



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

OF

**Classical Turntable with AM/FM Radio**

**Model No.: CR2405H-PA, CR2405H-BK, CR2405H, TRW201, CR2405C-PA,  
CR2402C, CR2402C-PA**

**Trademark: CROSLEY**

**FCC ID: 2AFY4-CR2405HPA**

**Report No.: ED150819033E**

**Issue Date: October 15, 2015**

*Prepared for*

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*Prepared by*

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DONGGUAN EMTEK CO., LTD.**

## VERIFICATION OF COMPLIANCE

Applicant:	DONGGUAN ANTIQUE ELECTRONIC ART WOODWORK LTD. Xinjiang Road, Jiangbian Village, Qishi Town, Dongguan, China
Manufacturer:	DONGGUAN ANTIQUE ELECTRONIC ART WOODWORK LTD. Xinjiang Road, Jiangbian Village, Qishi Town, Dongguan, China
Product Description:	Classical Turntable with AM/FM Radio
Trade Mark:	CROSLEY
Model Number:	CR2405H-PA, CR2405H-BK, CR2405H, TRW201, CR2405C-PA, CR2402C, CR2402C-PA (Note: The samples are the same except model number. So CR2405H-PA was selected for full test.)

### We hereby certify that:

The above equipment was tested by DONGGUAN 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 C63.10-2013 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(2014).

Date of Test : August 19, 2015 to September 11, 2015

Prepared by :

Mary Jiang/Editor

Reviewer :

Alan He/Supervisor

Approved & Authorized Signer :

Sam Lv/Manager

## Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	ED150819033E

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Appendix I (Photos of EUT) (14 pages)

## 1. GENERAL INFORMATION

### 1.1 Product Description

Product Name	Classical Turntable with AM/FM Radio
Model number	CR2405H-PA
Power Supply	AC 120V/60Hz
Product Software Version	V1.0
Product Hardware version	V1.0
Radio Software Version	V1.0
Radio Hardware version	V1.0
Test Software Version	V1.0
RF Power Setting in Test Software	0dbm
Technical Description	
	Bluetooth 2.1+EDR
Operation Frequency	2402-2480MHz
Modulation	GFSK, π/4-DQPSK, 8DPSK
Number of Channel	79
Channel space	1MHz
Max RF Output Power	-0.74dBm(0.000843W)
Antenna Type	Internal PCB antenna
Antenna Gain	0 dBi

## 1.2 Test Facility

### Site Description

EMC Lab. : Registered on FCC, June 18, 2014  
The Certificate Number is 247565.

Registered on Industry Canada, February 19, 2014  
The Certificate Number is 9444A

Name of Firm : DONGGUAN EMTEK CO., LTD.

Site Location : No.281, Guantai Road, Nancheng District,  
Dongguan, 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 placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013. 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

Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m 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 EUT was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

## 2.4 Configuration of Tested System

**Fig. 2-1 Configuration of Tested System**



**Table 2-1 Equipment Used in Tested System**

Item	Equipment	Trade Mark	Model No.	FCC ID	Note
1.	Classical Turntable with AM/FM Radio	CROSLEY	CR2405H-PA	2AFY4-CR2405HPA	<b>EUT</b>

**Note:**

- (1) Unless otherwise denoted as EUT in 『Remark』 column , device(s) used in tested system is a support equipment.

### 3. Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207	AC Power Conducted Emission	Compliant
§15.247(d),§15.209	Radiated Emission	Compliant
§15.247(a)(1)	Channel Separation test	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(a)(1)(iii)	Quantity of Hopping Channel	Compliant
§15.247(a)(1)(iii)	Time of Occupancy(Dwell Time)	Compliant
§15.247(b)	Max Peak output Power test	Compliant
§15.247(d)	Band edge test	Compliant
§15.203	Antenna Requirement	Compliant

#### 4. Description of test modes

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK,  $\Pi/4$ -DQPSK, 8DPSK have been tested. 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

## 5. TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0 \text{dB}$
Conducted Emissions Test	$\pm 2.0 \text{dB}$
Radiated Emission Test	$\pm 2.0 \text{dB}$
Power Density	$\pm 2.0 \text{dB}$
Occupied Bandwidth Test	$\pm 1.0 \text{dB}$
Band Edge Test	$\pm 3 \text{dB}$
All emission, radiated	$\pm 3 \text{dB}$
Antenna Port Emission	$\pm 3 \text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

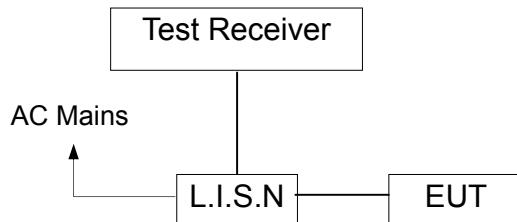
Measurement Uncertainty for a level of Confidence of 95%

## 6. Conducted Emissions Test

### 6.1 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 was complete.

### 6.2 Test SET-UP (Block Diagram of Configuration)



### 6.3 Measurement Equipment Used:

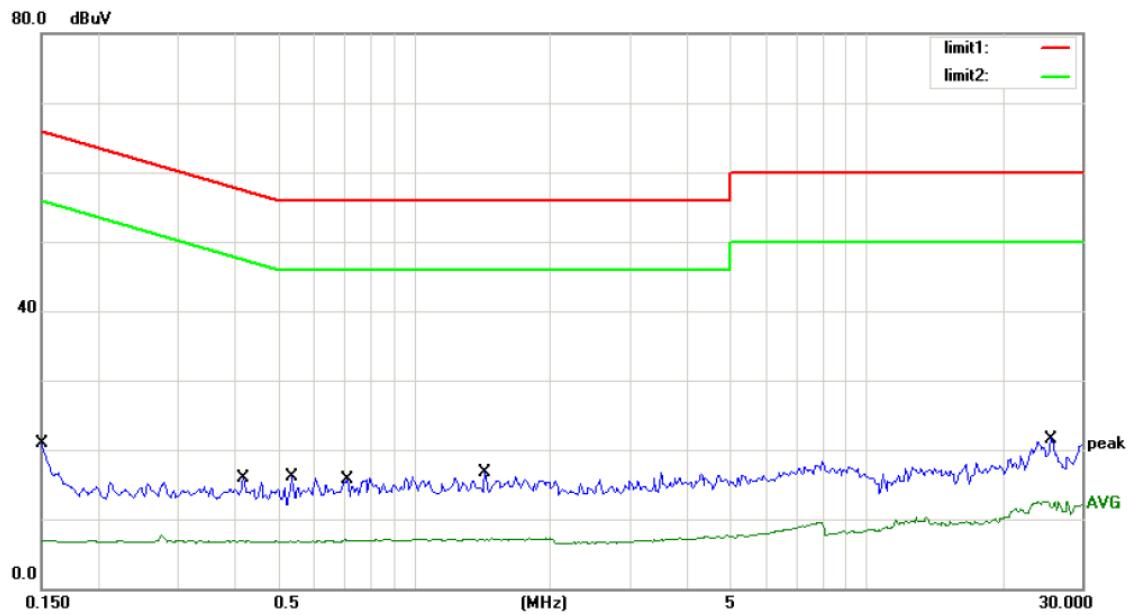
Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Last Cal.	Due date
Test Receiver	Rohde & Schwarz	ESCS30	100018	03/16/2015	03/15/2016
L.I.S.N	Rohde & Schwarz	ENV216	100017	03/16/2015	03/15/2016
RF Switching Unit	CDS	RSU-M2	38401	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

### 6.4 Measurement Result:

Pass.

All the modulation modes were tested the data of the worst mode (GFSK TX2402) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following data.



Site site #1

Limit: (CE)FCC PART 15 class B\_QP

Mode: TX2402

Note:

Phase: **L1**

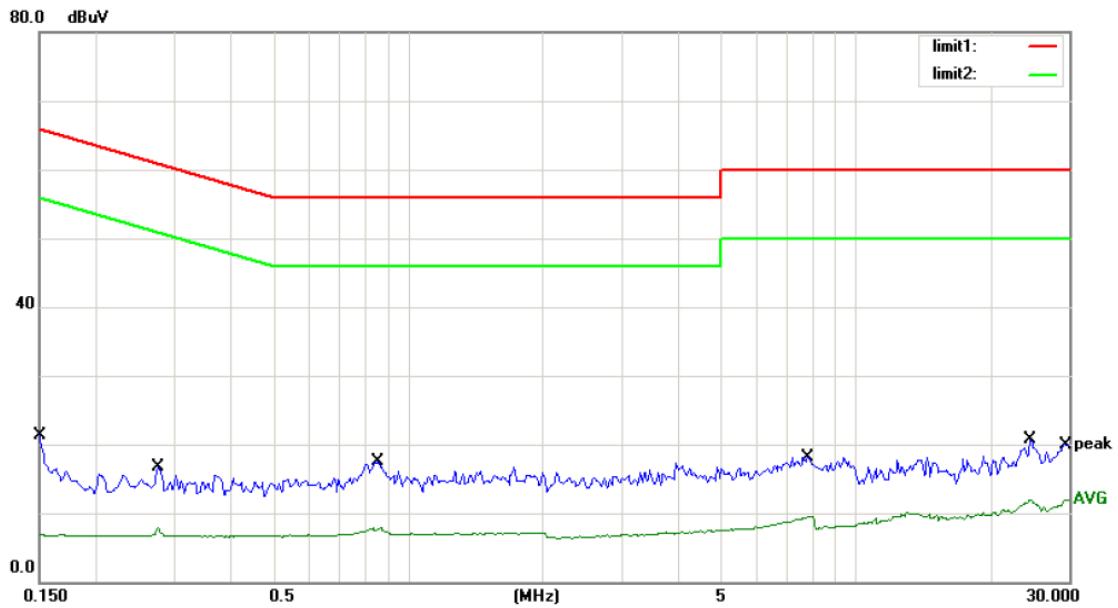
Power: AC 120V/60Hz

Temperature: 24

Humidity: 55 %

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Detector	Comment
			Level	Factor	ment				
			MHz	dBuV	dB	dBuV	dB		
1		0.1500	20.83	0.00	20.83	66.00	-45.17	QP	
2		0.1500	6.93	0.00	6.93	56.00	-49.07	AVG	
3		0.4200	15.88	0.00	15.88	57.45	-41.57	QP	
4		0.4200	6.79	0.00	6.79	47.45	-40.66	AVG	
5		0.5370	16.01	0.00	16.01	56.00	-39.99	QP	
6		0.5370	6.73	0.00	6.73	46.00	-39.27	AVG	
7		0.7125	15.77	0.00	15.77	56.00	-40.23	QP	
8		0.7125	6.86	0.00	6.86	46.00	-39.14	AVG	
9		1.4370	16.64	0.00	16.64	56.00	-39.36	QP	
10		1.4370	7.02	0.00	7.02	46.00	-38.98	AVG	
11		25.6500	21.60	0.00	21.60	60.00	-38.40	QP	
12	*	25.6500	11.79	0.00	11.79	50.00	-38.21	AVG	

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



Site site #1 Phase: **N** Temperature: 24

Limit: (CE)FCC PART 15 class B\_QP

Power: AC 120V/60Hz

Humidity: 55 %

Mode: TX2402

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1500	21.38	0.00	21.38	66.00	-44.62	QP	
2		0.1500	6.93	0.00	6.93	56.00	-49.07	AVG	
3		0.2760	16.73	0.00	16.73	60.94	-44.21	QP	
4		0.2760	7.99	0.00	7.99	50.94	-42.95	AVG	
5		0.8610	17.46	0.00	17.46	56.00	-38.54	QP	
6		0.8610	7.85	0.00	7.85	46.00	-38.15	AVG	
7		7.8300	18.13	0.00	18.13	60.00	-41.87	QP	
8		7.8300	9.52	0.00	9.52	50.00	-40.48	AVG	
9		24.6500	20.61	0.00	20.61	60.00	-39.39	QP	
10	*	24.6500	11.94	0.00	11.94	50.00	-38.06	AVG	
11		30.0000	19.85	0.00	19.85	60.00	-40.15	QP	
12		30.0000	11.81	0.00	11.81	50.00	-38.19	AVG	

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

### 6.5 Conducted Measurement Photos:



## 7. Radiated Emission Test

### 7.1 Measurement Procedure

1. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m 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 were complete.
5. The following table is the setting of spectrum analyzer:

When spectrum scanned from 30MHz to 1GHz setting resolution bandwidth 120KHz 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:

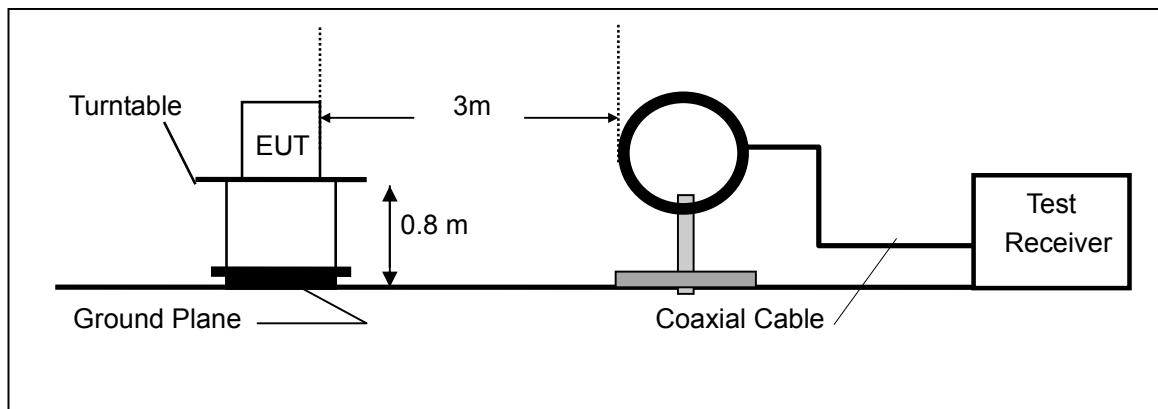
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

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

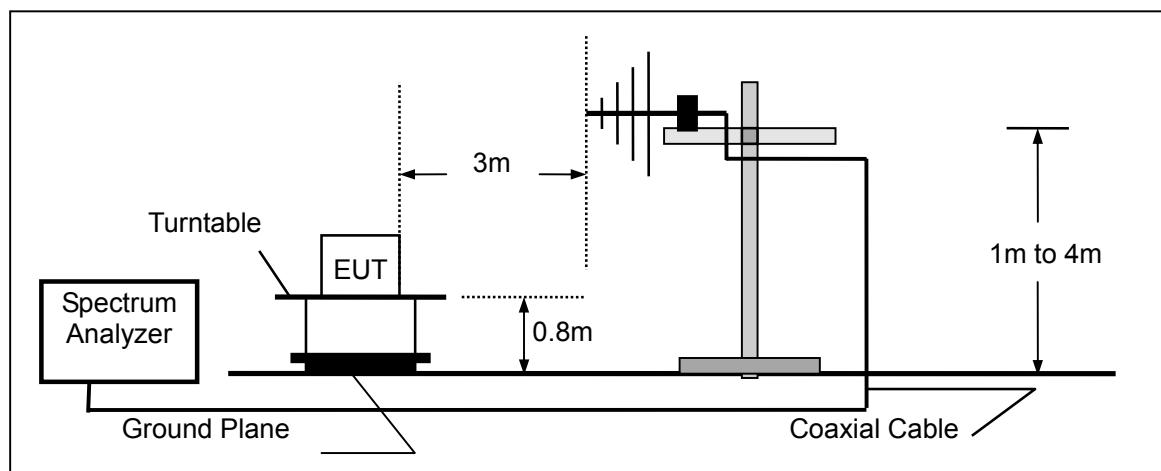
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

## 7.2 Test SET-UP (Block Diagram of Configuration)

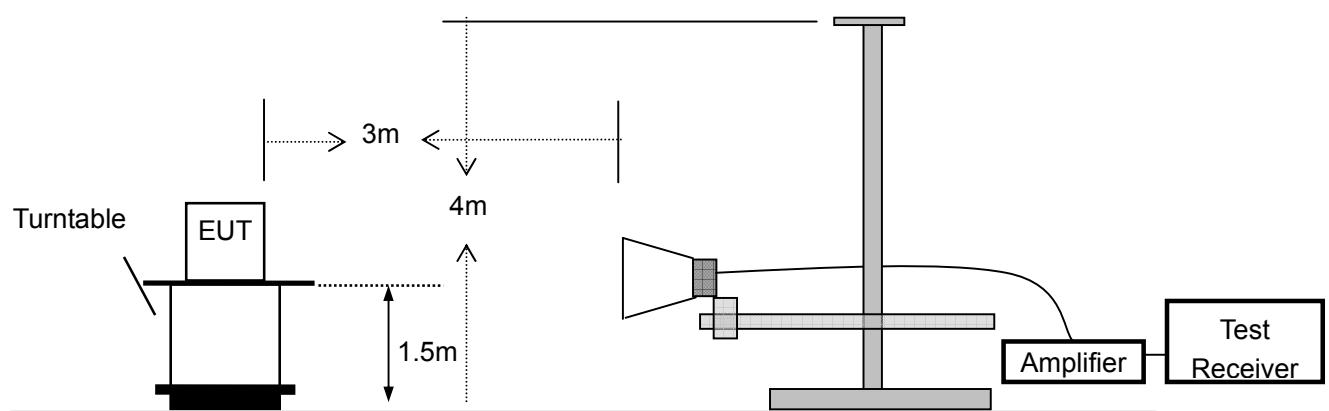
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



### 7.3 Measurement Equipment Used:

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI	1166.5950.03	03/16/2015	1 Year
2.	Bilog Antenna	Schwarzbeck	VULB9163	000141	03/16/2015	1 Year
3.	Power Amplifier	CDS	RSU-M352	818	03/16/2015	1 Year
4.	Power Amplifier	HP	8447F	OPT H64	03/16/2015	1 Year
5.	Color Monitor	SUNSPO	SP-140A	N/A	03/16/2015	1 Year
6.	Single Line Filter	JIANLI	XL-3	N/A	03/16/2015	1 Year
7.	Single Phase Power Line Filter	JIANLI	DL-2X100B	N/A	03/16/2015	1 Year
8.	3 Phase Power Line Filter	JIANLI	DL-4X100B	N/A	03/16/2015	1 Year
9.	DC Power Filter	JIANLI	DL-2X50B	N/A	03/16/2015	1 Year
10.	Cable	Schwarzbeck	PLF-100	549489	03/16/2015	1 Year
11.	Cable	Rosenberger	CIL02	A0783566	03/16/2015	1 Year
12.	Cable	Rosenberger	RG 233/U	525178	03/16/2015	1 Year
13.	Signal Analyzer	Rohde & Schwarz	FSV30	103040	12/29/2014	1 Year
14.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	12/29/2014	1 Year
15.	Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	12/29/2014	1 Year
16.	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year
17.	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year
18.	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year

## 7.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

## 15.205 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> )

- Remark 1. Emission level in dBuV/m=20 log (uV/m)  
 : 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.  
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of  $\xi$  15.205, and the emissions located in restricted bands also comply with 15.209 limit.

## 7.5 Measurement Result

### Below 30MHz:

Operation Mode:	TX	Test Date :	August 21, 2015
Frequency Range:	9KHz~30MHz	Temperature :	28°C
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant.Pol.	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	--

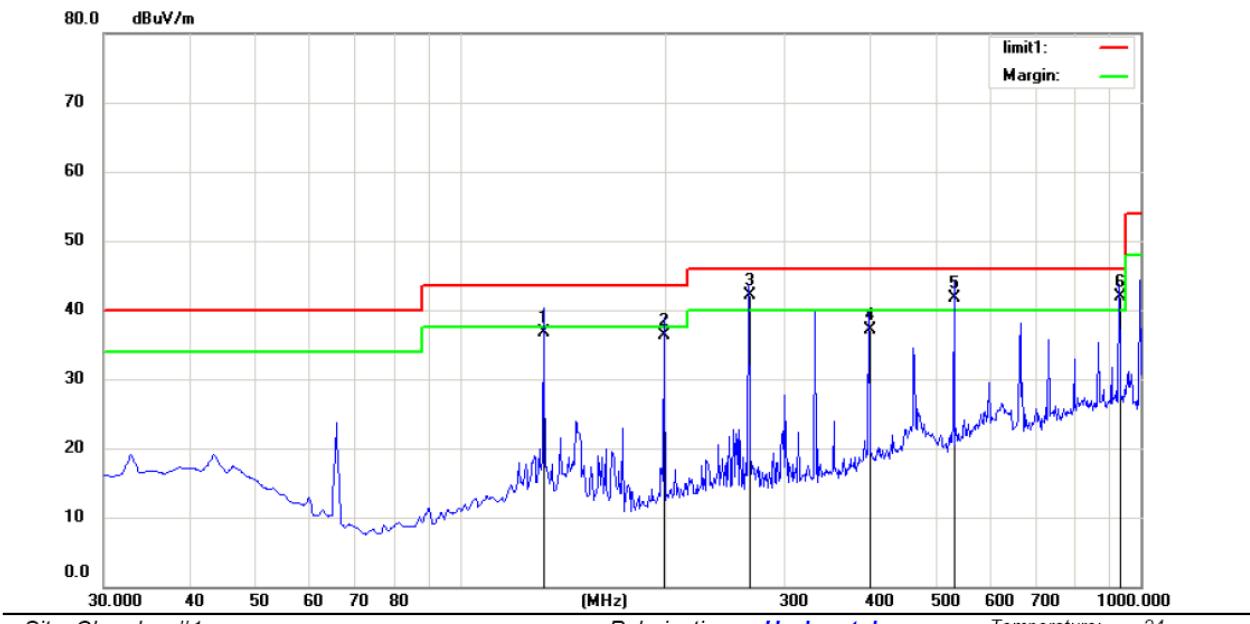
Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

### Below 1000MHz:

Pass.

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

Please refer to the following data.



Site Chamber #1

Polarization: **Horizontal**

Temperature: 24

Limit: (RE)FCC PART 15 class B 3m

Power: AC 120V/60Hz

Humidity: 55 %

Mode: TX2402

Note:

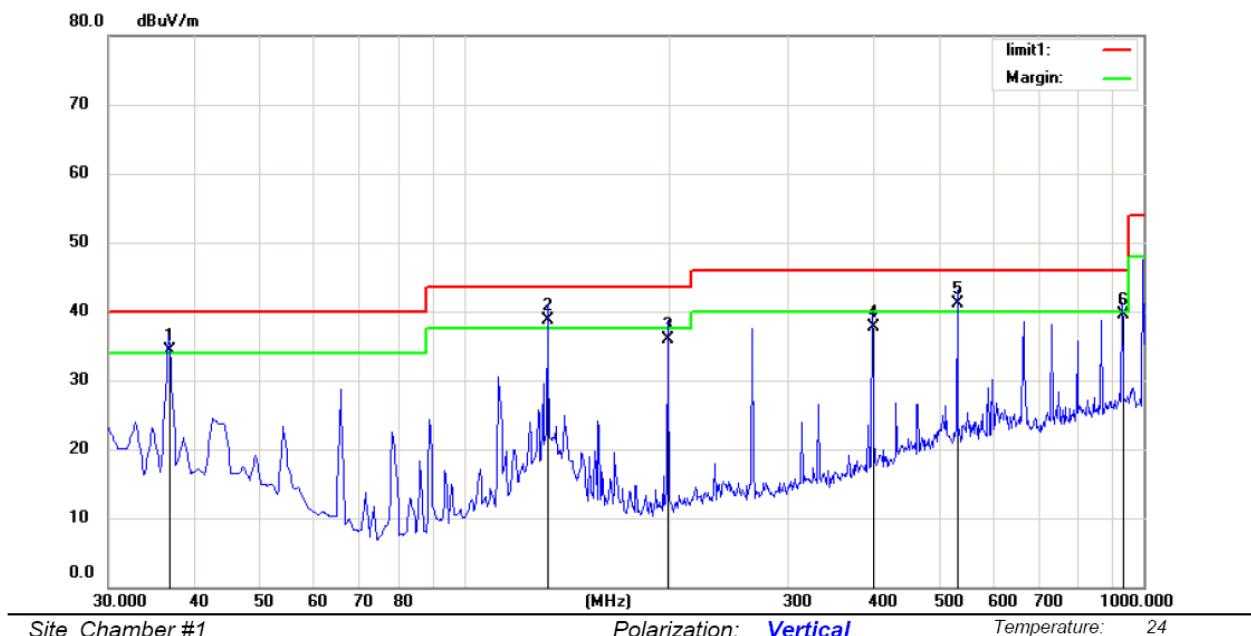
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree	Comment
1		132.8200	53.18	-16.39	36.79	43.50	-6.71	QP			
2		199.7500	54.00	-17.73	36.27	43.50	-7.23	QP			
3	*	265.7100	57.33	-15.32	42.01	46.00	-3.99	QP			
4		399.5700	48.36	-11.29	37.07	46.00	-8.93	QP			
5	!	532.4600	51.20	-9.57	41.63	46.00	-4.37	QP			
6	!	932.1000	44.66	-2.66	42.00	46.00	-4.00	QP			

\*:Maximum data

x:Over limit

!:over margin

Operator:



Site Chamber #1

Polarization: **Vertical**

Temperature: 24

Limit: (RE)FCC PART 15 class B 3m

Power: AC 120V/60Hz

Humidity: 55 %

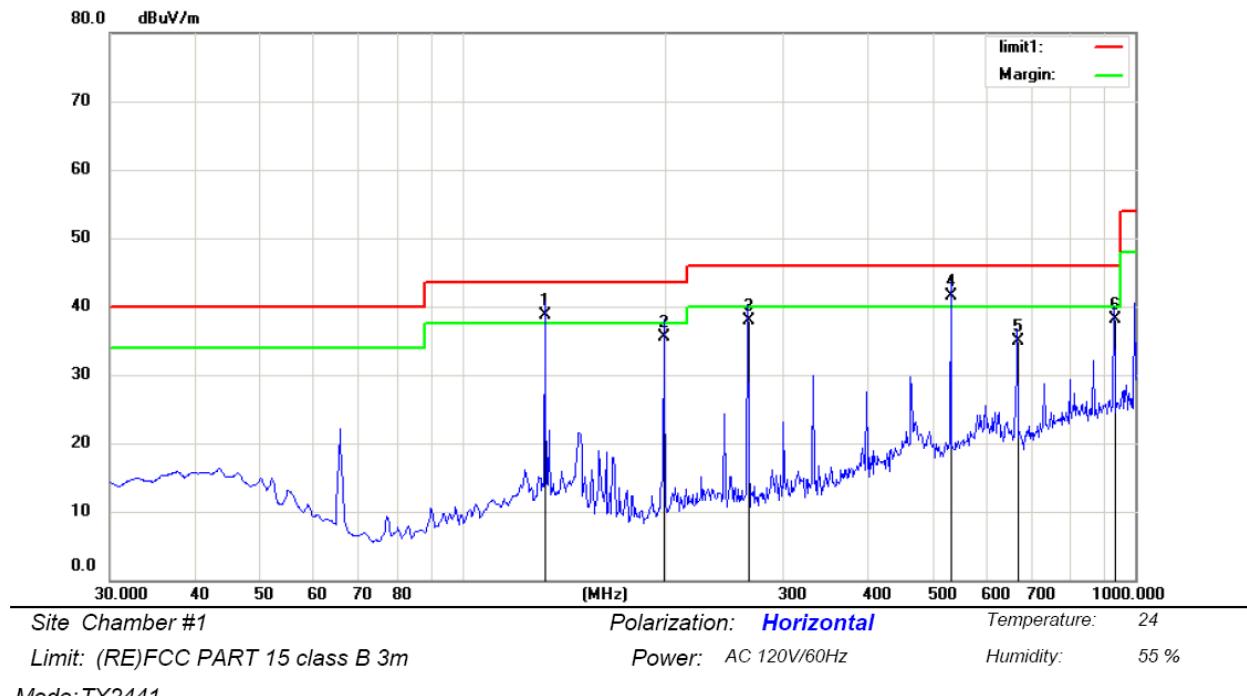
Mode: TX2402

Note:

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
			dBuV	dB	dBuV/m					
1 !		36.7900	48.33	-13.95	34.38	40.00	-5.62	QP		
2 *		132.8200	55.10	-16.43	38.67	43.50	-4.83	QP		
3		199.7500	53.65	-17.73	35.92	43.50	-7.58	QP		
4		399.5700	48.99	-11.29	37.70	46.00	-8.30	QP		
5 !		532.4600	50.79	-9.75	41.04	46.00	-4.96	QP		
6		932.1000	42.10	-2.60	39.50	46.00	-6.50	QP		

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

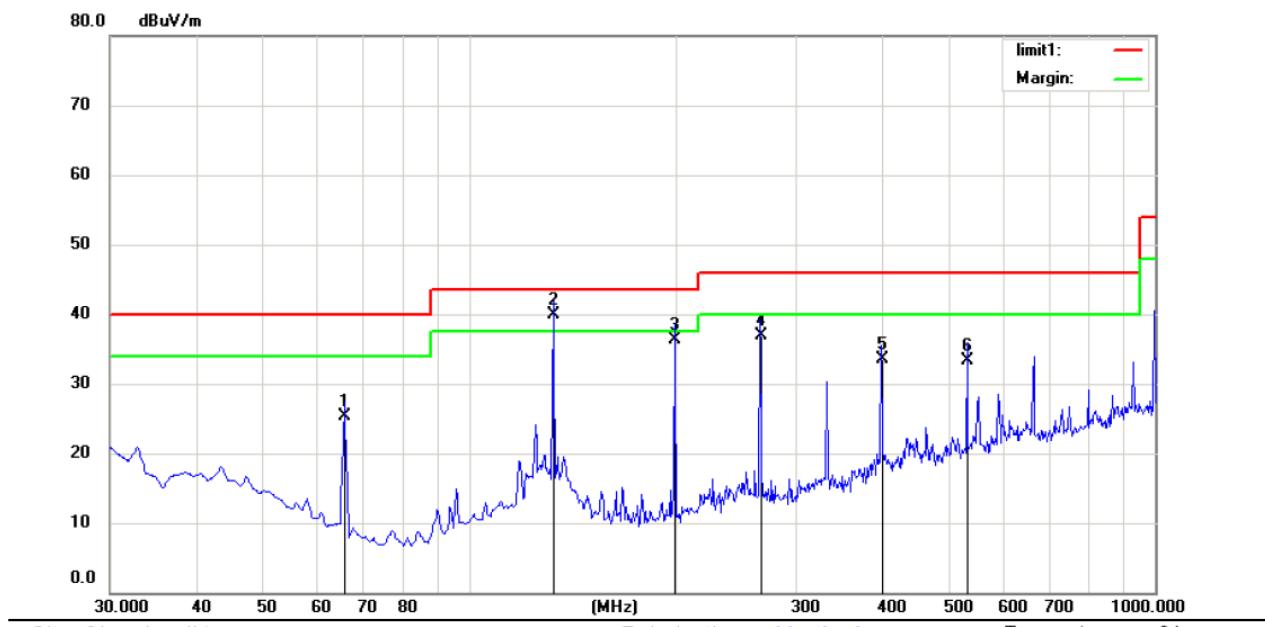
Operator:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	!	132.8200	55.07	-16.39	38.68	43.50	-4.82	QP		
2		199.7500	53.15	-17.73	35.42	43.50	-8.08	QP		
3		265.7100	53.20	-15.32	37.88	46.00	-8.12	QP		
4	*	532.4600	51.06	-9.57	41.49	46.00	-4.51	QP		
5		668.2600	42.69	-7.71	34.98	46.00	-11.02	QP		
6		932.1000	40.70	-2.66	38.04	46.00	-7.96	QP		

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

Operator:



Site Chamber #1

Polarization: **Vertical**

Temperature: 24

Limit: (RE)FCC PART 15 class B 3m

Power: AC 120V/60Hz

Humidity: 55 %

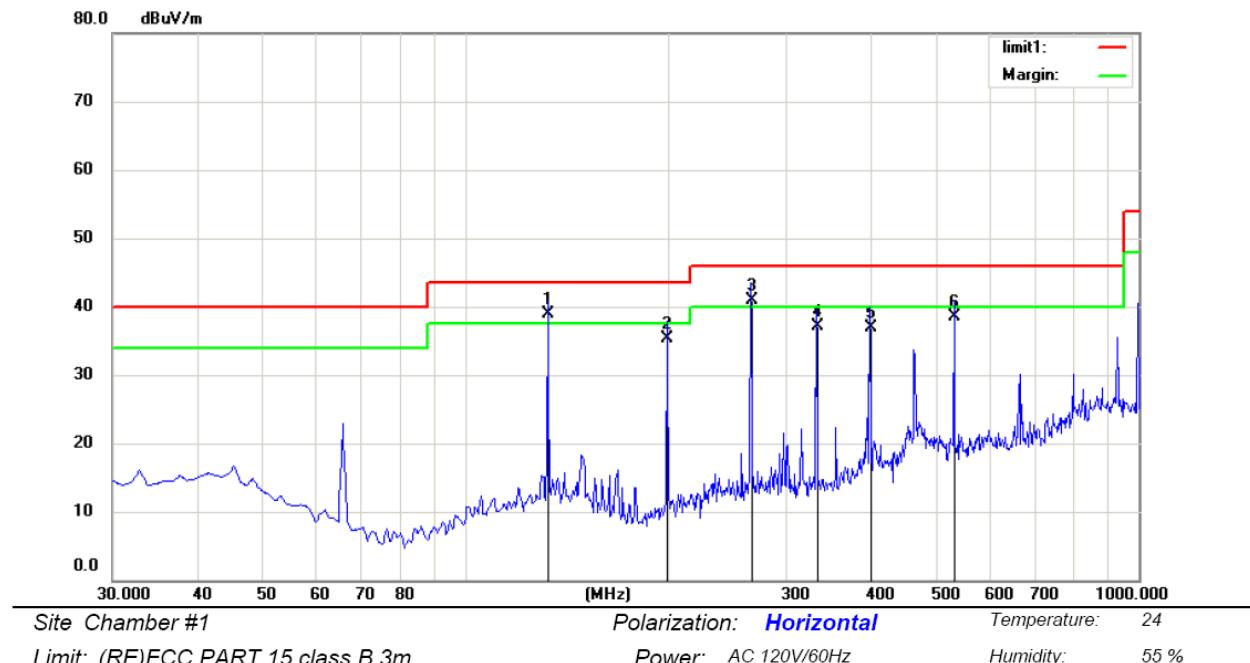
Mode: TX2441

Note:

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
			dBuV	dB	dBuV/m					
1		65.8900	46.32	-21.07	25.25	40.00	-14.75	QP		
2	*	132.8200	56.30	-16.43	39.87	43.50	-3.63	QP		
3		199.7500	54.10	-17.73	36.37	43.50	-7.13	QP		
4		265.7100	52.22	-15.32	36.90	46.00	-9.10	QP		
5		399.5700	44.78	-11.29	33.49	46.00	-12.51	QP		
6		532.4600	43.15	-9.75	33.40	46.00	-12.60	QP		

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

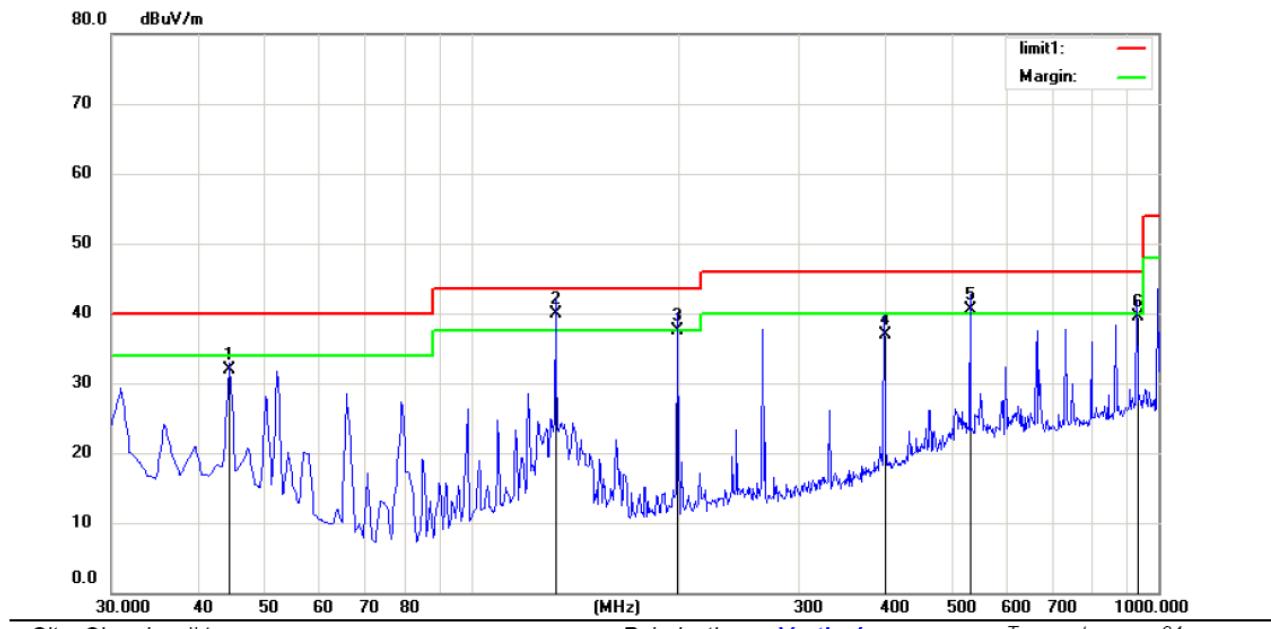
Operator:



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	132.8200	55.20	-16.39	38.81	43.50	-4.69	QP		
2		199.7500	52.99	-17.73	35.26	43.50	-8.24	QP		
3	!	265.7100	56.32	-15.32	41.00	46.00	-5.00	QP		
4		332.6400	50.33	-13.13	37.20	46.00	-8.80	QP		
5		399.5700	48.27	-11.29	36.98	46.00	-9.02	QP		
6		532.4600	48.12	-9.57	38.55	46.00	-7.45	QP		

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

Operator:



Site Chamber #1

Polarization: **Vertical**

Temperature: 24

Limit: (RE)FCC PART 15 class B 3m

Power: AC 120V/60Hz

Humidity: 55 %

Mode: TX2480

Note:

No.	Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height cm	Table Degree	Comment
			dBuV	dB	dBuV/m	dBuV/m	dB	Detector	degree	
1		44.5500	45.36	-13.47	31.89	40.00	-8.11	QP		
2	*	132.8200	56.25	-16.43	39.82	43.50	-3.68	QP		
3		199.7500	55.18	-17.73	37.45	43.50	-6.05	QP		
4		399.5700	48.12	-11.29	36.83	46.00	-9.17	QP		
5	!	532.4600	50.30	-9.75	40.55	46.00	-5.45	QP		
6		932.1000	42.15	-2.60	39.55	46.00	-6.45	QP		

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

Operator:

## Above 1000MHz

Worst Operation Mode: GFSK (CH1: 2402MHz) Test Date : August 21, 2015  
 Frequency Range: 1-25GHz Temperature : 25 °C  
 Test Result: PASS Humidity : 50 %  
 Measured Distance: 3m Test By: Andy  
 Test Voltage: AC 120V/60Hz

Freq. (MHz)	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
4804	V	65.39	46.39	74	54	-8.61	-7.61
7206	V	64.29	45.58	74	54	-9.71	-8.42
9608	V	61.68	44.62	74	54	-12.32	-9.38
12010	V	60.27	43.25	74	54	-13.73	-10.75
14412	V	59.85	42.59	74	54	-14.15	-11.41
16814	V	58.96	41.57	74	54	-15.04	-12.43
4804	H	65.25	46.05	74	54	-8.75	-7.95
7206	H	64.03	45.23	74	54	-9.97	-8.77
9608	H	61.56	44.21	74	54	-12.44	-9.79
12010	H	62.48	43.58	74	54	-11.52	-10.42
14412	H	60.53	42.31	74	54	-13.47	-11.69
16814	H	59.82	41.02	74	54	-14.18	-12.98

Other harmonics emissions are lower than 20dB below the allowable limit.

- Note:**
- (1) All Readings are Peak Value and AV.
  - (2) Emission Level= Reading Level+ Probe Factor +Cable Loss.
  - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
  - (4) The results of worst cased (GFSK) was recorded.

Worst Operation Mode: GFSK (CH40: 2441MHz) Test Date : August 21, 2015  
 Frequency Range: 1-25GHz Temperature : 25 °C  
 Test Result: PASS Humidity : 50 %  
 Measured Distance: 3m Test By: Andy  
 Test Voltage: AC 120V/60Hz

Freq. (MHz)	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
	H/V	PK	AV	PK	AV	PK	AV
4882	V	66.12	46.53	74	54	-7.88	-7.47
7323	V	65.36	45.56	74	54	-8.64	-8.44
9764	V	64.59	44.89	74	54	-9.41	-9.11
12205	V	63.26	43.96	74	54	-10.74	-10.04
14646	V	62.69	42.68	74	54	-11.31	-11.32
17087	V	61.52	41.52	74	54	-12.48	-12.48
4882	H	65.69	45.63	74	54	-8.31	-8.37
7323	H	64.35	44.58	74	54	-9.65	-9.42
9764	H	63.56	42.56	74	54	-10.44	-11.44
12205	H	62.63	41.52	74	54	-11.37	-12.48
14646	H	61.52	40.23	74	54	-12.48	-13.77
17087	H	60.56	39.52	74	54	-13.44	-14.48

Other harmonics emissions are lower than 20dB below the allowable limit.

- Note:**
- (1) All Readings are Peak Value and AV.
  - (2) Emission Level= Reading Level+ Probe Factor +Cable Loss.
  - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
  - (4) The results of worst cased (GFSK) was recorded.

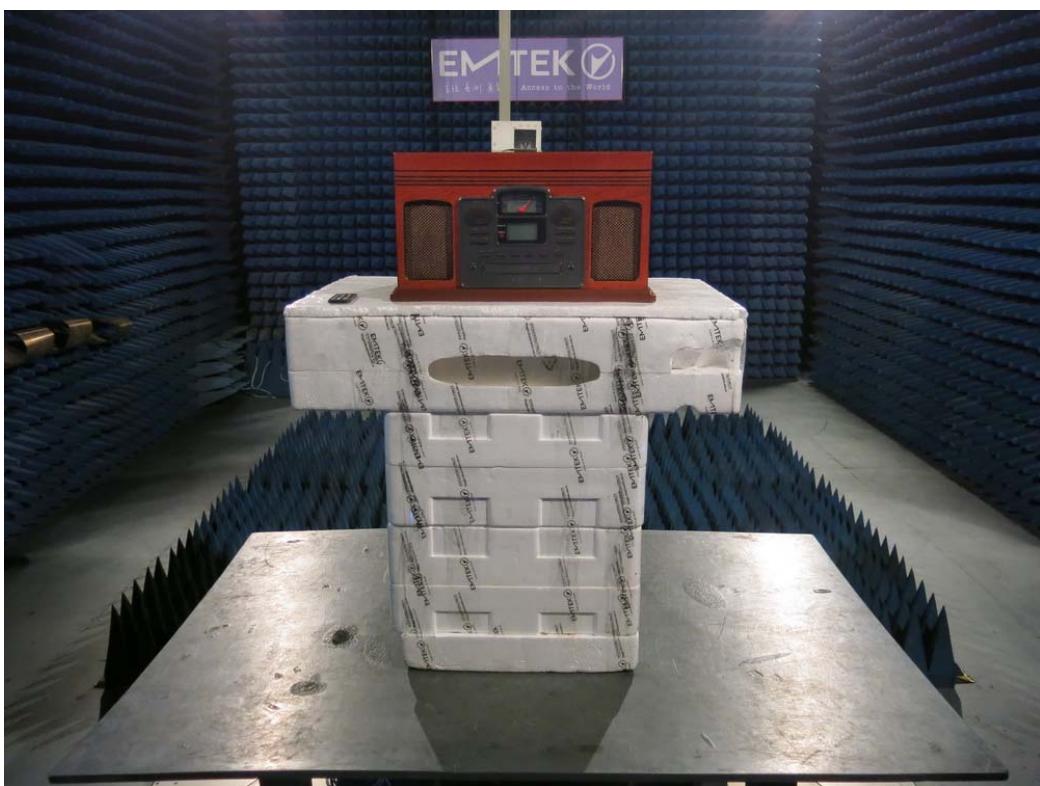
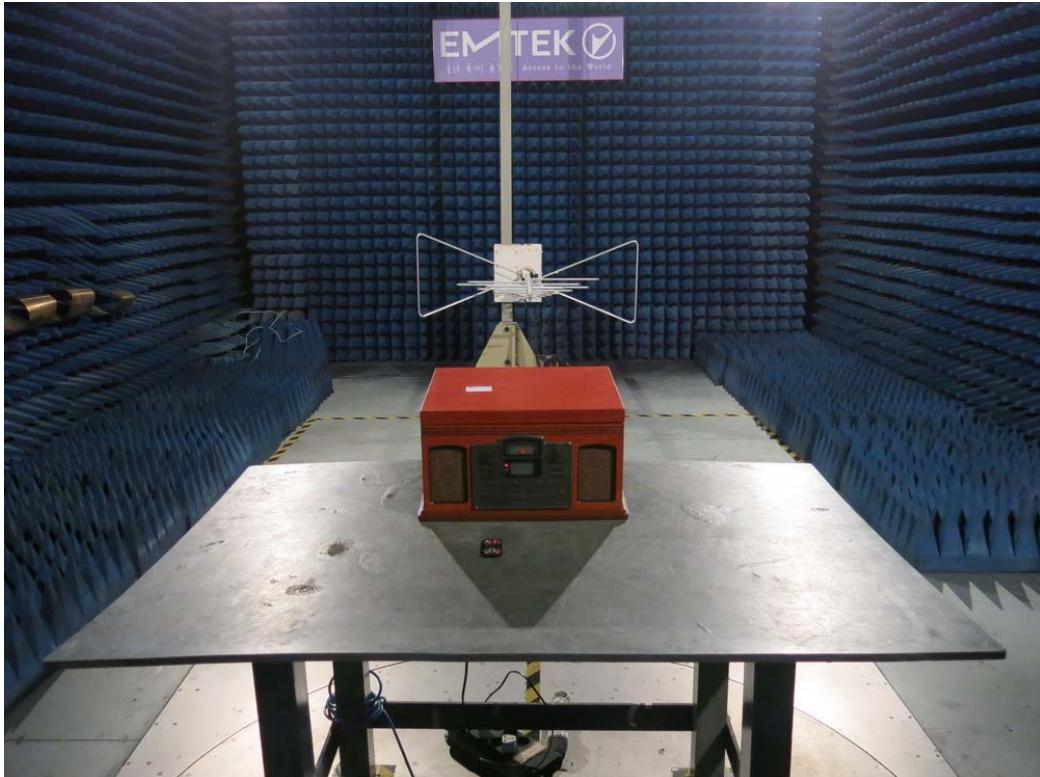
Worst Operation Mode: GFSK (CH79: 2480MHz) Test Date : August 21, 2015  
 Frequency Range: 1-25GHz Temperature : 25 °C  
 Test Result: PASS Humidity : 50 %  
 Measured Distance: 3m Test By: Andy  
 Test Voltage: AC 120V/60Hz

Freq. (MHz)	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
4960	V	66.09	45.31	74	54	-7.91	-8.69
7440	V	65.21	43.68	74	54	-8.79	-10.32
9920	V	64.95	42.7	74	54	-9.05	-11.3
12400	V	62.19	41.52	74	54	-11.81	-12.48
14880	V	59.28	40.53	74	54	-14.72	-13.47
17360	V	58.08	38.06	74	54	-15.92	-15.94
4960	H	64.93	45.74	74	54	-9.07	-8.26
7440	H	63.17	43.14	74	54	-10.83	-10.86
9920	H	61.34	42.86	74	54	-12.66	-11.14
12400	H	60.02	41.23	74	54	-13.98	-12.77
14880	H	59.28	39.65	74	54	-14.72	-14.35
17360	H	58.65	38.95	74	54	-15.35	-15.05

Other harmonics emissions are lower than 20dB below the allowable limit.

- Note:**
- (1) All Readings are Peak Value and AV.
  - (2) Emission Level= Reading Level+ Probe Factor +Cable Loss.
  - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
  - (4) The results of worst cased (GFSK) was recorded.

## 7.5 Radiated Measurement Photos:



## 8. Channel Separation 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:

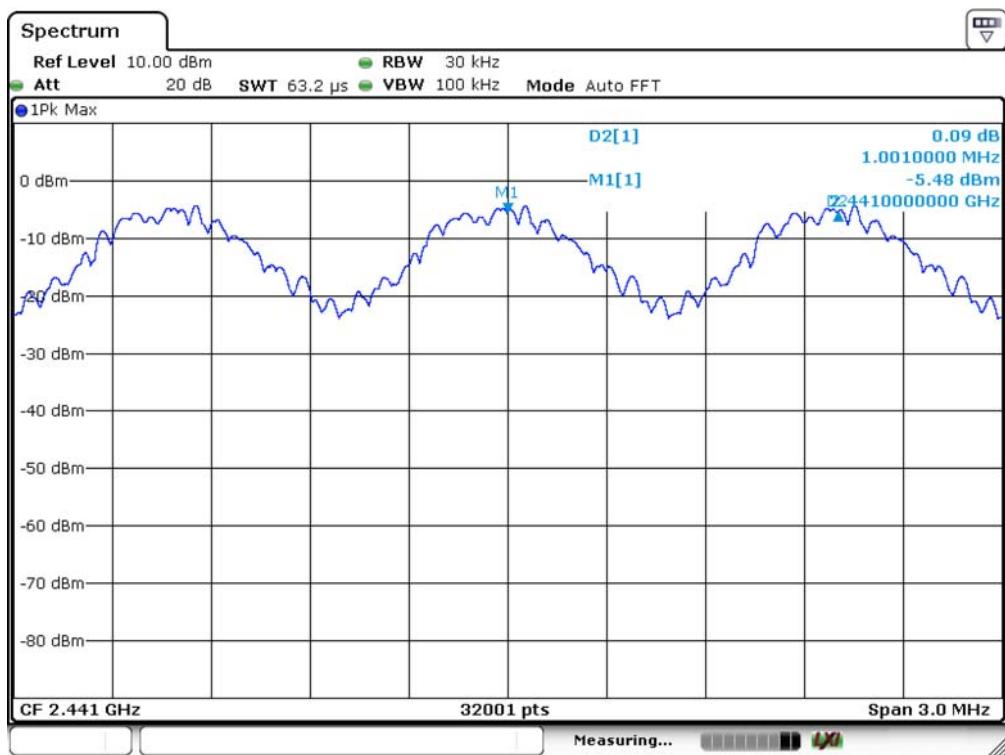
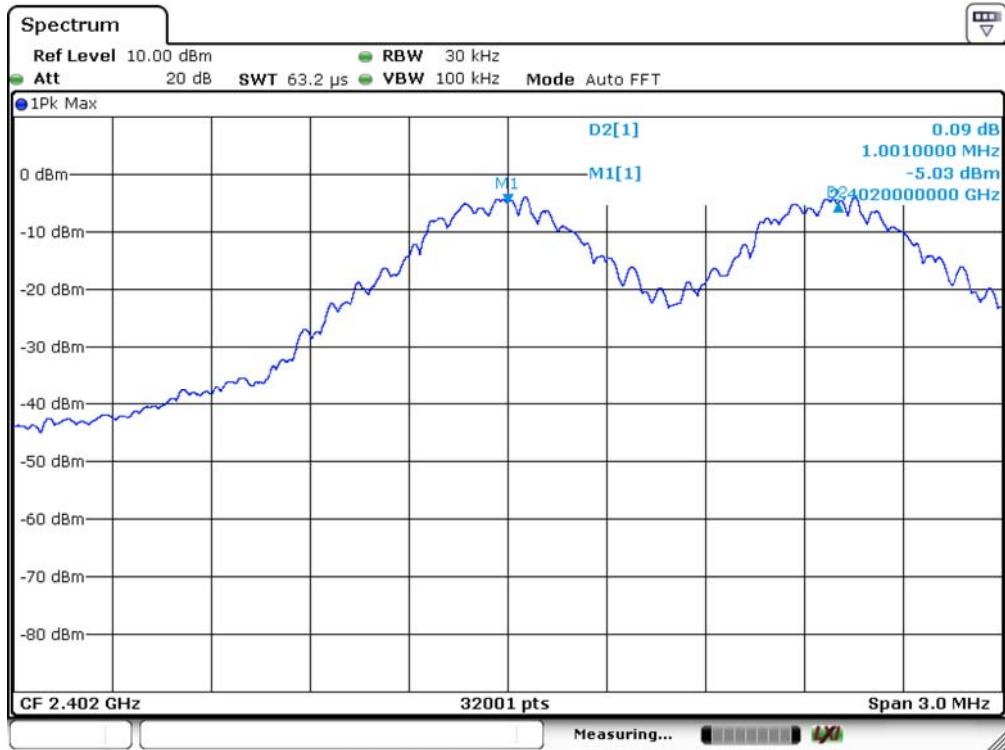
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

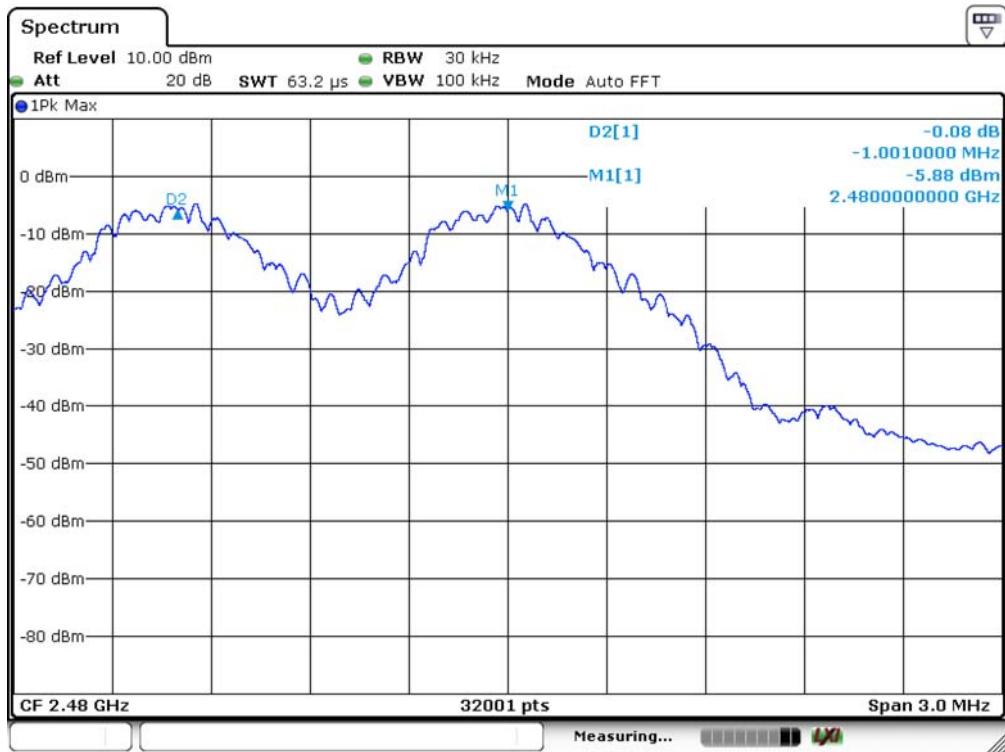
### 8.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	August 21, 2015
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %
Modulation:	GFSK		

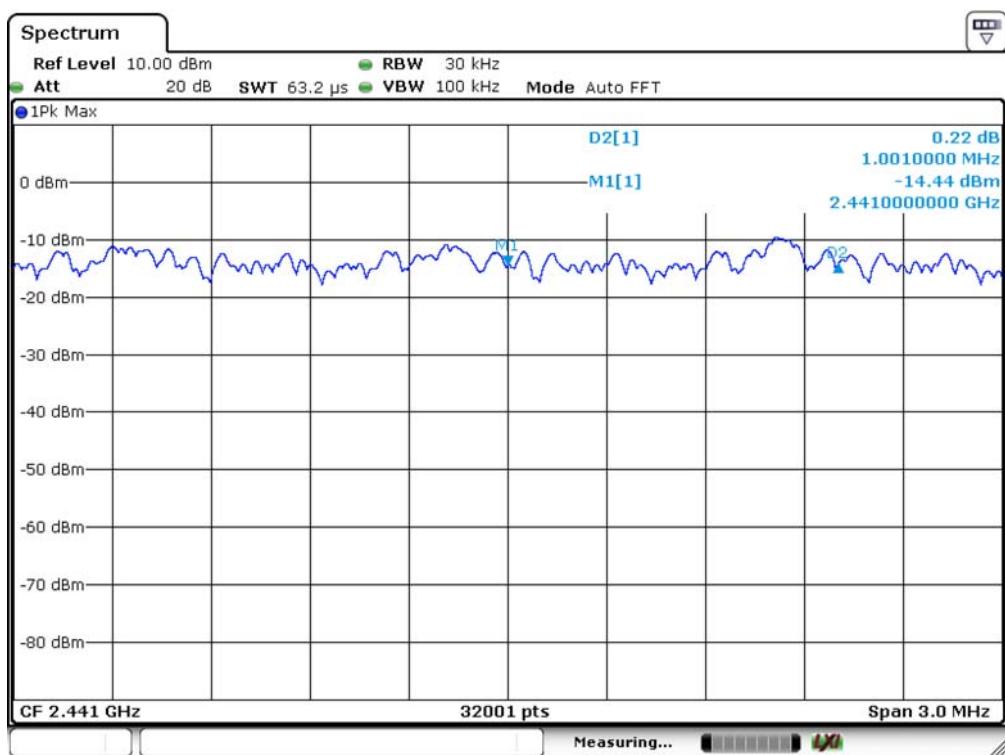
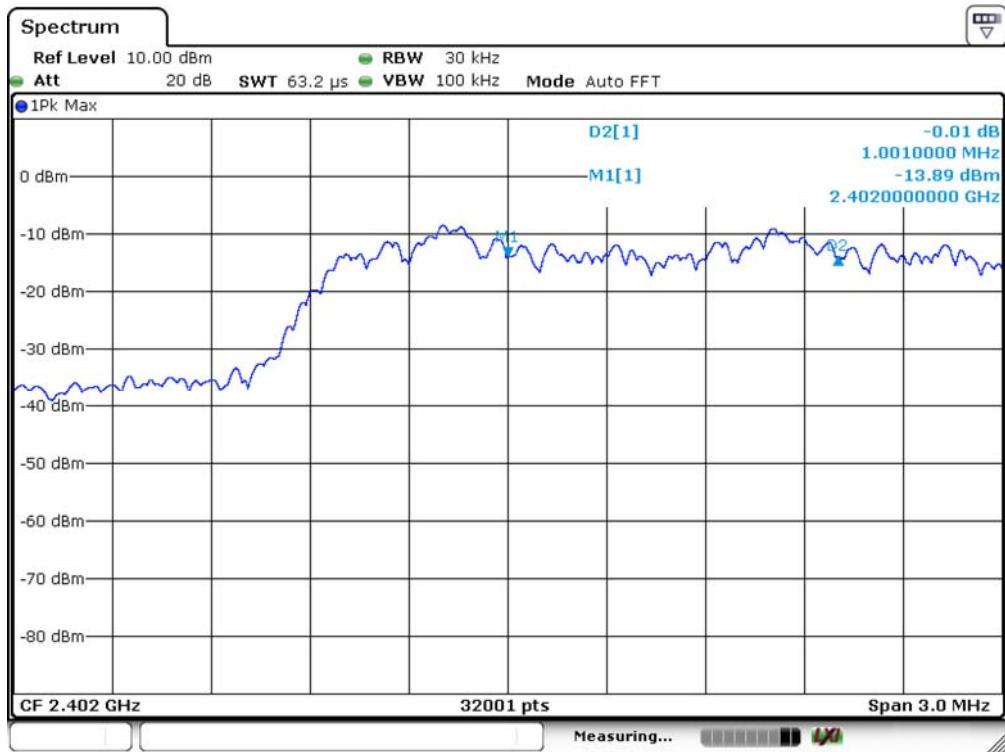
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
1	2402	1001	>903
40	2441	1001	>905
79	2480	1001	>905

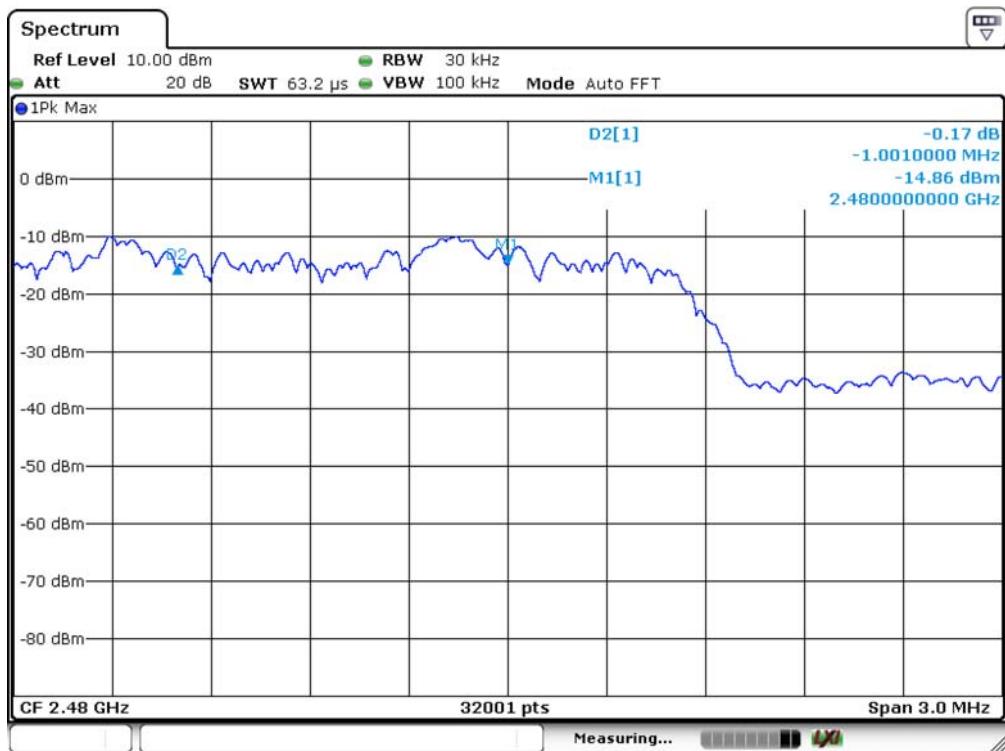




Spectrum Detector: PK Test Date : August 21, 2015  
 Test By: Andy Temperature : 24°C  
 Test Result: PASS Humidity : 53 %  
 Modulation: Π/4-DQPSK

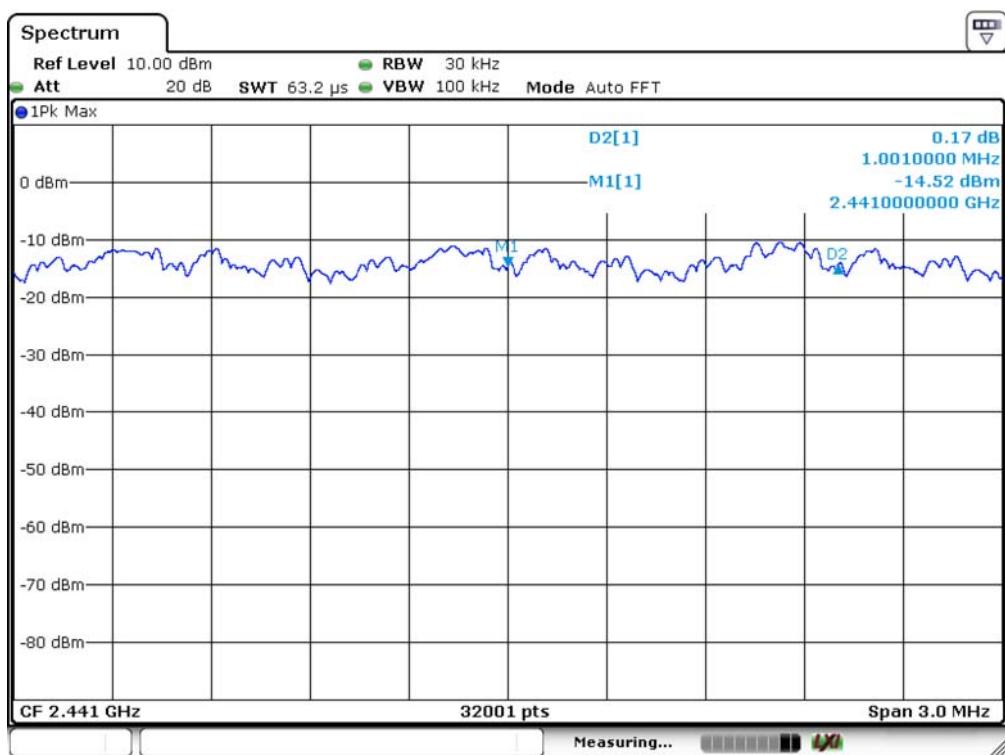
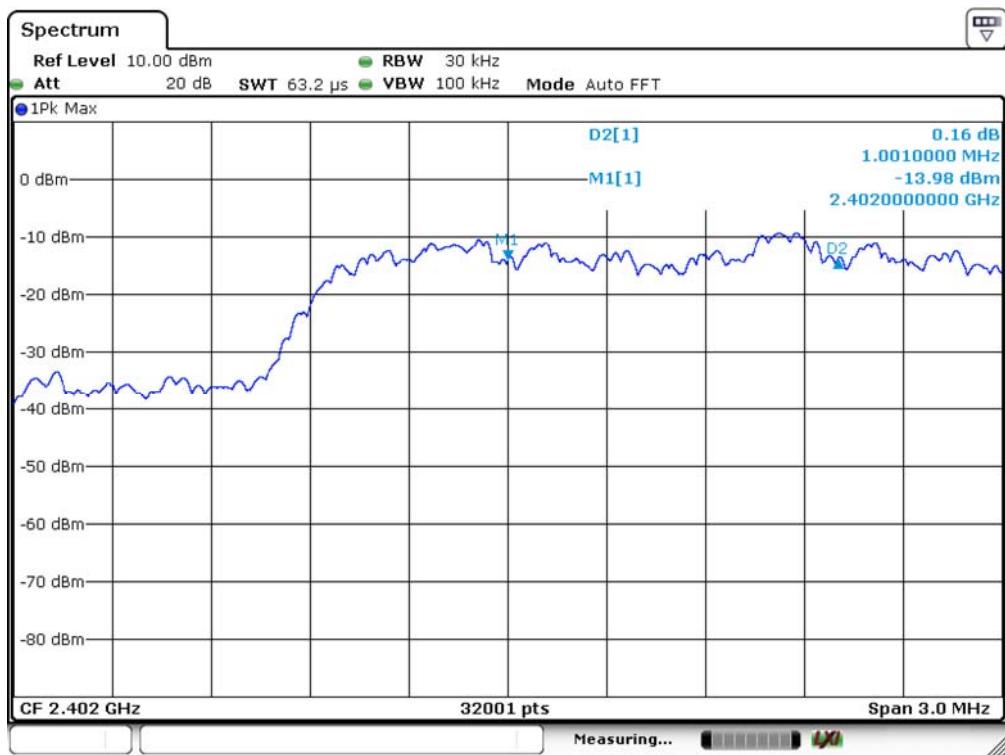
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1001	>897
40	2441	1001	>908
79	2480	1001	>897

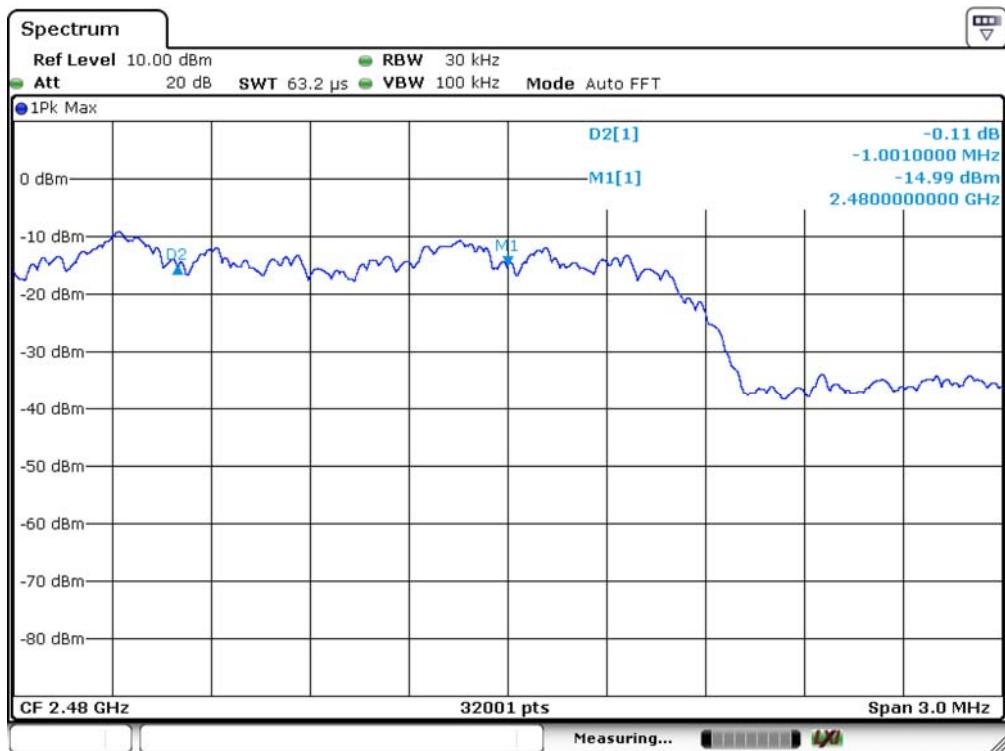




Spectrum Detector: PK Test Date : August 21, 2015  
 Test By: Andy Temperature : 24°C  
 Test Result: PASS Humidity : 53 %  
 Modulation: 8DPSK

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1001	>899
40	2441	1001	>906
79	2480	1001	>909



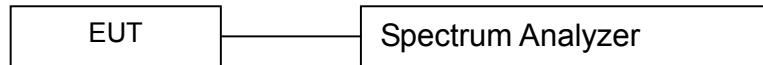


## 9. 20dB Bandwidth test

### 9.1 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.

### 9.2 Test SET-UP (Block Diagram of Configuration)



### 9.3 Measurement Equipment Used:

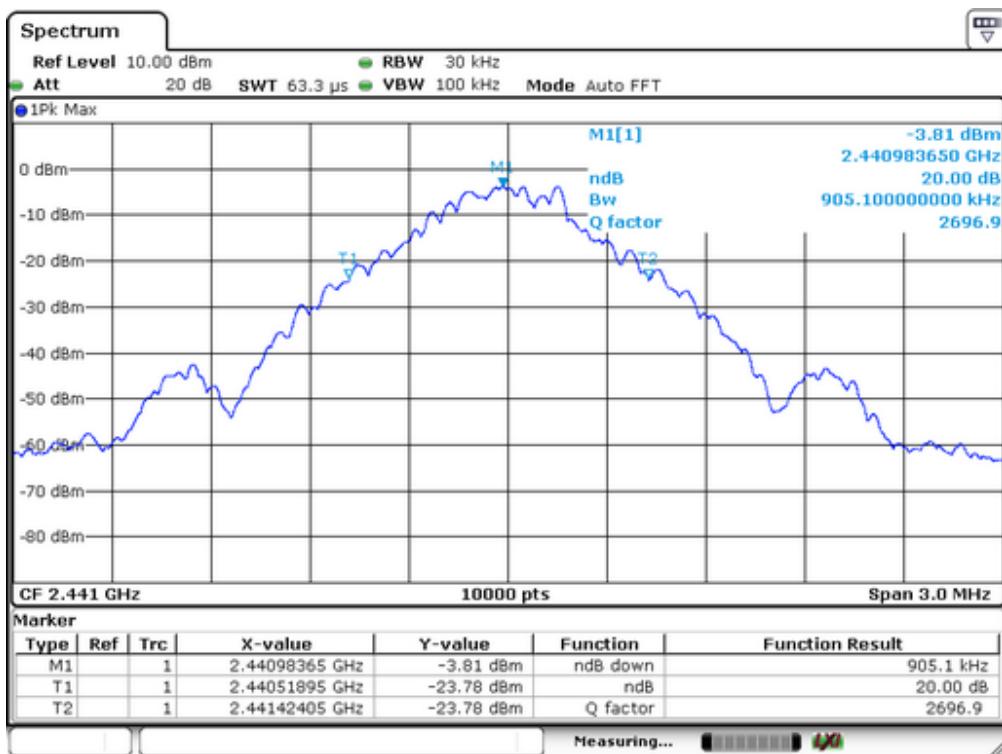
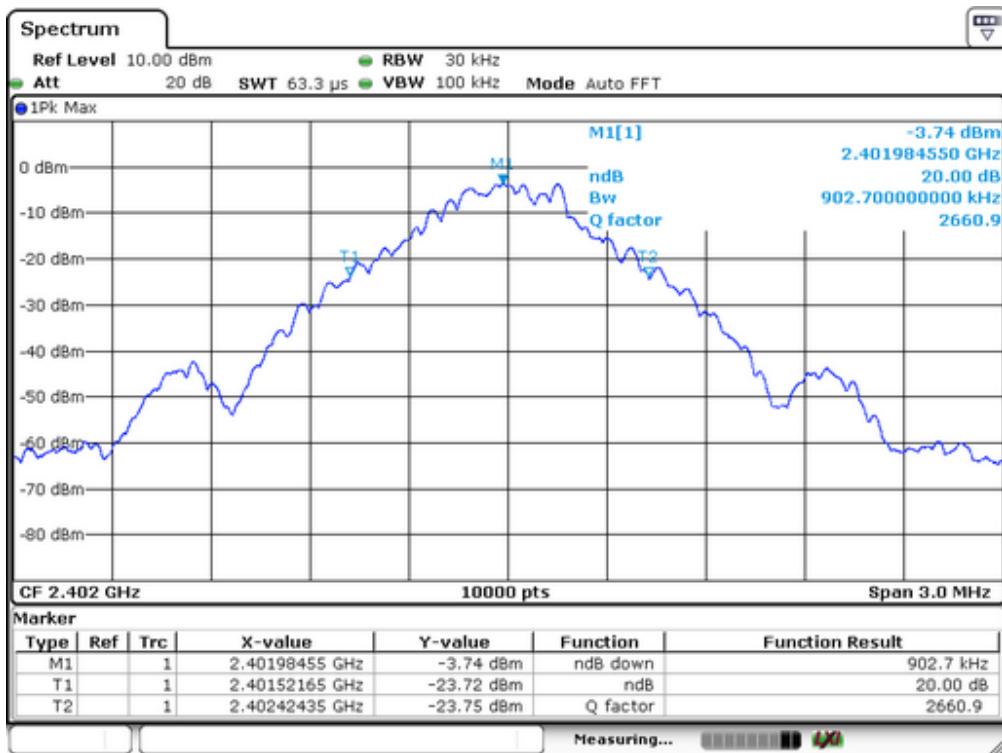
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

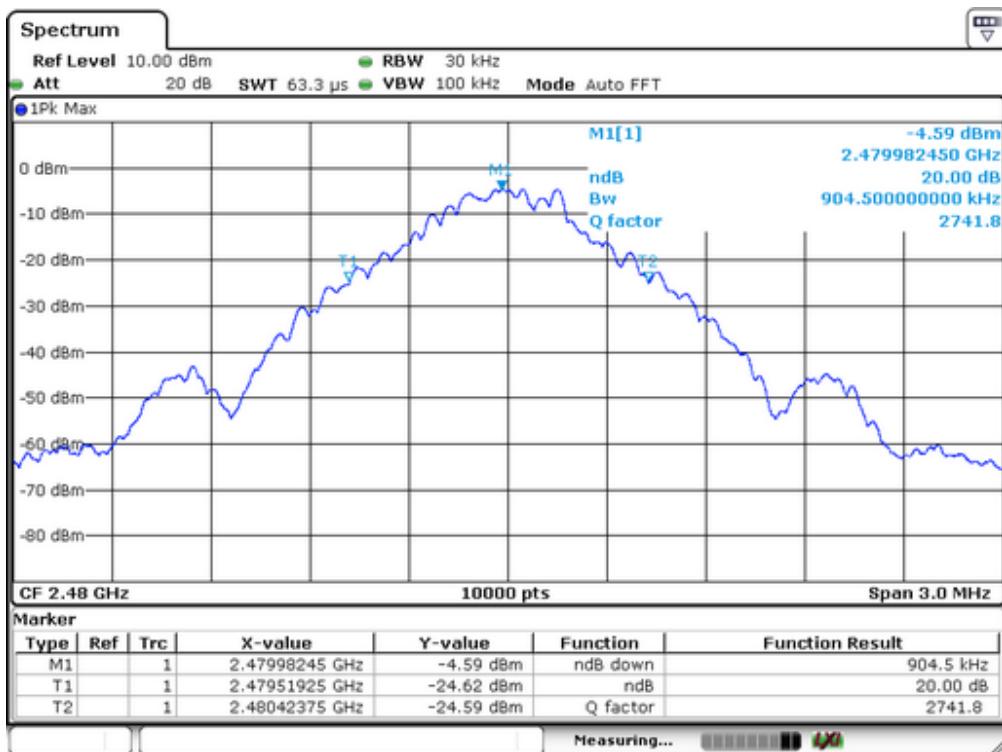
### 9.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	August 21, 2015
Test By:	Andy	Temperature :	24°C
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

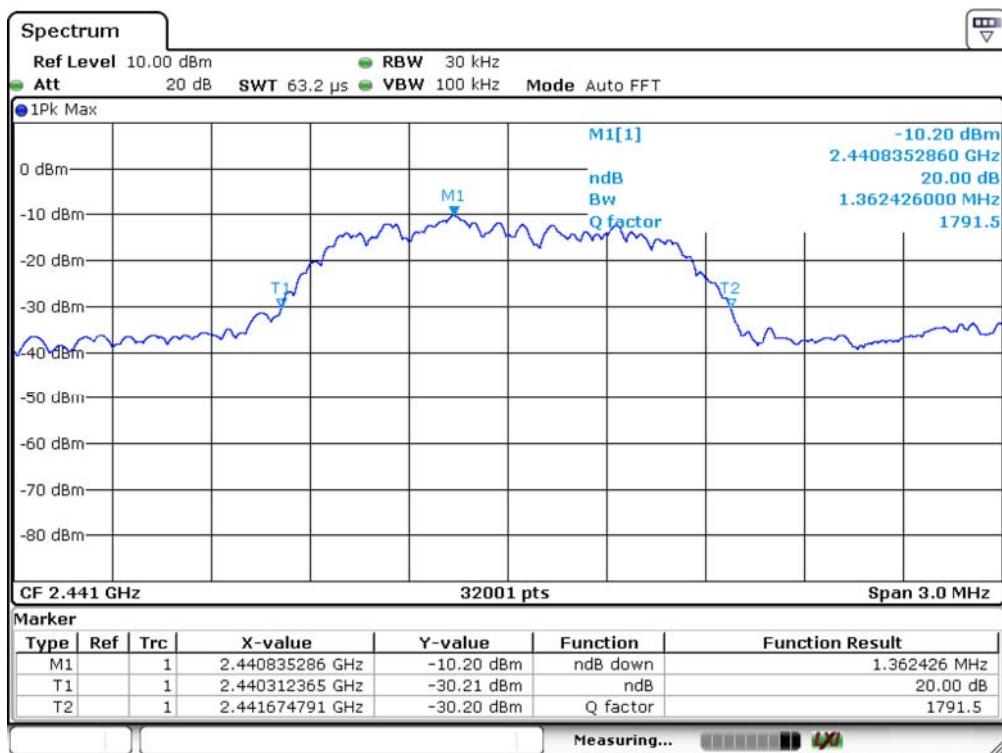
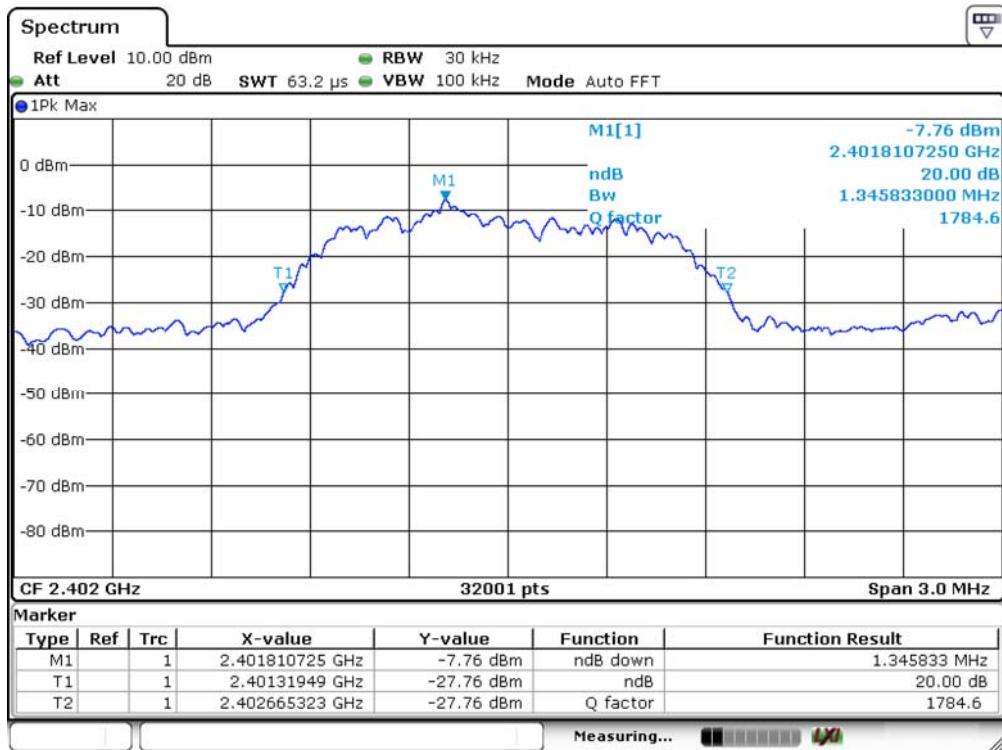
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	903
40	2441	905
79	2480	905

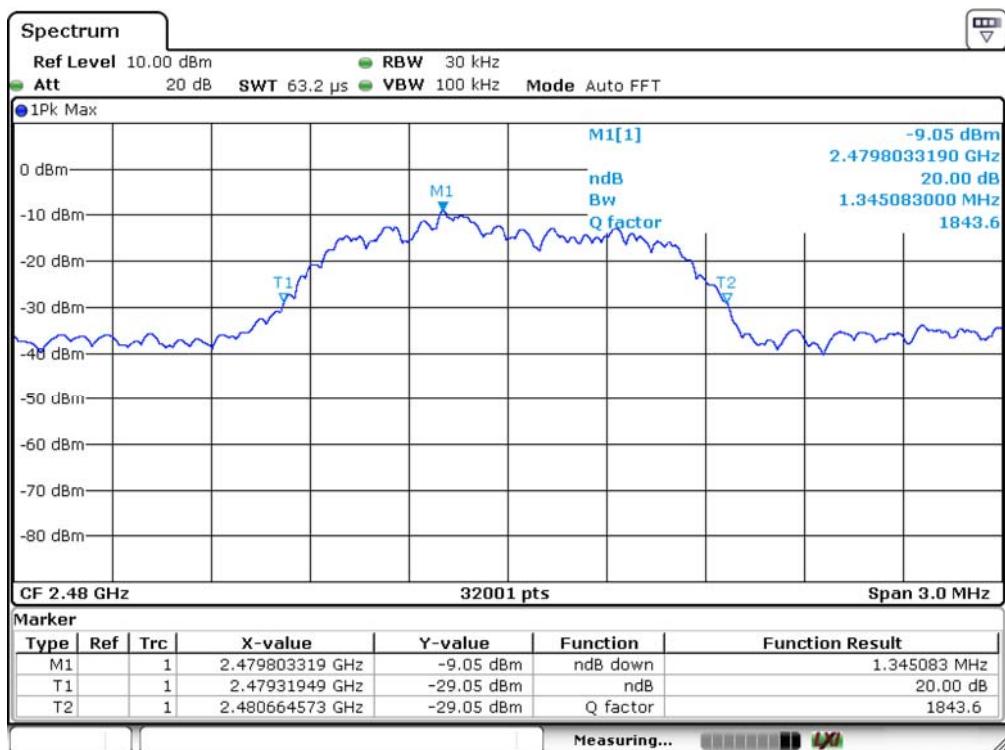




Spectrum Detector: PK      Test Date : August 21, 2015  
 Test By: Andy      Temperature : 24°C  
 Test Result: PASS      Humidity : 53 %  
 Modulation: Π/4-DQPSK

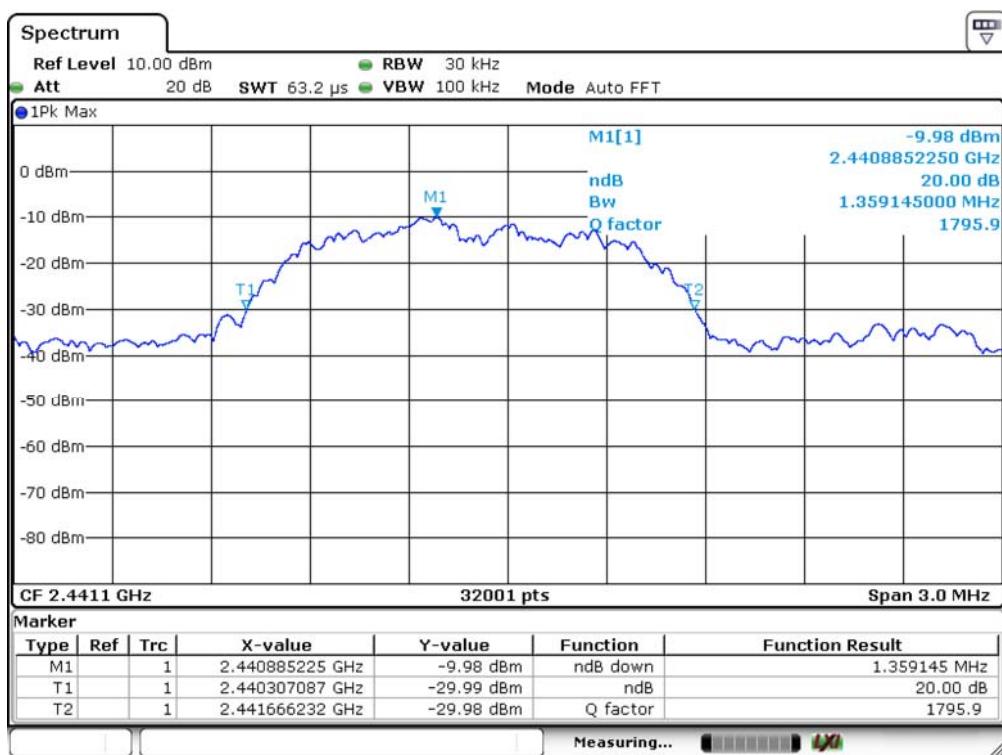
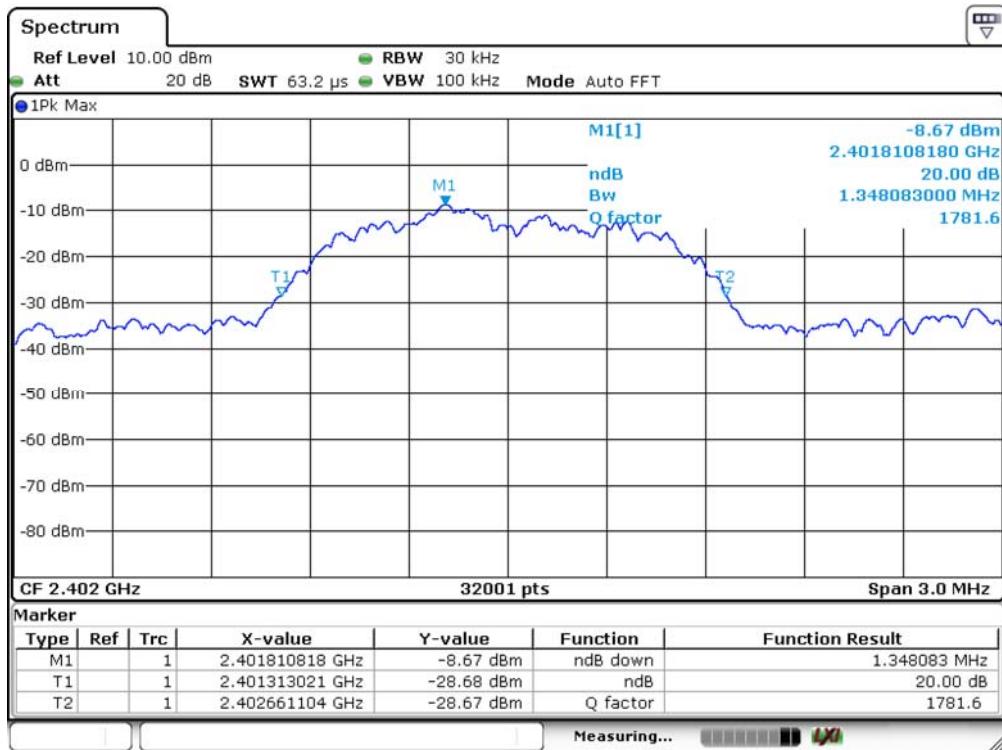
Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1346
40	2441	1362
79	2480	1345

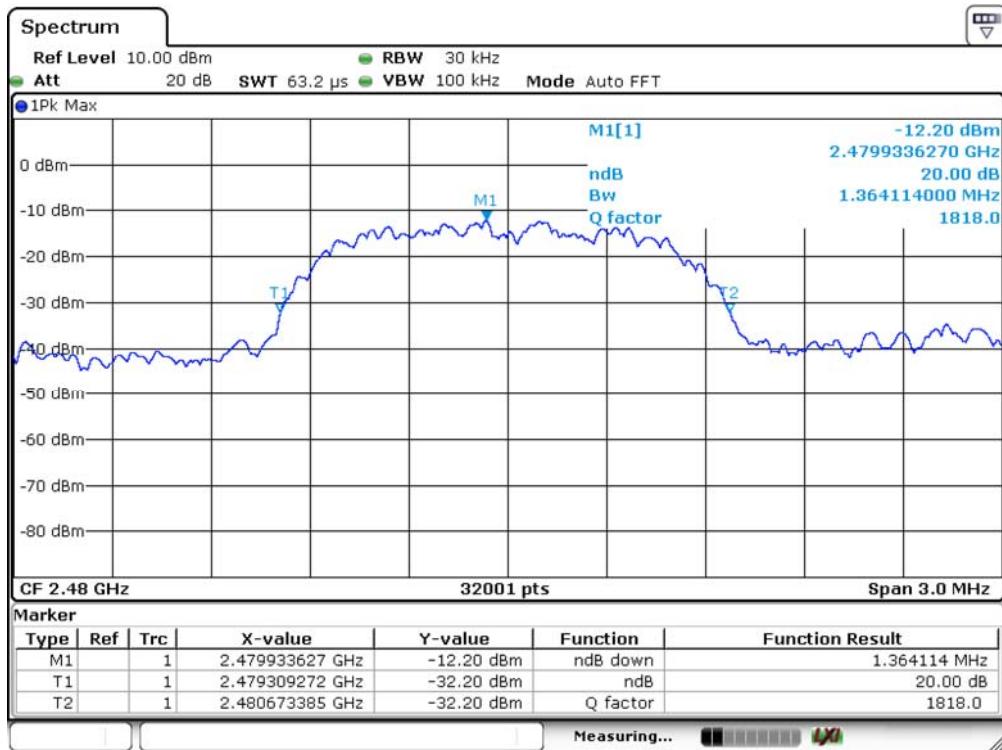




Spectrum Detector: PK                          Test Date : August 21, 2015  
 Test By: Andy                                  Temperature : 24°C  
 Test Result: PASS                              Humidity : 53 %  
 Modulation: 8DPSK

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1348
40	2441	1359
79	2480	1364





## 10. Quantity of Hopping Channel Test

### 10.1 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.

### 10.2 Test SET-UP (Block Diagram of Configuration)



### 10.3 Measurement Equipment Used:

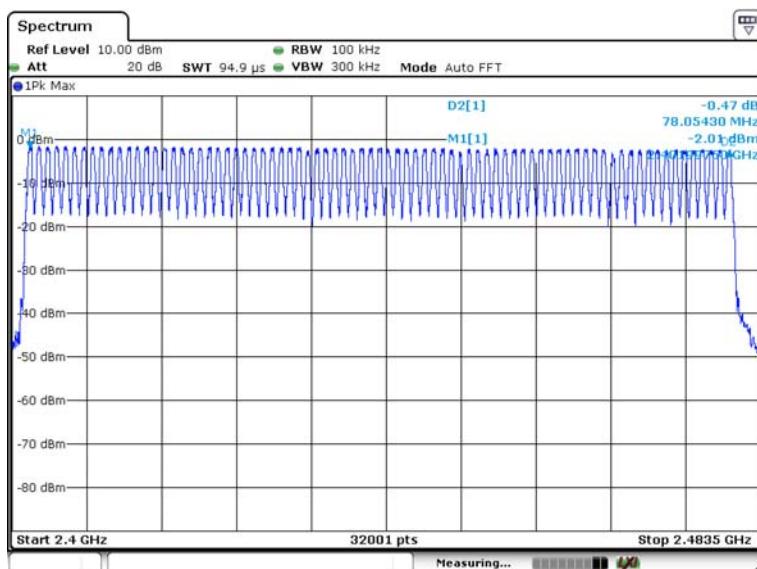
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

### 10.4 Measurement Results:

Refer to attached data chart.

Worst Test Mode	GFSK	Test Date :	August 21, 2015
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

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



## 11. Time of Occupancy (Dwell Time) test

### 11.1 Test Description

The Equipment Under Test (EUT) was set up to perform the dwell time measurements. The EUT was connected to the spectrum analyzer via a short coax cable. The dwell time is calculated by:

$$\text{Dwell time} = \text{time slot length} * \text{hop rate} / \text{number of hopping channels} * 31.6s$$

with:

- hop rate =  $1600 * 1/s$  for DH1 packets =  $1600 s^{-1}$
- hop rate =  $1600/3 * 1/s$  for DH3 packets =  $533.33 s^{-1}$
- number of hopping channels = 79
- $31.6 s = 0.4$  seconds multiplied by the number of hopping channels =  $0.4 s * 79$

The highest value of the dwell time is reported.

### 11.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1) (iii)

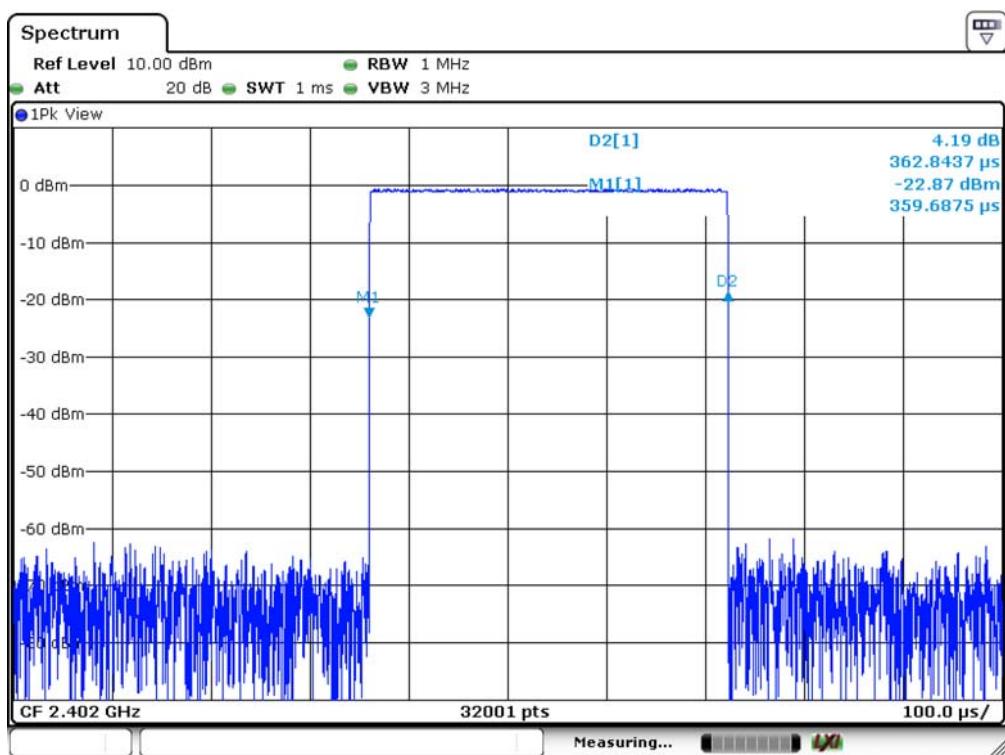
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Since the Bluetooth technology uses 79 channels this period is calculated to be 31.6seconds. Refer to attached data chart.

### 11.3 Test result

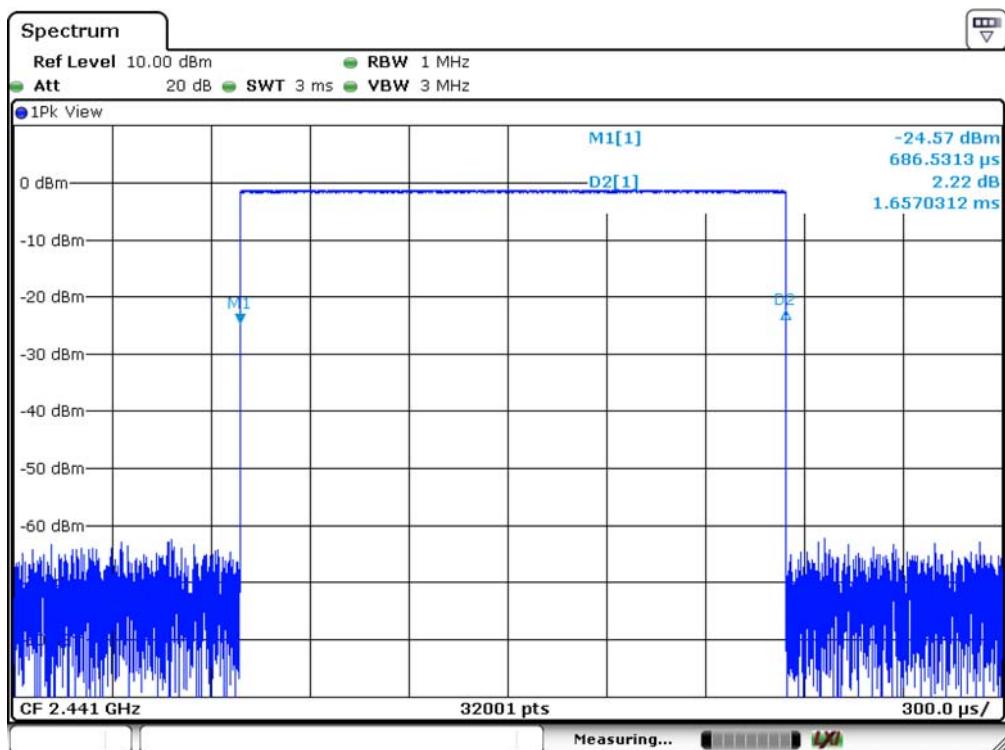
Mode	Number of transmission in a 31.6( 79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	$1600/(2*79) \times 31.6 = 320$	0.360	115.20	400
DH3	$1600/(4*79) \times 31.6 = 160$	1.657	265.12	400
DH5	$1600/(6*79) \times 31.6 = 106.67$	2.778	296.33	400

Remark: The results of worst cased was recorded.

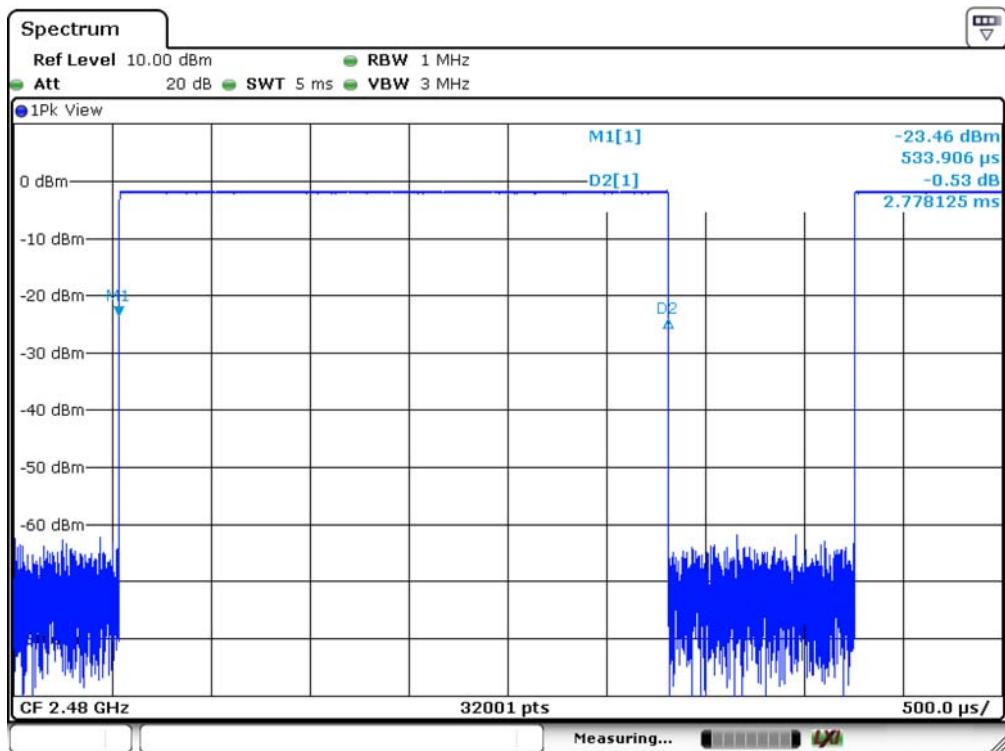
DH1:



DH3:



DH5:

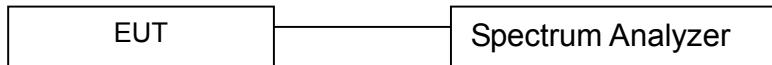


## 12. MAXIMUM PEAK OUTPUT POWER TEST

### 12.1 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 it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

### 12.2 Test SET-UP (Block Diagram of Configuration)



### 12.3 Measurement Equipment Used:

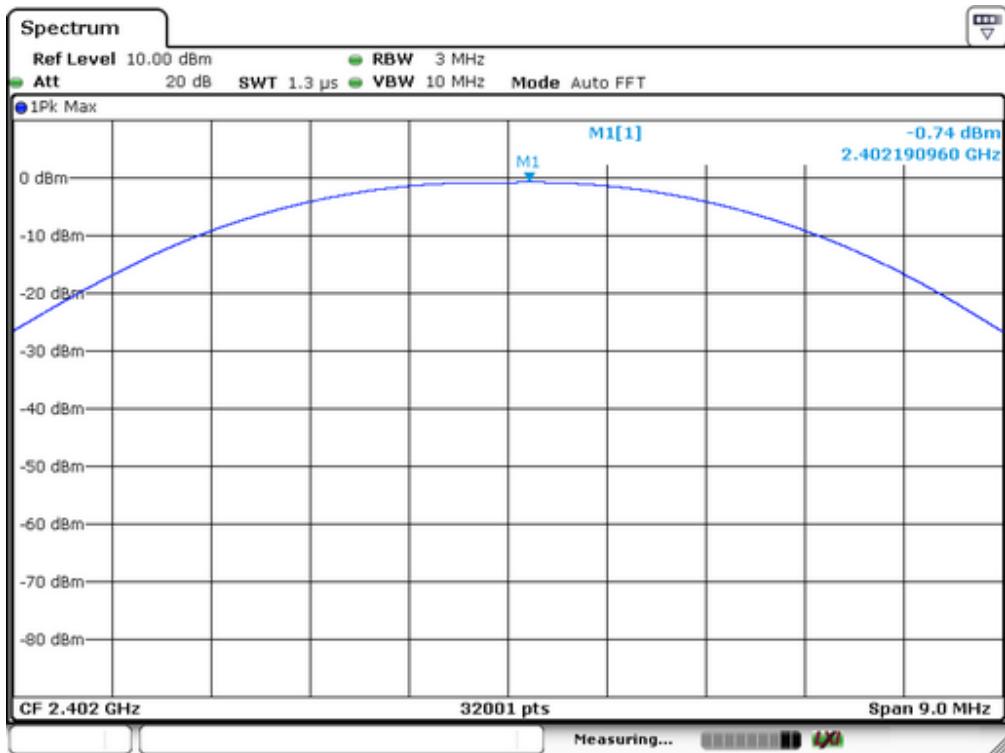
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

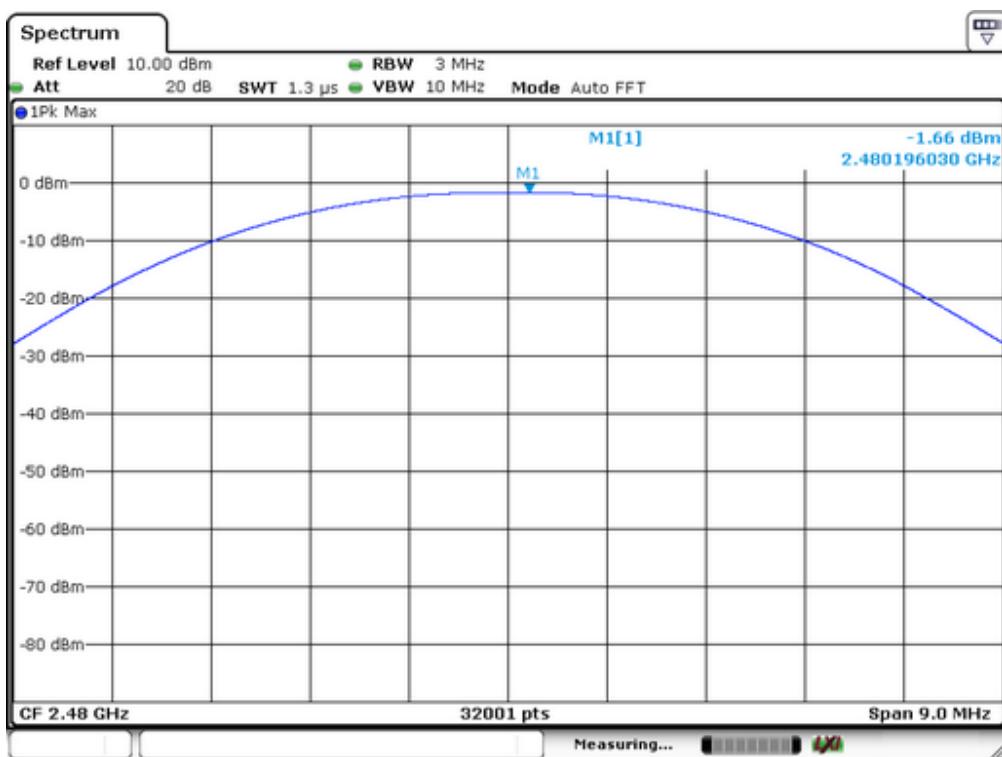
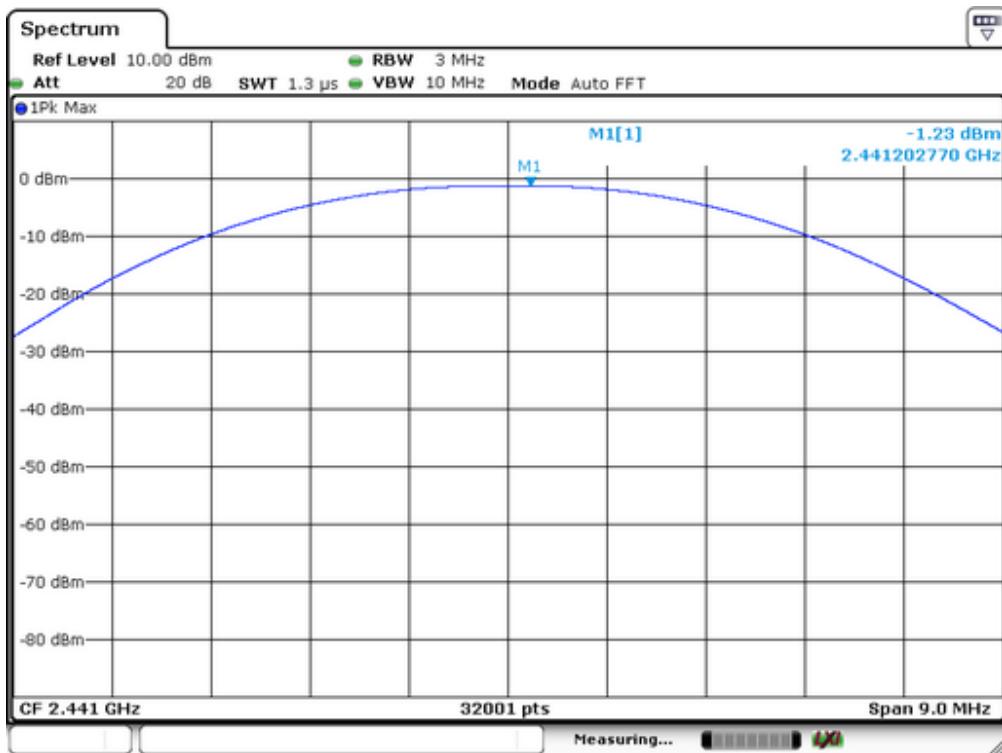
## 12.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	August 21, 2015
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %
Modulation:	GFSK		

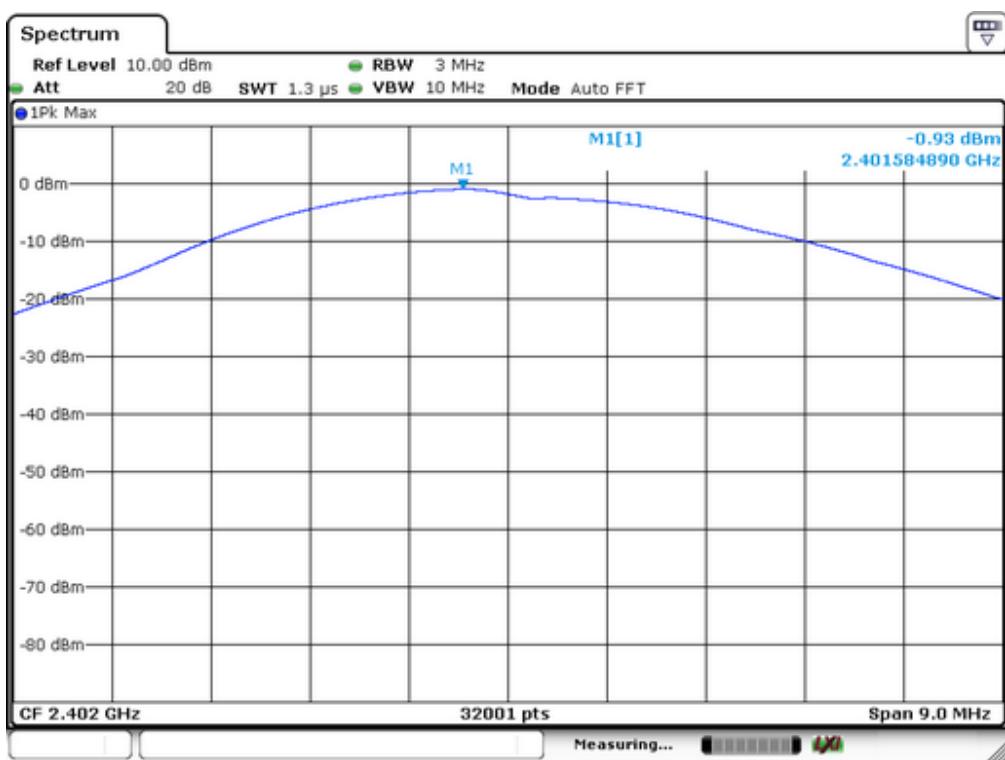
Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	<b>-0.74</b>	<b>0.843</b>	1000	PASS
40	2441	-1.23	0.753	1000	PASS
79	2480	-1.66	0.682	1000	PASS

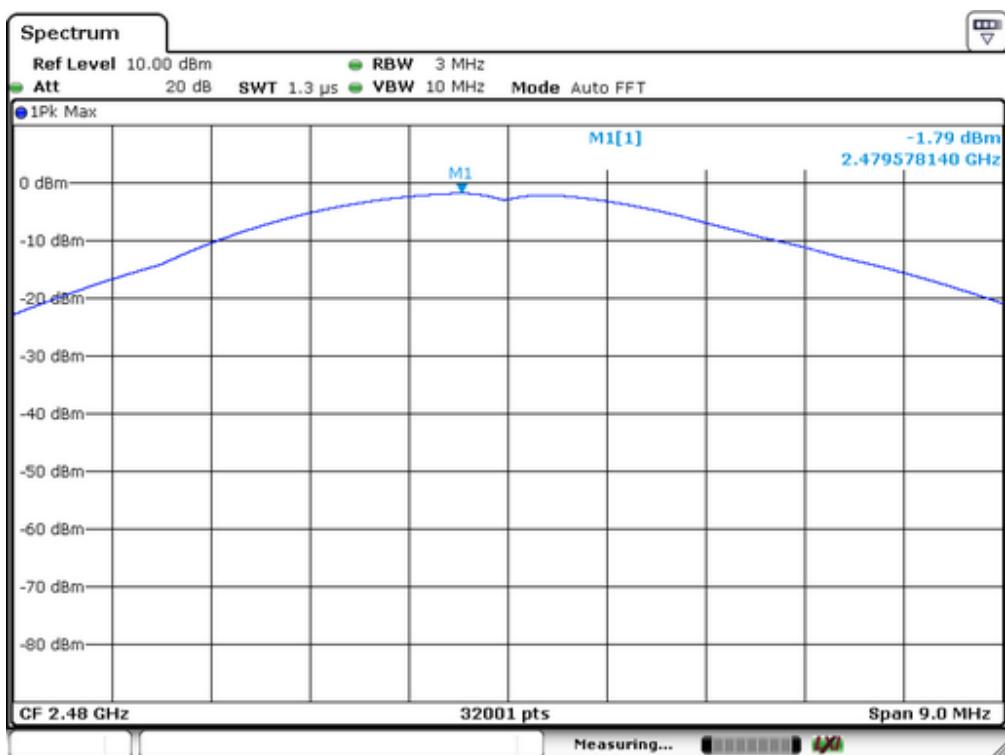
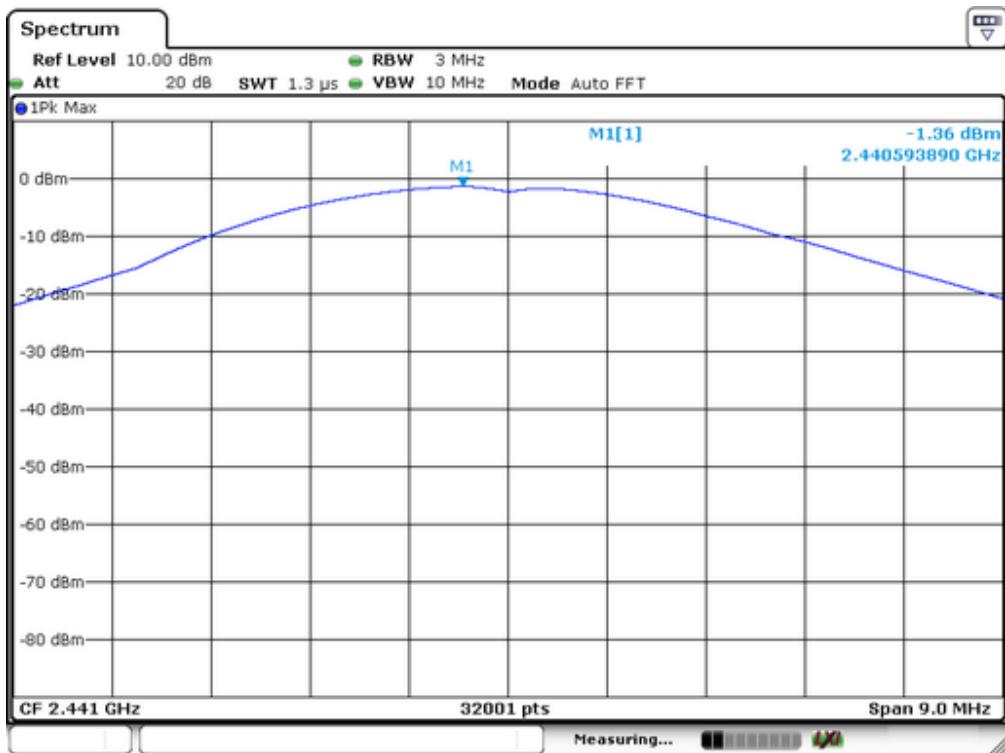




Spectrum Detector: PK      Test Date : August 21, 2015  
 Test By: Andy      Temperature : 25 °C  
 Test Result: PASS      Humidity : 50 %  
 Modulation: Π/4-DQPSK

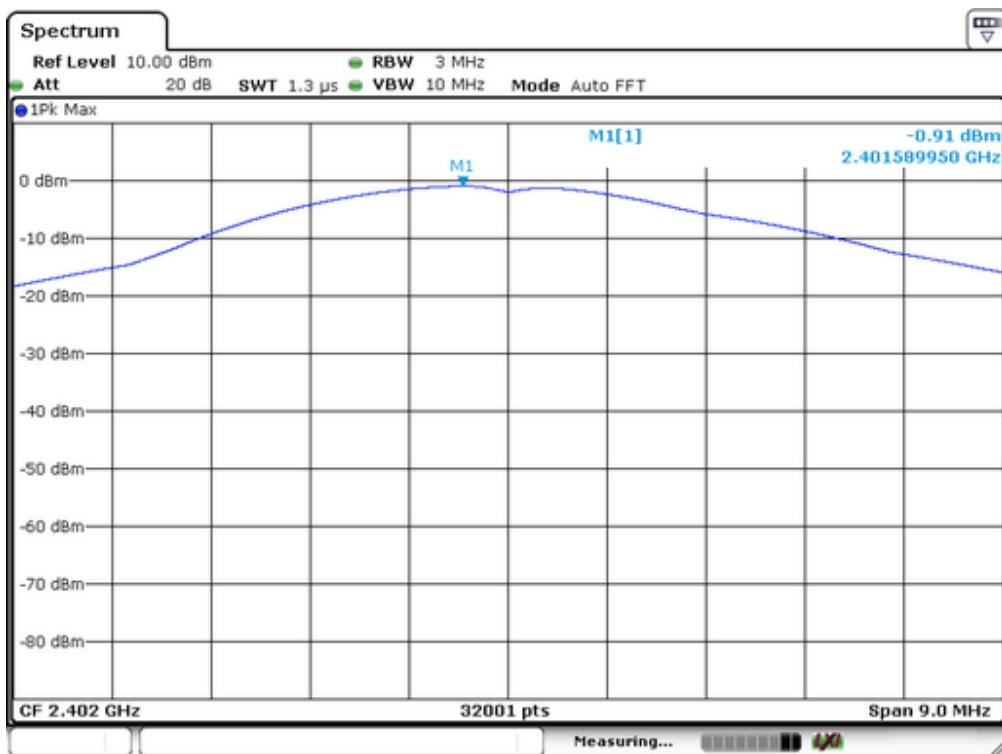
Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	-0.93	0.807	125	PASS
40	2441	-1.36	0.731	125	PASS
79	2480	-1.79	0.662	125	PASS

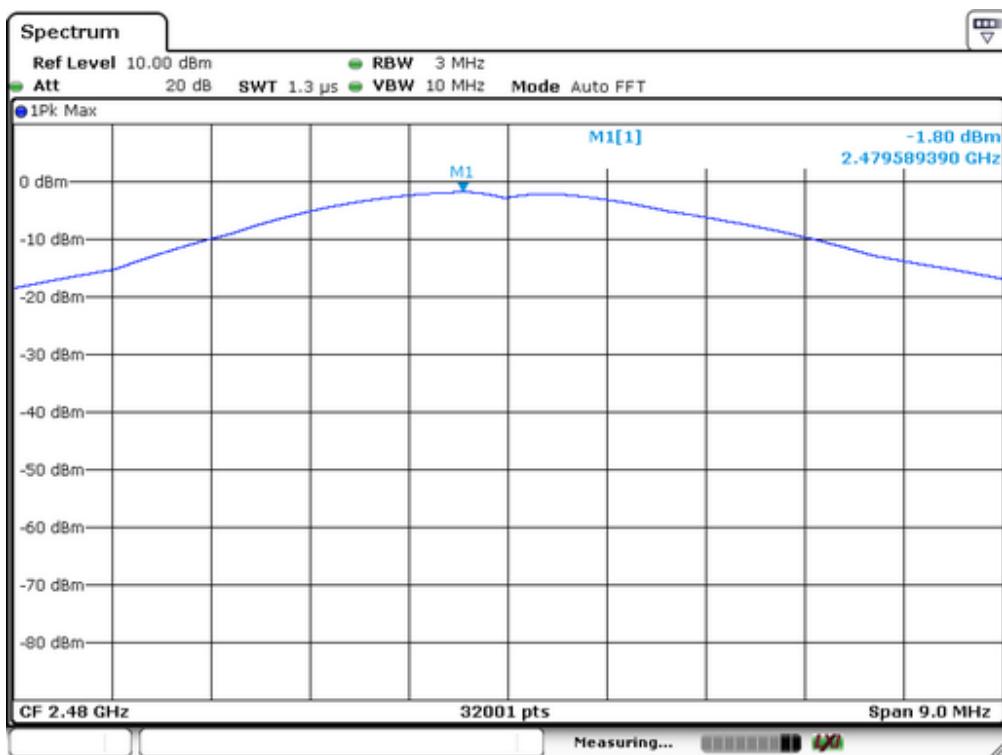
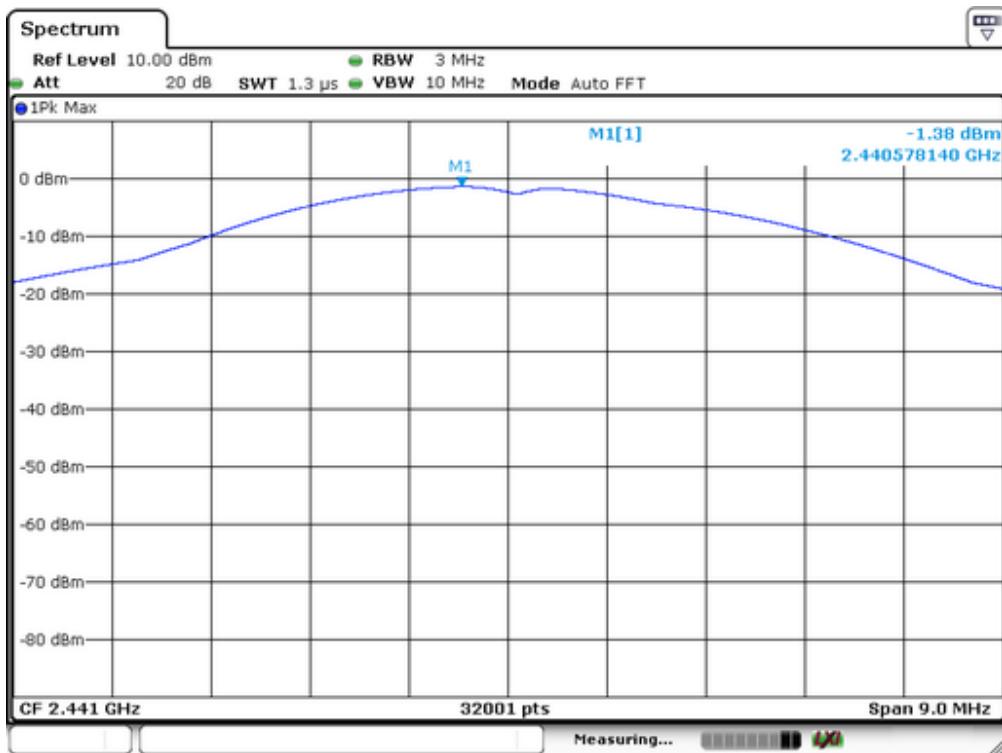




Spectrum Detector: PK      Test Date : August 21, 2015  
 Test By: Andy      Temperature : 25 °C  
 Test Result: PASS      Humidity : 50 %  
 Modulation: 8DPSK

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	-0.91	0.811	125	PASS
40	2441	-1.38	0.728	125	PASS
79	2480	-1.80	0.661	125	PASS





## 13. Band EDGE test

### 13.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a styrofoam table which is 1.5m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.
6. Use the following spectrum analyzer settings:

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:

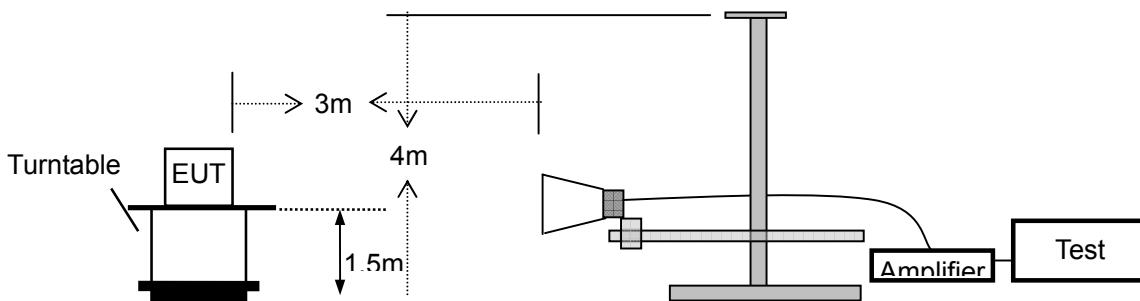
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

### 13.2 Test SET-UP (Block Diagram of Configuration)

For Conducted Test



## For Radiated emission Test



### 13.3 Measurement Equipment Used:

#### For Conducted Test

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

#### For Radiated emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1	Signal Analyzer	Rohde & Schwarz	FSV30	103040	12/29/2014	1 Year
2	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	12/29/2014	1 Year
3	Power Amplifier	LUNAR EM	LNA1G18-40	J1010000008 1	12/29/2014	1 Year
4	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year
5	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year
6	Cable	H+S	CBL-26	N/A	12/29/2014	1 Year

### 13.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	August 21, 2015
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

#### 1. Conducted Test

For Non-Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2399.29	GFSK	-1.31	-36.48	35.17	>20dBc
2399.75	pi/4-DQPSK	-2.97	-25.66	22.69	>20dBc
2399.75	8DPSK	-1.89	-26.27	24.38	>20dBc
2484.45	GFSK	-2.31	-62.61	60.3	>20dBc
2483.93	pi/4-DQPSK	-3.51	-60.62	57.11	>20dBc
2483.77	8DPSK	-2.85	-32.76	29.91	>20dBc

For Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2399.79	GFSK	-4.54	-52.05	47.51	>20dBc
2399.76	pi/4-DQPSK	-2.76	-27.74	24.98	>20dBc
2439.79	8DPSK	-1.54	-38.37	36.83	>20dBc
2484.23	GFSK	-2.47	-43.51	41.04	>20dBc
2483.74	pi/4-DQPSK	-4.08	-40.93	36.85	>20dBc
2484.32	8DPSK	-7.7	-56.73	49.03	>20dBc

## 2. Radiated emission Test

### **Worst test modulation GFSK**

For Non-Hopping Mode:

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
		PK	AV	PK	AV	PK	AV
2399	H	64.35	45.15	74	54	-9.65	-8.85
2397.48	V	60.72	40.38	74	54	-13.28	-13.62
2484.15	H	64.38	44.92	74	54	-9.62	-9.08
2485.69	V	59.27	38.47	74	54	-14.73	-15.53

For Hopping Mode:

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)		Margin (dB)	
		PK	AV	PK	AV	PK	AV
2399.95	H	65.35	45.72	74	54	-8.65	-8.28
2395	V	60.28	40.35	74	54	-13.72	-13.65
2487.05	H	64.17	41.29	74	54	-9.83	-12.71
2486.17	V	59.28	37.49	74	54	-14.72	-16.51

## 14. Antenna Application

### 14.1 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.

### 14.2 Result

The EUT's antenna, permanent attached antenna, used a PCB antenna and integrated on PCB, The antenna's gain is 0 dBi and meets the requirement.

# APPENDIX I (Photos of EUT)



