



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**802.11 a/b/g/n + BT2.1**

**MODEL NUMBER: A1395**

**FCC ID: BCGA1395  
IC: 579C-A1395**

**REPORT NUMBER: 10U13548-19, Revision A**

**ISSUE DATE: FEBRUARY 24, 2011**

*Prepared for*  
**APPLE, INC.**  
**1 INFINITE LOOP**  
**CUPERTINO, CA 95014, U.S.A.**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES (UL CCS)**  
**47173 BENICIA STREET**  
**FREMONT, CA 94538, U.S.A.**  
**TEL: (510) 771-1000**  
**FAX: (510) 661-0888**

**NVLAP**<sup>®</sup>

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/15/11	Initial Issue	F. Ibrahim
A	02/24/11	Revised description of EUT setup section, removed MPE section, removed AV power sections, and added co-location info in section 5.5.	F. Ibrahim

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE, INC.  
1 INFINITE LOOP  
CUPERTINO, CA, 95014, U.S.A.

**EUT DESCRIPTION:** 802.11a/b/g/n + BT 2.1

**MODEL:** A1395

**SERIAL NUMBER:** PT523312

**DATE TESTED:** FEBRUARY 5-12, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:



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FRANK IBRAHIM  
EMC SUPERVISOR  
UL CCS

Tested By:



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TOM CHEN  
EMC ENGINEER  
UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

802.11 a/b/g/n + BT2.1

The radio module is manufactured by Apple, Inc.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	13.94	24.77
2402 - 2480	Enhanced 8PSK	13.80	23.99

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the following antenna:

Antenna Name	Description	Manufacturer	Cable Length
631-1482 WiFi / Bluetooth	PIFA	Amphenol / Tyco	81.6 mm

	631-1482 WiFi / Bluetooth
	Peak Gain (includes Cable)
Freq [GHz]	dBi
2.4-2.484	0.59
5.15 - 5.25	4.07
5.25 - 5.35	4.2
5.47-5.725	4.21
5.725-5.85	3.57

#### **5.4. SOFTWARE AND FIRMWARE**

The firmware installed on the EUT was version 4.221.50.2 (BCM MFGTEST)

The EUT driver rev: 0x4dd3202

The test utility software: wl.exe version: 4.218 RC175.1

The test utility software used during testing was Bluetooth Test Mode with CBT.

#### **5.5. WORST-CASE CONFIGURATION AND MODE**

For radiated emissions below 1 GHz and Power Line Conducted Emissions, the worst-case configuration is determined to be the mode and channel with the highest output power

To determine the worst-position of highest emissions, the EUT's antenna was investigated for X, Y, Z positions, and the worst position was turned out to be a Y-position.

Radiated Co-located BE and Harmonics was performed in the 5.3 GHz band and in the 5.8 GHz band.

## 5.6. DESCRIPTION OF TEST SETUP

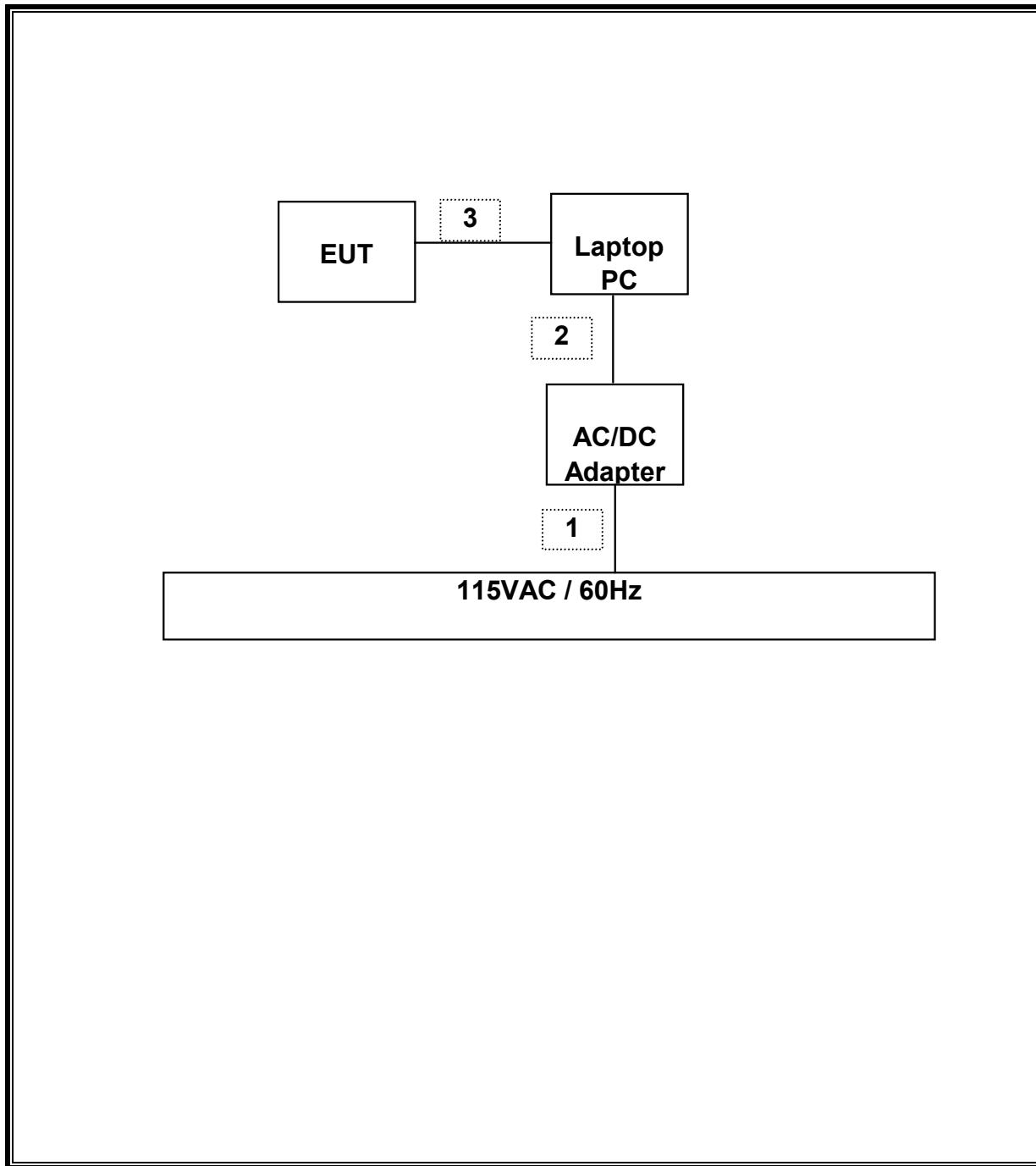
### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Apple	A1286	W8917005998	DoC
Laptop AC Adapter	Apple	A1290	N/A	DoC

### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2m	N/A
2	DC	1	DC	Un-shielded	2m	N/A
3	USB	1	USB	Un-shielded	1m	Connect to Laptop

**SETUP DIAGRAM FOR TESTS**



**Note:** laptop PC was used to control the operation of the EUT.

## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/06/11
Antenna, Bilog, 2 GHz	Sundt Sciences	JB1	C01016	07/12/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
Reject Filter, 2.0-2.9 GHz	Micro-Tronics	BRM50702	N02684	CNR
High Pass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02682	CNR
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/30/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01159	05/08/11
Peak Power Meter	Boonton	4541	C01186	03/01/11
Peak Power Sensor	Boonton	57318	C01202	02/23/11

## 7. ANTENNA PORT TEST RESULTS

### 7.1. BASIC DATA RATE GFSK MODULATION

#### 7.1.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

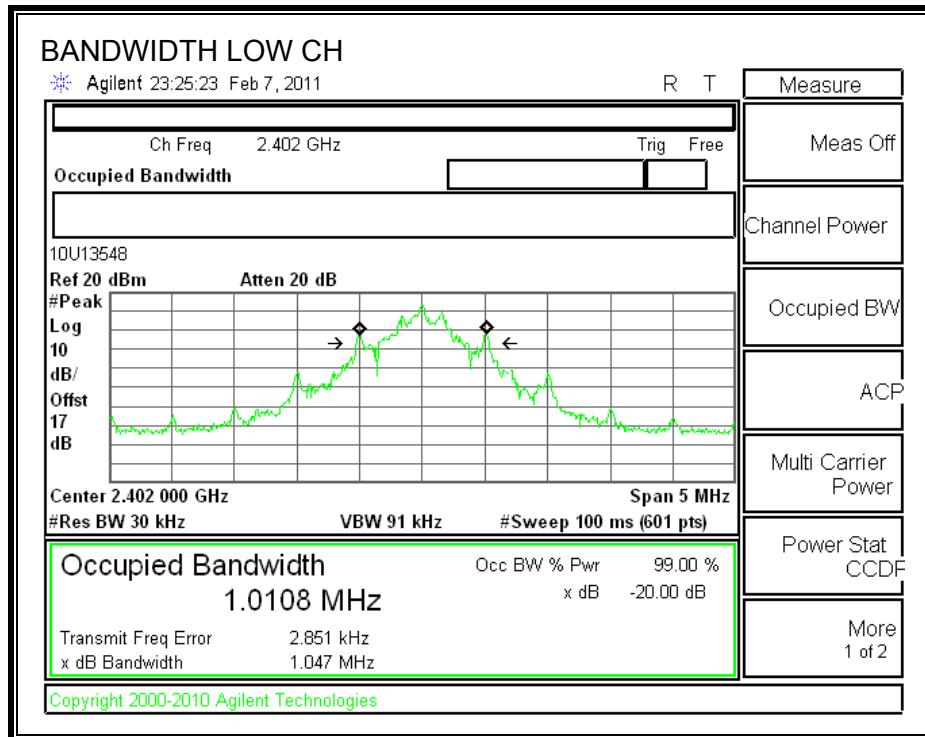
##### TEST PROCEDURE

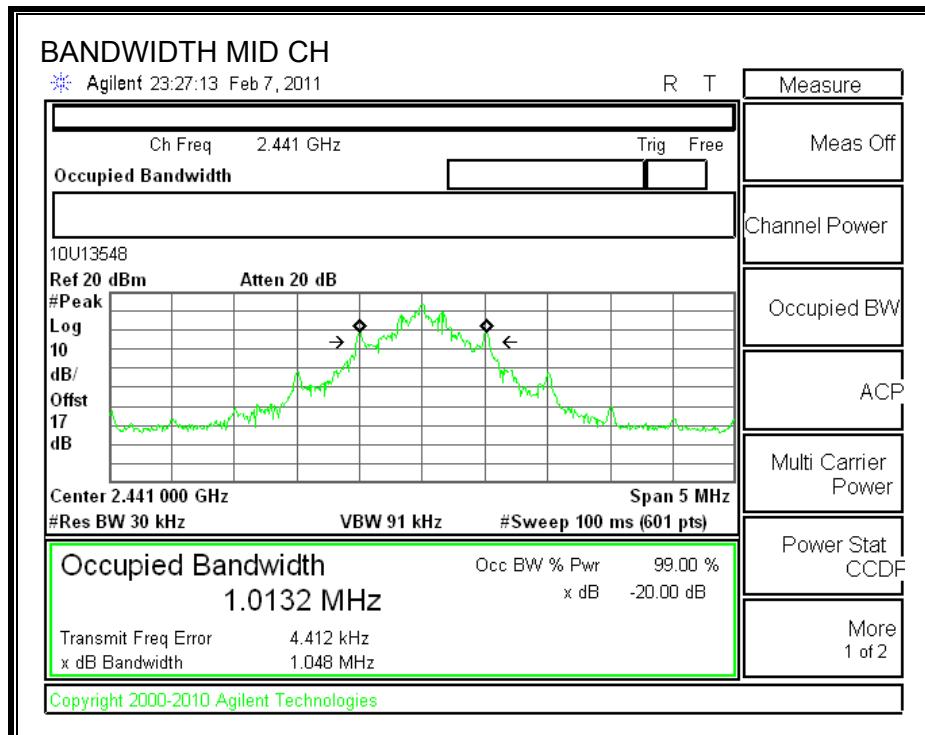
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

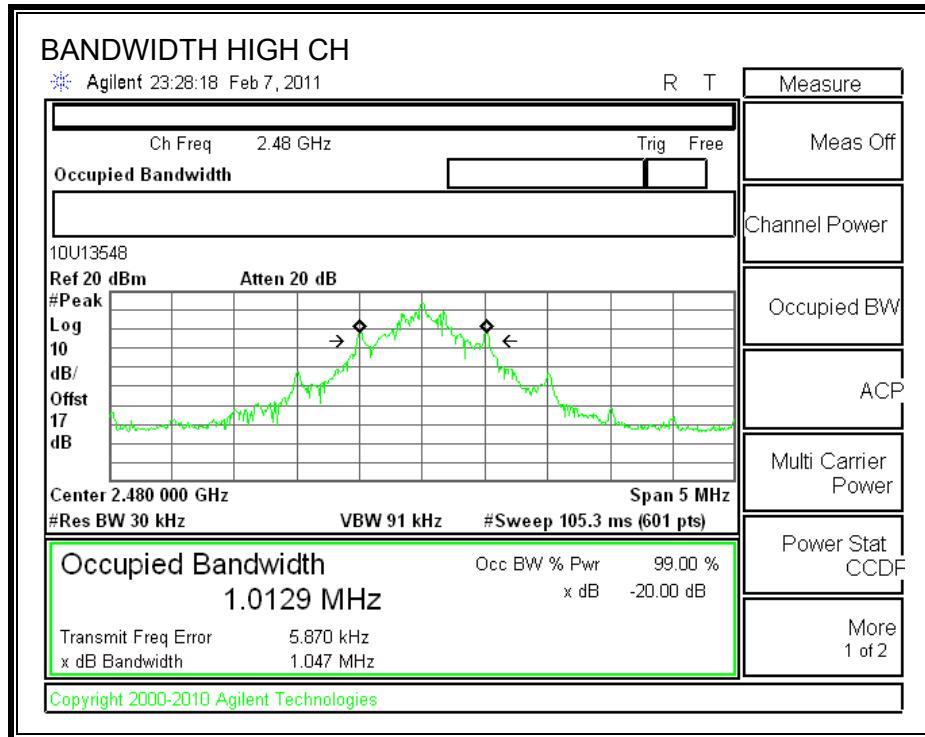
##### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1047.0	1012.4
Middle	2441	1048.0	1018.4
High	2480	1047.0	1019.2

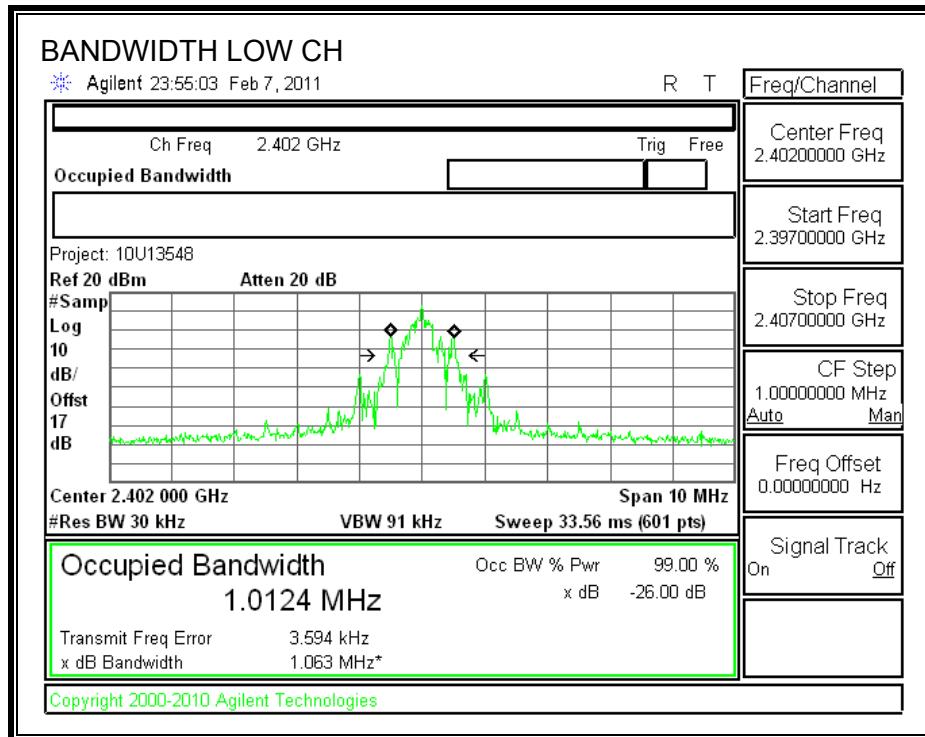
**20 dB BANDWIDTH**

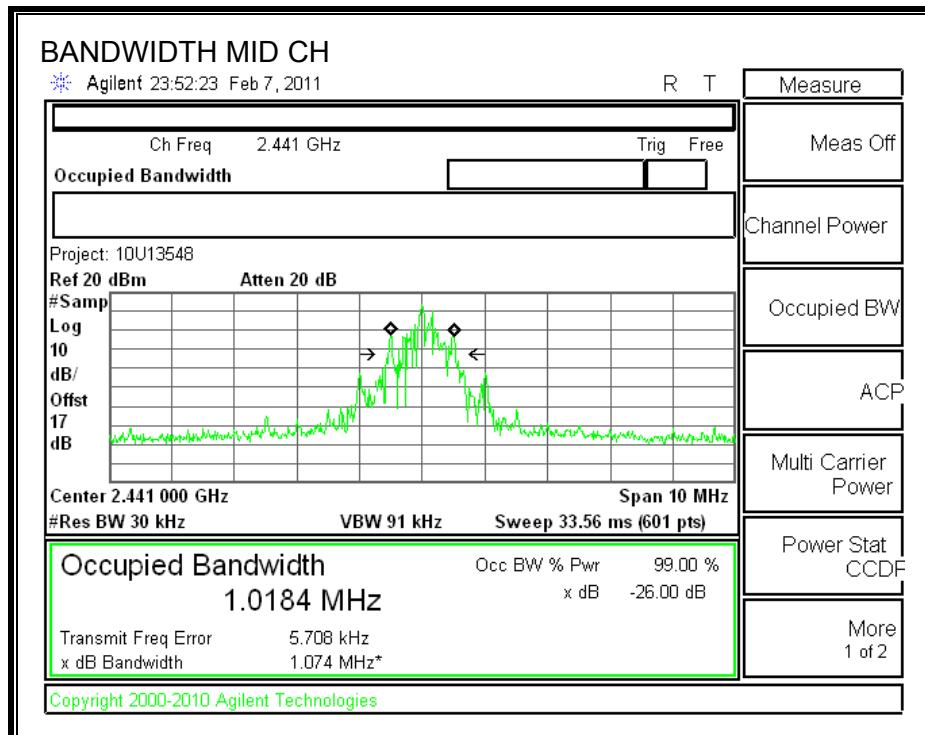


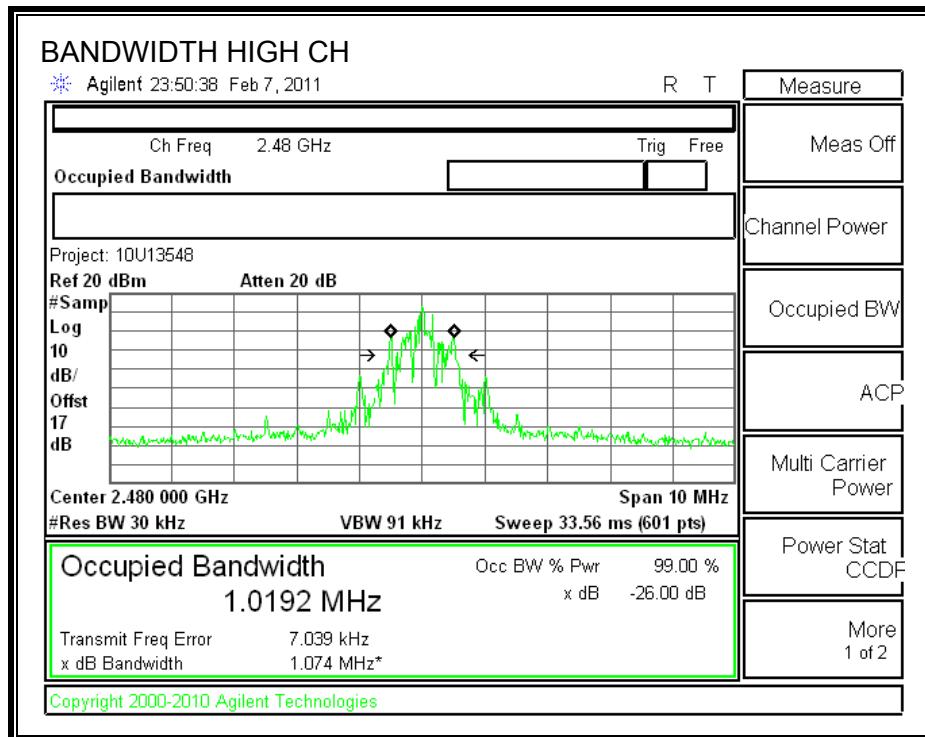




**99% BANDWIDTH**







### 7.1.2. HOPPING FREQUENCY SEPARATION

#### LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

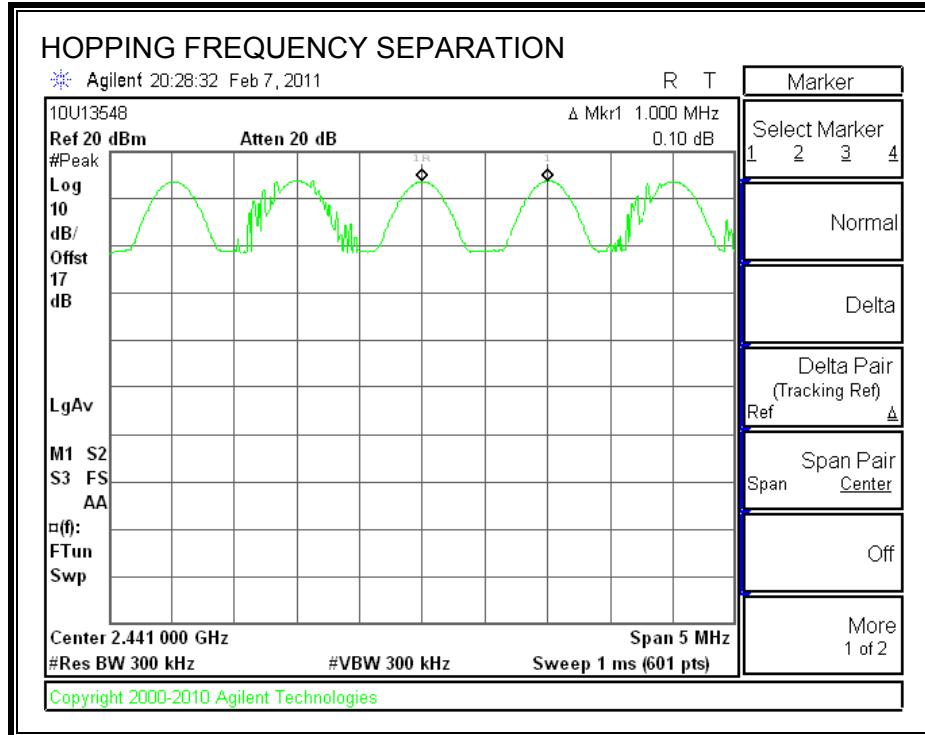
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

## RESULTS

### HOPPING FREQUENCY SEPARATION



### 7.1.3. NUMBER OF HOPPING CHANNELS

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

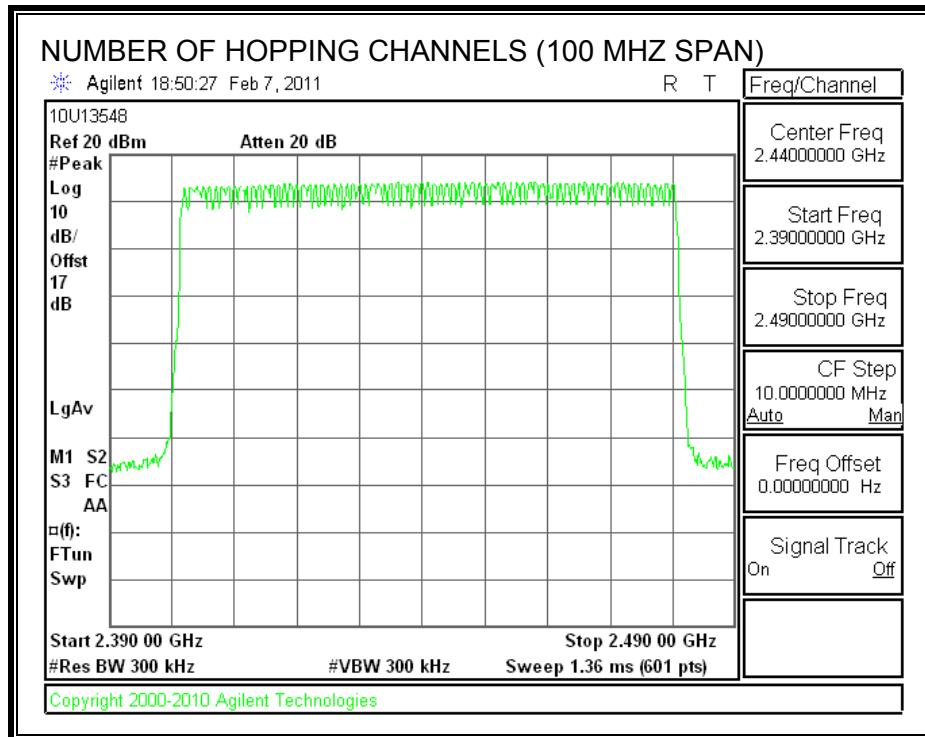
#### TEST PROCEDURE

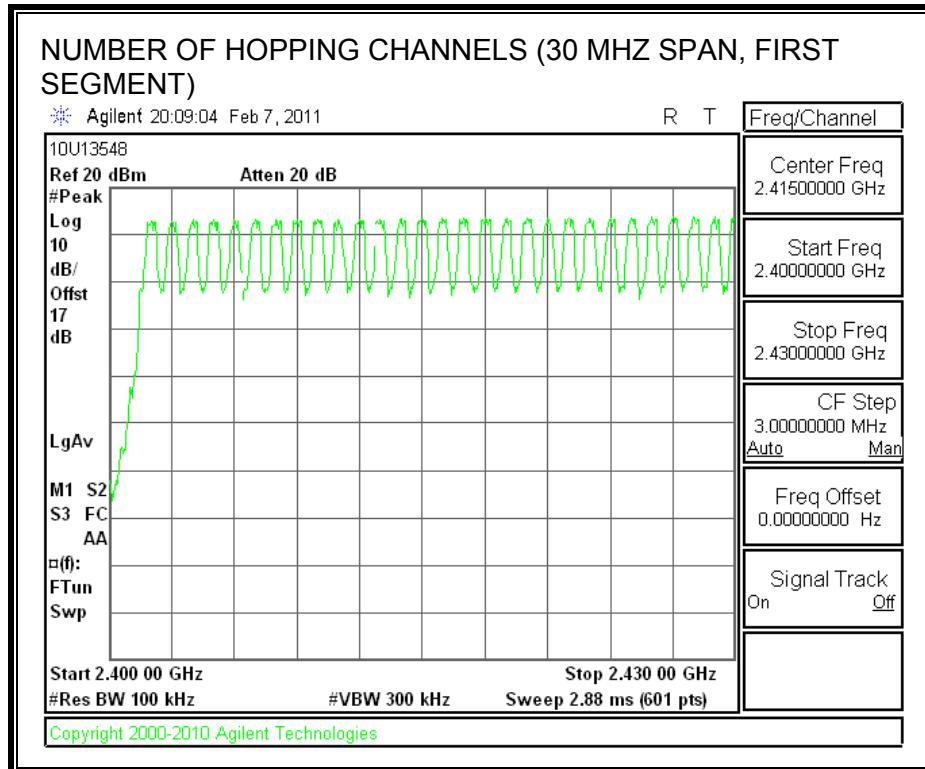
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

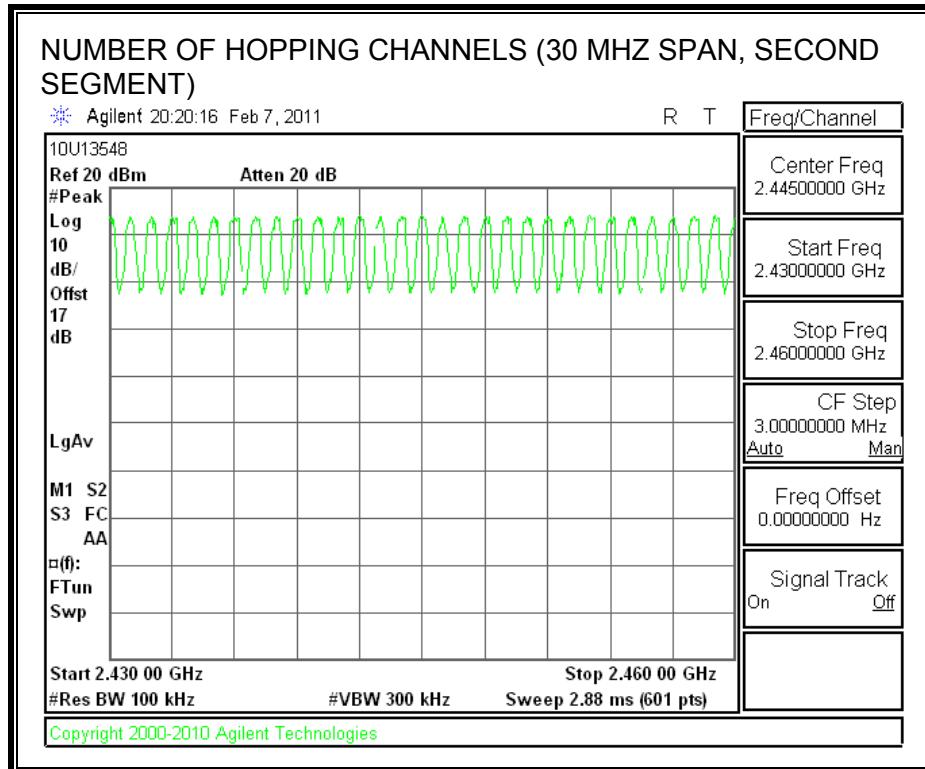
#### RESULTS

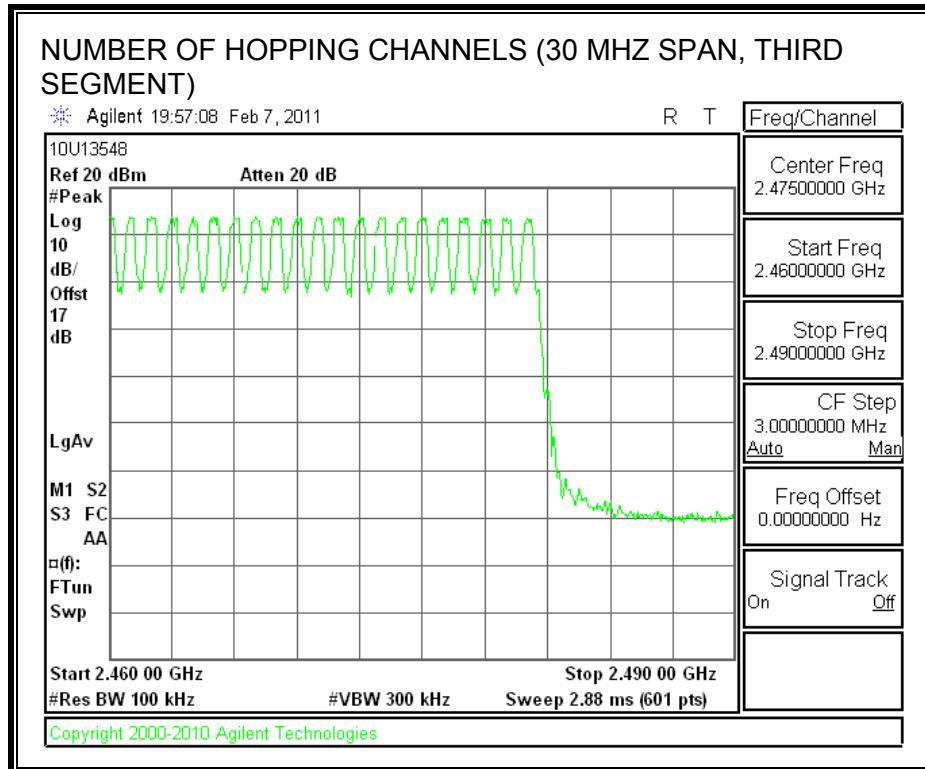
79 Channels observed.

**NUMBER OF HOPPING CHANNELS**









#### 7.1.4. AVERAGE TIME OF OCCUPANCY

##### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

##### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

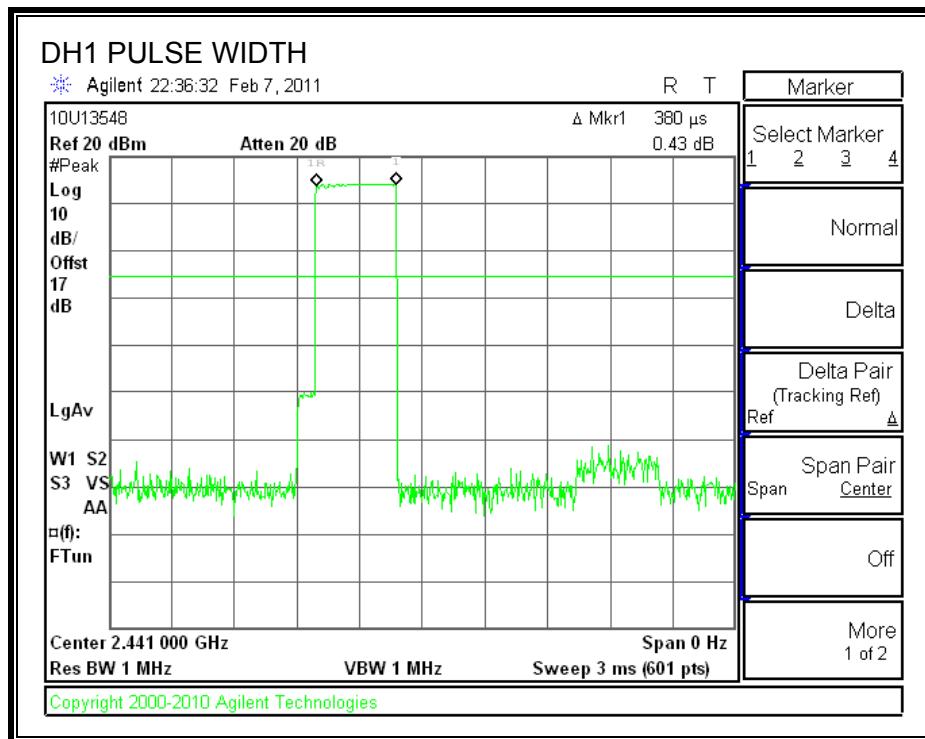
##### RESULTS

Time Of Occupancy =  $10 * \text{xx pulses} * \text{yy msec} = \text{zz msec}$

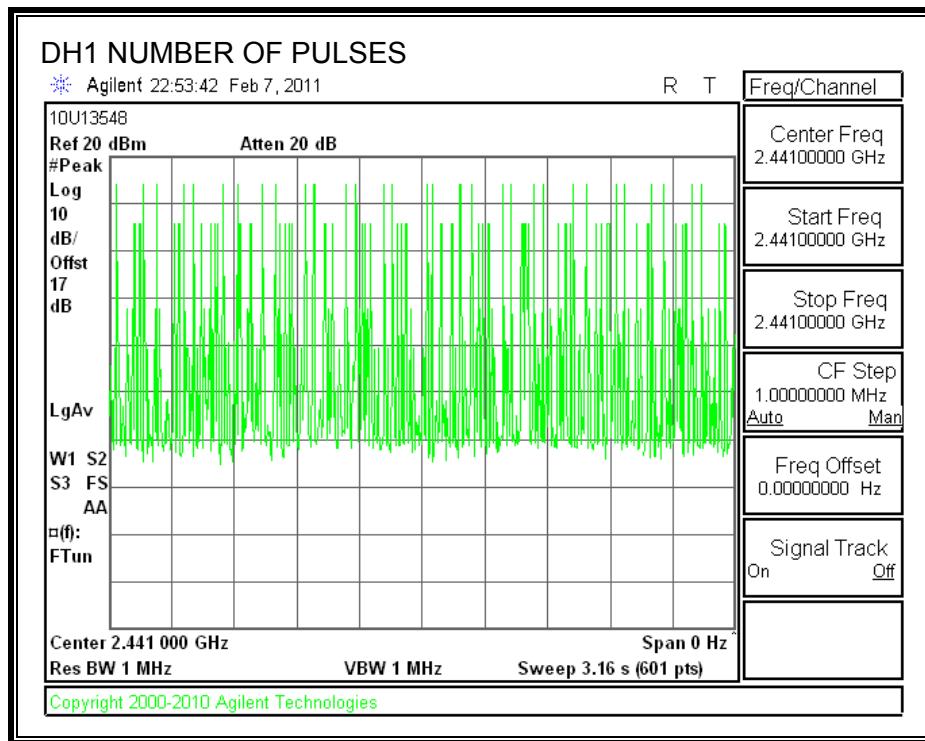
##### GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.38	31	0.118	0.4	0.282
DH3	1.635	19	0.311	0.4	0.089
DH5	2.89	10	0.289	0.4	0.111

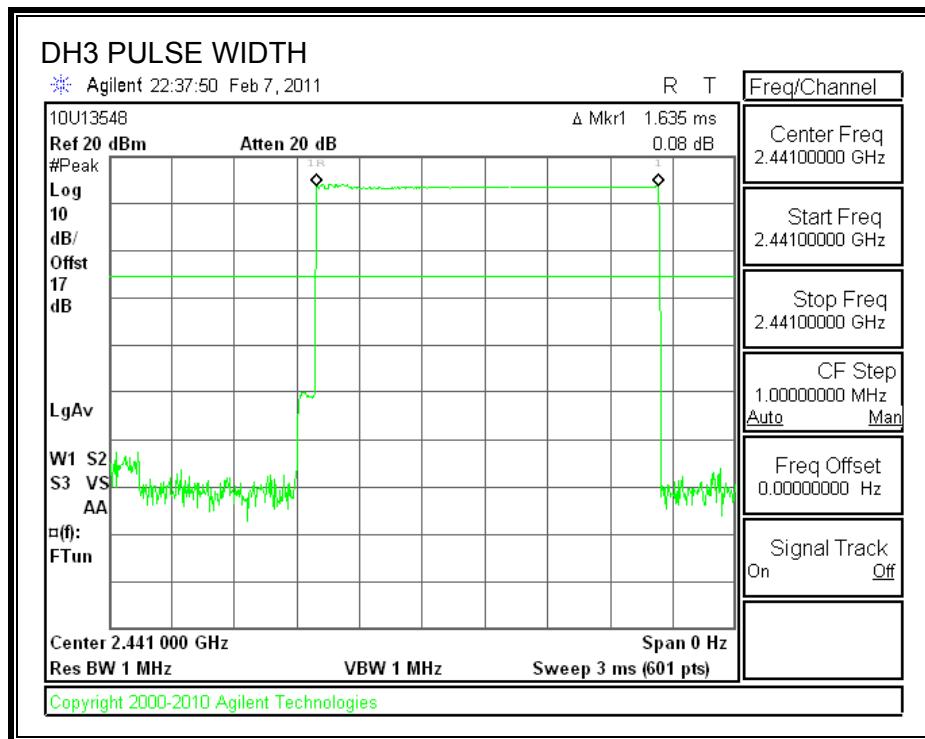
PULSE WIDTH



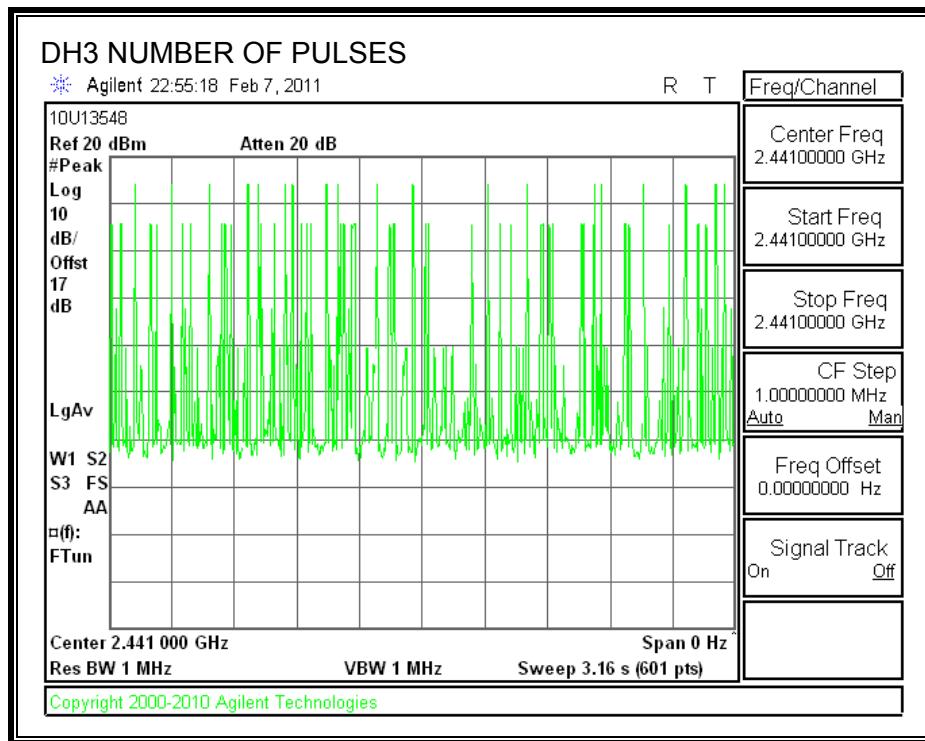
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



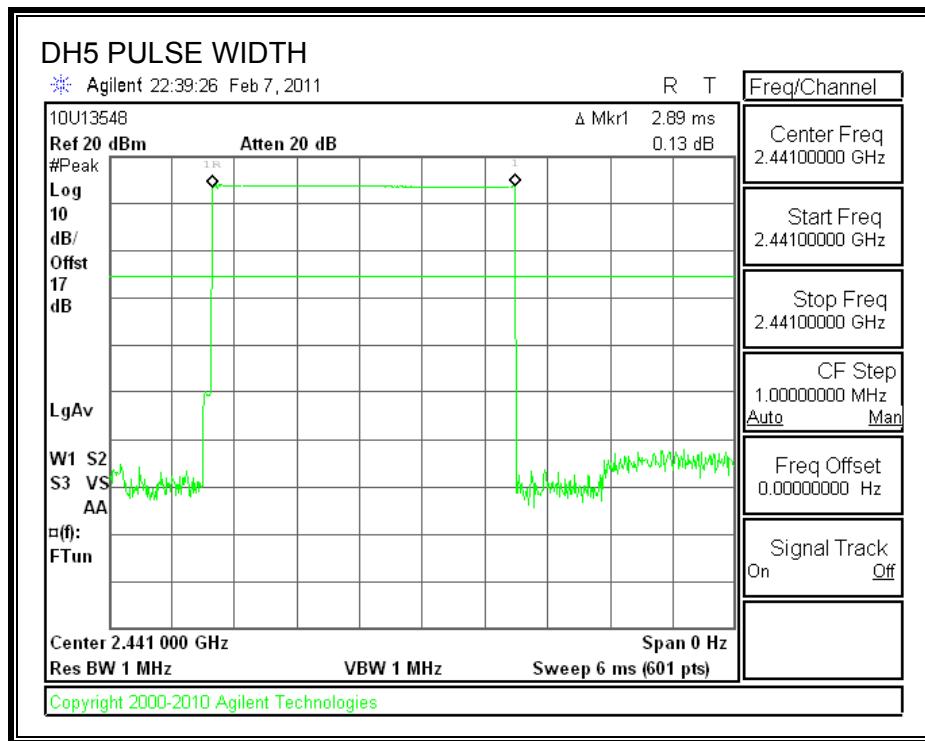
PULSE WIDTH



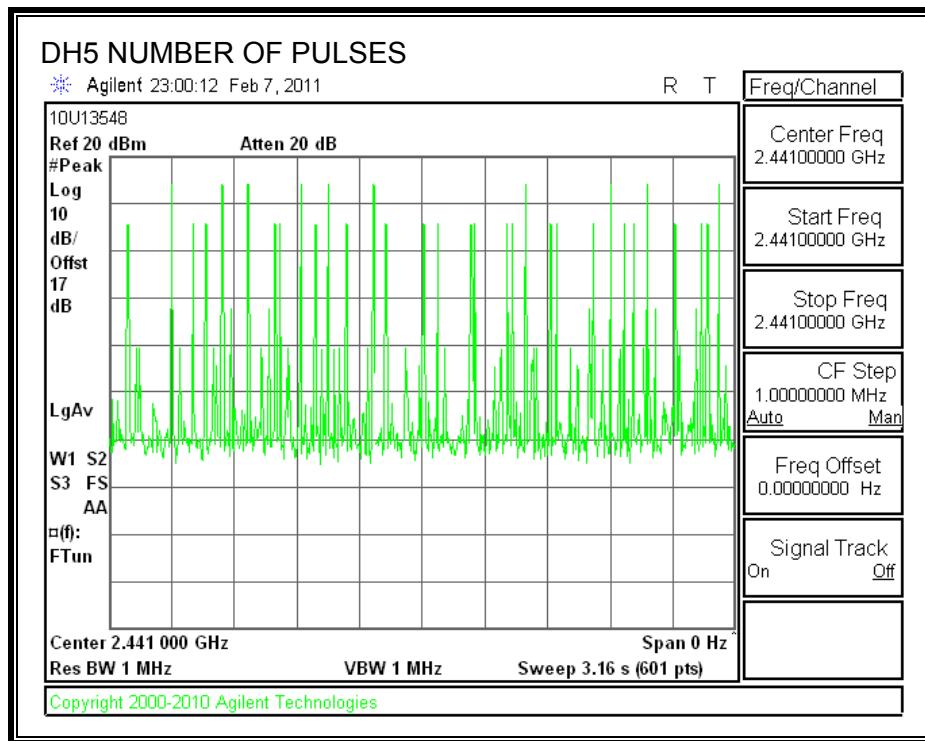
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



PULSE WIDTH



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



### 7.1.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

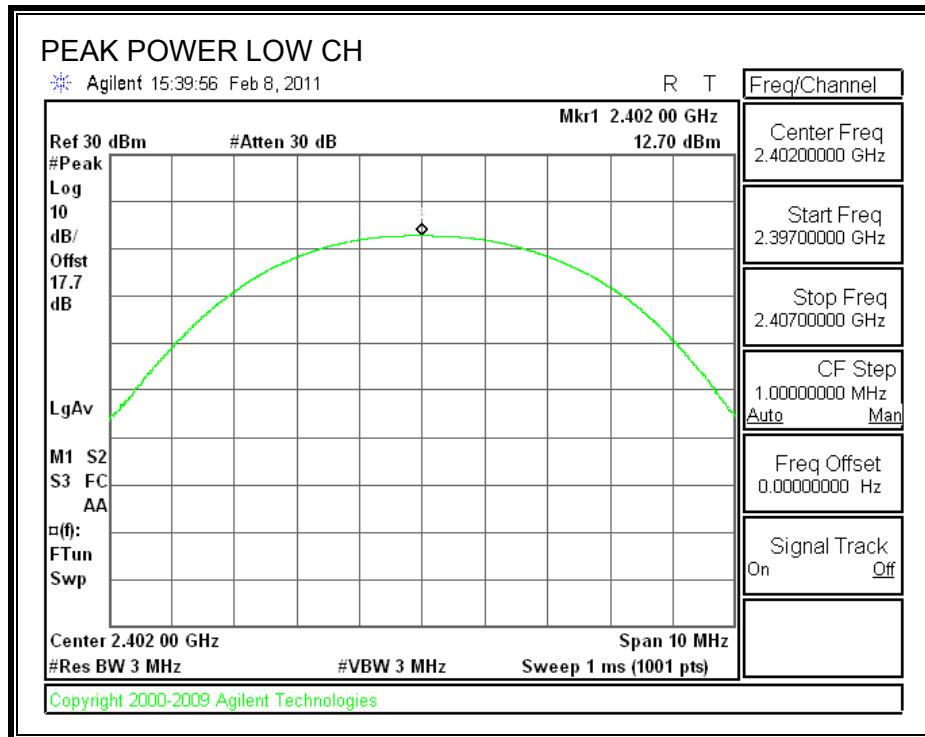
#### TEST PROCEDURE

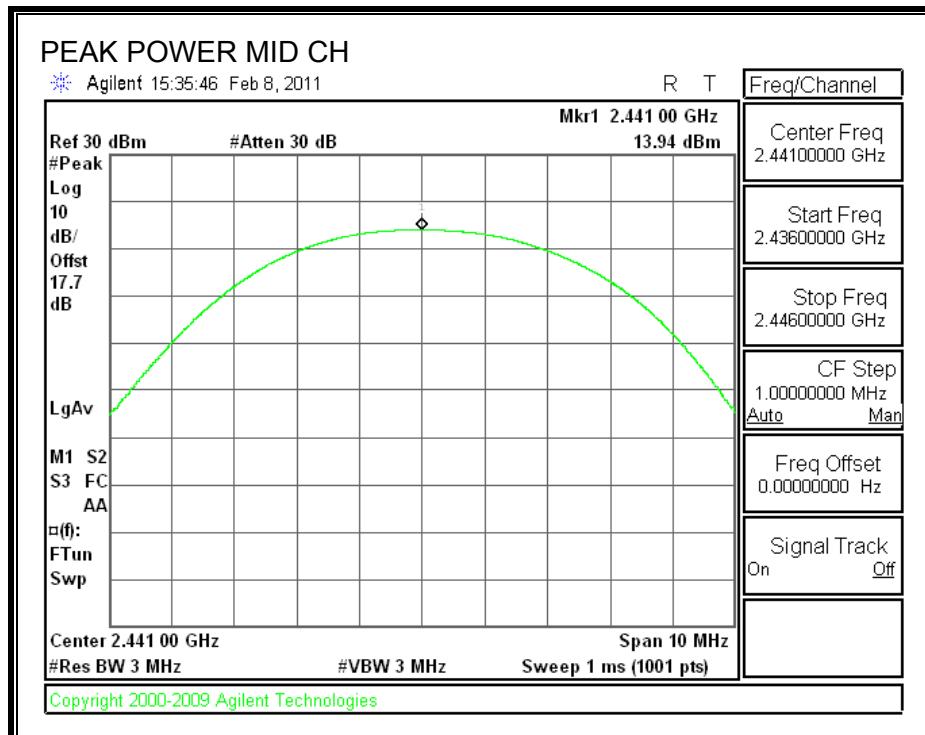
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

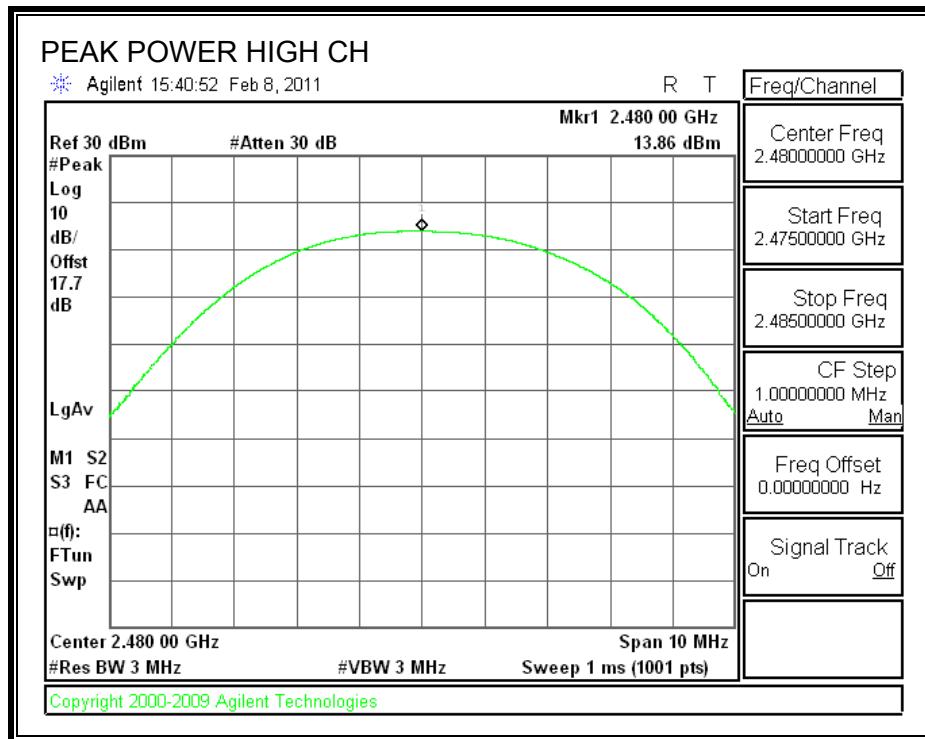
#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.70	30	-17.30
Middle	2441	13.94	30	-16.06
High	2480	13.86	30	-16.14

**OUTPUT POWER**







### 7.1.6. CONDUCTED SPURIOUS EMISSIONS

#### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### TEST PROCEDURE

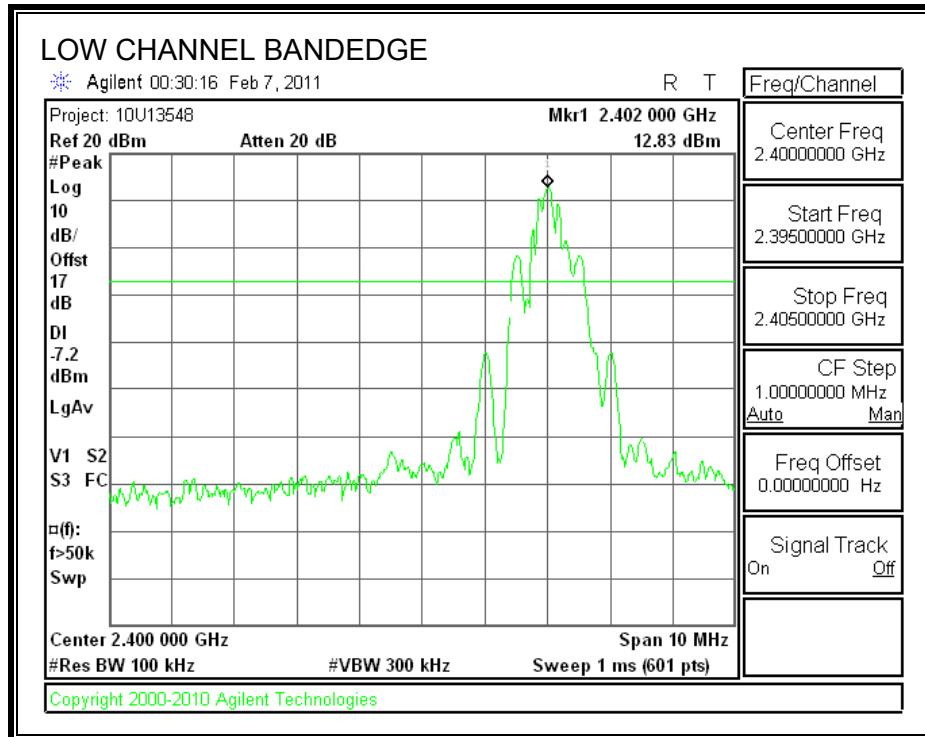
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

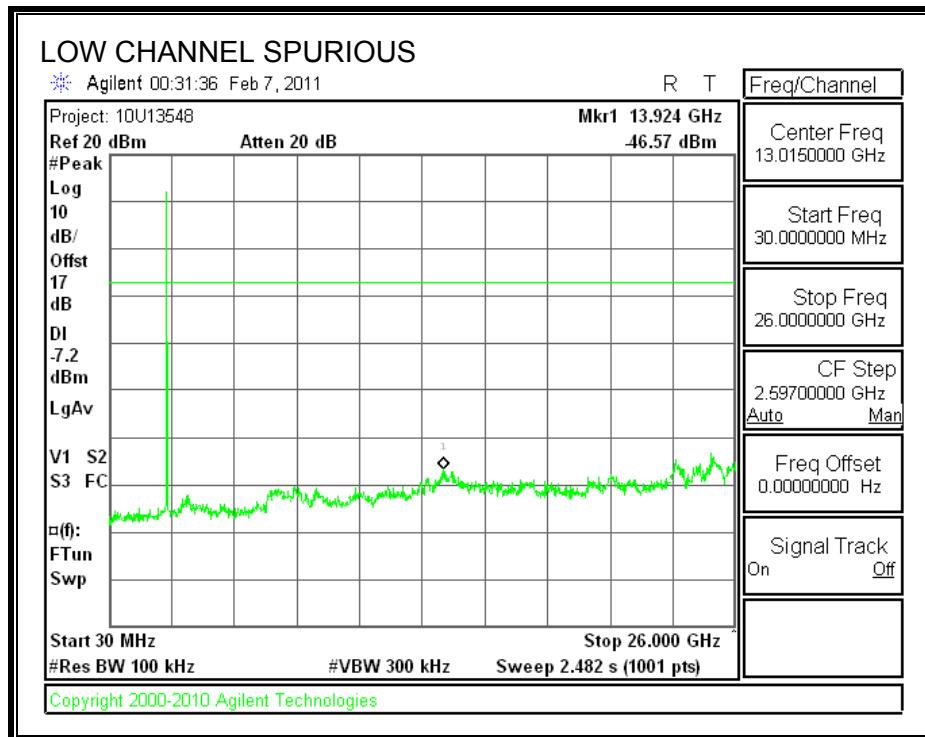
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

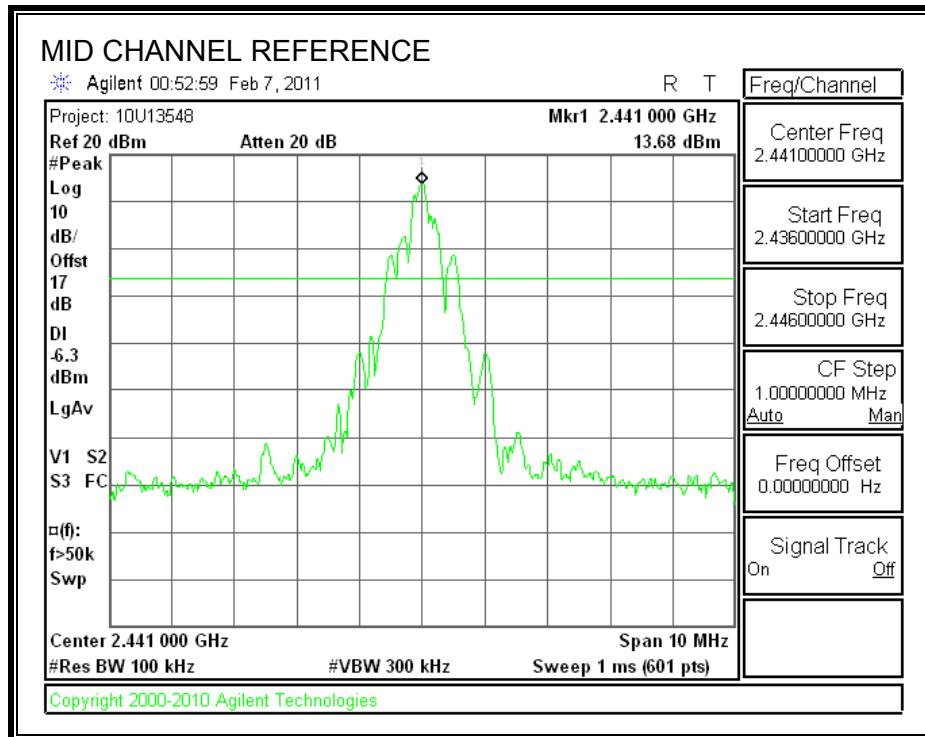
## RESULTS

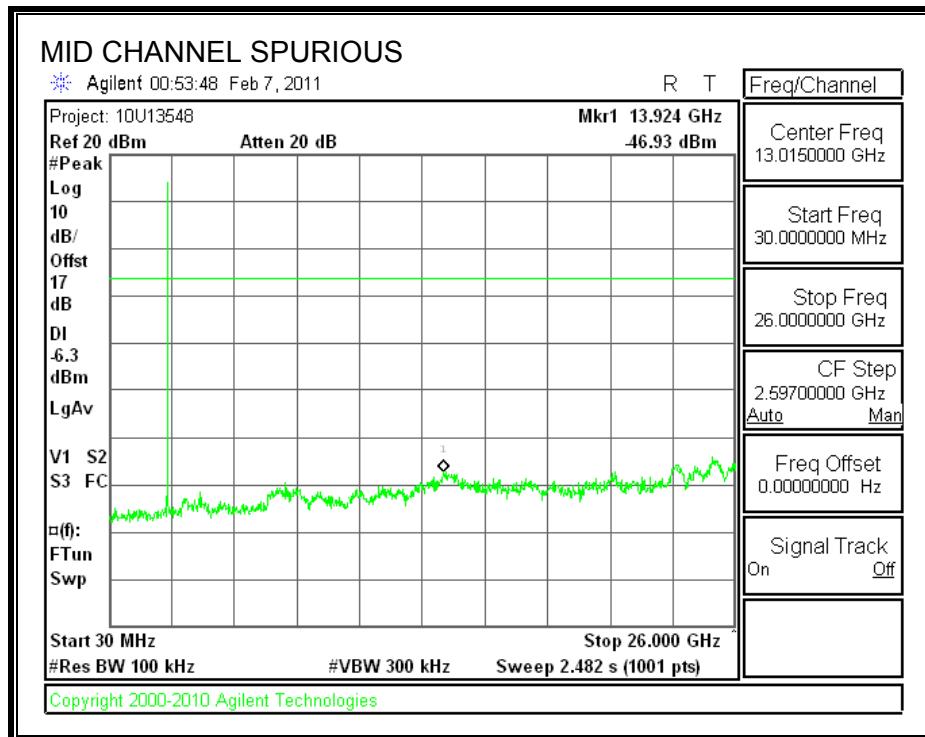
### SPURIOUS EMISSIONS, LOW CHANNEL



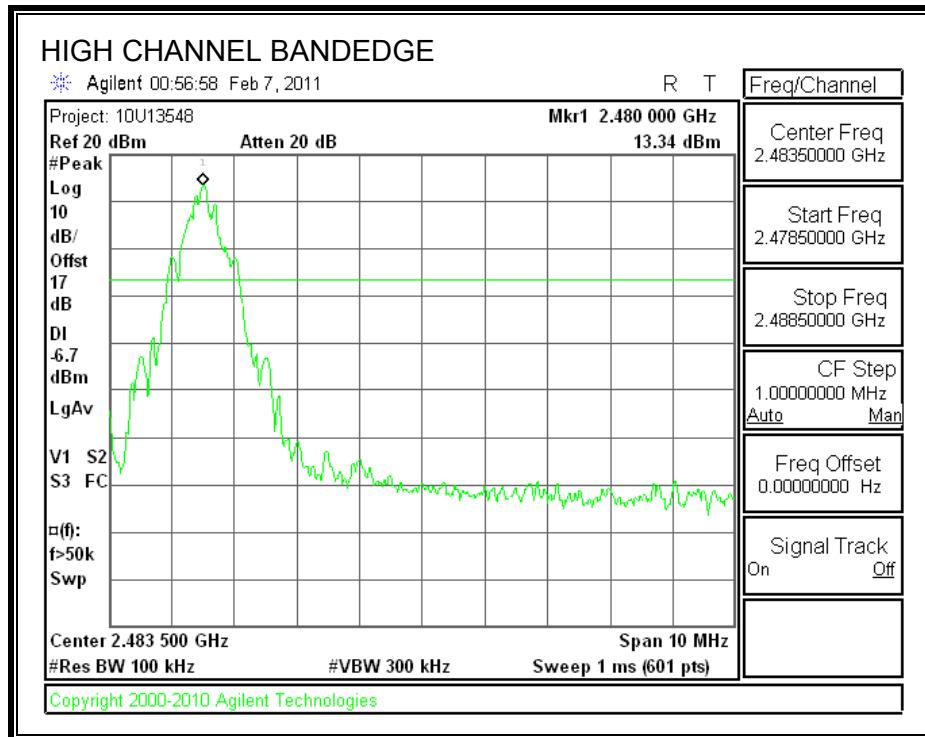


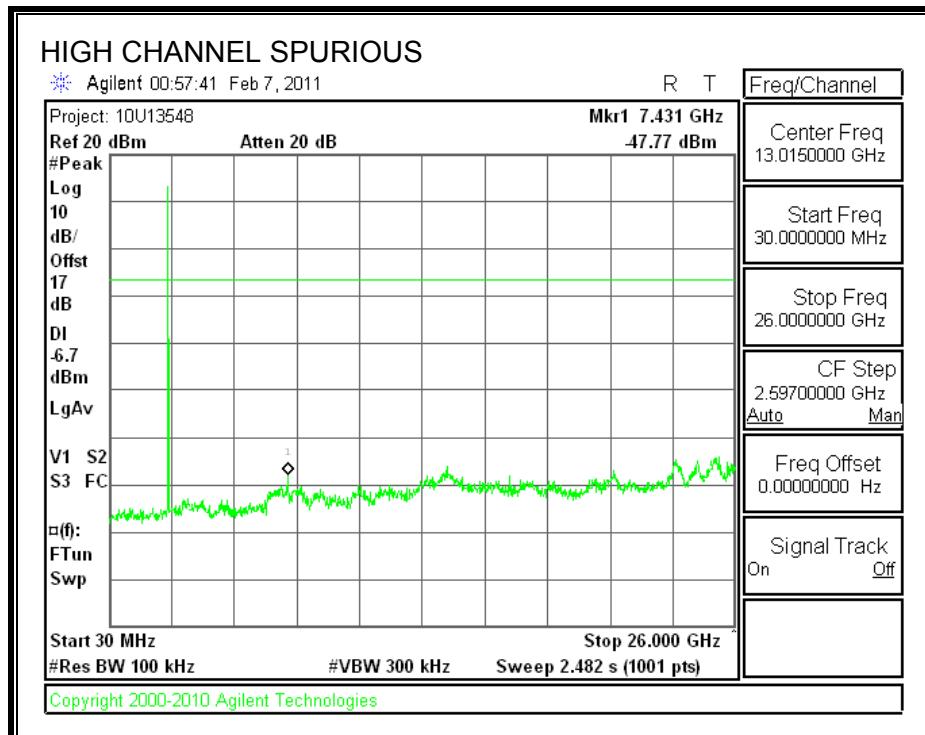
**SPURIOUS EMISSIONS, MID CHANNEL**



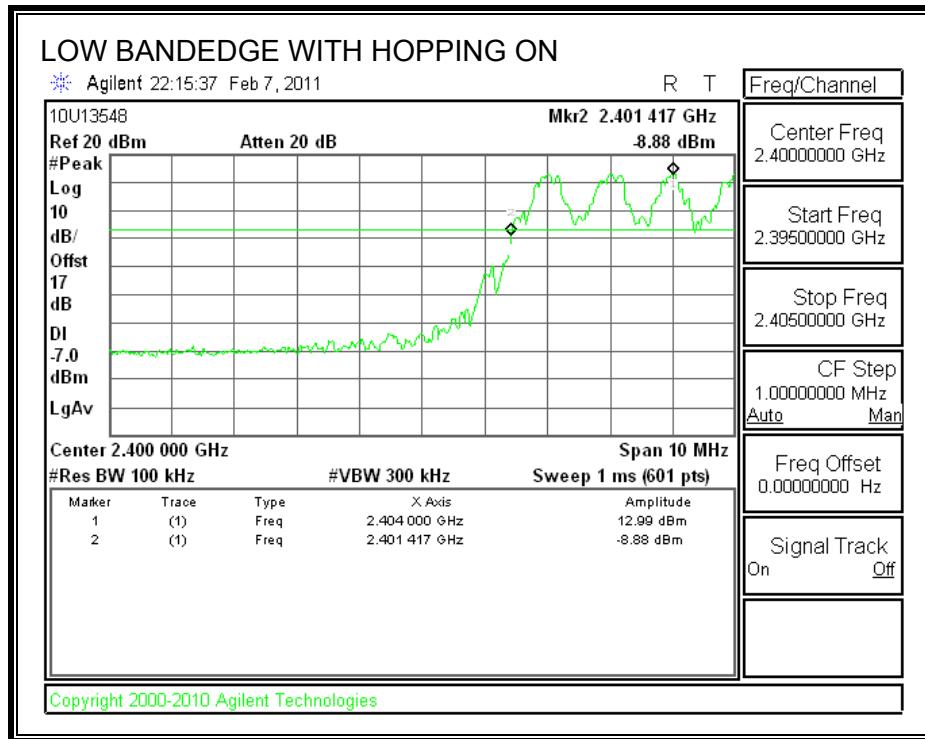


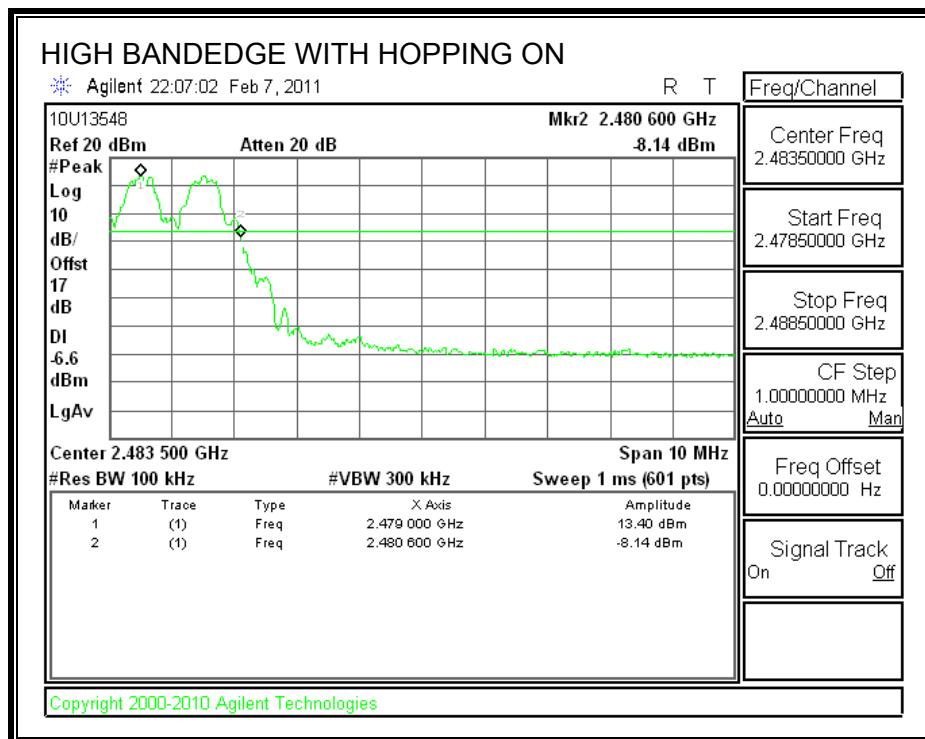
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**





## 7.2. ENHANCED DATA RATE 8PSK MODULATION

### 7.2.1. 20 dB AND 99% BANDWIDTH

#### LIMIT

None; for reporting purposes only.

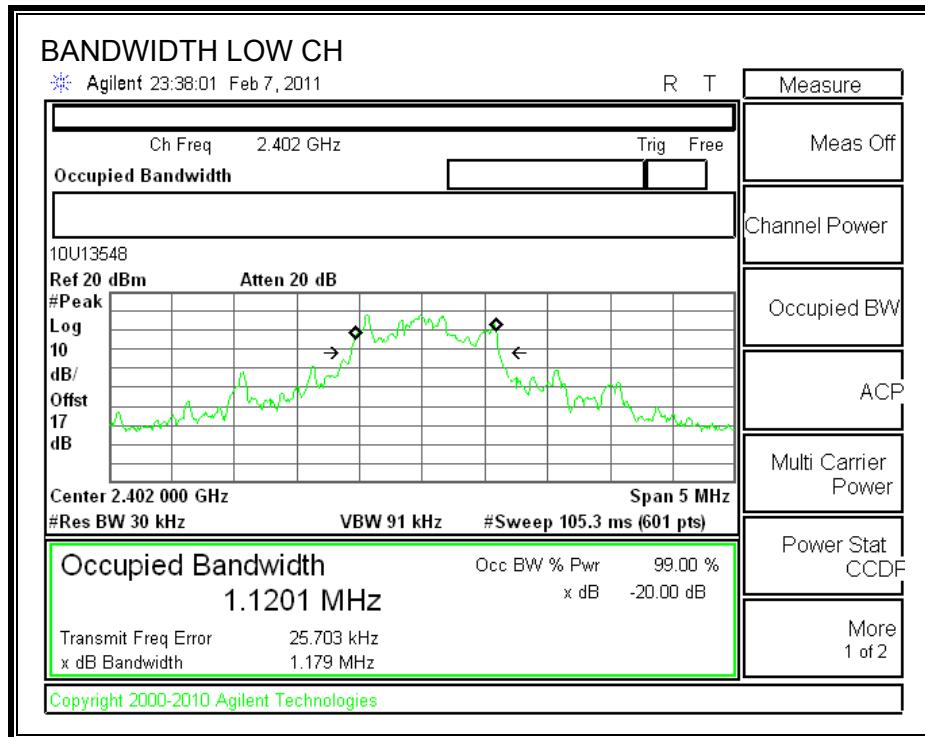
#### TEST PROCEDURE

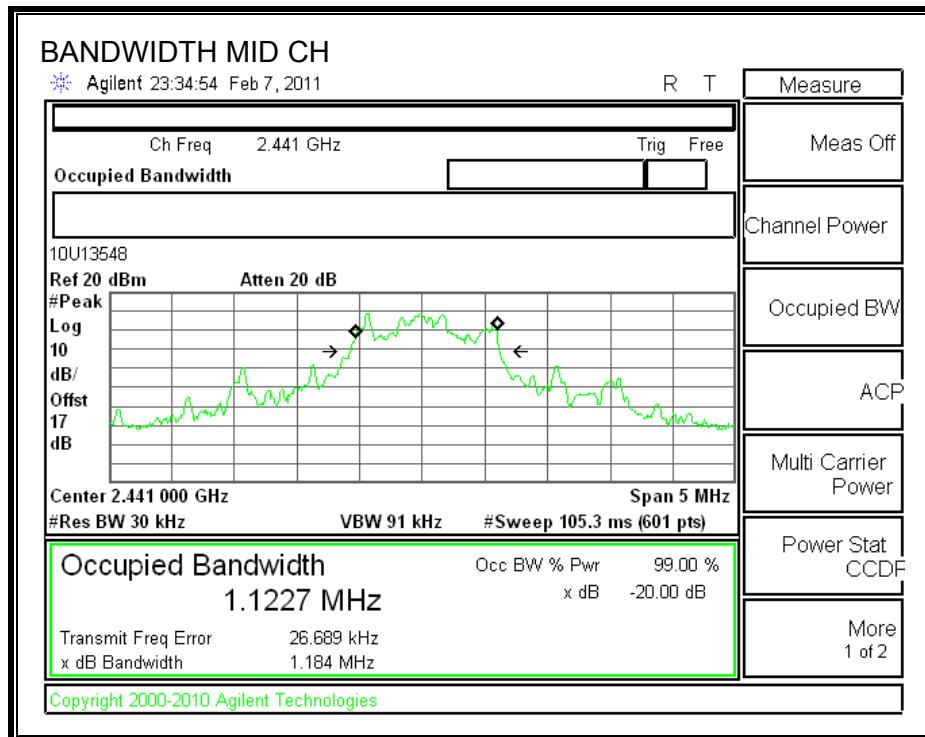
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq$  1% of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

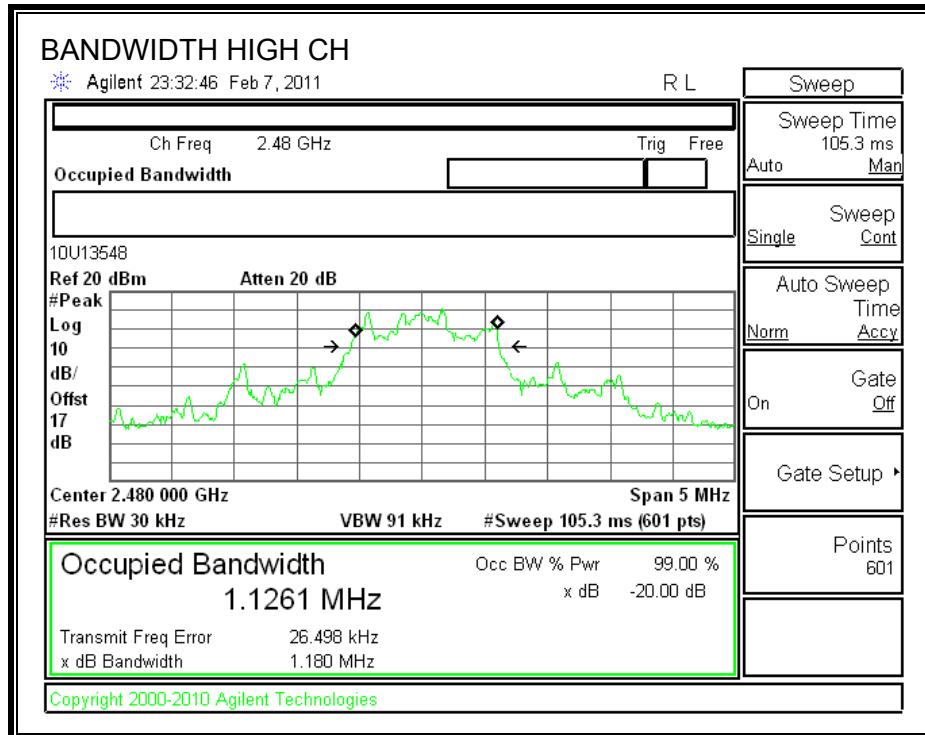
#### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1179	1077.3
Middle	2441	1184	1100.9
High	2480	1180	1108.3

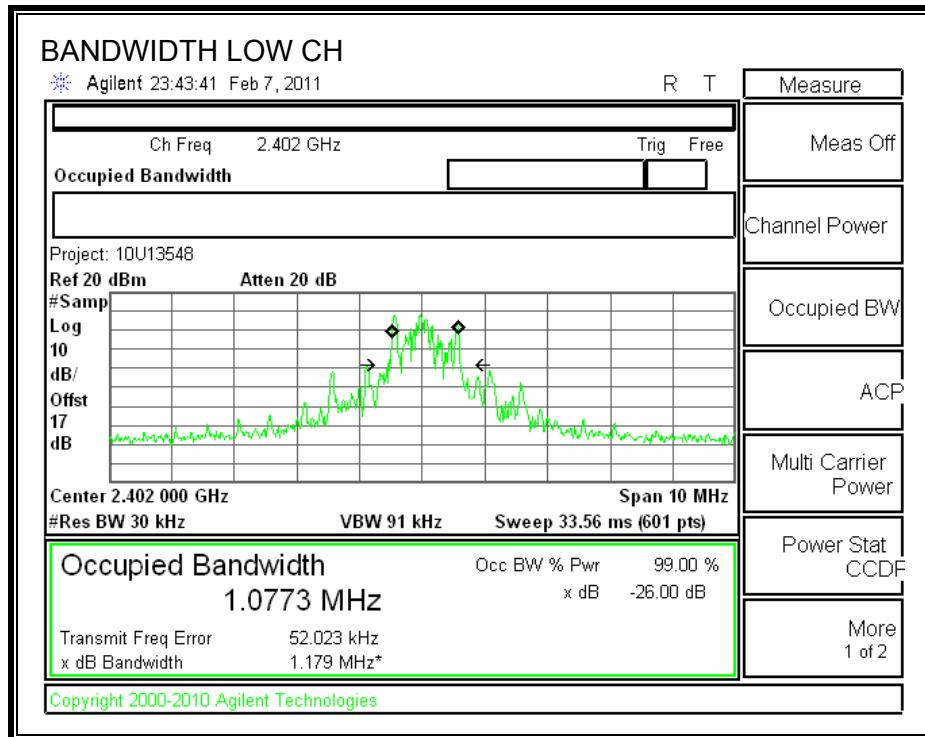
**20 dB BANDWIDTH**

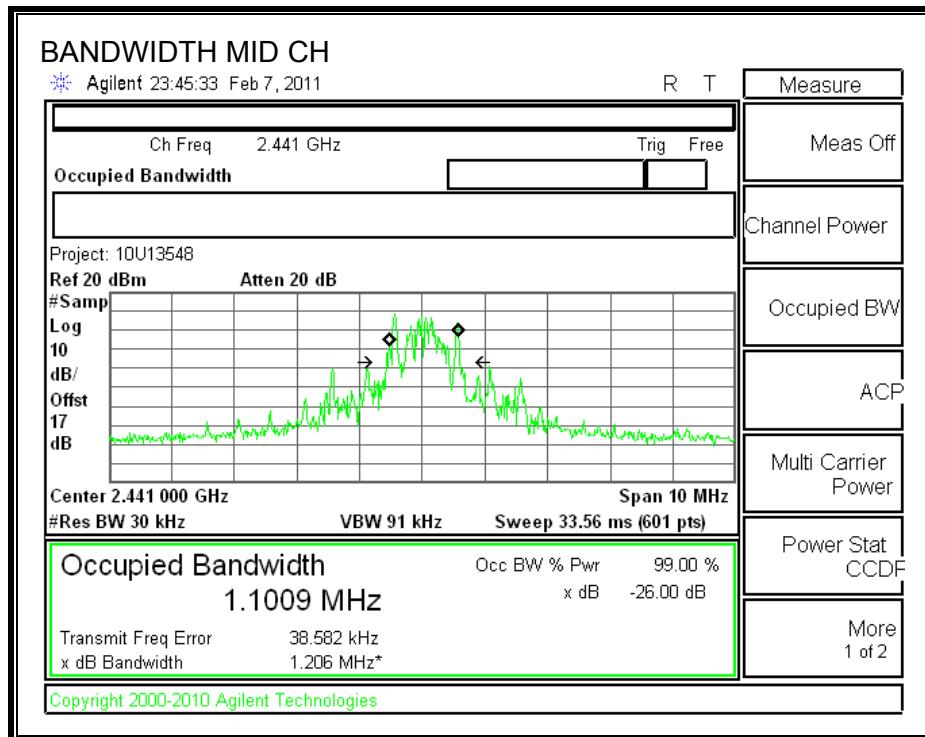


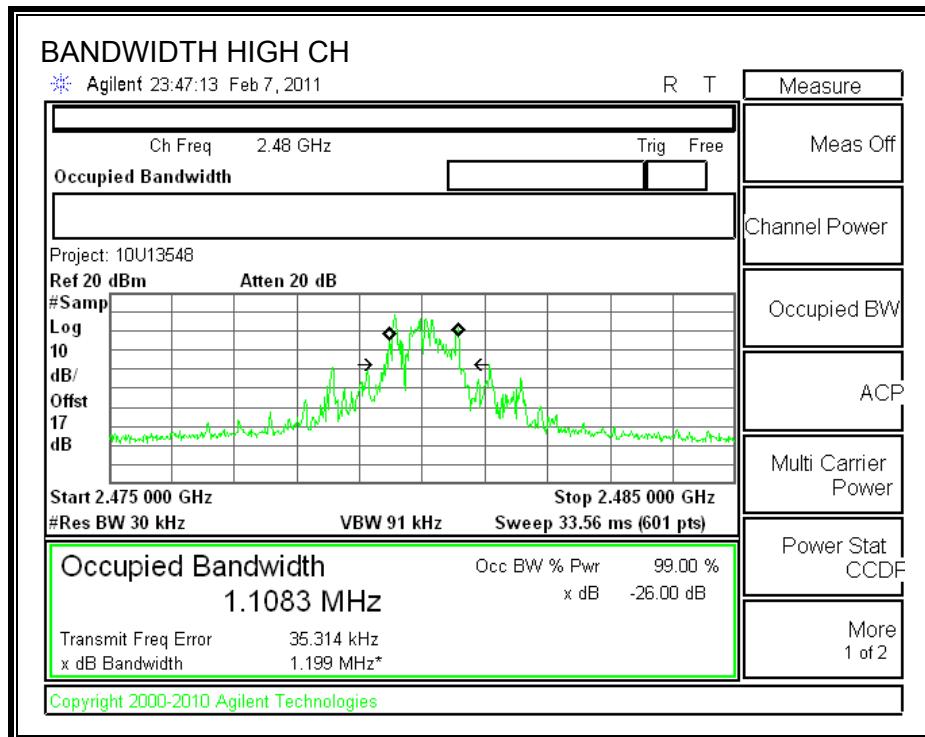




**99% BANDWIDTH**







## 7.2.2. HOPPING FREQUENCY SEPARATION

### LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

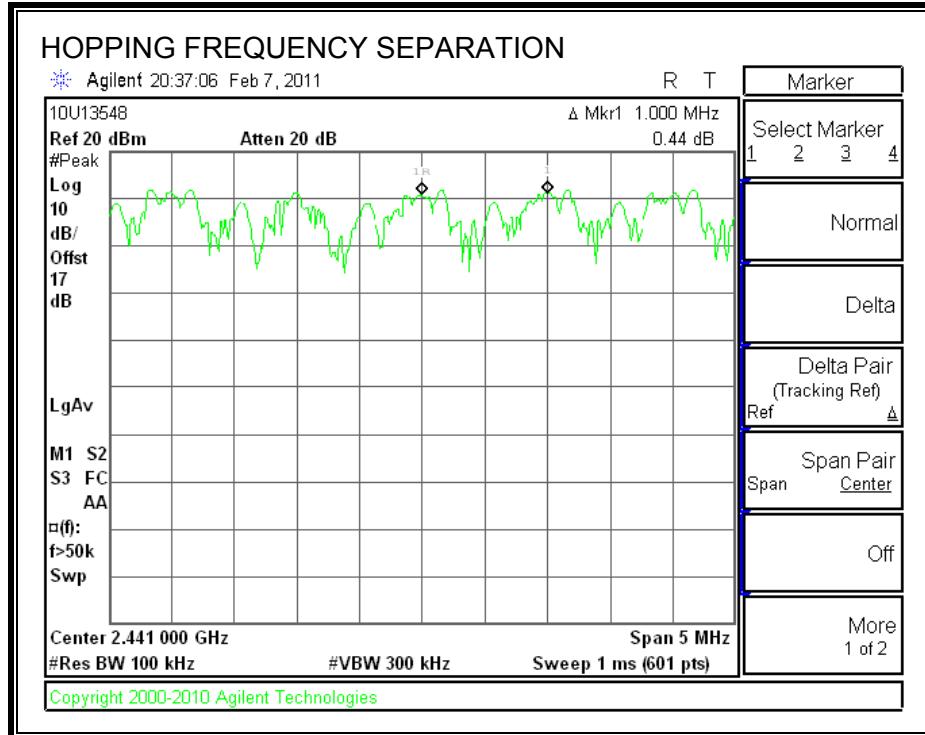
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

## RESULTS

### HOPPING FREQUENCY SEPARATION



### 7.2.3. NUMBER OF HOPPING CHANNELS

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

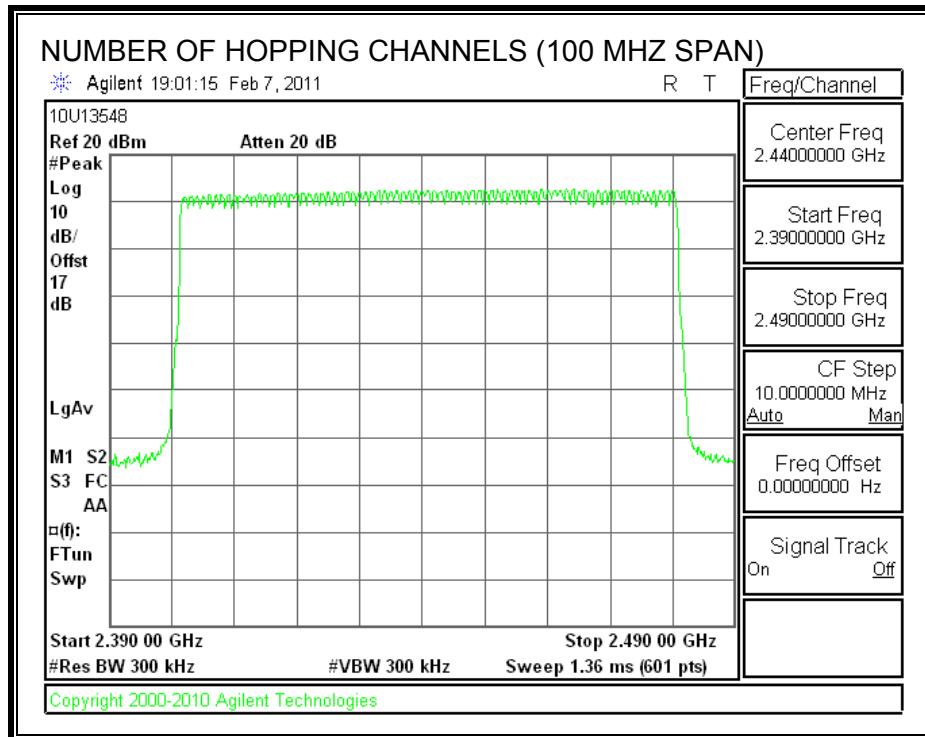
#### TEST PROCEDURE

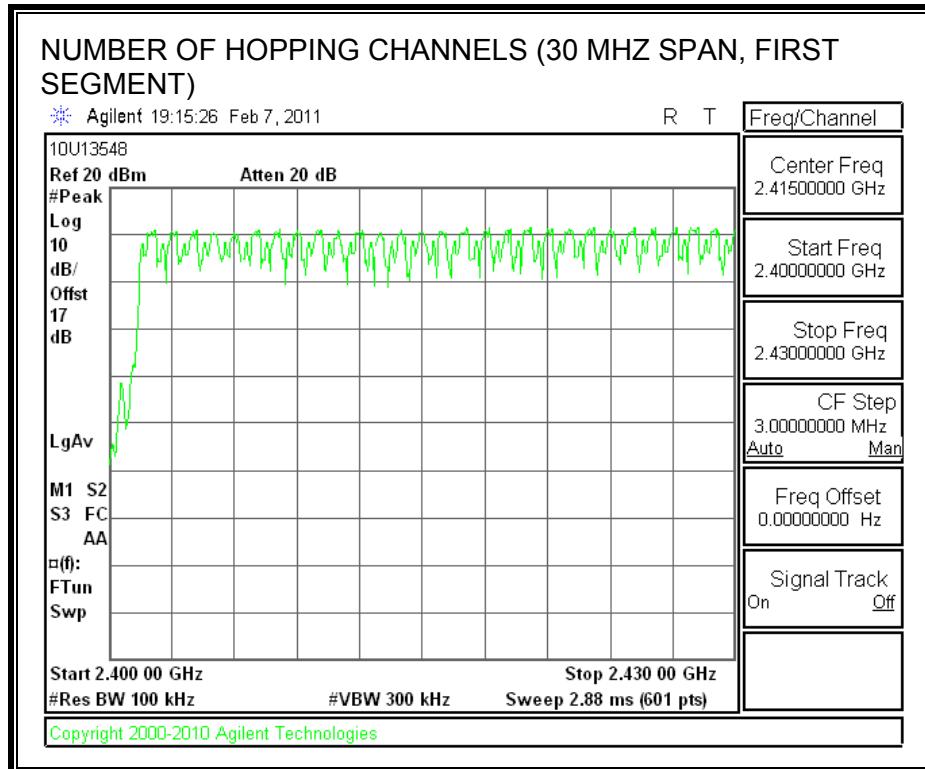
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

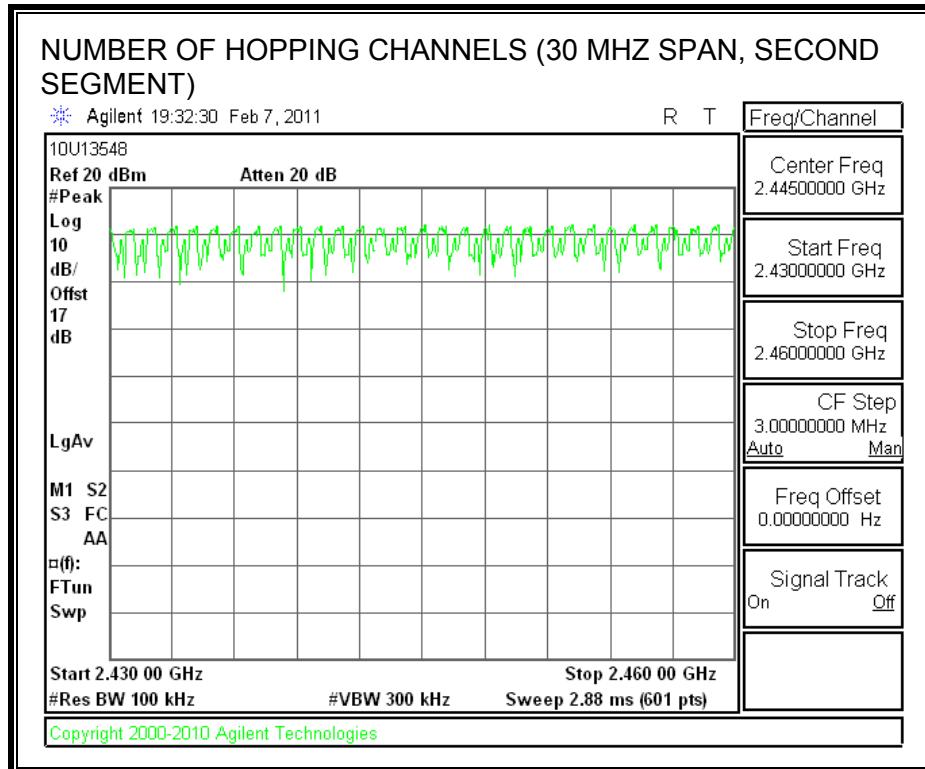
#### RESULTS

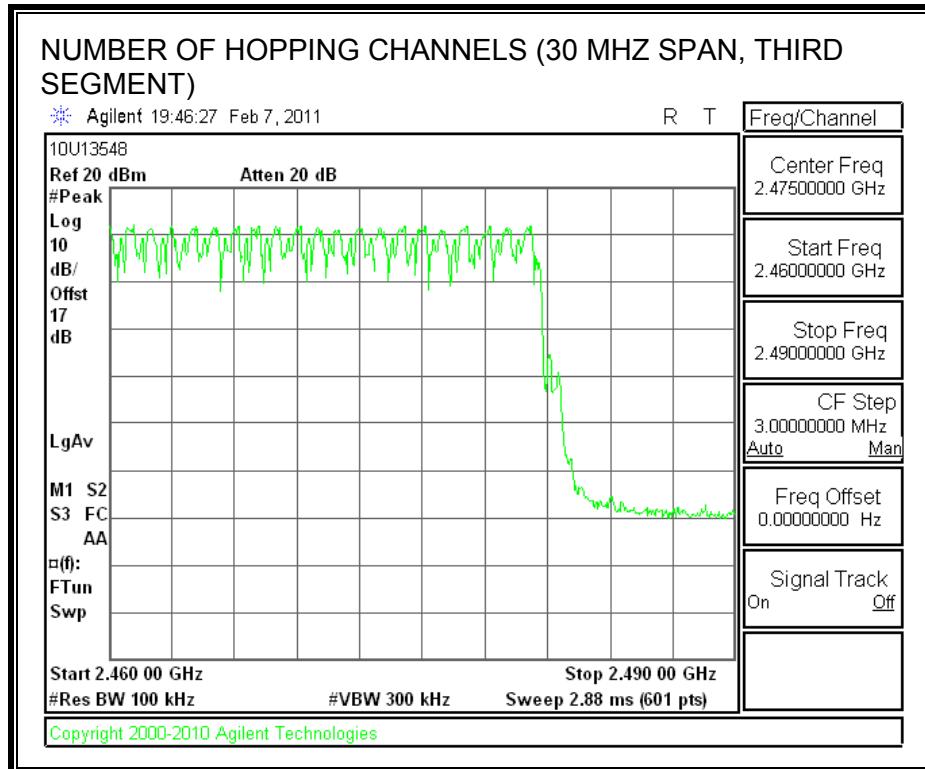
79 Channels observed.

**NUMBER OF HOPPING CHANNELS**









### 7.2.4. AVERAGE TIME OF OCCUPANCY

#### LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

#### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

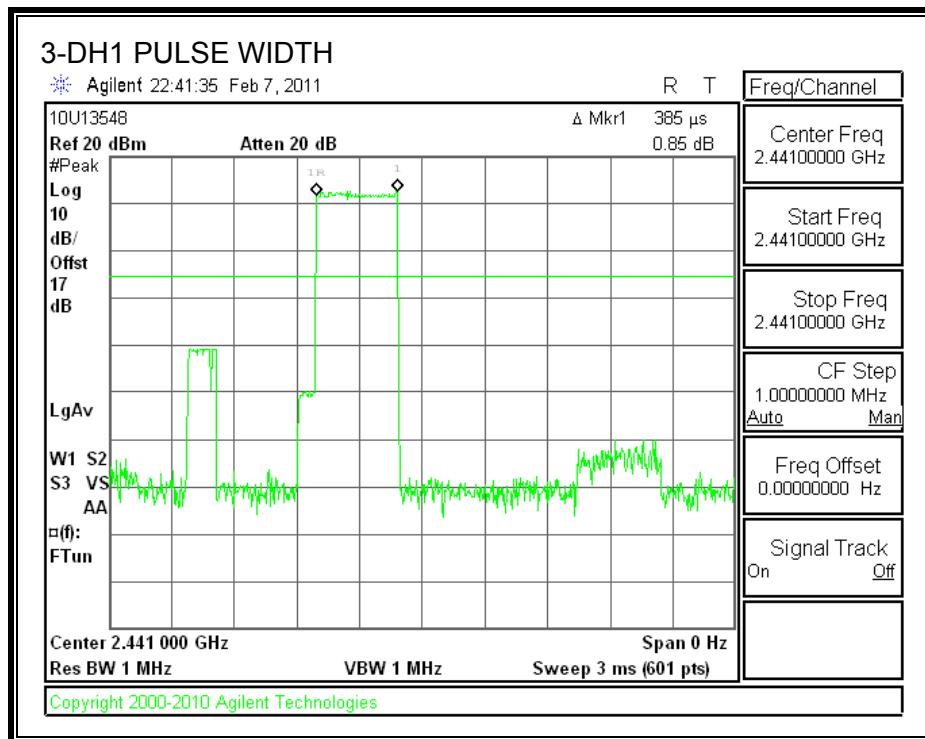
#### RESULTS

Time Of Occupancy =  $10 * \text{xx pulses} * \text{yy msec} = \text{zz msec}$

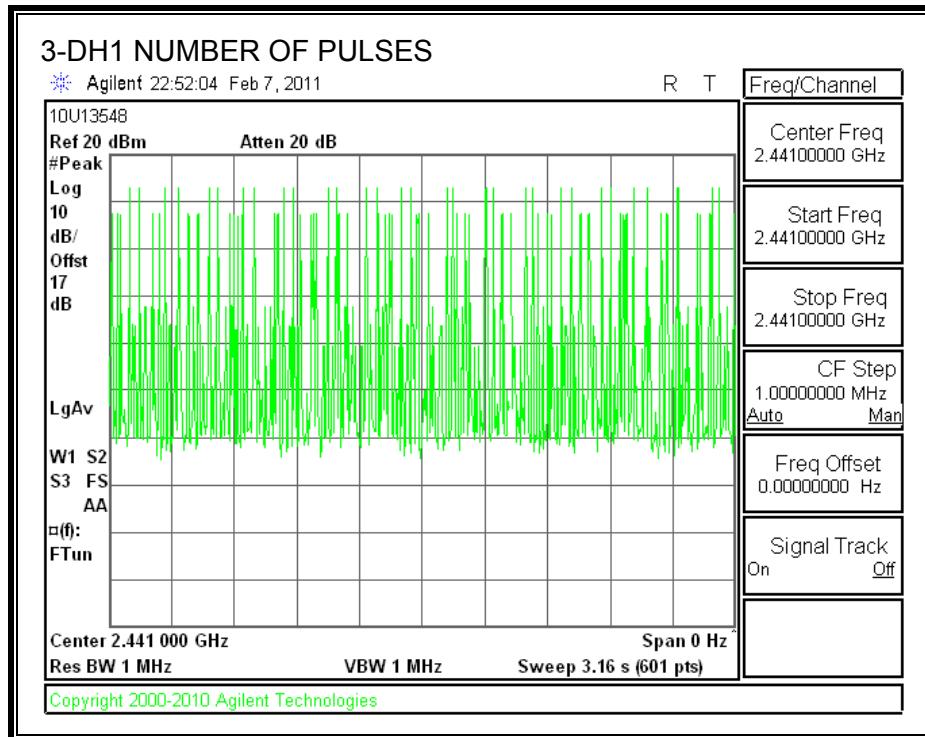
##### 8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
3DH1	0.385	31	0.119	0.4	-0.281
3DH3	1.64	16	0.262	0.4	-0.138
3DH5	2.89	13	0.376	0.4	-0.024

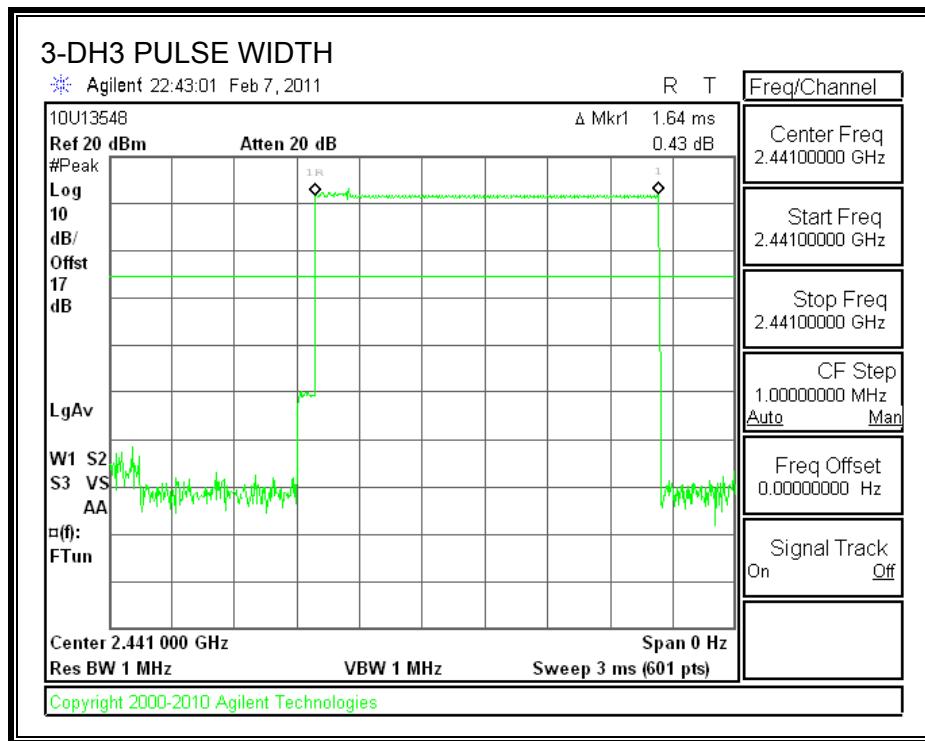
PULSE WIDTH



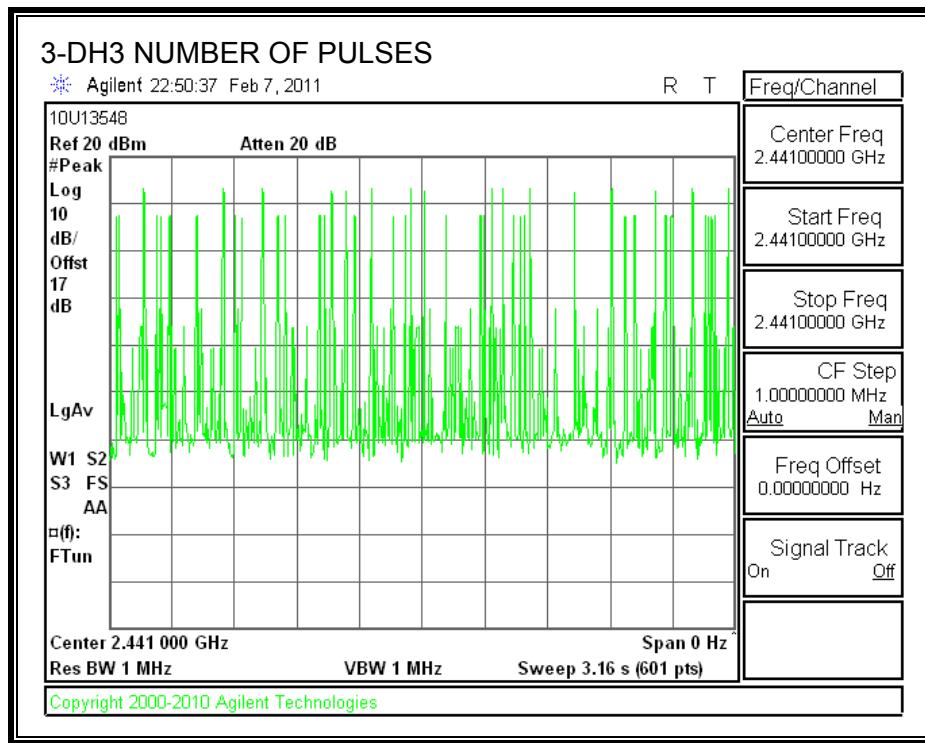
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



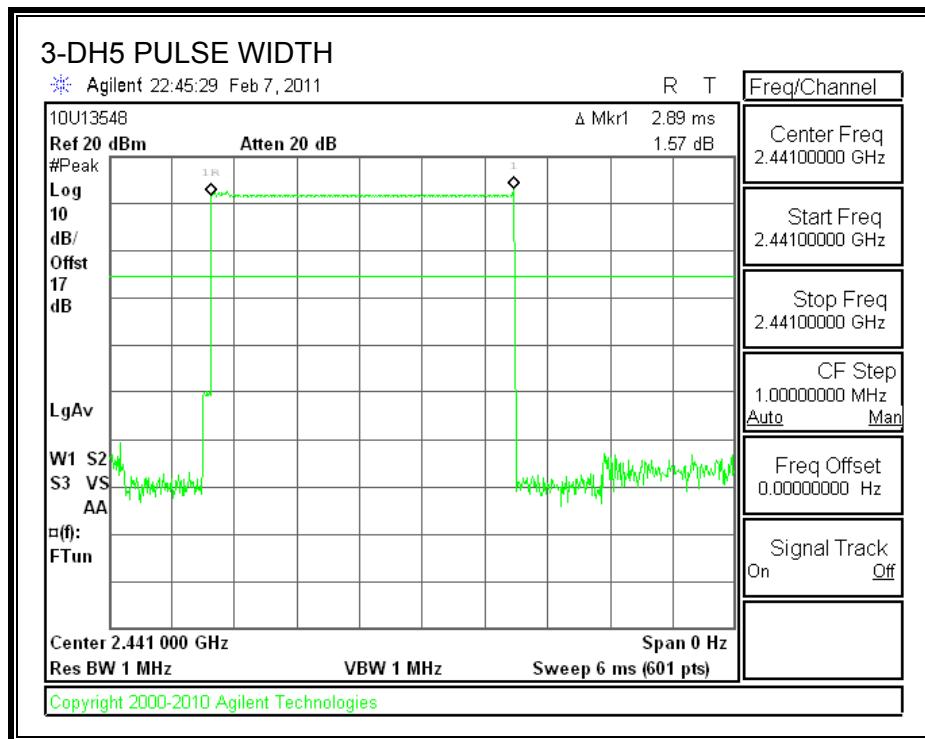
PULSE WIDTH



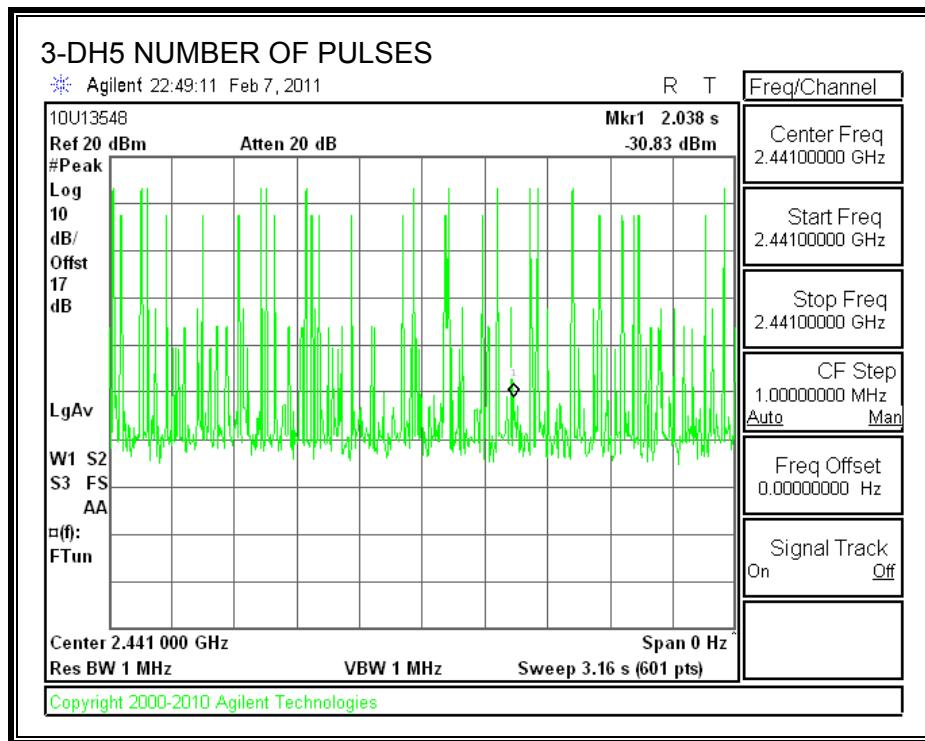
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



PULSE WIDTH



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



### 7.2.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

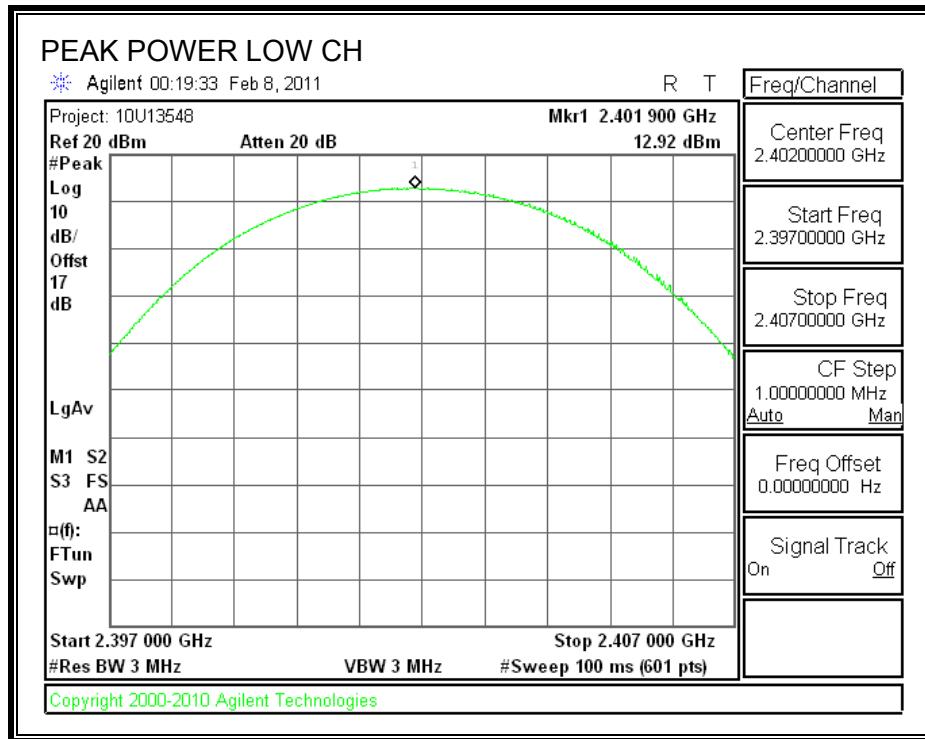
#### TEST PROCEDURE

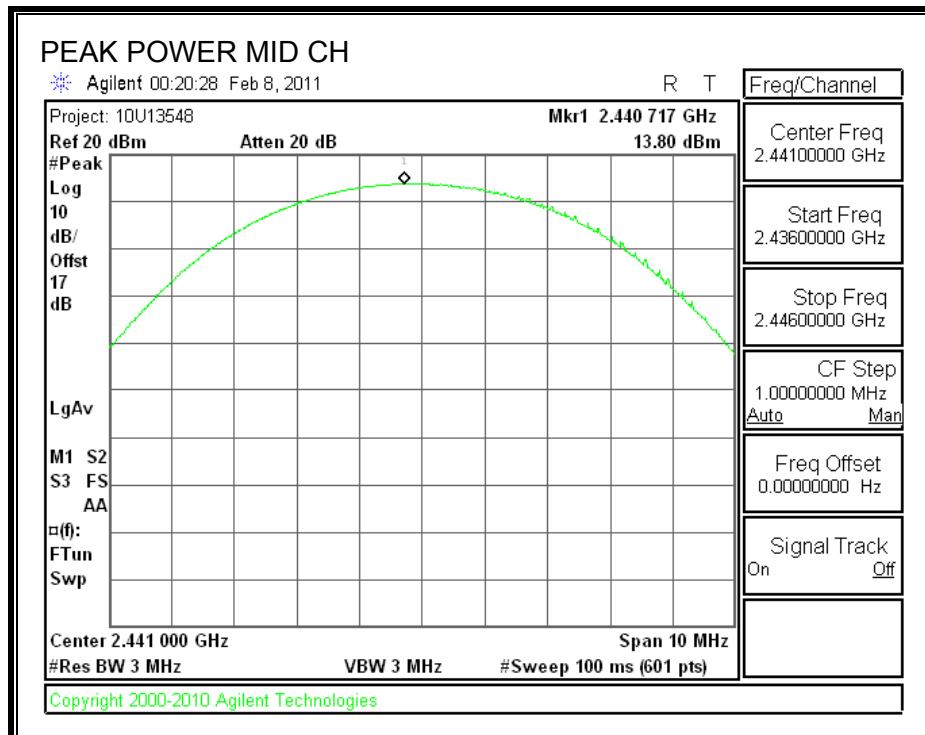
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

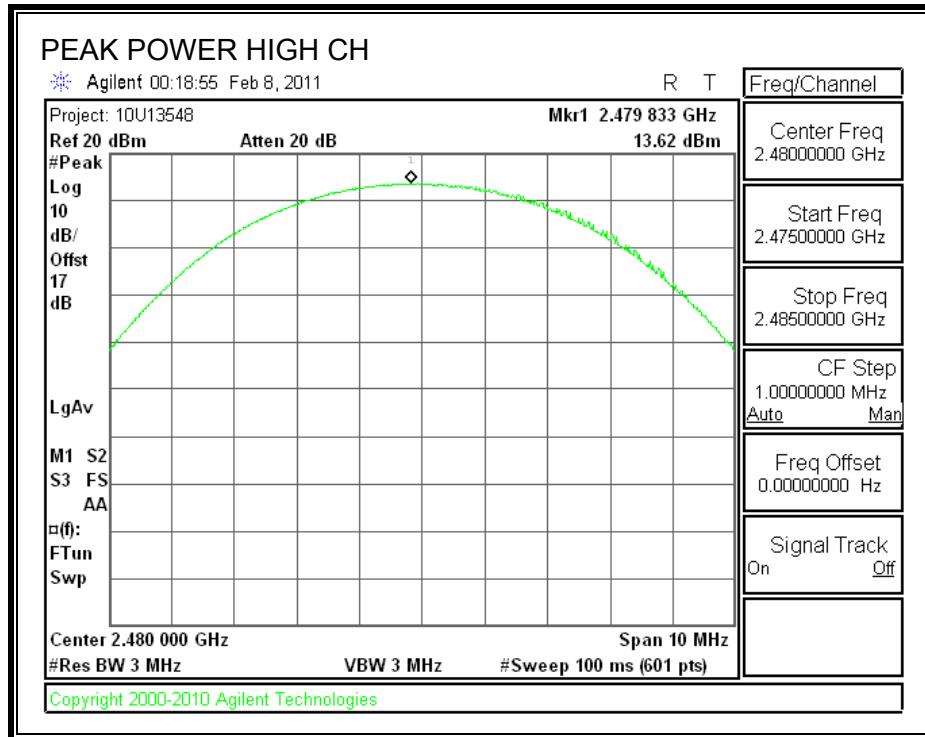
#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	12.92	30	-17.08
Middle	2441	13.80	30	-16.20
High	2480	13.62	30	-16.38

**OUTPUT POWER**







## 7.2.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### TEST PROCEDURE

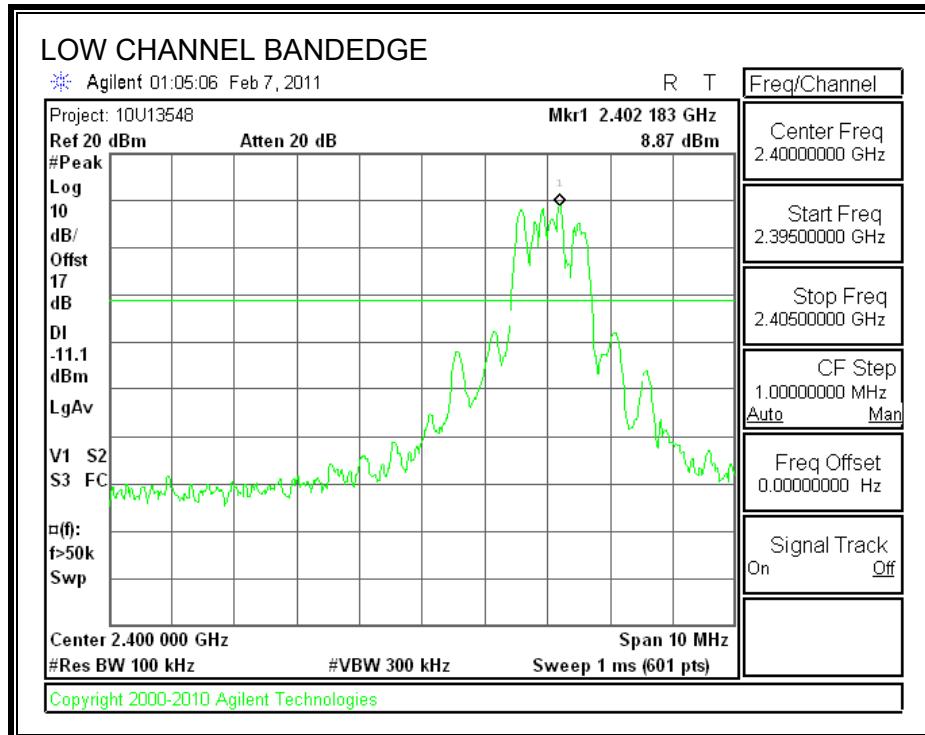
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

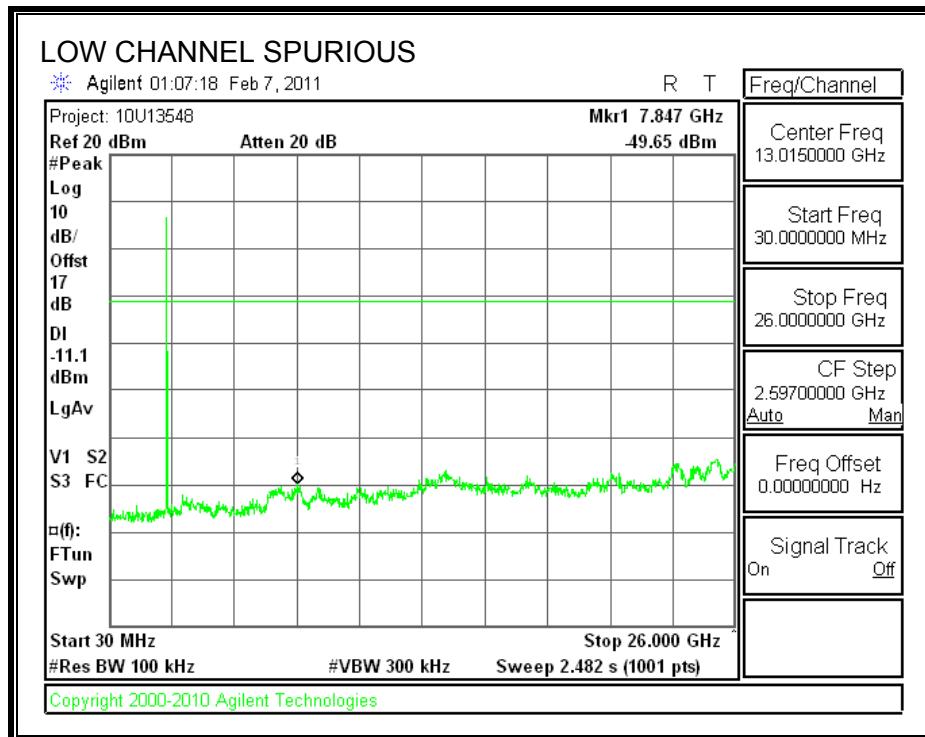
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

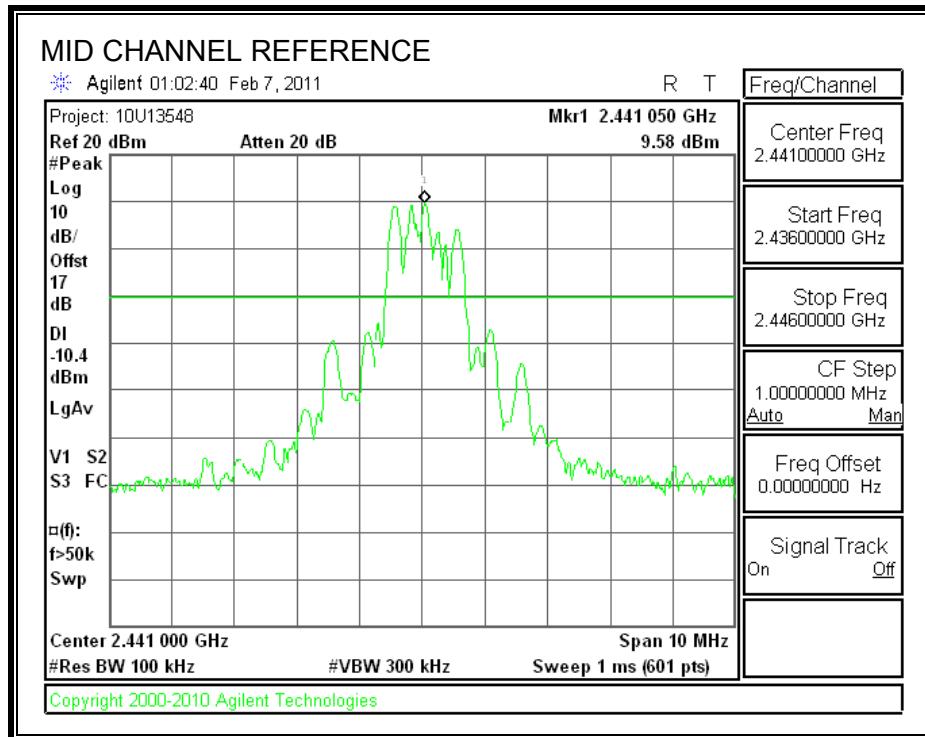
## RESULTS

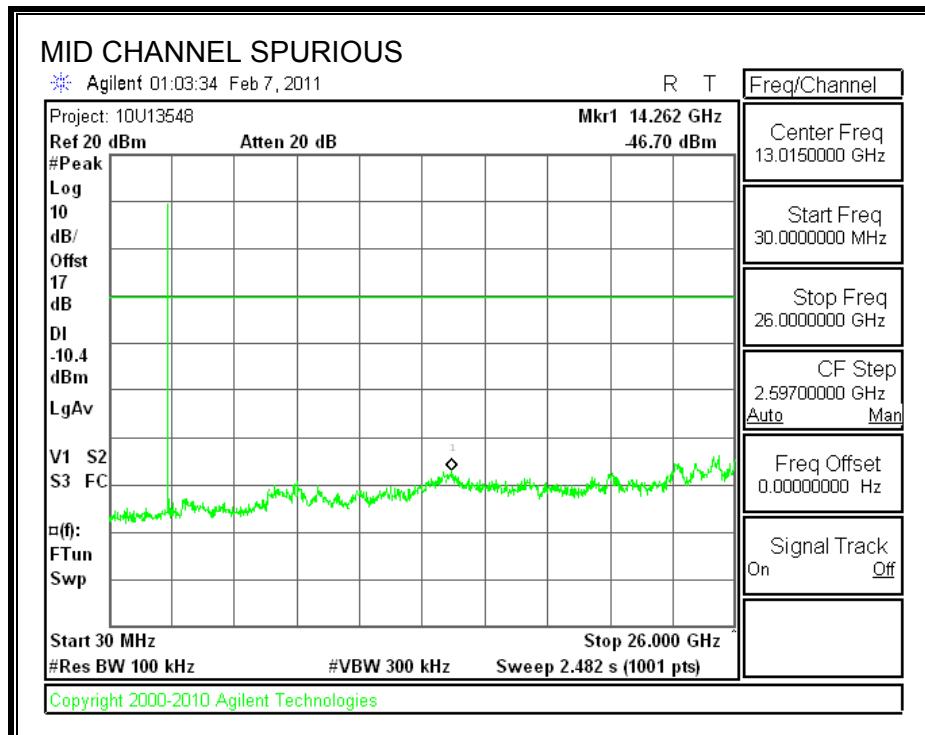
### SPURIOUS EMISSIONS, LOW CHANNEL



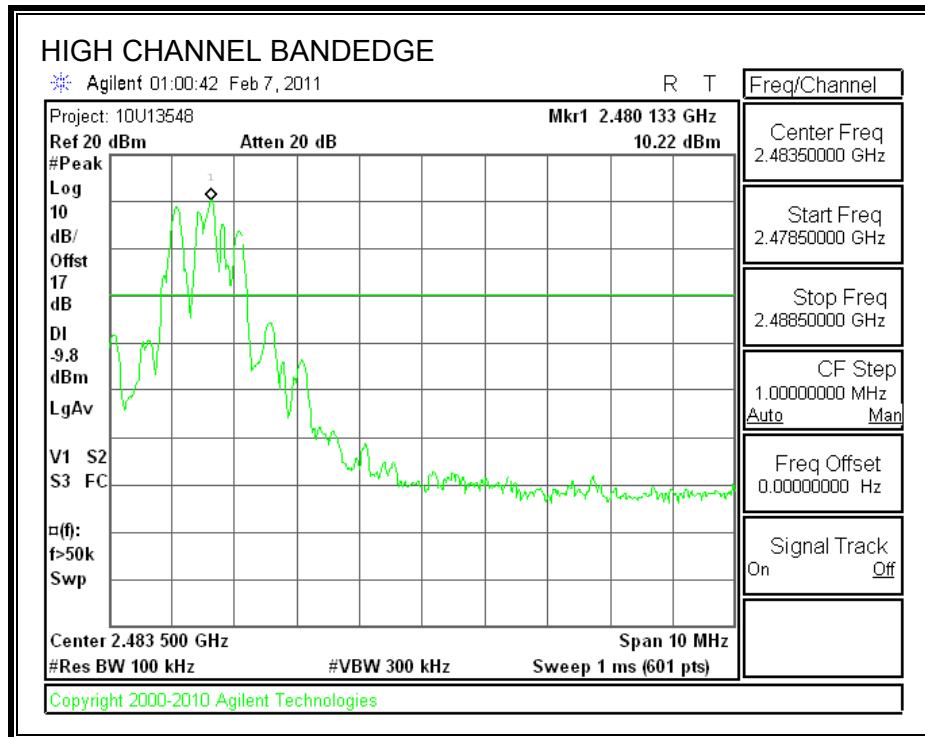


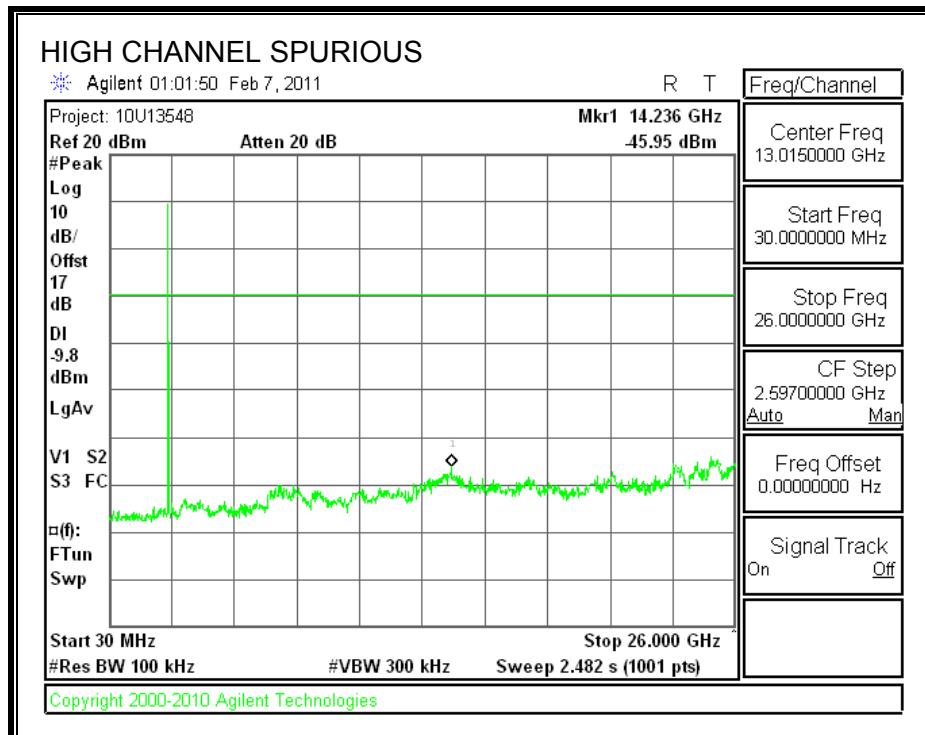
**SPURIOUS EMISSIONS, MID CHANNEL**



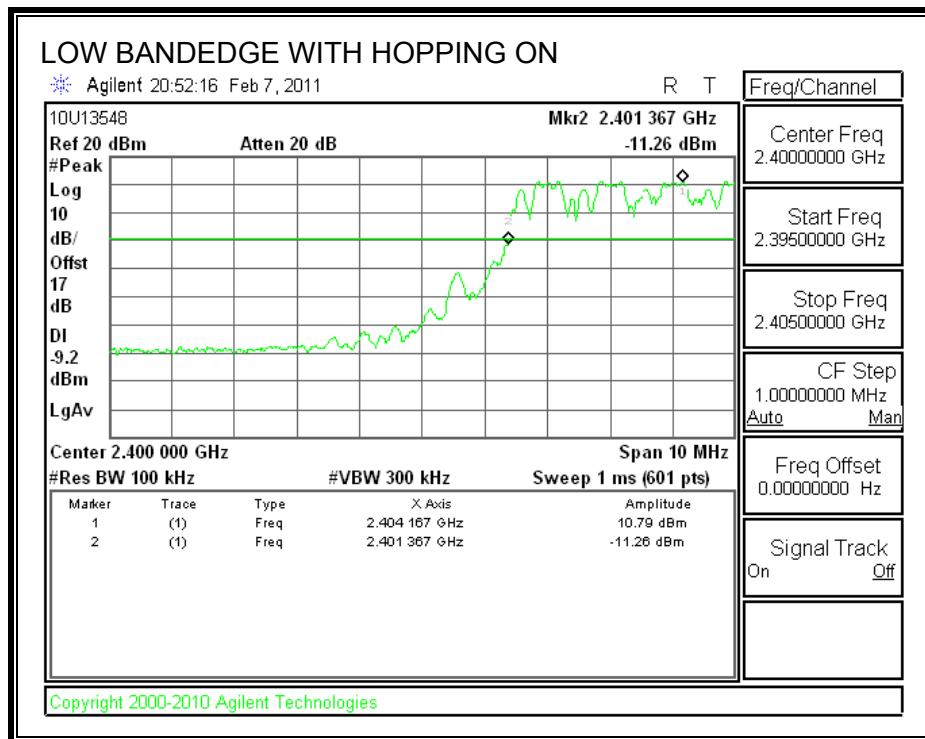


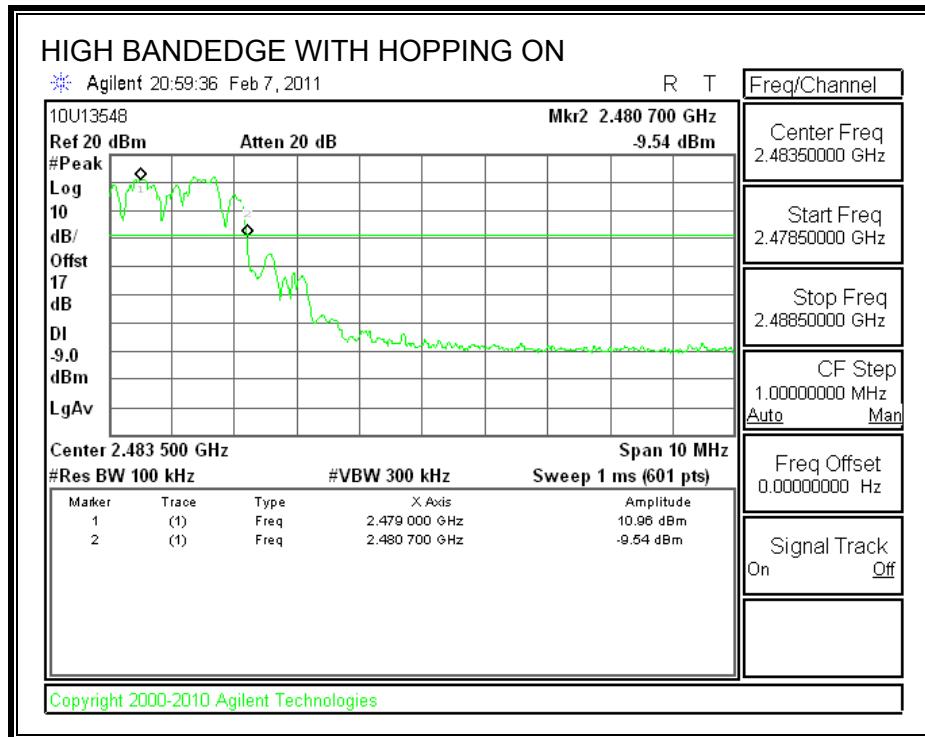
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**





## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

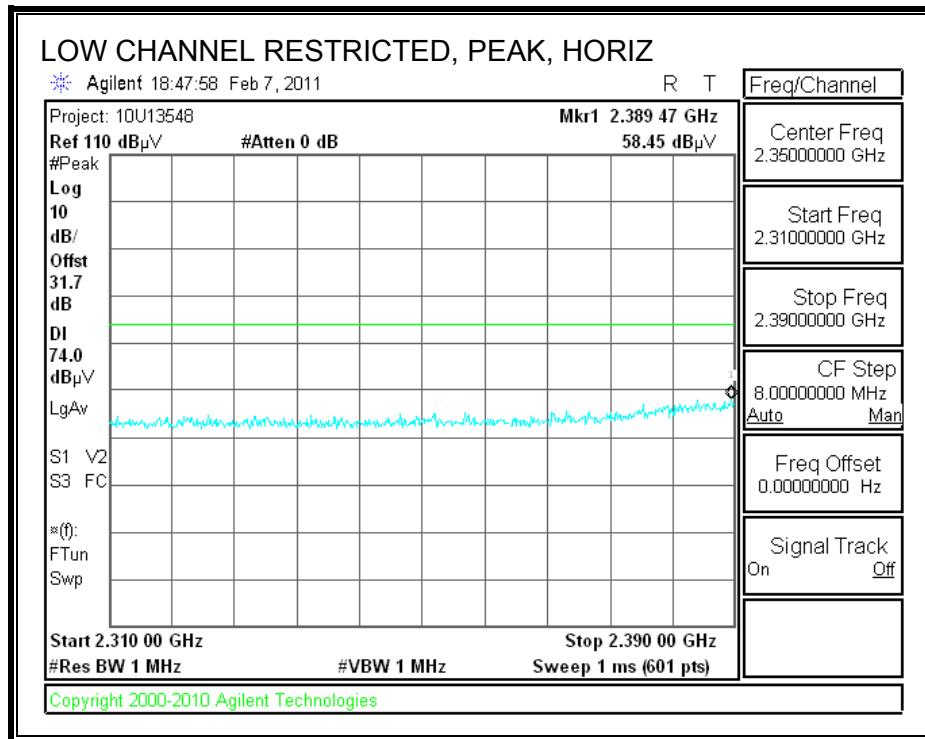
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

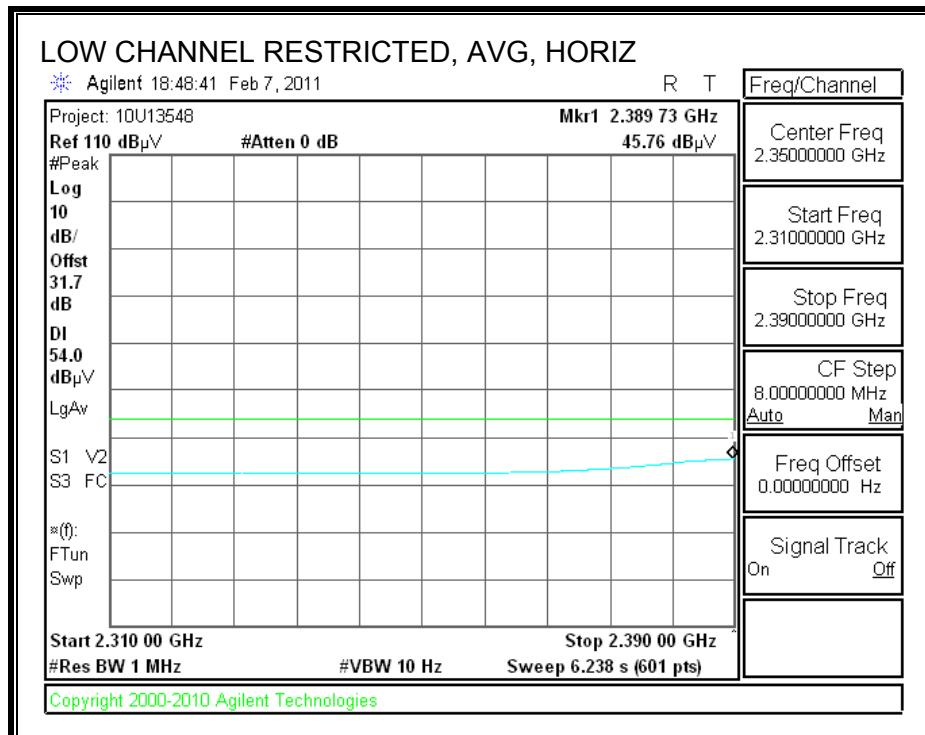
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

## 8.2. TRANSMITTER ABOVE 1 GHz

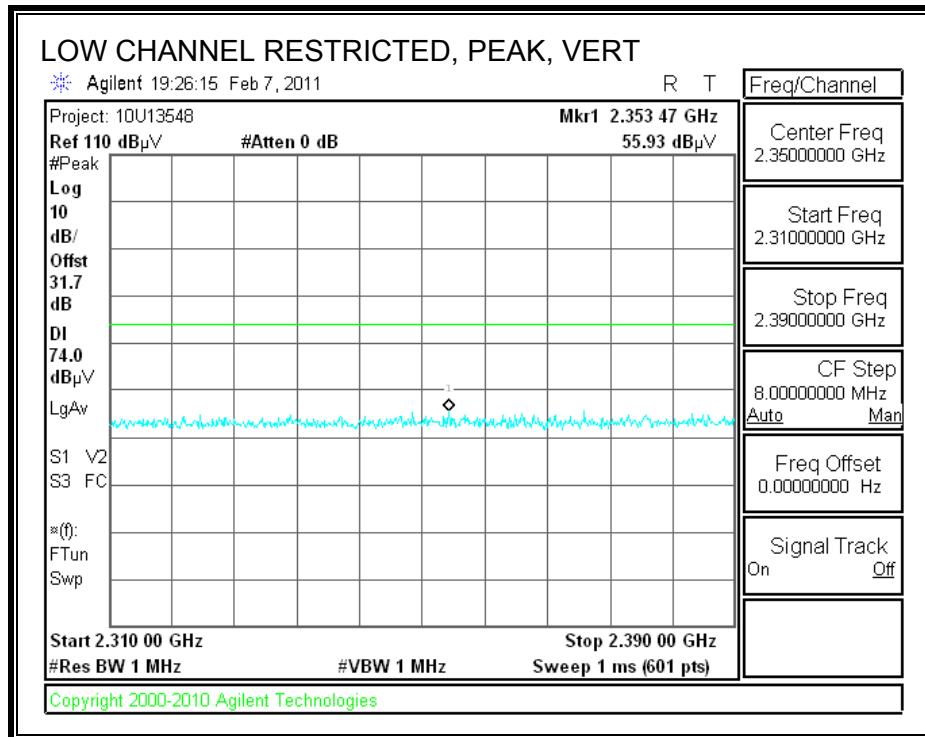
### 8.2.1. BASIC DATA RATE GFSK MODULATION

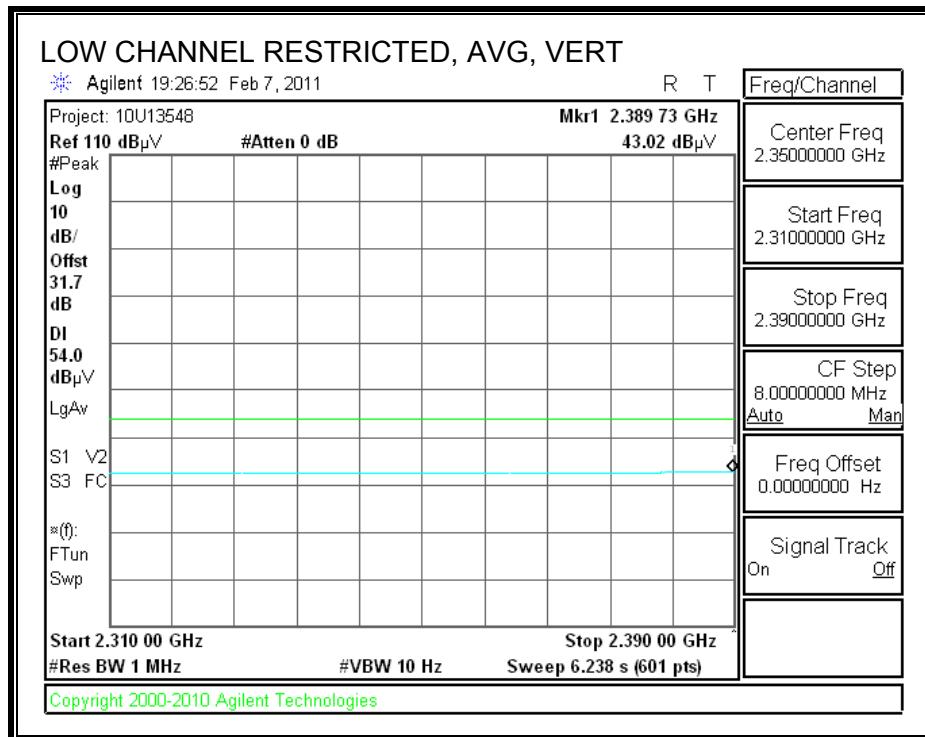
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



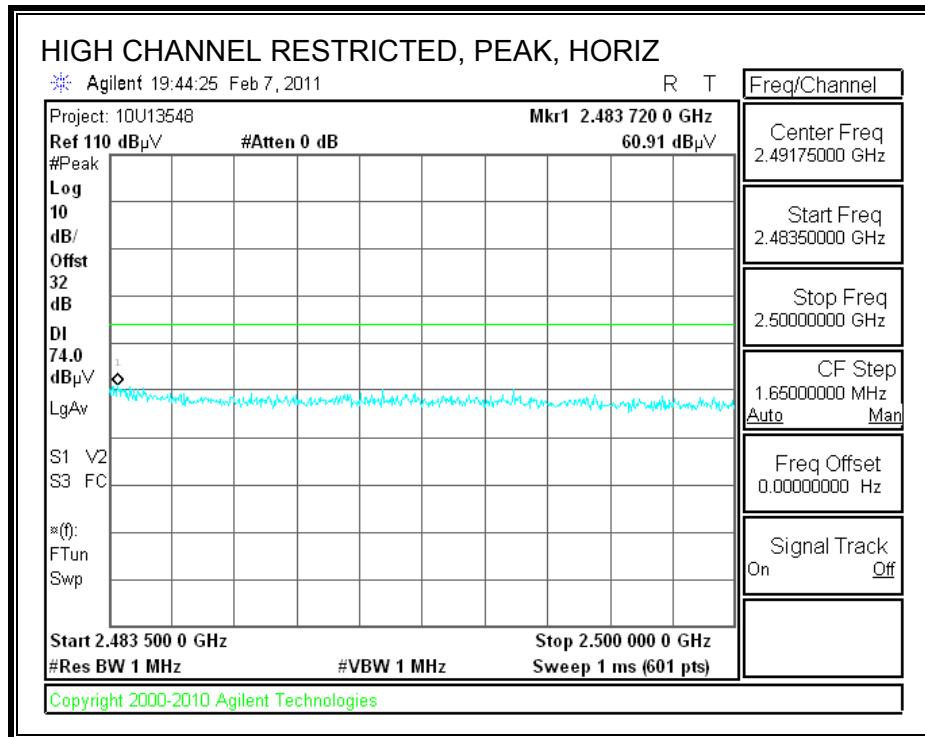


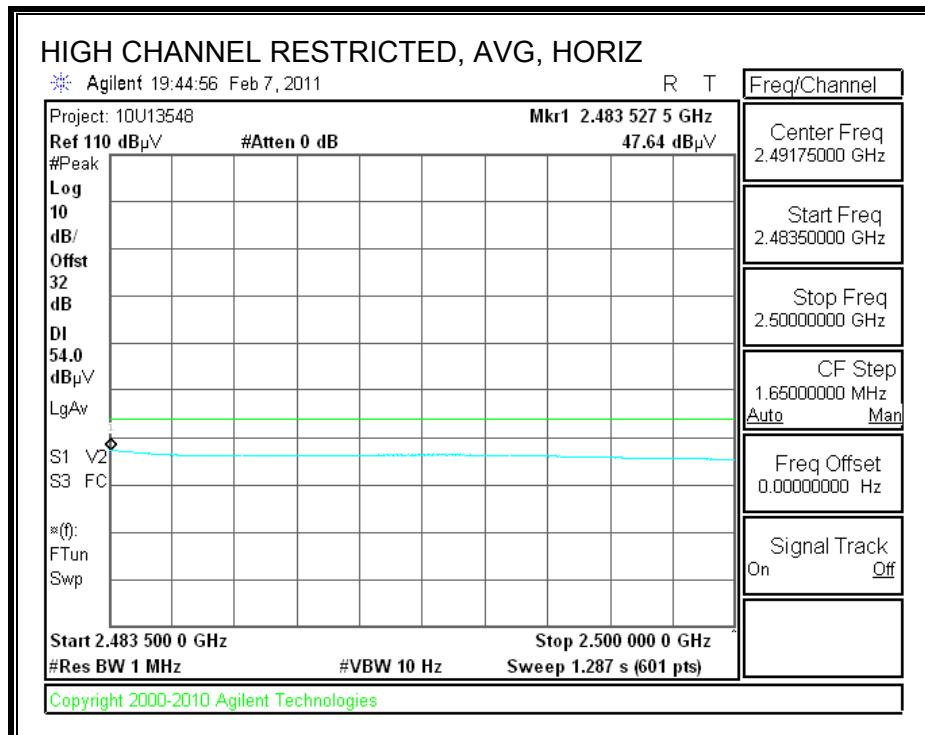
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



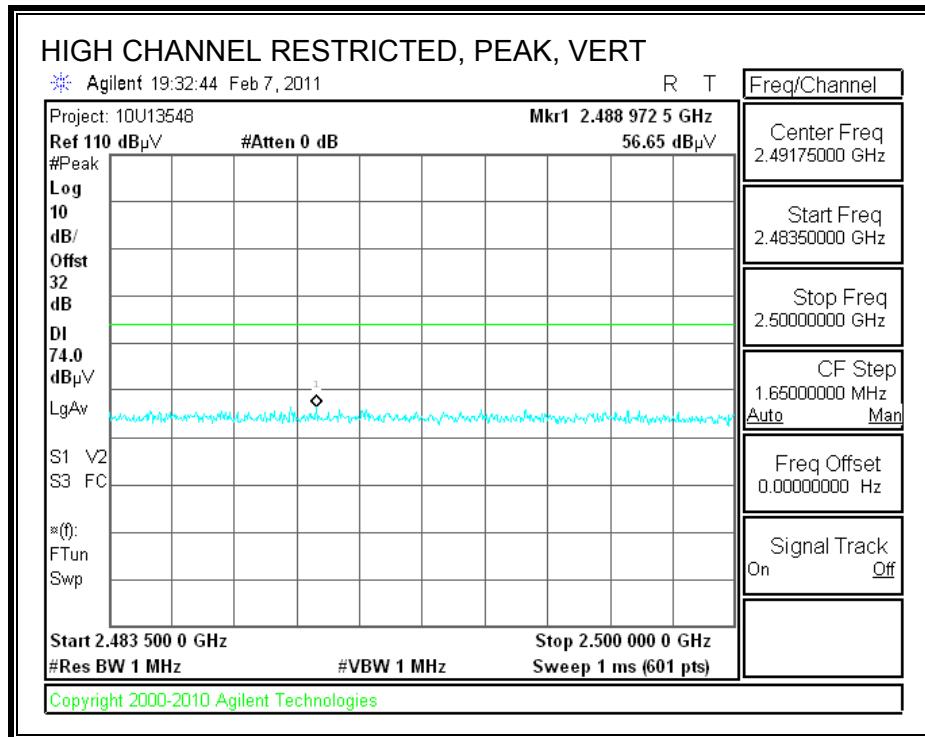


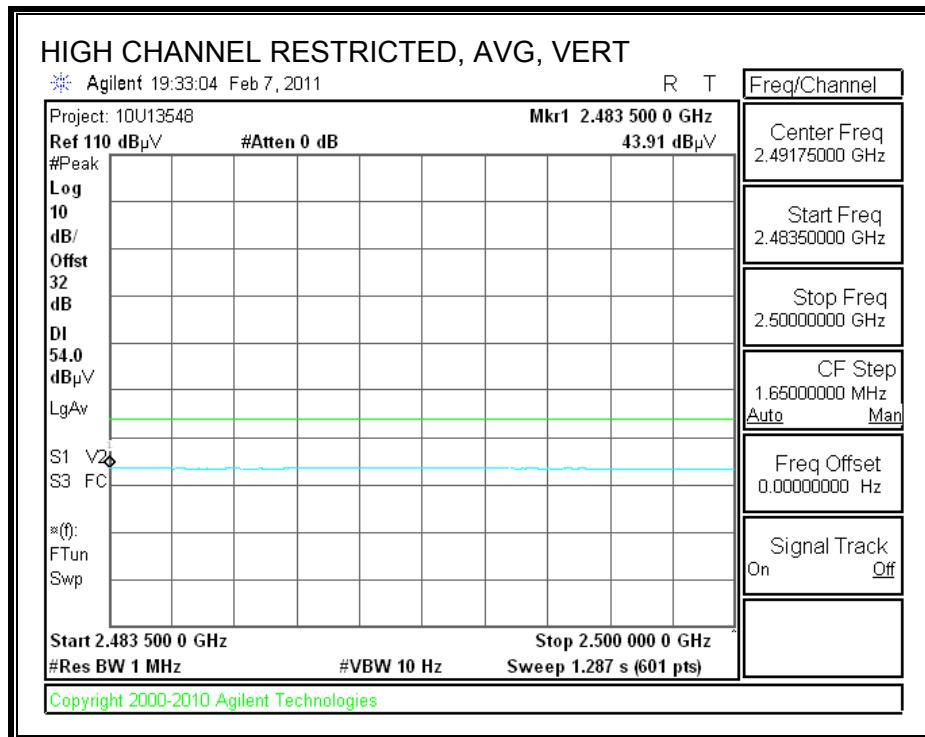
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





## HARMONICS AND SPURIOUS EMISSIONS

### **High Frequency Measurement** Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen  
Date: 02/09/11  
Project #: 10U13548  
Test Target: FCC Class B  
Mode Oper: GFSK, TX mode

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D	Corr	Distance Correct to 3 meters
Read	Analyzer Reading	Avg		Peak Field Strength Limit
AF	Antenna Factor	Peak		Margin vs. Average Limit
CL	Cable Loss	HPF		Margin vs. Peak Limit

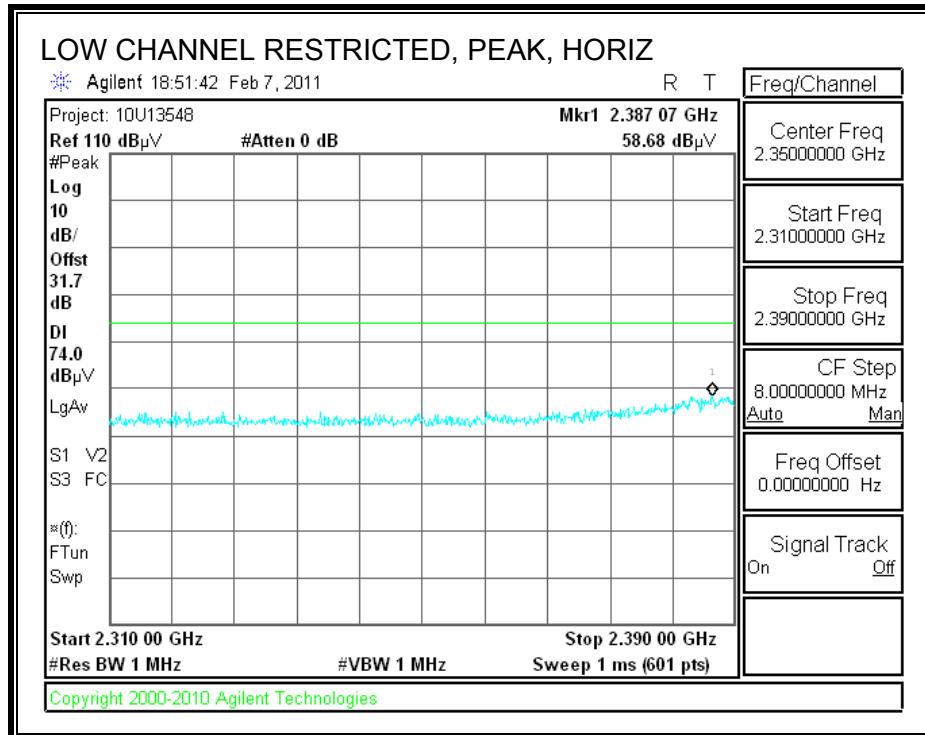
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>2402MHz GFSK</b>													
4.804	3.0	41.9	33.0	5.8	-36.5	0.0	0.6	44.8	74.0	-29.2	V	P	
4.804	3.0	34.1	33.0	5.8	-36.5	0.0	0.6	37.0	54.0	-17.0	V	A	
12.010	3.0	35.1	39.0	9.7	-35.4	0.0	0.9	49.3	74.0	-24.7	V	P	
12.010	3.0	22.8	39.0	9.7	-35.4	0.0	0.9	37.0	54.0	-17.0	V	A	
<b>2402MHz GFSK</b>													
4.804	3.0	46.4	33.0	5.8	-36.5	0.0	0.6	49.3	74.0	-24.7	H	P	
4.804	3.0	39.1	33.0	5.8	-36.5	0.0	0.6	42.1	54.0	-11.9	H	A	
12.010	3.0	35.4	39.0	9.7	-35.4	0.0	0.9	49.6	74.0	-24.4	H	P	
12.010	3.0	22.9	39.0	9.7	-35.4	0.0	0.9	37.1	54.0	-16.9	H	A	
<b>2441MHz GFSK</b>													
4.882	3.0	44.5	33.1	5.8	-36.5	0.0	0.6	47.6	74.0	-26.4	H	P	
4.882	3.0	37.0	33.1	5.8	-36.5	0.0	0.6	40.1	54.0	-13.9	H	A	
7.323	3.0	41.4	35.3	7.3	-36.2	0.0	0.6	48.4	74.0	-25.6	H	P	
7.323	3.0	32.5	35.3	7.3	-36.2	0.0	0.6	39.5	54.0	-14.5	H	A	
<b>2441MHz GFSK</b>													
4.882	3.0	39.4	33.1	5.8	-36.5	0.0	0.6	42.5	74.0	-31.5	V	P	
4.882	3.0	28.7	33.1	5.8	-36.5	0.0	0.6	31.8	54.0	-22.2	V	A	
7.323	3.0	38.5	35.3	7.3	-36.2	0.0	0.6	45.5	74.0	-28.5	V	P	
7.323	3.0	27.8	35.3	7.3	-36.2	0.0	0.6	34.8	54.0	-19.2	V	A	
<b>2480MHz GFSK</b>													
4.960	3.0	37.6	33.2	5.9	-36.5	0.0	0.6	40.8	74.0	-33.2	V	P	
4.960	3.0	26.7	33.2	5.9	-36.5	0.0	0.6	30.0	54.0	-24.0	V	A	
7.440	3.0	39.2	35.5	7.3	-36.2	0.0	0.6	46.4	74.0	-27.6	V	P	
7.440	3.0	29.3	35.5	7.3	-36.2	0.0	0.6	36.5	54.0	-17.5	V	A	
<b>2480MHz GFSK</b>													
4.960	3.0	41.9	33.2	5.9	-36.5	0.0	0.6	45.2	74.0	-28.8	H	P	
4.960	3.0	33.8	33.2	5.9	-36.5	0.0	0.6	37.1	54.0	-16.9	H	A	
7.440	3.0	43.9	35.5	7.3	-36.2	0.0	0.6	51.2	74.0	-22.8	H	P	
7.440	3.0	36.3	35.5	7.3	-36.2	0.0	0.6	43.6	54.0	-10.4	H	A	

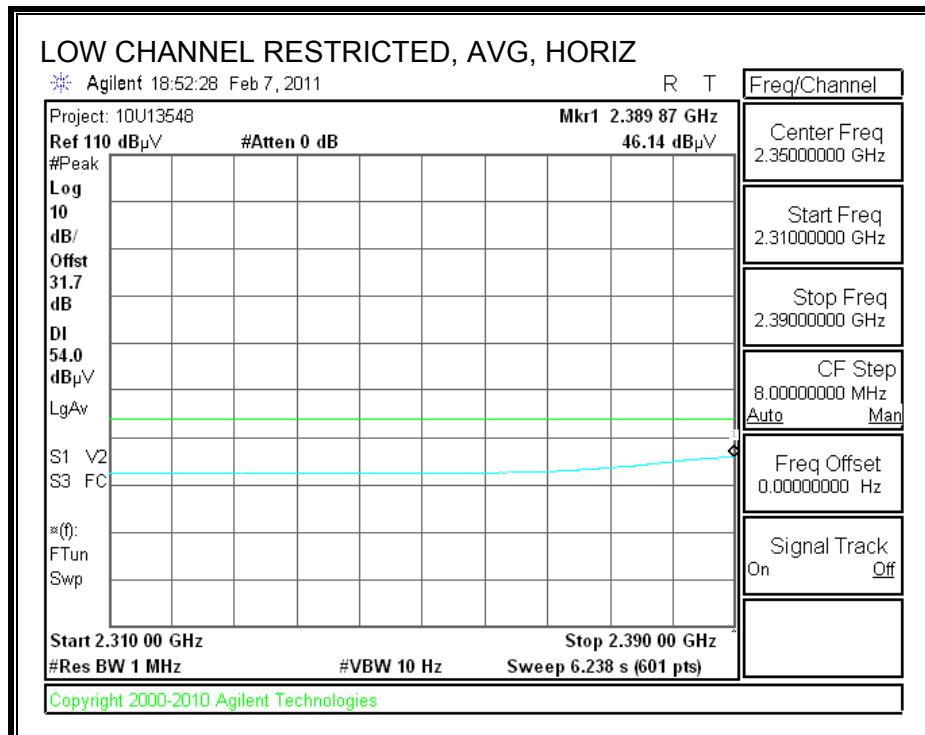
Rev. 4.1.2.7

Note: No other emissions were detected above the system noise floor.

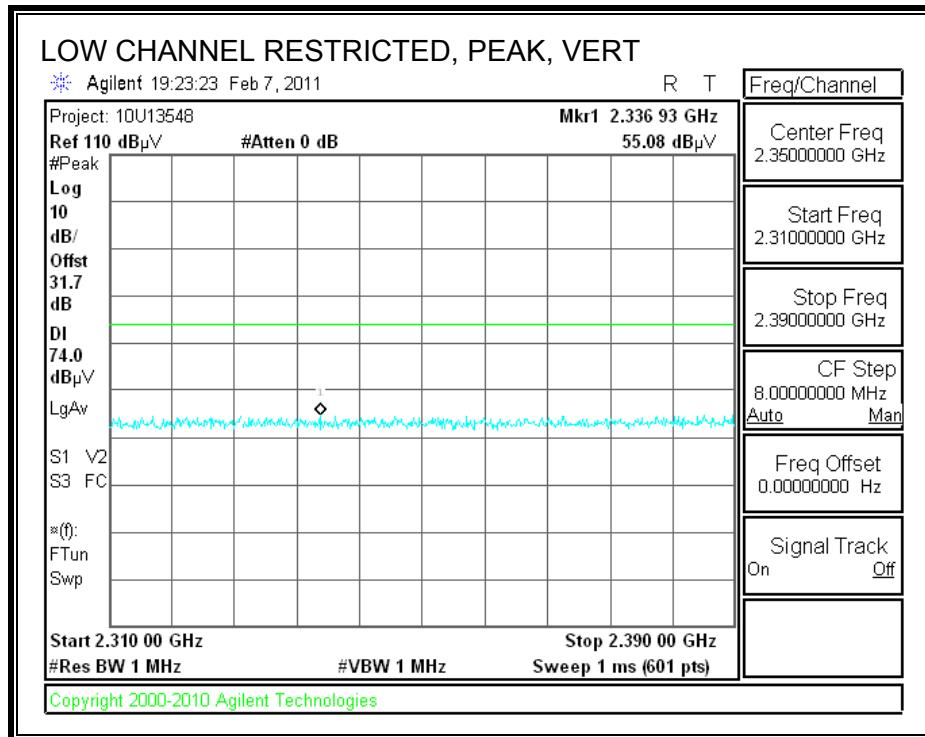
## 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

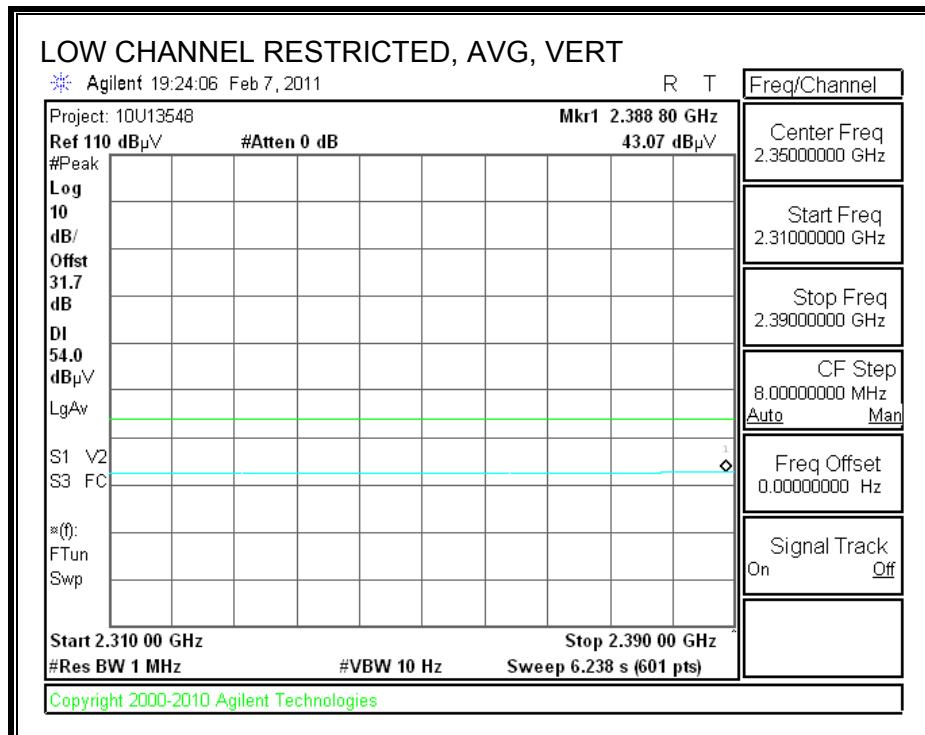
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



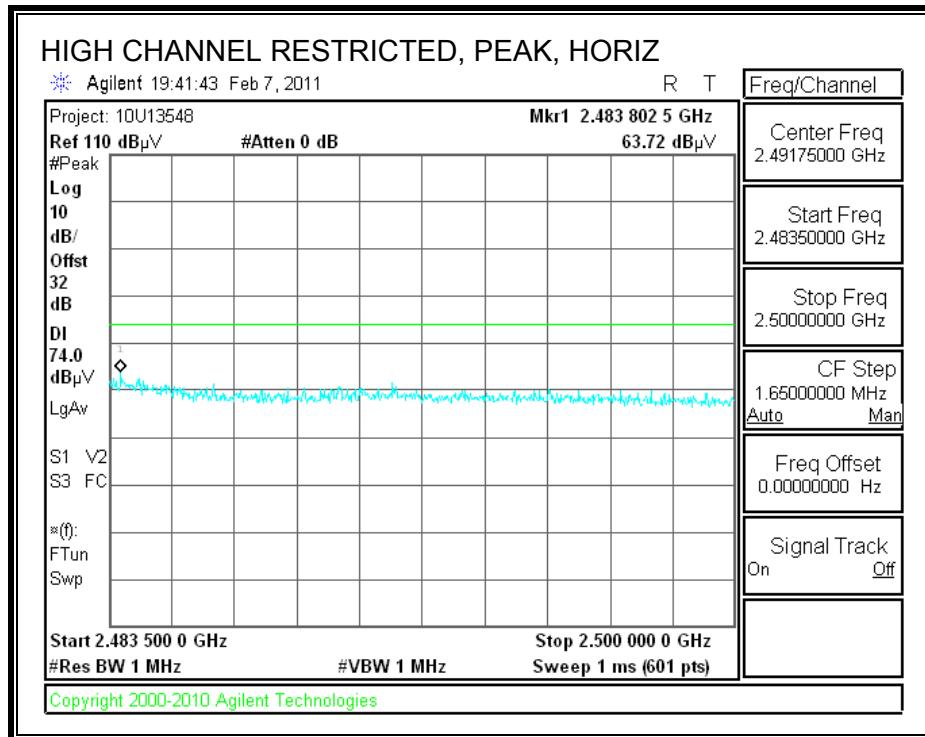


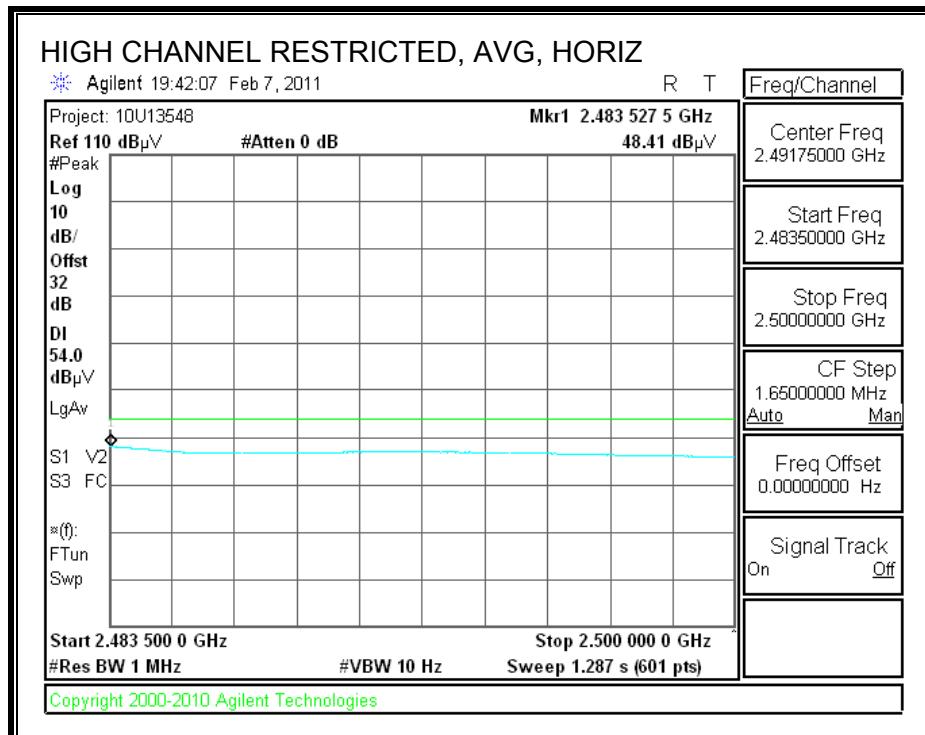
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



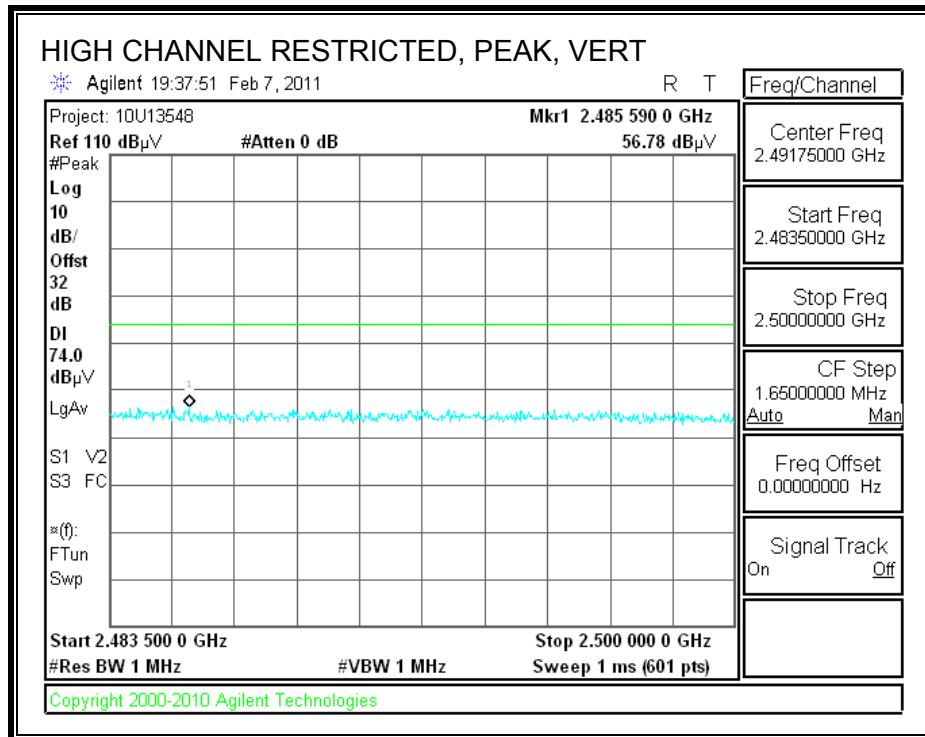


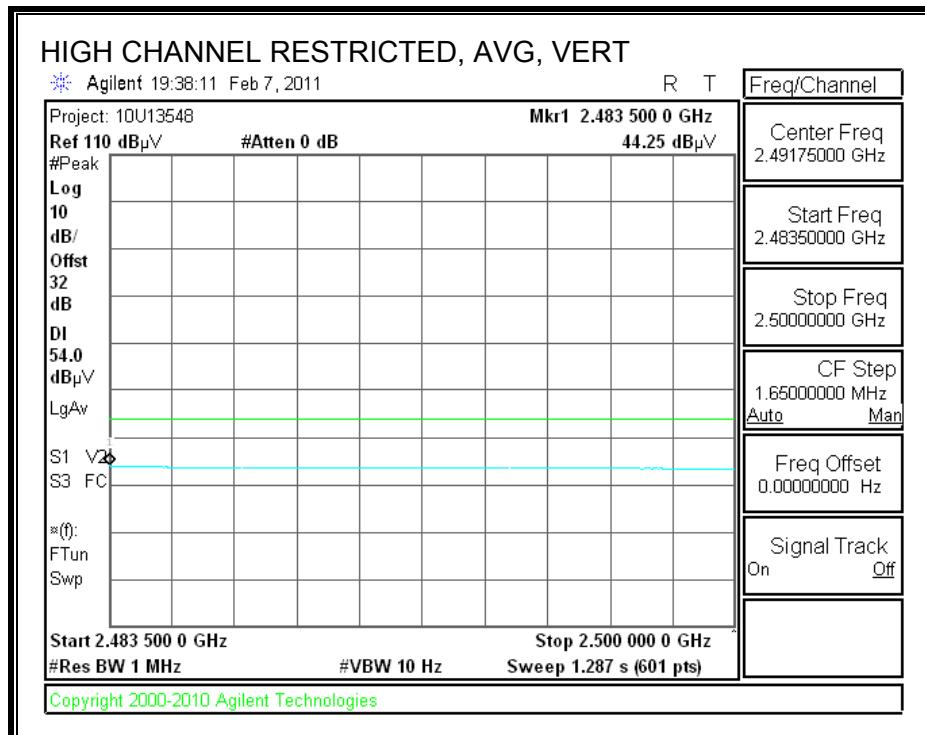
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





## HARMONICS AND SPURIOUS EMISSIONS

### **High Frequency Measurement** Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen  
Date: 02/09/11  
Project #: 10U13548  
Test Target: FCC Class B  
Mode Oper: 8PSK, TX mode

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D	Corr	Distance Correct to 3 meters
Read	Analyzer Reading	Avg		Peak Field Strength Limit
AF	Antenna Factor	Peak		Margin vs. Average Limit
CL	Cable Loss	HPF		Margin vs. Peak Limit

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>2402MHz 8PSK</b>													
4.804	3.0	40.6	33.0	5.8	-36.5	0.0	0.6	43.6	74.0	-30.5	V	P	
4.804	3.0	30.9	33.0	5.8	-36.5	0.0	0.6	33.8	54.0	-20.2	V	A	
12.010	3.0	35.0	39.0	9.7	-35.4	0.0	0.9	49.2	74.0	-24.8	V	P	
12.010	3.0	22.7	39.0	9.7	-35.4	0.0	0.9	36.9	54.0	-17.1	V	A	
<b>2402MHz 8PSK</b>													
4.804	3.0	43.7	33.0	5.8	-36.5	0.0	0.6	46.6	74.0	-27.4	H	P	
4.804	3.0	35.6	33.0	5.8	-36.5	0.0	0.6	38.5	54.0	-15.5	H	A	
12.010	3.0	35.3	39.0	9.7	-35.4	0.0	0.9	49.5	74.0	-24.5	H	P	
12.010	3.0	22.7	39.0	9.7	-35.4	0.0	0.9	36.9	54.0	-17.1	H	A	
<b>2441MHz 8PSK</b>													
4.882	3.0	41.3	33.1	5.8	-36.5	0.0	0.6	44.4	74.0	-29.6	H	P	
4.882	3.0	32.2	33.1	5.8	-36.5	0.0	0.6	35.3	54.0	-18.7	H	A	
7.323	3.0	39.8	35.3	7.3	-36.2	0.0	0.6	46.8	74.0	-27.2	H	P	
7.323	3.0	27.7	35.3	7.3	-36.2	0.0	0.6	34.7	54.0	-19.3	H	A	
<b>2441MHz 8PSK</b>													
4.882	3.0	38.6	33.1	5.8	-36.5	0.0	0.6	41.7	74.0	-32.3	V	P	
4.882	3.0	26.9	33.1	5.8	-36.5	0.0	0.6	30.0	54.0	-24.0	V	A	
7.323	3.0	37.3	35.3	7.3	-36.2	0.0	0.6	44.3	74.0	-29.7	V	P	
7.323	3.0	24.8	35.3	7.3	-36.2	0.0	0.6	31.8	54.0	-22.2	V	A	
<b>2480MHz 8PSK</b>													
4.960	3.0	40.5	33.2	5.9	-36.5	0.0	0.6	43.8	74.0	-30.2	H	P	
4.960	3.0	30.8	33.2	5.9	-36.5	0.0	0.6	34.1	54.0	-19.9	H	A	
7.440	3.0	40.7	35.5	7.3	-36.2	0.0	0.6	48.0	74.0	-26.0	H	P	
7.440	3.0	29.9	35.5	7.3	-36.2	0.0	0.6	37.2	54.0	-16.8	H	A	
<b>2480MHz 8PSK</b>													
4.960	3.0	37.8	33.2	5.9	-36.5	0.0	0.6	41.0	74.0	-33.0	V	P	
4.960	3.0	25.6	33.2	5.9	-36.5	0.0	0.6	28.9	54.0	-25.1	V	A	
7.440	3.0	37.4	35.5	7.3	-36.2	0.0	0.6	44.6	74.0	-29.4	V	P	
7.440	3.0	25.4	35.5	7.3	-36.2	0.0	0.6	32.7	54.0	-21.3	V	A	

Rev. 4.1.2.7

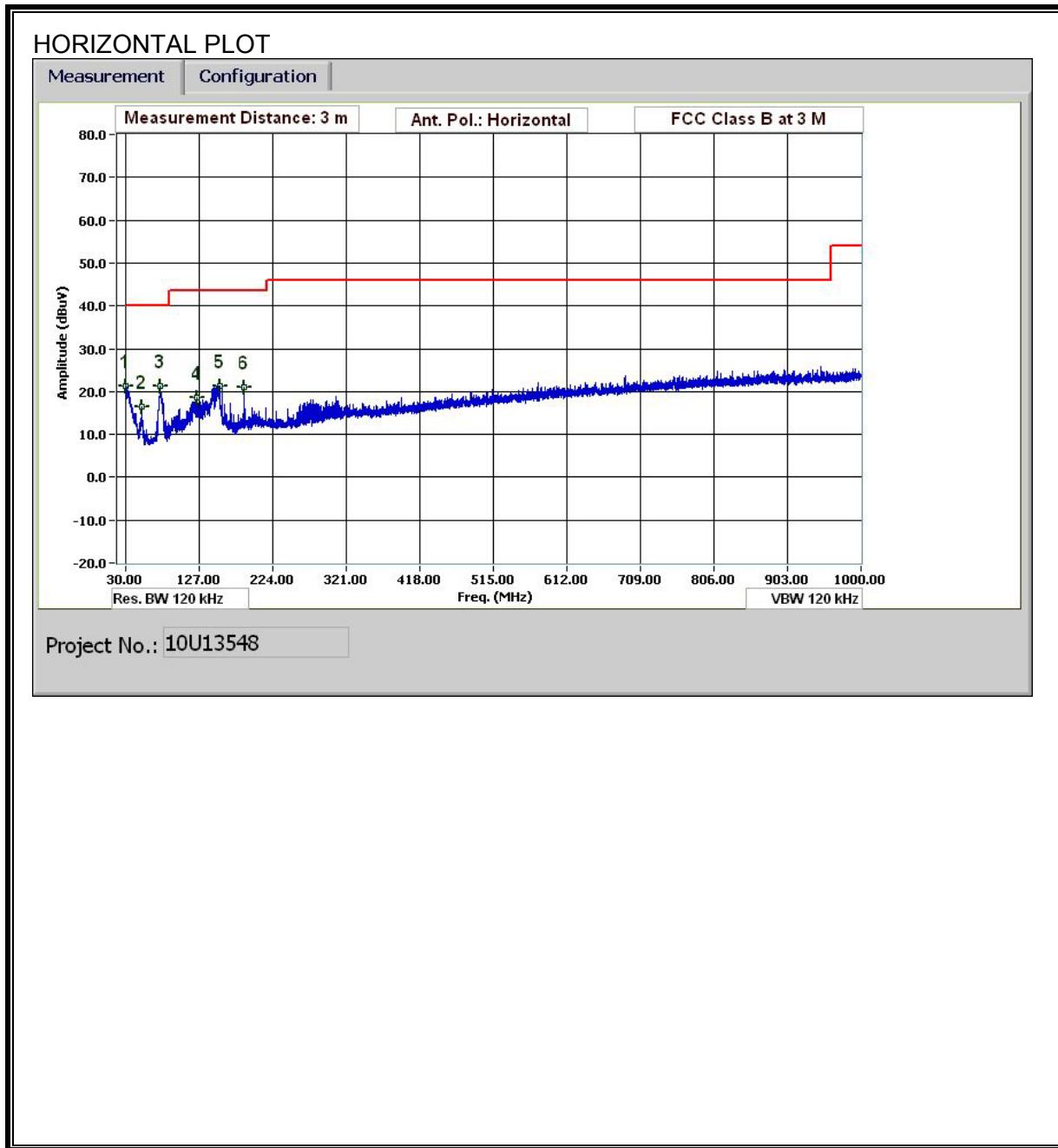
Note: No other emissions were detected above the system noise floor.

### 8.3. RECEIVER ABOVE 1 GHz

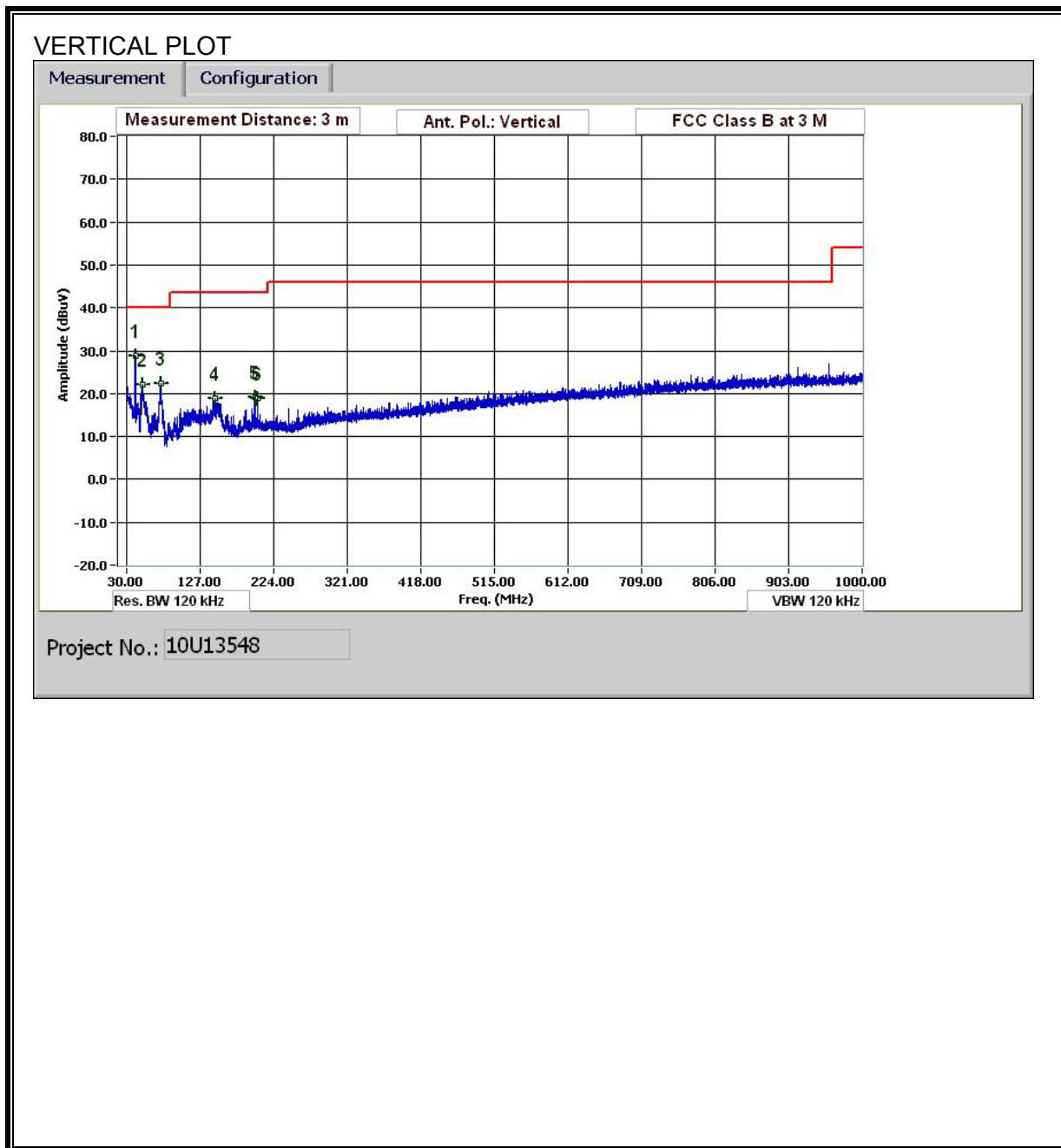
High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																																																																																																																																																																																									
<p>Project #: 10U13548 Date: 2/9/2011 Test Engineer: Tom Chen Configuration: EUT alone Mode: Bluetooth, RX mode</p> <p><u>Test Equipment:</u></p> <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="4">Horn &gt; 18GHz</td> <td>Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>RX RSS 210</td> </tr> <tr> <td colspan="8">Hi Frequency Cables</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="4">Peak Measurements RBW=VBW=1MHz</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td></td> <td></td> <td colspan="4">Average Measurements RBW=1MHz; VBW=10Hz</td> </tr> </table> <p><b>Data Table:</b></p> <table border="1"> <thead> <tr> <th>f GHz</th> <th>Dist (m)</th> <th>Read Pk dBuV</th> <th>Read Avg. dBuV</th> <th>AF dB/m</th> <th>CL dB</th> <th>Amp dB</th> <th>D Corr dB</th> <th>Fltr dB</th> <th>Peak dBuV/m</th> <th>Avg dBuV/m</th> <th>Pk Lim dBuV/m</th> <th>Avg Lim dBuV/m</th> <th>Pk Mar dB</th> <th>Avg Mar dB</th> <th>Notes (V/H)</th> </tr> </thead> <tbody> <tr> <td>1.113</td> <td>3.0</td> <td>48.4</td> <td>43.6</td> <td>24.2</td> <td>2.5</td> <td>-39.3</td> <td>0.0</td> <td>0.0</td> <td>35.8</td> <td>31.0</td> <td>74</td> <td>54</td> <td>-38.2</td> <td>-23.0</td> <td>V</td> </tr> <tr> <td>1.240</td> <td>3.0</td> <td>48.5</td> <td>41.3</td> <td>24.7</td> <td>2.6</td> <td>-39.1</td> <td>0.0</td> <td>0.0</td> <td>36.6</td> <td>29.4</td> <td>74</td> <td>54</td> <td>-37.4</td> <td>-24.6</td> <td>V</td> </tr> <tr> <td>4.127</td> <td>3.0</td> <td>42.5</td> <td>32.1</td> <td>32.4</td> <td>5.3</td> <td>-36.6</td> <td>0.0</td> <td>0.0</td> <td>43.5</td> <td>33.1</td> <td>74</td> <td>54</td> <td>-30.5</td> <td>-20.9</td> <td>V</td> </tr> <tr> <td>1.100</td> <td>3.0</td> <td>47.3</td> <td>32.8</td> <td>24.2</td> <td>2.5</td> <td>-39.3</td> <td>0.0</td> <td>0.0</td> <td>34.6</td> <td>20.2</td> <td>74</td> <td>54</td> <td>-39.4</td> <td>-33.8</td> <td>H</td> </tr> <tr> <td>1.507</td> <td>3.0</td> <td>47.0</td> <td>33.4</td> <td>25.6</td> <td>3.0</td> <td>-38.8</td> <td>0.0</td> <td>0.0</td> <td>36.8</td> <td>23.2</td> <td>74</td> <td>54</td> <td>-37.2</td> <td>-30.8</td> <td>H</td> </tr> <tr> <td>2.493</td> <td>3.0</td> <td>44.3</td> <td>32.1</td> <td>28.5</td> <td>3.9</td> <td>-37.5</td> <td>0.0</td> <td>0.0</td> <td>39.2</td> <td>27.1</td> <td>74</td> <td>54</td> <td>-34.8</td> <td>-26.9</td> <td>H</td> </tr> </tbody> </table> <p>Rev. 07.22.09</p> <p><b>Definitions:</b></p> <table> <tr> <td>f</td> <td>Measurement Frequency</td> <td>Amp</td> <td>Preamp Gain</td> <td>Avg Lim</td> <td>Average Field Strength Limit</td> </tr> <tr> <td>Dist</td> <td>Distance to Antenna</td> <td>D Corr</td> <td>Distance Correct to 3 meters</td> <td>Pk Lim</td> <td>Peak Field Strength Limit</td> </tr> <tr> <td>Read</td> <td>Analyzer Reading</td> <td>Avg</td> <td>Average Field Strength @ 3 m</td> <td>Avg Mar</td> <td>Margin vs. Average Limit</td> </tr> <tr> <td>AF</td> <td>Antenna Factor</td> <td>Peak</td> <td>Calculated Peak Field Strength</td> <td>Pk Mar</td> <td>Margin vs. Peak Limit</td> </tr> <tr> <td>CL</td> <td>Cable Loss</td> <td>HPF</td> <td>High Pass Filter</td> <td></td> <td></td> </tr> </table>																		Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit	T73; S/N: 6717 @3m	T144 Miteq 3008A00931						RX RSS 210	Hi Frequency Cables								3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz				3' cable 22807700	12' cable 22807600	20' cable 22807500			Average Measurements RBW=1MHz; VBW=10Hz				f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	1.113	3.0	48.4	43.6	24.2	2.5	-39.3	0.0	0.0	35.8	31.0	74	54	-38.2	-23.0	V	1.240	3.0	48.5	41.3	24.7	2.6	-39.1	0.0	0.0	36.6	29.4	74	54	-37.4	-24.6	V	4.127	3.0	42.5	32.1	32.4	5.3	-36.6	0.0	0.0	43.5	33.1	74	54	-30.5	-20.9	V	1.100	3.0	47.3	32.8	24.2	2.5	-39.3	0.0	0.0	34.6	20.2	74	54	-39.4	-33.8	H	1.507	3.0	47.0	33.4	25.6	3.0	-38.8	0.0	0.0	36.8	23.2	74	54	-37.2	-30.8	H	2.493	3.0	44.3	32.1	28.5	3.9	-37.5	0.0	0.0	39.2	27.1	74	54	-34.8	-26.9	H	f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit	Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit	Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit	AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit	CL	Cable Loss	HPF	High Pass Filter		
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## 8.4. WORST-CASE BELOW 1 GHz

**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**



**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)**



## HORIZONTAL AND VERTICAL DATA

### 30-1000MHz Frequency Measurement

Compliance Certification Services, Fremont 5m Chamber

Test Engr: Tom Chen  
Date: 02/07/11  
Project #: 10U13548  
Test Target: FCC Class B  
Mode Oper: TX mode, Worst case

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Vertical</b>													
41.4	3.0	43.5	13.0	0.6	28.4	0.0	0.0	28.7	40.0	-11.3	V	P	
51.361	3.0	41.5	8.3	0.6	28.4	0.0	0.0	22.1	40.0	-17.9	V	P	
75.002	3.0	42.3	7.7	0.8	28.3	0.0	0.0	22.4	40.0	-17.6	V	P	
146.765	3.0	33.1	12.8	1.1	28.3	0.0	0.0	18.8	43.5	-24.7	V	P	
199.087	3.0	34.1	11.9	1.2	28.2	0.0	0.0	19.0	43.5	-24.5	V	P	
202.807	3.0	33.8	12.0	1.3	28.2	0.0	0.0	18.8	43.5	-24.7	V	P	
<b>Horizontal</b>													
30.48	3.0	29.2	19.9	0.5	28.4	0.0	0.0	21.2	40.0	-18.8	H	P	
51.601	3.0	35.9	8.3	0.6	28.4	0.0	0.0	16.5	40.0	-23.5	H	P	
75.362	3.0	41.3	7.7	0.8	28.3	0.0	0.0	21.3	40.0	-18.7	H	P	
123.484	3.0	32.1	13.7	1.1	28.3	0.0	0.0	18.5	43.5	-25.0	H	P	
153.965	3.0	36.2	12.2	1.1	28.3	0.0	0.0	21.3	43.5	-22.2	H	P	
186.126	3.0	36.9	11.3	1.2	28.2	0.0	0.0	21.1	43.5	-22.4	H	P	

Rev. 1.27.09

Note: No other emissions were detected above the system noise floor.

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>
0.5-5	56	46
5-30	60	50

<sup>\*</sup> Decreases with the logarithm of the frequency.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

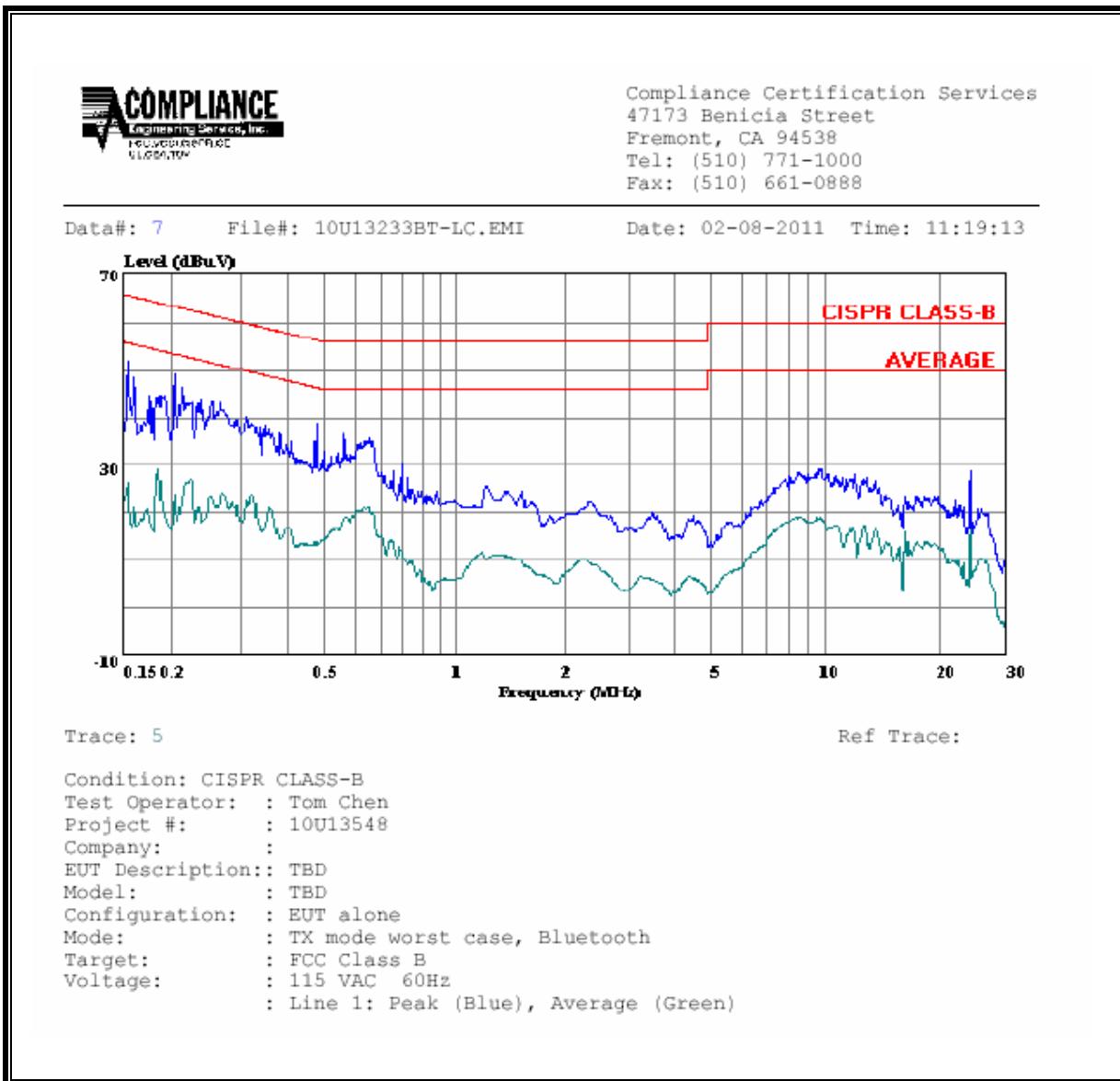
Line conducted data is recorded for both NEUTRAL and HOT lines.

## RESULTS

### 6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)										
Freq. (MHz)	Reading			Closs (dB)	Limit	EN_B		Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)			QP	AV	QP (dB)	AV (dB)	
0.15	52.15	--	26.29	0.00	65.84	55.84	-13.69	-29.55	L1	
0.20	49.37	--	23.99	0.00	63.45	53.45	-14.08	-29.46	L1	
0.21	46.48	--	23.13	0.00	63.13	53.13	-16.65	-30.00	L1	
0.15	48.81	--	20.81	0.00	65.89	55.89	-17.08	-35.08	L2	
0.18	43.43	--	31.26	0.00	64.63	54.63	-21.20	-23.37	L2	
0.64	41.94	--	29.60	0.00	56.00	46.00	-14.06	-16.40	L2	
6 Worst Data										

**LINE 1 RESULTS**



**LINE 2 RESULTS**

