



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

**FOR**

**BLUETOOTH TRANSCEIVER MODULE**

**MODEL NUMBER: EYTFEBS**

**FCC ID: QDS-BRCM1032**

**IC: 4324A-BRCM1032**

**REPORT NUMBER: 07U11299-1**

**ISSUE DATE: SEPTEMBER 21, 2007**

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

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



**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	9/21/07	Initial Issue	Hsin Fu Shih
B	10/2/07	Updated MPE calculation to report in power density	Hsin Fu Shih

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# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** BLUETOOTH TRANSCEIVER MODULE

**MODEL:** EYTFEBS

**SERIAL NUMBER:** CCS02032

**DATE TESTED:** SEPTEMBER 17 - 20, 2007

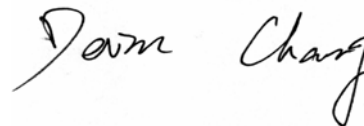
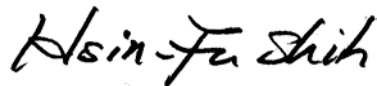
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	No Non-Compliance Noted
RSS-210 Issue 7 Annex 8 and RSS-GEN Issue 2	No Non-Compliance Noted

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:

Tested By:



HSIN FU SHIH  
ENGINEERING SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

DEVIN CHANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

## 3. FACILITIES AND ACCREDITATION

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

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
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%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth transceiver version 2.1 with EDR.

The radio module is manufactured by TAIYO YUDEN CO., LTD.

### 5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	-0.27	0.94
2402 - 2480	Enhanced QPSK	1.90	1.55
2402 - 2480	Enhanced 8PSK	2.44	1.75

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a chip antenna with a maximum gain of 2.02 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was Driver v5.1.0.1400.

The test utility software used during testing was BluetoolInstal v0.9.9.6.

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case 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 PC	Dell	Inspiron 0000	CN-901014-70166-57K-01JT	DOC
AC Adapter	Dell	PA-1600-06D1	CN-0F9710-71615-56H-5118	DOC

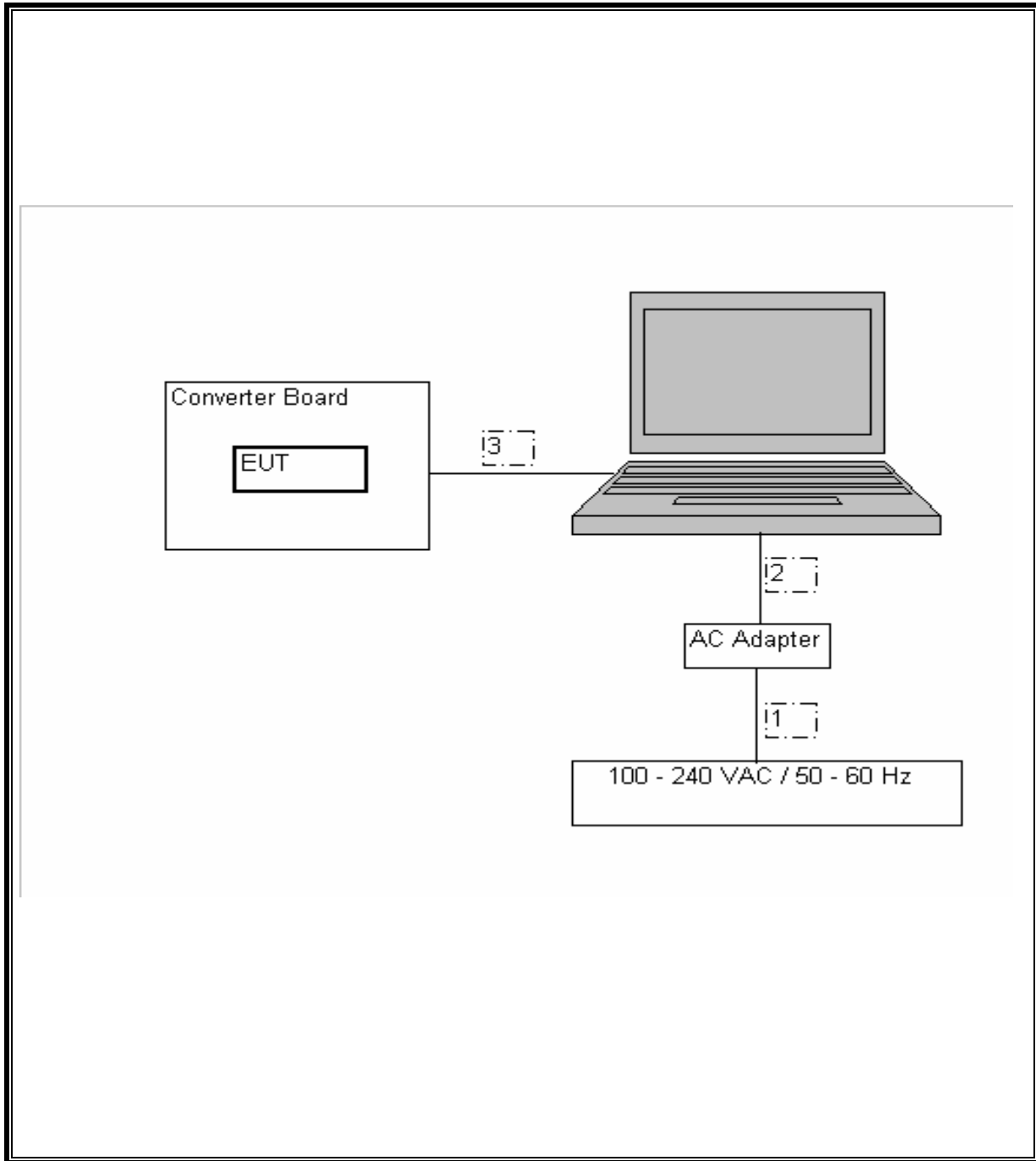
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115	Unshielded	1.8m	N/A
2	DC	1	DC	Unshielded	1.8m	N/A
3	USB	1	USB	Shielded	1.8m	N/A

### TEST SETUP

The EUT was connected to the host laptop via a USB cable and converter board. 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	Serial Number	Cal Due
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42510266	10/18/07
DC power supply	Agilent / HP	E3610A	KR24104150	CNR
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/02/07
Power Sensor 50MHz - 6GHz	Agilent / HP	E9327A	US4040755	12/02/07
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	01/21/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00369	08/03/08
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	04/15/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	10/13/07
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	05/09/08
2.4 - 2.5 Band Reject Filter	Micro Tronics	N/A	1	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. BASIC DATA RATE GFSK AND 8PSK MODULATION

#### 7.1.1. 20 dB AND 99% BANDWIDTH

##### LIMIT

None; for reporting purposes only.

##### TEST PROCEDURE

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

##### RESULTS

###### GFSK Mode

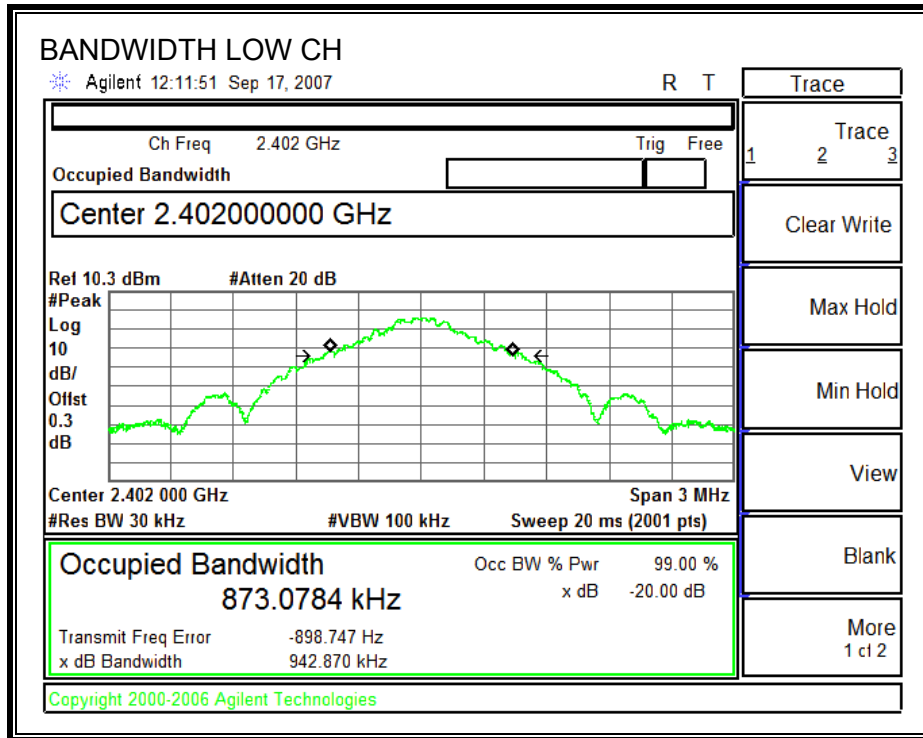
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	942.870	855.2384
Middle	2441	946.527	852.9787
High	2480	946.864	855.2430

###### 8PSK Mode

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1342	1194.8
Middle	2441	1346	1198.9
High	2480	1347	1204.6

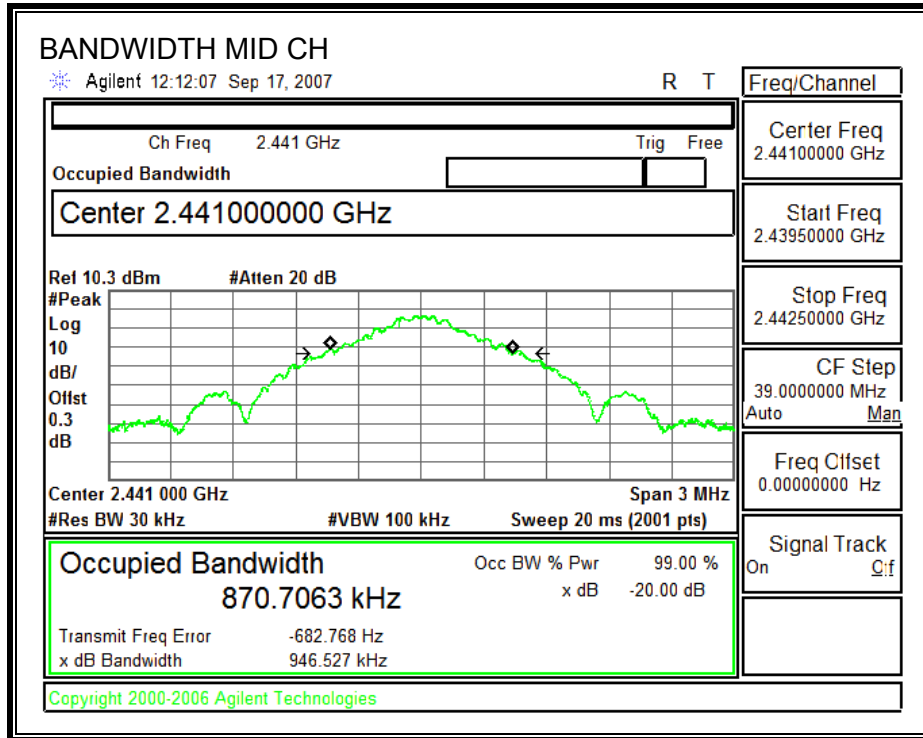
**20 dB BANDWIDTH**

GFSK Mode



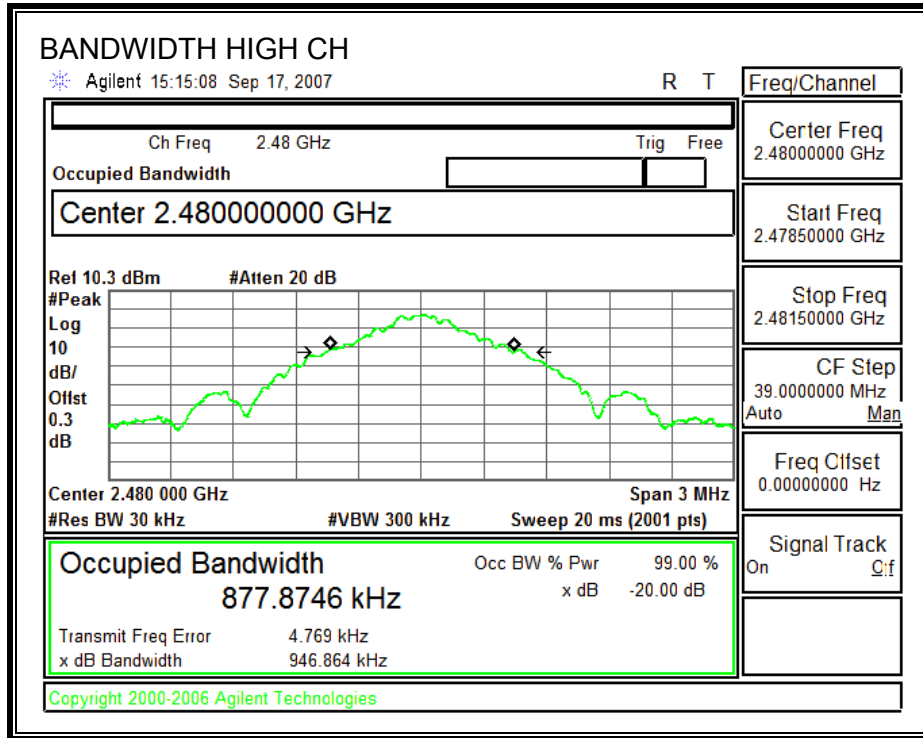
**20 dB BANDWIDTH**

GFSK Mode



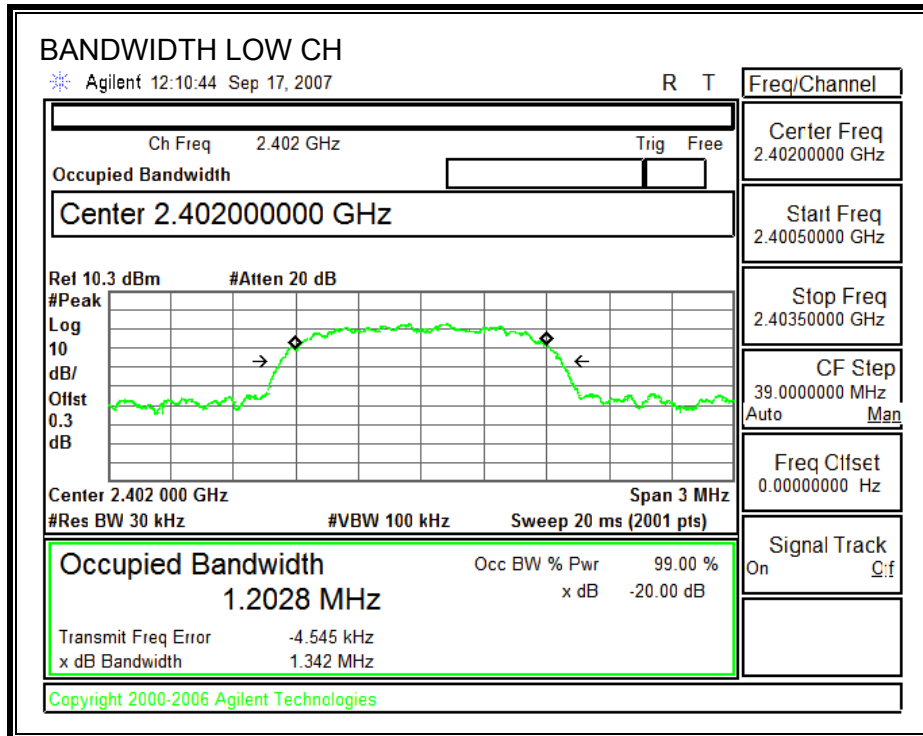
**20 dB BANDWIDTH**

GFSK Mode



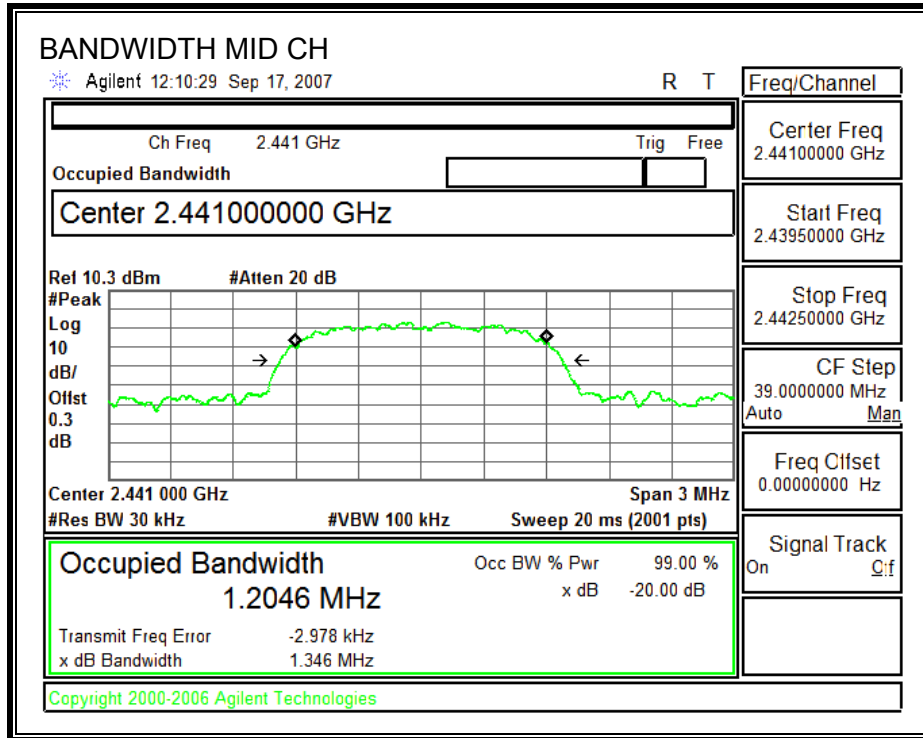
**20 dB BANDWIDTH**

8PSK Mode



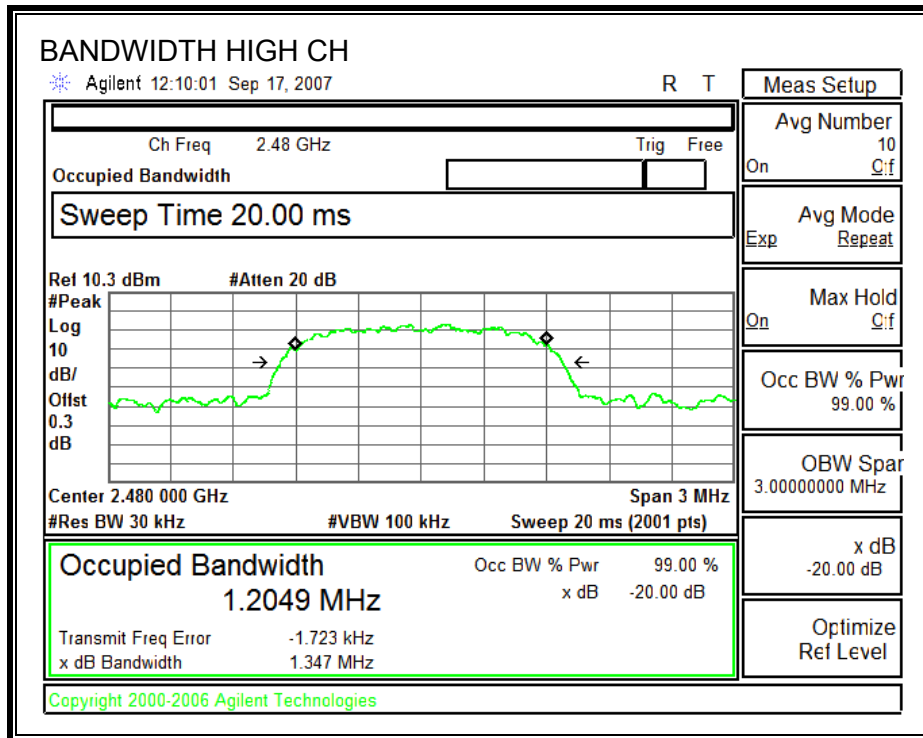
**20 dB BANDWIDTH**

8PSK Mode



**20 dB BANDWIDTH**

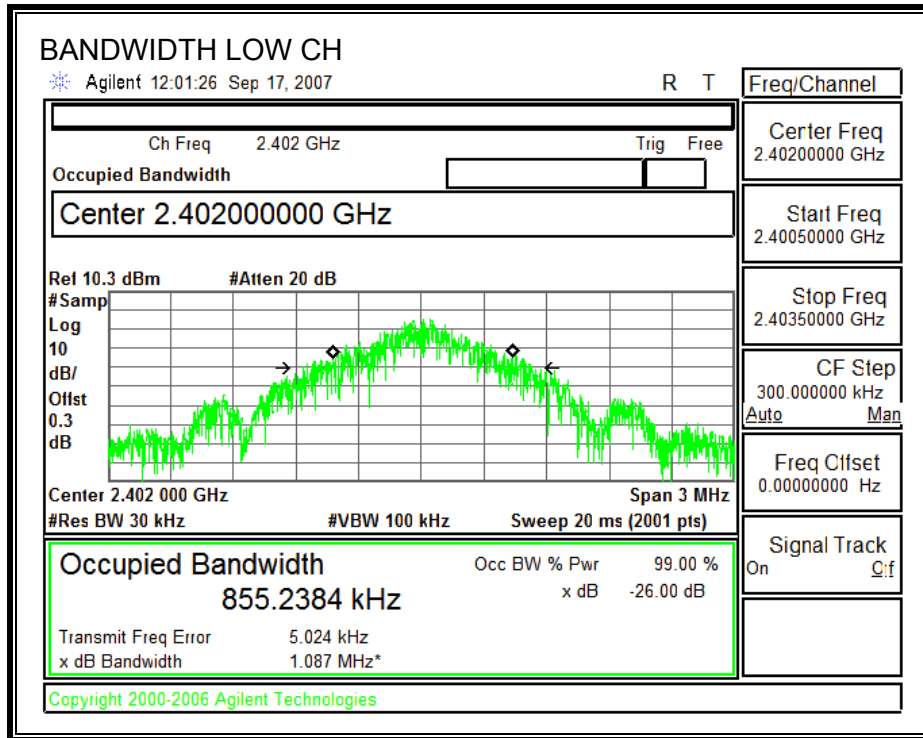
8PSK Mode





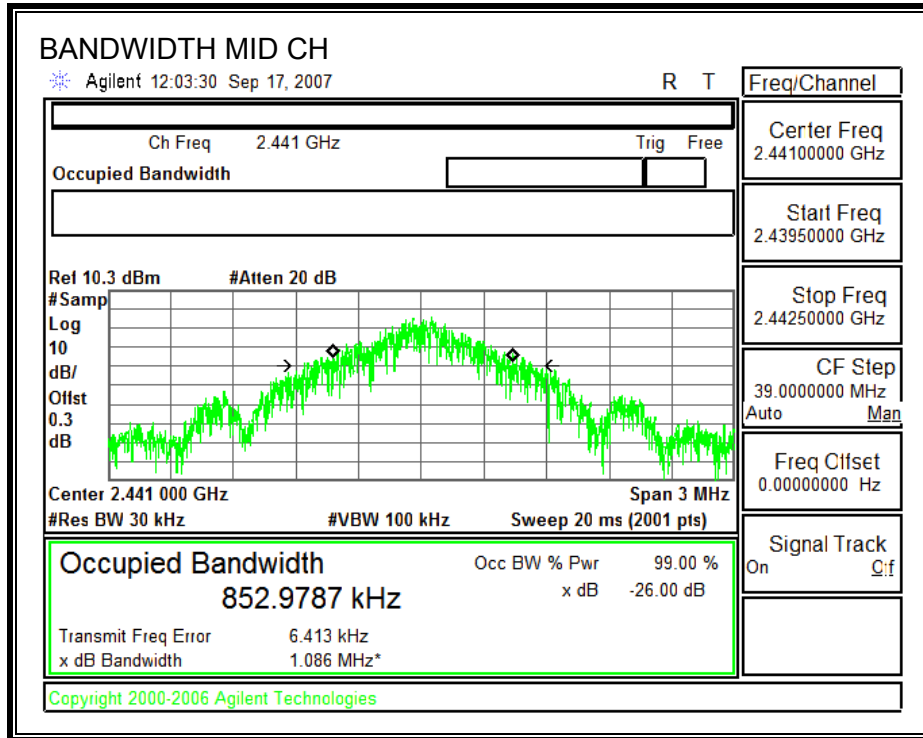
**99% BANDWIDTH**

GFSK Mode



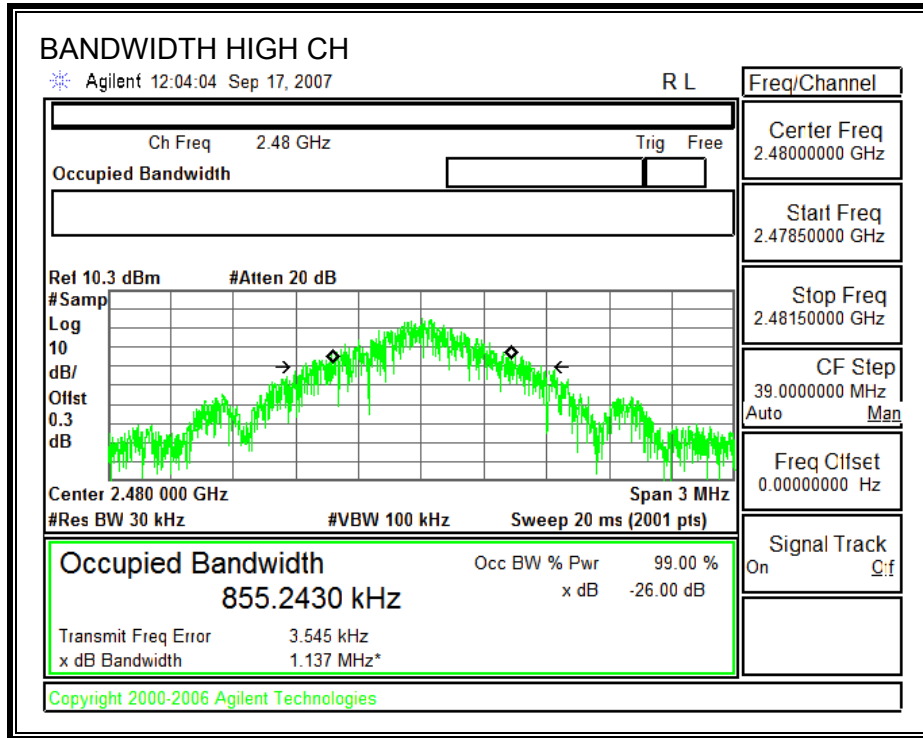
**99% BANDWIDTH**

GFSK Mode



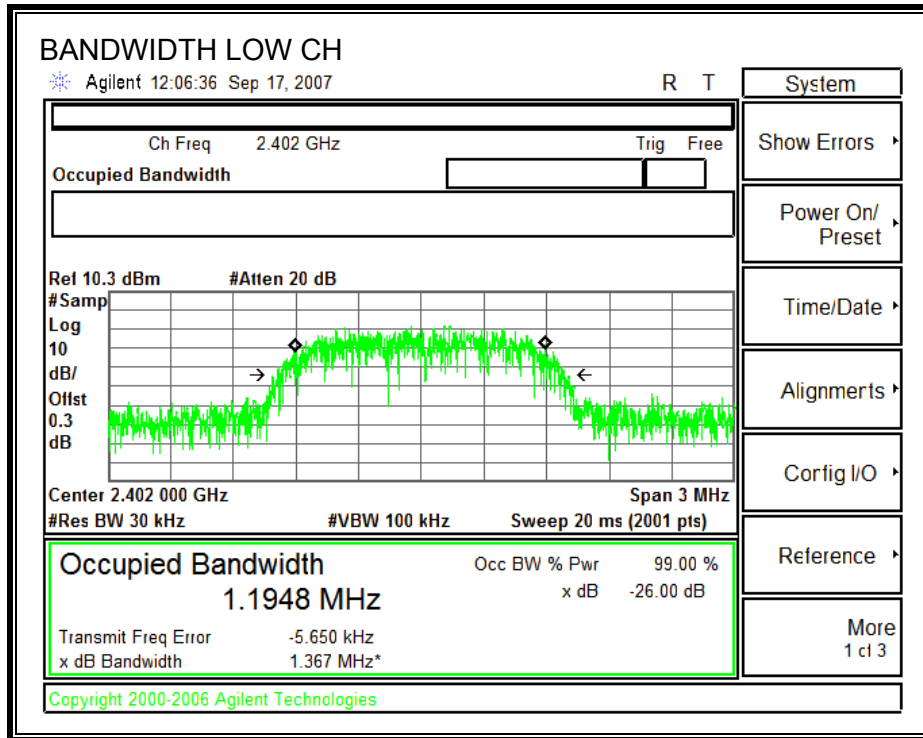
**99% BANDWIDTH**

GFSK Mode



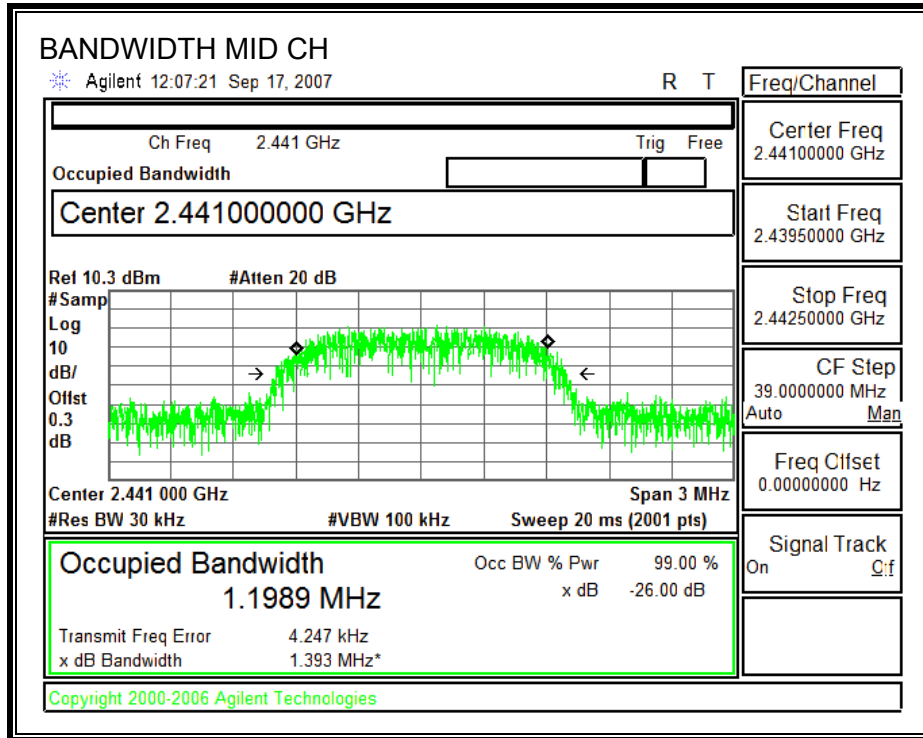
**99% BANDWIDTH**

8PSK Mode



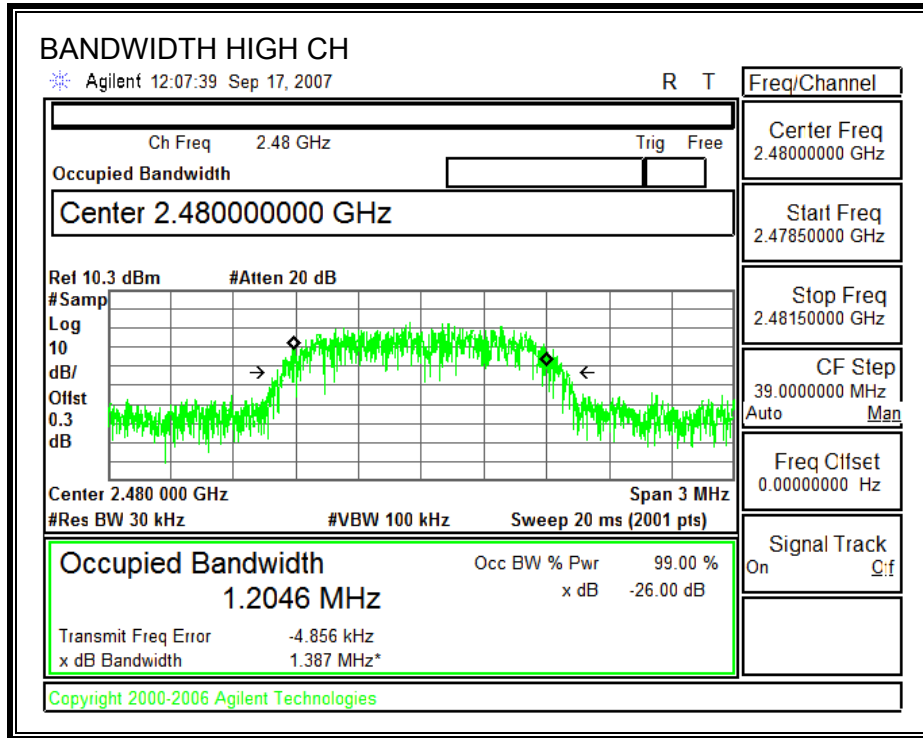
**99% BANDWIDTH**

8PSK Mode



**99% BANDWIDTH**

8PSK Mode



## **7.1.2. HOPPING FREQUENCY SEPARATION**

### **LIMIT**

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

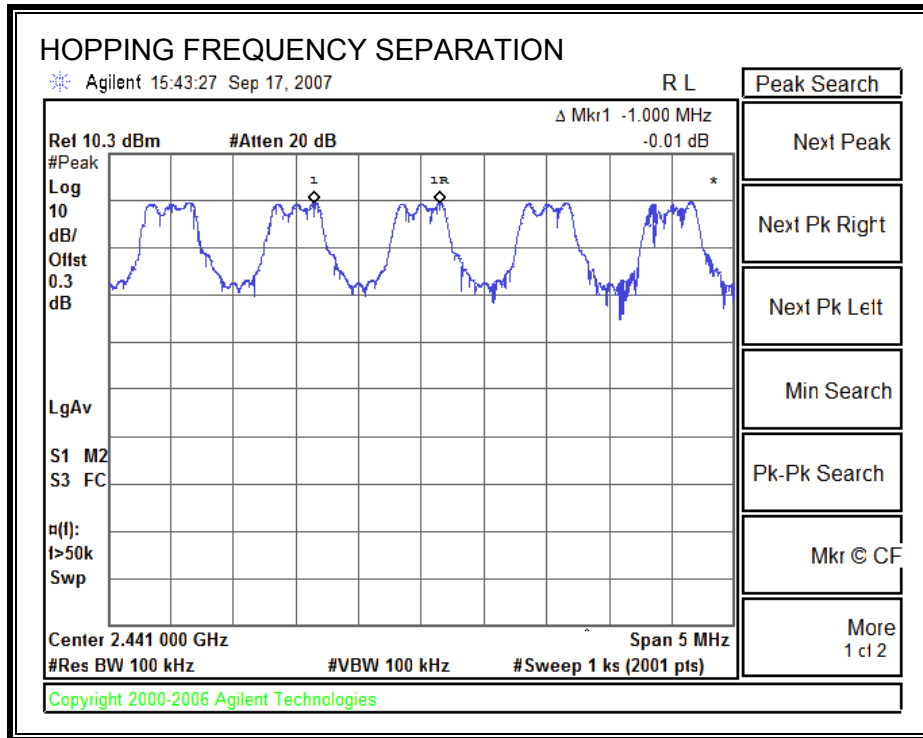
### **TEST PROCEDURE**

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

### **RESULTS**

**HOPPING FREQUENCY SEPARATION**

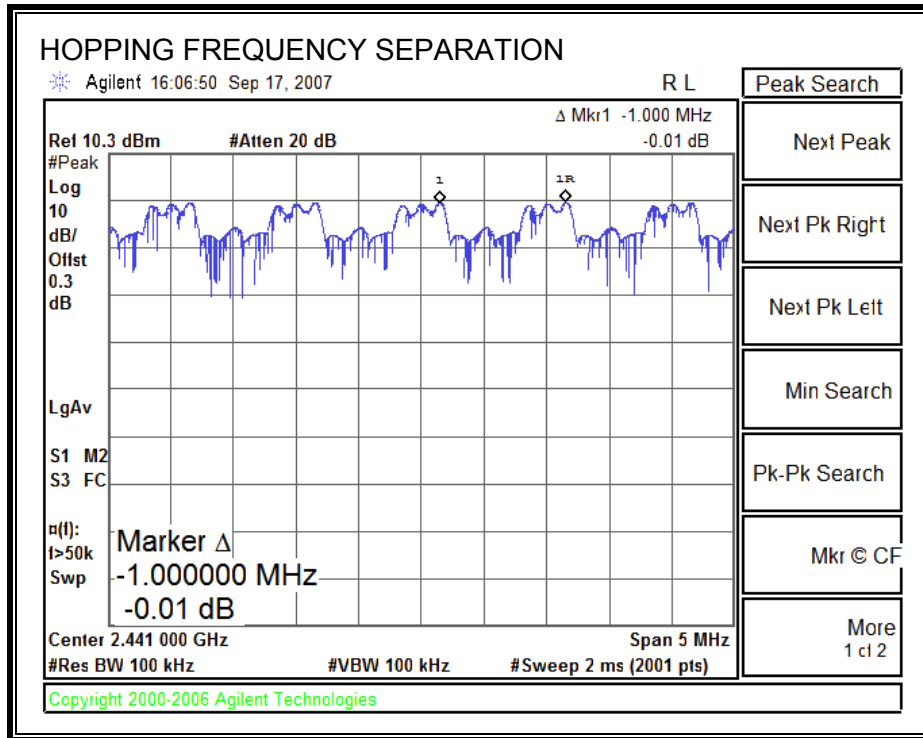
GFSK Mode





**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**

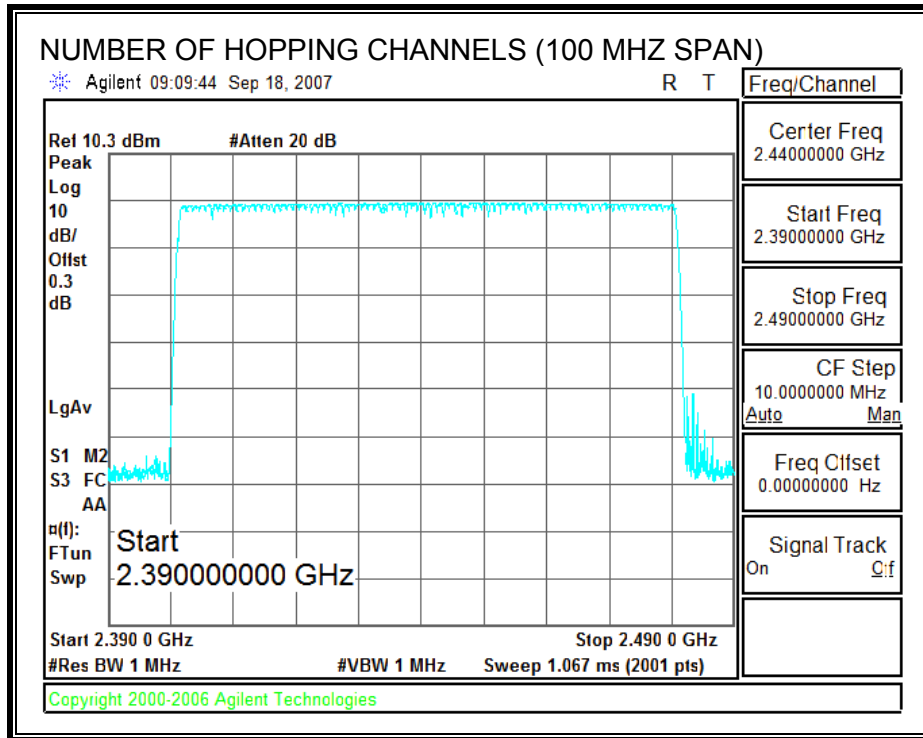
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

#### **RESULTS**

79 Channels observed.

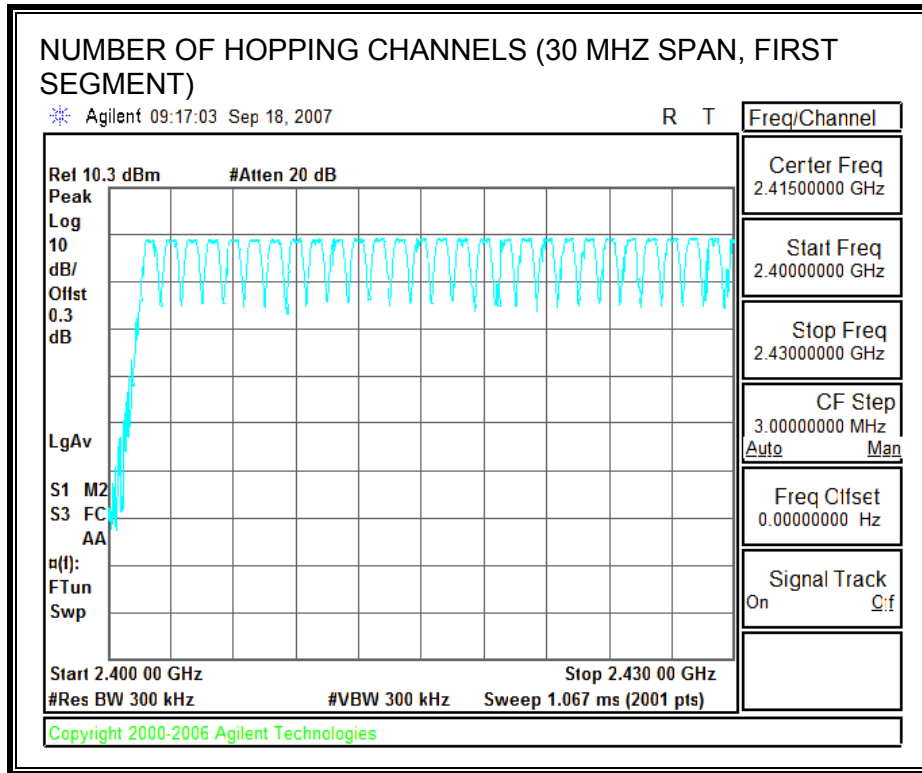
**NUMBER OF HOPPING CHANNELS**

GFSK Mode



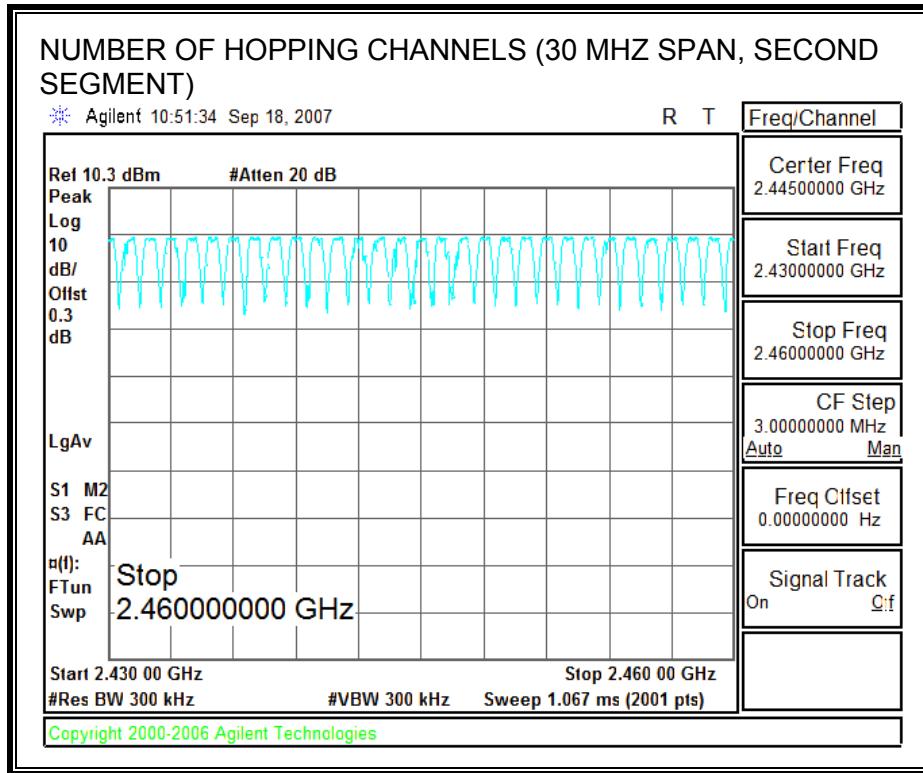
**NUMBER OF HOPPING CHANNELS**

GFSK Mode



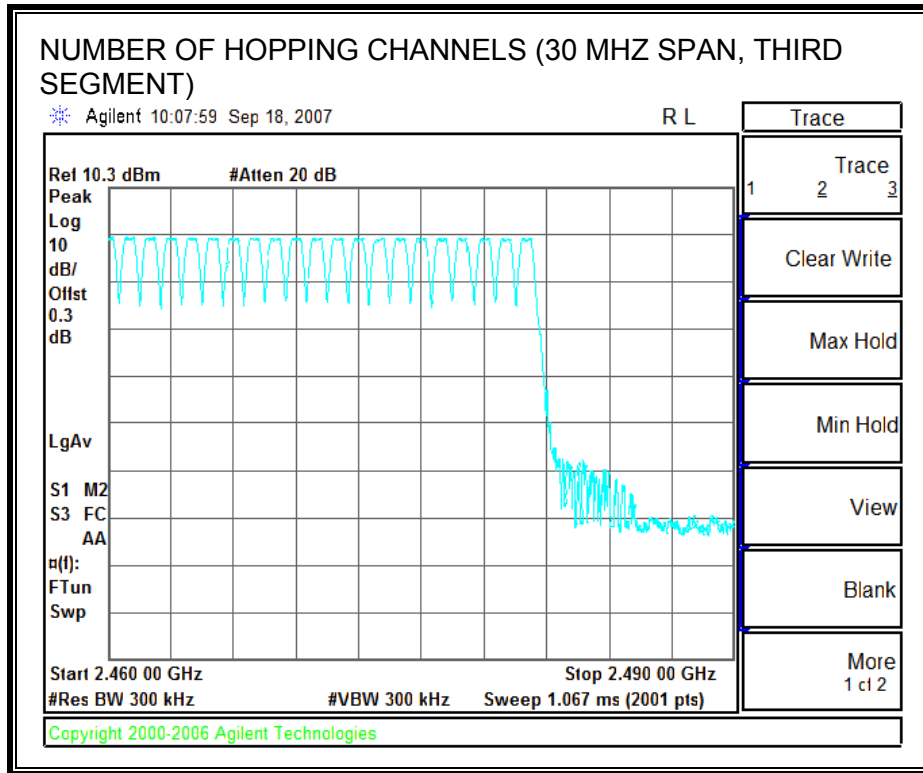
**NUMBER OF HOPPING CHANNELS**

GFSK Mode



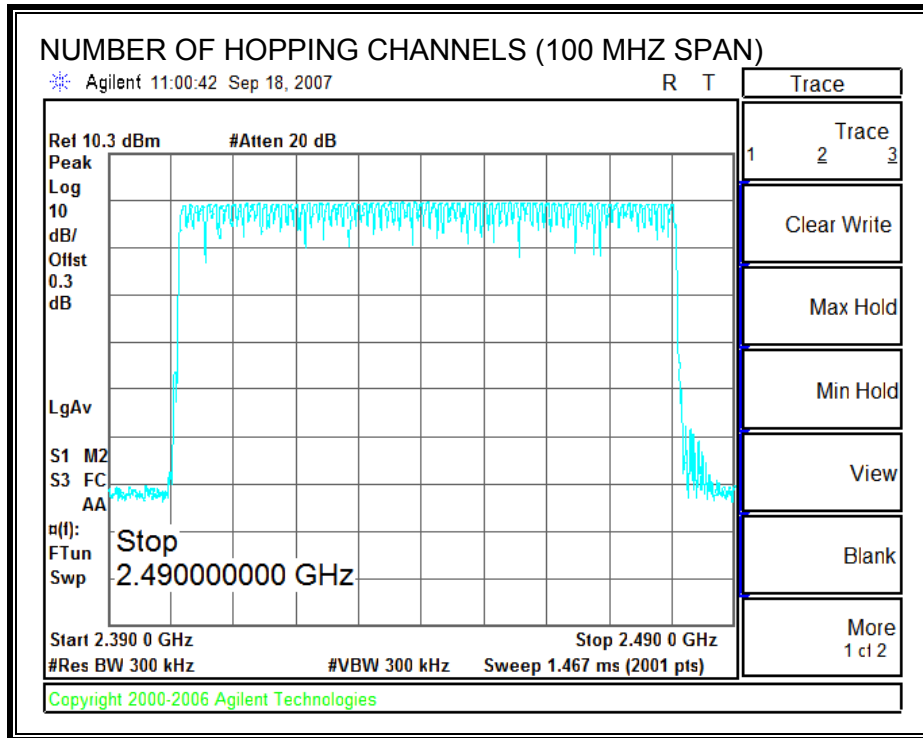
**NUMBER OF HOPPING CHANNELS**

GFSK Mode



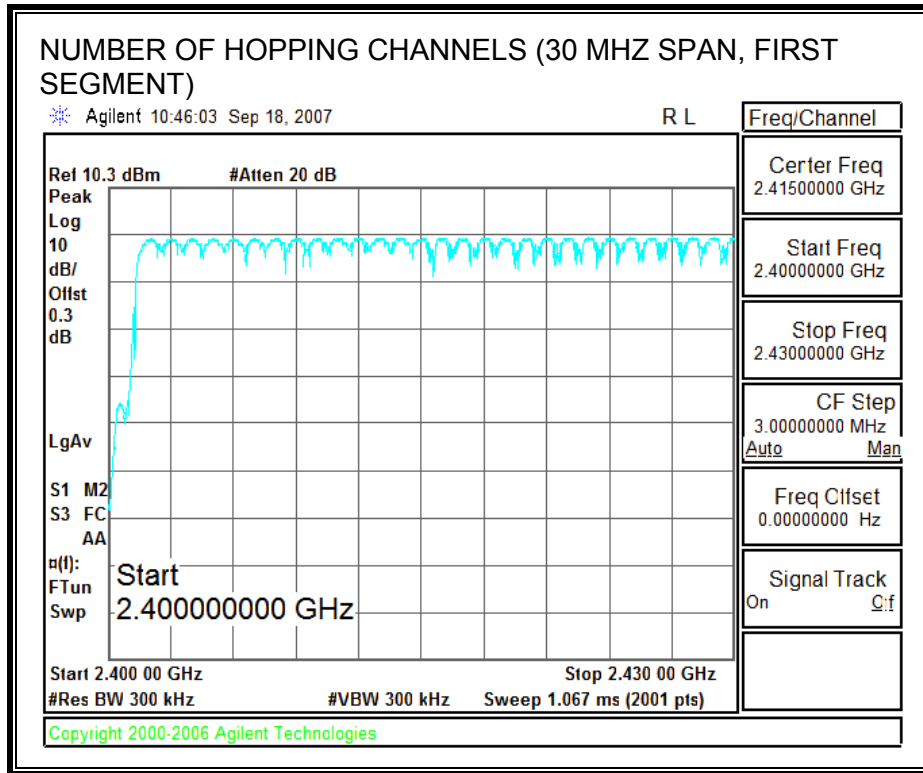
**NUMBER OF HOPPING CHANNELS**

8PSK Mode



**NUMBER OF HOPPING CHANNELS**

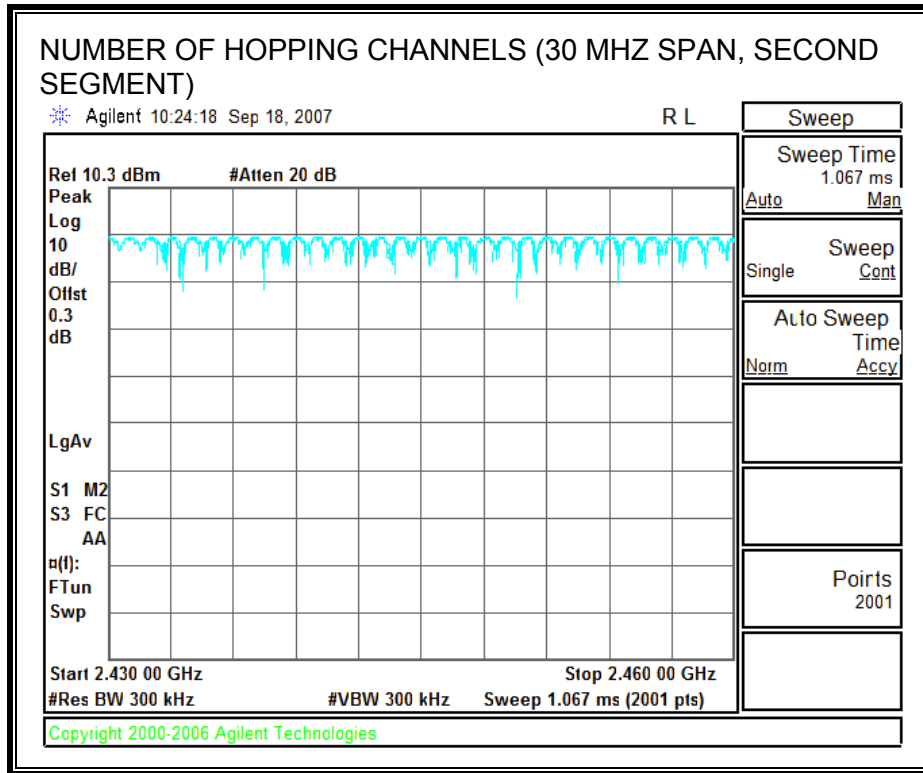
8PSK Mode





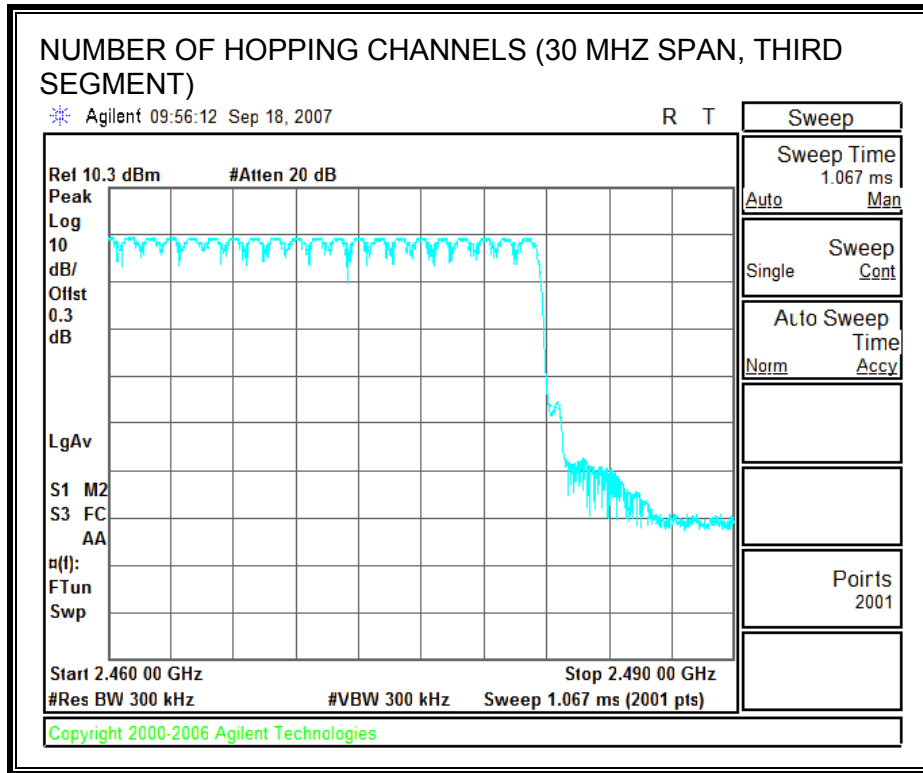
**NUMBER OF HOPPING CHANNELS**

8PSK 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

No non-compliance noted:

##### GFSK Mode

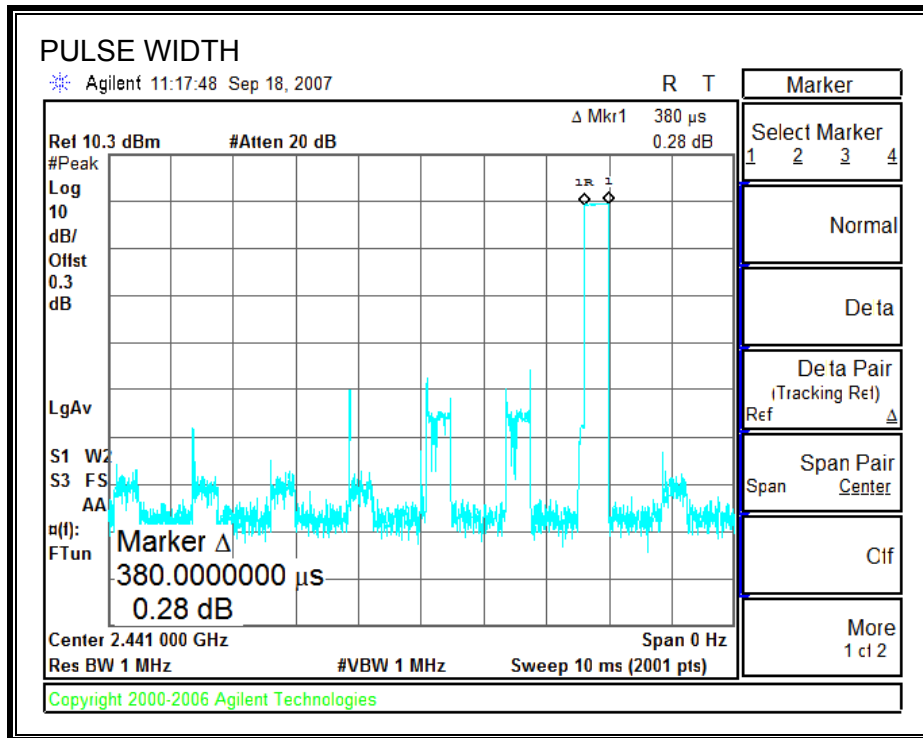
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.38	33	0.125	0.4	0.275
DH3	1.64	21	0.344	0.4	0.056
DH5	2.885	12	0.346	0.4	0.054

##### 8PSK Mode

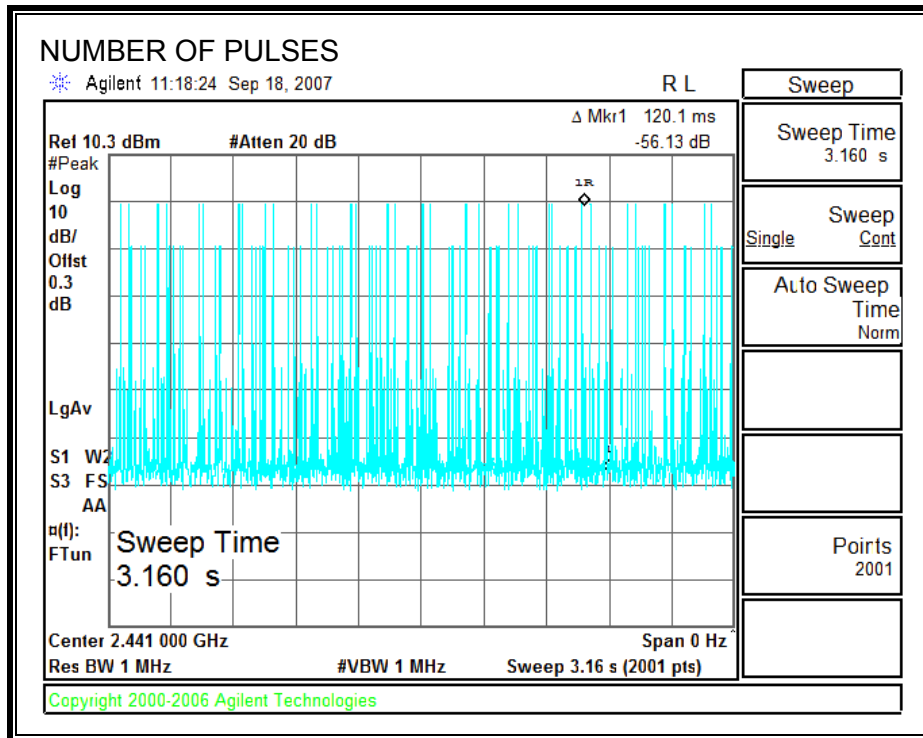
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.39	34	0.133	0.4	0.267
DH3	1.64	20	0.328	0.4	0.072
DH5	2.885	12	0.346	0.4	0.054

**GFSK-DH1**

**PULSE WIDTH**

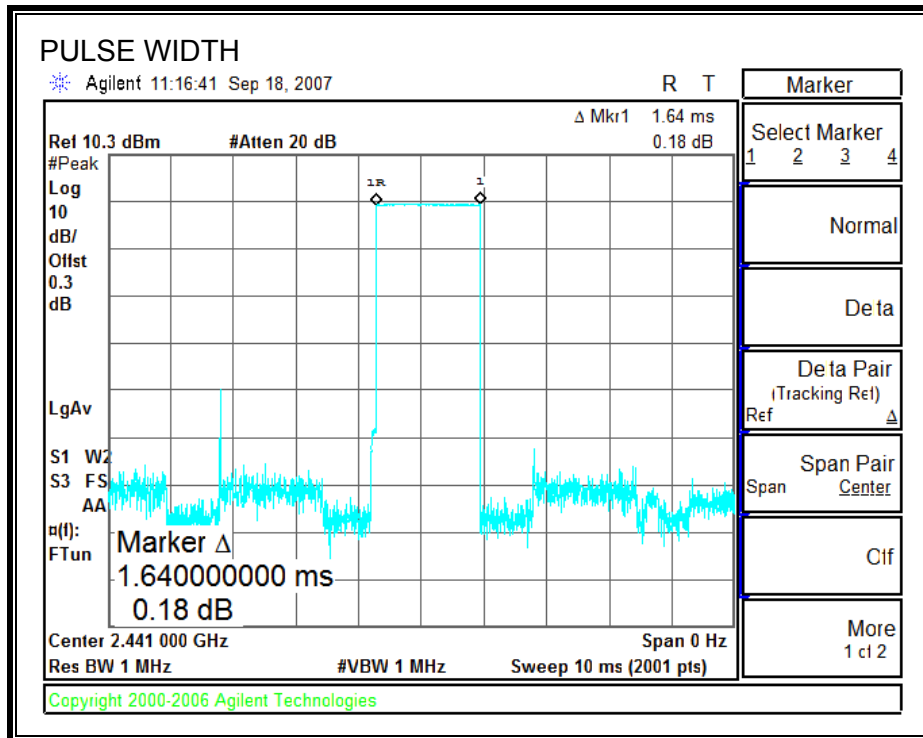


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

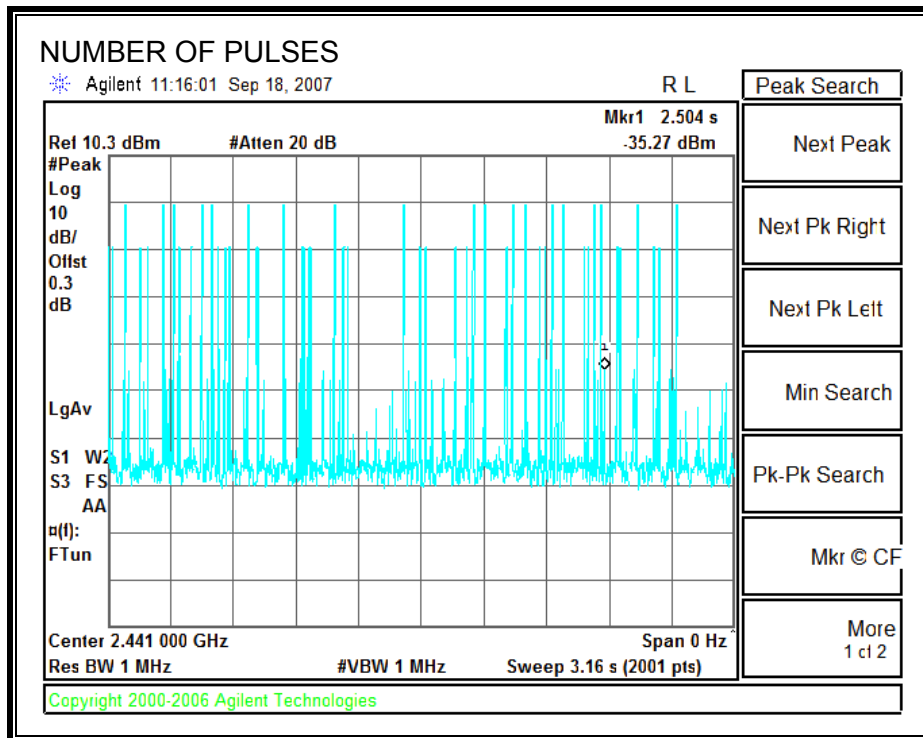


**GFSK-DH3**

**PULSE WIDTH**

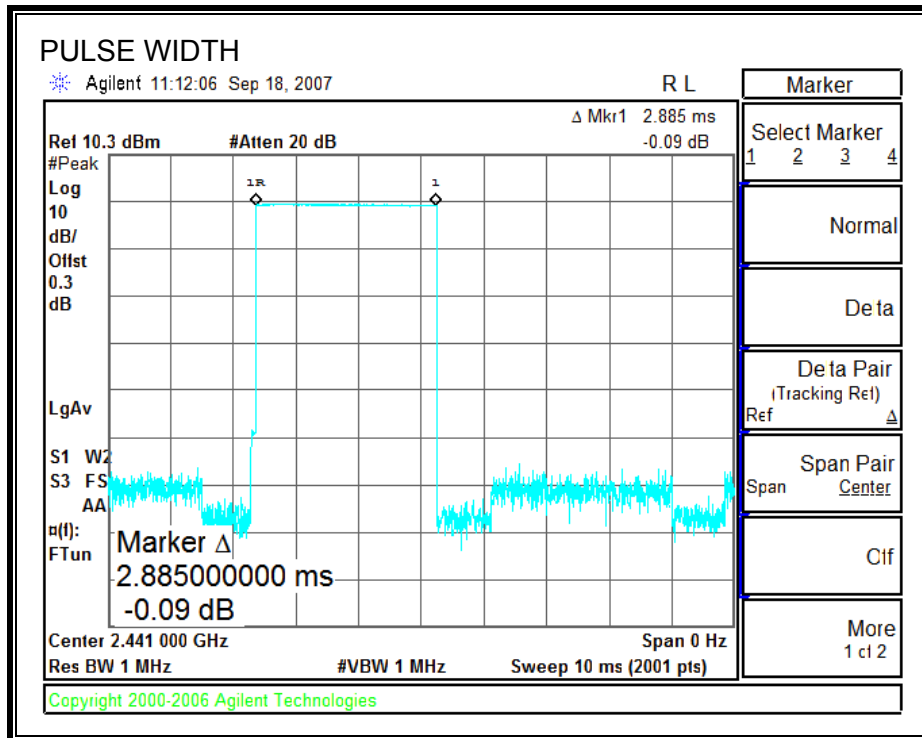


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

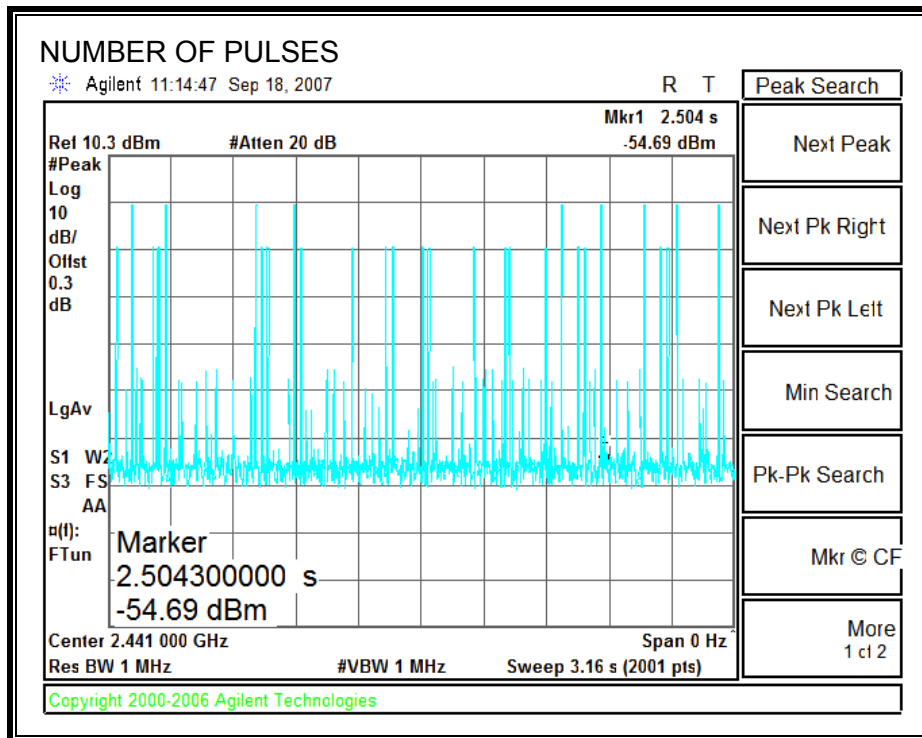


**GFSK-DH5**

**PULSE WIDTH**

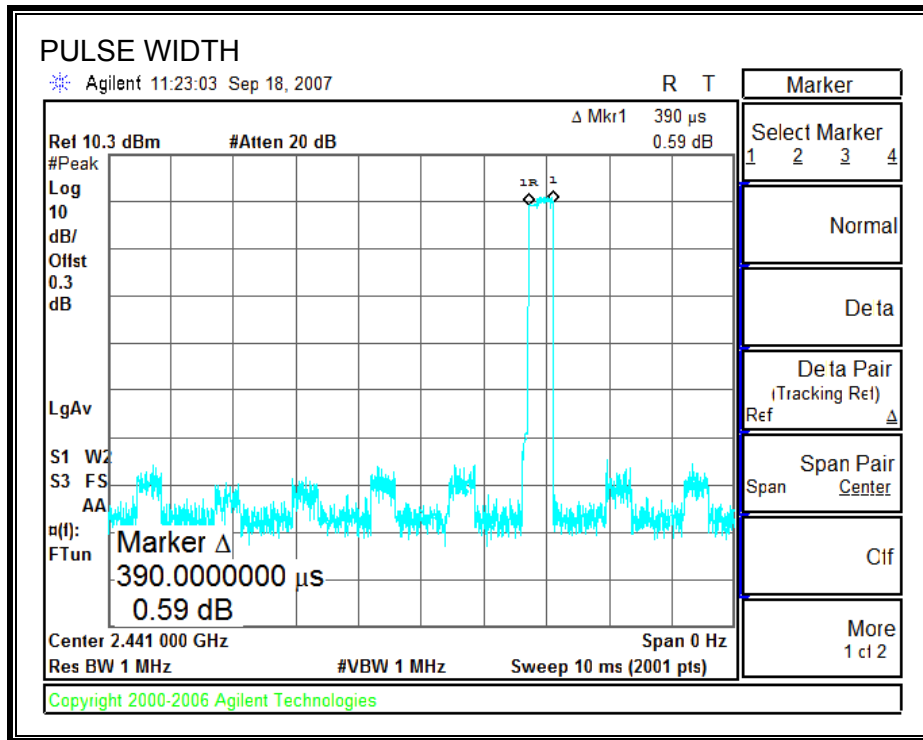


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

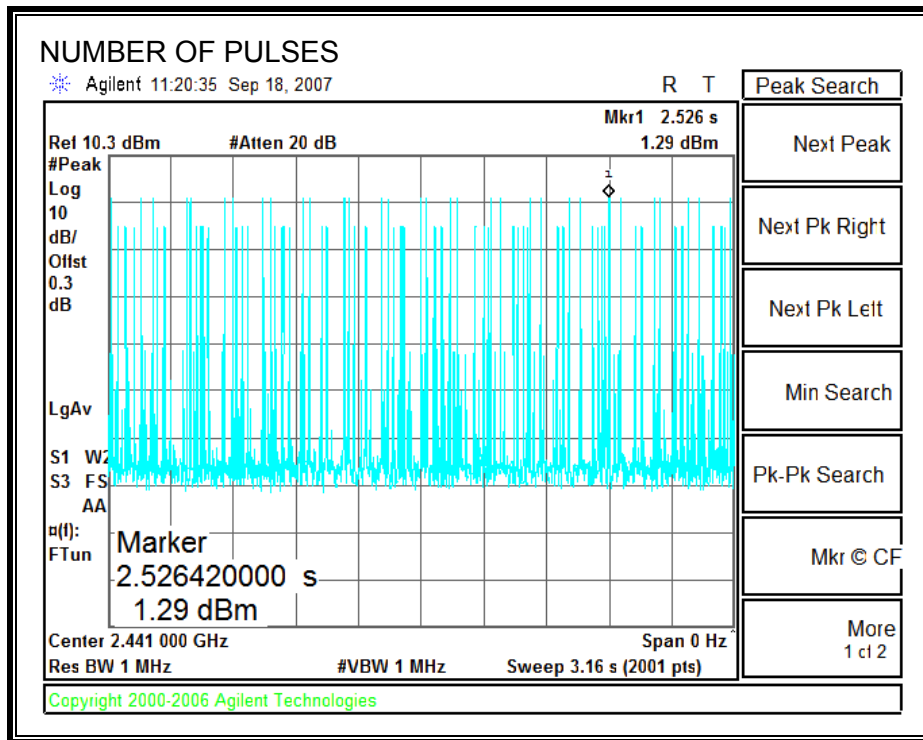


**8PSK-DH1**

**PULSE WIDTH**

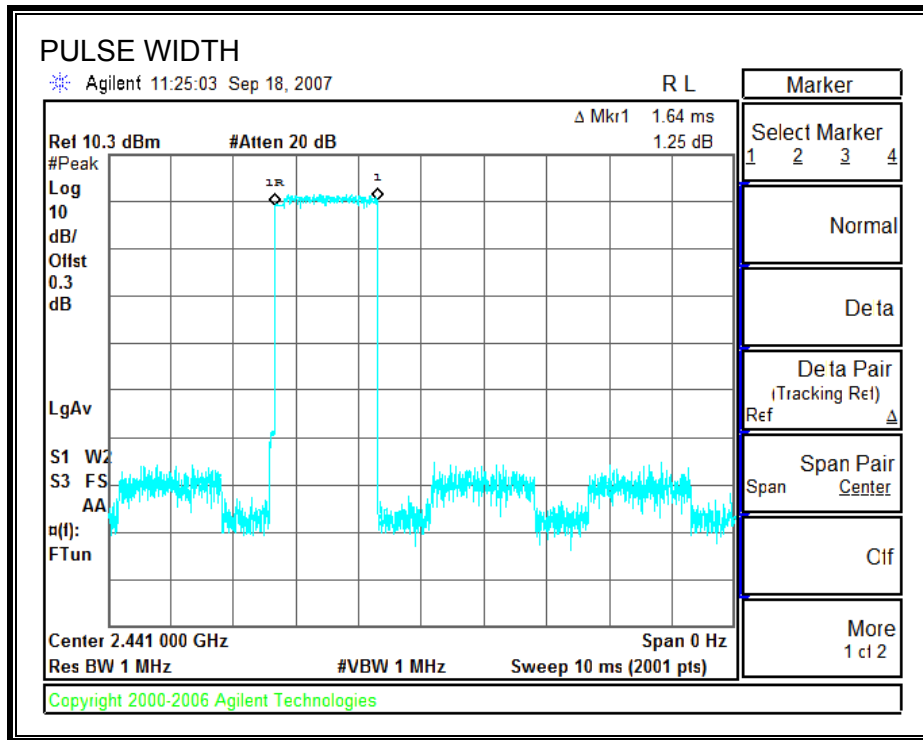


**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**

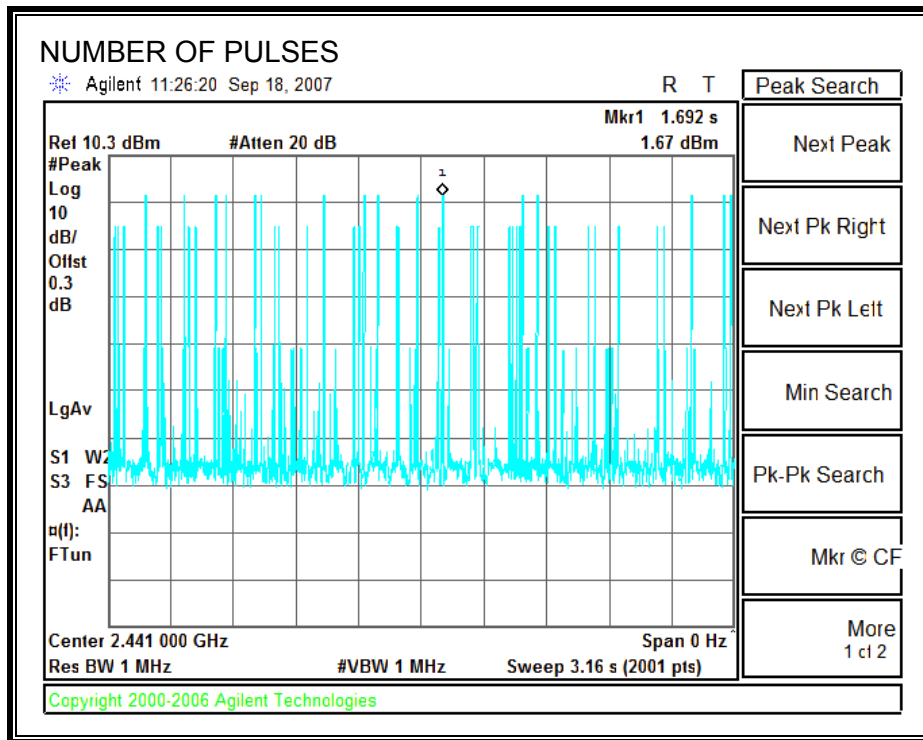


**8PSK-DH3**

**PULSE WIDTH**



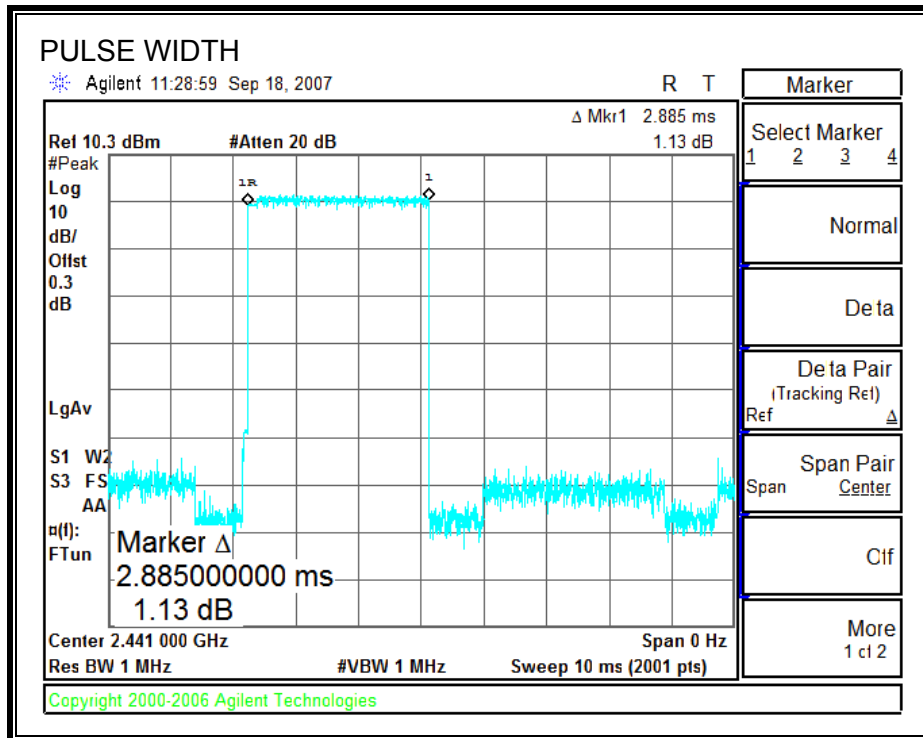
**NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD**



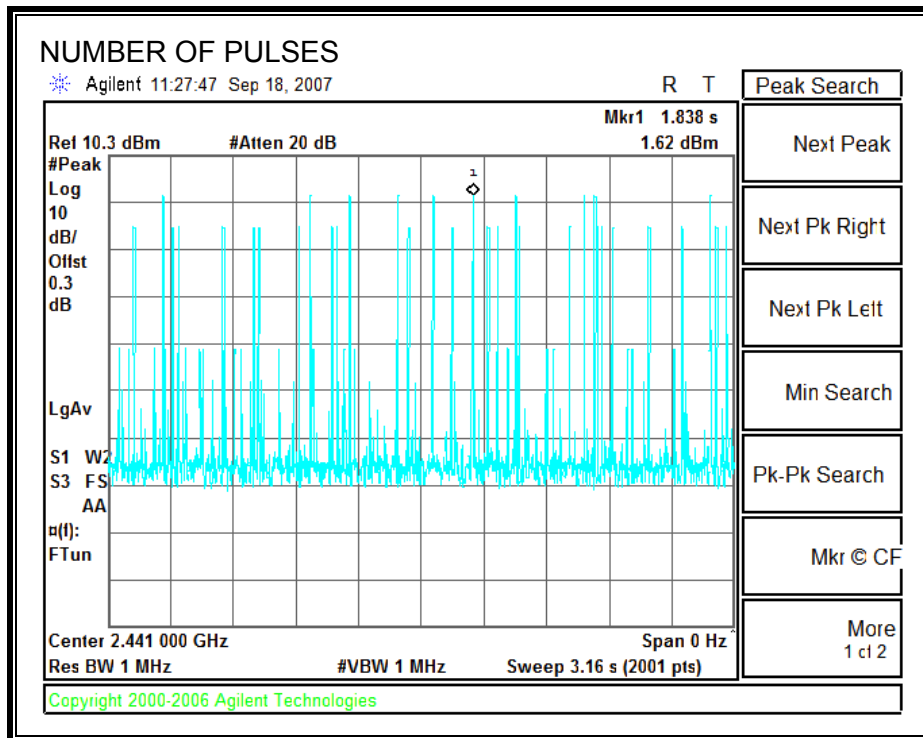


**8PSK-DH5**

**PULSE WIDTH**



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



### 7.1.5. OUTPUT POWER

#### LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

#### TEST PROCEDURE

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

#### RESULTS

##### GFSK Mode

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-0.68	30	-30.68
Middle	2441	-0.27	30	-30.27
High	2480	-0.48	30	-30.48

##### QPSK Mode

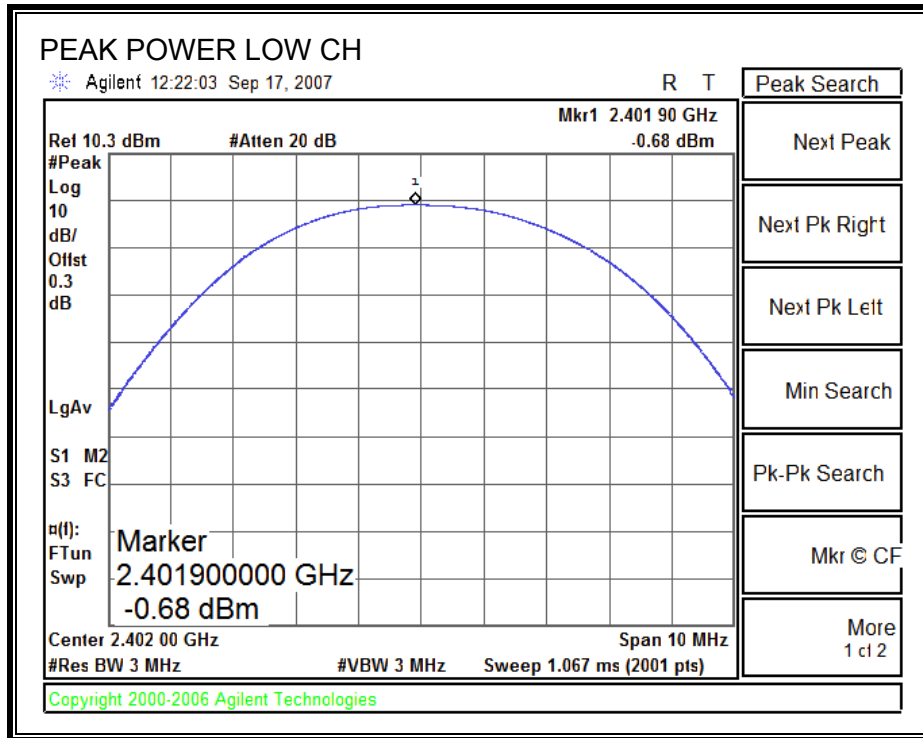
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	1.57	30	-28.43
Middle	2441	1.90	30	-28.10
High	2480	1.67	30	-28.33

##### 8PSK Mode

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.04	30	-27.96
Middle	2441	2.44	30	-27.56
High	2480	2.15	30	-27.85

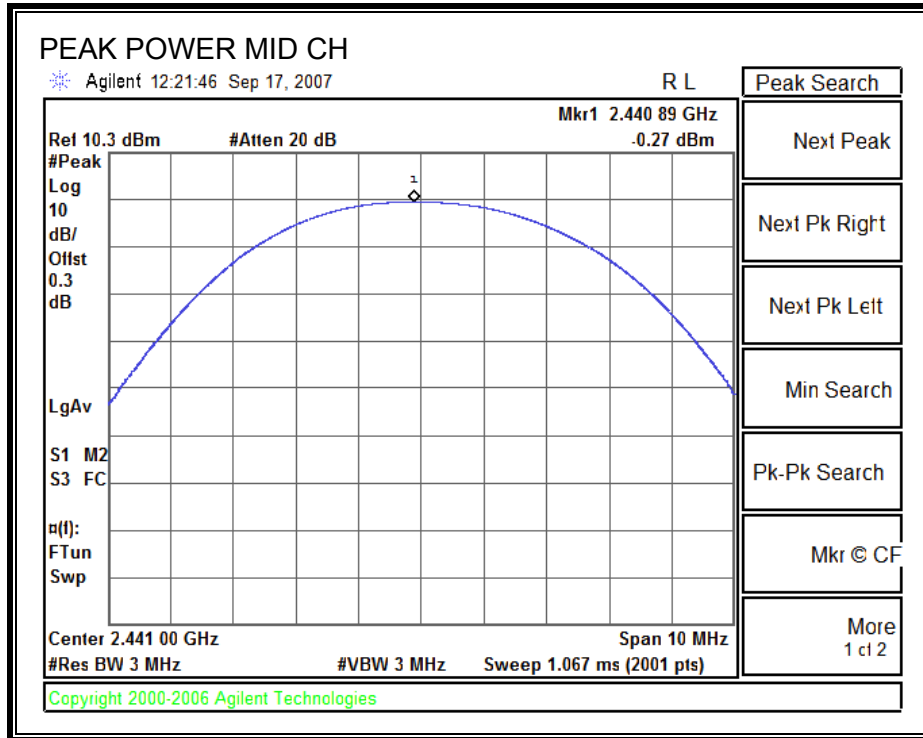
**OUTPUT POWER**

GFSK Mode



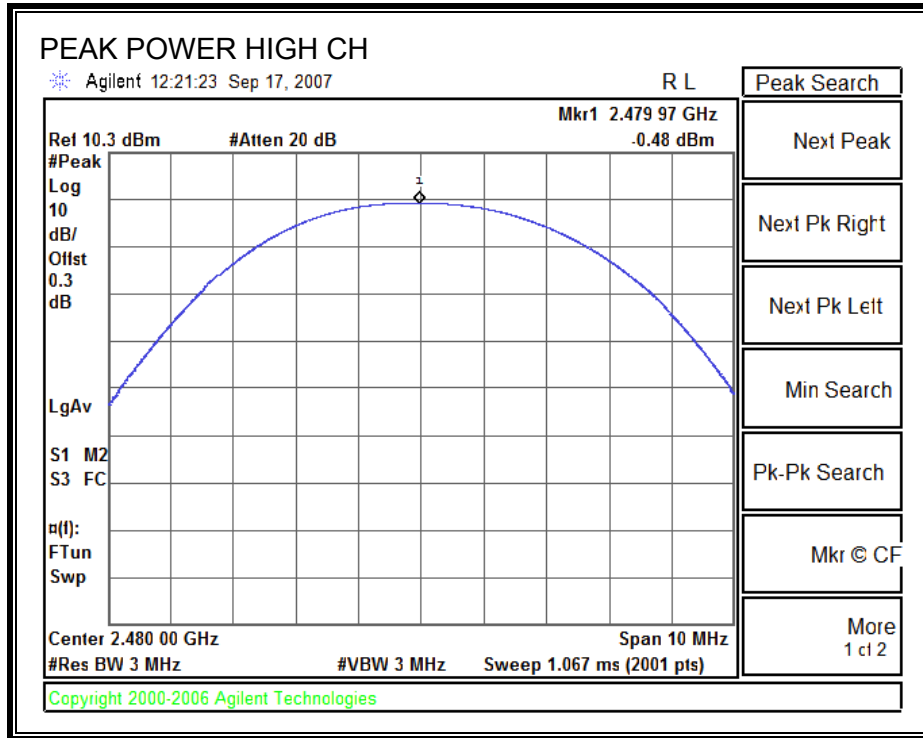
**OUTPUT POWER**

GFSK Mode



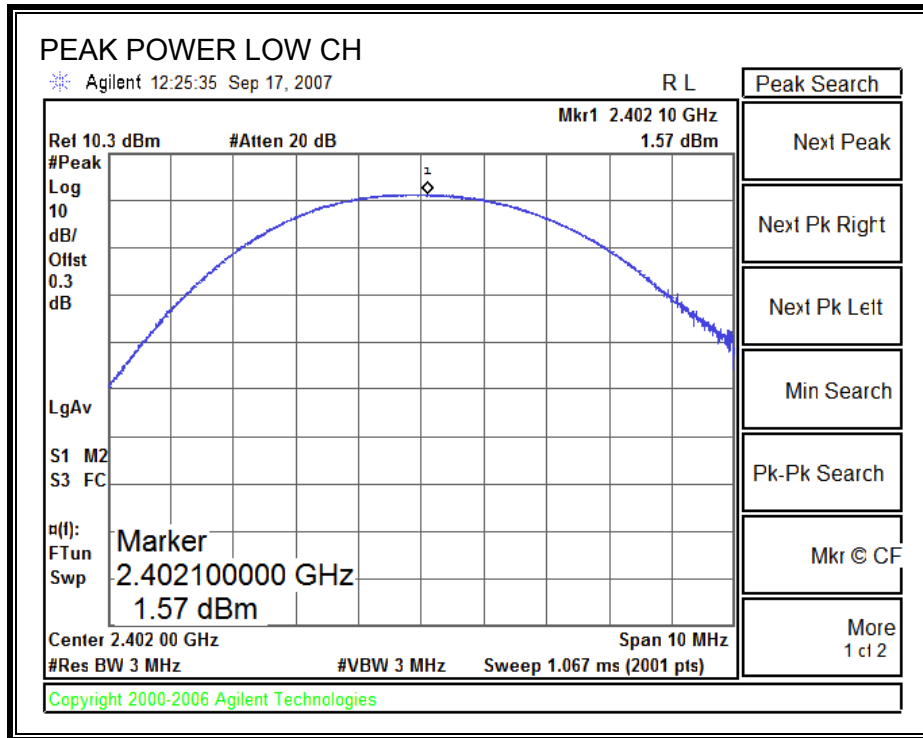
**OUTPUT POWER**

GFSK Mode



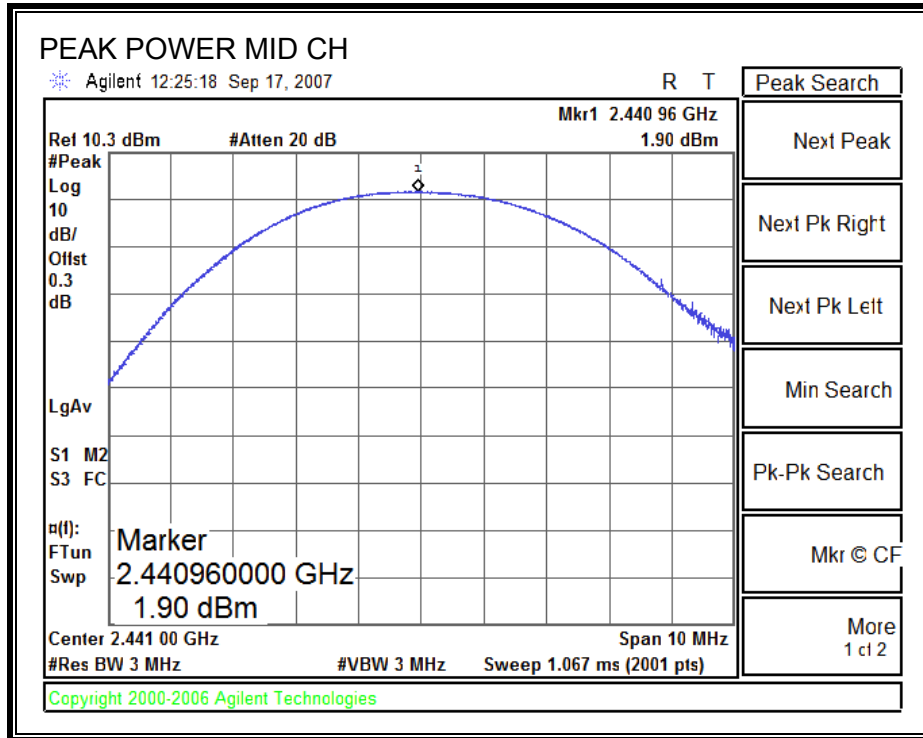
**OUTPUT POWER**

QPSK Mode



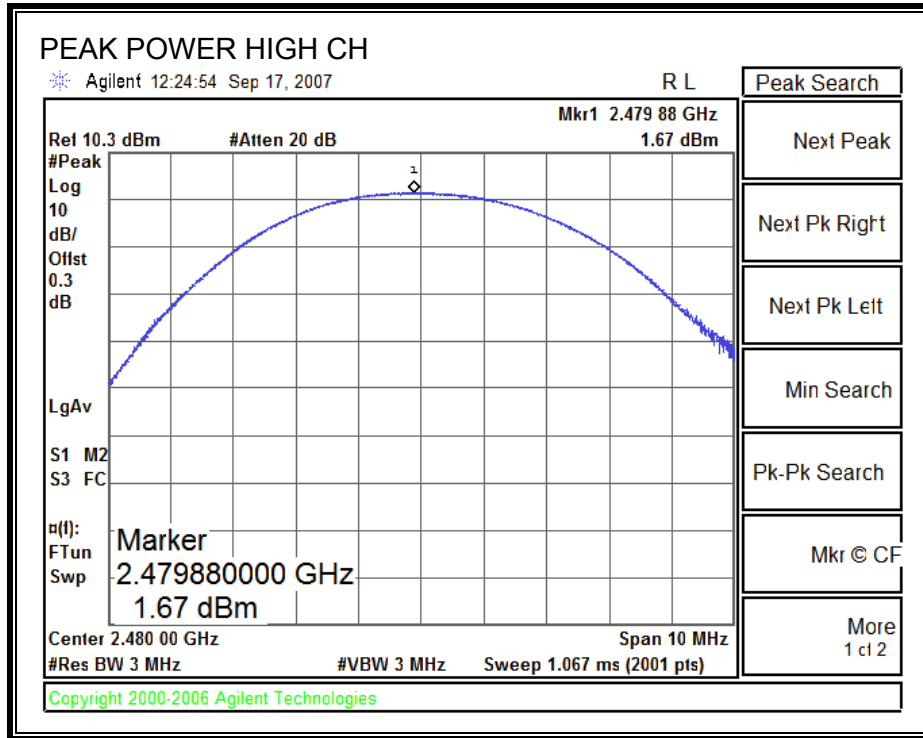
**OUTPUT POWER**

QPSK Mode



**OUTPUT POWER**

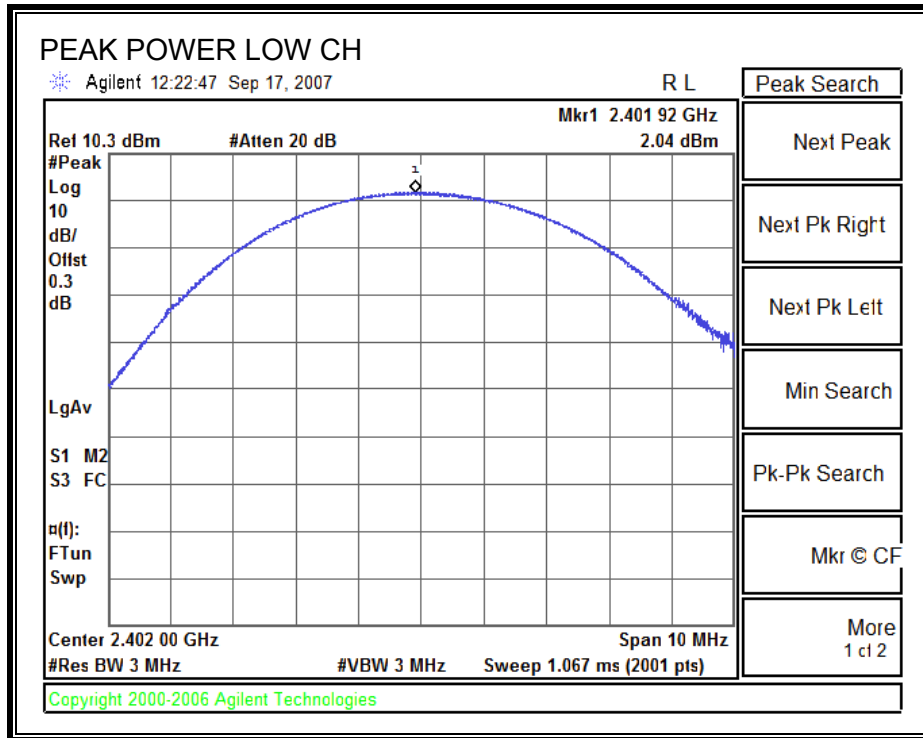
QPSK Mode





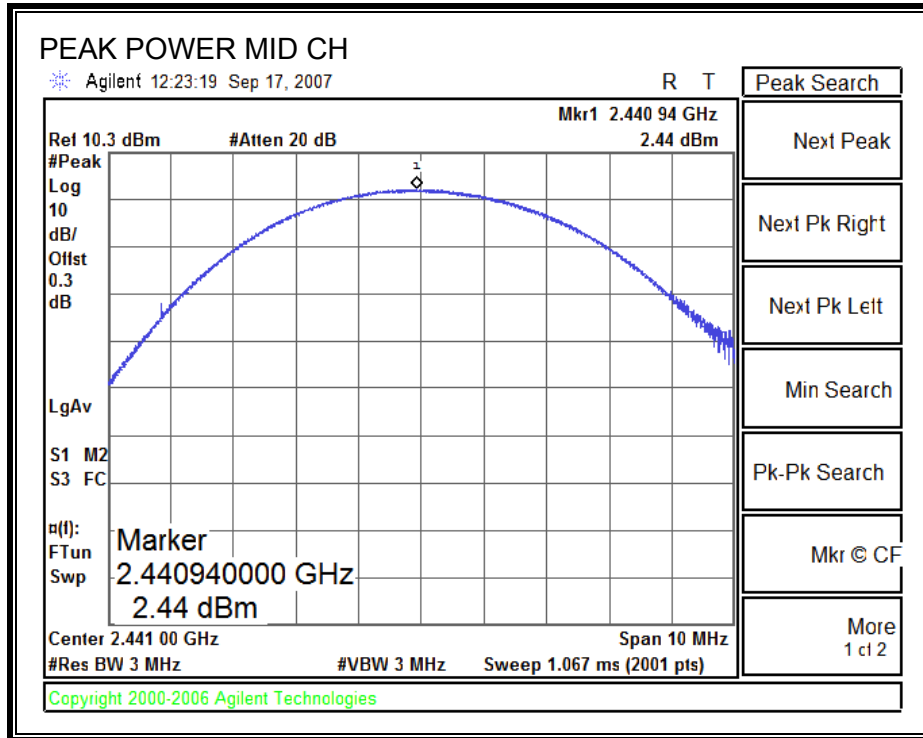
**OUTPUT POWER**

8PSK Mode



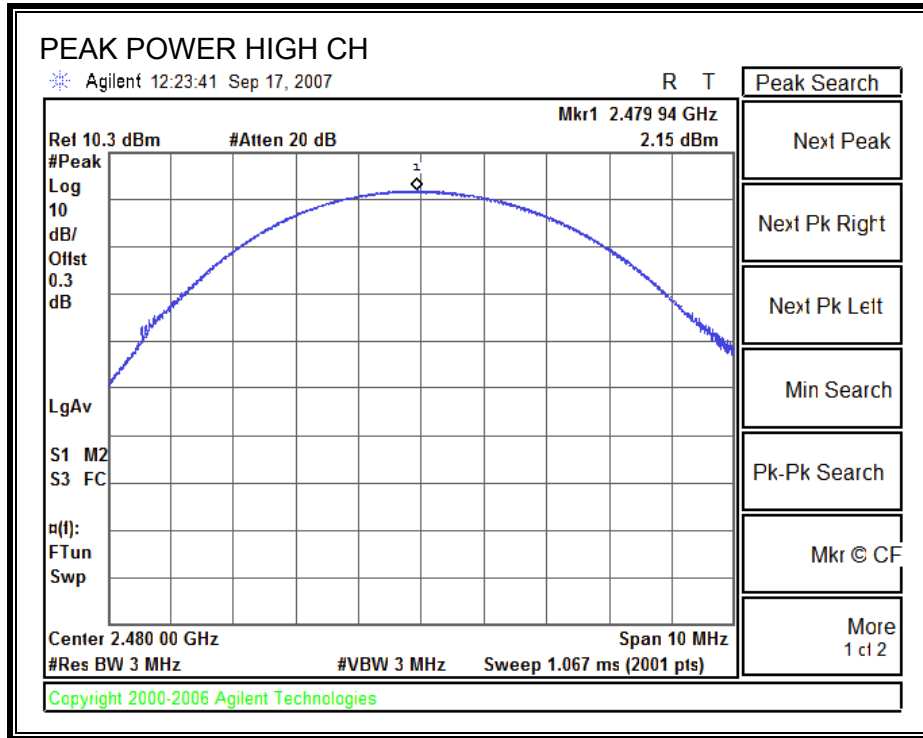
**OUTPUT POWER**

8PSK Mode



**OUTPUT POWER**

8PSK Mode



## 7.1.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.247 (c)

IC RSS-210 A8.5

Limit = -20 dBc

### TEST PROCEDURE

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

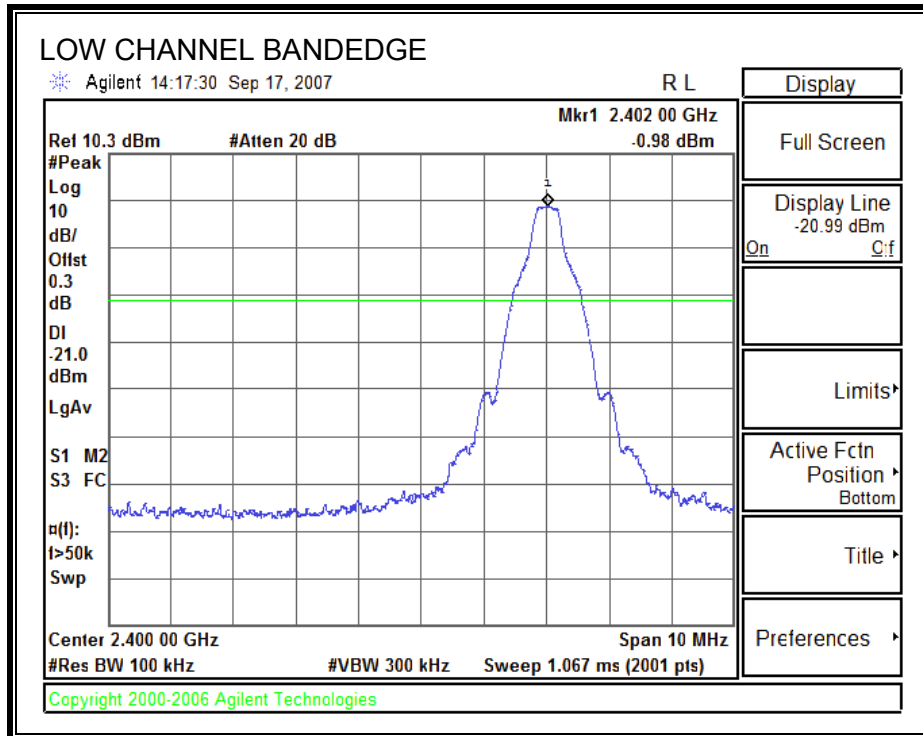
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

### RESULTS

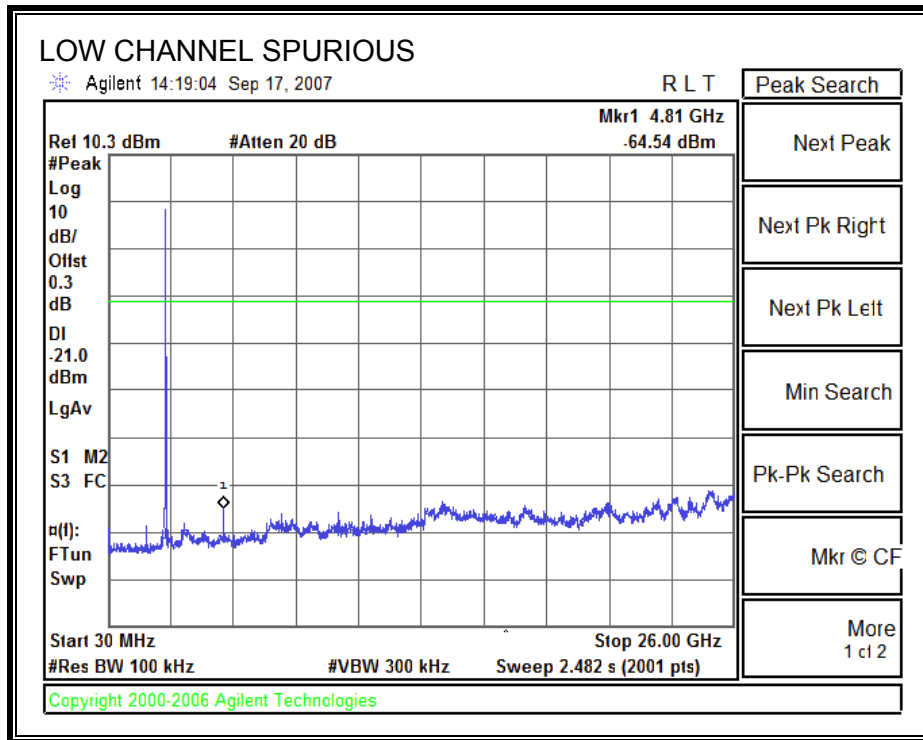
**SPURIOUS EMISSIONS, LOW CHANNEL**

GFSK Mode



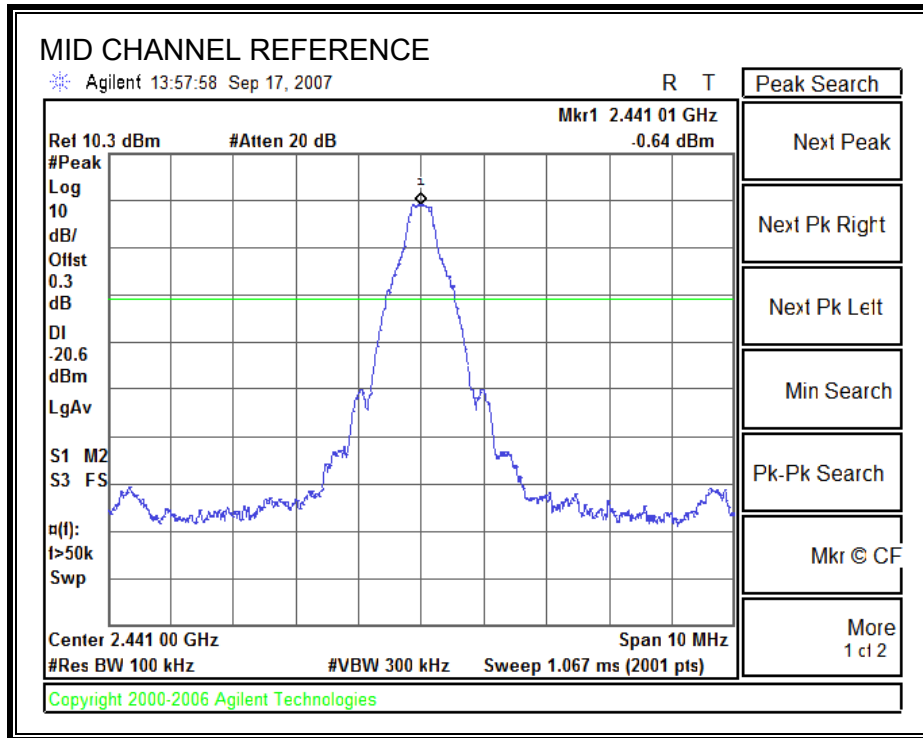
**SPURIOUS EMISSIONS, LOW CHANNEL**

GFSK Mode



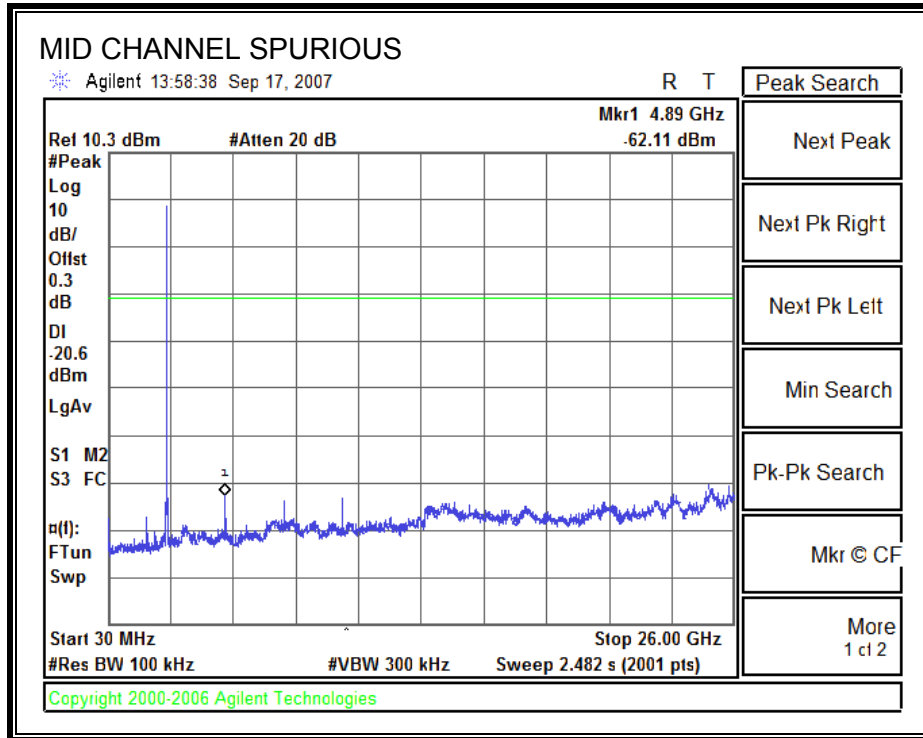
**SPURIOUS EMISSIONS, MID CHANNEL**

GFSK Mode



**SPURIOUS EMISSIONS, MID CHANNEL**

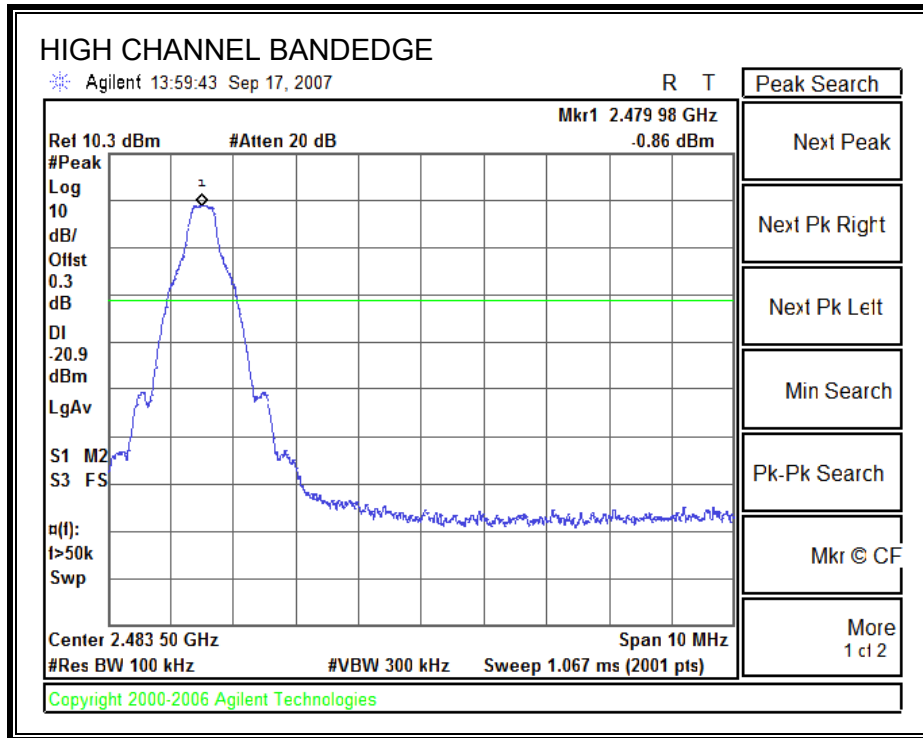
GFSK Mode





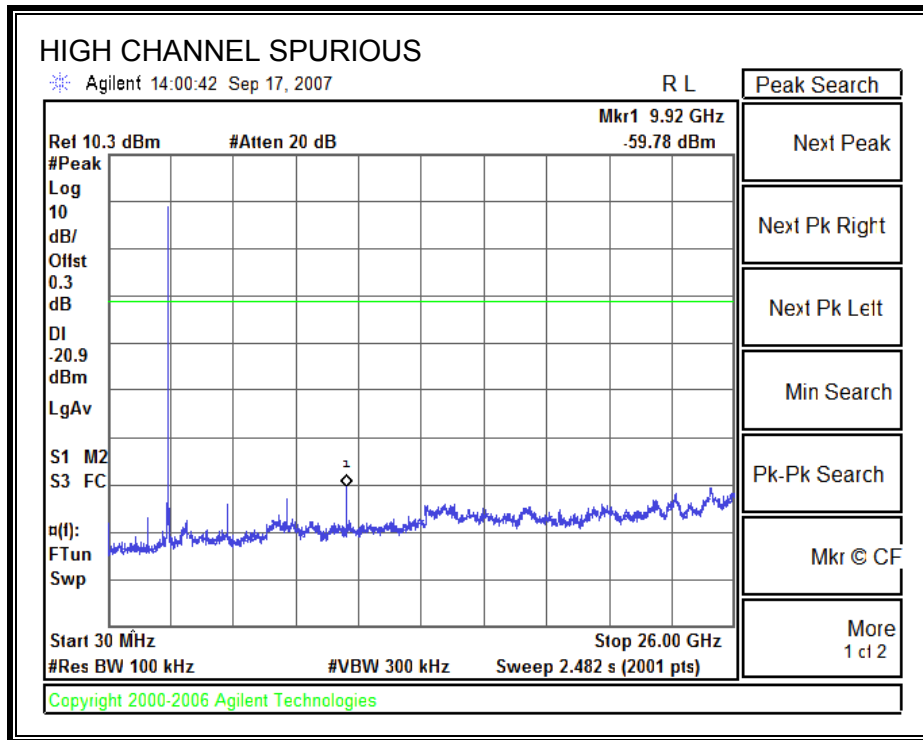
**SPURIOUS EMISSIONS, HIGH CHANNEL**

GFSK Mode



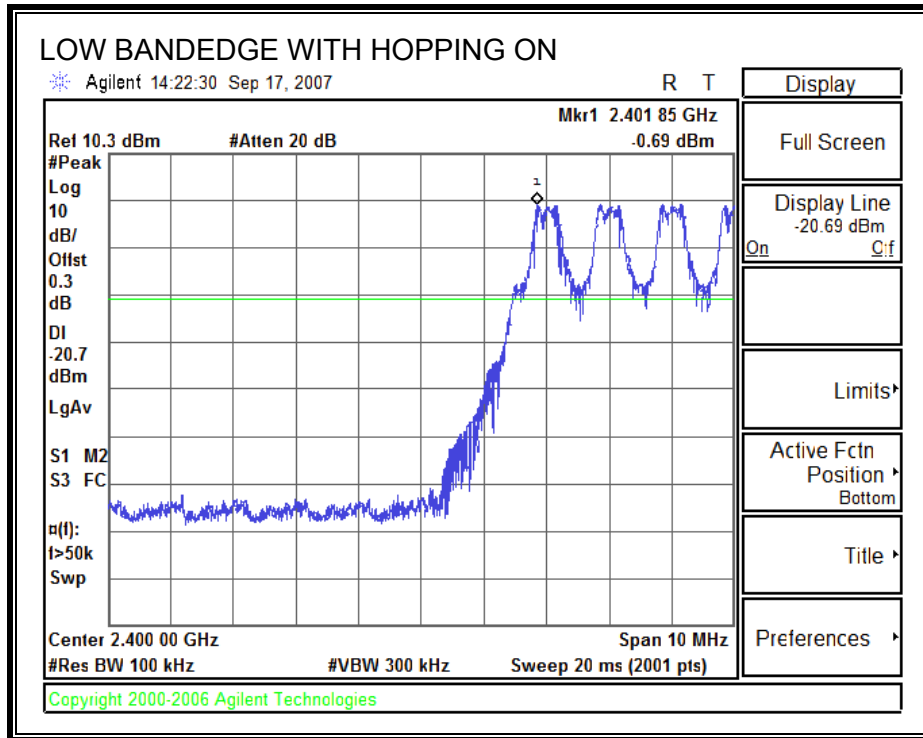
**SPURIOUS EMISSIONS, HIGH CHANNEL**

GFSK Mode



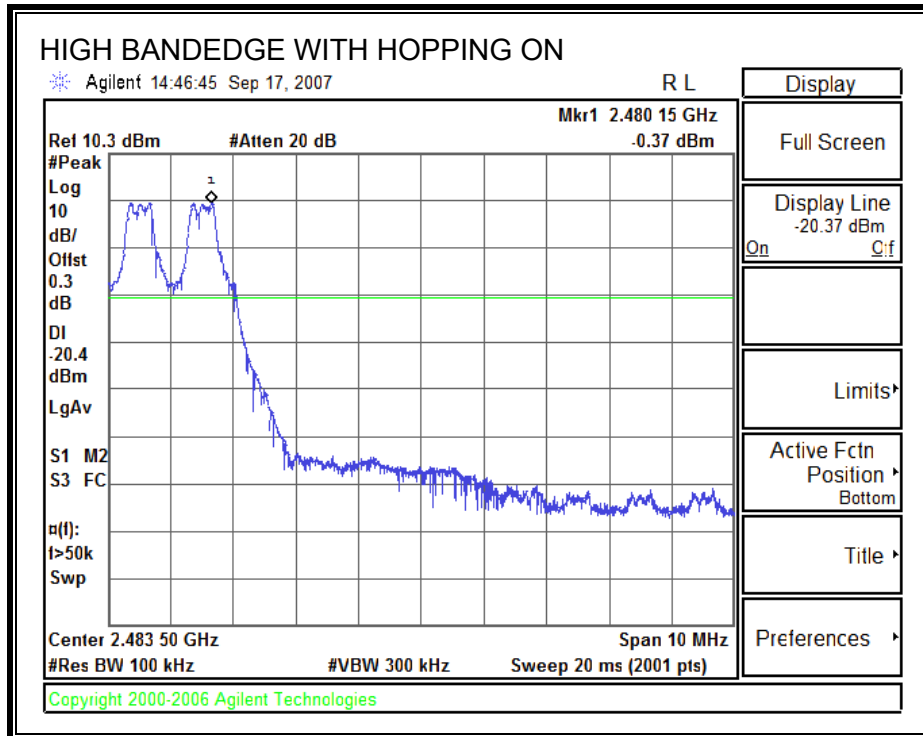
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

GFSK Mode



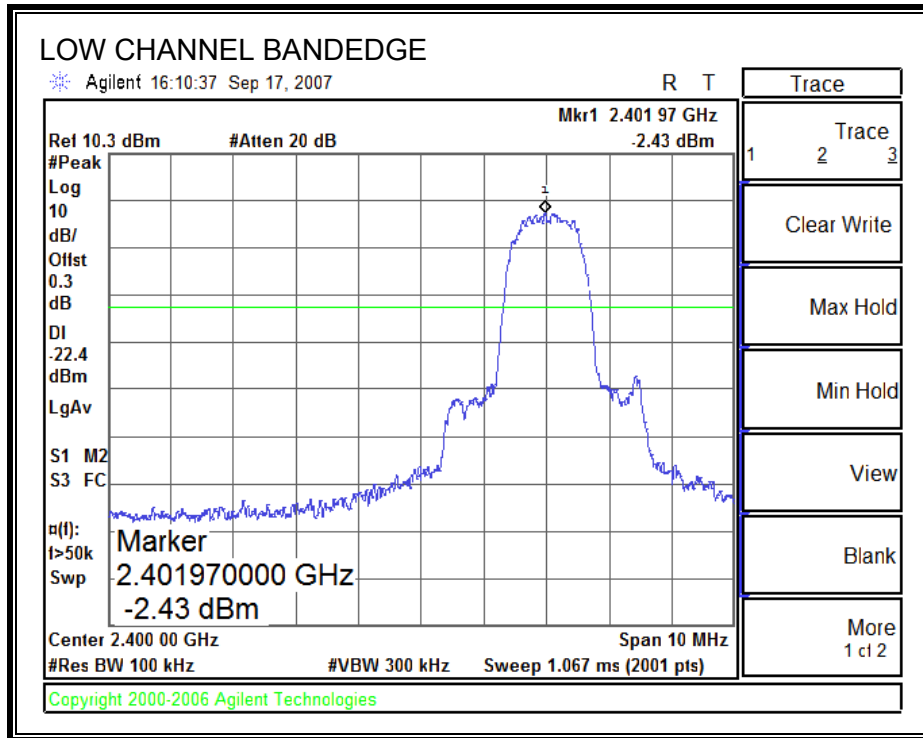
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

GFSK Mode



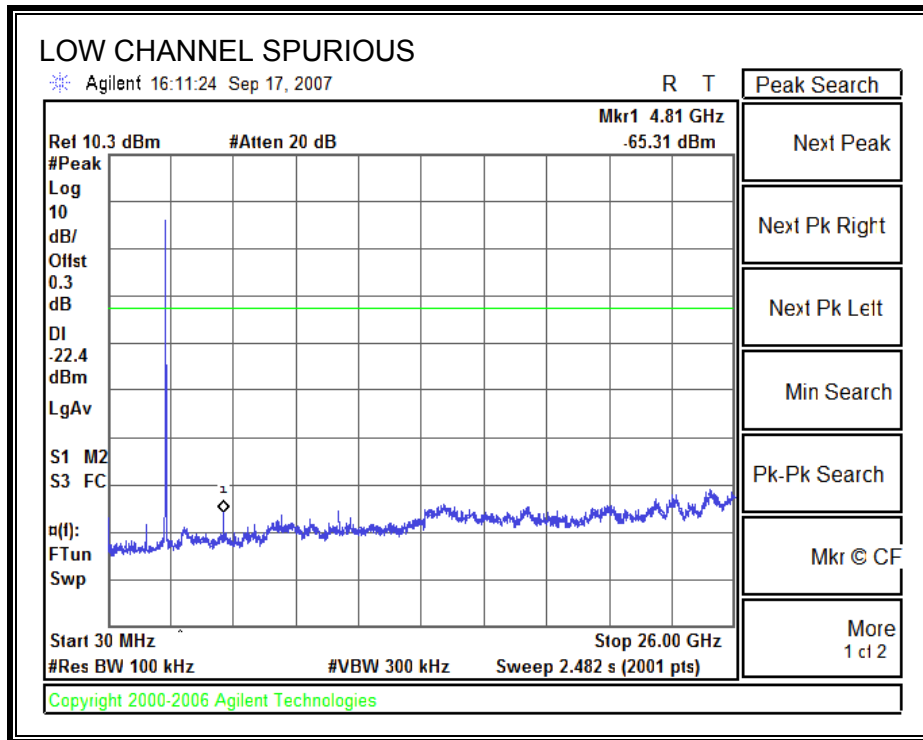
**SPURIOUS EMISSIONS, LOW CHANNEL**

8PSK Mode



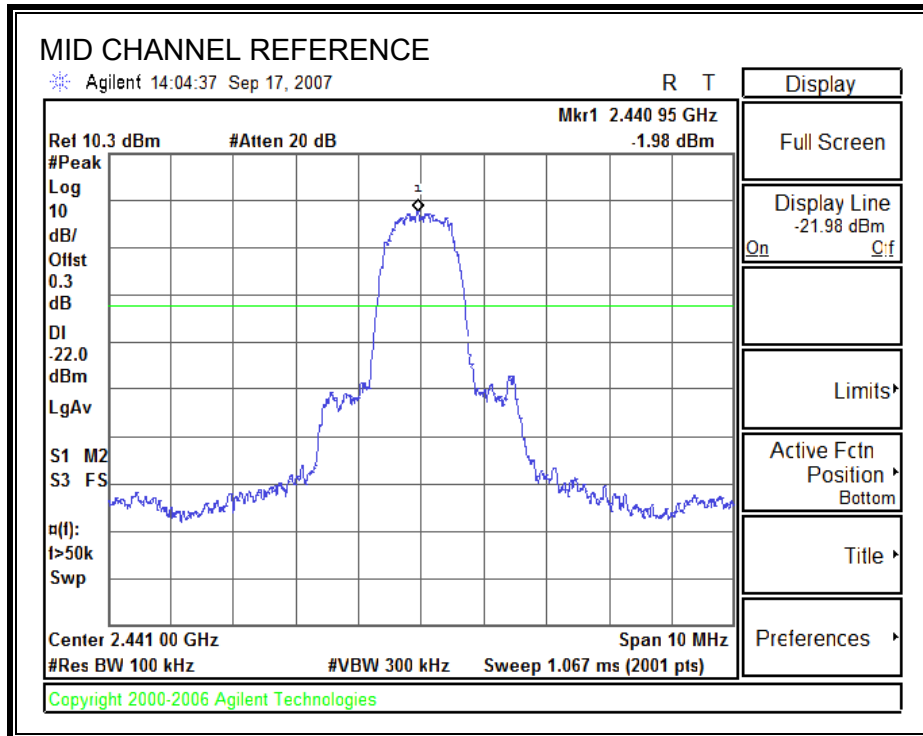
**SPURIOUS EMISSIONS, LOW CHANNEL**

8PSK Mode



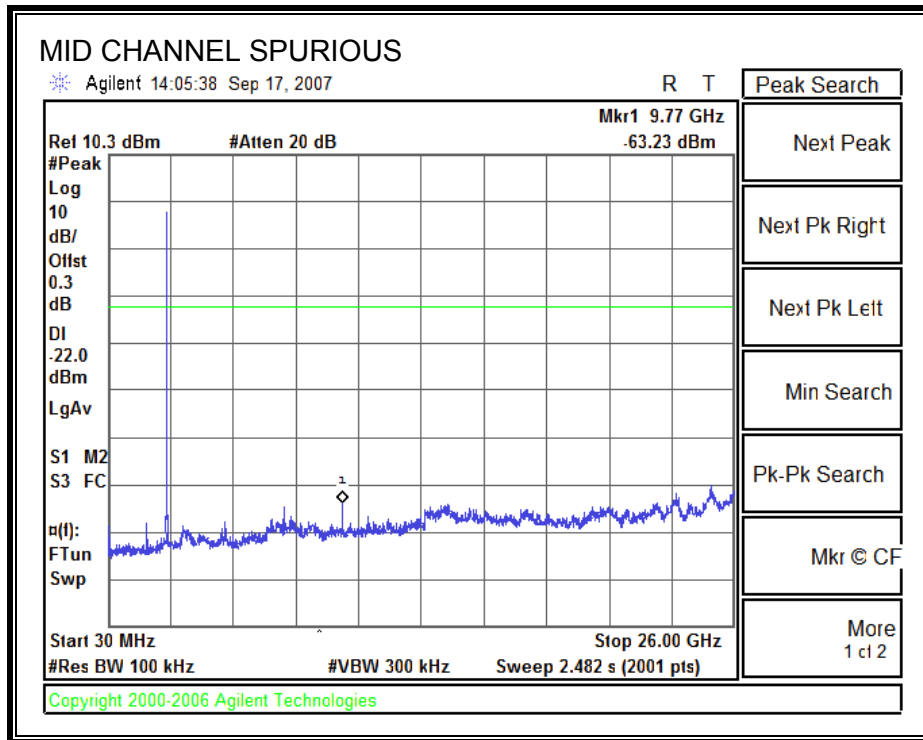
**SPURIOUS EMISSIONS, MID CHANNEL**

8PSK Mode



**SPURIOUS EMISSIONS, MID CHANNEL**

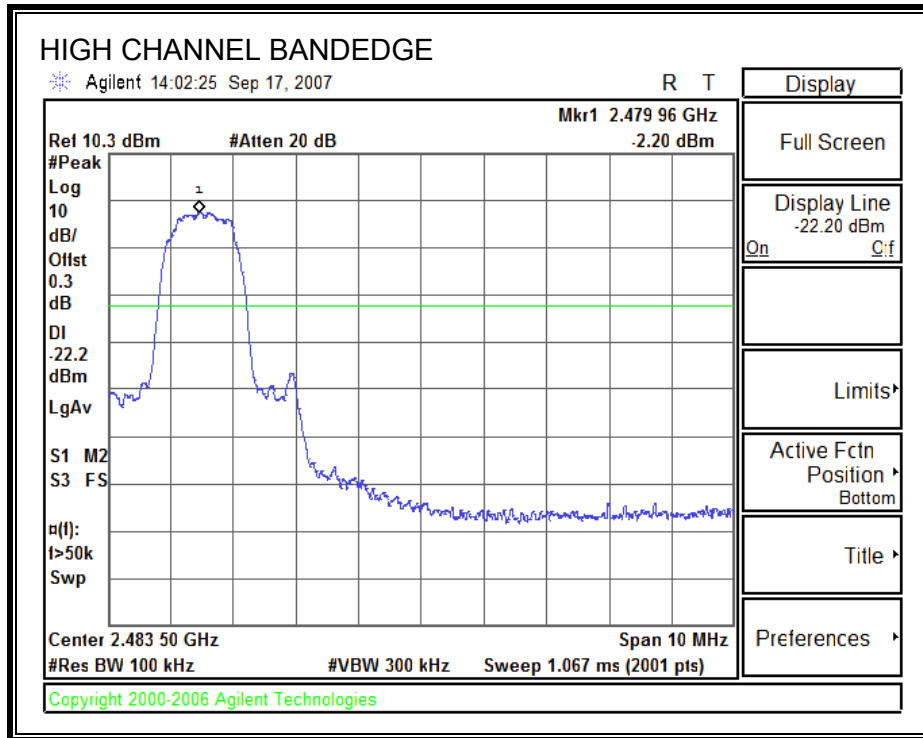
8PSK Mode





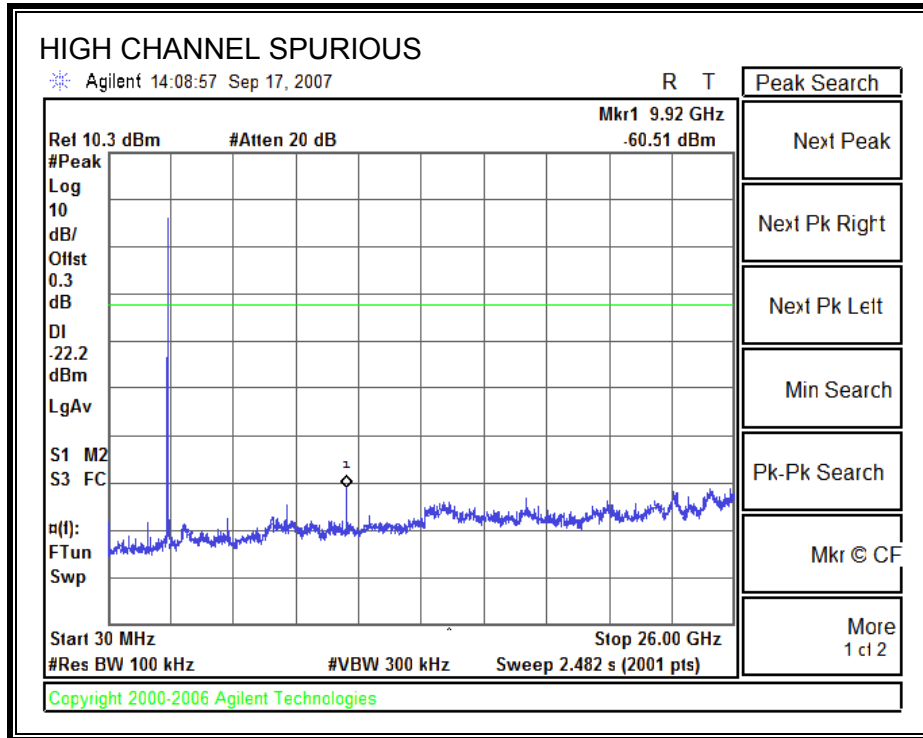
**SPURIOUS EMISSIONS, HIGH CHANNEL**

8PSK Mode



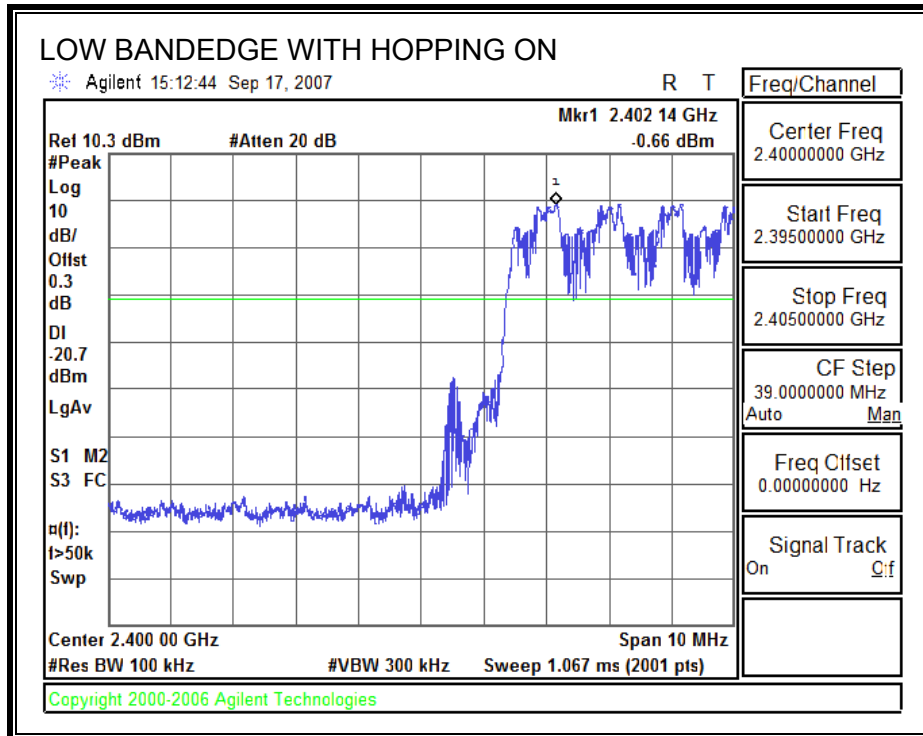
**SPURIOUS EMISSIONS, HIGH CHANNEL**

8PSK Mode



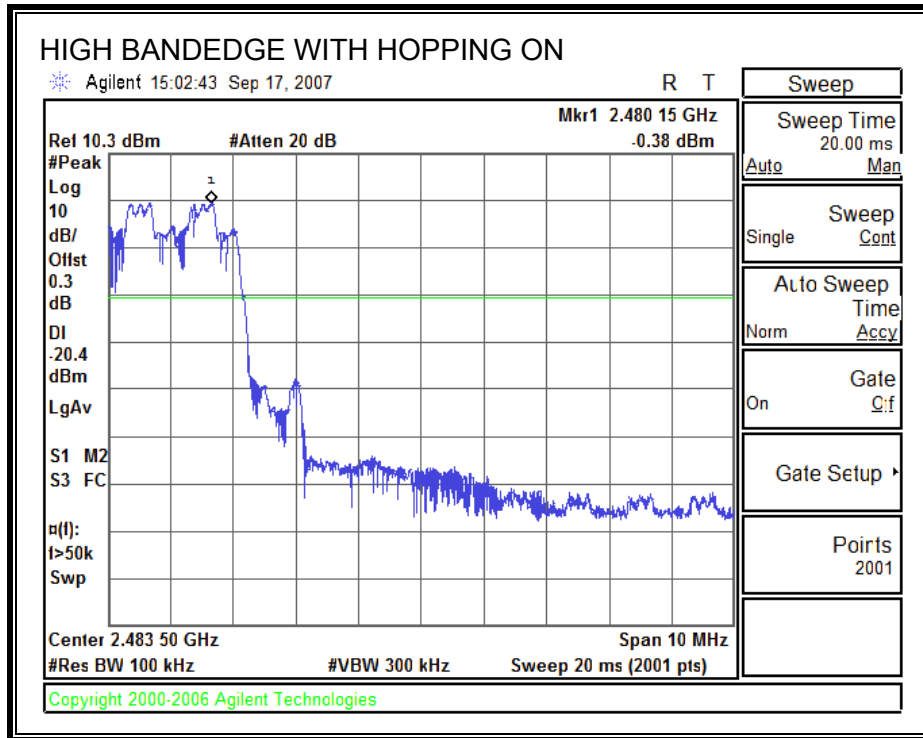
**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

8PSK Mode



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**

8PSK Mode



## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

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

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

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

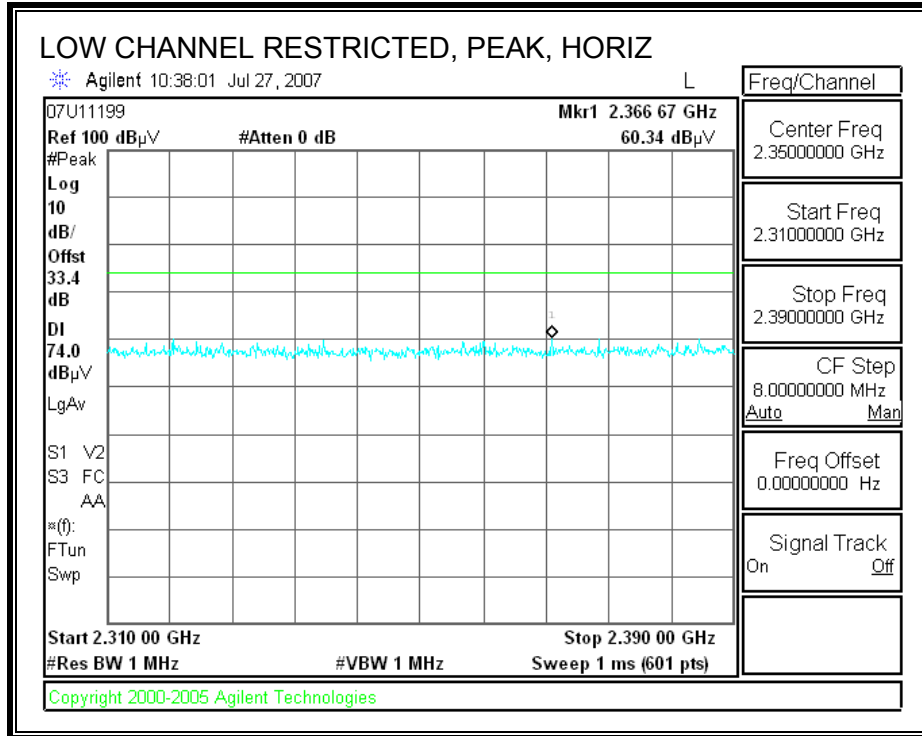
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. BASIC DATA RATE GFSK MODULATION

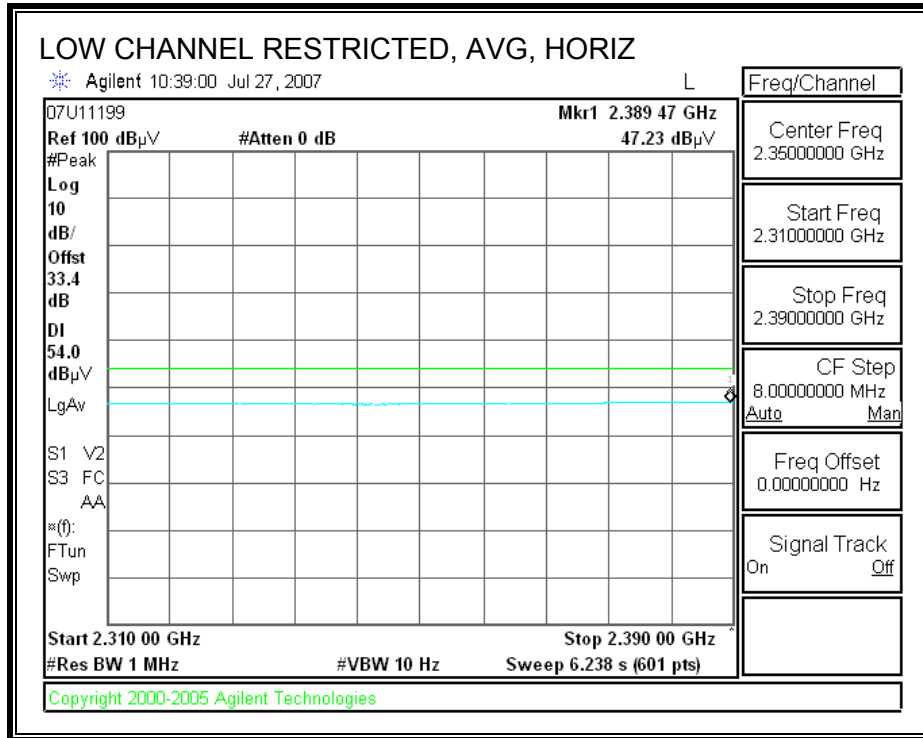
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

GFSK Mode



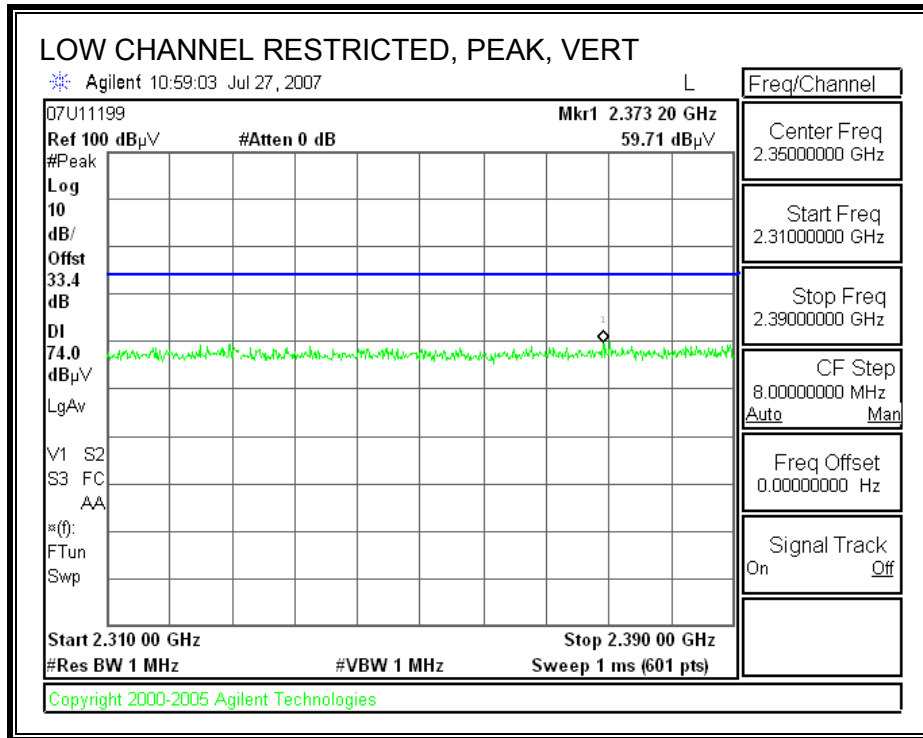
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**

GFSK Mode



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

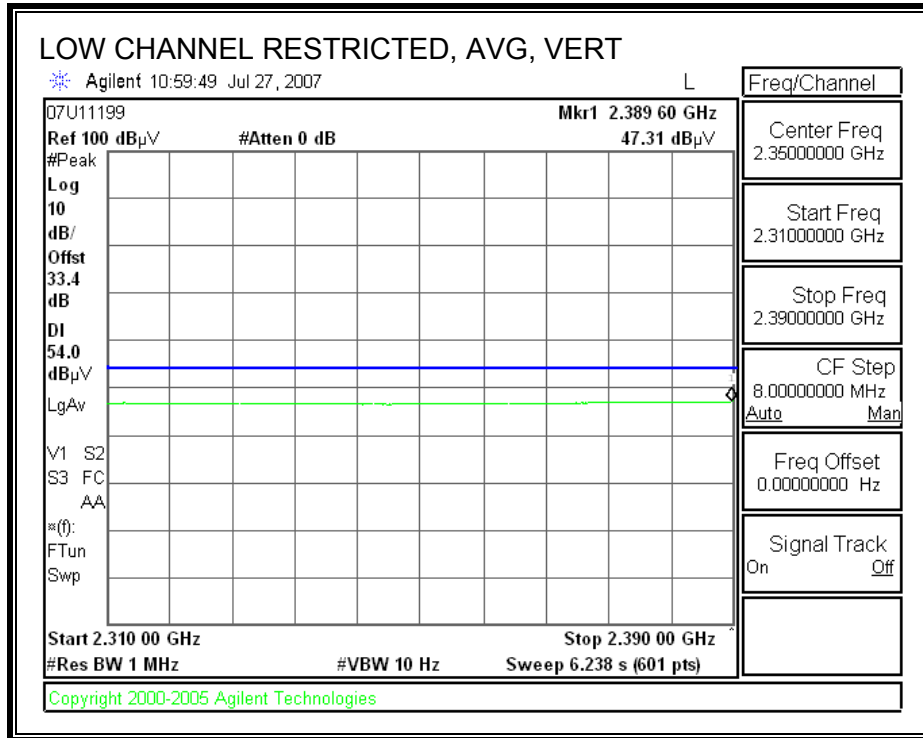
GFSK Mode





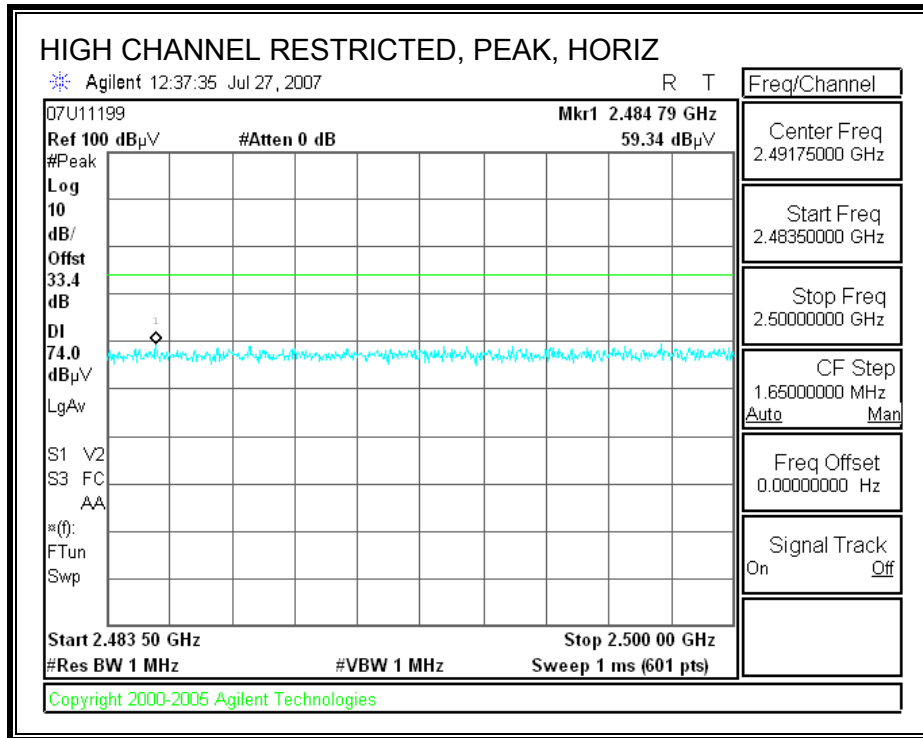
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

GFSK Mode



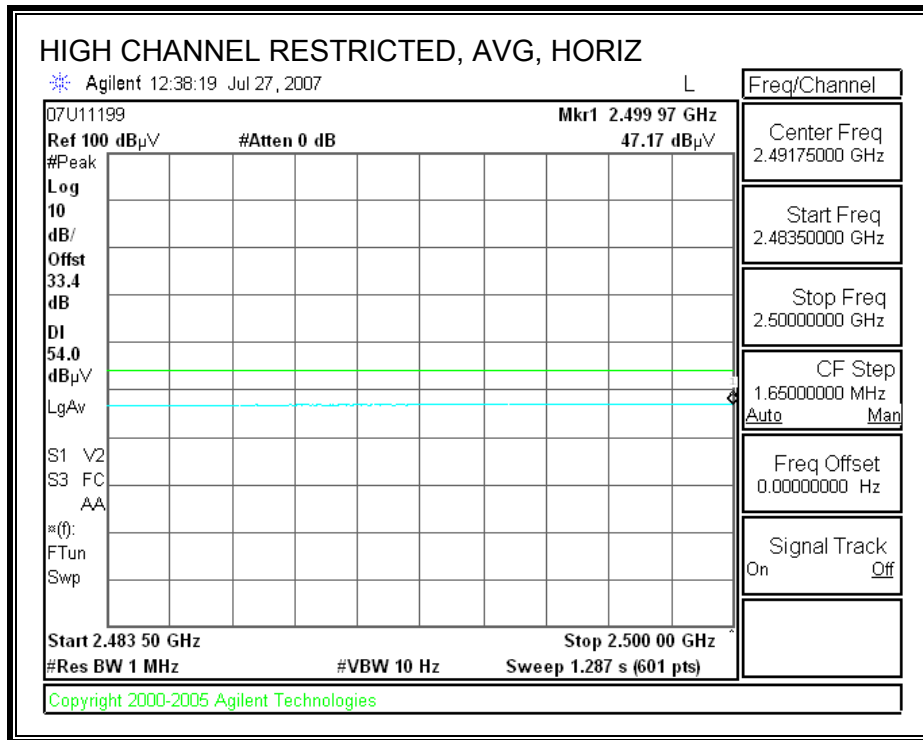
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

GFSK Mode



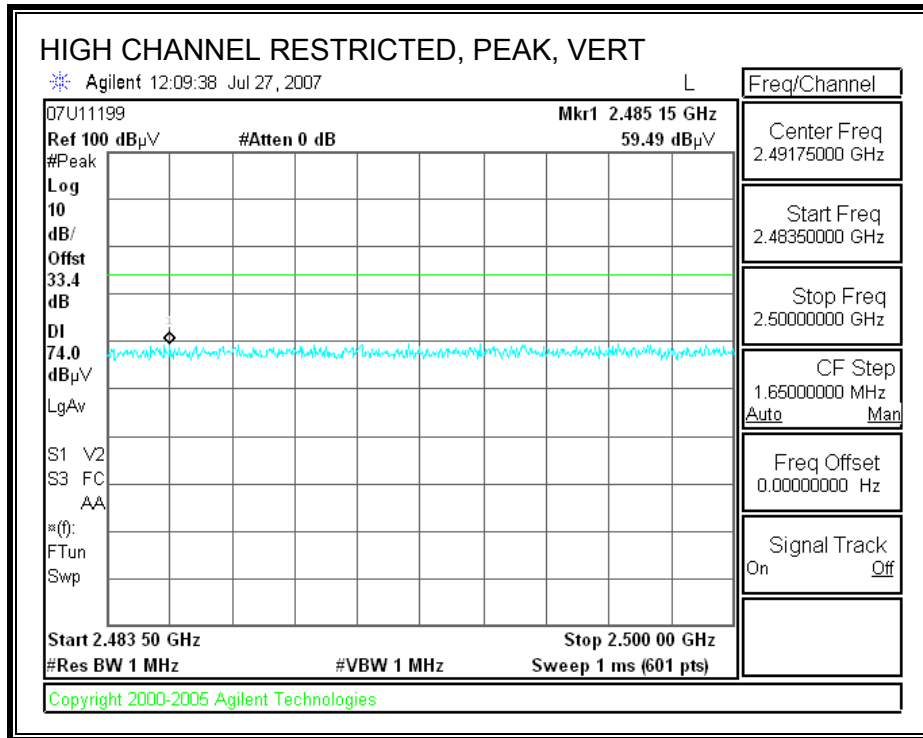
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

GFSK Mode



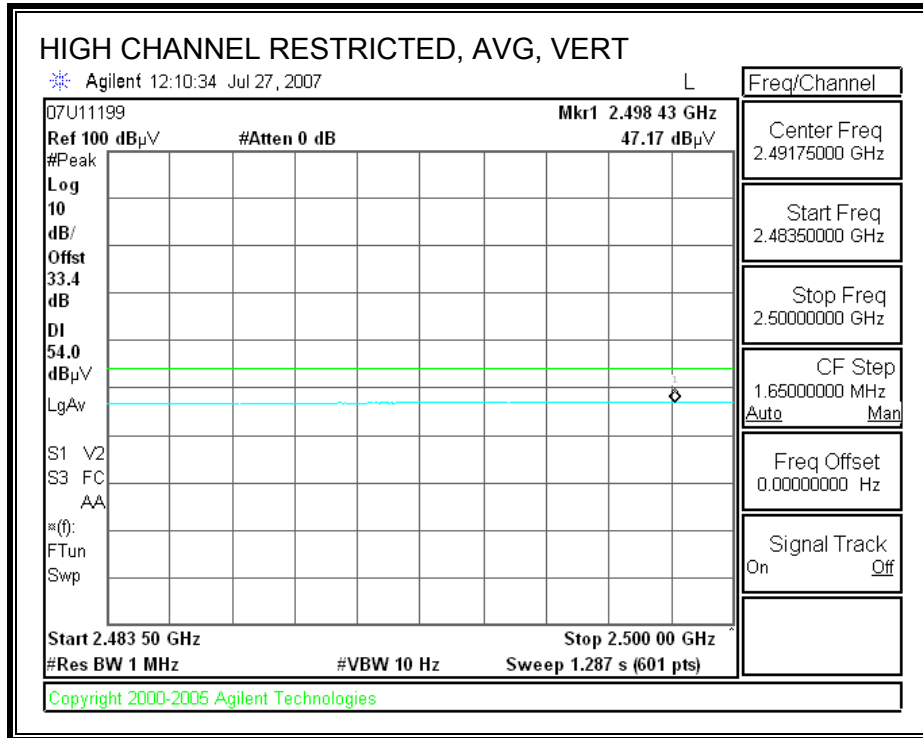
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

GFSK Mode



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

GFSK Mode



**HARMONICS AND SPURIOUS EMISSIONS**

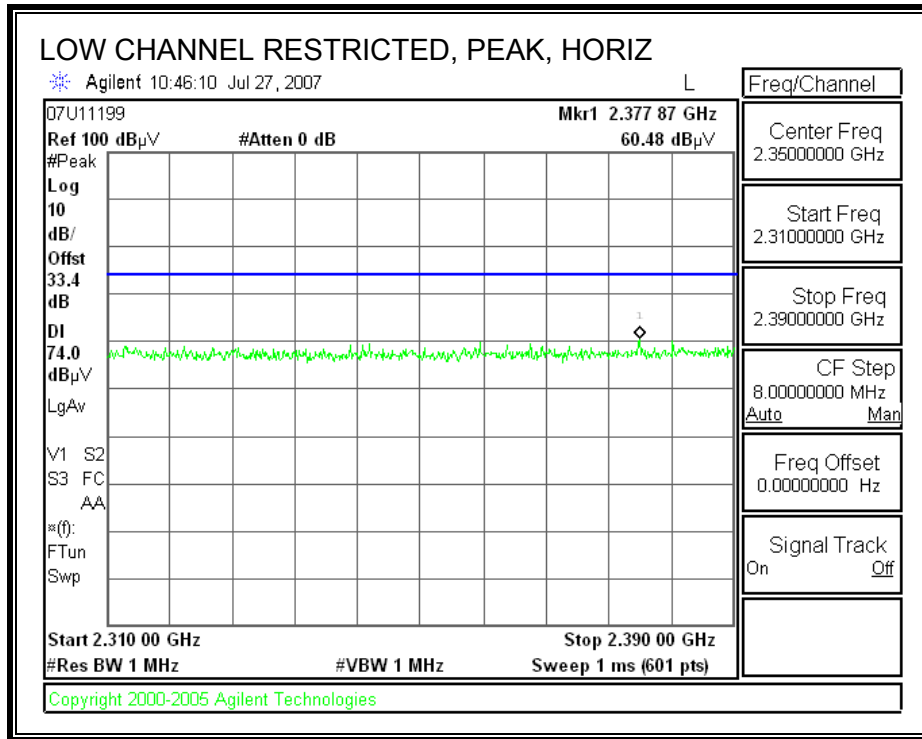
GFSK Mode

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company: Broadcom Project #: 07U11299 Date: September 17, 2007 Test Engineer: Ninous Davoudi Configuration: EUT with Support Equipment Mode: TX, GFSK																	
<b>Test Equipment:</b>																	
Horn 1-18GHz		Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit						
T60; S/N: 2238 @3m		T34 HP 8449B									FCC 15.209						
Hi Frequency Cables																	
2 foot cable		3 foot cable			12 foot cable			HPF			Reject Filter						
					B-5m Chamber						R_001			Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz			
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	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)		
<b>L ch</b>																	
1.030	3.0	50.7	40.3	25.5	3.3	-38.2	0.0	0.0	41.2	30.9	74	54	-32.8	-23.1	V		
1.419	3.0	49.7	32.4	26.5	3.8	-37.7	0.0	0.0	42.3	25.0	74	54	-31.7	-29.0	V		
1.702	3.0	55.1	32.8	27.2	4.1	-37.3	0.0	0.0	49.1	26.8	74	54	-24.9	-27.2	V		
1.931	3.0	51.5	36.4	27.8	4.4	-37.0	0.0	0.0	46.7	31.6	74	54	-27.3	-22.4	V		
1.320	3.0	51.2	34.0	26.2	3.6	-37.8	0.0	0.0	43.3	26.1	74	54	-30.7	-27.9	H		
1.430	3.0	49.3	32.3	26.5	3.8	-37.7	0.0	0.0	42.0	24.9	74	54	-32.0	-29.1	H		
no more emissions were detected																	
<b>M ch</b>																	
1.203	3.0	55.0	34.7	25.9	3.5	-38.0	0.0	0.0	46.4	26.1	74	54	-27.6	-27.9	V		
1.415	3.0	51.5	33.4	26.5	3.8	-37.7	0.0	0.0	44.1	25.9	74	54	-29.9	-28.1	V		
1.931	3.0	52.7	34.4	27.8	4.4	-37.0	0.0	0.0	48.0	29.7	74	54	-26.0	-24.3	V		
1.272	3.0	52.7	34.7	26.1	3.6	-37.9	0.0	0.0	44.5	26.5	74	54	-29.5	-27.5	H		
1.420	3.0	51.7	32.6	26.5	3.8	-37.7	0.0	0.0	44.3	25.2	74	54	-29.7	-28.8	H		
no more emissions were detected																	
<b>H ch</b>																	
1.202	3.0	52.6	34.1	25.9	3.5	-38.0	0.0	0.0	44.0	25.5	74	54	-30.0	-28.5	V		
1.421	3.0	52.3	33.3	26.5	3.8	-37.7	0.0	0.0	44.9	25.9	74	54	-29.1	-28.1	V		
1.920	3.0	53.1	35.2	27.7	4.4	-37.0	0.0	0.0	48.3	30.4	74	54	-25.7	-23.6	V		
1.280	3.0	47.4	33.6	26.1	3.6	-37.9	0.0	0.0	39.3	25.5	74	54	-34.7	-28.5	H		
1.400	3.0	48.7	34.4	26.4	3.8	-37.7	0.0	0.0	41.2	26.9	74	54	-32.8	-27.1	H		
no more emissions were detected																	
Rev. 4.12.7																	
f	Measurement Frequency					Amp	Preamp Gain					Avg Lim	Average Field Strength Limit				
Dist	Distance to Antenna					D Corr	Distance Correct to 3 meters					Pk Lim	Peak Field Strength Limit				
Read	Analyzer Reading					Avg	Average Field Strength @ 3 m					Avg Mar	Margin vs. Average Limit				
AF	Antenna Factor					Peak	Calculated Peak Field Strength					Pk Mar	Margin vs. Peak Limit				
CL	Cable Loss					HPF	High Pass Filter										

### 8.2.2. ENHANCED DATA RATE 8PSK MODULATION

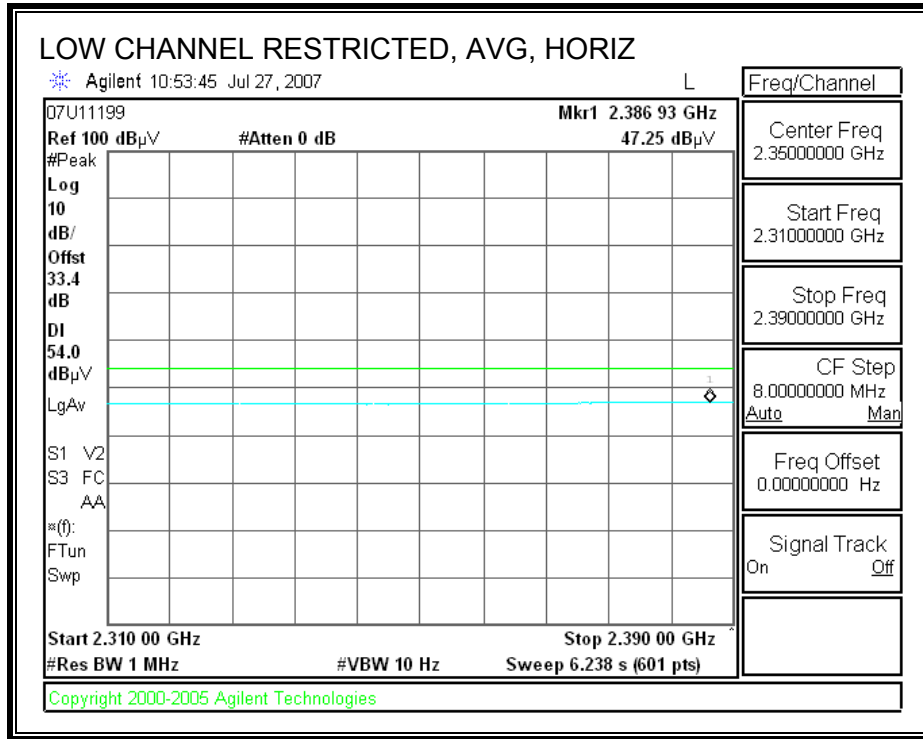
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

8PSK Mode



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

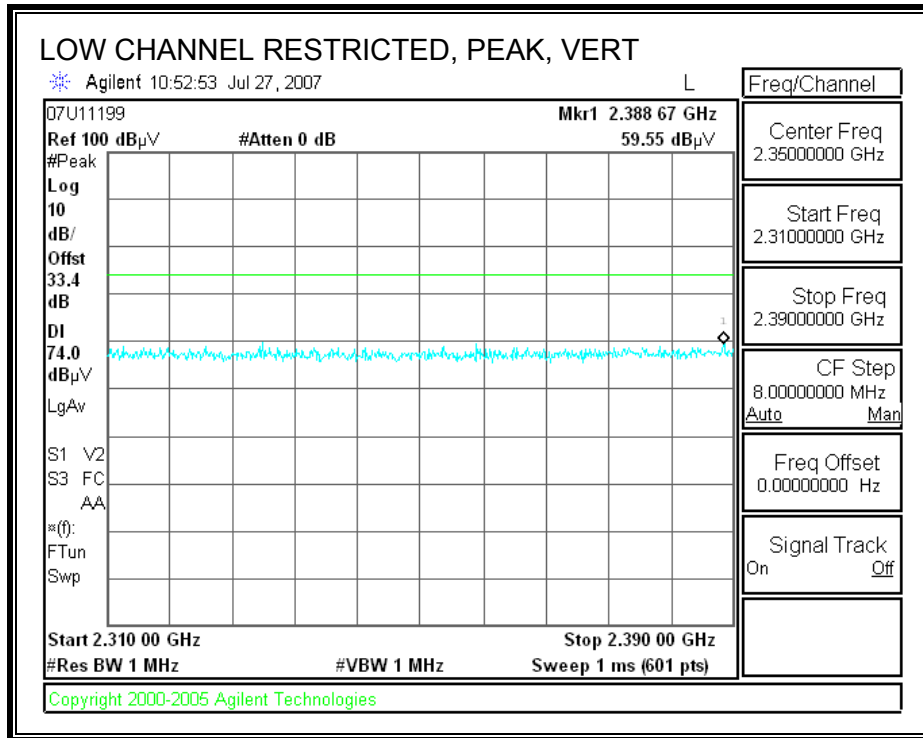
8PSK Mode





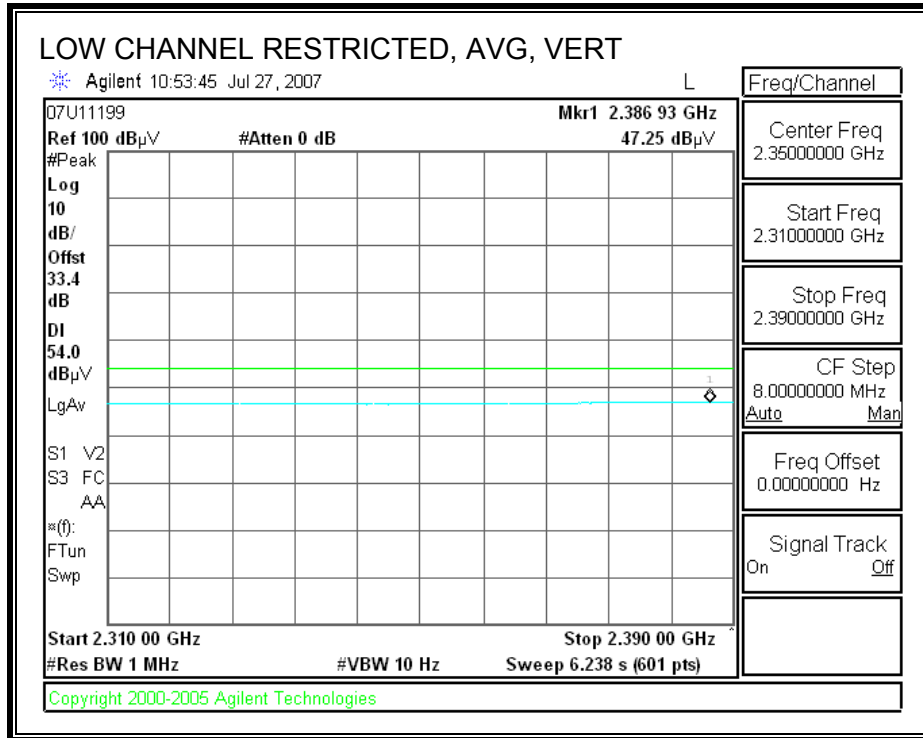
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

8PSK Mode



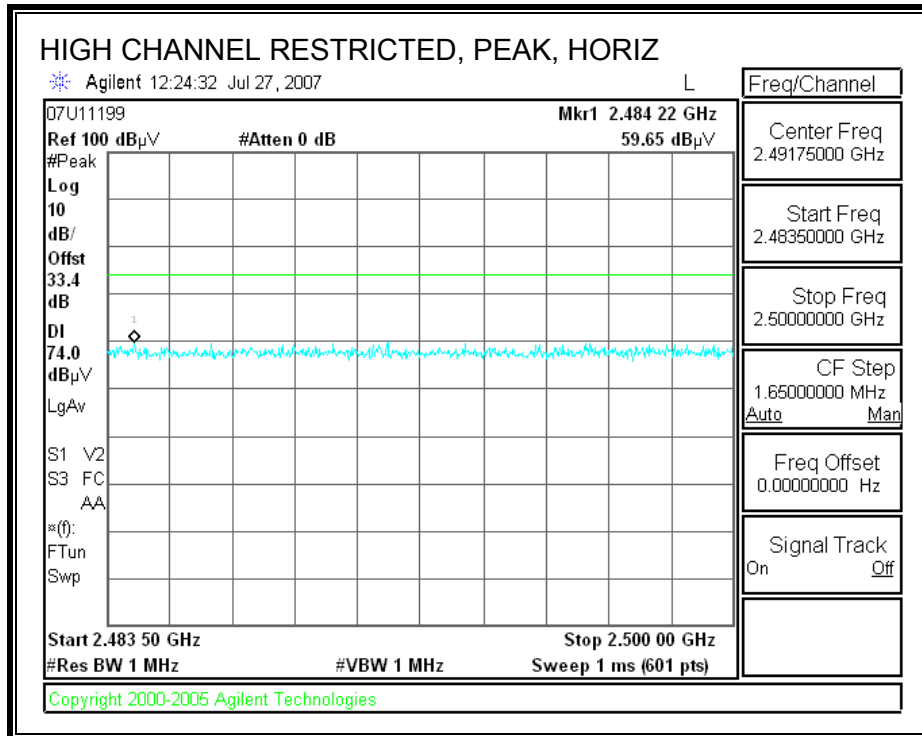
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**

8PSK Mode



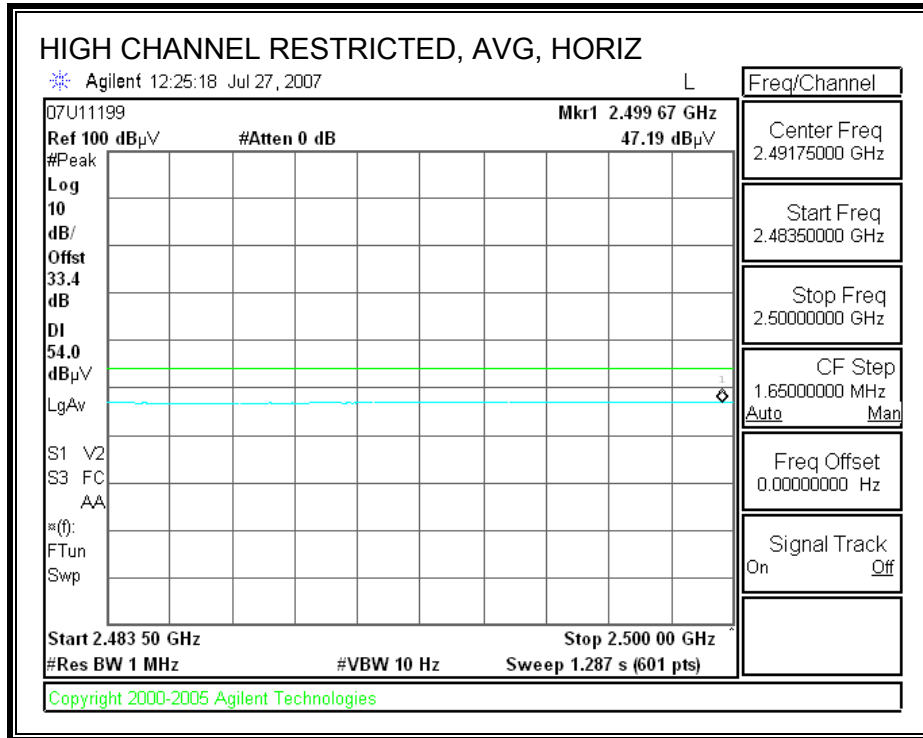
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

8PSK Mode



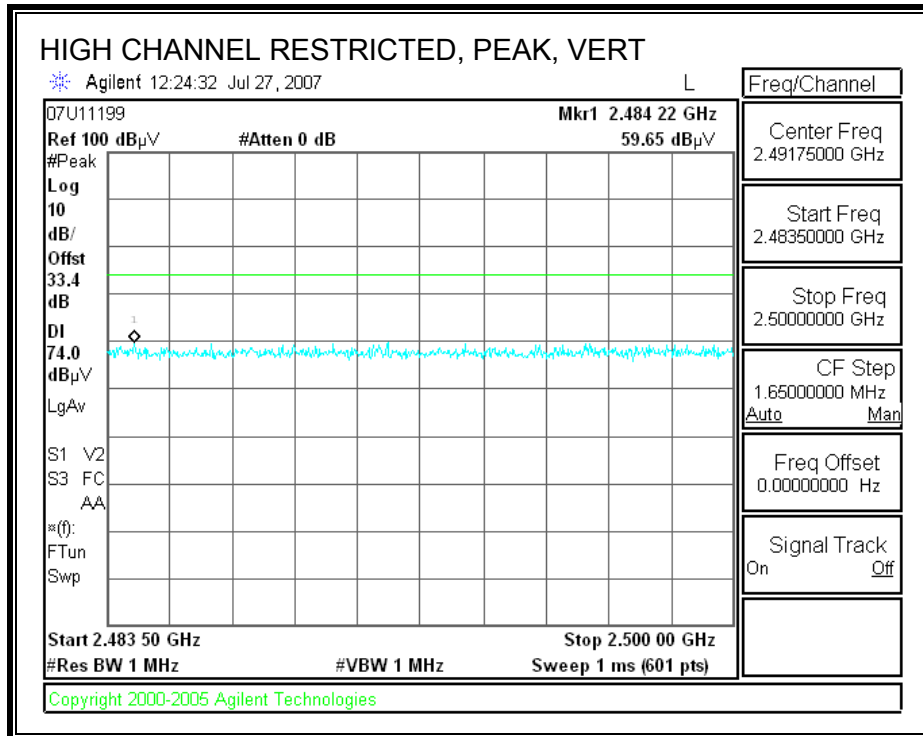
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

8PSK Mode



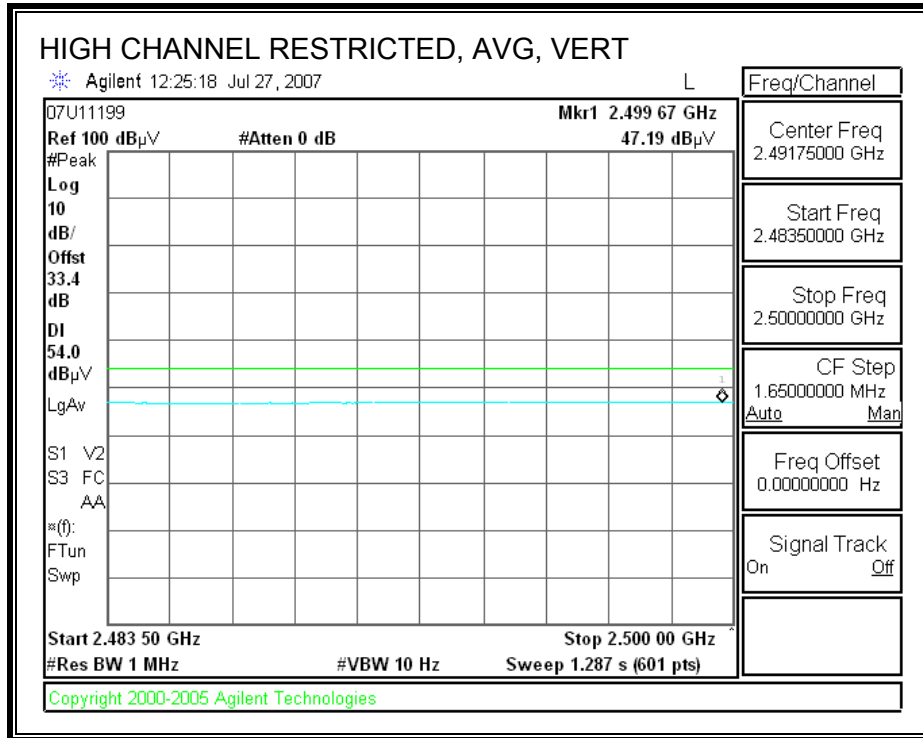
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**

8PSK Mode



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

8PSK Mode



**HARMONICS AND SPURIOUS EMISSIONS**

8PSK Mode

**High Frequency Measurement**

Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom  
 Project #: 07U11299  
 Date: September 19, 2007  
 Test Engineer: Ninous Davoudi  
 Configuration: EUT with Support Equipment  
 Mode: TX, 8PSK

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
		B-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)
L ch															
1.131	3.0	50.6	34.3	25.8	3.4	-38.1	0.0	0.0	41.6	25.3	74	54	-32.4	-28.7	V
1.416	3.0	52.1	32.7	26.5	3.8	-37.7	0.0	0.0	44.7	25.3	74	54	-29.3	-28.7	V
1.773	3.0	50.4	30.6	27.4	4.2	-37.2	0.0	0.0	44.8	25.0	74	54	-29.2	-29.0	V
1.235	3.0	49.7	33.3	26.0	3.5	-37.9	0.0	0.0	41.3	24.9	74	54	-32.7	-29.1	H
1.414	3.0	50.8	32.5	26.5	3.8	-37.7	0.0	0.0	43.3	25.1	74	54	-30.7	-28.9	H
no more emissions were detected															
M ch															
1.203	3.0	53.7	35.2	25.9	3.5	-38.0	0.0	0.0	45.1	26.6	74	54	-28.9	-27.4	V
1.414	3.0	52.1	33.3	26.5	3.8	-37.7	0.0	0.0	44.6	25.8	74	54	-29.4	-28.2	V
1.766	3.0	50.1	30.7	27.4	4.2	-37.2	0.0	0.0	44.5	25.0	74	54	-29.5	-29.0	V
1.031	3.0	48.6	34.2	25.5	3.3	-38.2	0.0	0.0	39.2	24.7	74	54	-34.8	-29.3	H
1.203	3.0	50.9	33.5	25.9	3.5	-38.0	0.0	0.0	42.4	25.0	74	54	-31.6	-29.0	H
no more emissions were detected															
H ch															
1.202	3.0	51.7	33.9	25.9	3.5	-38.0	0.0	0.0	43.2	25.4	74	54	-30.8	-28.6	V
1.696	3.0	54.0	31.9	27.2	4.1	-37.3	0.0	0.0	48.0	25.9	74	54	-26.0	-28.1	V
1.205	3.0	51.0	33.8	25.9	3.5	-38.0	0.0	0.0	42.5	25.3	74	54	-31.5	-28.7	H
1.705	3.0	49.2	31.8	27.2	4.1	-37.3	0.0	0.0	43.3	25.9	74	54	-30.7	-28.1	H
no more emissions were detected															

Rev. 4.12.7

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. RECEIVER ABOVE 1 GHz

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom  
 Project #: 07U11299  
 Date: September 20, 2007  
 Test Engineer: Ninous Davoudi  
 Configuration: EUT with Support Equipment  
 Mode: Rx

**Test Equipment:**

<b>Horn 1-18GHz</b>	<b>Pre-amplifer 1-26GHz</b>	<b>Pre-amplifer 26-40GHz</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T60; S/N: 2238 @3m	T34 HP 8449B			RX RSS 210

Hi Frequency Cables

<b>2 foot cable</b>	<b>3 foot cable</b>	<b>12 foot cable</b>	<b>HPF</b>	<b>Reject Filter</b>	<b>Peak Measurements</b> RBW=VBW=1MHz
		B-5m Chamber			<b>Average Measurements</b> RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
M ch															
1.101	3.0	53.2	39.0	25.7	3.4	-38.1	0.0	0.0	44.1	29.9	74	54	-29.9	-24.1	V
1.204	3.0	53.5	33.9	25.9	3.5	-38.0	0.0	0.0	44.9	25.3	74	54	-29.1	-28.7	V
1.416	3.0	52.1	33.5	26.5	3.8	-37.7	0.0	0.0	44.7	26.0	74	54	-29.3	-28.0	V
1.765	3.0	49.6	31.8	27.3	4.2	-37.2	0.0	0.0	43.9	26.2	74	54	-30.1	-27.8	V
1.415	3.0	51.8	33.5	26.5	3.8	-37.7	0.0	0.0	44.4	26.1	74	54	-29.6	-27.9	H
1.597	3.0	48.6	39.1	26.9	4.0	-37.4	0.0	0.0	42.1	32.6	74	54	-31.9	-21.4	H
1.766	3.0	46.0	30.5	27.4	4.2	-37.2	0.0	0.0	40.3	24.9	74	54	-33.7	-29.1	H
no more emissions were detected															

Rev. 4.12.7

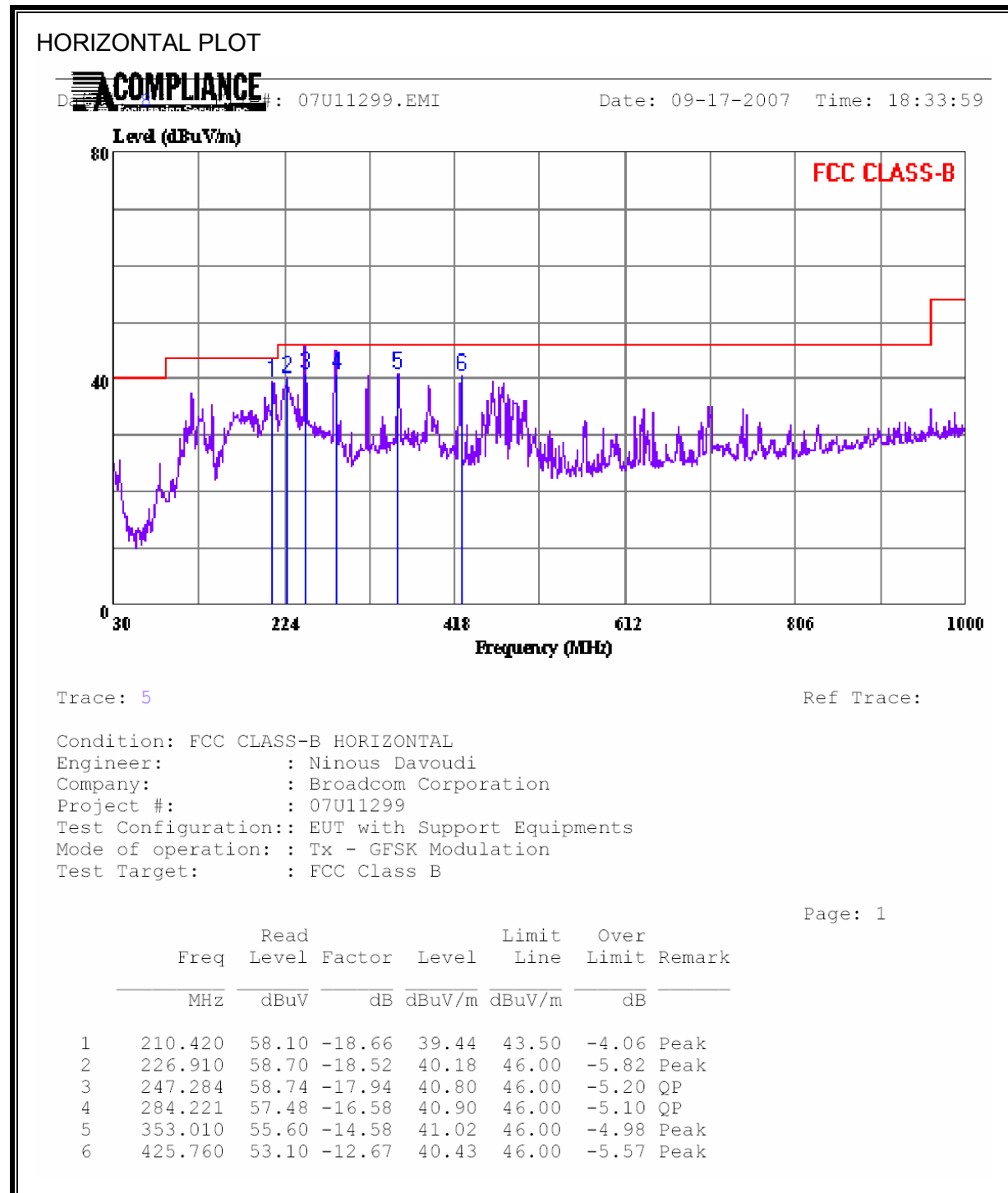
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		



### 8.4. WORST-CASE BELOW 1 GHz

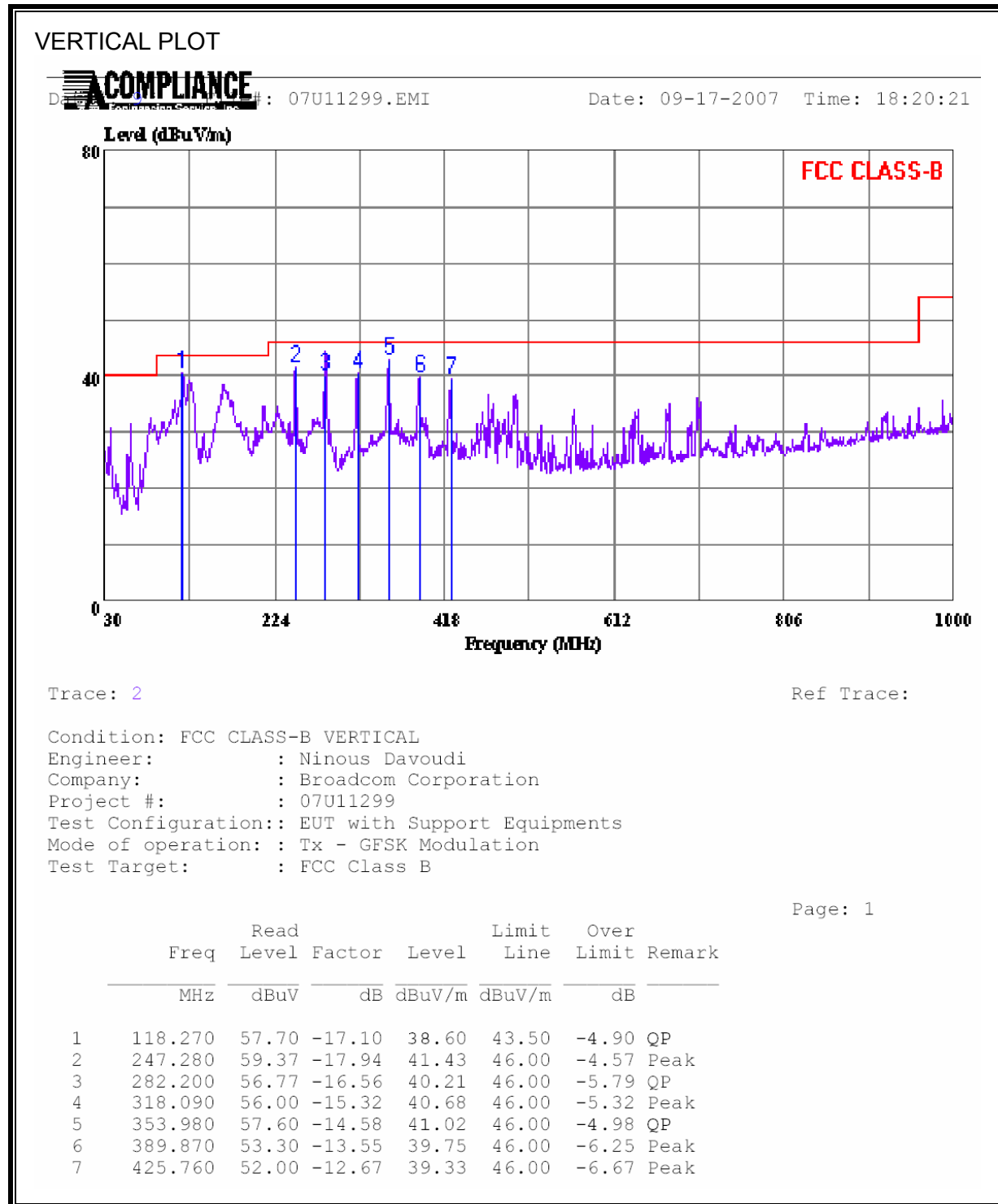
#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

GFSK Mode



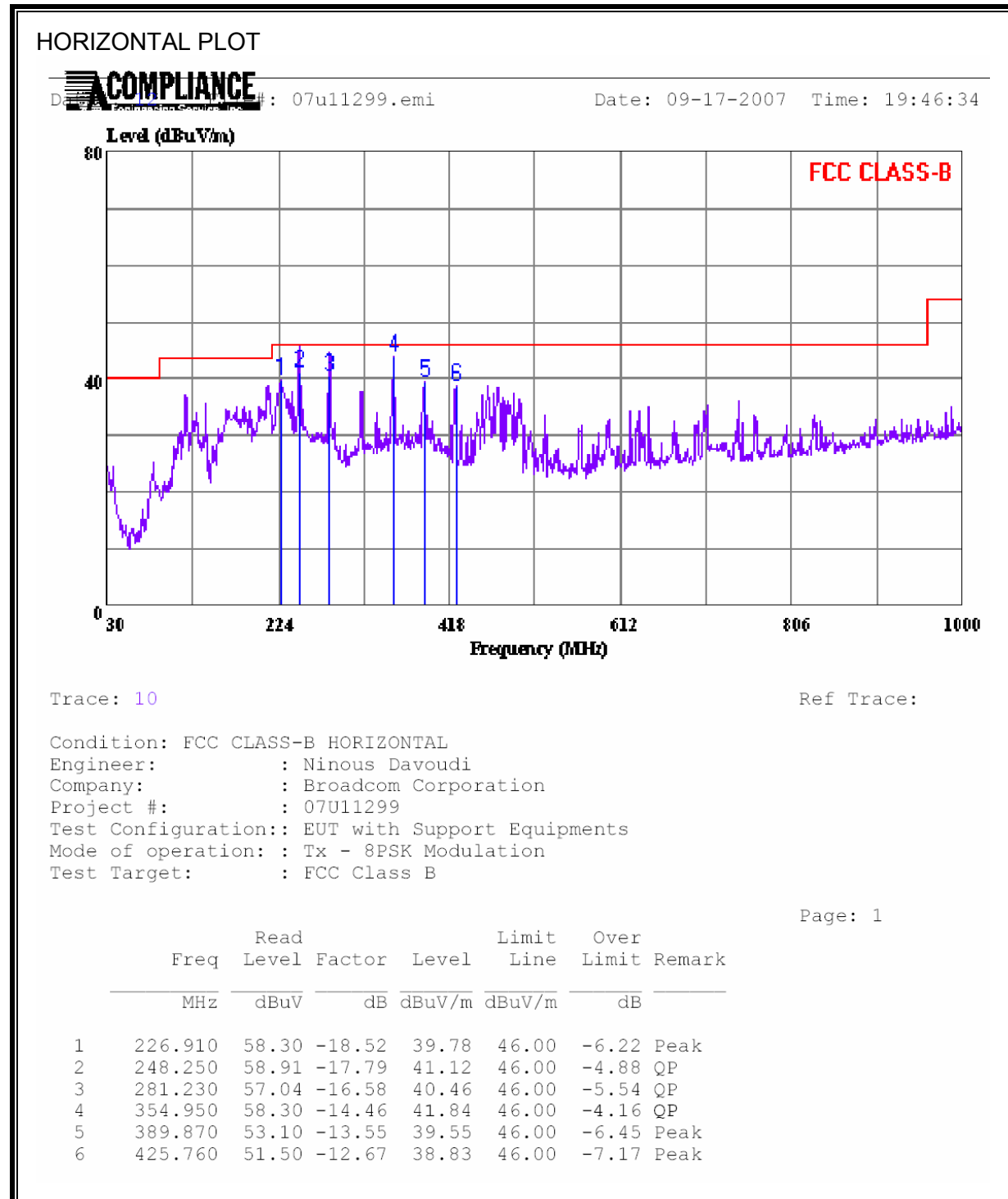
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**

GFSK Mode



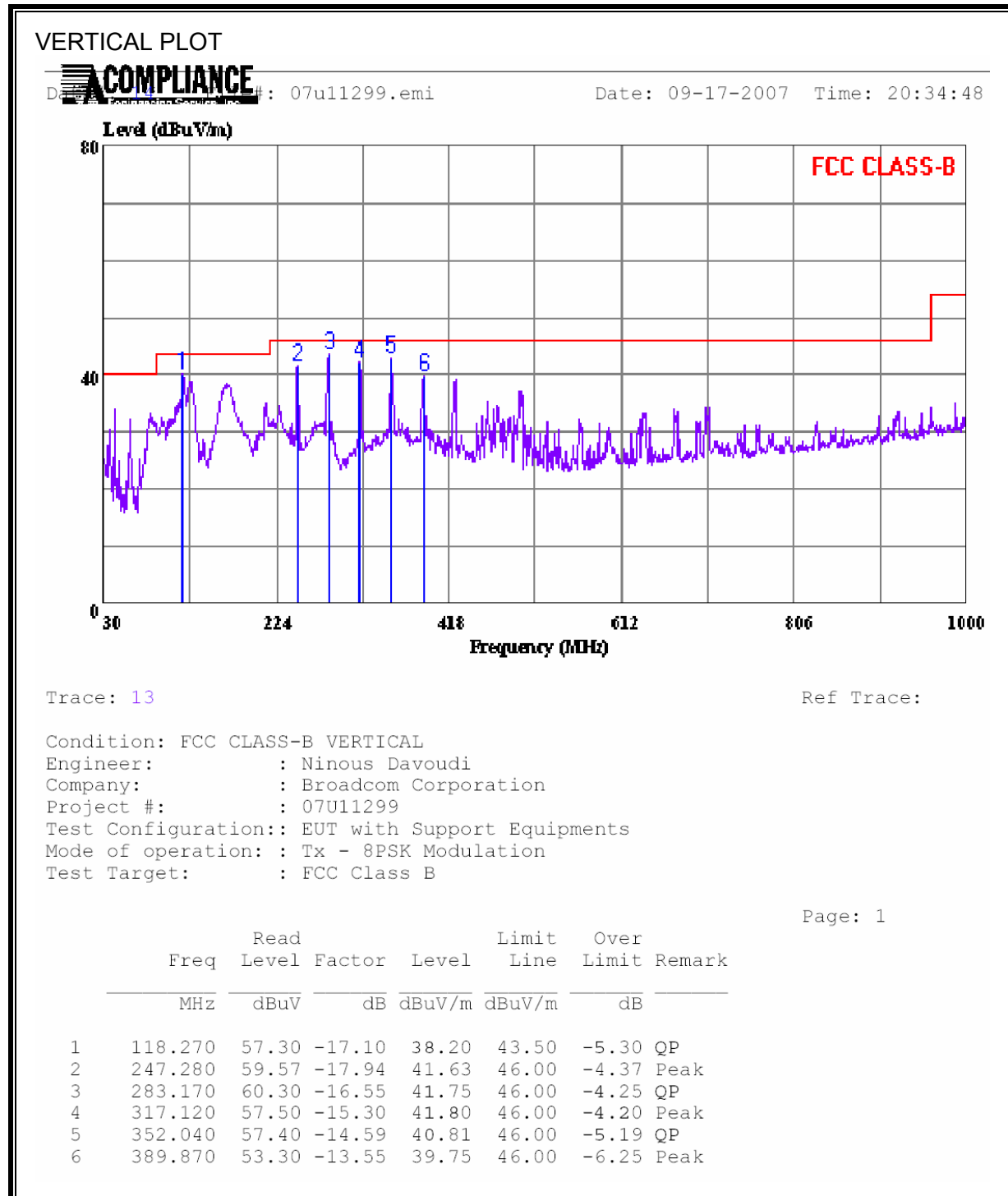
**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**

8PSK Mode



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

8PSK Mode



## 9. MAXIMUM PERMISSIBLE EXPOSURE

### FCC RULES

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz

\* = Plane-wave equivalent power density

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

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

**IC RULES**

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

**Table 5  
 Exposure Limits for Persons Not 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 <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

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

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

## **CALCULATIONS**

Given

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

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

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

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

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

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

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

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

**LIMITS**

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

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

**RESULTS**

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.

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
GFSK	2.4 GHz	20.0	-0.27	2.02	0.00	0.00
8PSK	2.4 GHz	20.0	2.44	2.02	0.00	0.01

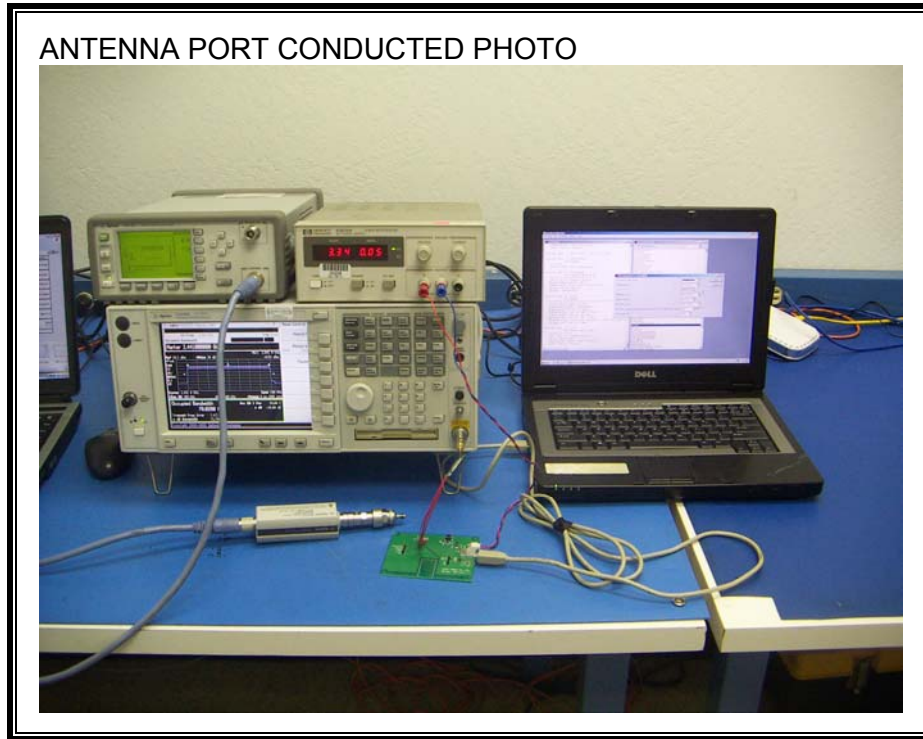
(MPE distance is greater than 20 cm)

Mode	Band	FCC Limit (mW/cm <sup>2</sup> )	IC Limit (W/m <sup>2</sup> )	Output (dBm)	Antenna (dBi)	MPE Distance (cm)
GFSK	2.4 GHz	1.0	10.0	-0.27	2.02	0.34
8PSK	2.4 GHz	1.0	10.0	2.44	2.02	0.47

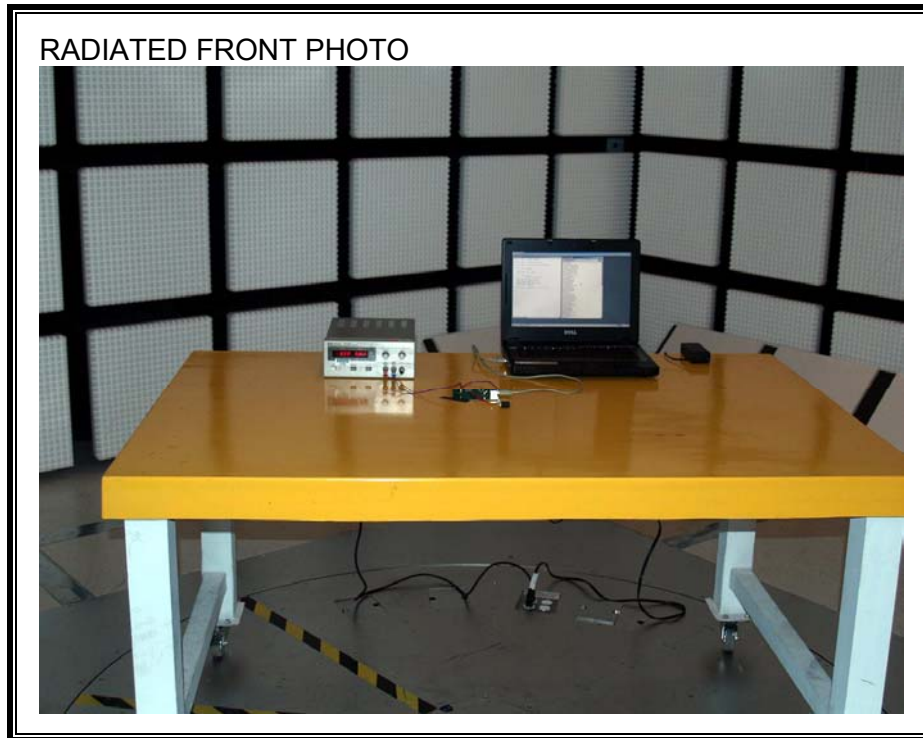


## 10. SETUP PHOTOS

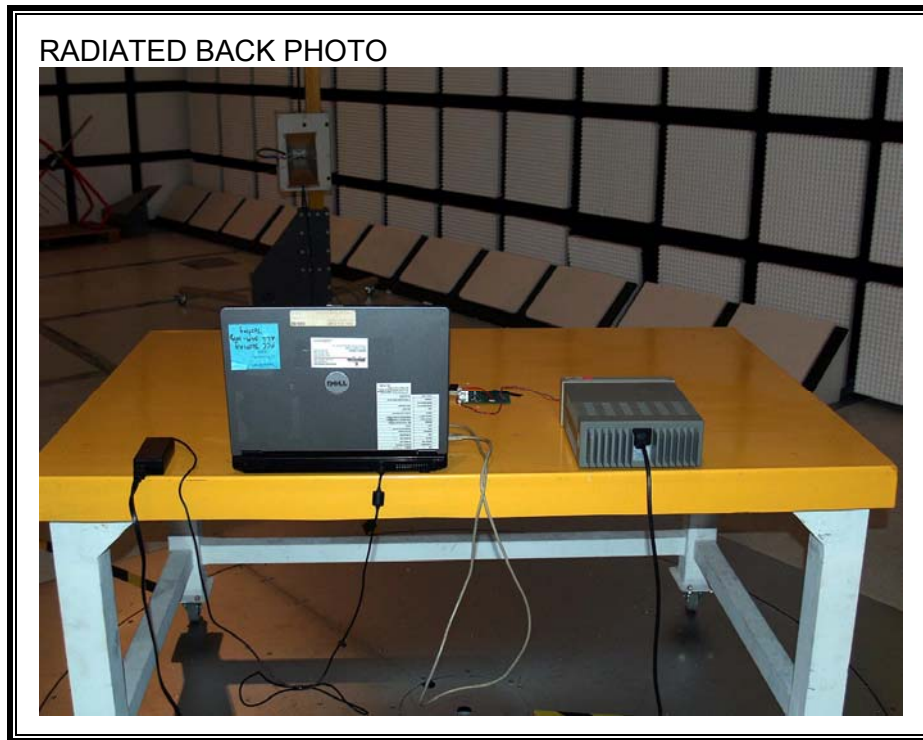
### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



**RADIATED RF MEASUREMENT SETUP**



**RADIATED RF MEASUREMENT SETUP**



**END OF REPORT**