



**FCC 47 CFR PART 15 SUBPART C**

**TEST REPORT**

**For**

**Keyboard Folio**

**Model: F5L090, F5L090xx, F5L096xx, F5L094xx, F5L095xx  
( X=" A-Z" or "0-9" or blank)**

**Brand: Belkin**

**Test Report Number:**

**SZ110623B02-RP**

*Prepared for*

**Belkin International Inc.**

**12045 East Waterfront Drive, Playa Vista, CA 90094**

Issued by:

Compliance Certification Services Inc.

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Issued Date: June 29, 2011



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Revision History

Rev.	Issue No.	Revisions	Effect Page	Revised By
00	SZ110623B02-RP	Initial Issue	ALL	Ethan Huang



**TABLE OF CONTENTS**

**1 TEST RESULT CERTIFICATION ..... 4**

**2 EUT DESCRIPTION ..... 5**

**3 TEST METHODOLOGY ..... 6**

    3.1. DESCRIPTION OF TEST MODES..... 6

**4 FACILITIES AND ACCREDITATIONS ..... 7**

    4.1. FACILITIES ..... 7

    4.2. ACCREDITATIONS ..... 7

    4.3. MEASUREMENT UNCERTAINTY..... 7

**5 SETUP OF EQUIPMENT UNDER TEST ..... 8**

    5.1. SETUP CONFIGURATION OF EUT ..... 8

    5.2. SUPPORT EQUIPMENT ..... 8

**6 FCC PART 15.247 REQUIREMENTS..... 9**

    6.1. 20DB BANDWIDTH ..... 9

    6.2. PEAK POWER ..... 12

    6.3. PEAK POWER SPECTRAL DENSITY ..... 14

    6.4. BAND EDGES MEASUREMENT ..... 15

    6.5. FREQUENCY SEPARATION ..... 21

    6.6. NUMBER OF HOPPING FREQUENCY ..... 23

    6.7. TIME OF OCCUPANCY (DWELL TIME)..... 25

    6.8. SPURIOUS EMISSIONS..... 28

    6.9. POWERLINE CONDUCTED EMISSIONS..... 40



# 1 TEST RESULT CERTIFICATION

<b>Product:</b>	Keyboard Folio
<b>Model:</b>	F5L090, F5L090xx, F5L096xx, F5L094xx, F5L095xx ( X="A-Z" or "0-9" or blank)
<b>Brand:</b>	Belkin
<b>Tested:</b>	June 23~28, 2011
<b>Applicant:</b>	<b>Belkin International Inc.</b> 12045 East Waterfront Drive, Playa Vista, CA 90094
<b>Manufacturer:</b>	<b>Dongguan Primax Electronic &amp; Telecommunication Products Ltd.</b> Liu Wu District, Shek Kit Town, Dongguan City, Guangdong Province, P.R. China

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

### We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. 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 15.207, 15.209 and 15.247.

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

**Approved by:**

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**Ethan Huang**  
Manager  
Compliance Certification Service Inc.

**Reviewed by:**

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**Aven Zhou**  
Supervisor of Report Dept.  
Compliance Certification Service Inc.



## 2 EUT DESCRIPTION

<b>Product</b>	Keyboard Folio
<b>Model Number</b>	F5L090, F5L090xx, F5L096xx, F5L094xx, F5L095xx ( X="A-Z" or "0-9" or blank)
<b>Trade Name</b>	Belkin
<b>Model Discrepancy</b>	All models are identical to each other except for market designation for marketing purpose, and not affect the safety and electromagnetic compatibility of the product.
<b>Identify Number</b>	SZ110623B02-RP
<b>Power Supply</b>	DC 5V Supplied by the PC or DC 3.7V supplied by the battery
<b>Received Date</b>	June 23, 2011
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	1.32dBm
<b>Modulation Technique</b>	FHSS(GFSK)
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	PCB Antenna Gain: 0.52dBi (Max)
<b>Temperature Range</b>	0°C ~ +35°C

**Note:** This submittal(s) (test report) is intended for FCC ID: K7SFL090 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



### 3 TEST METHODOLOGY

#### 3.1. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The following test mode(s) were scanned during the preliminary test below 1G:

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: Normal Link with Charge	■
Radiated Emission	Mode 1: Normal Link with Charge	■

Above 1G, Channel Low (2402MHz) · Mid (2441MHz) and High (2480MHz) were chosen for full testing for GFSK.



## 4 FACILITIES AND ACCREDITATIONS

### 4.1. FACILITIES

All measurement facilities used to collect the measurement data are located at **No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, Taiwan(R.O.C.)**

The sites are constructed in conformance with the requirements of ANSI C63.4:2003, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

### 4.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

<b>USA</b>	<b>A2LA</b>
<b>Taiwan</b>	<b>TAF</b>

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

<b>USA</b>	<b>FCC</b>
<b>Japan</b>	<b>VCCI</b>
<b>Canada</b>	<b>INDUSTRY CANADA</b>
<b>Taiwan</b>	<b>BSMI</b>
<b>Norway</b>	<b>Nemko</b>

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

<b>Measurement</b>	<b>Frequency</b>	<b>Uncertainty</b>
Conducted emissions	9kHz~30MHz	+/- 3.18dB
Radiated emissions	30MHz ~ 200MHz	+/- 3.79dB
	200MHz ~1000MHz	+/- 3.62dB
	Above 1000MHz	+/- 5.04dB
Band Edges	+/-0.182 dB	

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



## 5 SETUP OF EQUIPMENT UNDER TEST

### 5.1. SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

### 5.2. SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	NOTEBOOK	Studio 1435	S315448686549	N/A	DELL	N/A	Unshielded 1.80m

**Notes:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.





## 6 FCC PART 15.247 REQUIREMENTS

### 6.1. 20DB BANDWIDTH

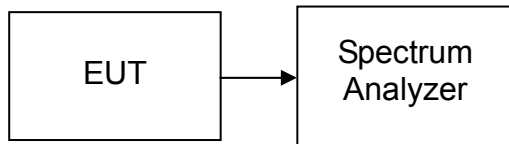
None; for reporting purpose only.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### TEST CONFIGURATION



#### TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT, then connect a low loss RF cable from antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=30kHz, VBW=30kHz, Span=3MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the test channels are investigated.

#### TEST RESULTS

No non-compliance noted

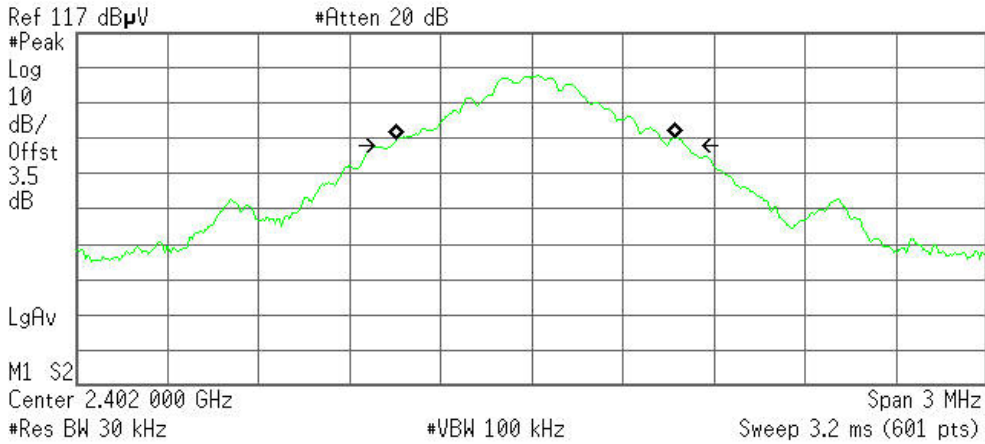


Test plot

20dB Bandwidth (CH Low)

Agilent 20:42:48 Jun 17, 2011

R T



Occupied Bandwidth 911.5738 kHz

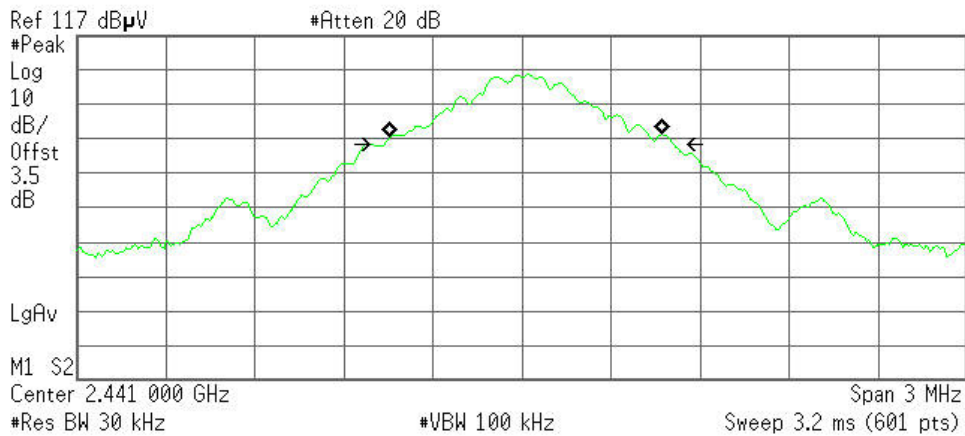
Occ BW % Pwr 99.00 % x dB -20.00 dB

Transmit Freq Error 12.057 kHz x dB Bandwidth 971.909 kHz

20dB Bandwidth (CH Mid)

Agilent 20:42:07 Jun 17, 2011

R T



Occupied Bandwidth 911.7057 kHz

Occ BW % Pwr 99.00 % x dB -20.00 dB

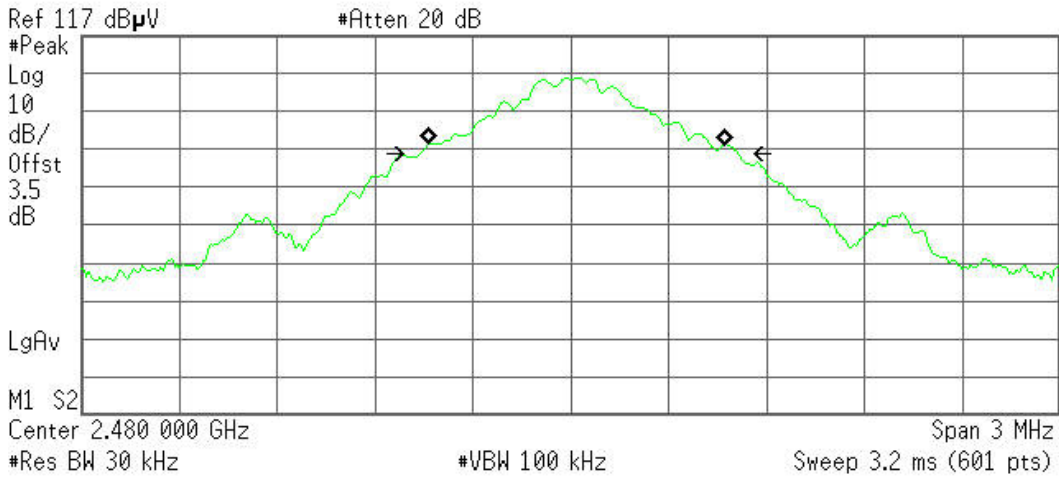
Transmit Freq Error 12.866 kHz x dB Bandwidth 968.812 kHz



20dB Bandwidth (CH High)

Agilent 20:40:30 Jun 17, 2011

R T



Occupied Bandwidth  
904.9925 kHz

Occ BW % Pwr 99.00 %  
x dB -20.00 dB

Transmit Freq Error 15.813 kHz  
x dB Bandwidth 969.556 kHz



## 6.2. PEAK POWER

### LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

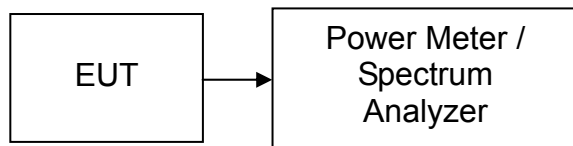
1. For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.
3. The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
RF Power Meter & Sensor	Anritsu	ML2487A	6K00001491	02/23/2011	02/23/2012
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

**Remark:** Each piece of equipment is scheduled for calibration once a year.

### Test Configuration



### TEST PROCEDURE

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.



## **TEST RESULTS**

*No non-compliance noted*

### **Test Data**

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (mW)	Result
Low	2402	-3.44000	3.50	0.06	0.00101	125	Pass
Mid	2441	-2.64000	3.50	0.86	0.00122		Pass
High	2480	-2.18000	3.50	1.32	0.00136		Pass



### 6.3. PEAK POWER SPECTRAL DENSITY

#### LIMIT

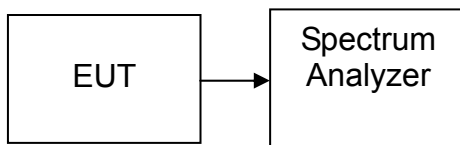
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

#### TEST RESULTS

*Not applicable. Since EUT is the Bluetooth device.*



### 6.4. BAND EDGES MEASUREMENT

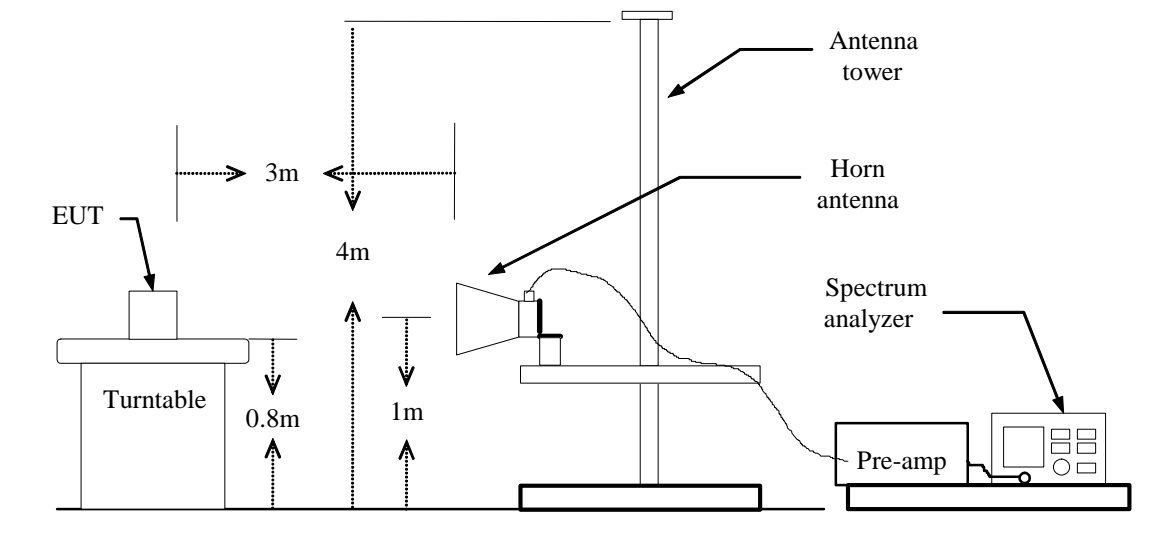
#### LIMIT

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

#### MEASUREMENT EQUIPMENT USED

Radiated Emission Test Site 966 (2)						
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration	
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012	
Amplifier	MITEQ	AM-1604-3000	1411843	03/21/2011	03/21/2012	
Turn Table	EMCO	2081-1.21	N/A	N.C.R	N.C.R	
Controller	CT	N/A	N/A	N.C.R	N.C.R	
High Noise Amplifier	Agilent	8449B	3008A01838	06/18/2011	06/18/2012	
Site NSA	C&C	N/A	N/A	N.C.R	N.C.R	
Bilog Antenna	SCHAFFNER	CBL6143	5082	06/18/2011	06/18/2012	
Horn Antenna	SCHWARZBECK	BBHA9120D	D286	03/19/2011	03/19/2012	
Signal Generator	Anritsu	MG3694A	#050125	03/21/2011	03/21/2012	
Horn Antenna	TRC	HA0301	N/A	03/19/2011	03/19/2012	
Loop Antenna	A.R.A	PLA-1030/B	1029	03/19/2011	03/19/2012	
Power Sensor	Anritsu	MA2491A	030619	06/18/2011	06/18/2012	
Power Meter	Anritsu	ML2487A	6K00001491	06/18/2011	06/18/2012	
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/30/2011	03/30/2012	

#### Test Configuration





### **TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

### **TEST RESULTS**

Refer to attach spectrum analyzer data chart.





Test Data

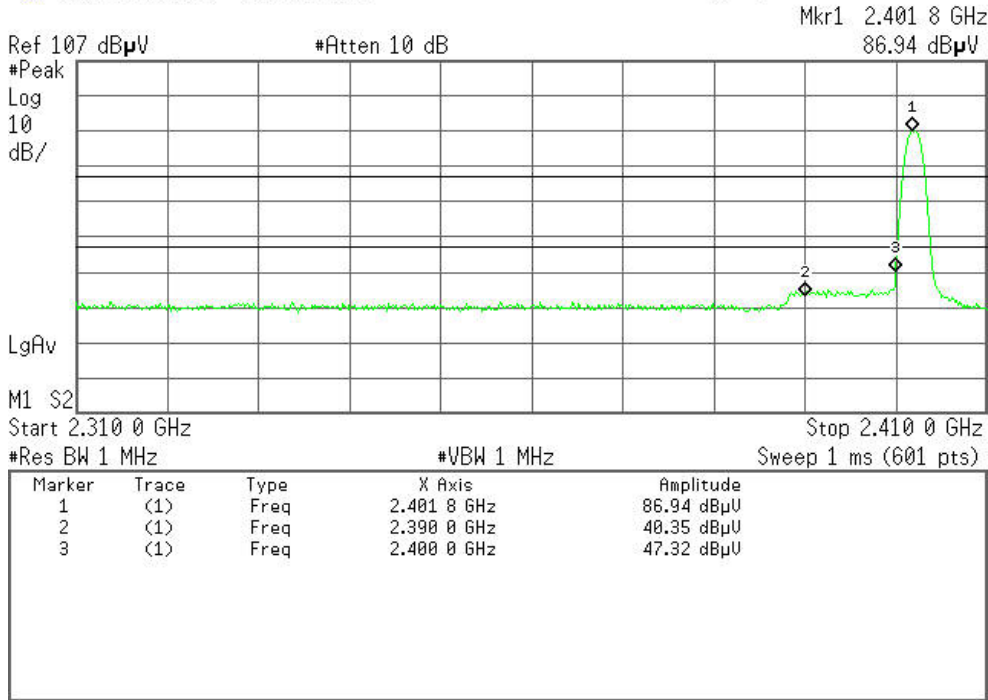
Band Edges (CH-Low)

Detector mode: Peak

Polarity: Vertical

Agilent 23:32:56 Jun 17, 2011

R T

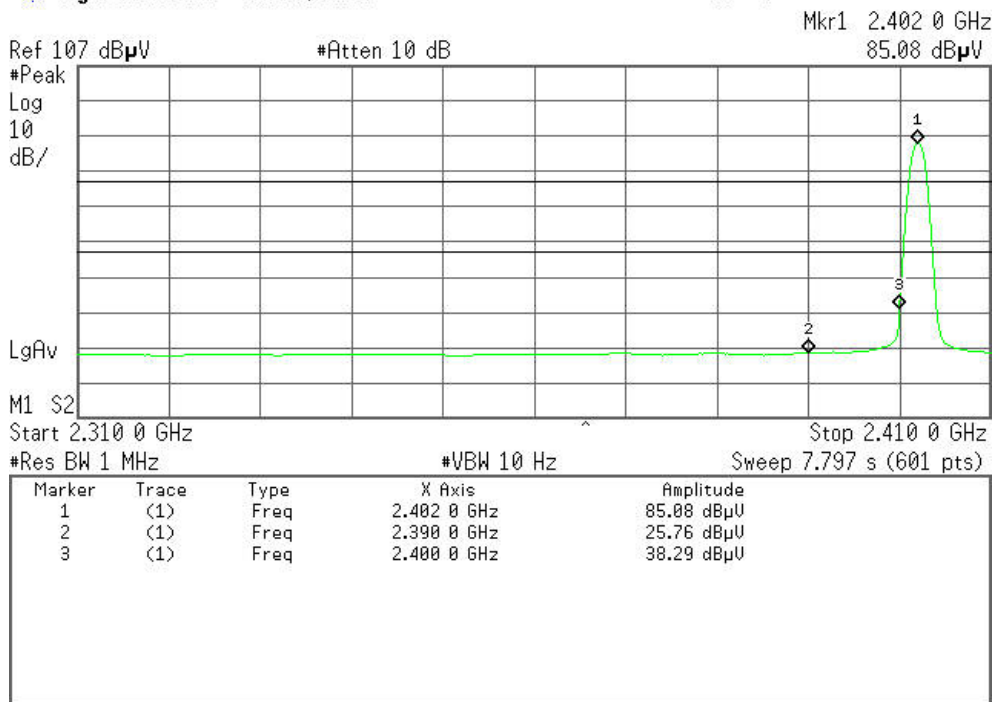


Detector mode: Average

Polarity: Vertical

Agilent 23:33:31 Jun 17, 2011

R T



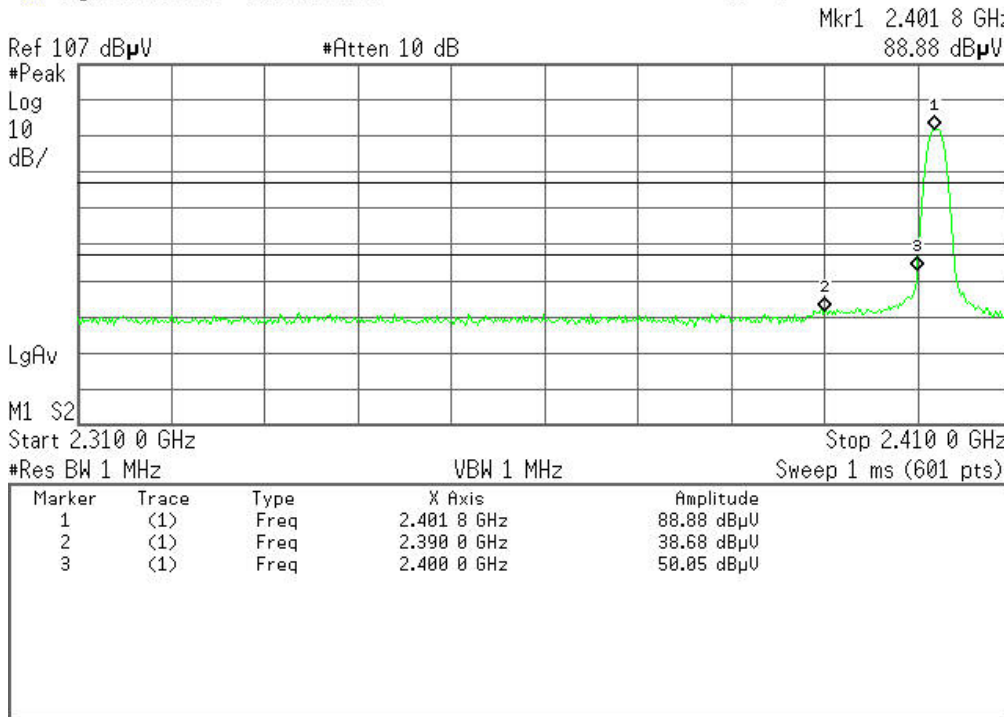


Detector mode: Peak

Polarity: Horizontal

Agilent 23:36:04 Jun 17, 2011

R T

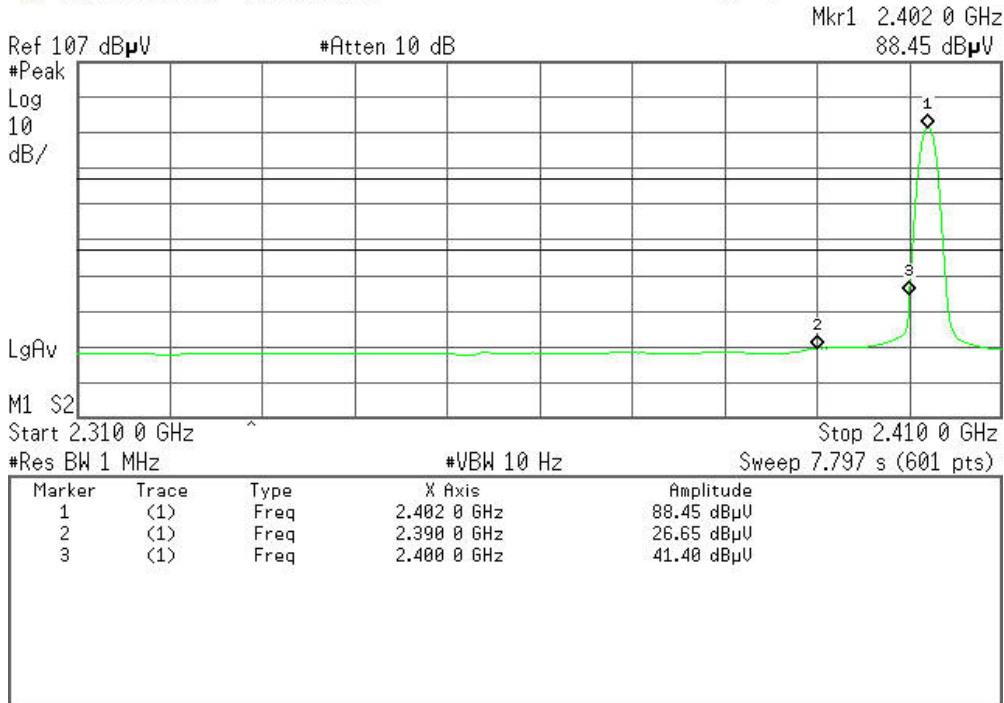


Detector mode: Average

Polarity: Horizontal

Agilent 23:36:47 Jun 17, 2011

R T





Band Edges (CH-High)

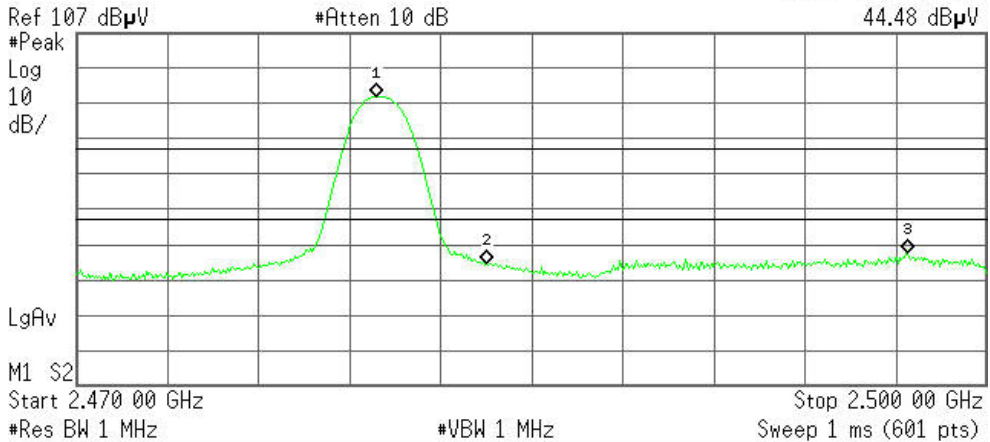
Detector mode: Peak

Polarity: Vertical

Agilent 00:00:03 Jun 18, 2011

R T

Mkr3 2.497 40 GHz  
44.48 dBµV



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 90 GHz	88.82 dBµV
2	(1)	Freq	2.483 50 GHz	41.41 dBµV
3	(1)	Freq	2.497 40 GHz	44.48 dBµV

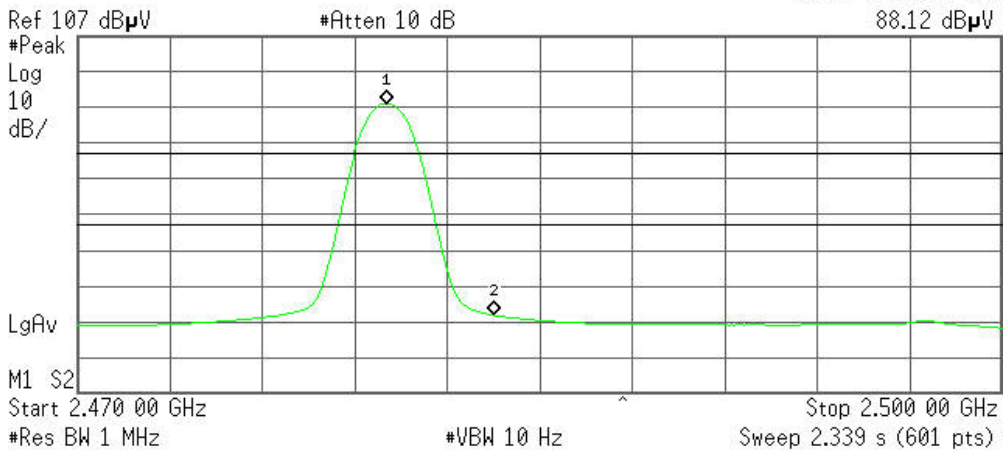
Detector mode: Average

Polarity: Vertical

Agilent 00:01:04 Jun 18, 2011

R T

Mkr1 2.480 05 GHz  
88.12 dBµV



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 05 GHz	88.12 dBµV
2	(1)	Freq	2.483 50 GHz	28.91 dBµV



Detector mode: Peak

Polarity: Horizontal

Agilent 00:09:05 Jun 18, 2011

R T

Mkr3 2.488 70 GHz  
43.58 dBµV



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 85 GHz	86.90 dBµV
2	(1)	Freq	2.483 50 GHz	40.07 dBµV
3	(1)	Freq	2.488 70 GHz	43.58 dBµV

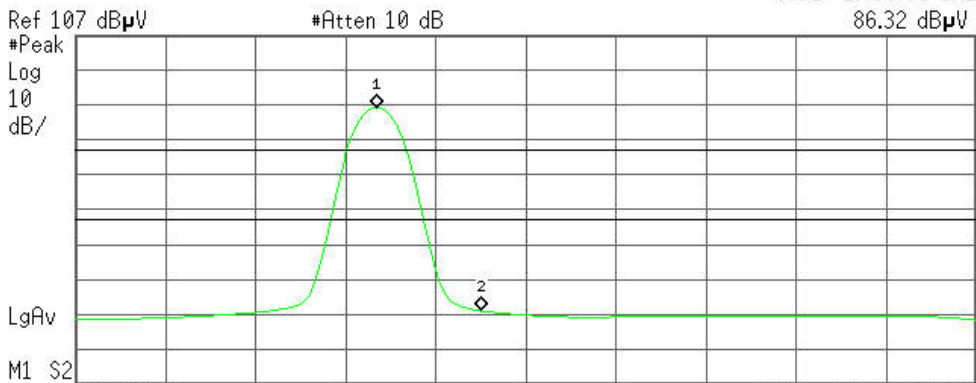
Detector mode: Average

Polarity: Horizontal

Agilent 00:09:56 Jun 18, 2011

R T

Mkr1 2.480 05 GHz  
86.32 dBµV



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 05 GHz	86.32 dBµV
2	(1)	Freq	2.483 50 GHz	27.98 dBµV



### 6.5. FREQUENCY SEPARATION

#### LIMIT

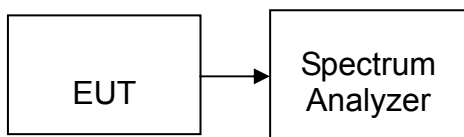
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2010	07/22/2011

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW=30kHz, VBW=30kHz, Adjust Span to 4 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

#### TEST RESULTS

*No non-compliance noted*

#### Test Data

Channel Separation (MHz)	Two-thirds of the 20 dB Bandwidth (kHz)	Channel Separation Limit	Result
1.000	647.939	> Two-thirds of the 20 dB Bandwidth	Pass



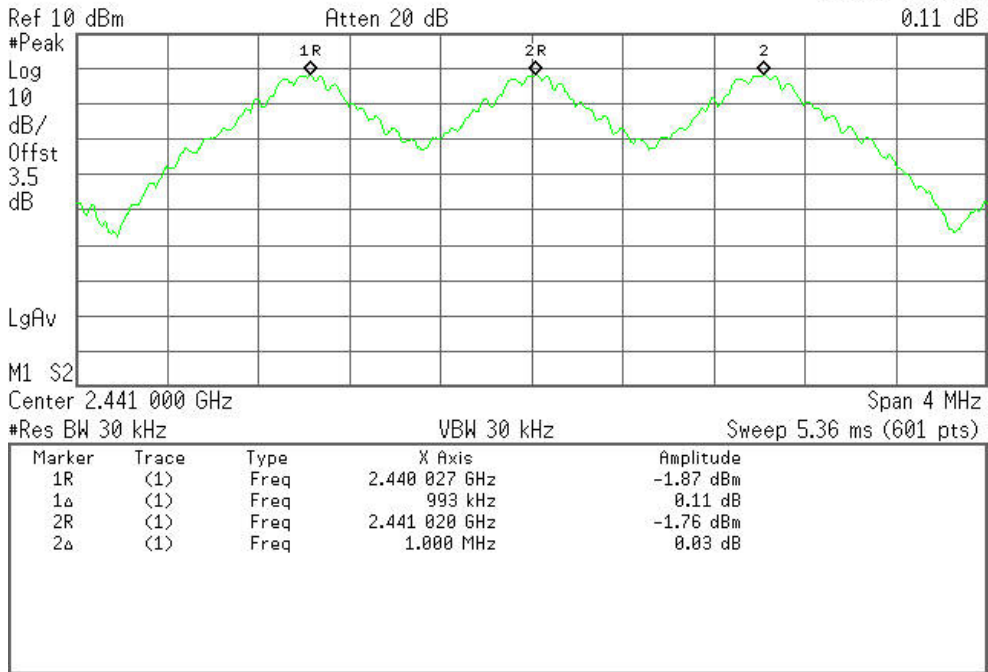
Test Plot

Measurement of Channel Separation

Agilent 01:56:43 Jun 18, 2011

R T

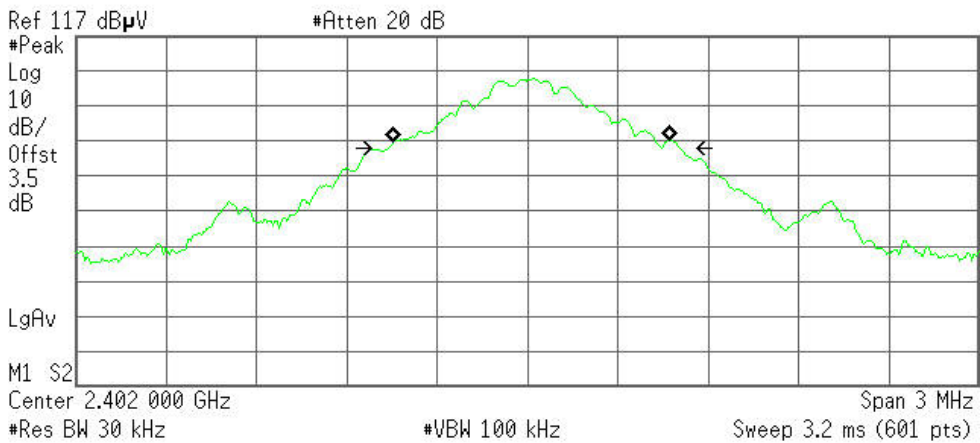
Mkr1 993 kHz 0.11 dB



20 dB bandwidth(CH Low)

Agilent 20:42:48 Jun 17, 2011

R T



Occupied Bandwidth 911.5738 kHz

Occ BW % Pwr 99.00 % x dB -20.00 dB

Transmit Freq Error 12.057 kHz x dB Bandwidth 971.909 kHz



### 6.6. NUMBER OF HOPPING FREQUENCY

#### LIMIT

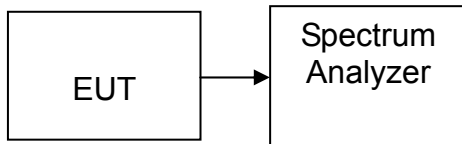
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### Test Configuration



#### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2402MHz, Stop = 2441MHz, Sweep = 1ms and Start=2441MHz, Stop = 2480MHz, Sweep = 1ms.
4. Set the spectrum analyzer as RBW, VBW=300kHz,
5. Max hold, view and count how many channel in the band.

#### TEST RESULTS

*No non-compliance noted*

#### Test Data

##### GFSK

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS



**Test Plot ( GFSK )**

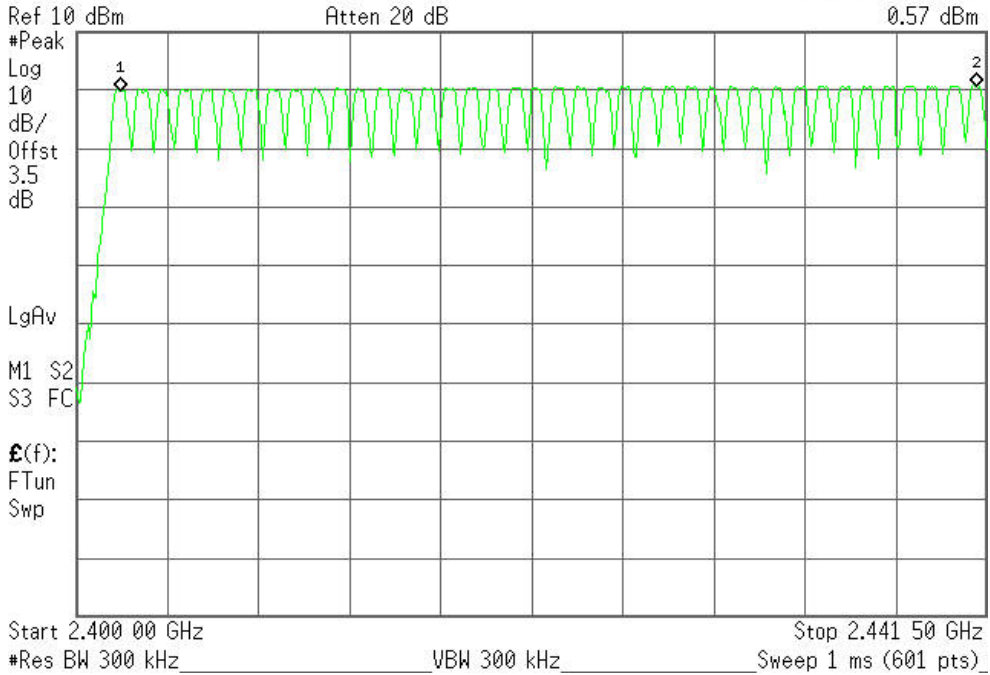
**Channel Number**

**2.400 GHz – 2.441 GHz**

Agilent 01:28:47 Jun 18, 2011

R T

Mkr2 2.441 02 GHz  
0.57 dBm

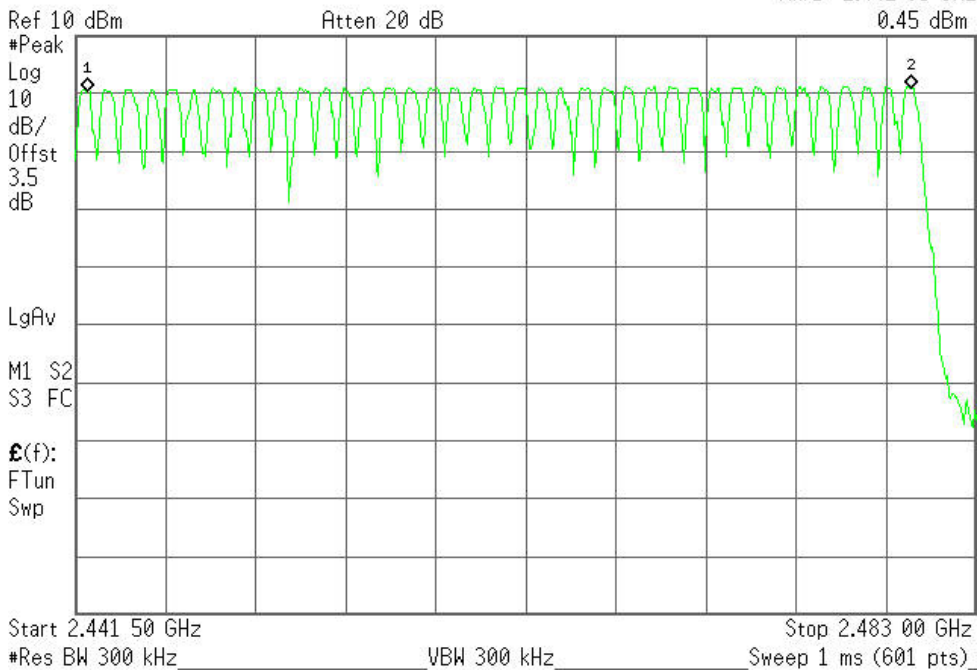


**2.441 GHz – 2.483 GHz**

Agilent 01:31:43 Jun 18, 2011

R T

Mkr1 2.442 05 GHz  
0.45 dBm







## 6.7. TIME OF OCCUPANCY (DWELL TIME)

### LIMIT

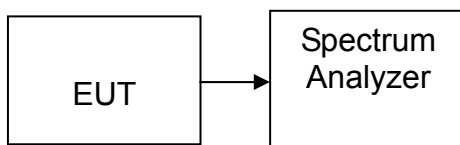
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

*Remark: Each piece of equipment is scheduled for calibration once a year.*

### Test Configuration



### TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.



**TEST RESULTS**

*No non-compliance noted*

**Test Data**

**DH 1**

CH Mid:  $0.416 * (1600/2)/79 * 31.6 = 51.2$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	0.416	133.12	31.60	400.00	PASS



**Test Plot**

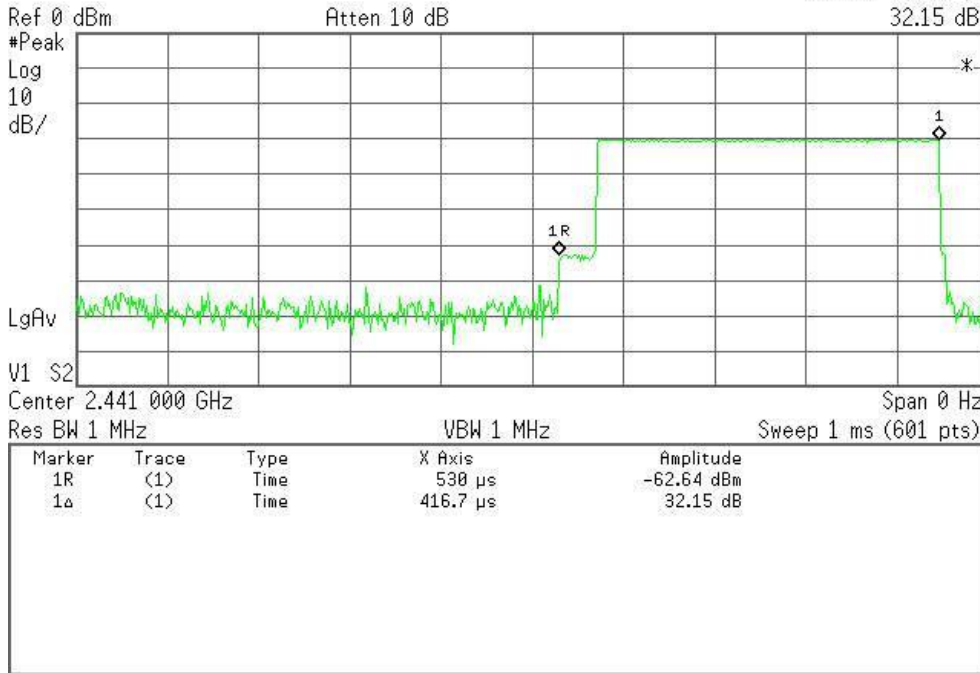
**DH 1**

**(CH Mid)**

Agilent 11:24:19 Jul 4, 2011

R T

Mkr1 416.7  $\mu$ s  
32.15 dB





## 6.8. SPURIOUS EMISSIONS

### 6.8.1. Conducted Measurement

#### LIMIT

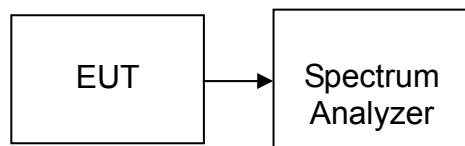
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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) (see Section 15.205(c)).

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012

*Remark: Each piece of equipment is scheduled for calibration once a year.*

#### Test Configuration



#### TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

#### TEST RESULTS

*No non-compliance noted*



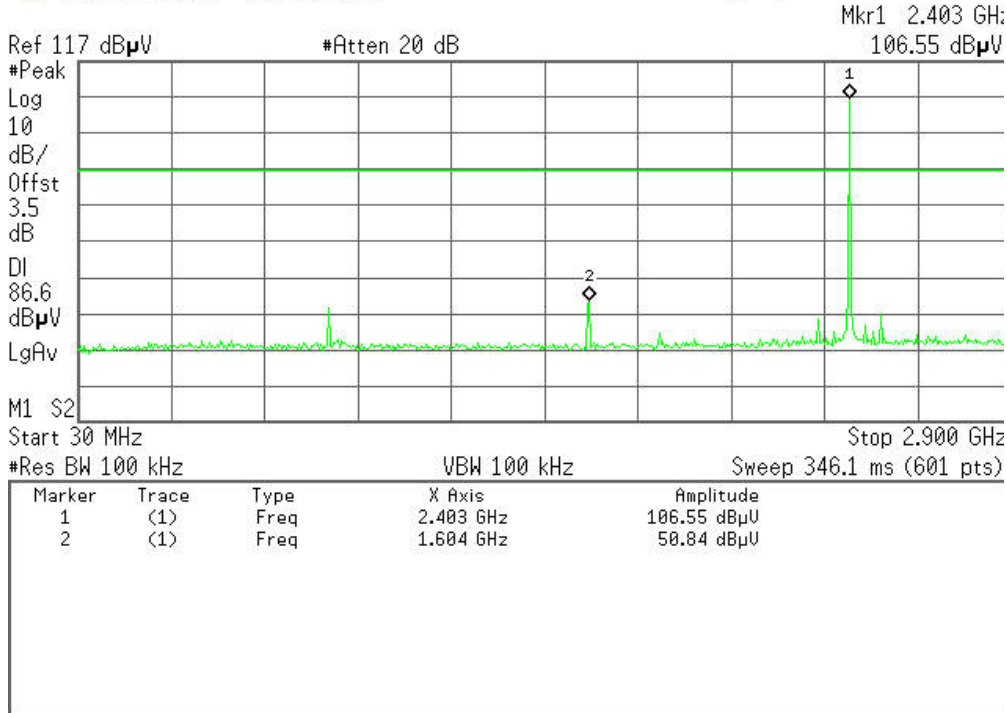
**Test Plot ( GFSK )**

**CH Low**

**30MHz ~2.9GHz**

Agilent 20:32:35 Jun 17, 2011

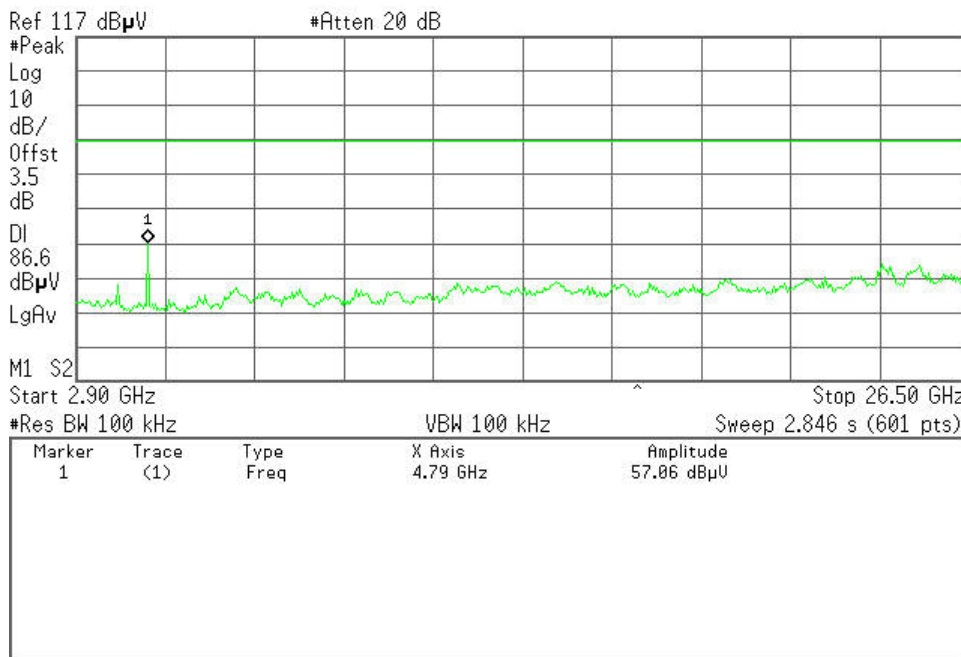
R T



**2.9MHz ~26.5GHz**

Agilent 20:33:12 Jun 17, 2011

R T



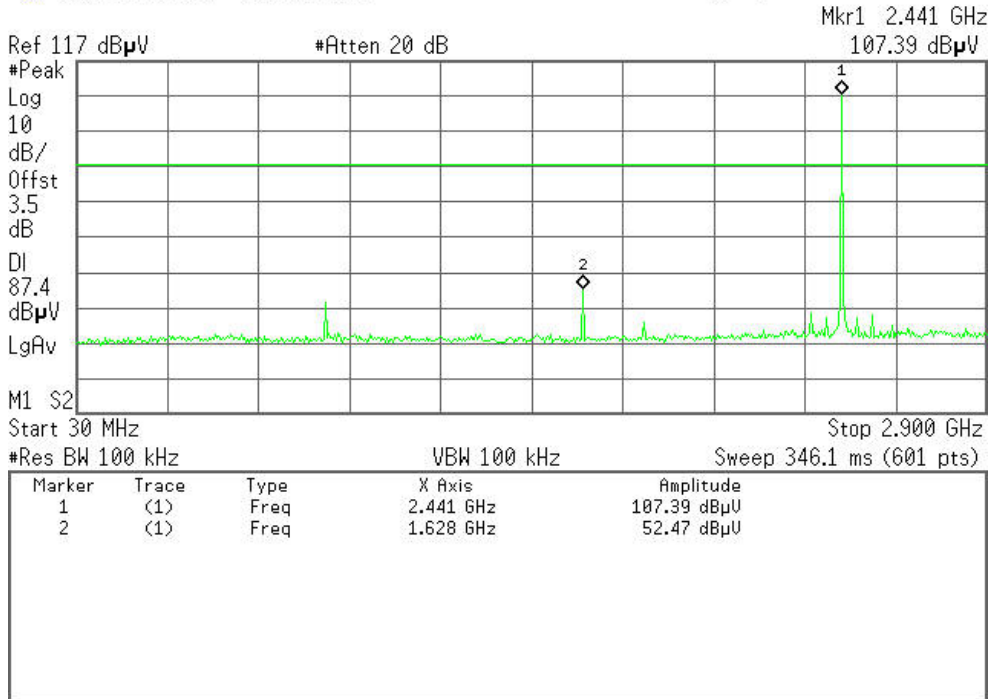


CH Mid

30MHz ~ 2.9GHz

Agilent 20:34:57 Jun 17, 2011

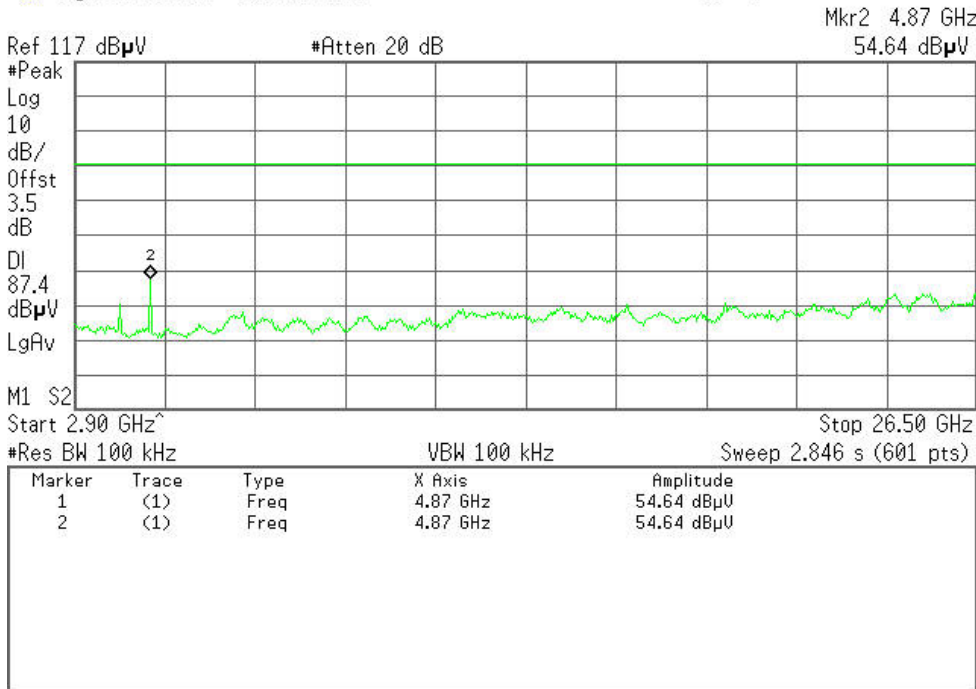
R T



2.9GHz ~ 26.5GHz

Agilent 20:36:15 Jun 17, 2011

R T



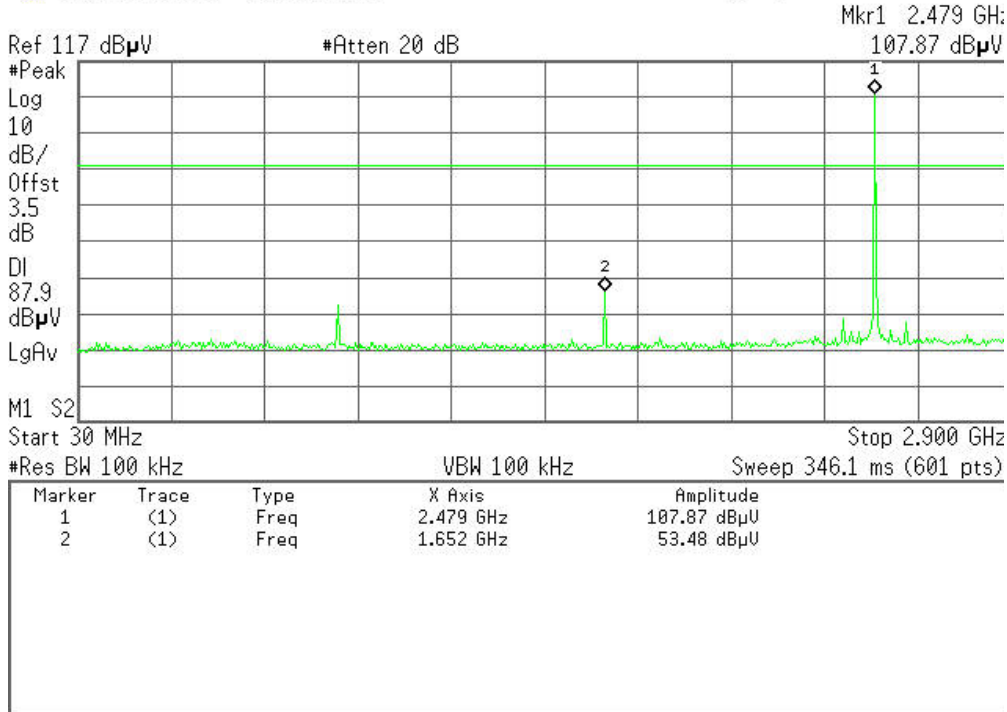


CH High

30MHz ~ 2.9GHz

Agilent 20:37:57 Jun 17, 2011

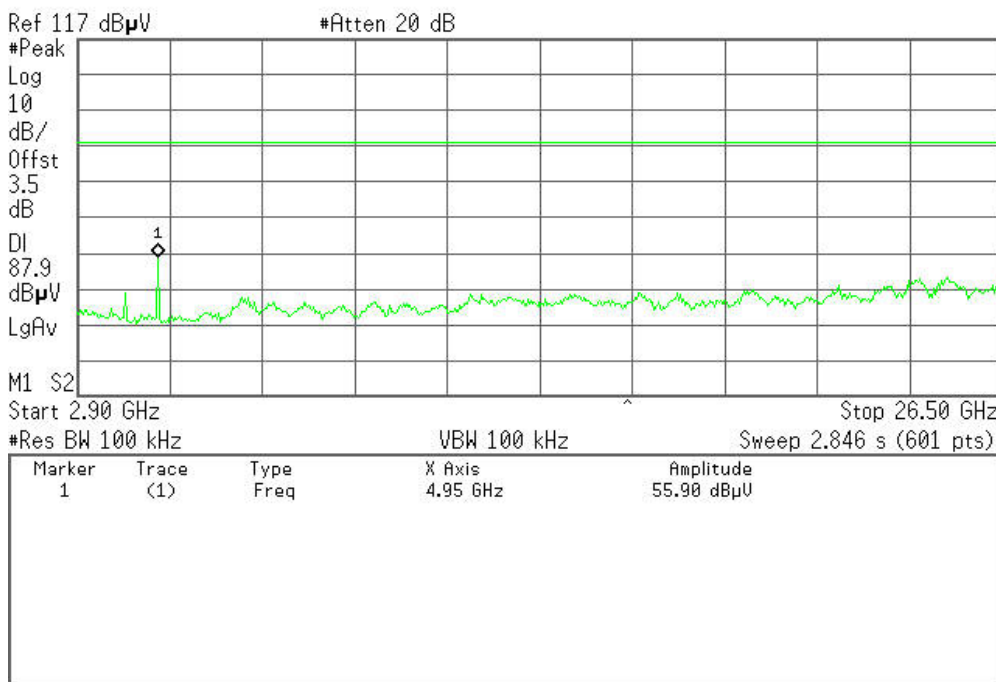
R T



2.9GHz ~ 26.5GHz

Agilent 20:39:14 Jun 17, 2011

R T





### 6.8.2. Radiated Emissions

#### LIMIT

1. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (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
88-216	150*	3
216-960	200*	3
Above 960	500	3

**Note:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength ( $\mu$ V/m at 3-meter)	Field Strength (dB $\mu$ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54





**MEASUREMENT EQUIPMENT USED**

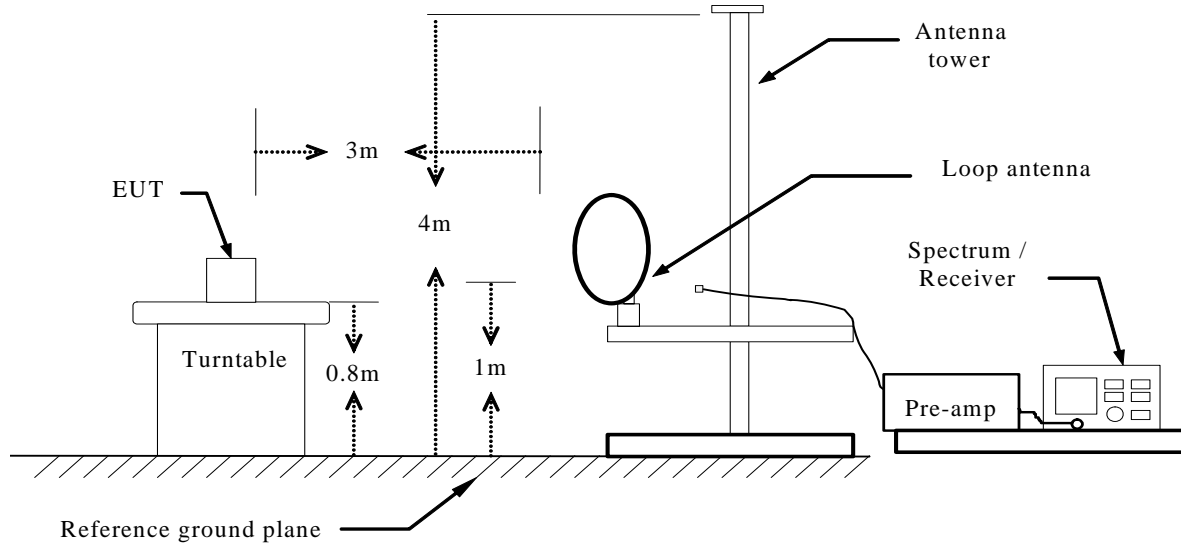
Radiated Emission Test Site 966 (2)						
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration	
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/21/2011	03/21/2012	
Amplifier	MITEQ	AM-1604-3000	1411843	03/21/2011	03/21/2012	
Turn Table	EMCO	2081-1.21	N/A	N.C.R	N.C.R	
Controller	CT	N/A	N/A	N.C.R	N.C.R	
High Noise Amplifier	Agilent	8449B	3008A01838	06/18/2011	06/18/2012	
Site NSA	C&C	N/A	N/A	N.C.R	N.C.R	
Bilog Antenna	SCHAFFNER	CBL6143	5082	06/18/2011	06/18/2012	
Horn Antenna	SCHWARZBECK	BBHA9120D	D286	03/19/2011	03/19/2012	
Signal Generator	Anritsu	MG3694A	#050125	03/21/2011	03/21/2012	
Horn Antenna	TRC	HA0301	N/A	03/19/2011	03/19/2012	
Loop Antenna	A.R.A	PLA-1030/B	1029	03/19/2011	03/19/2012	
Power Sensor	Anritsu	MA2491A	030619	06/18/2011	06/18/2012	
Power Meter	Anritsu	ML2487A	6K00001491	06/18/2011	06/18/2012	
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/30/2011	03/30/2012	

**Remark:** Each piece of equipment is scheduled for calibration once a year.

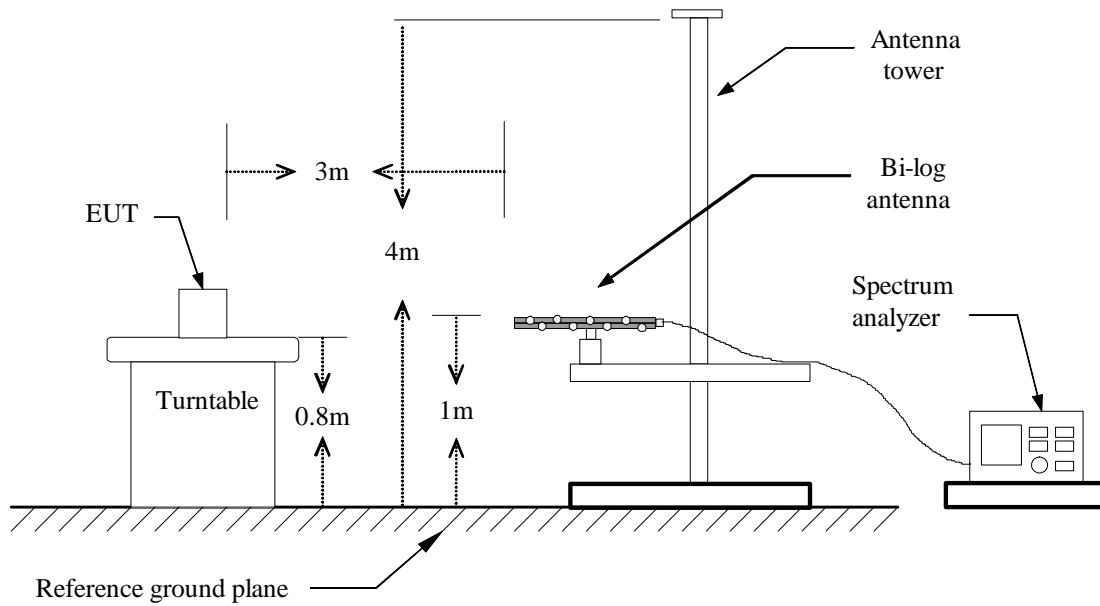


**Test Configuration**

**Below 30MHz**

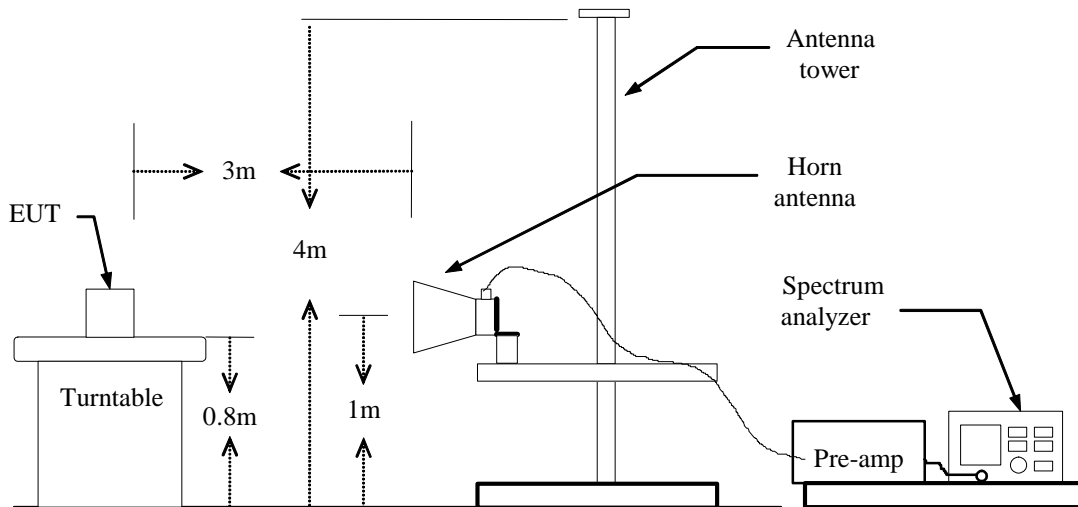


**Below 1 GHz**





## Above 1 GHz



## TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.



TEST RESULTS

Below 1 GHz

Operation Mode: Normal

Test Date: June 27,2011

Temperature: 26°C

Tested by: Sunday Hu

Humidity: 60% RH

Polarity: Ver. / Hor.

Table with 8 columns: Freq. (MHz), Ant.Pol. H/V, Detector Mode (PK/Q.P), Reading (dBuV/m), Factor (dB), Actual FS (dBuV/m), Limits 3m (dBuV/m), Safe Margin (dB). Rows include frequencies like 303.216, 432.550, 550.566, 696.066, 876.433, 899.766, 99.516, 479.433, 503.683, 527.933, 637.866, 899.766.

\*\*Remark: No emission found between lowest internal used/generated frequency to 30MHz.

Notes:

- 1. Measuring frequencies from 9kHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Peak/Quasi-peak detector mode.
3. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.
5. Freq(MHz). = Emission frequency in MHz
Reading (dBuV/m) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier gain
Actual FS (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
Limit (dBuV/m) = Limit stated in standard
Safe Margin(dB) = Measured (dBuV/m) - Limits (dBuV/m)
Ant. H/V = Current carrying line of reading
Detector = Mark Peak Reading or Quasi-peak Reading



**Above 1 GHz**

**Operation Mode:** TX(CH Low)

**Test Date:** June 27,2011

**Temperature:** 24°C

**Tested by:** Sunday Hu

**Humidity:** 52% RH

**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1198.33	V	57.22	---	-11.42	45.80	---	74.00	54.00	-8.20	Peak
1595.00	V	55.19	---	-10.31	44.88	---	74.00	54.00	-9.12	Peak
2003.33	V	52.66	---	-9.28	43.38	---	74.00	54.00	-10.62	Peak
2995.00	V	51.47	---	-5.99	45.48	---	74.00	54.00	-8.52	Peak
N/A										
1198.33	H	55.07	---	-11.42	43.65	---	74.00	54.00	-10.35	Peak
1805.00	H	53.40	---	-10.15	43.25	---	74.00	54.00	-10.75	Peak
2995.00	H	49.51	---	-5.99	43.52	---	74.00	54.00	-10.48	Peak
4908.33	H	45.42	---	-0.30	45.12	---	74.00	54.00	-8.88	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.
5. Freq.(MHz) = Emission frequency in MHz  
 Reading (dBuV/m) =Uncorrected Analyzer / Receiver Reading  
 Corr. Factor (dB) = Antenna factor + Cable loss – Amplifier gain  
 Actual FS (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)  
 Limit (dBuV/m) = Limit stated in standard  
 Margin (dB) = Actual FS (dBuV/m)- Limit (dBuV/m)  
 Pk = Peak Reading  
 AV. = Average Reading  
 Remark = Mark Peak Reading or Quasi-peak Reading



**Operation Mode:** TX(CH Mid)

**Test Date:** June 27, 2011

**Temperature:** 24°C

**Tested by:** Sunday Hu

**Humidity:** 52% RH

**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1198.33	V	57.13	---	-11.42	45.71	--	74.00	54.00	-8.29	Peak
3193.33	V	49.10	---	-5.51	43.59	--	74.00	54.00	-10.41	Peak
3730.00	V	47.11	---	-3.85	43.26	--	74.00	54.00	-10.74	Peak
5596.67	V	45.31	---	1.49	46.80	--	74.00	54.00	-7.20	Peak
N/A										
1490.00	H	52.77	---	-10.30	42.47	--	74.00	54.00	-11.53	Peak
1723.33	H	59.53	---	-10.21	49.32	--	74.00	54.00	-4.68	Peak
2995.00	H	49.63	---	-5.99	43.64	--	74.00	54.00	-10.36	Peak
4208.33	H	47.00	---	-2.90	44.10	--	74.00	54.00	-9.90	Peak
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GH z- 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.
5. Freq.(MHz) = Emission frequency in MHz  
 Reading (dBuV/m) =Uncorrected Analyzer / Receiver Reading  
 Corr. Factor (dB) = Antenna factor + Cable loss – Amplifier gain  
 Actual FS (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)  
 Limit (dBuV/m) = Limit stated in standard  
 Margin (dB) = Actual FS (dBuV/m)- Limit (dBuV/m)  
 Pk = Peak Reading  
 AV. = Average Reading  
 Remark = Mark Peak Reading or Quasi-peak Reading



Operation Mode: TX(CH High)
Temperature: 24 °C
Humidity: 52% RH

Test Date: June 27,2011
Tested by: Sunday Hu
Polarity: Ver. / Hor.

Table with 11 columns: Freq. (MHz), Ant. Pol H/V, Peak Reading (dBuV), AV Reading (dBuV), Ant. / CL CF (dB), Actual Fs (Peak and AV in dBuV/m), Peak Limit (dBuV/m), AV Limit (dBuV/m), Margin (dB), Remark. It contains two groups of data for frequencies 1198.33, 1590.00, 1991.66, 2983.33 and 1198.33, 1501.66, 1816.66, 2995.00.

Notes:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.
5. Freq.(MHz) = Emission frequency in MHz
Reading (dBuV/m) =Uncorrected Analyzer / Receiver Reading
Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier gain
Actual FS (dBuV/m) = Reading (dBuV) + Corr. Factor (dB/m)
Limit (dBuV/m) = Limit stated in standard
Margin (dB) = Actual FS (dBuV/m)- Limit (dBuV/m)
Pk = Peak Reading
AV = Average Reading
Remark = Mark Peak Reading or Quasi-peak Reading



### 6.9. POWERLINE CONDUCTED EMISSIONS

#### LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

#### MEASUREMENT EQUIPMENT USED

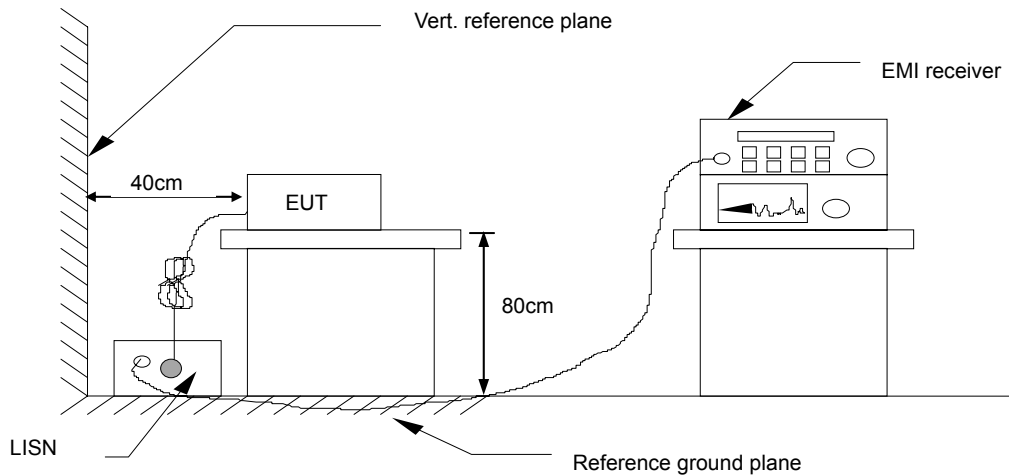
Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
ESCI EMI TEST RECEIVE.ESCI	ROHDE&SCHWARZ	1166.5950 03	100145	03/21/2011	03/21/2012
LISN	FCC	FCC-LISN-50-50-2-M	01068	03/21/2011	03/21/2012
LISN	EMCO	3825/2	8901-1459	03/21/2011	03/21/2012
CDN	FCC	FCC-TILISN-T4	20182	03/21/2011	03/21/2012
CDN	FCC	FCC-TLISN-T8-02	20183	03/21/2011	03/21/2012
CDN	FCC	FCC-TLISN-T4-02	20382	03/21/2011	03/21/2012
CDN	FCC	FCC-TLISN-T4-02	20383	03/21/2011	03/21/2012
CDN	FCC	FCC-801-T8-RJ45	04030	03/21/2011	03/21/2012
Current Probe	STODDART AIRCRAFT	91550-1	345-73	03/21/2011	03/21/2012
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/30/2011	03/30/2012

**Remark:** Each piece of equipment is scheduled for calibration once a year.





## Test Configuration



See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

## TEST 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 were complete.

## TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.



Test Data

Model No.	F5L090	RBW,VBW	9 kHz
Environmental Conditions	26°C, 60% RH	Test Mode	Mode 1
Tested by	Sunday Hu		

(The chart below shows the highest readings taken from the final data.)

Frequency Range Investigated (150 kHz to 30 MHz)										
Freq.	Q.P.	AVG	Cor.	Q.P.	AVG	Q.P.	AVG	Q.P.	AVG	Line
(MHz)	Level	Level	Factor	Result	Result	Limit	Limit	Margin	Margin	(L1/L2)
	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB uV)	(dB uV)	(dB)	(dB)	
0.430	34.34	19.90	11.51	45.85	31.41	57.25	47.25	-11.40	-15.84	L1
1.158	34.23	24.15	11.53	45.76	35.68	56.00	46.00	-10.24	-10.32	L1
1.842	35.27	25.75	11.55	46.82	37.30	56.00	46.00	-9.18	-8.70	L1
3.046	34.83	22.42	11.60	46.43	34.02	56.00	46.00	-9.57	-11.98	L1
3.342	35.05	18.41	11.61	46.66	30.02	56.00	46.00	-9.34	-15.98	L1
7.802	35.40	19.78	11.84	47.24	31.62	60.00	50.00	-12.76	-18.38	L1
0.166	45.99	7.58	11.52	57.51	19.10	65.15	55.15	-7.64	-36.05	L2
0.394	36.55	26.07	11.53	48.08	37.60	57.98	47.98	-9.90	-10.38	L2
1.309	36.09	26.66	11.53	47.62	38.19	56.00	46.00	-8.38	-7.81	L2
1.601	36.19	22.36	11.54	47.73	33.90	56.00	46.00	-8.27	-12.10	L2
3.410	36.64	22.79	11.61	48.25	34.40	56.00	46.00	-7.75	-11.60	L2
6.434	38.18	25.53	11.76	49.94	37.29	60.00	50.00	-10.06	-12.71	L2

- NOTE:** 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).  
2. Those frequencies only show peak emission level because that was below the Average limit, so no need to check average anymore.