FCC TEST REPORT(Bluetooth)

for

Audioengine Ltd.

B2 bluetooth speaker

Model Number: B2

FCC ID: PIBB2

Prepared for	:	Audioengine Ltd.
Address	:	6500 River Place Blvd, Bldg 7, Ste 250, Austin, Tx 78730, USA
Prepared by	:	Keyway Testing Technology Co., Ltd.
Address	:	Baishun Industrial Zone, Zhangmutou Town, Dongguan, Guangdong, China
		Tel: 86-769-8718 2258 Fax: 86-769-8718 1058

Report No.	:	14KWE08183004F
Date of Test	:	Aug. 16~23, 2014
Date of Report	:	Aug. 24, 2014

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Keyway Testing Technology Co., Ltd.

Applicant: **Address:**	Audioengine Ltd. 6500 River Place Blvd, Bldg 7, Ste 250, Austin, Tx 78730, USA		
Manufacturer: **Address:**	Audioengine Ltd. 6500 River Place Blvd, Bldg 7, Ste 250, Austin, Tx 78730, USA		
E.U.T:	B2 bluetooth speaker		
Model Number:	B2		
Trade Name:	Audioengine	**Serial No.:**	------
Date of Receipt:	Aug. 15, 2014	**Date of Test:**	Aug. 16~23, 2014
Test Specification:	FCC Part 15, Subpart C: Oct. 1, 2013 ANSI C63.4:2009		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date: Aug. 24, 2014**		

Tested by:	Reviewed by:	Approved by:
Jack Bu / Engineer	Andy Gao / Supervisor	Jade Yang / 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	PASS
Radiated Emissions	15.205(a)/15.209 15.247(d)	PASS
20dB Bandwidth	15.247(a)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Emissions from out of band	15.247(d)	PASS
Antenna Requirement	15.203	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:	B2 bluetooth speaker
Model No.:	B2
Operation Frequency:	2402~2480MHz
Channel numbers:	79 Channels
Channel separation:	1M
Modulation technology:	GFSK, Pi/4DQPSK, 8-DPSK
Antenna Type:	External antenna
Antenna gain:	2.15dBi
Power supply:	120 Vac

2.3. Difference between Model Numbers

None.

2.4. Independent Operation Modes

The basic operation modes are:

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

Modulation technology	Channel	Output Power(dBm)
GFSK	Middle	1.16
Pi/4DQPSK	Middle	1.11
8-DPSK	Middle	1.15

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

2.5. Test Supporting System

None.

3. TEST SITES

3.1. 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 : Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

3.2. List of Test and Measurement Instruments

3.2.1. 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	May 9,13	May 9,14
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	May 9,13	May 9,14
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	May 9,13	May 9,14
RF Cable	FUJIKURA	3D-2W	944 Cable	May 9,13	May 9,14

3.2.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	May 9,13	May 9,14
System Simulator	Agilent	E5515C	GB43130245	May 9,13	May 9,14
Power Splitter	Weinschel	1506A	NW425	May 9,13	May 9,14
Bilog Antenna	ETS-LINDGREEN	3142D	135452	May 20,13	May 20,14
Spectrum Analyzer	Agilent	E4411B	MY4511304	May 9,13	May 9,14
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	May 9,13	May 9,14
Signal Amplifier	SONOMA	310	187016	May 9,13	May 9,14
Signal Amplifier	Agilent	8449B	3008A00251	May 9,13	May 9,14
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	May 11,13	May. 11,14
Horn Antenna	SCHWARZBECK	BBHA9170	9170-068	May.11,13	May. 11,14
Spectrum Analyzer	Agilent	8593E	3911A04271	May 9,13	May 9,14
Spectrum Analyzer	Agilent	E4408B	MY44211125	May 9,13	May 9,14
Signal Amplifier	DAZE	ZN3380C	11001	May 9,13	May 9,14
High Pass filter	Micro	HPM50111	324216	May 9,13	May 9,14
Filter	COM-MW	ZBSF-C836.5-25-X	KW032	May 9,13	May 9,14
Filter	COM-MW	ZBSF-C1747.5-75-X2	KW035	May 9,13	May 9,14
Filter	COM-MW	ZBSF-C1880-60-X2	KW037	May 9,13	May 9,14
DC Power Supply	LongWei	PS-305D	010964729	May 9,13	May 9,14
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	May 9,13	May 9,14
Universal radio communication tester	Rohde&Schwarz	CMU200	3215420	May. 9,2013	May. 9,2014
Splitter	Agilent	11636B	0025164	May. 9,2013	May. 9,2014

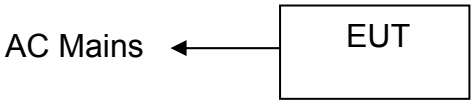
4. TEST SET-UP AND OPERATION MODES

4.1. 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.

4.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: B2 bluetooth speaker)

4.3. Test Operation Mode and Test Software

None.

4.4. Special Accessories and Auxiliary Equipment

None.

4.5. Countermeasures to Achieve EMC Compliance

None.

4.6. Test Environment:

Ambient conditions in the test laboratory:

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

5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.209 limits

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

5.1.2. Test Setup

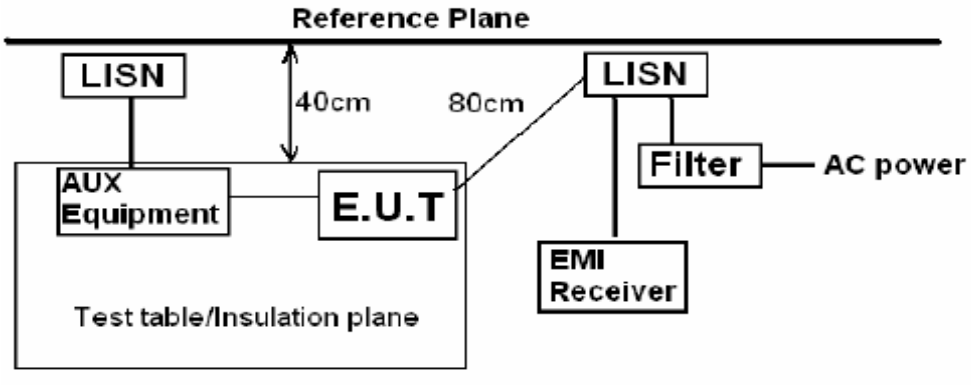
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the centre so as to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



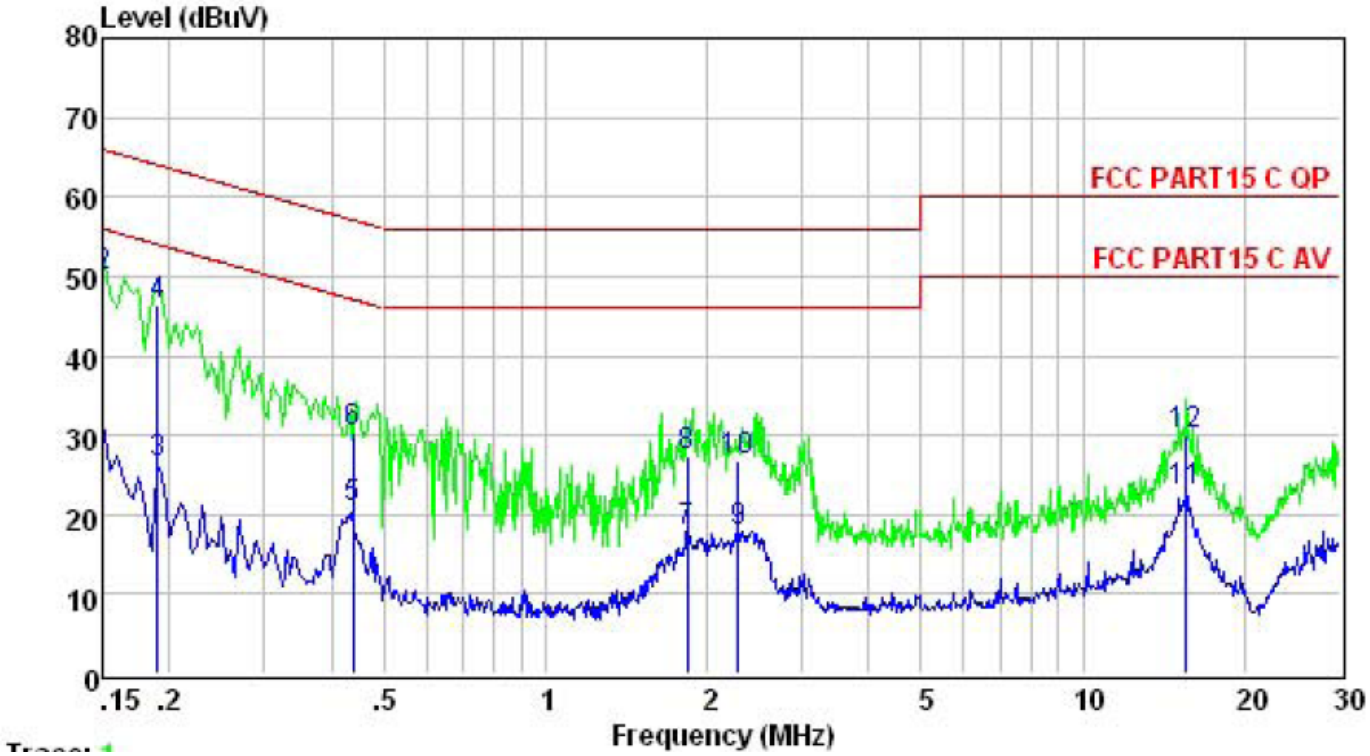
Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m

5.1.3. Test Mode

Set EUT in TX mode.

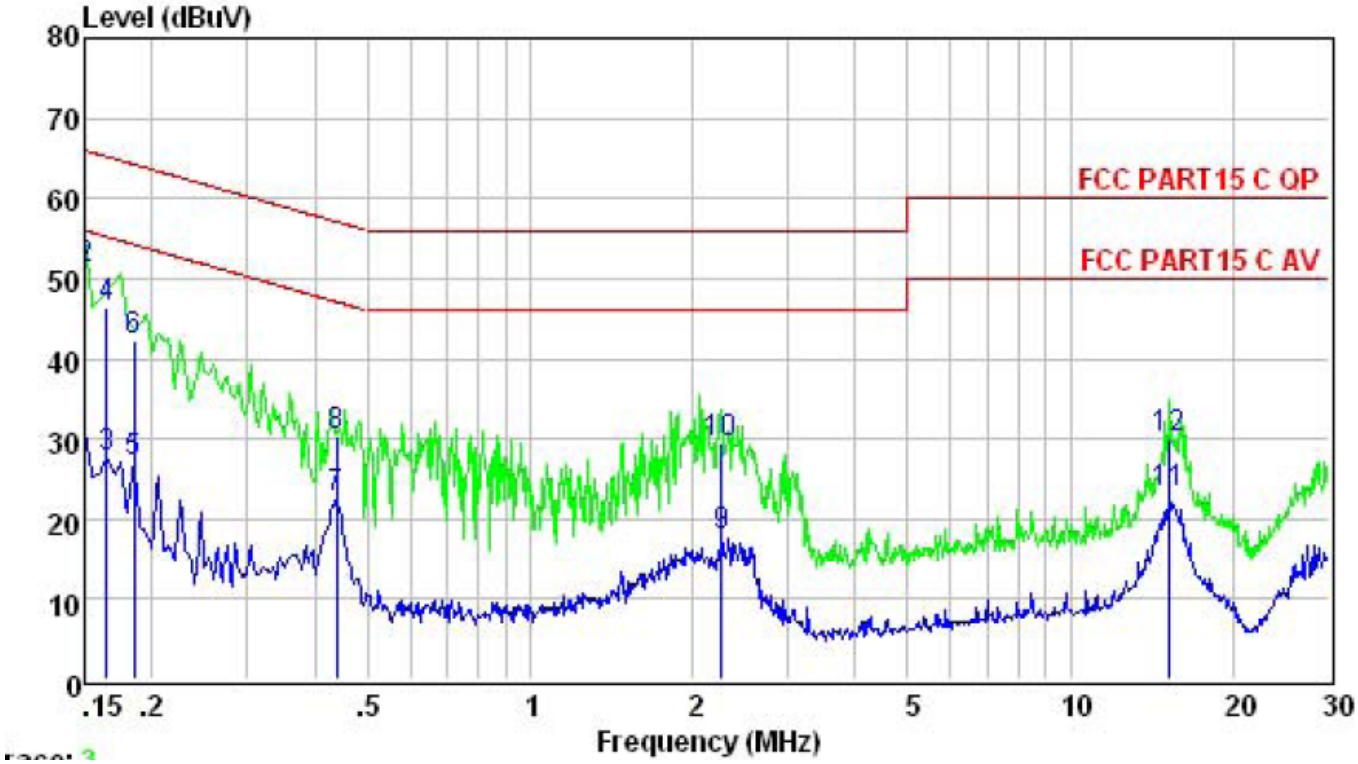
Test Data

Line



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	31.29	56.00	-24.71	Average
2	0.150	50.06	66.00	-15.94	QP
3	0.190	26.54	54.02	-27.48	Average
4	0.190	46.25	64.02	-17.77	QP
5	0.440	20.75	47.07	-26.32	Average
6	0.440	30.37	57.07	-26.70	QP
7	1.839	17.94	46.00	-28.06	Average
8	1.839	27.36	56.00	-28.64	QP
9	2.285	17.95	46.00	-28.05	Average
10	2.285	26.65	56.00	-29.35	QP
11	15.552	22.87	50.00	-27.13	Average
12	15.552	30.14	60.00	-29.86	QP

Neutral



	Freq	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	30.75	56.00	-25.25	Average
2	0.150	51.21	66.00	-14.79	QP
3	0.165	27.60	55.21	-27.61	Average
4	0.165	46.26	65.21	-18.95	QP
5	0.185	27.01	54.24	-27.23	Average
6	0.185	42.25	64.24	-21.99	QP
7	0.440	22.59	47.07	-24.48	Average
8	0.440	30.25	57.07	-26.82	QP
9	2.261	17.98	46.00	-28.02	Average
10	2.261	29.36	56.00	-26.64	QP
11	15.226	23.08	50.00	-26.92	Average
12	15.226	30.14	60.00	-29.86	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. 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. About above 1GHz test, use peak detector measurement

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 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.

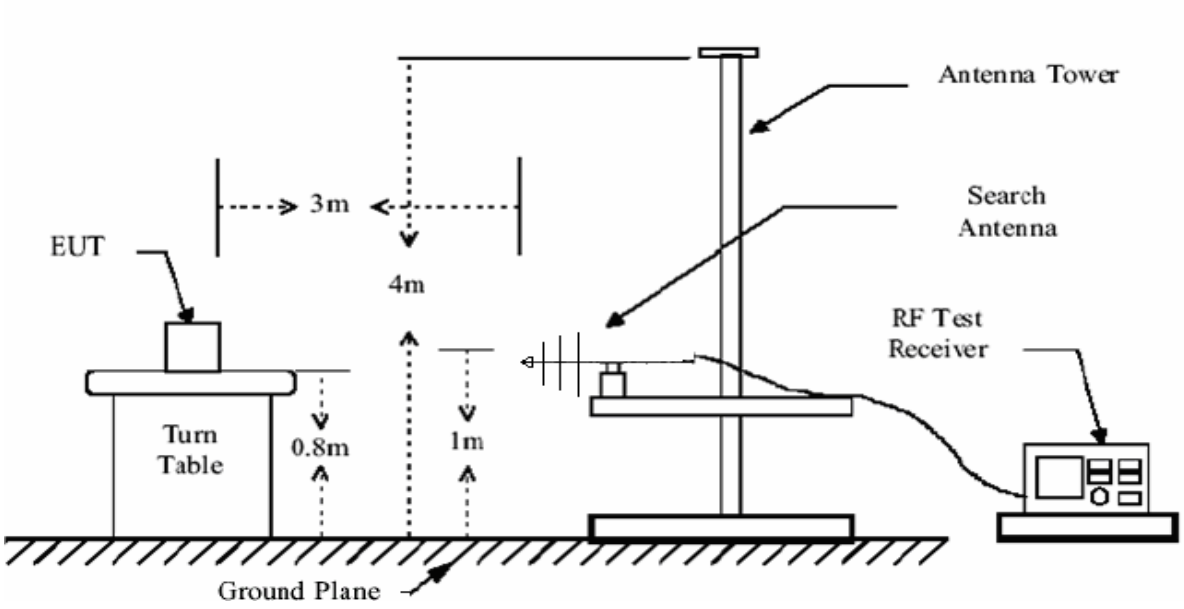
Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.

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

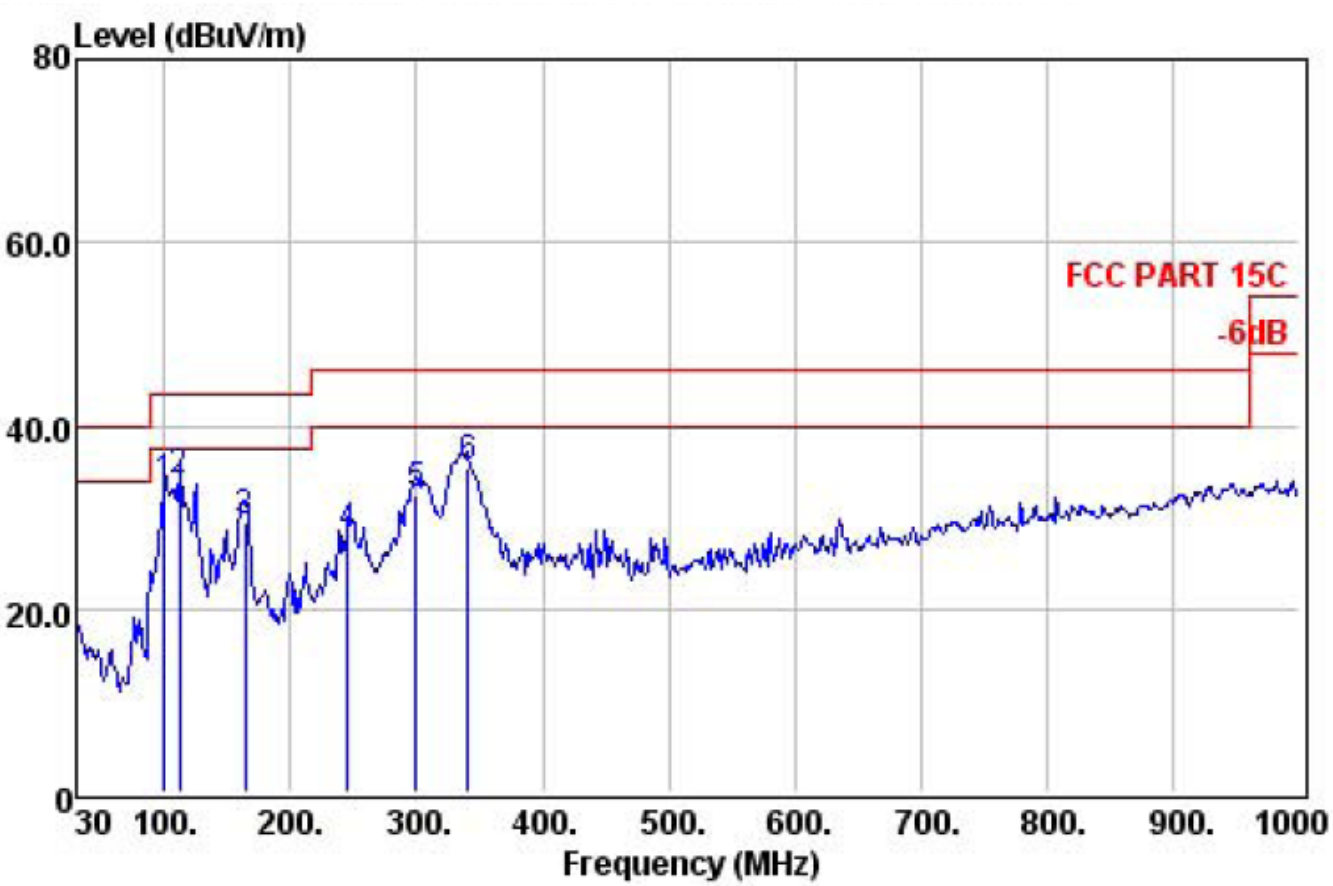
3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.

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

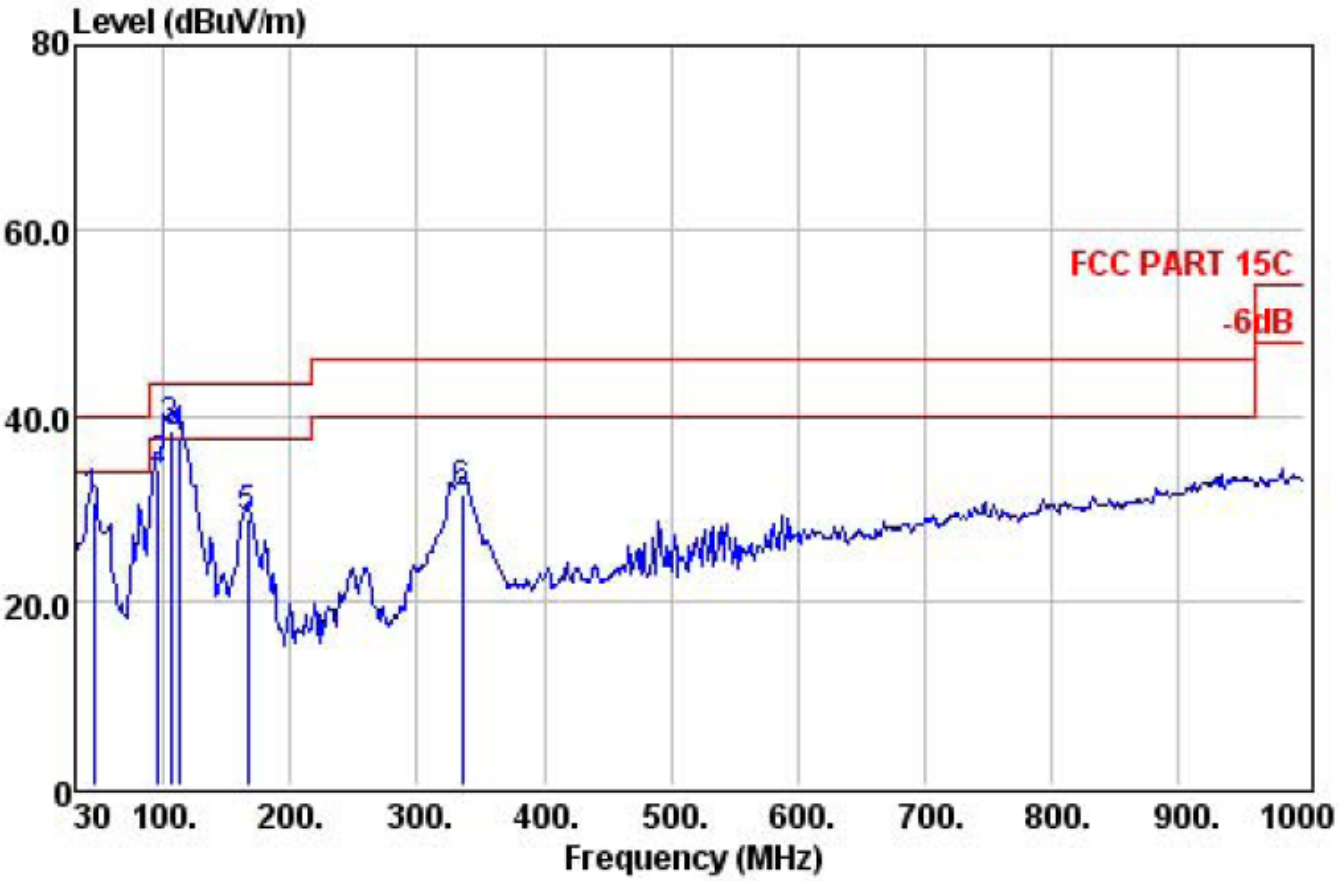


Below 1GHz
BT Mode Horizontal polarizations



	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	99.84	31.35	54.02	0.94	9.59	33.20	43.50	-10.30	QP
2	112.45	31.29	55.09	1.03	9.10	33.93	43.50	-9.57	QP
3	163.86	31.21	49.88	1.30	9.55	29.52	43.50	-13.98	QP
4	245.34	30.96	44.50	1.70	12.77	28.01	46.00	-17.99	QP
5	299.66	30.92	47.64	1.94	13.79	32.45	46.00	-13.55	QP
6	340.40	30.71	48.76	2.10	15.12	35.27	46.00	-10.73	QP

BT Mode Vertical polarizations



		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		44.55	31.40	50.34	0.56	11.03	30.53	40.00	-9.47	QP
2		95.96	31.35	55.14	0.94	9.40	34.13	43.50	-9.37	QP
3	!	105.66	31.33	59.27	1.03	9.43	38.40	43.50	-5.10	QP
4	!	112.45	31.29	58.70	1.03	9.10	37.54	43.50	-5.96	QP
5		165.80	31.21	48.92	1.30	9.72	28.73	43.50	-14.77	QP
6		335.55	30.74	45.11	2.10	14.92	31.39	46.00	-14.61	QP

Above 1GHz

GFSK 2402MHz Horizontal polarizations

	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	4804.00	27.49	25.85	11.96	32.94	43.26	74.00	-30.74	Peak
2	7596.00	28.02	16.90	16.63	37.20	42.71	74.00	-31.29	Peak
3	9245.00	28.50	17.40	16.90	37.69	43.49	74.00	-30.51	Peak
4	12917.00	29.18	16.08	18.14	40.50	45.54	74.00	-28.46	Peak
5	14719.00	29.51	15.34	19.83	39.69	45.35	74.00	-28.65	Peak
6	17983.00	30.49	11.29	22.25	45.11	48.16	74.00	-25.84	Peak

GFSK 2402MHz Vertical polarizations

	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	4882.00	27.53	25.62	12.14	33.11	43.34	74.00	-30.66	Peak
2	9092.00	28.43	19.06	16.89	37.50	45.02	74.00	-28.98	Peak
3	10350.00	28.84	18.40	17.04	38.96	45.56	74.00	-28.44	Peak
4	12271.00	29.05	17.26	17.59	39.46	45.26	74.00	-28.74	Peak
5	14821.00	29.52	16.87	19.88	39.27	46.50	74.00	-27.50	Peak
6	17320.00	30.23	12.49	21.62	45.11	48.99	74.00	-25.01	Peak

GFSK 2441MHz Horizontal polarizations

	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	4882.00	27.53	27.31	12.14	33.11	45.03	74.00	-28.97	Peak
2	8548.00	28.26	19.15	16.78	36.86	44.53	74.00	-29.47	Peak
3	10197.00	28.82	19.73	17.00	38.72	46.63	74.00	-27.37	Peak
4	12254.00	29.05	19.82	17.58	39.45	47.80	74.00	-26.20	Peak
5	14107.00	29.42	15.44	19.43	42.90	48.35	74.00	-25.65	Peak
6	17728.00	30.39	11.22	22.01	45.27	48.11	74.00	-25.89	Peak

GFSK 2441MHz Vertical polarizations

	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	4882.00	27.53	35.83	12.14	33.11	53.55	74.00	-20.45	Peak
2	6678.00	27.84	16.91	16.60	36.35	42.02	74.00	-31.98	Peak
3	8548.00	28.26	19.15	16.78	36.86	44.53	74.00	-29.47	Peak
4	10622.00	28.86	18.79	17.09	39.27	46.29	74.00	-27.71	Peak
5	12254.00	29.05	19.82	17.58	39.45	47.80	74.00	-26.20	Peak
6	14107.00	29.42	15.44	19.43	42.90	48.35	74.00	-25.65	Peak

GFSK 2480MHz Horizontal polarizations

	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	4960.00	27.58	25.53	12.36	33.32	43.63	74.00	-30.37	Peak
2	7392.00	27.98	17.01	16.62	37.36	43.01	74.00	-30.99	Peak
3	10843.00	28.88	15.41	17.13	39.41	43.07	74.00	-30.93	Peak
4	12067.00	29.01	16.19	17.43	39.41	44.02	74.00	-29.98	Peak
5	15535.00	29.63	16.64	20.34	38.53	45.88	74.00	-28.12	Peak
6	16861.00	30.05	10.74	21.23	44.27	46.19	74.00	-27.81	Peak

GFSK 2480MHz Vertical polarizations

	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	4960.00	27.58	25.77	12.36	33.32	43.87	74.00	-30.13	Peak
2	7987.00	28.10	19.20	16.66	36.43	44.19	74.00	-29.81	Peak
3	11965.00	29.00	16.53	17.36	39.43	44.32	74.00	-29.68	Peak
4	13750.00	29.35	11.61	19.08	43.25	44.59	74.00	-29.41	Peak
5	15943.00	29.69	13.80	20.60	40.10	44.81	74.00	-29.19	Peak
6	17660.00	30.36	9.02	21.94	45.31	45.91	74.00	-28.09	Peak

6. 20DB OCCUPY BANDWIDTH

6.1. 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

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: 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

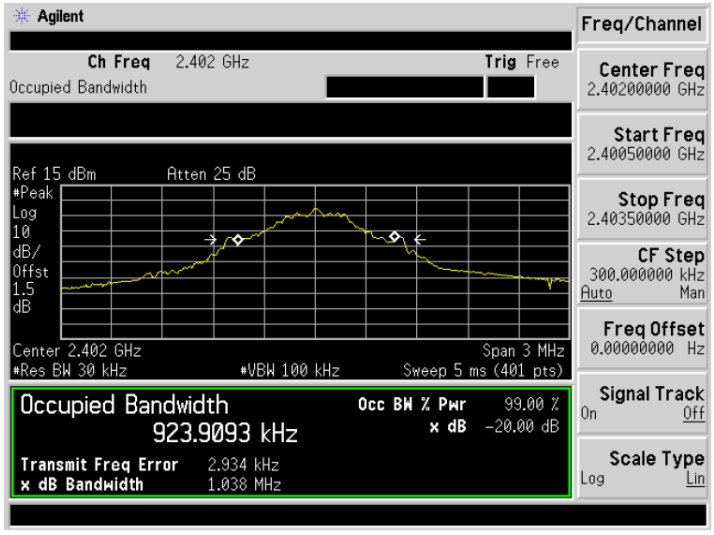
Test data:

	Channel Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2402	1.038	Pass
	2441	1.033	Pass
	2480	1.032	Pass
8DPSK	2402	1.081	Pass
	2441	1.052	Pass
	2480	1.076	Pass

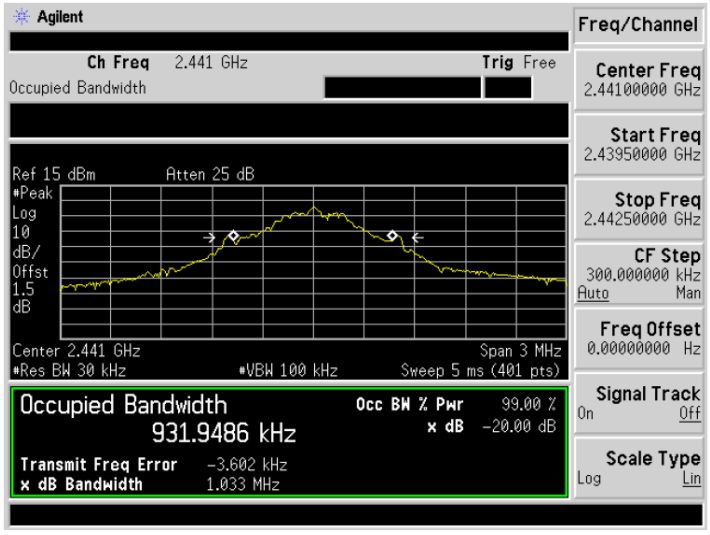
Test plot as follows:

GFSK

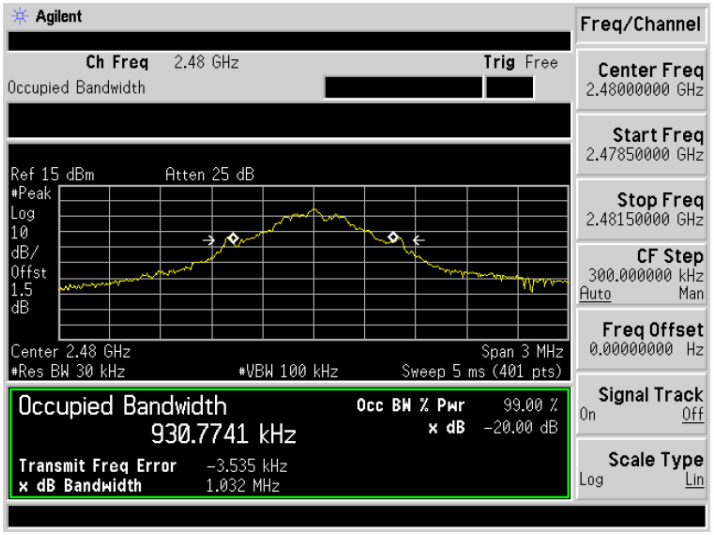
2402MHz



2441 MHz

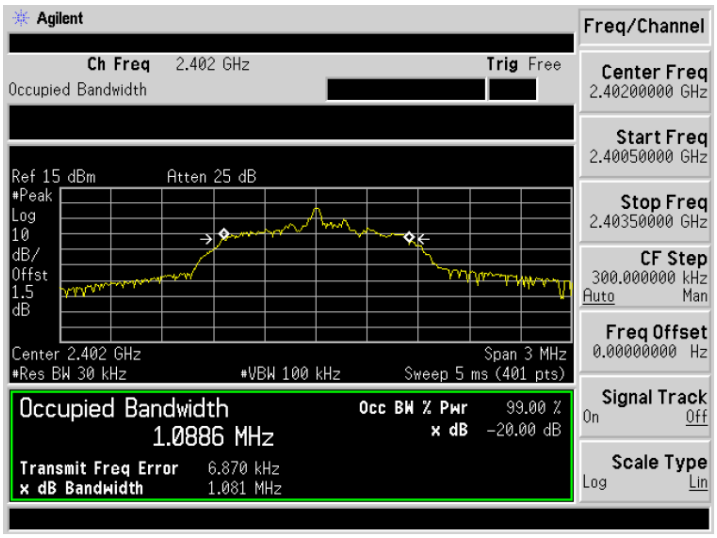


2480 MHz

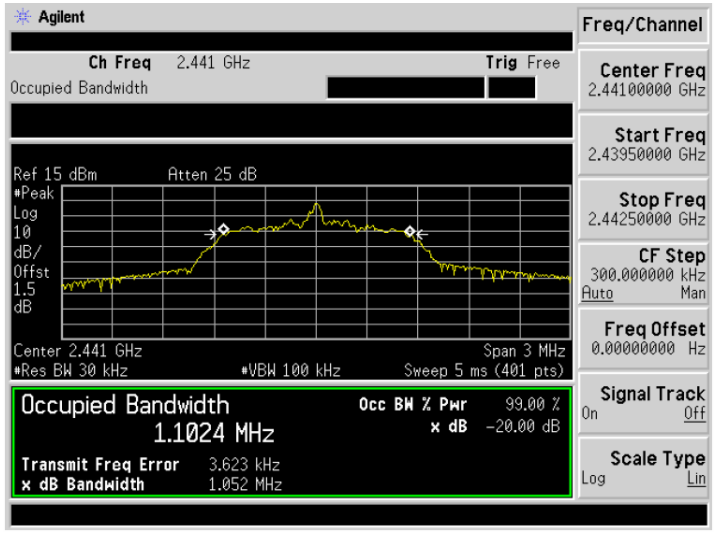


8DPSK

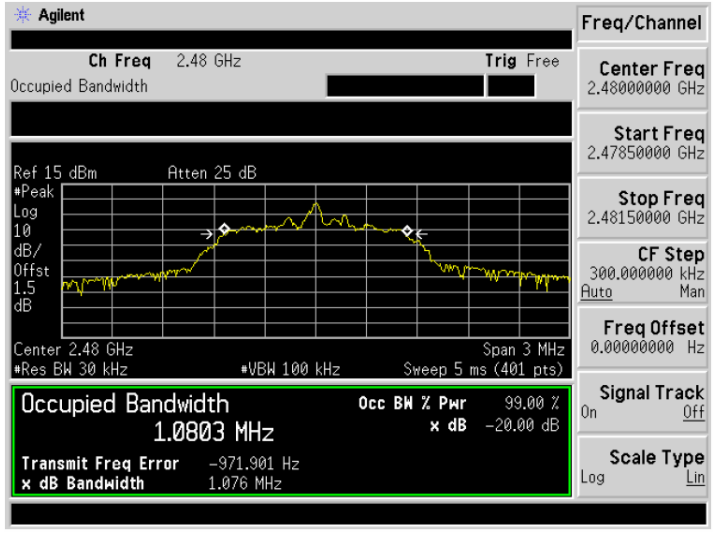
2402MHz



2441 MHz



2480 MHz



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 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

Test data:

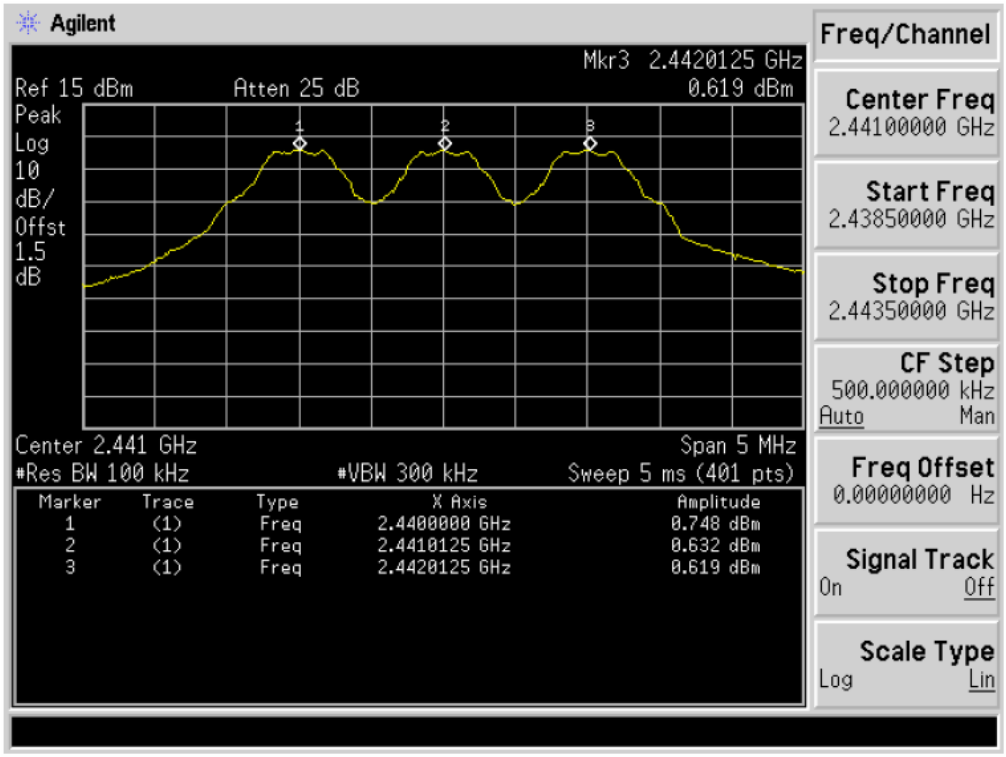
	Separation (MHz)	Limit (MHz)	Result
GFSK	1.0	0.689	PASS
8DPSK	1.0	0.701	PASS

Note 1: we pretest low, middle, high channel. The middle channel's data record in the report.

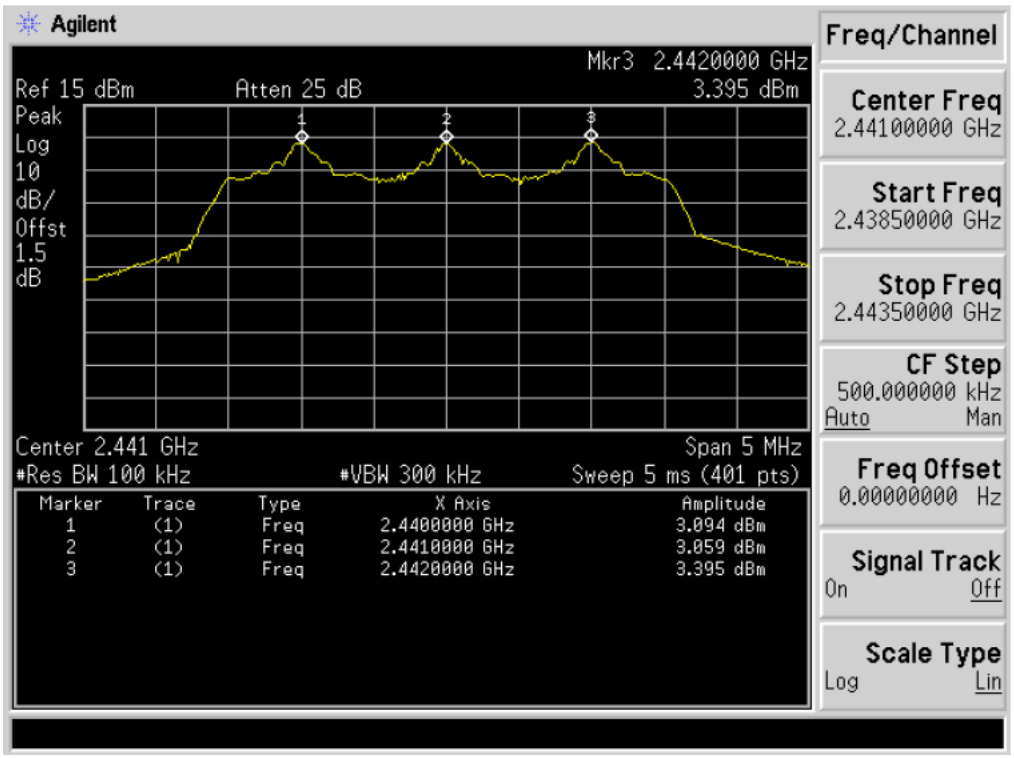
2: Limit according to section 6

Test plot as follows:

GFSK


Agilent
Mkr3 2.4420125 GHz
Ref 15 dBm
Atten 25 dB
0.619 dBm
Peak
Log
10
dB/
Offst
1.5
dB
Center 2.441 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.4400000 GHz 0.748 dBm
2 (1) Freq 2.4410125 GHz 0.632 dBm
3 (1) Freq 2.4420125 GHz 0.619 dBm
Freq/Channel
Center Freq
2.44100000 GHz
Start Freq
2.43850000 GHz
Stop Freq
2.44350000 GHz
CF Step
500.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

8DPSK


Agilent
Mkr3 2.4420000 GHz
Ref 15 dBm
Atten 25 dB
3.395 dBm
Peak
Log
10
dB/
Offst
1.5
dB
Center 2.441 GHz
Span 5 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 5 ms (401 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.4400000 GHz 3.094 dBm
2 (1) Freq 2.4410000 GHz 3.059 dBm
3 (1) Freq 2.4420000 GHz 3.395 dBm
Freq/Channel
Center Freq
2.44100000 GHz
Start Freq
2.43850000 GHz
Stop Freq
2.44350000 GHz
CF Step
500.000000 kHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Scale Type
Log Lin

8. MAXIMUM PEAK OUTPUT POWER

8.1. 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.

8.2. 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		Limit W	Result
		dBm	W		
GFSK	2402	1.18	0.001312	0.125	Pass
	2441	1.16	0.001306	0.125	Pass
	2480	1.19	0.001315	0.125	Pass
Pi/4DQPSK	2402	1.13	0.001297	0.125	Pass
	2441	1.11	0.001291	0.125	Pass
	2480	1.13	0.001297	0.125	Pass
8DPSK	2402	1.14	0.001300	0.125	Pass
	2441	1.15	0.001303	0.125	Pass
	2480	1.13	0.001297	0.125	Pass

9. NUMBER OF HOPPING FREQUENCY

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.

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 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

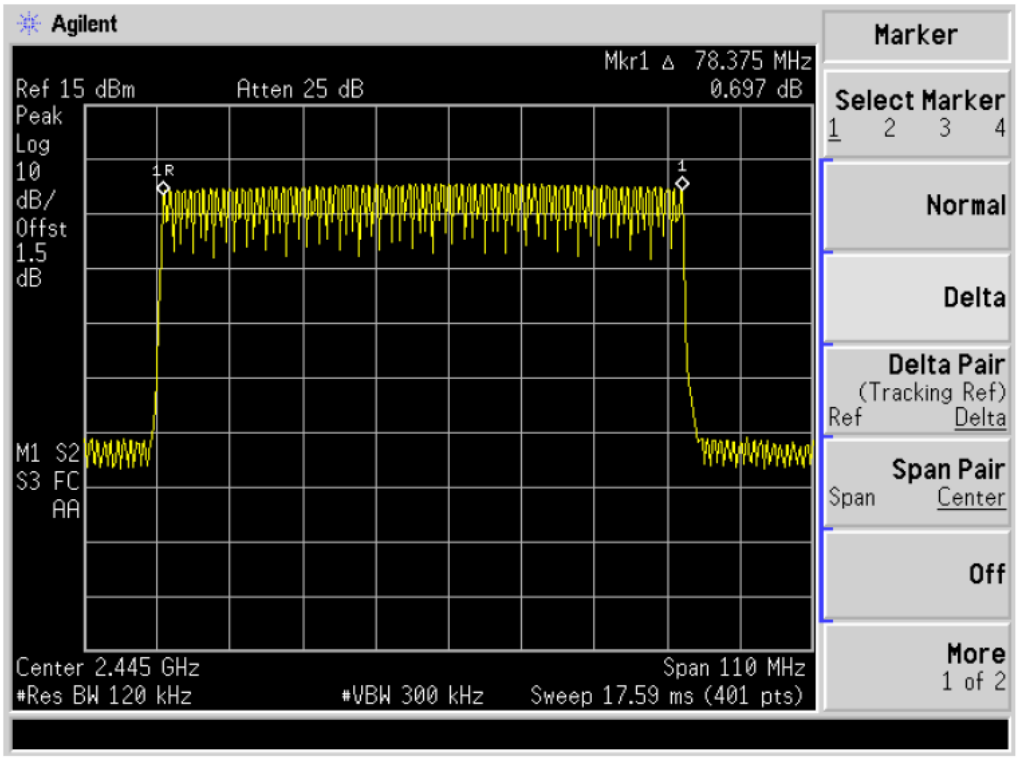
Trace=max hold

Test data:

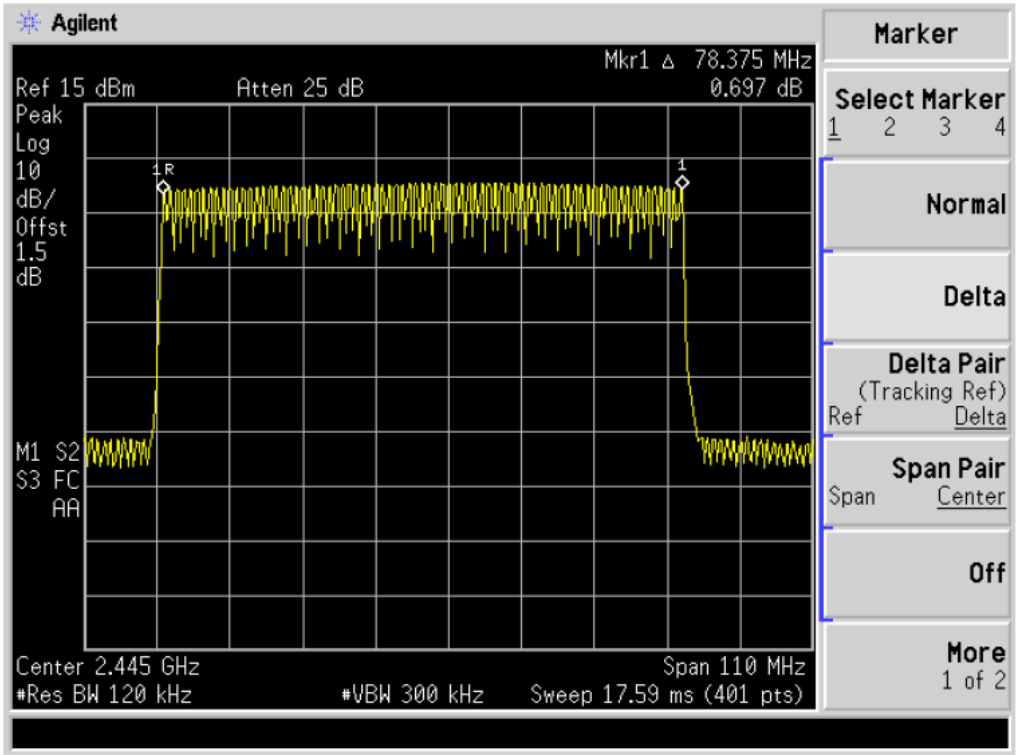
	Measured channel numbers	Limit	Result
GFSK	79	>15	PASS
Pi/4DQPSK	79	>15	PASS
8DPSK	79	>15	PASS

Test plot as follows:

GFSK


Agilent
Mkr1 Δ 78.375 MHz
Ref 15 dBm
Atten 25 dB
0.697 dB
Peak
Log
10
dB/
Offst
1.5
dB
1R
1
M1 S2
S3 FC
AA
Center 2.445 GHz
Span 110 MHz
#Res BW 120 kHz
#VBW 300 kHz
Sweep 17.59 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

8DPSK


Agilent
Mkr1 Δ 78.375 MHz
Ref 15 dBm
Atten 25 dB
0.697 dB
Peak
Log
10
dB/
Offst
1.5
dB
1R
1
M1 S2
S3 FC
AA
Center 2.445 GHz
Span 110 MHz
#Res BW 120 kHz
#VBW 300 kHz
Sweep 17.59 ms (401 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

10. DWELL TIME

10.1. 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.

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, 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= 0Hz

RBW =1 MHz

VBW = 3 MHz

Sweep=auto

Detector function=peak

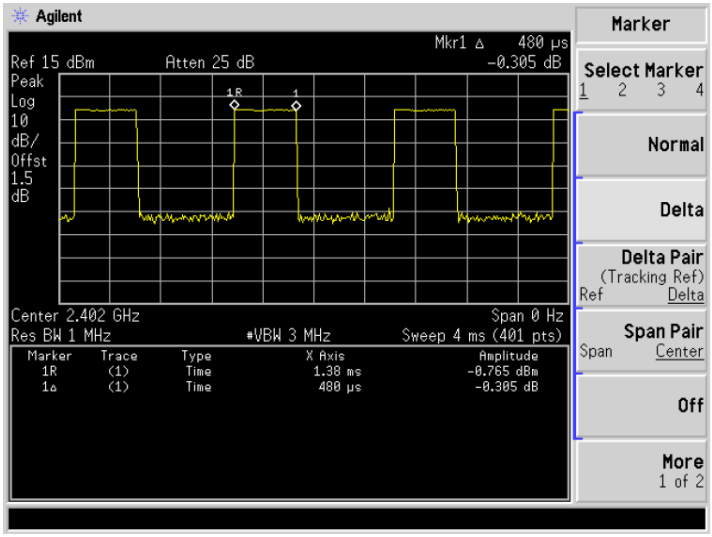
Test data:

Packet	Number of transmission in a 31.6 (79 hopping*0.4)	Length of transmission Time(ms)	Result(ms)	Limit(ms)
DH1	1600*(2*79)x31.6=320	0.48	153.60	400
DH3	1600*(4*79)x31.6=160	1.74	278.40	400
DH5	1600*(6*79)x31.6=106.67	2.98	317.88	400

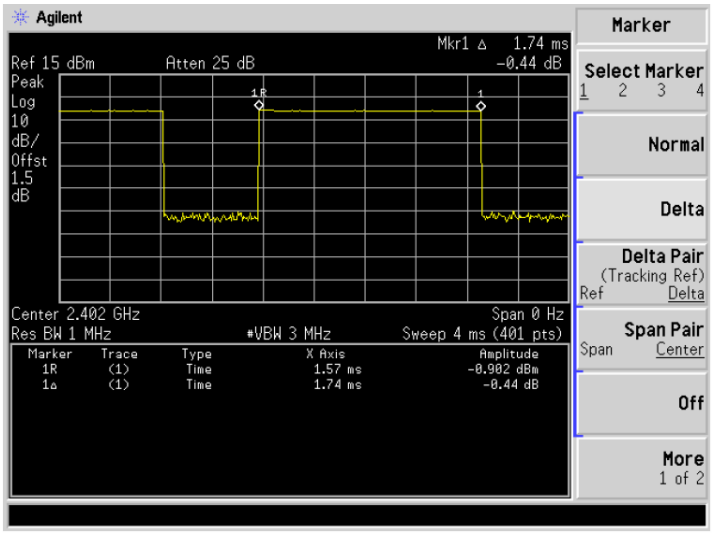
Test plot as follows:

GFSK/8DPSK

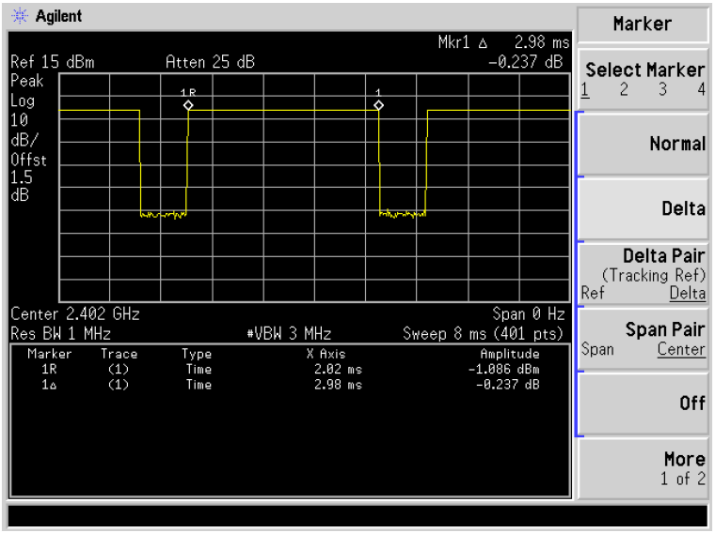
DH1



DH3



DH5



11. BAND EDGE COMPLIANCE TEST

11.1. 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

11.2. 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 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
GFSK	Hopping	<2400	H	48.02	74.00	54.00	Pass
		<2400	V	47.31	74.00	54.00	Pass
		>2483.5	H	47.29	74.00	54.00	Pass
		>2483.5	V	47.06	74.00	54.00	Pass
	Unhopping	<2400	H	48.11	74.00	54.00	Pass
		<2400	V	47.35	74.00	54.00	Pass
		>2483.5	H	48.04	74.00	54.00	Pass
		>2483.5	V	47.21	74.00	54.00	Pass
8DPSK	Hopping	<2400	H	48.41	74.00	54.00	Pass
		<2400	V	47.14	74.00	54.00	Pass
		>2483.5	H	48.31	74.00	54.00	Pass
		>2483.5	V	47.48	74.00	54.00	Pass
	Unhopping	<2400	H	49.01	74.00	54.00	Pass
		<2400	V	48.39	74.00	54.00	Pass
		>2483.5	H	48.79	74.00	54.00	Pass
		>2483.5	V	48.32	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.

12. ANTENNA REQUIREMENTS

12.1. 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. 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..

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.

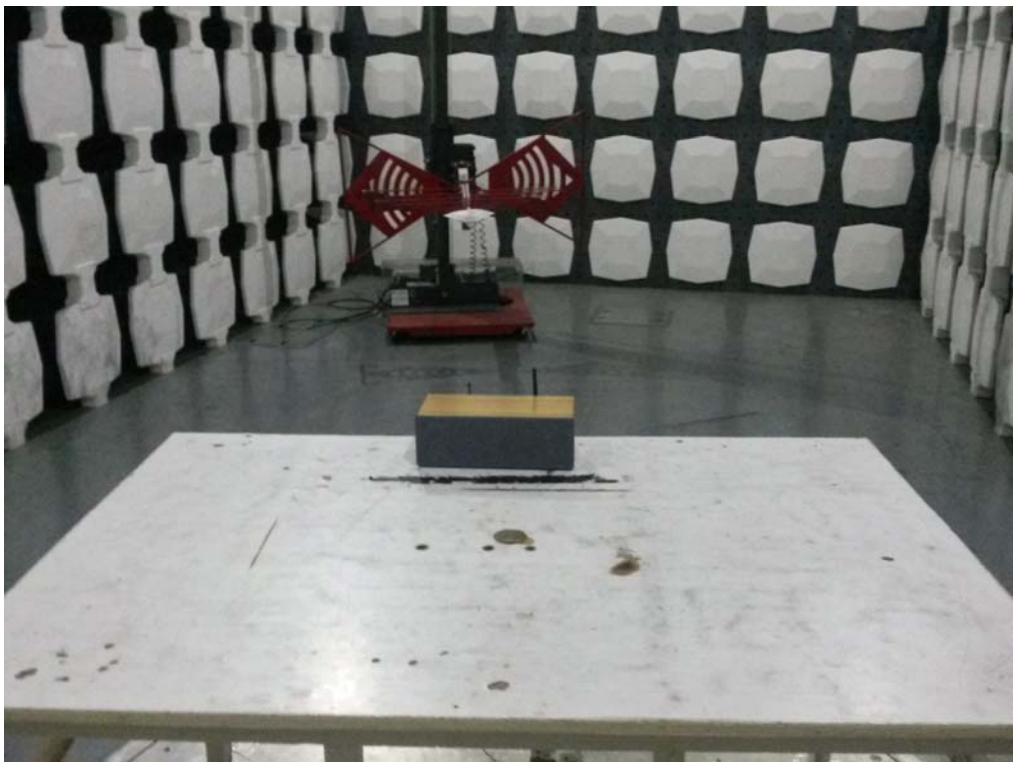
12.2. Result

The antennas used for this product are external antenna, used anti spiral antenna to connect, that no other antenna than furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 2.15dBi.

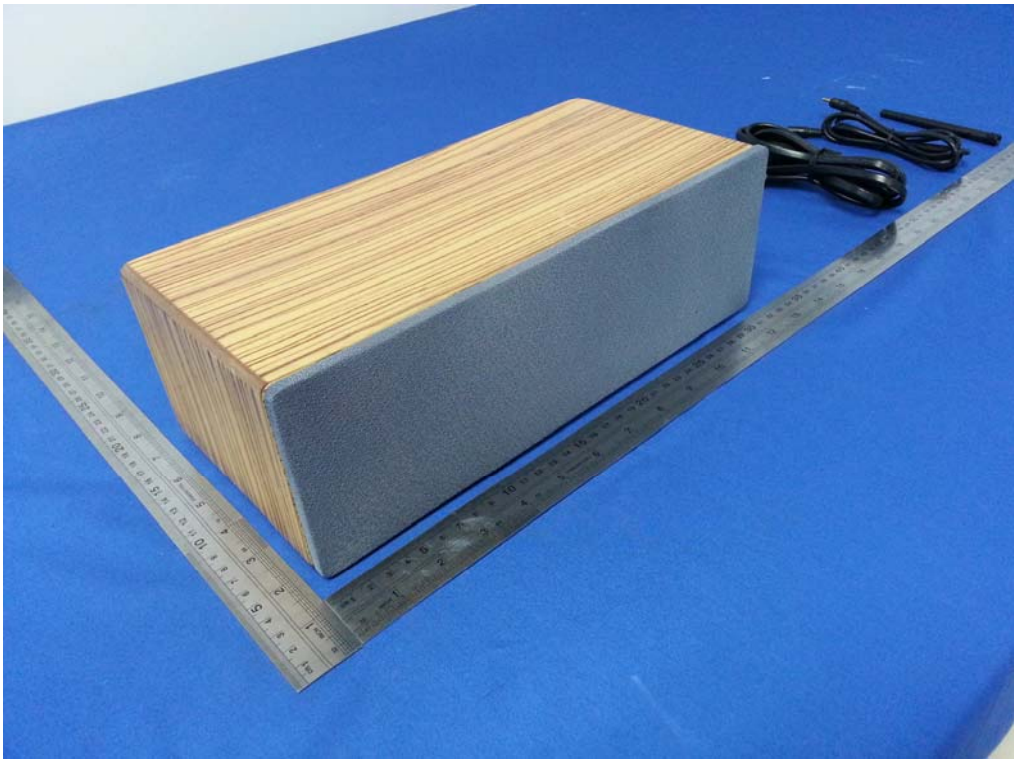
13. PHOTOGRAPHS OF TEST SET-UP

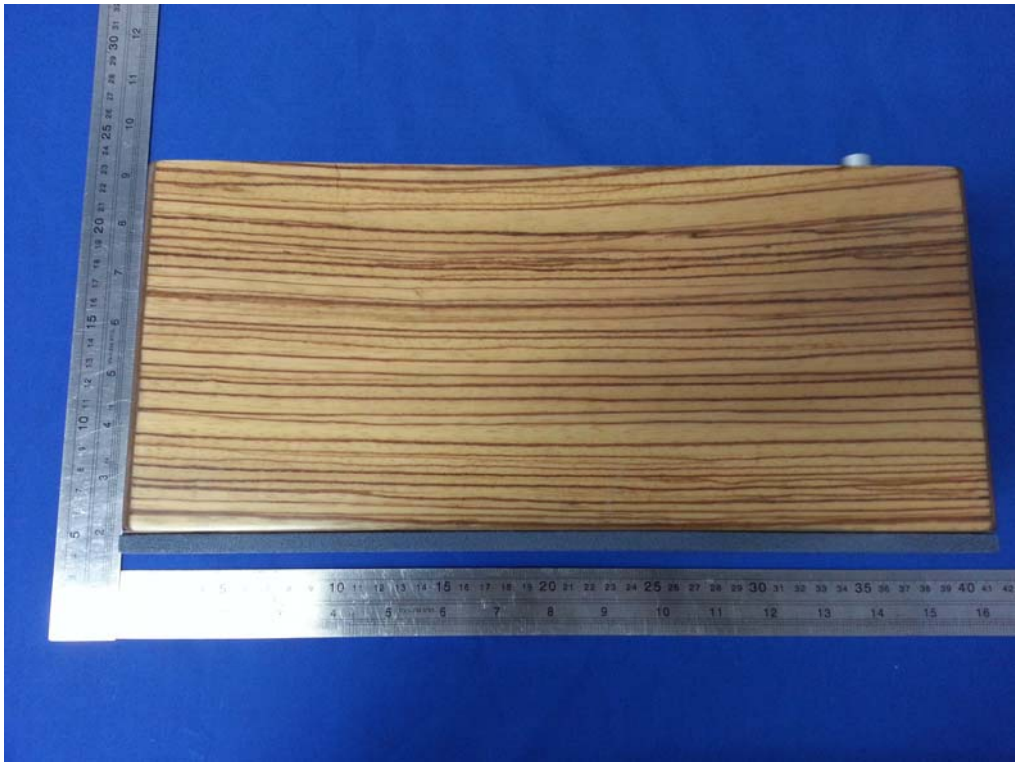
Conducted Emission Test

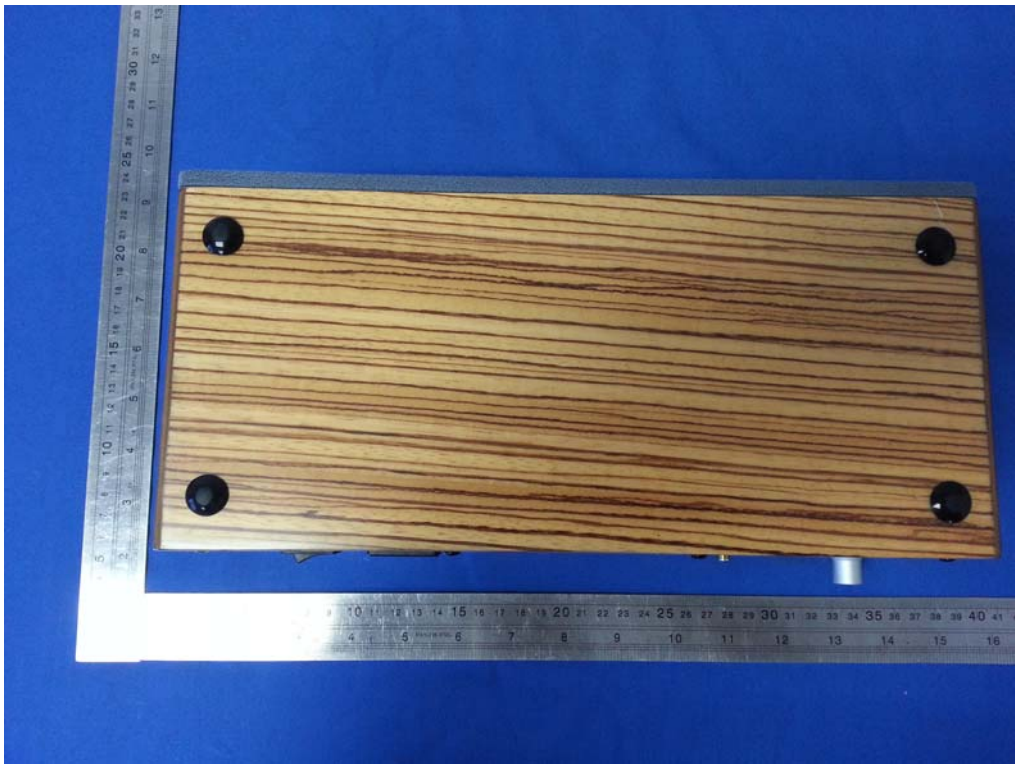
Radiated Emission Test



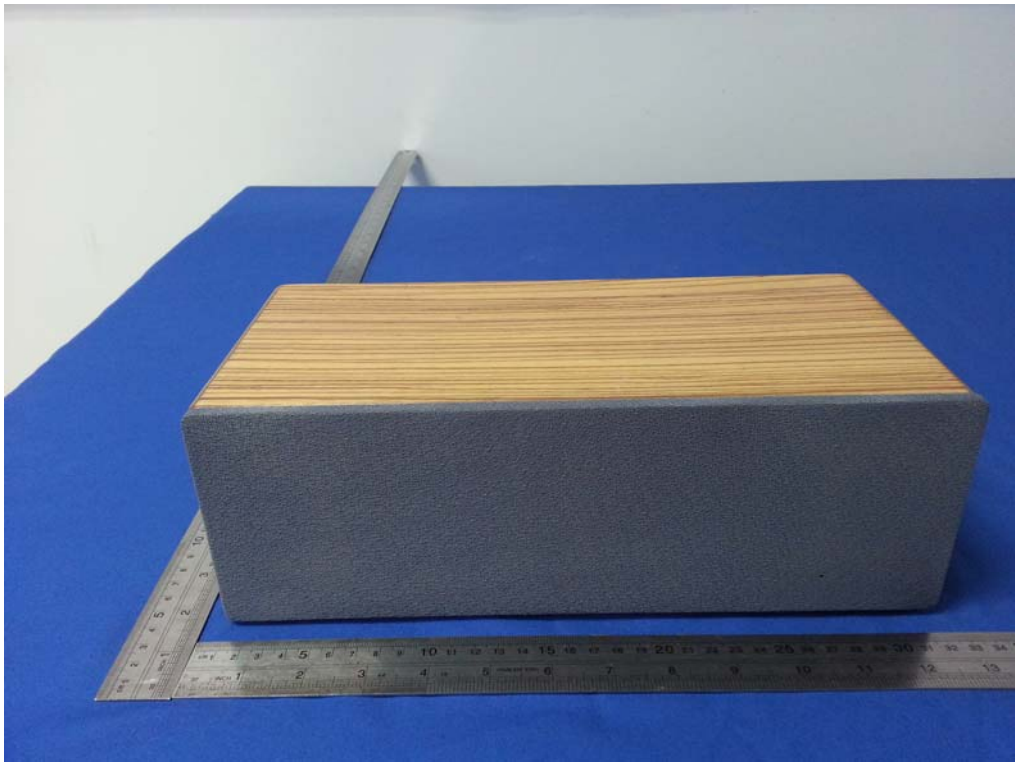
14. PHOTOGRAPHS OF THE EUT

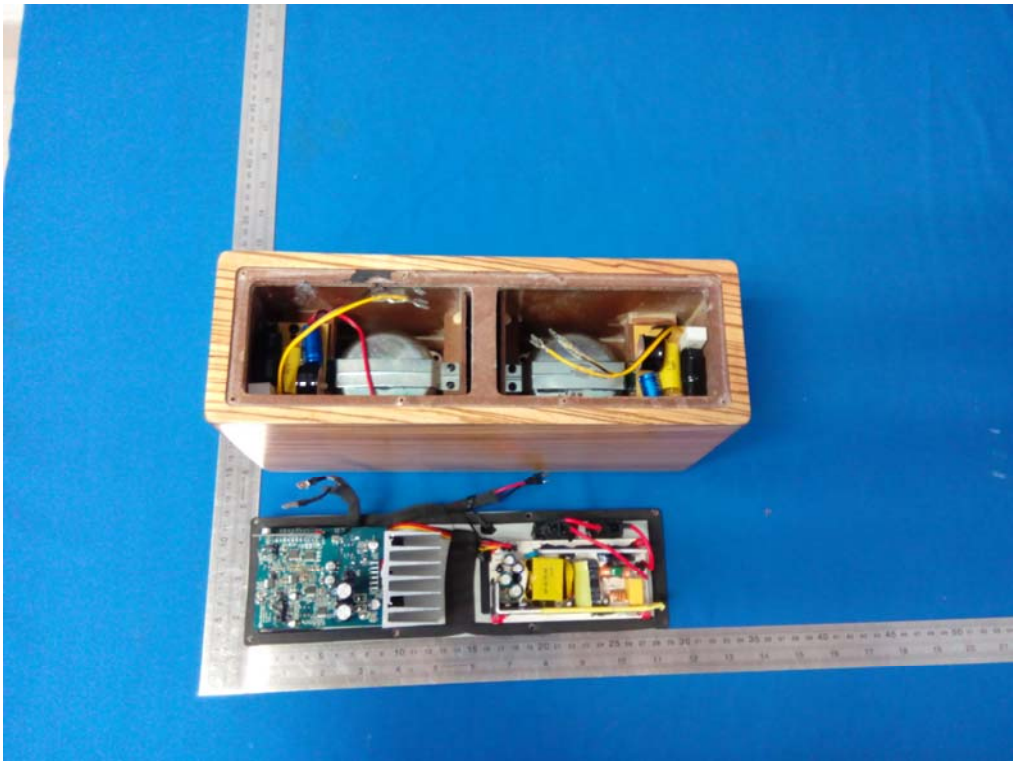


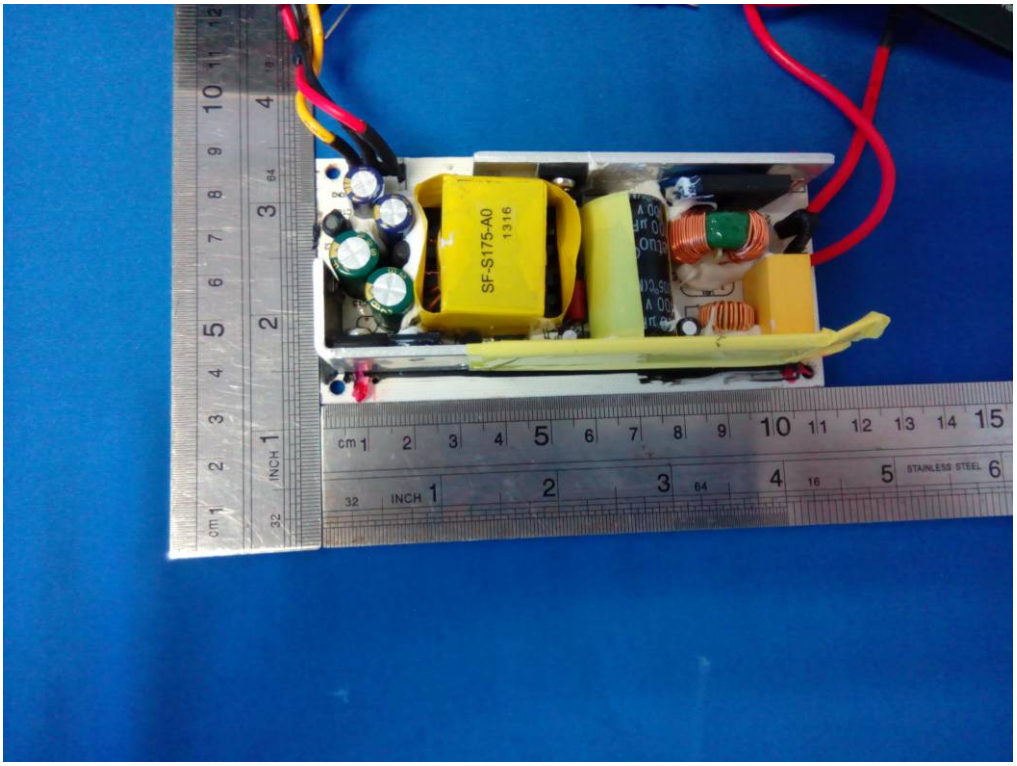


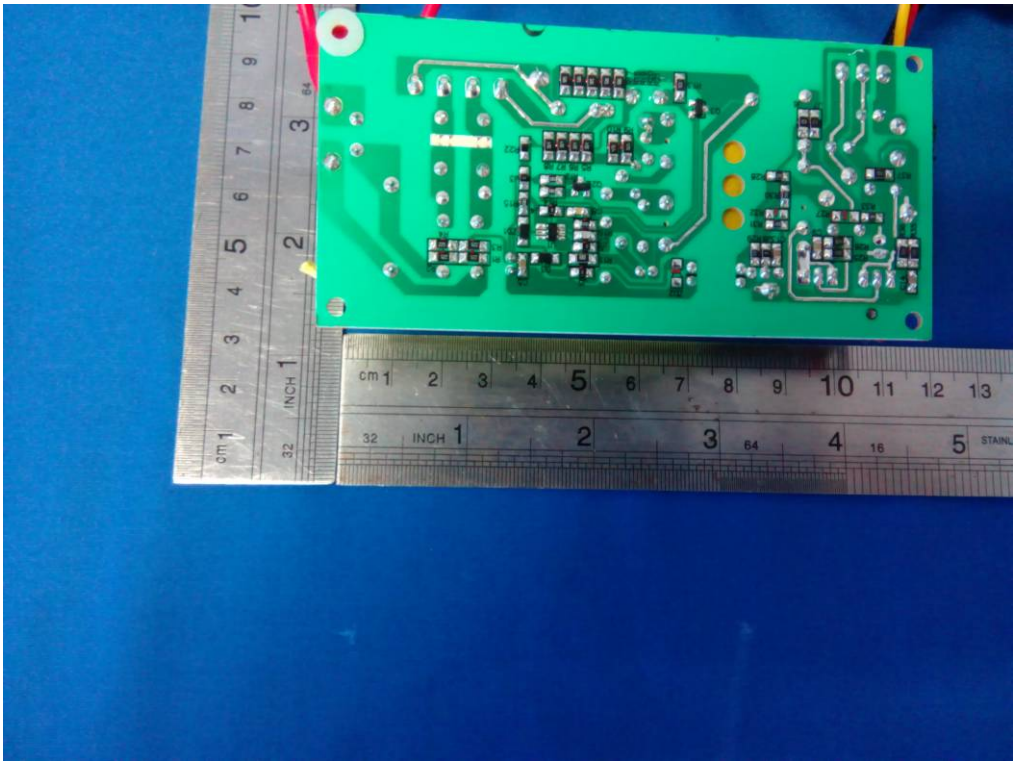


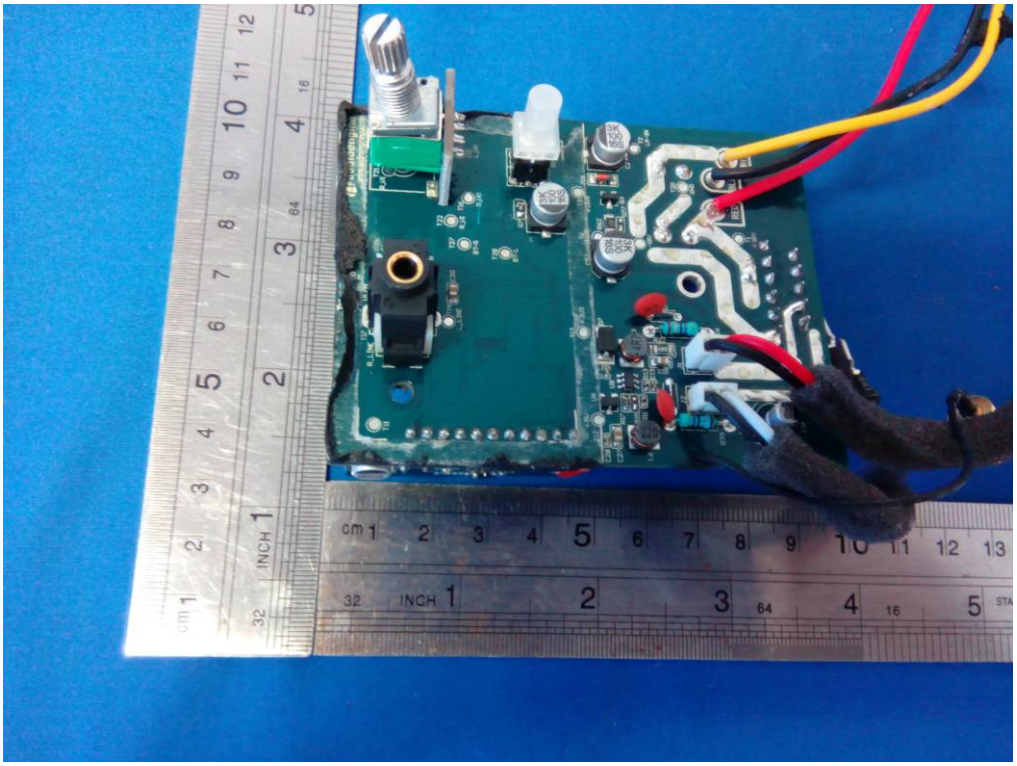

Volume
Power/Pair
Input
audioengine
www.audioengineusa.com
CE 0700

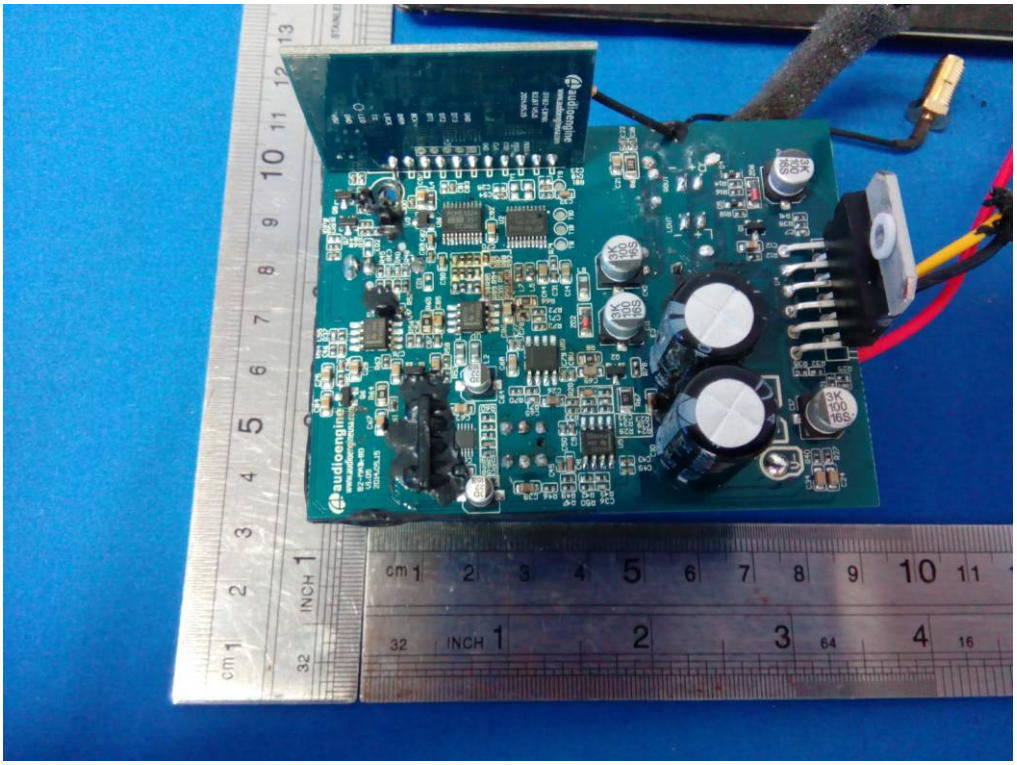


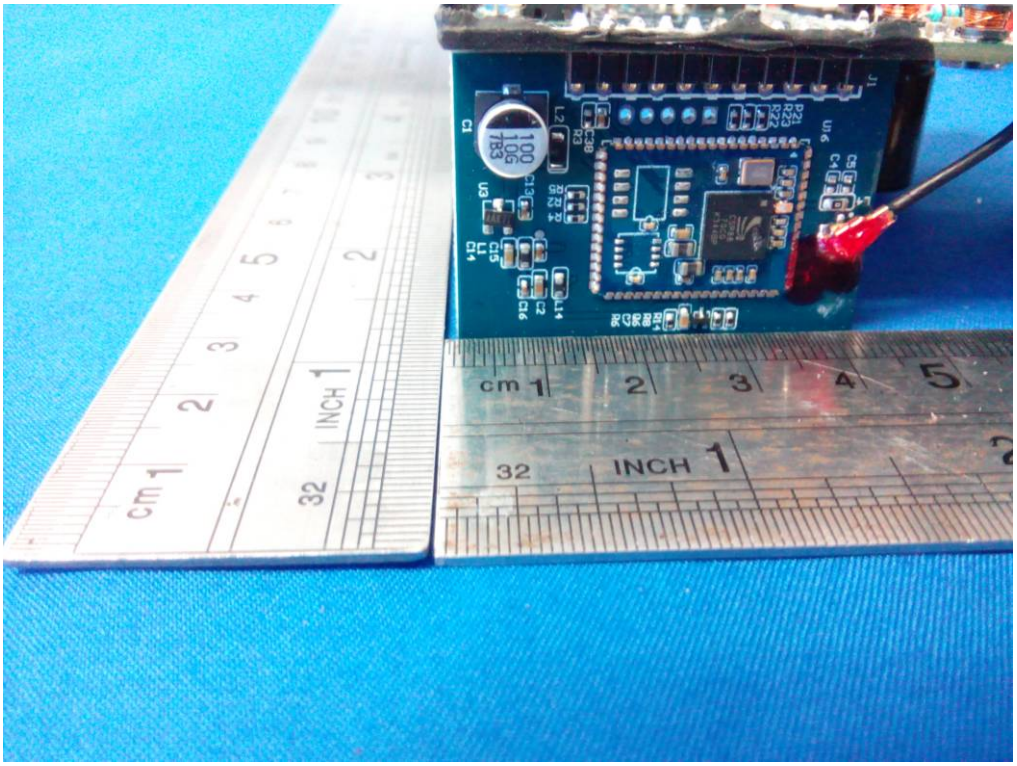


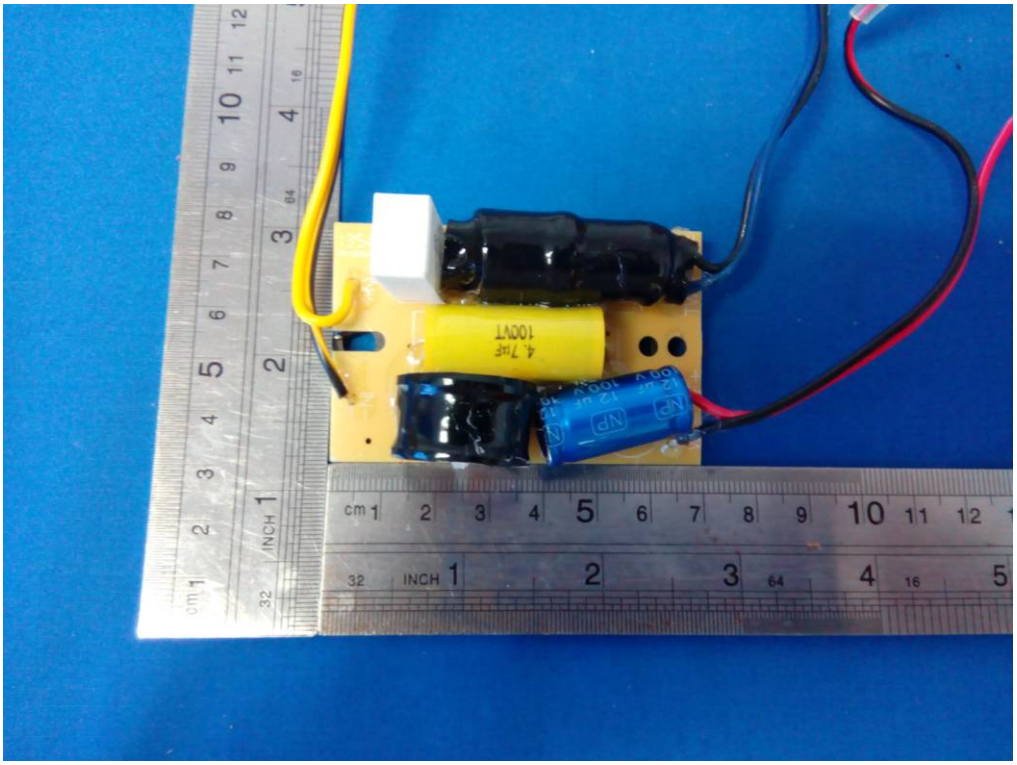

SF-S175-A0
1316

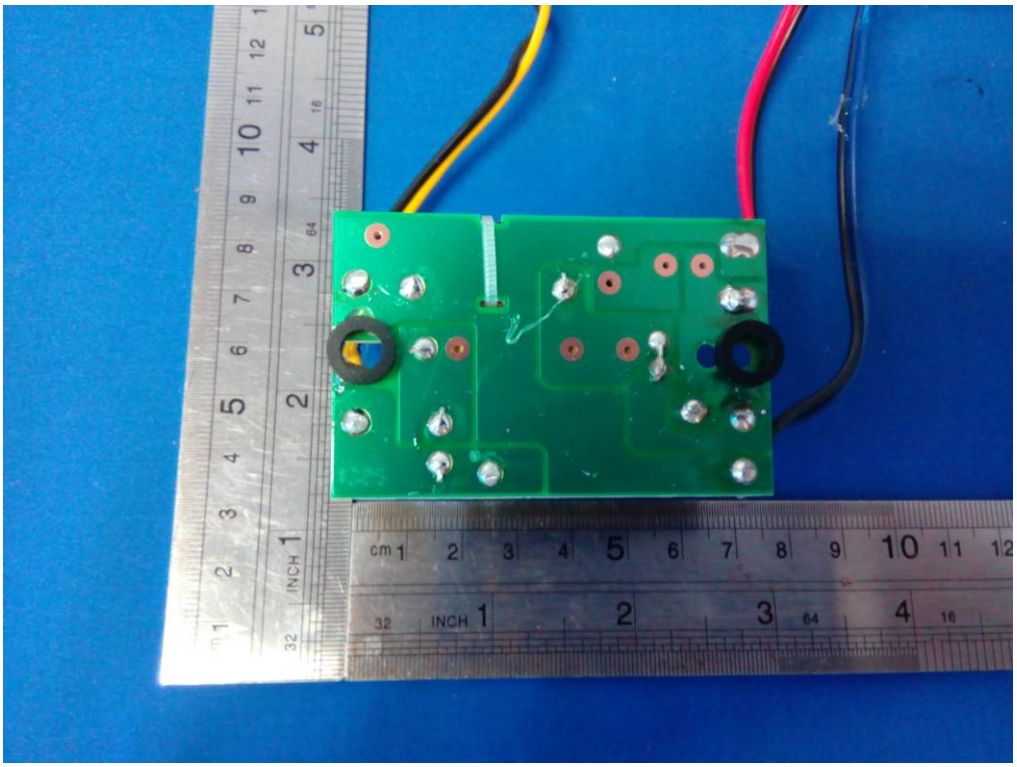


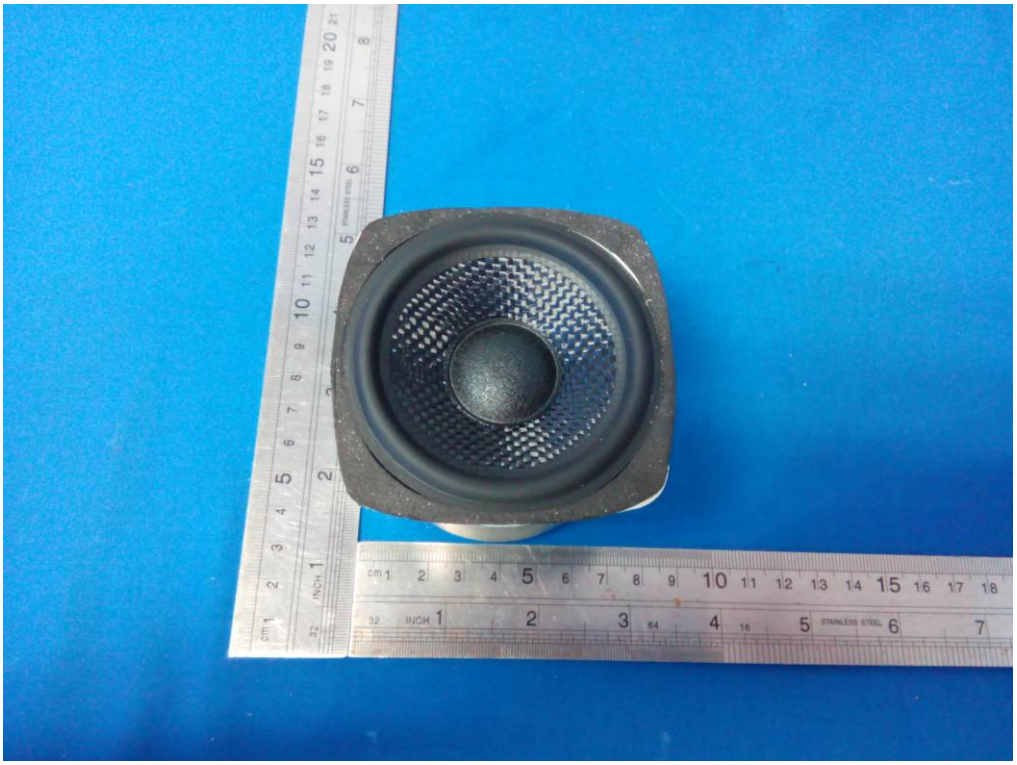


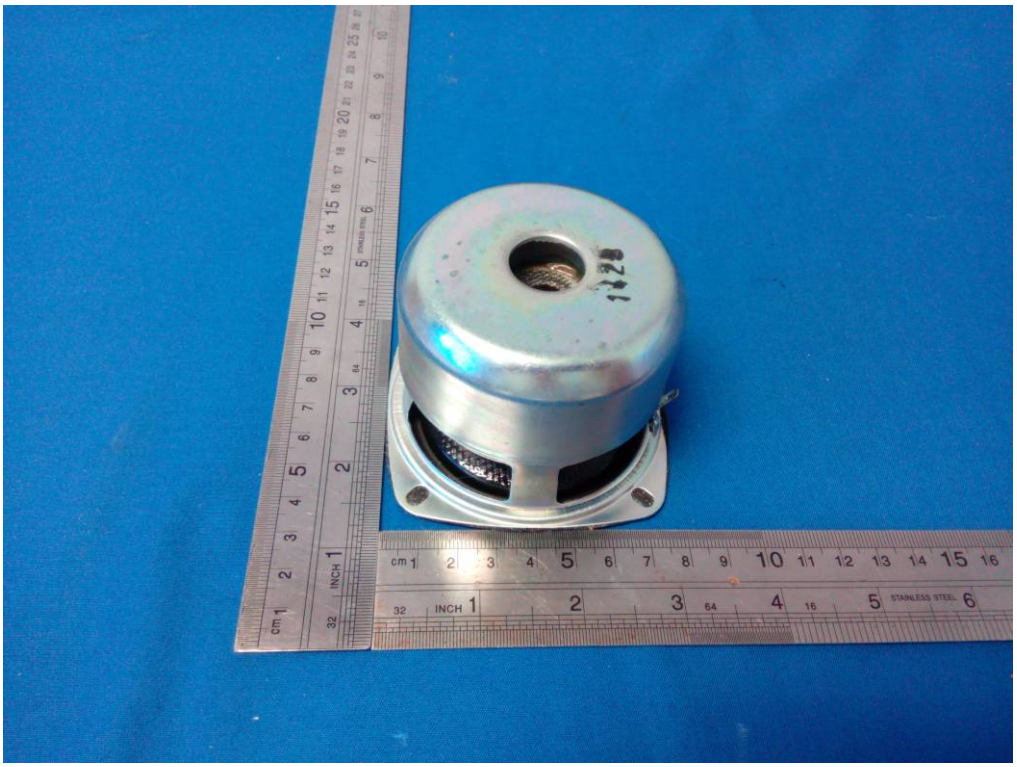


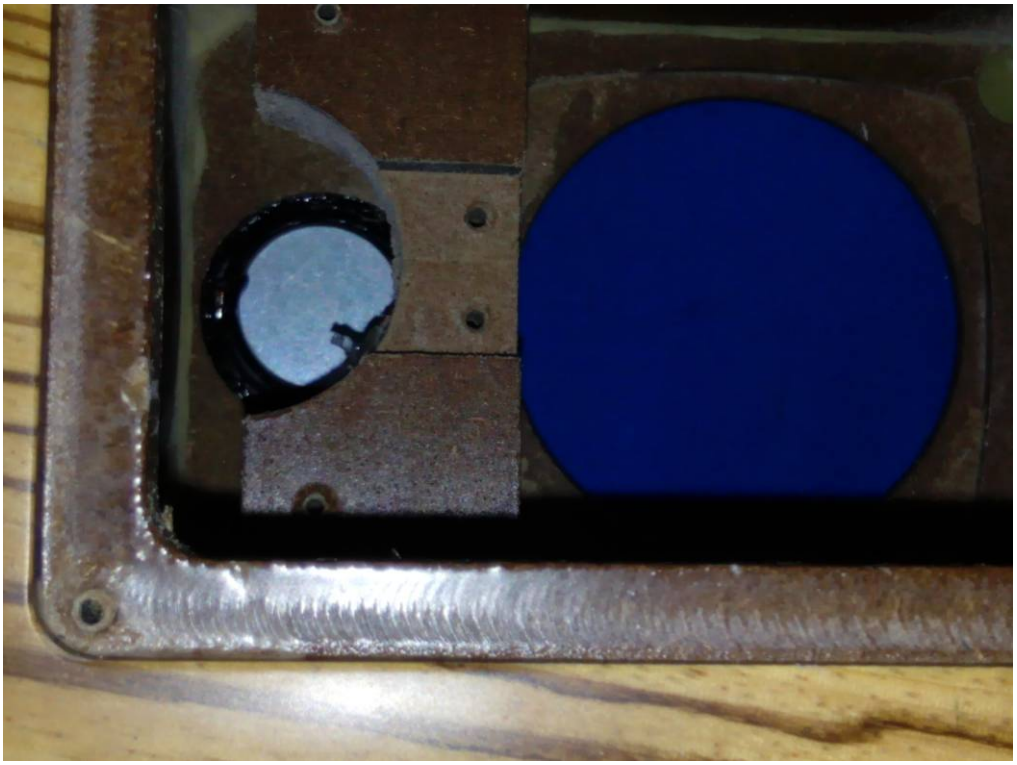












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