



**FCC CFR47 CERTIFICATION  
CLASS II PERMISSIVE CHANGE  
TEST REPORT**

**FOR**

**BROADCOM 802.11ag WIRELESS LAN PCI-E MINI CARD**

**MODEL NUMBER: BCM94311MCAG**

**FCC ID: QDS-BRCM1019**

**REPORT NUMBER: 05U3891-2B**

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*Prepared for*  
**BROADCOM CORP.  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, USA**

*Prepared by*  
**COMPLIANCE ENGINEERING SERVICES, INC.  
d.b.a.  
COMPLIANCE CERTIFICATION SERVICES  
561F MONTEREY ROAD,  
MORGAN HILL, CA 95037, USA  
TEL: (408) 463-0885  
FAX: (408) 463-0888**

**NVLAP<sup>®</sup>**  
**LAB CODE:200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
A	01/23/06	Initial Issue	Thu
B	02/06/06	Revised MPE Section 8.1.3	Thu
	02/06/06	Revised the EIRP limit of Conducted Spurious Emissions on Section 8.1.7 to match the antenna's gain	Thu

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Broadcom Corp.  
190 Mathilda Place  
Sunnyvale, CA 94086, USA

**EUT DESCRIPTION:** Broadcom 802.11ag Wireless LAN PCI-E Mini Card

**MODEL:** BCM94311MCAG

**SERIAL NUMBER:** 1030432

**DATE TESTED:** December 20, 2005 to January 09, 2006

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART E	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.

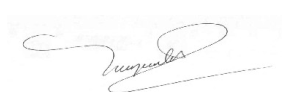
**Note:** The 802.11ag UNII Band is applicable to this report; another 5.2 GHz UNII band of operation is in separate report.

Approved & Released For CCS By:

Tested By:



THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES



VIEN TRAN  
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 Subpart E.

## 3. CROSS REFERENCE TO OTHER REPORTS ON THIS PRODUCT

Other FCC reports applicable to this product include CCS 05U3891-1.

## 4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 561F Monterey Road, Morgan Hill, 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>.

## 5. CALIBRATION AND UNCERTAINTY

### 5.1. MEASURING INSTRUMENT CALIBRATION

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

### 5.2. MEASUREMENT UNCERTAINTY

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

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

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

## 6. EQUIPMENT UNDER TEST

### 6.1. DESCRIPTION OF EUT

The EUT is an 802.11a/g transceiver WLAN module, operating in the UNII 5150-5325 MHz band.

### 6.2. CLASS II PERMISSIVE CHANGE DESCRIPTION

The EUT was originally certified on August 03, 2005 with a peak antenna gain of 5.1 dBi in the frequency range of 5150 – 5350 MHz. The major change filed under this application is:

1. Changing of 5GHz PA with a PIFA Stamped metal antenna of 5.6 dBi maximum gain at the 5150 – 5350 MHz band same as a previous project no: 05U3830.

### 6.3. MAXIMUM OUTPUT POWER

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

5150 to 5250 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5250	802.11a	14.52	28.31

5250 to 5350 MHz Authorized Band

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5250 - 5320	802.11a	17.01	50.23

### 6.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA Stamped metal antenna manufactured by Hitachi Cable, Ltd., which has a maximum gain of 5.6dBi at 5 GHz band

### 6.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was BCM94311, version. 3.100.53.0

The test utility software used during testing was wl\_tools.

## 6.6. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output powers were at 5300 MHz for 11a.

The worst-case data rate for this channel is determined to be 6 Mb/s for 11a mode based on previous experience with WLAN product design architectures.

### WORSRT-CASE POWER AND BIT RATE SETTING

The following power in the packet (dBm) was tuned during test at the worst case data rates detailed.

#### 802.11a - 5.2 GHz UNII BAND

CHANNEL	36	40	52	60	64
(MHz)	5180	5200	5260	5300	5320
Band Edge /Peak Excursion (dBm)	14.5	14.5	X	17	16.5
Emission (dBm)	17	x	17	x	17*
Peak Power / PSD (dBm)	14.5	14.5	17	17	16.5
Bit Rate (Mbps)	54 Mbps for Peak reading & 6 Mbps for Average reading				

**\*NOTE:**

For the rest of the RF Conducted and Radiated Emission tests, channel 64 is set to 17dBm for worst case power to cover all high channels\_Channel 60 (17dBm), and Channel 64 (16.5dBm)

## 6.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	Pavilion dv4030us	CNE52005T6	DoC
AC Adapter	HP	PPP0009S	CT 57BC30AU4RO0L0	DoC
Extended Card	ADEXELEC	PEX1-MINI	01/01/1900	N/A

### I/O CABLES

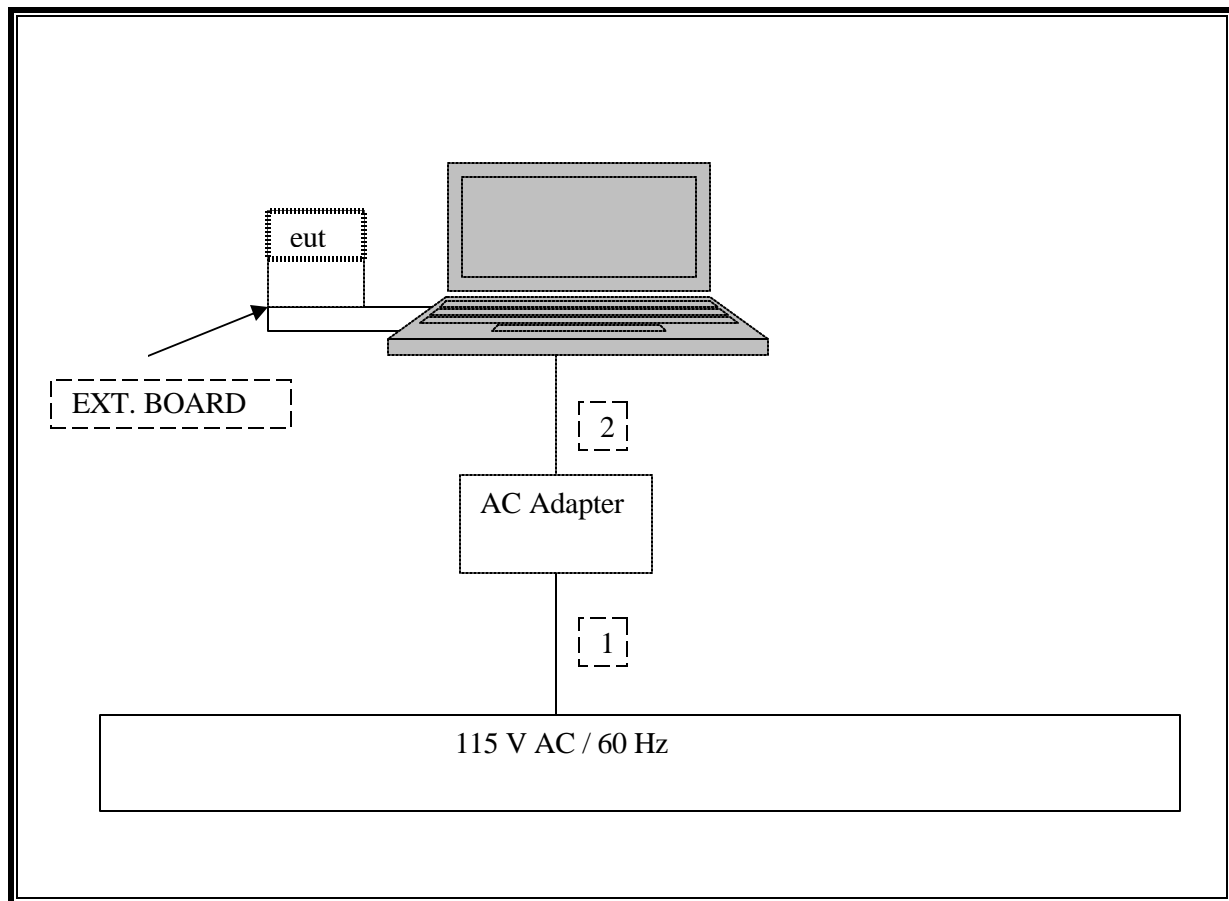
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC Power	1	AC power	Unshielded	1.5 m	N/A
2	DC Power	1	DC Power	Unshielded	1.5 m	N/A

### TEST SETUP

The EUT is installed in a host laptop computer via a card bus-to-mini PCI adapter / extension board during the tests. Test software exercised the radio card.



**SETUP DIAGRAM FOR TESTS**



## 7. 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
EMI Test Receiver	R & S	ESHS 20	827129/006	10/22/2006
Site A Line Stabilizer / Conditioner	Tripplite	LC-1800a	A0051681	CNR
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	08/30/2006
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	10/21/2006
Spectrum Analyzer	HP	E4446A	US42510266	08/25/2006
Antenna, Horn 1 ~ 18 GHz	EMCO	3117	29310	09/12/2006
Antenna, Horn 18 ~ 26 GHz	ARA	SWH-28	1007	06/02/2006
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	12/03/2006
Preamplifier, 1 ~ 26.5 GHz	HP	8449B	3008A00369	08/17/2006
PreAmplifier 26-40 GHz	MITEQ	NSP4000-SP2	924343	06/01/2006
Peak Power Meter	Agilent	E4416A	GB41291160	11/07/2006
Peak / Average Power Sensor	Agilent	E9327A	US40440755	11/07/2006
RF Filter Section	HP	85420E	3705A00256	11/21/2006
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	11/21/2006
Bilog Antenna 30MHz---- 2Ghz	Sunol Sciences	JB1 Antenna	A121003	12/22/2006
7.6 GHz High Pass Filter	Micro Tronics	HPM13350	1	N/A
5.15 - 5.32 Reject Filter	Micro Tronics	BRC13192	2	N/A

## 8. LIMITS AND RESULTS

### 8.1. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

#### 8.1.1. EMISSION BANDWIDTH

##### LIMIT

§15.403 (i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

##### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

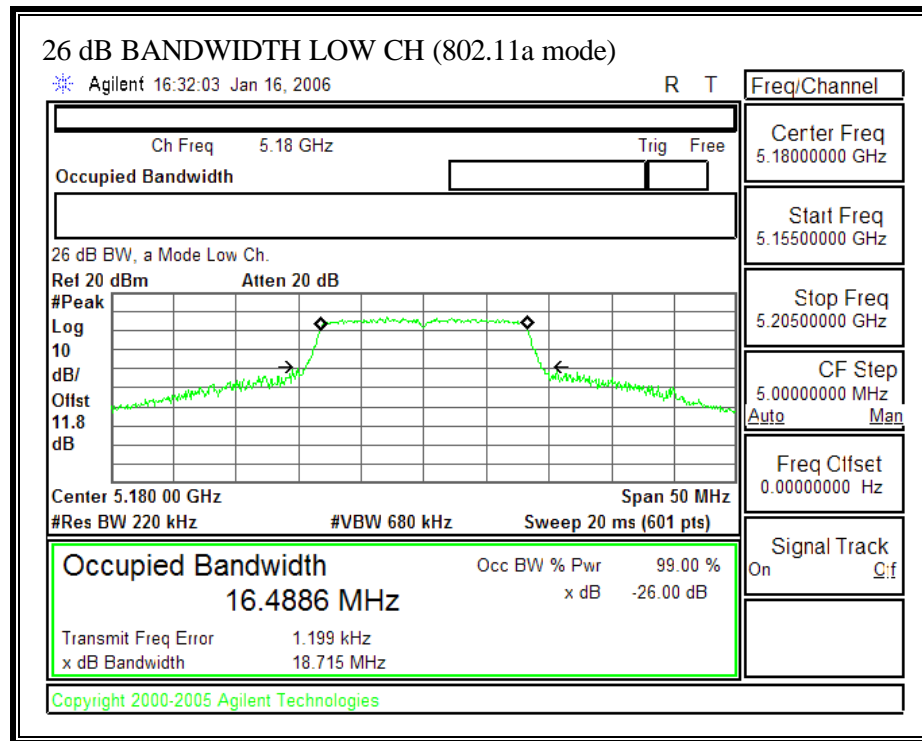
##### RESULTS

No non-compliance noted:

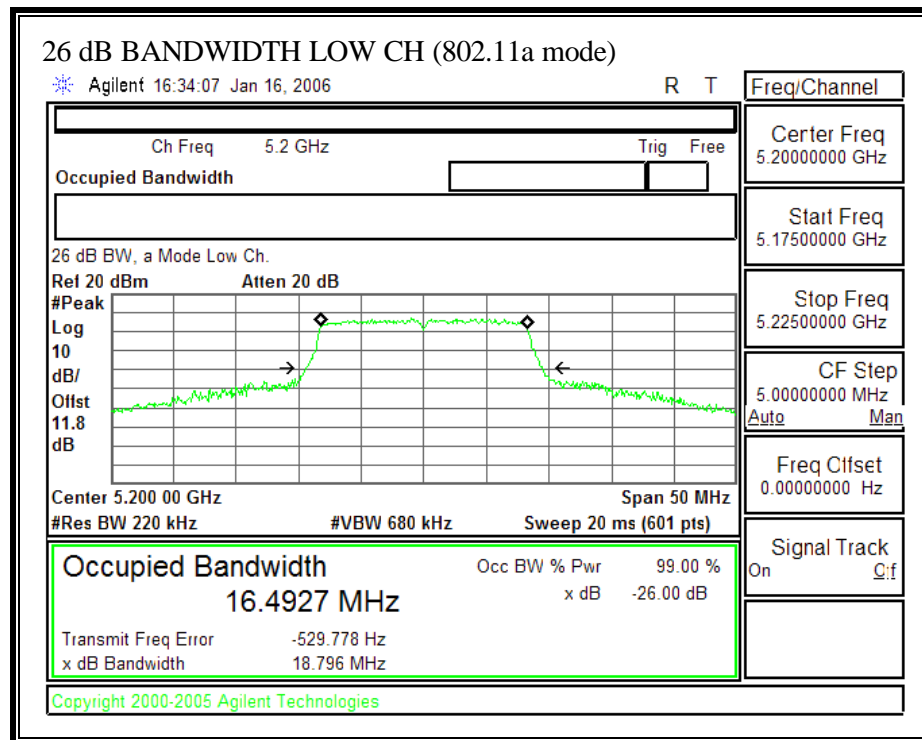
Channel	Frequency (MHz)	B (MHz)	10 Log B (dB)
Low	5180	18.72	12.72
Low	5200	18.80	12.74
Middle	5260	18.88	12.76
High	5300	19.15	12.82
High	5320	18.74	12.73

**26 dB EMISSION BANDWIDTH (802.11a MODE)**

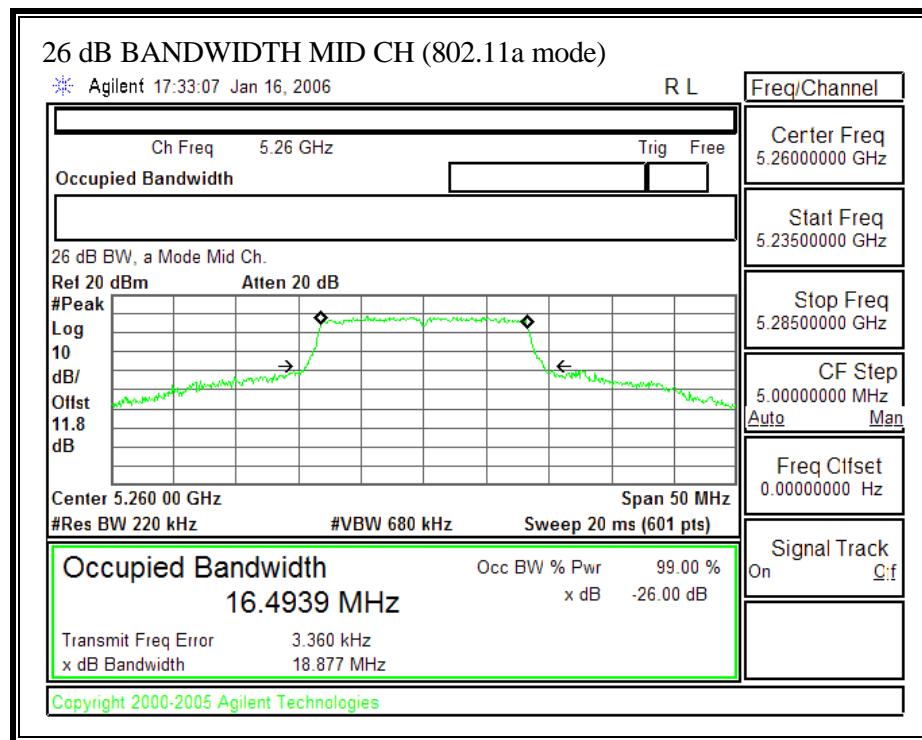
CH 36, 5180 MHz



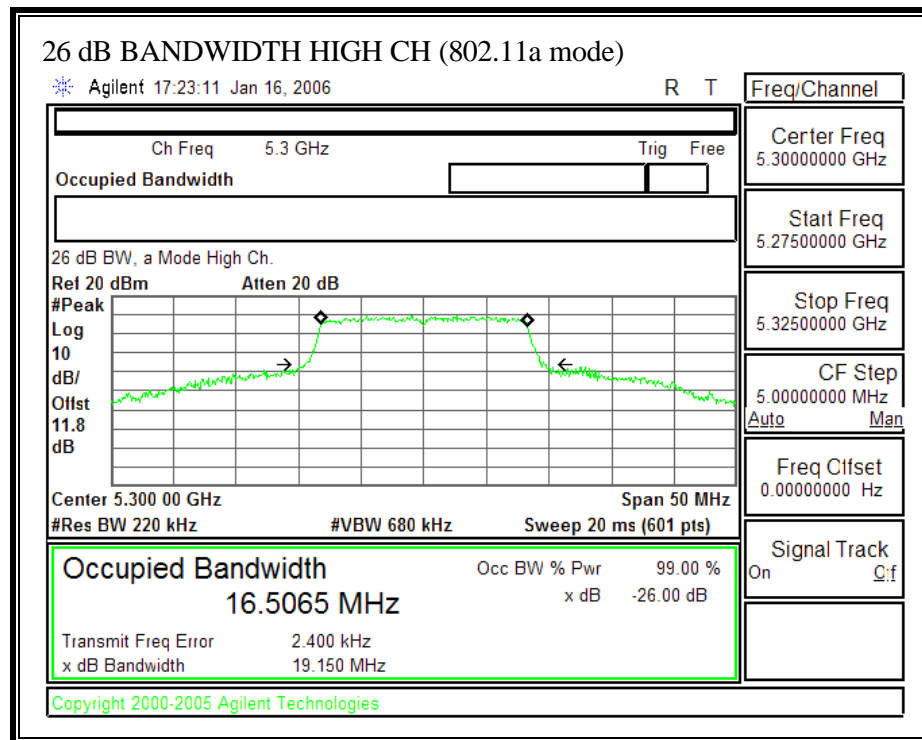
CH 40, 5200 MHz



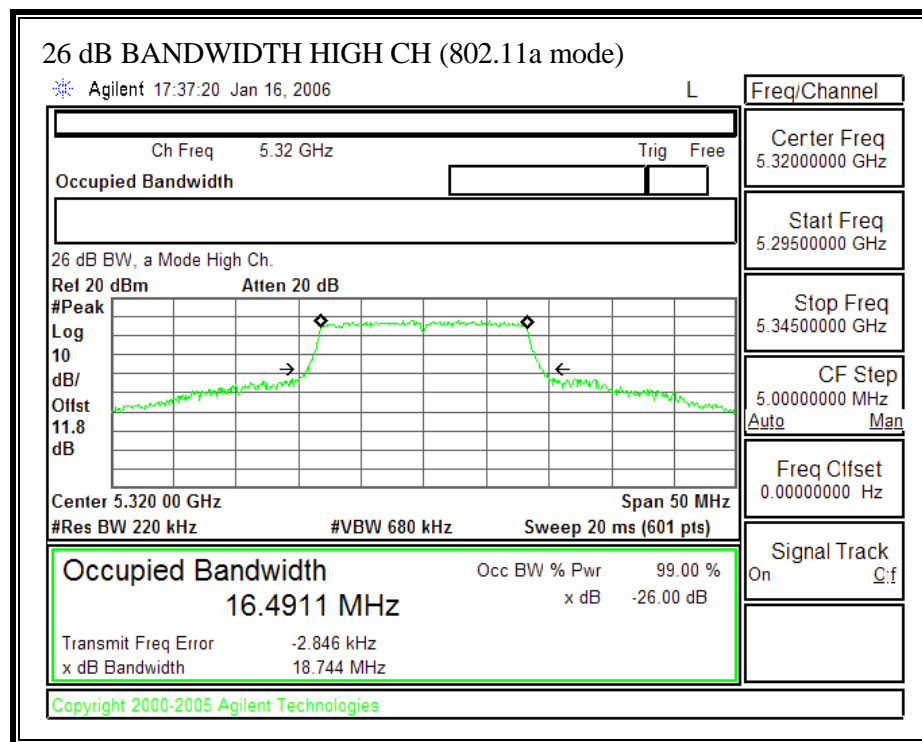
CH 52, 5260 MHz



CH 60, 5300 MHz



CH 64, 5320 MHz





### 8.1.2. PEAK POWER

#### LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**LIMITS AND RESULTS**

No non-compliance noted:

Limit in 5150 to 5250 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	18.72	16.72	5.60	16.72
Low	5200	17	18.80	16.74	5.60	16.74

Limit in 5250 to 5350 MHz Band

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Mid	5260	24	18.88	23.76	5.60	23.76
High	5300	24	19.15	23.82	5.60	23.82
High	5320	24	18.74	23.73	5.60	23.73

Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	14.52	16.72	-2.20
Low	5200	14.30	16.74	-2.44
Mid	5260	16.98	23.76	-6.78
High	5300	17.01	23.73	-6.72
High	5320	16.37	23.73	-7.36

### 8.1.3. 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	4.89/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.

**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  $S = 1.0 \text{ mW/cm}^2$

**RESULTS**

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

Mode	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm <sup>2</sup> )
802.11a	20.0	17.01	6.20	0.04

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.

### 8.1.4. 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 11.4 dB (including 10 dB pad and 1.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

#### 802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	14.64
Low	5200	14.43
Mid	5260	16.75
High	5300	16.73
High	5320	16.24

USING PEAK POWER METER WITH PACKET 54Mbps

### 8.1.5. PEAK POWER SPECTRAL DENSITY

#### LIMIT

§15.407 (a) (1) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

§15.407 (a) (1) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain = 5.6 dBi, therefore there is no reduction due to antenna gain.

#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

## **RESULTS**

No non-compliance noted:

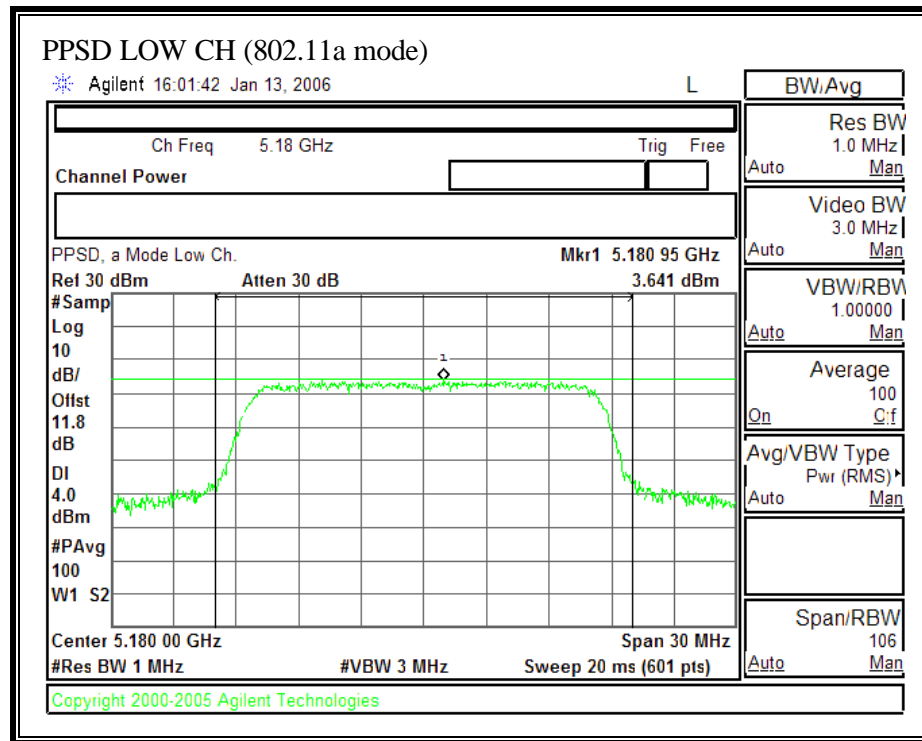
### 802.11a Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.64	4.00	-0.36
Low	5200	3.50	4.00	-0.51
Mid	5260	6.55	11.00	-4.45
High	5300	9.01	11.00	-1.99
High	5320	6.39	11.00	-4.61

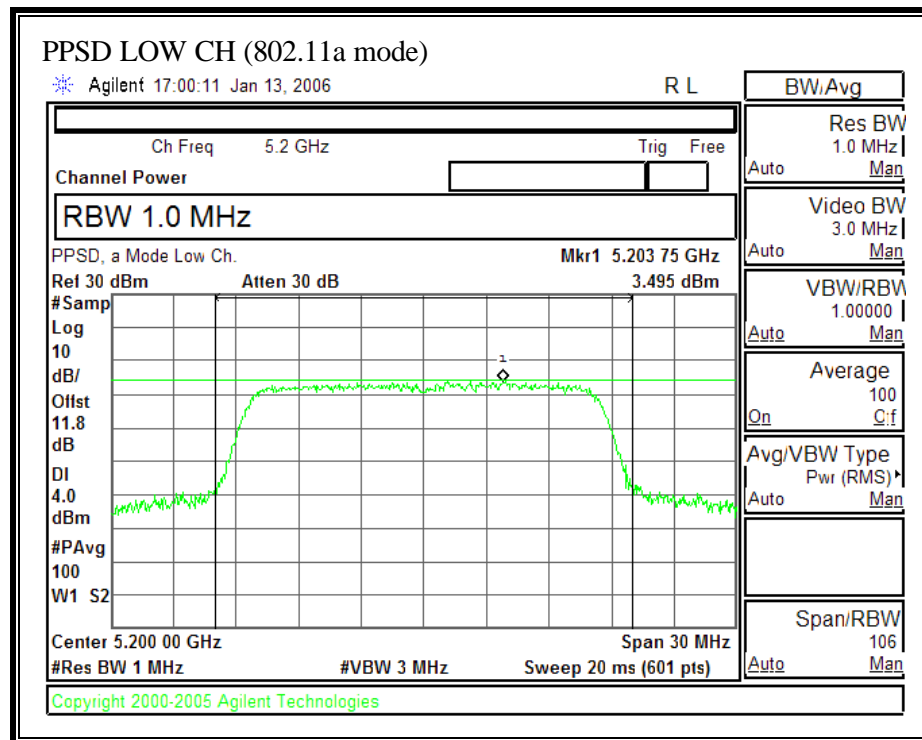


**PEAK POWER SPECTRAL DENSITY (802.11a MODE)**

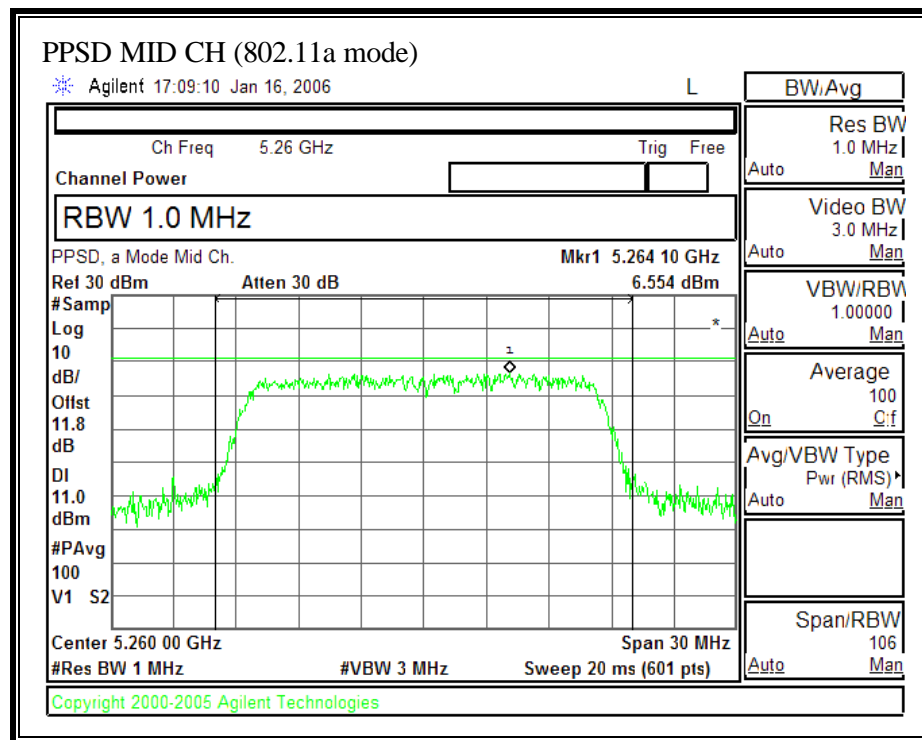
CH 36, 5180 MHz



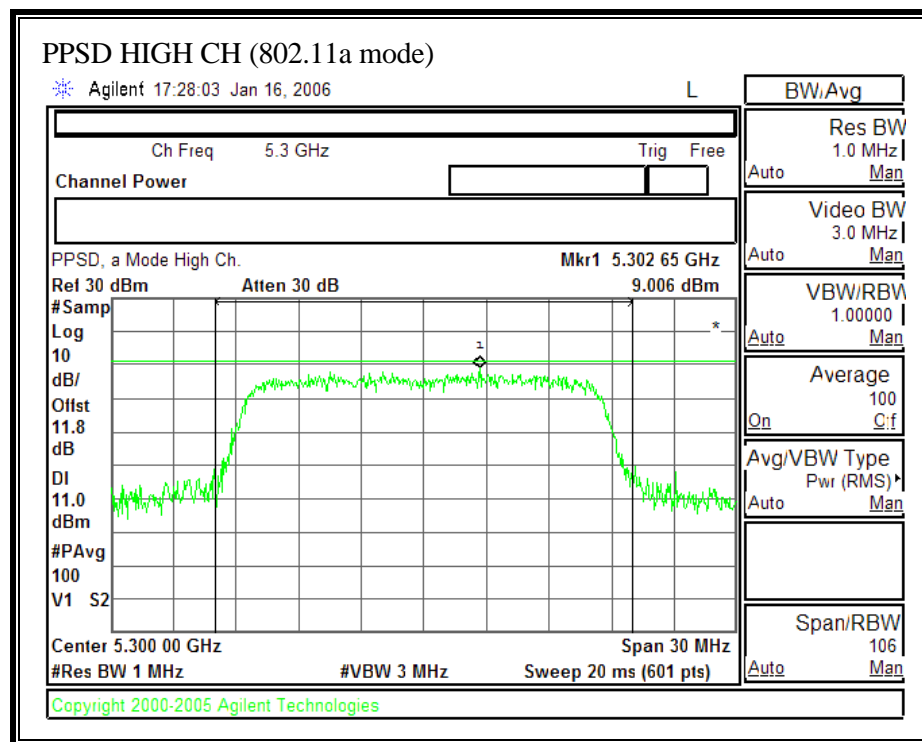
CH 40, 5200 MHz



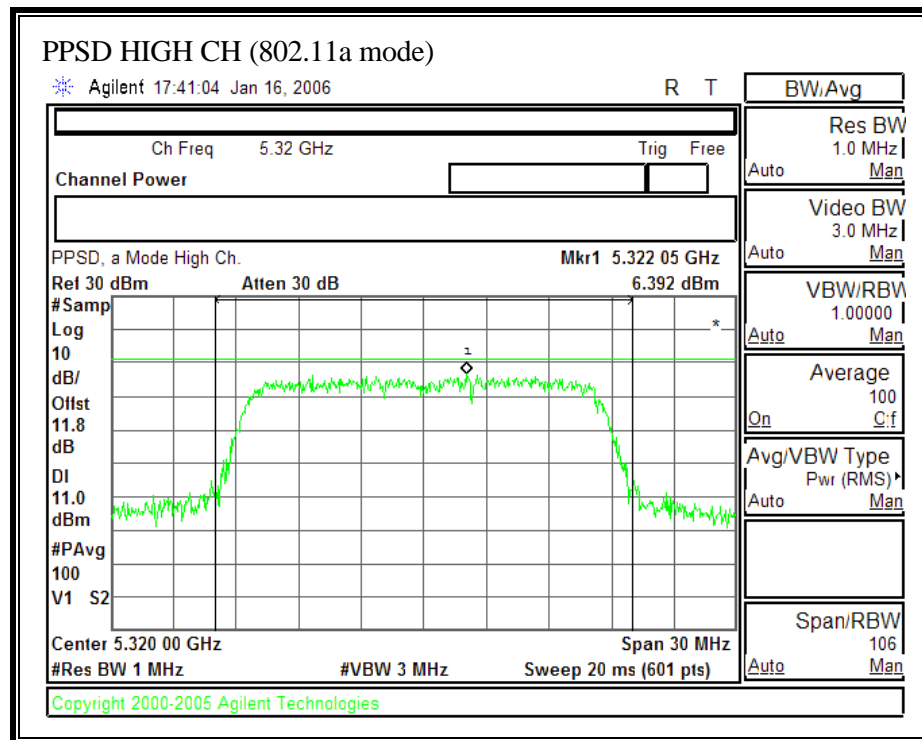
CH 52, 5260 MHz



CH 60, 5300 MHz



CH 64, 5320 MHz



### 8.1.6. PEAK EXCURSION

#### LIMIT

§15.407 (a) (6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

#### RESULTS

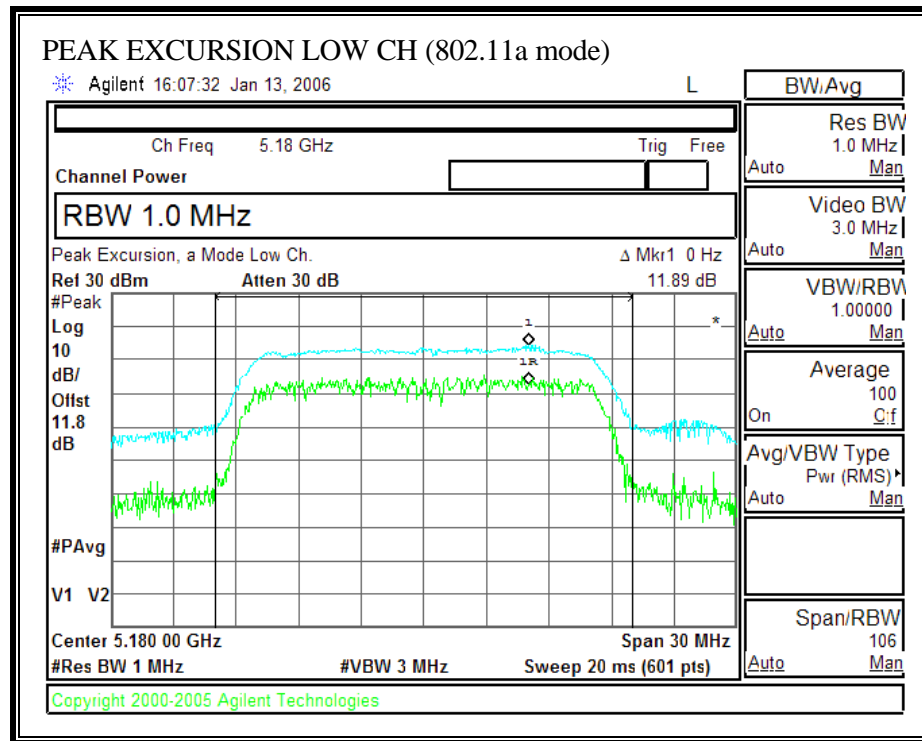
No non-compliance noted:

802.11a Mode

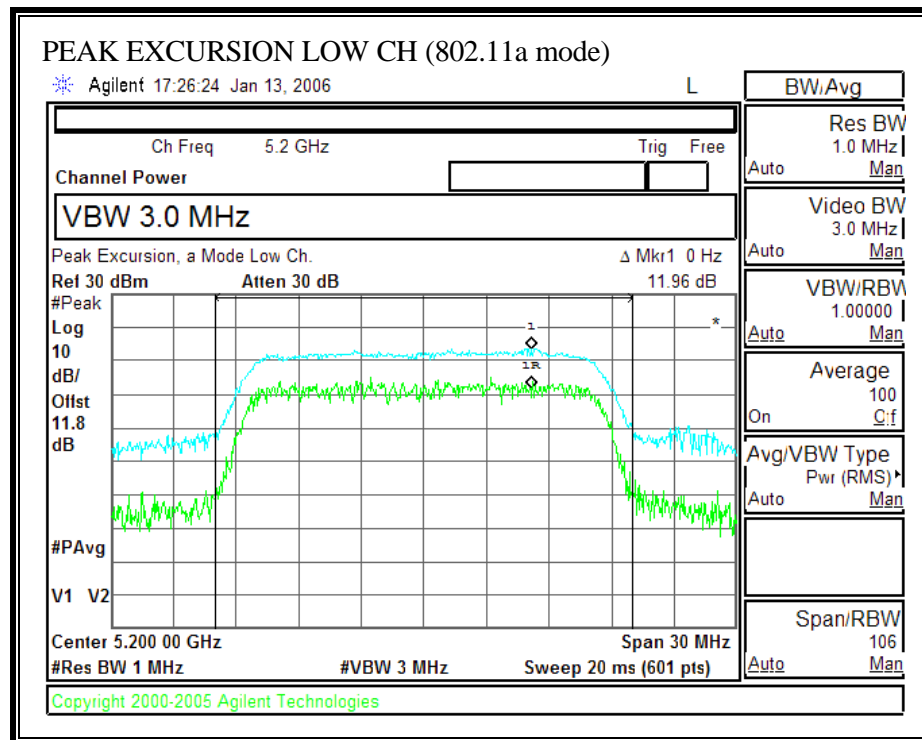
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	11.89	13	-1.11
Low	5200	11.96	13	-1.04
Middle	5260	11.39	13	-1.61
High	5300	11.37	13	-1.63
High	5320	11.82	13	-1.18

**PEAK EXCURSION (802.11a MODE)**

CH36, 5180 MHz

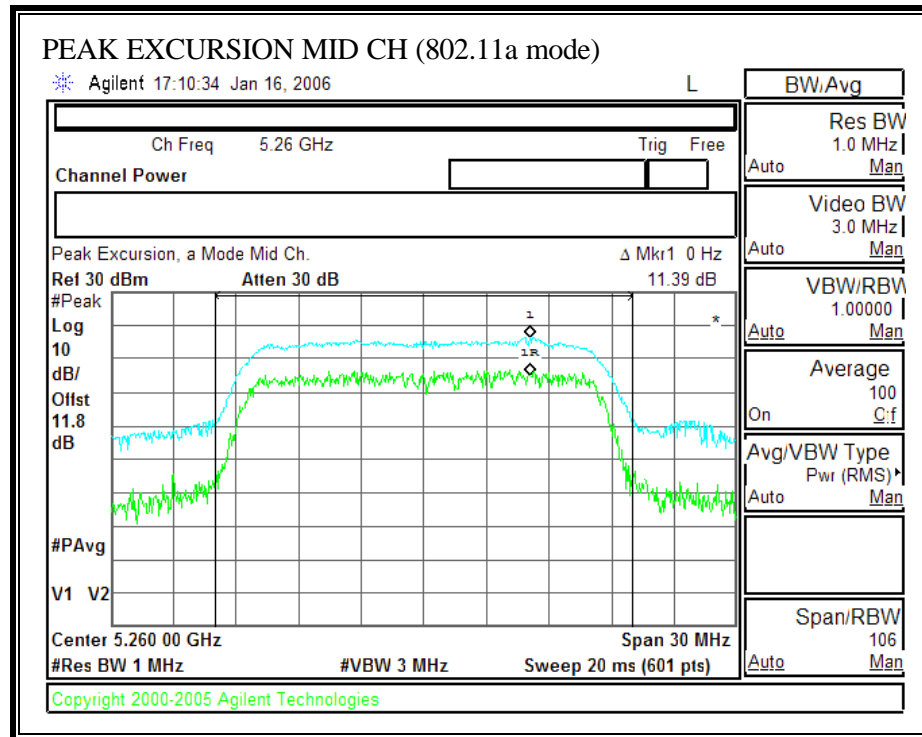


CH40, 5200 MHz

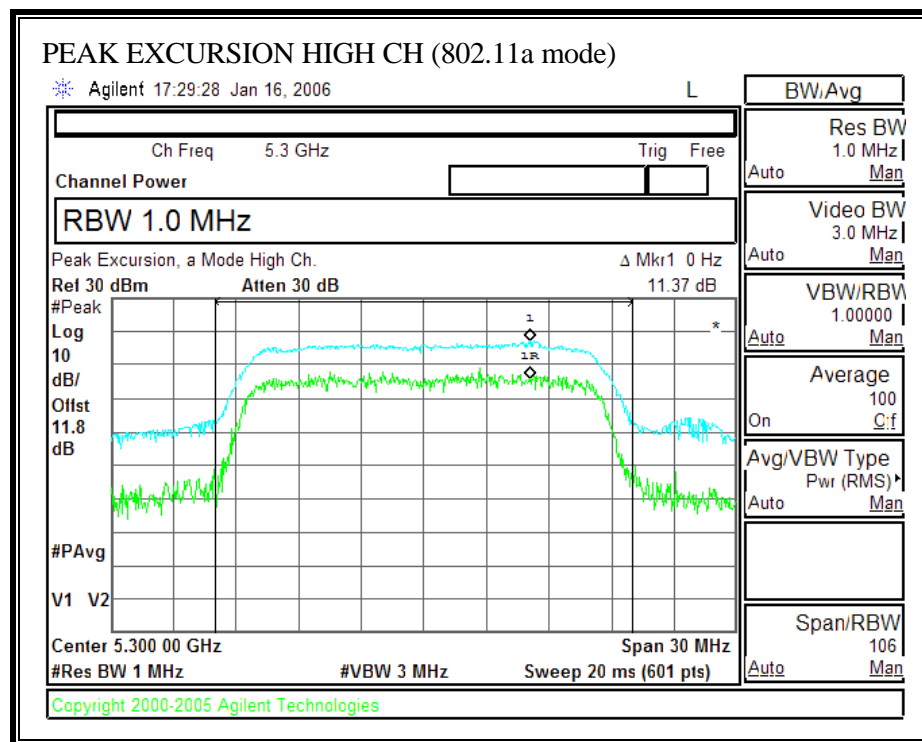




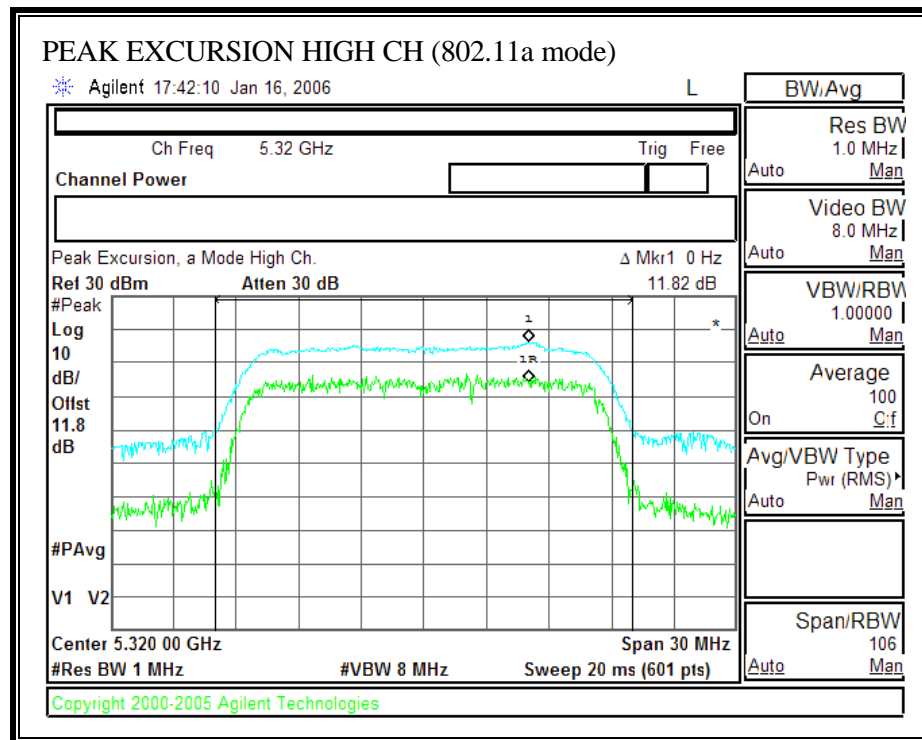
CH 52, 5260 MHz



CH 60, 5300 MHz



CH 64, 5320 MHz



## 8.1.7. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

§15.407 (b) (1 & 2) For transmitters operating in the 5.15-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm / MHz.

### TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to the average EIRP limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

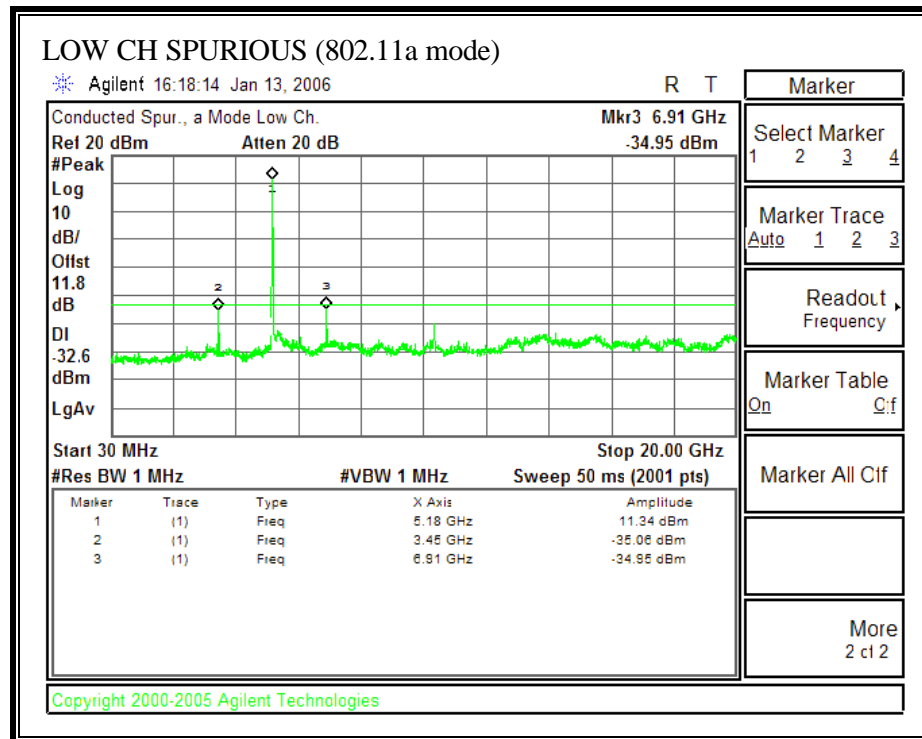
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

### RESULTS

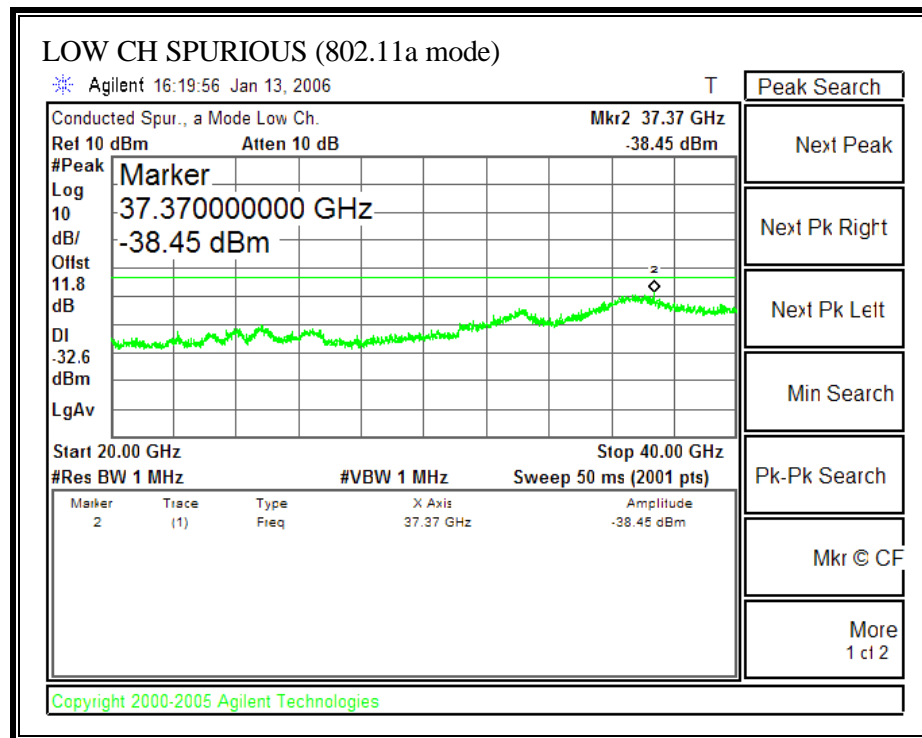
No non-compliance noted:

**SPURIOUS EMISSIONS (802.11a MODE)**

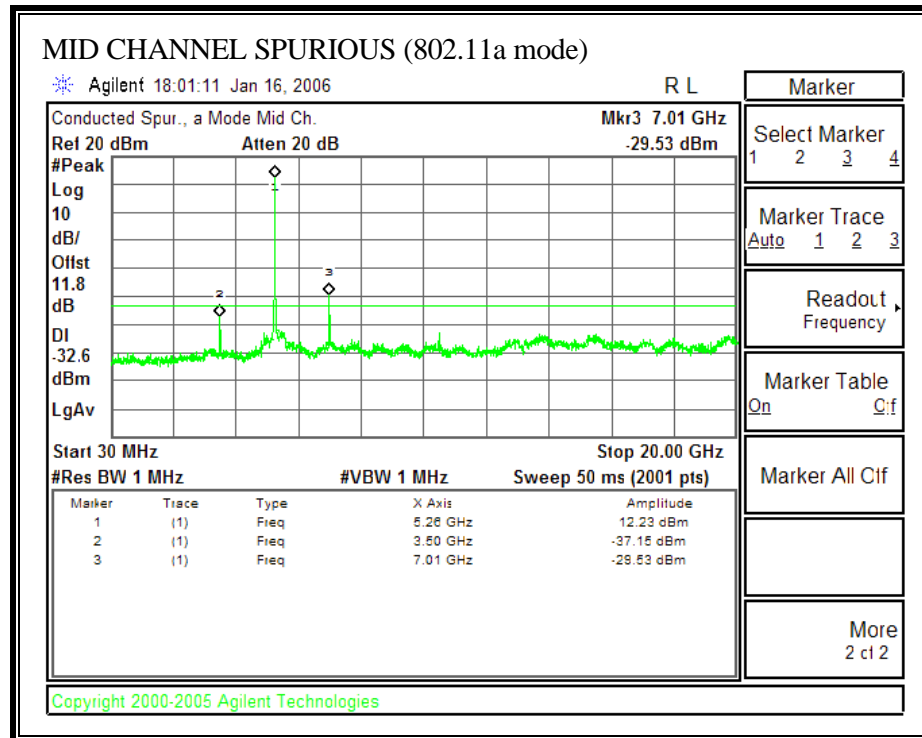
CH 36, 5180 MHz \_ 30 MHz TO 20 GHz



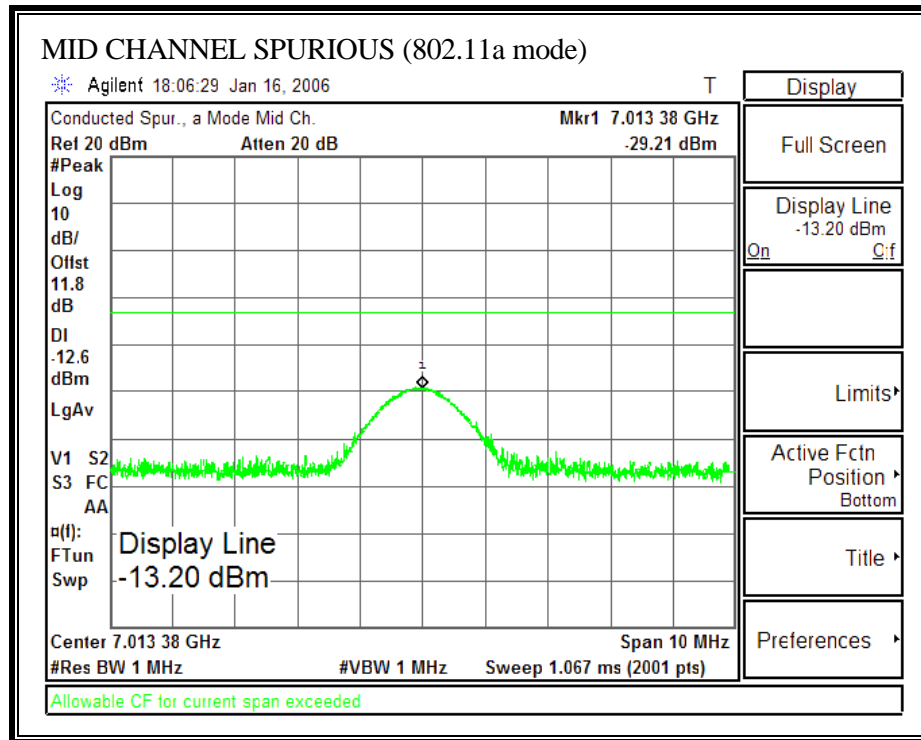
CH 36, 5180 MHz \_ 20 GHz TO 40 GHz



MID CH 52, 5260 MHz \_ 30 MHz TO 20 GHz

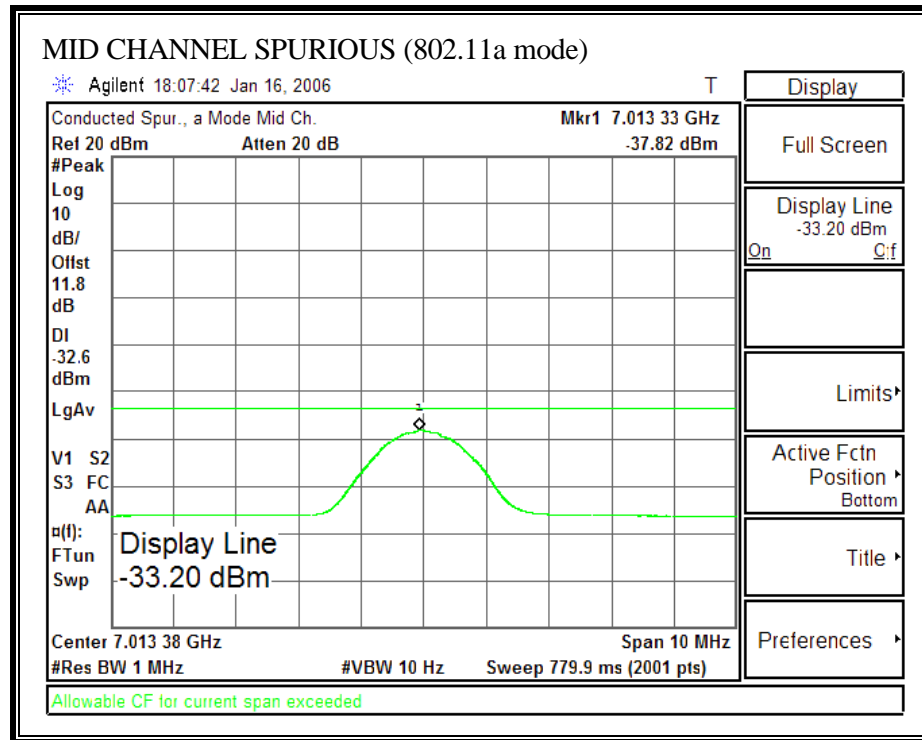


MID CH 52, 5260 MHz \_ 30 MHz TO 20 GHz  
Zoom in at highest Spurious\_Peak

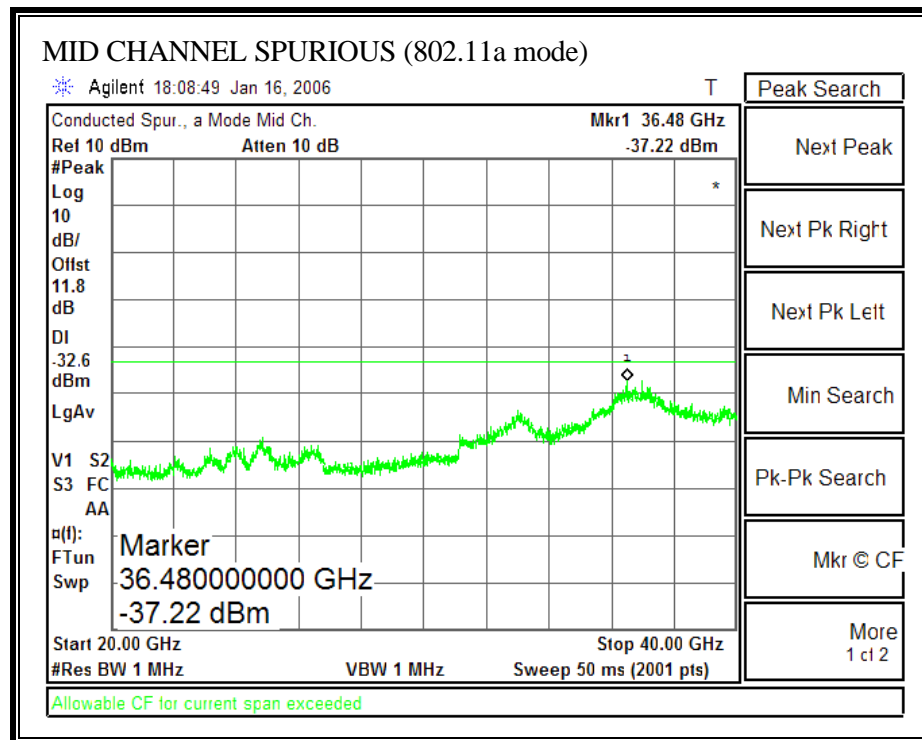




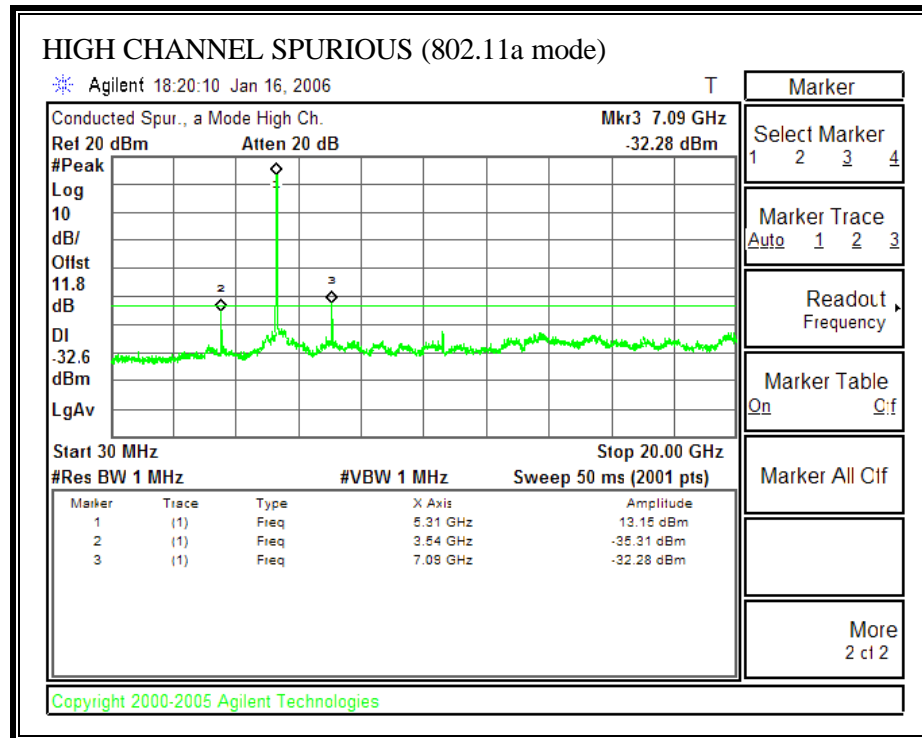
MID CH 52, 5260 MHz \_ 30 MHz TO 20 GHz  
Zoom in at highest Spurious Average



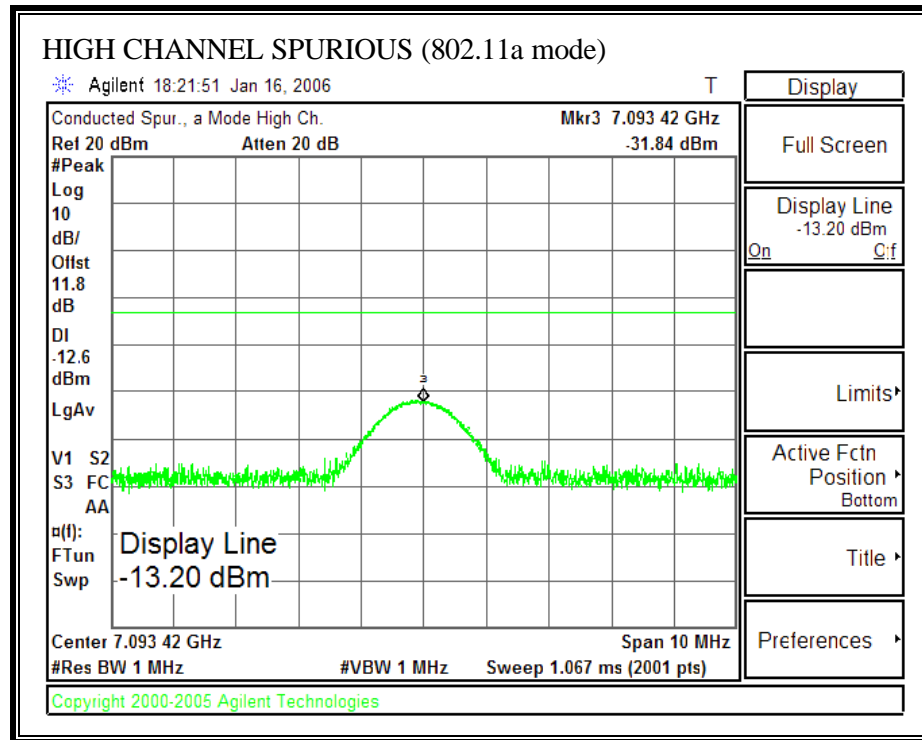
MID CH 52, 5260 MHz \_ 20 GHz TO 40 GHz



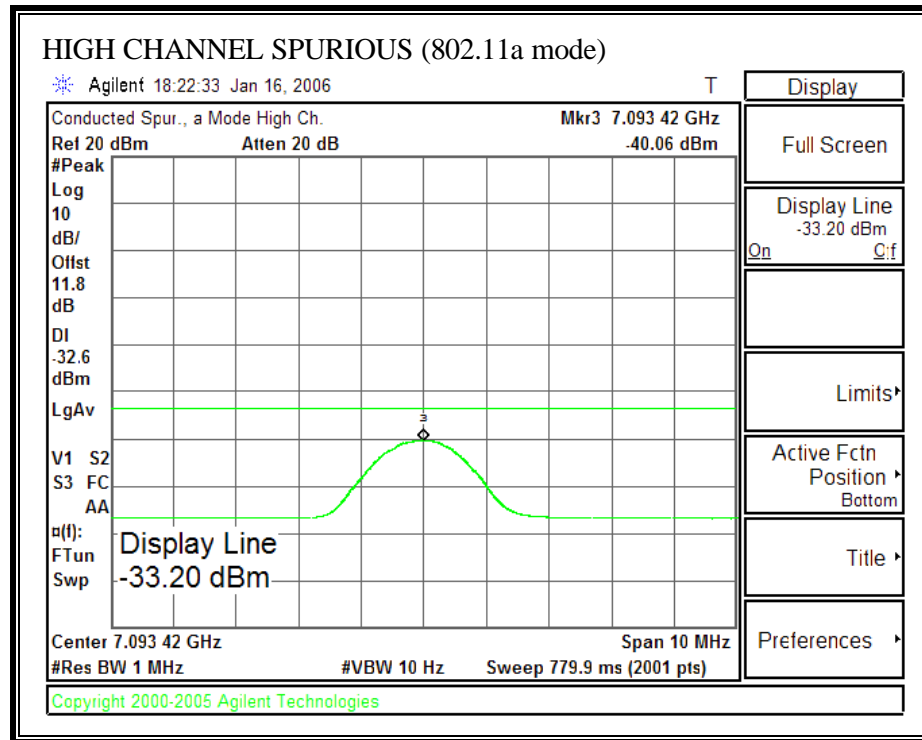
HI CH 64, 5320 MHz \_ 30 MHz TO 20 GHz



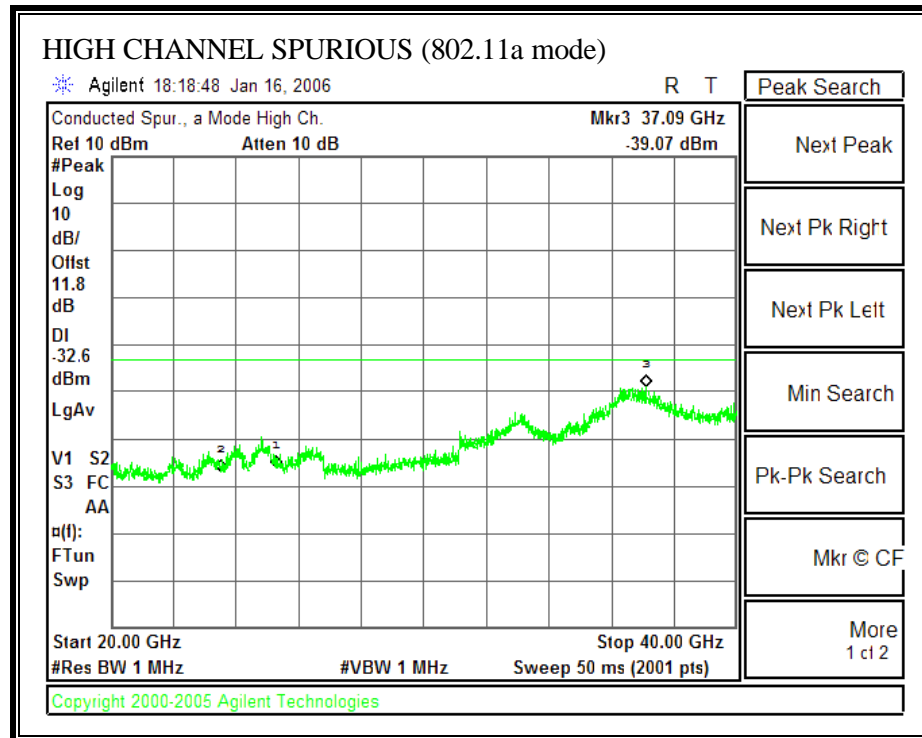
HI CH 64, 5320 MHz \_ 30 MHz TO 20 GHz  
Zoom in at highest Spurious\_Peak



HI CH 64, 5320 MHz \_ 30 MHz TO 20 GHz  
Zoom in at highest Spurious Average



HI CH 64, 5320 MHz \_ 20 GHz TO 40 GHz



## 8.2. RADIATED EMISSIONS

### 8.2.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### LIMITS

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

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<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			

<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**

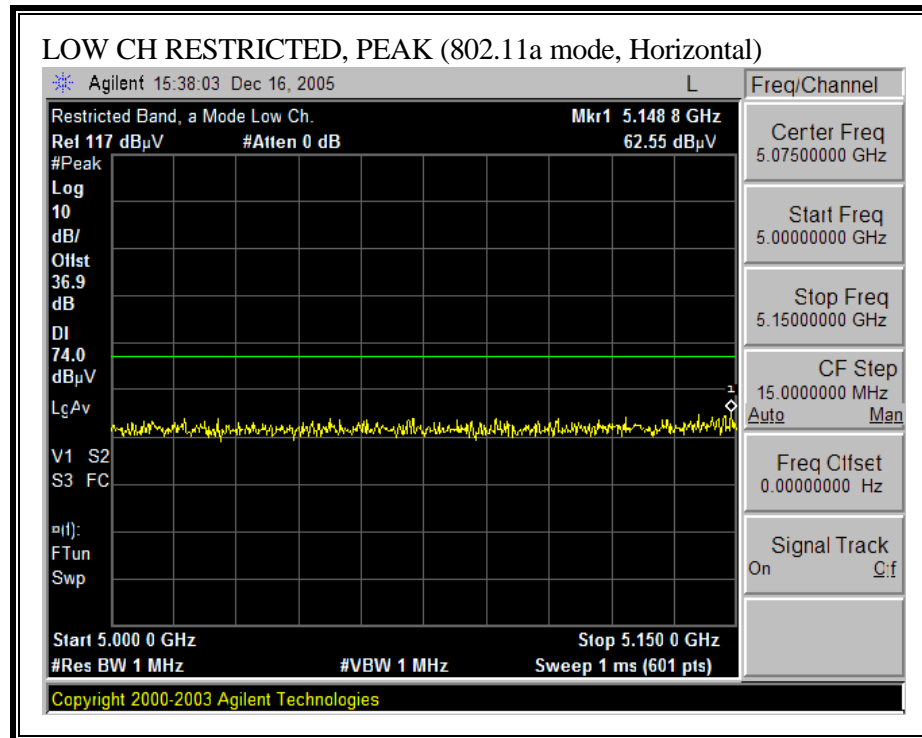
The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

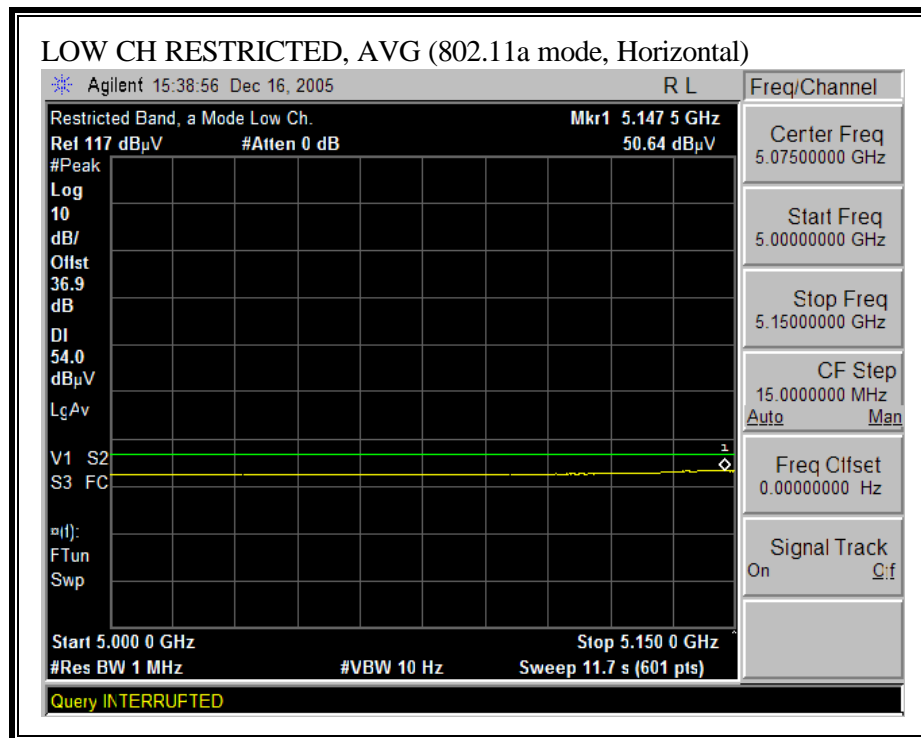
For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

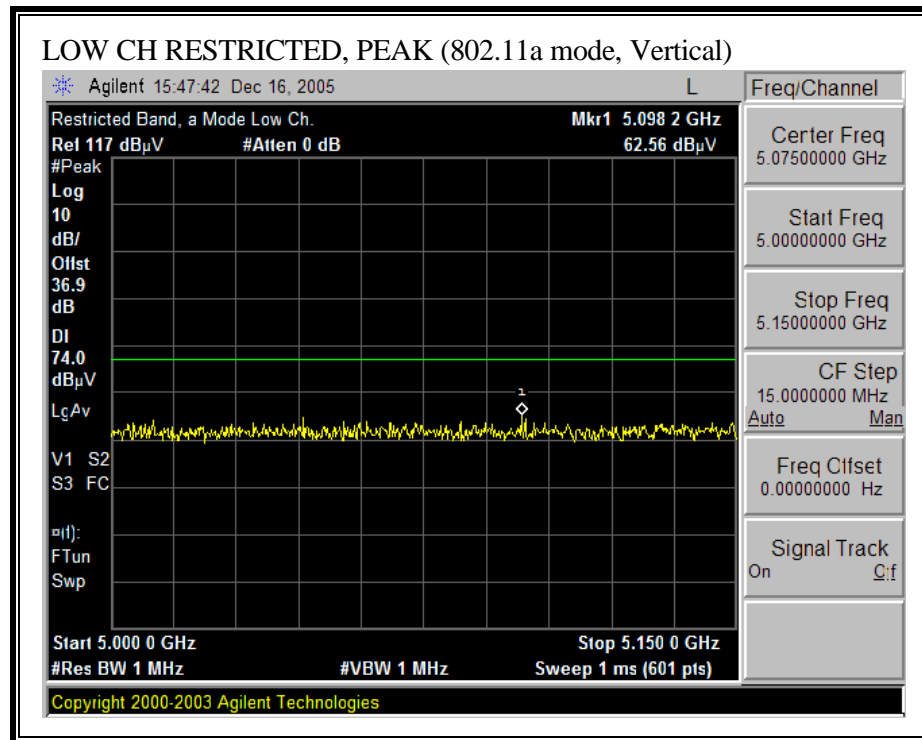
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

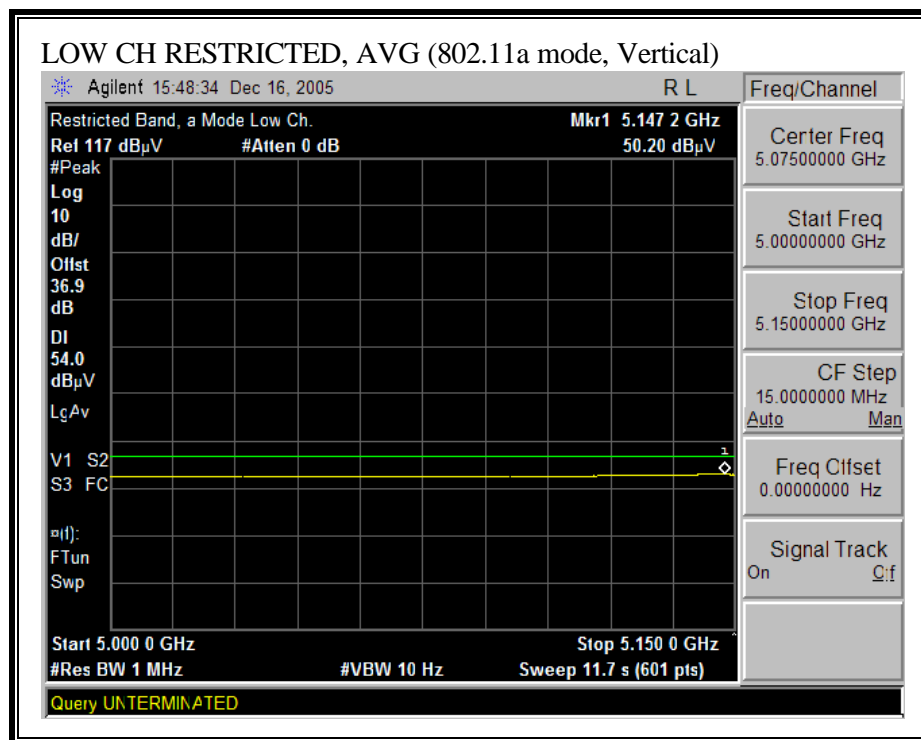
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

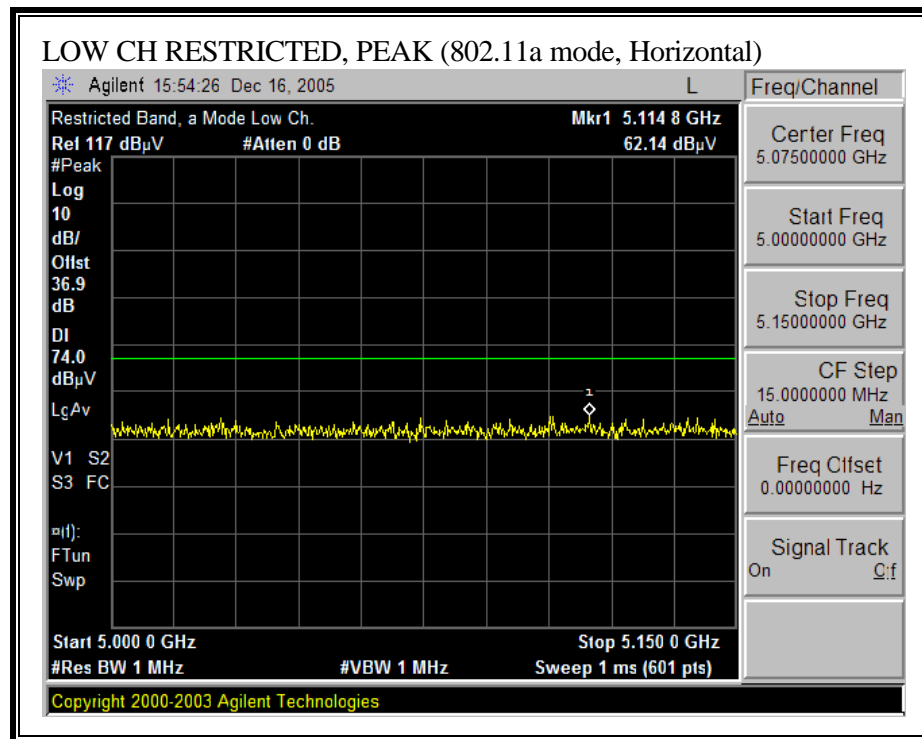
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

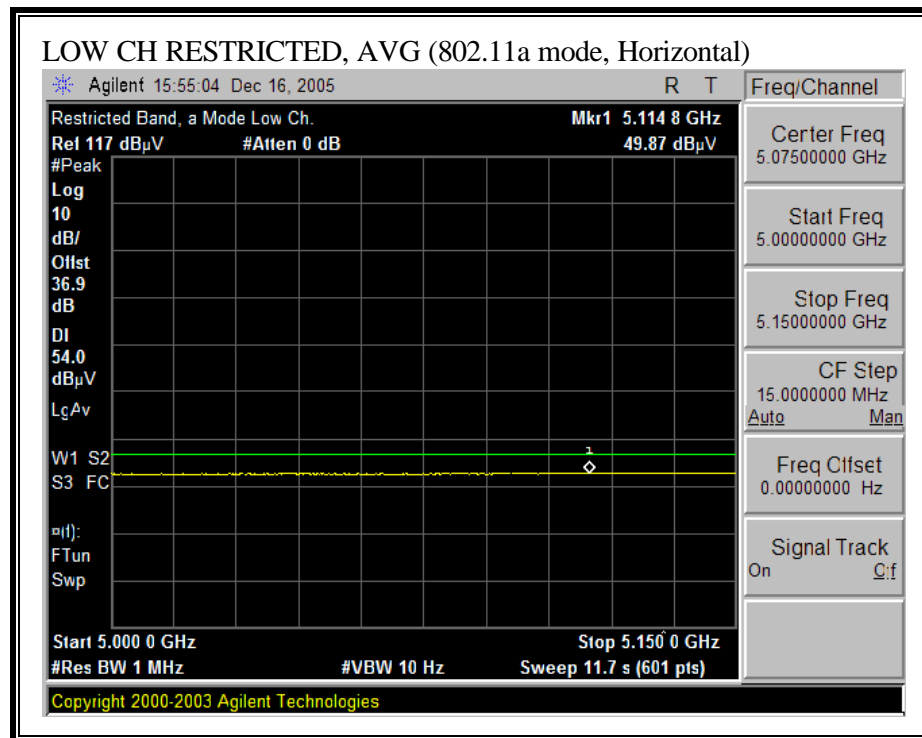
**8.2.2. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND****CHANNEL 36, 5180 MHz****RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)**

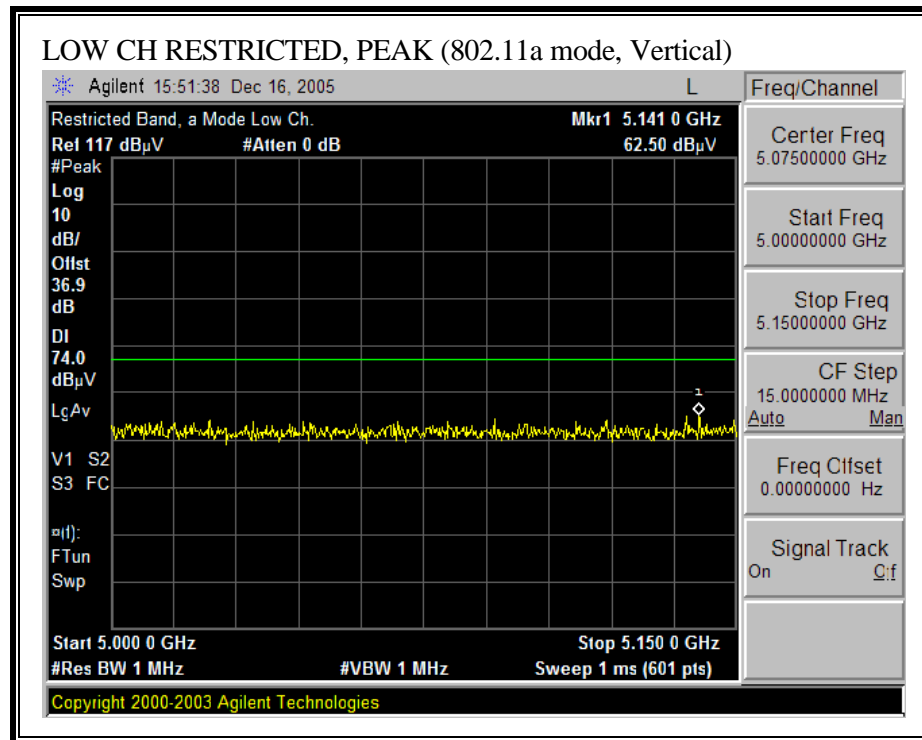


**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

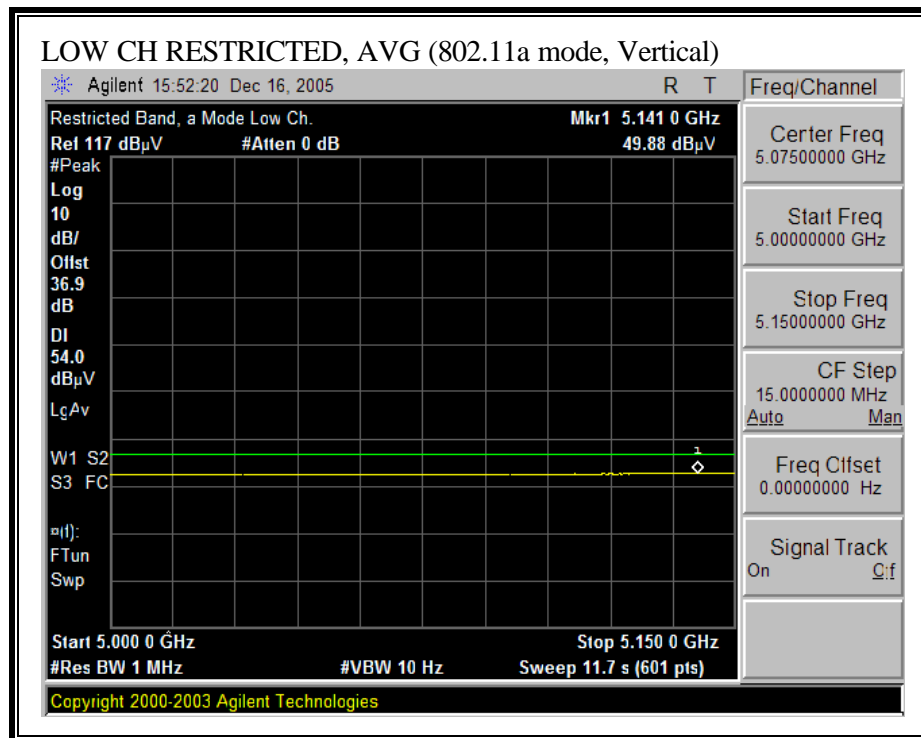


**CHANNEL 40, 5200 MHz****RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)**



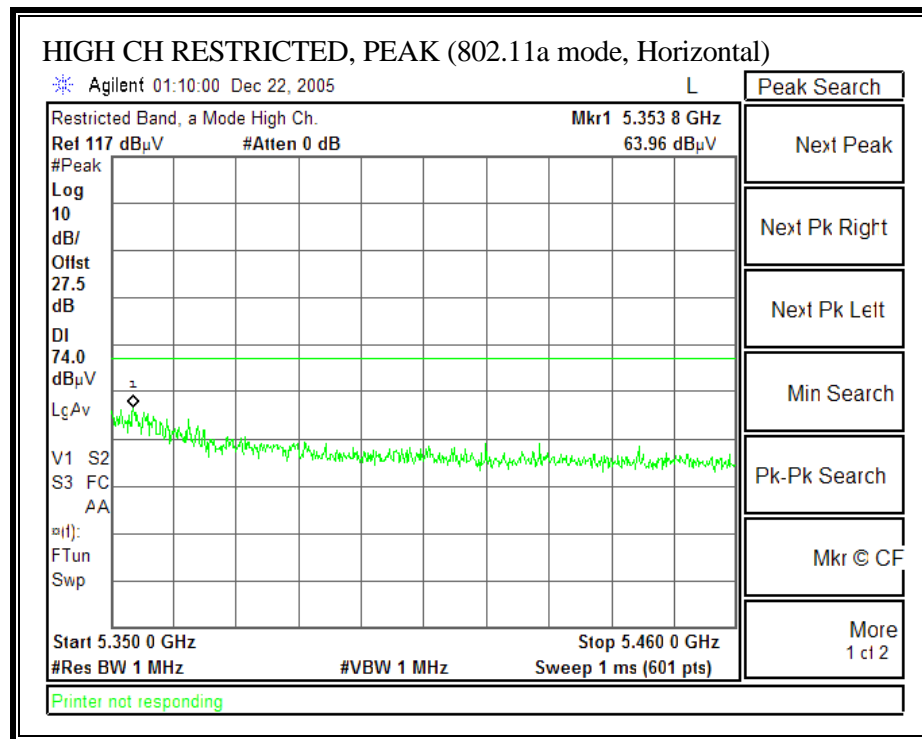
**RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)**

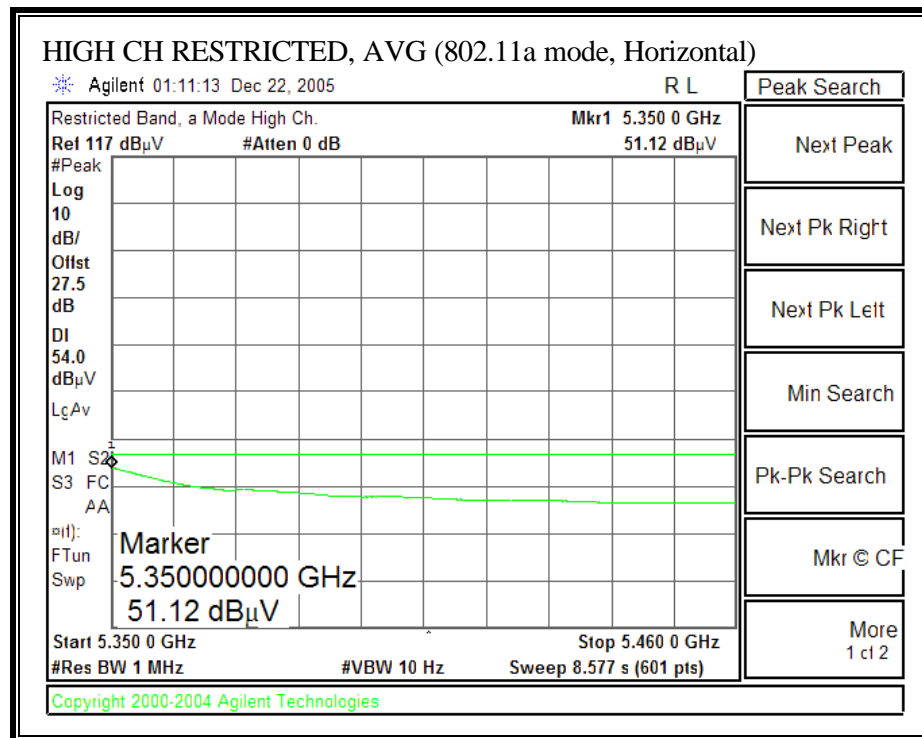


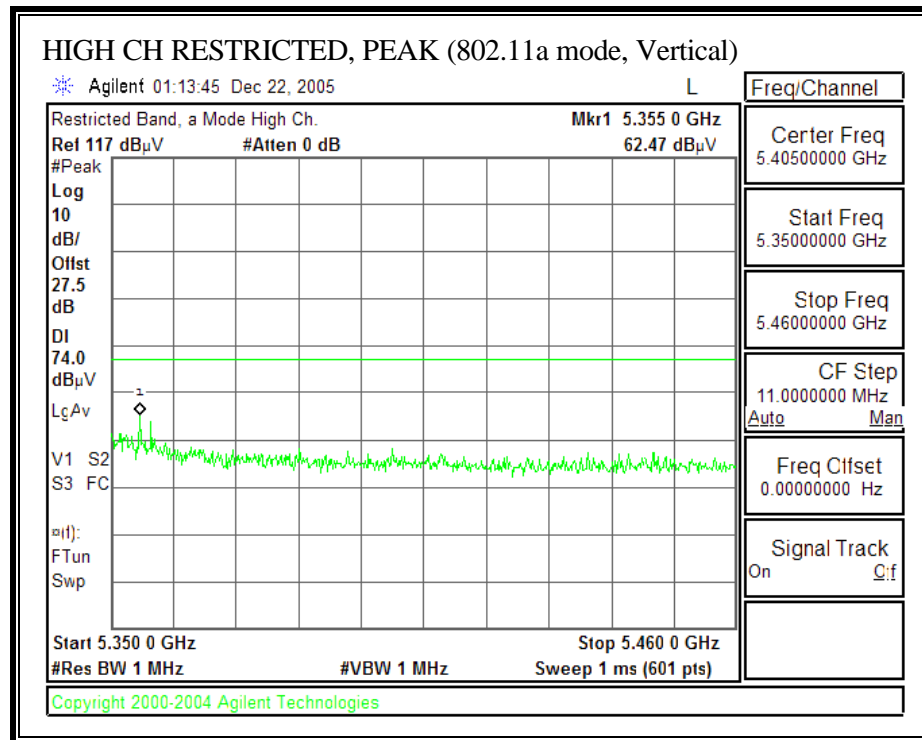


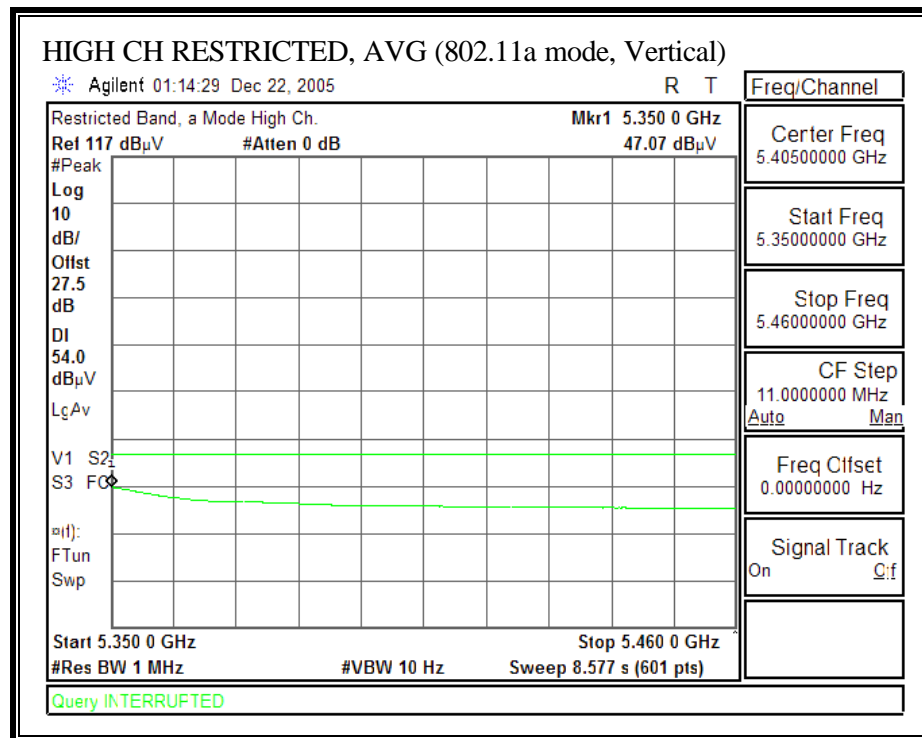
**CHANNEL 60, 5300 MHz**

**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)**



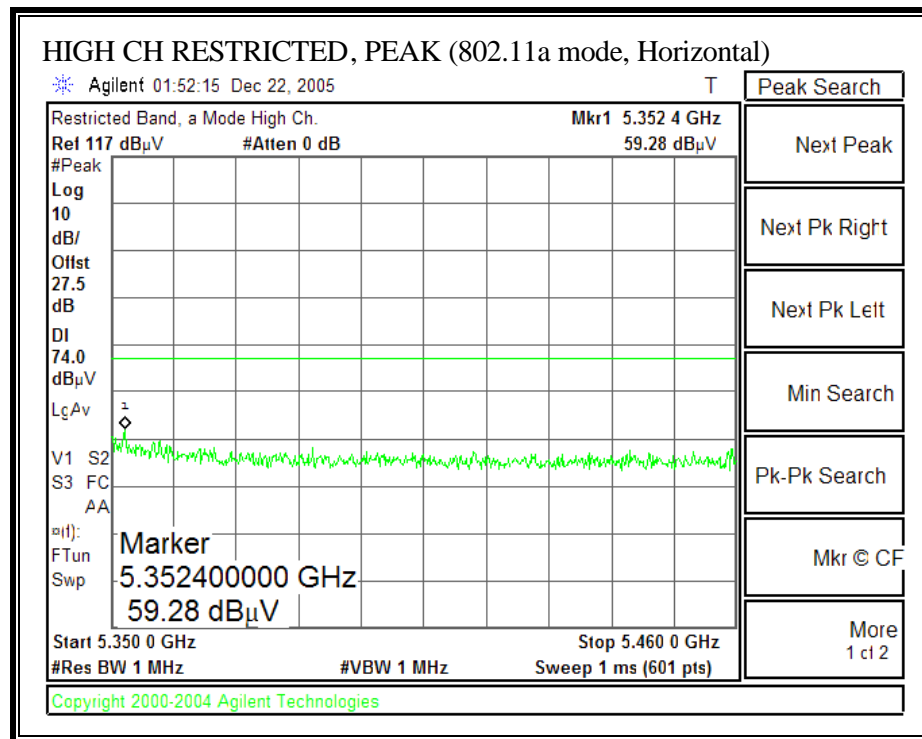


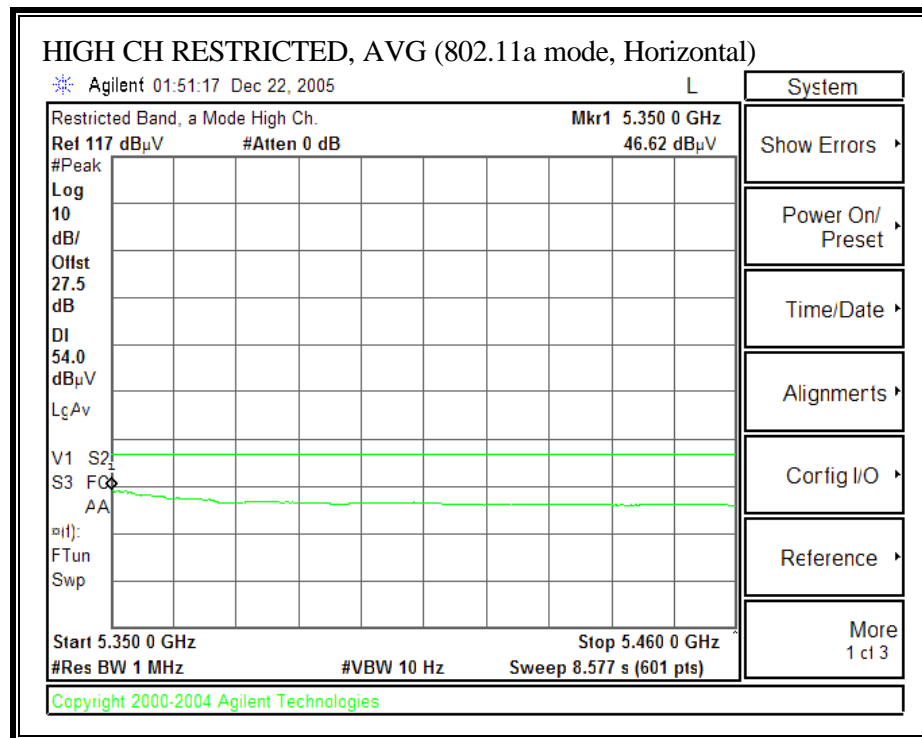
**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)**

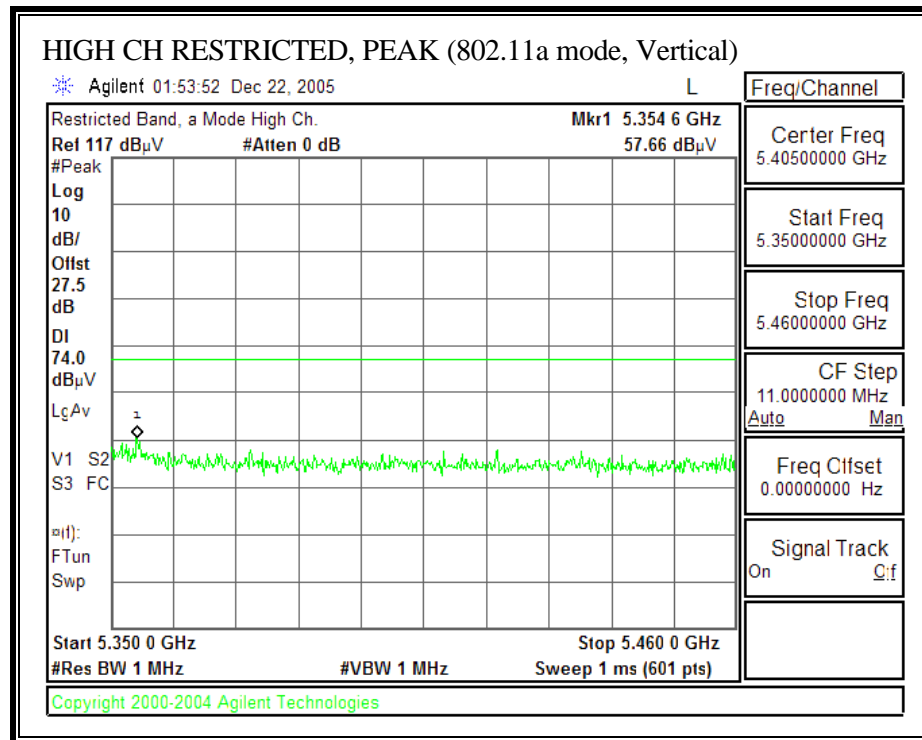


**CHANNEL 64, 5320 MHz**

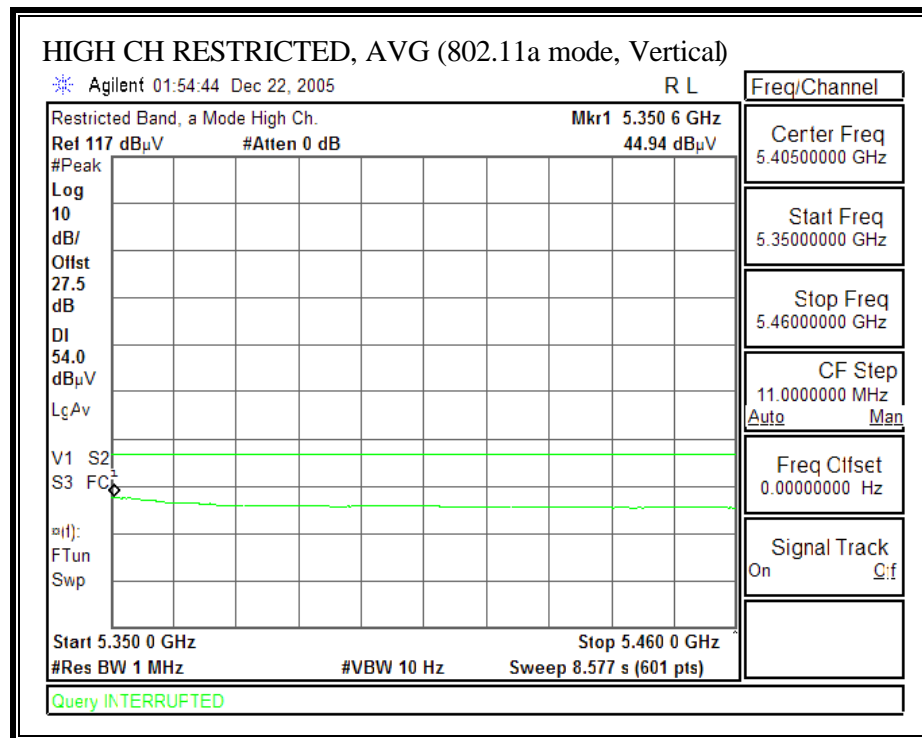
**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)**





**RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, VERTICAL)**





# HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

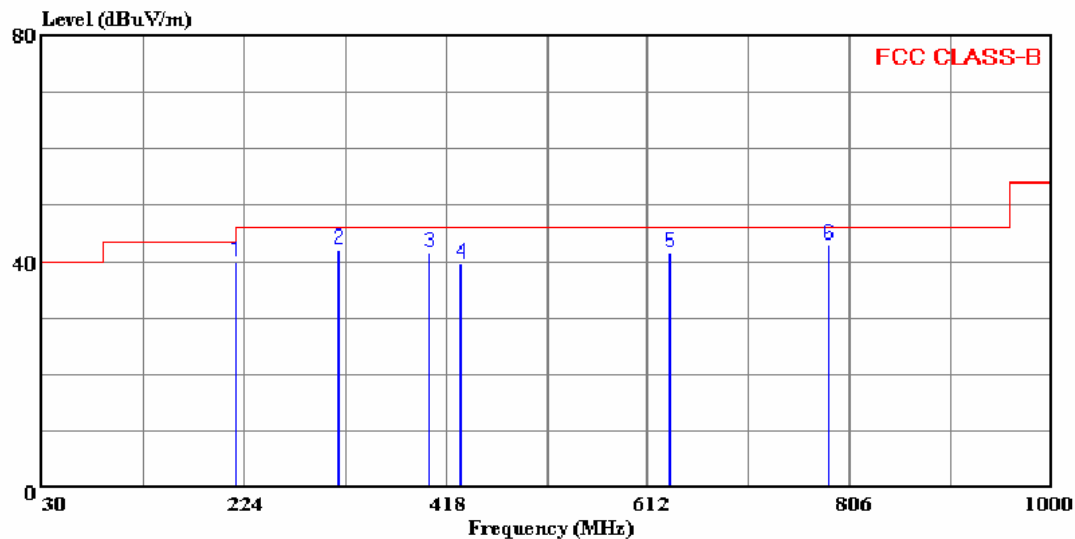
12/23/05 High Frequency Measurement															
Compliance Certification Services, Morgan Hill Open Field Site															
Test Engr: Vien Tran															
Project #:05U3891															
Company: Broadcom															
EUT Descrip.:802.11 abg WLAN PCI-E Mini Card															
EUT M/N:BCM94311MCAG															
Test Target:FCC 15.407															
Mode Oper:TX, 5.2GHz															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T73; S/N: 6717 @3m		T34 HP 8449B				T39-T88 ARA 18-40GHz & Mixer > 40GHz		FCC 15.205							
Hi Frequency Cables															
2 foot cable		3 foot cable		12 foot cable		HPF		Reject Filter		Peak Measurements		Average Measurements			
		Vien 187215002		Vien 197209005		HPF_7.6GHz		R_001		RBW=VBW=1MHz		RBW=1MHz ; VBW=10Hz			
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch, 5180MHz Average=17dBm															
15.540	3.0	44.7	34.2	39.6	5.8	-32.2	0.0	0.7	58.6	48.1	74	54	-15.4	-5.9	V
15.540	3.0	45.6	34.1	39.6	5.8	-32.2	0.0	0.7	59.5	48.0	74	54	-14.5	-6.0	H
Mid ch, 5260MHz Average=17dBm															
15.780	3.0	44.9	33.6	39.2	5.8	-32.2	0.0	0.7	58.4	47.1	74	54	-15.6	-6.9	V
15.780	3.0	44.3	33.5	39.2	5.8	-32.2	0.0	0.7	57.8	47.0	74	54	-16.2	-7.0	H
High Ch, 5320MHz Average=17dBm															
10.640	3.0	51.7	40.1	38.0	4.8	-32.6	0.0	0.8	62.6	51.0	74	54	-11.4	-3.0	V
15.960	3.0	45.4	33.6	38.9	5.9	-32.1	0.0	0.7	58.7	46.9	74	54	-15.3	-7.1	V
10.640	3.0	52.7	41.5	38.0	4.8	-32.6	0.0	0.8	63.6	52.3	74	54	-10.4	-1.7	H
15.960	3.0	44.7	33.5	38.9	5.9	-32.1	0.0	0.7	58.0	46.8	74	54	-16.0	-7.2	H
Note: No other emissions were detected above the system noise floor.															
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit										
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit										
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit										
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit										
CL	Cable Loss	HPF	High Pass Filter												

**8.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz****SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)****HORIZONTAL PLOT**

561F Monterey Road  
Morgan Hill, CA 95037  
Tel: (408) 463-0888  
Fax: (408) 463-0885

Data#: 13 File#: 3891.emi

Date: 12-19-2005 Time: 12:01:02



(Auxiliary ATC)

Trace:

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL

Test Operator: : Vien Tran

Project #: : 05u3891

Company: : Broadcom

EUT: : 802.11ag Wireless LAN PCI-E Mini Card

Model No.: : BCM94311MCAG

Configuration: : EUT, Laptop, &amp; Extended Card

Mode of operation: Tx 5 GHz\_Worst Case

Target of Test : FCC B

## HORIZONTAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	216.240	39.80	0.00	39.80	46.00	-6.20	Peak
2	315.180	42.20	0.00	42.20	46.00	-3.80	Peak
3	402.480	41.66	0.00	41.66	46.00	-4.34	Peak
4	432.550	39.53	0.00	39.53	46.00	-6.47	Peak
5	633.340	41.40	0.00	41.40	46.00	-4.60	Peak
6	785.630	42.86	0.00	42.86	46.00	-3.14	Peak

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

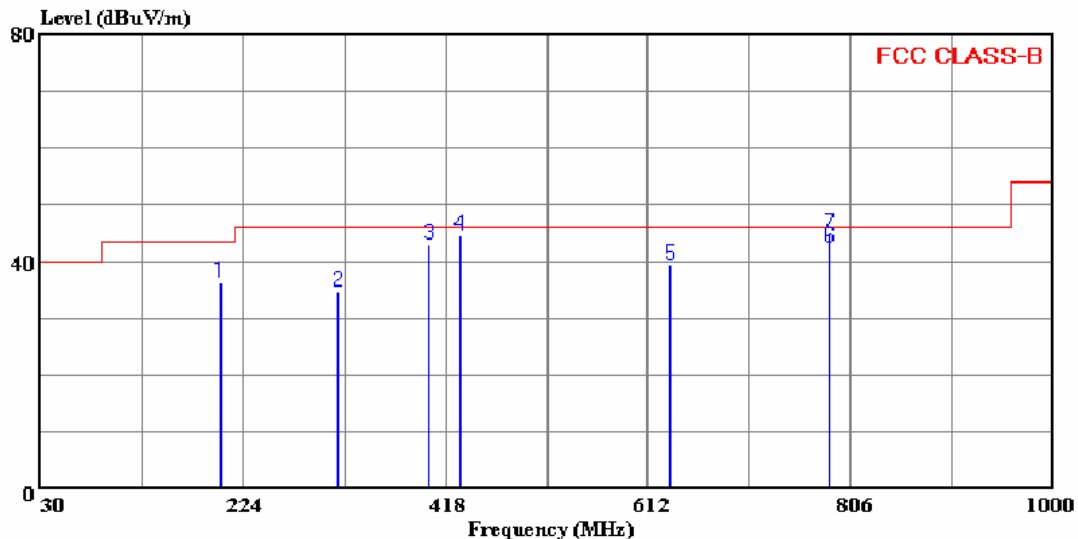
## VERTICAL PLOT



561F Monterey Road  
Morgan Hill, CA 95037  
Tel: (408) 463-0888  
Fax: (408) 463-0885

Data#: 17 File#: 3891.emi

Date: 12-19-2005 Time: 12:08:32



(Auxiliary ATC)

Trace:

Ref Trace:

Condition: FCC CLASS-B VERTICAL

Test Operator: : Vien Tran

Project #: : 05u3891

Company: : Broacom

EUT: : 802.11ag Wireless LAN PCI-E Mini Card

Model No.: : BCM94311MCAG

Configuration: : EUT, Laptop, &amp; Extended Card

Mode of operation: Tx 5 GHz\_Worst Case

Target of Test : FCC B

## VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	201.690	36.33	0.00	36.33	43.50	-7.17	Peak
2	315.180	34.62	0.00	34.62	46.00	-11.38	Peak
3	402.480	43.03	0.00	43.03	46.00	-2.97	Peak
4	431.580	44.45	0.00	44.45	46.00	-1.55	Peak
5	633.340	39.27	0.00	39.27	46.00	-6.73	Peak
6	785.630	42.31	0.00	42.31	46.00	-3.69	QP
7	785.630	44.99	0.00	44.99	46.00	-1.01	Peak

### 8.3. 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	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**

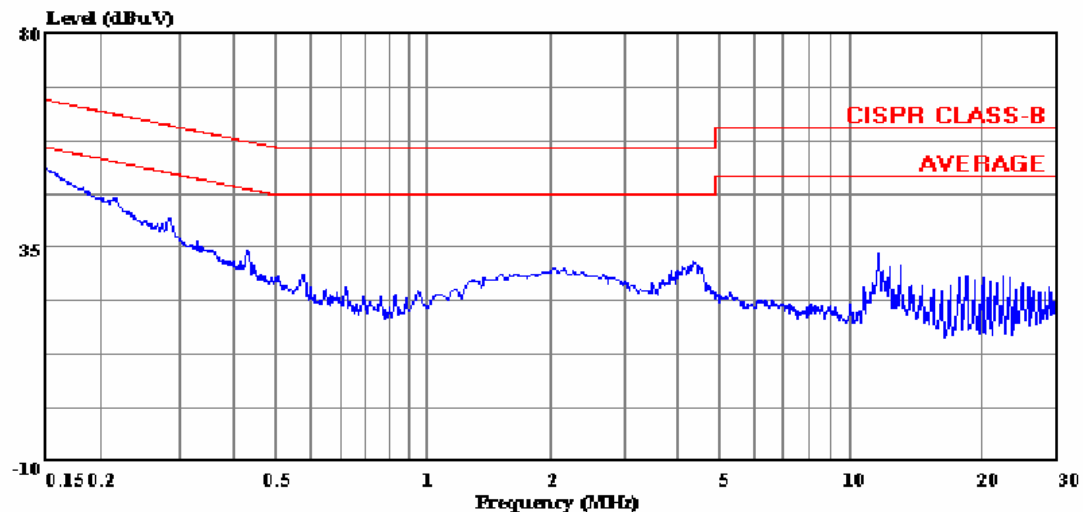
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.15	51.52	--	--	0.00	66.00	56.00	-14.48	-4.48	L1
0.22	45.34	--	--	0.00	62.82	52.82	-17.48	-7.48	L1
4.43	31.60	--	--	0.00	56.00	46.00	-24.40	-14.40	L1
0.16	51.18	--	--	0.00	65.46	55.46	-14.28	-4.28	L2
0.33	39.90	--	--	0.00	59.45	49.45	-19.55	-9.55	L2
0.92	34.62	--	--	0.00	56.00	46.00	-21.38	-11.38	L2
6 Worst Data									



**LINE 1 RESULTS**

Compliance Certification Services  
561F Monterey Road  
Morgan Hill, CA 95037  
Tel: (408) 463-0885  
Fax: (408) 463-0888

Data#: 7 File#: Lc3891.emi Date: 12-19-2005 Time: 14:02:58



(Auxiliary ATC)

Trace:

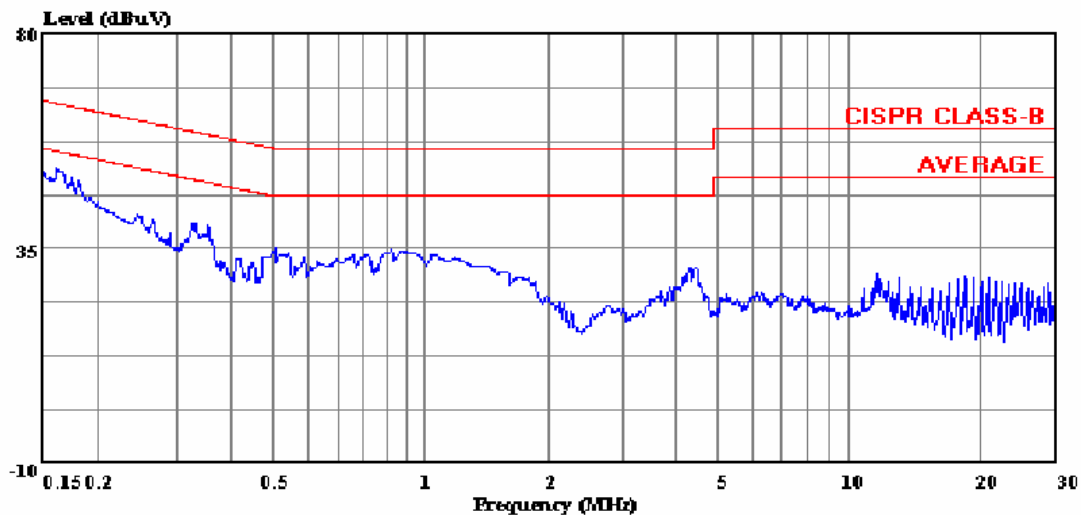
Ref Trace:

Condition: CISPR CLASS-B  
Test Operator : Vien Tran  
Project # : 05U3891  
Company : Broadcom  
EUT Description: 802.11 ag Wireless LAN PCI-E Mini Card  
Model : BCM94311MCAG  
EUT Config : EUT on Extended Car/ Laptop  
: AC Adapter  
Mode Of Oper : Tx 5 GHz Worst Case  
Target : FCC Class B  
Power Source : 115Vac, 60Hz  
: L1: Peak ( Black )

**LINE 2 RESULTS**

Compliance Certification Services  
 561F Monterey Road  
 Morgan Hill, CA 95037  
 Tel: (408) 463-0885  
 Fax: (408) 463-0888

Data#: 14 File#: Lc3891.emi Date: 12-19-2005 Time: 14:26:12



(Auxiliary ATC)

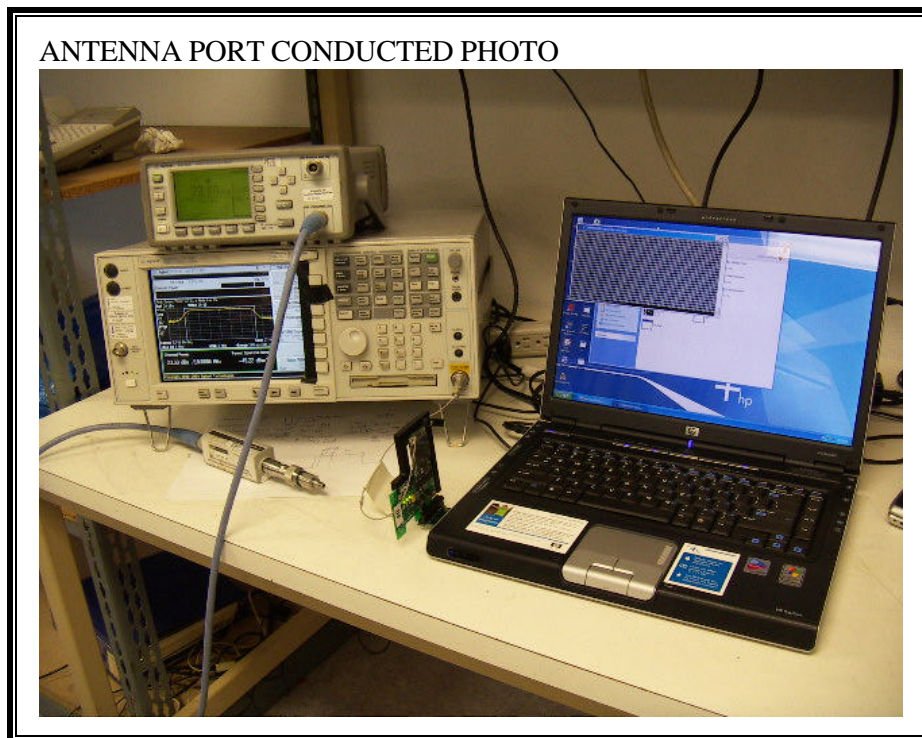
Trace:

Ref Trace:

Condition: CISPR CLASS-B  
 Test Operator : Vien Tran  
 Project # : 05U3891  
 Company : Broadcom  
 EUT Description: 802.11 ag Wireless LAN PCI-E Mini Card  
 Model : BCM94311MCAG  
 EUT Config : EUT on Extended Car/ Laptop  
               : AC Adapter  
 Mode Of Oper : Tx 5 GHz Worst Case  
 Target : FCC Class B  
 Power Source : 115Vac, 60Hz  
               : L2: Peak ( Black )

## 9. SETUP PHOTOS

### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

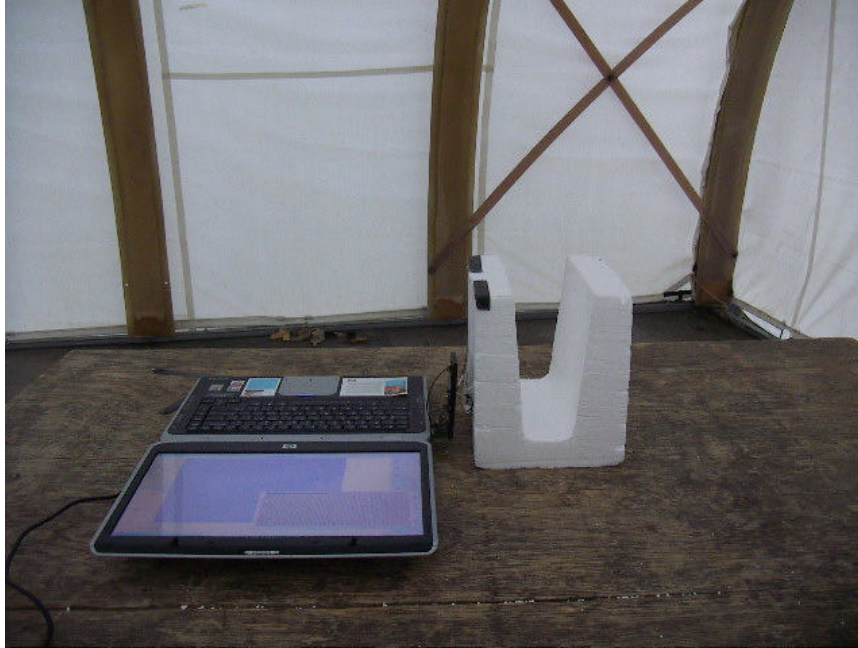


**RADIATED RF MEASUREMENT SETUP**

RADIATED FRONT PHOTO



RADIATED BACK PHOTO



RADIATED SIDE PHOTO





**POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP**

LINE CONDUCTED FRONT PHOTO



LINE CONDUCTED BACK PHOTO



**END OF REPORT**