



**FCC CFR47 PART 15 SUBPART C
CERTIFICATION TEST REPORT**

FOR

BROADCOM WIRELESS BLUETOOTH AND UWB MINICARD

MODEL NUMBER: BCM92046mPCIe_UWB

FCC ID: QDS-BRCM1035

REPORT NUMBER: 07U11428-2

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Broadcom Wireless Bluetooth and UWB Minicard

MODEL: BCM92046mPCIe_UWB

SERIAL NUMBER: 016

DATE TESTED: November 9 -14, 2007

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

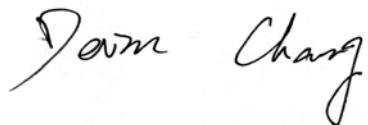
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section.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



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COMPLIANCE CERTIFICATION SERVICES

Tested By:



DEVIN CHANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. SCOPE

This report documents the test results of the Bluetooth portion of the EUT.

The test results of the UWB portion of the EUT are documented in a separate report. The Bluetooth is the dominant transmitter, therefore the co-located test results are presented in this report.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. 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>.

5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

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

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a combination Bluetooth transceiver and Ultra Wide Band transceiver module in which both transceivers share a single antenna. The EUT is intended for handheld use. The Bluetooth radio uses the modulations defined by Bluetooth version 2.1 with EDR

The radio module is manufactured by Broadcom.

6.2. OUTPUT POWER

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

GFSK 2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2402 - 2480	-1.90	0.65

8PSK 2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2402 - 2480	0.70	1.17

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes a TYCO IFA antenna, with a maximum antenna gain of 3.15 dBi over the 2402 to 2480 MHz frequency range of the Bluetooth radio. The antenna is integral to end products.

6.4. SOFTWARE AND FIRMWARE

The device driver version was 5.1.0.1400

The test utility software used during testing was Broadcom Bluetool V1.0.0.6.

6.5. WORST-CASE CONFIGURATION

The worst-case channel is determined as the channel with the highest output power.

6.6. DESCRIPTION OF TEST SETUP FOR ABOVE 1 GHz

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Dell	Inspiron 1720	20839182877	DOC
AC Adapter	Dell	DA90PS1-00	CN-0MM545-48661-78J-9M7S	DOC

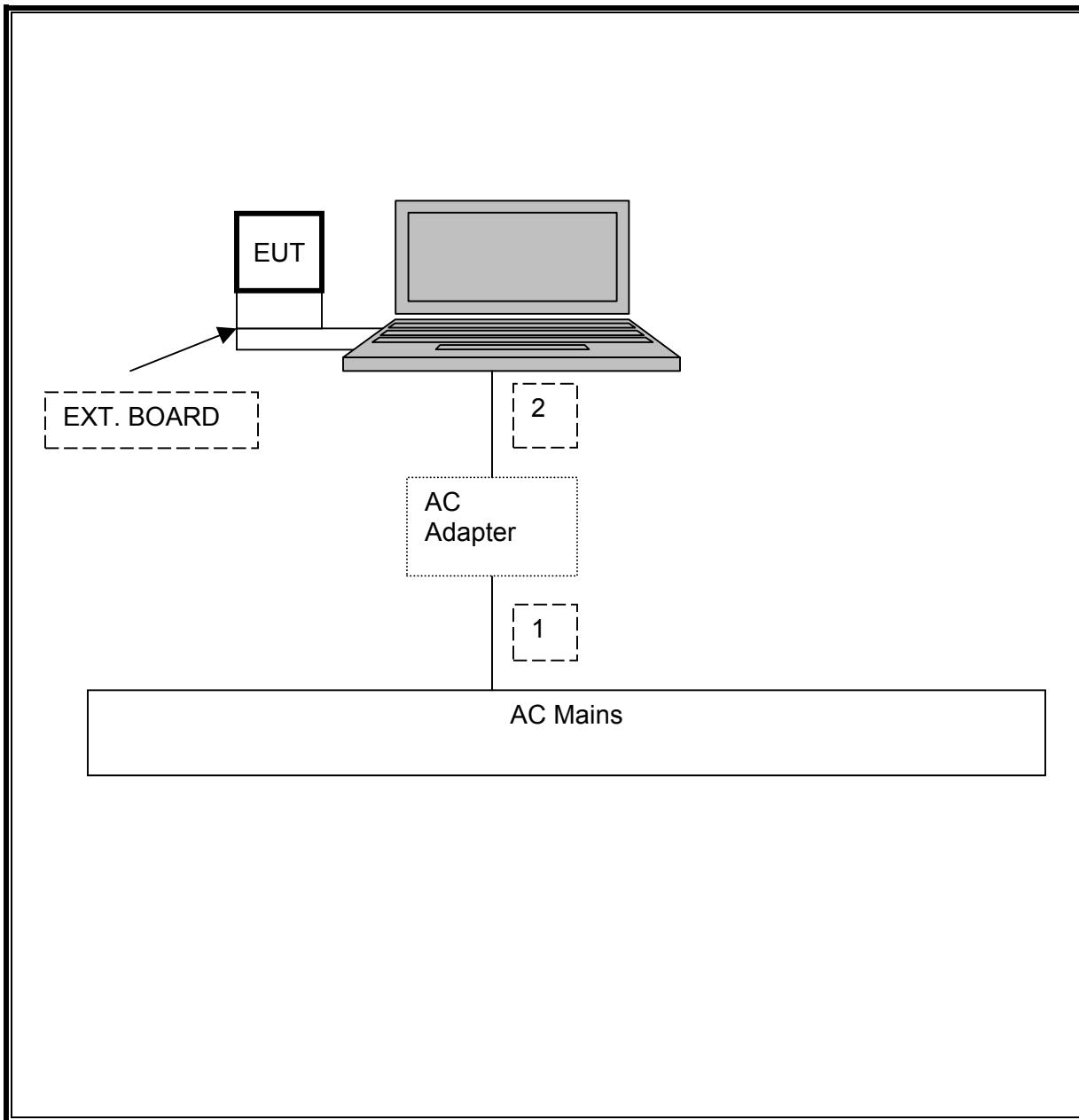
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Unshielded	1m	N/A
2	DC	1	DC	Unshielded	1.5m	N/A

TEST SETUP

The EUT is installed on an Expresscard to MiniPCI-E adapter / extender card connected to a host laptop computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6.7. DESCRIPTION OF TEST SETUP FOR BELOW 1 GHz

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Inspiron 1720	9955271197	DoC
AC/DC Adapter	Dell	DA90PS1-00	48661-78J-9M4Q	DoC
Mini PCI Test Jig	WiQuest	Rev03.00	T3801	N/A
AC/DC Adapter	Cincon	TR25120	25120-0023430	N/A

I/O CABLES

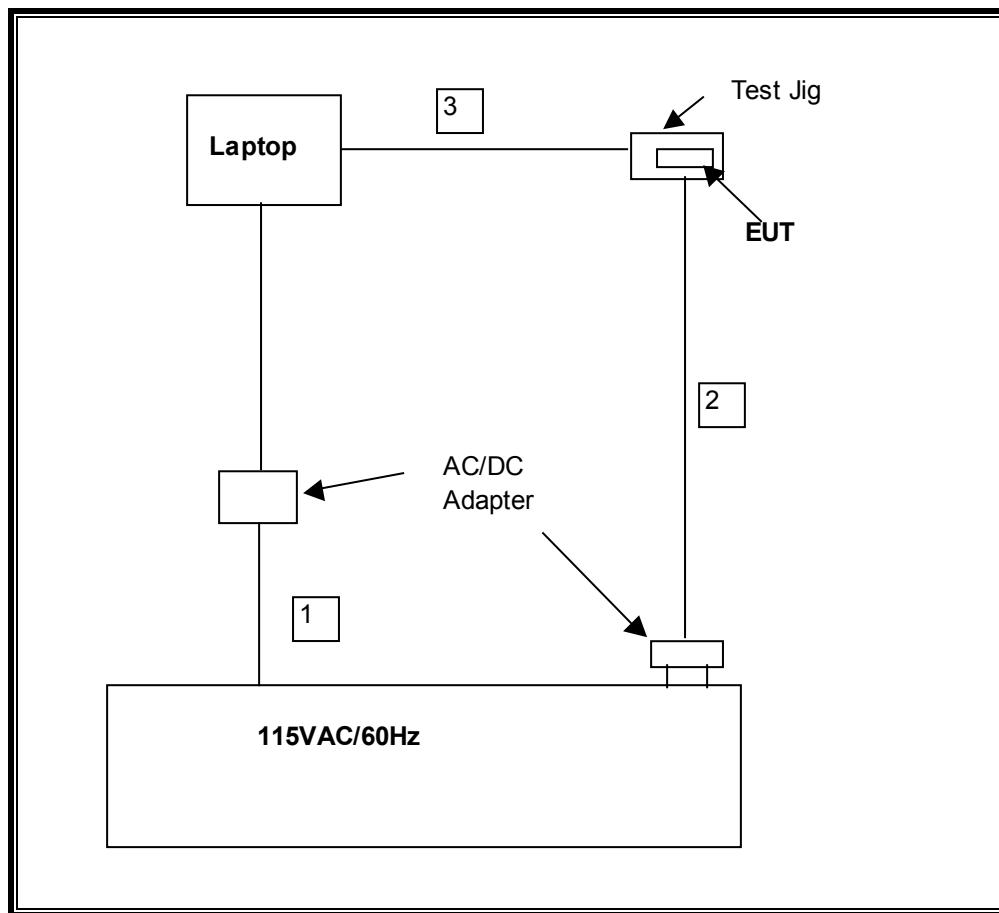
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	1.5m	N/A
2	DC	1	DC Plug	Un-shielded	1.5m	Ferrite bead at each end
3	USB	1	USB	Shielded	1.5m	N/A

The ferrite beads on the power supply cable to the test jig are required to reduce emissions from the test jig itself, these emissions are present without the EUT installed.

TEST SETUP

The EUT is installed in a test jig that is connected to a control computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



7. TEST AND MEASUREMENT EQUIPMENT

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Peak power Meter	Agilent / HP	E4416A	GB41291160	12/2/2007
Power Sensor	Agilent / HP	E9323A	US4040755	12/2/2007
RF Filter Section	Agilent / HP	85420E	3705A00256	6/12/2008
EM Receiver, 9 kHz ~ 29 GHz	Agilent / HP	8542E	3942A00286	6/12/2008
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	4/15/2008
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	8/3/2008
Antenna, BiLog, 2 GHz	Sund Sciences	JB1	C01011	10/13/2008
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	5/9/2008
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	5/7/2008
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	9/15/2008
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	9/15/2008
EM Test Receiver, 30 MHz	R&S	ESHS 20	N02396	1/27/2008

8. LIMITS AND RESULTS

8.1. ANTENNA PORT CHANNEL TESTS

8.1.1. 20 dB BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

RESULTS

No non-compliance noted:

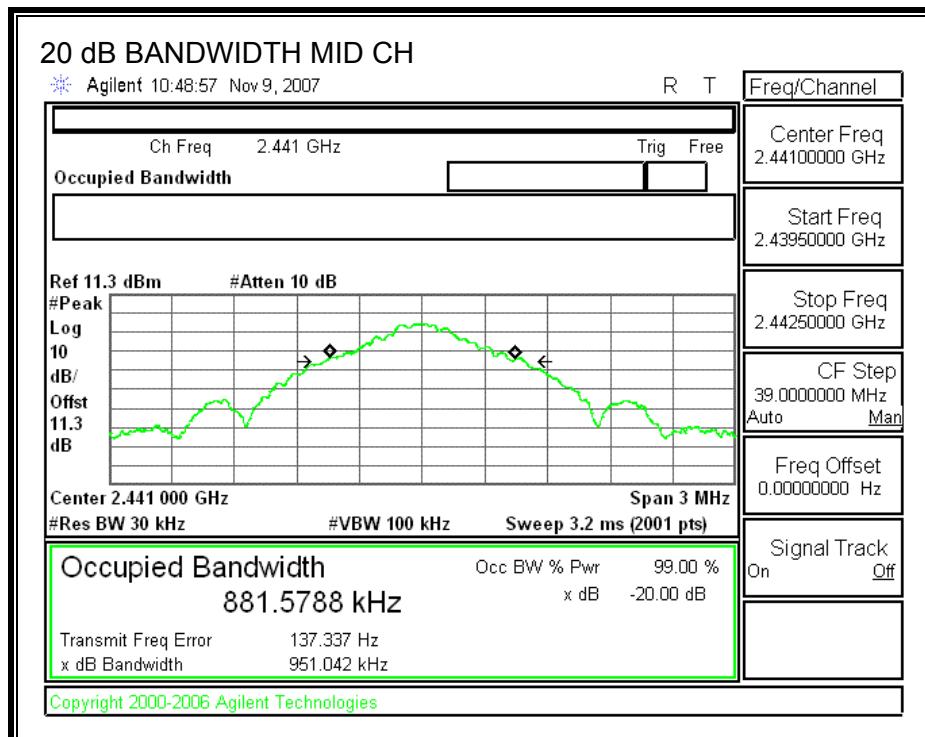
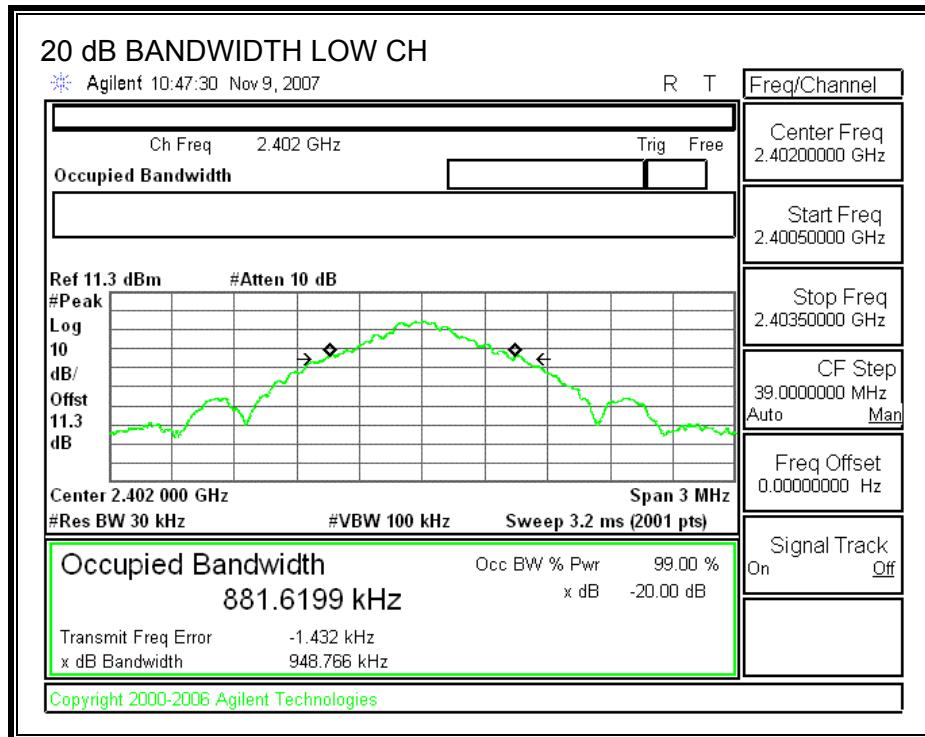
GFSK

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	948.8
Middle	2441	951.0
High	2480	951.0

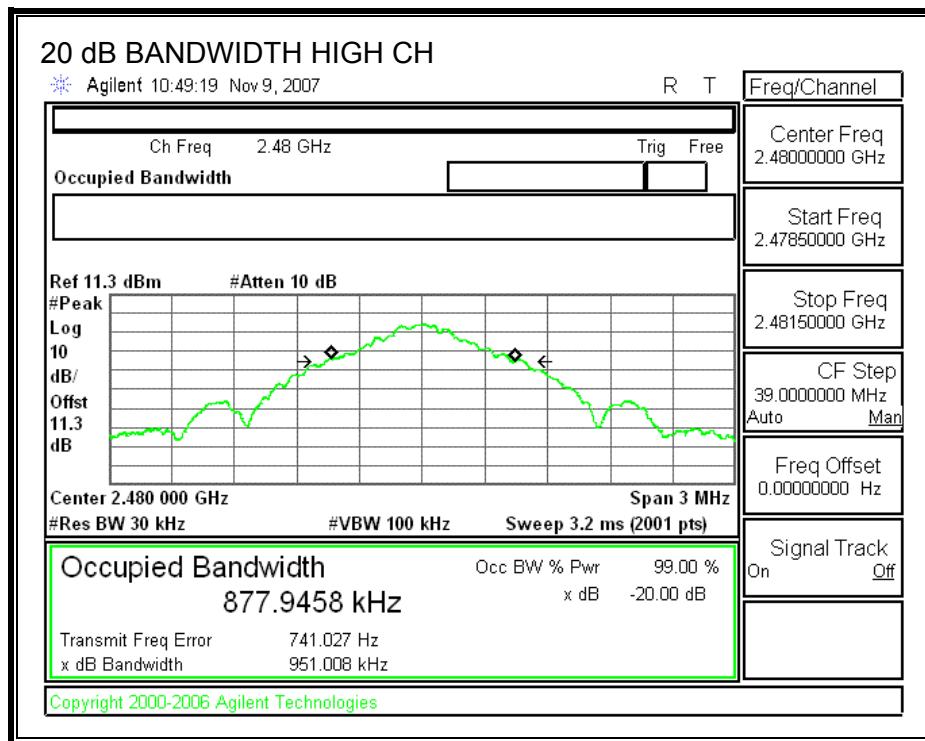
8PSK

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	1350
Middle	2441	1349
High	2480	1350

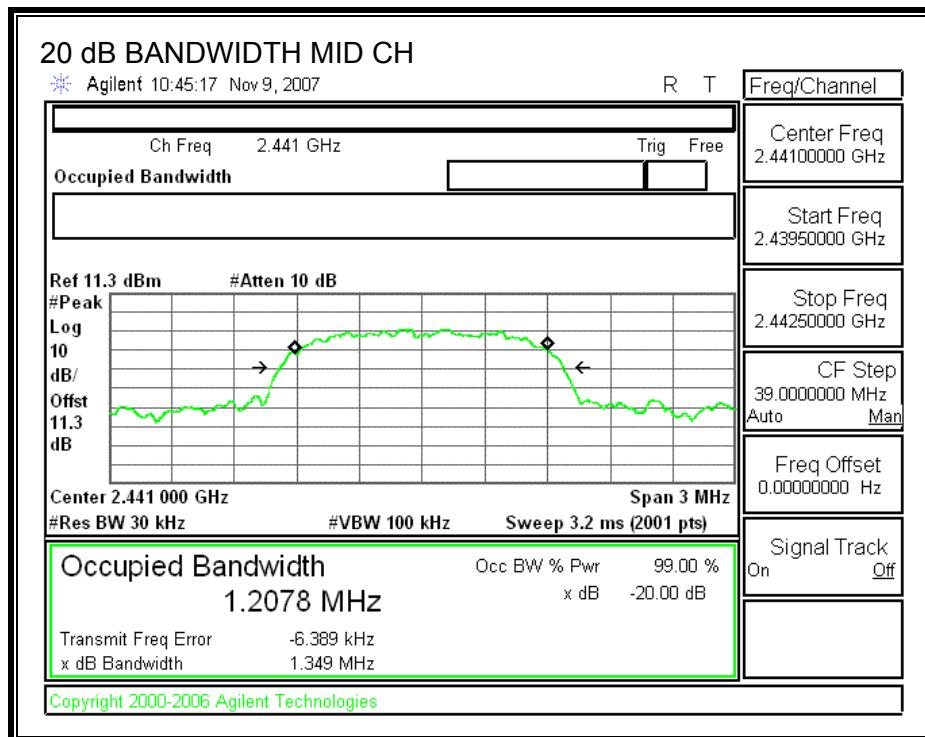
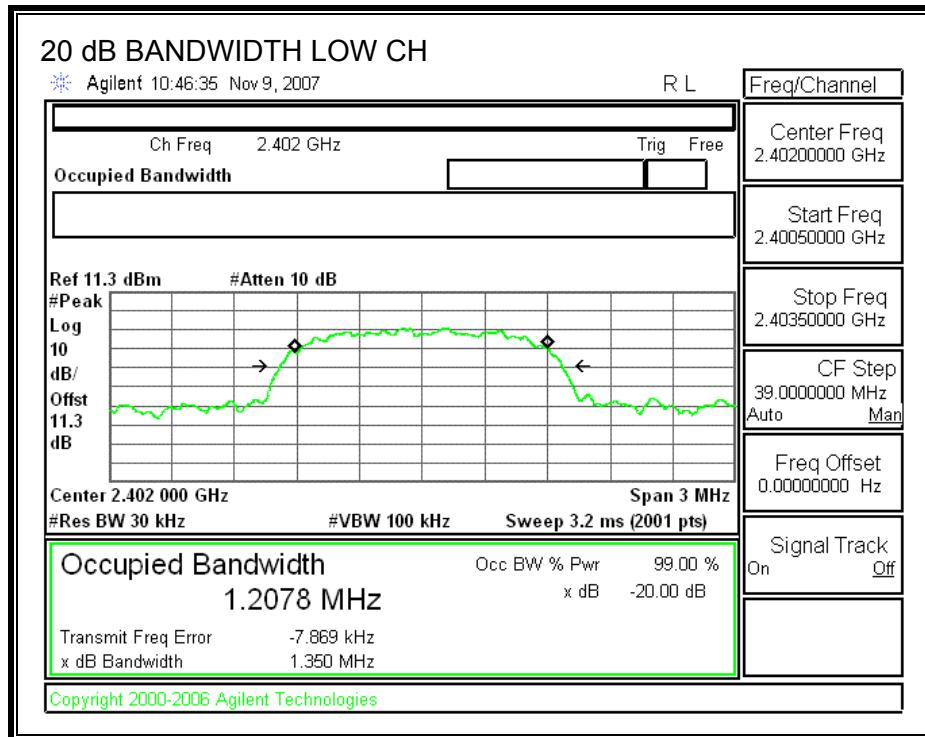
GFSK Mode



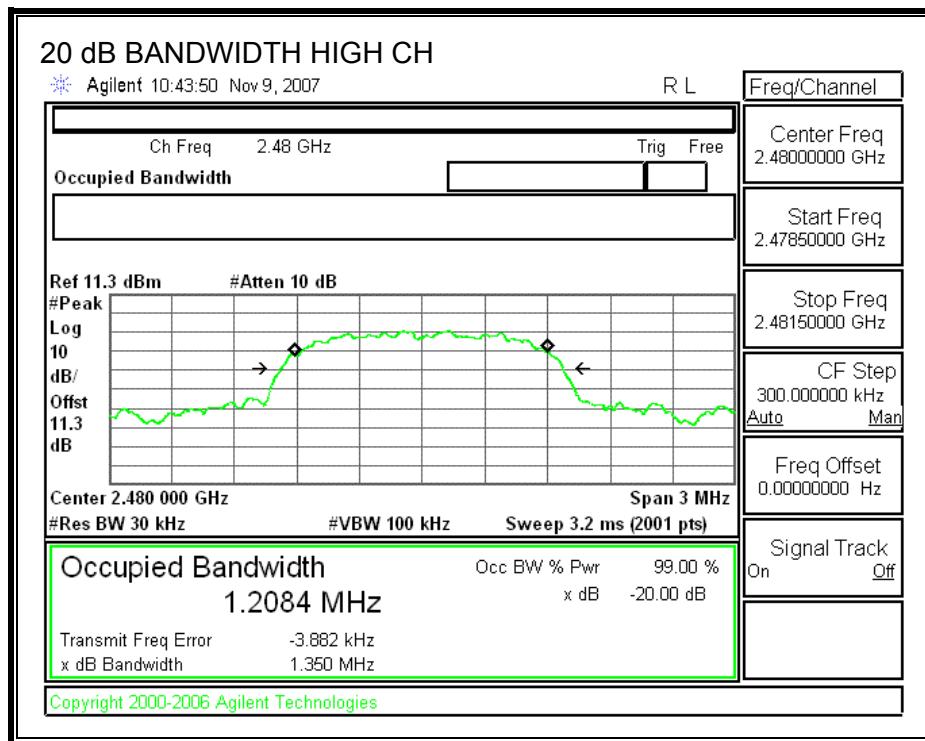
GFSK Mode



8PSK Mode



8PSK Mode



8.1.2. 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

No non-compliance noted:

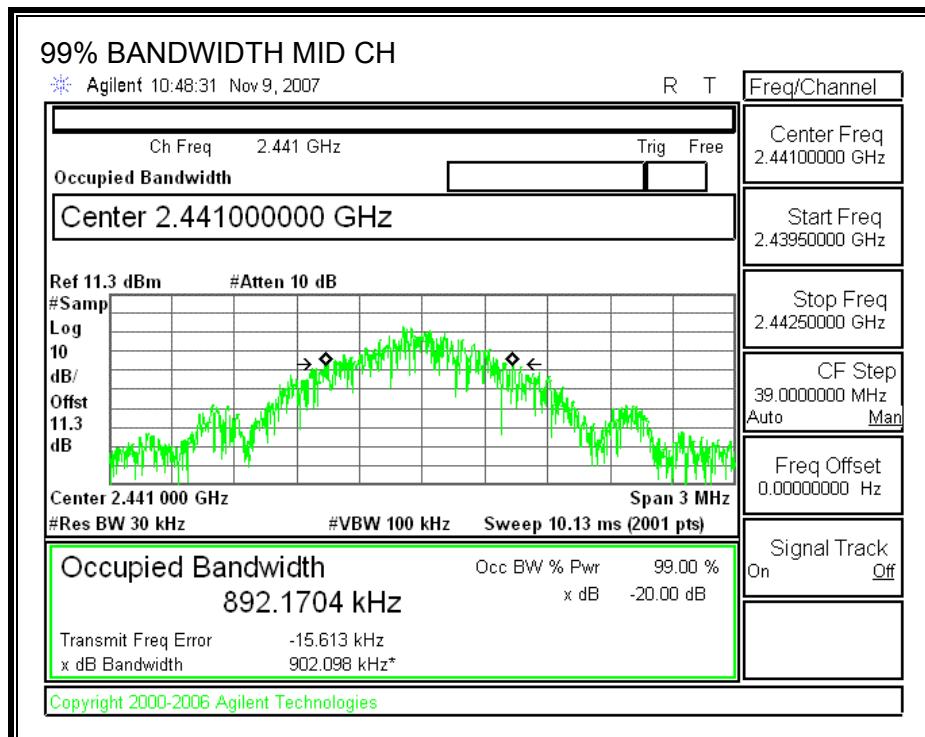
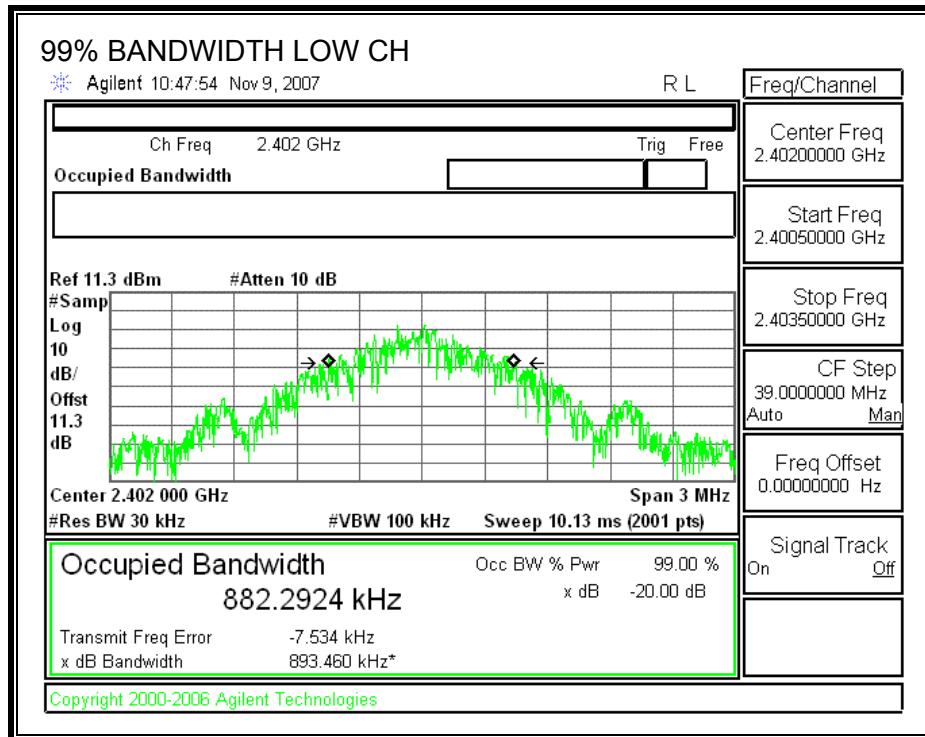
GFSK Mode

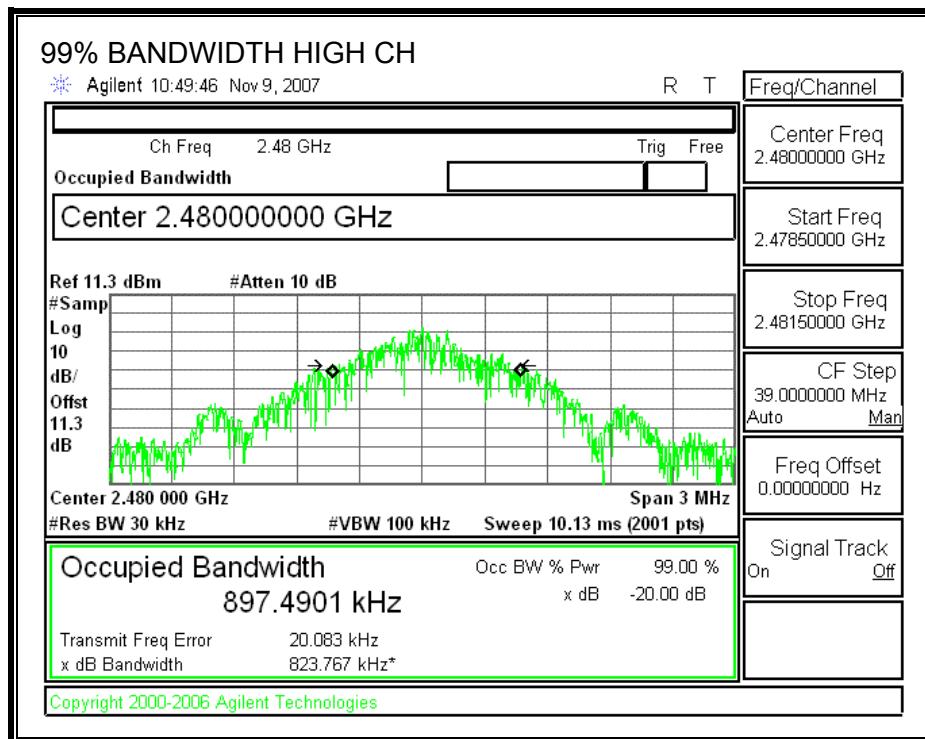
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	2402	882.2924
Middle	2441	892.1704
High	2480	897.4901

8PSK Mode

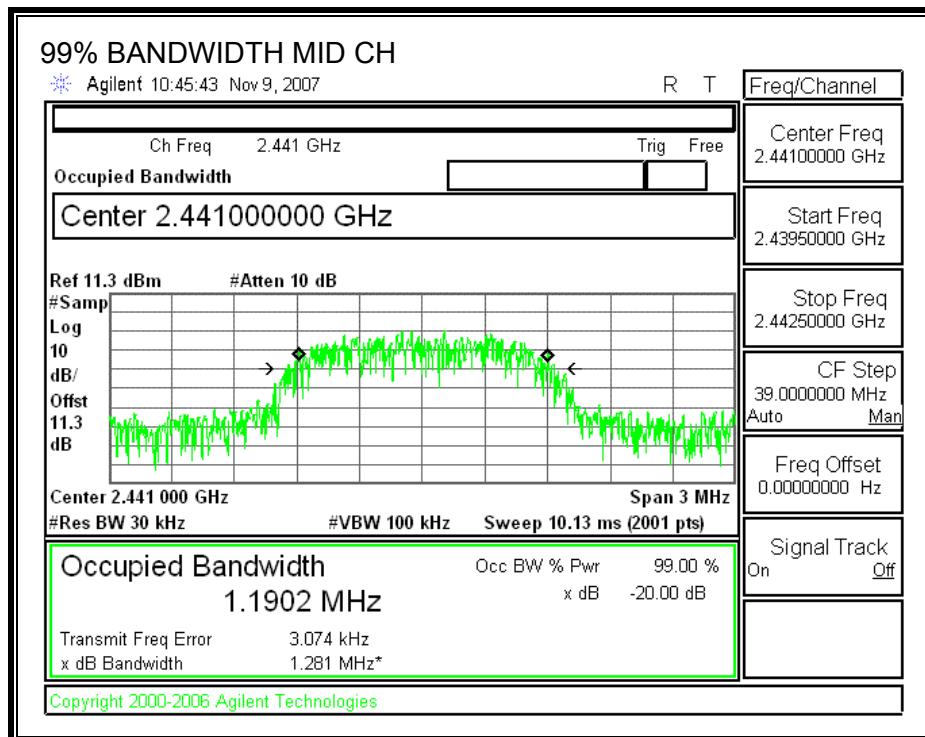
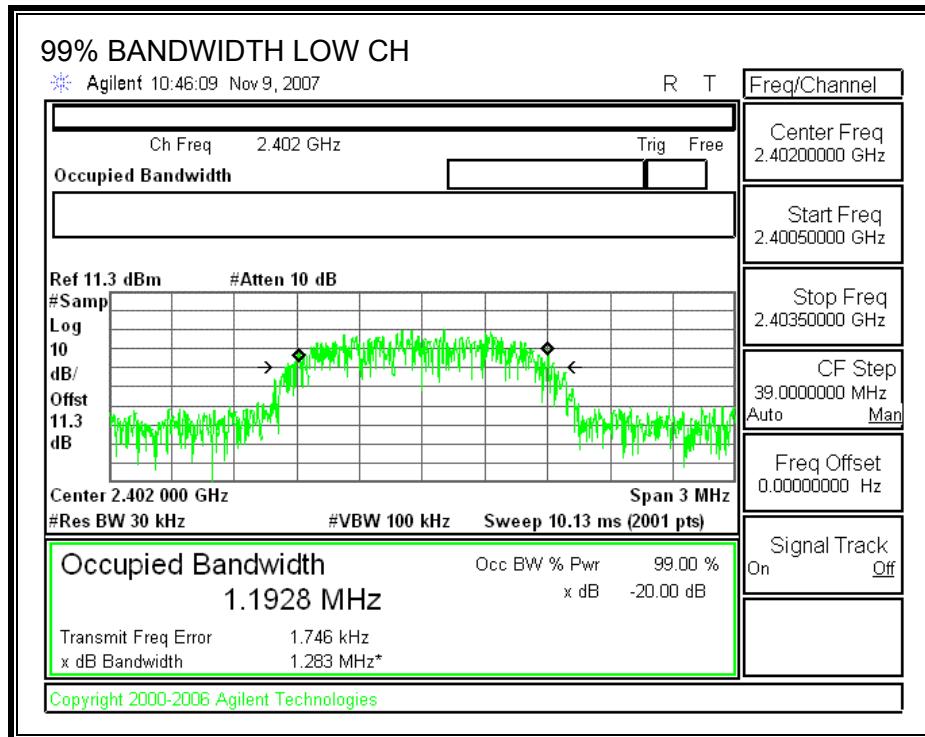
Channel	Frequency (MHz)	99% Bandwidth (kHz)
Low	2402	1192.8
Middle	2441	1190.2
High	2480	1169.9

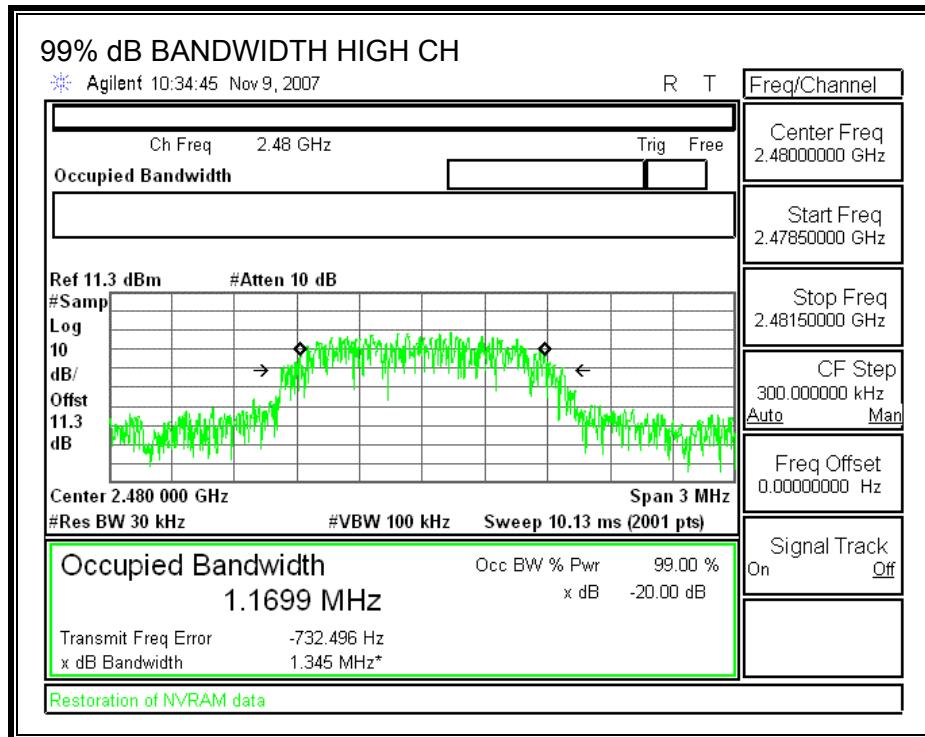
GFSK Mode





8PSK Mode





8.1.3. HOPPING FREQUENCY SEPARATION

LIMIT

§15.247 (a) (1) 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.

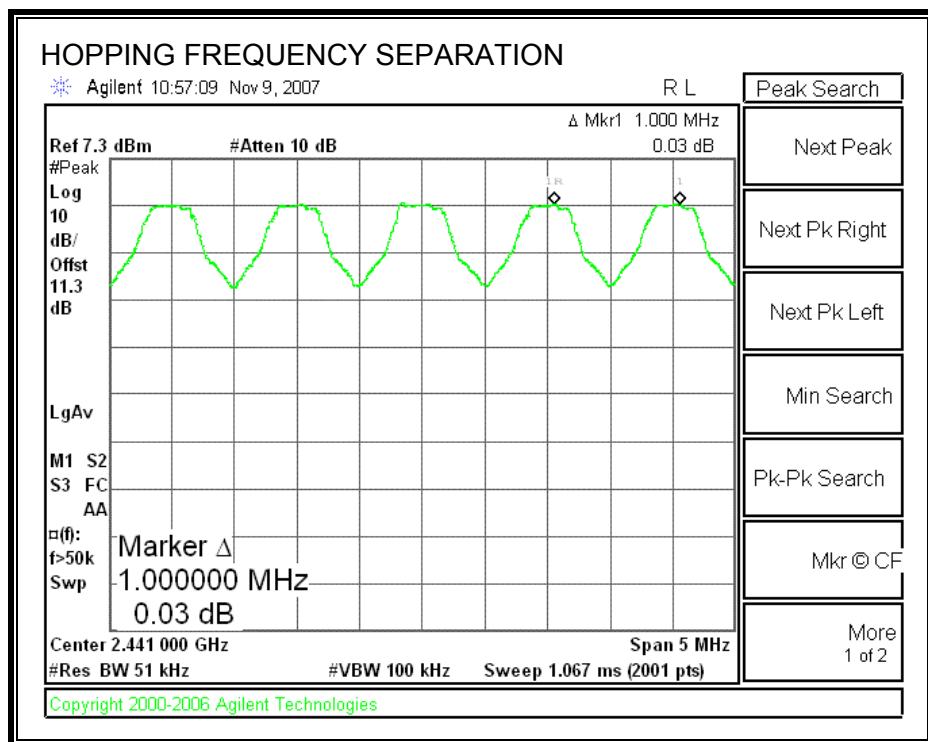
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 51 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

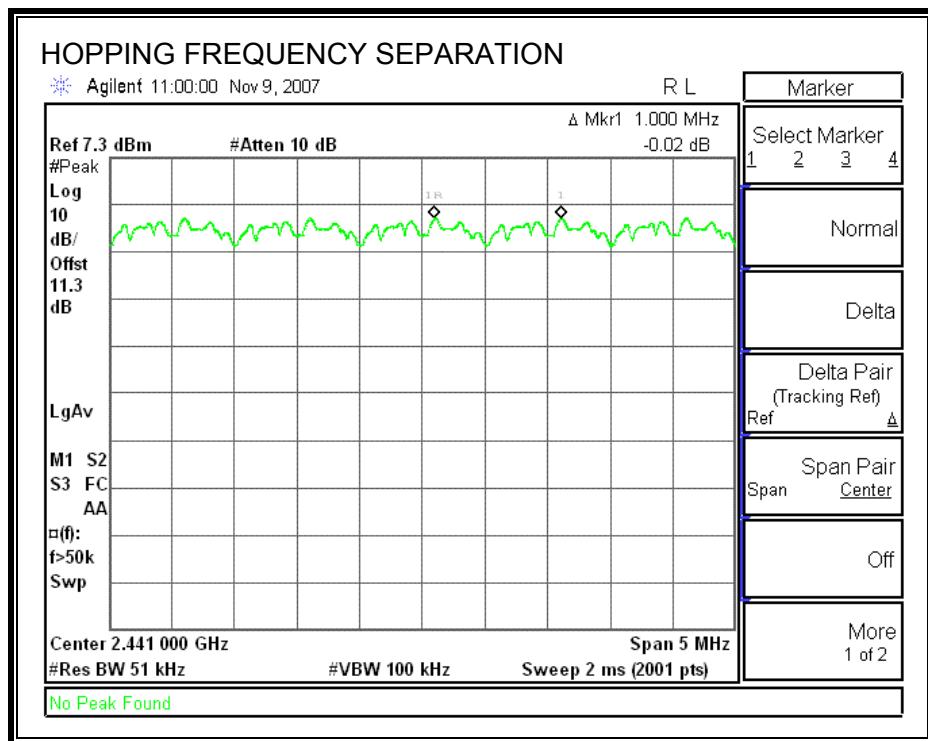
RESULTS

No non-compliance noted:

GFSK



8PSK



8.1.4. NUMBER OF HOPPING CHANNELS

LIMIT

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

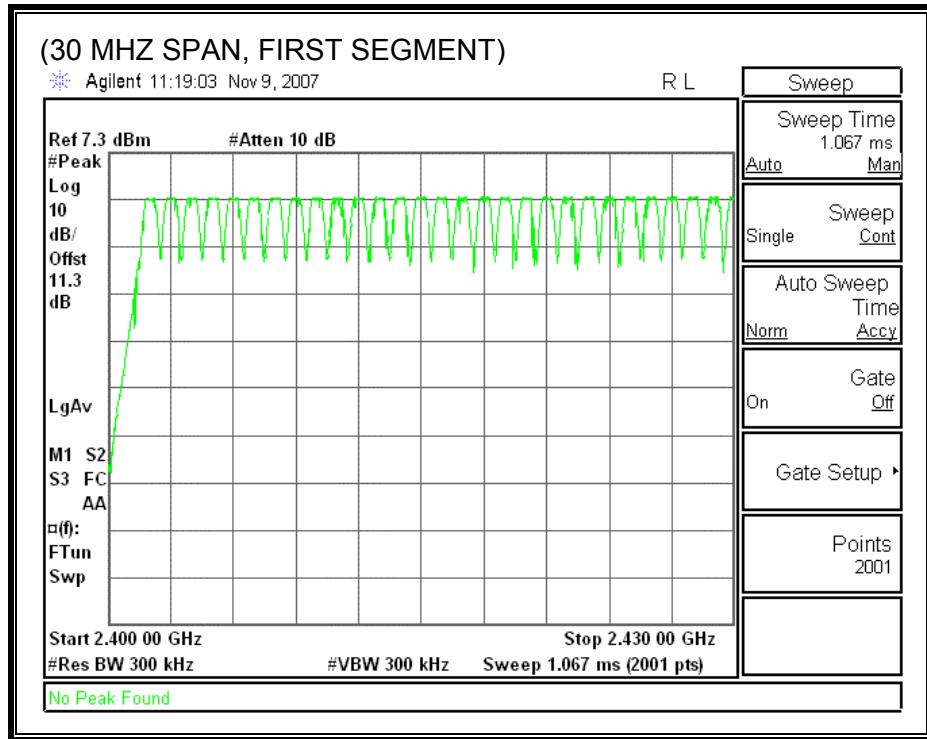
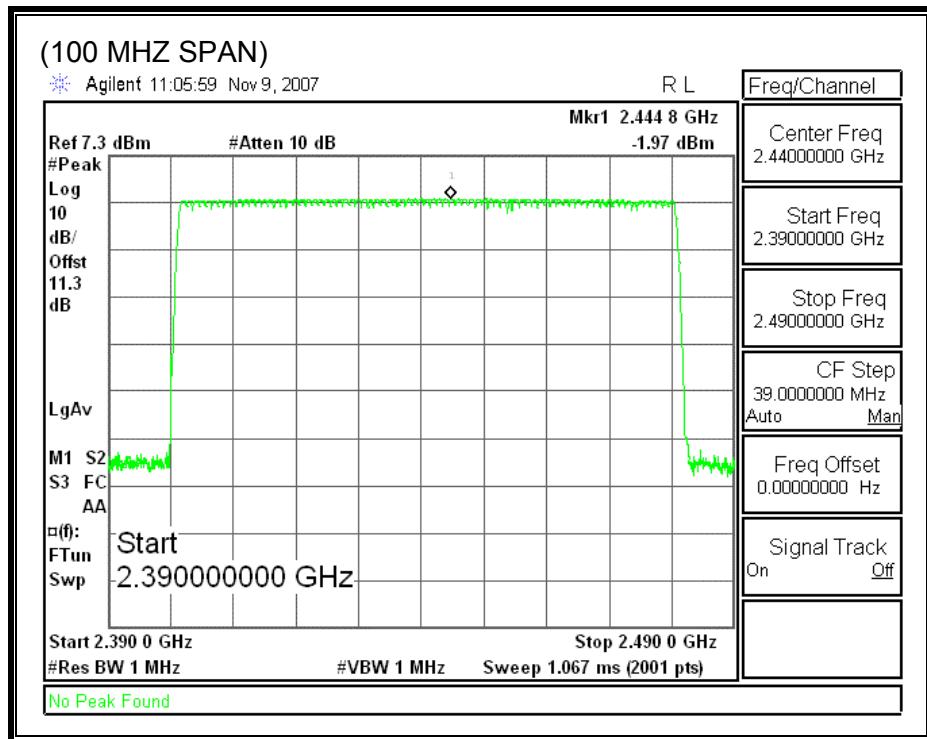
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

RESULTS

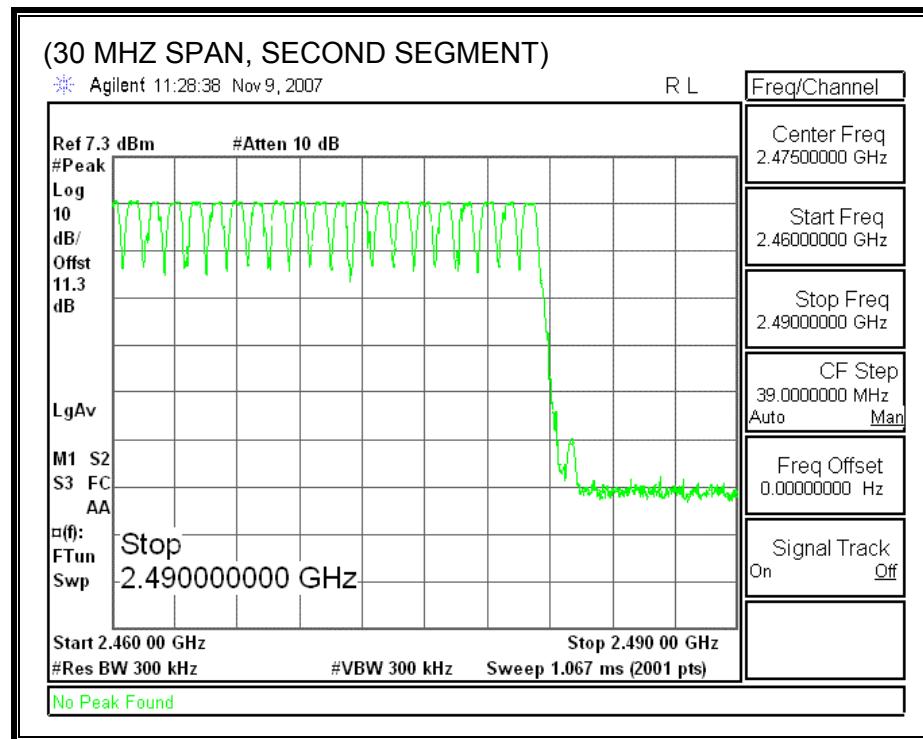
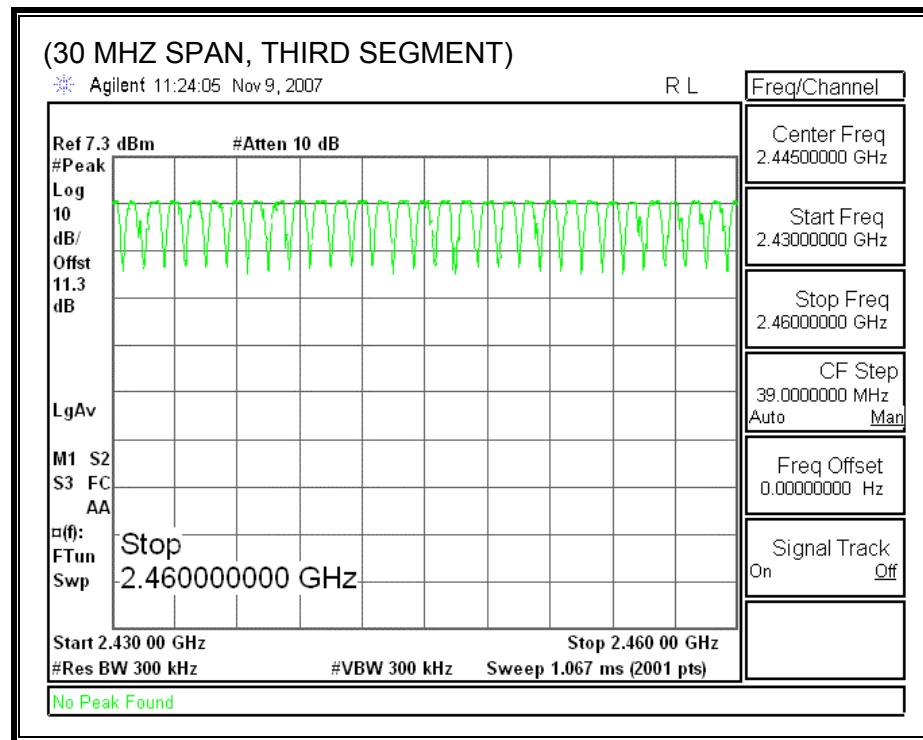
No non-compliance noted:

79 Channels observed.

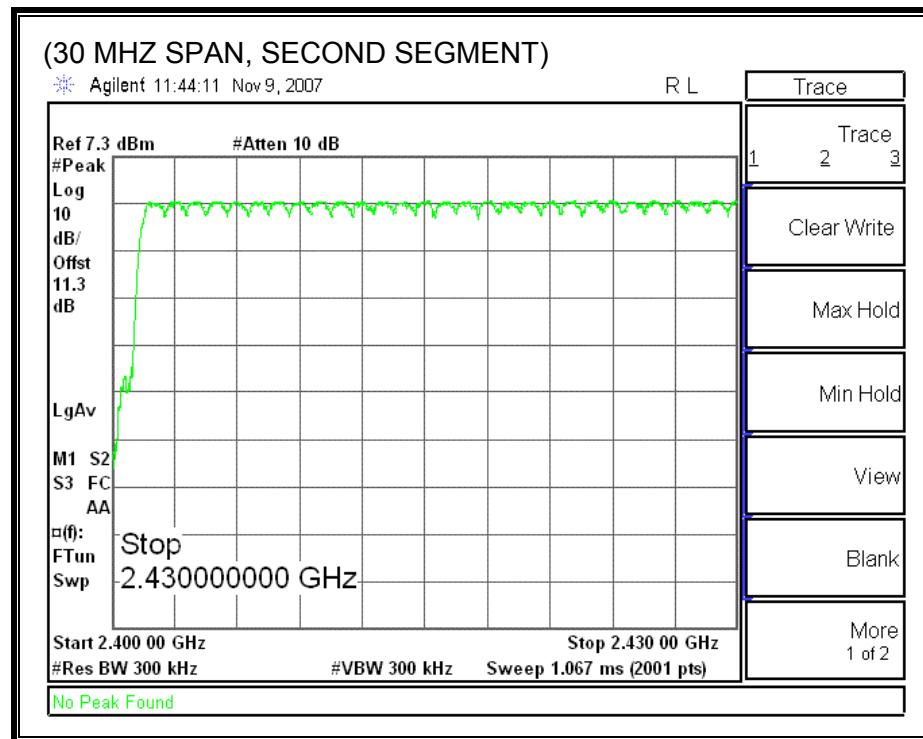
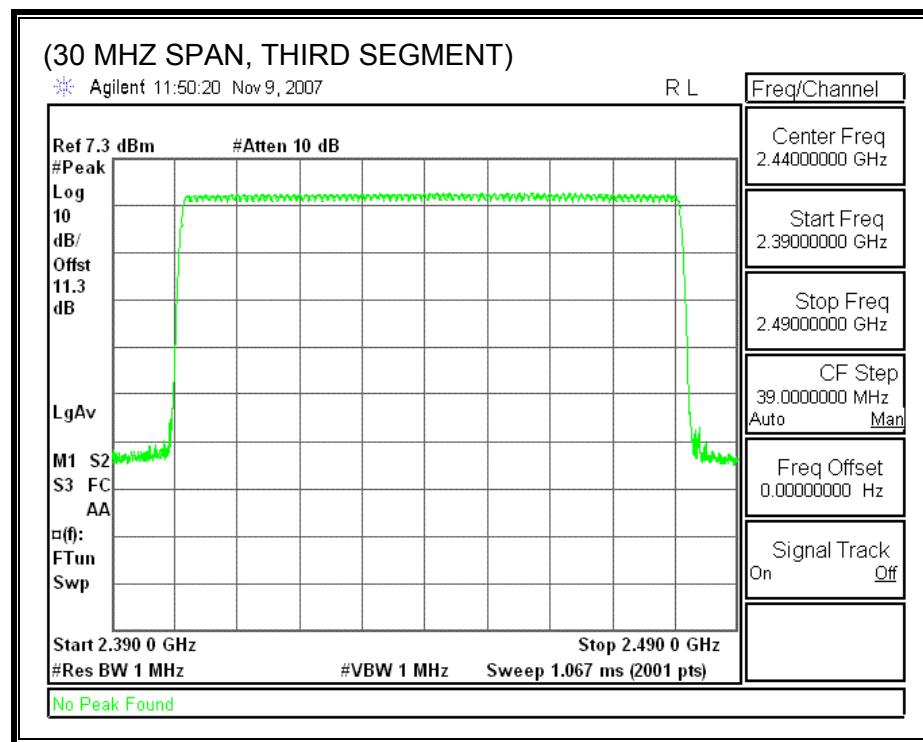
GFSK

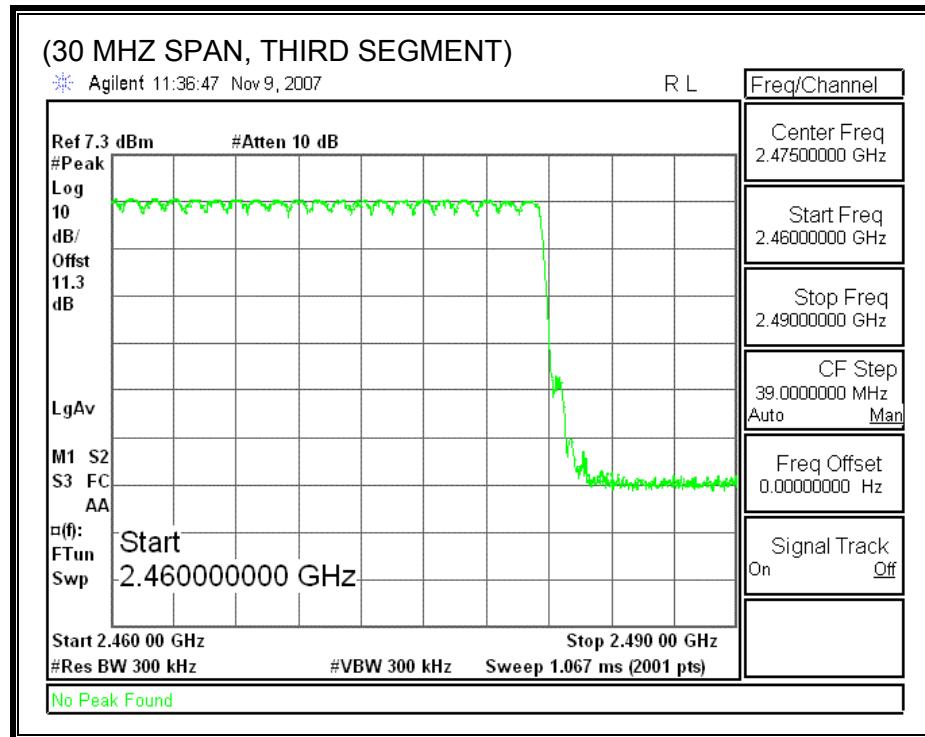
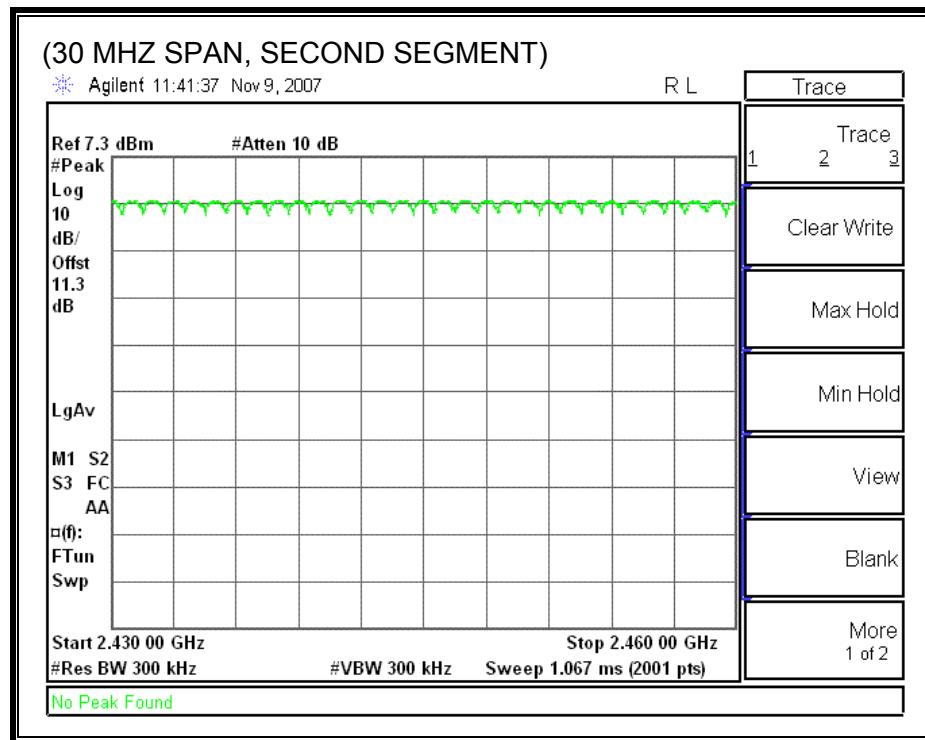


GFSK



8PSK



8PSK

8.1.5. AVERAGE TIME OF OCCUPANCY

LIMIT

§15.247 (a) (1) (iii) Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels. 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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

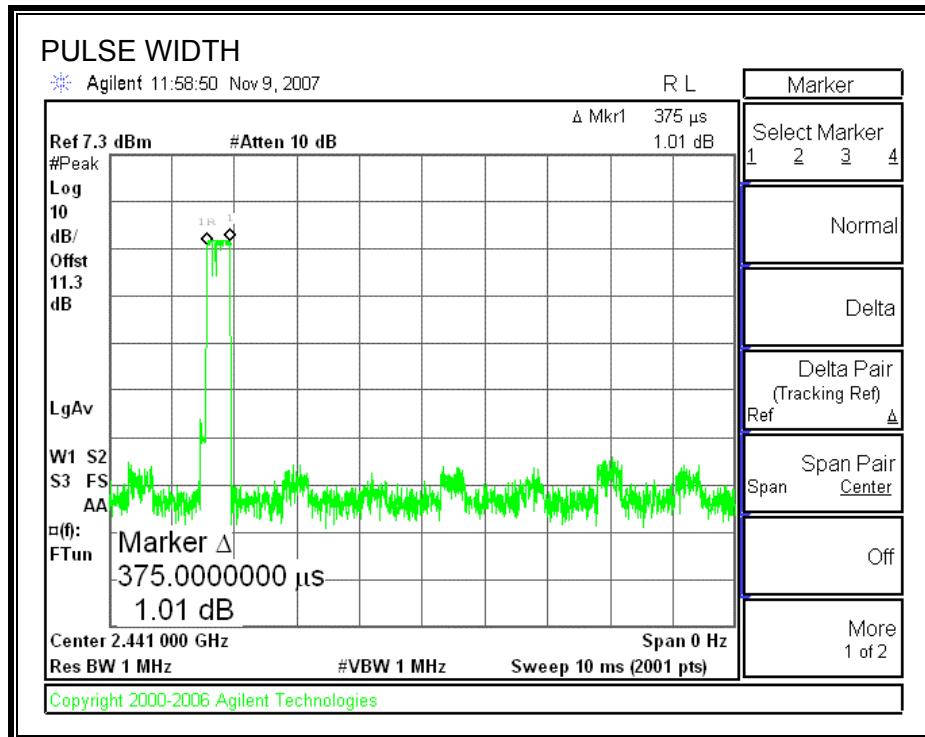
RESULTS

No non-compliance noted:

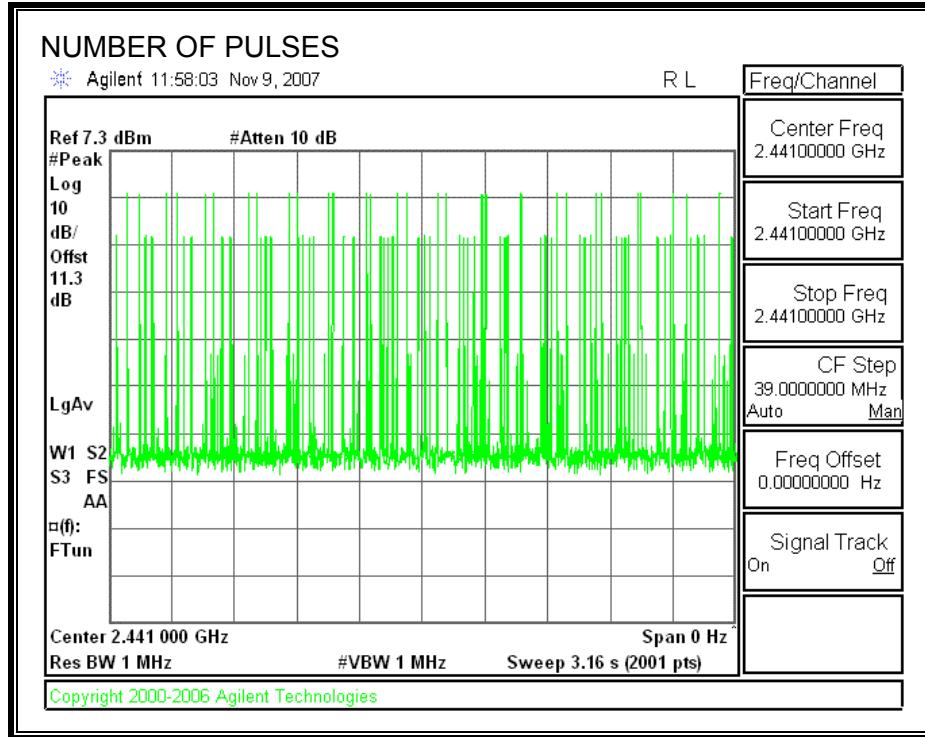
GFSK					
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.375	31	0.116	0.4	0.284
DH3	1.635	21	0.343	0.4	0.057
DH5	2.885	11	0.317	0.4	0.083
8PSK					
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.39	35	0.137	0.4	0.264
DH3	1.64	20	0.328	0.4	0.072
DH5	2.89	10	0.289	0.4	0.111

GFSK-DH1

PULSE WIDTH

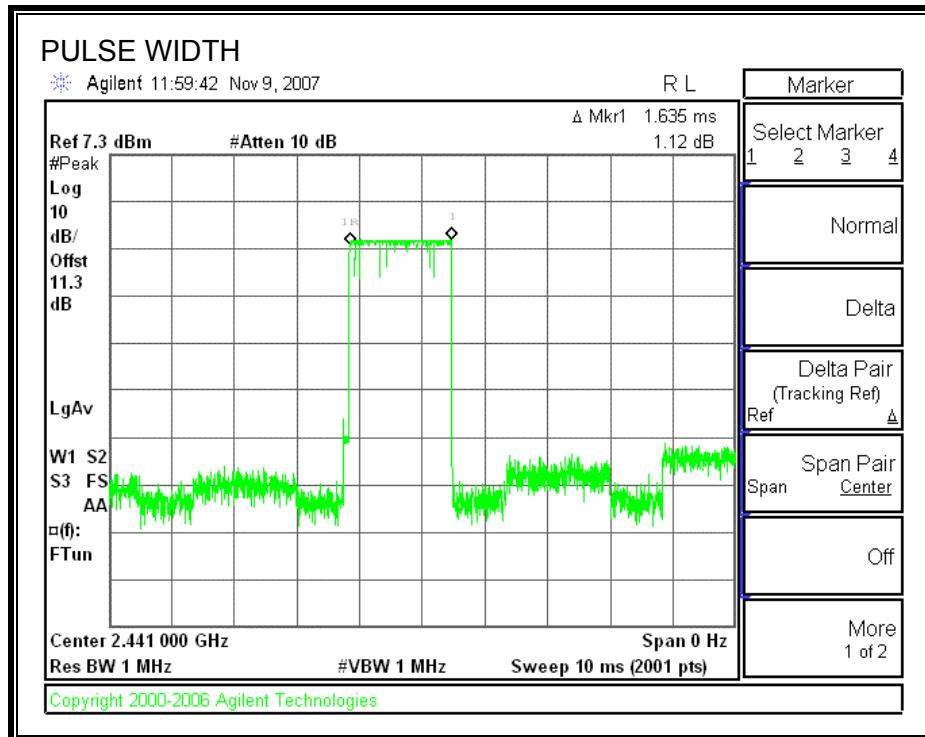


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

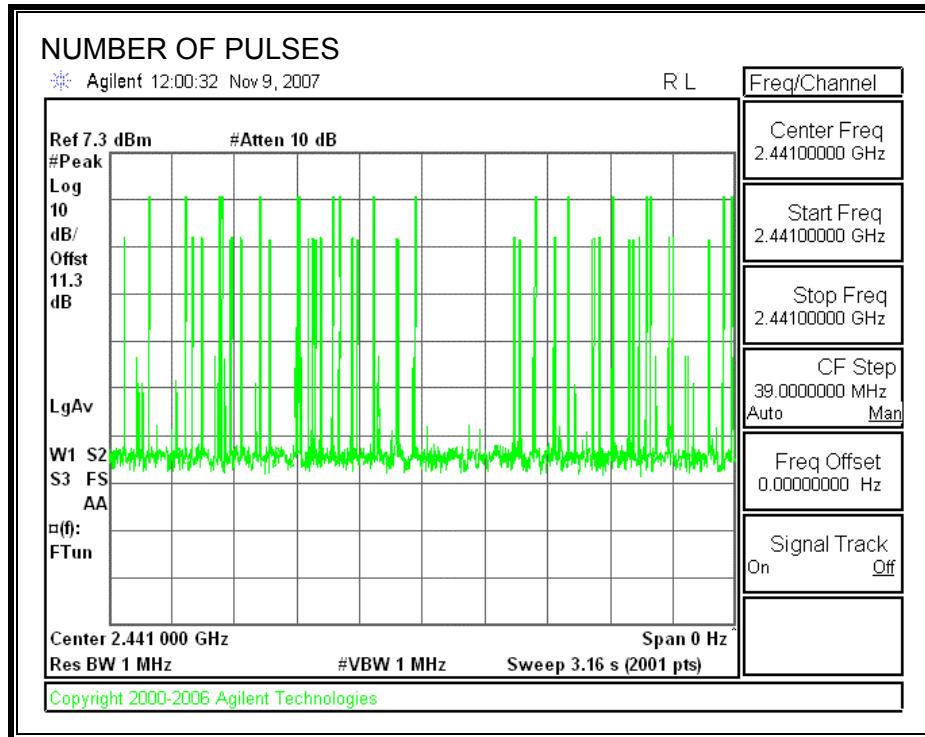


GFSK-DH3

PULSE WIDTH

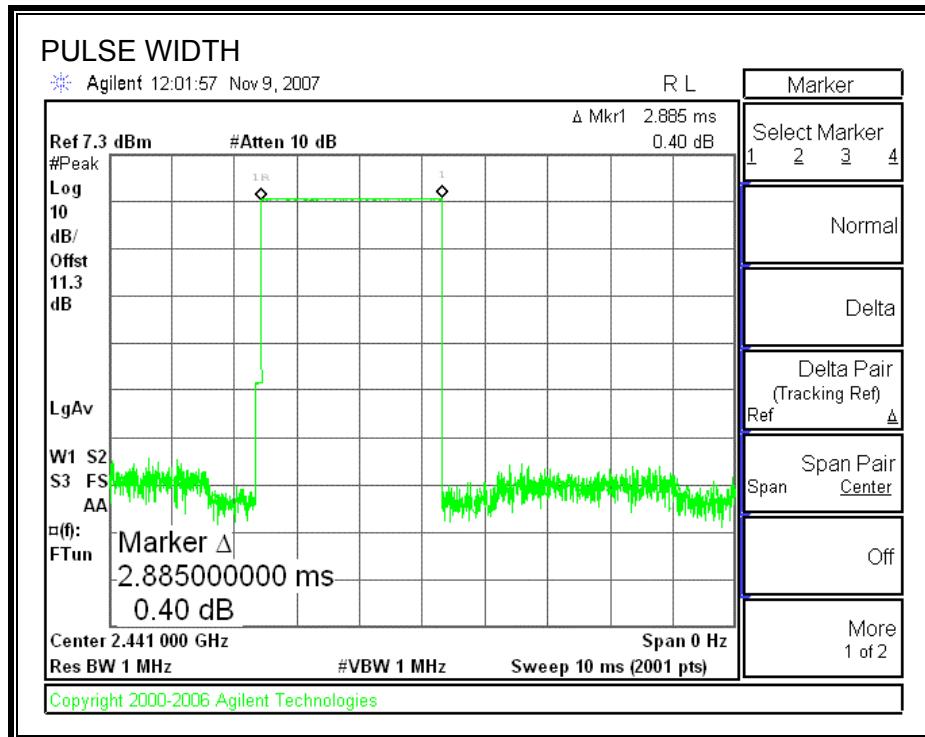


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

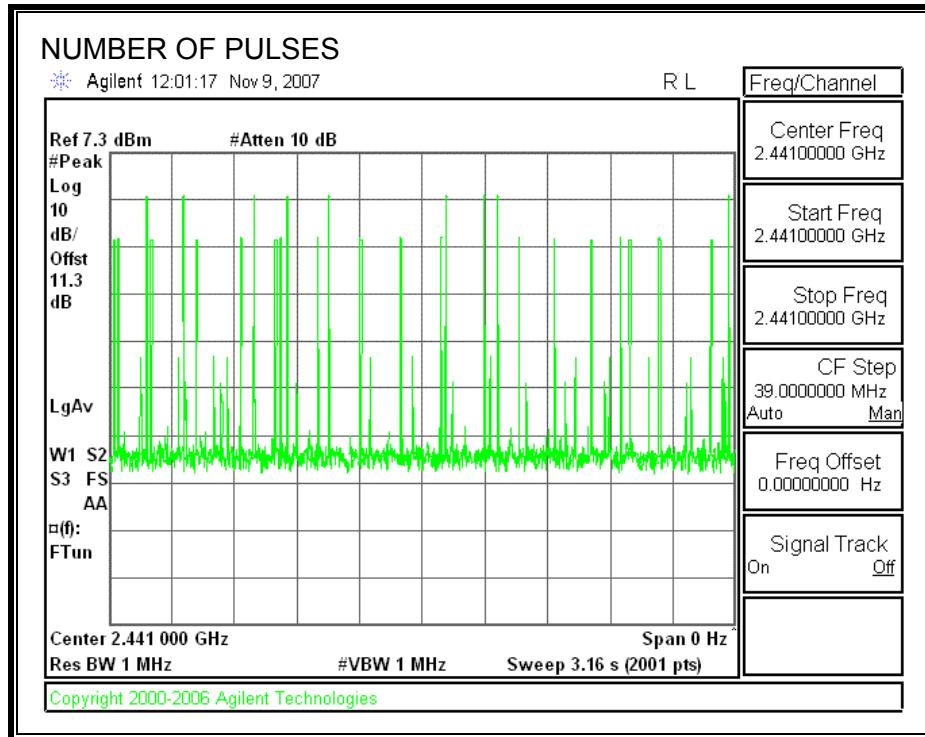


GFSK-DH5

PULSE WIDTH

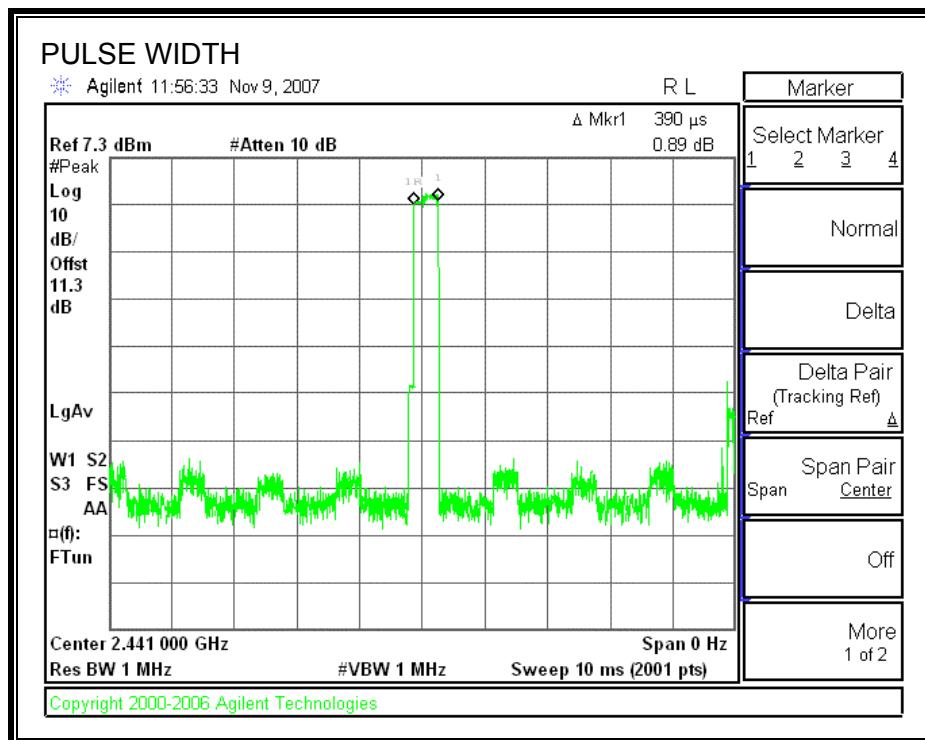


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

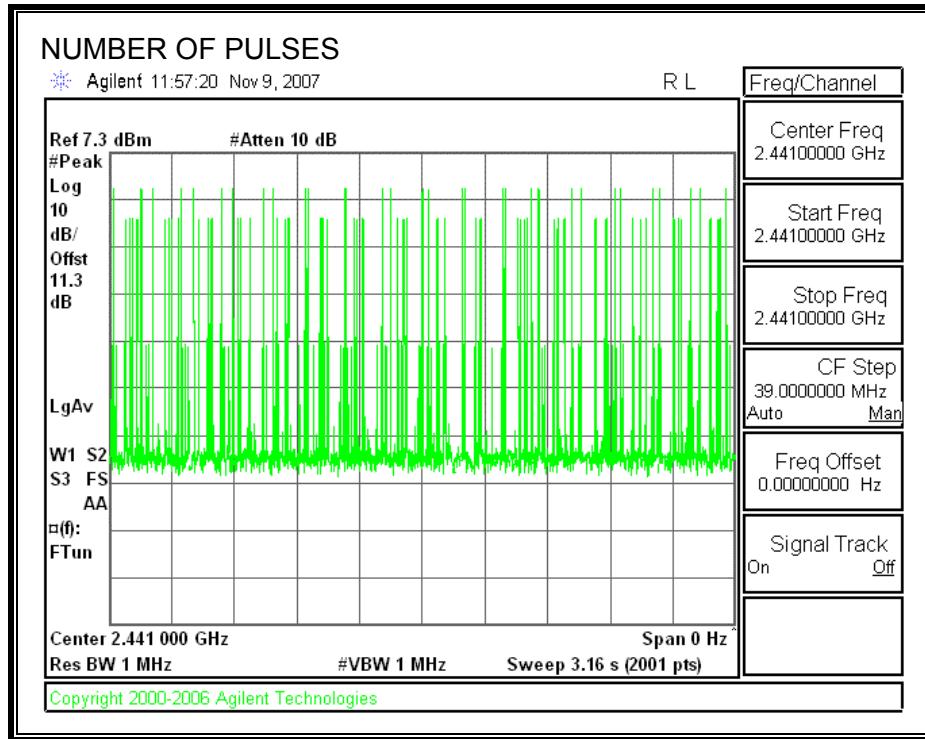


8PSK-DH1

PULSE WIDTH

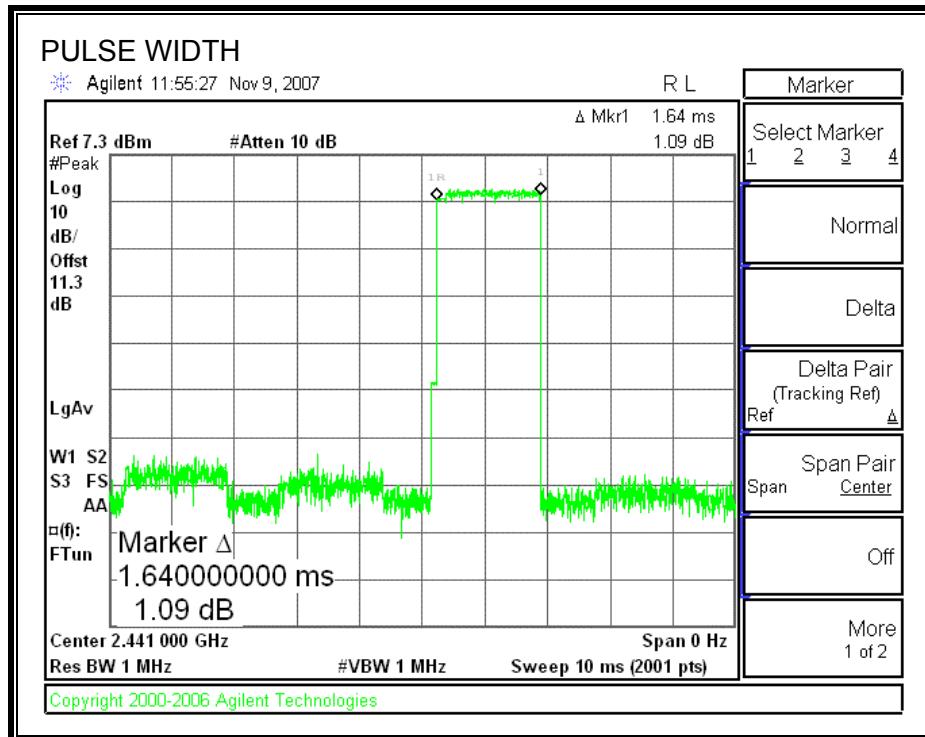


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

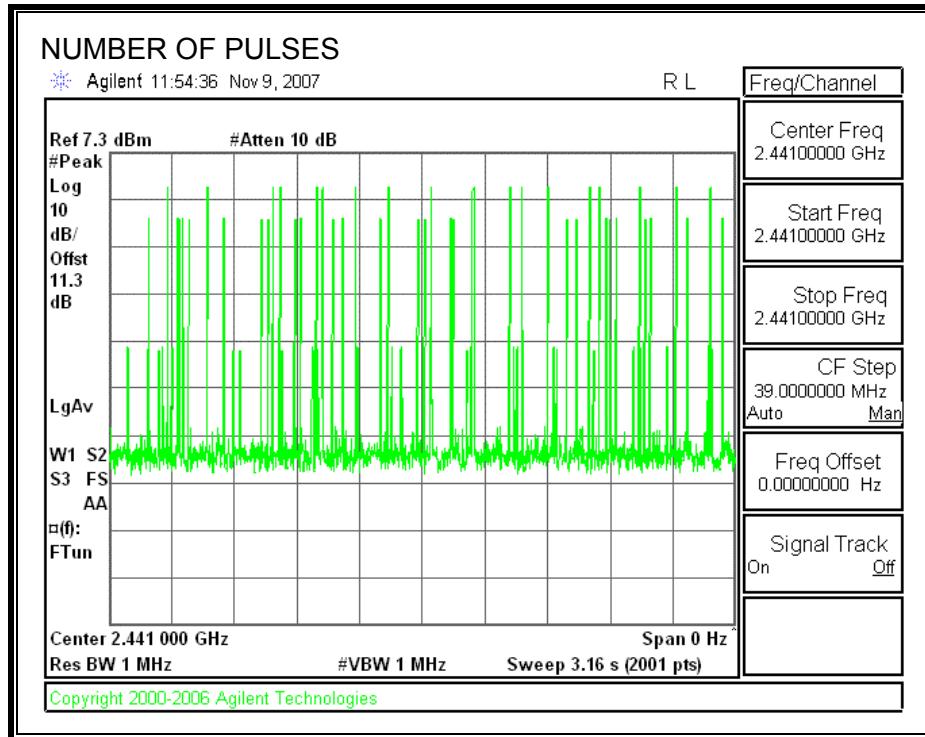


8PSK-DH3

PULSE WIDTH

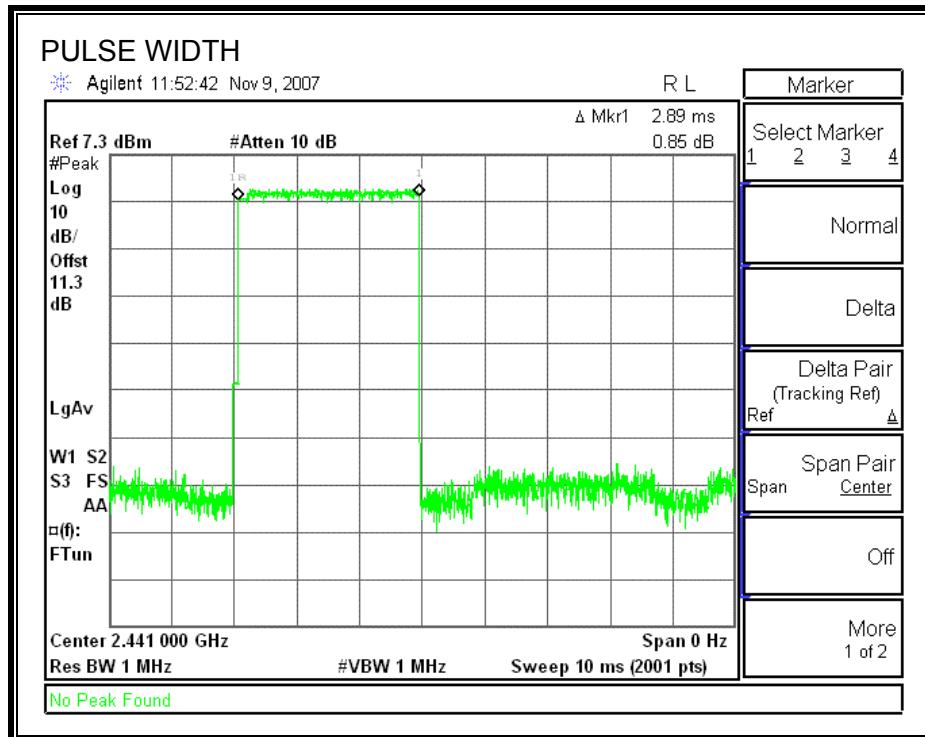


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

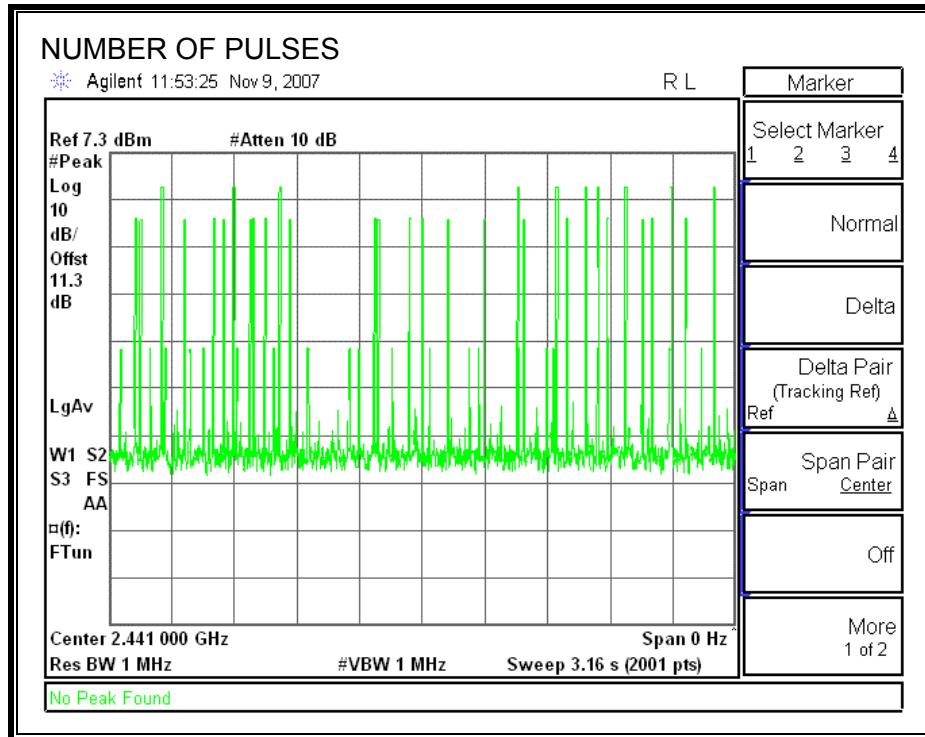


8PSK-DH5

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD



8.1.6. PEAK OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 3.15 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

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

RESULTS

No non-compliance noted:

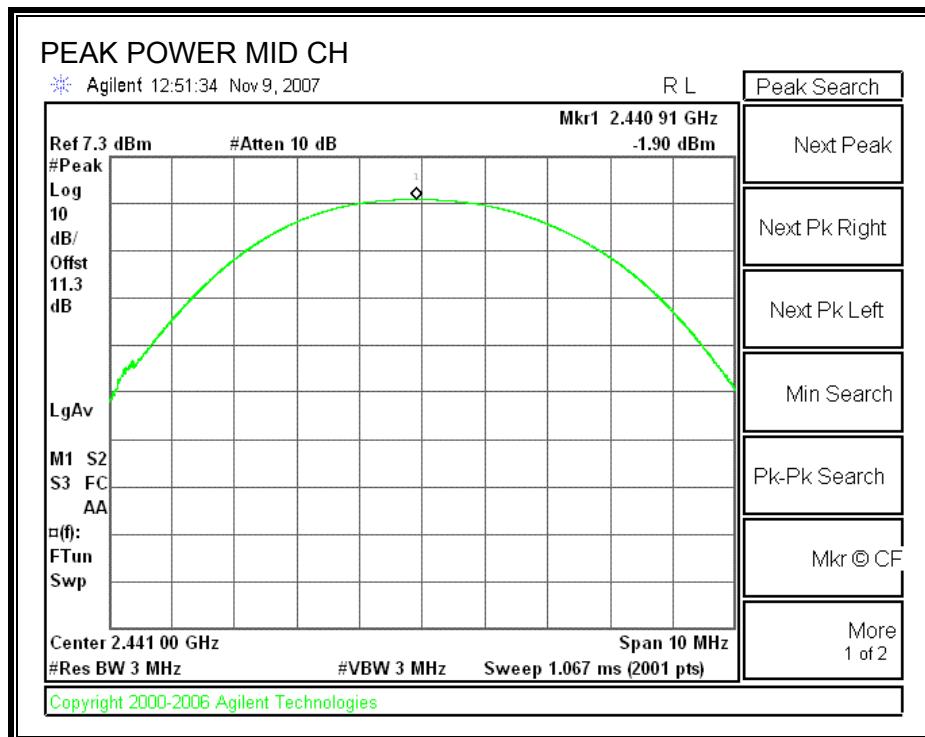
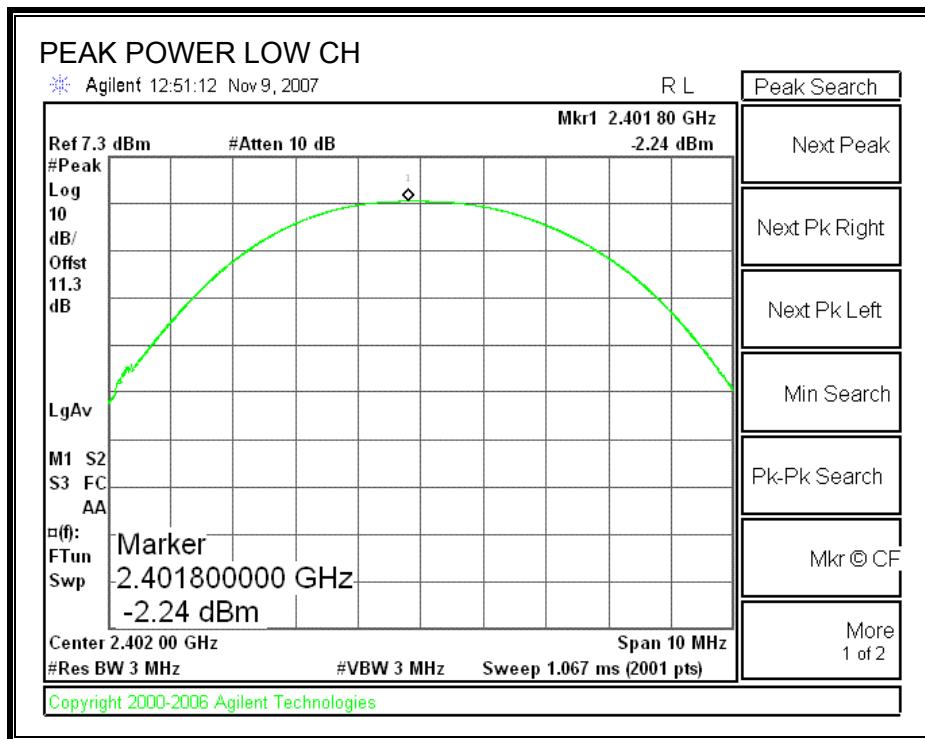
GFSK

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-2.24	30	-32.24
Middle	2441	-1.90	30	-31.90
High	2480	-2.30	30	-32.30

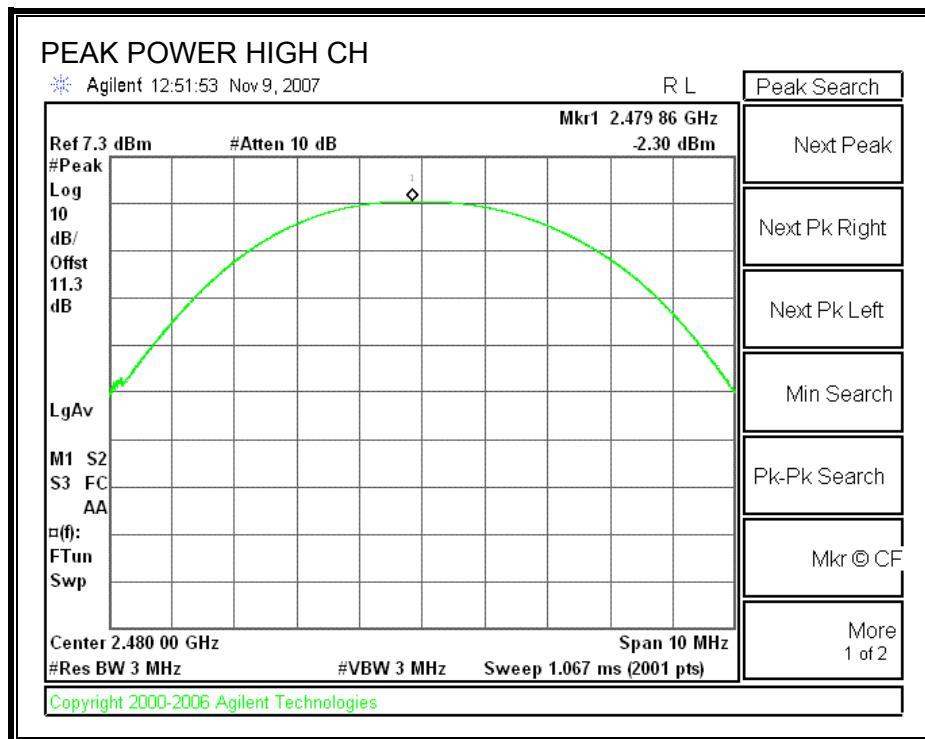
8PSK

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	0.46	30	-29.54
Middle	2441	0.70	30	-29.30
High	2480	0.24	30	-29.76

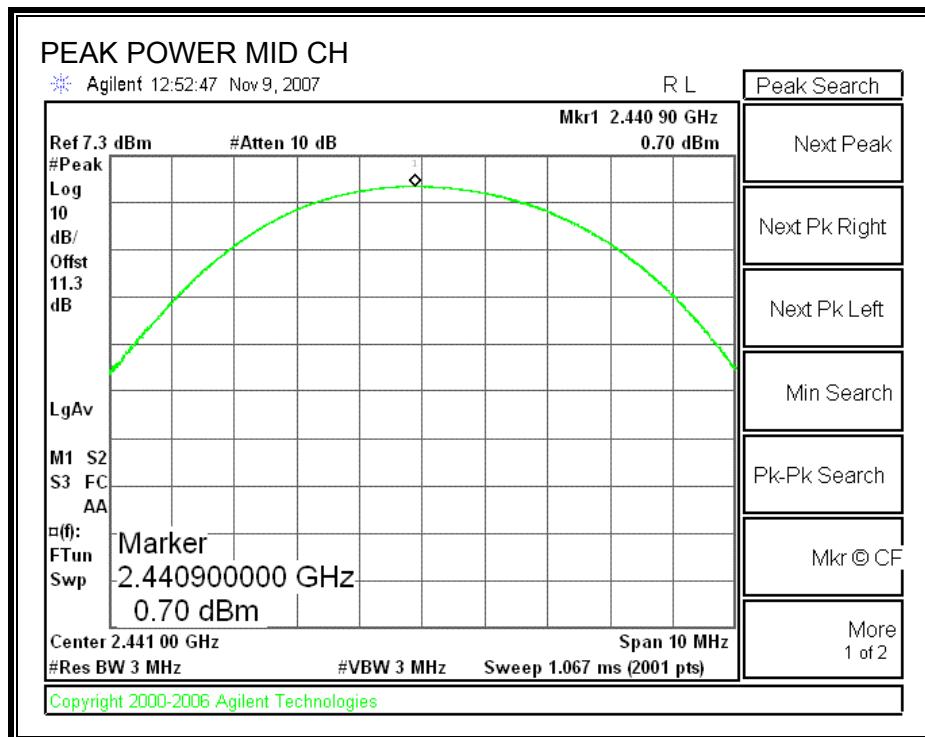
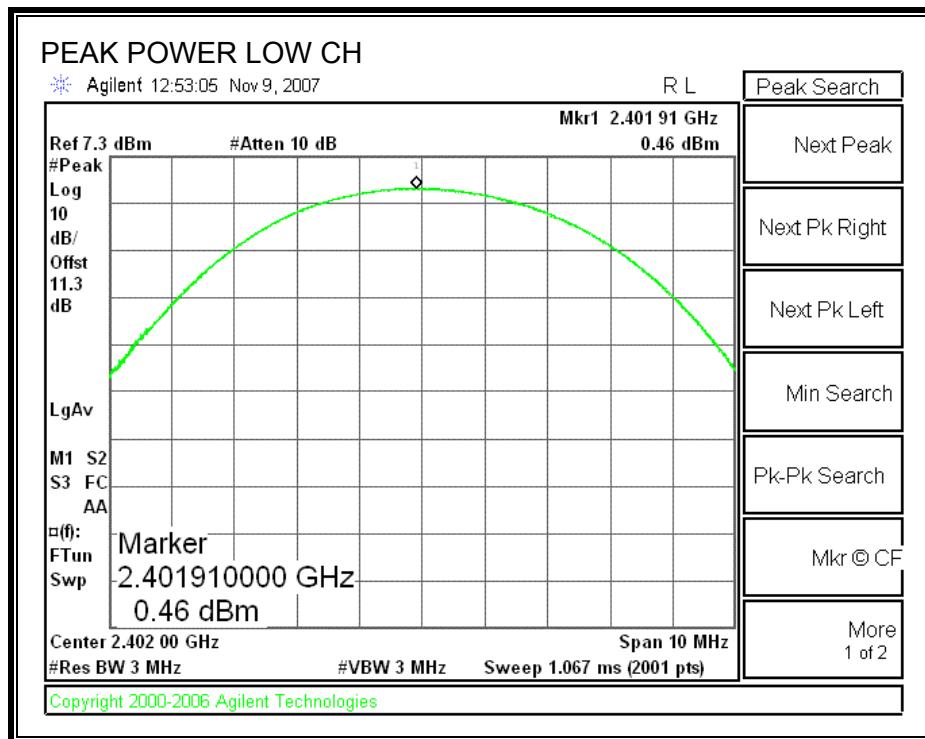
GFSK



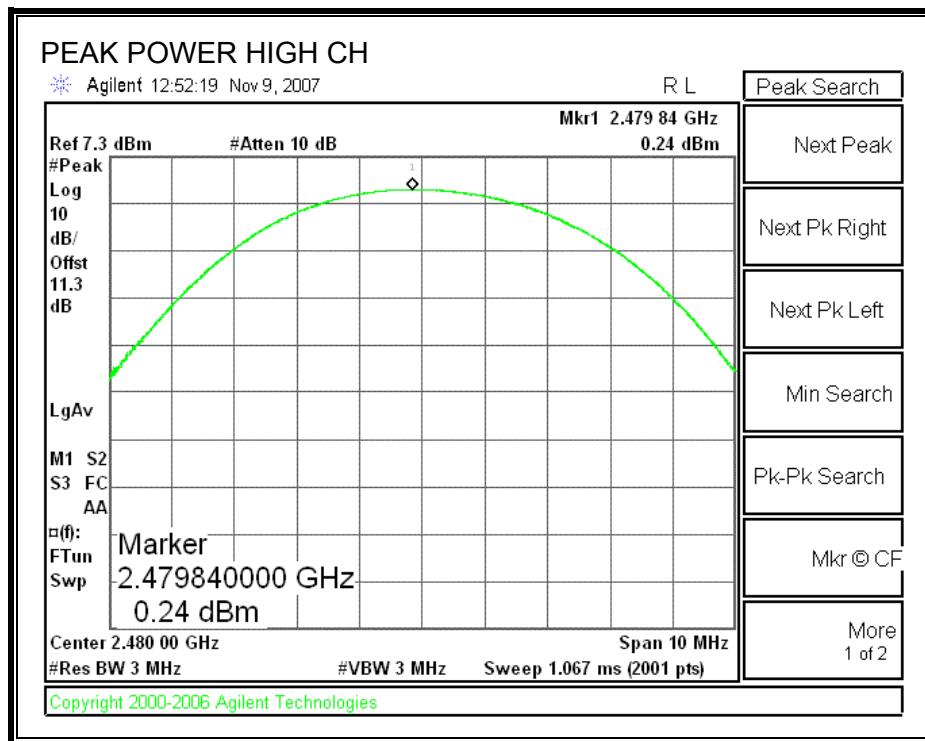
GFSK



8PSK



8PSK



8.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

§15.247 (c) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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.

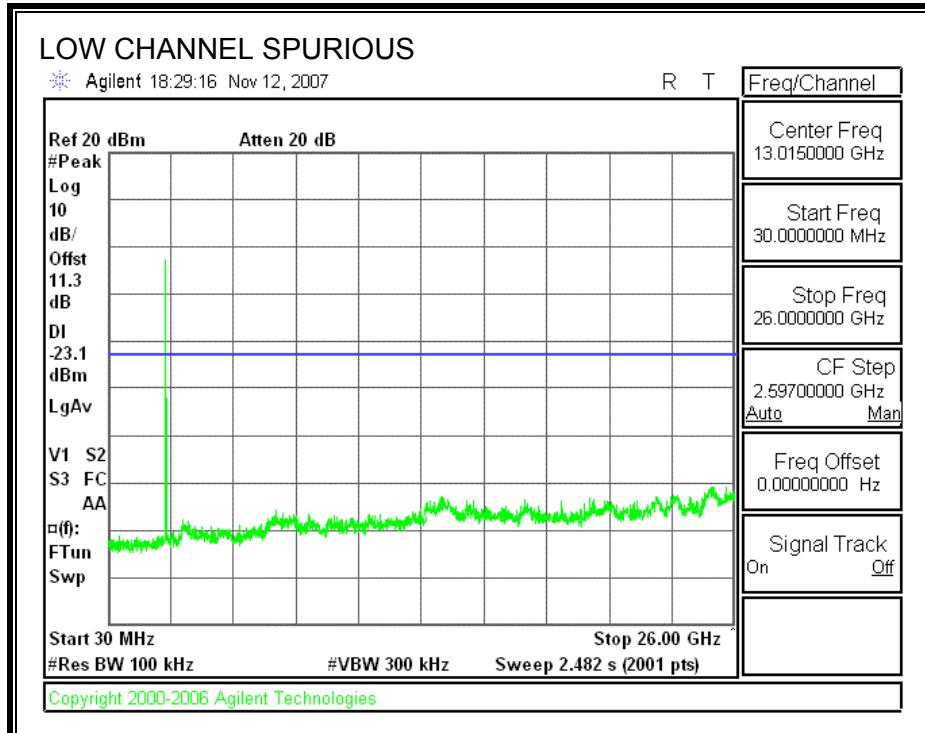
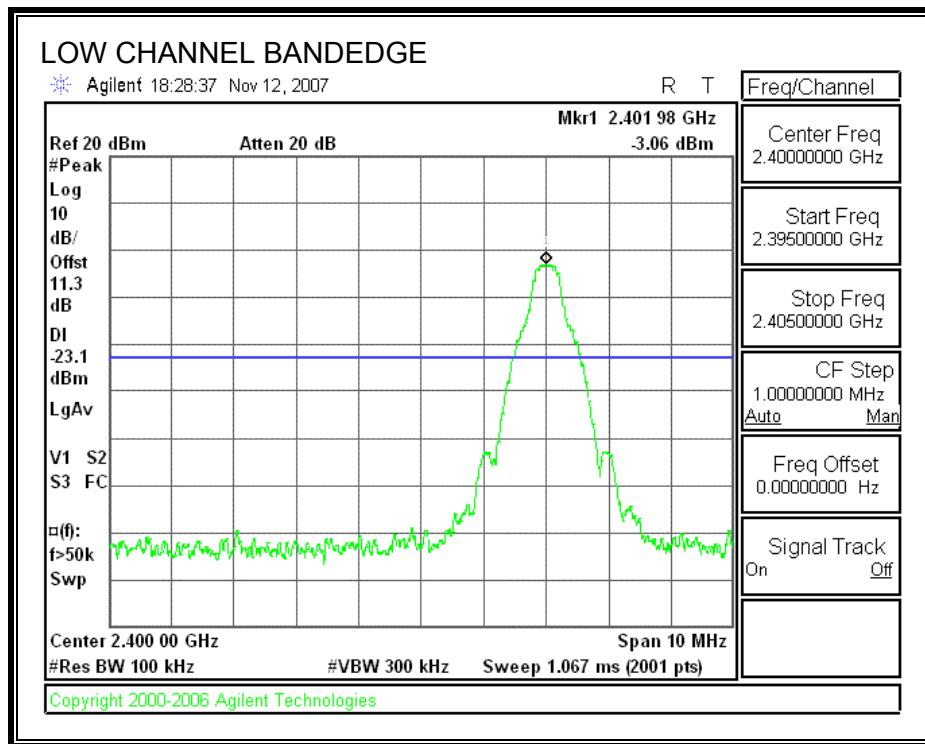
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

RESULTS

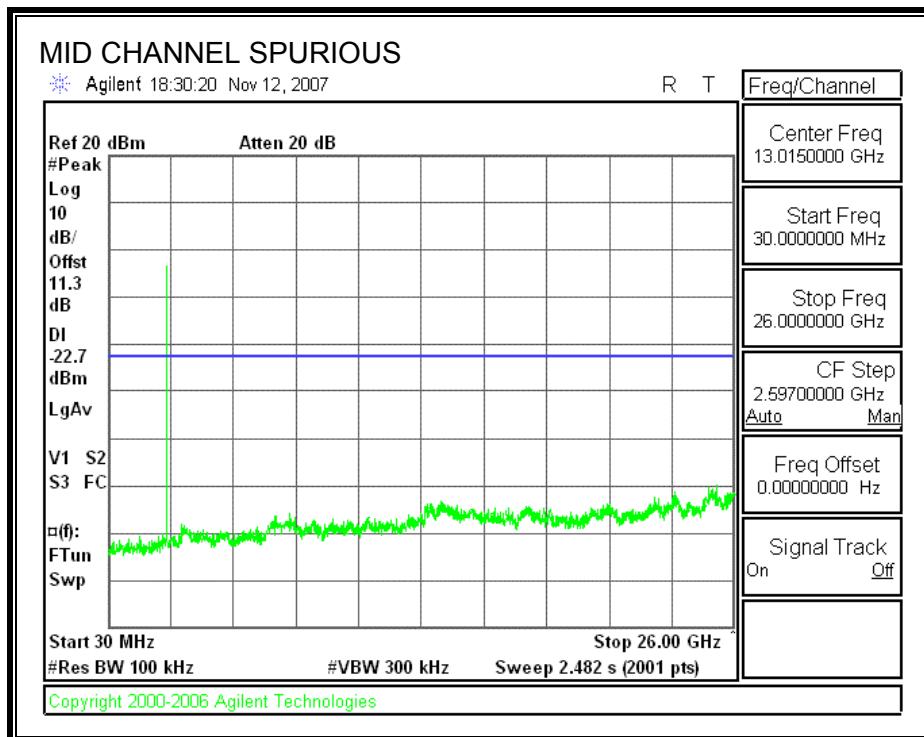
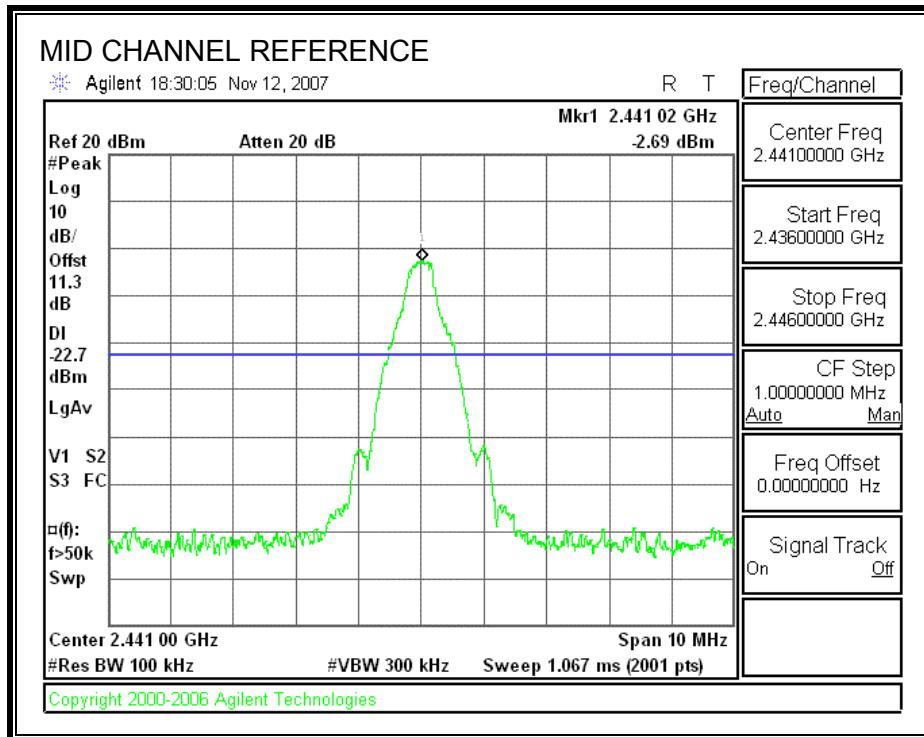
No non-compliance noted:

GFSK

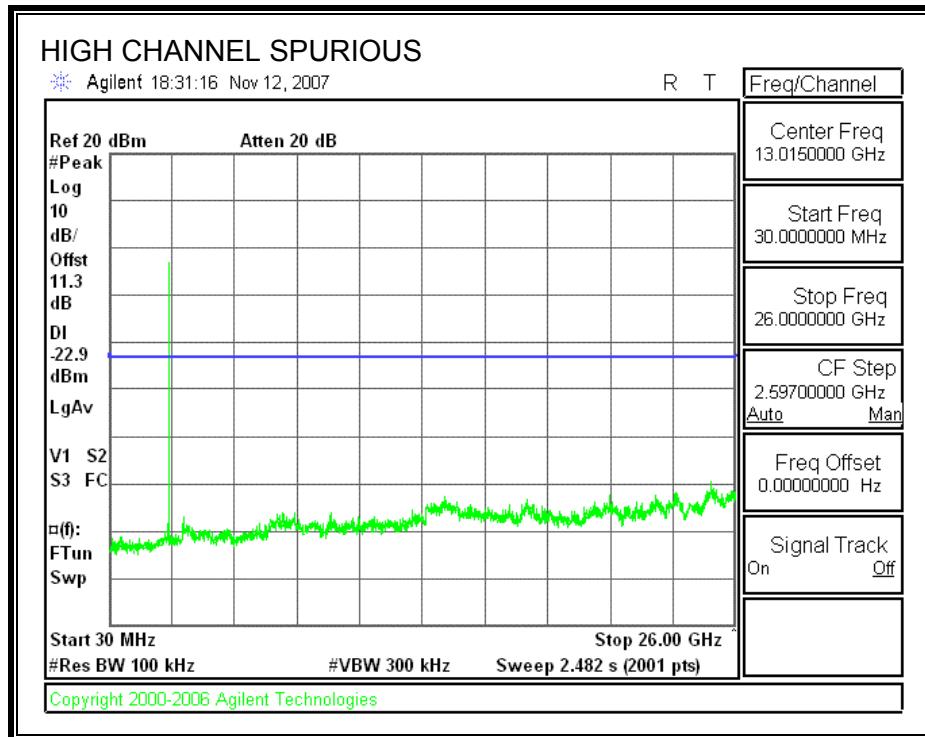
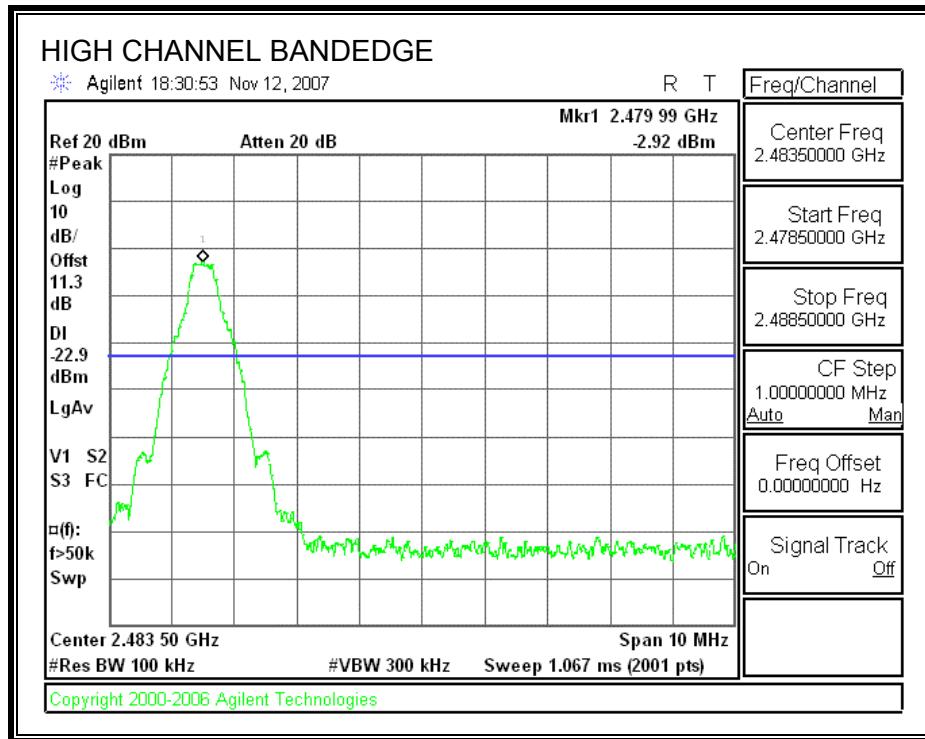
SPURIOUS EMISSIONS, LOW CHANNEL



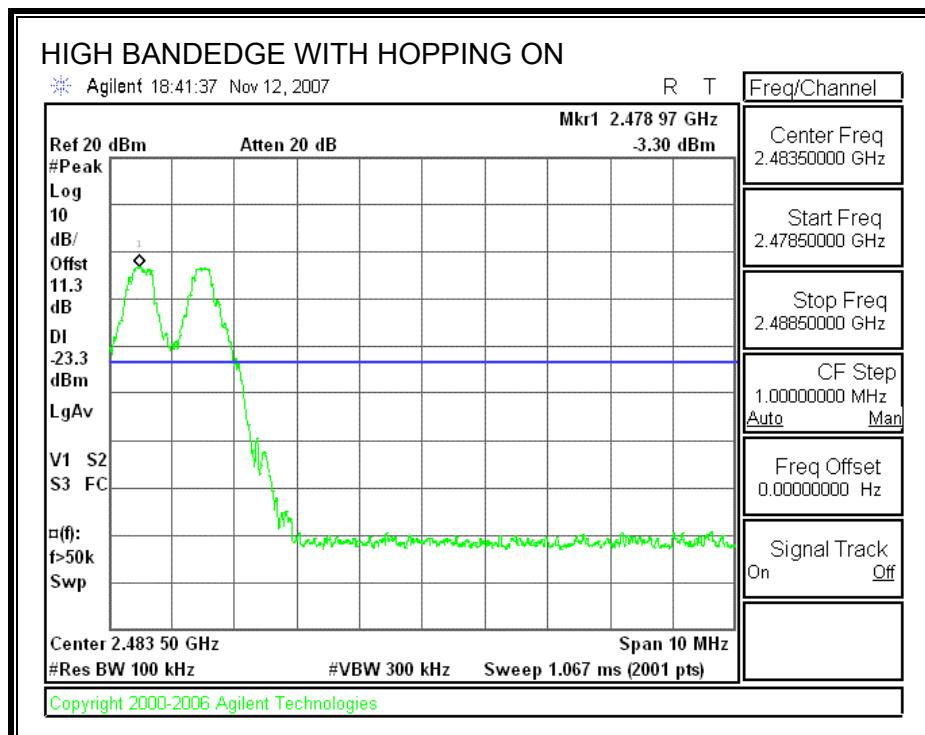
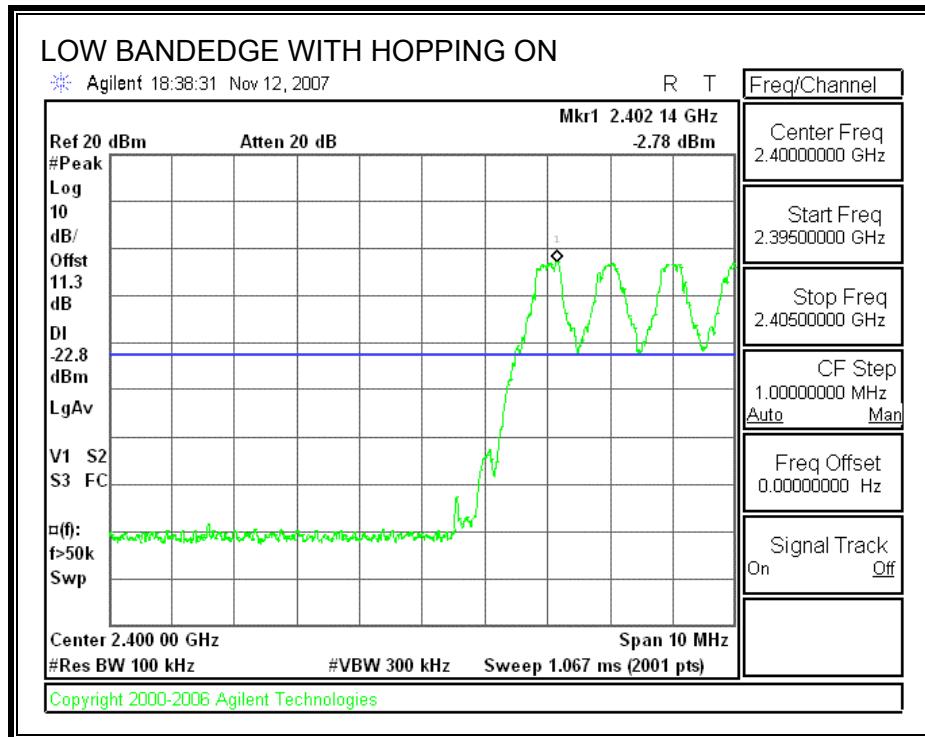
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL

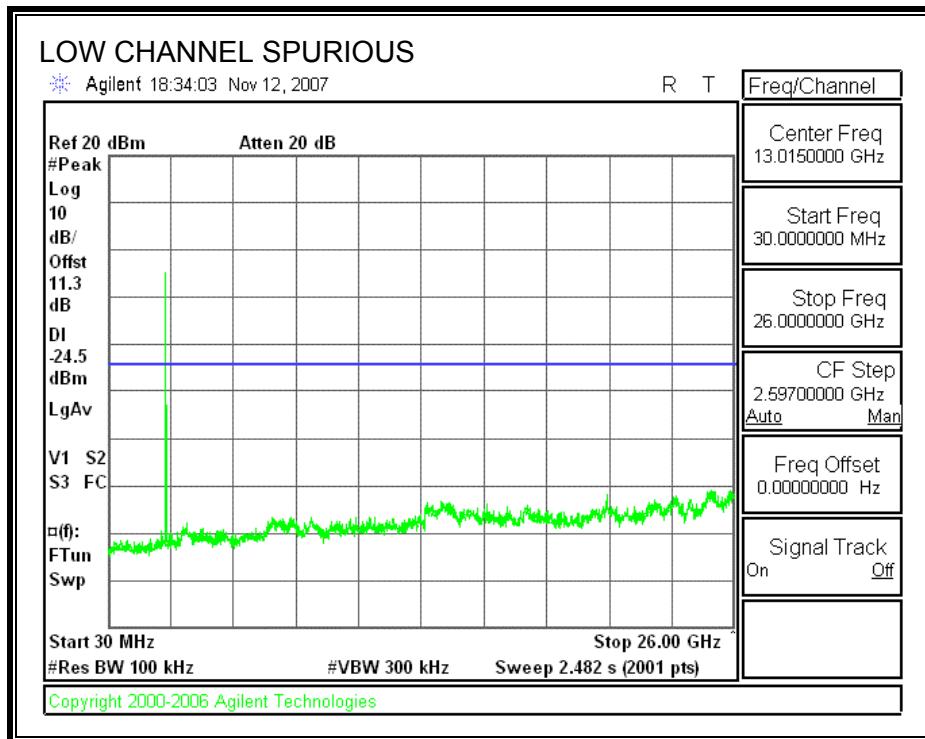
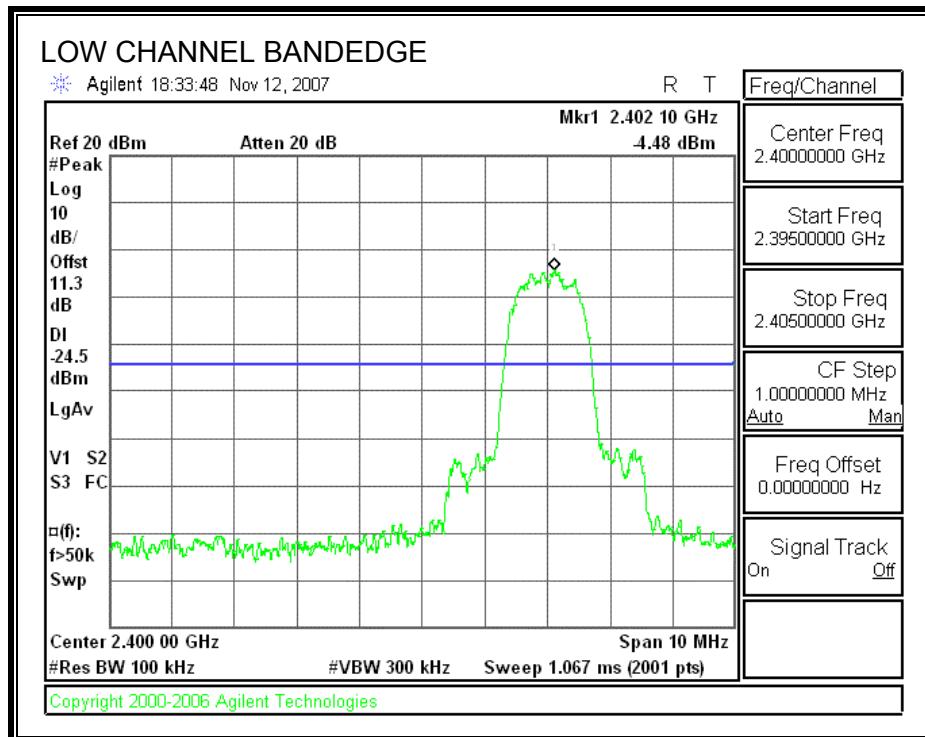


SPURIOUS BANDEdge EMISSIONS WITH HOPPING ON

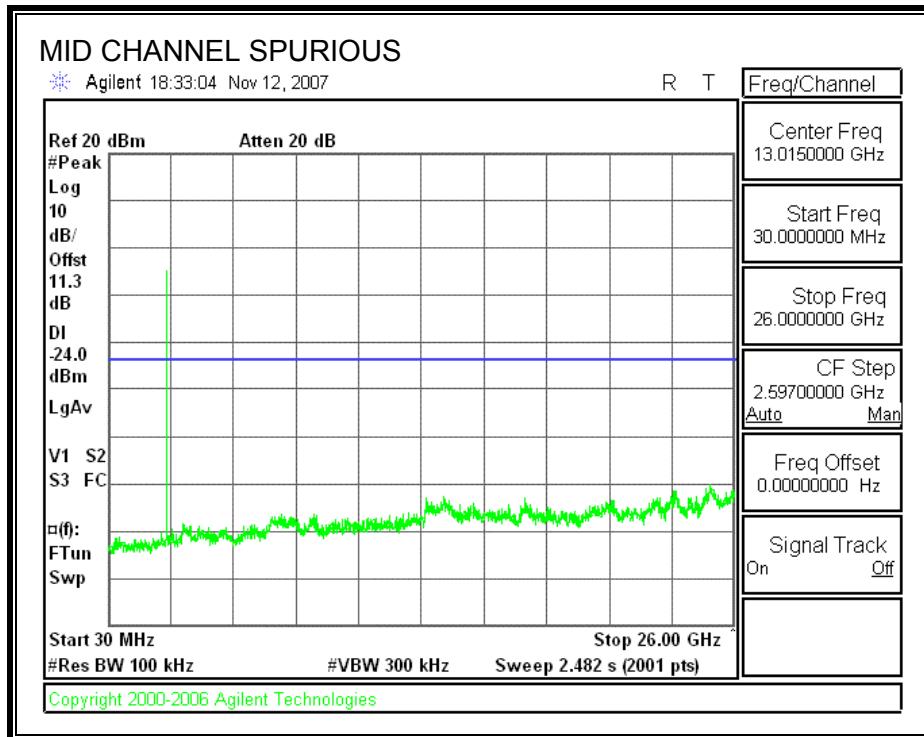
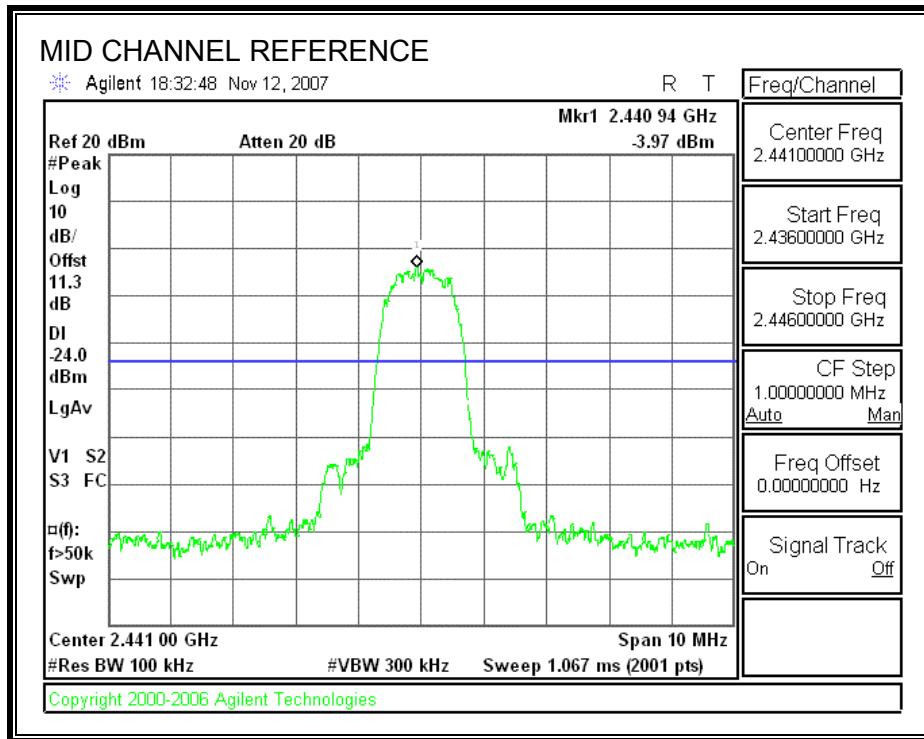


8PSK

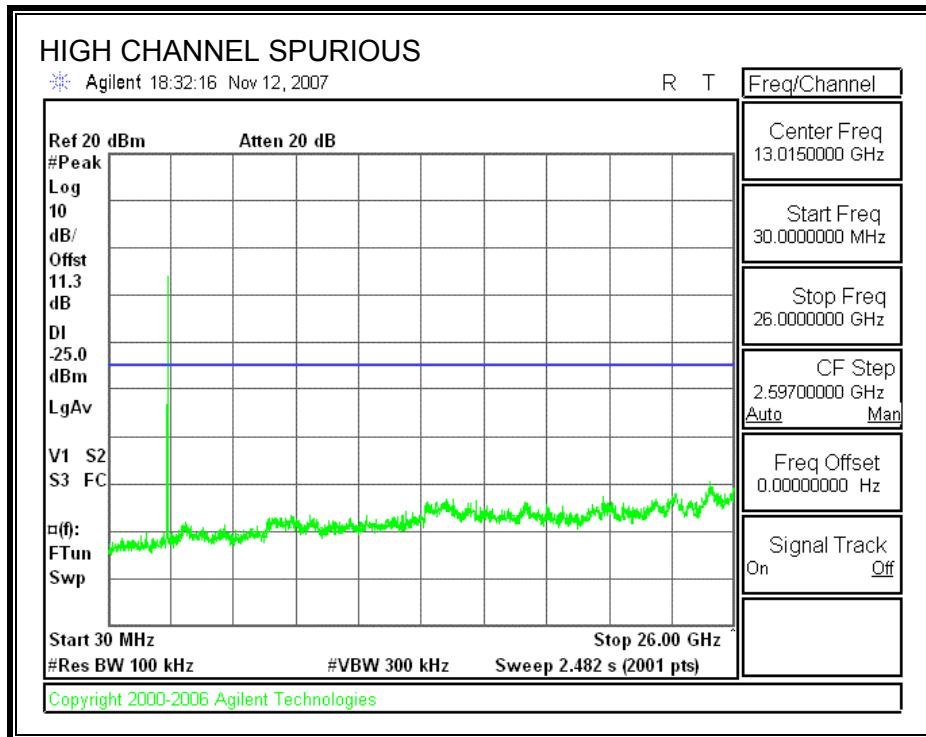
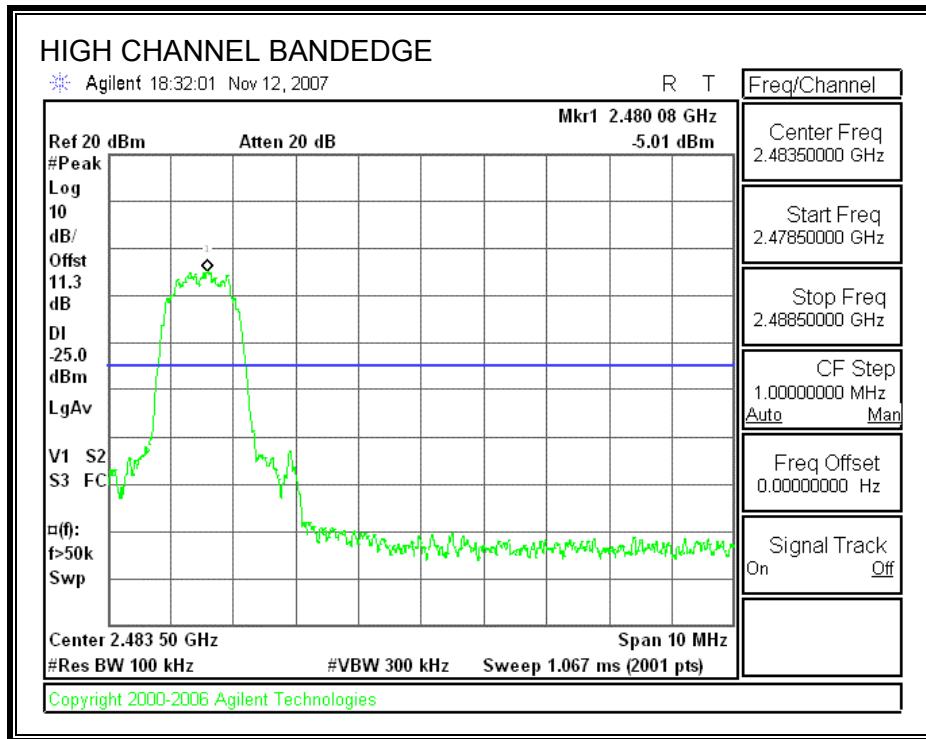
SPURIOUS EMISSIONS, LOW CHANNEL



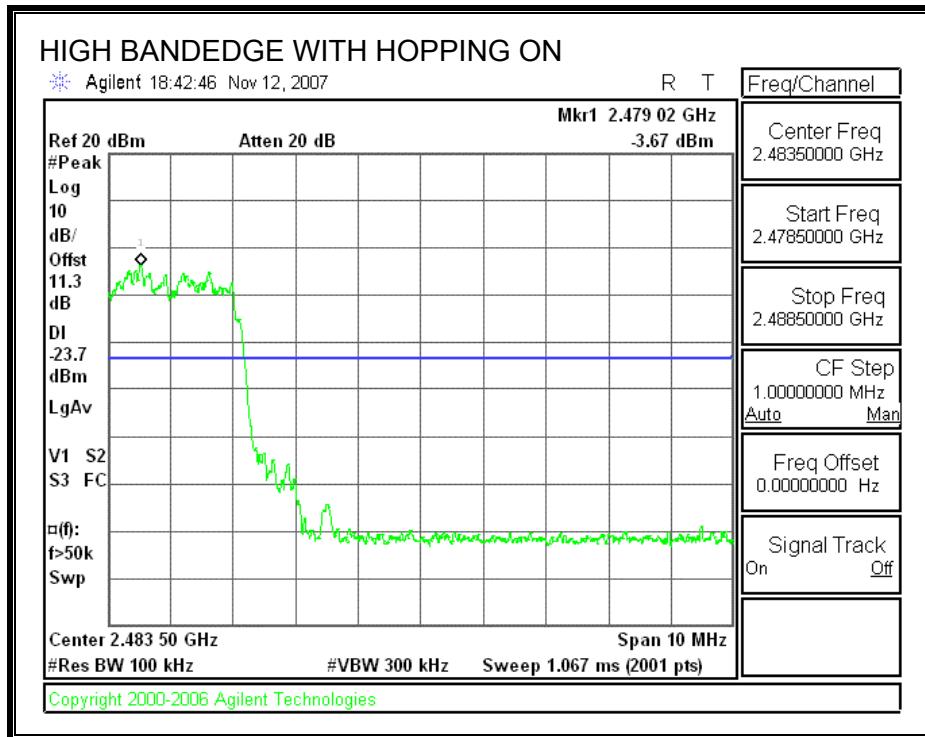
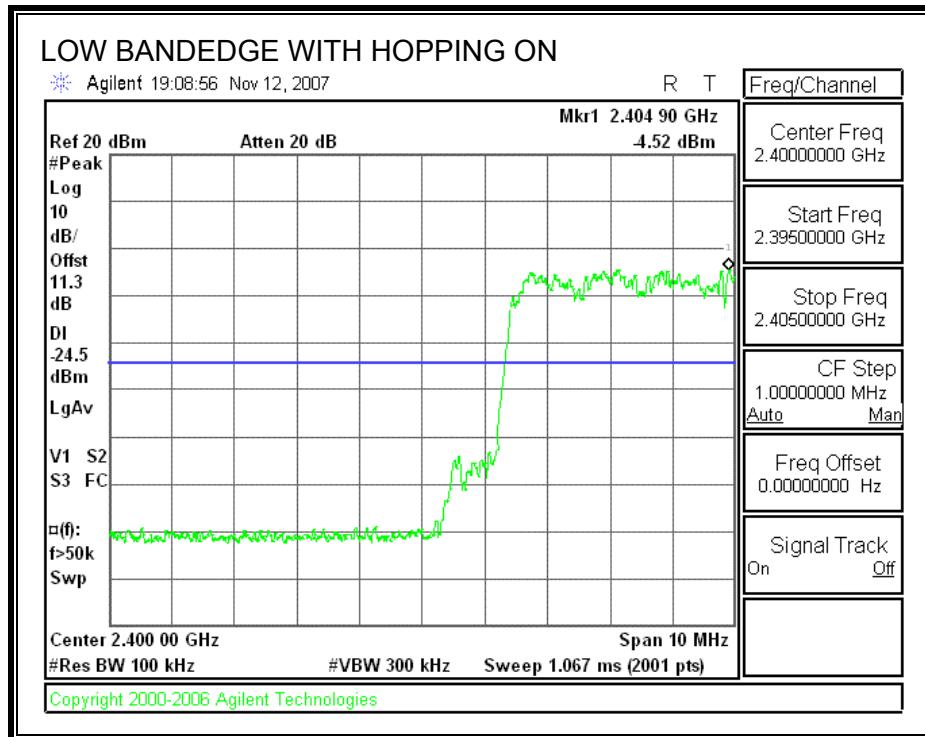
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEdge EMISSIONS WITH HOPPING ON



8.2. RADIATED EMISSIONS

8.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

LIMITS

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

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.

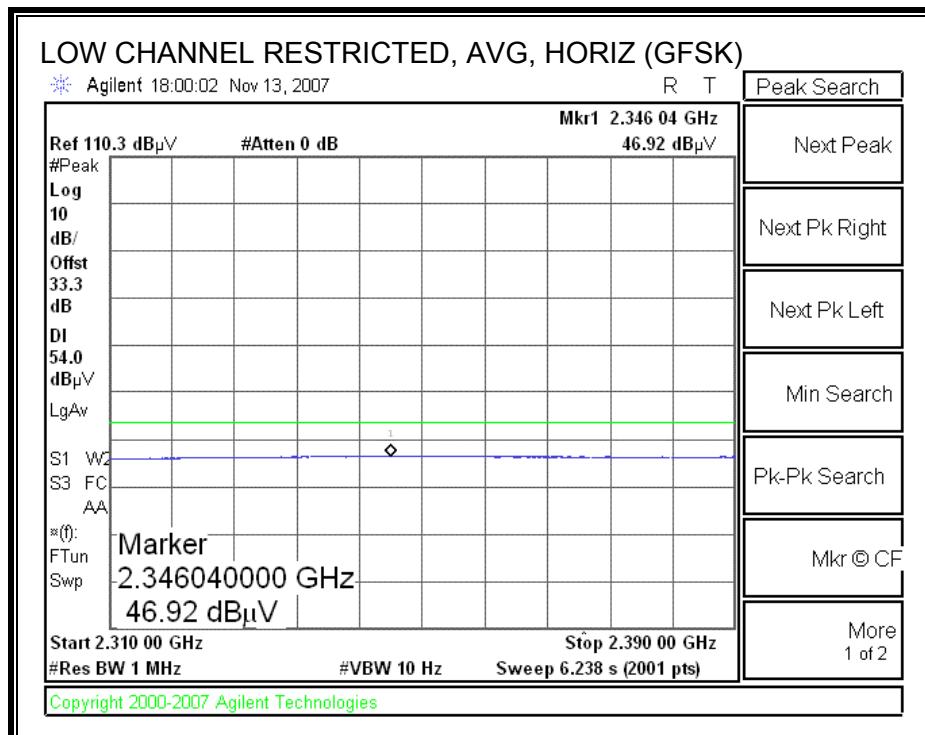
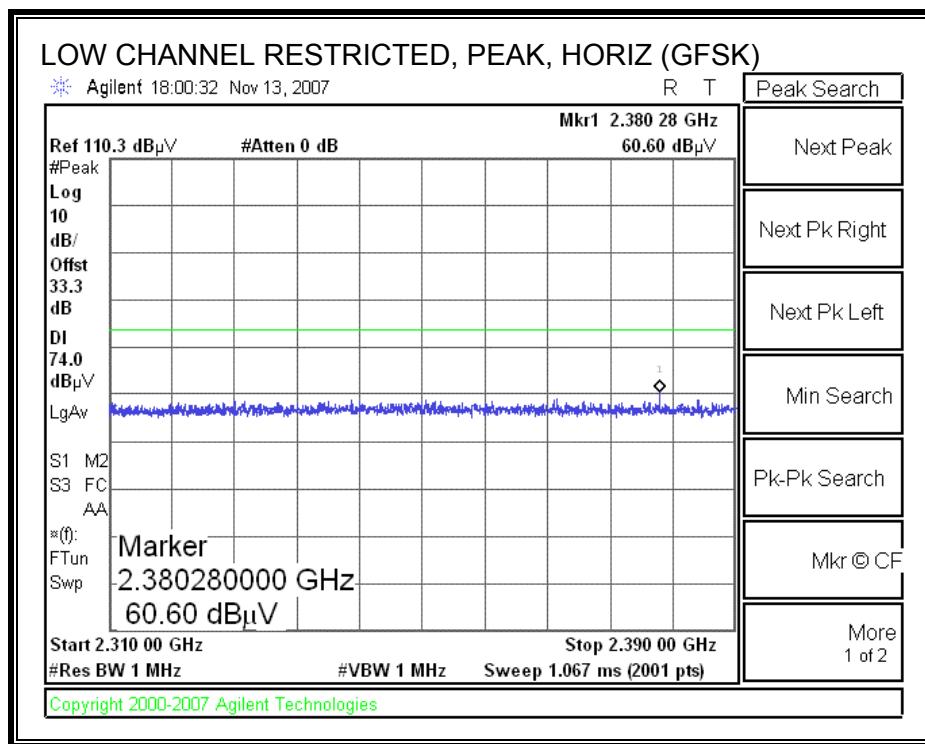
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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.

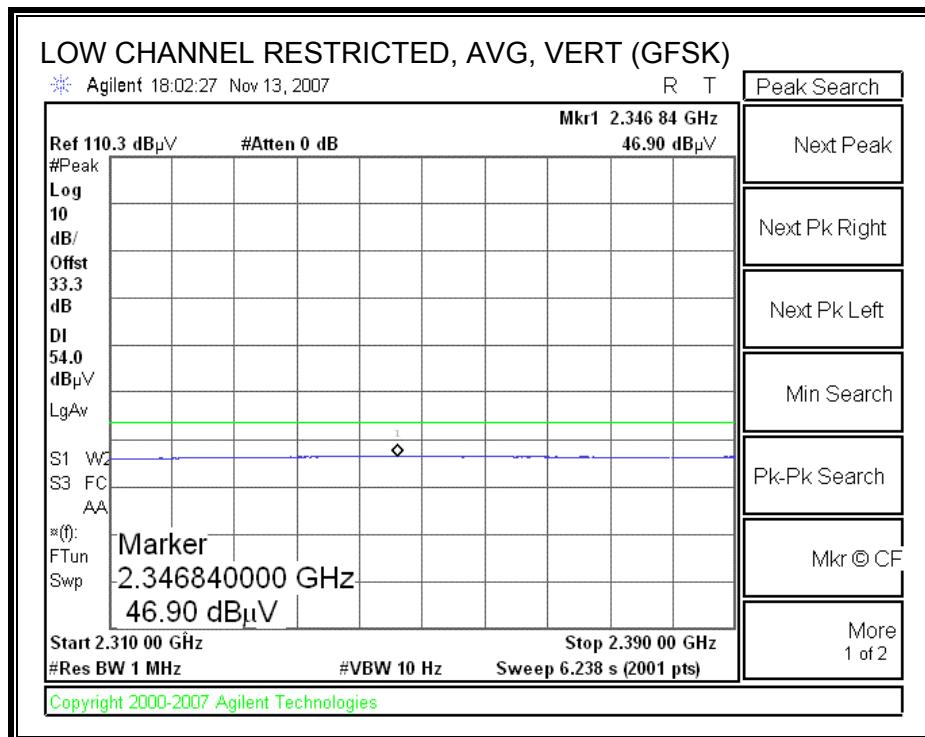
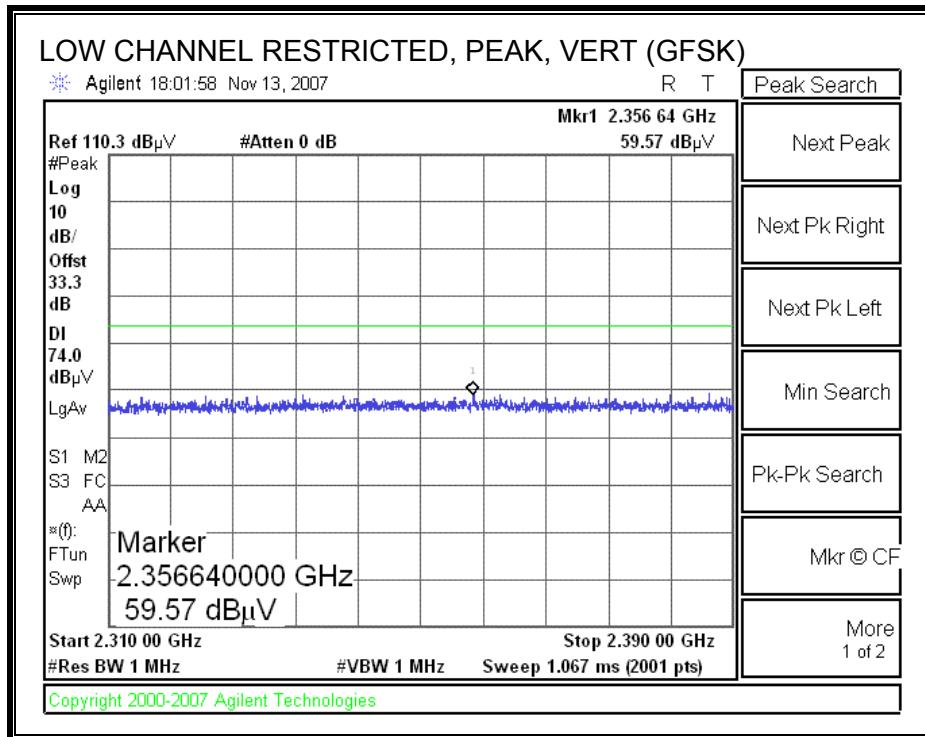
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

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.

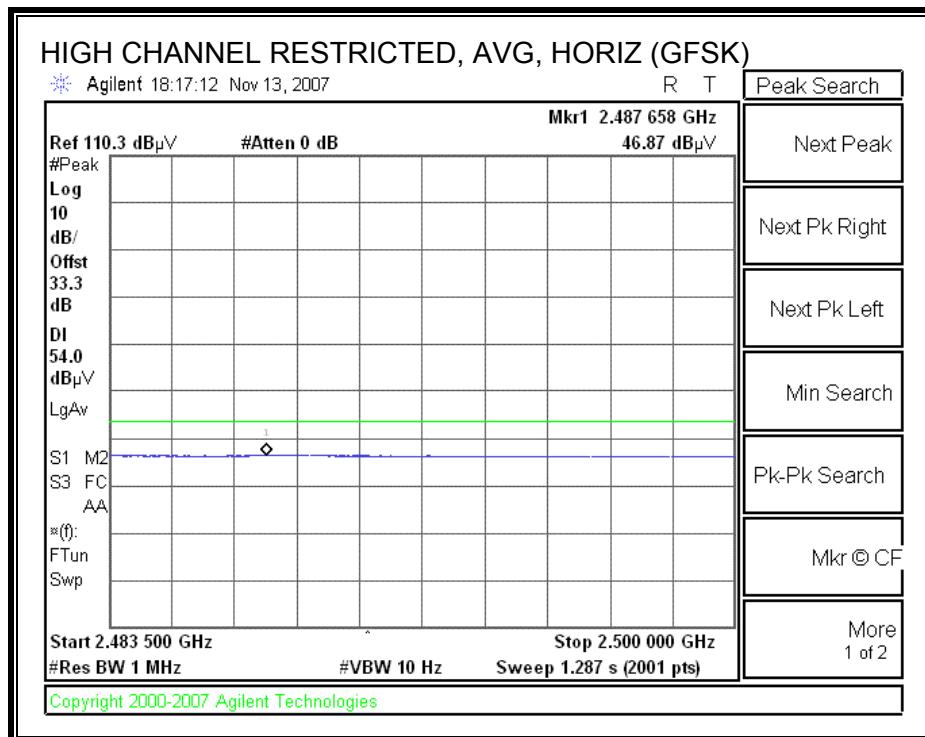
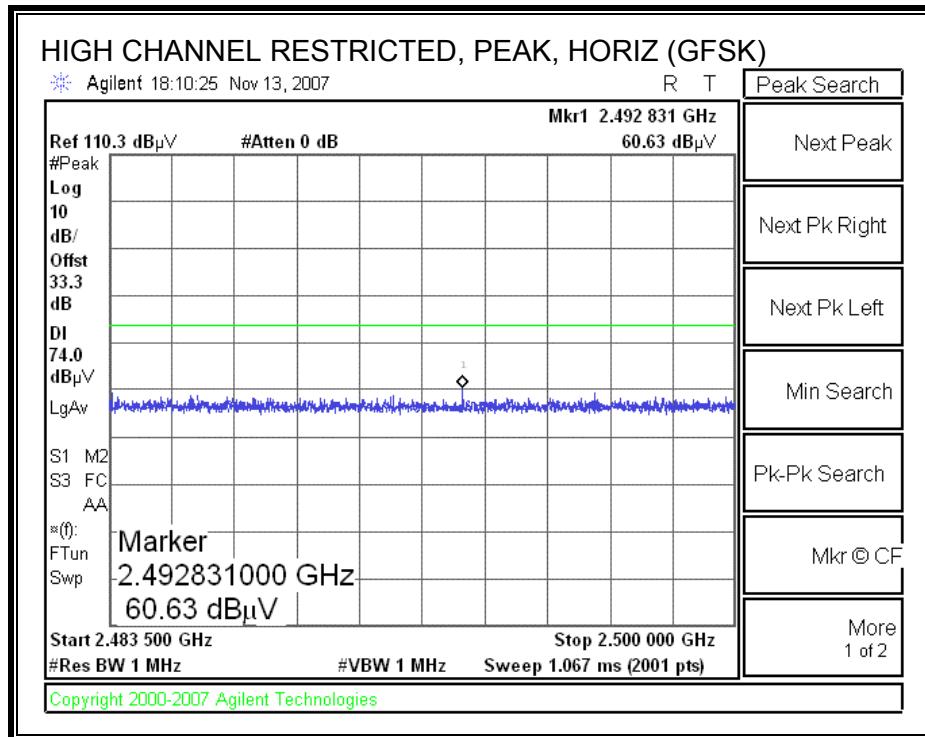
8.2.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ

RESTRICTED BANDEDGE (LOW CHANNEL GFSK, HORIZONTAL)

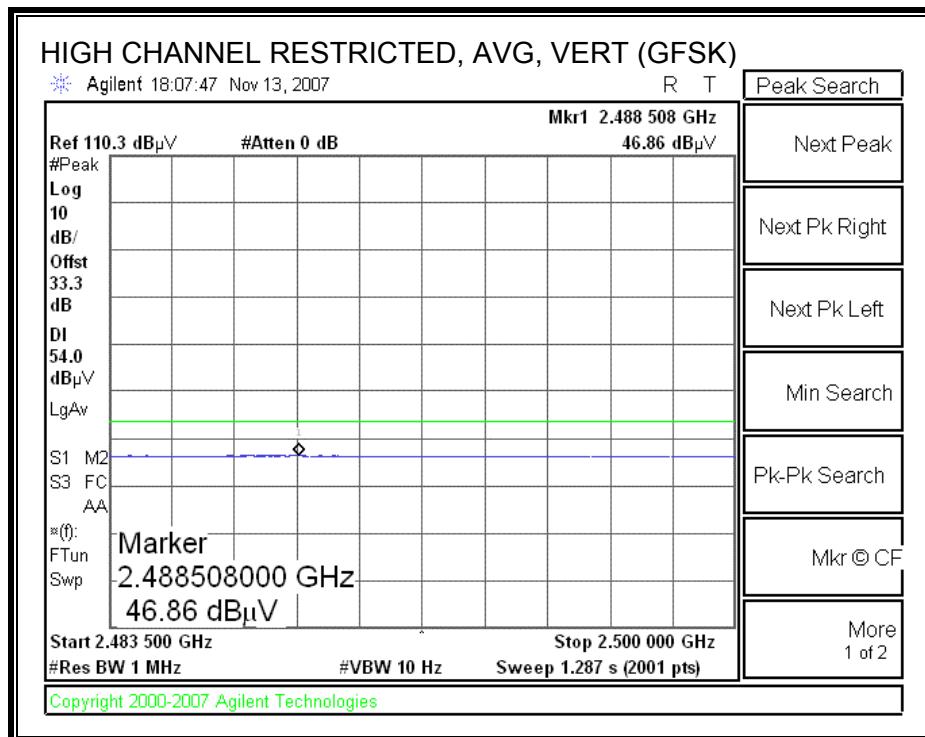
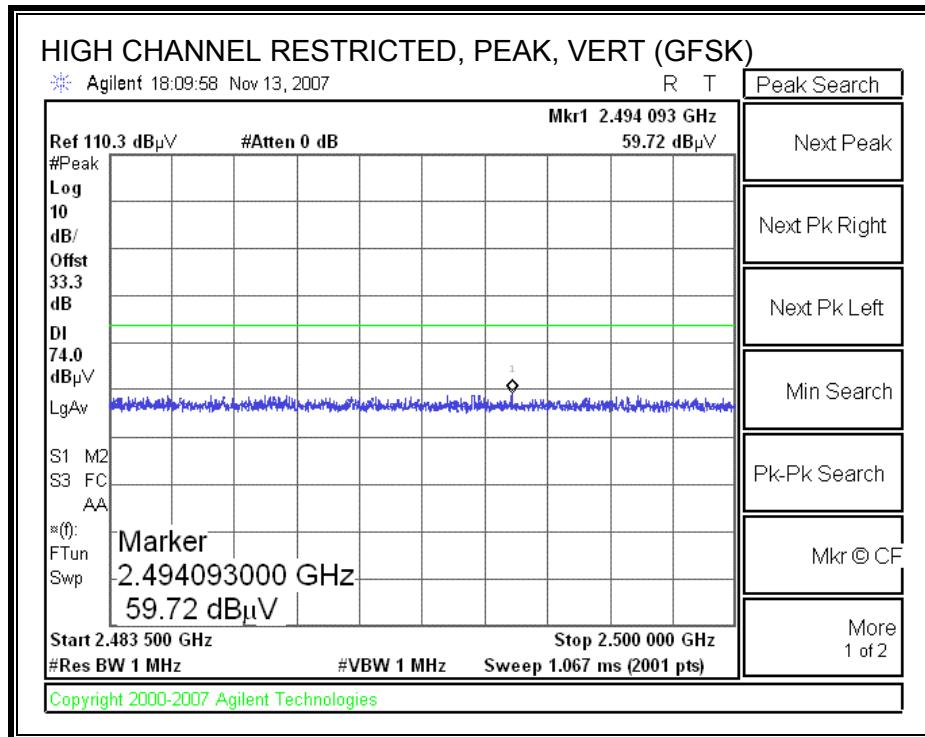
RESTRICTED BANDEDGE (LOW CHANNEL GFSK , VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL GFSK , HORIZONTAL)



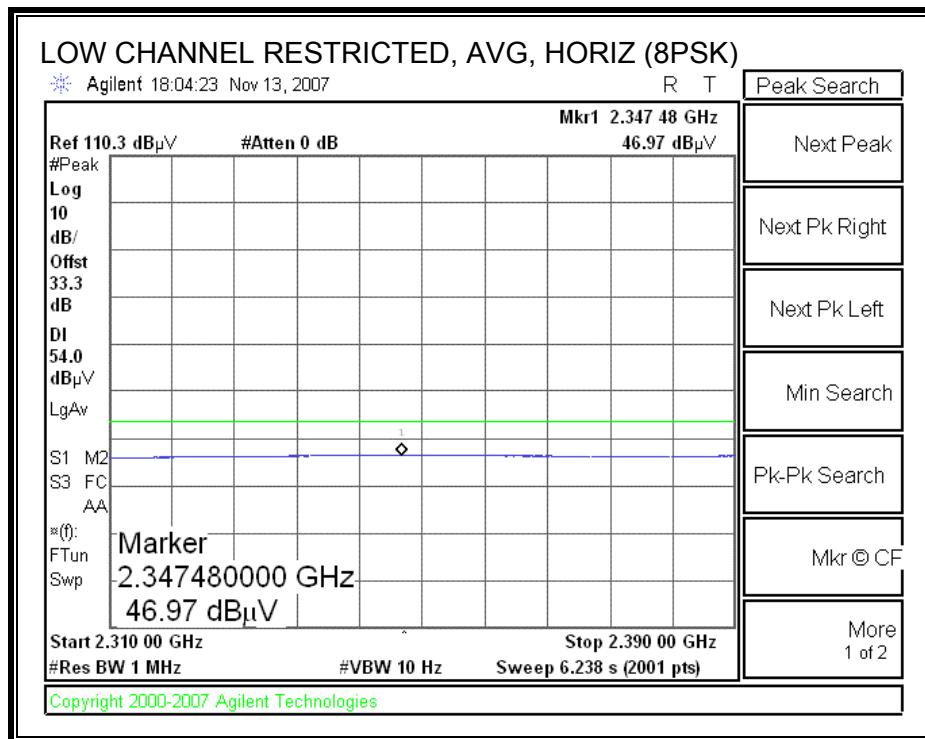
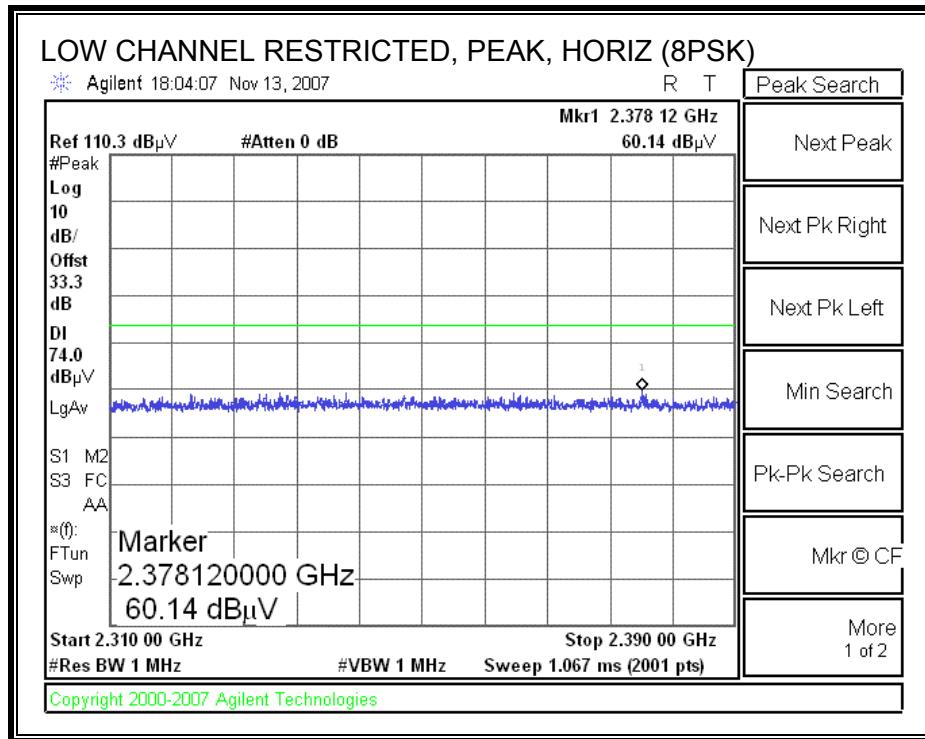
RESTRICTED BANDEDGE (HIGH CHANNEL GFSK, VERTICAL)



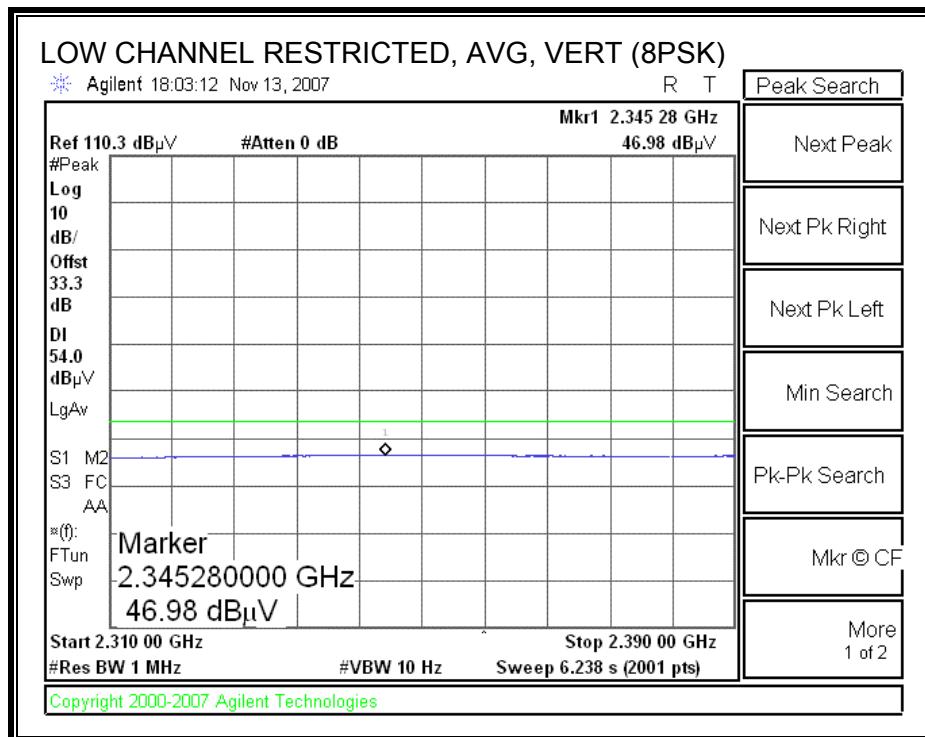
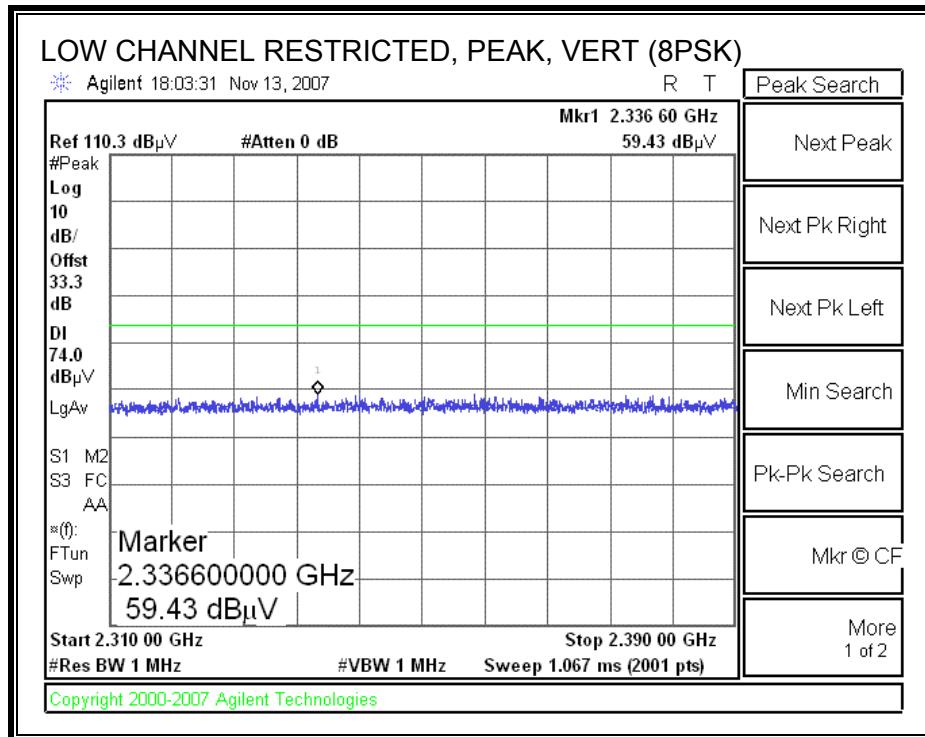
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																	
Company: Broadcom Project #: 07U11428 Date: 11/13/07 Test Engineer: Devin Chang Configuration: EUT With DELL Laptop Mode: GFSK Mode																	
Test Equipment:016																	
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz						Limit					
T73; S/N: 6717 @3m		T144 Miteq 3008A00931										FCC 15.209					
Hi Frequency Cables																	
2 foot cable		3 foot cable		12 foot cable		HPF			Reject Filter			Peak Measurements RBW=VBW=1MHz					
				A-5m Chamber								R_001					
Average Measurements RBW=1MHz ; VBW=10Hz																	
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)		
Low Ch. (2402 MHz)																	
1.010	3.0	50.3	33.7	23.8	3.0	-39.5	0.0	0.0	37.6	21.1	74	54	-36.4	-32.9	V		
1.347	3.0	51.3	35.1	25.1	3.5	-39.0	0.0	0.0	40.8	24.6	74	54	-33.2	-29.4	V		
1.010	3.0	52.4	38.2	23.8	3.0	-39.5	0.0	0.0	39.7	25.6	74	54	-34.3	-28.4	H		
1.347	3.0	52.1	36.0	25.1	3.5	-39.0	0.0	0.0	41.6	25.5	74	54	-32.4	-28.5	H		
Mid Ch. (2441 MHz)																	
1.010	3.0	49.4	33.9	23.8	3.0	-39.5	0.0	0.0	36.7	21.2	74	54	-37.3	-32.8	V		
1.347	3.0	52.0	35.0	25.1	3.5	-39.0	0.0	0.0	41.5	24.5	74	54	-32.5	-29.5	V		
1.010	3.0	53.5	38.0	23.8	3.0	-39.5	0.0	0.0	40.8	25.3	74	54	-33.2	-28.7	H		
1.347	3.0	52.6	36.1	25.1	3.5	-39.0	0.0	0.0	42.1	25.6	74	54	-31.9	-28.4	H		
Hi Ch. (2480 MHz)																	
1.010	3.0	48.4	33.8	23.8	3.0	-39.5	0.0	0.0	35.8	21.2	74	54	-38.2	-32.8	V		
1.347	3.0	52.7	35.6	25.1	3.5	-39.0	0.0	0.0	42.2	25.1	74	54	-31.8	-28.9	V		
1.010	3.0	53.8	38.4	23.8	3.0	-39.5	0.0	0.0	41.2	25.8	74	54	-32.8	-28.2	H		
1.347	3.0	51.6	35.7	25.1	3.5	-39.0	0.0	0.0	41.2	25.2	74	54	-32.8	-28.8	H		
Rev. 4.12.7																	
f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss				Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter				Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit									

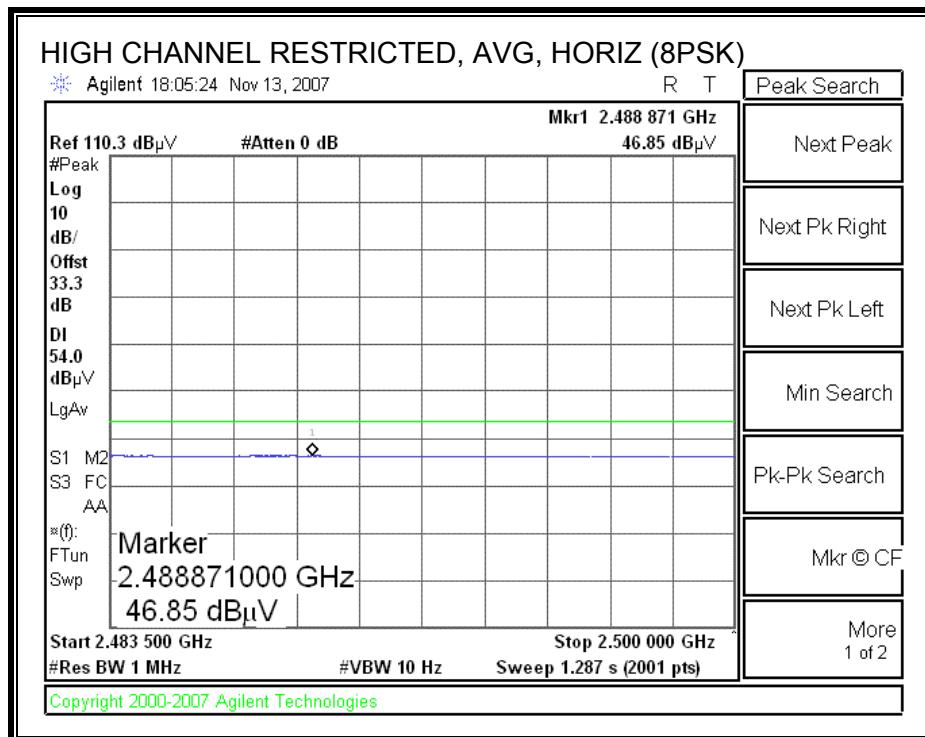
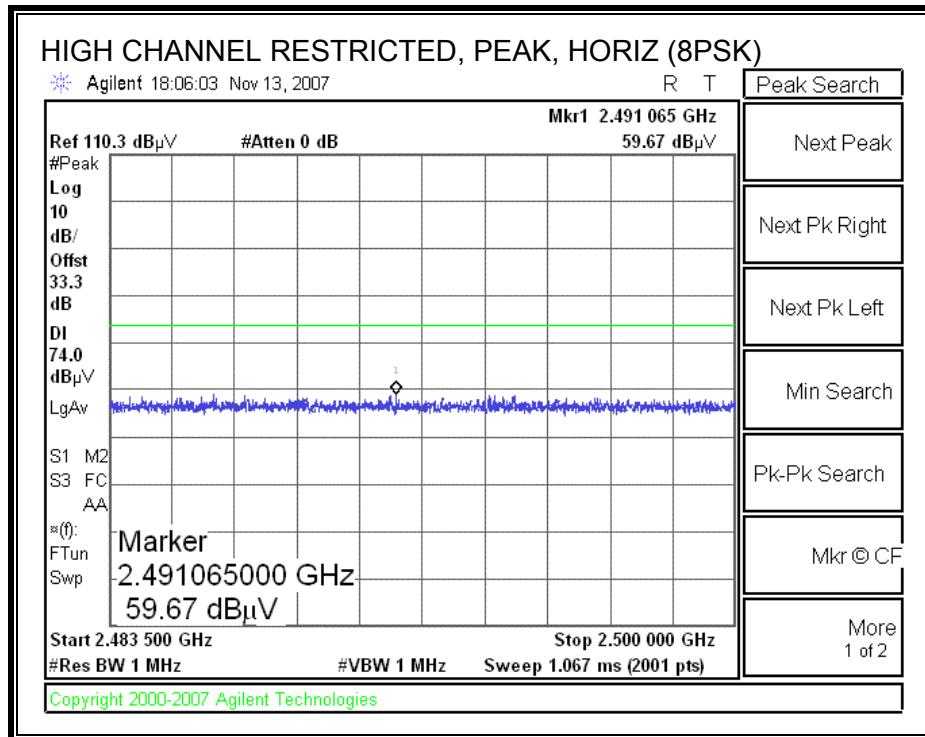
RESTRICTED BANDEDGE (LOW CHANNEL 8PSK, HORIZONTAL)



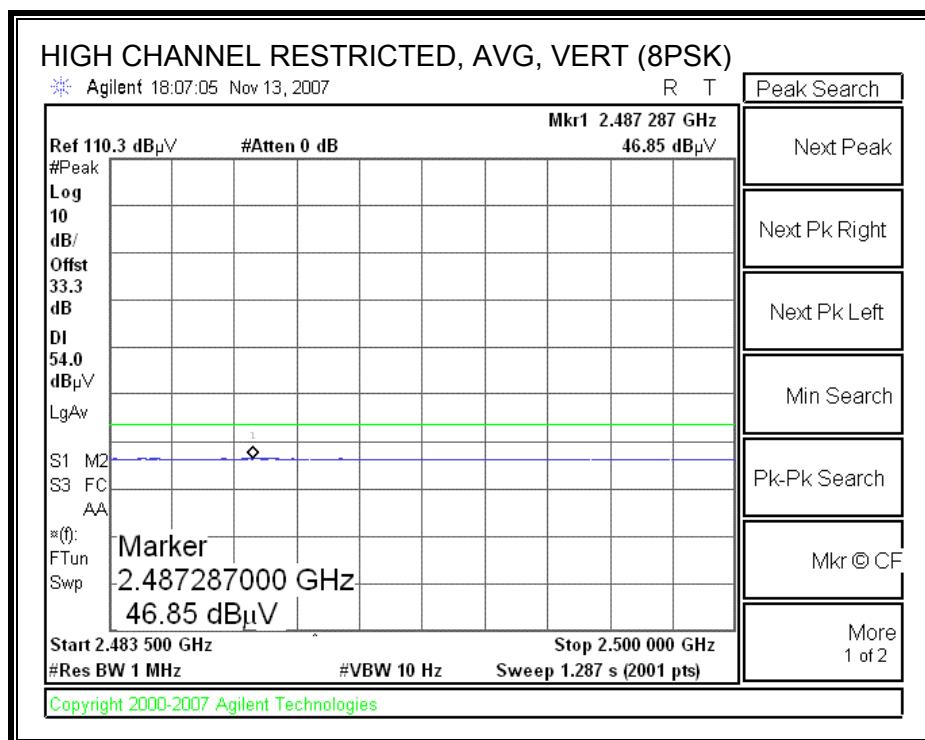
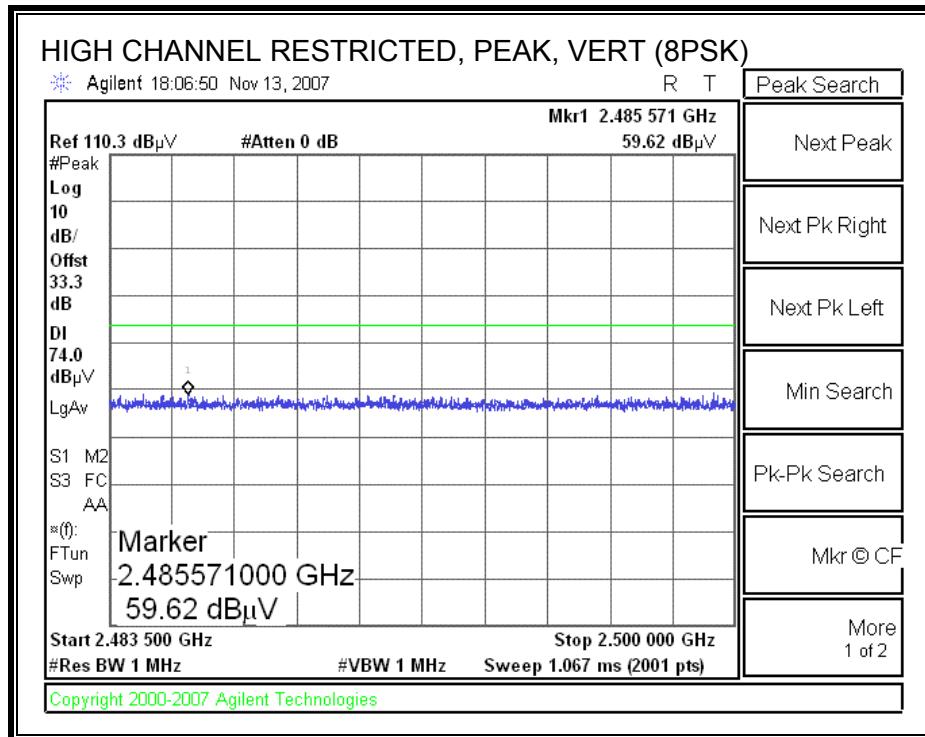
RESTRICTED BANDEDGE (LOW CHANNEL 8PSK, VERTICAL)



RESTRICTED BANDEDGE (HIGH CHANNEL 8PSK, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL 8PSK , VERTICAL)

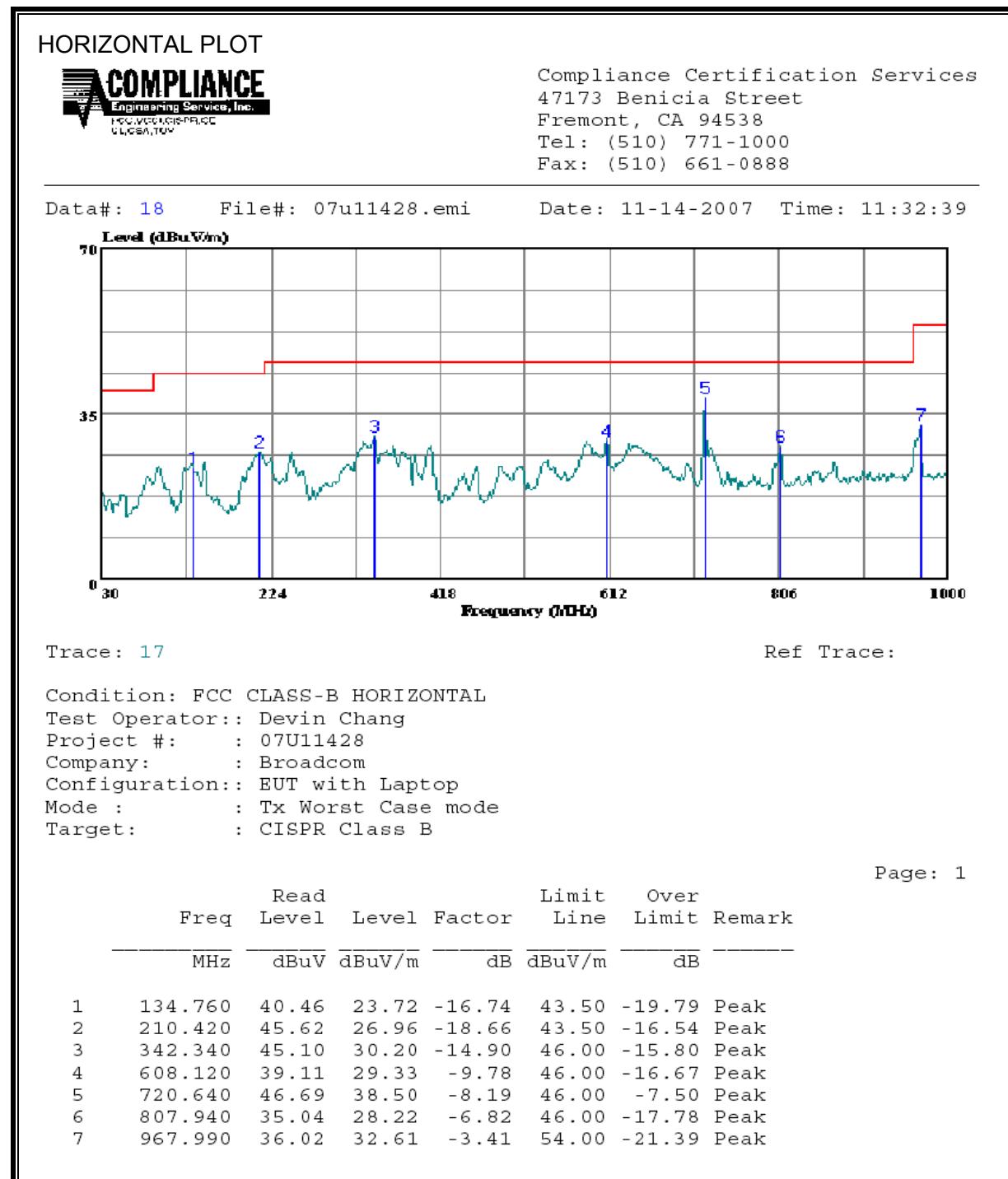


HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																																																																																																																																																																																																																																																																																																																																																																																			
<p>Company: Broadcom Project #: 07U11428 Date: 11/13/07 Test Engineer: Devin Chang Configuration: EUT With DELL Laptop Mode: 8PSK Mode</p> <p><u>Test Equipment:016</u></p> <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="4">Horn > 18GHz</td> <td>Limit</td> </tr> <tr> <td>T73; S/N: 6717 @3m</td> <td>T144 Miteq 3008A00931</td> <td></td> <td colspan="4"></td> <td>FCC 15.209</td> </tr> <tr> <td colspan="18">Hi Frequency Cables</td> </tr> <tr> <td>2 foot cable</td> <td>3 foot cable</td> <td>12 foot cable</td> <td colspan="4">A-5m Chamber</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="9"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz </td> </tr> <tr> <td>f GHz</td> <td>Dist (m)</td> <td>Read Pk dBuV</td> <td>Read Avg. dBuV</td> <td>AF dB/m</td> <td>CL dB</td> <td>Amp dB</td> <td>D Corr dB</td> <td>Fltr dB</td> <td>Peak dBuV/m</td> <td>Avg dBuV/m</td> <td>Pk Lim dBuV/m</td> <td>Avg Lim dBuV/m</td> <td>Pk Mar dB</td> <td>Avg Mar dB</td> <td colspan="3">Notes (V/H)</td> </tr> <tr> <td colspan="18">Low Ch. (2402 MHz)</td> </tr> <tr> <td>1.010</td> <td>3.0</td> <td>49.1</td> <td>34.7</td> <td>23.8</td> <td>3.0</td> <td>-39.5</td> <td>0.0</td> <td>0.0</td> <td>36.5</td> <td>22.1</td> <td>74</td> <td>54</td> <td>-37.5</td> <td>-31.9</td> <td colspan="3">V</td> </tr> <tr> <td>1.347</td> <td>3.0</td> <td>51.5</td> <td>35.3</td> <td>25.1</td> <td>3.5</td> <td>-39.0</td> <td>0.0</td> <td>0.0</td> <td>41.0</td> <td>24.8</td> <td>74</td> <td>54</td> <td>-33.0</td> <td>-29.2</td> <td colspan="3">V</td> </tr> <tr> <td>1.010</td> <td>3.0</td> <td>48.7</td> <td>34.7</td> <td>23.8</td> <td>3.0</td> <td>-39.5</td> <td>0.0</td> <td>0.0</td> <td>36.1</td> <td>22.1</td> <td>74</td> <td>54</td> <td>-37.9</td> <td>-31.9</td> <td colspan="3">H</td> </tr> <tr> <td>1.347</td> <td>3.0</td> <td>49.7</td> <td>34.7</td> <td>25.1</td> <td>3.5</td> <td>-39.0</td> <td>0.0</td> <td>0.0</td> <td>39.2</td> <td>24.2</td> <td>74</td> <td>54</td> <td>-34.8</td> <td>-29.8</td> <td colspan="3">H</td> </tr> <tr> <td colspan="18">Mid Ch. 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8.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

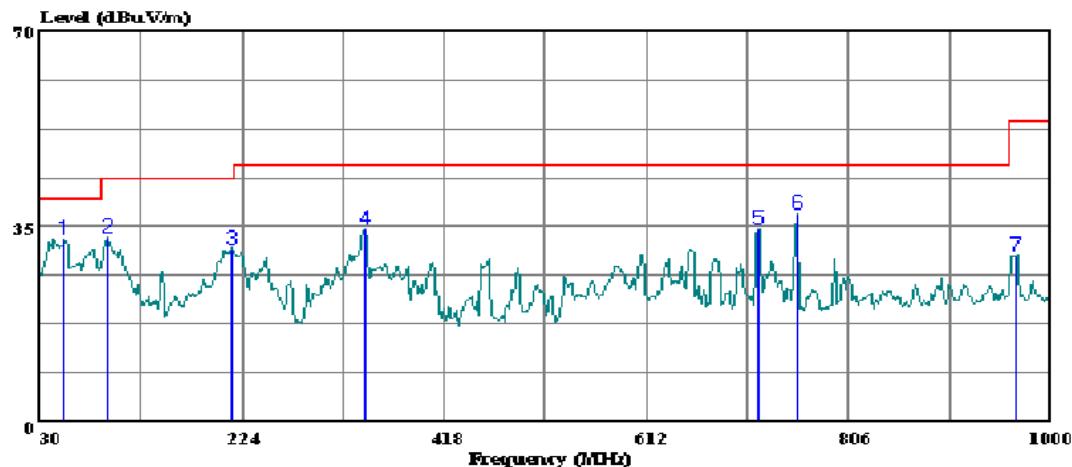
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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

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

Data#: 20 File#: 07u11428.emi Date: 11-14-2007 Time: 11:53:55



Trace: 19

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Devin Chang
Project #: 07U11428
Company: Broadcom
Configuration:: EUT with Laptop
Mode : Tx Worst Case mode
Target: CISPR Class B

Page: 1

Freq	Read			Limit	Over	Remark
	Level	Level	Factor			
MHz	dBuV	dBuV/m	dB	dBuV/m	dB	
1 53.280	55.26	32.64	-22.62	40.00	-7.36	Peak
2 94.990	54.79	33.00	-21.79	43.50	-10.50	Peak
3 214.300	49.72	30.93	-18.79	43.50	-12.57	Peak
4 342.340	49.47	34.57	-14.90	46.00	-11.43	Peak
5 719.670	42.57	34.43	-8.14	46.00	-11.57	Peak
6 756.530	44.74	37.15	-7.59	46.00	-8.85	Peak
7 966.050	33.41	29.77	-3.64	54.00	-24.23	Peak

8.3. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

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.

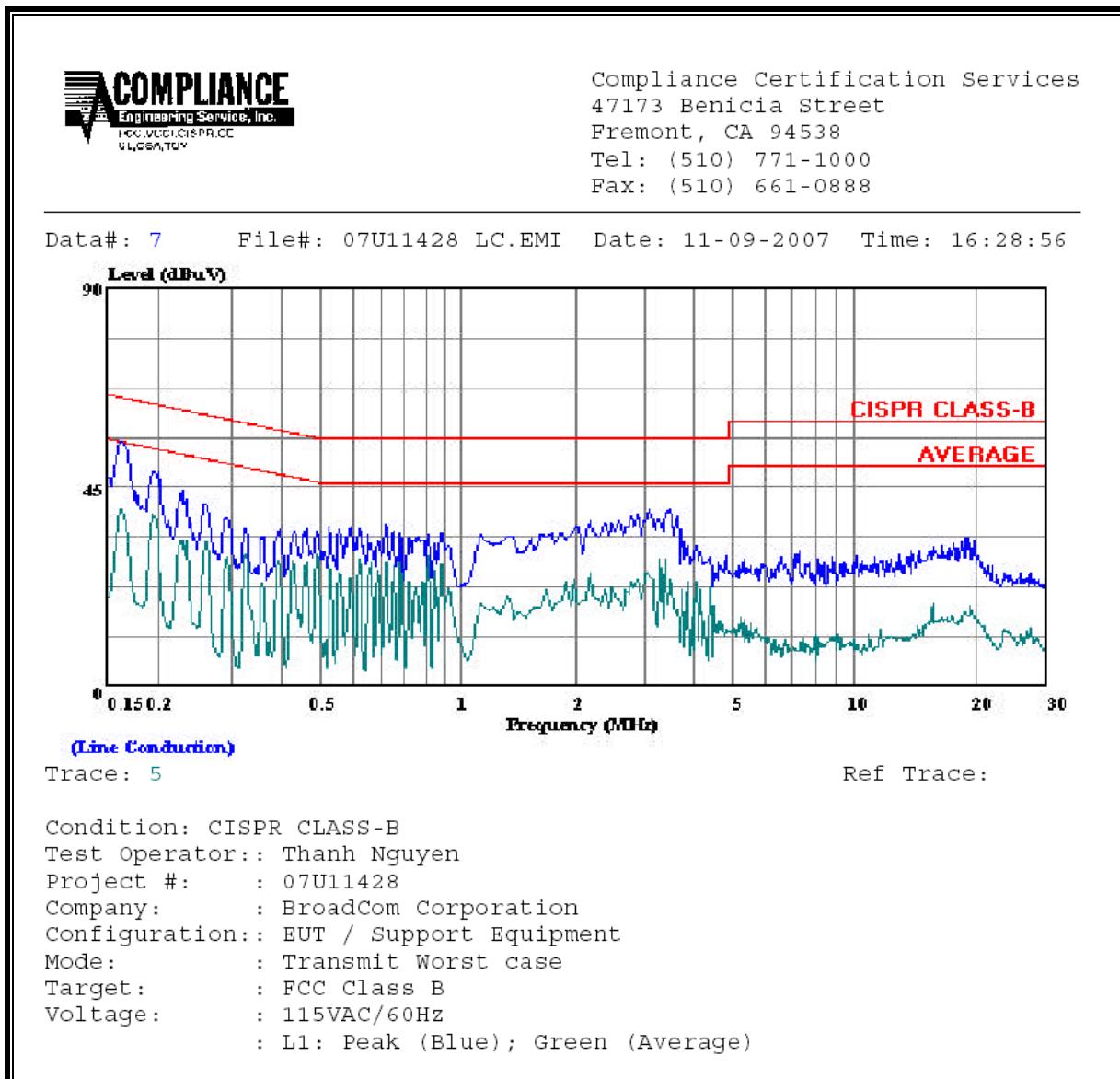
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

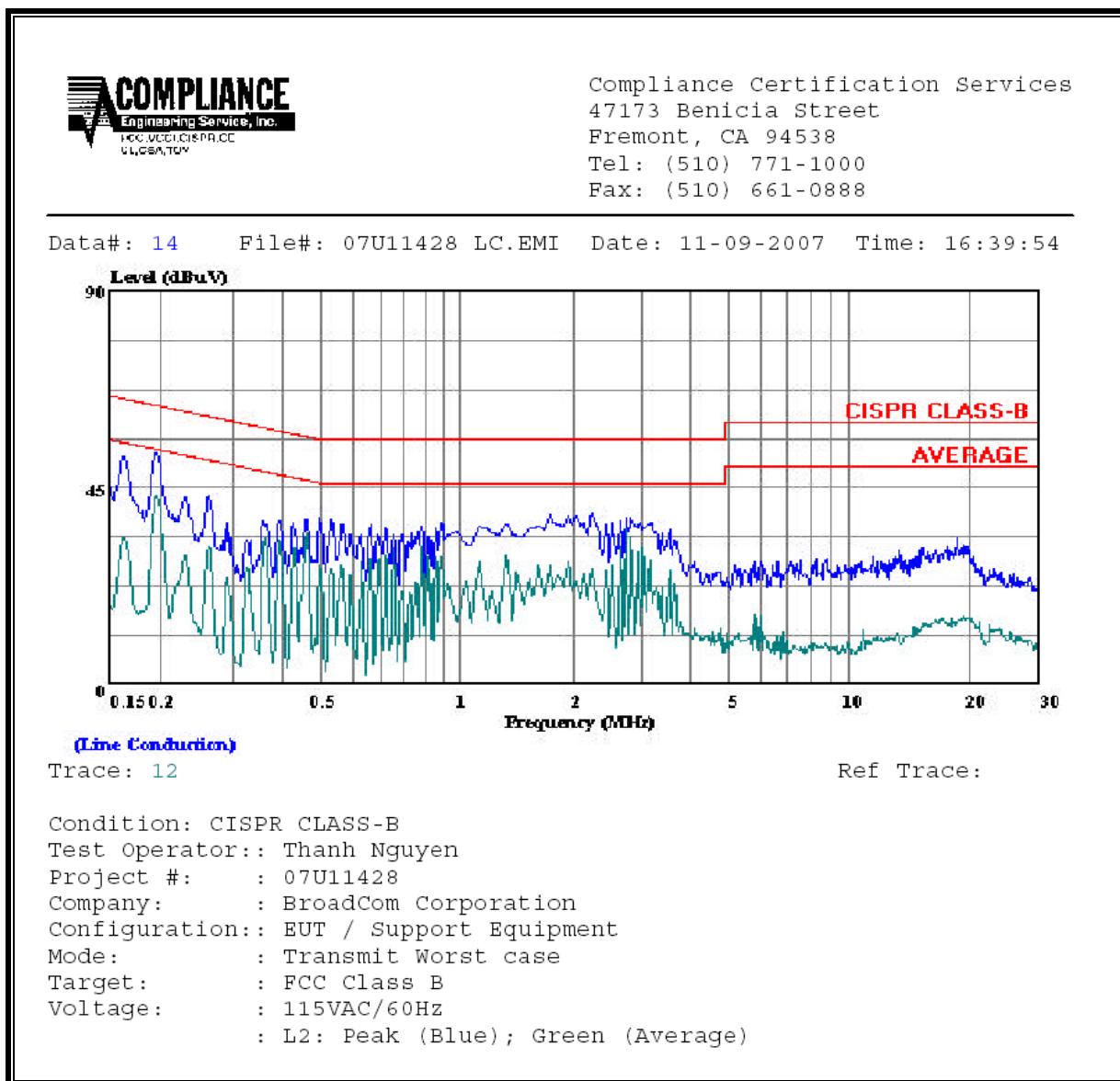
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Closs (dB)	Limit		Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)		QP	AV	QP (dB)	AV (dB)	
0.16	55.38	--	39.99	0.00	65.31	55.31	-9.93	-15.32	L1
0.72	36.58	--	29.79	0.00	56.00	46.00	-19.42	-16.21	L1
3.19	39.58	--	29.02	0.00	56.00	46.00	-16.42	-16.98	L1
0.20	52.80	--	43.02	0.00	63.82	53.82	-11.02	-10.80	L2
0.99	37.10	--	31.73	0.00	56.00	46.00	-18.90	-14.27	L2
2.33	39.28	--	35.48	0.00	56.00	46.00	-16.72	-10.52	L2
6 Worst Data									

LINE 1 RESULTS



LINE 2 RESULTS



9. CO-LOCATED TRANSMITTER EMISSIONS

PROCEDURE

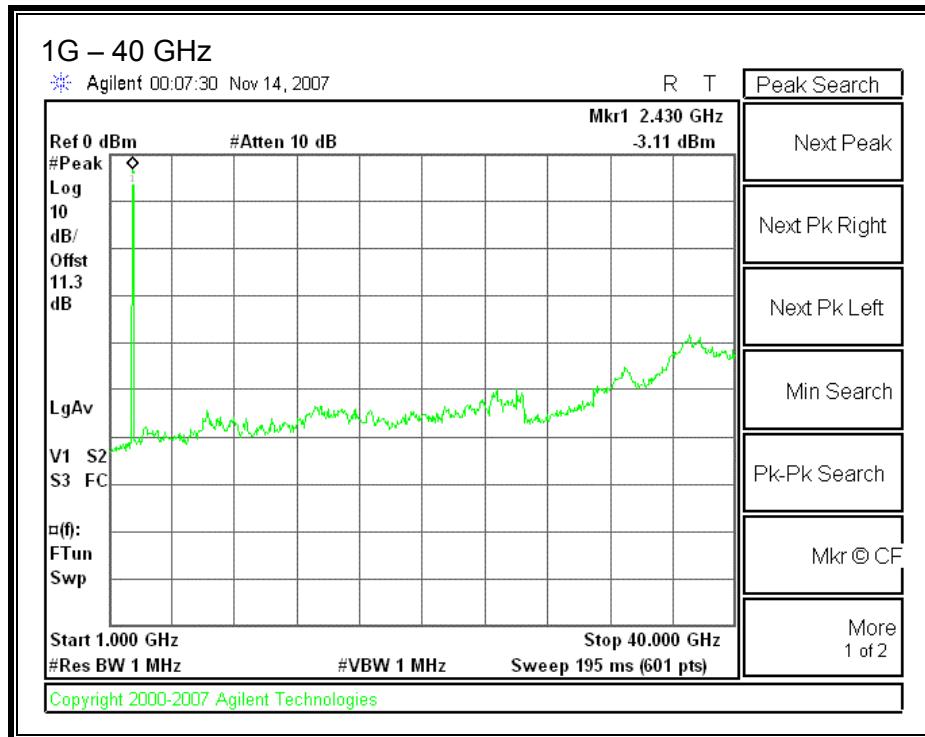
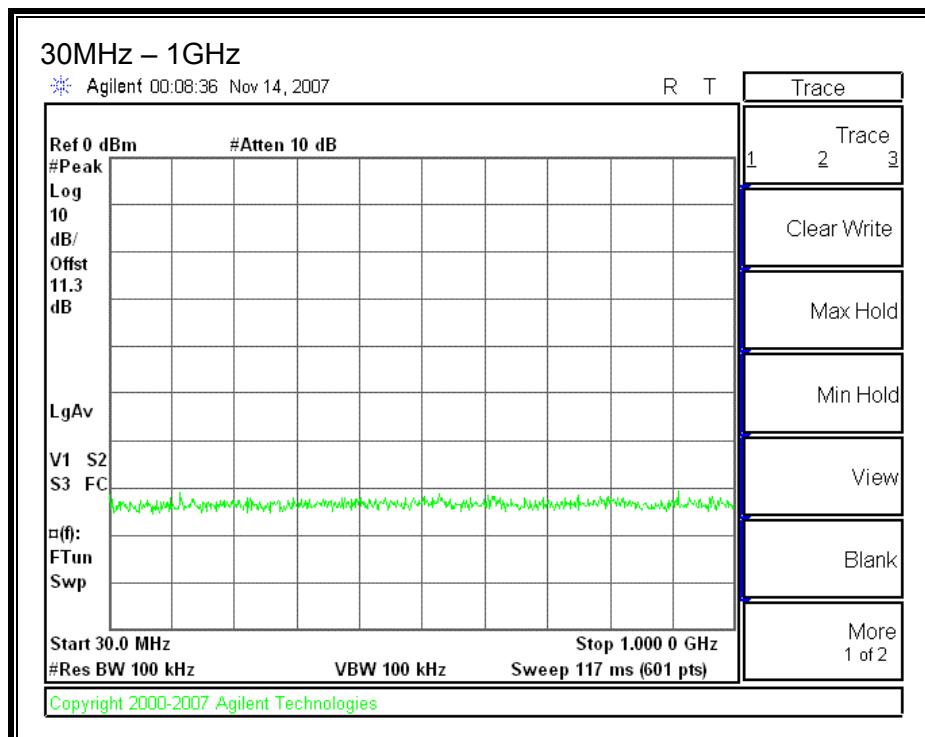
This EUT consists of two transmitters that share a single antenna port.

The preliminary test phase consists of conducted measurements over the spectrum from 30 MHz to 40 GHz. Reference measurements of the emissions with each transmitter operating independently are made. Co-located measurements of the emissions with both transmitters operating simultaneously are made and compared with the reference measurements. The spectrum is searched for intermodulation products and other spurious emissions.

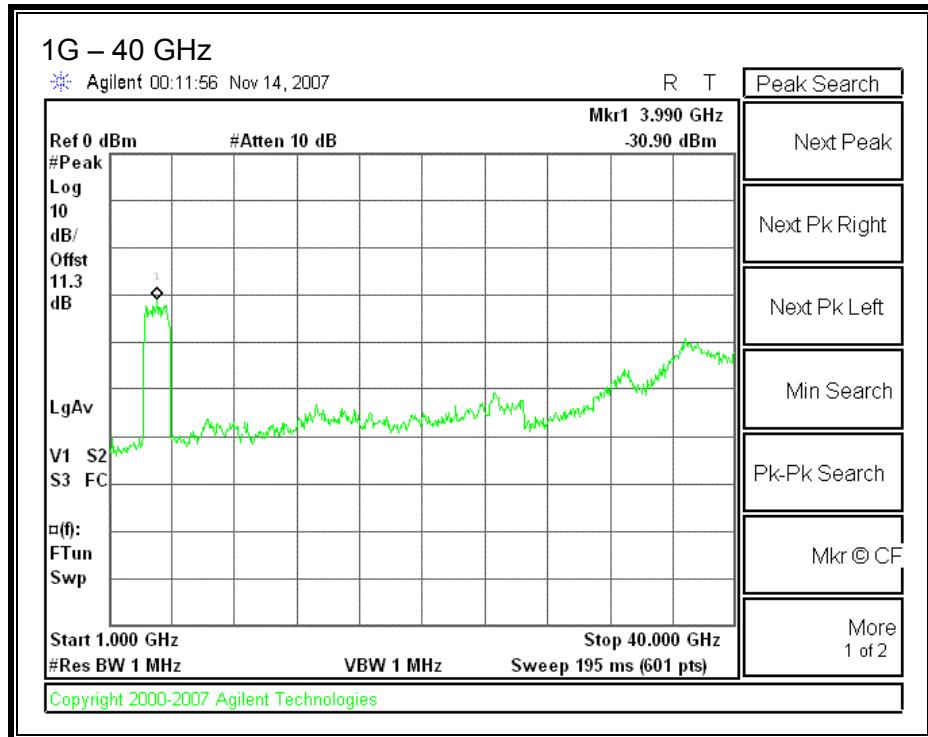
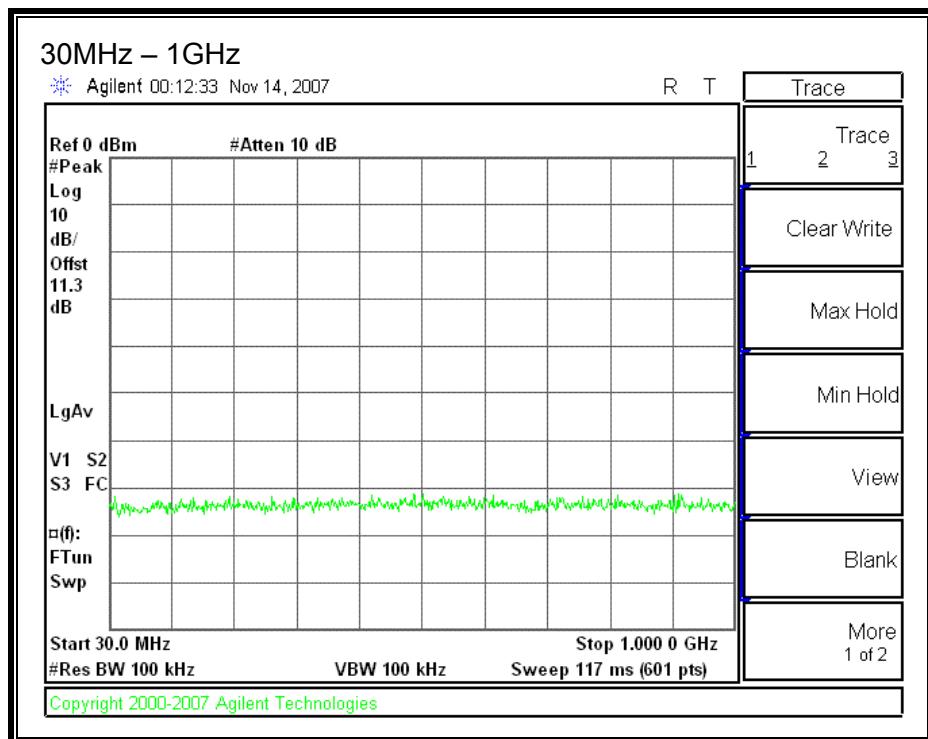
Final radiated tests are made at all frequencies where intermodulation products or other spurious emissions are identified during the preliminary test.

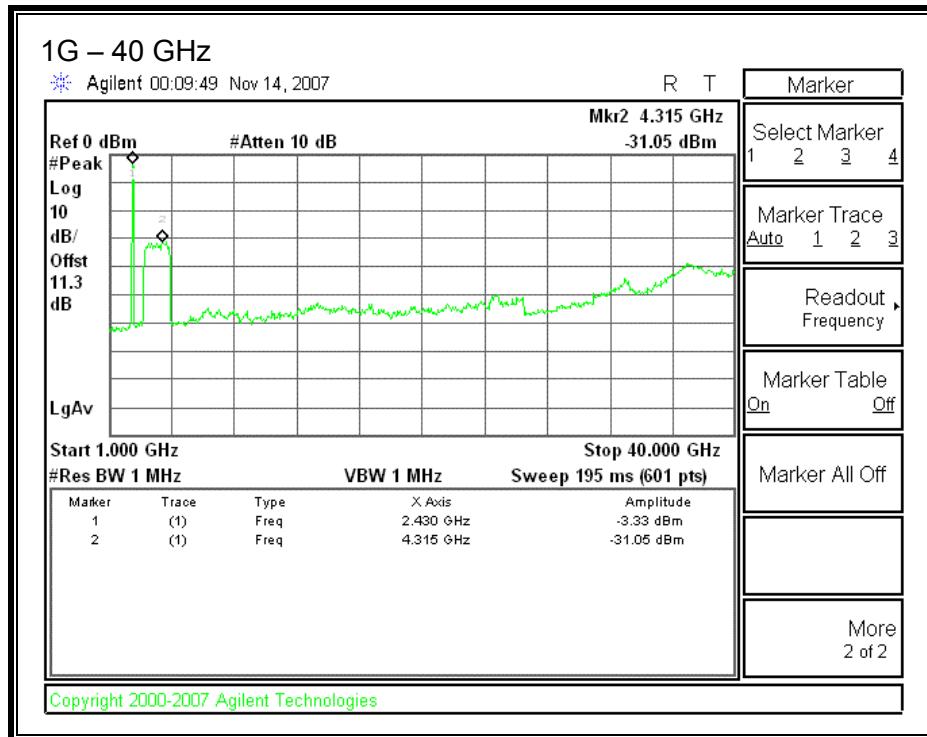
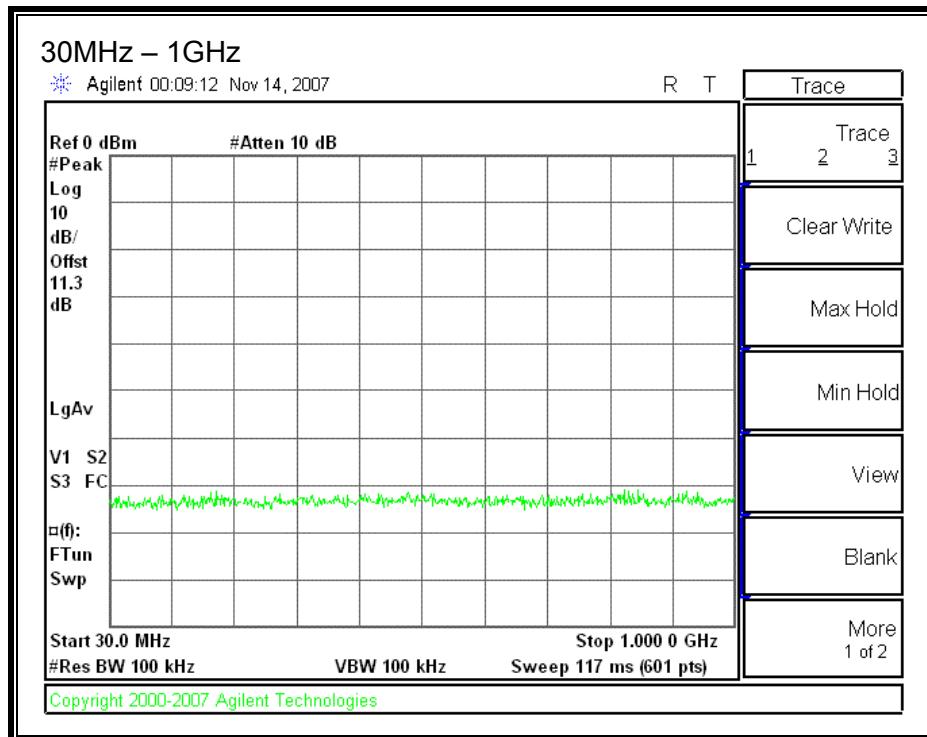
RESULTS

No intermodulation products or other spurious emissions were identified in the preliminary tests.

BLUETOOTH TRANSMITTING, UWB OFF

BLUETOOTH OFF, UWB TRANSMITTING



BLUETOOTH AND UWB TRANSMITTING SIMULTANEOUSLY

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.

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

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

LIMITS

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

RESULTS

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)
GFSK	2.4 GHz	20.0	-1.90	3.15	0.000265
8PSK	2.4 GHz	20.0	0.70	3.15	0.000482

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

CO-LOCATED MPE CALCULATIONS

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power * Gain product (in linear units) of each transmitter.

yields

$$d = 0.282 * \sqrt{((P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)) / S}$$

where

d = distance in cm

Px = Power of transmitter x in mW

Gx = Numeric gain of antenna x

S = Power Density in mW/cm^2

In the table below, Power and Gain are entered in units of dBm and dBi respectively, then converted to their linear forms for the purpose of the calculations.

LIMITS

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

RESULTS

(MPE distance equals 20 cm)

Transmitter	Output Power (dBm)	Antenna Gain (dBi)	Radiated EIRP (dBm)	MPE Distance (cm)	FCC Power Density (mW/cm^2)
Bluetooth	0.70	3.15			
UWB			-17.40		
Combined				20.0	0.000486

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.