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

OF

Bluetooth Audio Phone

Model No.: BT400HM

Trade Mark: useasy

FCC ID: 2AD75-BT400HM

Report No.: KAD150126106E2

Issue Date: February 26, 2015

Prepared for

Protel Communication Equipment(Huizhou) Co., Ltd.
Building A1, No.19, JinZhong Road, Huinan High-Tech Industrial Park, Hui-Ao Avenue, HuiZhou City, GuangDong Province, PRC

Prepared by

DONGGUAN EMTEK CO., LTD.

No.281, Guantai Road, Nancheng District,
Dongguan, Guangdong, China
TEL: 86-769-22807078
FAX: 86-769-22807079

VERIFICATION OF COMPLIANCE

Applicant:	Protel Communication Equipment(Huizhou) Co., Ltd. Building A1, No.19, JinZhong Road, Huinan High-Tech Industrial Park, Hui-Ao Avenue, HuiZhou City, GuangDong Province, PRC
Manufacturer:	Protel Communication Equipment(Huizhou) Co., Ltd. Building A1, No.19, JinZhong Road, Huinan High-Tech Industrial Park, Hui-Ao Avenue, HuiZhou City, GuangDong Province, PRC
Product Description:	Bluetooth Audio Phone
Trade Mark:	useasy
Model Number:	BT400HM
Kind of Device:	Bluetooth Ver. 3.0+EDR
Date of Test:	January 26, 2015 to February 26, 2015

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 C63.4 (2014) 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).

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

Approved By

Sam Lv / Q.A. Manager
DONGGUAN EMTEK CO., LTD.

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	KAD150126106E2

Table of Contents

1. GENERAL INFORMATION 6

1.1 PRODUCT DESCRIPTION 6
1.2 RELATED SUBMITTAL(S) / GRANT (S) 6
1.3 TEST METHODOLOGY 6
1.4 SPECIAL ACCESSORIES 6
1.5 EQUIPMENT MODIFICATIONS 7
1.6 TEST FACILITY 7

2. SYSTEM TEST CONFIGURATION 8

2.1 EUT CONFIGURATION 8
2.2 EUT EXERCISE 8
2.3 TEST PROCEDURE 8
2.4 LIMITATION 9
2.5 CONFIGURATION OF TESTED SYSTEM 12

3. SUMMARY OF TEST RESULTS 13

4. DESCRIPTION OF TEST MODES 14

5. CONDUCTED EMISSIONS TEST 15

5.1 MEASUREMENT PROCEDURE: 15
5.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 15
5.3 MEASUREMENT EQUIPMENT USED: 15
5.4 MEASUREMENT RESULT: 15
5.5 CONDUCTED MEASUREMENT PHOTOS: 18

6. RADIATED EMISSION TEST 19

6.1 MEASUREMENT PROCEDURE 19
6.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 20
6.3 MEASUREMENT EQUIPMENT USED: 21
6.4 MEASUREMENT RESULT 22
6.5 RADIATED MEASUREMENT PHOTOS: 28

7. CHANNEL SEPARATION TEST 29

7.1 MEASUREMENT PROCEDURE 29
7.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 29
7.3 MEASUREMENT EQUIPMENT USED: 29
7.4 MEASUREMENT RESULTS: 29

8. 20DB BANDWIDTH TEST 36

8.1 MEASUREMENT PROCEDURE 36
8.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 36
8.3 MEASUREMENT EQUIPMENT USED: 36

8.4 MEASUREMENT RESULTS:.....36
9. QUANTITY OF HOPPING CHANNEL TEST 43
9.1 MEASUREMENT PROCEDURE 43
9.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....43
9.3 MEASUREMENT EQUIPMENT USED: 43
9.4 MEASUREMENT RESULTS:.....43
10. TIME OF OCCUPANCY (DWELL TIME) TEST 44
10.1 TEST DESCRIPTION.....44
10.2 TEST REQUIREMENTS / LIMITS 44
10.3 TEST RESULT 44
11. MAXIMUM PEAK OUTPUT POWER TEST 47
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:.....48
12. BAND EDGE TEST 54
12.1 MEASUREMENT PROCEDURE 54
12.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION).....54
12.3 MEASUREMENT EQUIPMENT USED: 55
12.4 MEASUREMENT RESULTS:.....56
13. ANTENNA APPLICATION 58
13.1 ANTENNA REQUIREMENT 58
13.2 RESULT 58

Appendix I (Photos of EUT) (3 pages)

1. GENERAL INFORMATION

1.1 Product Description

The Protel Communication Equipment(Huizhou) Co., Ltd., Model: BT400HM (referred to as the EUT in this report) The EUT is a short range, lower power transmitter. It is designed by way of utilizing the following modulation achieves the system operating.

A major technical descriptions of EUT is described as following:

A). Operation Frequency: 2402-2480MHz
B). Kind of device: Bluetooth Ver. 3.0+EDR
C). Modulation: GFSK, π/4-DQPSK, 8DPSK
D). Number of Channel: 79
E). Channel space: 1MHz
F). Measured RF Output Power: 0.81dBm (0.001205W)
G). Antenna Type: Internal PCB antenna
H). Antenna GAIN: 0 dBi
I). Input Rating: DC 5V

Remark:
The basic data rate of 1Mbps uses GFSK modulation and the enhanced data rate uses PSK modulation. For the enhanced data rate of 3Mbps 8DPSK modulation and of 2Mbps π/4-DQPSK modulation is used.

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AD75-BT400HM filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and FCC Public Notice DA 00-705.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2014). 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. : 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 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 C63.4-2014. 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 EUT was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2014.

2.4 Limitation

(1) Channel Separation test

FCC Part 15, Subpart C Section 15.247(a)(1). 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

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

(4) Time of Occupancy(Dwell Time)

FCC Part 15, Subpart C Section 15.247

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

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, In any 100kHz bandwidth outside the frequency band in with the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Operating Frequency Range(MHz)	Spurious emission frequency	Limit	
		Peak power ration to emission(dBc)	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

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 limit of radiated emission for frequency below 1000MHz. The emissions from an intentional radiator shall not exceed the field strength level specified in the following table:

Frequency (MHz)	Field strength μV/m	Distance(m)	Field strength at 3m dBμV/m
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	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

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.

FCC Part 15, Section 15.35(b) limit of radiated emission for frequency above 1000MHz

Frequency(MHz)	Class A(dBμV/m)(at 3m)		Class B(dBμV/m)(at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80.0	60.0	74.0	54.0

FCC Part 15, Subpart C Section 15.249. The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency(MHz)	Filed Strength of Fundamental(at 3m)		Filed Strength of Harmonics(at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
902-928	114	94	74.0	54.0
2400-2483.5	114	94	74.0	54.0
5725-5875	114	94	74.0	54.0
24000-24250	128	108	88.0	68.0

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

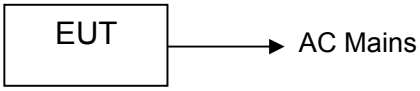


Table 2-1 Equipment Used in Tested System

Item	Equipment	Trade Mark	Model No.	FCC ID	Note
1.	Bluetooth Audio Phone	useasy	BT400HM	2AD75-BT400HM	***EUT***
2	Adapter	N/A	YSV6-0501000	N/A	***Support Equipment***

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, Π/4-DQPSK, 8DPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

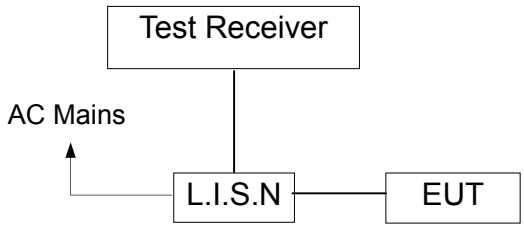
Channel	Frequency(MHz)
1	2402
40	2441
79	2480

5. Conducted Emissions Test

5.1 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.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used:

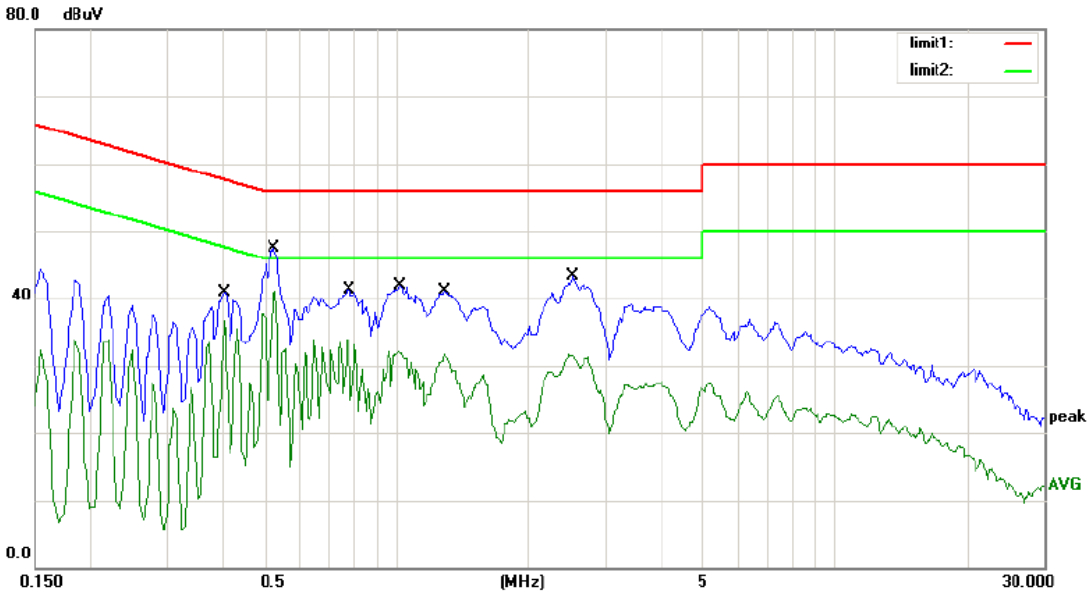
Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**Last Cal.**	**Due date**
Test Receiver	Rohde & Schwarz	ESCS30	100018	05/16/2014	05/15/2015
L.I.S.N	Rohde & Schwarz	ENV216	100017	05/16/2014	05/15/2015
RF Switching Unit	CDS	RSU-M2	38401	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

5.4 Measurement Result:

Pass.

All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) 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 Phase: L1 Temperature: 24

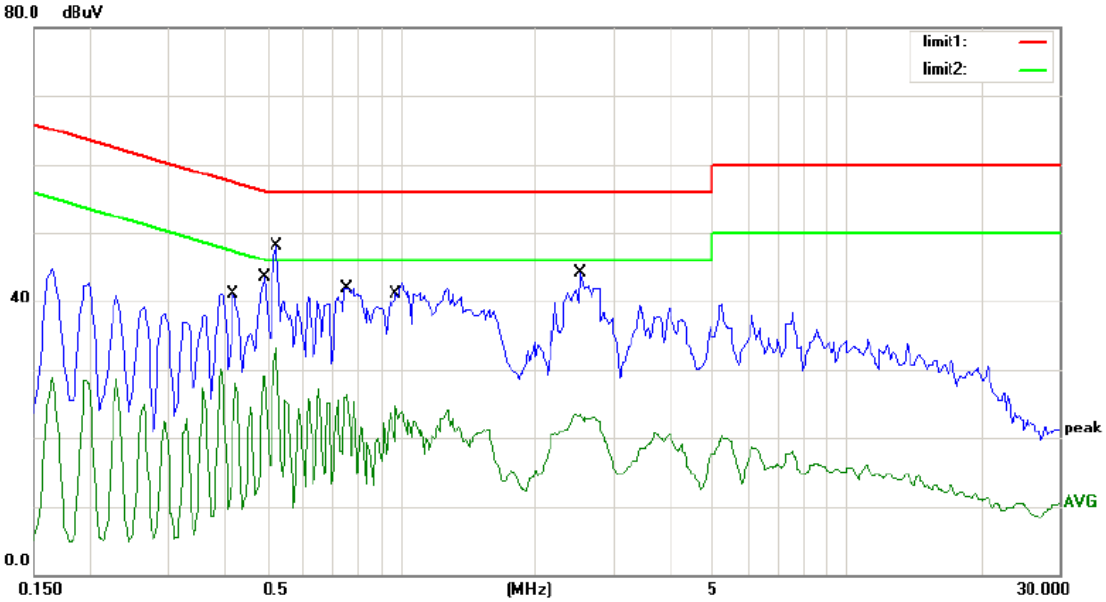
Limit: (CE)FCC PART 15 class B QP Power: AC 120V/60Hz Humidity: 55 %

Mode: TX2402

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4050	40.92	0.00	40.92	57.75	-16.83	QP	
2		0.4050	36.62	0.00	36.62	47.75	-11.13	AVG	
3		0.5250	47.47	0.00	47.47	56.00	-8.53	QP	
4	*	0.5250	41.13	0.00	41.13	46.00	-4.87	AVG	
5		0.7800	41.33	0.00	41.33	56.00	-14.67	QP	
6		0.7800	33.97	0.00	33.97	46.00	-12.03	AVG	
7		1.0250	41.87	0.00	41.87	56.00	-14.13	QP	
8		1.0250	32.03	0.00	32.03	46.00	-13.97	AVG	
9		1.2900	41.04	0.00	41.04	56.00	-14.96	QP	
10		1.2900	31.64	0.00	31.64	46.00	-14.36	AVG	
11		2.5300	43.28	0.00	43.28	56.00	-12.72	QP	
12		2.5300	31.71	0.00	31.71	46.00	-14.29	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		0.4200	41.10	0.00	41.10	57.45	-16.35	QP	
2		0.4200	28.18	0.00	28.18	47.45	-19.27	AVG	
3		0.4950	43.58	0.00	43.58	56.08	-12.50	QP	
4		0.4950	29.17	0.00	29.17	46.08	-16.91	AVG	
5	*	0.5250	48.16	0.00	48.16	56.00	-7.84	QP	
6		0.5250	33.18	0.00	33.18	46.00	-12.82	AVG	
7		0.7550	41.98	0.00	41.98	56.00	-14.02	QP	
8		0.7550	26.40	0.00	26.40	46.00	-19.60	AVG	
9		0.9750	41.20	0.00	41.20	56.00	-14.80	QP	
10		0.9750	24.67	0.00	24.67	46.00	-21.33	AVG	
11		2.5200	44.09	0.00	44.09	56.00	-11.91	QP	
12		2.5200	23.53	0.00	23.53	46.00	-22.47	AVG	

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

5.5 Conducted Measurement Photos:

6. Radiated Emission Test

6.1 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 were complete.
5. The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	**X-Y axis**
Mode B	Y-Z axis
Mode C	X-Z axis

From the above modes, the worst case was found in Mode A. Therefore only the test data of the mode was recorded in this report.

6. 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:

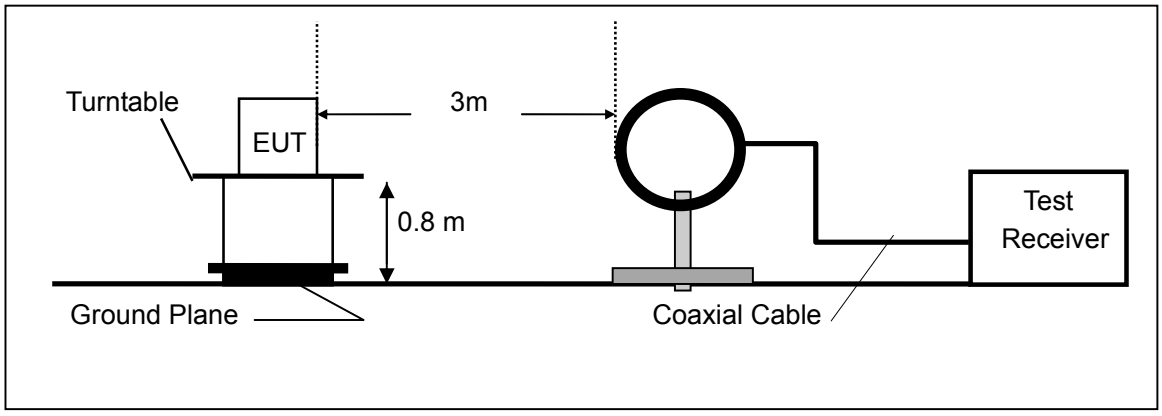
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

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

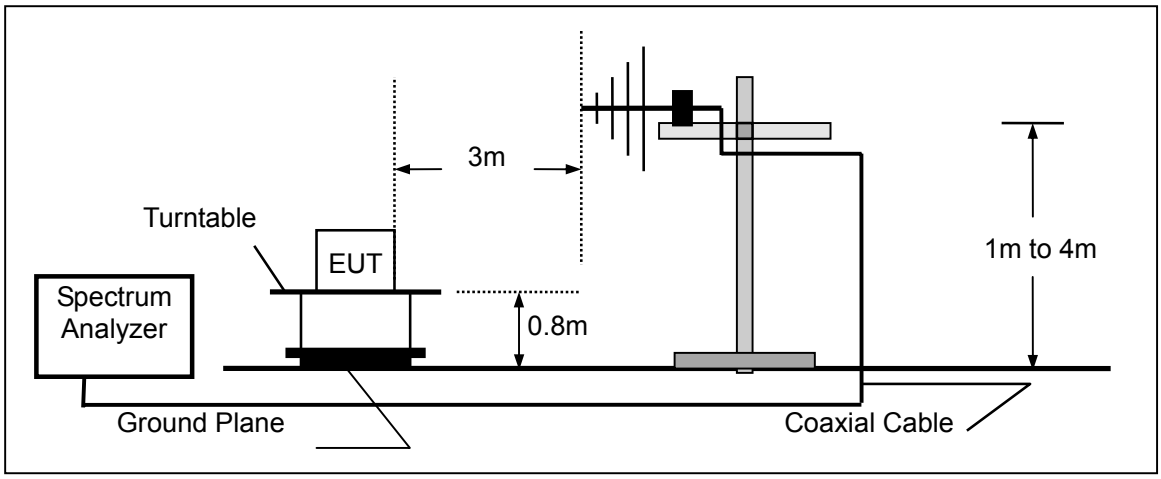
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

6.2 Test SET-UP (Block Diagram of Configuration)

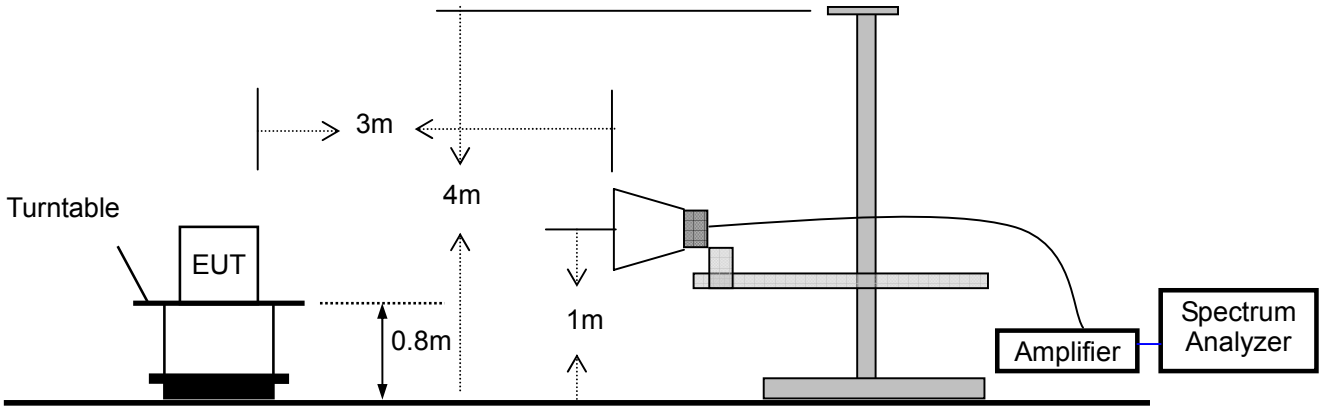
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



6.3 Measurement Equipment Used:

EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/16/2014	05/15/2015
Pre-Amplifier	HP	8447D	2944A07999	05/16/2014	05/15/2015
Bilog Antenna	SCHWARZBECK	VULB9163	142	05/16/2014	05/15/2015
Loop Antenna	ARA	PLA-1030/B	1029	05/16/2014	05/15/2015
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170399	05/16/2014	05/15/2015
Horn Antenna	Schwarzbeck	BBHA9120D	D143	05/16/2014	05/15/2015
Cable	Schwarzbeck	AK9513	ACRX1	05/19/2014	05/18/2015
Cable	Schwarzbeck	N/A	FP2RX2	05/19/2014	05/18/2015
Cable	Schwarzbeck	AK9513	CRPX1	05/19/2014	05/18/2015
Cable	Schwarzbeck	AK9513	CRRX2	05/19/2014	05/18/2015

6.4 Measurement Result

Below 30MHz:

Operation Mode:	TX	Test Date :	February 12, 2015
Frequency Range:	9KHz~30MHz	Temperature :	28℃
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	Andy

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

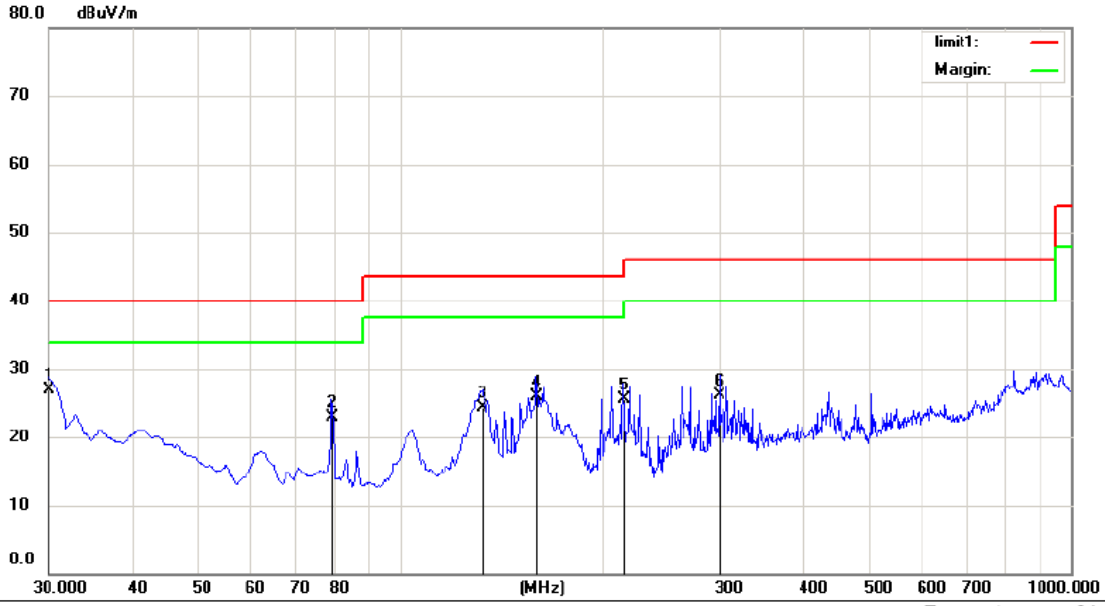
Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Below 1000MHz:

Pass.

All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

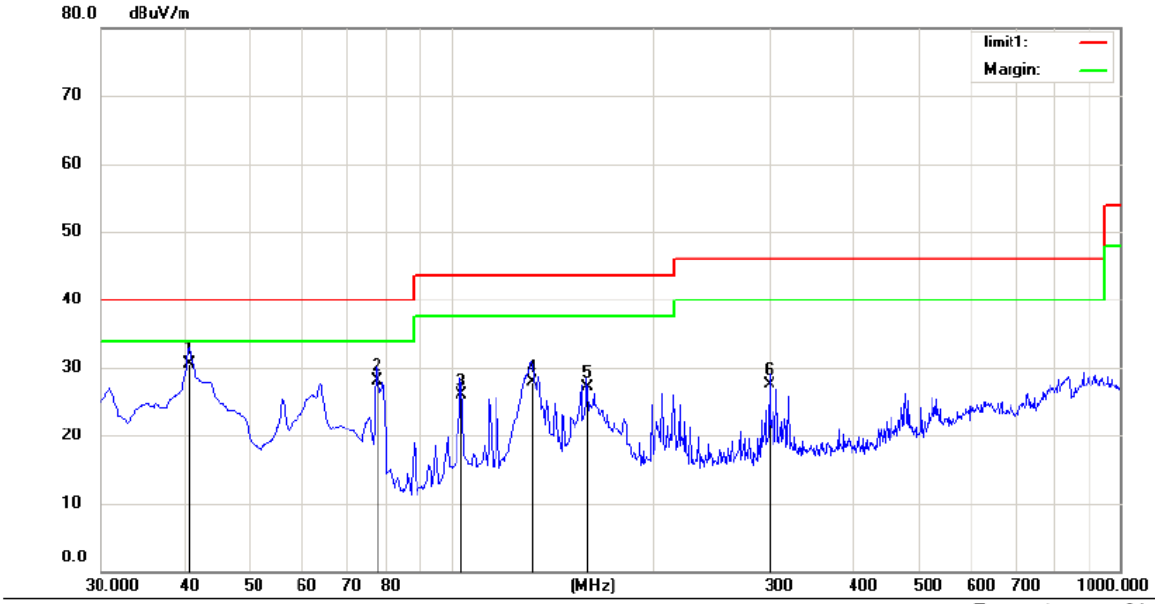
Please refer to the following data.



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.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	30.0000	42.06	-15.15	26.91	40.00	-13.09	QP			
2		79.4700	45.42	-22.50	22.92	40.00	-17.08	QP			
3		132.8200	40.71	-16.39	24.32	43.50	-19.18	QP			
4		159.9800	44.32	-18.44	25.88	43.50	-17.62	QP			
5		215.2700	41.88	-16.46	25.42	43.50	-18.08	QP			
6		299.6600	40.43	-14.34	26.09	46.00	-19.91	QP			

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



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.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	40.6700	44.10	-13.64	30.46	40.00	-9.54	QP			
2		77.5300	50.63	-22.60	28.03	40.00	-11.97	QP			
3		103.7200	44.40	-18.43	25.97	43.50	-17.53	QP			
4		131.8500	44.26	-16.40	27.86	43.50	-15.64	QP			
5		159.9800	45.49	-18.44	27.05	43.50	-16.45	QP			
6		299.6600	41.86	-14.34	27.52	46.00	-18.48	QP			

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

Above 1000MHz

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.

Operation Mode:	CH1: 2402MHz	Test Date :	February 12, 2015
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4804	V	66.22	44.12	74	54	-7.78	-9.88
7206	V	65.02	43.08	74	54	-8.98	-10.92
9608	V	64.13	42.69	74	54	-9.87	-11.31
12010	V	63.82	41.72	74	54	-10.18	-12.28
14412	V	62.74	40.35	74	54	-11.26	-13.65
16814	V	60.59	39.85	74	54	-13.41	-14.15
4804	H	65.18	45.72	74	54	-8.82	-8.28
7206	H	64.03	44.23	74	54	-9.97	-9.77
9608	H	63.85	43.16	74	54	-10.15	-10.84
12010	H	62.49	42.56	74	54	-11.51	-11.44
14412	H	61.59	41.72	74	54	-12.41	-12.28
16814	H	60.38	40.59	74	54	-13.62	-13.41

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.

Operation Mode:	CH40: 2441MHz	Test Date :	February 12, 2015
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4882	V	65.32	44.12	74	54	-8.68	-9.88
7323	V	64.01	43.28	74	54	-9.99	-10.72
9764	V	63.82	42.47	74	54	-10.18	-11.53
12205	V	62.49	41.35	74	54	-11.51	-12.65
14646	V	61.24	40.59	74	54	-12.76	-13.41
17087	V	60.36	38.75	74	54	-13.64	-15.25
4882	H	64.85	45.39	74	54	-9.15	-8.61
7323	H	63.55	44.15	74	54	-10.45	-9.85
9764	H	62.19	43.69	74	54	-11.81	-10.31
12205	H	61.24	42.82	74	54	-12.76	-11.18
14646	H	60.69	41.13	74	54	-13.31	-12.87
17087	H	59.75	40.76	74	54	-14.25	-13.24

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.

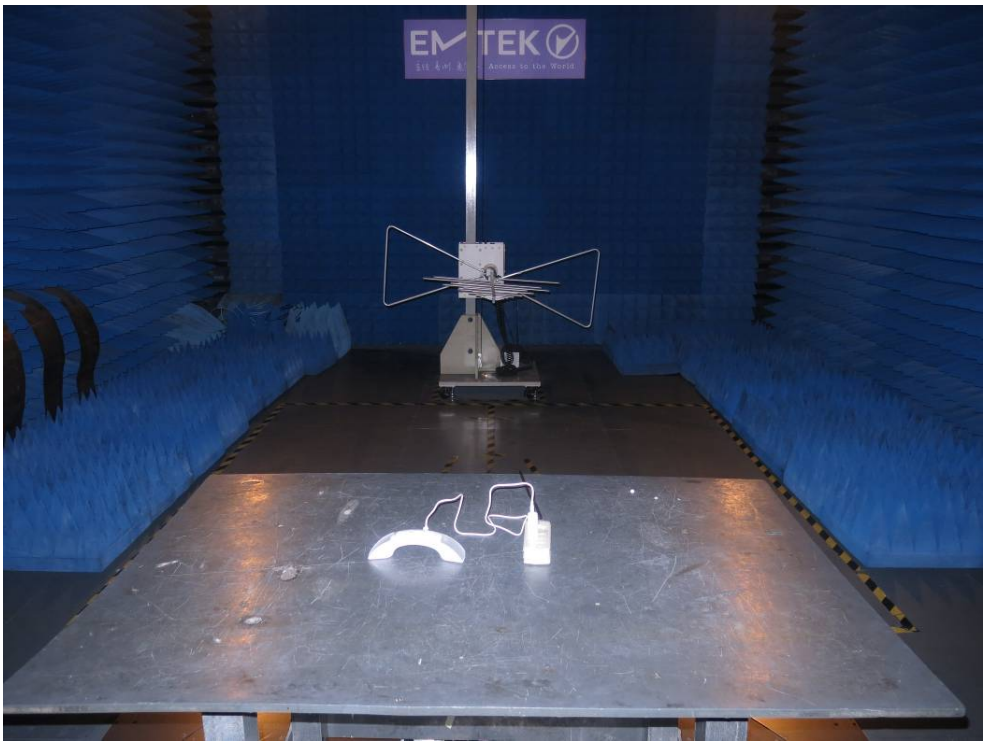
Operation Mode:	CH79: 2480MHz	Test Date :	February 12, 2015
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

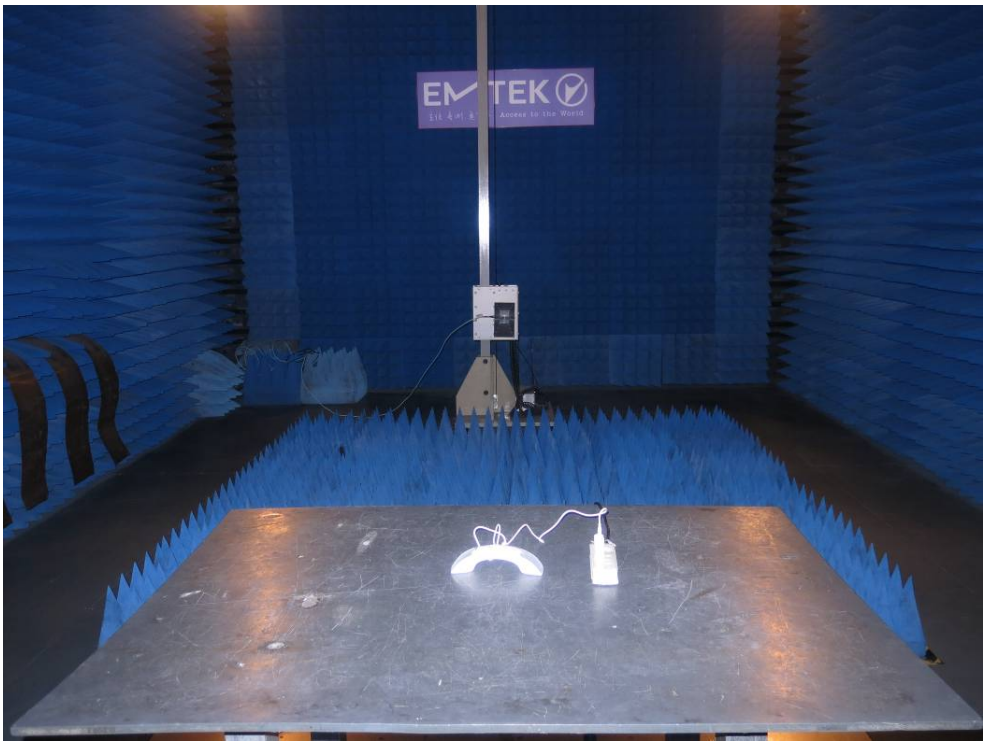
Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4960	V	66.22	45.11	74	54	-7.78	-8.89
7440	V	64.12	44.25	74	54	-9.88	-9.75
9920	V	63.08	43.19	74	54	-10.92	-10.81
12400	V	62.75	42.58	74	54	-11.25	-11.42
14880	V	61.54	41.49	74	54	-12.46	-12.51
17360	V	60.33	40.69	74	54	-13.67	-13.31
4960	H	65.85	46.22	74	54	-8.15	-7.78
7440	H	64.18	45.36	74	54	-9.82	-8.64
9920	H	62.95	44.72	74	54	-11.05	-9.28
12400	H	61.23	43.13	74	54	-12.77	-10.87
14880	H	60.28	42.95	74	54	-13.72	-11.05
17360	H	59.42	40.57	74	54	-14.58	-13.43

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.

6.5 Radiated Measurement Photos:



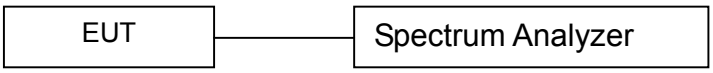


7. Channel Separation test

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:

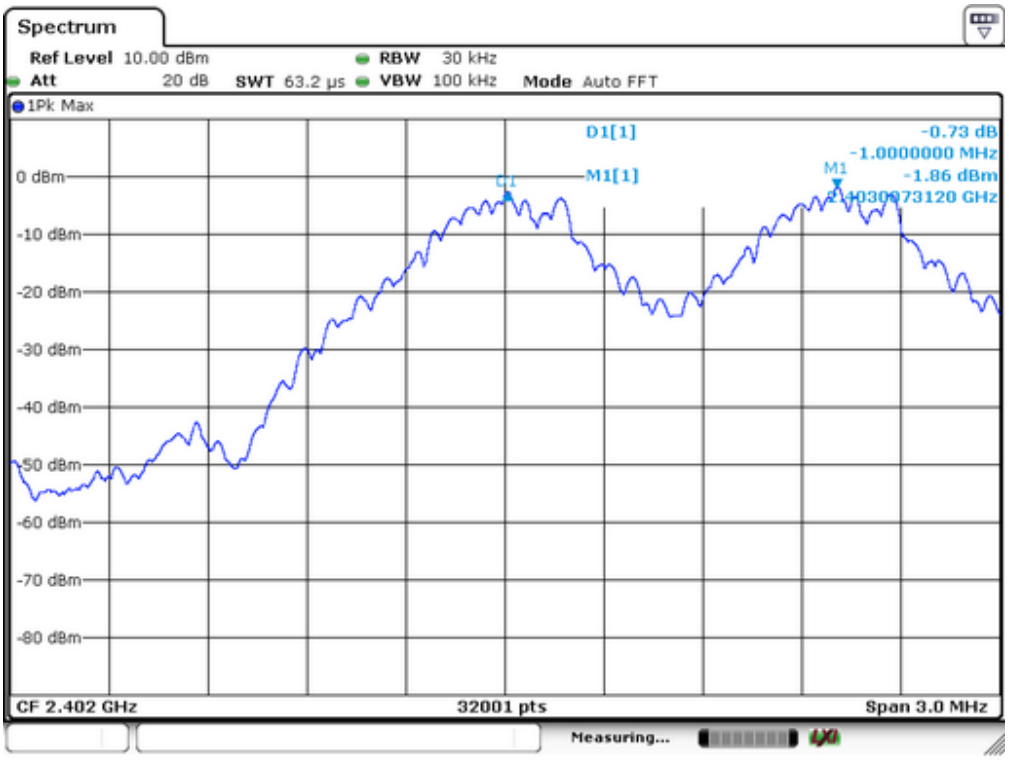
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

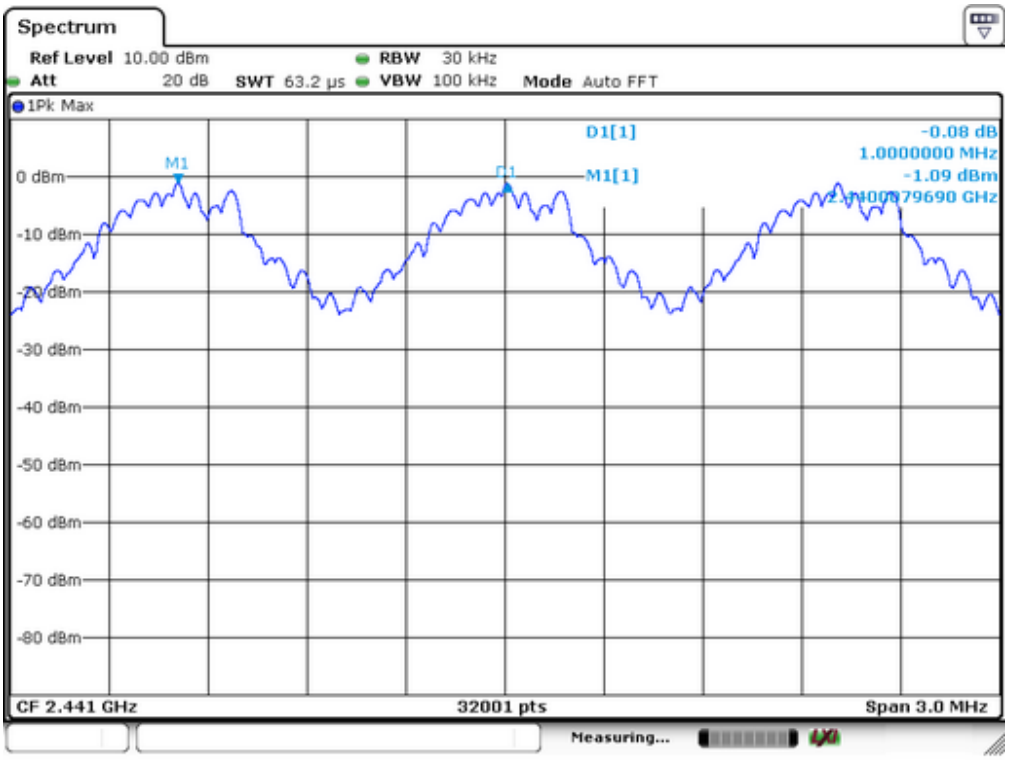
7.4 Measurement Results:

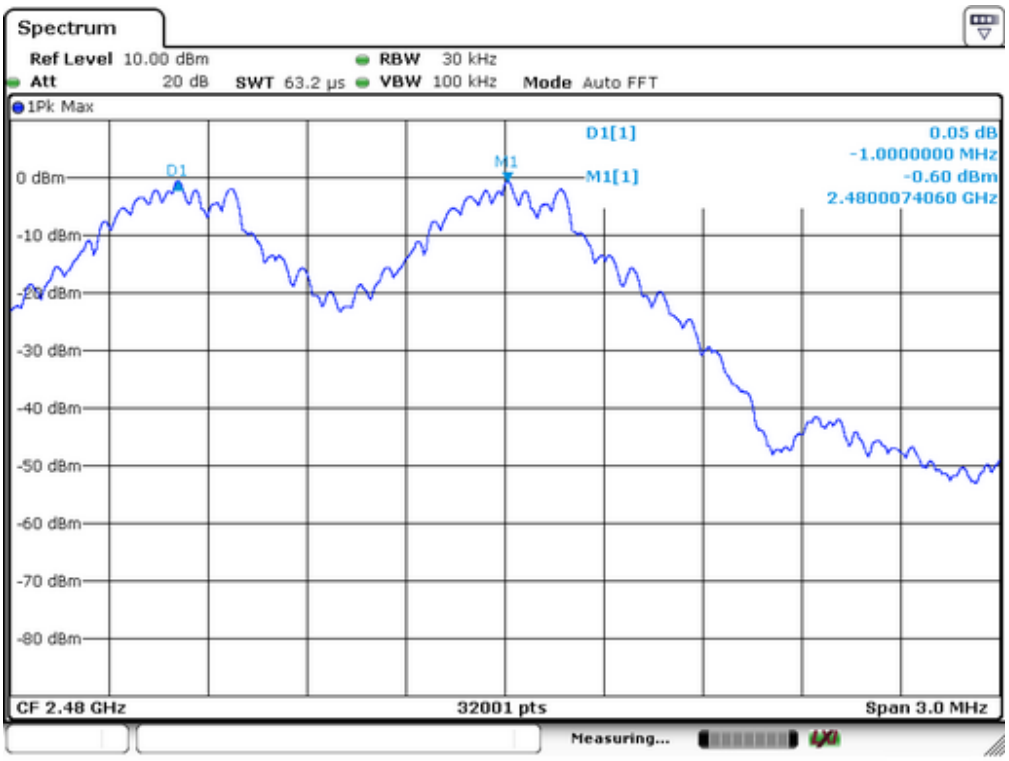
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Modulation:	GFSK		

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit (kHz)
1	2402	1000	>839
40	2441	1000	>837
79	2480	1000	>819

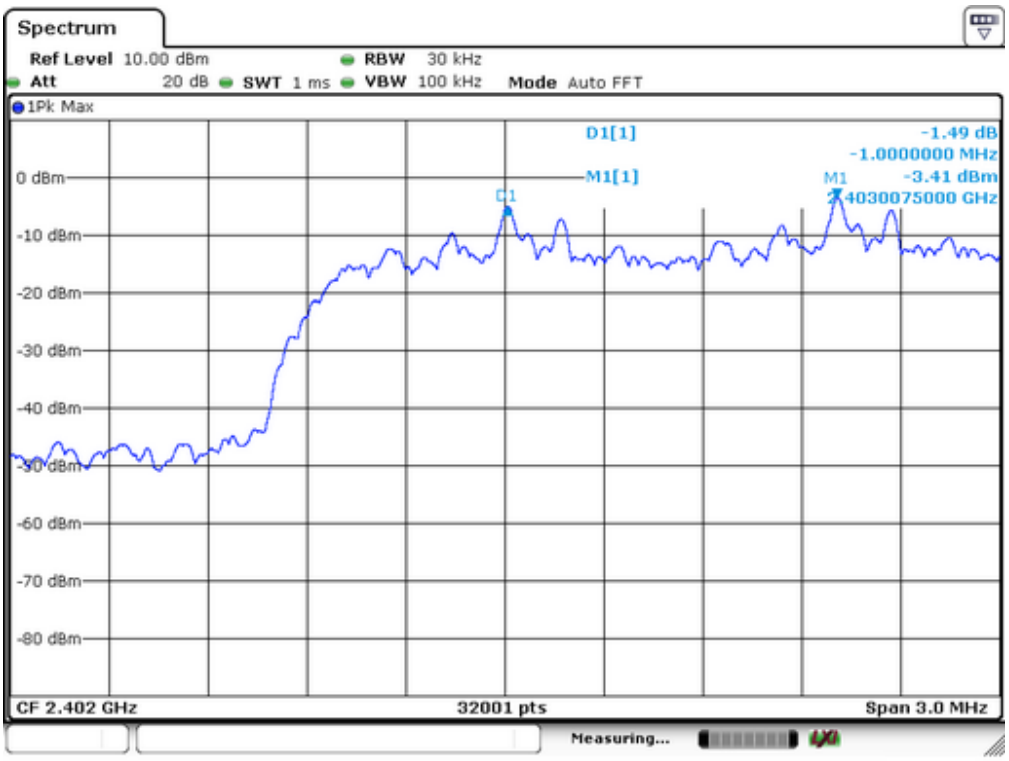

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.73 dB
-1.0000000 MHz
M1[1]
-1.86 dBm
2.4030973120 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Measuring...

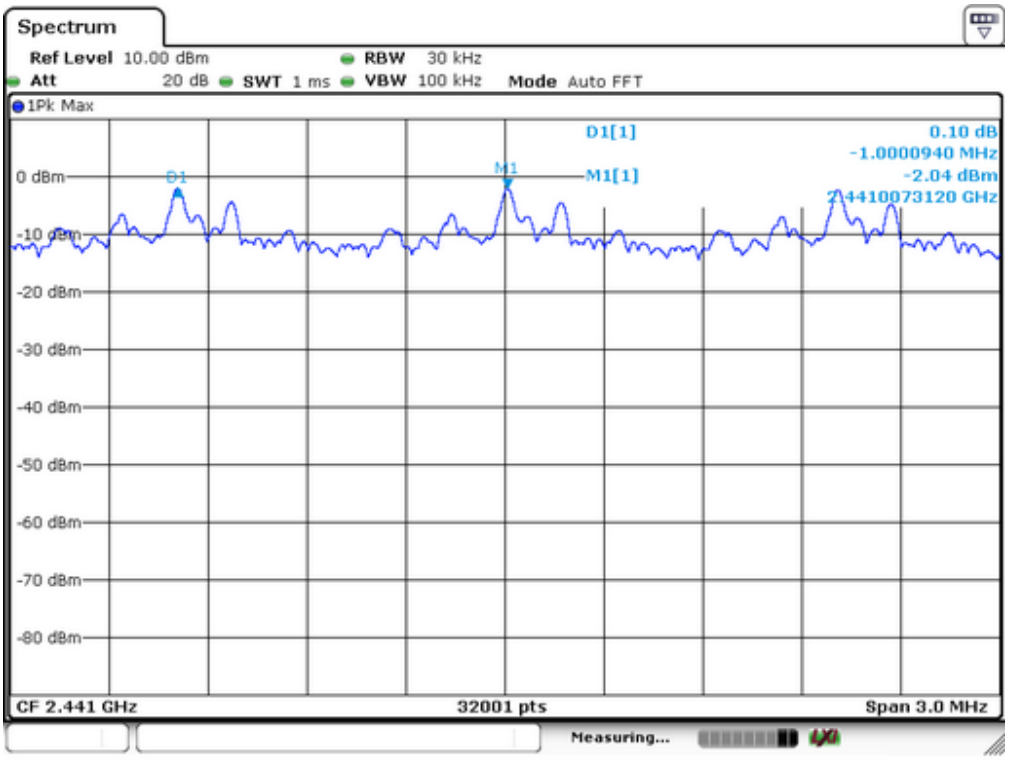

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.08 dB
1.0000000 MHz
M1[1]
-1.09 dBm
2.4400879690 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...

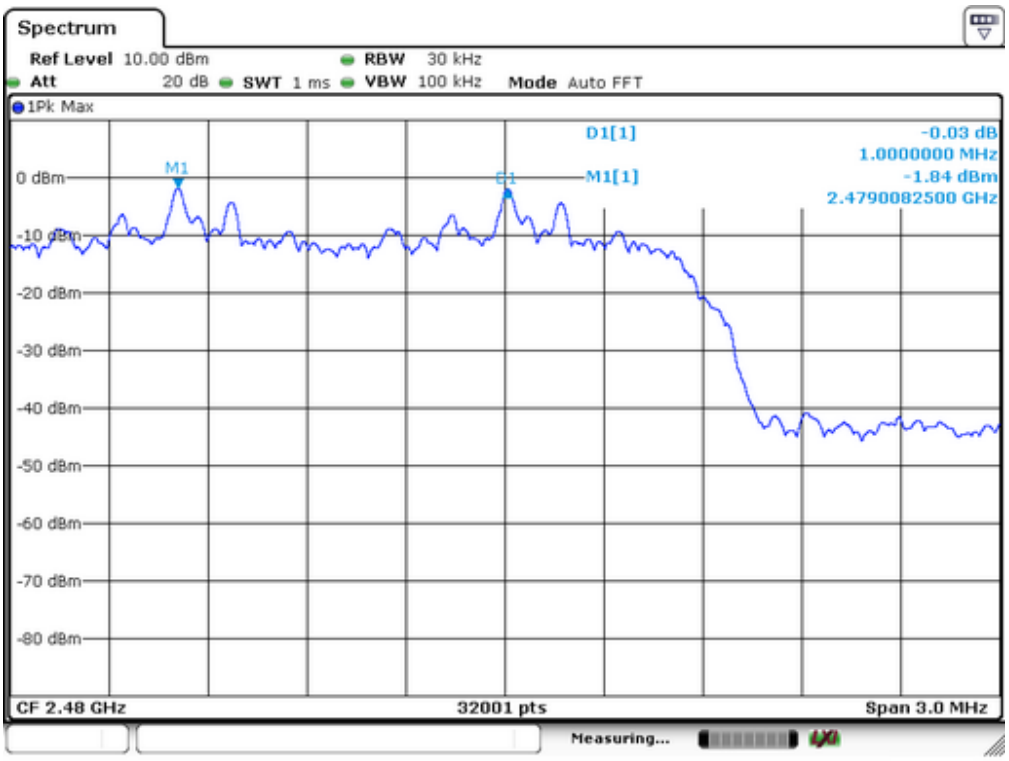


Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	Π/4-DQPSK		

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000	>843
40	2441	1000	>827
79	2480	1000	>826

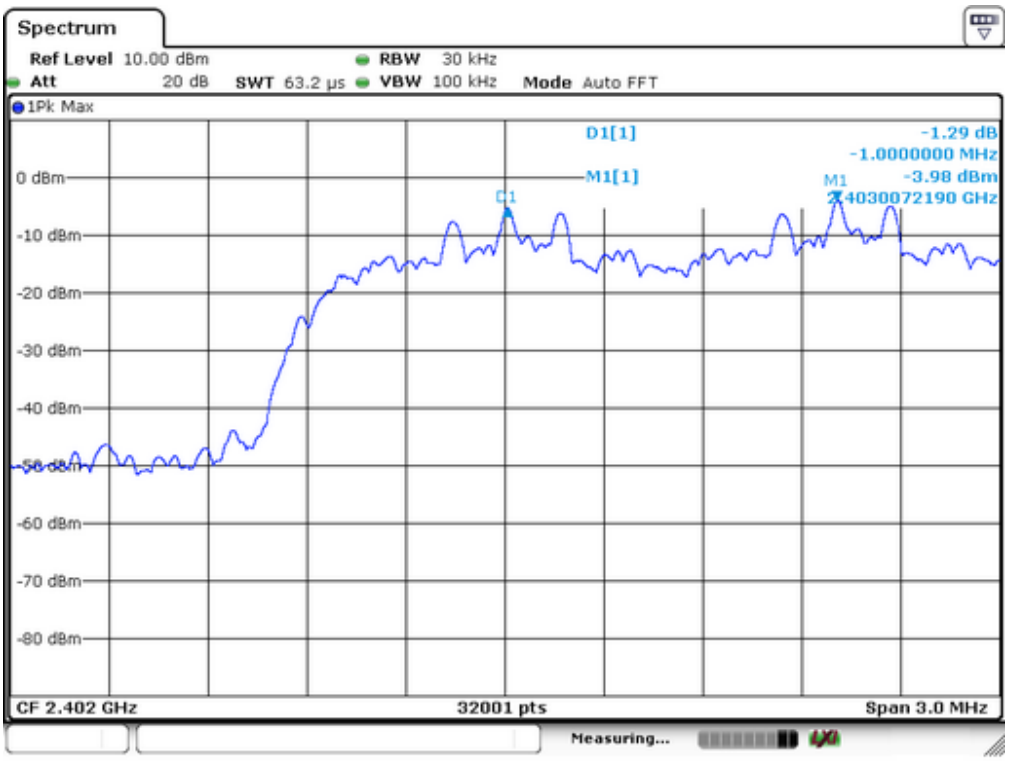

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
D1[1] -1.49 dB
-1.0000000 MHz
M1[1] -3.41 dBm
2.4030075000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Measuring...

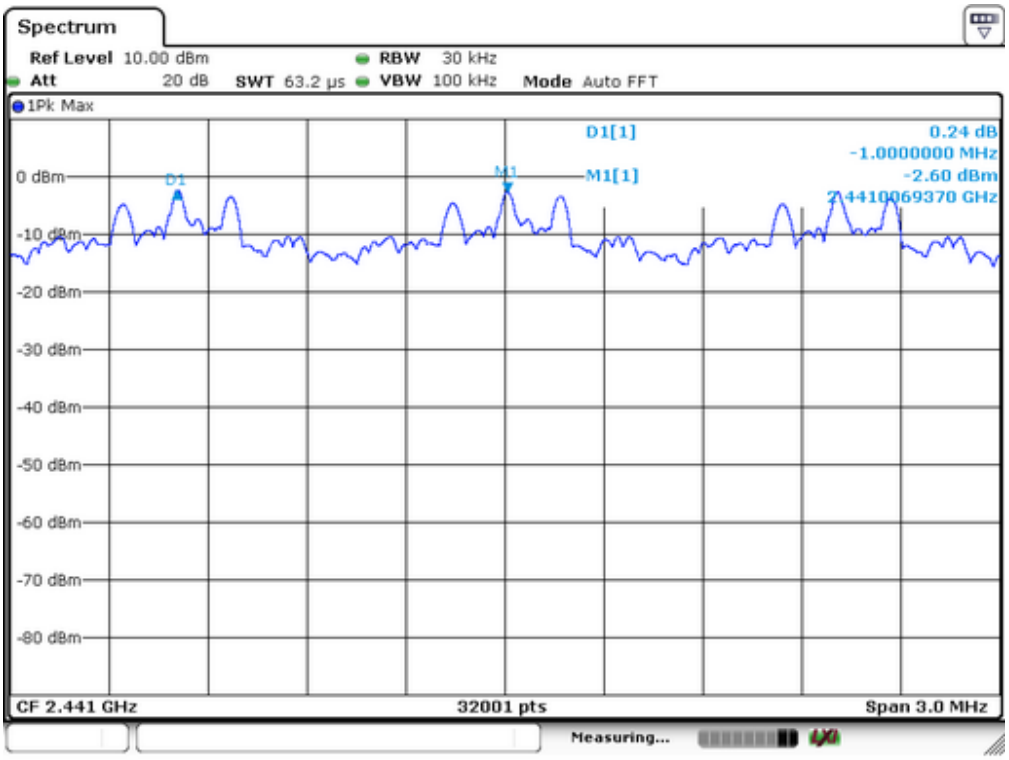

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
D1[1] 0.10 dB
-1.0000940 MHz
M1[1] -2.04 dBm
2.4410073120 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...

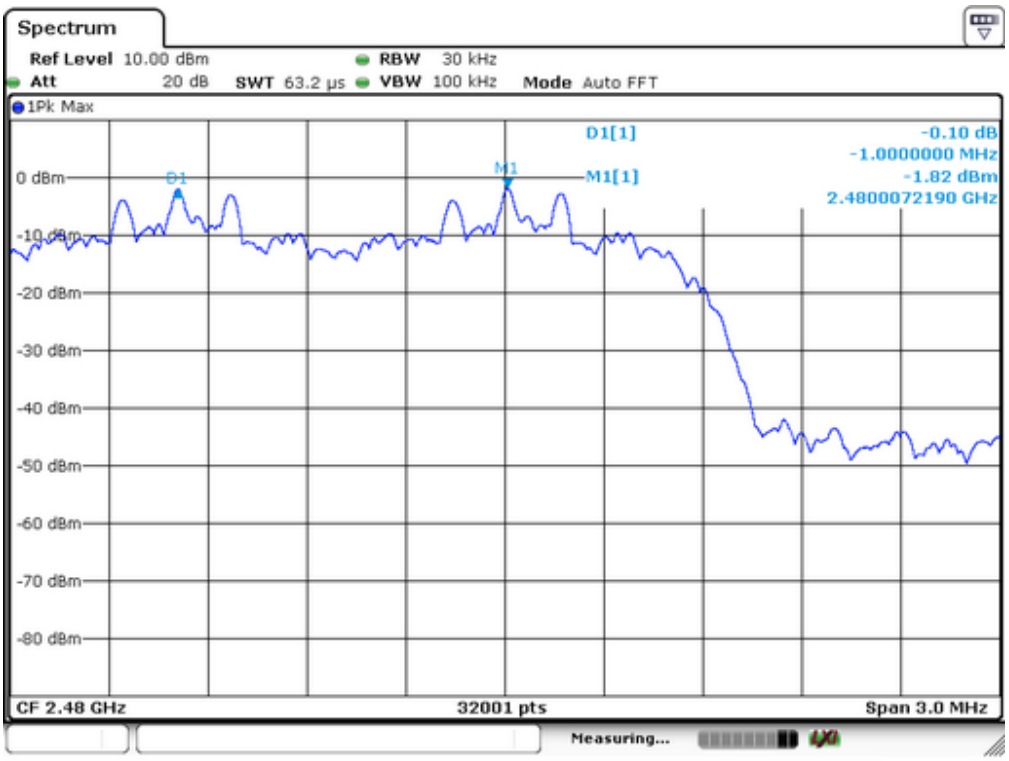


Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	8DPSK		

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000	>819
40	2441	1000	>839
79	2480	1000	>838


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-1.29 dB
-1.0000000 MHz
M1[1]
-3.98 dBm
2.4030072190 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
0.24 dB
-1.0000000 MHz
M1[1]
-2.60 dBm
2.4410069370 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Measuring...

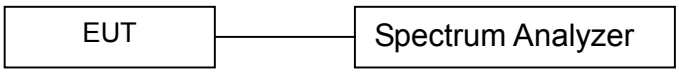

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.10 dB
-1.0000000 MHz
M1[1]
-1.82 dBm
2.4800072190 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Measuring...

8. 20dB Bandwidth 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:

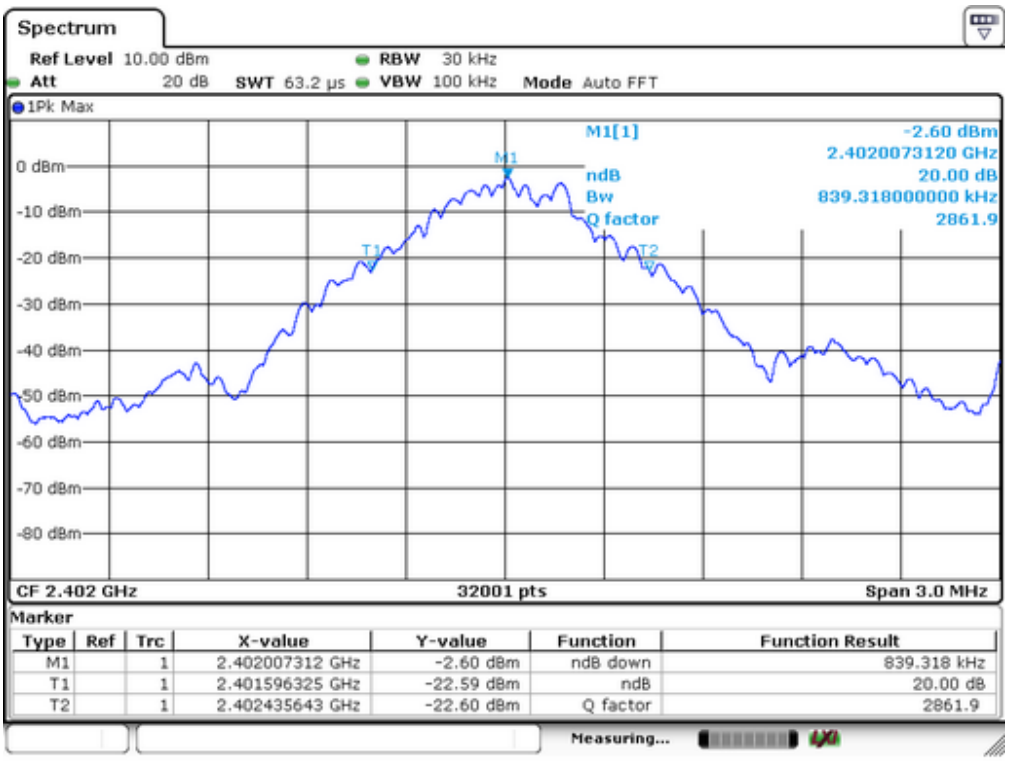
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

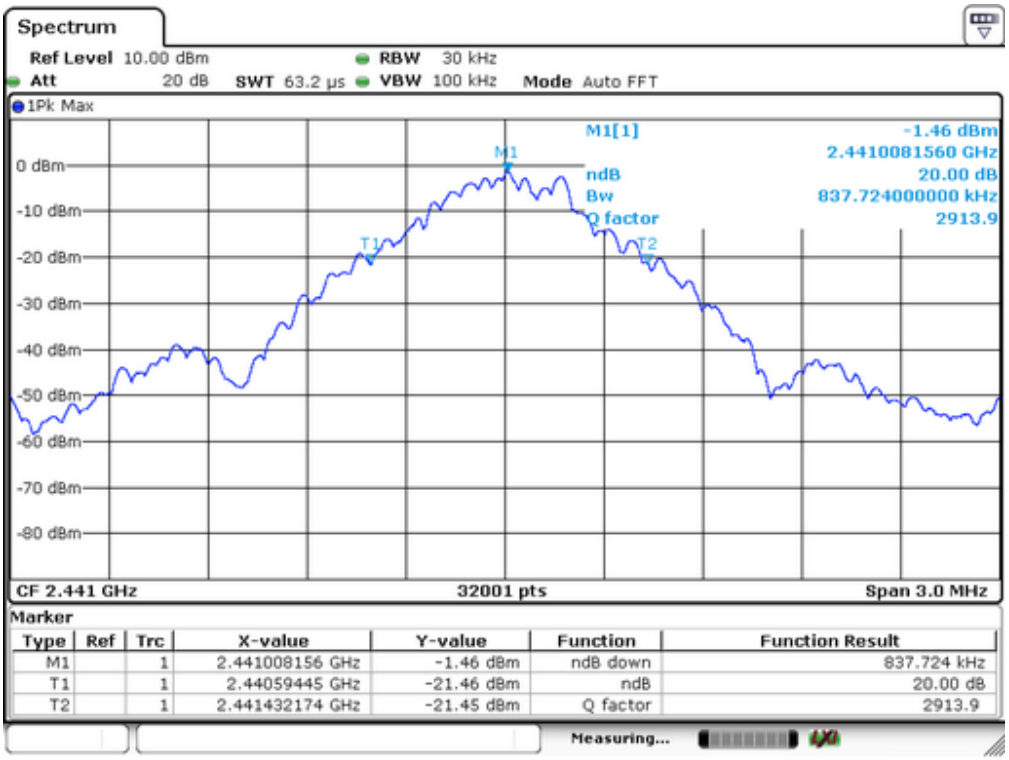
8.4 Measurement Results:

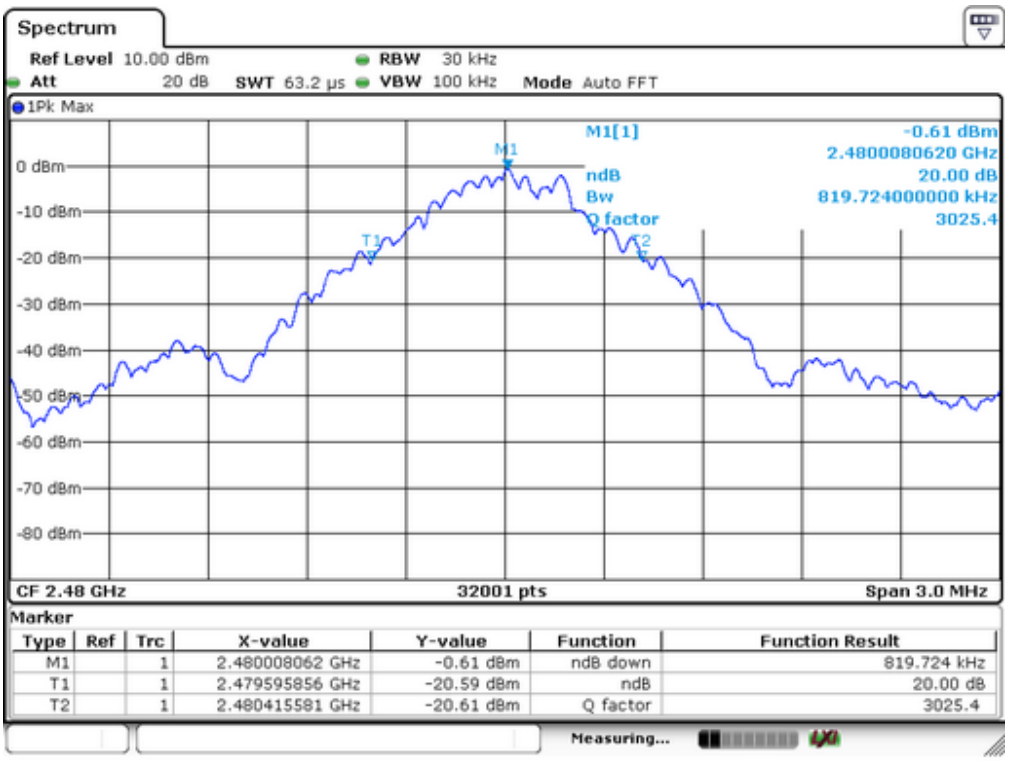
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	839
40	2441	837
79	2480	819

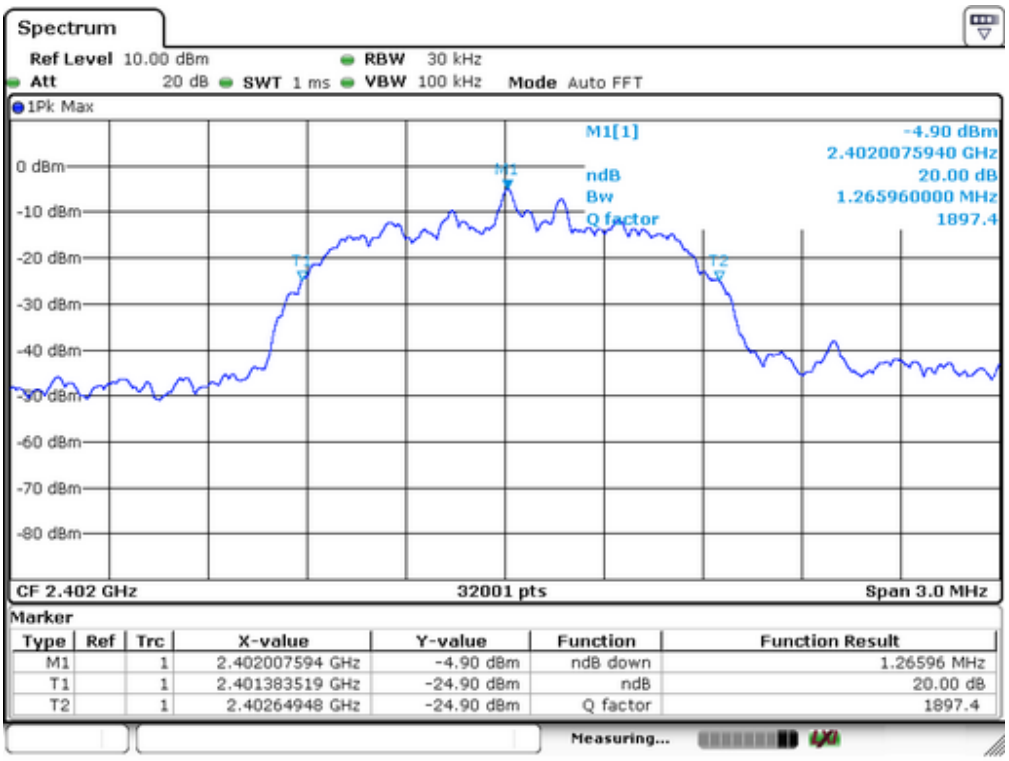

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-2.60 dBm
2.4020073120 GHz
ndB 20.00 dB
Bw 839.318000000 kHz
Q factor 2861.9
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.402007312 GHz -2.60 dBm ndB down 839.318 kHz
T1 1 2.401596325 GHz -22.59 dBm ndB 20.00 dB
T2 1 2.402435643 GHz -22.60 dBm Q factor 2861.9
Measuring...

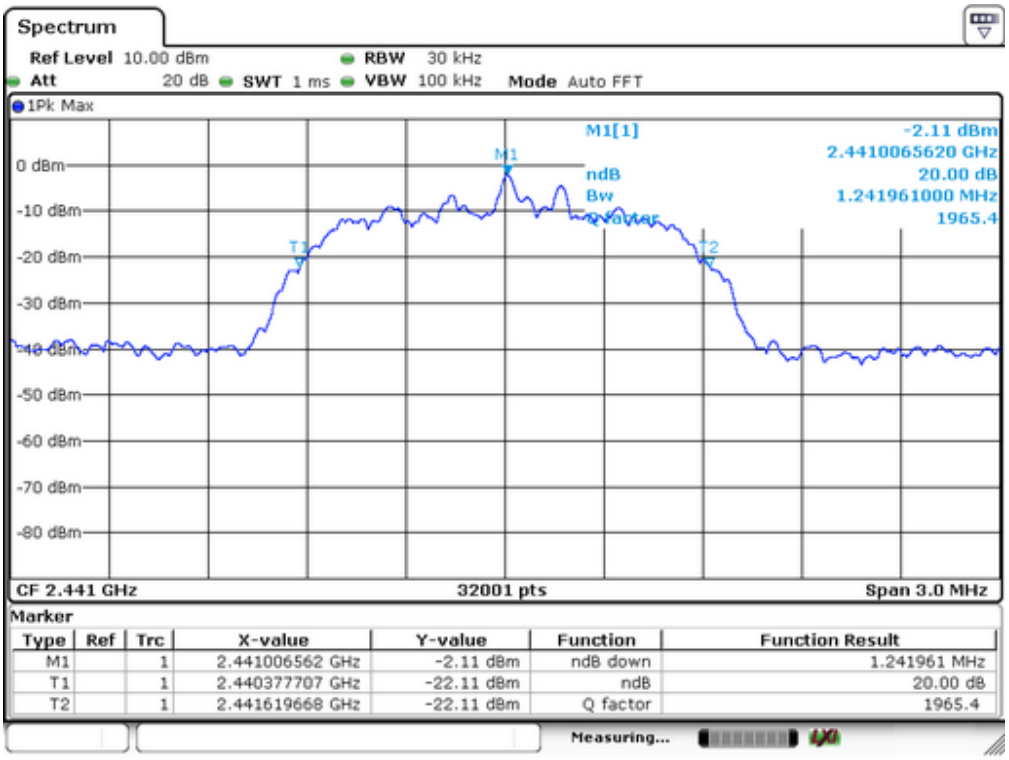

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-1.46 dBm
2.4410081560 GHz
ndB 20.00 dB
Bw 837.724000000 kHz
Q factor 2913.9
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441008156 GHz -1.46 dBm ndB down 837.724 kHz
T1 1 2.44059445 GHz -21.46 dBm ndB 20.00 dB
T2 1 2.441432174 GHz -21.45 dBm Q factor 2913.9
Measuring...

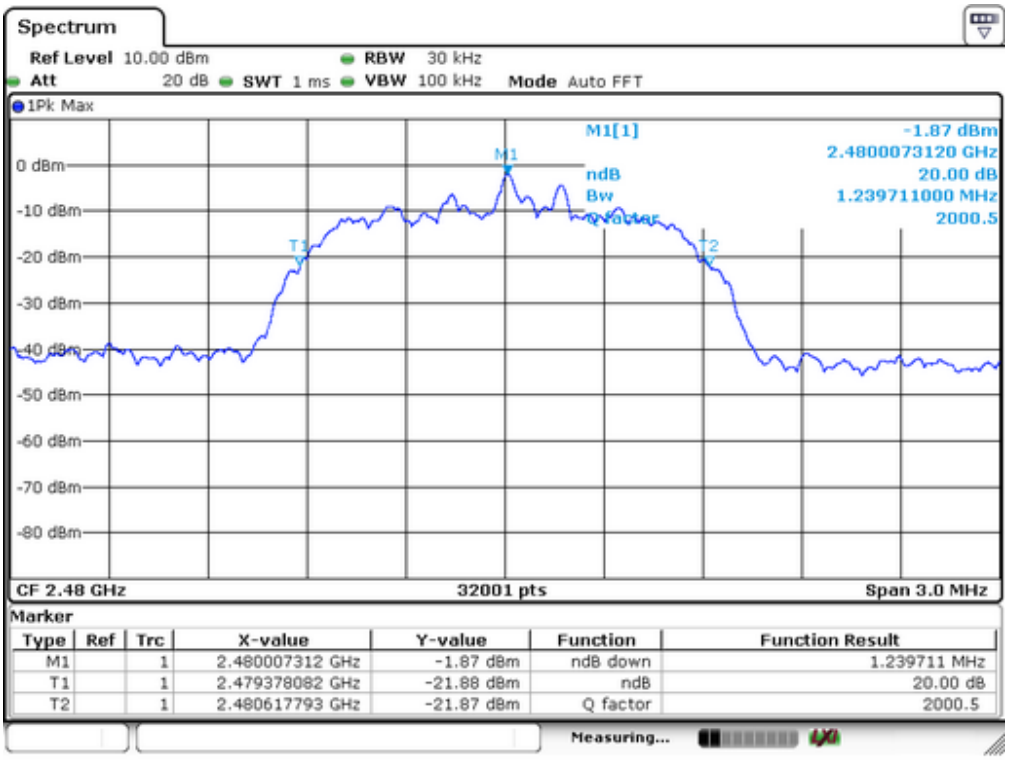


Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	Π/4-DQPSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1265
40	2441	1241
79	2480	1239

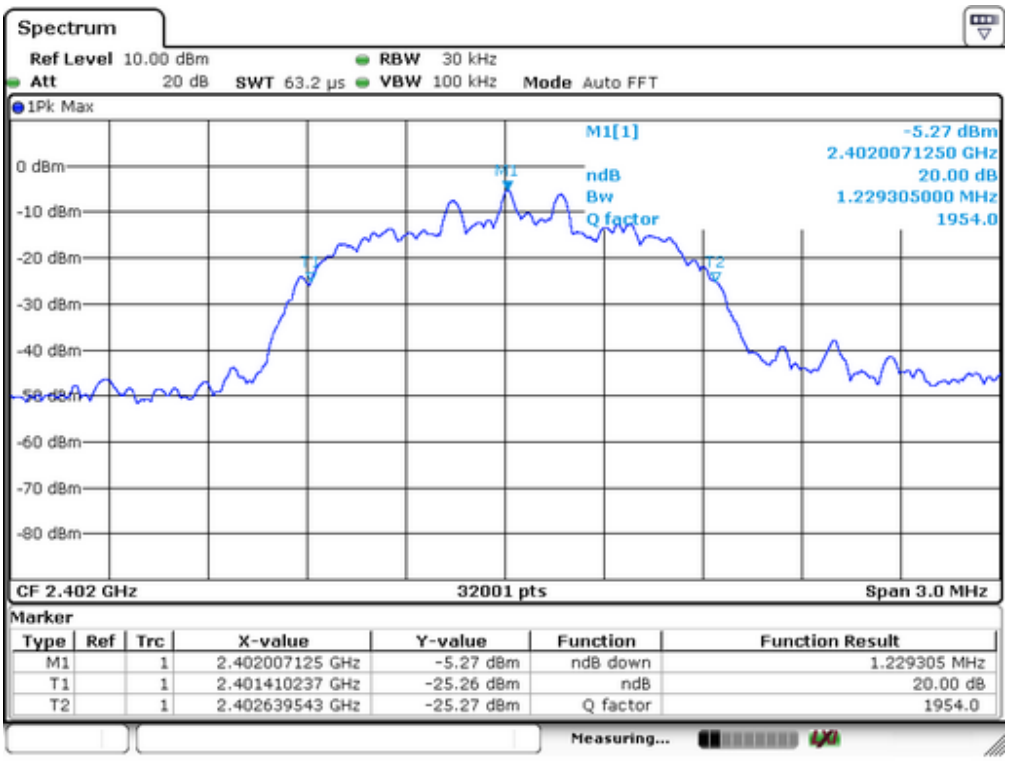

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1]
-4.90 dBm
2.4020075940 GHz
ndB 20.00 dB
Bw 1.265960000 MHz
Q factor 1897.4
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.402007594 GHz -4.90 dBm ndB down 1.26596 MHz
T1 1 2.401383519 GHz -24.90 dBm ndB 20.00 dB
T2 1 2.40264948 GHz -24.90 dBm Q factor 1897.4
Measuring...

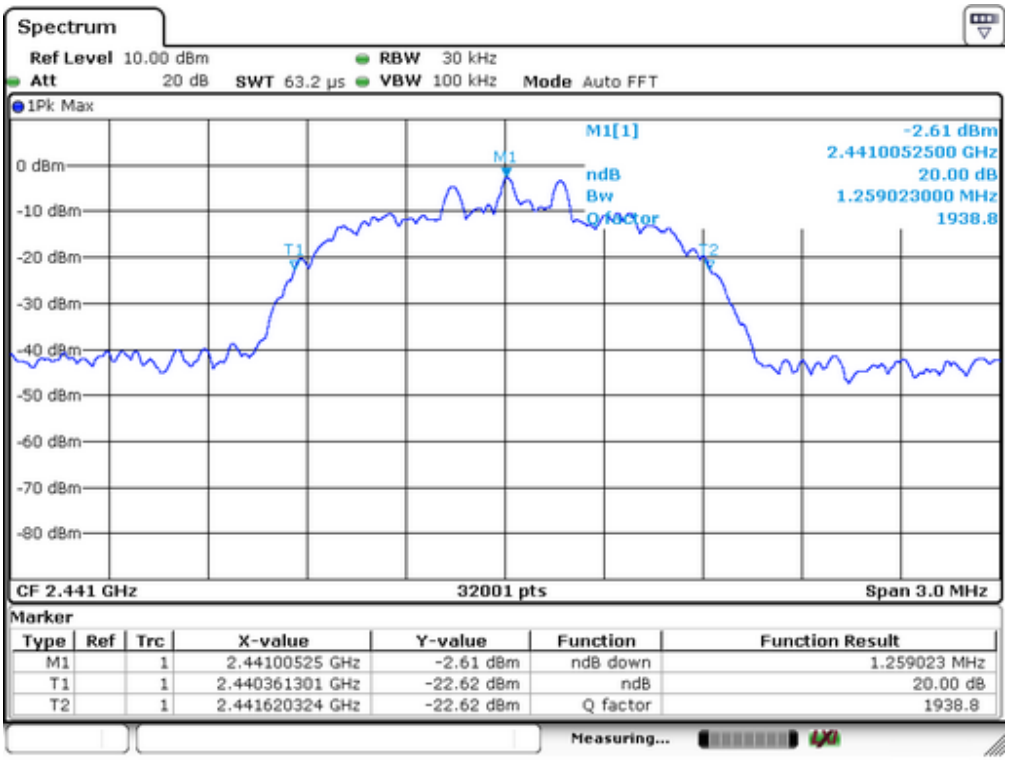

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB SWT 1 ms VBW 100 kHz Mode Auto FFT
1Pk Max
M1[1]
-2.11 dBm
2.4410065620 GHz
ndB 20.00 dB
Bw 1.241961000 MHz
1965.4
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441006562 GHz -2.11 dBm ndB down 1.241961 MHz
T1 1 2.440377707 GHz -22.11 dBm ndB 20.00 dB
T2 1 2.441619668 GHz -22.11 dBm Q factor 1965.4
Measuring...

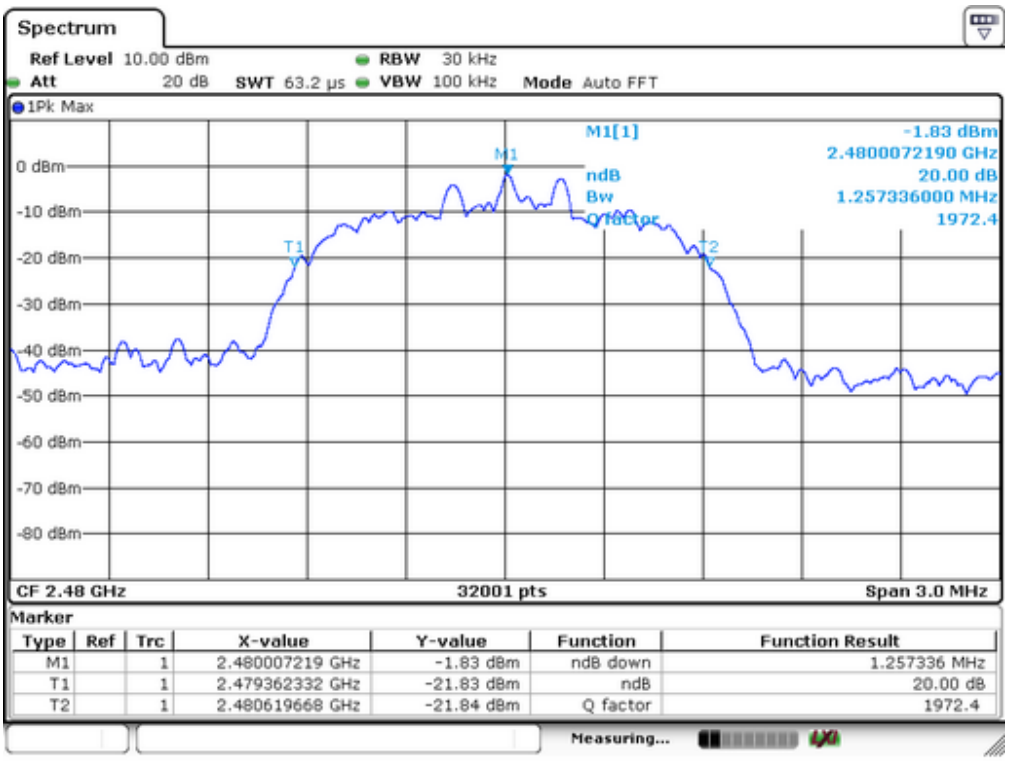


Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	8DPSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1229
40	2441	1259
79	2480	1257


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-5.27 dBm
2.4020071250 GHz
ndB 20.00 dB
Bw 1.229305000 MHz
Q factor 1954.0
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.402007125 GHz -5.27 dBm ndB down 1.229305 MHz
T1 1 2.401410237 GHz -25.26 dBm ndB 20.00 dB
T2 1 2.402639543 GHz -25.27 dBm Q factor 1954.0
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-2.61 dBm
2.4410052500 GHz
ndB 20.00 dB
Bw 1.259023000 MHz
Q factor 1938.8
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.44100525 GHz -2.61 dBm ndB down 1.259023 MHz
T1 1 2.440361301 GHz -22.62 dBm ndB 20.00 dB
T2 1 2.441620324 GHz -22.62 dBm Q factor 1938.8
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-1.83 dBm
2.4800072190 GHz
ndB 20.00 dB
Bw 1.257336000 MHz
Q factor 1972.4
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.480007219 GHz -1.83 dBm ndB down 1.257336 MHz
T1 1 2.479362332 GHz -21.83 dBm ndB 20.00 dB
T2 1 2.480619668 GHz -21.84 dBm Q factor 1972.4
Measuring...

9. Quantity of Hopping Channel 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)

EUT ——— Spectrum Analyzer

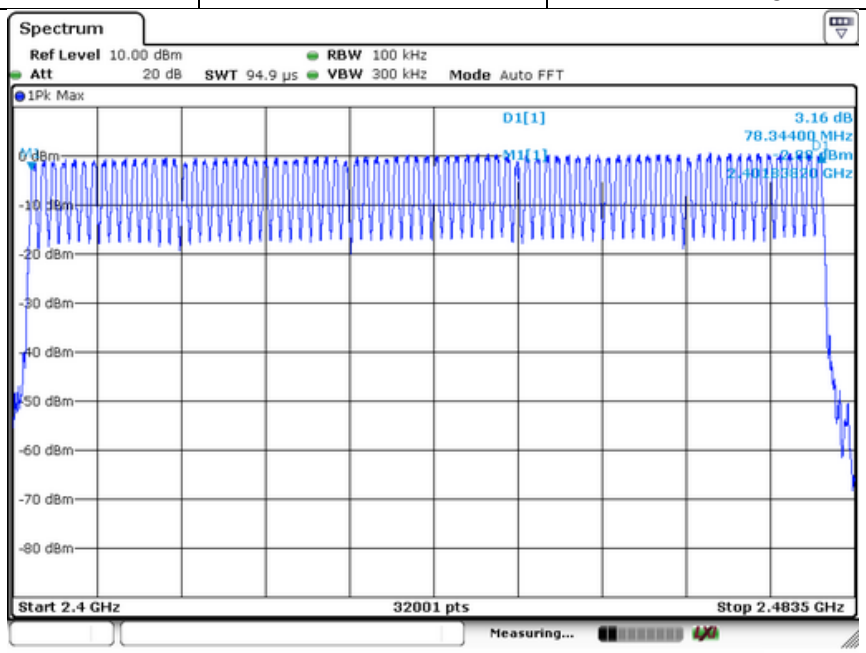
9.3 Measurement Equipment Used:

EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

9.4 Measurement Results:

Worst Test Mode	GFSK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

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



10. Time of Occupancy (Dwell Time) test

10.1 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:

Dwell time = time slot length * hop rate / 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.

10.2 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.

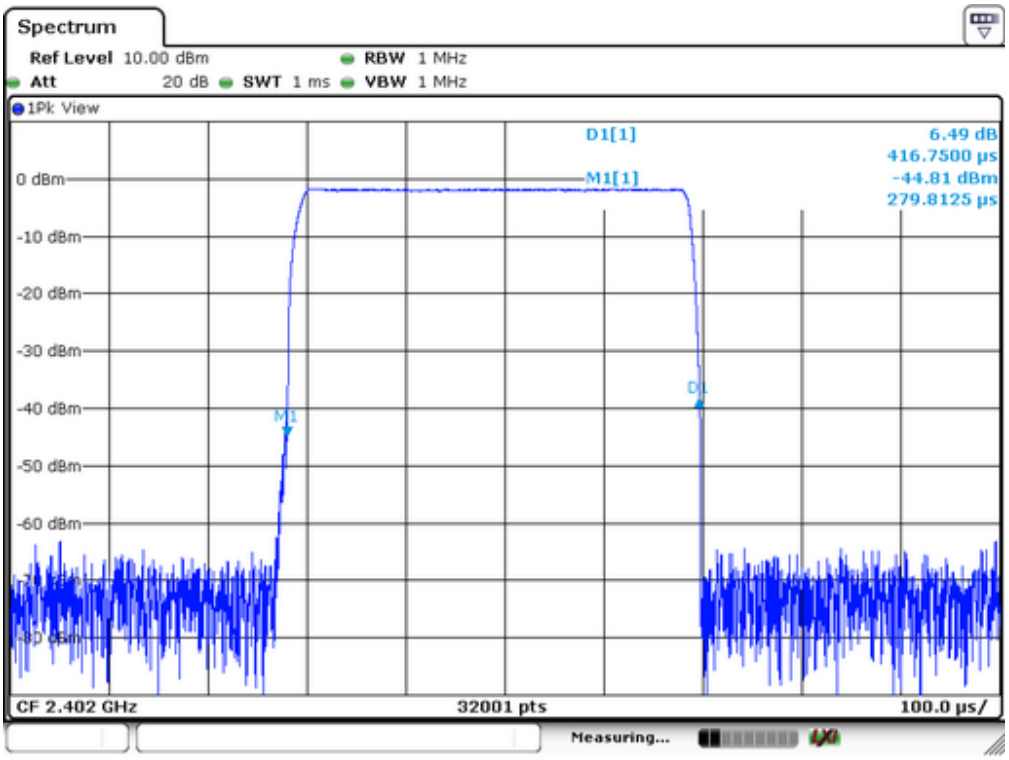
10.3 Test result

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) x 31.6 = 320	0.416	133.12	400
DH3	1600/(4*79) x 31.6 =160	1.674	267.84	400
DH5	1600/(6*79) x 31.6 =106.67	2.927	312.22	400

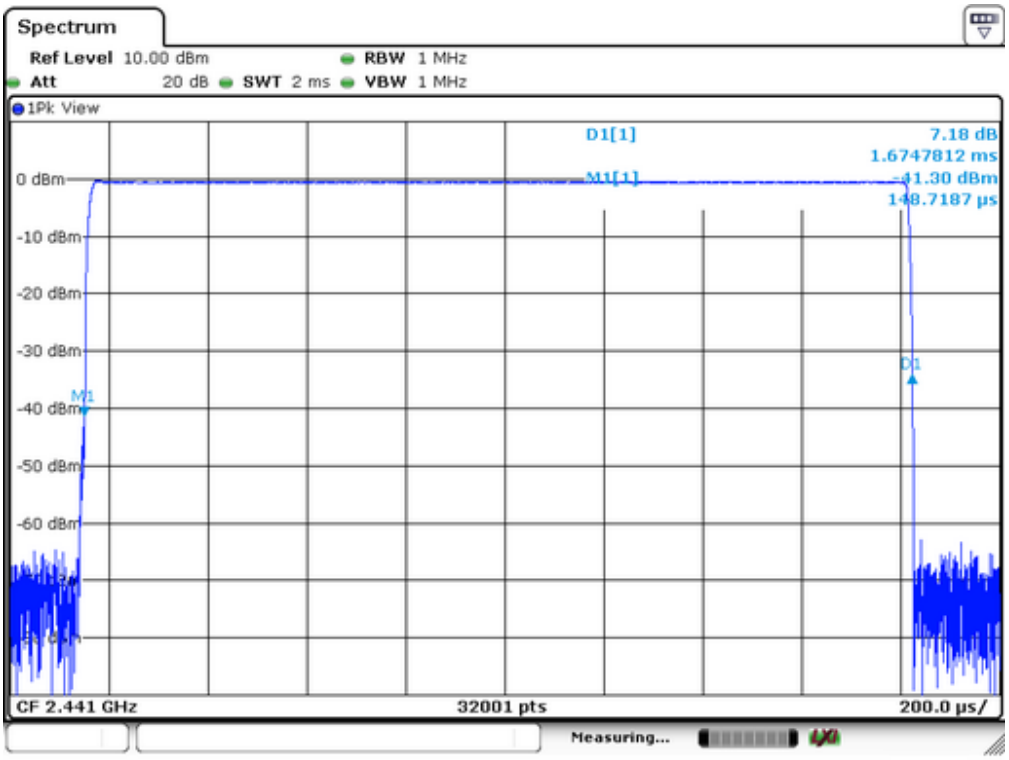
Remark: The results of worst cased was recorded.

.

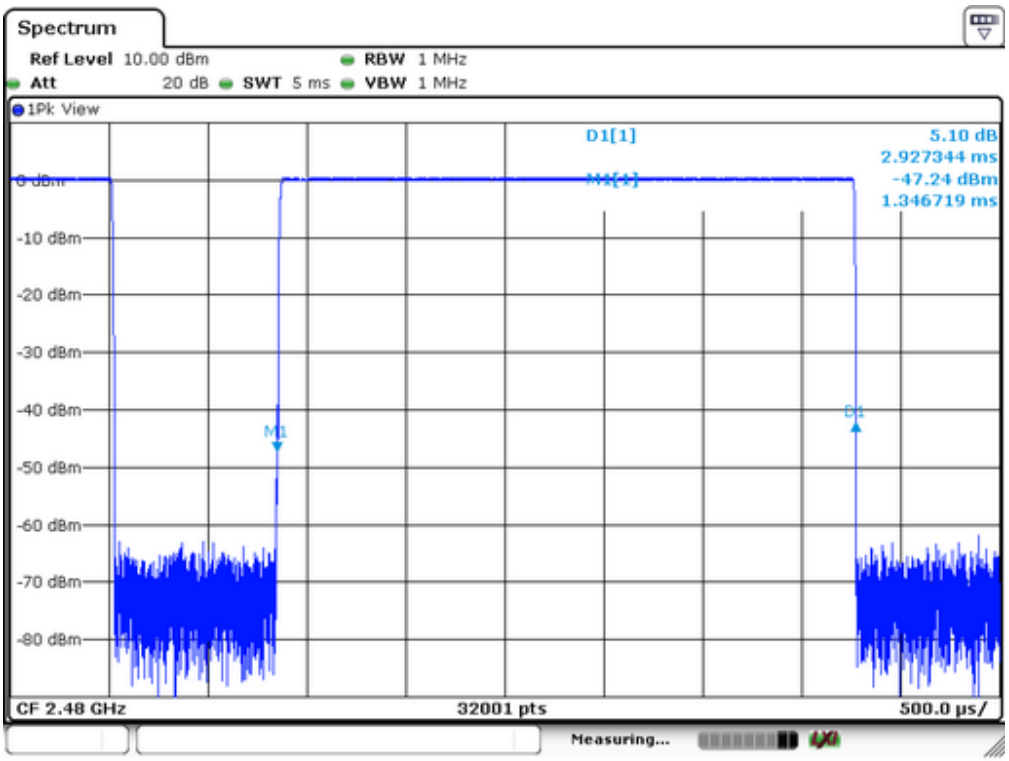
DH1:


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 1 ms VBW 1 MHz
1Pk View
D1[1] 6.49 dB
416.7500 µs
M1[1] -44.81 dBm
279.8125 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D1
CF 2.402 GHz
32001 pts
100.0 µs/
Measuring...

DH3:


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 2 ms VBW 1 MHz
1Pk View
D1[1] 7.18 dB
1.6747812 ms
M1[1] -41.30 dBm
148.7187 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
M1
D1
CF 2.441 GHz
32001 pts
200.0 µs/
Measuring...

DH5:

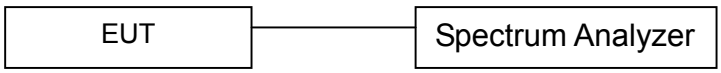

Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 5 ms VBW 1 MHz
1Pk View
D1[1]
5.10 dB
2.927344 ms
M1[1]
-47.24 dBm
1.346719 ms
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
D1
CF 2.48 GHz
32001 pts
500.0 µs/
Measuring...

11. MAXIMUM PEAK OUTPUT POWER TEST

11.1 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.

11.2 Test SET-UP (Block Diagram of Configuration)



11.3 Measurement Equipment Used:

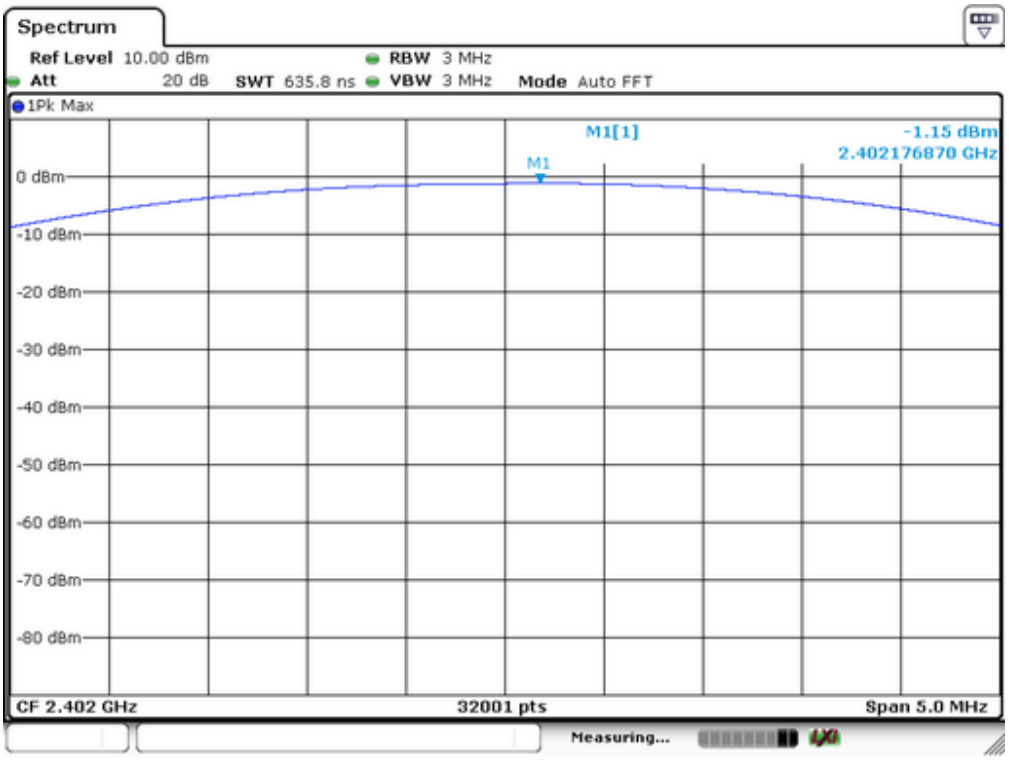
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

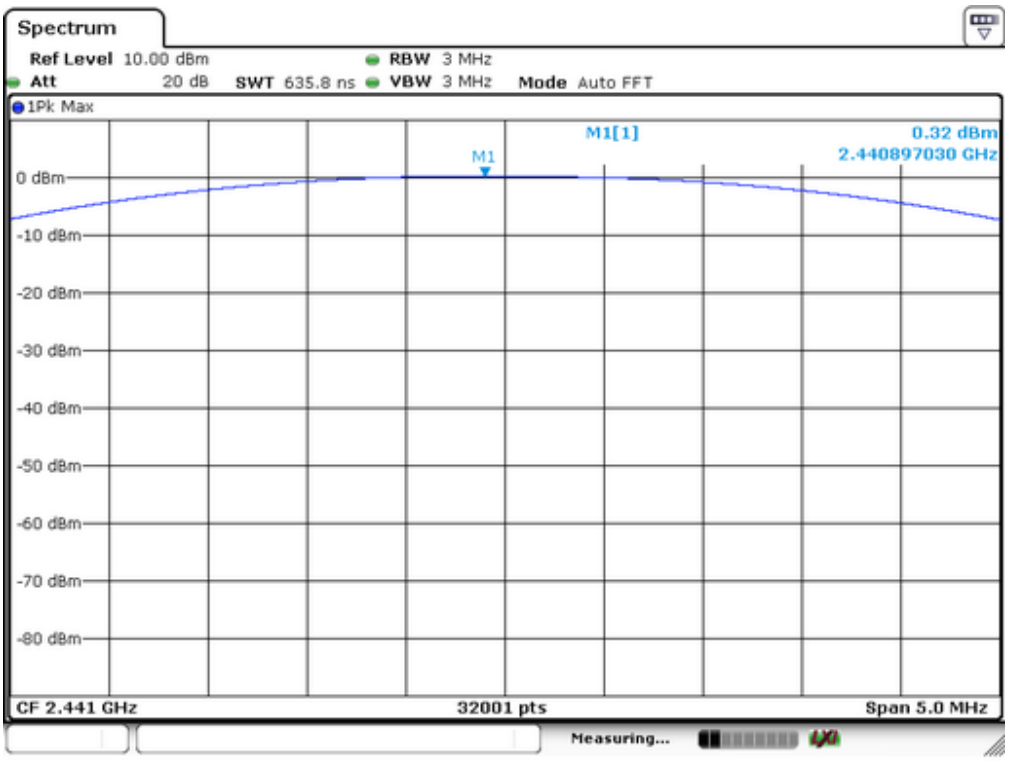
11.4Measurement Results:

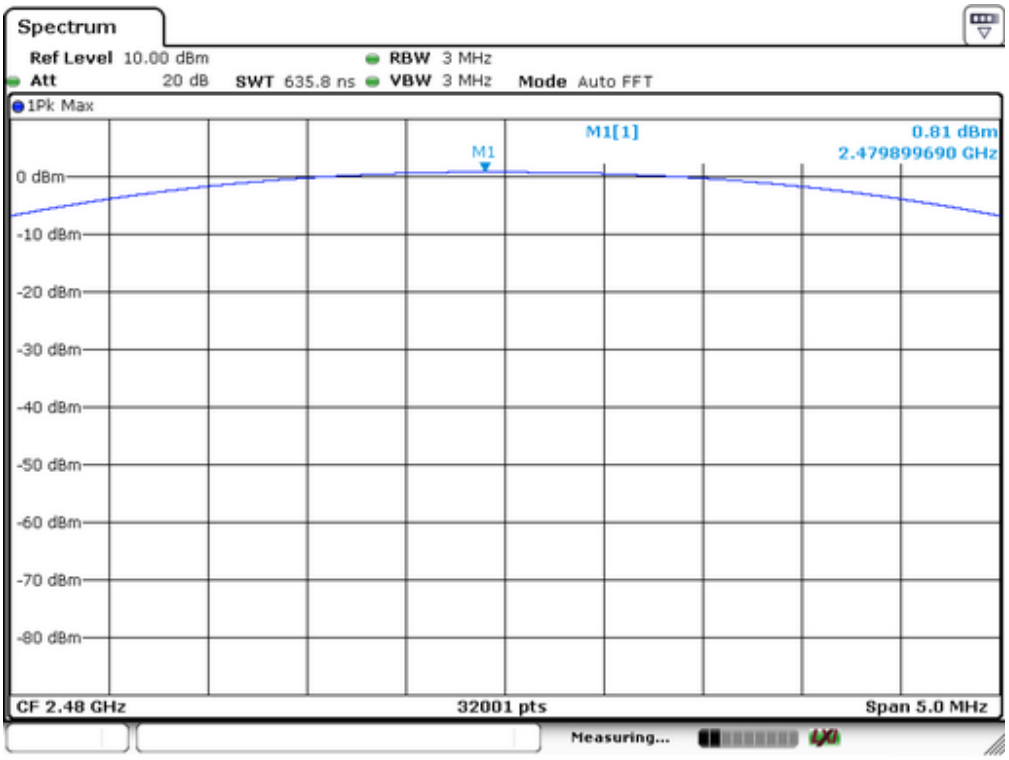
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
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	-1.15	0.767	1000	PASS
40	2441	0.32	1.076	1000	PASS
79	2480	**0.81**	**1.205**	1000	PASS

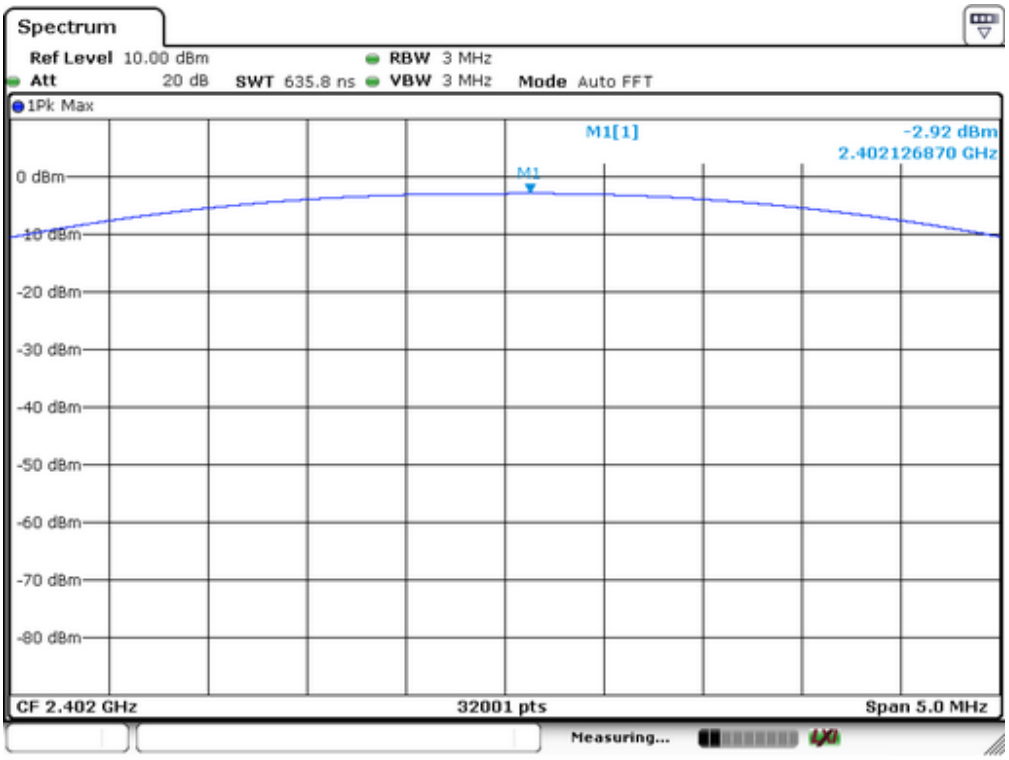


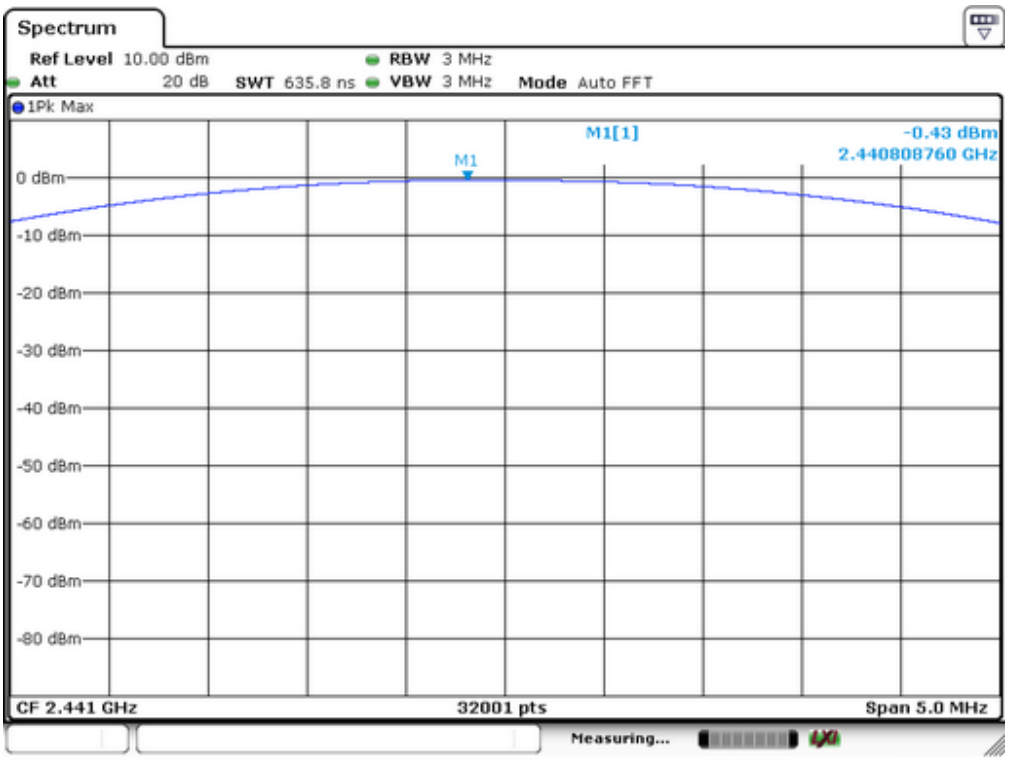

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 635.8 ns
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
0.32 dBm
2.440897030 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 5.0 MHz
Measuring...

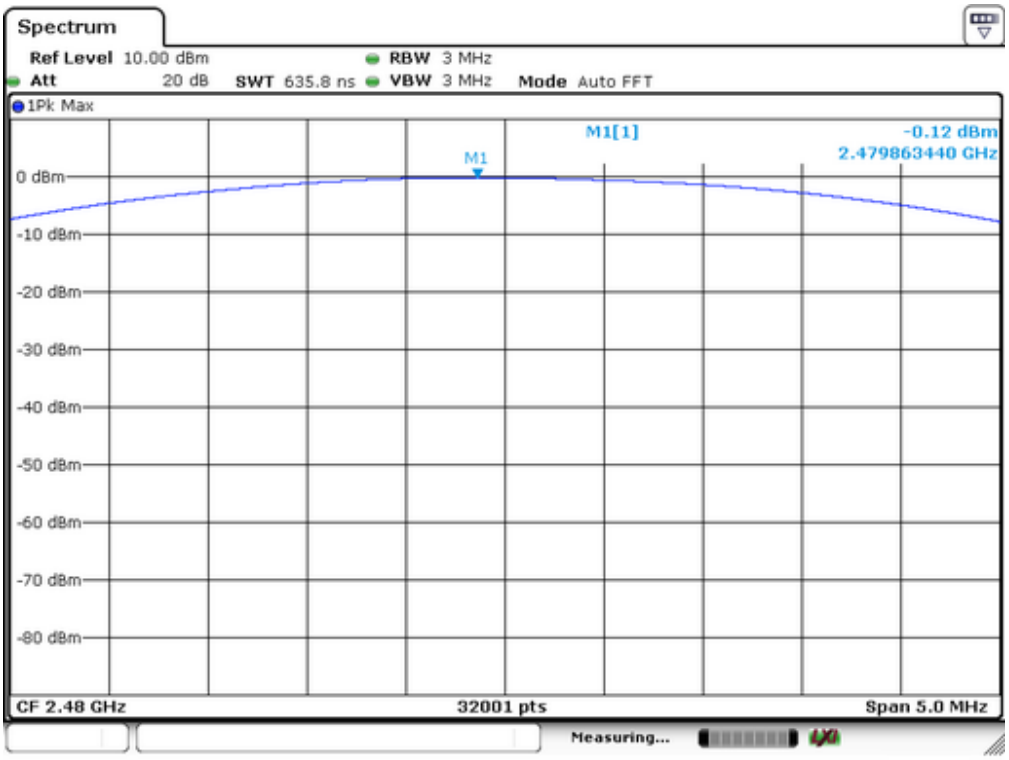

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 635.8 ns
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
0.81 dBm
2.479899690 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 5.0 MHz
Measuring...

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
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	-2.92	0.511	125	PASS
40	2441	-0.43	0.906	125	PASS
79	2480	-0.12	0.973	125	PASS

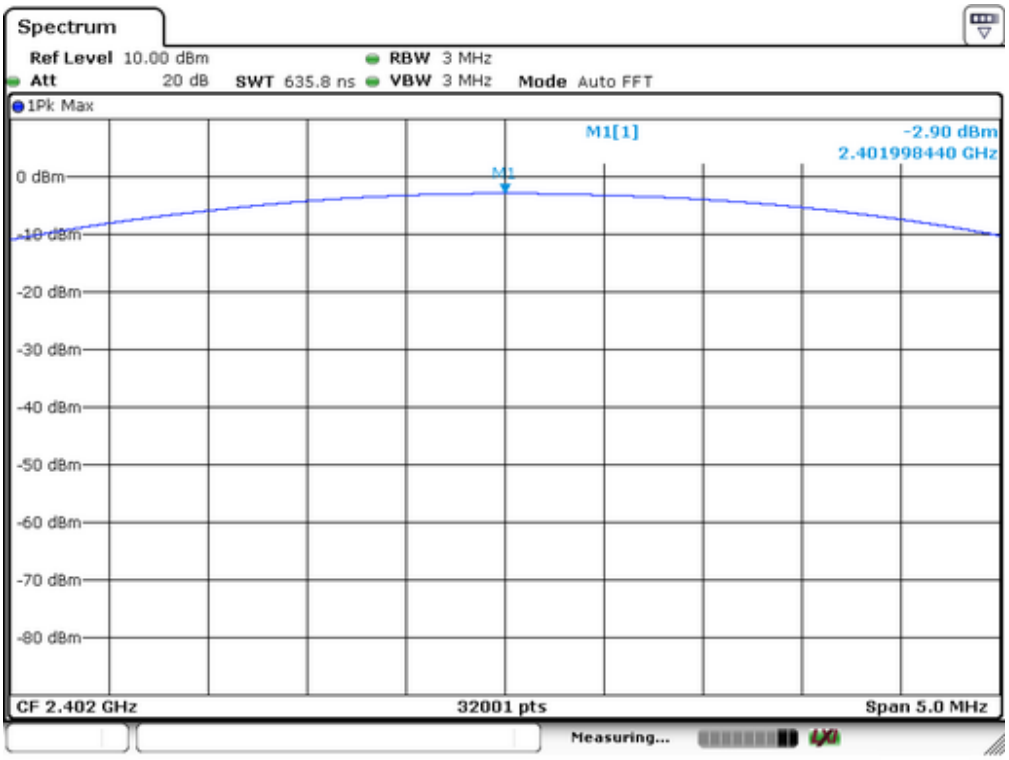


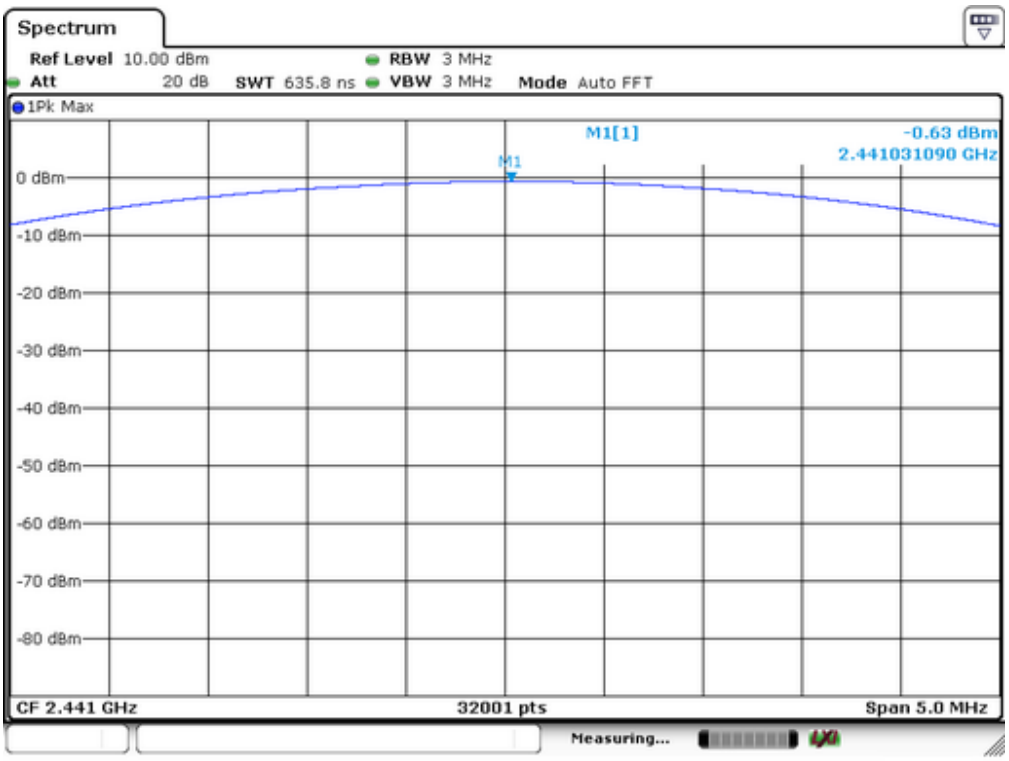

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 635.8 ns
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
-0.43 dBm
2.440808760 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 5.0 MHz
Measuring...

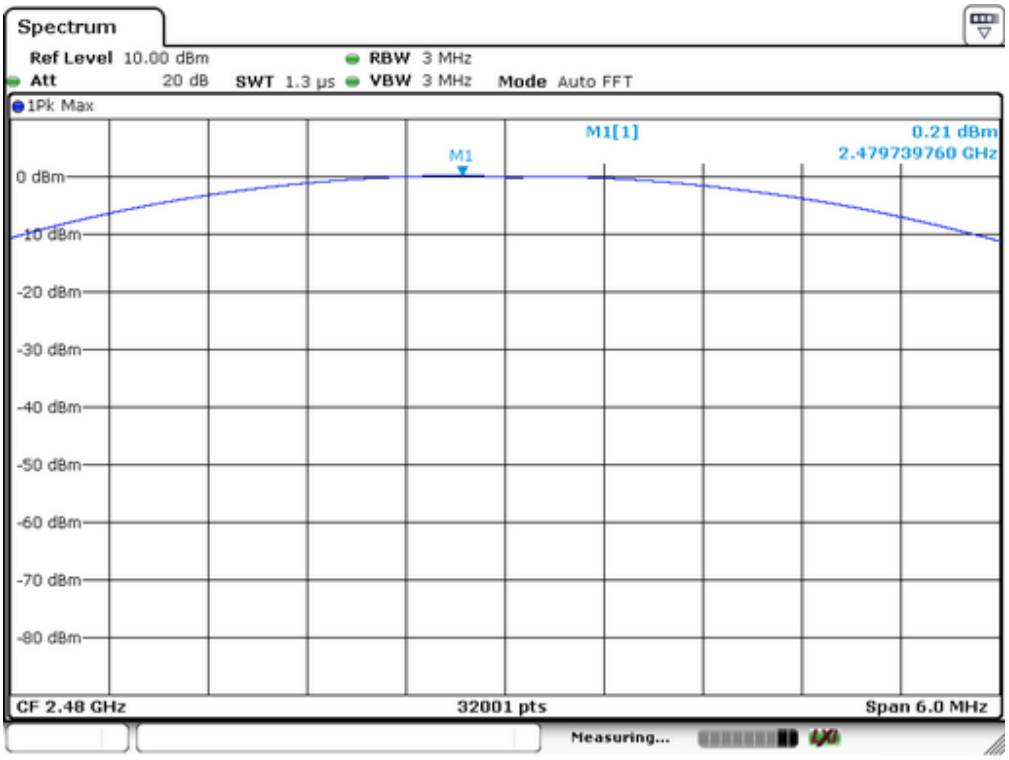

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 635.8 ns
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
-0.12 dBm
2.479863440 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 5.0 MHz
Measuring...

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
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	-2.9	0.513	125	PASS
40	2441	-0.63	0.865	125	PASS
79	2480	0.21	1.050	125	PASS




Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 635.8 ns
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
-0.63 dBm
2.441031090 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
32001 pts
Span 5.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Pk Max
M1[1]
0.21 dBm
2.479739760 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
32001 pts
Span 6.0 MHz
Measuring...

12. Band EDGE test

12.1 Measurement Procedure

For Conducted Test

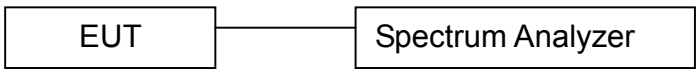
1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW=100KHz, VBW=300KHz, scan up through 10^{th} harmonic. All harmonics/spurs must be at least 20dB down from the highest emission level within authorized band as measured with a 100KHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

For Radiated emission Test

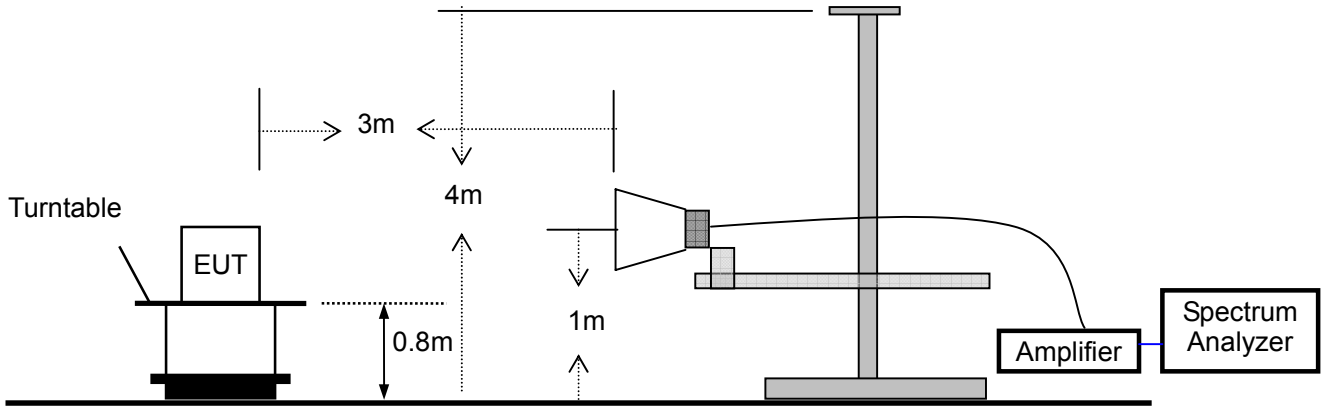
1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
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.

12.2 Test SET-UP (Block Diagram of Configuration)

For Conducted Test



For Radiated emission Test



12.3Measurement Equipment Used:

For Conducted Test

EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	05/16/2014	05/15/2015
Coaxial Cable	CDS	79254	46107086	05/16/2014	05/15/2015

For Radiated emission Test

EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/16/2014	05/15/2015
Pre-Amplifier	HP	8447D	2944A07999	05/16/2014	05/15/2015
Bilog Antenna	SCHWARZBECK	VULB9163	142	05/16/2014	05/15/2015
Loop Antenna	ARA	PLA-1030/B	1029	05/16/2014	05/15/2015
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170399	05/16/2014	05/15/2015
Horn Antenna	Schwarzbeck	BBHA9120D	D143	05/16/2014	05/15/2015
Cable	Schwarzbeck	AK9513	ACRX1	05/19/2014	05/18/2015
Cable	Schwarzbeck	N/A	FP2RX2	05/19/2014	05/18/2015
Cable	Schwarzbeck	AK9513	CRPX1	05/19/2014	05/18/2015
Cable	Schwarzbeck	AK9513	CRRX2	05/19/2014	05/18/2015

12.4Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	February 12, 2015
Test By:	Andy	Temperature :	25 ℃
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)
2399.99	GFSK	-1.18	-48.88	47.7	>20dBc
2399.53	pi/4-DQPSK	-4.15	-52.24	48.09	>20dBc
2399.05	8DPSK	-4.42	-50.44	46.02	>20dBc
2484.01	GFSK	0.54	-62.97	63.51	>20dBc
2483.88	pi/4-DQPSK	-1.09	-62.71	61.62	>20dBc
2483.62	8DPSK	-0.91	-61.09	60.18	>20dBc

For Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2399.18	GFSK	-0.98	-53.78	52.8	>20dBc
2399.71	pi/4-DQPSK	-2.8	-56.54	53.74	>20dBc
2399.12	8DPSK	-3.66	-38.43	34.77	>20dBc
2485.95	GFSK	-1.83	-42.59	40.76	>20dBc
2486	pi/4-DQPSK	-2.48	-58.93	56.45	>20dBc
2484.16	8DPSK	-1.1	-59.81	58.71	>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
2399.56	H	64.23	44.13	74	54	-9.77	-9.87
2398.86	V	59.57	39.56	74	54	-14.43	-14.44
2484.06	H	62.16	45.05	74	54	-11.84	-8.95
2483.95	V	58.76	39.49	74	54	-15.24	-14.51

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
2399.16	H	64.12	45.72	74	54	-9.88	-8.28
2399.54	V	60.38	40.35	74	54	-13.62	-13.65
2483.87	H	65.72	44.15	74	54	-8.28	-9.85
2484.15	V	59.49	39.57	74	54	-14.51	-14.43

13. Antenna Application

13.1 Antenna requirement

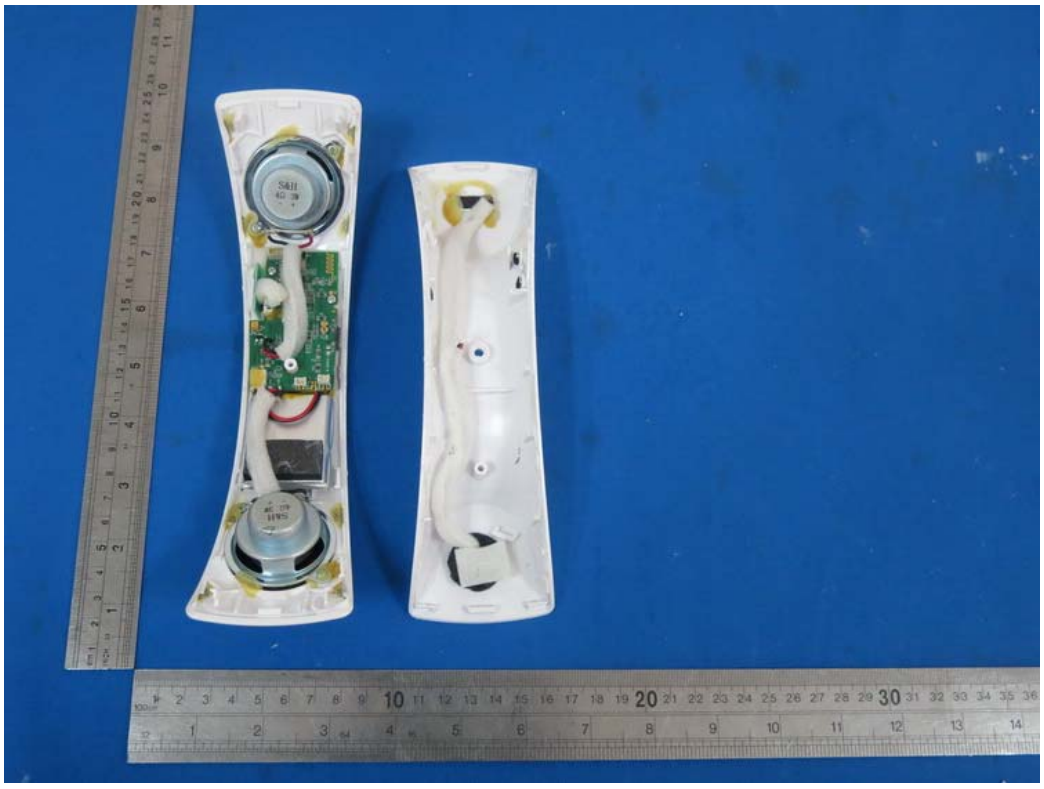
The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

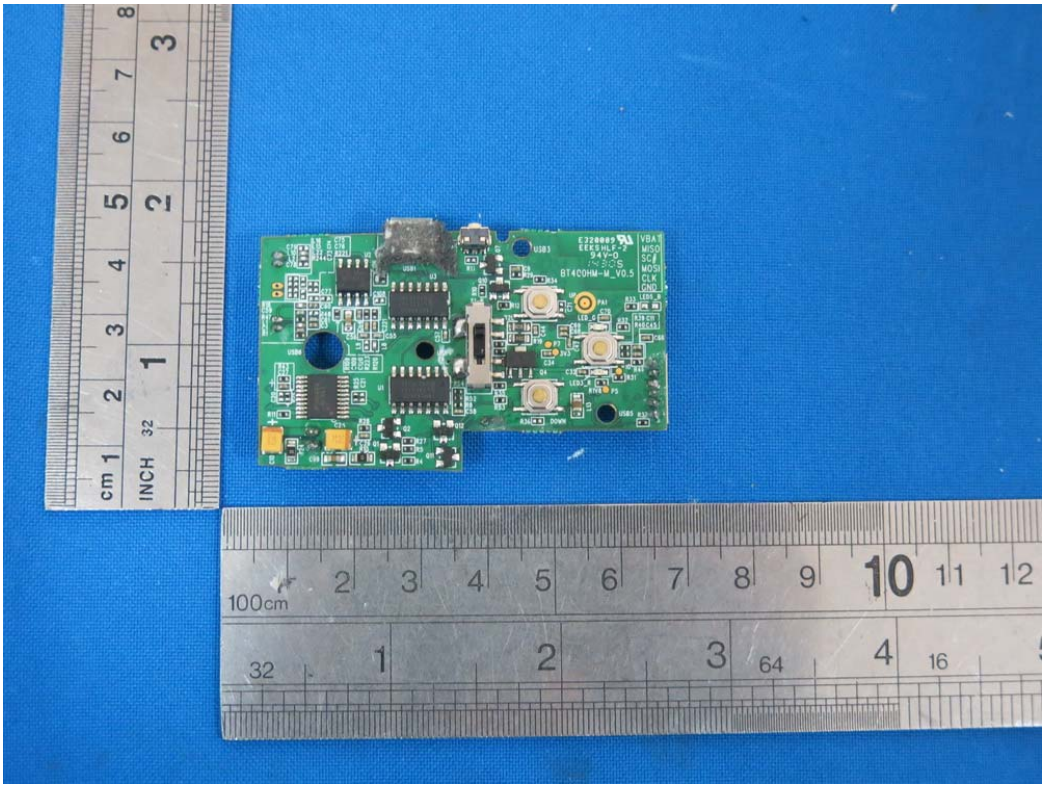
FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

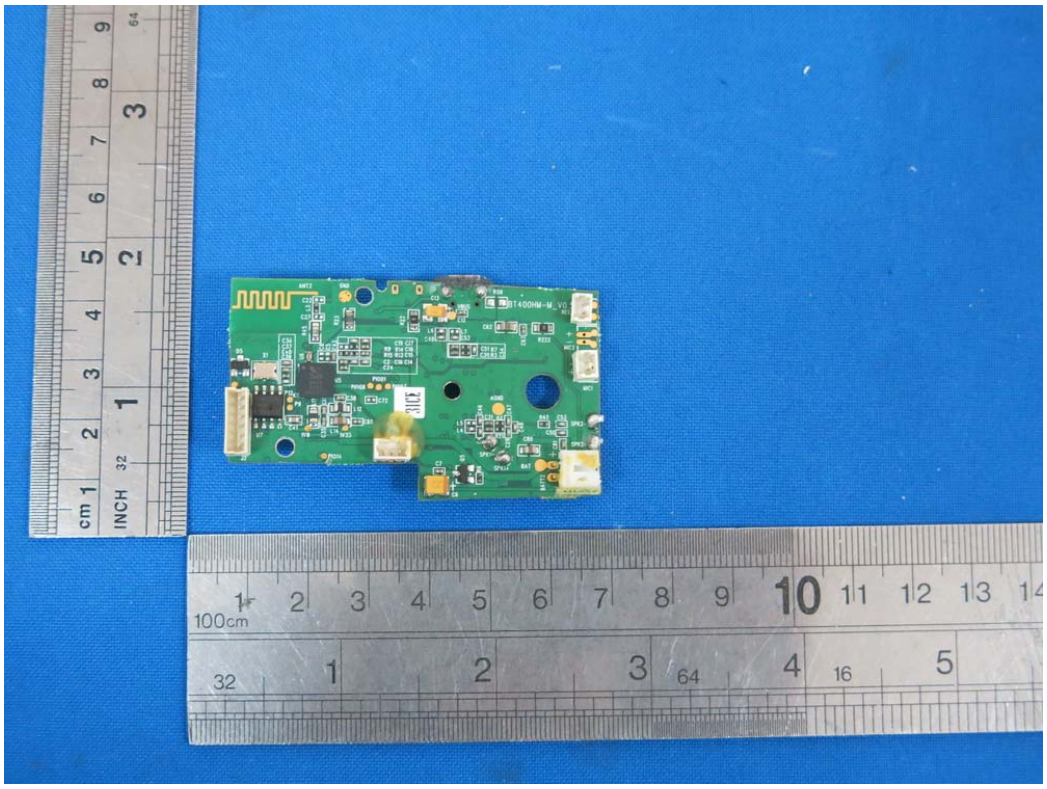
13.2 Result

The EUT's antenna, 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)






cm 1 2 3 4 5
INCH 32 1 2 3
100cm
1 2 3 4 5 6 7 8 9 10 11 12 13
32 1 2 3 64 4 16 5


3.7V