

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENTS**

OF

MINI PORTABLE BLUETOOTH SPEAKER

MODEL No.: G2

FCC ID:YKGBTWO-020

Trademark: Cambridge Audio

REPORT NO.: ES140724258E

ISSUE DATE: September 13, 2014

Prepared for

Audio Partnership PLC.

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VERIFICATION OF COMPLIANCE

Applicant:	Audio Partnership PLC. Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom.
Manufacturer:	SHENZHEN FENDA TECHNOLOGY CO., LTD. Fenda Hi-Tech Park, Zhoushi Road, Shiyan Town, Baoan District, Shenzhen City, Guangdong, China.
Product Description:	MINI PORTABLE BLUETOOTH SPEAKER
Model Number:	G2
Trademark:	Cambridge Audio
Serial Number:	N/A
File Number:	ES140724258E
Date of Test:	August 25, 2014 to September 13, 2014

We hereby certify that:

The above equipment was tested by SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247 REQUIREMENTS

The test results of this report relate only to the tested sample identified in this report.

Date of Test : August 25, 2014 to September 13, 2014

Prepared by :

Jack Li

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Table of Contents

1.	GENERAL INFORMATION	5
1.1	PRODUCT DESCRIPTION.....	5
1.2	RELATED SUBMITTAL(S) / GRANT (S).....	5
1.3	TEST METHODOLOGY	5
1.4	SPECIAL ACCESSORIES.....	5
1.5	EQUIPMENT MODIFICATIONS	5
1.6	TEST FACILITY	6
2.	SYSTEM TEST CONFIGURATION	7
2.1	EUT CONFIGURATION.....	7
2.2	EUT EXERCISE.....	7
2.3	TEST PROCEDURE	7
2.4	LIMITATION	7
2.5	CONFIGURATION OF TESTED SYSTEM	10
2.6	DESCRIPTION OF TEST MODES.....	10
3.	SUMMARY OF TEST RESULTS.....	11
4.	CONDUCTED EMISSIONS TEST	12
4.1	MEASUREMENT PROCEDURE:	12
4.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	12
4.3	MEASUREMENT EQUIPMENT USED:.....	12
4.4	CONDUCTED EMISSION LIMIT	12
4.5	MEASUREMENT RESULT:.....	13
5.	RADIATED EMISSION TEST	14
5.1	MEASUREMENT PROCEDURE	15
5.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	16
5.3	MEASUREMENT EQUIPMENT USED:.....	17
5.4	MEASUREMENT RESULT.....	18
6.	CHANNEL SEPARATION TEST	24
6.1	MEASUREMENT PROCEDURE	27
6.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	27
6.3	MEASUREMENT EQUIPMENT USED:.....	27
6.4	MEASUREMENT RESULTS:.....	27
7.	BANDWIDTH TEST	28
7.1	MEASUREMENT PROCEDURE	34
7.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	34
7.3	MEASUREMENT EQUIPMENT USED:.....	34
7.4	MEASUREMENT RESULTS:.....	34
8.	QUANTITY OF HOPPING CHANNEL TEST	35

8.1	MEASUREMENT PROCEDURE	41
8.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	41
8.3	MEASUREMENT EQUIPMENT USED:	41
8.4	MEASUREMENT RESULTS:.....	41
9.	TIME OF OCCUPANCY (DWELL TIME) TEST	42
9.1	MEASUREMENT PROCEDURE	42
9.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	42
9.3	MEASUREMENT EQUIPMENT USED:	42
9.4	MEASUREMENT RESULTS:.....	42
10.	MAXIMUM PEAK OUTPUT POWER TEST	45
10.1	MEASUREMENT PROCEDURE	45
10.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	45
10.3	MEASUREMENT EQUIPMENT USED:	45
10.4	MEASUREMENT RESULTS:.....	45
11.	BAND EDGE TEST.....	45
11.1	MEASUREMENT PROCEDURE	47
11.2	TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....	47
11.3	MEASUREMENT EQUIPMENT USED:	47
11.4	MEASUREMENT RESULTS:.....	47
12.	ANTENNA PORT EMISSION	50
12.1	TEST EQUIPMENT	50
12.2	MEASURING INSTRUMENTS AND SETTING	50
12.3	TEST PROCEDURES	50
12.4	BLOCK DIAGRAM OF TEST SETUP	50
12.5	TEST RESULT	50
13.	ANTENNA APPLICATION	54
13.1	ANTENNA REQUIREMENT	54
13.2	RESULT	54

1. GENERAL INFORMATION

1.1 Product Description

A major technical descriptions of EUT is described as following:

- A). Operation Frequency: 2402-2480MHz;
- B). Modulation: GFSK, 1/4Π-DQPSK, 8DPSK;
- C). Number of Channel: 79 channels;
- D). RF Output Power: 4.81dBm Max;
- E). Antenna Type: PCB antenna
- F). Antenna GAIN: 2dBi
- G). Power Supply: DC 7.4V from Li-ion Battery or DC 12V from AC Adapter
- H). Adapter: Model: YJS036B-1202000D
Input: 100-240V~ 50/60Hz, 1000mA
Output: DC 12.0V, 2000mA

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: YKBGTWO-020 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

The composite system is compliance with Subpart B is authorized under a DOC procedure.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (2009) and FCC Public Notice DA 00-705. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab.

: Accredited by CNAS, 2013.10.29
The certificate is valid until 2016.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2006(identical to ISO/IEC17025:2005)

The Certificate Registration Number is L2291

Accredited by TUV Rheinland Shenzhen 2010.5.25
The Laboratory has been assessed according to the requirements ISO/IEC 17025

Accredited by FCC, October 28, 2010
The Certificate Registration Number is 406365.

Accredited by Industry Canada, March 5, 2010
The Certificate Registration Number is 4480A-2.

Name of Firm

: SHENZHEN EMTEK CO., LTD

Site Location

: Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-2009 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.

2.4 Limitation

(1) Channel Separation test

FCC Part 15, Subpart C Section 15.247(a)(1) and RSS 210 A8.1(2) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 Bandwidth of the hopping channel, whichever is greater.

Frequency Range (MHz)	Limit(kHz)
902-928	>25kHz
2400-2483.5	>25kHz
5725-5850	>25kHz

(2) 20dB Bandwidth

Frequency Range(MHz)	Quantity of Hopping Channel	Limit(kHz)			
		50	25	15	75
902-928		<250	>250	NA	NA
2400-2483.5		NA	NA	>1000	<1000

(3) Quantity of Hopping Channel

FCC Part 15, Subpart C Section 15.247 and RSS 210 A8.1(4)

Frequency Range (MHz)	Limit(Quantity of Hopping Channel)			
	20dB bandwidth <250kHz	20dB bandwidth >25 0kHz	20dB bandwidth <1MHz	20dB bandwidth >1 MHz
902-928	50	25	NA	NA
2400-2483.5	NA	NA	75	15
5725-5850	NA	NA	75	NA

(4) Time of Occupancy(Dwell Time)

FCC Part 15, Subpart C Section 15.247 and RSS 210 A8.1(4)

Frequency Range (MHz)	LIMIT(rms)		
	20dB bandwidth <250kHz(50Channel)	20dB bandwidth >250kHz (25Channel)	20dB bandwidth <1MHz(75Channel)
902-928	400(20S)	400(10S)	NA
2400-2483.5	NA	NA	400(30S)
5725-5850	NA	NA	400(30S)

Note: The “()”is all channel’s average time of occupancy.

(5) Maximum Peak Output Power

FCC Part 15, Subpart C Section 15.247 and RSS 210 A8.4

Frequency Range (MHz)	Quantity of Hopping Channel	LIMIT(W)			
		50	25	15	75
902-928		1(30dBm)	0.125(21dBm)	NA	NA
2400-2483.5		NA	NA	0.125(21dBm)	1(30dBm)
5725-5850		NA	NA	NA	1(30dBm)

(6) Band edge

FCC Part15, Subpart C Section 15.247 and RSS 210 A8.5

Operating Frequency Range(MHz)	Spurious emission frequency	Peak power ration to emission(dBc)	Limit Emission level(dBuV/m)
902-928	<902	>20	NA

	>928	>20	NA
	960-1240	NA	54
2400-2483.5	<2400	>20	NA
	>2483.5-2500	NA	54
5725-5850	<5350-5460	NA	54
	<5725	>20	NA
	>5850	>20	NA

(7) Conducted Emission

FCC Part15, Subpart C Section 15.247 and RSS-GEN, Section 7.2.2

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

(8) Radiated Emission

FCC Part 15, Subpart C Section 15.209 and RSS 210 A8.5 limit of radiated emission for frequency below 1000GHz. The emissions from an intentional radiator shall not exceed the field strength level specified in the following table:

Frequency (MHz)	Field strength $\mu\text{V}/\text{m}$	Distance(m)	Field strength at 3m $\text{dB}\mu\text{V}/\text{m}$
0.009~0.490	2400/F(KHz)	300	See the remark
0.490~1.705	2400/F(KHz)	30	
1.705~30.0	30	30	
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

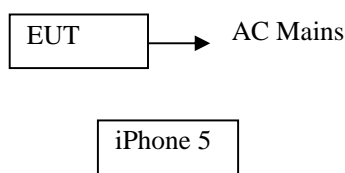
Remark 1. Emission level in $\text{dB}\mu\text{V}/\text{m}=20 \log (\mu\text{V}/\text{m})$

: 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. Distance extrapolation factor $=40 \log (\text{Specific distance}/ \text{test distance})(\text{dB})$;
 Limit line= $\text{Specific limits}(\text{dB}\mu\text{V}) + \text{distance extrapolation factor}$.

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
MINI PORTABLE BLUETOOTH SPEAKER	Cambridge Audio	G2	YKBGTWO-020	N/A	EUT
iPhone 5	apple	A1324	N/A	N/A	

2.6 Description of test modes

The EUT has been tested under TX operating condition. were conducted to determine the final configuration from all possible combinations. This Report Records BT function test data ,We use software control the EUT, Let EUT hopping on and transmit with highest power, All the modes GFSK, 1/4π-DQPSK, 8DPSK have been tested and the worst result was reported with modulation GFSK. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel	Frequency(MHz)
1	2402
40	2441
79	2480

3. Summary of Test Results

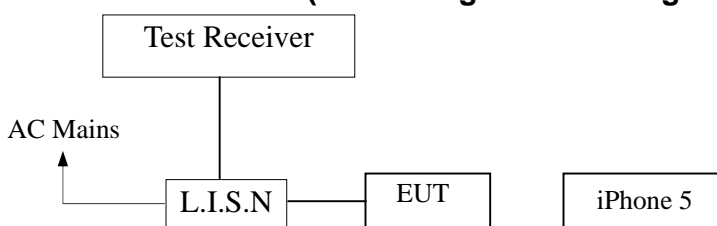
FCC Rule	Description Of Test	Result
15.247(a)(1)	Channel Separation test	Pass
15.247(a)(1)	20dB Bandwidth	Pass
15.247(a)(1)	Quantity of Hopping Channel	Pass
15.247(a)(1)	Time of Occupancy (Dwell Time)	Pass
15.247(b)(1)	Max Peak output Power test	Pass
15.247(d)	Band edge test	Pass
15.207	AC Power Conducted Emission	Pass
15.247(d)	Radiated Emission	Pass
§15.247(d)	Antenna Port Emission	Pass
15.203&15.247(b)	Antenna Application	Pass
N/A	99%dB Bandwidth	Pass

4. Conducted Emissions Test

4.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Equipment Used:

Conducted Emission Test Site # 2					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/17/2014	05/16/2015
L.I.S.N	Rohde & Schwarz	ESH2-Z5	834549/005	05/17/2014	05/16/2015
50ΩCoaxial Switch	Anritsu	MP59B	M20531	05/17/2014	05/16/2015

4.4 Conducted Emission Limit

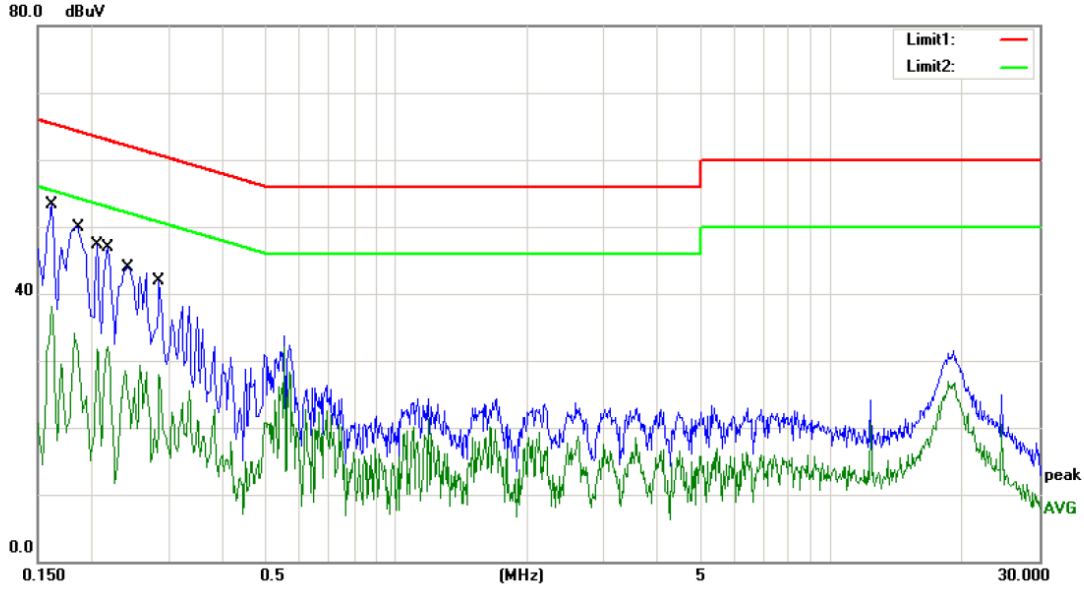
(7) Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

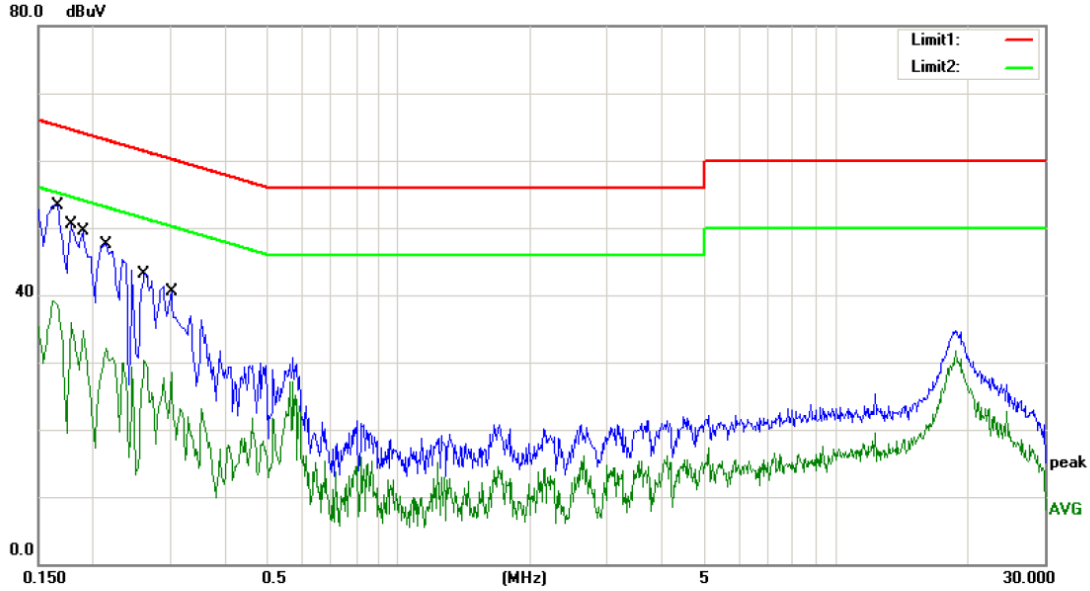
4.5 Measurement Result:



Site Conduction #1 Phase: **L1** Temperature: 26
 Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 60 %
 Mode: Bluetooth ON
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1620	53.34	0.00	53.34	65.36	-12.02	QP	
2		0.1620	38.05	0.00	38.05	55.36	-17.31	AVG	
3		0.1860	49.96	0.00	49.96	64.21	-14.25	QP	
4		0.1860	34.03	0.00	34.03	54.21	-20.18	AVG	
5		0.2060	47.27	0.00	47.27	63.37	-16.10	QP	
6		0.2060	31.66	0.00	31.66	53.37	-21.71	AVG	
7		0.2180	46.82	0.00	46.82	62.89	-16.07	QP	
8		0.2180	32.17	0.00	32.17	52.89	-20.72	AVG	
9		0.2420	43.88	0.00	43.88	62.03	-18.15	QP	
10		0.2420	28.59	0.00	28.59	52.03	-23.44	AVG	
11		0.2860	41.98	0.00	41.98	60.64	-18.66	QP	
12		0.2860	27.98	0.00	27.98	50.64	-22.66	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: ZHL



Site Conduction #1 Phase: **N** Temperature: 26
 Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 60 %
 Mode: Bluetooth ON
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1660	53.40	0.00	53.40	65.16	-11.76	QP	
2		0.1660	39.17	0.00	39.17	55.16	-15.99	AVG	
3		0.1780	50.52	0.00	50.52	64.58	-14.06	QP	
4		0.1780	35.38	0.00	35.38	54.58	-19.20	AVG	
5		0.1900	49.40	0.00	49.40	64.04	-14.64	QP	
6		0.1900	34.76	0.00	34.76	54.04	-19.28	AVG	
7		0.2140	47.53	0.00	47.53	63.05	-15.52	QP	
8		0.2140	32.06	0.00	32.06	53.05	-20.99	AVG	
9		0.2620	43.16	0.00	43.16	61.37	-18.21	QP	
10		0.2620	30.38	0.00	30.38	51.37	-20.99	AVG	
11		0.3020	40.46	0.00	40.46	60.19	-19.73	QP	
12		0.3020	28.55	0.00	28.55	50.19	-21.64	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: ZHL

5. Radiated Emission Test

5.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured was complete.

When spectrum scanned from 30 MHz to 1GHz setting resolution bandwidth 120 kHz and video bandwidth 300kHz.

EMI Test Receiver	Setting
Attenuation	Auto
RB	120kHz
VB	300kHz
Detector	QP
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

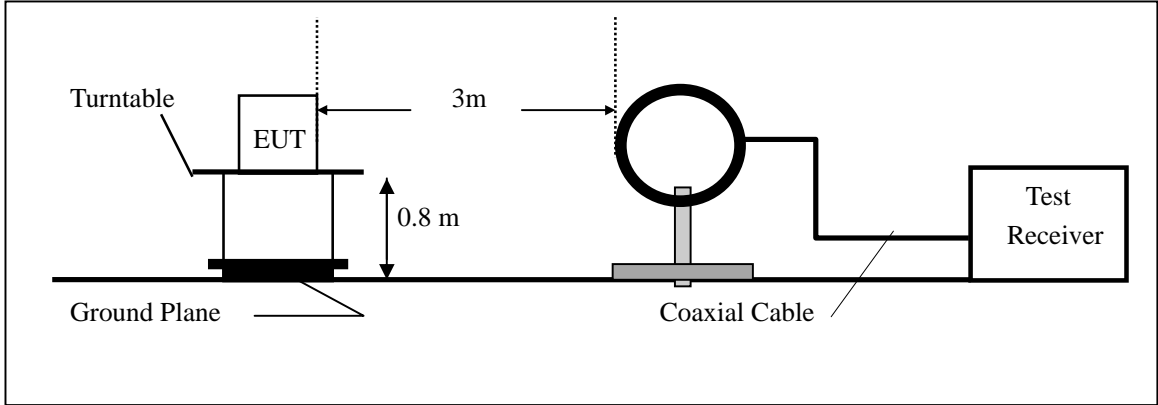
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz.

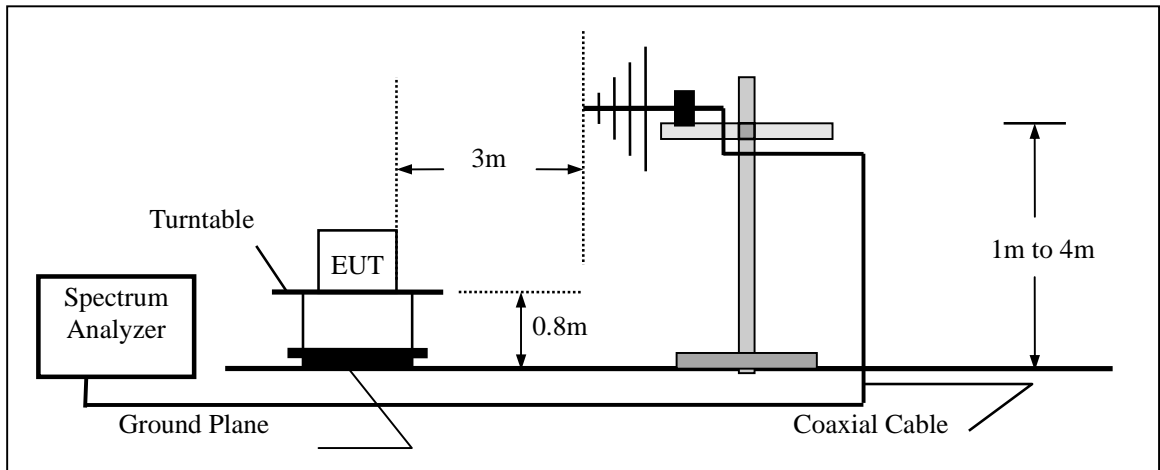
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	AVG
Trace	Max hold

5.2 Test SET-UP (Block Diagram of Configuration)

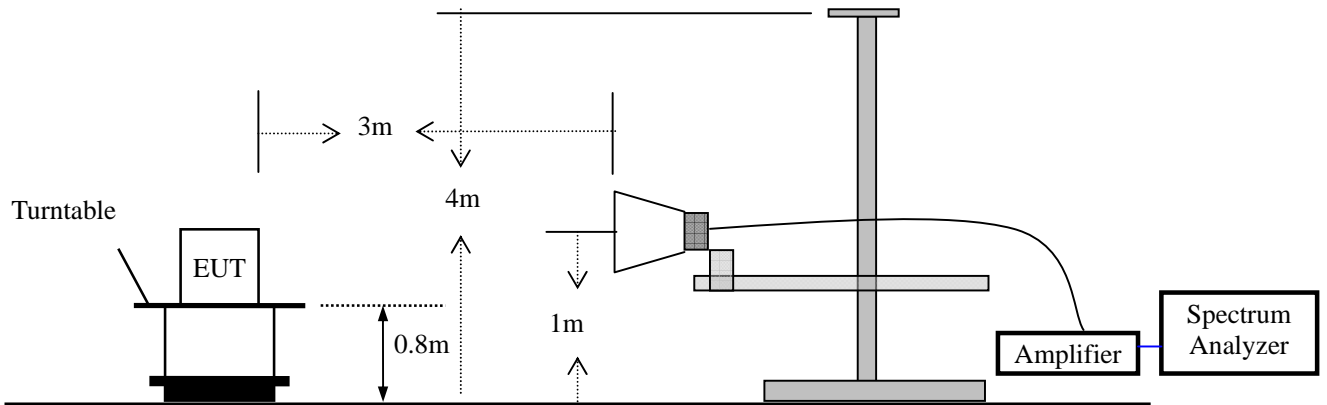
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz

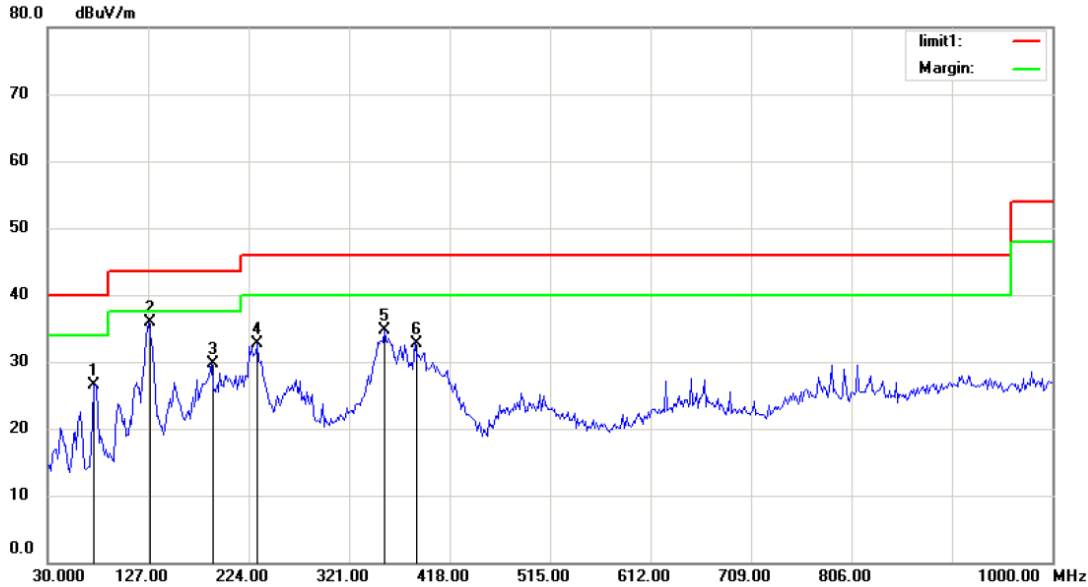


5.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSP7	839511/010	05/17/2014	05/16/2015
Spectrum Analyzer	HP	E4407B	839840481	05/17/2014	05/16/2015
EMI Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/17/2014	05/16/2015
Pre-Amplifier	HP	8447D	2944A07999	05/17/2014	05/16/2015
Bilog Antenna	Schwarzbeck	VULB9163	142	05/17/2014	05/16/2015
Loop Antenna	ARA	PLA-1030/B	1029	05/17/2014	05/16/2015
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/17/2014	05/16/2015
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/17/2014	05/16/2015

5.4 Measurement Result

All the modulation modes were tested the data of the Worse result(GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

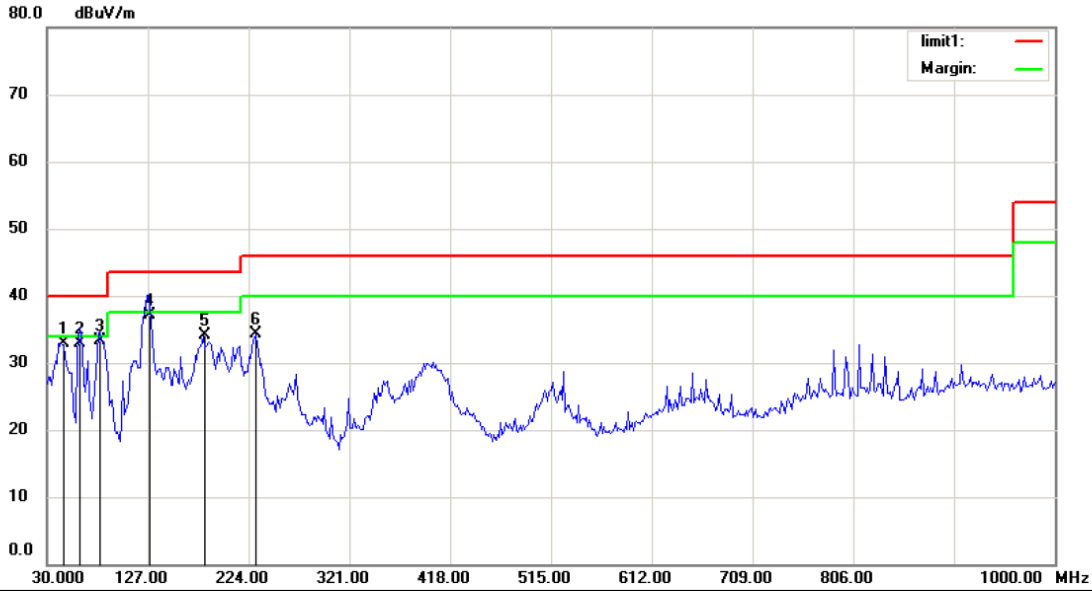


Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH00
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		75.0801	19.44	7.11	26.55	40.00	-13.45	QP		
2	*	127.9327	26.16	9.78	35.94	43.50	-7.56	QP		
3		188.5577	19.74	9.88	29.62	43.50	-13.88	QP		
4		232.0833	19.98	12.64	32.62	46.00	-13.38	QP		
5		354.8878	18.06	16.73	34.79	46.00	-11.21	QP		
6		384.4231	14.88	17.92	32.80	46.00	-13.20	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL

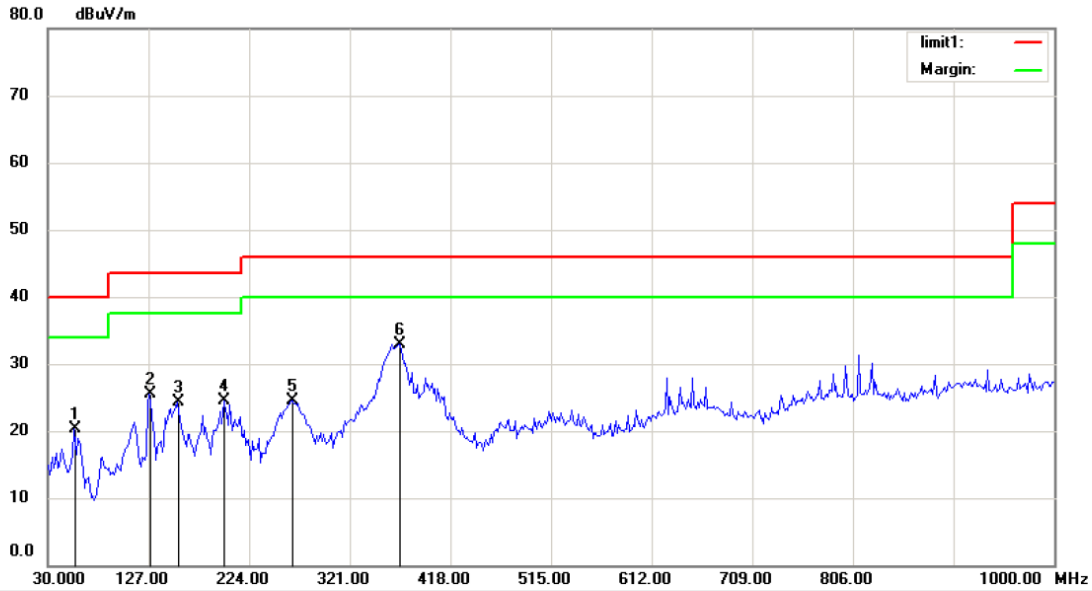


Site 3m Chamber #1 Polarization: **Vertical** Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH00
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		43.9904	17.81	15.18	32.99	40.00	-7.01	QP		
2		61.0897	20.40	12.43	32.83	40.00	-7.17	QP		
3		81.2980	25.60	7.66	33.26	40.00	-6.74	QP		
4	*	127.9327	27.30	9.78	37.08	43.50	-6.42	QP		
5		180.7853	25.51	8.57	34.08	43.50	-9.42	QP		
6		230.5288	21.71	12.54	34.25	46.00	-11.75	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL

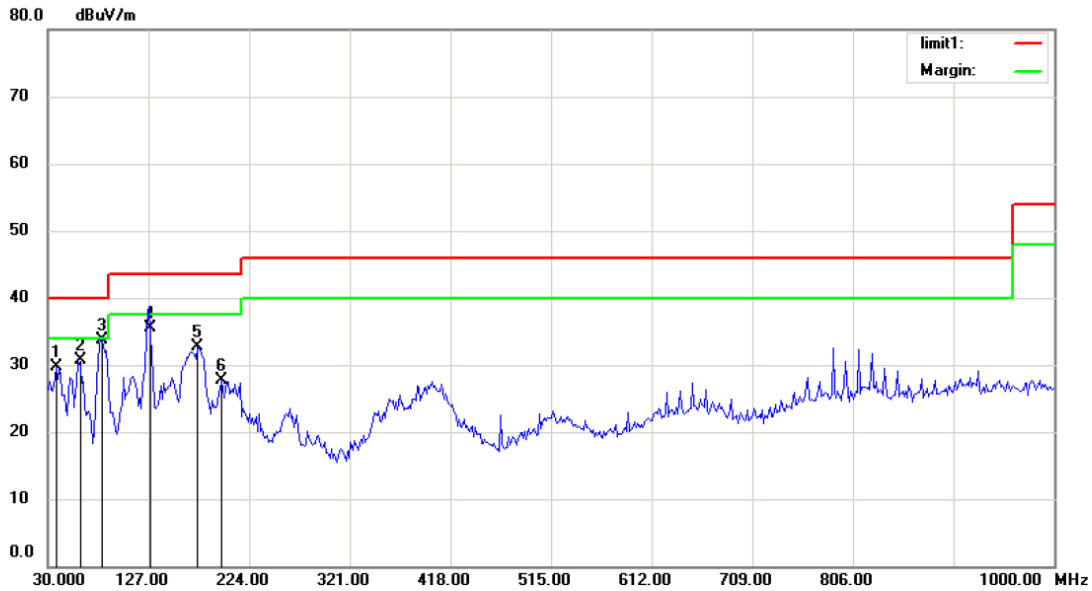


Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH39
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		54.8718	10.82	9.41	20.23	40.00	-19.77	QP		
2		127.9327	15.81	9.78	25.59	43.50	-17.91	QP		
3		154.3590	15.73	8.50	24.23	43.50	-19.27	QP		
4		199.4391	14.18	10.38	24.56	43.50	-18.94	QP		
5		264.7276	9.96	14.60	24.56	46.00	-21.44	QP		
6	*	368.8782	15.81	17.07	32.88	46.00	-13.12	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL

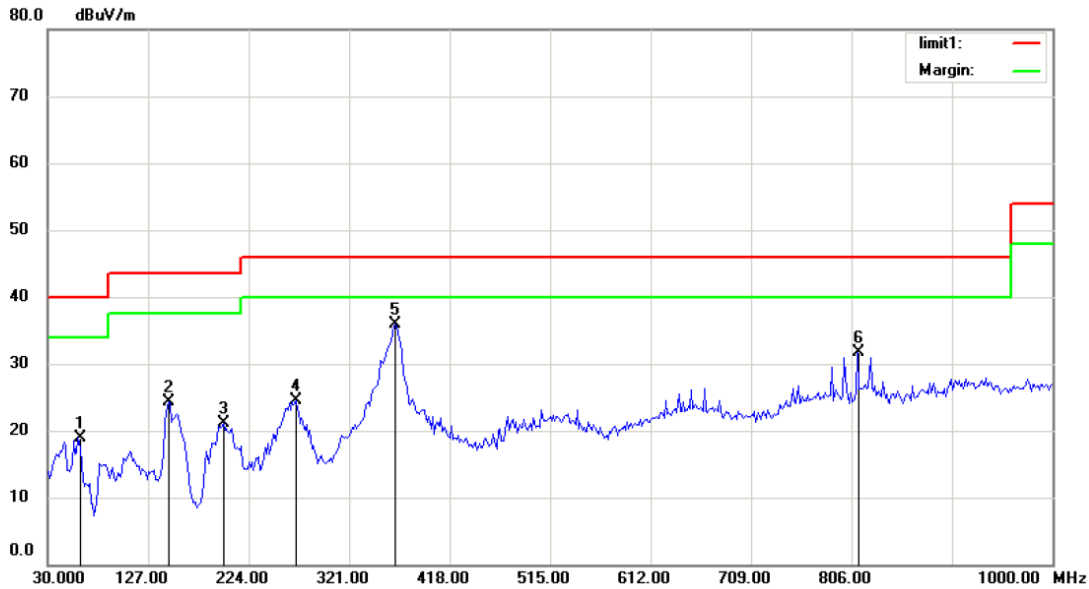


Site 3m Chamber #1 Polarization: **Vertical** Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH39
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		37.7724	15.80	13.97	29.77	40.00	-10.23	QP		
2		59.5353	17.94	12.71	30.65	40.00	-9.35	QP		
3	*	82.8525	25.72	8.04	33.76	40.00	-6.24	QP		
4		127.9327	25.80	9.78	35.58	43.50	-7.92	QP		
5		174.5673	24.81	7.98	32.79	43.50	-10.71	QP		
6		197.8846	17.26	10.50	27.76	43.50	-15.74	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL

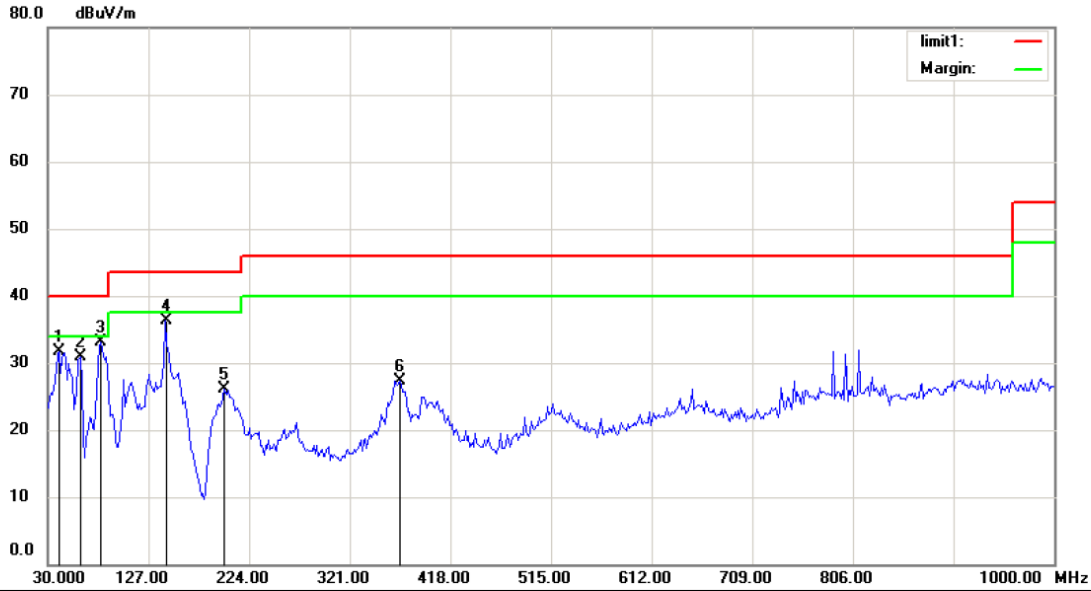


Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH78
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		59.5353	6.17	12.71	18.88	40.00	-21.12	QP		
2		146.5864	15.61	8.75	24.36	43.50	-19.14	QP		
3		199.4391	10.81	10.38	21.19	43.50	-22.31	QP		
4		269.3910	9.70	14.88	24.58	46.00	-21.42	QP		
5	*	365.7692	18.80	17.05	35.85	46.00	-10.15	QP		
6		811.9071	7.03	24.64	31.67	46.00	-14.33	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL



Site 3m Chamber #1 Polarization: **Vertical** Temperature: 24
 Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 53 %
 Mode:GFSK TX CH78
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		40.8814	17.39	14.36	31.75	40.00	-8.25	QP		
2		61.0897	18.51	12.43	30.94	40.00	-9.06	QP		
3	*	81.2980	25.49	7.66	33.15	40.00	-6.85	QP		
4		143.4776	27.36	8.92	36.28	43.50	-7.22	QP		
5		199.4391	15.74	10.38	26.12	43.50	-17.38	QP		
6		368.8782	10.25	17.07	27.32	46.00	-18.68	QP		

*:Maximum data x:Over limit !:over margin

Operator: ZHL

All the modulation modes were tested the data of the Worse result(GFSK) are recorded in the following pages and the others modulation methods do not exceed the limits.

Operation Mode: CH1: 2402MHz Test Date : August 27, 2014
 Frequency Range: 1-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Measured Distance: 3m Test By: KK
 Test mode: GFSK

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
4804.00	V	51.81	32.94	74.00	54.00	-22.19	-21.06
7206.00	V	52.03	32.66	74.00	54.00	-21.97	-21.34
9608.00	V	52.51	32.73	74.00	54.00	-21.49	-21.27
12010.00	V	53.19	33.81	74.00	54.00	-20.81	-20.19
14412.00	V	51.75	32.65	74.00	54.00	-22.25	-21.35
16814.00	V	53.34	34.80	74.00	54.00	-20.66	-19.2
4804.00	H	52.15	33.43	74.00	54.00	-21.85	-20.57
7206.00	H	52.93	33.87	74.00	54.00	-21.07	-20.13
9608.00	H	53.22	34.02	74.00	54.00	-20.78	-19.98
12010.00	H	52.41	33.17	74.00	54.00	-21.59	-20.83
14412.00	H	53.00	34.25	74.00	54.00	-21	-19.75
16814.00	H	52.94	34.09	74.00	54.00	-21.06	-19.91

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: CH40: 2441MHz Test Date : August 27, 2014
 Frequency Range: 1-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Measured Distance: 3m Test By: KK
 Test mode: GFSK

Freq. (MHz)	Ant.Pol H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
4882.00	V	52.97	33.67	74.00	54.00	-21.03	-20.33
7323.00	V	53.19	33.39	74.00	54.00	-20.81	-20.61
9764.00	V	53.67	33.46	74.00	54.00	-20.33	-20.54
12205.00	V	54.35	34.54	74.00	54.00	-19.65	-19.46
14646.00	V	52.91	33.17	74.00	54.00	-21.09	-20.83
17087.00	V	54.50	35.53	74.00	54.00	-19.50	-18.47
4882.00	H	53.31	34.16	74.00	54.00	-20.69	-19.84
7323.00	H	54.09	34.60	74.00	54.00	-19.91	-19.40
9764.00	H	54.38	34.25	74.00	54.00	-19.62	-19.75
12205.00	H	53.57	33.40	74.00	54.00	-20.43	-20.60
14646.00	H	54.16	34.28	74.00	54.00	-19.84	-19.72
17087.00	H	54.10	34.82	74.00	54.00	-19.90	-19.18

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: CH79: 2480MHz Test Date : August 27, 2014
 Frequency Range: 1-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Measured Distance: 3m Test By: KK
 Test mode: GFSK

Freq. (MHz)	Ant.Pol H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
4960.00	V	44.26	26.19	74.00	54.00	-29.74	-27.81
7440.00	V	48.68	29.31	74.00	54.00	-25.32	-24.69
9920.00	V	51.89	33.63	74.00	54.00	-22.11	-20.37
12400.00	V	52.39	33.20	74.00	54.00	-21.61	-20.80
14880.00	V	52.57	34.00	74.00	54.00	-21.43	-20.00
17360.00	V	52.71	33.70	74.00	54.00	-21.29	-20.30
4960.00	H	52.42	33.56	74.00	54.00	-21.58	-20.44
7440.00	H	52.66	33.57	74.00	54.00	-21.34	-20.43
9920.00	H	52.12	32.65	74.00	54.00	-21.88	-21.35
12400.00	H	51.99	33.57	74.00	54.00	-22.01	-20.43
14880.00	H	52.79	33.46	74.00	54.00	-21.21	-20.54
17360.00	H	53.72	34.96	74.00	54.00	-20.28	-19.04

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

6. Channel Separation test

6.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

6.4 Measurement Results:

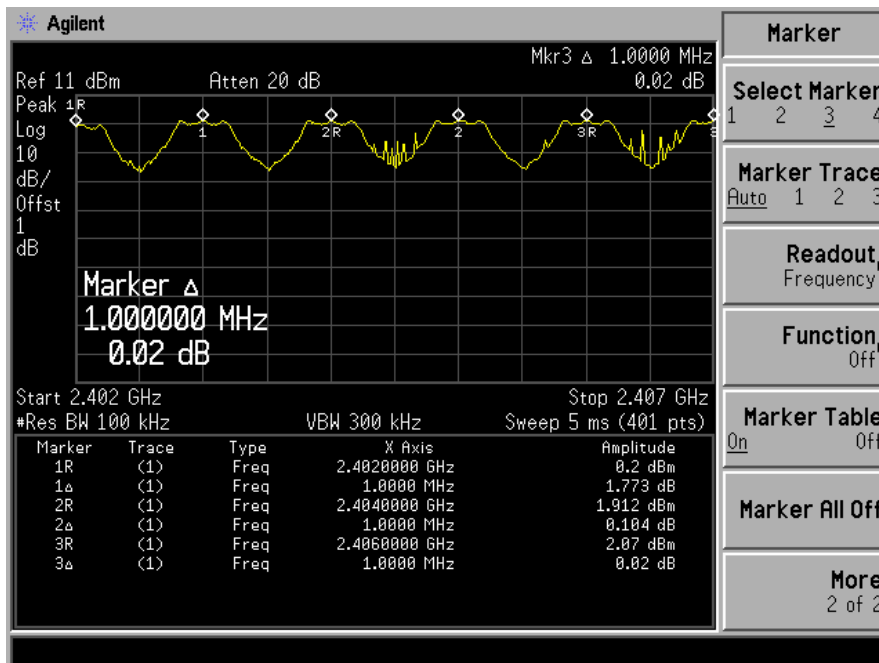
The following table is the setting of spectrum analyzer.

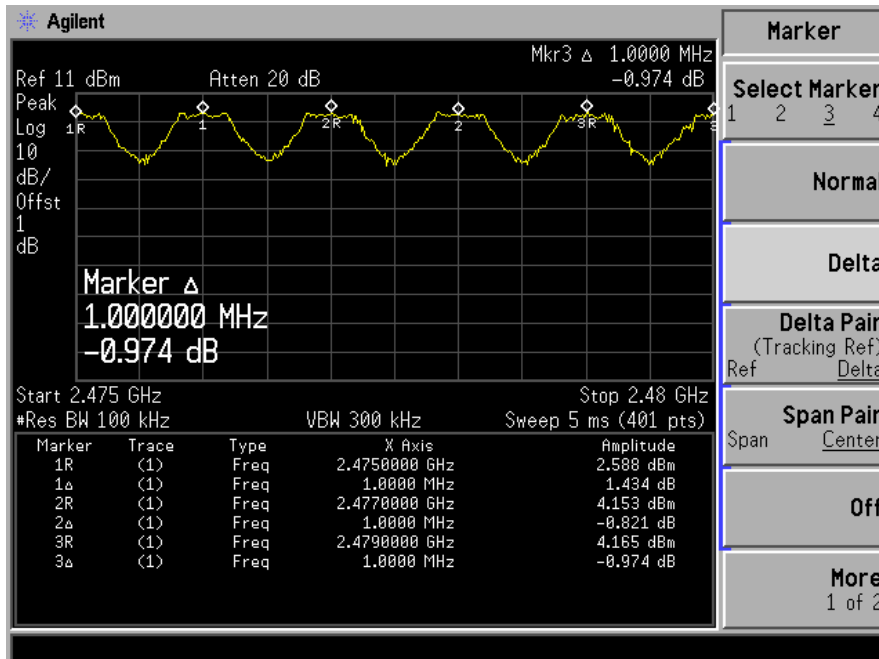
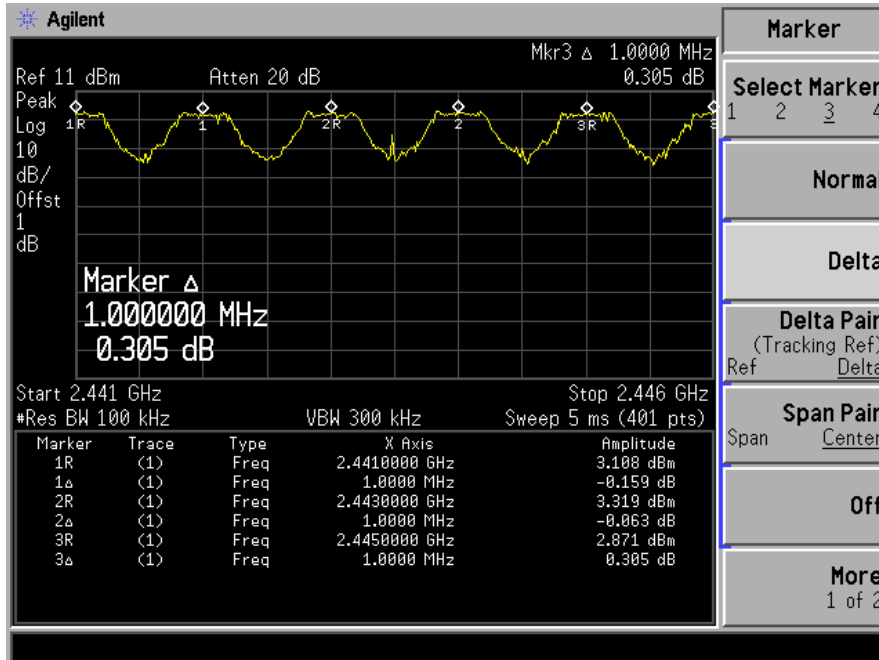
EMI Test Receiver	Setting
Attenuation	Auto
RB	100kHz
VB	300kHz
Detector	Peak
Trace	Max hold

Refer to attached data chart.

Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24 °C
 Test Result: PASS Humidity : 53 %
 Modulation: GFSK

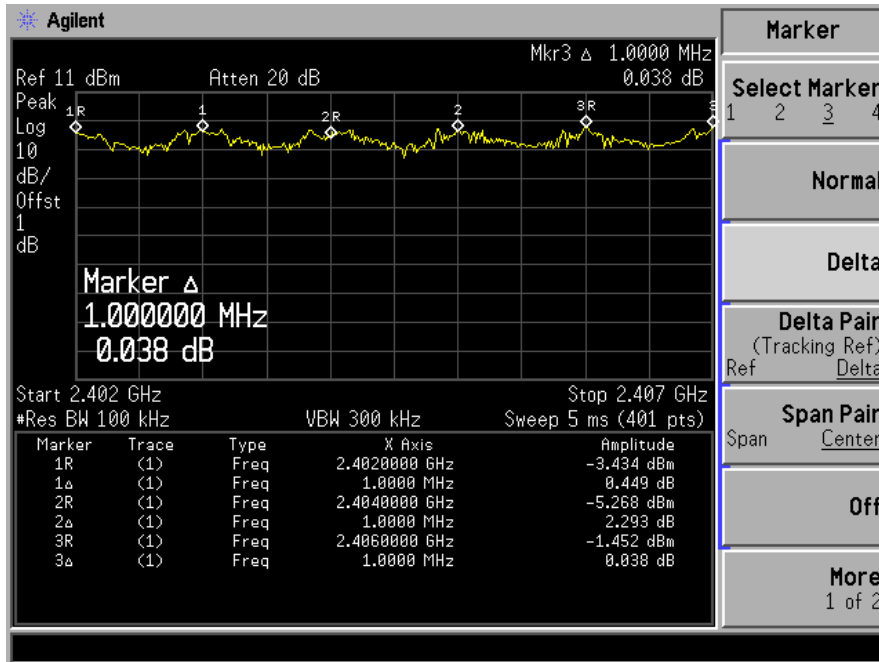
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 20dB Down BW(kHz)
1	2402	1000.00	>857.987
40	2441	1000.00	>848.374
79	2480	1000.00	>846.712

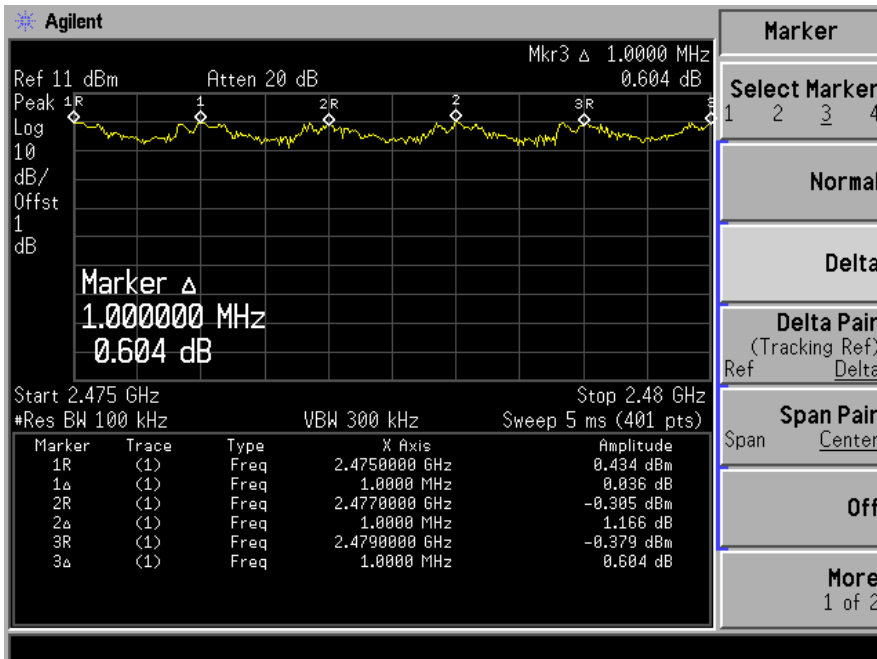
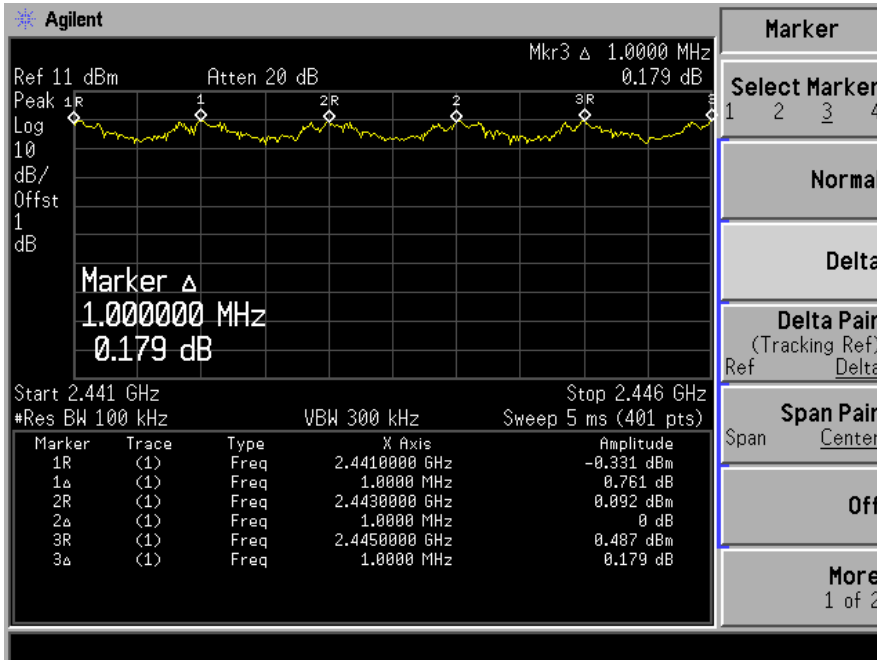




Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Modulation: 1/4πDQPSK

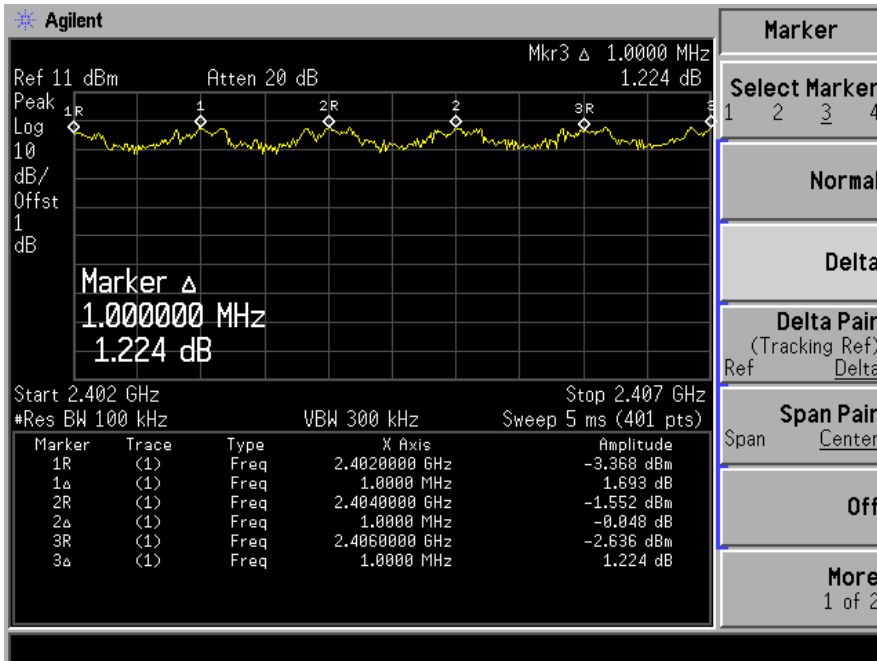
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000.00	>810.000
40	2441	1000.00	>814.000
79	2480	1000.00	>798.000

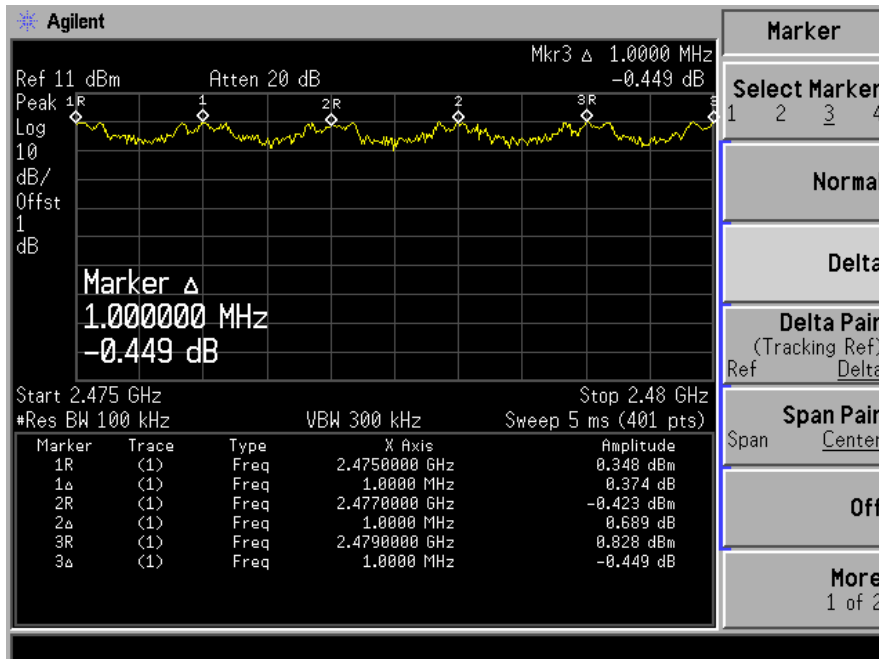
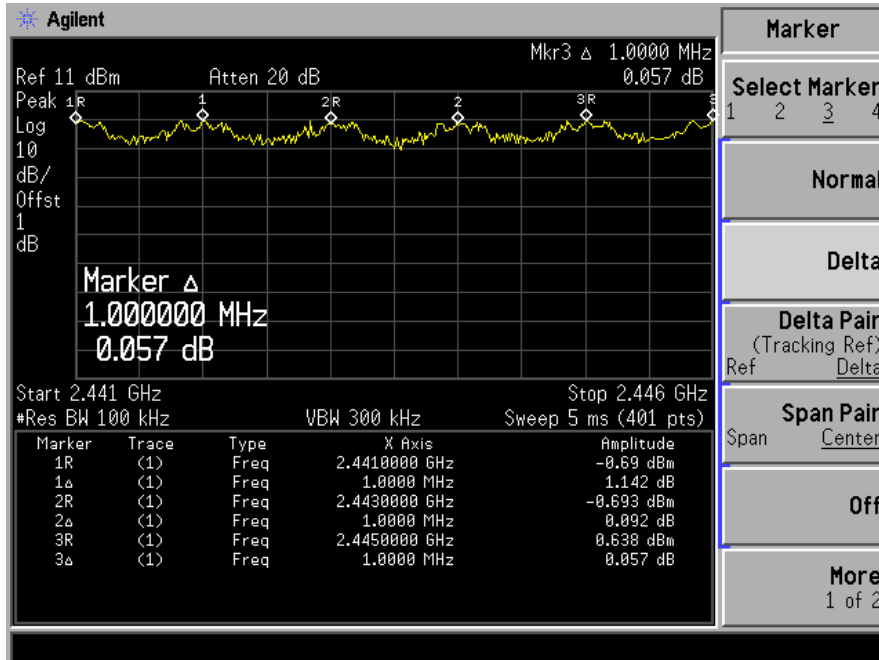




Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Modulation: 8DPSK

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000.00	>802.000
40	2441	1000.00	>804.667
79	2480	1000.00	>809.333



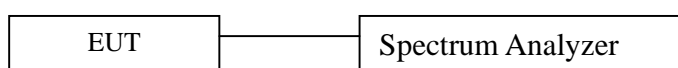


7. Bandwidth test

7.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

7.4 Measurement Results:

The following table is the setting of spectrum analyzer.

EMI Test Receiver	Setting
Attenuation	Auto
Span	3MHz
RB	30kHz
VB	100kHz
Detector	Peak
Trace	Max hold

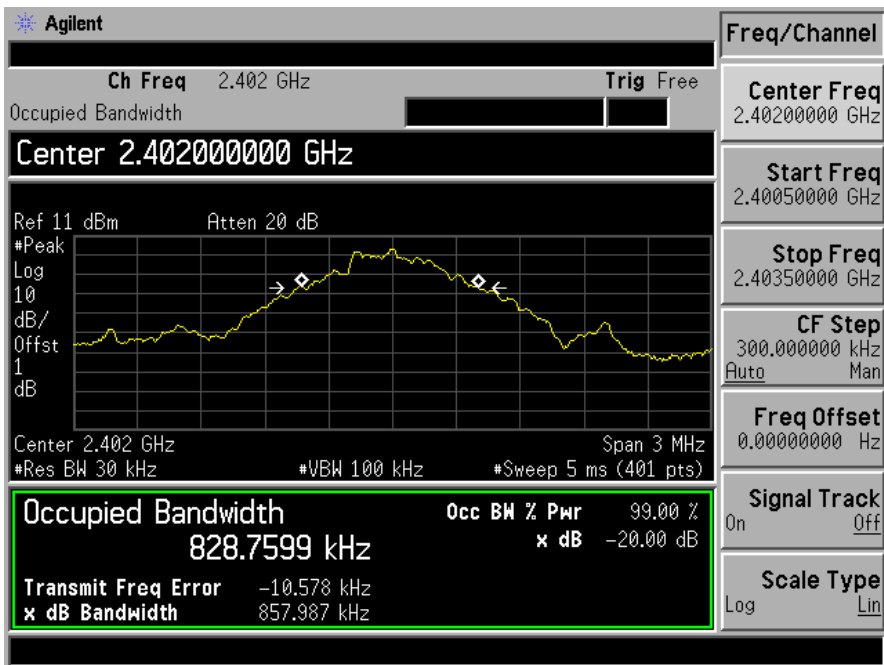
All the modes GFSK, 1/4π-DQPSK,8DPSK have been tested and the result recorded as below.

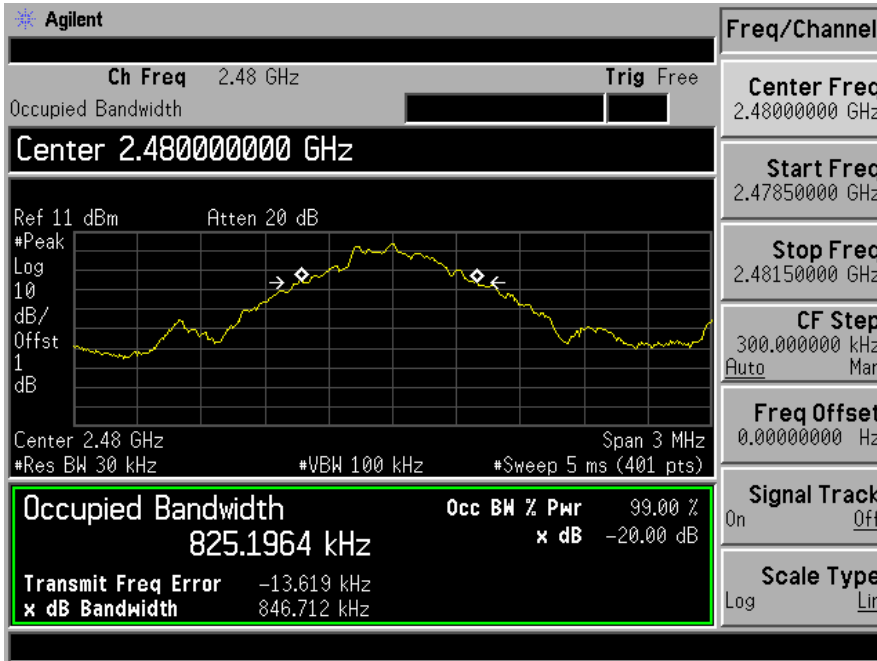
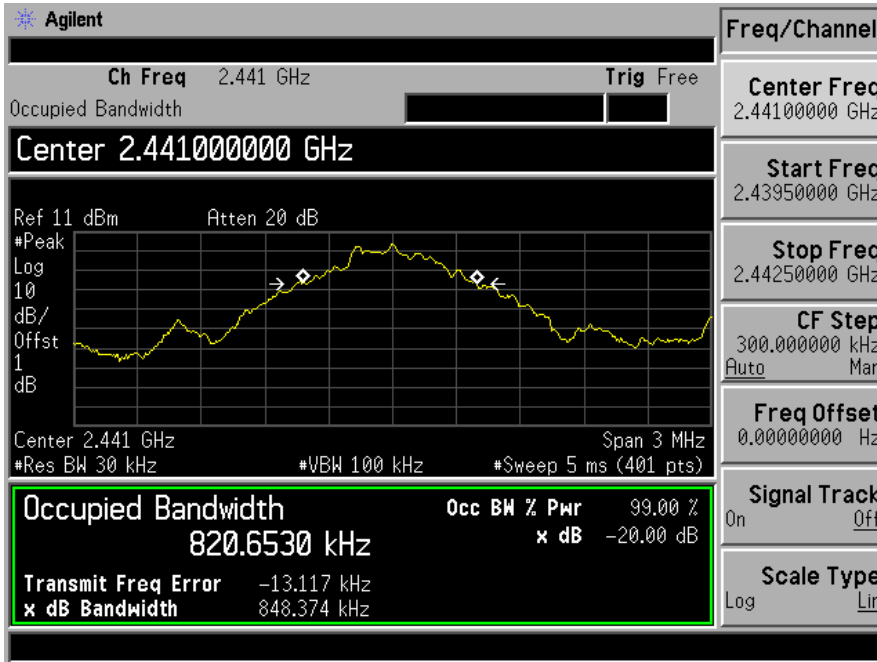
7.4.1. 20dB Bandwidth and 99% Bandwidth test data Chart:

Refer to attached data chart.

Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24 °C
 Test Result: PASS Humidity : 53 %
 Modulation: GFSK

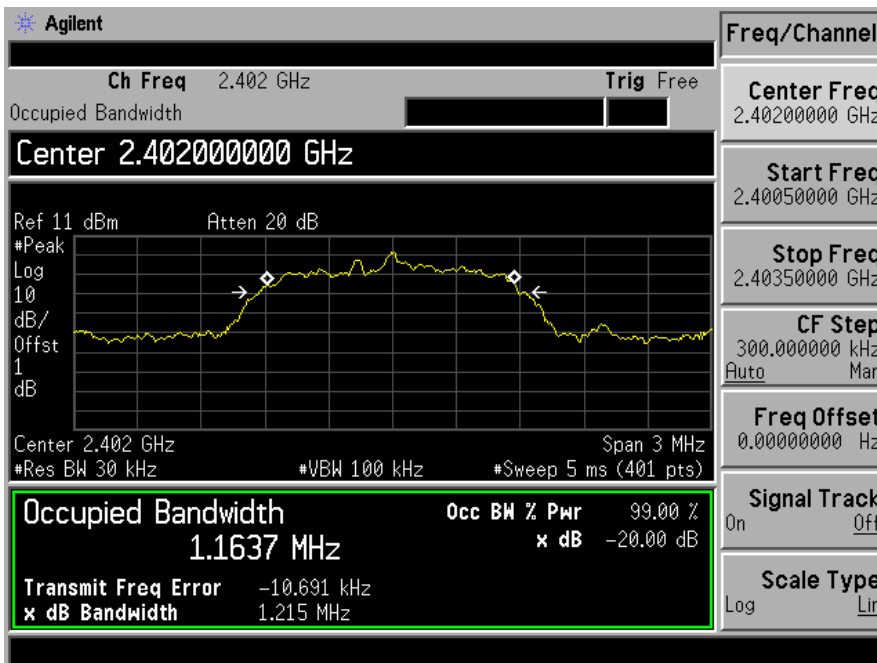
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	857.987
40	2441	848.374
79	2480	846.712

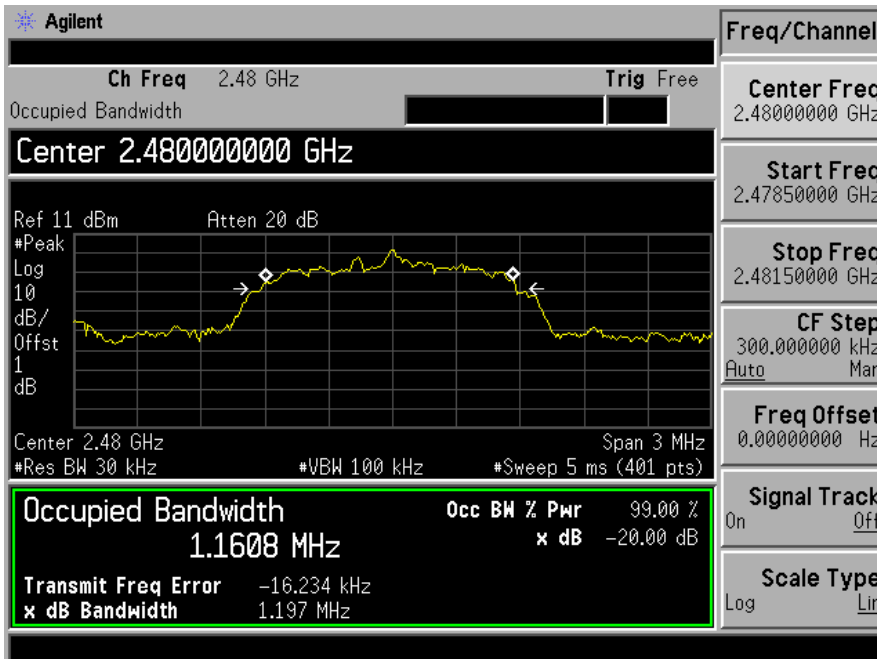
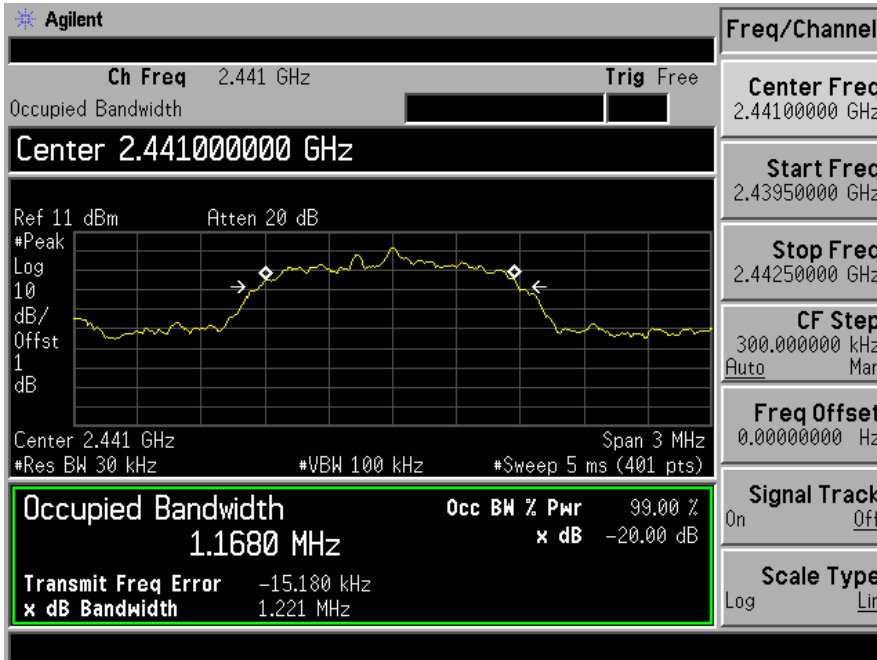




Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24 °C
 Test Result: PASS Humidity : 53 %
 Modulation: 1/4Π-DQPSK

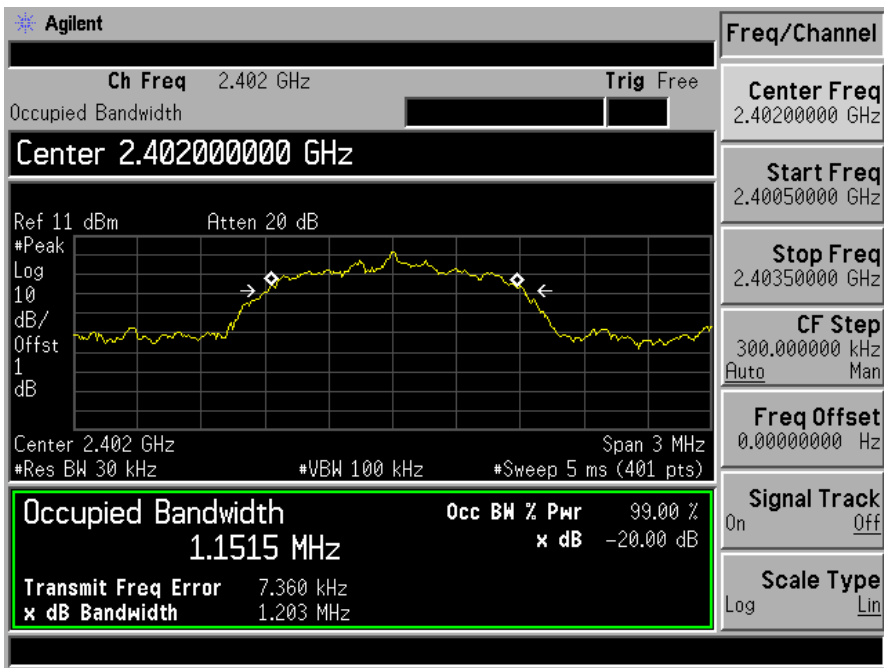
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1215.00
40	2441	1221.00
79	2480	1197.00

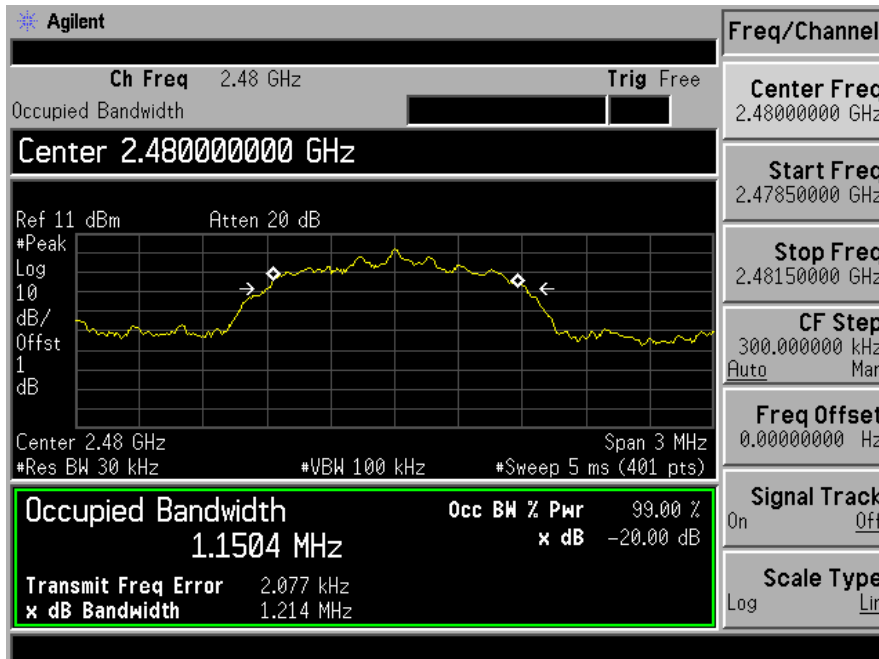
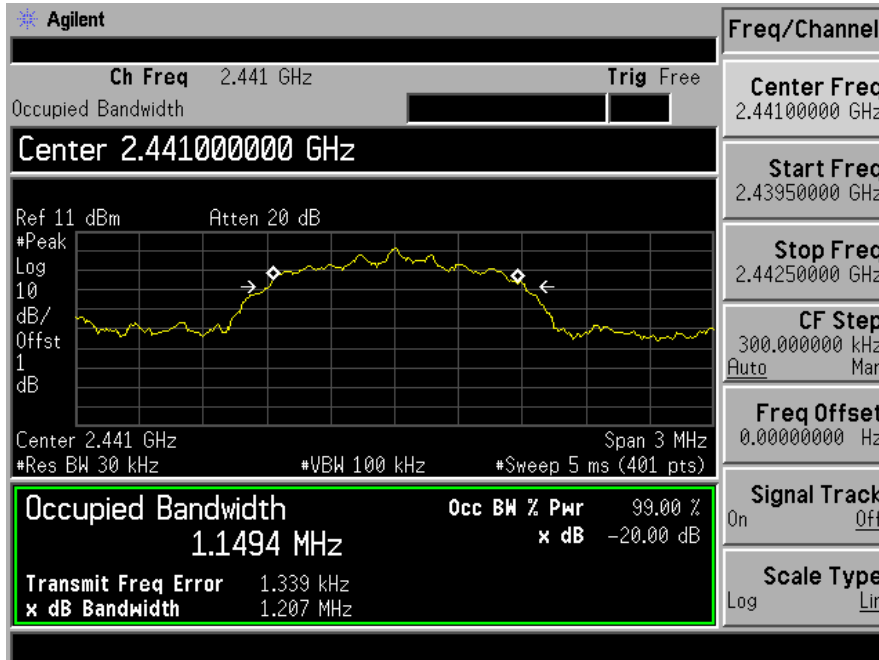




Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24 °C
 Test Result: PASS Humidity : 53 %
 Modulation: 8DPSK

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1203.00
40	2441	1207.00
79	2480	1214.00





8. Quantity of Hopping Channel Test

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

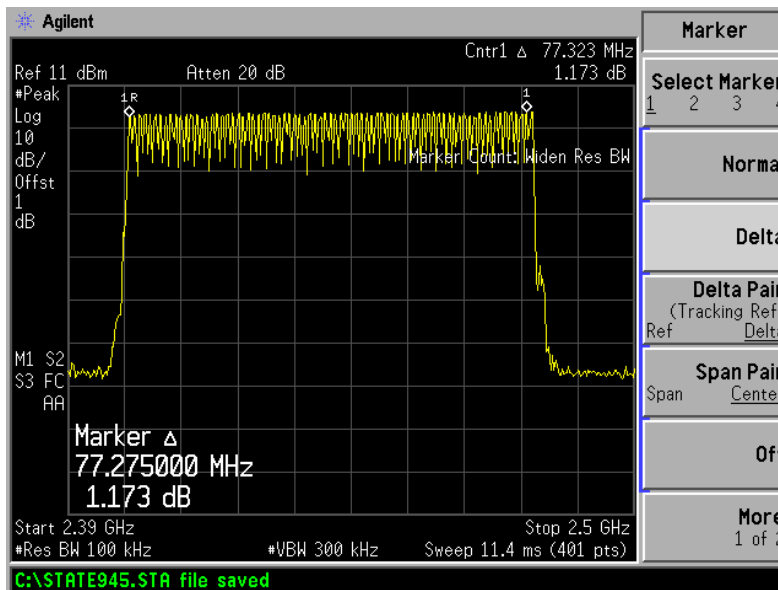
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

8.4 Measurement Results:

All the modulation modes were tested the data of the GFSK mode are recorded in the following pages.

Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel limit
2402-2480	79	> 15

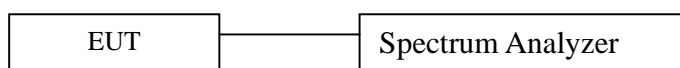


9. Time of Occupancy (Dwell Time) test

9.1 Measurement Procedure

- a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- b. Turn on the EUT and connect its antenna terminal to measurement 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. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- e. Repeat above procedures until all different time-slot modes have been completed.

9.2 Test SET-UP (Block Diagram of Configuration)



9.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

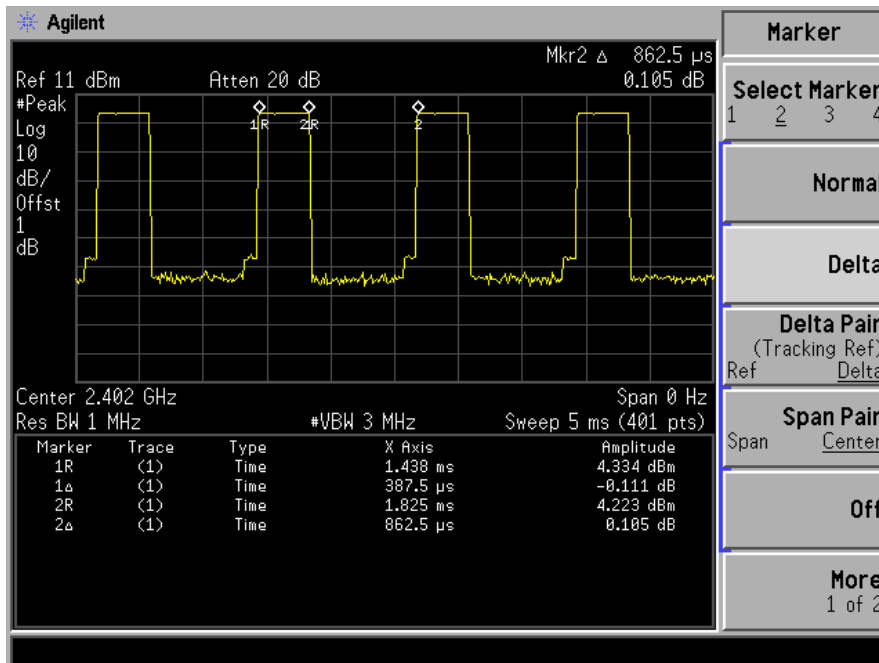
9.4 Measurement Results:

All the modulation modes were tested and the data of the GFSK mode are recorded in the following pages. Low, Middle and Highest channels have been tested, the worst test data channel 2402 were recorded in this report.

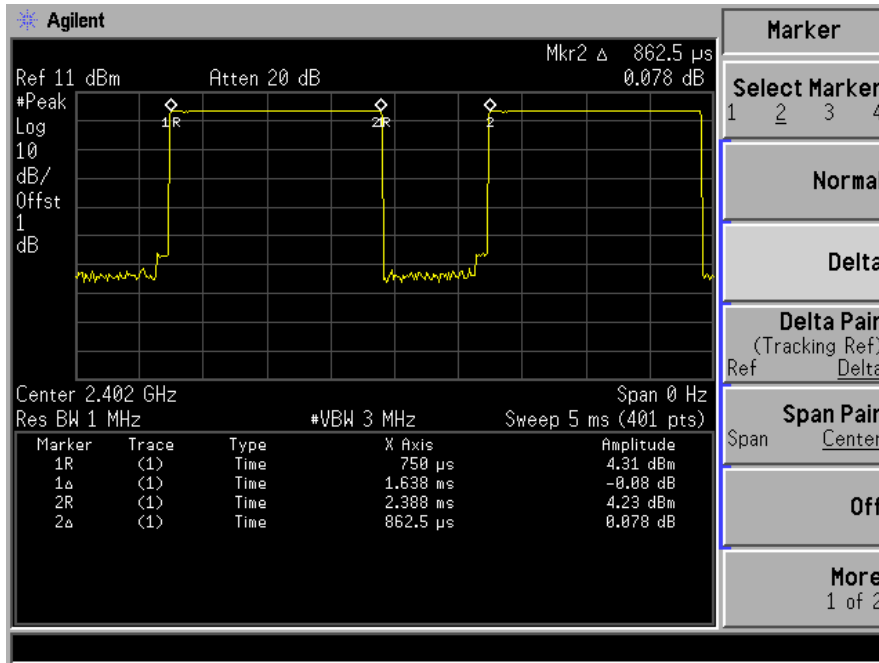
Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %

Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	$1600/(2*79) \times 31.6 = 320$	0.3875	124.00	400
DH3	$1600/(4*79) \times 31.6 = 160$	1.6380	262.08	400
DH5	$1600/(6*79) \times 31.6 = 106.67$	2.9000	309.34	400

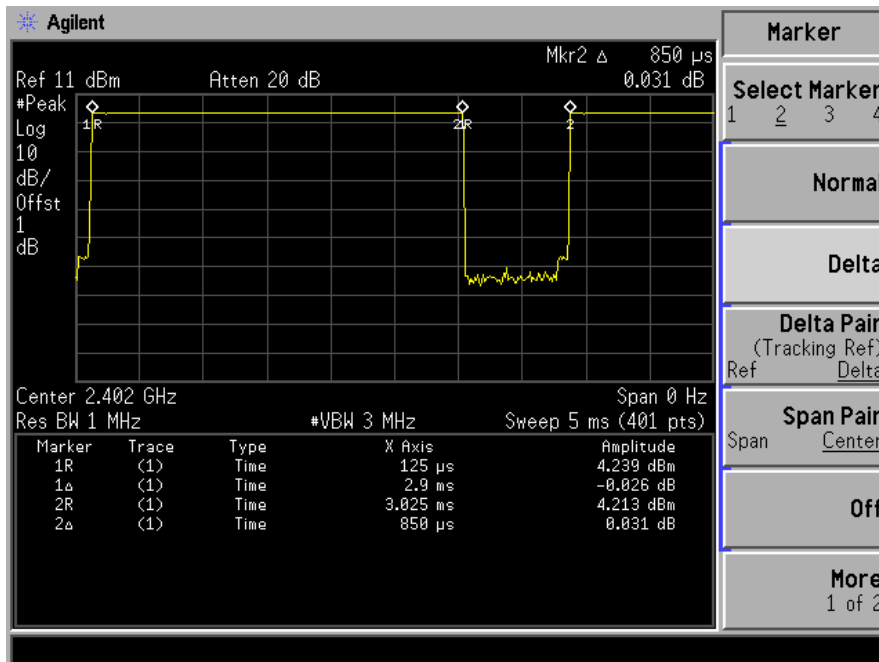
DH1



DH3



DH5

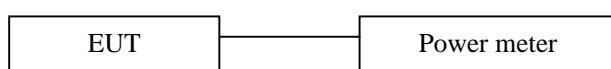


10. MAXIMUM PEAK OUTPUT POWER TEST

10.1 Measurement Procedure

- a. The testing follows FCC public Notice DA 00-705 Measurement Guidelines.
- b. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- c. Set to the maximum output power setting and enable the EUT transmit continuously.
- d. Measure the conducted output power with cable loss and record the results in the test report.
- e. Measure and record the results in the report.

10.2 Test SET-UP (Block Diagram of Configuration)



10.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	Boonton	4232A	29001	05/17/2014	05/16/2015
Power sensor	Boonton	51011-EMC	31184	05/17/2014	05/16/2015

10.4 Measurement Results:

All the modes GFSK, 1/4Π-DQPSK,8DPSK have been tested and the result recorded as below.

Spectrum Detector:	PK	Test Date :	September 12, 2014
Test By:	KK	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power Limit(mW)	Pass/Fail
1	2402.00	4.31	1000mW	PASS
40	2441.00	4.51	1000mW	PASS
79	2480.00	4.81	1000mW	PASS

Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Modulation: 1/4Π-DQPSK

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power Limit(mW)	Pass/Fail
1	2402.00	2.99	125mW	PASS
40	2441.00	3.11	125mW	PASS
79	2480.00	3.35	125mW	PASS

Spectrum Detector: PK Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test Result: PASS Humidity : 53 %
 Modulation: 8DPSK

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power Limit(mW)	Pass/Fail
1	2402.00	3.13	125mW	PASS
40	2441.00	3.34	125mW	PASS
79	2480.00	3.57	125mW	PASS

11. Band EDGE test

11.1 Measurement Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA00-705 Measurement Guidelines.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
6. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.For average measurement:
The RBW of test receiver/spectrum analyzer is 1MHz and the VBW for Average detection (AV) of test receiver/spectrum analyzer is 10Hz above 1GHz.

The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

11.2 Test SET-UP (Block Diagram of Configuration)

As 5.2 Test set up (B) and (C)

11.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

11.4 Measurement Results:

All the modes GFSK, 1/4π-DQPSK, 8DPSK and hopping mode have been tested and the result recorded as below.

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test channel: 00 Humidity : 53 %
 Modulation: GFSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2312.38	H	55.69	41.18	74	54
2385.66	V	54.35	39.84	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test channel: 78 Humidity : 53 %
 Modulation: GFSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2483.75	H	54.84	40.33	74	54
2488.52	V	53.50	38.99	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test channel: 00 Humidity : 53 %
 Modulation: 1/4π-DQPSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2312.55	H	55.53	41.02	74	54
2364.48	V	54.19	39.68	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24°C
 Test channel: 78 Humidity : 53 %
 Modulation: 1/4π-DQPSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2484.49	H	54.95	40.44	74	54
2492.71	V	53.61	39.10	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24℃
 Test channel: 00 Humidity : 53 %
 Modulation: 8DPSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2347.51	H	55.77	41.26	74	54
2376.10	V	54.43	39.92	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24℃
 Test channel: 78 Humidity : 53 %
 Modulation: 8DPSK

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2489.57	H	55.88	41.37	74	54
2496.44	V	54.54	40.03	74	54

Spectrum Detector: PK/AV Test Date : September 12, 2014
 Test By: KK Temperature : 24℃
 Modulation: Hopping mode Humidity : 53 %

Frequency (MHz)	Polarity	Level (dBuV/m)		Limited (dBuV/m)	
		PK	AV	PK	AV
2390.00	H	53.87	39.36	74	54
2390.00	V	52.53	38.02	74	54
2483.50	H	53.51	39.00	74	54
2483.50	V	52.17	37.66	74	54

12. Antenna Port Emission

12.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

12.2 Measuring Instruments and setting

All the modulation modes were tested and the data of the GFSK mode are recorded in the following pages and the others modulation methods do not exceed the limits.

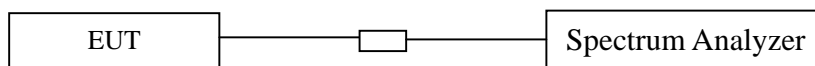
The following table is the setting of spectrum analyzer.

EMI Test Receiver	Setting
Attenuation	Auto
RB	100kHz
VB	300kHz
Detector	Peak
Trace	Max hold

12.3 Test Procedures

The conducted spurious emissions were measured conducted using a spectrum analyzer at low, mid, and hi channels, the limit was determined by attenuation 20dB of the RF peak power output.

12.4 Block Diagram of Test setup

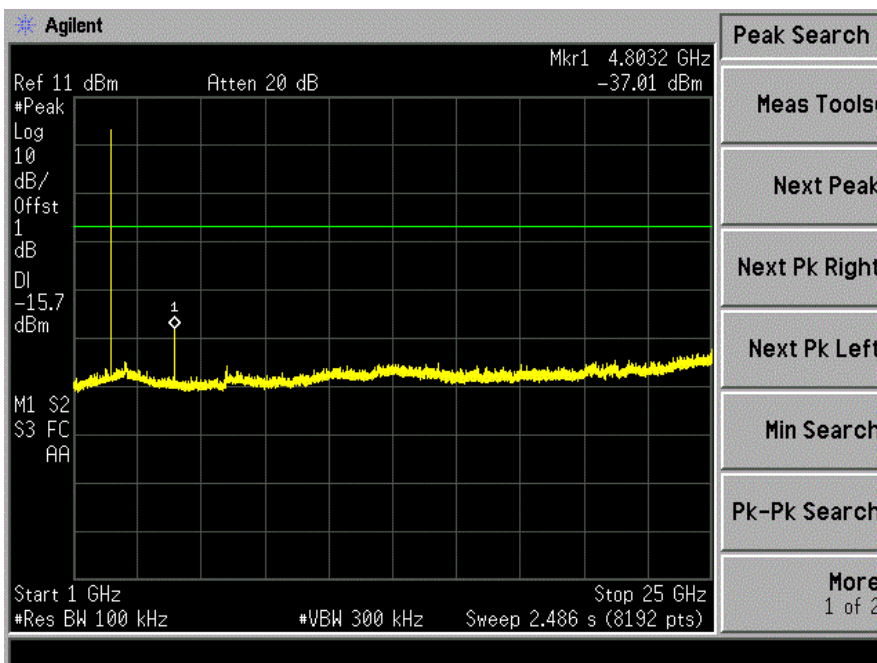
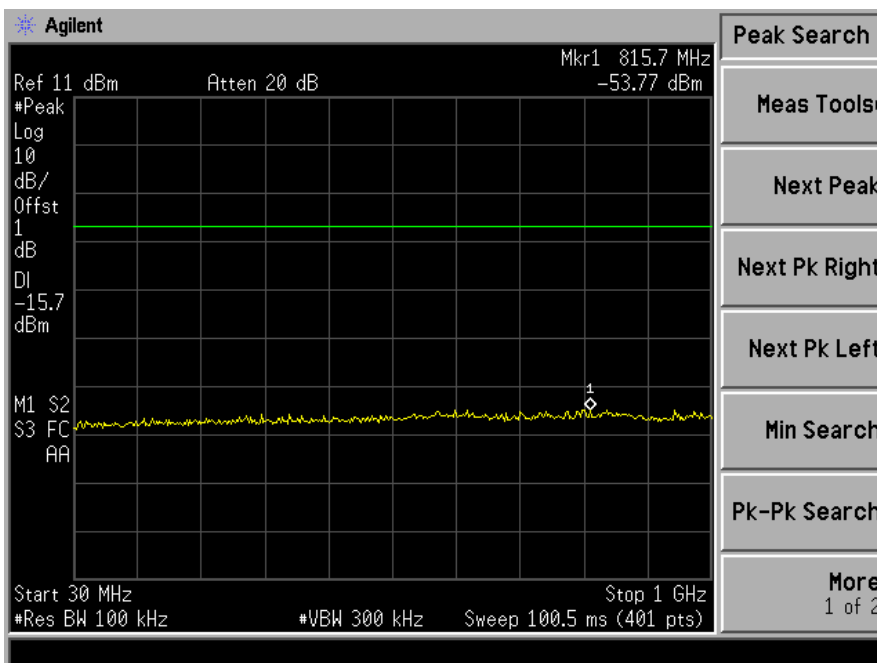


12.5 Test Result

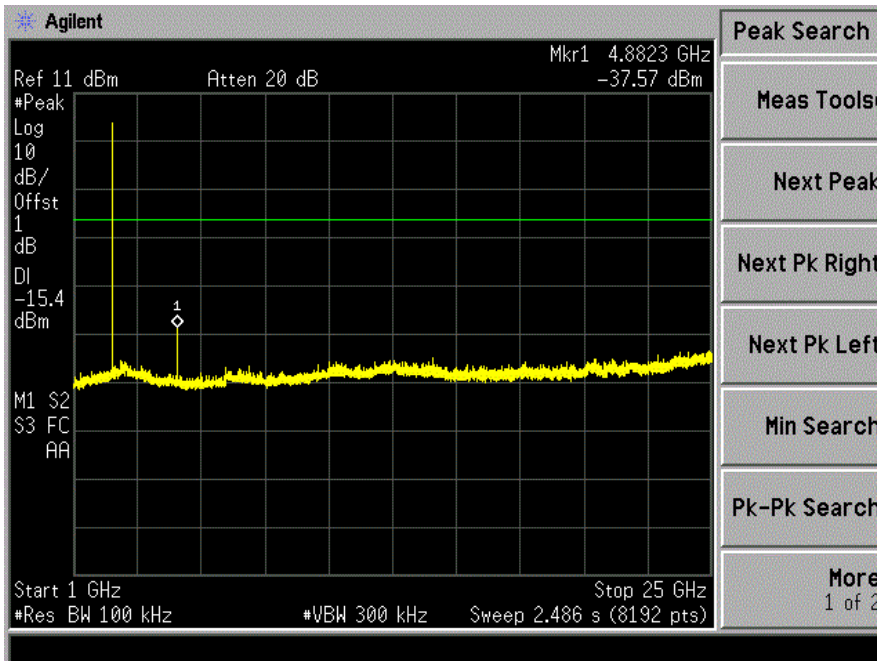
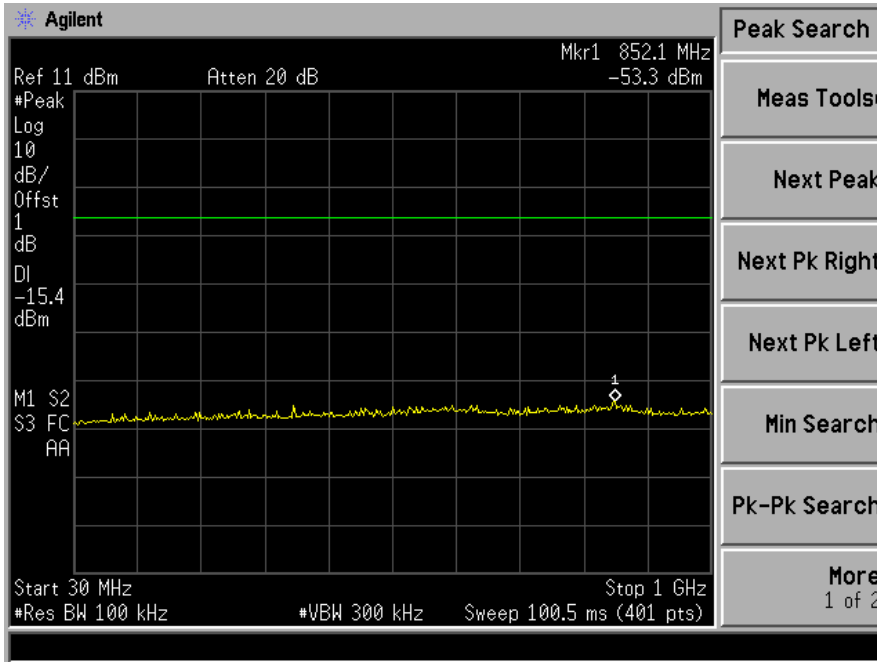
PASS.

All the modes GFSK, 1/4Π-DQPSK,8DPSK have been tested and the worst result (GFSK) recorded in the following pages and the others modulation methods do not exceed the limits.

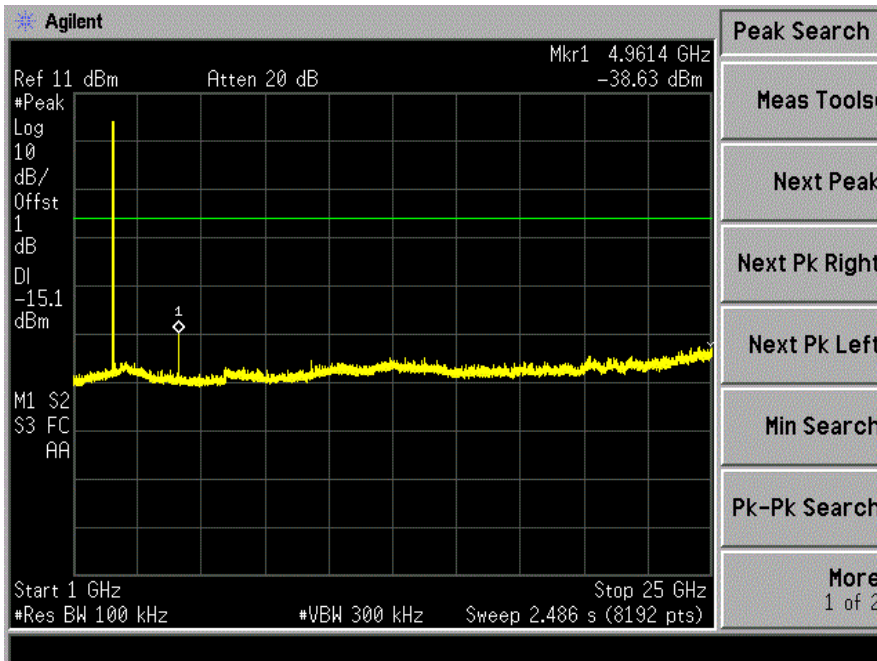
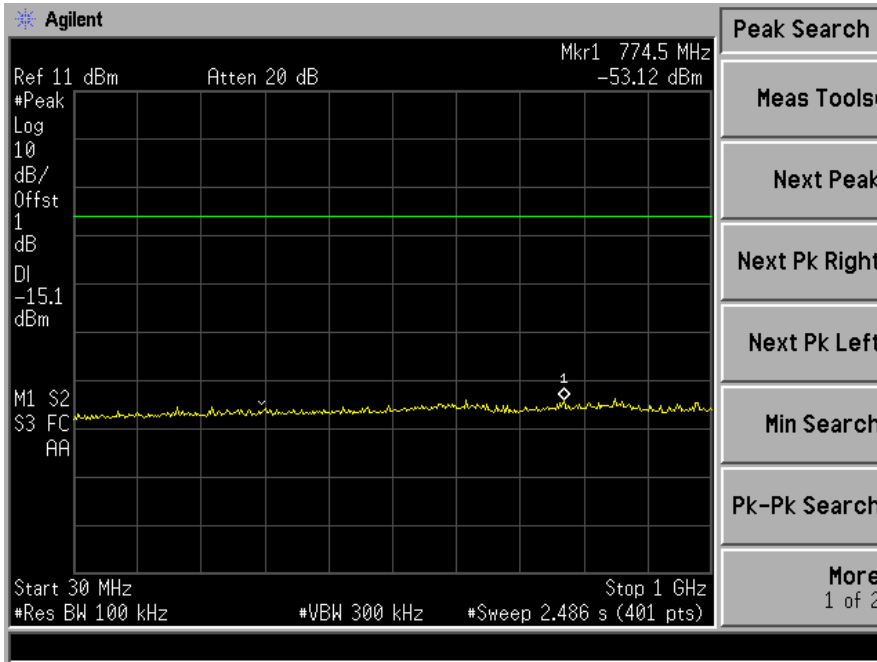
TX 2402MHz



TX 2441MHz



TX 2480MHz



13. Antenna Application

13.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247

FCC part 15C section 15.247 requirements:

Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

13.2 Result

The EUT's antenna is Chip Antenna, The antenna's gain is 2dBi and meets the requirement.