FCC TEST REPORT(Bluetooth)

for

DEI Sales Inc. dba Definitive Technology

Home theater with wireless subwoofer

Model Number: W Studio

FCC ID: IPUSTUDIOBAR
IC : 10392A-WSTUDIOBAR

Prepared for : DEI Sales Inc. dba Definitive Technology
Address : 1 Viper Way Vista,CA 92081 USA

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Report No. : 14KWE05145301F
Date of Test : May 11~17, 2014
Date of Report : May 17, 2014

TABLE OF CONTENTS

Test Report Declaration Page
1. TEST SUMMARY 4
2. GENERAL PRODUCT INFORMATION 5
2.1. Product Function 5
2.2. Description of Device (EUT) 5
2.3. Independent Operation Modes 5
2.4. Test Supporting System 5
2.5. Channel List 6
2.6. TEST SITES 6
2.7. List of Test and Measurement Instruments 7
3. TEST SET-UP AND OPERATION MODES 8
3.1. Principle of Configuration Selection 8
3.2. Block Diagram of Test Set-up 8
3.3. Test Operation Mode and Test Software 8
3.4. Special Accessories and Auxiliary Equipment 8
3.5. Countermeasures to Achieve EMC Compliance 8
4. EMISSION TEST RESULTS 9
4.1. Conducted Emission at the Mains Terminals Test 9
4.2. Radiated Emission Test 11
5. 20DB & 99% OCCUPY BANDWIDTH 17
5.1. Limits 17
5.2. Test setup 17
6. FREQUENCY SEPARATION 19
6.1. Limits 19
6.2. Test setup 19
7. MAXIMUM PEAK OUTPUT POWER 21
7.1. Limits 21
7.2. Test setup 21
8. NUMBER OF HOPPING FREQUENCY 22
8.1. Limits 22
8.2. Test setup 22
9. DWELL TIME 23
9.1. Limits 23
9.2. Test setup 23
10. BAND EDGE COMPLIANCE TEST 25
10.1. Limits 25
10.2. Test setup 25
11. ANTENNA REQUIREMENTS 27
11.1. Limits 27
11.2. Result 27
12. PHOTOGRAPHS OF TEST SET-UP 28
13. PHOTOGRAPHS OF THE EUT 30

Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	DEI Sales Inc. dba Definitive Technology 1 Viper Way Vista,CA 92081 USA		
Manufacturer: **Address:**	DEI Sales Inc. dba Definitive Technology 1 Viper Way Vista,CA 92081 USA		
E.U.T:	Home theater with wireless subwoofer		
Model Number:	W Studio		
Trade Name:	Definitive Technology	**Serial No.:**	------
Date of Receipt:	May 10 , 2014	**Date of Test:**	May 11~17, 2014
Test Specification:	FCC Part 15, Subpart 15.247: Oct. 1, 2013 ANSI C63.4:2009 RSS 210 Issue 8.0:2010		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: May 17, 2014**		

Tested by:	Reviewed by:	Approved by:
Andy Gao / Engineer	Jade Yang/ Supervisor	Chris Du / Manager

Other Aspects:

None.

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

This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207,RSS-210, ISSUE 8 RSS-GEN Clause 7.2.4	PASS
Radiated Emissions	15.205(a)/15.209/15.247(d) RSS-210, ISSUE 8	PASS
20dB&99% Bandwidth	15.247(a)(1) RSS-210, ISSUE 8 RSS-GEN Clause 4.6.1	PASS
Frequency Separation	15.247(a)(1) RSS-210, ISSUE 8 Clause A8.1(b)	PASS
Maximum Peak Output Power	15.247(b)(1) RSS-210, ISSUE 8 Clause A8.4	PASS
Number of Hopping Frequency	15.247(a)(1)(iii) RSS-210, ISSUE 8 Clause A8.1(d)	PASS
Dwell time	15.247(a)(1)(iii) RSS-210, ISSUE 8Clause A8.1(d)	PASS
Emissions from out of band	15.247(d) RSS-210, ISSUE 8 Clause 2.5	PASS
Antenna Requirement	15.203 RSS-GEN	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:	Home theater with wireless subwoofer
Model No.:	W Studio
Operation Frequency:	2412MHz~2462MHz (802.11b/802.11g/802.11n(H20)) 2422MHz~2452MHz (802.11n(H40)) 5180-5240 MHz; 5745-5805 MHz(5G 802.11a/n(HT20)) 5190-5230 MHz; 5755-5795 MHz(802.11n(HT40)) 2403.5MHz~2477.3MHz
Channel numbers:	11 for 802.11b/802.11g/802.11n(H20) ,7 for 802.11n(H40) 49 Channels for FSK 7channels for 5G 802.11a/n(HT20) 8channels for 802.11n(HT40)
Modulation technology:	Direct Sequence Spread Spectrum (DSSS) for (IEEE 802.11b) Orthogonal Frequency Division Multiplexing(OFDM) for (IEEE 802.11g/802.11n) FSK
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps,54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps
Antenna Type:	Internal
Antenna gain:	3.3dBi for WIFI 3.25dBi for FSK
Power supply:	AC 120V/60Hz

2.3. Independent Operation Modes

The basic operation modes are:

Channel	Frequency
Low	2403.5MHz
Middle	2440.4MHz
High	2477.3MHz

2.4. Test Supporting System

Adapter

Manufacturer : EDAC
Model No. : EA11001B
Input : AC 100~240V 2.5A 50-60Hz
Output : DC 19-24 5.2A

2.5. Channel List

1	2.4035	26	2.4420
2	2.4051	27	2.4435
3	2.4066	28	2.4450
4	2.4081	29	2.4466
5	2.4097	30	2.4481
6	2.4112	31	2.4496
7	2.4128	32	2.4512
8	2.4143	33	2.4527
9	2.4158	34	2.4543
10	2.4174	35	2.4558
11	2.4189	36	2.4573
12	2.4204	37	2.4589
13	2.4220	38	2.4604
14	2.4235	39	2.4619
15	2.4251	40	2.4635
16	2.4266	41	2.4650
17	2.4281	42	2.4666
18	2.4297	43	2.4681
19	2.4312	44	2.4696
20	2.4327	45	2.4712
21	2.4343	46	2.4727
22	2.4358	47	2.4742
23	2.4374	48	2.4758
24	2.4389	49	2.4773
25	2.4404		

2.6. TEST SITES

2.6.1. Test Facilities

Lab Qualifications : 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

2.7. List of Test and Measurement Instruments

2.7.1. 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. 27,14	Apr. 27,15
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,14	Apr. 27,15
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,14	Apr. 27,15
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,14	Apr. 27,15

2.7.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,14	Apr. 27,15
System Simulator	Agilent	E5515C	GB43130245	Apr. 27,14	Apr. 27,15
Power Splitter	Weinschel	1506A	NW425	Apr. 27,14	Apr. 27,15
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	R&S	FSV40	132.1.3008K39 -100967	Apr. 27,14	Apr. 27,15
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,14	Apr. 27,15
Signal Amplifier	SONOMA	310	187016	Apr. 27,14	Apr. 27,15
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,14	Apr. 27,15
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. 27,14	Apr. 27,15
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,14	Apr. 27,15
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 27,14	Apr. 27,15
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,14	Apr. 27,15
High Pass filter	Micro	HPM50111	324216	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	Apr. 27,14	Apr. 27,15
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	Apr. 27,14	Apr. 27,15
DC Power Supply	LongWei	PS-305D	010964729	Apr. 27,14	Apr. 27,15
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 27,14	Apr. 27,15
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	Apr. 27,14	Apr. 27,15
Splitter	Agilent	11636B	0025164	Apr. 27,14	Apr. 27,15

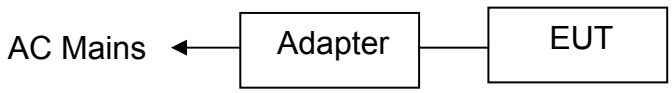
3. TEST SET-UP AND OPERATION MODES

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: Home theater with wireless subwoofer)

3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Conducted Emission at the Mains Terminals Test

4.1.1. Limit 15.209 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

4.1.2. Test Setup

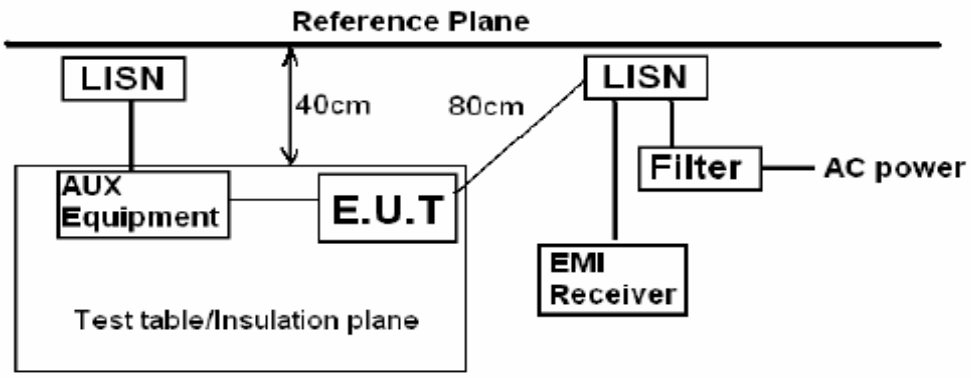
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to 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

Line

	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dB	
1	0.165	37.05	55.21	-18.16	Average
2	0.165	42.90	65.21	-22.31	QP
3	0.328	35.12	49.50	-14.38	Average
4	0.328	38.93	59.50	-20.57	QP
5	0.979	24.10	46.00	-21.90	Average
6	0.979	32.70	56.00	-23.30	QP

Neutral

	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dB	
1	0.165	38.12	55.21	-17.09	Average
2	0.165	45.63	65.21	-19.58	QP
3	0.336	33.81	49.31	-15.50	Average
4	0.336	39.62	59.31	-19.69	QP
5	0.654	30.24	46.00	-15.76	Average
6	0.654	35.42	56.00	-20.58	QP

4.2. Radiated Emission Test

4.2.1. 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)	

4.2.2. 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.

4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. 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 frequency range from 30MHz to 10th 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.

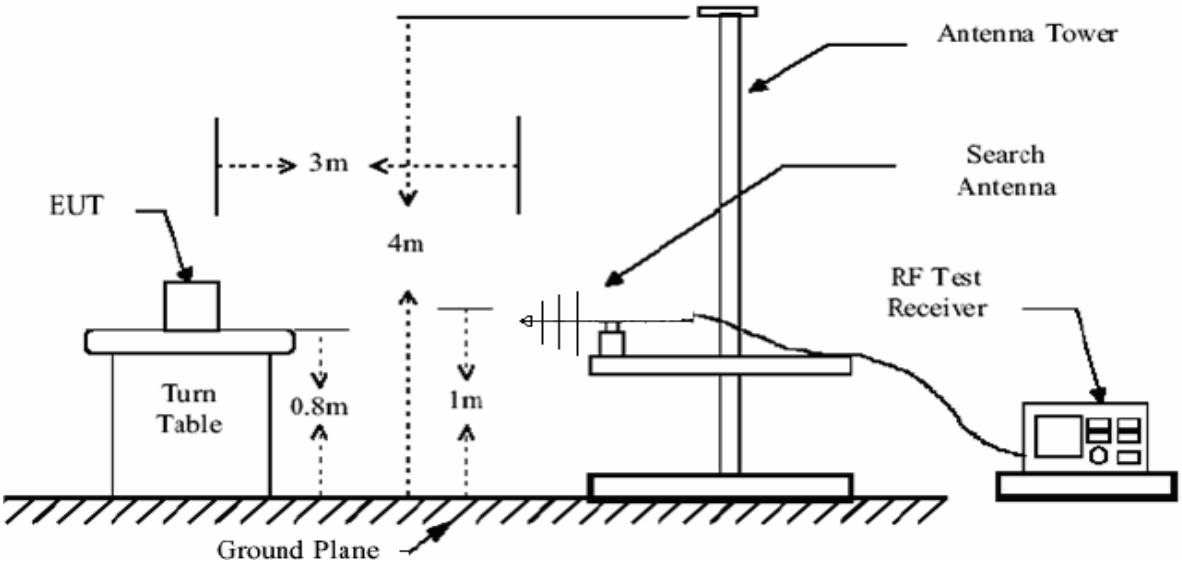
2. Measurement Uncertainty: ±3.2 dB at a level of confidence of 95%.

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: During the test, pre-scan the GFSK, Pi/4DQPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.

6: Pre-scan below 1GHz for all model, The other test only show wost model in report.



Below 1GHz
Horizontal

		Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
		MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1		88.20	31.35	58.70	0.94	8.90	37.19	43.50	-6.31	QP
2	!	102.75	31.35	59.94	1.03	9.52	39.14	43.50	-4.36	QP
3	!	175.50	31.17	58.80	1.39	10.27	39.29	43.50	-4.21	QP
4	!	267.65	30.95	57.74	1.78	12.97	41.54	46.00	-4.46	QP
5	!	529.55	30.74	50.46	2.94	19.25	41.91	46.00	-4.09	QP
6	!	701.24	30.67	44.92	3.88	21.93	40.06	46.00	-5.94	QP

Vertical

		Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
		MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1		102.75	31.35	58.10	1.03	9.52	37.30	43.50	-6.20	QP
2	!	175.50	31.17	58.02	1.39	10.27	38.51	43.50	-4.99	QP
3	!	212.36	31.06	57.47	1.53	11.59	39.53	43.50	-3.97	QP
4	!	284.14	30.94	56.27	1.87	13.29	40.49	46.00	-5.51	QP
5		553.80	30.89	47.12	3.12	19.55	38.90	46.00	-7.10	QP
6	!	677.96	30.75	46.75	3.80	21.99	41.79	46.00	-4.21	QP

Above 1GHz
TX 2403.5MHz
Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4807.00	27.49	35.92	11.96	32.94	53.33	74.00	-20.67	Peak
2	7211.00	27.94	24.85	16.61	37.28	50.80	74.00	-23.20	Peak
3	10537.00	28.85	14.25	17.07	39.22	41.69	74.00	-32.31	Peak
4	12084.00	29.02	16.41	17.44	39.42	44.25	74.00	-29.75	Peak
5	14515.00	29.48	10.04	19.69	40.53	40.78	74.00	-33.22	Peak
6	16385.00	29.86	7.16	20.90	42.68	40.88	74.00	-33.12	Peak

Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4807.00	27.49	34.56	11.96	32.94	51.97	74.00	-22.03	Peak
2	7211.00	27.94	24.73	16.61	37.28	50.68	74.00	-23.32	Peak
3	9177.00	28.47	16.65	16.89	37.61	42.68	74.00	-31.32	Peak
4	10656.00	28.87	14.78	17.10	39.29	42.30	74.00	-31.70	Peak
5	12424.00	29.08	14.81	17.73	39.49	42.95	74.00	-31.05	Peak
6	14685.00	29.50	14.85	19.80	39.83	44.98	74.00	-29.02	Peak

TX 2440.4MHz
Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4881.00	27.53	34.97	12.14	33.11	52.69	74.00	-21.31	Peak
2	7321.00	27.96	24.78	16.62	37.33	50.77	74.00	-23.23	Peak
3	9330.00	28.53	15.88	16.91	37.79	42.05	74.00	-31.95	Peak
4	11064.00	28.91	16.15	17.18	39.55	43.97	74.00	-30.03	Peak
5	12220.00	29.04	19.70	17.56	39.44	47.66	74.00	-26.34	Peak
6	13903.00	29.38	13.12	19.24	43.40	46.38	74.00	-27.62	Peak

Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4881.00	27.53	33.46	12.14	33.11	51.18	74.00	-22.82	Peak
2	7321.00	27.96	25.00	16.62	37.33	50.99	74.00	-23.01	Peak
3	9007.00	28.40	18.95	16.88	37.40	44.83	74.00	-29.17	Peak
4	10554.00	28.86	16.24	17.08	39.23	43.69	74.00	-30.31	Peak
5	13461.00	29.29	11.31	18.75	42.84	43.61	74.00	-30.39	Peak
6	14838.00	29.53	16.83	19.89	39.20	46.39	74.00	-27.61	Peak

TX 2477.3MHz
Horizontal

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4955.00	27.58	33.81	12.32	33.32	51.87	74.00	-22.13	Peak
2	7432.00	27.98	24.27	16.62	37.37	50.28	74.00	-23.72	Peak
3	8769.00	28.33	15.59	16.83	37.12	41.21	74.00	-32.79	Peak
4	10860.00	28.89	14.88	17.14	39.42	42.55	74.00	-31.45	Peak
5	12050.00	29.01	13.98	17.41	39.41	41.79	74.00	-32.21	Peak
6	13495.00	29.30	11.88	18.77	43.00	44.35	74.00	-29.65	Peak

Vertical

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	4955.00	27.58	34.57	12.32	33.32	52.63	74.00	-21.37	Peak
2	7432.00	27.98	24.73	16.62	37.37	50.74	74.00	-23.26	Peak
3	9789.00	28.72	17.27	16.95	38.23	43.73	74.00	-30.27	Peak
4	11948.00	28.99	16.05	17.35	39.45	43.86	74.00	-30.14	Peak
5	13750.00	29.35	11.61	19.08	43.25	44.59	74.00	-29.41	Peak
6	15535.00	29.63	15.26	20.34	38.53	44.50	74.00	-29.50	Peak

5. 20DB & 99% OCCUPY BANDWIDTH

5.1. Limits

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

5.2. 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 Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

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

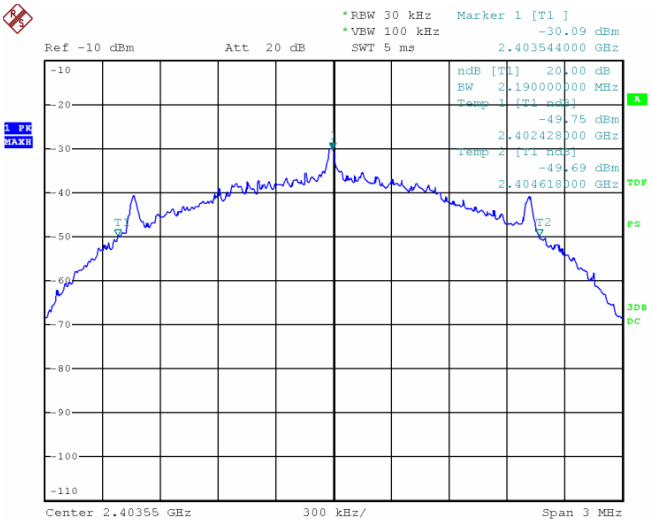
Test data:

Channel Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2403.5	2.19	2.17	Pass
2440.4	2.18	2.15	Pass
2477.3	2.18	2.15	Pass

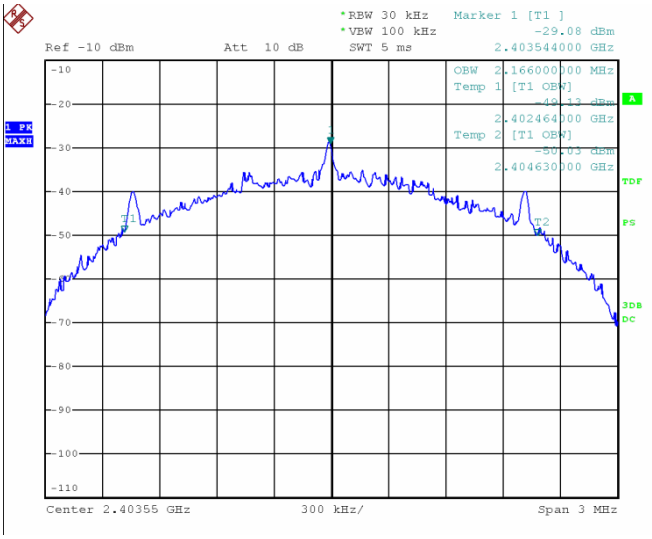
Test plot as follows:

2403.5MHz

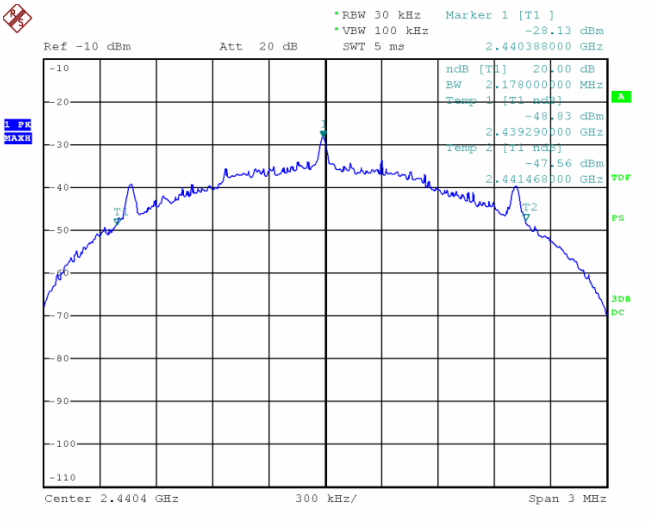
20dB

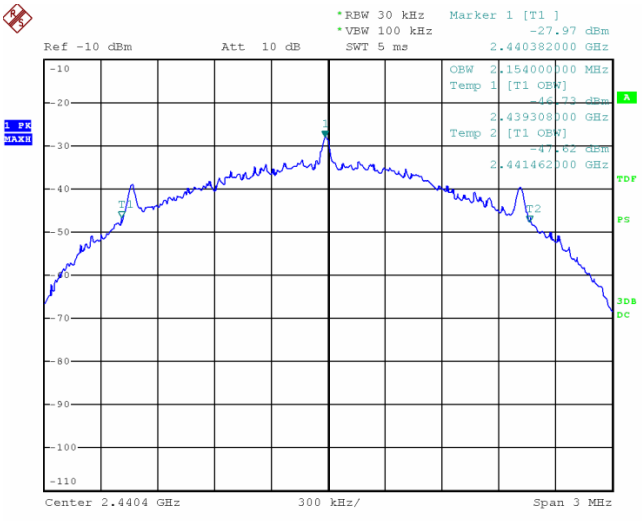


99%

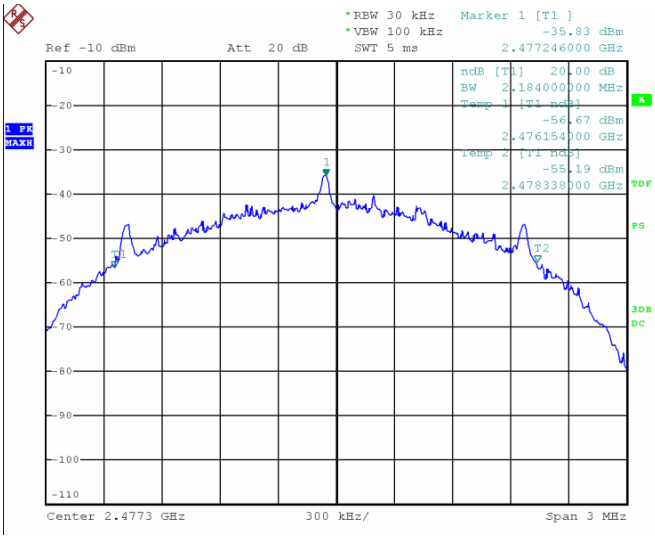


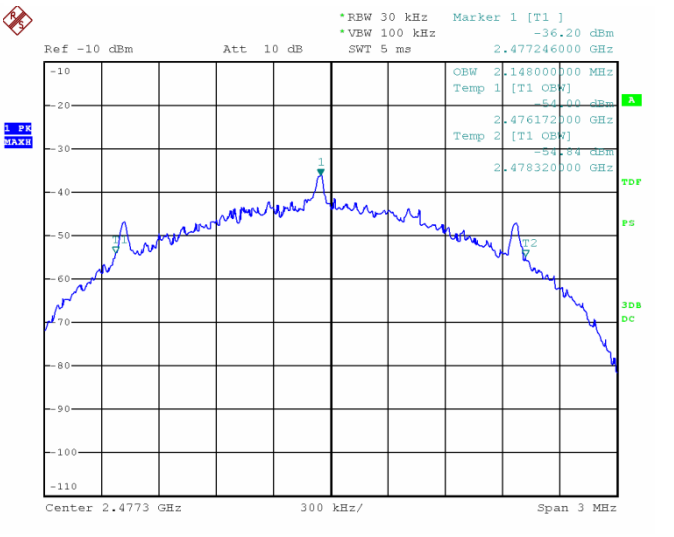
2440.4 MHz





2477.3 MHz





6. FREQUENCY SEPARATION

6.1. 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.

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 Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

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

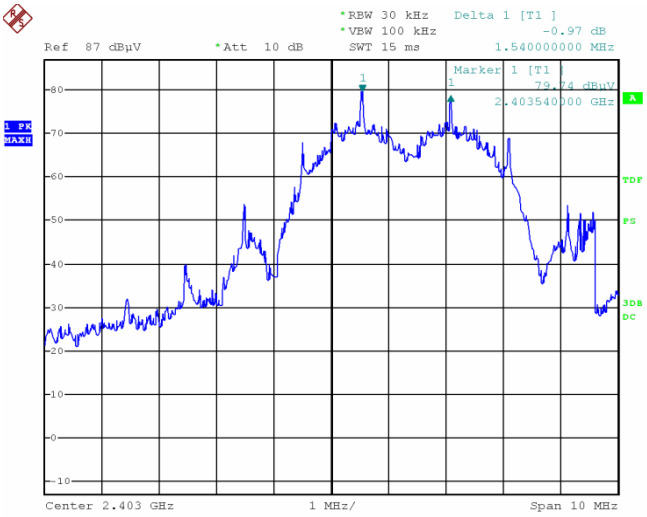
Trace=max hold

Channel	Frequency (GHz)	Separation (MHz)	Channel	Frequency (GHz)	Separation (MHz)	Channel	Frequency (GHz)	Separation (MHz)	Channel	Frequency (GHz)	Separation (MHz)
1	2.4035	1.6	14	2.4235	1.5	27	2.4435	1.5	40	2.4635	1.6
2	2.4051	1.6	15	2.4251	1.6	28	2.4450	1.5	41	2.4650	1.5
3	2.4066	1.5	16	2.4266	1.5	29	2.4466	1.5	42	2.4666	1.5
4	2.4081	1.5	17	2.4281	1.5	30	2.4481	1.5	43	2.4681	1.5
5	2.4097	1.6	18	2.4297	1.6	31	2.4496	1.5	44	2.4696	1.5
6	2.4112	1.5	19	2.4312	1.5	32	2.4512	1.6	45	2.4712	1.5
7	2.4128	1.6	20	2.4327	1.5	33	2.4527	1.5	46	2.4727	1.5
8	2.4143	1.5	21	2.4343	1.6	34	2.4543	1.6	47	2.4742	1.5
9	2.4158	1.5	22	2.4358	1.5	35	2.4558	1.5	48	2.4758	1.6
10	2.4174	1.6	23	2.4374	1.5	36	2.4573	1.5	49	2.4773	1.5
11	2.4189	1.5	24	2.4389	1.5	37	2.4589	1.6			
12	2.4204	1.5	25	2.4404	1.5	38	2.4604	1.5			
13	2.4220	1.6	26	2.4420	1.6	39	2.4619	1.5			

Note1: Limit according to section 5

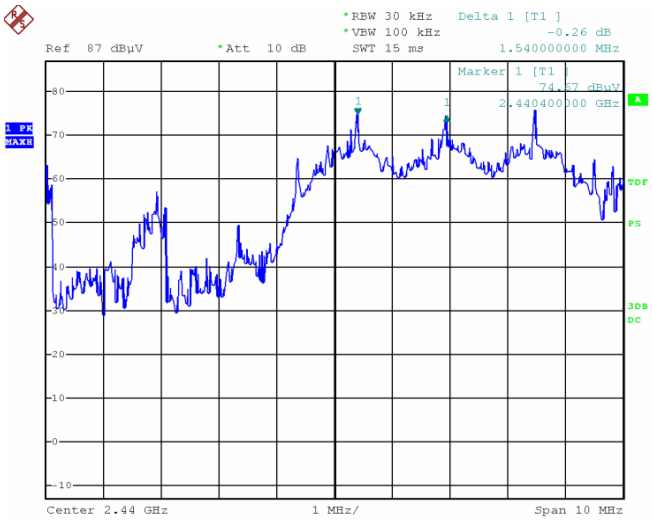
Test plot as follows:

Low



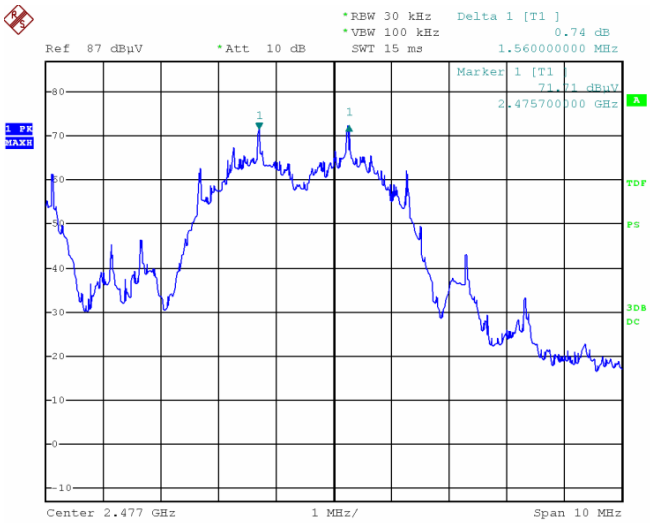
Channel Separation is 1.54MHz, the limit is 1.46MHz

Middle



Channel Separation is 1.54MHz, the limit is 1.45MHz

High



Channel Separation is 1.56MHz, the limit is 1.45MHz

7. MAXIMUM PEAK OUTPUT POWER

7.1. 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.

7.2. 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 Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

Test data:

Channel Frequency (MHz)	**Peak output Power dBm**	**Limit dBm**	**Result**
2403.5	13.36	21.00	Pass
2440.4	13.31	21.00	Pass
2477.3	13.27	21.00	Pass

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 Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW ≥1% of the span

VBW ≥ RBW

Sweep=auto

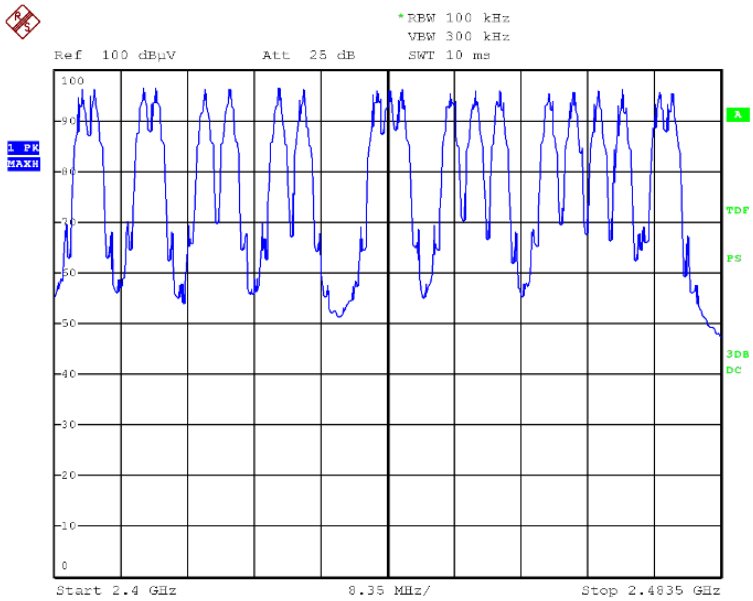
Detector function=peak

Trace=max hold

Test data:

	Measured channel numbers	Limit	Result
	20	>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,
2. Set the spectrum analyzer:

Span= 0Hz
RBW =100 kHz
VBW = 300 kHz
Sweep=auto
Detector function=peak

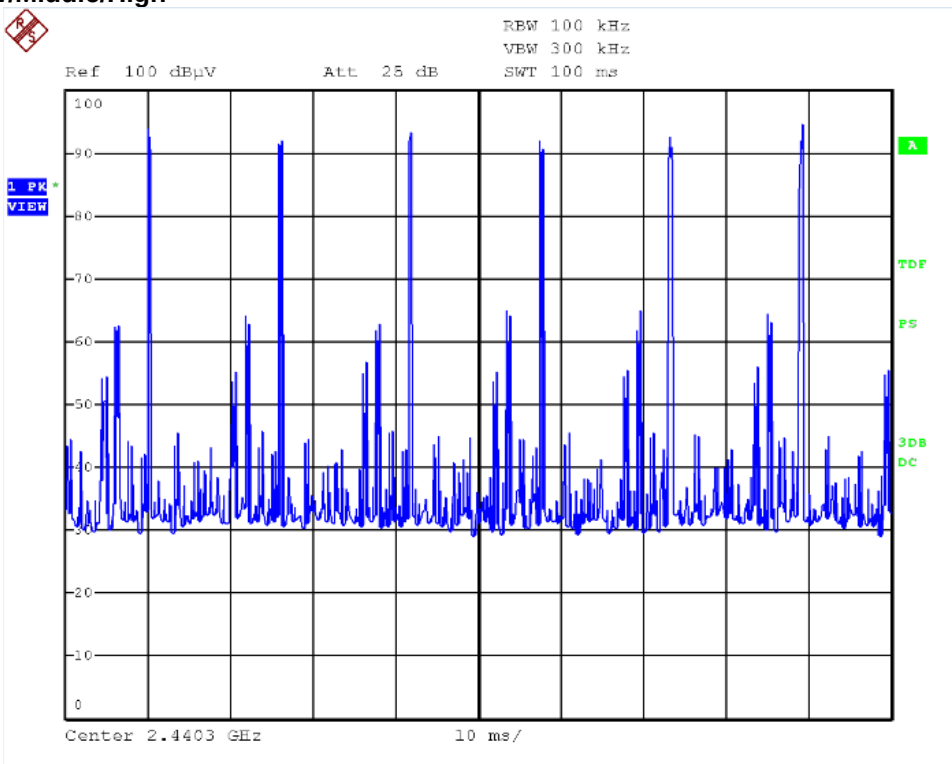
Test data:

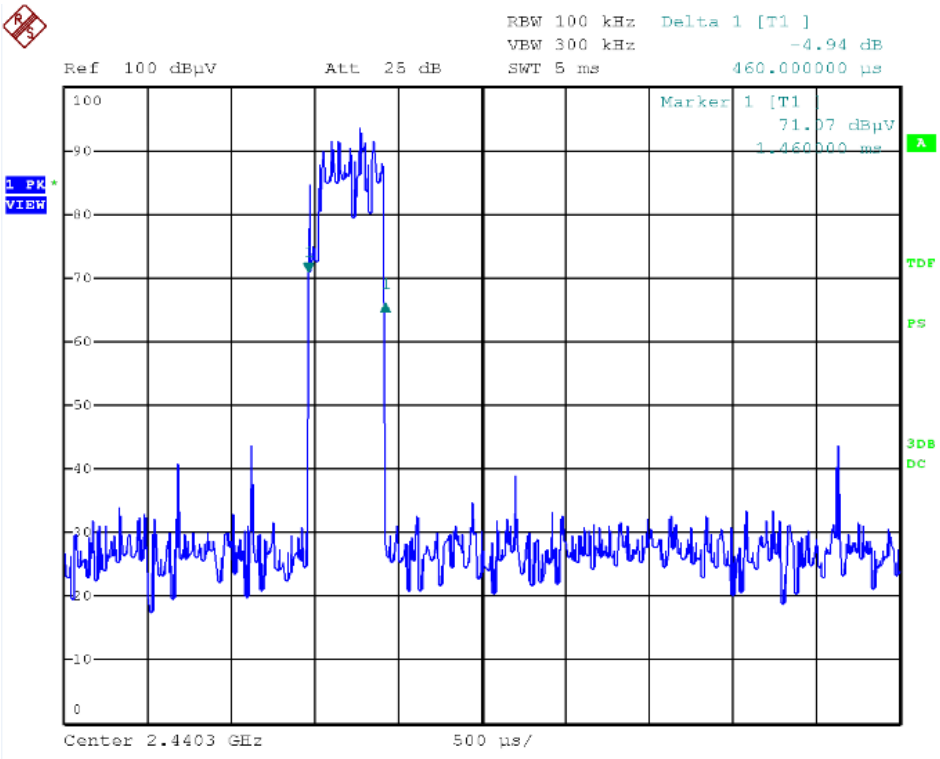
	Dwell time(ms)	**Limit(ms)**	**Result**
	220.8	<400	Pass

The test period: T= 60hop(per sec) * 0.4 * 20 * 0.46ms =220.8ms

Test plot as follows:

Low/Middle/High





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.

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

Test data as follows:

For radiated test as follows:

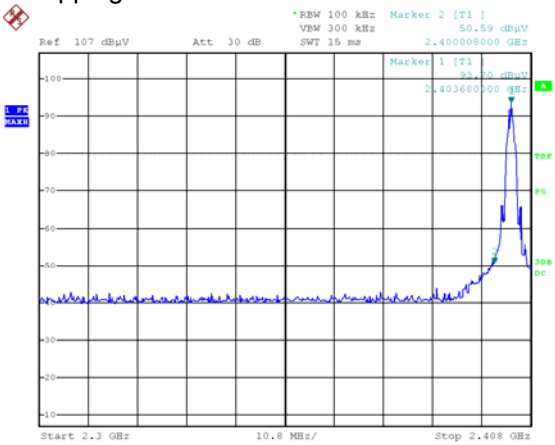
Unhopping

	Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
			PK	PK	AV	
Unhopping	<2400	H	51.04	74.00	54.00	Pass
	<2400	V	50.37	74.00	54.00	Pass
	>2483.5	H	50.89	74.00	54.00	Pass
	>2483.5	V	50.17	74.00	54.00	Pass
Hopping	<2400	H	50.78	74.00	54.00	Pass
	<2400	V	50.63	74.00	54.00	Pass
	>2483.5	H	50.16	74.00	54.00	Pass
	>2483.5	V	50.49	74.00	54.00	Pass

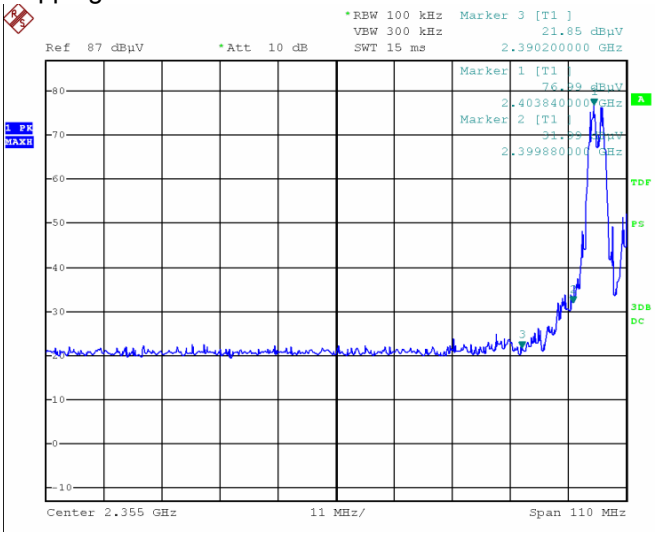
If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

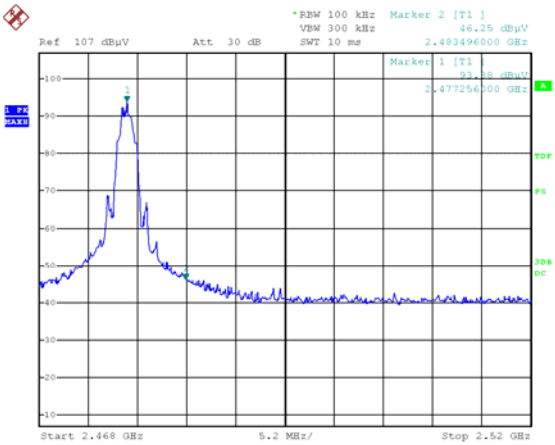
For conducted test

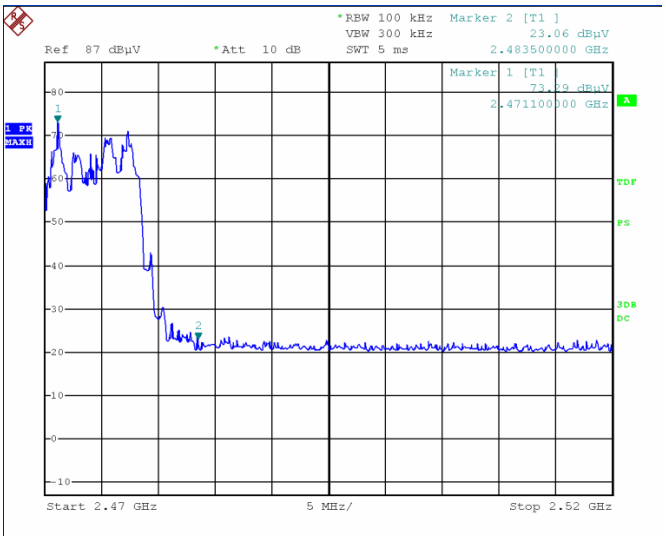
Unhopping



Hopping







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

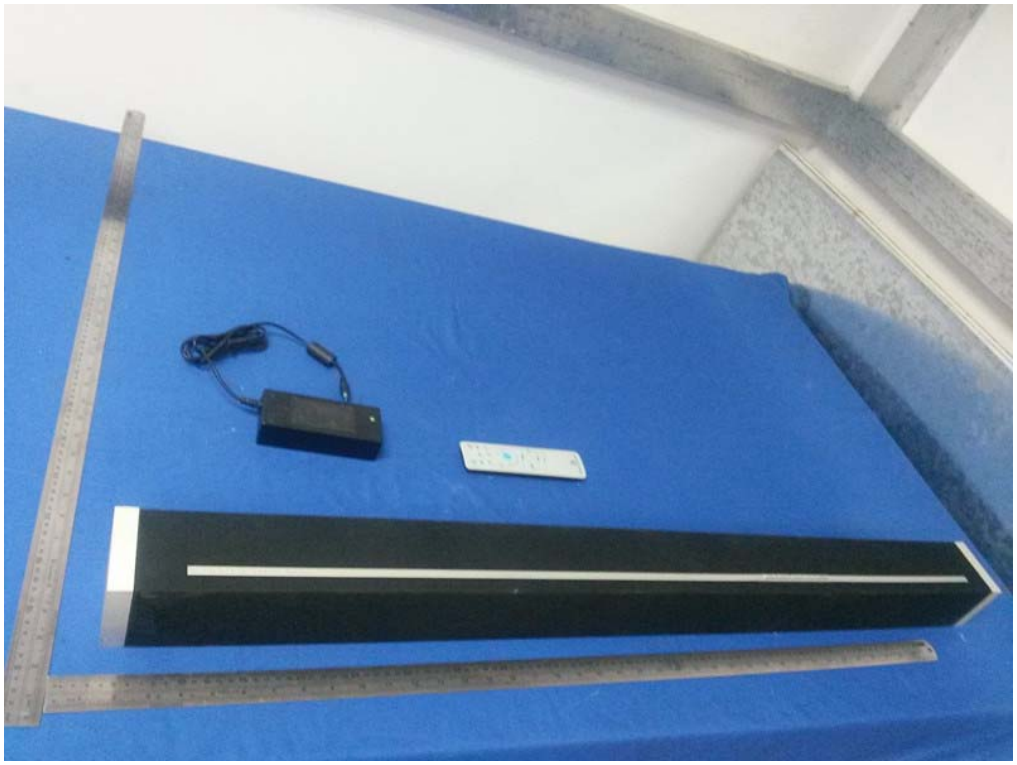
The antennas used for this product are integral Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 3.3dBi.

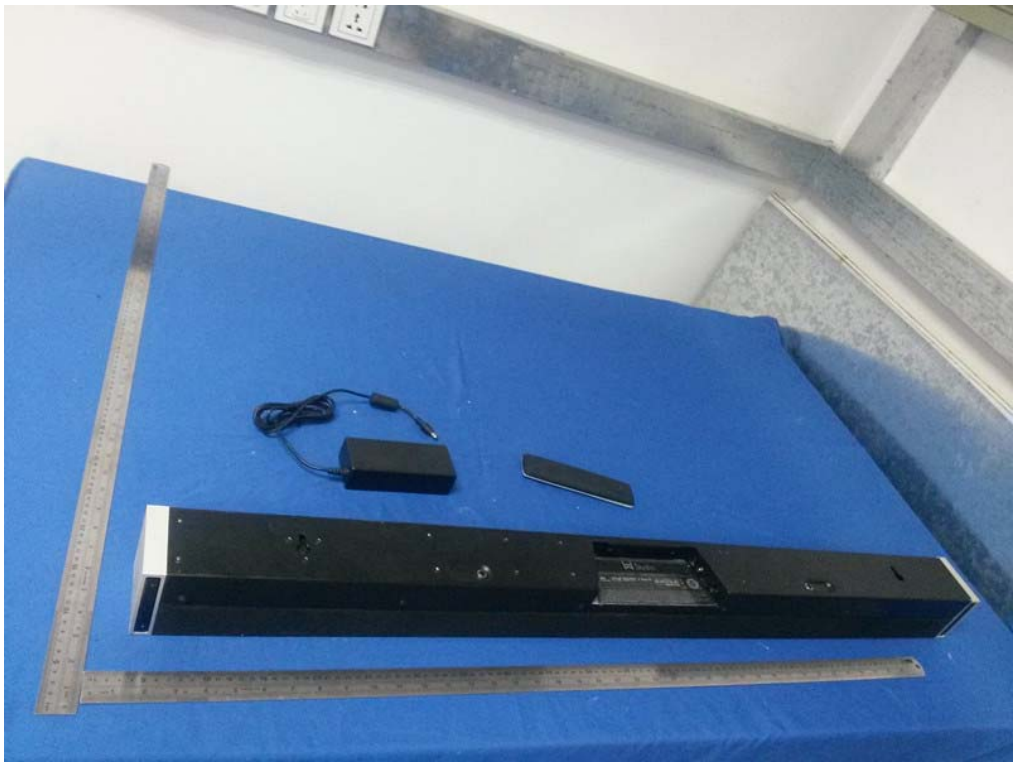
12. PHOTOGRAPHS OF TEST SET-UP

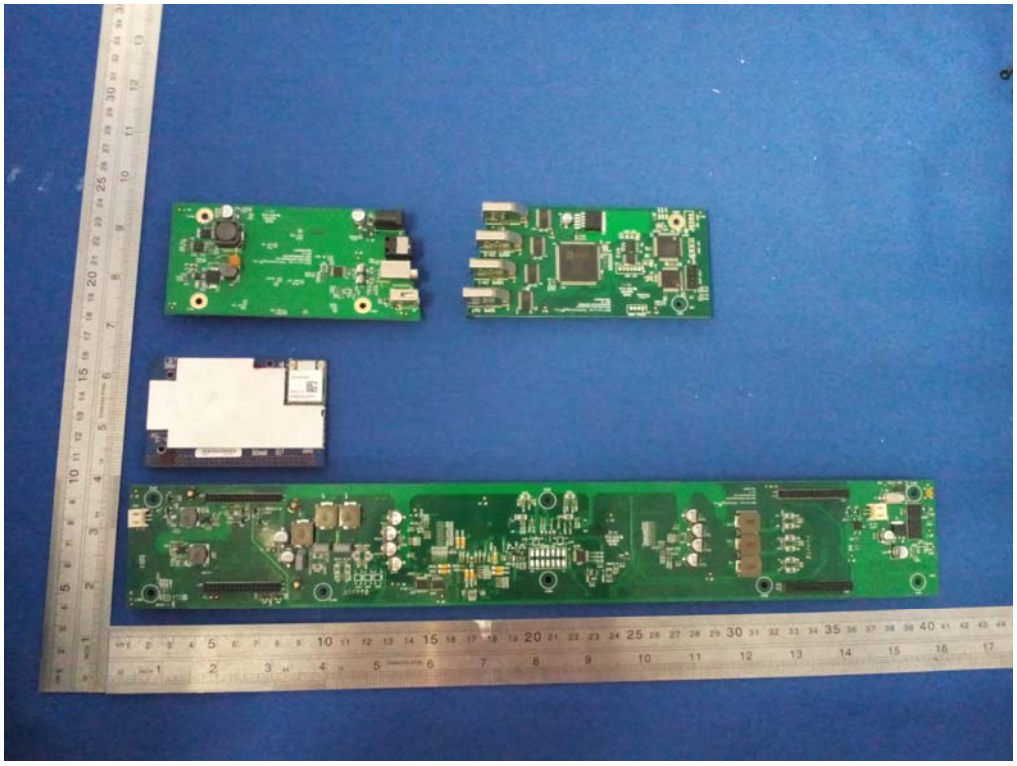
Conducted Emission

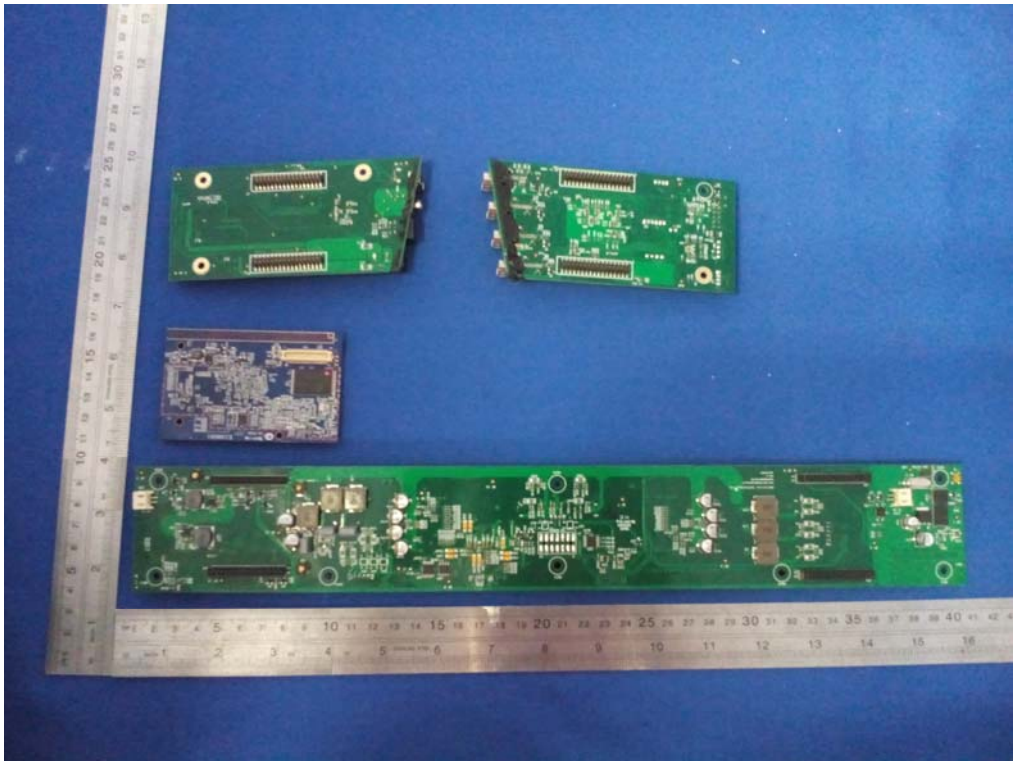
Radiated Emission Test

13. PHOTOGRAPHS OF THE EUT









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