



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

**CERTIFICATION TEST REPORT**

**FOR**

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

**MODEL NUMBER: BCM94331CD**

**FCC ID: QDS-BRCM1064  
IC: 4324A-BRCM1064**

**REPORT NUMBER: 12U14227-4, Revision C**

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*Prepared for*

**BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, 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 LAB CODE 200065-0**

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A	06/04/12	Revised sections 5.3, 5.5 and 7.1.4	F. Ibrahim
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C	06/07/12	Revised section 7.1.4	F. Ibrahim

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, USA

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

**MODEL:** BCM94331CD

**SERIAL NUMBER:** C8Y2104004NDRJVE4 (P508)

**DATE TESTED:** MAY 01 - MAY 10, 2012

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

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.

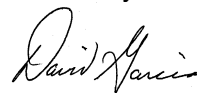
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of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



FRANK IBRAHIM  
EMC SUPERVISOR  
UL CCS

Tested By:



DAVID GARCIA  
EMC ENGINEER  
UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, 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

The EUT is an 802.11a/b/g/n 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	7.90	6.17
2402 - 2480	Enhanced 8PSK	9.12	8.17

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bgn WLAN and Bluetooth antenna with a maximum gain of 4.8dBi.

**Note:** This antenna was connected during radiated emissions testing. Part number is (604-3215)

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom Bluetooth Version 1.5.2

The test utility software used during testing was Bluetool, ver. 1.5.2.8.

### 5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Radiated emission 30-1000 MHz and power line conducted emission were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	G560	CBU4495773	DoC
AC Adapter	Lenovo	ADP-65KH B	11S36001646ZZ10011FKEZ	DoC
Adapter Board	Catalyst	MINI2EXP	JUAN 02	N/A
Adapter Board	Broadcom	BCM94331CSMFG	1458923	N/A

### I/O CABLES

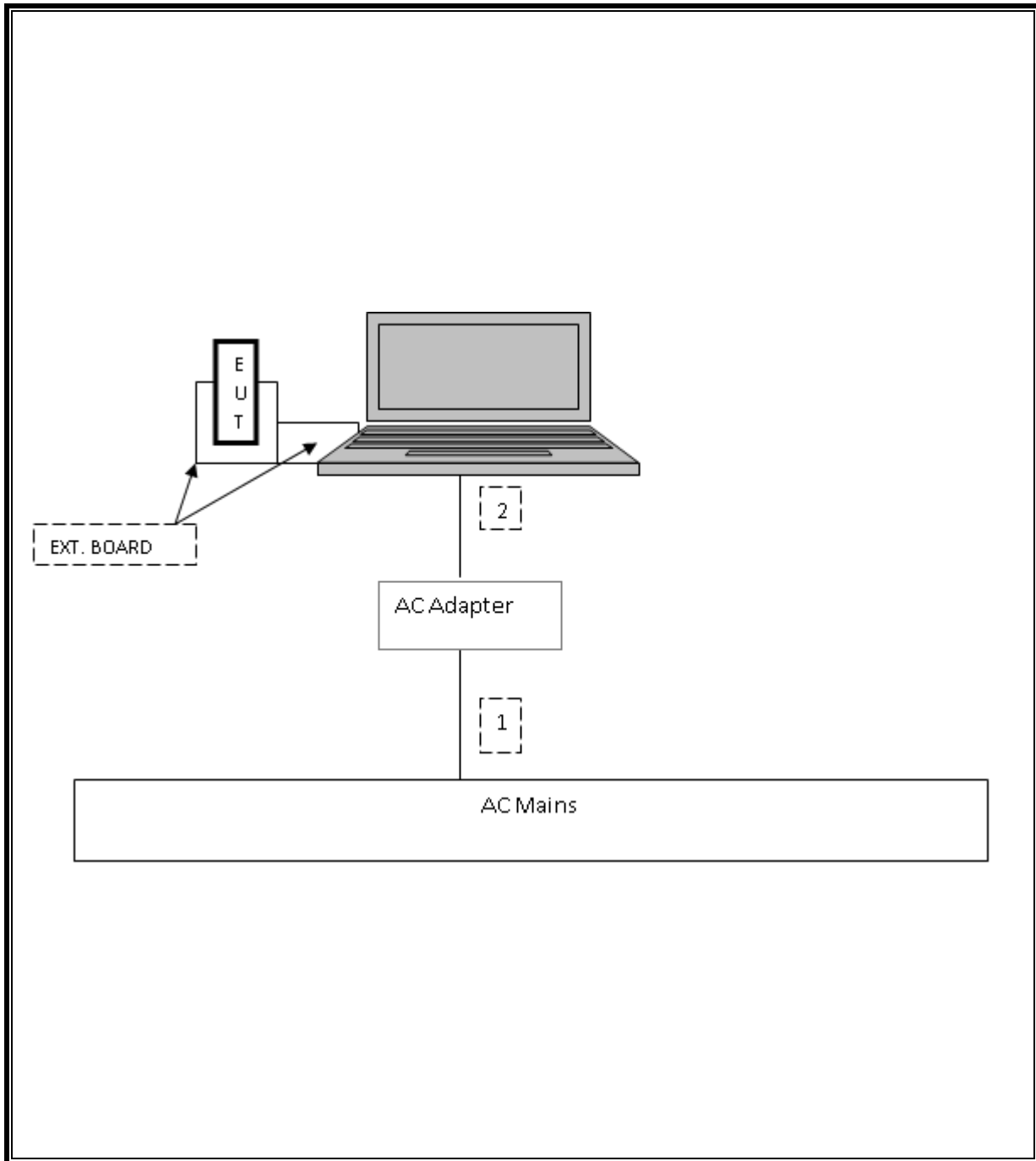
I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US 115V	Un-Shielded	1m	NA
2	DC	1	DC	Un-Shielded	1.8m	Ferrite at laptop's end

### 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 Date	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	09/02/11	09/02/12
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01176	08/04/11	08/04/12
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	1000741	07/06/11	07/06/12
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/19/11	08/19/13
Antenna, Horn, 18 GHz	EMCO	3115	C00872	09/20/11	09/20/12
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	01/26/12	01/26/13
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	07/28/11	07/28/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	07/18/11	07/18/12
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	11/11/11	11/11/12
LISN, 30 MHz	FCC	50/250-25-2	C00626	12/13/11	12/13/12

## 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.

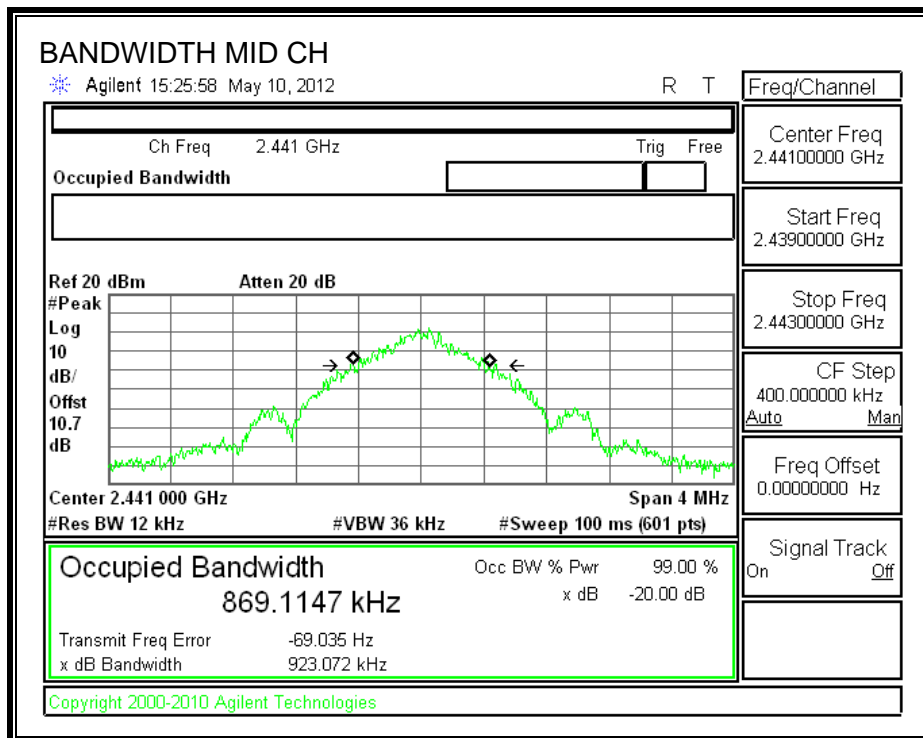
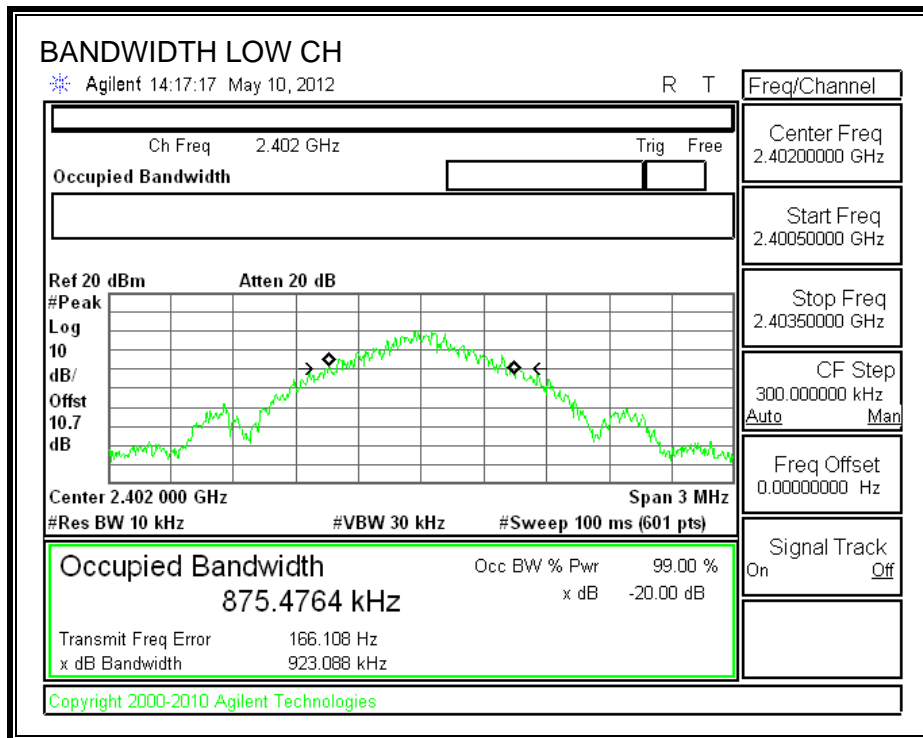
##### TEST PROCEDURE

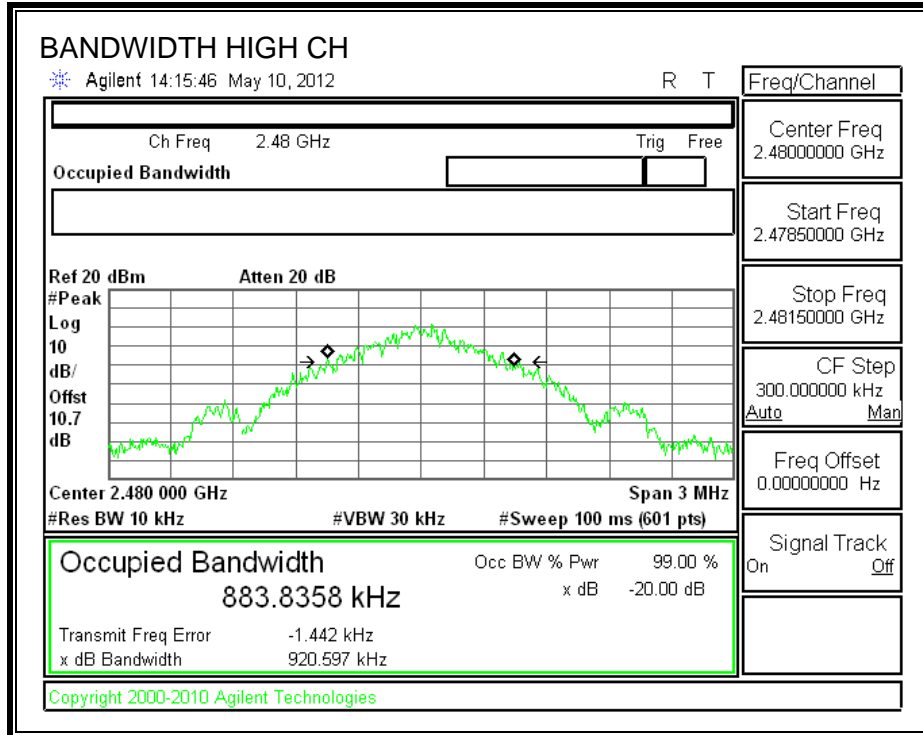
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

##### RESULTS

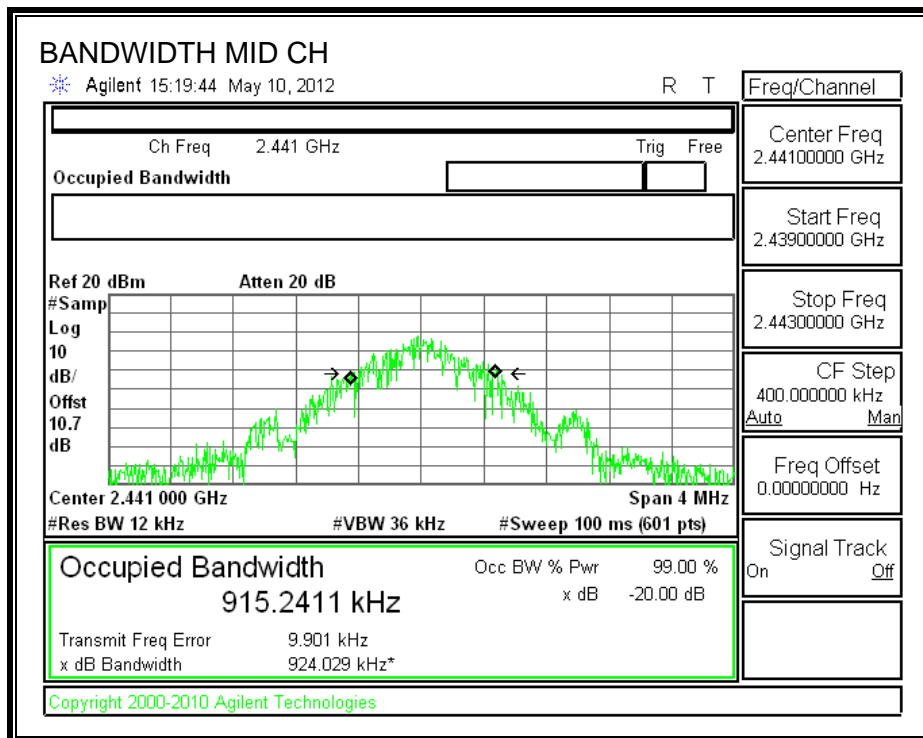
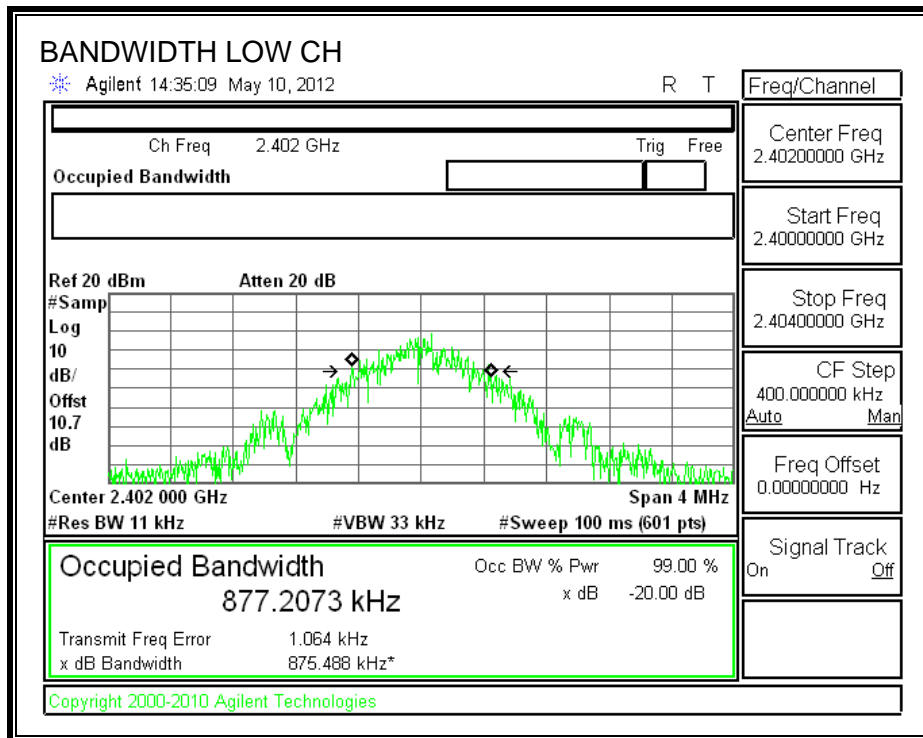
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	923.088	877.2073
Middle	2441	923.072	915.2411
High	2480	920.597	902.4211

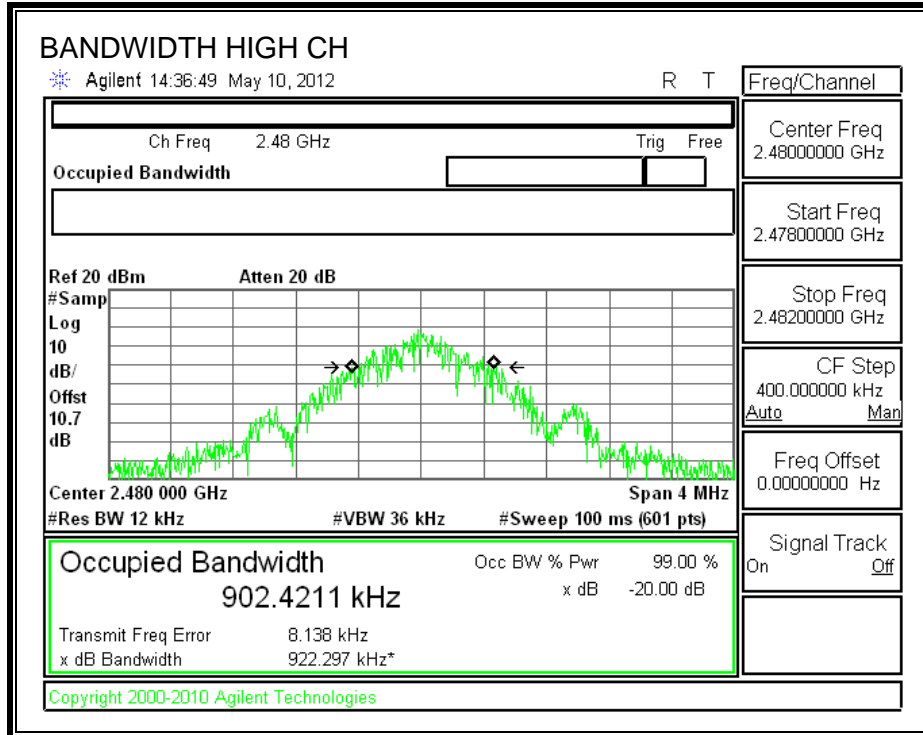
**20 dB BANDWIDTH**





**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.

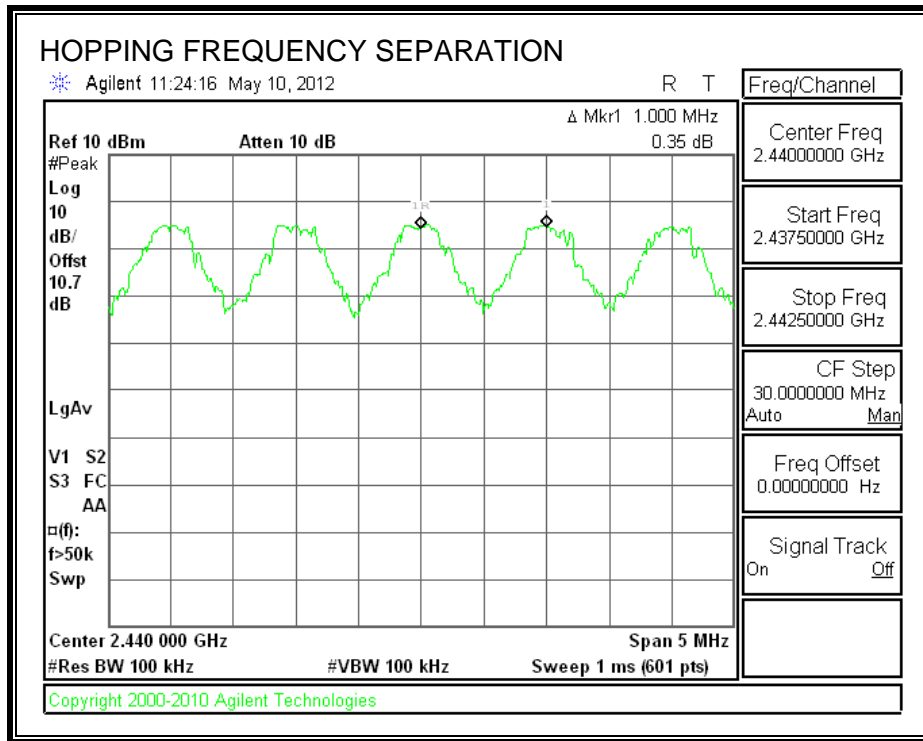
### TEST PROCEDURE

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**

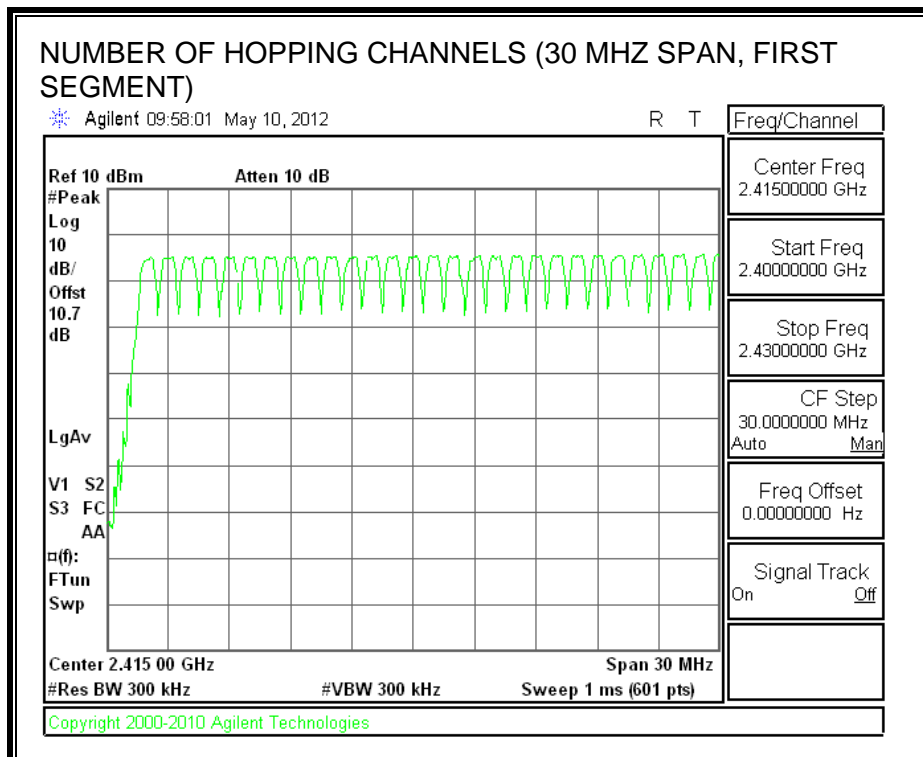
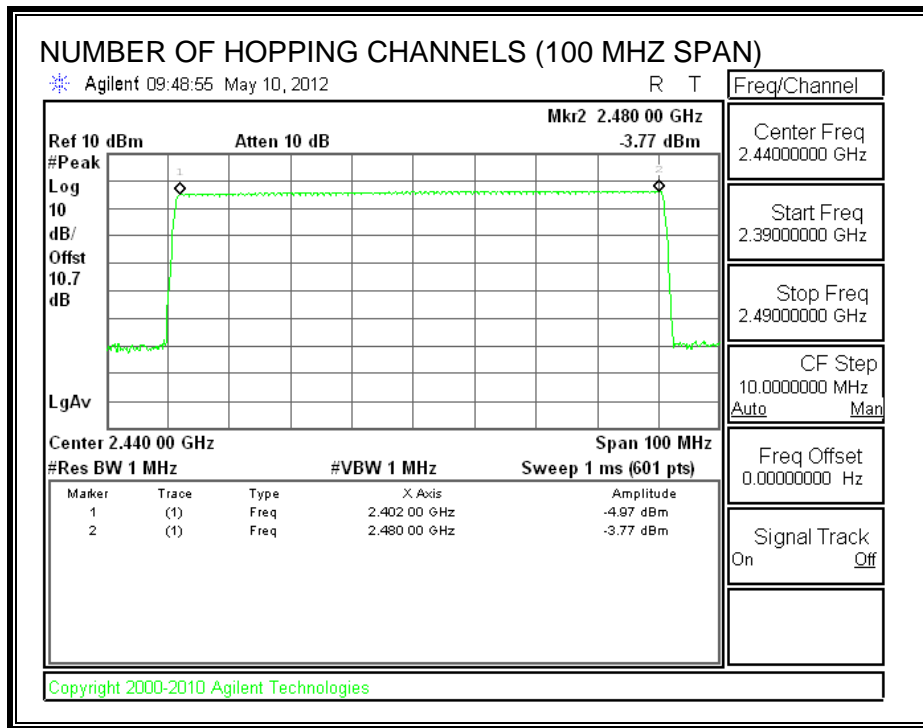
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

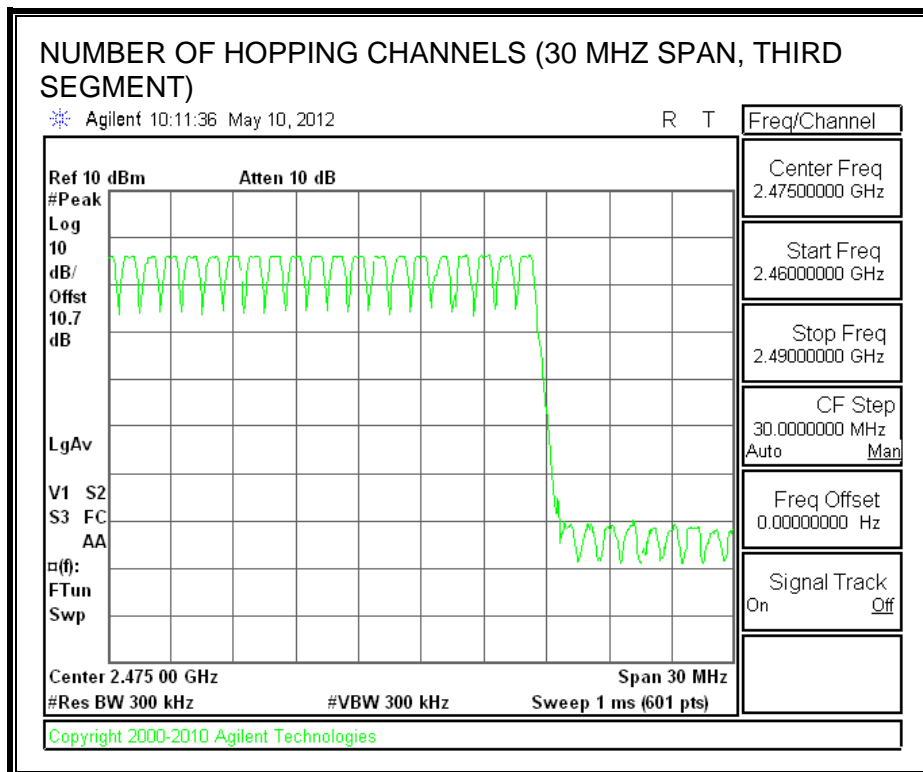
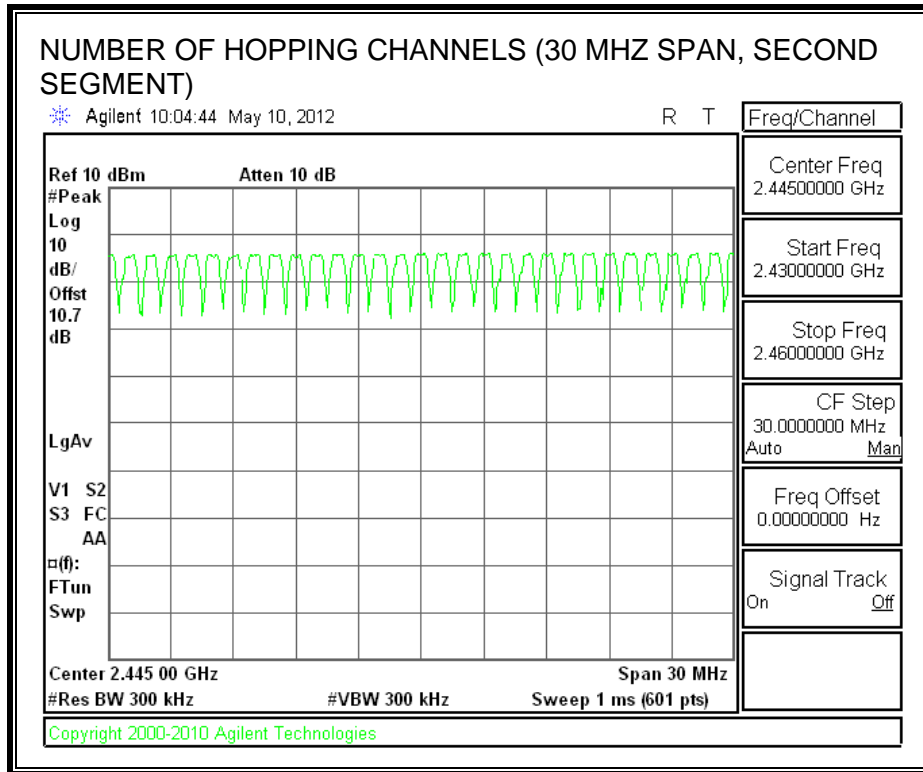
#### **RESULTS**

Normal Mode: 79 Channels observed.

AFH Mode: 20 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

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

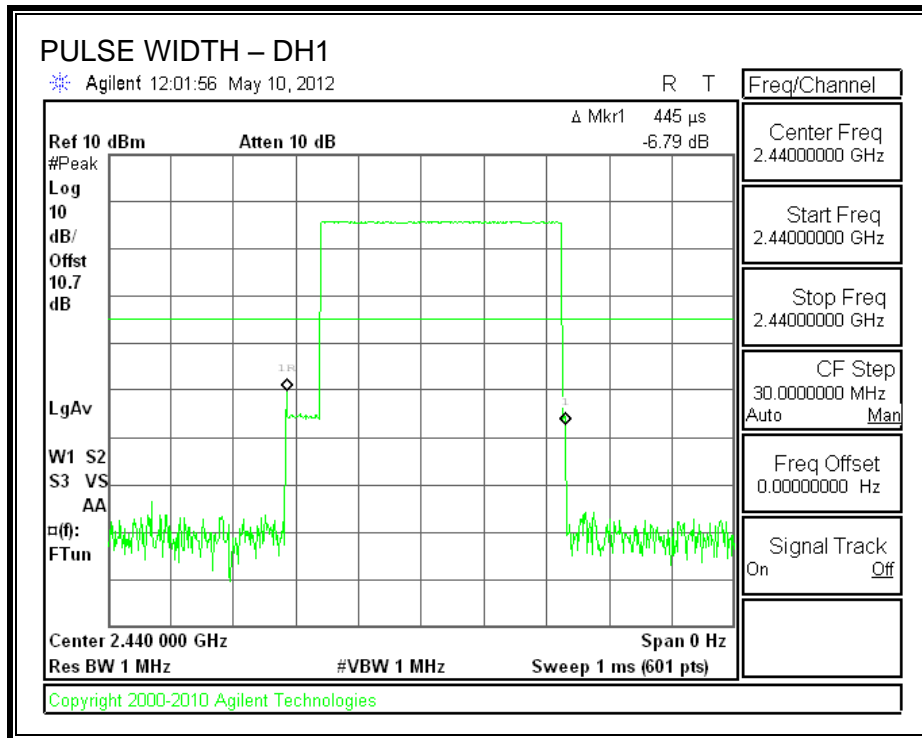
##### GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.445	36	0.160	0.4	-0.240
DH3	1.708	17	0.290	0.4	-0.110
DH5	2.947	13	0.383	0.4	-0.017

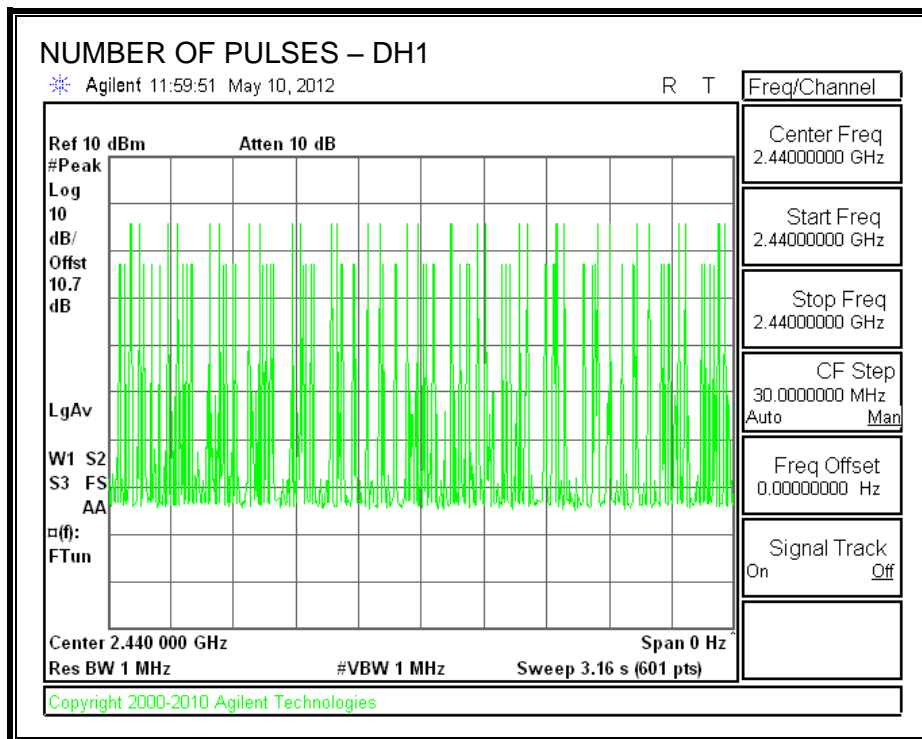
##### AFH Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.445	64	0.285	0.4	-0.115
DH3	1.708	21	0.359	0.4	-0.041
DH5	2.947	13	0.383	0.4	-0.017

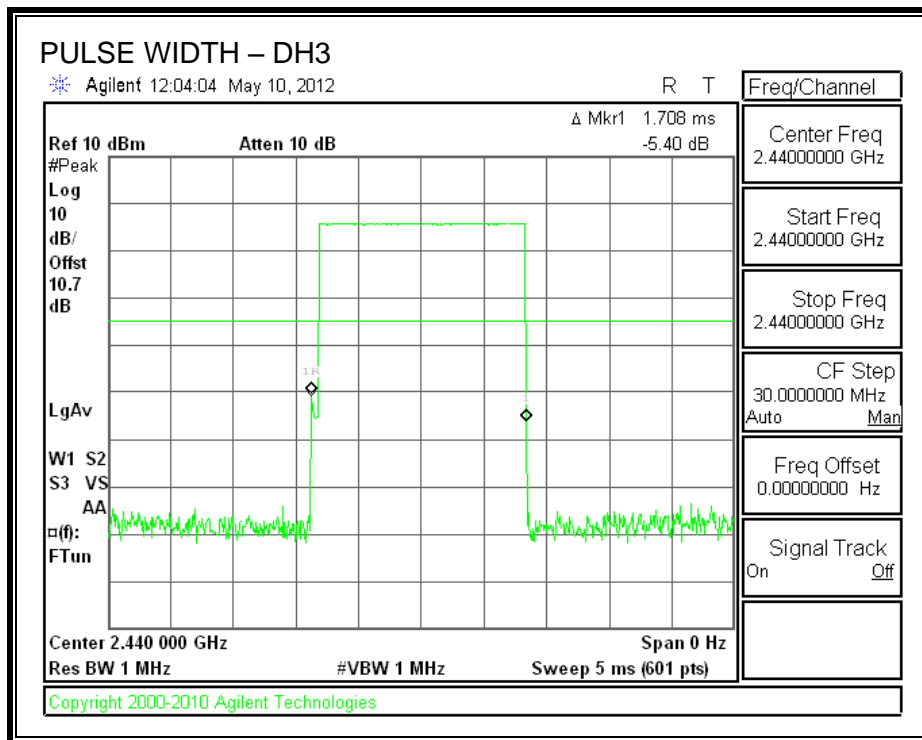
**PULSE WIDTH - DH1**



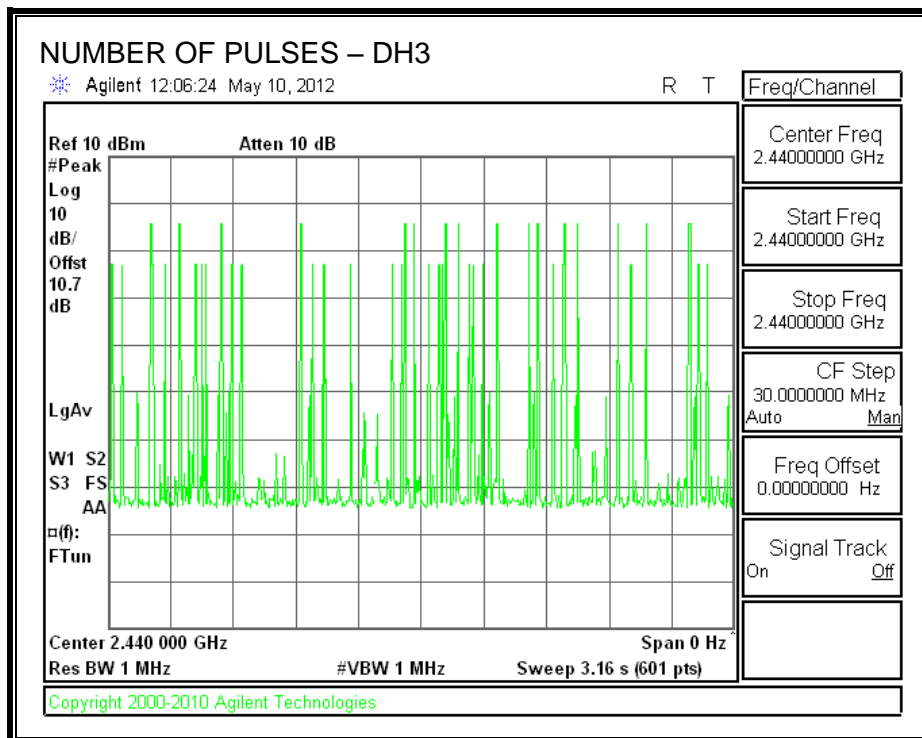
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1**



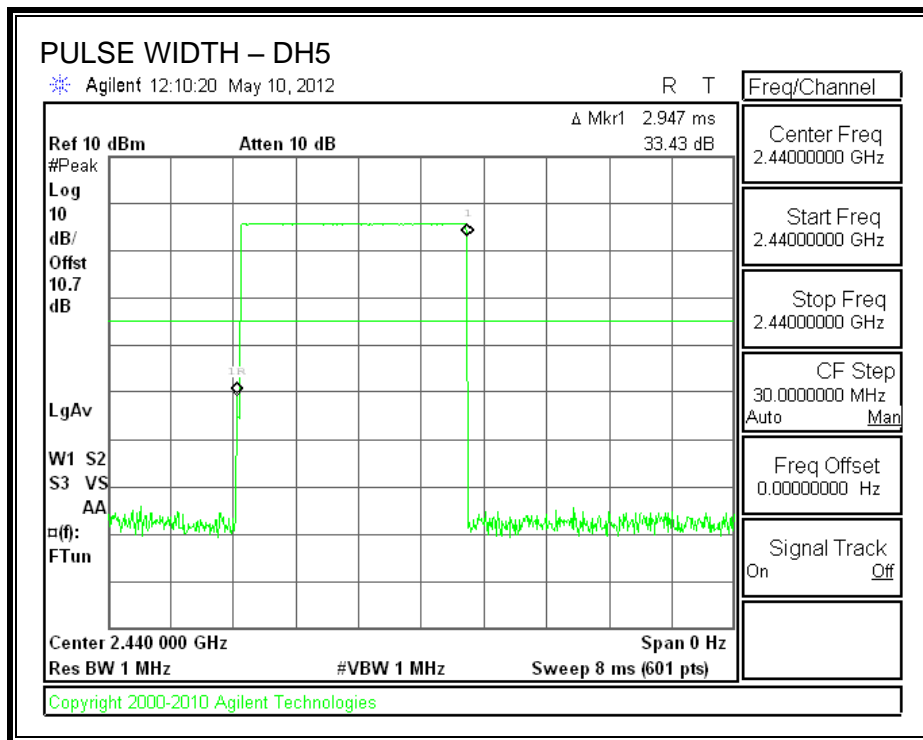
**PULSE WIDTH – DH3**



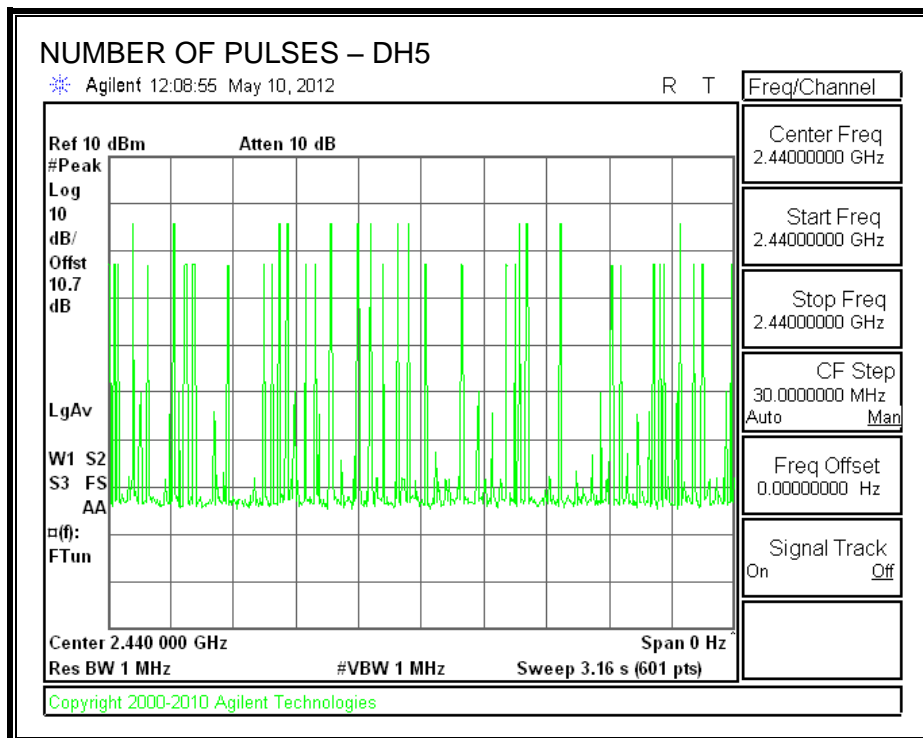
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**



**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.

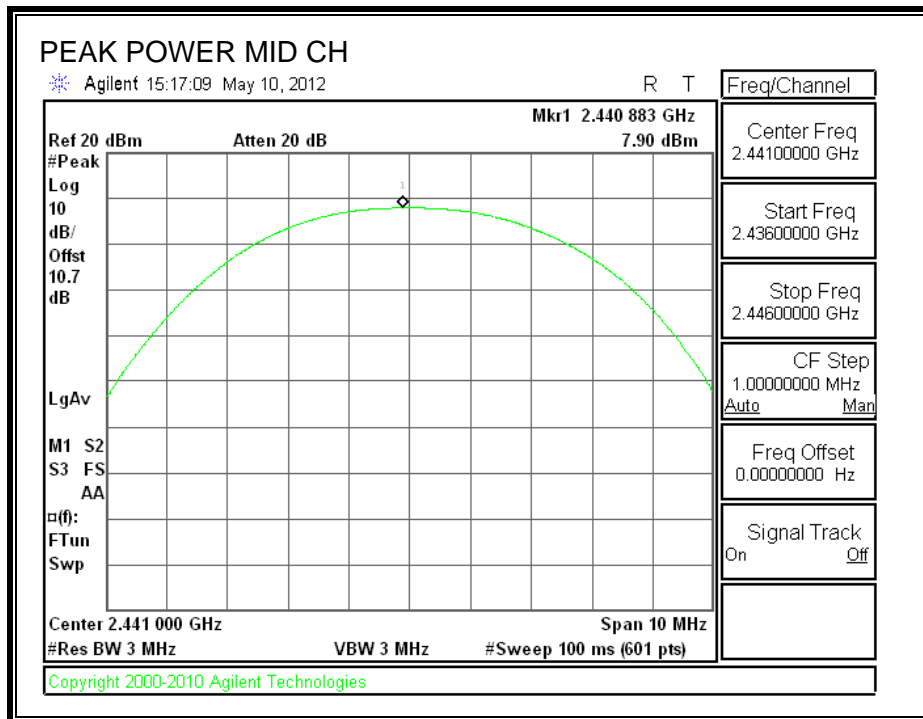
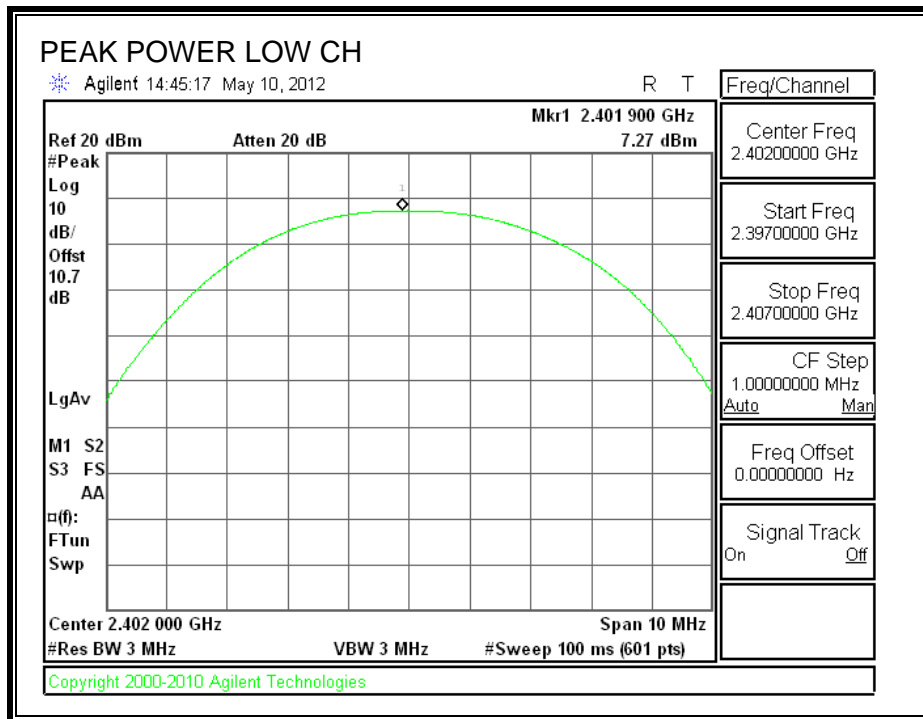
#### TEST PROCEDURE

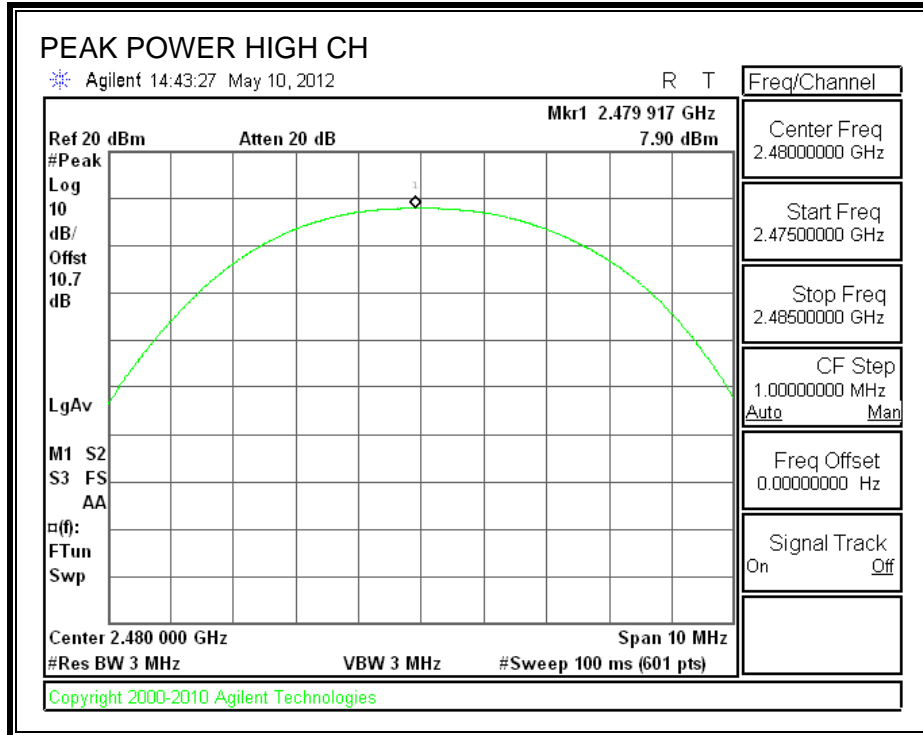
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.27	30	-22.73
Middle	2441	7.90	30	-22.10
High	2480	7.90	30	-22.10

**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 10.68 dB (including 10 dB pad and 0.68 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	6.99
Middle	2441	7.66
High	2480	7.71

## 7.1.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### TEST PROCEDURE

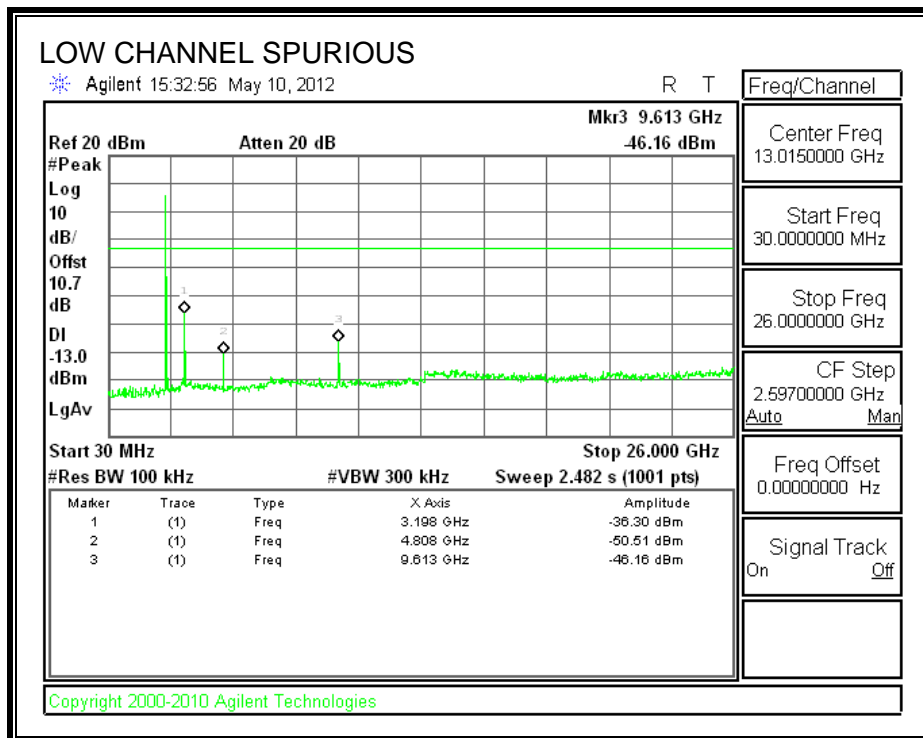
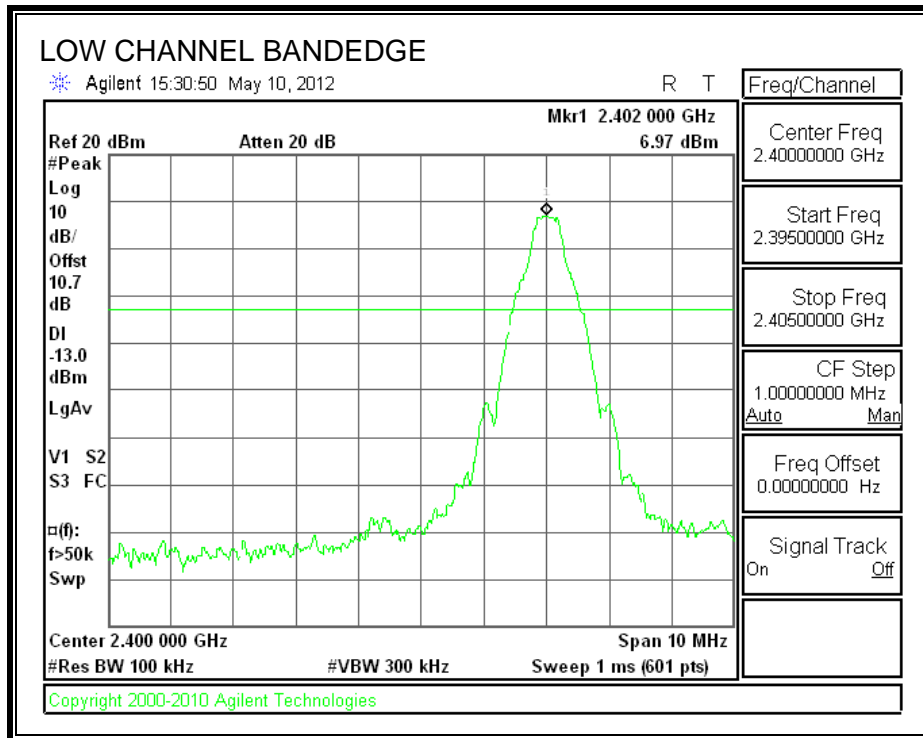
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

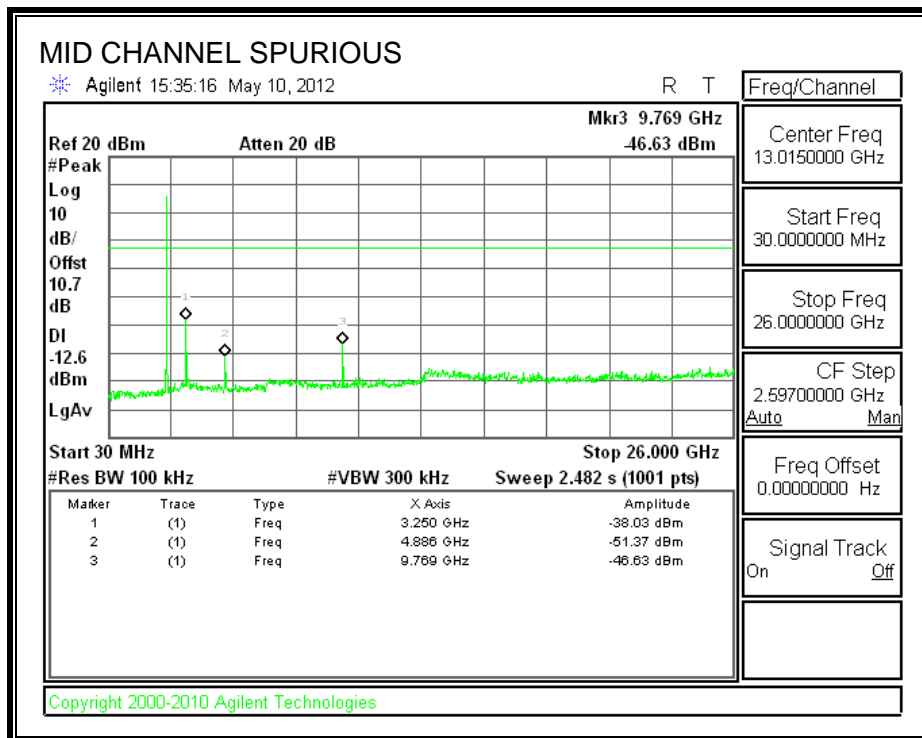
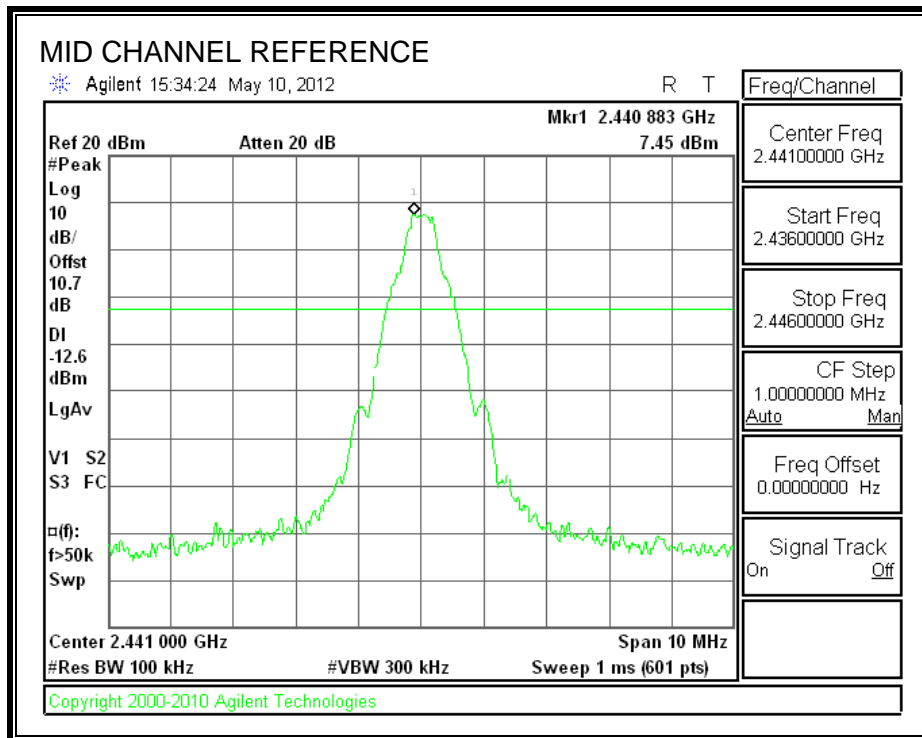
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**

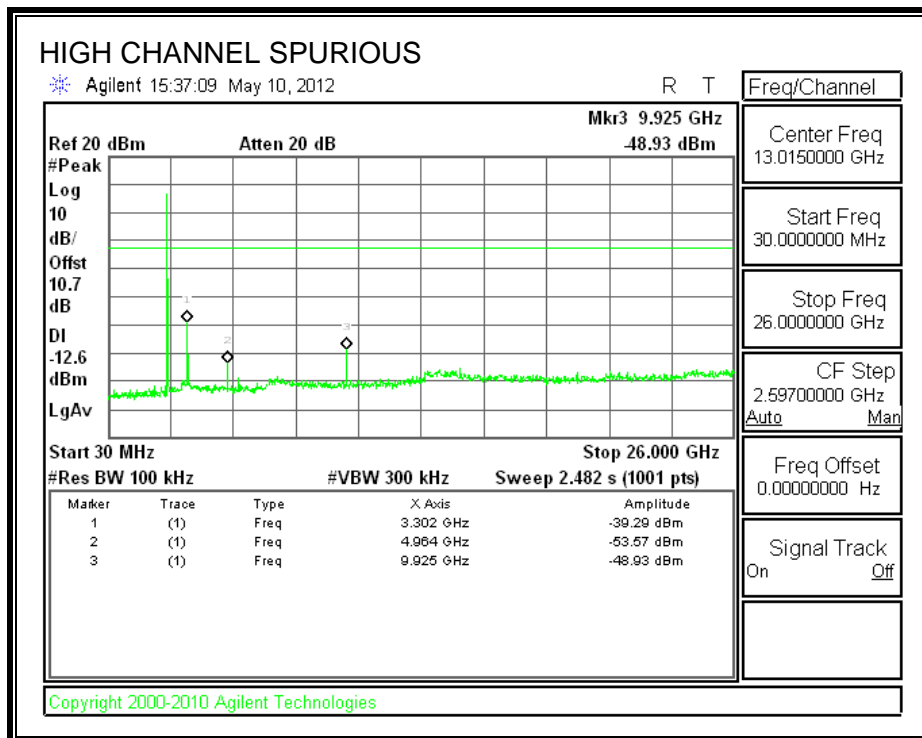
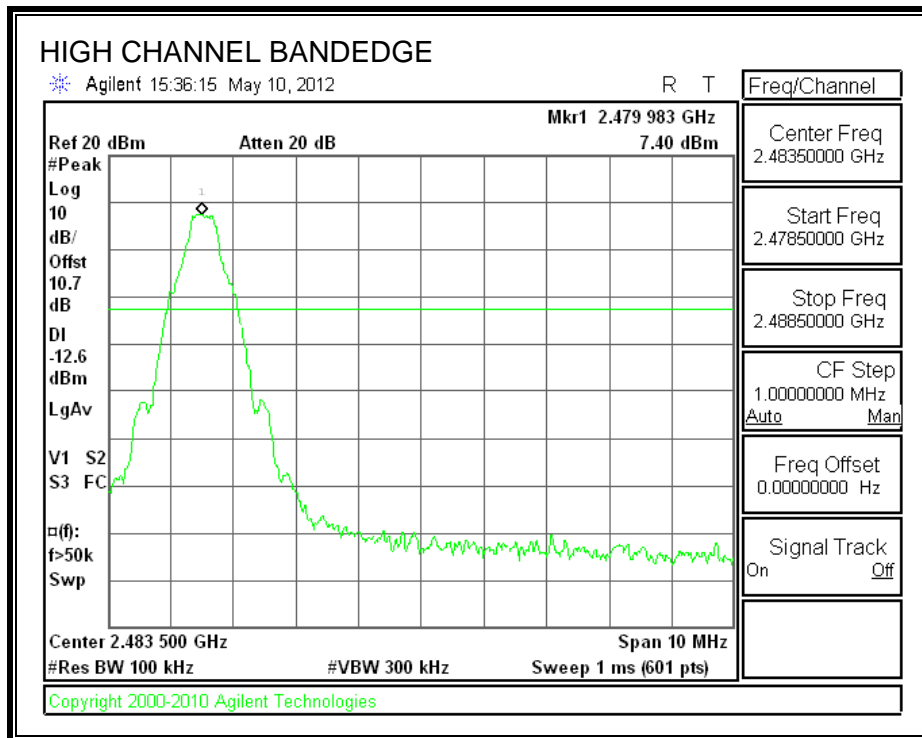
**SPURIOUS EMISSIONS, LOW CHANNEL**



**SPURIOUS EMISSIONS, MID CHANNEL**

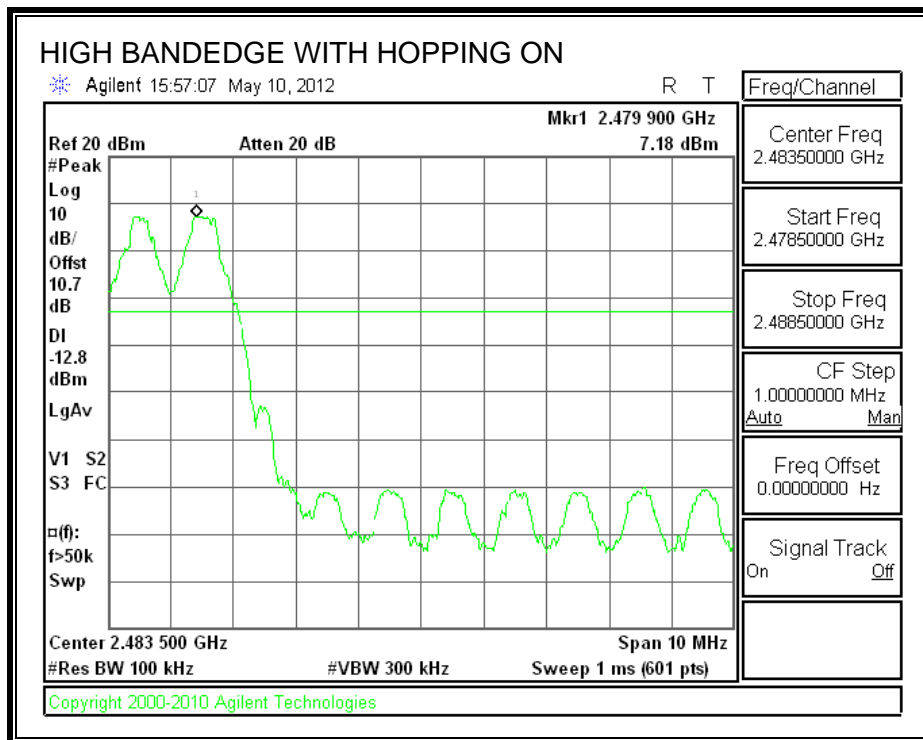
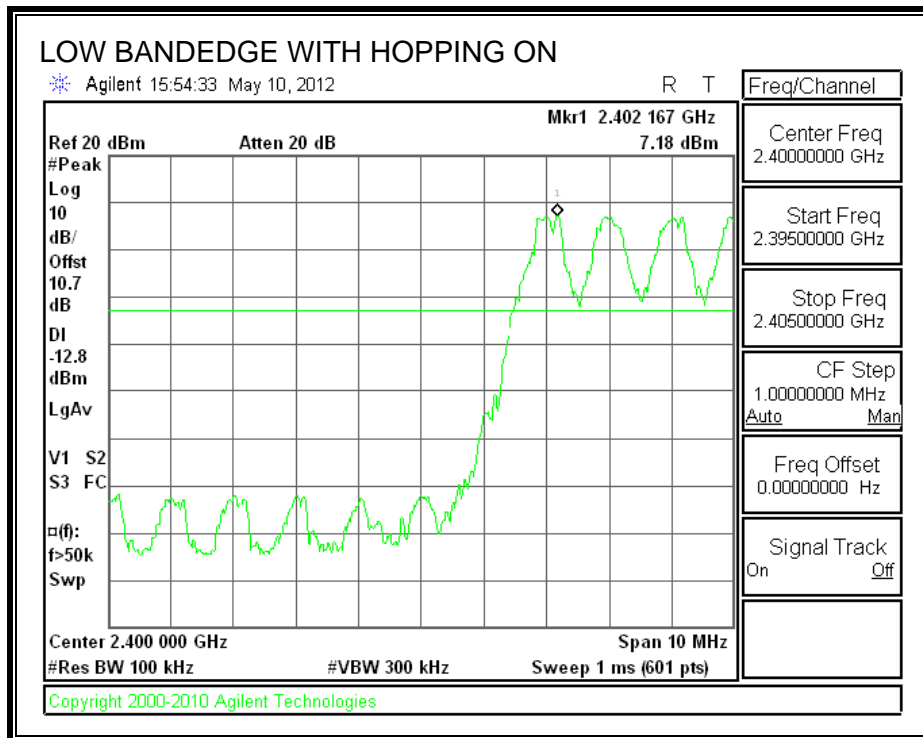


**SPURIOUS EMISSIONS, HIGH CHANNEL**





**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.

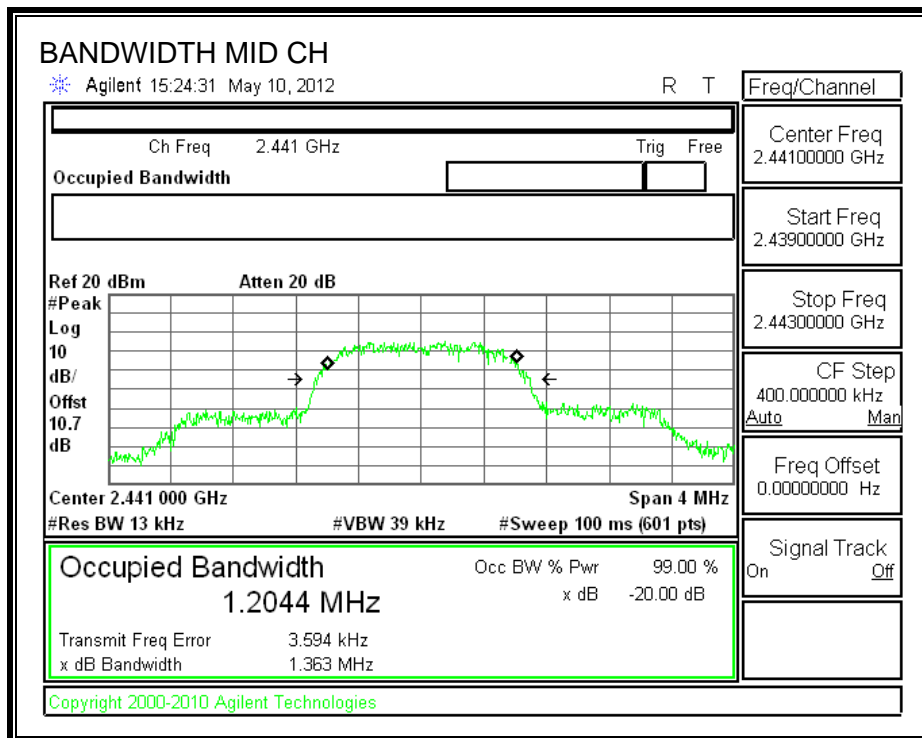
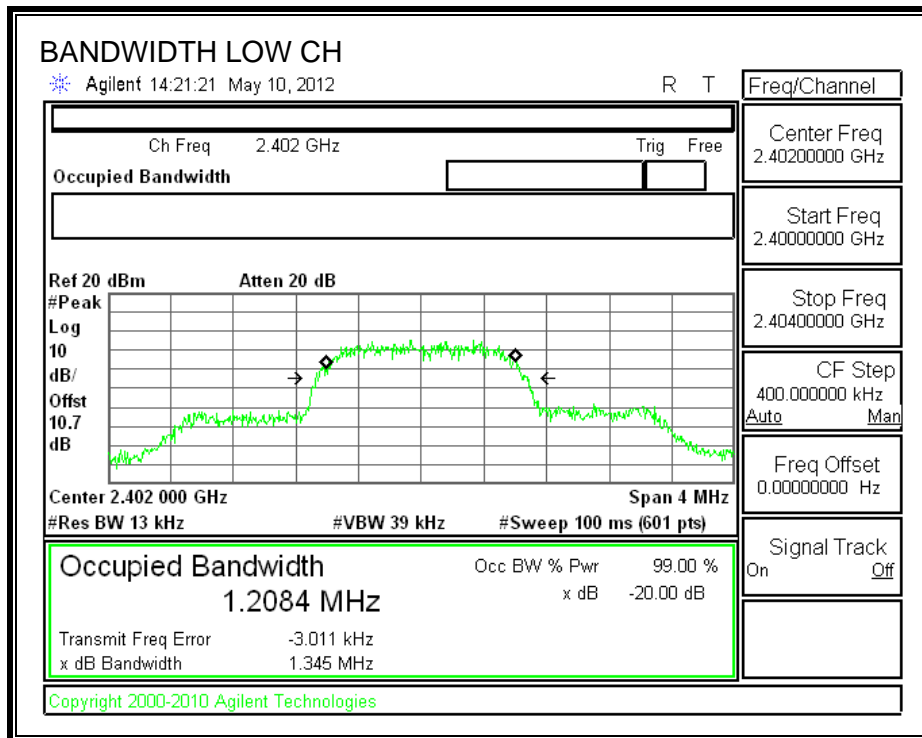
#### TEST PROCEDURE

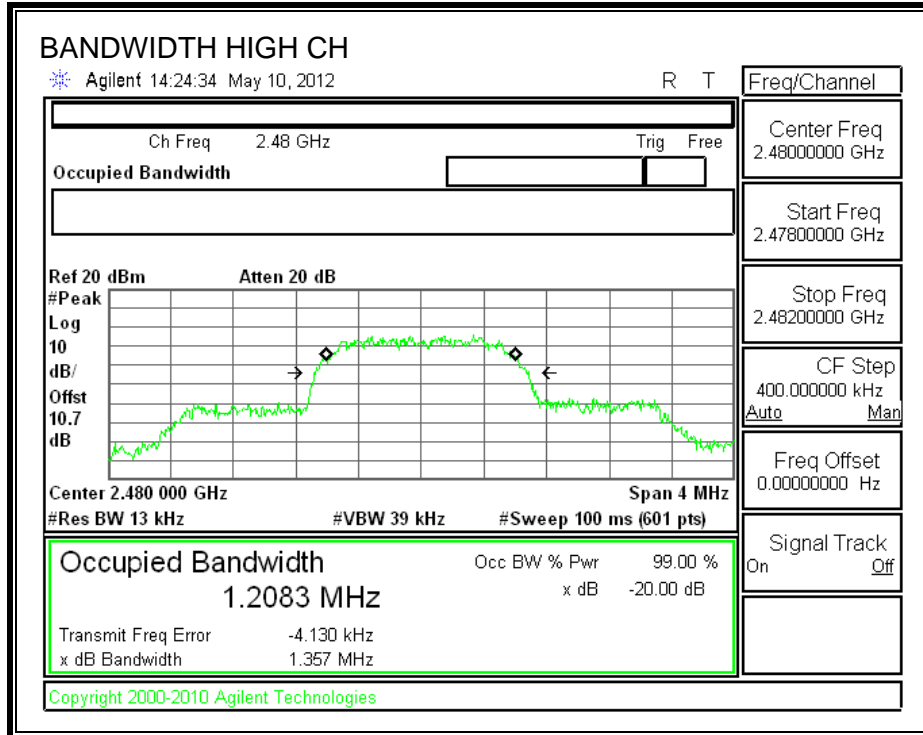
The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1\%$  of the 20 dB bandwidth. The VBW is set to  $\geq$  RBW. The sweep time is coupled.

#### RESULTS

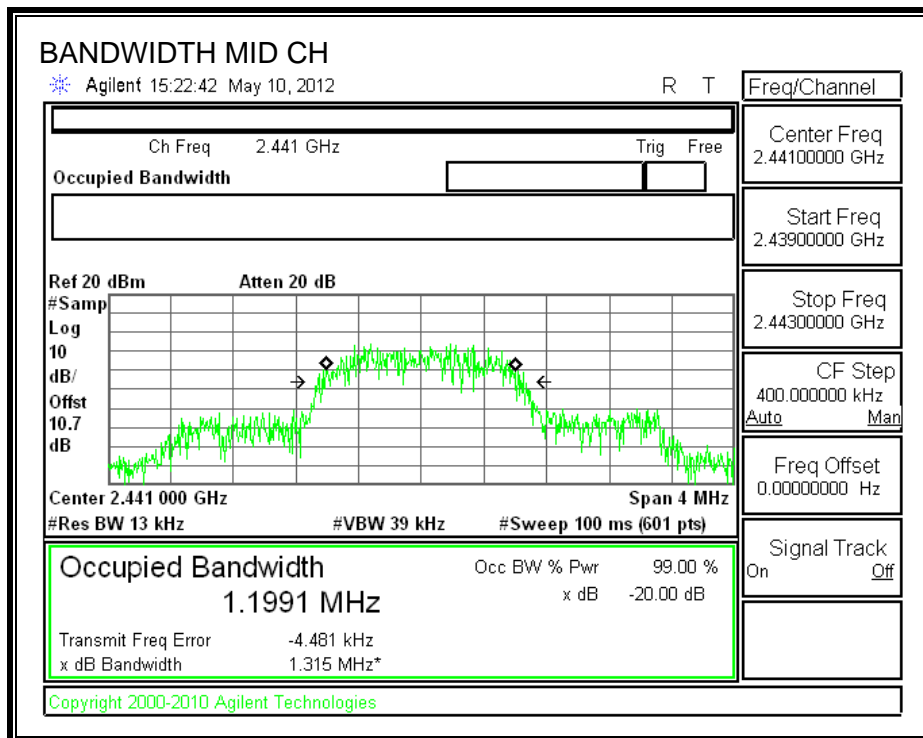
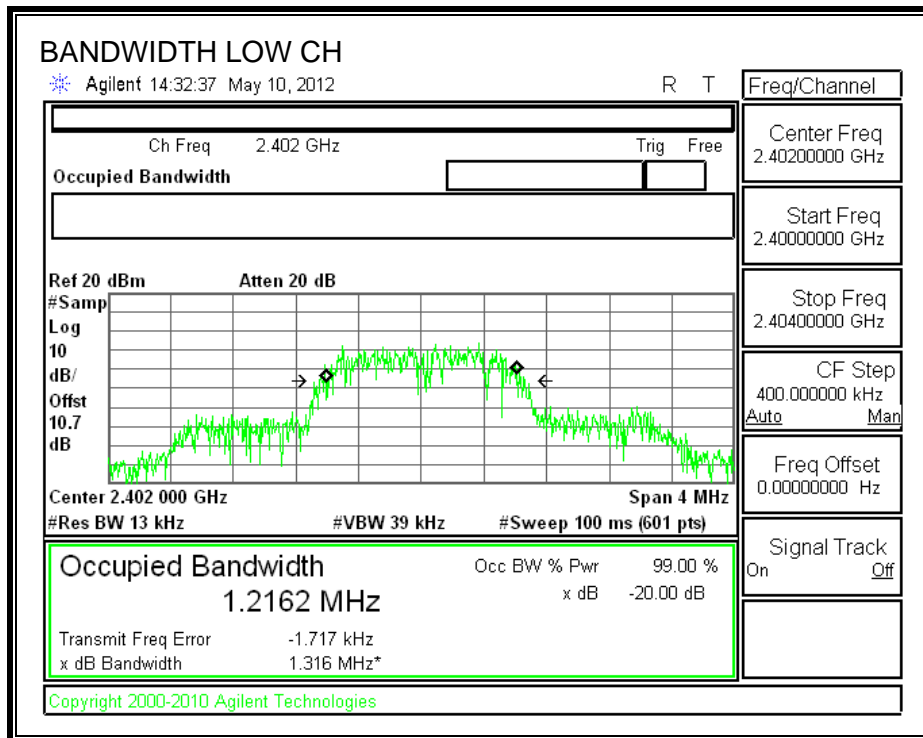
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1345	1216.2
Middle	2441	1363	1199.1
High	2480	1357	1219.1

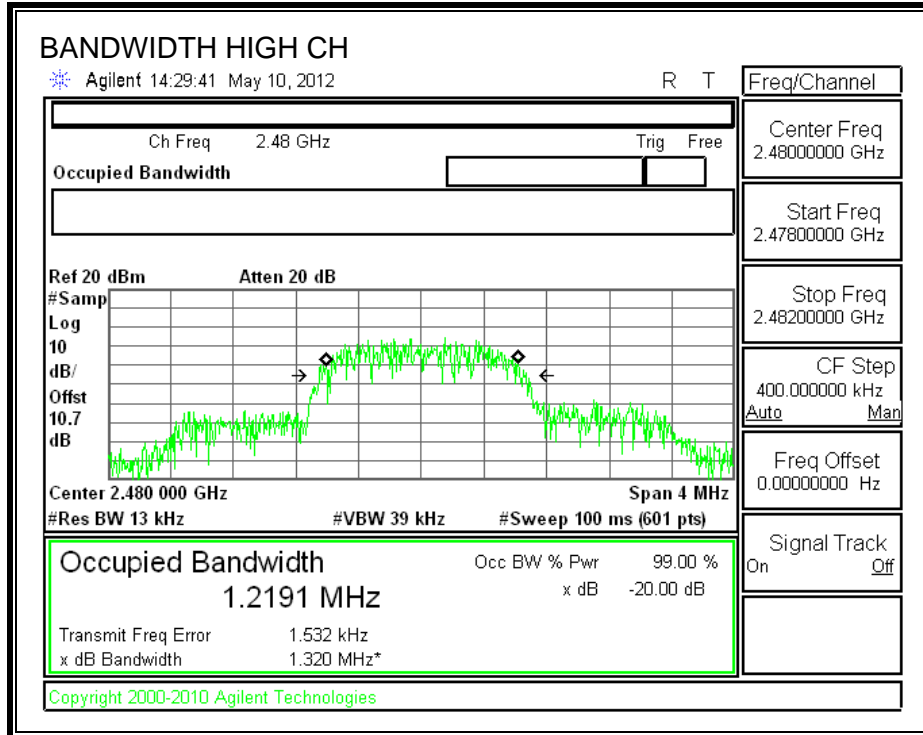
**20 dB BANDWIDTH**





**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.

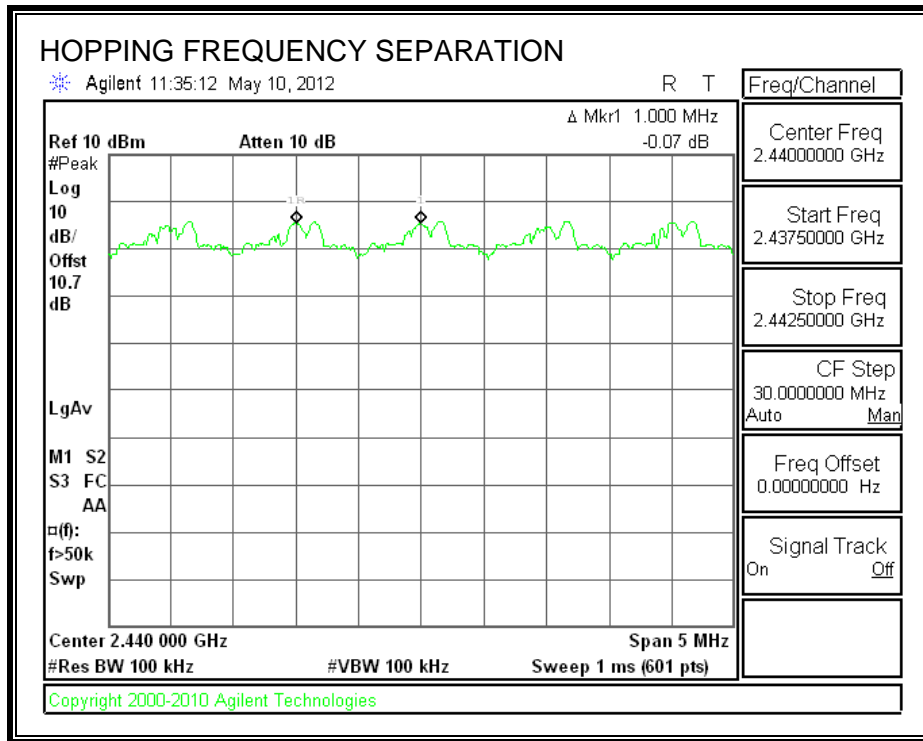
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

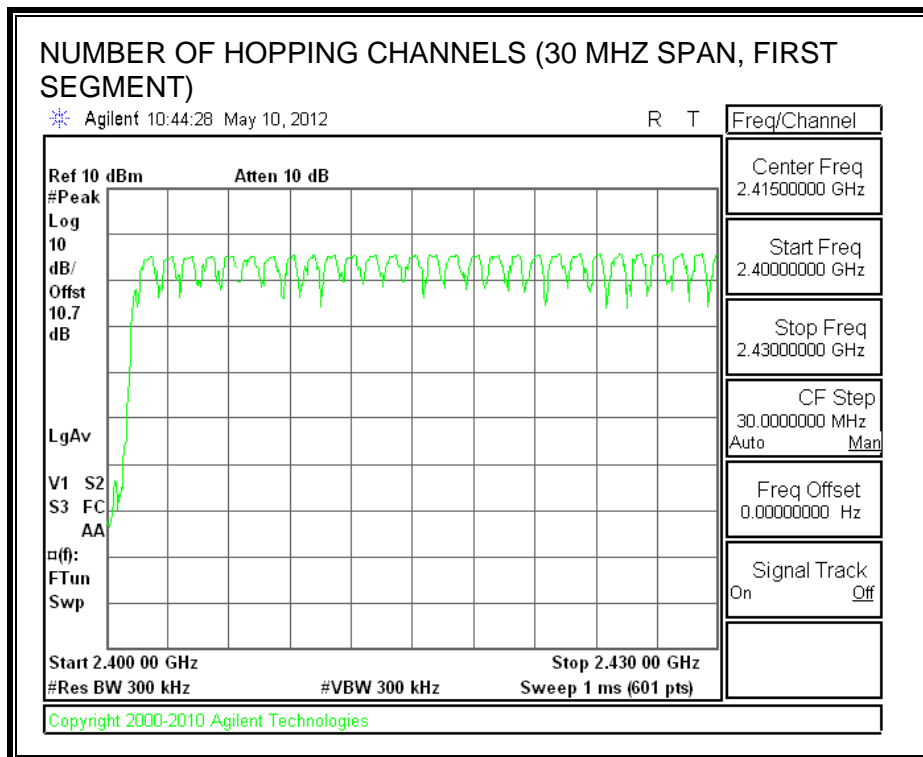
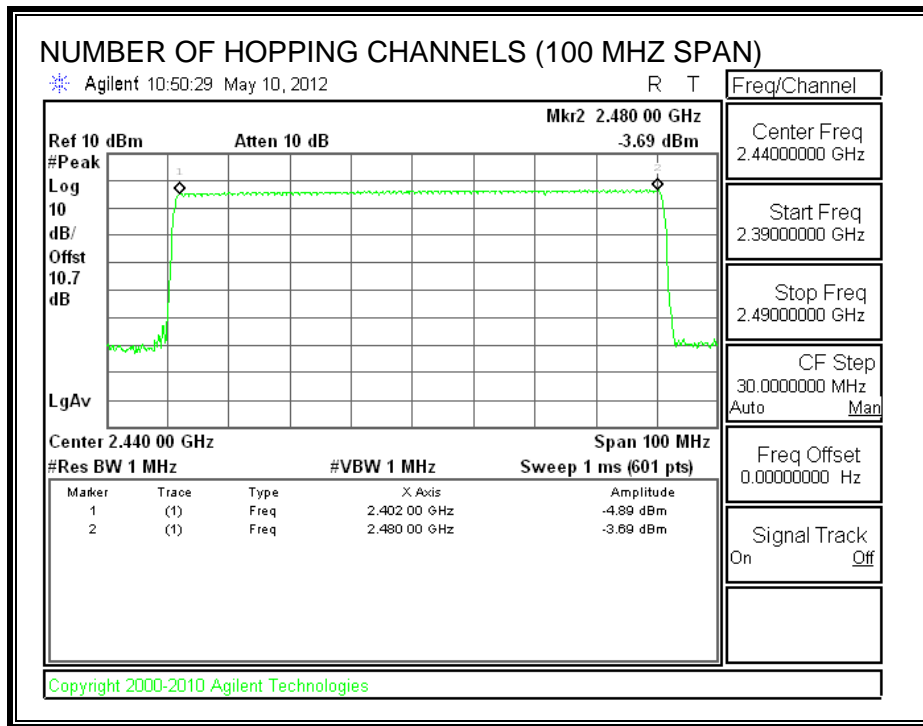
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

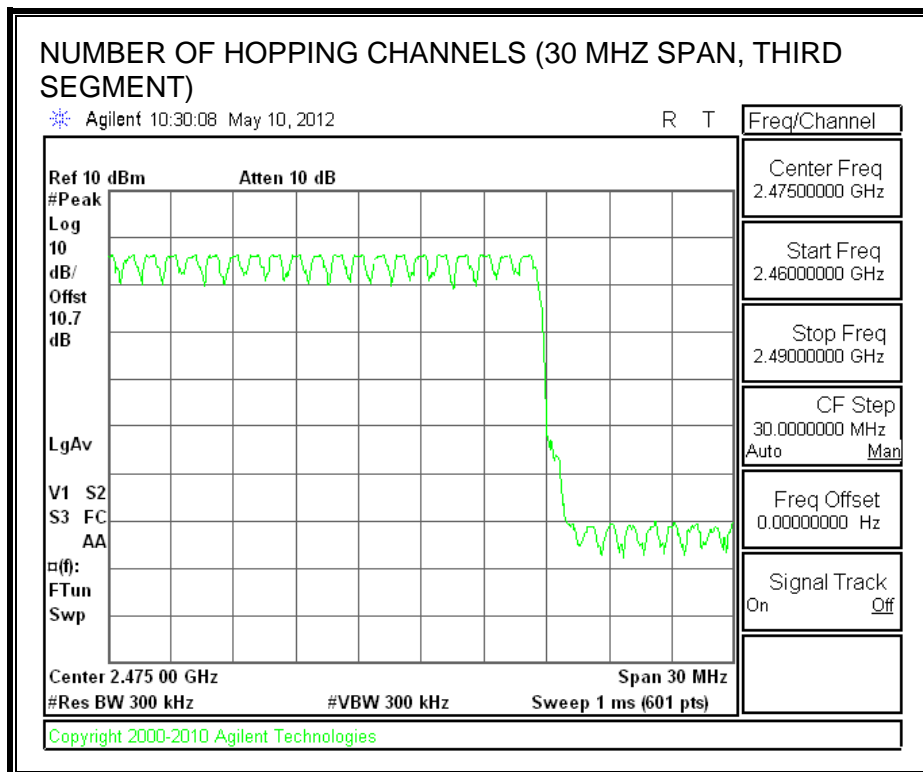
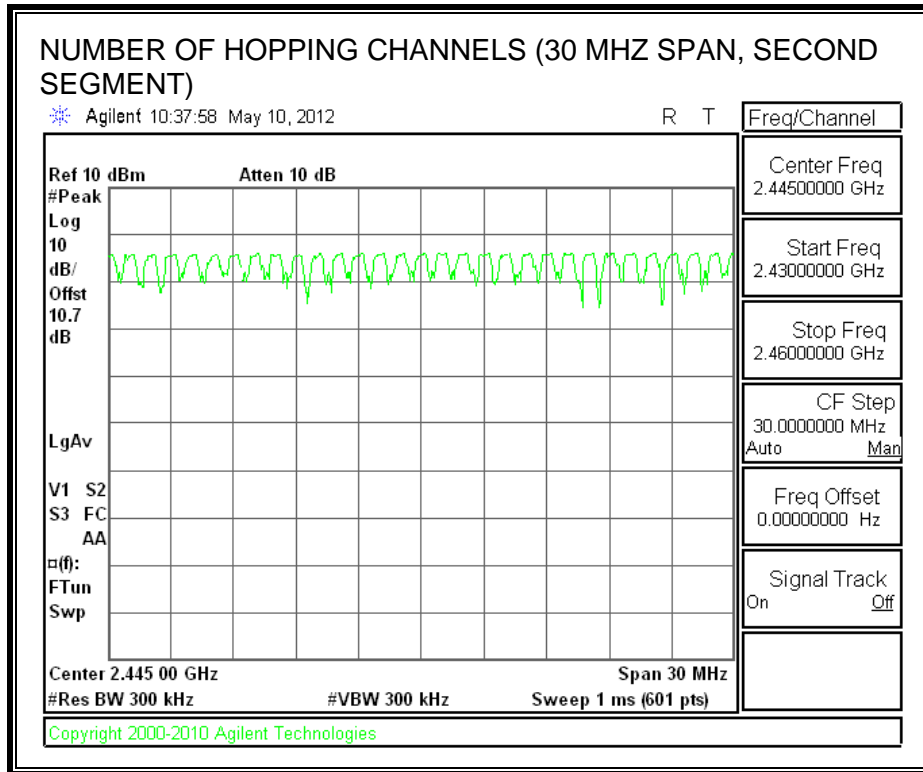
#### **RESULTS**

Normal Mode: 79 Channels observed.

AFH Mode: 20 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  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{ pulse width}$ .

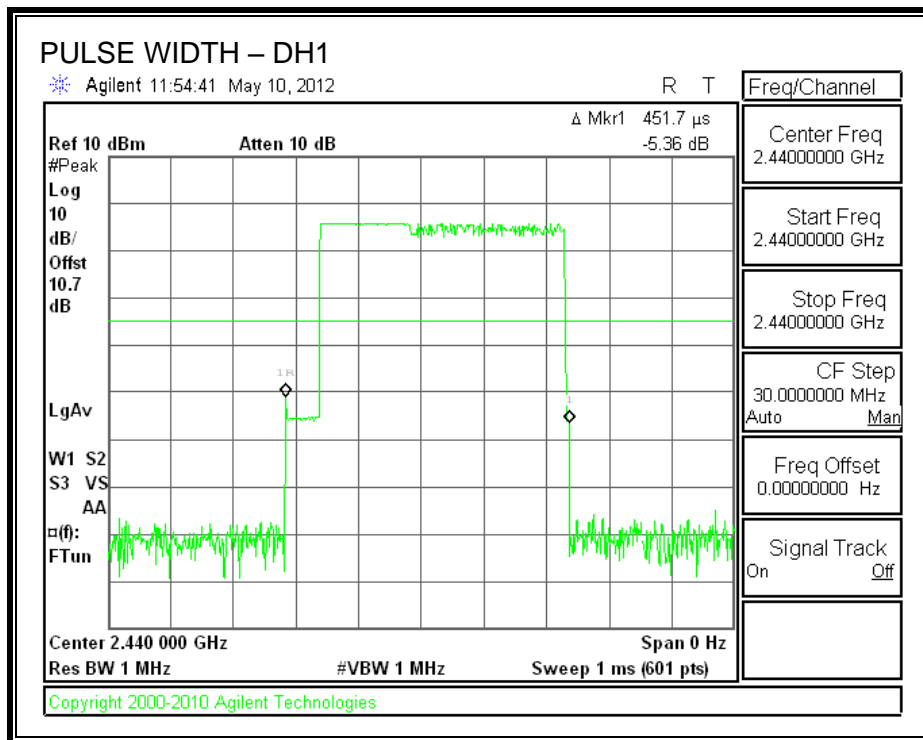
#### RESULTS

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

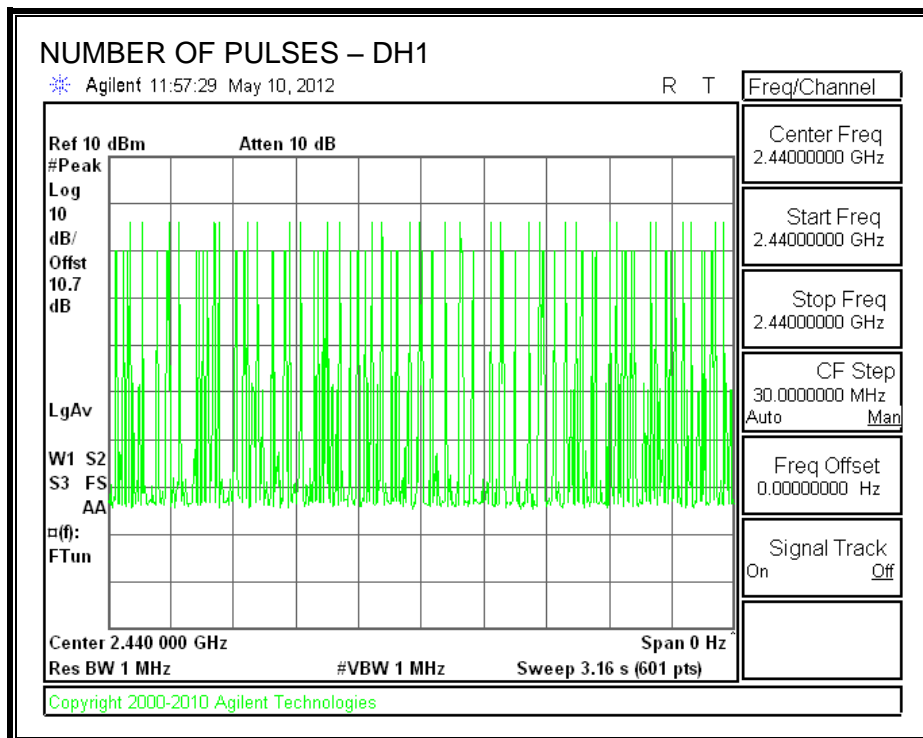
#### 8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.4517	32	0.145	0.4	-0.255
DH3	1.7	16	0.272	0.4	-0.128
DH5	2.947	12	0.354	0.4	-0.046

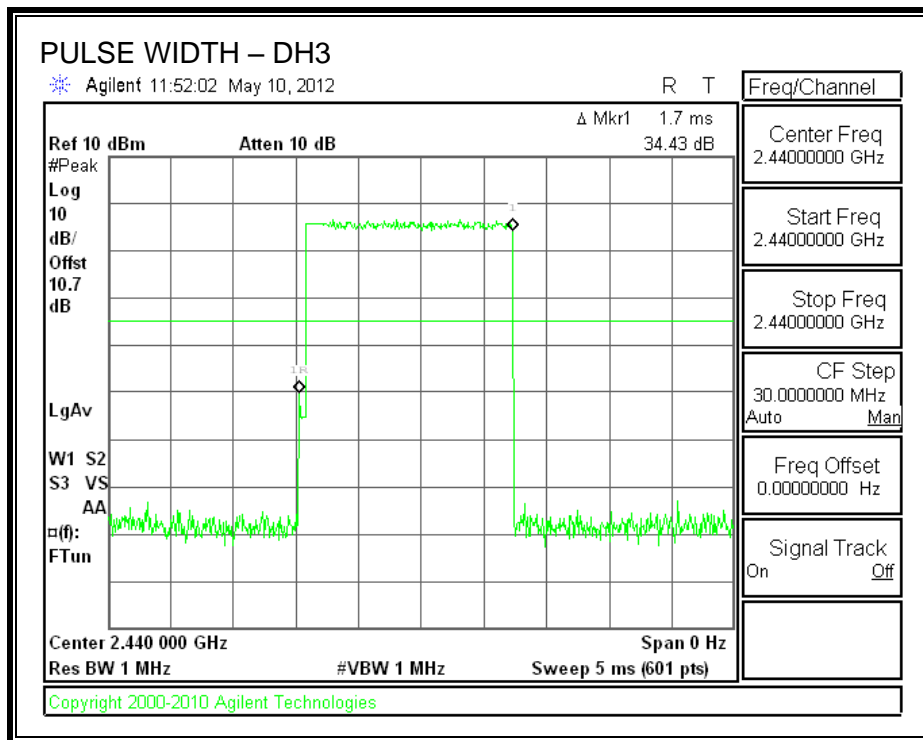
**PULSE WIDTH - DH1**



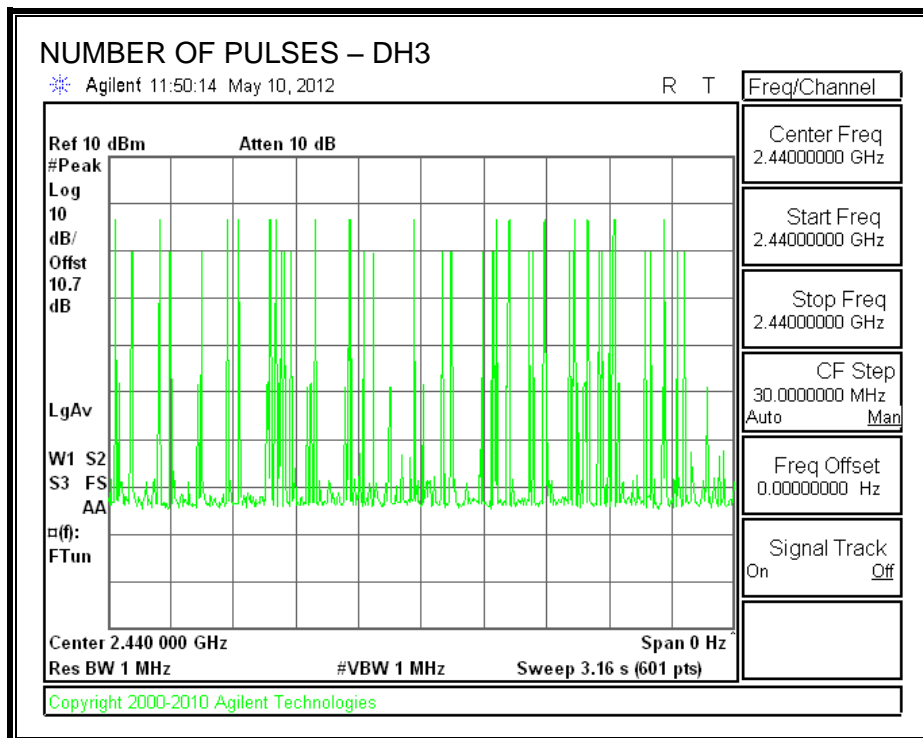
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD - DH1**



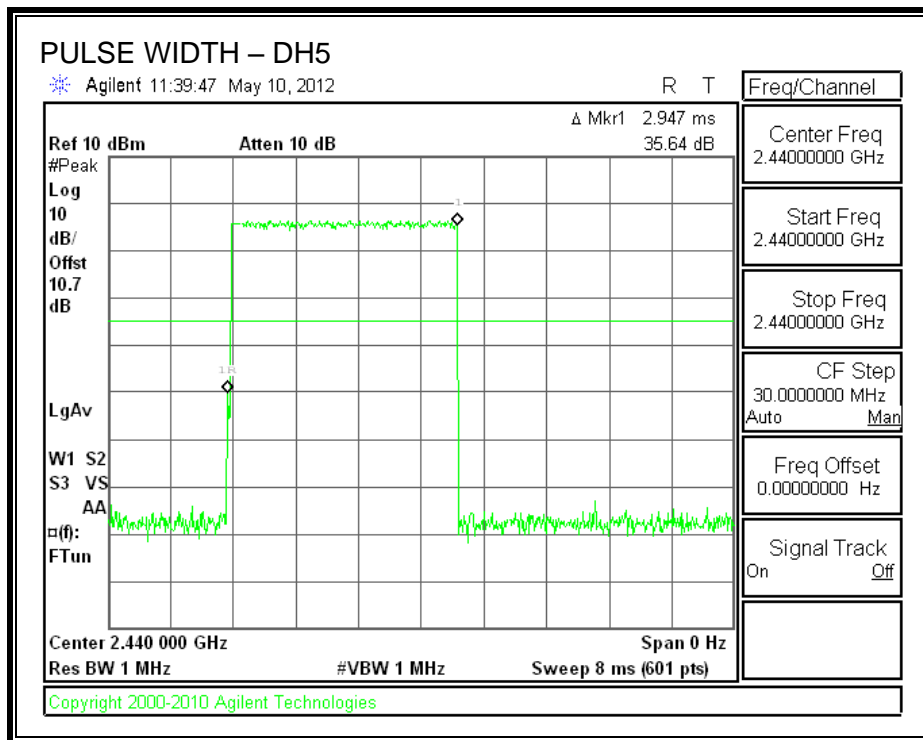
**PULSE WIDTH – DH3**



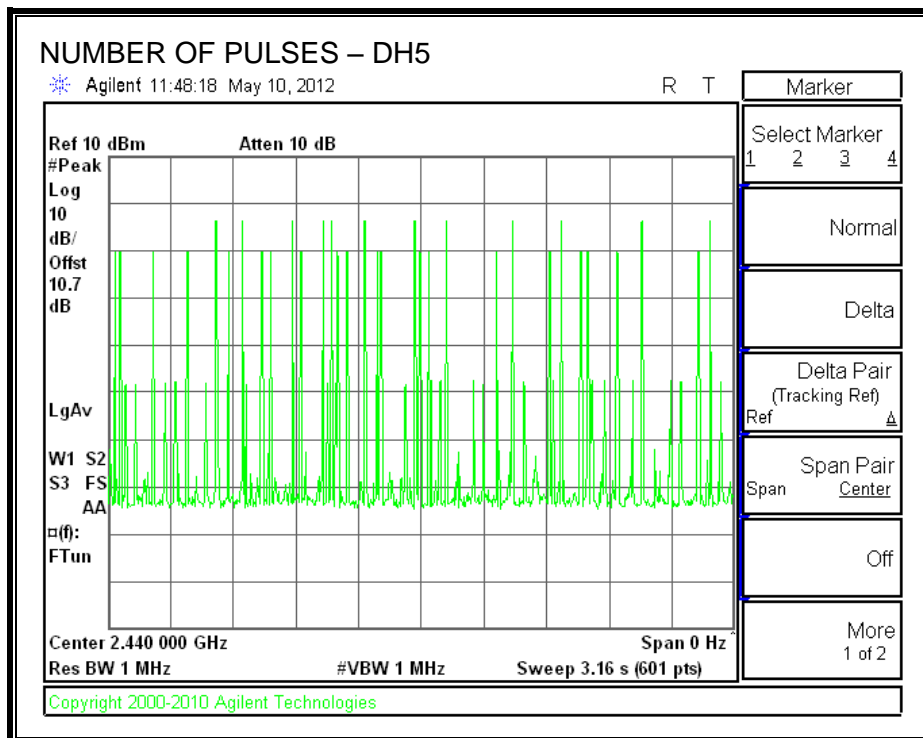
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3**



**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

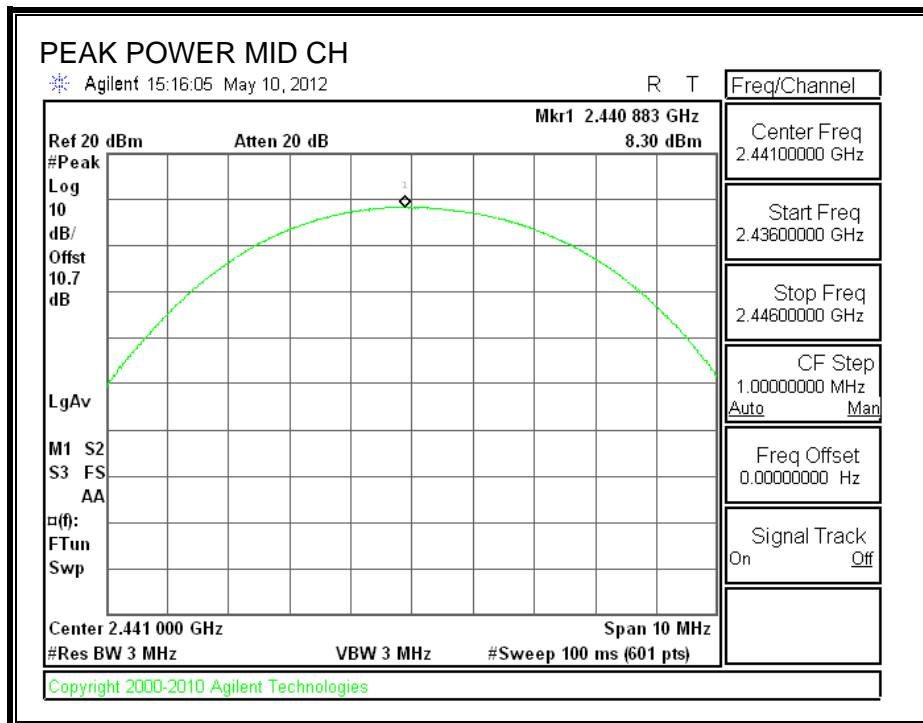
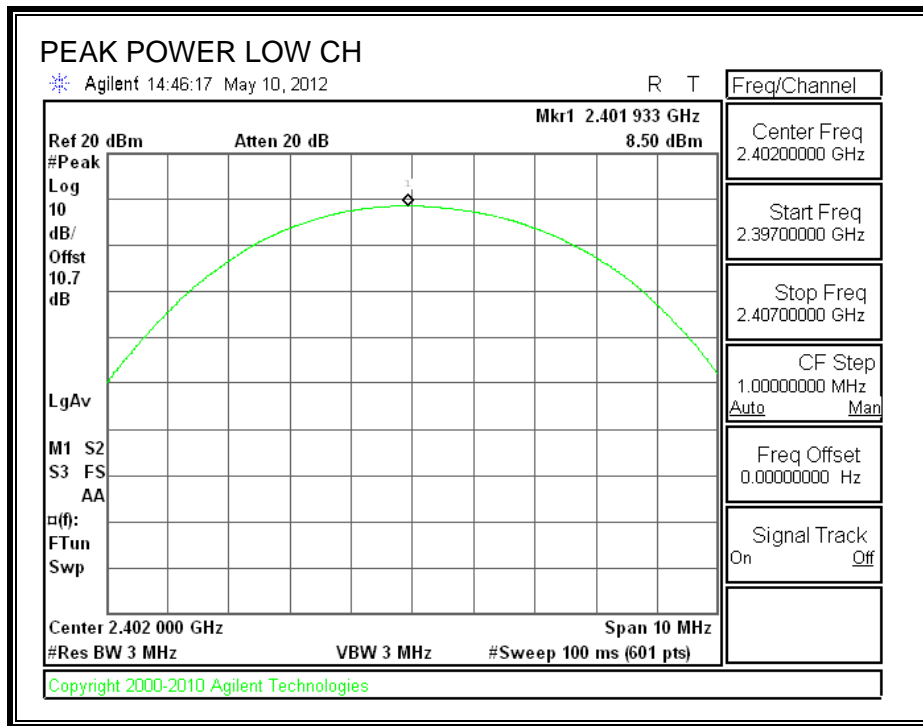
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

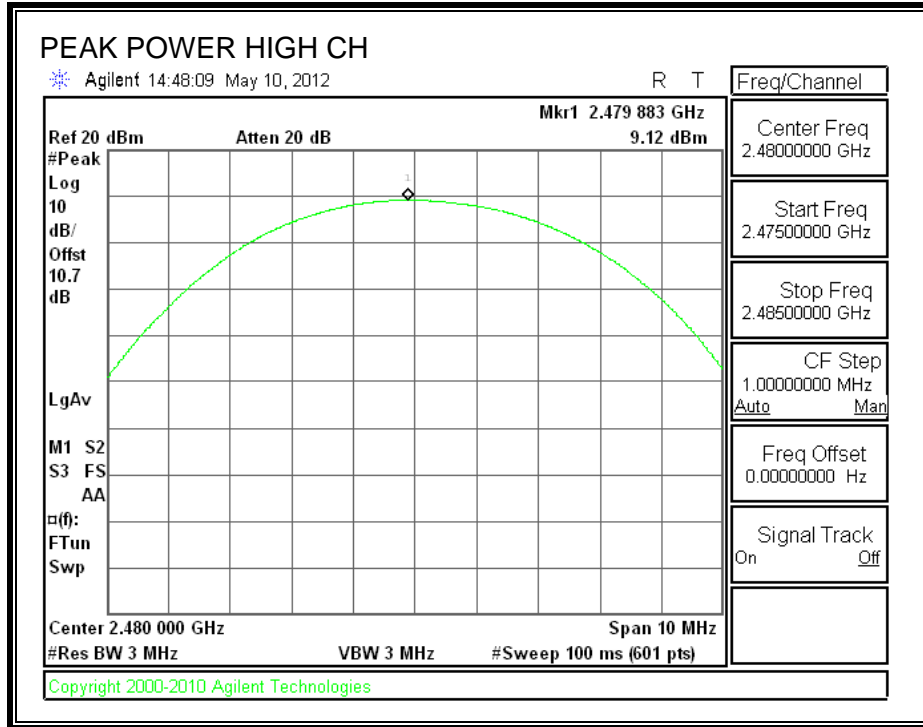
### RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.50	20.97	-12.47
Middle	2441	8.30	20.97	-12.67
High	2480	9.12	20.97	-11.85



**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 10.68 dB (including 10 dB pad and 0.68 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	5.52
Middle	2441	6.21
High	2480	6.27

## 7.2.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### TEST PROCEDURE

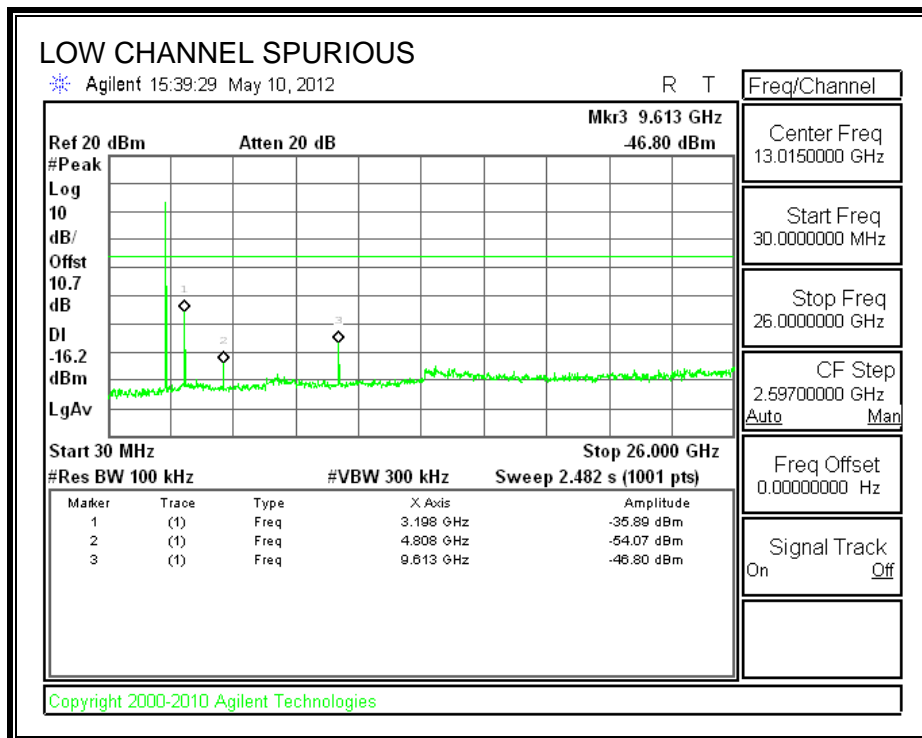
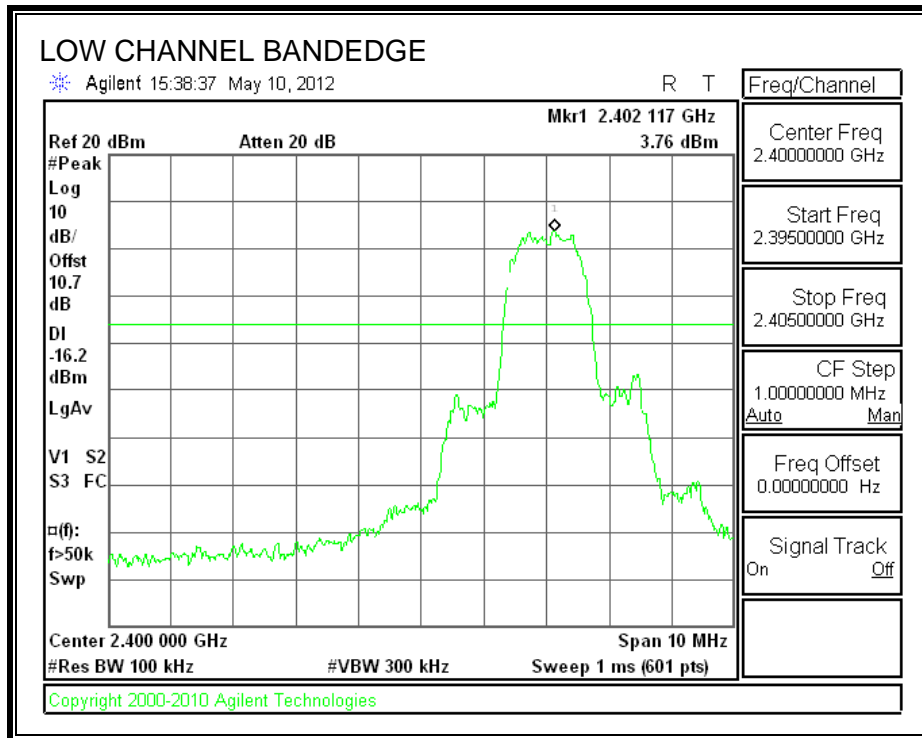
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

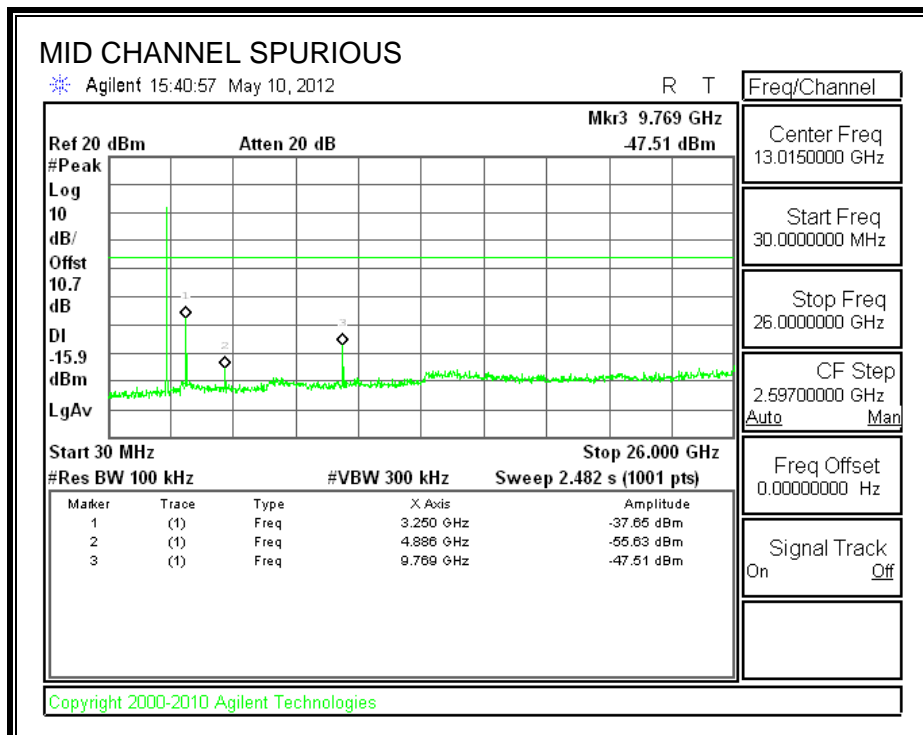
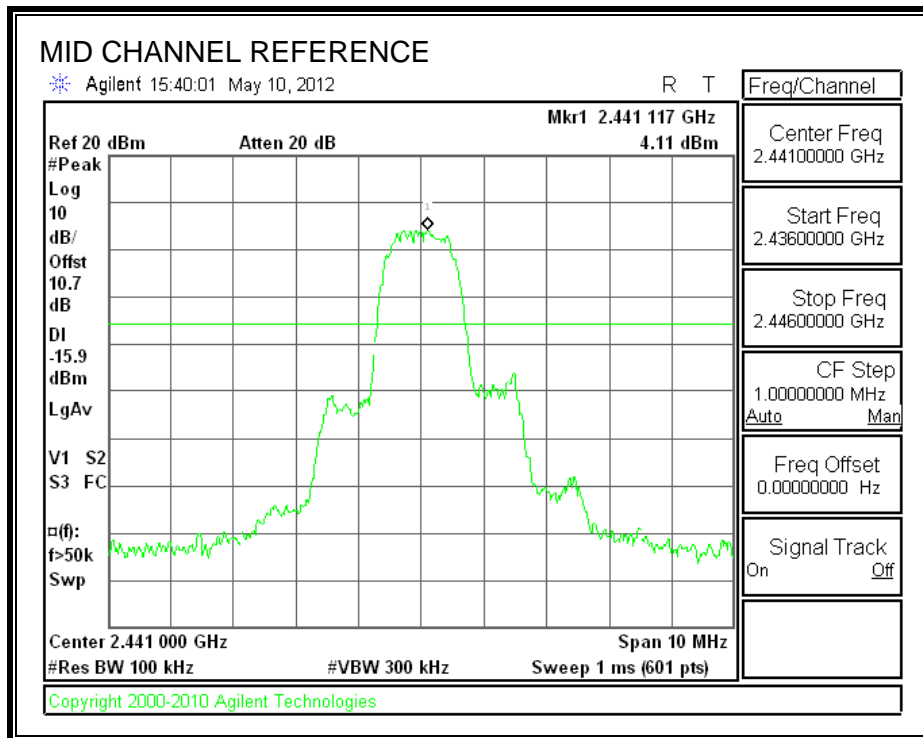
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

**RESULTS**

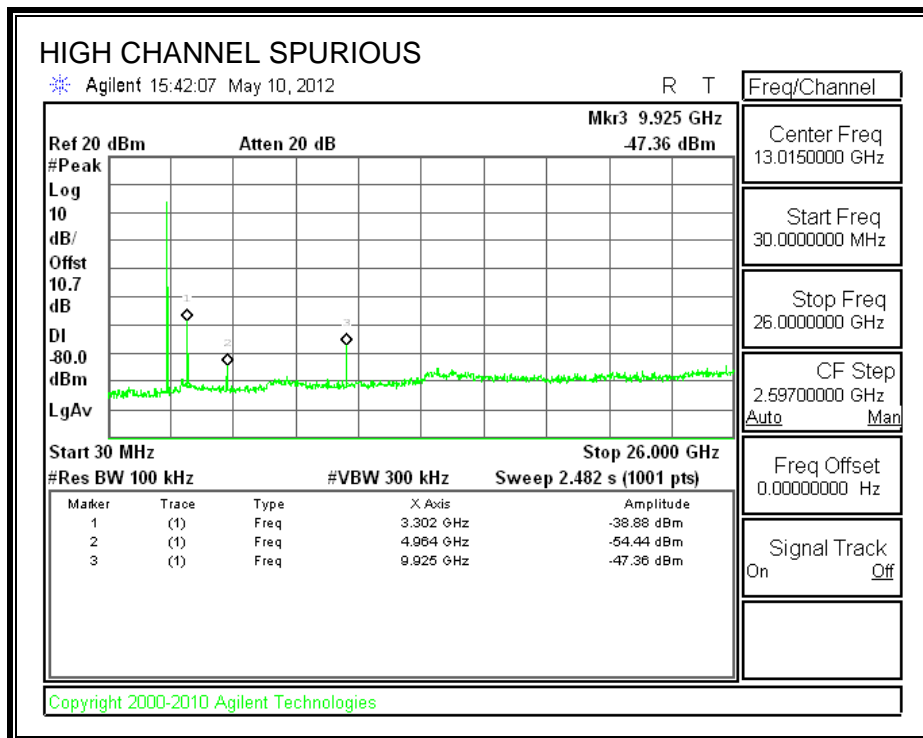
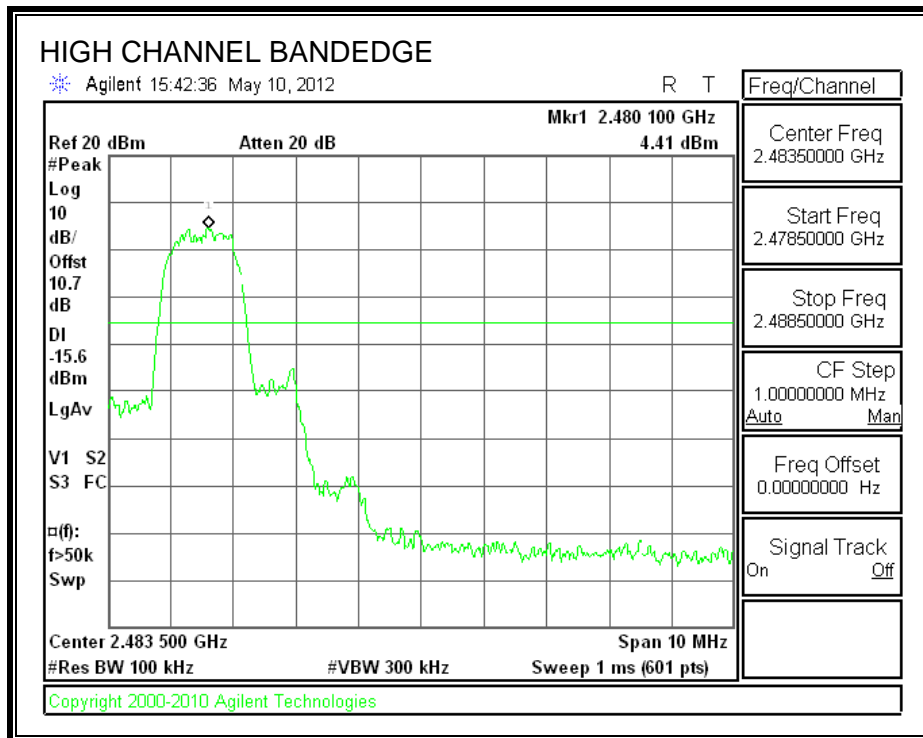
**SPURIOUS EMISSIONS, LOW CHANNEL**



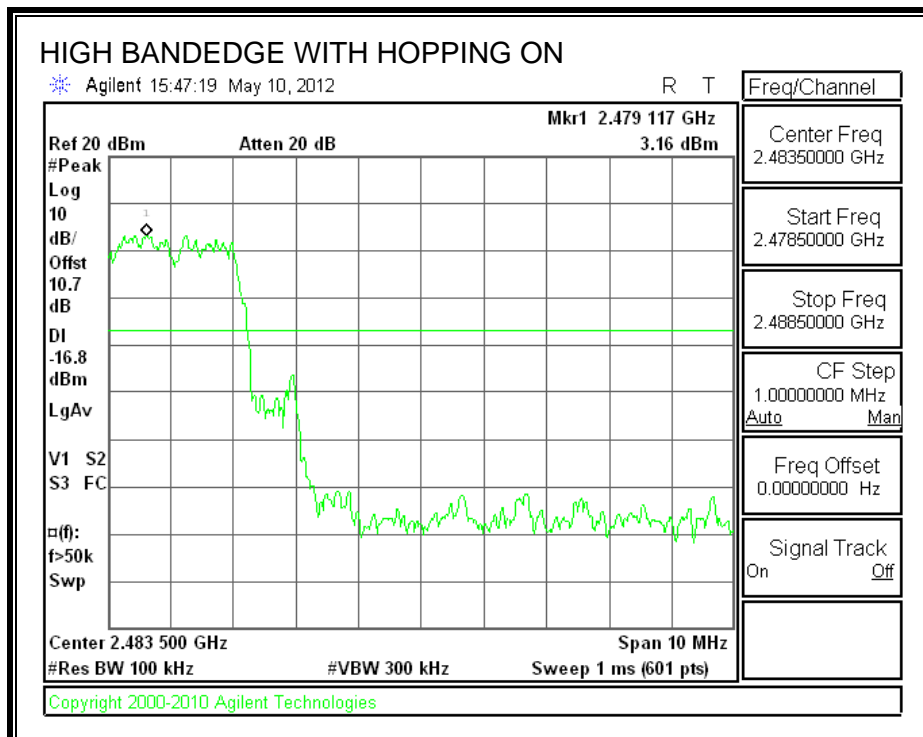
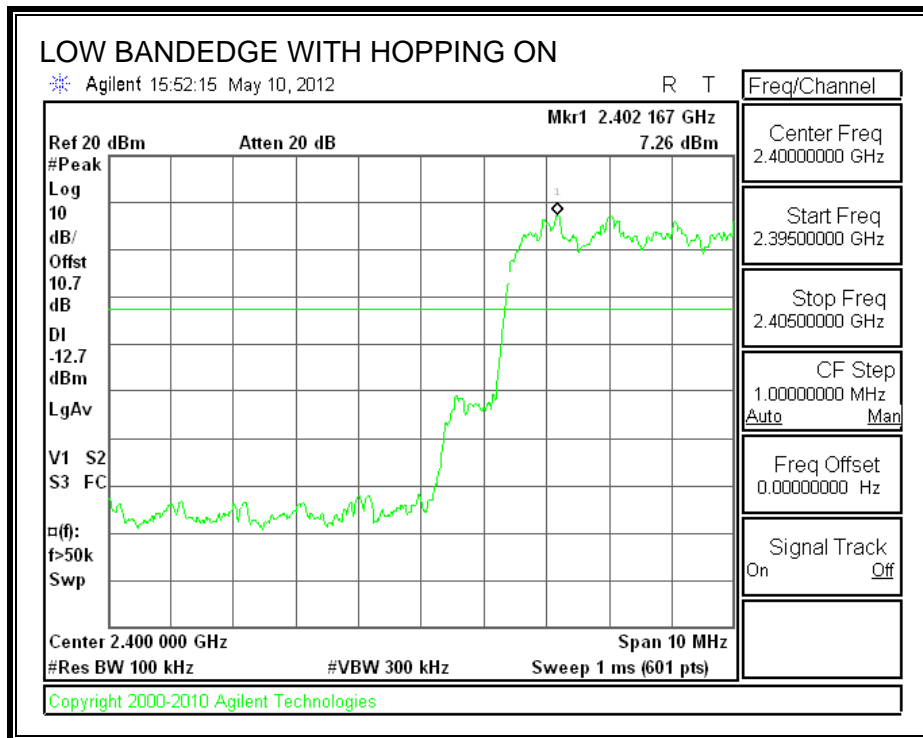
**SPURIOUS EMISSIONS, MID CHANNEL**



**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.

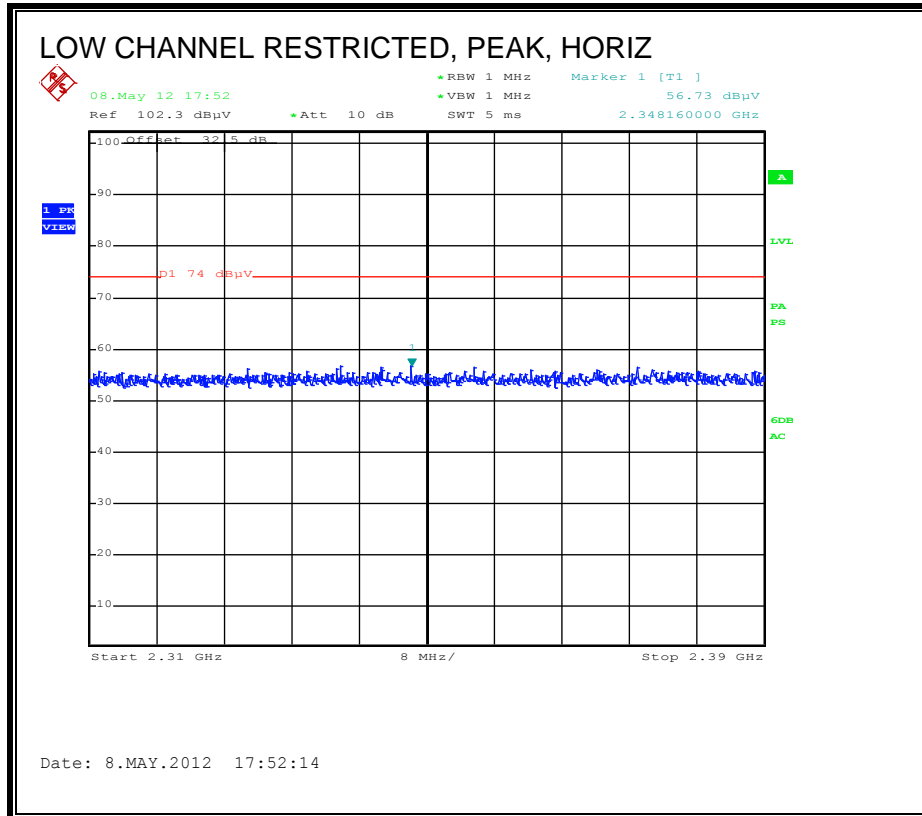
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

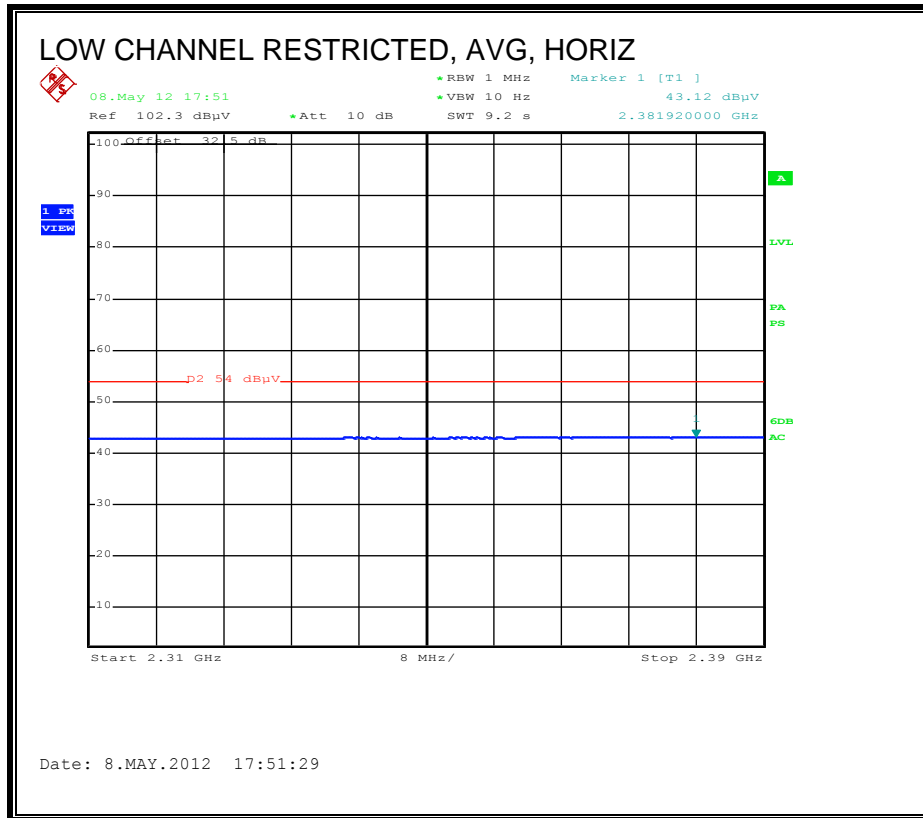
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 8.2. TRANSMITTER ABOVE 1 GHz

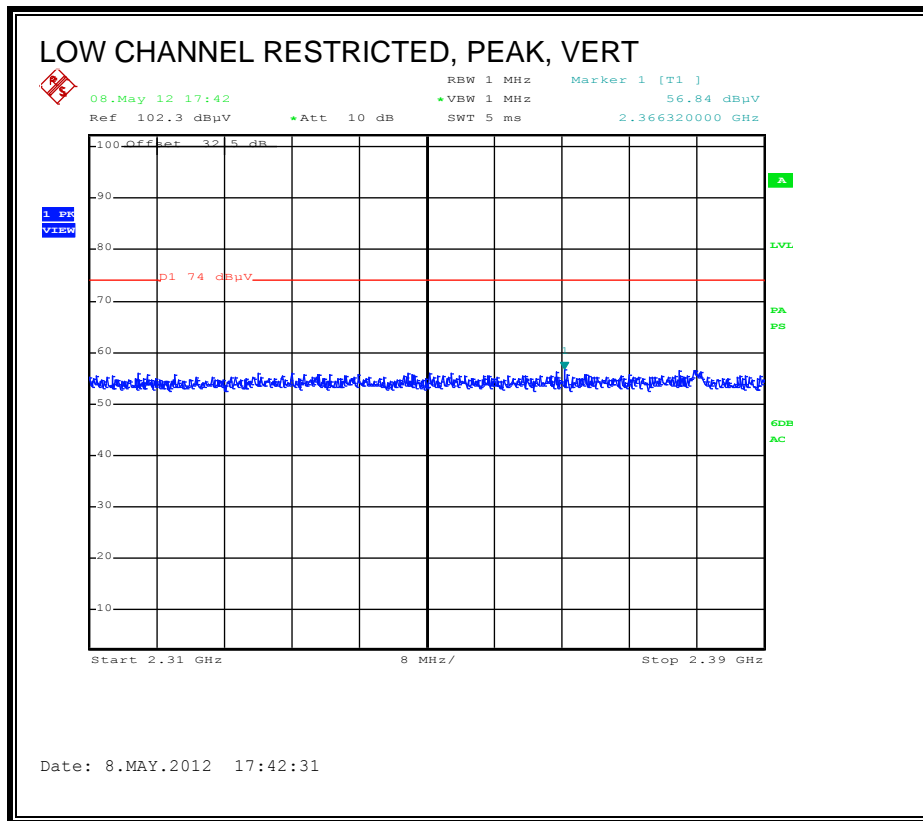
### 8.2.1. BASIC DATA RATE GFSK MODULATION

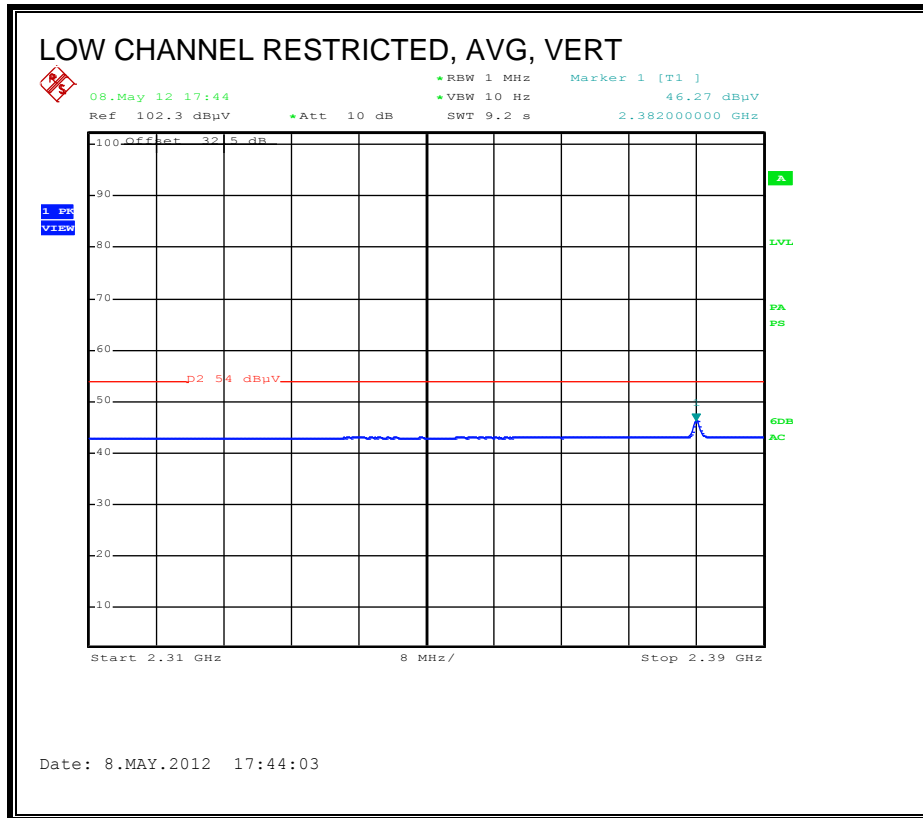
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



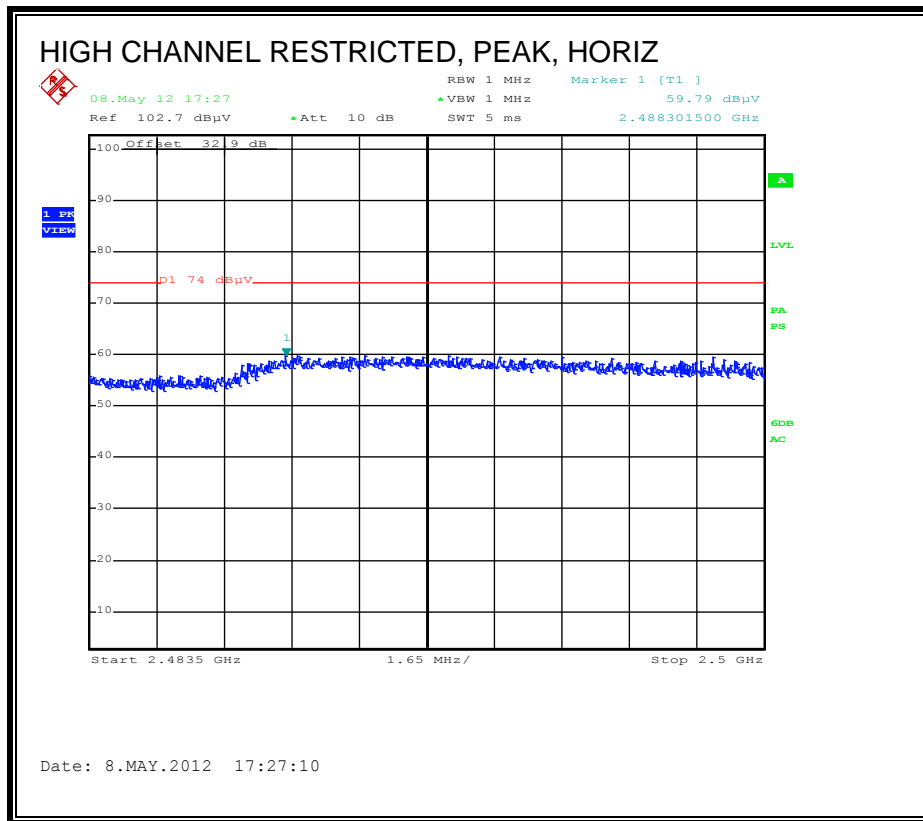


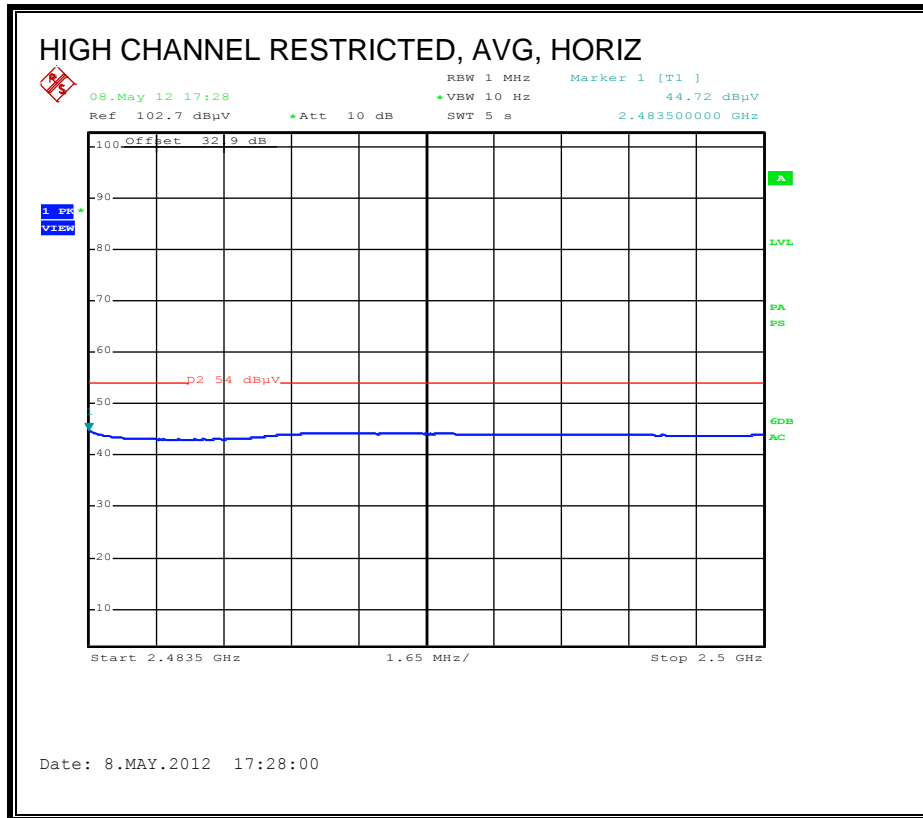
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



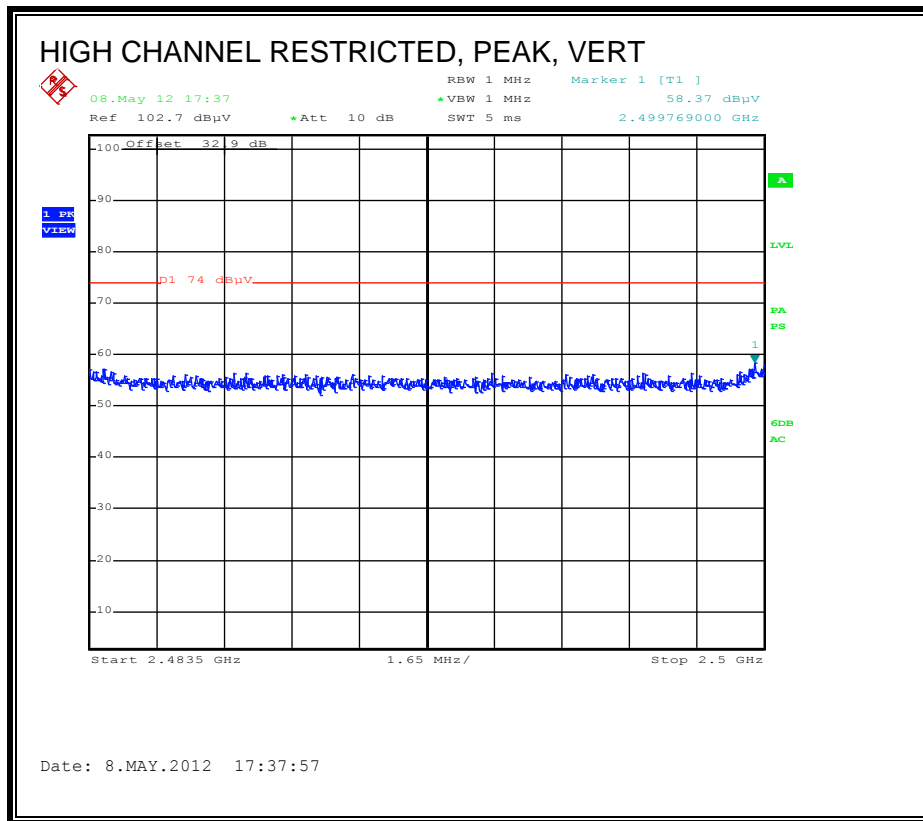


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

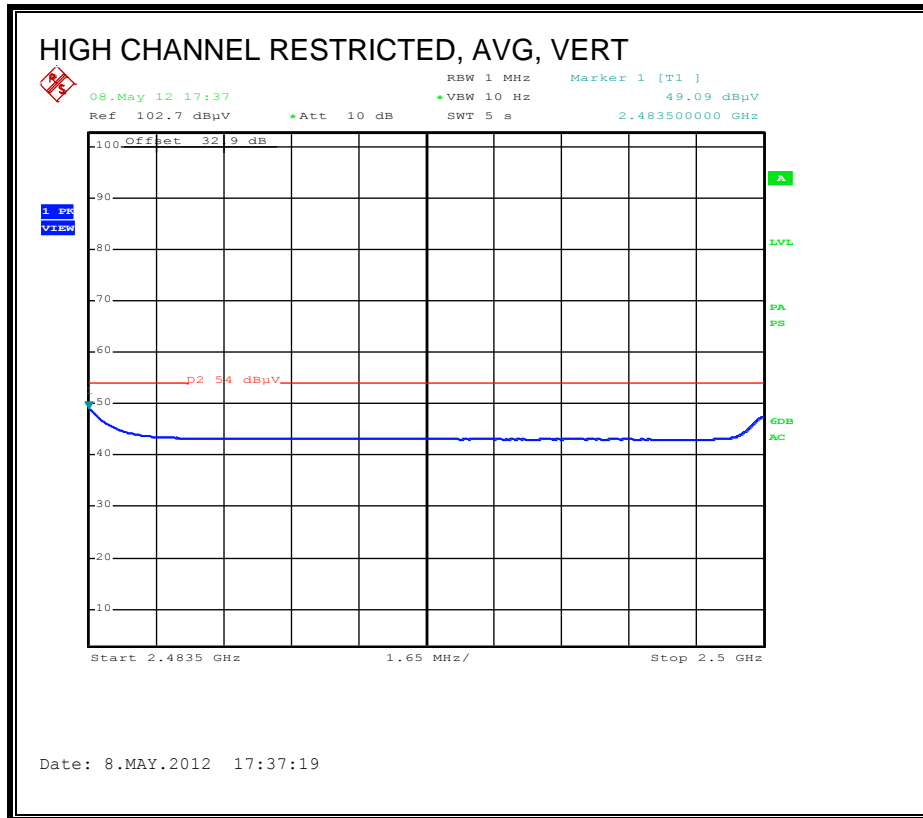




**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





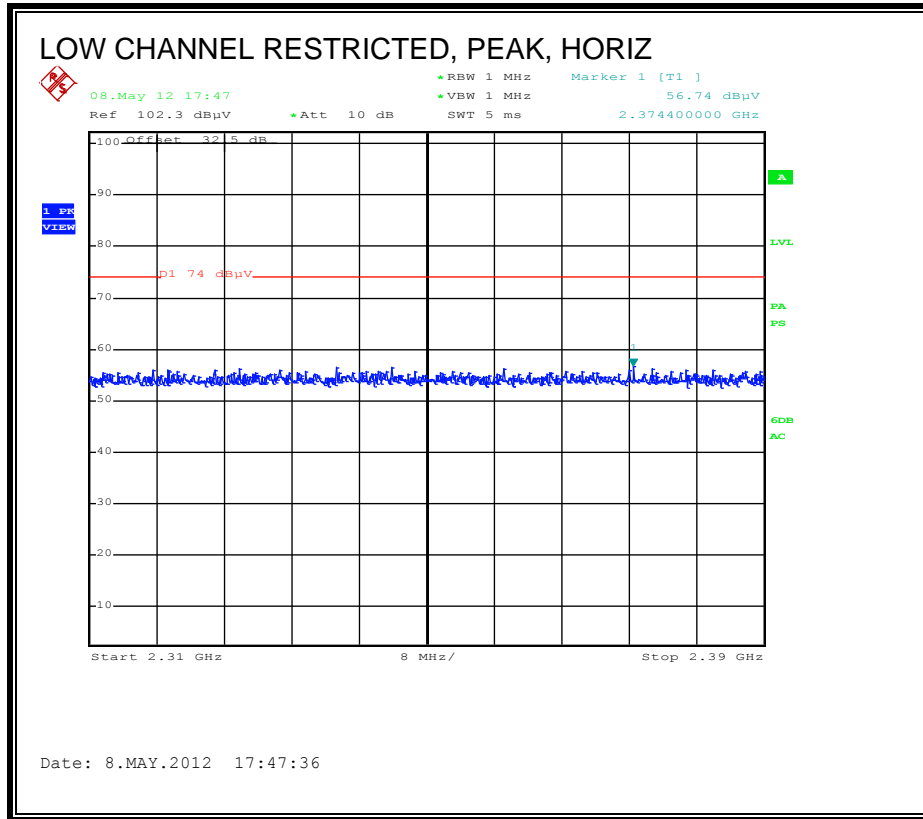


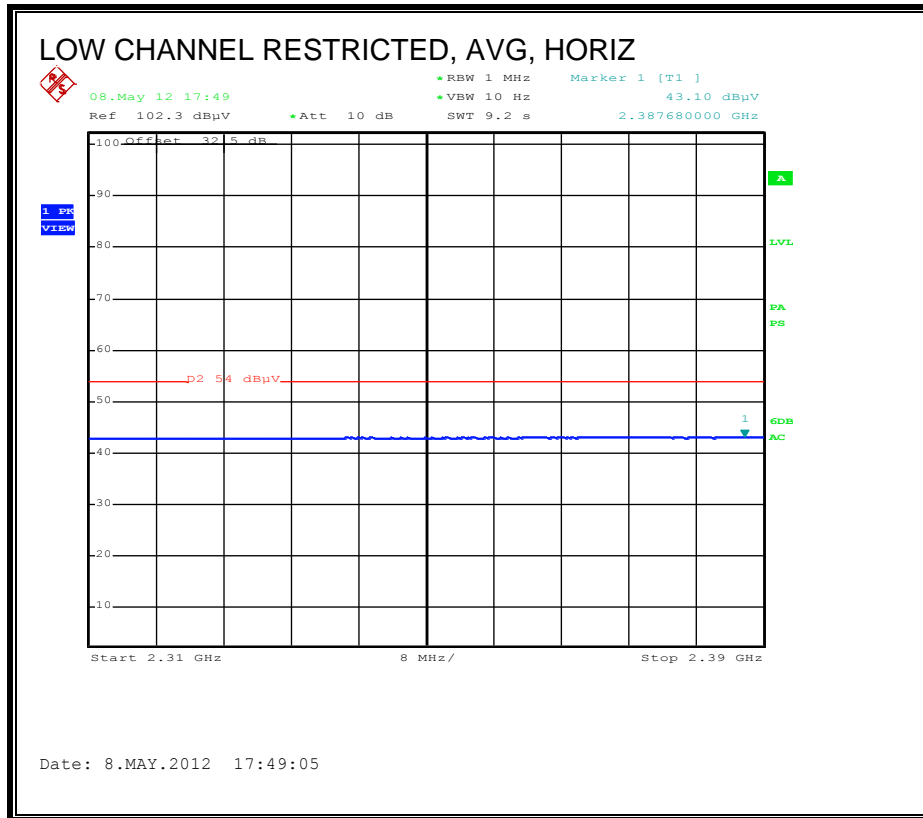
**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		David Garcia											
Date:		05/08/12											
Project #:		12U14227											
Company:		Broadcom											
Test Target:		15.205											
Mode Oper:		Bluetooth GFSK											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dB	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Low Channel: 2402 MHz</b>													
4.804	3.0	40.1	33.1	6.8	-34.1	0.0	0.0	45.9	74.0	-28.1	H	P	
4.804	3.0	33.9	33.1	6.8	-34.1	0.0	0.0	39.7	54.0	-14.3	H	A	
4.804	3.0	39.5	33.1	6.8	-34.1	0.0	0.0	45.3	74.0	-28.7	V	P	
4.804	3.0	31.2	33.1	6.8	-34.1	0.0	0.0	37.0	54.0	-17.0	V	A	
<b>Mid Channel: 2441 MHz</b>													
4.882	3.0	40.0	33.2	6.8	-34.0	0.0	0.0	45.9	74.0	-28.1	H	P	
4.882	3.0	31.6	33.2	6.8	-34.0	0.0	0.0	37.6	54.0	-16.4	H	A	
7.323	3.0	35.5	36.3	9.1	-33.1	0.0	0.0	47.8	74.0	-26.2	H	P	
7.323	3.0	23.2	36.3	9.1	-33.1	0.0	0.0	35.5	54.0	-18.5	H	A	
4.882	3.0	41.7	33.2	6.8	-34.0	0.0	0.0	47.6	74.0	-26.4	V	P	
4.882	3.0	33.5	33.2	6.8	-34.0	0.0	0.0	39.4	54.0	-14.6	V	A	
7.323	3.0	35.3	36.3	9.1	-33.1	0.0	0.0	47.6	74.0	-26.4	V	P	
7.323	3.0	23.3	36.3	9.1	-33.1	0.0	0.0	35.6	54.0	-18.4	V	A	
<b>High Channel: 2480 MHz</b>													
4.960	3.0	51.9	33.2	6.9	-34.0	0.0	0.0	58.0	74.0	-16.0	H	P	
4.960	3.0	25.6	33.2	6.9	-34.0	0.0	0.0	31.7	54.0	-22.3	H	A	
7.440	3.0	35.7	36.5	9.1	-33.0	0.0	0.0	48.2	74.0	-25.8	H	P	
7.440	3.0	23.9	36.5	9.1	-33.0	0.0	0.0	36.4	54.0	-17.6	H	A	
4.960	3.0	51.3	33.2	6.9	-34.0	0.0	0.0	57.4	74.0	-16.6	V	P	
4.960	3.0	31.4	33.2	6.9	-34.0	0.0	0.0	37.4	54.0	-16.6	V	A	
7.440	3.0	35.2	36.5	9.1	-33.0	0.0	0.0	47.8	74.0	-26.2	V	P	
7.440	3.0	23.1	36.5	9.1	-33.0	0.0	0.0	35.6	54.0	-18.4	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

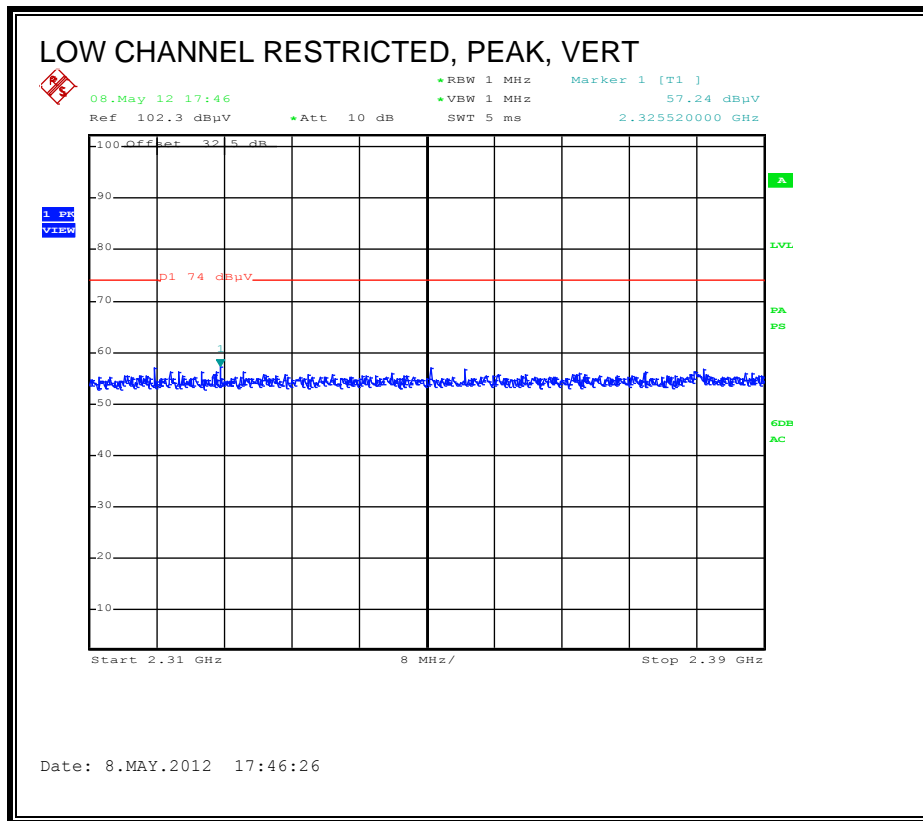
### 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

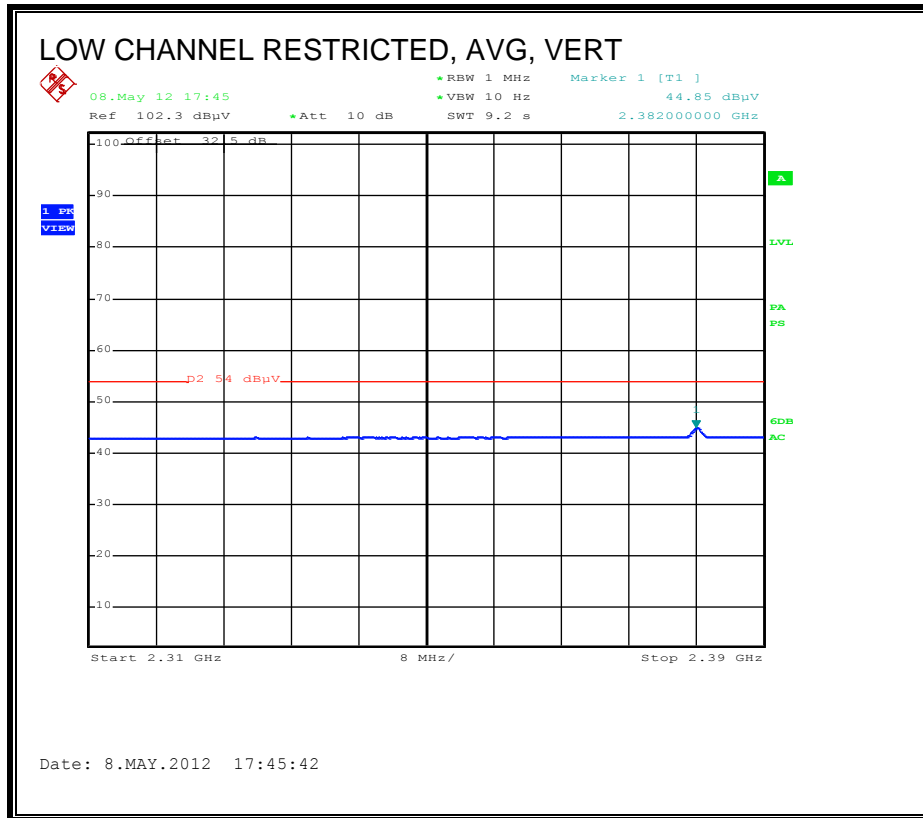
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



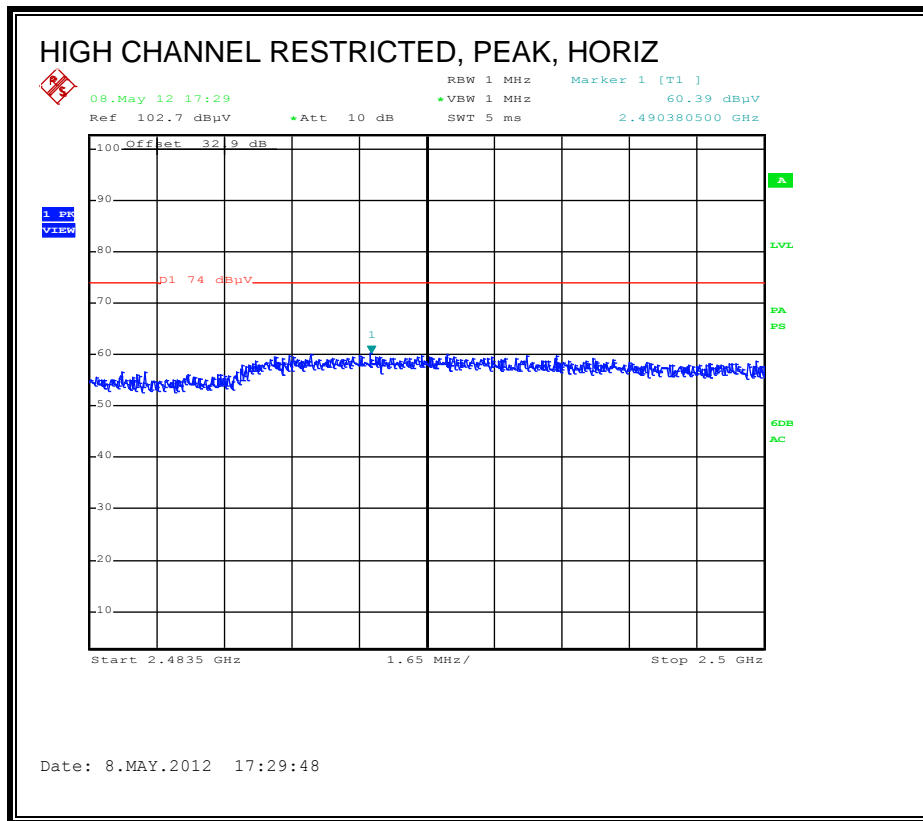


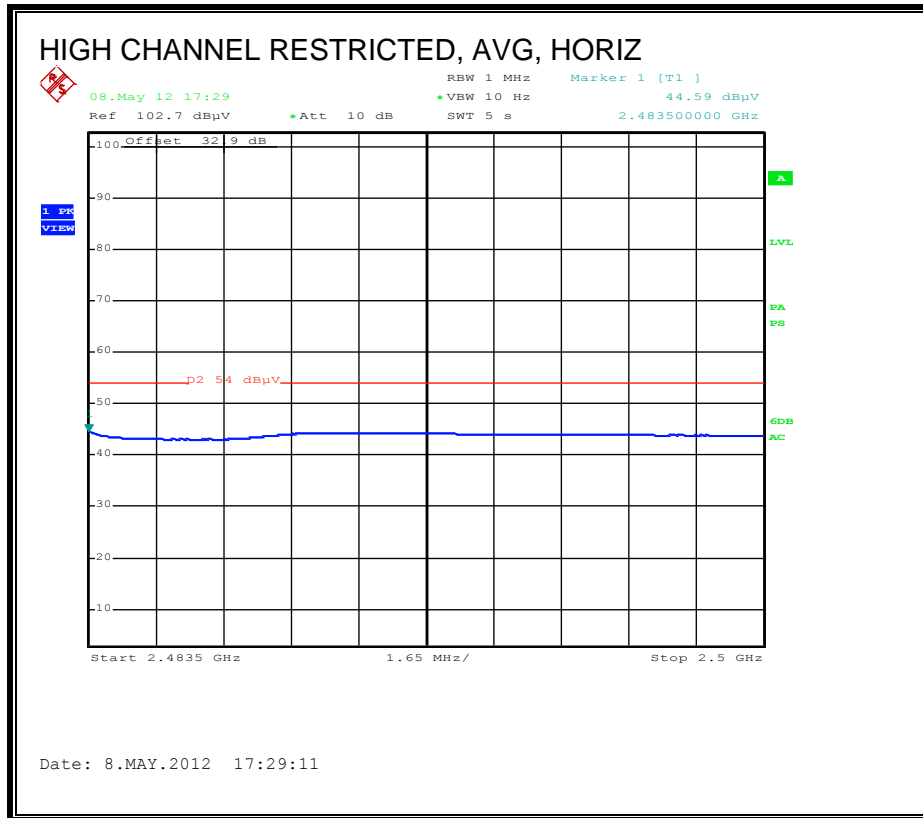
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**





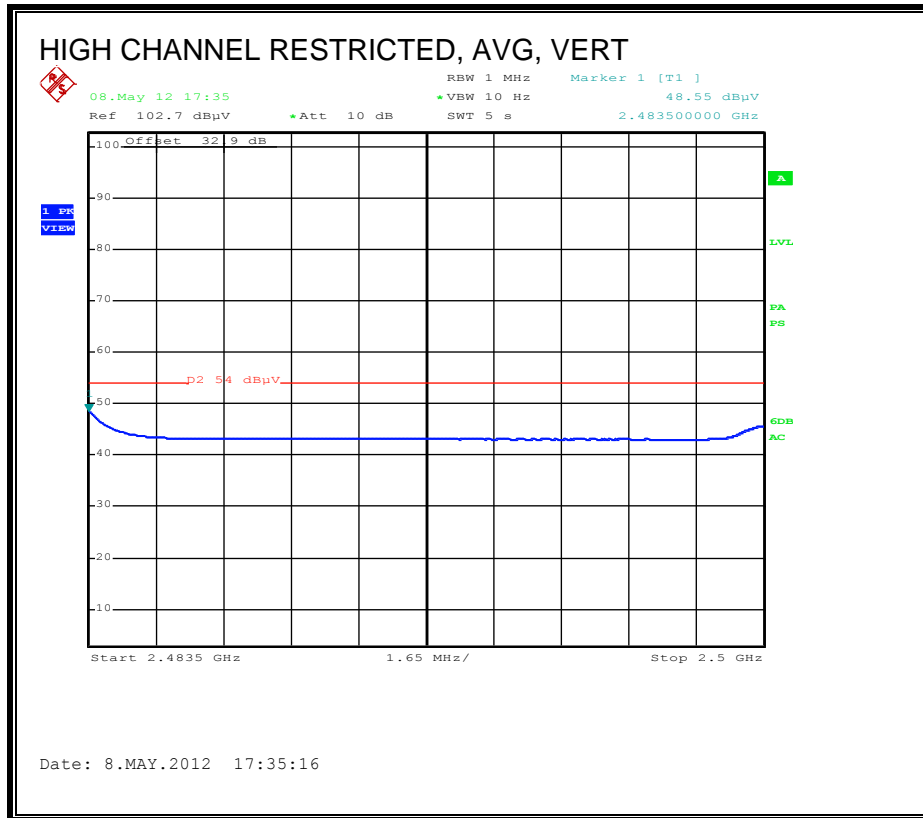
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**









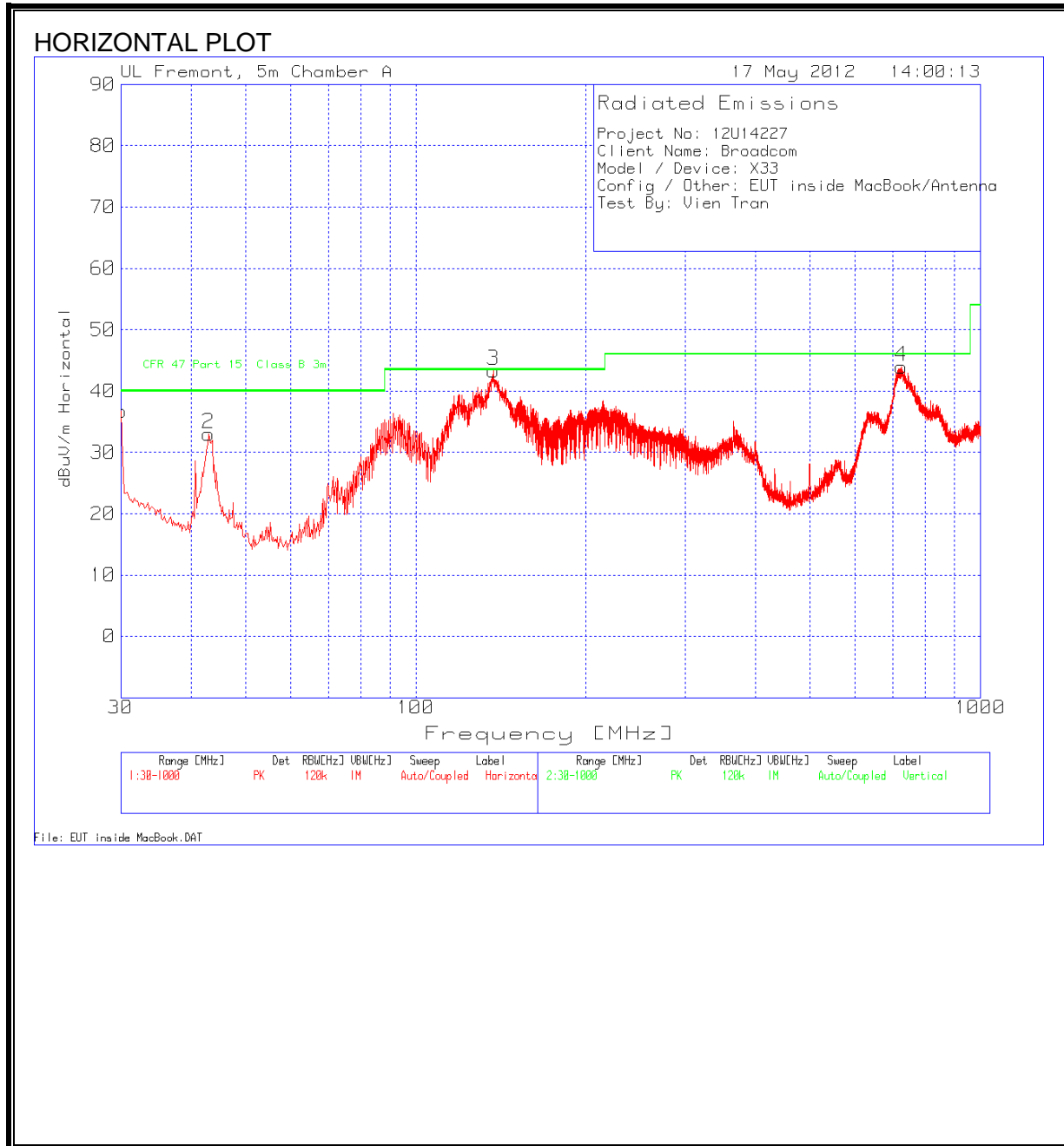


**HARMONICS AND SPURIOUS EMISSIONS**

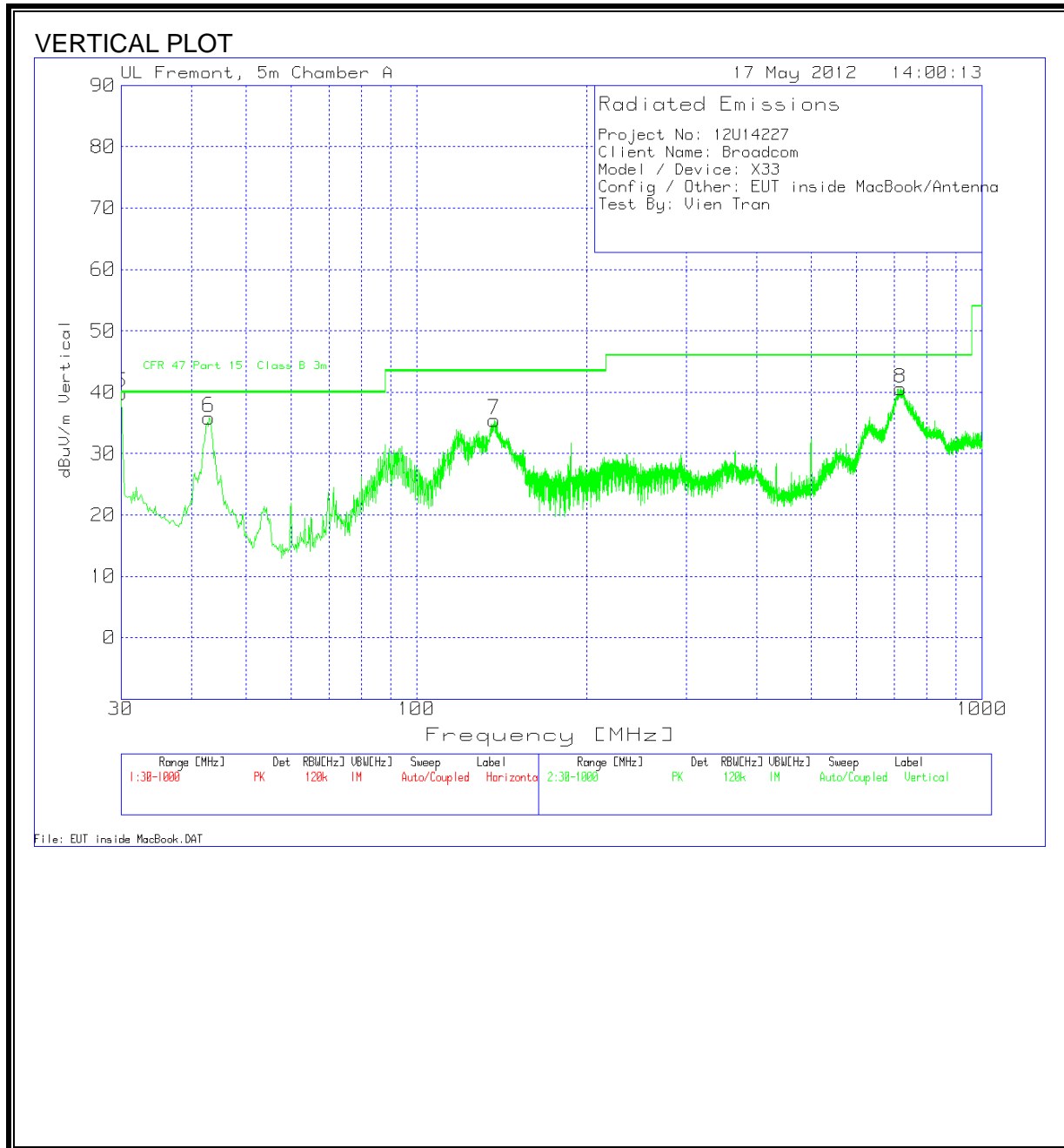
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		David Garcia											
Date:		05/08/12											
Project #:		12U14227											
Company:		Broadcom											
Test Target:		15.205											
Mode Oper:		Bluetooth 8PSK											
f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit									
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit									
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit									
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit									
CL	Cable Loss	HPF	High Pass Filter										
f	Dist	Read	AF	CL	Amp	D Corr	Fltr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP
<b>Low Channel: 2402 MHz</b>													
4.804	3.0	39.8	33.1	6.8	-34.1	0.0	0.0	45.6	74.0	-28.4	H	P	
4.804	3.0	30.5	33.1	6.8	-34.1	0.0	0.0	36.3	54.0	-17.7	H	A	
4.804	3.0	39.1	33.1	6.8	-34.1	0.0	0.0	44.9	74.0	-29.1	V	P	
4.804	3.0	29.5	33.1	6.8	-34.1	0.0	0.0	35.3	54.0	-18.7	V	A	
<b>Mid Channel: 2441 MHz</b>													
4.882	3.0	38.7	33.2	6.8	-34.0	0.0	0.0	44.6	74.0	-29.4	H	P	
4.882	3.0	28.7	33.2	6.8	-34.0	0.0	0.0	34.6	54.0	-19.4	H	A	
7.323	3.0	35.0	36.3	9.1	-33.1	0.0	0.0	47.3	74.0	-26.7	H	P	
7.323	3.0	23.0	36.3	9.1	-33.1	0.0	0.0	35.3	54.0	-18.7	H	A	
4.882	3.0	39.6	33.2	6.8	-34.0	0.0	0.0	45.5	74.0	-28.5	V	P	
4.882	3.0	30.1	33.2	6.8	-34.0	0.0	0.0	36.0	54.0	-18.0	V	A	
7.323	3.0	35.3	36.3	9.1	-33.1	0.0	0.0	47.6	74.0	-26.4	V	P	
7.323	3.0	23.1	36.3	9.1	-33.1	0.0	0.0	35.4	54.0	-18.6	V	A	
<b>High Channel: 2480 MHz</b>													
4.960	3.0	52.7	33.2	6.9	-34.0	0.0	0.0	58.8	74.0	-15.2	H	P	
4.960	3.0	25.6	33.2	6.9	-34.0	0.0	0.0	31.7	54.0	-22.3	H	A	
7.440	3.0	35.9	36.5	9.1	-33.0	0.0	0.0	48.5	74.0	-25.5	H	P	
7.440	3.0	23.6	36.5	9.1	-33.0	0.0	0.0	36.1	54.0	-17.9	H	A	
4.960	3.0	53.8	33.2	6.9	-34.0	0.0	0.0	59.8	74.0	-14.2	V	P	
4.960	3.0	26.0	33.2	6.9	-34.0	0.0	0.0	32.1	54.0	-21.9	V	A	
7.440	3.0	35.5	36.5	9.1	-33.0	0.0	0.0	48.1	74.0	-25.9	V	P	
7.440	3.0	23.5	36.5	9.1	-33.0	0.0	0.0	36.0	54.0	-18.0	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

### 8.3. WORST-CASE BELOW 1 GHz

#### IONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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



**HORIZONTAL AND VERTICAL DATA**

Project No: 12U14227									
Client Name: Broadcom									
Model / Device: X33									
Config / Other: EUT inside MacBook/Antenna									
Test By: Vien Tran									

**Horizontal 30 - 1000MHz**

Test Frequency	Meter Reading	Detector	1GHz ChmbrA Amplified. TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
30	42.99	PK	-27.5	21.3	36.79	40.0	-3.21	200	Horz
42.9876	48.53	PK	-27.4	11.9	33.03	40.0	-6.97	400	Horz
137.3901	57.02	PK	-26.7	13.0	43.32	43.5	-0.18	200	Horz
137.3901	53.81	QK	-26.7	13.0	40.11	43.5	-3.39	200	Horz
725.9033	47.02	PK	-23.3	20.2	43.92	46.0	-2.08	100	Horz
725.9033	45.14	PK	-23.3	20.2	42.04	46.0	-3.96	100	Horz

**Vertical 30 - 1000MHz**

Test Frequency	Meter Reading	Detector	1GHz ChmbrA Amplified. TX [dB]	T243 Sunol Bilog.TXT [dB]	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
30	46.01	PK	-27.5	21.3	39.81	40.0	-0.19	400	Vert
30	40.72	PK	-27.5	21.3	34.52	40.0	-5.48	400	Vert
42.9876	51.35	PK	-27.4	11.9	35.85	40.0	-4.15	100	Vert
137.3901	49.18	PK	-26.7	13.0	35.48	43.5	-8.02	200	Vert
717.3741	43.66	PK	-23.2	20.1	40.56	46.0	-5.44	100	Vert

PK - Peak detector  
 QP - Quasi-Peak detector  
 Av - Average detector

## 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.

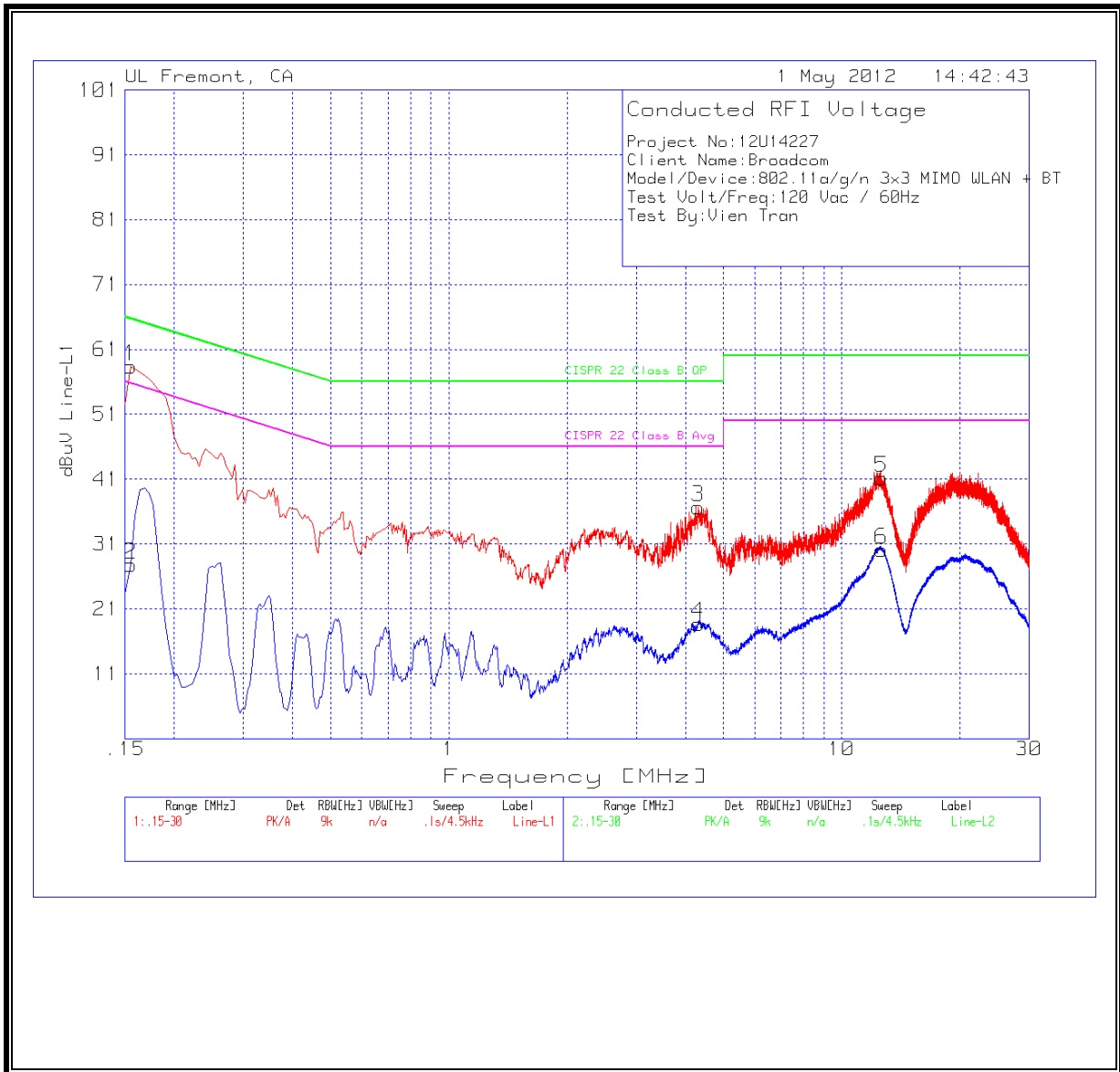
**RESULTS**

**6 WORST EMISSIONS**

Project No:12U14227									
Client Name:Broadcom									
Model/Device:802.11a/g/n 3x3 MIMO WLAN + BT									
Test Volt/Freq:120 Vac / 60Hz									
Test By:Vien Tran									
<b>Line-L1 .15 - 30MHz</b>									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.155	58.27	PK	0.1	0.00	58.37	65.8	-7.43	-	-
0.155	27.73	Av	0.1	0.00	27.83	-	-	55.80	-27.97
4.308	36.5	PK	0.1	0.10	36.70	56	-19.30	-	-
4.308	18.47	Av	0.1	0.10	18.67	-	-	46.00	-27.33
12.615	40.75	PK	0.2	0.20	41.15	60	-18.85	-	-
12.615	29.67	Av	0.2	0.20	30.07	-	-	50.00	-19.93
<b>Line-L2 .15 - 30MHz</b>									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBuV	CISPR 22 Class B QP	Margin	CISPR 22 Class B Avg	Margin
0.164	54.87	PK	0.1	0	54.97	65.3	-10.33	-	-
0.164	35.78	Av	0.1	0	35.88	-	-	55.3	-19.42
4.232	36.83	PK	0.1	0.1	37.03	56	-18.97	-	-
4.232	19.17	Av	0.1	0.1	19.37	-	-	46	-26.63
12.539	41.39	PK	0.2	0.2	41.79	60	-18.21	-	-
12.539	29.68	Av	0.2	0.2	30.08	-	-	50	-19.92
PK - Peak detector									
QP - Quasi-Peak detector									
Av - Average detector									



**LINE 1 RESULTS**



**LINE 2 RESULTS**

