

FCC PART 15C TEST REPORT FOR CERTIFICATION
On Behalf of

Bang & Olufsen a/s

Wireless Speaker

Model Number: Beoplay M3

FCC ID: TTUBEOPLAYM3

Prepared for:	Bang & Olufsen a/s
	Peter Bangs Vej 15, 7600 Struer, Denmark
Prepared By:	EST Technology Co., Ltd.
	San Tun Management Zone, Houjie District, Dongguan, China
Tel: 86-769-83081888-808	

Report Number:	ESTE-R1707002
Date of Test:	May 03 ~ June 20, 2017
Date of Report:	July 04, 2017

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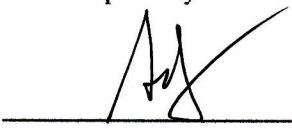
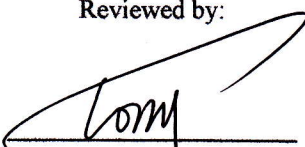
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EST Technology Co., Ltd.

Applicant:	Bang & Olufsen a/s		
Address:	Peter Bangs Vej 15, 7600 Struer, Denmark		
Manufacturer:	Bang & Olufsen a/s		
Address:	Peter Bangs Vej 15, 7600 Struer, Denmark		
E.U.T:	Wireless Speaker		
Model Number:	Beoplay M3		
Power Supply:	AC 100-240V ~ 50/60Hz		
Test Voltage:	AC 120V/60Hz AC 240V/60Hz		
Trade Name:	Bang & Olufsen	Serial No.:	-----
Date of Receipt:	May 03, 2017	Date of Test:	May 03 ~ June 20, 2017
Test Specification:	FCC Rules and Regulations Part 15 Subpart C:2016 ANSI C63.10:2013		
Test Result:	The device described above is tested by EST Technology Co., Ltd. The measurement results were contained in this test report and EST Technology Co., Ltd. was assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliance with the FCC Rules and Regulations Part 15 Subpart C requirements. This report applies to above tested sample only and shall not be reproduced in part without written approval of EST Technology Co., Ltd.		
Prepared by:		Reviewed by:	
 Amy / Assistant		 Tony / Engineer	
		Date: July 04, 2017 Approved by:  Iceman Hu / Manager	
Other Aspects:			
None.			
<i>Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested</i>			
<i>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 EST Technology Co., Ltd.</i>			

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	:	Wireless Speaker		
FCC ID	:	TTUBEOPLAYM3		
Model Number	:	Beoplay M3		
Operation frequency	:	2402MHz~2480MHz		
Number of channel	:	79	40	
Antenna	:	Integrated PCB antenna		
		Frequency Range	Antenna 0	Antenna 1
		2400~2483.5 MHz	-1.16 dBi	-2.27 dBi
		5150~5875 MHz	4.26 dBi	4.67 dBi
		Note: Bluetooth uses Antenna 0 11a,b,g,n,ac uses Antenna 0 / Antenna 1 11n,ac uses MIMO		
Modulation	:	Dual-mode Bluetooth 4.0 BT BDR: GFSK BT EDR: $\pi/4$ -DQPSK BT EDR: 8-DPSK		Dual-mode Bluetooth 4.0 BLE: GFSK
Sample Type	:	Prototype production		

2. SUMMARY OF TEST

2.1. Summary of test result

Description of Test Item	Standard	Results
Power Line Conducted Emission	FCC Part 15: 15.207 ANSI C63.10:2013	PASS
Radiated Emission	FCC Part 15: 15.209 ANSI C63.10:2013 KDB 558074	PASS
Band Edge Compliance	FCC Part 15: 15.247 ANSI C63.10:2013 KDB 558074	PASS
6dB Bandwidth	FCC Part 15: 15.247 ANSI C63.10:2013 KDB 558074	PASS
Peak Output Power	FCC Part 15: 15.247 ANSI C63.10:2013 KDB 558074	PASS
Power Spectral Density	FCC Part 15: 15.247 ANSI C63.10:2013 KDB 558074	PASS
Antenna requirement	FCC Part 15: 15.203	PASS
Note: KDB 558074 D01 DTS Meas Guidance v04		

2.2. Test Facilities

EMC Lab : Certified by CNAS, CHINA
 Registration No.: L5288
 Date of registration: December 07, 2015

Certificated by FCC, USA
 Registration No.: 989591
 Date of registration: November 15, 2016

Certificated by Industry Canada
 Registration No.: 9405A-1
 Date of registration: December 30, 2015

Certificated by VCCI, Japan
 Registration No.: R-3663 & C-4103
 Date of registration: July 25, 2011

Certificated by TUV Rheinland, Germany
 Registration No.: UA 50195514 0001
 Date of registration: January 07, 2011

Certificated by TUV/PS, Shenzhen
 Registration No.: SCN1017
 Date of registration: January 27, 2011

Certificated by Intertek ETL SEMKO
 Registration No.: 2011-RTL-L1-18
 Date of registration: April 28, 2011

Certificated by Siemic, Inc.
 Registration No.: SLCN021
 Date of registration: November 8, 2011

Certificated by Nemko, Hong Kong
 Registration No.: 175193
 Date of registration: May 4, 2011

Name of Firm : EST Technology Co., Ltd.

Site Location : San Tun Management Zone, Houjie Town, Dongguan, Guangdong, China

2.3. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.54dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	3.62
Uncertainty for Radiation Emission test (1GHz to 18GHz)	4.86
Uncertainty for radio frequency	7×10^{-8}
Uncertainty for conducted RF Power	0.20dB
Uncertainty for Power density test	0.26dB

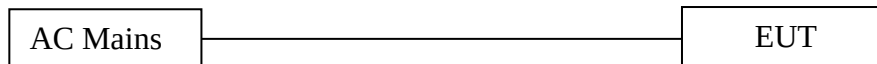
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2.4. Assistant equipment used for test

2.4.1. N/A

2.5. Block Diagram

For radiated emissions test: EUT was placed on a turn table, which is 0.8 (or 1.5) meter high above ground. EUT was be set into Bluetooth test mode by software before test.



(EUT: Wireless Speaker)

2.6. Test mode

A special test software was used to control EUT work in Continuous TX mode(100% duty cycle), and select test channel, wireless mode and data rate.

Mode	Channel	Frequency
BT 4.0-BLE GFSK	Low	2402MHz
	Middle	2440MHz
	High	2480MHz

2.7. Channel List for Bluetooth

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2402	2	2404
3	2406	4	2408
5	2410	6	2412
7	2414	8	2416
9	2418	10	2420
11	2422	12	2424
13	2426	14	2428
15	2430	16	2432
17	2434	18	2436
19	2438	20	2440
21	2442	22	2444
23	2446	24	2448
25	2450	26	2452
27	2454	28	2456
29	2458	30	2460
31	2462	32	2464
33	2466	34	2468
35	2470	36	2472
37	2474	38	2476
39	2478	40	2480

2.8. Test Equipment

2.8.1. For conducted emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESHS30	832354	June 25,16	1 Year
Artificial Mains Networ	Rohde & Schwarz	ENV216	101260	June 25,16	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	101100	June 25,16	1 Year

2.8.2. For radiated emission test(9 kHz-30MHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESCI	100435	June 25,16	1 Year
Loop Antenna	ETS-LINDGREN	6502	00071730	June 25,16	3 Year
RF Cable	MIYAZAKI	5D-2W	966 Chamber No.1	June 25,16	1 Year

2.8.3. For radiated emissions test (30-1000MHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESVS10	100004	June 25,16	1 Year
Spectrum Analyzer	Agilent	E4411B	MY50140697	June 25,16	1 Year
Bilog Antenna	Teseq	CBL 6111D	27090	June 28,15	3 Year
Signal Amplifier	Agilent	310N	187037	June 25,16	1 Year
RF Cable	MIYAZAKI	5D-2W	966 Chamber No.1	June 25,16	1 Year

2.8.4. For radiated emission test(above 1GHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	SCHWARZB ECK	BBHA 9120 D	BBHA9120D1 002	June 28,15	3 Year
Board-Band Horn Antenna	SCHWARZB ECK	BBHA 9170	9170-497	June 28,15	3Year
Signal Amplifier	SCHWARZB ECK	BBV9718	9718-212	June 25,16	1 Year
Spectrum Analyzer	Agilent	E4408B	MY44211139	June 25,16	1 Year
Spectrum Analyzer	Rohde &Schwarz	FSV	103173	June 25,16	1 Year
RF Cable	Hubersuhner	RG 214/U	513423	June 25,16	1 Year

3 POWER LINE CONDUCTED EMISSION TEST

3.1 Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μ V)	Average Level dB(μ V)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

3.2 Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power connected to the power mains through a line impedance stabilization network (L.I.S.N. 1#). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Test.

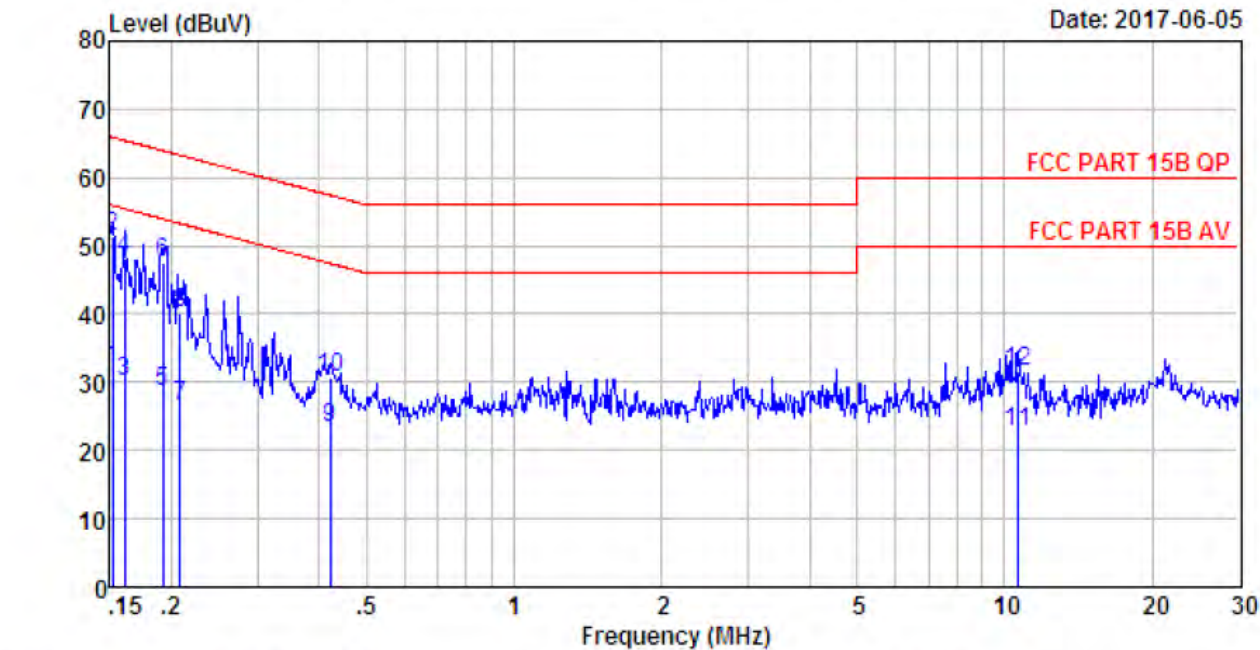
The bandwidth of test receiver (R & S ESHS30) is set at 10kHz.

The frequency range from 150kHz to 30MHz is checked.

3.3. Test Result

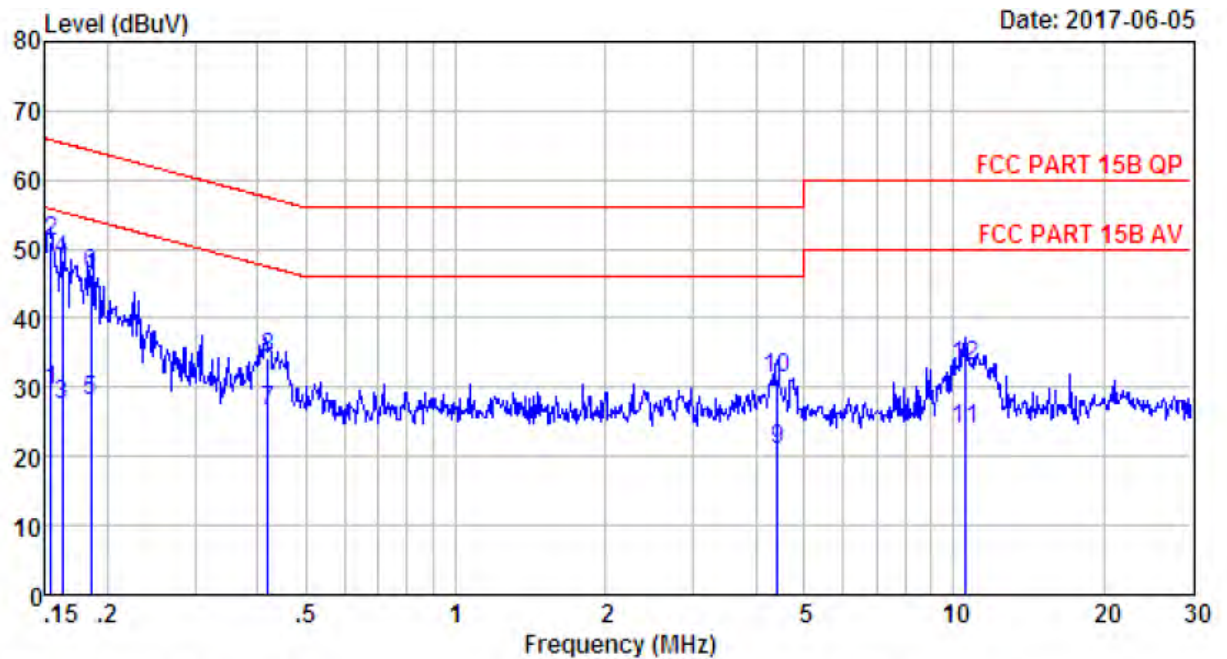
PASS. (All emissions not reported below are too low against the prescribed limits.)

3.4. Test data



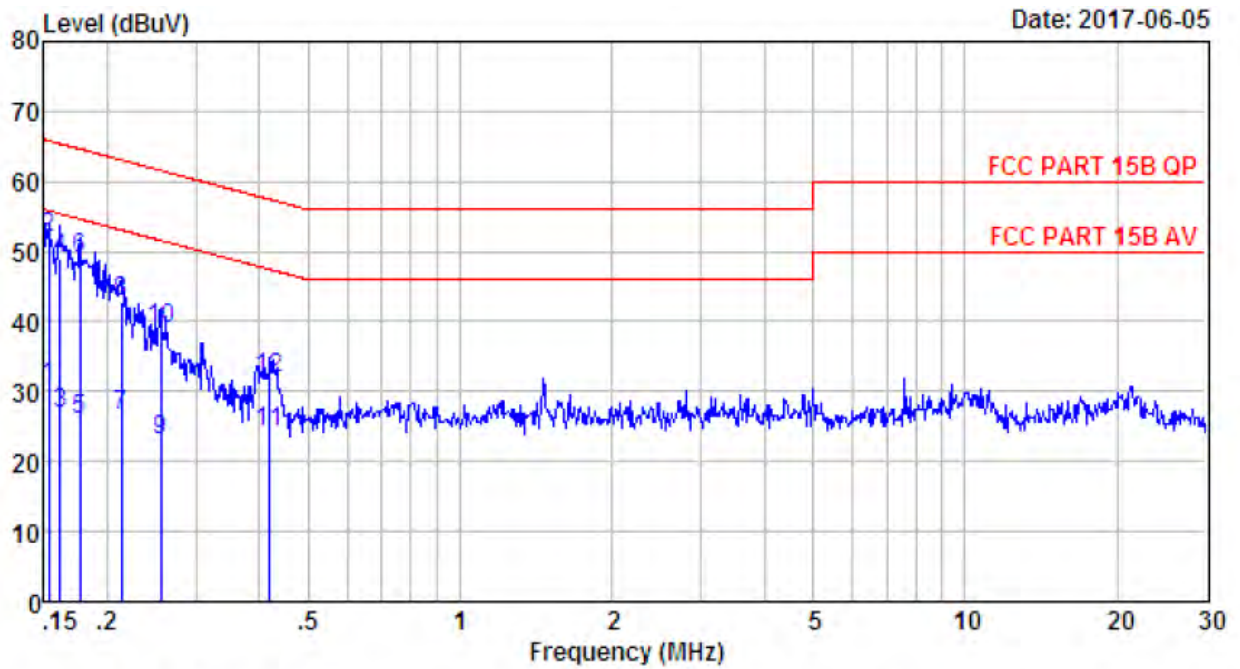
Site no : 844 Shield Room Data no. : 1089
Env. / Ins. : Temp:24.3'C Humi:58% Press:101.50kPa LINE Phase : NEUTRAL
Limit : FCC PART 15B QP
Engineer : Tony
EUT : Wireless Speaker
Power : AC 120V/60Hz
M/N : Beoplay M3
Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15	9.46	9.81	12.74	32.01	55.91	23.90	Average
2	0.15	9.46	9.81	32.12	51.39	65.91	14.52	QP
3	0.16	9.49	9.81	10.93	30.23	55.43	25.20	Average
4	0.16	9.49	9.81	28.85	48.15	65.43	17.28	QP
5	0.19	9.58	9.80	9.18	28.56	53.93	25.37	Average
6	0.19	9.58	9.80	28.15	47.53	63.93	16.40	QP
7	0.21	9.60	9.80	7.04	26.44	53.27	26.83	Average
8	0.21	9.60	9.80	20.73	40.13	63.27	23.14	QP
9	0.42	9.59	9.81	3.91	23.31	47.42	24.11	Average
10	0.42	9.59	9.81	11.38	30.78	57.42	26.64	QP
11	10.62	9.71	9.88	3.16	22.75	50.00	27.25	Average
12	10.62	9.71	9.88	11.92	31.51	60.00	28.49	QP



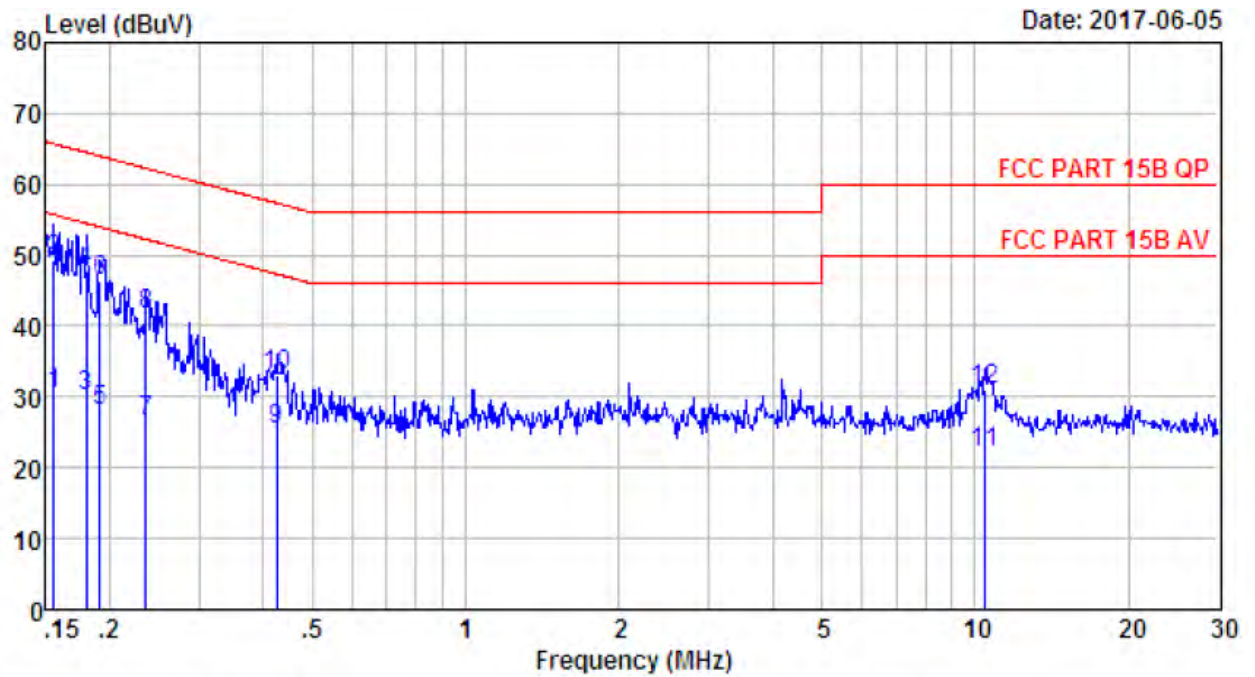
Site no : 844 Shield Room Data no. : 1091
 Env. / Ins. : Temp:24.3'C Humi:58% Press:101.50kPa LINE Phase : LINE
 Limit : FCC PART 15B QP
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15	9.61	9.81	10.13	29.55	55.78	26.23	Average
2	0.15	9.61	9.81	31.79	51.21	65.78	14.57	QP
3	0.16	9.61	9.81	8.13	27.55	55.34	27.79	Average
4	0.16	9.61	9.81	29.01	48.43	65.34	16.91	QP
5	0.19	9.61	9.80	8.57	27.98	54.24	26.26	Average
6	0.19	9.61	9.80	26.88	46.29	64.24	17.95	QP
7	0.42	9.61	9.81	7.10	26.52	47.46	20.94	Average
8	0.42	9.61	9.81	14.86	34.28	57.46	23.18	QP
9	4.43	9.64	9.84	1.54	21.02	46.00	24.98	Average
10	4.43	9.64	9.84	11.80	31.28	56.00	24.72	QP
11	10.51	9.66	9.88	4.50	24.04	50.00	25.96	Average
12	10.51	9.66	9.88	13.52	33.06	60.00	26.94	QP



Site no : 844 Shield Room Data no. : 1093
 Env. / Ins. : Temp:24.3'C Humi:58% Press:101.50kPa LINE Phase : NEUTRAL
 Limit : FCC PART 15B QP
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 240V/60Hz
 M/N : Beoplay M3
 Test Mode : IX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.15	9.47	9.81	11.33	30.61	55.82	25.21	Average
2	0.15	9.47	9.81	32.69	51.97	65.82	13.85	QP
3	0.16	9.50	9.81	7.53	26.84	55.38	28.54	Average
4	0.16	9.50	9.81	29.66	48.97	65.38	16.41	QP
5	0.18	9.54	9.80	6.57	25.91	54.64	28.73	Average
6	0.18	9.54	9.80	29.61	48.95	64.64	15.69	QP
7	0.21	9.60	9.80	7.07	26.47	53.10	26.63	Average
8	0.21	9.60	9.80	23.39	42.79	63.10	20.31	QP
9	0.25	9.60	9.82	3.51	22.93	51.60	28.67	Average
10	0.25	9.60	9.82	19.51	38.93	61.60	22.67	QP
11	0.42	9.59	9.81	4.91	24.31	47.46	23.15	Average
12	0.42	9.59	9.81	12.50	31.90	57.46	25.56	QP



Site no : 844 Shield Room Data no. : 1095
 Env. / Ins. : Temp:24.3'C Humi:58% Press:101.50kPa LINE Phase : LINE
 Limit : FCC PART 15B QP
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 240V/60Hz
 M/N : Beoplay M3
 Test Mode : TX Mode

	Freq. (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.16	9.61	9.81	11.13	30.55	55.69	25.14	Average
2	0.16	9.61	9.81	29.81	49.23	65.69	16.46	QP
3	0.18	9.61	9.80	10.67	30.08	54.50	24.42	Average
4	0.18	9.61	9.80	28.46	47.87	64.50	16.63	QP
5	0.19	9.61	9.80	8.57	27.98	53.98	26.00	Average
6	0.19	9.61	9.80	26.92	46.33	63.98	17.65	QP
7	0.24	9.61	9.82	7.25	26.68	52.26	25.58	Average
8	0.24	9.61	9.82	22.32	41.75	62.26	20.51	QP
9	0.43	9.61	9.81	6.10	25.52	47.33	21.81	Average
10	0.43	9.61	9.81	13.64	33.06	57.33	24.27	QP
11	10.45	9.66	9.88	2.73	22.27	50.00	27.73	Average
12	10.45	9.66	9.88	11.36	30.90	60.00	29.10	QP

4 RADIATED EMISSION TEST

4.1 Limit

4.1.1 15.209 limits

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark : (1) Emission level $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V/m}$

(2) The smaller limit shall apply at the cross point between two frequency bands.

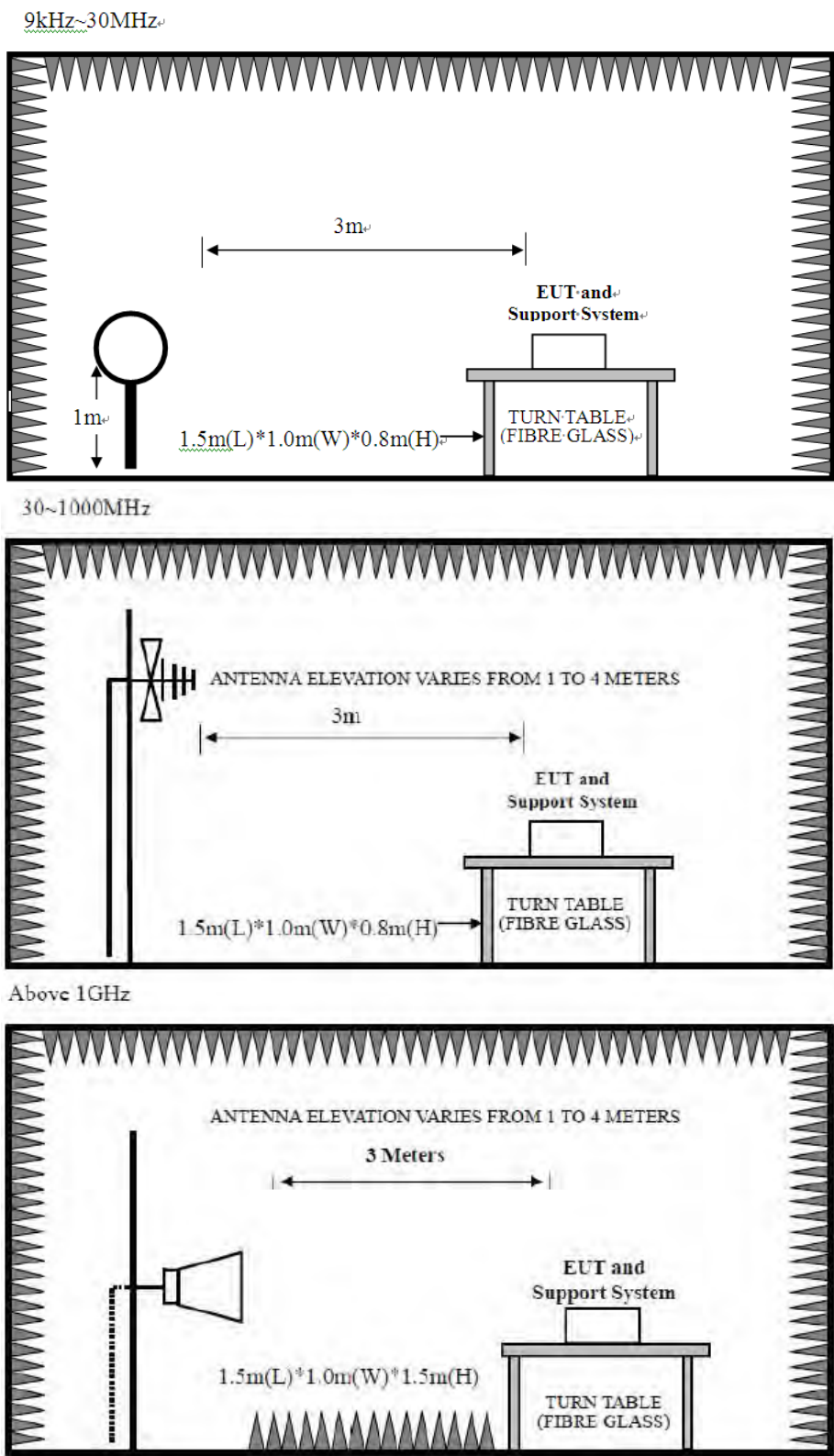
(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

4.1.2 15.205 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. Block Diagram of Test setup



4.3. Test Procedure

EUT was placed on a turn table, which is 0.8 meter high above ground for 9kHz~1000MHz test, and which is 1.5 meter high above ground for above 1GHz test. The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it. EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

The test frequency analyzer system was set to Peak Detect (300Hz RBW in 9kHz to 150kHz and 10kHz RBW in 150kHz to 30MHz) Function and Specified Bandwidth with Maximum Hold Mode.

The bandwidth of the EMI test receiver (R&S ESVS10) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 1MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz

PEAK detector, 1MHz/1MHz for PAEK measurement,

PEAK detector, 1MHz/10Hz for Average measurement

The frequency range from 30MHz to 10th harmonic (25GHz) are checked.

4.4. Test Result

PASS.

All the emissions from 30MHz to 25 GHz were comply with 15.209 limits.

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

2、 The frequency 2402MHz 、 2440MHz and 2480 MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

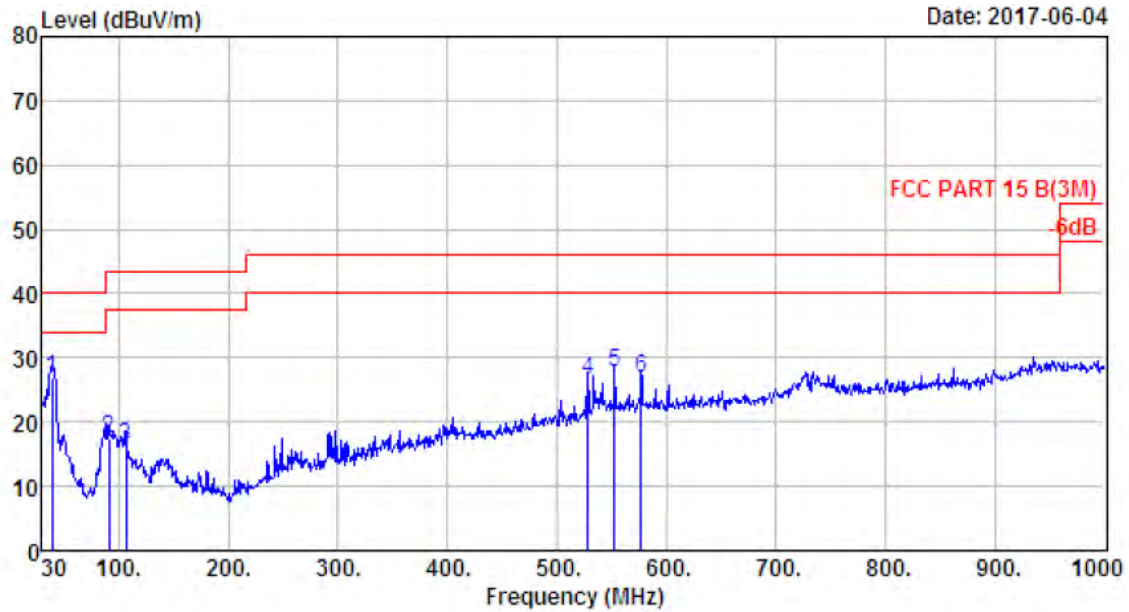
4.5. Test Data

9 kHz – 30 MHz

Pass

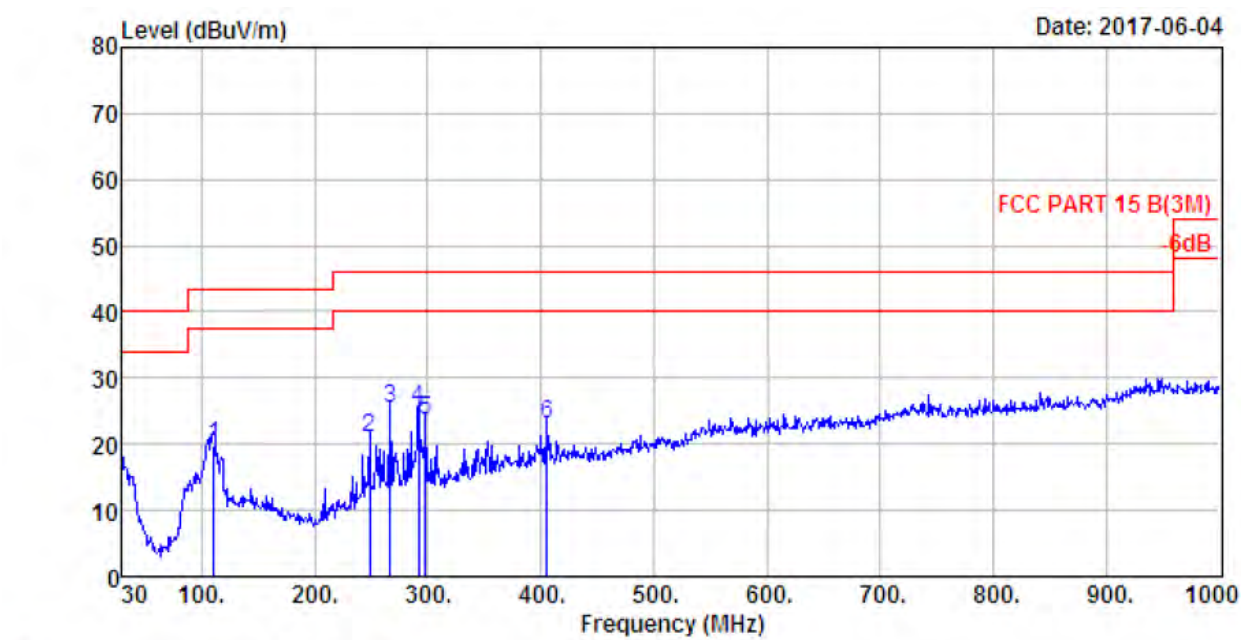
Note: The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

30-1000 MHz



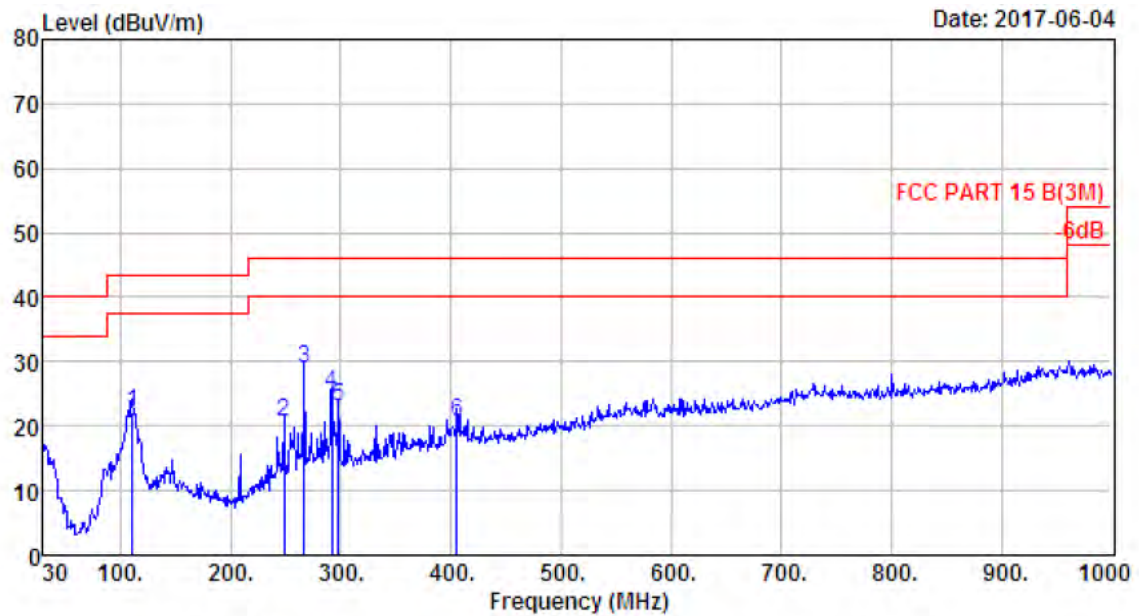
Site no. : 1# 966 Chamber Data no. : 573
 Dis. / Ant. : 3m 27137 Ant. pol. : VERTICAL
 Limit : FCC PART 15 B(3M)
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	38.730	13.48	0.79	12.68	26.95	40.00	13.05	QP
2	91.110	8.41	1.29	7.85	17.55	43.50	25.95	QP
3	106.630	10.15	1.38	4.71	16.24	43.50	27.26	QP
4	528.580	18.20	3.21	5.24	26.65	46.00	19.35	QP
5	552.830	19.53	3.27	5.05	27.85	46.00	18.15	QP
6	577.080	19.53	3.30	4.00	26.83	46.00	19.17	QP



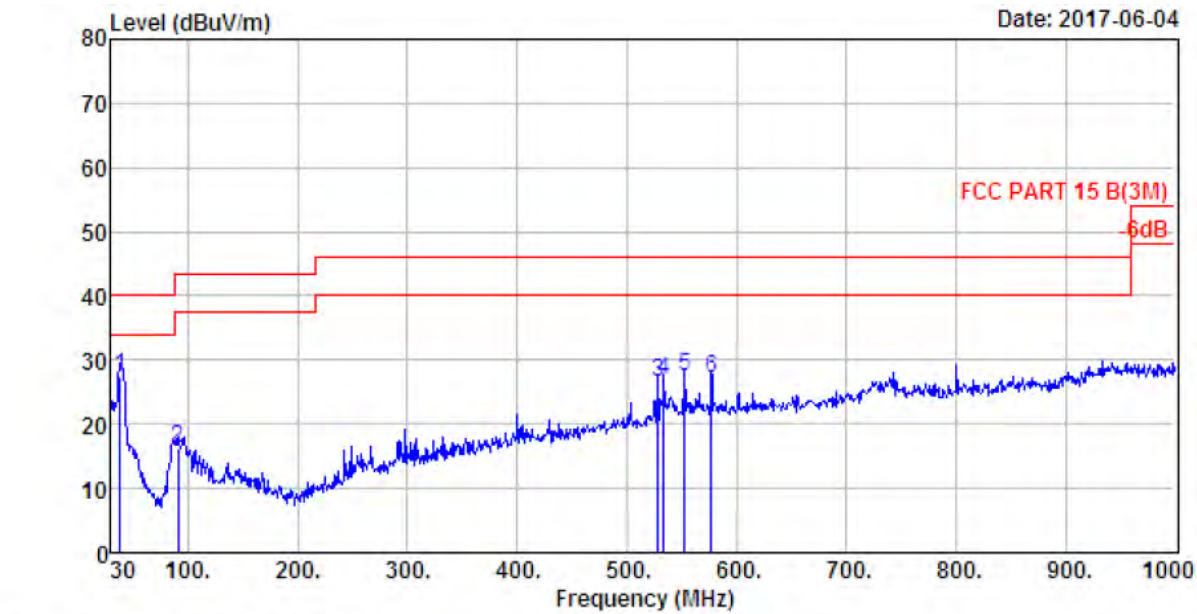
Site no. : 1# 966 Chamber Data no. : 574
Dis. / Ant. : 3m 27137 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Wireless Speaker
Power : AC 120V/60Hz
M/N : Beoplay M3
Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	110.510	10.52	1.42	7.85	19.79	43.50	23.71	QP
2	248.250	11.52	2.13	7.36	21.01	46.00	24.99	QP
3	266.680	12.79	2.27	10.46	25.52	46.00	20.48	QP
4	291.900	12.83	2.33	10.14	25.30	46.00	20.70	QP
5	297.720	12.99	2.36	8.31	23.66	46.00	22.34	QP
6	405.390	16.18	2.61	4.10	22.89	46.00	23.11	QP



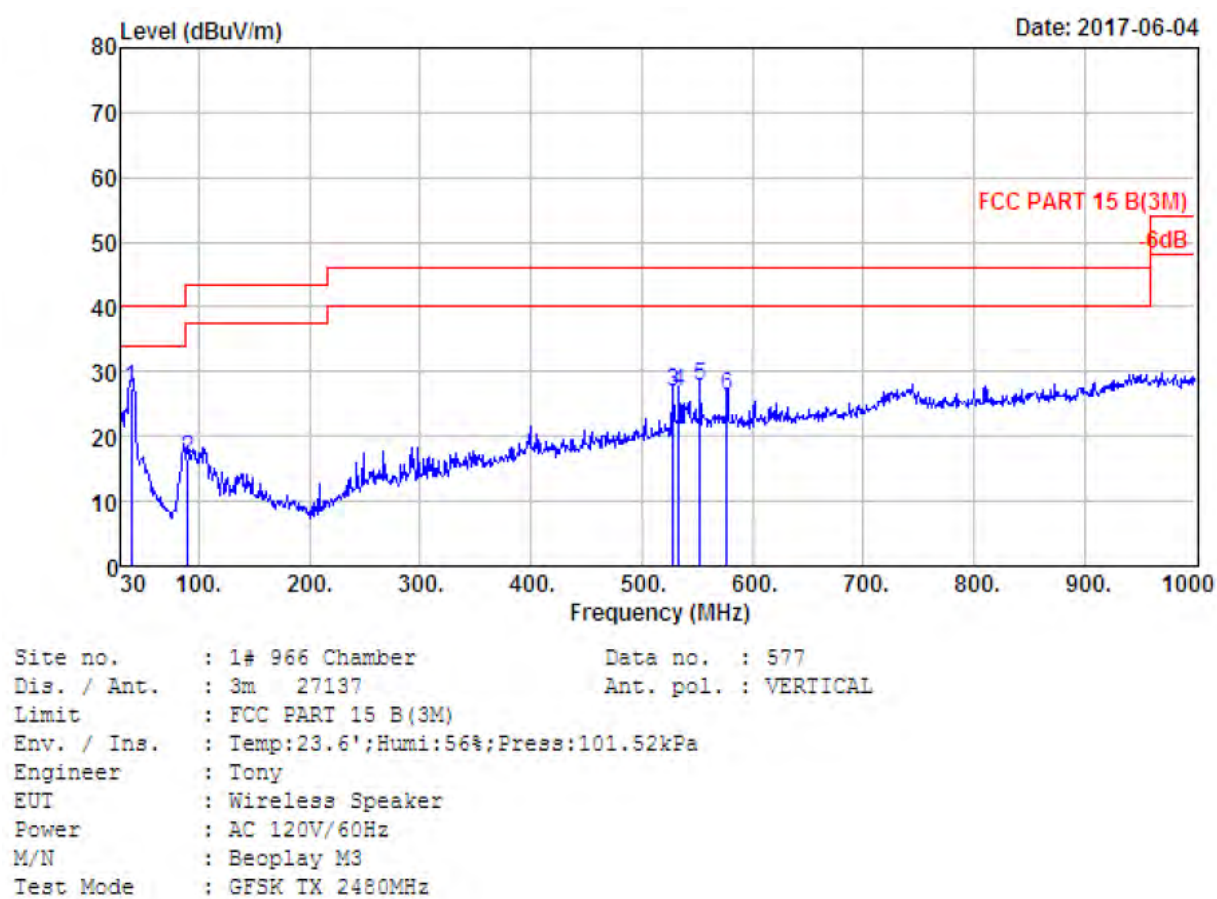
Site no. : 1# 966 Chamber Data no. : 575
 Dis. / Ant. : 3m 27137 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15 B(3M)
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2440MHz

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	110.510	10.52	1.42	10.25	22.19	43.50	21.31	QP
2	248.250	11.52	2.13	7.16	20.81	46.00	25.19	QP
3	266.680	12.79	2.27	13.84	28.90	46.00	17.10	QP
4	291.900	12.83	2.33	9.85	25.01	46.00	20.99	QP
5	297.720	12.99	2.36	7.62	22.97	46.00	23.03	QP
6	405.390	16.18	2.61	1.92	20.71	46.00	25.29	QP

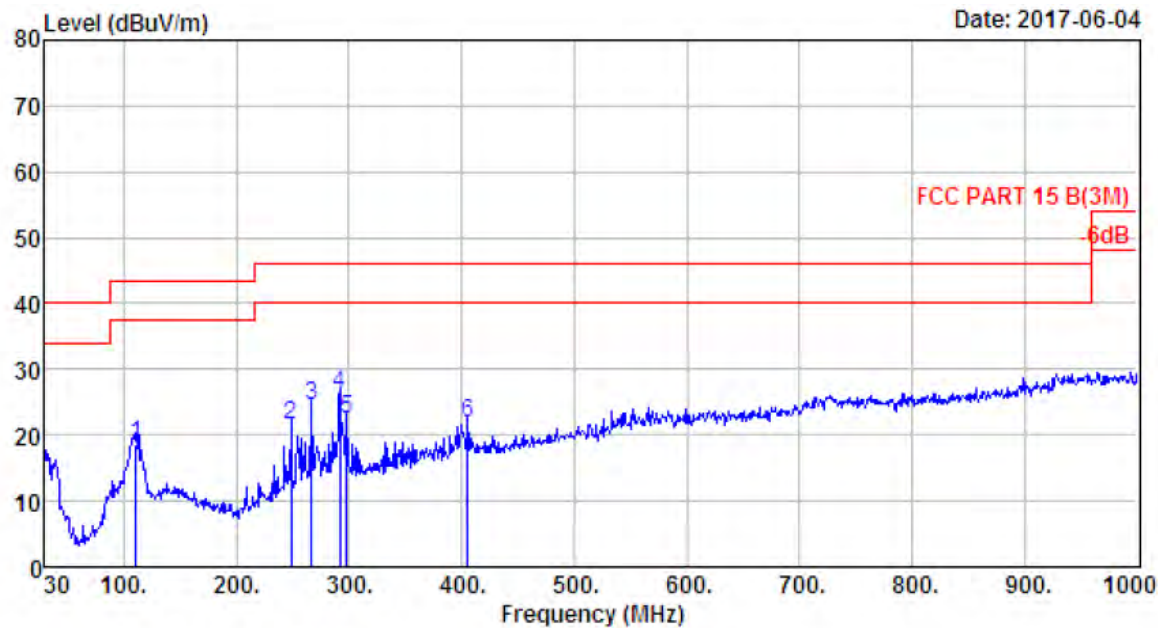


Site no.	: 1# 966 Chamber	Data no.	: 576
Dis. / Ant.	: 3m 27137	Ant. pol.	: VERTICAL
Limit	: FCC PART 15 B(3M)		
Env. / Ins.	: Temp:23.6';Humi:56%;Press:101.52kPa		
Engineer	: Tony		
EUT	: Wireless Speaker		
Power	: AC 120V/60Hz		
M/N	: Beoplay M3		
Test Mode	: GFSK TX 2440MHz		

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	37.760	14.05	0.79	12.63	27.47	40.00	12.53	QP
2	91.110	8.41	1.29	6.43	16.13	43.50	27.37	QP
3	528.580	18.20	3.21	5.09	26.50	46.00	19.50	QP
4	533.430	18.68	3.29	4.81	26.78	46.00	19.22	QP
5	552.830	19.53	3.27	4.67	27.47	46.00	18.53	QP
6	577.080	19.53	3.30	4.19	27.02	46.00	18.98	QP



	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	38.730	13.48	0.79	13.10	27.37	40.00	12.63	QP
2	90.140	8.38	1.33	6.70	16.41	43.50	27.09	QP
3	528.580	18.20	3.21	5.32	26.73	46.00	19.27	QP
4	533.430	18.68	3.29	4.91	26.88	46.00	19.12	QP
5	552.830	19.53	3.27	4.82	27.62	46.00	18.38	QP
6	577.080	19.53	3.30	3.33	26.16	46.00	19.84	QP



Site no. : 1# 966 Chamber Data no. : 578
Dis. / Ant. : 3m 27137 Ant. pol. : HORIZONTAL
Limit : FCC PART 15 B(3M)
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Wireless Speaker
Power : AC 120V/60Hz
M/N : Beoplay M3
Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	ANT Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	110.510	10.52	1.42	6.53	18.47	43.50	25.03	QP
2	248.250	11.52	2.13	7.83	21.48	46.00	24.52	QP
3	266.680	12.79	2.27	9.36	24.42	46.00	21.58	QP
4	291.900	12.83	2.33	11.00	26.16	46.00	19.84	QP
5	297.720	12.99	2.36	6.96	22.31	46.00	23.69	QP
6	405.390	16.18	2.61	3.01	21.80	46.00	24.20	QP

Above 1000MHz

Site no. : 1# 966 Chamber Data no. : 469
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	6.62	34.64	101.67	101.26	74.00	-27.26	Peak
2	4804.00	31.25	11.77	35.64	30.94	38.32	74.00	35.68	Peak
3	7206.00	36.52	11.54	33.95	28.19	42.30	74.00	31.70	Peak
4	8684.00	37.32	11.45	33.66	28.37	43.48	74.00	30.52	Peak
5	11030.00	39.50	11.27	33.98	25.68	42.47	74.00	31.53	Peak
6	14056.00	41.51	10.90	33.06	25.21	44.56	74.00	29.44	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : 1# 966 Chamber Data no. : 470
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	6.62	34.64	99.98	99.57	74.00	-25.57	Peak
2	4804.00	31.25	11.77	35.64	30.44	37.82	74.00	36.18	Peak
3	7206.00	36.52	11.54	33.95	26.80	40.91	74.00	33.09	Peak
4	8684.00	37.32	11.45	33.66	28.97	44.08	74.00	29.92	Peak
5	11166.00	39.41	11.17	33.31	26.56	43.83	74.00	30.17	Peak
6	13750.00	40.78	11.20	33.02	25.20	44.16	74.00	29.84	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : 1# 966 Chamber Data no. : 473
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.60	6.67	34.85	101.85	101.27	74.00	-27.27	Peak
2	4880.00	31.37	12.07	35.76	32.32	40.00	74.00	34.00	Peak
3	7320.00	36.55	11.57	34.14	28.28	42.26	74.00	31.74	Peak
4	8684.00	37.32	11.45	33.66	28.07	43.18	74.00	30.82	Peak
5	11336.00	39.30	11.04	33.44	26.60	43.50	74.00	30.50	Peak
6	13206.00	39.38	11.46	32.79	25.97	44.02	74.00	29.98	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : 1# 966 Chamber Data no. : 474
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2440MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.60	6.67	34.85	100.86	100.28	74.00	-26.28	Peak
2	4880.00	31.37	12.07	35.76	30.05	37.73	74.00	36.27	Peak
3	7320.00	36.55	11.57	34.14	28.78	42.76	74.00	31.24	Peak
4	8684.00	37.32	11.45	33.66	29.28	44.39	74.00	29.61	Peak
5	12186.00	38.67	11.22	33.58	28.03	44.34	74.00	29.66	Peak
6	13597.00	40.36	11.38	32.65	25.63	44.72	74.00	29.28	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : 1# 966 Chamber Data no. : 475
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.58	6.71	35.11	101.42	100.60	74.00	-26.60	Peak
2	4960.00	31.49	12.44	36.01	30.25	38.17	74.00	35.83	Peak
3	7440.00	36.54	11.61	34.22	28.82	42.75	74.00	31.25	Peak
4	8684.00	37.32	11.45	33.66	26.79	41.90	74.00	32.10	Peak
5	12186.00	38.67	11.22	33.58	28.32	44.63	74.00	29.37	Peak
6	13801.00	40.93	11.14	33.07	24.84	43.84	74.00	30.16	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

Site no. : 1# 966 Chamber Data no. : 476
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.58	6.71	35.11	101.20	100.38	74.00	-26.38	Peak
2	4960.00	31.49	12.44	36.01	30.30	38.22	74.00	35.78	Peak
3	7440.00	36.54	11.61	34.22	28.02	41.95	74.00	32.05	Peak
4	8684.00	37.32	11.45	33.66	28.14	43.25	74.00	30.75	Peak
5	11200.00	39.39	11.14	33.24	25.70	42.99	74.00	31.01	Peak
6	13546.00	40.21	11.44	32.61	26.10	45.14	74.00	28.86	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

18000MHz – 25000MHz

Pass

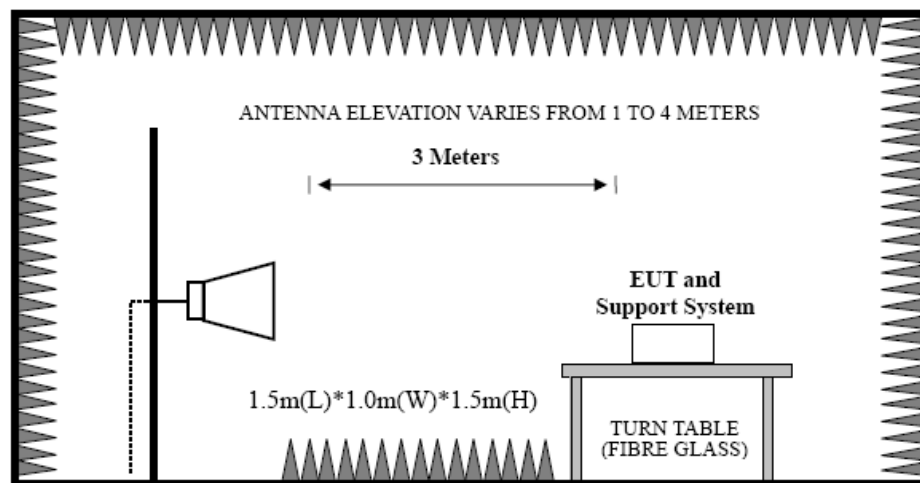
Note: The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

5 BAND EDGE COMPLIANCE TEST

5.1 Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits

5.2 Block Diagram of Test setup



5.3 Test Procedure

1. The EUT is placed on a turntable, which is 1.5m above the ground plane and worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

Peak : RBW = 1MHz, VBW = 1MHz, Detector=PEAK detector, Sweep time = auto.

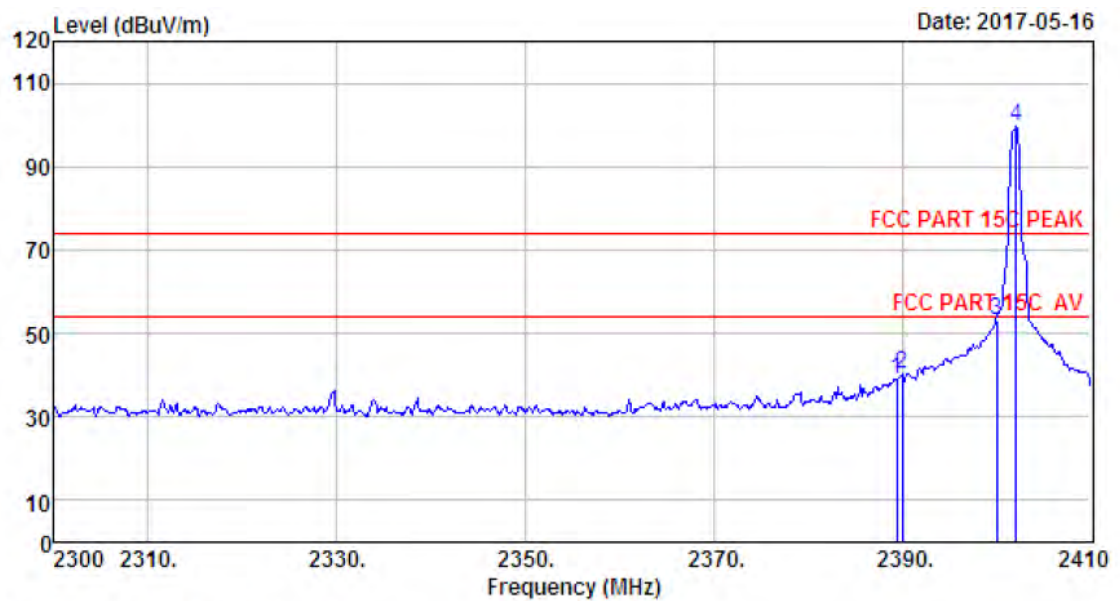
AV : RBW = 1MHz, VBW = 10Hz, Detector=PEAK detector, Sweep time = auto.

5.4 Test Result

Pass (The testing data was attached in the next pages.)

- Note:
- 1、 For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
 - 2、 The frequency 2402MHz and 2480 MHz is fundamental frequency which no limit, the limit on plots is automatically generated by the software, it's not fundamental limit, we can't remove it.

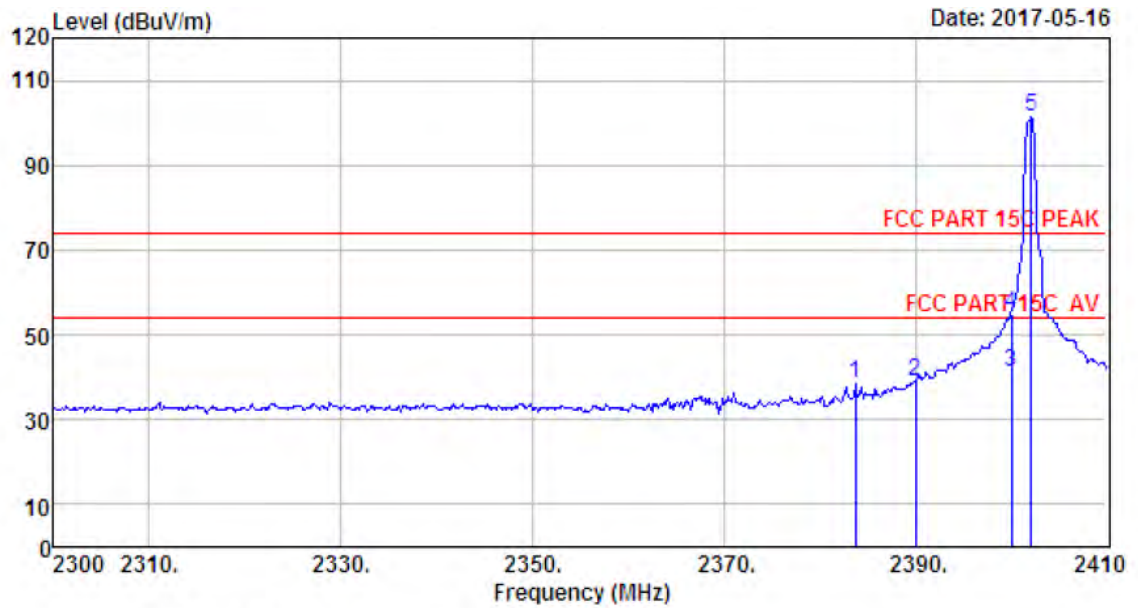
5.5 Test Data



Site no. : 1# 966 Chamber Data no. : 471
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2389.43	27.64	6.62	34.62	39.42	39.06	74.00	34.94	Peak
2	2390.00	27.64	6.62	34.62	40.84	40.48	74.00	33.52	Peak
3	2400.00	27.61	6.62	34.64	53.64	53.23	74.00	20.77	Peak
4	2402.08	27.61	6.62	34.64	99.95	99.54	74.00	-25.54	Peak

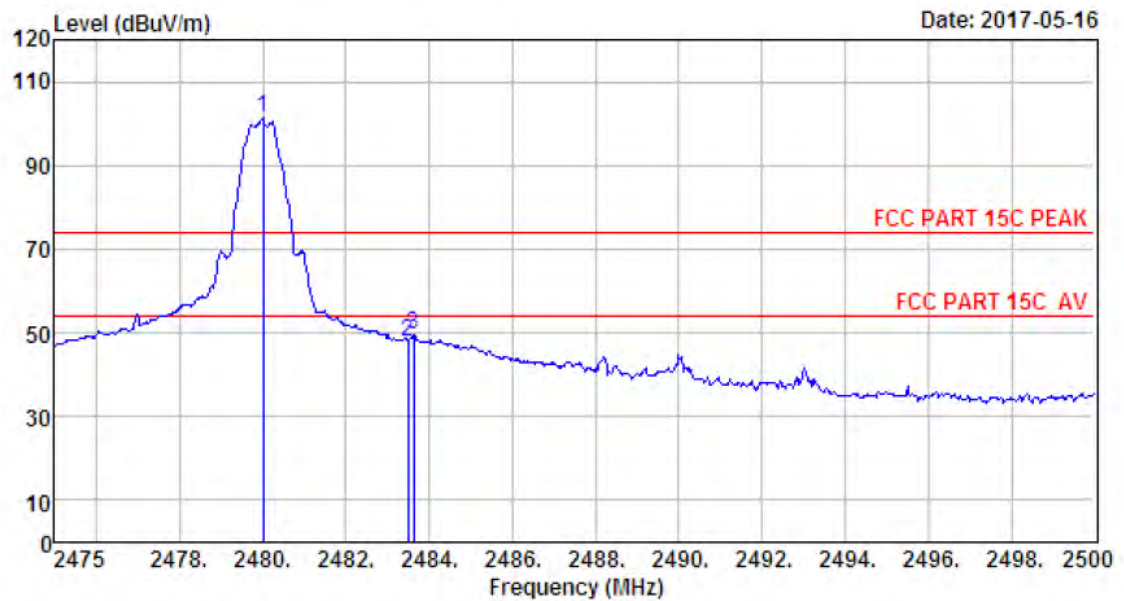
Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 1# 966 Chamber Data no. : 472
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2402MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2383.71	27.64	6.60	34.62	38.86	38.48	74.00	35.52	Peak
2	2390.00	27.64	6.62	34.62	39.35	38.99	74.00	35.01	Peak
3	2400.00	27.61	6.62	34.64	41.53	41.12	54.00	12.88	Average
4	2400.00	27.61	6.62	34.64	55.34	54.93	74.00	19.07	Peak
5	2402.08	27.61	6.62	34.64	101.71	101.30	74.00	-27.30	Peak

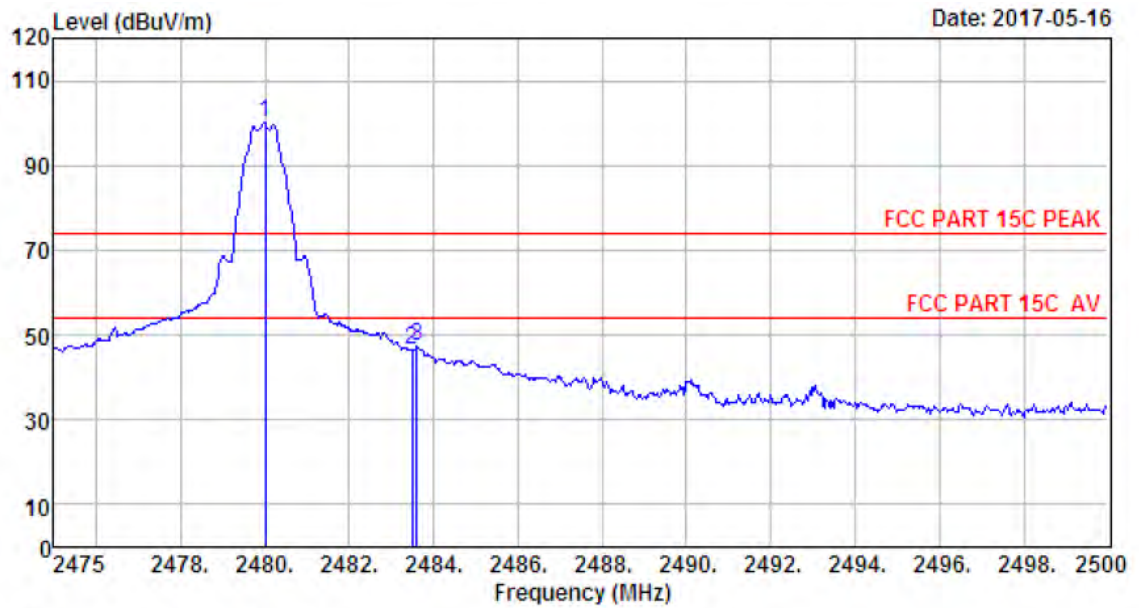
Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 1# 966 Chamber Data no. : 477
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUI : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.58	6.71	35.11	102.13	101.31	74.00	-27.31	Peak
2	2483.50	27.58	6.71	35.11	48.65	47.83	74.00	26.17	Peak
3	2483.63	27.58	6.71	35.11	50.23	49.41	74.00	24.59	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 1# 966 Chamber Data no. : 478
 Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
 Engineer : Tony
 EUT : Wireless Speaker
 Power : AC 120V/60Hz
 M/N : Beoplay M3
 Test Mode : GFSK TX 2480MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.58	6.71	35.11	101.07	100.25	74.00	-26.25	Peak
2	2483.50	27.58	6.71	35.11	47.17	46.35	74.00	27.65	Peak
3	2483.60	27.58	6.71	35.11	48.09	47.27	74.00	26.73	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

6 6dB Bandwidth Test

6.1 Limit

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

6.2 Test Procedure

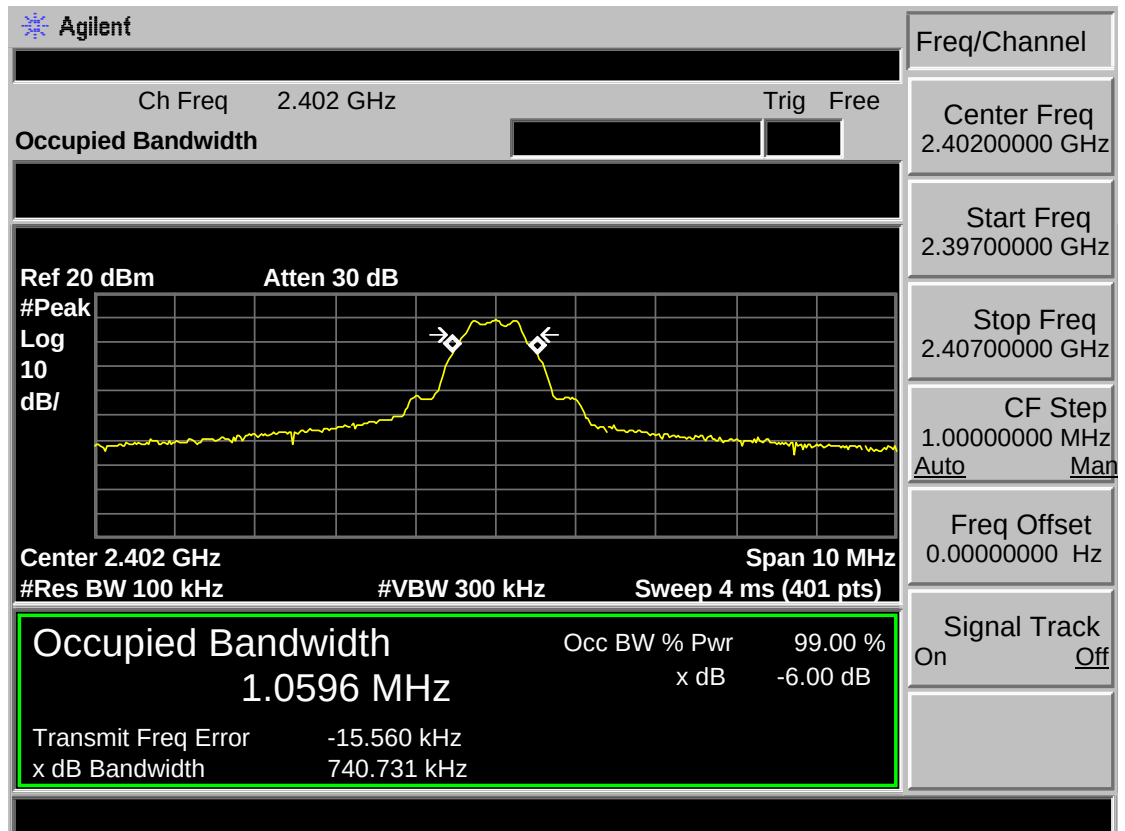
- 1, The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable.
- 2, Follow the test procedure as described in KDB 558074
 - (1). Set resolution bandwidth (RBW) = 100 kHz.
 - (2). Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
 - (3). Detector = Peak.
 - (4). Trace mode = max hold.
 - (5). Sweep = auto couple.
 - (6). Allow the trace to stabilize.
 - (7). Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.3 Test Result

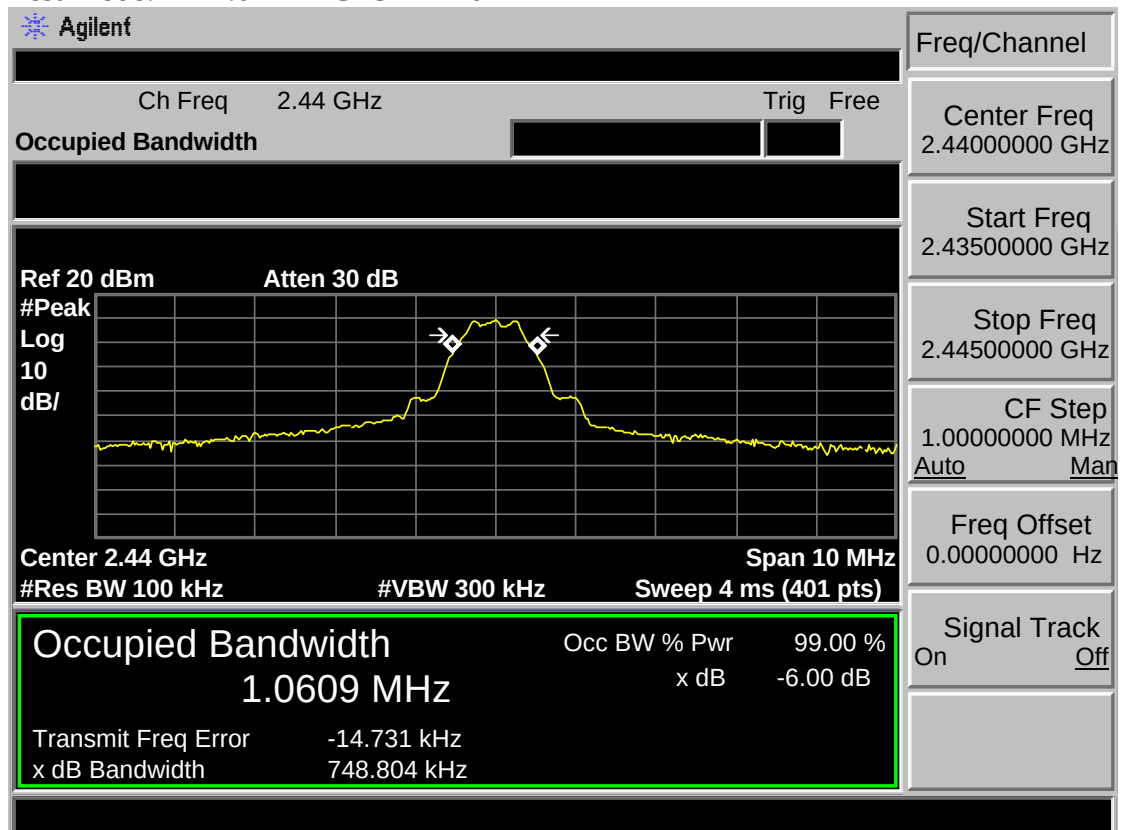
EUT: Wireless Speaker			
M/N: Beoplay M3			
Test date: 2017-05-20		Tested by: Tony.Tang	Test site: RF Site
Test Mode	CH	6dB bandwidth (MHz)	Limit (KHz)
BT 4.0-BLE GFSK	CH1	0.741	>500
	CH20	0.749	>500
	CH40	0.754	>500
Conclusion : PASS			

6.4 Test Data

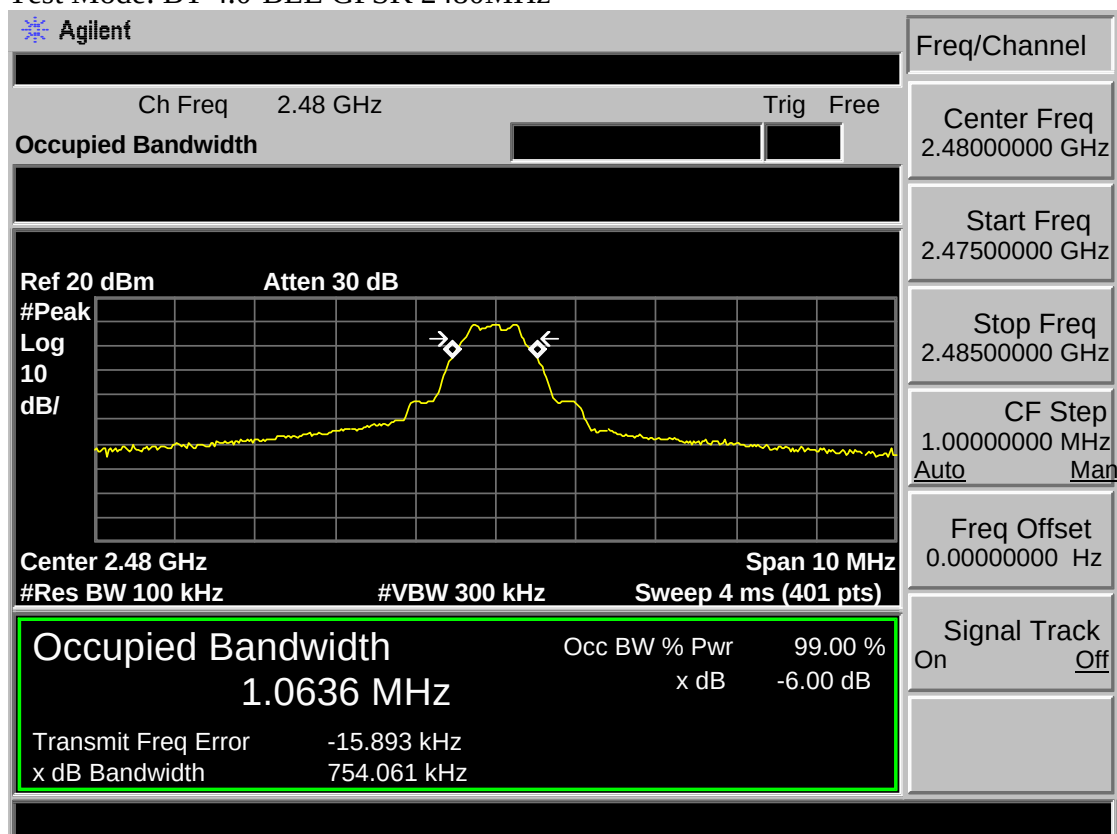
Test Mode: BT 4.0-BLE GFSK 2402MHz



Test Mode: BT 4.0-BLE GFSK 2440MHz



Test Mode: BT 4.0-BLE GFSK 2480MHz



7 OUTPUT POWER TEST

7.1 Limit

For systems using digital modulation in the 2400—2483.5MHz, The Peak out put Power shall not exceed 1W(30dBm)

7.2 Test Procedure

- 1, The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable.
- 2, Follow the test procedure as described in KDB 558074
 - (1). Set the RBW $\geq$ DTS bandwidth.
 - (2). Set VBW $\geq$ 3 x RBW.
 - (3). Set span $\geq$ 3 x RBW.
 - (4). Sweep time = auto couple.
 - (5). Detector = peak.
 - (6). Trace mode = max hold.
 - (7). Allow trace to fully stabilize.
 - (8). Use peak marker function to determine the peak amplitude level.

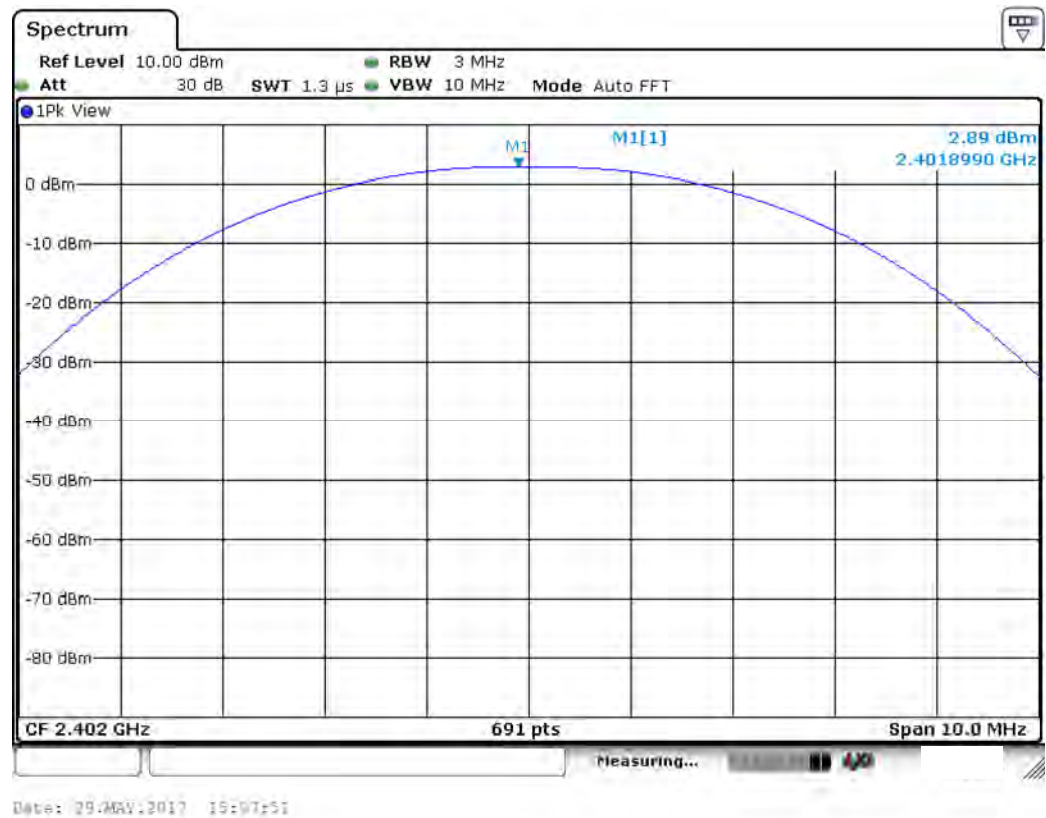
Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

7.3 Test Result

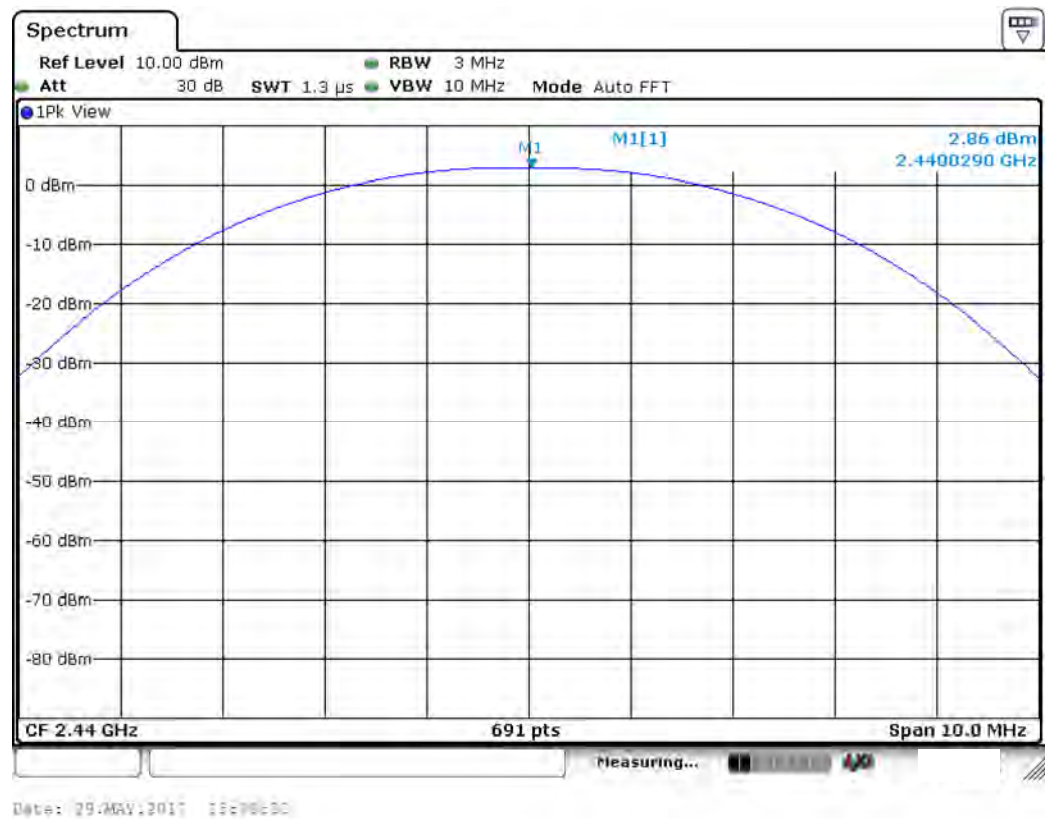
EUT:Wireless Speaker			
M/N:Beoplay M3			
Test date: 2017-05-16		Test site: 3m Chamber	Tested by: Tony Tang
Pass			
Test Mode	CH	Peak output Power (dBm)	Limit (dBm)
BT 4.0-BLE GFSK	CH1	2.89	30
	CH20	2.86	30
	CH40	2.81	30
Conclusion : PASS			

7.4 Test Data

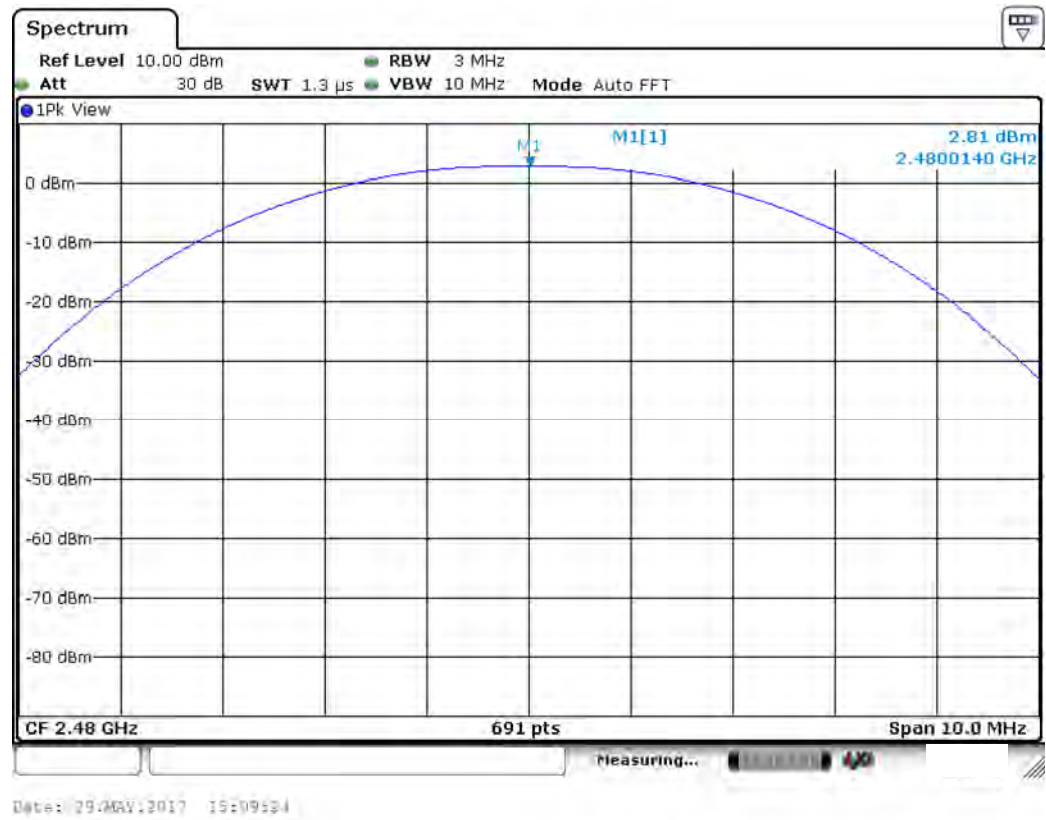
Test Mode: BT 4.0-BLE GFSK 2402MHz



Test Mode: BT 4.0-BLE GFSK 2440MHz



Test Mode: BT 4.0-BLE GFSK 2480MHz



8 POWER SPECTRAL DENSITY TEST

8.1 Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

8.2 Test Procedure

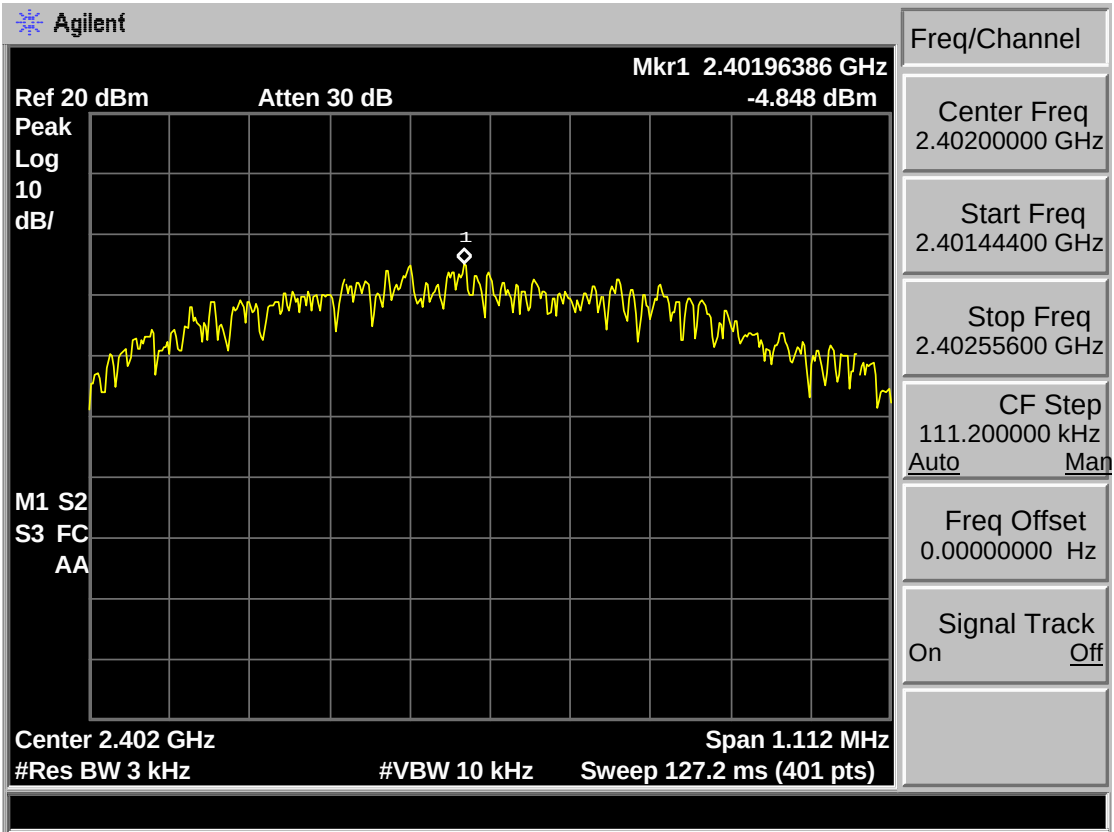
- 1, The transmitter output (antenna port) was connected to the spectrum analyzer. Connect EUT antenna terminal to the spectrum analyzer with a low loss SMA cable.
- 2, Follow the test procedure as described in KDB 558074
 - (1). Set analyzer center frequency to DTS channel center frequency.
 - (2). Set the span to 1.5 times the DTS bandwidth.
 - (3). Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
 - (4). Set the VBW $\geq 3 \text{ RBW}$.
 - (5). Detector = peak.
 - (6). Sweep time = auto couple.
 - (7). Trace mode = max hold.
 - (8). Allow trace to fully stabilize.
 - (9). Use the peak marker function to determine the maximum amplitude level.
 - (10). If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

8.3 Test Result

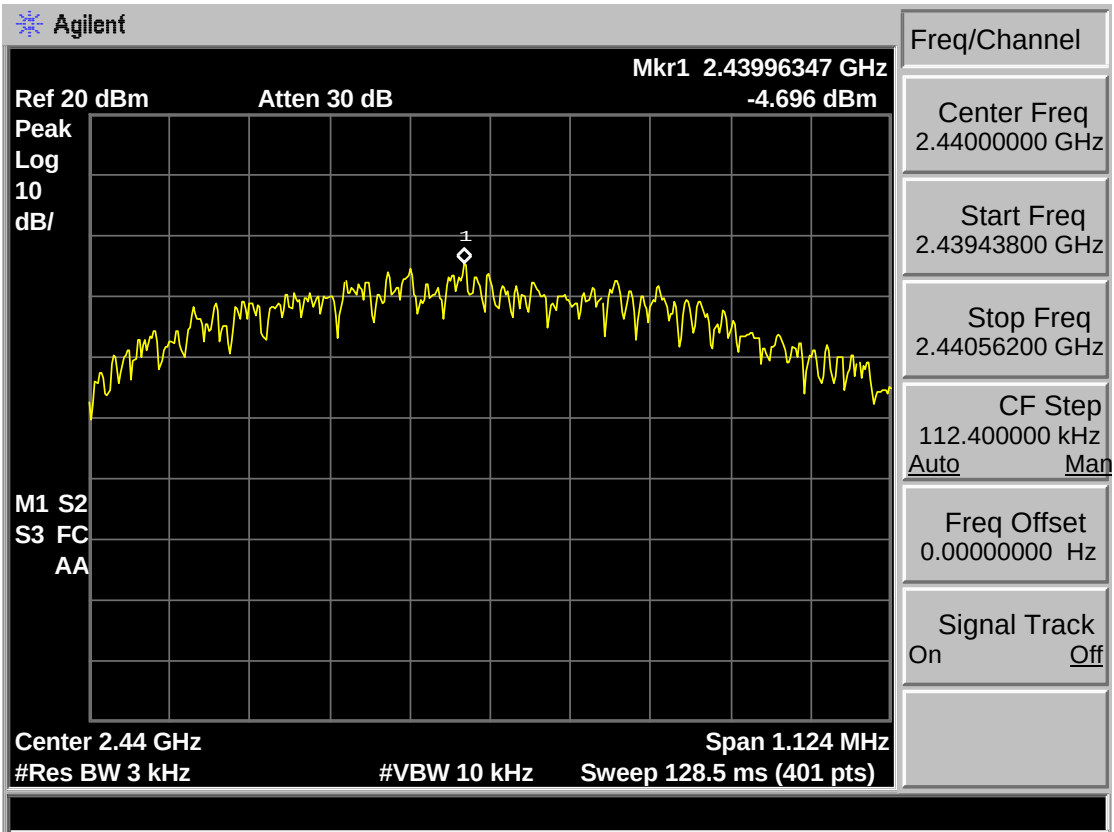
EUT: Wireless Speaker			
M/N: Beoplay M3			
Test date: 2017-05-20		Test site: 3m Chamber	Tested by: Tony Tang
Pass			
Test Mode	CH	Power density (dBm/3kHz)	Limit (dBm/3kHz)
BT 4.0-BLE GFSK	CH1	-4.848	8
	CH20	-4.696	8
	CH40	-4.964	8
Conclusion : PASS			

8.4 Test Data

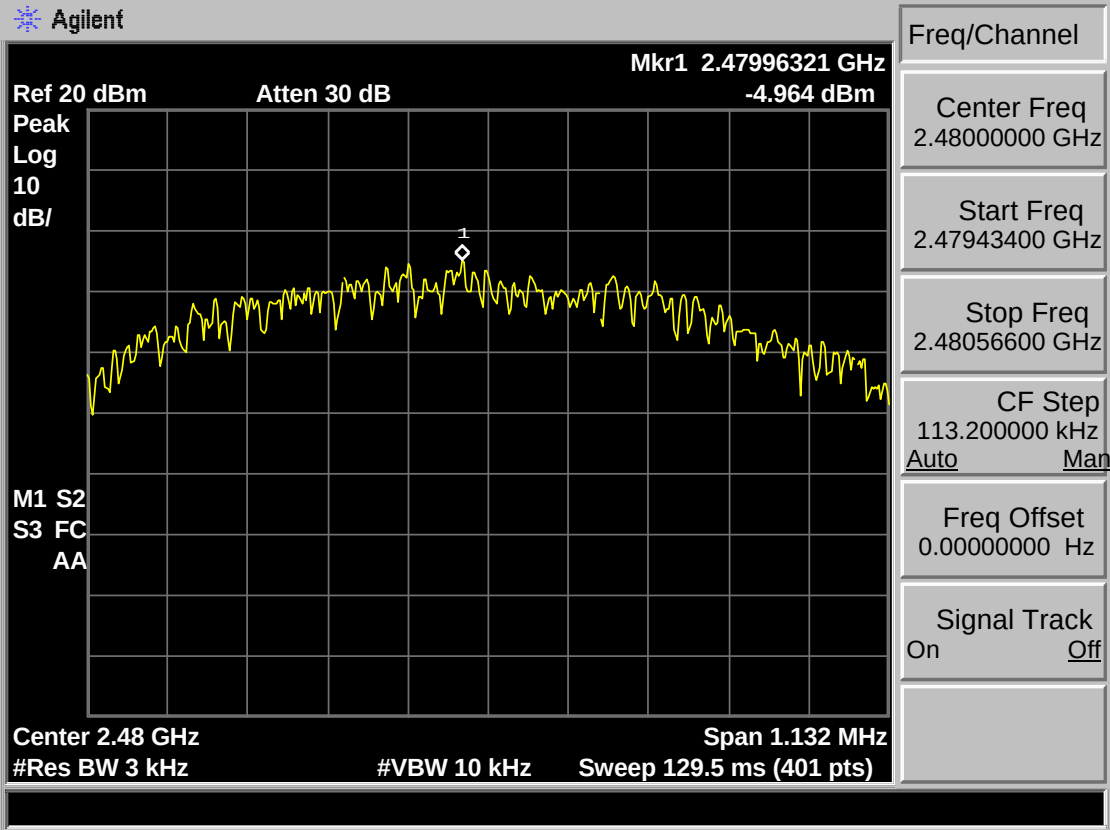
Test Mode: BT 4.0-BLE GFSK 2402MHz



Test Mode: BT 4.0-BLE GFSK 2440MHz



Test Mode: BT 4.0-BLE GFSK 2480MHz



9 ANTENNA REQUIREMENTS

9.1 Limit

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.

9.2 Result

The antennas used for this product are Integrated PCB 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 -1.16 dBi in 2.4G band and 4.67dBi in 5G Band.