



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 7  
CERTIFICATION TEST REPORT**

**FOR**

**802.11g/Draft 802.11n Wireless LAN + Bluetooth  
PCI-E Mini Card**

**MODEL NUMBER: BCM943225HMB**

**FCC ID: QDS-BRCM1048  
IC: 4324A-BRCM1048**

**REPORT NUMBER: 09U12521-2**

**ISSUE DATE: MAY 05, 2009**

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

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



**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
---	05/05/09	Initial Issue	T. Chan

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS</b> .....	<b>4</b>
<b>2. TEST METHODOLOGY</b> .....	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION</b> .....	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY</b> .....	<b>5</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	5
4.2. <i>MEASUREMENT UNCERTAINTY</i> .....	5
<b>5. EQUIPMENT UNDER TEST</b> .....	<b>6</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	6
5.2. <i>MAXIMUM OUTPUT POWER</i> .....	6
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> .....	6
5.4. <i>SOFTWARE AND FIRMWARE</i> .....	6
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i> .....	6
5.6. <i>DESCRIPTION OF TEST SETUP</i> .....	7
<b>6. TEST AND MEASUREMENT EQUIPMENT</b> .....	<b>9</b>
<b>7. ANTENNA PORT TEST RESULTS</b> .....	<b>10</b>
7.1.1. <i>HOPPING FREQUENCY SEPARATION</i> .....	10
7.1.2. <i>NUMBER OF HOPPING CHANNELS</i> .....	12
7.1.3. <i>AVERAGE TIME OF OCCUPANCY</i> .....	17
7.1.4. <i>20 dB AND 99% BANDWIDTH</i> .....	24
7.1.5. <i>OUTPUT POWER</i> .....	33
7.1.6. <i>CONDUCTED SPURIOUS EMISSIONS</i> .....	38
<b>8. RADIATED TEST RESULTS</b> .....	<b>47</b>
8.1. <i>TRANSMITTER ABOVE 1 GHz</i> .....	48
8.1.1. <i>GFSK MODE</i> .....	48
8.1.2. <i>8PSK MODE</i> .....	53
8.2. <i>RECEIVER ABOVE 1 GHz</i> .....	58
8.3. <i>WORST-CASE BELOW 1 GHz</i> .....	59
<b>9. AC POWER LINE CONDUCTED EMISSIONS</b> .....	<b>60</b>
<b>10. MAXIMUM PERMISSIBLE EXPOSURE</b> .....	<b>63</b>
<b>11. SETUP PHOTOS</b> .....	<b>66</b>

# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** 802.11g/Draft 802.11n Wireless LAN + Bluetooth  
PCI-E Mini Card

**MODEL:** BCM943225HMB

**SERIAL NUMBER:** P105

**DATE TESTED:** APRIL 28 ~ 29, 2009

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 2	Pass

Compliance Certification Services, Inc. (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 CCS based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

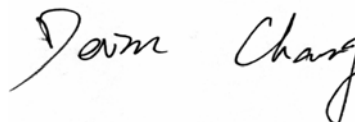
**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:



THU CHAN  
EMC MANAGER  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



DEVIN CHANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 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 2, and RSS-210 Issue 7.

## 3. FACILITIES AND ACCREDITATION

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

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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

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

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is an 802.11g Wireless LAN + Bluetooth PCI-E Mini Card and manufactured by Broadcom Corporation. Model number is BCM943225HMB.

### 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	3.87	2.44
2402 - 2480	Enhanced 8PSK	6.50	4.47

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bg WLAN and Bluetooth antennas, with a maximum gain of 3.9dBi.

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was Broadcom BCM2070 Bluetooth 2.1 + EDR USB device, ver 5.5.0.4100.

The test utility software used during testing was Blue Tool Blue Tool, ver 1.1.2.7.

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on preliminary tests of the chipset utilized in this radio.

All final tests in the GFSK mode were made at 1 Mb/s.

All final tests in the 8PSK mode were made at 3 Mb/s.

For radiated emissions below 1 GHz the worst-case configuration is determined to be the mode and channel with the highest output power.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Pavilion zv6000	CND52904S1	DoC
AC Adapter	HP	PA-1121-12HD	58B240ALLRQCEE	DoC

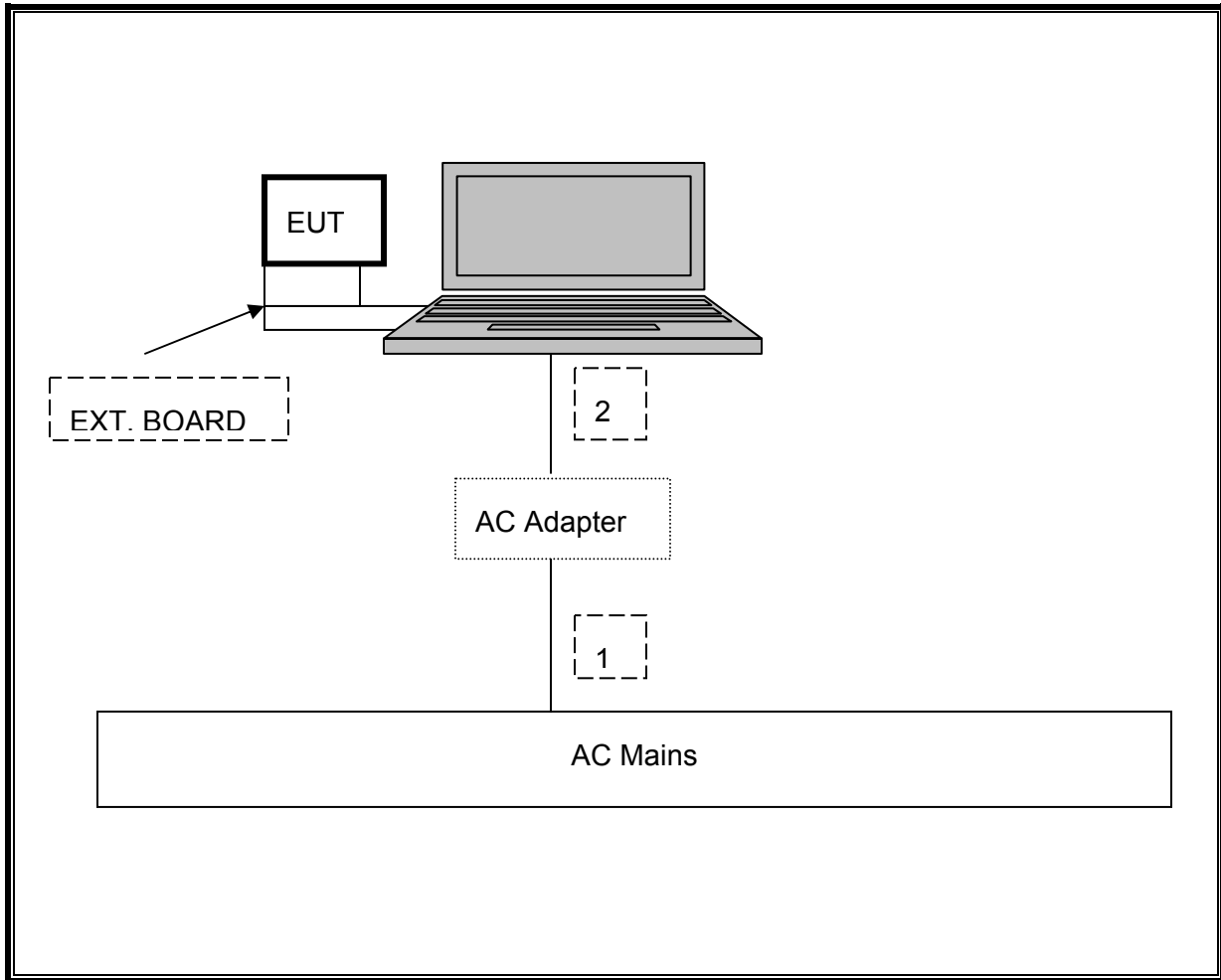
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.8m	N/A
2	DC	1	DC	Unshielded	1.8m	Ferrite at laptop's end

### TEST SETUP

The EUT is connected to a host laptop computer via an extended card during the test. Test software exercised the radio card.

**SETUP DIAGRAM**





## 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
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/22/10
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01161	08/06/09
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	11/14/09
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	12/01/09
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	09/19/09
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	02/11/10
Peak Power Meter	Boonton	4541	N/A	01/15/10
Peak / Average Power Sensor	Boonton	57318	N/A	02/02/10
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/09
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/07/09
2.4 - 2.5 Reject Filter	Micro Tronics	BRM50702	N/A	N/A
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/09

## 7. ANTENNA PORT TEST RESULTS

### 7.1.1. 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.

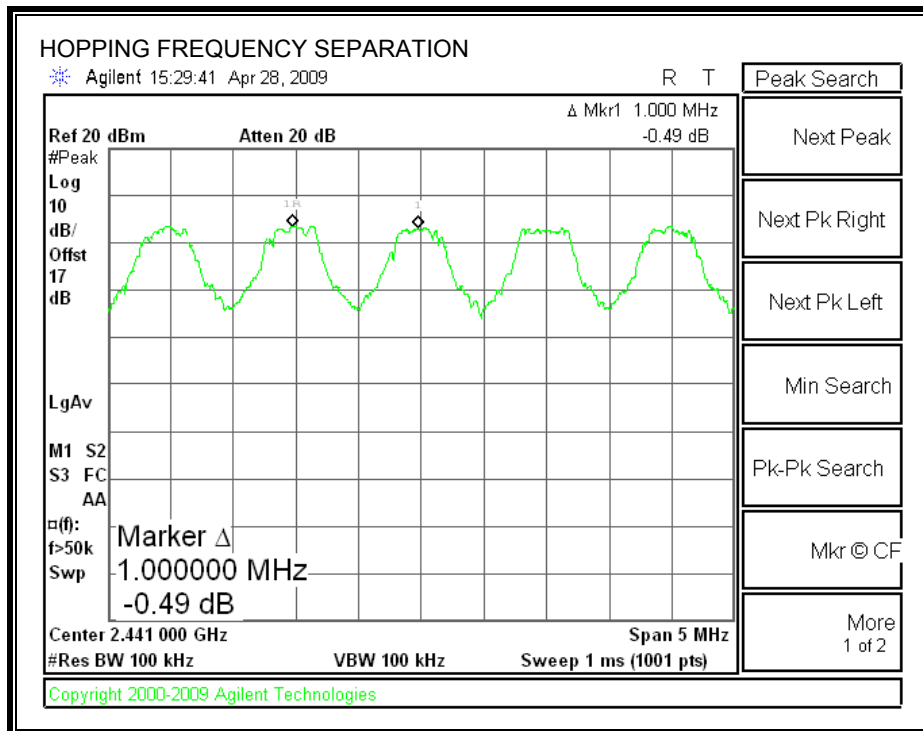
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

#### TEST PROCEDURE

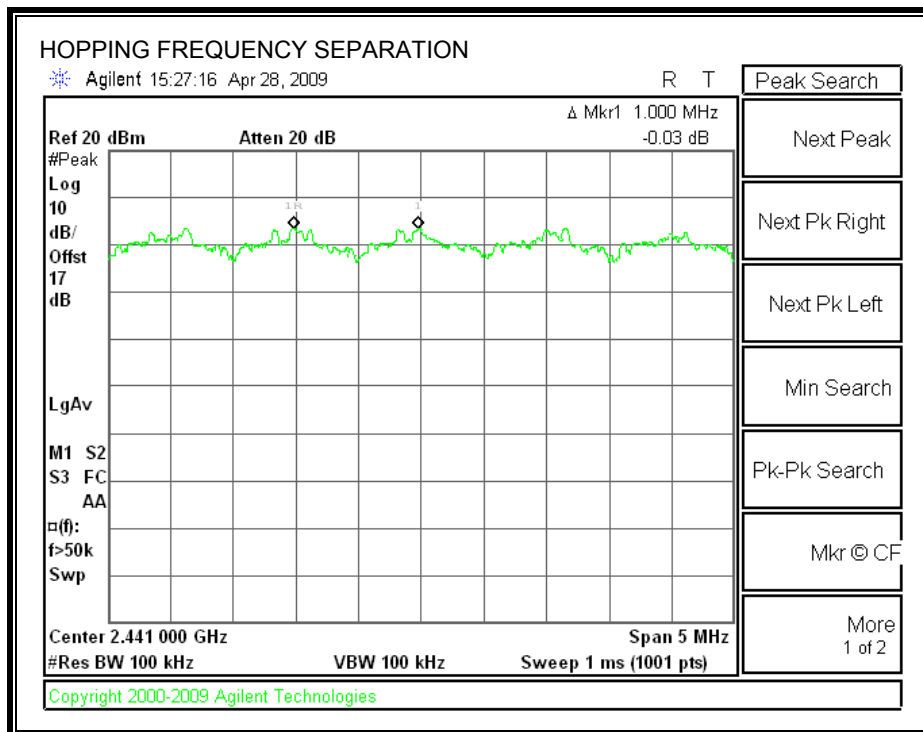
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

#### RESULTS

**HOPPING FREQUENCY SEPARATION – GFSK MODE**



**HOPPING FREQUENCY SEPARATION – 8PSK MODE**



## **7.1.2. 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.

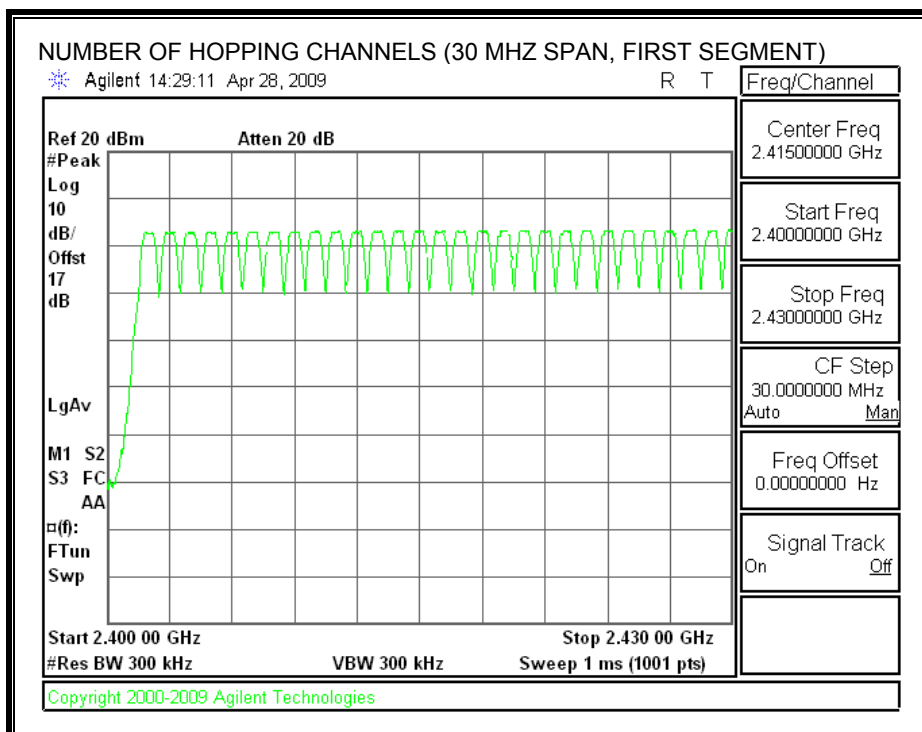
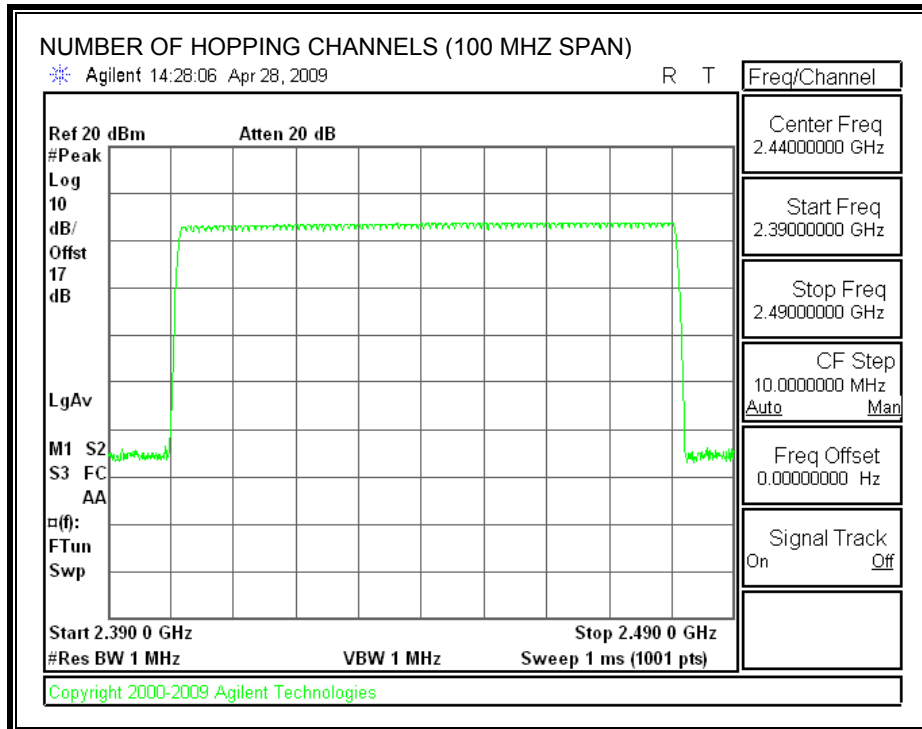
### **TEST PROCEDURE**

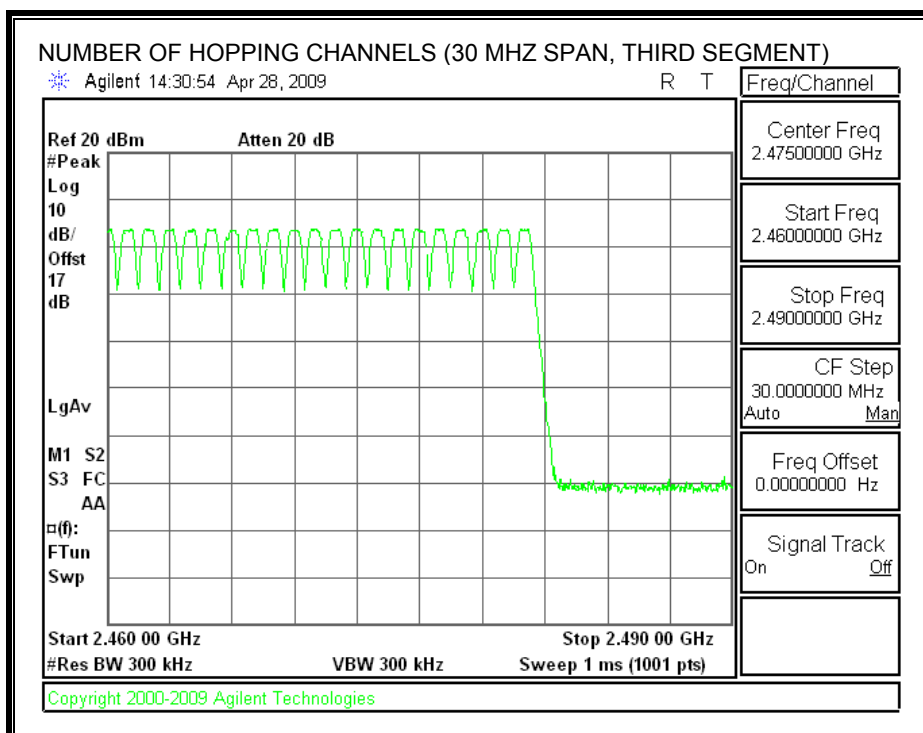
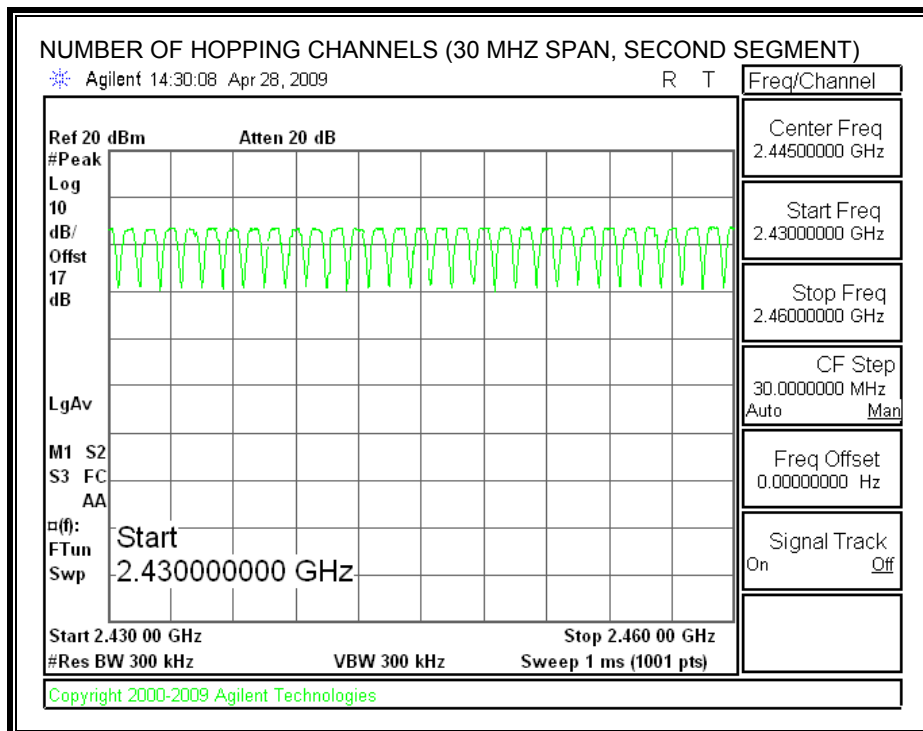
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

### **RESULTS**

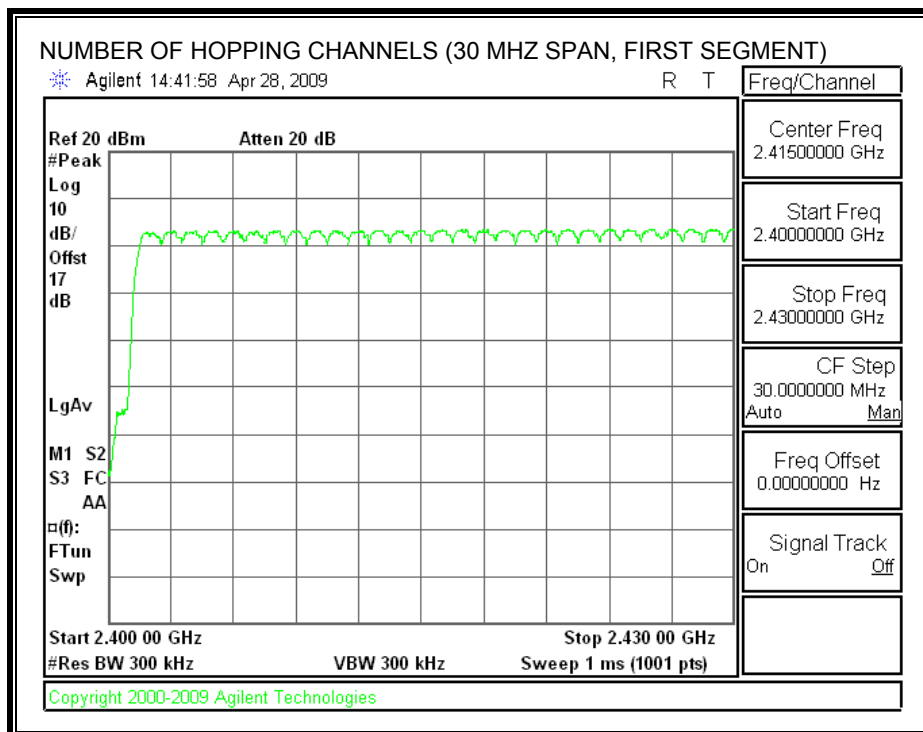
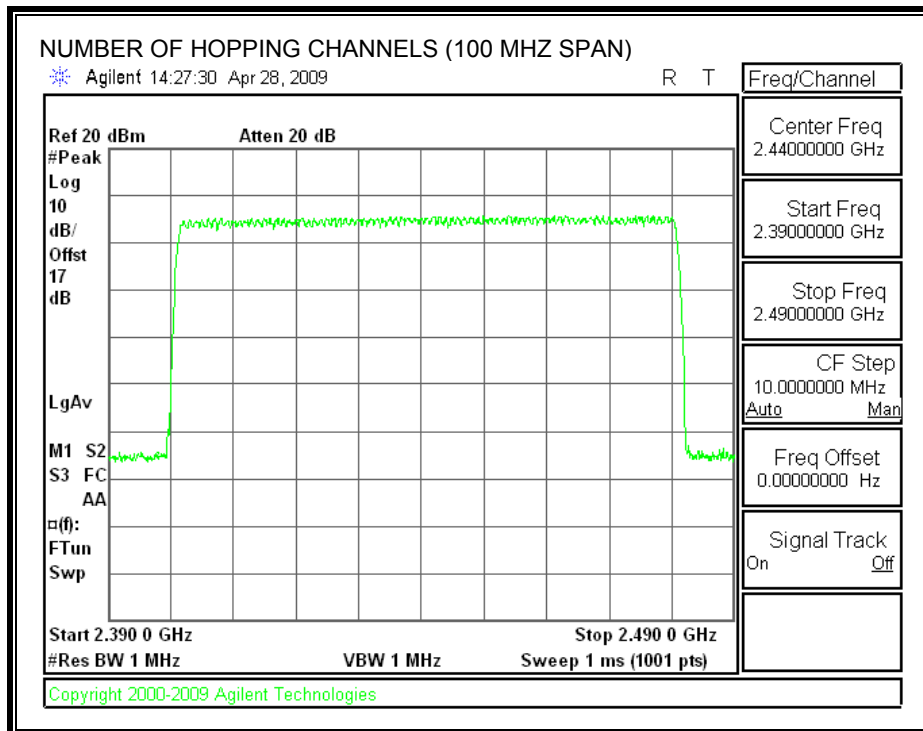
79 Channels observed.

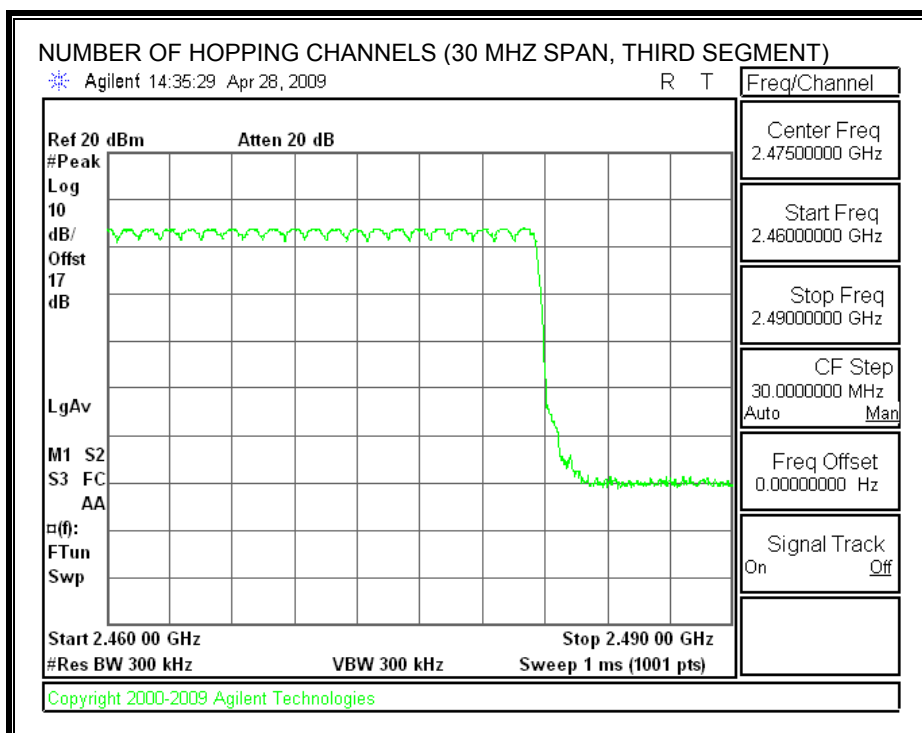
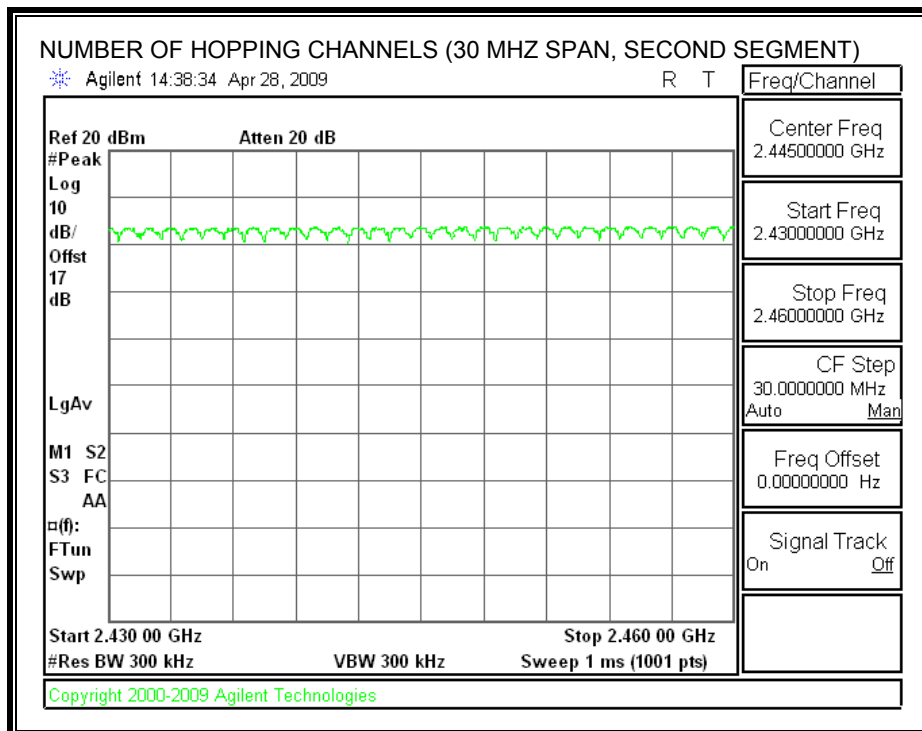
**NUMBER OF HOPPING CHANNELS – GFSK MODE**





**NUMBER OF HOPPING CHANNELS – 8PSK MODE**







**7.1.3. 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 \* (# of pulses in 3.16 s) \* pulse width.

**RESULTS**

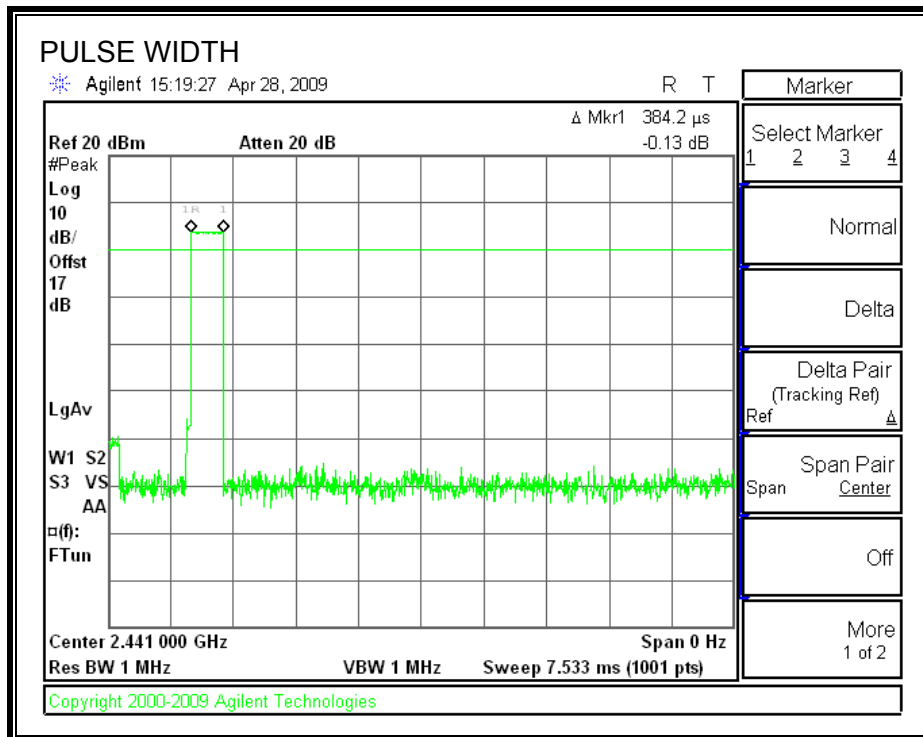
GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.384	33	0.127	0.4	0.273
DH3	1.627	20	0.325	0.4	0.075
DH5	2.878	13	0.374	0.4	0.026

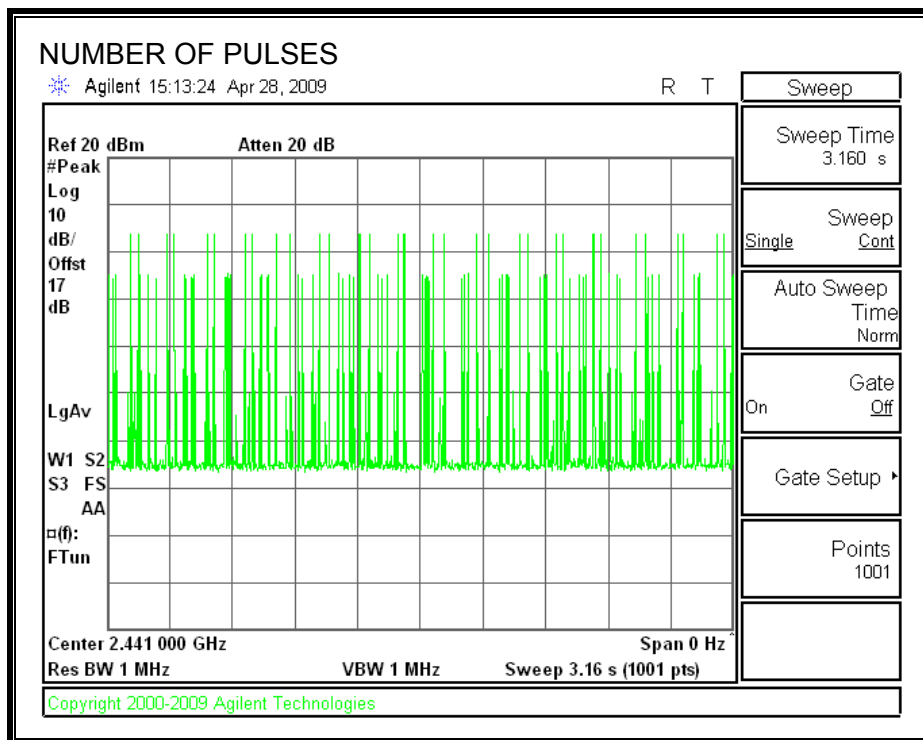
8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.392	34	0.133	0.4	0.267
DH3	1.642	18	0.296	0.4	0.104
DH5	2.885	11	0.317	0.4	0.083

**GFSK MODE - FREQUENCY PACKET DH1**

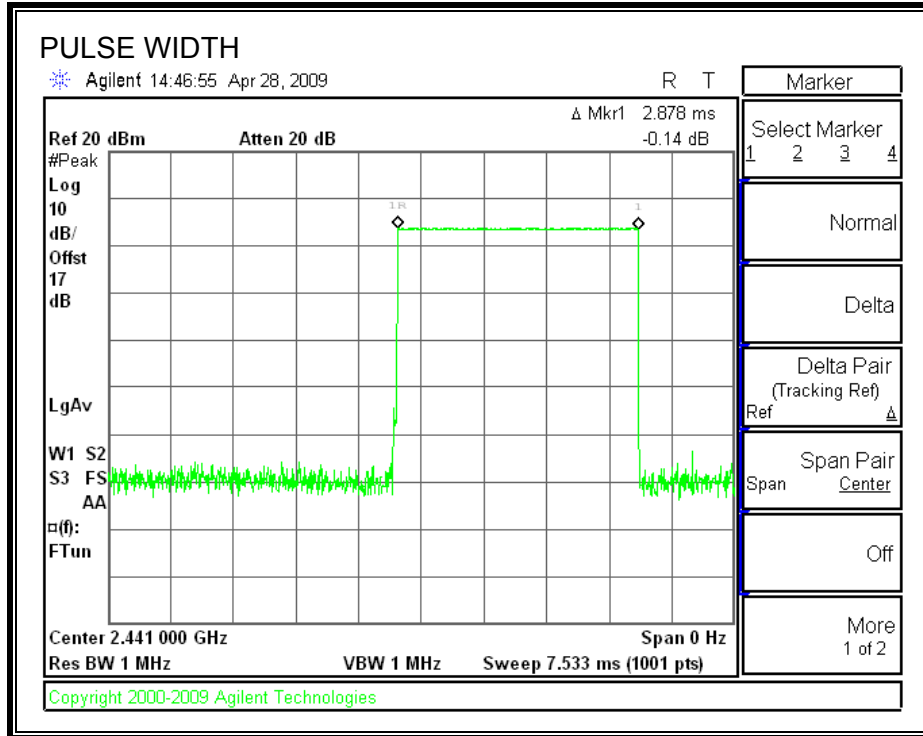


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

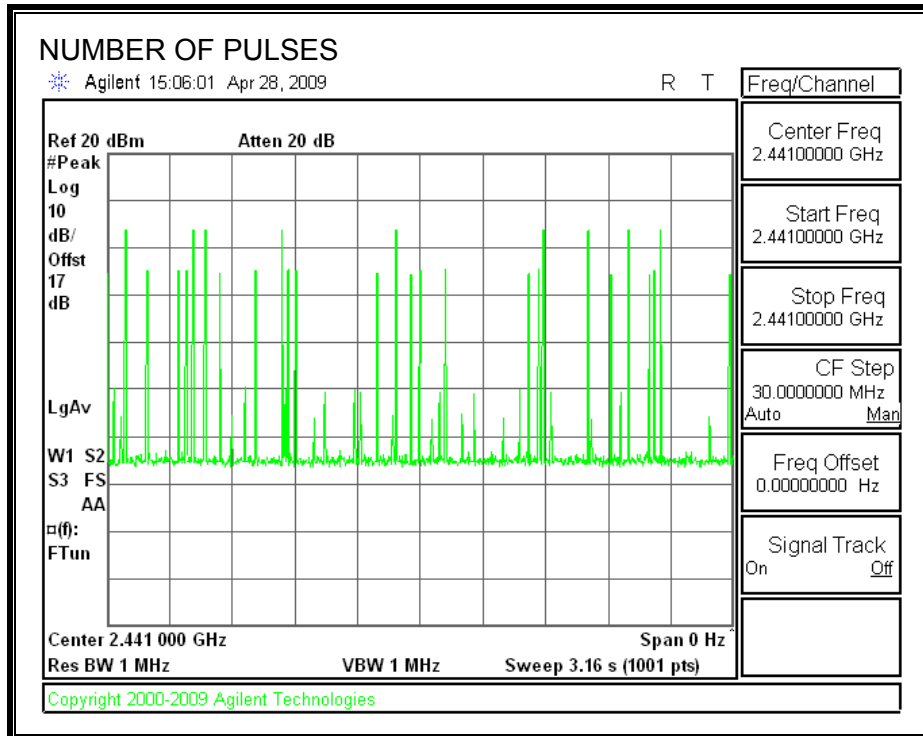




**FREQUENCY PACKET DH5**



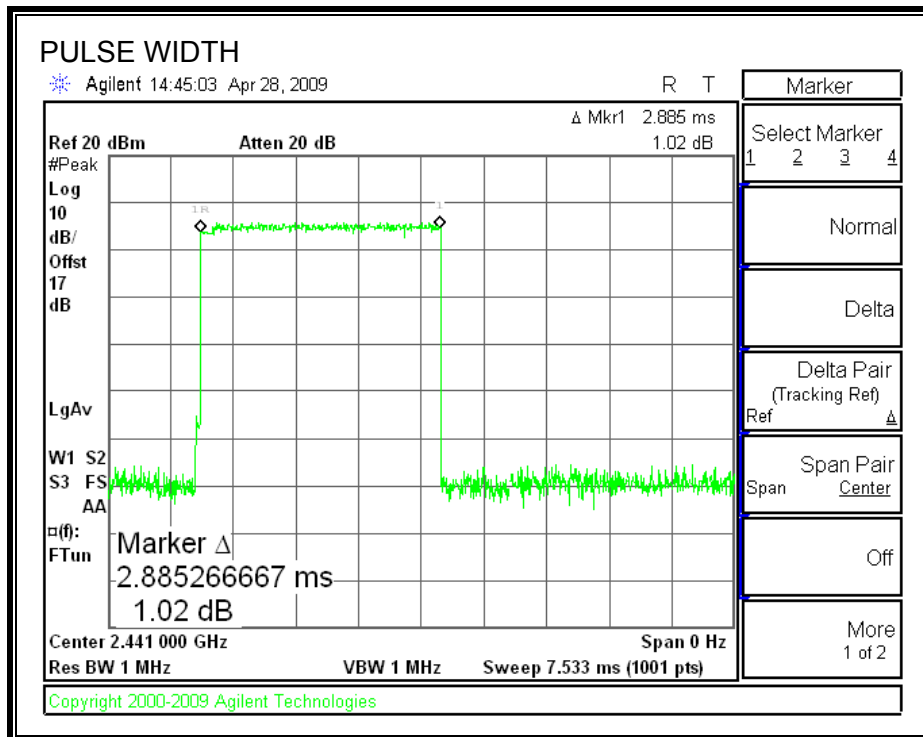
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



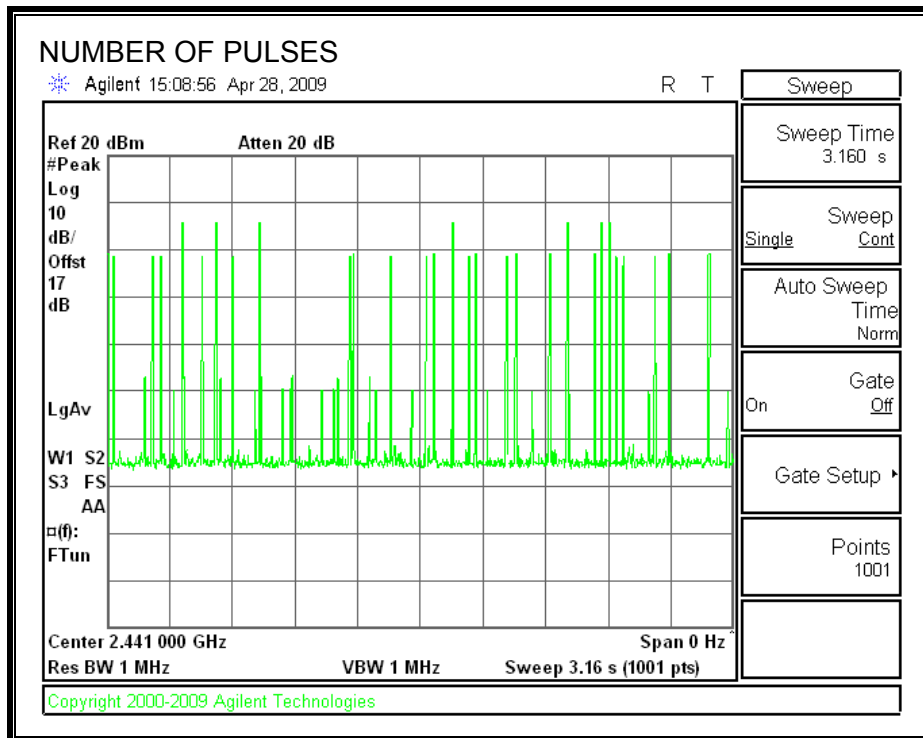




**FREQUENCY PACKET DH5**



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



### 7.1.4. 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

##### GFSK MODE

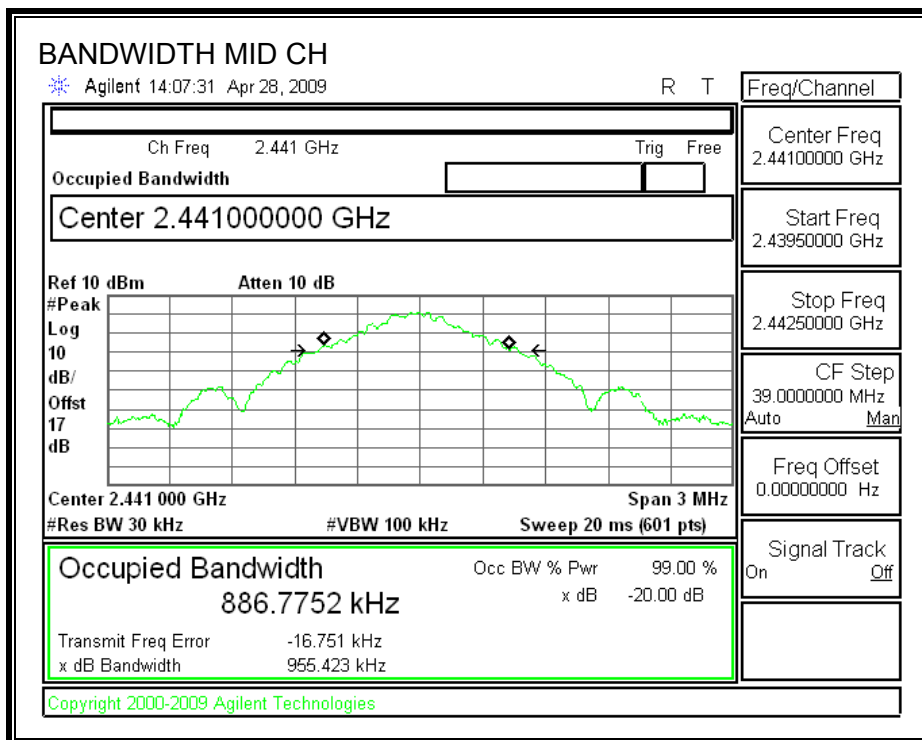
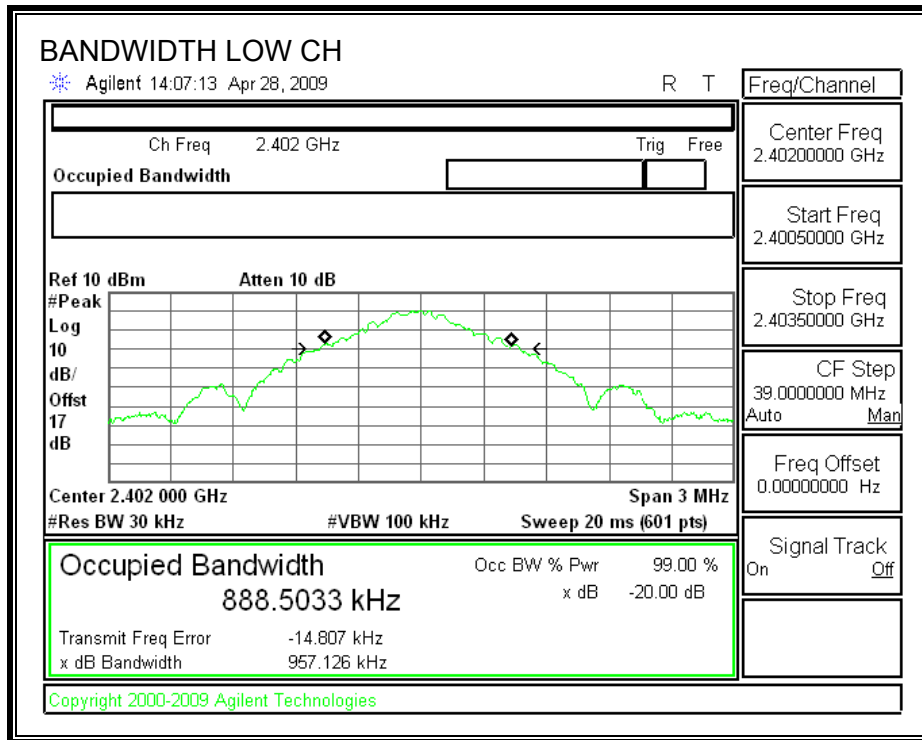
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
0	2402	957.126	884.6045
39	2441	955.423	878.5046
78	2480	957.167	871.0199

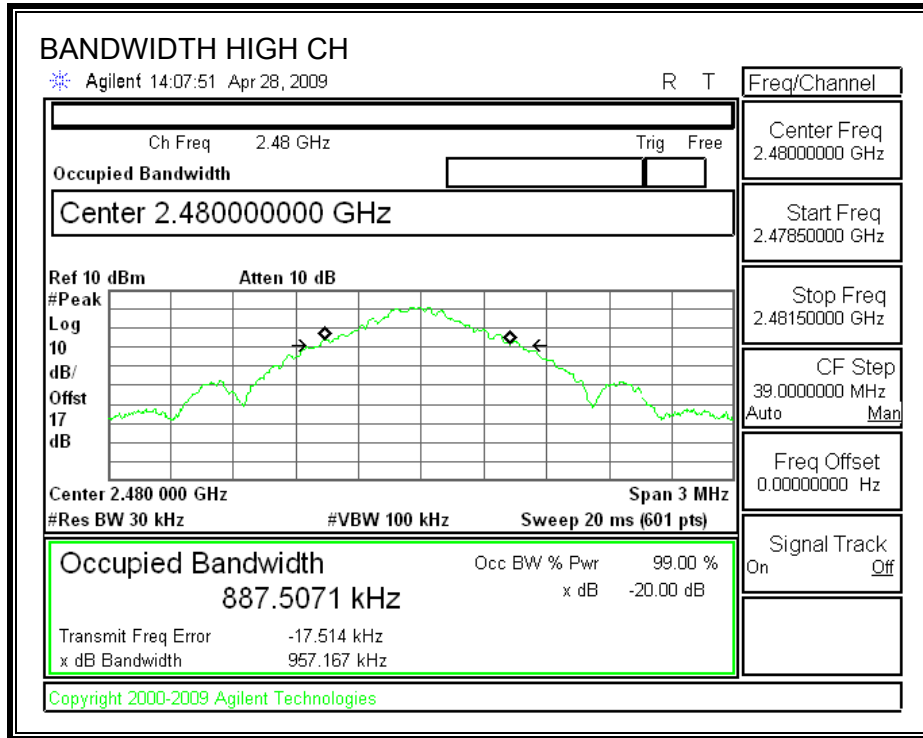
##### 8PSK MODE

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
0	2402	1.349	1.1979
39	2441	1.348	1.1873
78	2480	1.349	1.1903

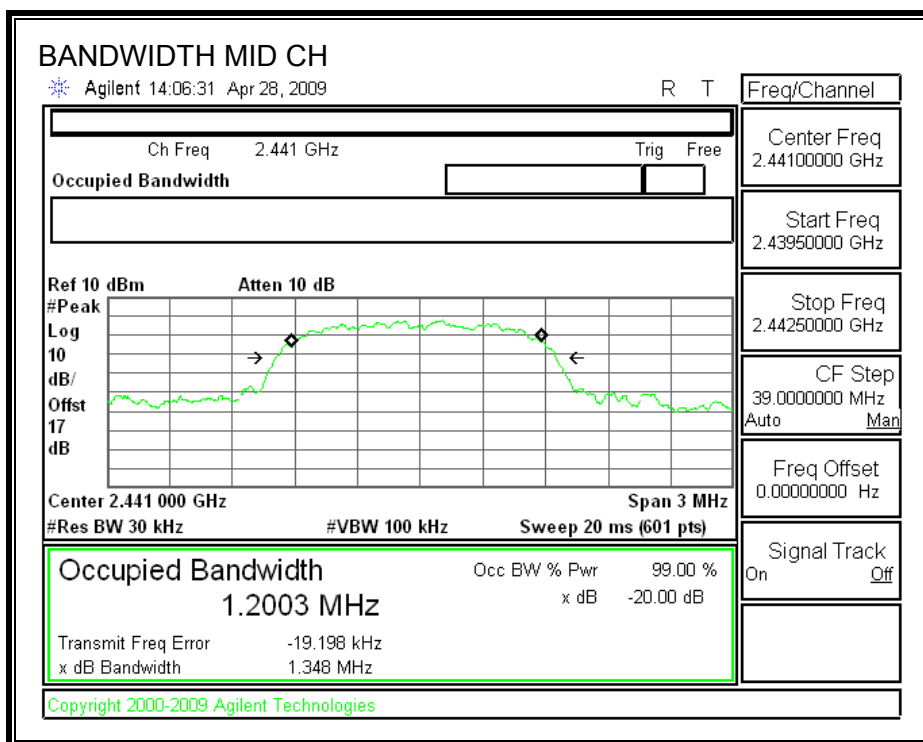
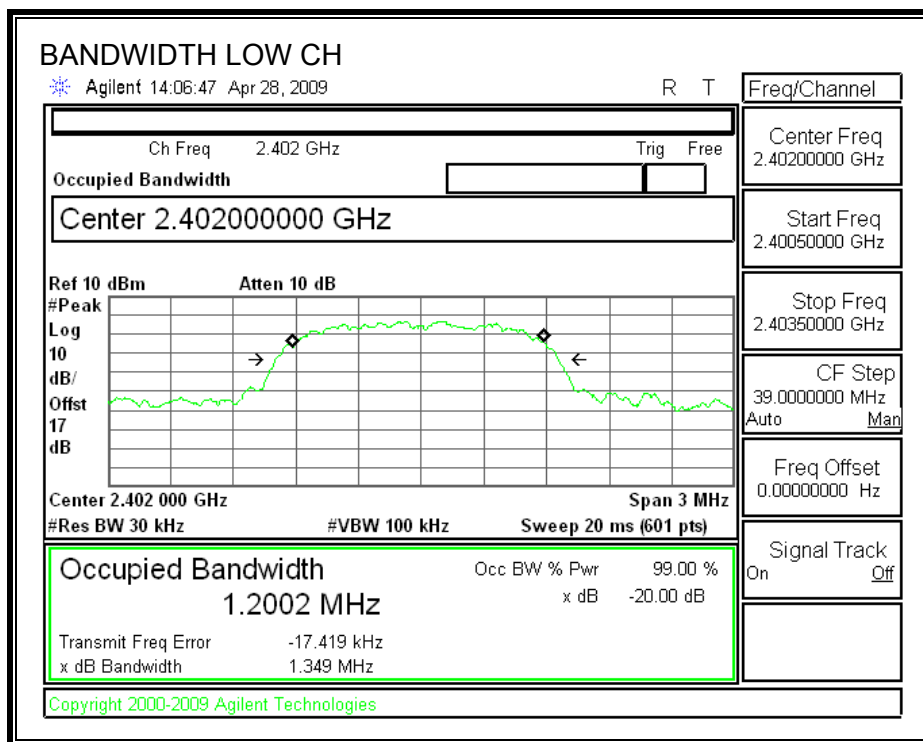


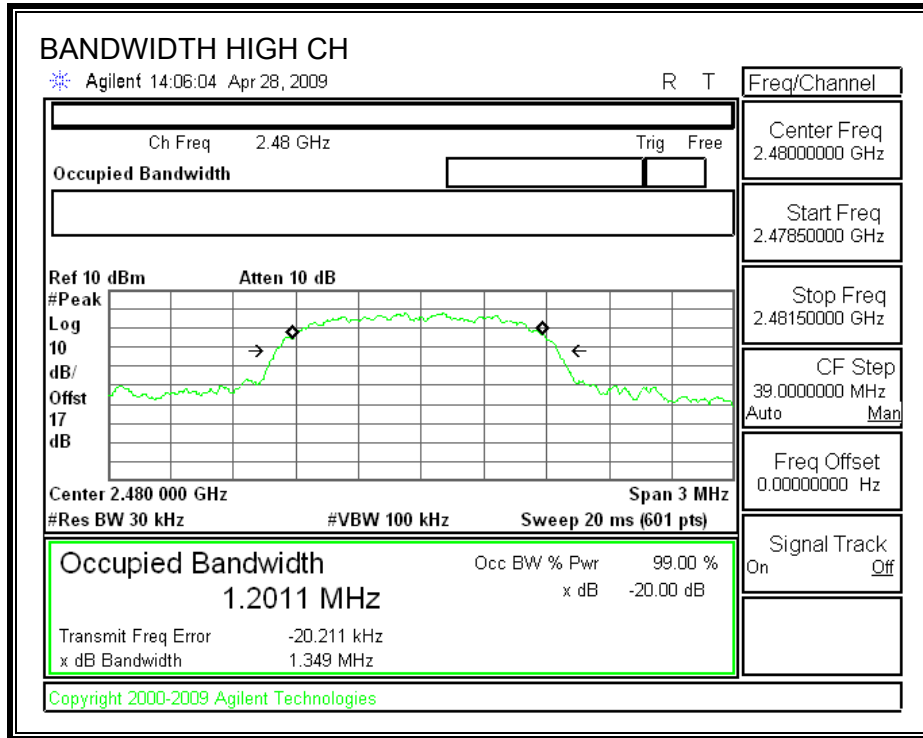
**GFSK MODE**  
**20 dB BANDWIDTH**



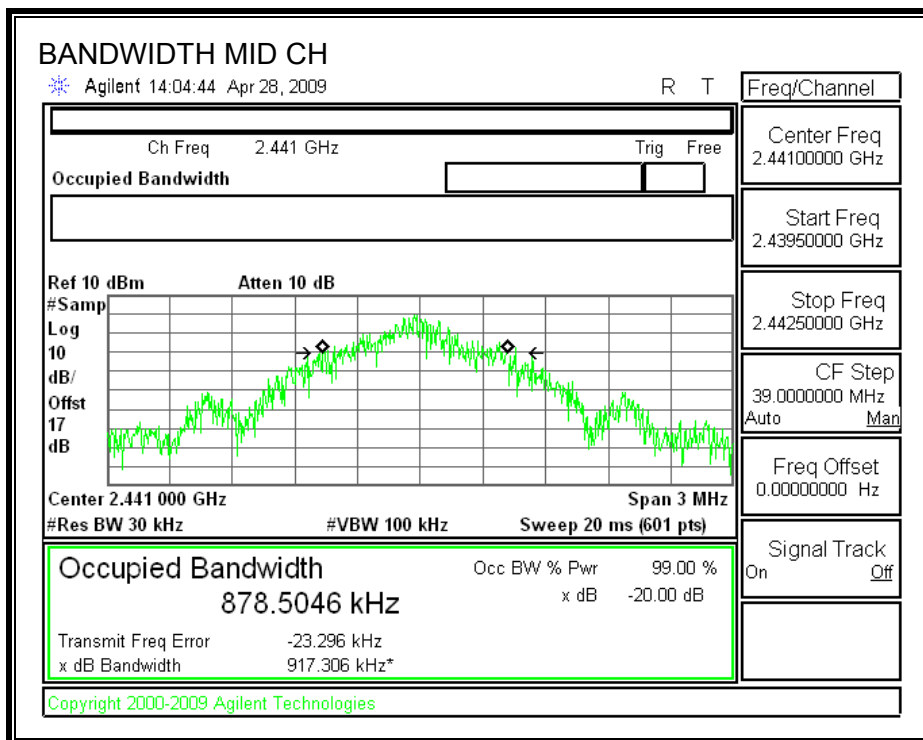
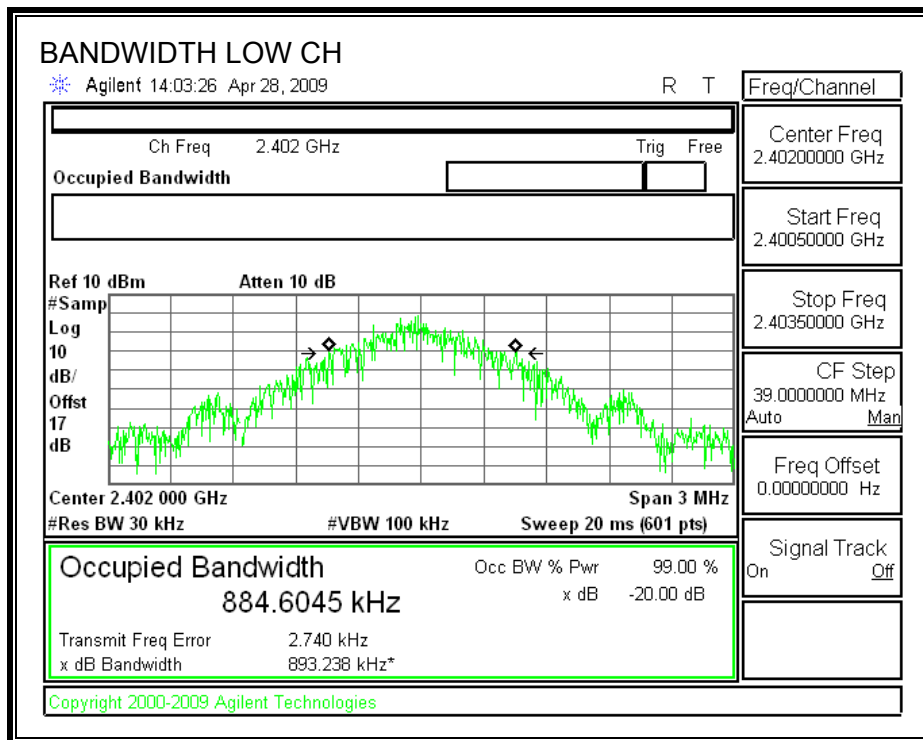


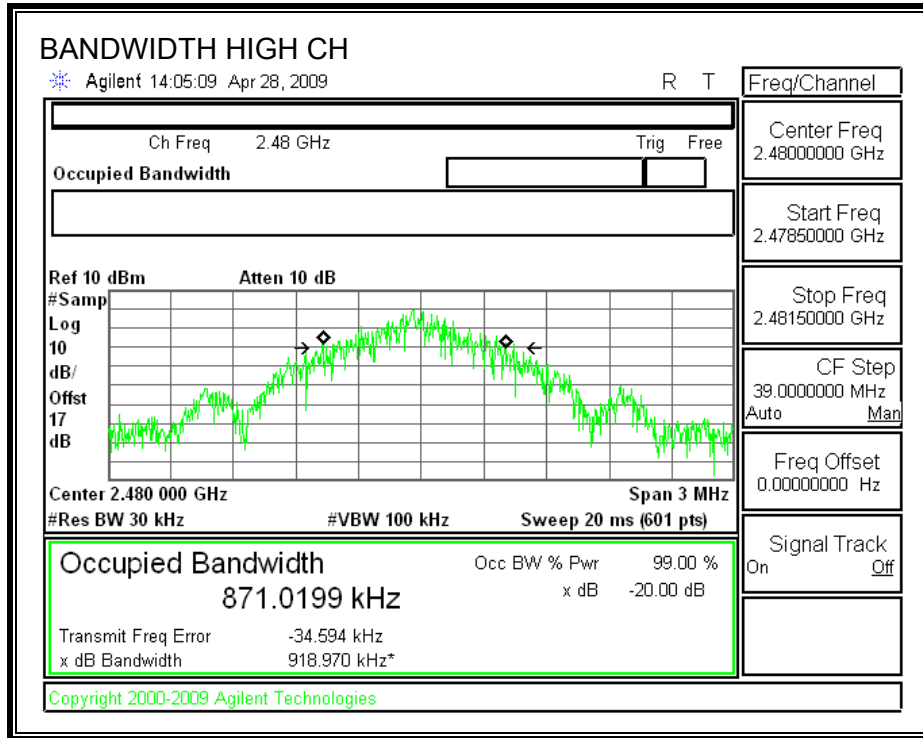
**8PSK**  
**20 dB BANDWIDTH**



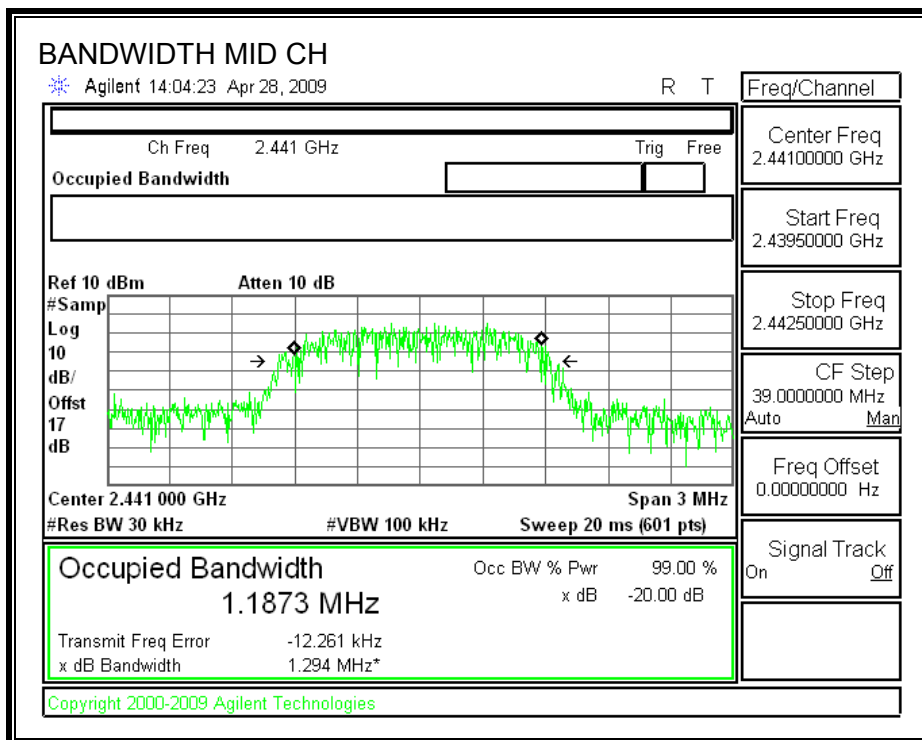
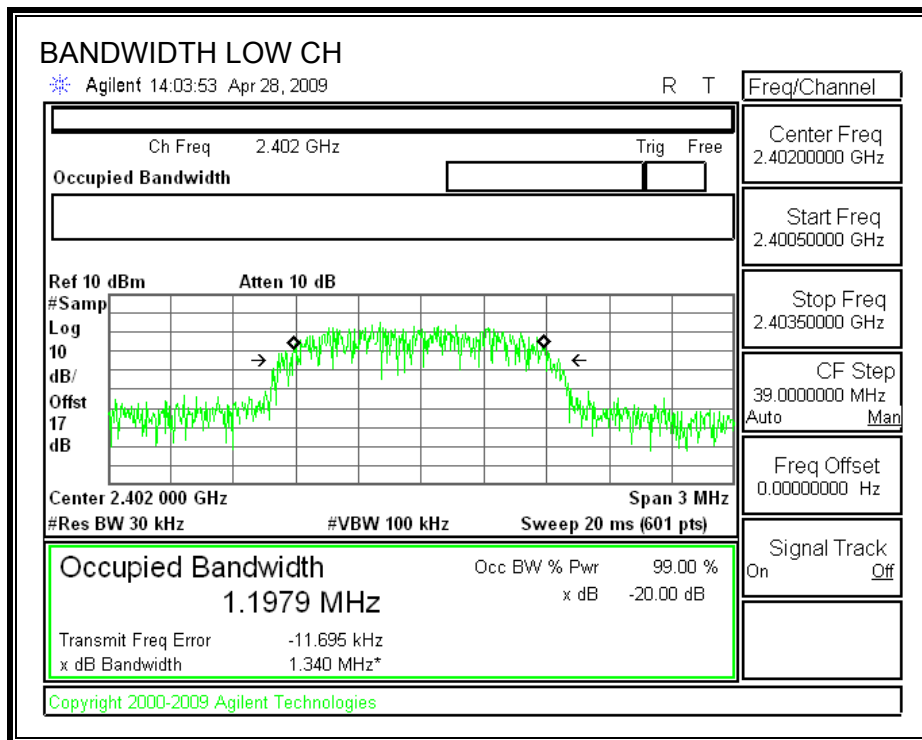


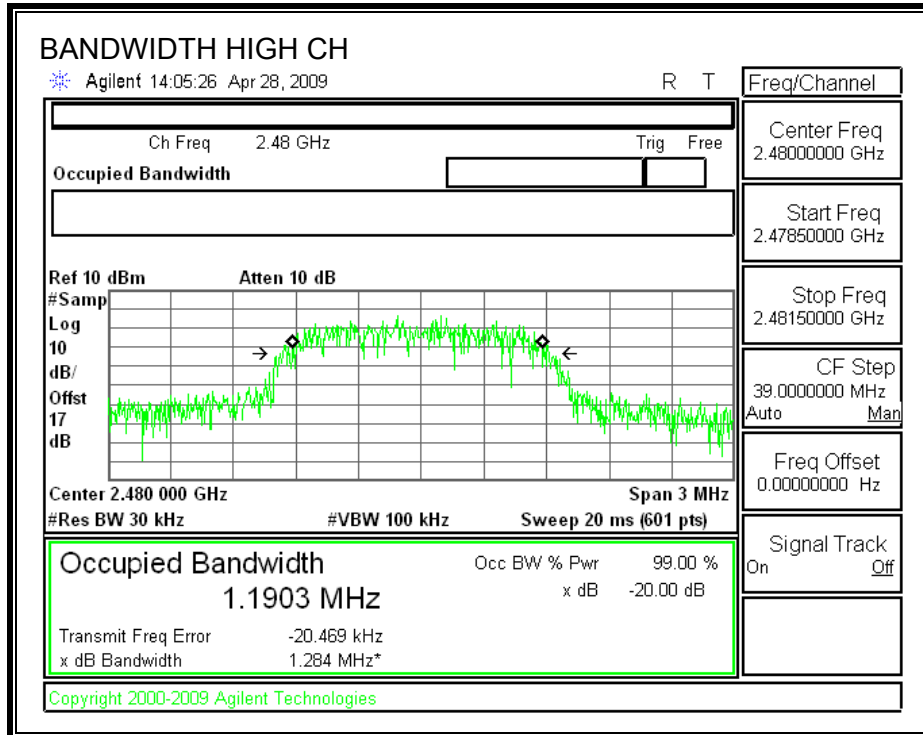
**GFSK MODE**  
**99% BANDWIDTH**





**8PSK**  
**99% dB BANDWIDTH**







### 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.

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 analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

#### RESULTS

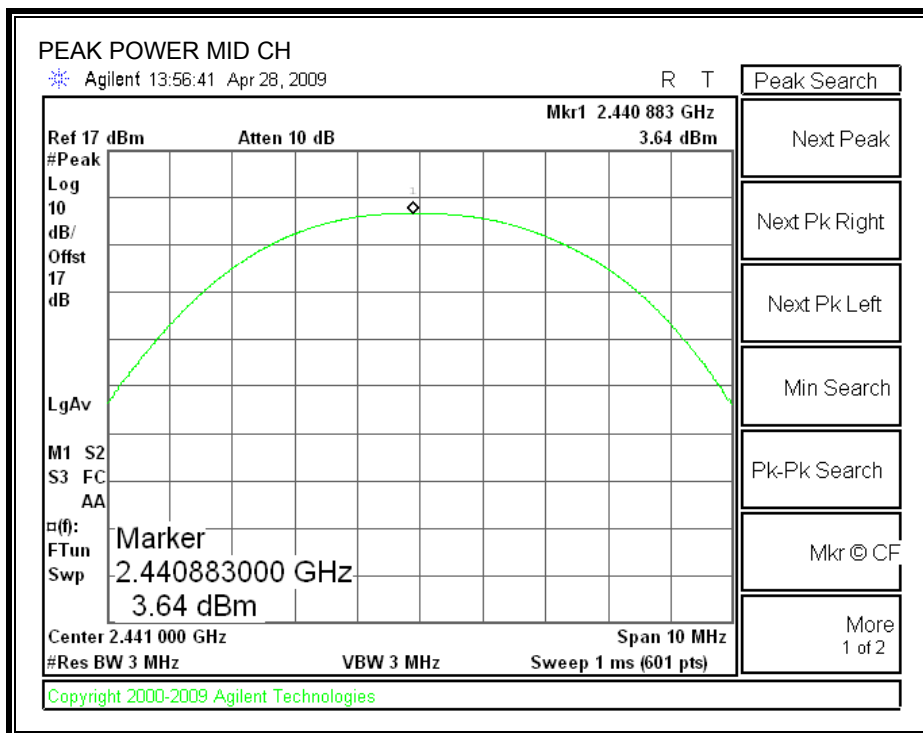
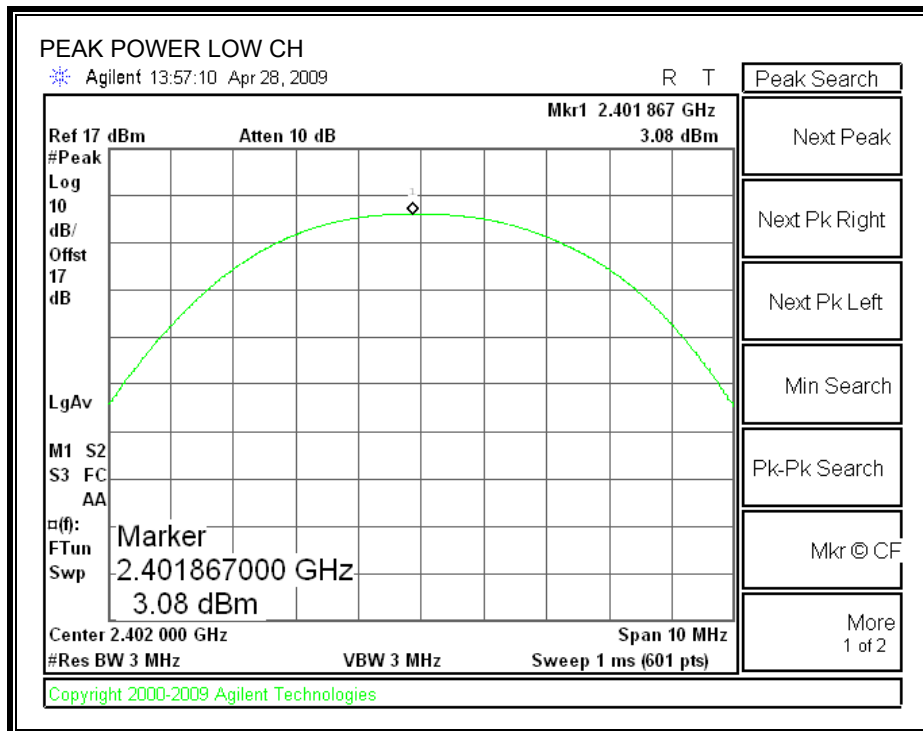
##### GFSK MODE

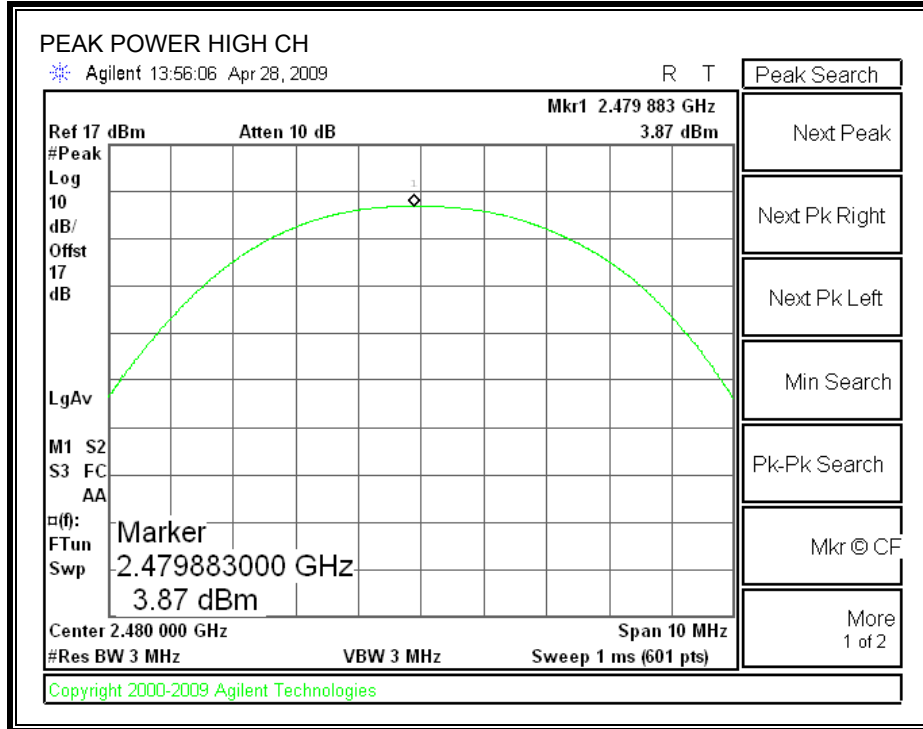
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
0	2402	3.08	30	-26.92
39	2441	3.64	30	-26.36
78	2480	3.87	30	-26.13

##### 8PSK MODE

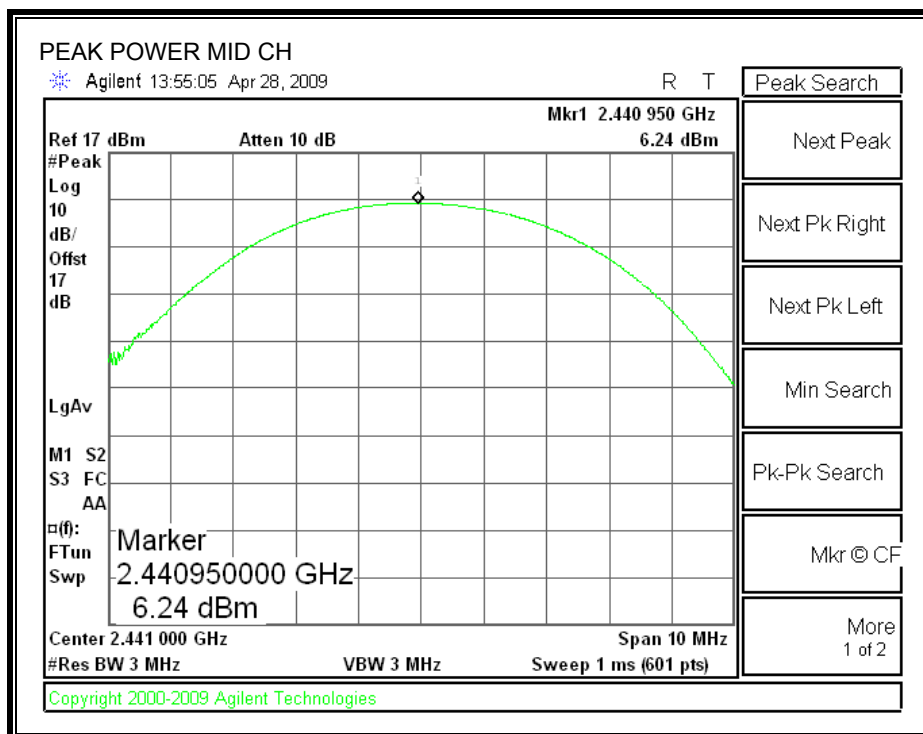
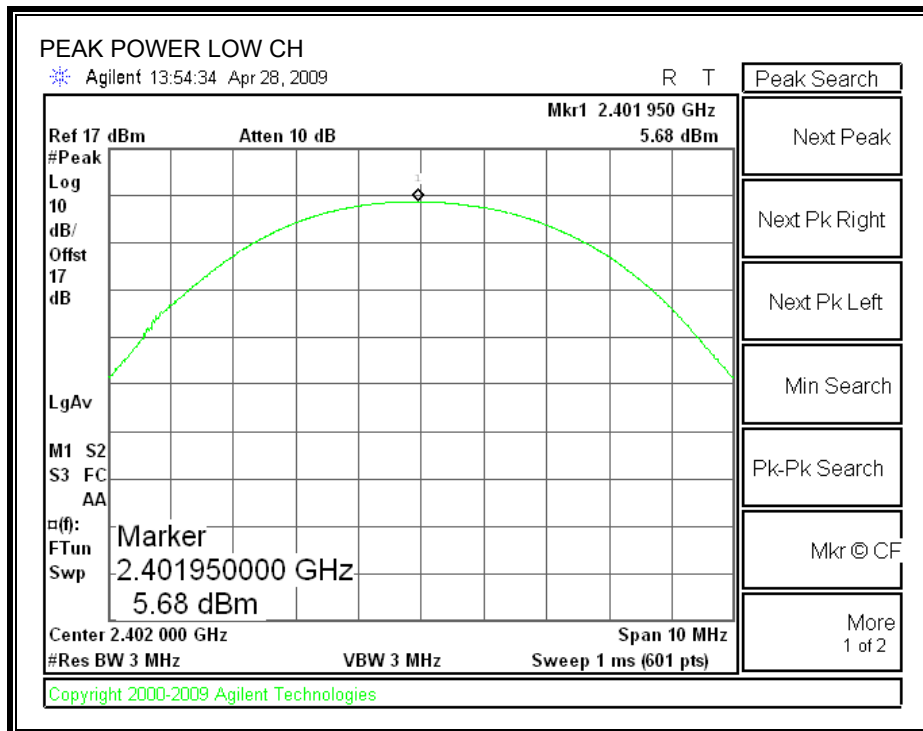
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
0	2402	5.68	21	-15.32
39	2441	6.24	21	-14.76
78	2480	6.50	21	-14.50

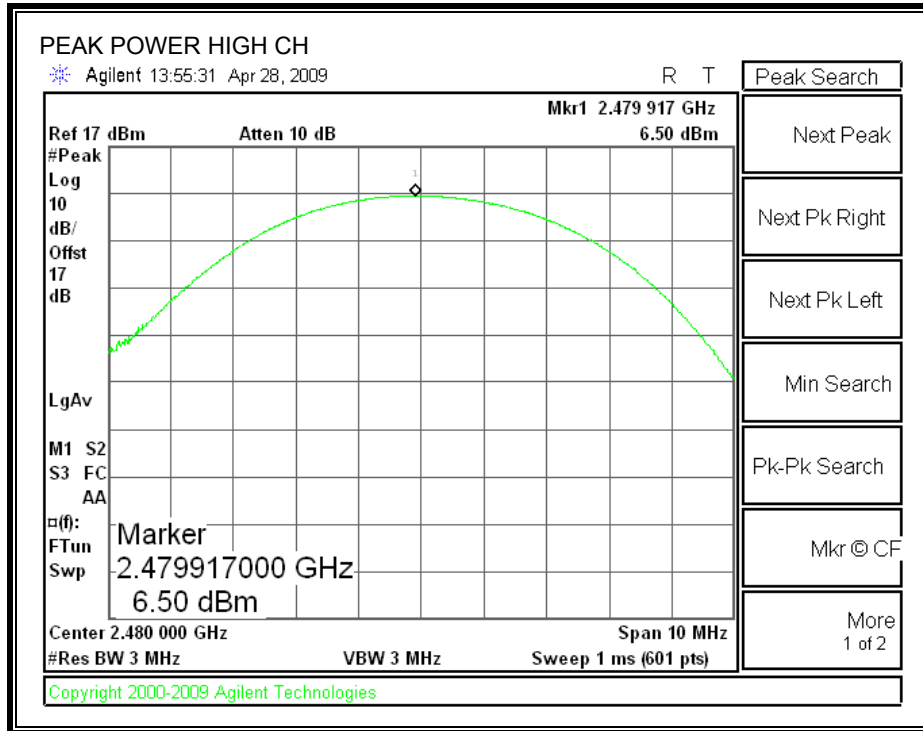
**OUTPUT POWER - GFSK**





**OUTPUT POWER – 8PSK**





## **7.1.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

### **TEST PROCEDURE**

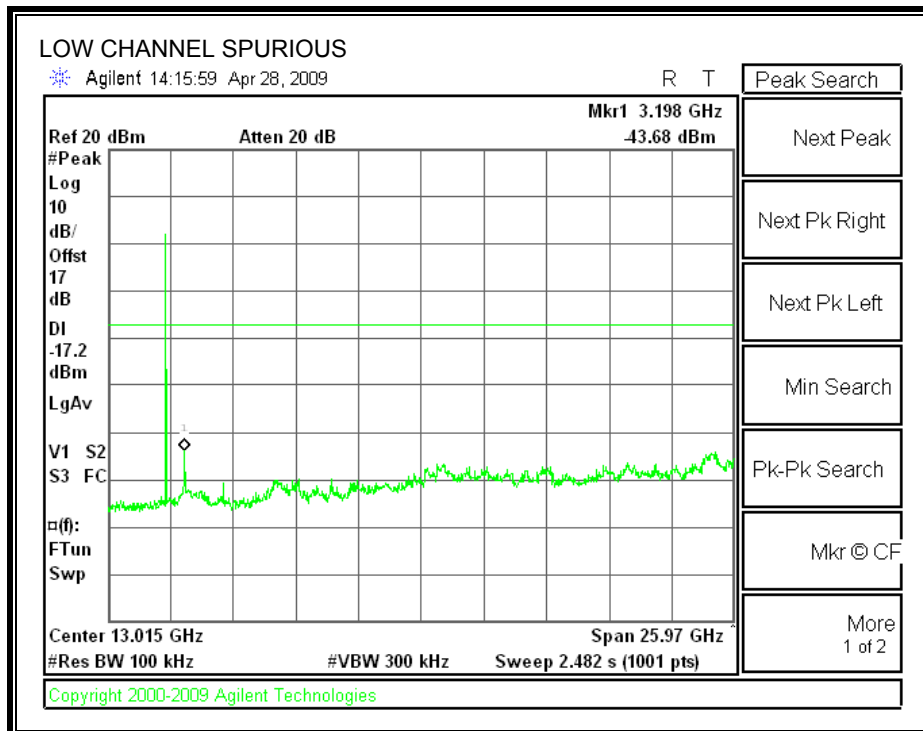
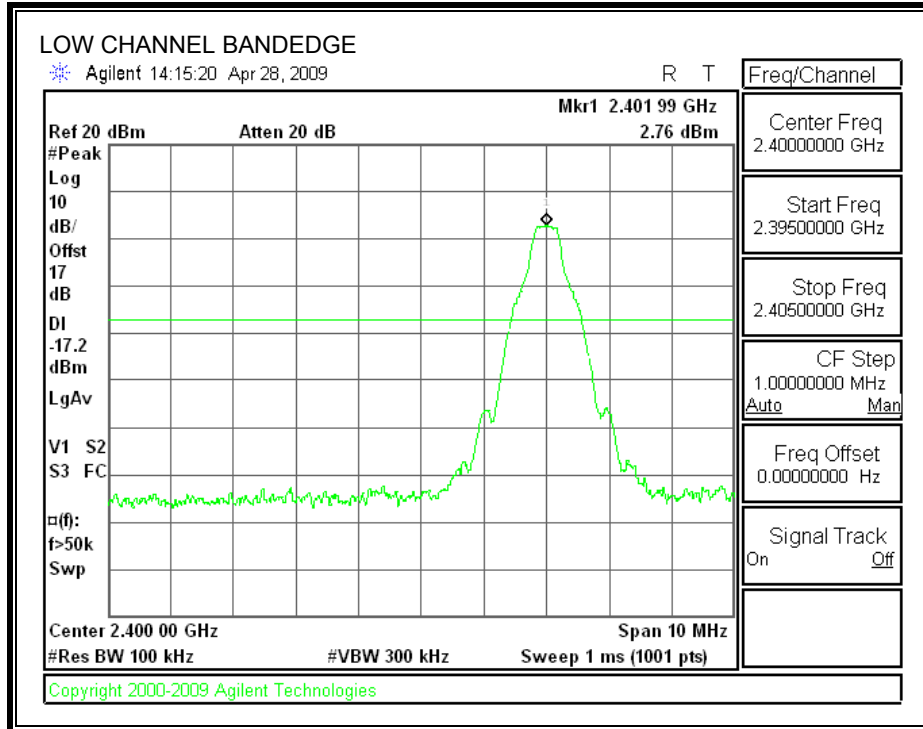
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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**

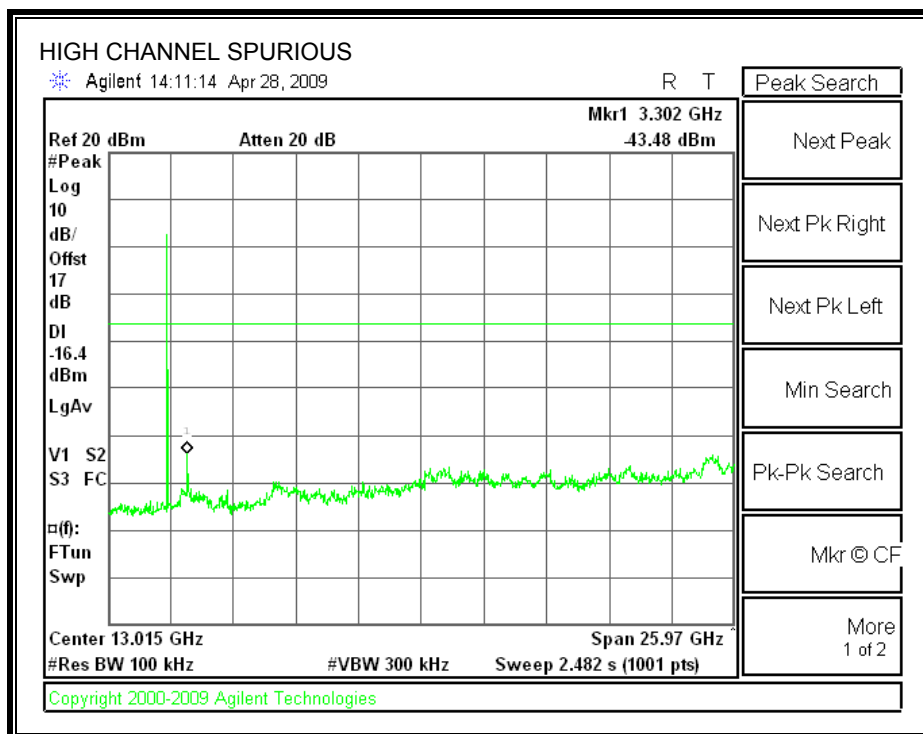
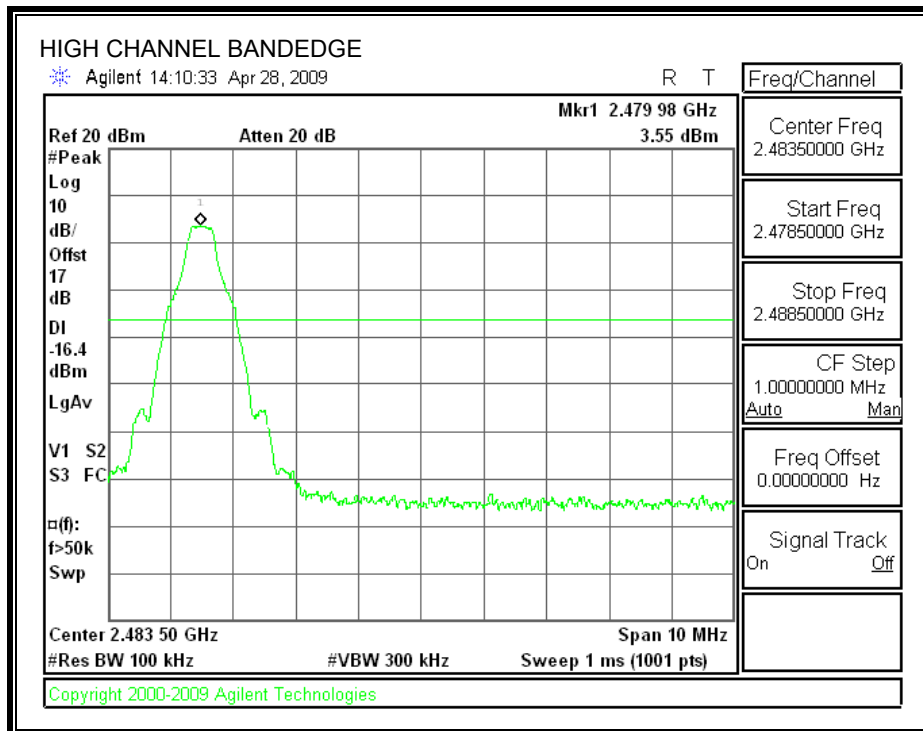
**SPURIOUS EMISSIONS, LOW CHANNEL – GFSK MODE**



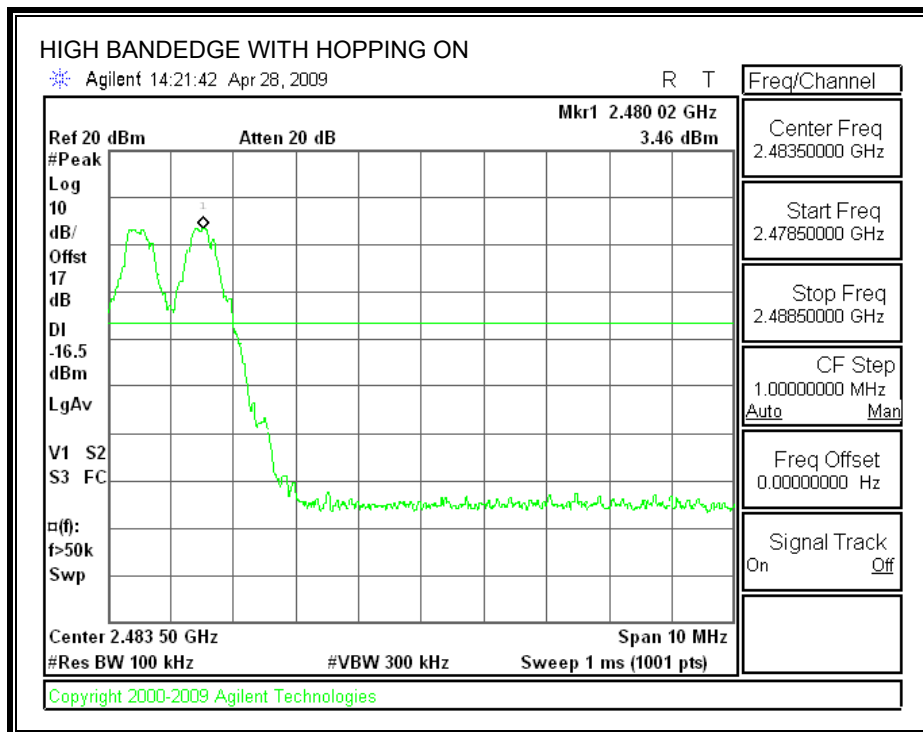
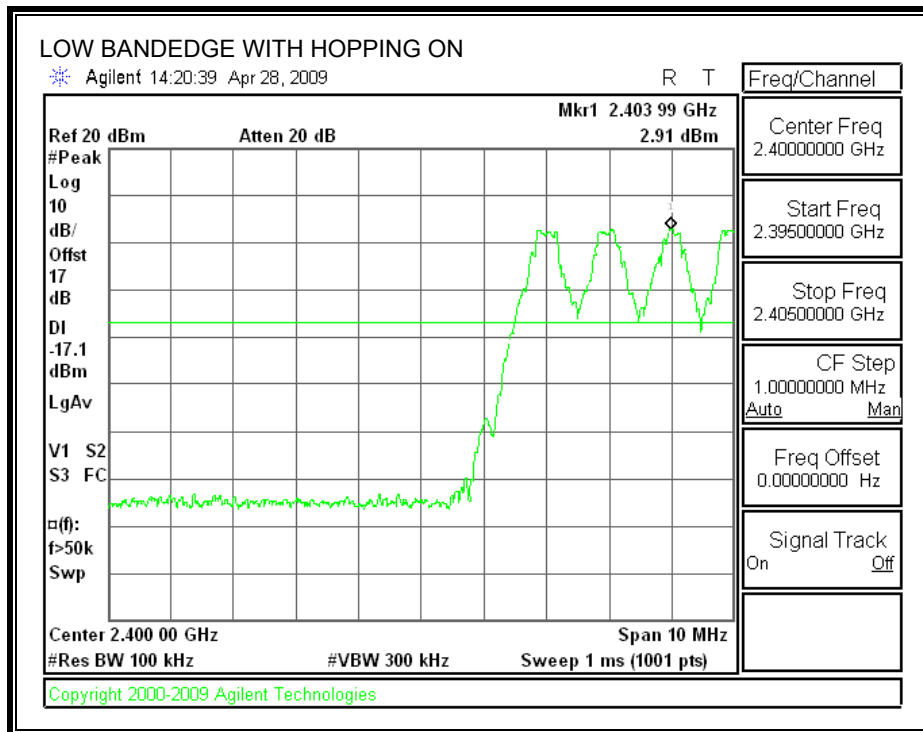




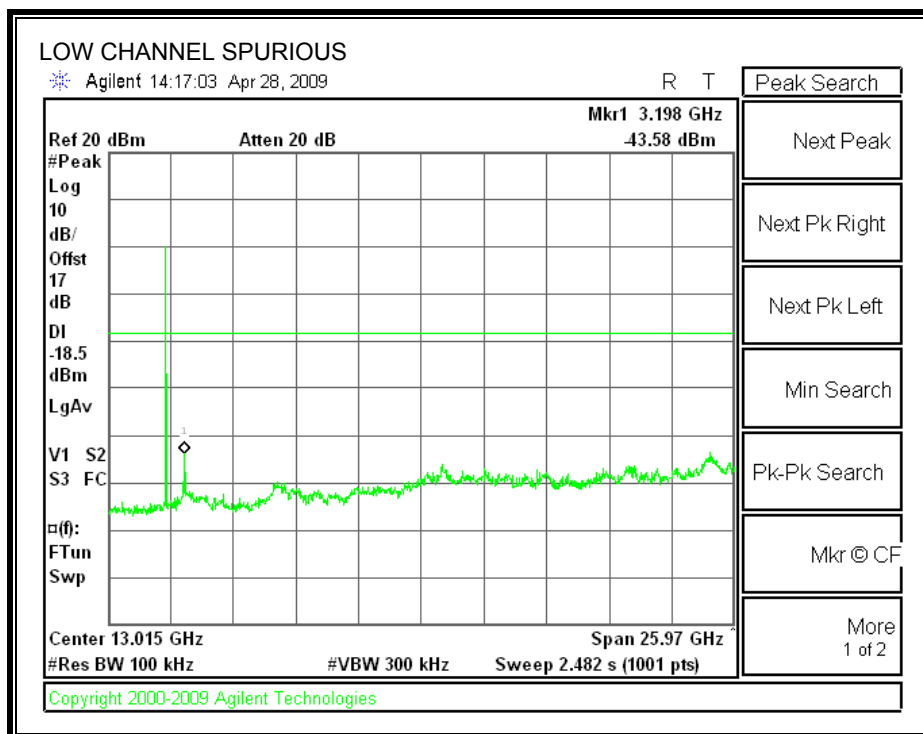
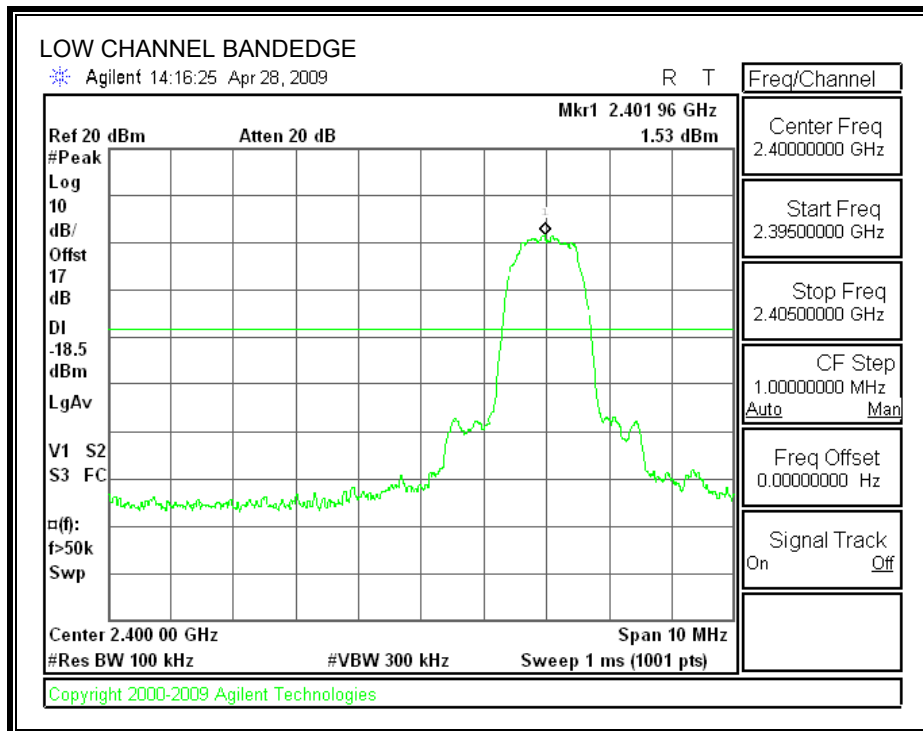
**SPURIOUS EMISSIONS, HIGH CHANNEL – GFSK MODE**



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON – GFSK MODE**

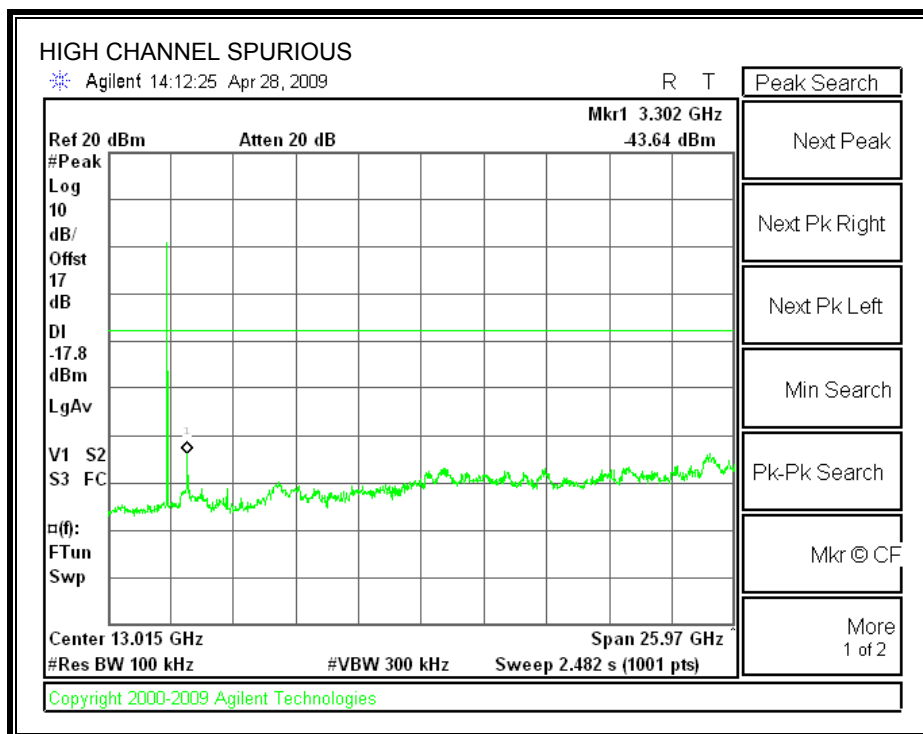
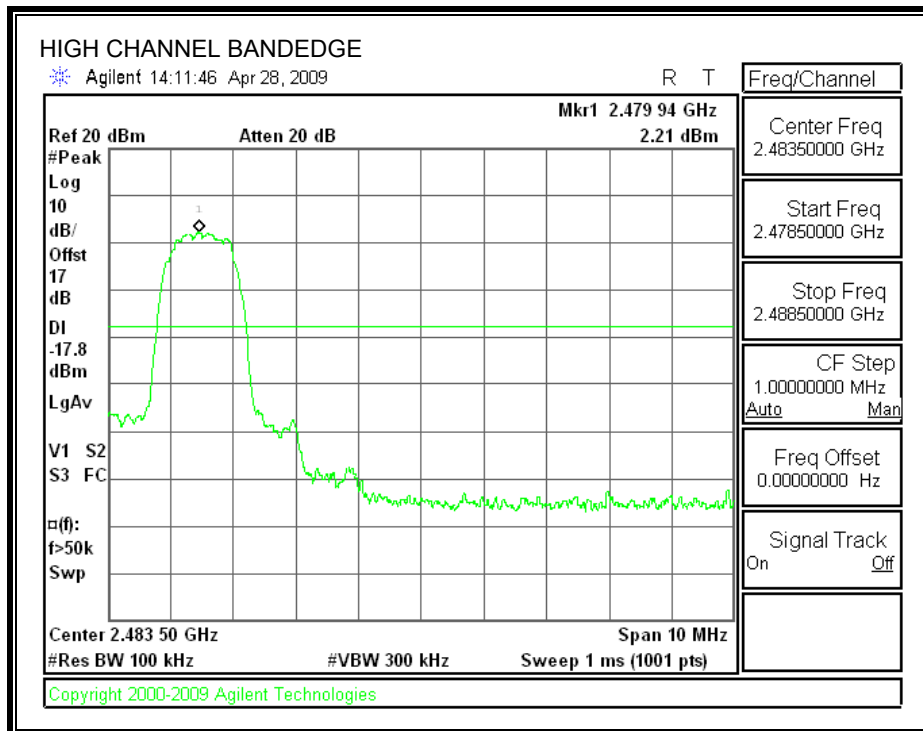


**SPURIOUS EMISSIONS, LOW CHANNEL – 8PSK MODE**

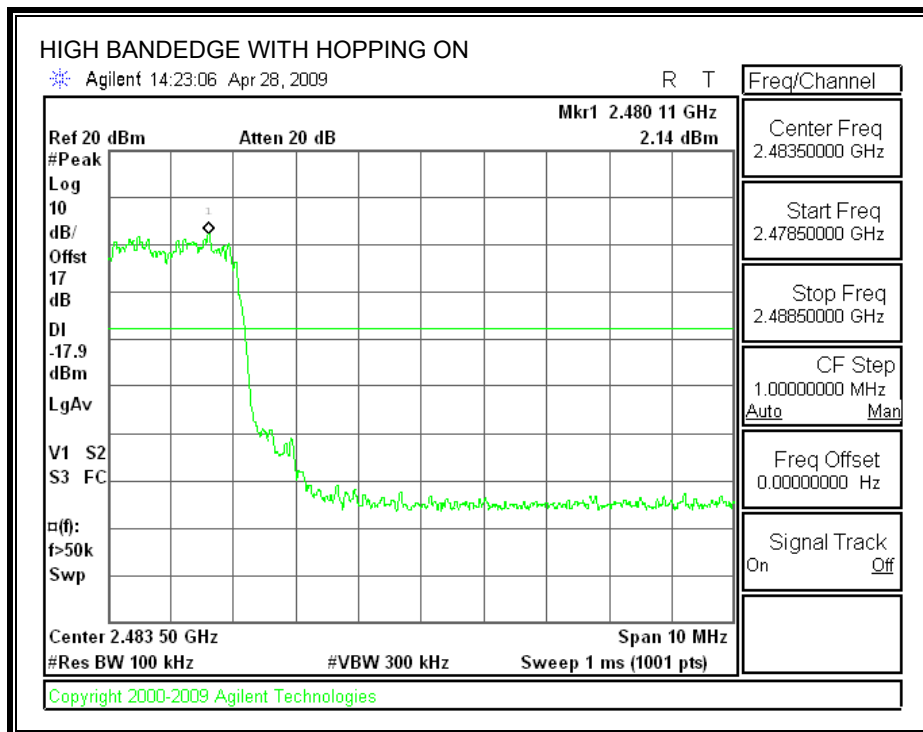
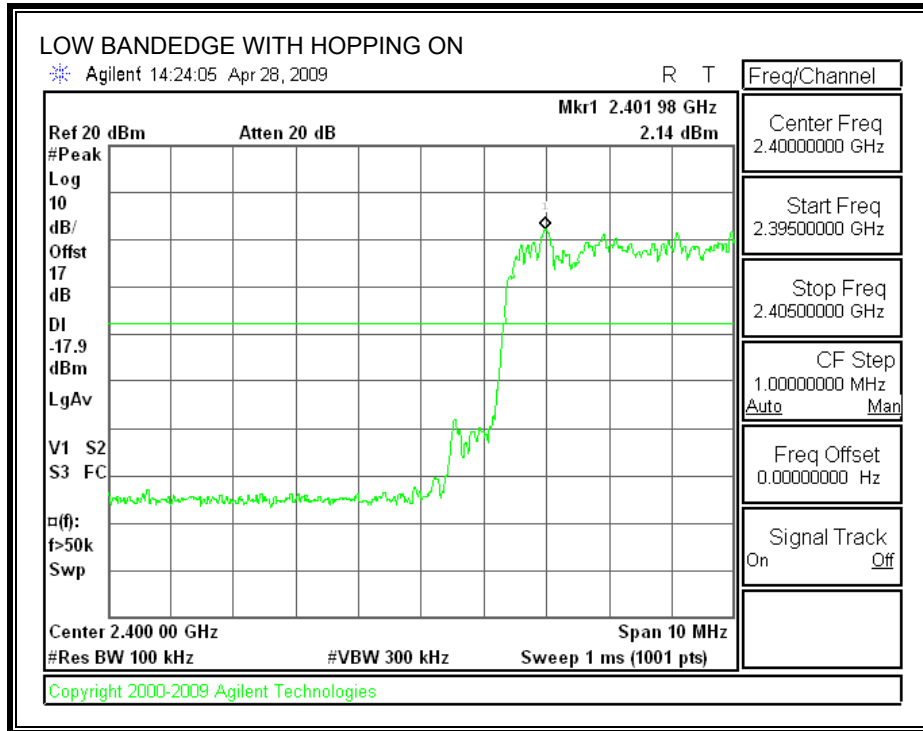




**SPURIOUS EMISSIONS, HIGH CHANNEL – 8PSK MODE**



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON – 8PSK MODE**



## 8. RADIATED TEST RESULTS

### 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.

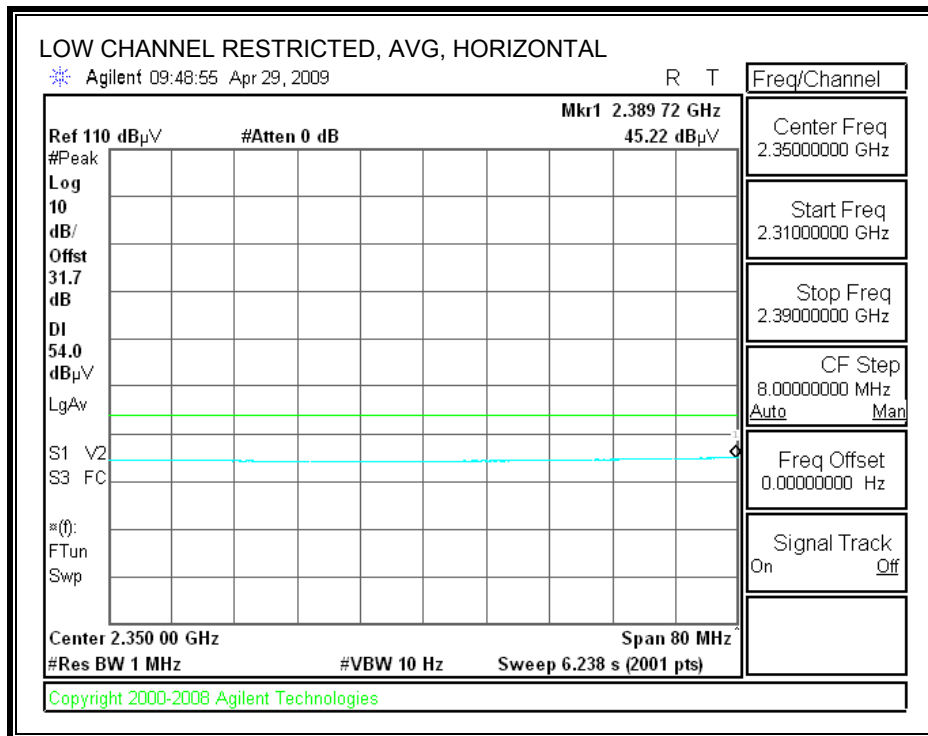
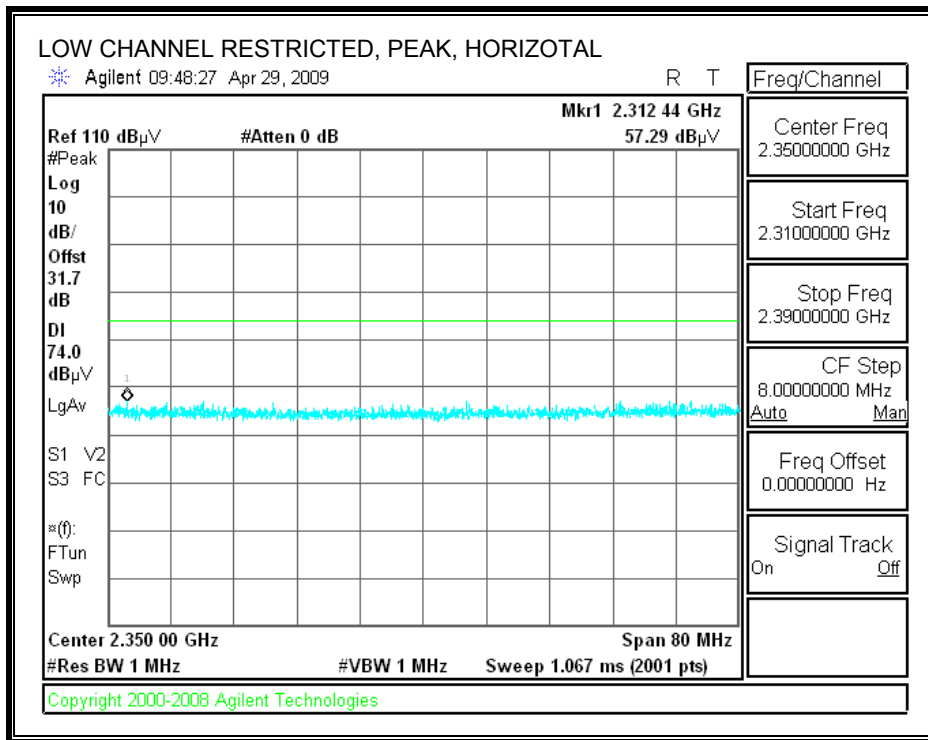
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

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.

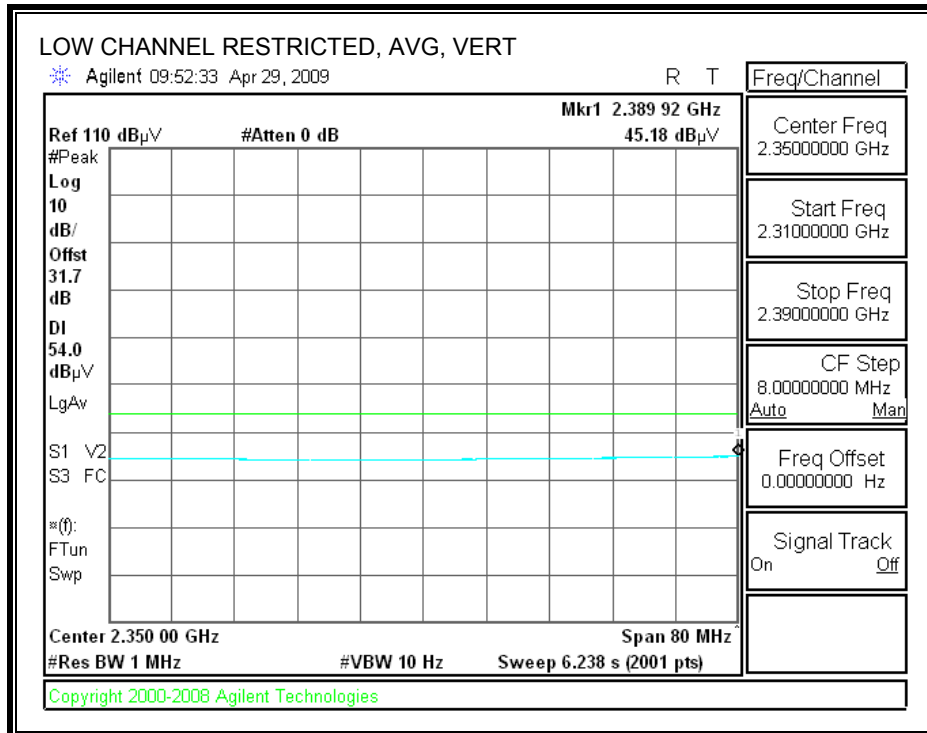
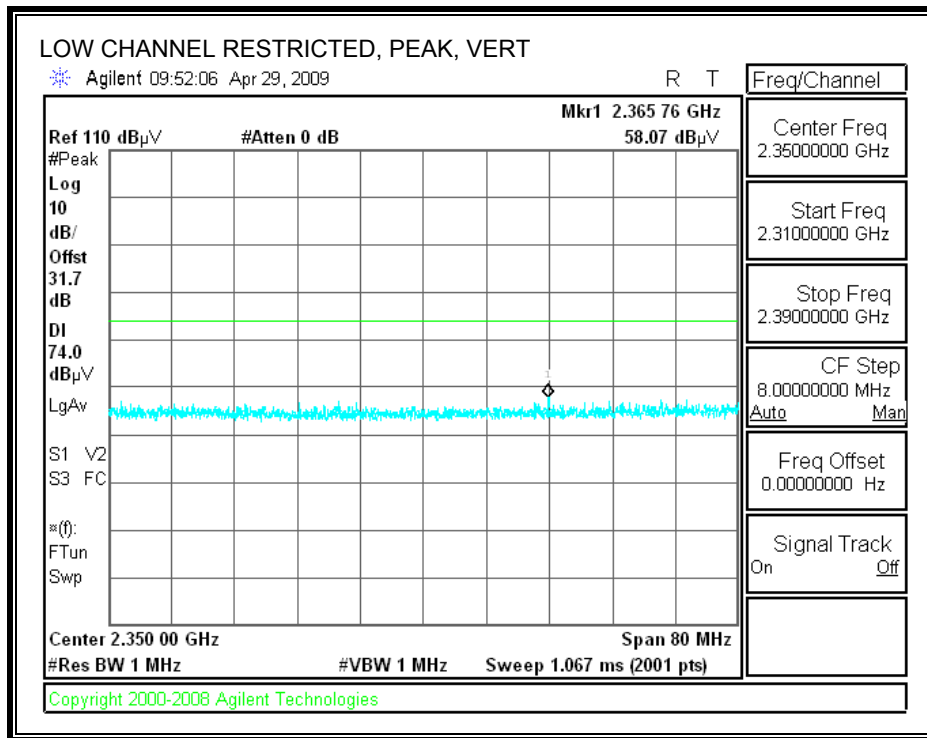
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

**8.1. TRANSMITTER ABOVE 1 GHz**  
**8.1.1. GFSK MODE**  
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**

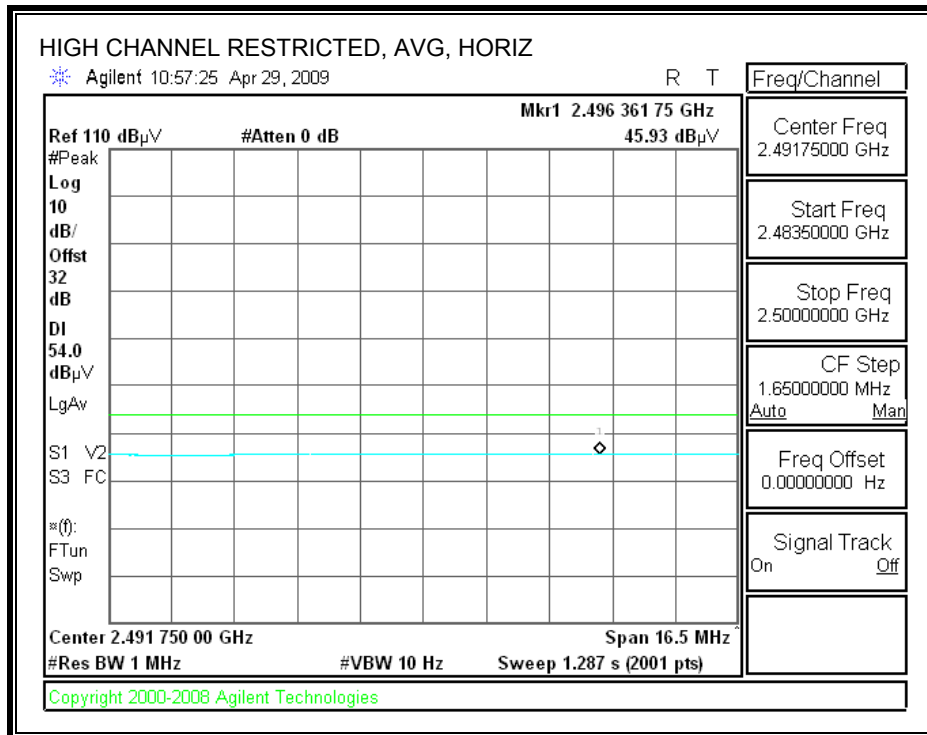
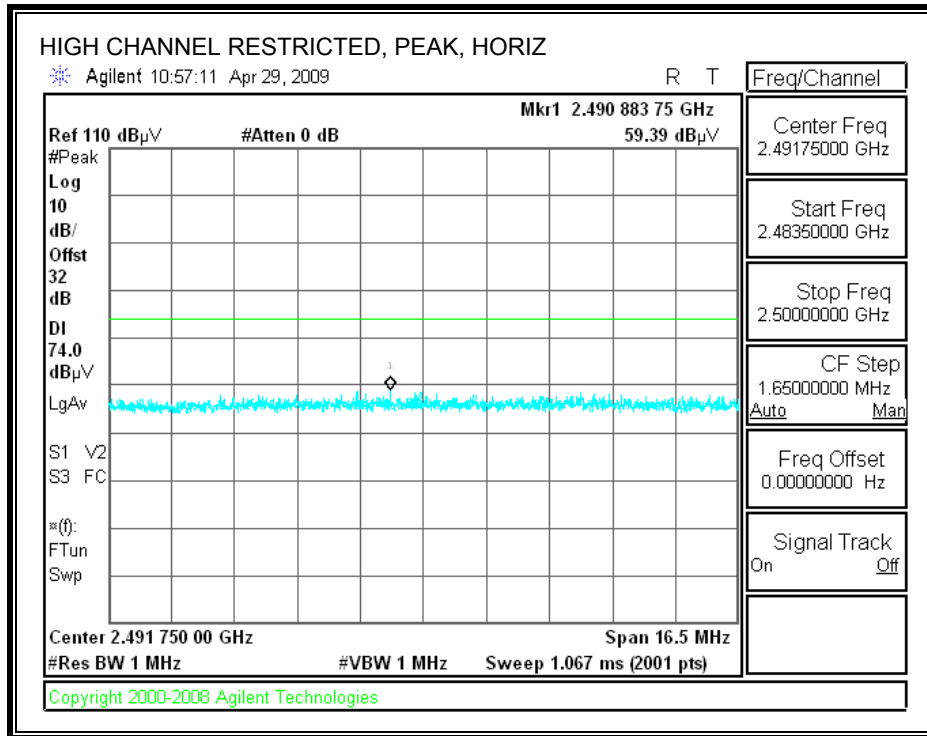




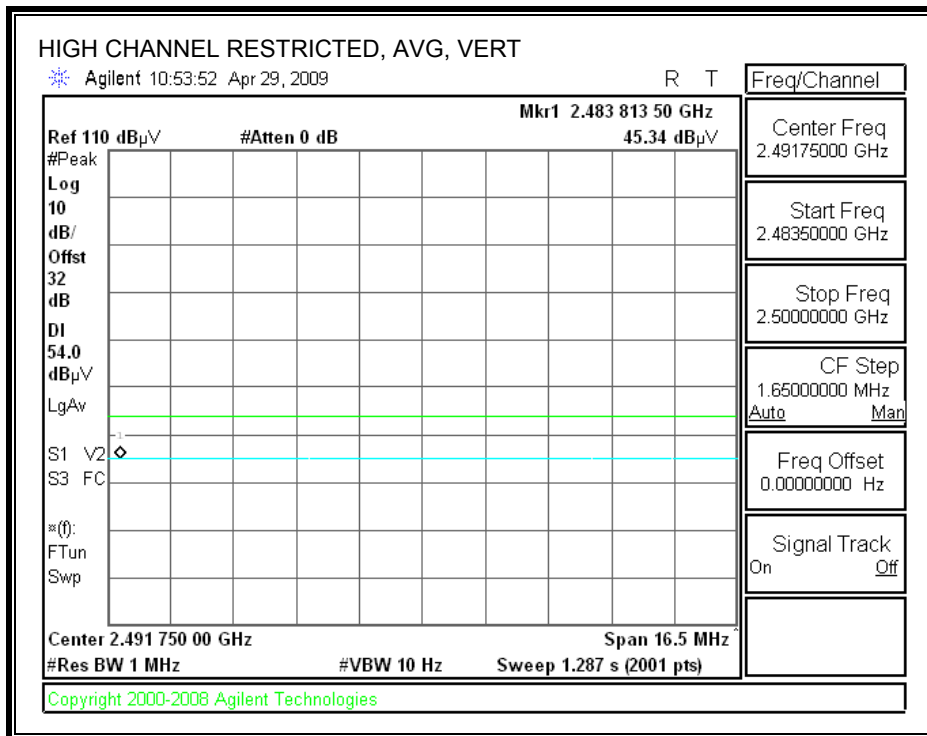
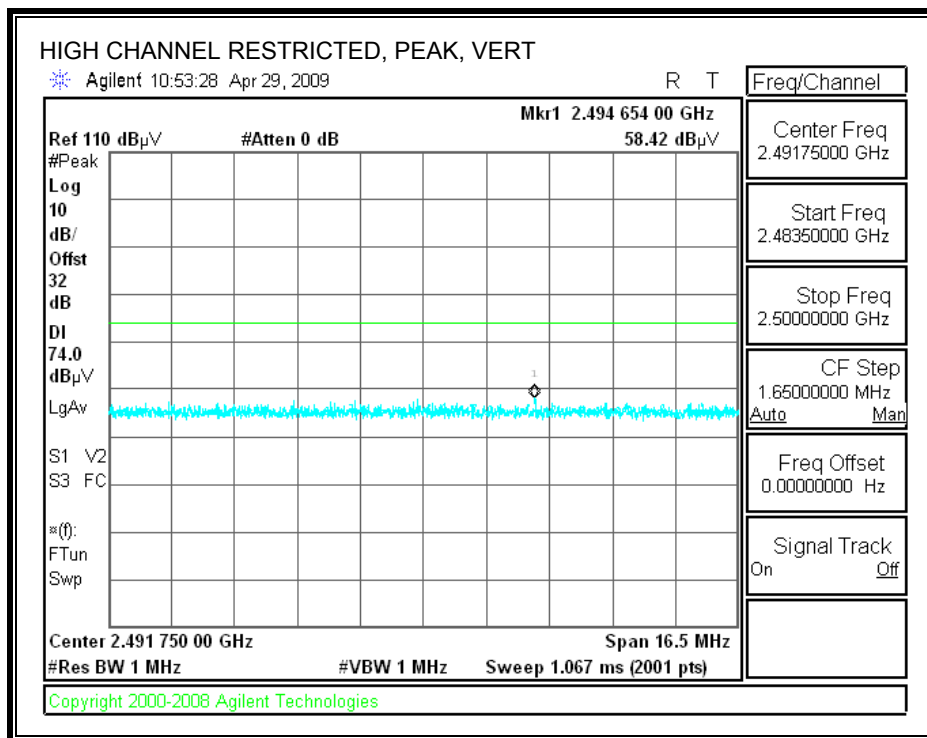
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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

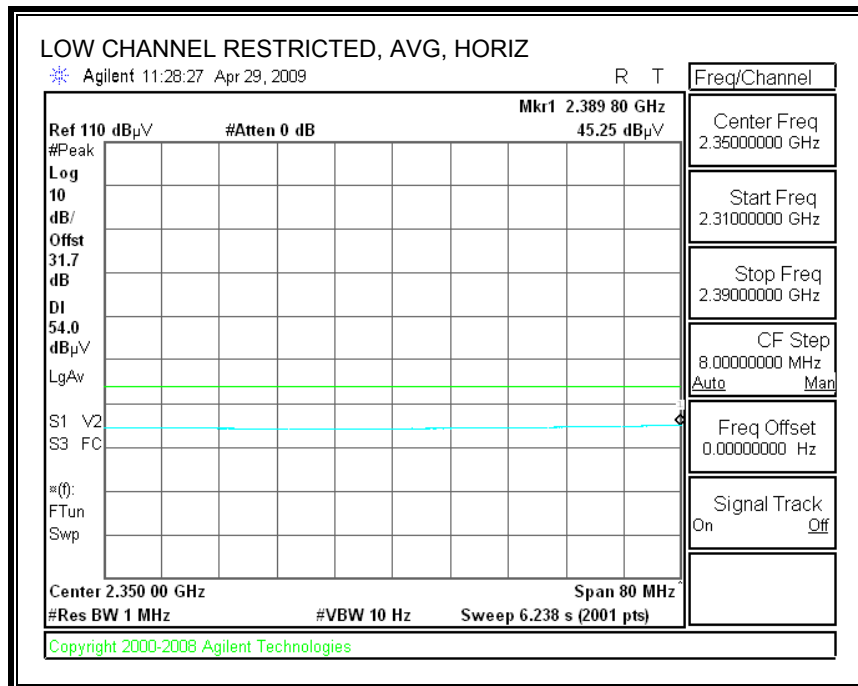
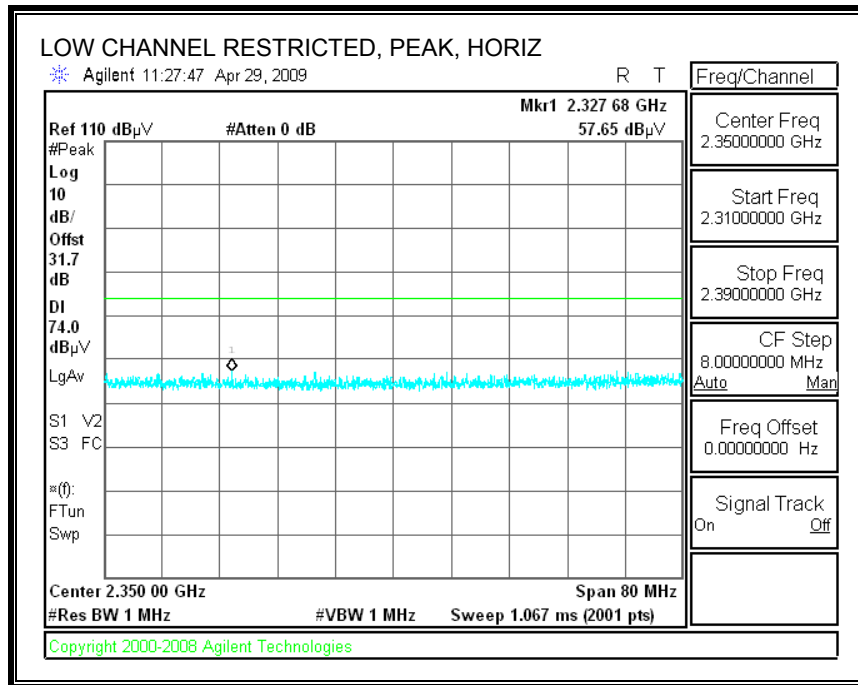


**HARMONICS AND SPURIOUS EMISSIONS – GFSK MODE**

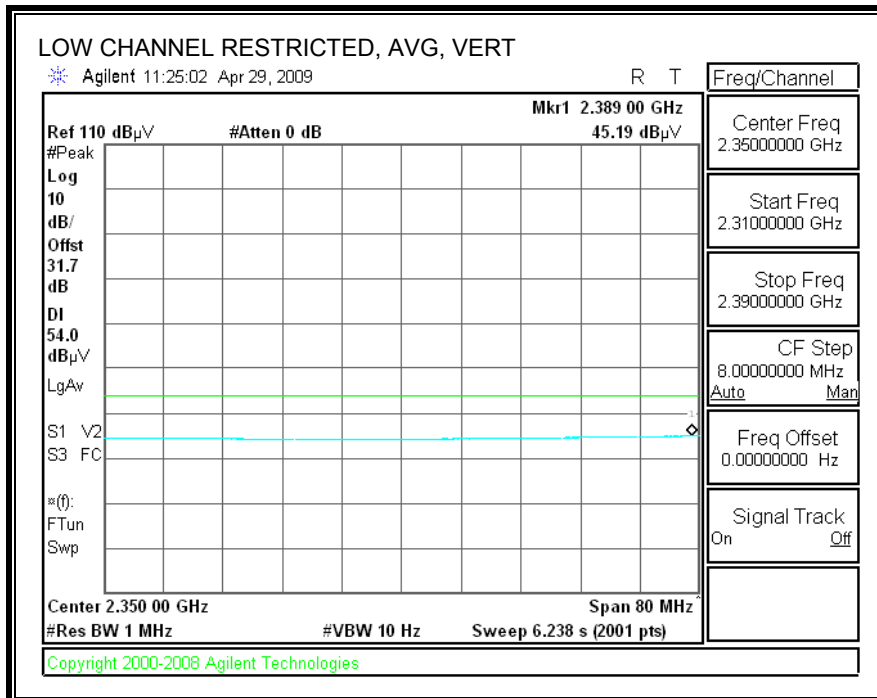
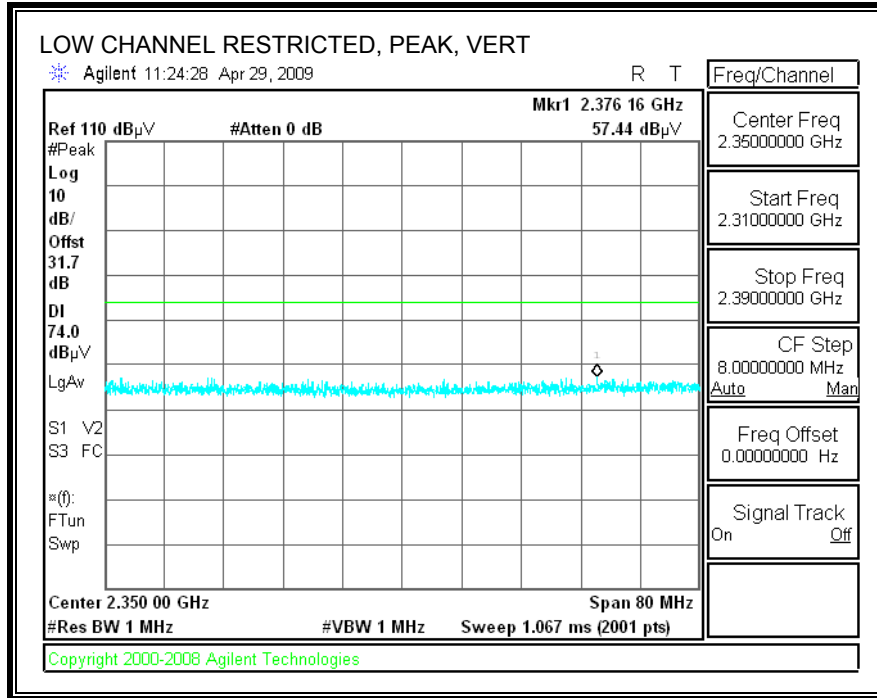
High Frequency Measurement																				
Compliance Certification Services, Fremont 5m Chamber																				
Test Engr:		Devin Chang																		
Date:		04/29/09																		
Project #:		09U12521																		
Company:		Broadcom																		
Test Target:		EUT with Laptop																		
Mode Oper:		Tx_GFSK																		
f	Measurement	Frequency	Amp	Presamp	Gain												Average	Field	Strength	Limit
Dist	Distance to	Antenna	D Corr	Distance	Correct												Peak	Field	Strength	Limit
Read	Analyzer	Reading	Avg	Average	Field												Margin	vs.	Average	Limit
AF	Antenna	Factor	Peak	Calculated	Peak												Margin	vs.	Peak	Limit
CL	Cable	Loss	HPF	High	Pass															
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes					
<b>2402MHz</b>																				
4.804	3.0	48.9	32.8	5.8	-34.8	0.0	0.0	52.6	74.0	-21.4	H	P	150.0	263.7						
4.804	3.0	45.7	32.8	5.8	-34.8	0.0	0.0	49.4	54.0	-4.6	H	A	150.0	263.7						
4.804	3.0	46.1	32.8	5.8	-34.8	0.0	0.0	49.8	74.0	-24.2	V	P	100.0	347.4						
4.804	3.0	42.1	32.8	5.8	-34.8	0.0	0.0	45.7	54.0	-8.3	V	A	100.0	347.4						
<b>2441MHz</b>																				
4.882	3.0	46.9	32.8	5.8	-34.9	0.0	0.0	50.7	74.0	-23.3	H	P	145.0	259.2						
4.882	3.0	43.1	32.8	5.8	-34.9	0.0	0.0	46.9	54.0	-7.1	H	A	145.0	259.2						
7.323	3.0	38.9	35.2	7.3	-34.7	0.0	0.0	46.7	74.0	-27.3	H	P	107.9	99.4						
7.323	3.0	27.4	35.2	7.3	-34.7	0.0	0.0	35.2	54.0	-18.8	H	A	107.9	99.4						
4.882	3.0	43.0	32.8	5.8	-34.9	0.0	0.0	46.8	74.0	-27.2	V	P	100.0	261.7						
4.882	3.0	37.7	32.8	5.8	-34.9	0.0	0.0	41.5	54.0	-12.5	V	A	100.0	261.7						
7.323	3.0	38.8	35.2	7.3	-34.7	0.0	0.0	46.7	74.0	-27.3	V	P	103.7	283.9						
7.323	3.0	29.0	35.2	7.3	-34.7	0.0	0.0	36.9	54.0	-17.1	V	A	103.7	283.9						
<b>2480MHz</b>																				
4.960	3.0	49.7	32.9	5.9	-34.9	0.0	0.0	53.6	74.0	-20.4	H	P	143.8	267.4						
4.960	3.0	46.8	32.9	5.9	-34.9	0.0	0.0	50.7	54.0	-3.3	H	A	143.8	267.4						
7.440	3.0	38.5	35.4	7.3	-34.6	0.0	0.0	46.6	74.0	-27.4	H	P	121.4	287.8						
7.440	3.0	27.6	35.4	7.3	-34.6	0.0	0.0	35.7	54.0	-18.3	H	A	121.4	287.8						
4.960	3.0	49.1	32.9	5.9	-34.9	0.0	0.0	53.1	74.0	-20.9	V	P	146.2	262.1						
4.960	3.0	46.4	32.9	5.9	-34.9	0.0	0.0	50.4	54.0	-3.6	V	A	146.2	262.1						
7.440	3.0	38.6	35.4	7.3	-34.6	0.0	0.0	46.6	74.0	-27.4	V	P	100.0	275.1						
7.440	3.0	27.1	35.4	7.3	-34.6	0.0	0.0	35.1	54.0	-18.9	V	A	100.0	275.1						

Rev. 4.1.2.7  
 Note: No other emissions were detected above the system noise floor.

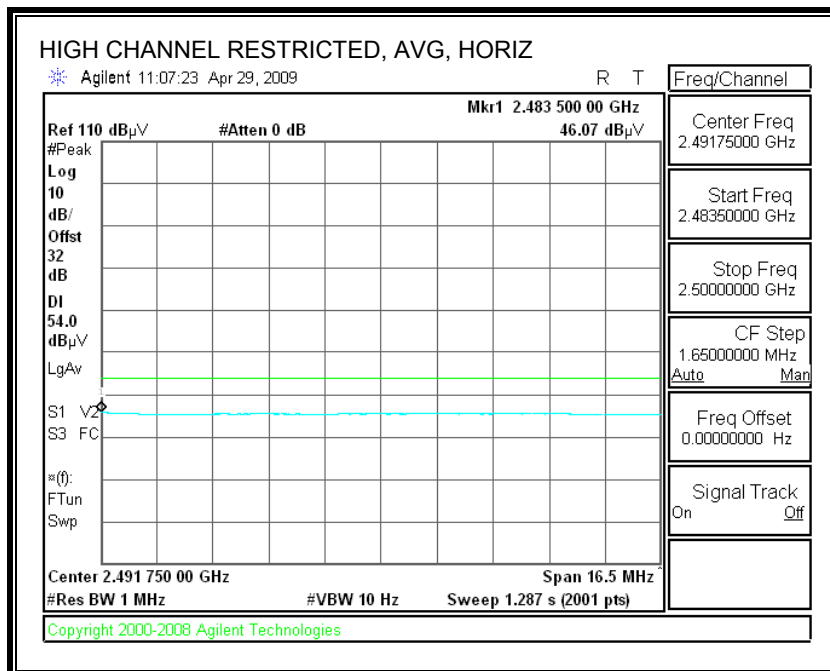
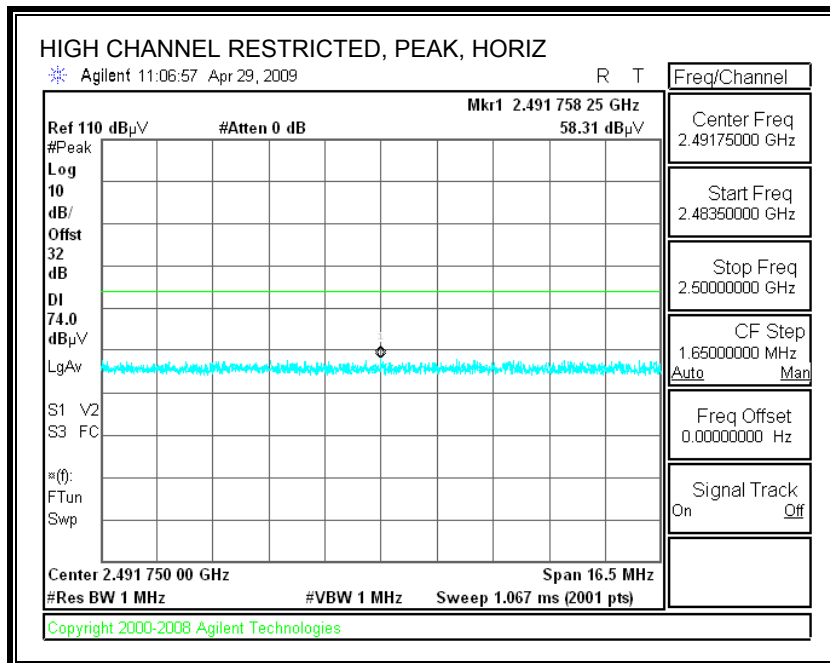
**8.1.2. 8PSK MODE**  
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**



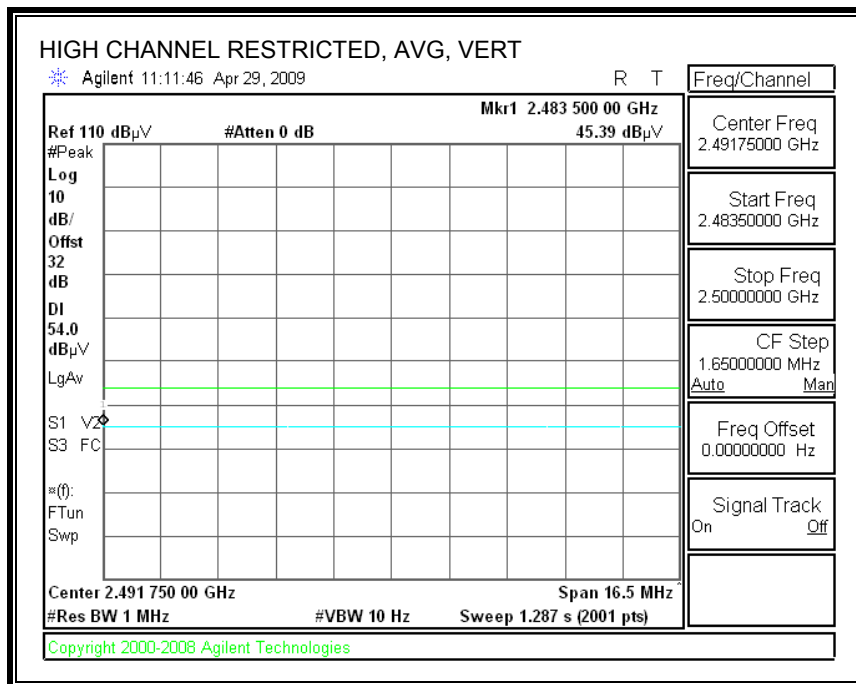
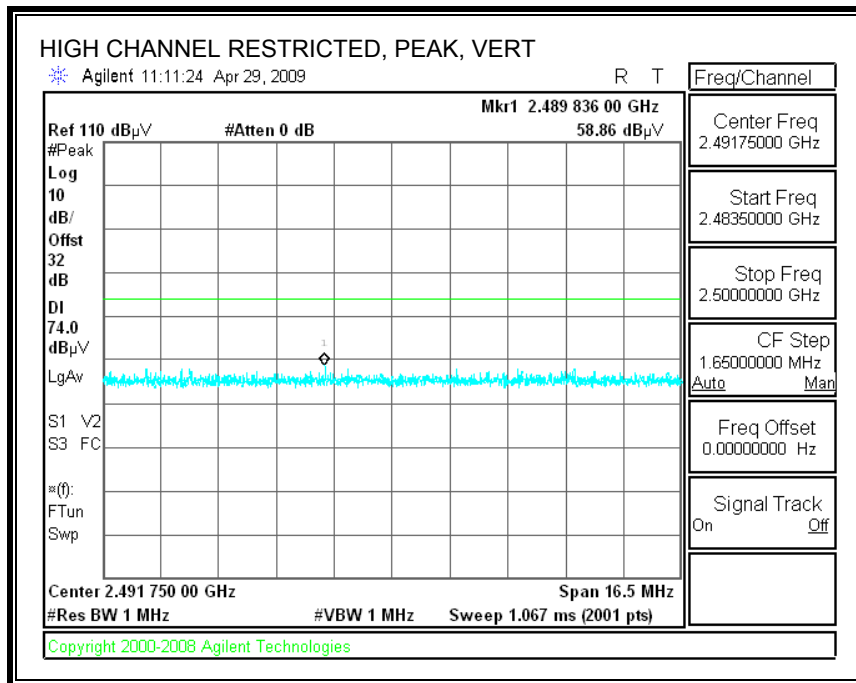
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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





**HARMONICS AND SPURIOUS EMISSIONS – 8PSK MODE**

High Frequency Measurement																						
Compliance Certification Services, Fremont 5m Chamber																						
Test Engr:		Devin Chang																				
Date:		04/29/09																				
Project #:		09U12521																				
Company:		Broadcom																				
Test Target:		EUT with Laptop																				
Mode Oper:		Tx_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	Filtr	Corr.	Limit	Margin	Ant. Pol.	Det.	Ant.High	Table Angle	Notes							
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	cm	Degree							
<b>2402MHz</b>																						
4.804	3.0	49.9	32.8	5.8	-34.8	0.0	0.0	53.6	74.0	-20.4	H	P	150.1	262.4								
4.804	3.0	43.2	32.8	5.8	-34.8	0.0	0.0	46.9	54.0	-7.1	H	A	150.1	262.4								
4.804	3.0	47.9	32.8	5.8	-34.8	0.0	0.0	51.6	74.0	-22.4	V	P	100.0	251.2								
4.804	3.0	40.2	32.8	5.8	-34.8	0.0	0.0	43.9	54.0	-10.1	V	A	100.0	251.2								
<b>2441MHz</b>																						
4.882	3.0	48.2	32.8	5.8	-34.9	0.0	0.0	52.0	74.0	-22.0	H	P	147.2	260.1								
4.882	3.0	41.1	32.8	5.8	-34.9	0.0	0.0	44.9	54.0	-9.1	H	A	147.2	260.1								
7.323	3.0	39.1	35.2	7.3	-34.7	0.0	0.0	46.9	74.0	-27.1	H	P	100.3	102.5								
7.323	3.0	27.5	35.2	7.3	-34.7	0.0	0.0	35.3	54.0	-18.7	H	A	100.3	102.5								
4.882	3.0	44.8	32.8	5.8	-34.9	0.0	0.0	48.7	74.0	-25.4	V	P	100.0	31.7								
4.882	3.0	37.2	32.8	5.8	-34.9	0.0	0.0	41.0	54.0	-13.0	V	A	100.0	31.7								
7.323	3.0	40.1	35.2	7.3	-34.7	0.0	0.0	47.9	74.0	-26.1	V	P	103.8	283.2								
7.323	3.0	28.8	35.2	7.3	-34.7	0.0	0.0	36.7	54.0	-17.3	V	A	103.8	283.2								
<b>2480MHz</b>																						
4.960	3.0	51.4	32.9	5.9	-34.9	0.0	0.0	55.3	74.0	-18.7	H	P	144.6	267.8								
4.960	3.0	45.0	32.9	5.9	-34.9	0.0	0.0	48.9	54.0	-5.1	H	A	144.6	267.8								
7.440	3.0	39.7	35.4	7.3	-34.6	0.0	0.0	47.8	74.0	-26.2	H	P	137.9	280.0								
7.440	3.0	28.0	35.4	7.3	-34.6	0.0	0.0	36.1	54.0	-17.9	H	A	137.9	280.0								
4.960	3.0	48.4	32.9	5.9	-34.9	0.0	0.0	52.3	74.0	-21.7	V	P	100.0	32.9								
4.960	3.0	41.3	32.9	5.9	-34.9	0.0	0.0	45.2	54.0	-8.8	V	A	100.0	32.9								
7.440	3.0	40.5	35.4	7.3	-34.6	0.0	0.0	48.5	74.0	-25.5	V	P	101.8	283.7								
7.440	3.0	28.8	35.4	7.3	-34.6	0.0	0.0	36.8	54.0	-17.2	V	A	101.8	283.7								

Rev. 4.1.2.7

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

## 8.2. RECEIVER ABOVE 1 GHz

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Test Engr:		Devin Chang														
Date:		04/29/09														
Project #:		09U12521														
Company:		Broadcom														
Test Target:		EUT with Laptop														
Mode Oper:		Rx mode														
f	Measurement Frequency			Amp	Prsamp 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	Filtr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes	
<b>2402MHz</b>																
2.160	3.0	51.4	27.9	3.6	-35.3	0.0	0.0	47.6	74.0	-26.4	H	P	105.6	282.7		
2.160	3.0	35.1	27.9	3.6	-35.3	0.0	0.0	31.3	54.0	-22.7	H	A	105.6	282.7		
2.160	3.0	53.7	27.9	3.6	-35.3	0.0	0.0	49.9	74.0	-24.1	V	P	100.1	314.0		
2.160	3.0	37.3	27.9	3.6	-35.3	0.0	0.0	33.5	54.0	-20.5	V	A	100.1	314.0		
3.191	3.0	44.0	30.4	4.5	-35.1	0.0	0.0	43.8	74.0	-30.2	H	P	100.4	62.8		
3.191	3.0	32.5	30.4	4.5	-35.1	0.0	0.0	32.3	54.0	-21.7	H	A	100.4	62.8		
3.191	3.0	45.9	30.4	4.5	-35.1	0.0	0.0	45.6	74.0	-28.4	V	P	100.8	142.2		
3.191	3.0	32.5	30.4	4.5	-35.1	0.0	0.0	32.3	54.0	-21.7	V	A	100.8	142.2		
<b>2441MHz</b>																
2.160	3.0	52.4	27.9	3.6	-35.3	0.0	0.0	48.6	74.0	-25.4	H	P	106.5	183.2		
2.160	3.0	35.9	27.9	3.6	-35.3	0.0	0.0	32.1	54.0	-21.9	H	A	106.5	183.2		
2.160	3.0	64.0	27.9	3.6	-35.3	0.0	0.0	60.2	74.0	-13.8	V	P	100.8	311.8		
2.160	3.0	38.5	27.9	3.6	-35.3	0.0	0.0	34.7	54.0	-19.3	V	A	100.8	311.8		
3.257	3.0	42.9	30.6	4.6	-35.1	0.0	0.0	42.9	74.0	-31.1	H	P	110.7	198.5		
3.257	3.0	35.4	30.6	4.6	-35.1	0.0	0.0	35.4	54.0	-18.6	H	A	110.7	198.5		
3.257	3.0	44.3	30.6	4.6	-35.1	0.0	0.0	44.3	74.0	-29.7	V	P	100.0	141.9		
3.257	3.0	36.5	30.6	4.6	-35.1	0.0	0.0	36.6	54.0	-17.4	V	A	100.0	141.9		
<b>2480MHz</b>																
2.160	3.0	52.8	27.9	3.6	-35.3	0.0	0.0	49.0	74.0	-25.0	H	P	105.0	180.0		
2.160	3.0	36.8	27.9	3.6	-35.3	0.0	0.0	33.0	54.0	-21.0	H	A	105.0	180.0		
2.160	3.0	51.9	27.9	3.6	-35.3	0.0	0.0	48.1	74.0	-25.9	V	P	104.8	179.1		
2.160	3.0	35.4	27.9	3.6	-35.3	0.0	0.0	31.6	54.0	-22.4	V	A	104.8	179.1		
3.309	3.0	42.1	30.7	4.6	-35.1	0.0	0.0	42.3	74.0	-31.7	H	P	104.5	261.6		
3.309	3.0	35.4	30.7	4.6	-35.1	0.0	0.0	35.6	54.0	-18.4	H	A	104.5	261.6		
3.309	3.0	43.9	30.7	4.6	-35.1	0.0	0.0	44.1	74.0	-29.9	V	P	101.1	134.4		
3.309	3.0	36.0	30.7	4.6	-35.1	0.0	0.0	36.2	54.0	-17.8	V	A	101.1	134.4		
Rev. 4.1.2.7																
Note: No other emissions were detected above the system noise floor.																

### 8.3. WORST-CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)

30-1000MHz Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Devin Chang											
Date:		04/29/09											
Project #:		09U12521											
Company:		Broadcom											
Test Target:		EUT with Laptop											
Mode Oper:		Tx mode											
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	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
99.723	3.0	58.6	10.0	0.9	32.6	0.0	0.0	36.9	43.5	-6.6	H	P	
120.004	3.0	50.1	13.7	1.0	32.6	0.0	0.0	32.2	43.5	-11.3	H	P	
199.927	3.0	53.8	12.0	1.3	32.6	0.0	0.0	34.5	43.5	-9.0	H	P	
443.897	3.0	52.8	15.8	2.0	32.7	0.0	0.0	37.9	46.0	-8.1	H	P	
797.912	3.0	48.6	21.0	2.8	32.5	0.0	0.0	39.9	46.0	-6.1	H	P	
99.723	3.0	58.6	10.0	0.9	32.6	0.0	0.0	36.9	43.5	-6.6	V	P	
120.004	3.0	50.1	13.7	1.0	32.6	0.0	0.0	32.2	43.5	-11.3	V	P	
443.897	3.0	52.8	15.8	2.0	32.7	0.0	0.0	37.9	46.0	-8.1	V	P	
797.792	3.0	48.7	21.0	2.8	32.5	0.0	0.0	40.0	46.0	-6.0	V	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	56 to 46
0.5-5	56	46
5-30	60	50

\* 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

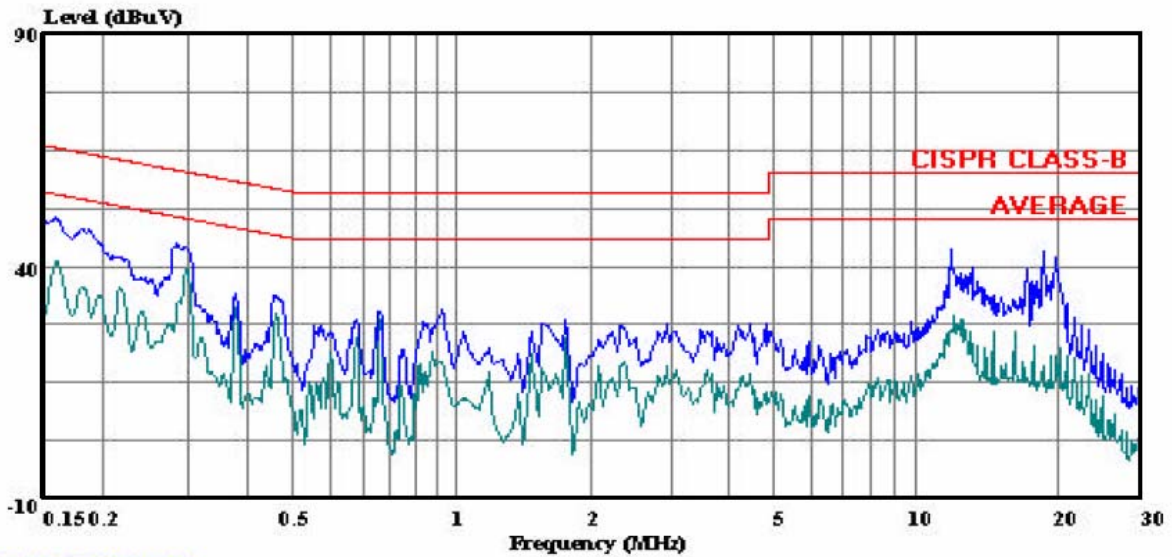
CONDUCTED EMISSIONS DATA (115VAC 60Hz)										
Freq. (MHz)	Reading			Class (dB)	Limit QP	FCC B		Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)			AV	QP (dB)	AV (dB)		
0.16	50.40	--	40.87	0.00	65.46	55.46	-15.06	-14.59	L1	
0.30	44.66	--	39.28	0.00	60.24	50.24	-15.58	-10.96	L1	
12.19	43.69	--	29.42	0.00	60.00	50.00	-16.31	-20.58	L1	
0.31	45.86	--	40.45	0.00	59.92	49.92	-14.06	-9.47	L2	
12.12	44.09	--	30.85	0.00	60.00	50.00	-15.91	-19.15	L2	
19.95	47.48	--	31.53	0.00	60.00	50.00	-12.52	-18.47	L2	
6 Worst Data										

**LINE 1 RESULTS**



Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538  
Tel: (510) 771-1000  
Fax: (510) 661-0888

Data#: 7 File#: 09U12521 BT.EMI Date: 05-04-2009 Time: 14:32:44



**(Line Conduction)**

Trace: 5

Ref Trace:

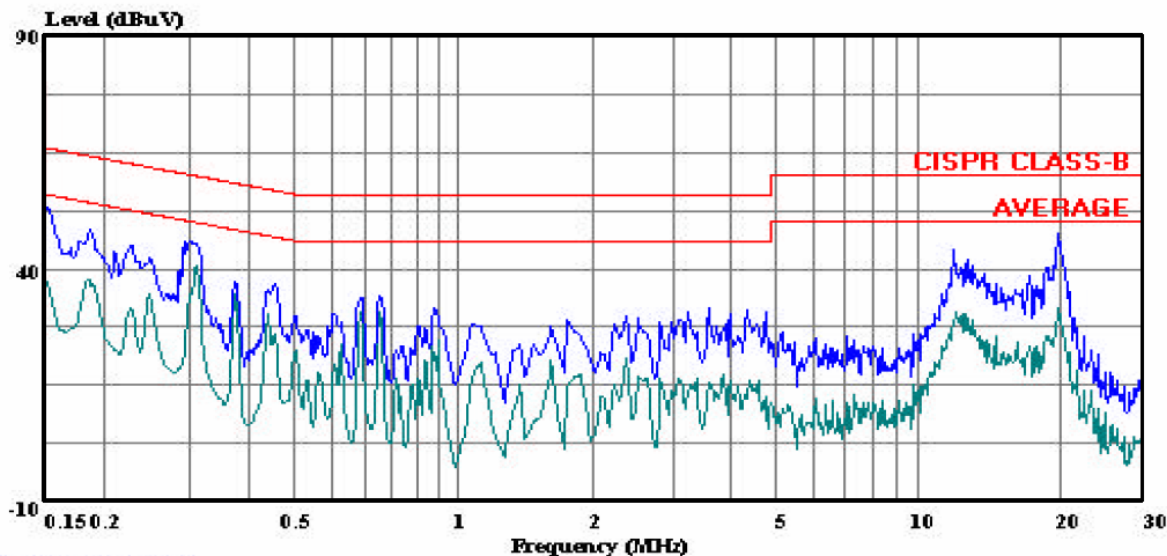
Condition: CISPR CLASS-B  
Test Operator:: Devin Chang  
Project #: : 09U12521  
Company: : Broadcom  
Configuration:: EUT WithLaptop  
Mode: : Tx Mode  
Target: : FCC Class B  
Voltage: : 115VAC/60 Hz  
: Line 1:Blue (Peak); Green (Average)

**LINE 2 RESULTS**



Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538  
Tel: (510) 771-1000  
Fax: (510) 661-0888

Data#: 14 File#: 09U12521 BT.EMI Date: 05-04-2009 Time: 15:34:24



(Line Conduction)

Trace: 12

Ref Trace:

Condition: CISPR CLASS-B  
Test Operator:: Devin Chang  
Project #: : 09U12521  
Company: : Broadcom  
Configuration:: EUT WithLaptop  
Mode: : Tx Mode  
Target: : FCC Class B  
Voltage: : 115VAC/60 Hz  
: Line 2:Blue (Peak); Green (Average)

## 10. MAXIMUM PERMISSIBLE EXPOSURE

### FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**IC RULES**

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5  
 Exposure Limits for Persons Not Classified As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

- Notes:**
1. Frequency, *f*, is in MHz.
  2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.
  3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).



**CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

And

$$S = E^2 / 3770$$

Where

- E = Field Strength in Volts/meter
- P = Power in Watts
- G = Numeric antenna gain
- d = Distance in meters
- S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

Where

- d = MPE distance in cm
- P = Power in dBm
- G = Antenna Gain in dBi
- S = Power Density Limit in mW/cm<sup>2</sup>

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

The power density in units of mW/cm<sup>2</sup> is converted to units of W/m<sup>2</sup> by multiplying by a factor of 10.

**LIMITS**

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup>

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>

**RESULTS**

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
GFSK	2.4 GHz	20.0	3.87	3.90	0.0012	0.01
8PSK	2.4 GHz	20.0	6.50	3.90	0.0022	0.02