



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

**CERTIFICATION TEST REPORT**

**FOR**

**802.11a/g/n/ac WLAN + Bluetooth PCI-E Custom Combination Card**

**MODEL NUMBER: BCM94360CD**

**FCC ID: QDS-BRCM1070  
IC: 4324A-BRCM1070**

**REPORT NUMBER: 12U14669-2**

**ISSUE DATE: FEBRUARY 04, 2013**

*Prepared for*

**BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, U.S.A.**

*Prepared by*

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



**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	02/04/13	Initial Issue	F. Ibrahim

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS .....</b>	<b>5</b>
<b>2. TEST METHODOLOGY .....</b>	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION .....</b>	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY .....</b>	<b>6</b>
4.1. MEASURING INSTRUMENT CALIBRATION .....	6
4.2. SAMPLE CALCULATION .....	6
4.3. MEASUREMENT UNCERTAINTY .....	6
<b>5. EQUIPMENT UNDER TEST .....</b>	<b>7</b>
5.1. DESCRIPTION OF EUT .....	7
5.2. MAXIMUM OUTPUT POWER .....	7
5.3. DESCRIPTION OF AVAILABLE ANTENNAS .....	7
5.4. SOFTWARE AND FIRMWARE .....	7
5.5. WORST-CASE CONFIGURATION AND MODE .....	7
5.6. DESCRIPTION OF TEST SETUP .....	8
<b>6. TEST AND MEASUREMENT EQUIPMENT .....</b>	<b>10</b>
<b>7. ANTENNA PORT TEST RESULTS .....</b>	<b>11</b>
7.1. BASIC DATA RATE GFSK MODULATION .....	11
7.1.1. 20 dB AND 99% BANDWIDTH .....	11
7.1.2. HOPPING FREQUENCY SEPARATION .....	18
7.1.3. NUMBER OF HOPPING CHANNELS .....	20
7.1.4. AVERAGE TIME OF OCCUPANCY .....	25
7.1.5. OUTPUT POWER .....	32
7.1.6. AVERAGE POWER .....	36
7.1.7. CONDUCTED SPURIOUS EMISSIONS .....	37
7.2. ENHANCED DATA RATE 8PSK MODULATION .....	46
7.2.1. 20 dB AND 99% BANDWIDTH .....	46
7.2.2. HOPPING FREQUENCY SEPARATION .....	53
7.2.3. NUMBER OF HOPPING CHANNELS .....	55
7.2.4. AVERAGE TIME OF OCCUPANCY .....	60
7.2.5. OUTPUT POWER .....	67
7.2.6. AVERAGE POWER .....	71
7.2.7. CONDUCTED SPURIOUS EMISSIONS .....	72
<b>8. RADIATED TEST RESULTS .....</b>	<b>81</b>
8.1. LIMITS AND PROCEDURE .....	81
8.2. TRANSMITTER ABOVE 1 GHz .....	82
8.2.1. BASIC DATA RATE GFSK MODULATION .....	82
8.2.2. ENHANCED DATA RATE 8PSK MODULATION .....	91

8.3. WORST-CASE BELOW 1 GHz.....	100
9. AC POWER LINE CONDUCTED EMISSIONS.....	101
10. SETUP PHOTOS .....	105

## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, U.S.A.

**EUT DESCRIPTION:** 802.11a/g/n/ac WLAN + Bluetooth PCI-E Custom Combination Card

**MODEL:** BCM94360CD

**SERIAL NUMBER:** 1626297

**DATE TESTED:** DECEMBER 26, 2012 - JANUARY 4, 2013

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

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.

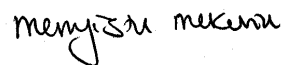
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of 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:



FRANK IBRAHIM  
WISE PROJECT LEAD  
UL CCS

Tested By:



MENGISTU MEKURIA  
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:

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

### 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

The EUT is an 802.11a/g/n/ac WLAN + Bluetooth PCI-E Custom Combination Card.

The radio module is manufactured by Broadcom.

### 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	7.54	5.68
2402 - 2480	Enhanced 8PSK	8.76	7.52

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes the following BT antennas:

- Amphenol/ Molex BT antenna, with a maximum gain of 4.8 dBi.
- Amphenol/ Molex BT antenna, with a maximum gain of 3.29 dBi

The 4.8 dBi BT antenna was selected for the testing as worst-case with higher gain.

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 6.30.118.23.

The test utility software used during testing was Broadcom Bluetool, rev. 1.4.2.6.

### 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC. The EUT was oriented in a flat orientation, similar to the orientation it would have in real installations; see setup photos for details.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	DV6000	CNF7120G34	DoC
AC Adapter	HP	PA-1900-08R1	599830ALLUB6N1	N/A
Adapter Board	Broadcom	BCM94331CSAD	1514447	N/A

### I/O CABLES

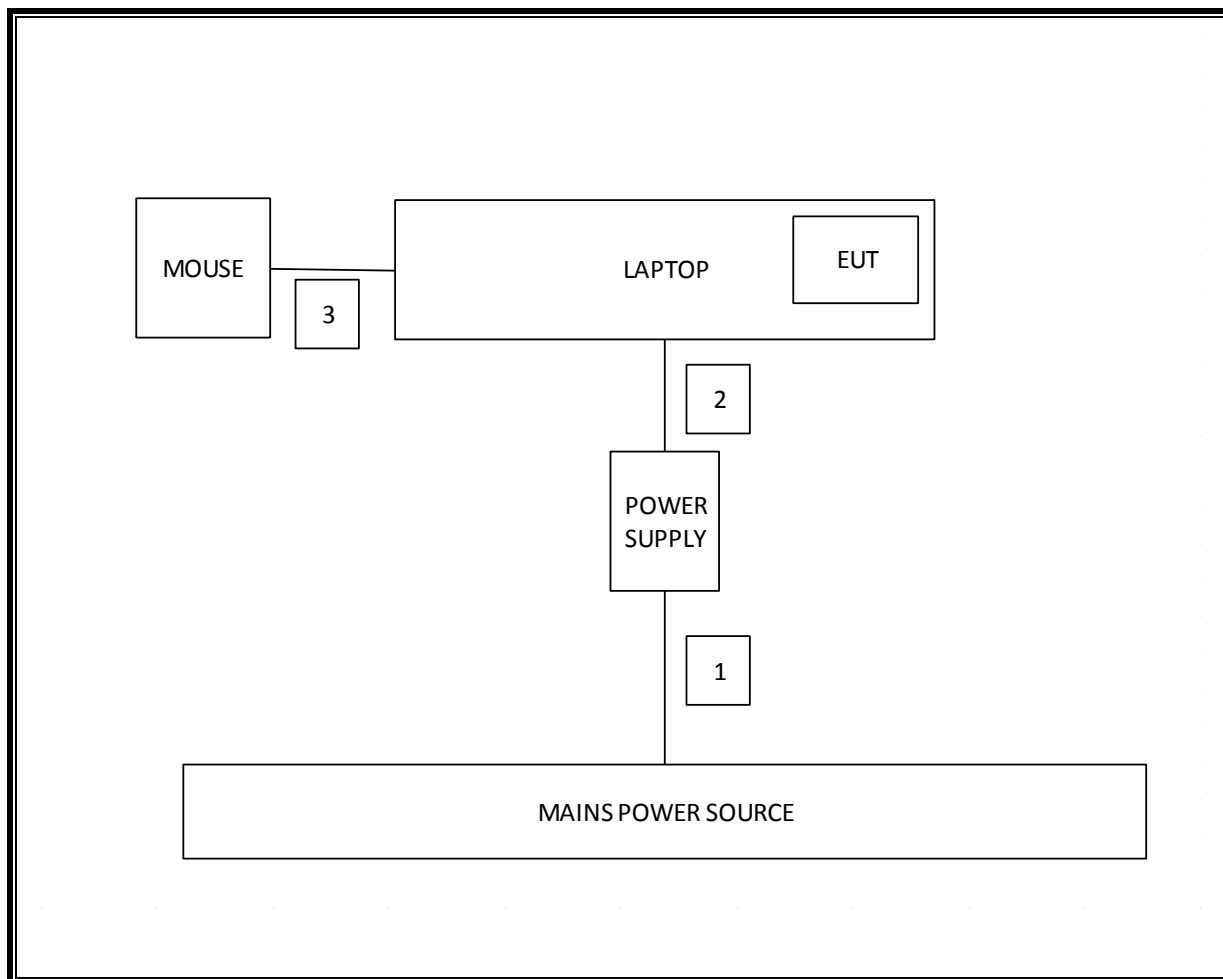
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US 115V	Un-Shielded	1m	NA
2	DC	1	DC	Un-Shielded	1.8m	NA
2	USB	1	USB	Shielded	1.8m	NA

### TEST SETUP

The EUT is attached to a jig board which is installed in the PCMCIA slot of a host laptop computer during the tests. Test software exercised the radio card.



**SETUP DIAGRAM FOR TESTS**



## 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
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	12/13/13
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	10/21/13
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/08/13
Antenna, Horn, 18 GHz	EMCO	3115	C00945	11/12/13
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/13
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	06/14/13
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1		02/07/13
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	10/19/13
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/02/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/30/13
P-Series single channel Power Meter	Agilent / HP	N1911A		07/27/13
Peak / Average Power Sensor	Agilent / HP	E9323A		07/26/13
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/13/14

## 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.

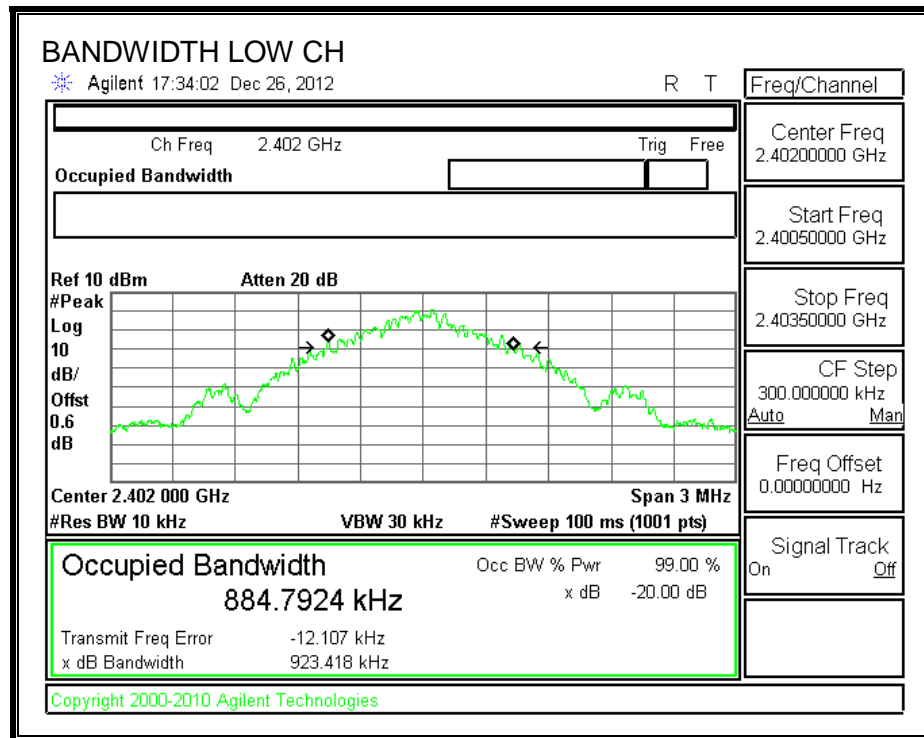
##### TEST PROCEDURE

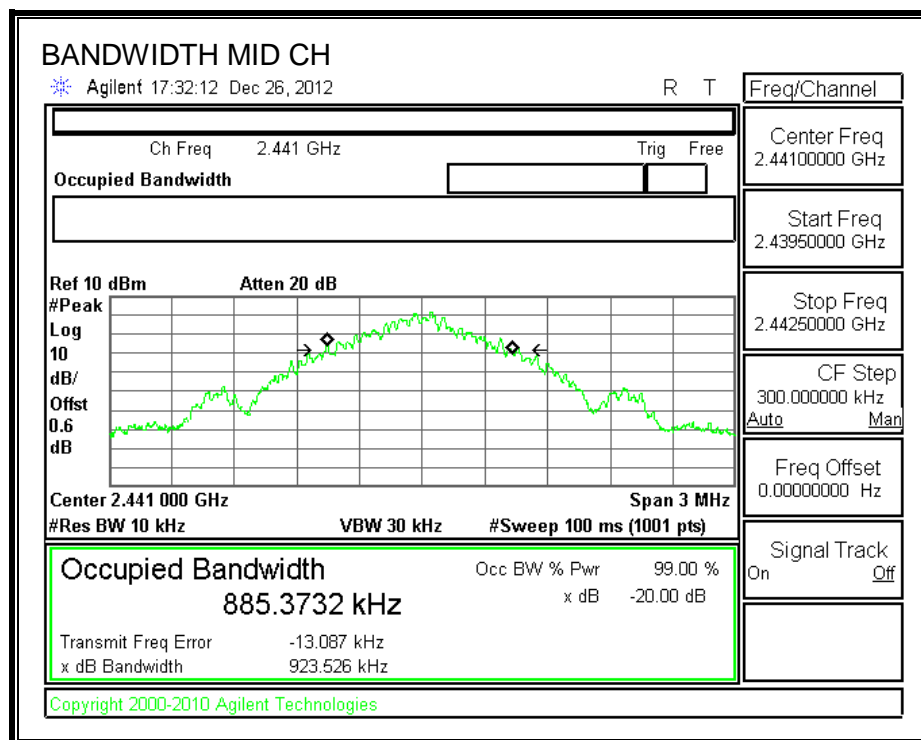
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

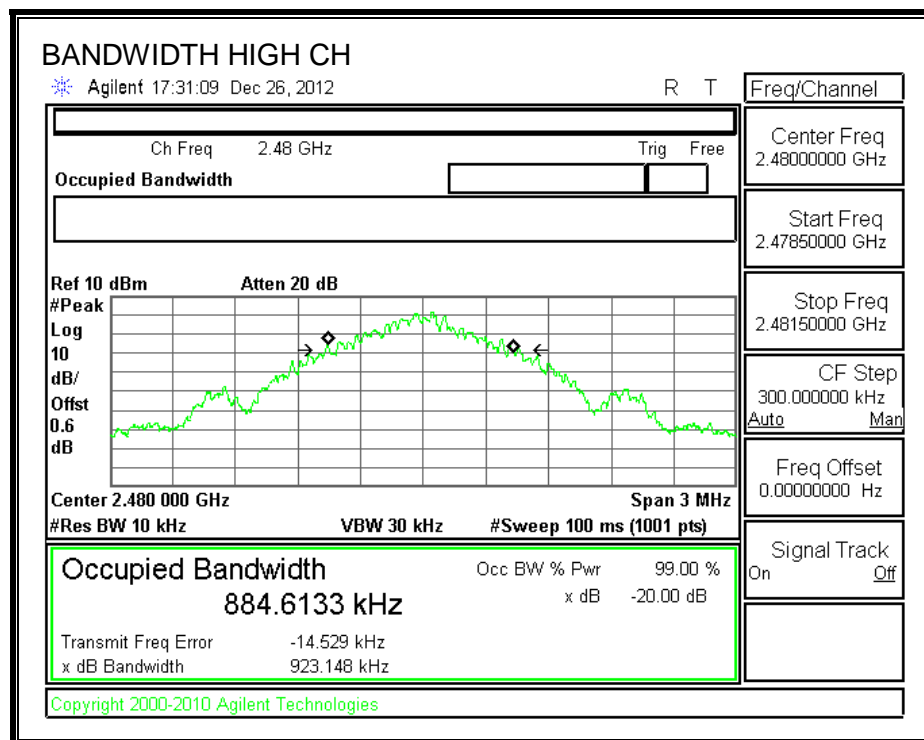
##### RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	923.418	875.7017
Middle	2441	923.526	866.9124
High	2480	923.148	887.3331

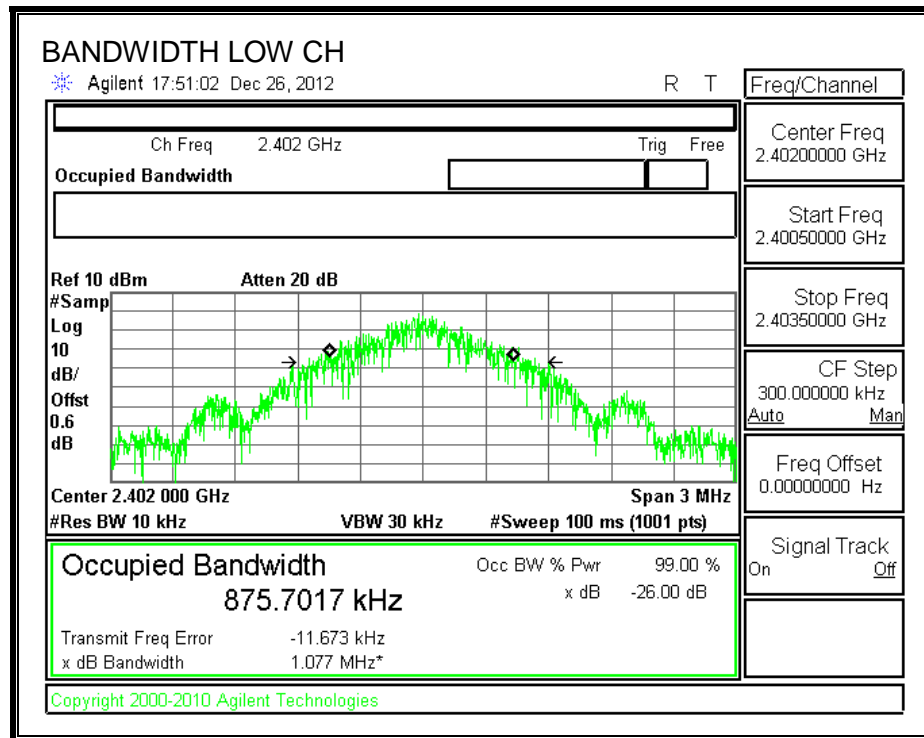
## 20 dB BANDWIDTH

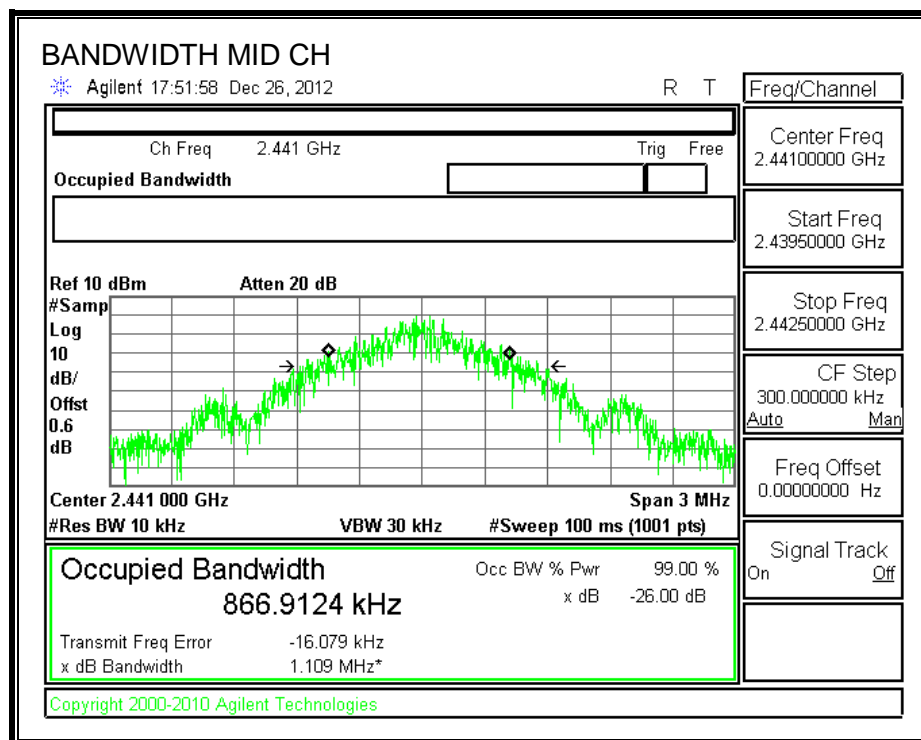




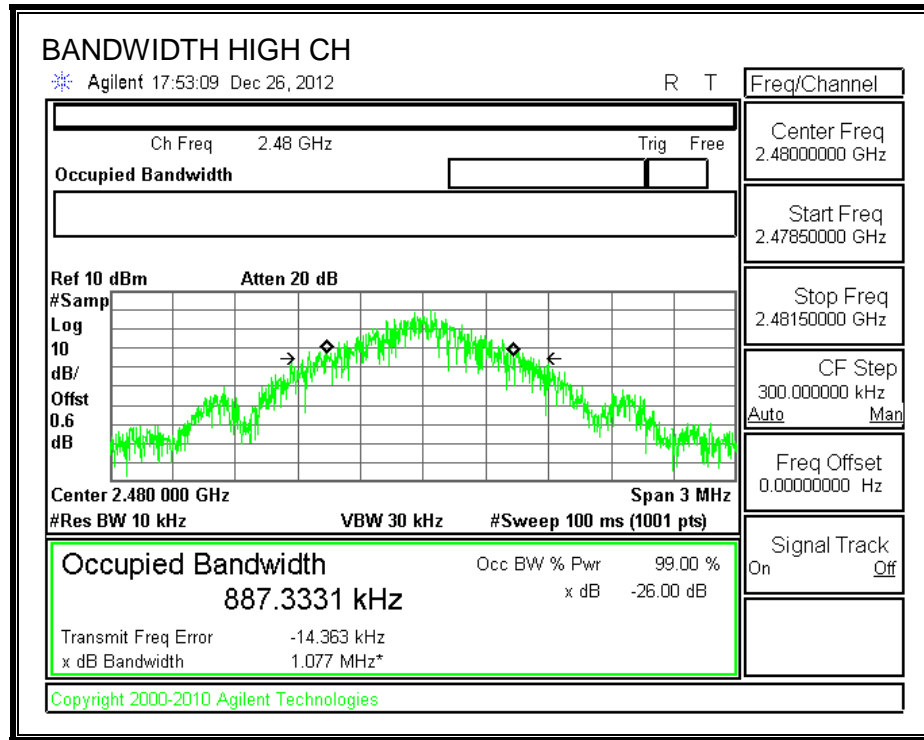


**99% BANDWIDTH**









## 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 hopping channel, whichever is greater.

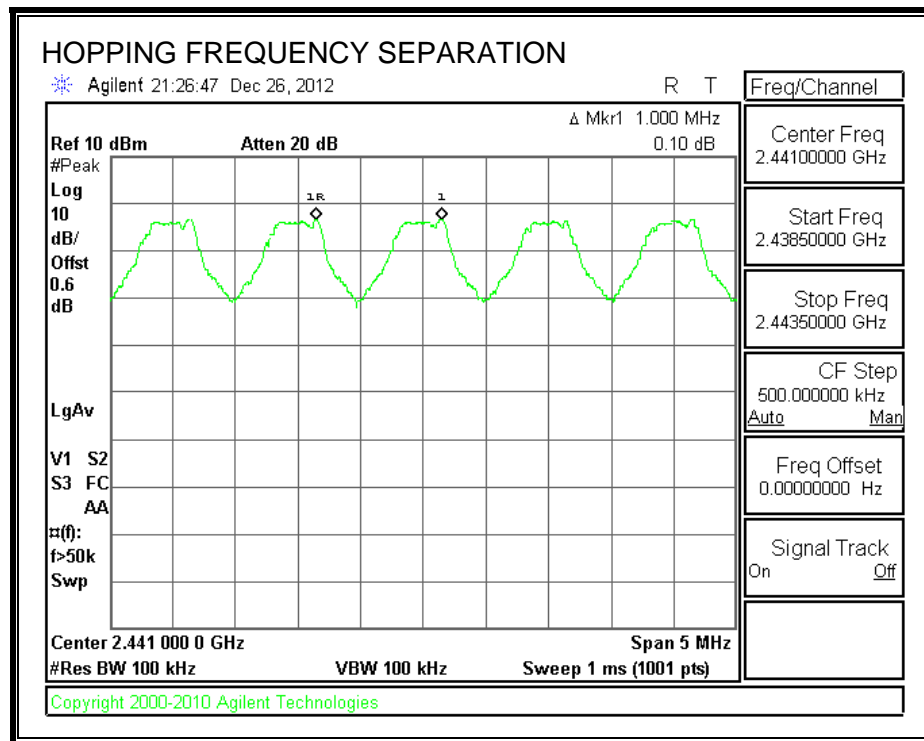
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### TEST PROCEDURE

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

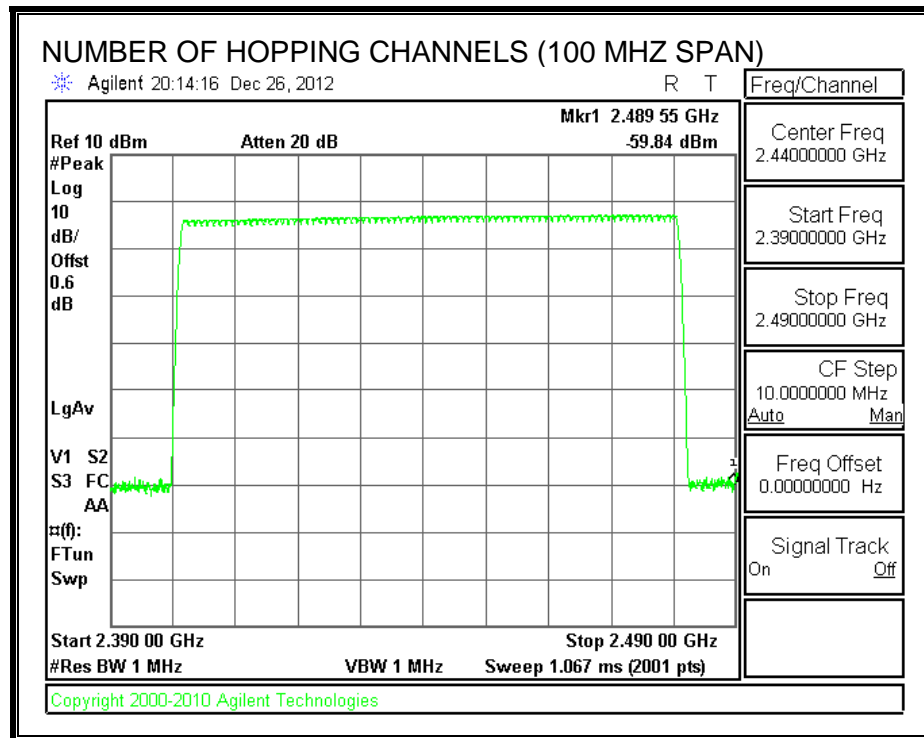
#### **TEST PROCEDURE**

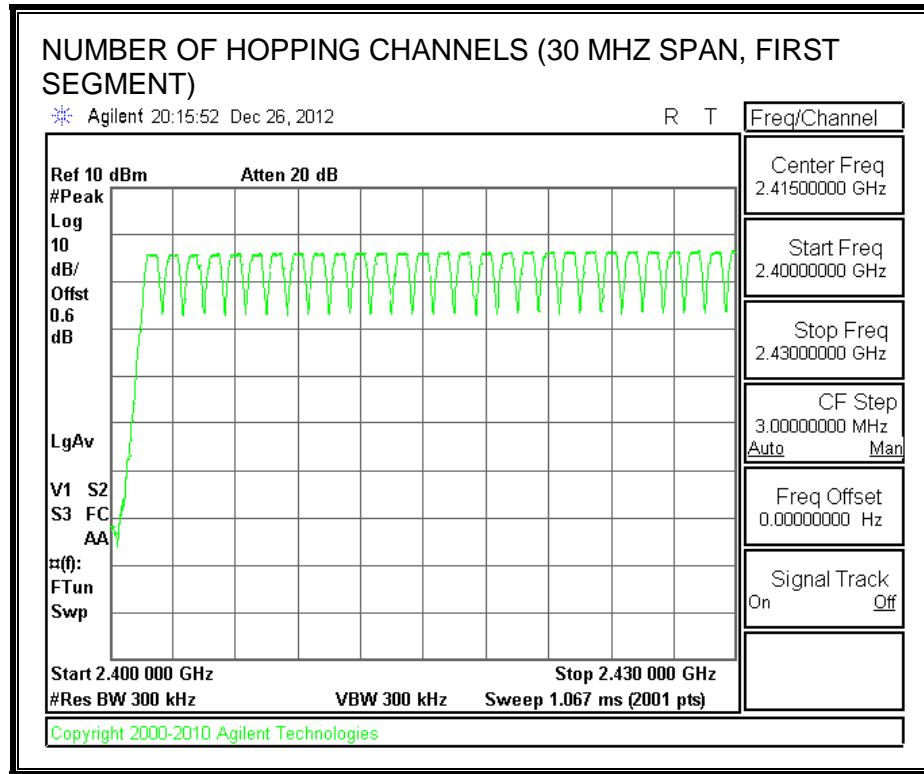
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

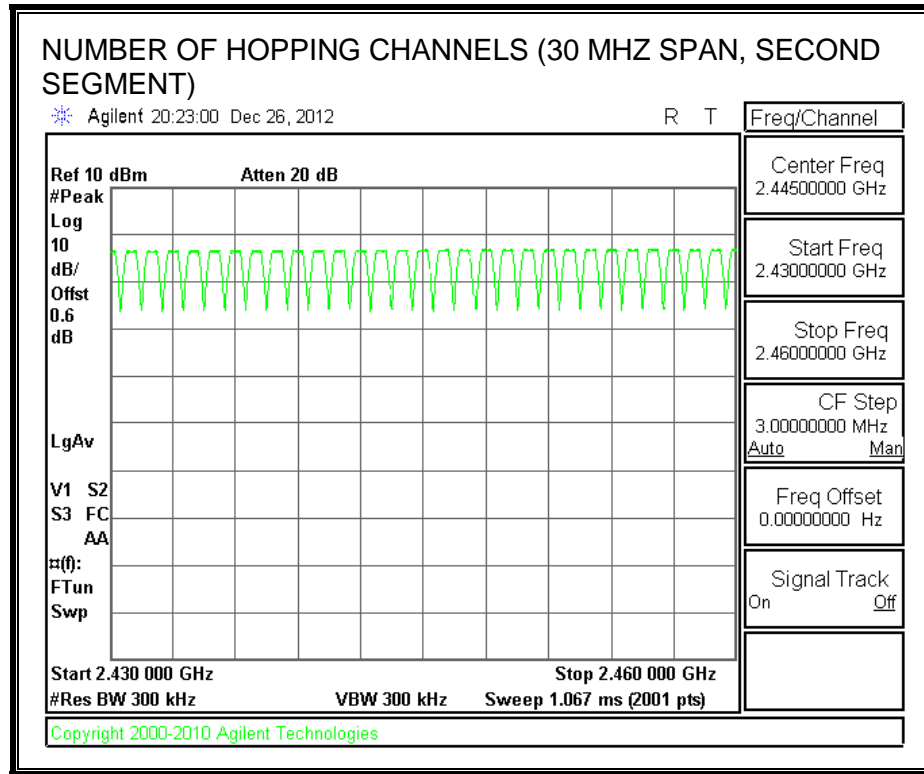
#### **RESULTS**

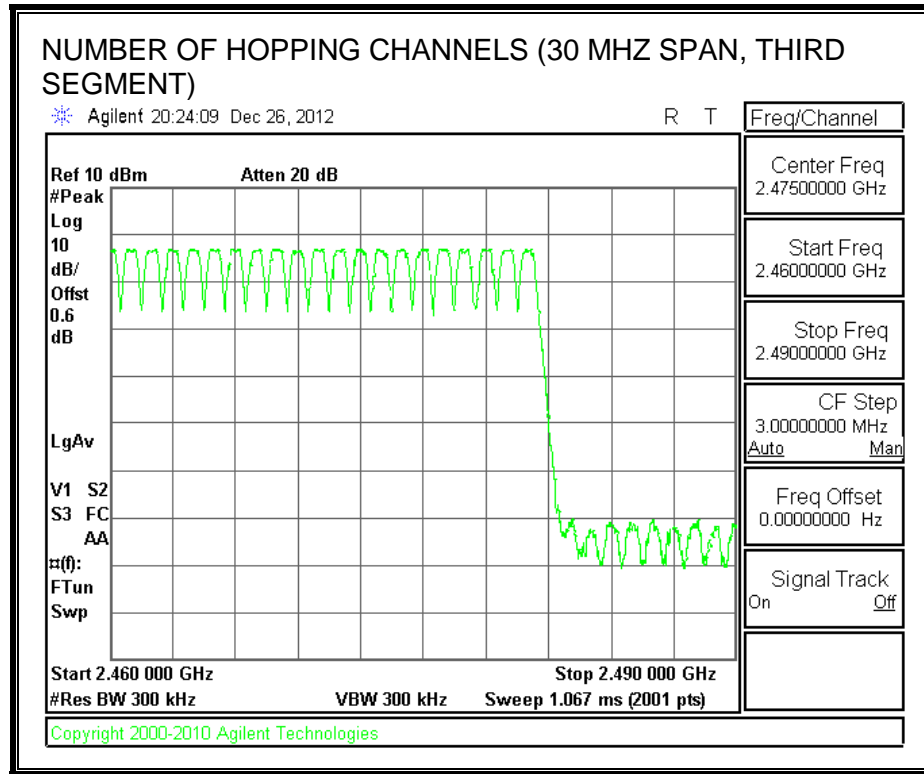
Normal Mode: 79 Channels observed.

# **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.

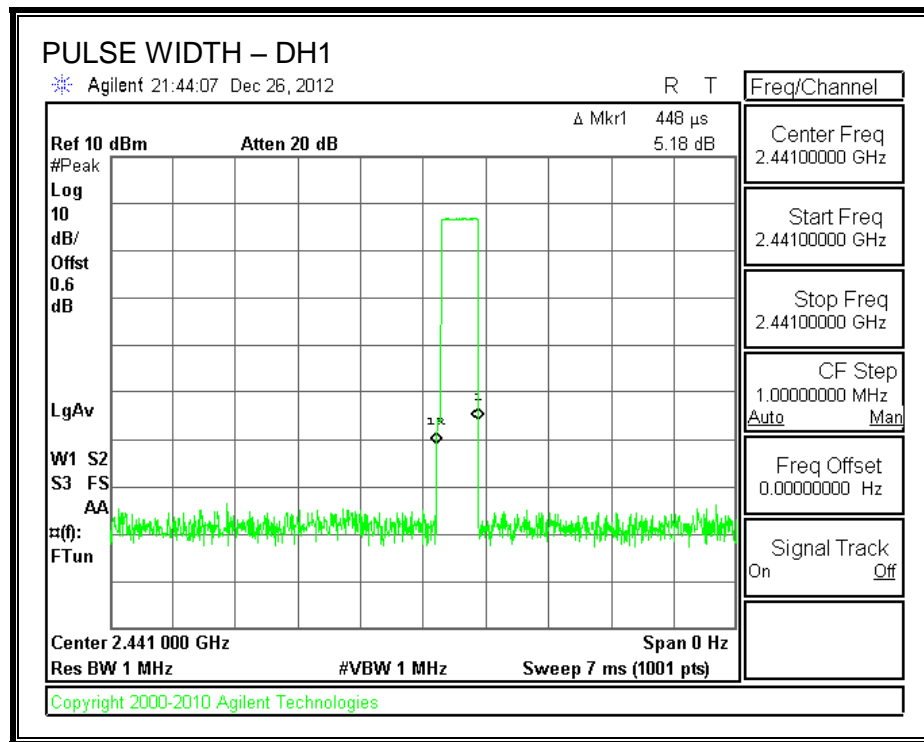
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels \* 0.4 seconds) is equal to  $10 * (\# \text{ of pulses in } 0.8 \text{ s}) * \text{pulse width}$ .

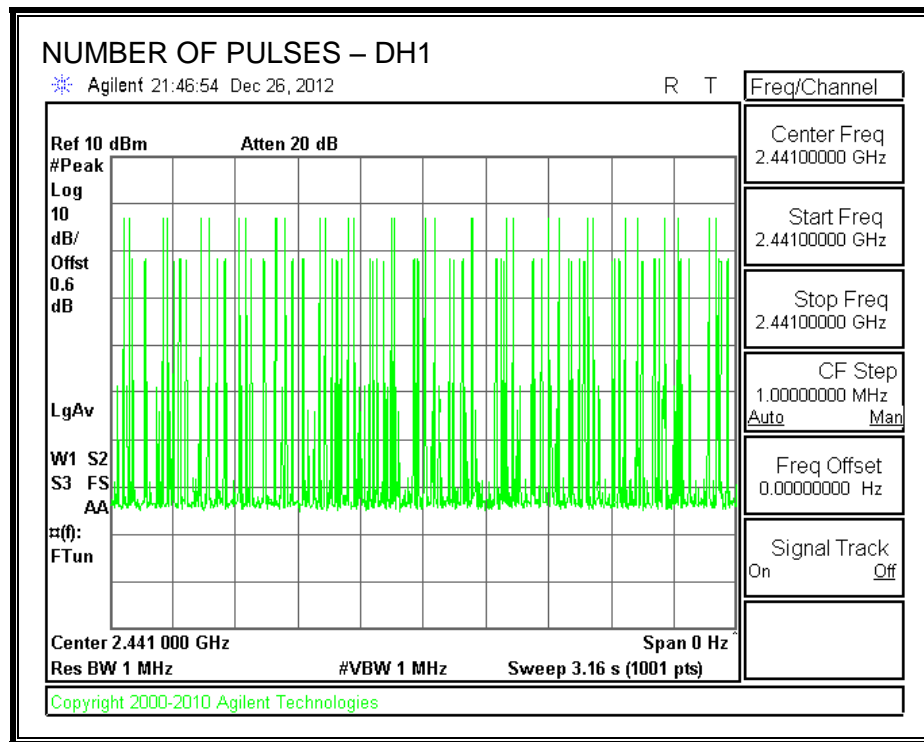
### RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.448	33	0.148	0.4	-0.252
DH3	1.701	17	0.289	0.4	-0.111
DH5	2.954	11	0.325	0.4	-0.075
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.448	64	0.287	0.4	-0.113
DH3	1.701	21	0.357	0.4	-0.043
DH5	2.954	13	0.384	0.4	-0.016

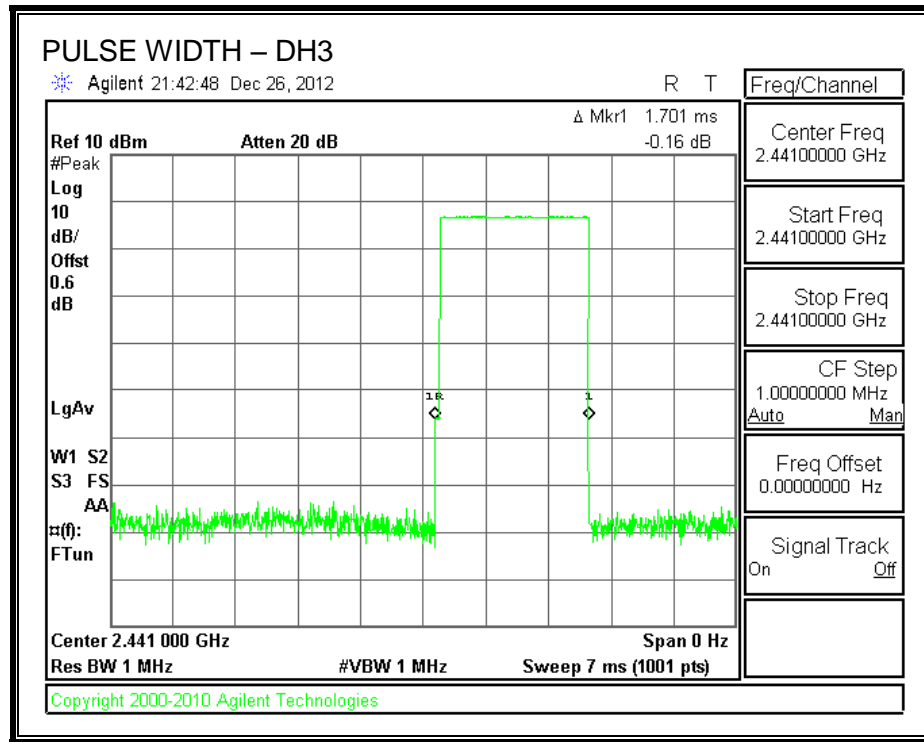
**PULSE WIDTH - DH1**



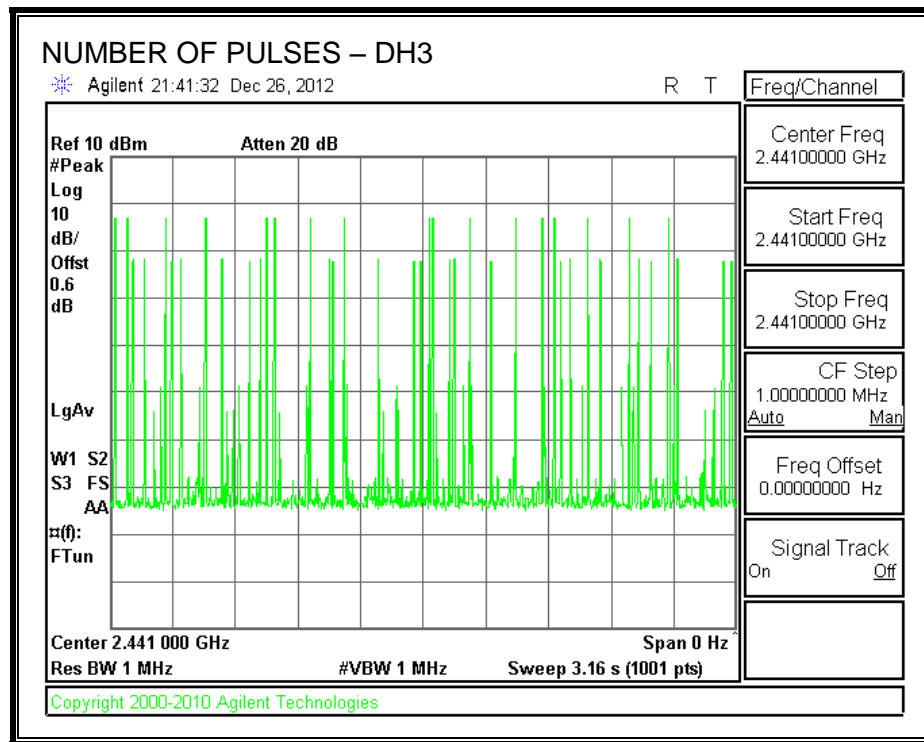
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



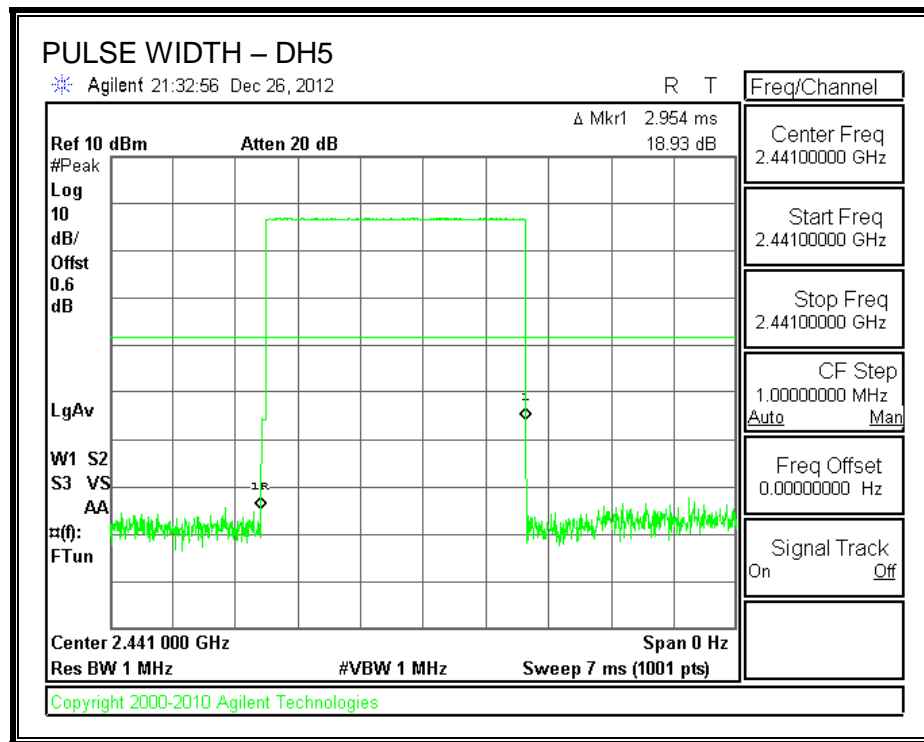
### PULSE WIDTH – DH3



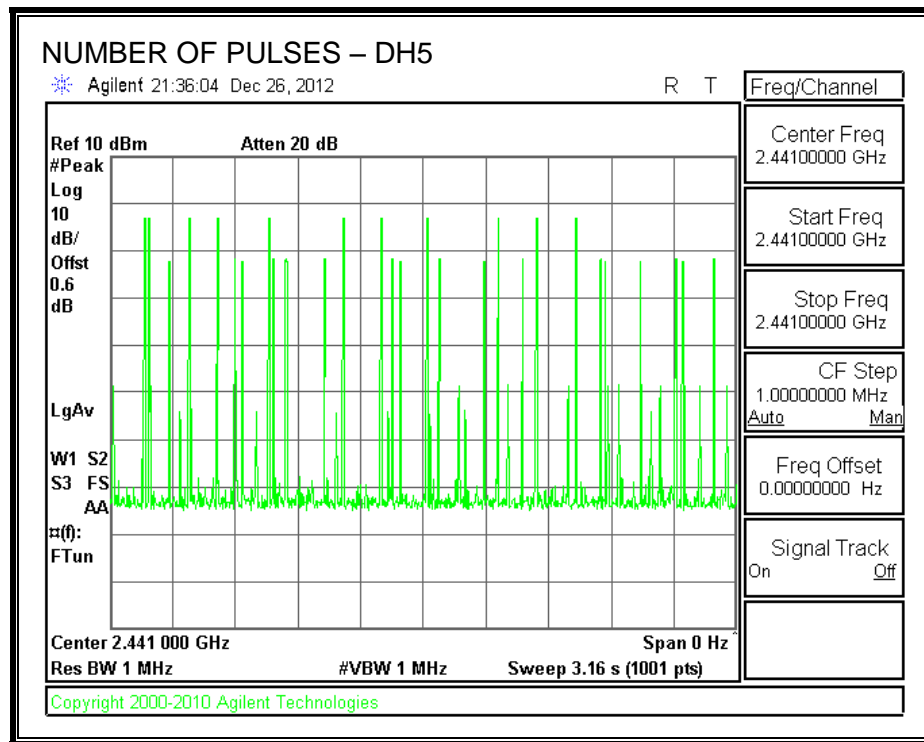
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**



# **PULSE WIDTH – DH5**



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**



### 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

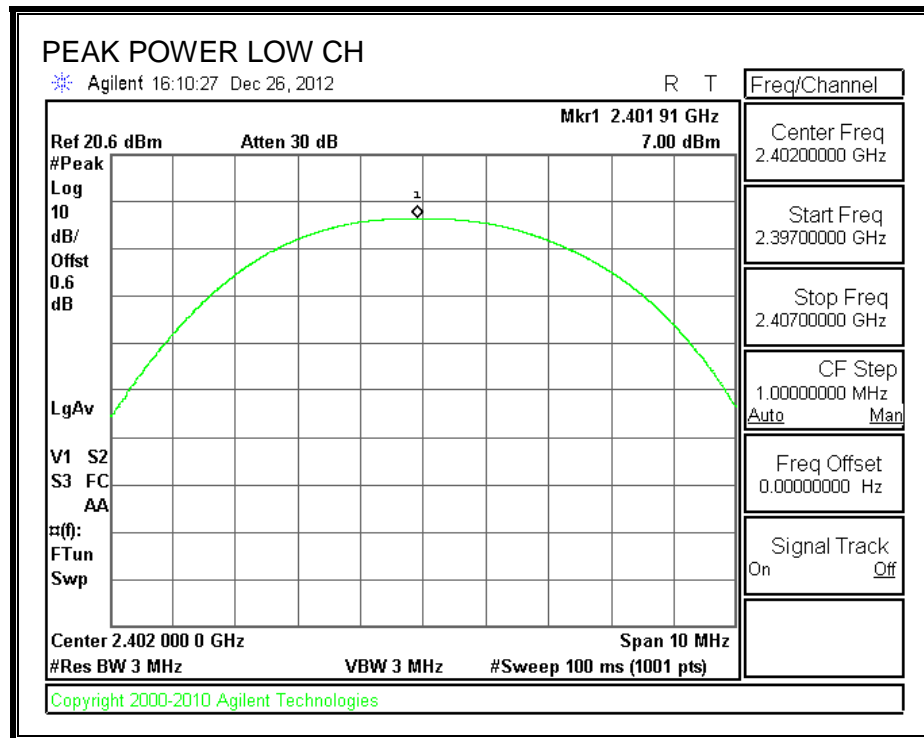
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

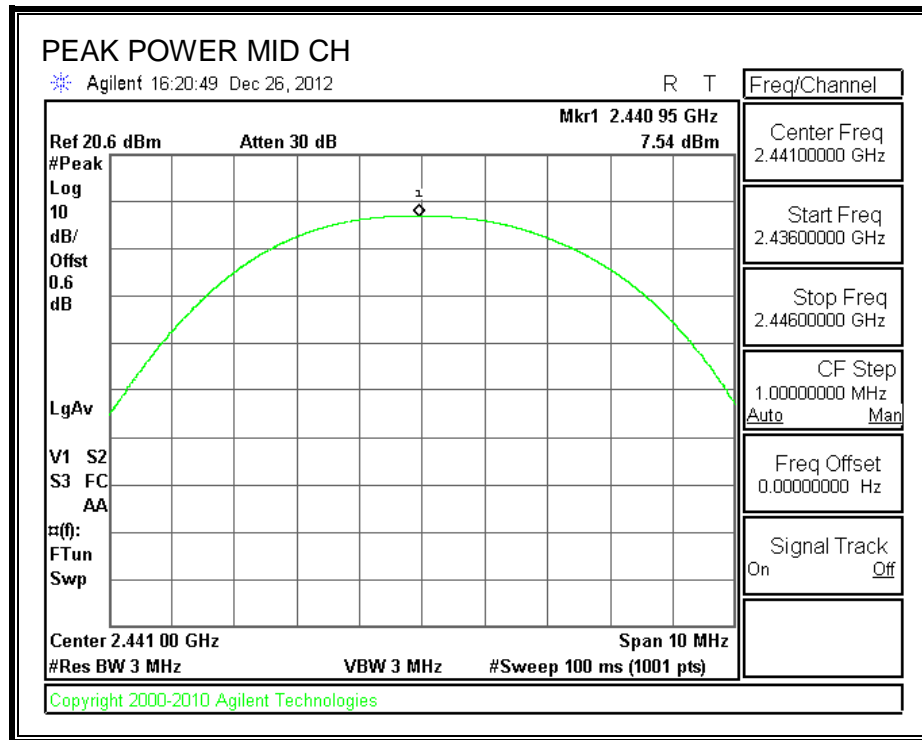
#### RESULTS

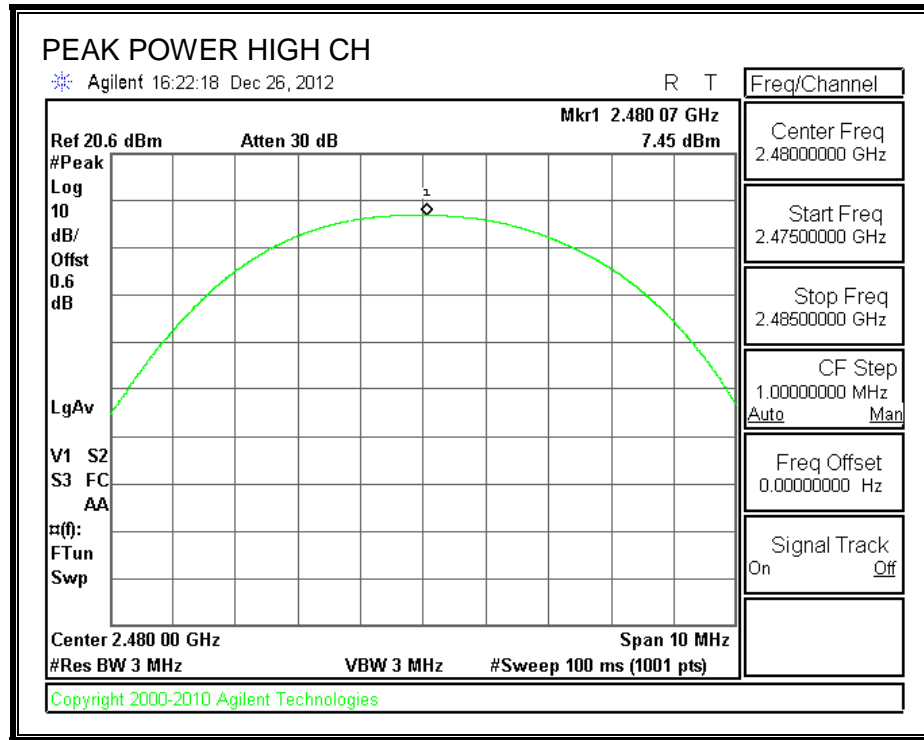
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.00	30	-23.00
Middle	2441	7.54	30	-22.46
High	2480	7.45	30	-22.55



## OUTPUT POWER







### 7.1.6. AVERAGE POWER

#### LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 10.6 dB (including 10 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.63
Middle	2441	7.15
High	2480	7.08

### **7.1.7. CONDUCTED SPURIOUS EMISSIONS**

#### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

#### **TEST PROCEDURE**

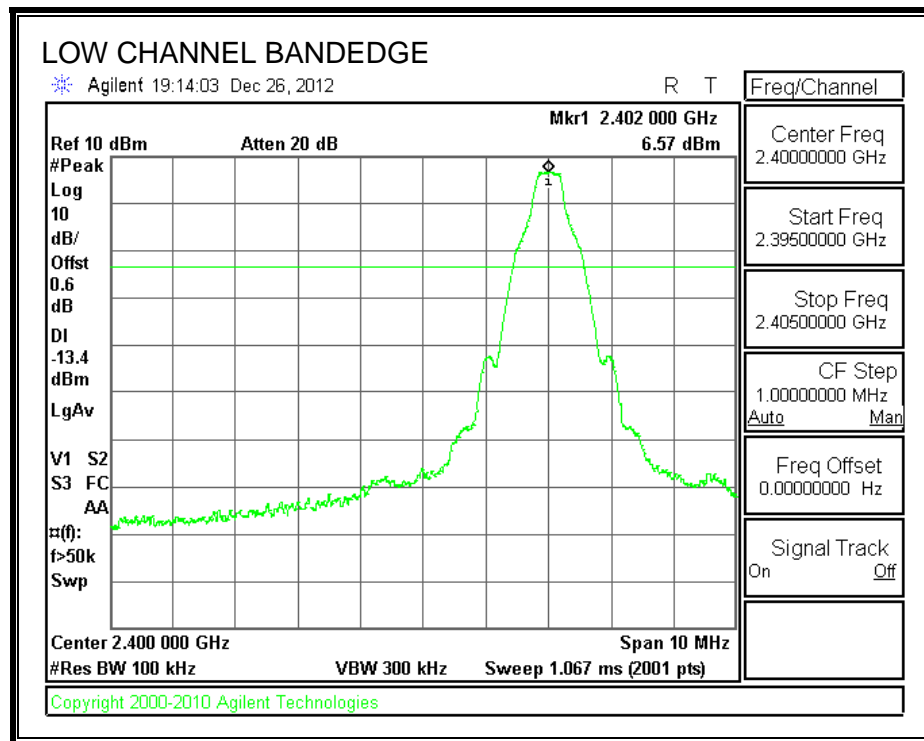
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

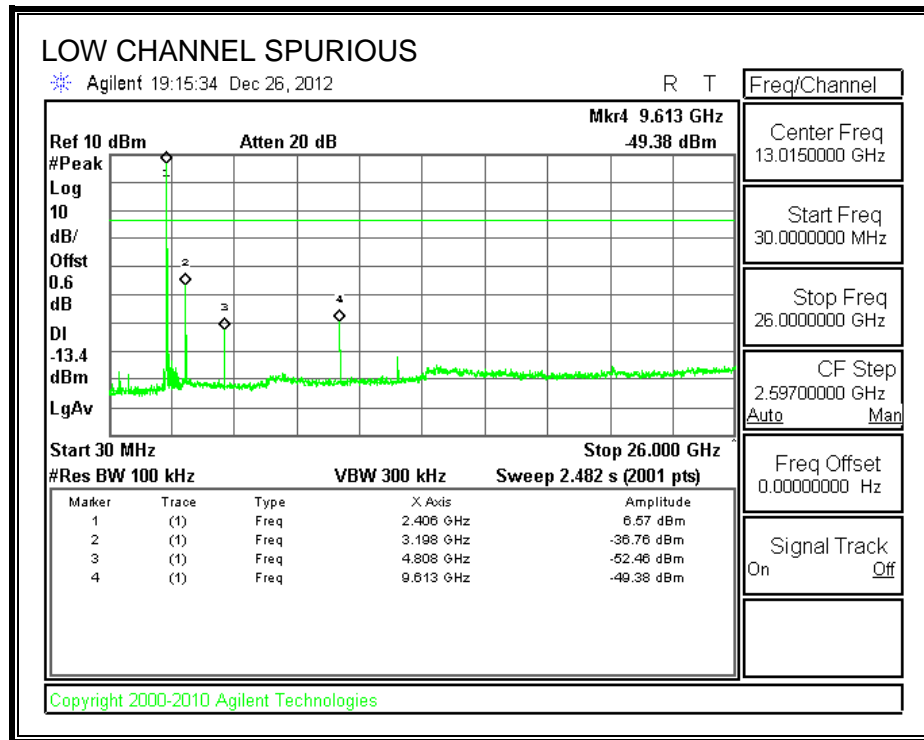
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

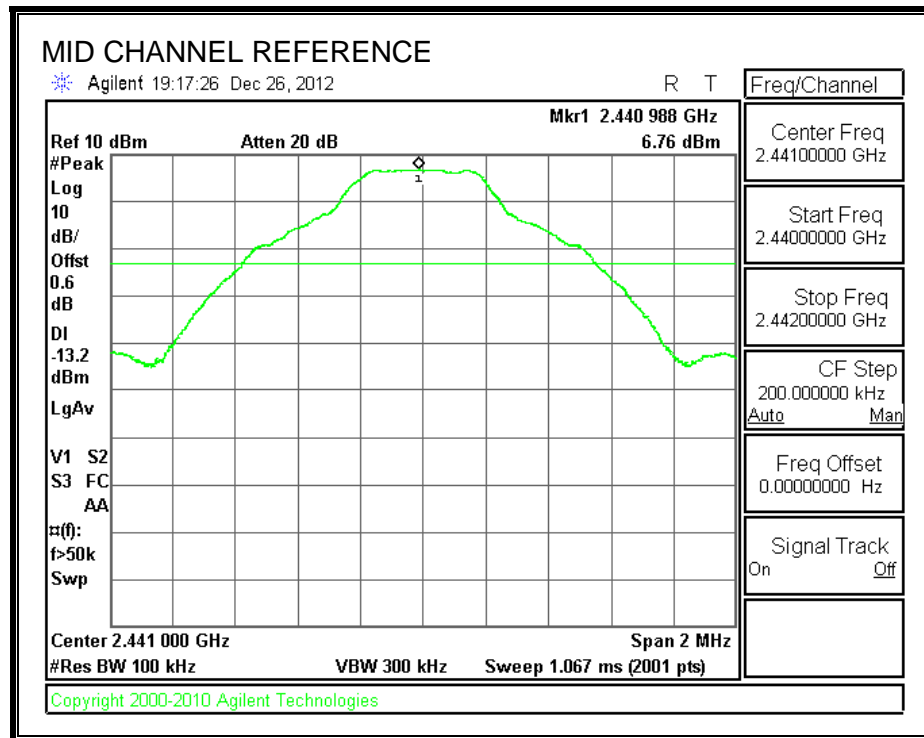
## RESULTS

### SPURIOUS EMISSIONS, LOW CHANNEL

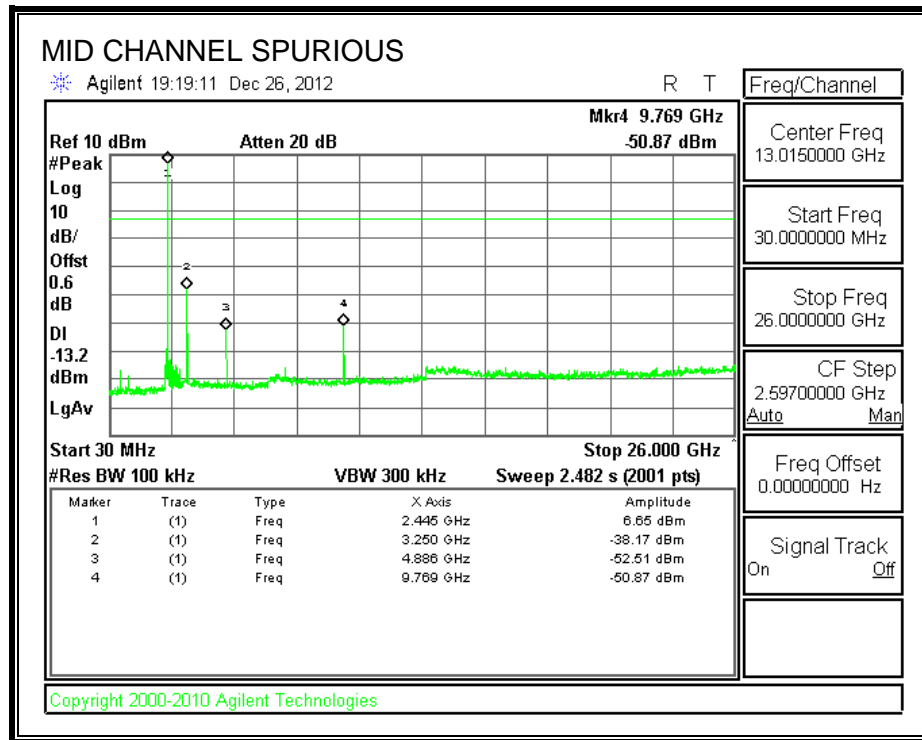




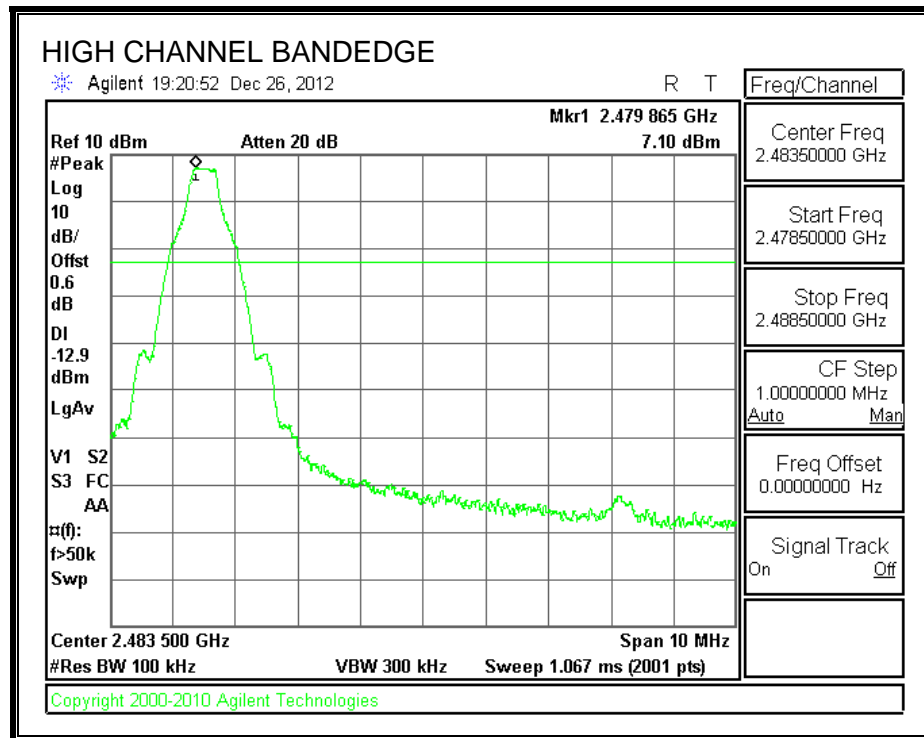
**SPURIOUS EMISSIONS, MID CHANNEL**

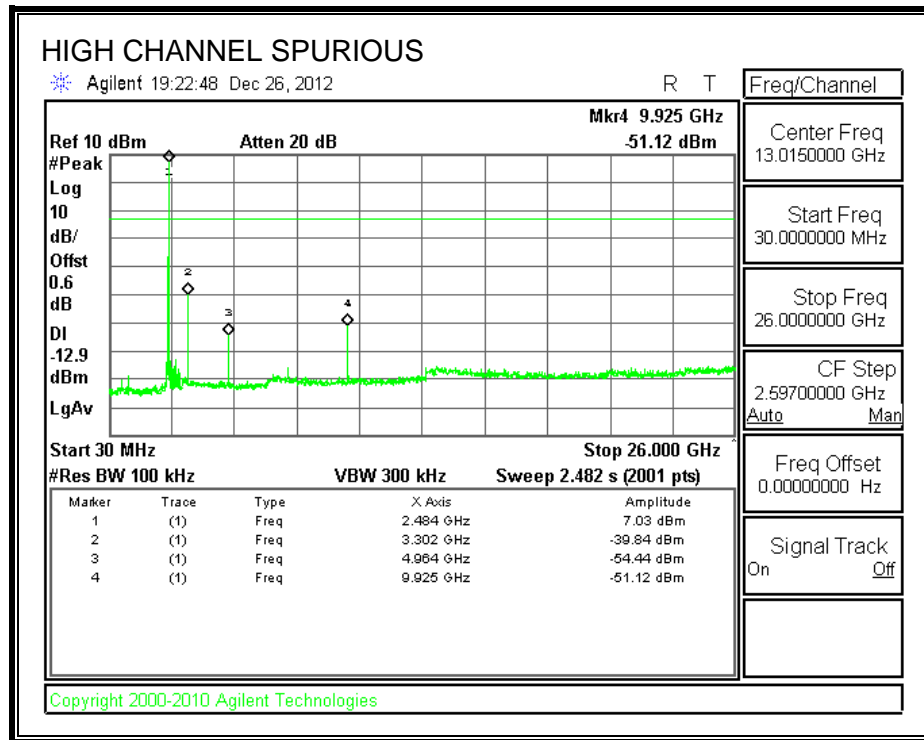




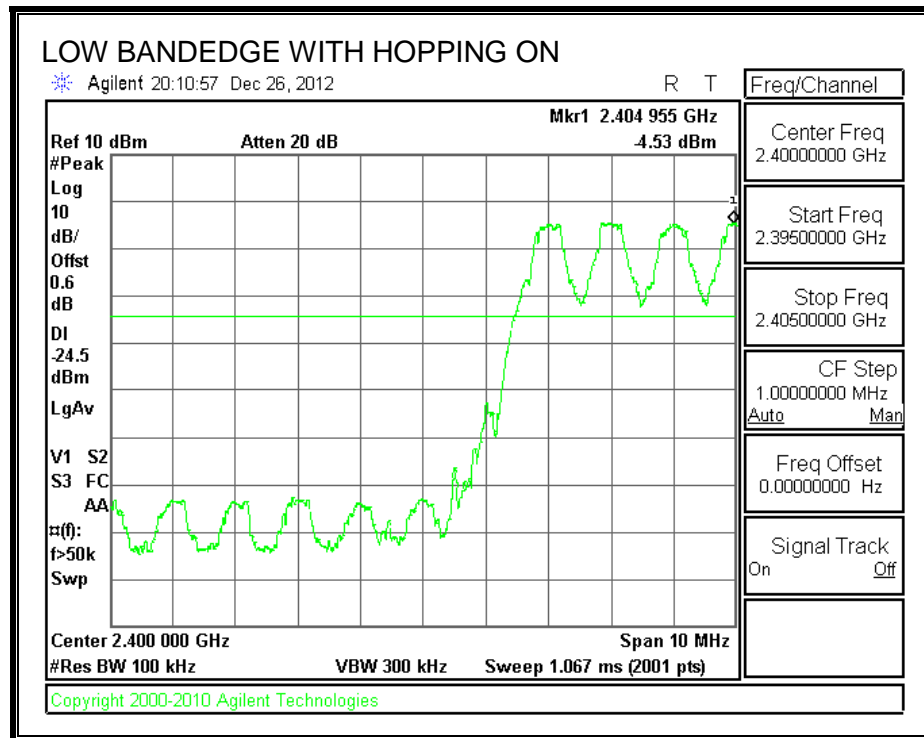


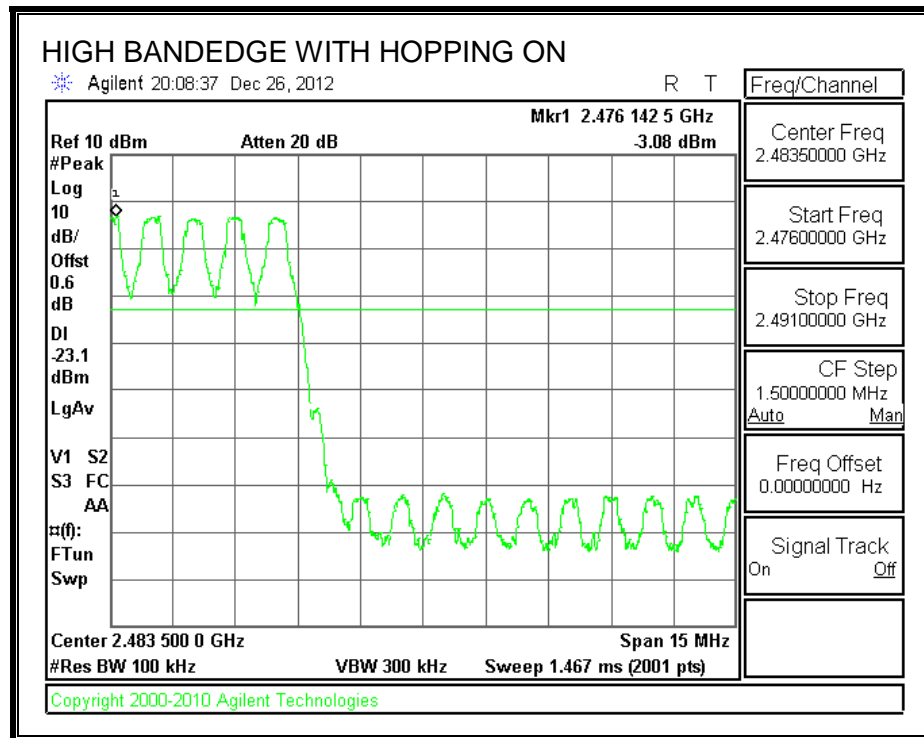
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**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.

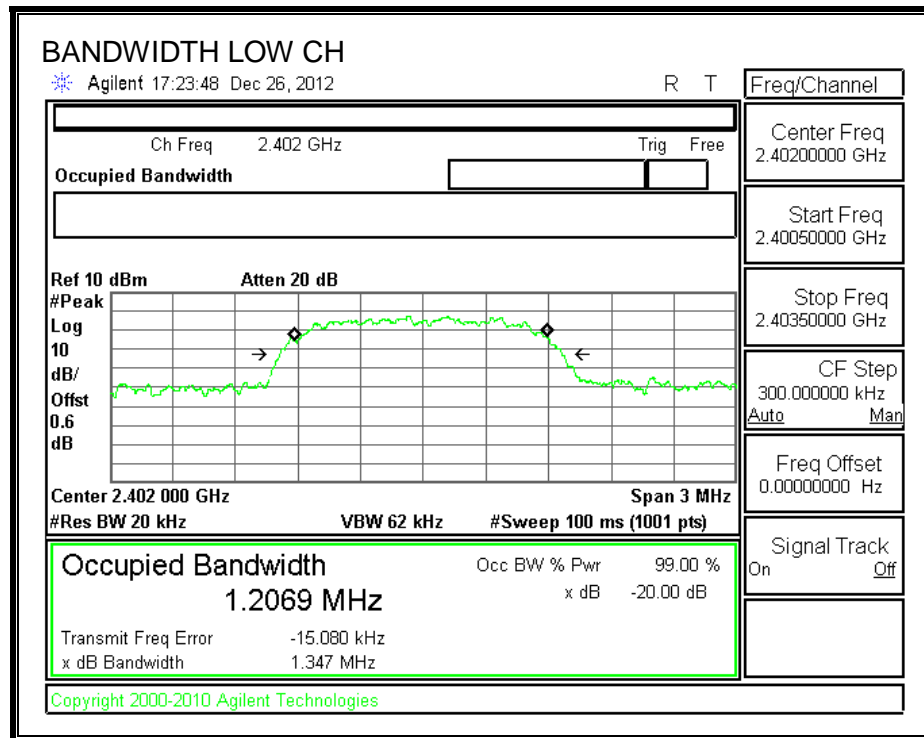
#### TEST PROCEDURE

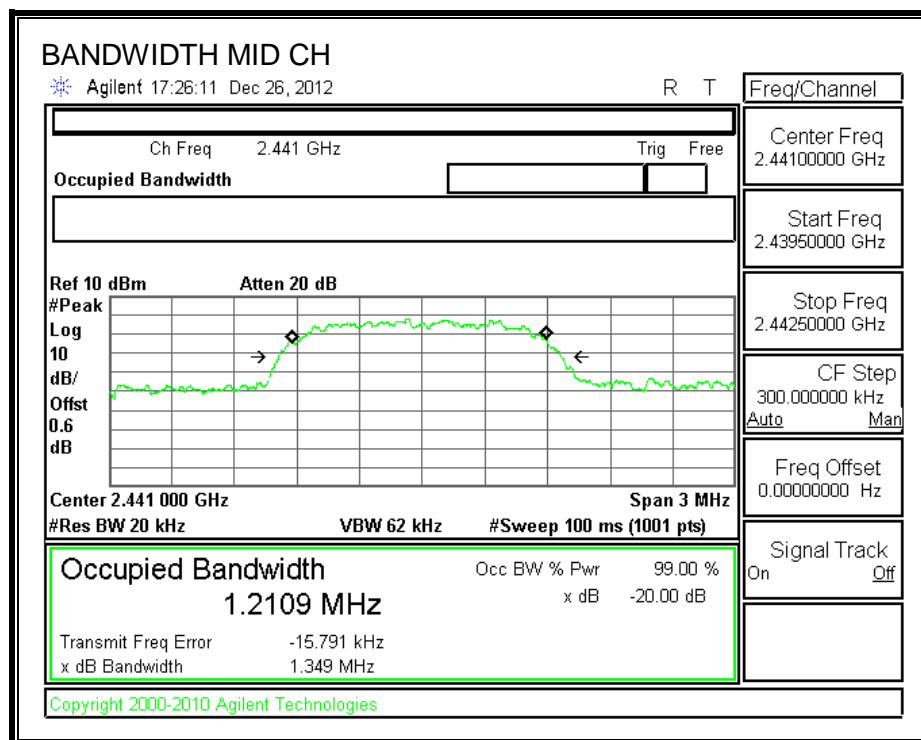
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### RESULTS

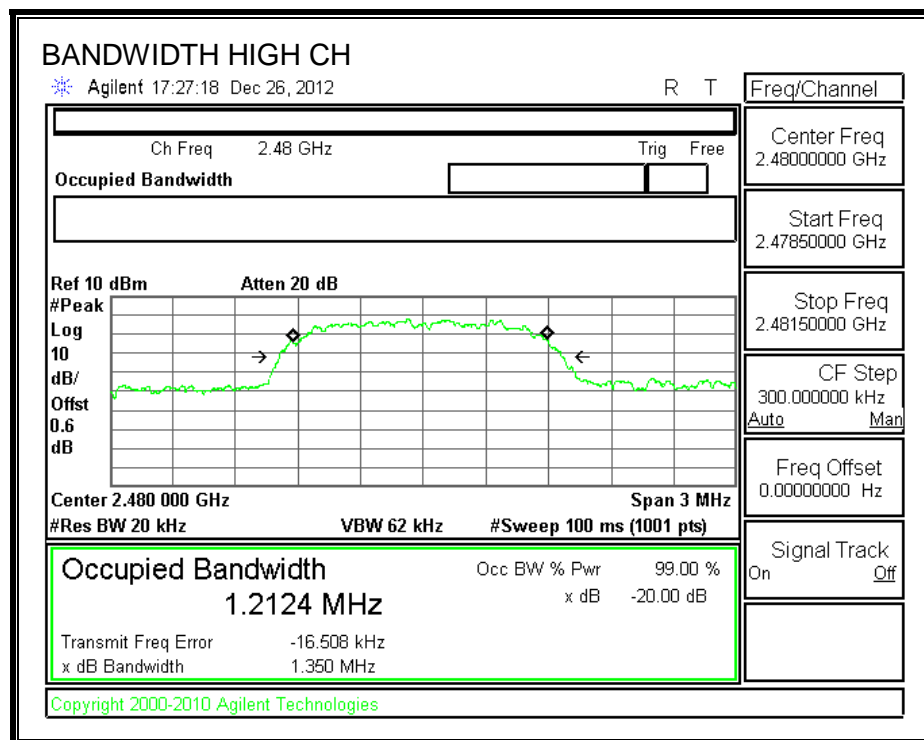
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.347	1.2183
Middle	2441	1.349	1.1955
High	2480	1.350	1.2074

## 20 dB BANDWIDTH

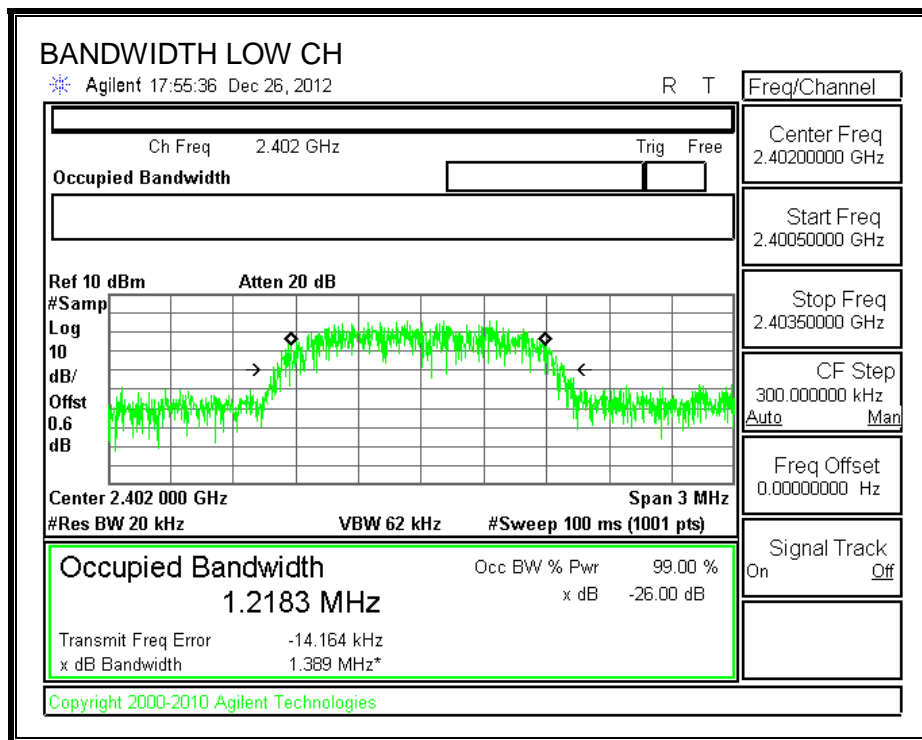


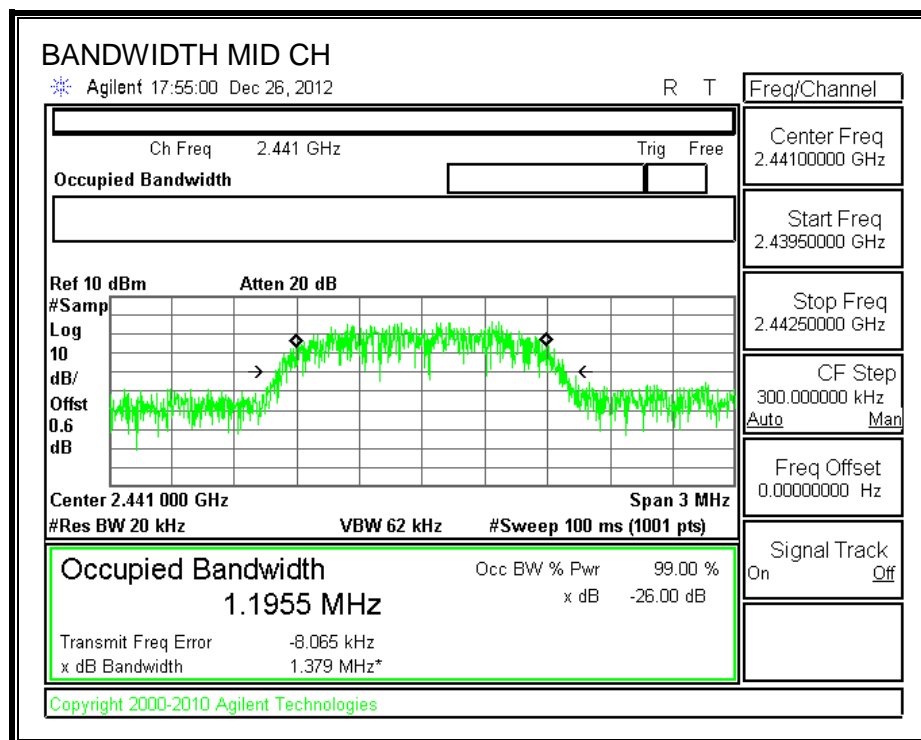


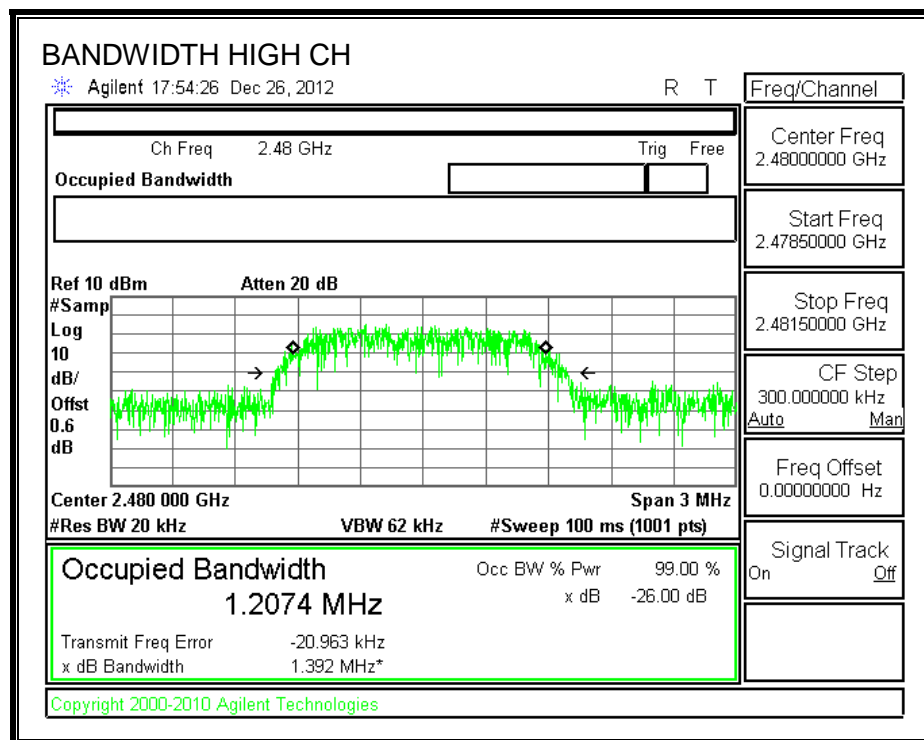




**99% BANDWIDTH**







## 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 hopping channel, whichever is greater.

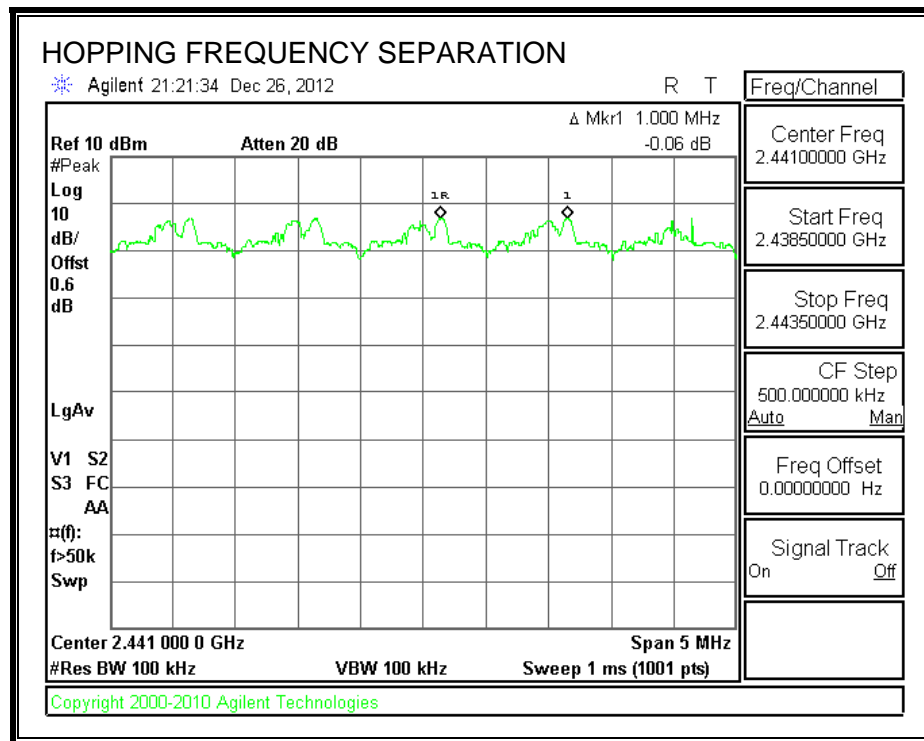
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

### TEST PROCEDURE

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

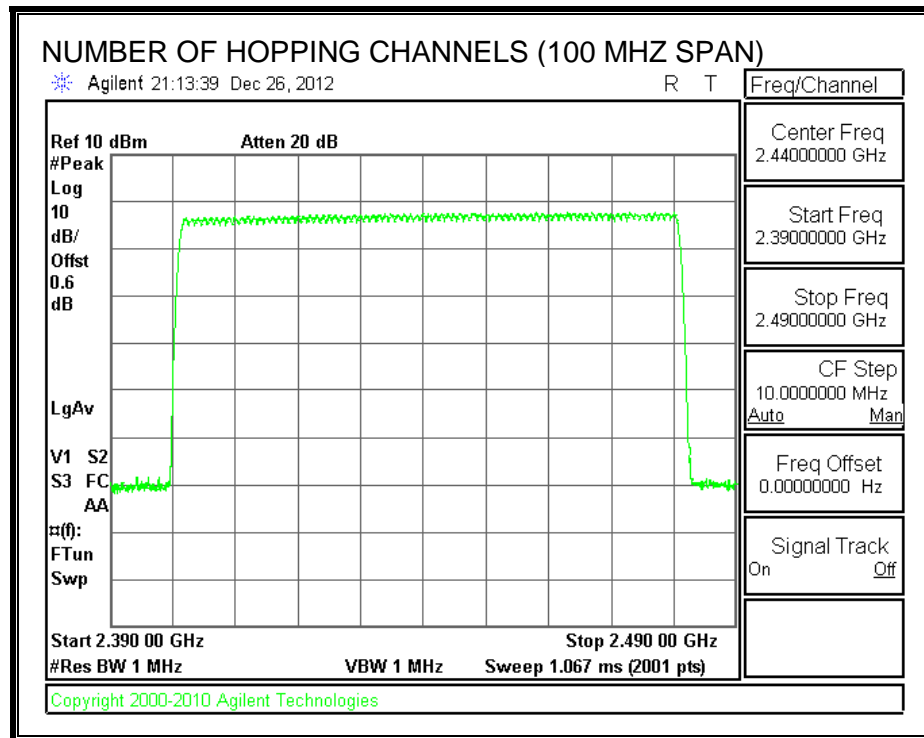
#### **TEST PROCEDURE**

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.

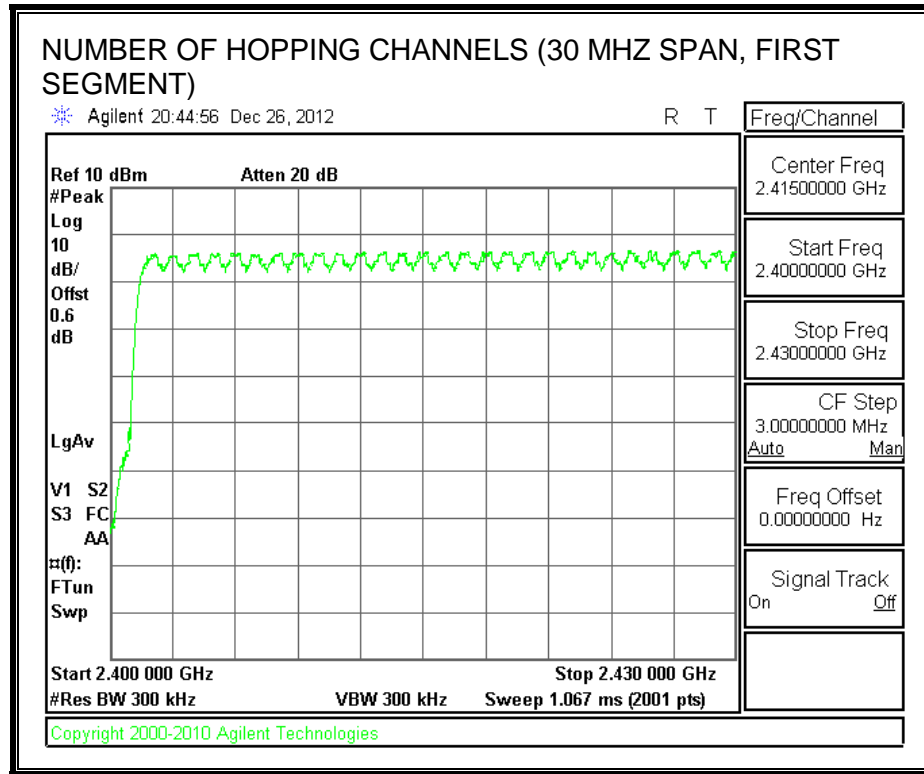
#### **RESULTS**

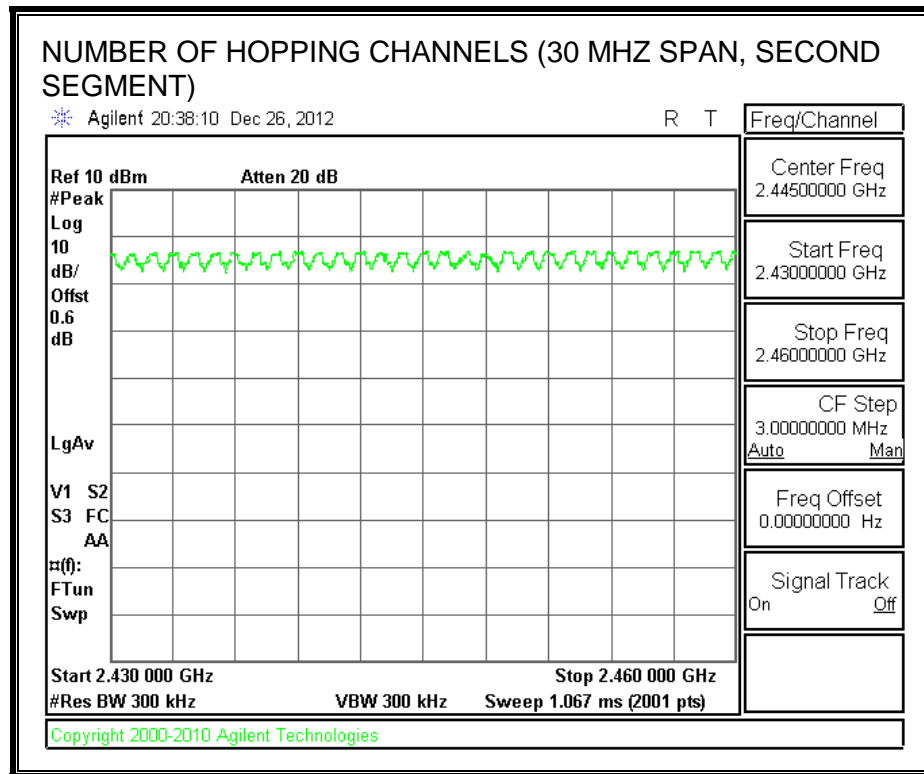
Normal Mode: 79 Channels observed.

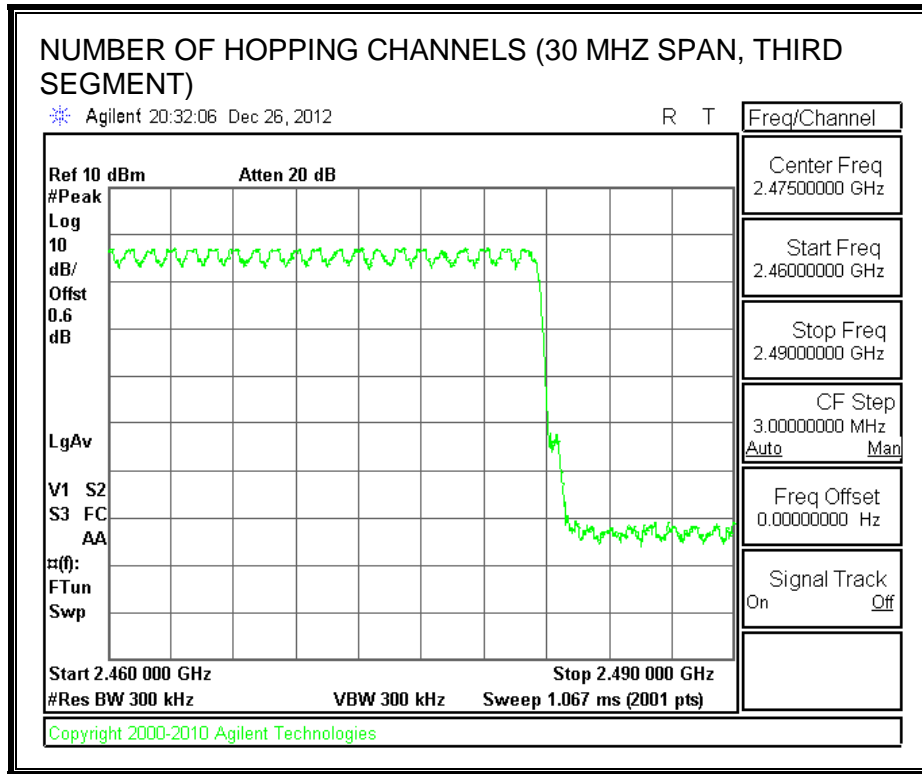
**NUMBER OF HOPPING CHANNELS**











## 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

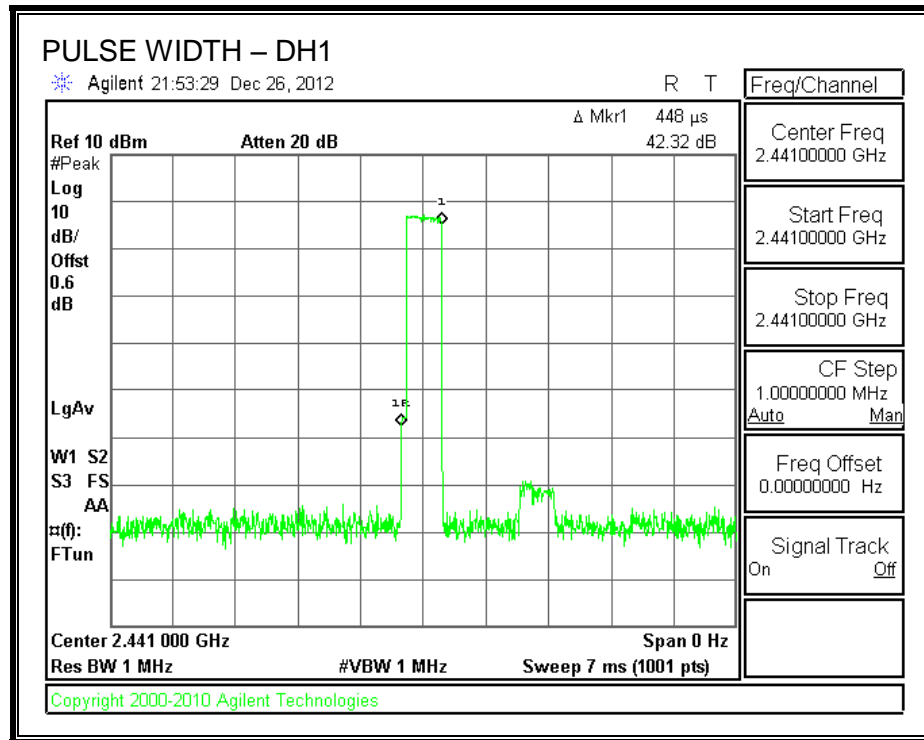
Time Of Occupancy =  $10 * xx \text{ pulses} * yy \text{ msec} = zz \text{ msec}$

#### 8PSK (EDR) Mode

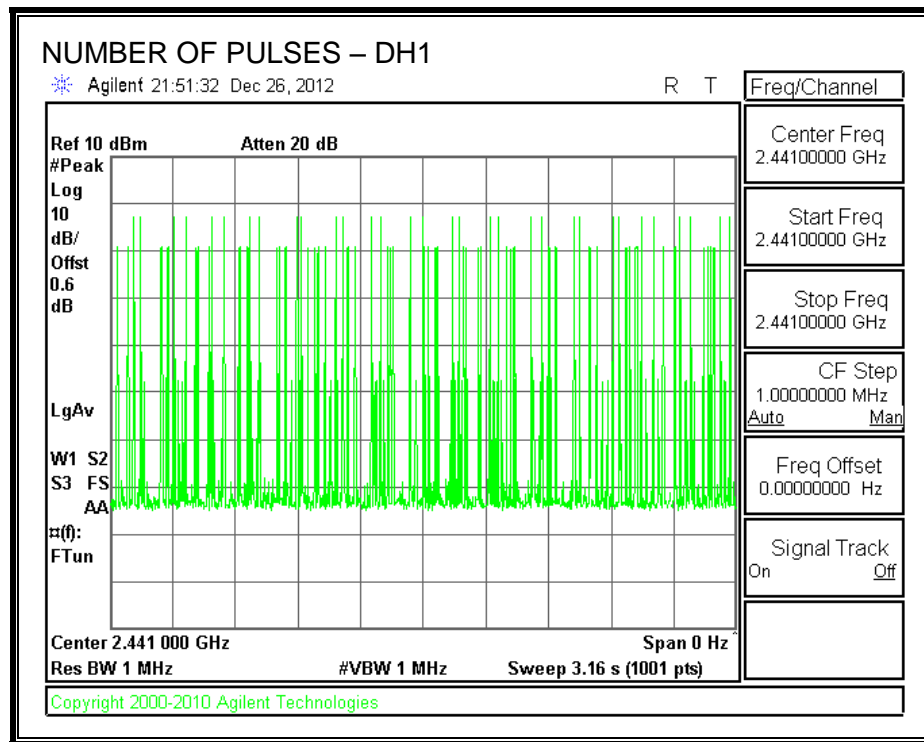
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.448	32	0.143	0.4	-0.257
DH3	1.701	22	0.374	0.4	-0.026
DH5	2.954	8	0.236	0.4	-0.164

**Note:** for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate in section 7.1.4 demonstrates compliance with channel occupancy when AFH is employed.

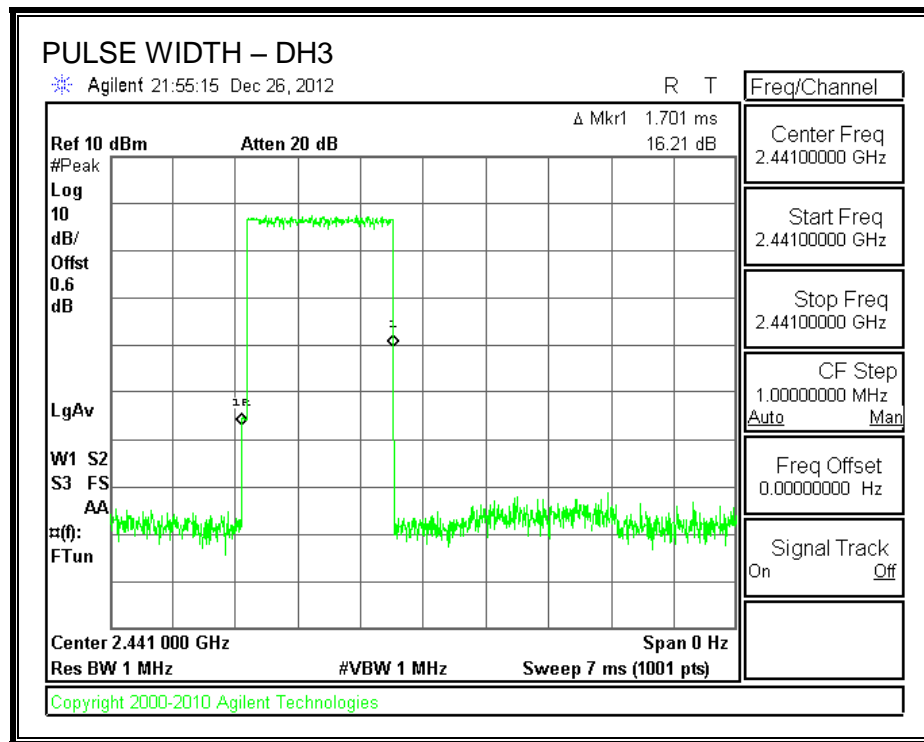
**PULSE WIDTH - DH1**



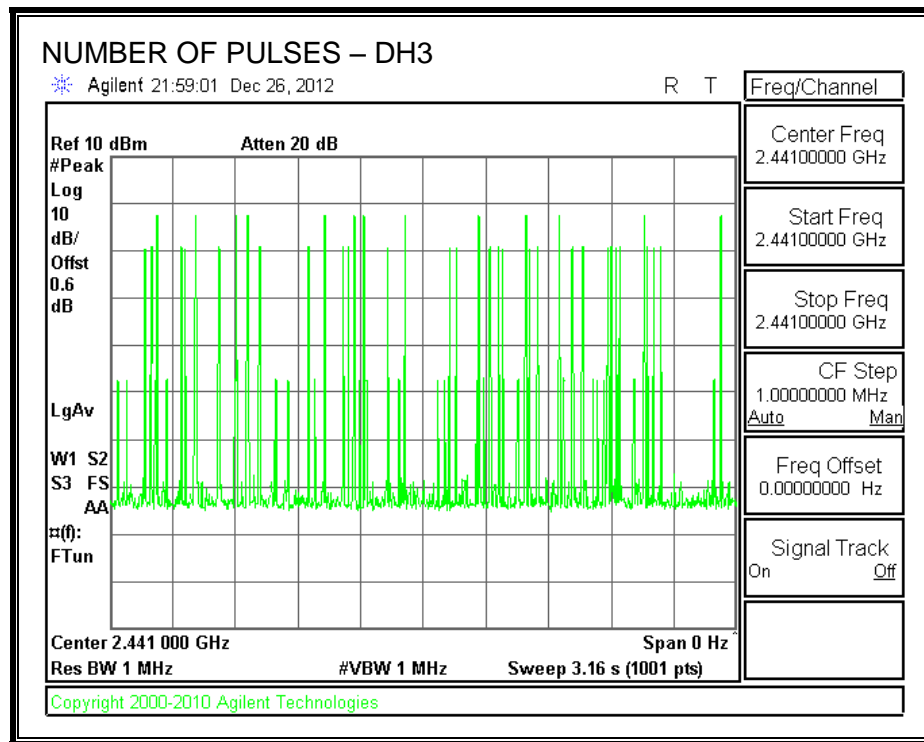
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1**



### PULSE WIDTH – DH3

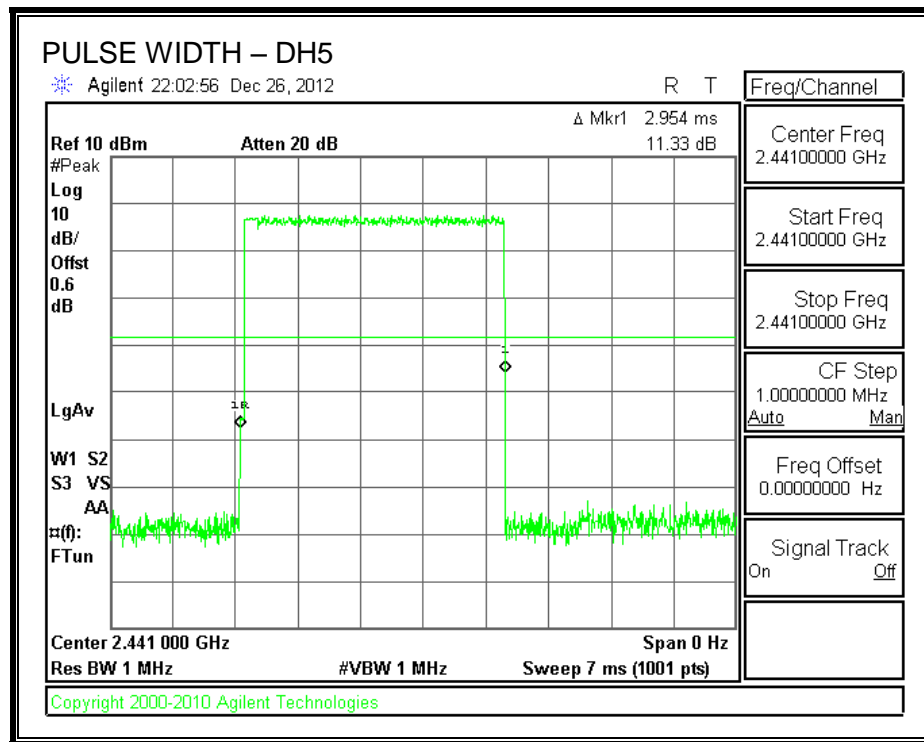


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**

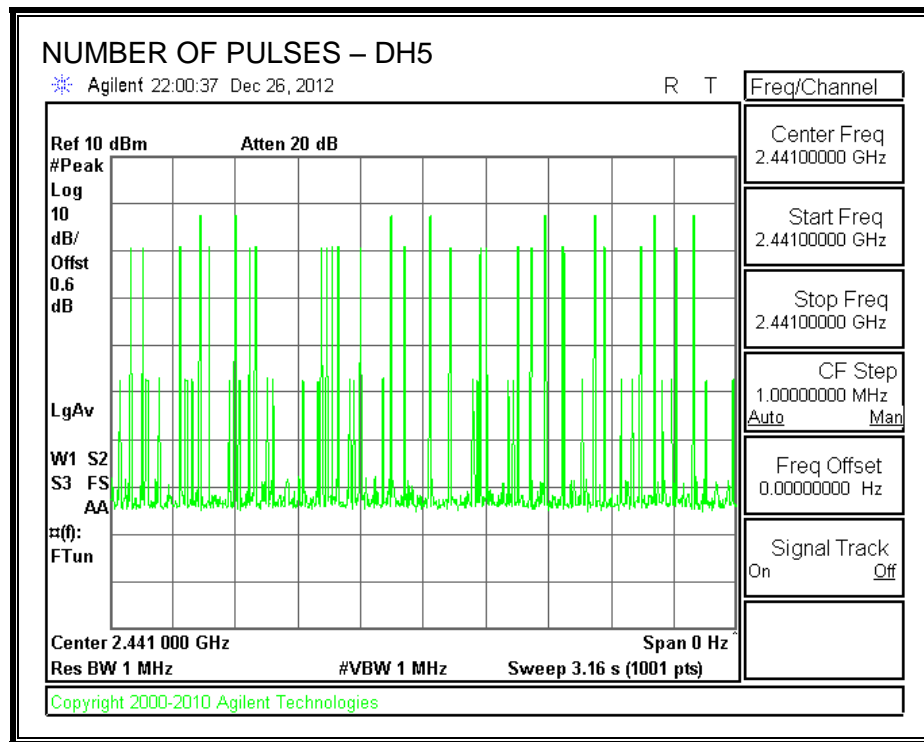




## PULSE WIDTH – DH5



**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5**



## 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 20.97 dBm.

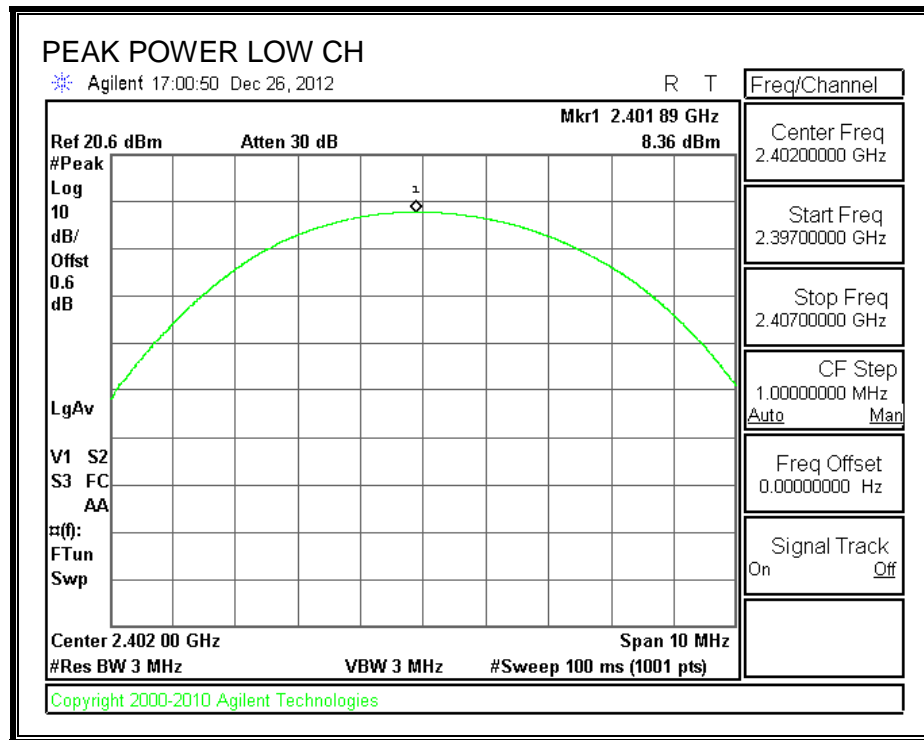
### TEST PROCEDURE

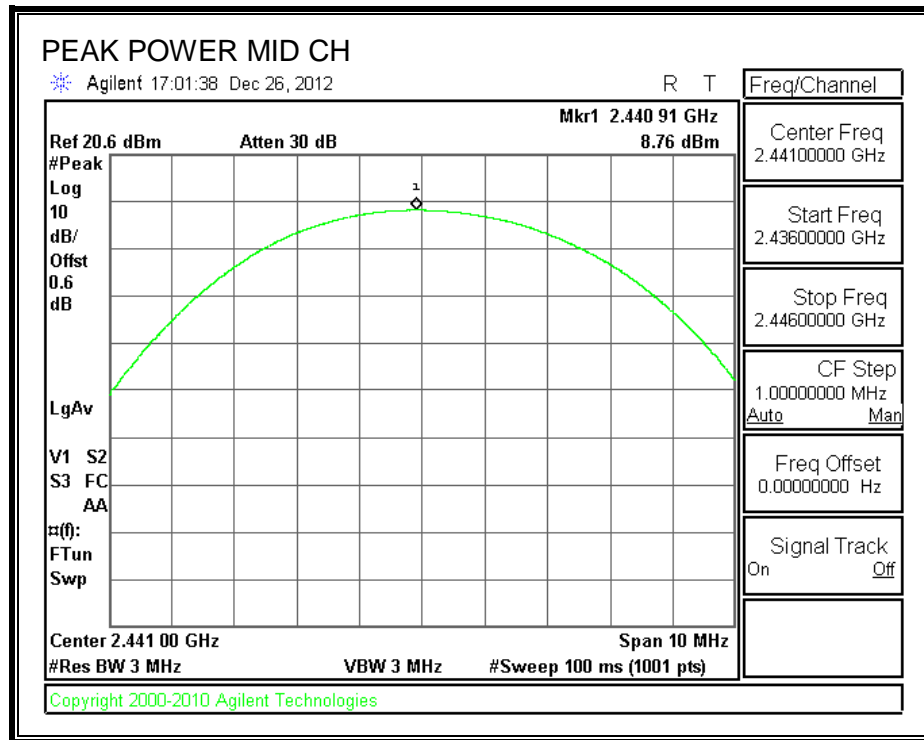
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

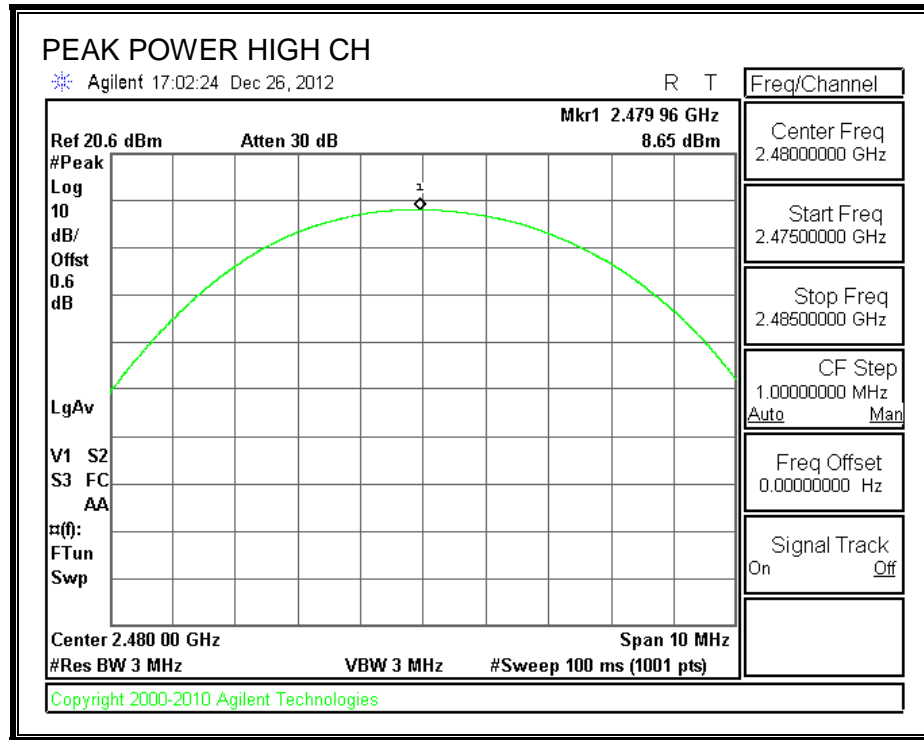
### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.36	20.97	-12.61
Middle	2441	8.76	20.97	-12.21
High	2480	8.65	20.97	-12.32

## OUTPUT POWER







## 7.2.6. AVERAGE POWER

### LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

The cable assembly insertion loss of 10.6 dB (including 10 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.12
Middle	2441	5.68
High	2480	5.65

## **7.2.7. 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.

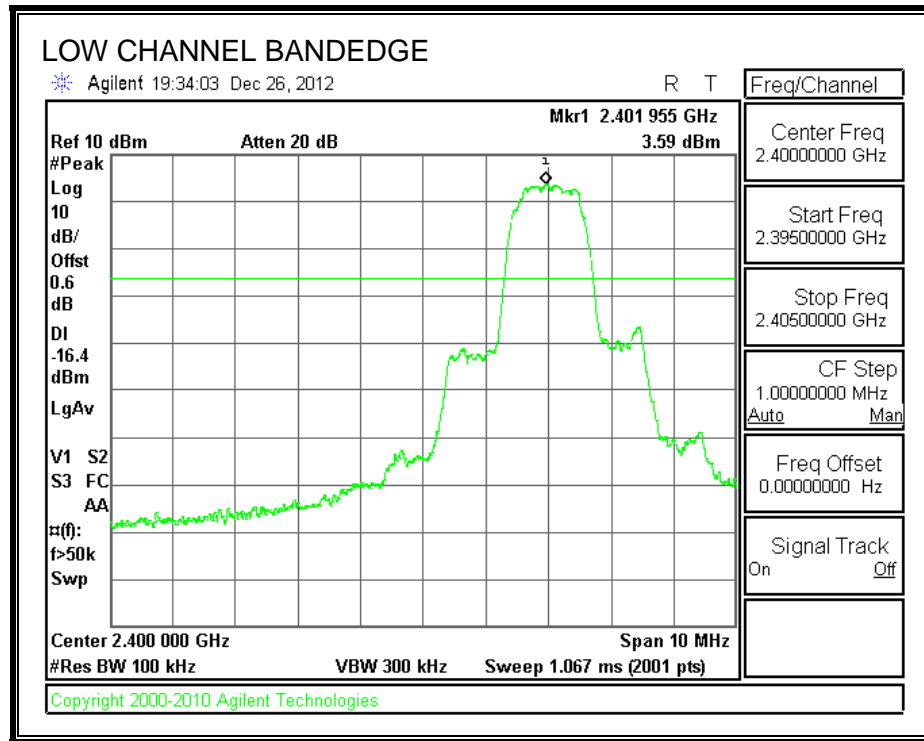
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

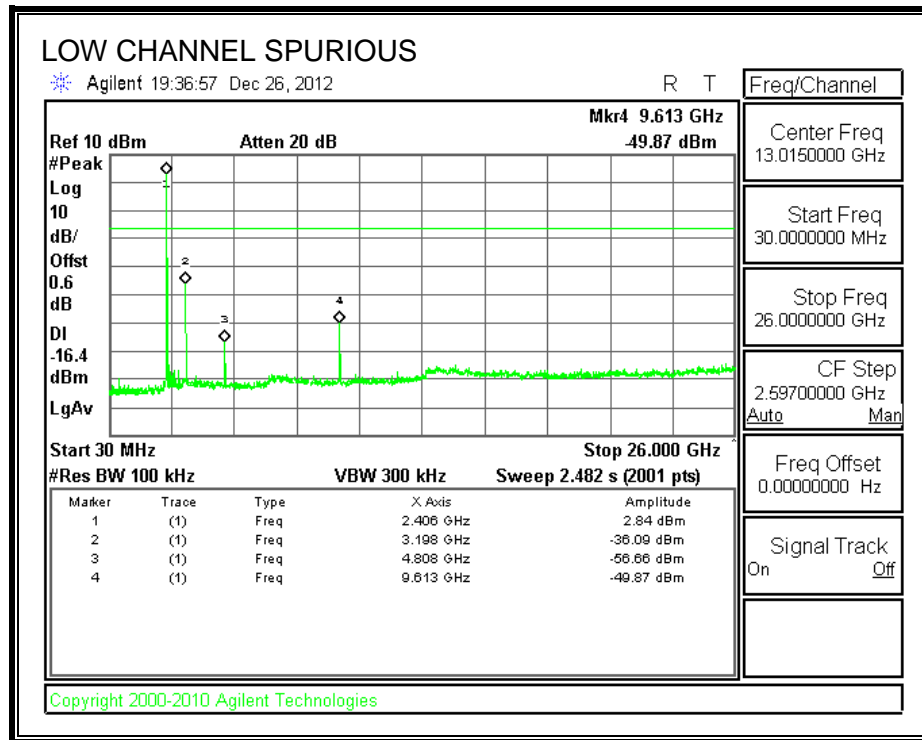
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.



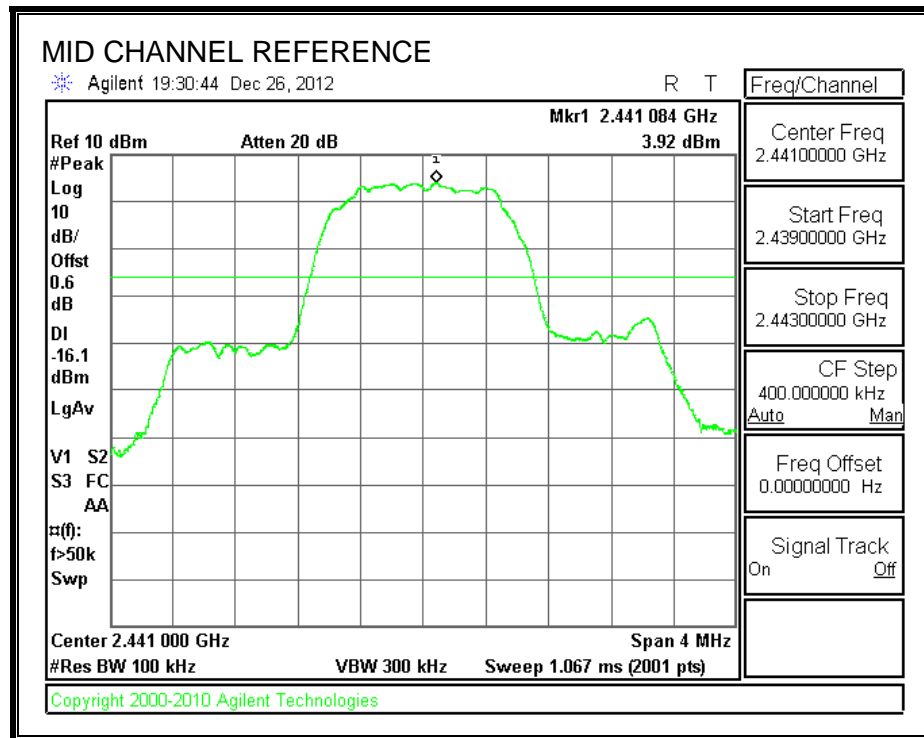
## RESULTS

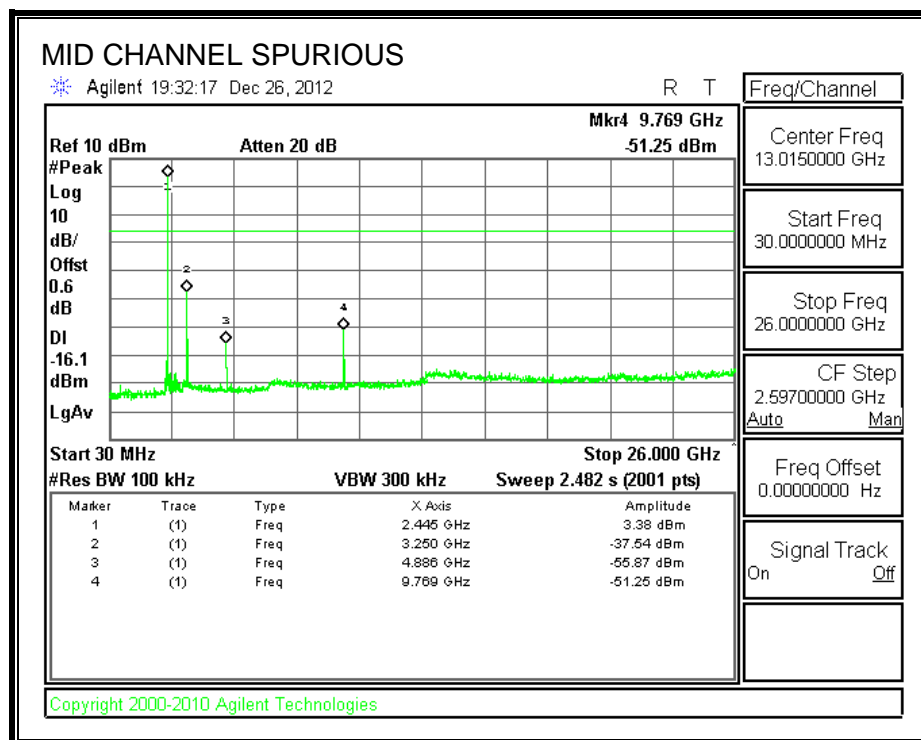
### SPURIOUS EMISSIONS, LOW CHANNEL



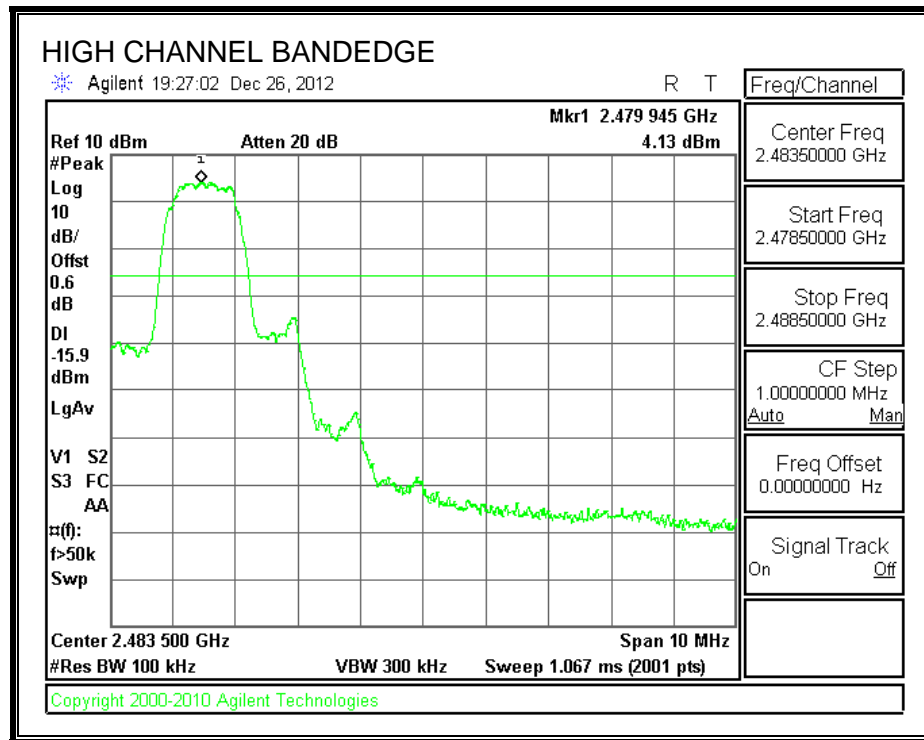


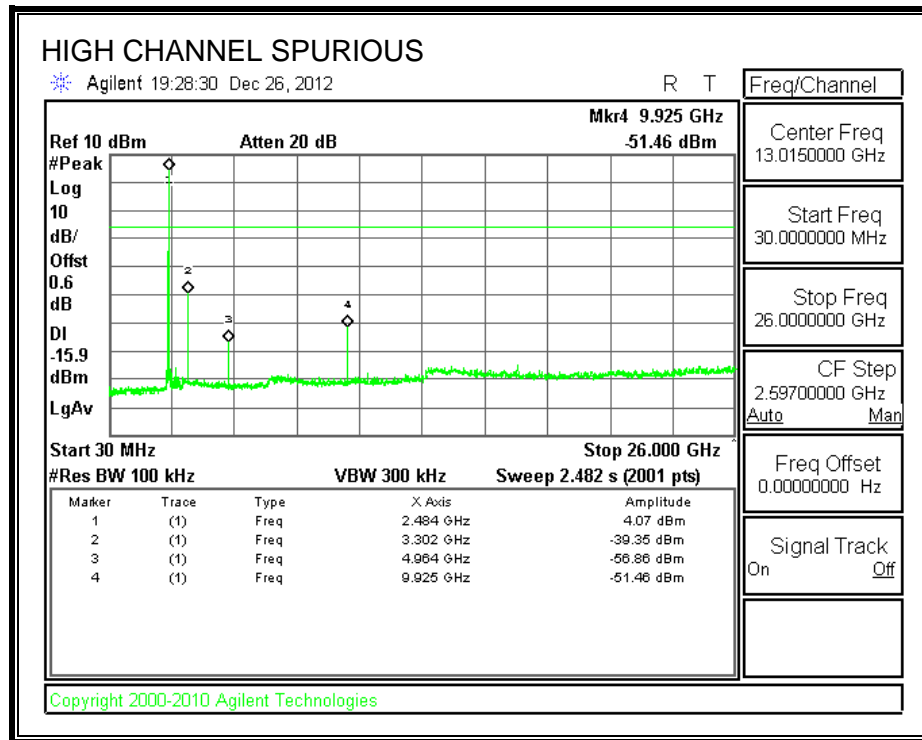
**SPURIOUS EMISSIONS, MID CHANNEL**



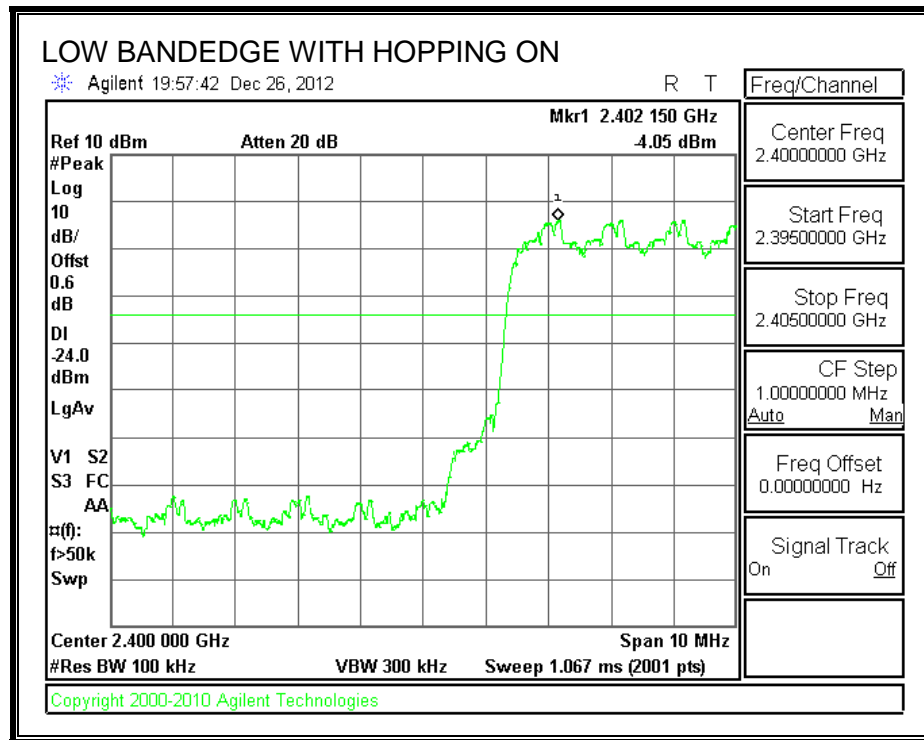


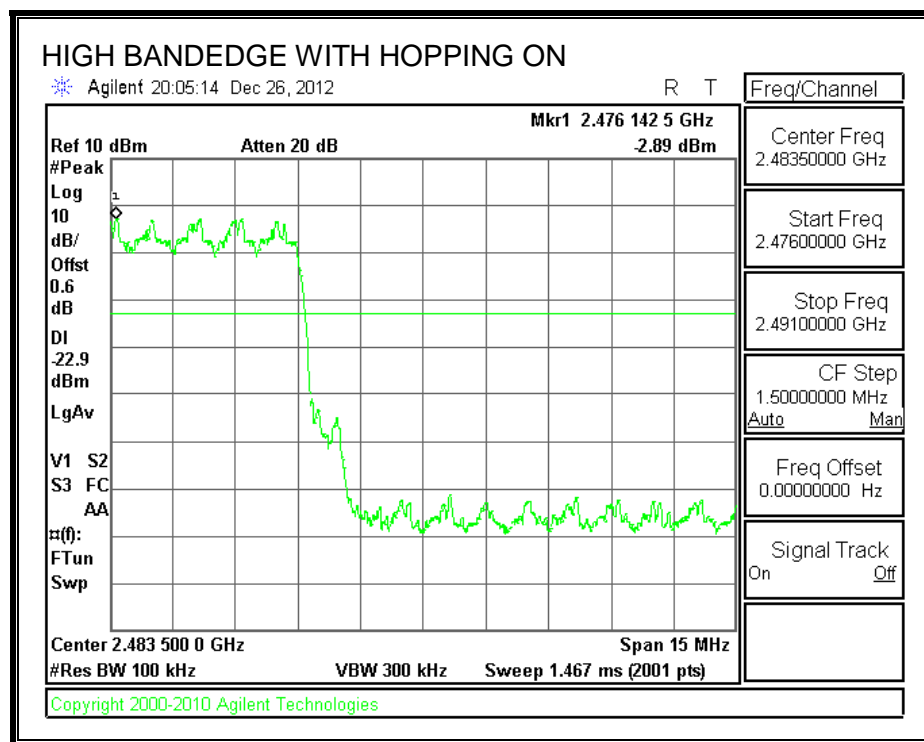
**SPURIOUS EMISSIONS, HIGH CHANNEL**





**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.

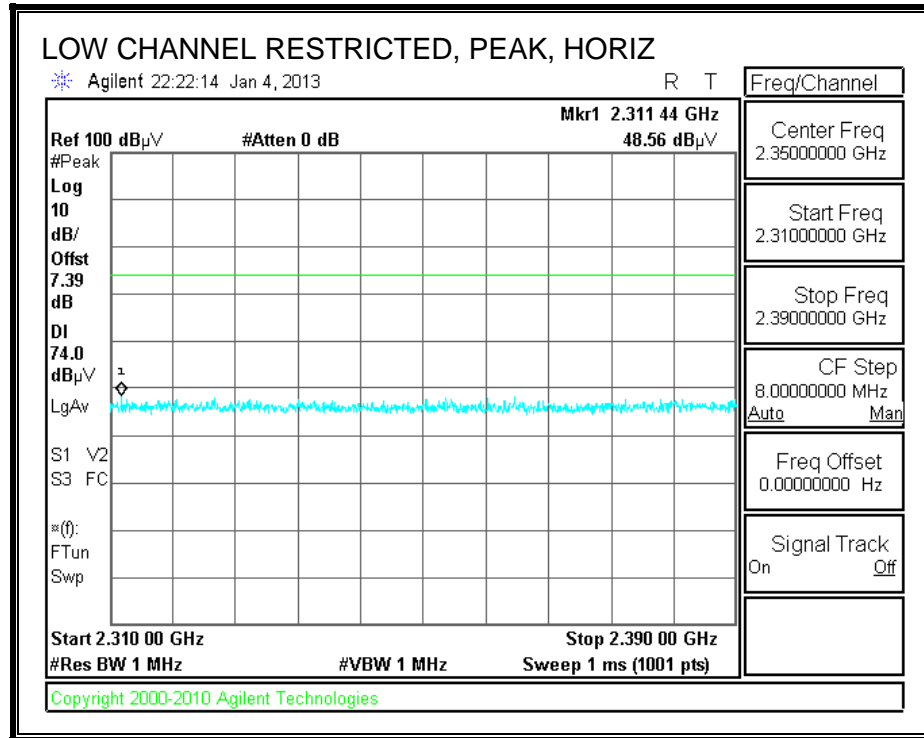
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

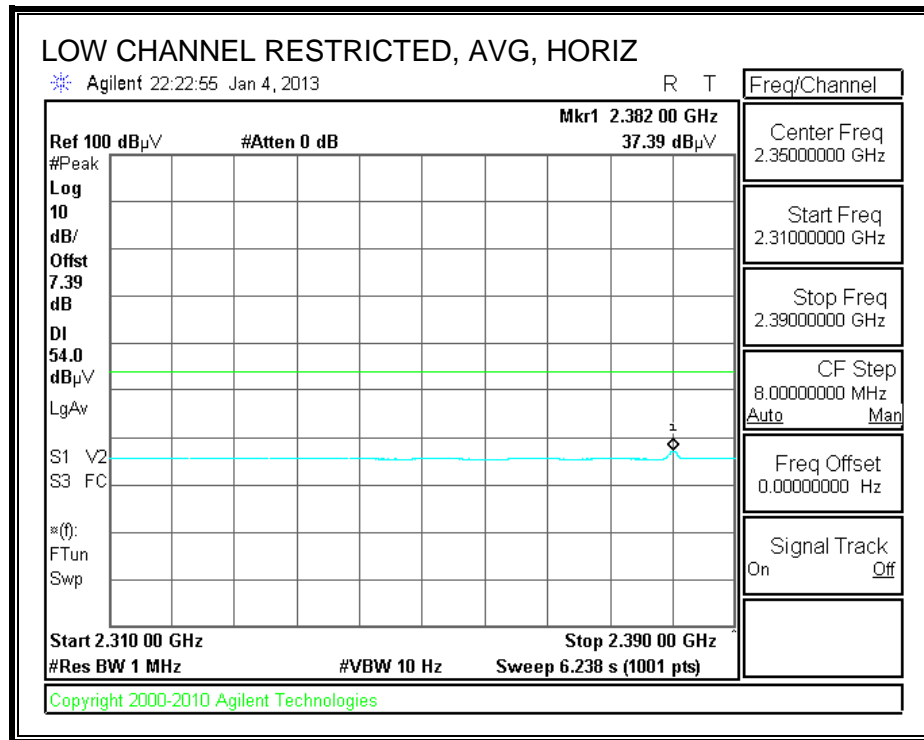
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 8.2. TRANSMITTER ABOVE 1 GHz

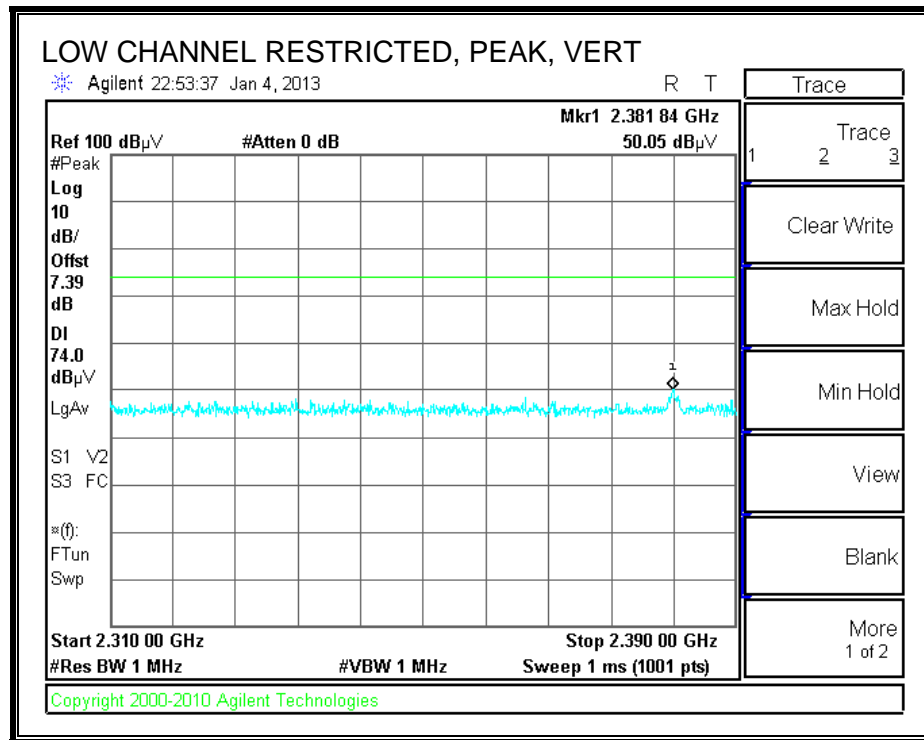
### 8.2.1. BASIC DATA RATE GFSK MODULATION

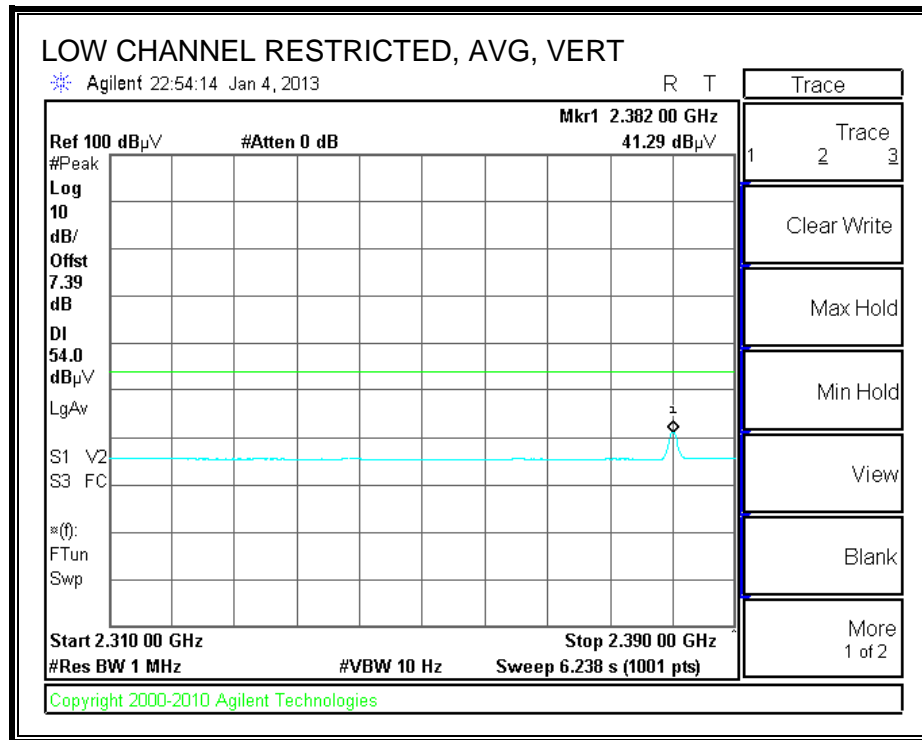
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



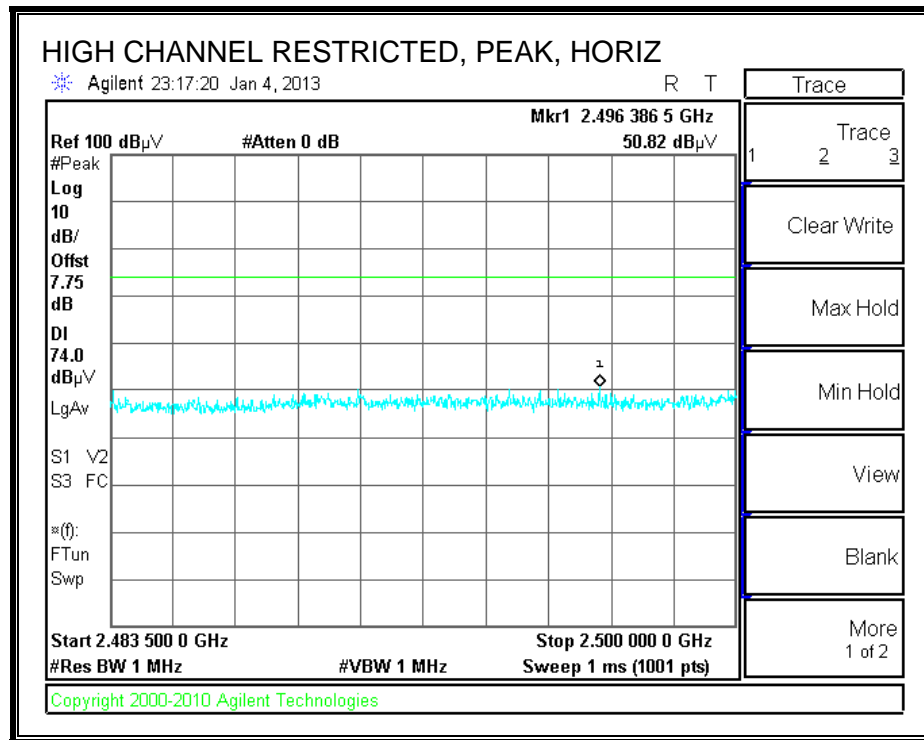


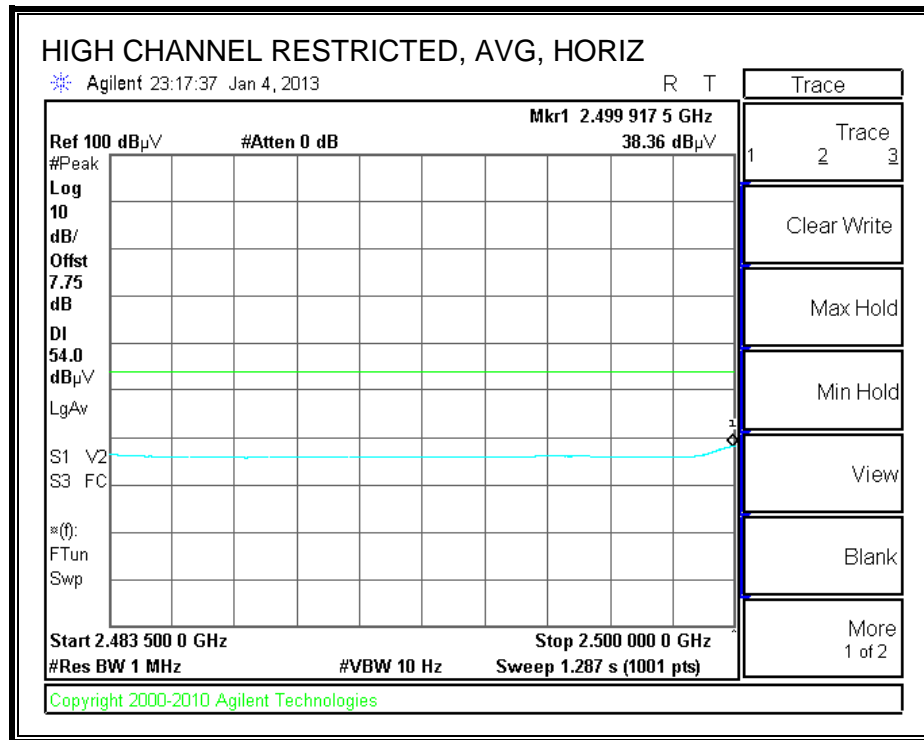
**RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)**



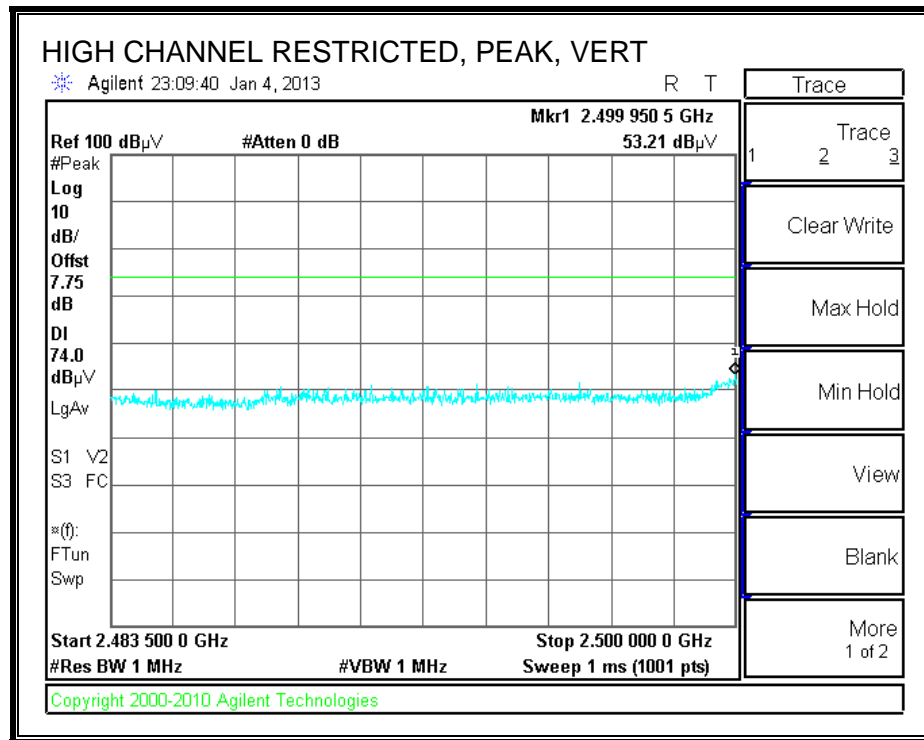


**RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)**

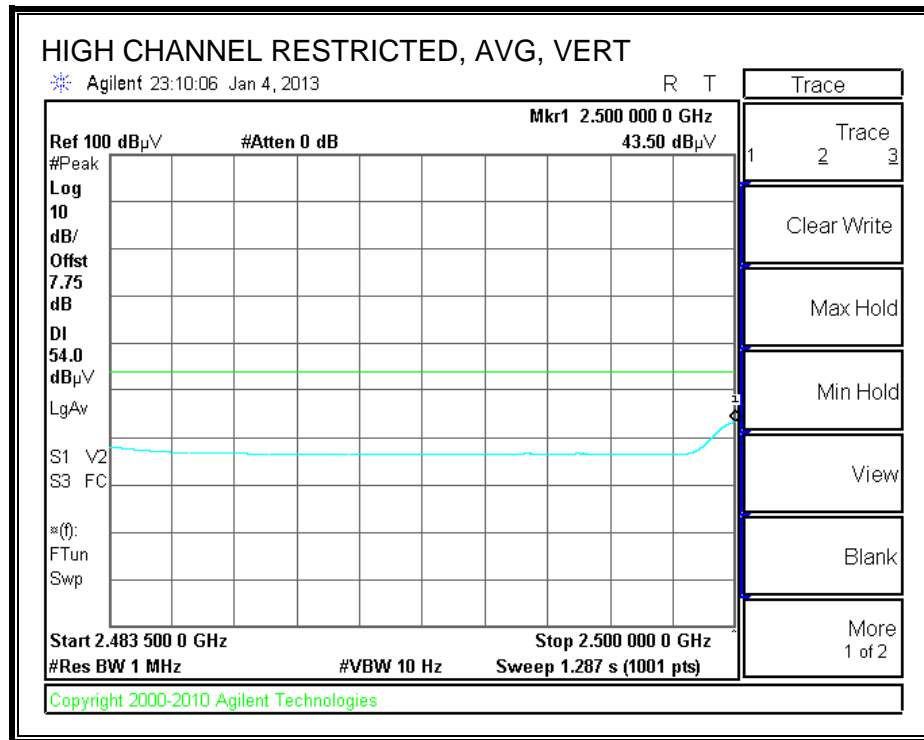




**RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)**







## HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 3m Chamber

**Company:** BROADCOM

**Project #:** 12U14665

**Date:** 1/4/2013

**Test Engineer:** MENGISTU MEKURIA

**Configuration:** EUT WITH SUPPORT LAPTOP AND EXTERNAL ANTENNA

**Mode:** TX MODE, GFSK

**Test Equipment:**

**Horn 1-18GHz**  
 T73; S/N: 6717 @3m

**Pre-amplifier 1-26GHz**  
 T144 Miteq 3008A00931

**Pre-amplifier 26-40GHz**  
 T88 Miteq 26-40GHz

**Horn > 18GHz**  
 T39; ARA 18-26GHz; S/N:1013

**Limit**  
 FCC 15.209

Hi Frequency Cables  

**3' cable 22807700**  
 3' cable 22807700

**12' cable 22807600**  
 12' cable 22807600

**20' cable 22807500**  
 20' cable 22807500

**HPF**  
 [ ]

**Reject Filter**  
 R\_001

**Peak Measurements**  
RBW=VBW=1MHz

**Average Measurements**  
RBW=1MHz ; VBW=10Hz

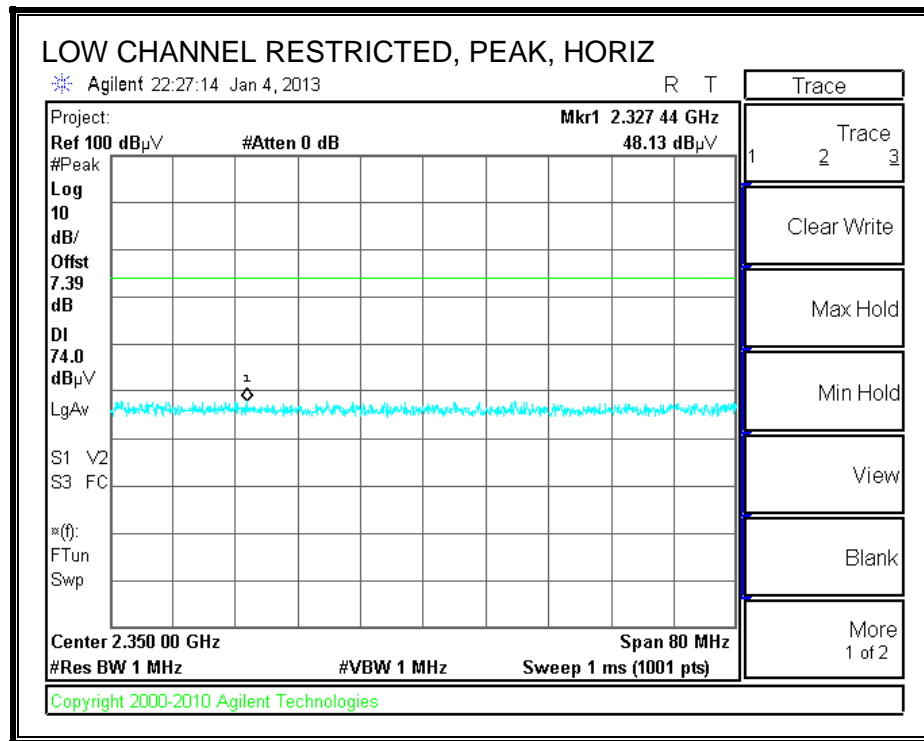
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Channel (2402 MHz)</b>															
4.804	3.0	41.8	34.3	33.4	6.8	-35.5	0.0	0.0	46.4	39.0	74	54	-27.6	-15.0	V
4.804	3.0	41.8	34.9	33.4	6.8	-35.5	0.0	0.0	46.5	39.5	74	54	-27.5	-14.5	H
<b>Mid Channel (2441 MHz)</b>															
4.882	3.0	39.9	32.6	33.5	6.8	-35.5	0.0	0.0	44.7	37.4	74	54	-29.3	-16.6	V
7.323	3.0	36.9	23.9	35.7	9.1	-35.4	0.0	0.0	46.3	33.3	74	54	-27.7	-20.7	V
4.882	3.0	41.6	34.2	33.5	6.8	-35.5	0.0	0.0	46.4	39.0	74	54	-27.6	-15.0	H
7.323	3.0	37.0	24.7	35.7	9.1	-35.4	0.0	0.0	46.4	34.1	74	54	-27.6	-19.9	H
<b>High Channel (2480 MHz)</b>															
4.960	3.0	39.9	32.1	33.6	6.9	-35.5	0.0	0.0	44.9	37.0	74	54	-29.1	-17.0	V
7.440	3.0	37.0	24.8	35.9	9.1	-35.5	0.0	0.0	46.5	34.4	74	54	-27.5	-19.6	V
4.960	3.0	41.1	31.0	33.6	6.9	-35.5	0.0	0.0	46.0	36.0	74	54	-28.0	-18.0	H
7.440	3.0	38.0	26.2	35.9	9.1	-35.5	0.0	0.0	47.6	35.7	74	54	-26.4	-18.3	H

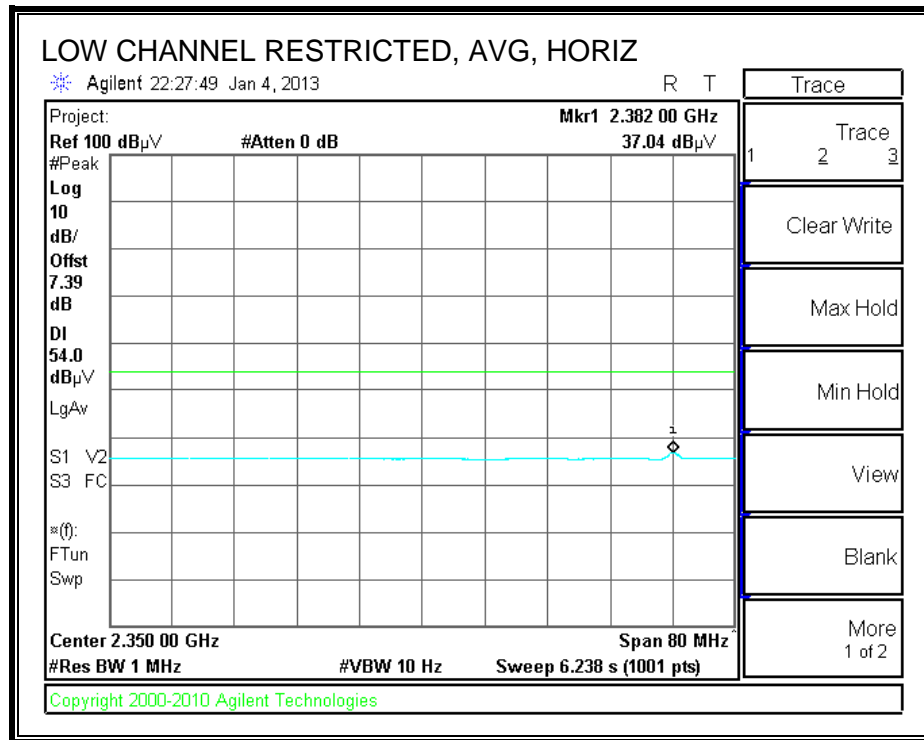
Rev. 11.10.11

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		

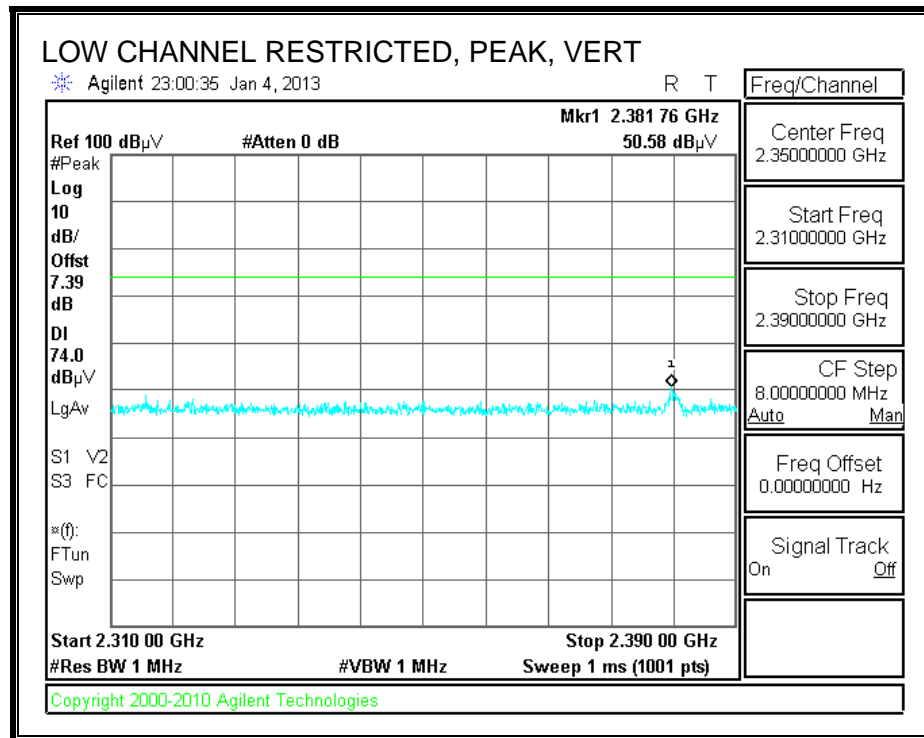
## 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

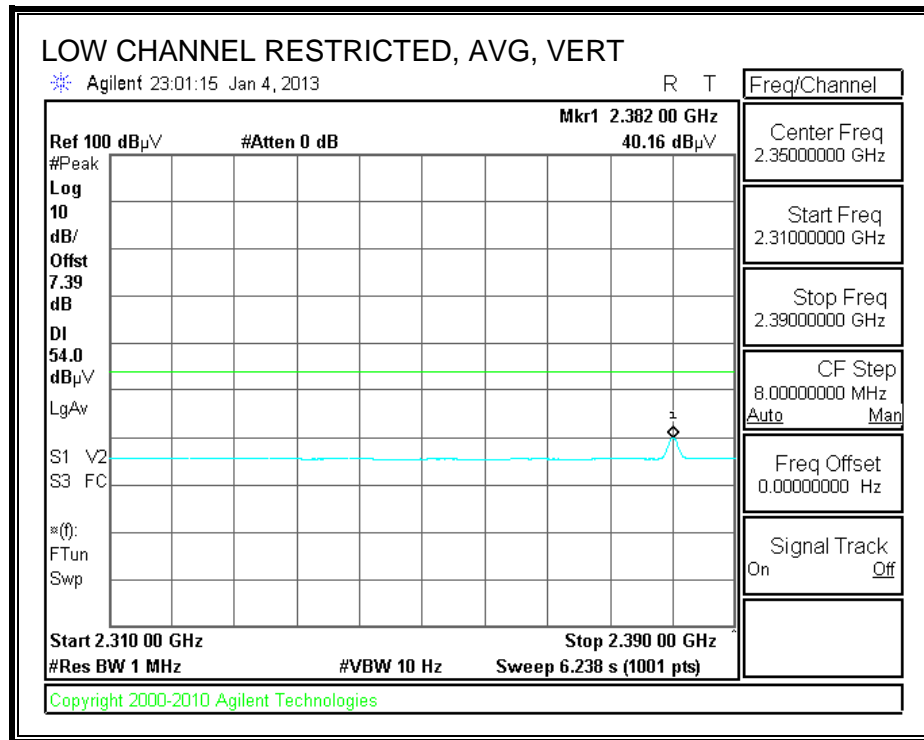
### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



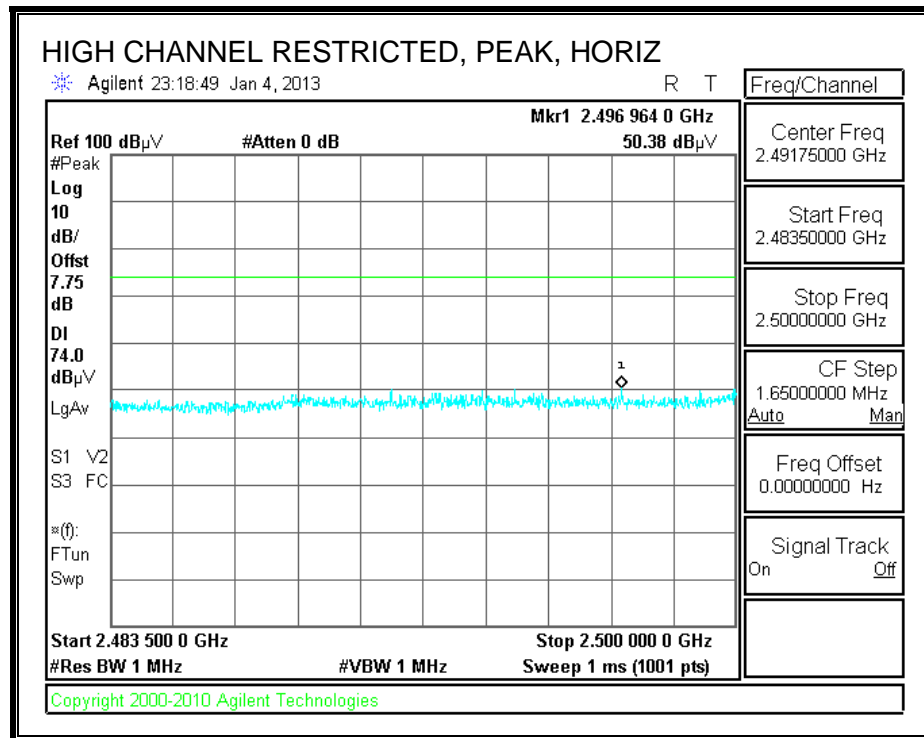


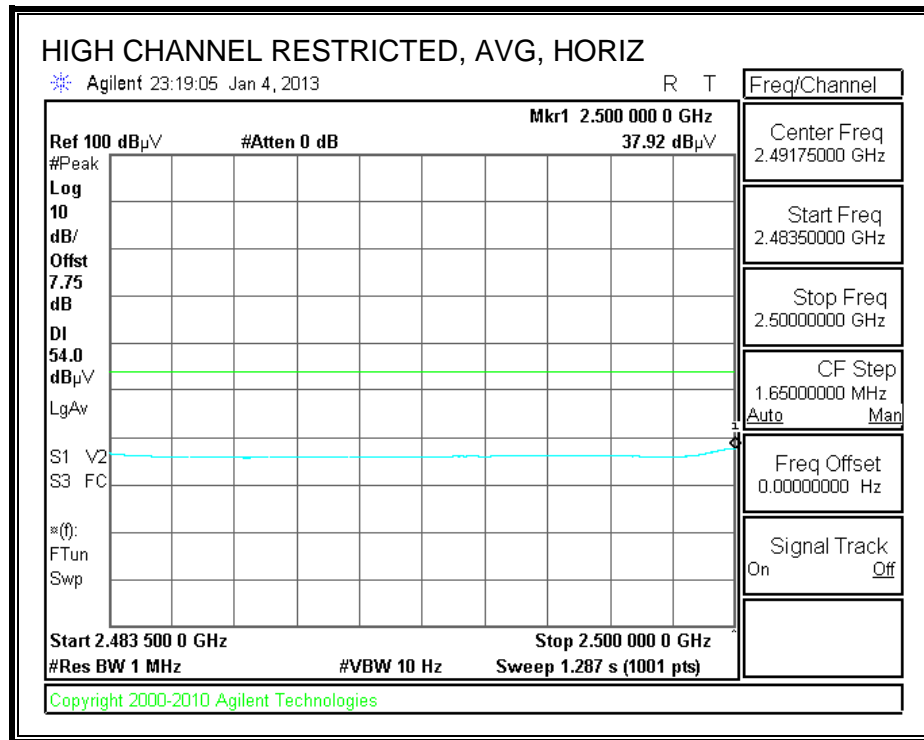
**RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)**





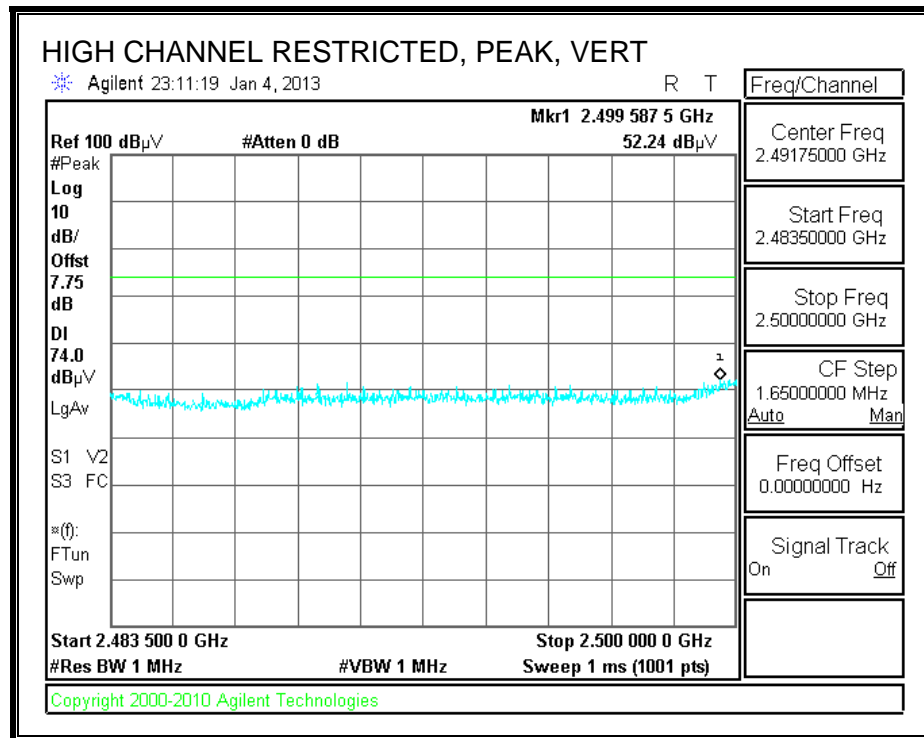
**RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)**

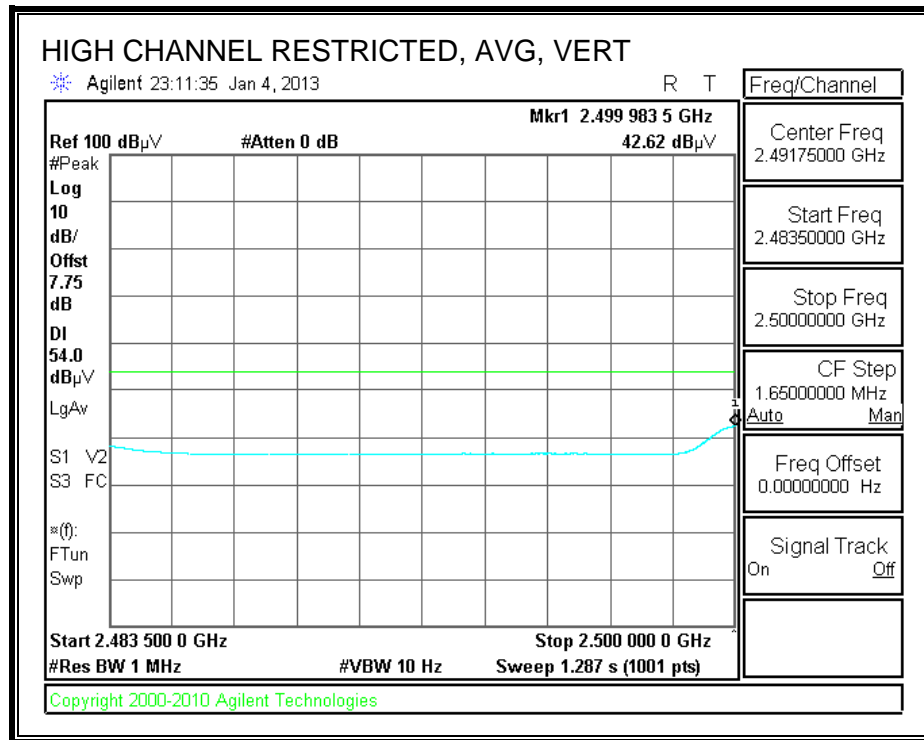






**RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)**





## HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 3m Chamber															
Company:		BROADCOM													
Project #:		12U14665													
Date:		1/4/2013													
Test Engineer:		MENGISTU MEKURIA													
Configuration:		EUT WITH SUPPORT LAPTOP AND EXTERNAL ANTENNA													
Mode:		TX MODE, 8PSK													
<b>Test Equipment:</b>															
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit			
T59; S/N: 3245 @3m			T144 Miteq 3008A00931			T88 Miteq 26-40GHz			T39; ARA 18-26GHz; S/N:1013			FCC 15.209			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			
3' cable 22807700			12' cable 22807600			20' cable 22807500						R_001			
<div style="display: flex; justify-content: space-between;"> <div> <b>Peak Measurements</b> RBW=VBW=1MHz <b>Average Measurements</b> RBW=1MHz ; VBW=10Hz </div> </div>															
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Low Channel (2402 MHz)</b>															
4.804	3.0	40.2	30.7	33.1	6.8	-35.5	0.0	0.0	44.5	35.0	74	54	-29.5	-19.0	V
4.804	3.0	41.0	31.5	33.1	6.8	-35.5	0.0	0.0	45.3	35.8	74	54	-28.7	-18.2	H
<b>Mid Channel (2441 MHz)</b>															
4.882	3.0	39.9	29.3	33.1	6.8	-35.5	0.0	0.0	44.4	33.7	74	54	-29.6	-20.3	V
7.323	3.0	36.1	23.7	35.8	9.1	-35.4	0.0	0.0	45.6	33.2	74	54	-28.4	-20.8	V
4.882	3.0	41.0	30.7	33.1	6.8	-35.5	0.0	0.0	45.4	35.2	74	54	-28.6	-18.8	H
7.323	3.0	36.5	24.0	35.8	9.1	-35.4	0.0	0.0	46.0	33.5	74	54	-28.0	-20.5	H
<b>High Channel (2480 MHz)</b>															
4.960	3.0	39.7	28.9	33.2	6.9	-35.5	0.0	0.0	44.3	33.5	74	54	-29.7	-20.5	V
7.440	3.0	36.5	24.1	36.0	9.1	-35.5	0.0	0.0	46.1	33.8	74	54	-27.9	-20.2	V
4.960	3.0	39.6	28.6	33.2	6.9	-35.5	0.0	0.0	44.2	33.2	74	54	-29.8	-20.8	H
7.440	3.0	38.2	25.8	36.0	9.1	-35.5	0.0	0.0	47.9	35.5	74	54	-26.1	-18.5	H
Rev. 11.10.11															
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											

### 8.3. WORST-CASE BELOW 1 GHz

#### HORIZONTAL AND VERTICAL DATA

Project No:12U14669										
Client Name:Broadcom										
Model / Device:BCM94360CD										
Config / Other:EUT With Support Board & Laptop										
Test By:M. Mekuria										
Horizontal 30 - 1000MHz										
Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
1	32.7138	47.11	PK	-27.6	19.2	38.71	40	-1.29	100	Horz
2	102.3042	57.38	PK	-26.9	10.9	41.38	43.5	-2.12	100	Horz
3	215.8973	55.88	PK	-26.2	10.5	40.18	43.5	-3.32	100	Horz
4	481.8525	50.35	PK	-25	17.3	42.65	46	-3.35	100	Horz
Vertical 30 - 1000MHz										
Marker No.	Test Frequency	Meter Reading	Detector	25MHz-1GHz ChmbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
5	36.0092	37.91	PK	-27.5	16.9	27.31	40	-12.69	400	Vert
6	100.7534	51.7	PK	-26.9	10.4	35.2	43.5	-8.3	300	Vert
7	167.8237	47.87	PK	-26.4	11.7	33.17	43.5	-10.33	200	Vert
8	234.8941	53.7	PK	-26	11.2	38.9	46	-7.1	100	Vert

## 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.

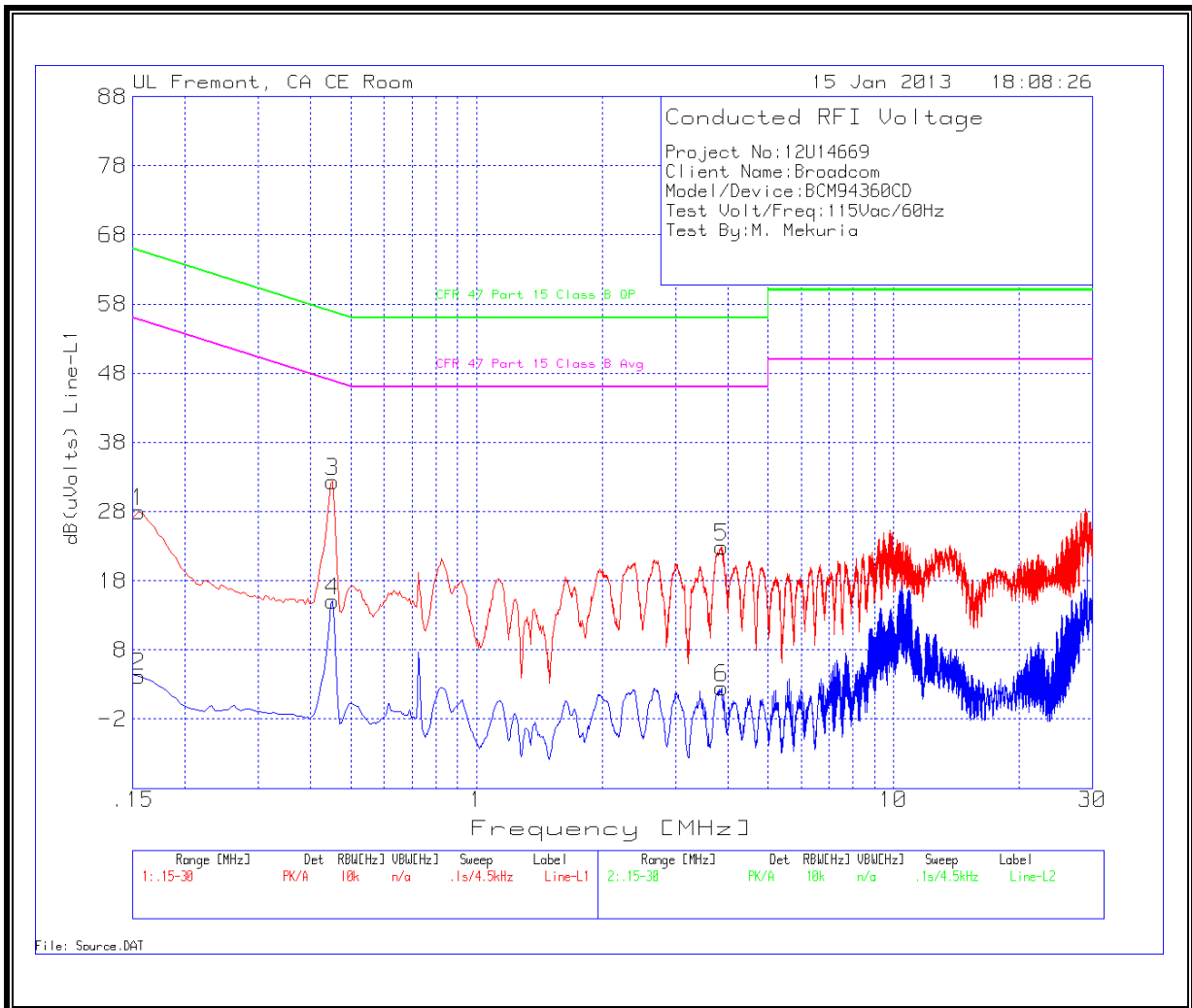
Line conducted data is recorded for both NEUTRAL and HOT lines.

## RESULTS

### 6 WORST EMISSIONS

Project No:12U14669									
Client Name:Broadcom									
Model/Device:BCM94360CD									
Test Volt/Freq:115Vac/60Hz									
Test By:M. Mekuria									
Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.1545	27.91	PK	0.1	0	28.01	65.8	-37.79	-	-
0.1545	4.13	Av	0.1	0	4.23	-	-	55.8	-51.57
0.4515	32.2	PK	0.1	0	32.3	56.8	-24.5	-	-
0.4515	15.02	Av	0.1	0	15.12	-	-	46.8	-31.68
3.867	22.7	PK	0.1	0.1	22.9	56	-33.1	-	-
3.867	2.39	Av	0.1	0.1	2.59	-	-	46	-43.41
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L2.TXT (dB)	LC Cables 2&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.1545	27.77	PK	0.1	0	27.87	65.8	-37.93	-	-
0.1545	4.7	Av	0.1	0	4.8	-	-	55.8	-51
0.4515	32	PK	0.1	0	32.1	56.8	-24.7	-	-
0.4515	14.88	Av	0.1	0	14.98	-	-	46.8	-31.82
3.867	23.48	PK	0.1	0.1	23.68	56	-32.32	-	-
3.867	3.14	Av	0.1	0.1	3.34	-	-	46	-42.66

**LINE 1 RESULTS**



**LINE 2 RESULTS**

