



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

CERTIFICATION TEST REPORT

FOR

802.11g/DRAFT 802.11n WIRELESS LAN PCI-E MINICARD

MODEL NUMBER: BCM94313HMG2L

**FCC ID: QDS-BRCM1050
IC: 4324A-BRCM1050**

REPORT NUMBER: 09U12836-1

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NVLAP LAB CODE 200065-0

Revision History

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11g / Draft 802.11n WLAN PCI-E Minicard

MODEL: BCM94313HMG2L

SERIAL NUMBER: 1287221

DATE TESTED: SEPTEMBER 24 -28, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:



THU CHAN
EMC MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:



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, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11g / Draft 802.11n WLAN PCI-E Minicard.
The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

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

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2472	802.11b	23.10	204.17
2412 - 2472	802.11g	25.31	339.63
2412 - 2472	802.11n 20 SISO	Covered by the worst case 802.11g Mode Legacy testing	

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bgn WLAN antenna, with a maximum gain of 3.9dBi.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom version 5.60.18.20.

The test utility software used during testing was Broadcom version 5.60.18 TOB.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

802.11b Mode (20 MHz BW operation): 1 Mbps, CCK.
802.11g Mode (20 MHz BW operation): 6 Mbps, OFDM.

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power, that was determined to be 11b mode, mid channel.

For Radiated Band Edge measurements preliminary testing showed that the worst case was horizontal polarization, so final measurements were performed with horizontal polarization.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Dell	Inspiron 1526	N/A	DoC
AC Adapter	Dell	DA65NS0-00	CN-0CF745-48661-741-2P2E	N/A

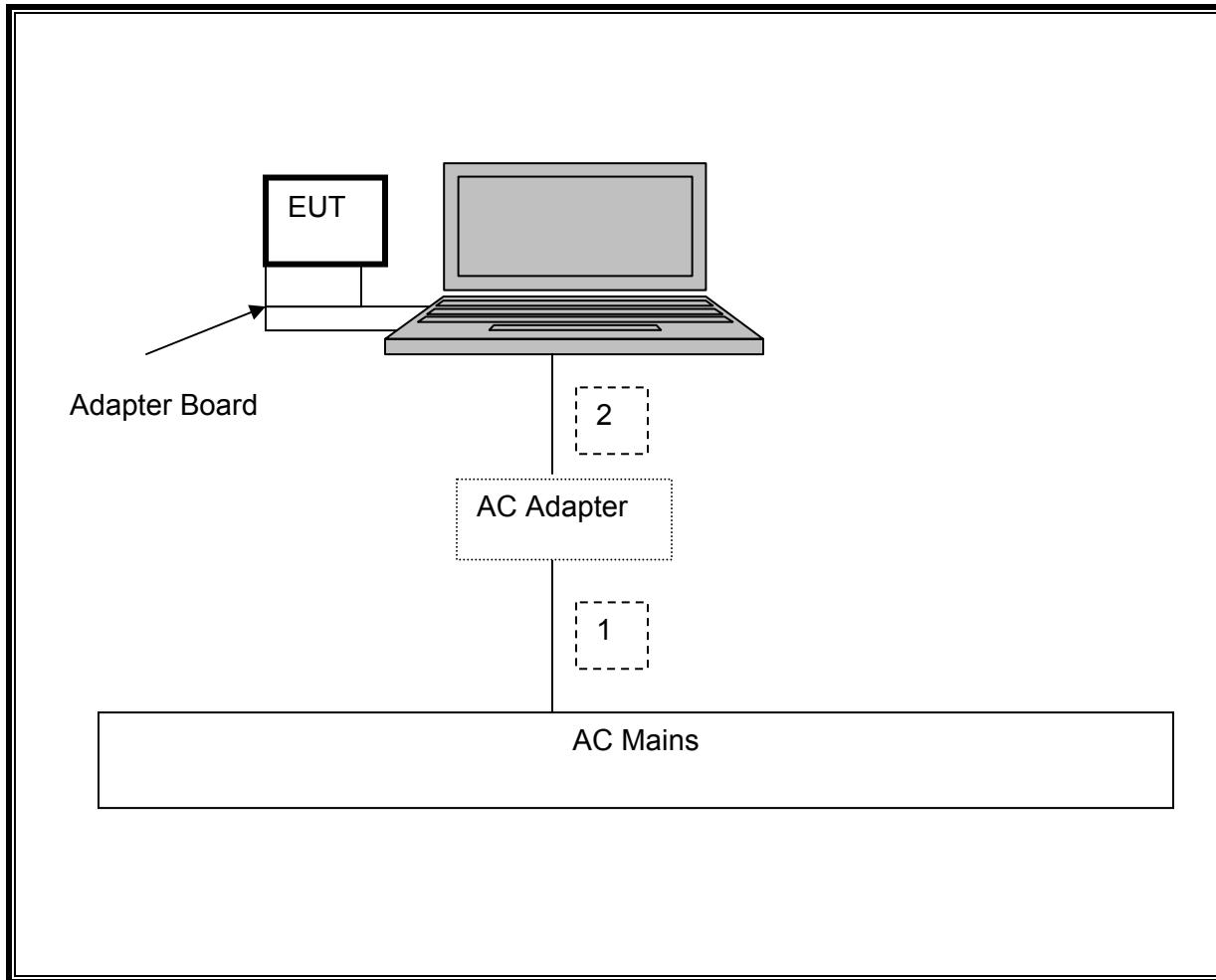
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.8 m	N/A
2	DC	1	DC	Unshielded	1.8 m	Ferrite on laptop's end

TEST SETUP

The EUT is connected to a host laptop computer via Express card to MiniPCI-E adapter board during the test. Test software exercised the radio card.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	03/24/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/22/10
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	11/28/09
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	03/31/10
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/05/10
Peak Power Meter	Boonton	4541	C01186	01/19/10
Peak Power Sensor	Boonton	4541	C01189	01/15/10
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/09

7. ANTENNA PORT TEST RESULTS

7.1. 802.11b MODE IN THE 2.4 GHz BAND

7.1.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

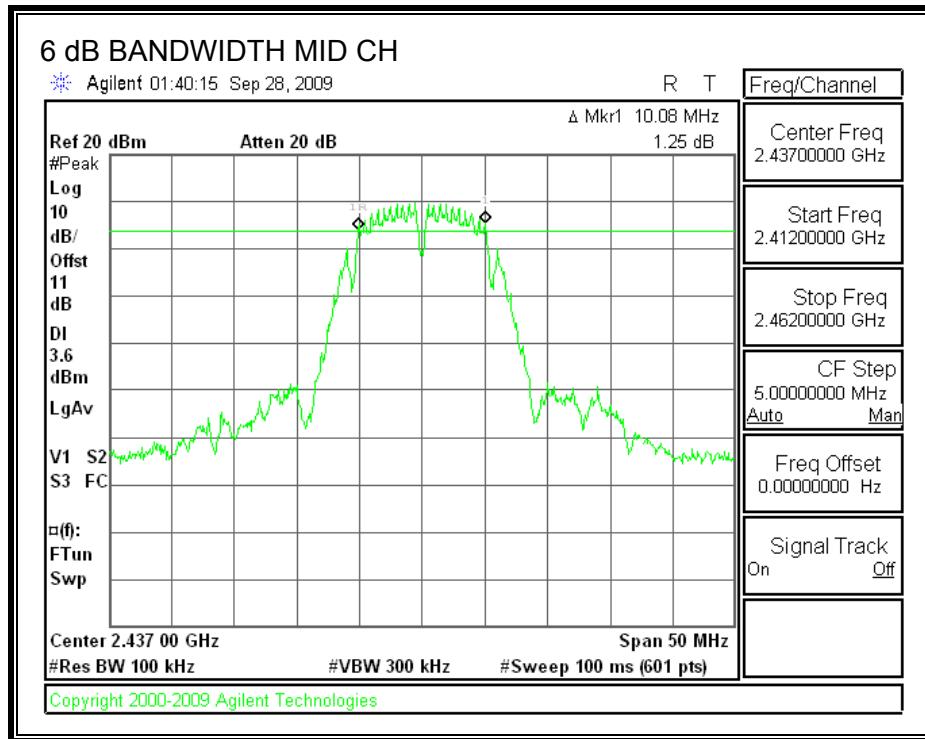
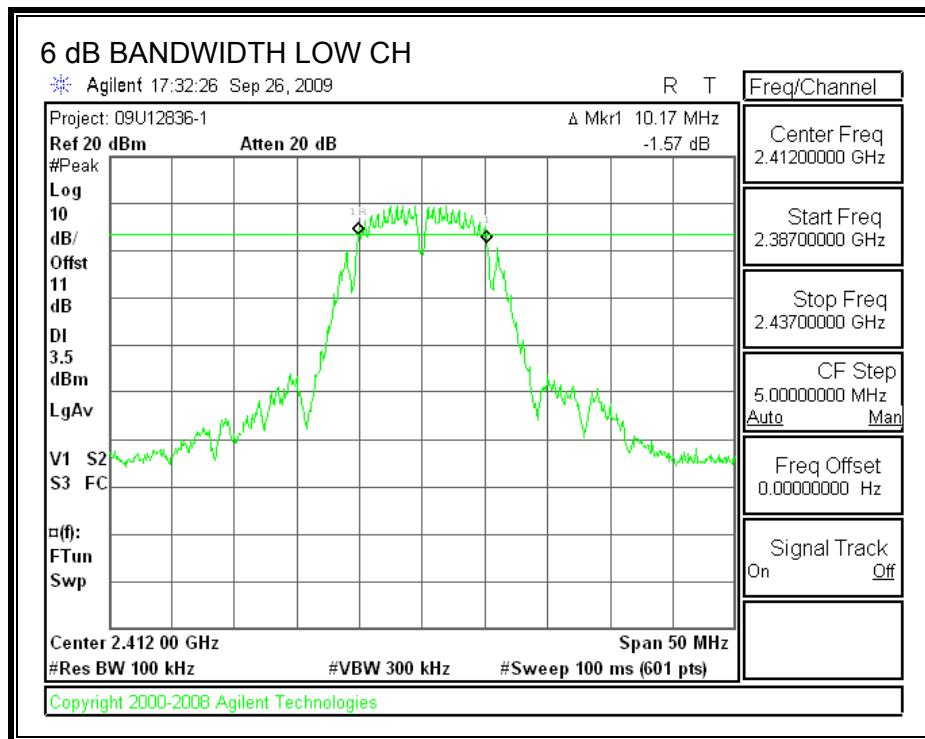
TEST PROCEDURE

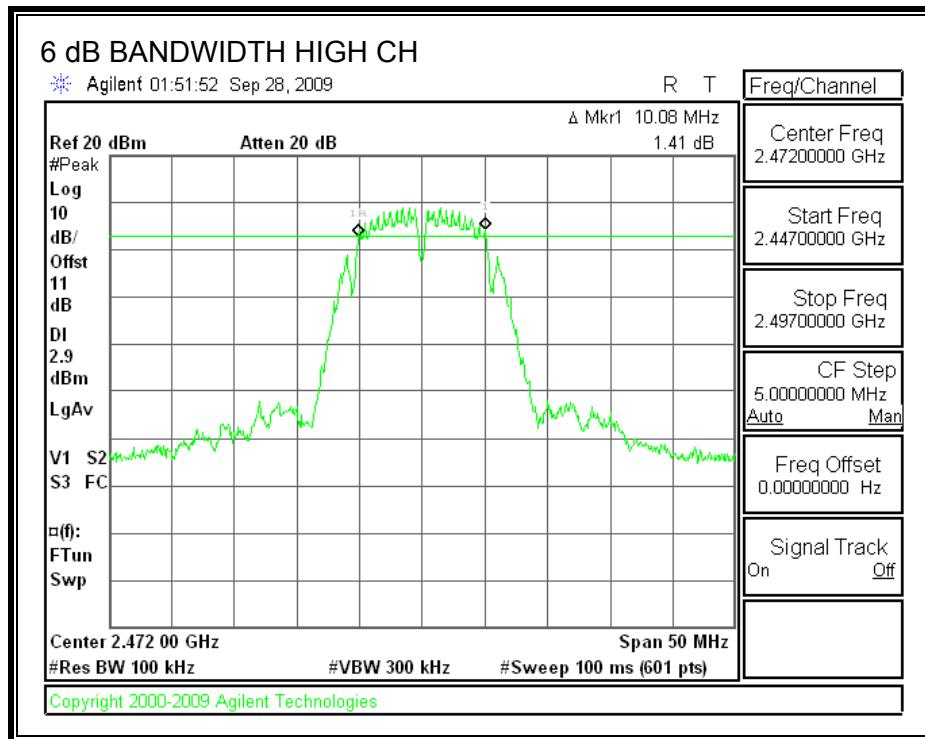
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	10.17	0.5
Middle	2437	10.08	0.5
High	2472	10.08	0.5

6 dB BANDWIDTH





7.1.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

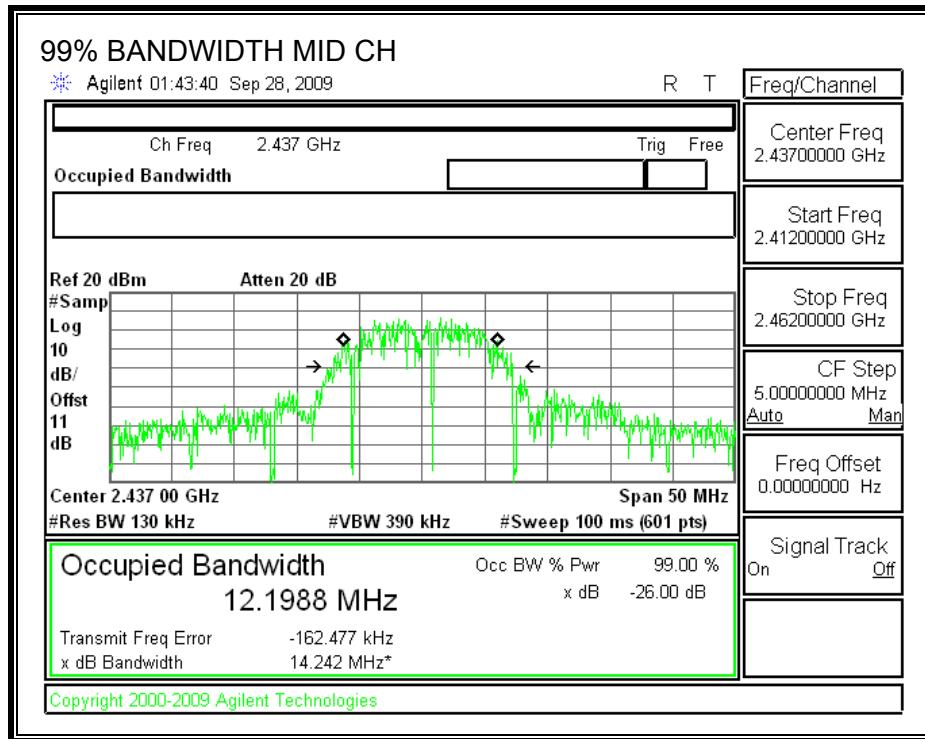
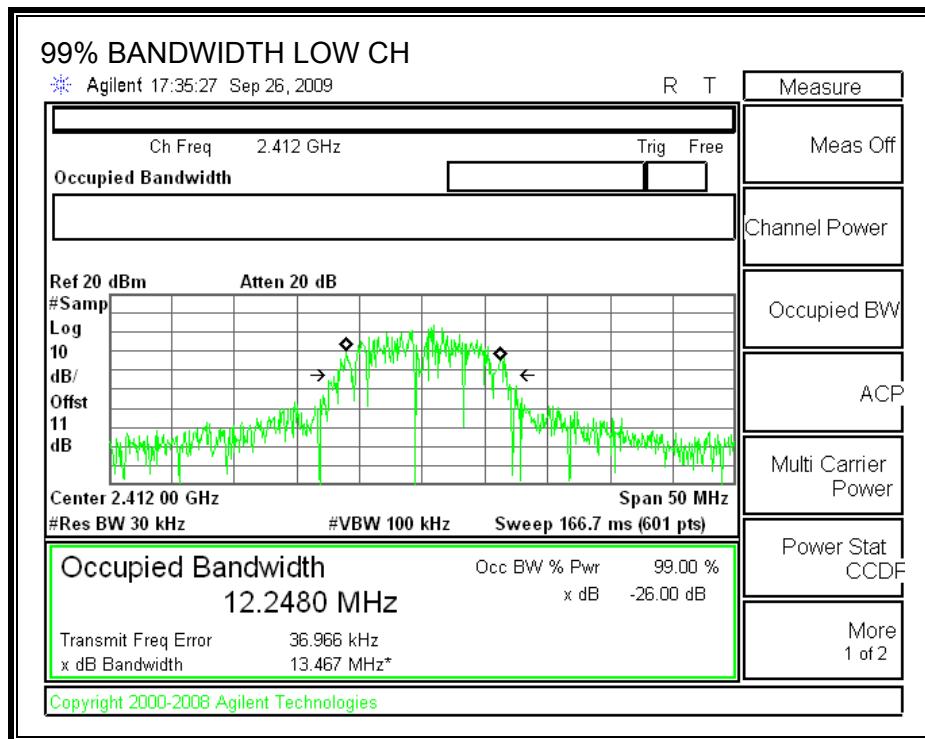
TEST PROCEDURE

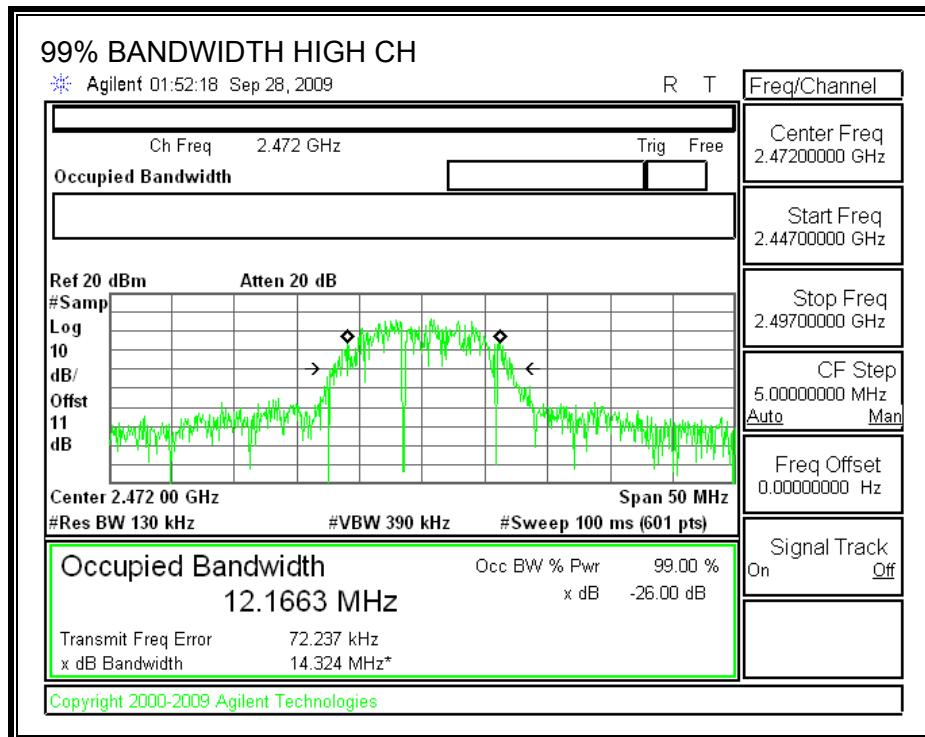
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	12.2480
Middle	2437	12.1988
High	2472	12.1663

99% BANDWIDTH





7.1.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Peak Power Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	23.10	30	-6.90
Middle	2437	22.93	30	-7.07
High	2472	22.37	30	-7.63

7.1.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

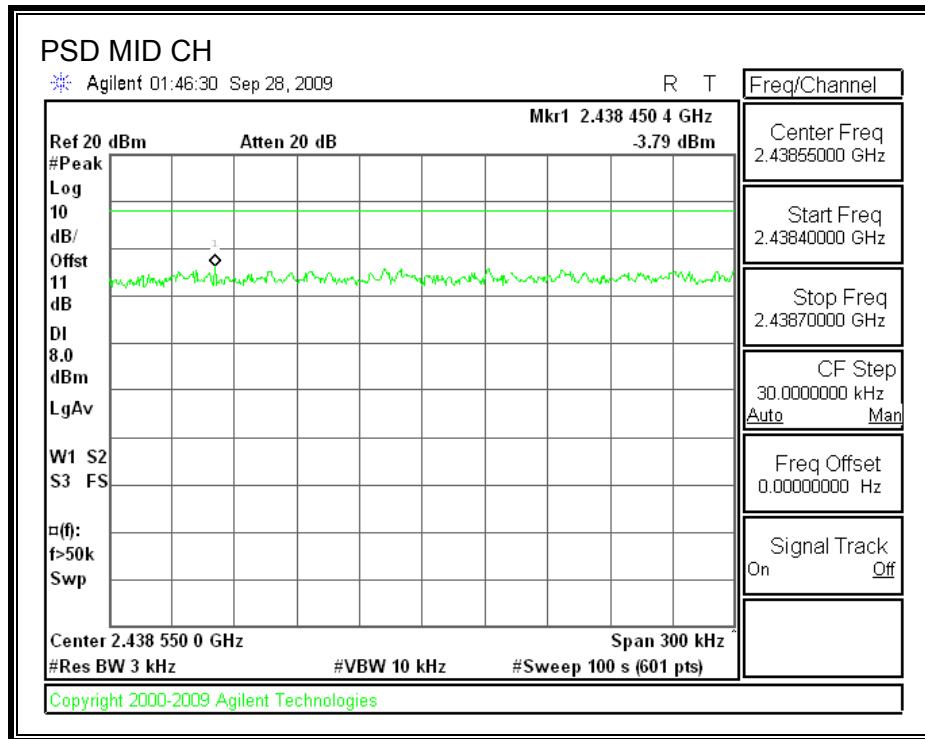
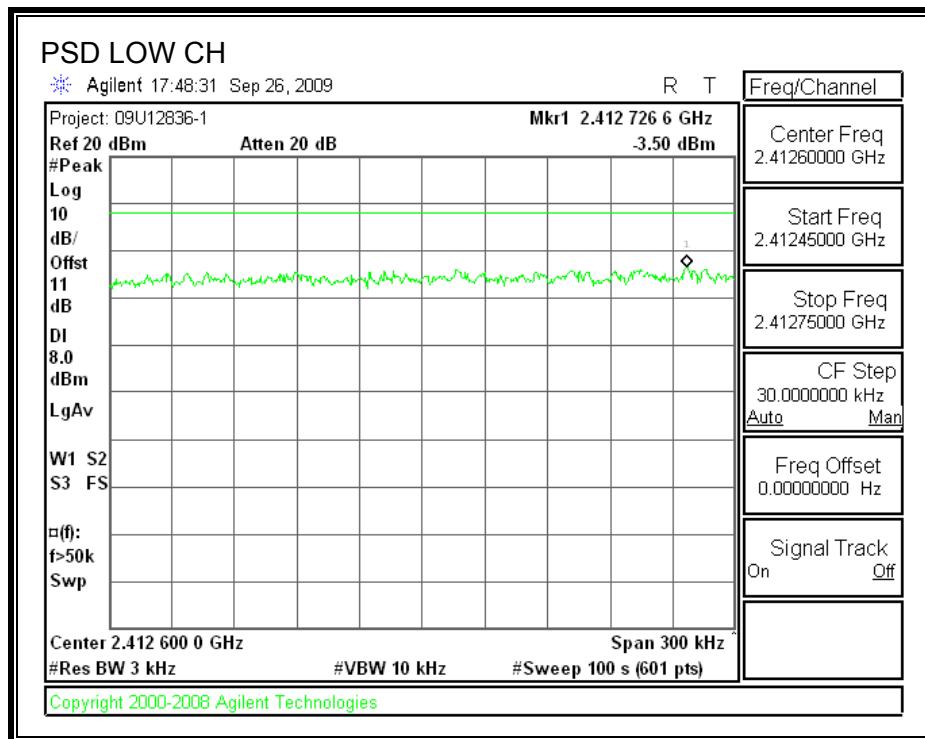
TEST PROCEDURE

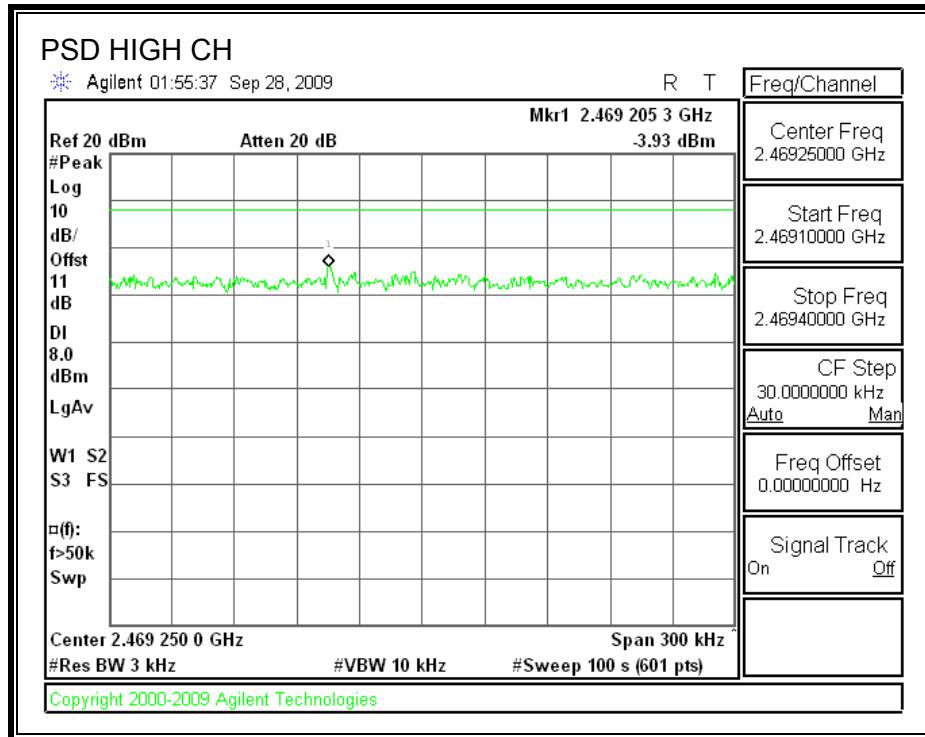
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-3.50	8	-11.50
Middle	2437	-3.79	8	-11.79
High	2472	-3.93	8	-11.93

POWER SPECTRAL DENSITY





7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

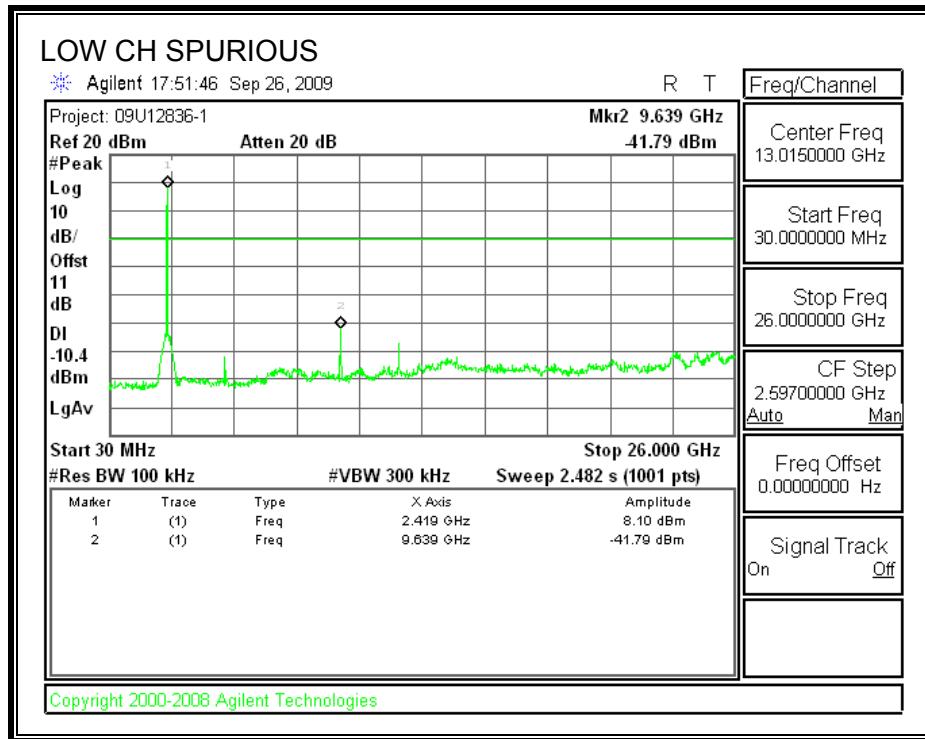
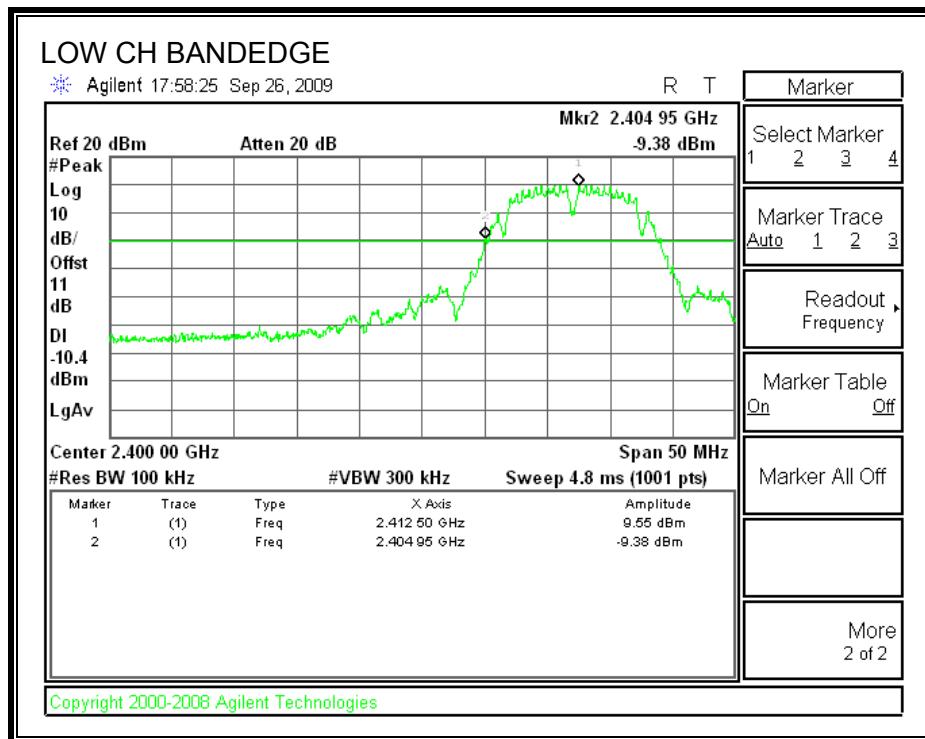
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

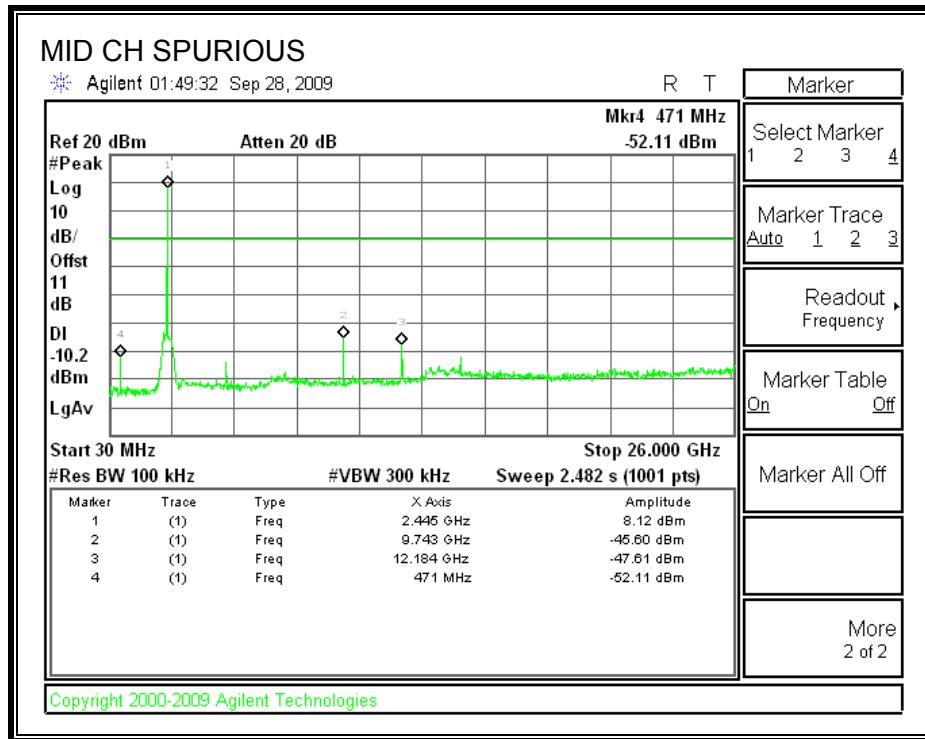
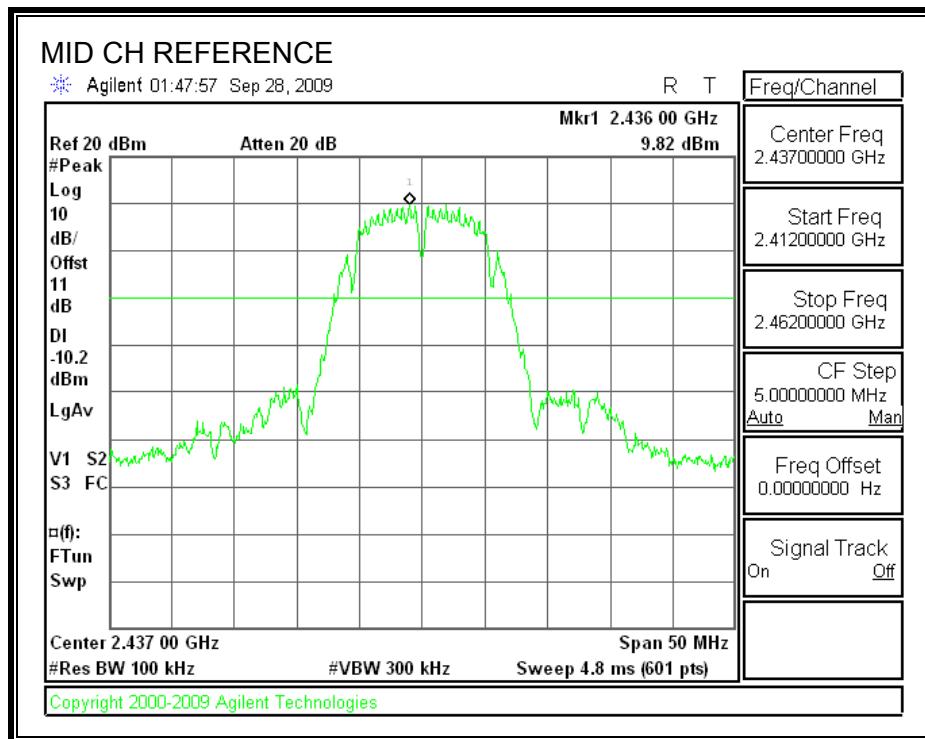
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

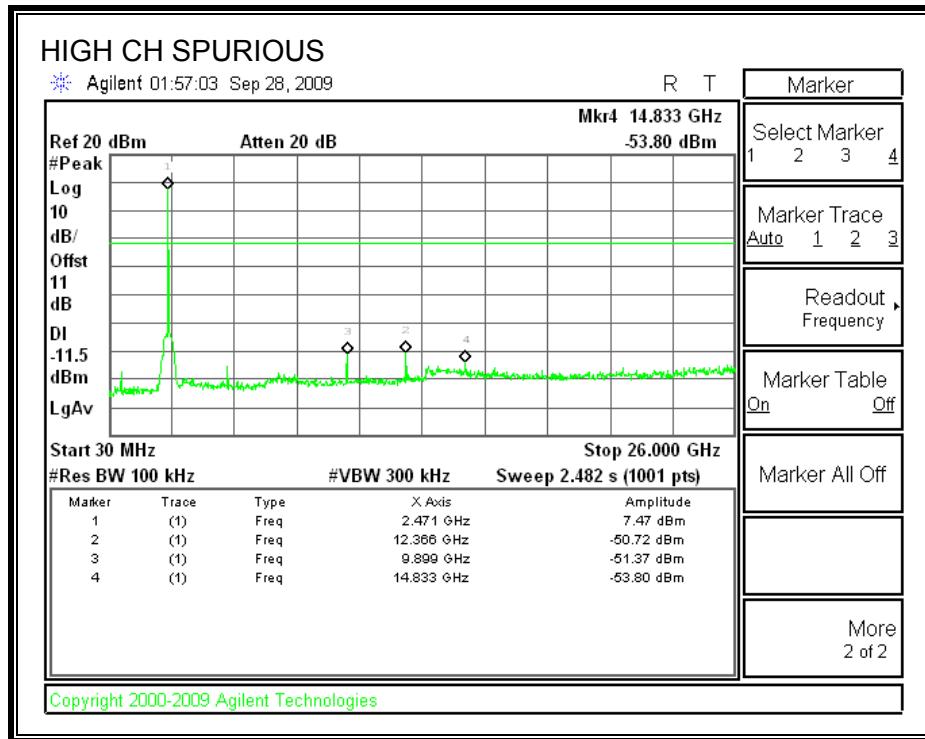
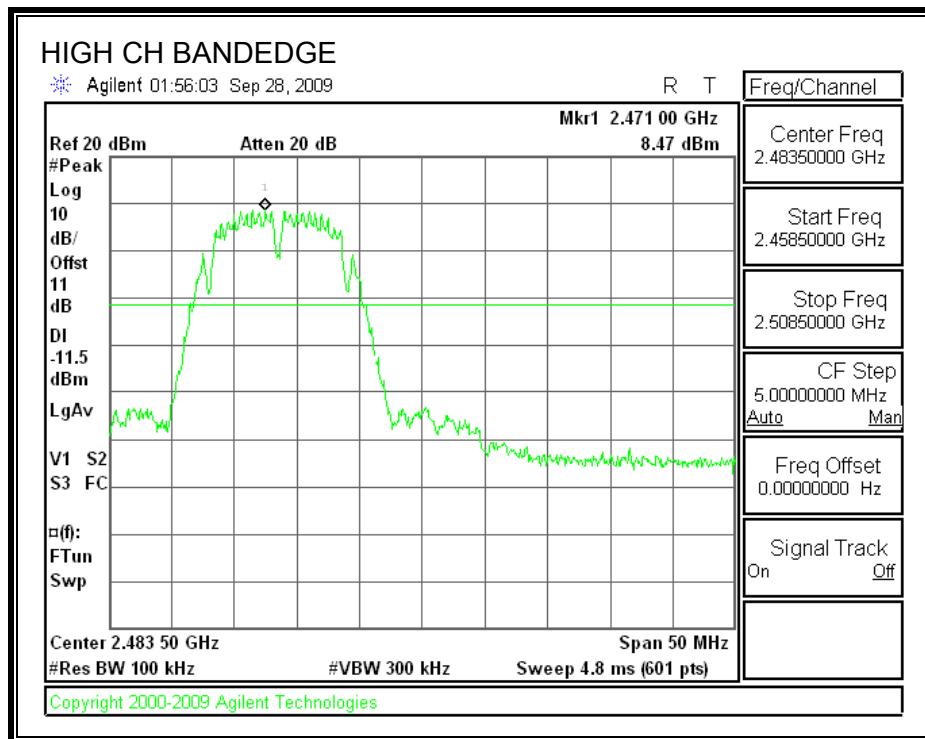
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



7.2. 802.11g MODE IN THE 2.4 GHz BAND

7.2.1. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

The minimum 6 dB bandwidth shall be at least 500 kHz.

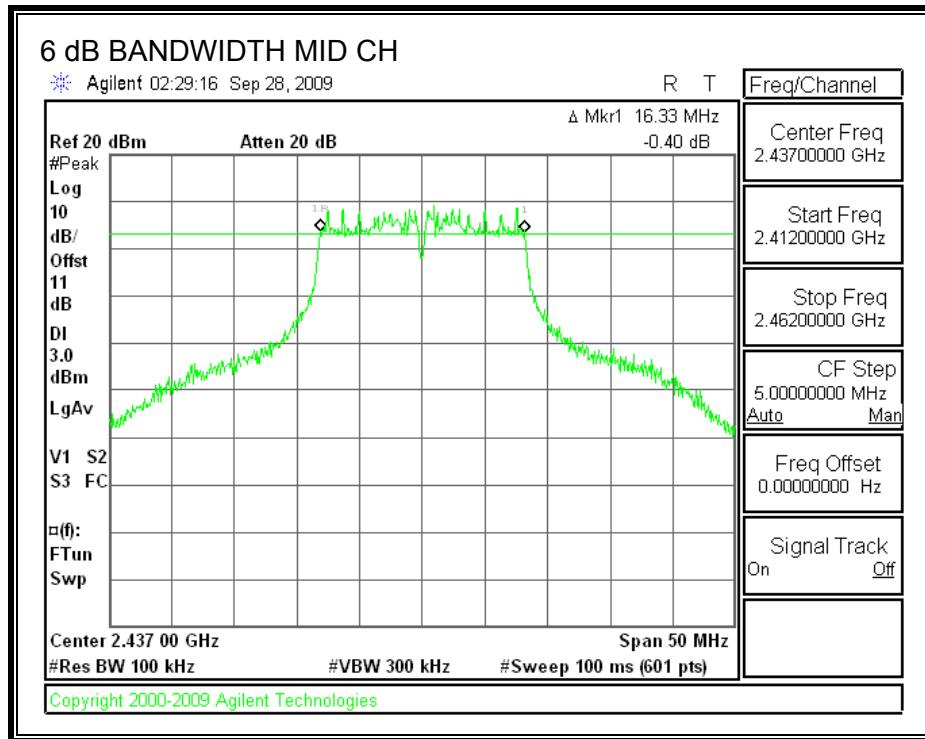
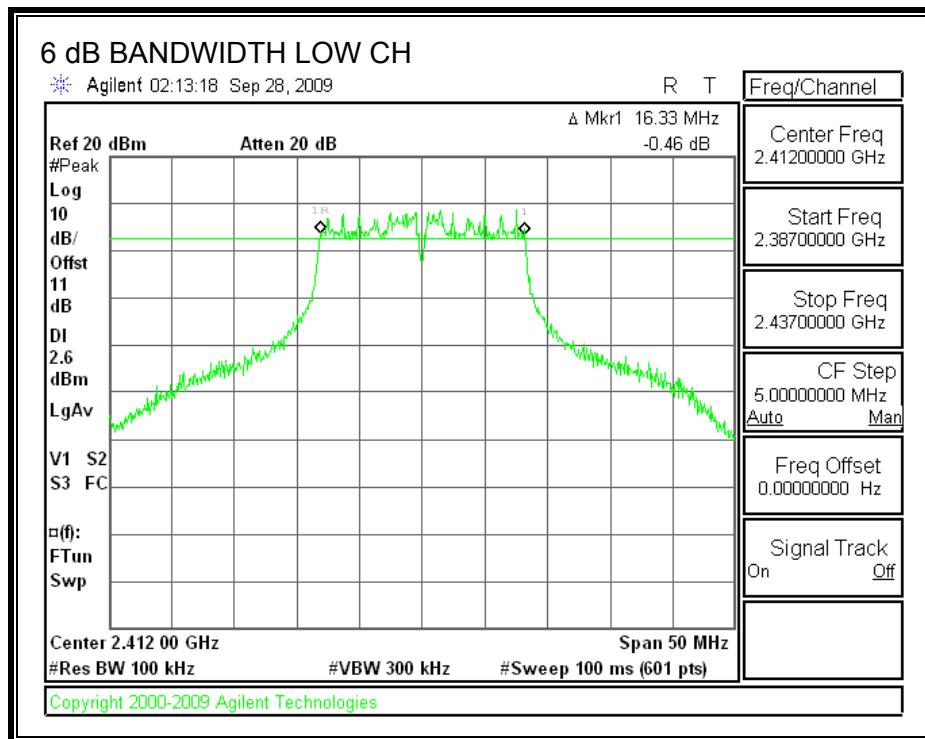
TEST PROCEDURE

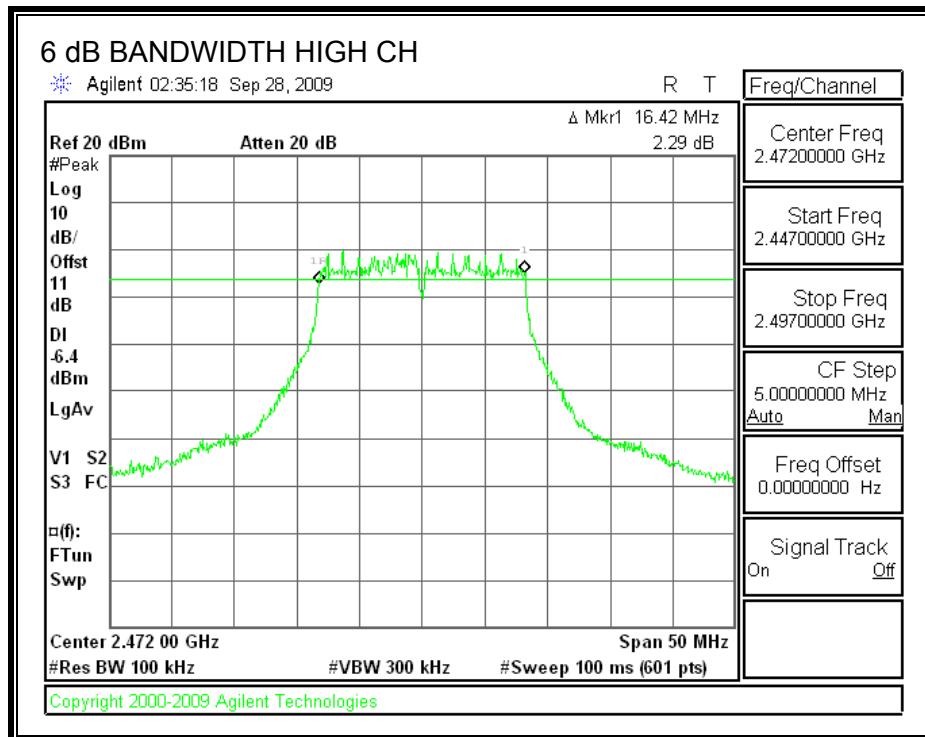
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.33	0.5
Middle	2437	16.33	0.5
High	2472	16.42	0.5

6 dB BANDWIDTH





7.2.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

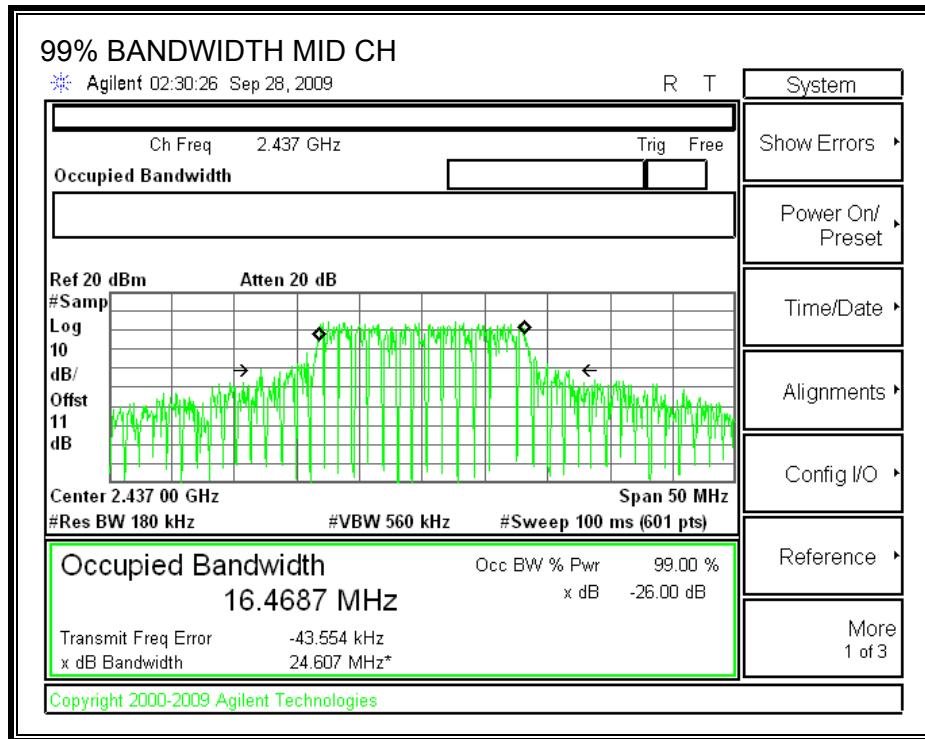
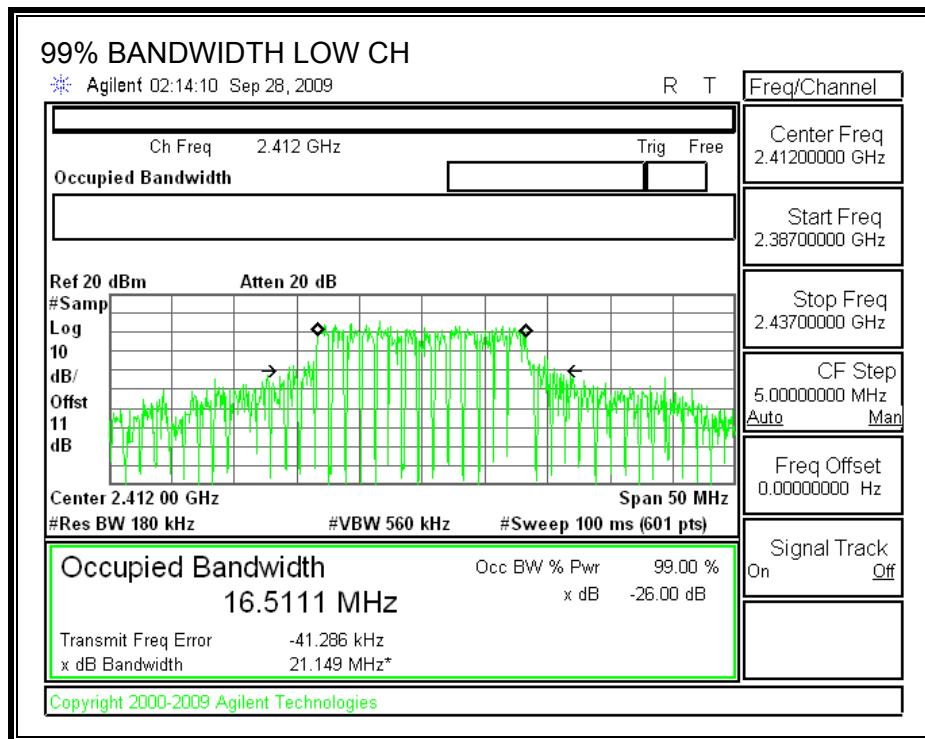
TEST PROCEDURE

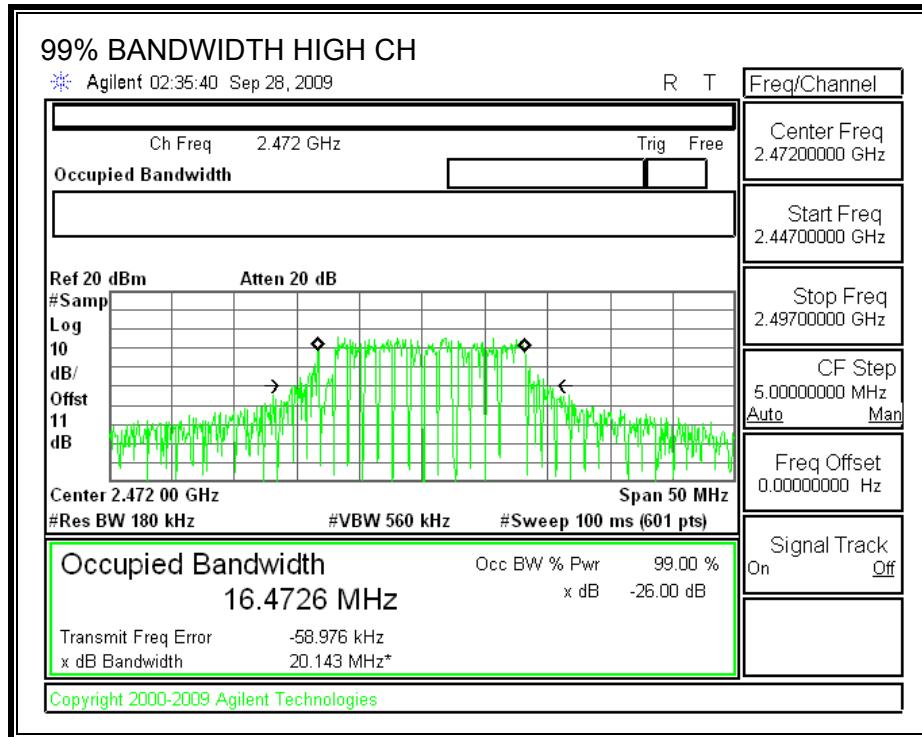
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.5111
Middle	2437	16.4687
High	2472	16.4726

99% BANDWIDTH





7.2.3. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

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

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Peak Power Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	25.21	30	-4.79
Middle	2437	25.31	30	-4.69
High	2472	20.95	30	-9.05

7.2.4. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

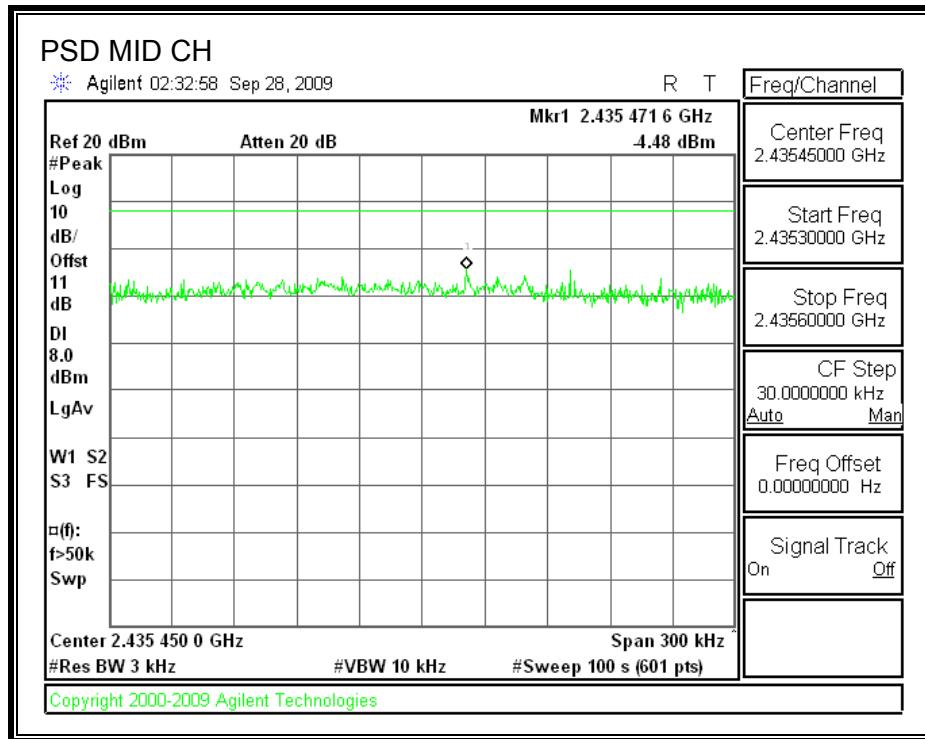
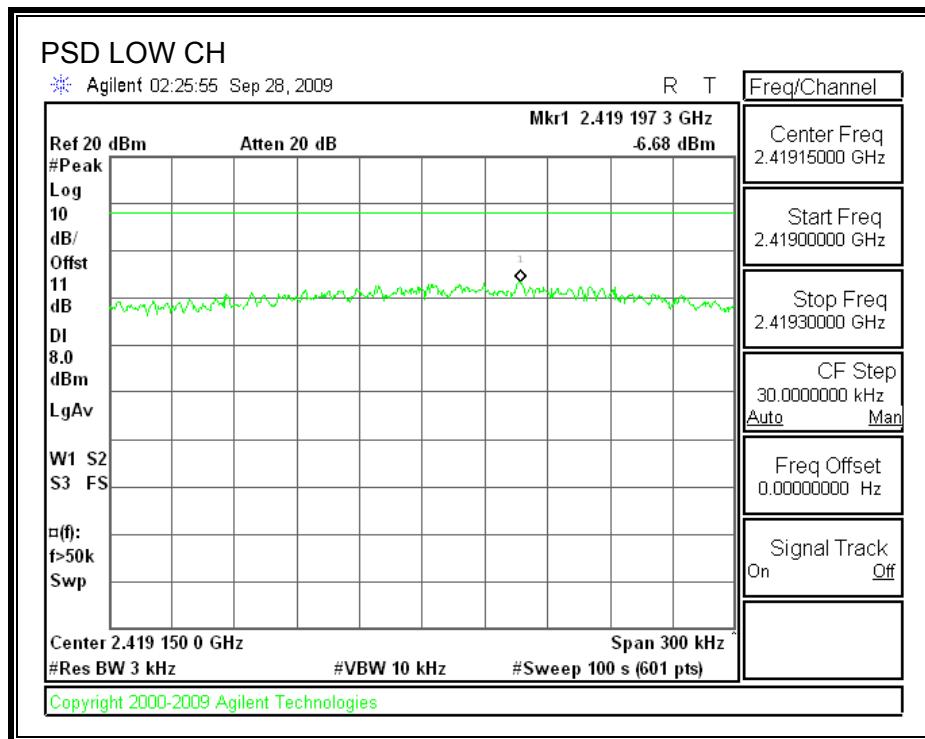
TEST PROCEDURE

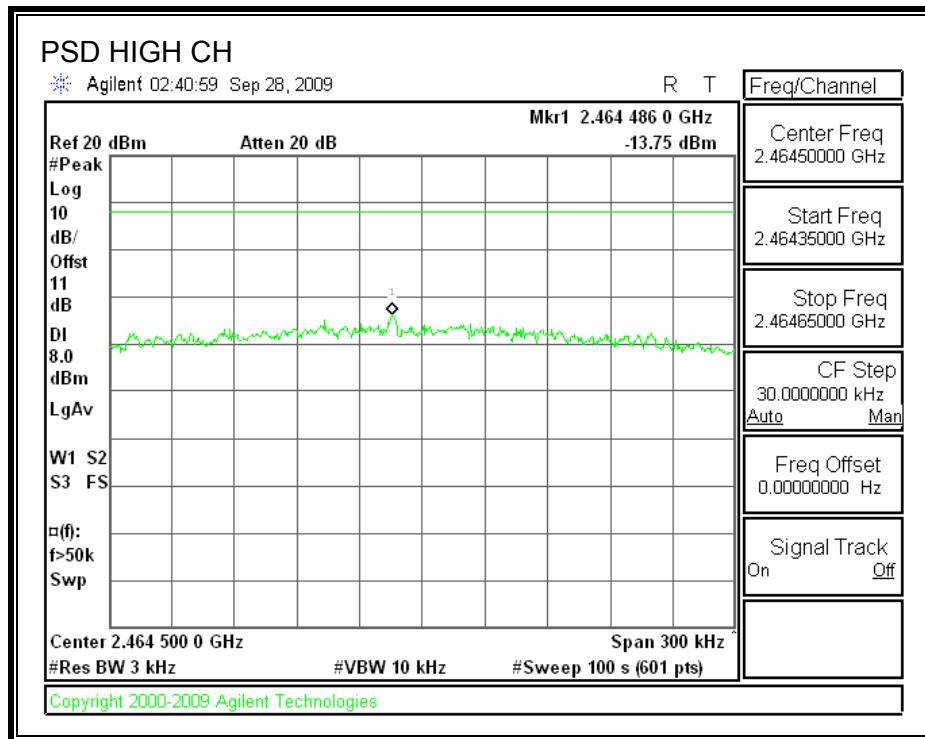
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-6.68	8	-14.68
Middle	2437	-4.48	8	-12.48
High	2472	-13.75	8	-21.75

POWER SPECTRAL DENSITY





7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

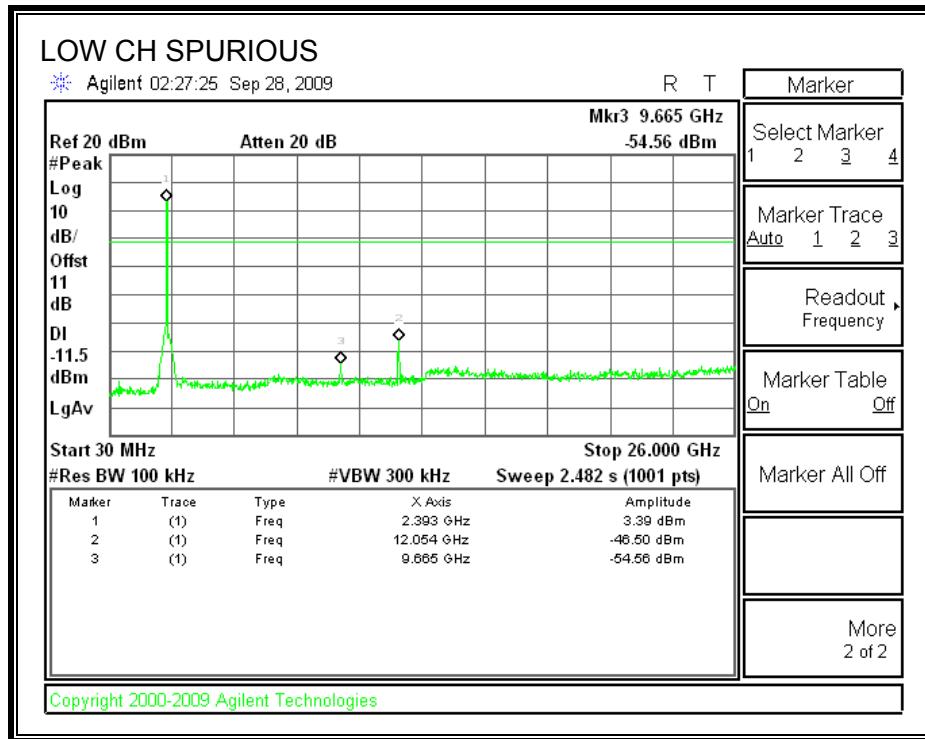
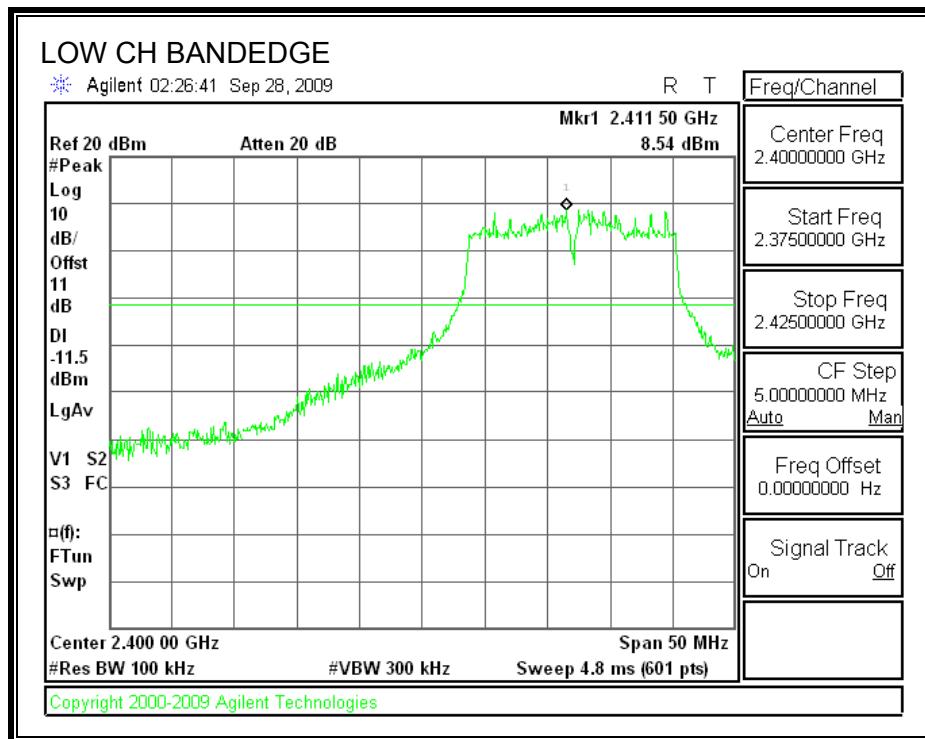
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

TEST PROCEDURE

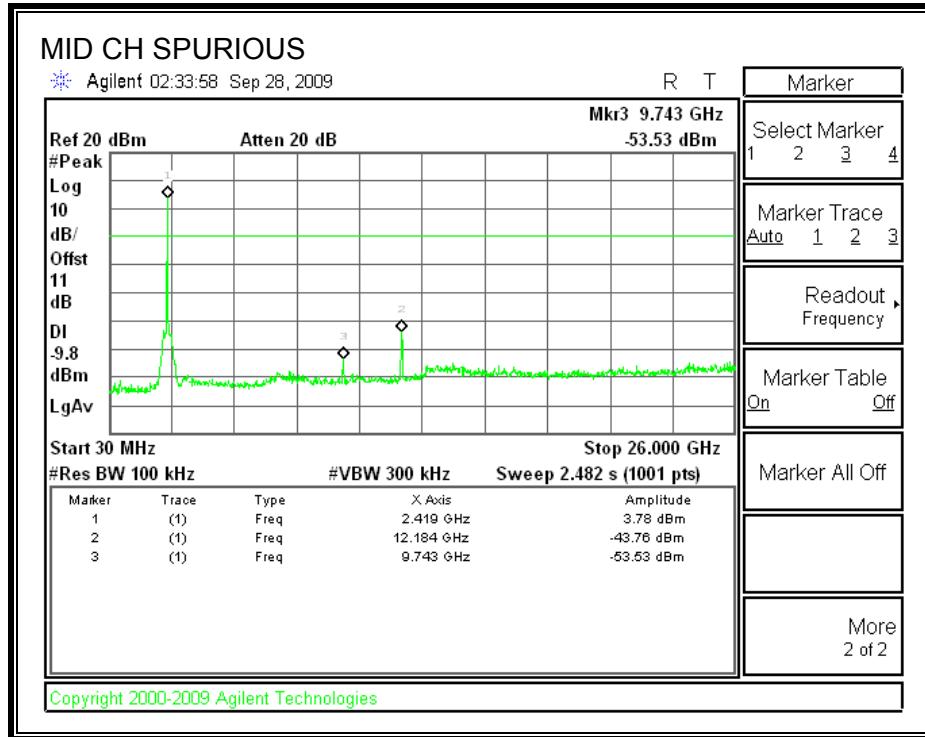
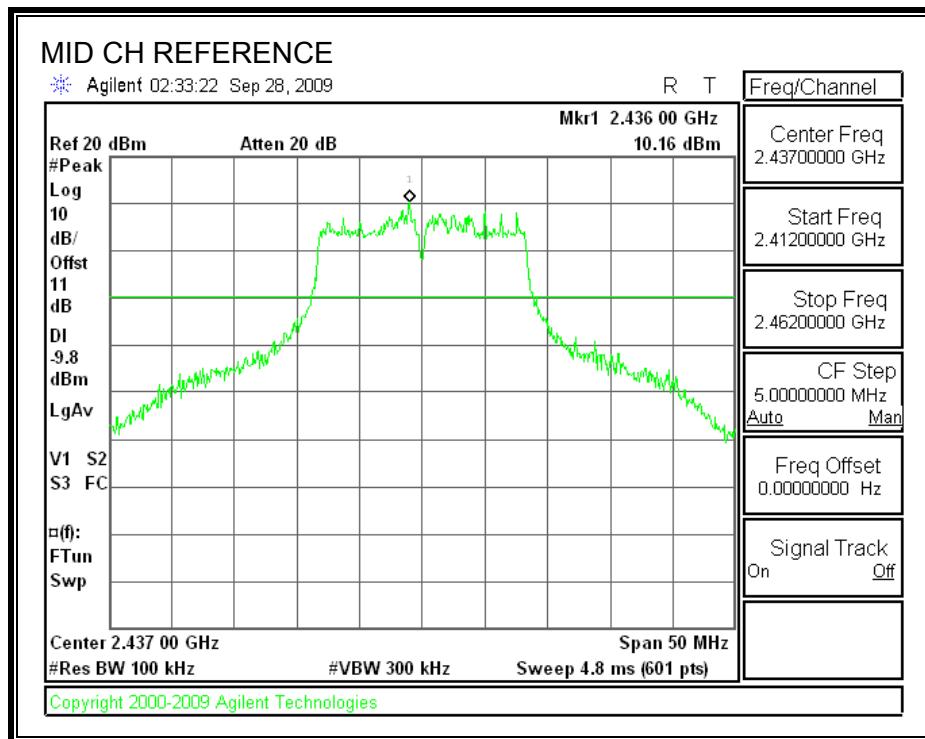
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

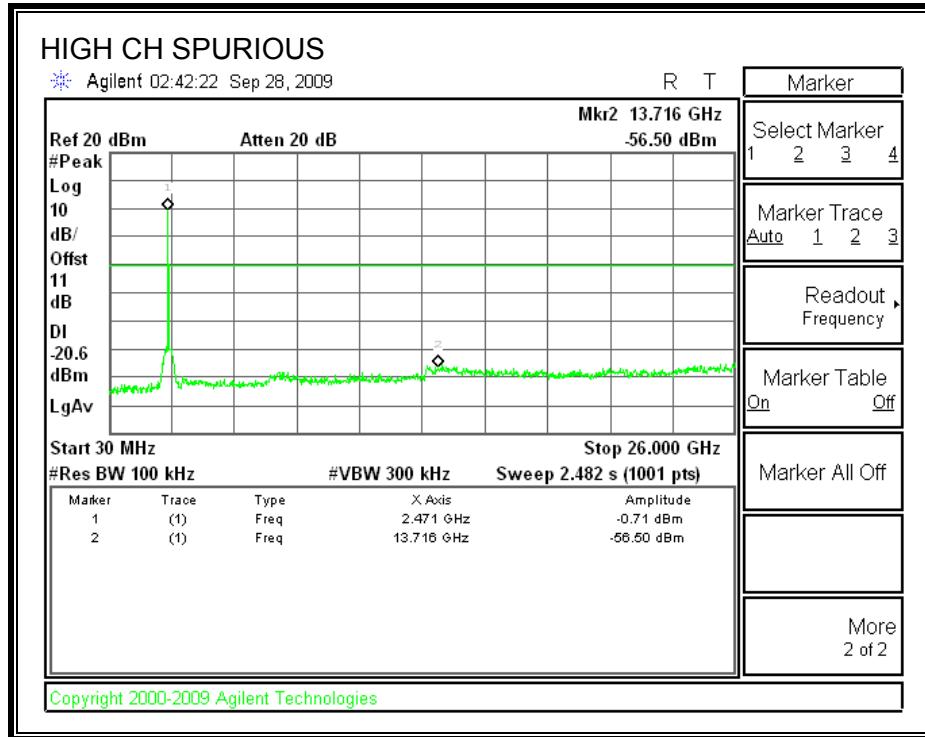
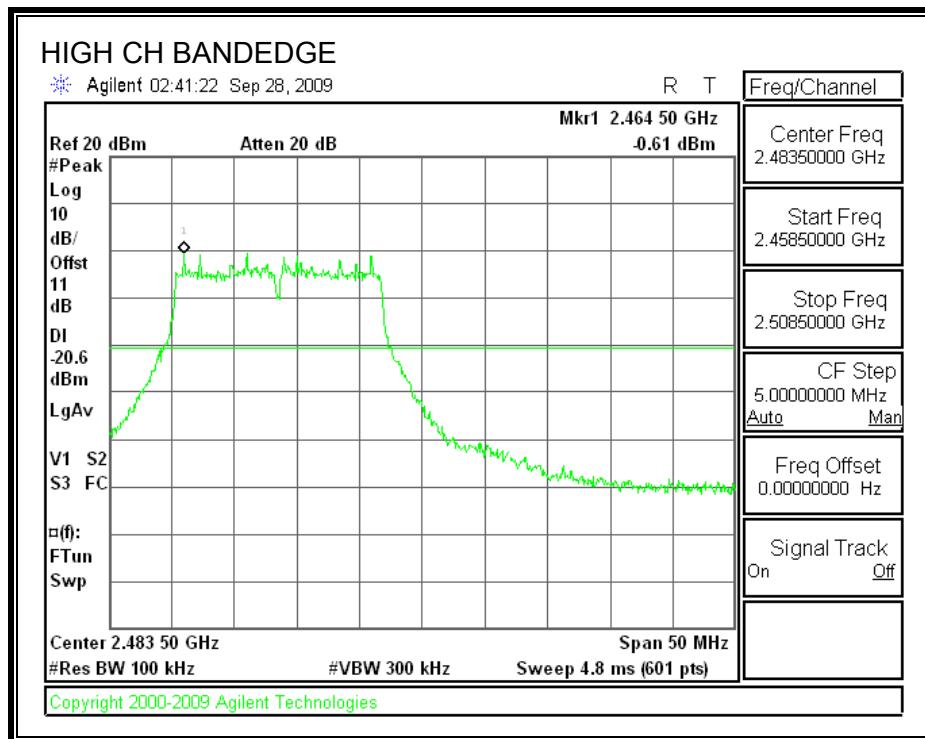
SPURIOUS EMISSIONS, LOW CHANNEL



SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

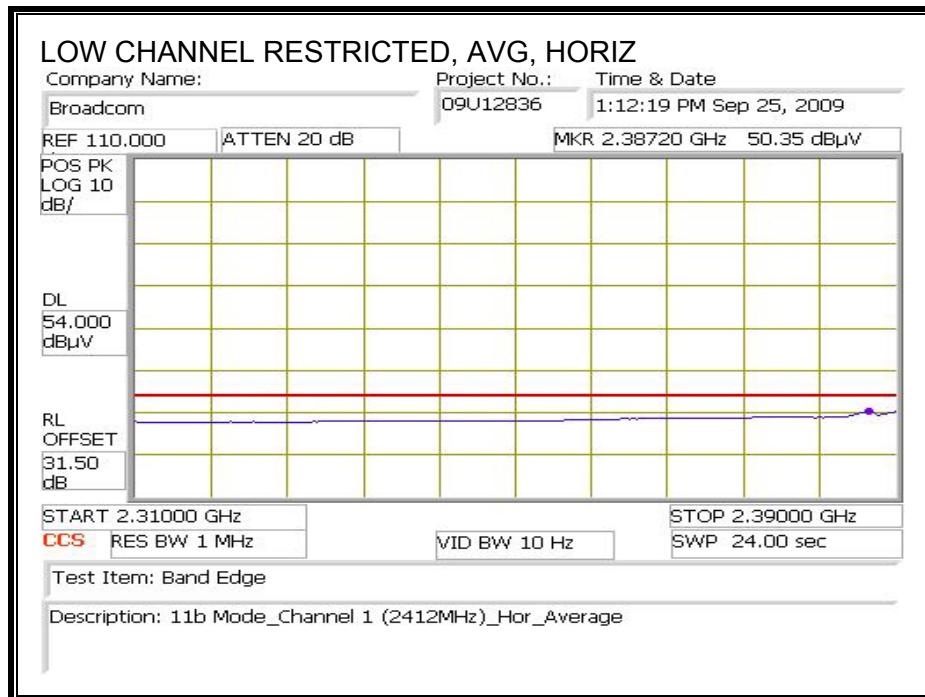
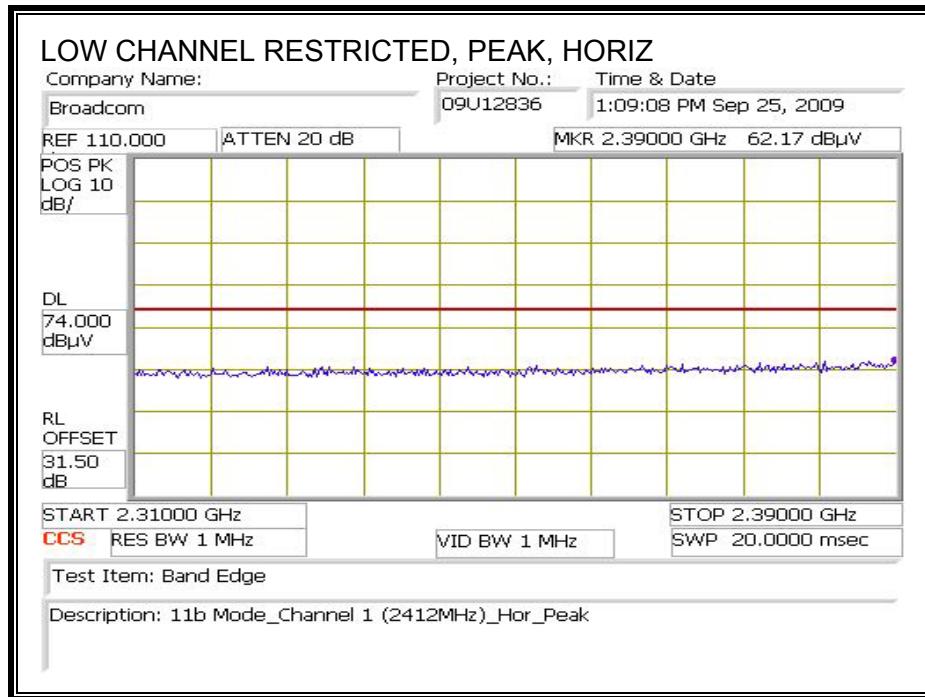
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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

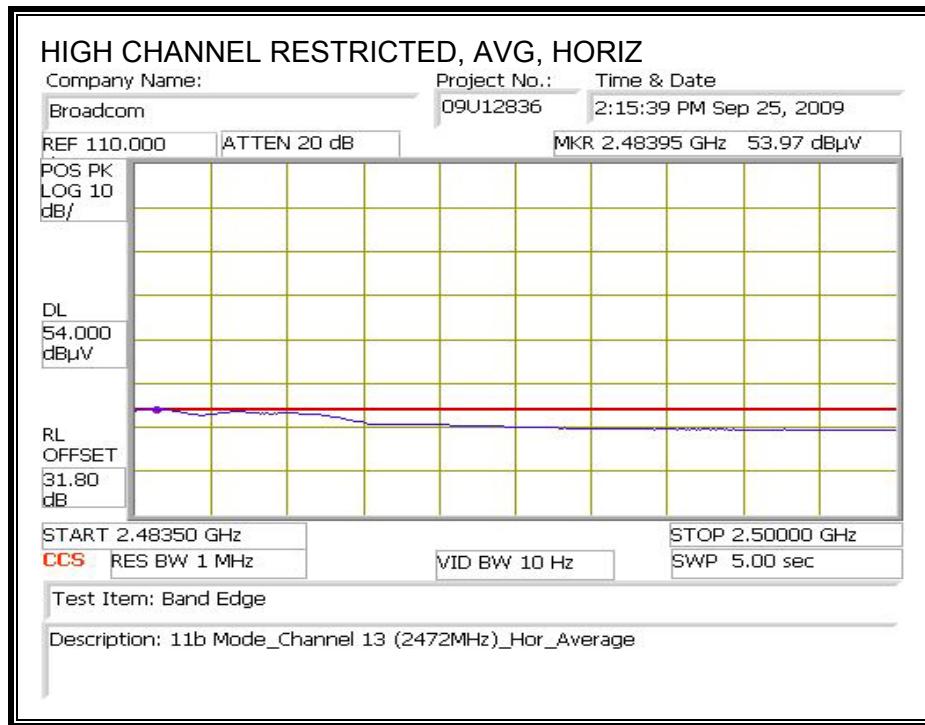
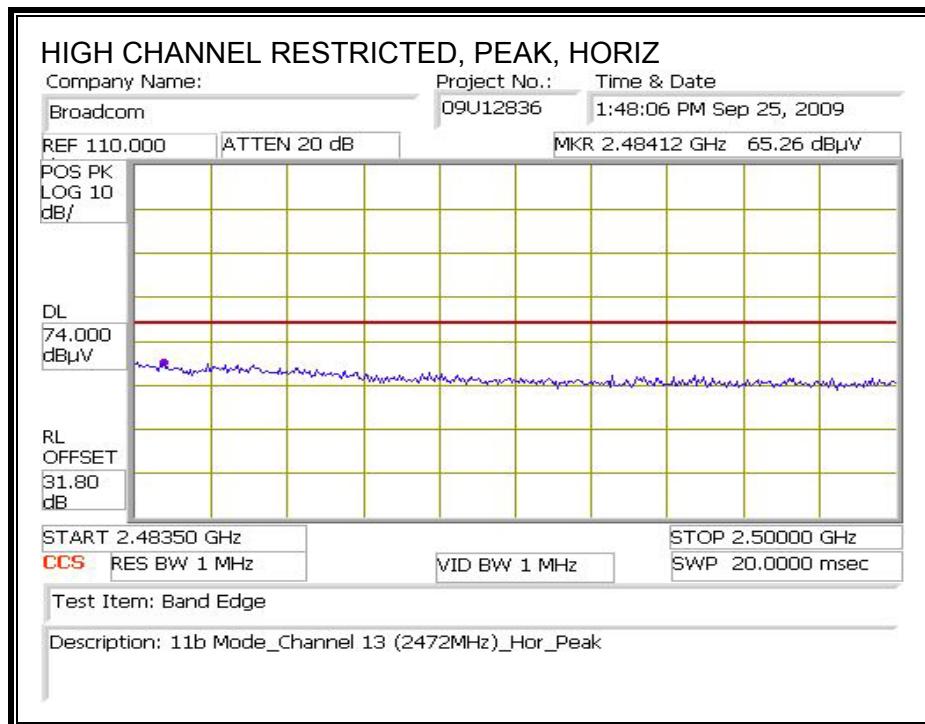
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.1.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



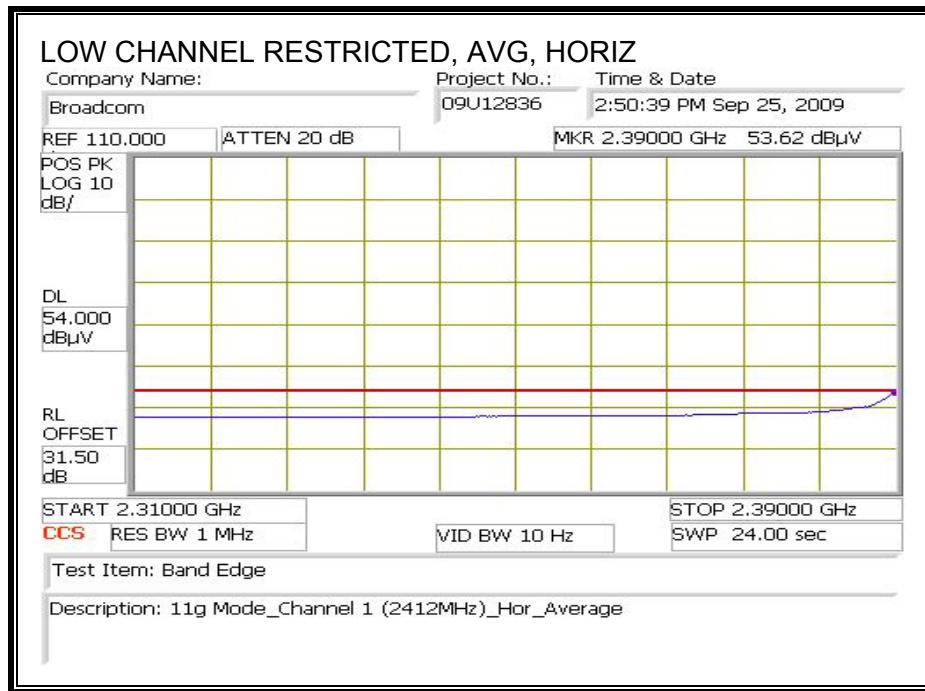
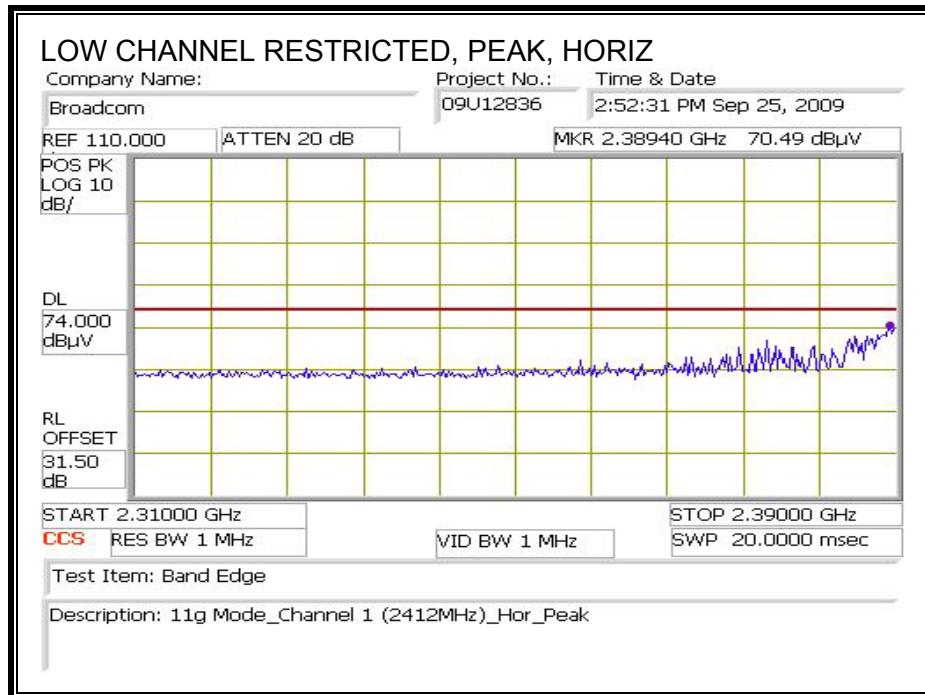
HARMONICS AND SPURIOUS EMISSIONS

Note: Harmonic and spurious emissions

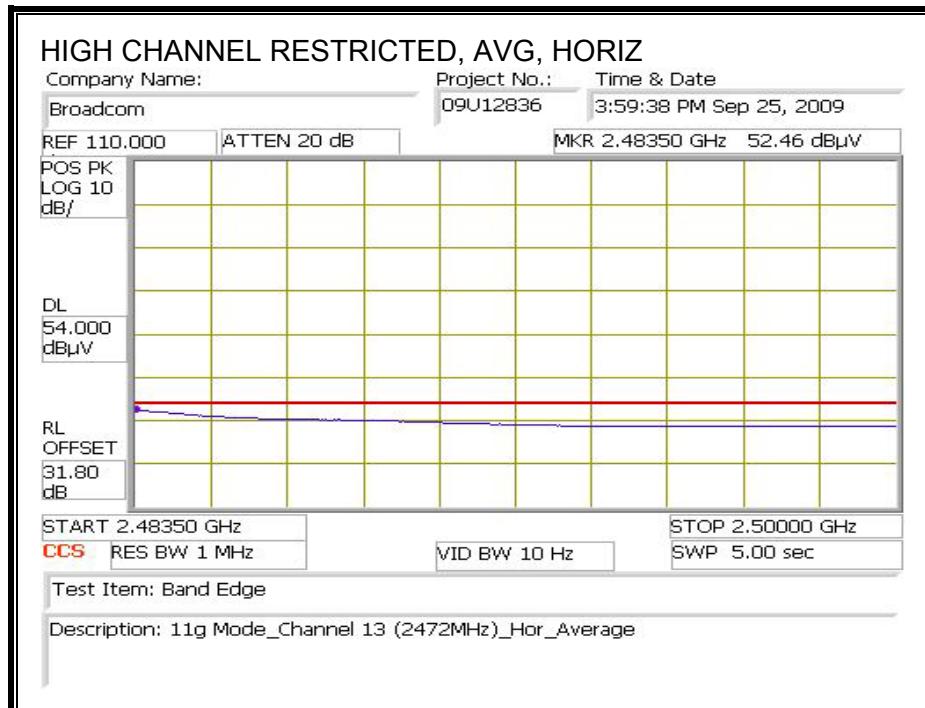
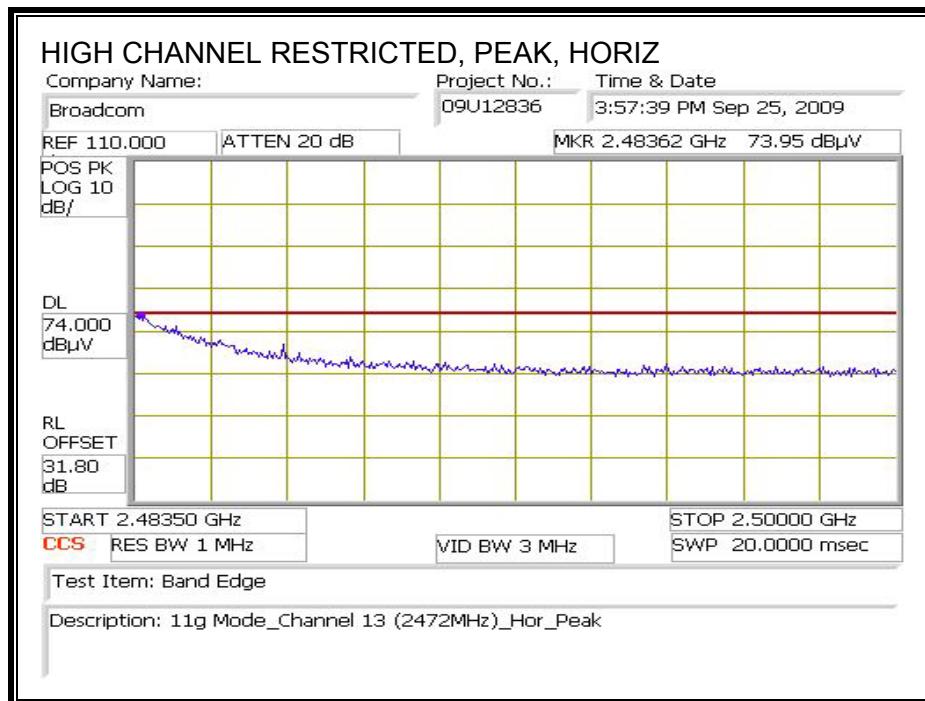
High Frequency Measurement Compliance Certification Services, Fremont 3m Chamber															
Company:	Broadcom														
Project #:	09U12836														
Date:	09_26_2009														
Test Engineer:	Thanh Nguyen														
Configuration:	EUT plug into the Laptop.														
Mode:	Transmit b mode														
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 15.205			
Hi Frequency Cables															
3' cable 22807700			12' cable 22807600			20' cable 22807500			HPF			Reject Filter			
3' cable 22807700			12' cable 22807600			20' cable 22807500						R_001			
Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz															
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Ch, 2412 MHz															
4.824	3.0	41.1	36.6	32.7	5.8	-34.8	0.0	0.0	44.8	40.2	74	54	-29.2	-13.8	V
12.060	3.0	31.6	20.1	36.5	9.8	-32.5	0.0	0.0	47.3	35.9	74	54	-26.7	-18.1	V
4.824	3.0	42.5	39.4	32.7	5.8	-34.8	0.0	0.0	46.1	43.1	74	54	-27.9	-10.9	H
12.060	3.0	34.0	25.0	38.5	9.8	-32.5	0.0	0.0	49.8	40.8	74	54	-24.2	-13.2	H
Mid ch, 2437 MHz															
4.874	3.0	44.4	39.6	32.7	5.8	-34.8	0.0	0.0	48.1	43.3	74	54	-25.9	-10.7	V
7.311	3.0	37.8	30.4	35.5	7.3	-34.1	0.0	0.0	46.4	39.0	74	54	-27.6	-15.0	V
12.185	3.0	33.4	23.0	38.5	9.8	-32.5	0.0	0.0	49.3	38.8	74	54	-24.7	-15.2	V
4.874	3.0	36.1	30.0	32.7	5.8	-34.8	0.0	0.0	39.8	33.7	74	54	-34.2	-20.3	H
7.311	3.0	40.8	35.9	35.5	7.3	-34.1	0.0	0.0	49.4	44.5	74	54	-24.6	-9.5	H
High Ch 2472 MHz															
4.944	3.0	41.0	37.1	32.8	5.9	-34.8	0.0	0.0	44.8	41.0	74	54	-29.2	-13.0	V
7.413	3.0	42.6	38.0	35.6	7.3	-34.1	0.0	0.0	51.4	46.9	74	54	-22.6	-7.1	V
12.360	3.0	37.0	31.4	38.5	9.9	-32.5	0.0	0.0	52.8	47.3	74	54	-21.2	-6.7	V
4.944	3.0	40.0	36.3	32.8	5.9	-34.8	0.0	0.0	43.9	40.1	74	54	-30.1	-13.9	H
7.413	3.0	39.1	33.6	35.6	7.3	-34.1	0.0	0.0	47.9	42.4	74	54	-26.1	-11.6	H
No other emissions above noise floor.															
f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss					Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter					Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit					

8.1.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 3m Chamber																																																																									
Company: Broadcom Project #: 09U12836 Date: 09_26_2009 Test Engineer: Thanh Nguyen Configuration: EUT plug into the Laptop. Mode: Transmit g mode																																																																									
Test Equipment: <table border="1"> <tr> <td>Horn 1-18GHz</td> <td>Pre-amplifier 1-26GHz</td> <td>Pre-amplifier 26-40GHz</td> <td colspan="4">Horn > 18GHz</td> <td>Limit</td> </tr> <tr> <td>T60; S/N: 2238 @3m</td> <td>T34 HP 8449B</td> <td></td> <td colspan="4"></td> <td>FCC 15.205</td> </tr> <tr> <td colspan="15">Hi Frequency Cables</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td colspan="4">HPF</td> <td>Reject Filter</td> <td colspan="6"> Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz </td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td colspan="4"></td> <td>R_001</td> <td colspan="6"></td> </tr> </table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit	T60; S/N: 2238 @3m	T34 HP 8449B						FCC 15.205	Hi Frequency Cables															3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF				Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz						3' cable 22807700	12' cable 22807600	20' cable 22807500					R_001						
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit																																																																		
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Low Ch, 2412 MHz																																																																									
4.824	3.0	44.0	27.0	32.7	5.8	-34.8	0.0	0.0	47.6	30.6	74	54	-26.4	-23.4	V																																																										
12.060	3.0	42.7	25.9	38.5	9.8	-32.5	0.0	0.0	58.5	41.7	74	54	-15.5	-12.3	V																																																										
4.824	3.0	49.2	33.9	32.7	5.8	-34.8	0.0	0.0	52.8	37.5	74	54	-21.2	-16.5	H																																																										
12.060	3.0	39.5	24.7	38.5	9.8	-32.5	0.0	0.0	55.3	40.4	74	54	-18.7	-13.6	H																																																										
Mid ch, 2437 MHz																																																																									
4.874	3.0	40.6	23.6	32.7	5.8	-34.8	0.0	0.0	44.3	27.3	74	54	-29.7	-26.7	V																																																										
7.311	3.0	44.1	29.6	35.5	7.3	-34.1	0.0	0.0	52.7	38.3	74	54	-21.3	-15.7	V																																																										
12.185	3.0	36.4	22.9	38.5	9.8	-32.5	0.0	0.0	52.2	38.7	74	54	-21.8	-15.3	V																																																										
4.874	3.0	47.5	28.4	32.7	5.8	-34.8	0.0	0.0	51.2	32.1	74	54	-22.8	-21.9	H																																																										
7.311	3.0	43.3	27.7	35.5	7.3	-34.1	0.0	0.0	51.9	36.3	74	54	-22.1	-17.7	H																																																										
High Ch, 2472MHz																																																																									
4.944	3.0	37.7	25.7	32.8	5.9	-34.8	0.0	0.0	41.5	29.6	74	54	-32.5	-24.4	V																																																										
7.416	3.0	47.8	32.0	35.6	7.3	-34.1	0.0	0.0	56.7	40.9	74	54	-17.3	-13.1	V																																																										
12.360	3.0	39.1	25.8	38.5	9.9	-32.5	0.0	0.0	55.0	41.7	74	54	-19.0	-12.3	V																																																										
4.944	3.0	42.1	23.6	32.8	5.9	-34.8	0.0	0.0	45.9	27.4	74	54	-28.1	-26.6	H																																																										
7.416	3.0	40.7	27.1	35.6	7.3	-34.1	0.0	0.0	49.6	36.0	74	54	-24.4	-18.0	H																																																										
No other emissions above noise floor.																																																																									
f Dist Read AF CL	Measurement Frequency Distance to Antenna Analyzer Reading Antenna Factor Cable Loss	Amp D Corr Avg Peak HPF	Preamp Gain Distance Correct to 3 meters Average Field Strength @ 3 m Calculated Peak Field Strength High Pass Filter	Avg Lim Pk Lim Avg Mar Pk Mar	Average Field Strength Limit Peak Field Strength Limit Margin vs. Average Limit Margin vs. Peak Limit																																																																				

Note: High channel 2472MHz was set to highest output power same as middle channel for harmonic measurement.

8.2. RECEIVER ABOVE 1 GHz IN THE 2.4 GHz BAND

High Frequency Measurement Compliance Certification Services, Fremont 3m Chamber																																																																																																																																																																																																																										
<p>Company: Broadcom Project #: 09U12836 Date: 09/22/09 Test Engineer: Vien Tran Configuration: FUT / Laptop Mode: Rx in 2.4GHz_Worst-Case</p>																																																																																																																																																																																																																										
<p><u>Test Equipment:</u></p> <table border="1"><tr><td>Horn 1-18GHz</td><td>Pre-amplifier 1-26GHz</td><td>Pre-amplifier 26-40GHz</td><td colspan="4">Horn > 18GHz</td><td>Limit</td></tr><tr><td>T60: S/N: 2238 @3m</td><td>T34 HP 8449B</td><td></td><td colspan="4"></td><td>FCC 15.209</td></tr><tr><td colspan="15">Hi Frequency Cables</td></tr><tr><td>3' cable 22807700</td><td>12' cable 22807600</td><td>20' cable 22807500</td><td colspan="4">HPF</td><td>Reject Filter</td><td colspan="7">Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz</td></tr><tr><td>3' cable 22807700</td><td>12' cable 22807600</td><td>20' cable 22807500</td><td colspan="4"></td><td></td><td colspan="7"></td></tr><tr><td>f GHz</td><td>Dist (m)</td><td>Read Pk dBuV</td><td>Read Avg. dBuV</td><td>AF dB/m</td><td>CL dB</td><td>Amp dB</td><td>D Corr dB</td><td>Fltr dB</td><td>Peak dBuV/m</td><td>Avg dBuV/m</td><td>Pk Lim dBuV/m</td><td>Avg Lim dBuV/m</td><td>Pk Mar dB</td><td>Avg Mar dB</td><td>Notes (V/H)</td></tr><tr><td>1.000</td><td>3.0</td><td>56.1</td><td>39.9</td><td>24.5</td><td>2.4</td><td>-38.3</td><td>0.0</td><td>0.0</td><td>44.7</td><td>28.5</td><td>74</td><td>54</td><td>-29.3</td><td>-25.5</td><td>H</td></tr><tr><td>2.492</td><td>3.0</td><td>54.6</td><td>33.7</td><td>28.3</td><td>3.9</td><td>-36.3</td><td>0.0</td><td>0.0</td><td>50.6</td><td>29.7</td><td>74</td><td>54</td><td>-23.4</td><td>-24.3</td><td>H</td></tr><tr><td>4.975</td><td>3.0</td><td>49.9</td><td>29.3</td><td>32.8</td><td>5.9</td><td>-34.8</td><td>0.0</td><td>0.0</td><td>53.8</td><td>33.2</td><td>74</td><td>54</td><td>-20.2</td><td>-20.8</td><td>H</td></tr><tr><td>1.000</td><td>3.0</td><td>56.9</td><td>41.8</td><td>24.5</td><td>2.4</td><td>-38.3</td><td>0.0</td><td>0.0</td><td>45.5</td><td>30.4</td><td>74</td><td>54</td><td>-28.5</td><td>-23.6</td><td>V</td></tr><tr><td>1.196</td><td>3.0</td><td>55.5</td><td>39.5</td><td>25.1</td><td>2.6</td><td>-38.0</td><td>0.0</td><td>0.0</td><td>45.2</td><td>29.2</td><td>74</td><td>54</td><td>-28.8</td><td>-24.8</td><td>V</td></tr><tr><td>2.492</td><td>3.0</td><td>56.1</td><td>32.9</td><td>28.3</td><td>3.9</td><td>-36.3</td><td>0.0</td><td>0.0</td><td>52.1</td><td>28.9</td><td>74</td><td>54</td><td>-21.9</td><td>-25.1</td><td>V</td></tr><tr><td>4.975</td><td>3.0</td><td>53.8</td><td>28.5</td><td>32.8</td><td>5.9</td><td>-34.8</td><td>0.0</td><td>0.0</td><td>57.7</td><td>32.4</td><td>74</td><td>54</td><td>-16.3</td><td>-21.6</td><td>V</td></tr><tr><td colspan="15"><p>f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit</p></td></tr></table>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit	T60: S/N: 2238 @3m	T34 HP 8449B						FCC 15.209	Hi Frequency Cables															3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF				Reject Filter	Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz							3' cable 22807700	12' cable 22807600	20' cable 22807500													f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	1.000	3.0	56.1	39.9	24.5	2.4	-38.3	0.0	0.0	44.7	28.5	74	54	-29.3	-25.5	H	2.492	3.0	54.6	33.7	28.3	3.9	-36.3	0.0	0.0	50.6	29.7	74	54	-23.4	-24.3	H	4.975	3.0	49.9	29.3	32.8	5.9	-34.8	0.0	0.0	53.8	33.2	74	54	-20.2	-20.8	H	1.000	3.0	56.9	41.8	24.5	2.4	-38.3	0.0	0.0	45.5	30.4	74	54	-28.5	-23.6	V	1.196	3.0	55.5	39.5	25.1	2.6	-38.0	0.0	0.0	45.2	29.2	74	54	-28.8	-24.8	V	2.492	3.0	56.1	32.9	28.3	3.9	-36.3	0.0	0.0	52.1	28.9	74	54	-21.9	-25.1	V	4.975	3.0	53.8	28.5	32.8	5.9	-34.8	0.0	0.0	57.7	32.4	74	54	-16.3	-21.6	V	<p>f Measurement Frequency Dist Distance to Antenna Read Analyzer Reading AF Antenna Factor CL Cable Loss Amp Preamp Gain D Corr Distance Correct to 3 meters Avg Average Field Strength @ 3 m Peak Calculated Peak Field Strength HPF High Pass Filter Avg Lim Average Field Strength Limit Pk Lim Peak Field Strength Limit Avg Mar Margin vs. Average Limit Pk Mar Margin vs. Peak Limit</p>														
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz				Limit																																																																																																																																																																																																																			
T60: S/N: 2238 @3m	T34 HP 8449B						FCC 15.209																																																																																																																																																																																																																			
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2.492	3.0	54.6	33.7	28.3	3.9	-36.3	0.0	0.0	50.6	29.7	74	54	-23.4	-24.3	H																																																																																																																																																																																																											
4.975	3.0	49.9	29.3	32.8	5.9	-34.8	0.0	0.0	53.8	33.2	74	54	-20.2	-20.8	H																																																																																																																																																																																																											
1.000	3.0	56.9	41.8	24.5	2.4	-38.3	0.0	0.0	45.5	30.4	74	54	-28.5	-23.6	V																																																																																																																																																																																																											
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8.3. WORST-CASE BELOW 1 GHz

WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL

HORIZONTAL VERTICAL DATA													
30-1000MHz Frequency Measurement													
Compliance Certification Services, Fremont 3m Chamber													
Test Engr:	Vien Tran												
Date:	09/24/09												
Project #:	09U12836												
Company:	Broadcom												
EUT Description:	802.11g/Draft 802n WLAN PCI-E Minicard												
EUT M/N:	BCM94313HMG2L												
Test Target:	FCC Class B												
Mode Oper:	Tx in 2.4GHz Band_Worst-Case												
f	Measurement Frequency	Amp	Preamp Gain							Margin	Margin vs. Limit		
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters										
Read	Analyzer Reading	Filter	Filter Insert Loss										
AF	Antenna Factor	Corr.	Calculated Field Strength										
CL	Cable Loss	Limit	Field Strength Limit										
f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
HORIZONTAL													
166.566	3.0	50.0	11.9	1.1	27.7	0.0	0.0	35.4	43.5	-8.1	H	EP	
365.654	3.0	46.9	14.5	1.7	27.8	0.0	0.0	35.2	46.0	-10.8	H	EP	
399.855	3.0	53.2	15.0	1.7	28.0	0.0	0.0	42.0	46.0	-4.0	H	EP	
696.867	3.0	48.9	18.9	2.4	28.5	0.0	0.0	41.7	46.0	-4.3	H	EP	
899.796	3.0	38.7	22.1	2.7	27.9	0.0	0.0	35.7	46.0	-10.3	H	EP	
VERTICAL													
166.566	3.0	52.7	11.9	1.1	27.7	0.0	0.0	38.1	43.5	-5.4	V	EP	
240.009	3.0	51.9	11.8	1.3	27.4	0.0	0.0	37.6	46.0	-8.4	V	EP	
299.891	3.0	48.7	13.5	1.5	27.4	0.0	0.0	36.3	46.0	-9.7	V	EP	
699.748	3.0	47.7	18.9	2.4	28.5	0.0	0.0	40.5	46.0	-5.5	V	EP	
799.712	3.0	43.5	20.9	2.5	28.2	0.0	0.0	38.7	46.0	-7.3	V	EP	
899.436	3.0	38.9	22.1	2.7	27.9	0.0	0.0	35.8	46.0	-10.2	V	EP	
Rev. 1.27.09													
Note: No other emissions were detected above the system noise floor.													

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

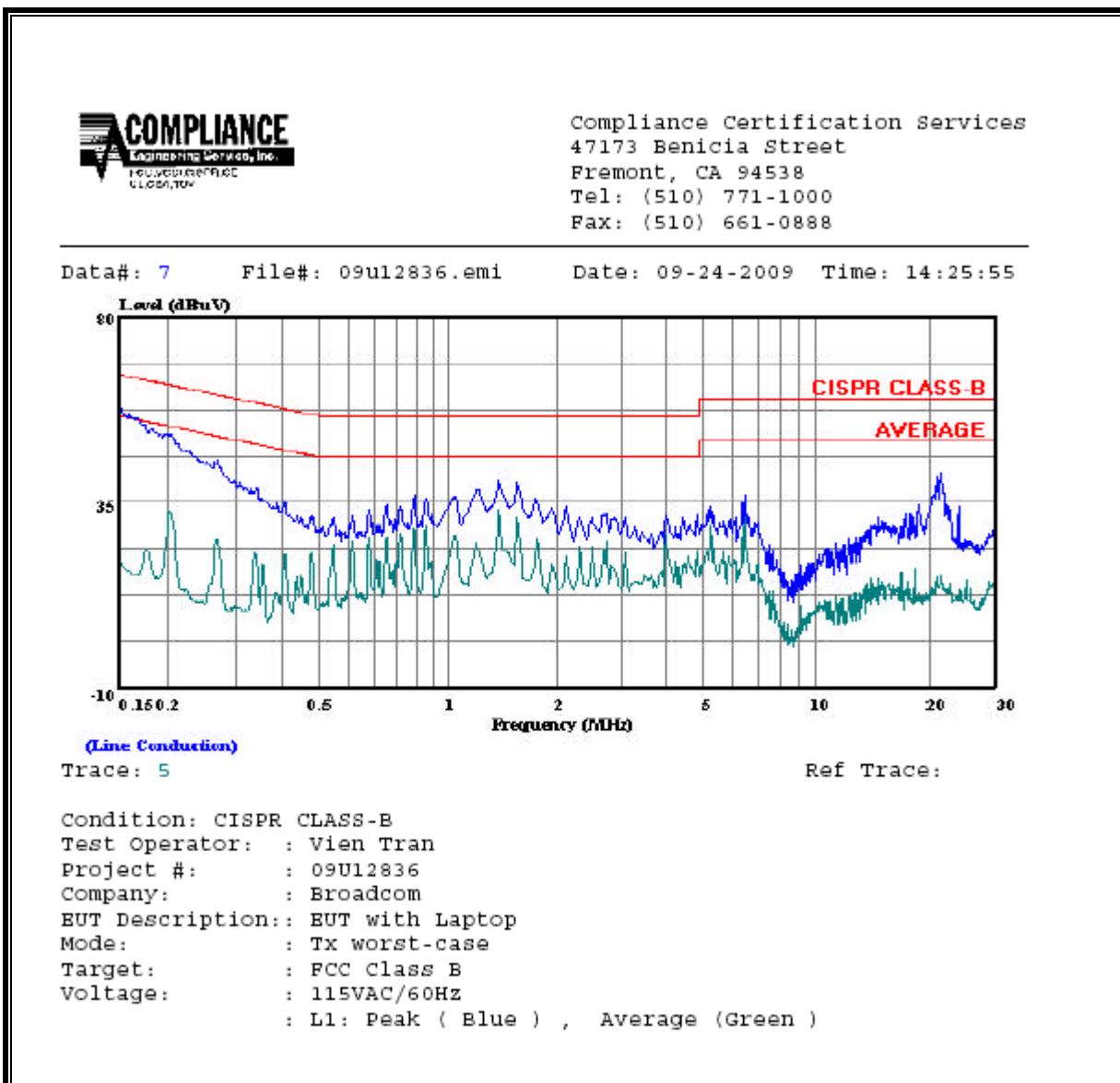
ANSI C63.4

RESULTS

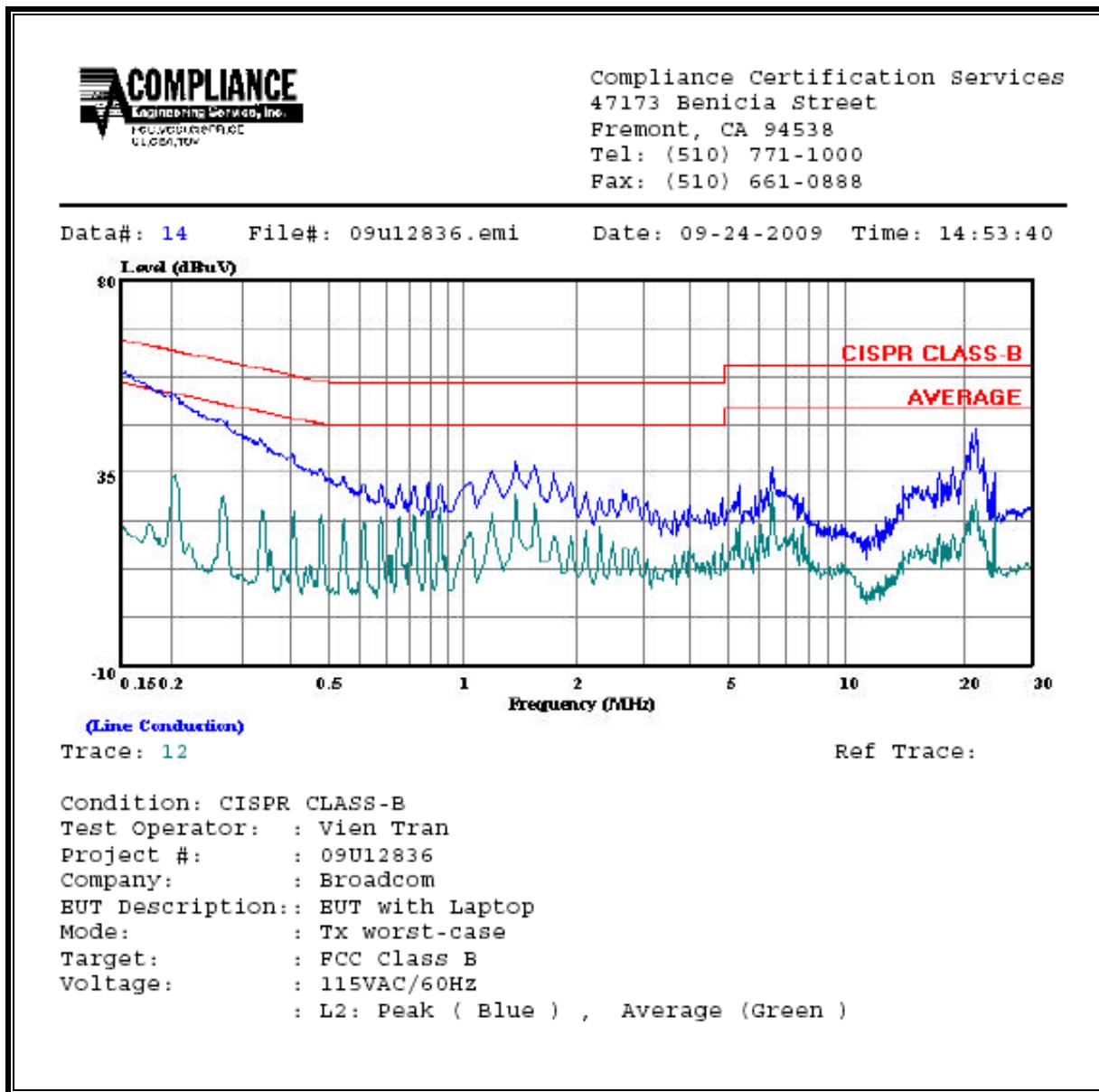
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Closs (dB)	Limit	FCC_B	Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.20	51.52	--	32.65	0.00	63.45	53.45	-11.93	-20.80	L1
1.49	39.47	--	33.14	0.00	56.00	46.00	-16.53	-12.86	L1
21.49	42.04	--	17.10	0.00	60.00	50.00	-17.96	-32.90	L1
0.20	53.64	--	34.30	0.00	63.45	53.45	-9.81	-19.15	L2
1.49	37.49	--	30.31	0.00	56.00	46.00	-18.51	-15.69	L2
21.49	45.16	--	21.49	0.00	60.00	50.00	-14.84	-28.51	L2
6 Worst Data									

LINE 1 RESULTS



LINE 2 RESULTS



10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

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

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

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

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

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

f = frequency in MHz

* = Plane-wave equivalent power density

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

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

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 ²)	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/m² is equivalent to 1 mW/cm².
 3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μ T) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

$$S = EIRP / (4 * \pi * D^2)$$

where

S = Power density in W/m²

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m² is converted to units of mWc/m² by dividing by 10.

Distance is given by:

$$D = \sqrt{EIRP / (4 * \pi * S)}$$

where

D = Separation distance in m

EIRP = Equivalent Isotropic Radiated Power in W

S = Power density in W/m²

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

$$\text{Total EIRP} = (P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)$$

where

P_x = Power of transmitter x

G_x = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

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

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m²

RESULTS

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m ²)	FCC Power Density (mW/cm ²)
2.4 GHz	WLAN	0.20	25.31	3.90	1.66	0.166