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

OF

EXO-400

Model No.: EXO400

Trademark: bēm WIRELESS

FCC ID: PXK-EXO400

Report No.: KAD150325101E1

Issue Date: June 17, 2015

Prepared for

ECORE TECHNOLOGY COMPANY LIMITED
North of Bingang East Road, Huahu Development Zone, Ezhou city, Hubei Province, China

Prepared by

DONGGUAN EMTEK CO., LTD.

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

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VERIFICATION OF COMPLIANCE

Applicant:	ECORE TECHNOLOGY COMPANY LIMITED North of Bingang East Road, Huahu Development Zone, Ezhou city, Hubei Province, China
Manufacturer:	ECORE TECHNOLOGY COMPANY LIMITED North of Bingang East Road, Huahu Development Zone, Ezhou city, Hubei Province, China
Product Description:	EXO-400
Trade Mark:	bēm WIRELESS
Model Number:	EXO400

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 : March 25, 2015 to June 17, 2015

Prepared by : Ivy Huang/Editor

Reviewer : Hong Yang/Supervisor

Approved & Authorized Signer : Sam Lv/Manager

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	KAD150325101E1

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Appendix I (Photos of EUT) (3 pages)

1. GENERAL INFORMATION

1.1 Product Description

Product Name	EXO-400	
Model number	EXO400	
Power Supply	DC 5V, 1A	
Technical Description		
	Bluetooth 4.0	Bluetooth 2.1+EDR
Operation Frequency	2402-2480MHz	
Modulation	GFSK	GFSK, π/4-DQPSK, 8DPSK
Number of Channel	40	79
Channel space	2MHz	1MHz
Max RF Output Power	1.16dBm(0.001306W)	0.94dBm(0.001242W)
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 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 C63.10-2013. 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

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 C63.10-2013.

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)	20dB bandwidth <250kHz(50Channel)	LIMIT(rms) 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

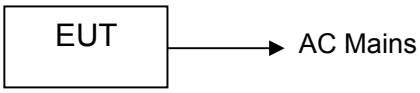


Table 2-1 Equipment Used in Tested System

Item	Equipment	Trade Mark	Model No.	FCC ID	Note
1.	EXO-400	bēm WIRELESS	EXO400	PXK-EXO400	***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. TEST SYSTEM UNCERTAINTY

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

Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0dB
Conducted Emissions Test	±2.0dB
Radiated Emission Test	±2.0dB
Power Density	±2.0dB
Occupied Bandwidth Test	±1.0dB
Band Edge Test	±3dB
All emission, radiated	±3dB
Antenna Port Emission	±3dB
Temperature	±0.5℃
Humidity	±3%

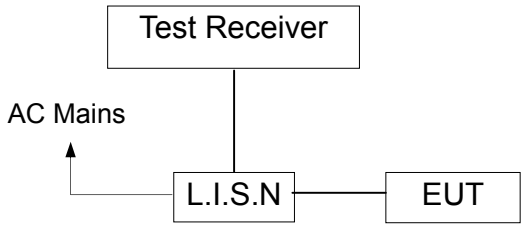
Measurement Uncertainty for a level of Confidence of 95%

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:

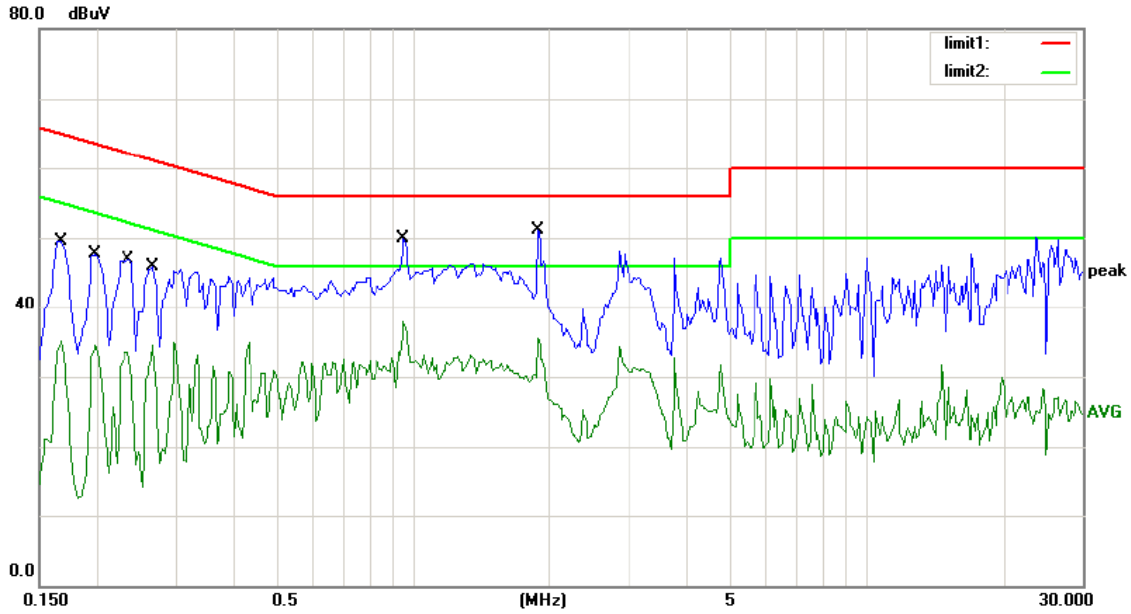
Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**Last Cal.**	**Due date**
Test Receiver	Rohde & Schwarz	ESCS30	100018	03/16/2015	03/15/2016
L.I.S.N	Rohde & Schwarz	ENV216	100017	03/16/2015	03/15/2016
RF Switching Unit	CDS	RSU-M2	38401	03/16/2015	03/15/2016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

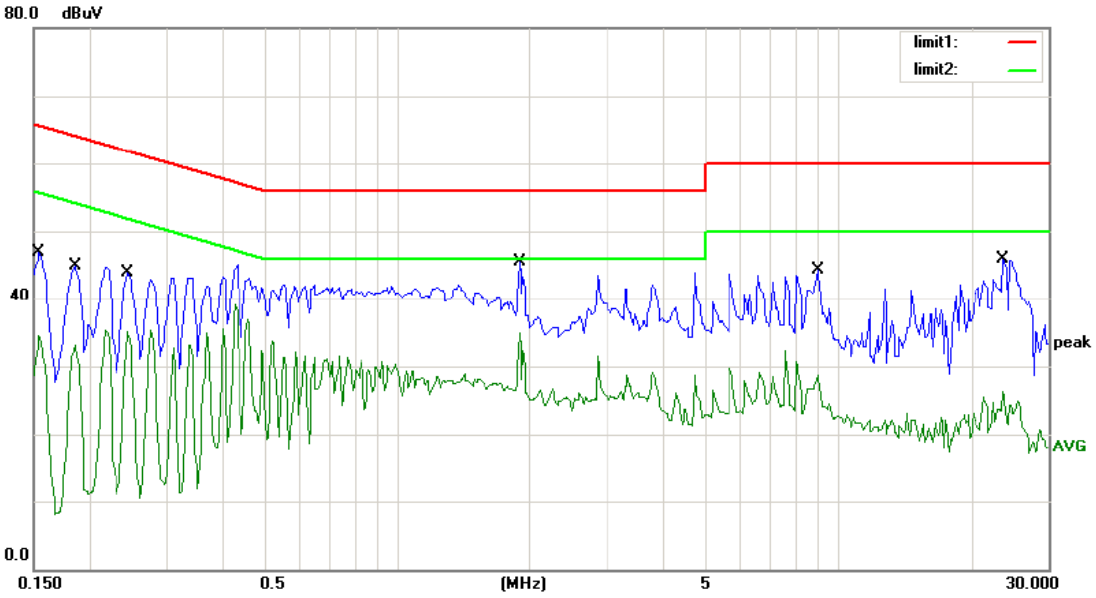
Limit: (CE)FCC Part 15B_QP Power: AC 120V/60Hz Humidity: 55 %

Mode: TX

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1680	47.50	0.00	47.50	65.06	-17.56	QP	
2		0.1680	35.11	0.00	35.11	55.06	-19.95	AVG	
3		0.1995	45.20	0.00	45.20	63.63	-18.43	QP	
4		0.1995	34.53	0.00	34.53	53.63	-19.10	AVG	
5		0.2353	44.20	0.00	44.20	62.26	-18.06	QP	
6		0.2353	33.44	0.00	33.44	52.26	-18.82	AVG	
7		0.2670	42.10	0.00	42.10	61.21	-19.11	QP	
8		0.2670	34.55	0.00	34.55	51.21	-16.66	AVG	
9		0.9555	47.50	0.00	47.50	56.00	-8.50	QP	
10		0.9555	37.84	0.00	37.84	46.00	-8.16	AVG	
11	*	1.8960	48.90	0.00	48.90	56.00	-7.10	QP	
12		1.8960	35.51	0.00	35.51	46.00	-10.49	AVG	

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

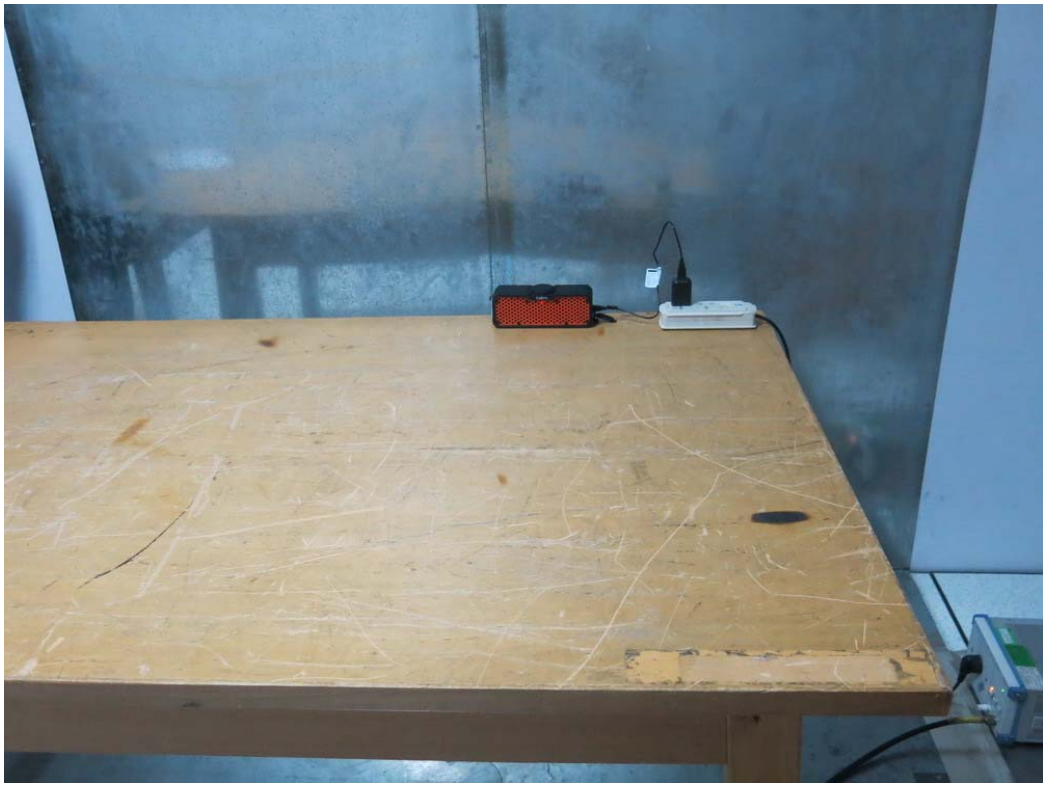


Site site #1 Phase: N Temperature: 24
Limit: (CE)FCC Part 15B_QP Power: AC 120V/60Hz Humidity: 55 %
Mode: TX
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1544	43.50	0.00	43.50	65.76	-22.26	QP	
2		0.1544	34.50	0.00	34.50	55.76	-21.26	AVG	
3		0.1860	41.20	0.00	41.20	64.21	-23.01	QP	
4		0.1860	33.11	0.00	33.11	54.21	-21.10	AVG	
5		0.2444	39.80	0.00	39.80	61.95	-22.15	QP	
6		0.2444	35.01	0.00	35.01	51.95	-16.94	AVG	
7		1.9005	42.20	0.00	42.20	56.00	-13.80	QP	
8	*	1.9005	34.98	0.00	34.98	46.00	-11.02	AVG	
9		9.0000	42.10	0.00	42.10	60.00	-17.90	QP	
10		9.0000	28.62	0.00	28.62	50.00	-21.38	AVG	
11		23.7000	42.20	0.00	42.20	60.00	-17.80	QP	
12		23.7000	26.29	0.00	26.29	50.00	-23.71	AVG	

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

6.5 Conducted Measurement Photos:



7. Radiated Emission Test

7.1 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 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:

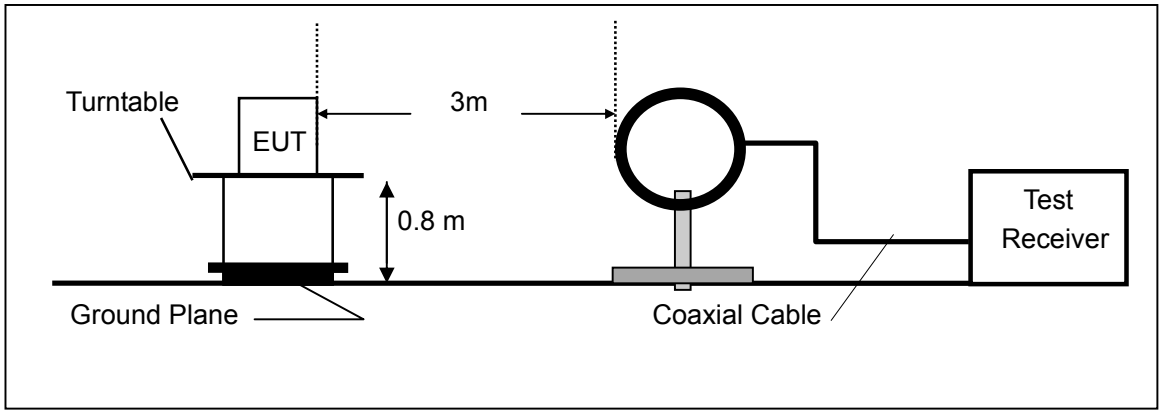
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

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

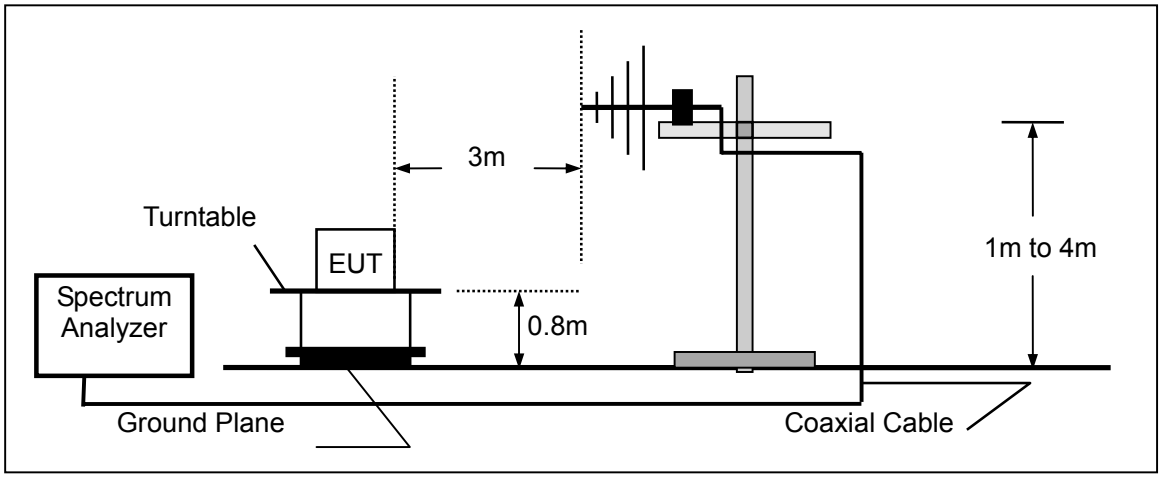
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

7.2 Test SET-UP (Block Diagram of Configuration)

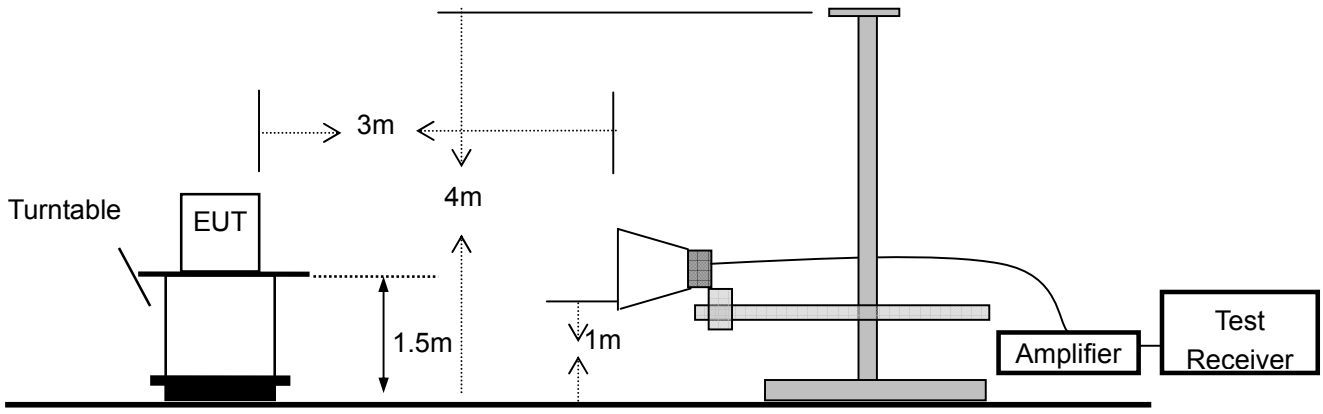
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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
[1]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	([2])

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 ξ 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 :	March 30, 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)
--	--	--	--	--

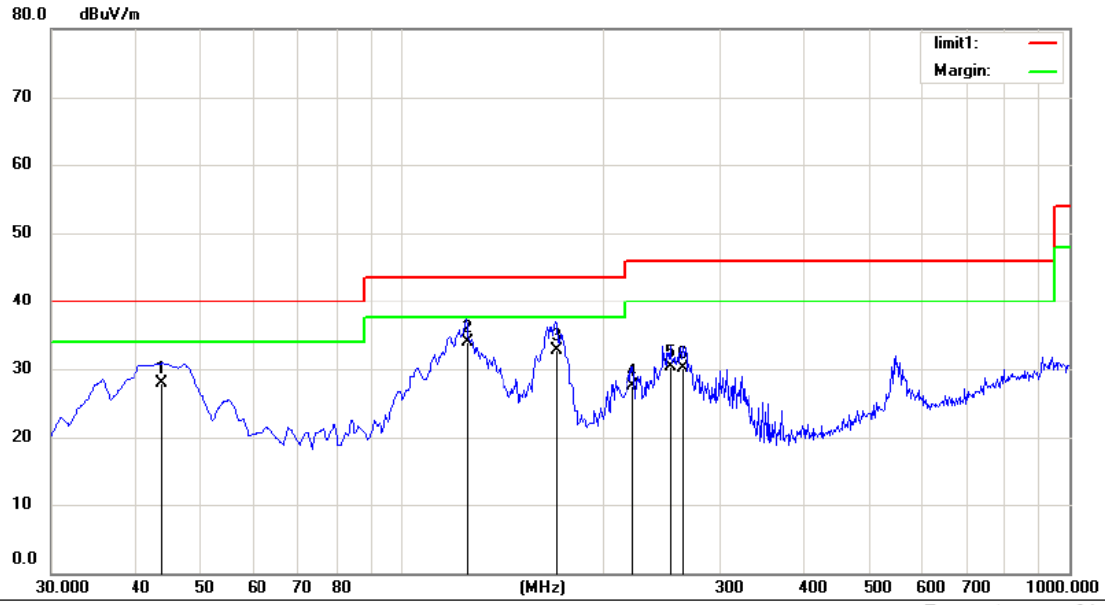
Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Below 1000MHz:

Pass.

All the modulation modes were tested the data of the worst mode (GFSK) 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

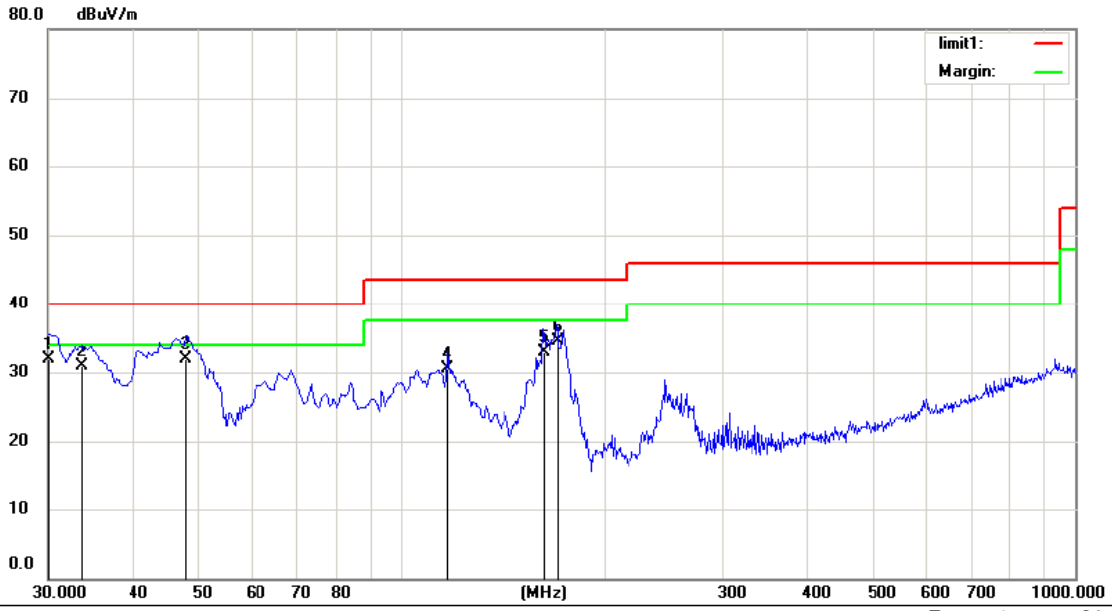
Limit: (RE)FCC Part 15B 3m Power: AC 120V/60Hz Humidity: 55 %

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		43.9658	41.20	-13.33	27.87	40.00	-12.13	QP			
2	*	125.0600	50.40	-16.40	34.00	43.50	-9.50	QP			
3		170.6500	51.10	-18.47	32.63	43.50	-10.87	QP			
4		222.0600	43.60	-16.16	27.44	46.00	-18.56	QP			
5		253.1000	45.90	-15.56	30.34	46.00	-15.66	QP			
6		264.7400	45.50	-15.34	30.16	46.00	-15.84	QP			

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



Site Chamber #1 Polarization: **Vertical** Temperature: 24

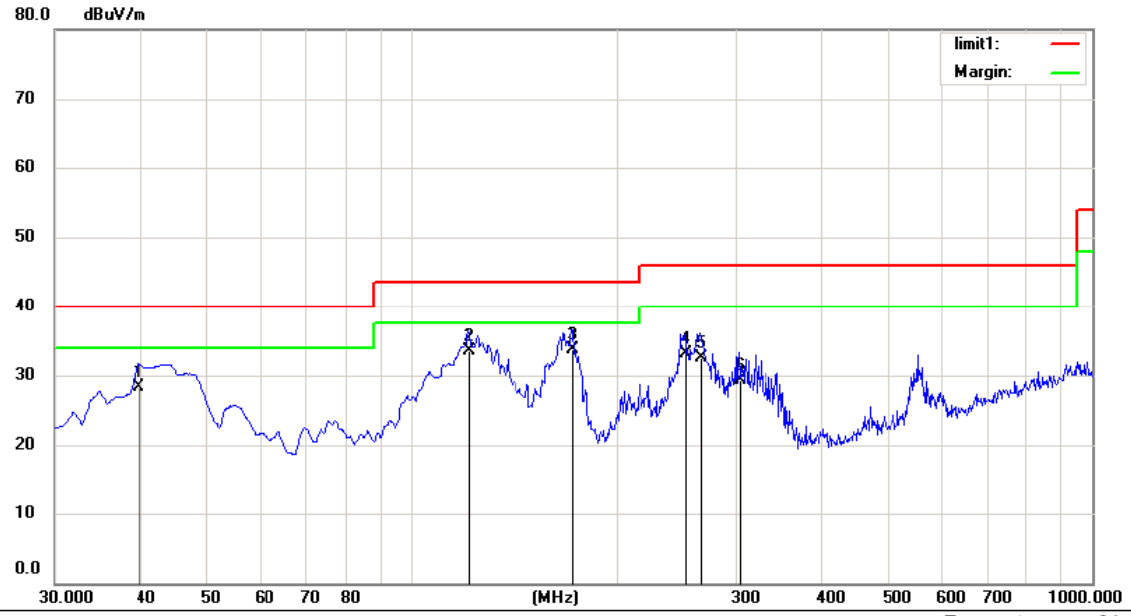
Limit: (RE)FCC Part 15B 3m Power: AC 120V/60Hz Humidity: 55 %

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	47.10	-15.15	31.95	40.00	-8.05	QP			
2		33.6802	45.20	-14.34	30.86	40.00	-9.14	QP			
3		47.9940	46.40	-14.57	31.83	40.00	-8.17	QP			
4		117.3000	47.60	-17.14	30.46	43.50	-13.04	QP			
5		162.8900	51.30	-18.41	32.89	43.50	-10.61	QP			
6		170.6500	52.90	-18.47	34.43	43.50	-9.07	QP			

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



Site Chamber #1 Polarization: **Horizontal** Temperature: 24

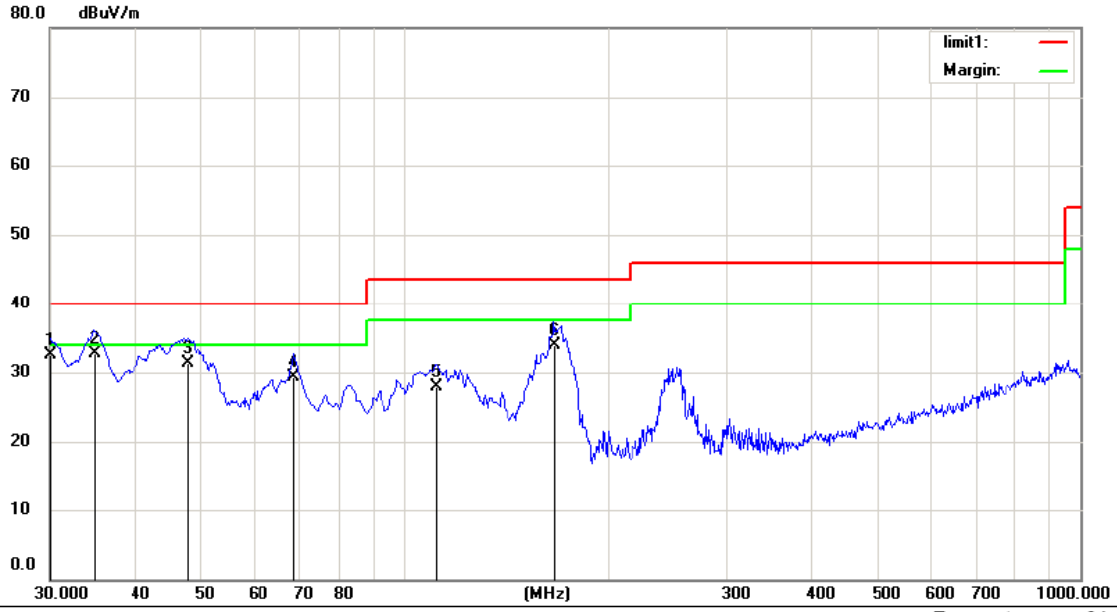
Limit: (RE)FCC Part 15B 3m Power: AC 120V/60Hz Humidity: 55 %

Mode: TX2441

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		39.7146	42.10	-13.70	28.40	40.00	-11.60	QP			
2		121.1800	50.40	-16.82	33.58	43.50	-9.92	QP			
3	*	172.5900	52.30	-18.57	33.73	43.50	-9.77	QP			
4		252.1300	48.60	-15.54	33.06	46.00	-12.94	QP			
5		265.7100	47.90	-15.32	32.58	46.00	-13.42	QP			
6		303.5400	43.30	-14.09	29.21	46.00	-16.79	QP			

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



Site Chamber #1
Limit: (RE)FCC Part 15B 3m
Mode: TX2441
Note:

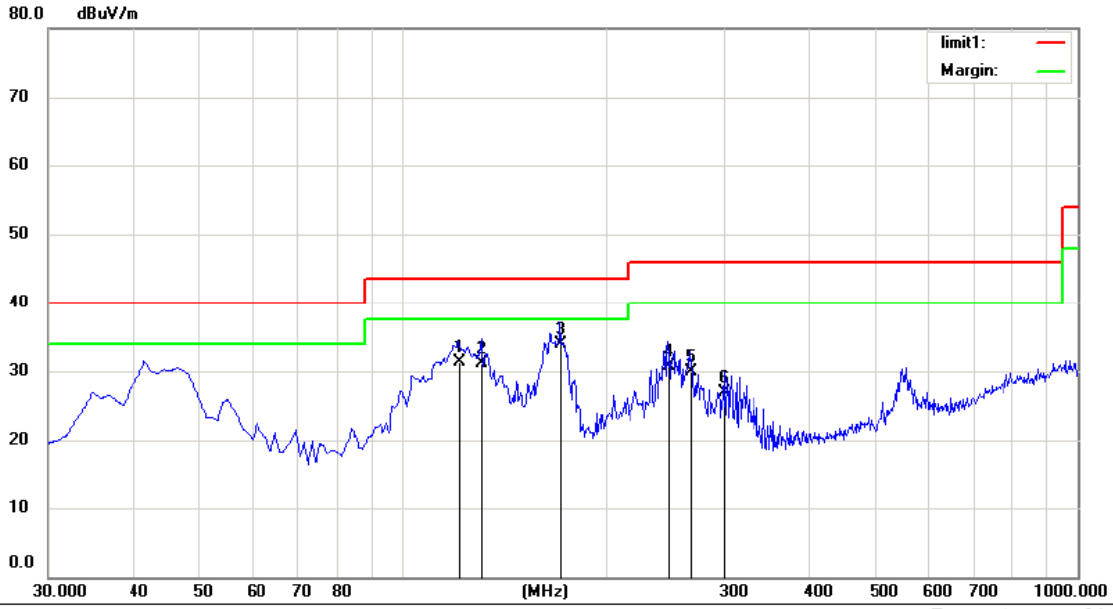
Polarization: **Vertical**
Power: AC 120V/60Hz

Temperature: 24
Humidity: 55 %

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	47.60	-15.15	32.45	40.00	-7.55	QP			
2	*	34.8500	46.80	-14.19	32.61	40.00	-7.39	QP			
3		47.9940	45.90	-14.57	31.33	40.00	-8.67	QP			
4		68.8000	51.20	-21.80	29.40	40.00	-10.60	QP			
5		111.4800	45.30	-17.48	27.82	43.50	-15.68	QP			
6		166.7700	52.40	-18.40	34.00	43.50	-9.50	QP			

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

Operator: Snake



Site Chamber #1 Polarization: **Horizontal** Temperature: 24

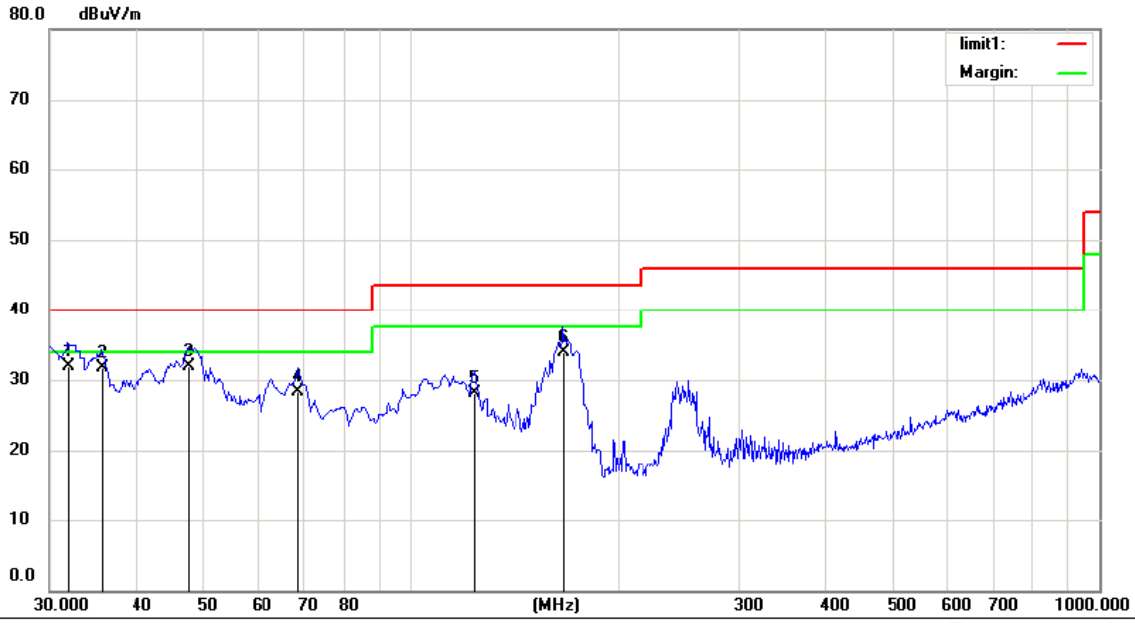
Limit: (RE)FCC Part 15B 3m Power: AC 120V/60Hz Humidity: 55 %

Mode: TX2480

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		121.1800	48.10	-16.82	31.28	43.50	-12.22	QP			
2		130.8800	47.30	-16.29	31.01	43.50	-12.49	QP			
3	*	171.6200	52.40	-18.51	33.89	43.50	-9.61	QP			
4		248.2500	46.30	-15.52	30.78	46.00	-15.22	QP			
5		266.6800	45.10	-15.29	29.81	46.00	-16.19	QP			
6		299.6600	41.30	-14.34	26.96	46.00	-19.04	QP			

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



Site Chamber #1 Polarization: **Vertical** Temperature: 24

Limit: (RE)FCC Part 15B 3m Power: AC 120V/60Hz Humidity: 55 %

Mode: TX2480

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	*	31.9400	46.50	-14.63	31.87	40.00	-8.13	QP			
2		35.6240	45.90	-14.10	31.80	40.00	-8.20	QP			
3		47.6584	46.30	-14.45	31.85	40.00	-8.15	QP			
4		68.8000	50.10	-21.80	28.30	40.00	-11.70	QP			
5		124.0900	44.60	-16.50	28.10	43.50	-15.40	QP			
6		166.7700	52.40	-18.40	34.00	43.50	-9.50	QP			

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

Above 1000MHz

Worst Operation Mode:	GFSK (CH1: 2402MHz)	Test Date :	March 30, 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	66.48	45.13	74	54	-7.52	-8.87
7206	V	65.03	44.82	74	54	-8.97	-9.18
9608	V	64.82	43.61	74	54	-9.18	-10.39
12010	V	63.15	42.72	74	54	-10.85	-11.28
14412	V	60.82	41.15	74	54	-13.18	-12.85
16814	V	59.34	40.39	74	54	-14.66	-13.61
4804	H	65.34	46.82	74	54	-8.66	-7.18
7206	H	64.82	45.72	74	54	-9.18	-8.28
9608	H	63.19	44.33	74	54	-10.81	-9.67
12010	H	62.96	43.92	74	54	-11.04	-10.08
14412	H	59.04	42.85	74	54	-14.96	-11.15
16814	H	57.48	41.03	74	54	-16.52	-12.97

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 :	March 30, 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	66.33	44.11	74	54	-7.67	-9.89
7323	V	65.72	43.38	74	54	-8.28	-10.62
9764	V	64.82	42.19	74	54	-9.18	-11.81
12205	V	63.95	41.23	74	54	-10.05	-12.77
14646	V	62.82	40.82	74	54	-11.18	-13.18
17087	V	60.72	39.82	74	54	-13.28	-14.18
4882	H	65.92	45.92	74	54	-8.08	-8.08
7323	H	64.37	44.15	74	54	-9.63	-9.85
9764	H	63.82	43.69	74	54	-10.18	-10.31
12205	H	62.16	42.82	74	54	-11.84	-11.18
14646	H	60.95	41.72	74	54	-13.05	-12.28
17087	H	58.95	40.38	74	54	-15.05	-13.62

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.

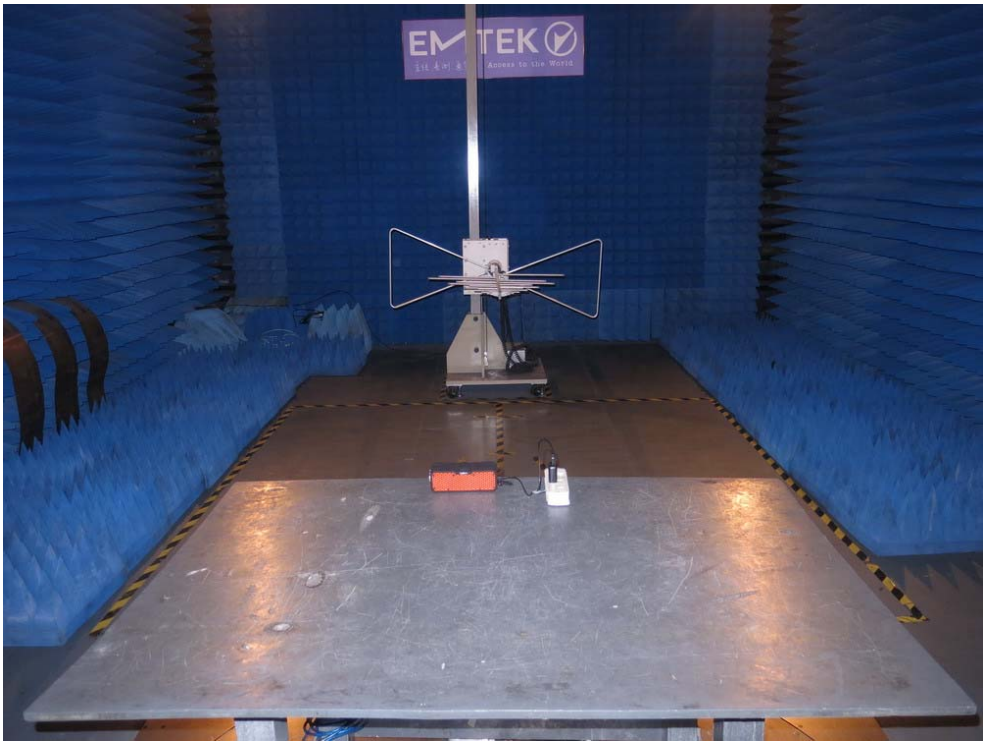
Worst Operation Mode:	GFSK (CH79: 2480MHz)	Test Date :	March 30, 2015
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq.	Ant. Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
(MHz)	H/V	PK	AV	PK	AV	PK	AV
4960	V	65.33	44.18	74	54	-8.67	-9.82
7440	V	64.72	43.38	74	54	-9.28	-10.62
9920	V	63.59	42.82	74	54	-10.41	-11.18
12400	V	62.15	41.13	74	54	-11.85	-12.87
14880	V	61.02	40.59	74	54	-12.98	-13.41
17360	V	60.38	38.95	74	54	-13.62	-15.05
4960	H	66.33	45.72	74	54	-7.67	-8.28
7440	H	65.82	44.66	74	54	-8.18	-9.34
9920	H	64.72	43.69	74	54	-9.28	-10.31
12400	H	63.81	42.17	74	54	-10.19	-11.83
14880	H	62.33	41.35	74	54	-11.67	-12.65
17360	H	60.82	40.07	74	54	-13.18	-13.93

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:



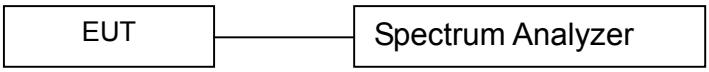


8. Channel Separation test

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:

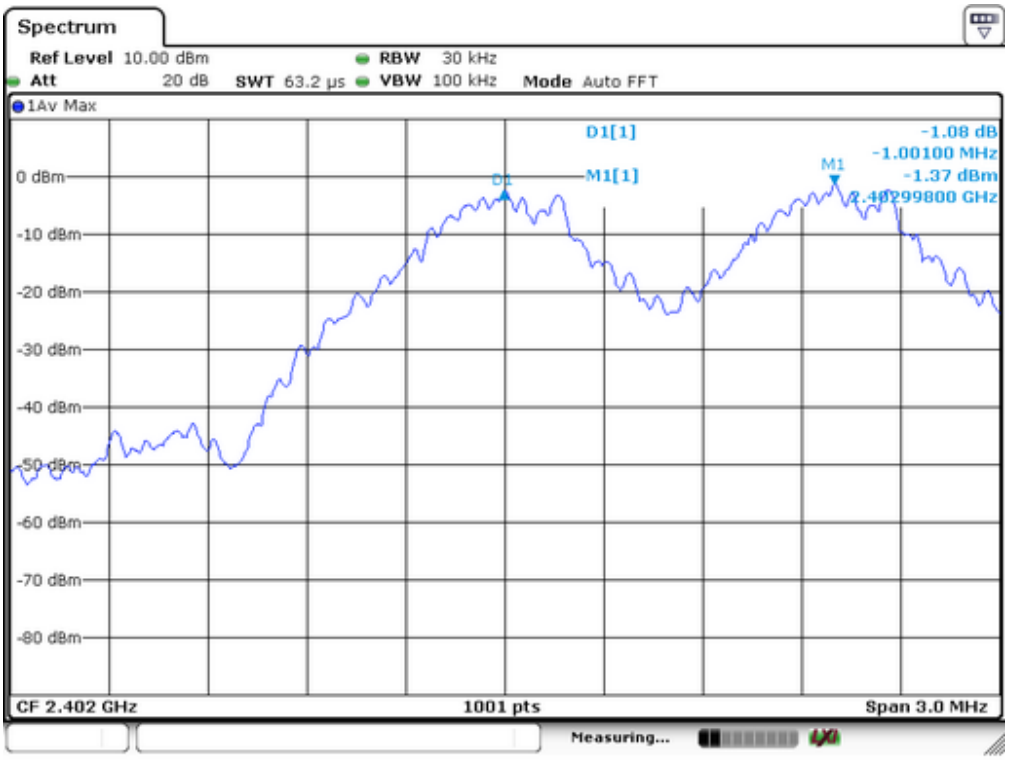
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

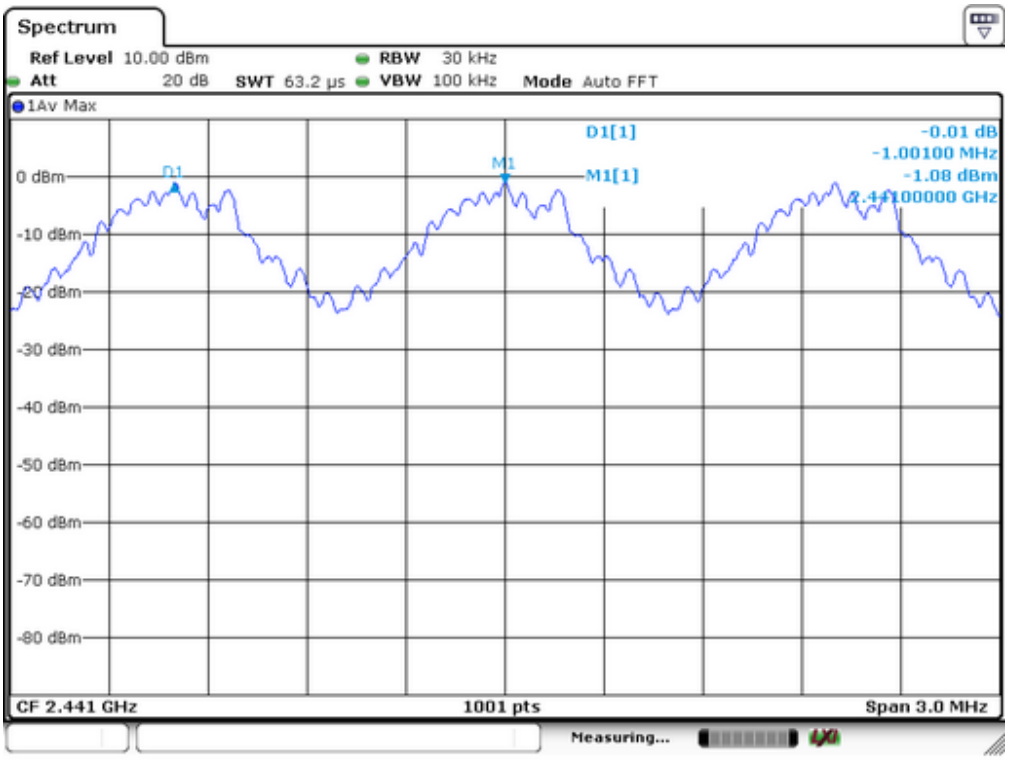
8.4 Measurement Results:

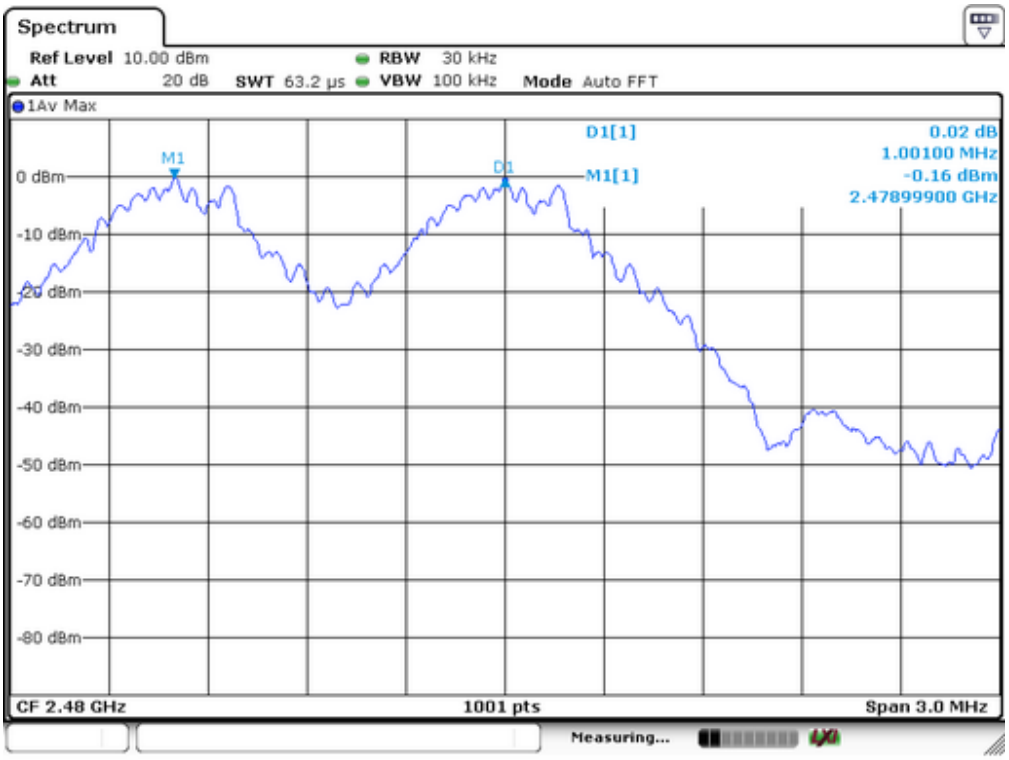
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	March 30, 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	1001	>845
40	2441	1001	>836
79	2480	1001	>836

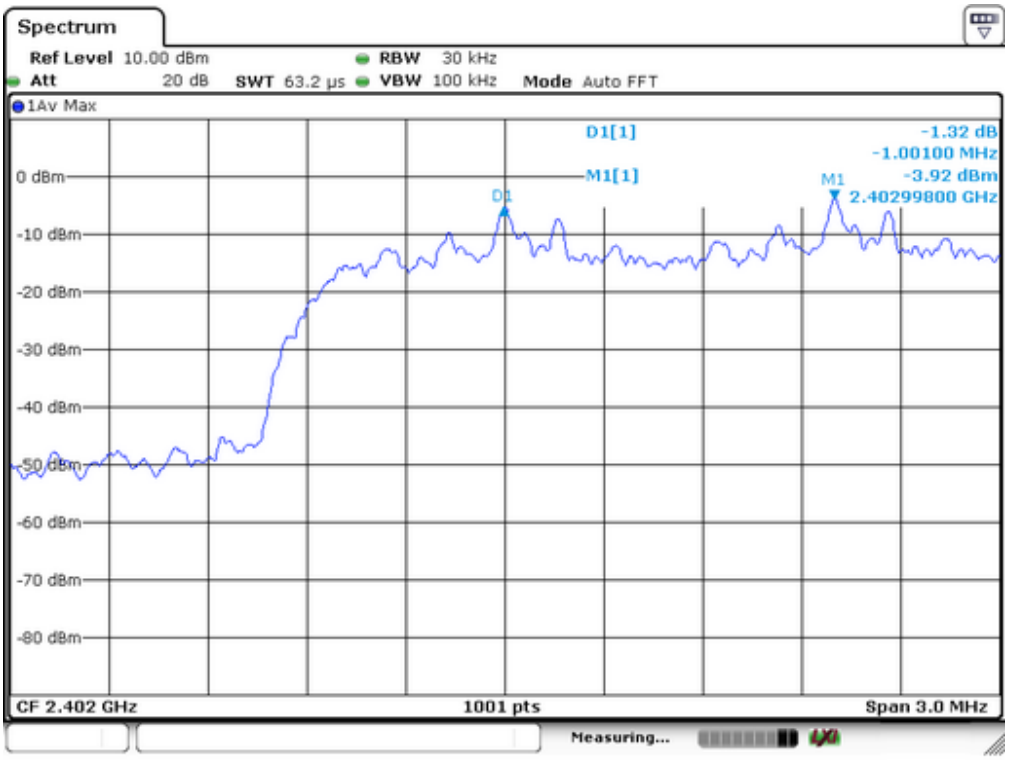

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-1.08 dB
-1.00100 MHz
M1[1]
-1.37 dBm
2.40299800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Measuring...

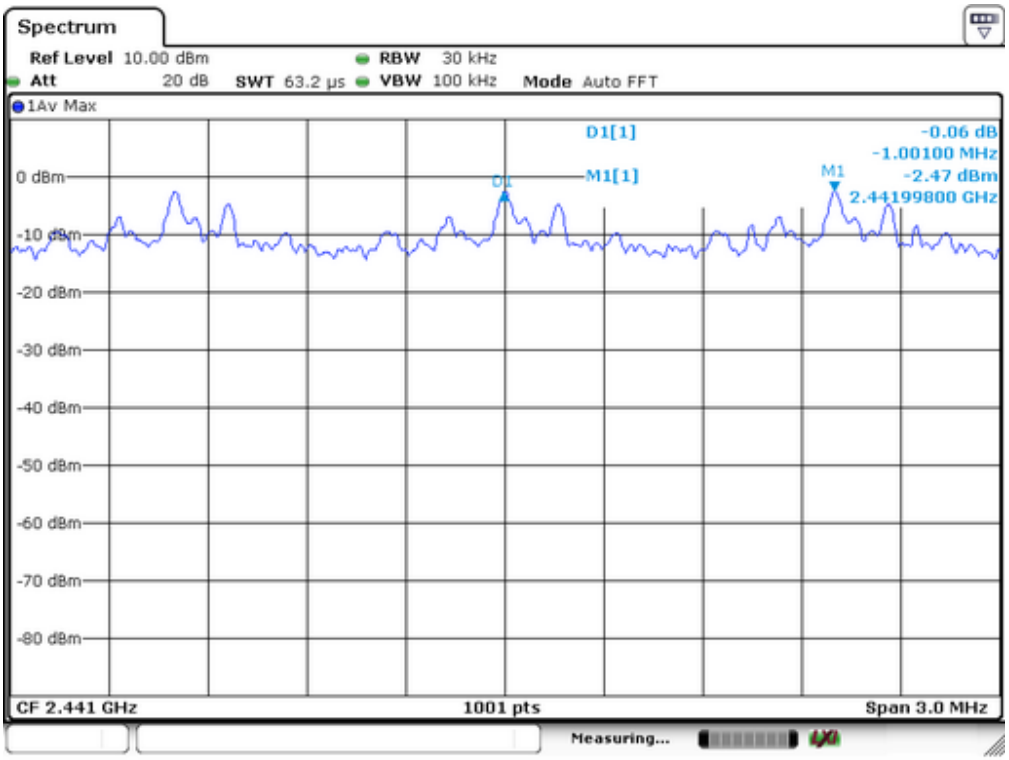

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-0.01 dB
-1.00100 MHz
M1[1]
-1.08 dBm
2.44100000 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Measuring...

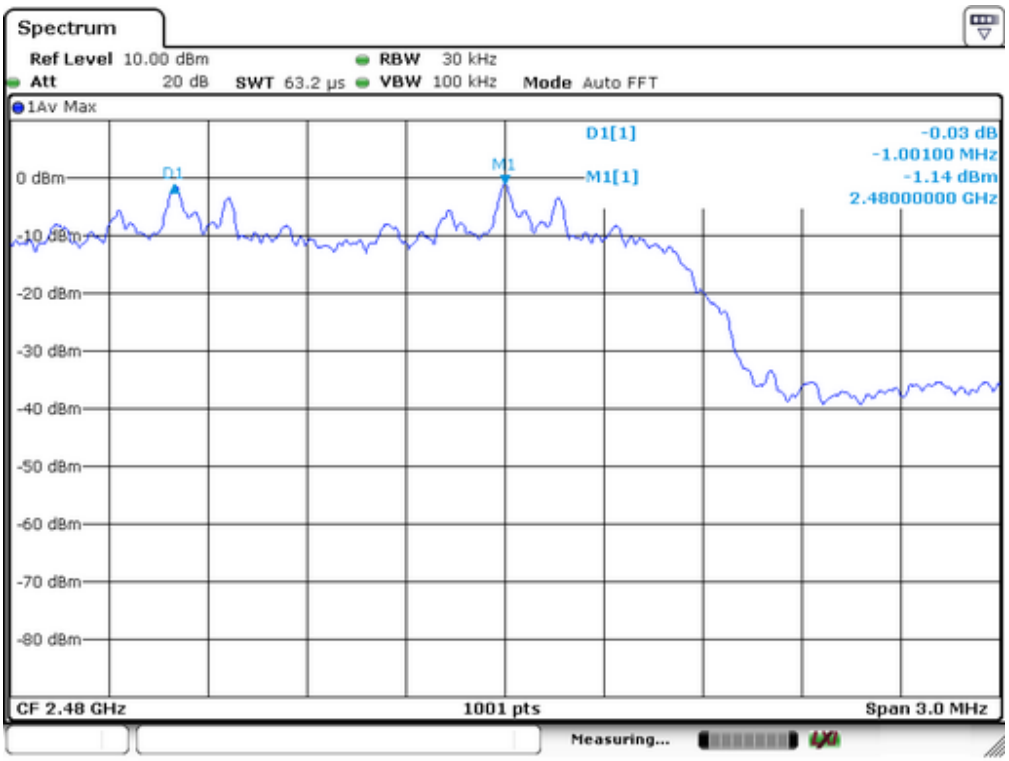


Spectrum Detector:	PK	Test Date :	March 30, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	Π/4-DQPSK		

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1001	>844
40	2441	1001	>826
79	2480	1001	>830

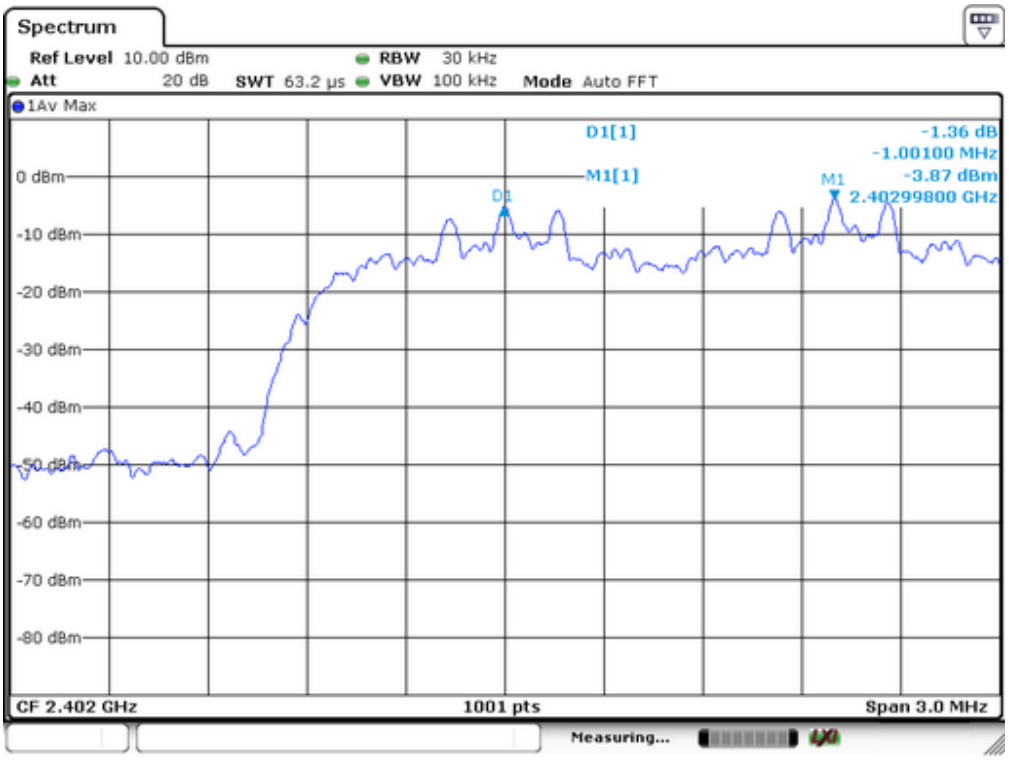

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-1.32 dB
-1.00100 MHz
M1[1]
-3.92 dBm
2.40299800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Measuring...

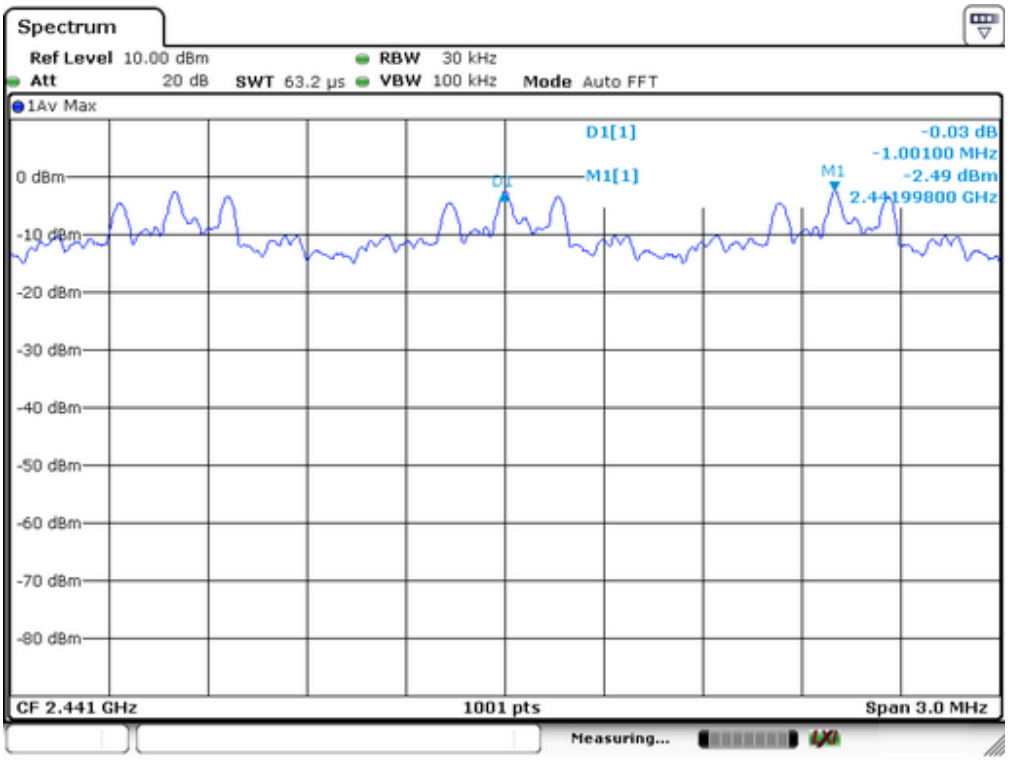

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-0.06 dB
-1.00100 MHz
M1[1]
-2.47 dBm
2.44199800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Measuring...

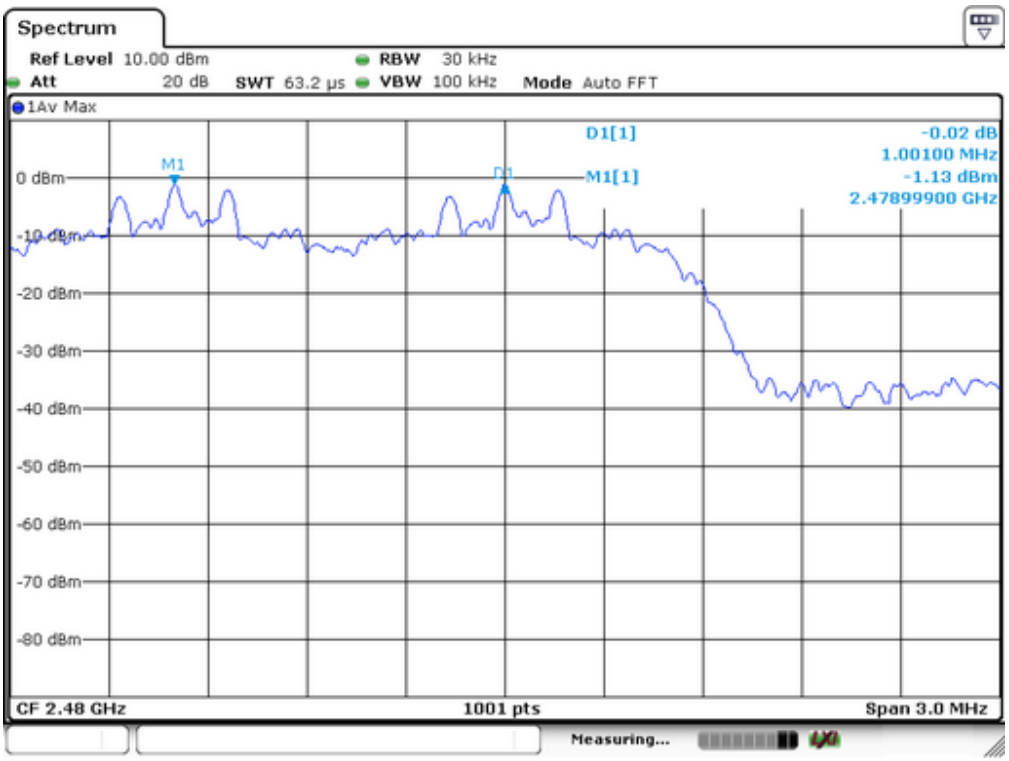


Spectrum Detector:	PK	Test Date :	March 30, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	8DPSK		

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1001	>816
40	2441	1001	>838
79	2480	1001	>840


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-1.36 dB
-1.00100 MHz
M1[1]
-3.87 dBm
2.40299800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 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
1Av Max
D1[1]
-0.03 dB
-1.00100 MHz
M1[1]
-2.49 dBm
2.44199800 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Measuring...

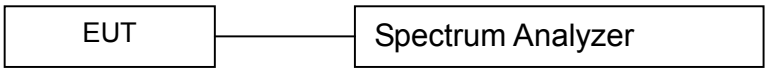

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
D1[1]
-0.02 dB
1.00100 MHz
M1[1]
-1.13 dBm
2.47899900 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Measuring...

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:

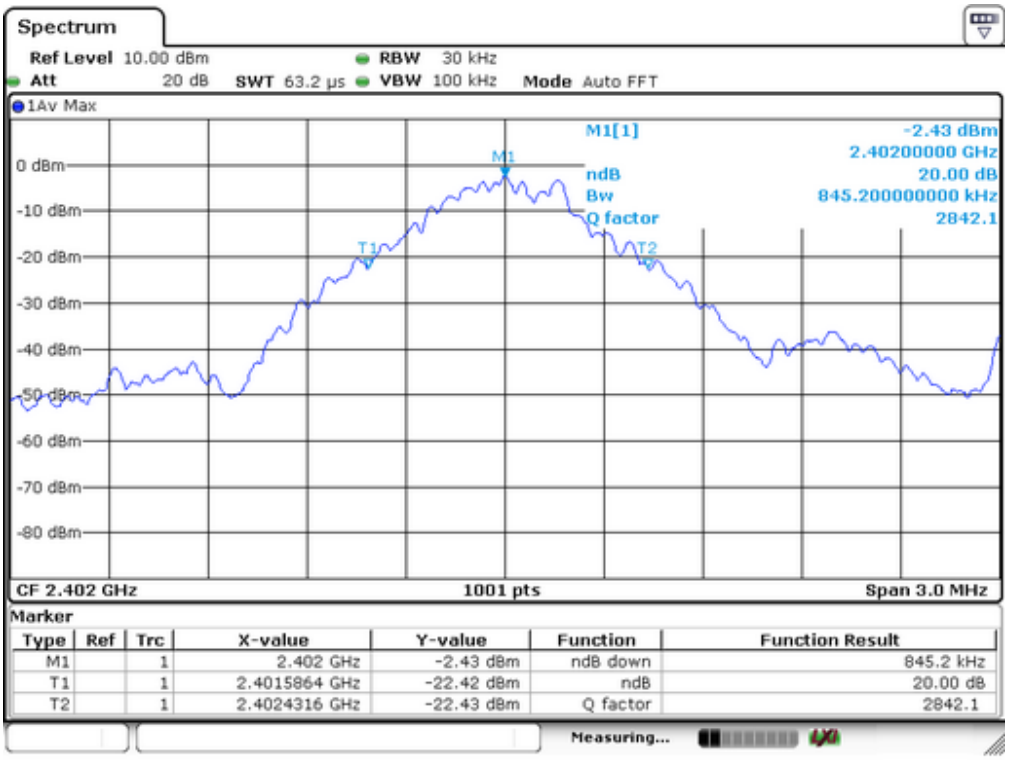
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

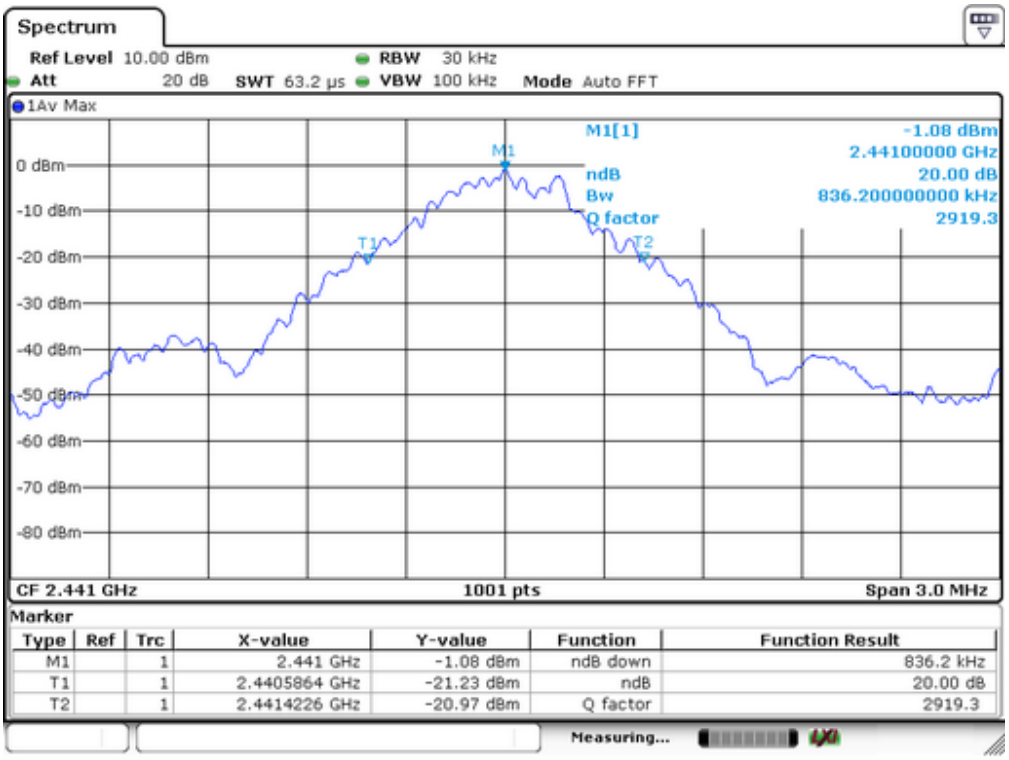
9.4 Measurement Results:

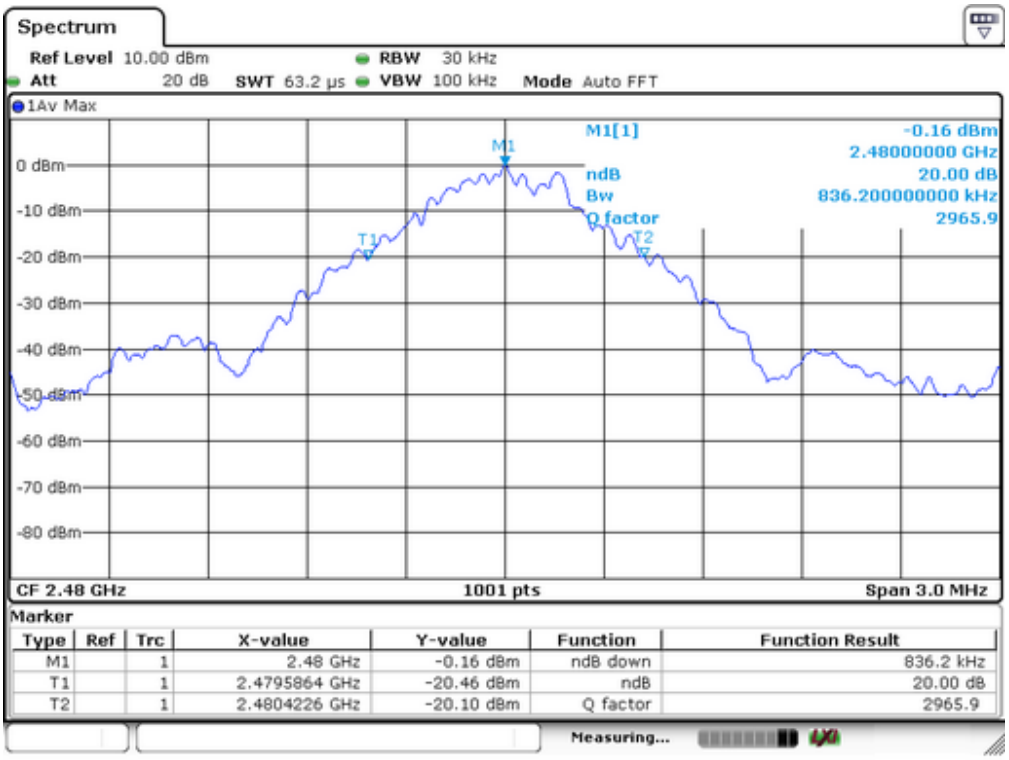
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	March 30, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	845
40	2441	836
79	2480	836

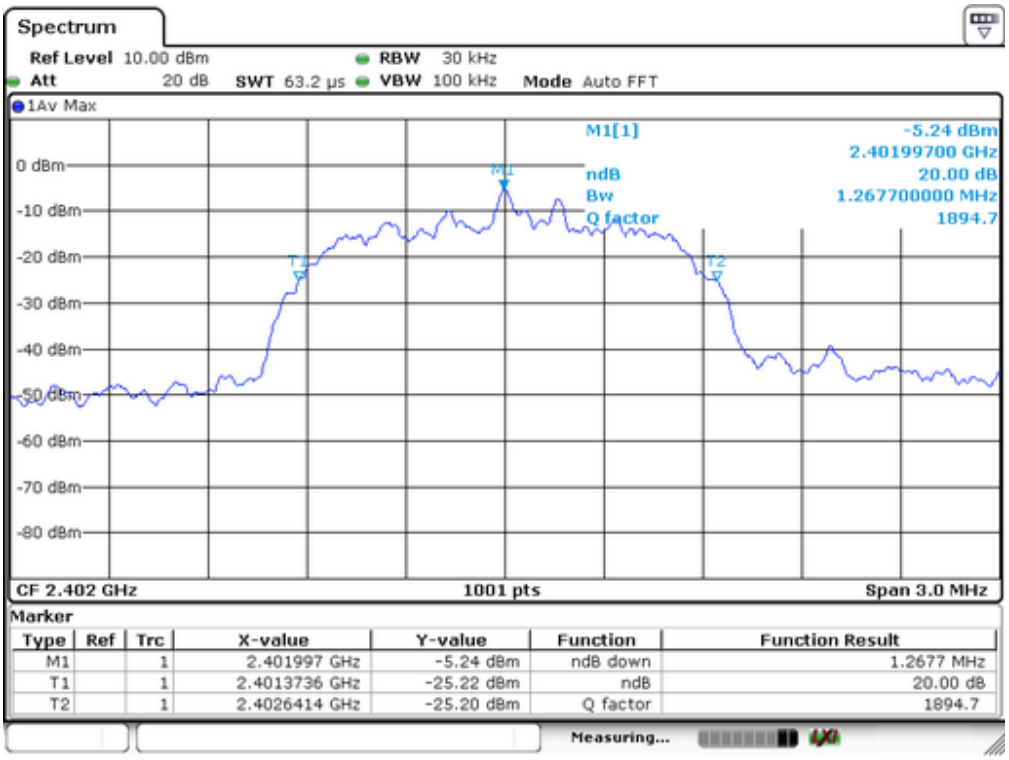

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-2.43 dBm
2.40200000 GHz
ndB 20.00 dB
Bw 845.200000000 kHz
Q factor 2842.1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.402 GHz -2.43 dBm ndB down 845.2 kHz
T1 1 2.4015864 GHz -22.42 dBm ndB 20.00 dB
T2 1 2.4024316 GHz -22.43 dBm Q factor 2842.1
Measuring...

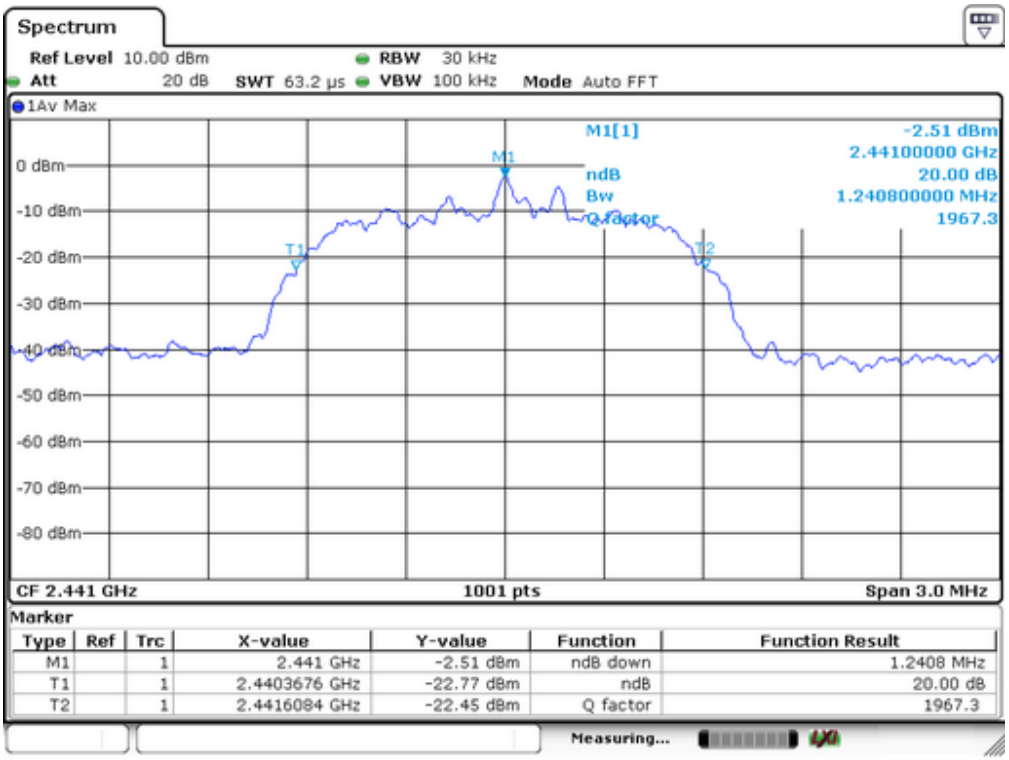

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-1.08 dBm
2.44100000 GHz
ndB 20.00 dB
Bw 836.200000000 kHz
Q factor 2919.3
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441 GHz -1.08 dBm ndB down 836.2 kHz
T1 1 2.4405864 GHz -21.23 dBm ndB 20.00 dB
T2 1 2.4414226 GHz -20.97 dBm Q factor 2919.3
Measuring...

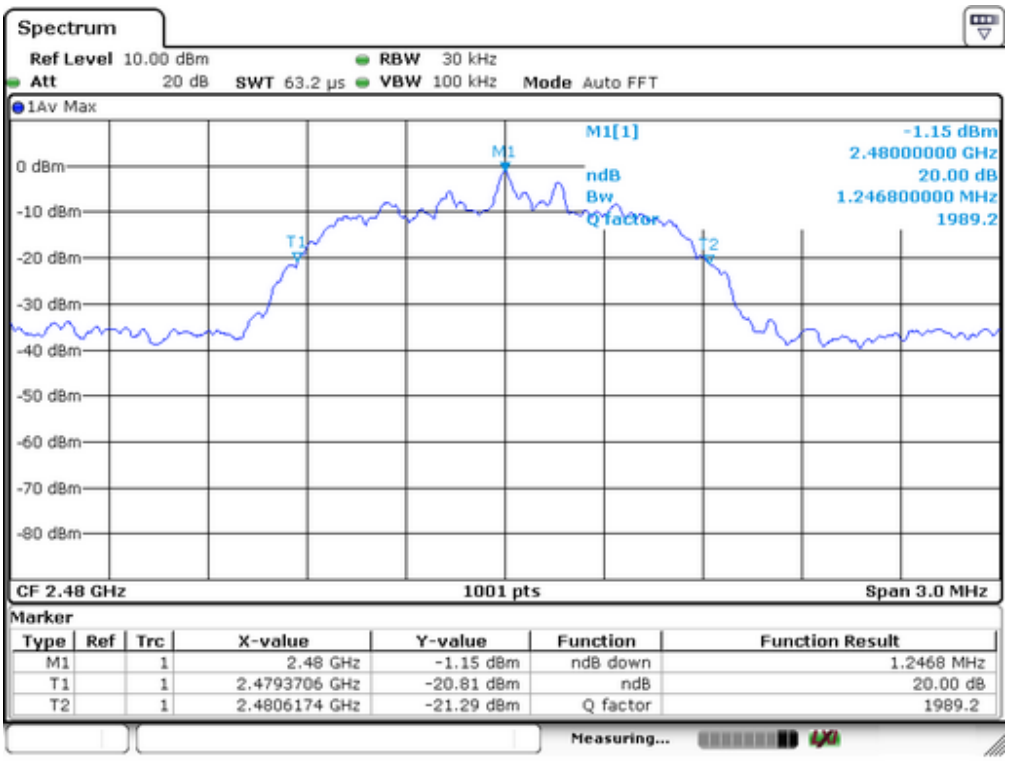


Spectrum Detector:	PK	Test Date :	March 30, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	Π/4-DQPSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1267
40	2441	1240
79	2480	1246

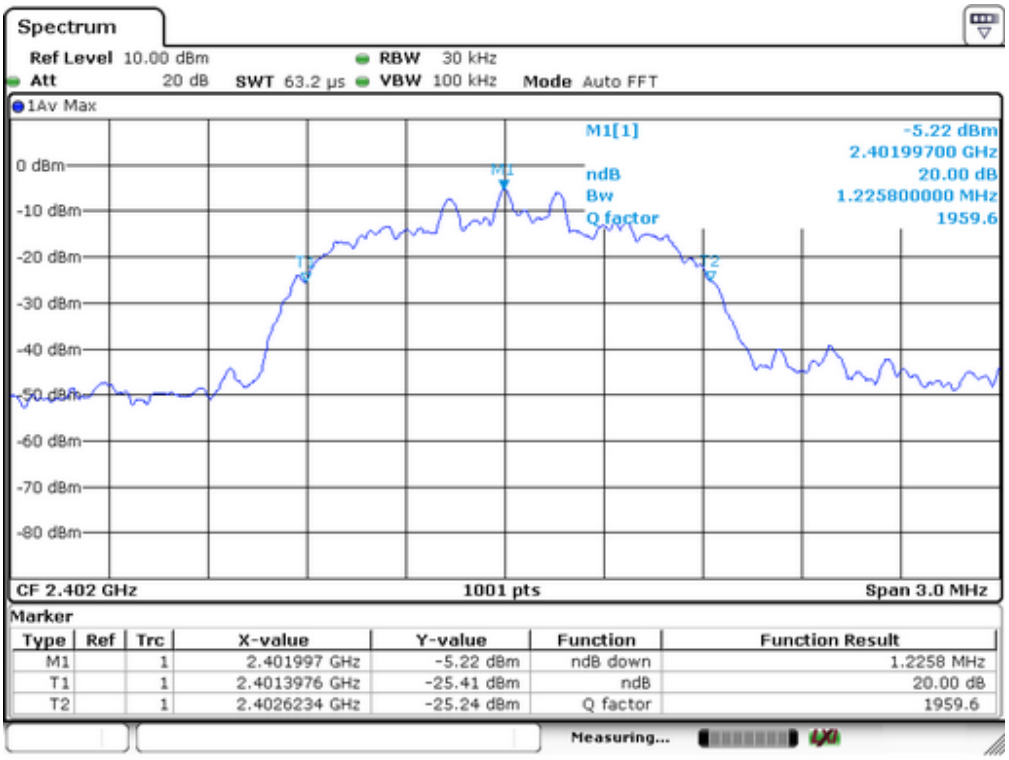

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-5.24 dBm
2.40199700 GHz
ndB 20.00 dB
Bw 1.267700000 MHz
Q factor 1894.7
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401997 GHz -5.24 dBm ndB down 1.2677 MHz
T1 1 2.4013736 GHz -25.22 dBm ndB 20.00 dB
T2 1 2.4026414 GHz -25.20 dBm Q factor 1894.7
Measuring...

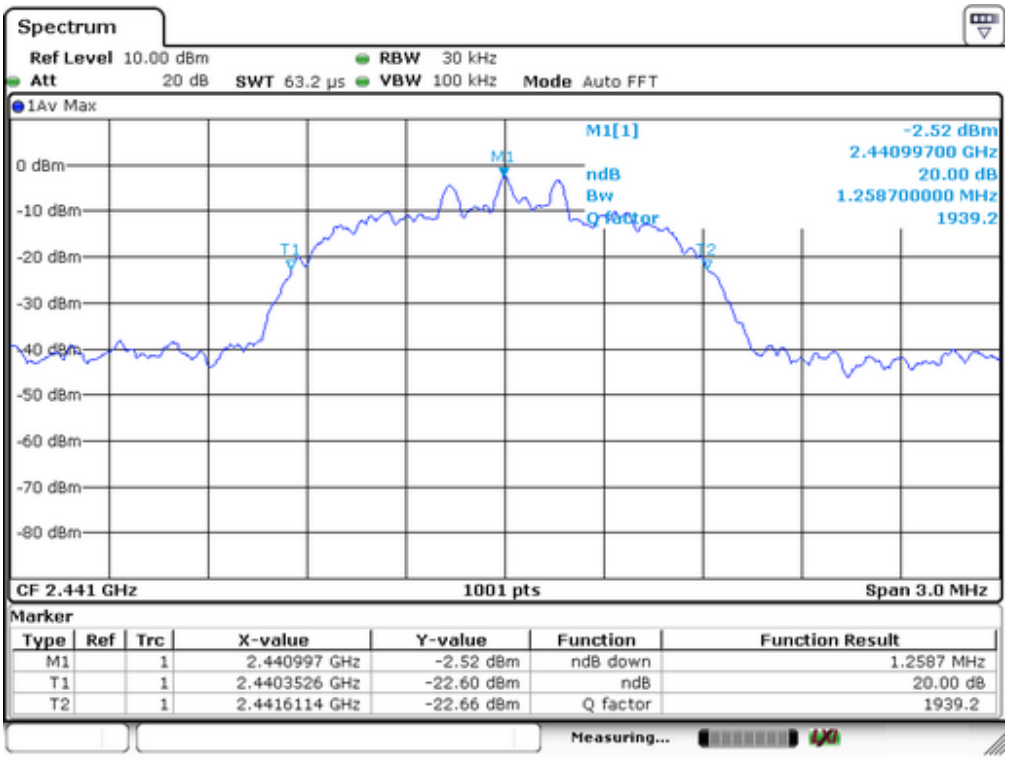

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-2.51 dBm
2.44100000 GHz
ndB 20.00 dB
Bw 1.240800000 MHz
Q factor 1967.3
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.441 GHz -2.51 dBm ndB down 1.2408 MHz
T1 1 2.4403676 GHz -22.77 dBm ndB 20.00 dB
T2 1 2.4416084 GHz -22.45 dBm Q factor 1967.3
Measuring...

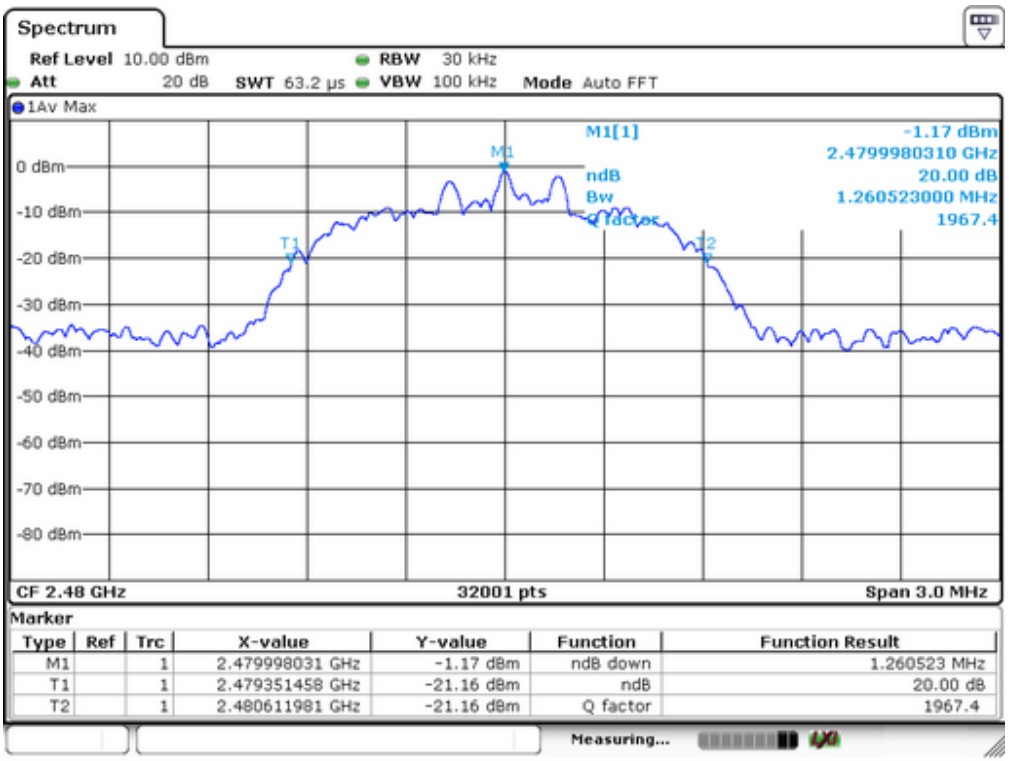


Spectrum Detector:	PK	Test Date :	March 30, 2015
Test By:	Andy	Temperature :	24℃
Test Result:	PASS	Humidity :	53 %
Modulation:	8DPSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1225
40	2441	1258
79	2480	1260


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-5.22 dBm
2.40199700 GHz
ndB 20.00 dB
Bw 1.225800000 MHz
Q factor 1959.6
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.401997 GHz -5.22 dBm ndB down 1.2258 MHz
T1 1 2.4013976 GHz -25.41 dBm ndB 20.00 dB
T2 1 2.4026234 GHz -25.24 dBm Q factor 1959.6
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-2.52 dBm
2.44099700 GHz
ndB 20.00 dB
Bw 1.258700000 MHz
Q factor 1939.2
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.440997 GHz -2.52 dBm ndB down 1.2587 MHz
T1 1 2.4403526 GHz -22.60 dBm ndB 20.00 dB
T2 1 2.4416114 GHz -22.66 dBm Q factor 1939.2
Measuring...

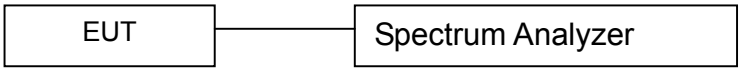

Spectrum
Ref Level 10.00 dBm
RBW 30 kHz
Att 20 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Av Max
M1[1]
-1.17 dBm
2.4799980310 GHz
ndB
20.00 dB
Bw
1.260523000 MHz
Q factor
1967.4
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.48 GHz
32001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479998031 GHz -1.17 dBm ndB down 1.260523 MHz
T1 1 2.479351458 GHz -21.16 dBm ndB 20.00 dB
T2 1 2.480611981 GHz -21.16 dBm Q factor 1967.4
Measuring...

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:

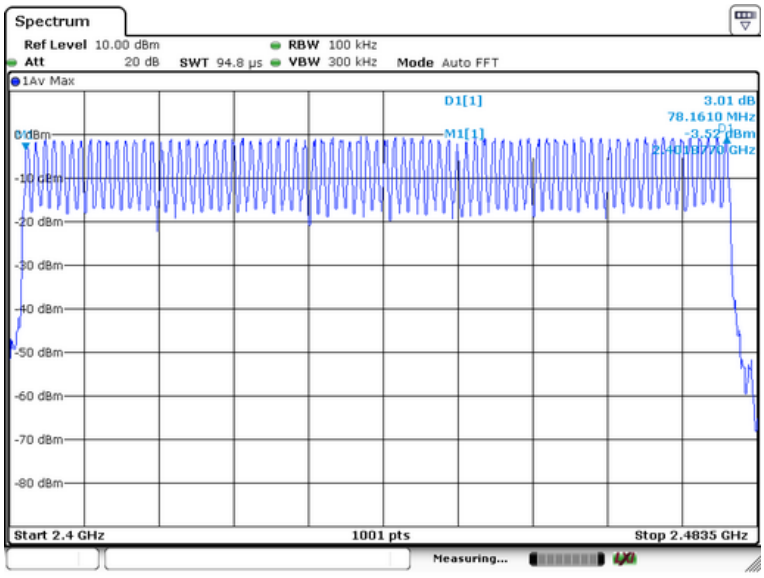
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

10.4 Measurement Results:

Refer to attached data chart.

Worst Test Mode	GFSK	Test Date :	March 30, 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



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:

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.

11.2 Test Requirements / Limits

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

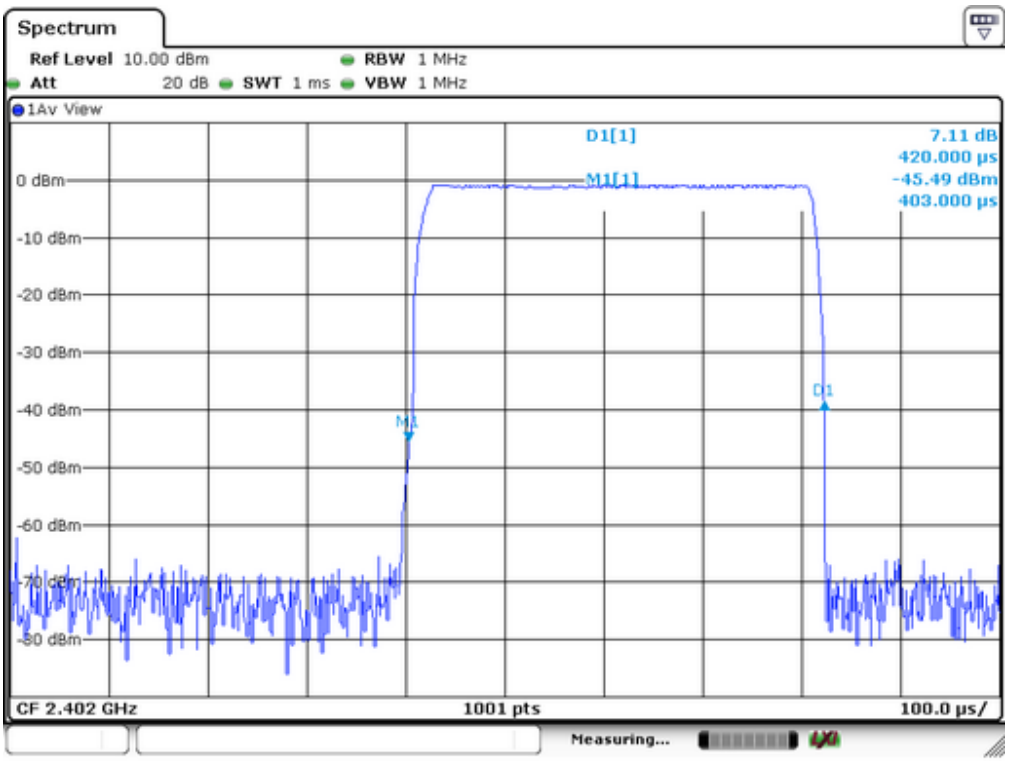
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Since the Bluetooth technology uses 79 channels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

11.3 Test result

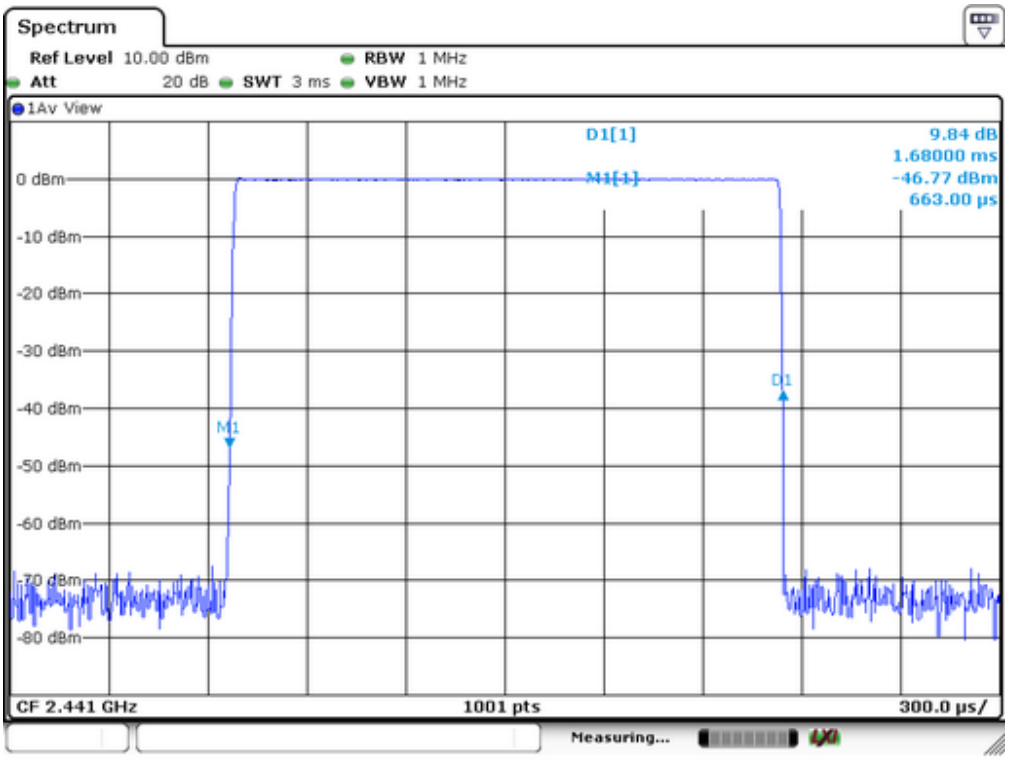
Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	1600/(2*79) x 31.6 = 320	0.420	134.4	400
DH3	1600/(4*79) x 31.6 =160	1.680	268.8	400
DH5	1600/(6*79) x 31.6 =106.67	2.930	312.5	400

Remark: The results of worst cased was recorded.
.

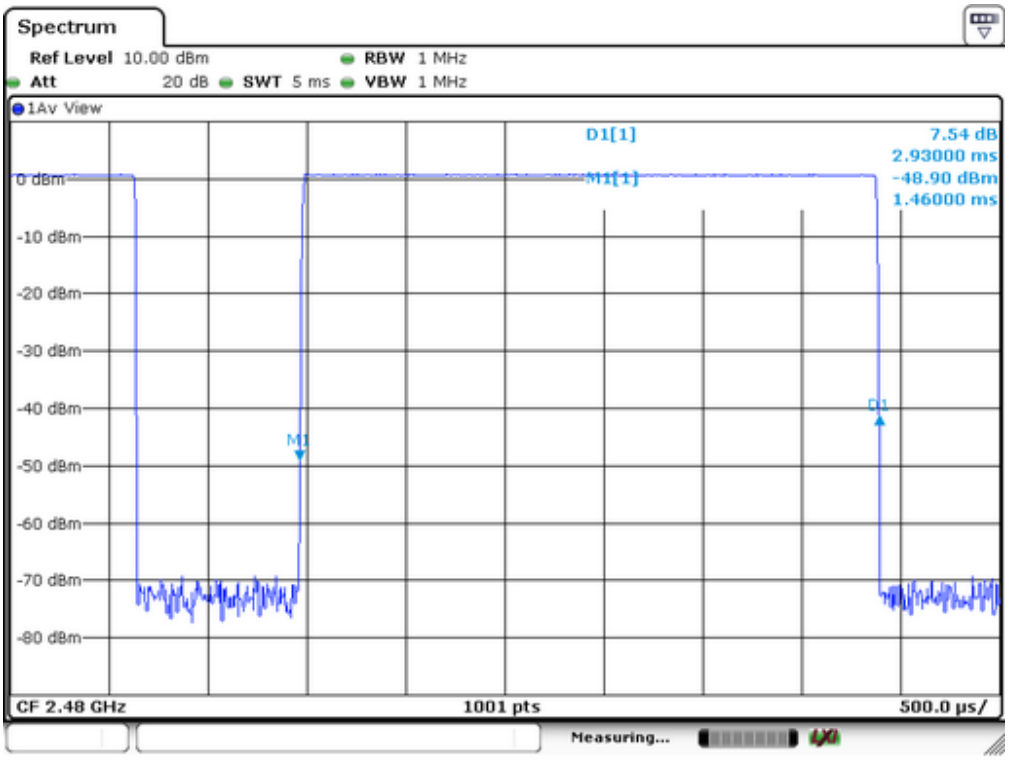
DH1:


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 1 ms VBW 1 MHz
1Av View
D1[1] 7.11 dB
420.000 µs
M1[1] -45.49 dBm
403.000 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
D1
CF 2.402 GHz
1001 pts
100.0 µs/
Measuring...

DH3:


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 3 ms VBW 1 MHz
1Av View
D1[1] 9.84 dB
1.68000 ms
M1[1] -46.77 dBm
663.00 µs
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
D1
CF 2.441 GHz
1001 pts
300.0 µs/
Measuring...

DH5:


Spectrum
Ref Level 10.00 dBm
RBW 1 MHz
Att 20 dB SWT 5 ms VBW 1 MHz
1Av View
D1[1] 7.54 dB
2.93000 ms
M1[1] -48.90 dBm
1.46000 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
1001 pts
500.0 µs/
Measuring...

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.

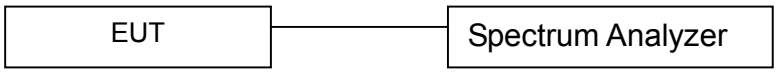
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

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:

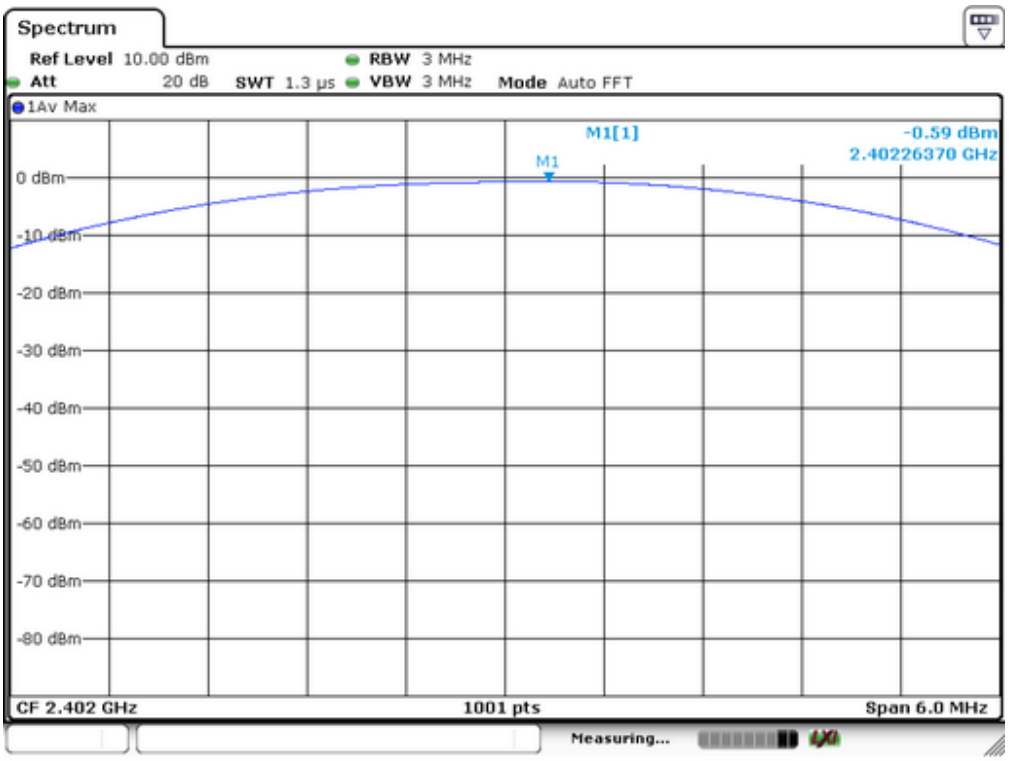
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	03/16/2015	03/15/2016
Coaxial Cable	CDS	79254	46107086	03/16/2015	03/15/2016

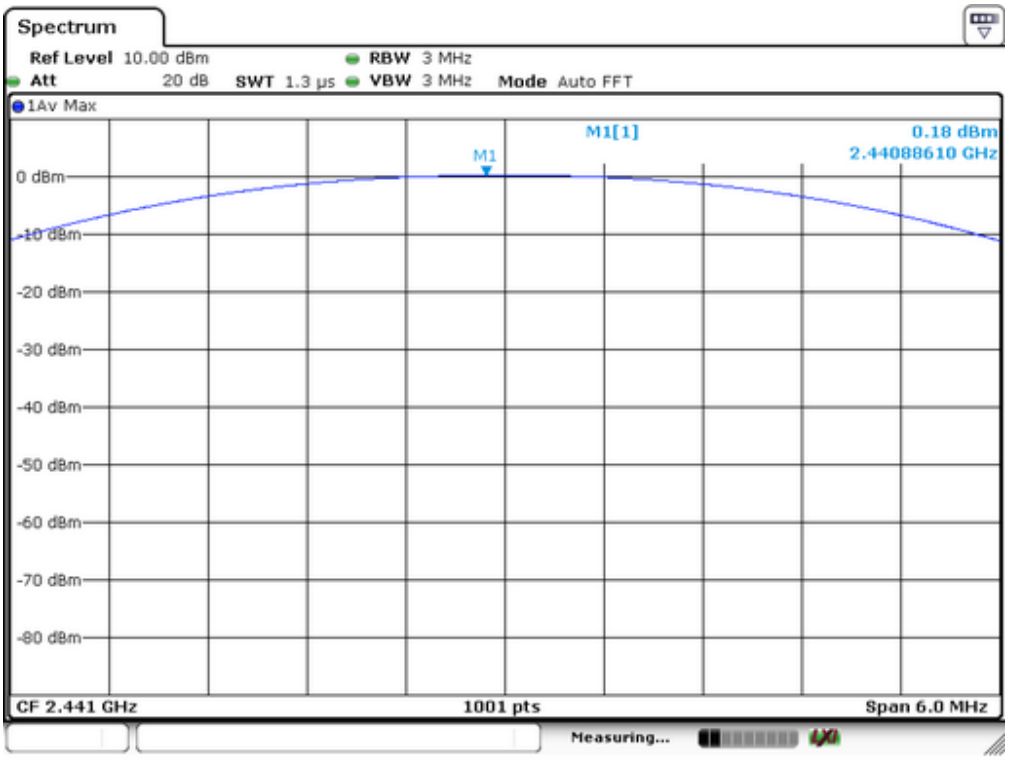
12.4Measurement Results:

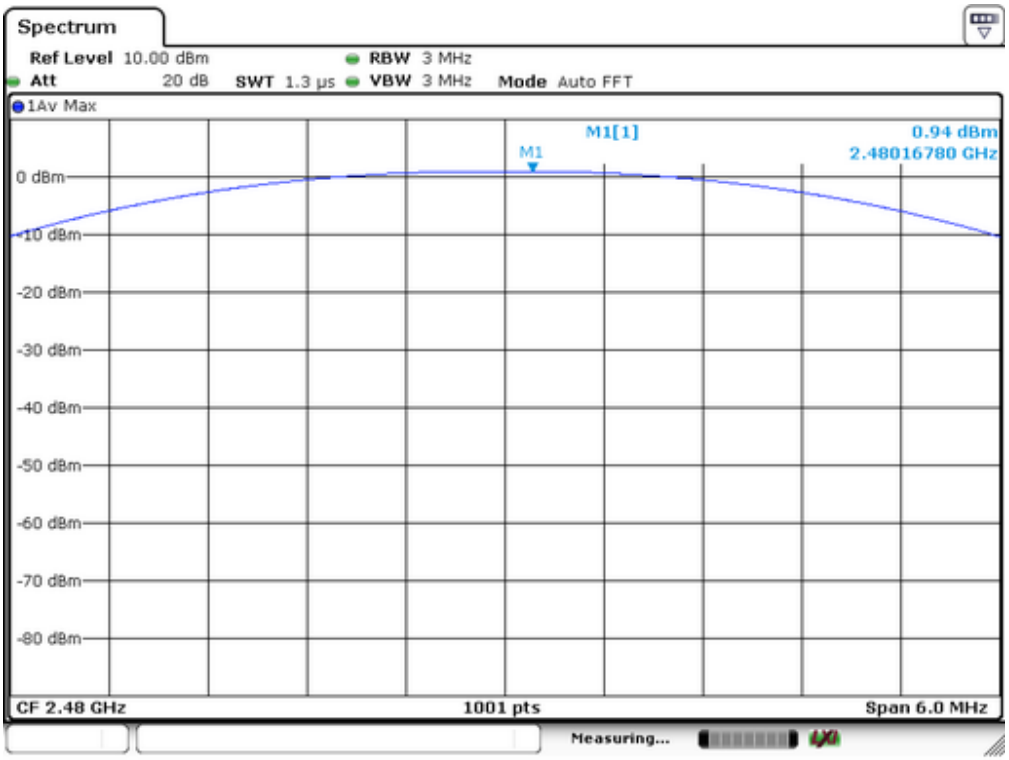
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	March 30, 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	-0.59	0.873	1000	PASS
40	2441	0.18	1.042	1000	PASS
79	2480	**0.94**	**1.242**	1000	PASS

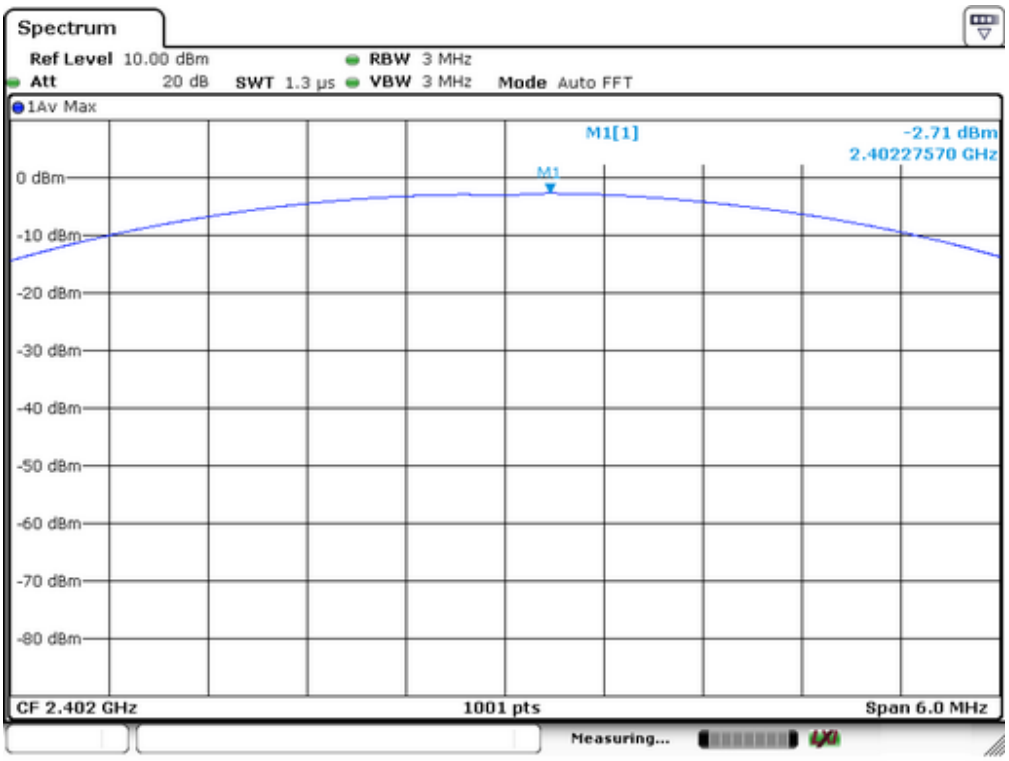


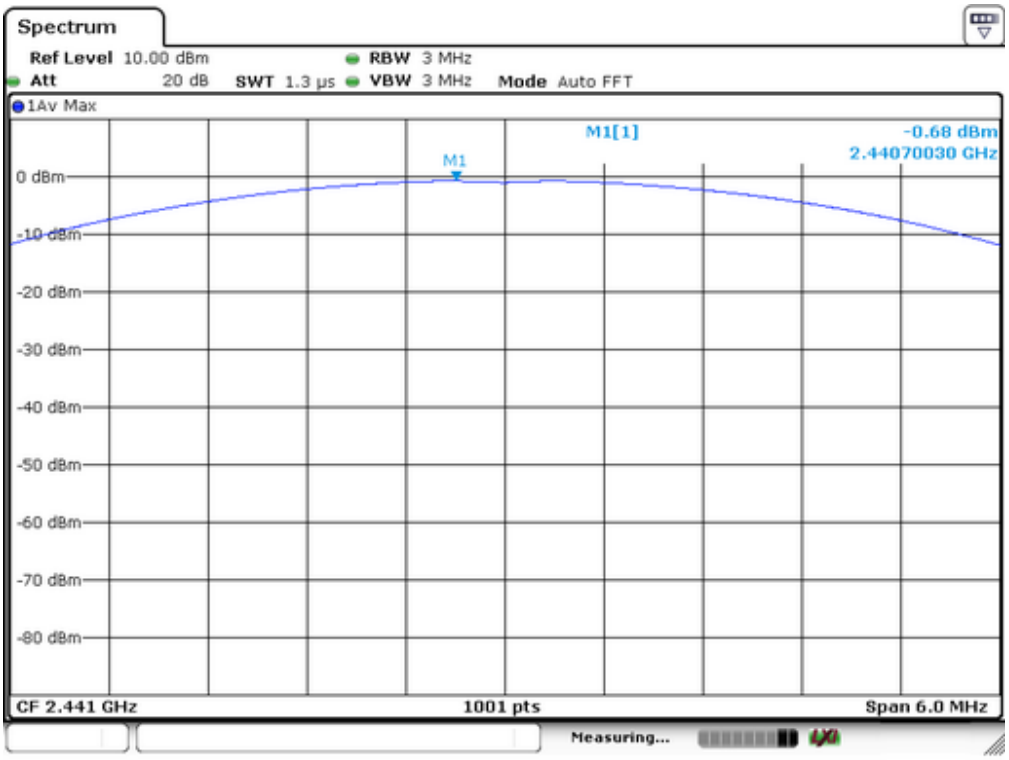

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
0.18 dBm
2.44088610 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 6.0 MHz
Measuring...

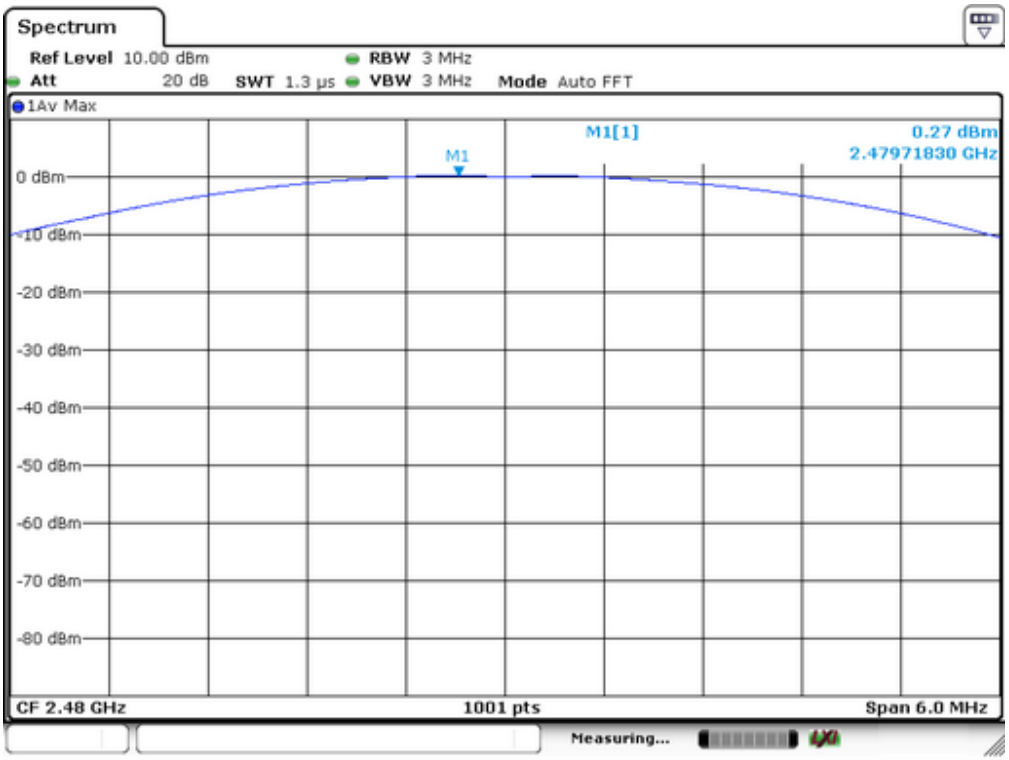

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
0.94 dBm
2.48016780 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
1001 pts
Span 6.0 MHz
Measuring...

Spectrum Detector:	PK	Test Date :	March 30, 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	-2.71	0.536	125	PASS
40	2441	-0.68	0.855	125	PASS
79	2480	0.27	1.064	125	PASS

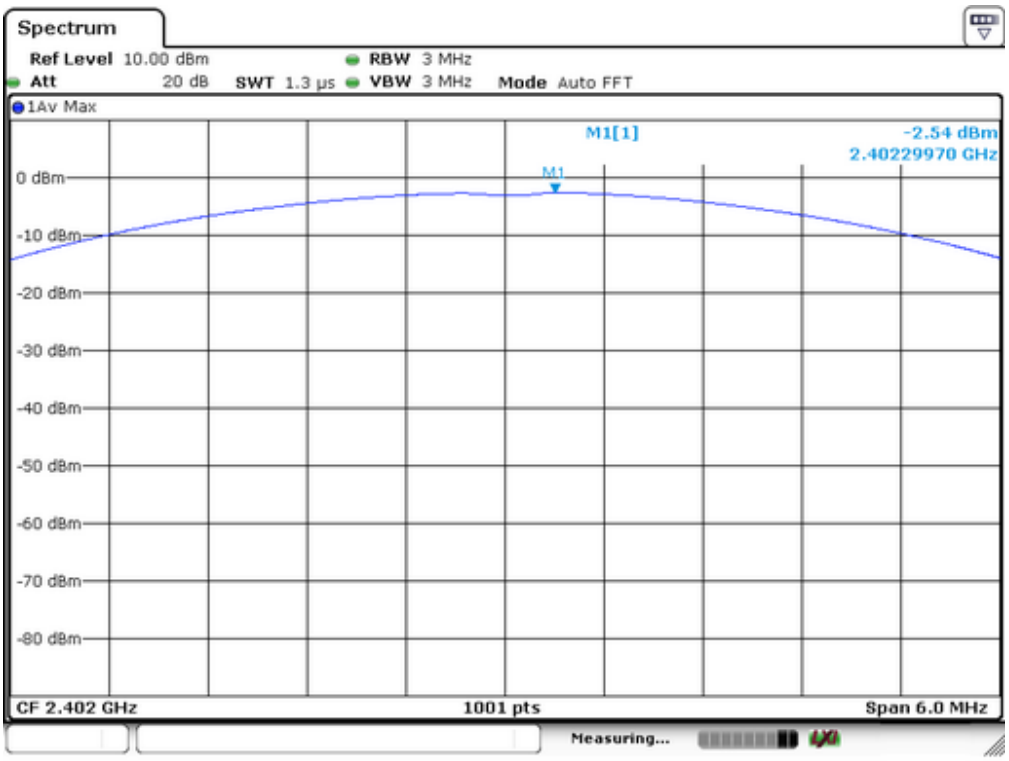


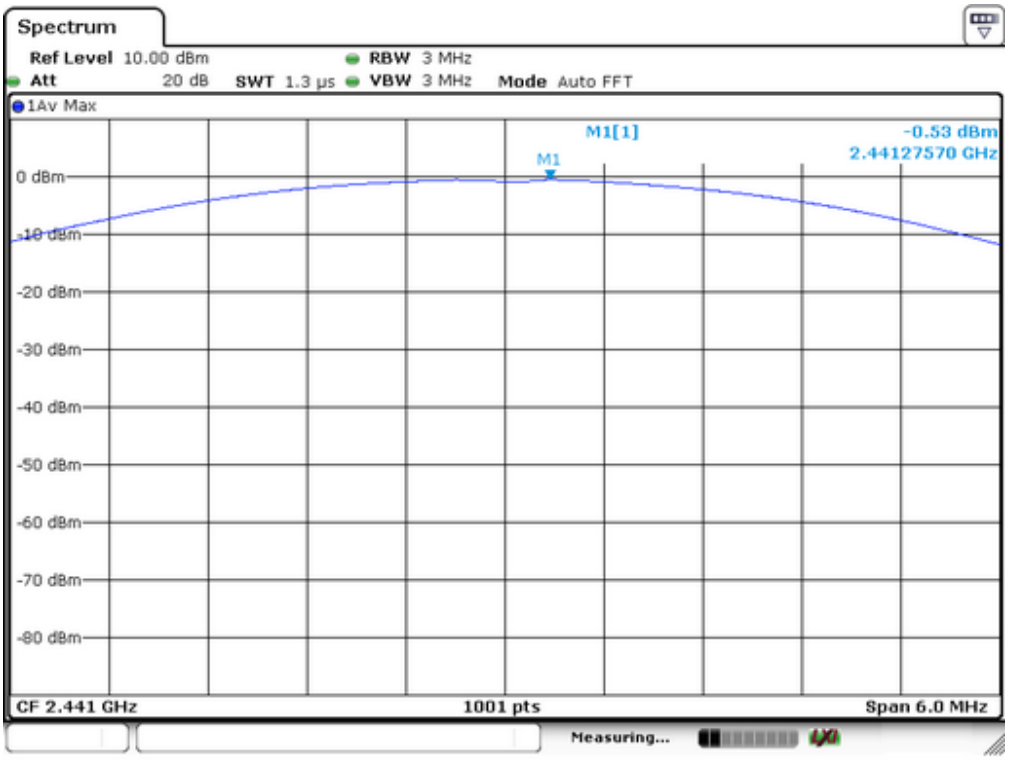

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
-0.68 dBm
2.44070030 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 6.0 MHz
Measuring...

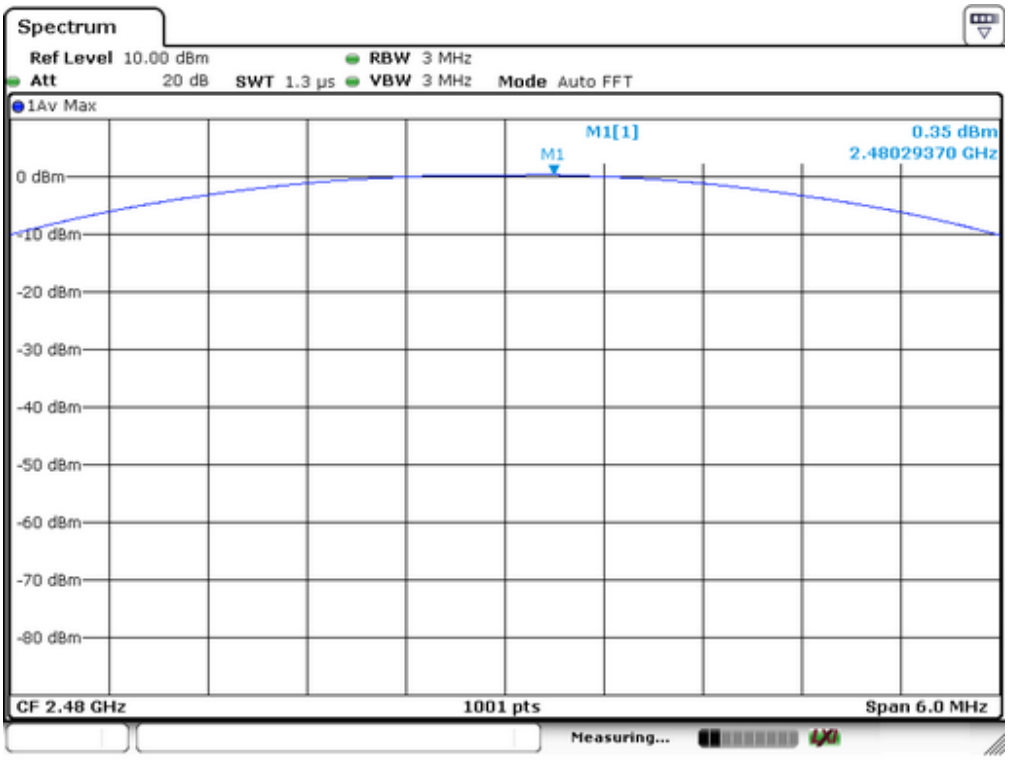

Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
0.27 dBm
2.47971830 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
1001 pts
Span 6.0 MHz
Measuring...

Spectrum Detector:	PK	Test Date :	March 30, 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	-2.54	0.557	125	PASS
40	2441	-0.53	0.885	125	PASS
79	2480	0.35	1.084	125	PASS




Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
-0.53 dBm
2.44127570 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
1001 pts
Span 6.0 MHz
Measuring...


Spectrum
Ref Level 10.00 dBm
RBW 3 MHz
Att 20 dB
SWT 1.3 µs
VBW 3 MHz
Mode Auto FFT
1Av Max
M1[1]
0.35 dBm
2.48029370 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
1001 pts
Span 6.0 MHz
Measuring...

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 turn 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:

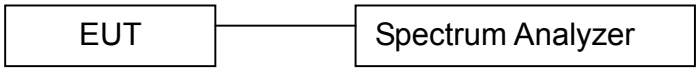
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

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

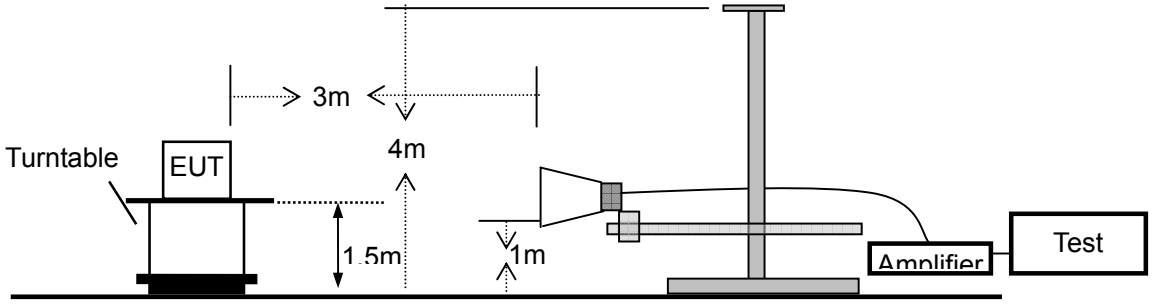
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

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 :	March 30, 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	-0.86	-43.99	43.13	>20dBc
2399.98	pi/4-DQPSK	-4.29	-50.7	46.41	>20dBc
2399.98	8DPSK	-4.17	-49.64	45.47	>20dBc
2483.98	GFSK	0.88	-59.36	60.24	>20dBc
2484.00	pi/4-DQPSK	-0.27	-54.15	53.88	>20dBc
2484.01	8DPSK	-0.22	-54.33	54.11	>20dBc

For Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2399.98	GFSK	0.12	-46.6	46.72	>20dBc
2399.98	pi/4-DQPSK	-2.95	-52.97	50.02	>20dBc
2399.99	8DPSK	-2.86	-53.32	50.46	>20dBc
2486.96	GFSK	0.86	-59.41	60.27	>20dBc
2483.51	pi/4-DQPSK	-0.3	-56.23	55.93	>20dBc
2484.31	8DPSK	-0.29	-55.84	55.55	>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
2398.459	H	65.33	44.38	74	54	-8.67	-9.62
2399.059	V	60.79	40.92	74	54	-13.21	-13.08
2483.956	H	66.03	45.13	74	54	-7.97	-8.87
2484.029	V	59.86	38.95	74	54	-14.14	-15.05

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
2399.489	H	65.72	46.38	74	54	-8.28	-7.62
2398.014	V	60.33	40.32	74	54	-13.67	-13.68
2483.896	H	66.92	45.19	74	54	-7.08	-8.81
2484.169	V	59.15	40.52	74	54	-14.85	-13.48

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.

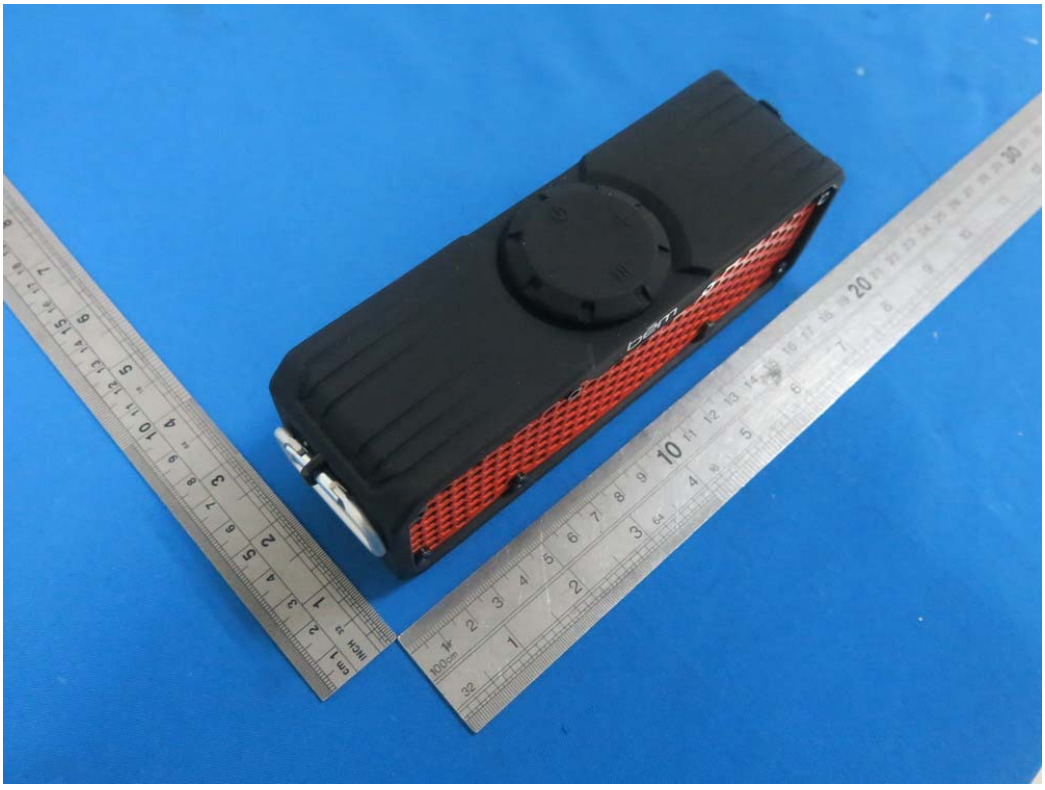
FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by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

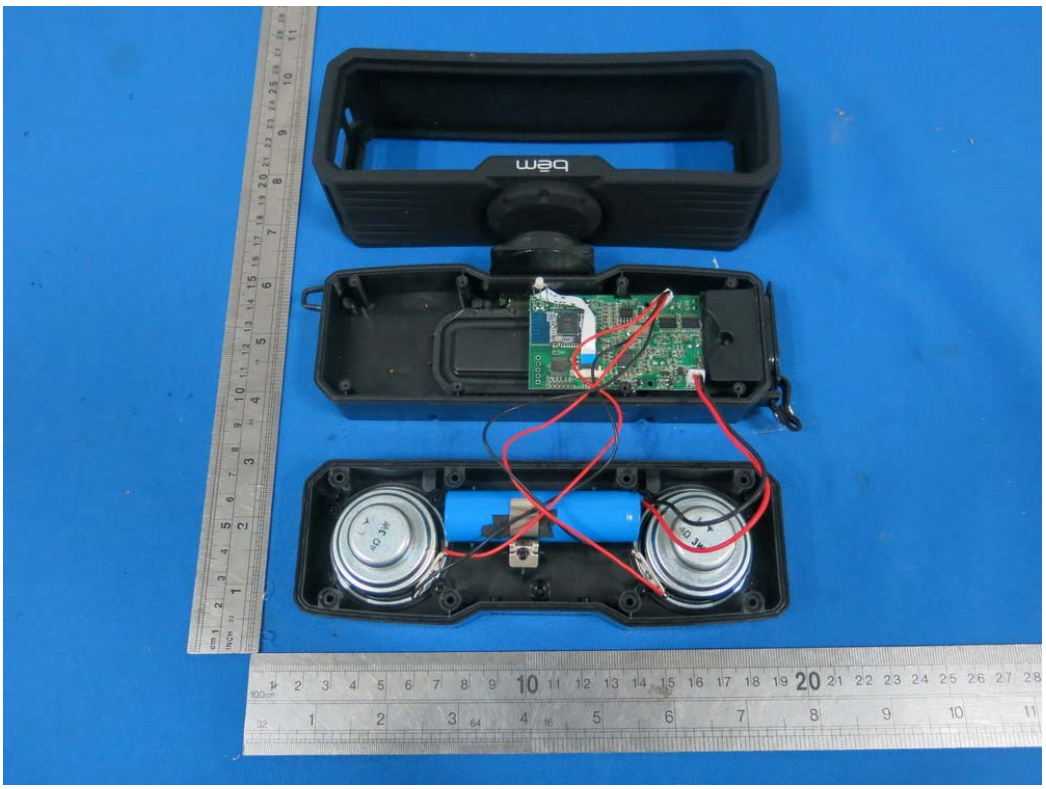
14.2 Result

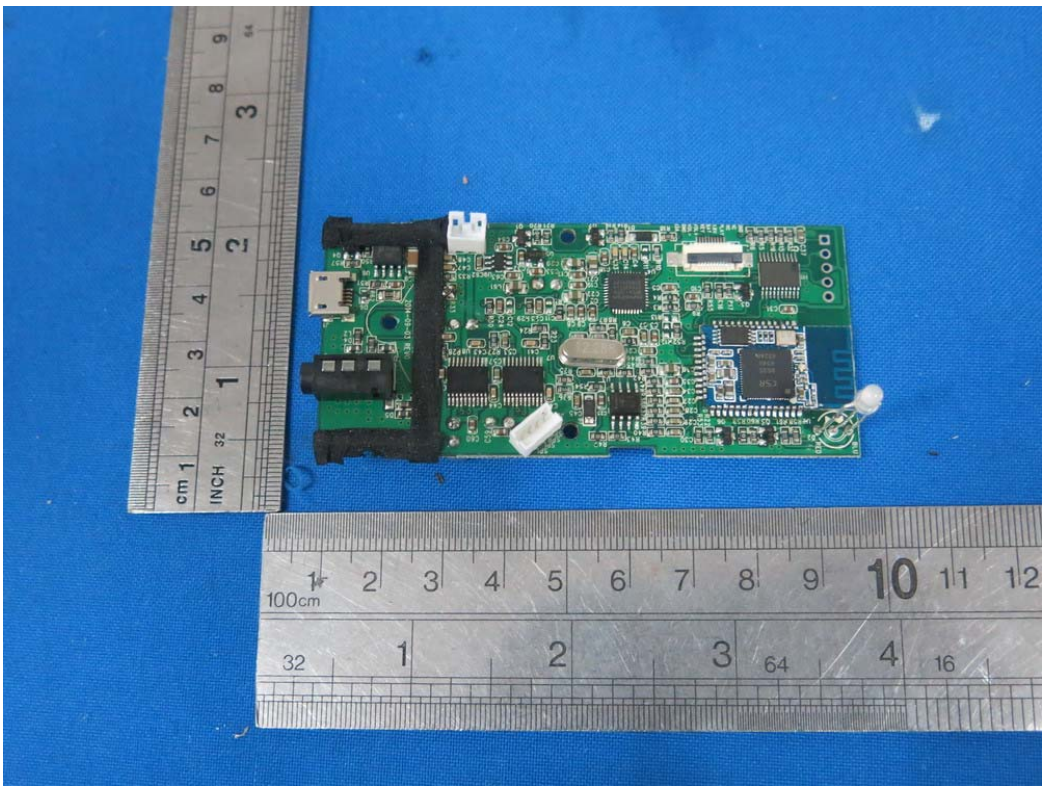
The EUT's antenna, permanent attached antenna, used a PCB antenna and integrated on PCB, The antenna's gain is 0 dBi and meets the requirement.

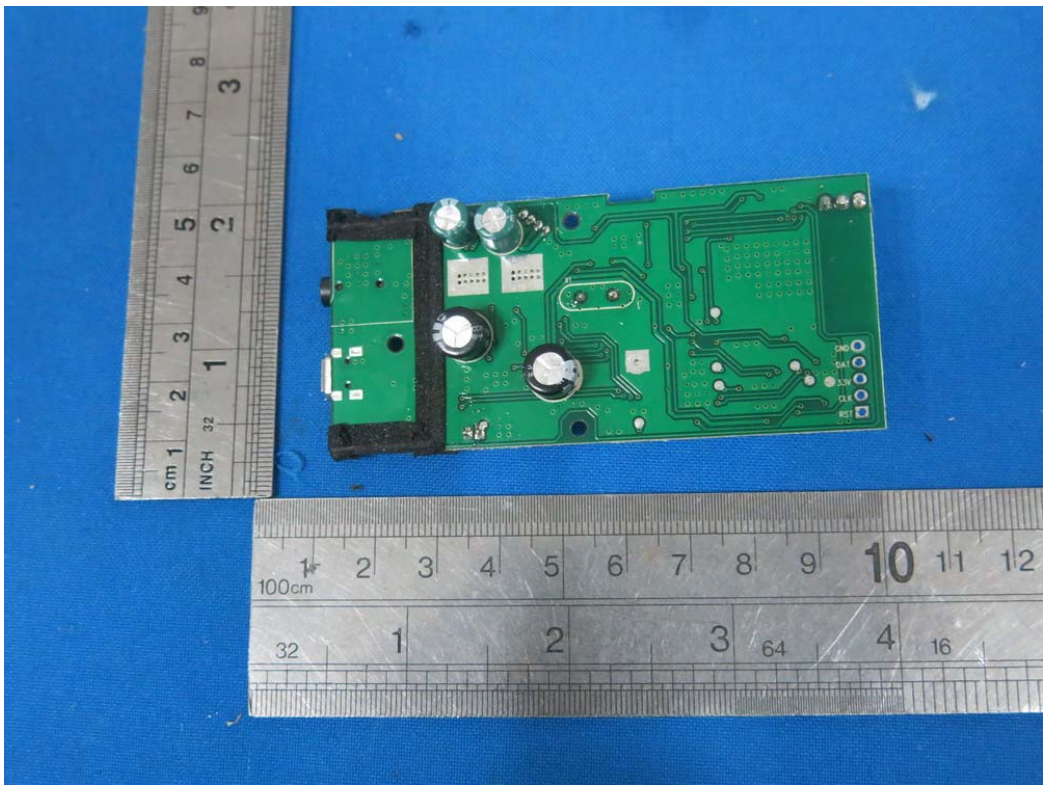
APPENDIX I
(Photos of EUT)


bem


bem






cm 1
INCH 32
100cm
10
32
64
16