



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

**CERTIFICATION TEST REPORT**

**FOR**

**MP3 PLAYER**

**MODEL NUMBER: 1126**

**FCC ID: C3K-1126**

**IC ID: 3048A-1126**

**REPORT NUMBER: 07U11226-1**

**ISSUE DATE: OCTOBER 1, 2007**

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**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	10/01/07	Initial Issue	Hsin Fu Shih

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** MICROSOFT CORPORATION  
1065 LA AVENIDA  
MOUNTAIN VIEW, CA 94043, USA

**EUT DESCRIPTION:** HDD MP3 PLAYER

**MODEL:** 1126

**SERIAL NUMBER:** 1401267733

**DATE TESTED:** September 5 - 27, 2007

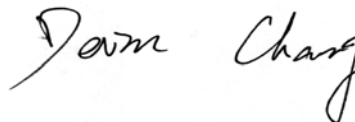
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED
IC RSS-210 ISSUE 7 ANNEX 8	NO NON-COMPLIANCE NOTED

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. 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.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 an 802.11b/g MP3 player. Model # 1126, with Samsung 80GB HDD and Samsung LCD

The radio module is manufactured by Marvell.

Power adapter #1: Delta / Model No:1128(DPSN-8CBA Rev.3)

Power adapter #2: Phihong / Model No:1128(PSM05A-050Q EV4)

### 5.2. MAXIMUM OUTPUT POWER

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

2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11b	12.93	19.63
2412 - 2462	802.11g	10.88	12.25

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Helical antenna with a maximum gain of 1 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The client provided a program which enables a user to control the frequency and output power of the module with 60% duty cycle for b mode and 72% duty cycle for g mode.

## 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 2462 MHz.

The worst-case data rate for this channel is determined to be 1 Mb/s, based on previous experience with Marvell WLAN product design architectures.

Thus all emissions tests were made in the 802.11b mode, 2462 MHz, 1 Mb/s.

The EUT is a portable device; therefore X, Y & Z positions have been investigated. The worst case is to evaluated at Y positions.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	FCC ID	Model	Serial Number
Laptop PC	HP	DOC	pavilion ze4101	CN24600055
AC/DC Adapter	HP	DOC	ADP-75HB	MVT0240165081
Headset	Microsoft	DOC	812950-001	N/A

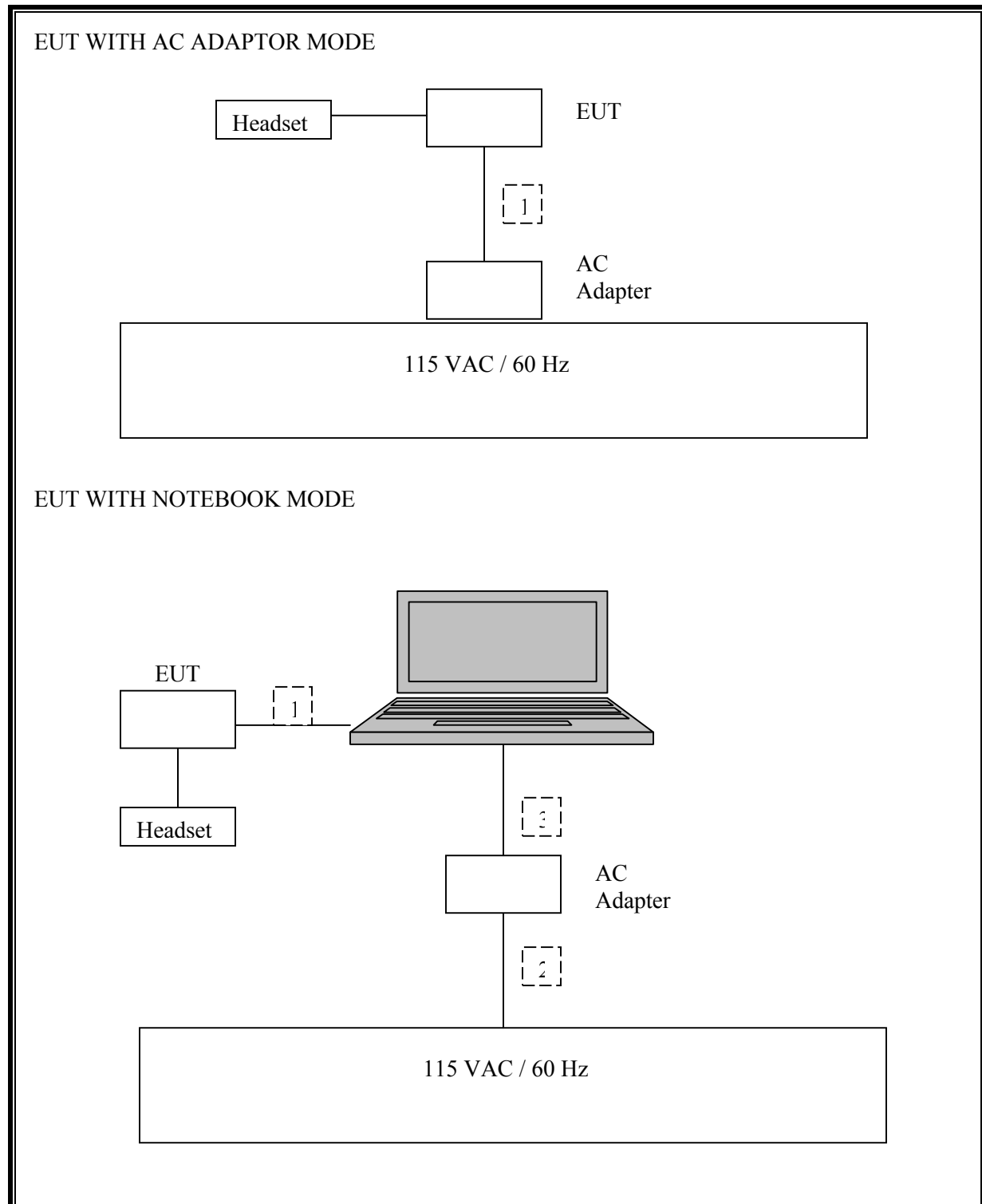
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	USB	1	USB	Unshielded	1.2 m	N/A
2	AC	1	AC	Unshielded	1.5 m	N/A
3	DC	1	DC	Unshielded	2.0 m	N/A

### TEST SETUP

The EUT is connected in a host laptop computer via an interface board adapter / extension board during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**





## 6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	S/N	Cal Due
EMI Test Receiver	R & S	ESHS 20	827129/006	1/27/08
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	10/15/07
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/15/07
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	1/7/08
SA Display Section 2	Agilent / HP	85662A	2816A16696	4/7/08
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	1/21/08
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00931	8/3/08
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	4/15/08
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	10/13/07
Preamp 30-1000MHz	Sonoma	310N	185623	1/20/08
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	8/7/08
Power Sensor 10MHz - 18GHz	Agilent / HP	8481A	2702A66876	4/22/08
Power Meter	Agilent / HP	438A	2822A05684	6/20/08
Peak Power Meter	Agilent	E4416A	GB41291160	12/2/07
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/2/07
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	1	CNR

## 7. LIMITS AND RESULTS

### 7.1. CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND

#### 7.1.1. 6 dB BANDWIDTH

##### LIMIT

§15.247 (a) (2)

RSS-210 Clause A8.2 (1)

##### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

##### RESULTS

No non-compliance noted:

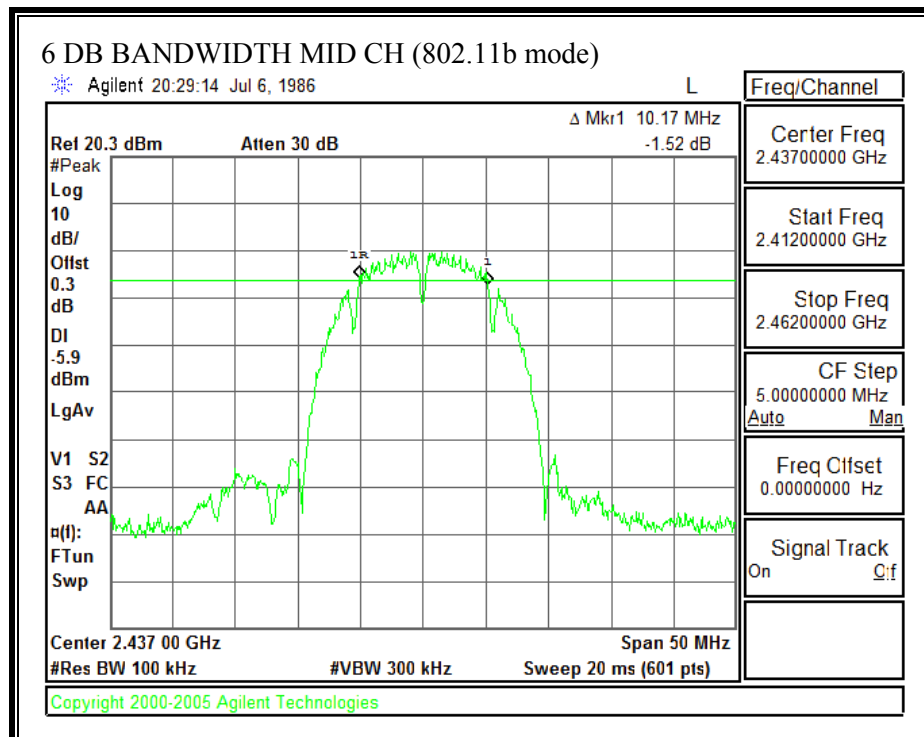
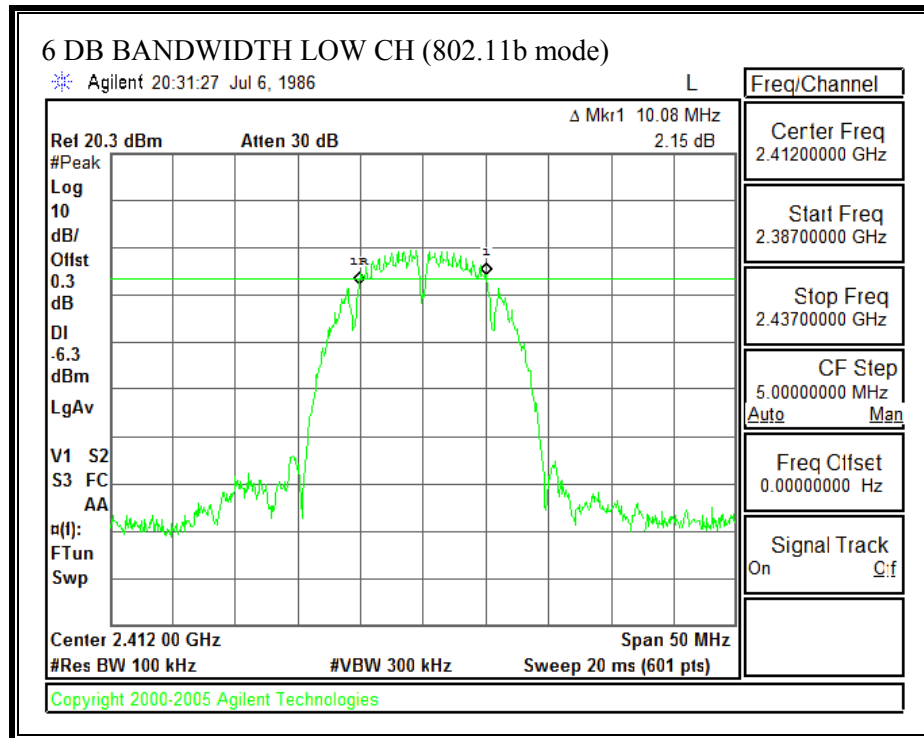
##### 802.11b Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	10080	500	9580
Middle	2437	10170	500	9670
High	2462	10170	500	9670

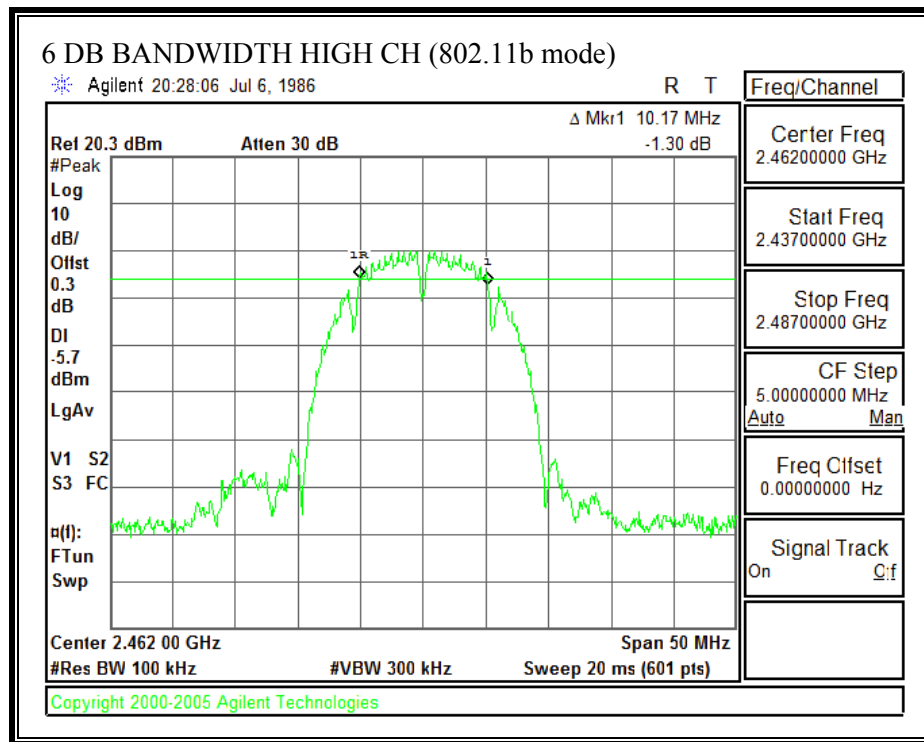
##### 802.11g Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)	Margin (kHz)
Low	2412	16250	500	15750
Middle	2437	16330	500	15830
High	2462	16420	500	15920

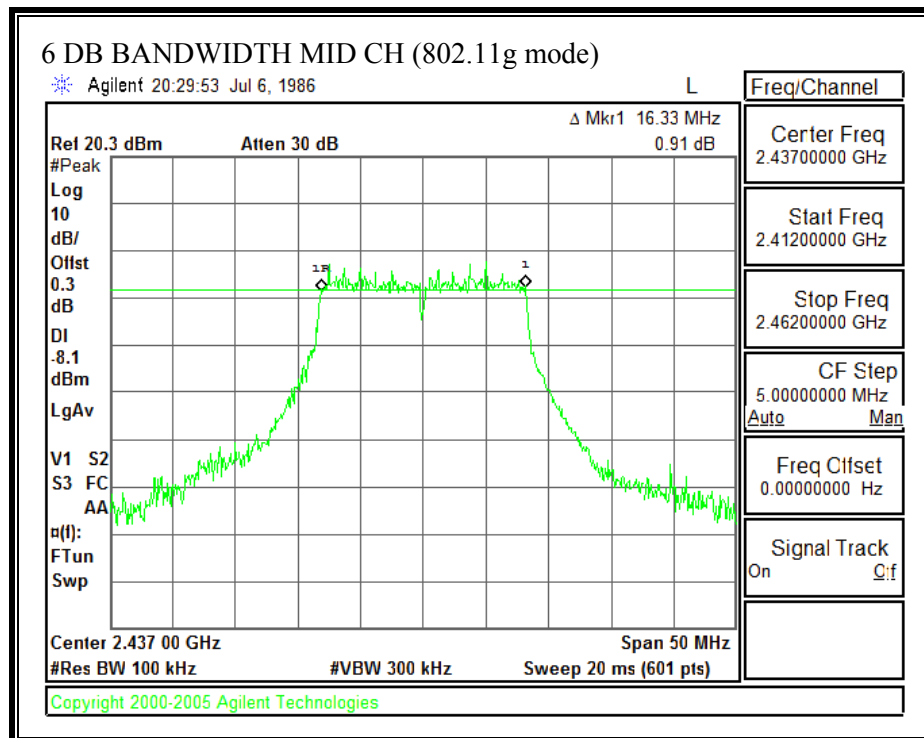
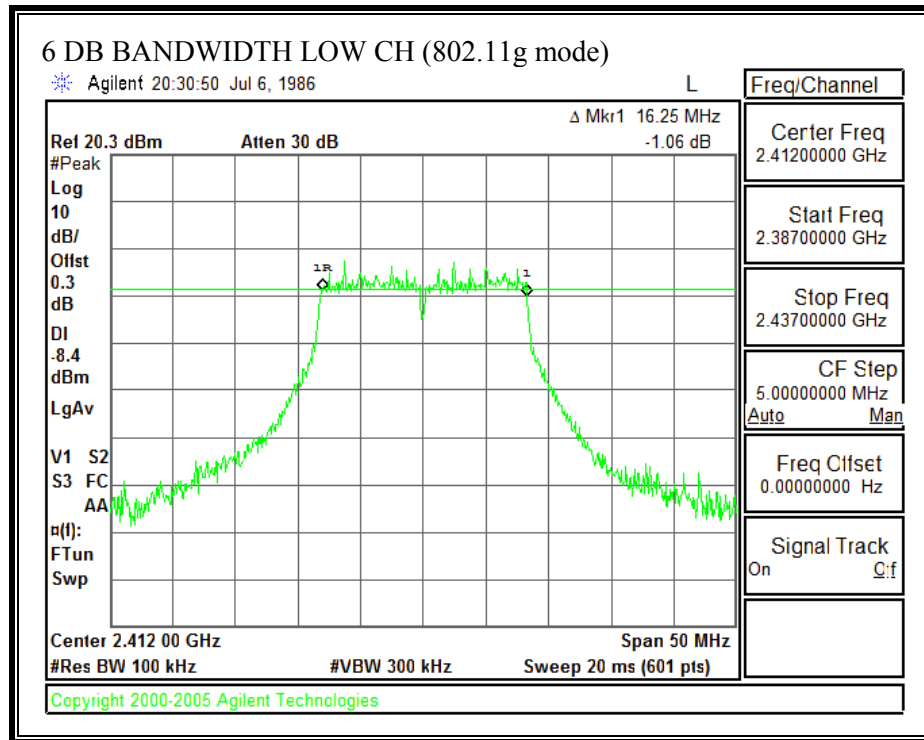
**6 DB BANDWIDTH (802.11b MODE)**



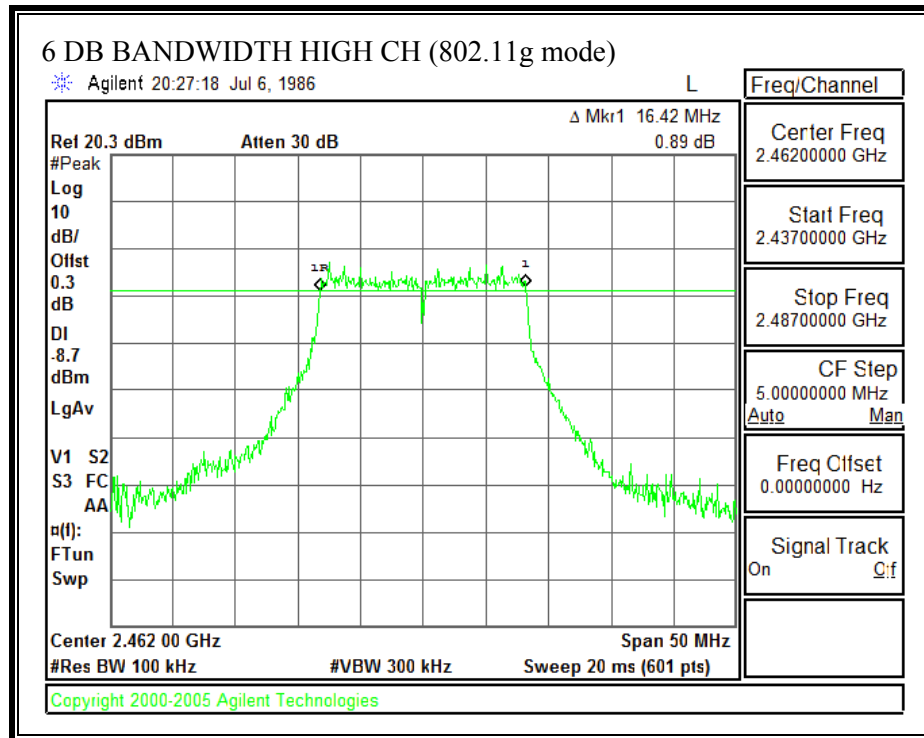
**6 DB BANDWIDTH (802.11b MODE)**



**6 DB BANDWIDTH (802.11g MODE)**



**6 DB BANDWIDTH (802.11g MODE)**



### 7.1.2. 99% BANDWIDTH

#### **LIMIT**

None; for reporting purposes only.

#### **TEST PROCEDURE**

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

#### **RESULTS**

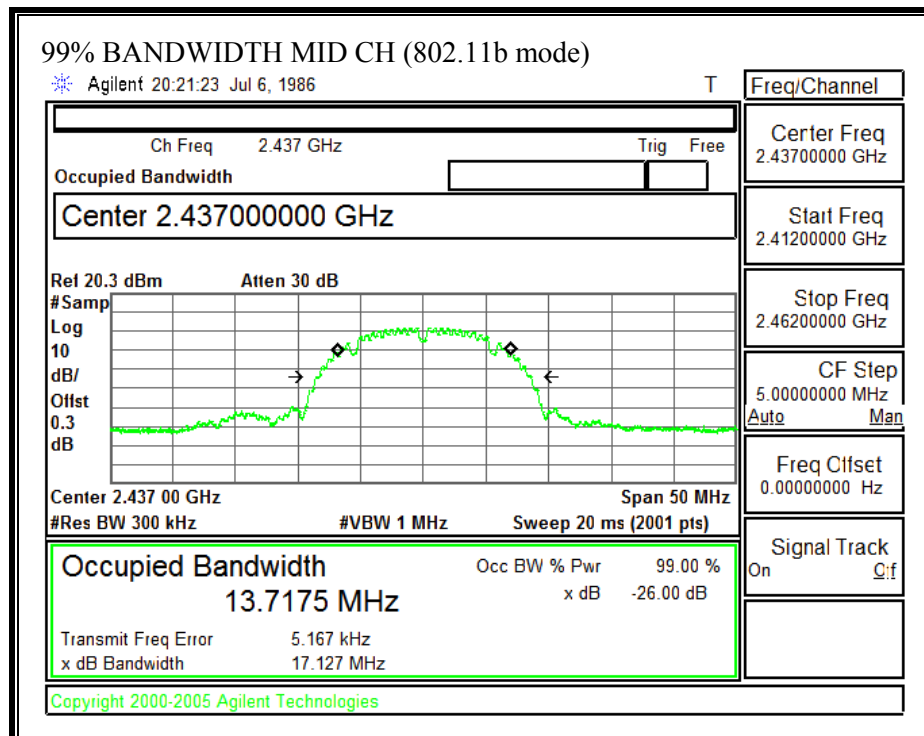
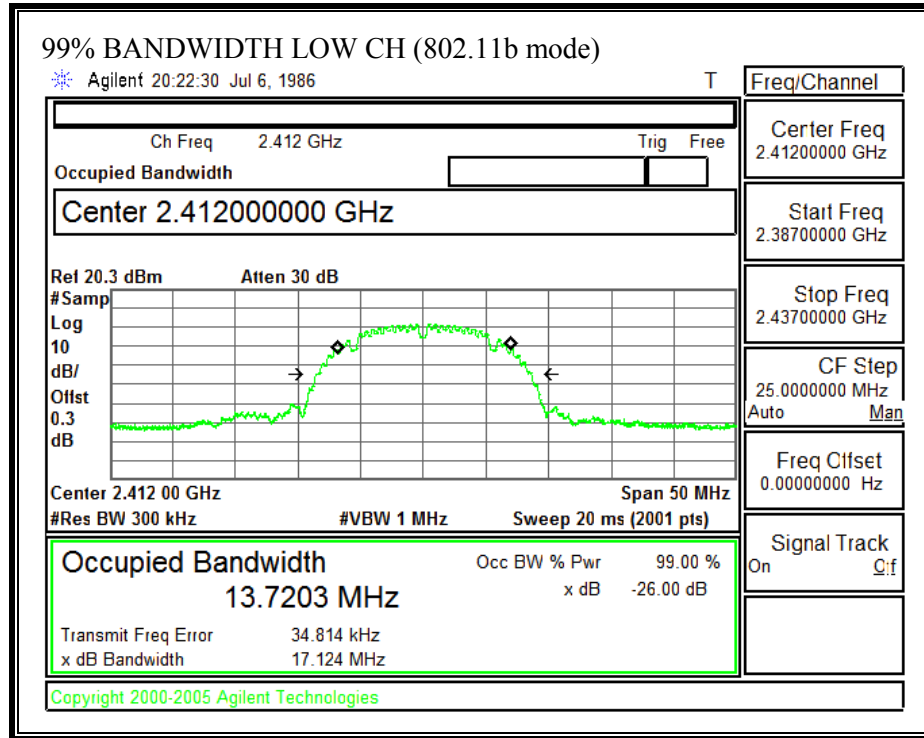
##### 802.11b Mode

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	13.7203
Middle	2437	13.7175
High	2462	13.7167

##### 802.11g Mode

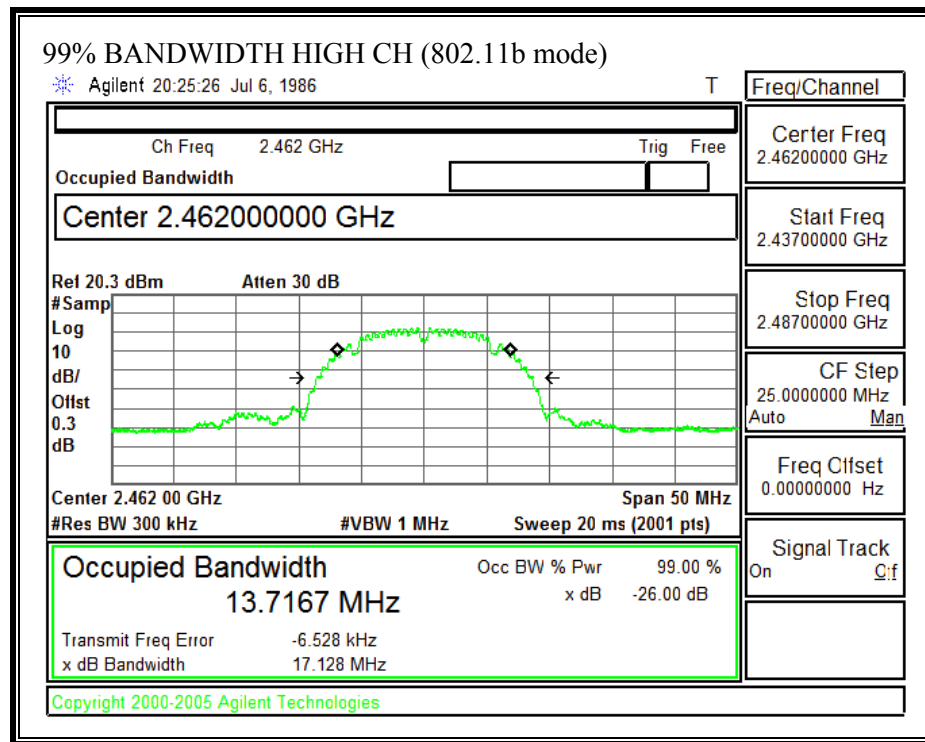
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.1711
Middle	2437	17.2168
High	2462	17.1910

**99% BANDWIDTH (802.11b MODE)**

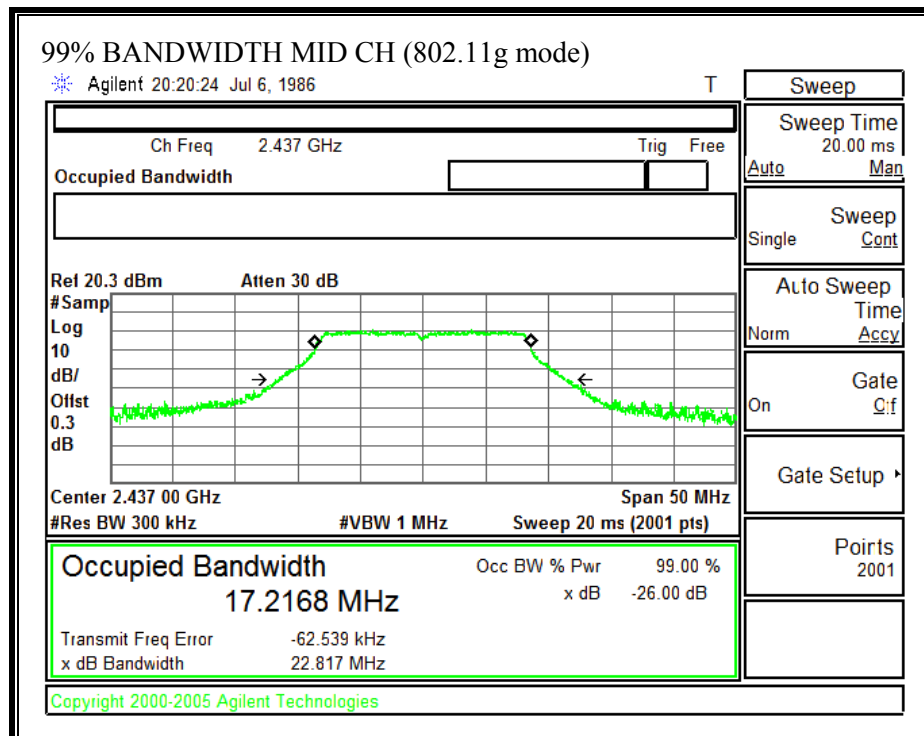
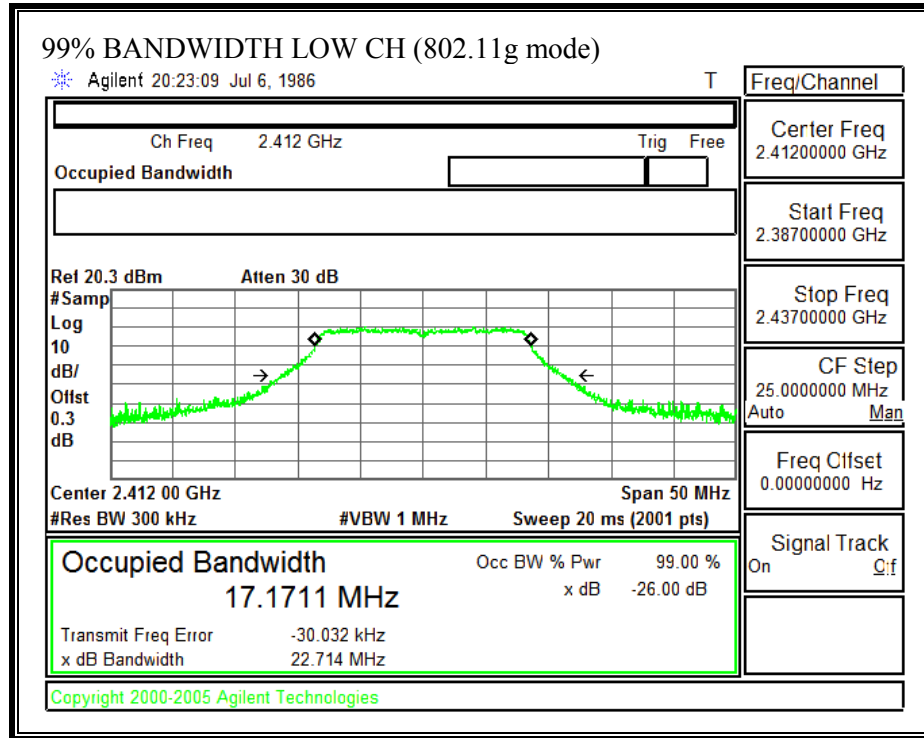




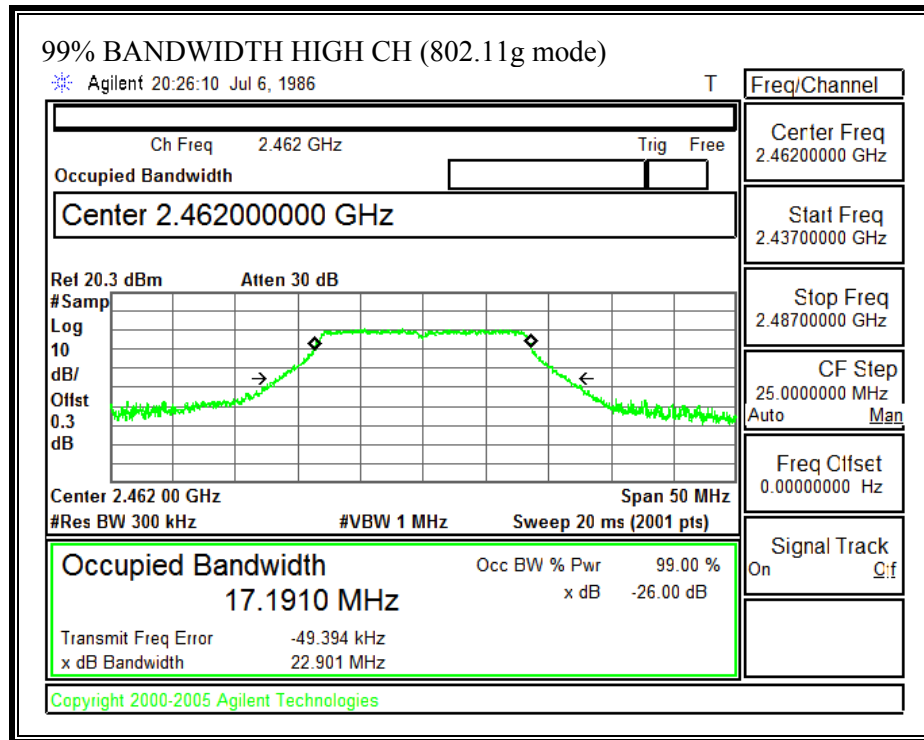
**99% BANDWIDTH (802.11b MODE)**



**99% BANDWIDTH (802.11g MODE)**



**99% BANDWIDTH (802.11g MODE)**



### **7.1.3. 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) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt.

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

§15.247 (b) (4) (i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### **TEST PROCEDURE**

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.

## **RESULTS**

The maximum antenna gain is 1dBi @ 2.45GHz for other than fixed, point-to-point operations, therefore the limit is still 30 dBm for 2.45GHz band.

No non-compliance noted:

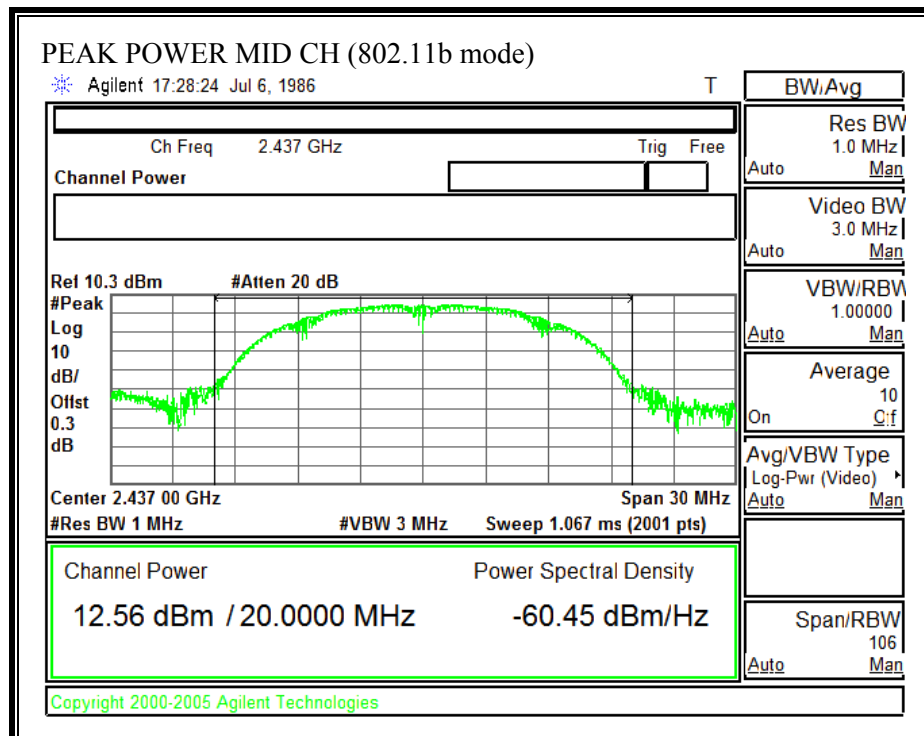
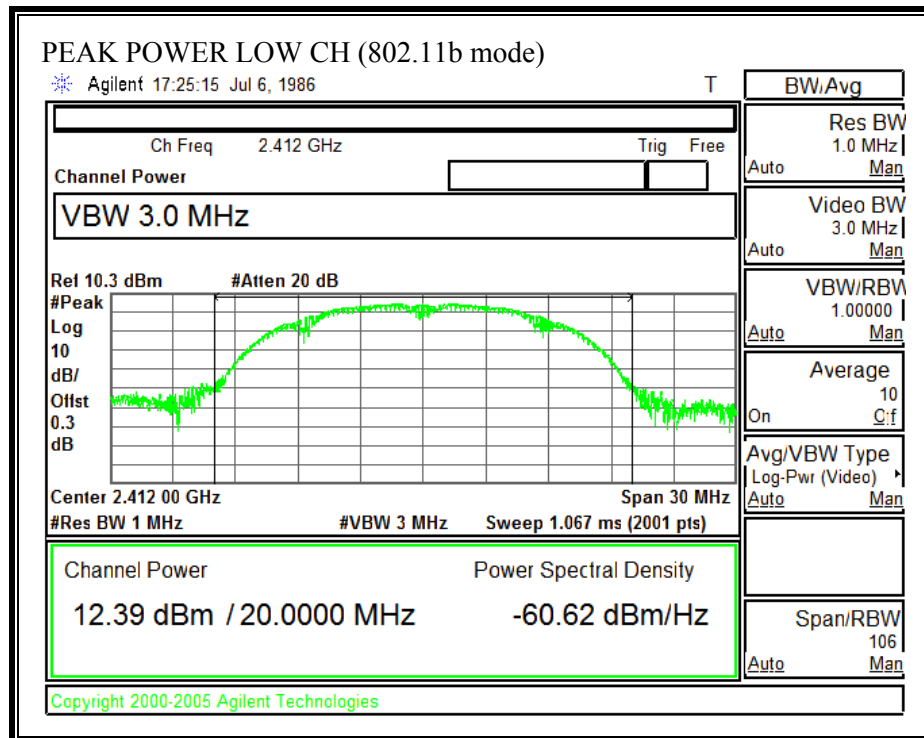
### 802.11b Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	12.39	30	-17.61
Middle	2437	12.56	30	-17.44
High	2462	12.93	30	-17.07

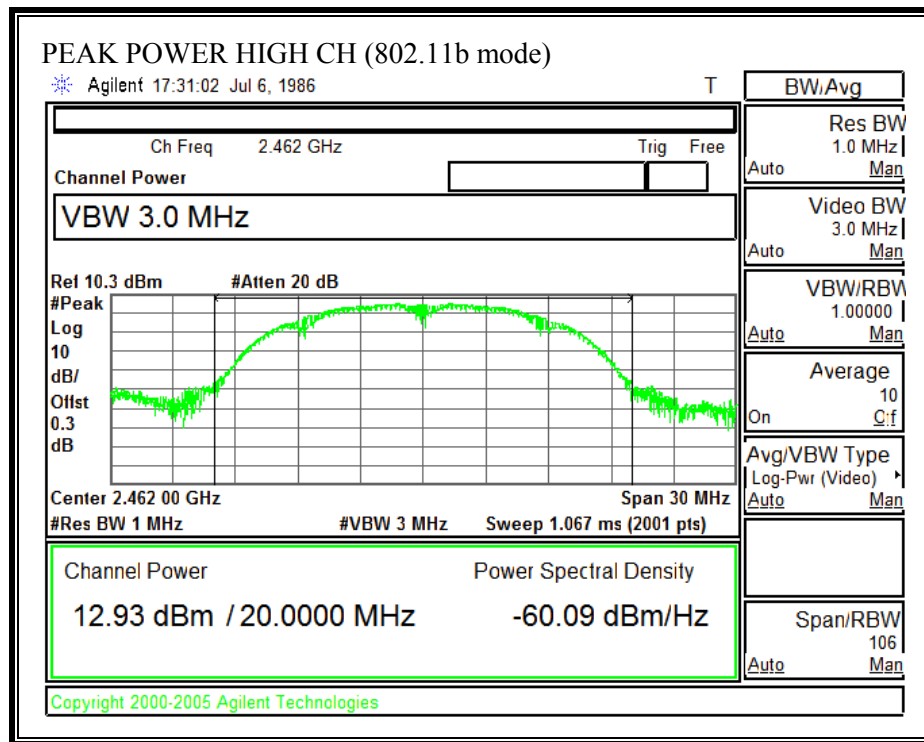
### 802.11g Mode

Channel	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	10.16	30	-19.84
Middle	2437	10.31	30	-19.69
High	2462	10.53	30	-19.47

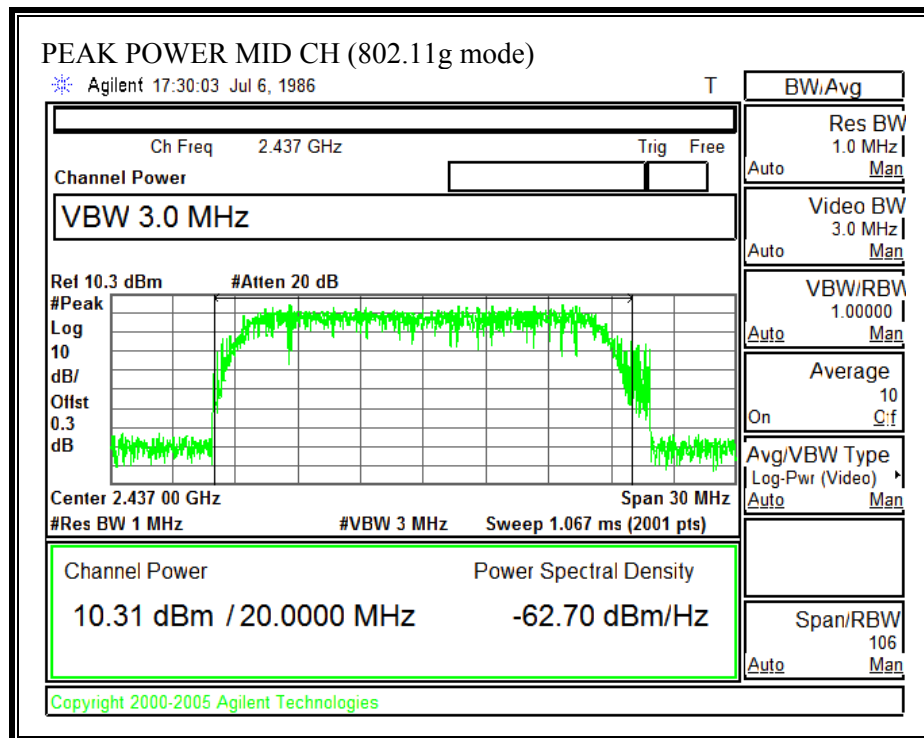
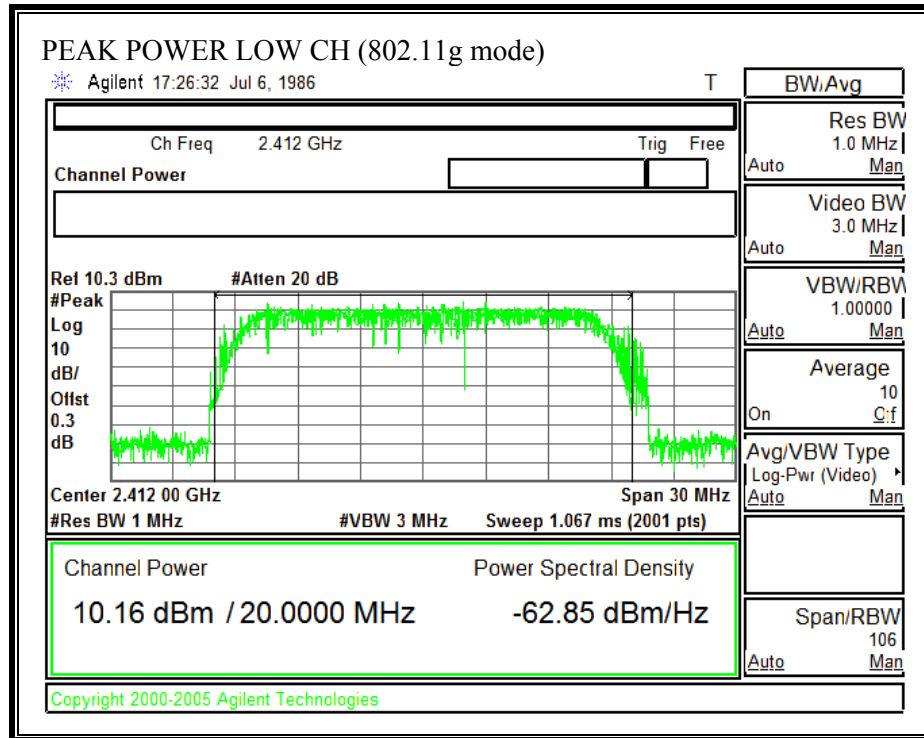
**OUTPUT POWER (802.11b MODE)**



**OUTPUT POWER (802.11b MODE)**

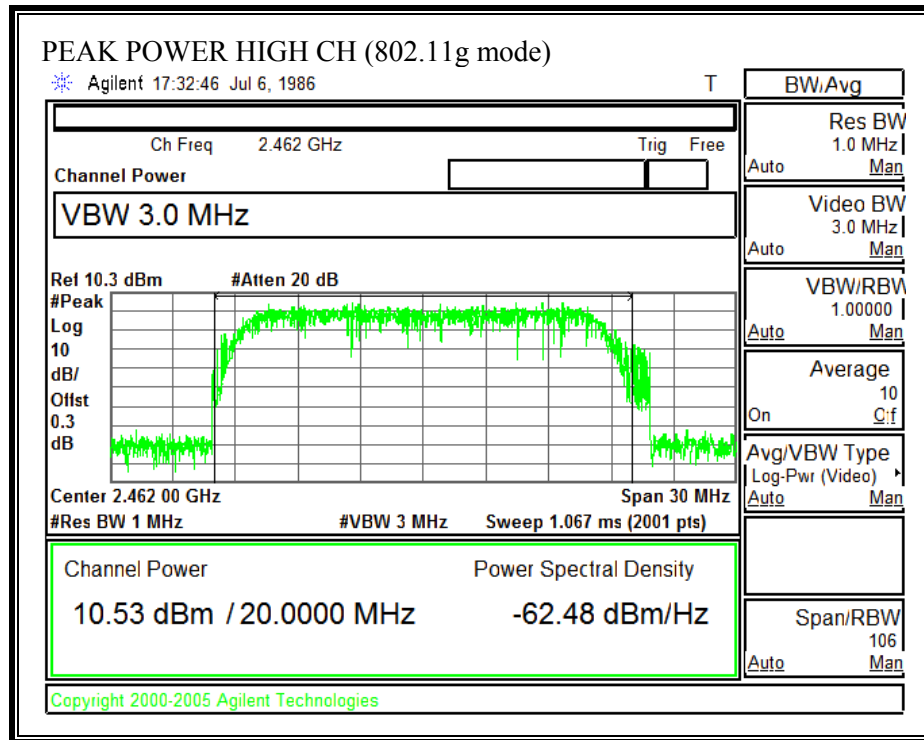


**OUTPUT POWER (802.11g MODE)**





**OUTPUT POWER (802.11g MODE)**



#### 7.1.4. AVERAGE POWER

##### AVERAGE POWER LIMIT

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter output is connected to a power meter.

##### RESULTS

The cable assembly insertion loss of 0.3 dB (including 0 dB pad and 0.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

##### 802.11b Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	10.31
Middle	2437	10.65
High	2462	10.88

##### 802.11g Mode

Channel	Frequency (MHz)	Power (dBm)
Low	2412	8.23
Middle	2437	8.66
High	2462	8.77

### 7.1.5. PEAK POWER SPECTRAL DENSITY (FCC)

#### **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.

#### **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**

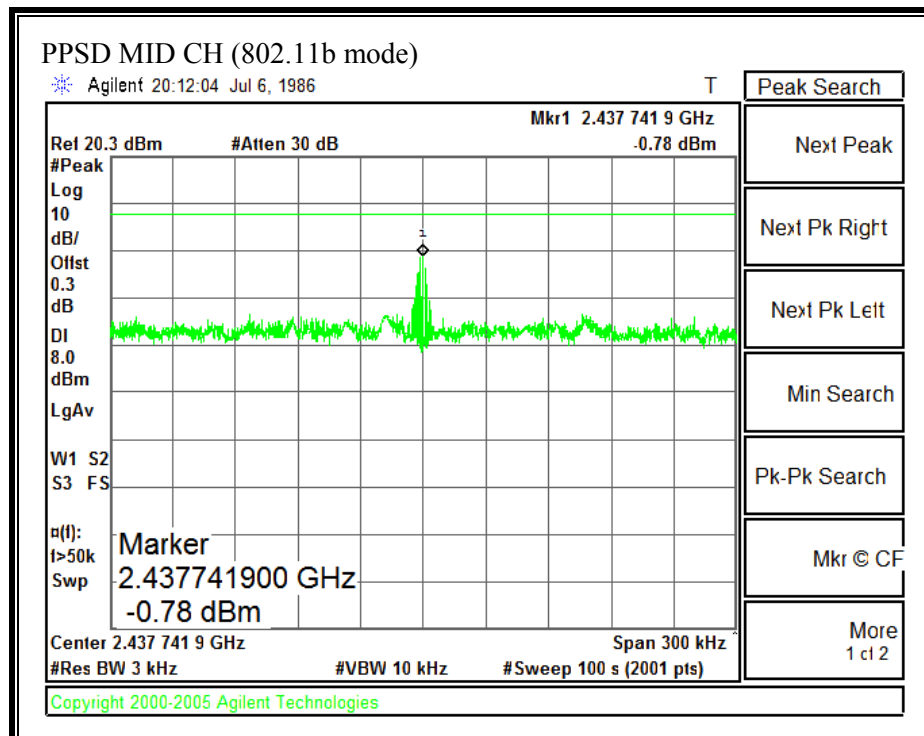
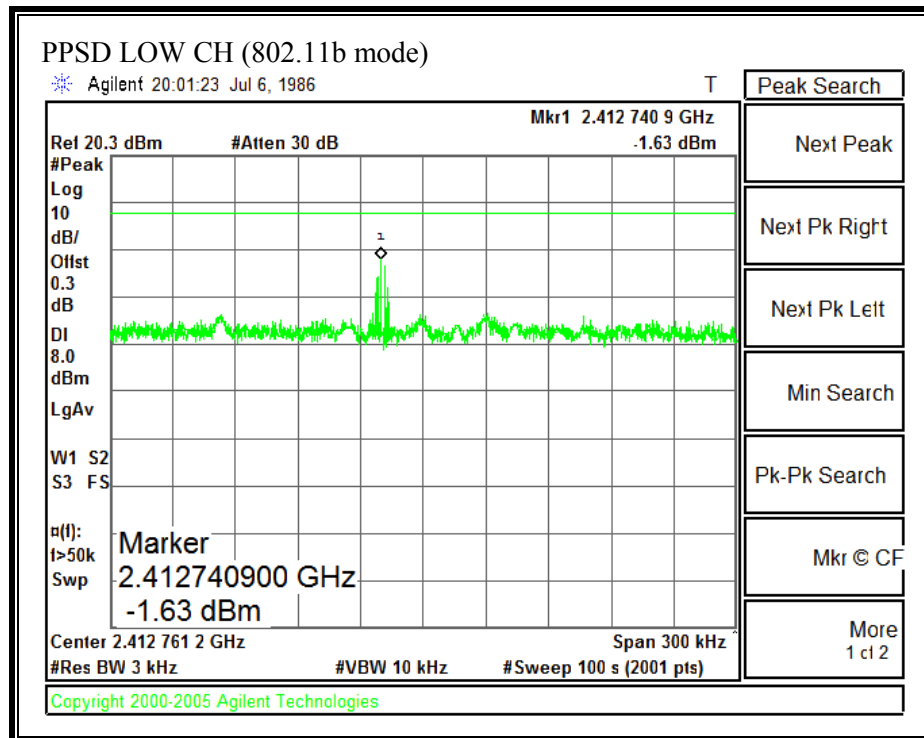
##### 802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-1.63	8	-9.63
Middle	2437	-0.78	8	-8.78
High	2462	-0.49	8	-8.49

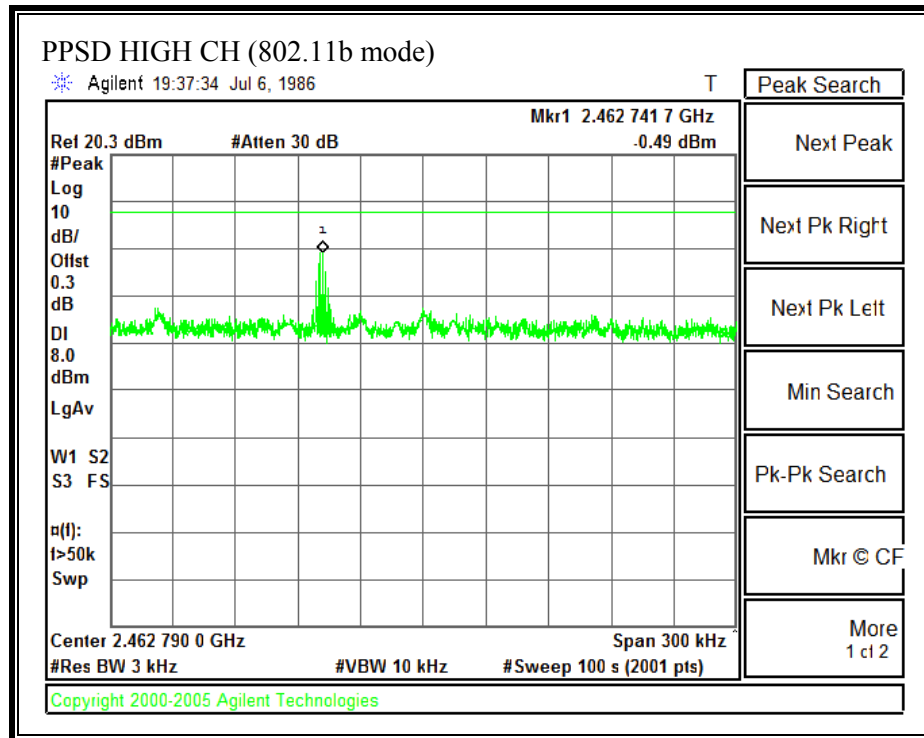
##### 802.11g Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-17.71	8	-25.71
Middle	2437	-17.08	8	-25.08
High	2462	-17.01	8	-25.01

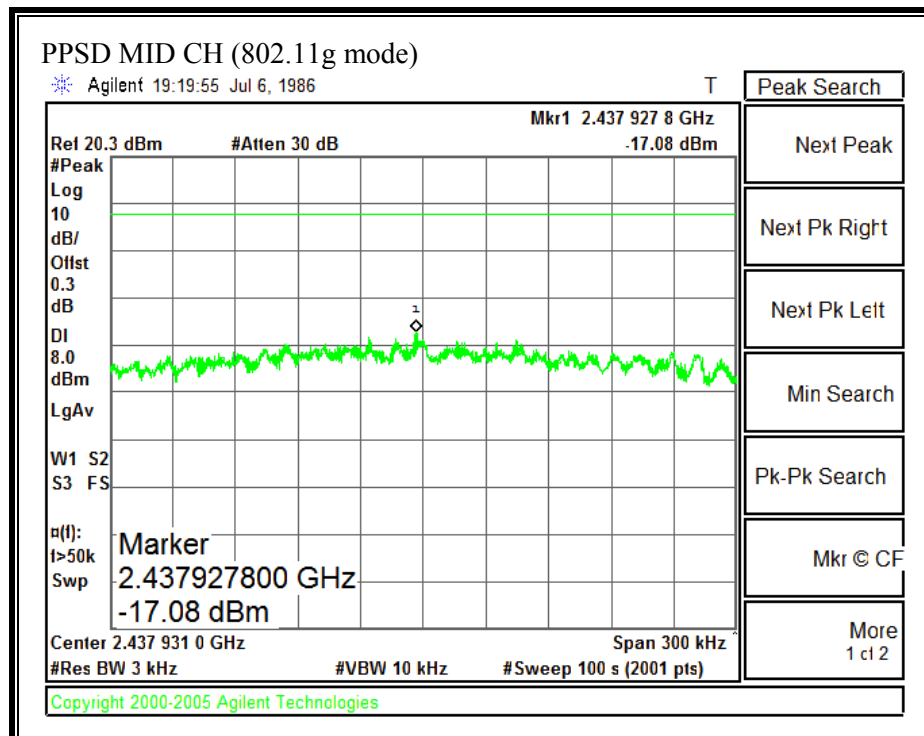
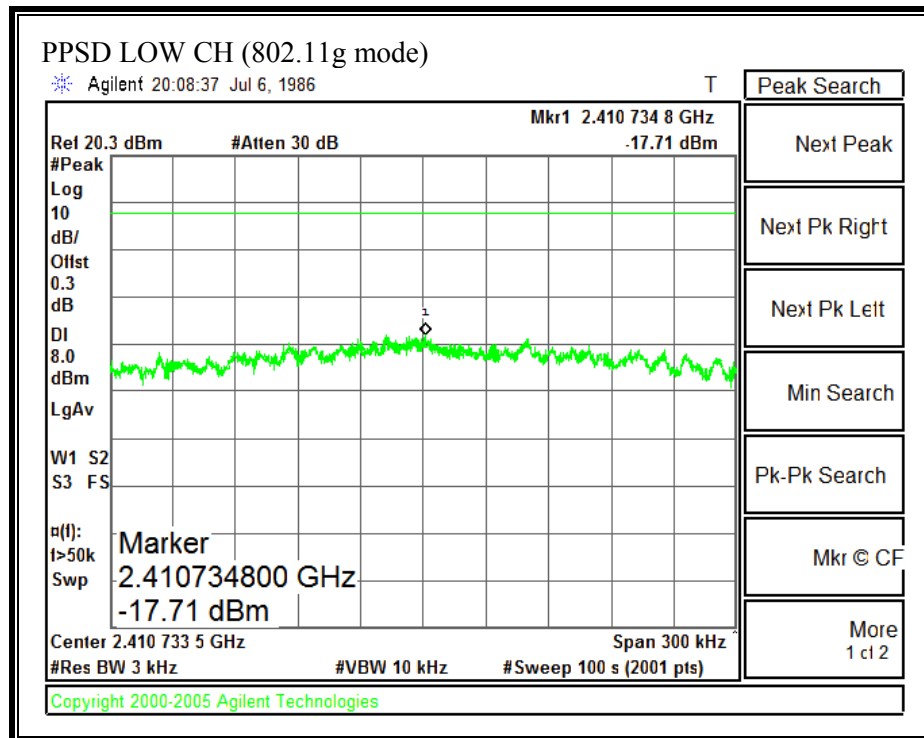
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**



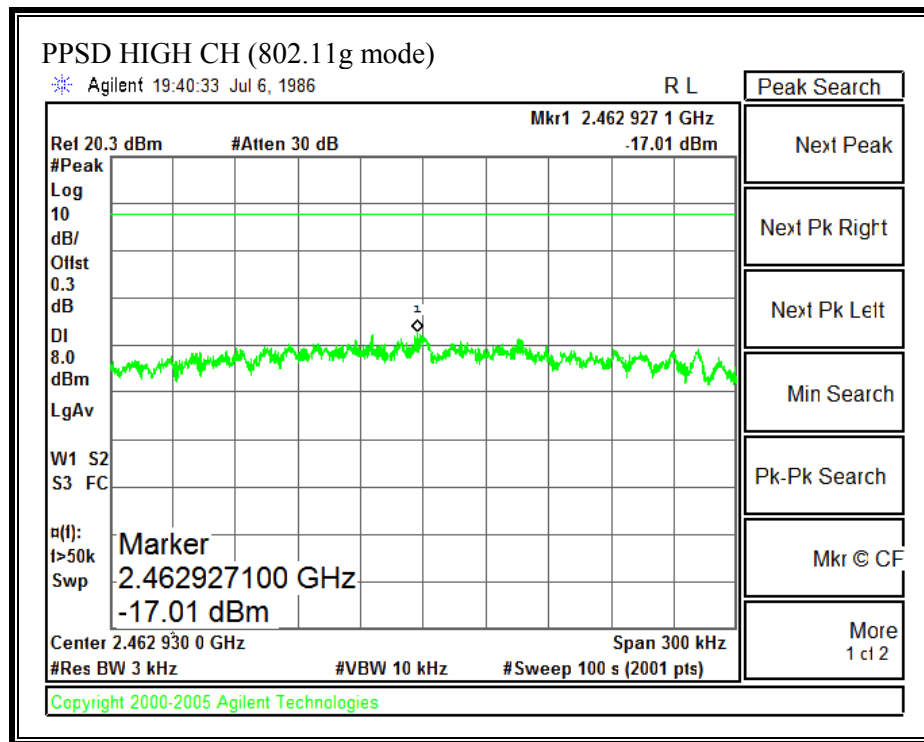
**PEAK POWER SPECTRAL DENSITY (802.11b MODE)**



**PEAK POWER SPECTRAL DENSITY (802.11g MODE)**



**PEAK POWER SPECTRAL DENSITY (802.11g MODE)**



## **7.1.6. 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.

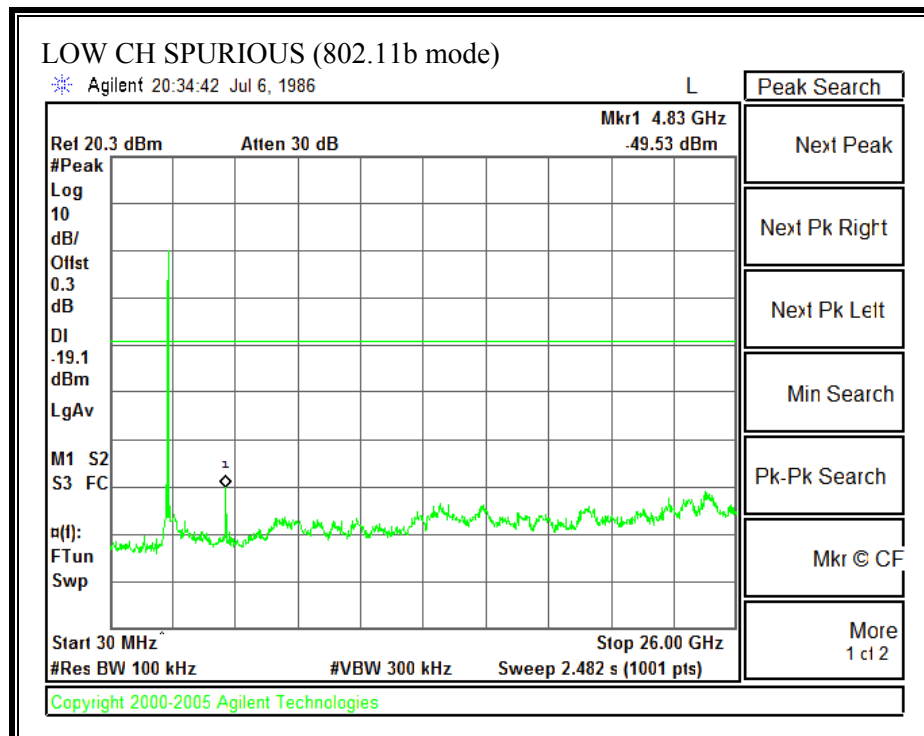
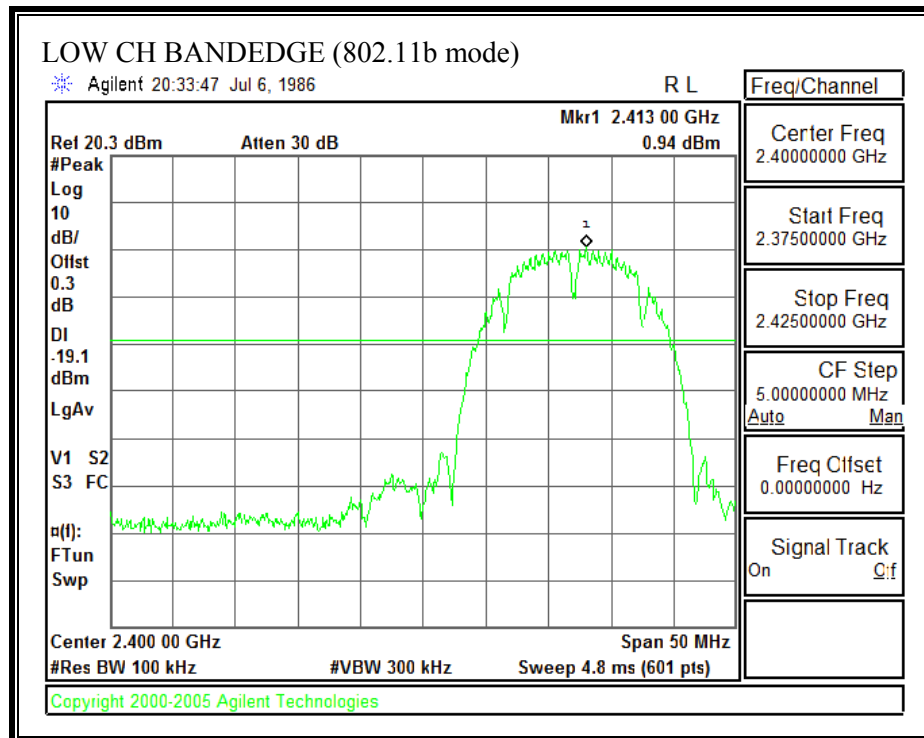
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

### **RESULTS**

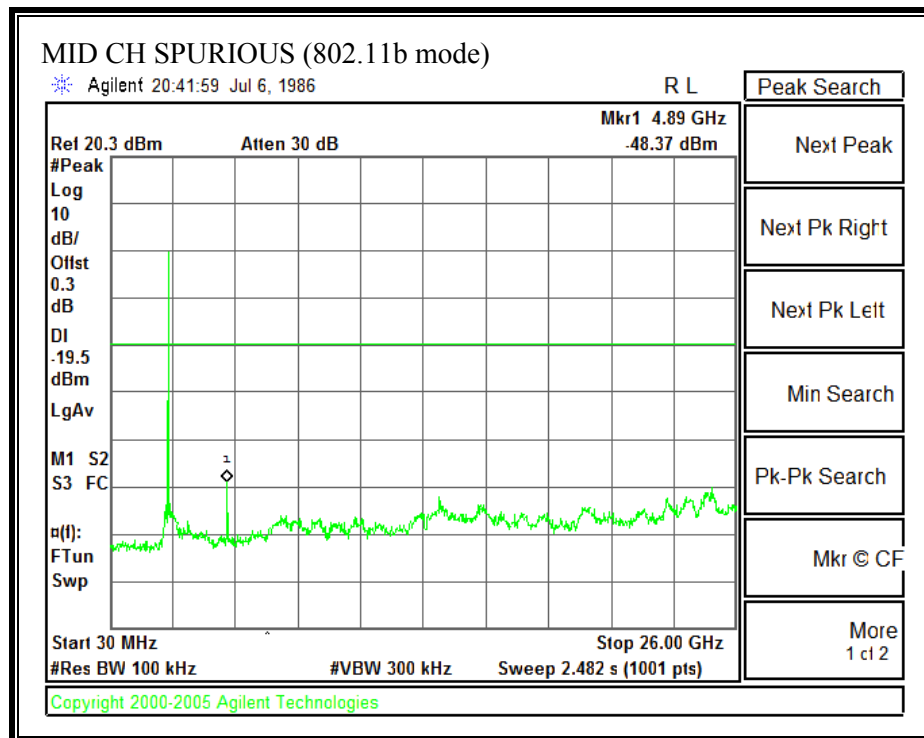
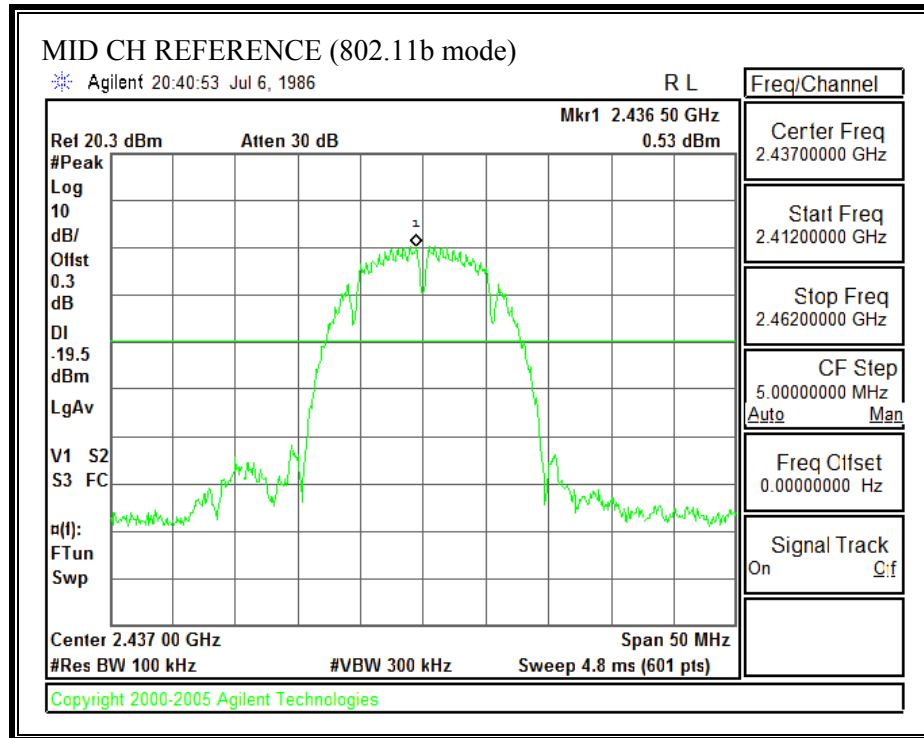
No non-compliance noted:



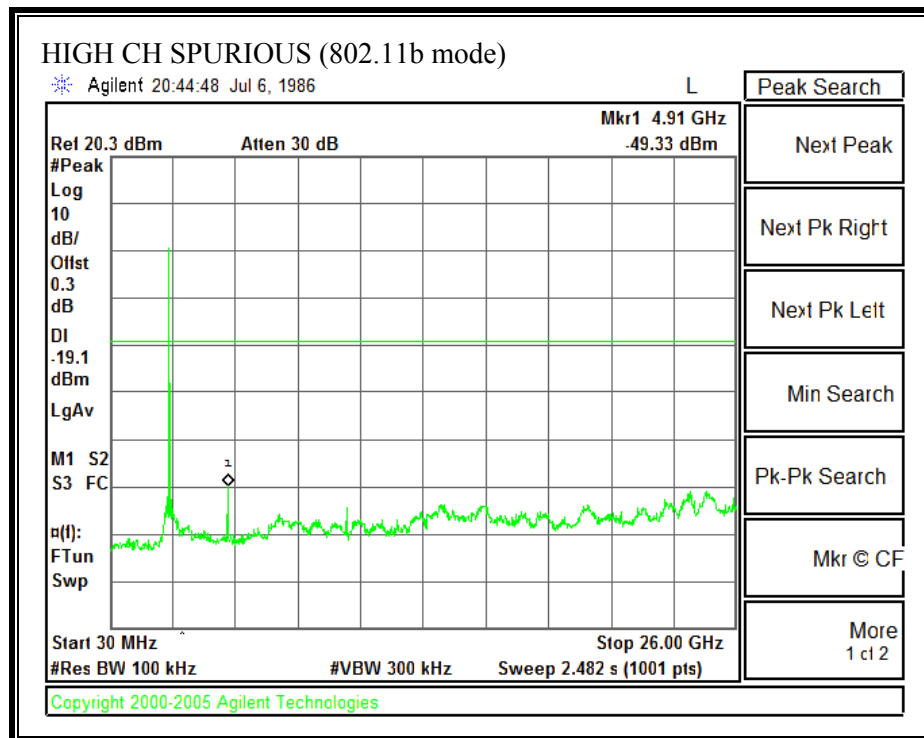
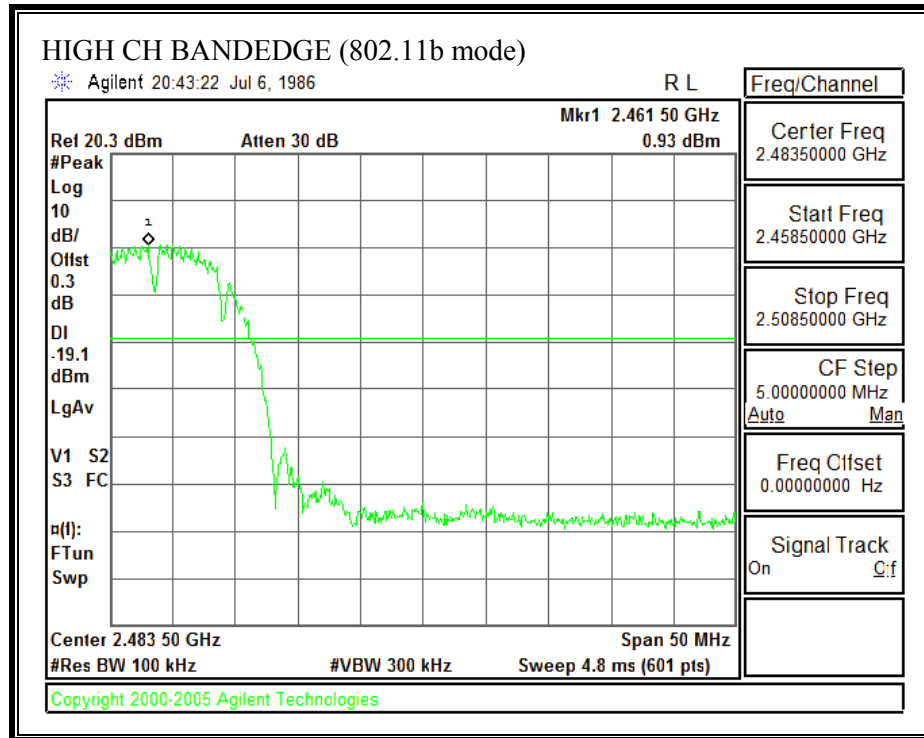
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11b MODE)**



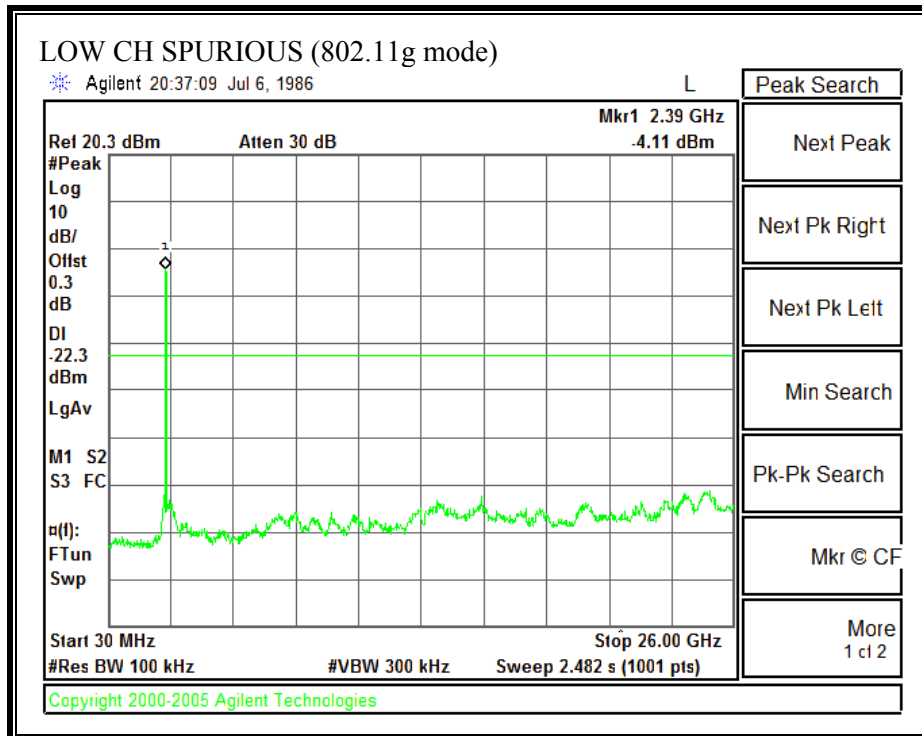
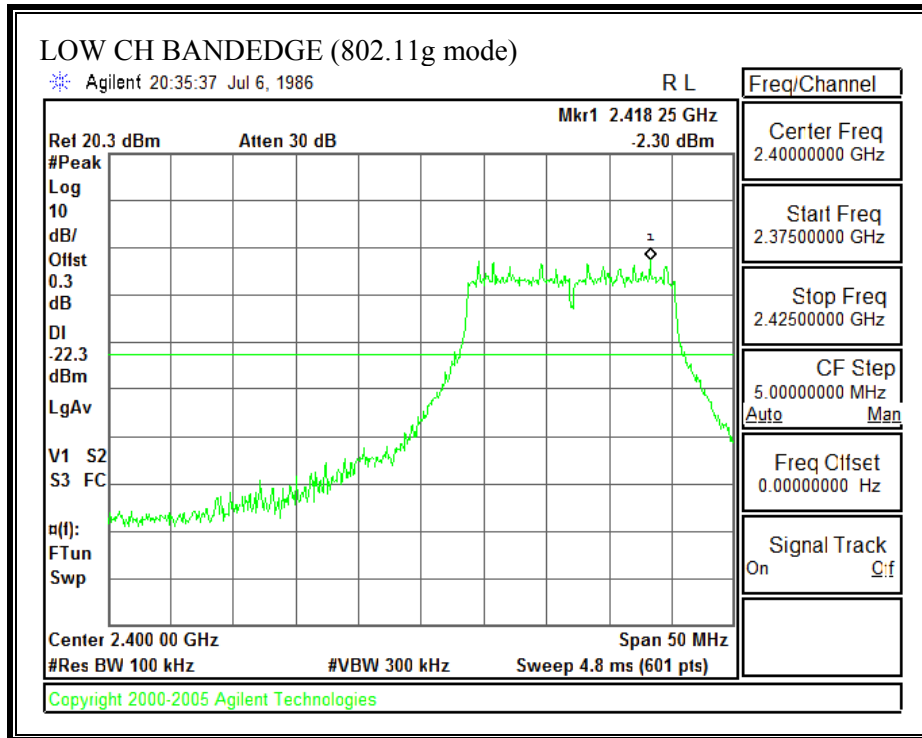
**SPURIOUS EMISSIONS, MID CHANNEL (802.11b MODE)**



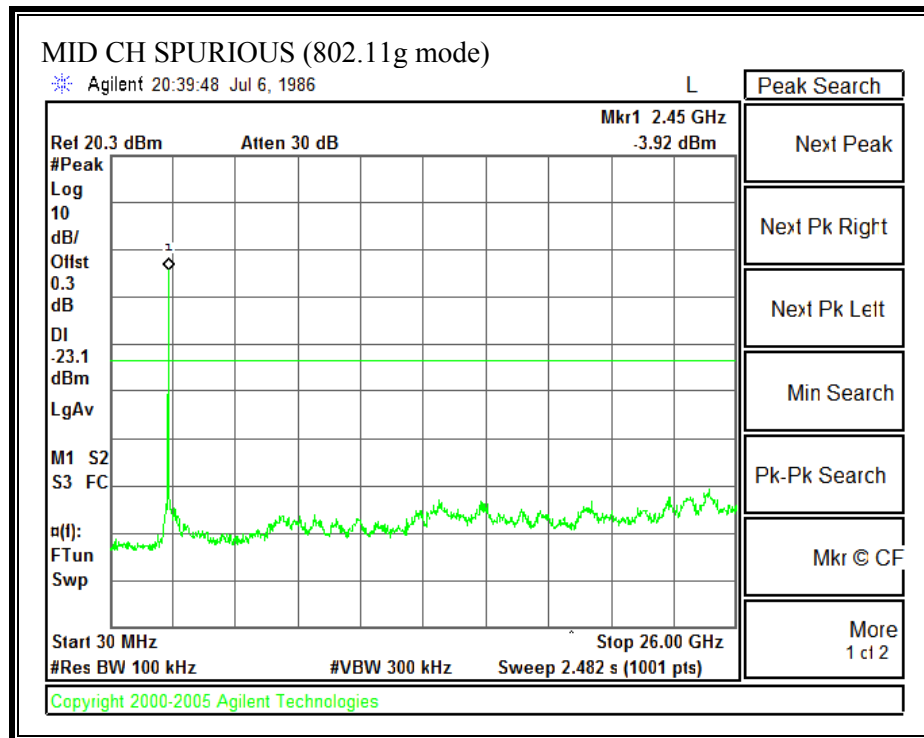
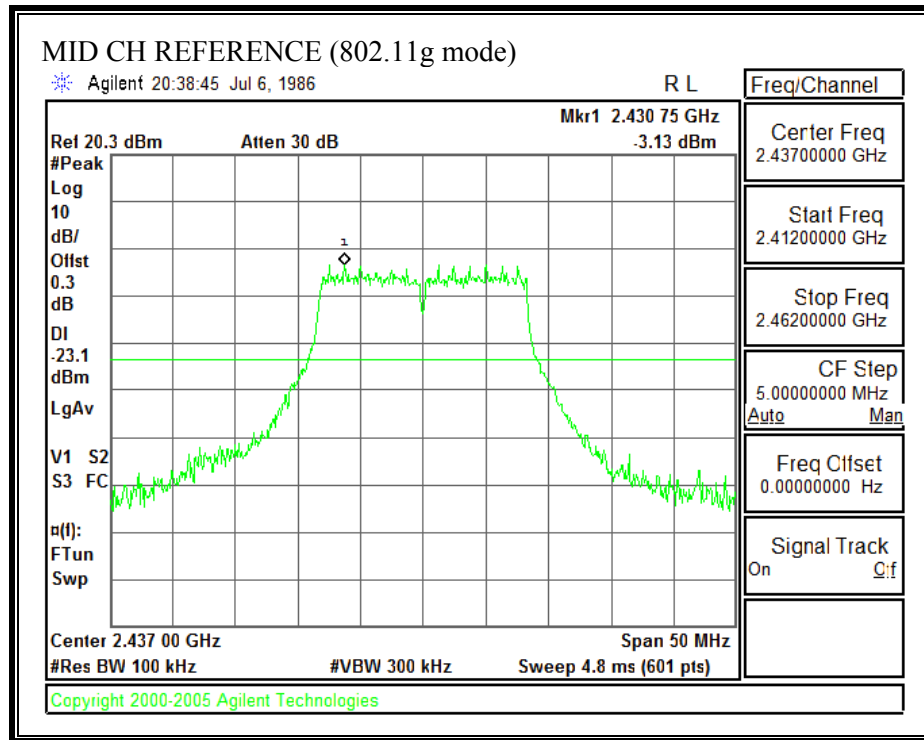
**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11b MODE)**



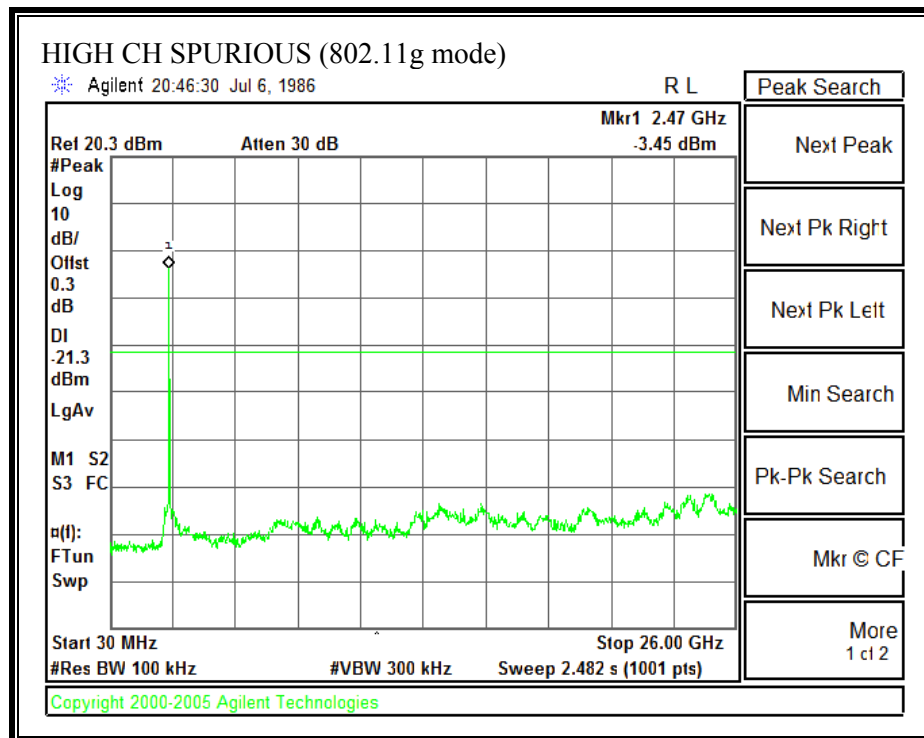
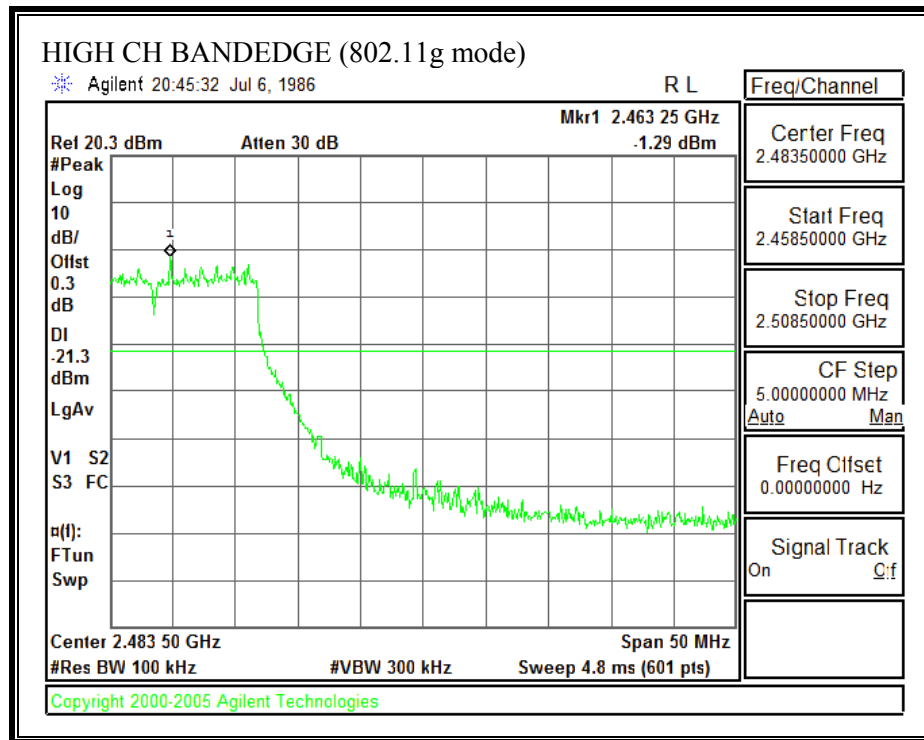
**SPURIOUS EMISSIONS, LOW CHANNEL (802.11g MODE)**



**SPURIOUS EMISSIONS, MID CHANNEL (802.11g MODE)**



**SPURIOUS EMISSIONS, HIGH CHANNEL (802.11g MODE)**



## 7.2. RADIATED EMISSIONS

### 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.

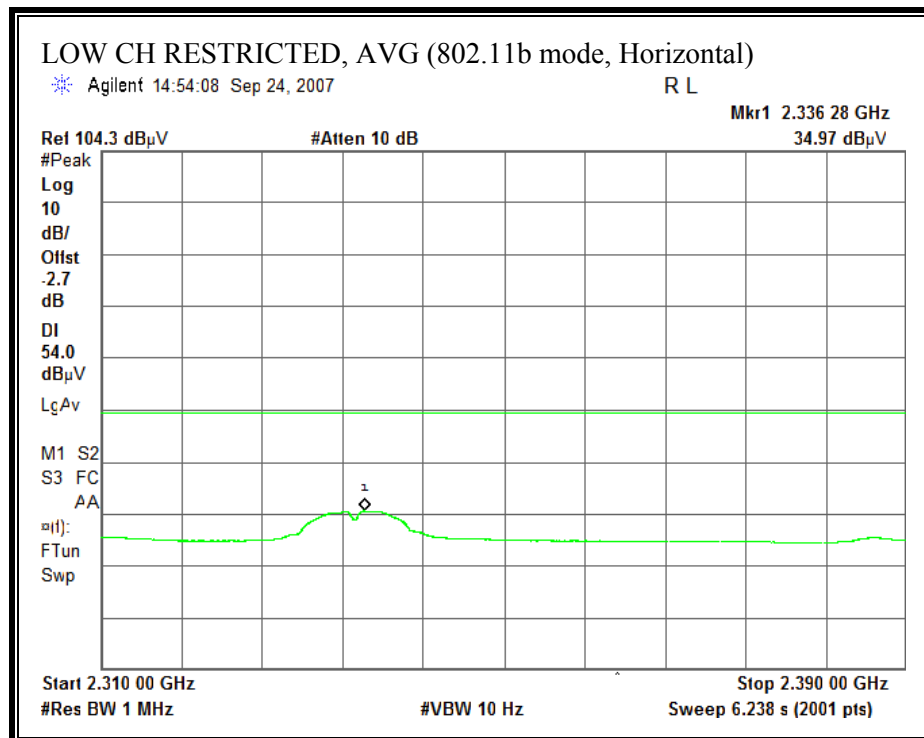
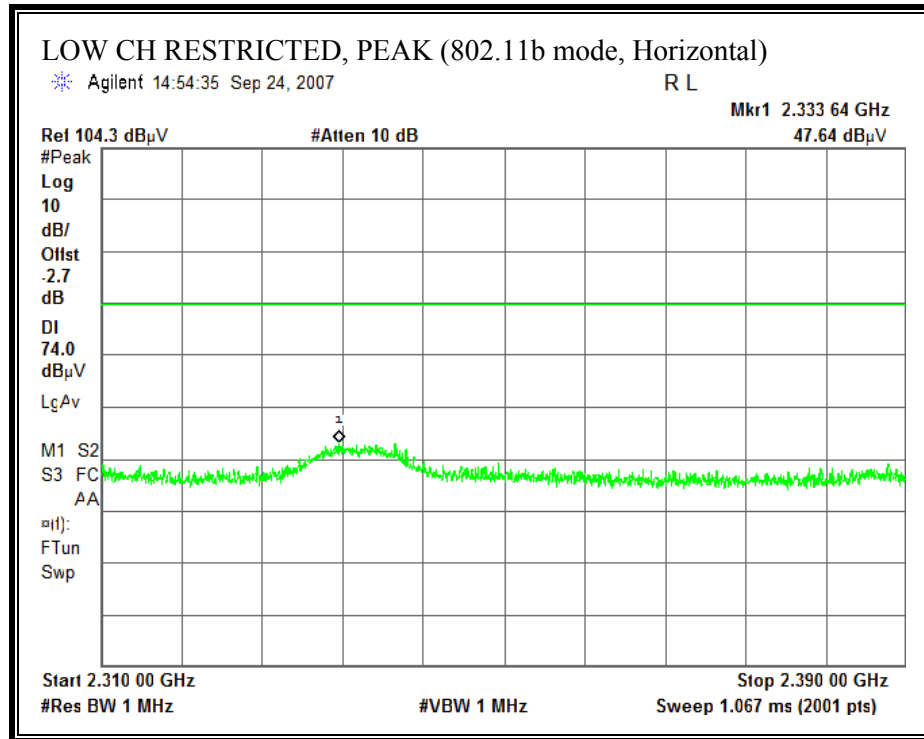
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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.

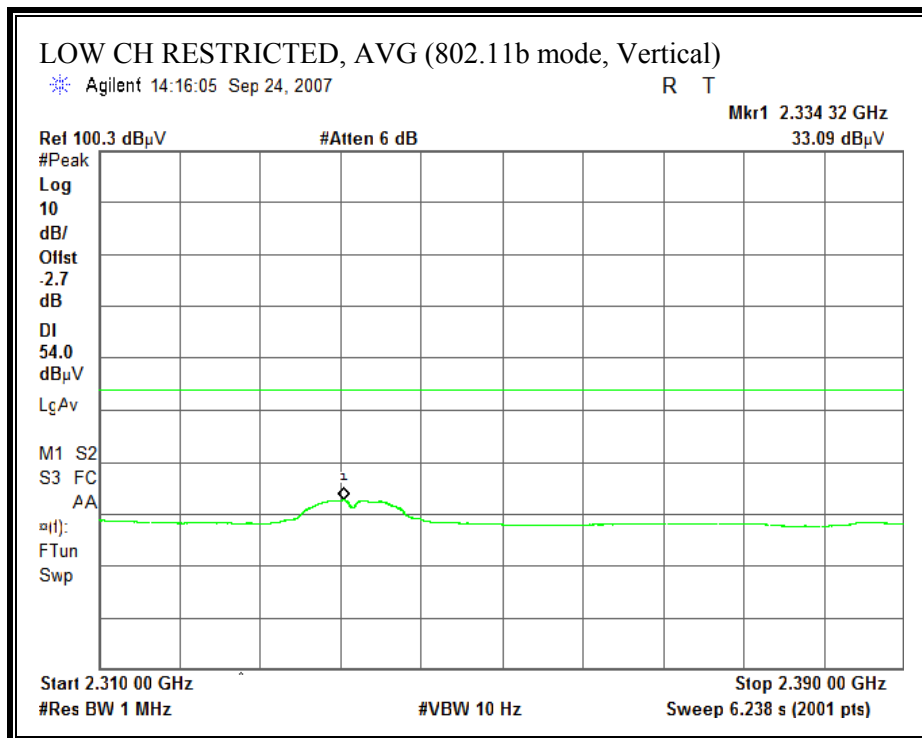
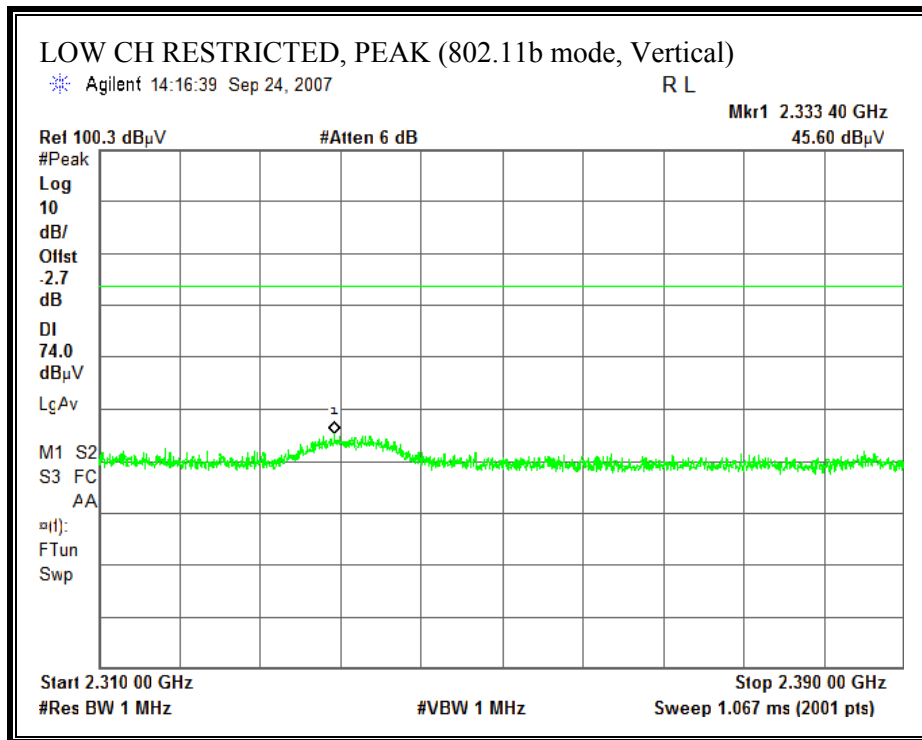
## 7.2.1. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

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

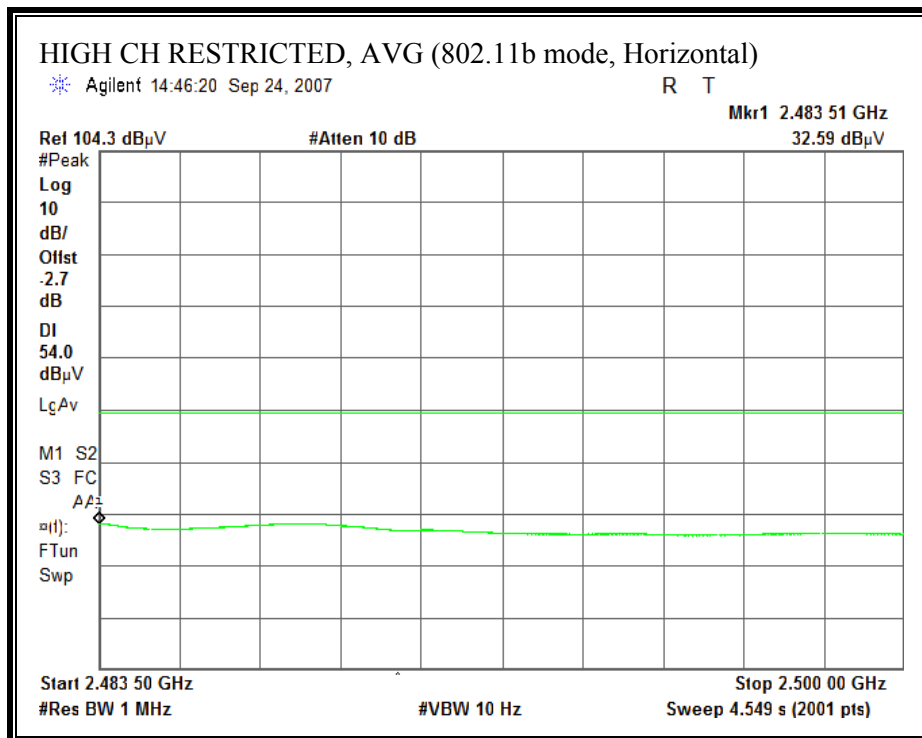
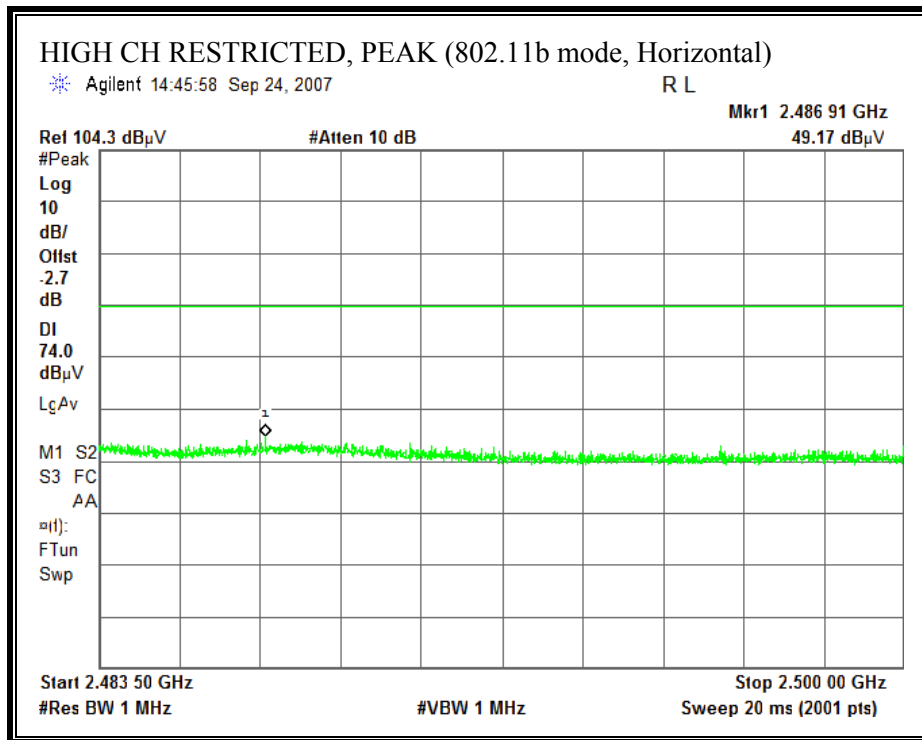




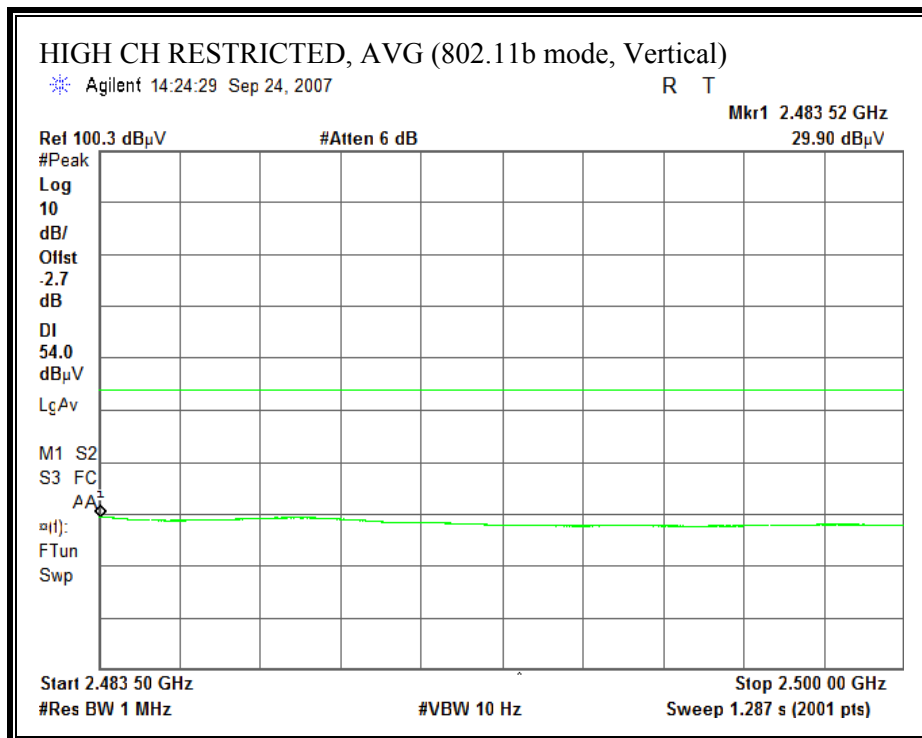
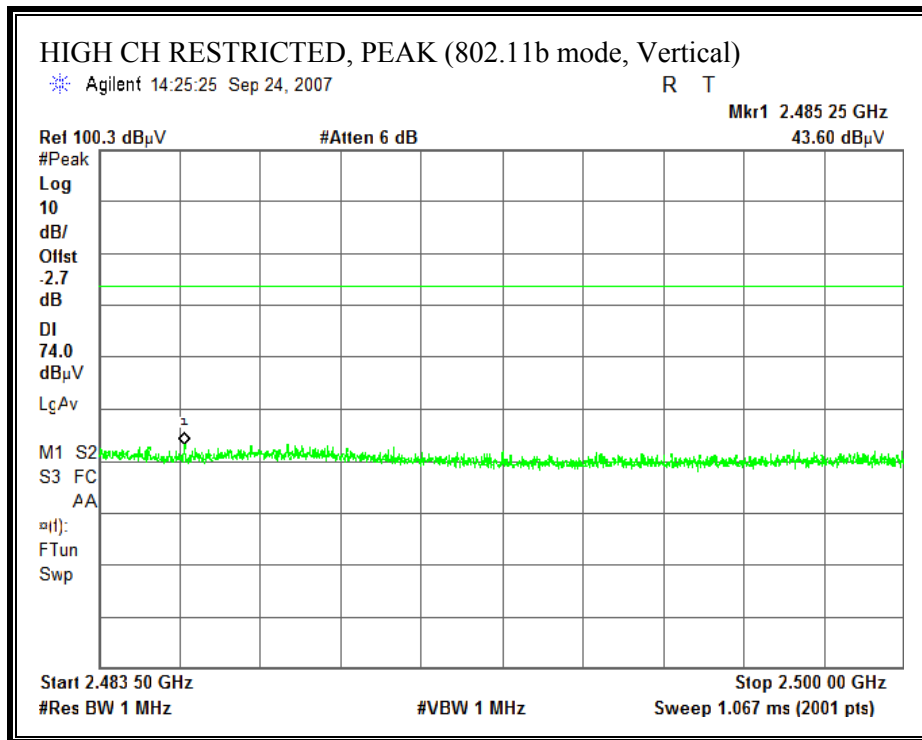
**RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)**



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



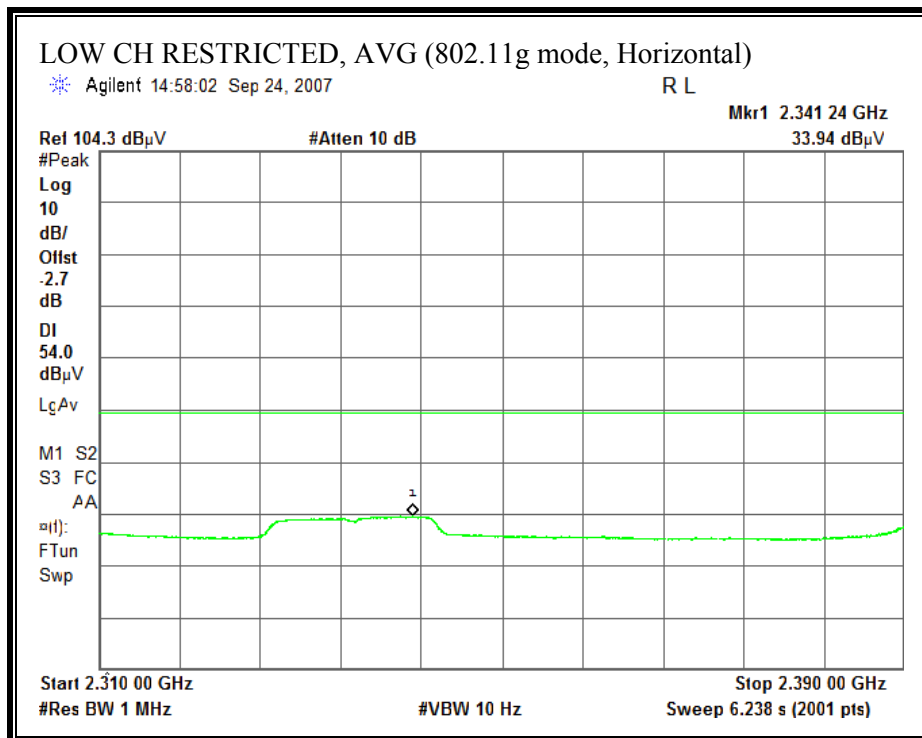
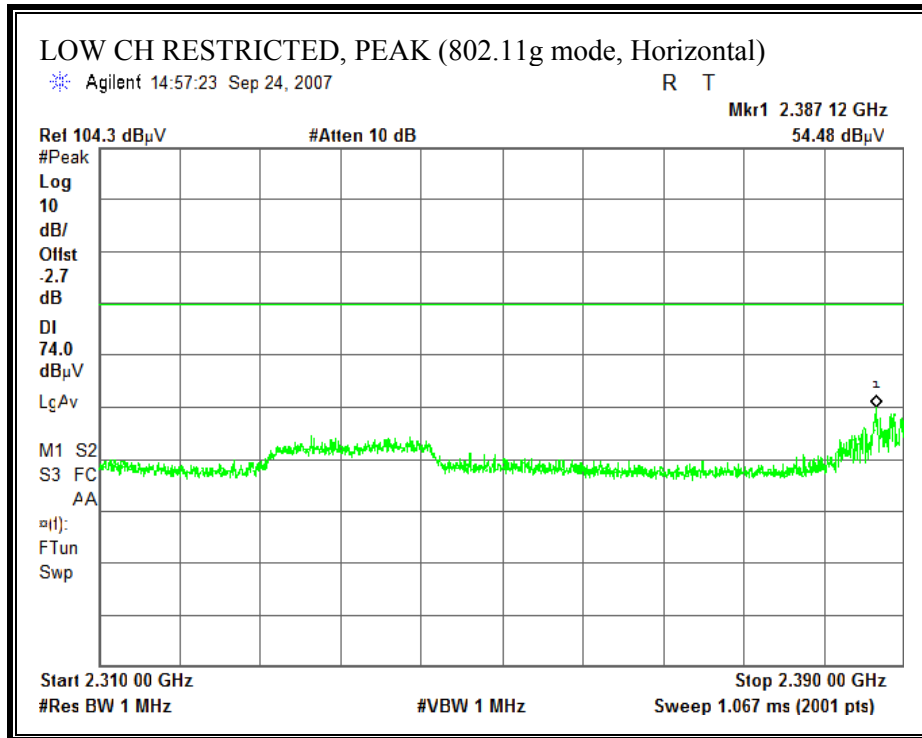
**RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)**



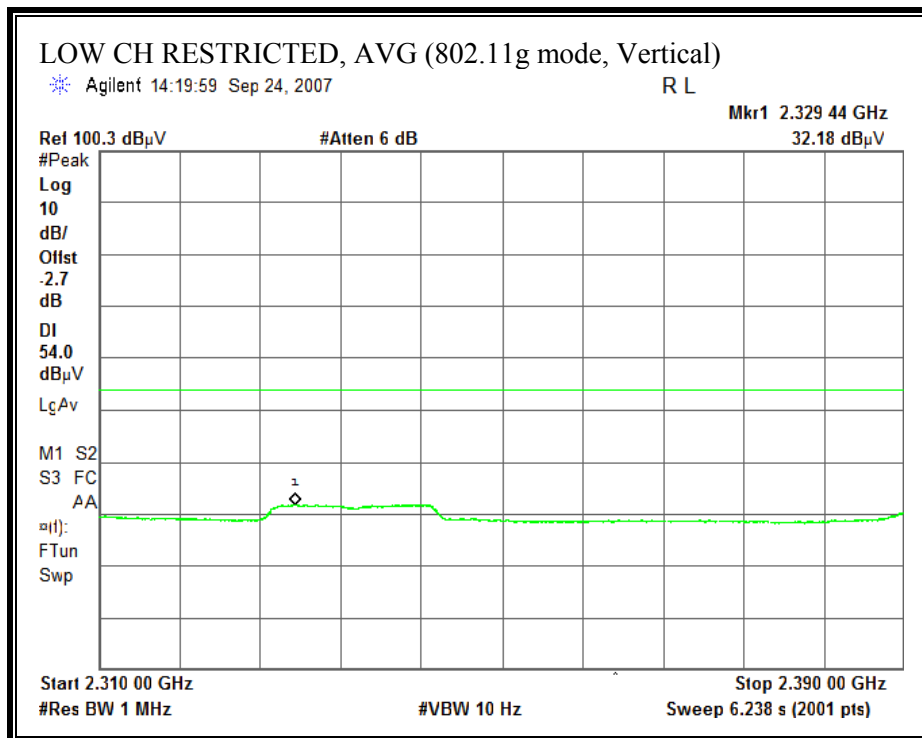
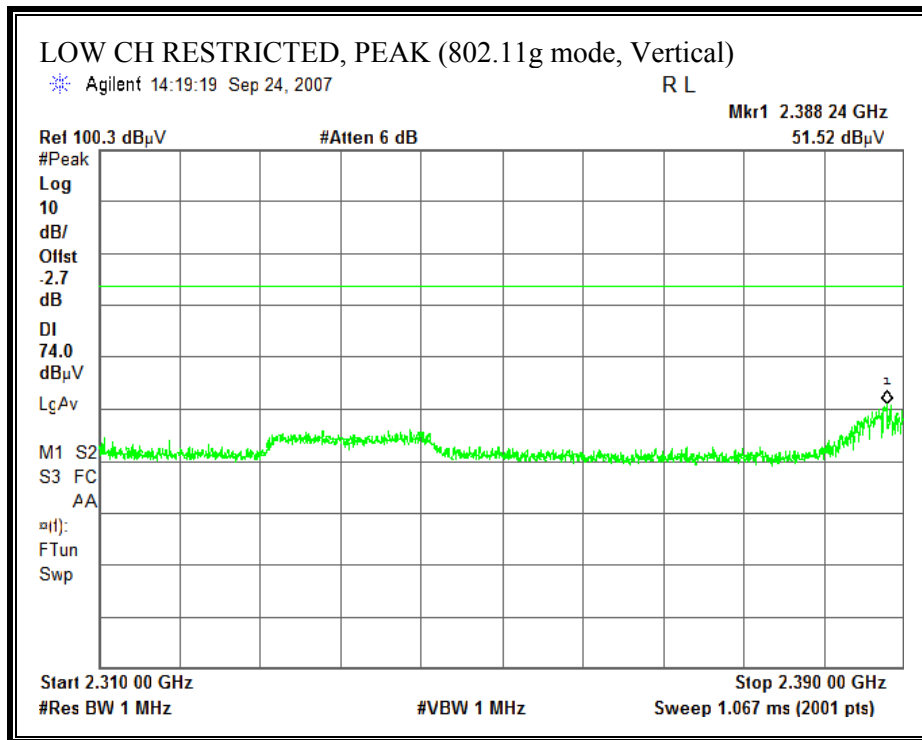
# **HARMONICS AND SPURIOUS EMISSIONS (b MODE)**

High Frequency Measurement																
Compliance Certification Services, Fremont 5m Chamber																
Company: Microsoft Project #: 07U11226 Date: 09/26/07 Test Engineer: Devin Chang Configuration: EUT Mode: B Mode-TX S/N: E417031																
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 Average Measurements RBW=1MHz ; VBW=10Hz	
						B-5m Chamber						R_001				
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	Duty Cycle dB	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
<b>LO CH (2412MHz)</b>																
1.188	3.0	48.4	38.8	25.9	3.5	-38.0	0.0	0.0	39.8	30.2	74	54	-34.2	-23.8	V	
1.716	3.0	46.2	37.5	27.2	4.2	-37.3	0.0	0.0	40.3	31.6	74	54	-33.7	-22.4	V	
4.824	3.0	45.8	35.5	33.0	7.1	-34.8	-4.4	0.0	51.1	36.3	74	54	-22.9	-17.7	V	
1.716	3.0	47.9	38.5	27.2	4.2	-37.3	0.0	0.0	42.0	32.6	74	54	-32.0	-21.4	H	
4.824	3.0	41.3	30.8	33.0	7.1	-34.8	-4.4	0.0	46.6	31.7	74	54	-27.4	-22.3	H	
7.326	3.0	37.6	26.0	35.5	8.7	-34.1	-4.4	0.0	47.7	31.6	74	54	-26.3	-22.4	H	
<b>MID CH (2437MHz)</b>																
1.188	3.0	48.5	39.8	25.9	3.5	-38.0	0.0	0.0	39.8	31.2	74	54	-34.2	-22.8	V	
1.716	3.0	46.6	38.2	27.2	4.2	-37.3	0.0	0.0	40.7	32.3	74	54	-33.3	-21.7	V	
4.874	3.0	49.2	38.4	33.1	7.2	-34.8	-4.4	0.0	54.6	39.4	74	54	-19.4	-14.6	V	
1.716	3.0	46.3	38.0	27.2	4.2	-37.3	0.0	0.0	40.4	32.1	74	54	-33.6	-21.9	H	
4.874	3.0	46.7	35.8	33.1	7.2	-34.8	-4.4	0.0	52.1	36.8	74	54	-21.9	-17.2	H	
<b>HI CH (2462MHz)</b>																
1.188	3.0	48.3	39.9	25.9	3.5	-38.0	0.0	0.0	39.7	31.3	74	54	-34.3	-22.7	V	
1.716	3.0	47.1	38.6	27.2	4.2	-37.3	0.0	0.0	41.2	32.7	74	54	-32.8	-21.3	V	
4.924	3.0	51.6	40.1	33.1	7.2	-34.8	-4.4	0.0	57.1	41.1	74	54	-16.9	-12.9	V	
1.716	3.0	46.9	38.3	27.2	4.2	-37.3	0.0	0.0	41.0	32.4	74	54	-33.0	-21.6	H	
4.924	3.0	49.5	38.4	33.1	7.2	-34.8	-4.4	0.0	54.9	39.4	74	54	-19.1	-14.6	H	
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											

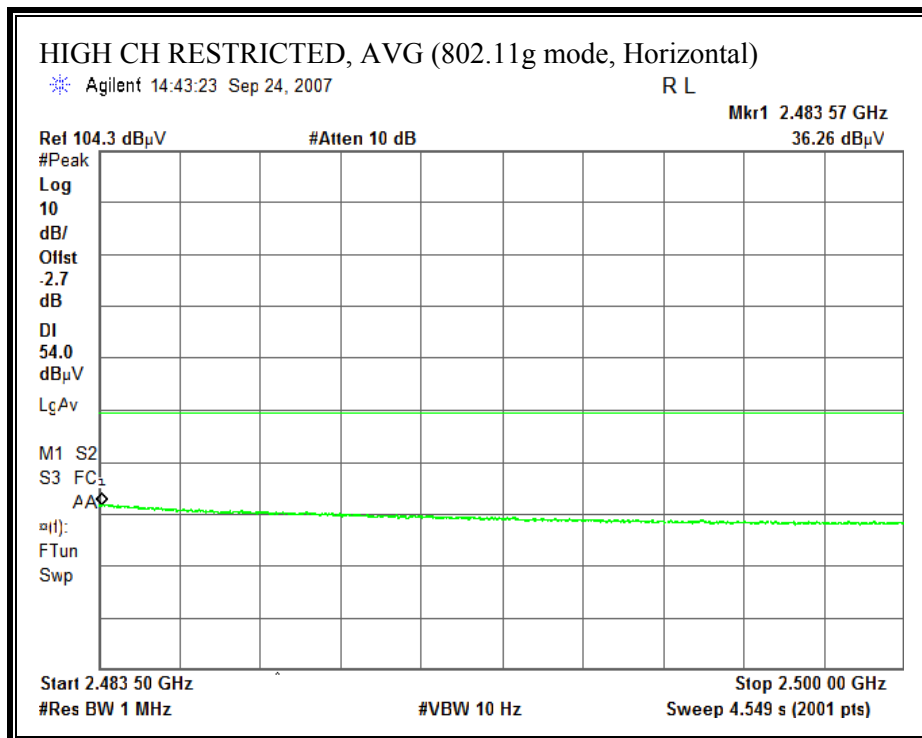
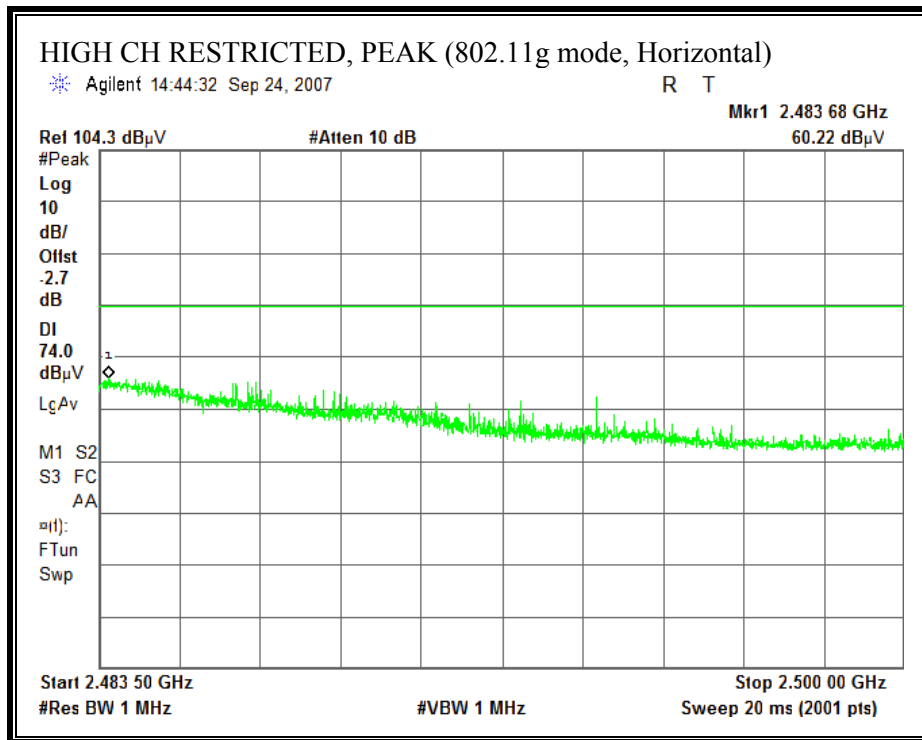
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)**



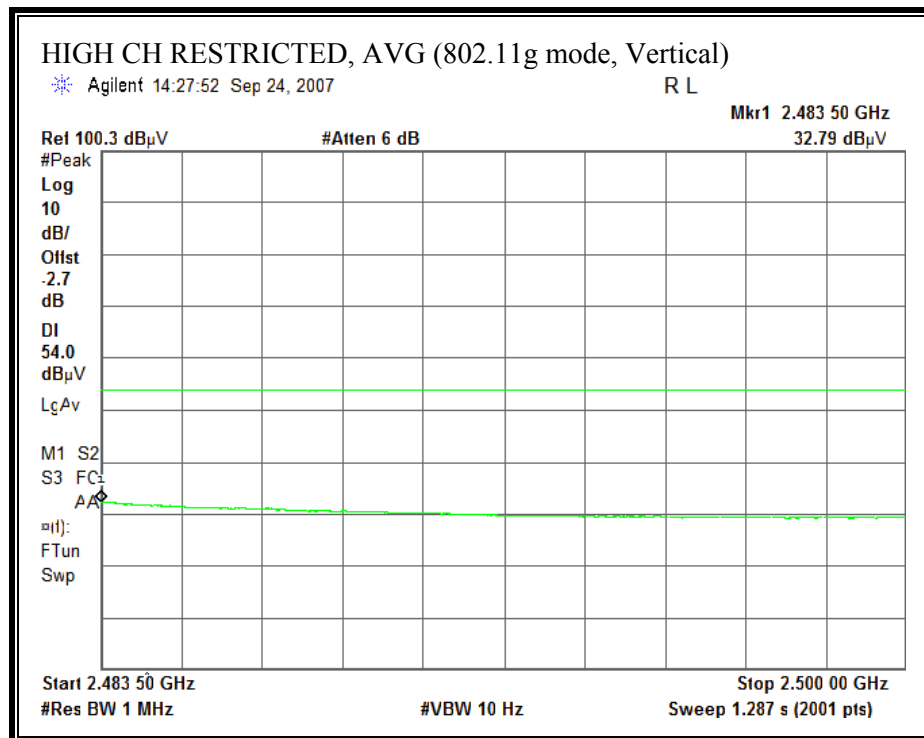
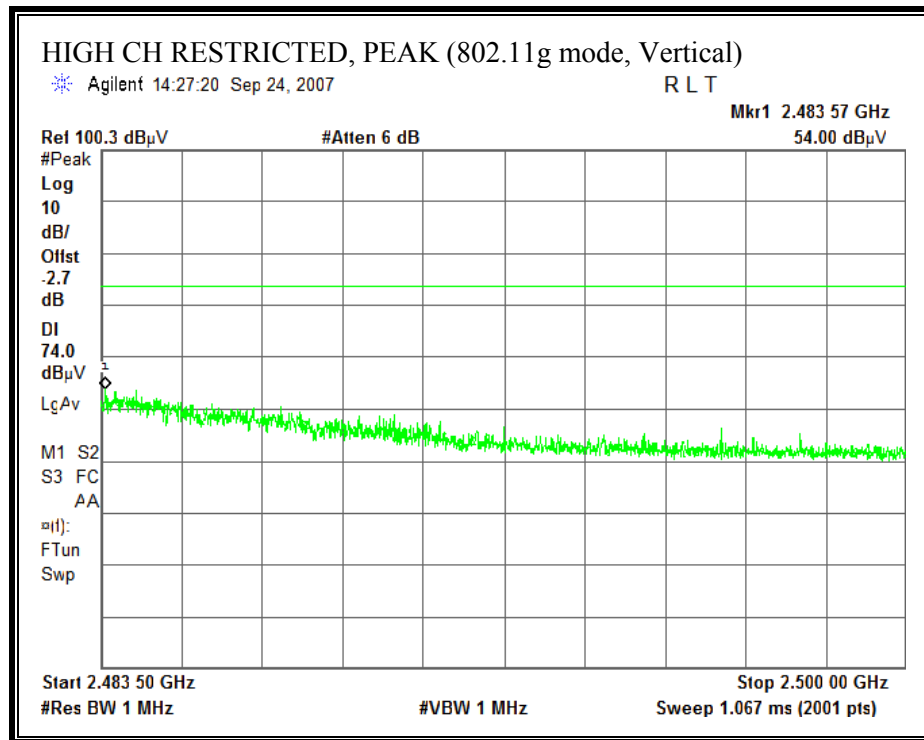
**RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)**



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



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





# HARMONICS AND SPURIOUS EMISSIONS (g MODE)

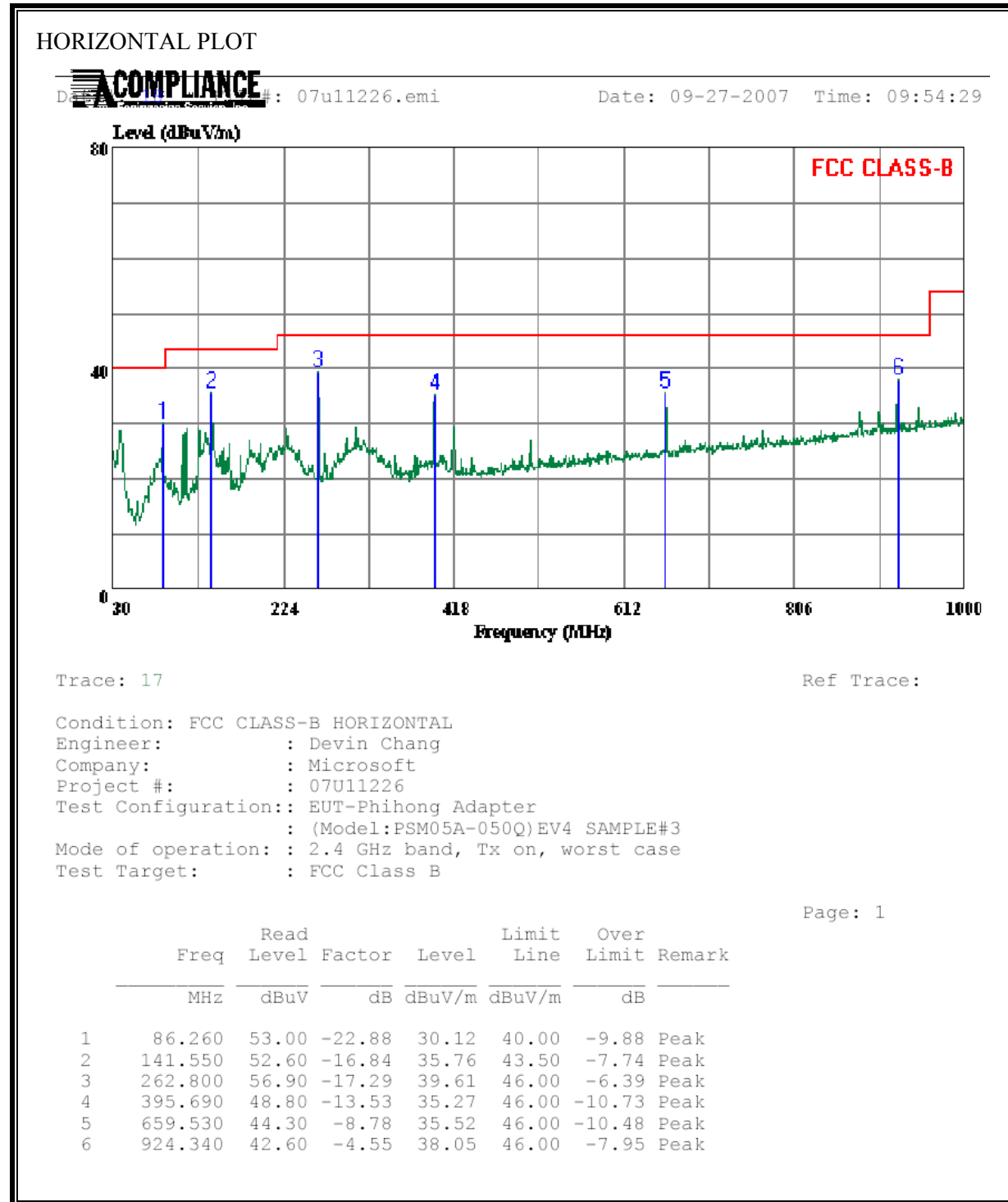
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<b>Company:</b> Microsoft <b>Project #:</b> 07U11226 <b>Date:</b> 09/26/07 <b>Test Engineer:</b> Devin Chang <b>Configuration:</b> EUT <b>Mode:</b> G Mode-TX <b>S/N:</b> E417031																																																																																																																																																																																																																																																																																																																															
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<td>0.0</td> <td>47.1</td> <td>29.3</td> <td>74</td> <td>54</td> <td>-26.9</td> <td>-24.7</td> <td>V</td> </tr> <tr> <td>1.716</td> <td>3.0</td> <td>47.0</td> <td>38.4</td> <td>27.2</td> <td>4.2</td> <td>-37.3</td> <td>0.0</td> <td>0.0</td> <td>41.1</td> <td>32.5</td> <td>74</td> <td>54</td> <td>-32.9</td> <td>-21.5</td> <td>H</td> </tr> <tr> <td>4.824</td> <td>3.0</td> <td>38.5</td> <td>24.4</td> <td>33.0</td> <td>7.1</td> <td>-34.8</td> <td>-2.9</td> <td>0.0</td> <td>43.8</td> <td>26.8</td> <td>74</td> <td>54</td> <td>-30.2</td> <td>-27.2</td> <td>H</td> </tr> <tr> <td colspan="16"><b>MID CH (2437MHz)</b></td> </tr> <tr> <td>1.188</td> <td>3.0</td> <td>48.0</td> <td>39.8</td> <td>25.9</td> <td>3.5</td> <td>-38.0</td> <td>0.0</td> <td>0.0</td> <td>39.4</td> <td>31.2</td> <td>74</td> <td>54</td> <td>-34.6</td> <td>-22.8</td> <td>V</td> </tr> <tr> <td>1.716</td> <td>3.0</td> <td>47.3</td> <td>38.7</td> <td>27.2</td> <td>4.2</td> <td>-37.3</td> <td>0.0</td> <td>0.0</td> <td>41.4</td> <td>32.9</td> <td>74</td> <td>54</td> <td>-32.6</td> <td>-21.1</td> <td>V</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>44.2</td> <td>28.5</td> <td>33.1</td> <td>7.2</td> <td>-34.8</td> <td>-2.9</td> <td>0.0</td> <td>49.6</td> <td>31.0</td> <td>74</td> <td>54</td> <td>-24.4</td> <td>-23.0</td> <td>V</td> </tr> <tr> <td>1.716</td> <td>3.0</td> <td>47.2</td> <td>39.6</td> <td>27.2</td> <td>4.2</td> <td>-37.3</td> <td>0.0</td> <td>0.0</td> <td>41.3</td> <td>33.7</td> <td>74</td> <td>54</td> <td>-32.7</td> <td>-20.3</td> <td>H</td> </tr> <tr> <td>4.874</td> <td>3.0</td> <td>41.8</td> <td>27.2</td> <td>33.1</td> <td>7.2</td> <td>-34.8</td> <td>-2.9</td> <td>0.0</td> <td>47.2</td> <td>29.7</td> <td>74</td> <td>54</td> <td>-26.8</td> <td>-24.3</td> <td>H</td> </tr> <tr> <td colspan="16"><b>HI CH (2462MHz)</b></td> </tr> <tr> <td>1.188</td> <td>3.0</td> <td>48.4</td> <td>39.6</td> <td>25.9</td> <td>3.5</td> <td>-38.0</td> <td>0.0</td> <td>0.0</td> <td>39.8</td> <td>30.9</td> <td>74</td> <td>54</td> <td>-34.2</td> <td>-23.1</td> <td>V</td> </tr> <tr> <td>1.716</td> <td>3.0</td> <td>47.1</td> <td>38.3</td> <td>27.2</td> <td>4.2</td> <td>-37.3</td> <td>0.0</td> <td>0.0</td> <td>41.2</td> <td>32.4</td> <td>74</td> <td>54</td> <td>-32.8</td> <td>-21.6</td> <td>V</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>47.8</td> <td>30.5</td> <td>33.1</td> <td>7.2</td> <td>-34.8</td> <td>-2.9</td> <td>0.0</td> <td>53.3</td> <td>33.0</td> <td>74</td> <td>54</td> <td>-20.7</td> <td>-21.0</td> <td>V</td> </tr> <tr> <td>1.716</td> <td>3.0</td> <td>47.8</td> <td>39.4</td> <td>27.2</td> <td>4.2</td> <td>-37.3</td> <td>0.0</td> <td>0.0</td> <td>41.9</td> <td>33.5</td> <td>74</td> <td>54</td> <td>-32.1</td> <td>-20.5</td> <td>H</td> </tr> <tr> <td>4.924</td> <td>3.0</td> <td>45.8</td> <td>29.7</td> <td>33.1</td> <td>7.2</td> <td>-34.8</td> <td>-2.9</td> <td>0.0</td> <td>51.3</td> <td>32.3</td> <td>74</td> <td>54</td> <td>-22.7</td> <td>-21.7</td> <td>H</td> </tr> </tbody> 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(2437MHz)</b>																1.188	3.0	48.0	39.8	25.9	3.5	-38.0	0.0	0.0	39.4	31.2	74	54	-34.6	-22.8	V	1.716	3.0	47.3	38.7	27.2	4.2	-37.3	0.0	0.0	41.4	32.9	74	54	-32.6	-21.1	V	4.874	3.0	44.2	28.5	33.1	7.2	-34.8	-2.9	0.0	49.6	31.0	74	54	-24.4	-23.0	V	1.716	3.0	47.2	39.6	27.2	4.2	-37.3	0.0	0.0	41.3	33.7	74	54	-32.7	-20.3	H	4.874	3.0	41.8	27.2	33.1	7.2	-34.8	-2.9	0.0	47.2	29.7	74	54	-26.8	-24.3	H	<b>HI CH (2462MHz)</b>																1.188	3.0	48.4	39.6	25.9	3.5	-38.0	0.0	0.0	39.8	30.9	74	54	-34.2	-23.1	V	1.716	3.0	47.1	38.3	27.2	4.2	-37.3	0.0	0.0	41.2	32.4	74	54	-32.8	-21.6	V	4.924	3.0	47.8	30.5	33.1	7.2	-34.8	-2.9	0.0	53.3	33.0	74	54	-20.7	-21.0	V	1.716	3.0	47.8	39.4	27.2	4.2	-37.3	0.0	0.0	41.9	33.5	74	54	-32.1	-20.5	H	4.924	3.0	45.8	29.7	33.1	7.2	-34.8	-2.9	0.0	51.3	32.3	74	54	-22.7	-21.7	H
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	Duty Cycle 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)																																																																																																																																																																																																																																																																																																																
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1.188	3.0	47.3	37.7	25.9	3.5	-38.0	0.0	0.0	38.6	29.1	74	54	-35.4	-24.9	V																																																																																																																																																																																																																																																																																																																
1.716	3.0	46.3	37.0	27.2	4.2	-37.3	0.0	0.0	40.4	31.1	74	54	-33.6	-22.9	V																																																																																																																																																																																																																																																																																																																
4.824	3.0	41.8	26.9	33.0	7.1	-34.8	-2.9	0.0	47.1	29.3	74	54	-26.9	-24.7	V																																																																																																																																																																																																																																																																																																																
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4.824	3.0	38.5	24.4	33.0	7.1	-34.8	-2.9	0.0	43.8	26.8	74	54	-30.2	-27.2	H																																																																																																																																																																																																																																																																																																																
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1.188	3.0	48.0	39.8	25.9	3.5	-38.0	0.0	0.0	39.4	31.2	74	54	-34.6	-22.8	V																																																																																																																																																																																																																																																																																																																
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1.716	3.0	47.2	39.6	27.2	4.2	-37.3	0.0	0.0	41.3	33.7	74	54	-32.7	-20.3	H																																																																																																																																																																																																																																																																																																																
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<table border="0"> <tr> <td>f</td> <td>Measurement Frequency</td> <td>Amp</td> <td>Preamp Gain</td> <td>Avg Lim</td> <td>Average Field Strength Limit</td> </tr> <tr> <td>Dist</td> <td>Distance to Antenna</td> <td>D Corr</td> <td>Distance Correct to 3 meters</td> <td>Pk Lim</td> <td>Peak Field Strength Limit</td> </tr> <tr> <td>Read</td> <td>Analyzer Reading</td> <td>Avg</td> <td>Average Field Strength @ 3 m</td> <td>Avg Mar</td> <td>Margin vs. Average Limit</td> </tr> <tr> <td>AF</td> <td>Antenna Factor</td> <td>Peak</td> <td>Calculated Peak Field Strength</td> <td>Pk Mar</td> <td>Margin vs. Peak Limit</td> </tr> <tr> <td>CL</td> <td>Cable Loss</td> <td>HPF</td> <td>High Pass Filter</td> <td></td> <td></td> </tr> </table>																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																																																																																																																																																																																																																																																																																				
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# HARMONICS AND SPURIOUS EMISSIONS (RX MODE)

High Frequency Measurement																			
Compliance Certification Services, Fremont 5m Chamber																			
Company: Microsoft																			
Project #: 07U11226																			
Date: 09/26/07																			
Test Engineer: Devin Chang																			
Configuration: EUT																			
Mode: RX Worst case Mode																			
S/N: E417031																			
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			
								B-5m Chamber											
<div> <div>Peak Measurements</div> <div>RBW=VBW=1MHz</div> <div>Average Measurements</div> <div>RBW=1MHz ; VBW=10Hz</div> </div>																			
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)				
HI CH (2462MHz)																			
1.188	3.0	50.7	41.4	25.9	3.5	-38.0	0.0	0.0	42.1	32.8	74	54	-31.9	-21.2	V				
1.716	3.0	50.1	39.7	27.2	4.2	-37.3	0.0	0.0	44.2	33.8	74	54	-29.8	-20.2	V				
2.508	3.0	50.8	41.3	28.9	5.1	-36.2	0.0	0.0	48.6	39.1	74	54	-25.4	-14.9	V				
1.188	3.0	46.7	33.9	25.9	3.5	-38.0	0.0	0.0	38.1	25.3	74	54	-35.9	-28.7	H				
1.716	3.0	47.7	40.3	27.2	4.2	-37.3	0.0	0.0	41.9	34.4	74	54	-32.1	-19.6	H				
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														

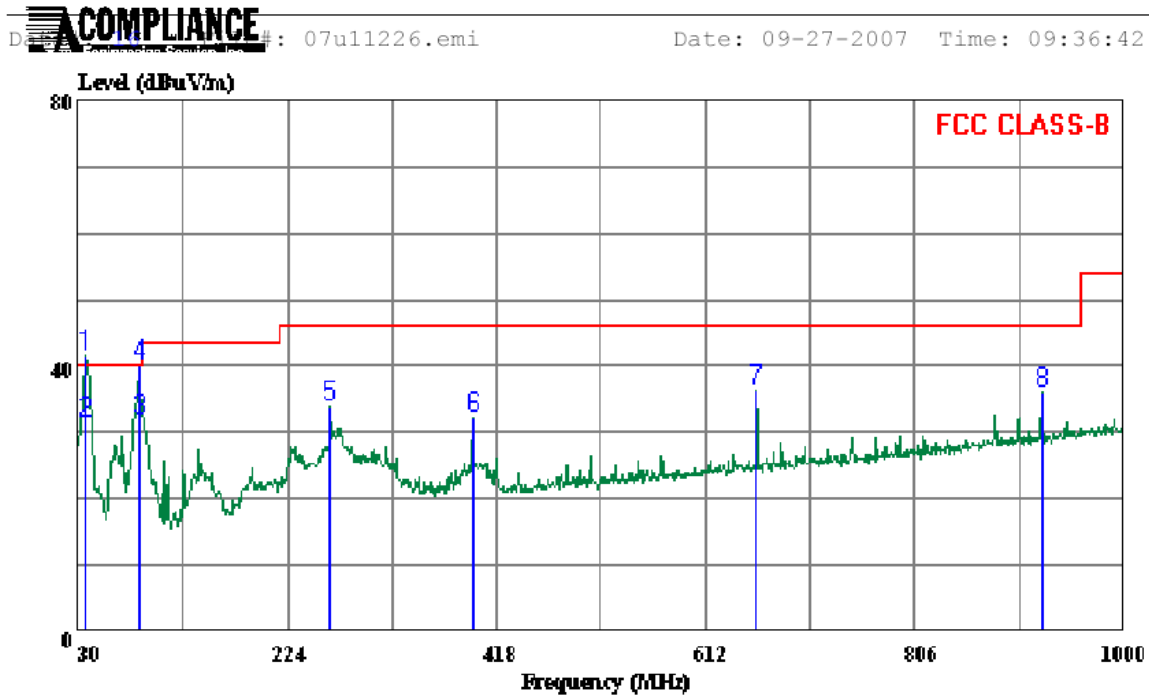
## 7.2.2. RADIATED EMISSIONS BELOW 1 GHz

### SPURIOUS EMISSIONS 30 TO 1000 MHz (PHIHONG ADAPTOR, HORIZONTAL)



**SPURIOUS EMISSIONS 30 TO 1000 MHz (PHIHONG ADAPTOR, VERTICAL)**

VERTICAL PLOT

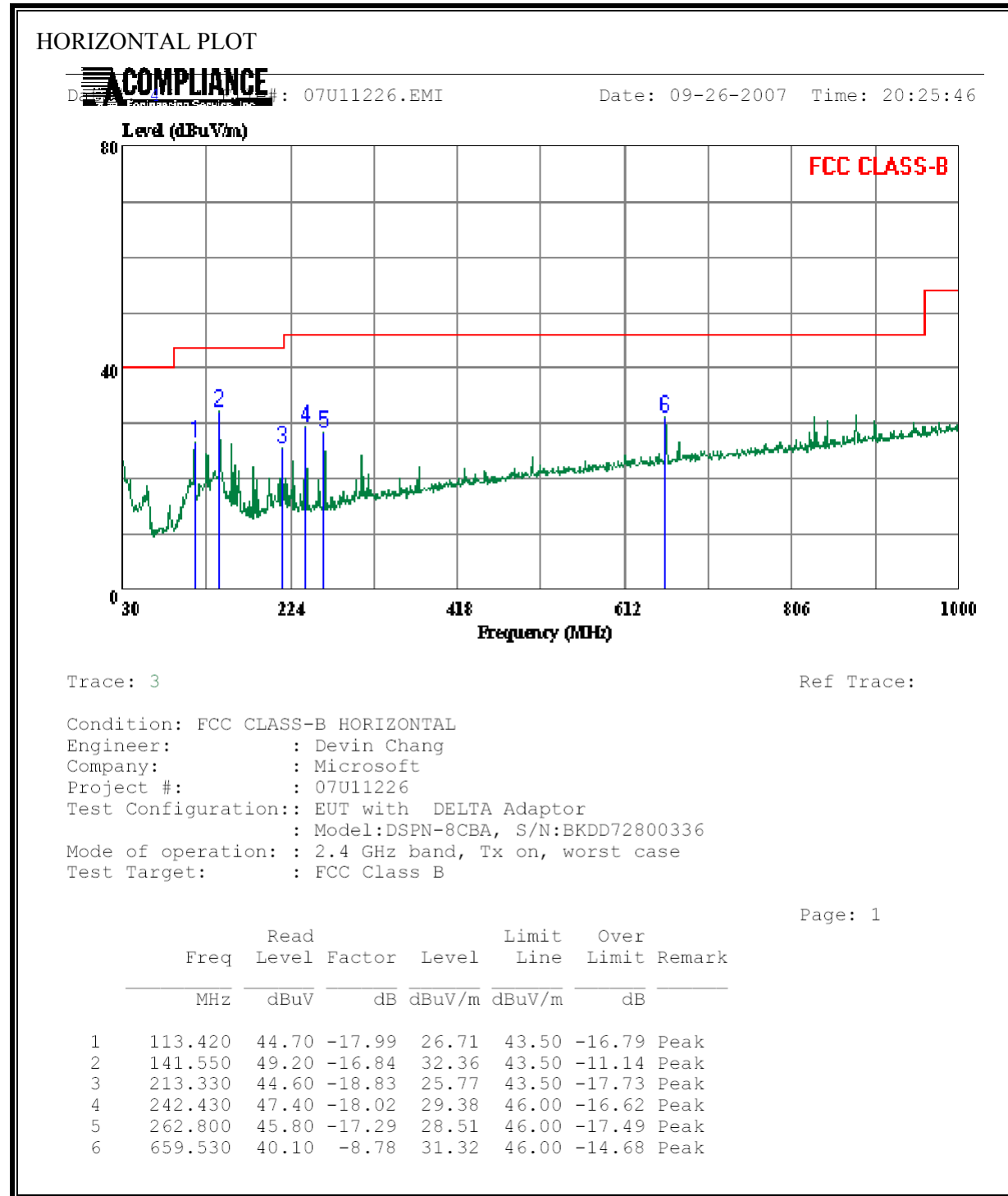


Condition: FCC CLASS-B VERTICAL  
Engineer: : Devin Chang  
Company: : Microsoft  
Project #: : 07U11226  
Test Configuration: EUT-Phihong Adapter  
: (Model:PSM05A-050Q)EV4 SAMPLE#3  
Mode of operation: : 2.4 GHz band, Tx on, worst case  
Test Target: : FCC Class B

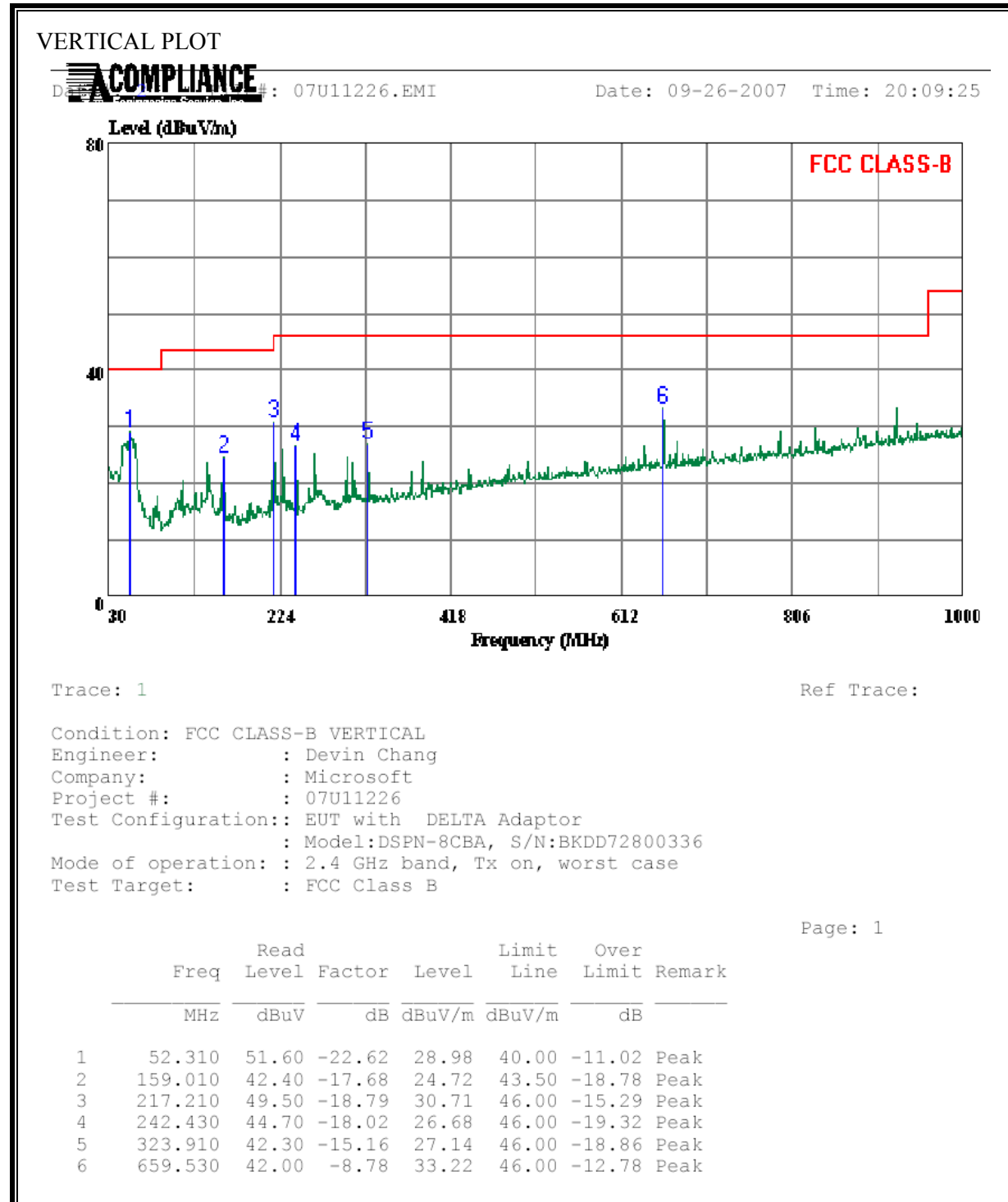
Page: 1

	Freq	Read	Factor	Level	Limit	Over	Remark
	MHz	Level		dBuV/m	Line	Limit	
		dBuV	dB		dBuV/m	dB	
1 *	36.790	55.00	-13.53	41.47	40.00	1.47	Peak
2	36.990	45.21	-13.53	31.68	40.00	-8.32	QP
3	86.260	54.80	-22.88	31.92	40.00	-8.08	QP
4 *	86.260	63.00	-22.88	40.12	40.00	0.12	Peak
5	262.800	51.30	-17.29	34.01	46.00	-11.99	Peak
6	395.690	45.80	-13.53	32.27	46.00	-13.73	Peak
7	659.530	45.00	-8.78	36.22	46.00	-9.78	Peak
8	924.340	40.50	-4.55	35.95	46.00	-10.05	Peak

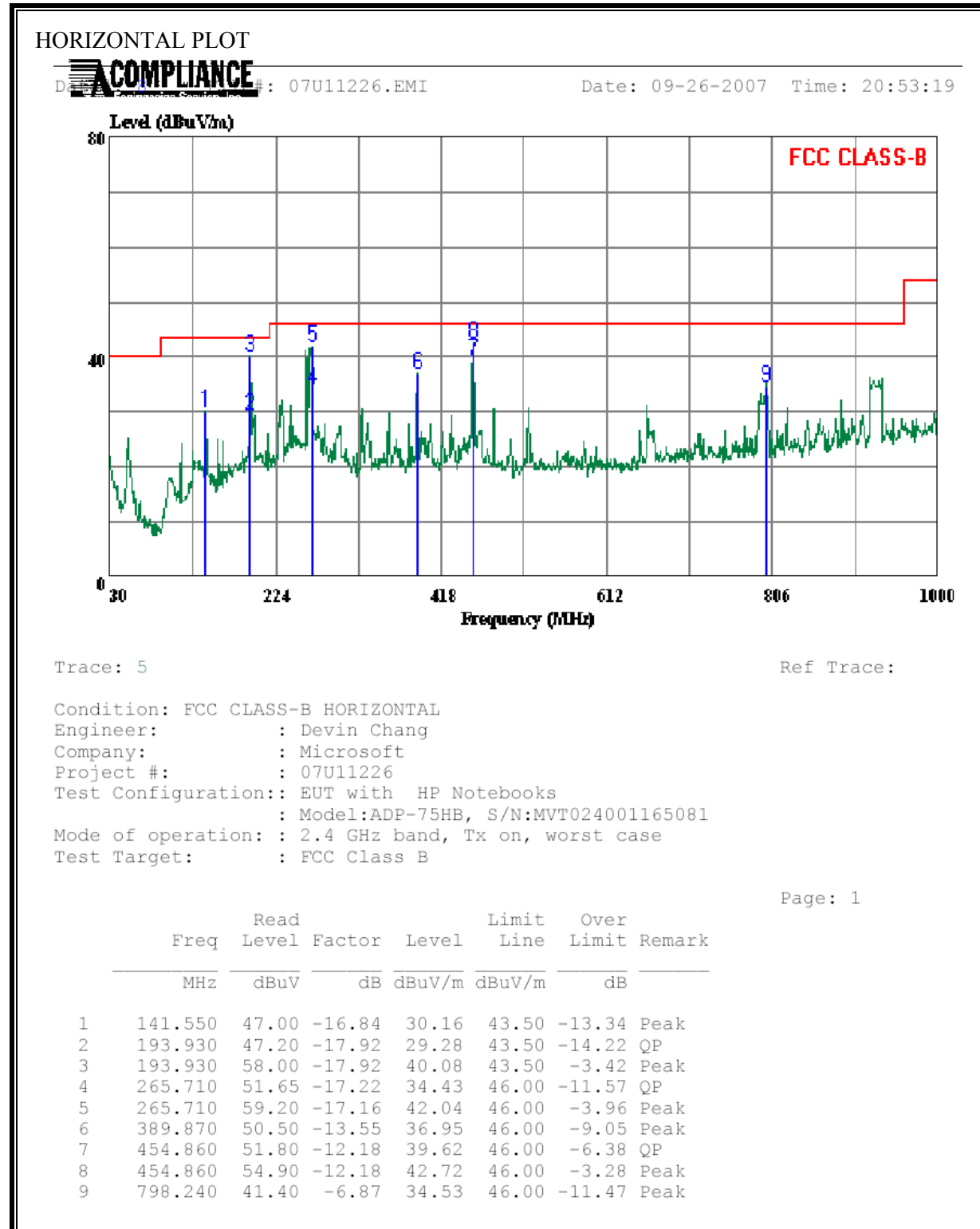
**SPURIOUS EMISSIONS 30 TO 1000 MHz (DELTA ADAPTOR, HORIZONTAL)**



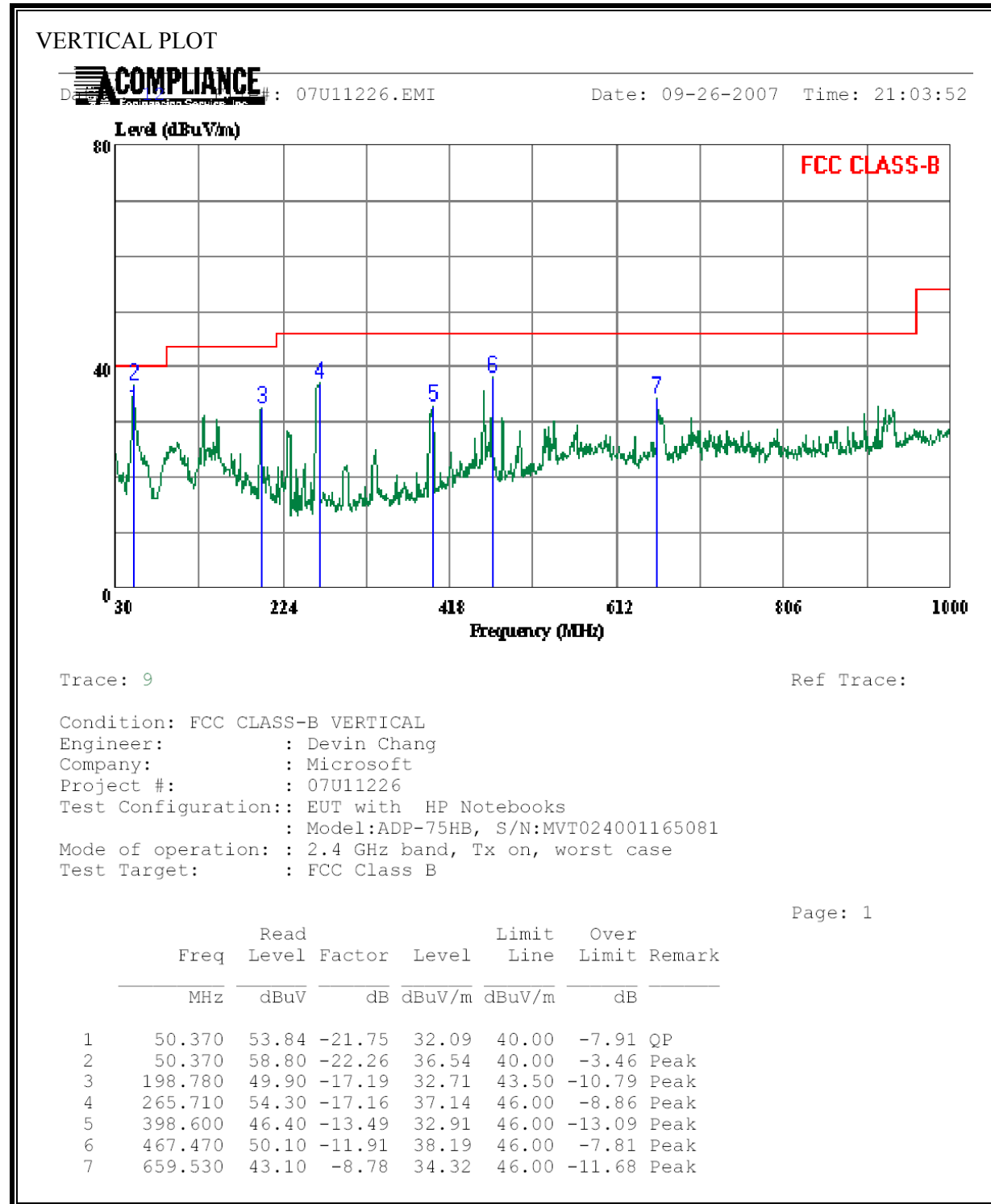
**SPURIOUS EMISSIONS 30 TO 1000 MHz (DELTA ADAPTOR, VERTICAL)**



**SPURIOUS EMISSIONS 30 TO 1000 MHz (EUT WITH NOTEBOOK, HORIZONTAL)**



**SPURIOUS EMISSIONS 30 TO 1000 MHz (EUT WITH NOTEBOOK, VERTICAL)**





### 7.3. 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 <sup>*</sup>	56 to 46 <sup>*</sup>
0.5-5	56	46
5-30	60	50

<sup>\*</sup> 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**

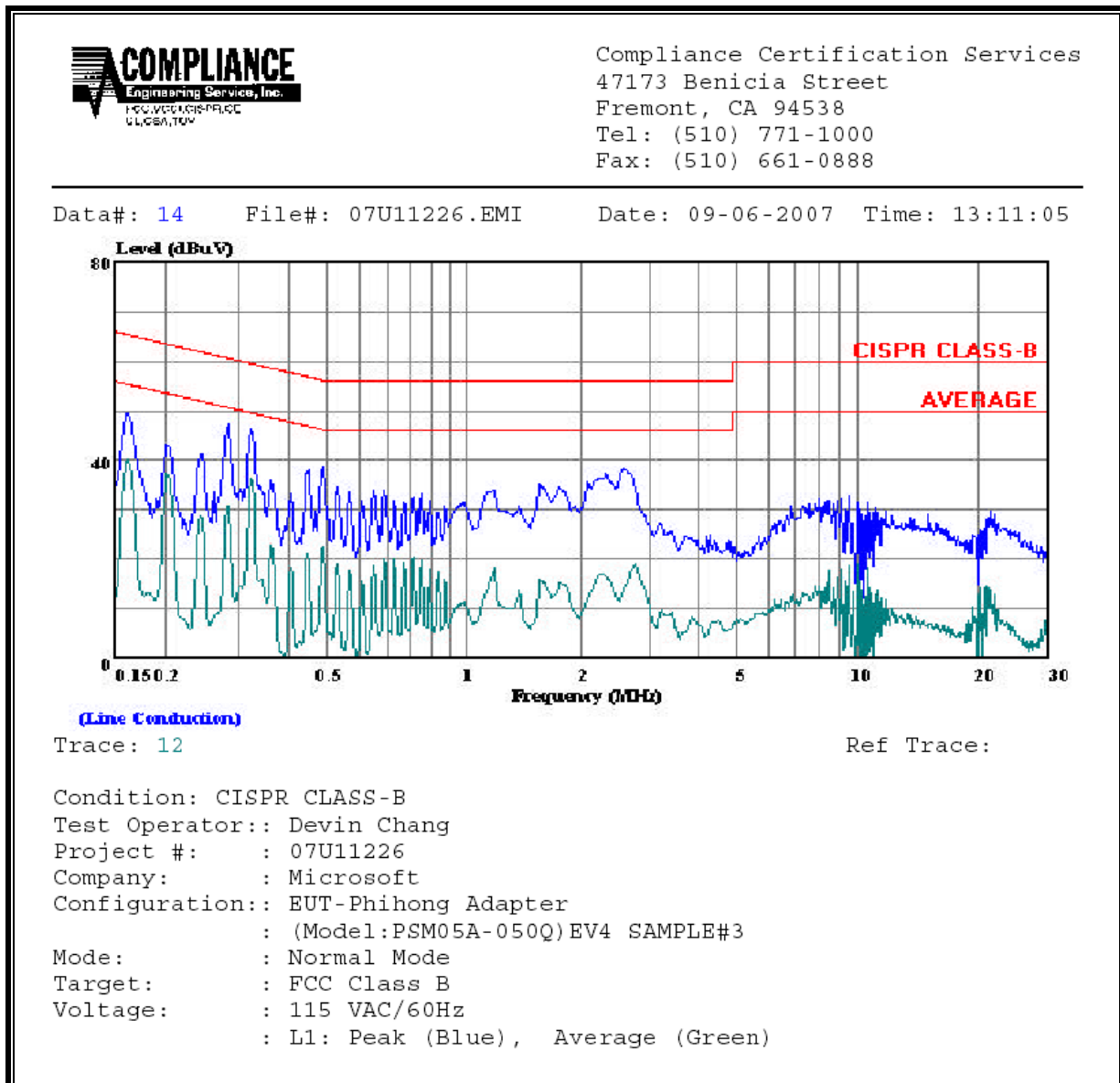
No non-compliance noted.

## 6 WORST EMISSIONS

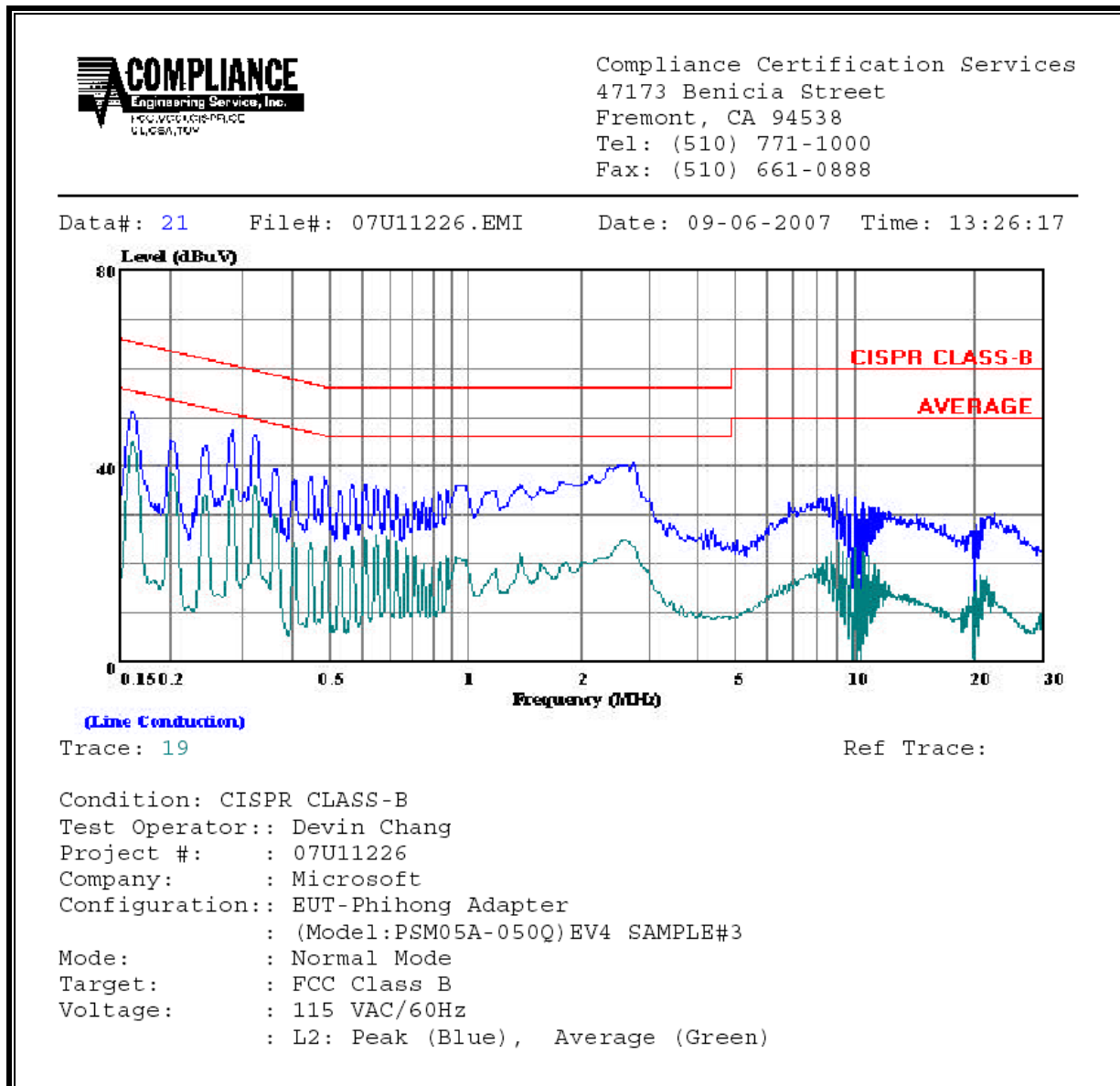
PHIHONG ADAPTOR

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.16	49.46	—	39.71	0.00	65.46	55.46	-16.00	-15.75	L1
0.28	47.44	—	37.37	0.00	60.73	50.73	-13.29	-13.36	L1
2.69	38.40	—	19.07	0.00	56.00	46.00	-17.60	-26.93	L1
0.16	51.18	—	44.91	0.00	65.46	55.46	-14.28	-10.55	L2
0.28	47.42	—	35.20	0.00	60.73	50.73	-13.31	-15.53	L2
0.32	46.52	—	36.16	0.00	59.63	49.63	-13.11	-13.47	L2
6 Worst Data									

LINE 1 RESULTS



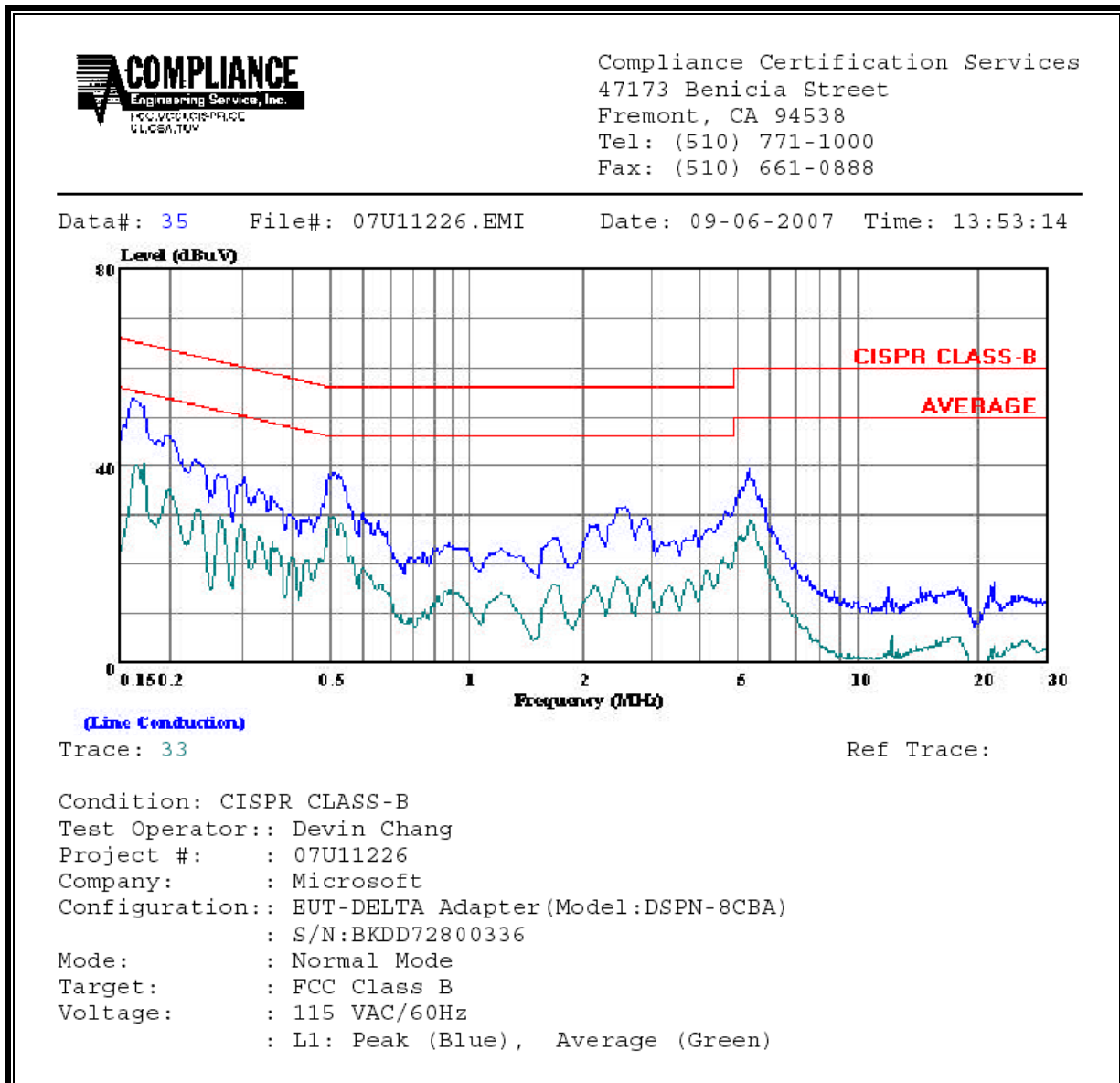
## LINE 2 RESULTS



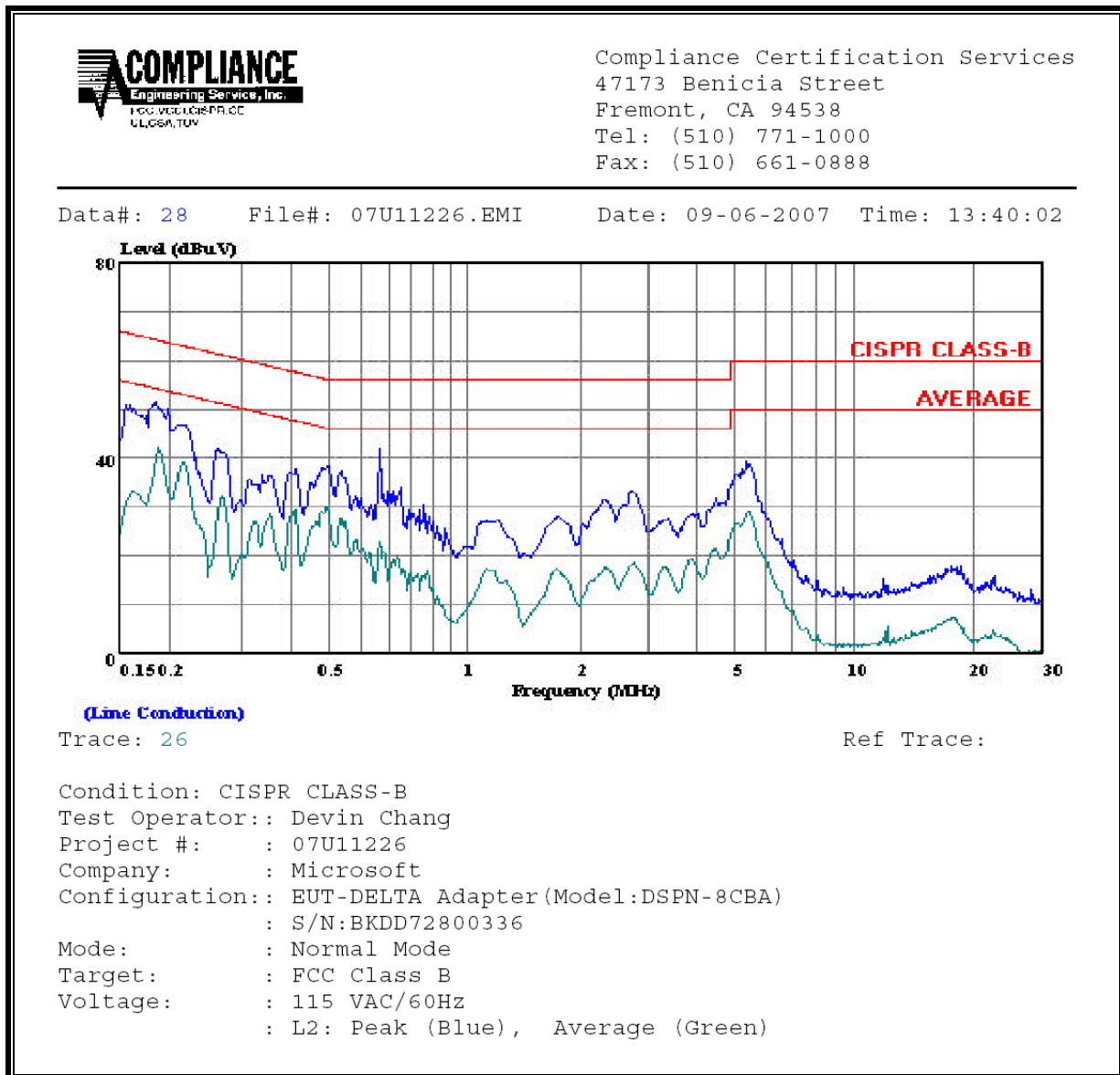
DETLA ADAPTOR

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	51.52	--	42.08	0.00	64.35	54.35	-12.83	-12.27	L1
0.22	46.75	--	39.06	0.00	62.97	52.97	-16.22	-13.91	L1
0.26	41.90	--	32.17	0.00	61.37	51.37	-19.47	-19.20	L1
0.16	53.82	--	40.02	0.00	65.41	55.41	-11.59	-15.39	L2
0.51	38.46	--	29.65	0.00	56.00	46.00	-17.54	-16.35	L2
5.45	39.62	--	29.05	0.00	60.00	50.00	-20.38	-20.95	L2
6 Worst Data									

**LINE 1 RESULTS**



## LINE 2 RESULTS

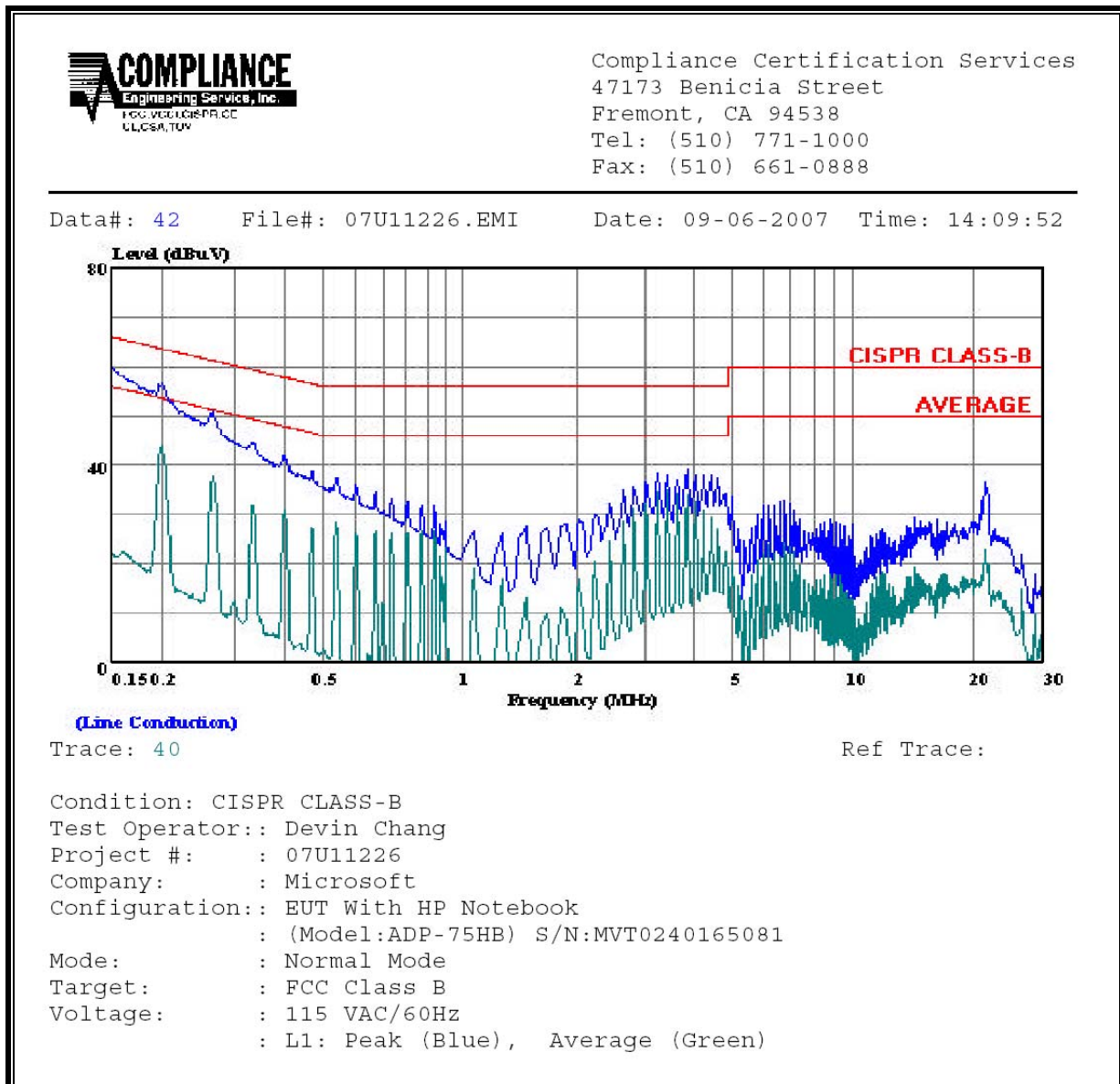


EUT WITH NOTEBOOK

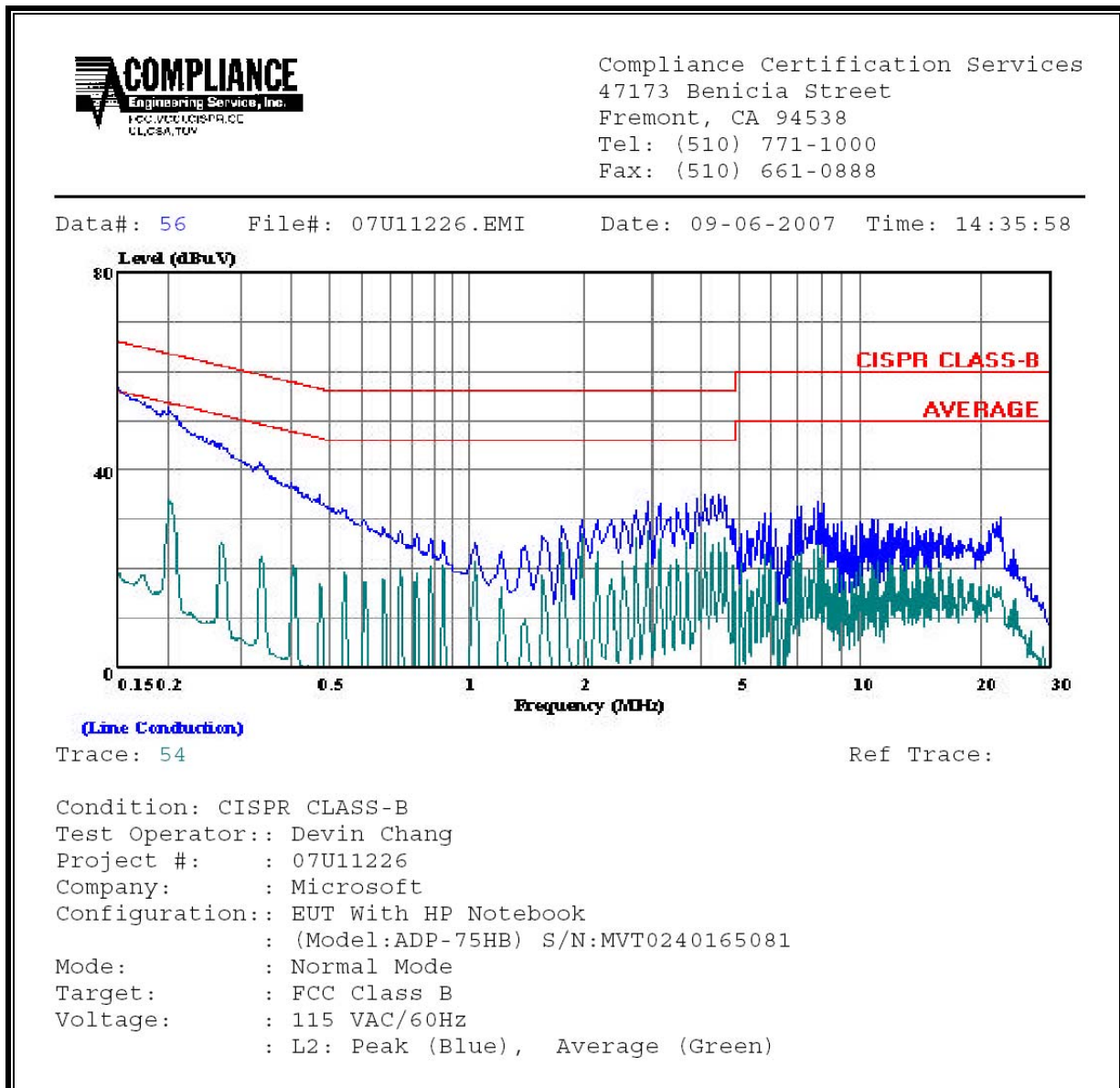
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.20	56.92	--	43.95	0.00	63.61	53.61	-6.69	-9.66	L1
0.27	50.78	--	37.39	0.00	61.24	51.24	-10.46	-13.85	L1
3.94	39.20	--	34.86	0.00	56.00	46.00	-16.80	-11.14	L1
0.20	51.14	--	33.63	0.00	63.53	53.53	-12.39	-19.90	L2
0.27	45.21	--	45.21	0.00	61.15	51.15	-15.94	-5.94	L2
2.08	33.54	--	33.54	0.00	56.00	46.00	-22.46	-12.46	L2
6 Worst Data									



LINE 1 RESULTS



## LINE 2 RESULTS



## 7.4. 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	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

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

**Notes:** 1. Frequency,  $f$ , is in MHz.  
2. A power density of 10 W/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  $S = 1.0 \text{ mW/cm}^2$

From IC Safety Code 6, Section 2.2 Table 5 Column 4,  $S = 10 \text{ W/m}^2$

## **RESULTS**

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density ( $\text{mW/cm}^2$ )	IC Power Density ( $\text{W/m}^2$ )
802.11b	2.4 GHz	20.0	13.93	1.00	0.00618	0.06
802.11g	2.4 GHz	20.0	10.88	1.00	0.00306	0.03

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.