

APPLICATION FOR CERTIFICATION

On Behalf of  
FUTABA Corporation  
Radio Control  
Model No. : TM-FH  
FCC ID : AZPTMFH-24G  
Brand: Futaba

Prepared for : FUTABA Corporation  
629 Oshiba Mobara, Chiba Prefecture, 297-8588 Japan.

Prepared by : AUDIX Technology Corporation  
EMC Department  
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Date of Report : Jul. 22, 2011

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## TEST REPORT CERTIFICATION

Applicant : FUTABA Corporation  
 Manufacturer : FUTABA Corporation  
 EUT Description : Radio Control  
 FCC ID : AZPTMFH-24G  
     (A) Model No. : TM-FH  
     (B) Serial No. : N/A  
     (C) Brand : Futaba  
     (D) Power Supply : DC 12V  
     (E) Test Voltage : DC 12V (Via DC Power Supply)

Measurement Procedure Used:

FCC RULES AND REGULATIONS PART 15 SUBPART C, Oct. 2010  
AND ANSI C63.4/2003

(FCC CFR 47 Part 15C, §15.207 and §15.209 and §15.247)


The device described above was tested by AUDIX Technology Corporation to determine the maximum emission levels emanating from the device. The maximum emission levels were compared to the FCC Part 15 subpart C limits.

The measurement results are contained in this test report and AUDIX Technology Corporation is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT to be technically compliant with the FCC official limits.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of AUDIX Technology Corporation.

Date of Test : Jul. 20, 2011                      Date of Report : Jul. 22, 2011

Producer :   
                     (Tina Huang/Administrator)

Signatory :   
                     (Ben Cheng/Manager)

# 1. GENERAL INFORMATION

## 1.1. Description of Device (EUT)

Description	:	Radio Control (RF Module)
Model Number	:	TM-FH
Serial Number	:	N/A
FCC ID	:	AZPTMFH-24G
Applicant	:	FUTABA Corporation 629 Oshiba Mobara, Chiba Prefecture, 297-8588 Japan.
Manufacturer	:	FUTABA Corporation 629 Oshiba Mobara, Chiba Prefecture, 297-8588 Japan.
Radio Technology	:	FHSS Modulation
Frequency Band	:	2403.250MHz ~ 2447.500MHz
Tested Frequency	:	2403.250MHz (Channel 01) 2425.00MHz (Channel 30) 2447.500MHz (Channel 60)
Frequency Channel	:	60 channels
Antenna (Pencil Antenna)	:	Antenna Gain: 2.0dBi
Date of Receipt of Sample	:	Jun. 07, 2011
Date of Test	:	Jul. 20, 2011

## 1.2. Tested Supporting System Details

### 1.2.1. DC POWER SUPPLY

Model Number : 3303A  
 Serial Number : 721773  
 Manufacturer : TOP WARD  
 DC Power Cable\*2 : Non-Shielded, Detachable, 0.8m  
 AC Power Cord : Non-Shielded, Detachable, 1.8m

### 1.2.2. CONTROL BOARD (SIMULATOR)

Model Number : N/A  
 Serial Number : N/A  
 Manufacturer : FUTABA

## 1.3. Description of Test Facility

Name of Firm : **AUDIX Technology Corporation**  
**EMC Department**  
 No. 53-11, Tin-Fu Tsun, Lin-Kou Hsiang,  
 Taipei Hsien, Taiwan

Test Location & Facility (AC) : **Semi-Anechoic Chamber**  
 No. 53-11, Tin-Fu Tsun, Lin-Kou Hsiang,  
 Taipei Hsien, Taiwan.  
 May 14, 2009 Renewal on  
 Federal Communication Commission  
 Registration Number: 90993

NVLAP Lab. Code : 200077-0

TAF Accreditation No : 1724

## 1.4. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Radiation Test (Distance: 3m)	30MHz~300MHz	±2.91dB
	300MHz~1000MHz	±2.94dB
	Above 1GHz	± 5.02dB

Remark : Uncertainty =  $ku_c(y)$

Test Item	Uncertainty
20dB Bandwidth	± 0.2kHz
Carrier Frequency Separation	± 0.2kHz
Time Of Occupancy	± 0.03sec
Maximum peak Output power	± 0.52dBm
Emission Limitations	± 0.13dB
Band Edges	± 0.13dB

## **2. CONDUCTED EMISSION MEASUREMENT**

【The EUT only employs DC power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207】



### 3. RADIATED EMISSION MEASUREMENT

#### 3.1. Test Equipment

The following test equipment was used during the radiated emission measurement:

##### 3.1.1. For Frequency Range 30MHz~1000MHz (at Semi-Anechoic Chamber)

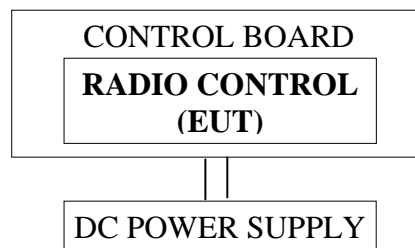
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'
2.	Test Receiver	R & S	ESCS30	100265	Sep. 01, 10'	Aug. 31, 11'
3.	Pre-Amplifier	HP	8447D	2944A06305	Feb. 10, 11'	Feb. 09, 12'
4.	Biconical Antenna	CHASE	VBA6106A	1264	Mar. 08, 11'	Mar. 07, 12'
5.	Log Periodic Antenna	Schwarzbeck	UHALP91 08-A	0810	Mar. 08, 11'	Mar. 07, 12'

##### 3.1.2. For Frequency Above 1GHz (at Semi-Anechoic Chamber)

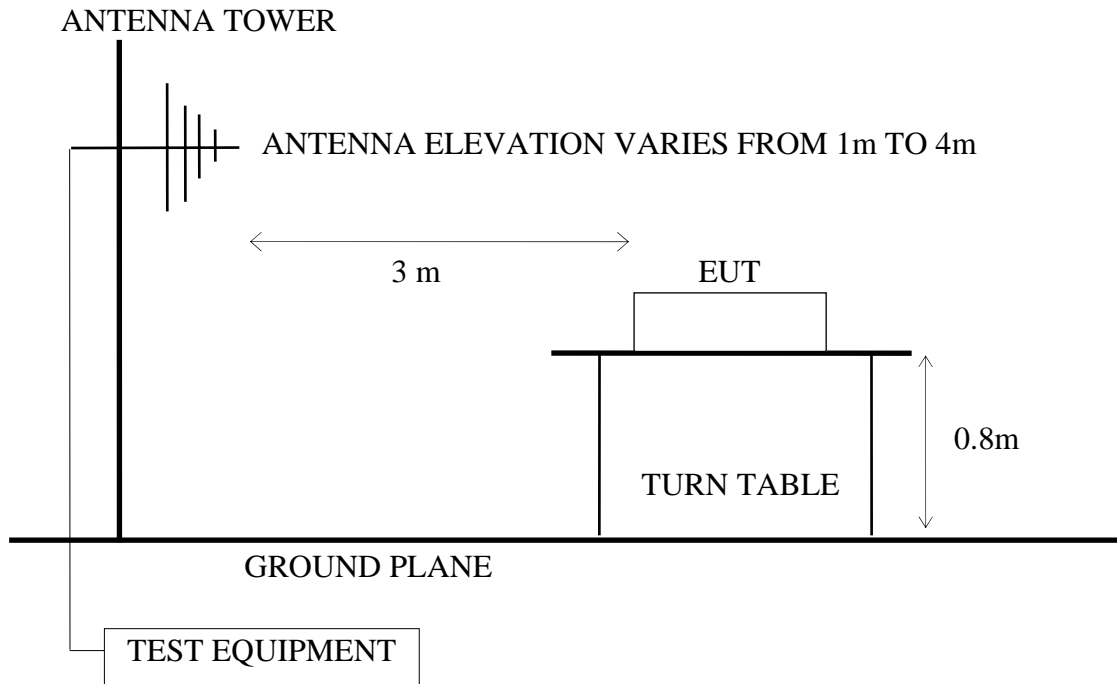
Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'
2.	Pre-Amplifier	HP	8449B	3008A00529	Dec. 10, 10'	Dec. 09, 11'
3.	2.4GHz Notch Filter	EWT	EWT-14-0 070-R1	G2	Dec. 04, 10'	Dec. 03, 11'
4.	3.5G High Pass Filter	HP	84300-800 38	005	Jan. 05, 11'	Jan. 04, 12'
5.	Horn Antenna	EMCO	3115	9112-3775	May 09, 11'	May 08, 12'
6.	Horn Antenna	EMCO	3116	2653	Oct. 04, 10'	Oct. 03, 11'

#### 3.2. Test Setup

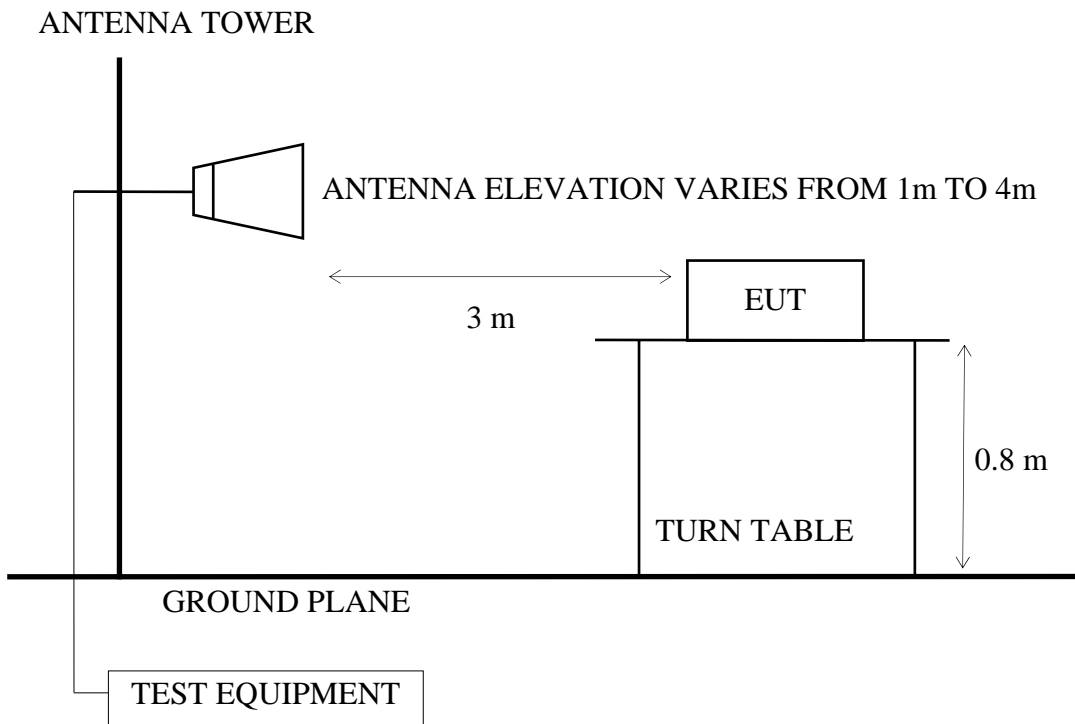
##### 3.2.1. Block Diagram of connection between EUT and simulators



3.2.2. Semi-Anechoic Chamber (3m) Setup Diagram for 30-1000MHz



3.2.3. Semi-Anechoic Chamber (3m) Setup Diagram for above 1GHz



### 3.3. Radiated Emission Limits (§15.209)

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMITS	
		$\mu\text{V/m}$	$\text{dB}\mu\text{V/m}$
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
Above 960	3	500	54.0
Above 1000	3	74.0 $\text{dB}\mu\text{V/m}$ (Peak) 54.0 $\text{dB}\mu\text{V/m}$ (Average)	

- Remark :
- (1) Emission level ( $\text{dB}\mu\text{V/m}$ ) = 20 log Emission level ( $\mu\text{V/m}$ )
  - (2) The tighter limit applies at the edge between two frequency bands.
  - (3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
  - (4) The limits in this table are based on CFR 47 Part 15.205(a)(b) and Part 15.209 (a).
  - (5) The over 1GHz limit, FCC limit is used based on CFR 47 Part 15.35 (b) and Part 15.205(b) & Part 15.209(e) and Part 15.207(c).

### 3.4. Operating Condition of EUT

- 3.4.1. Set up the EUT (Radio Control) as shown on 3.2.
- 3.4.2. To turn on the power of all equipment.
- 3.4.3. The EUT was set the PC system using test program “Futaba Term”.
- 3.4.4. Transmit Mode: The EUT was set to continuously transmit signals at 2403.250MHz、2425.000MHz and 2447.500MHz during testing.
- 3.4.5. Receive Mode: The EUT was set to continuously receive signals at 2425.000MHz during testing.

### 3.5. Test Procedure

The EUT and its simulators were placed on a turn table which was 0.8 meter above the ground. The turn table rotated 360 degrees to determine the position of the maximum emission level. EUT was set 3 meters away from the receiving antenna which was mounted on an antenna tower. The antenna could be moved up and down between 1 to 4 meters to find out the maximum emission level. Broadband antenna such as calibrated biconical and log-periodical antenna or horn antenna were used as a receiving antenna. Both horizontal and vertical polarization of the antenna were set on measurement. In order to find the maximum emission, all of the interface cables were manipulated according to FCC ANSI C63.4-2003 regulation.

The bandwidth of the R&S Test Receiver ESCS30 was set at 120kHz. (For 30MHz to 1000MHz)

The resolution bandwidth and video bandwidth of test spectrum analyzer is 1MHz for peak detection (PK) at frequency above 1GHz.

The frequency range from 30MHz to 25GHz (Up to 10<sup>th</sup> harmonics from fundamental frequency) was checked.

Above 1GHz was measured with peak and average detector. For frequency from 7.5GHz to 25GHz, we checked it in 1 meter distance and with a shorter cable 2 meter instead of original's. There is no signal exist at 10GHz higher.

### 3.6. Radiated Emission Measurement Results

#### **PASSED.**

(All emissions not reported below are too low against the prescribed limits.)

EUT : Radio Control          M/N : TM-FH

Test Date : Jul. 20, 2011    Temperature : 27°C    Humidity : 51%

#### **For Frequency Range 30MHz~1000MHz:**

The EUT emitted the fundamental frequency with data code at the stand, side and lying conditions.

The EUT select **worst position "stand"** and with following test modes was performed during this section testing and all the test results are listed in section 3.6.1.

Mode	Channel	Frequency	Test Mode	Position	Reference Test Data	
					Horizontal	Vertical
1.	01	2403.250MHz	Transmit	Stand	# 13	# 14
2.	30	2425.000MHz		Stand	# 13	# 14
3.	60	2447.500MHz		Stand	# 13	# 14
4.	30	2425.000MHz	Receive	Stand	# 2	# 1

\* Above all final readings were measured with Quasi-Peak detector.

**For Frequency above 1GHz:**

The EUT select **worst position “stand”** and with following test modes was performed during this section testing and all the test results are listed in section 3.6.2.

Mode	Chnnel	Frequency	Test Mode	Position	Test Frequency Range
1.	01	2403.250MHz	Transmit	Stand	<b>1000-2680MHz*</b>
2.					2680-4000MHz
3.					<b>4000-5500MHz*</b>
4.					<b>5500-7500MHz*</b>
5.					<b>7500-10000MHz*</b>
6.					10000-25000MHz
7.	30	2425.000MHz	Transmit	Stand	<b>1000-2680MHz*</b>
8.					2680-4000MHz
9.					<b>4000-5500MHz*</b>
10.					<b>5500-7500MHz*</b>
11.					<b>7500-10000MHz*</b>
12.					10000-25000MHz
13.	60	2447.500MHz	Transmit	Stand	<b>1000-2680MHz*</b>
14.					2680-4000MHz
15.					<b>4000-5500MHz*</b>
16.					<b>5500-7500MHz*</b>
17.					<b>7500-10000MHz*</b>
18.					10000-25000MHz
19.	30	2425.000MHz	Receive	Stand	1000-2680MHz
20.					2680-5500MHz
21.					5500-25000MHz

Remark 1 : The emissions level were too low against the official limit and not report.

Remark 2 : “\*” means there is spurious emission falling the frequency band and be measures.

**For Restricted Bands:**

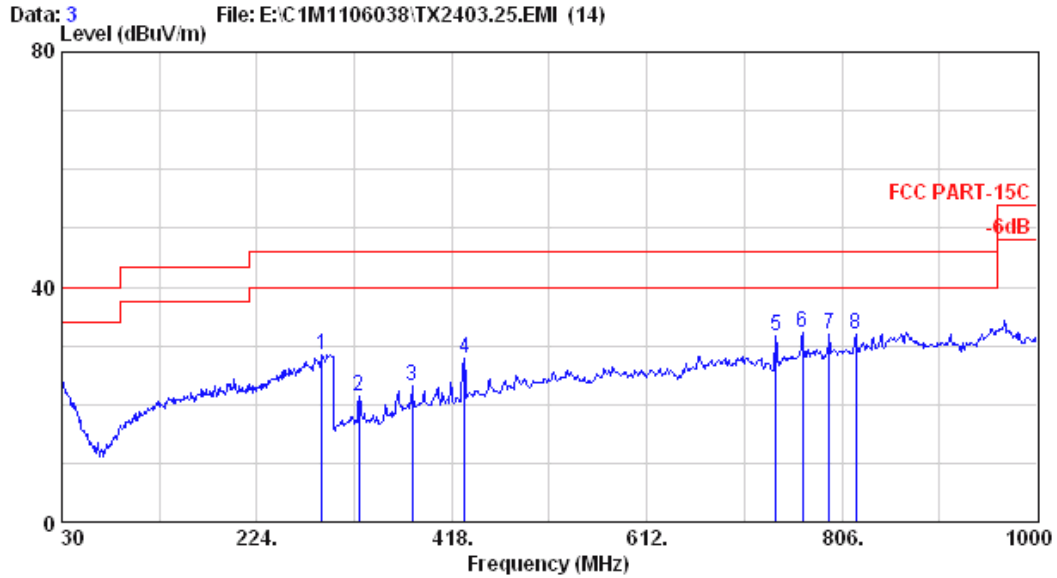
The EUT was tested in restricted bands and all the test results are listed in section 3.6.3. (The restricted bands defined in part 15.205(a))

Mode	Channel	Frequency	Test Mode	Reference Test Data	
				Horizontal	Vertical
1.	01	2403.250MHz	Transmit	# 2, #3	#1, #4
2.	60	2447.500MHz	Transmit	#8, #5	#7, #6

3.6.1. Frequency Range 30-1000MHz



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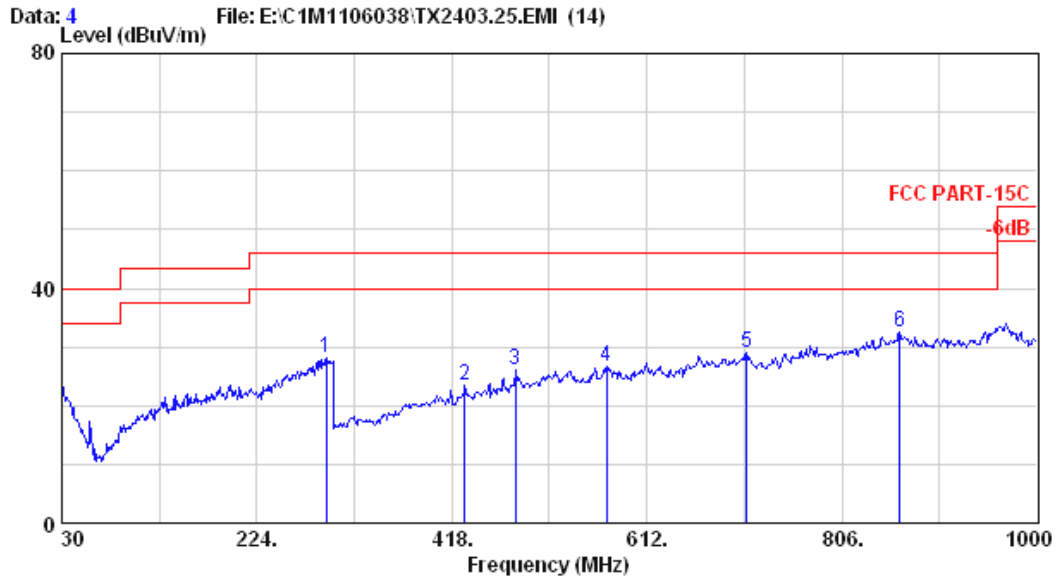
Site no. : A/C Chamber Data no. : 3  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27\*C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	25.97	3.80	-1.23	28.54	46.00	17.46	
2	15.15	4.20	2.07	21.42	46.00	24.58	
3	17.19	4.60	1.27	23.06	46.00	22.94	
4	17.26	5.20	5.32	27.78	46.00	18.22	
5	22.38	6.64	2.60	31.62	46.00	14.38	
6	23.86	6.80	1.70	32.36	46.00	13.64	
7	23.98	6.90	1.18	32.06	46.00	13.94	
8	23.66	7.00	1.38	32.04	46.00	13.96	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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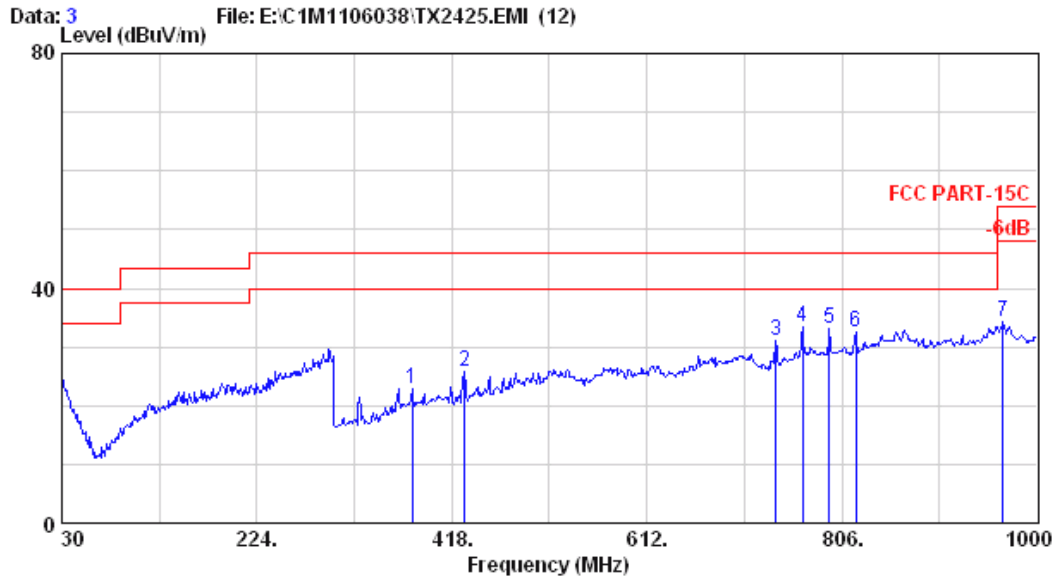
Site no. : A/C Chamber Data no. : 4  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	292.870	26.24	3.90	-1.99	28.15	46.00	17.85	
2	430.610	17.26	5.20	1.06	23.52	46.00	22.48	
3	481.050	18.74	6.10	1.23	26.07	46.00	19.93	
4	572.230	21.12	6.50	-0.98	26.63	46.00	19.37	
5	710.940	23.54	6.51	-1.12	28.92	46.00	17.08	
6	863.230	26.09	7.20	-0.72	32.57	46.00	13.43	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 3  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2425MHz

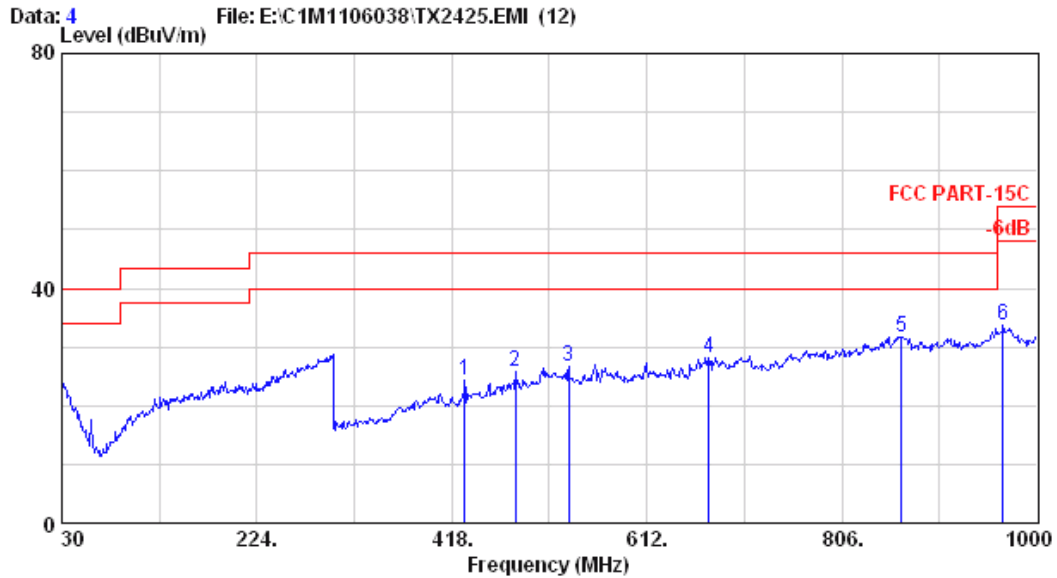
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	378.230	17.19	4.60	1.20	22.99	46.00	23.01	
2	430.610	17.26	5.20	3.19	25.65	46.00	20.35	
3	740.040	22.38	6.64	2.03	31.05	46.00	14.95	
4	767.200	23.86	6.80	2.87	33.53	46.00	12.47	
5	793.390	23.98	6.90	2.36	33.24	46.00	12.76	
6	819.580	23.66	7.00	1.83	32.49	46.00	13.51	
7	966.050	26.89	7.70	-0.45	34.14	54.00	19.86	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.





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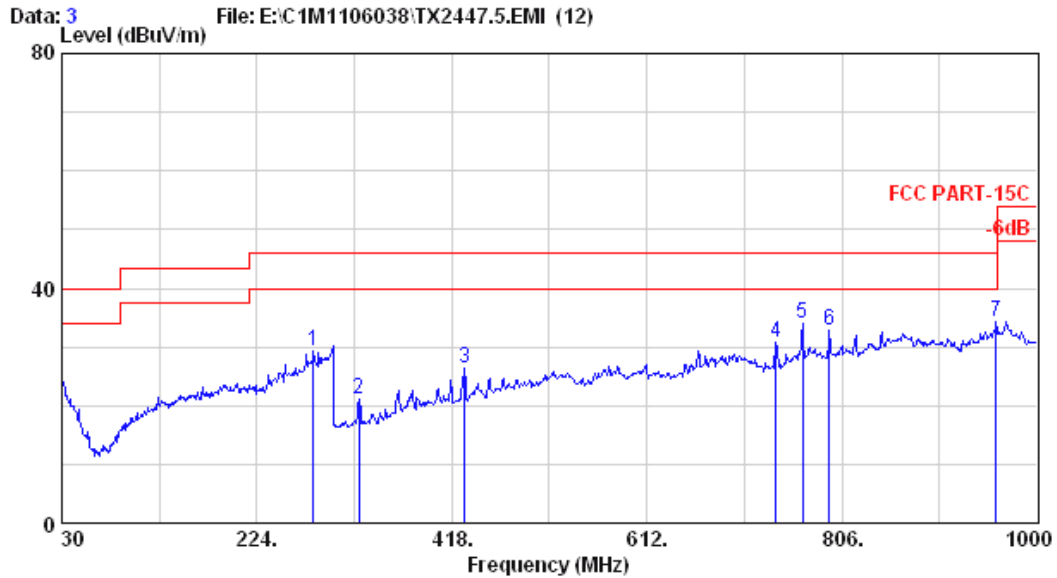
Site no. : A/C Chamber Data no. : 4  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2425MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	430.610	17.26	5.20	1.77	24.23	46.00	21.77	
2	481.050	18.74	6.10	0.90	25.74	46.00	20.26	
3	534.400	19.57	7.00	0.18	26.75	46.00	19.25	
4	674.080	22.87	6.40	-1.09	28.18	46.00	17.82	
5	865.170	26.00	7.20	-1.41	31.79	46.00	14.21	
6	966.050	26.89	7.70	-0.85	33.74	54.00	20.26	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 3  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

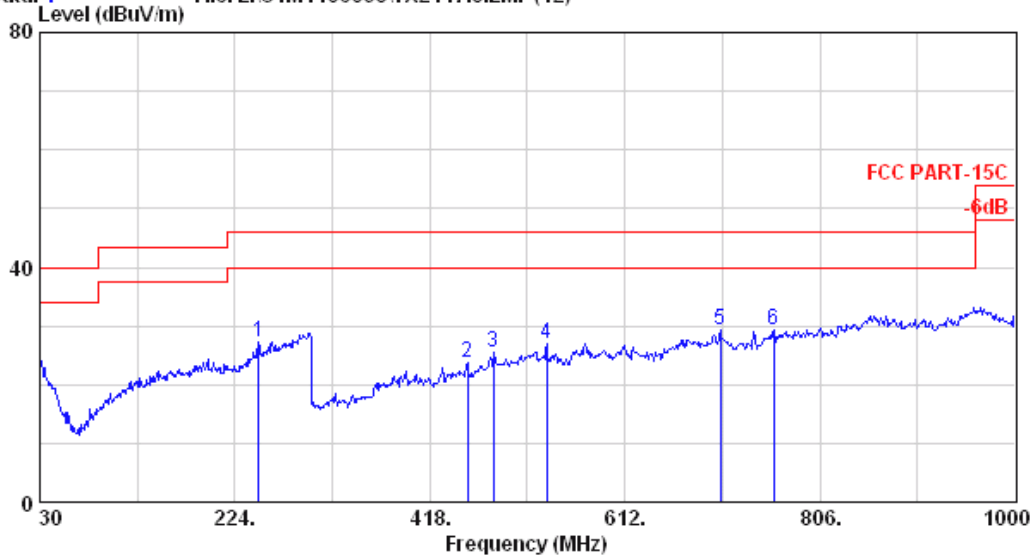
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	280.260	25.30	3.80	0.08	29.17	46.00	16.83	
2	325.850	15.15	4.20	1.89	21.24	46.00	24.76	
3	430.610	17.26	5.20	3.98	26.44	46.00	19.56	
4	740.040	22.38	6.64	1.84	30.86	46.00	15.14	
5	767.200	23.86	6.80	3.20	33.86	46.00	12.14	
6	793.390	23.98	6.90	1.99	32.87	46.00	13.13	
7	959.260	26.38	7.60	0.38	34.37	46.00	11.63	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Data: 4 File: E:\C1M1106038\TX2447.5.EMI (12)



Site no. : A/C Chamber Data no. : 4  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

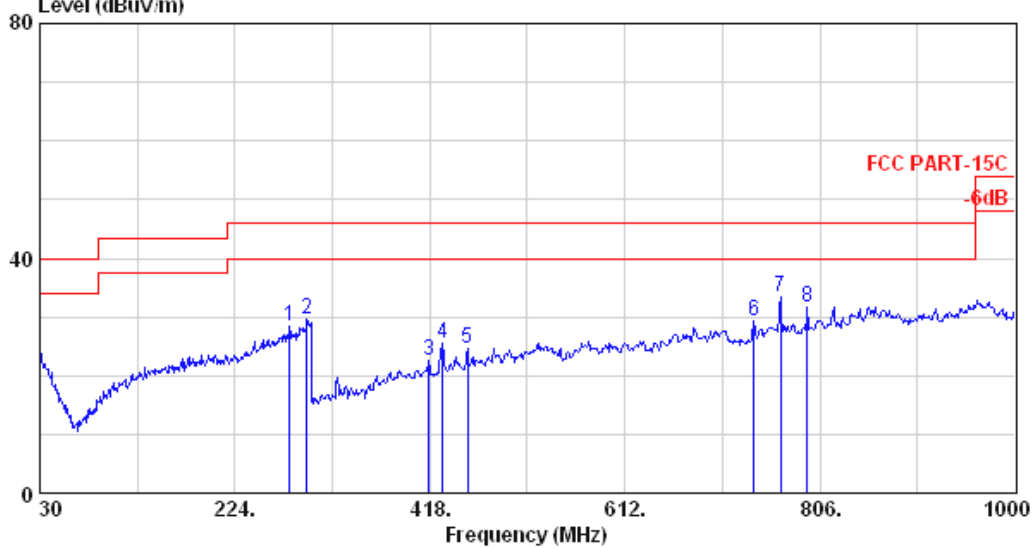
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	247.280	23.61	3.50	0.29	27.40	46.00	18.60	
2	455.830	17.75	5.50	0.36	23.61	46.00	22.39	
3	481.050	18.74	6.10	0.76	25.60	46.00	20.40	
4	534.400	19.57	7.00	0.53	27.10	46.00	18.90	
5	707.060	23.55	6.60	-0.98	29.17	46.00	16.83	
6	760.410	23.66	6.75	-1.23	29.18	46.00	16.82	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Data: 2 File: E:\C1M1106038\RX2425.EMI (2)



Site no. : A/C Chamber Data no. : 2  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : RX2425MHz

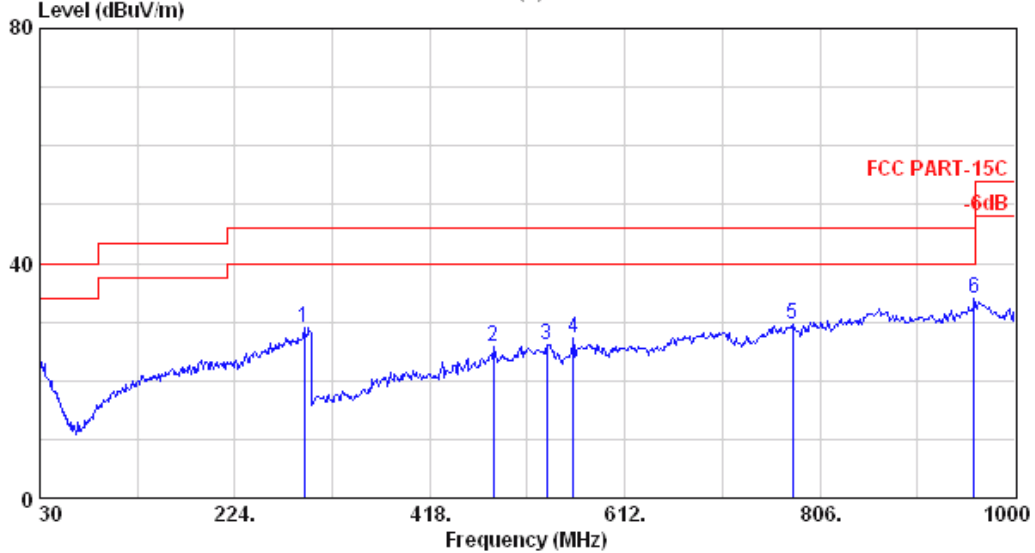
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBµV)	Emission Level (dBµV/m)	Limits (dBµV/m)	Margin (dB)	Remark
1	278.320	25.25	3.80	-0.52	28.53	46.00	17.47	
2	295.780	26.48	4.00	-0.88	29.59	46.00	16.41	
3	417.030	16.95	5.08	0.63	22.65	46.00	23.35	
4	430.610	17.26	5.20	2.99	25.45	46.00	20.55	
5	455.830	17.75	5.50	1.45	24.70	46.00	21.30	
6	740.040	22.38	6.64	0.26	29.28	46.00	16.72	
7	767.200	23.86	6.80	2.82	33.48	46.00	12.52	
8	793.390	23.98	6.90	0.71	31.59	46.00	14.41	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Data: 1 File: E:\C1M1106038\RX2425.EMI (2)



Site no. : A/C Chamber Data no. : 1  
 Dis. / Ant. : 3m VBA6106A/UHALP9108A Ant. pol. : VERTICAL  
 Limit : FCC PART-15C  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : RX2425MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	292.870	26.24	3.90	-1.09	29.05	46.00	16.95	
2	481.050	18.74	6.10	0.85	25.69	46.00	20.31	
3	534.400	19.57	7.00	-0.46	26.11	46.00	19.89	
4	560.590	20.03	6.70	0.44	27.17	46.00	18.83	
5	778.840	24.15	6.80	-1.27	29.68	46.00	16.32	
6	959.260	26.38	7.60	-0.06	33.93	46.00	12.07	

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

3.6.2. Above 1GHz Frequency Range Measurement Results

Date of Test : Jul. 20, 2011 Temperature : 27°C

EUT : Radio Control Humidity : 51%

Test Mode : Transmitting Mode, Frequency: 2403.25MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Horizontal (dBμV)	Emission Level Horizontal (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2540.560	28.39	6.53	10.66	45.58	74.00	28.42
4806.500	32.92	9.14	11.15	53.22	74.00	20.78
7209.750	35.80	11.22	13.35	60.37	74.00	13.63
* 9613.000	37.76	13.04	11.95	62.75	83.50	20.75

- Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from  $20\log(3/1)$ .

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Horizontal (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2540.56	45.58	-30.36	15.22	54.00	38.78
4806.50	53.22	-30.36	22.86	54.00	31.14
7209.75	60.37	-30.36	30.01	54.00	23.99
9613.00	62.75	-30.36	32.39	63.50	31.11

- Remarks: 1. Duty Cycle Factor= $20\log(\text{dwell time}/100\text{ms})=20\log(3.017\text{ms}/100\text{ms})=-30.41$   
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from  $20\log(3/1)$ .

Date of Test : Jul. 20, 2011 Temperature : 27°C

EUT : Radio Control Humidity : 51%

Test Mode : Transmitting Mode, Frequency: 2403.25MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Vertical (dBμV)	Emission Level Vertical (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2249.920	27.96	6.17	13.46	47.59	74.00	26.41
2308.720	28.01	6.23	16.30	50.55	74.00	23.45
2535.520	28.33	6.53	18.88	53.74	74.00	20.26
4806.500	32.92	9.14	17.55	59.62	74.00	14.38
7209.750	35.80	11.22	15.48	62.50	74.00	11.50
* 9613.000	37.76	0.00	40.51	78.27	83.50	5.23

- Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Vertical (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2249.92	47.59	-30.36	17.23	54.00	36.77
2308.72	50.55	-30.36	20.19	54.00	33.81
2535.52	53.74	-30.36	23.38	54.00	30.62
4806.50	59.62	-30.36	29.26	54.00	24.74
7209.75	62.50	-30.36	32.14	54.00	21.86
* 9613.00	78.27	-30.36	47.91	63.50	15.59

- Remarks: 1. Duty Cycle Factor=20log(dwelling time/100ms)=20log(3.017ms/100ms)=-30.41  
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmitting Mode, Frequency: 2425MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Horizontal (dBμV)	Emission Level Horizontal (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2552.320	28.39	6.56	9.71	44.66	74.00	29.34
4850.000	33.02	9.15	12.53	54.71	74.00	19.29
7275.000	35.96	11.32	11.11	58.39	74.00	15.61
*9700.000	37.82	13.00	11.81	62.64	83.50	20.86

Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Horizontal (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2552.32	44.66	-30.36	14.30	54.00	39.70
4850.00	54.71	-30.36	24.35	54.00	29.65
7275.00	59.39	-30.36	29.03	54.00	24.97
* 9700.00	62.64	-30.36	32.28	63.50	31.22

Remarks: 1. Duty Cycle Factor=20log(dwel time/100ms)=20log(3.017ms/100ms)=-30.41  
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).



Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmitting Mode, Frequency: 2425MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Vertical (dBμV)	Emission Level Vertical (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2308.720	28.01	6.23	14.33	48.58	74.00	25.42
2569.120	28.45	6.58	11.96	46.99	74.00	27.01
4853.500	33.02	9.15	20.60	62.78	74.00	11.22
7275.000	35.96	11.32	15.41	62.69	74.00	11.31
* 9700.000	37.82	13.00	23.60	74.43	83.50	9.07

Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Vertical (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2308.72	48.58	-30.36	18.22	54.00	35.78
2535.52	53.30	-30.36	22.94	54.00	31.06
4850.50	62.78	-30.36	32.42	54.00	21.58
7275.00	62.69	-30.36	32.33	54.00	21.67
* 9700.00	74.43	-30.36	44.07	63.50	19.43

Remarks: 1. Duty Cycle Factor=20log(dwell time/100ms)=20log(3.017ms/100ms)=-30.41  
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmitting Mode, Frequency: 2447.5MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Horizontal (dBμV)	Emission Level Horizontal (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2543.920	28.39	6.54	11.50	46.43	74.00	27.57
4895.000	33.09	9.16	12.95	55.21	74.00	18.79
7342.500	36.13	11.48	10.76	58.36	74.00	15.64
* 9790.000	37.88	0.00	23.20	61.07	83.50	22.43

Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Horizontal (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2543.92	46.43	-30.36	16.07	54.00	37.93
4895.00	55.21	-30.36	24.85	54.00	29.15
7342.50	58.36	-30.36	28.00	54.00	26.00
* 9790.00	61.07	-30.36	30.71	63.50	32.79

Remarks: 1. Duty Cycle Factor=20log(dwel time/100ms)=20log(3.017ms/100ms)=-30.41  
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from 20log(3/1).

Date of Test : Jul. 20, 2011 Temperature : 27°C

EUT : Radio Control Humidity : 51%

Test Mode : Transmitting Mode, Frequency: 2447.5MHz, Position: Stand

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading Vertical (dBμV)	Emission Level Vertical (dBμV/m)	Limits (dBμV/m)	Margin (dB)
2296.960	27.99	6.23	16.30	50.53	74.00	23.47
2565.760	28.45	6.58	15.89	50.92	74.00	23.08
4895.000	33.09	9.16	21.81	64.07	74.00	9.93
7342.500	36.13	11.48	18.55	66.15	74.00	7.85
* 9790.000	37.88	0.00	33.05	70.92	83.50	12.58

- Remarks: 1. Emission level=Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.  
 3. All final readings of measurement were with Peak values.  
 4. \*: Measured at 1m and limit is transformed to 83.5dBμV/m by adding a factor 9.5 which is calculated from  $20\log(3/1)$ .

Emission Frequency (MHz)	Peak Value (dB/m)	Duty Cycle Factor (dB)	Average Value Vertical (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2296.96	50.53	-30.36	20.17	54.00	33.83
2565.76	50.92	-30.36	20.56	54.00	33.44
4895.00	64.07	-30.36	33.71	54.00	20.29
7342.50	66.15	-30.36	35.79	54.00	18.21
* 9790.00	70.92	-30.36	40.56	63.50	22.94

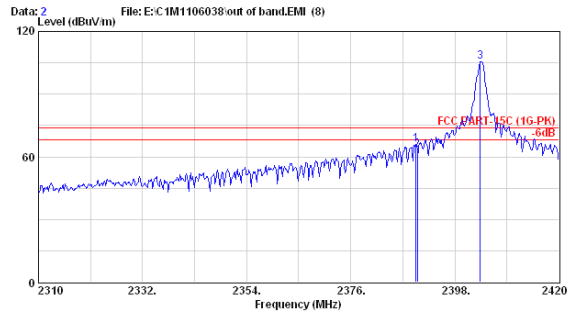
- Remarks: 1. Duty Cycle Factor= $20\log(\text{dwell time}/100\text{ms})=20\log(3.017\text{ms}/100\text{ms})=-30.41$   
 2. Average value=Peak value+ Duty Cycle Factor  
 3. All final readings of measurement were with Average values.  
 4. \*: Measured at 1m and limit is transformed to 63.5dBμV/m by adding a factor 9.5 which is calculated from  $20\log(3/1)$ .

### 3.6.3. Restricted Bands Measurement Results

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmit, Channel: 01, Frequency: 2403.250MHz



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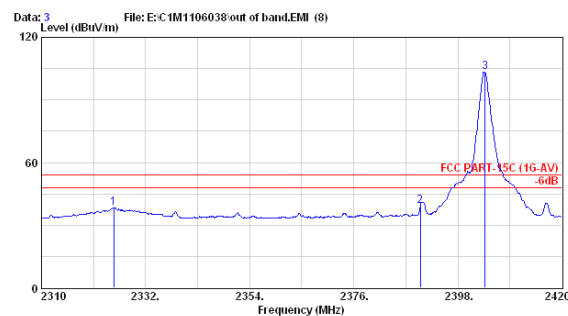
Site no. : A/C Chamber Data no. : 2  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C (1G-PK)  
 Env. / Ins. : E4446A 27°C / 51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2389.750	28.10	6.34	31.54	65.97	74.00	8.03	Peak
2 2390.080	28.10	6.34	28.93	63.37	74.00	10.63	Peak
3 2403.390	28.11	6.36	70.98	105.45	74.00	-31.45	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 3  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C (1G-AV)  
 Env. / Ins. : E4446A 27°C / 51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

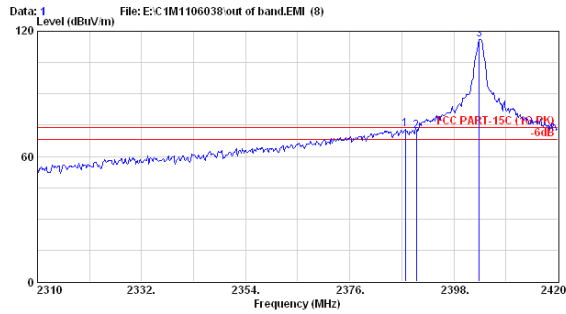
Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2325.290	28.03	6.26	4.00	38.29	54.00	15.71	Average
2 2390.080	28.10	6.34	4.51	38.95	54.00	15.05	Average
3 2403.720	28.11	6.36	68.78	103.25	54.00	-49.25	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmit, Channel: 01, Frequency: 2403.250MHz



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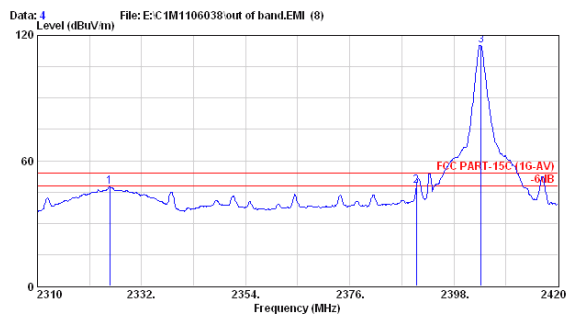
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 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-PK)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-PH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2387.770	28.10	6.34	38.43	72.87	74.00	1.13	Peak
2 2390.080	28.10	6.34	37.63	72.07	74.00	1.93	Peak
3 2403.390	28.11	6.36	81.76	116.23	74.00	-42.23	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 4  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-AV)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-PH  
 Power Rating : DC 12V  
 Test Mode : TX2403.25MHz

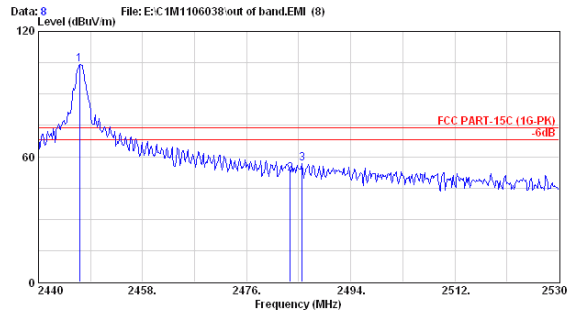
Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1 2325.290	28.03	6.26	13.20	47.49	54.00	6.51	Average
2 2390.080	28.10	6.34	13.40	47.84	54.00	6.16	Average
3 2403.720	28.11	6.36	80.81	115.28	54.00	-61.28	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmit, Channel: 60, Frequency: 2447.500MHz



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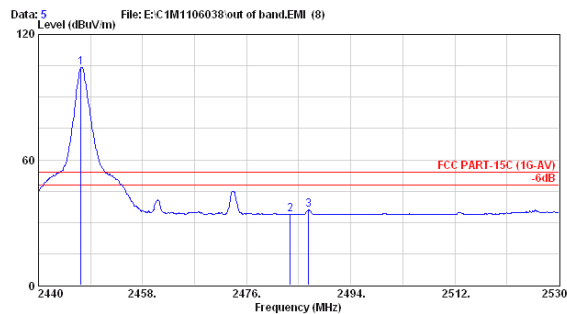
Site no. : A/C Chamber Data no. : 8  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C (1G-PK)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-PH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2447.110	28.15	6.41	69.54	104.10	74.00	-30.10	Peak
2	2483.560	28.18	6.45	17.26	51.89	74.00	22.11	Peak
3	2485.630	28.18	6.45	22.01	56.65	74.00	17.35	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 5  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : HORIZONTAL  
 Limit : FCC PART-15C (1G-AV)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-PH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

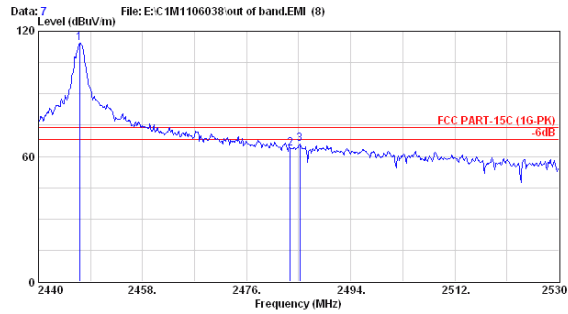
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2447.380	28.15	6.41	69.70	104.26	54.00	-50.26	Average
2	2483.560	28.18	6.45	-0.64	33.99	54.00	20.01	Average
3	2486.710	28.18	6.45	1.53	36.17	54.00	17.83	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

Date of Test : Jul. 20, 2011 Temperature : 27°C  
 EUT : Radio Control Humidity : 51%  
 Test Mode : Transmit, Channel: 60, Frequency: 2447.500MHz



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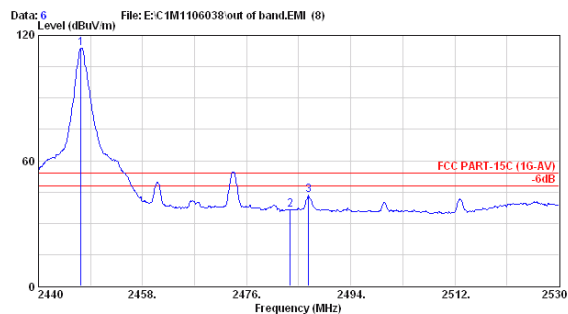
Site no. : A/C Chamber Data no. : 7  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-PK)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2447.110	28.15	6.41	79.65	114.21	74.00	-40.21	Peak
2	2483.560	28.18	6.45	29.00	63.63	74.00	10.37	Peak
3	2485.180	28.18	6.45	31.15	65.79	74.00	8.21	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.



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Site no. : A/C Chamber Data no. : 6  
 Dis. / Ant. : 3m 3115 (3775) Ant. pol. : VERTICAL  
 Limit : FCC PART-15C (1G-AV)  
 Env. / Ins. : E4446A 27°C /51% Engineer : Jarwei Wang  
 EUT : TM-FH  
 Power Rating : DC 12V  
 Test Mode : TX2447.5MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2447.380	28.15	6.41	79.49	114.05	54.00	-60.05	Average
2	2483.560	28.18	6.45	1.95	36.58	54.00	17.42	Average
3	2486.710	28.18	6.45	8.78	43.42	54.00	10.58	Average

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.  
 2. The emission levels that are 20dB below the official limit are not reported.

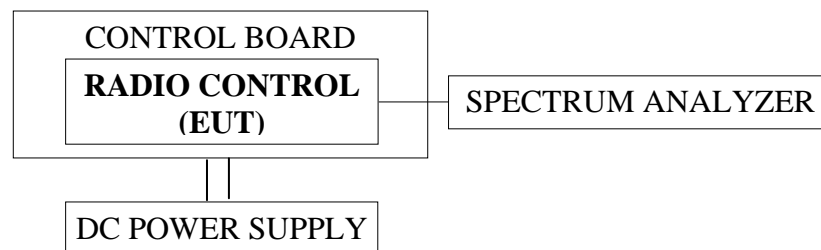
## 4. 20dB BANDWIDTH MEASUREMENT

### 4.1. Test Equipment

The following test equipment was used during the 20dB bandwidth measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 4.2. Block Diagram of Test Setup



### 4.3. Specification Limits (§15.247(a)(1))

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 4.4. Operating Condition of EUT

- 4.4.1. Set up the EUT and simulator as shown on 4.2.
- 4.4.2. To turn on the power of all equipment.
- 4.4.3. EUT (Radio Control) was on transmitting frequency function during the testing.

### 4.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 3kHz RBW and 3kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

RBW=1% of the 20dB bandwidth

VBW=RBW



#### 4.6. Test Results

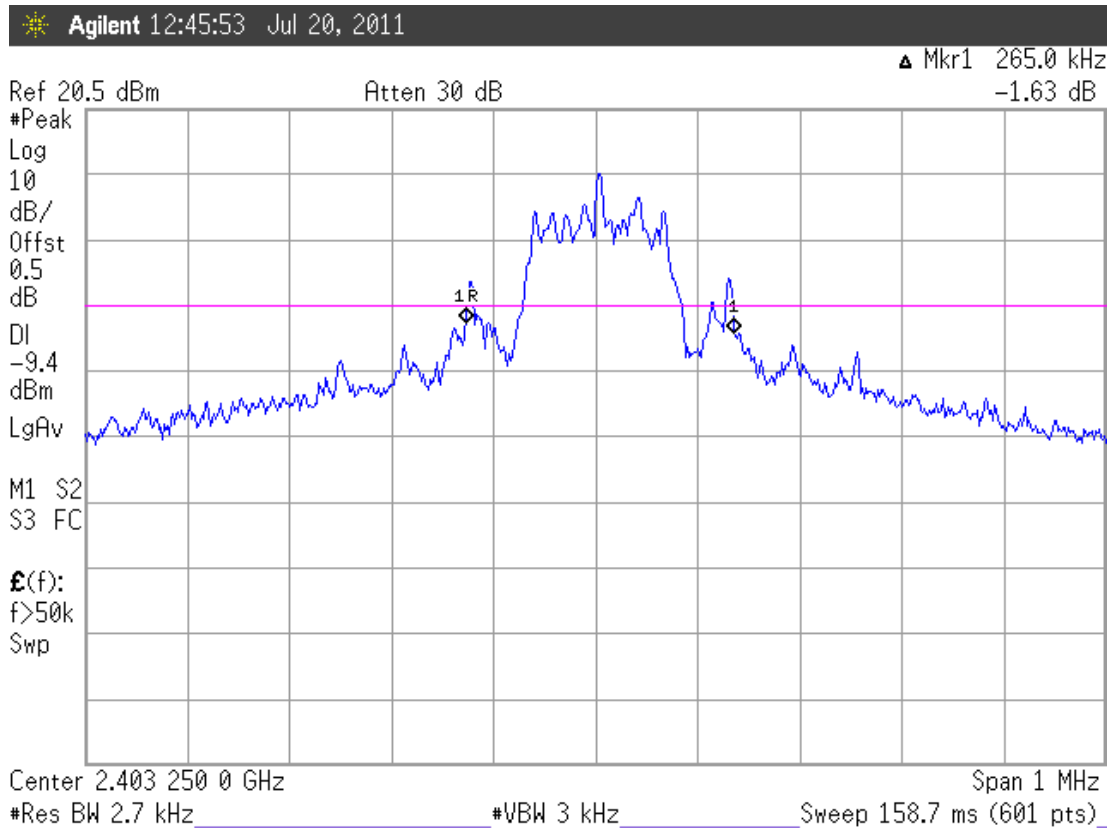
**PASSED.** All the test results are attached in next pages.

Test Date : Jul. 20, 2011 Temperature :27°C Humidity : 53%

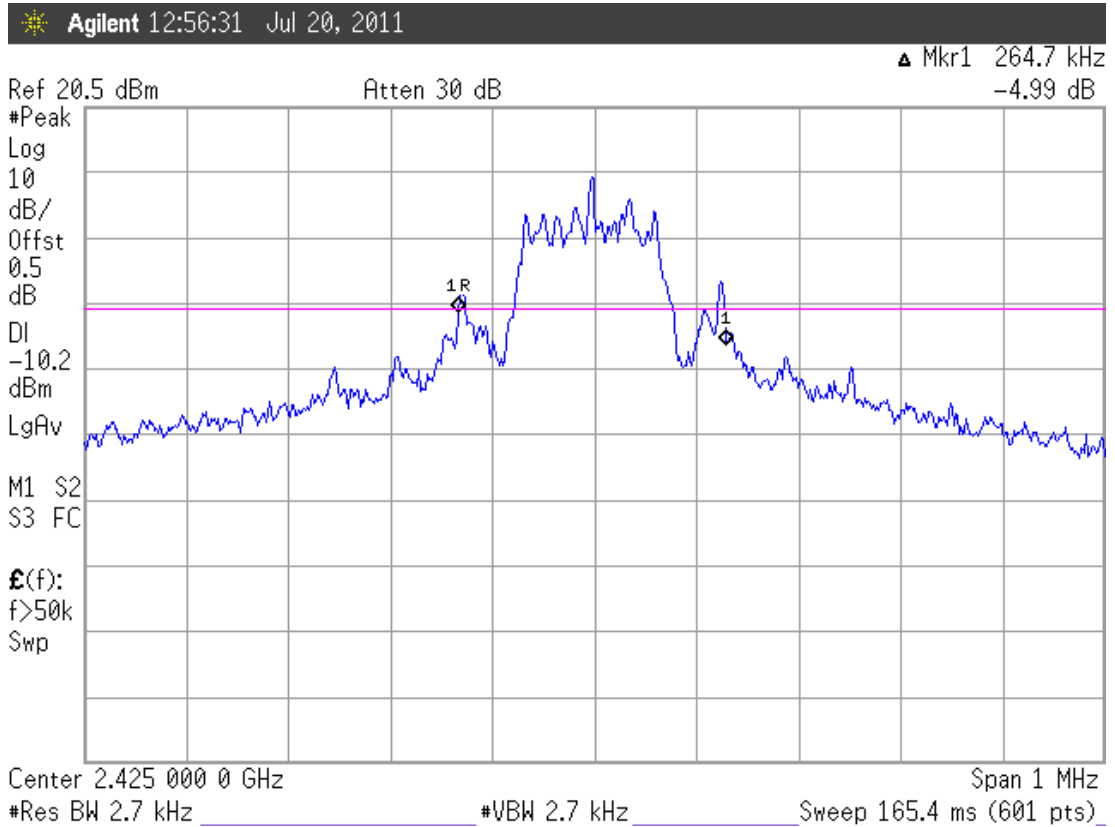
No.	Channel	Test Frequency	20dB Bandwidth	2/3 (20dB Bandwidth)
1.	01	2403.250MHz	<b>265.0kHz</b>	<b>176.67kHz</b>
2.	30	2425.000MHz	<b>264.7kHz</b>	<b>176.00kHz</b>
3.	60	2447.500MHz	<b>264.8kHz</b>	<b>176.53kHz</b>

The maximum two-thirds of the 20dB bandwidth shall be at maximum 176.67kHz.

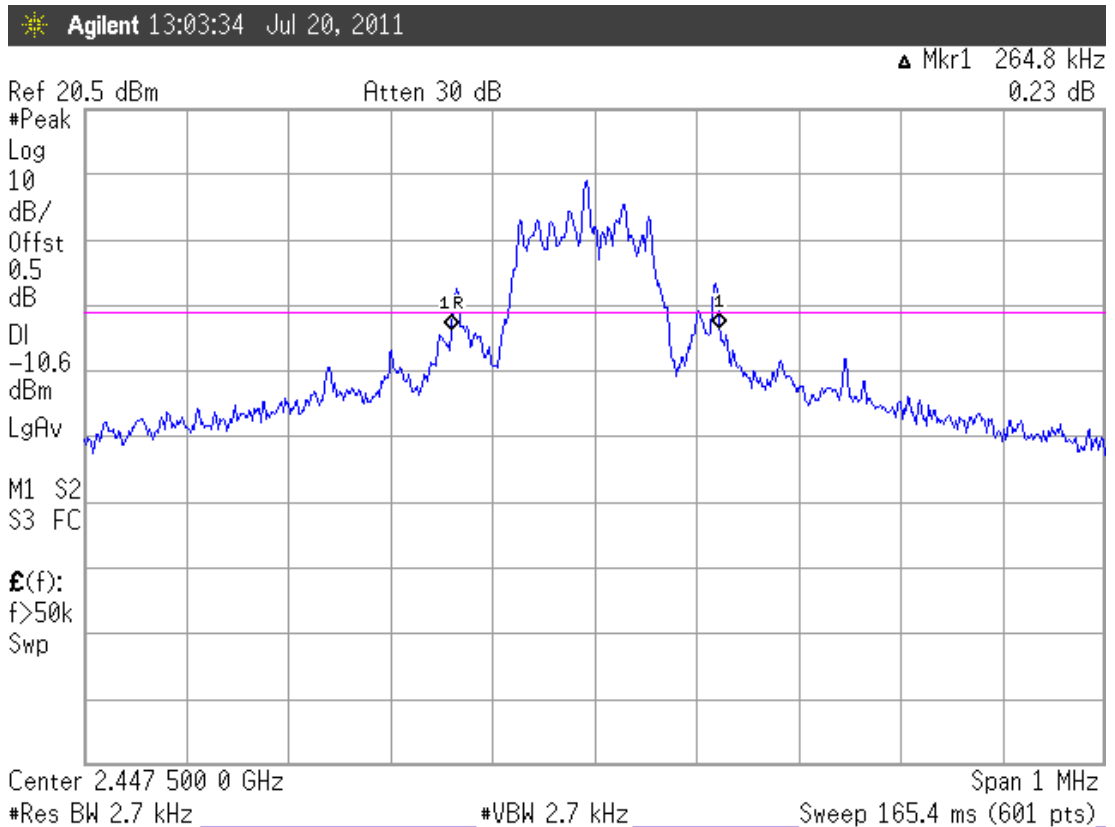
##### 4.6.1. Channel 01, Frequency: 2403.250MHz



4.6.2. Channel 30, Frequency: 2425.000MHz



4.6.3. Channel 60, Frequency: 2447.500MHz



## 5. CARRIER FREQUENCY SEPARATION MEASUREMENT

### 5.1. Test Equipment

The following test equipment was used during the carrier frequency separation measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 5.2. Block Diagram of Test Setup

The same as section.4.2.

### 5.3. Specification Limits (§15.247(a)(1))

Alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

### 5.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 5.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The channel separation was measure by spectrum analyzer with 39kHz RBW and 39kHz VBW. The video bandwidth not to be smaller than resolution bandwidth, the peak was mark on adjacent bandwidth, the between of peak is carrier frequency separation.

RBW=1% Span

VBW=RBW

### 5.6. Test Results

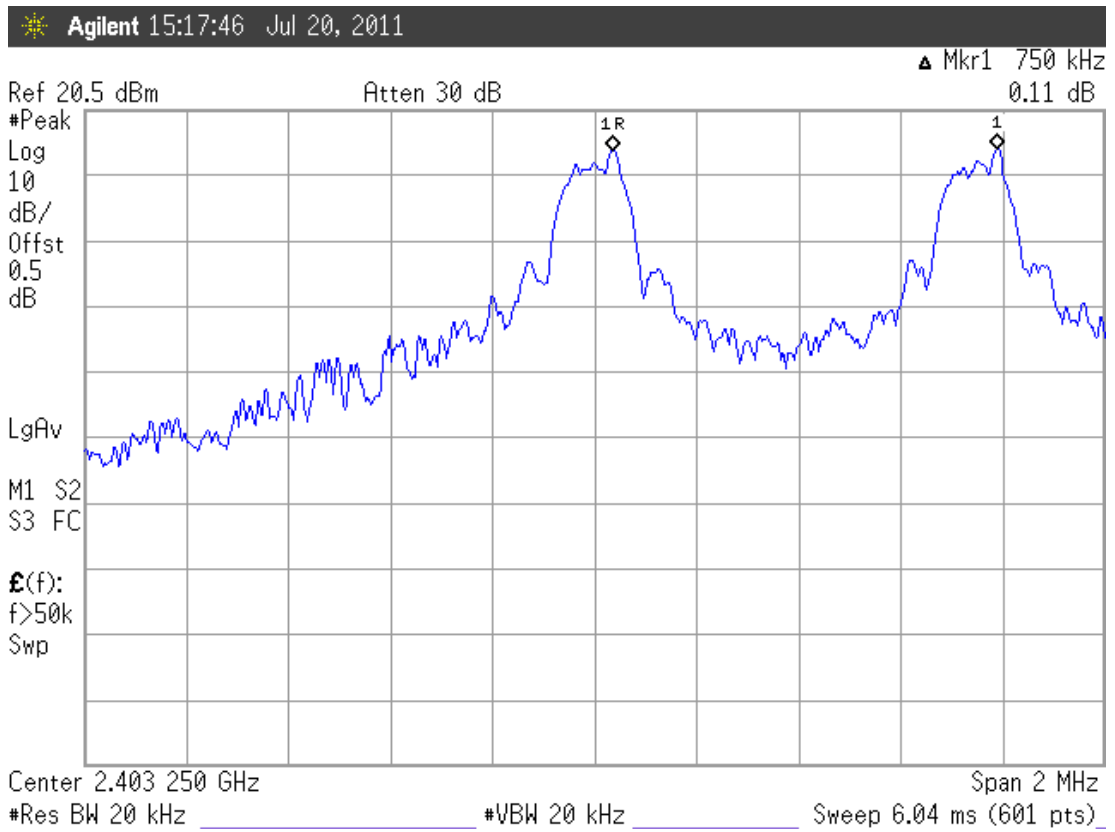
**PASSED.** All the test results are attached in next pages.

Test Date : Jul. 20, 2011 Temperature :27°C Humidity : 53%

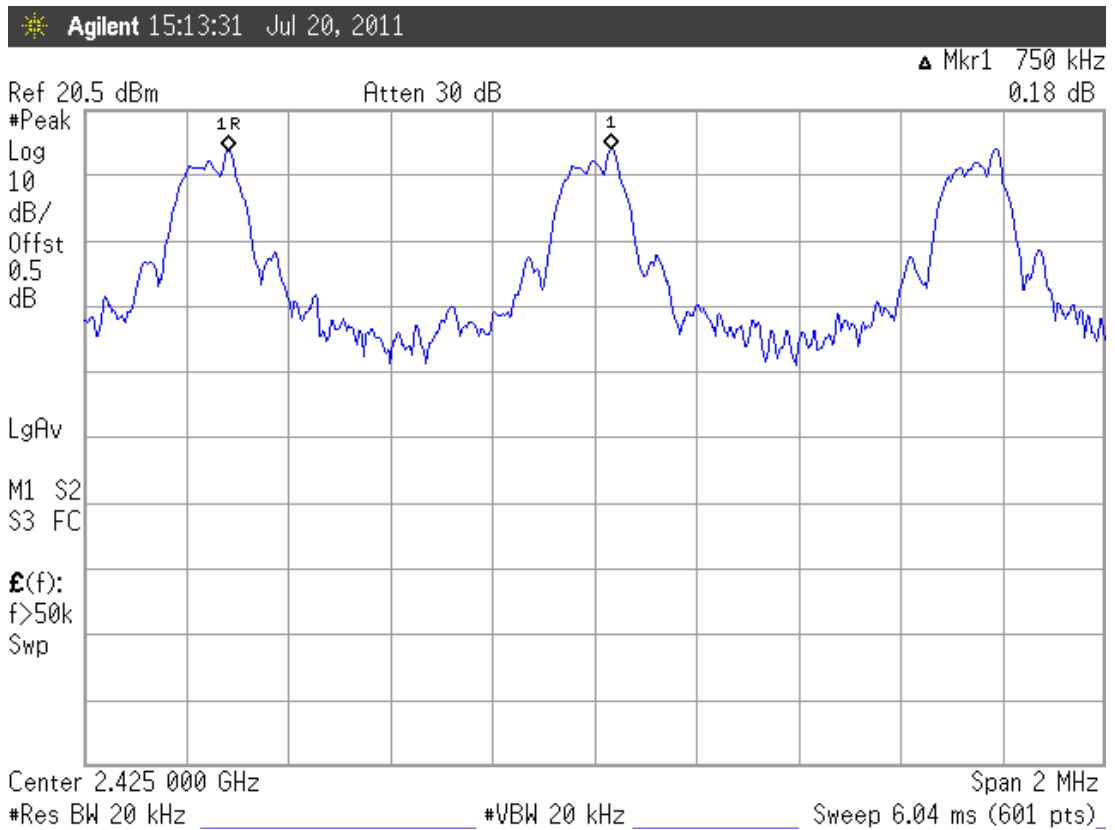
The minimum adjacent channel carrier frequency separation: 750kHz ◦

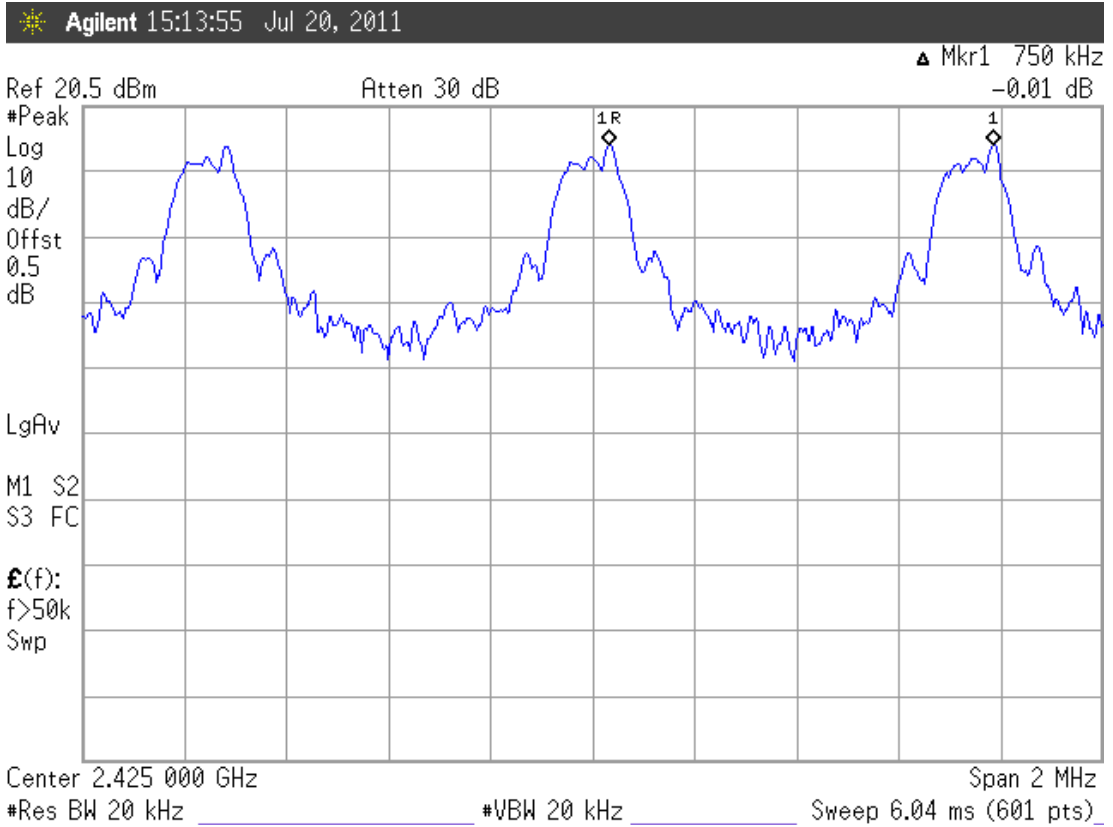
[Above values have met the requirement as specified in section 4.3: frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.]

5.6.1. Channel 01, Test Frequency: 2403.250MHz

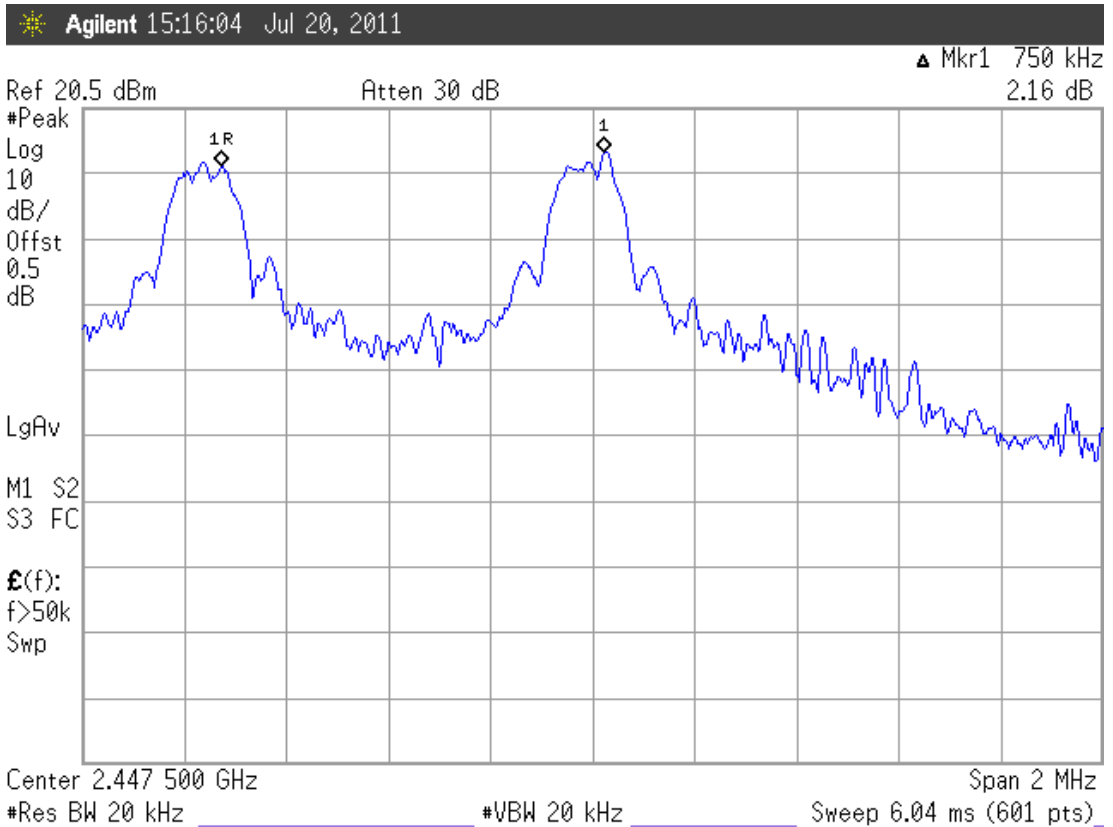


5.6.2. Channel 30, Test Frequency: 2425.000MHz





5.6.3. Channel 60, Test Frequency: 2447.500MHz



## 6. TIME OF OCCUPANCY MEASUREMENT

### 6.1. Test Equipment

The following test equipment was used during the time of occupancy measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 6.2. Block Diagram of Test Setup

The same as section.4.2.

### 6.3. Specification Limits (§15.247(a)(1)(iii))

Frequency hopping systems in the 2400-2483.5MHz shall use at least 15 non-overlapping 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 number of hopping channels employed.

### 6.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 6.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 1MHz RBW and 1MHz VBW.  $VBW \geq RBW$  ; Span=zero span.  
Centered on a hopping channel sweep=as necessary to capture the entire dwell time per hopping channel ; Detector function=peak ; Trace=Max hold

### 6.6. Test Results

**PASSED.** All the test results are attached in next pages.

Test Date : Jul. 20, 2011    Temperature :27°C    Humidity : 53%

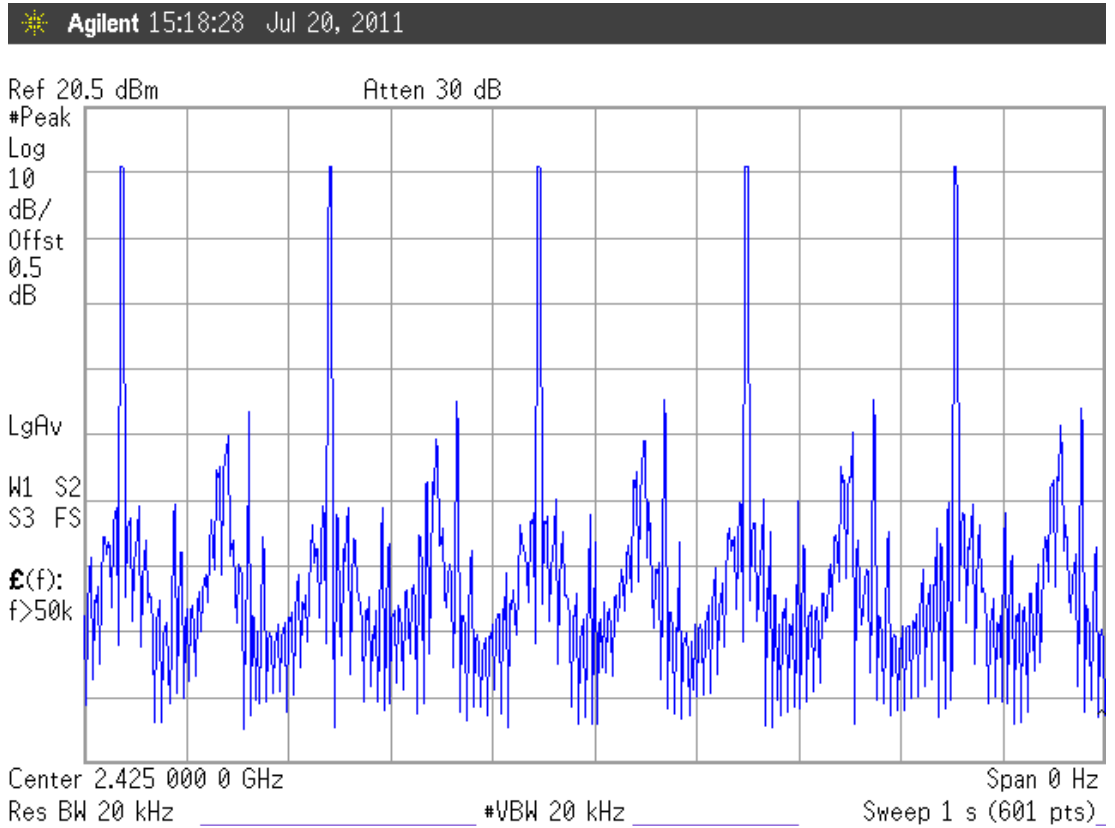
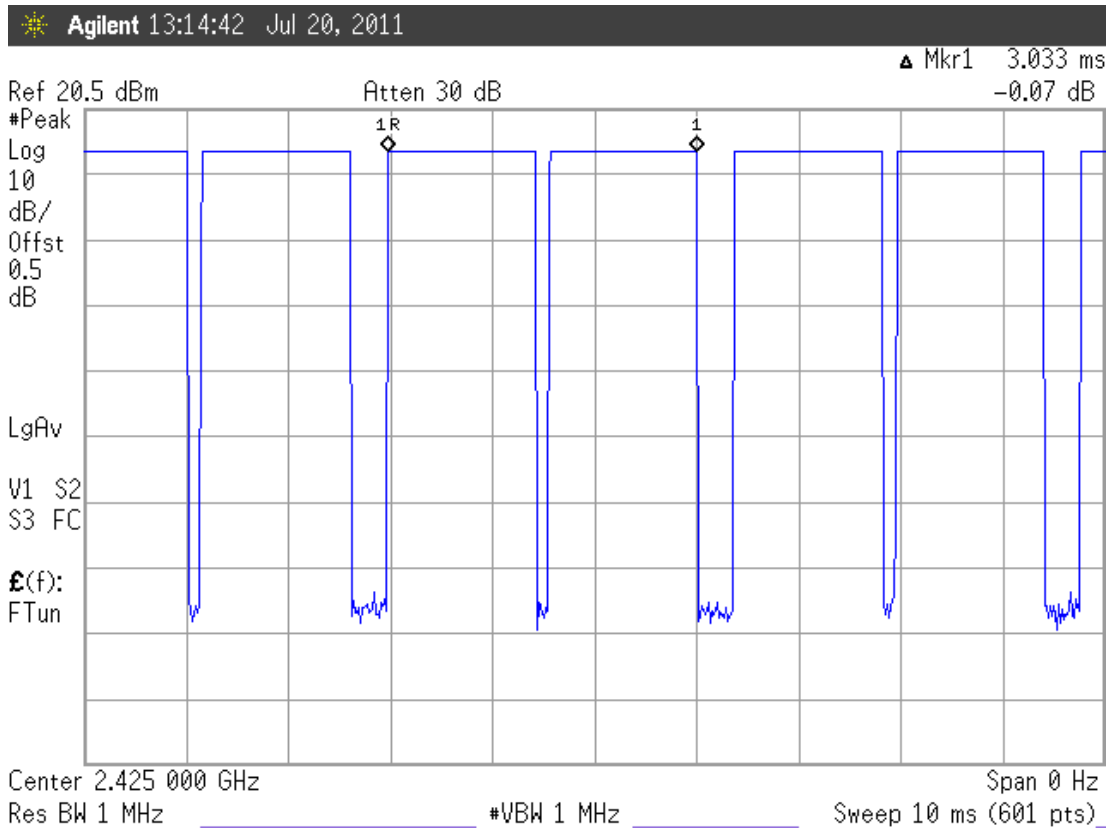
Duty cycle: 60 channels\*0.4 seconds = 24 seconds

#### **Test Frequency: 2425.000MHz**

For per second of 5 channels appearance, the longest time of occupancy for each of 24 seconds is:

5 channels\*24 seconds\* 3.033ms = 363.96ms (<400ms)

6.6.1. Channel 30, Test Frequency: 2425.000MHz



## 7. NUMBER OF HOPPING CHANNELS MEASUREMENT

### 7.1. Test Equipment

The following test equipment was used during the number of hopping channels measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 7.2. Block Diagram of Test Setup

The same as section.4.2.

### 7.3. Specification Limits (§15.247(a)(1)(iii))

Frequency hopping systems which use fewer than 20 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels.

### 7.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 7.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 100kHz RBW and 100kHz VBW. Sweep=Auto ; Detector function=peak ; Trace=Max hold

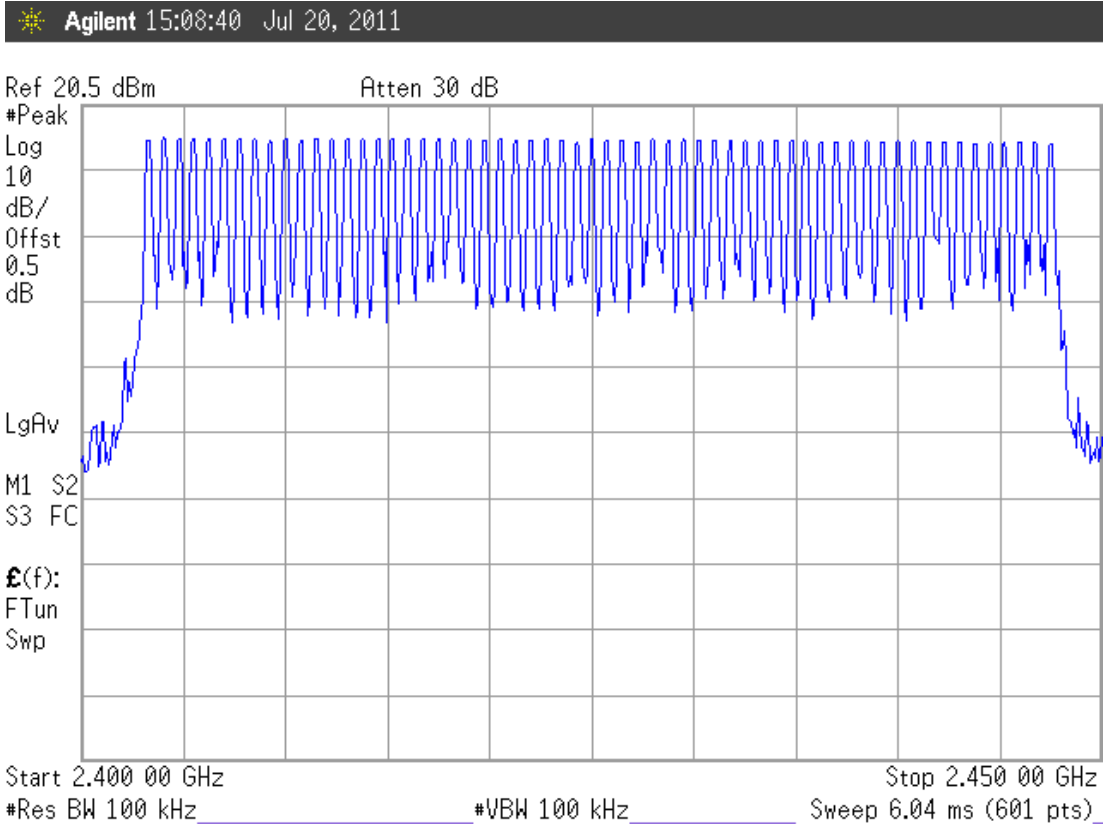
### 7.6. Test Results

**PASSED.** All the test results are attached in next page.

Test Date : Jul. 20, 2011 Temperature :27°C Humidity : 53%

The number hopping channel is 60.





## 8. MAXIMUM PEAK OUTPUT POWER MEASUREMENT

### 8.1. Test Equipment

The following test equipment was used during the maximum peak output power measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 8.2. Block Diagram of Test Setup

The same as section.4.2.

### 8.3. Specification Limits (§15.247(b)-(1))

The Limits of maximum Peak Output Power for frequency hopping systems in 2400-2483.5MHz is: 0.125Watt. (21dBm)

### 8.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in 4.4 except the test set up replaced by section 8.2.

### 8.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. The bandwidth of the fundamental frequency was measure by spectrum analyzer with 1MHz RBW and 13MHz VBW. Sweep=Auto ; Detector function=peak ; Trace=Max hold

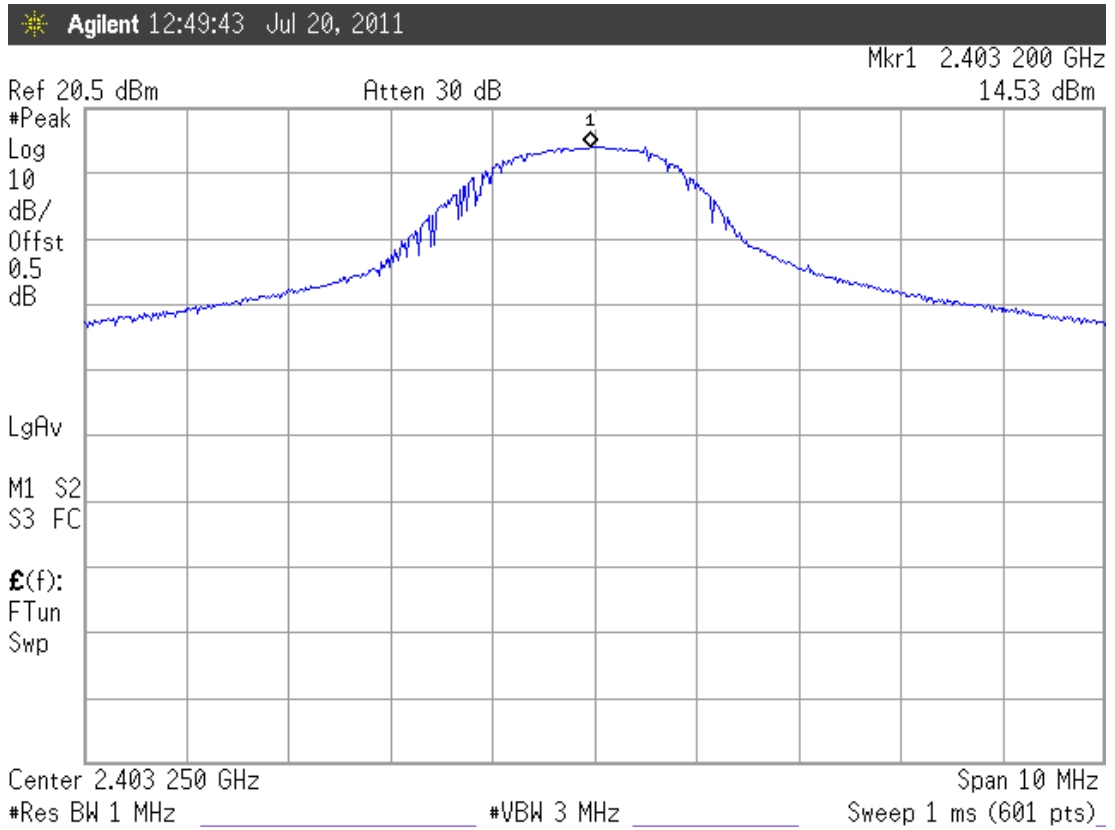
### 8.6. Test Results

**PASSED.** All the test results are listed below.

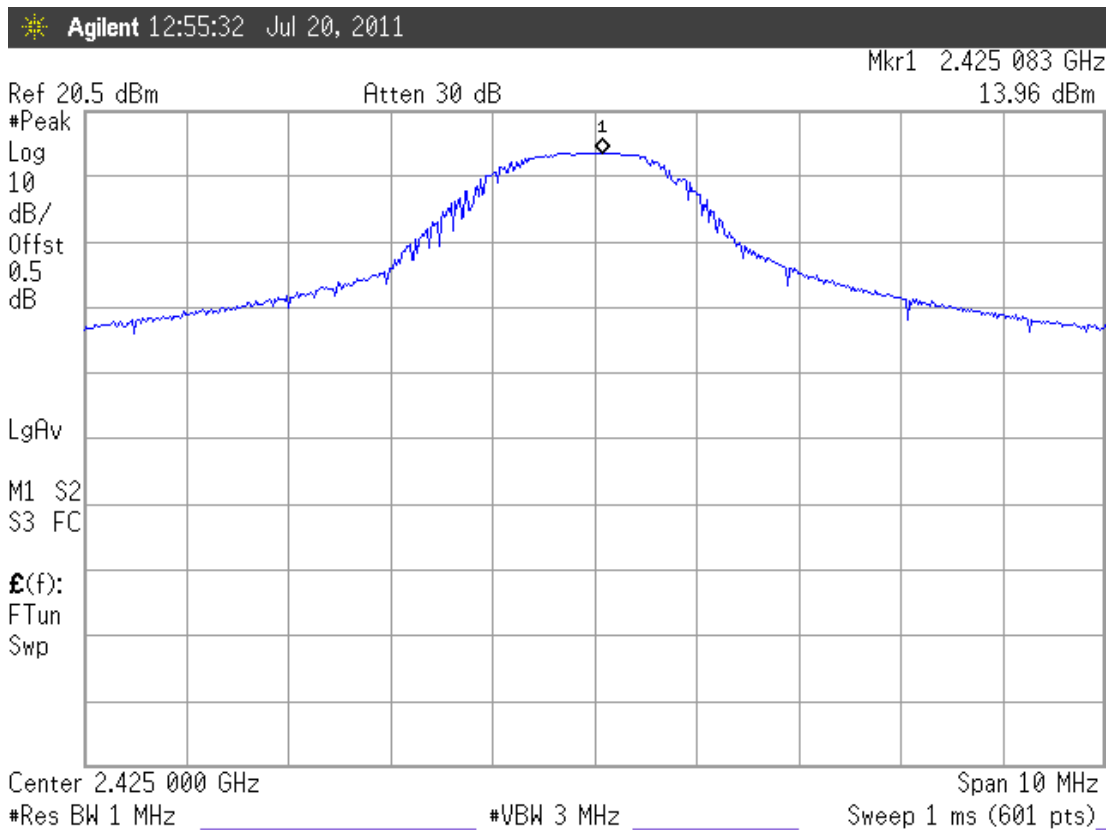
Test Date : Jul. 20, 2011 Temperature :27°C Humidity : 53%

No.	Channel	Test Frequency	Peak Output Power	Limit
1.	01	2403.250MHz	<b>14.53dBm</b>	21dBm
2.	30	2425.000MHz	<b>13.96dBm</b>	21dBm
3.	60	2447.500MHz	<b>13.52dBm</b>	21dBm

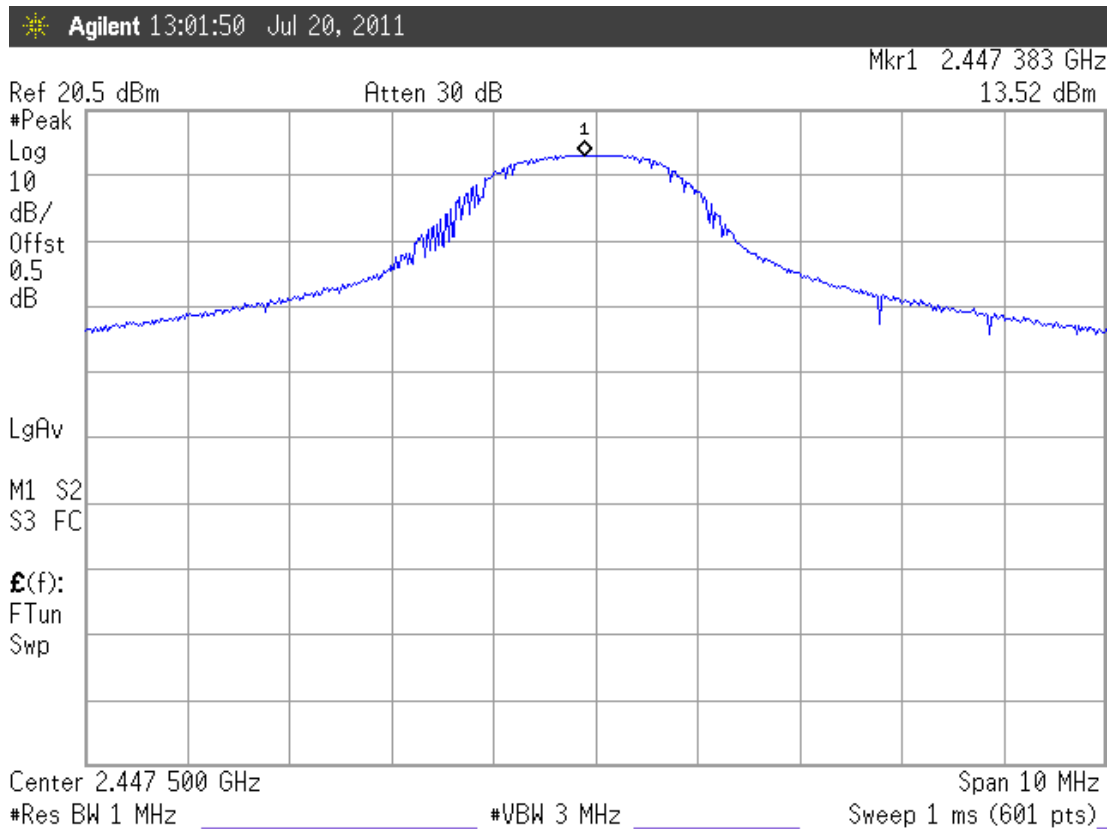
8.6.1. Channel 01, Frequency: 2403.250MHz



8.6.2. Channel 30, Frequency: 2425.000MHz



### 8.6.3. Channel 60, Frequency: 2447.500MHz



## 9. EMISSION LIMITATIONS MEASUREMENT

### 9.1. Test Equipment

The following test equipment was used during the emission limitations measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	N9010A-526	MY48031076	Oct. 05, 10'	Oct. 04, 11'

### 9.2. Block Diagram of Test Setup

The same as section.4.2.

### 9.3. Specification Limits (§15.247(c))

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).(※ This test result attaching to §3.6.3)

### 9.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 9.5. Test Procedure (DA 00-705)

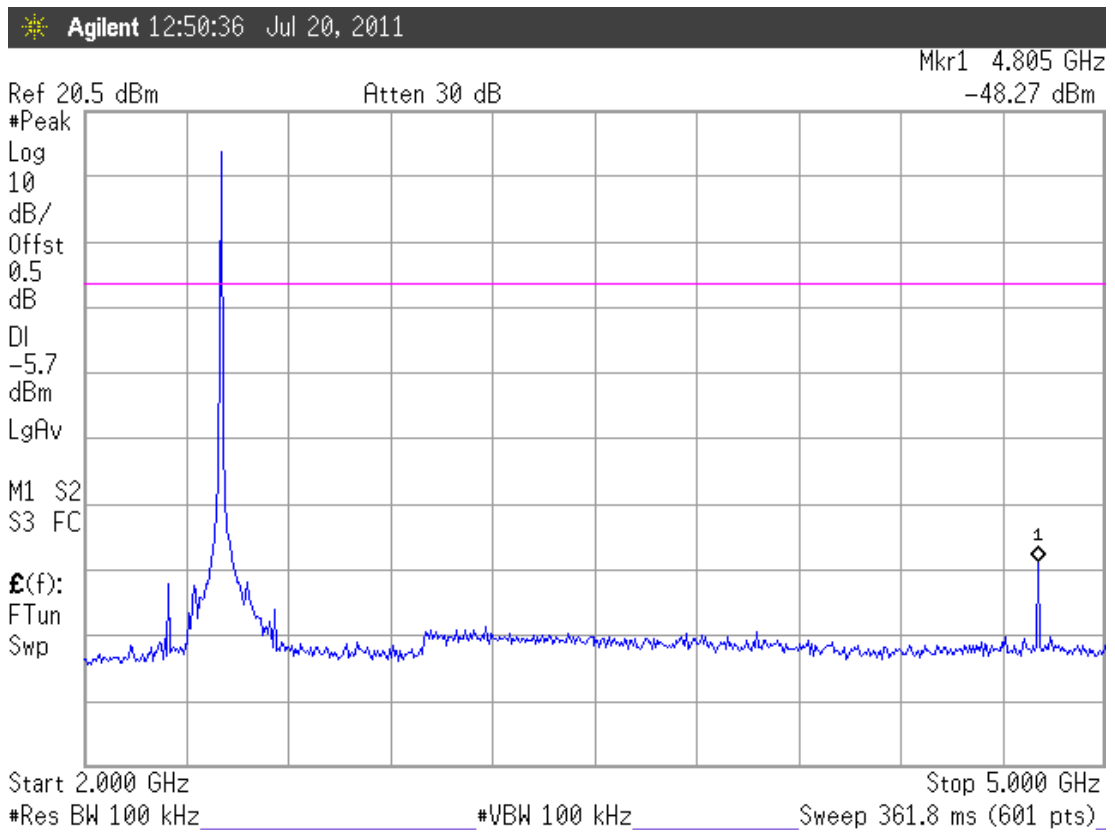
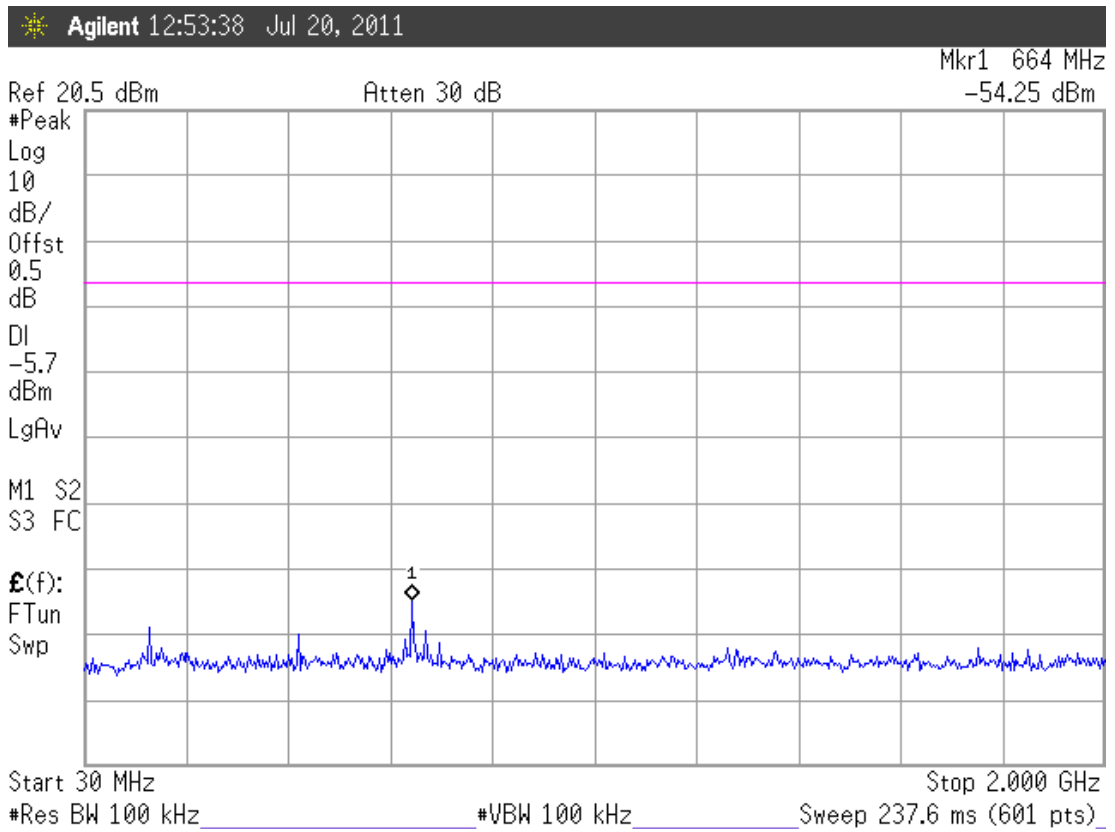
The transmitter output was connected to the spectrum analyzer. Set both RBW and VBW of spectrum analyzer to 100kHz with frequency range from 30MHz to 25GHz.

### 9.6. Test Results

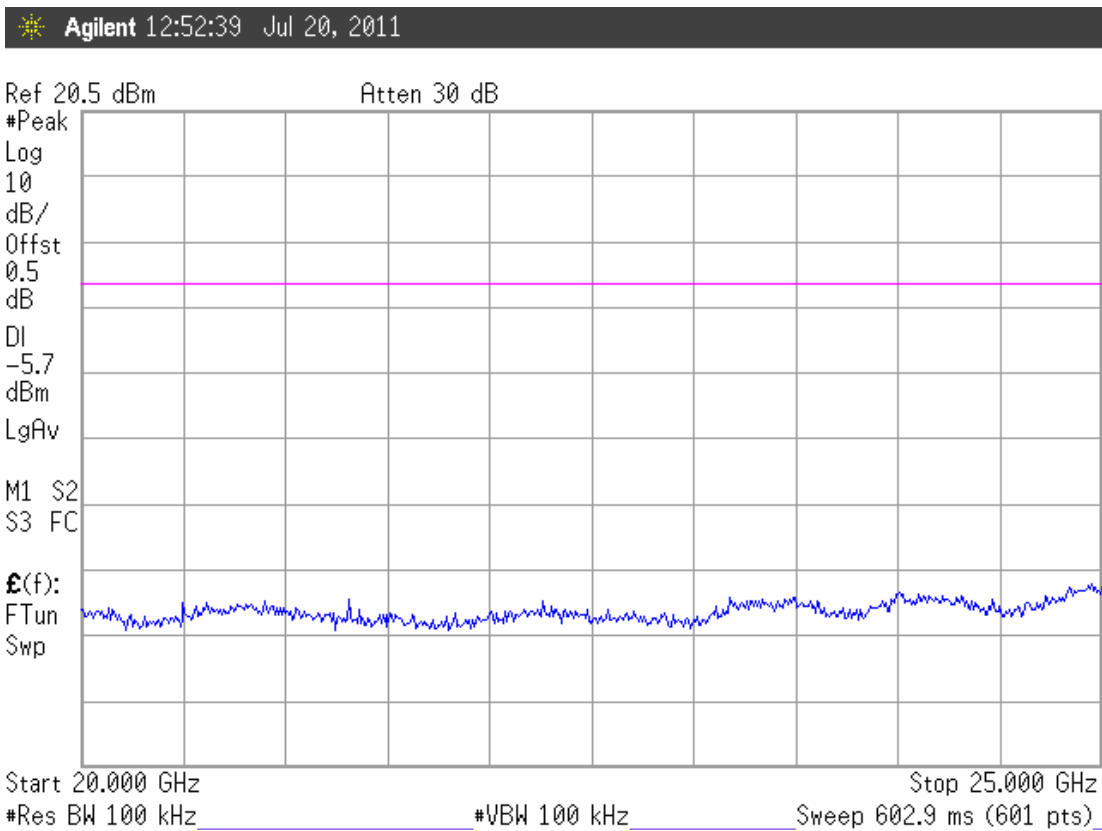
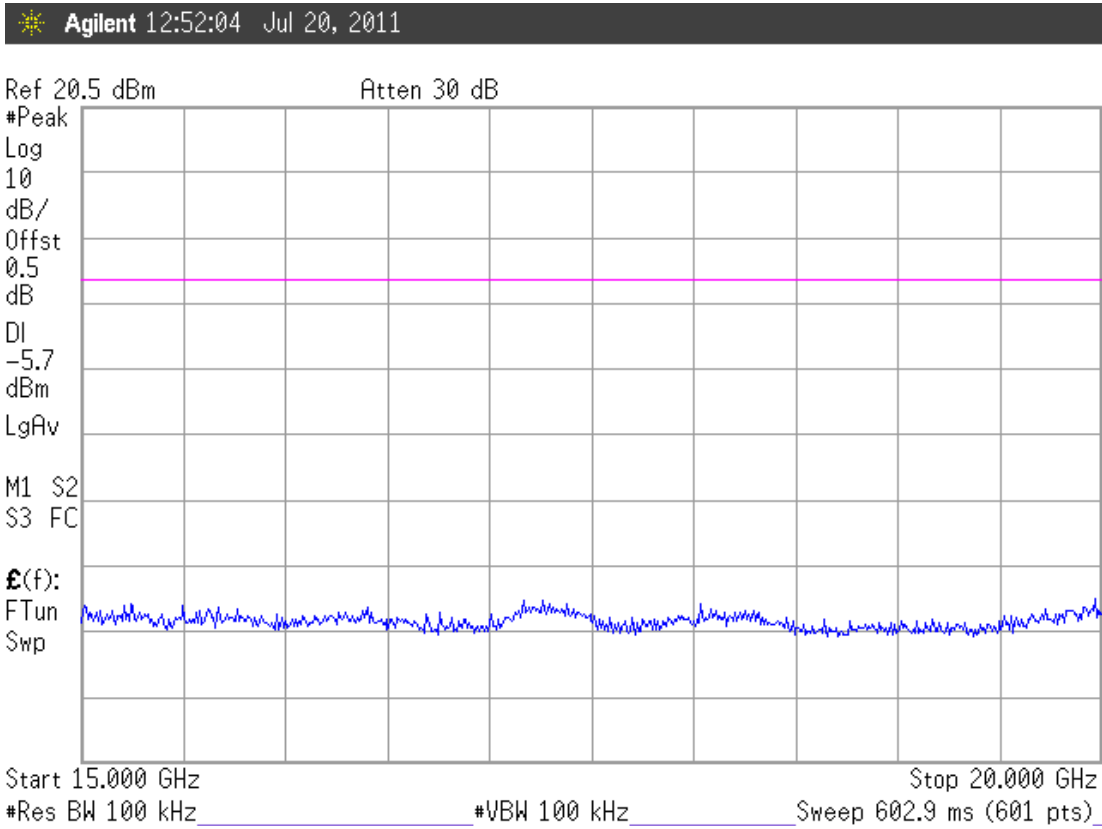
**PASSED.** All the test results are attached in next pages.

Test Date : Jul. 20, 2011    Temperature :27°C    Humidity : 53%

9.6.1. Channel 01, Frequency: 2403.250MHz

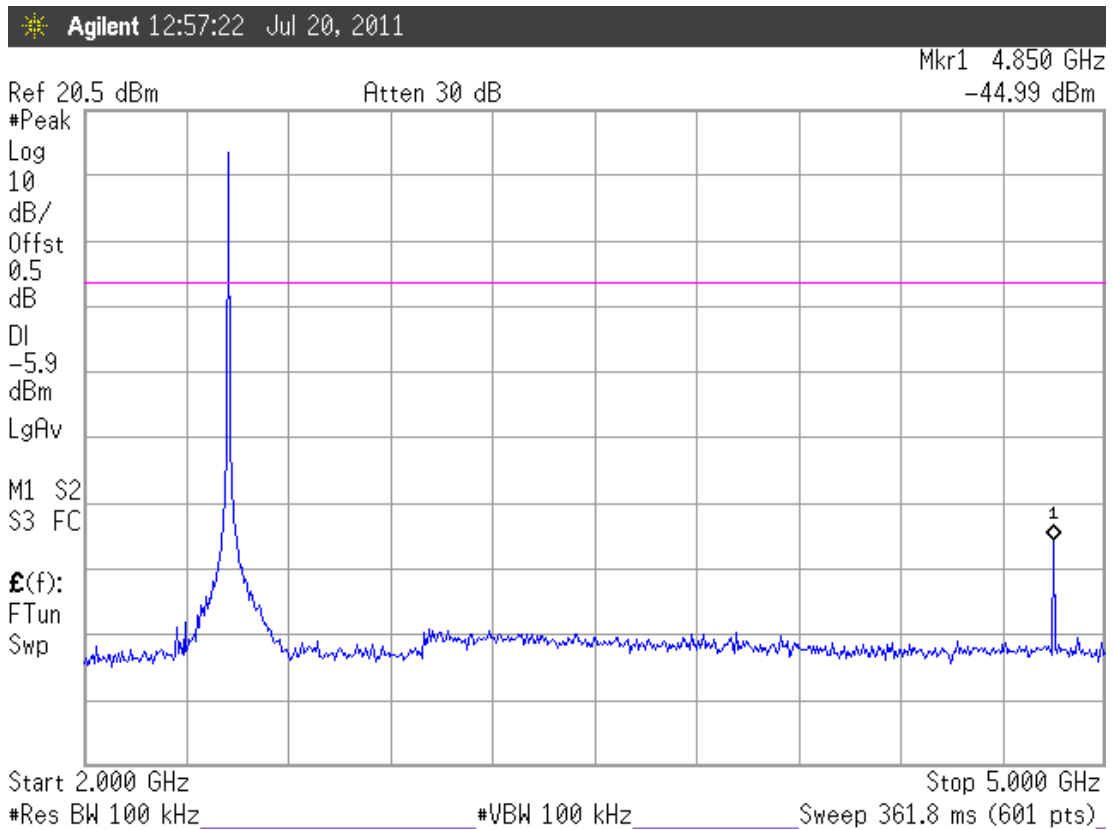
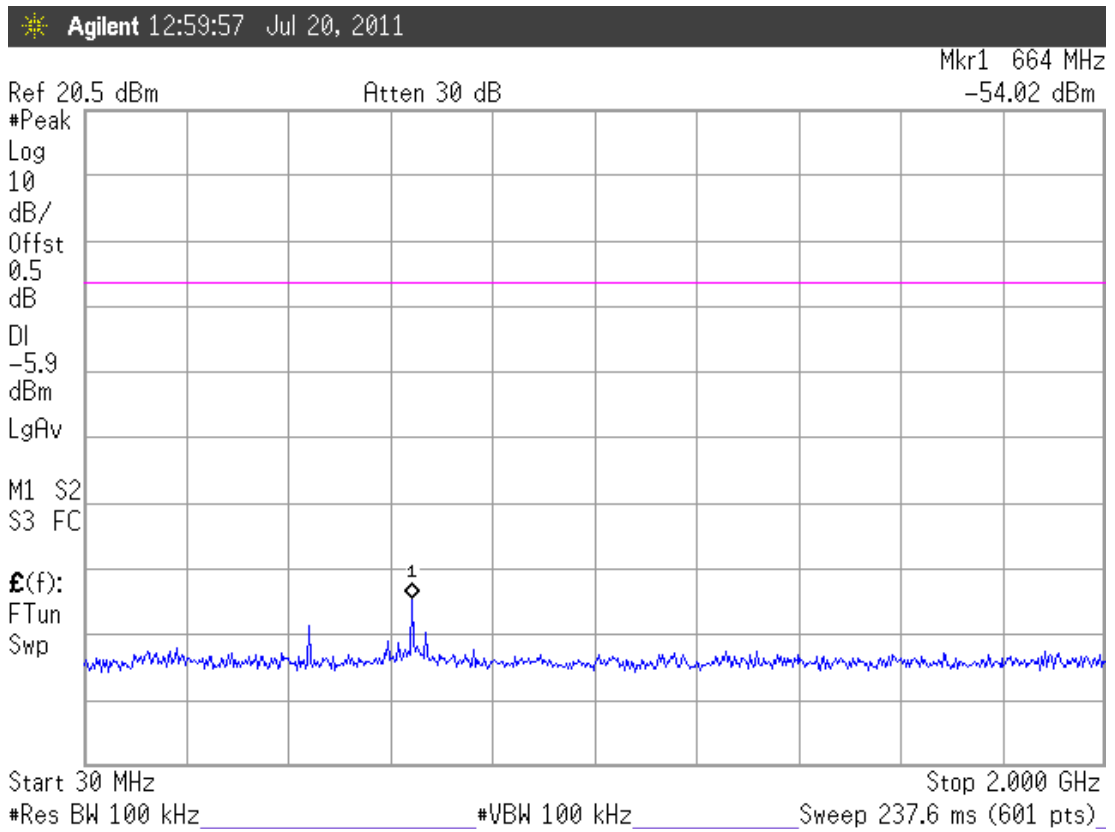




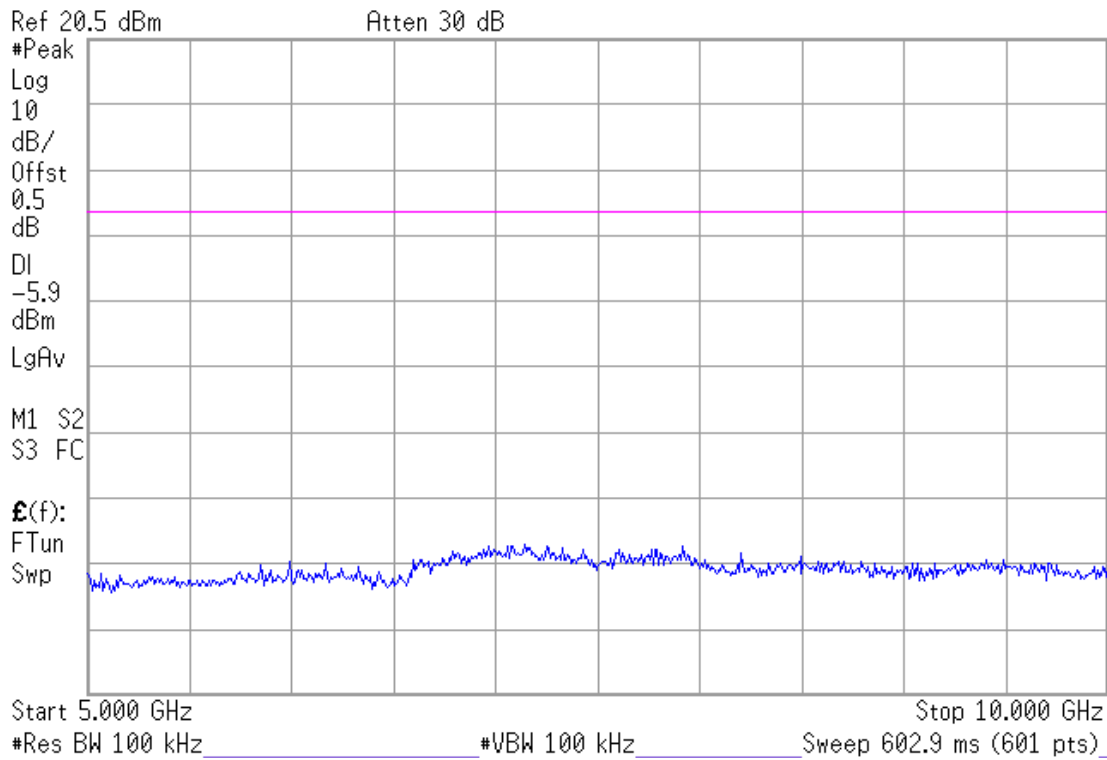




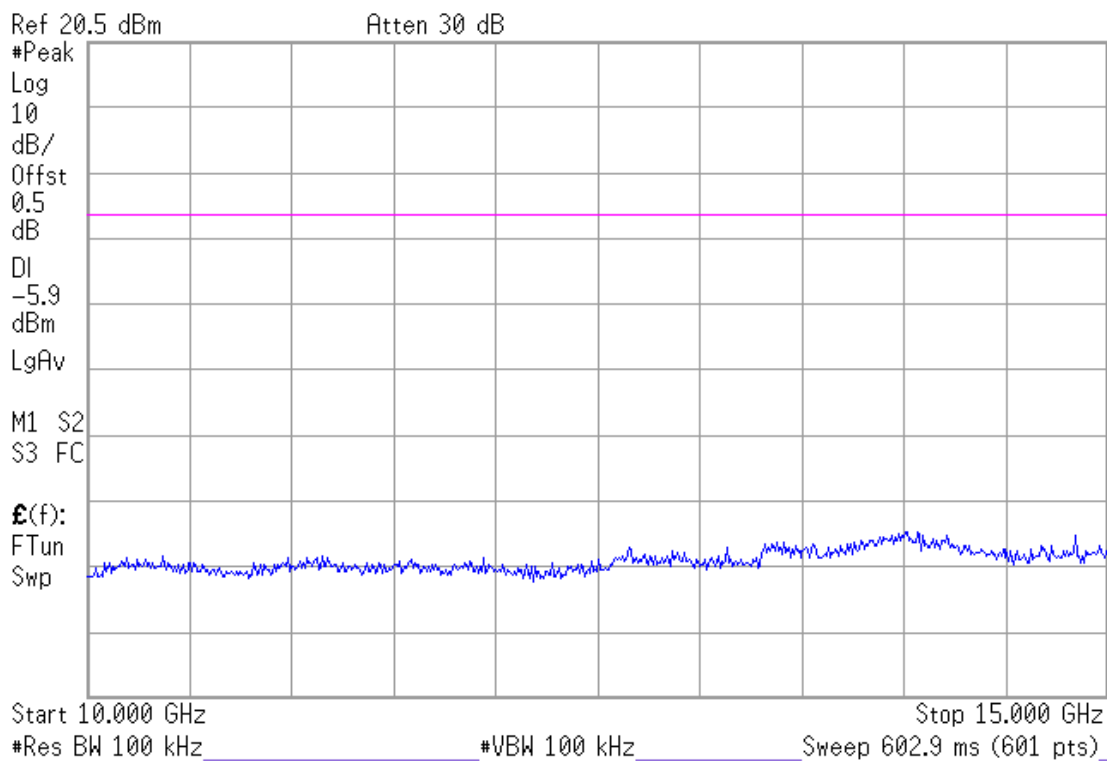
9.6.2. Channel 30, Frequency: 2425.000MHz



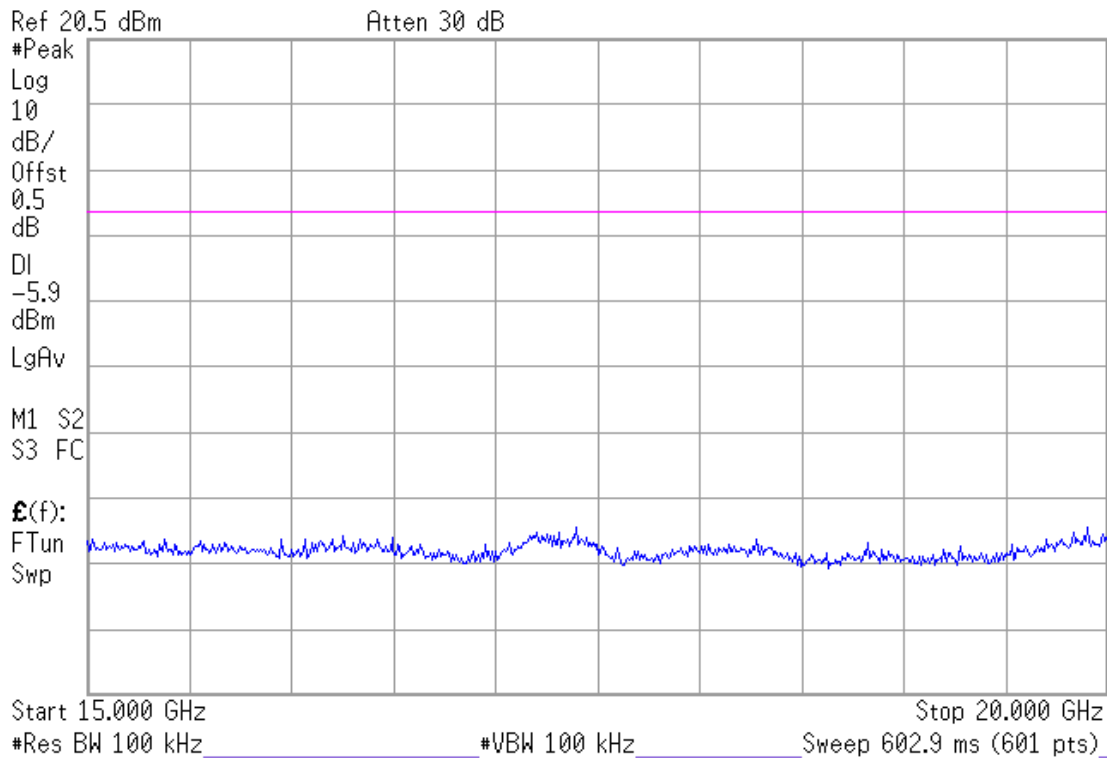
Agilent 12:57:50 Jul 20, 2011



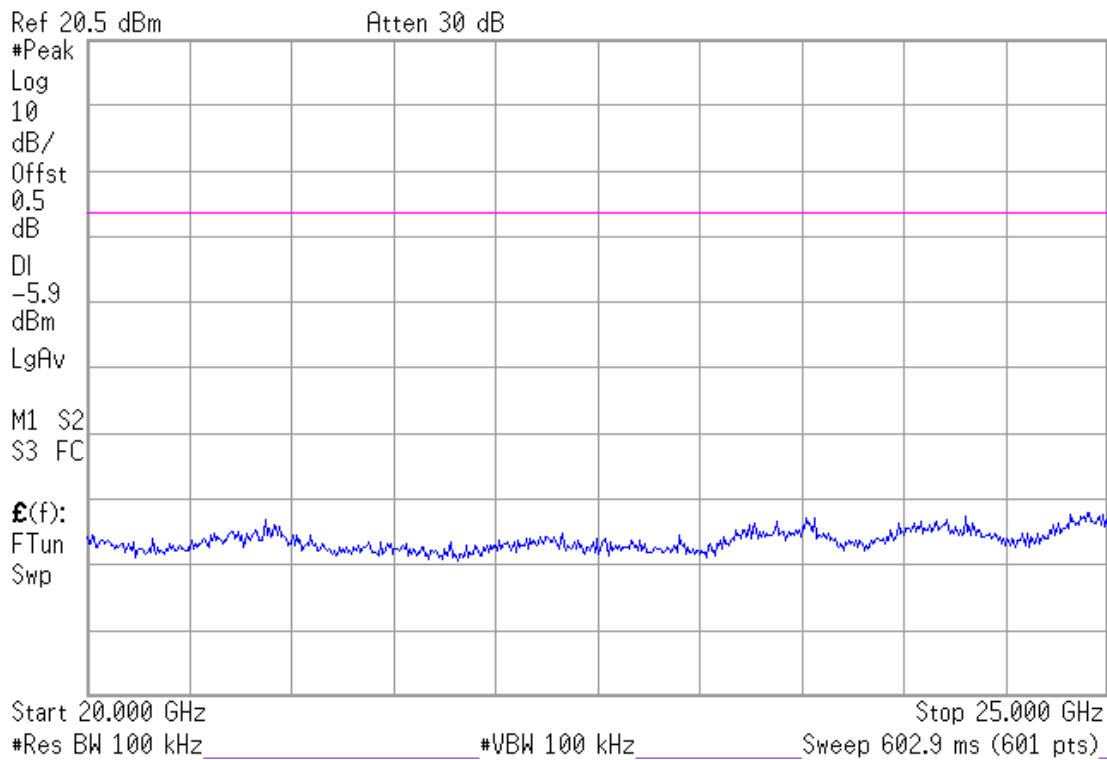
Agilent 12:58:21 Jul 20, 2011



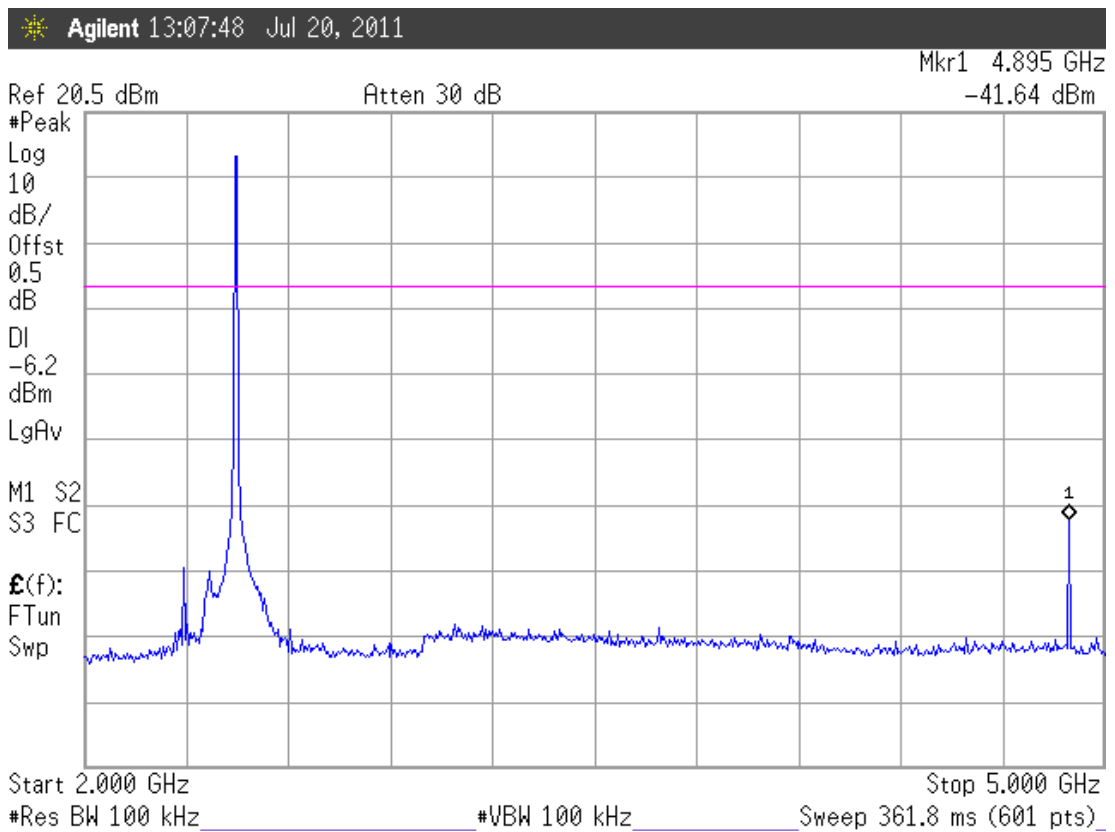
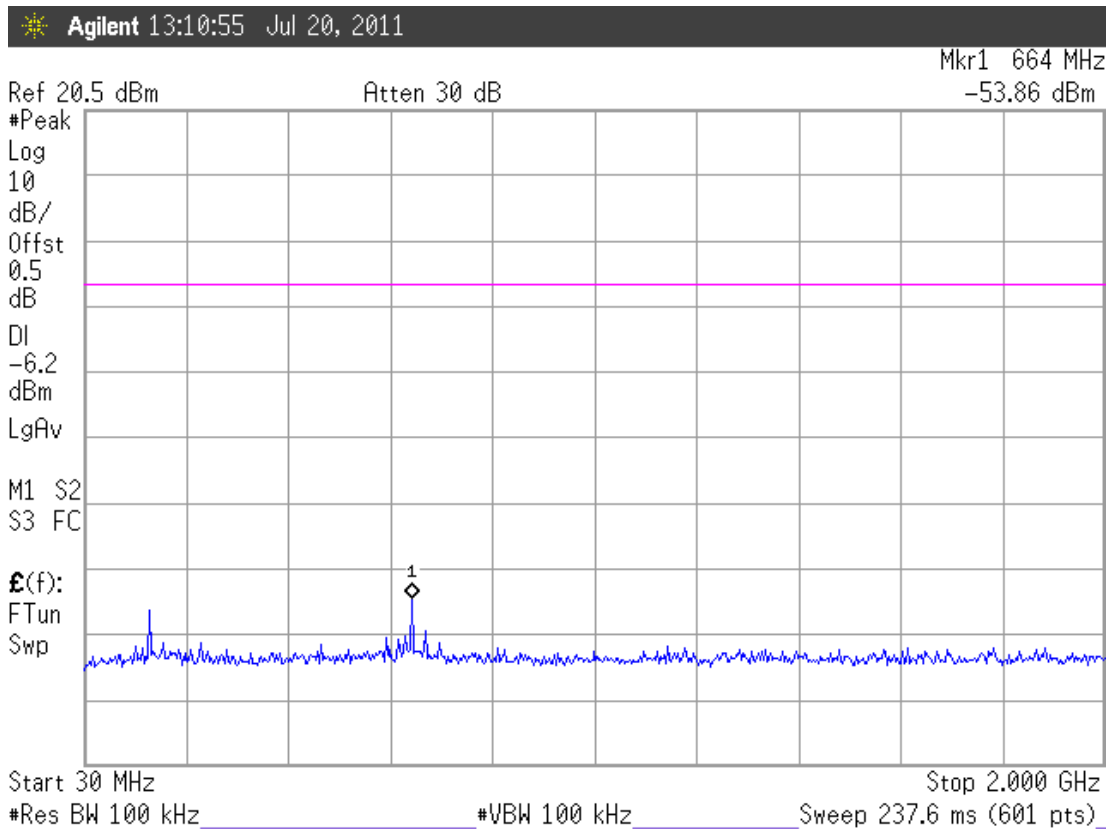
Agilent 12:58:59 Jul 20, 2011



Agilent 12:59:27 Jul 20, 2011

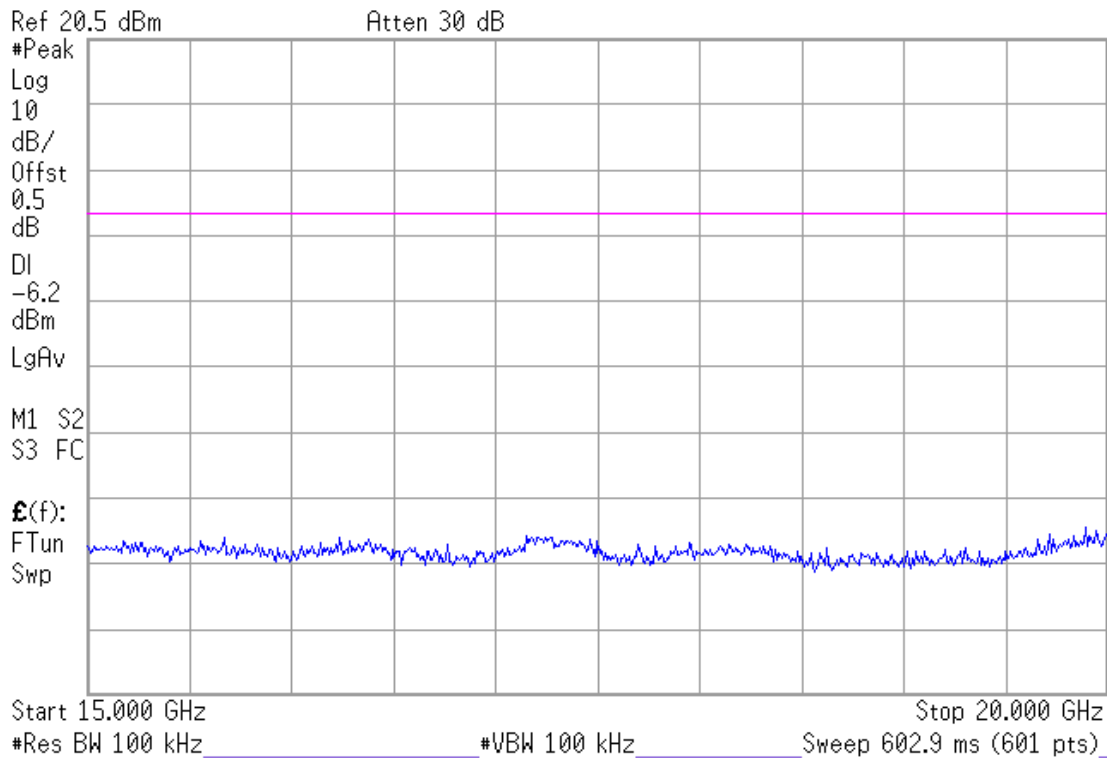


9.6.3. Channel 60, Frequency: 2447.500MHz

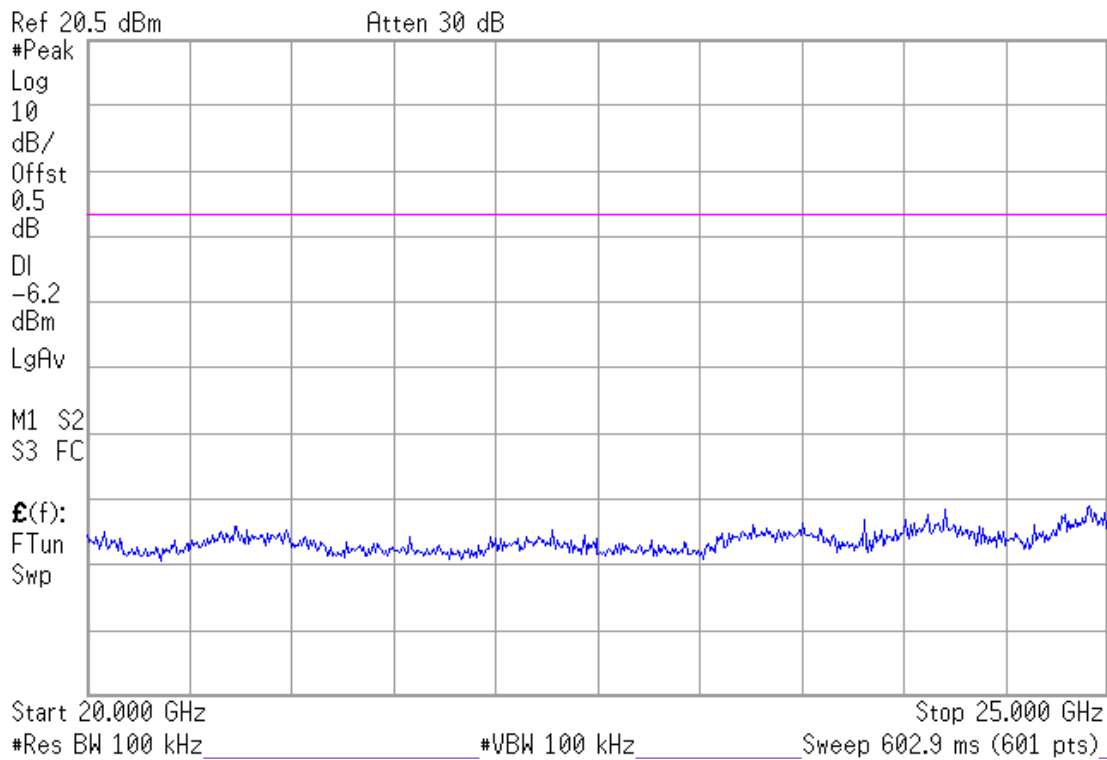




Agilent 13:09:24 Jul 20, 2011



Agilent 13:09:55 Jul 20, 2011



## 10. BAND EDGES MEASUREMENT

### 10.1. Test Equipment

The following test equipment was used during the band edges measurement:

Item	Type	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1.	Spectrum Analyzer	Agilent	E4446A	US44300366	Aug. 04, 10'	Aug. 03, 11'

### 10.2. Block Diagram of Test Setup

The same as section.4.2.

### 10.3. Specification Limits (§15.247(c))

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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 restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)). (※ This test result attaching to §3.6.3)

### 10.4. Operating Condition of EUT

Same as carrier frequency separation measurement which was listed in section 4.4.

### 10.5. Test Procedure (DA 00-705)

The transmitter output was connected to the spectrum analyzer. Set both RBW and VBW of spectrum analyzer to 100kHz with suitable frequency span including 100kHz bandwidth from band edge.

### 10.6. Test Results

**PASSED.** The testing data was attached in the next pages.

Test Date : Jul. 20, 2011    Temperature :27°C    Humidity : 53%

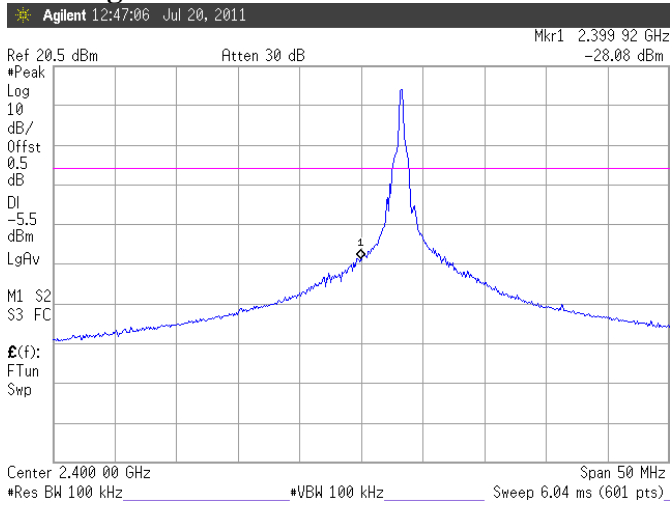
Signal Channel Mode:

1. Below Band edge : The highest emission level is -28.08dBm on 2.39992GHz ◦
2. Upper Band edge: The highest emission level is -49.71dBm on 2.48257GHz ◦

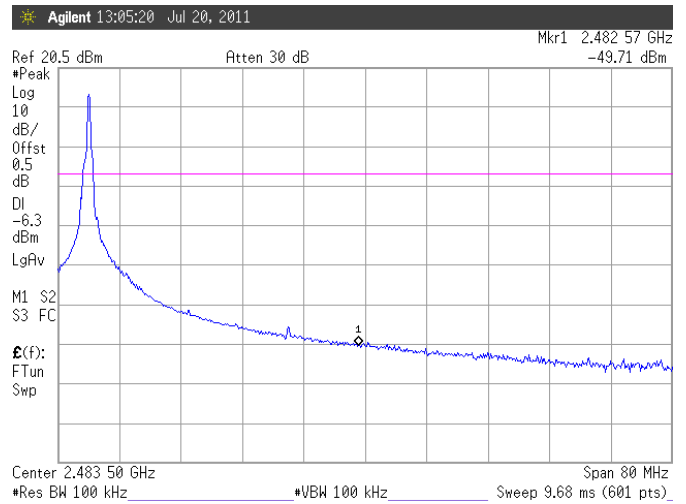
Hopping Mode:

1. Below Band edge : The highest emission level is -30.07dBm on 2.40000GHz ◦
2. Upper Band edge: The highest emission level is -49.06dBm on 2.48360GHz ◦

### Signal Channel Mode:

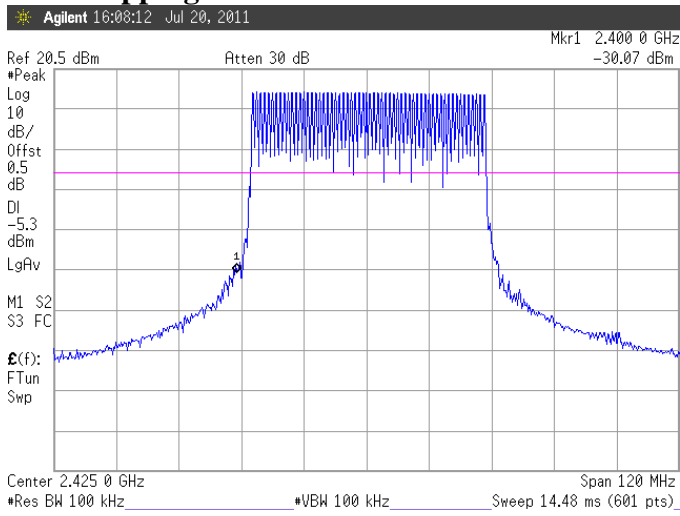


Below Band edge

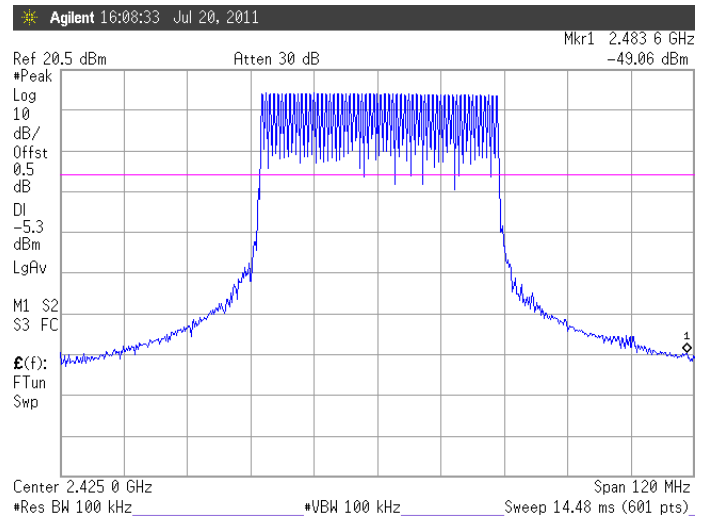


Upper Band edge

### Hopping Mode:



Below Band edge



Upper Band edge



## **11.DEVIATION TO TEST SPECIFICATIONS**

**【NONE】**