

FCC TEST REPORT(Bluetooth)

for

APAT ELECTRICAL LTD

Bluetooth Speaker

Model Number:TWIST-II

FCC ID: 2AEB3TWIST-II

Prepared for : APAT ELECTRICAL LTD

Address : Rm2406,Block A,HuangDu Plaza,3008YiaTian Road,
Shenzhen, China

Prepared by : Keyway Testing Technology Co., Ltd.

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Report No. : 16KWE104474F

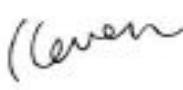
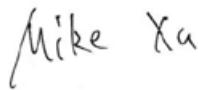
Date of Test : Sep. 14~Oct.11, 2016

Date of Report : Oct. 12, 2016

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Keyway Testing Technology Co., Ltd.

Applicant:	APAT ELECTRICAL LTD Rm2406,Block A,HuangDu Plaza,3008YiaTian Road, Shenzhen, China		
Manufacturer:	APAT ELECTRICAL LTD Rm2406,Block A,HuangDu Plaza,3008YiaTian Road, Shenzhen, China		
E.U.T:	Bluetooth Speaker		
Model Number:	TWIST-II		
Serial Model:	N/A		
Trade Name:	N/A	Serial No.:	-----
Date of Receipt:	Sep. 13, 2016	Date of Test:	Sep. 14~Oct.11, 2016
Test Specification:	FCC Part 15, Subpart C Section 15.247: 2015 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied.		
Issue Date: Oct.12, 2016			
Tested by:	Reviewed by:	 Andy Gao	
		Keven Wu / Engineer	Mike Xu / Supervisor
		Andy Gao / Supervisor	
Other Aspects: None.			
Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested			
This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.			

1. TEST SUMMARY

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emissions	15.205(a)/15.209	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:	Bluetooth Speaker
Model No.:	TWIST-II
Serial Model:	N/A
Model Difference	N/A
Operation Frequency:	2402MHz ~2480MHz
Channel numbers:	79 Channels
Channel spacing	1MHz
Modulation technology:	BT(1Mbps): GFSK BT EDR(2Mbps): $\pi/4$ -DQPSK BT EDR(3Mbps): 8-DPSK
Bit Rate of Transmitter	1Mbps/2Mbps/3Mbps
Antenna Type:	PCB antenna
Antenna gain:	0.5dBi
Power supply:	DC 3.7V from Battery or DC 5V from adapter
Adapter:	I/P:AC 100~240V 50/60Hz 0.15A O/P:DC 5V 0.7A

2.3. Difference between Model Numbers

None.

2.4. Independent Operation Modes

The basic operation modes are:

2.4.1. EUT work BT mode and Test mode as below:

Pretest Mode	Description
Mode 1	CH00
Mode 2	CH39
Mode 3	CH78
Mode 4	BT link

2.5. Test Supporting System

.N/A

2.6. Test Facilities

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

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

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

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

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

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

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

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

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

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

2.7. List of Test and Measurement Instruments

2.7.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 09,17
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 09,16	Apr. 09,17
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 09,16	Apr. 09,17

2.7.2. For radiated emission test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 09,16	Apr. 08,17
Bilog Antenna	ETS-LINDGREEN	3142D	135452	Apr. 09,16	Apr. 08,17
Spectrum Analyzer	Agilent	E4411B	MY4511304	Apr. 09,16	Apr. 08,17
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 09,16	Apr. 08,17
Signal Amplifier	SONOMA	310	187016	Apr. 09,16	Apr. 08,17
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 09,16	Apr. 08,17
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	SCHWARZBECK	BBHA9170	9170-068	Apr. 09,16	Apr. 08,17
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 09,16	Apr. 08,17
High Pass filter	Micro	HPM50111	324216	Apr. 09,16	Apr. 08,17
Constant temperature and humidity box	GF	GTH-800-40-1P	MAA9906-005	Apr. 09,16	Apr. 08,17
Attenuation	MCE	24-10-34	BN9258	Apr. 02,16	Apr. 01,17
Loop Antenna	ARA	PLA-1030/B	1029	Apr. 02,16	Apr. 01,17
Spectrum Analyzer	Agilent	N9020A	MY56070279	Jul.26,16	Jul.25,17

3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

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

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(*EUT: Bluetooth Speaker*)

3.3. Test Operation Mode and Test Software

None.

3.4. Special Accessories and Auxiliary Equipment

Adapter:	Manufacturer:Cenique Infotainment Group Limited I/P:AC 100~240V 50/60Hz 0.15A O/P:DC 5V 0.7A DC Line:Unshielded,detachable 1.2m
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3.5. Countermeasures to Achieve EMC Compliance

None.

3.6. Test Environment:

Ambient conditions in the test laboratory:

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

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limits

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(i)	Peak Output Power	0.125 w or 20.96dBm	2400-2483.5	PASS

4.2. Test Procedure

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
 $VBW \geq RBW$
Sweep = auto
Detector function = peak
Trace = max hold

4.3. Test setup



Test data:

1Mbps			
Test Channel	Frequency (MHz)	Peak Output Power (dBm)	LIMIT (dBm)
CH00	2402	-1.081	30
CH39	2441	-0.291	30
CH78	2480	0.002	30
2Mbps			
CH00	2402	-0.817	20.96
CH39	2441	-0.041	20.96
CH78	2480	0.086	20.96
3Mbps			
CH00	2402	-0.905	20.96
CH39	2441	-0.043	20.96
CH78	2480	0.462	20.96

CH00 -1Mbps**CH39 -1Mbps**

CH78 -1Mbps**CH00 -2Mbps**

CH39 -2Mbps**CH78 -2Mbps**

CH00 -3Mbps**CH39 -3Mbps**



5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.207 limits

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

5.1.2. Test Setup

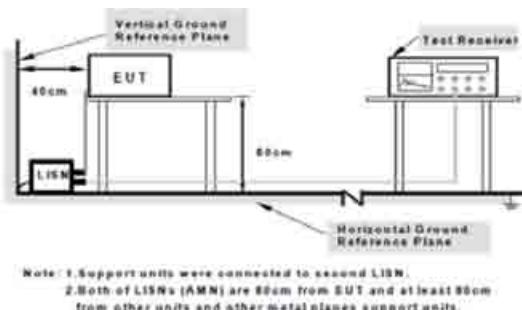
The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to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

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

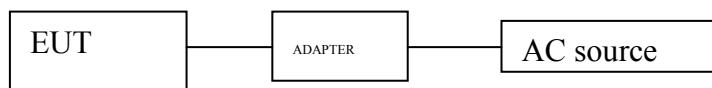
The frequency range from 150 kHz to 30 MHz was investigated.

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

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

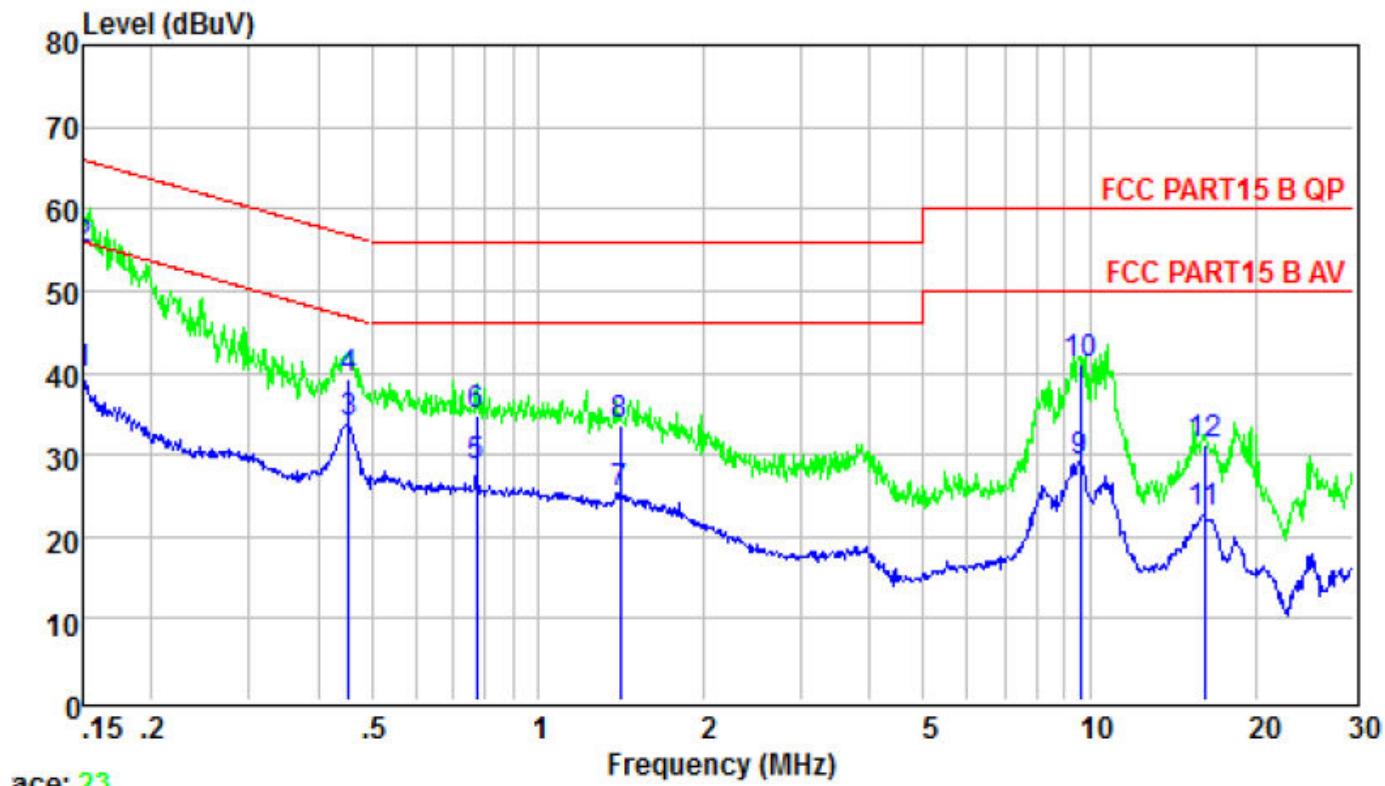


Block diagram of Test Setup



5.1.3. Test result

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 5V from Adapter AC 120V/60Hz	Test Mode :	Mode 4

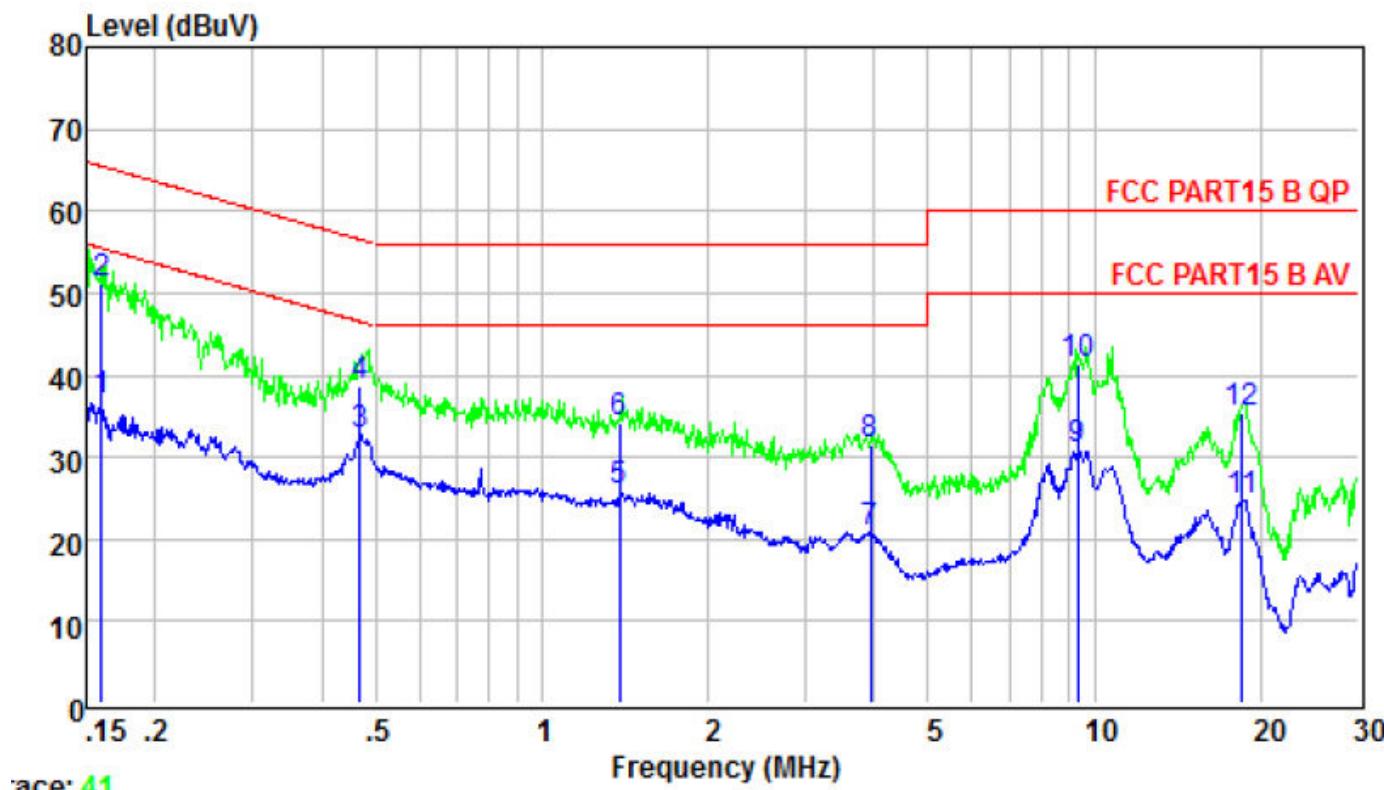


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Freq	Level	Limit	Over
MHz	dBuV	dBuV	dB

	Freq	Level	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.150	39.82	56.00	-16.18	Average
2	0.150	54.96	66.00	-11.04	QP
3	0.454	34.01	46.80	-12.79	Average
4	0.454	39.25	56.80	-17.55	QP
5	0.775	28.68	46.00	-17.32	Average
6	0.775	34.65	56.00	-21.35	QP
7	1.411	25.29	46.00	-20.71	Average
8	1.411	33.54	56.00	-22.46	QP
9	9.603	29.29	50.00	-20.71	Average
10	9.603	40.91	60.00	-19.09	QP
11	16.140	22.96	50.00	-27.04	Average
12	16.140	31.32	60.00	-28.68	QP

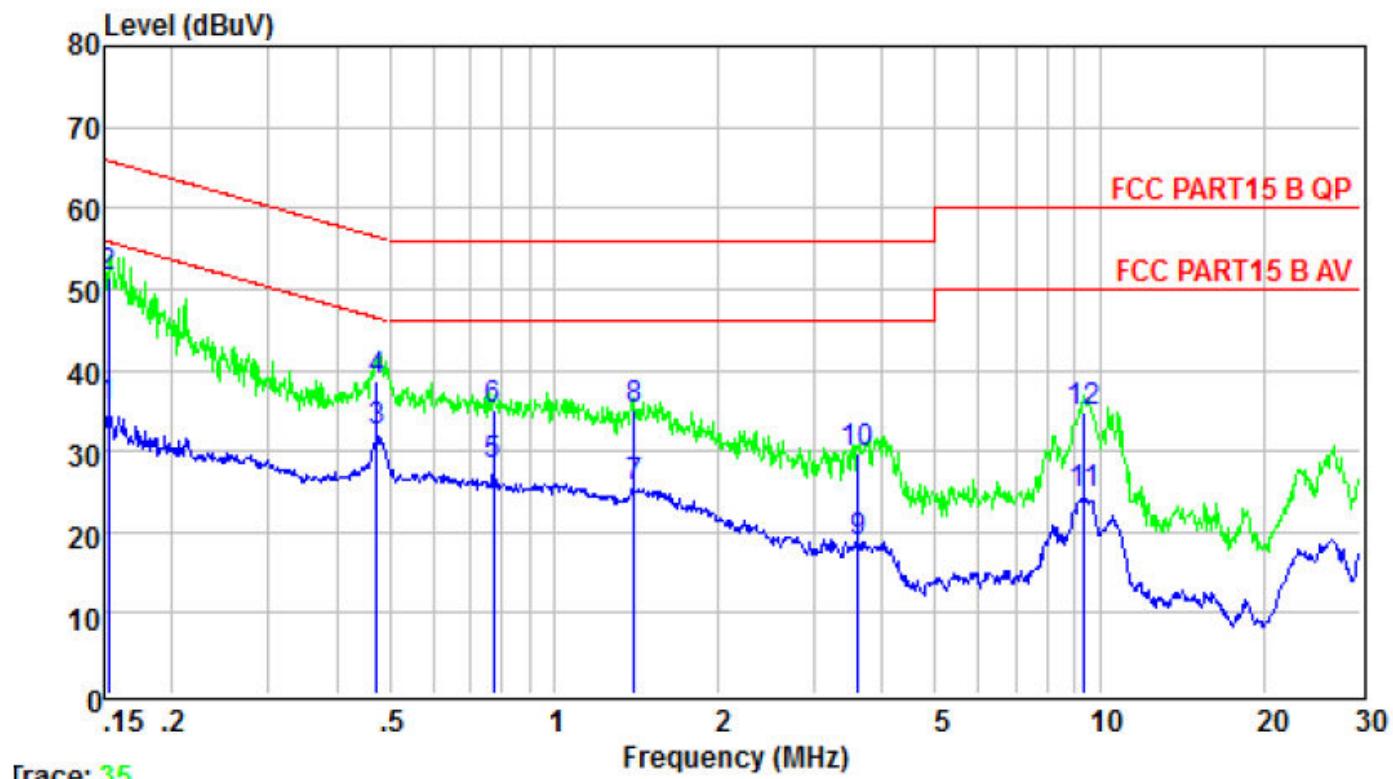
EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 5.0V from Adapter AC 120V/60Hz	Test Mode :	Mode 4



	Freq	Level	Limit	Over
	MHz	dBuV	dBuV	dB

	MHz	dBuV	dBuV	dB	Remark
1	0.160	36.87	55.47	-18.60	Average
2	0.160	51.23	65.47	-14.24	QP
3	0.469	32.78	46.54	-13.76	Average
4	0.469	38.56	56.54	-17.98	QP
5	1.381	25.73	46.00	-20.27	Average
6	1.381	34.34	56.00	-21.66	QP
7	3.922	20.76	46.00	-25.24	Average
8	3.922	31.56	56.00	-24.44	QP
9	9.302	30.97	50.00	-19.03	Average
10	9.302	41.36	60.00	-18.64	QP
11	18.524	24.77	50.00	-25.23	Average
12	18.524	35.44	60.00	-24.56	QP

EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	L
Test Voltage :	DC 5V from Adapter AC 240V/60Hz	Test Mode :	Mode 4

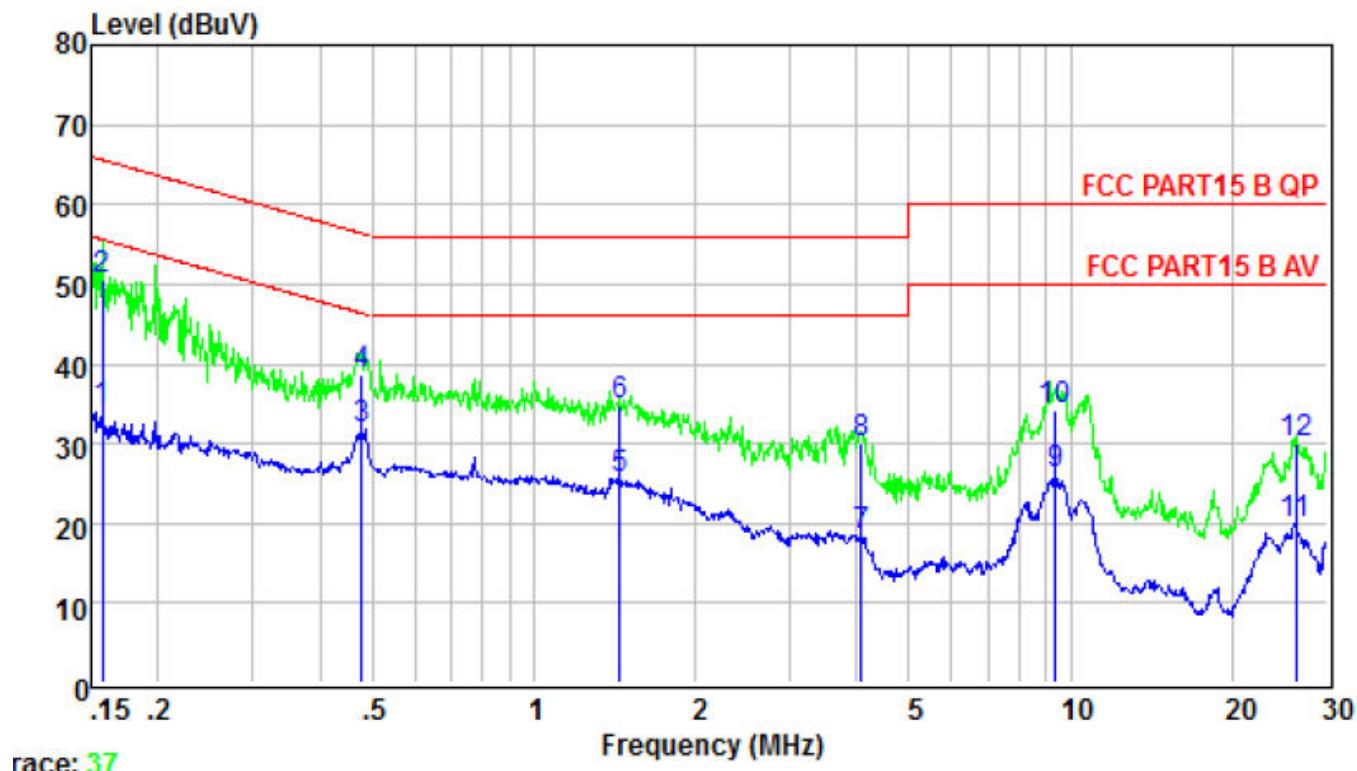


		Limit	Over	
Freq	Level	Line	Limit	Remark

	MHz	dBuV	dBuV	dB	
--	-----	------	------	----	--

1	0.152	35.40	55.87	-20.47	Average
2	0.152	51.35	65.87	-14.52	QP
3	0.474	32.45	46.45	-14.00	Average
4	0.474	38.52	56.45	-17.93	QP
5	0.775	28.39	46.00	-17.61	Average
6	0.775	34.96	56.00	-21.04	QP
7	1.403	25.46	46.00	-20.54	Average
8	1.403	35.13	56.00	-20.87	QP
9	3.603	18.71	46.00	-27.29	Average
10	3.603	29.67	56.00	-26.33	QP
11	9.352	24.75	50.00	-25.25	Average
12	9.352	34.87	60.00	-25.13	QP

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N
Test Voltage :	DC 5V from Adapter AC 240V/60Hz	Test Mode :	Mode 4



Freq	Level	Limit		Over Limit	Remark
		Line	dBuV		
		MHz	dBuV	dBuV	dB
1	0.157	34.07	55.60	-21.53	Average
2	0.157	50.56	65.60	-15.04	QP
3	0.479	31.81	46.36	-14.55	Average
4	0.479	38.59	56.36	-17.77	QP
5	1.449	25.62	46.00	-20.38	Average
6	1.449	34.66	56.00	-21.34	QP
7	4.070	18.49	46.00	-27.51	Average
8	4.070	30.04	56.00	-25.96	QP
9	9.352	26.10	50.00	-23.90	Average
10	9.352	34.12	60.00	-25.88	QP
11	26.278	20.05	50.00	-29.95	Average
12	26.278	30.01	60.00	-29.99	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 blow 1G and 1.5m above 1G. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

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

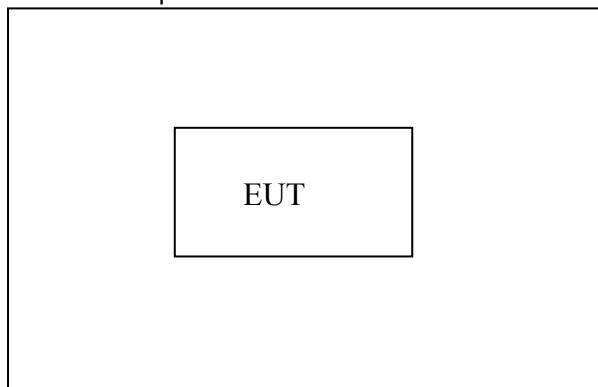
The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

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

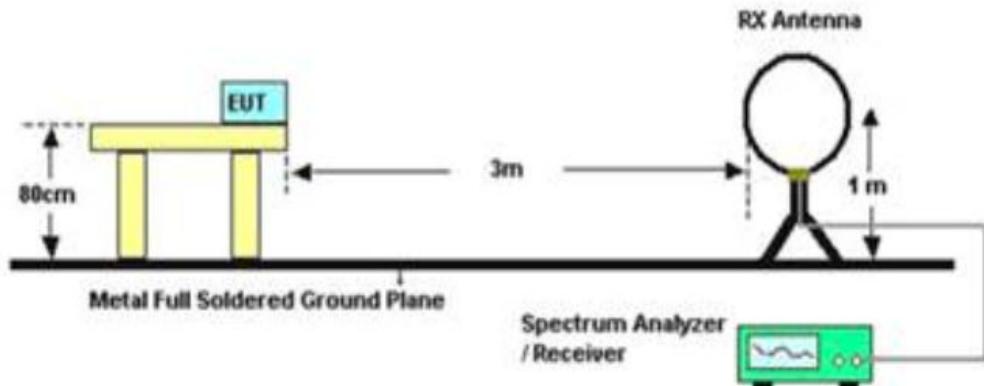
The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

- Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
 2. Measurement Uncertainty: ±3.2 dB at a level of confidence of 95%.
 3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
 4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
 5. EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation).
 6. We pretest all modulation, the worst data was show in the report.

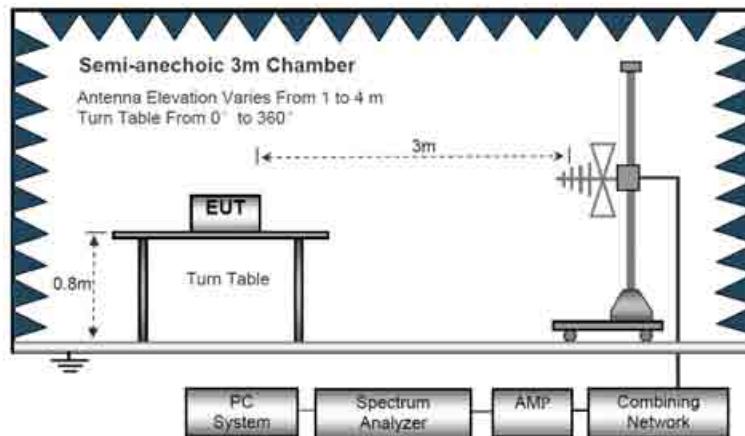
Block diagram of Test Setup



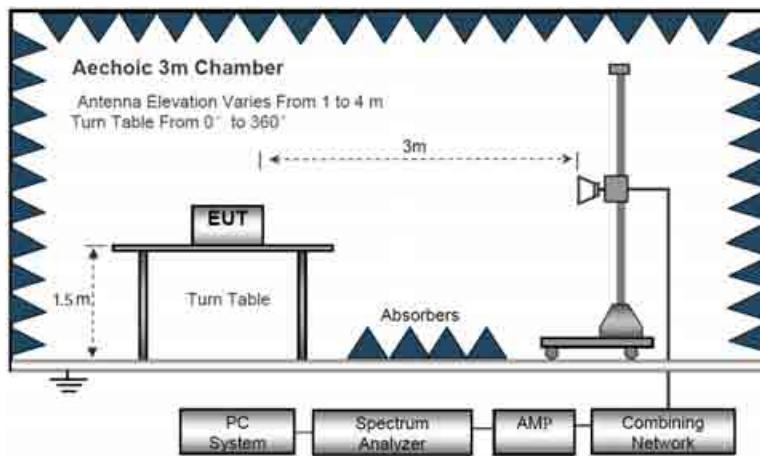
Radiated Emission Test-Up Frequency Below 30MHz



30MHz- 1GHz



Above 1GHz



Below 30MHz

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

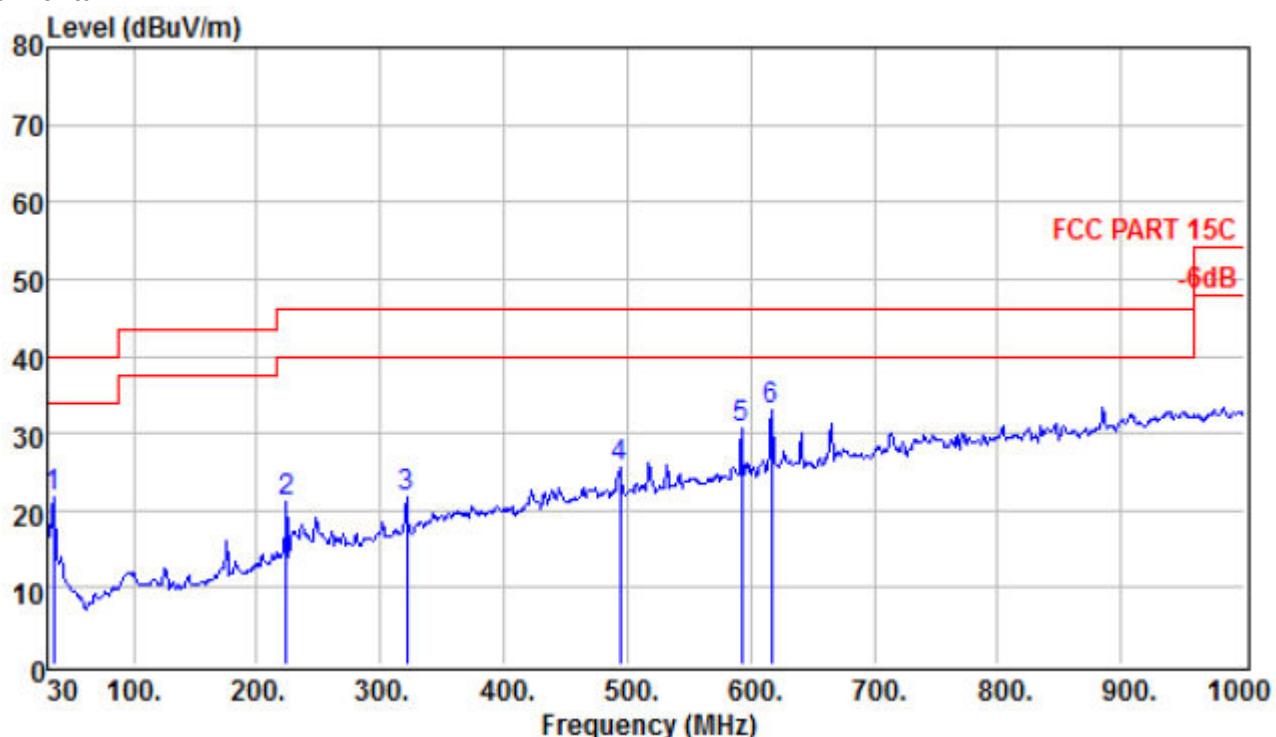
Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})(\text{dB})$;

Limit line = specific limits(dBuV) + distance extrapolation factor.

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	TX
Test Voltage :	DC 3.7V		

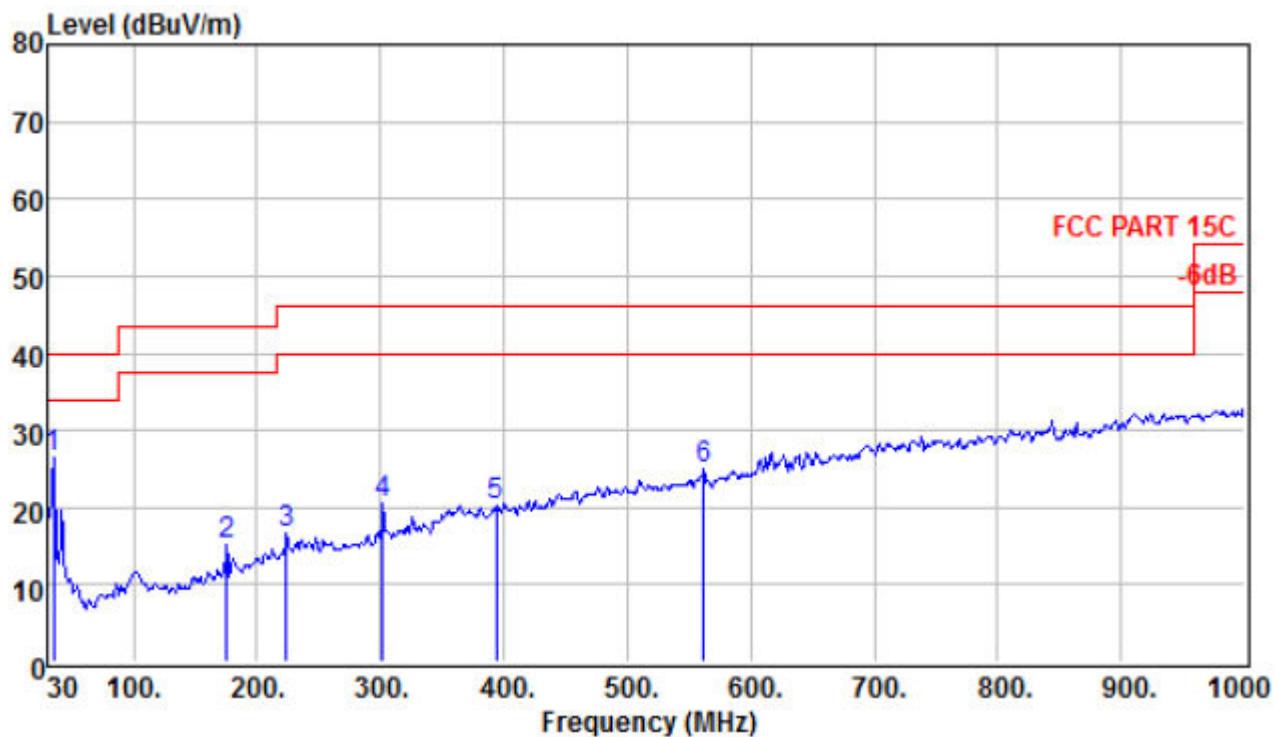
30-1GHz

Horizontal



Freq	Read	Preamp	Antenna	Cable	Limit	Line	Over	Remark
	Level	Factor	Factor	Loss				
MHz	dB _{UV}	dB	dB/m	dB	dB _{UV} /m	dB _{UV} /m	dB	
1 34.850	36.48	31.38	15.94	0.56	21.60	40.00	-18.40	QP
2 224.000	38.39	30.95	12.15	1.53	21.12	46.00	-24.88	QP
3 321.000	36.22	30.84	14.39	2.02	21.79	46.00	-24.21	QP
4 493.660	34.70	30.59	18.60	2.77	25.48	46.00	-20.52	QP
5 592.600	37.61	30.68	20.36	3.29	30.58	46.00	-15.42	QP
6 616.850	39.27	30.64	21.07	3.38	33.08	46.00	-12.92	QP

Vertical



Freq	Read	Preamp	Antenna	Cable	Limit	Line	Over	Remark	
	Level	Factor	Factor	Loss					
	MHz				dBuV	dB	dBuV/m	dBuV/m	dB
1	34.850	41.25	31.38	15.94	0.56	26.37	40.00	-13.63	QP
2	175.500	34.75	31.17	10.27	1.39	15.24	43.50	-28.26	QP
3	224.000	34.05	30.95	12.15	1.53	16.78	46.00	-29.22	QP
4	301.600	35.77	30.92	13.84	1.94	20.63	46.00	-25.37	QP
5	393.750	32.17	30.63	16.27	2.37	20.18	46.00	-25.82	QP
6	561.560	39.05	30.88	19.64	3.12	24.93	46.00	-21.07	QP

NOTE:

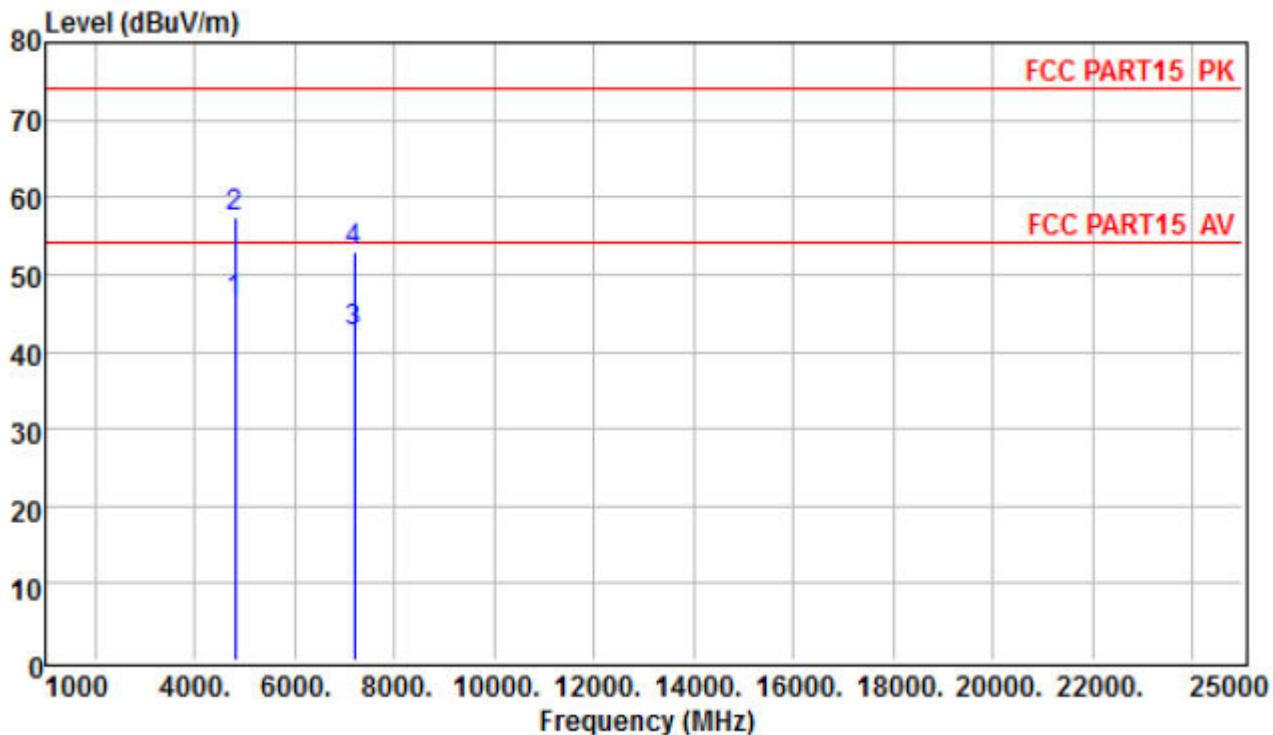
Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit

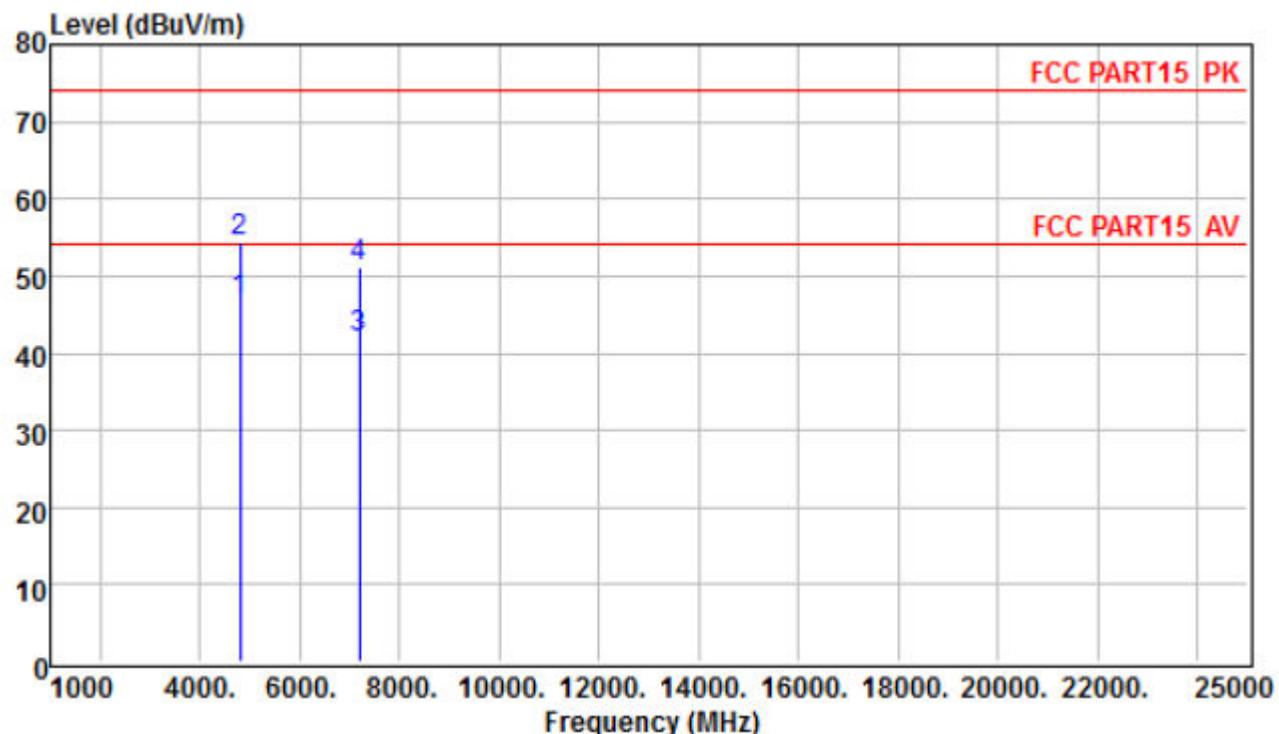
3Mbps(High channel) is the worst mode,only worst case is presented in the report.

Above 1GHz

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	1Mbps-2402
Test Voltage :	DC 3.7V		

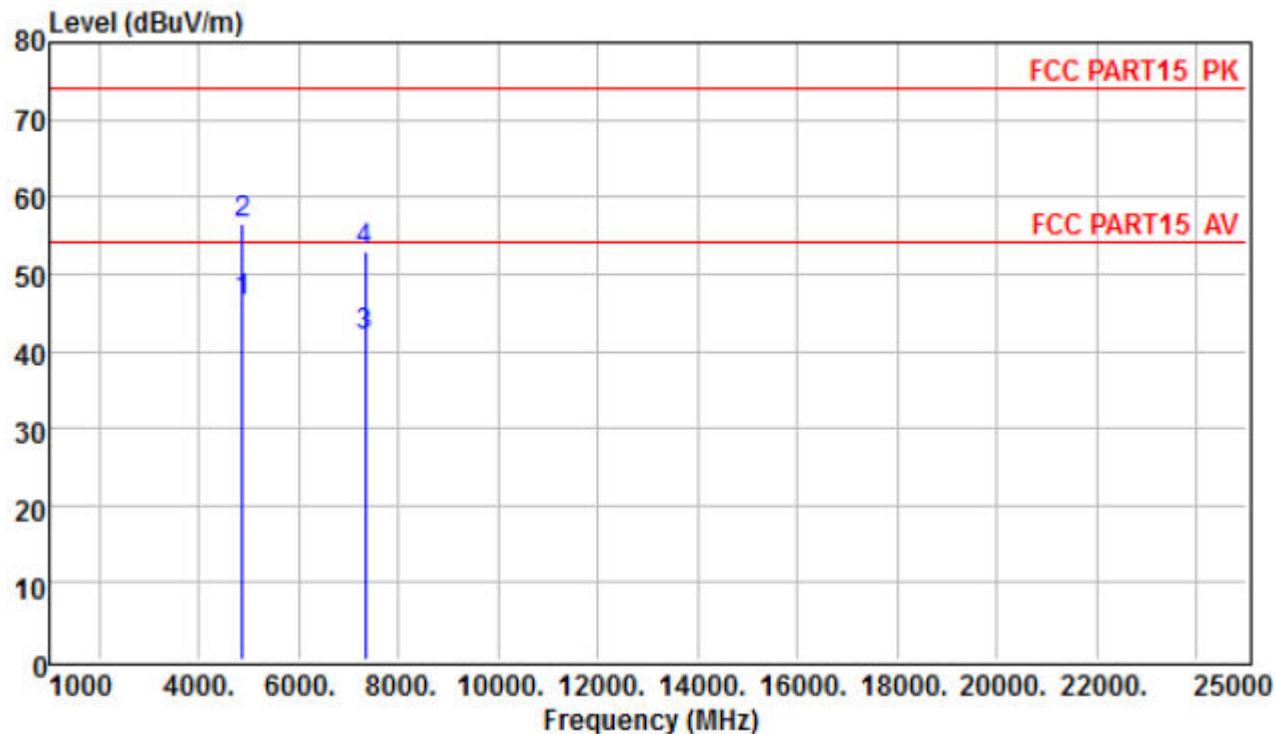
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Over Line	Over Limit	Remark
	Level	Factor	Factor		Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4804.000	29.08	27.49	32.94	11.96	46.49	54.00	-7.51	Average
2	4804.000	39.91	27.49	32.94	11.96	57.32	74.00	-16.68	Peak
3	7206.000	28.49	27.94	25.28	16.61	42.44	54.00	-11.56	Average
4	7206.000	39.05	27.94	25.28	16.61	53.00	74.00	-21.00	Peak

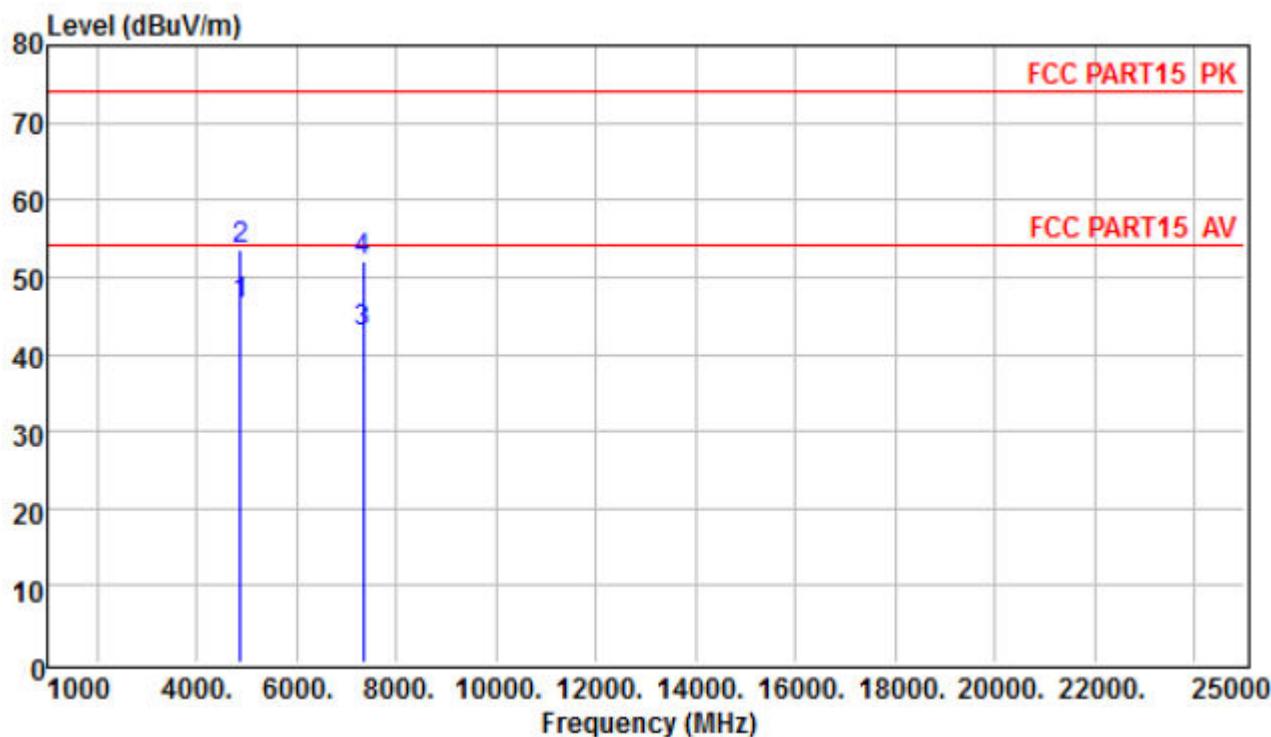
Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Line	Limit	Remark
	Level	Factor	Factor	Cable Loss					
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4804.000	29.15	27.49	32.94	11.96	46.56	54.00	-7.44	Average
2	4804.000	36.93	27.49	32.94	11.96	54.34	74.00	-19.66	Peak
3	7206.000	28.10	27.94	25.28	16.61	42.05	54.00	-11.95	Average
4	7206.000	37.11	27.94	25.28	16.61	51.06	74.00	-22.94	Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	1Mbps -2441
Test Voltage :	DC 3.7V		

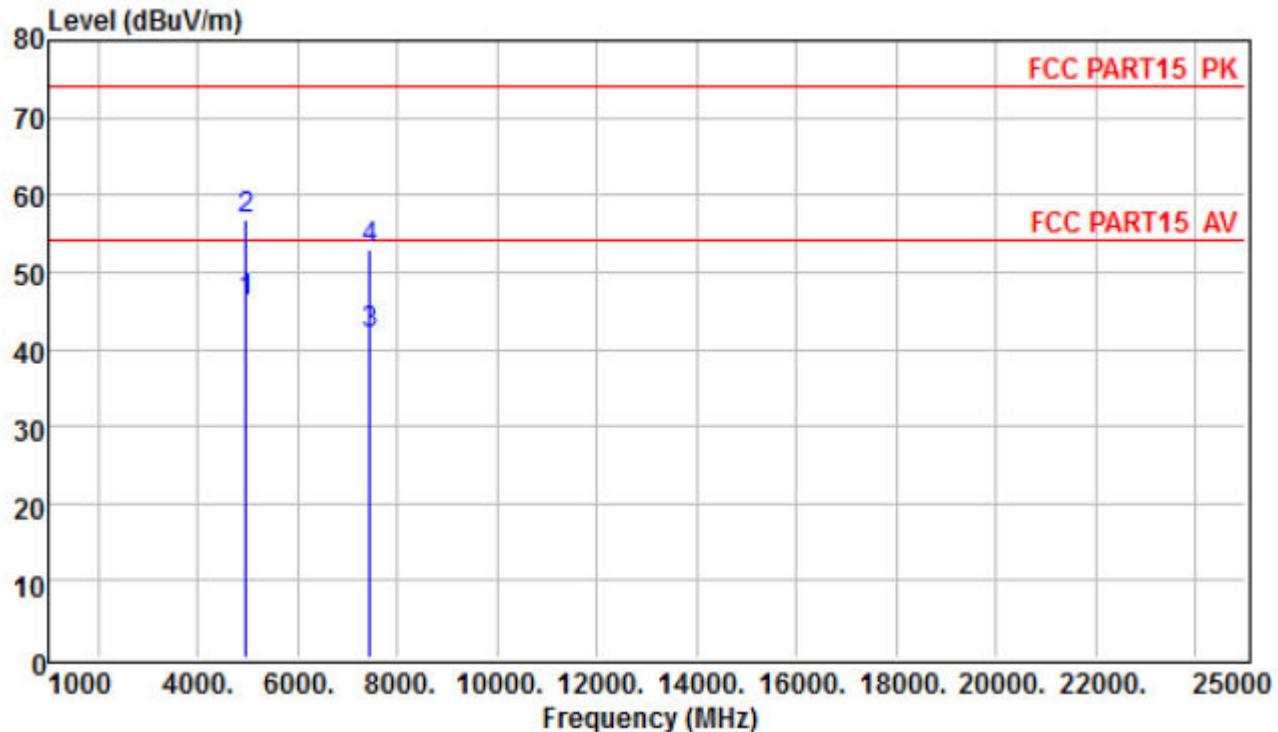
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Line	Over	Remark
	Level	Factor	Factor	Loss	Level				
	MHz	dBuV		dB	dB	dBuV/m	dBuV/m		
1	4882.000	29.77	27.53	32.11	12.14	46.49	54.00	-7.51	Average
2	4882.000	39.73	27.53	32.11	12.14	56.45	74.00	-17.55	Peak
3	7323.000	28.99	27.96	24.33	16.62	41.98	54.00	-12.02	Average
4	7323.000	39.99	27.96	24.33	16.62	52.98	74.00	-21.02	Peak

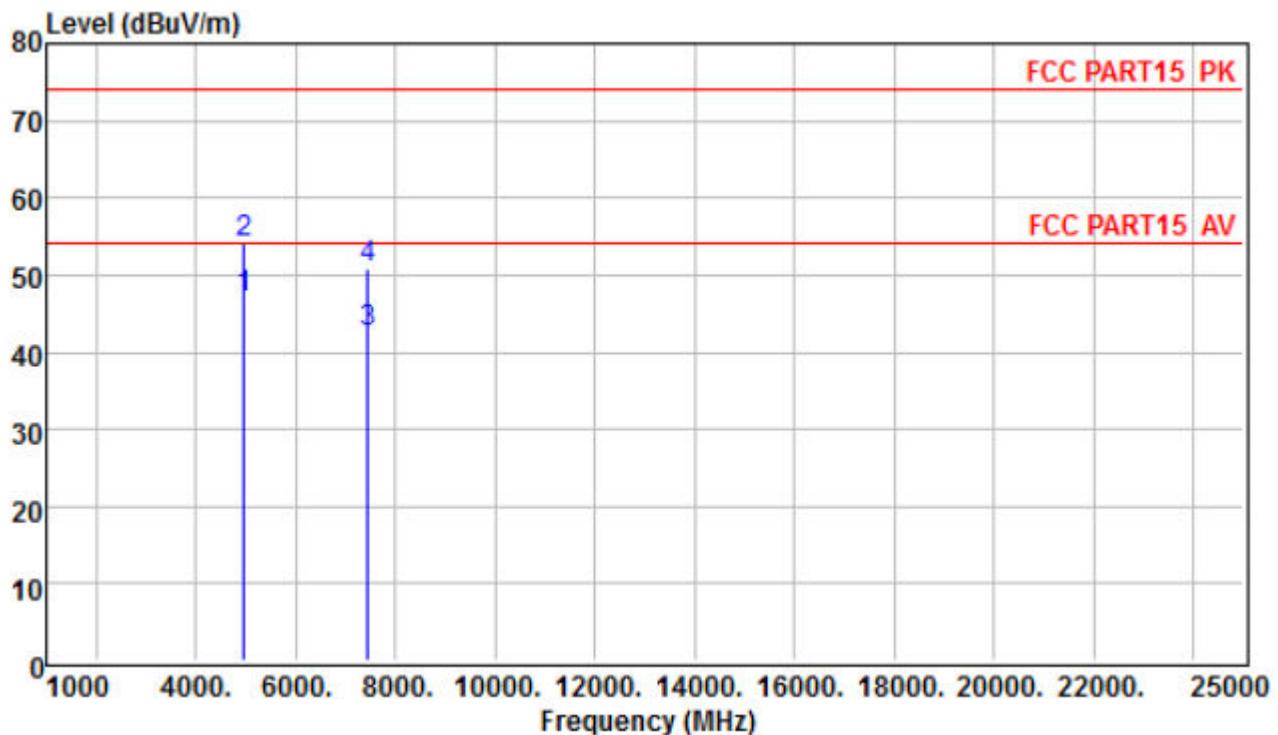
Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Limit	Remark
	Level	Factor	Factor	Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4882.000	29.73	27.53	32.11	12.14	46.45	54.00	-7.55 Average
2	4882.000	36.72	27.53	32.11	12.14	53.44	74.00	-20.56 Peak
3	7323.000	29.88	27.96	24.33	16.62	42.87	54.00	-11.13 Average
4	7323.000	38.99	27.96	24.33	16.62	51.98	74.00	-22.02 Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	1Mbps -2480
Test Voltage :	DC 3.7V		

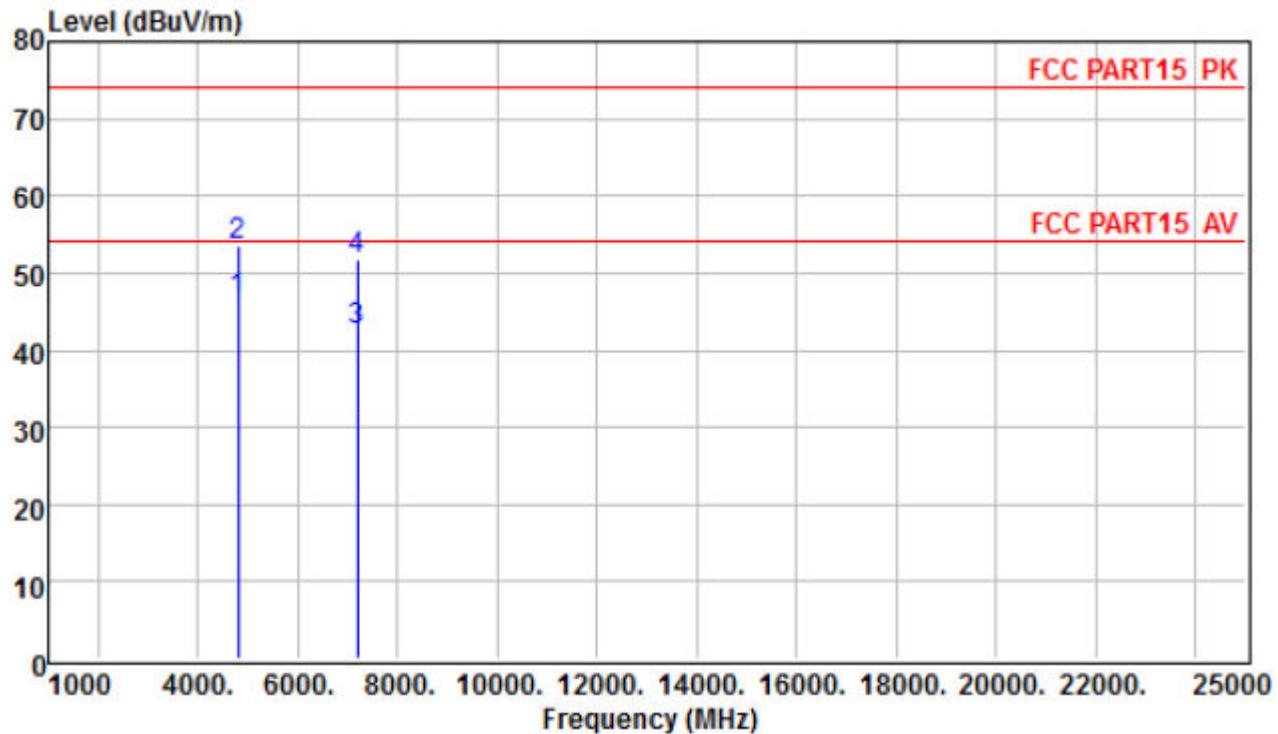
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Over Line	Over Limit	Remark
	Level	Factor	Factor	Loss	Level				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4960.000	29.88	27.58	31.32	12.36	45.98	54.00	-8.02	Average
2	4960.000	40.77	27.58	31.32	12.36	56.87	74.00	-17.13	Peak
3	7440.000	28.86	27.99	24.38	16.62	41.87	54.00	-12.13	Average
4	7440.000	39.86	27.99	24.38	16.62	52.87	74.00	-21.13	Peak

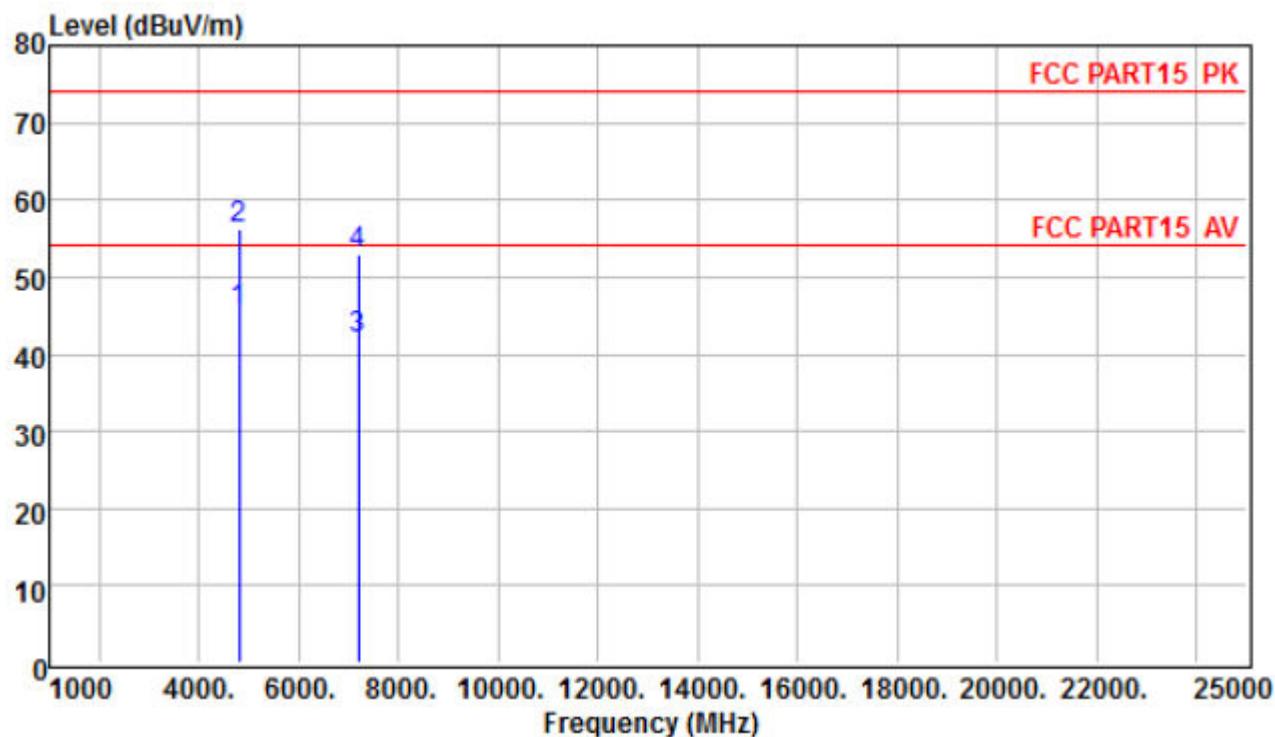
Horizontal

Freq	Read Level		Preamp	Antenna	Cable	Limit Level	Limit Line	Over Limit	Remark
	MHz	dBuV	Factor	Factor	Cable Loss				
1	4960.000	30.75	27.58	31.32	12.36	46.85	54.00	-7.15	Average
2	4960.000	37.88	27.58	31.32	12.36	53.98	74.00	-20.02	Peak
3	7440.000	29.66	27.99	24.38	16.62	42.67	54.00	-11.33	Average
4	7440.000	37.86	27.99	24.38	16.62	50.87	74.00	-23.13	Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	2Mbps-2402
Test Voltage :	DC 3.7V		

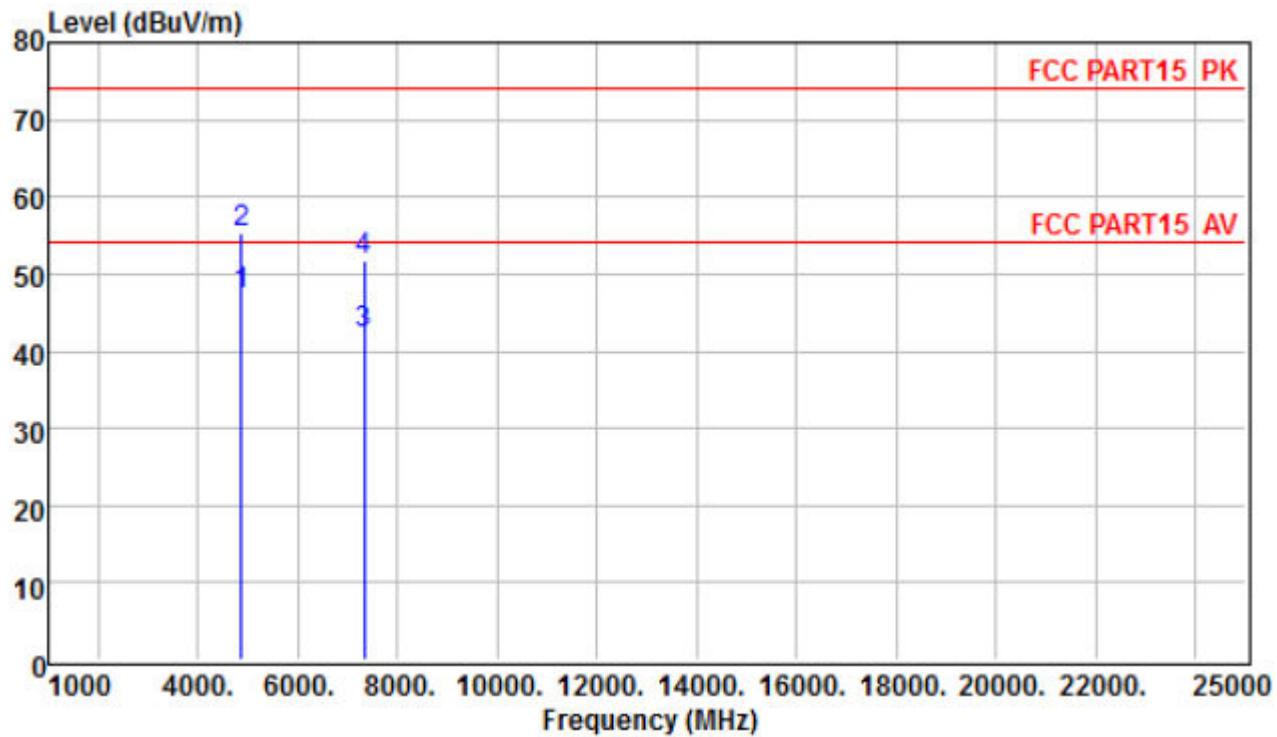
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit Line	Over Limit	Remark
	Level	Factor	Factor	Loss	Level			
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4804.000	29.03	27.49	32.94	11.96	46.44	54.00	-7.56 Average
2	4804.000	36.15	27.49	32.94	11.96	53.56	74.00	-20.44 Peak
3	7206.000	28.70	27.94	25.28	16.61	42.65	54.00	-11.35 Average
4	7206.000	37.70	27.94	25.28	16.61	51.65	74.00	-22.35 Peak

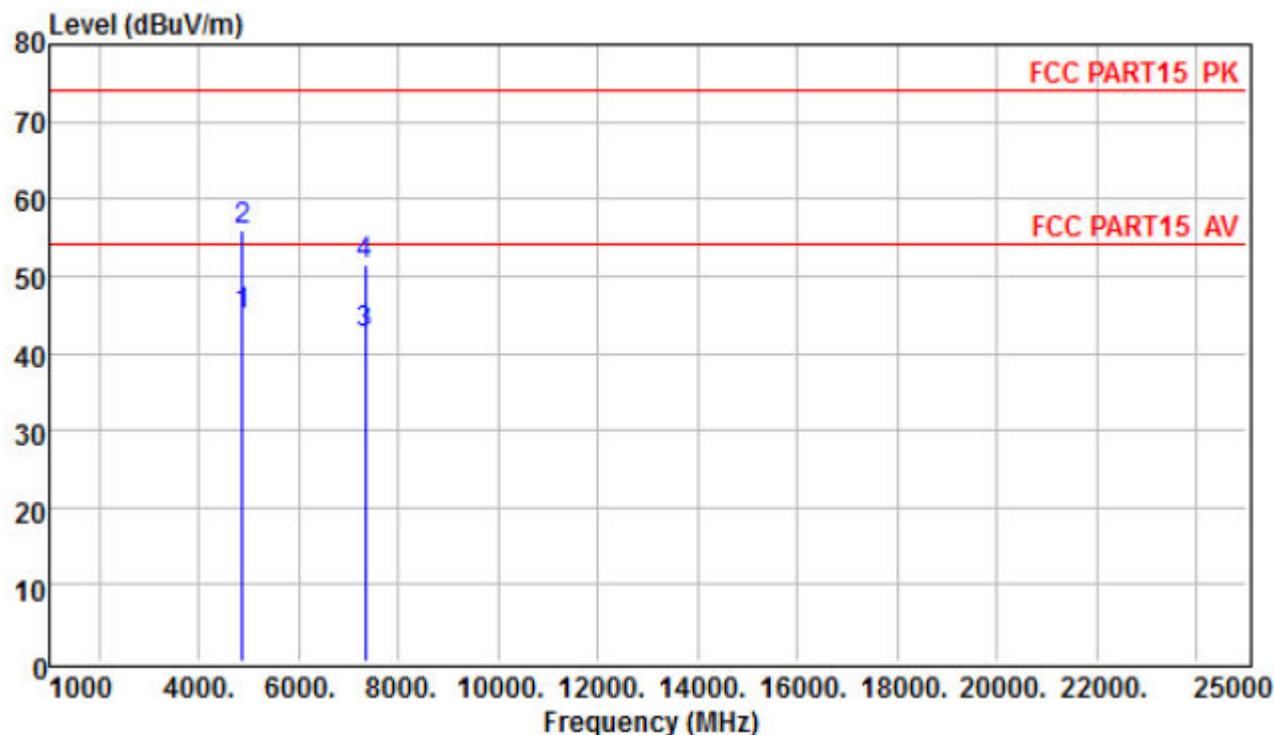
Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Remark	
	Level	Factor	Factor	Cable Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4804.000	28.04	27.49	32.94	11.96	45.45	54.00	-8.55 Average
2	4804.000	38.93	27.49	32.94	11.96	56.34	74.00	-17.66 Peak
3	7206.000	28.03	27.94	25.28	16.61	41.98	54.00	-12.02 Average
4	7206.000	38.91	27.94	25.28	16.61	52.86	74.00	-21.14 Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	2Mbps -2441
Test Voltage :	DC 3.7V		

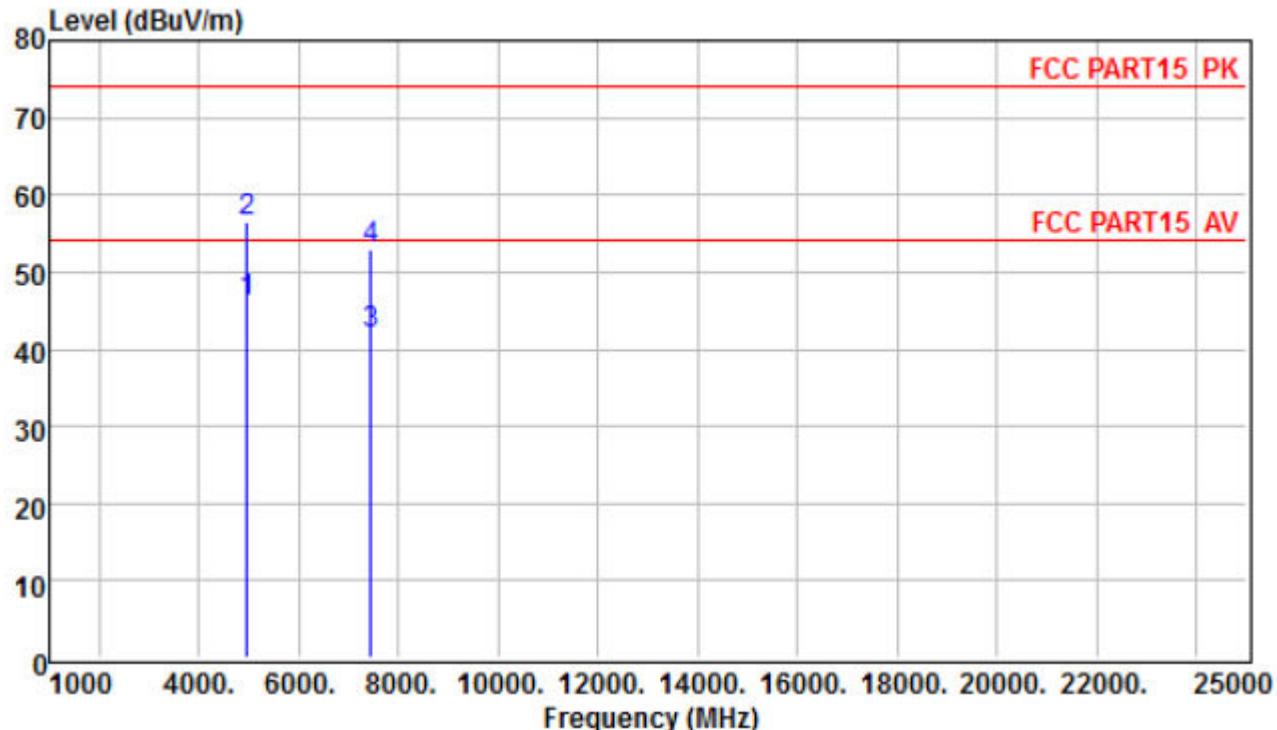
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Line	Over Limit	Remark
	Freq	Level	Factor	Factor	Cable Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4882.000	30.62	27.53	32.11	12.14	47.34	54.00	-6.66	Average
2	4882.000	38.73	27.53	32.11	12.14	55.45	74.00	-18.55	Peak
3	7323.000	29.17	27.96	24.33	16.62	42.16	54.00	-11.84	Average
4	7323.000	38.88	27.96	24.33	16.62	51.87	74.00	-22.13	Peak

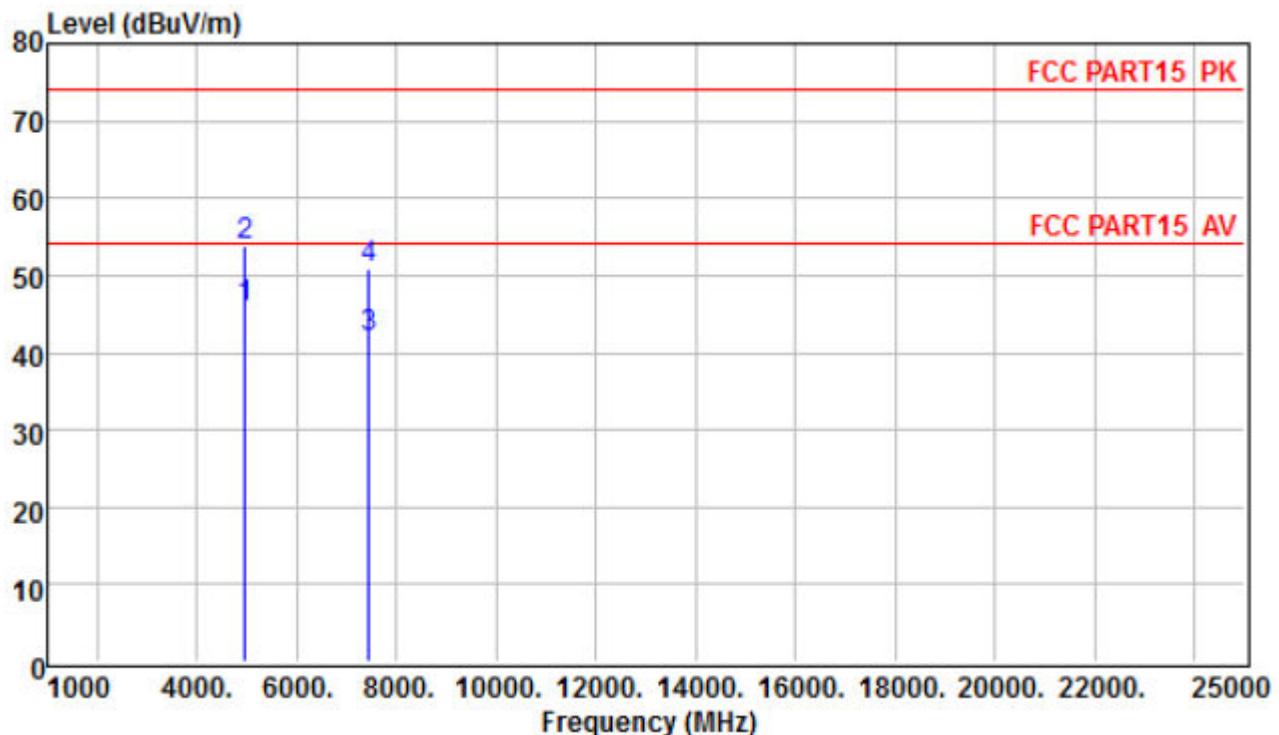
Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Remark	
	Level	Factor	Factor	Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4882.000	28.26	27.53	32.11	12.14	44.98	54.00	-9.02 Average
2	4882.000	39.31	27.53	32.11	12.14	56.03	74.00	-17.97 Peak
3	7323.000	29.68	27.96	24.33	16.62	42.67	54.00	-11.33 Average
4	7323.000	38.46	27.96	24.33	16.62	51.45	74.00	-22.55 Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	2Mbps -2480
Test Voltage :	DC 3.7V		

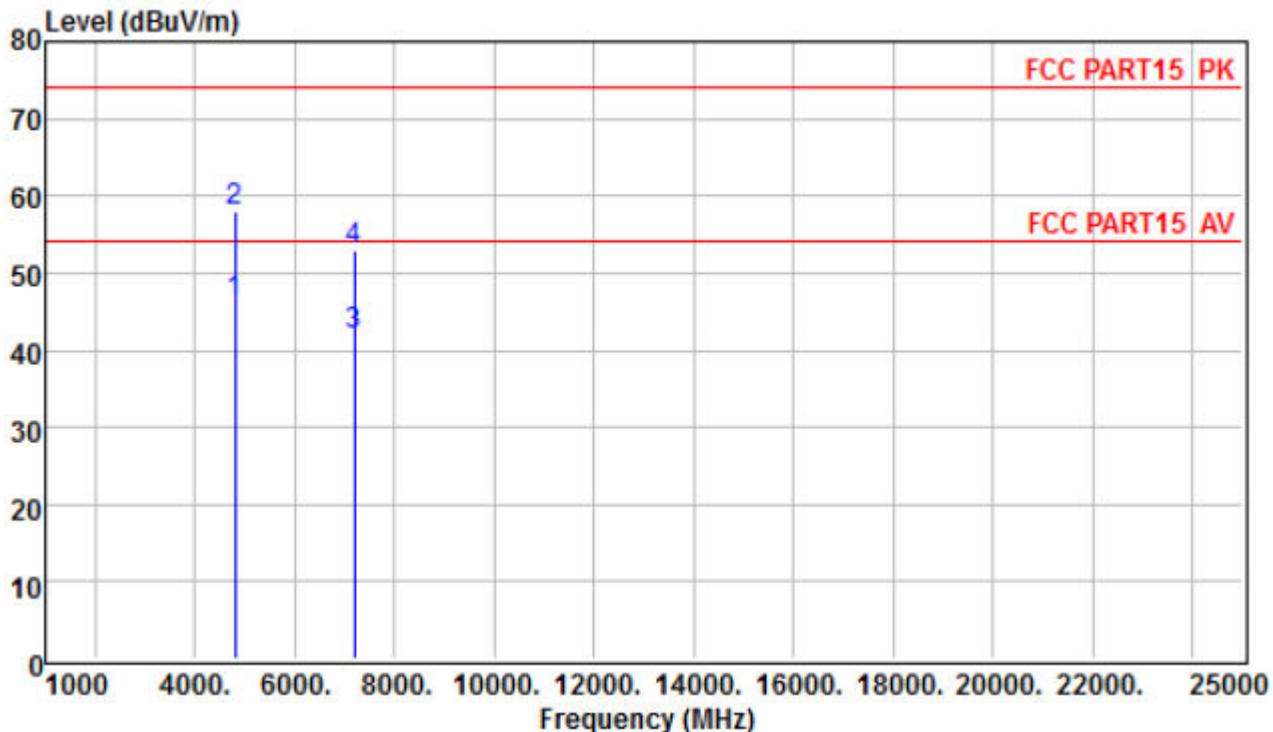
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Over	Line	Limit	Remark
	Level	Factor	Factor		Loss					
	MHz	dBuV		dB	dB/m	dB	dBuV/m	dBuV/m		
1	4960.000	30.13	27.58	31.32	12.36	46.23	54.00	-7.77	Average	
2	4960.000	40.33	27.58	31.32	12.36	56.43	74.00	-17.57	Peak	
3	7440.000	28.86	27.99	24.38	16.62	41.87	54.00	-12.13	Average	
4	7440.000	39.96	27.99	24.38	16.62	52.97	74.00	-21.03	Peak	

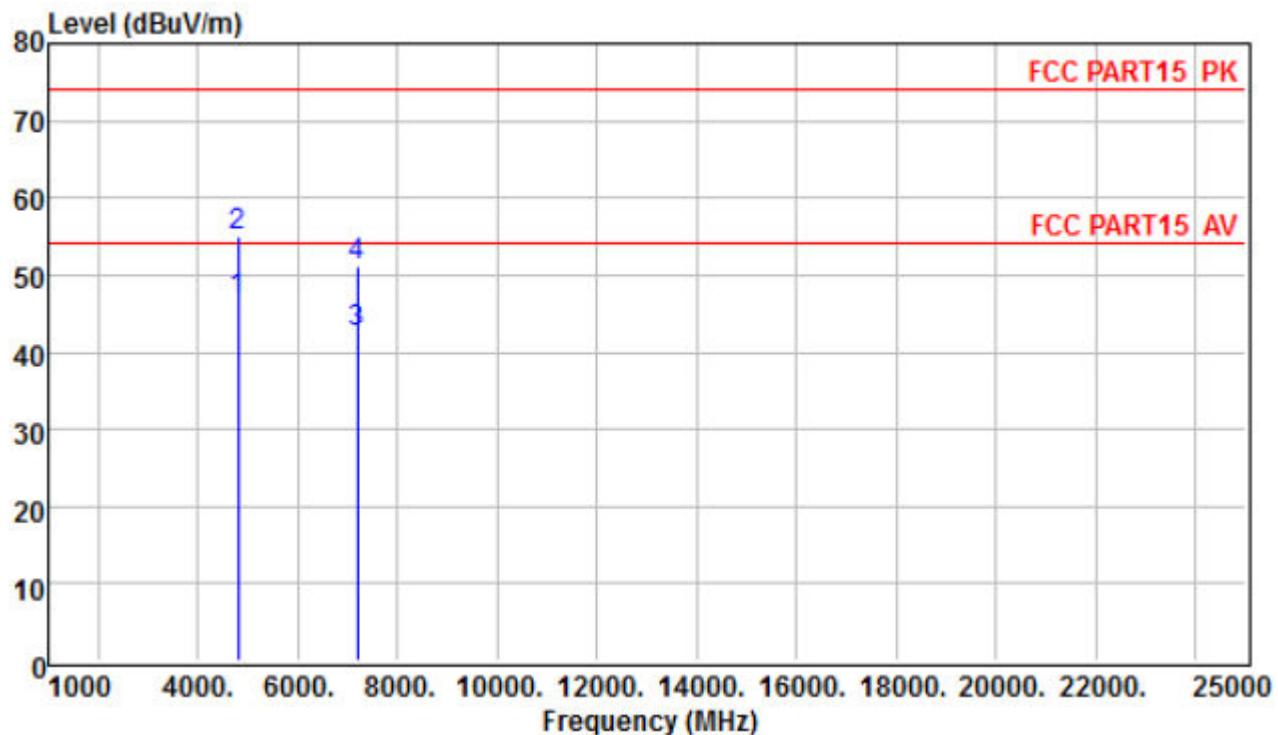
Horizontal

Freq	Read Level		Preamp	Antenna	Cable	Limit Level	Line Limit	Over Limit Remark	
	MHz	dBuV	Factor	Factor	Loss				
	MHz	dBuV		dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4960.000	29.77	27.58	31.32	12.36	45.87	54.00	-8.13	Average
2	4960.000	37.87	27.58	31.32	12.36	53.97	74.00	-20.03	Peak
3	7440.000	28.86	27.99	24.38	16.62	41.87	54.00	-12.13	Average
4	7440.000	37.86	27.99	24.38	16.62	50.87	74.00	-23.13	Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	3Mbps-2402
Test Voltage :	DC 3.7V		

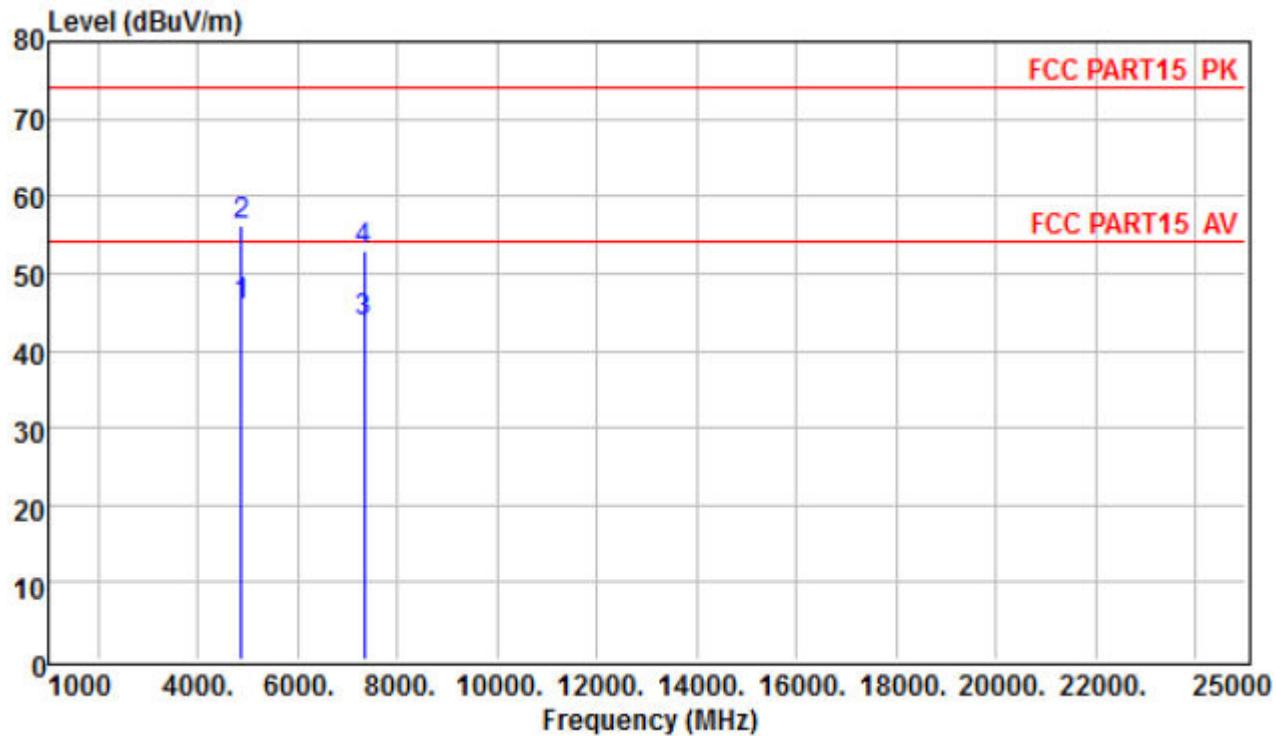
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Over Line	Over Limit	Remark
	Level	Factor	Factor	Loss	Level				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4804.000	28.57	27.49	32.94	11.96	45.98	54.00	-8.02	Average
2	4804.000	40.55	27.49	32.94	11.96	57.96	74.00	-16.04	Peak
3	7206.000	27.92	27.94	25.28	16.61	41.87	54.00	-12.13	Average
4	7206.000	39.03	27.94	25.28	16.61	52.98	74.00	-21.02	Peak

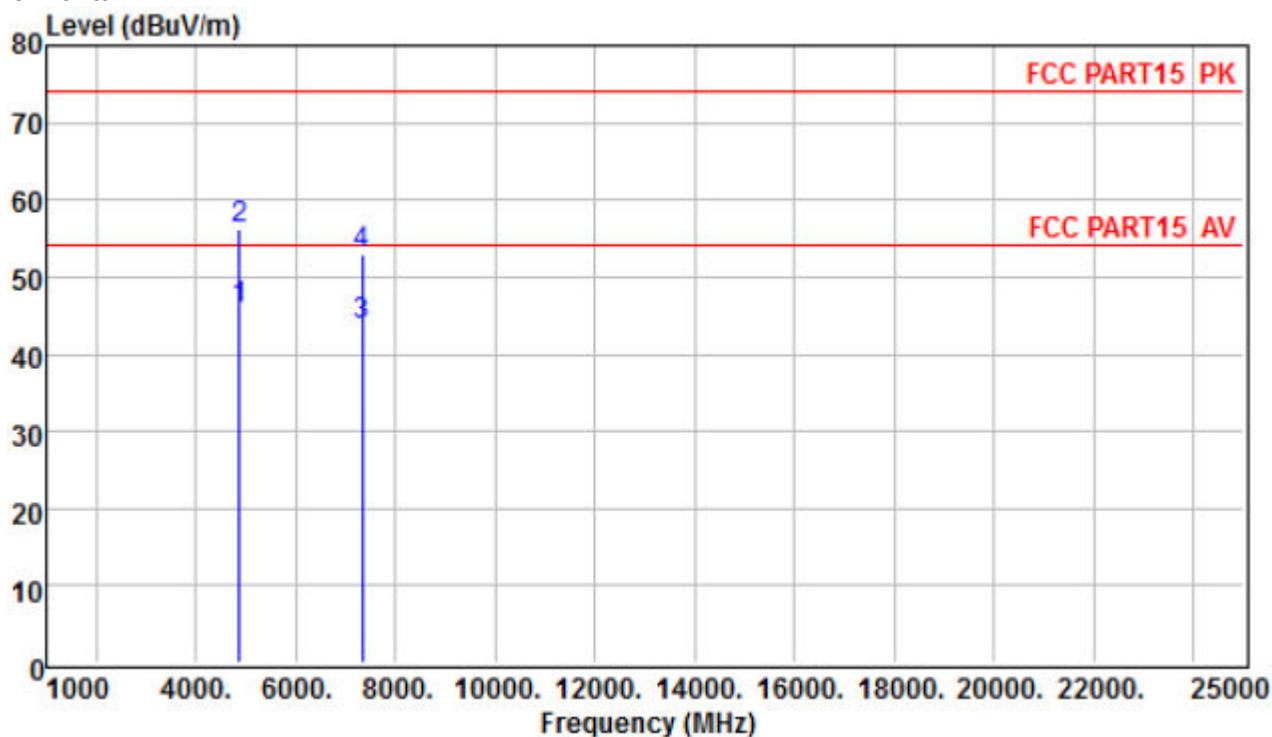
Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Remark	
	Level	Factor	Factor	Cable Loss				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB
1	4804.000	29.15	27.49	32.94	11.96	46.56	54.00	-7.44 Average
2	4804.000	37.74	27.49	32.94	11.96	55.15	74.00	-18.85 Peak
3	7206.000	28.72	27.94	25.28	16.61	42.67	54.00	-11.33 Average
4	7206.000	37.17	27.94	25.28	16.61	51.12	74.00	-22.88 Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	3Mbps -2441
Test Voltage :	DC 3.7V		

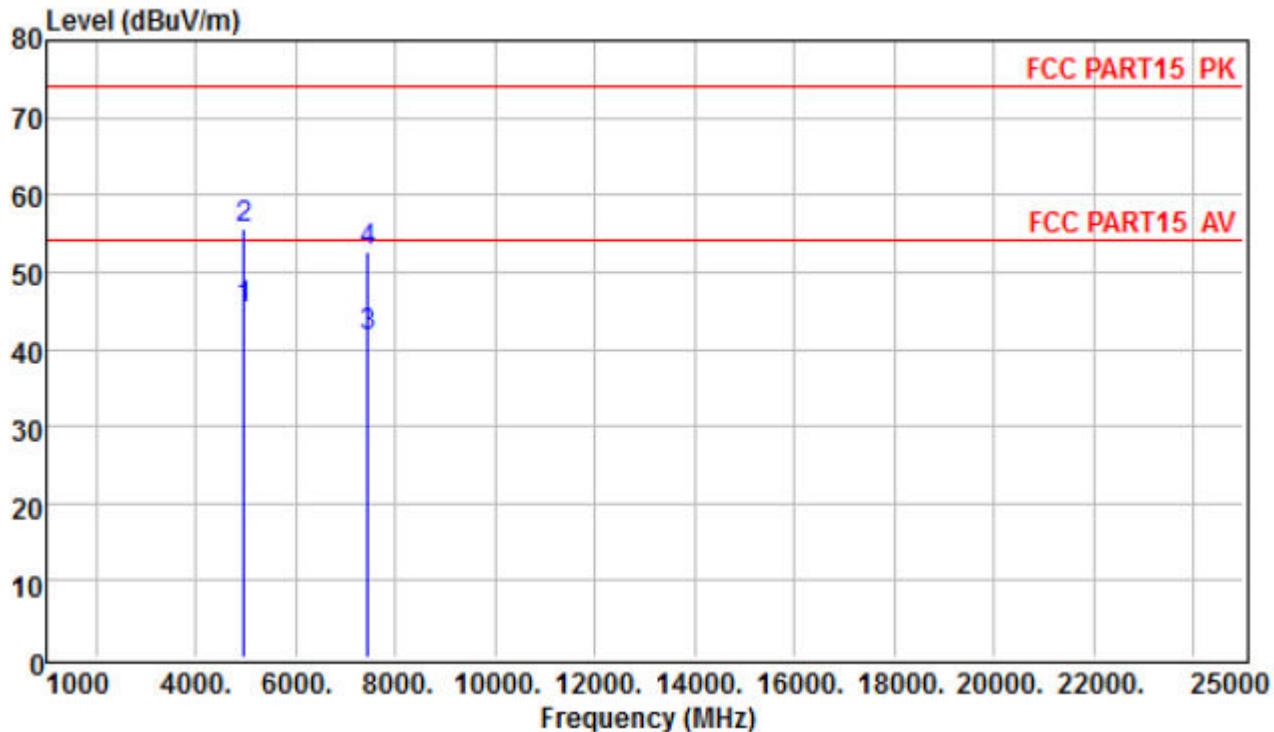
Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Over Line	Over Limit	Remark
	Level	Factor	Factor	Loss	Level				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4882.000	29.15	27.53	32.11	12.14	45.87	54.00	-8.13	Average
2	4882.000	39.15	27.53	32.11	12.14	55.87	74.00	-18.13	Peak
3	7323.000	30.57	27.96	24.33	16.62	43.56	54.00	-10.44	Average
4	7323.000	38.68	27.96	24.33	16.62	51.67	74.00	-22.33	Peak

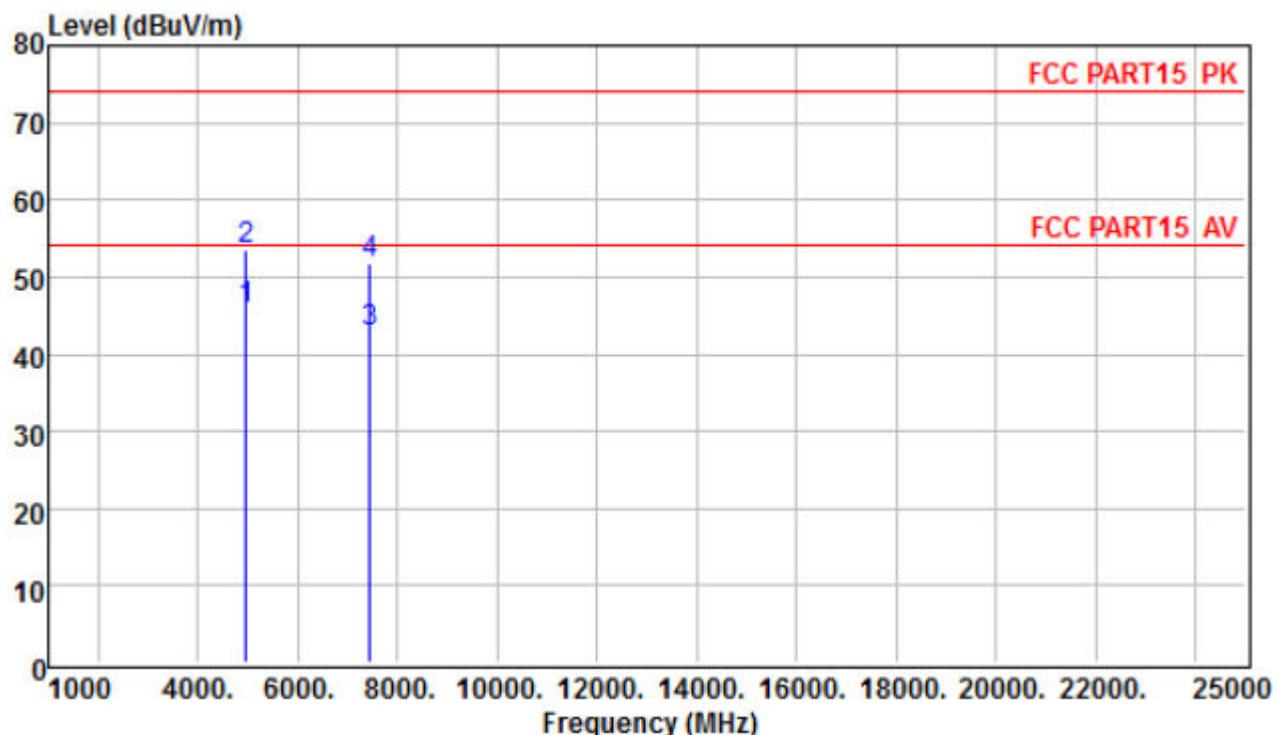
Horizontal

Freq	Read		Preamp	Antenna	Cable	Limit	Line	Over Limit	Remark
	MHz	dBuV	Factor	Factor	Cable Loss				
1	4882.000	29.16	27.53	32.11	12.14	45.88	54.00	-8.12	Average
2	4882.000	39.62	27.53	32.11	12.14	56.34	74.00	-17.66	Peak
3	7323.000	30.77	27.96	24.33	16.62	43.76	54.00	-10.24	Average
4	7323.000	39.88	27.96	24.33	16.62	52.87	74.00	-21.13	Peak

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010hPa	Test Mode :	3Mbps -2480
Test Voltage :	DC 3.7V		

Vertical

Freq	Read		Preamp	Antenna	Cable	Limit	Line	Over	Remark
	Level	Factor	Factor	Loss	Level				
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4960.000	29.24	27.58	31.32	12.36	45.34	54.00	-8.66	Average
2	4960.000	39.57	27.58	31.32	12.36	55.67	74.00	-18.33	Peak
3	7440.000	28.75	27.99	24.38	16.62	41.76	54.00	-12.24	Average
4	7440.000	39.64	27.99	24.38	16.62	52.65	74.00	-21.35	Peak

Horizontal

Freq	Read	Preamp	Antenna	Cable	Limit	Over	Over		
	Level	Factor	Factor	Loss				Remark	
	MHz	dBuV	dB	dB/m	dB	dBuV/m	dBuV/m	dB	
1	4960.000	29.77	27.58	31.32	12.36	45.87	54.00	-8.13	Average
2	4960.000	37.35	27.58	31.32	12.36	53.45	74.00	-20.55	Peak
3	7440.000	29.86	27.99	24.38	16.62	42.87	54.00	-11.13	Average
4	7440.000	38.64	27.99	24.38	16.62	51.65	74.00	-22.35	Peak

NOTE:

Absolute Level= ReadingLevel+antenna Factor+cable loss-preamp factor,

Over Limit= Absolute Level – Limit

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has not to be reported.

EUT Pre-scan X/Y/Z orientation, only worst case is presented in the report (Z orientation)

For radiated bandedge test as follows:

Frequency (MHz)	Meter Reading (dB μ V)	antenna Factor (dB)	cable loss (dB)	preamp factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Type	Comment
1Mbps Non-hopping									
2390	34.23	30.44	8.94	26.32	47.29	74	-26.71	peak	Vertical
2390	35.56	30.44	8.94	26.32	48.62	74	-25.38	peak	Horizontal
2483.5	35.53	30.05	9.07	26.34	48.31	74	-25.69	peak	Vertical
2483.5	36.87	30.05	9.07	26.34	49.65	74	-24.35	peak	Horizontal
1Mbps hopping									
2390	36.02	30.44	8.94	26.32	49.08	74	-24.92	peak	Vertical
2390	35.87	30.44	8.94	26.32	48.93	74	-25.07	peak	Horizontal
2483.5	36.11	30.05	9.07	26.34	48.89	74	-25.11	peak	Vertical
2483.5	36.09	30.05	9.07	26.34	48.87	74	-25.13	peak	Horizontal
2Mbps Non-hopping									
2390	35.88	30.44	8.94	26.32	48.94	74	-25.06	peak	Vertical
2390	35.76	30.44	8.94	26.32	48.82	74	-25.18	peak	Horizontal
2483.5	36.83	30.05	9.07	26.34	49.61	74	-24.39	peak	Vertical
2483.5	36.14	30.05	9.07	26.34	48.92	74	-25.08	peak	Horizontal
2Mbps hopping									
2390	36.23	30.44	8.94	26.32	49.29	74	-24.71	peak	Vertical
2390	35.12	30.44	8.94	26.32	48.18	74	-25.82	peak	Horizontal
2483.5	36.05	30.05	9.07	26.34	48.83	74	-25.17	peak	Vertical
2483.5	36.45	30.05	9.07	26.34	49.23	74	-24.77	peak	Horizontal
3Mbps Non-hopping									
2390	36.32	30.44	8.94	26.32	49.38	74	-24.62	peak	Vertical
2390	34.11	30.44	8.94	26.32	47.17	74	-26.83	peak	Horizontal
2483.5	35.07	30.05	9.07	26.34	47.85	74	-26.15	peak	Vertical
2483.5	36.12	30.05	9.07	26.34	48.9	74	-25.1	peak	Horizontal
3Mbps hopping									
2390	35.86	30.44	8.94	26.32	48.92	74	-25.08	peak	Vertical
2390	34.81	30.44	8.94	26.32	47.87	74	-26.13	peak	Horizontal
2483.5	35.02	30.05	9.07	26.34	47.8	74	-26.2	peak	Vertical
2483.5	35.76	30.05	9.07	26.34	48.54	74	-25.46	peak	Horizontal

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

Spurious Emission in Restricted Band:(1-25G)

All the modulation modes have been tested and all other emissions more than 20dB below the limit, the worst result was report as below:

Polar (H/V)	Frequency	Meter Reading	antenna Factor	cable loss	preamp factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1Mbps Non-hopping									
Vertical	3265.000	34.11	30.26	10.68	26.63	48.42	74	-25.58	Pk
Horizontal	3265.000	35.09	30.26	10.68	26.63	49.4	74	-24.6	PK
Vertical	4037.000	35.12	31.55	10.52	27.02	50.17	74	-23.83	Pk
Horizontal	4037.000	33.04	31.55	10.52	27.02	48.09	74	-25.91	PK
1Mbps hopping									
Vertical	3352.000	34.24	30.34	10.78	26.67	48.69	74	-25.31	Pk
Horizontal	3352.000	33.02	30.34	10.78	26.67	47.47	74	-26.53	PK
Vertical	4137.000	33.12	30.69	10.95	27.08	47.68	74	-26.32	Pk
Horizontal	4137.000	34.43	30.69	10.95	27.08	48.99	74	-25.01	PK

6. 20DB BANDWIDTH

6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth($10 \times \log 1\% = 20\text{dB}$)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.

2. Set the spectrum analyzer:

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

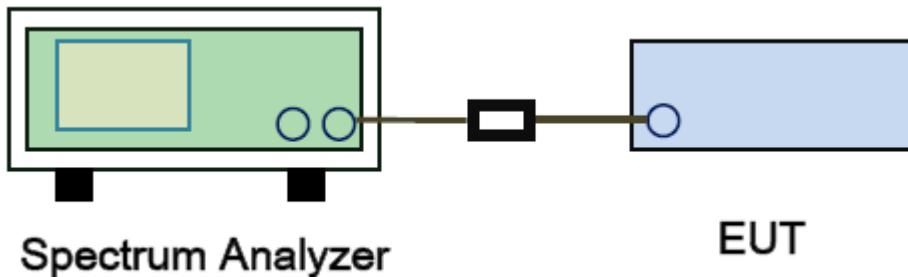
$\text{RBW} \geq 1\%$ of the 20dB bandwidth

$\text{VBW} \geq \text{RBW}$

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /C78(1Mbps)		

Frequency	20dB Bandwidth (kHz)	Result
2402 MHz	908.4	PASS
2441 MHz	870.6	PASS
2480 MHz	868.4	PASS

Test plot as follows:

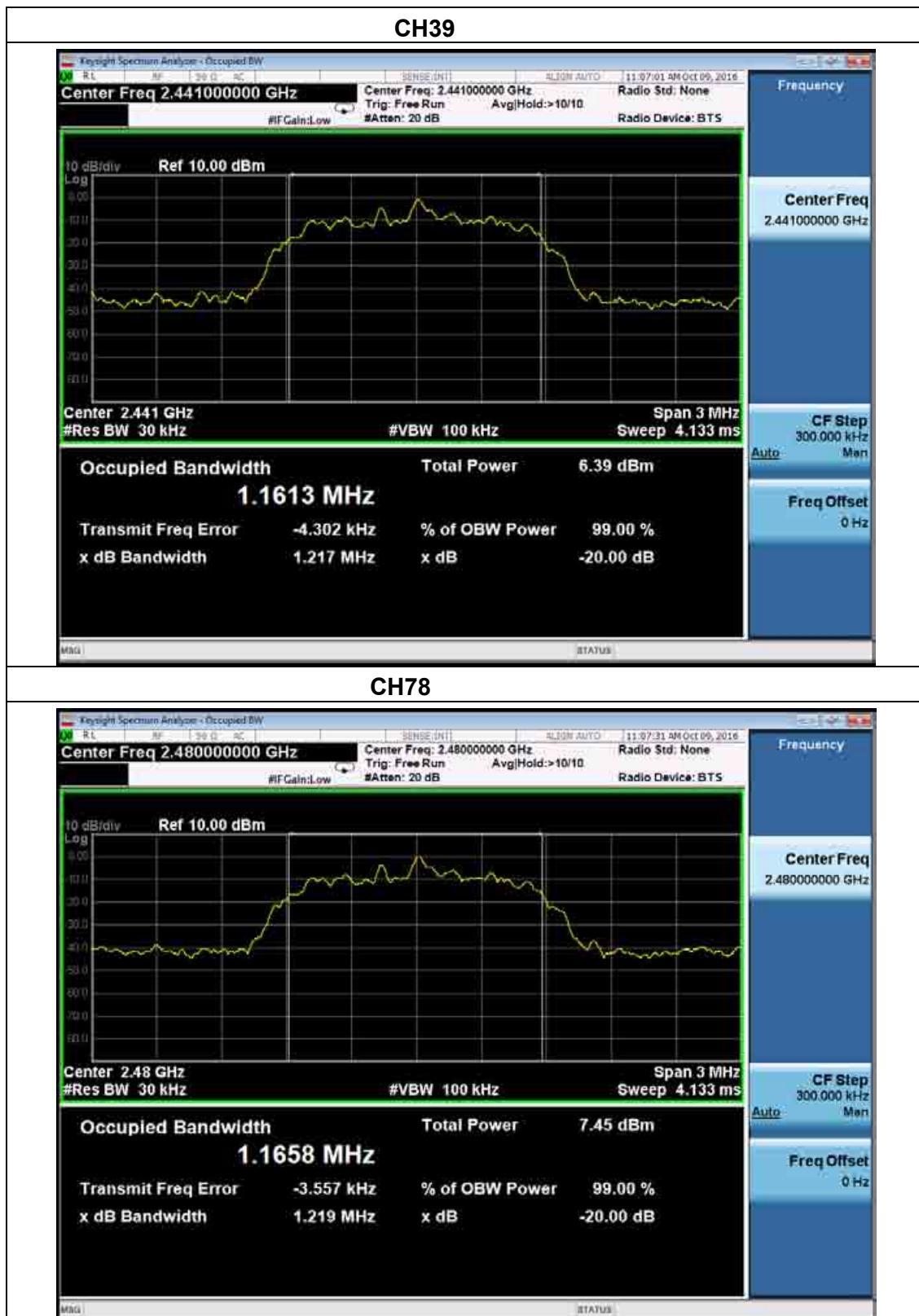


CH39 -1Mbps**CH78 -1Mbps**

EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /C78(2Mbps)		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.216	PASS
2441 MHz	1.217	PASS
2480 MHz	1.219	PASS





EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78(3Mbps)		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.205	PASS
2441 MHz	1.207	PASS
2480 MHz	1.207	PASS



CH39**CH78**

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 .

2. Set the spectrum analyzer:

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

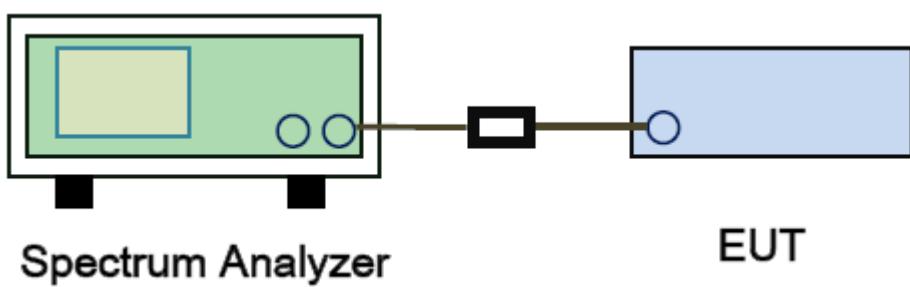
RBW \geq 1% of the span(30KHz)

VBW \geq RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold



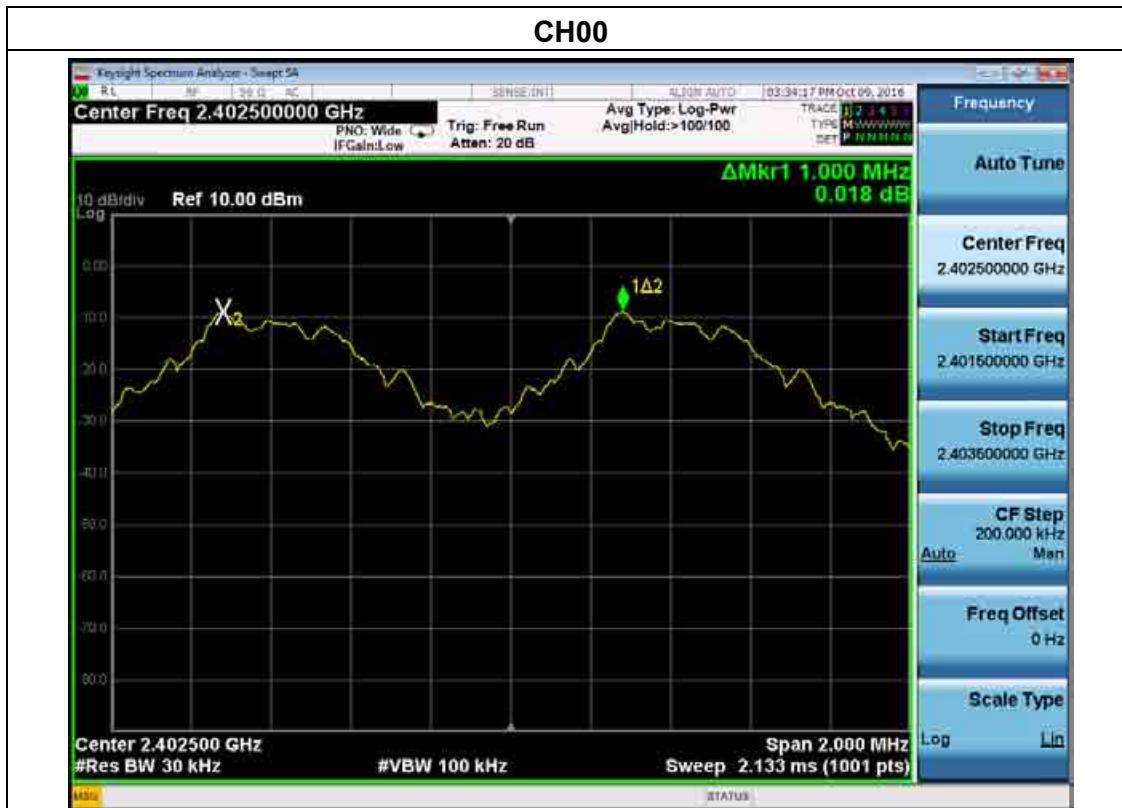
Test data:

EUT :	Bluetooth Speaker	Model Name :	TWIST-II
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78(1Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	908.4	Complies
2441 MHz	1.000	870.6	Complies
2480 MHz	1.000	868.4	Complies

Ch. Separation Limits: > 20dB bandwidth

Test plot as follows:





EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78(2Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	810.667	Complies
2441 MHz	1.000	811.333	Complies
2480 MHz	1.000	812.667	Complies

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



CH39 -2Mbps



CH78 -2Mbps



EUT :	BLUETOOTH SPEAKER	Model Name :	TWIST-II
Temperature :	24 °C	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78(3Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	803.333	Complies
2441 MHz	1.000	804.667	Complies
2480 MHz	1.000	804.667	Complies

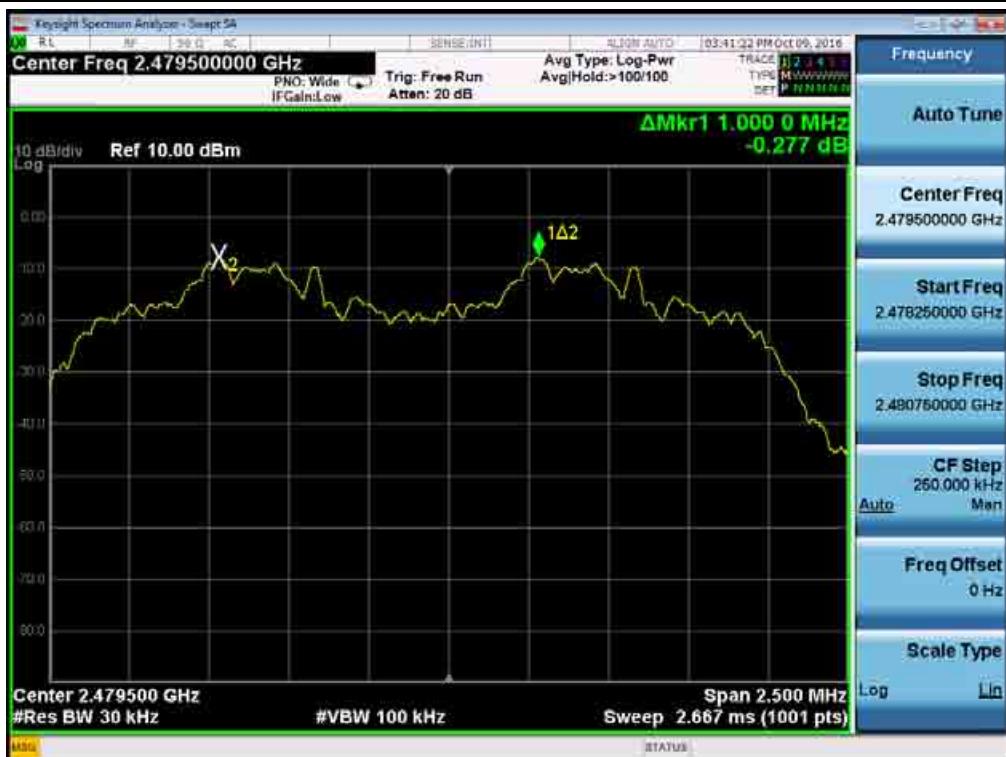
Ch. Separation Limits: >2/3 of 20dB bandwidth



CH39 -3Mbps



CH78 -3Mbps



8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

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

8.2. Test setup

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

2. Set the spectrum analyzer:

Span: the frequency band of operation

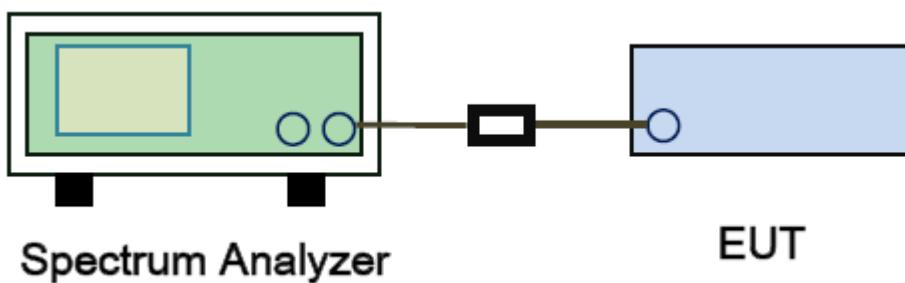
RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

Measured channel numbers	Limit	Result
79	≥15	PASS

Test plot as follows:



9. DWELL TIME

9.1. Limits

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

9.2. Test setup

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

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)*0.4

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

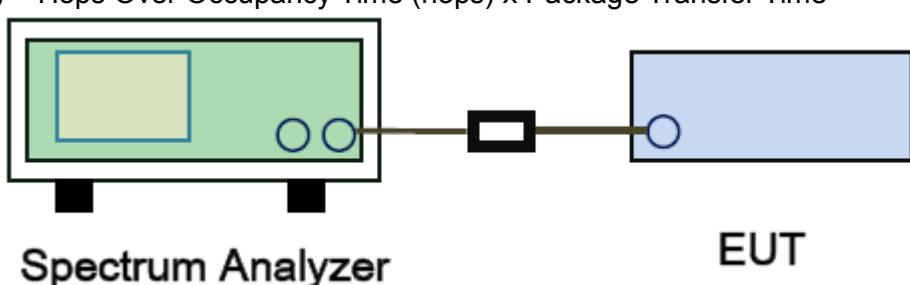
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),

Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

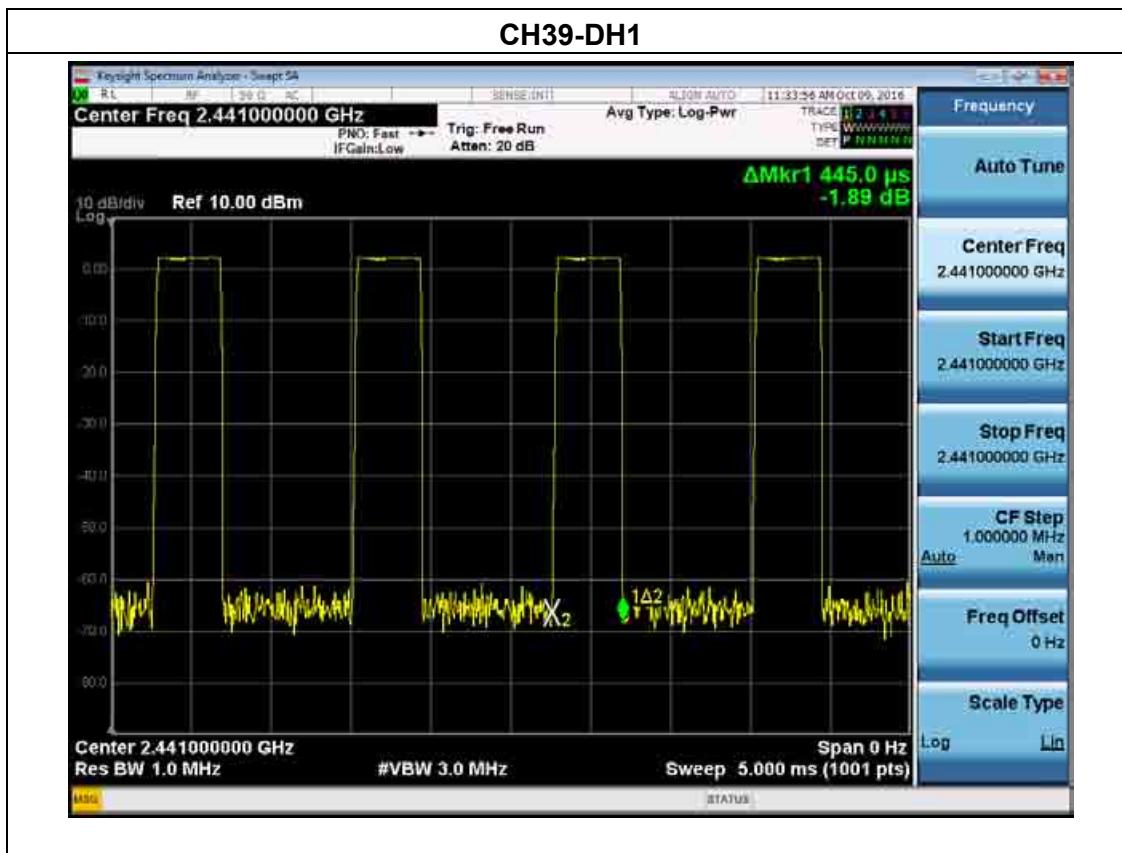
Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

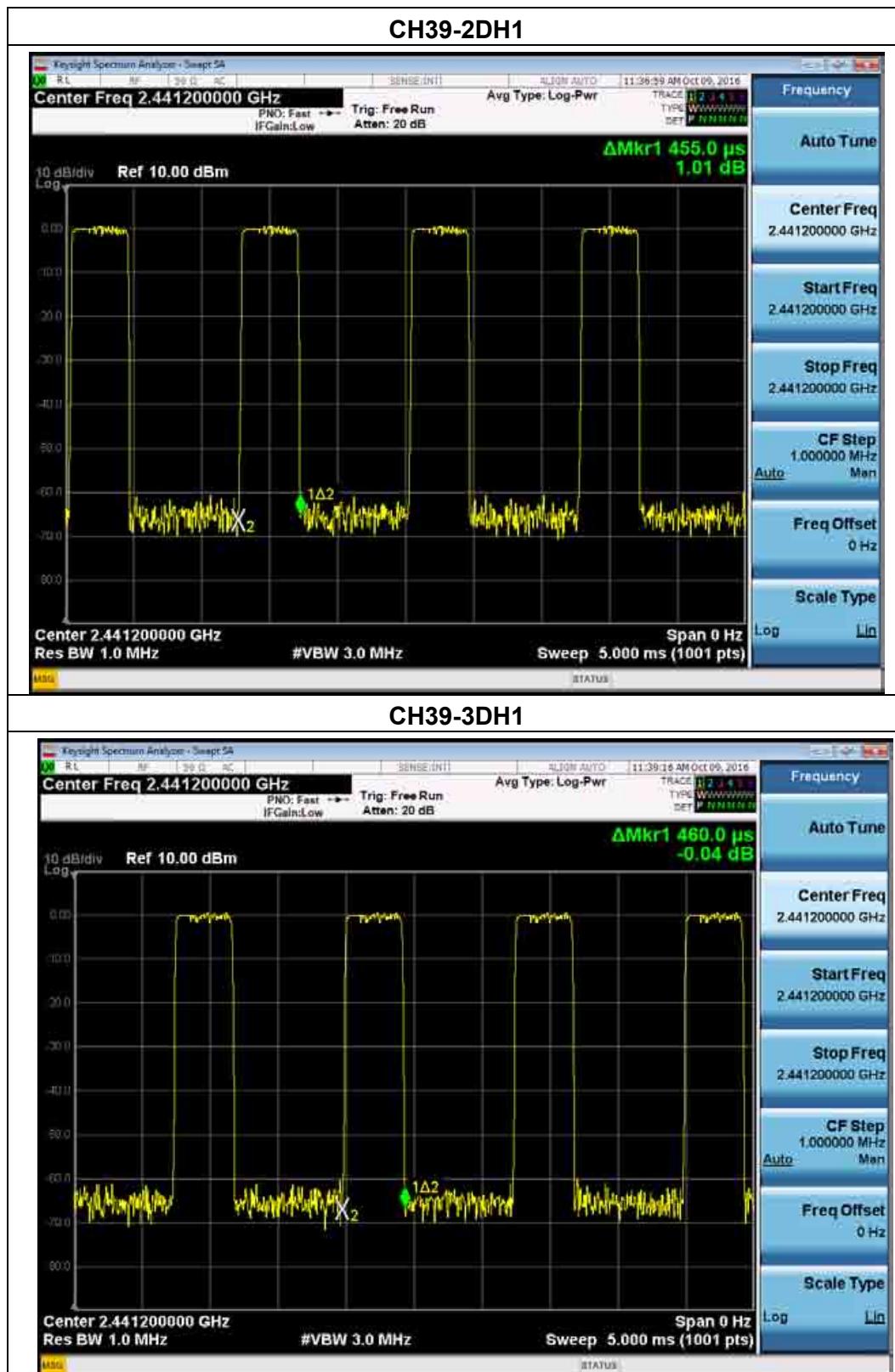


Test data:

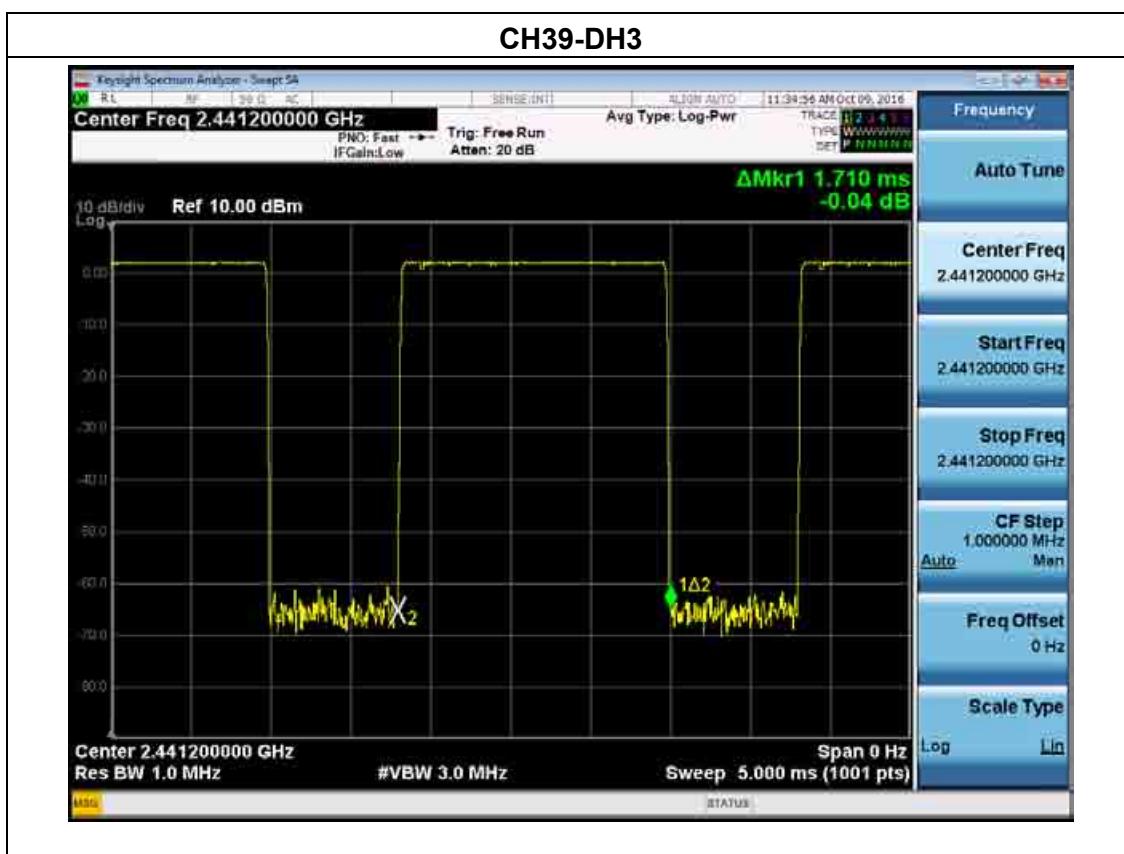
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.45	0.14	0.4
2DH1	2441 MHz	0.46	0.15	0.4
3DH1	2441 MHz	0.46	0.15	0.4

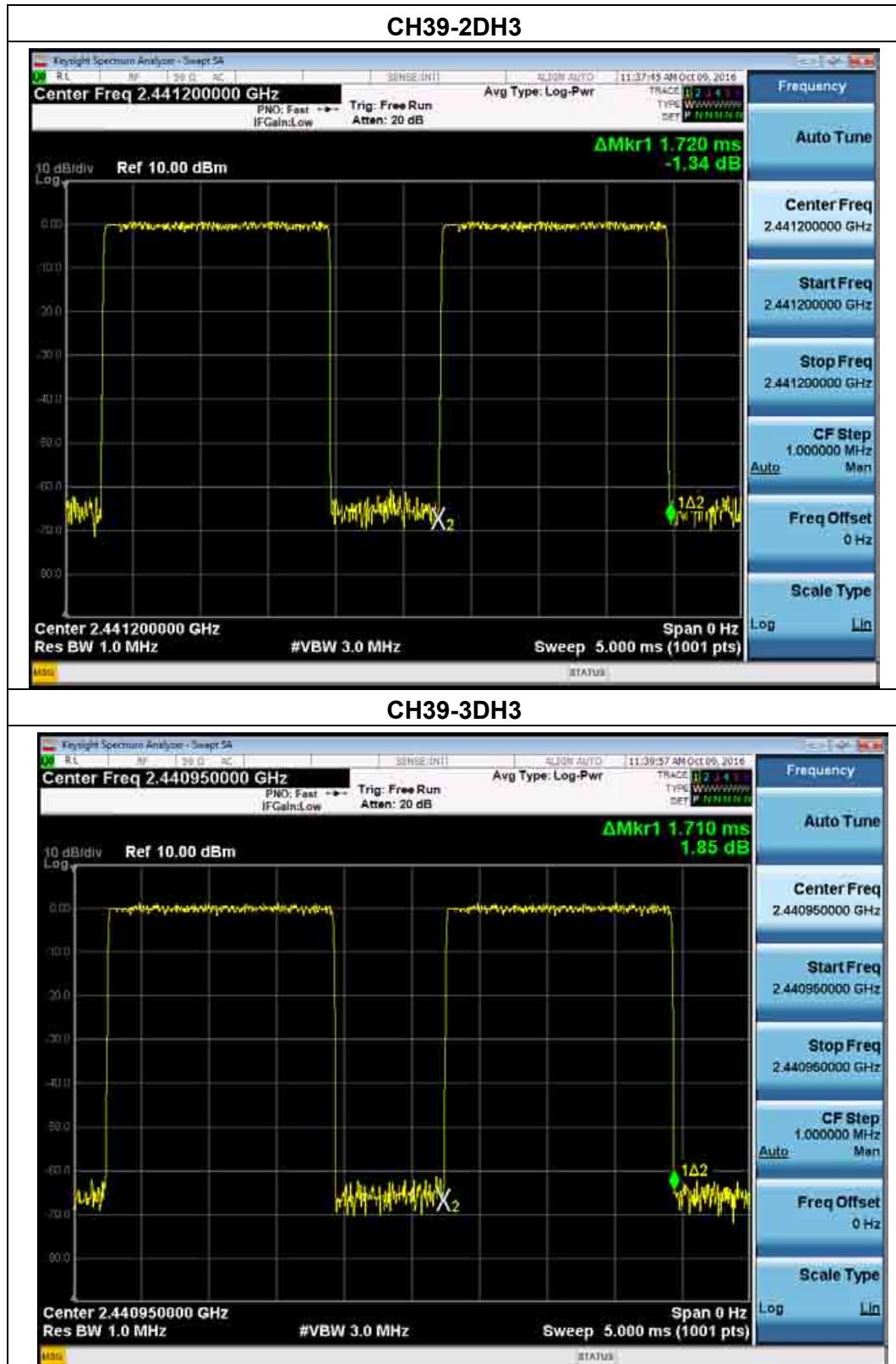
Test plot as follows as below:



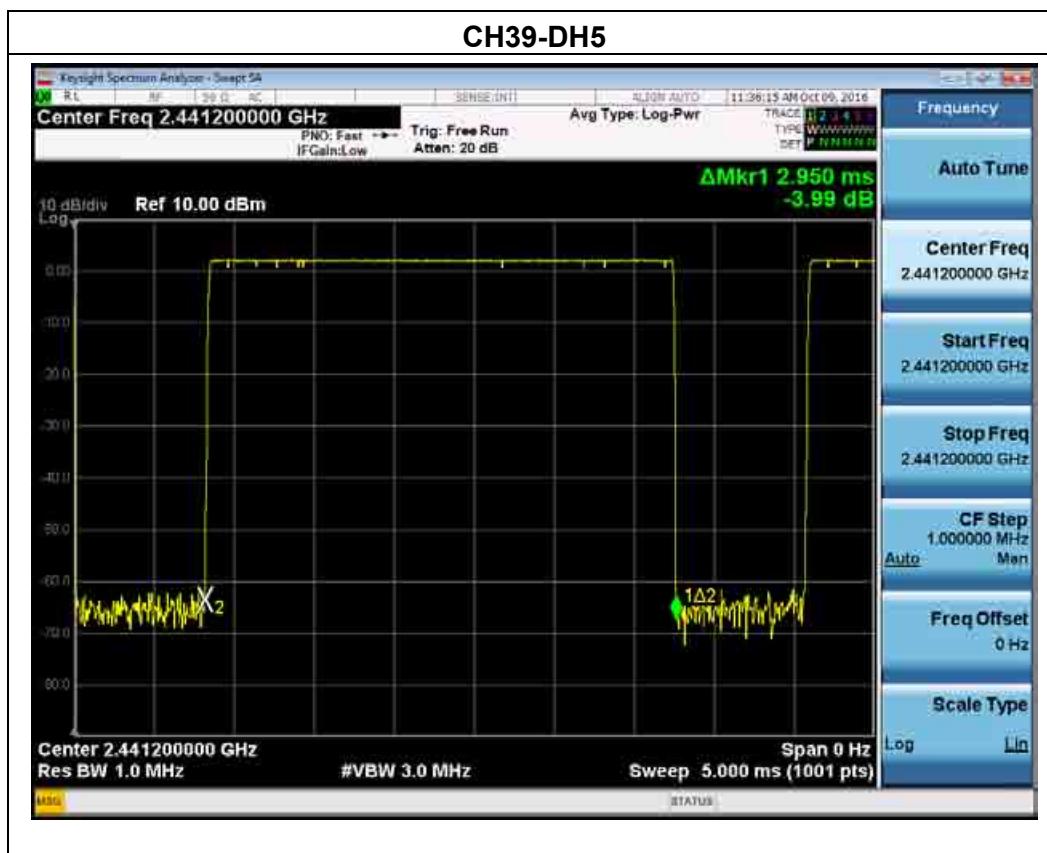


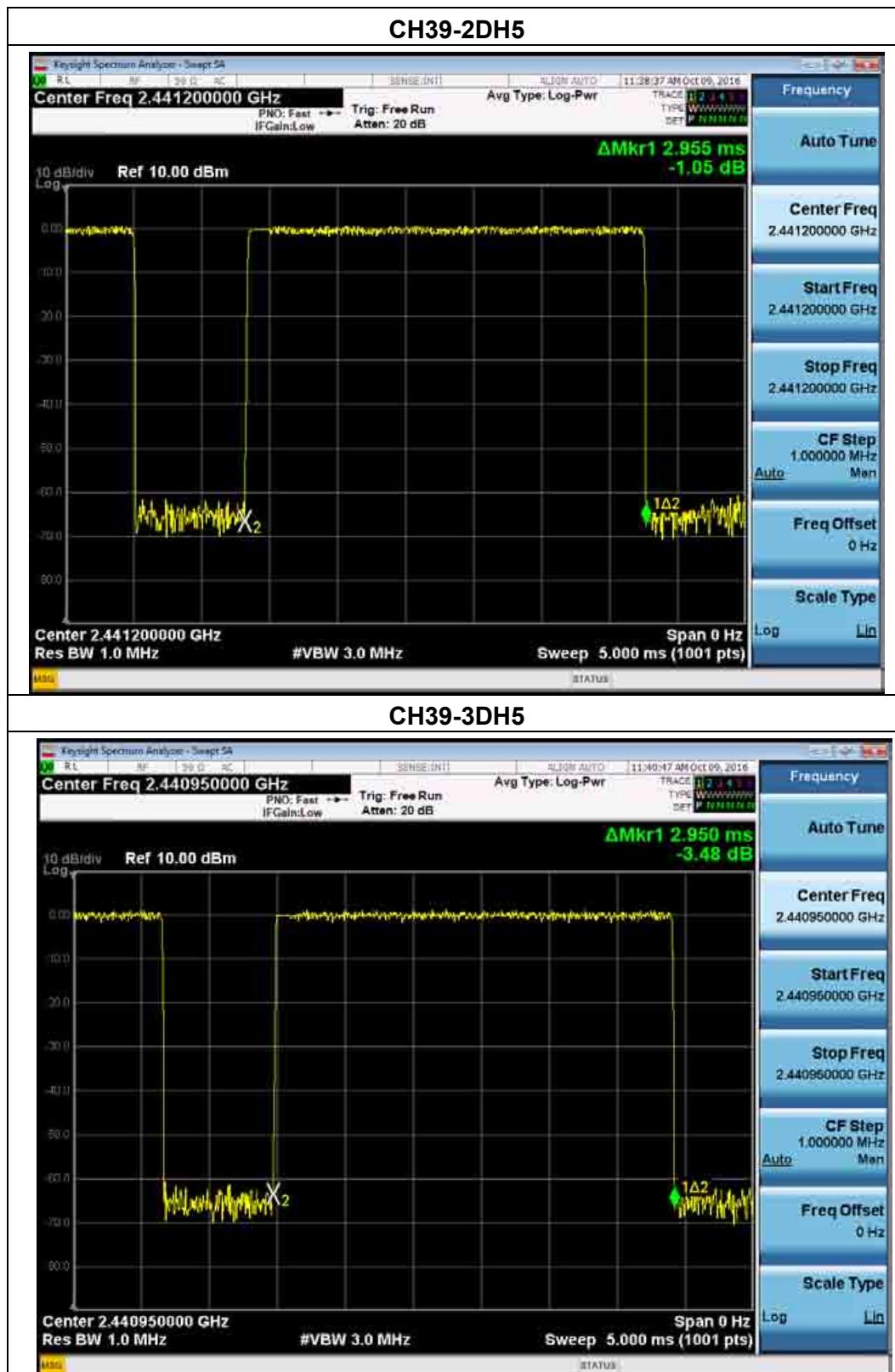
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH3	2441 MHz	1.71	0.27	0.4
2DH3	2441 MHz	1.72	0.28	0.4
3DH3	2441 MHz	1.71	0.27	0.4





Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH5	2441 MHz	2.95	0.31	0.4
2DH5	2441 MHz	2.96	0.32	0.4
3DH5	2441 MHz	2.95	0.31	0.4



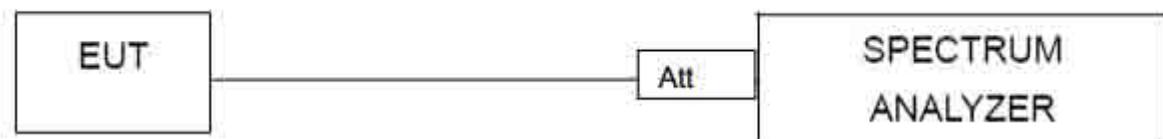


10. BAND EDGE COMPLIANCE TEST

10.1. Limits

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 a radiated 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see §15.205(c)).

10.2. Test setup



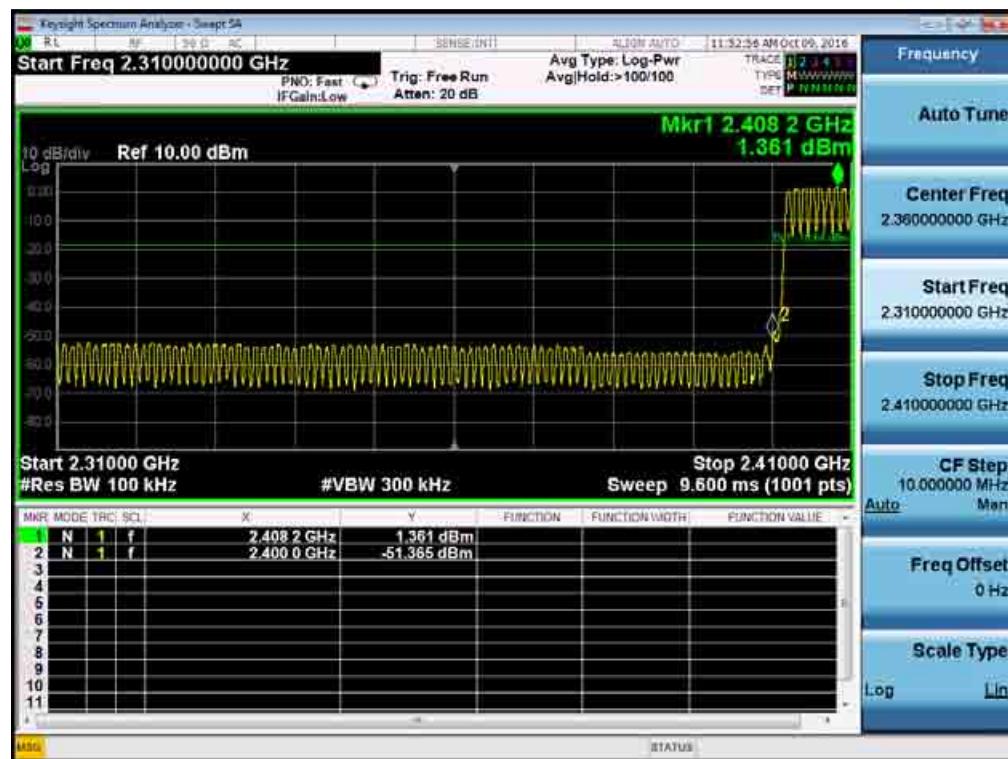
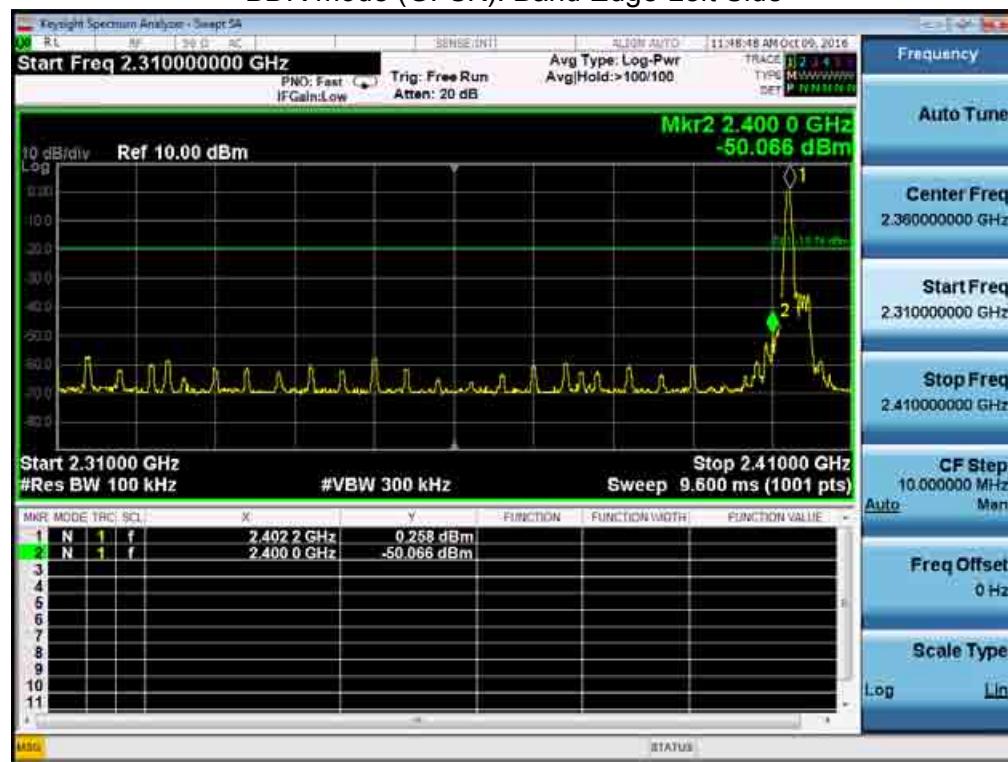
10.3. TEST Procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

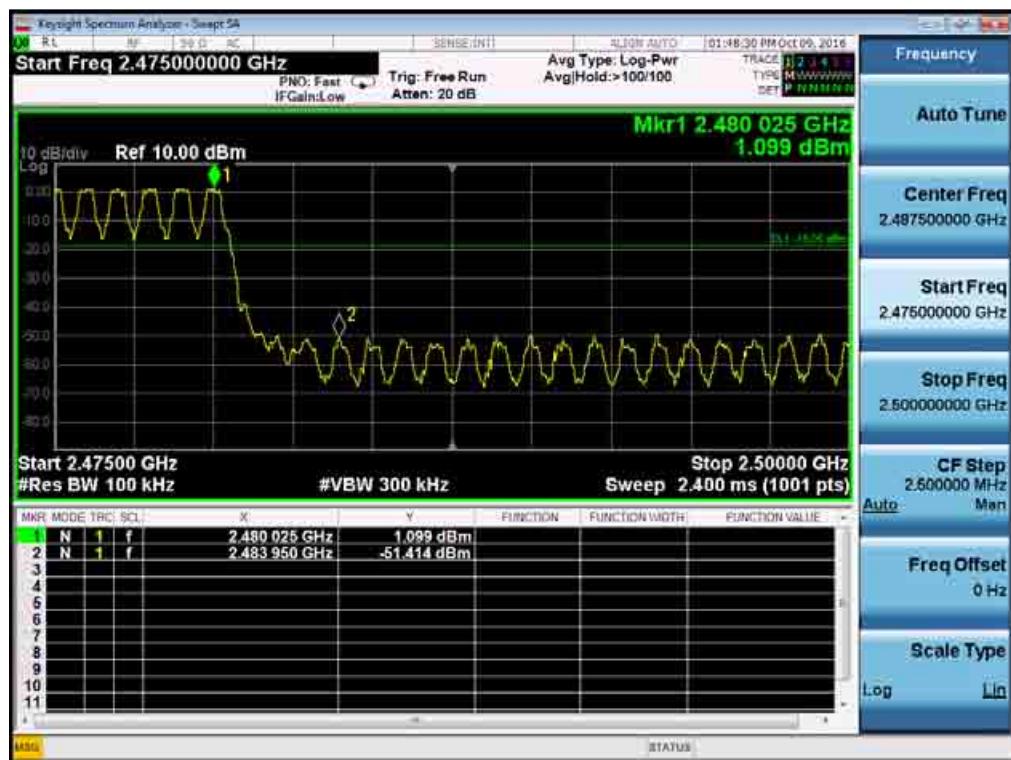
For conducted test:

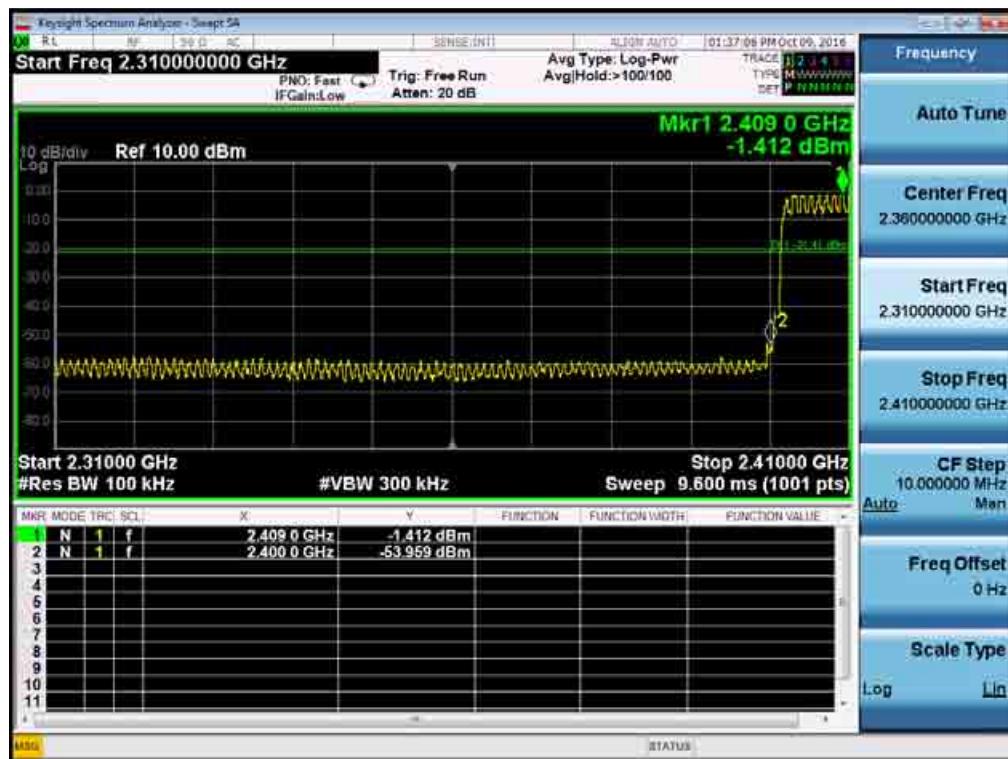
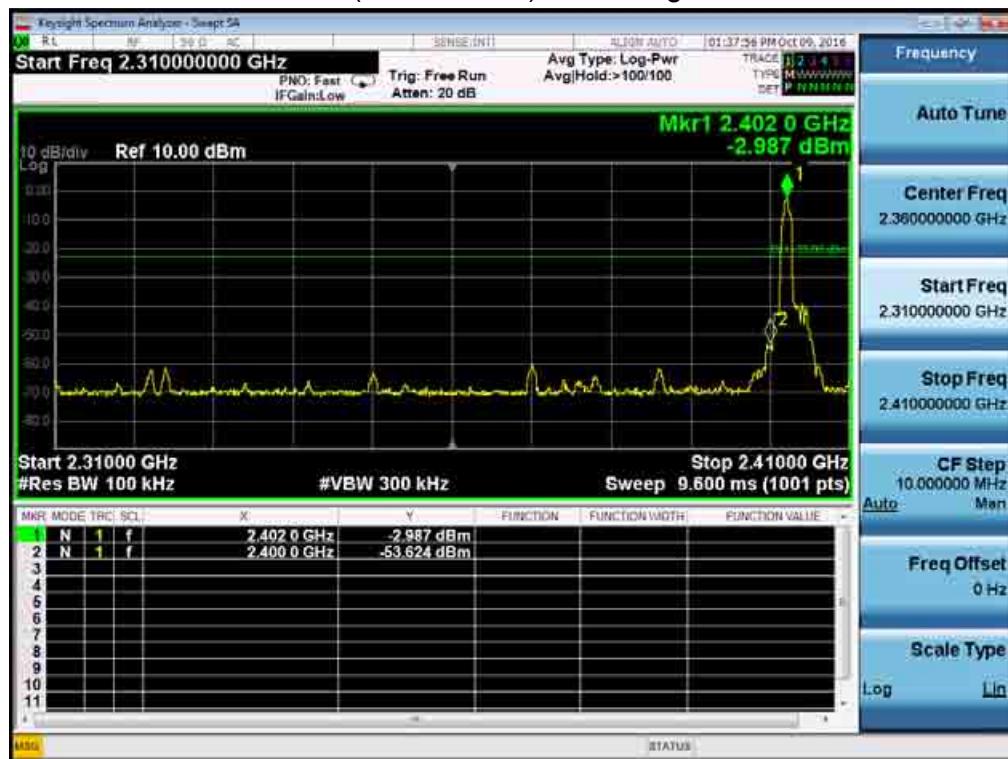
Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK Non-hopping			
Left band	50.324	20	Pass
Right band	62.148	20	Pass
$\pi/4$ -DQPSK Non-hopping			
Left band	50.637	20	Pass
Right band	62.242	20	Pass
8DPSK Non-hopping			
Left band	50.22	20	Pass
Right band	60.134	20	Pass
GFSK hopping			
Left band	52.726	20	Pass
Right band	52.513	20	Pass
$\pi/4$ -DQPSK hopping			
Left band	52.547	20	Pass
Right band	59.044	20	Pass
8DPSK hopping			
Left band	56.998	20	Pass
Right band	59.916	20	Pass

BDR mode (GFSK): Band Edge-Left Side



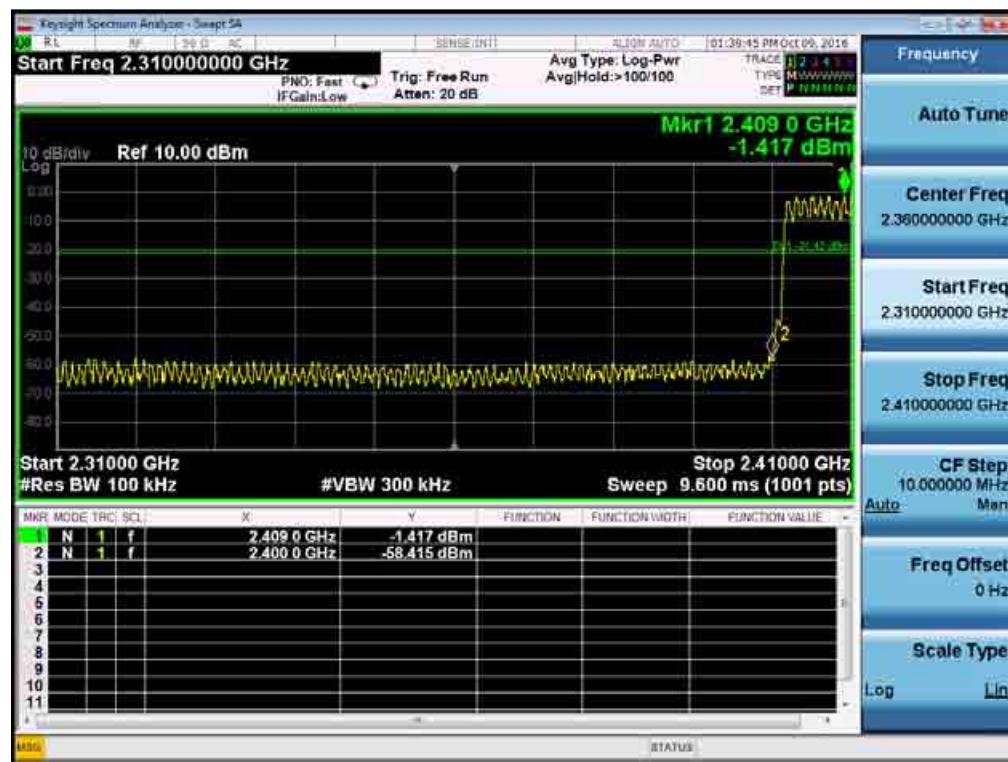
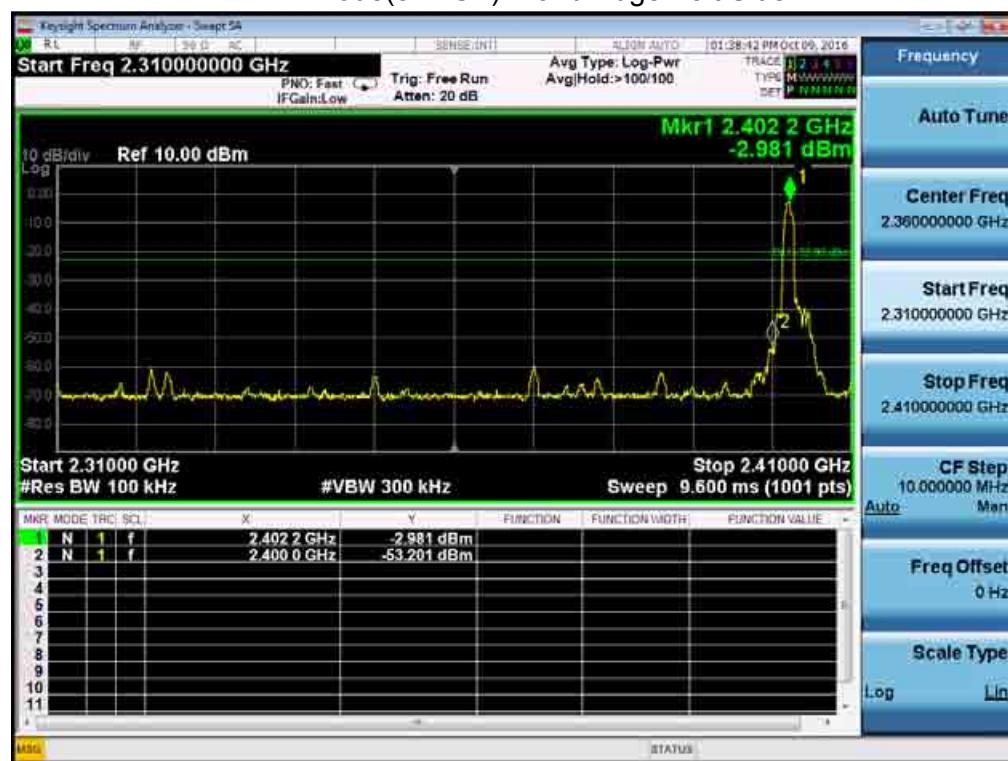
BDR mode (GFSK): Band Edge-Right Side



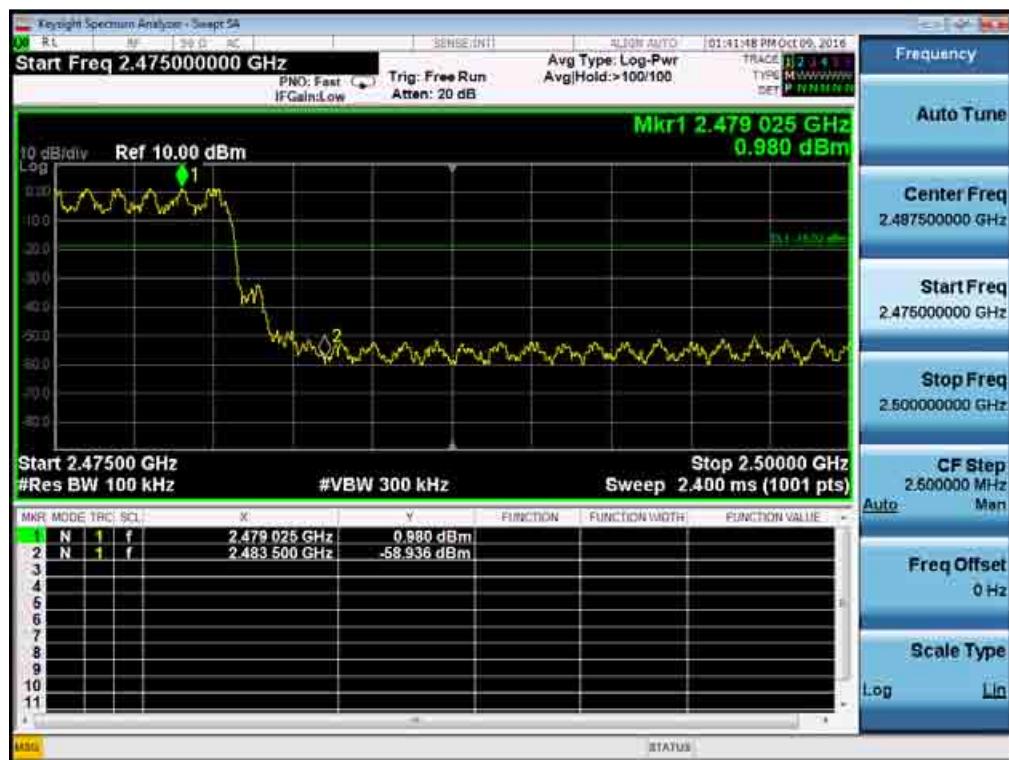
EDR mode ($\pi/4$ -DQPSK): Band Edge-Left Side

EDR mode ($\pi/4$ -DQPSK): Band Edge- Right Side

EDR mode(8DPSK): Band Edge-Left Side



EDR mode(8DPSK): Band Edge-Right Side



NOTE:

Hopping enabled and disabled have evaluated, and the worst data was reported

11. ANTENNA REQUIREMENTS

11.1. Limits

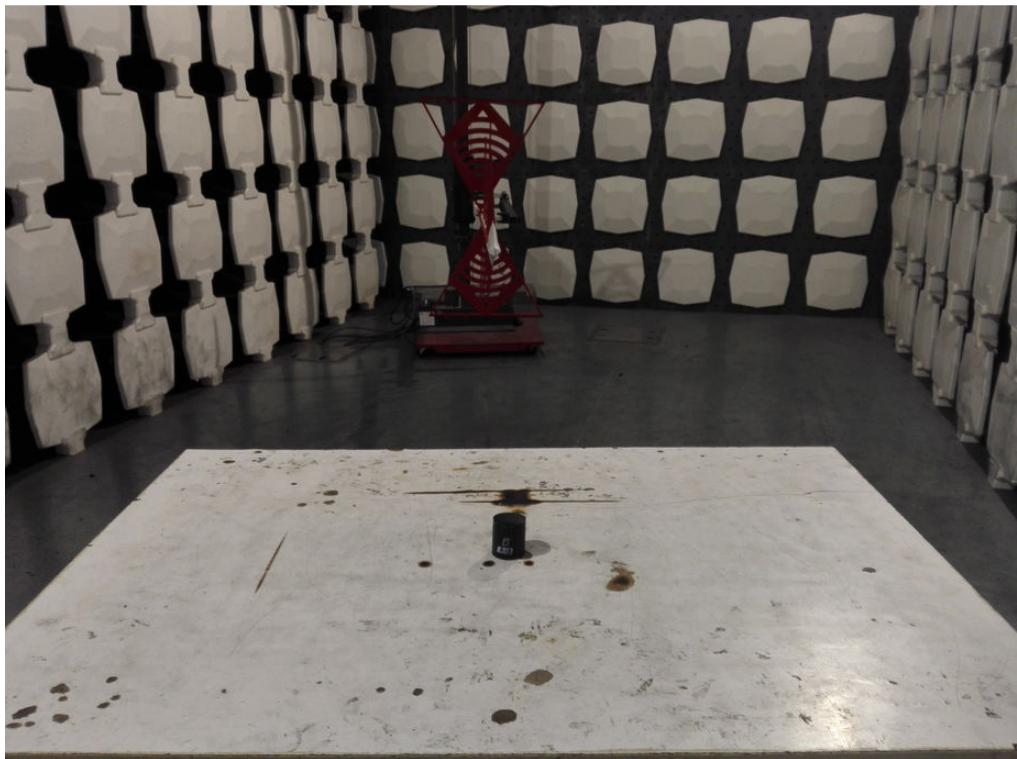
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional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

11.2. Result

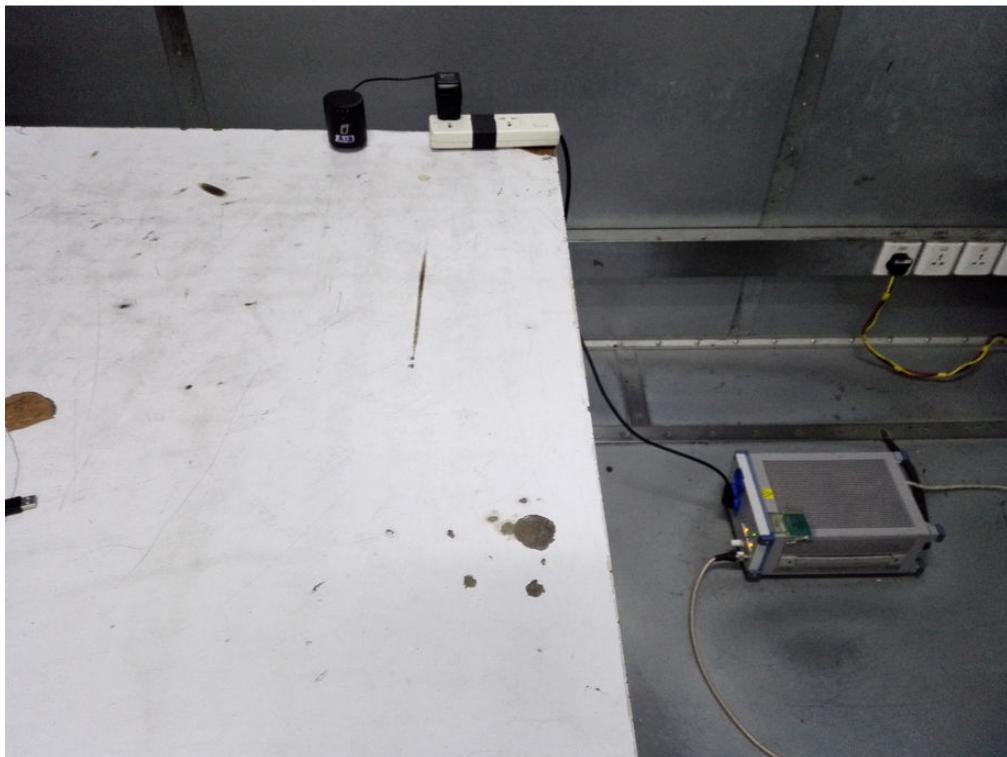
The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.5dBi.

12. PHOTOGRAPHS OF TEST SET-UP

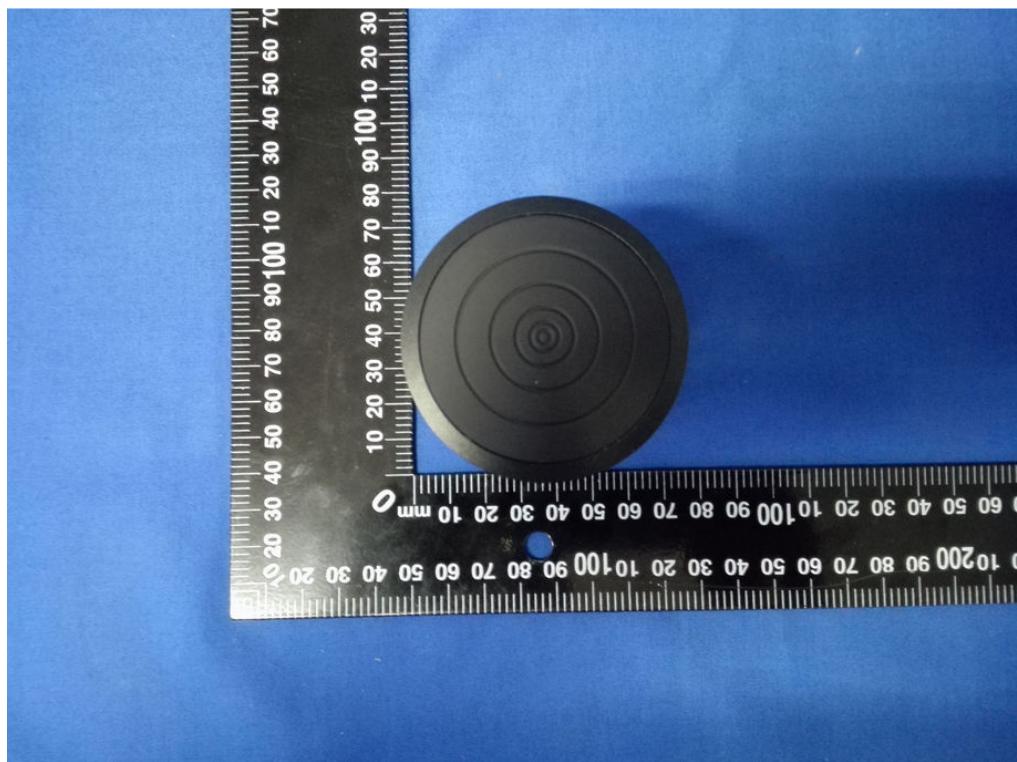
Radiated Emission Test

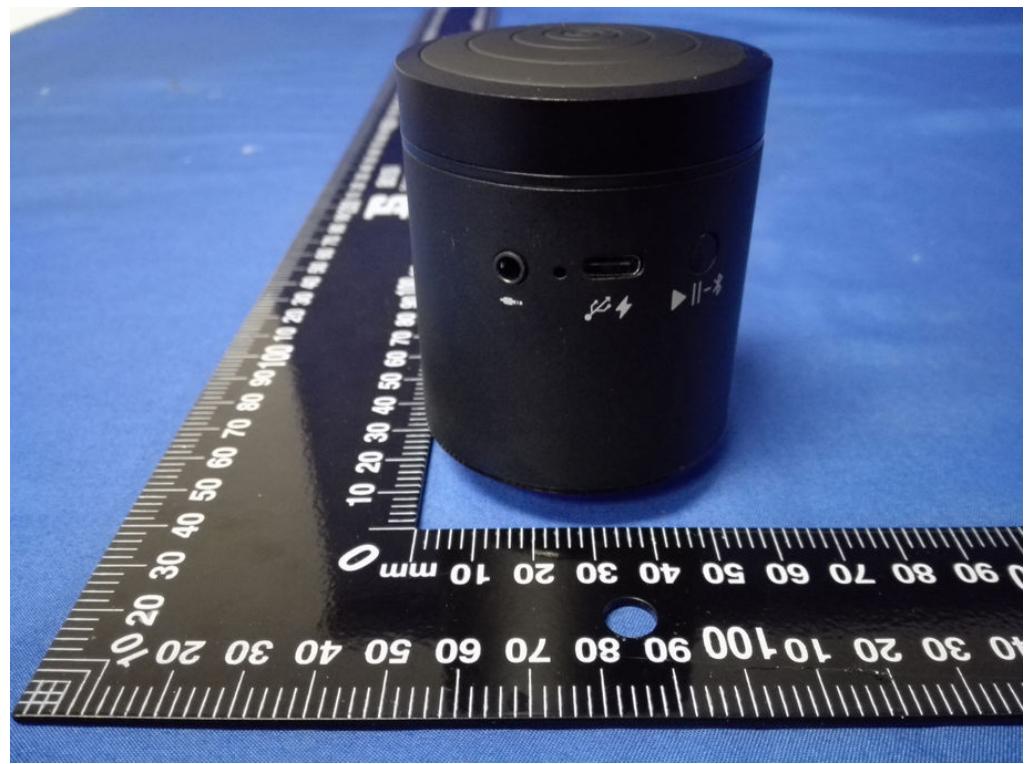
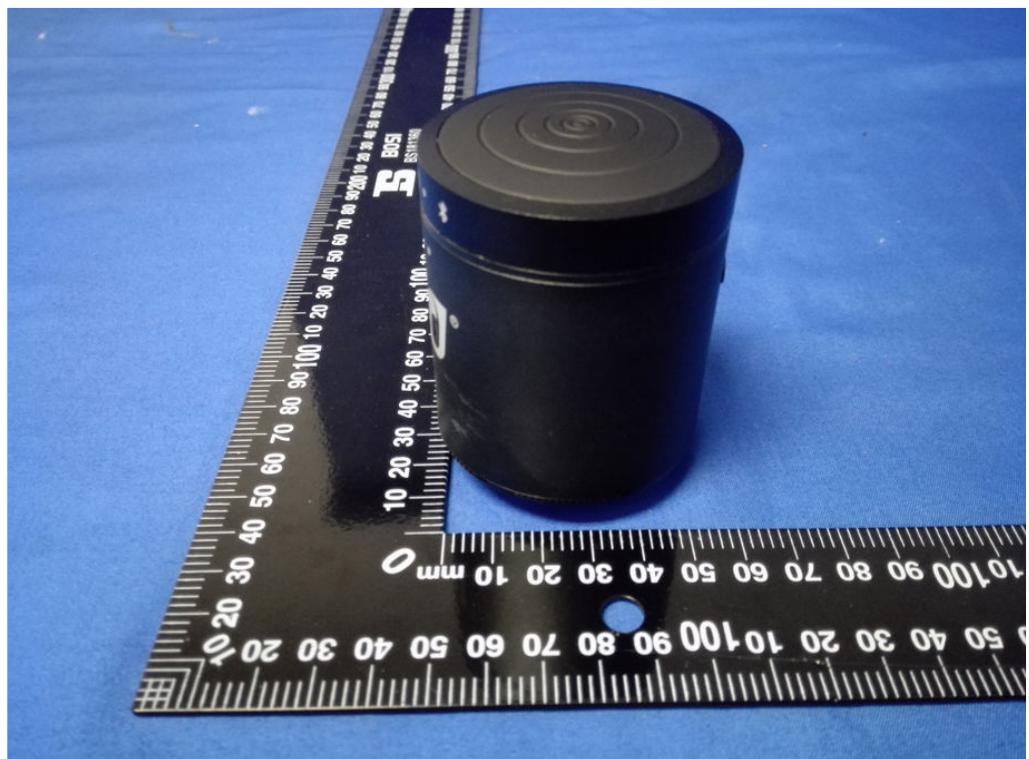


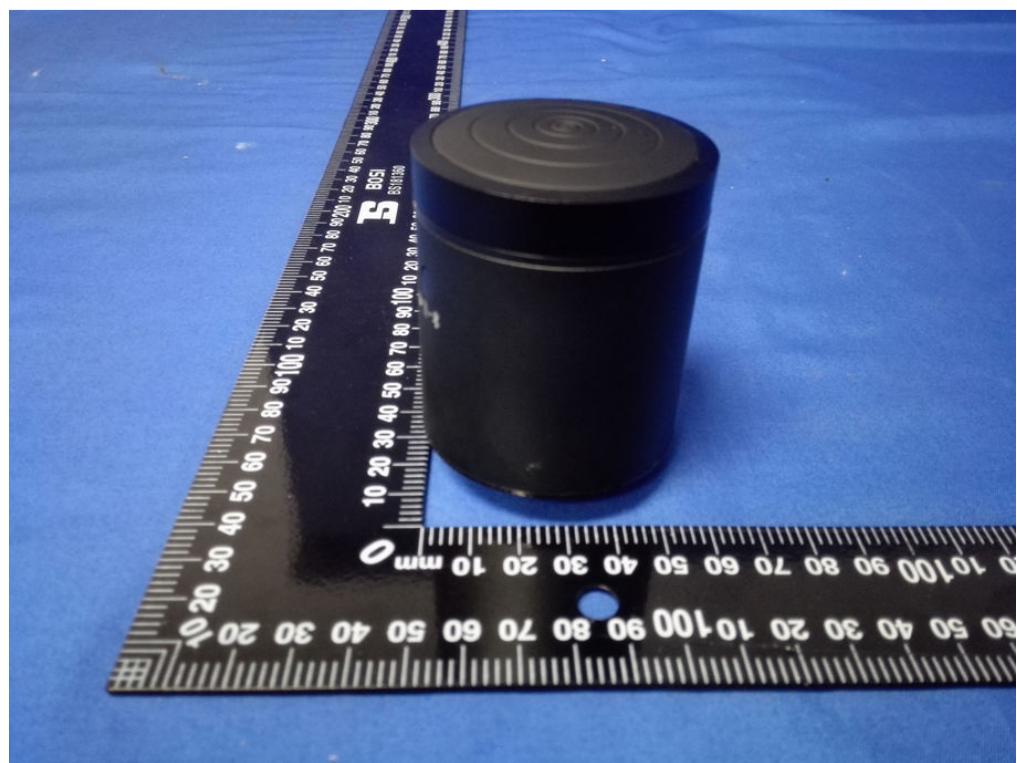
Conducted Emission

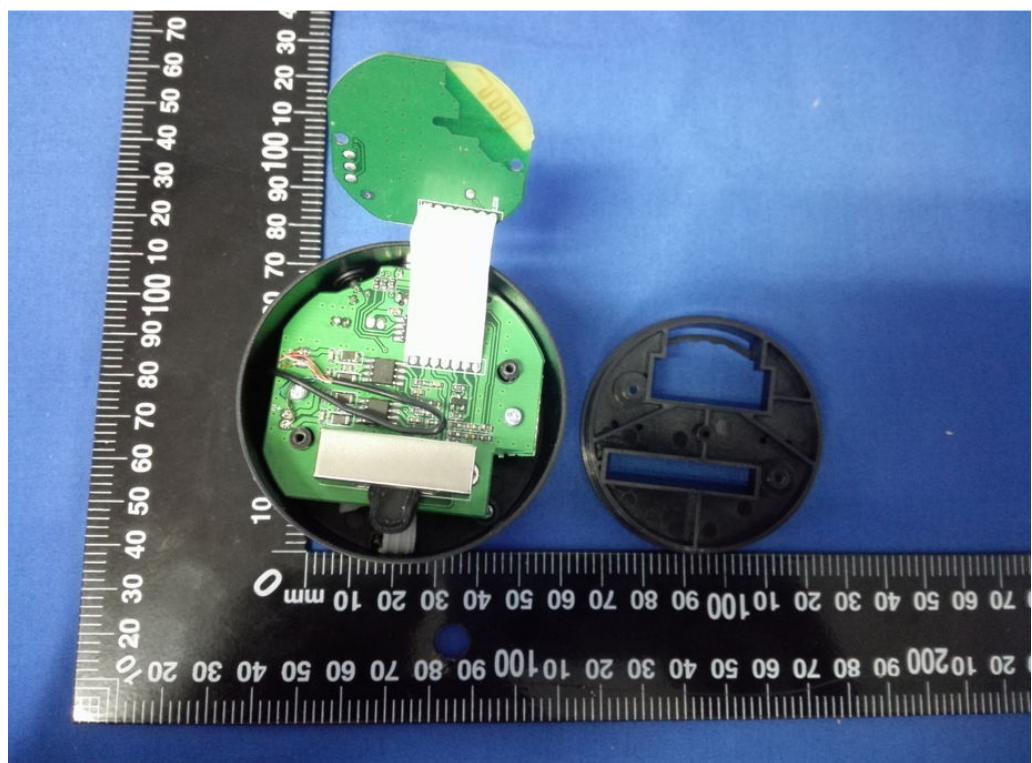
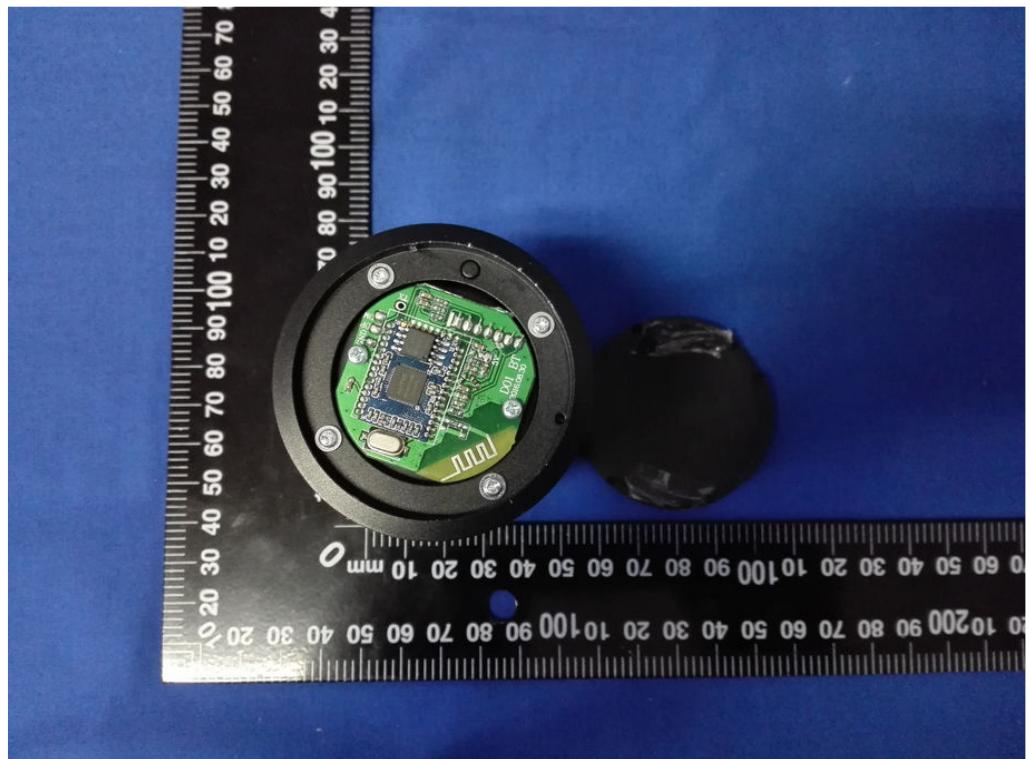


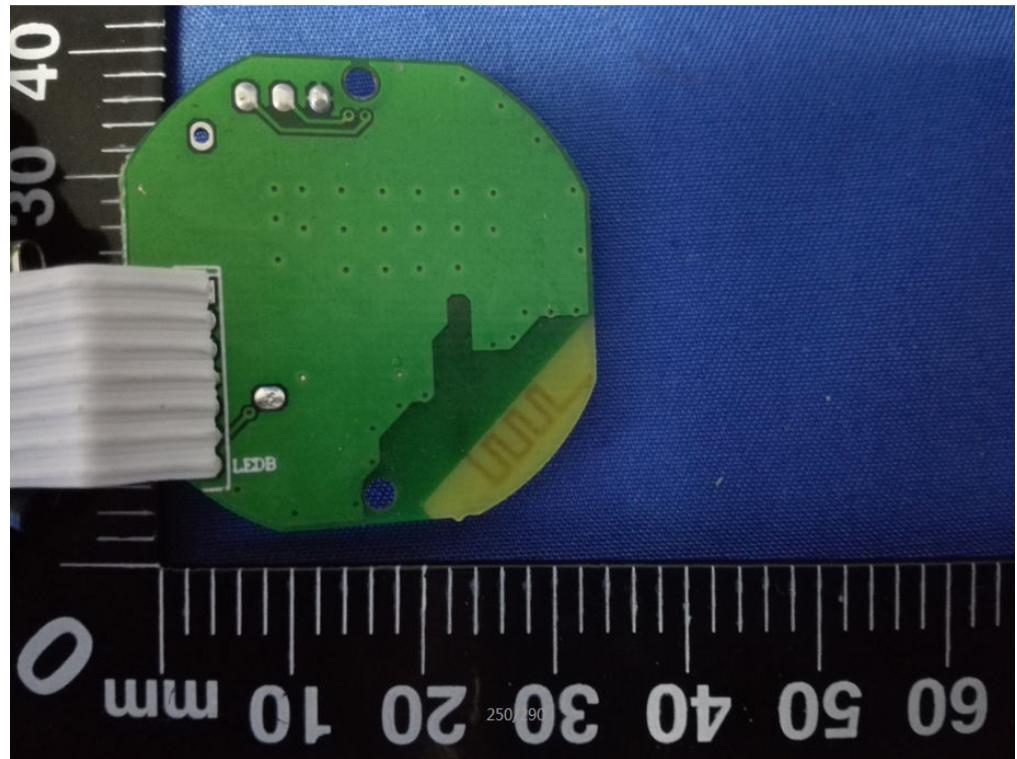
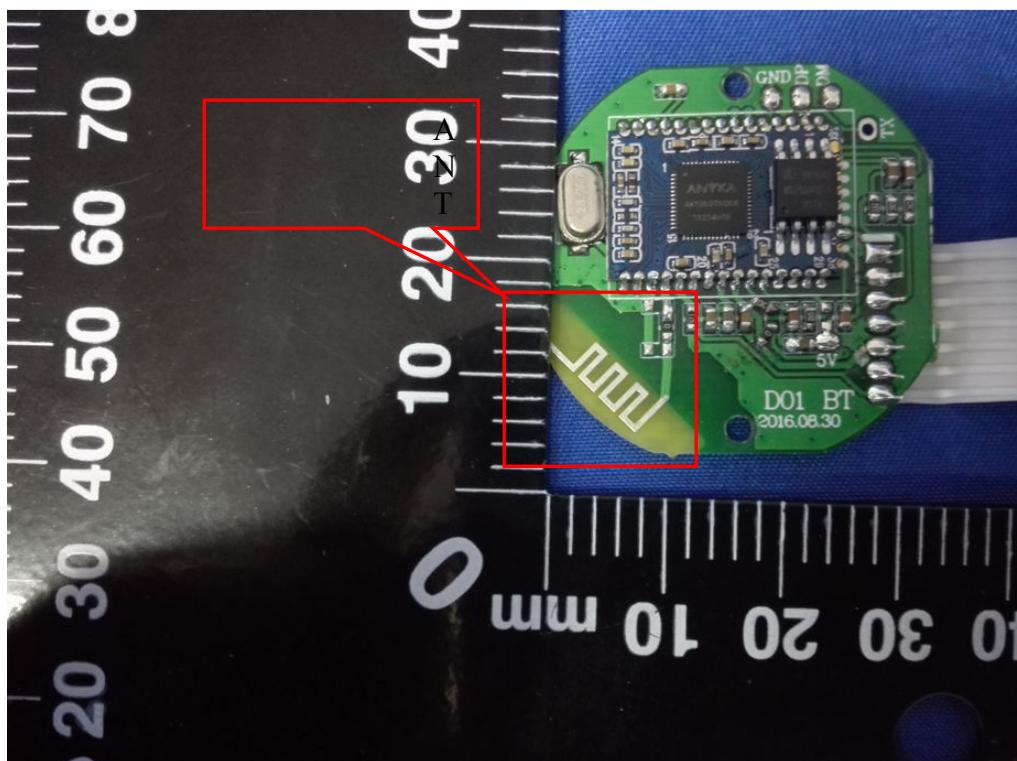
13. PHOTOGRAPHS OF THE EUT

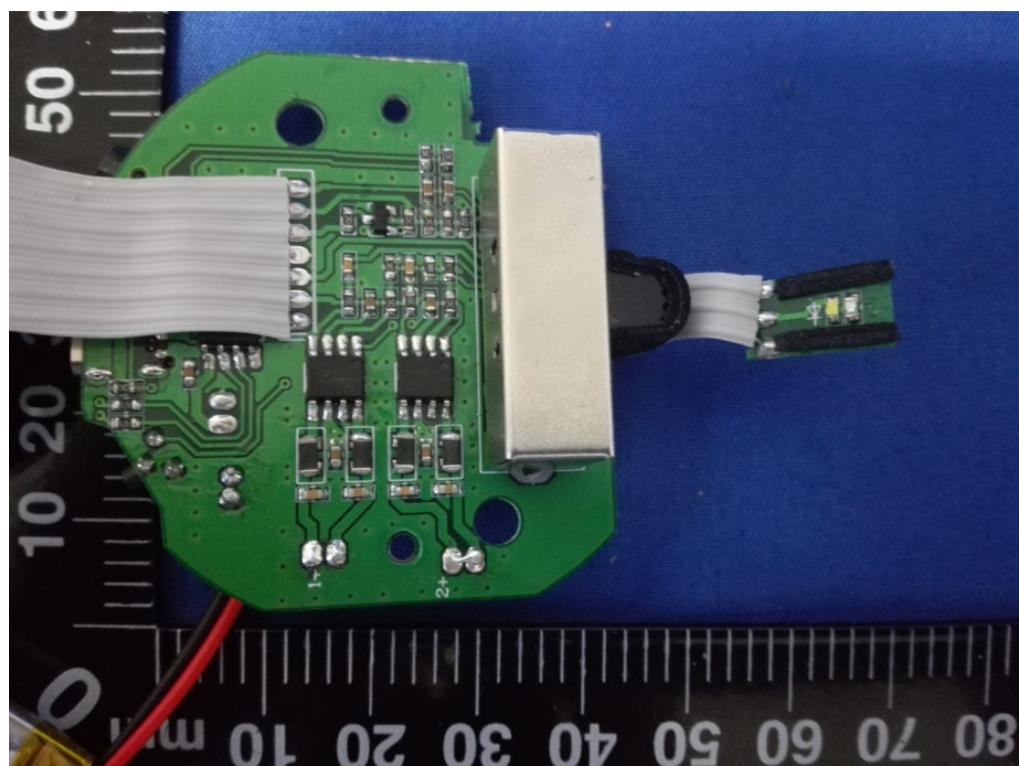
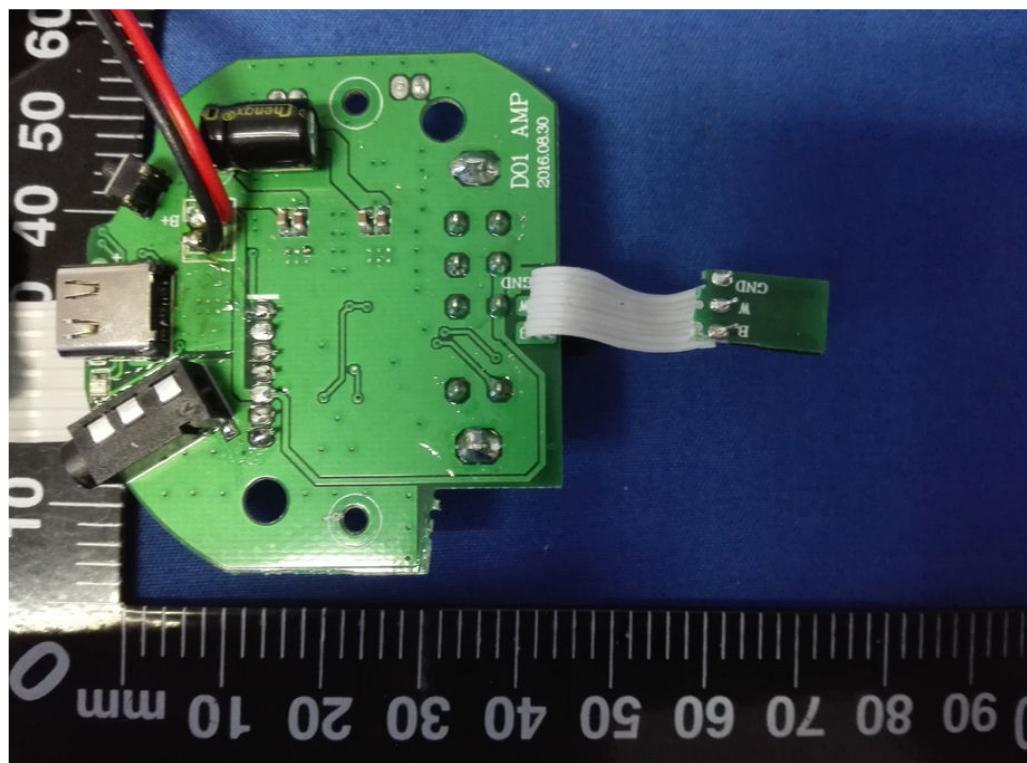


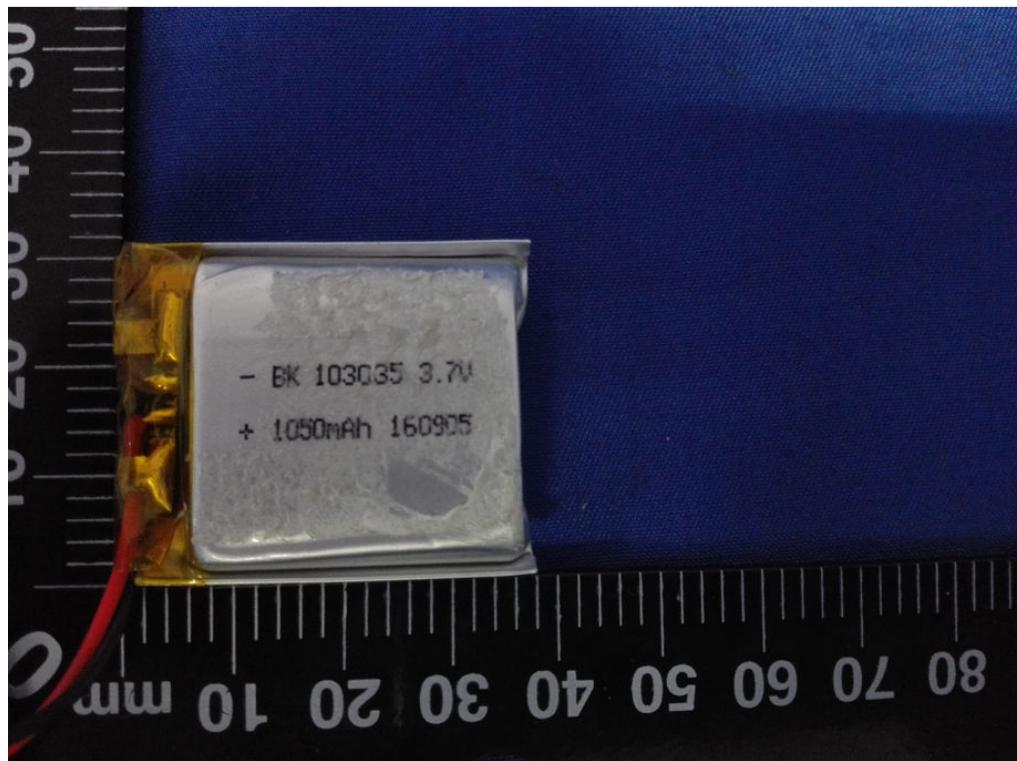
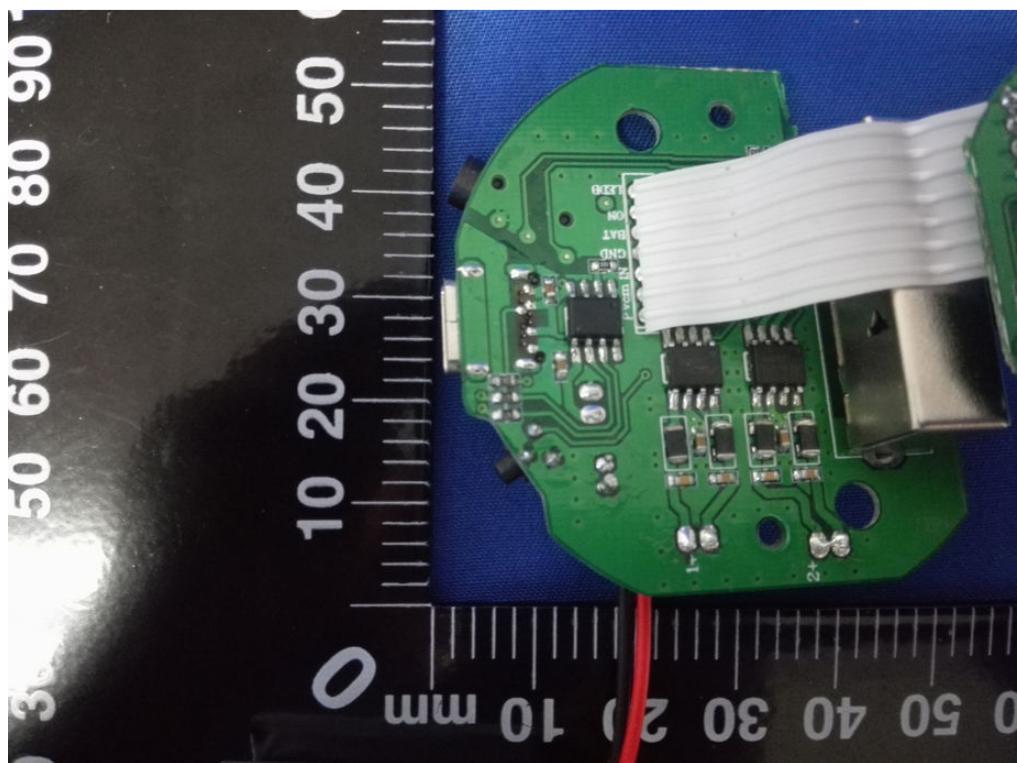












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