

# FCC TEST REPORT(Bluetooth)

for

SHENZHEN S&G INTERNATIONAL LTD

Levitating Bluetooth Speaker

Model Number: SGL001, SGL002, SGL003, SGL004, SGL005

FCC ID: 2AEGTSGL001

Prepared for : SHENZHEN S&G INTERNATIONAL LTD  
Address : 4F, No.8 Bldg, Weidonglong Industry Zone, Qinghu,  
Longhua, Shenzhen, P.R.China

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Report No. : 15KWE033147F  
Date of Test : Mar. 22~25, 2015  
Date of Report : Mar. 26, 2015

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# Keyway Testing Technology Co., Ltd.

<b>Applicant:</b> <b>Address:</b>	SHENZHEN S&G INTERNATIONAL LTD 4F, No.8 Bldg, Weidonglong Industry Zone, Qinghu, Longhua, Shenzhen, P.R.China		
<b>Manufacturer:</b> <b>Address:</b>	V-PHOTRON TECHNOLOGY(SHENZHEN) CO., LTD 4F, No.8 Bldg, Weidonglong Industry Zone, Qinghu, Longhua, Shenzhen, P.R.China		
<b>E.U.T:</b>	Levitating Bluetooth Speaker		
<b>Model Number:</b>	SGL001, SGL002, SGL003, SGL004, SGL005		
<b>Trade Name:</b>	-----	<b>Serial No.:</b>	01
<b>Date of Receipt:</b>	Mar. 22, 2015	<b>Date of Test:</b>	Mar. 22~25, 2015
<b>Test Specification:</b>	FCC Part 15, Subpart C Section 15.249: 2014 ANSI C63.4:2014		
<b>Test Result:</b>	The equipment under test was found to be compliance with the requirements of the standards applied.		
<b>Issue Date: Mar. 26, 2015</b>			
Tested by:	Reviewed by:	Approved by:	
			
William Huang / Engineer	Andy Gao / Supervisor	Jade Yang / Supervisor	
<b>Other Aspects:</b>	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	15.209 15.249(a)(d)	PASS
20dB Bandwidth	15.249	PASS
Emissions from out of band	15.249(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:	Levitating Bluetooth Speaker
Model No.:	SGL001, SGL002, SGL003, SGL004, SGL005
Operation Frequency:	2402~2480MHz
Channel numbers:	79 Channels
Channel separation:	1M
Modulation technology:	GFSK, PI/4 DPSK, 8DPSK
Antenna Type:	Integral Antenna
Antenna gain:	0dBi
Power supply:	DC 12V from adapter input AC 120V/60Hz
BT version:	4.1
Adapter	M/N: SK02G-1200200C I/P: AC 100-240V 50/60Hz O/P: DC 12V 2A
Hardware version	REV03
Software version	BT001

### 2.3. Difference between Model Numbers

The product was different for outlook color and model number.

### 2.4. Independent Operation Modes

1	Charging Mode		
2	TX Mode	Channel	Frequency
		Low	2402MHz
		Middle	2441MHz
		High	2480MHz
Note: Bluetooth signal has 3 packages DH1, DH3, DH5, DH5 package is largest; we are testing DH5 in the report.			

## 2.5. 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 : Building1, Baishun Industrial Zone, Zhangmutou  
Town, Dongguan, Guangdong, China

## 2.6. List of Test and Measurement Instruments

### 2.6.1. For conducted emission at the mains terminals test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,14	Apr. 27,15
Artificial Mains Network	Rohde&Schwarz	ENV216	101315	Apr. 27,14	Apr. 27,15
Artificial Mains Network (AUX)	Rohde&Schwarz	ENV216	101314	Apr. 27,14	Apr. 27,15
RF Cable	FUJIKURA	3D-2W	944 Cable	Apr. 27,14	Apr. 27,15

### 2.6.2. For radiated emission, 20dB bandwidth, band edge test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde&Schwarz	ESCI	101156	Apr. 27,14	Apr. 26,15
Bilog Antenna (30MHz~1GHz)	ETS-LINDGREEN	3142D	135452	Apr. 27,14	Apr. 26,15
Loop antenna (9kHz~30MHz)	teseq	HLA6120	22032	Apr. 30,14	Apr. 29,15
3m Semi-anechoic Chamber	ETS-LINDGREEN	966	KW01	Apr. 27,14	Apr. 26,15
Signal Amplifier	SONOMA	310	187016	Apr. 27,14	Apr. 26,15
Signal Amplifier	Agilent	8449B	3008A00251	Apr. 27,14	Apr. 26,15
RF Cable	IMRO	IMRO-400	966 Cable 1#	Apr. 27,14	Apr. 26,15
Antenna Connect	Keyway	KW032	032	Apr. 27,14	Apr. 26,15
MULTI-DEVICE Controller	ETS-LINDGREEN	2090	126913	N/A	N/A
Horn Antenna (1GHz ~18GHz)	DAZE	ZN30701	11003	Apr. 27,14	Apr. 26,15
Horn Antenna (18GHz ~26.5GHz)	SCHWARZBECK	BBHA9170	9170-068	Apr. 27,14	Apr. 26,15
Spectrum Analyzer	Agilent	8593E	3911A04271	Apr. 27,14	Apr. 26,15
Spectrum Analyzer	Agilent	E4408B	MY44211125	Apr. 30,14	Apr. 29,15
Signal Amplifier	DAZE	ZN3380C	11001	Apr. 27,14	Apr. 26,15

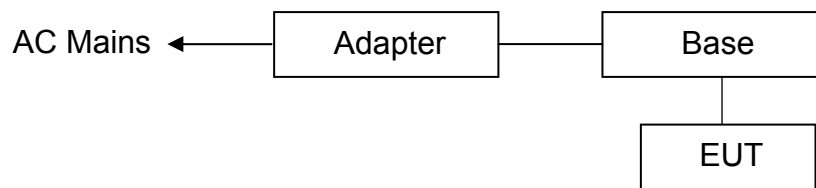
### 3. TEST SET-UP AND OPERATION MODES

#### 3.1. Principle of Configuration Selection

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

#### 3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: Levitating Bluetooth Speaker)

#### 3.3. Test Operation Mode and Test Software

None.

#### 3.4. Special Accessories and Auxiliary Equipment

Base

Model	SGL001
Brand name	Levitating
Input	DC 12V
Output	DC 5V 1A

#### 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. EMISSION TEST RESULTS

### 4.1. Conducted Emission at the Mains Terminals Test

#### 4.1.1. Limit 15.207 limits

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

#### 4.1.2. Test Setup

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

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

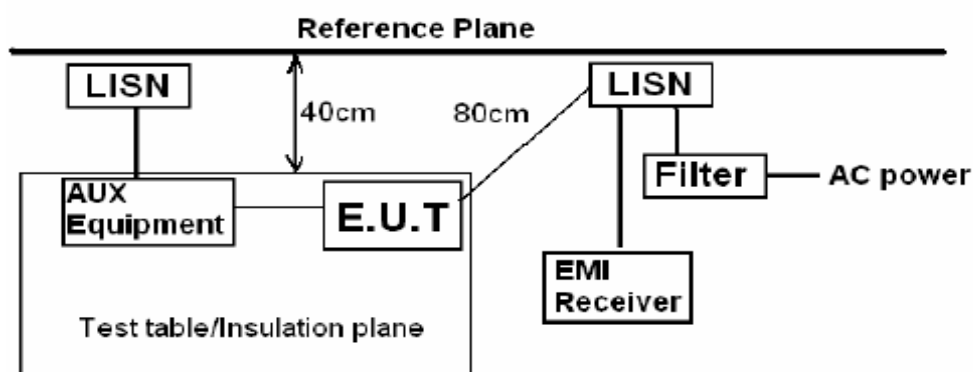
The frequency range from 150 kHz to 30 MHz was investigated.

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

Measurement Uncertainty:  $\pm 2.6$  dB at a level of confidence of 95%.

Pretest for all mode, the worst case was GFSK Low channel and the data was reported on the following page.

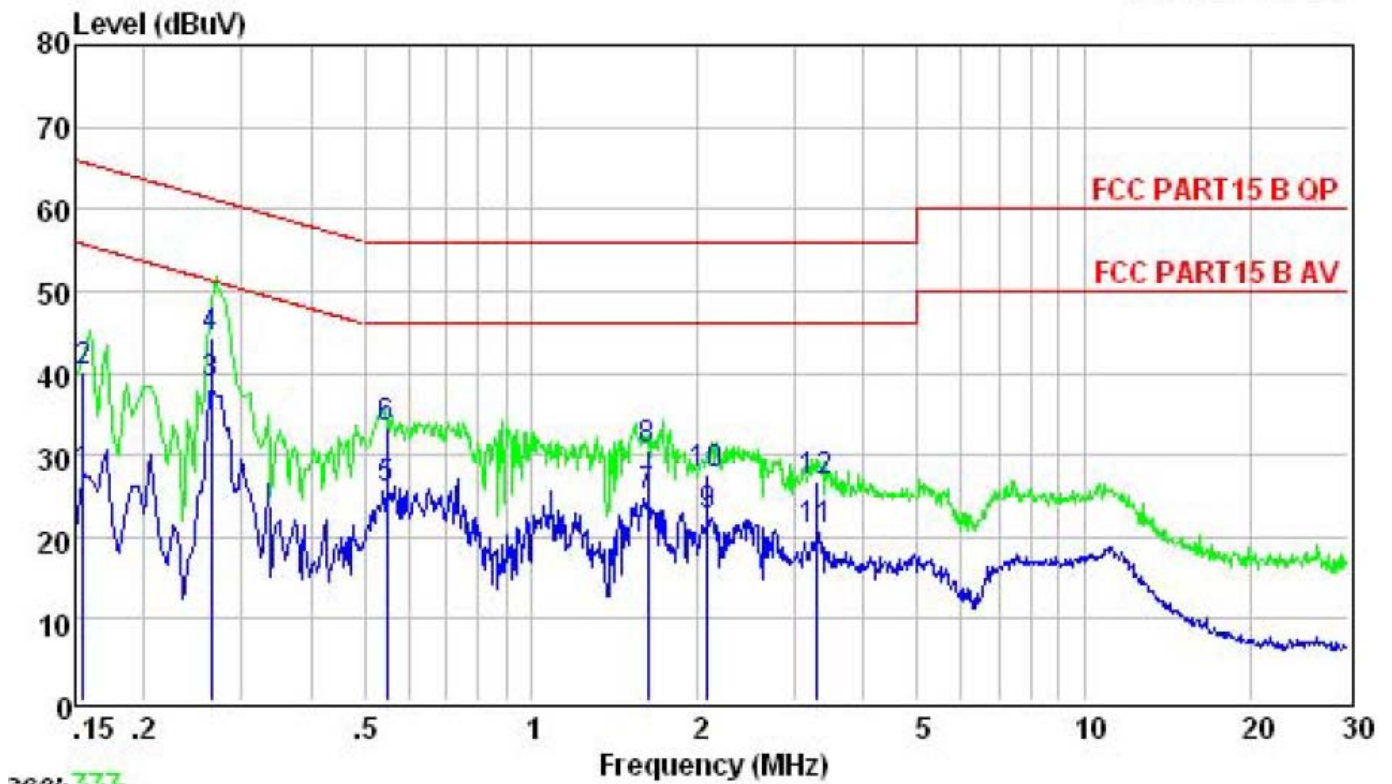
The test voltage is AC 120V/60Hz



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

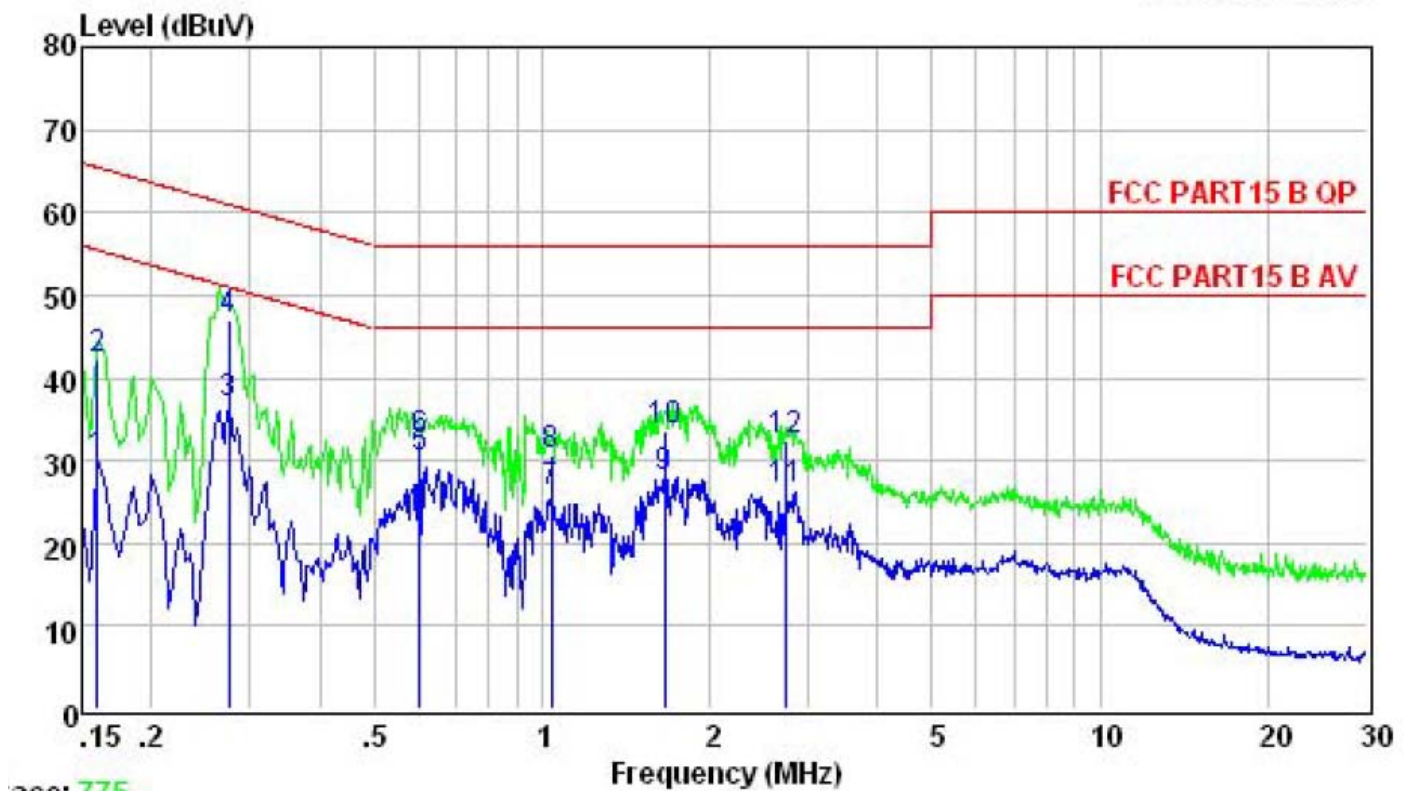


## Line



	Freq	Level	Limit	Over	
	MHz	dBuV	Line	Limit	Remark
	MHz	dBuV	dBuV	dB	
1	0.155	27.69	55.74	-28.05	Average
2	0.155	40.25	65.74	-25.49	QP
3	0.264	38.54	51.29	-12.75	Average
4	0.264	44.42	61.29	-16.87	QP
5	0.549	25.76	46.00	-20.24	Average
6	0.549	33.38	56.00	-22.62	QP
7	1.628	25.10	46.00	-20.90	Average
8	1.628	30.57	56.00	-25.43	QP
9	2.088	22.71	46.00	-23.29	Average
10	2.088	27.69	56.00	-28.31	QP
11	3.293	20.77	46.00	-25.23	Average
12	3.293	26.85	56.00	-29.15	QP

## Neutral



	Freq	Level	Limit	Over	Remark
	MHz	dBuV	Line	Limit	
			dBuV	dB	
1	0.160	30.05	55.47	-25.42	Average
2	0.160	42.12	65.47	-23.35	QP
3	0.274	36.93	50.98	-14.05	Average
4	0.274	46.98	60.98	-14.00	QP
5	0.604	30.30	46.00	-15.70	Average
6	0.604	32.48	56.00	-23.52	QP
7	1.037	26.29	46.00	-19.71	Average
8	1.037	30.57	56.00	-25.43	QP
9	1.662	28.02	46.00	-17.98	Average
10	1.662	33.68	56.00	-22.32	QP
11	2.736	26.41	46.00	-19.59	Average
12	2.736	32.54	56.00	-23.46	QP

## 4.2. Radiated Emission Test

### 4.2.1. Limit 15.209 & 249 limits

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Fundamental Frequency	Field Strength of Fundamental		Field Strength of Harmonics	
	mV/m	dBμV/m	μV/m	dBμV/m
902- 928 MHz	50	94	500	54
2400- 2483.5 MHz	50	94	500	54
5725- 5875 MHz	50	94	500	54
24.0- 24.25GHz	250	108	2500	68

### 4.2.2. Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 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	( <sup>2</sup> )

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

### 4.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector below 1GHz.

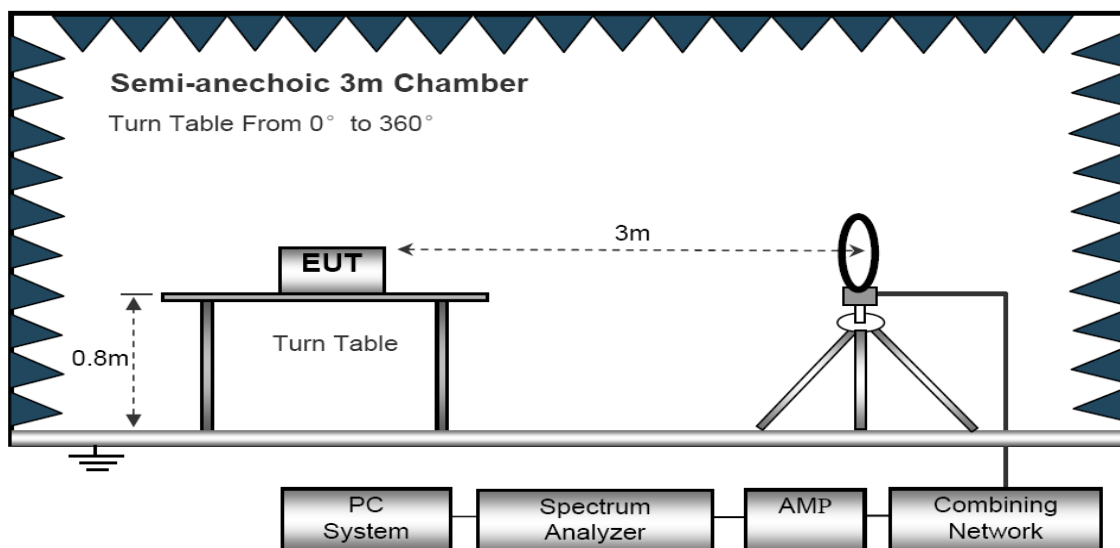
The bandwidth of the EMI test receiver is set at 10kHz for frequency range from 9kHz to 30 MHz, 120kHz for frequency range from 30MHz to 1000 MHz.

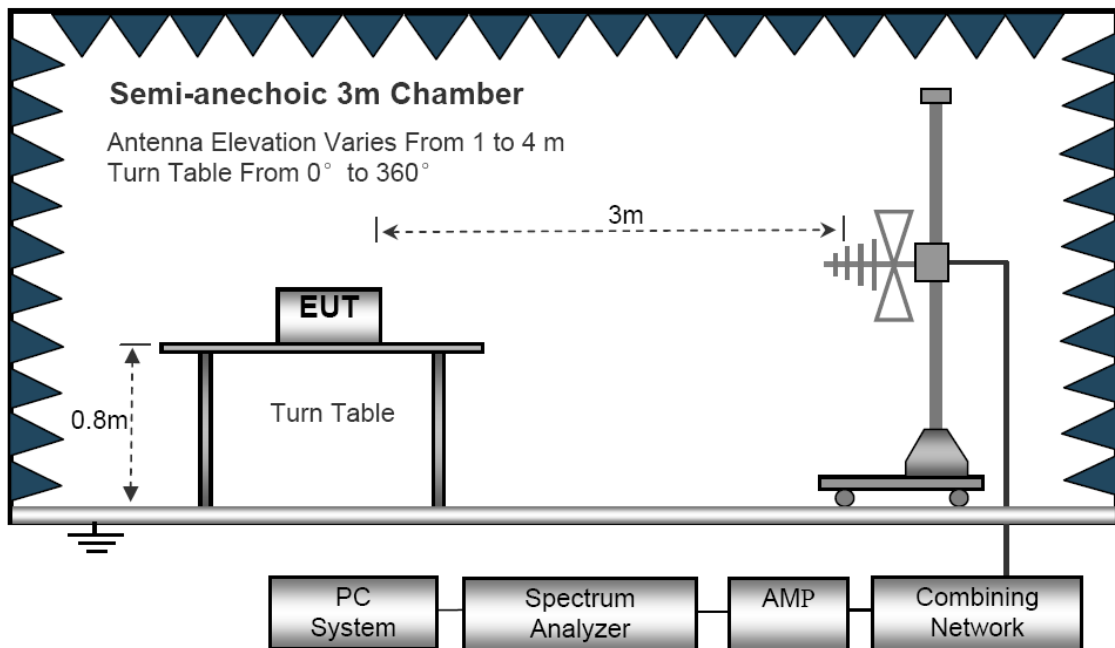
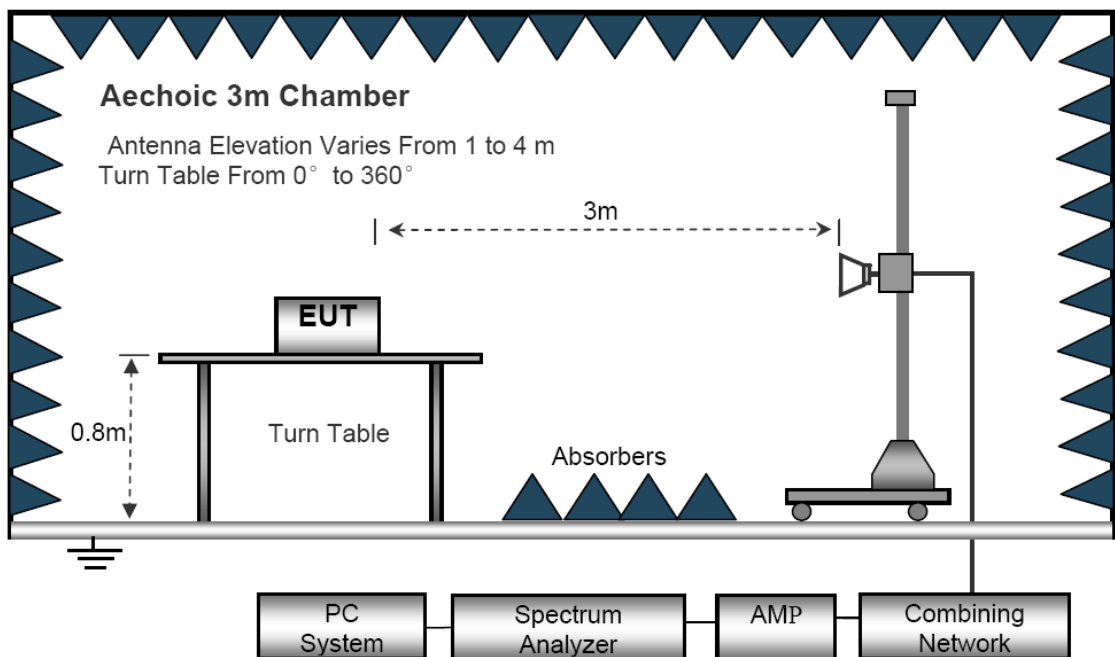
The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz.

The frequency range from 9kHz to 10<sup>th</sup> 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. For all test, used peak detector.

- Notes: 1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamplifier Factor.
2. Measurement Uncertainty:  $\pm 3.2$  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, the worst case was GFSK low channel and the data was reported on the following page.
  5. During the test, pre-scan the GFSK, Pi/4DPSK, 8DPSK modulation, and found the 8DPSK modulation which it is worse case.
  6. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis which it is worse case.
  7. The emission below 30MHz was background noise and met the limit, so no data show it.

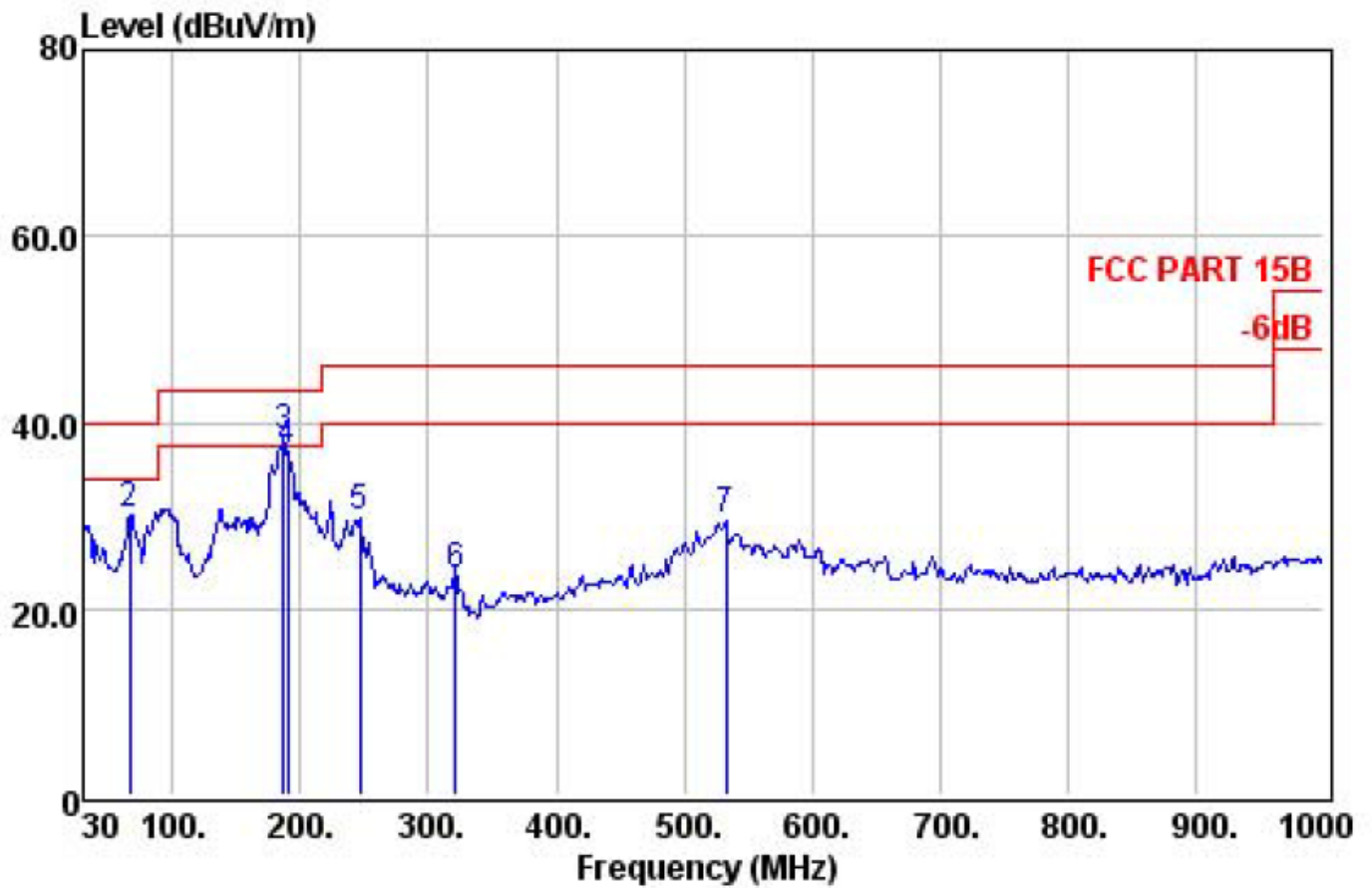
#### Below 30MHz



**30MHz~1GHz****Above 1GHz**

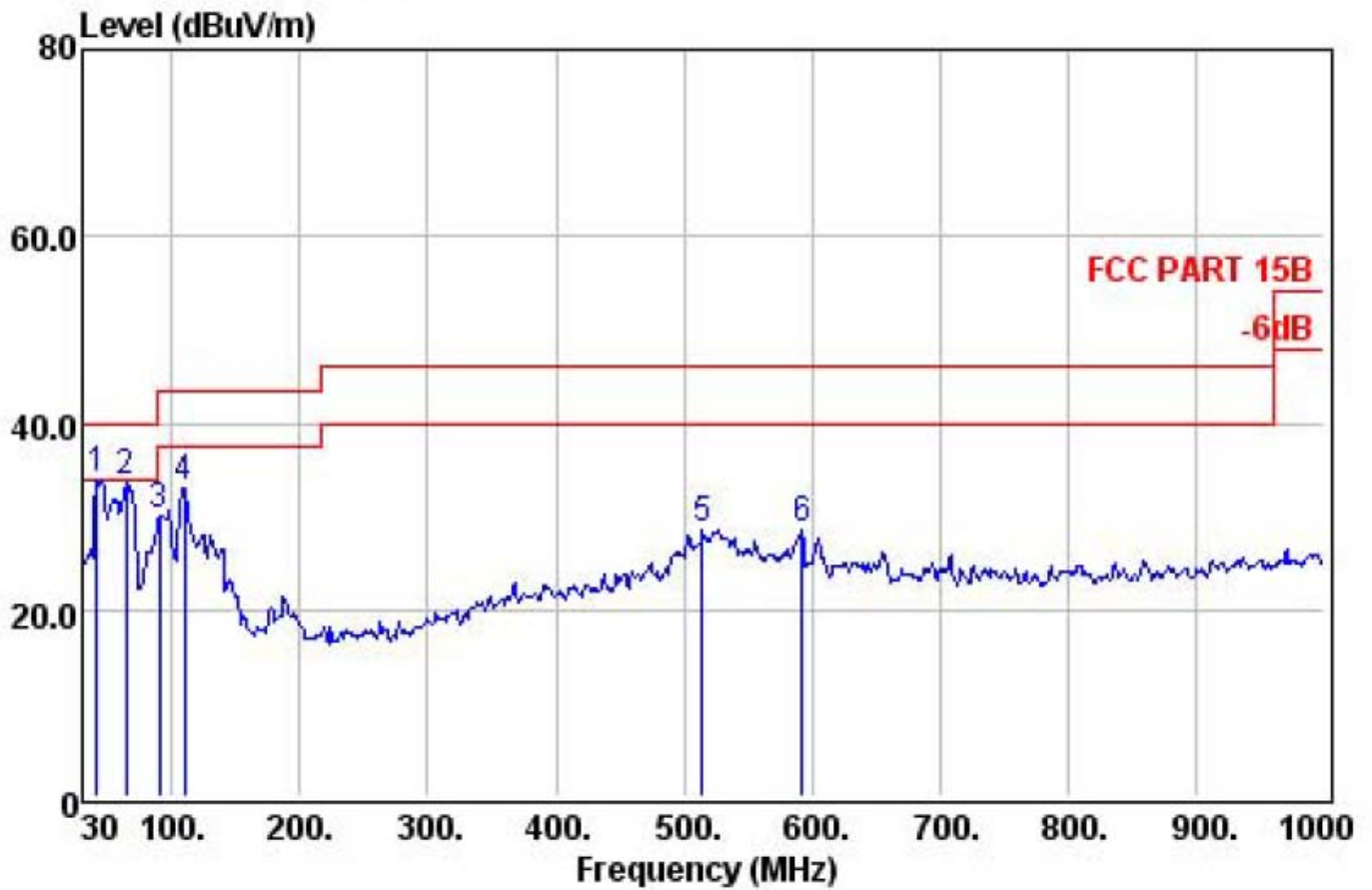


Below 1GHz  
GFSK Low channel Horizontal polarizations



	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	30.00	31.41	42.93	0.56	18.80	30.88	40.00	-9.12	QP
2	66.86	31.31	53.05	0.85	7.44	30.03	40.00	-9.97	QP
3	187.14	31.13	57.92	1.39	10.19	38.37	43.50	-5.13	QP
4	190.05	31.12	56.51	1.39	10.10	36.88	43.50	-6.62	QP
5	246.31	30.96	46.28	1.70	12.80	29.82	46.00	-16.18	QP
6	321.00	30.84	37.88	2.02	14.39	23.45	46.00	-22.55	QP
7	532.46	30.76	37.78	3.03	19.29	29.34	46.00	-16.66	QP

## GFSK Low channel Vertical polarizations



	Freq	Preamp Factor	Read Level	Cable&Antenna Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	41.64	31.38	52.38	0.56	12.23	33.79	40.00	-6.21	QP
2	63.95	31.32	56.87	0.75	7.38	33.68	40.00	-6.32	QP
3	90.14	31.35	51.48	0.94	9.11	30.18	43.50	-13.32	QP
4	109.54	31.31	54.10	1.03	9.31	33.13	43.50	-10.37	QP
5	515.00	30.63	37.29	2.94	19.00	28.60	46.00	-17.40	QP
6	592.60	30.68	35.50	3.29	20.36	28.47	46.00	-17.53	QP

## Above 1GHz

## 8DPSK 2402MHz Horizontal polarizations

	Freq	Preamplifier	Read	Cable	Antenna		Limit	Over	
		Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.53	7.34	28.72	89.27	94.00	-4.73	Average
2	2402.00	26.32	92.59	7.34	28.72	102.33	114.00	-11.67	Peak
3	4804.00	27.49	31.93	11.96	32.94	49.34	74.00	-24.66	Peak
4	9245.00	28.50	17.81	16.90	37.69	43.90	74.00	-30.10	Peak
5	12118.00	29.02	16.63	17.47	39.42	44.50	74.00	-29.50	Peak
6	14719.00	29.51	14.30	19.83	39.69	44.31	74.00	-29.69	Peak

## 8DPSK 2402MHz Vertical polarizations

	Freq	Preamplifier	Read	Cable	Antenna		Limit	Over	
		Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	80.02	7.34	28.72	89.76	94.00	-4.24	Average
2	2402.00	26.32	92.74	7.34	28.72	102.48	114.00	-11.52	Peak
3	4804.00	27.49	32.06	11.96	32.94	49.47	74.00	-24.53	Peak
4	8293.00	28.19	17.96	16.72	36.63	43.12	74.00	-30.88	Peak
5	12917.00	29.18	16.08	18.14	40.50	45.54	74.00	-28.46	Peak
6	14719.00	29.51	15.34	19.83	39.69	45.35	74.00	-28.65	Peak

## 8DPSK 2441MHz Horizontal polarizations

	Freq	Preamplifier	Read	Cable	Antenna		Limit	Over	
		Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.77	7.48	28.76	89.68	94.00	-4.32	Average
2	2441.00	26.33	92.47	7.48	28.76	102.38	114.00	-11.62	Peak
3	4882.00	27.53	32.01	12.14	33.11	49.73	74.00	-24.27	Peak
4	7358.00	27.97	16.00	16.62	37.34	41.99	74.00	-32.01	Peak
5	10690.00	28.87	17.94	17.10	39.31	45.48	74.00	-28.52	Peak
6	15008.00	29.55	16.38	20.01	38.50	45.34	74.00	-28.66	Peak



**8DPSK 2441MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.87	7.48	28.76	89.78	94.00	-4.22	Average
2	2441.00	26.33	92.68	7.48	28.76	102.59	114.00	-11.41	Peak
3	4882.00	27.53	32.12	12.14	33.11	49.84	74.00	-24.16	Peak
4	7477.00	27.99	16.73	16.63	37.39	42.76	74.00	-31.24	Peak
5	10775.00	28.88	12.66	17.12	39.37	40.27	74.00	-33.73	Peak
6	14804.00	29.52	15.46	19.87	39.34	45.15	74.00	-28.85	Peak

**8DPSK 2480MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.56	7.57	28.79	89.58	94.00	-4.42	Average
2	2480.00	26.34	92.51	7.57	28.79	102.53	114.00	-11.47	Peak
3	4960.00	27.58	31.23	12.36	33.32	49.33	74.00	-24.67	Peak
4	7545.00	28.01	14.80	16.63	37.30	40.72	74.00	-33.28	Peak
5	10826.00	28.88	14.83	17.13	39.40	42.48	74.00	-31.52	Peak
6	12985.00	29.20	12.84	18.20	40.66	42.50	74.00	-31.50	Peak

**8DPSK 2480MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.55	7.57	28.79	89.57	94.00	-4.43	Average
2	2480.00	26.34	92.85	7.57	28.79	102.87	114.00	-11.13	Peak
3	4960.00	27.58	31.56	12.36	33.32	49.66	74.00	-24.34	Peak
4	7069.00	27.91	17.38	16.60	37.23	43.30	74.00	-30.70	Peak
5	9823.00	28.73	17.27	16.95	38.26	43.75	74.00	-30.25	Peak
6	15552.00	29.63	14.89	20.35	38.60	44.21	74.00	-29.79	Peak

**GFSK 2402MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.31	7.34	28.72	89.05	94.00	-4.95	Average
2	2402.00	26.32	91.83	7.34	28.72	101.57	114.00	-12.43	Peak
3	4804.00	27.49	31.83	11.96	32.94	49.24	74.00	-24.76	Peak
4	7069.00	27.91	17.65	16.60	37.23	43.57	74.00	-30.43	Peak
5	11540.00	28.95	10.57	17.27	39.87	38.76	74.00	-35.24	Peak
6	14804.00	29.52	14.48	19.87	39.34	44.17	74.00	-29.83	Peak

**GFSK 2402MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.59	7.34	28.72	89.33	94.00	-4.67	Average
2	2402.00	26.32	91.59	7.34	28.72	101.33	114.00	-12.67	Peak
3	4804.00	27.49	31.71	11.96	32.94	49.12	74.00	-24.88	Peak
4	8259.00	28.18	16.04	16.71	36.61	41.18	74.00	-32.82	Peak
5	12985.00	29.20	14.84	18.20	40.66	44.50	74.00	-29.50	Peak
6	15960.00	29.69	13.74	20.62	40.17	44.84	74.00	-29.16	Peak

**GFSK 2441MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.36	7.48	28.76	89.27	94.00	-4.73	Average
2	2441.00	26.33	91.16	7.48	28.76	101.07	114.00	-12.93	Peak
3	4882.00	27.53	31.63	12.14	33.11	49.35	74.00	-24.65	Peak
4	9092.00	28.43	19.06	16.89	37.50	45.02	74.00	-28.98	Peak
5	11370.00	28.94	14.49	17.24	39.79	42.58	74.00	-31.42	Peak
6	14481.00	29.47	13.69	19.67	40.70	44.59	74.00	-29.41	Peak

**GFSK 2441MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.36	7.48	28.76	89.27	94.00	-4.73	Average
2	2441.00	26.33	91.45	7.48	28.76	101.36	114.00	-12.64	Peak
3	4882.00	27.53	31.66	12.14	33.11	49.38	74.00	-24.62	Peak
4	7443.00	27.99	16.77	16.62	37.38	42.78	74.00	-31.22	Peak
5	10605.00	28.86	16.27	17.09	39.26	43.76	74.00	-30.24	Peak
6	14107.00	29.42	12.44	19.43	42.90	45.35	74.00	-28.65	Peak

**GFSK 2480MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.37	7.57	28.79	89.39	94.00	-4.61	Average
2	2480.00	26.34	91.22	7.57	28.79	101.24	114.00	-12.76	Peak
3	4960.00	27.58	30.84	12.36	33.32	48.94	74.00	-25.06	Peak
4	7477.00	27.99	16.52	16.63	37.39	42.55	74.00	-31.45	Peak
5	9704.00	28.68	10.03	16.94	38.17	36.46	74.00	-37.54	Peak
6	13818.00	29.36	9.30	19.14	43.32	42.40	74.00	-31.60	Peak

**GFSK 2480MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.05	7.57	28.79	89.07	94.00	-4.93	Average
2	2480.00	26.34	91.31	7.57	28.79	101.33	114.00	-12.67	Peak
3	4960.00	27.58	30.44	12.36	33.32	48.54	74.00	-25.46	Peak
4	8208.00	28.16	18.07	16.70	36.57	43.18	74.00	-30.82	Peak
5	10945.00	28.89	15.68	17.16	39.47	43.42	74.00	-30.58	Peak
6	14974.00	29.55	13.77	19.99	38.64	42.85	74.00	-31.15	Peak

**PI/4DPSK 2402MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.68	7.34	28.72	89.42	94.00	-4.58	Average
2	2402.00	26.32	91.60	7.34	28.72	101.34	114.00	-12.66	Peak
3	4804.00	27.49	31.78	11.96	32.94	49.19	74.00	-24.81	Peak
4	6831.00	27.87	16.60	16.60	36.75	42.08	74.00	-31.92	Peak
5	9483.00	28.59	15.98	16.92	37.98	42.29	74.00	-31.71	Peak
6	13087.00	29.22	12.11	18.32	41.10	42.31	74.00	-31.69	Peak

**PI/4DPSK 2402MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2402.00	26.32	79.45	7.34	28.72	89.19	94.00	-4.81	Average
2	2402.00	26.32	91.59	7.34	28.72	101.33	114.00	-12.67	Peak
3	4804.00	27.49	31.71	11.96	32.94	49.12	74.00	-24.88	Peak
4	6712.00	27.84	15.64	16.60	36.44	40.84	74.00	-33.16	Peak
5	9619.00	28.65	16.27	16.93	38.10	42.65	74.00	-31.35	Peak
6	12985.00	29.20	14.84	18.20	40.66	44.50	74.00	-29.50	Peak

**PI/4DPSK 2441MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.47	7.48	28.76	89.38	94.00	-4.62	Average
2	2441.00	26.33	91.27	7.48	28.76	101.18	114.00	-12.82	Peak
3	4882.00	27.53	31.49	12.14	33.11	49.21	74.00	-24.79	Peak
4	7137.00	27.93	15.91	16.60	37.26	41.84	74.00	-32.16	Peak
5	10231.00	28.82	18.32	17.01	38.77	45.28	74.00	-28.72	Peak
6	13376.00	29.27	13.48	18.65	42.44	45.30	74.00	-28.70	Peak

**PI/4DPSK 2441MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	79.52	7.48	28.76	89.43	94.00	-4.57	Average
2	2441.00	26.33	91.66	7.48	28.76	101.57	114.00	-12.43	Peak
3	4882.00	27.53	31.57	12.14	33.11	49.29	74.00	-24.71	Peak
4	7341.00	27.97	16.69	16.62	37.34	42.68	74.00	-31.32	Peak
5	11370.00	28.94	15.14	17.24	39.79	43.23	74.00	-30.77	Peak
6	13546.00	29.31	10.25	18.83	43.05	42.82	74.00	-31.18	Peak

**PI/4DPSK 2480MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.62	7.57	28.79	89.64	94.00	-4.36	Average
2	2480.00	26.34	91.45	7.57	28.79	101.47	114.00	-12.53	Peak
3	4960.00	27.58	31.11	12.36	33.32	49.21	74.00	-24.79	Peak
4	7103.00	27.92	15.71	16.60	37.24	41.63	74.00	-32.37	Peak
5	11455.00	28.95	12.90	17.26	39.86	41.07	74.00	-32.93	Peak
6	14770.00	29.52	12.99	19.85	39.48	42.80	74.00	-31.20	Peak

**PI/4DPSK 2480MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	CableAntenna Loss	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	79.30	7.57	28.79	89.32	94.00	-4.68	Average
2	2480.00	26.34	91.59	7.57	28.79	101.61	114.00	-12.39	Peak
3	4960.00	27.58	31.22	12.36	33.32	49.32	74.00	-24.68	Peak
4	7018.00	27.90	17.62	16.60	37.21	43.53	74.00	-30.47	Peak
5	10129.00	28.81	16.07	16.99	38.61	42.86	74.00	-31.14	Peak
6	13818.00	29.36	10.96	19.14	43.32	44.06	74.00	-29.94	Peak

## 5. 20DB OCCUPY BANDWIDTH

### 5.1. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 5.2. Test setup

1. Set the RBW =100kHz.
2. Set the VBW = 300kHz
3. Span=3MHz
4. Detector = peak.
5. Sweep time = auto couple.
6. Allow trace to fully stabilize, and view the plot.
7. Measure and record the result in the test report.

Measurement Uncertainty:  $\pm 500\text{kHz}$  at a level of confidence of 95%..

Test data:

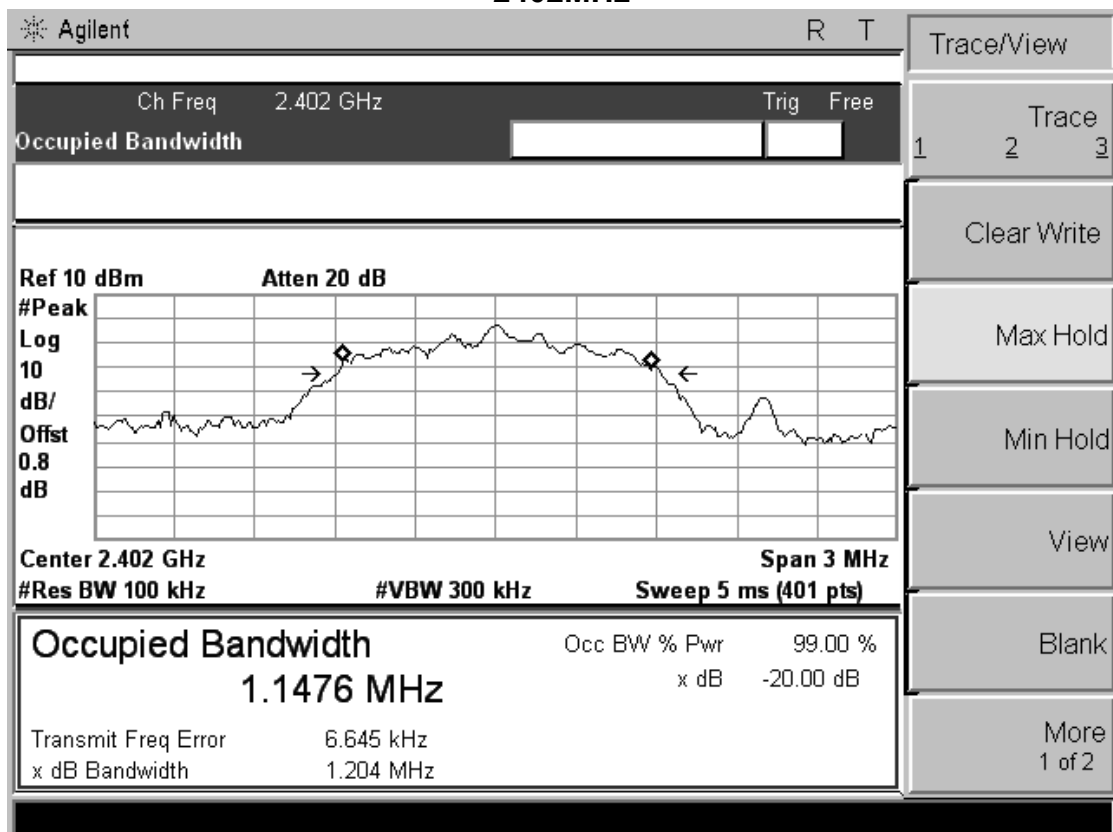
	Channel Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2402	0.865	Pass
	2441	0.893	Pass
	2480	0.881	Pass
PI/4 DPSK	2402	1.201	Pass
	2441	1.198	Pass
	2480	1.201	Pass
8DPSK	2402	1.204	Pass
	2441	1.201	Pass
	2480	1.225	Pass

Test plot as follows:

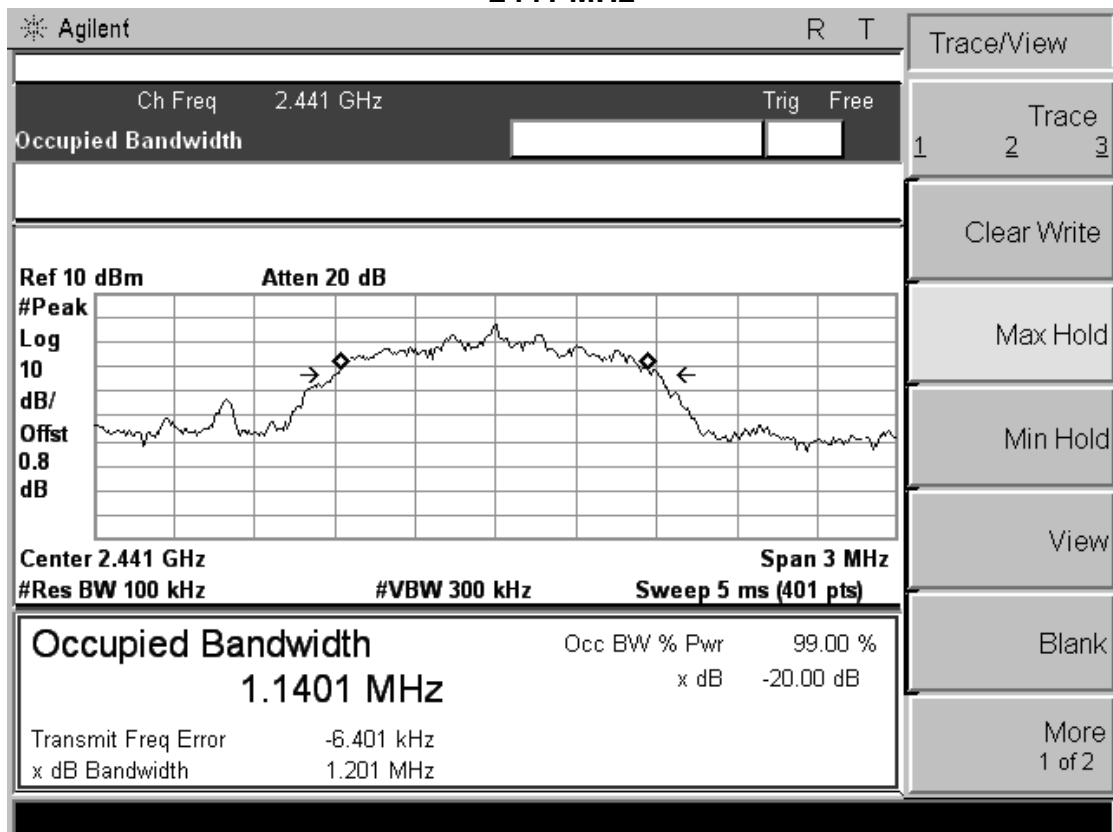
The data only show the worst mode

8DPSK

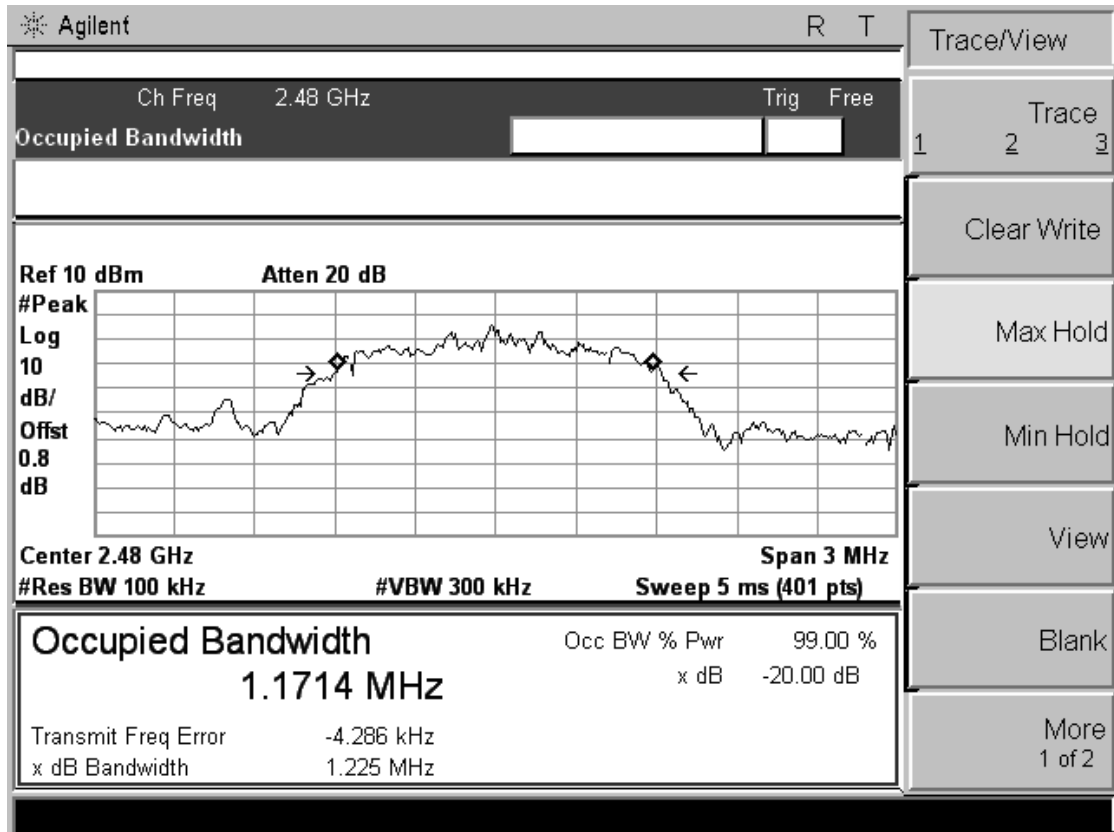
2402MHz



2441 MHz



## 2480 MHz





## 6. BAND EDGE COMPLIANCE TEST

### 6.1. Limits

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.

### 6.2. Test setup

The EUT was placed on a turn table which was 0.8 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

The 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. For all test, used peak detector.

Measurement Uncertainty:  $\pm 3.2$  dB at a level of confidence of 95%.

Test data as follows:

	Frequency (MHz)	Antenna polarization (H/V)	Test Frequency (MHz)	Emission (dBuV/m)	Band edge Limit (dBuV/m)		Result
				PK	PK	AV	
Hopping	<2400	H	2438.87	50.31	74.00	54.00	Pass
	<2400	V	2438.15	49.87	74.00	54.00	Pass
	>2483.5	H	2485.31	50.03	74.00	54.00	Pass
	>2483.5	V	2485.63	50.36	74.00	54.00	Pass
Unhopping	<2400	H	2439.74	49.85	74.00	54.00	Pass
	<2400	V	2438.97	50.29	74.00	54.00	Pass
	>2483.5	H	2484.49	50.43	74.00	54.00	Pass
	>2483.5	V	2486.94	49.93	74.00	54.00	Pass

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

We pretest all mode, the worst mode was GFSK.

## 7. ANTENNA REQUIREMENTS

### 7.1. 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.

### 7.2. Result

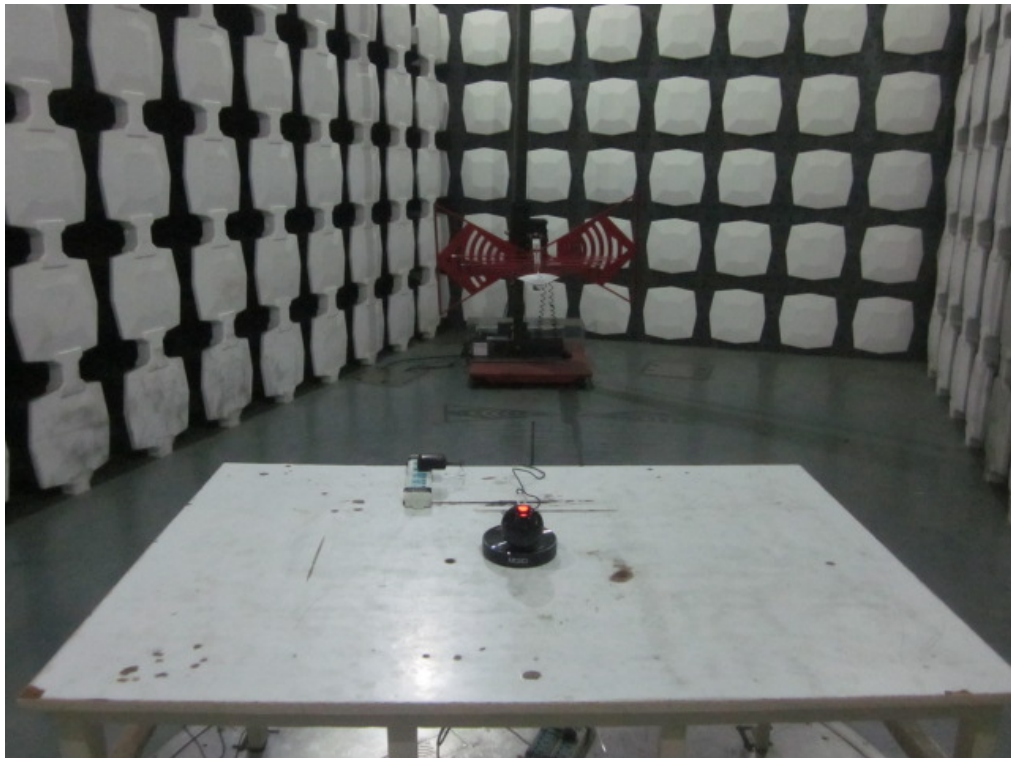
The antennas used for this product are PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0dBi.

## 8. PHOTOGRAPHS OF TEST SET-UP

Conducted Emission



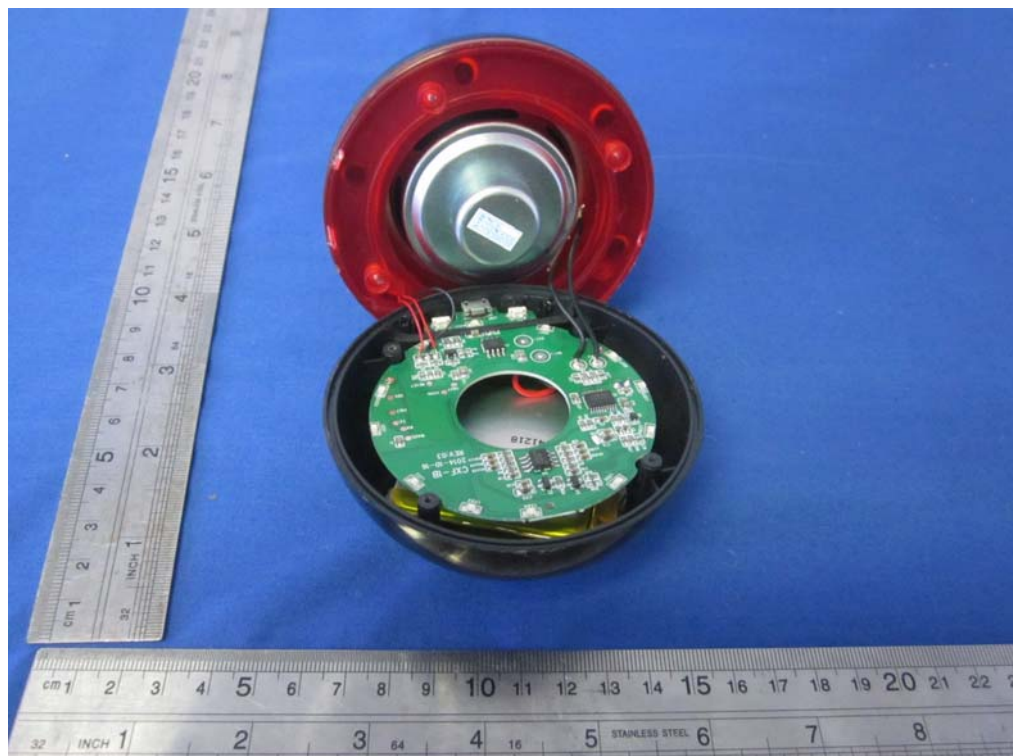
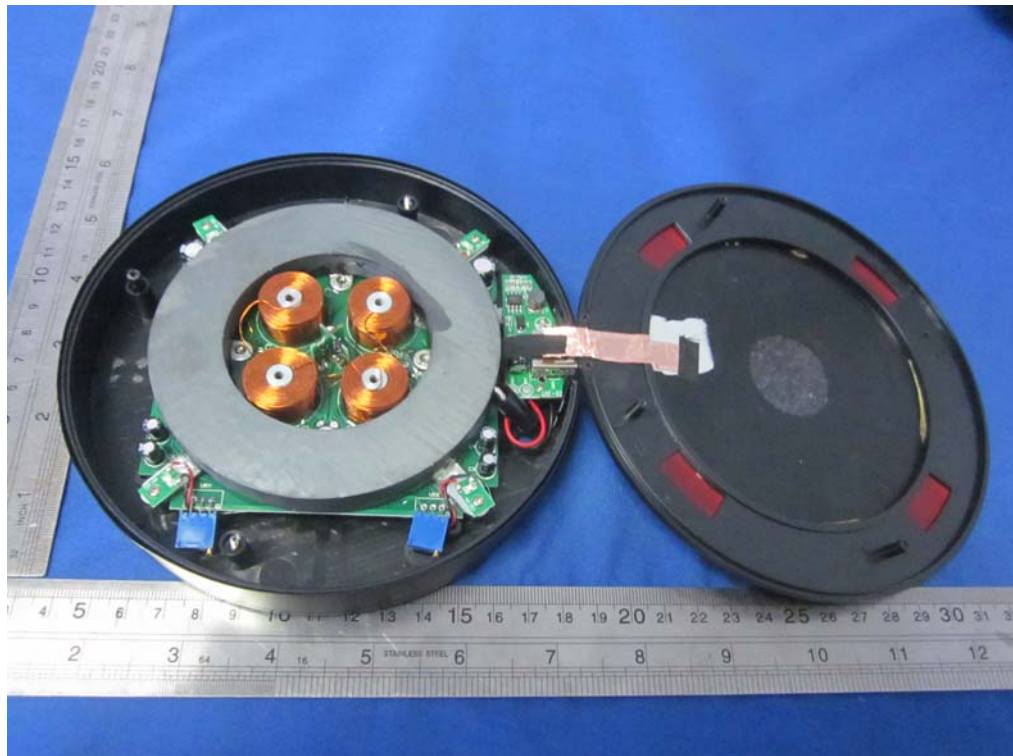
## Radiated Emission Test



## 9. PHOTOGRAPHS OF THE EUT







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