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

OF

Mono Bluetooth Headset

Model No.: ERT-HMD-6154

Trade Mark: N/A

FCC ID: 2ACOXERTHMD45S

Report No.: KAD140617081E

Issue Date: July 09, 2014

Prepared for

EAST RISE TECHNOLOGY CO., LIMITED
ROOMS 2017-8 PARK-IN COMM CTR 56 DUNDAS ST MONGKOK KL
Hongkong China

Prepared by

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VERIFICATION OF COMPLIANCE

Applicant:	EAST RISE TECHNOLOGY CO., LIMITED ROOMS 2017-8 PARK-IN COMM CTR 56 DUNDAS ST MONGKOK KL Hongkong China
Manufacturer:	EAST RISE TECHNOLOGY CO., LIMITED ROOMS 2017-8 PARK-IN COMM CTR 56 DUNDAS ST MONGKOK KL Hongkong China
Product Description:	Mono Bluetooth Headset
Trade Mark:	N/A
Model Number:	ERT-HMD-6154
Kind of Device:	Bluetooth Ver. 3.0+EDR
File Number:	KAD140617081E
Date of Test:	June 17, 2014 to July 02, 2014

We hereby certify that:

The above equipment was tested by DONGGUAN EMTEK CO., LTD. and SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247(2013).

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	/	KAD140617081E

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Appendix I (Photos of EUT) (3 pages)

1. GENERAL INFORMATION

1.1 Product Description

The EAST RISE TECHNOLOGY CO., LIMITED, Model: ERT-HMD-6154 (referred to as the EUT in this report) The EUT is an short range, lower power, Mono Bluetooth Headset designed as an Input Device. 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). Modulation: GFSK, π/4-DQPSK, 8DPSK
C). Number of Channel: 79
D). Channel space: 1MHz
E). Rated RF Output Power: -0.91dBm(0.000811W)
F). Antenna Type: Internal PCB antenna
G). Antenna GAIN: 2.0dBi
H). Input Rating: DC 5V

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: 2ACOXERTHMD45S 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 (2009). Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab.	:	Accredited by FCC, Aug. 18, 2011 The Certificate Number is 247565. Accredited by Industry Canada, June 20, 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 C63.4-2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

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

2.4 Limitation

(1) Channel Separation test

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

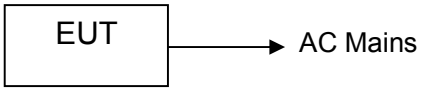


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Note
1.	Mono Bluetooth Headset	N/A	ERT-HMD-6154	2ACOXERTHMD45S	***EUT***
2	Adapter	/	YSV6-0501000	/	***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
§15.247(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
§15.207	AC Power Conducted Emission	Compliant
§15.247(d),§15.209	Radiated Emission	Compliant
§15.203	Antenna Requirement	Compliant
§1.1310	RF Exposure	Compliant

4. Description of test modes

The EUT (Mono Bluetooth Headset) has been tested under normal operating condition.
This EUT is a FHSS system, we use blue test to control the EUT with parallel port, Let EUT hopping on and transmit at every channel with highest power, Only output power use conducted method, others are using radiated method. After sirfdemo330R1 send the command to EUT, it can be removed, and the EUT keep hopping. 79 Channels are provided by EUT. The operating modes of the EUTs used for testing are described as follows:

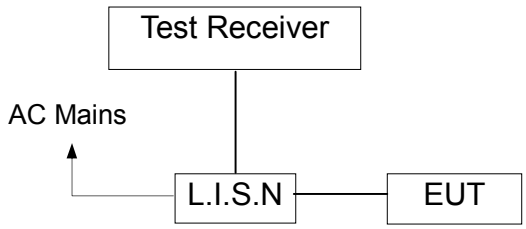
Op. Mode	Description of Operating Modes	Remarks
op-mode 1	The EUT transmits on 2402 MHz	Basic data rate 1 Mbps
op-mode 2	The EUT transmits on 2441 MHz	Basic data rate 1 Mbps
op-mode 3	The EUT transmits on 2480 MHz	Basic data rate 1 Mbps
op-mode 4	The EUT is in hopping mode	The EUT is hopping on 79 channels, Basic data rate 1Mbps
op-mode 6	The EUT transmits on 2402 MHz	Enhanced data rate 2 Mbps
op-mode 7	The EUT transmits on 2441 MHz	Enhanced data rate 2 Mbps
op-mode 8	The EUT transmits on 2480 MHz	Enhanced data rate 2 Mbps
op-mode 10	The EUT transmits on 2402 MHz	Enhanced data rate 3 Mbps
op-mode 11	The EUT transmits on 2441 MHz	Enhanced data rate 3 Mbps
op-mode 12	The EUT transmits on 2480 MHz	Enhanced data rate 3 Mbps

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)



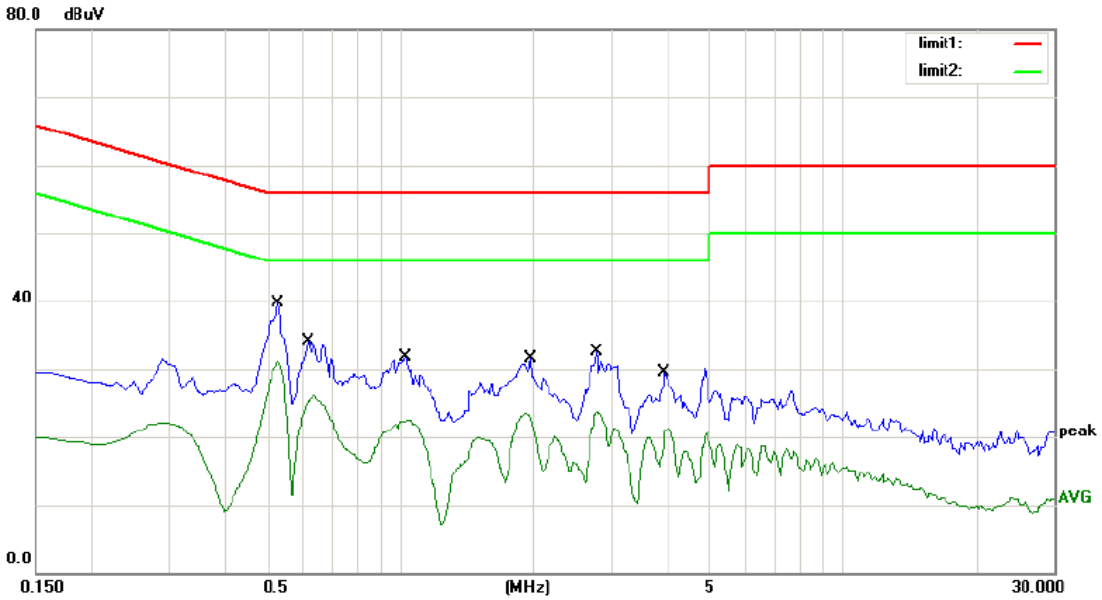
5.3 Measurement Equipment Used:

Conducted Emission Test Site # 4					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
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

5.4 Measurement Result:

Pass.

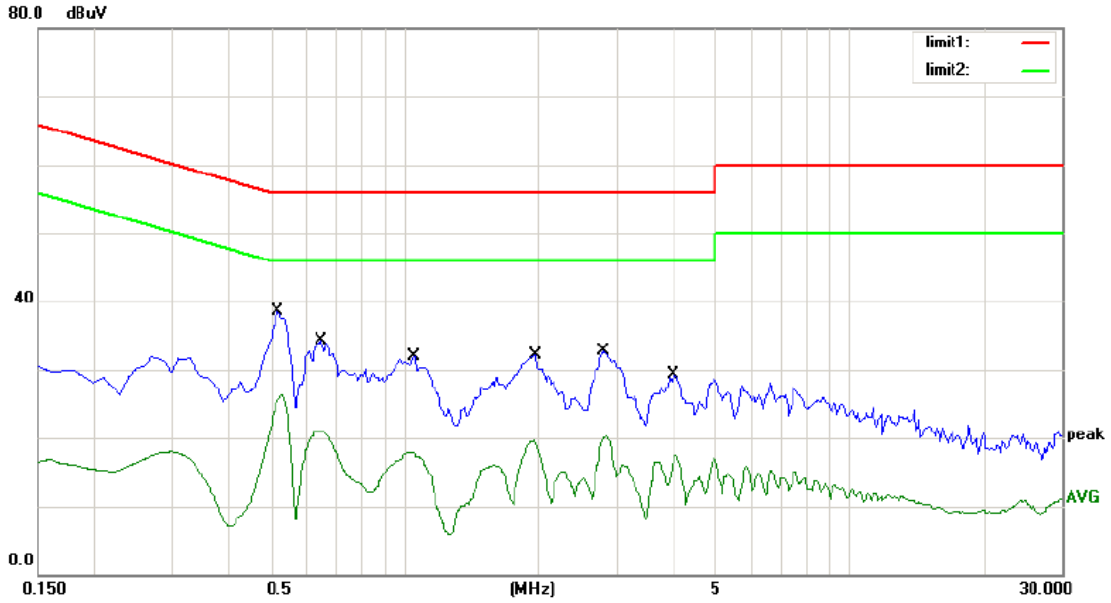
Please refer to the following data.



Site site #1 Phase: *L1* Temperature: 24
Limit: (CE)FCC PART 15 class C_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		0.5300	39.62	0.00	39.62	56.00	-16.38	QP	
2	*	0.5300	31.09	0.00	31.09	46.00	-14.91	AVG	
3		0.6200	34.10	0.00	34.10	56.00	-21.90	QP	
4		0.6200	26.06	0.00	26.06	46.00	-19.94	AVG	
5		1.0300	31.63	0.00	31.63	56.00	-24.37	QP	
6		1.0300	22.48	0.00	22.48	46.00	-23.52	AVG	
7		1.9800	31.52	0.00	31.52	56.00	-24.48	QP	
8		1.9800	23.59	0.00	23.59	46.00	-22.41	AVG	
9		2.7800	32.47	0.00	32.47	56.00	-23.53	QP	
10		2.7800	23.78	0.00	23.78	46.00	-22.22	AVG	
11		3.9600	29.45	0.00	29.45	56.00	-26.55	QP	
12		3.9600	21.31	0.00	21.31	46.00	-24.69	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 C_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	*	0.5200	38.44	0.00	38.44	56.00	-17.56	QP	
2		0.5200	26.39	0.00	26.39	46.00	-19.61	AVG	
3		0.6500	34.28	0.00	34.28	56.00	-21.72	QP	
4		0.6500	21.18	0.00	21.18	46.00	-24.82	AVG	
5		1.0500	31.95	0.00	31.95	56.00	-24.05	QP	
6		1.0500	17.90	0.00	17.90	46.00	-28.10	AVG	
7		1.9700	32.13	0.00	32.13	56.00	-23.87	QP	
8		1.9700	19.65	0.00	19.65	46.00	-26.35	AVG	
9		2.8200	32.67	0.00	32.67	56.00	-23.33	QP	
10		2.8200	20.34	0.00	20.34	46.00	-25.66	AVG	
11		4.0200	29.27	0.00	29.27	56.00	-26.73	QP	
12		4.0200	17.45	0.00	17.45	46.00	-28.55	AVG	

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

5.5 Conducted Measurement Photos:

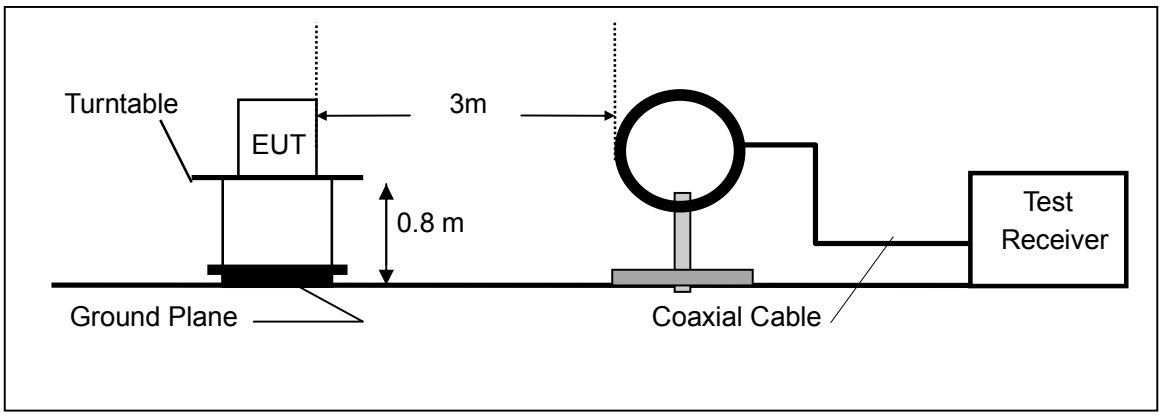
6. Radiated Emission Test

6.1 Measurement Procedure

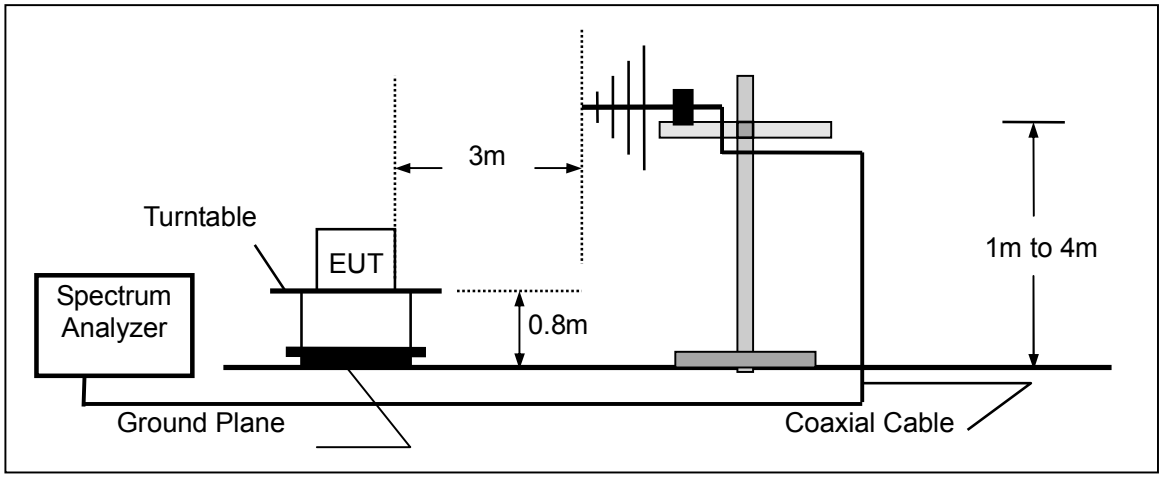
1 The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.
5. For range 9KHz~30MHz, The measured value is really too low to be recorded.

6.2 Test SET-UP (Block Diagram of Configuration)

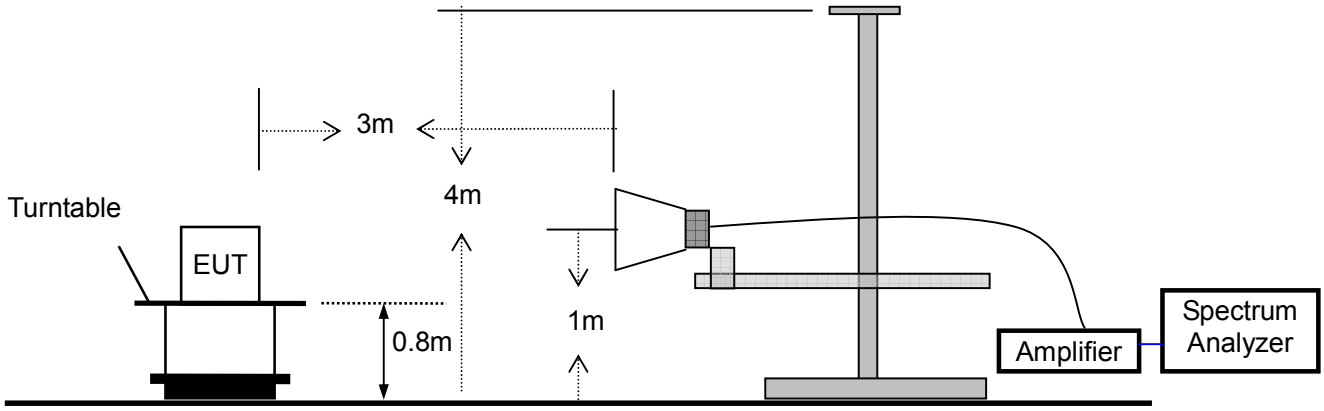
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(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.
Spectrum Analyzer	Rohde & Schwarz	FSP7	839511/010	05/16/2014	05/15/2015
Spectrum Analyzer	HP	E4407B	839840481	05/16/2014	05/15/2015
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	05/19/2014	05/18/2015
Loop Antenna	Schwarzbeck	FMZB 1519	012	05/19/2014	05/18/2015
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/19/2014	05/18/2015
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4446A	US44300399	05/16/2014	05/15/2015

6.4 Measurement Result

Operation Mode:	TX Mode (CH1: 2402MHz)	Test Date :	June 20, 2014
Frequency Range:	30~1000MHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Margin (dB)	Note
30.0000	V	22.35	40.00	-17.65	PK
35.8200	V	32.05	40.00	-7.95	PK
38.7300	V	23.25	40.00	-16.75	PK
47.4600	V	19.14	40.00	-20.86	PK
52.3100	V	19.60	40.00	-20.40	PK
61.0400	V	21.87	40.00	-18.13	PK
30.0000	H	14.35	40.00	-25.65	PK
36.7900	H	17.15	40.00	-22.85	PK
39.7000	H	18.05	40.00	-21.95	PK
43.5800	H	14.97	40.00	-25.03	PK
122.1500	H	20.24	43.50	-23.26	PK
132.8200	H	18.20	43.50	-25.30	PK

Note: (1) All Readings are Peak Value.
(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 was recorded.

Operation Mode:	TX Mode (CH40: 2441MHz)	Test Date :	June 20, 2014
Frequency Range:	30~1000MHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

‘

Freq. (MHz)	Ant. Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Margin (dB)	Note
30.5600	V	20.34	40.00	-19.66	PK
35.1200	V	31.67	40.00	-8.33	PK
38.5600	V	23.28	40.00	-16.72	PK
42.4700	V	19.67	40.00	-20.33	PK
55.4500	V	20.22	40.00	-19.78	PK
68.2400	V	21.78	40.00	-18.22	PK
32.6700	H	17.38	40.00	-22.62	PK
36.3700	H	18.20	40.00	-21.8	PK
39.6800	H	23.95	40.00	-16.05	PK
48.3100	H	15.56	40.00	-24.44	PK
128.8700	H	22.22	43.50	-21.28	PK
132.8900	H	18.78	43.50	-24.72	PK

Note: (1) All Readings are Peak Value.
(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 was recorded.

Operation Mode:	TX Mode (CH79: 2480MHz)	Test Date :	June 20, 2014
Frequency Range:	30~1000MHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Margin (dB)	Note
31.4500	V	27.45	40.00	-12.55	PK
38.4100	V	29.05	40.00	-10.95	PK
40.6300	V	24.25	40.00	-15.75	PK
46.3400	V	20.14	40.00	-19.86	PK
53.1100	V	19.56	40.00	-20.44	PK
61.5600	V	21.81	40.00	-18.19	PK
31.1000	H	14.35	40.00	-25.65	PK
39.6600	H	17.65	40.00	-22.35	PK
41.5600	H	18.04	40.00	-21.96	PK
49.1800	H	14.67	40.00	-25.33	PK
120.5600	H	20.45	43.50	-23.05	PK
131.4200	H	18.67	43.50	-24.83	PK

Note: (1) All Readings are Peak Value.
(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 was recorded.

Operation Mode:	TX Mode (CH1: 2402MHz)	Test Date :	June 20, 2014
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
2402	V	67.18	48.22	74	54	-6.82	-5.78
4804	V	66.24	47.15	74	54	-7.76	-6.85
7206	V	65.07	46.85	74	54	-8.93	-7.15
9608	V	64.85	45.22	74	54	-9.15	-8.78
12010	V	63.25	44.85	74	54	-10.75	-9.15
2402	H	66.17	47.18	74	54	-7.83	-6.82
4804	H	65.95	46.28	74	54	-8.05	-7.72
7206	H	64.22	45.25	74	54	-9.78	-8.75
9608	H	63.18	44.15	74	54	-10.82	-9.85
12010	H	60.28	43.28	74	54	-13.72	-10.72

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 was recorded.
(5) These test result outsourced to SHENZHEN EMTEK CO., LTD.

Operation Mode:	TX Mode (CH40: 2441MHz)	Test Date :	June 20, 2014
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
2441	V	64.47	47.52	74	54	-9.53	-6.48
4882	V	63.22	46.55	74	54	-10.78	-7.45
7323	V	62.85	45.92	74	54	-11.15	-8.08
9764	V	61.27	44.12	74	54	-12.73	-9.88
12205	V	60.74	43.28	74	54	-13.26	-10.72
2441	H	65.28	46.52	74	54	-8.72	-7.48
4882	H	64.22	45.17	74	54	-9.78	-8.83
7323	H	63.85	44.22	74	54	-10.15	-9.78
9764	H	62.48	43.95	74	54	-11.52	-10.05
12205	H	61.28	42.12	74	54	-12.72	-11.88

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 was recorded.
(5) These test result outsourced to SHENZHEN EMTEK CO., LTD.

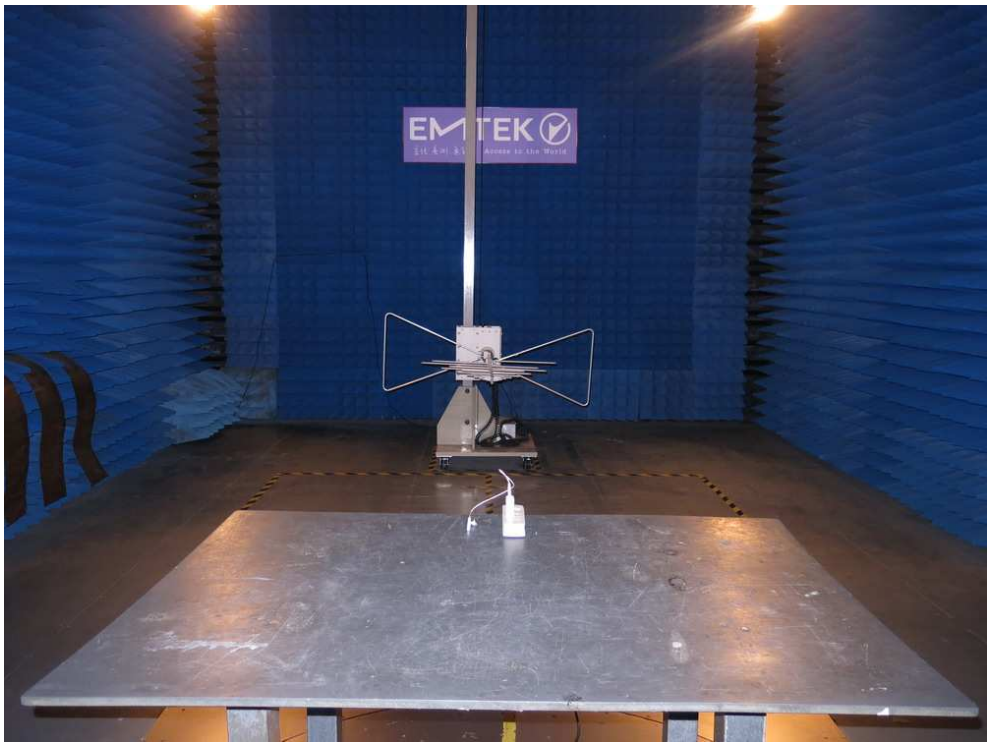
Operation Mode:	TX Mode (CH79: 2480MHz)	Test Date :	June 20, 2014
Frequency Range:	1-25GHz	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant. Pol. H/V	Emission Level(dBuV/m		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
2480	V	65.42	46.22	74	54	-8.58	-7.78
4960	V	64.85	45.95	74	54	-9.15	-8.05
7440	V	63.15	44.12	74	54	-10.85	-9.88
9920	V	62.85	43.28	74	54	-11.15	-10.72
12400	V	61.22	42.46	74	54	-12.78	-11.54
2480	H	66.95	45.12	74	54	-7.05	-8.88
4960	H	65.12	44.22	74	54	-8.88	-9.78
7440	H	64.22	43.95	74	54	-9.78	-10.05
9920	H	63.17	42.25	74	54	-10.83	-11.75
12400	H	62.75	41.85	74	54	-11.25	-12.15

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 was recorded.
(5) These test result outsourced to SHENZHEN EMTEK CO., LTD.

6.5 Radiated Measurement Photos:

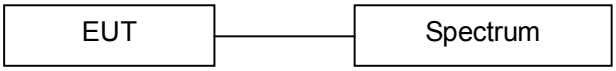


7. Channel Separation test

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:

Same as 6.3 Radiated Emission Measurement.

7.4 Measurement Results:

Refer to attached data chart.

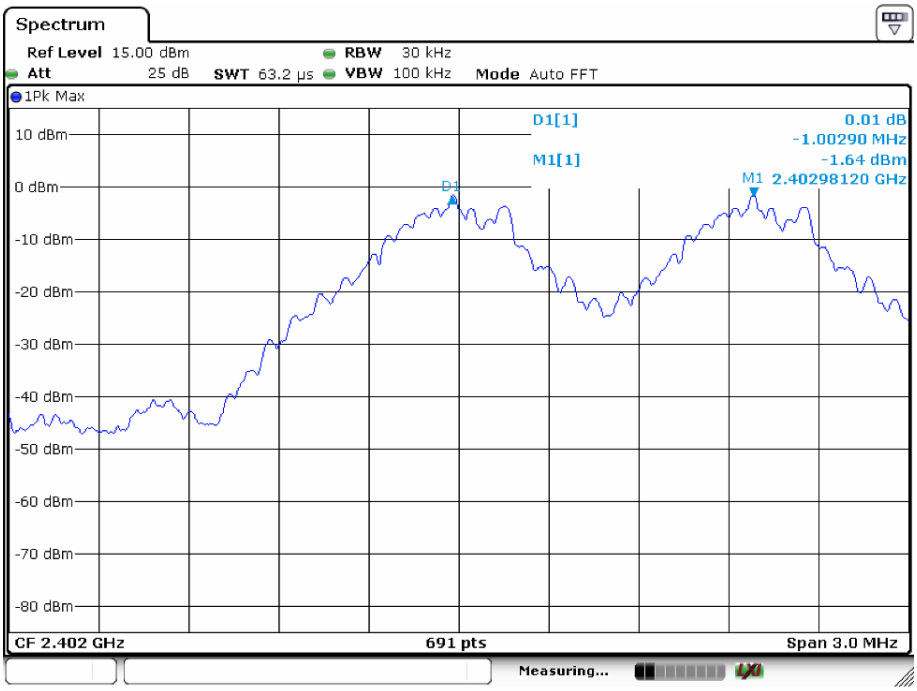
Spectrum Detector:	PK	Test Date :	June 20, 2014
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

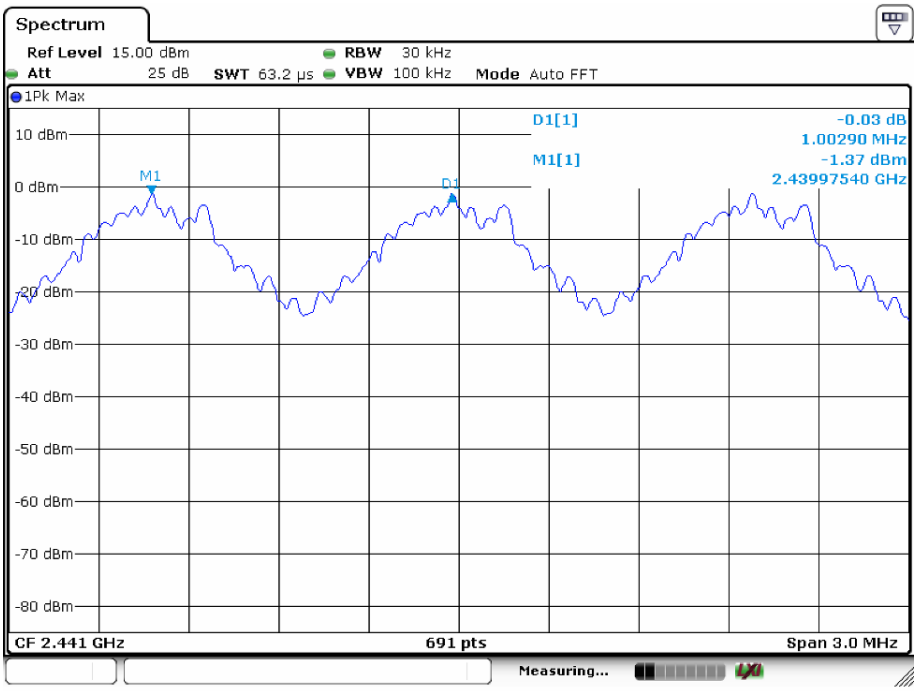
Channel frequency (MHz)	Separation Read Value (KHz)	Separation Limit (KHz)	Data Rate
2402	1002	>816	1Mbps
2441	1002	>820	1Mbps
2480	1002	>824	1Mbps
2402	1002	>830	2Mbps
2441	1002	>827	2Mbps
2480	1002	>827	2Mbps
2402	1002	>810	3Mbps
2441	1002	>836	3Mbps
2480	1002	>836	3Mbps

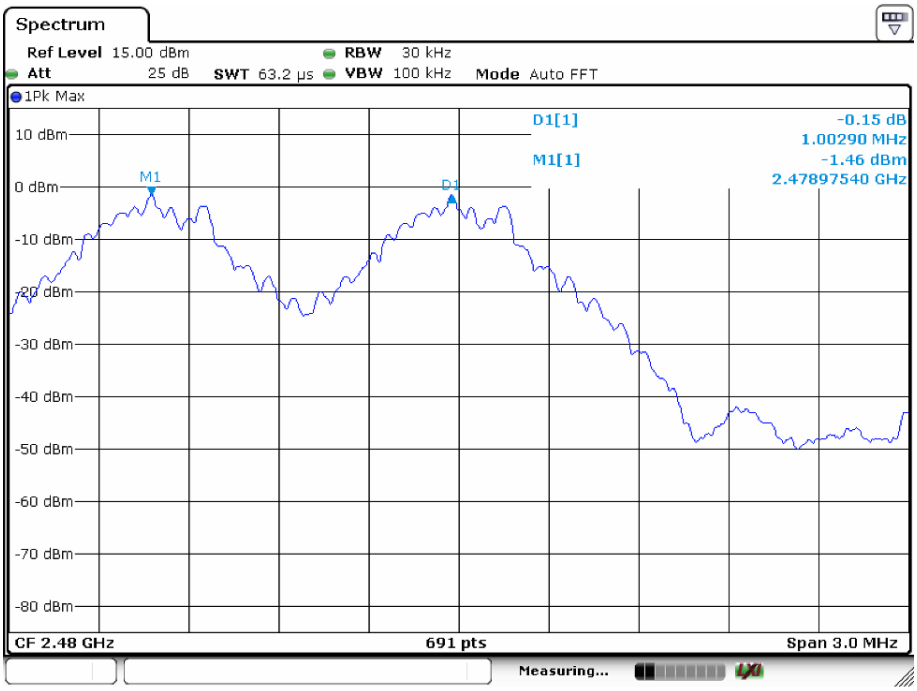
Remark:

1. The limit of data rates 2Mbps and 3Mbps is 2/3 of 20dB BW;

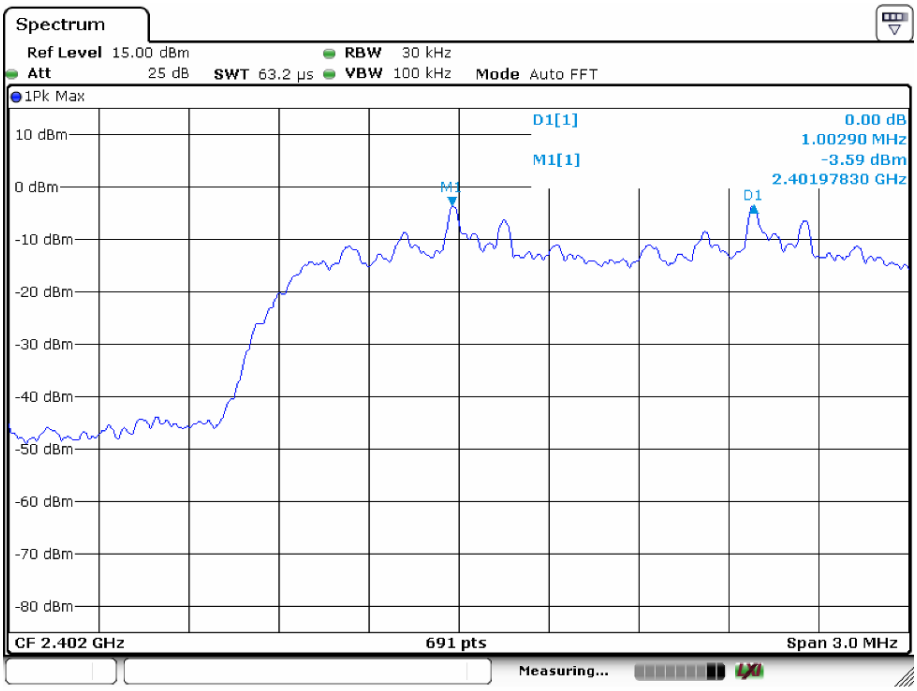
1Mbps:

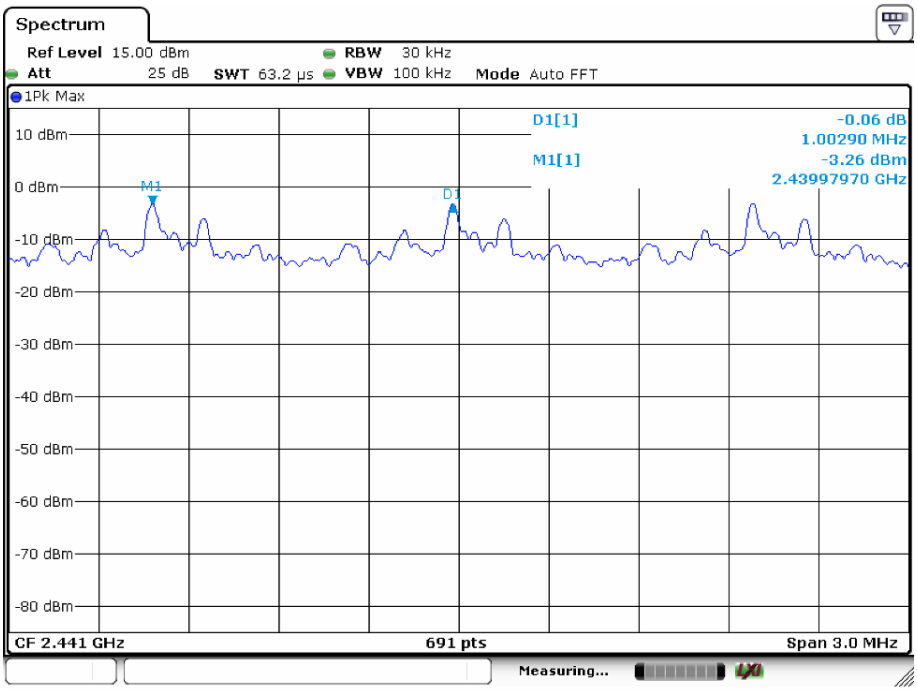

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
0.01 dB
-1.00290 MHz
M1[1]
-1.64 dBm
M1 2.40298120 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
691 pts
Span 3.0 MHz
Measuring...

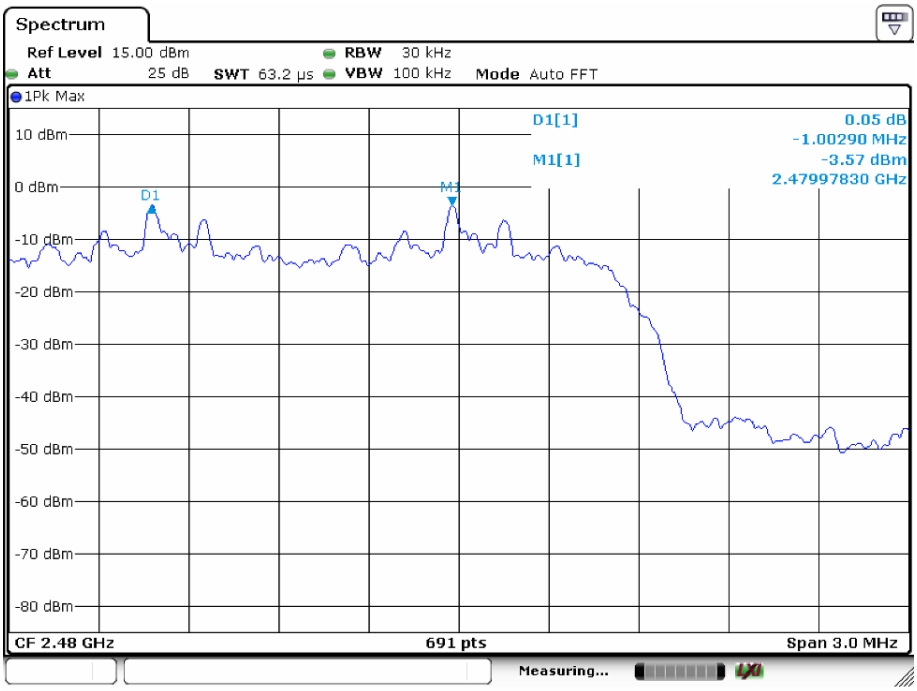

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.03 dB
1.00290 MHz
M1[1]
-1.37 dBm
2.43997540 GHz
M1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
691 pts
Span 3.0 MHz
Measuring...


Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.15 dB
1.00290 MHz
M1[1]
-1.46 dBm
2.47897540 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
691 pts
Span 3.0 MHz
Measuring...

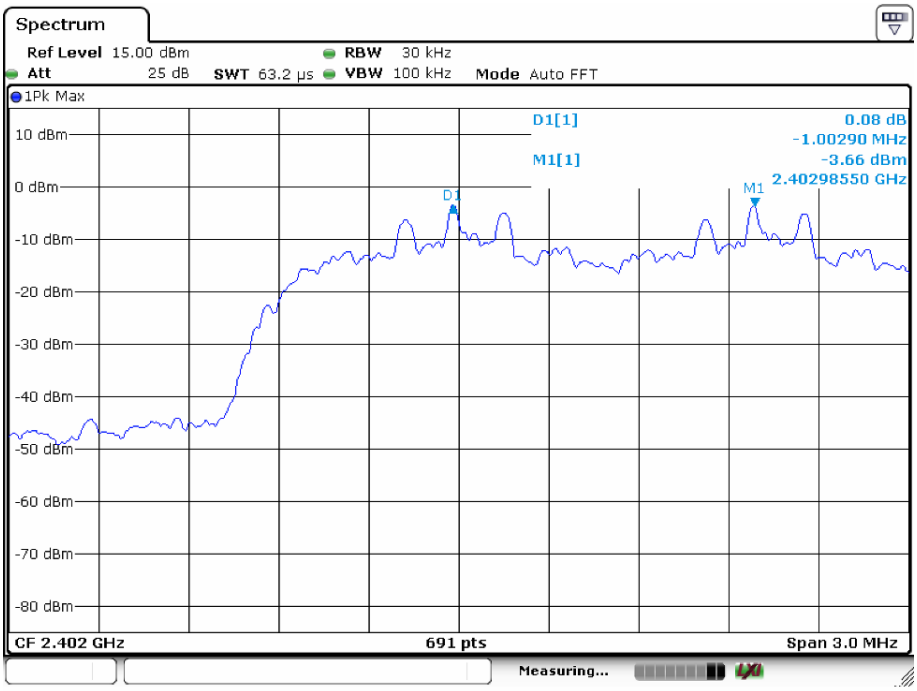
2Mbps:

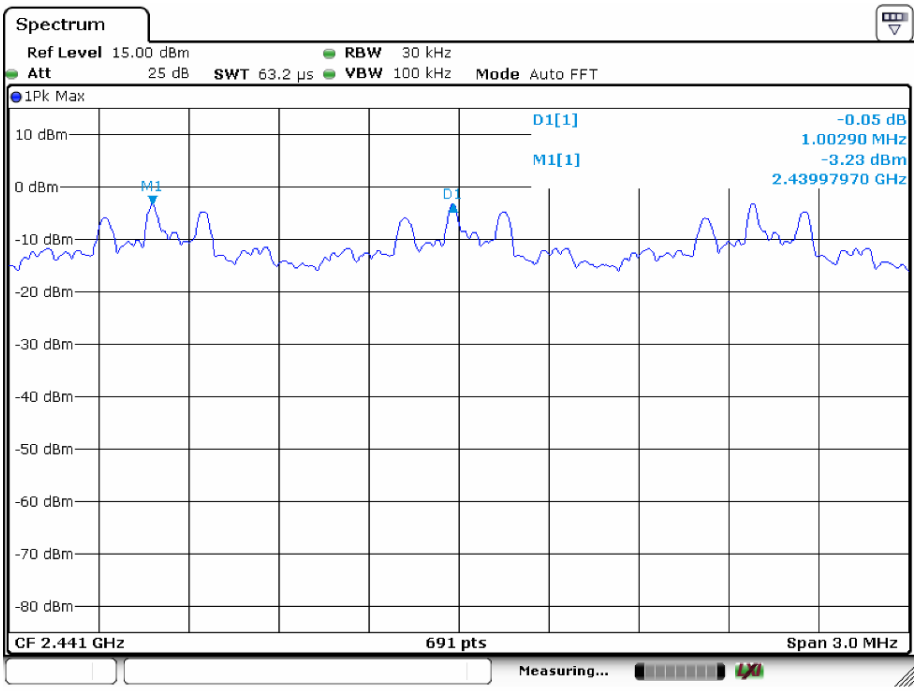

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
0.00 dB
1.00290 MHz
M1[1]
-3.59 dBm
2.40197830 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
691 pts
Span 3.0 MHz
Measuring...

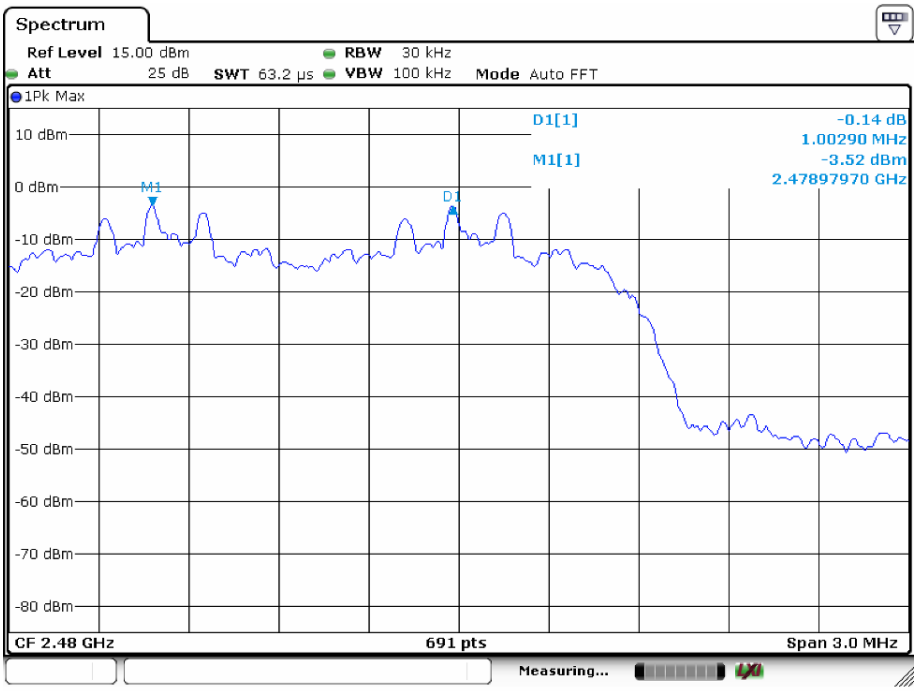

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.06 dB
1.00290 MHz
M1[1]
-3.26 dBm
2.43997970 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
D1
CF 2.441 GHz
691 pts
Span 3.0 MHz
Measuring...


Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
0.05 dB
-1.00290 MHz
M1[1]
-3.57 dBm
2.47997830 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1
M1
CF 2.48 GHz
691 pts
Span 3.0 MHz
Measuring...

3Mbps:


Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
0.08 dB
-1.00290 MHz
M1[1]
-3.66 dBm
2.40298550 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.402 GHz
691 pts
Span 3.0 MHz
Measuring...


Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.05 dB
1.00290 MHz
M1[1]
-3.23 dBm
2.43997970 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.441 GHz
691 pts
Span 3.0 MHz
Measuring...

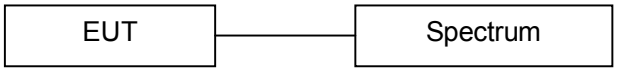

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
D1[1]
-0.14 dB
1.00290 MHz
M1[1]
-3.52 dBm
2.47897970 GHz
M1
D1
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
691 pts
Span 3.0 MHz
Measuring...

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:

Same as 6.3 Radiated Emission Measurement.

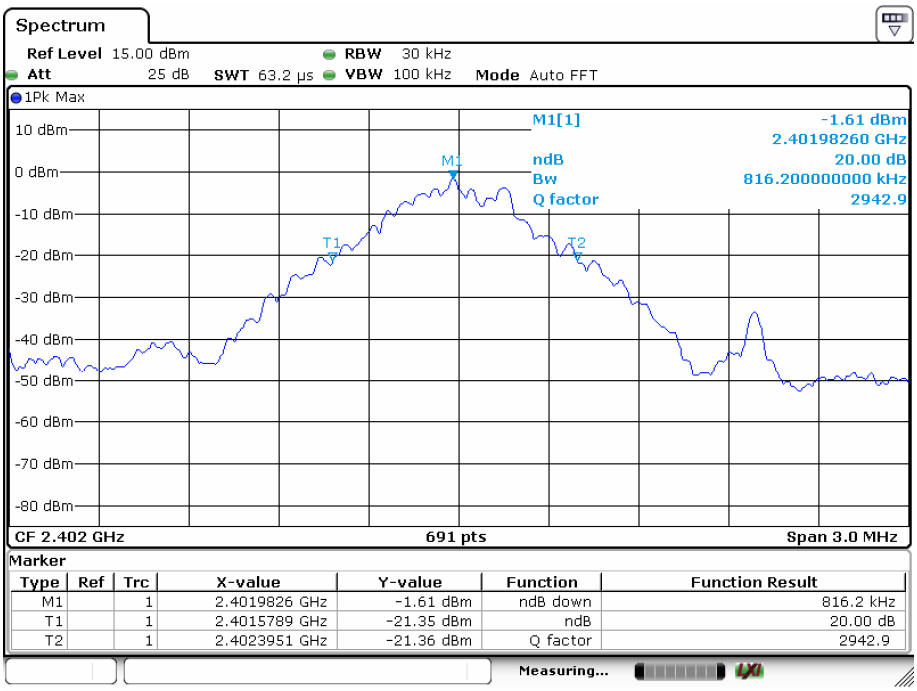
8.4 Measurement Results:

Refer to attached data chart.

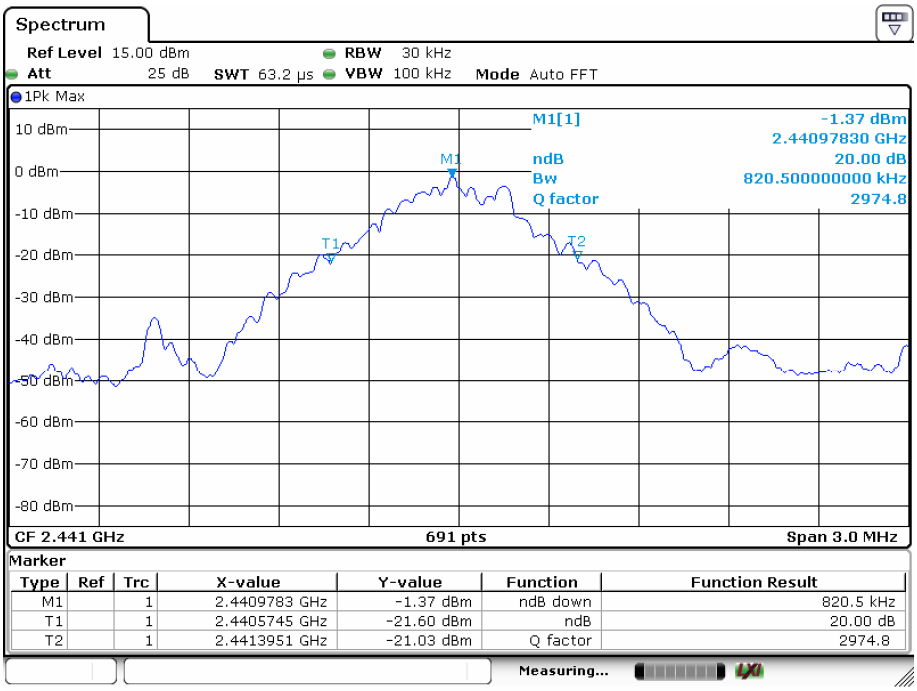
Spectrum Detector:	PK	Test Date :	June 20, 2014
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

Operating Mode	Channel frequency (MHz)	20dB Down BW(kHz)
op-mode 1	2402	816
op-mode 2	2441	820
op-mode 3	2480	824
op-mode 5	2402	1246
op-mode 6	2441	1241
op-mode 7	2480	1241
op-mode 10	2402	1215
op-mode 11	2441	1254
op-mode 12	2480	1254

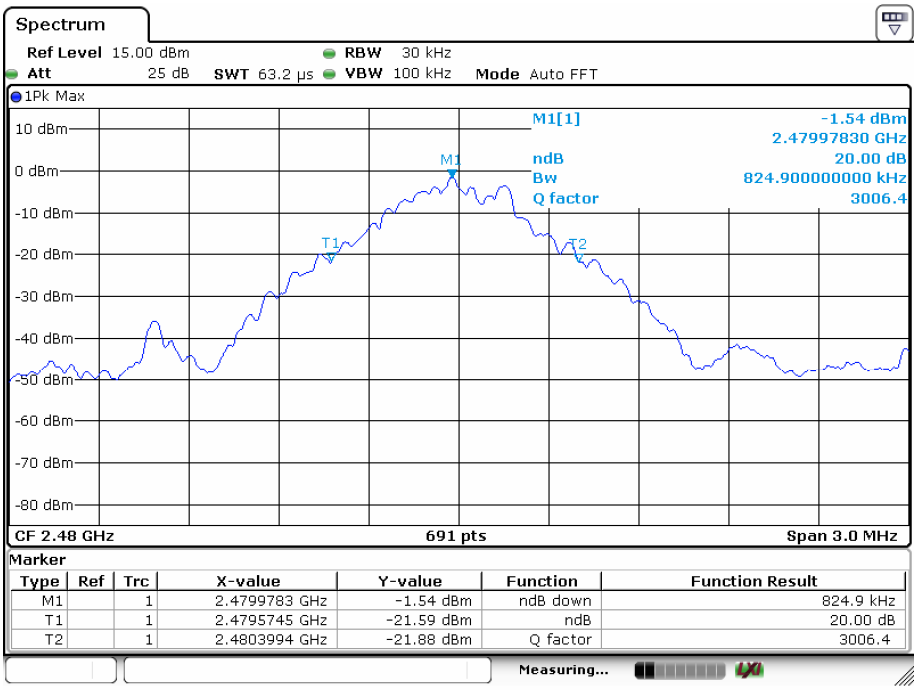
op-mode 1:



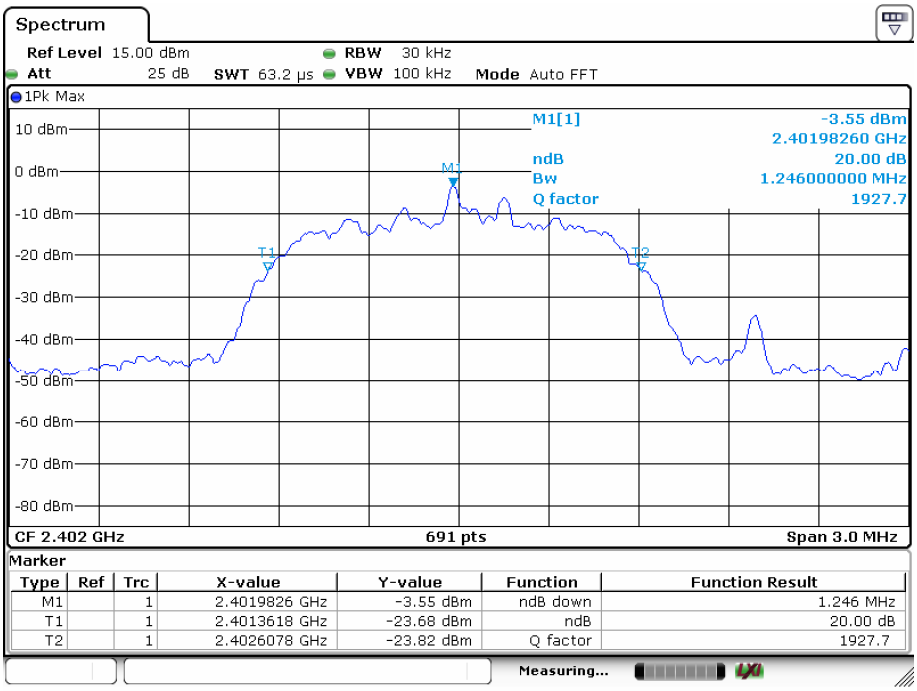
op-mode 2:



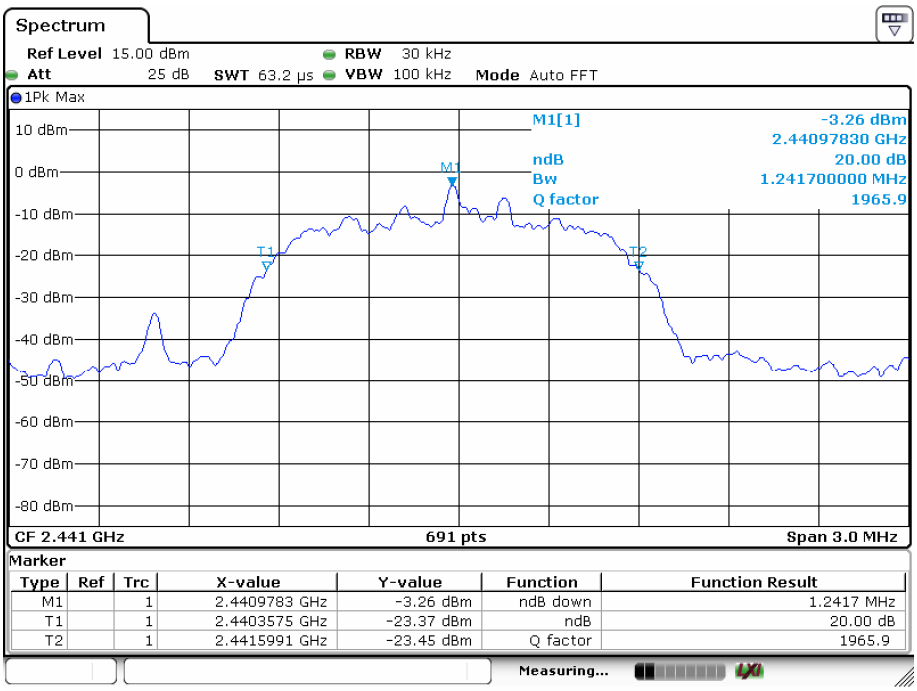
op-mode 3:



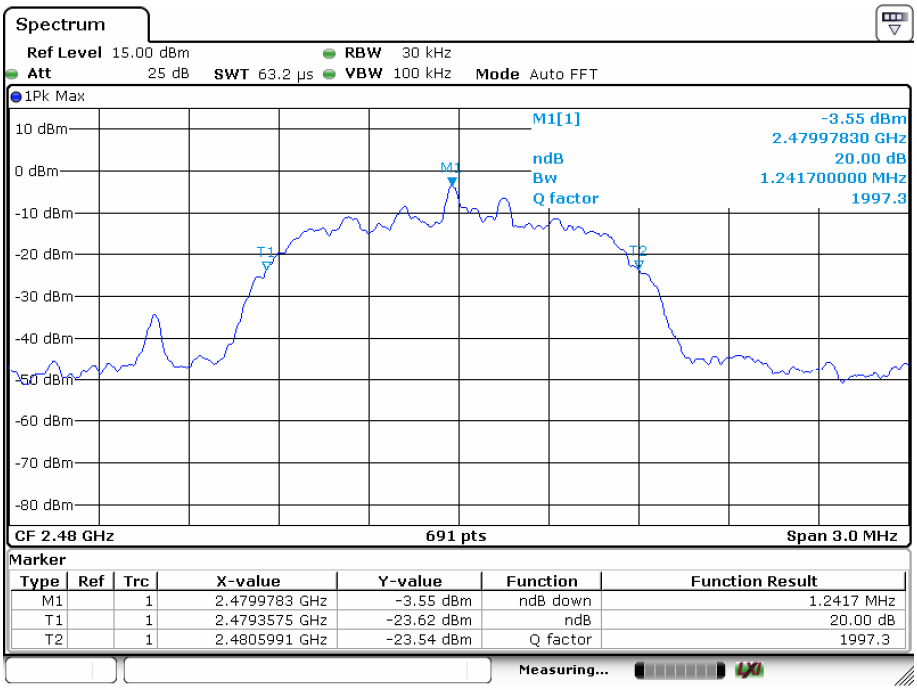
op-mode 5:



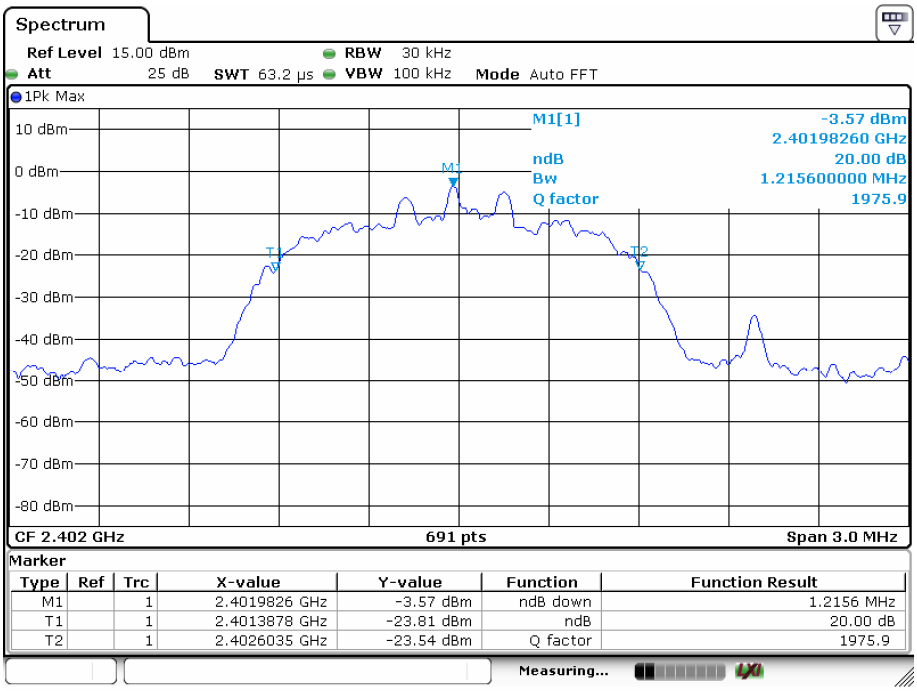
op-mode 6:



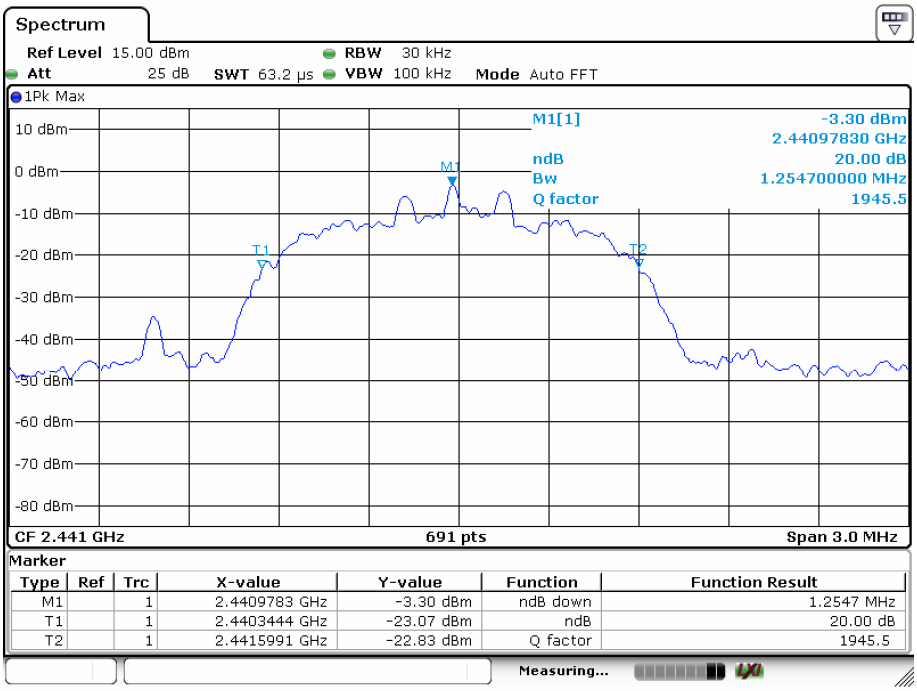
op-mode 7:



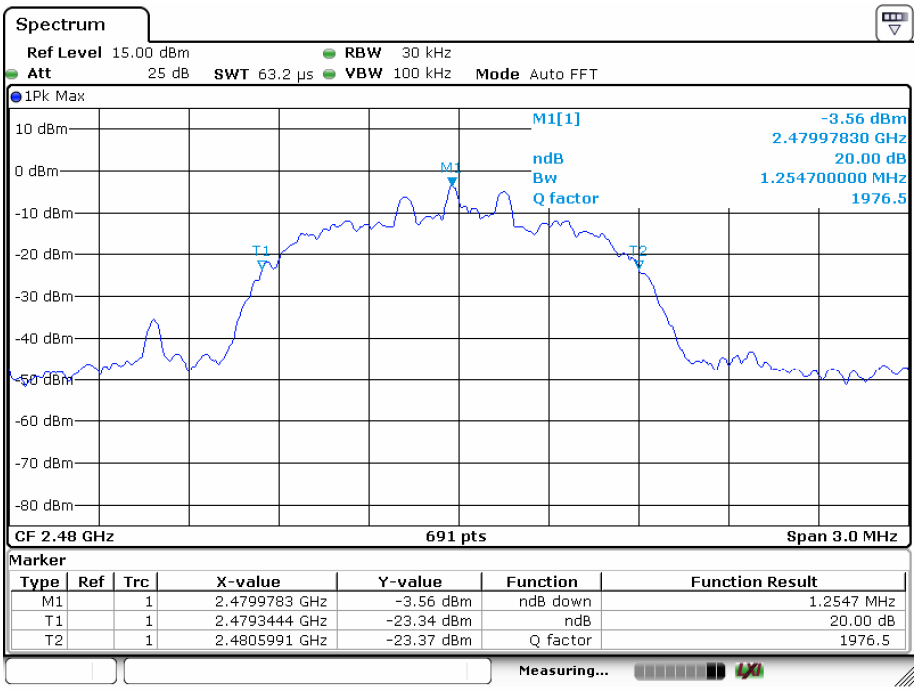
op-mode 10



op-mode 11



op-mode 12

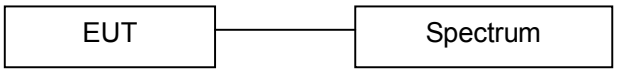

Spectrum
Ref Level 15.00 dBm
RBW 30 kHz
Att 25 dB
SWT 63.2 µs
VBW 100 kHz
Mode Auto FFT
1Pk Max
M1[1]
-3.56 dBm
2.47997830 GHz
ndB
20.00 dB
Bw
1.254700000 MHz
Q factor
1976.5
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
T1
T2
CF 2.48 GHz
691 pts
Span 3.0 MHz
Marker
Type | Ref | Trc | X-value | Y-value | Function | Function Result
M1 | | 1 | 2.4799783 GHz | -3.56 dBm | ndB down | 1.2547 MHz
T1 | | 1 | 2.4793444 GHz | -23.34 dBm | ndB | 20.00 dB
T2 | | 1 | 2.4805991 GHz | -23.37 dBm | Q factor | 1976.5
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)



9.3 Measurement Equipment Used:

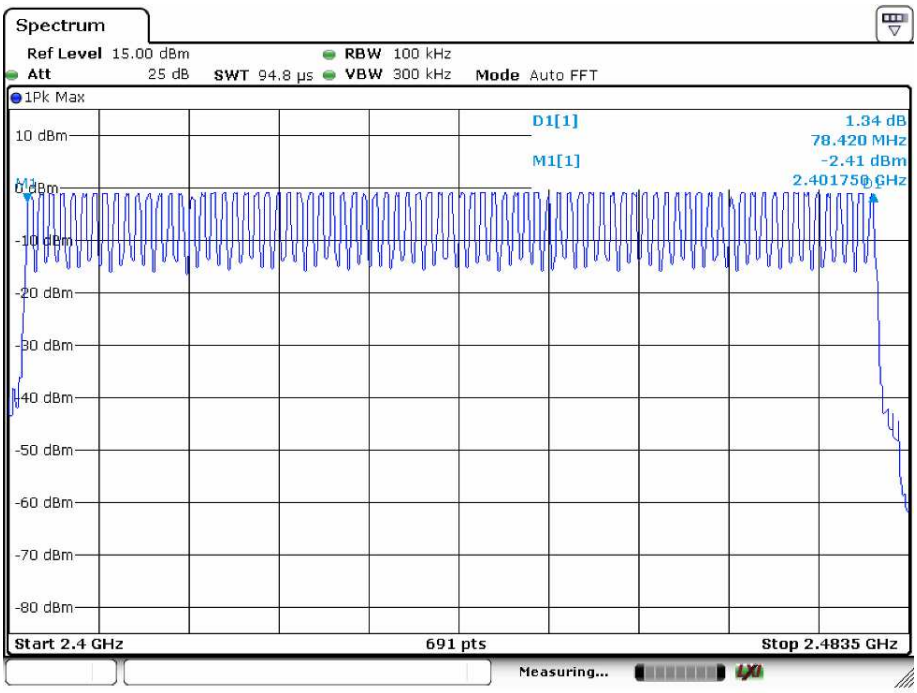
Same as 6.3 Radiated Emission Measurement.

9.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	June 20, 2014
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

Operating Mode	Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel
op-mode 4	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 Protocol

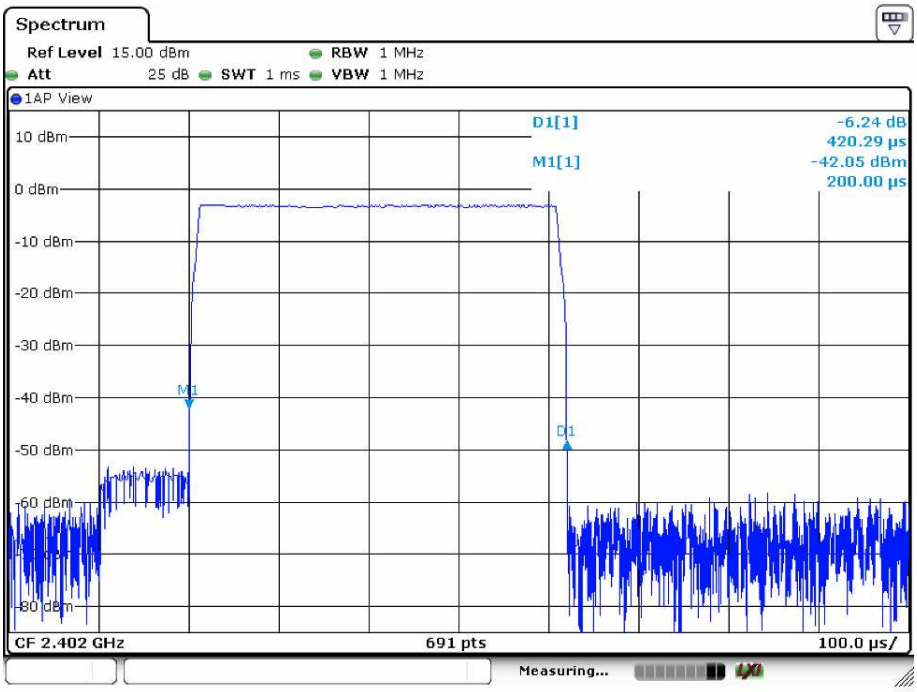
Packet type	Time slot length(ms)	Dwell time	Dwell time(ms)
DH1	0.420	time slot length *1600/2 /79 * 31.6	134.40
DH3	1.678	time slot length *1600/4 /79 * 31.6	268.48
DH5	2.924	time slot length *1600/6 /79 * 31.6	311.89

Remark: The results of worst cased was recorded.
.

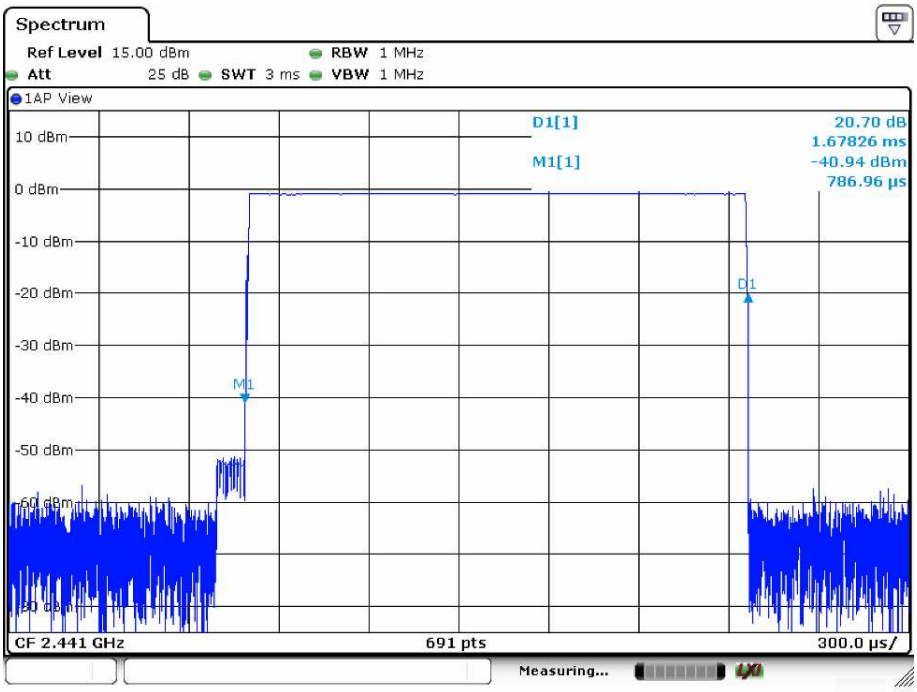
10.4 Test result: Dwell time

PASS.

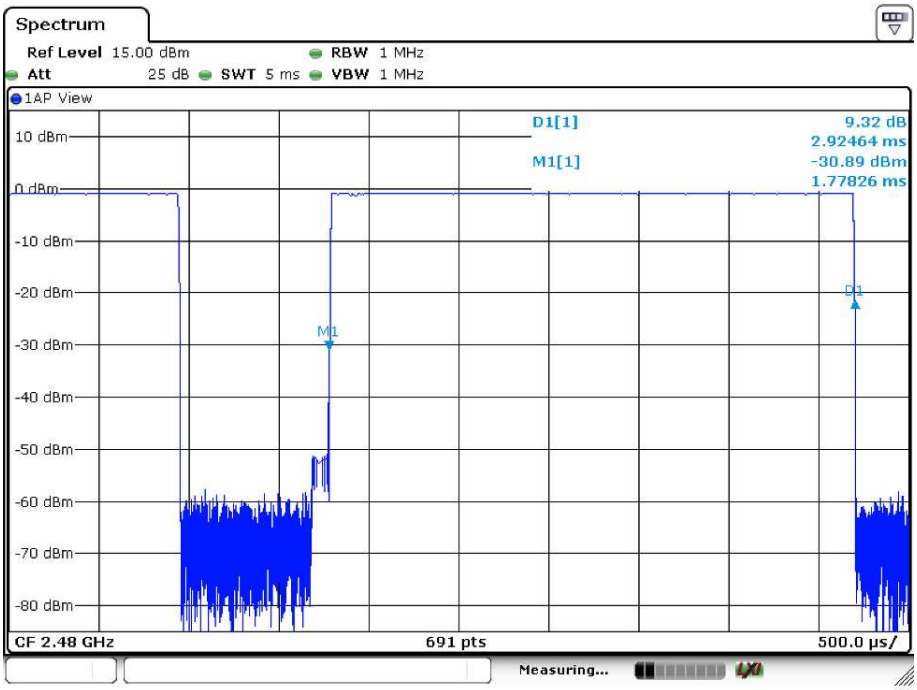
DH1:


Spectrum
Ref Level 15.00 dBm
RBW 1 MHz
Att 25 dB
SWT 1 ms
VBW 1 MHz
1AP View
D1[1]
-6.24 dB
420.29 µs
M1[1]
-42.05 dBm
200.00 µs
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
M1
D1
CF 2.402 GHz
691 pts
100.0 µs/
Measuring...

DH3:


Spectrum
Ref Level 15.00 dBm
RBW 1 MHz
Att 25 dB
SWT 3 ms
VBW 1 MHz
1AP View
D1[1]
20.70 dB
1.67826 ms
M1[1]
-40.94 dBm
786.96 µs
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-80 dBm
M1
D1
CF 2.441 GHz
691 pts
300.0 µs/
Measuring...

DH5:


Spectrum
Ref Level 15.00 dBm
RBW 1 MHz
Att 25 dB
SWT 5 ms
VBW 1 MHz
1AP View
D1[1]
9.32 dB
2.92464 ms
M1[1]
-30.89 dBm
1.77826 ms
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
M1
D1
CF 2.48 GHz
691 pts
500.0 µs/
Measuring...

11. M AX IMUM 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.

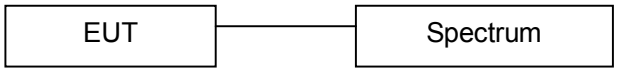
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

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

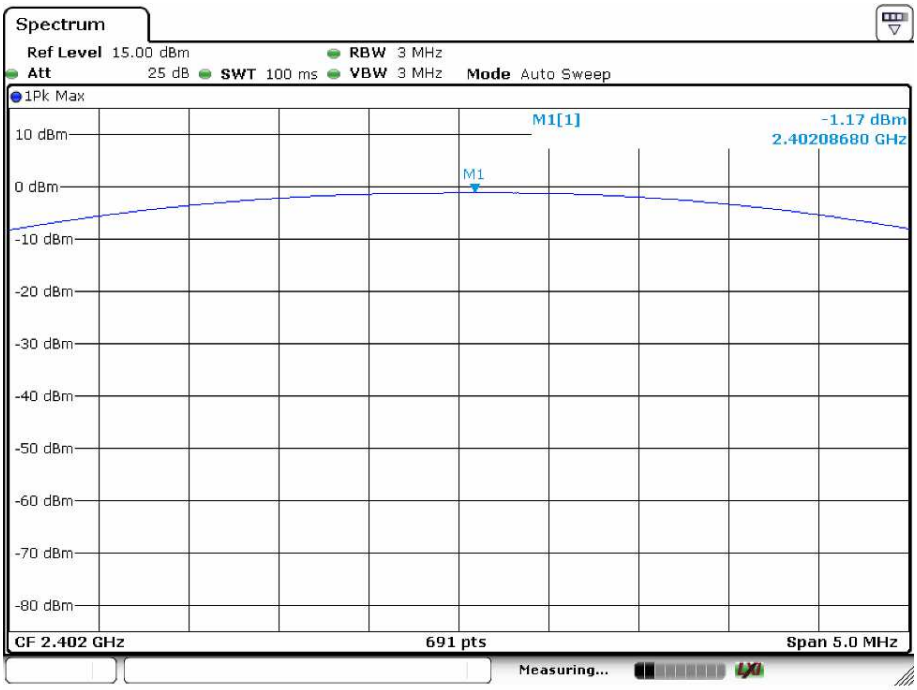
11.4 Measurement Results:

Refer to attached data chart.

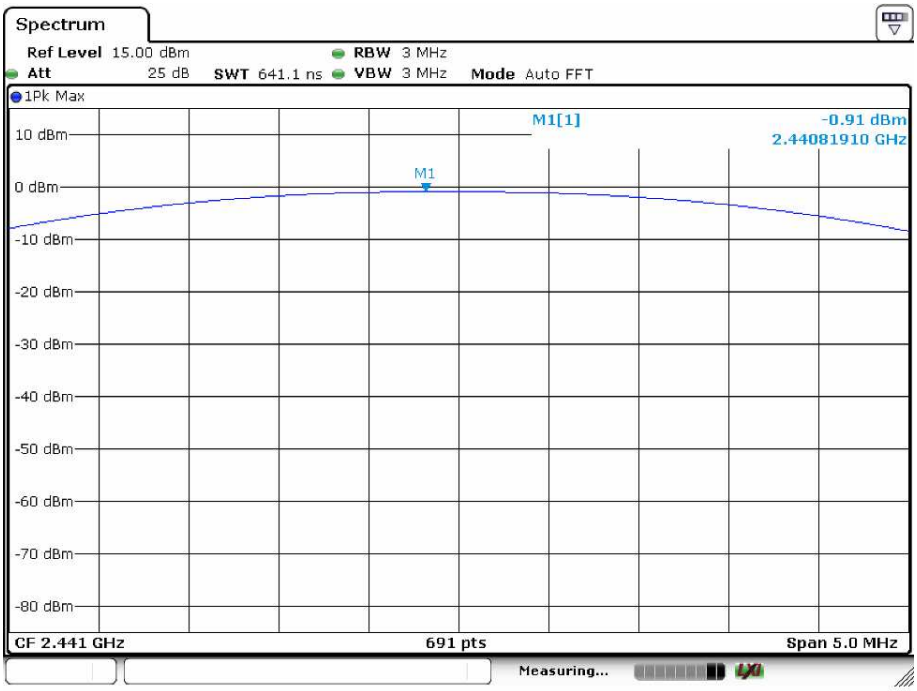
Spectrum Detector:	PK	Test Date :	June 20, 2014
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

Operating Mode	Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Peak Power Limit(mW)	Pass/Fail
op-mode 1	2402	0.764	-1.17	1000	PASS
op-mode 2	2441	**0.811**	**-0.91**	1000	PASS
op-mode 3	2480	0.785	-1.05	1000	PASS
op-mode 5	2402	0.596	-2.25	125	PASS
op-mode 6	2441	0.635	-1.97	125	PASS
op-mode 7	2480	0.603	-2.20	125	PASS
op-mode 10	2402	0.638	-1.95	125	PASS
op-mode 11	2441	0.690	-1.61	125	PASS
op-mode 12	2480	0.658	-1.82	125	PASS

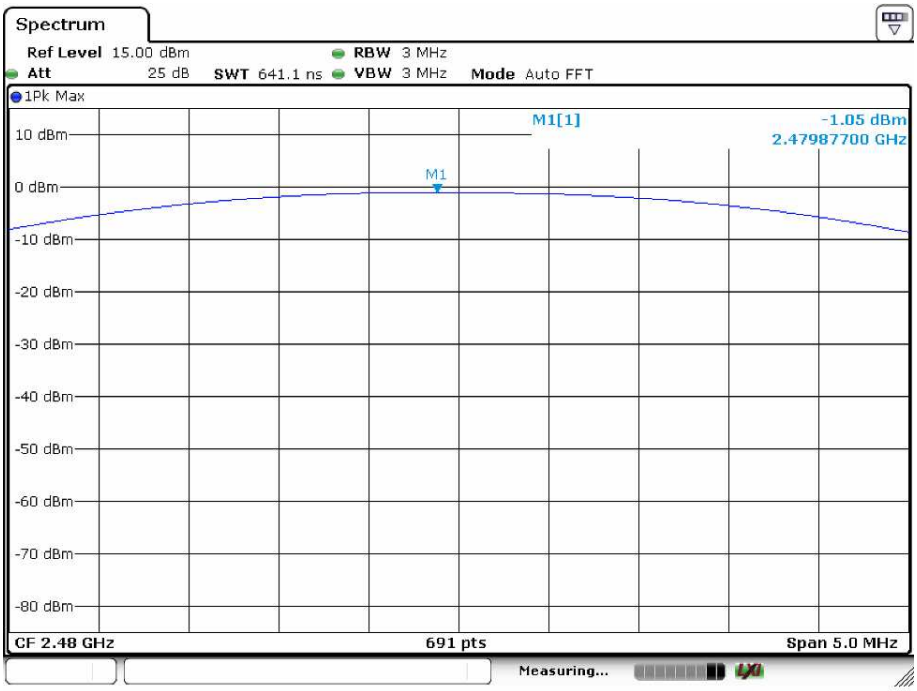
op-mode 1:



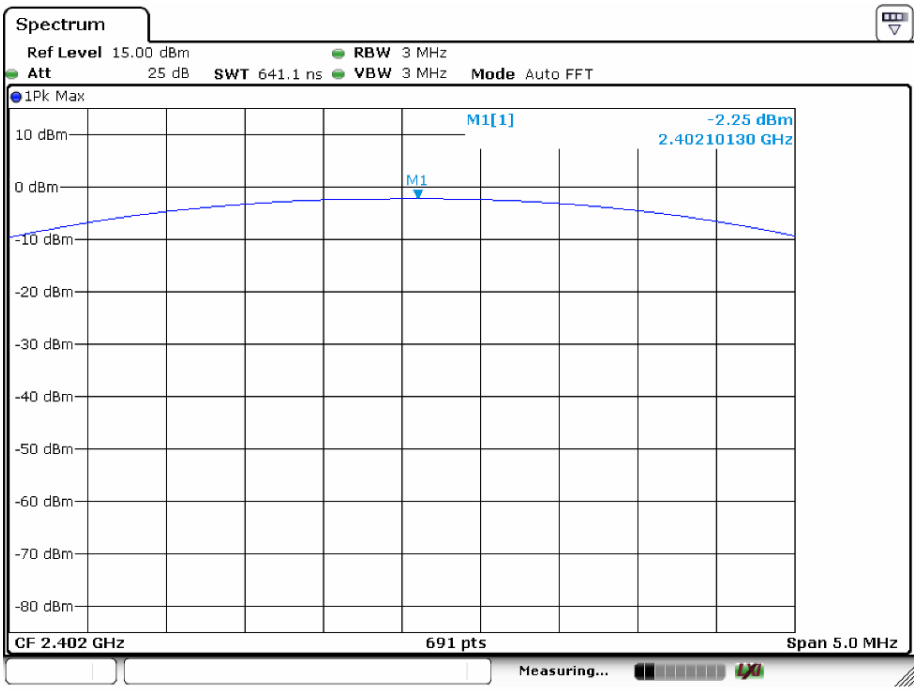
op-mode 2:



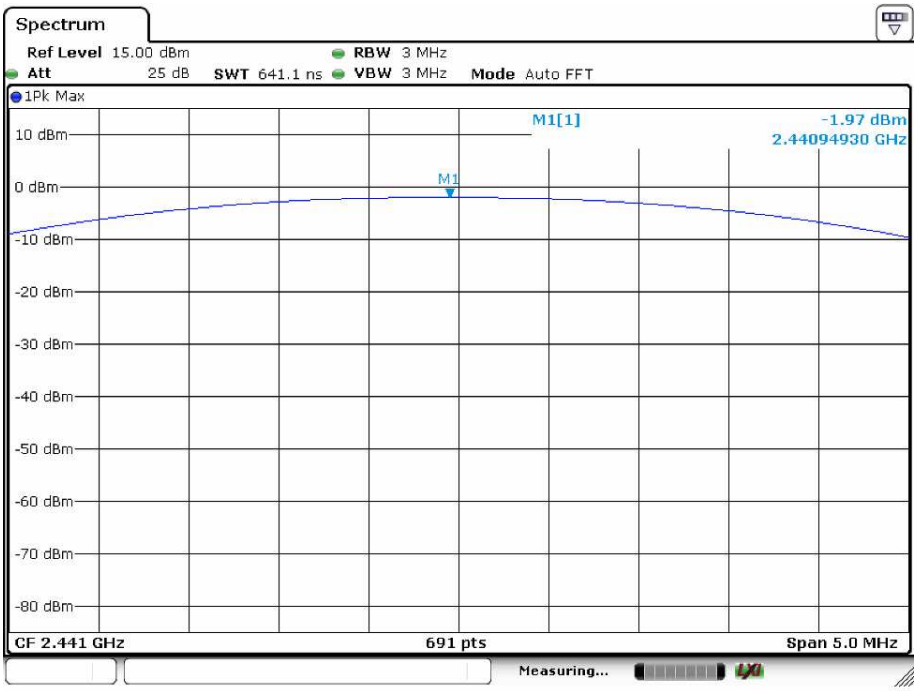
op-mode 3:



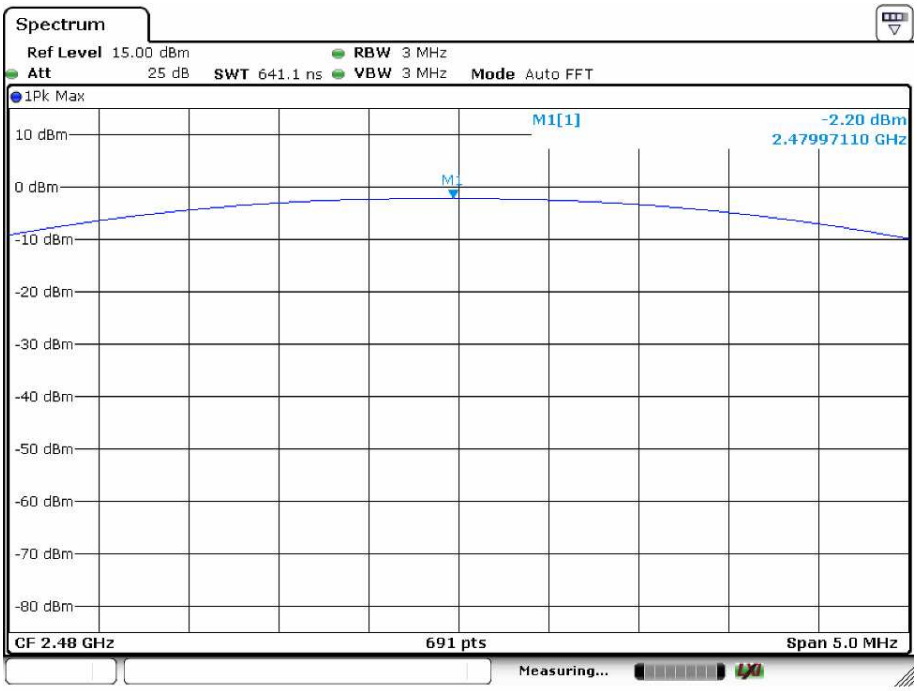
op-mode 5:



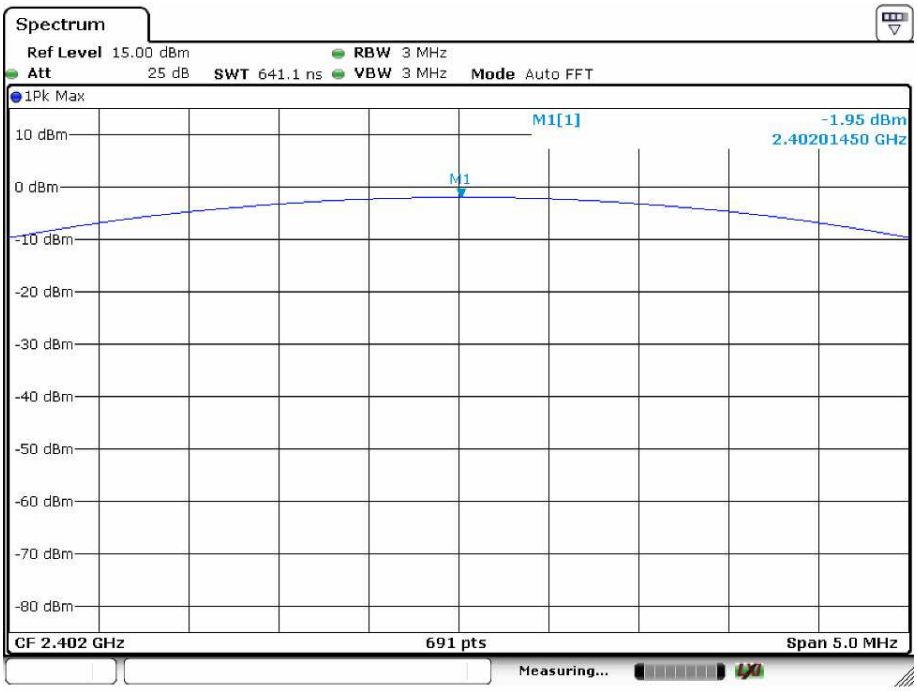
op-mode 6:



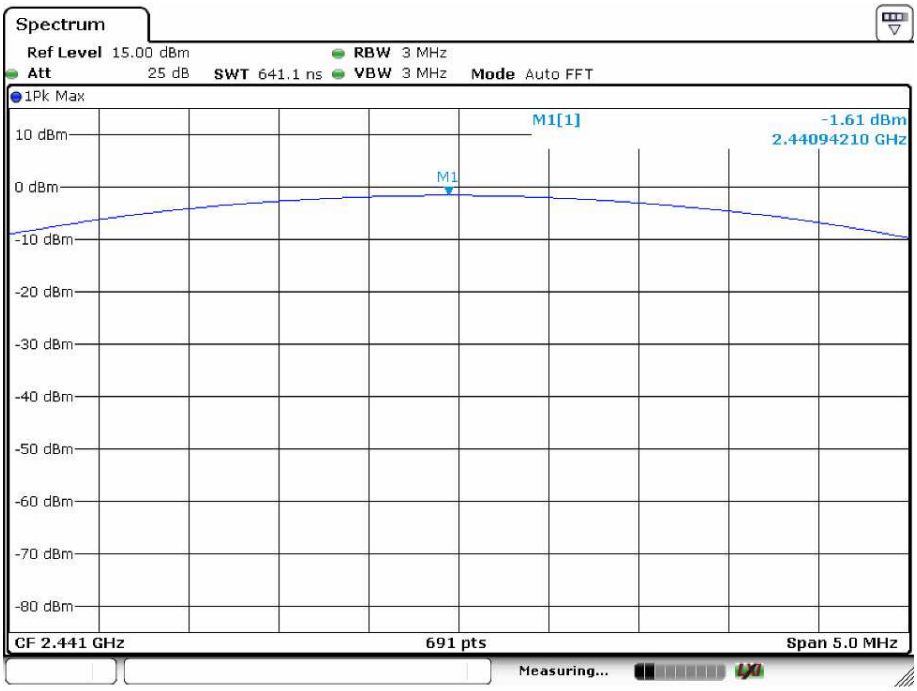
op-mode 7:



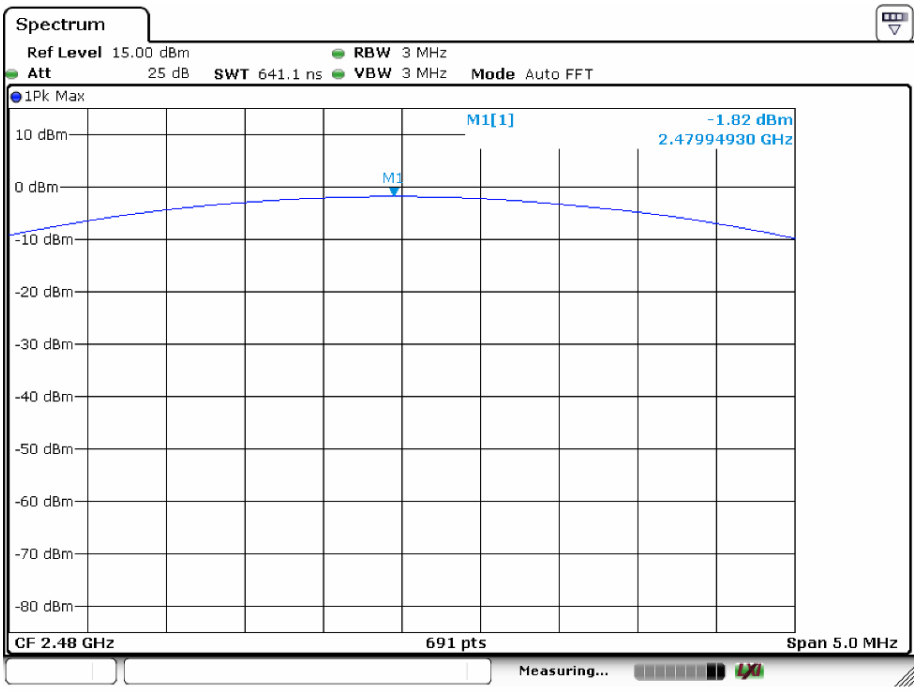
op-mode 10:



op-mode 11:



op-mode 12:



12. Band EDGE test

12.1 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 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)

Same as 6.2 Radiated Emission Set-up.

12.3 Measurement Equipment Used:

Same as 6.3 Radiated Emission Measurement.

12.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	June 20, 2014
Test By:	Andy	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

1. Conducted Test

For Non-Hopping Mode:

Frequency (MHz)	Operating Mode	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
<2400	op-mode 1	-1.10	-34.26	33.16	>20dBc
	op-mode 5	-3.05	-42.91	39.86	>20dBc
	op-mode 10	-2.98	-42.72	39.74	>20dBc
>2483.5	op-mode 3	-0.82	-59.04	58.22	>20dBc
	op-mode 7	-3.02	-57.28	54.26	>20dBc
	op-mode 12	-3.02	-57.41	54.39	>20dBc

For Hopping Mode:

Frequency (MHz)	Operating Mode	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
<2400	op-mode 1	-1.60	-38.78	37.18	>20dBc
	op-mode 5	-3.76	-42.75	38.99	>20dBc
	op-mode 10	-2.78	-45.45	42.67	>20dBc
>2483.5	op-mode 3	-0.89	-59.22	58.33	>20dBc
	op-mode 7	-3.18	-57.27	54.09	>20dBc
	op-mode 12	-2.78	-55.54	52.76	>20dBc

2. Radiated emission Test

For Non-Hopping Mode:

Frequency (MHz)	Operating Mode	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)	
			PK	AV	PK	AV
<2400	op-mode 1	V	50.12	39.55	74.00	54.00
	op-mode 5	H	51.76	37.14	74.00	54.00
>2483.5	op-mode 3	V	47.67	36.78	74.00	54.00
	op-mode 7	H	47.45	35.22	74.00	54.00

For Hopping Mode:

Frequency (MHz)	Operating Mode	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)	
			PK	AV	PK	AV
<2400	op-mode 1	V	53.51	40.22	74.00	54.00
	op-mode 5	H	50.67	37.57	74.00	54.00
>2483.5	op-mode 3	V	48.78	38.32	74.00	54.00
	op-mode 7	H	45.54	34.53	74.00	54.00

13. Antenna Application

13.1 Antenna requirement

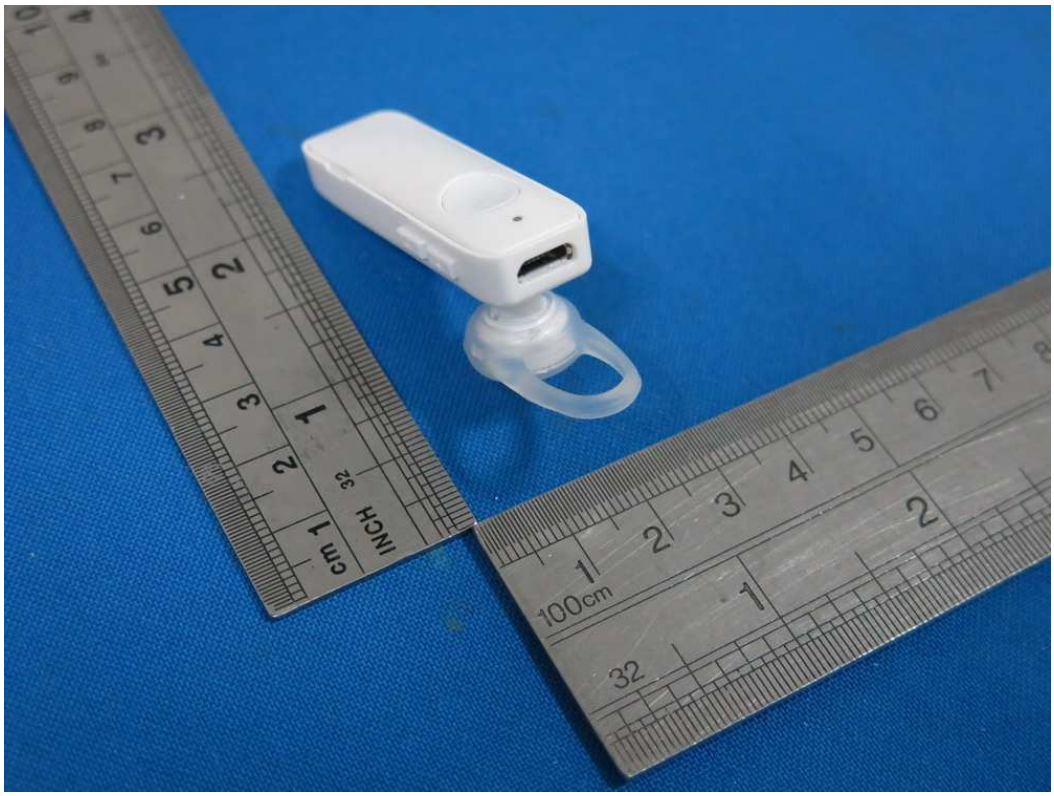
The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

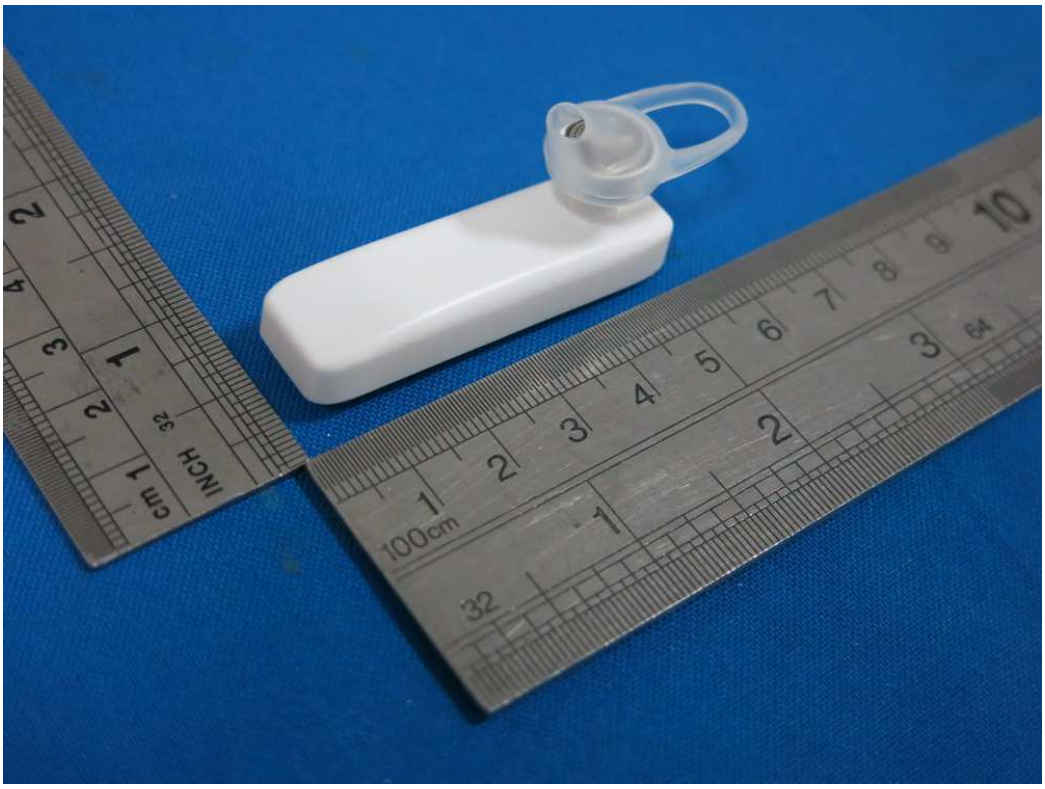
FCC part 15C section 15.247 requirements:
Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by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

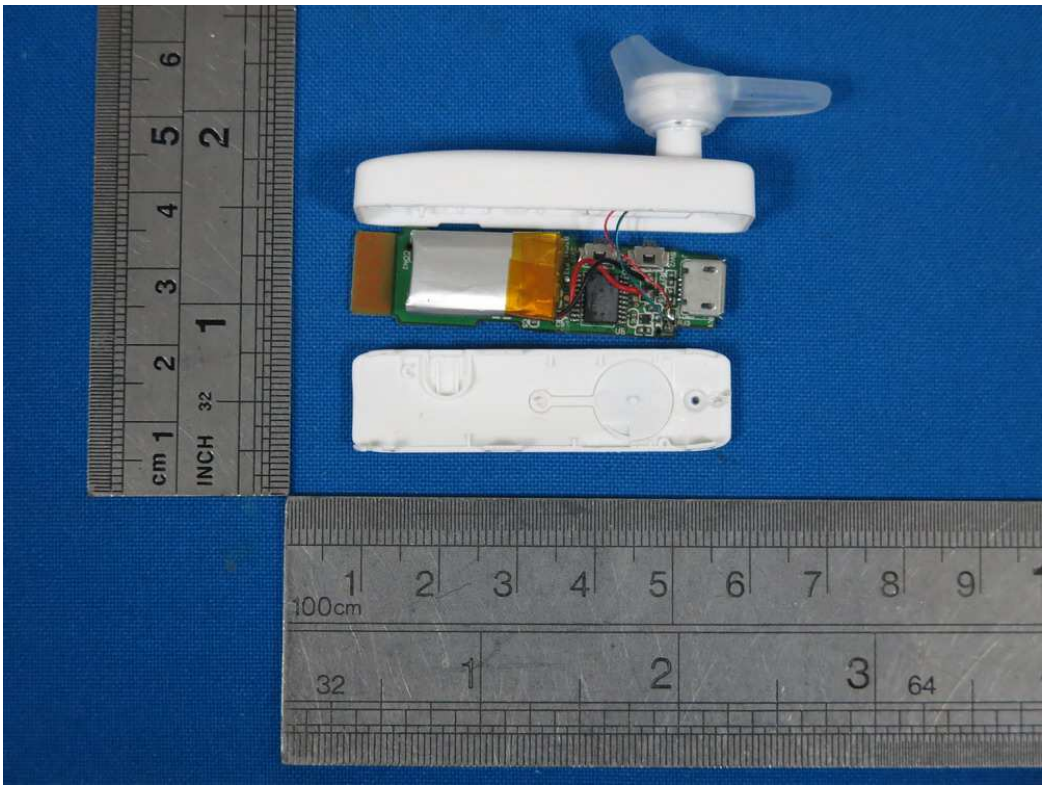
13.2 Result

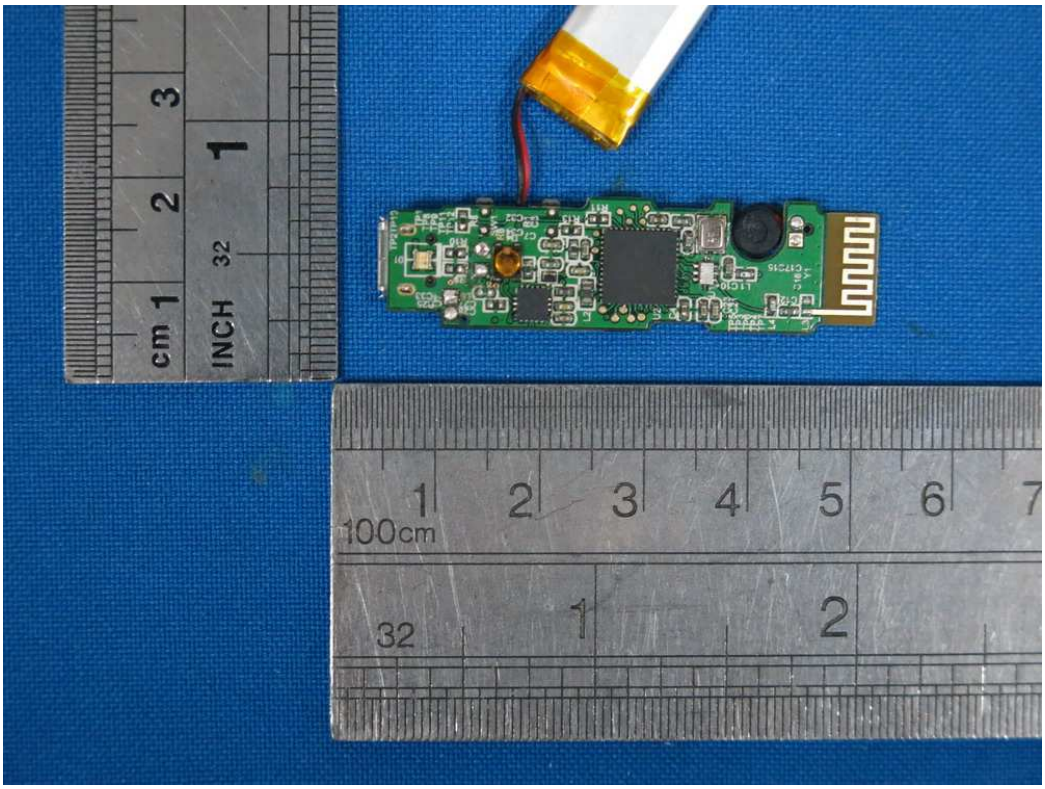
The EUT's antenna used a PCB antenna and integrated on PCB, The antenna's gain is 2.0 dBi and meets the requirement.

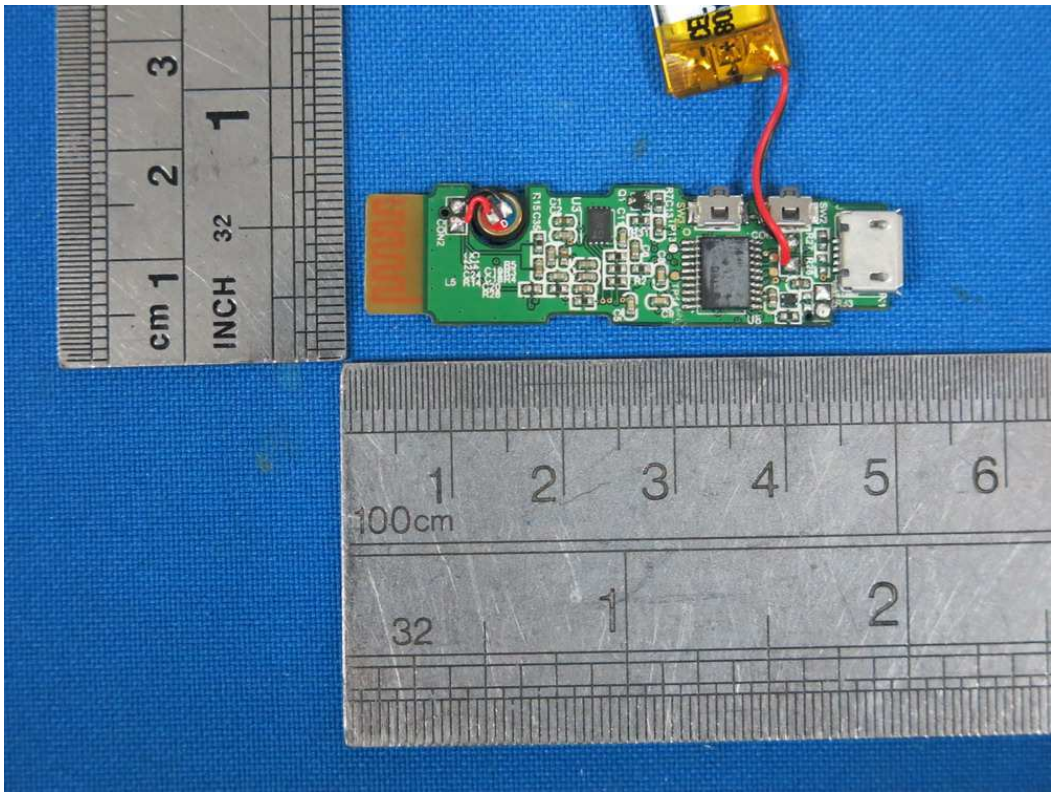
APPENDIX I
(Photos of EUT)


cm
INCH
100cm


cm
INCH
100cm






cm 1
INCH 32
100cm