

FCC TEST REPORT(Bluetooth)

for

ZAGG INC

FreeRein Reflect Headphone

Model Number: IFRFRH-GY0, IFRFRH-PK0, IFRFRH-GR0,  
IFRFRH-RD0, IFRFRH-BL0, IFRFRH-PU0, IFRFRH-OR0

FCC ID: QTGIFRFRH-GY0

Prepared for : ZAGG INC  
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Prepared by : Keyway Testing Technology Co., Ltd.  
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Report No. : 15KWE033252F  
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>	ZAGG INC		
<b>Address:</b>	3855 South 500 West Salt Lake City, UT 84115 USA		
<b>Manufacturer:</b>	Fine Acoustic Electronic Factory		
<b>Address:</b>	No.139 Sanjiang industrial Area, Hengli Town, Dong Guan City, Guangdong, China		
<b>E.U.T:</b>	FreeRein Reflect Headphone		
<b>Model Number:</b>	IFRFRH-GY0, IFRFRH-PK0, IFRFRH-GR0, IFRFRH-RD0, IFRFRH-BL0, IFRFRH-PU0, IFRFRH-OR0		
<b>Trade Name:</b>	iFrogz	<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: Feb. 29, 2015</b>	
<b>Tested by:</b>	<b>Reviewed by:</b>	<b>Approved by:</b>	
 <hr/> William Huang / Engineer	 <hr/> Andy Gao / Supervisor	 <hr/> 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:	FreeRein Reflect Headphone
Model No.:	IFRFRH-GY0, IFRFRH-PK0, IFRFRH-GR0, IFRFRH-RD0, IFRFRH-BL0, IFRFRH-PU0, IFRFRH-OR0
Operation Frequency:	2402~2480MHz
Channel numbers:	79 Channels
Channel separation:	1M
Modulation technology:	GFSK, Pi/4DPSK, 8-DPSK
Antenna Type:	Integral Antenna
Antenna gain:	0dBi
Power supply:	DC 3.7V DC 5V from adapter input AC 120V/60Hz
BT version:	3.0
Hardware version	LD602-V11.24
Software version	BT V3

### 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	Aux in Mode		
3	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 Supporting System

Adapter	Provide: Keyway M/N: KW050 I/P: AC 100-240V 50/60Hz O/P: DC 5V 0.5A
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## 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 : Building1, 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. 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

### 2.7.2. 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

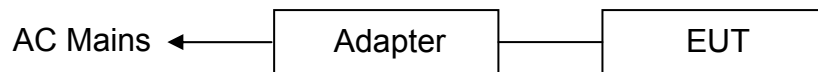
### 3. TEST SET-UP AND OPERATION MODES

#### 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: FreeRein Reflect Headphone)

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

None.

#### 3.4. Special Accessories and Auxiliary Equipment

None.

#### 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.

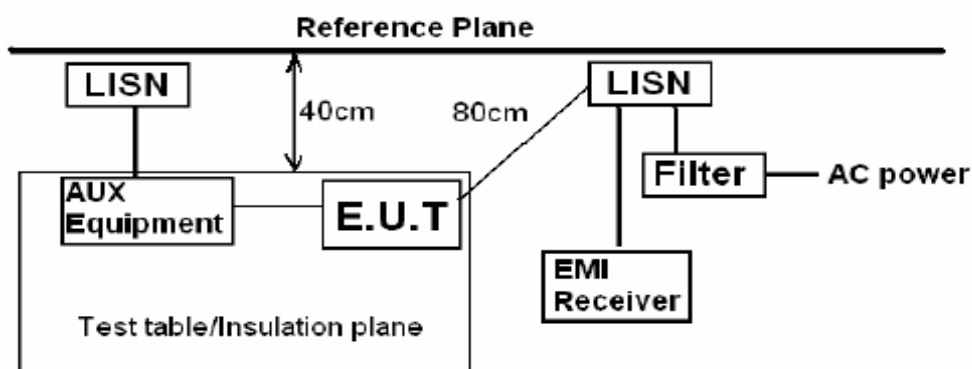
The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

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%.

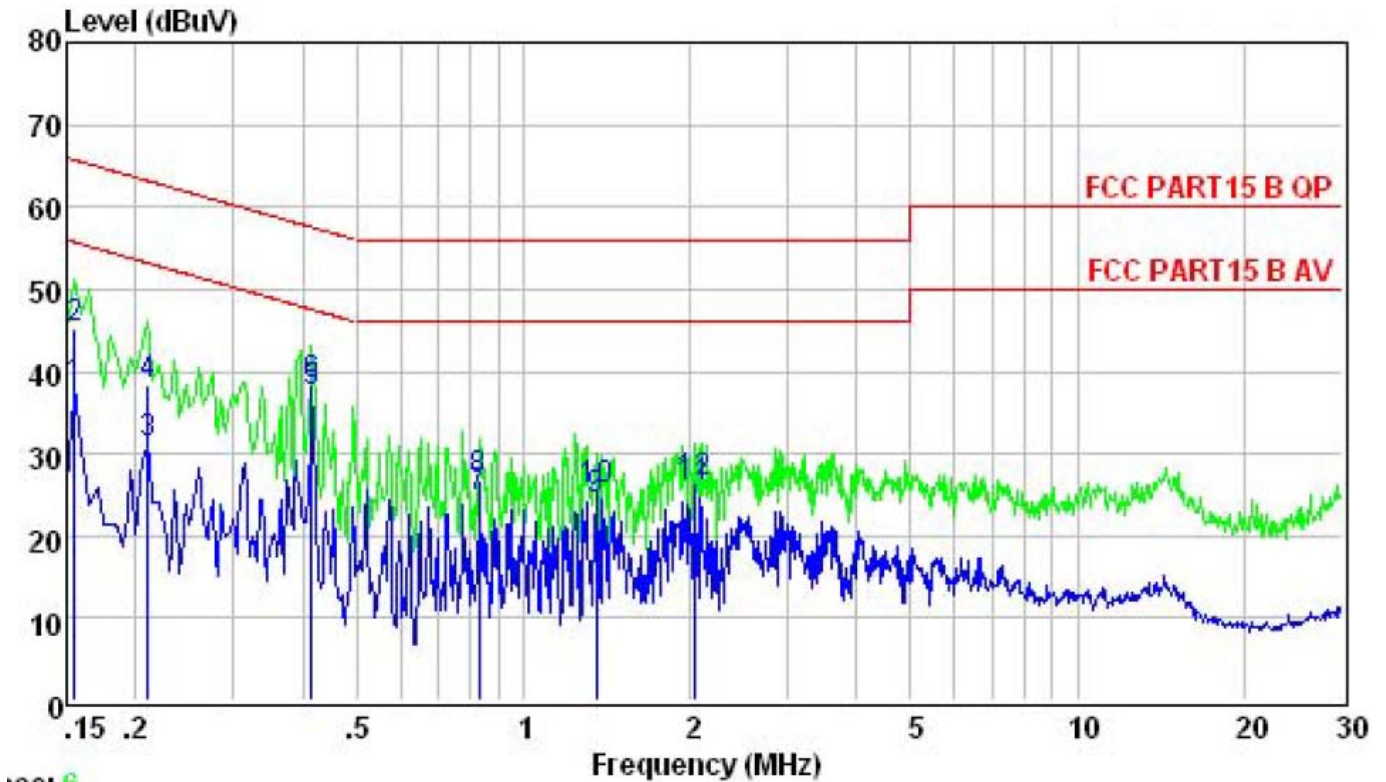
Pretest for all mode, the worst case was Charging mode and the data was reported on the following page.



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



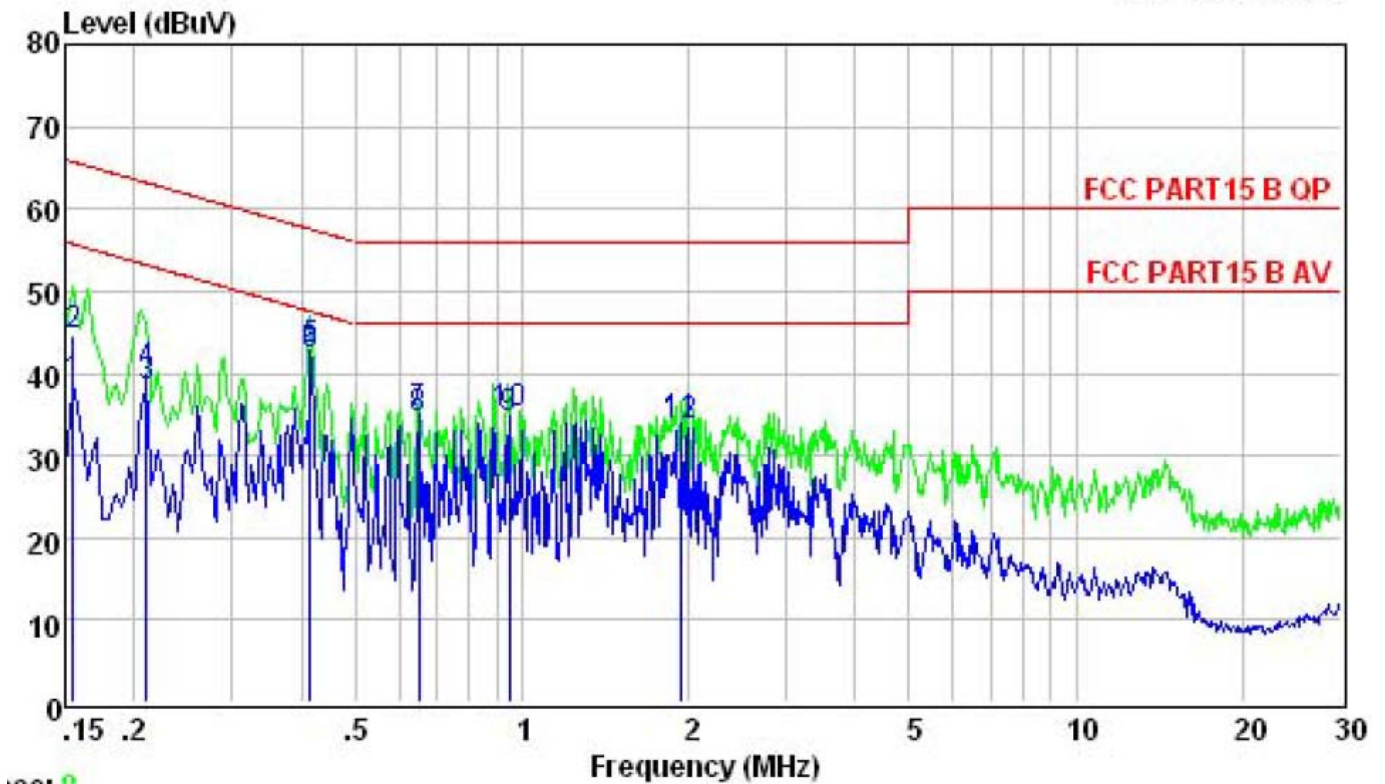
Line  
Input: AC 120V/60Hz



Line: 6

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.155	38.10	55.74	-17.64	Average
2	0.155	45.20	65.74	-20.54	QP
3	0.211	31.12	53.18	-22.06	Average
4	0.211	38.44	63.18	-24.74	QP
5	0.415	37.59	47.55	-9.96	Average
6	0.415	38.25	57.55	-19.30	QP
7	0.830	24.56	46.00	-21.44	Average
8	0.830	26.68	56.00	-29.32	QP
9	1.352	24.50	46.00	-21.50	Average
10	1.352	25.60	56.00	-30.40	QP
11	2.044	25.79	46.00	-20.21	Average
12	2.044	26.51	56.00	-29.49	QP

Neutral  
 Input: AC 120V/60Hz



00:00

	Freq	Level	Limit	Over	Remark
	MHz	dBuV	dBuV	dB	
1	0.155	38.74	55.74	-17.00	Average
2	0.155	44.60	65.74	-21.14	QP
3	0.211	38.38	53.18	-14.80	Average
4	0.211	40.20	63.18	-22.98	QP
5	0.415	42.90	47.55	-4.65	Average
6	0.415	42.20	57.55	-15.35	QP
7	0.651	35.11	46.00	-10.89	Average
8	0.651	34.50	56.00	-21.50	QP
9	0.948	34.57	46.00	-11.43	Average
10	0.948	35.20	56.00	-20.80	QP
11	1.939	33.89	46.00	-12.11	Average
12	1.939	33.50	56.00	-22.50	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)	20log <sup>(2400/F(kHz))</sup> + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log <sup>(24000/F(kHz))</sup> + 40
1.705 ~ 30	30	30	100 * 30	20log <sup>(30)</sup> + 40
30 ~ 88	100	3	100	20log <sup>(100)</sup>
88 ~ 216	150	3	150	20log <sup>(150)</sup>
216 ~ 960	200	3	200	20log <sup>(200)</sup>
Above 960	500	3	500	20log <sup>(500)</sup>

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-Preamp 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.

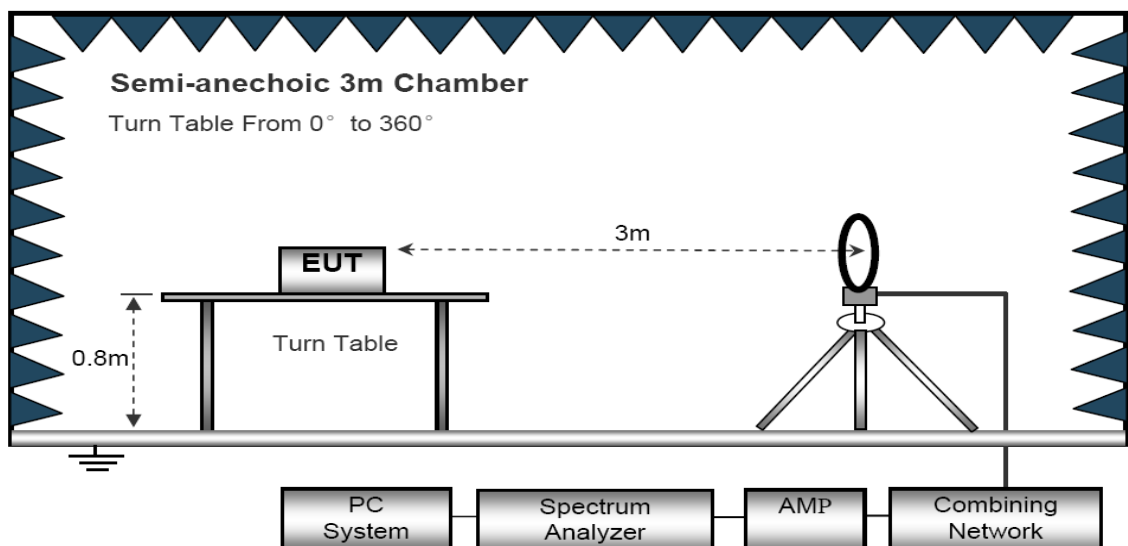
4. For emissions below 1GHz, the worst case was GFSK low channel and the data was reported on the following page.

5. During the test, pre-scan the GFSK, Pi/4DPSK, 8DPSK modulation, and found the 8DPSK modulation which it is worse case and the data recording in the report.

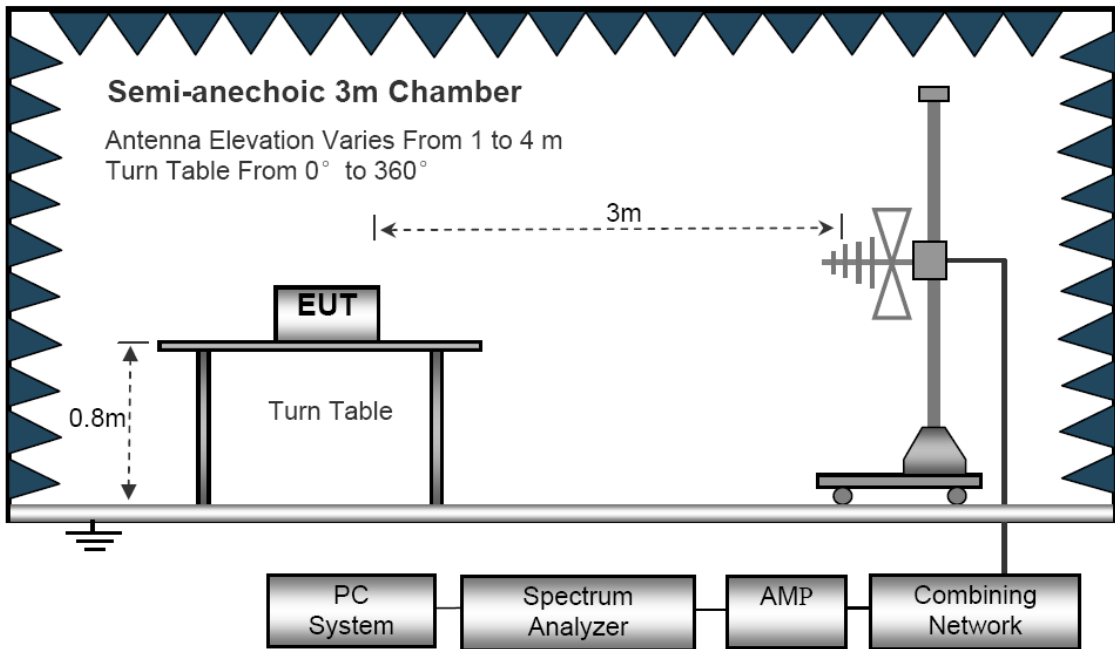
6. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the X-axis which it is worse case.

7. The emission below 30MHz was background noise and met the limit, so no data show it.

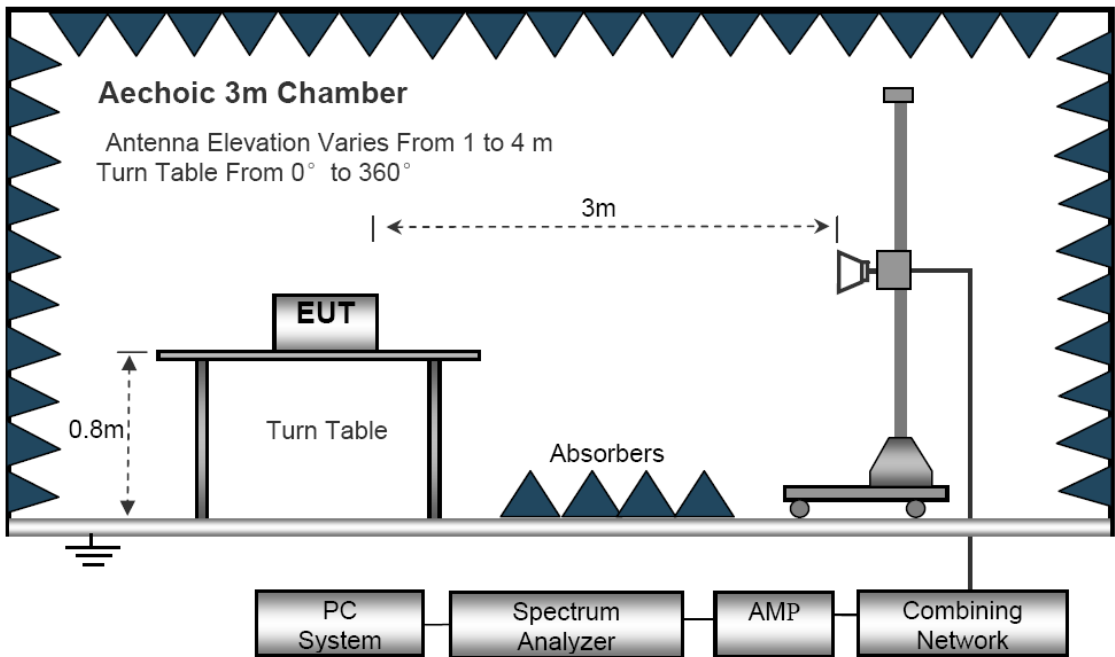
#### Below 30MHz



30MHz~1GHz

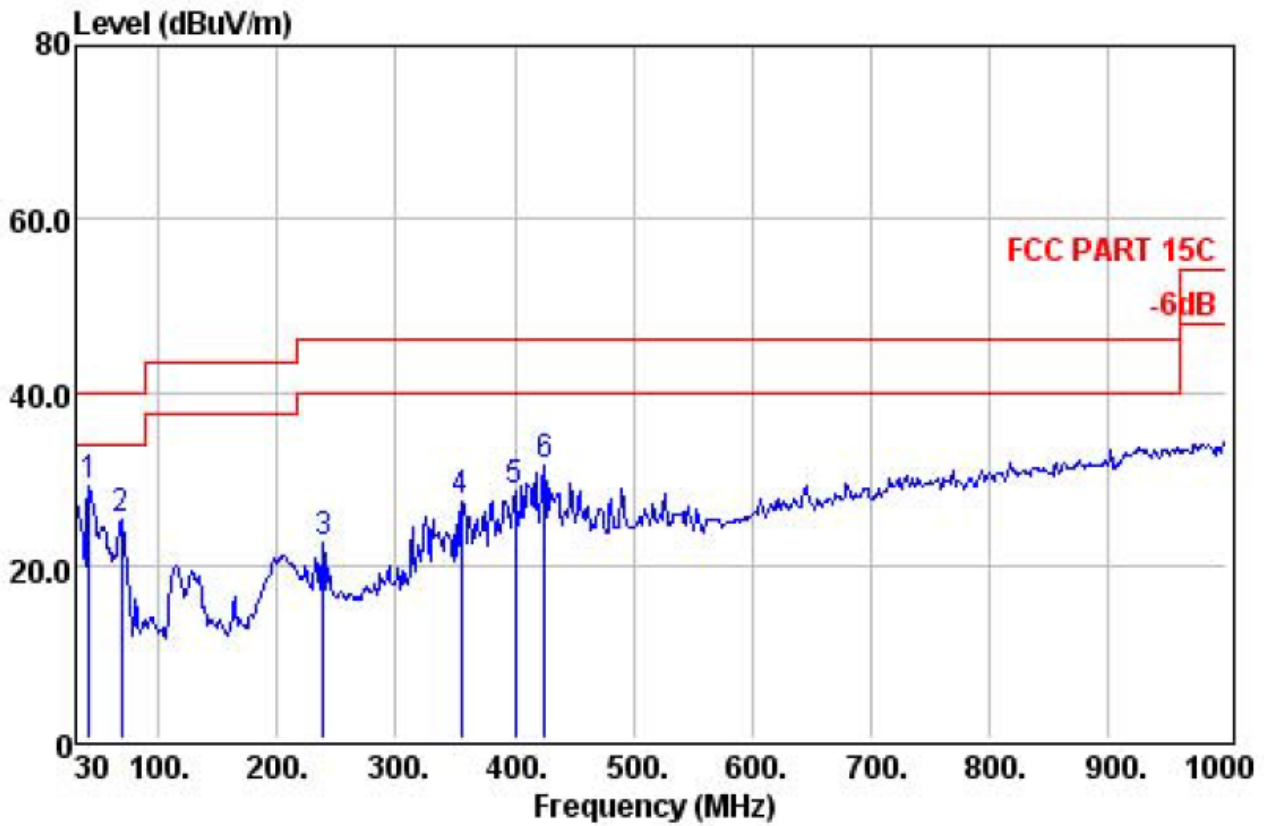


Above 1GHz



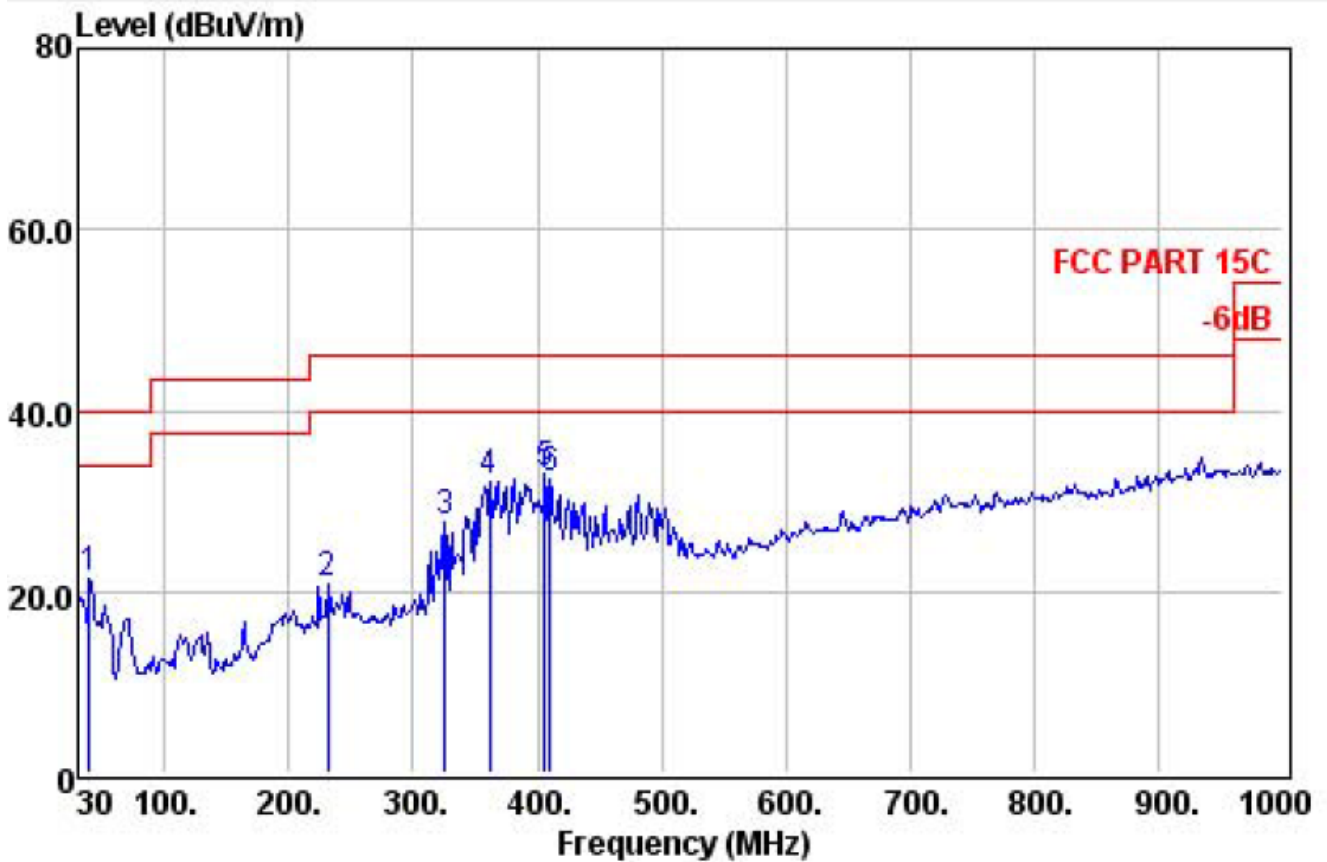


Below 1GHz  
GFSK Low channel Horizontal polarizations



	Preamp	Read	CableAntenna		Limit	Over		
	Freq	Factor	Level	Loss	Line	Limit	Remark	
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB
1	41.64	31.38	47.87	0.56	12.23	29.28	40.00	-10.72 QP
2	68.80	31.32	48.26	0.85	7.48	25.27	40.00	-14.73 QP
3	238.55	30.94	39.44	1.61	12.58	22.69	46.00	-23.31 QP
4	354.95	30.64	39.95	2.18	15.92	27.41	46.00	-18.59 QP
5	400.54	30.63	40.35	2.37	16.32	28.41	46.00	-17.59 QP
6	425.76	30.63	42.47	2.55	17.12	31.51	46.00	-14.49 QP

GFSK Low channel Vertical polarizations



	Preamp	Read	Cable&Antenna		Limit	Over			
	Freq	Factor	Level	Loss	Factor	Level	Line	Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	39.70	31.37	39.28	0.56	13.08	21.55	40.00	-18.45	Peak
2	231.76	30.93	37.62	1.61	12.39	20.69	46.00	-25.31	Peak
3	325.85	30.81	41.80	2.02	14.53	27.54	46.00	-18.46	Peak
4	361.74	30.61	44.32	2.18	16.12	32.01	46.00	-13.99	Peak
5	406.36	30.63	44.63	2.37	16.50	32.87	46.00	-13.13	Peak
6	410.24	30.64	43.92	2.48	16.63	32.39	46.00	-13.61	Peak

## Above 1GHz

## 8DPSK 2402MHz Horizontal polarizations

	Freq	Preamp Factor	Read Level	CableAntenna 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	79.24	7.34	28.72	88.98	94.00	-5.02	Average
2	2402.00	26.32	91.83	7.34	28.72	101.57	114.00	-12.43	Peak
3	4804.00	27.49	31.11	11.96	32.94	48.52	74.00	-25.48	Peak
4	6644.00	27.83	15.51	16.60	36.26	40.54	74.00	-33.46	Peak
5	9126.00	28.45	16.54	16.89	37.54	42.52	74.00	-31.48	Peak
6	13070.00	29.21	13.02	18.30	41.02	43.13	74.00	-30.87	Peak

## 8DPSK 2402MHz Vertical polarizations

	Freq	Preamp Factor	Read Level	CableAntenna 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	78.63	7.34	28.72	88.37	94.00	-5.63	Average
2	2402.00	26.32	91.34	7.34	28.72	101.08	114.00	-12.92	Peak
3	4804.00	27.49	30.96	11.96	32.94	48.37	74.00	-25.63	Peak
4	6644.00	27.83	14.90	16.60	36.26	39.93	74.00	-34.07	Peak
5	9483.00	28.59	16.34	16.92	37.98	42.65	74.00	-31.35	Peak
6	11931.00	28.99	11.23	17.35	39.47	39.06	74.00	-34.94	Peak

## 8DPSK 2441MHz Horizontal polarizations

	Freq	Preamp Factor	Read Level	CableAntenna 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	78.76	7.48	28.76	88.67	94.00	-5.33	Average
2	2441.00	26.33	91.58	7.48	28.76	101.49	114.00	-12.51	Peak
3	4882.00	27.53	30.46	12.14	33.11	48.18	74.00	-25.82	Peak
4	7256.00	27.95	16.54	16.61	37.30	42.50	74.00	-31.50	Peak
5	10452.00	28.85	17.45	17.06	39.12	44.78	74.00	-29.22	Peak
6	12543.00	29.11	15.11	17.82	39.62	43.44	74.00	-30.56	Peak



**8DPSK 2441MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2441.00	26.33	78.46	7.48	28.76	88.37	94.00	-5.63	Average
2	2441.00	26.33	91.06	7.48	28.76	100.97	114.00	-13.03	Peak
3	4882.00	27.53	30.55	12.14	33.11	48.27	74.00	-25.73	Peak
4	7494.00	28.00	16.42	16.63	37.40	42.45	74.00	-31.55	Peak
5	9109.00	28.44	15.29	16.89	37.52	41.26	74.00	-32.74	Peak
6	11965.00	29.00	14.65	17.36	39.43	42.44	74.00	-31.56	Peak

**8DPSK 2480MHz Horizontal polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	78.27	7.57	28.79	88.29	94.00	-5.71	Average
2	2480.00	26.34	90.92	7.57	28.79	100.94	114.00	-13.06	Peak
3	4960.00	27.58	30.21	12.36	33.32	48.31	74.00	-25.69	Peak
4	7256.00	27.95	14.89	16.61	37.30	40.85	74.00	-33.15	Peak
5	9976.00	28.79	13.42	16.96	38.39	39.98	74.00	-34.02	Peak
6	12356.00	29.07	11.79	17.67	39.47	39.86	74.00	-34.14	Peak

**8DPSK 2480MHz Vertical polarizations**

	Freq	Preamp Factor	Read Level	Cable Loss	Antenna Factor	Level	Limit Line	Over Limit	Remark
	MHz	dB	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	2480.00	26.34	78.73	7.57	28.79	88.75	94.00	-5.25	Average
2	2480.00	26.34	91.42	7.57	28.79	101.44	114.00	-12.56	Peak
3	4960.00	27.58	30.27	12.36	33.32	48.37	74.00	-25.63	Peak
4	6559.00	27.81	16.93	16.60	36.03	41.75	74.00	-32.25	Peak
5	8735.00	28.32	15.36	16.82	37.08	40.94	74.00	-33.06	Peak
6	12339.00	29.07	13.58	17.65	39.47	41.63	74.00	-32.37	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:

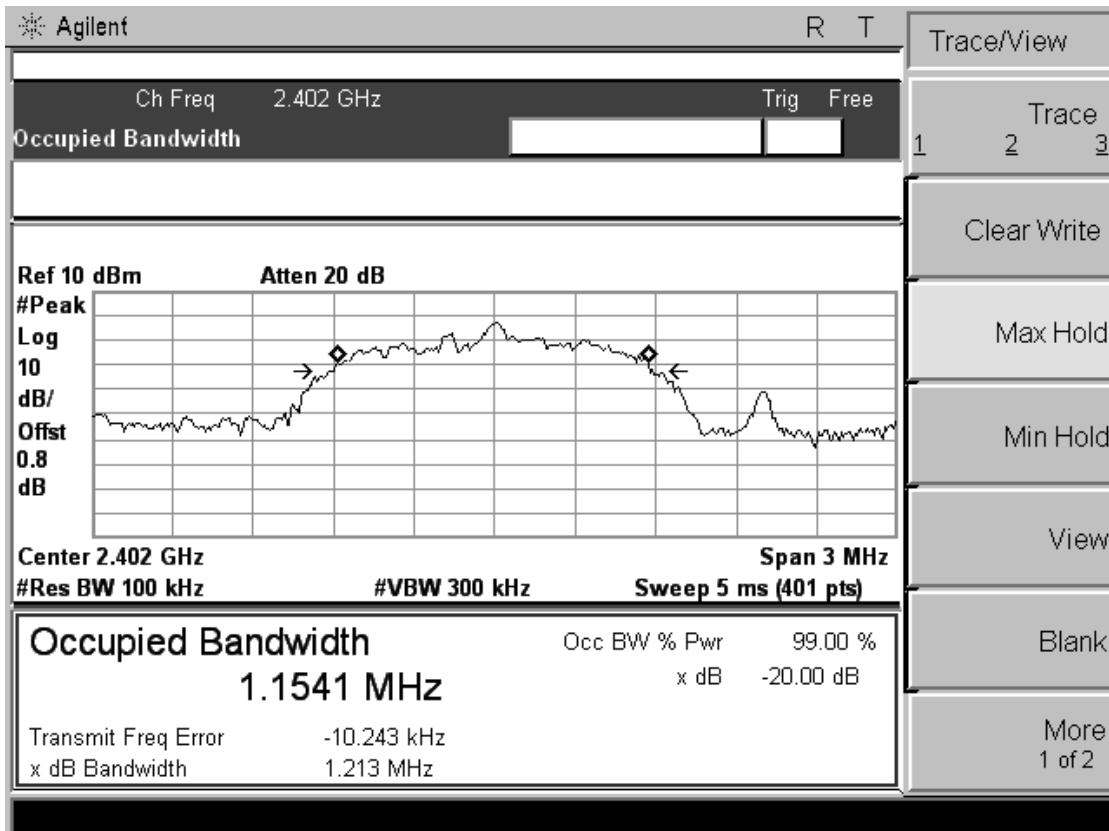
	Channel Frequency (MHz)	20dB Bandwidth (MHz)	Result
GFSK	2402	0.858	Pass
	2441	0.864	Pass
	2480	0.858	Pass
Pi/4DPSK	2402	1.201	Pass
	2441	1.202	Pass
	2480	1.205	Pass
8DPSK	2402	1.213	Pass
	2441	1.212	Pass
	2480	1.215	Pass

Test plot as follows:

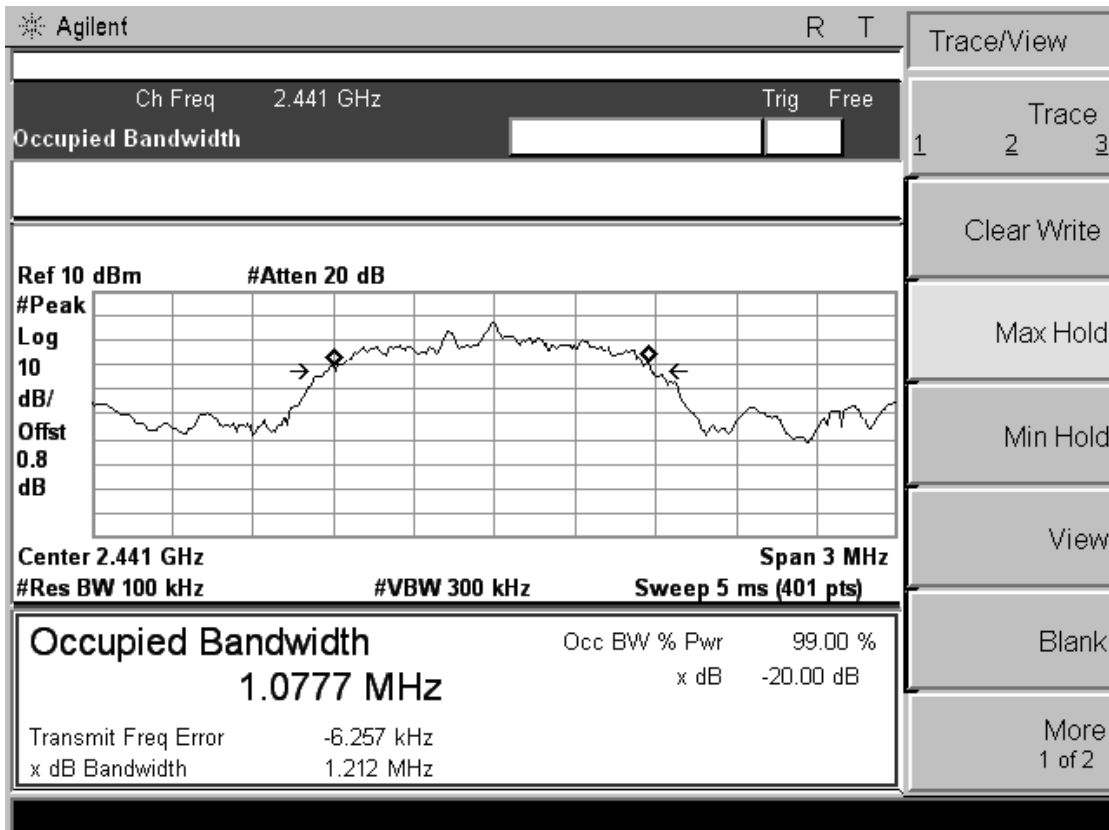
The data only show the worst mode

8DPSK

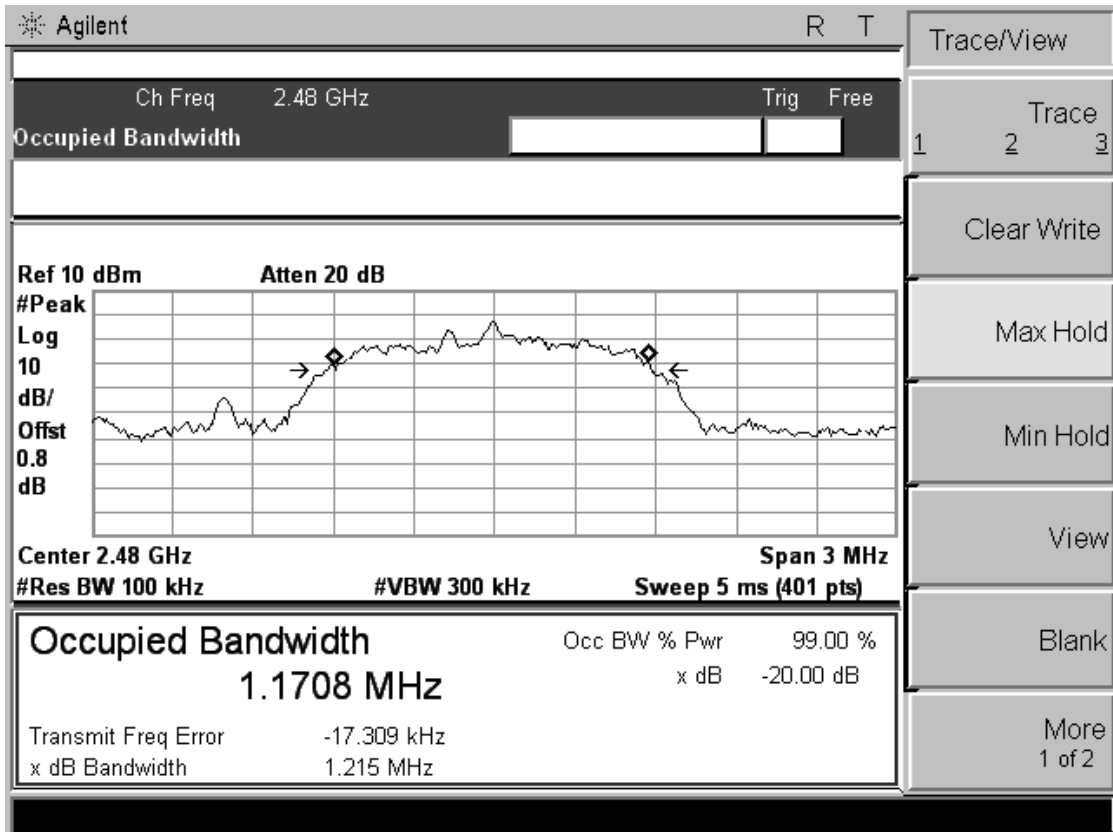
2402MHz



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	2438.74	49.87	74.00	54.00	Pass
	<2400	V	2438.19	49.27	74.00	54.00	Pass
	>2483.5	H	2483.94	49.97	74.00	54.00	Pass
	>2483.5	V	2484.08	49.53	74.00	54.00	Pass
Unhopping	<2400	H	2438.49	50.03	74.00	54.00	Pass
	<2400	V	2439.11	50.21	74.00	54.00	Pass
	>2483.5	H	2484.48	50.33	74.00	54.00	Pass
	>2483.5	V	2485.03	50.27	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 8DPSK.

## 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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