

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

*OF*

**Digital Wireless Camera and Receiver**

**MODEL No.: SM703DT**

**BRAND NAME: LYD**

**FCC ID: XZF-SM703DT**

**REPORT NO.: KAD120703003E**

**ISSUE DATE: July 27, 2012**

*Prepared for*

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*Prepared by*

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## VERIFICATION OF COMPLIANCE

Applicant:	SHENZHEN LYD TECHNOLOGY CO., LTD Building A, Cunnan Industrial Estate, Shuidou Laowei, Longhua Town, Bao'an District, Shenzhen, China.
Product Description:	Digital Wireless Camera and Receiver
Brand Name:	LYD
Model Number:	SM703DT
Serial Number:	N/A
File Number:	KAD120703003E
Date of Test:	July 03, 2012 to July 23, 2012

### We hereby certify that:

The above equipment was tested by DONGGUAN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (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.

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

*Approved By*



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

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## **1. GENERAL INFORMATION**

### **1.1 Product Description**

The SHENZHEN LYD TECHNOLOGY CO., LTD Model: SM703DT (referred to as the EUT in this report) The EUT is a short range, lower power, Digital Wireless Camera and Receiver designed as an Input Device. It is designed by way of utilizing the GFSK modulation achieves the system operating.

A major technical descriptions of EUT is described as following:

- A). Operation Frequency: 2402-2480MHz
- B). Modulation: GFSK
- C). Number of Channel: 40
- D). Channel space: 2MHz
- E). Rated RF Output Power: 10.21dBm
- F). Antenna Type: Whip Antenna
- G). Antenna GAIN: 3 dBi
- H). Power Supply: AC 100-240V, 50/60Hz Come from Adapter

## **1.2 Related Submittal(s) / Grant (s)**

This submittal(s) (test report) is intended for FCC ID: XZF-SM703DT filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a DoC procedure.

## **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 CNAS, 2012.07.04  
The certificate is valid until 2015.07.03  
The Laboratory has been assessed and proved to be in  
compliance with CNAS/CL01:2006  
The Certificate Registration Number is L3150

Accredited by TUV Product Service Group 2011.07.05  
The certificate is valid until 2012.11.12  
The Laboratory has been assessed according to the  
requirements ISO/IEC 17025: 2005

Accredited by FCC, Aug. 18, 2011  
The Certificate Number is 247565

Accredited by Industry Canada, January 13, 2011  
The Certificate Registration Number. is 46405-9444

Name of Firm  
Site Location

: DONGGUAN EMTEK CO., LTD  
: 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 this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.

### 2.4 Limitation

#### (1) Channel Separation test

FCC Part 15, Subpart C Section 15.247(a)(1). 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		Limit(kHz)			
Frequency Range(MHz)	Quantity of Hopping Channel	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 which 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 1000GHz. The emissions from an intentional radiator shall not exceed the field strength level specified in the following table:

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance(m)	Field strength at 3m $\text{dB}\mu\text{V/m}$
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

Remark: 1. Emission level in  $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$   
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( $\text{dB}\mu\text{V/m}$ )(at 3m)		Class B( $\text{dB}\mu\text{V/m}$ )(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	Series No.	Note
1.	Digital Wireless Camera and Receiver	LYD	SM703DT	XZF-SM703DT	N/A	<b>EUT</b>

**Note:**

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

### 3. Description of test modes

The EUT (Digital Wireless Camera and Receiver) has been tested under normal operating condition. This EUT is a FHSS system, we use blue test to control the EUT with LPT1, 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. 40 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for best.

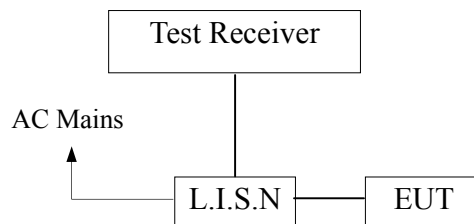
Channel	Frequency(MHz)
01	2402
20	2440
40	2480

## 4. Conducted Emissions Test

### 4.1 Measurement Procedure:

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

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



### 4.3 Measurement Equipment Used:

Conducted Emission Test Site # 4					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/29/2012	05/29/2013
L.I.S.N	Rohde & Schwarz	ESH2-Z5	834549/005	05/29/2012	05/29/2013
50ΩCoaxial Switch	Anritsu	MP59B	M20531	05/29/2012	05/29/2013

#### 4.4 Measurement Result:

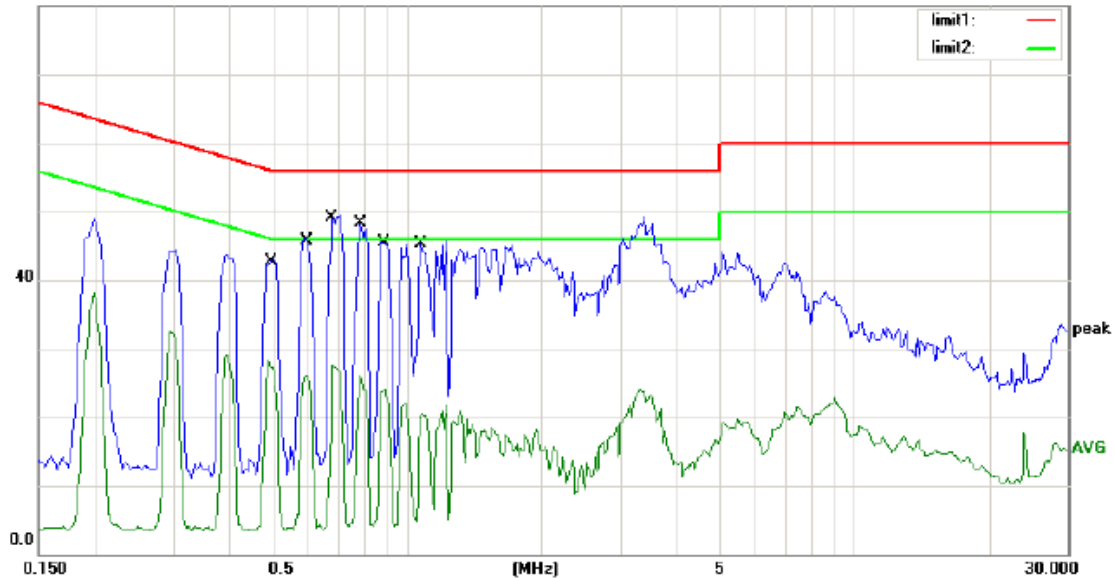
##### Conducted Emission Measurement

File :SM703DT  
80.0 dBuV

Data :#1

Date: 2012/07/04

Time: 14:48:42



Site site #1

Phase: **L1**

Temperature: 25

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

Power: AC 120V/60Hz

Humidity: 50 %

EUT:

M/N: SM703DT

Mode: TX

Note: EUT:Digital Wireless Camera and Receiver

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	0.4900	41.07	0.00	41.07	56.17	-15.10	QP	
2	0.4900	28.29	0.00	28.29	46.17	-17.88	AVG	
3	0.6000	43.15	0.00	43.15	56.00	-12.85	QP	
4	0.6000	26.19	0.00	26.19	46.00	-19.81	AVG	
5 *	0.6800	46.54	0.00	46.54	56.00	-9.46	QP	
6	0.6800	27.42	0.00	27.42	46.00	-18.58	AVG	
7	0.7900	45.39	0.00	45.39	56.00	-10.61	QP	
8	0.7900	26.13	0.00	26.13	46.00	-19.87	AVG	
9	0.8900	43.58	0.00	43.58	56.00	-12.42	QP	
10	0.8900	24.14	0.00	24.14	46.00	-21.86	AVG	
11	1.0800	43.48	0.00	43.48	56.00	-12.52	QP	
12	1.0800	20.47	0.00	20.47	46.00	-25.53	AVG	

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

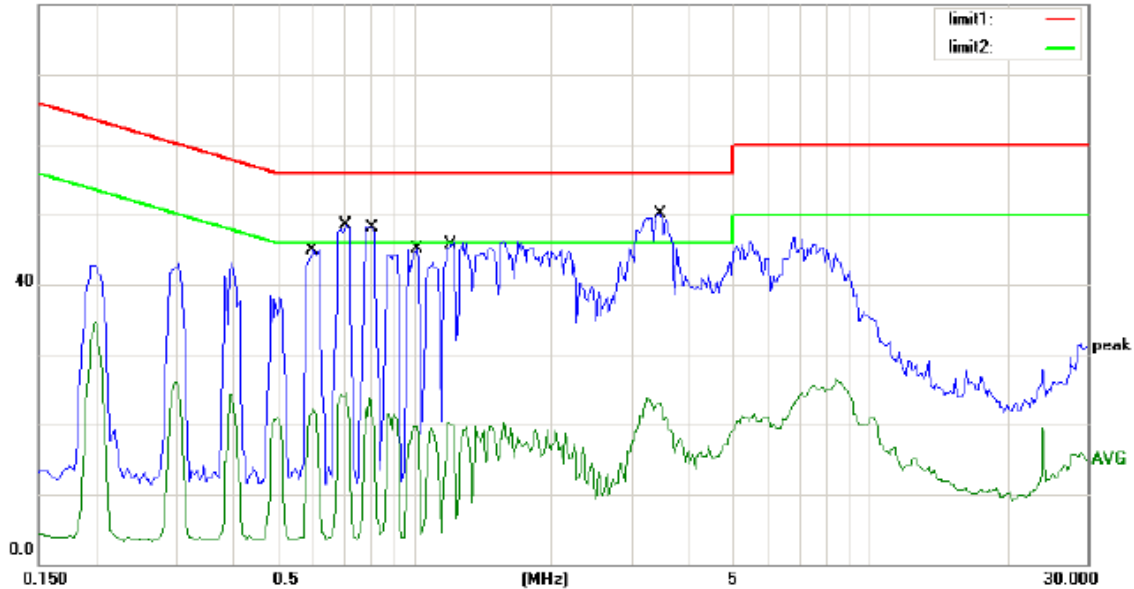
### Conducted Emission Measurement

File :SM703DT  
80.0 dBuV

Data :#2

Date: 2012/07/04

Time: 14:50:46



Site site #1

Phase: N

Temperature: 25

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

Power: AC 120V/60Hz

Humidity: 50 %

EUT:

M/N: SM703DT

Mode: TX

Note: EUT:Digital Wireless Camera and Receiver

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.6000	42.95	0.00	42.95	56.00	-13.05	QP	
2		0.6000	22.26	0.00	22.26	46.00	-23.74	AVG	
3		0.7100	45.58	0.00	45.58	56.00	-10.42	QP	
4		0.7100	24.42	0.00	24.42	46.00	-21.58	AVG	
5		0.8000	45.23	0.00	45.23	56.00	-10.77	QP	
6		0.8000	23.60	0.00	23.60	46.00	-22.40	AVG	
7		1.0200	42.15	0.00	42.15	56.00	-13.85	QP	
8		1.0200	21.49	0.00	21.49	46.00	-24.51	AVG	
9		1.1900	43.06	0.00	43.06	56.00	-12.94	QP	
10		1.1900	20.21	0.00	20.21	46.00	-25.79	AVG	
11	*	3.4750	47.19	0.00	47.19	56.00	-8.81	QP	
12		3.4750	23.17	0.00	23.17	46.00	-22.83	AVG	

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



#### 4.5 Conducted Measurement Photos:



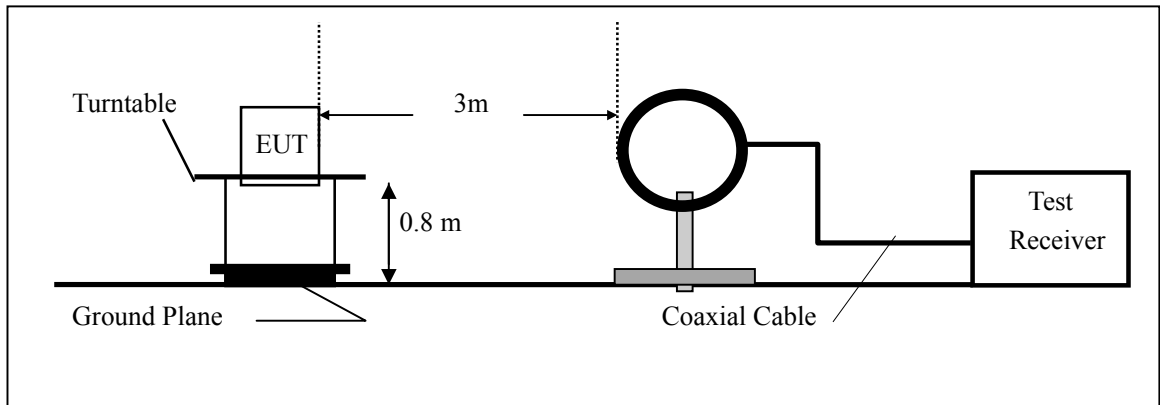
## 5. Radiated Emission Test

### 5.1 Measurement Procedure

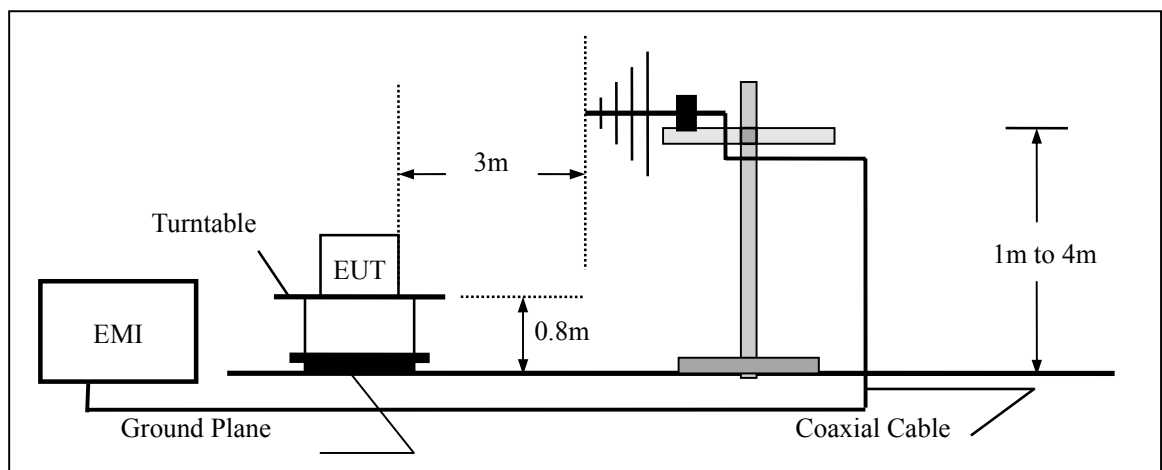
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above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

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

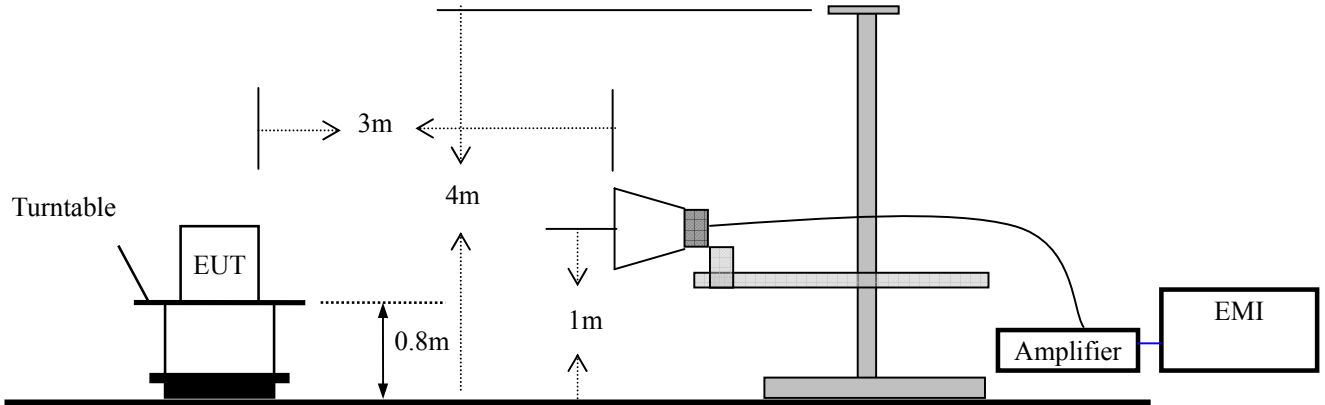
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



5.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSP7	839511/010	05/29/2012	05/29/2013
Spectrum Analyzer	HP	E4407B	839840481	05/29/2012	05/29/2013
EMI Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/29/2012	05/29/2013
Pre-Amplifier	HP	8447D	2944A07999	05/29/2012	05/29/2013
Bilog Antenna	Schwarzbeck	VULB9163	142	05/29/2012	05/29/2013
Loop Antenna	ARA	PLA-1030/B	1029	05/29/2012	05/29/2013
Horn Antenna	Electro-Metrics	EM-6961	103314	05/29/2012	05/29/2013
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/29/2012	05/29/2013

#### 5.4 Measurement Result

Operation Mode: TX Mode      Test Date : July 11, 2012  
Frequency Range: 30~1000MHz      Temperature : 25 °C  
Test Result: PASS      Humidity : 50 %  
Measured Distance: 3m      Test By: Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV)	Limit 3m (dBuV/m)	Margin (dB)	Note
62.980	V	36.57	40.00	-3.43	PK
95.960	V	36.43	43.50	-7.07	PK
191.990	V	34.09	43.50	-9.41	PK
288.020	V	37.05	46.00	-8.95	PK
335.550	V	36.69	46.00	-9.31	PK
807.940	V	42.60	46.00	-3.40	PK
95.960	H	27.88	43.50	-15.62	PK
191.990	H	25.42	43.50	-18.08	PK
288.020	H	29.22	46.00	-16.78	PK
335.550	H	35.96	46.00	-10.04	PK
359.800	H	30.38	46.00	-15.62	PK
384.050	H	30.69	40.00	-15.31	PK

**No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.209.**

**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.

Operation Mode:	CH01: 2402Hz	Test Date :	July 11, 2012
Frequency Range:	1-25GHz	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
2402.000	V	53.62	39.25	74.00	54.00	-20.38	-14.75
4804.00	V	54.36	32.26	74.00	54.00	-19.64	-21.74
7206.00	V	60.15	33.45	74.00	54.00	-13.85	-20.55
9608.00	V	62.23	48.26	74.00	54.00	-11.77	-8.74
12010.00	V	54.41	40.26	74.00	54.00	-19.59	-13.74
2402.000	H	58.72	45.30	74.00	54.00	-15.28	-8.70
4804.00	H	48.25	38.50	74.00	54.00	-25.75	-15.50
7206.00	H	40.63	36.42	74.00	54.00	-33.37	-17.58
9608.00	H	44.58	35.51	74.00	54.00	-29.42	-18.49
12010.00	H	55.46	43.55	74.00	54.00	-18.54	-10.45

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

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

Operation Mode:	CH20: 2440Hz	Test Date :	July 11, 2012
Frequency Range:	1-25GHz	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %
Measured Distance:	3m	Test By:	Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
4880.00	V	56.25	48.16	74.00	54.00	-17.75	-5.84
7320.00	V	58.75	46.24	74.00	54.00	-15.25	-7.76
9760.00	V	55.42	43.76	74.00	54.00	-18.58	-10.24
12200.00	V	44.24	32.55	74.00	54.00	-29.76	-21.45
4880.00	H	56.58	47.12	74.00	54.00	-17.42	-6.88
7320.00	H	52.28	39.71	74.00	54.00	-21.72	-14.29
9760.00	H	49.37	32.11	74.00	54.00	-24.63	-21.89
12200.00	H	53.26	44.20	74.00	54.00	-20.74	-9.80

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

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

Operation Mode: CH40: 2480MHz      Test Date : July 11, 2012  
Frequency Range: 1-25GHz      Temperature : 25 °C  
Test Result: PASS      Humidity : 50 %  
Measured Distance: 3m      Test By: Andy

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
2480.00	V	52.42	40.26	74.00	54.00	-21.58	-13.74
4960.00	V	50.24	41.74	74.00	54.00	-23.76	-12.26
7440.00	V	48.25	38.50	74.00	54.00	-25.75	-15.50
9920.00	V	40.63	36.42	74.00	54.00	-33.37	-17.58
12400.00	V	44.58	35.51	74.00	54.00	-29.42	-18.49
2480.00	H	56.87	43.25	74.00	54.00	-17.13	-10.75
4960.00	H	50.34	39.35	74.00	54.00	-23.66	-14.65
7440.00	H	43.34	33.69	74.00	54.00	-30.66	-20.31
9920.00	H	52.13	40.20	74.00	54.00	-21.87	-13.80
12400.00	H	45.69	33.68	74.00	54.00	-28.31	-20.32

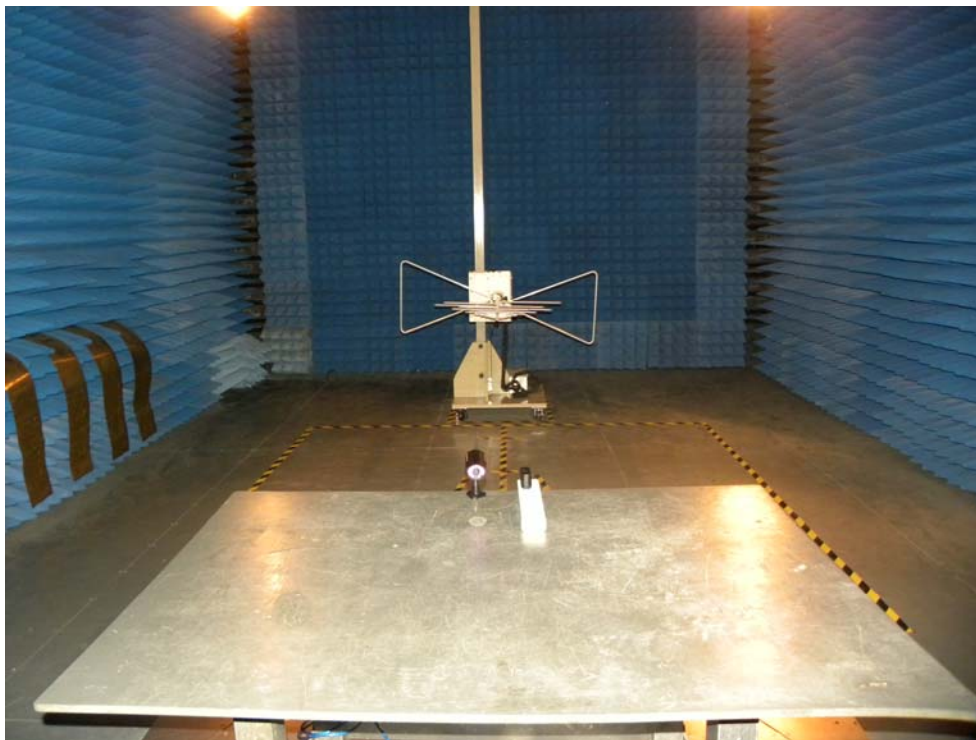
**No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.**

**Note:** (1) All Readings are Peak Value and AV.

(2) Emission Level= Reading Level+ Probe Factor +Cable Loss.

(3) The average measurement was not performed when the peak measured data under the limit of average detection.

### 5.5 Radiated Measurement Photos:



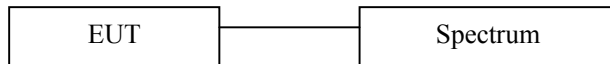


## 6. Channel Separation test

### 6.1 Measurement Procedure

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

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



### 6.3 Measurement Equipment Used:

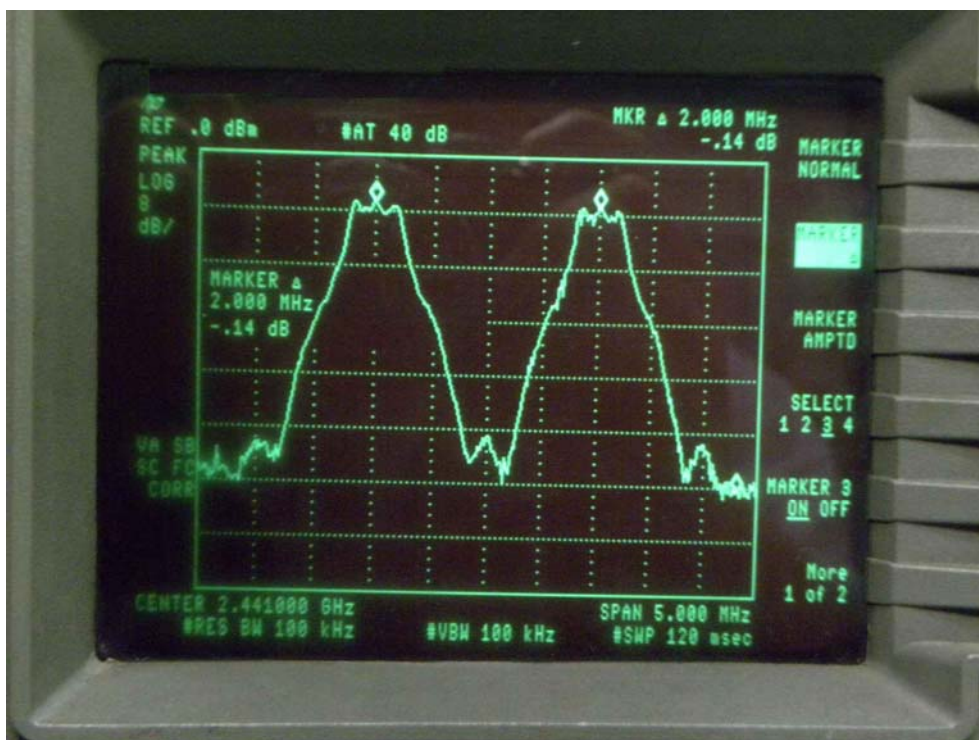
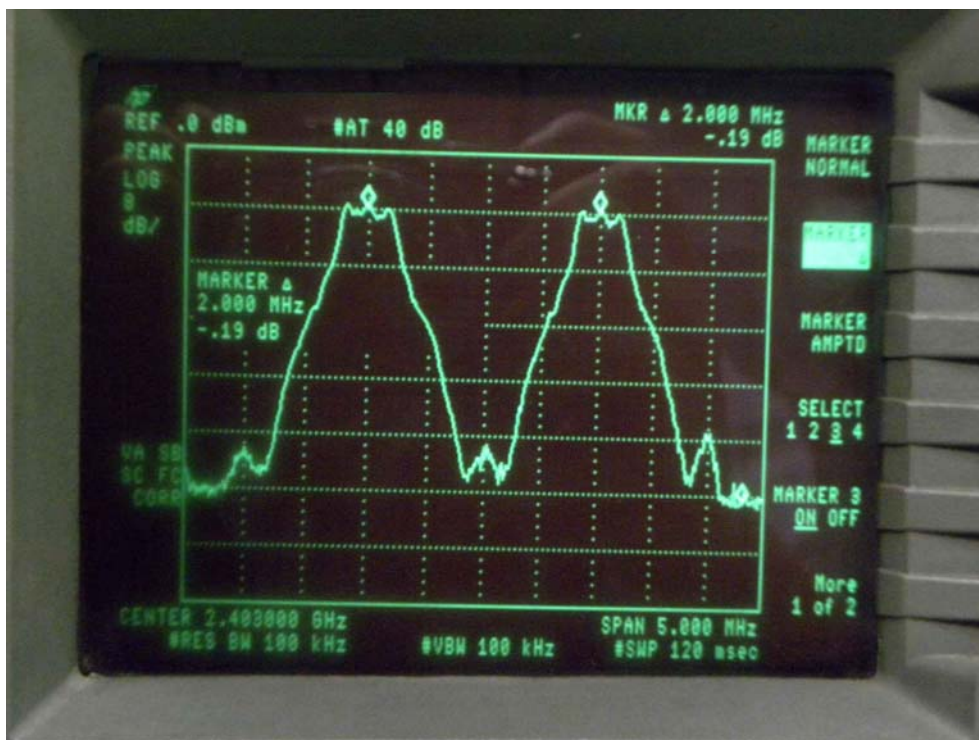
Same as 5.3 Radiated Emission Measurement.

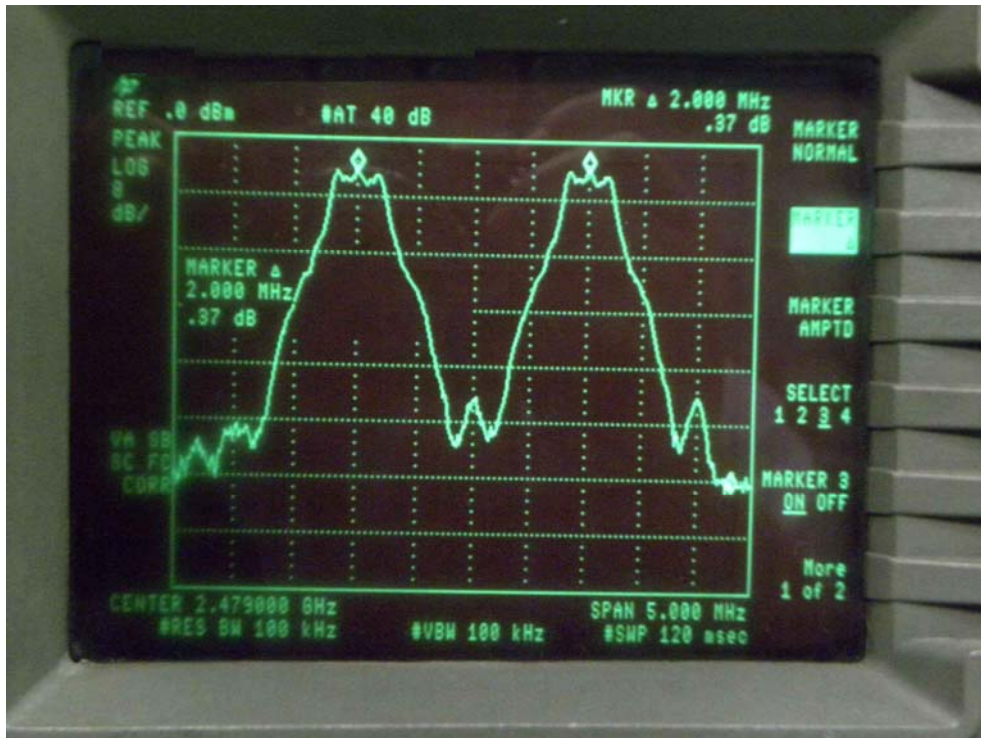
### 6.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

Channel number	Channel frequency (MHz)	Separation Read Value (MHz)	20dB Down BW(MHz)
01	2402	2	>1.122
20	2440	2	>1.094
40	2480	2	>1.118



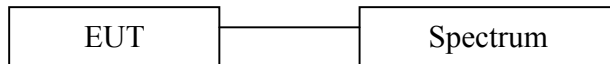


## 7. 20dB Bandwidth test

### 7.1 Measurement Procedure

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

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



### 7.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

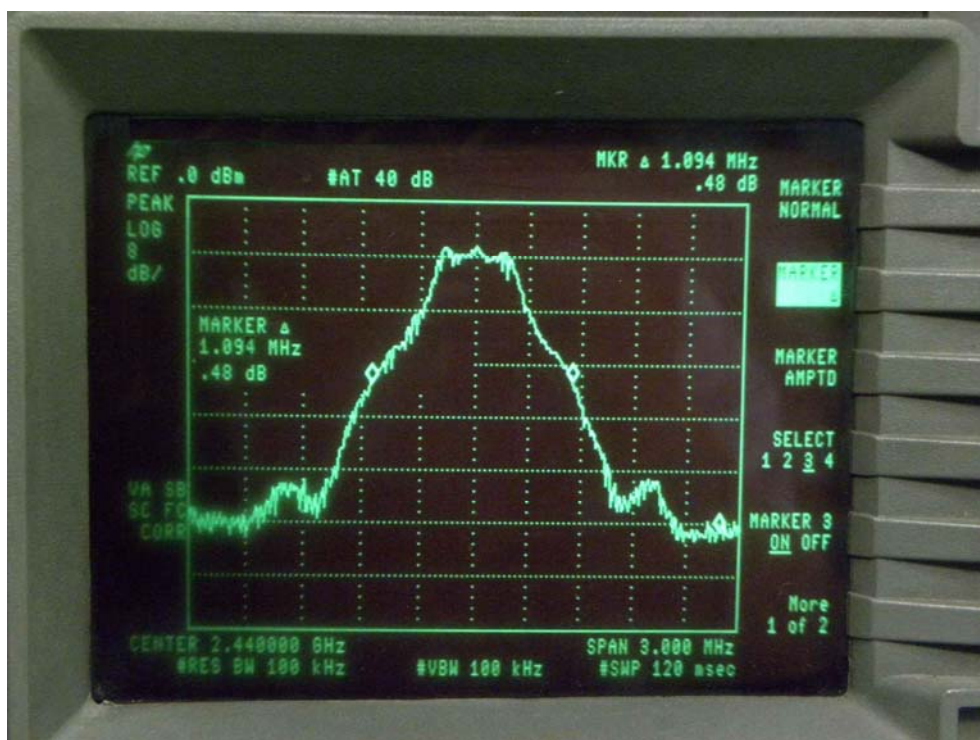
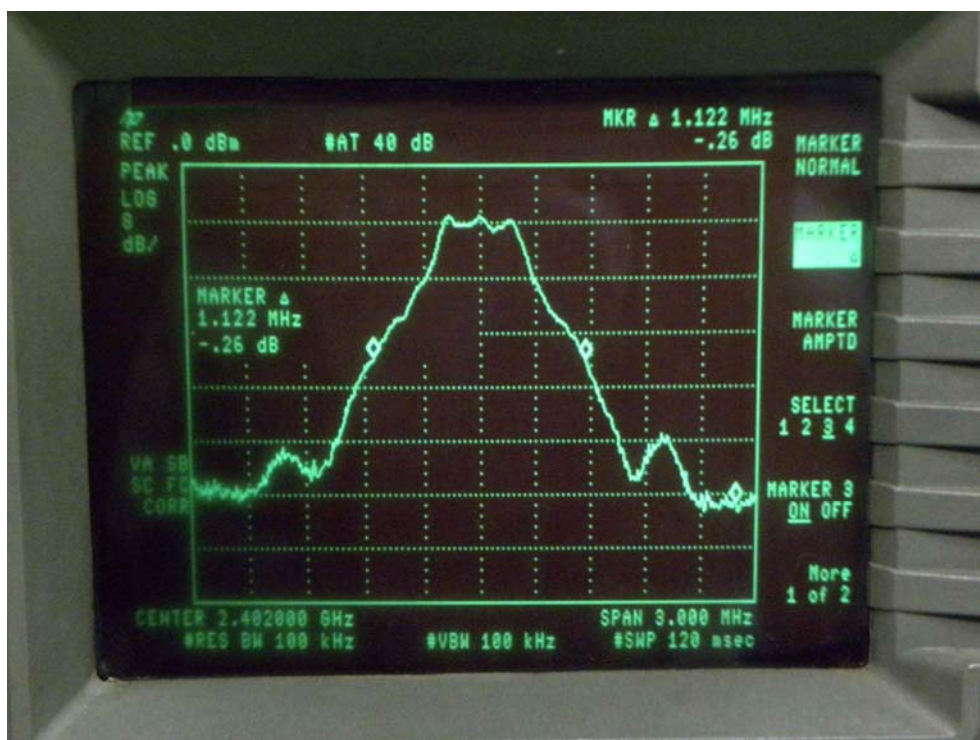
### 7.4 Measurement Results:

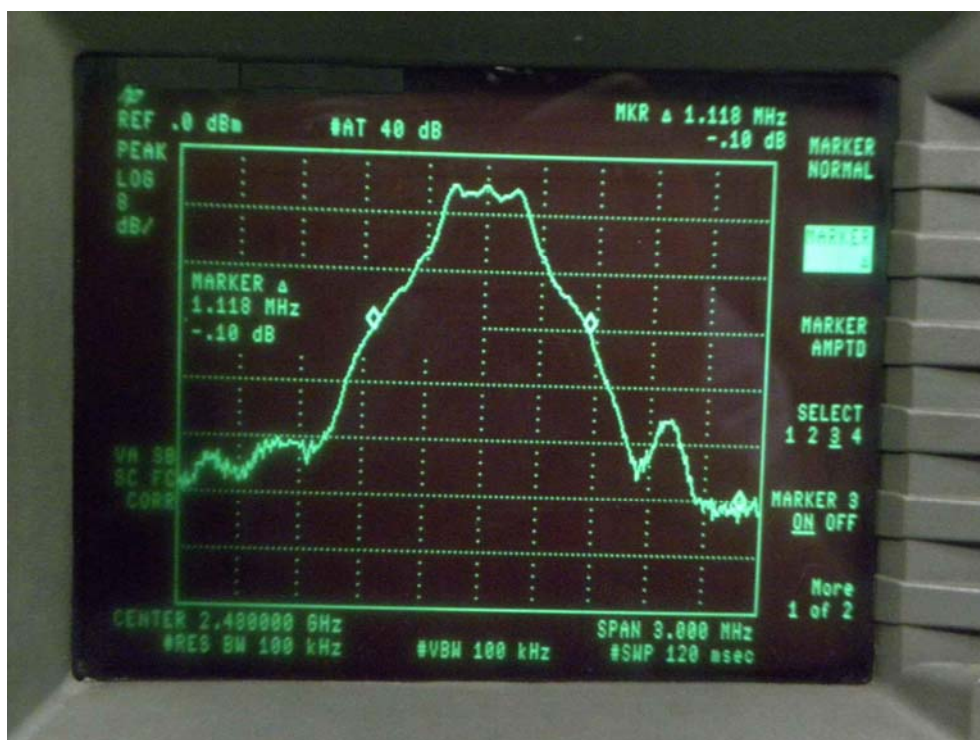
Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
01	2402	1122
20	2440	1094
40	2480	1118





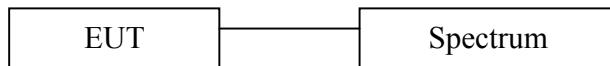


## 8. Quantity of Hopping Channel Test

### 8.1 Measurement Procedure

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

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



### 8.3 Measurement Equipment Used:

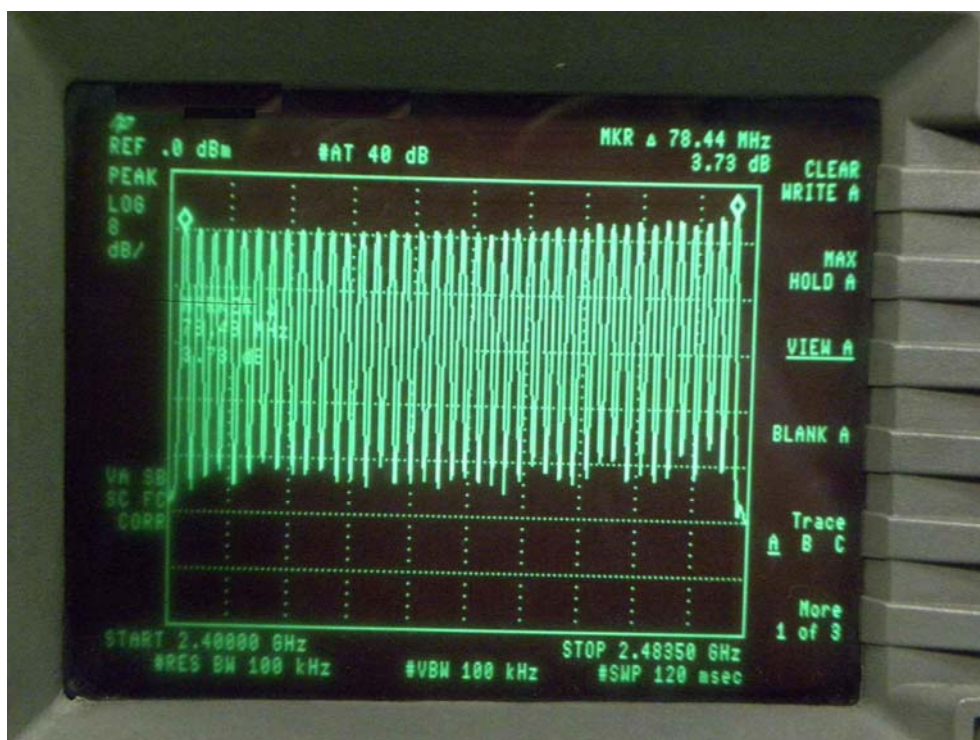
Same as 5.3 Radiated Emission Measurement.

### 8.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel(Limit)
2402-2480MHz	40	>15



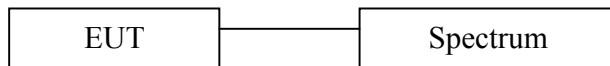


## 9. Time of Occupancy (Dwell Time) test

### 9.1 Measurement Procedure

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

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



### 9.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

#### 9.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

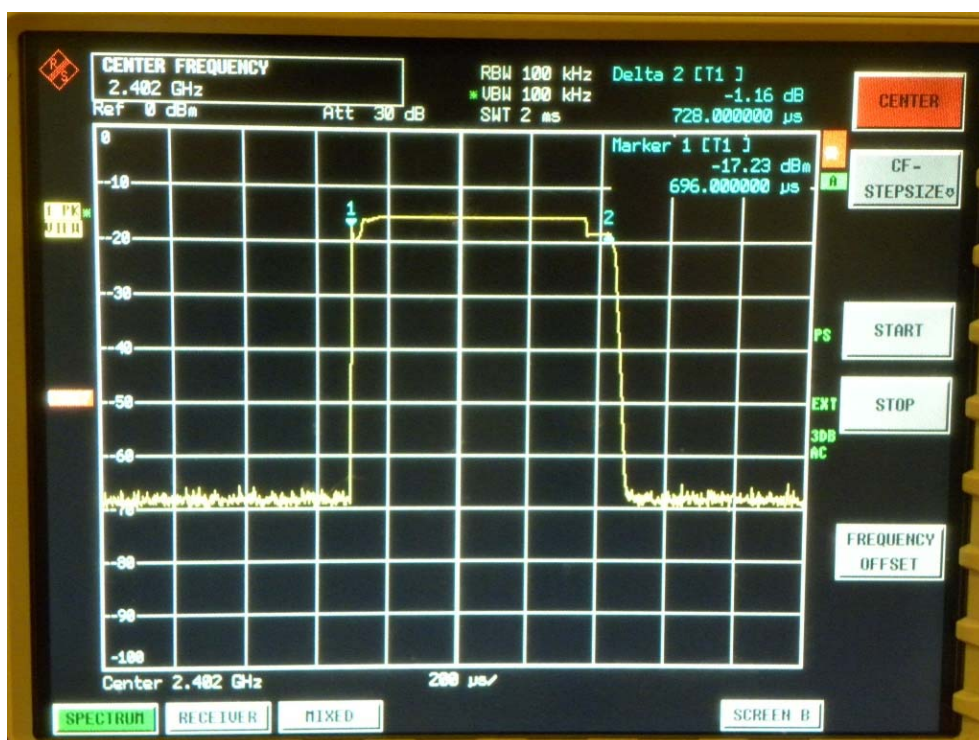
Mode	Number of transmission in a 16 ( 40 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	20 x 16 = 320	0.728	232.96	400
DH3	10 x 16 = 160	1.490	238.40	400
DH5	6.67 x 31.6 = 106.6	2.700	288.00	400

DH5 Packet permit maximum  $1600 / 40 / 6 = 6.67$  hops per second in each channel (5 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times  $6.67 \times 31.6 = 106.6$  within 16 seconds.

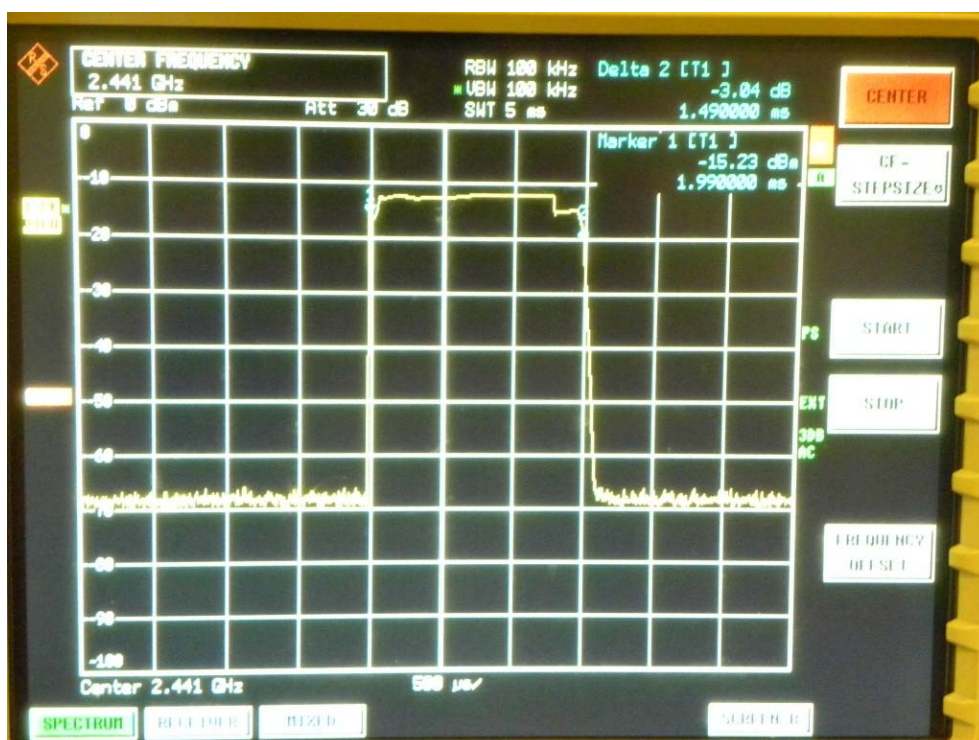
DH3 Packet permit maximum  $1600 / 40 / 4 = 10$  hops per second in each channel (3 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times  $10 \times 16 = 160$  within 16 seconds.

DH1 Packet permit maximum  $1600 / 40 / 2 = 20$  hops per second in each channel (1 time slot RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times  $20 \times 16 = 320$  within 16 seconds.

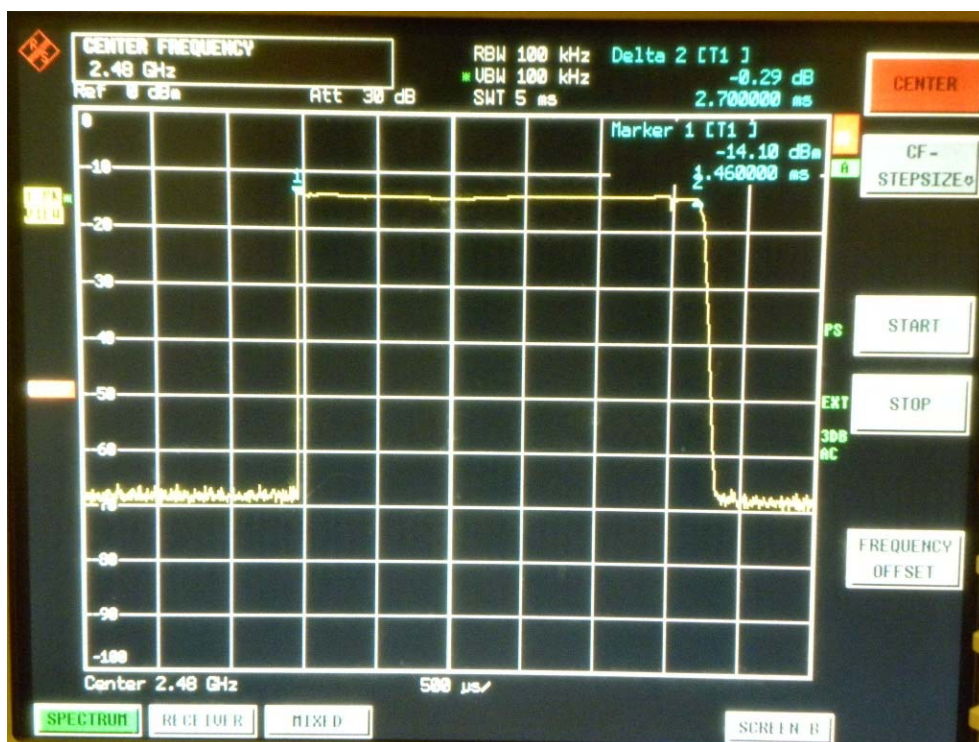
DH1:



DH3:



DH5:

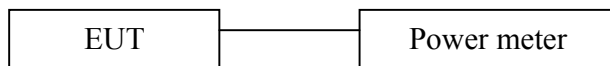


## 10. MAXIMUM PEAK OUTPUT POWER TEST

### 10.1 Measurement Procedure

- Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- 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.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

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



### 10.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	Boonton	4232A	29001	05/29/2012	05/29/2013
Power sensor	Boonton	51011-EMC	31184	05/29/2012	05/29/2013

### 10.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

Channel number	Channel Frequency (MHz)	Peak Power output(mW)	Peak Power output(dBm)	Limit (mW)	Pass/Fail
01	2402	9.01	9.55	125	PASS
20	2440	10.49	10.21	125	PASS
40	2480	9.86	9.94	125	PASS

## 11. Band EDGE test

### 11.1 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.

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

Same as 5.2 Radiated Emission Set-up.

### 11.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

### 11.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	July 09, 2012
Test By:	Andy	Temperature :	25 °C
Test Result:	PASS	Humidity :	50 %

#### 1. Conducted Test

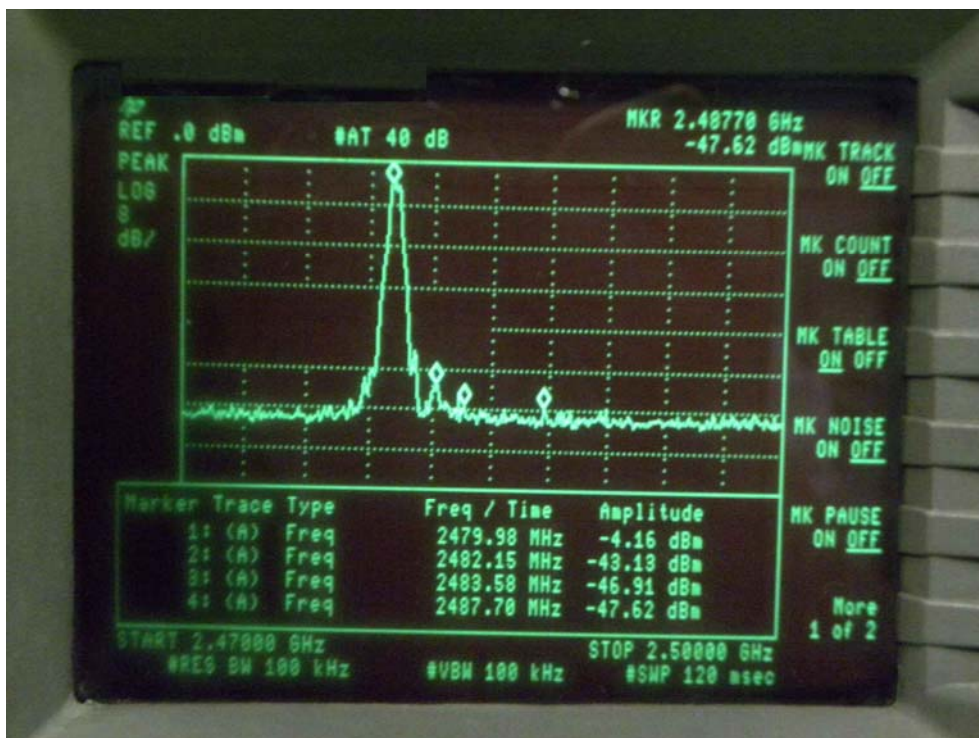
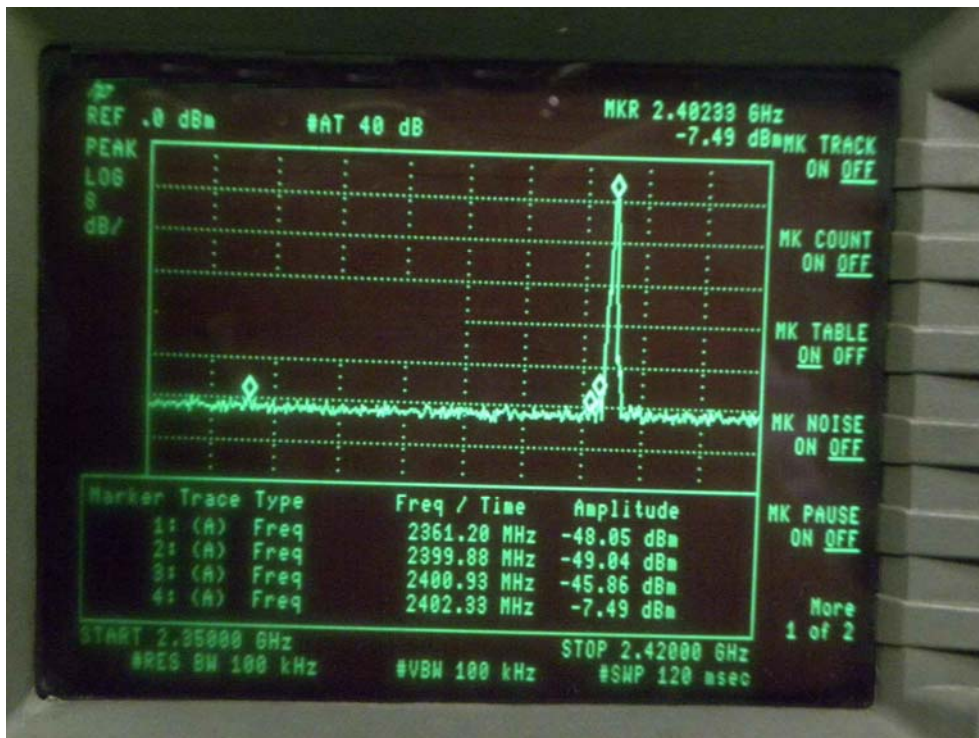
Frequency (MHz)	Peak Power Output(dBm)	Emission read Value(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
<2400	-7.49	-49.04	41.55	>20dBc
>2483.5	-4.16	-47.12	42.96	>20dBc

#### 2. Radiated emission test

Frequency (MHz)	Antenna polarization (H/V)	Emission (dBuV/m)		Band edge Limit (dBuV/m)	
		QP	AV	QP	AV
<2400	V	56.19	48.76	74.00	54.00
>2483.5	V	56.65	49.33	74.00	54.00

Remark: The results of Horizontal polarization and Vertical polarization are same.





## **12. Antenna Application**

### **12.1 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 2.4GHz 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.

### **12.2. Result**

The unit is produced with a unique coupling from the transmitter to the whip antenna. The antenna is not replaceable or user serviceable. The requirements of 15.203 are met; there are no deviations or exceptions to the specification.



### 13. RF EXPOSURE EVALUATION

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency(RF) Radiation as specified in § 1.1307(b)

Limits for Maximum Permissible Exposure(MPE)

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density(mW/cm <sup>2</sup> )	Average Time
<b>(A) Limits for Occupational/Control Exposures</b>				
<b>300-1500</b>	--	--	<b>F/300</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>5</b>	<b>6</b>
<b>(B) Limits for General Population/Uncontrol Exposures</b>				
<b>300-1500</b>	--	--	<b>F/1500</b>	<b>6</b>
<b>1500-100000</b>	--	--	<b>1</b>	<b>30</b>

#### 13.1 Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * R^2)$

Where

$P_d$ = Power density in mW/cm<sup>2</sup>

$P_{out}$ =output power to antenna in Mw

$G$ = gain of antenna in linear scale

$\pi$ =3.1416

$R$ = distance between observation point and center of the radiator in cm

$P_d$  the limit of MPE, 1mW/cm<sup>2</sup>. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

#### 13.2 Measurement Result

Channel	Channel Frequency (MHz)	Output Peak power (mW)	Antenna Gain (dBi)	Power density at 20cm (mW/ cm <sup>2</sup> )	Power density Limits (mW/cm <sup>2</sup> )
Low	2402	9.01	3	3.58e-03	1
Middle	2440	10.49	3	4.18e-03	1
High	2480	9.86	3	3.92e-03	1