



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

**FOR**

**802.11ag/Draft 802.11n WIRELESS LAN AND  
BLUETOOTH 2.1 PCI-E MODULE**

**MODEL NUMBER: BCM94321COEX2**

**FCC ID: QDS-BRCM1027**

**REPORT NUMBER: 07U11041-12**

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## 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** 802.11ag/Draft 802.11n WIRELESS LAN AND  
BLUETOOTH 2.1 PCI-E MODULE

**MODEL:** BCM94321COEX2

**SERIAL NUMBER:** 1129122

**DATE TESTED:** MAY 15-23, 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:

Tested By:



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TOM CHEN  
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 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccssemc.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 module operating in the 2400-2483.5 MHz band. Its radio module is manufactured by BROADCOM CORPORATION.

### 5.2. MAXIMUM OUTPUT POWER

The 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	4.86	3.06

8PSK 2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Output Power (dBm)	Output Power (mW)
2402 - 2480	6.38	4.35

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB antenna, with a maximum gain of 3.36 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was BCM\_BTDL\_v1.7.1

The EUT driver software installed in the laptop support equipment during testing was Broadcom Bluetool, rev. v5.1.0.1400.

The test utility software used during testing was BluetoothInstall 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. The highest measured output power was at 2480 MHz for GFSK modulation and 2402 MHz for 8PSK modulation.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

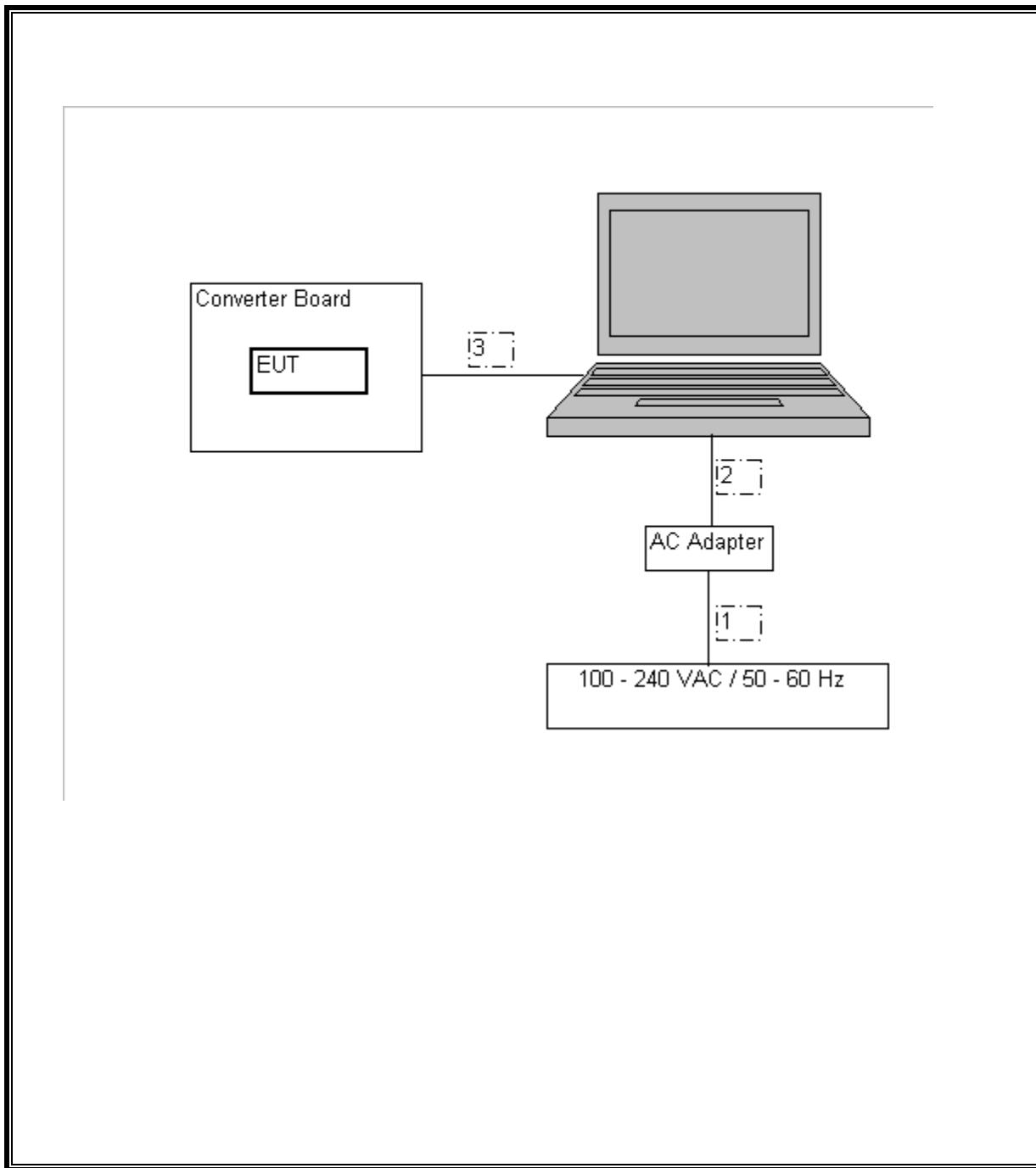
PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Dell	Inspiron 0000	J-901014-70166-57K-0	DoC
AC Adapter	Dell	PA-1600-06D1	F9710	DoC

### 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	1.5m	N/A
2	DC	1	DC	Unshielded	1.5m	N/A
3	USB	1	USB	Shielded	1.0m	N/A

### TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**

## 6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Cal Due
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/2/2007
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/2/2007
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY45300064	3/18/2008
Temperature / Humidity Chamber	Thermotron	SE 600-10-10	29800	6/12/2007
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/3/2007
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	4/15/2008
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	8/13/2007
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	1/23/2008
AC Power Source	ELGAR	1751	1842	CNR

## 7. LIMITS AND RESULTS

### 7.1. ANTENNA PORT CHANNEL TESTS FOR EUT WITH GFSK MODULATION

#### 7.1.1. 20 dB BANDWIDTH

##### LIMIT

None; for reporting purposes only.

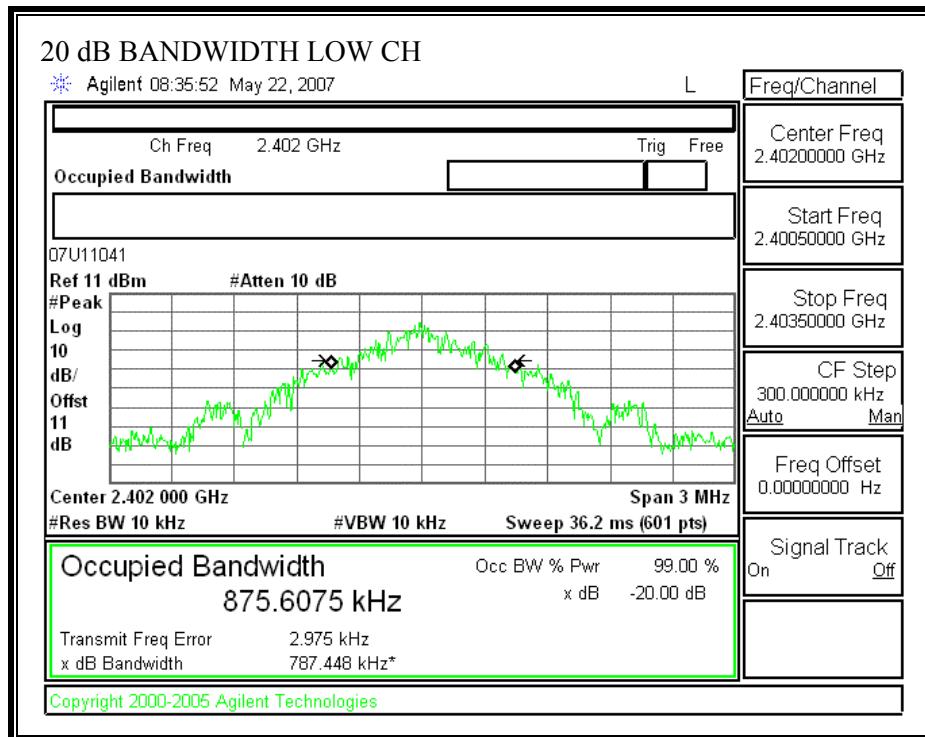
##### TEST PROCEDURE

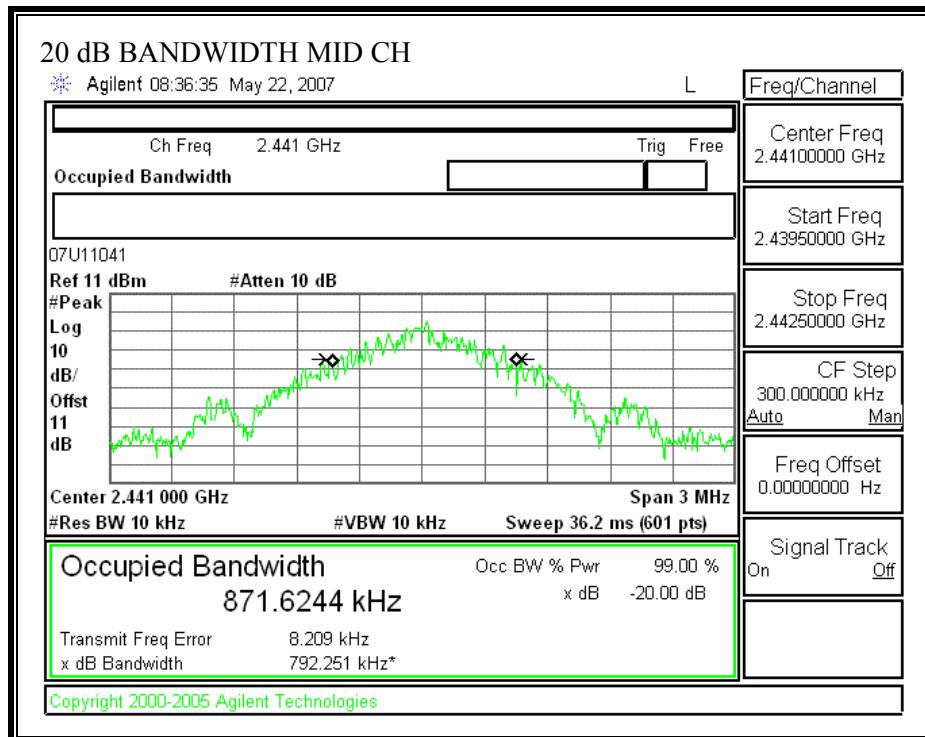
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

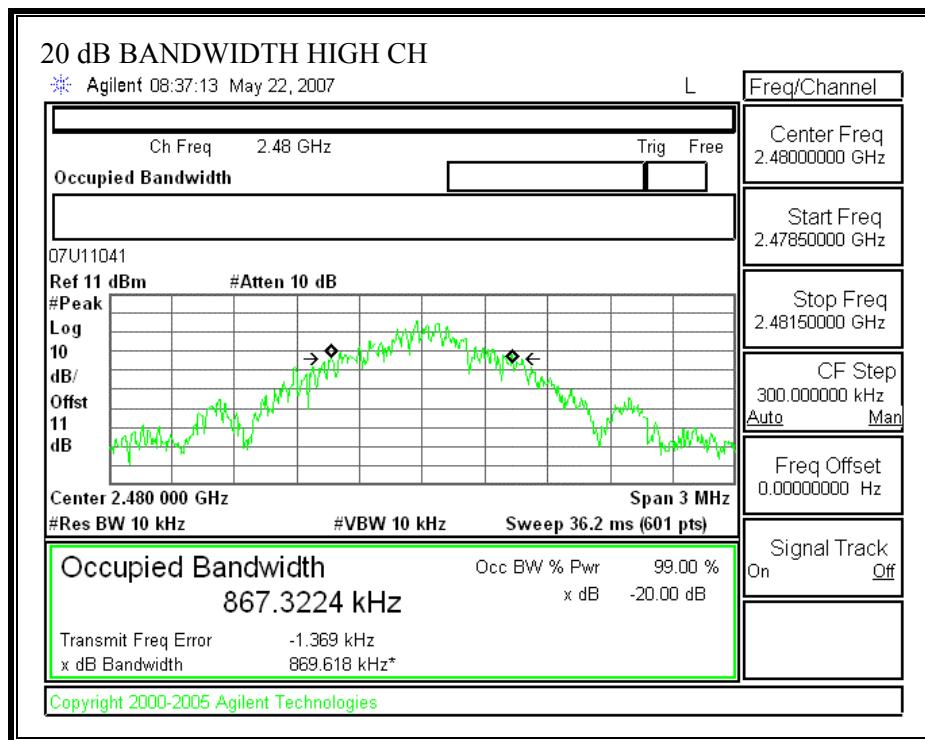
##### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	787.45
Middle	2441	792.25
High	2480	869.62

**20 dB BANDWIDTH**





### 7.1.2. HOPPING FREQUENCY SEPARATION

#### LIMIT

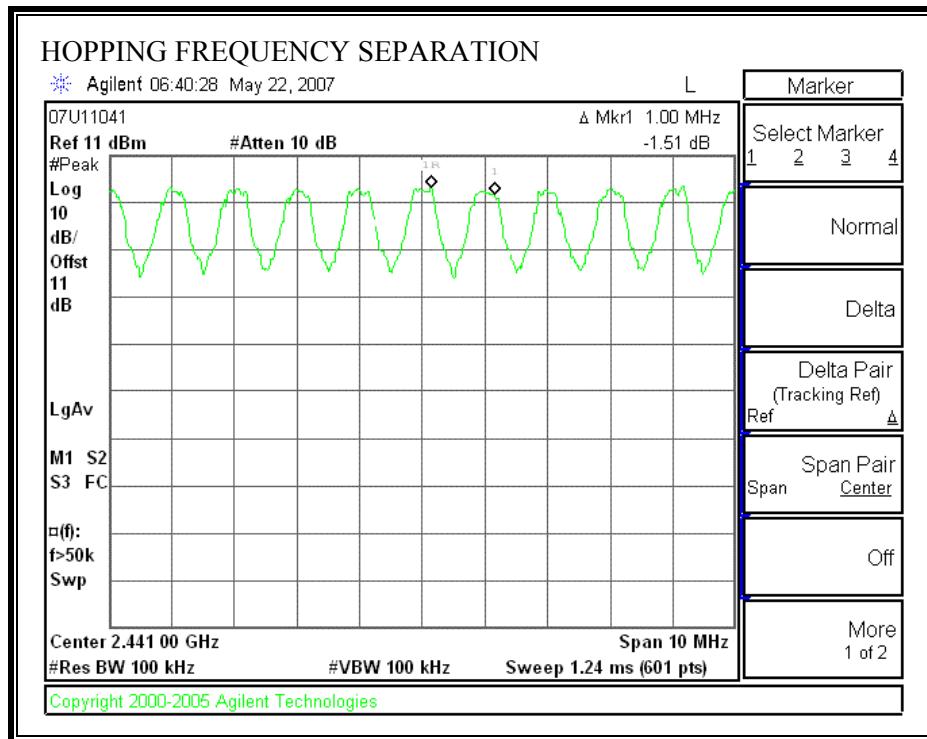
§15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

#### 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

No non-compliance noted:

**HOPPING FREQUENCY SEPARATION**

### 7.1.3. 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.

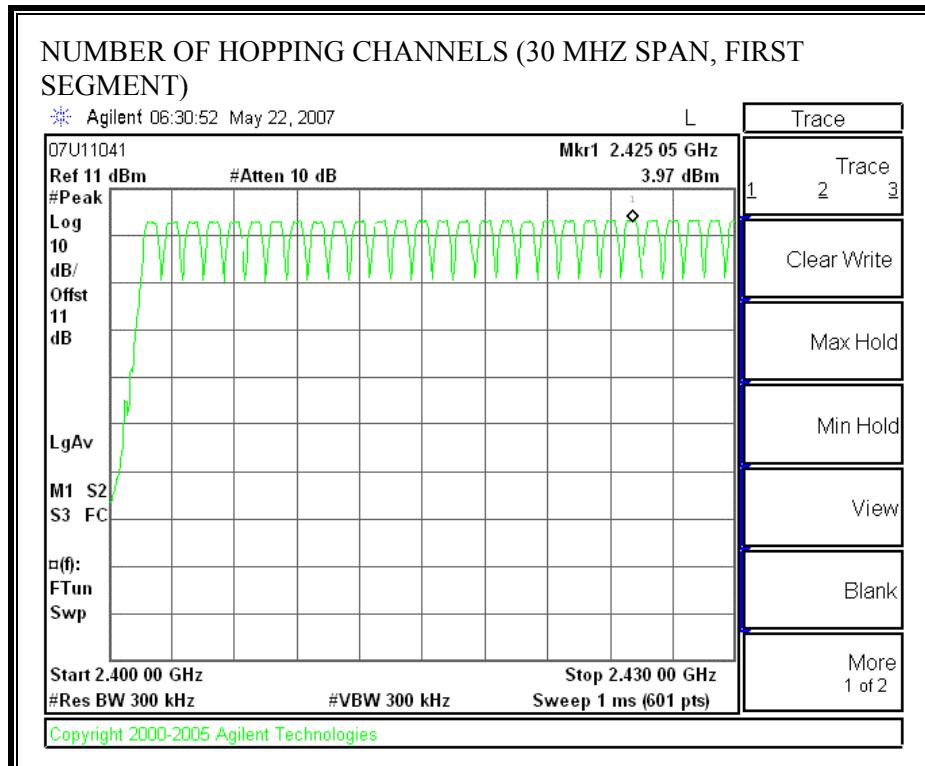
#### TEST PROCEDURE

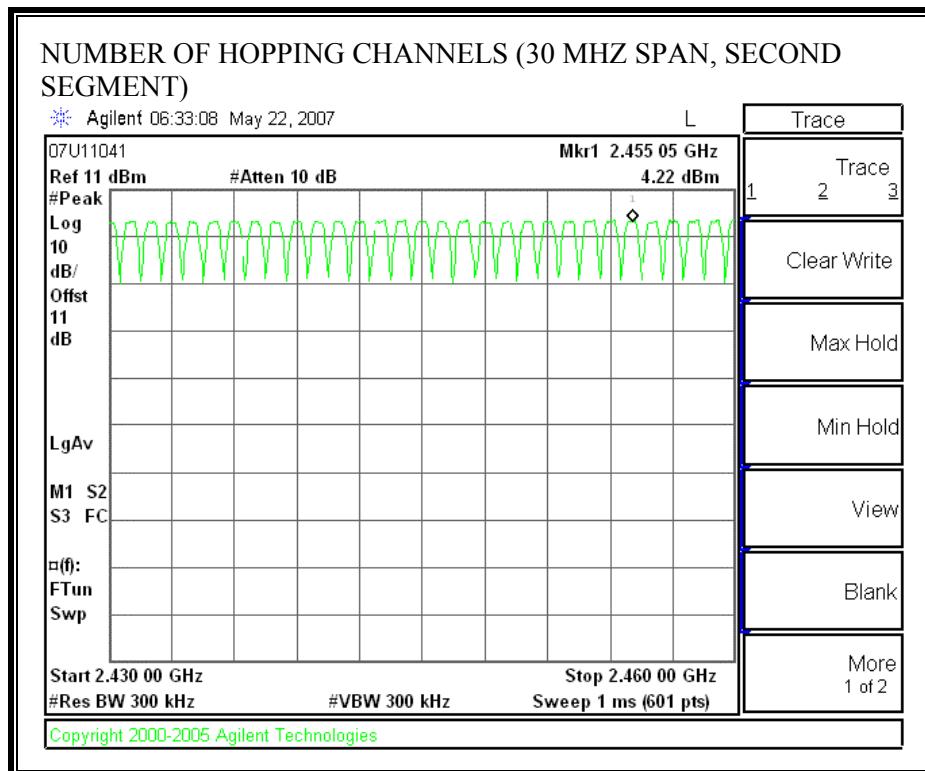
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

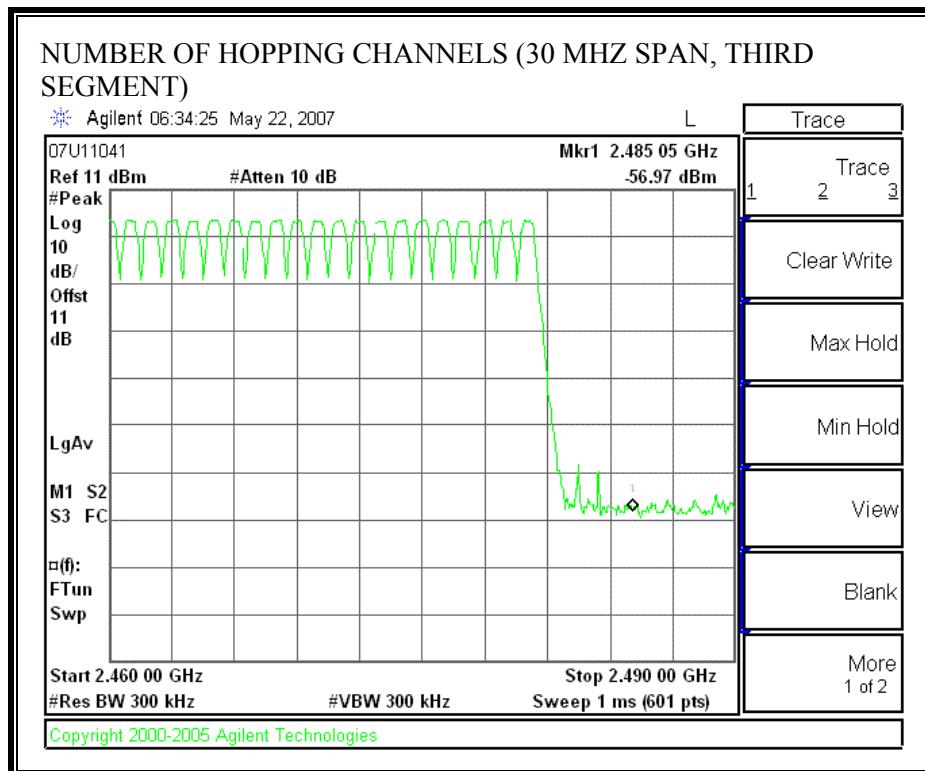
#### RESULTS

No non-compliance noted:

79 Channels observed.

**NUMBER OF HOPPING CHANNELS**





### 7.1.4. 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

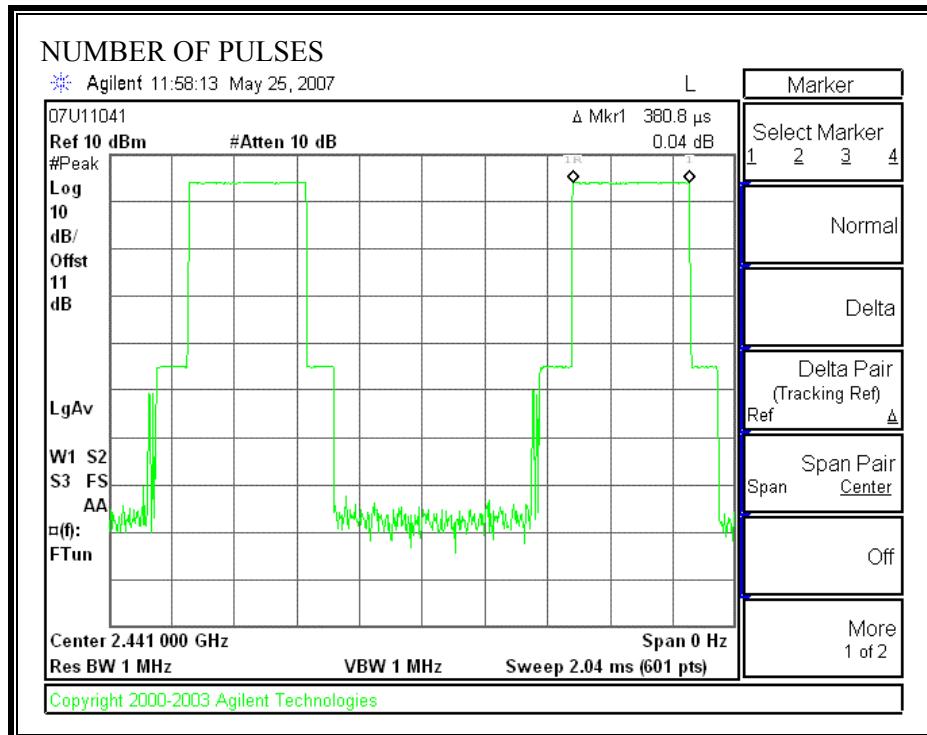
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

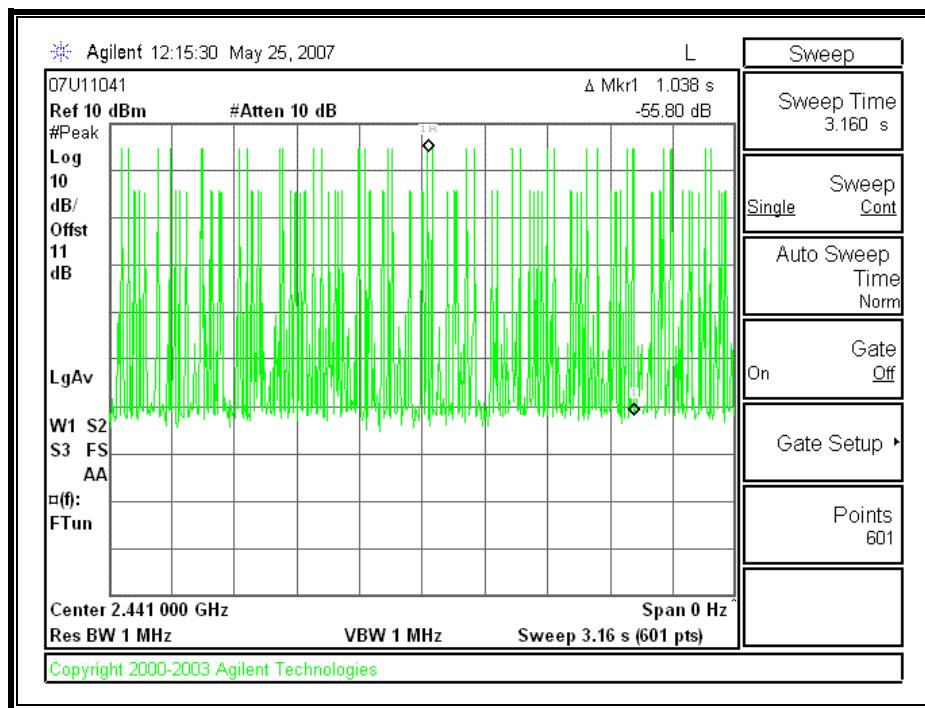
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

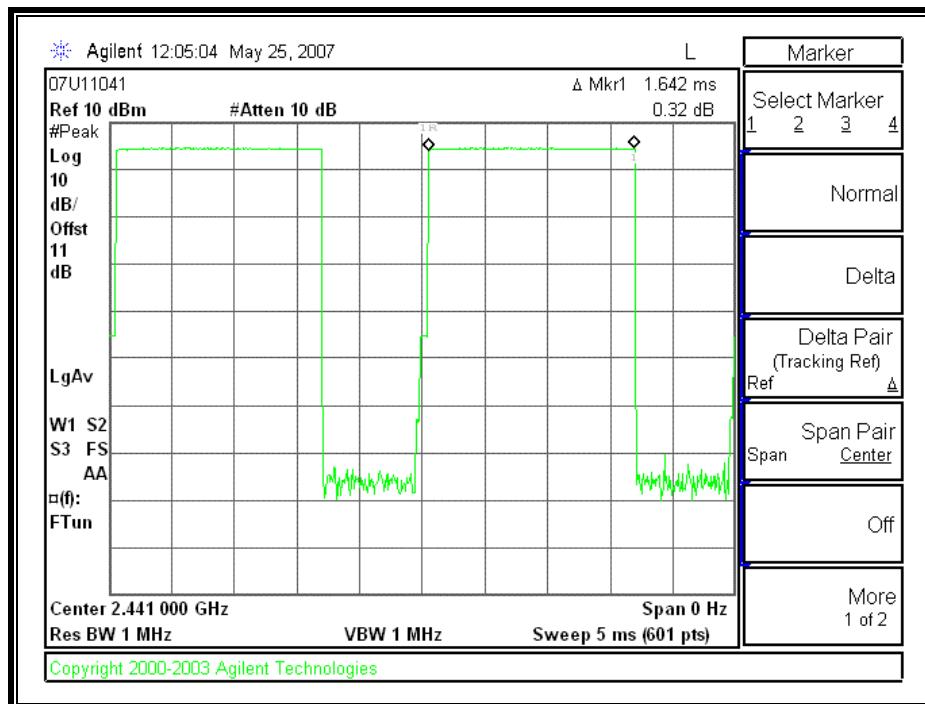
#### RESULTS

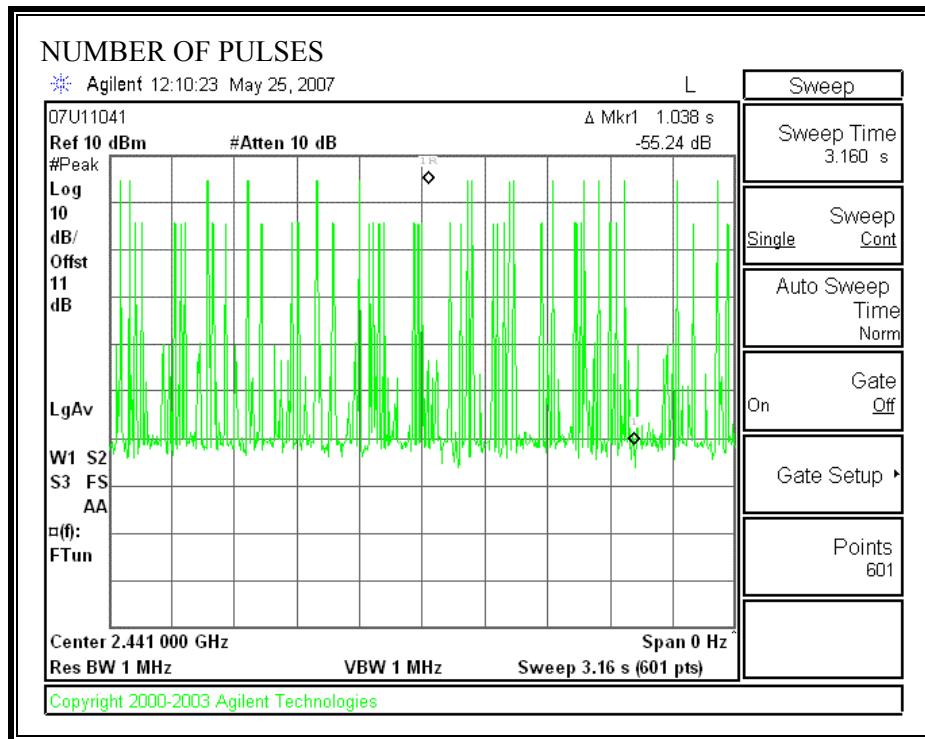
No non-compliance noted:

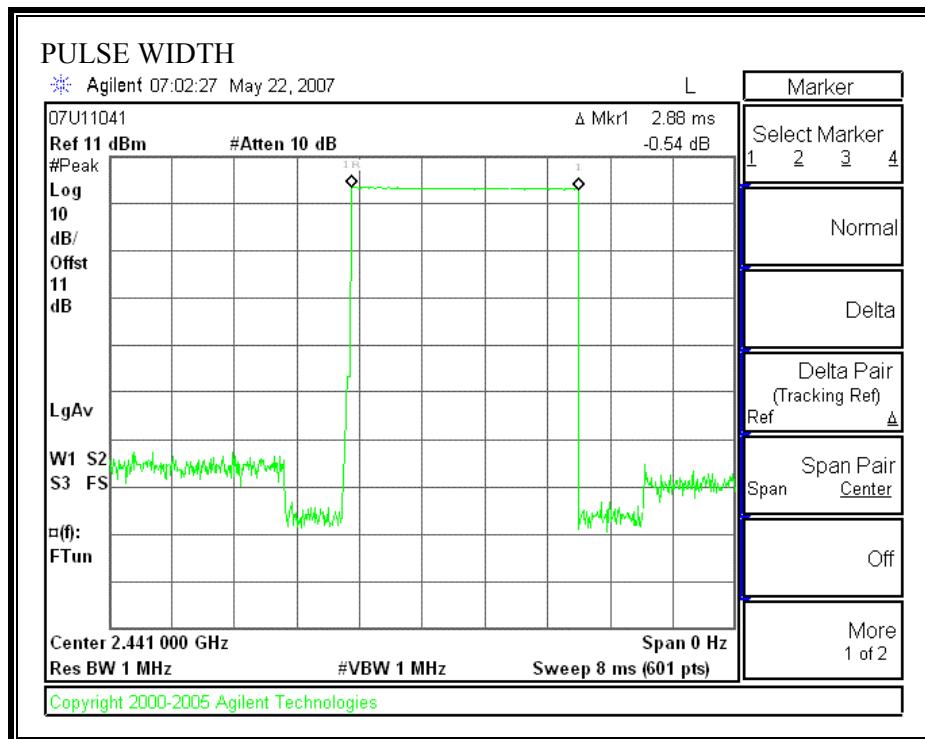
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.381	30	0.114	0.4	0.286
DH3	1.642	16	0.263	0.4	0.137
DH5	2.88	12	0.346	0.4	0.054

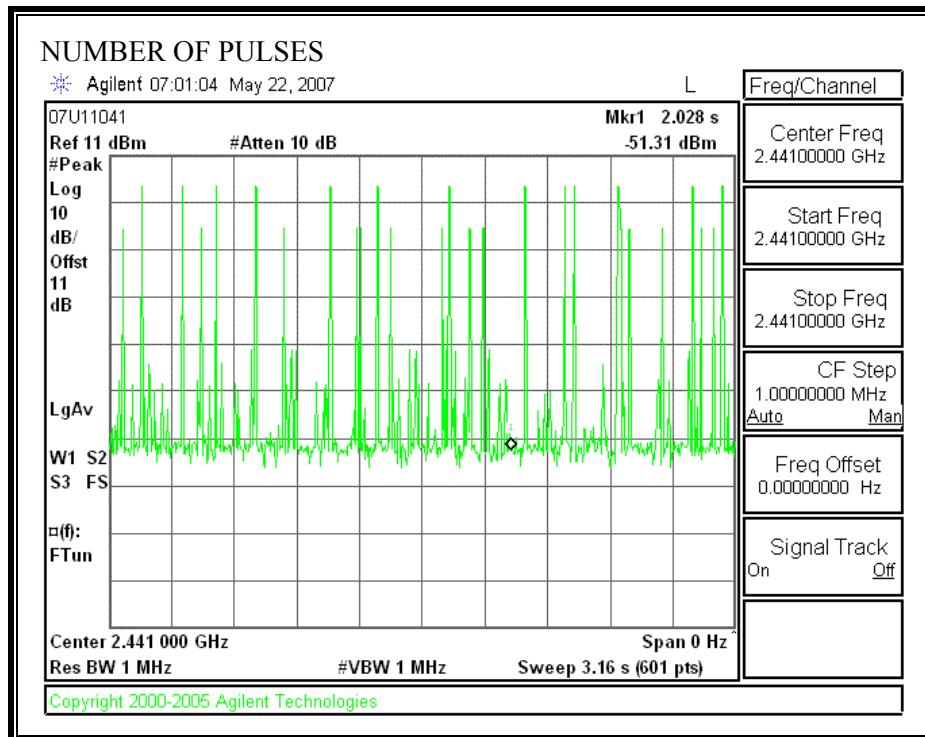
**PACKET TYPE: DH1****PULSE WIDTH**

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

**PACKET TYPE: DH3****PULSE WIDTH**

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

**PACKET TYPE: DH5****PULSE WIDTH**

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

## 7.1.5. 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 3.36 dBi, therefore the limit is 30 dBm.

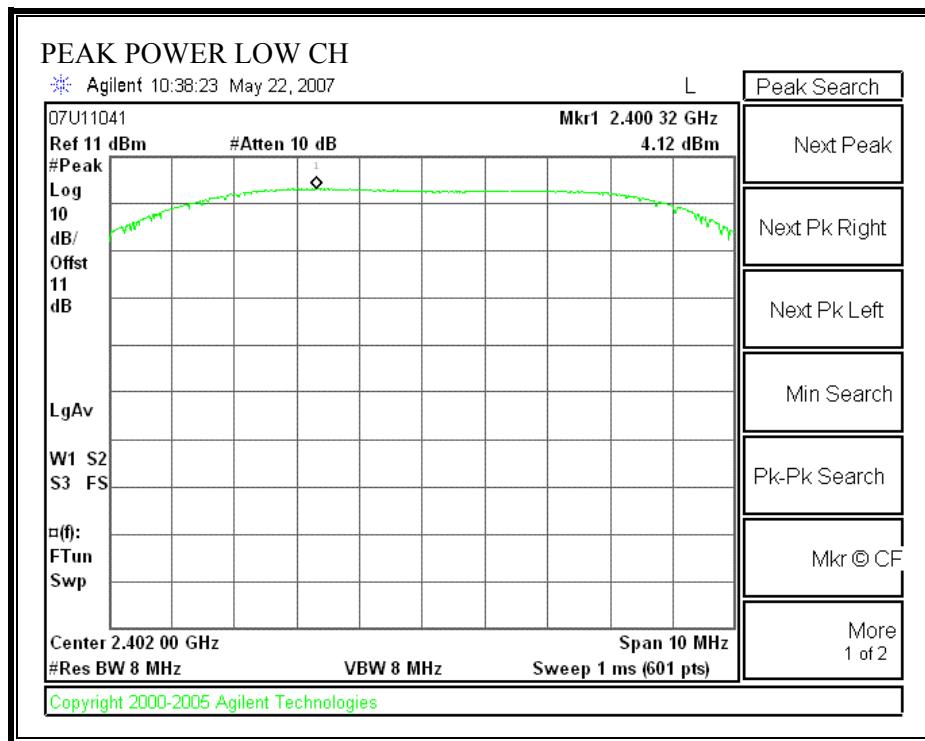
### TEST PROCEDURE

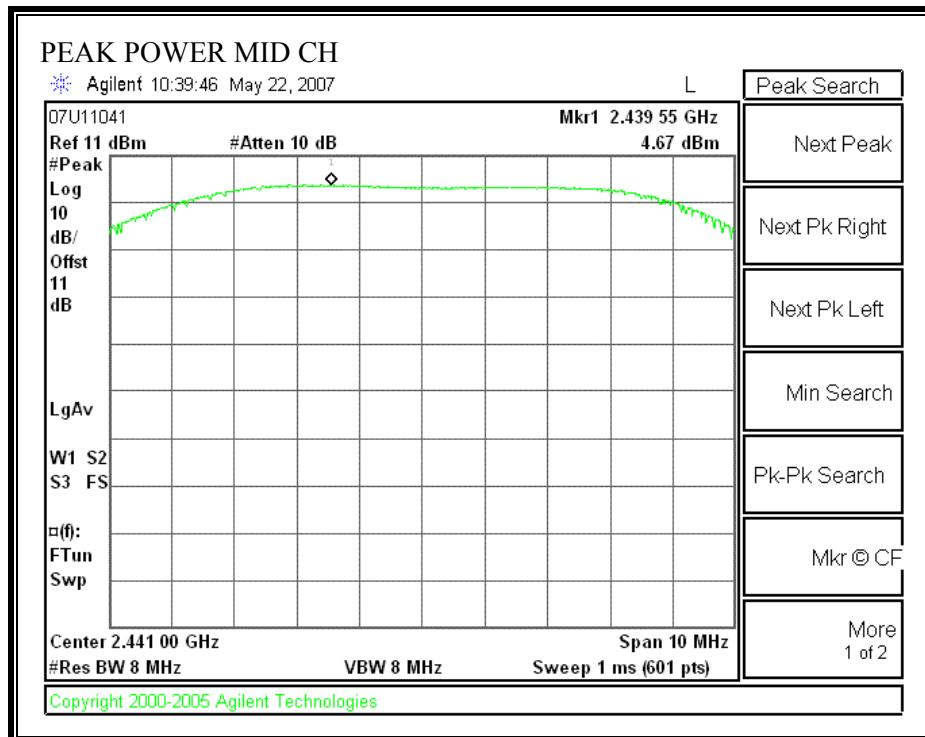
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

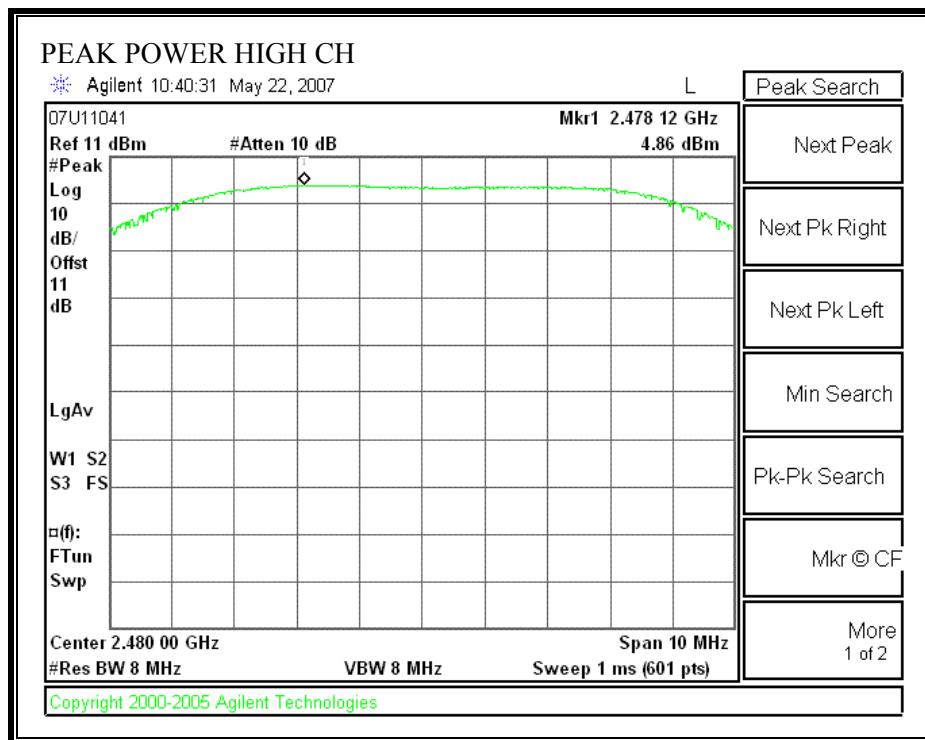
### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	4.12	30	-25.88
Middle	2441	4.67	30	-25.33
High	2480	4.86	30	-25.14

**OUTPUT POWER**





## 7.1.6. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§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	4.80/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.

**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 and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{(30 * P * G) / (3770 * S)}$$

Changing to units of Power to mW and Distance to cm, using:

$$P (\text{mW}) = P (\text{W}) / 1000 \text{ and}$$

$$d (\text{cm}) = 100 * d (\text{m})$$

yields

$$d = 100 * \sqrt{(30 * (P / 1000) * G) / (3770 * S)}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

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

Substituting the logarithmic form of power and gain using:

$$P (\text{mW}) = 10^{(P (\text{dBm}) / 10)} \text{ and}$$

$$G (\text{numeric}) = 10^{(G (\text{dBi}) / 10)}$$

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

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

**LIMITS**

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

**RESULTS**

No non-compliance noted: (MPE distance equals 20 cm)

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.

MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )
20.0	4.86	3.36	0.00

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.

### 7.1.7. AVERAGE POWER

#### AVERAGE POWER LIMIT

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 1 dB (including 0 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.11
Middle	2441	3.67
High	2480	3.91

### 7.1.8. PEAK POWER SPECTRAL DENSITY

#### LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

§15.247 (f) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

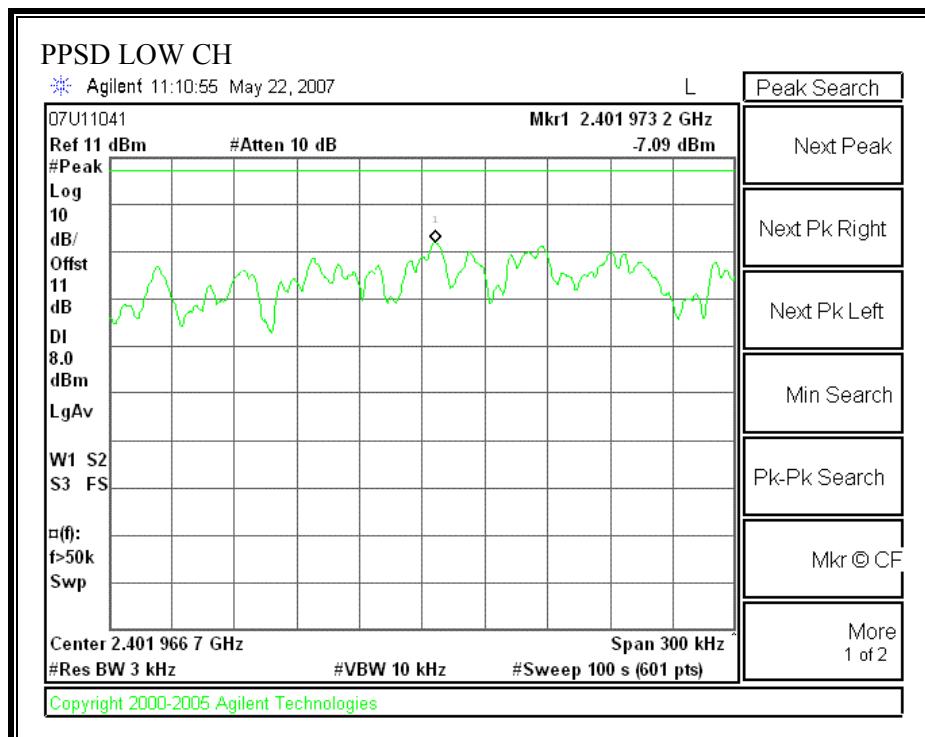
#### TEST PROCEDURE

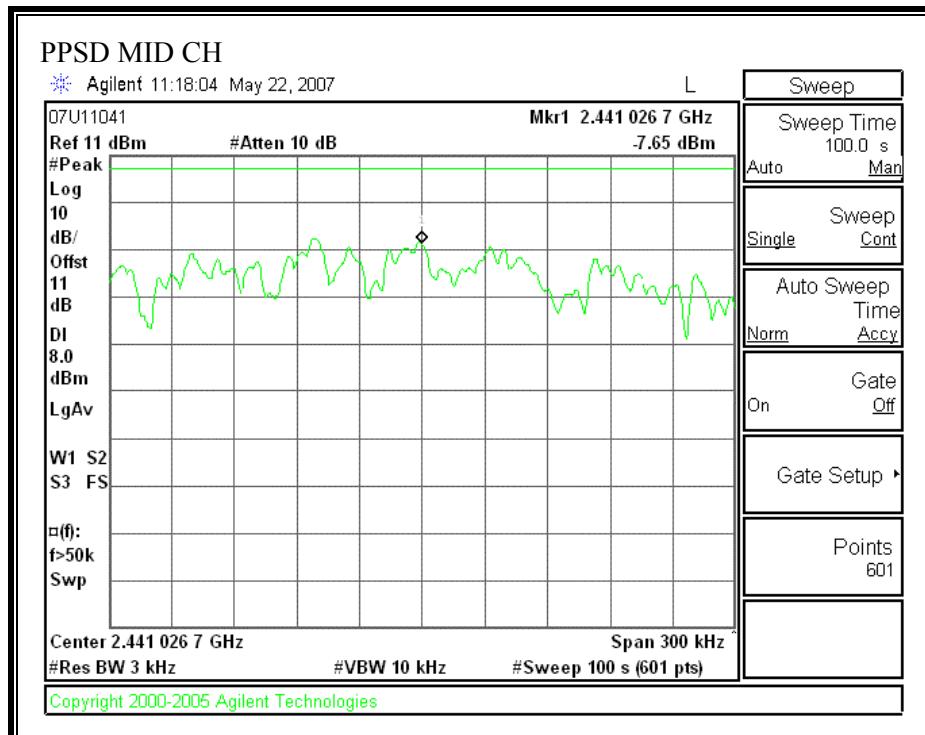
The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

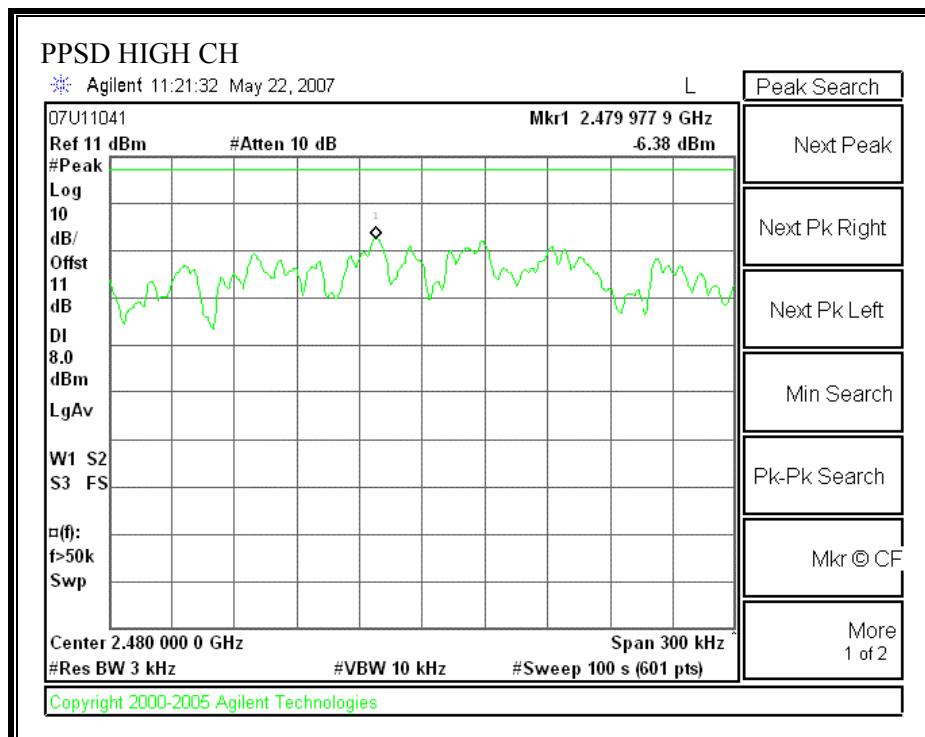
#### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-7.09	8	-15.09
Middle	2441	-7.65	8	-15.65
High	2480	-6.38	8	-14.38

**PEAK POWER SPECTRAL DENSITY**





## 7.1.9. 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)).

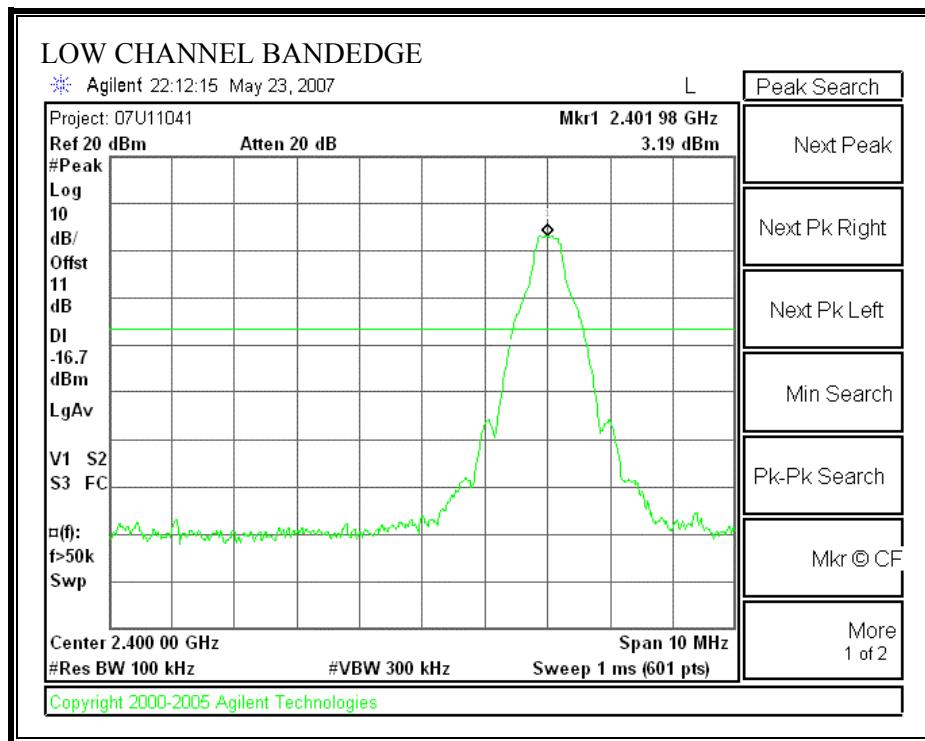
### TEST PROCEDURE

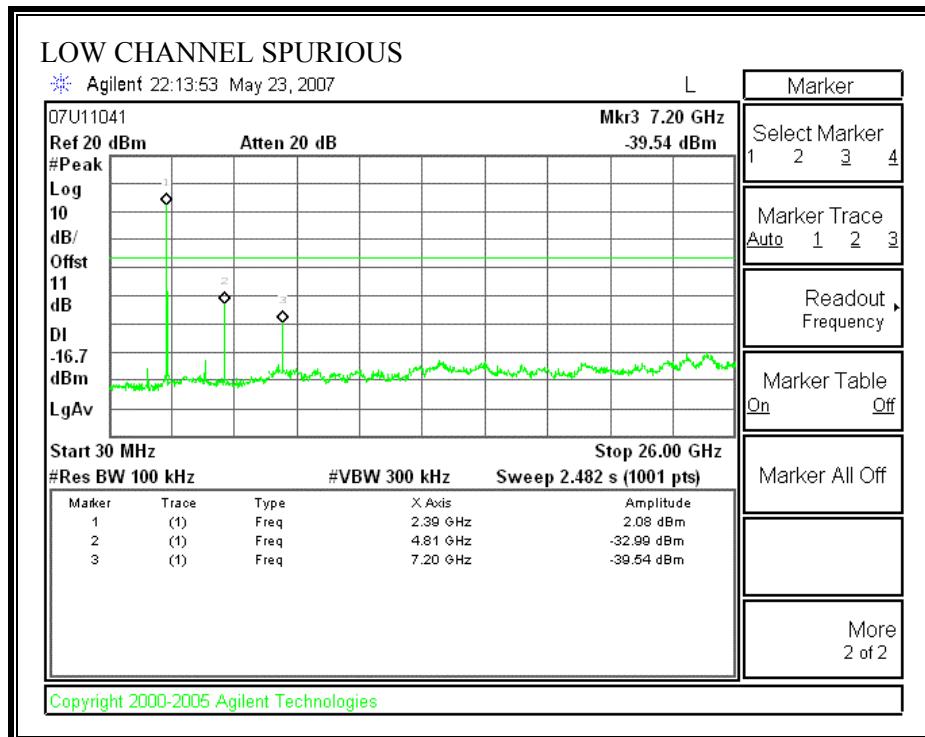
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

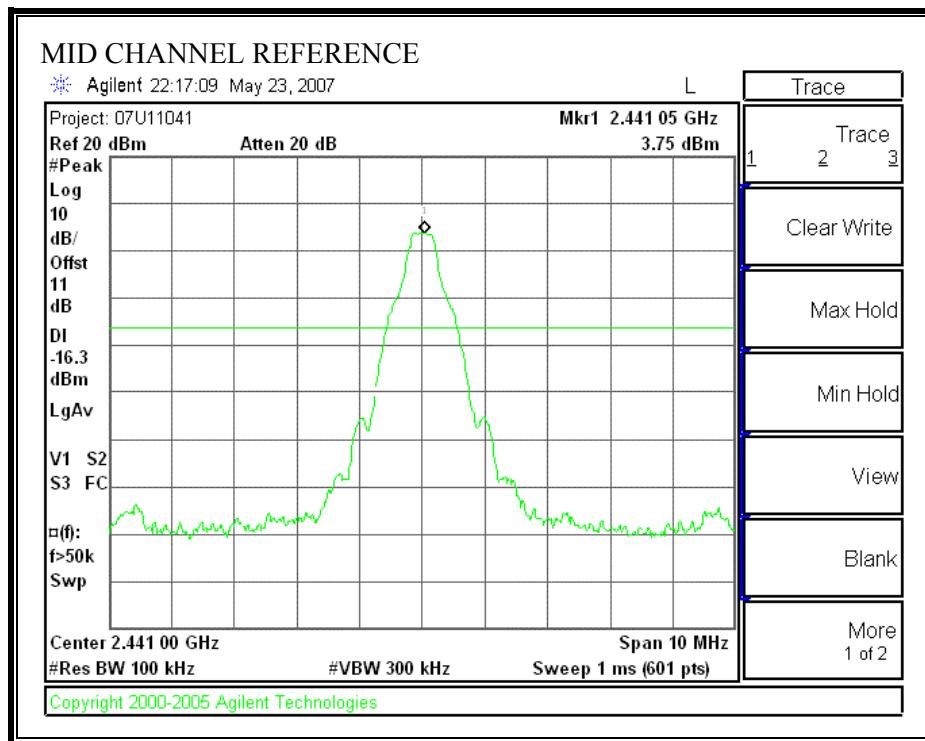
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

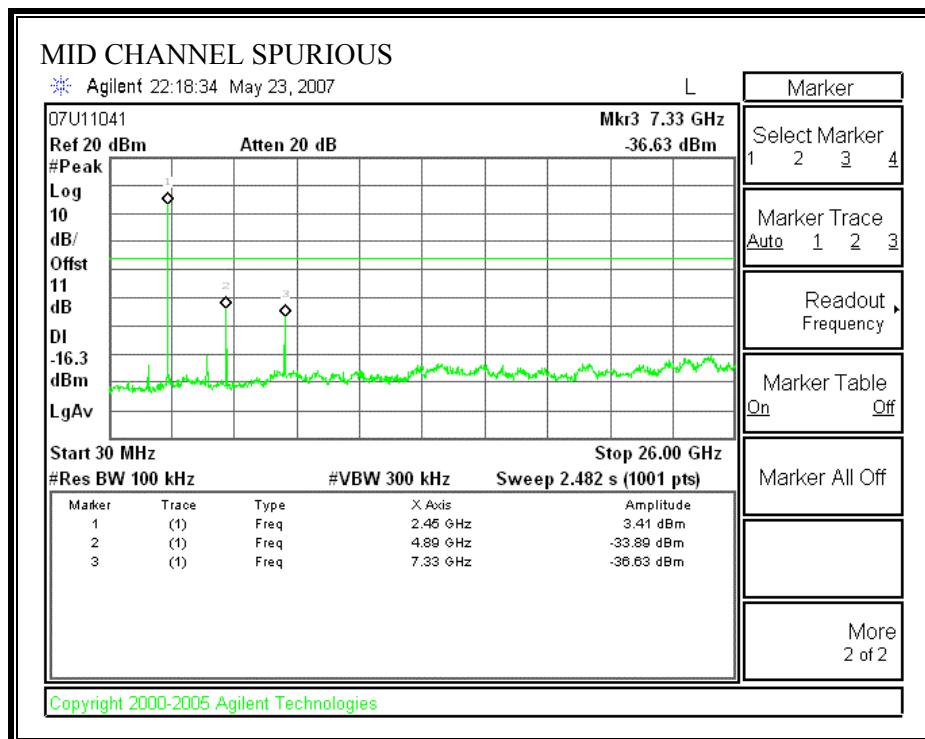
### RESULTS

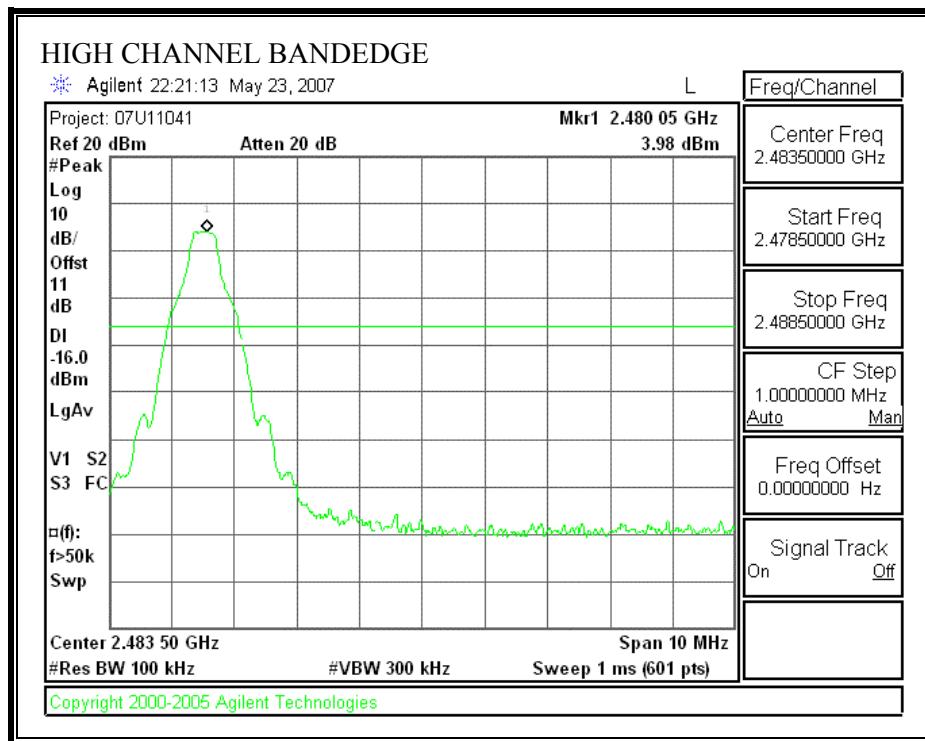
No non-compliance noted:

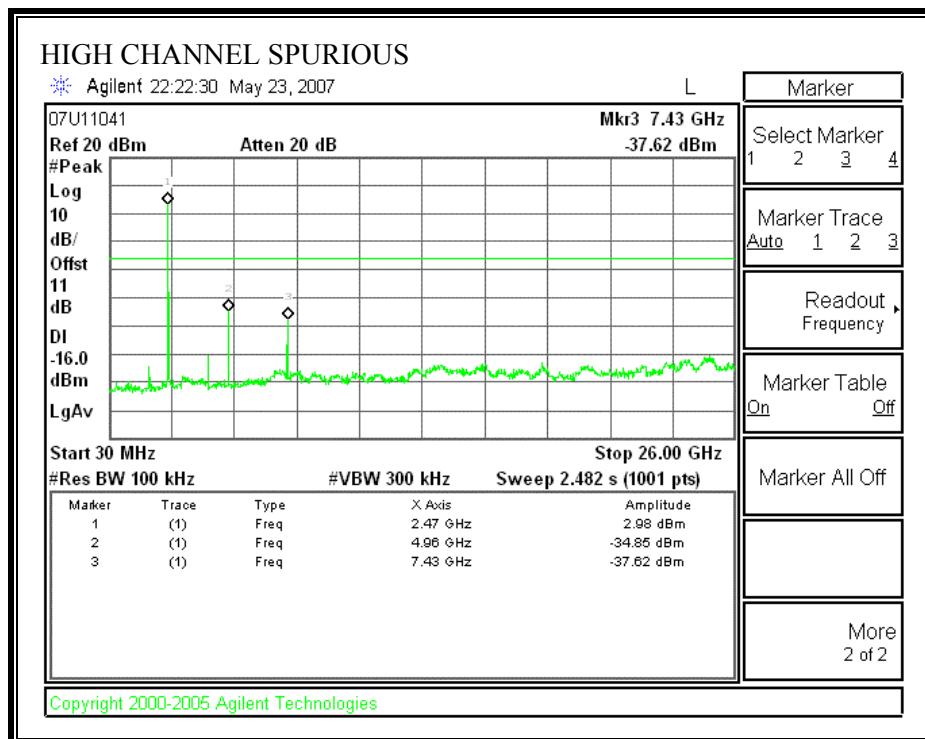
**SPURIOUS EMISSIONS, LOW CHANNEL**

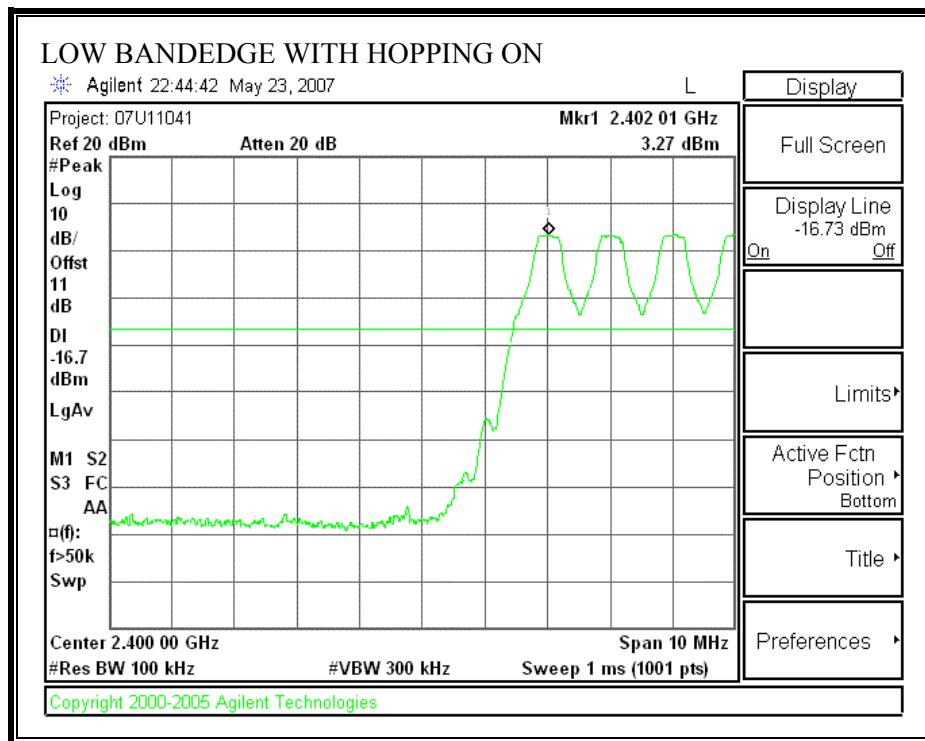


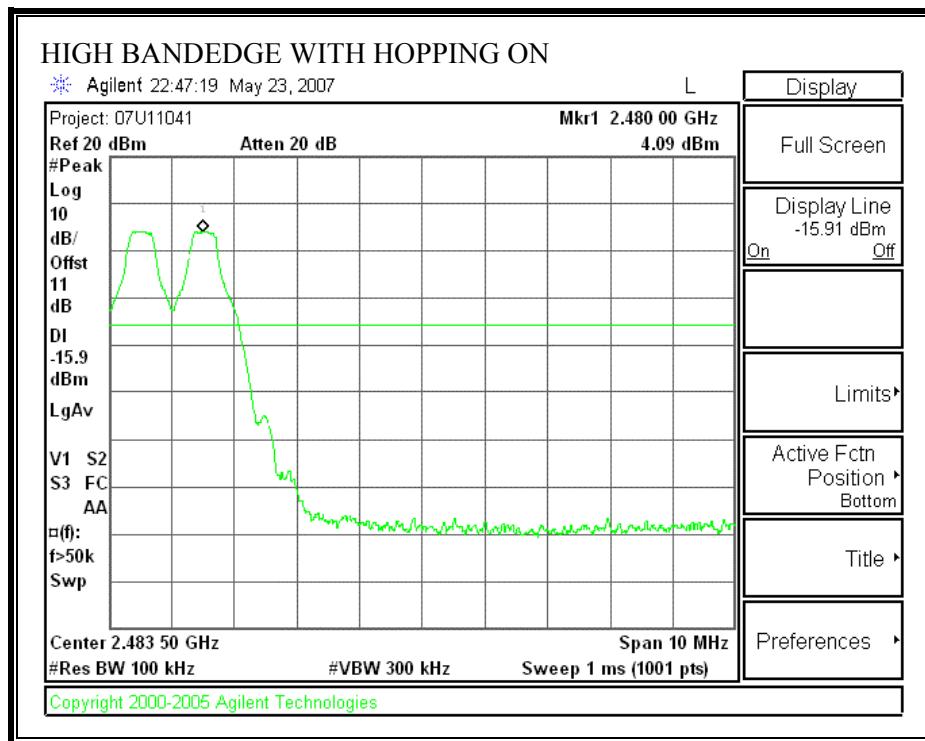
**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 7.2. ANTENNA PORT CHANNEL TESTS FOR EUT WITH 8PSK MODULATION

### 7.2.1. 20 dB BANDWIDTH

#### LIMIT

None; for reporting purposes only.

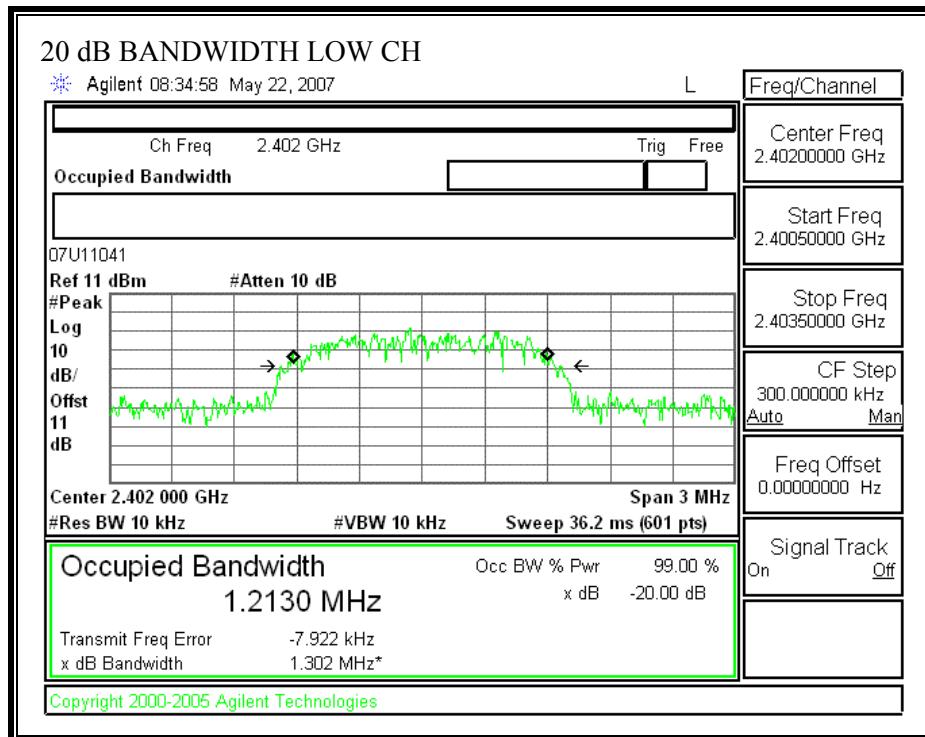
#### TEST PROCEDURE

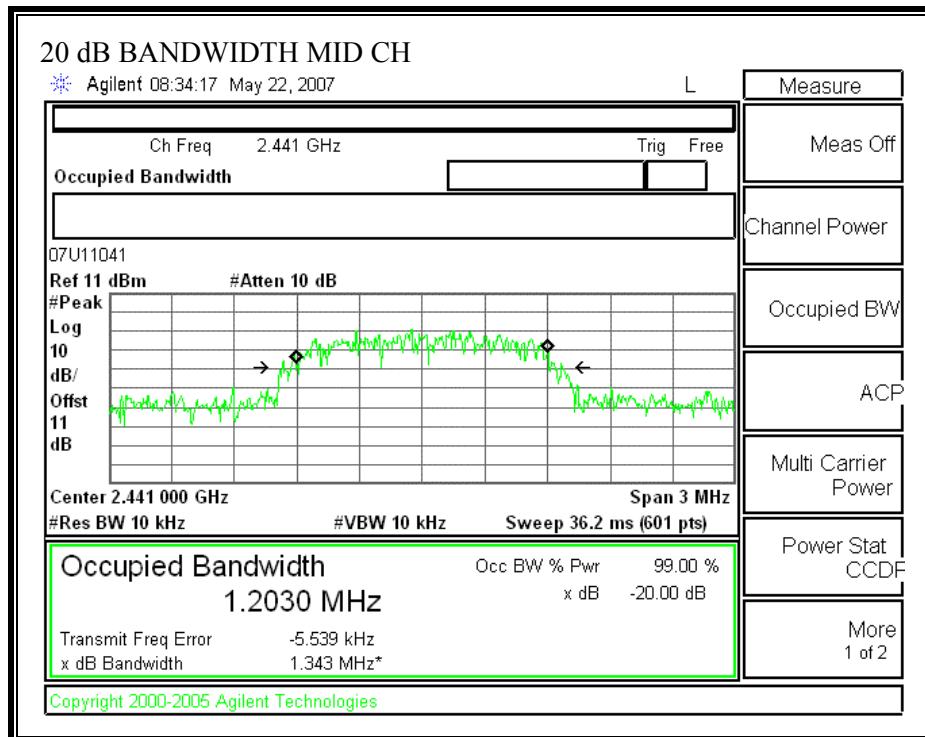
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 20 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

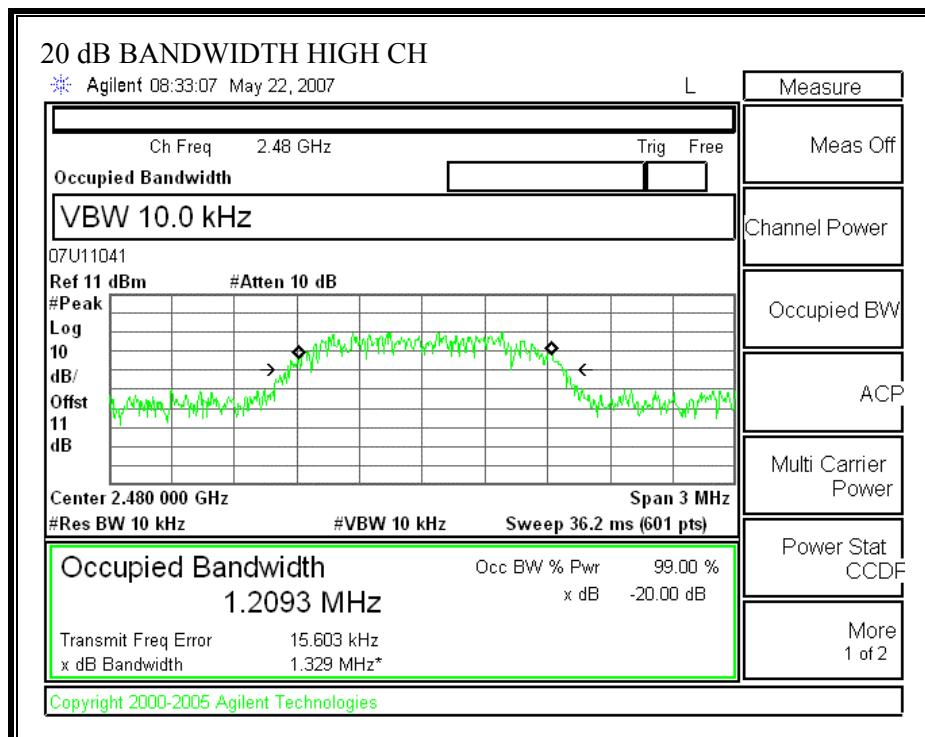
#### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	2402	1302
Middle	2441	1343
High	2480	1329

**20 dB BANDWIDTH**





## 7.2.2. HOPPING FREQUENCY SEPARATION

### LIMIT

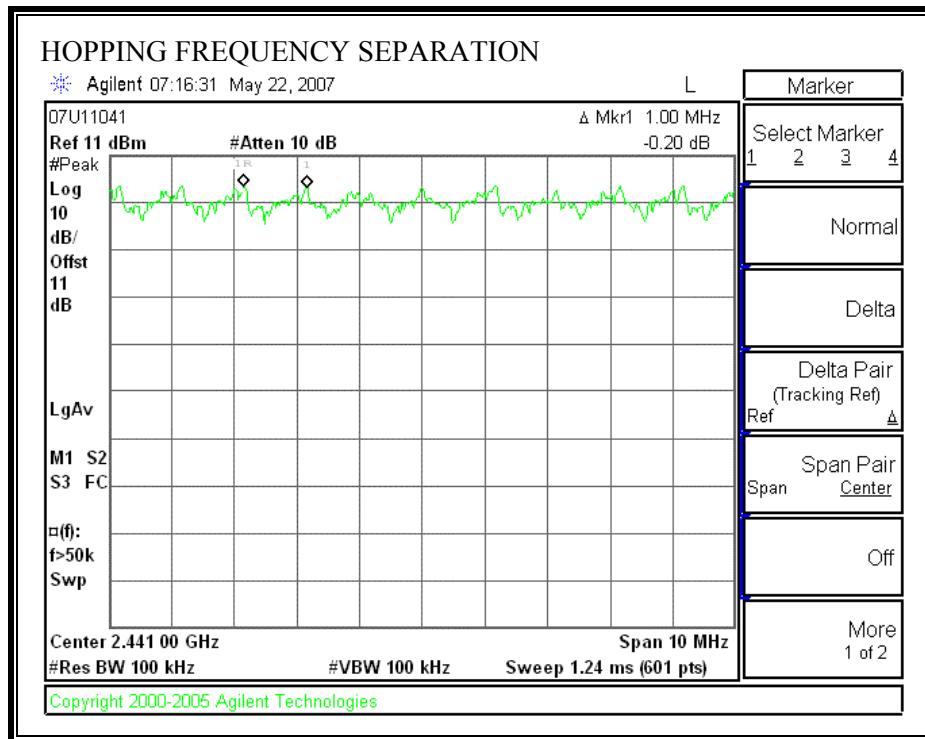
§15.247 (a) (1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

### 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

No non-compliance noted:

**HOPPING FREQUENCY SEPARATION**

### 7.2.3. 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.

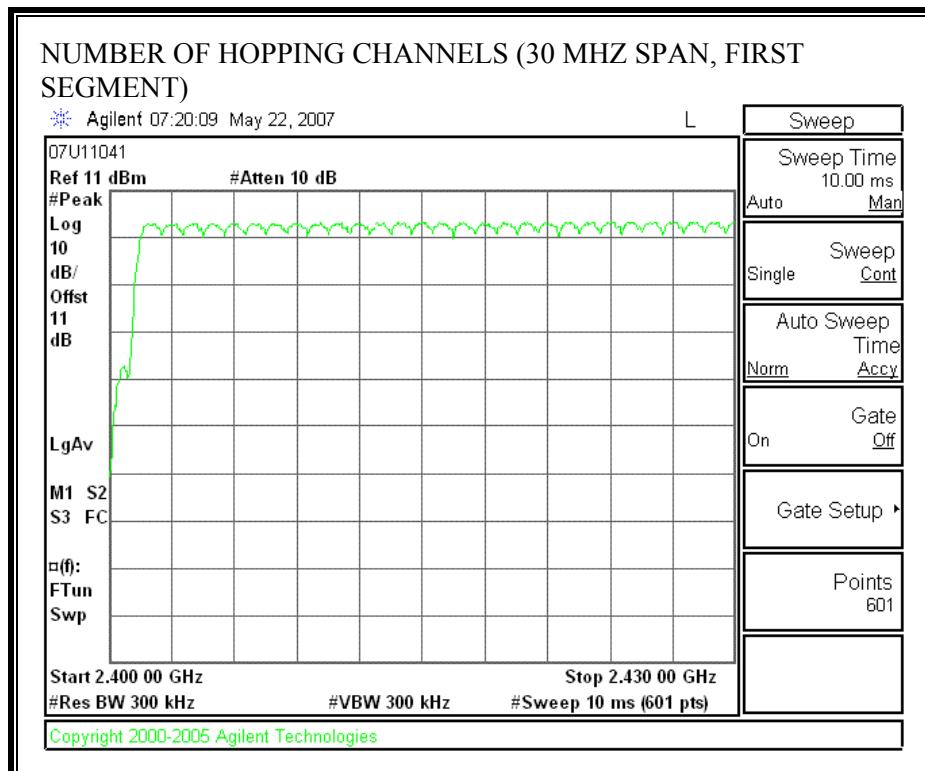
#### TEST PROCEDURE

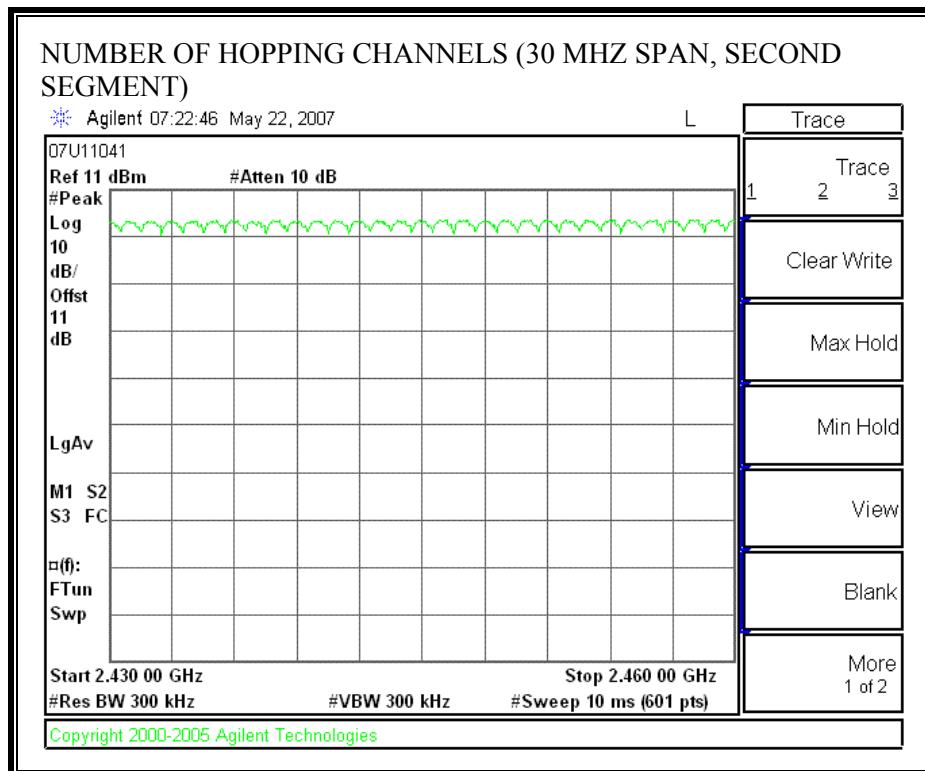
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to 1 % of the span. The analyzer is set to Max Hold.

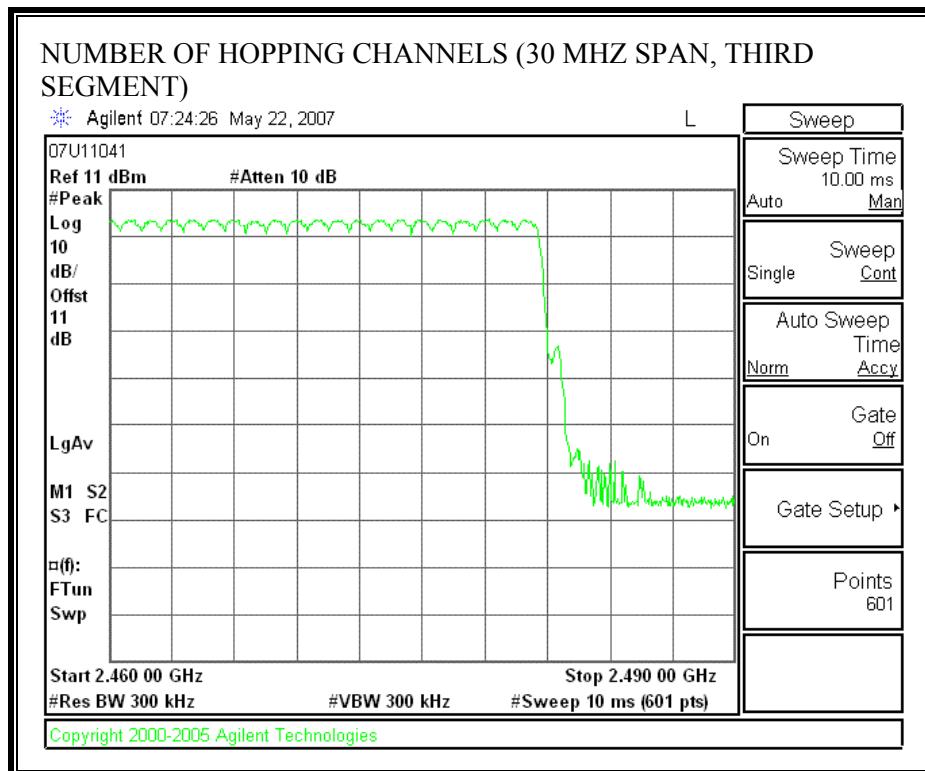
#### RESULTS

No non-compliance noted:

79 Channels observed.

**NUMBER OF HOPPING CHANNELS**





## 7.2.4. 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

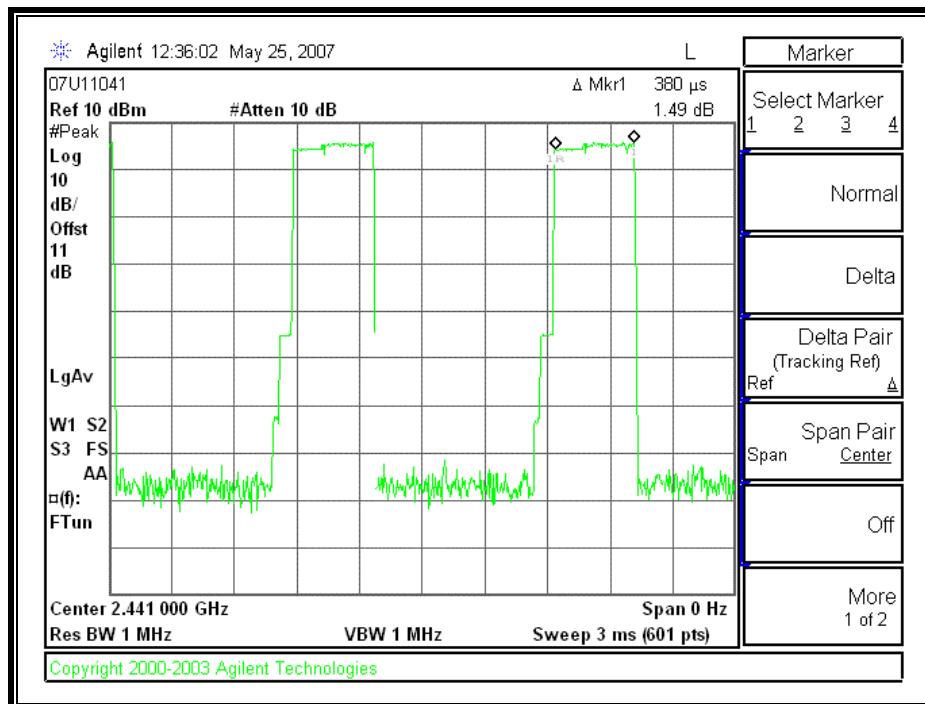
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

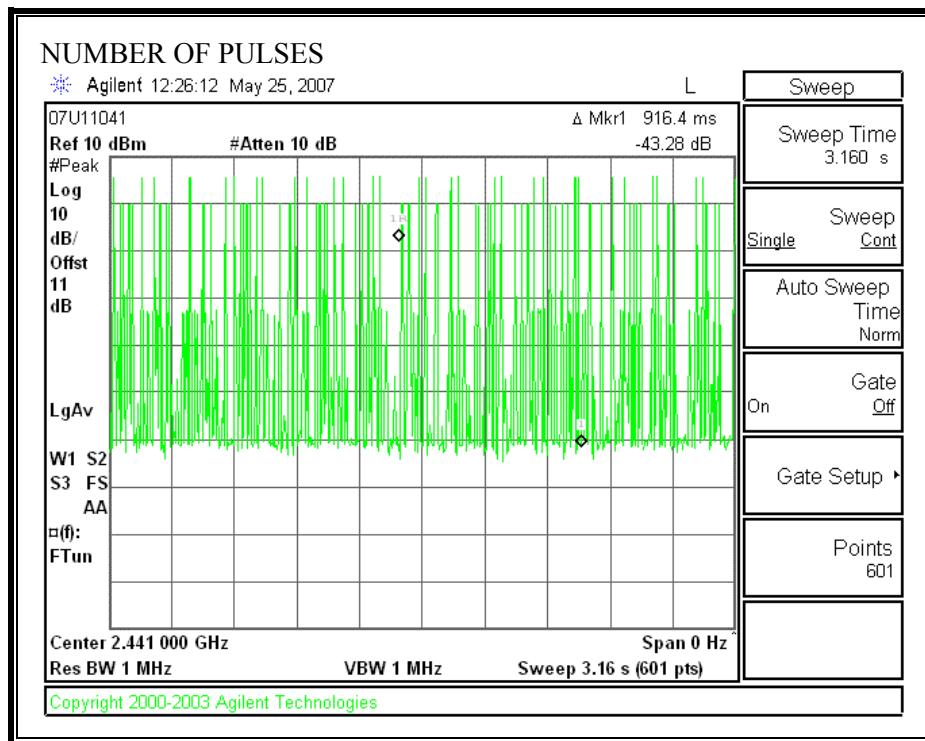
The average time of occupancy in the specified 31.6 second period (79 channels \* 0.4 s) is equal to  $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$ .

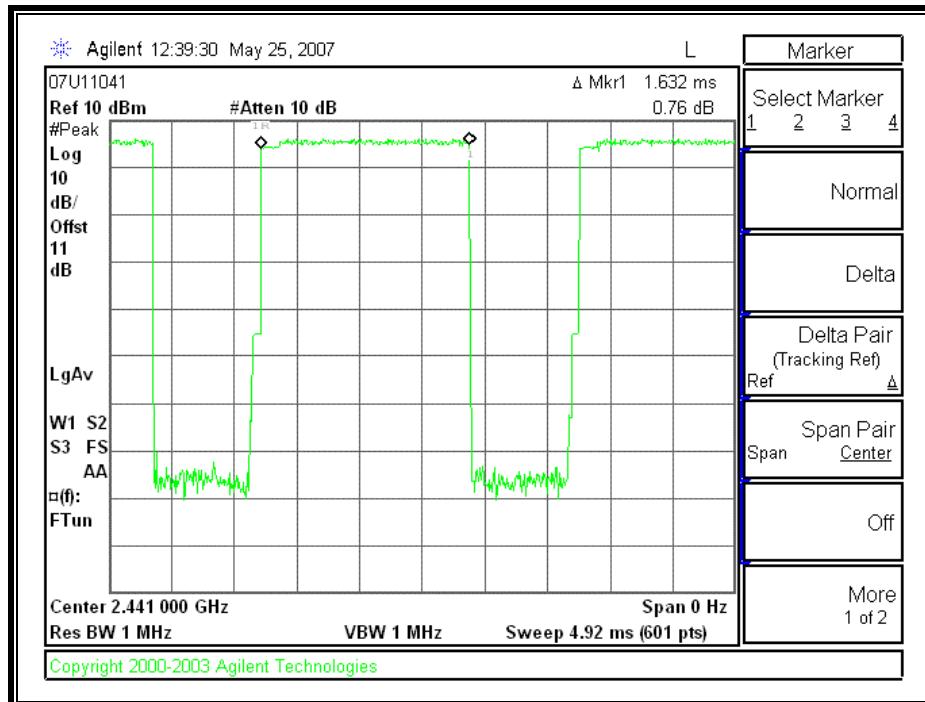
### RESULTS

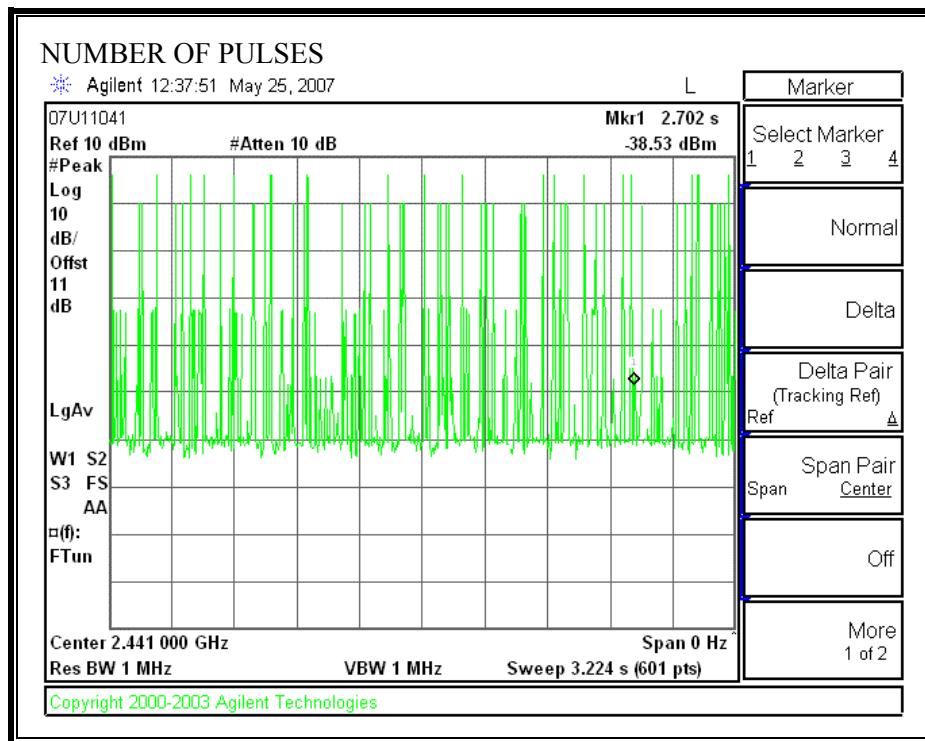
No non-compliance noted:

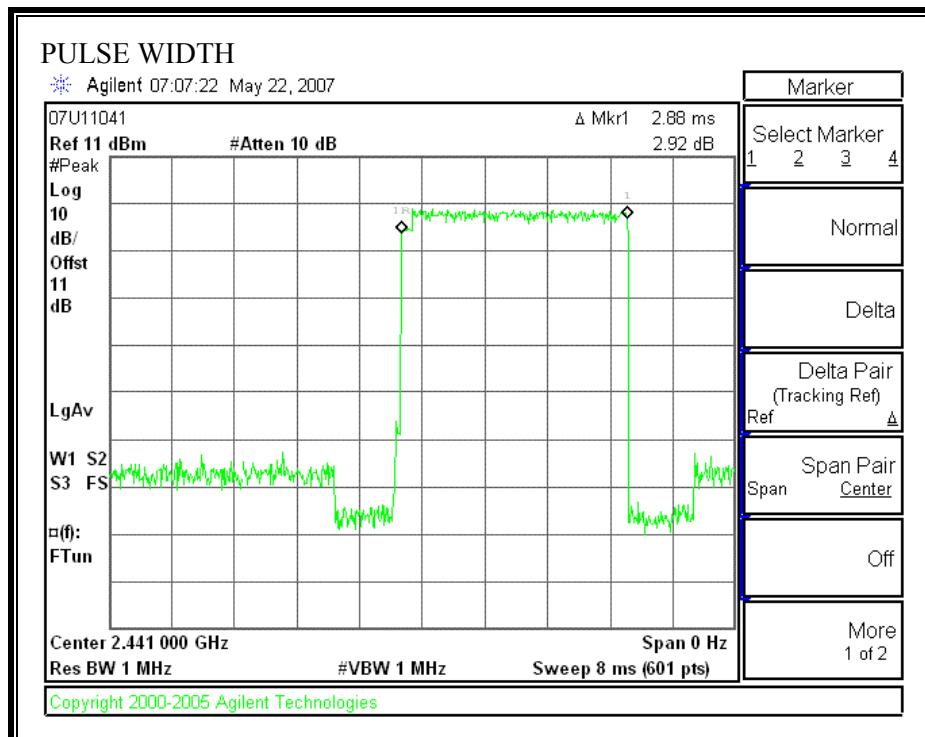
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3-DH1	0.38	30	0.114	0.4	0.286
<b>3-DH3</b>	1.632	19	0.310	0.4	0.090
3-DH5	2.88	12	0.346	0.4	0.054

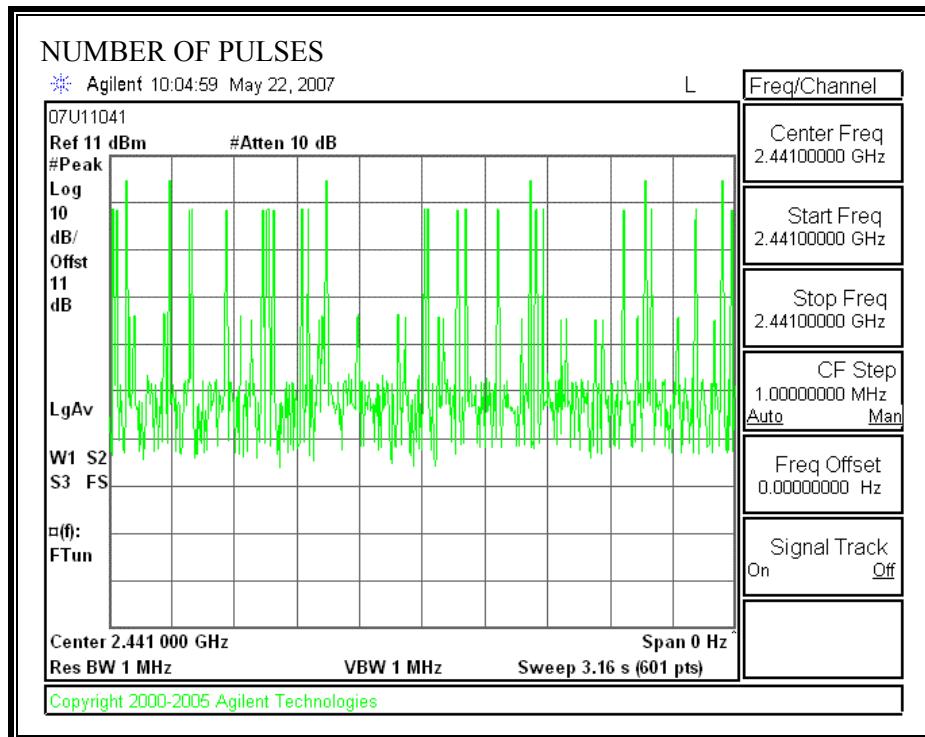
**PACKET TYPE:3-DH1****PULSE WIDTH**

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

**PACKET TYPE: 3-DH3****PULSE WIDTH**

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

**PACKET TYPE: 3-DH5****PULSE WIDTH**

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

## 7.2.5. 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 3.36 dBi, therefore the limit is 30 dBm.

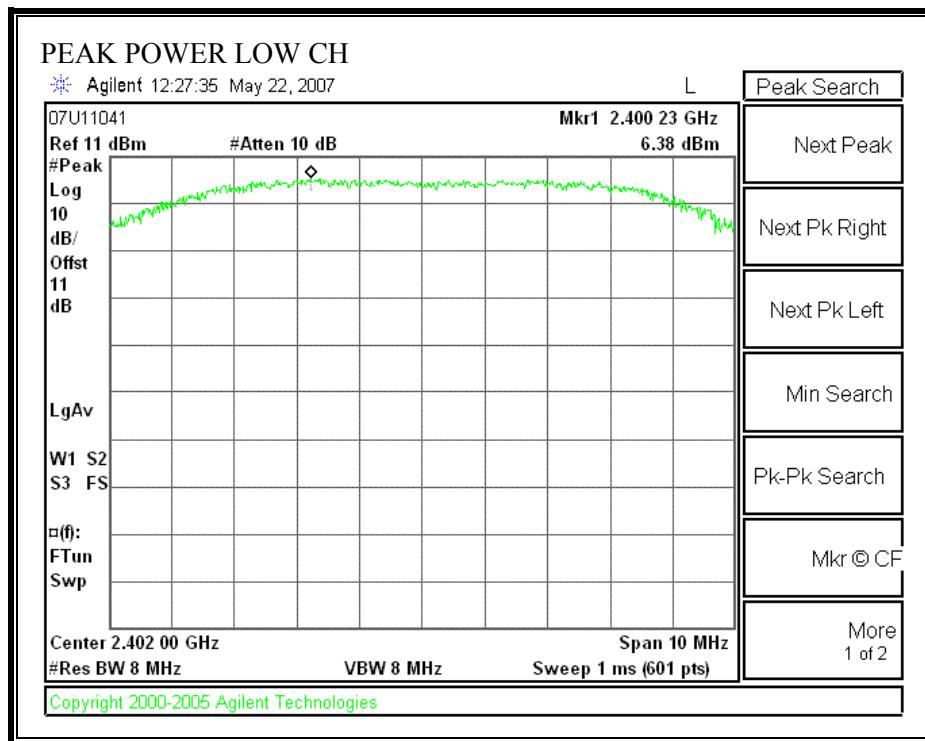
### TEST PROCEDURE

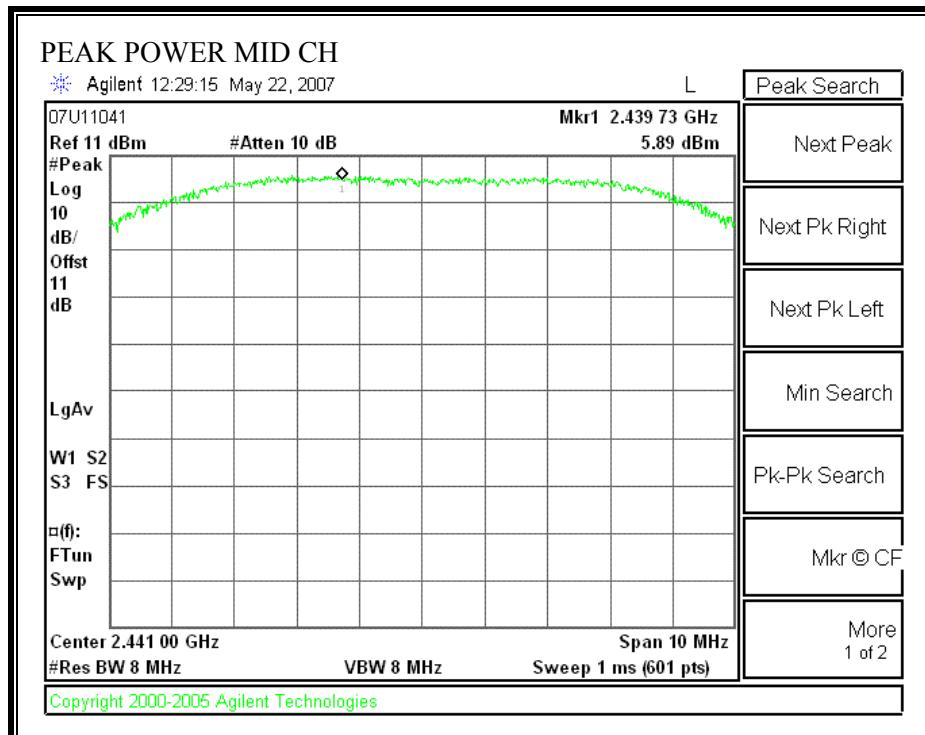
The transmitter output is connected to a spectrum analyzer and the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

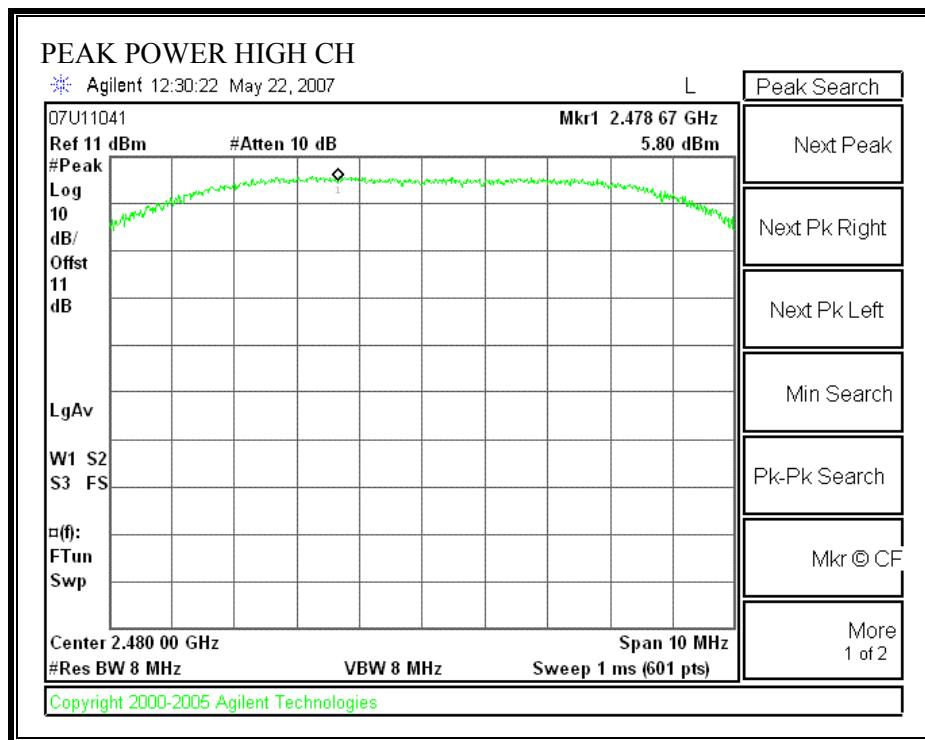
### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	6.38	30	-23.62
Middle	2441	5.89	30	-24.11
High	2480	5.80	30	-24.20

**OUTPUT POWER**





## 7.2.6. MAXIMUM PERMISSIBLE EXPOSURE

### LIMITS

§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	4.80/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.

**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 and rearranging the terms to express the distance as a function of the remaining variables yields:

$$d = \sqrt{(30 * P * G) / (3770 * S)}$$

Changing to units of Power to mW and Distance to cm, using:

$$P (\text{mW}) = P (\text{W}) / 1000 \text{ and}$$

$$d (\text{cm}) = 100 * d (\text{m})$$

yields

$$d = 100 * \sqrt{(30 * (P / 1000) * G) / (3770 * S)}$$

$$d = 0.282 * \sqrt{(P * G / S)}$$

where

d = distance in cm

P = Power in mW

G = Numeric antenna gain

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

Substituting the logarithmic form of power and gain using:

$$P (\text{mW}) = 10^{(P (\text{dBm}) / 10)} \text{ and}$$

$$G (\text{numeric}) = 10^{(G (\text{dBi}) / 10)}$$

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

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

**LIMITS**

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

**RESULTS**

No non-compliance noted: (MPE distance equals 20 cm)

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.

MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )
20.0	6.38	3.36	0.00

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.

## 7.2.7. AVERAGE POWER

### AVERAGE POWER LIMIT

None; for reporting purposes only.

### TEST PROCEDURE

The transmitter output is connected to a power meter.

### RESULTS

No non-compliance noted:

The cable assembly insertion loss of 1 dB (including 0 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.06
Middle	2441	3.59
High	2480	3.80

## 7.2.8. PEAK POWER SPECTRAL DENSITY

### LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

§15.247 (f) The digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

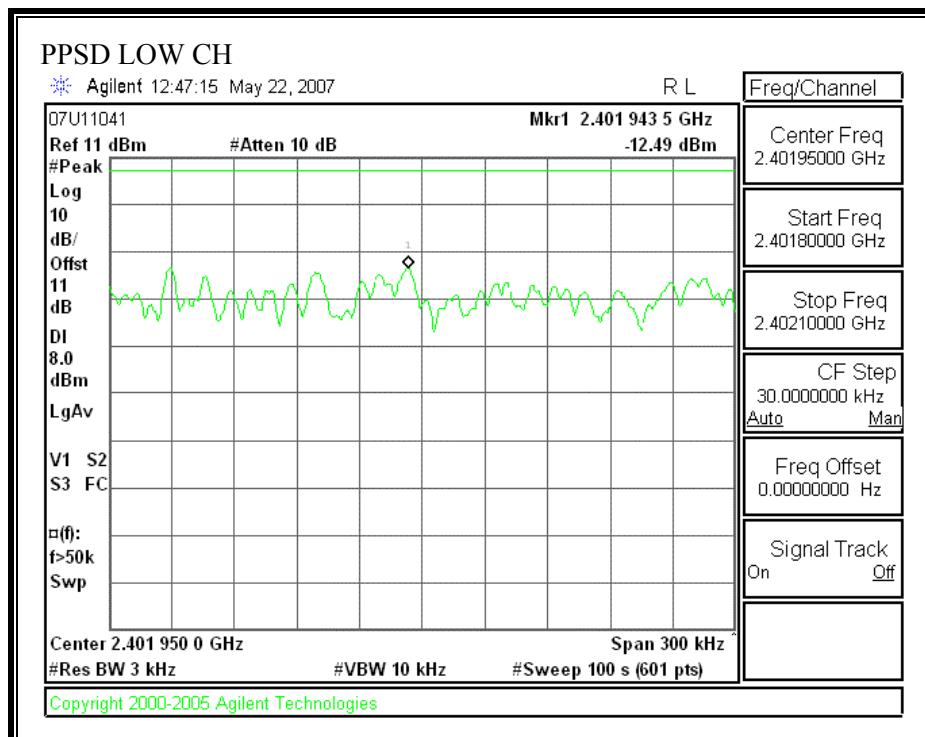
### TEST PROCEDURE

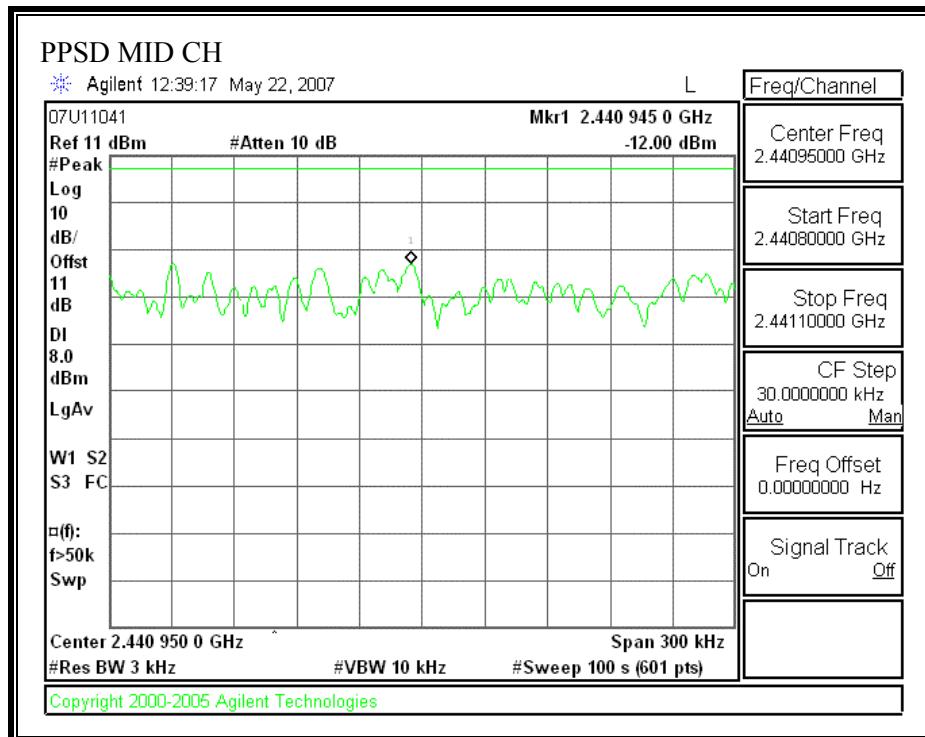
The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW > 3 kHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

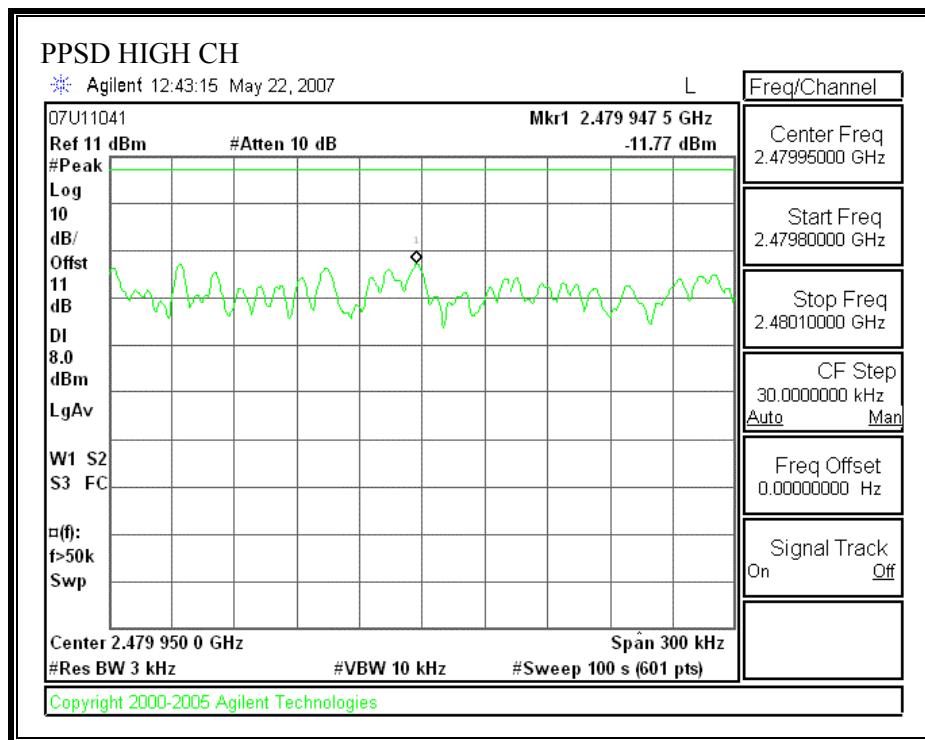
### RESULTS

No non-compliance noted:

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-12.49	8	-20.49
Middle	2441	-12.00	8	-20.00
High	2480	-11.77	8	-19.77

**PEAK POWER SPECTRAL DENSITY**





## 7.2.9. 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)).

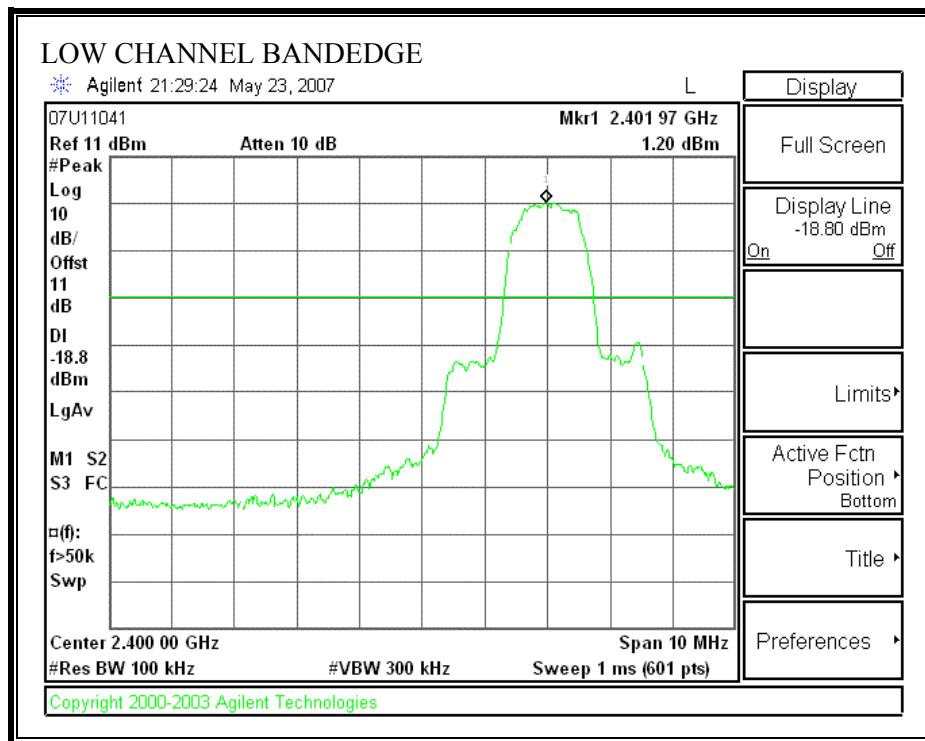
### TEST PROCEDURE

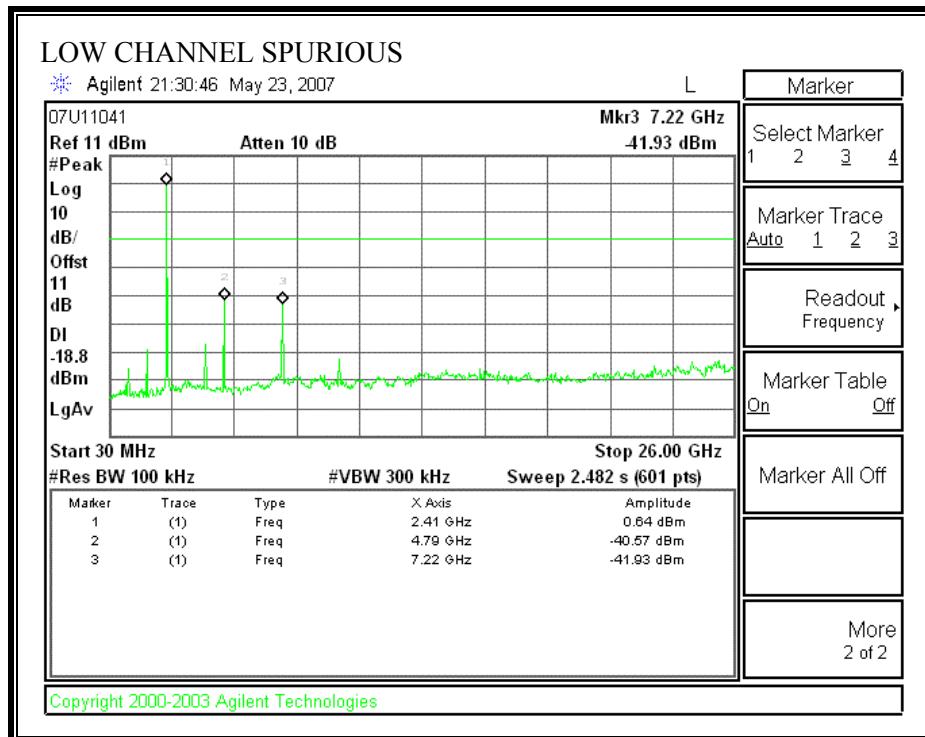
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

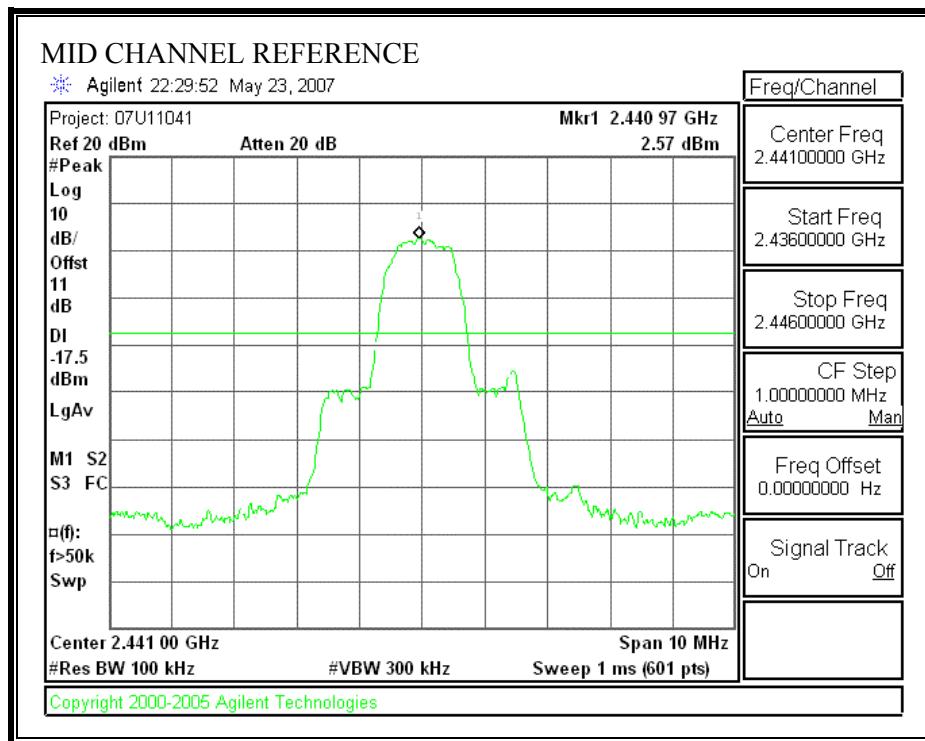
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

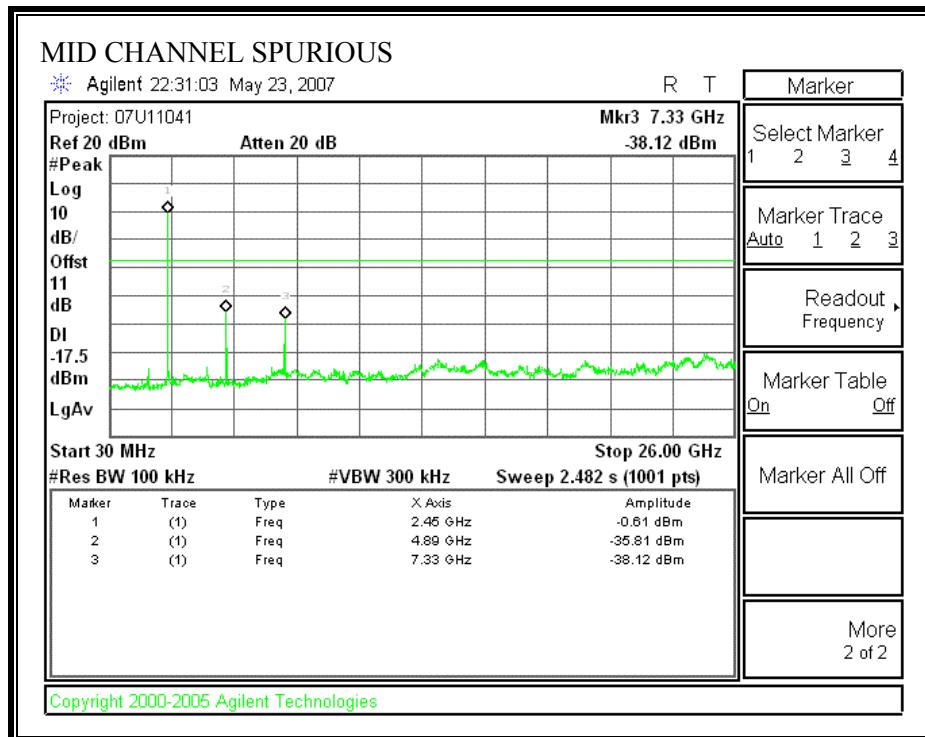
### RESULTS

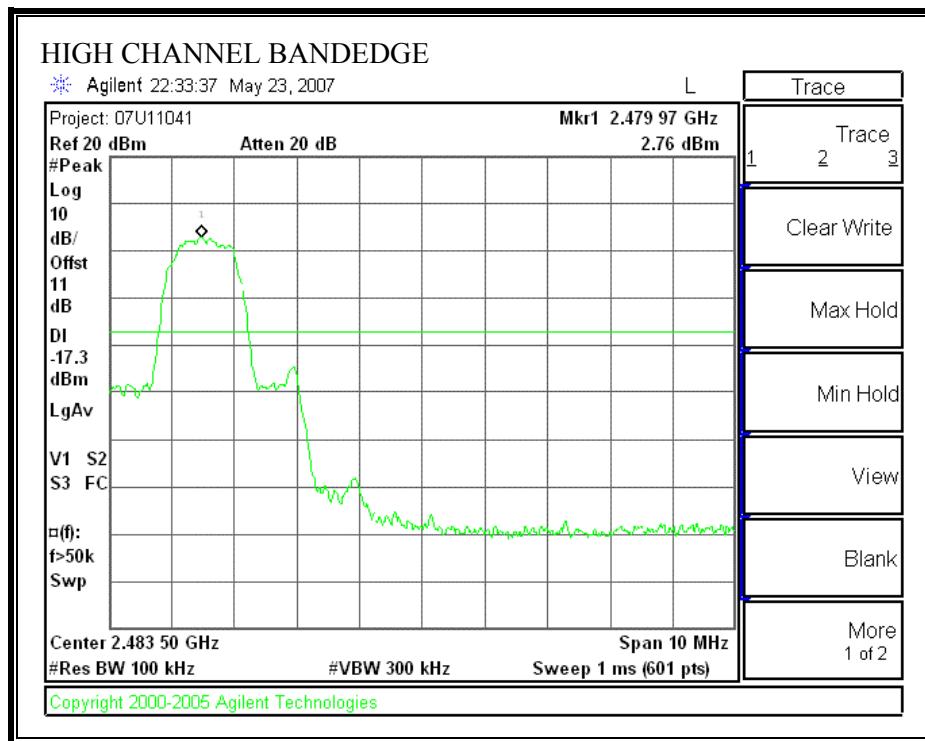
No non-compliance noted:

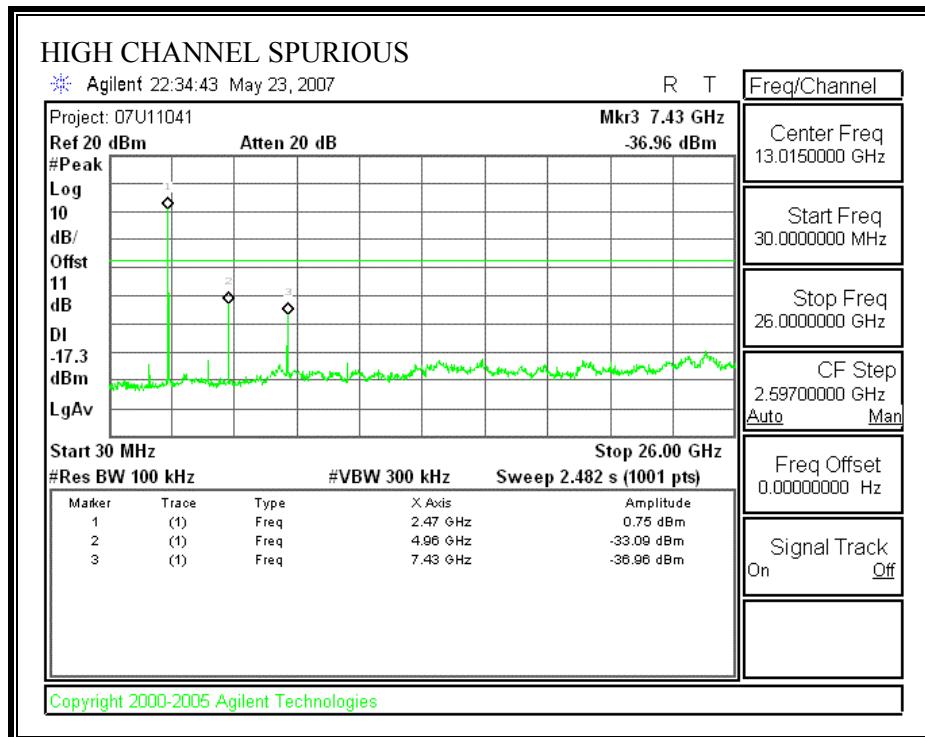
**SPURIOUS EMISSIONS, LOW CHANNEL**

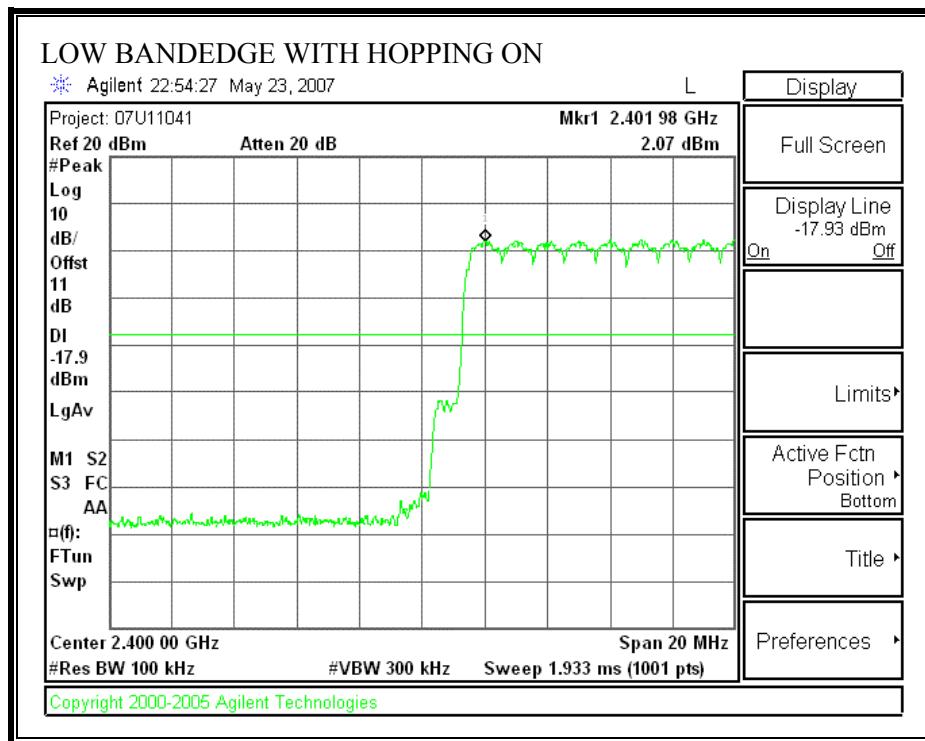


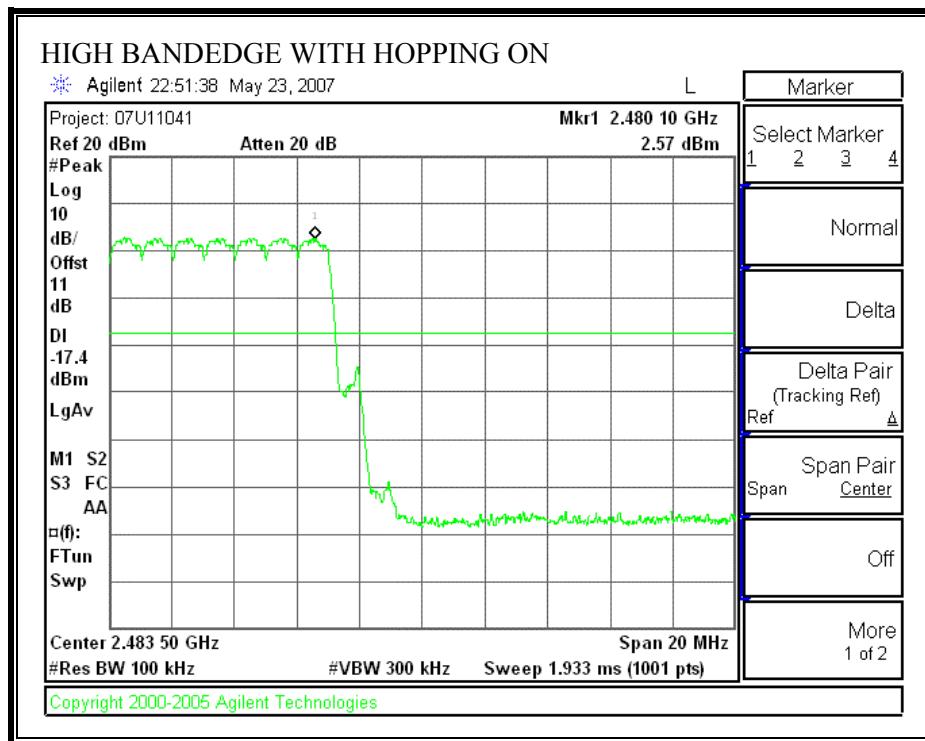
**SPURIOUS EMISSIONS, MID CHANNEL**



**SPURIOUS EMISSIONS, HIGH CHANNEL**



**SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON**



## 7.3. RADIATED EMISSIONS

### 7.3.1. 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*
<sup>1</sup> 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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	( <sup>2</sup> )
13.36 - 13.41			

\*: 4.5 – 5.25 per Standard LP0002.

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> 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.

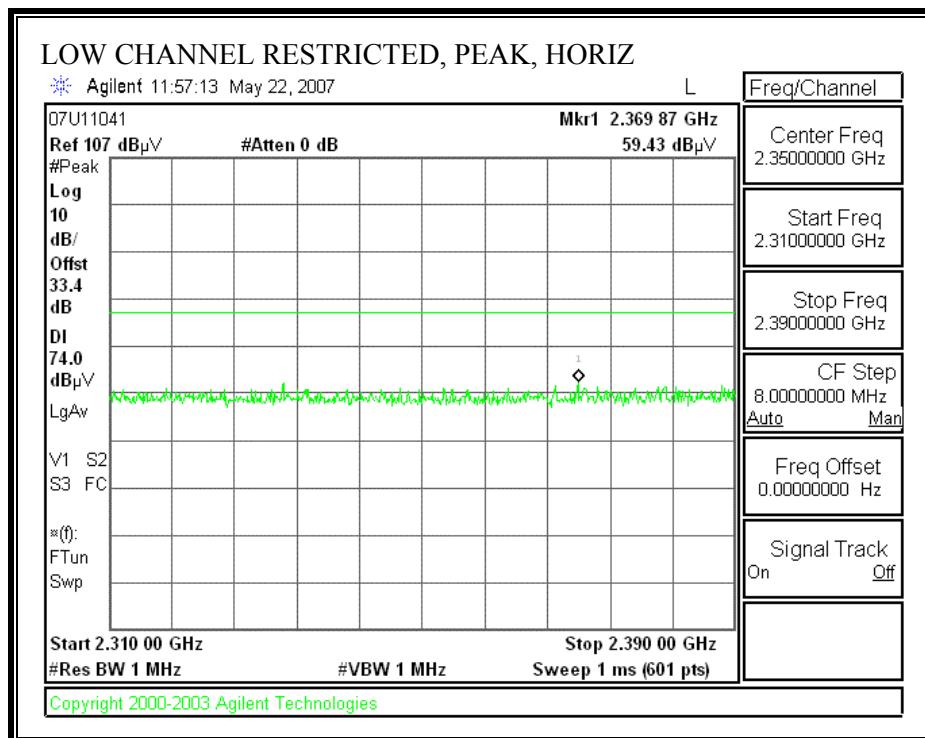
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

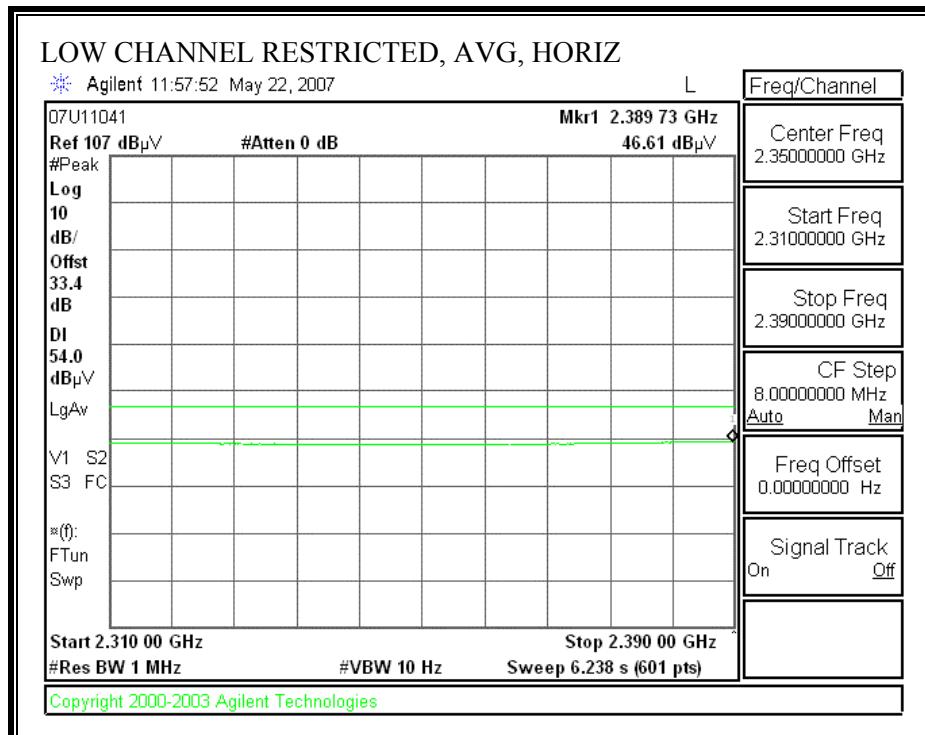
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

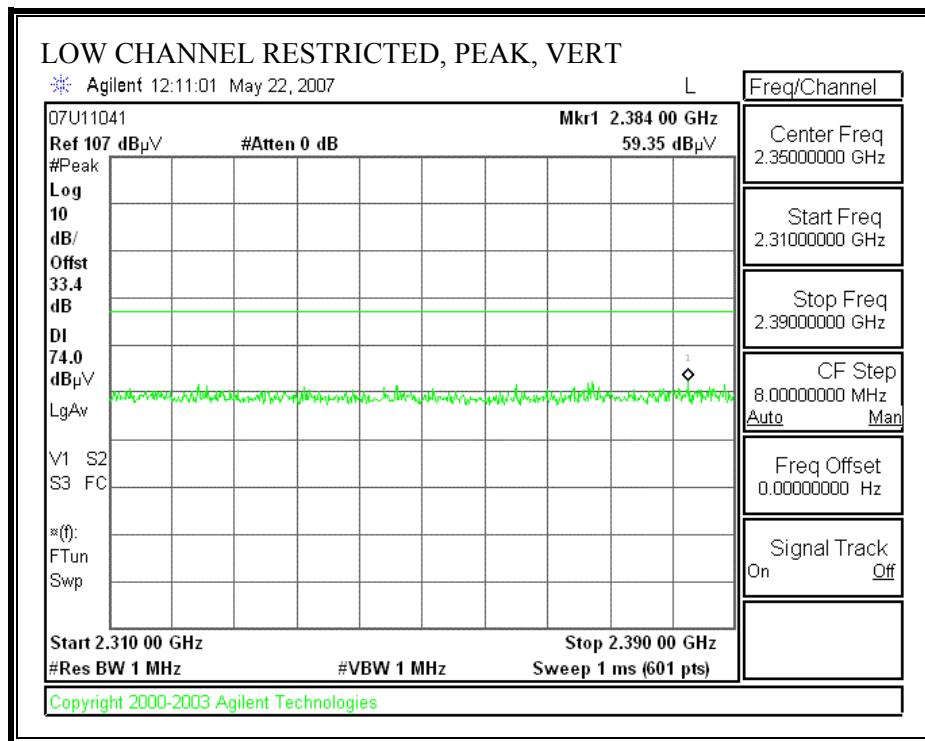
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

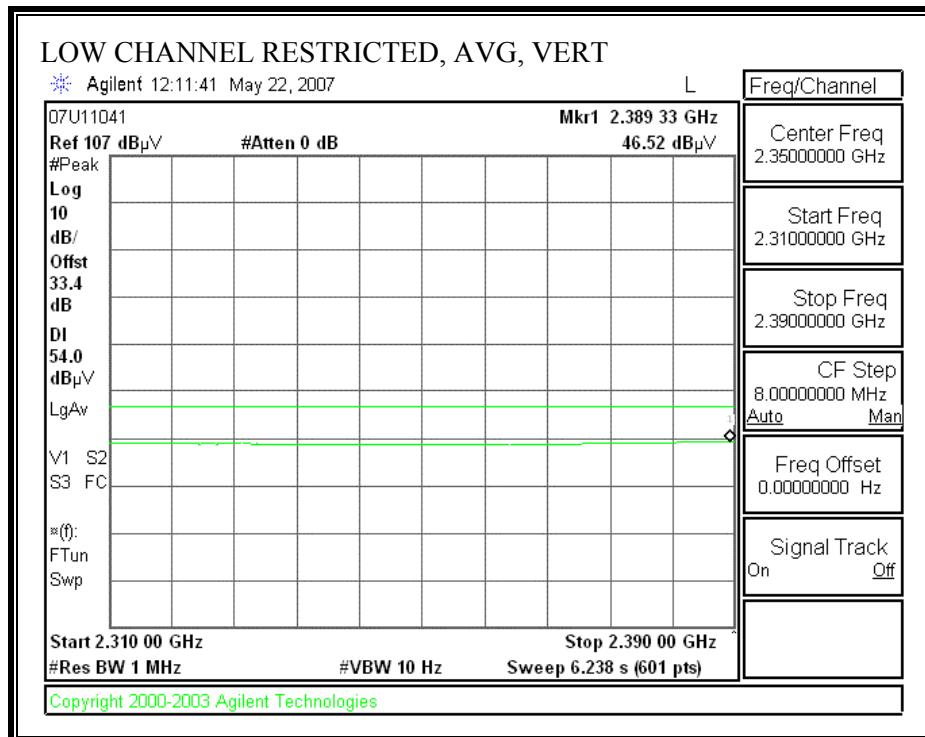
### 7.3.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ WITH GFSK MODULATION

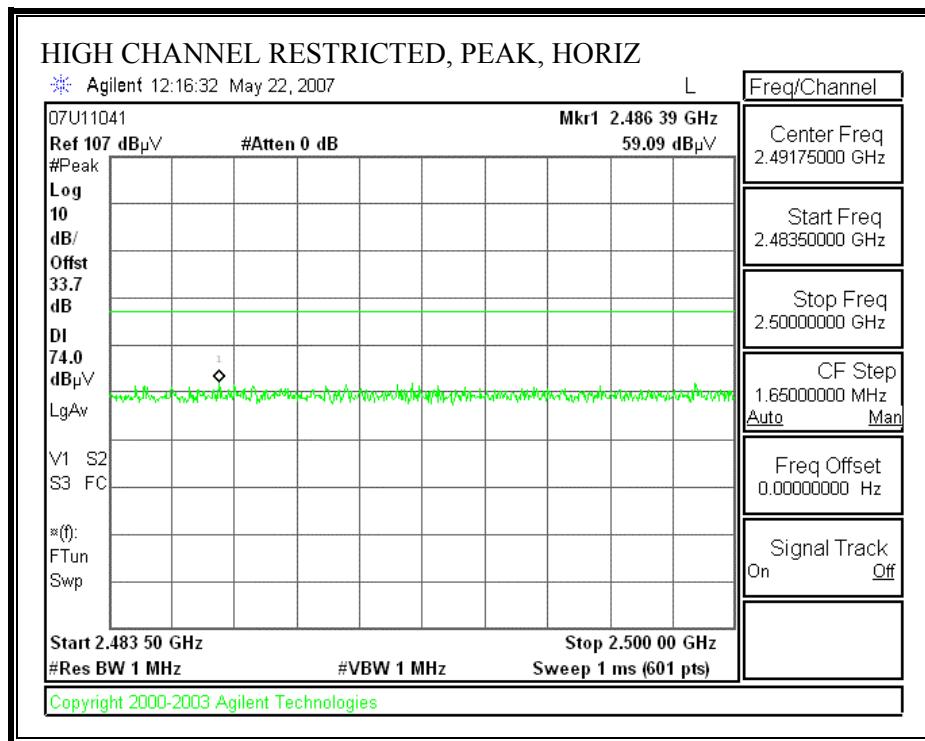
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

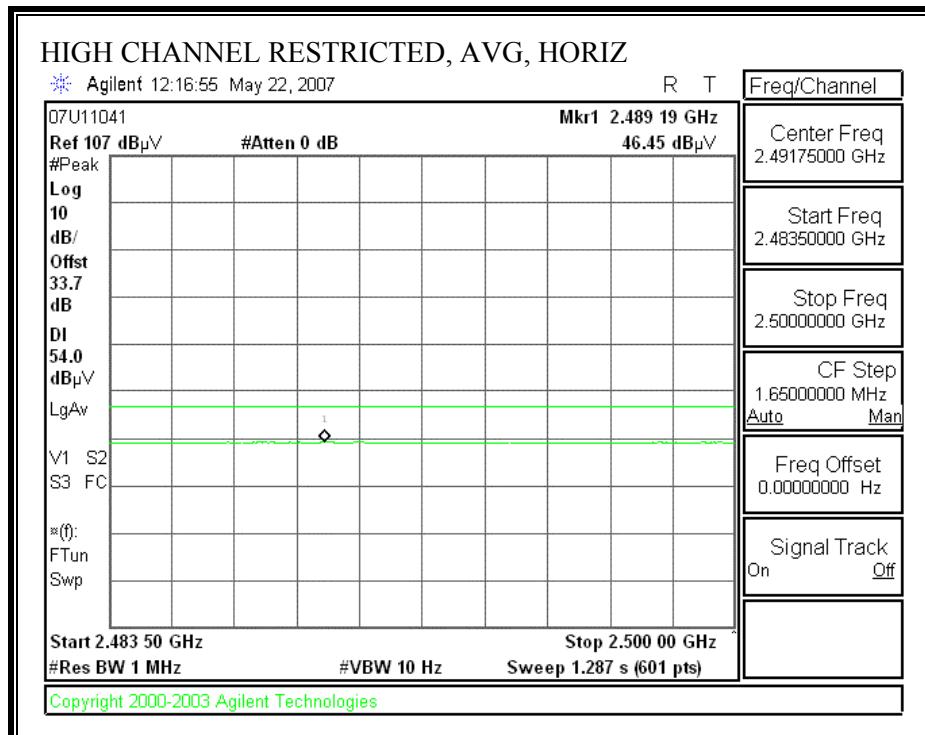


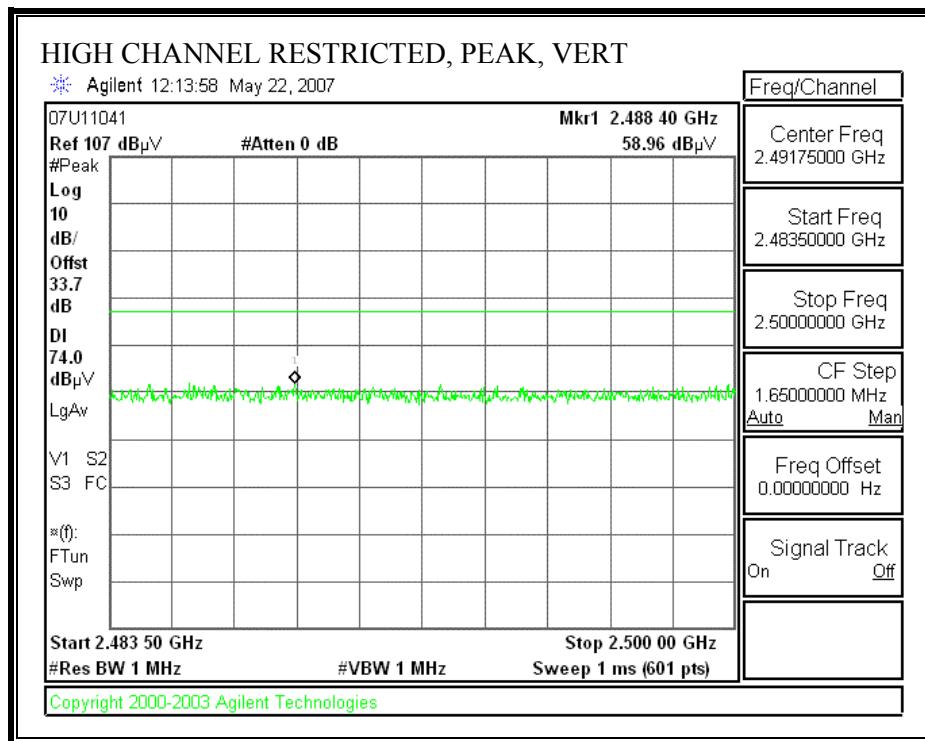


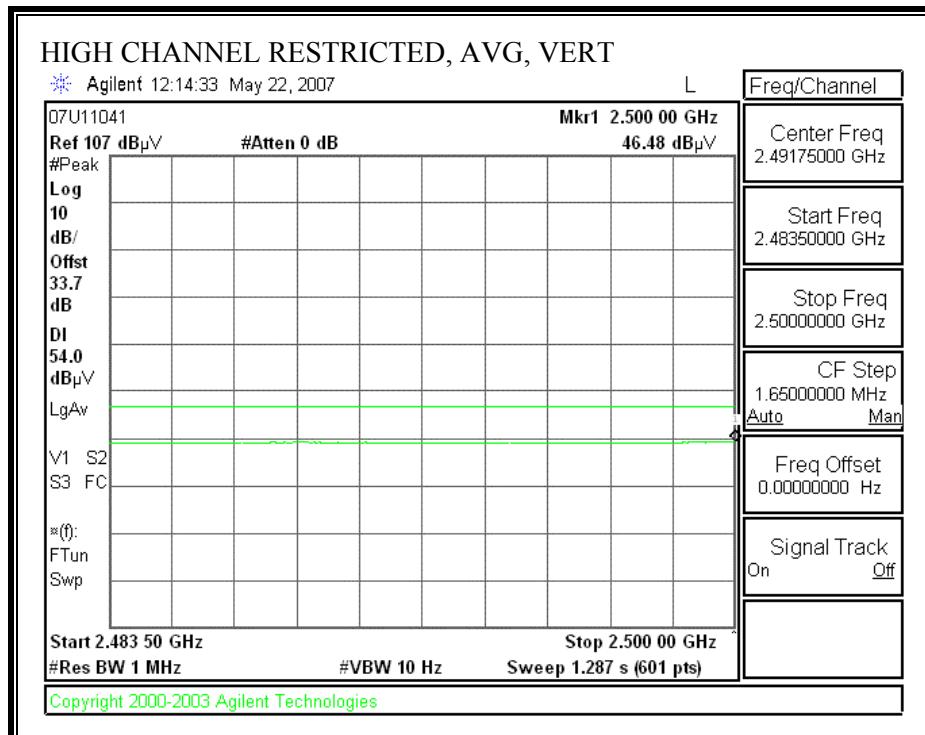
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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

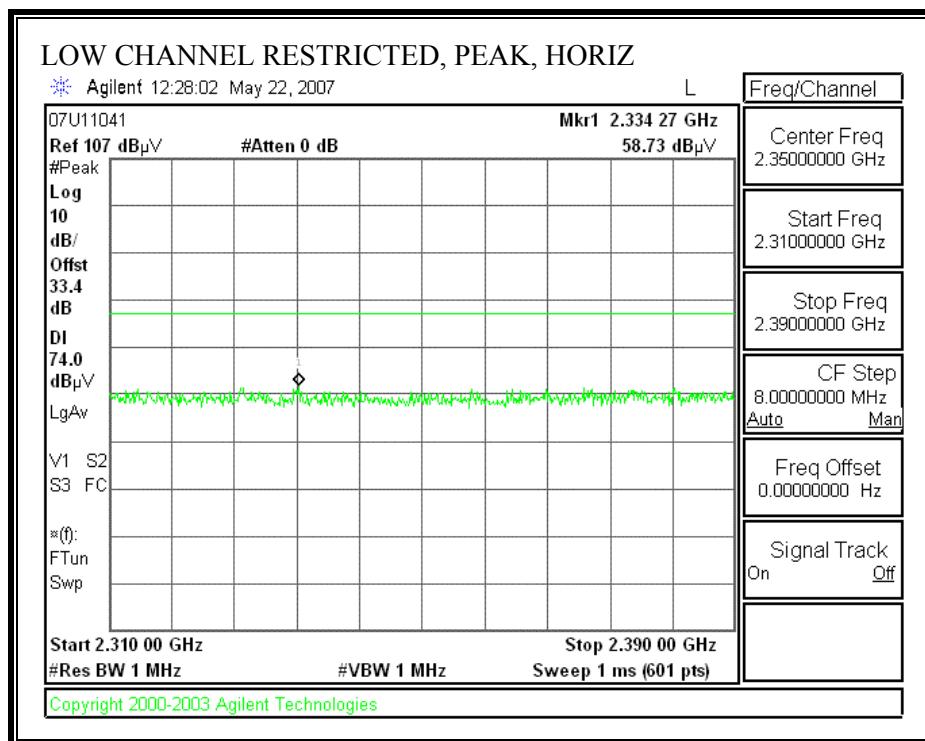


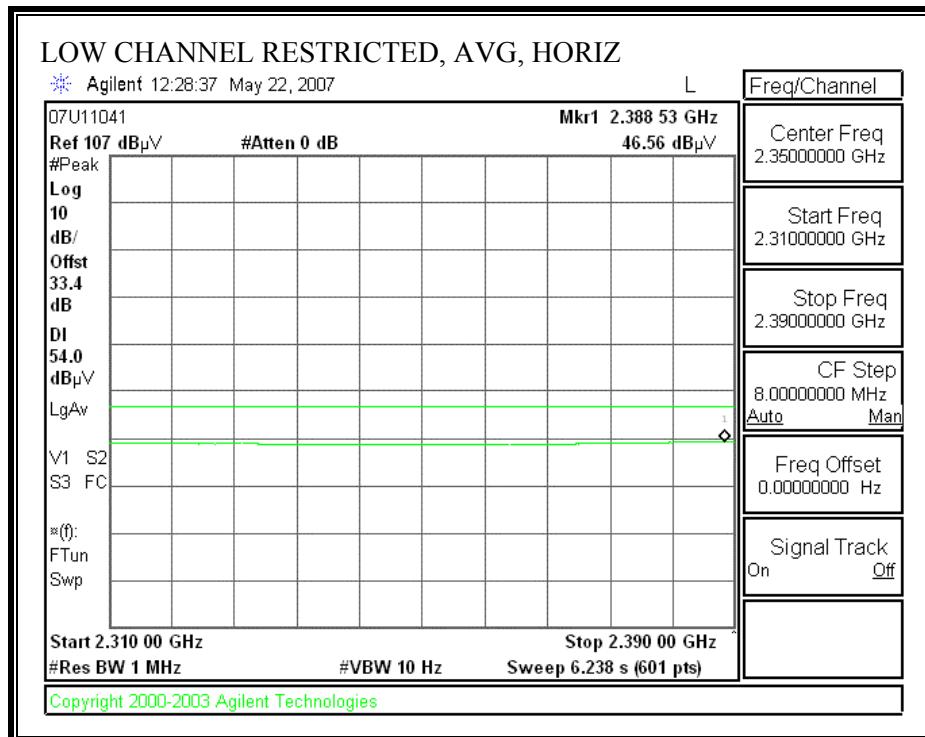
**HARMONICS AND SPURIOUS EMISSIONS**

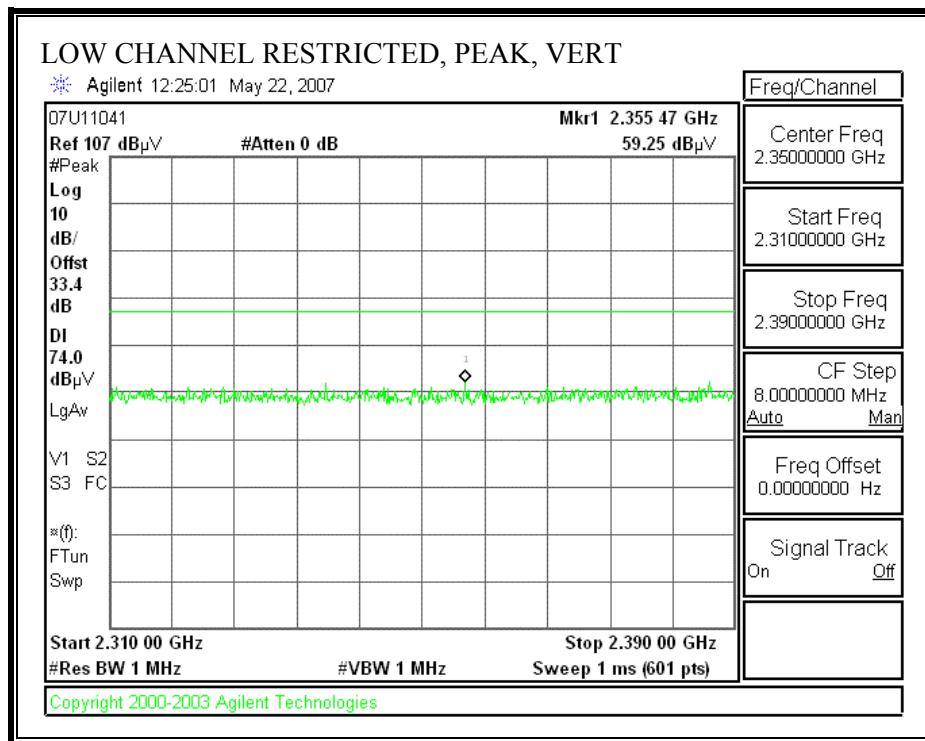
High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber															
Company: Broadcom Project #: 07U11041 Date: 5/21/2007 Test Engineer: Mengistu Mekuria Configuration: EUT with Support Laptop Mode: Tx GFSK, L/M/H Channels Duty Cycle Correction Factor = -24.78dB															
<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 B-5m Chamber															
									HPF			Reject Filter			
									HPF_4.0GHz						
<b>Peak Measurements</b> RBW=VBW=1MHz <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	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>Low Ch (2402MHz)</b>															
4.804	3.0	57.9	37.9	33.0	7.1	-34.8	0.0	0.6	63.8	43.8	74	54	-10.2	-10.2	H
7.206	3.0	49.6	29.6	35.4	8.6	-34.2	0.0	0.6	60.0	40.0	74	54	-14.0	-14.0	H
4.804	3.0	55.2	35.2	33.0	7.1	-34.8	0.0	0.6	61.1	41.1	74	54	-12.9	-12.9	V
7.206	3.0	51.0	31.0	35.4	8.6	-34.2	0.0	0.6	61.4	41.4	74	54	-12.6	-12.6	V
<b>Mid Ch (2441MHz)</b>															
4.882	3.0	62.3	42.3	33.1	7.2	-34.8	0.0	0.6	68.3	48.3	74	54	-5.7	-5.7	H
7.323	3.0	48.3	28.3	35.5	8.7	-34.1	0.0	0.6	59.0	39.0	74	54	-15.0	-15.0	H
4.882	3.0	60.0	40.0	33.1	7.2	-34.8	0.0	0.6	66.0	46.0	74	54	-8.0	-8.0	V
7.323	3.0	50.2	30.2	35.5	8.7	-34.1	0.0	0.6	60.9	40.9	74	54	-13.1	-13.1	V
<b>Hi Ch (2480MHz)</b>															
4.960	3.0	56.4	36.4	33.1	7.2	-34.8	0.0	0.6	62.6	42.6	74	54	-11.4	-11.4	H
7.440	3.0	50.9	30.9	35.6	8.7	-34.1	0.0	0.6	61.8	41.8	74	54	-12.2	-12.2	H
9.920	3.0	42.5	22.5	37.3	10.2	-32.9	0.0	0.8	58.0	38.0	74	54	-16.0	-16.0	V
4.960	3.0	51.9	31.9	33.1	7.2	-34.8	0.0	0.6	58.1	38.1	74	54	-15.9	-15.9	V
7.440	3.0	54.3	34.3	35.6	8.7	-34.1	0.0	0.6	65.2	45.2	74	54	-8.8	-8.8	V
9.920	3.0	44.6	24.6	37.3	10.2	-32.9	0.0	0.8	60.2	40.2	74	54	-13.8	-13.8	V
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															

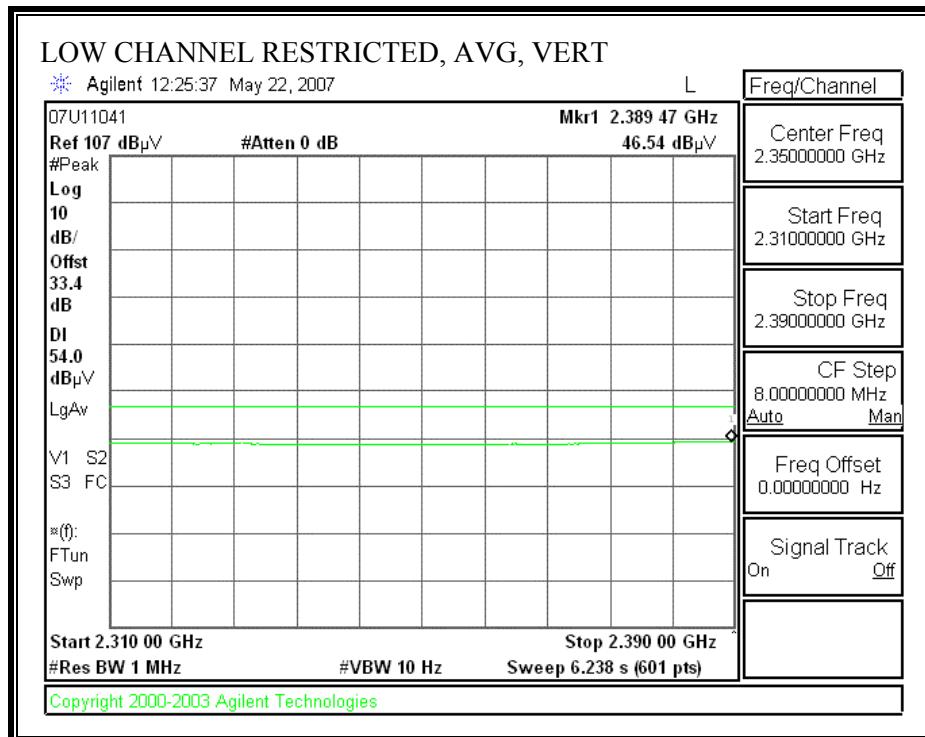
### 7.3.3. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ WITH 8PSK MODULATION

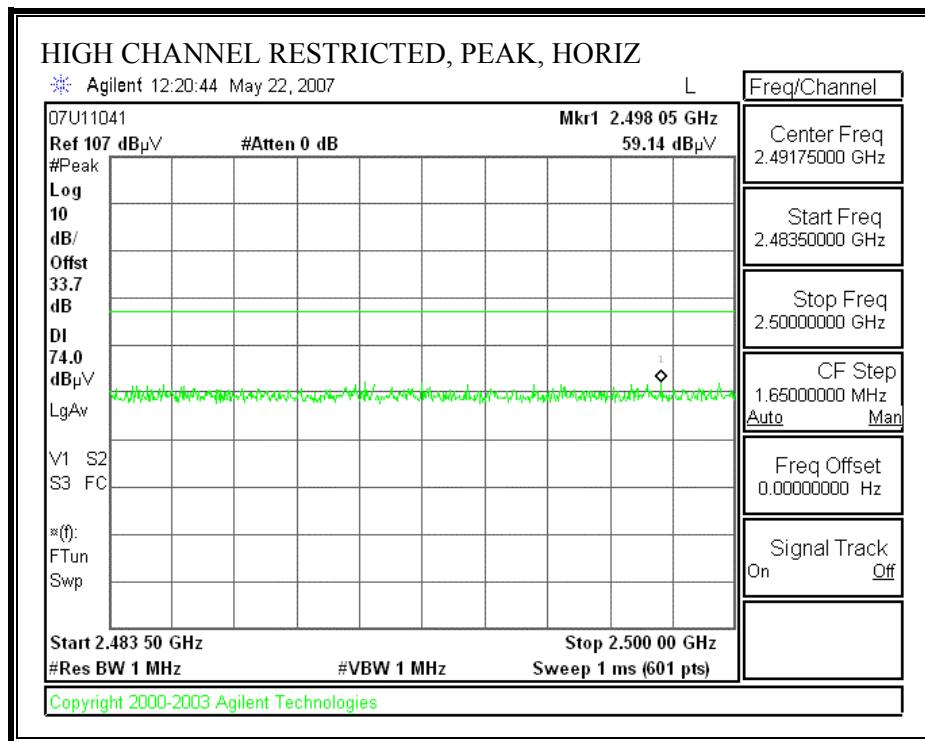
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

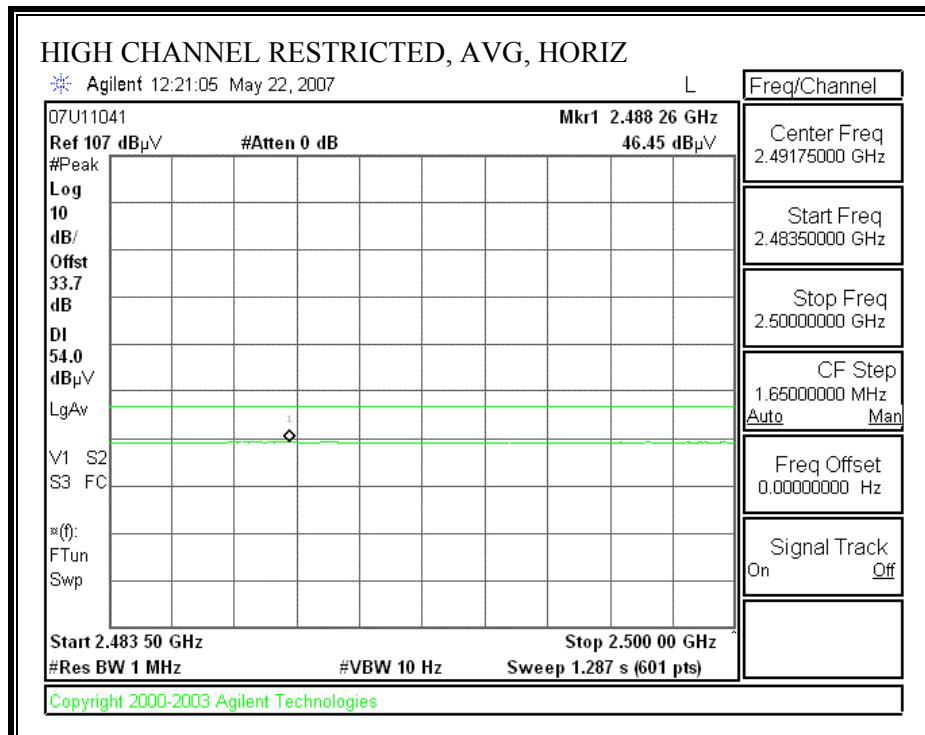


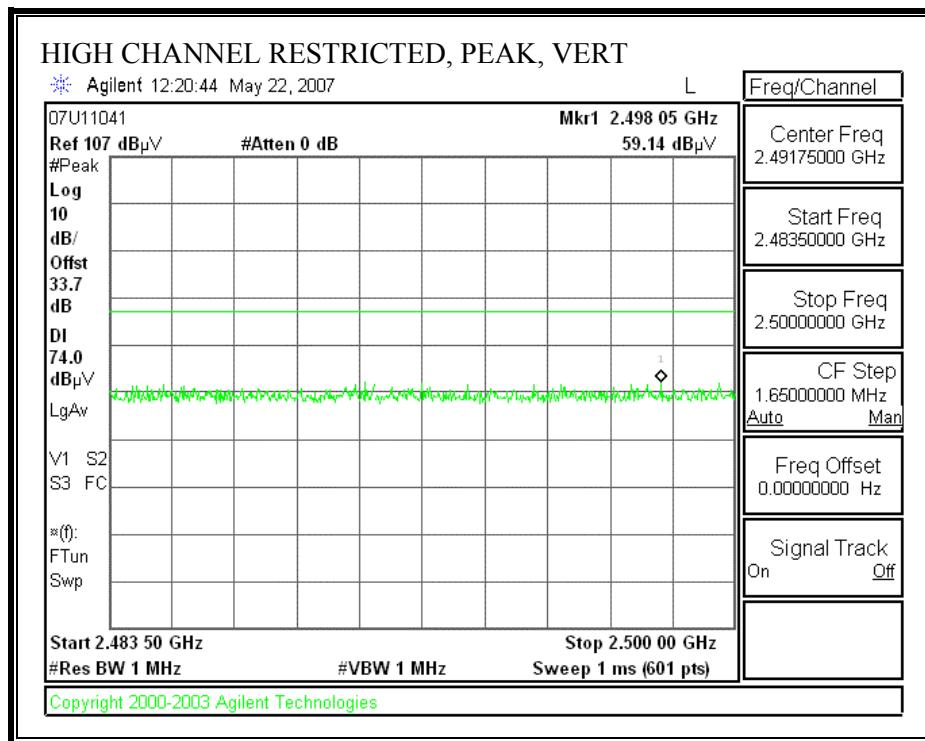


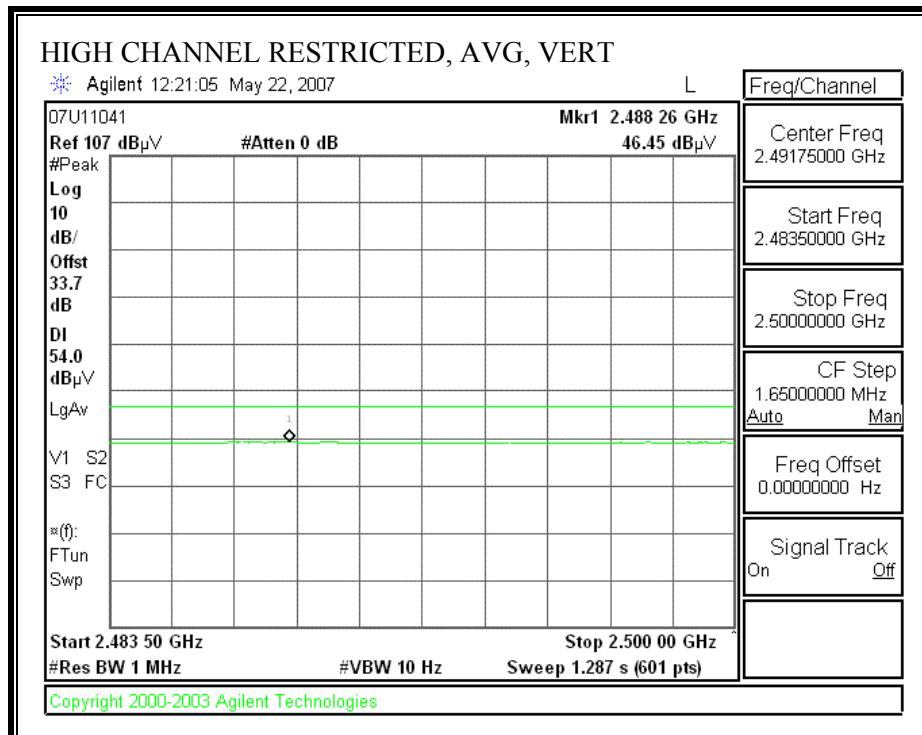
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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



**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																																																																										
<p>Company: Broadcom Project #: 07U11041 Date: 5/21/2007 Test Engineer: Mengistu Mekuria Configuration: EUT with Support Laptop Mode: Tx 8PSK, L/M/H Channels Duty Cycle Correction Factor = -24.75dB</p> <p><u>Test Equipment:</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="3">Horn &gt; 18GHz</td> <td>Limit</td> </tr> <tr> <td>T60; S/N: 2238 @3m</td> <td>T34 HP 8449B</td> <td></td> <td colspan="3"></td> <td>FCC 15.209</td> </tr> <tr> <td colspan="15">Hi Frequency Cables</td> </tr> <tr> <td>2 foot cable</td> <td>3 foot cable</td> <td>12 foot cable</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="10"> <u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz; VBW=10Hz         </td> </tr> <tr> <td><b>f</b></td> <td><b>Dist</b></td> <td><b>Read Pk</b></td> <td><b>Read Avg</b></td> <td><b>AF</b></td> <td><b>CL</b></td> <td><b>Amp</b></td> <td><b>D Corr</b></td> <td><b>Fltr</b></td> <td><b>Peak</b></td> <td><b>Avg</b></td> <td><b>Pk Lim</b></td> <td><b>Avg Lim</b></td> <td><b>Pk Mar</b></td> <td><b>Avg Mar</b></td> <td><b>Notes</b></td> </tr> <tr> <td>GHz</td> <td>(m)</td> <td>dBuV</td> <td>dBuV</td> <td>dB/m</td> <td>dB</td> <td>dB</td> <td>dB</td> <td>dB</td> <td>dBuV/m</td> <td>dBuV/m</td> <td>dBuV/m</td> <td>dBuV/m</td> <td>dB</td> <td>dB</td> <td>(V/H)</td> </tr> </table>															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	<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz; VBW=10Hz										<b>f</b>	<b>Dist</b>	<b>Read Pk</b>	<b>Read Avg</b>	<b>AF</b>	<b>CL</b>	<b>Amp</b>	<b>D Corr</b>	<b>Fltr</b>	<b>Peak</b>	<b>Avg</b>	<b>Pk Lim</b>	<b>Avg Lim</b>	<b>Pk Mar</b>	<b>Avg Mar</b>	<b>Notes</b>	GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)
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																																																																																				
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2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz; VBW=10Hz																																																																																					
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GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)																																																																											
<b>Low Ch (2402MHz)</b>																																																																																										
4.804	3.0	60.7	40.7	33.0	7.1	-34.8	0.0	0.6	66.6	46.6	74	54	-7.4	-7.4	H																																																																											
7.206	3.0	52.6	32.6	35.4	8.6	-34.2	0.0	0.6	63.1	43.1	74	54	-10.9	-10.9	H																																																																											
4.804	3.0	57.1	37.1	33.0	7.1	-34.8	0.0	0.6	62.9	42.9	74	54	-11.1	-11.1	V																																																																											
7.206	3.0	54.2	34.2	35.4	8.6	-34.2	0.0	0.6	64.6	44.6	74	54	-9.4	-9.4	V																																																																											
<b>Mid Ch (2441MHz)</b>																																																																																										
4.882	3.0	64.3	44.3	33.1	7.2	-34.8	0.0	0.6	70.3	50.3	74	54	-3.7	-3.7	H																																																																											
7.323	3.0	49.8	29.8	35.5	8.7	-34.1	0.0	0.6	60.5	40.5	74	54	-13.5	-13.5	H																																																																											
4.882	3.0	59.7	39.7	33.1	7.2	-34.8	0.0	0.6	65.8	45.8	74	54	-8.2	-8.2	V																																																																											
7.323	3.0	52.0	32.0	35.5	8.7	-34.1	0.0	0.6	62.7	42.7	74	54	-11.3	-11.3	V																																																																											
<b>Hi Ch (2480MHz)</b>																																																																																										
4.960	3.0	55.8	35.8	33.1	7.2	-34.8	0.0	0.6	62.0	42.0	74	54	-12.0	-12.0	H																																																																											
7.440	3.0	54.8	34.8	35.6	8.7	-34.1	0.0	0.6	65.7	45.7	74	54	-8.3	-8.3	H																																																																											
4.960	3.0	51.7	31.7	33.1	7.2	-34.8	0.0	0.6	57.9	37.9	74	54	-16.1	-16.1	V																																																																											
7.440	3.0	59.2	39.2	35.6	8.7	-34.1	0.0	0.6	70.1	50.1	74	54	-3.9	-3.9	V																																																																											
9.920	3.0	45.2	25.2	37.3	10.2	-32.9	0.0	0.8	60.7	40.7	74	54	-13.3	-13.3	V																																																																											
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																																																																																					

### 7.3.4. RECEIVER ABOVE 1 GHz WITH GFSK MODULATION

#### RESULTS

No non-compliance noted:

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																										
<b>Company:</b> Broadcom <b>Project #:</b> 07U11041 <b>Date:</b> 5/21/2007 <b>Test Engineer:</b> Mengistu Mekuria <b>Configuration:</b> EUT with Support Laptop <b>Mode:</b> Receiver Mode, GFSK Modulation																																										
<b>Test Equipment:</b>																																										
<b>Horn 1-18GHz</b>		<b>Pre-amplifier 1-26GHz</b>		<b>Pre-amplifier 26-40GHz</b>		<b>Horn &gt; 18GHz</b>		<b>Limit</b>																																		
T60; S/N: 2238 @3m		T144 Miteq 3008A00931								RX RSS 210																																
<b>Hi Frequency Cables</b> <table border="1"> <tr> <td><b>2 foot cable</b></td> <td><b>3 foot cable</b></td> <td><b>12 foot cable</b></td> <td><b>HPF</b></td> <td><b>Reject Filter</b></td> <td colspan="9"> <b>Peak Measurements</b>            RBW=VBW=1MHz  <b>Average Measurements</b>            RBW=1MHz ; VBW=10Hz         </td> </tr> <tr> <td></td> <td></td> <td>B-5m Chamber</td> <td></td> <td></td> <td colspan="9"></td> </tr> </table>															<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>Average Measurements</b> RBW=1MHz ; VBW=10Hz											B-5m Chamber											
<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>Average Measurements</b> RBW=1MHz ; VBW=10Hz																																					
		B-5m Chamber																																								
<b>f</b> GHz	<b>Dist</b> (m)	<b>Read Pk</b> dBuV	<b>Read Avg</b> dBuV	<b>AF</b> dB/m	<b>CL</b> dB	<b>Amp</b> dB	<b>D Corr</b> dB	<b>Fltr</b> dB	<b>Peak</b> dBuV/m	<b>Avg</b> dBuV/m	<b>Pk Lim</b> dBuV/m	<b>Avg Lim</b> dBuV/m	<b>Pk Mar</b> dB	<b>Avg Mar</b> dB	<b>Notes</b> (V/H)																											
1500	3.0	63.0	45.4	26.7	3.9	-38.8	0.0	0.0	54.8	37.2	74	54	-19.2	-16.8	V																											
1990	3.0	61.3	41.6	27.9	4.5	-38.1	0.0	0.0	55.7	35.9	74	54	-18.3	-18.1	V																											
3980	3.0	45.4	33.5	32.4	6.4	-36.6	0.0	0.0	47.6	35.7	74	54	-26.4	-18.3	V																											
1500	3.0	56.8	44.8	26.7	3.9	-38.8	0.0	0.0	48.6	36.6	74	54	-25.4	-17.4	H																											
1987	3.0	57.8	39.1	27.9	4.5	-38.1	0.0	0.0	52.1	33.5	74	54	-21.9	-20.5	H																											
2990	3.0	51.0	33.6	30.4	5.6	-37.4	0.0	0.0	49.6	32.2	74	54	-24.4	-21.8	H																											
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																																										

### 7.3.5. RECEIVER ABOVE 1 GHZ WITH 8PSK MODULATION

#### RESULTS

No non-compliance noted:

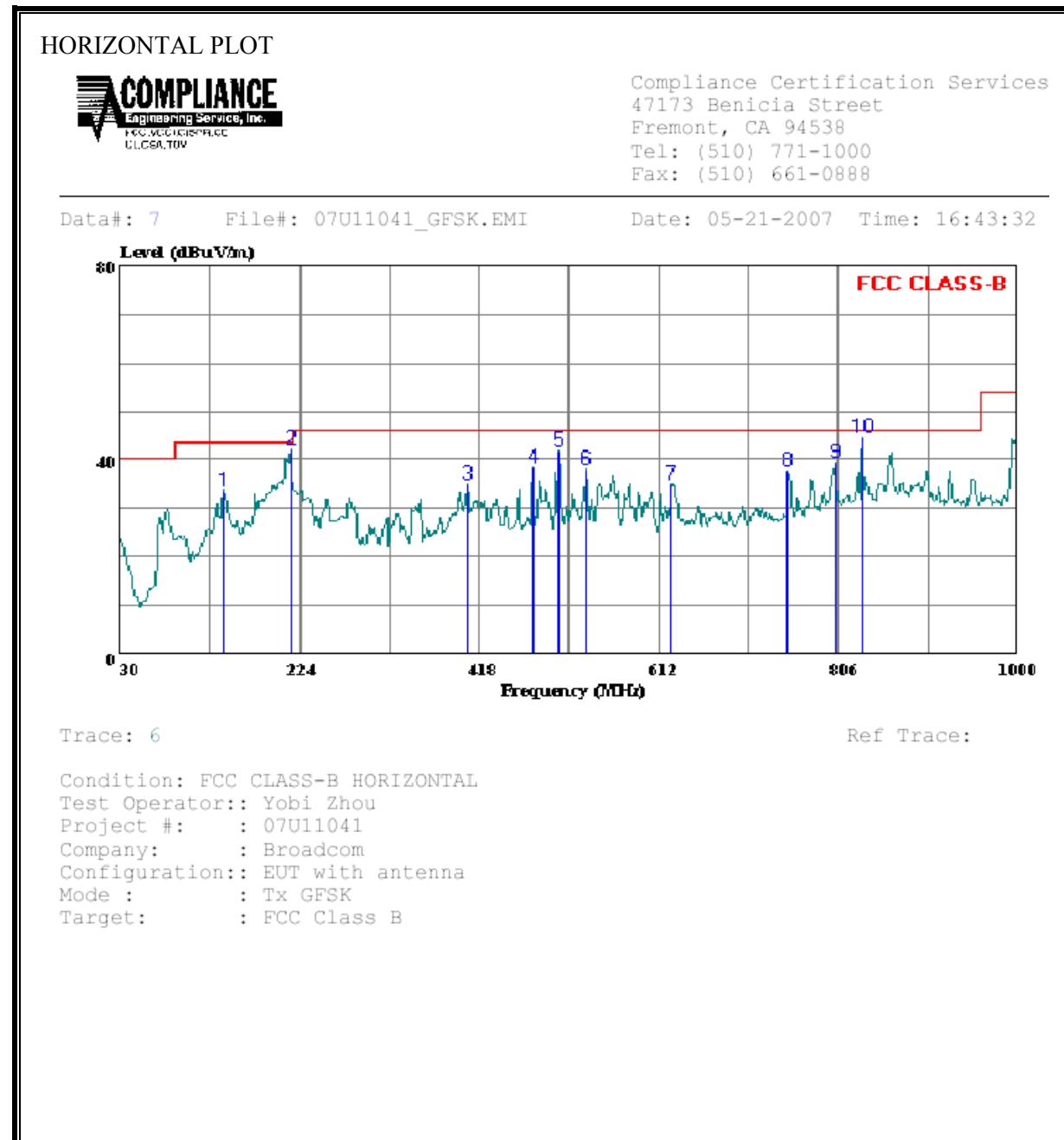
High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber																																										
Company: Broadcom Project #: 07U11041 Date: 5/21/2007 Test Engineer: Mengistu Mekuria Configuration: EUT with Support Laptop Mode: Receiver Mode, 8PSK Modulation																																										
<b>Test Equipment:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Horn 1-18GHz</td><td style="width: 20%;">Pre-amplifier 1-26GHz</td><td style="width: 20%;">Pre-amplifier 26-40GHz</td><td colspan="4" style="width: 40%;">Horn &gt; 18GHz</td><td style="width: 10%;">Limit</td></tr> <tr> <td>T60; S/N: 2238 @3m</td><td>T34 HP 8449B</td><td></td><td colspan="4"></td><td>RX RSS 210</td></tr> </table> Hi Frequency Cables <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">2 foot cable</td><td style="width: 20%;">3 foot cable</td><td style="width: 20%;">12 foot cable</td><td style="width: 20%;">B-5m Chamber</td><td style="width: 20%;">HPF</td><td style="width: 20%;">Reject Filter</td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit	T60; S/N: 2238 @3m	T34 HP 8449B						RX RSS 210	2 foot cable	3 foot cable	12 foot cable	B-5m Chamber	HPF	Reject Filter						
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit																																			
T60; S/N: 2238 @3m	T34 HP 8449B						RX RSS 210																																			
2 foot cable	3 foot cable	12 foot cable	B-5m Chamber	HPF	Reject Filter																																					
<b>Peak Measurements</b> RBW=VBW=1MHz <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	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)																											
1.500	3.0	61.9	44.9	26.7	3.9	-37.6	0.0	0.0	54.9	37.9	74	54	-19.1	-16.1	V																											
1.990	3.0	62.2	41.8	27.9	4.5	-36.9	0.0	0.0	57.8	37.4	74	54	-16.2	-16.6	V																											
3.980	3.0	46.1	34.0	32.4	6.4	-35.0	0.0	0.0	49.9	37.9	74	54	-24.1	-16.1	V																											
1.500	3.0	58.8	45.4	26.7	3.9	-37.6	0.0	0.0	51.8	38.4	74	54	-22.2	-15.6	H																											
1.573	3.0	57.0	43.8	26.9	4.0	-37.5	0.0	0.0	50.4	37.2	74	54	-23.6	-16.8	H																											
1.987	3.0	58.7	39.7	27.9	4.5	-36.9	0.0	0.0	54.2	35.2	74	54	-19.8	-18.8	H																											

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		

### 7.3.6. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz WITH GFSK MODULATION

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



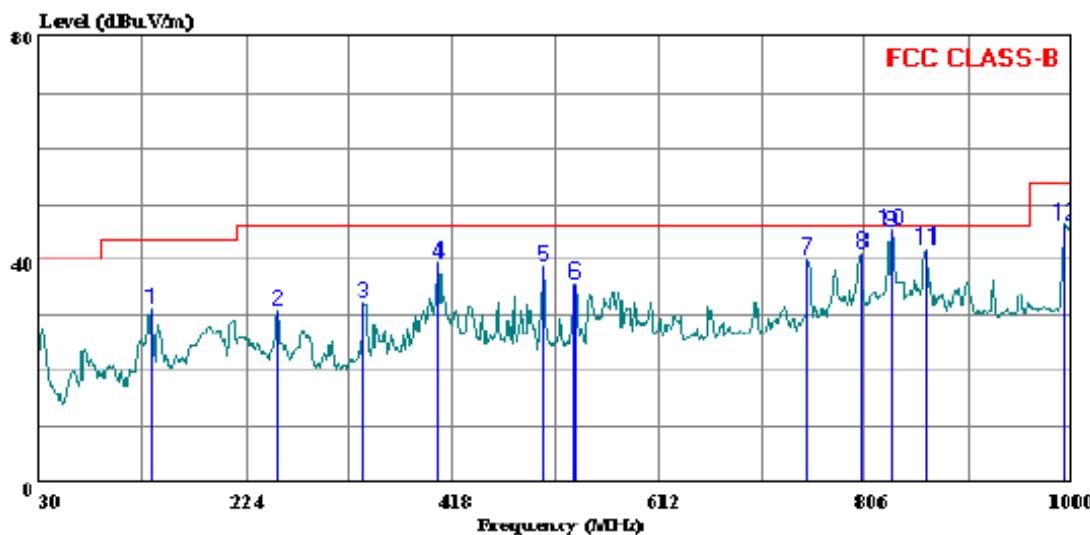
## HORIZONTAL DATA

Freq	Read		Level	Limit	Over	Limit	Remark
	MHz	dBuV					
			dB	dBuV/m	dBuV/m	dB	
1	141.550	50.27	-16.84	33.43	43.50	-10.07	Peak
2	213.330	61.14	-18.83	42.31	43.50	-1.19	Peak
3	405.390	48.37	-13.26	35.11	46.00	-10.89	Peak
4	475.230	50.18	-11.69	38.49	46.00	-7.51	Peak
5	504.330	53.22	-11.33	41.89	46.00	-4.11	Peak
6	533.430	48.89	-10.67	38.22	46.00	-7.78	Peak
7	625.580	44.65	-9.68	34.97	46.00	-11.03	Peak
8	751.680	45.32	-7.64	37.68	46.00	-8.32	Peak
9	803.090	46.47	-6.82	39.65	46.00	-6.35	Peak
10	832.190	50.97	-6.21	44.76	46.00	-1.24	Peak

**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#: 5 File#: 07U11041\_GFSK.EMI Date: 05-21-2007 Time: 16:30:20



Trace: 1

Ref Trace:

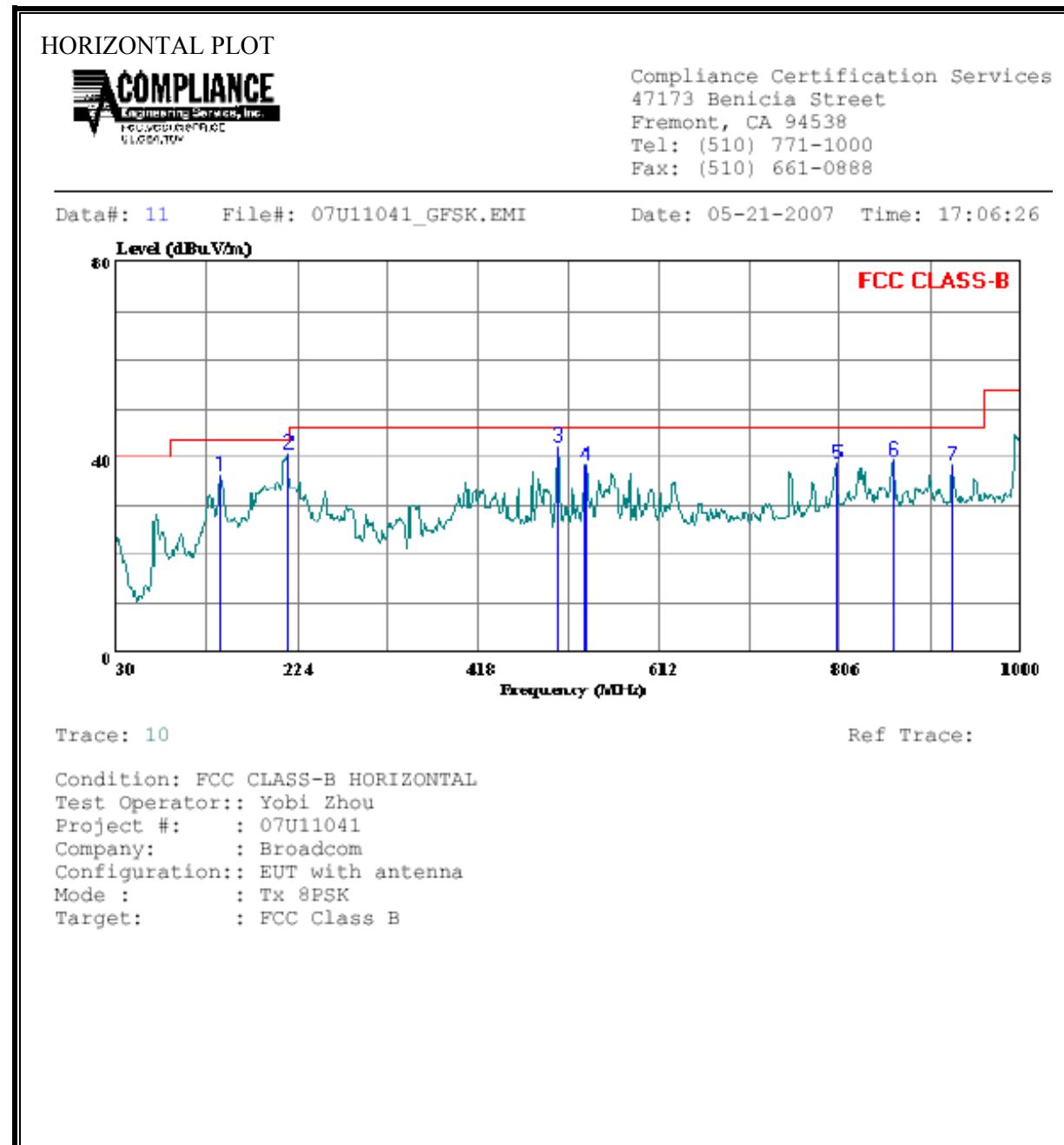
Condition: FCC CLASS-B VERTICAL  
Test Operator::: Yobi Zhou  
Project #: : 07U11041  
Company: : Broadcom  
Configuration::: EUT with antenna  
Mode : : Tx GFSK  
Target: : FCC Class B

## VERTICAL DATA

Freq	Read		Level	Limit	Over	Limit	Remark
	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	134.760	48.01	-16.74	31.27	43.50	-12.24	Peak
2	255.040	48.39	-17.54	30.85	46.00	-15.15	Peak
3	334.580	47.10	-14.99	32.11	46.00	-13.89	Peak
4	405.390	52.70	-13.26	39.44	46.00	-6.56	Peak
5	504.330	50.10	-11.33	38.77	46.00	-7.23	Peak
6	533.430	46.26	-10.67	35.59	46.00	-10.41	Peak
7	751.680	47.66	-7.64	40.02	46.00	-5.98	Peak
8	803.090	48.05	-6.82	41.23	46.00	-4.77	Peak
9	829.280	51.25	-6.38	44.87	46.00	-1.13	QP
10	829.280	51.80	-6.38	45.42	46.00	-0.58	Peak
11	863.230	47.59	-5.67	41.92	46.00	-4.08	Peak
12	994.180	49.28	-3.01	46.27	54.00	-7.73	Peak

### 7.3.7. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz WITH 8PSK MODULATION

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



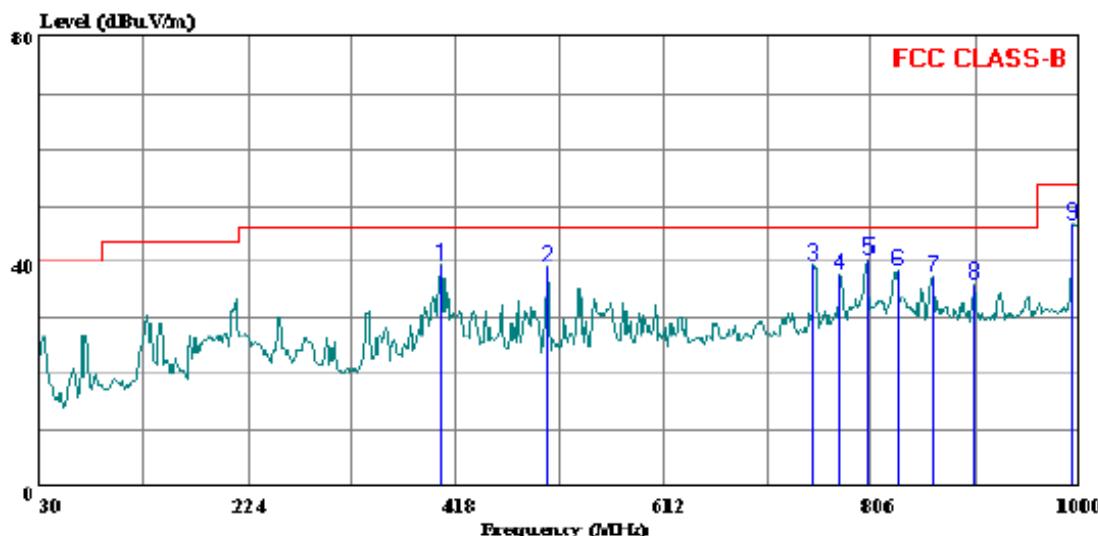
## HORIZONTAL DATA

Freq	MHz	Read		Level	Limit Line	Over Limit	Remark
		Level	Factor				
		dBuV		dB	dBuV/m	dBuV/m	dB
1	140.580	53.25	-16.82	36.43	43.50	-7.07	Peak
2	213.330	59.81	-18.83	40.98	43.50	-2.52	Peak
3	504.330	53.64	-11.33	42.31	46.00	-3.69	Peak
4	533.430	49.01	-10.67	38.34	46.00	-7.66	Peak
5	803.090	45.57	-6.82	38.75	46.00	-7.25	Peak
6	863.230	45.16	-5.67	39.49	46.00	-6.51	Peak
7	926.280	42.86	-4.43	38.43	46.00	-7.57	Peak

**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#: 9 File#: 07U11041\_GFSK.EMI Date: 05-21-2007 Time: 16:55:51



Trace: 8

Ref Trace:

Condition: FCC CLASS-B VERTICAL  
Test Operator:: Yobi Zhou  
Project #: 07U11041  
Company: : Broadcom  
Configuration:: EUT with antenna  
Mode : : Tx 8PSK  
Target: : FCC Class B

## VERTICAL DATA

Freq	Read		Level	Limit	Over	Limit	Remark
	Level	Factor					
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	405.390	52.89	-13.26	39.63	46.00	-6.37	Peak
2	504.330	50.38	-11.33	39.05	46.00	-6.95	Peak
3	751.680	47.05	-7.64	39.41	46.00	-6.59	Peak
4	775.930	44.37	-6.75	37.62	46.00	-8.38	Peak
5	803.090	47.42	-6.82	40.60	46.00	-5.40	Peak
6	829.280	44.85	-6.38	38.47	46.00	-7.53	Peak
7	863.230	43.11	-5.67	37.44	46.00	-8.56	Peak
8	902.030	40.78	-4.77	36.01	46.00	-9.99	Peak
9	994.180	49.84	-3.01	46.83	54.00	-7.17	Peak

## 7.4. POWERLINE CONDUCTED EMISSIONS

### LIMIT

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

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 resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

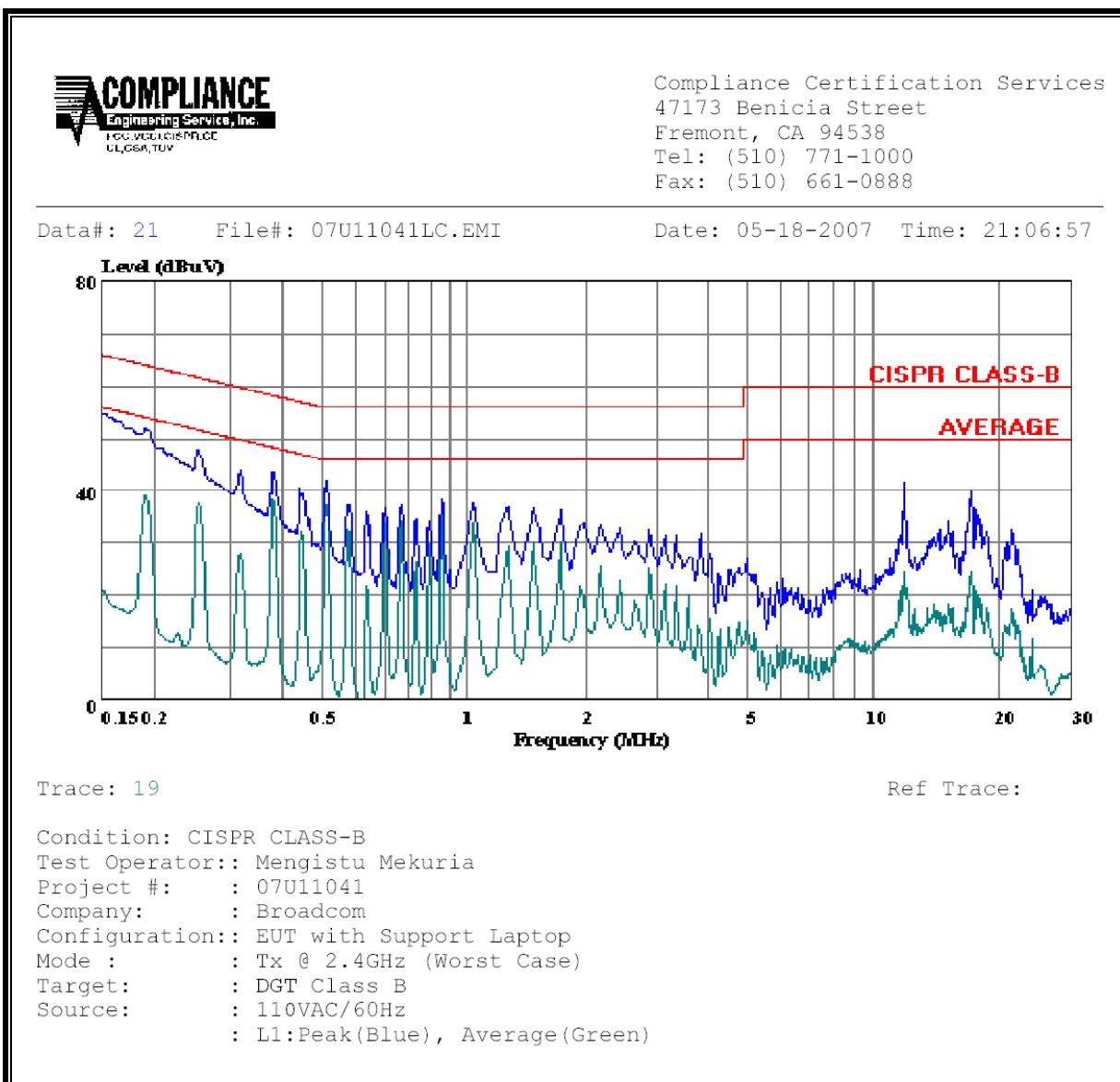
Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

No non-compliance noted:

**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (110VAC 60Hz)										
Freq. (MHz)	Reading			Class	Limit	FCC B		Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)			(dB)	QP	AV	QP (dB)	
0.19	51.98	--	38.97	0.00	64.04	54.04	-12.06	-15.07	L1	
0.26	47.89	--	37.18	0.00	61.56	51.56	-13.67	-14.38	L1	
0.38	43.58	--	38.39	0.00	58.28	48.28	-14.70	-9.89	L1	
0.51	40.74	--	37.48	0.00	56.00	46.00	-15.26	-8.52	L1	
0.77	37.30	--	34.40	0.00	56.00	46.00	-18.70	-11.60	L1	
0.96	38.30	--	35.50	0.00	56.00	46.00	-17.70	-10.50	L1	

**LINE 1 RESULTS**

**LINE 2 RESULTS**