



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

**CERTIFICATION TEST REPORT
FOR
BLUETOOTH TRANSCEIVER MODULE
MODEL NUMBER: BCM92070MD_REF**

FCC ID: QDS-BRCM1043

IC: 4324A-BRCM1043

REPORT NUMBER: 08U12247-11

ISSUE DATE: JANUARY 19, 2009

Prepared for

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
---	01/19/09	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: BLUETOOTH TRANSCEIVER MODULE

MODEL: BCM92070MD_REF

SERIAL NUMBER: 0000P2 (Radiated), 0000P1 (Conducted)

DATE TESTED: JANUARY 8 - 13, 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.

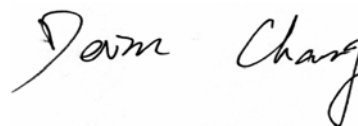
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this 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 Annex 8

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 a Bluetooth transceiver module.

The radio module is manufactured by Broadcom Corp.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm) (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	2.08	1.61
2402 - 2480	Enhanced 8PSK	4.27	2.67

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a build-in antenna, with a maximum gain of 1.87 dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was Broadcom, 2070 Bluetooth rev.5.1.0.1400.

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

5.5. WORST-CASE CONFIGURATION AND MODE

For Radiated test, the EUT has been evaluated at X, Y, and Z-axis. The highest measured output power was at X-Axis.

The worst-case Bluetooth channel is determined as the 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	DELL	INSPIRON	300866347 1FM6U7U0W/I0	DoC
AC Adapter	DELL	LA65NS0-00	CN-CDF623-71615-775-605A	N/A
Adapter Board	Broadcom	BCM9USB323V	1238291	N/A
Adapter Board	Broadcom	BCM9USB323V	1238301	N/A

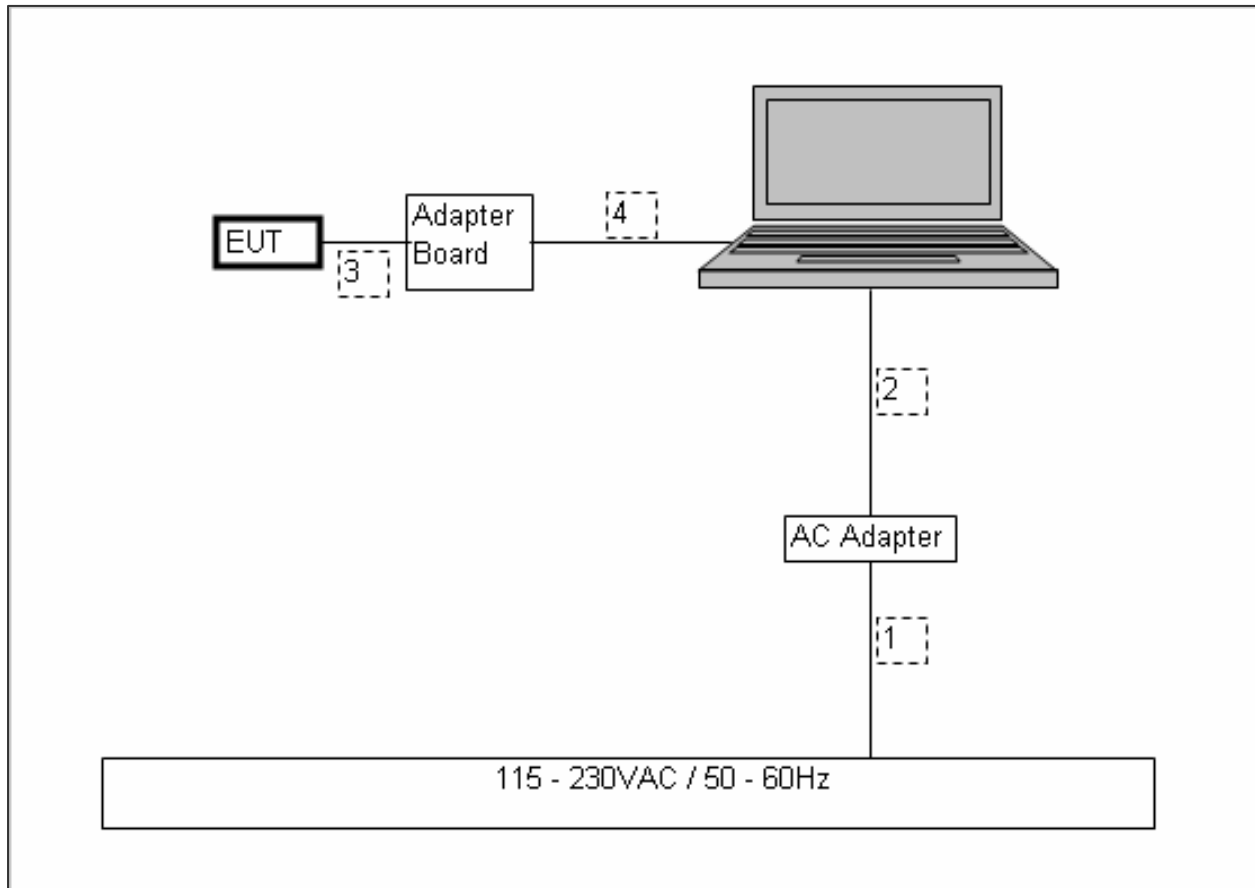
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Unshielded	1m	N/A
2	DC	1	DC	Unshielded	1.8m	N/A
3	Ribbon	1	Ribbon Cable	Unshielded	.3m	EUT / Adapter Board
4	USB	1	USB	UnShielded	.8m	N/A

TEST SETUP

The EUT is connected to a host laptop computer via a 5 VDC adapter board during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	08/07/09
Bilog Antenna	Sunol Sciences	JB1	C01016	10/13/09
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	09/27/09
Preamplifier, 1300 MHz	Agilent / HP	8447D	C01064	05/09/09
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	06/12/09
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/09
Peak / Average Power Sensor	Agilent	E9327A	C00964	12/07/09
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	01/27/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	09/15/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	09/15/09
Antenna, Horn, 18 GHz	ETS	3117	C01005	04/15/09

7. ANTENNA PORT TEST RESULTS

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

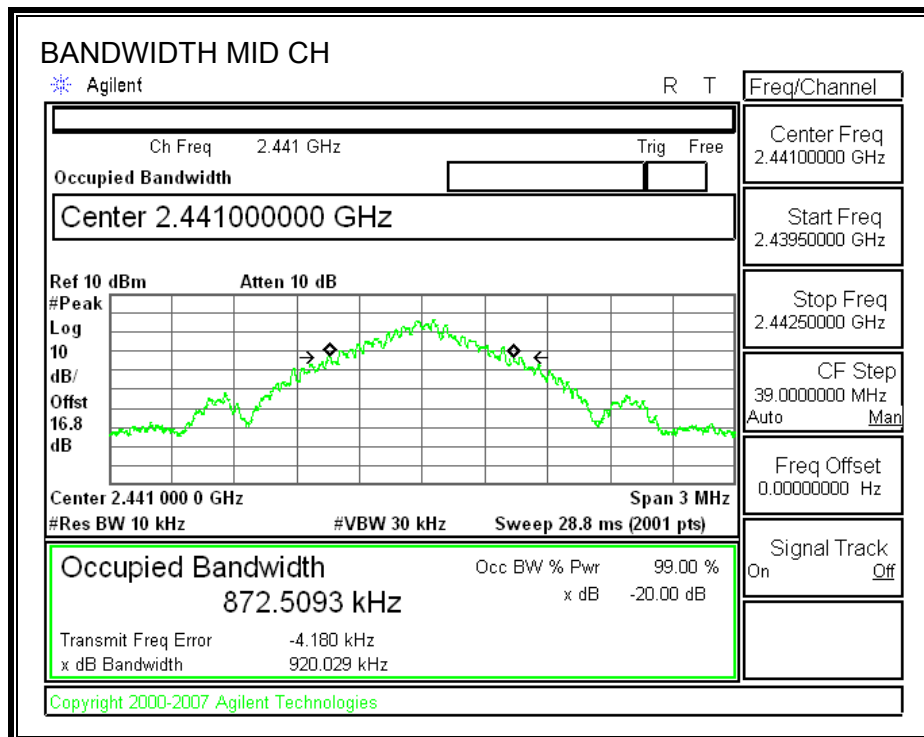
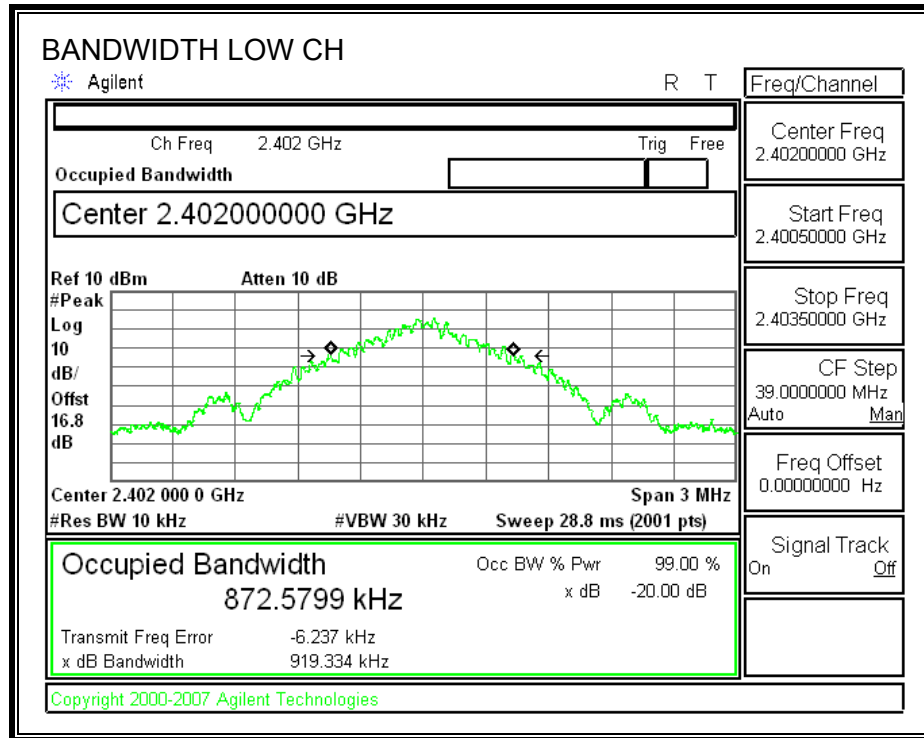
GFSK MODE

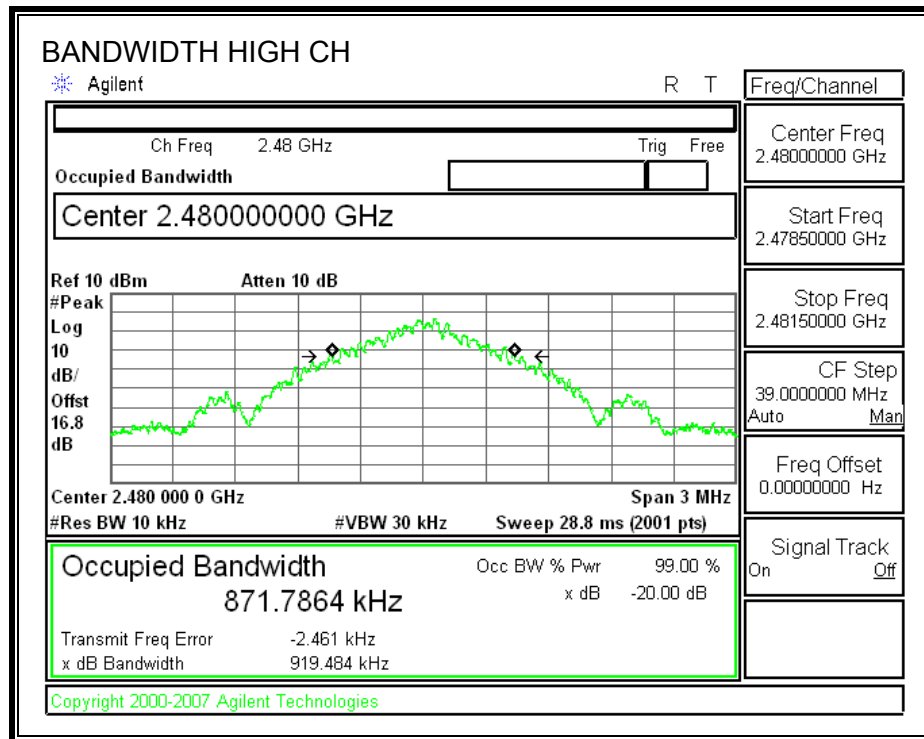
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
0	2402	919.334	886.625
39	2441	920.029	870.229
78	2480	919.484	871.794

8PSK MODE

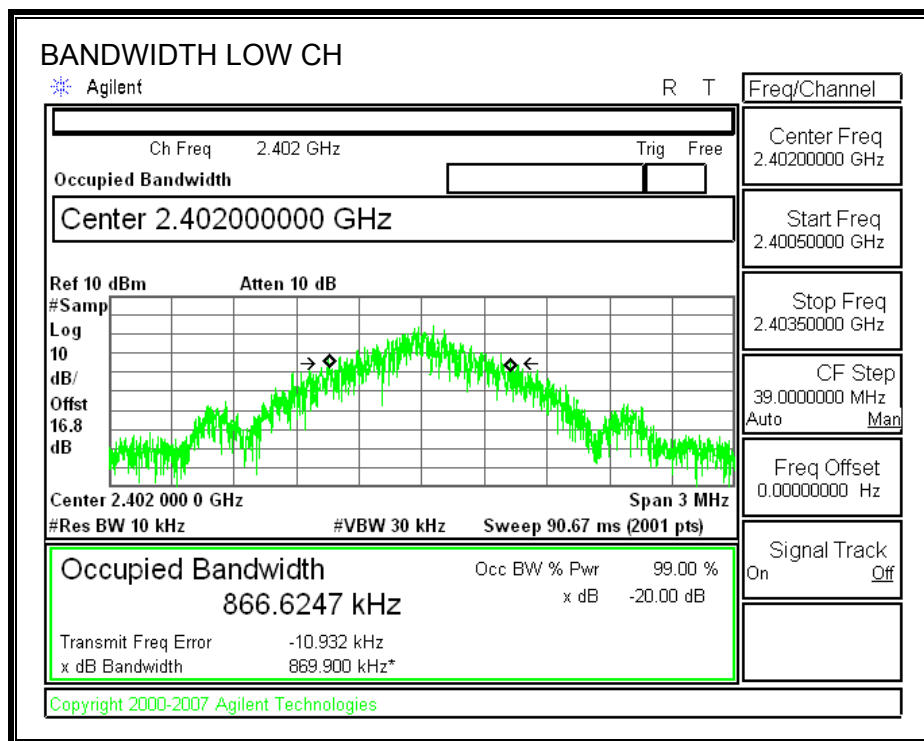
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
0	2402	1.343	1.199
39	2441	1.346	1.208
78	2480	1.348	1.204

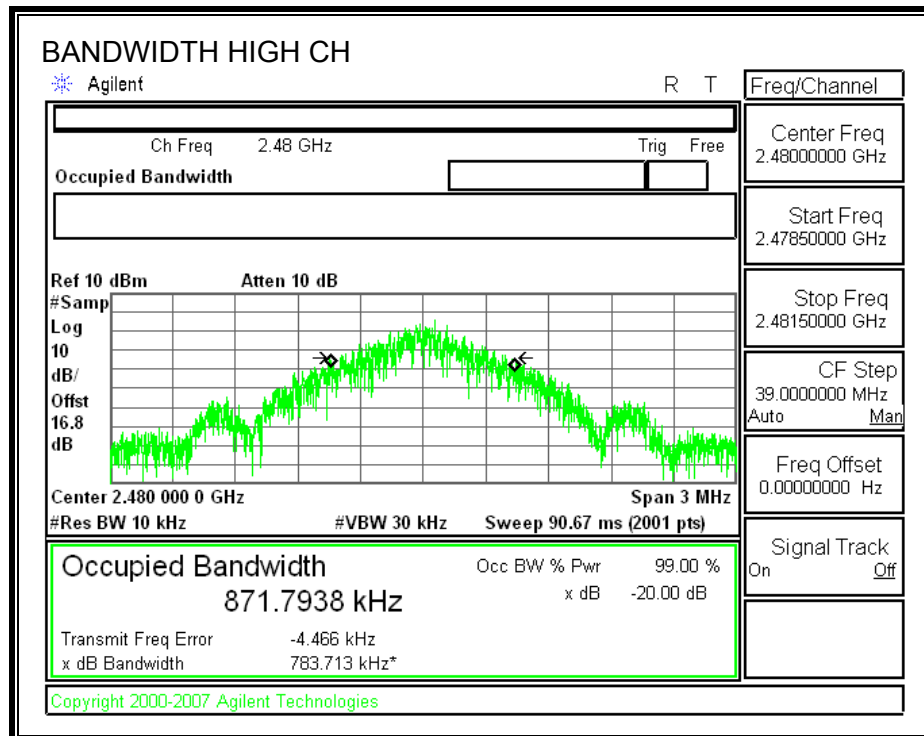
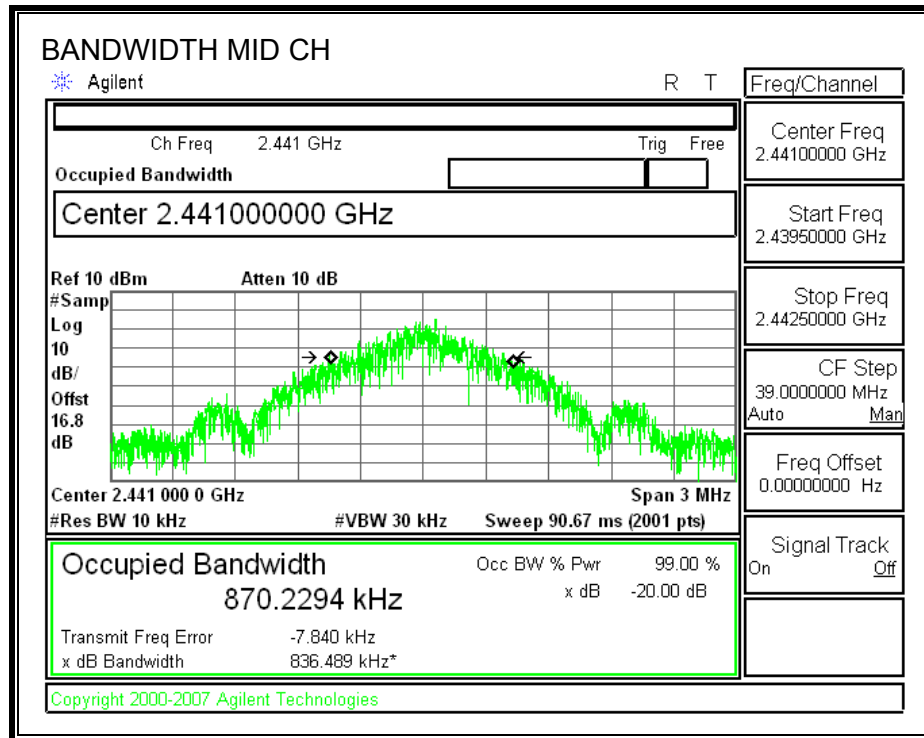
GFSK MODE - 20 dB BANDWIDTH



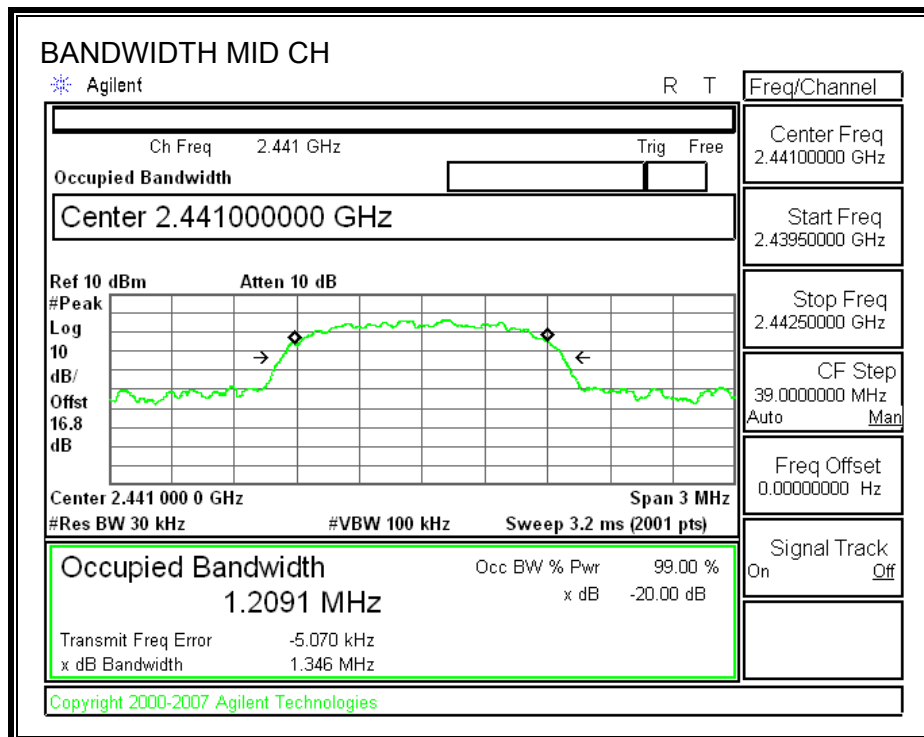
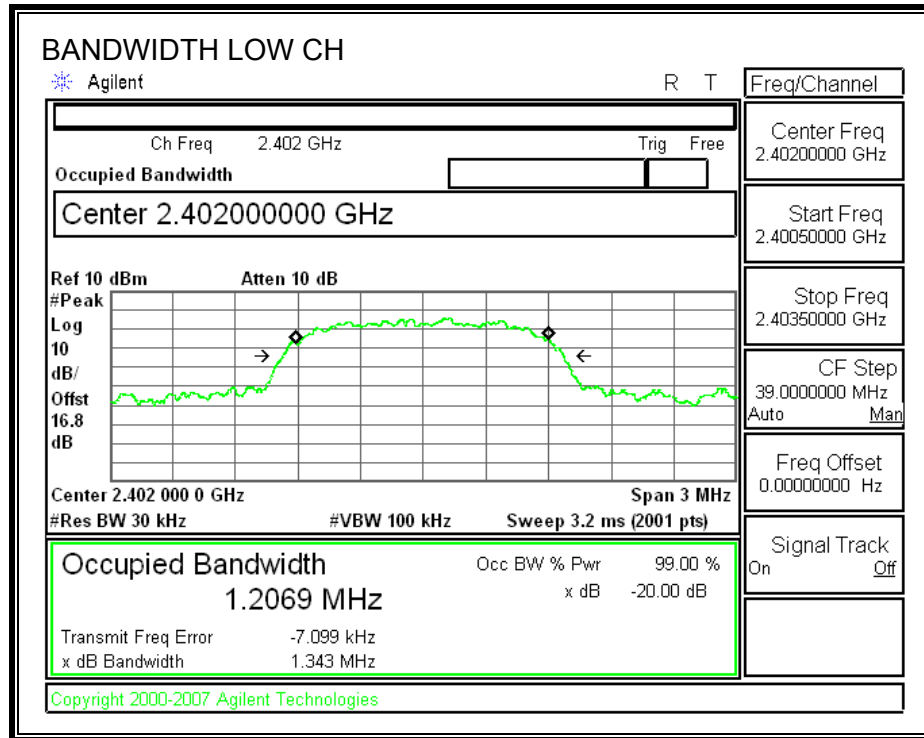


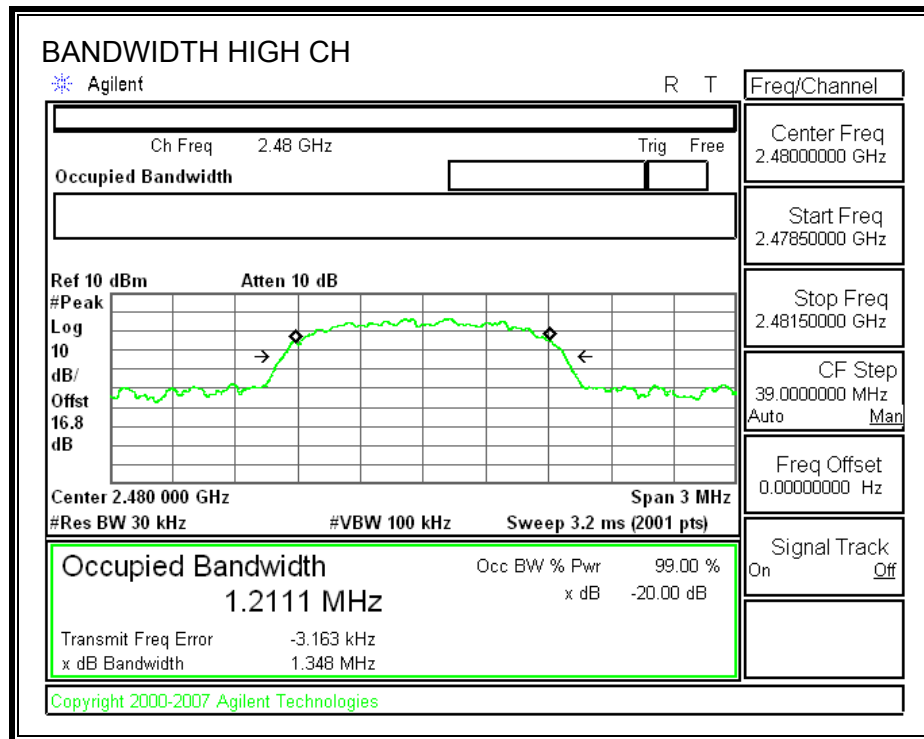
99% BANDWIDTH



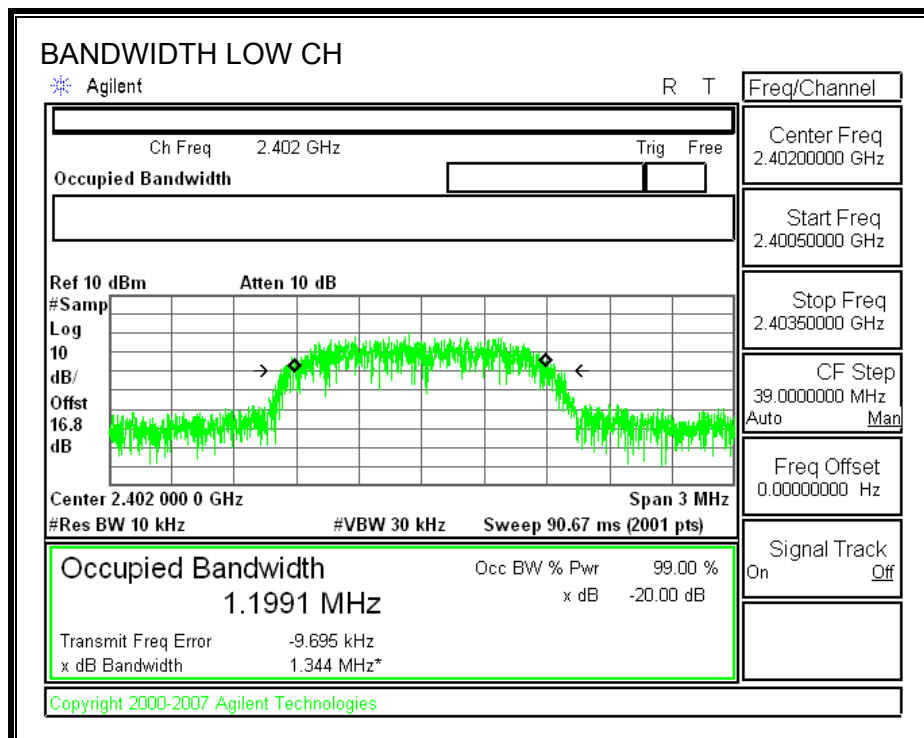


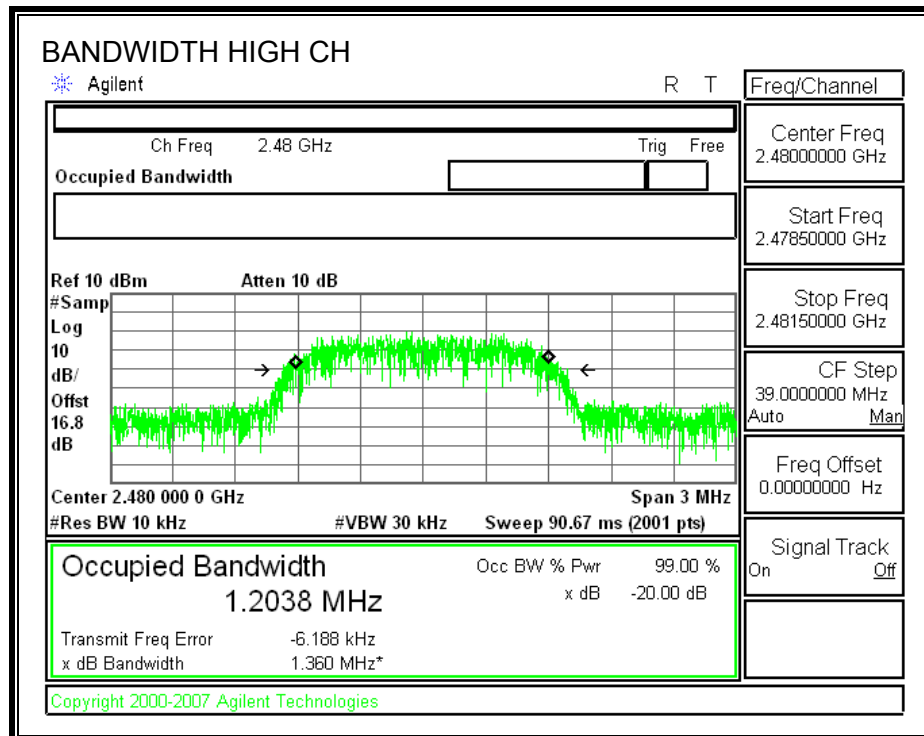
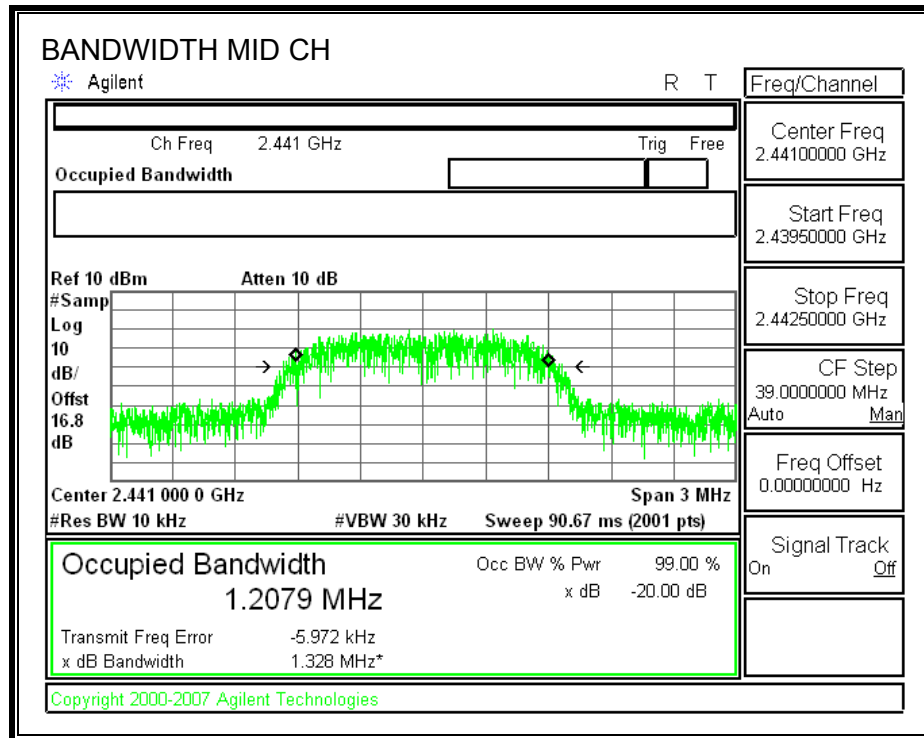
8PSK MODE - 20 dB BANDWIDTH





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 300 kHz. The sweep time is coupled.

RESULTS

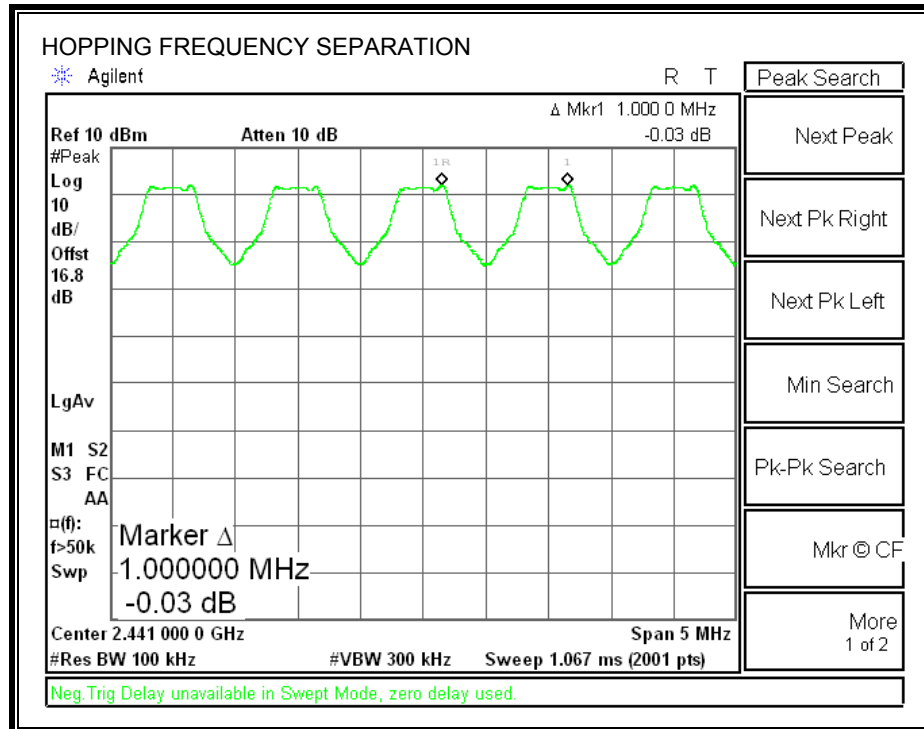
GFSK MODE

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	Freq. Separation (kHz)
39	2441	920.029	1000

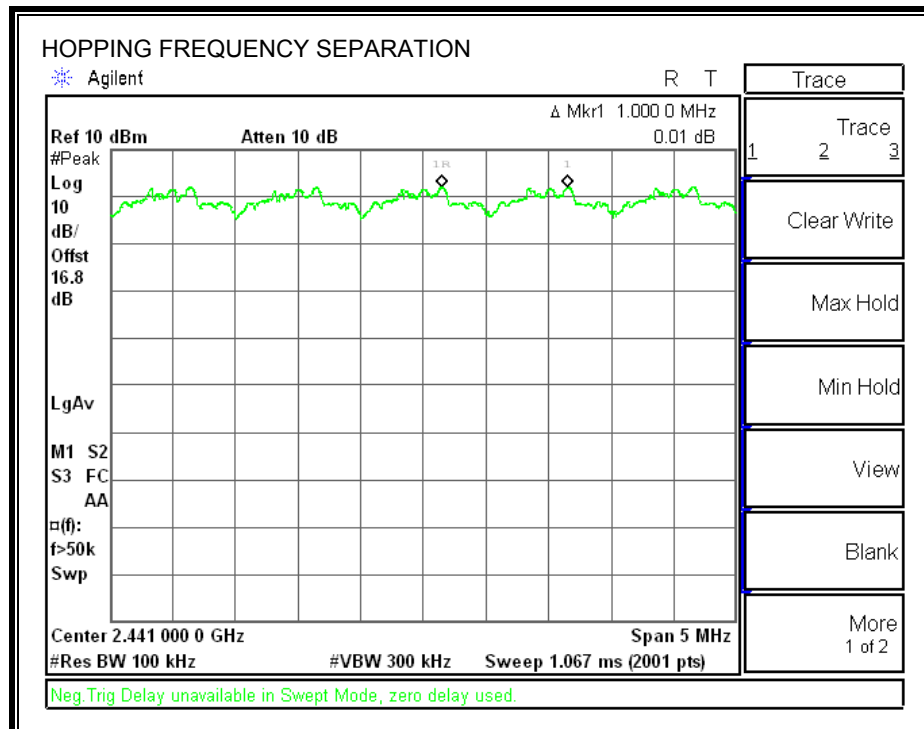
8PSK MODE

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	2/3 of 20dB BW (KHz)	Freq. Separation (KHz)
39	2441	1346.0	897	1000

HOPPING FREQUENCY SEPARATION – GFSK MODE



HOPPING FREQUENCY SEPARATION – 8PSK MODE



7.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

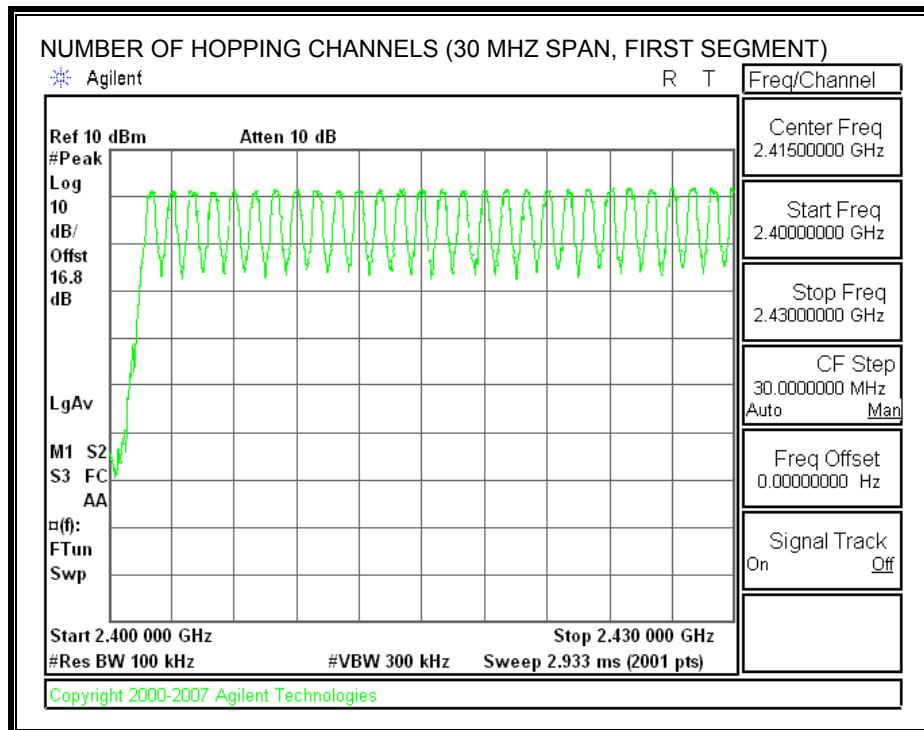
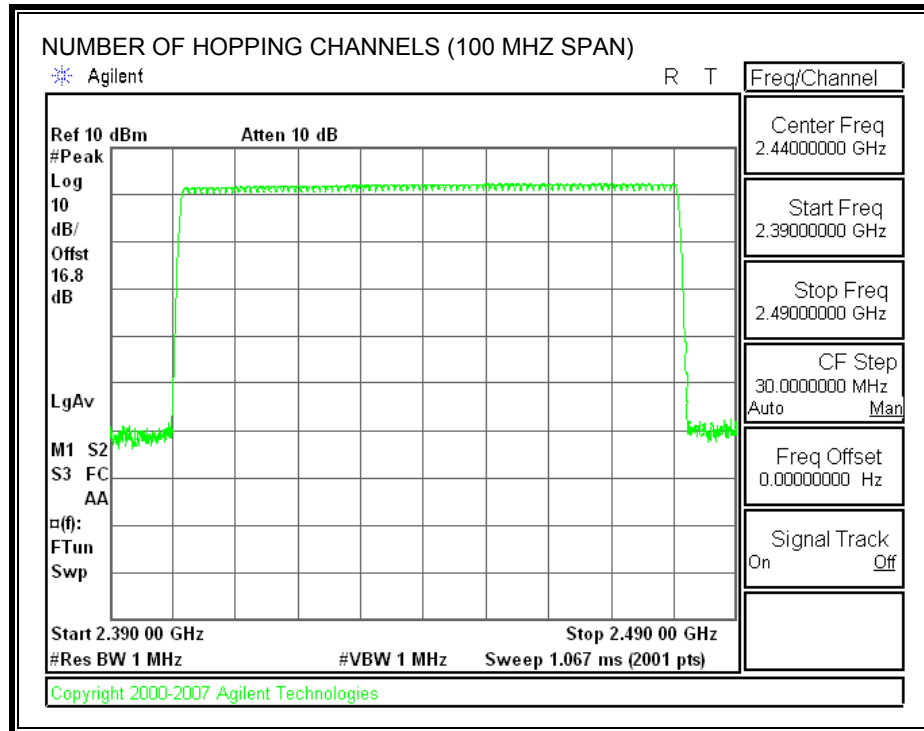
TEST PROCEDURE

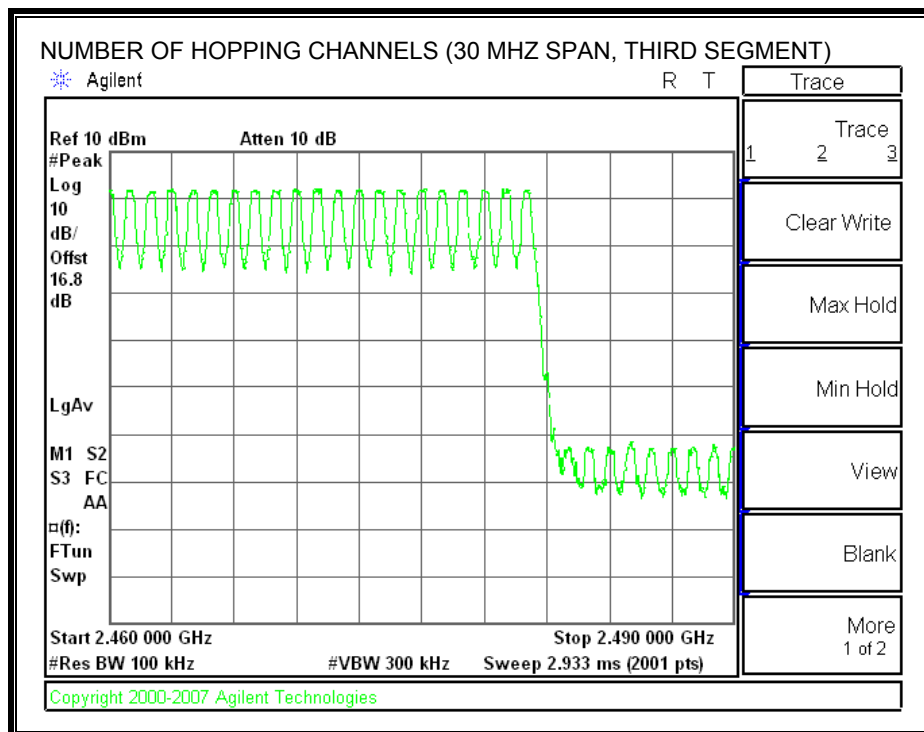
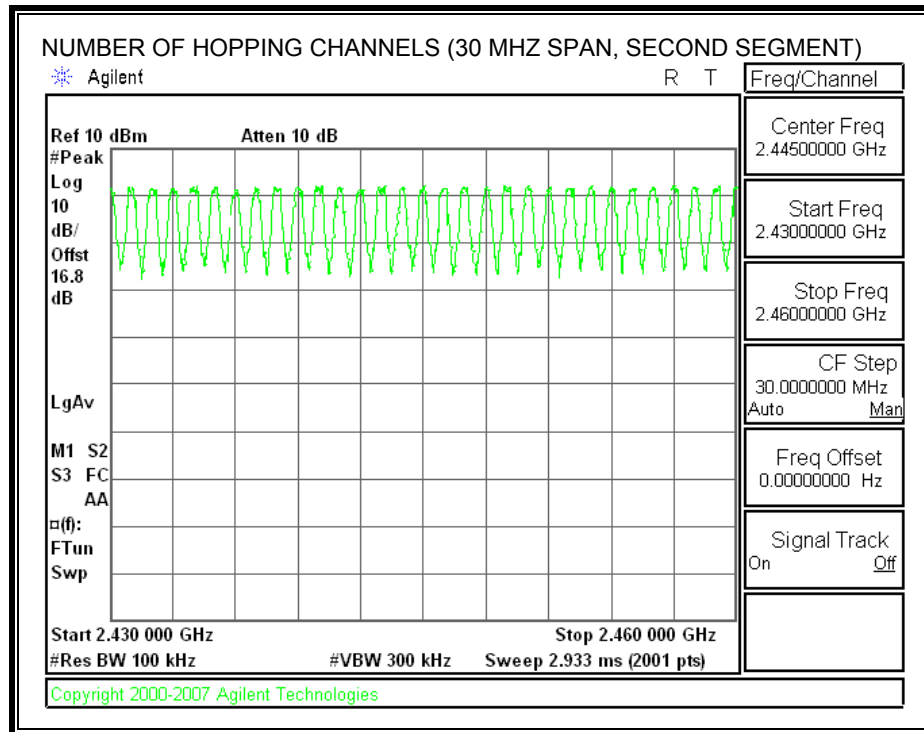
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

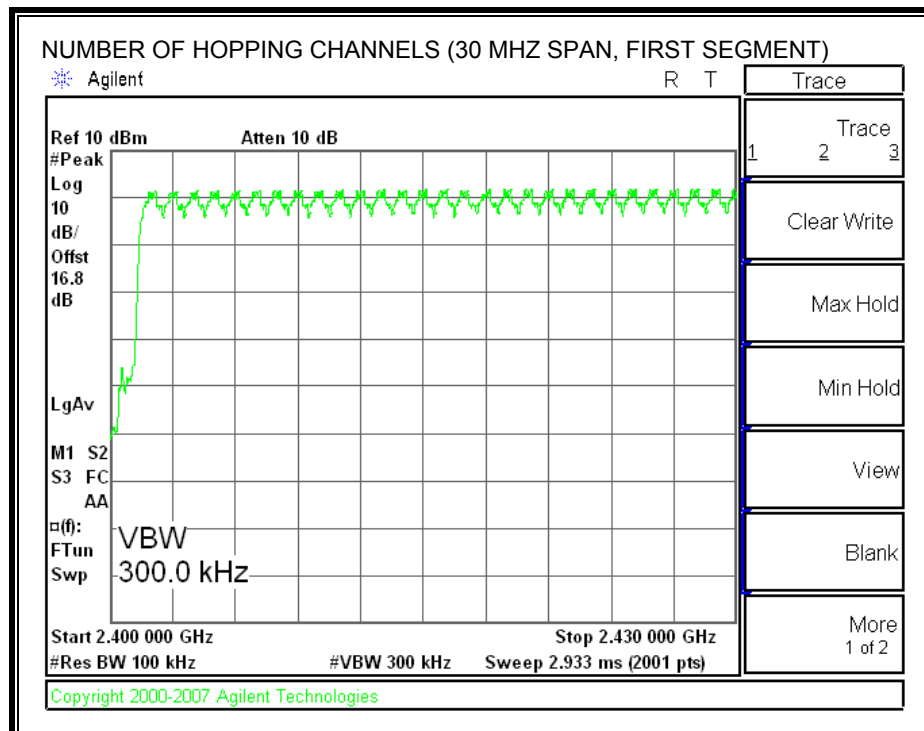
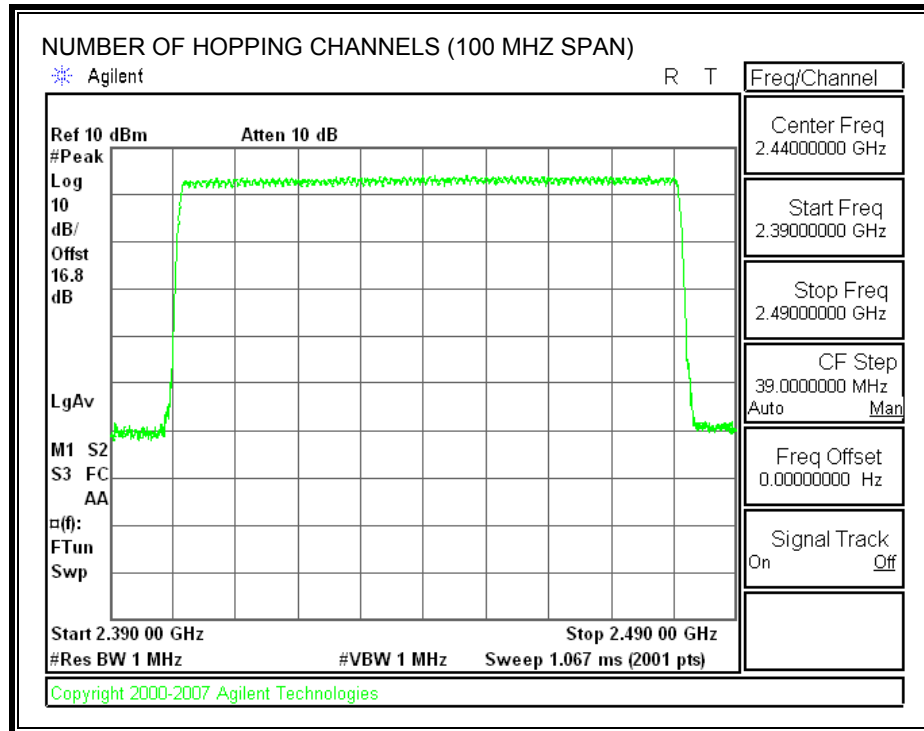
79 Channels observed.

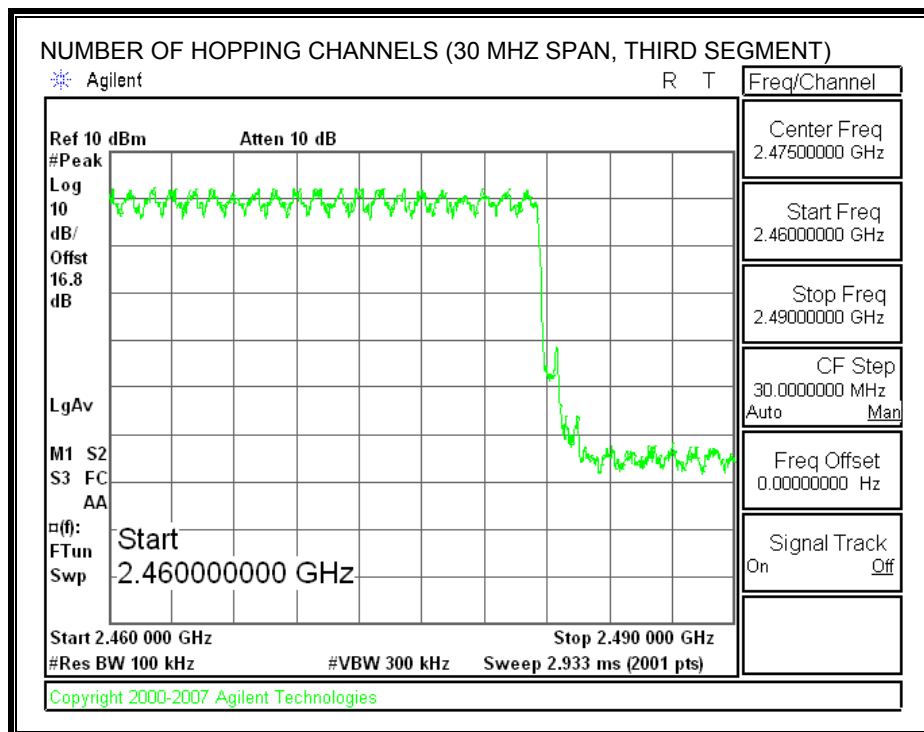
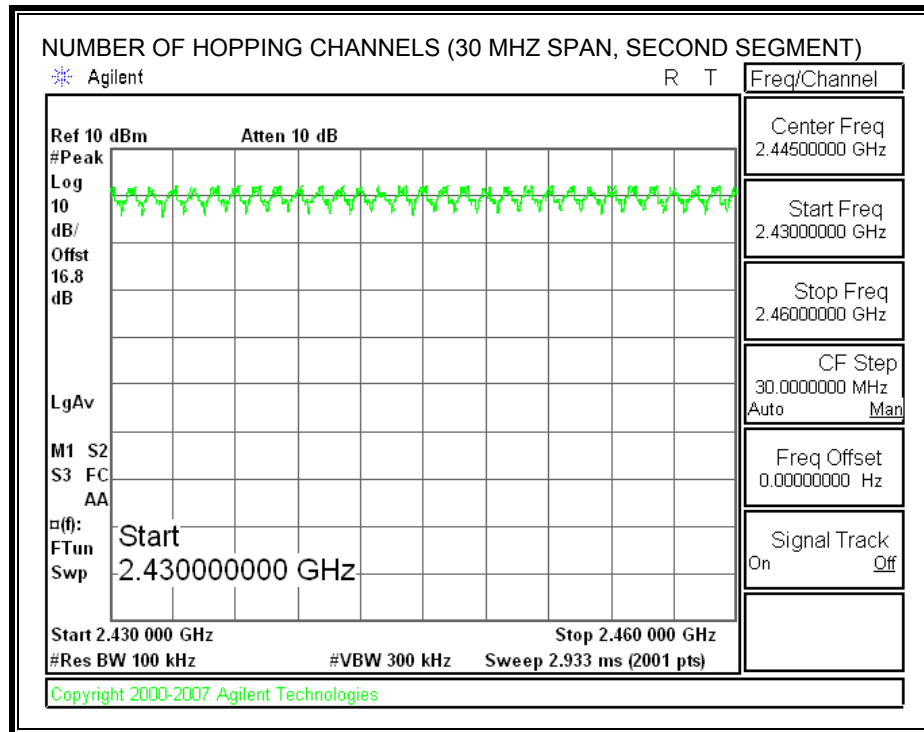
NUMBER OF HOPPING CHANNELS – GFSK MODE





NUMBER OF HOPPING CHANNELS – 8PSK MODE





7.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

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

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

RESULTS

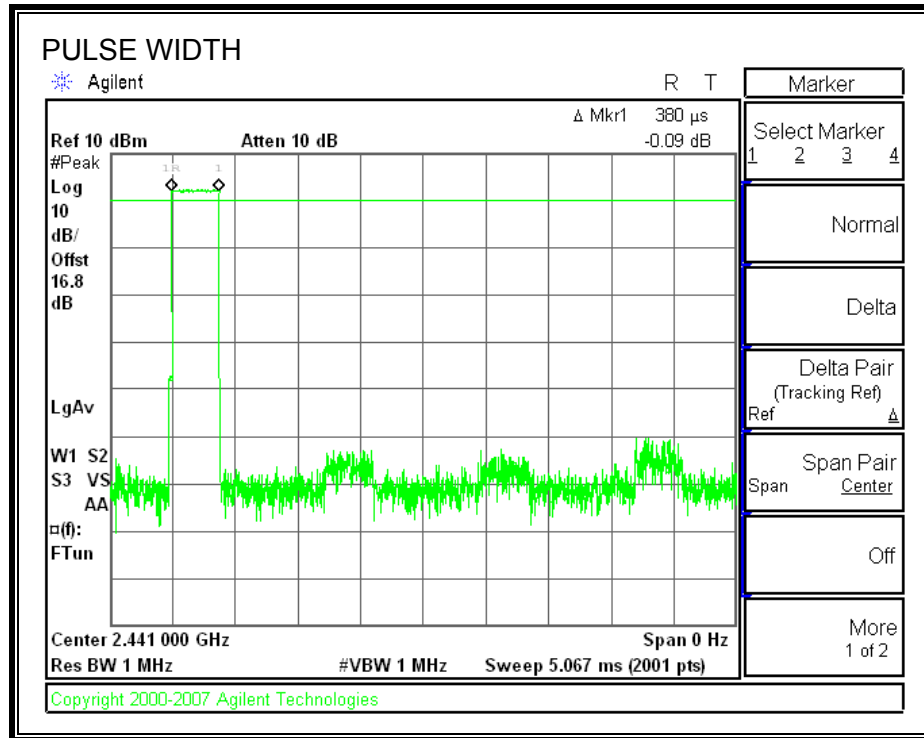
GFSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.380	32	0.122	0.4	-0.278
DH3	1.637	17	0.278	0.4	-0.122
DH5	2.885	13	0.375	0.4	-0.025

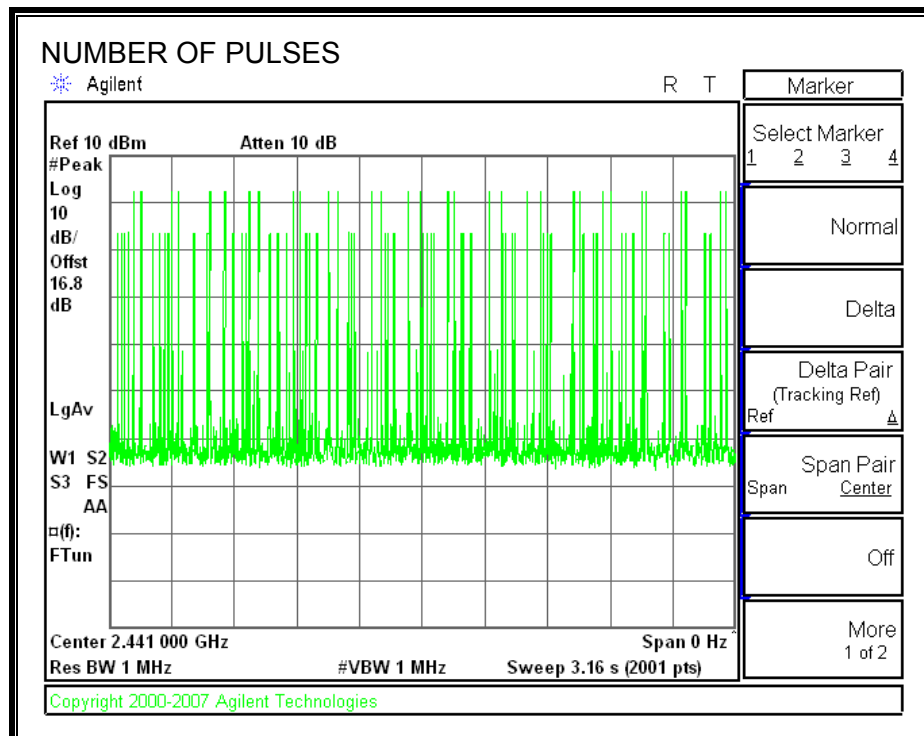
8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.388	35	0.136	0.4	-0.264
DH3	1.639	18	0.295	0.4	-0.105
DH5	2.883	11	0.317	0.4	-0.083

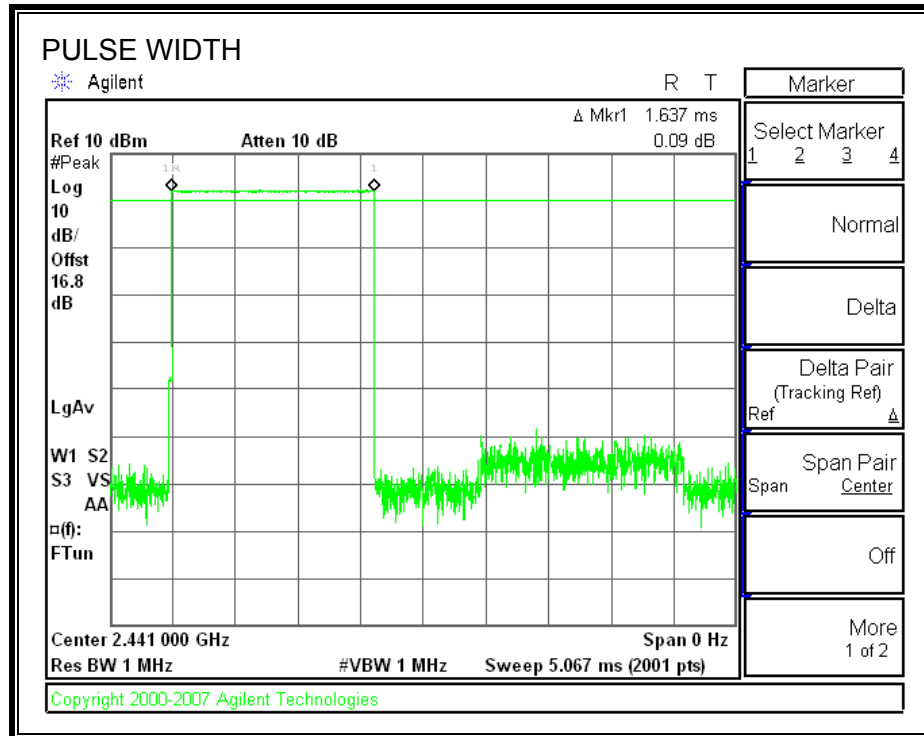
GFSK MODE - FREQUENCY PACKET DH1



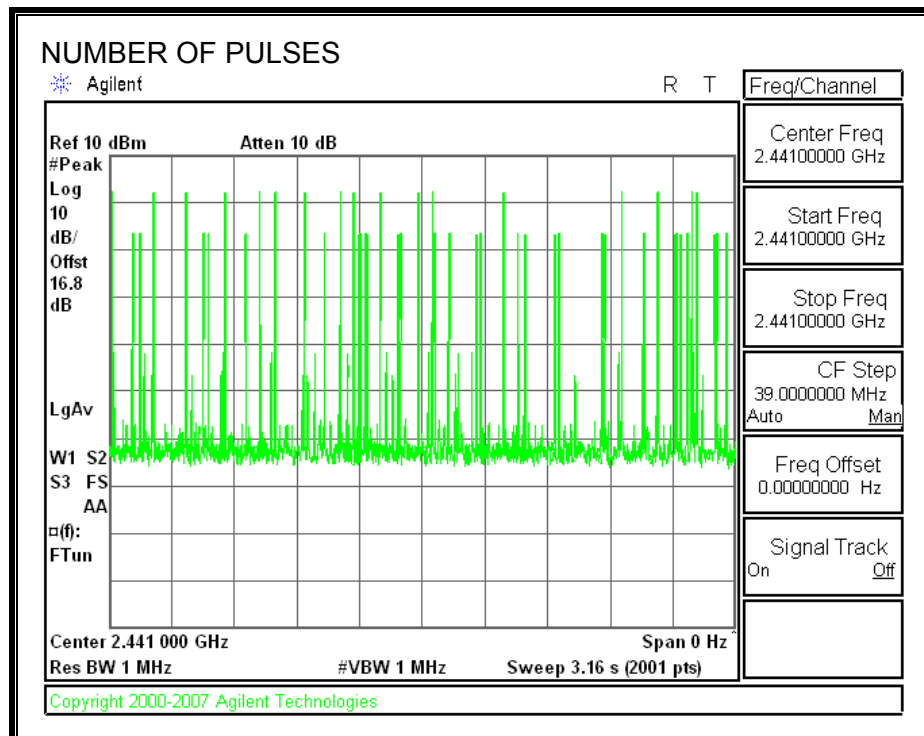
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



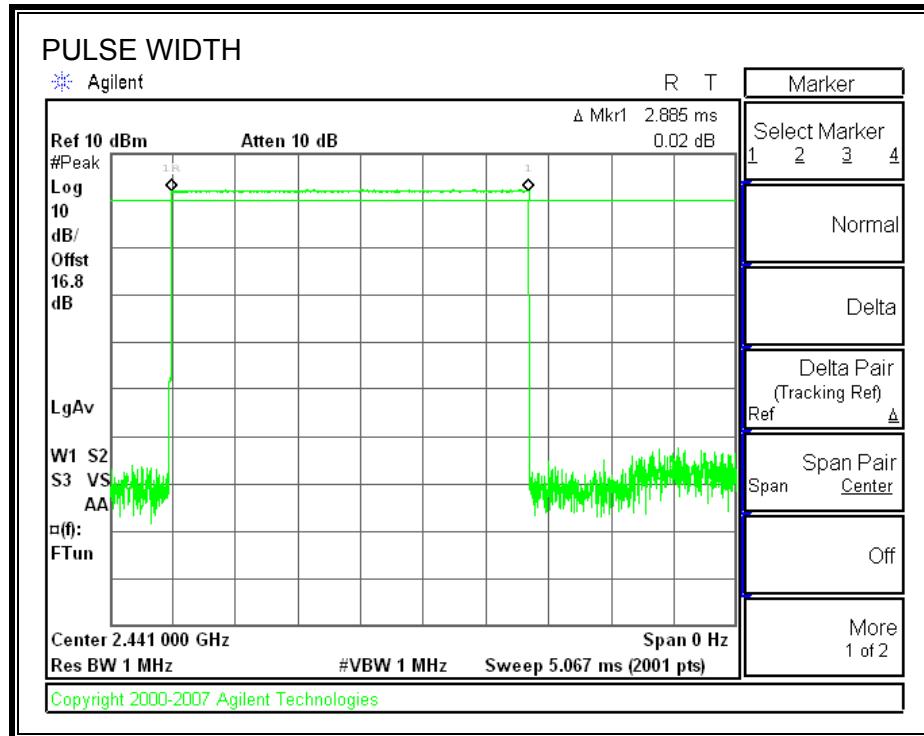
GFSK MODE - FREQUENCY PACKET DH3



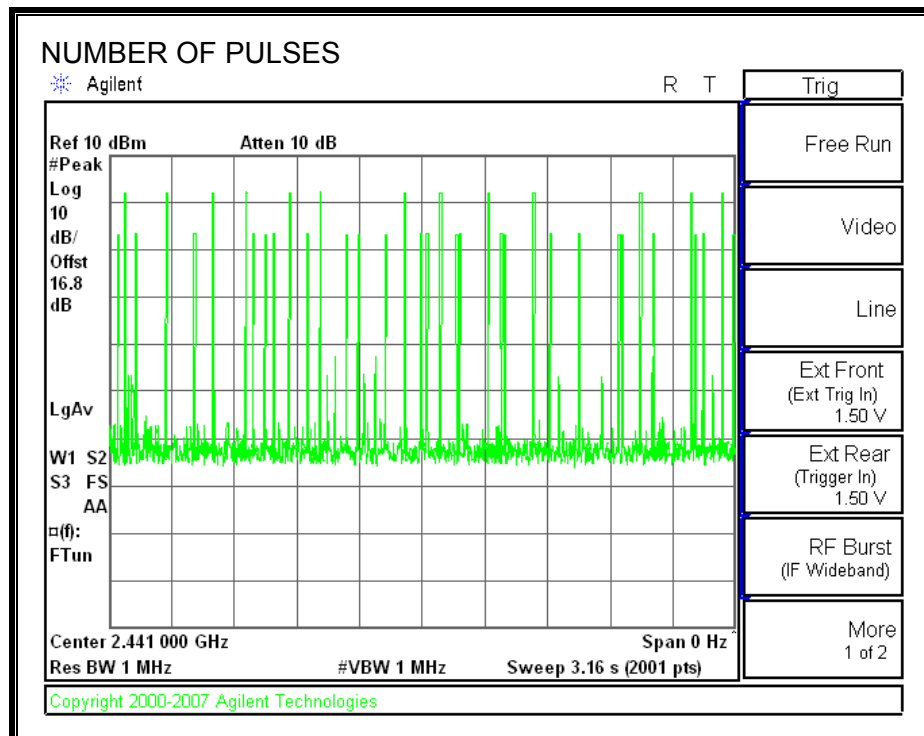
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



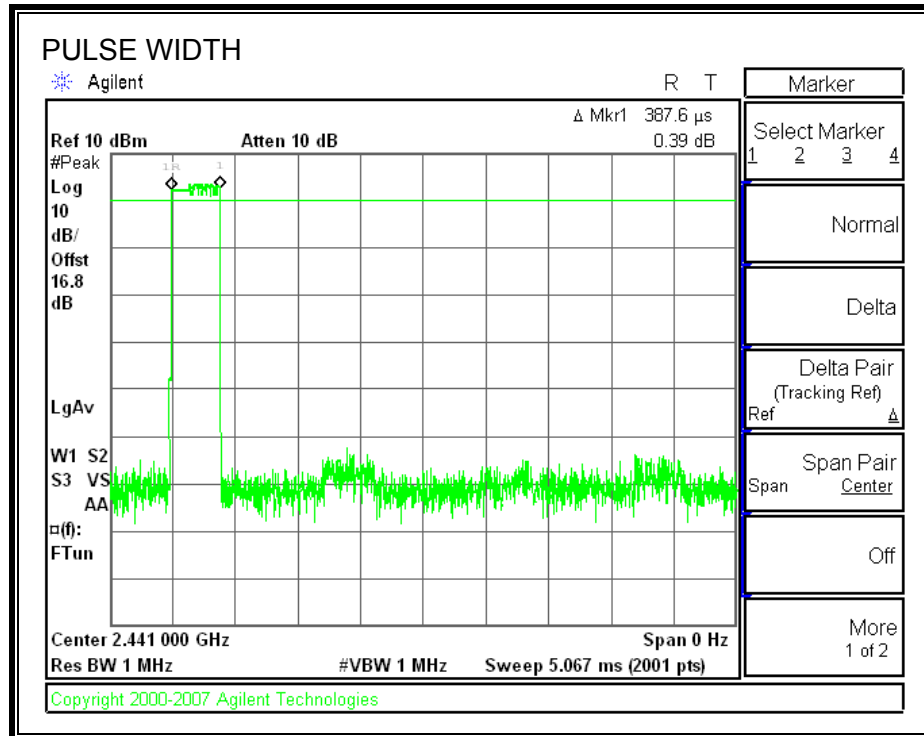
GFSK MODE - FREQUENCY PACKET DH5



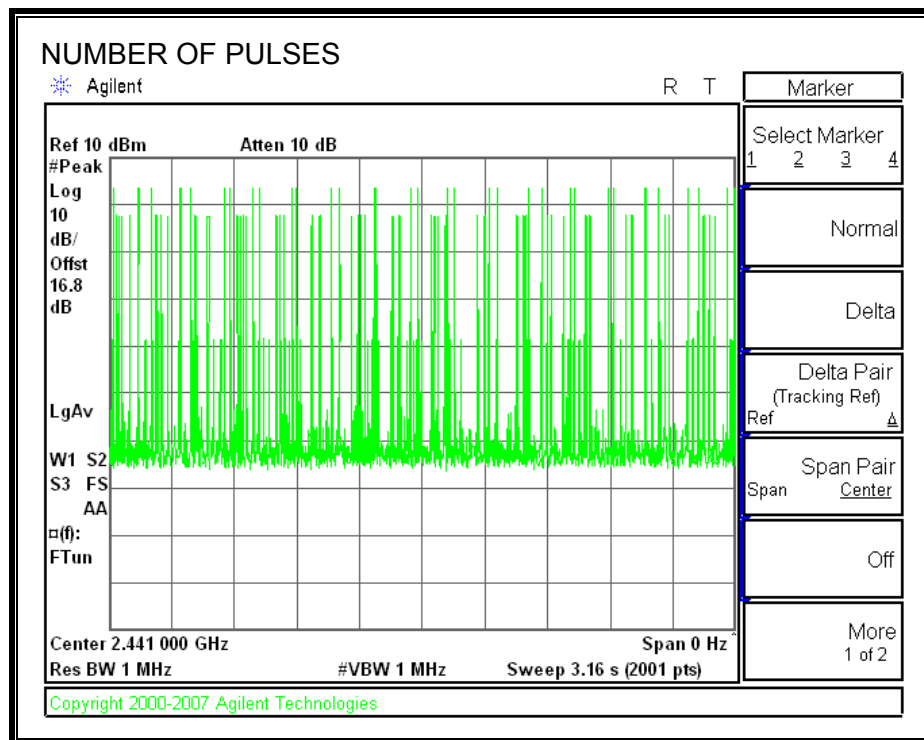
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



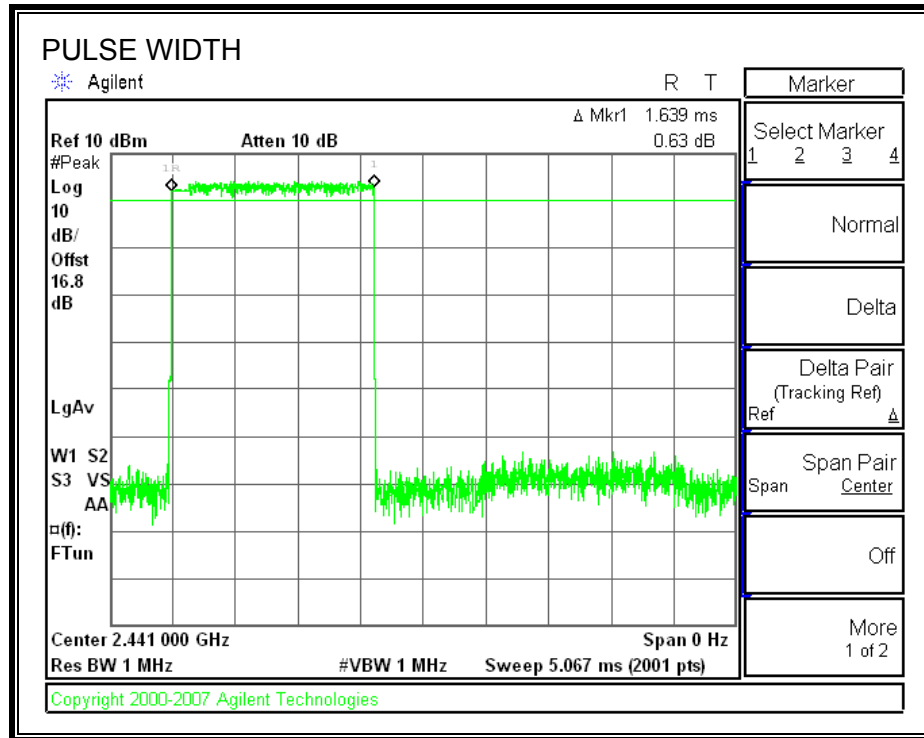
8PSK MODE - FREQUENCY PACKET DH1



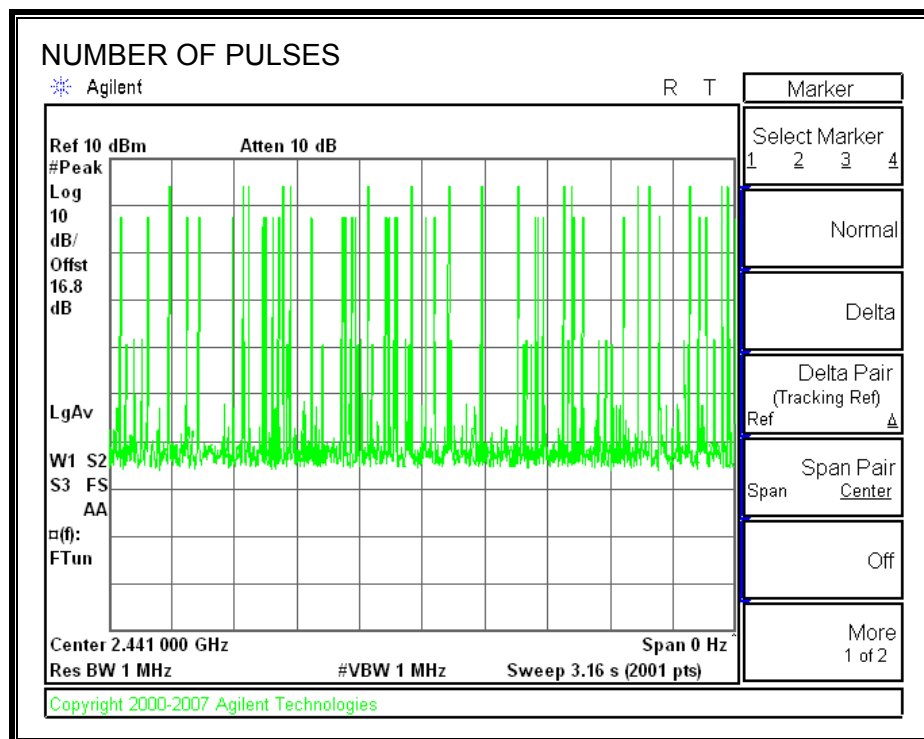
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



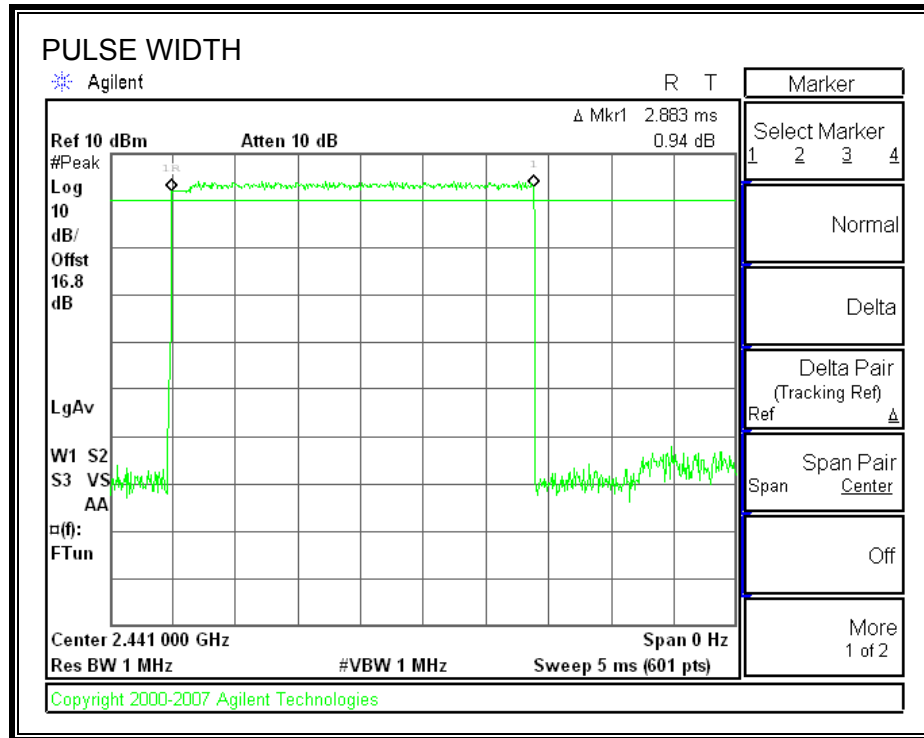
8PSK MODE - FREQUENCY PACKET DH3



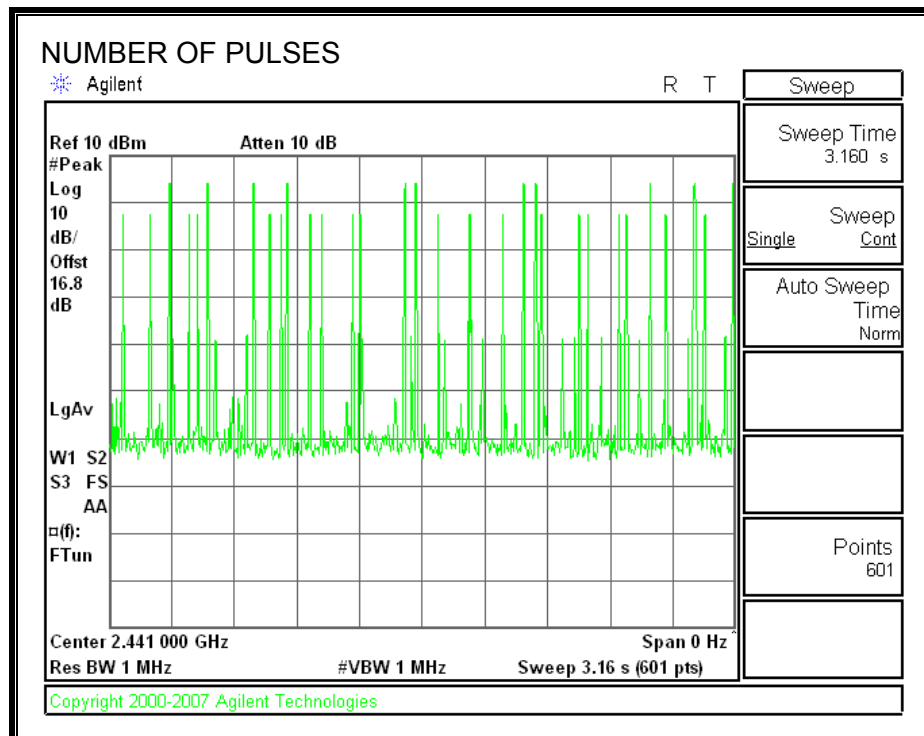
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



8PSK MODE - FREQUENCY PACKET DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

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

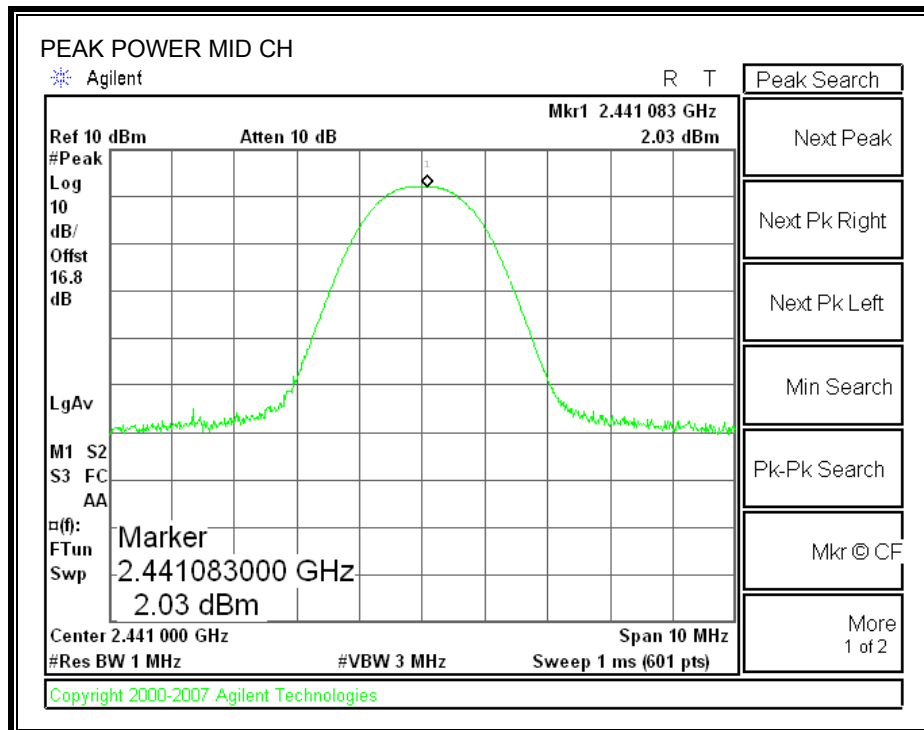
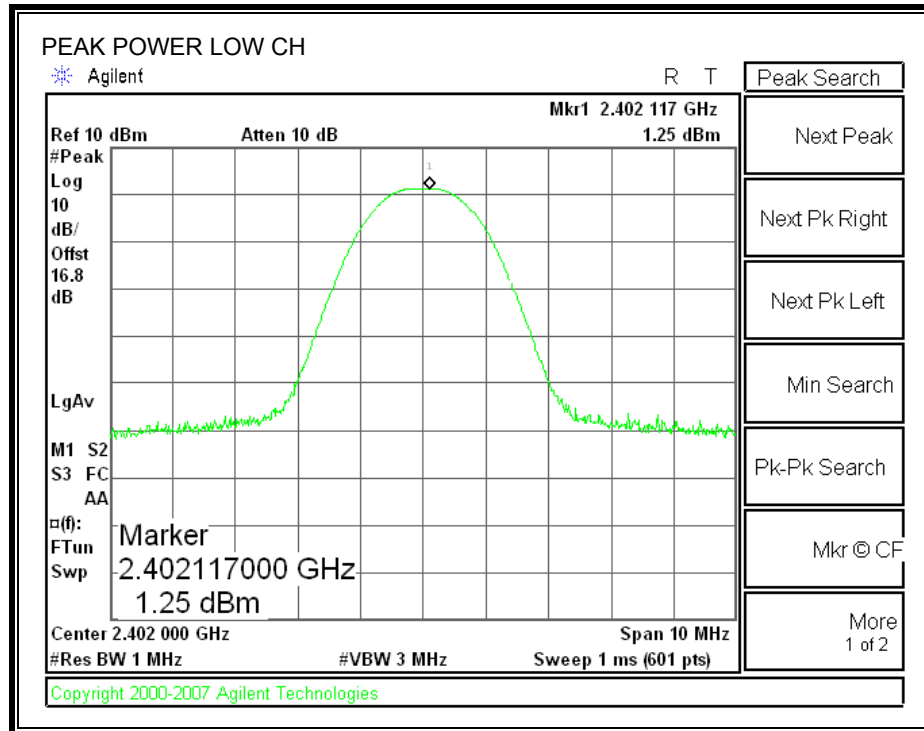
GFSK MODE

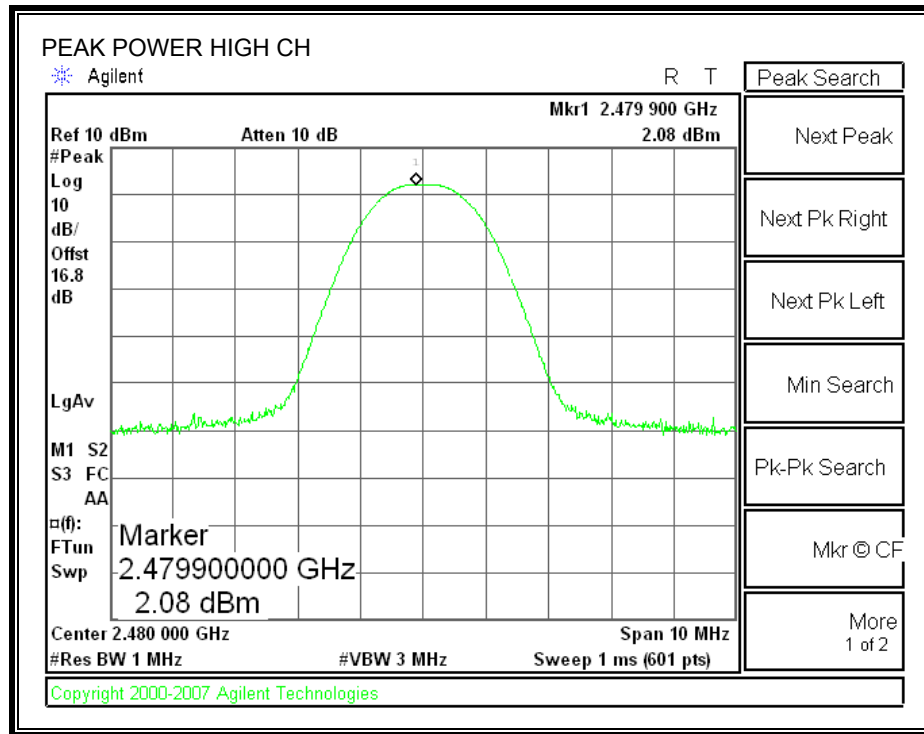
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
0	2402	1.25	30	-28.75
39	2441	2.03	30	-27.97
78	2480	2.08	30	-27.92

8PSK MODE

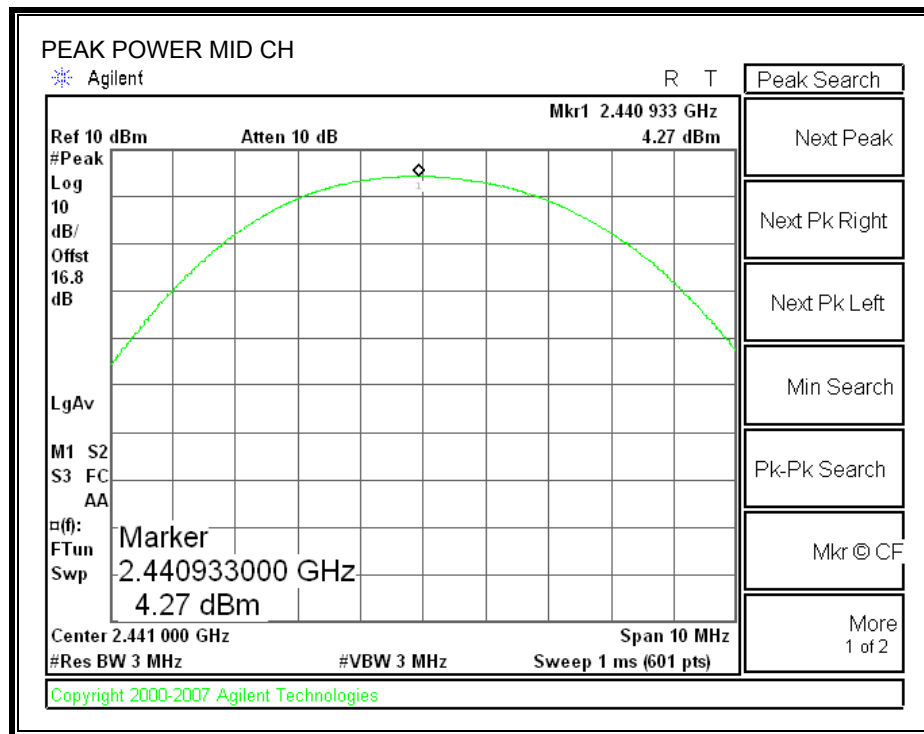
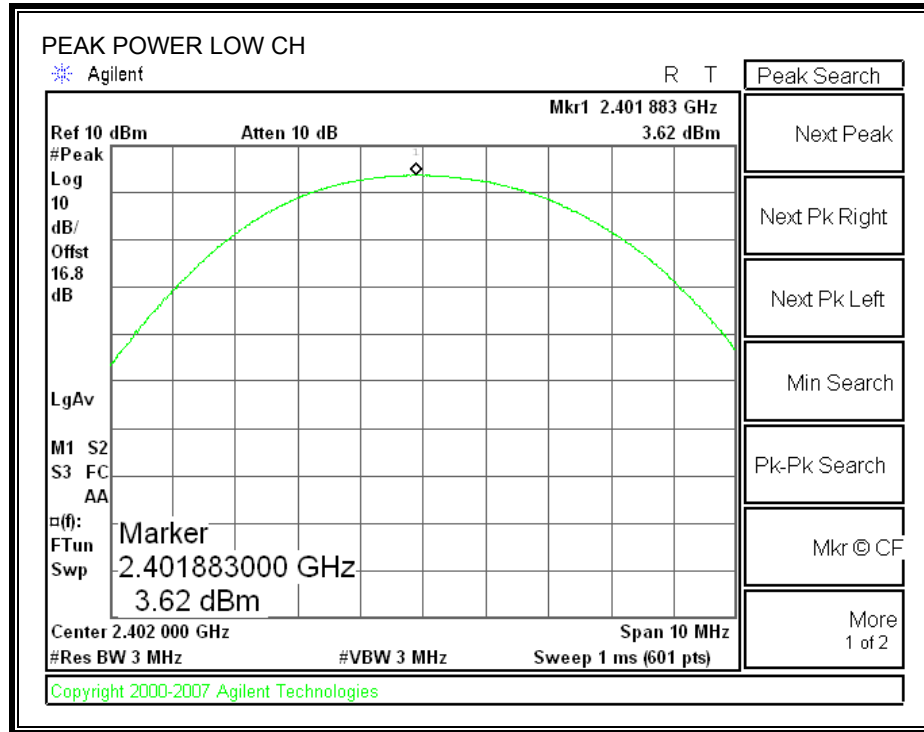
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
0	2402	3.62	21	-17.35
39	2441	4.27	21	-16.70
78	2480	4.24	21	-16.73

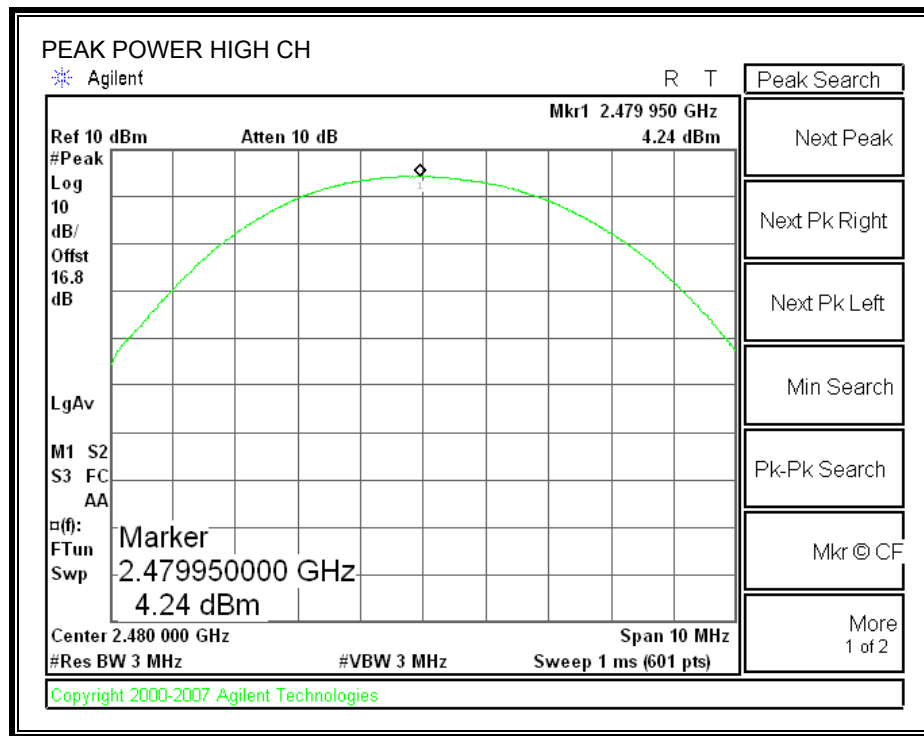
OUTPUT POWER - GFSK





OUTPUT POWER – 8PSK





7.1.6. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

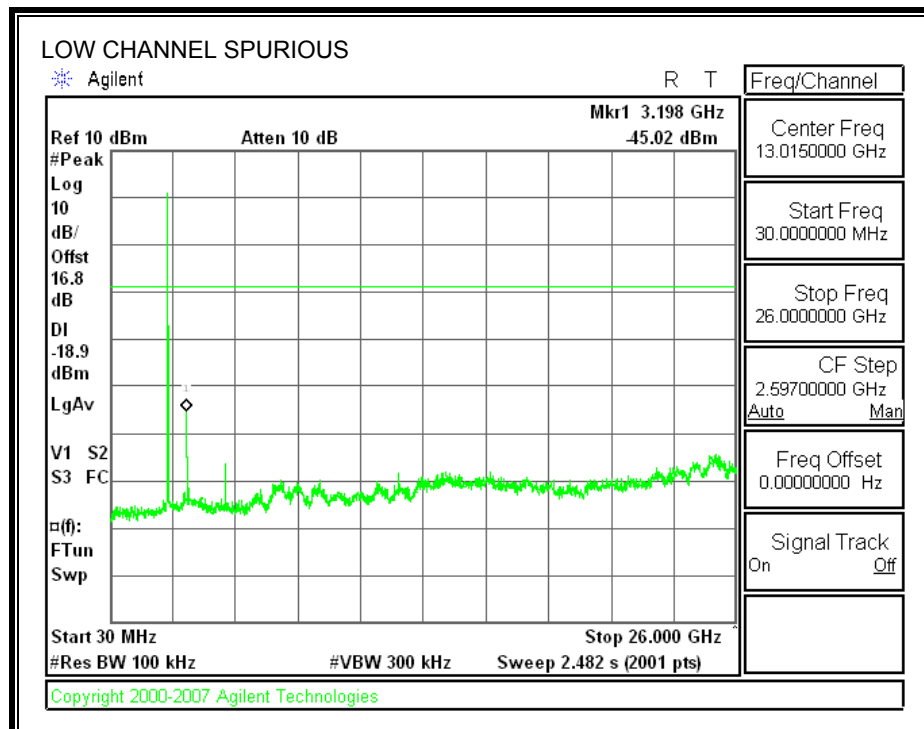
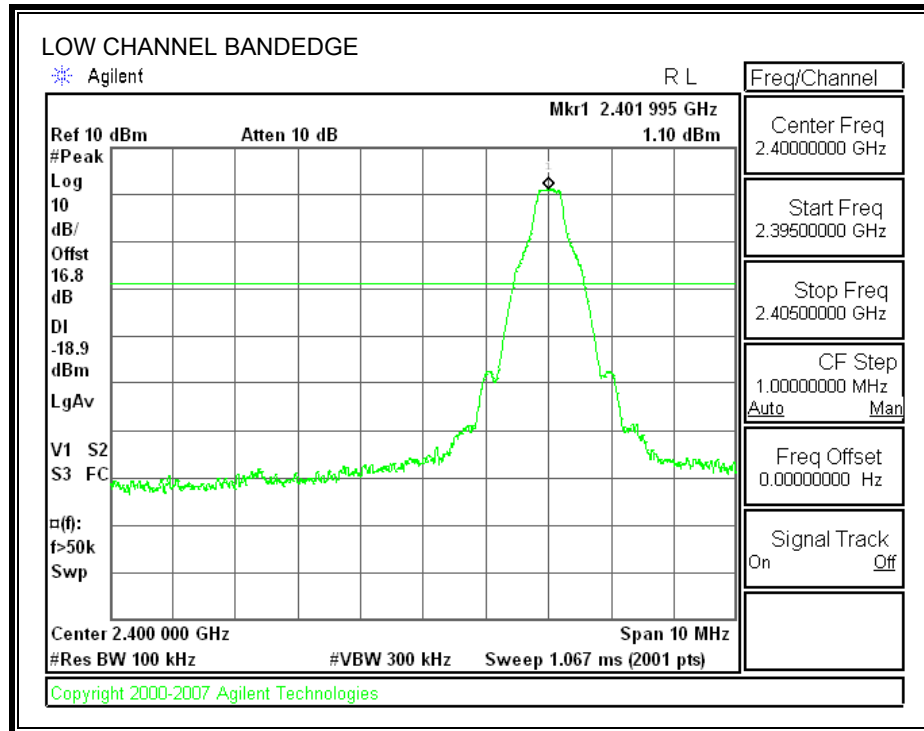
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

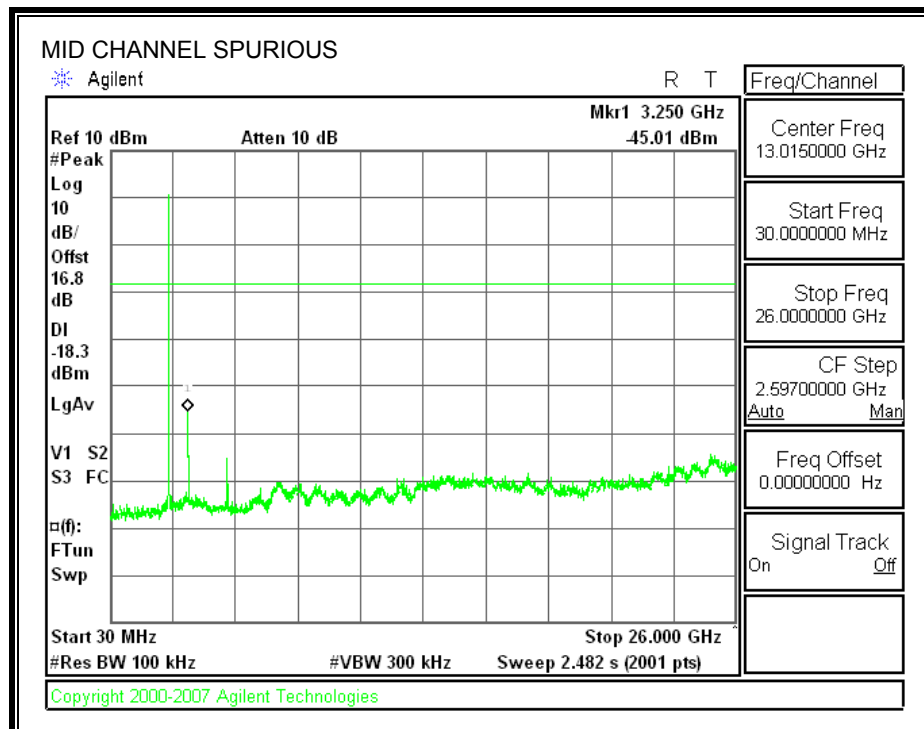
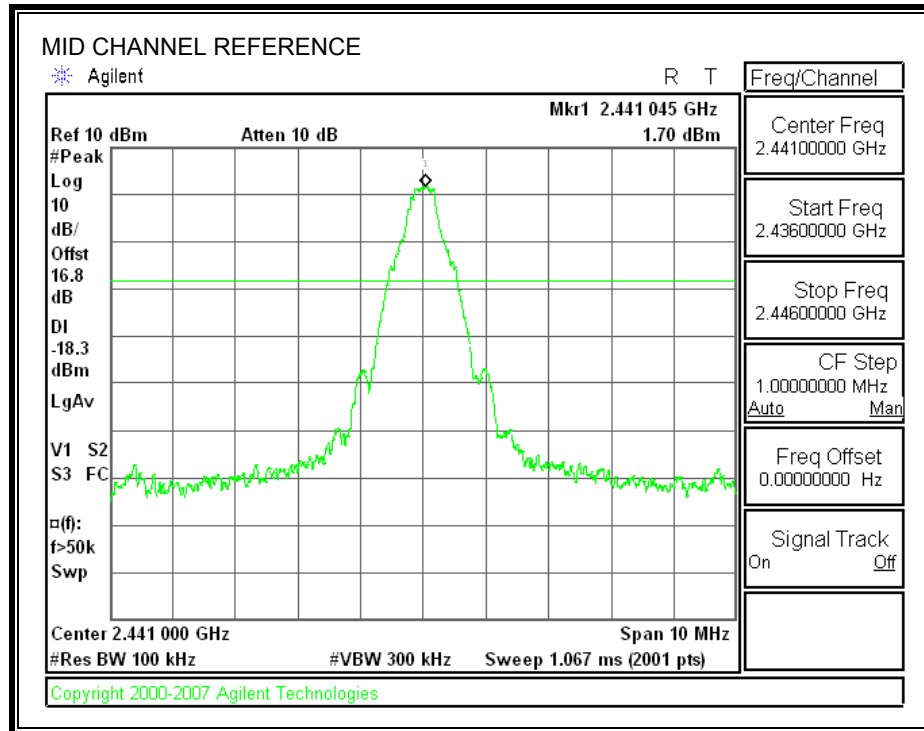
The band edges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

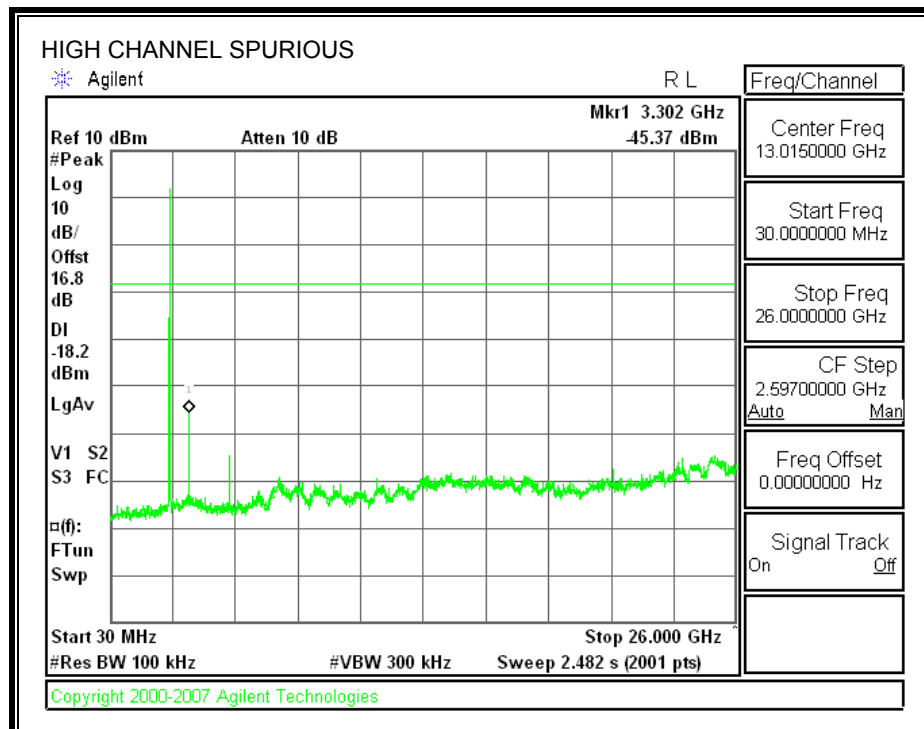
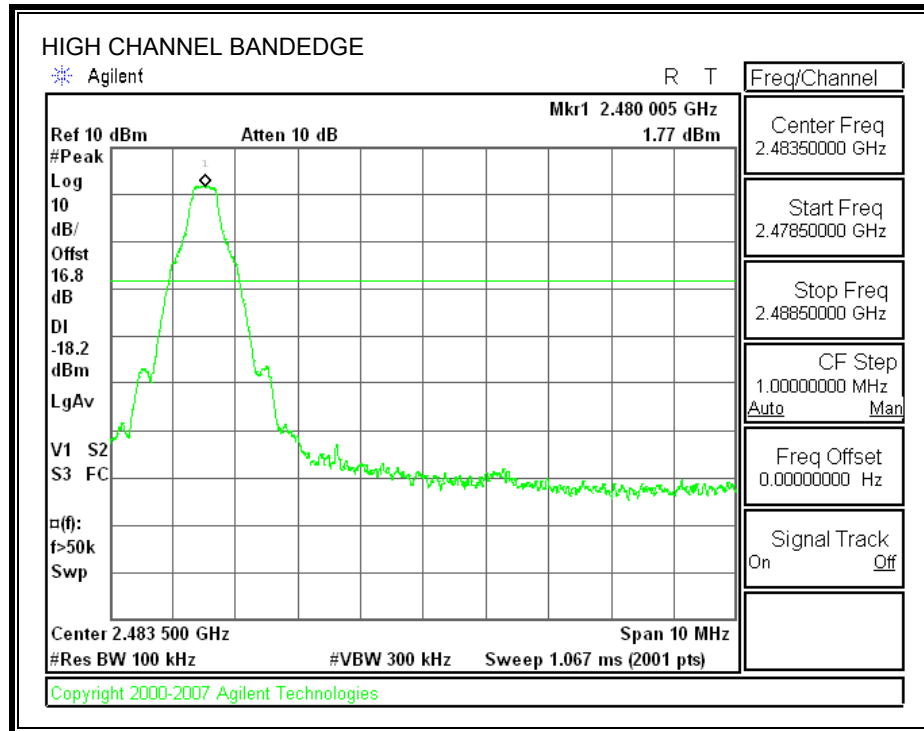
SPURIOUS EMISSIONS, LOW CHANNEL – GFSK MODE



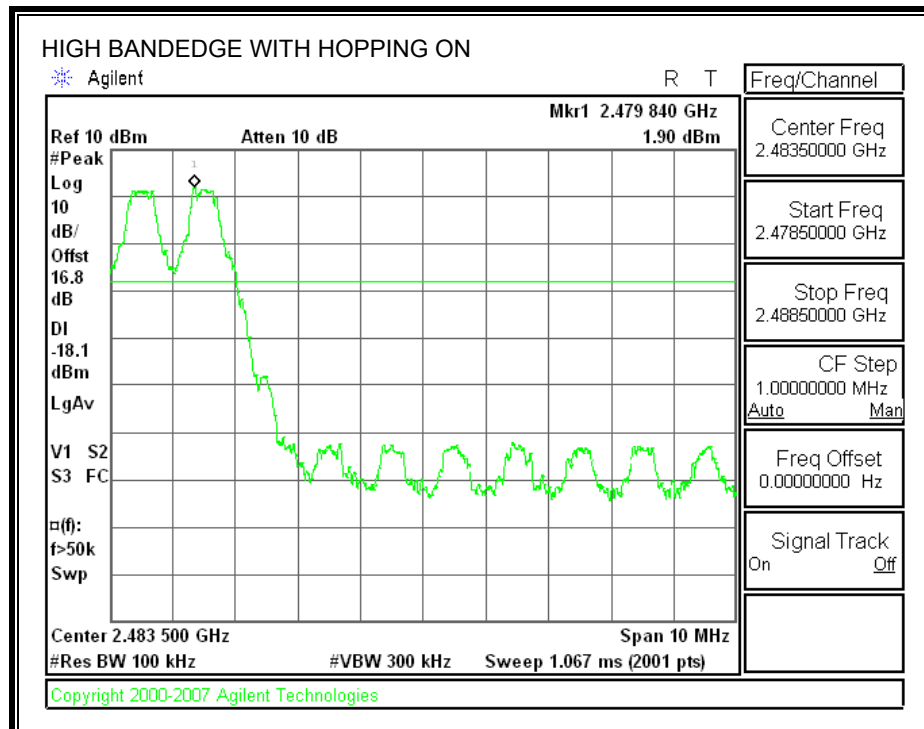
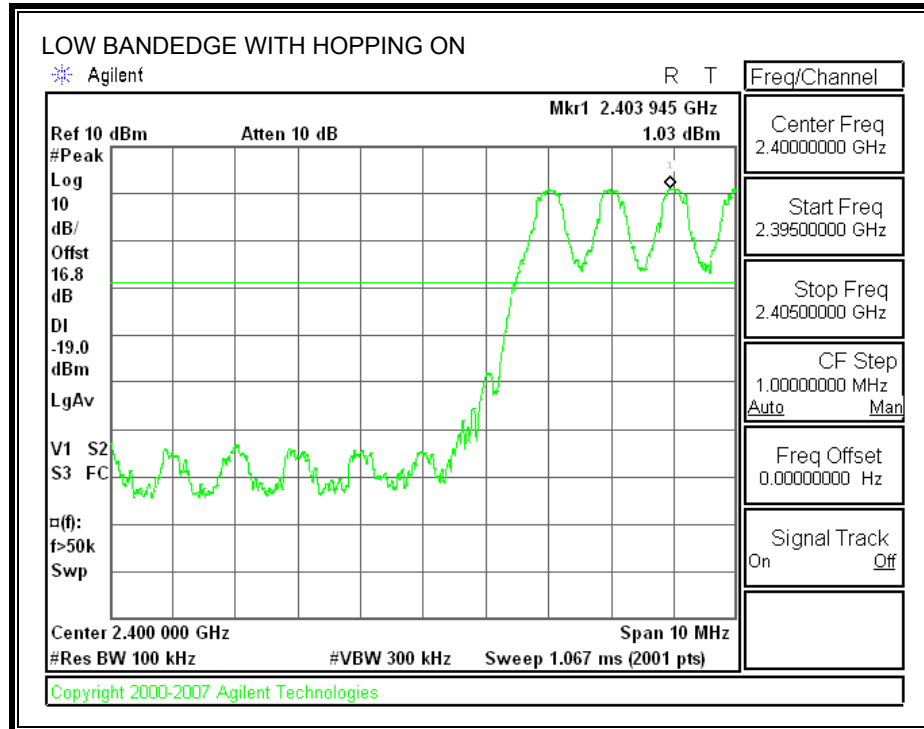
SPURIOUS EMISSIONS, MID CHANNEL – GFSK MODE



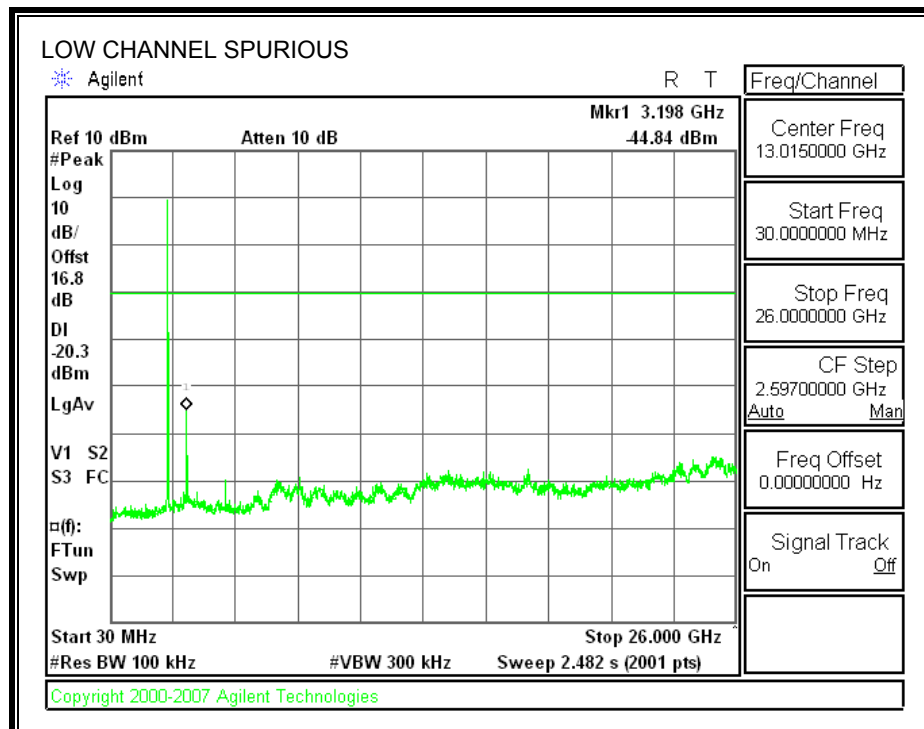
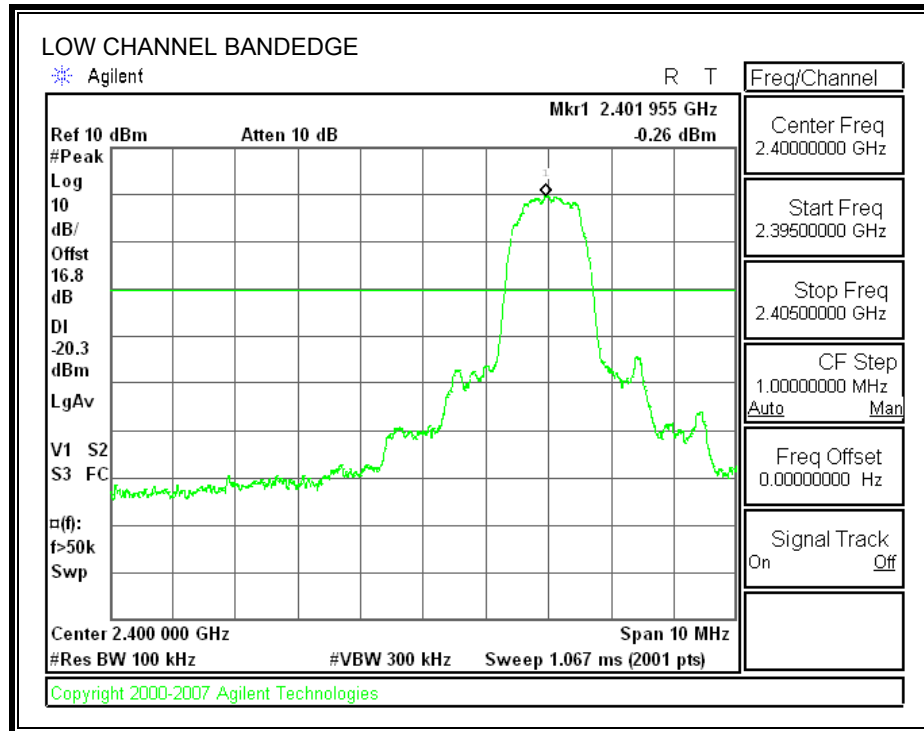
SPURIOUS EMISSIONS, HIGH CHANNEL – GFSK MODE



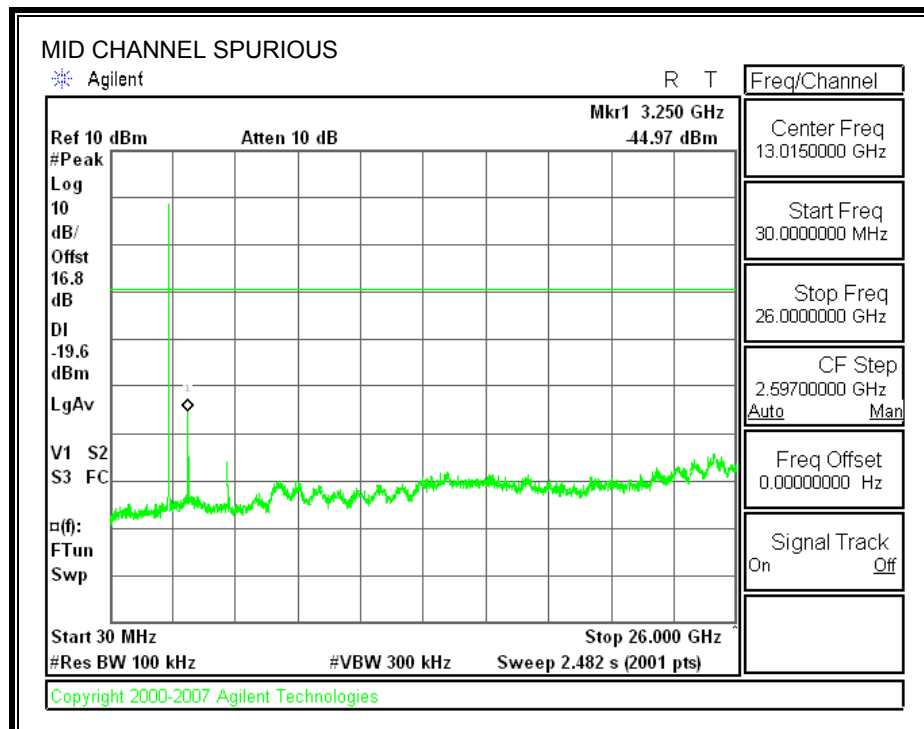
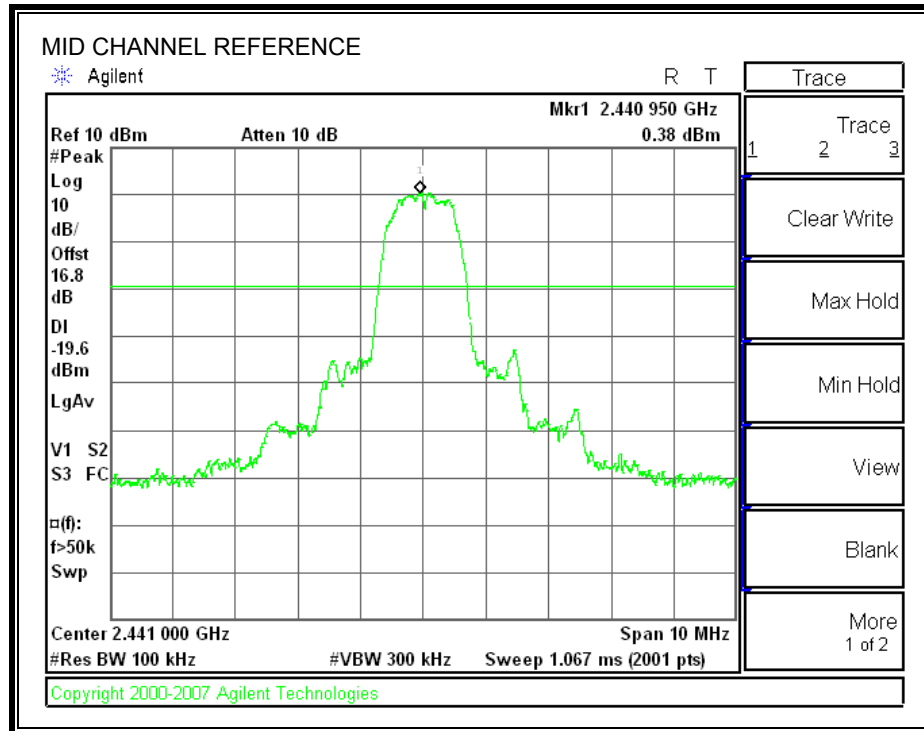
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON – GFSK MODE



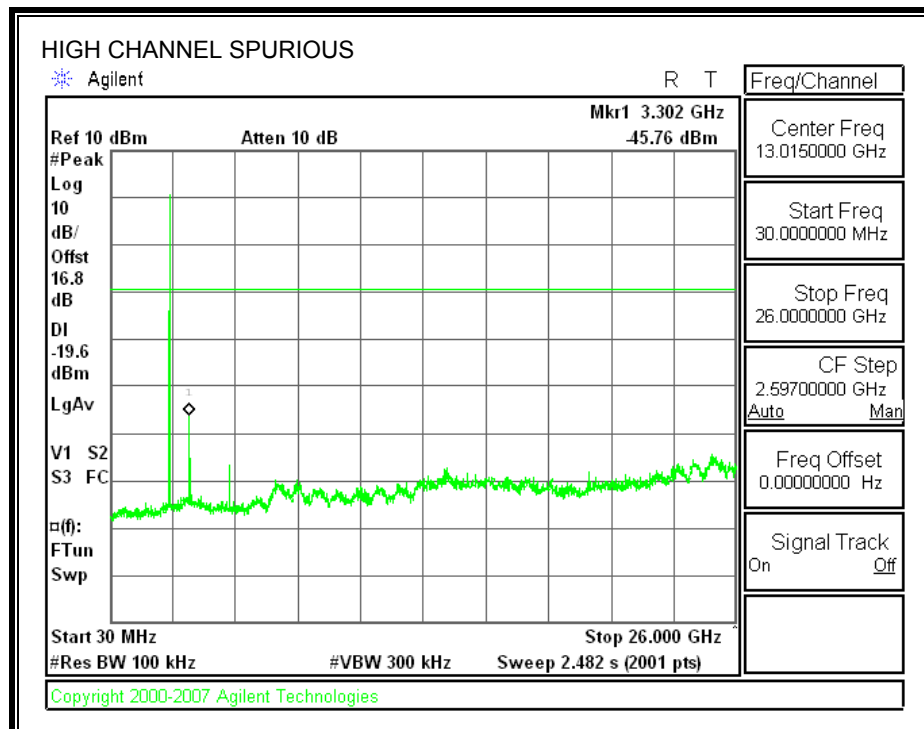
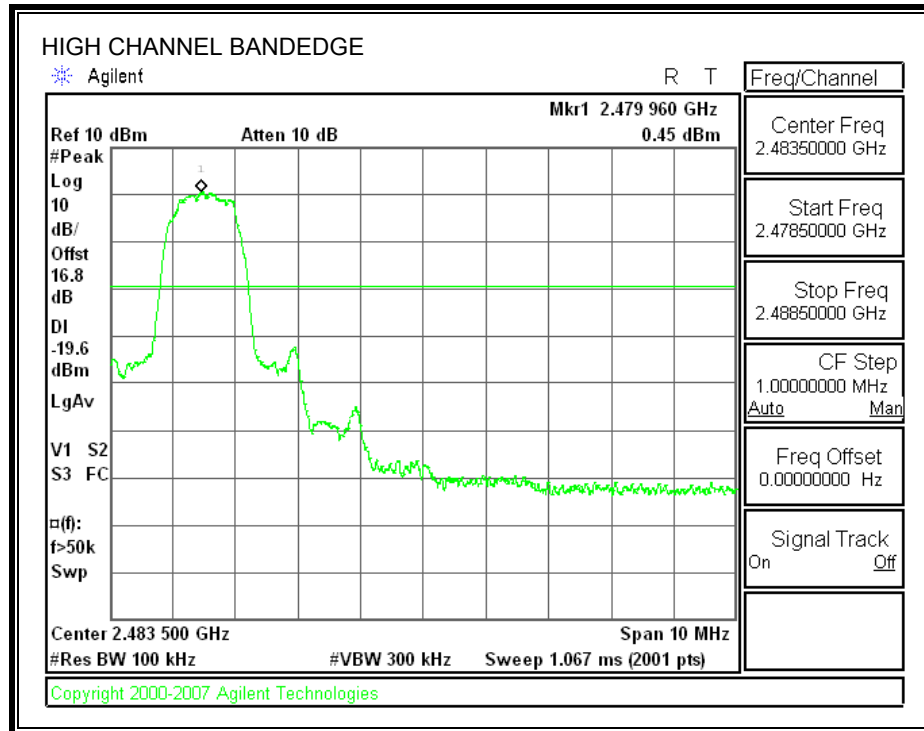
SPURIOUS EMISSIONS, LOW CHANNEL – 8PSK MODE



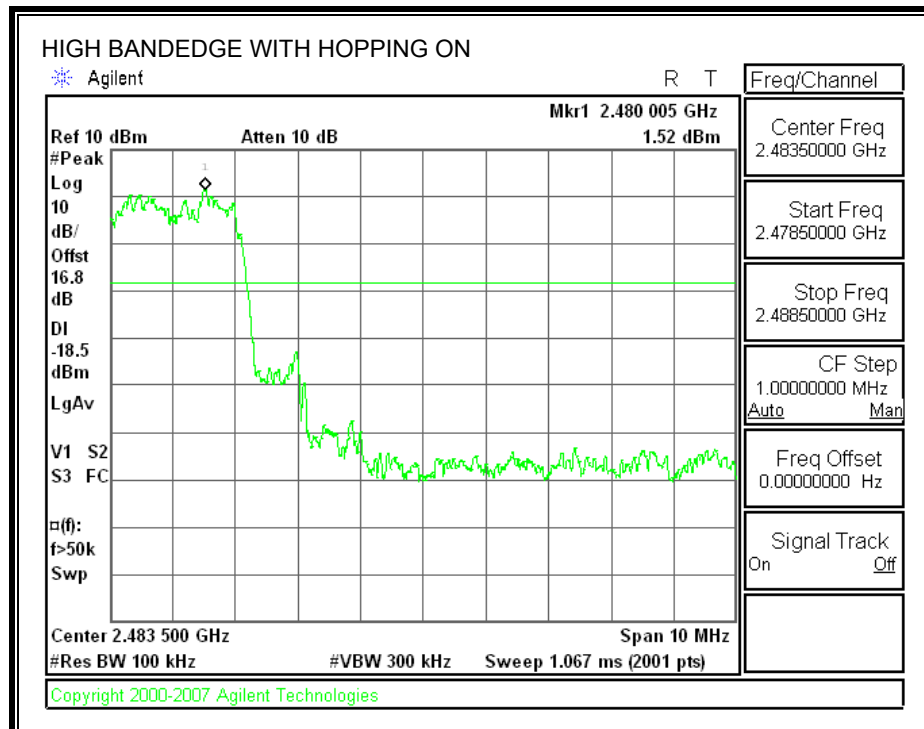
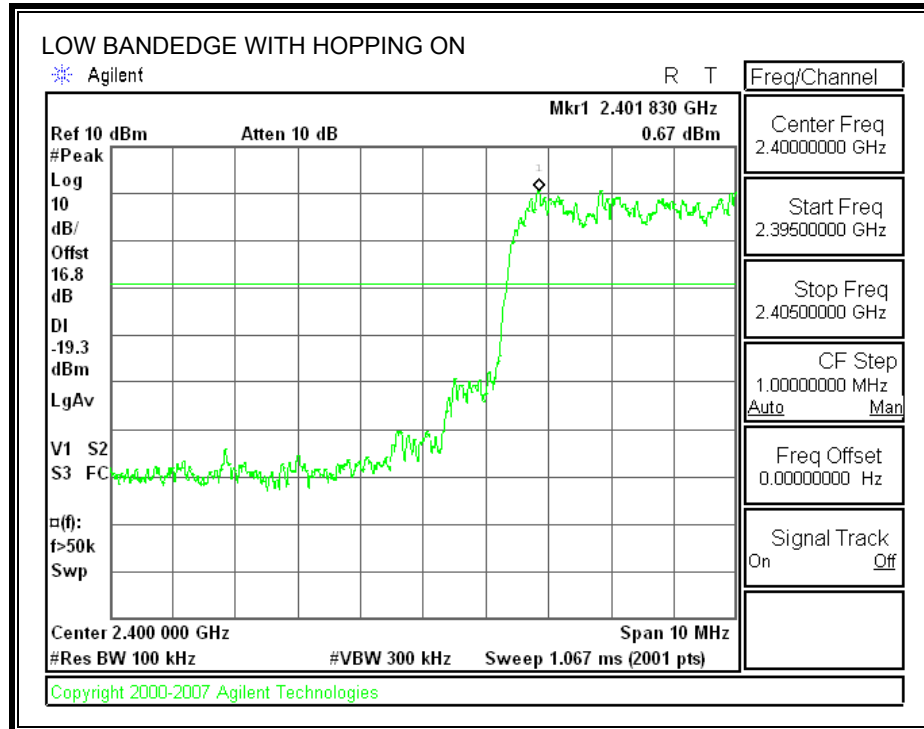
SPURIOUS EMISSIONS, MID CHANNEL – 8PSK MODE



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.

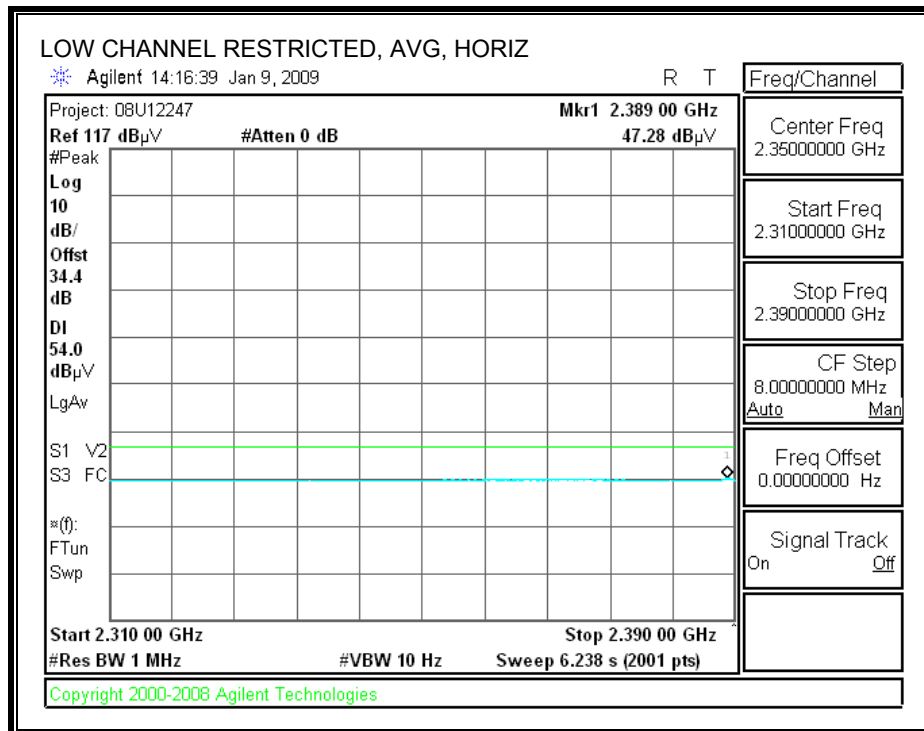
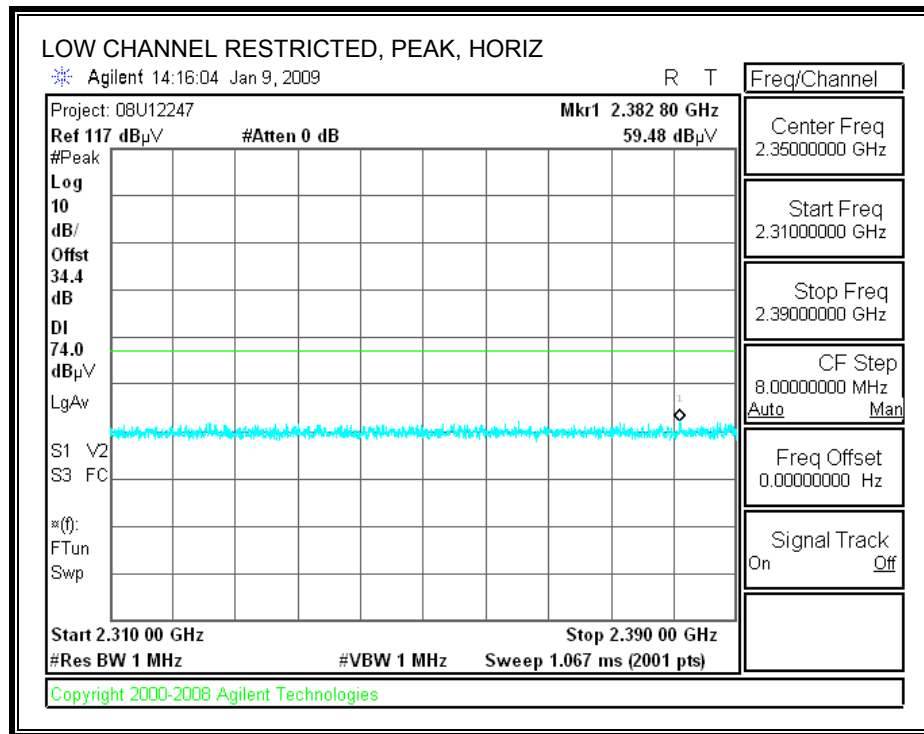
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

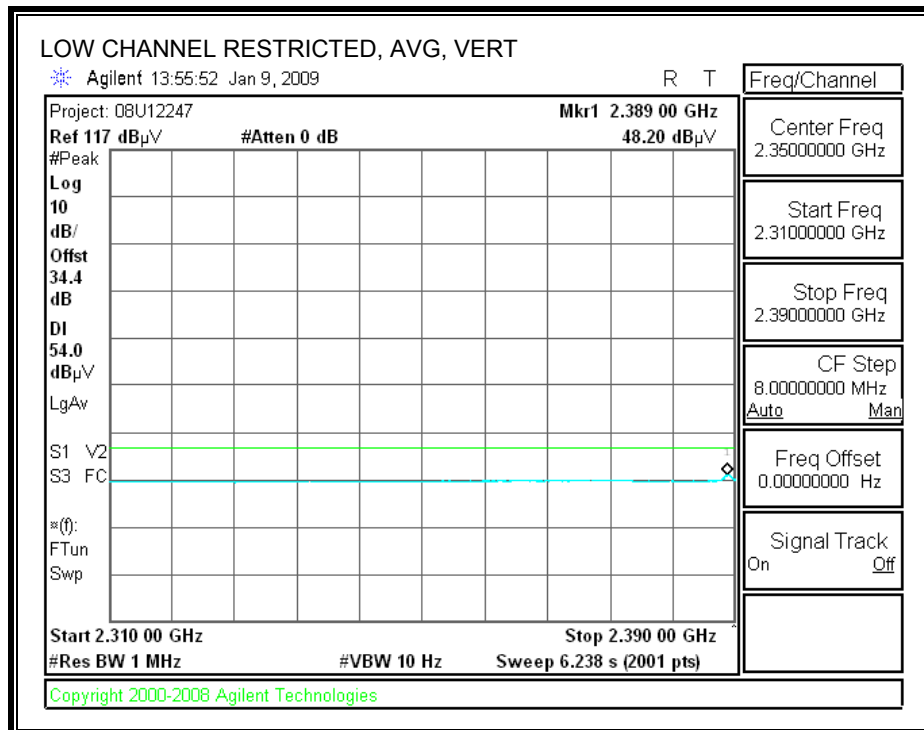
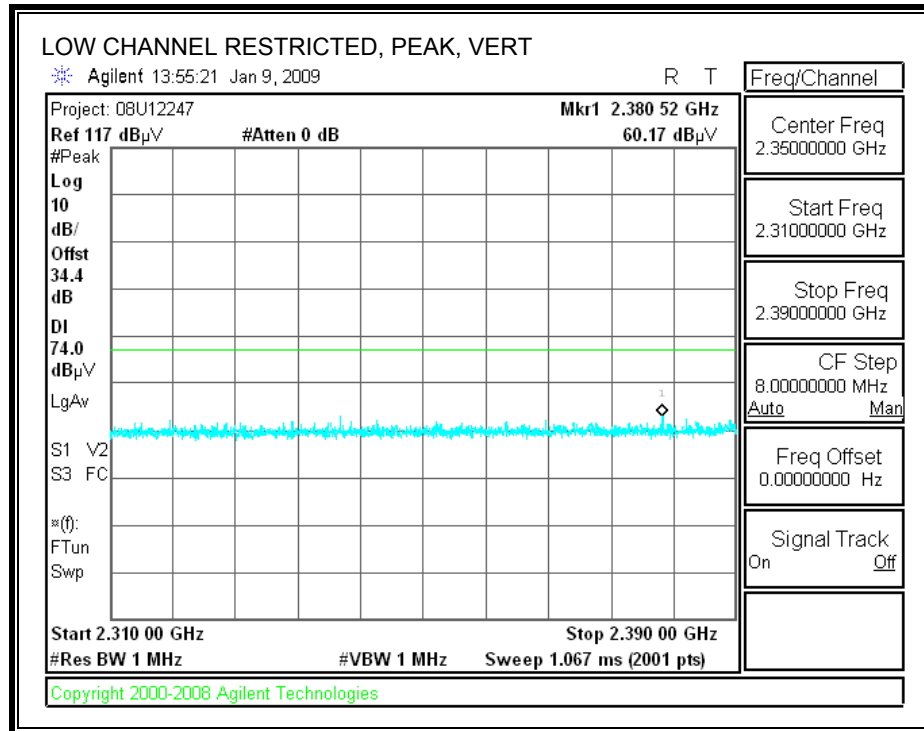
8.1. TRANSMITTER ABOVE 1 GHz

8.1.1. GFSK MODE

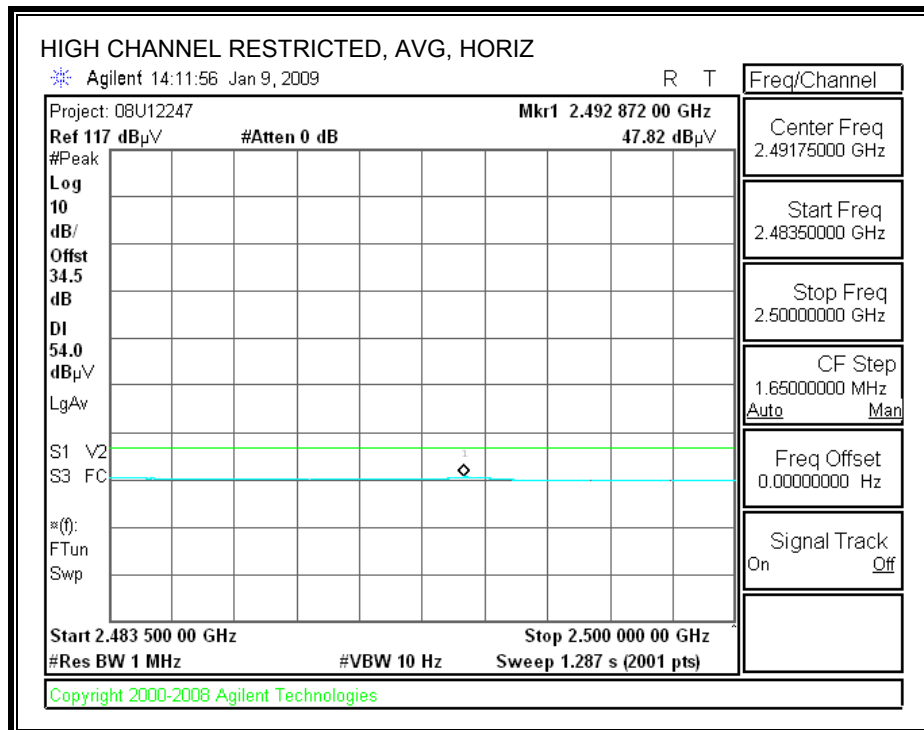
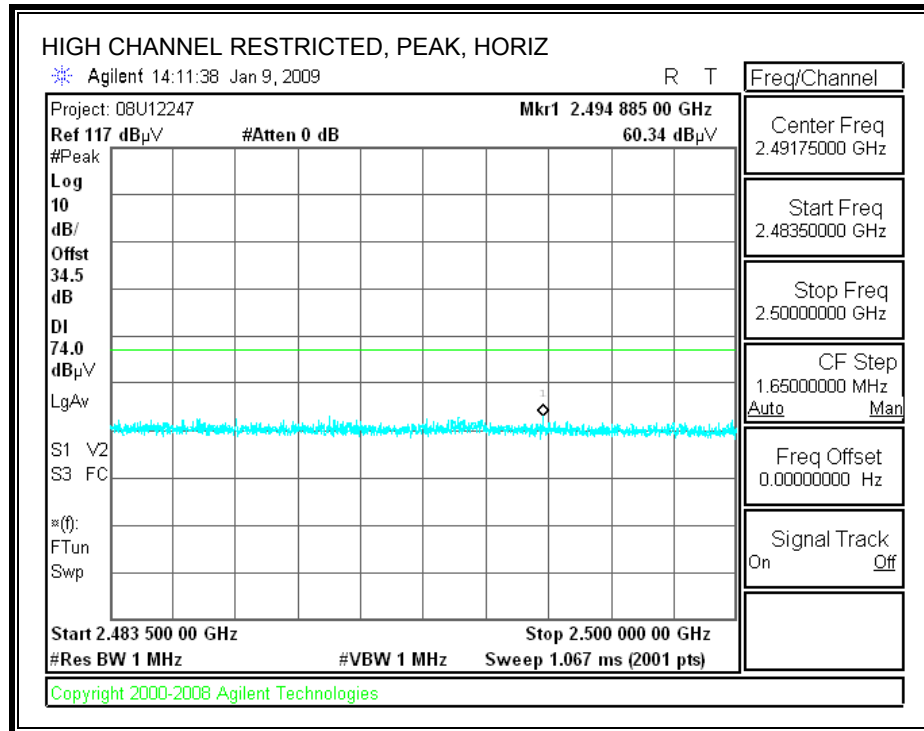
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



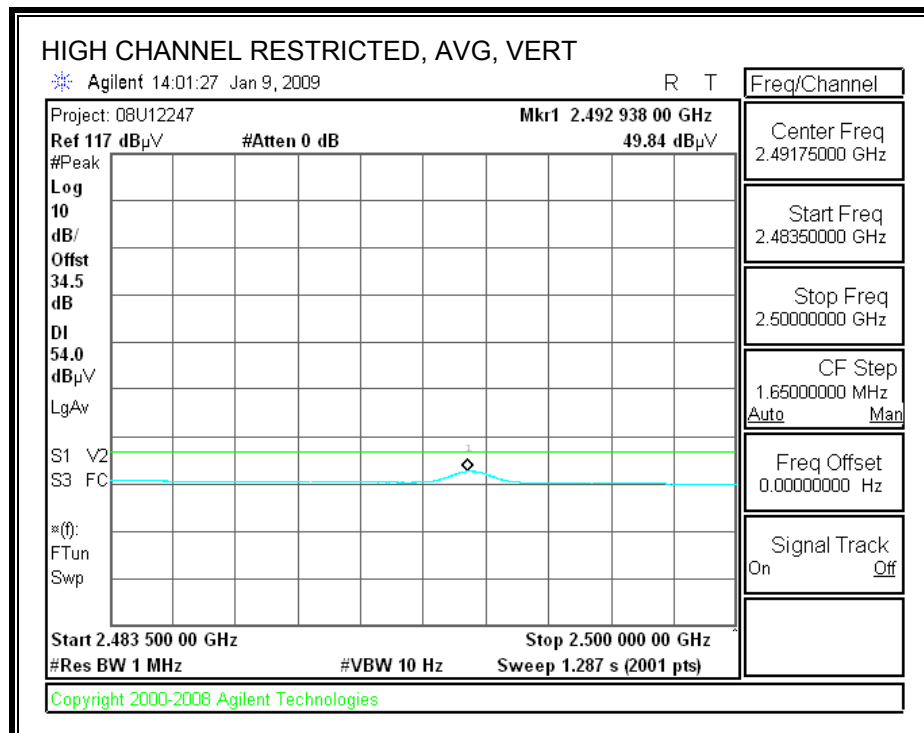
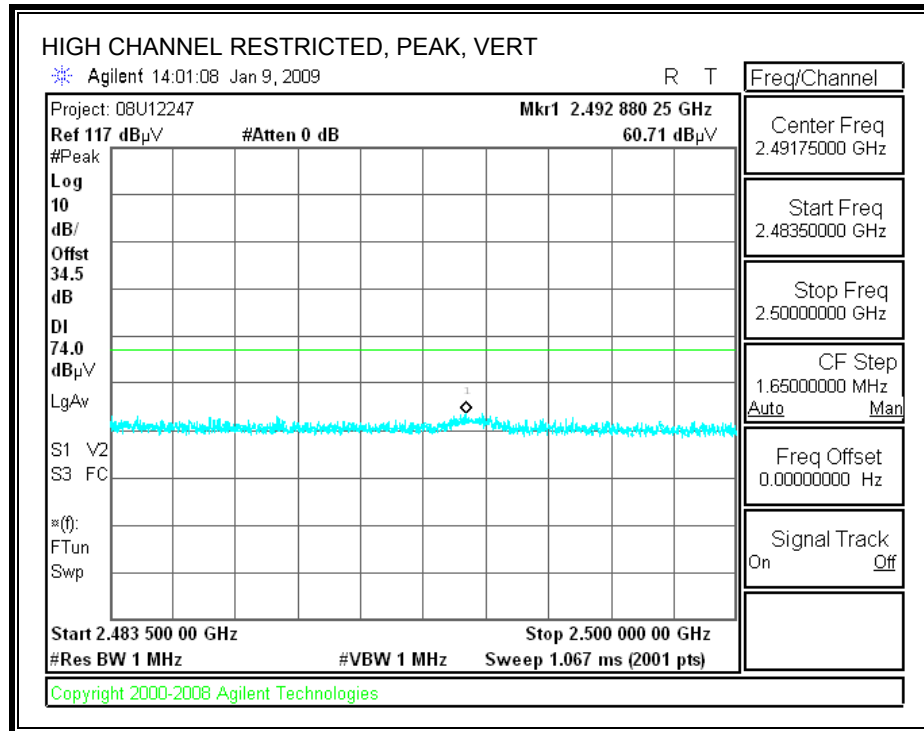
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)

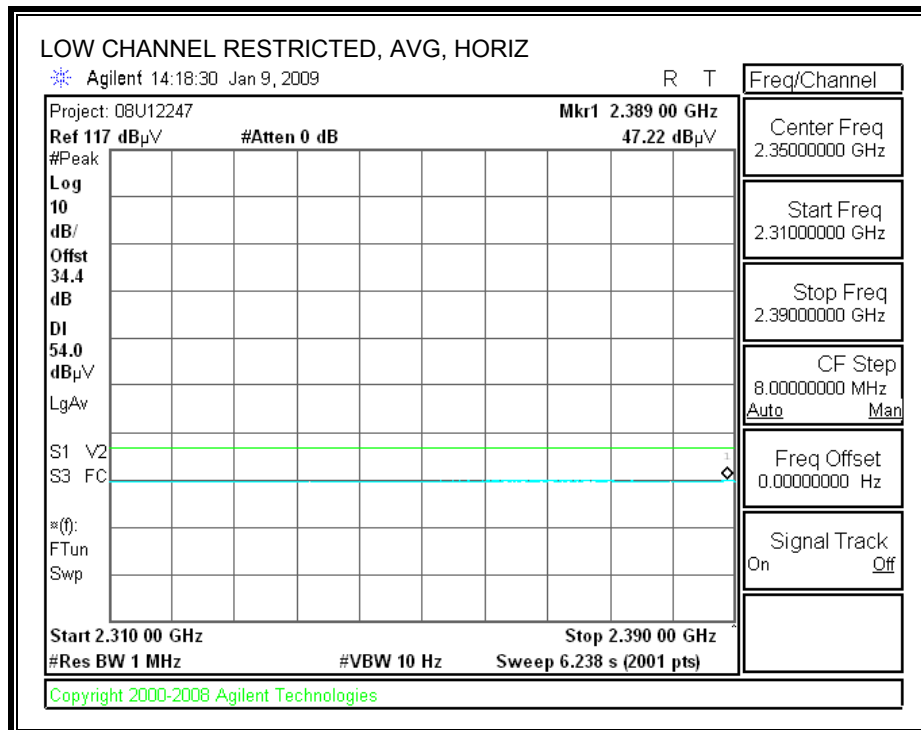
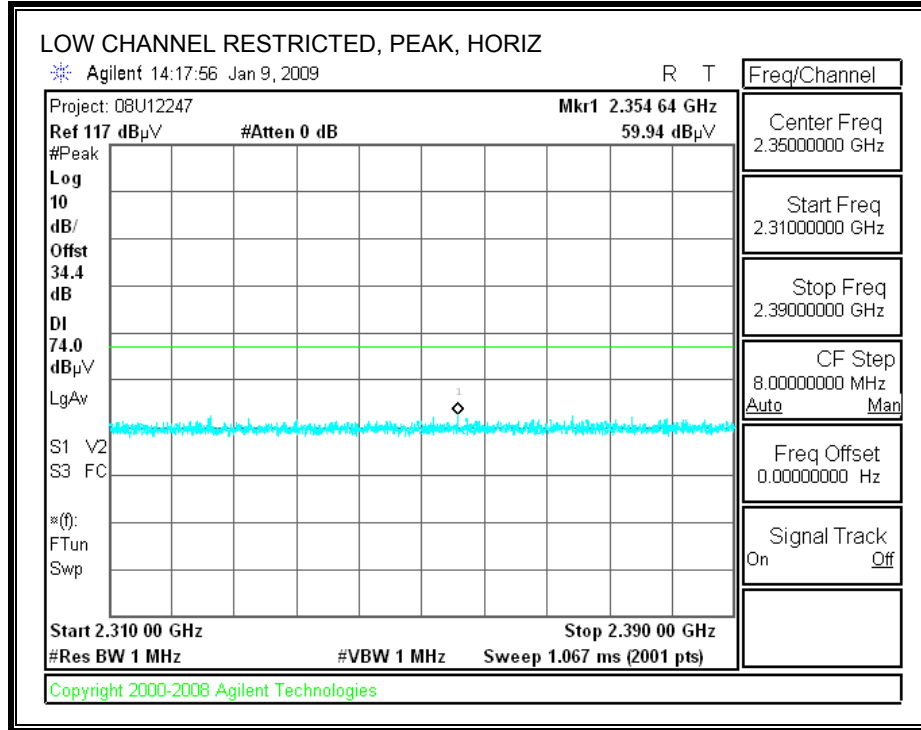


HARMONICS AND SPURIOUS EMISSIONS – GFSK MODE

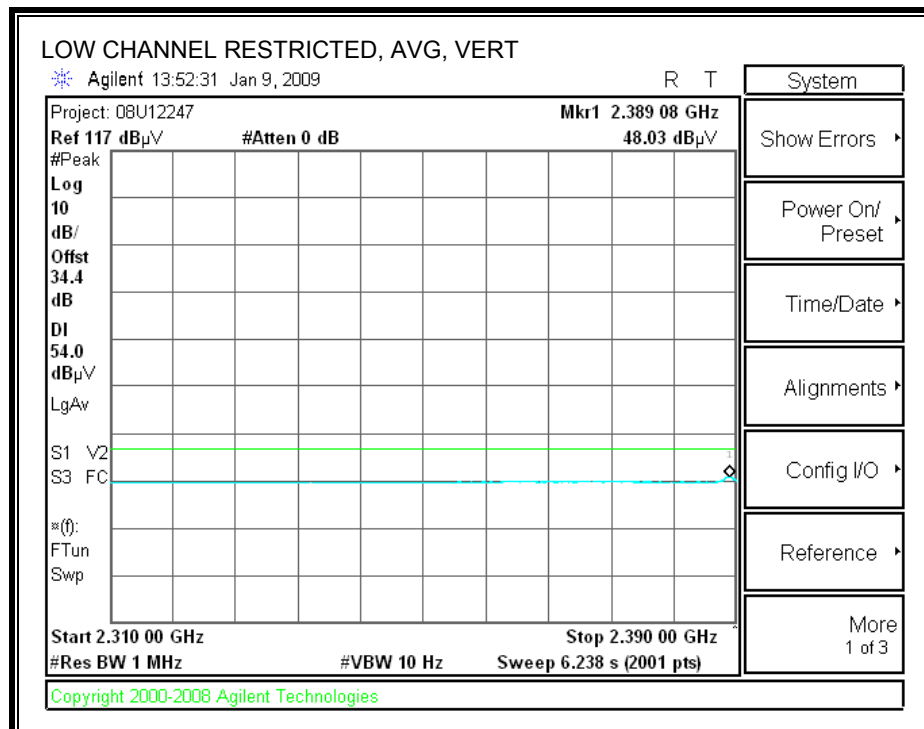
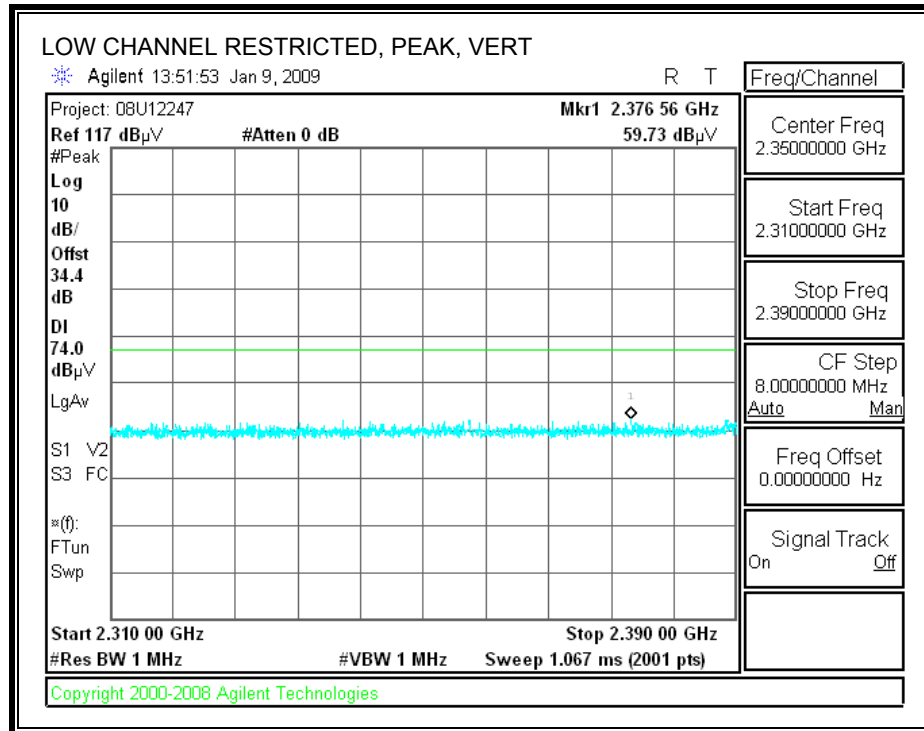
High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company:		Broadcom														
Project #:		08U12247														
Date:		01/09/08														
Test Engineer:		Vien Tran														
Configuration:		EUT / Laptop														
Mode:		Tx Bluetooth GFSK														
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T119; S/N: 29301 @3m			T34 HP 8449B									FCC 15.209				
Hi Frequency Cables																
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF		Reject Filter		<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz ; VBW=10Hz			
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF_4.0GHz							
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
LOW CHANNEL, 2402MHz																
4804	3.0	45.7	40.5	33.5	5.8	-34.8	0.0	0.6	50.8	45.6	74	54	-23.2	-8.4	V	
4804	3.0	41.9	31.2	33.5	5.8	-34.8	0.0	0.6	46.9	36.3	74	54	-27.1	-17.7	H	
MID CHANNEL, 2441MHz																
4882	3.0	45.2	39.5	33.6	5.8	-34.8	0.0	0.6	50.5	44.8	74	54	-23.5	-9.2	V	
4882	3.0	41.4	30.9	33.6	5.8	-34.8	0.0	0.6	46.7	36.2	74	54	-27.3	-17.8	H	
HIGH CHANNEL, 2480MHz																
4960	3.0	45.0	39.4	33.7	5.9	-34.8	0.0	0.6	50.5	44.9	74	54	-23.5	-9.1	V	
4960	3.0	41.1	30.8	33.7	5.9	-34.8	0.0	0.6	46.6	36.3	74	54	-27.4	-17.7	H	
No other emissions were detected above system noise floor																
Rev. 10.15.08																
f	Measurement Frequency			Amp	Preamp Gain			Avg Lim	Average Field Strength Limit							
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Pk Lim	Peak Field Strength Limit							
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Avg Mar	Margin vs. Average Limit							
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Pk Mar	Margin vs. Peak Limit							
CL	Cable Loss			HPF	High Pass Filter											

8.1.2. 8PSK MODULATION

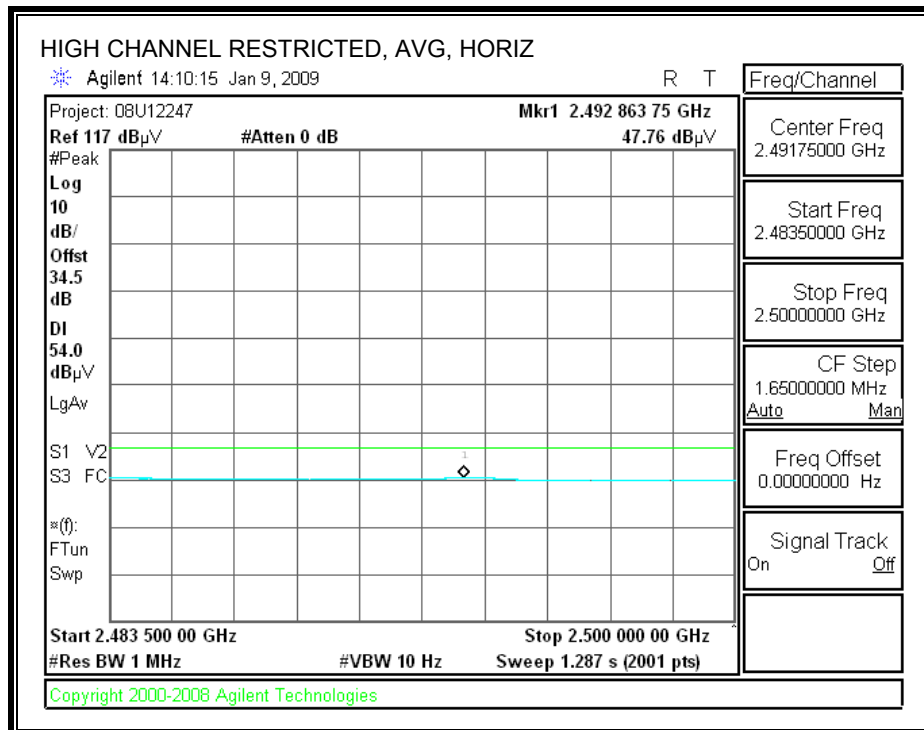
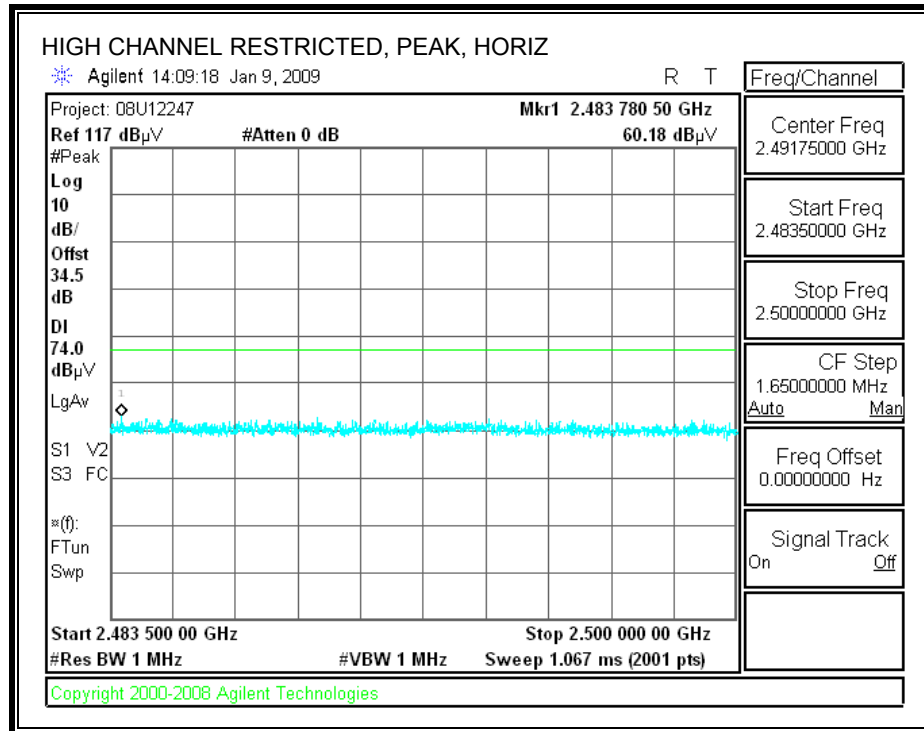
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



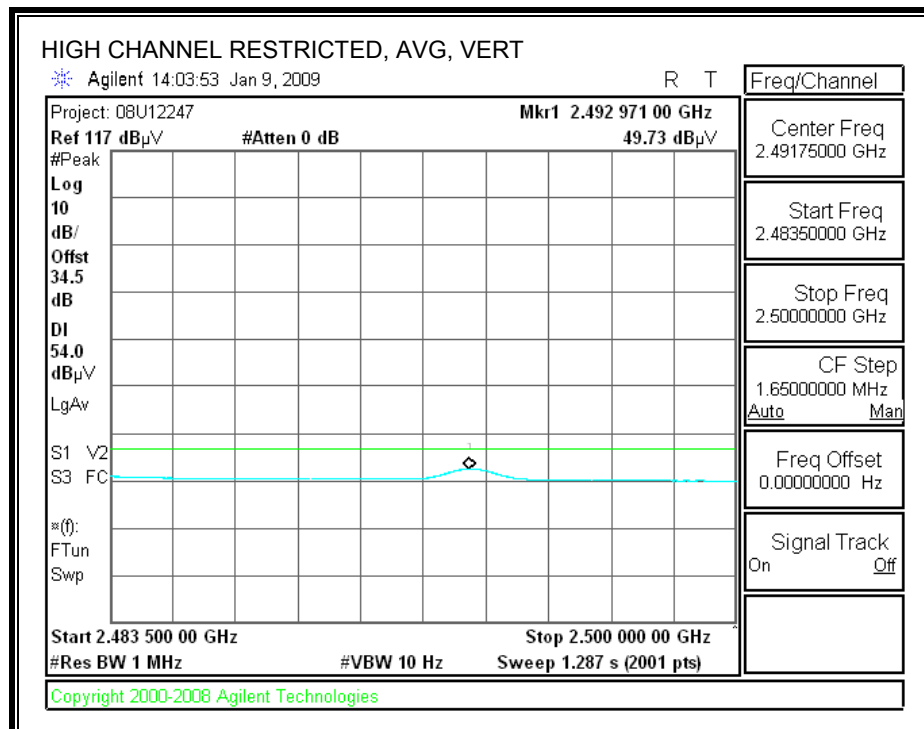
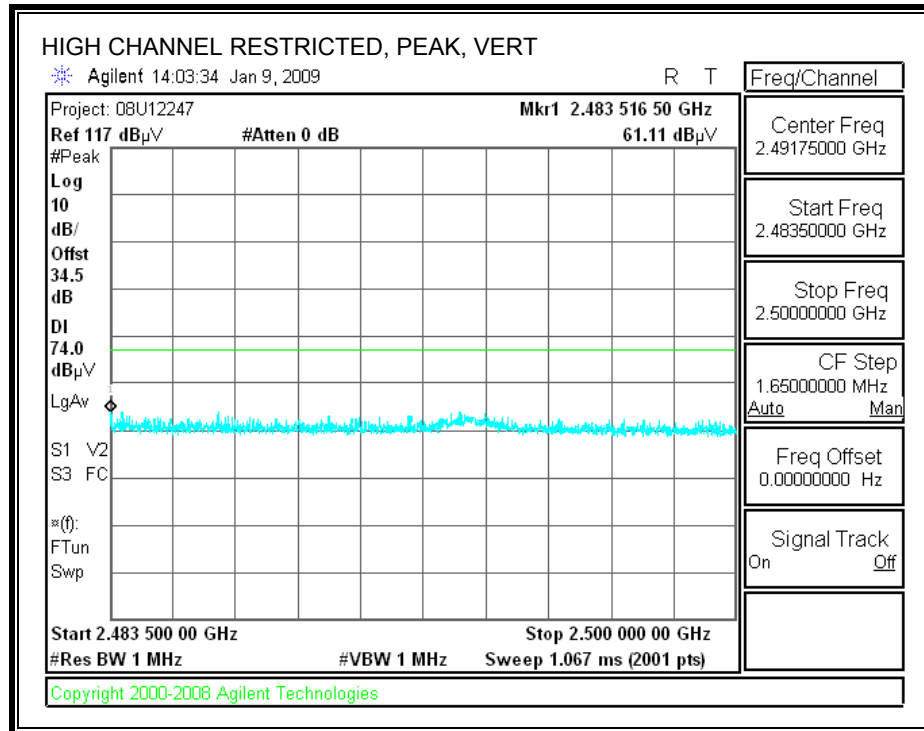
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



RESTRICTED BANEDGE (HIGH CHANNEL, VERTICAL)



HARMONICS AND SPURIOUS EMISSIONS – 8PSK MODE

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company:		Broadcom															
Project #:		08U12247															
Date:		01/09/08															
Test Engineer:		Vien Tran															
Configuration:		EUT / Laptop															
Mode:		Tx Bluetooth 8PSK															
Test Equipment:																	
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit					
T119; S/N: 29301 @3m			T34 HP 8449B									FCC 15.209					
Hi Frequency Cables																	
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF		Reject Filter		<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz ; VBW=10Hz				
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF_4.0GHz								
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
LOW CHANNEL, 2402MHz																	
4.804	3.0	46.3	39.1	33.5	5.8	-34.8	0.0	0.6	51.4	44.2	74	54	-22.6	-9.8	V		
4.804	3.0	41.7	31.2	33.5	5.8	-34.8	0.0	0.6	46.8	36.3	74	54	-27.2	-17.7	H		
MID CHANNEL, 2441MHz																	
4.882	3.0	46.5	39.6	33.6	5.8	-34.8	0.0	0.6	51.8	44.9	74	54	-22.2	-9.1	V		
4.882	3.0	41.9	31.4	33.6	5.8	-34.8	0.0	0.6	47.2	36.7	74	54	-26.8	-17.3	H		
HIGH CHANNEL, 2480MHz																	
4.960	3.0	46.1	38.9	33.7	5.9	-34.8	0.0	0.6	51.6	44.4	74	54	-22.4	-9.6	V		
4.960	3.0	41.6	31.1	33.7	5.9	-34.8	0.0	0.6	47.1	36.6	74	54	-26.9	-17.4	H		
No other emissions were detected above system noise floor																	
Rev. 10.15.08																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

8.2. RECEIVER ABOVE 1 GHz

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company:		Broadcom															
Project #:		08U12247															
Date:		01/12/09															
Test Engineer:		Devin Chang															
Configuration:		EUT / Laptop															
Mode:		Rx Mode															
Test Equipment:																	
Horn 1-18GHz				Pre-amplifier 1-26GHz				Pre-amplifier 26-40GHz				Horn > 18GHz				Limit	
T60; S/N: 2238 @3m				T145 Agilent 3008A0050												RX RSS 210	
Hi Frequency Cables																	
3' cable 22807700				12' cable 22807600				20' cable 22807500				HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz	
3' cable 22807700				12' cable 22807600				20' cable 22807500									
f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
1.205	3.0	54.3	40.0	27.0	2.6	-36.0	0.0	0.0	47.9	33.6	74	54	-26.1	-20.4	V		
1.607	3.0	63.0	41.4	28.0	3.1	-35.7	0.0	0.0	58.4	36.8	74	54	-15.6	-17.2	V		
2.411	3.0	58.6	45.3	29.5	3.8	-35.1	0.0	0.0	56.9	43.6	74	54	-17.1	-10.4	V		
1.205	3.0	53.7	43.6	27.0	2.6	-36.0	0.0	0.0	47.3	37.2	74	54	-26.7	-16.8	H		
1.607	3.0	57.4	45.6	28.0	3.1	-35.7	0.0	0.0	52.8	41.0	74	54	-21.2	-13.0	H		
2.411	3.0	55.0	39.0	29.5	3.8	-35.1	0.0	0.0	53.3	37.3	74	54	-20.7	-16.7			
No other emissions were detected above system noise floor																	
Rev. 10.15.08																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

8.3. WORST-CASE BELOW 1 GHz

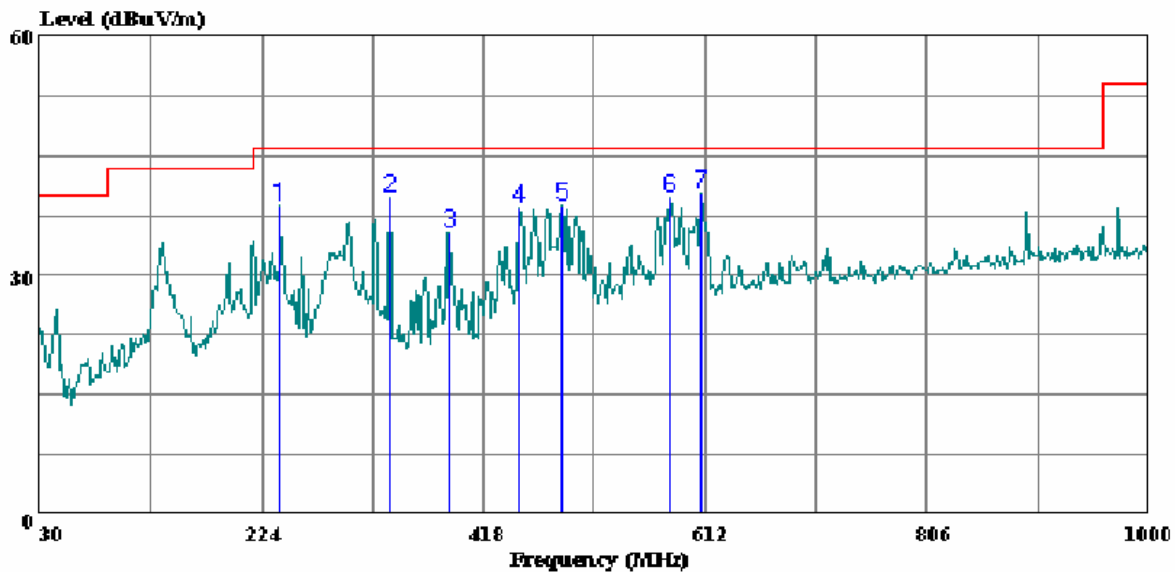
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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

Data#: 11 File#: 08u12247.EMI

Date: 01-12-2009 Time: 11:34:32



Trace: 10

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: Devin Chang
Project #: 08U12247
Company: Broadcom
Configuration:: EUT with NB
Mode : worst case
Target: FCC CLASS B

Page: 1

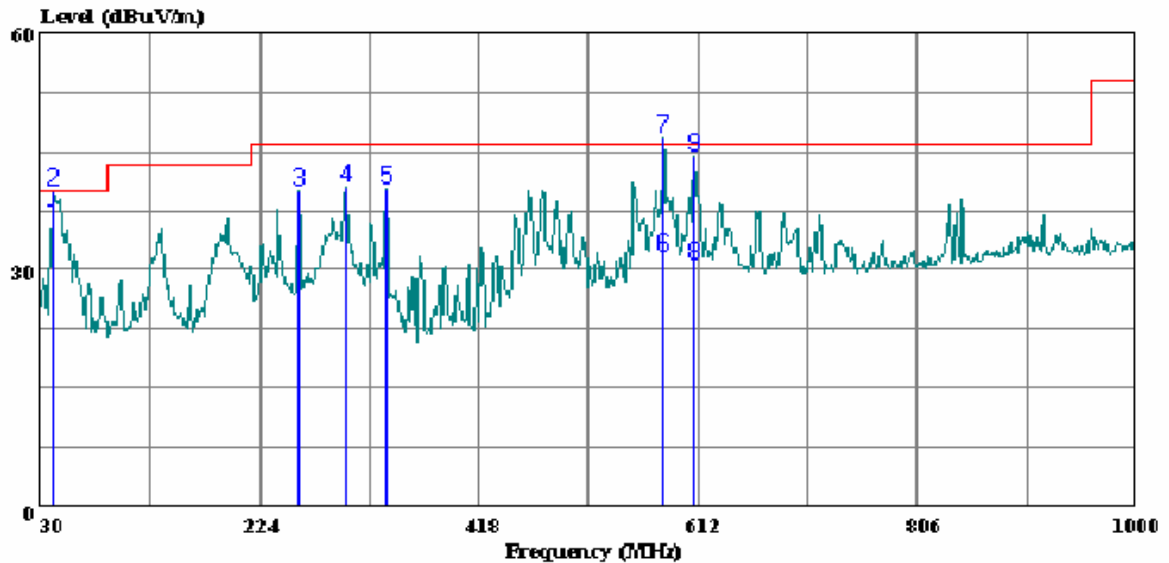
	Freq	Read	Factor	Level	Limit	Over	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	239.520	51.83	-13.21	38.63	46.00	-7.37	Peak
2	336.520	49.67	-10.00	39.67	46.00	-6.33	Peak
3	387.930	43.83	-8.53	35.30	46.00	-10.70	Peak
4	450.010	44.83	-6.45	38.39	46.00	-7.61	Peak
5	485.900	43.83	-5.20	38.63	46.00	-7.37	Peak
6	581.930	42.83	-3.17	39.66	46.00	-6.34	Peak
7	608.120	43.00	-2.64	40.36	46.00	-5.64	Peak

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



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

Data#: 17 File#: 08u12247.EMI Date: 01-12-2009 Time: 12:03:01



Trace: 14

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Devin Chang
Project #: 08U12247
Company: Broadcom
Configuration:: EUT with NB
Mode : worst case
Target: FCC CLASS B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	40.670	49.43	-13.72	35.71	40.00	-4.29	QP
2 *	40.670	52.95	-12.83	40.11	40.00	0.11	Peak
3	258.920	52.83	-12.87	39.97	46.00	-6.03	Peak
4	299.660	51.50	-11.04	40.46	46.00	-5.54	Peak
5	336.520	50.33	-10.00	40.33	46.00	-5.67	Peak
6	581.930	34.88	-3.17	31.71	46.00	-14.29	QP
7 *	581.930	50.00	-3.17	46.83	46.00	0.83	Peak
8	608.120	33.23	-2.64	30.59	46.00	-15.41	QP
9	608.120	47.00	-2.64	44.36	46.00	-1.64	Peak

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

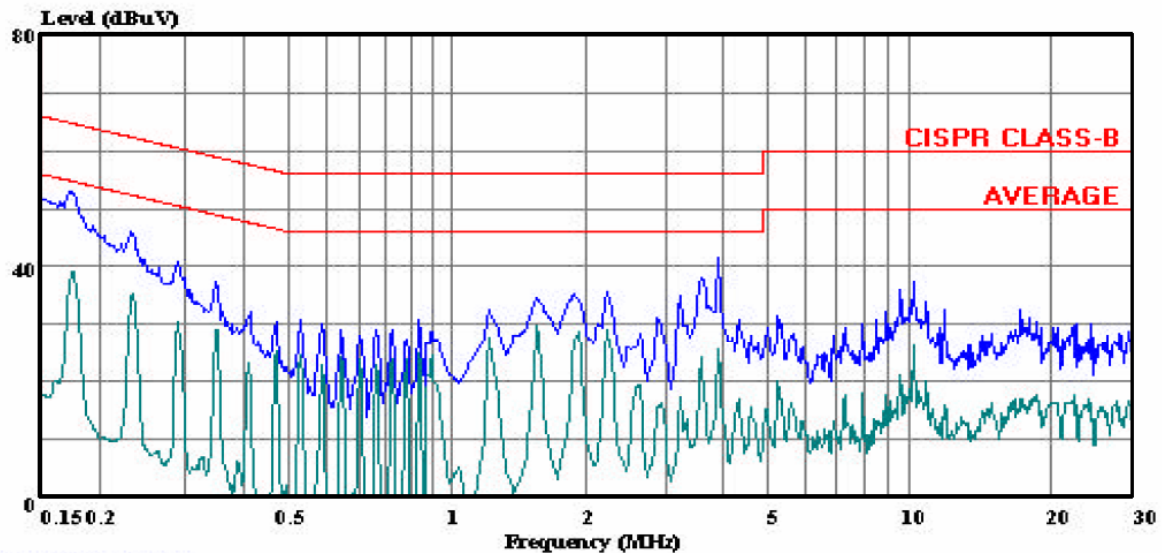
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	52.72	--	39.14	0.00	64.67	54.67	-11.95	-15.53	L1
0.23	45.92	--	35.19	0.00	62.31	52.31	-16.39	-17.12	L1
2.04	35.63	--	28.84	0.00	56.00	46.00	-20.37	-17.16	L1
0.18	53.11	--	40.88	0.00	64.67	54.67	-11.56	-13.79	L2
0.23	44.58	--	34.33	0.00	62.31	52.31	-17.73	-17.98	L2
3.68	41.78	--	26.08	0.00	56.00	46.00	-14.22	-19.92	L2
6 Worst Data									

LINE 1 RESULTS



Compliance Certification Services
47173 Benicia Street
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Data#: 7 File#: 08U12247.EMI Date: 01-13-2009 Time: 13:34:54



(Line Conduction)

Trace: 5

Ref Trace:

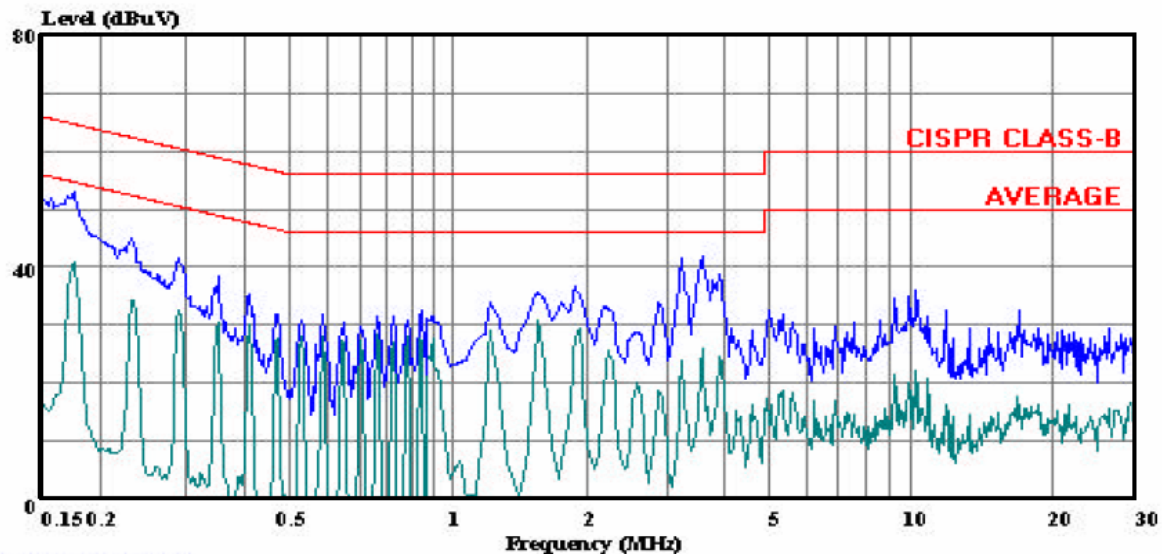
Condition: CISPR CLASS-B
Test Operator:: Devin Chang
Project #: 08U12247
Company: Broadcom
Configuration:: EUT with Laptop
Mode: Charging Mode
Target: FCC Class B
Voltage: 115VAC / 60Hz
: L1: Peak (Blue). Average (Green)

LINE 2 RESULTS



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Data#: 14 File#: 08U12247.EMI Date: 01-13-2009 Time: 13:53:10



(Line Conduction)

Trace: 12

Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Devin Chang
Project #: 08U12247
Company: Broadcom
Configuration:: EUT with Laptop
Mode: Charging Mode
Target: FCC Class B
Voltage: 115VAC / 60Hz
L2: Peak (Blue), Average (Green)

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 ²)	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 ²)	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 ²)	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 ²)	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 Classed 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 ²)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* 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/m² is equivalent to 1 mW/cm².
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/cm²

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/cm² is converted to units of W/m² by multiplying by a factor of 10.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm²

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m²

RESULTS

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)	IC Power Density (W/m ²)
GFSK	2.4 GHz	20.0	2.08	1.87	0.0005	0.005
8PSK	2.4 GHz	20.0	4.27	1.87	0.0008	0.008