

FCC Test Report

Product Name	Waterproof Bluetooth Speaker
Model No.	VIBROX SE
FCC ID.	2AJAAVIBROXSE

Applicant	Dongguan Meiloon Acoustic Equipments Co., Ltd.
Address	77, Yuanlin Road Fenghuanggang Ind Estate, Tangxia Town, 523727 Dongguan City, Guangdong Province, China.

Date of Receipt	Aug. 31, 2017
Issued Date	Oct. 16, 2017
Report No.	1780551R-RFUSP01V00-A
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Test Report

Issued Date: Oct. 16, 2017

Report No.: 1780551R-RFUSP01V00-A



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Applicant	Dongguan Meiloon Acoustic Equipments Co., Ltd.
Address	77, Yuanlin Road Fenghuanggang Ind Estate, Tangxia Town, 523727 Dongguan City, Guangdong Province, China.
Manufacturer	Vibes Audio, LLC
Model No.	VIBROX SE
FCC ID.	2AJAAVIBROXSE
EUT Rated Voltage	DC 3.8V (Power by Battery) or DC 5V (Power by USB)
EUT Test Voltage	DC 5V (Power by USB)
Trade Name	VIBES
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v04
Test Result	Complied

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Approved By :



(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Waterproof Bluetooth Speaker
Trade Name	VIBES
Model No.	VIBROX SE
FCC ID.	2AJAAVIBROXSE
Frequency Range	2402 – 2480MHz
Channel Number	V4.0: 40CH
Type of Modulation	V4.0: GFSK(1Mbps)
Antenna Type	Printed Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”
Power Adapter	MFR: DYS, M/N: APP521-050210U Input: AC 100-240V~50/60Hz, 0.45A MAX Output: 5.0V $\overline{\text{---}}$, 2.1A Cable Out: Non-shielded, 1.5m

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	FIHONEST COMMUNICA Co.,Ltd.	N/A	Printed Antenna	0dBi for 2.4 GHz

Note: The antenna of EUT is conforming to FCC 15.203.

Center Frequency of Each Channel: (For V4.0)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz
Channel 04:	2410 MHz	Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz
Channel 08:	2418 MHz	Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz
Channel 12:	2426 MHz	Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz
Channel 16:	2434 MHz	Channel 17:	2436 MHz	Channel 18:	2438 MHz	Channel 19:	2440 MHz
Channel 20:	2442 MHz	Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz
Channel 24:	2450 MHz	Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz
Channel 28:	2458 MHz	Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz
Channel 32:	2466 MHz	Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz
Channel 36:	2474 MHz	Channel 37:	2476 MHz	Channel 38:	2478 MHz	Channel 39:	2480 MHz

Note:

1. The EUT is a Waterproof Bluetooth Speaker with built-in Bluetooth V4.0 、V2.1+EDR transceiver, this report for Bluetooth V4.0.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth V4.0 transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit - BLE
-----------	------------------------

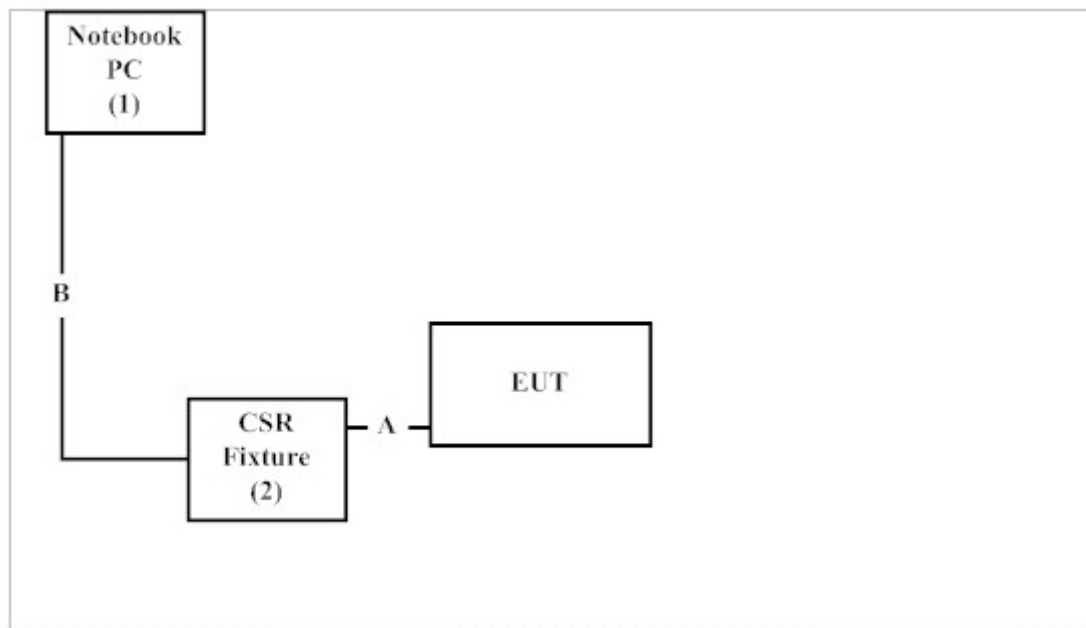
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	P62G	229FJC2	N/A
2	CSR Fixture	N/A	N/A	N/A	N/A

Signal Cable Type		Signal cable Description
A	Signal Cable	Non-Shielded, 0.1m
B	CSR Signal Cable	Non-Shielded, 0.8m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4.
- (2) Execute software “Blue Test 3 v2.6.2” on the Notebook PC.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press “OK” to start the continuous Transmit.
- (5) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en

Site Description: Accredited by TAF
Accredited Number: 3023

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E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conduction measurements /ASR1

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	EMI Test Receiver	R&S	ESR7	101601	2017.01.06	2018.01.05
X	Two-Line V-Network	R&S	ENV216	101306	2017.02.16	2018.02.15
X	Two-Line V-Network	R&S	ENV216	101307	2017.03.17	2018.03.16
X	Coaxial Cable	Quietek	RG400_BNC	RF001	2017.05.24	2018.05.23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSV30	103464	2017.01.09	2018.01.08
X	Power Meter	Anritsu	ML2496A	1548003	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531024	2016.12.15	2017.12.14
X	Power Sensor	Anritsu	MA2411B	1531025	2016.12.15	2017.12.14
	Bluetooth Tester	R&S	CBT	101238	2017.01.03	2018.01.02

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek Conduction Test System V8.0.110

For Radiated measurements /ACB1

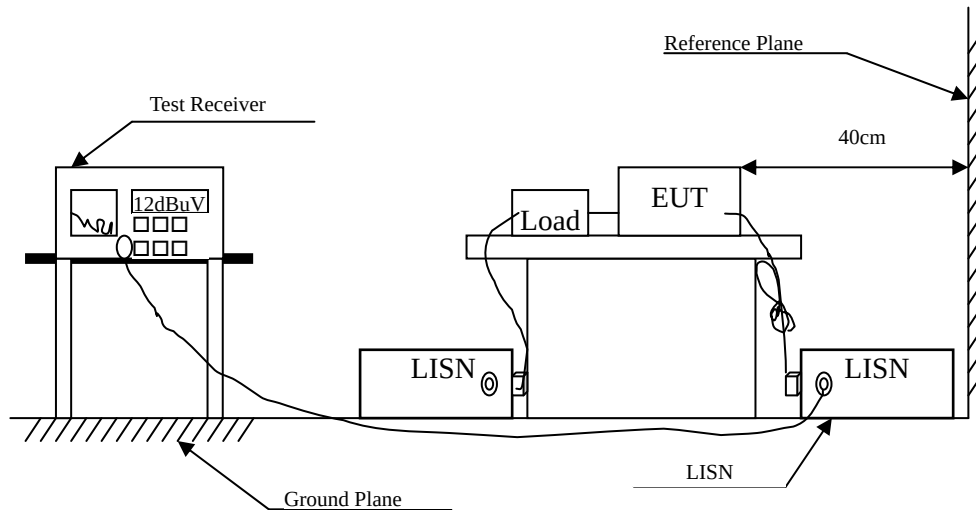
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Loop Antenna	TESEQ	HLA6121	37133	2016.03.18	2018.03.17
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	2017.02.13	2018.02.12
X	Horn Antenna	ETS-Lindgren	3117	00203800	2016.10.13	2017.10.12
X	Horn Antenna	Com-Power	AH-840	101087	2017.05.24	2018.05.23
X	Pre-Amplifier	EMCI	EMC001330	980316	2017.05.16	2018.05.15
X	Pre-Amplifier	EMCI	EMC051835SE	980311	2017.05.17	2018.05.16
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2017.05.17	2018.05.16
X	Pre-Amplifier	EMCI	EMC184045SE	980314	2017.05.17	2018.05.16
X	Filter	MICRO TRONICS	BRM50702	G249	2017.08.11	2018.08.10
	Filter	MICRO TRONICS	BRM50716	G187	2017.08.16	2018.08.15
X	EMI Test Receiver	R&S	ESR7	101602	2016.12.15	2017.12.14
X	Spectrum Analyzer	R&S	FSV40	101148	2017.01.24	2018.01.23
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	2017.05.25	2018.05.24
X	Mircoflex Cable	HUBER SUHNER	SUCOFLEX 102	MY3381/2	2017.08.11	2018.08.10

Note:

1. Loop Antenna is calibrated every two year, the other equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

2.4. Uncertainty

$\pm 2.35\text{dB}$

2.5. Test Result of Conducted Emission

Product : Waterproof Bluetooth Speaker
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 1: Transmit - BLE (2440MHz)
 Test Date : 2017/09/28

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
LINE 1					
Quasi-Peak					
0.161	9.636	33.506	43.143	-22.543	65.686
0.321	9.688	29.225	38.913	-22.201	61.114
4.897	9.829	9.975	19.804	-36.196	56.000
11.744	9.959	-0.464	9.495	-50.505	60.000
16.001	10.036	9.963	19.998	-40.002	60.000
24.526	10.100	19.637	29.737	-30.263	60.000
Average					
0.161	9.636	19.322	28.959	-26.727	55.686
0.321	9.688	17.729	27.417	-23.697	51.114
4.897	9.829	4.849	14.678	-31.322	46.000
11.744	9.959	-4.226	5.733	-44.267	50.000
16.001	10.036	-3.368	6.668	-43.332	50.000
24.526	10.100	2.009	12.109	-37.891	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Waterproof Bluetooth Speaker
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 1: Transmit - BLE (2440MHz)
 Test Date : 2017/09/28

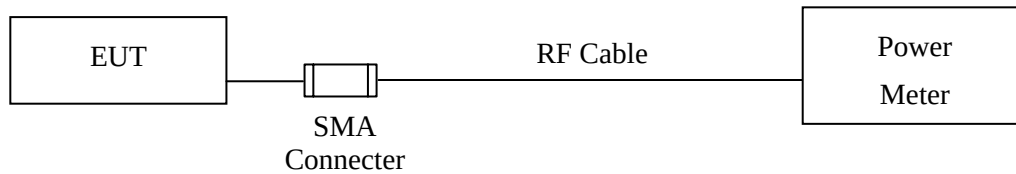
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.152	10.709	34.636	45.345	-20.598	65.943
0.301	9.957	29.044	39.000	-22.686	61.686
4.835	9.874	12.626	22.500	-33.500	56.000
15.999	10.083	10.841	20.924	-39.076	60.000
22.393	10.180	14.799	24.979	-35.021	60.000
28.779	10.253	21.889	32.142	-27.858	60.000
Average					
0.152	10.709	19.697	30.406	-25.537	55.943
0.301	9.957	17.977	27.934	-23.752	51.686
4.835	9.874	7.081	16.955	-29.045	46.000
15.999	10.083	-3.537	6.546	-43.454	50.000
22.393	10.180	-1.378	8.802	-41.198	50.000
28.779	10.253	1.566	11.819	-38.181	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.2 PKPM1 Peak power meter method.

3.4. Uncertainty

± 0.86 dB

3.5. Test Result of Peak Power Output

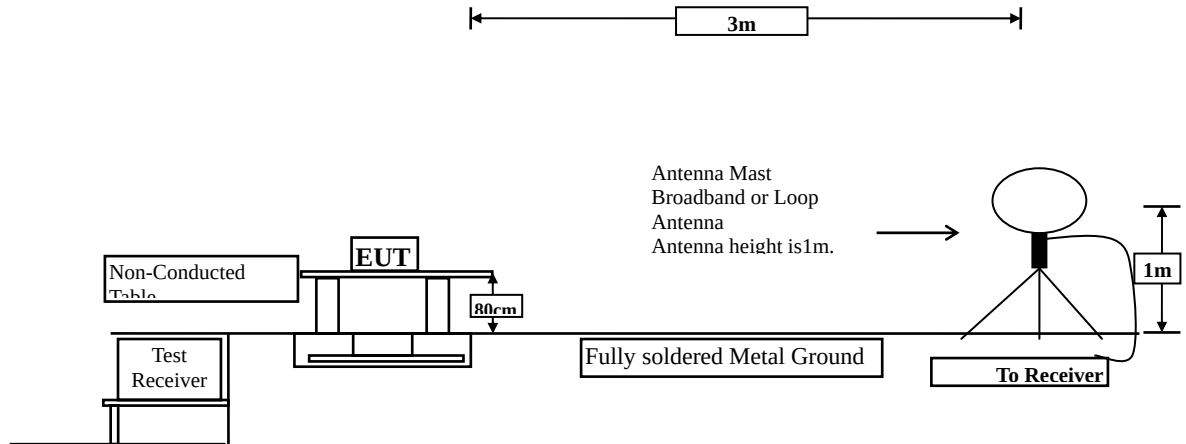
Product : Waterproof Bluetooth Speaker
Test Item : Peak Power Output
Test Mode : Mode 1: Transmit - BLE
Test Date : 2017/09/28

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	-0.15	1 Watt= 30 dBm	Pass
Channel 19	2440.00	3.55	1 Watt= 30 dBm	Pass
Channel 39	2480.00	4.72	1 Watt= 30 dBm	Pass

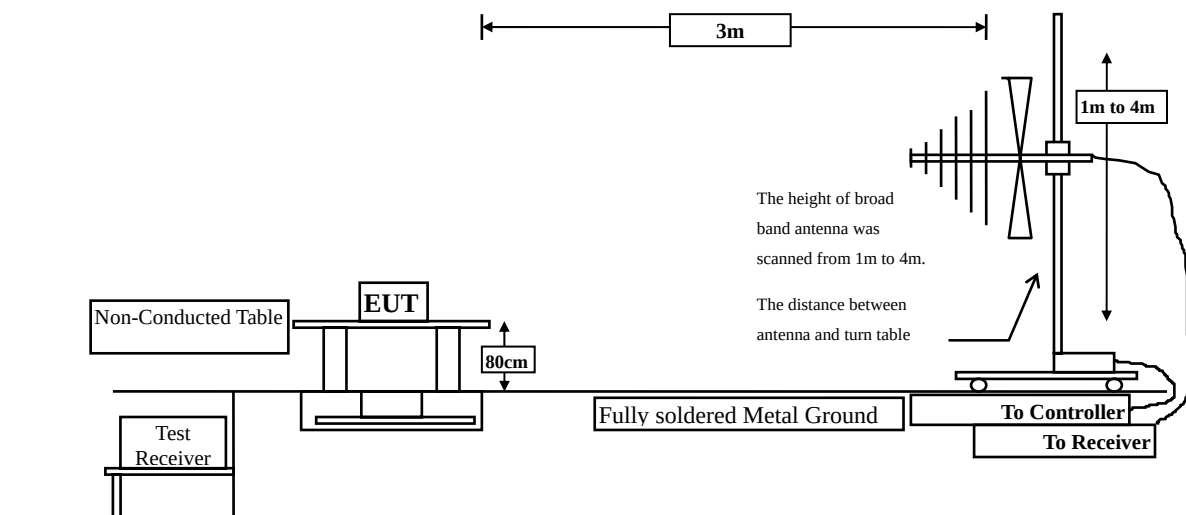
4. Radiated Emission

4.1. Test Setup

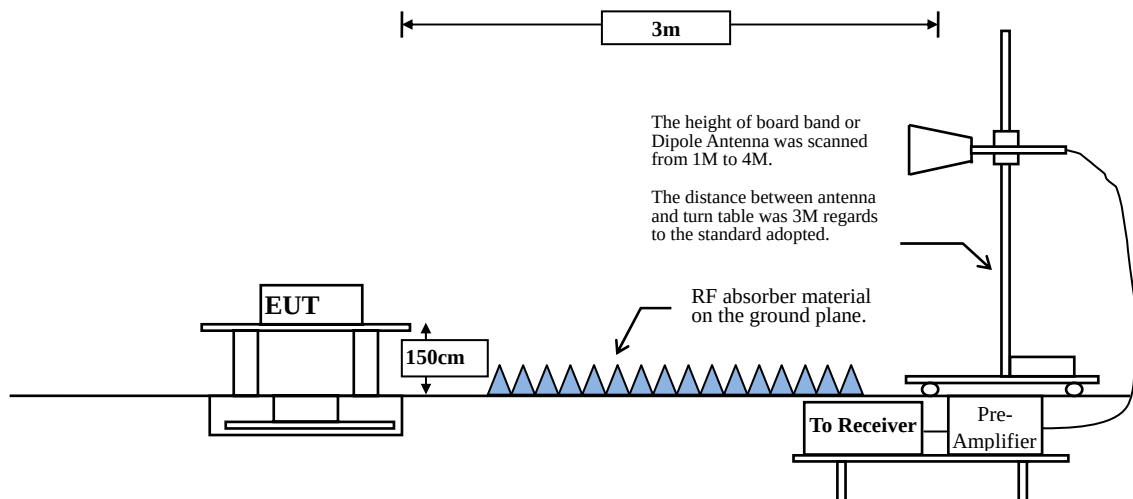
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



4.2. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
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

- Remarks:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

$VBW \geq 3 \times RBW$.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle $\geq 98\%$

$VBW \geq 1/T$, when duty cycle $< 98\%$

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
BLE	69.2	0.4493	2226	3k

Note: Duty Cycle Refer to Section 9

4.4. Uncertainty

Horizontal polarization :

30-300MHz: $\pm 4.08\text{dB}$; 300M-1GHz: $\pm 3.86\text{dB}$; 1-18GHz: $\pm 3.77\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

Vertical polarization :

30-300MHz: $\pm 4.81\text{dB}$; 300M-1GHz: $\pm 3.87\text{dB}$; 1-18GHz : $\pm 3.83\text{dB}$; 18-40GHz: $\pm 3.98\text{dB}$

4.5. Test Result of Radiated Emission

Product : Waterproof Bluetooth Speaker
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit - BLE(2402MHz)
 Test Date : 2017/09/29

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4804.000	-6.114	50.570	44.456	-29.544	74.000
7206.000	-3.112	50.790	47.678	-26.322	74.000
9608.000	-0.801	46.110	45.310	-28.690	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4804.000	-6.114	51.650	45.536	-28.464	74.000
7206.000	-3.112	51.050	47.938	-26.062	74.000
9608.000	-0.801	45.700	44.900	-29.100	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Waterproof Bluetooth Speaker
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit - BLE (2440MHz)
 Test Date : 2017/09/29

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4880.000	-6.069	52.650	46.581	-27.419	74.000
7320.000	-3.027	52.520	49.493	-24.507	74.000
9760.000	-0.527	46.010	45.482	-28.518	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4880.000	-6.069	53.580	47.511	-26.489	74.000
7320.000	-3.027	54.350	51.323	-22.677	74.000
9760.000	-0.527	46.340	45.812	-28.188	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Waterproof Bluetooth Speaker
 Test Item : Harmonic Radiated Emission
 Test Mode : Mode 1: Transmit - BLE (2480MHz)
 Test Date : 2017/09/29

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
4960.000	-6.055	52.030	45.975	-28.025	74.000
7440.000	-2.861	50.110	47.248	-26.752	74.000
9920.000	-0.306	45.530	45.224	-28.776	74.000
Average					
Detector:					
--					54.000
Vertical					
Peak Detector:					
4960.000	-6.055	53.520	47.465	-26.535	74.000
7440.000	-2.861	50.300	47.438	-26.562	74.000
9920.000	-0.306	45.310	45.004	-28.996	74.000
Average					
Detector:					
--					54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Waterproof Bluetooth Speaker
 Test Item : General Radiated Emission
 Test Mode : Mode 1: Transmit - BLE (2440MHz)
 Test Date : 2017/09/28

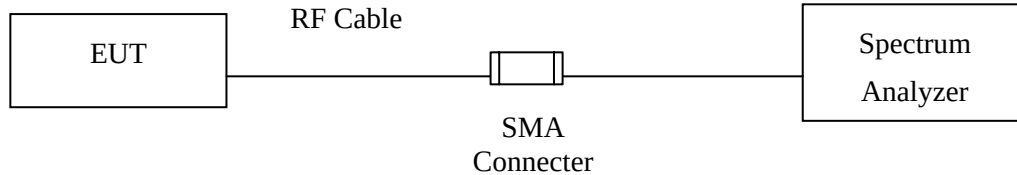
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
79.203	-15.468	42.126	26.658	-13.342	40.000
115.754	-13.831	38.004	24.173	-19.327	43.500
427.841	-7.393	31.434	24.042	-21.958	46.000
607.783	-4.008	30.689	26.681	-19.319	46.000
738.522	-2.306	31.020	28.714	-17.286	46.000
960.638	0.360	31.300	31.659	-22.341	54.000
Vertical					
79.203	-15.468	46.516	31.048	-8.952	40.000
219.783	-13.325	42.227	28.902	-17.098	46.000
419.406	-7.599	34.090	26.491	-19.509	46.000
600.754	-4.051	30.916	26.866	-19.134	46.000
855.203	-0.898	31.041	30.143	-15.857	46.000
983.130	0.651	31.338	31.989	-22.011	54.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
4. The emission levels of other frequencies are very lower than the limit and not show in test report.
5. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. 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 conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

5.4. Uncertainty

±1.23dB

5.5. Test Result of RF Antenna Conducted Test

Product : Waterproof Bluetooth Speaker
Test Item : RF Antenna Conducted Test
Test Mode : Mode 1: Transmit - BLE
Test Date : 2017/09/29

Figure Channel 00:

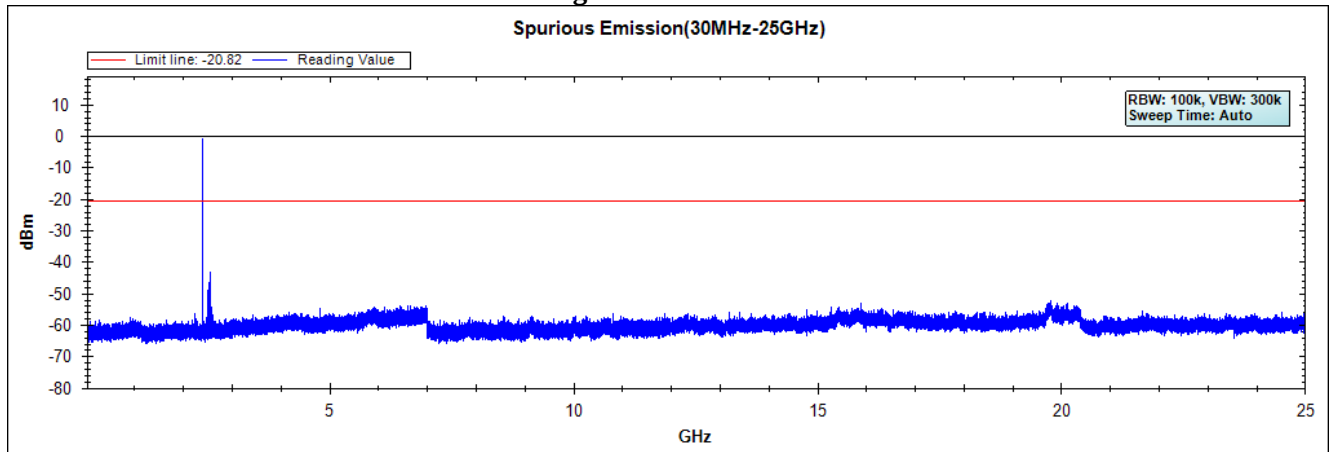


Figure Channel 19:

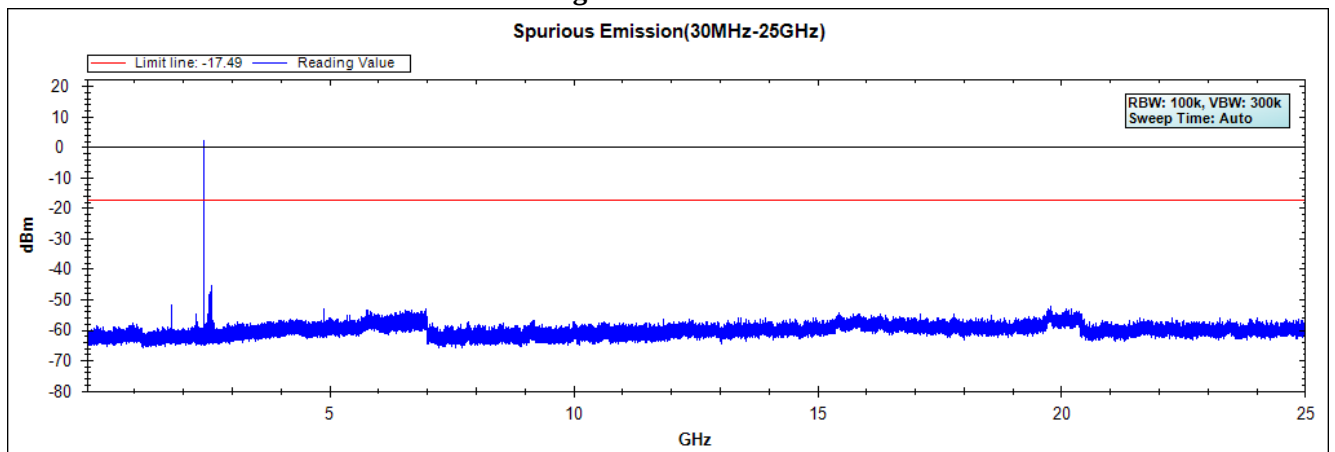
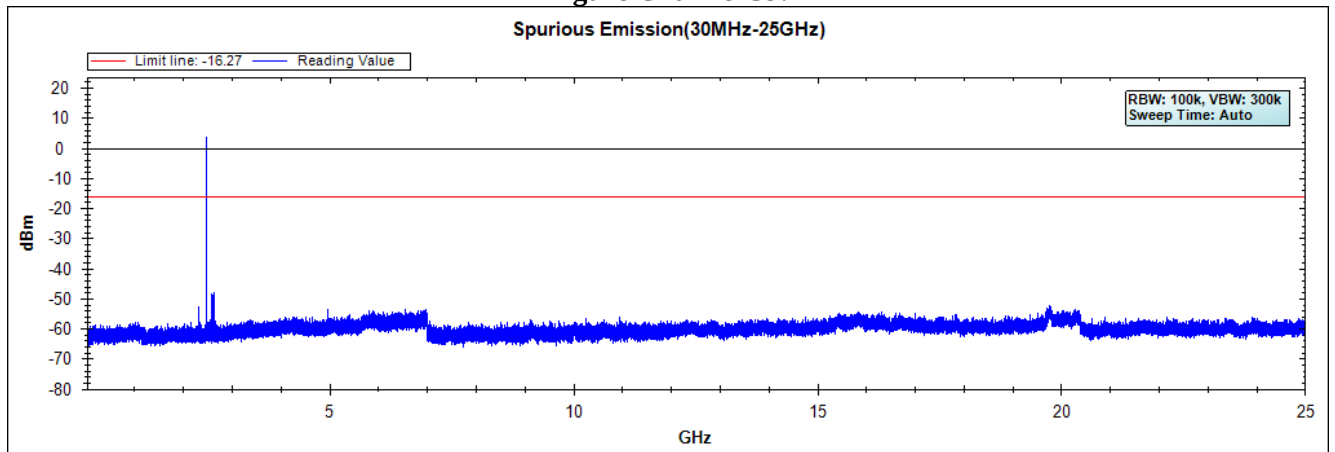


Figure Channel 39:

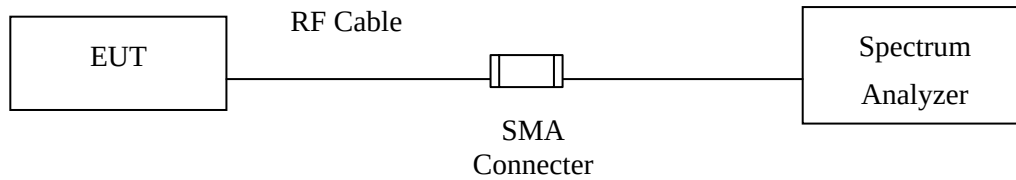


Note: The above test pattern is synthesized by multiple of the frequency range.

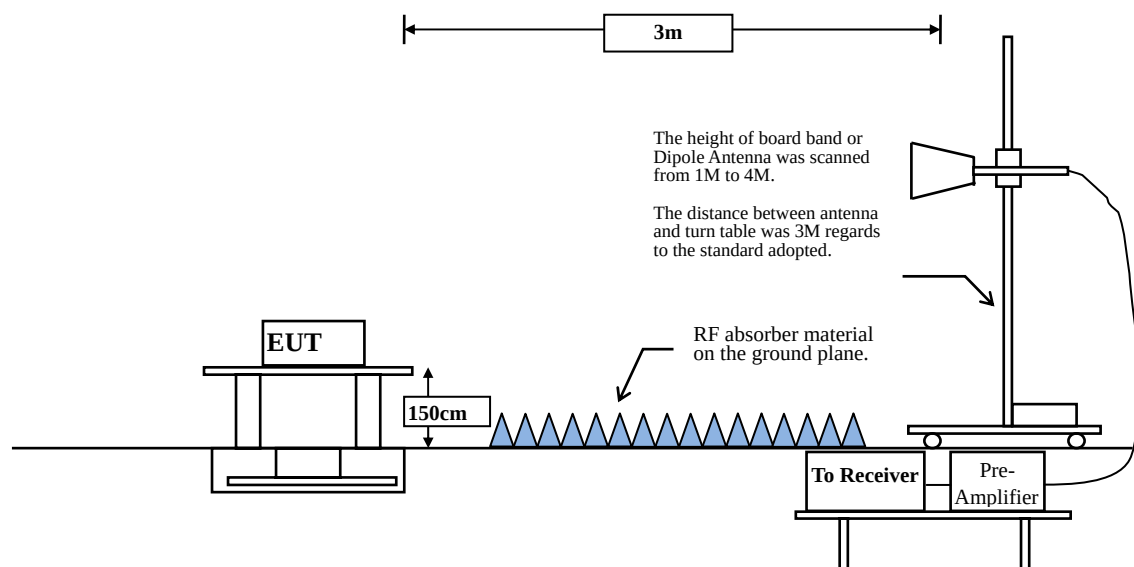
6. Band Edge

6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:



6.2. Limit

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 conducted or measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

RBW and VBW Parameter setting:

According to KDB 558074 section 12.2.4. Peak power measurement procedure

RBW = as specified in Table 1.

$VBW \geq 3 \times RBW$.

Table 1 —RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to KDB 558074 section 12.2.5. Average power measurement procedure

RBW = 1MHz.

VBW = 10Hz, when duty cycle $\geq 98\%$

$VBW \geq 1/T$, when duty cycle $< 98\%$

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
BLE	69.2	0.4493	2226	3k

Note: Duty Cycle Refer to Section 9

6.4. Uncertainty

Conducted: $\pm 1.23\text{dB}$

Radiated:

Horizontal polarization : 1-18GHz: $\pm 3.77\text{dB}$

Vertical polarization : 1-18GHz : $\pm 3.83\text{dB}$

6.5. Test Result of Band Edge

Product : Waterproof Bluetooth Speaker
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit - BLE
 Test Date : 2017/09/28

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2382.319	10.230	38.148	48.378	74.00	54.00	Pass
00 (Peak)	2390.000	10.262	36.092	46.354	74.00	54.00	Pass
00 (Peak)	2400.000	10.304	55.154	65.457	--	--	--
00 (Peak)	2402.319	10.312	85.479	95.792	--	--	--
00 (Average)	2375.797	10.204	26.197	36.401	74.00	54.00	Pass
00 (Average)	2390.000	10.262	25.564	35.826	74.00	54.00	Pass
00 (Average)	2400.000	10.304	44.668	54.971	--	--	--
00 (Average)	2402.029	10.312	84.677	94.989	--	--	--

Figure Channel 00:

Horizontal (Peak)

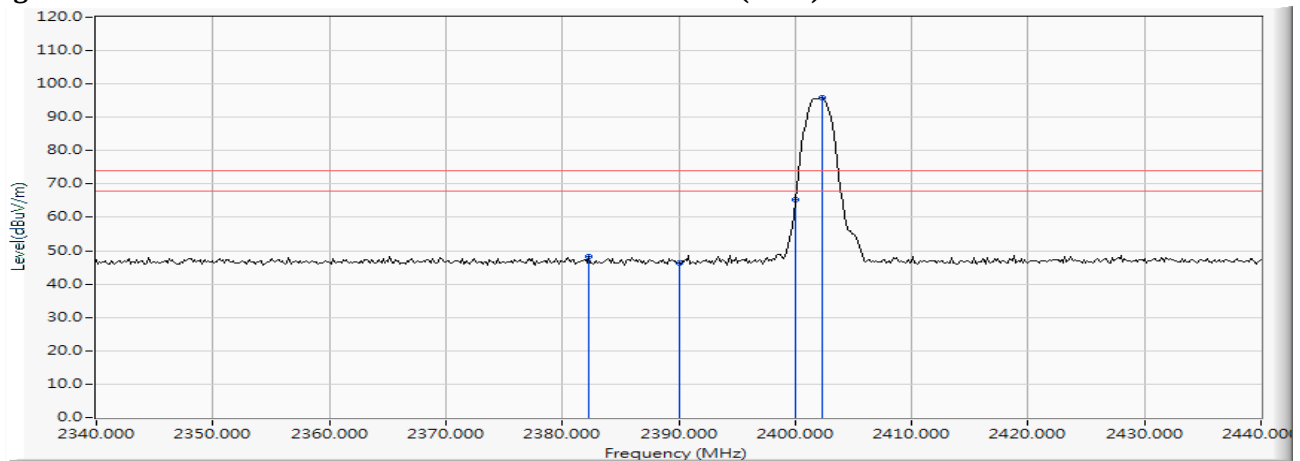
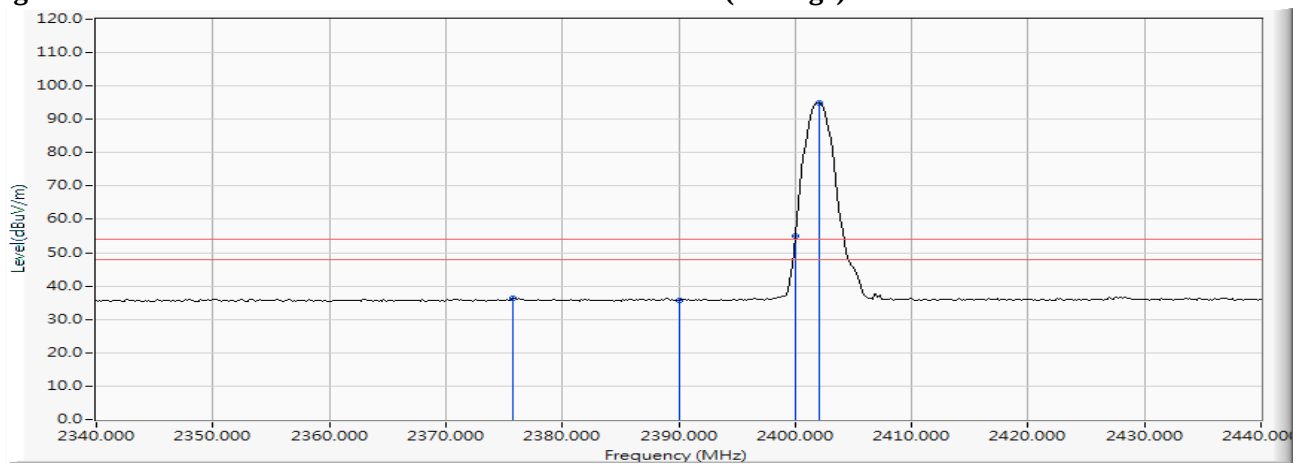


Figure Channel 00:

Horizontal (Average)



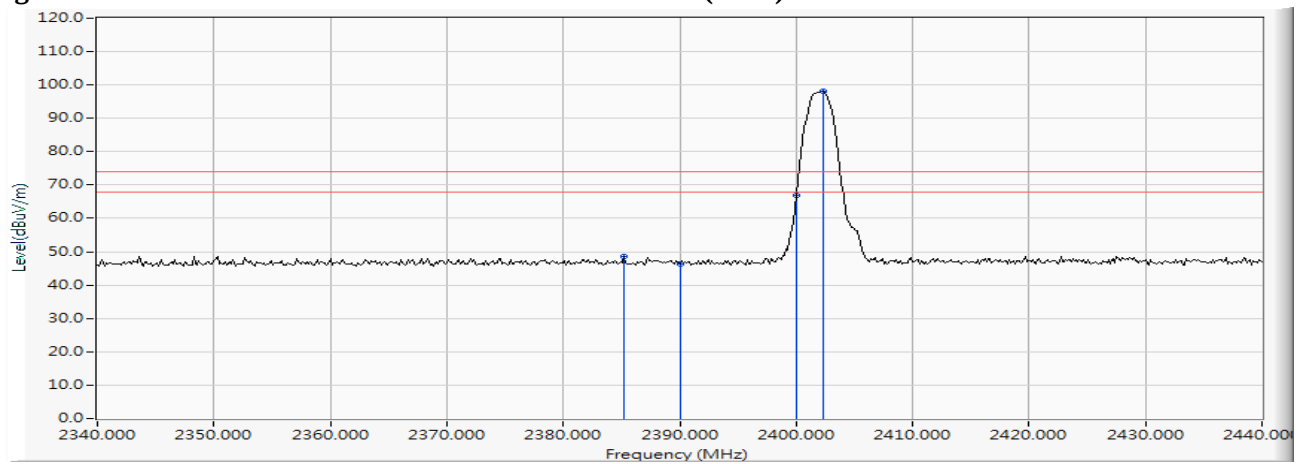
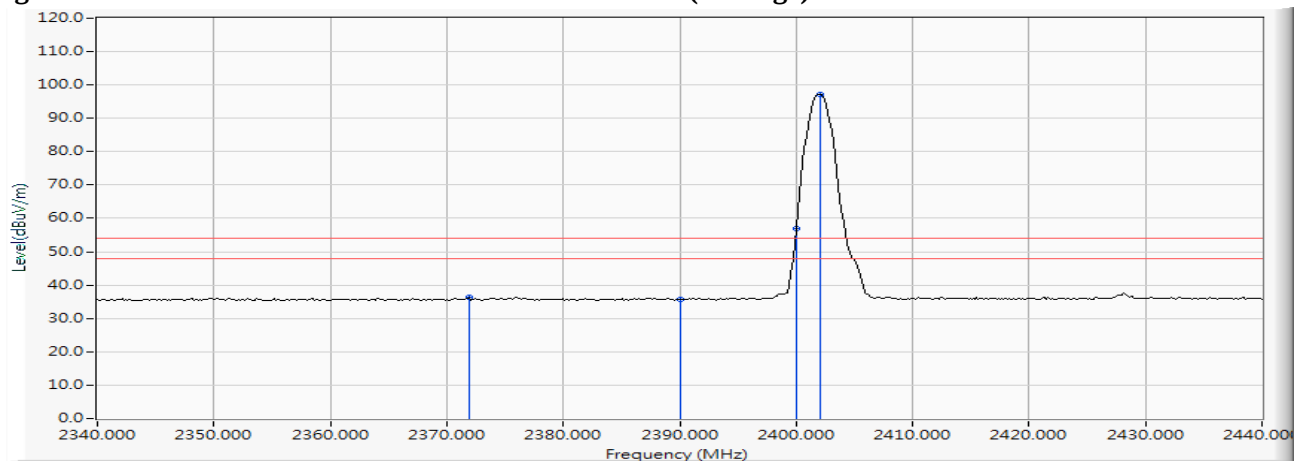
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Waterproof Bluetooth Speaker
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit - BLE
 Test Date : 2017/09/28

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
00 (Peak)	2385.217	10.243	38.433	48.675	74.00	54.00	Pass
00 (Peak)	2390.000	10.262	36.196	46.458	74.00	54.00	Pass
00 (Peak)	2400.000	10.304	56.572	66.875	--	--	--
00 (Peak)	2402.319	10.312	87.673	97.986	--	--	--
00 (Average)	2371.884	10.190	26.145	36.334	74.00	54.00	Pass
00 (Average)	2390.000	10.262	25.417	35.679	74.00	54.00	Pass
00 (Average)	2400.000	10.304	46.785	57.088	--	--	--
00 (Average)	2402.029	10.312	86.856	97.168	--	--	--

Figure Channel 00:**Vertical (Peak)****Figure Channel 00:****Vertical (Average)**

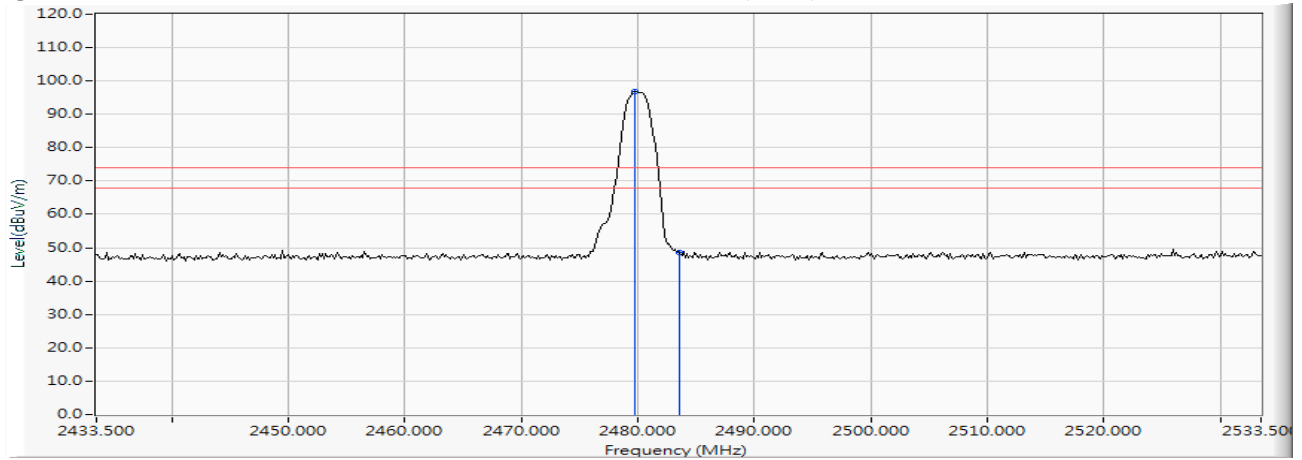
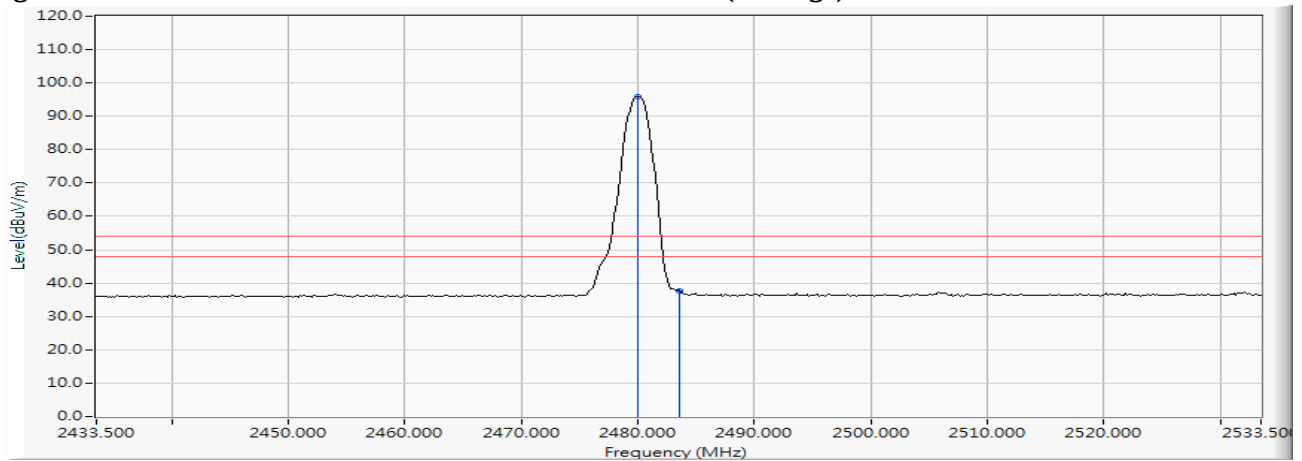
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Waterproof Bluetooth Speaker
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit - BLE
 Test Date : 2017/09/28

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
39 (Peak)	2479.732	10.627	86.137	96.764	--	--	--
39 (Peak)	2483.500	10.640	38.075	48.716	74.00	54.00	Pass
39 (Average)	2480.022	10.628	85.344	95.972	--	--	--
39 (Average)	2483.500	10.640	27.122	37.763	74.00	54.00	Pass

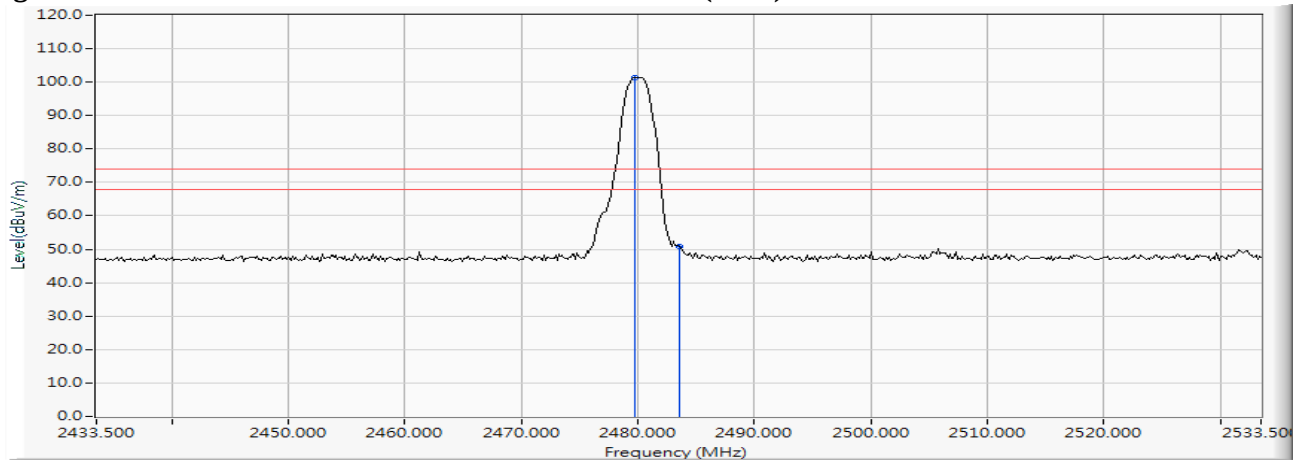
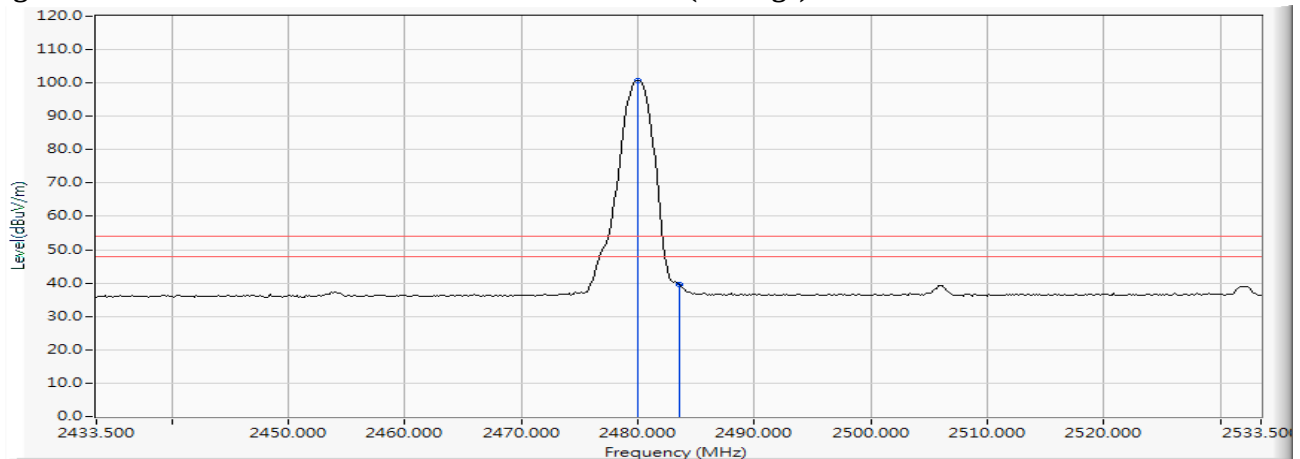
Figure Channel 39:**Horizontal (Peak)****Figure Channel 39:****Horizontal (Average)****Note:**

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Waterproof Bluetooth Speaker
 Test Item : Band Edge
 Test Mode : Mode 1: Transmit - BLE
 Test Date : 2017/09/28

RF Radiated Measurement (Vertical):

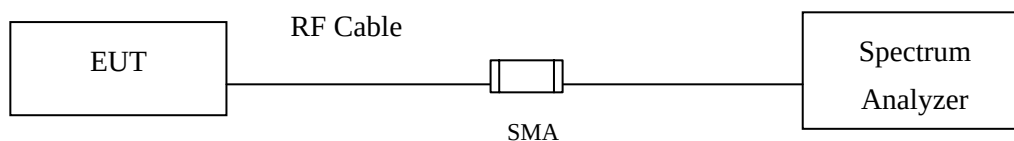
Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
39 (Peak)	2479.732	10.627	90.829	101.456	--	--	--
39 (Peak)	2483.500	10.640	40.067	50.708	74.00	54.00	Pass
39 (Average)	2480.022	10.628	90.059	100.687	--	--	--
39 (Average)	2483.500	10.640	28.960	39.601	74.00	54.00	Pass

Figure Channel 39:
Vertical (Peak)

Figure Channel 39:
Vertical (Average)

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Measurement Level = Reading Level + Correct Factor.
3. The average measurement was not performed when the peak measured data under the limit of average detection.

7. 6dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, $VBW \geq 3 \cdot RBW$

7.4. Uncertainty

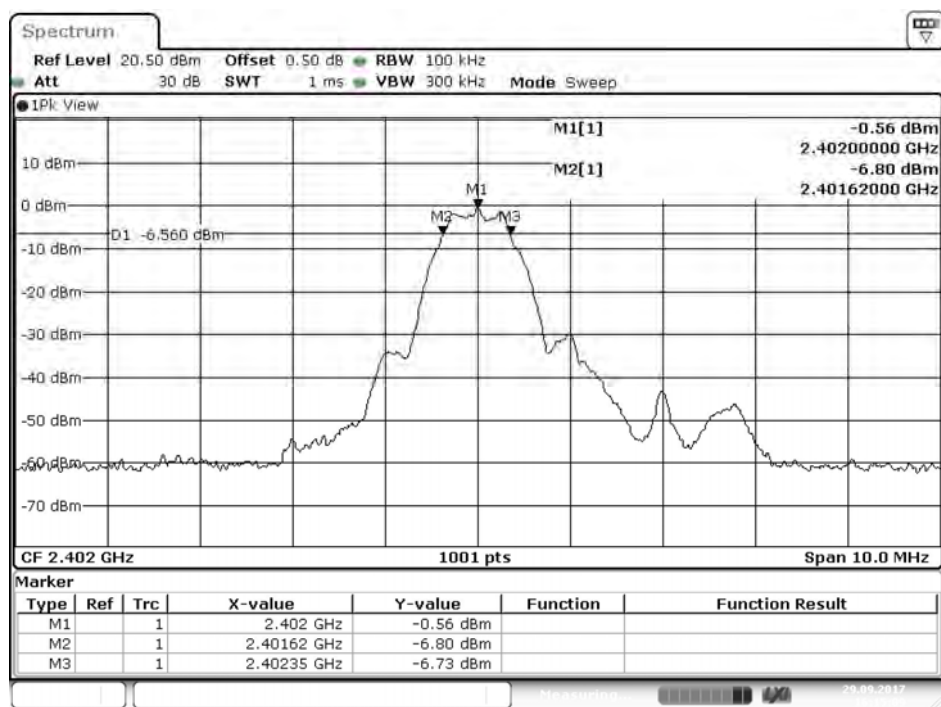
$\pm 279.2\text{Hz}$

7.5. Test Result of 6dB Bandwidth

Product : Waterproof Bluetooth Speaker
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit - BLE (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	730	>500	Pass

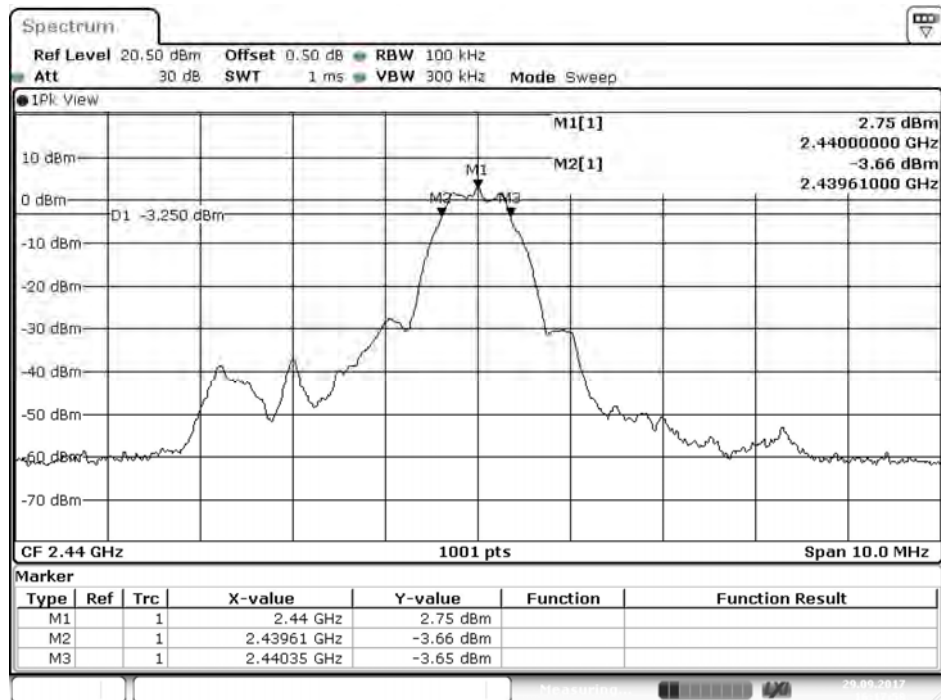
Figure Channel 00:



Product : Waterproof Bluetooth Speaker
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit - BLE (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	740	>500	Pass

Figure Channel 19:

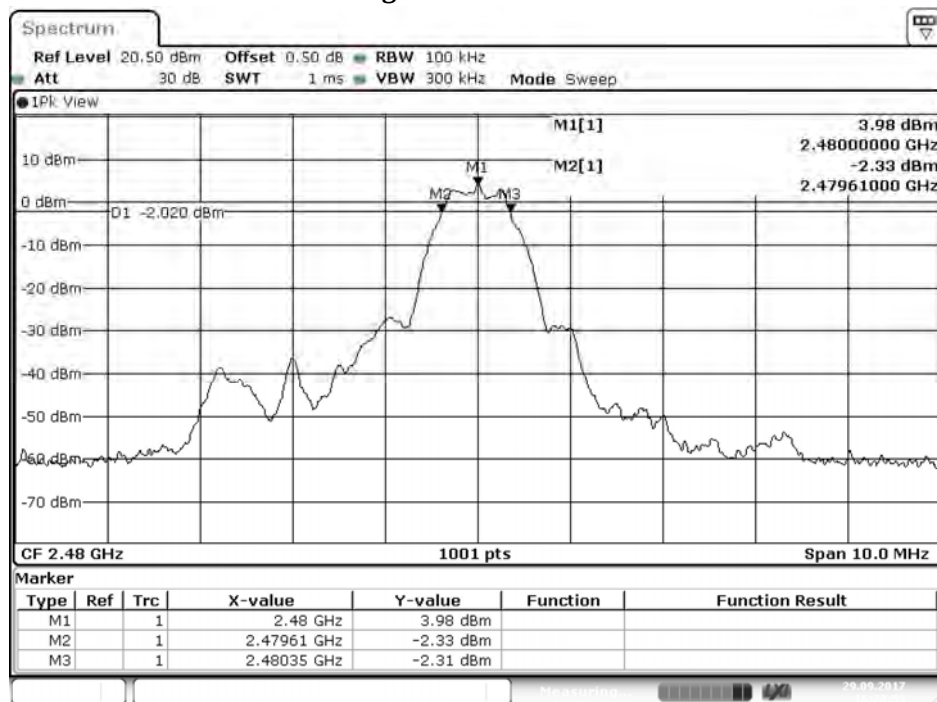


Date: 29.SEP.2017 16:17:58

Product : Waterproof Bluetooth Speaker
 Test Item : 6dB Bandwidth Data
 Test Mode : Mode 1: Transmit - BLE (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	740	>500	Pass

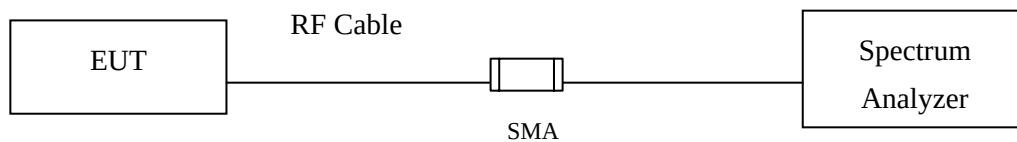
Figure Channel 39:



Date: 29.SEP.2017 16:20:53

8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

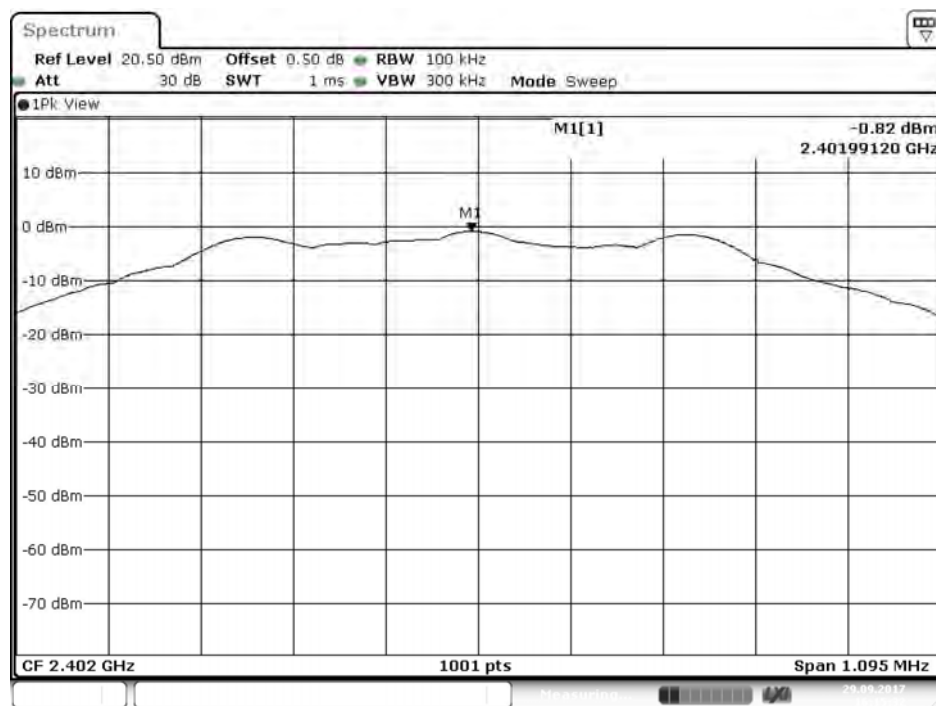
$\pm 1.23\text{dB}$

8.5. Test Result of Power Density

Product : Waterproof Bluetooth Speaker
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit - BLE (2402MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	-0.82	$\leq 8\text{dBm}$	Pass

Figure Channel 00:

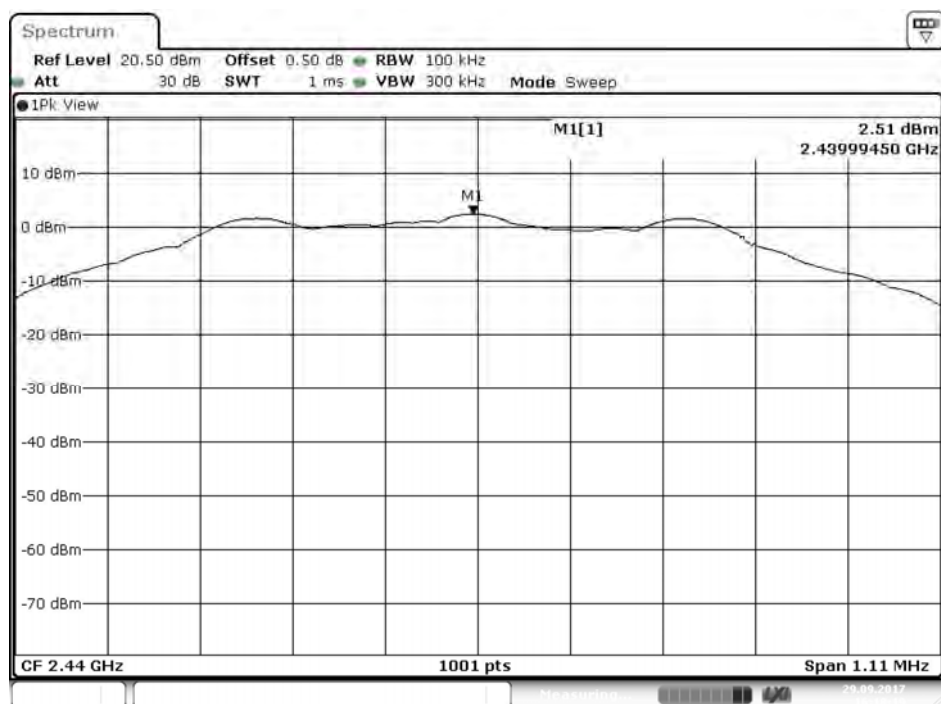


Date: 29.SEP.2017 16:15:32

Product : Waterproof Bluetooth Speaker
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit - BLE (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	2.51	$\leq 8\text{dBm}$	Pass

Figure Channel 19:

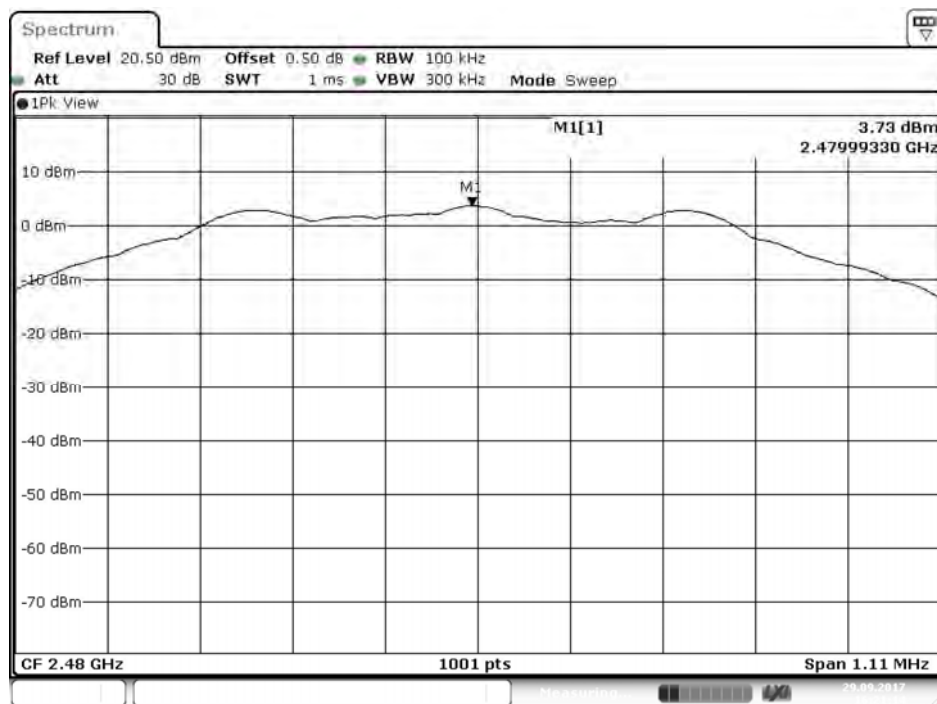


Date: 29.SEP.2017 16:18:20

Product : Waterproof Bluetooth Speaker
 Test Item : Power Density Data
 Test Mode : Mode 1: Transmit - BLE (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	3.73	$\leq 8\text{dBm}$	Pass

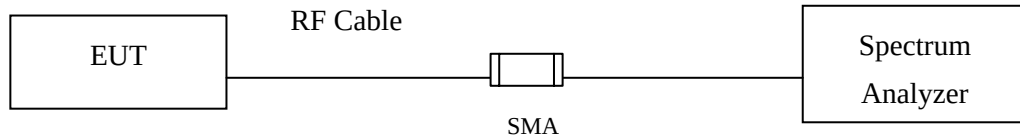
Figure Channel 39:



Date: 29.SEP.2017 16:21:14

9. Duty Cycle

9.1. Test Setup



9.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

9.3. Uncertainty

$\pm 2.31\text{msec}$

9.4. Test Result of Duty Cycle

Product : Waterproof Bluetooth Speaker
 Test Item : Duty Cycle
 Test Mode : Mode 1: Transmit - BLE

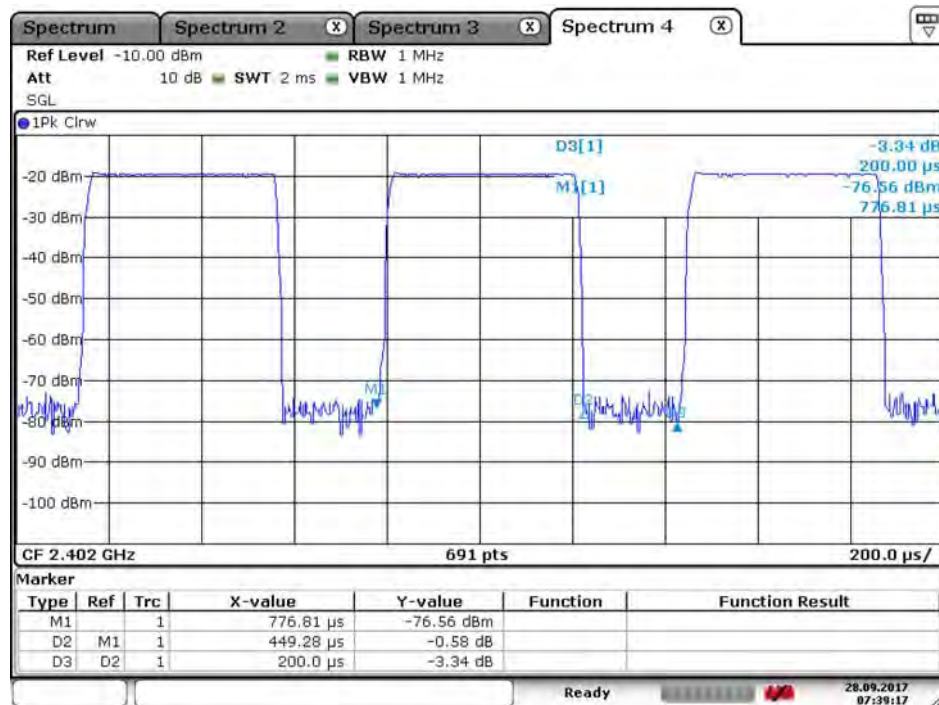
Duty Cycle Formula:

Duty Cycle = $T_{on} / (T_{on} + T_{off})$

Duty Factor = $10 \log (1/\text{Duty Cycle})$

Results:

2.4GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
BLE	0.4493	0.6493	69.2	1.6



Date: 28.SEP.2017 07:39:17

10. EMI Reduction Method During Compliance Testing

No modification was made during testing.