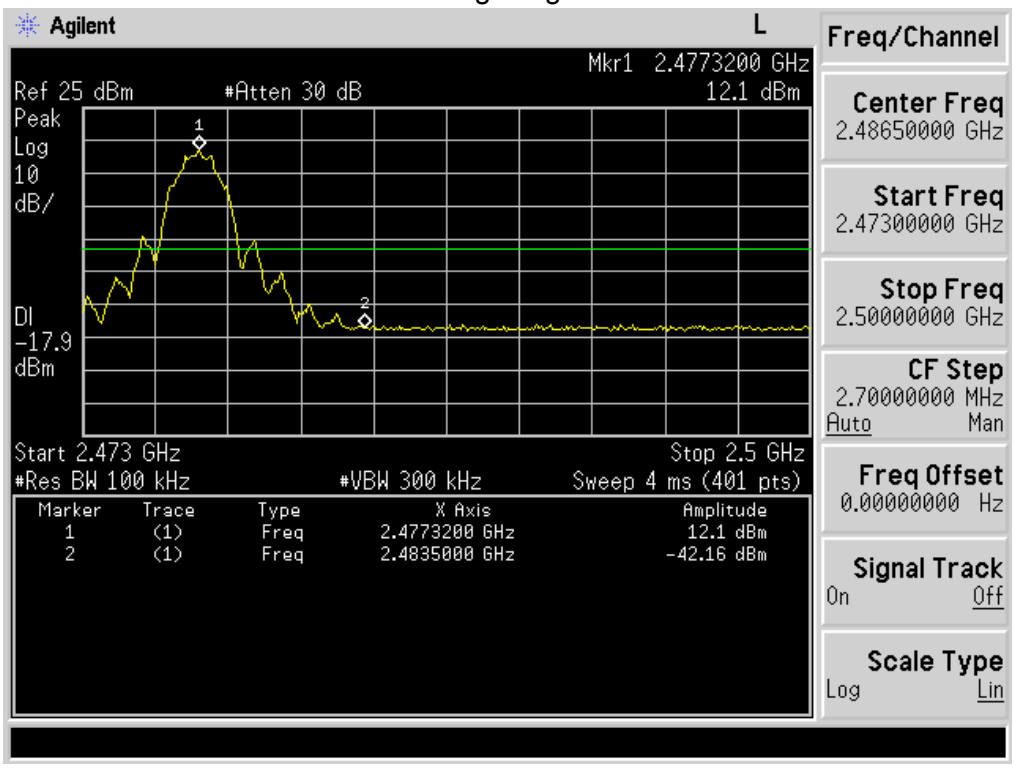
Frequency Band MHz	Delta Peak to band emission (dBc)	＞Limit (dBc)	Result
Non-hopping			
2310-2400	50.62	20	Pass
2483.5-2500	41.74	20	Pass
hopping			
2310-2400	54.26	20	Pass
2483.5-2500	53.20	20	Pass

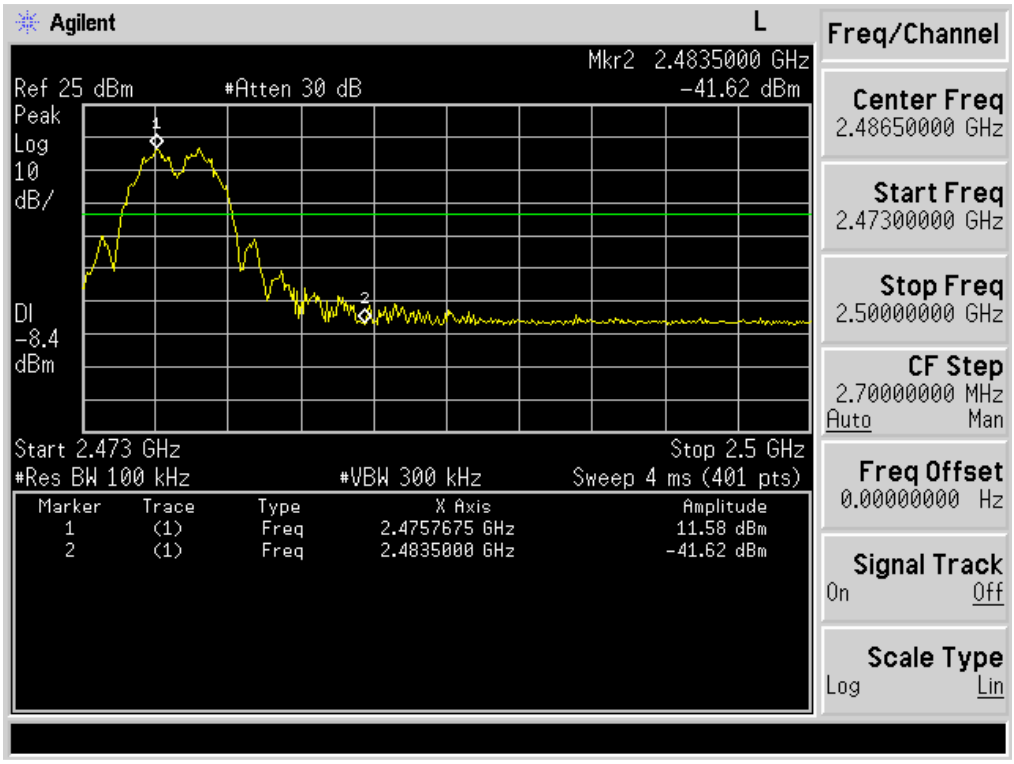
Band Edge-Left Side





Band Edge-Right Side





11. ANTENNA REQUIREMENTS

11.1. Limits

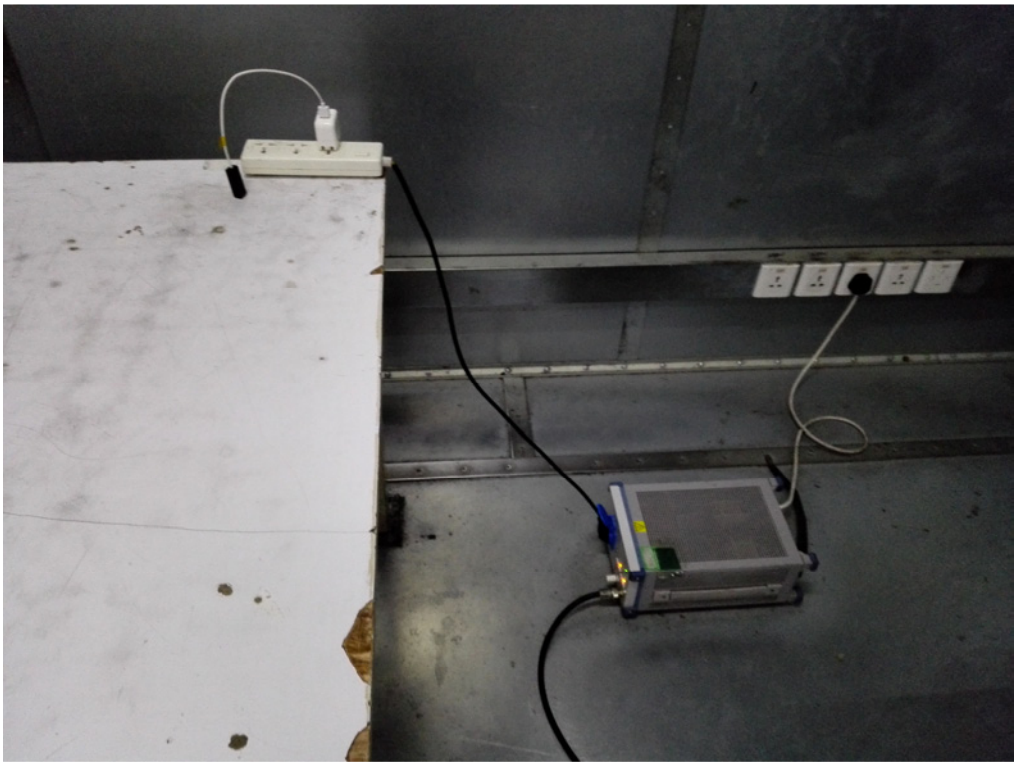
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

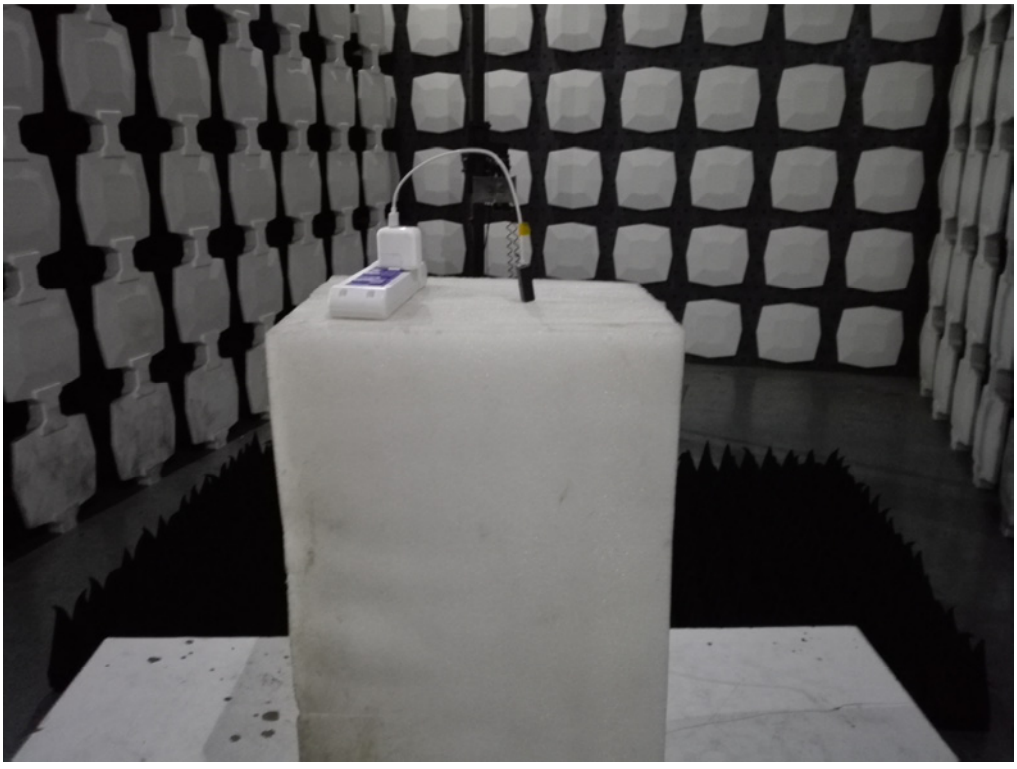
The antennas used for this product are Permanently fixed antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.0dBi.

12. PHOTOGRAPHS OF TEST SET-UP

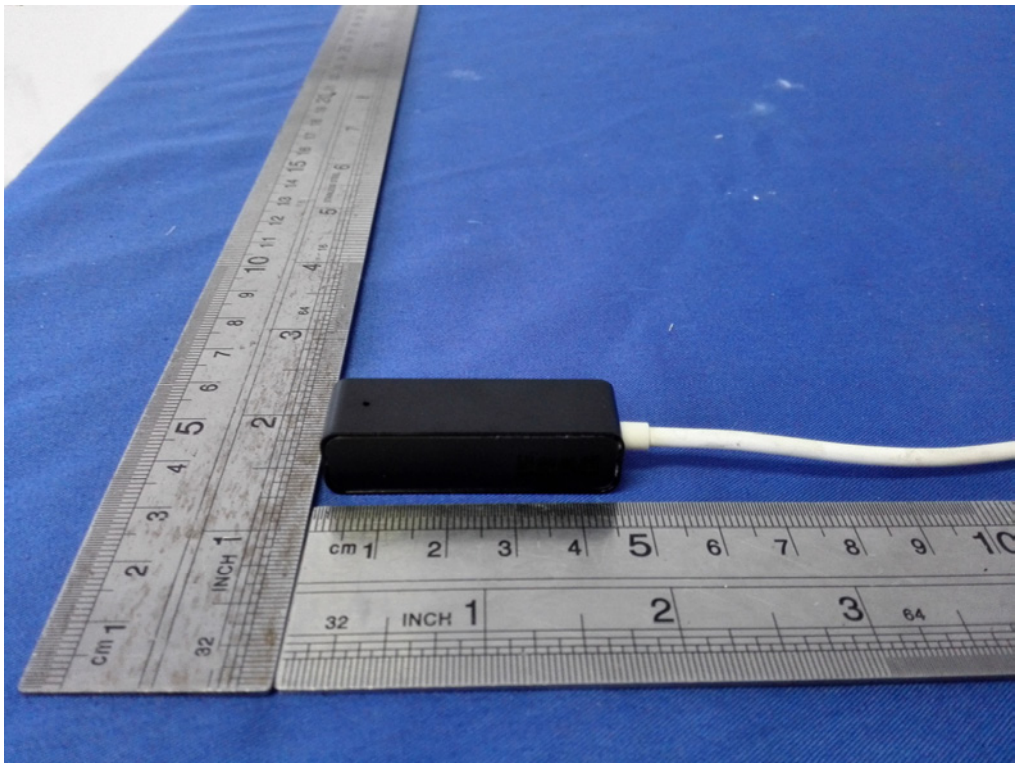
Conducted Emission at the Mains Terminals Test

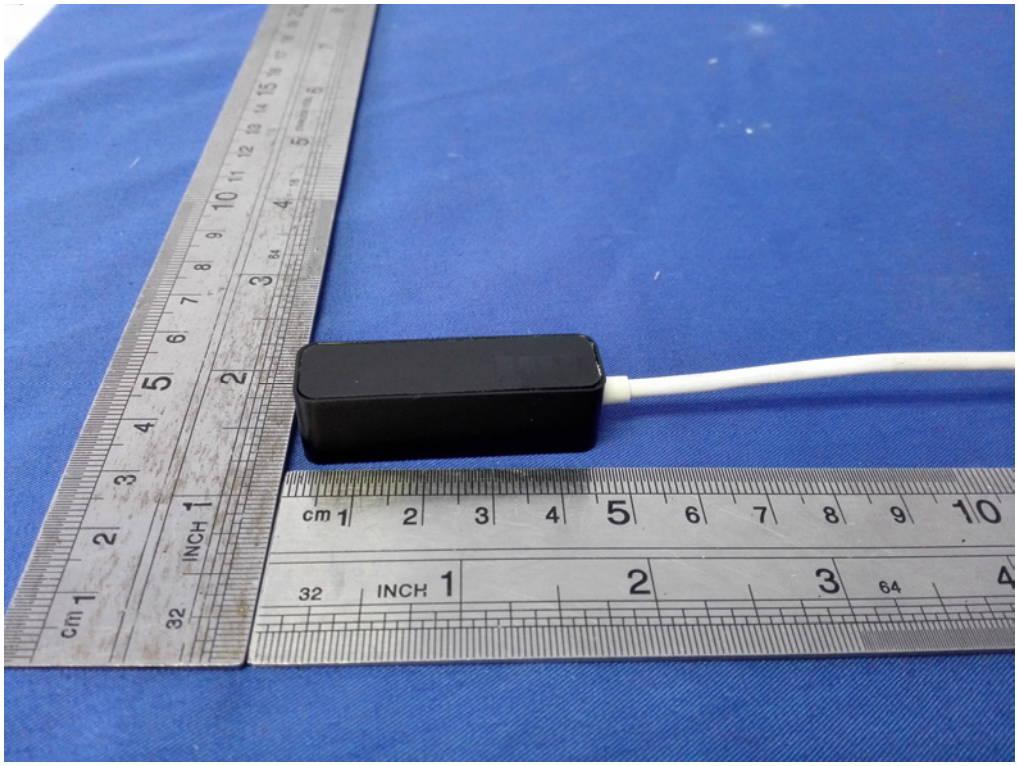


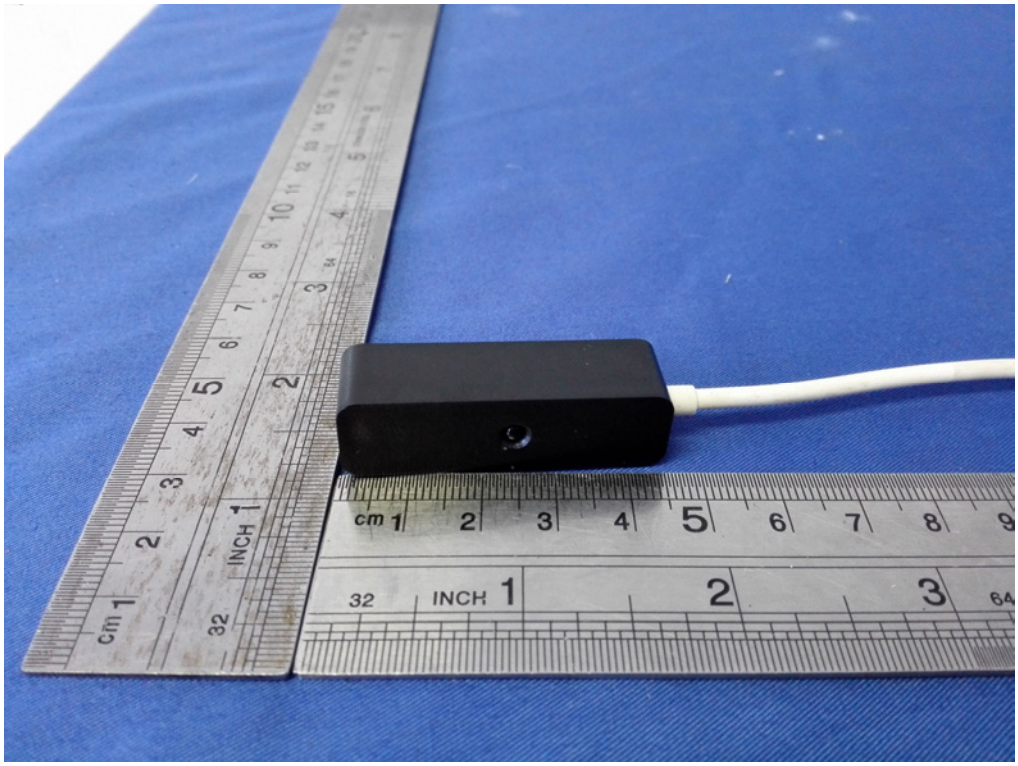
Radiated Emission Test



13. PHOTOGRAPHS OF THE EUT




cm 1 2 3 4 5 6 7 8 9 10
INCH 1 2 3 4
32 64


cm 1 2 3 4 5 6 7 8 9
INCH 1 2 3
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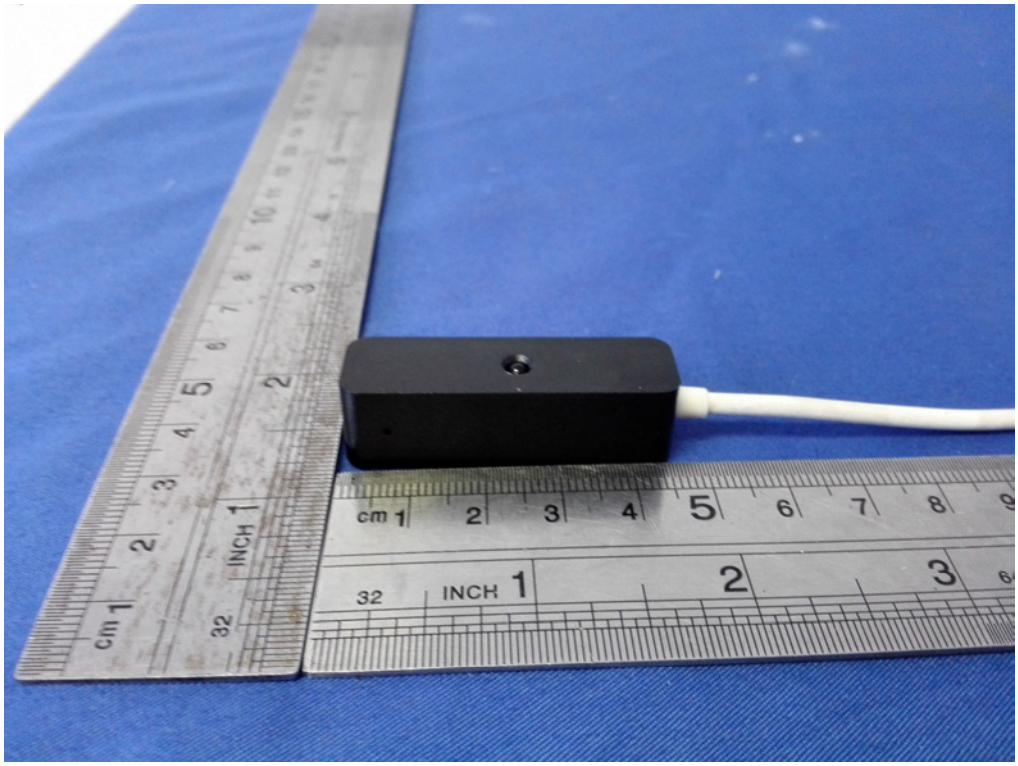
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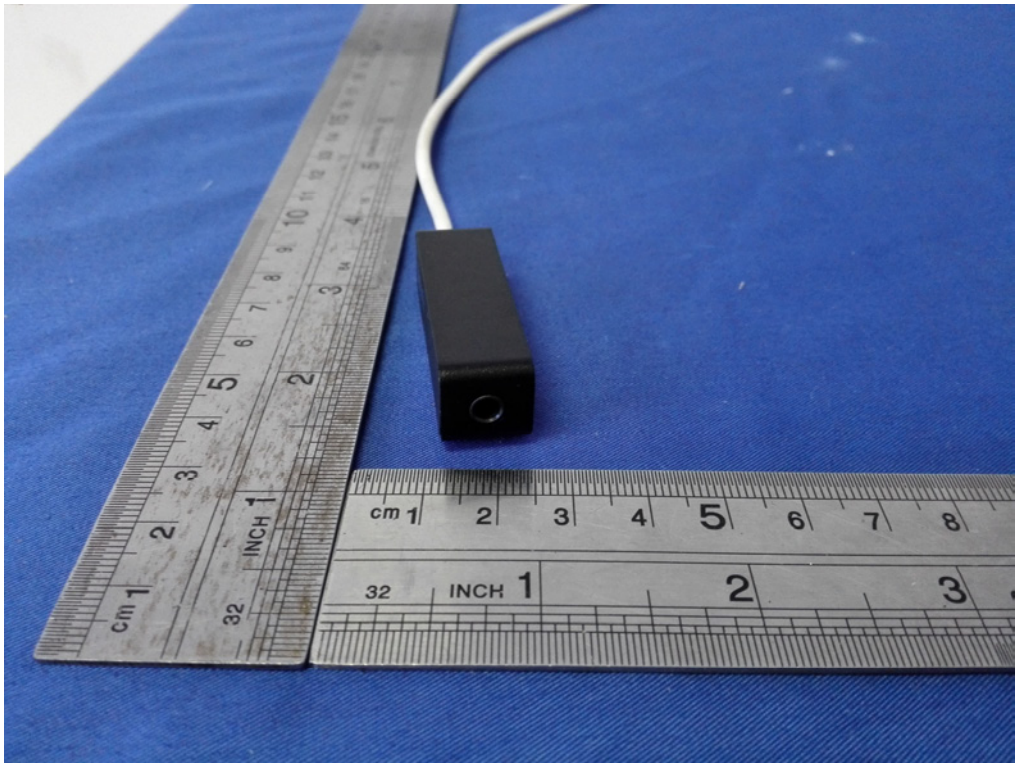
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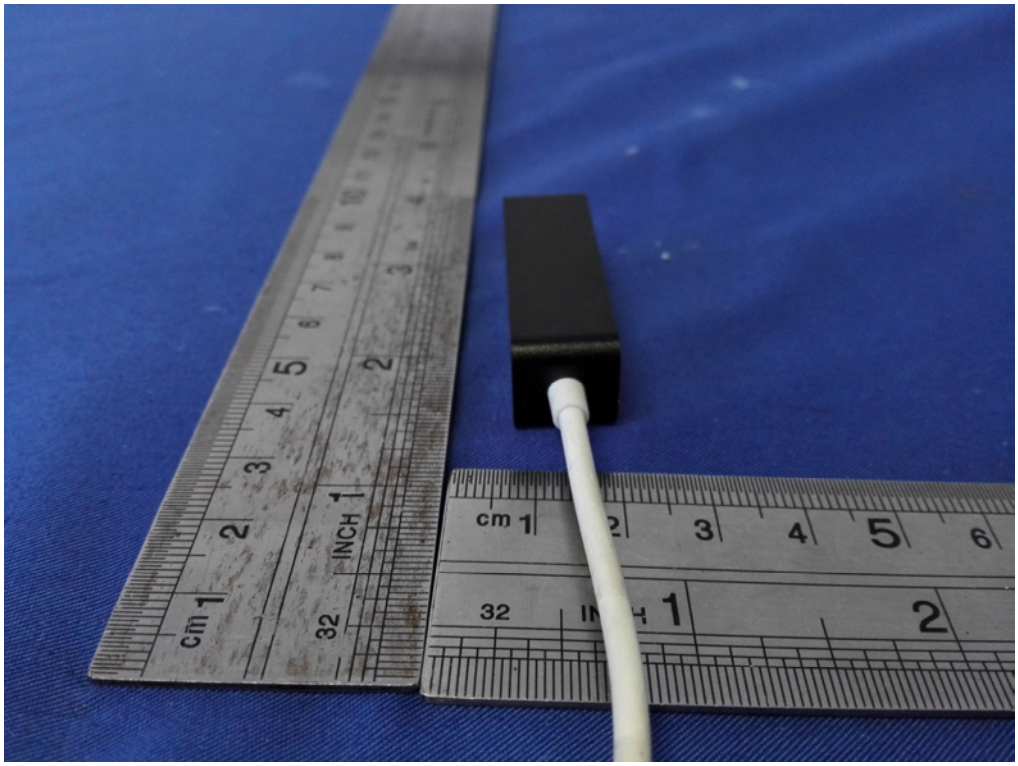

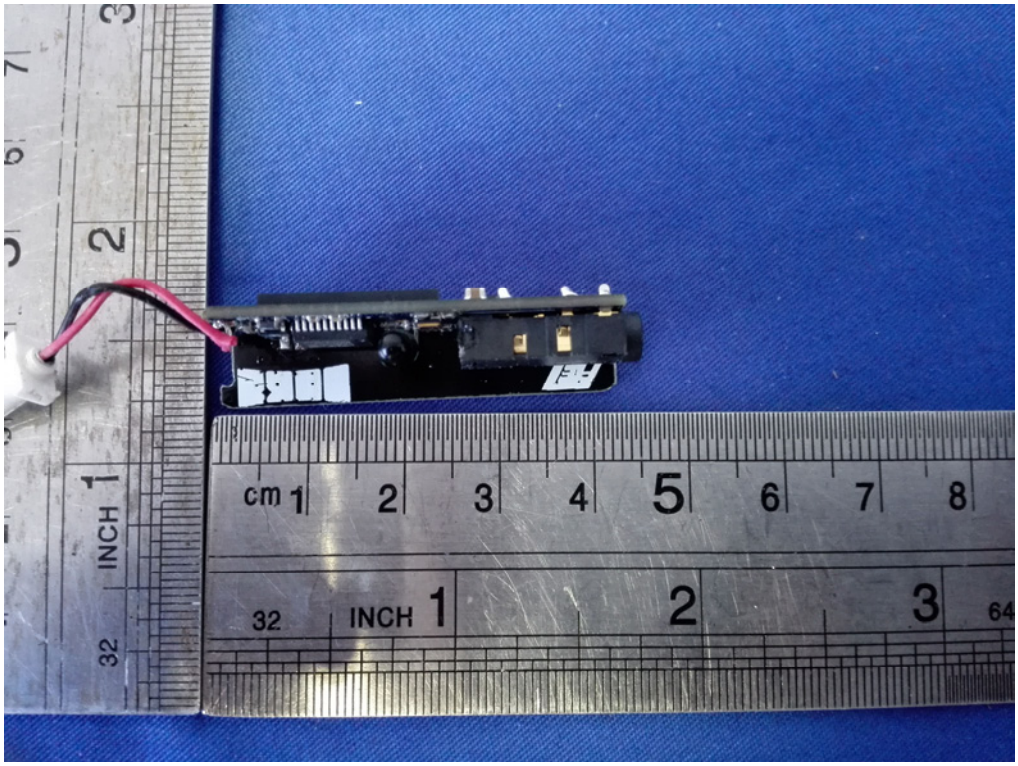

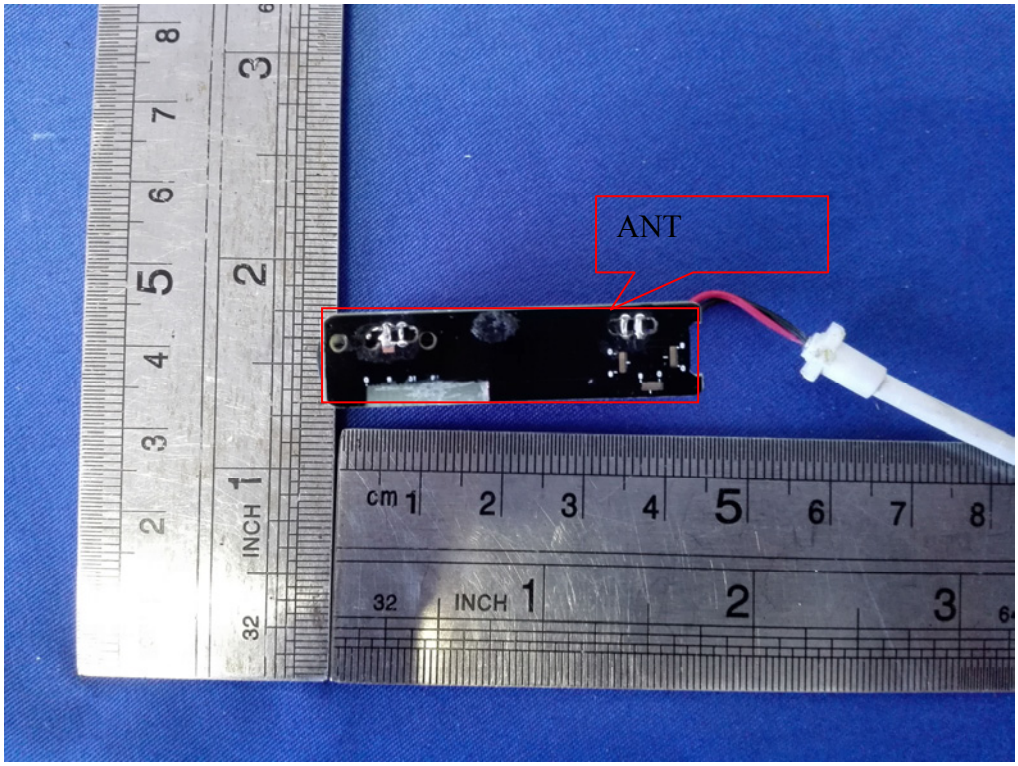
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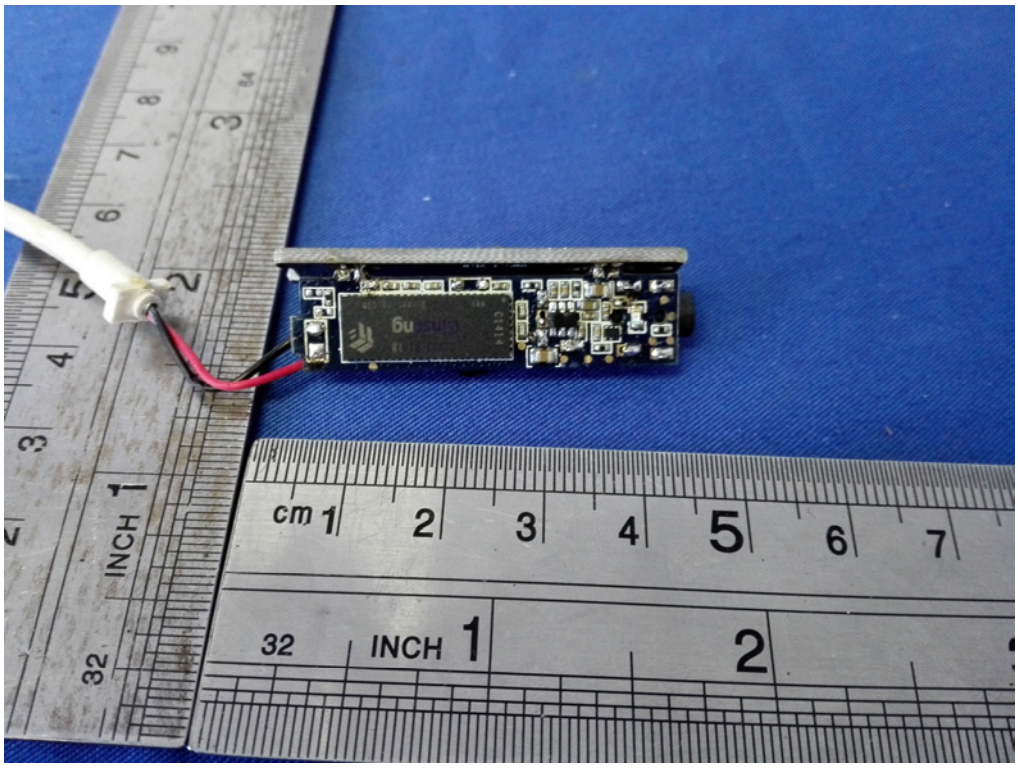

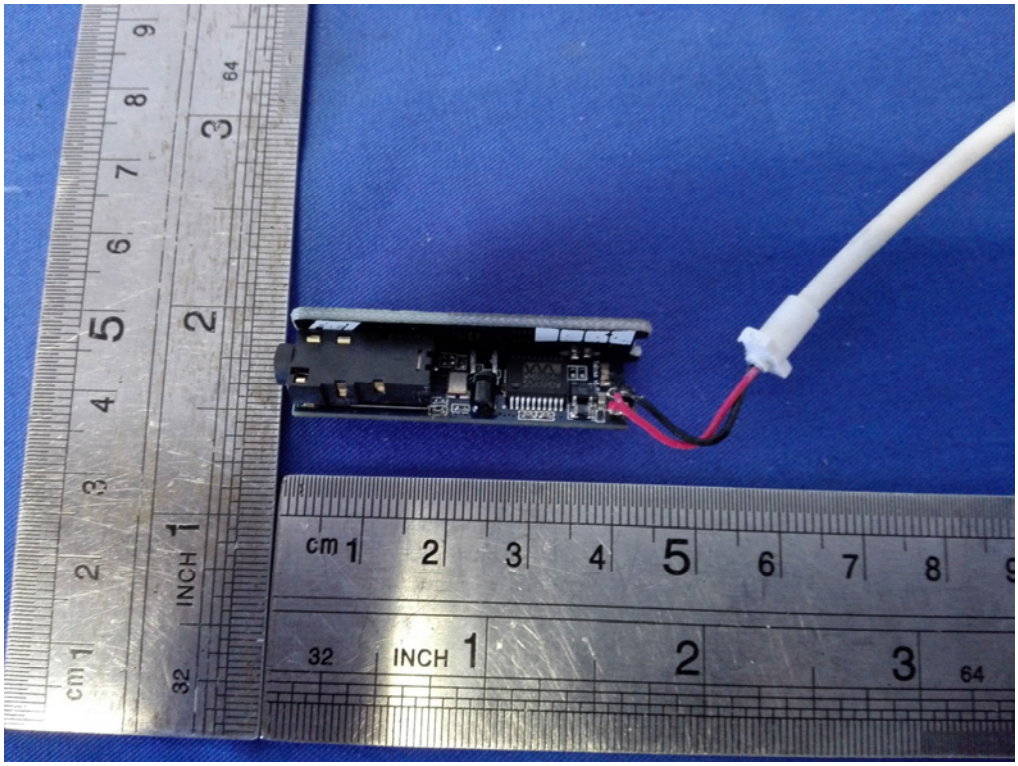

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