



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

**CERTIFICATION TEST REPORT**

**FOR**

**802.11g / Draft 802.11n WLAN + BLUETOOTH PCI-E MINICARD**

**MODEL NUMBER: BCM94313HMGB**

**FCC ID: QDS-BRCM1051**

**IC: 4324A-BRCM1051**

**REPORT NUMBER: 09U12871-2, Revision A**

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/04/09	Initial Issue	T. Chan
A	11/09/09	Addressed TCB Questions on Date Tested and Worst Case Highest Output Power g-Mode	T. Chan

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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 + Bluetooth PCI-E Minicard

**MODEL:** BCM94313HMGB

**SERIAL NUMBER:** 55 (P202)

**DATE TESTED:** OCTOBER 23 – NOVEMBER 03, 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:



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THU CHAN  
EMC MANAGER  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



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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 + Bluetooth 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	22.93	196.34
2412 - 2472	802.11g	26.15	412.10
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 5.60.18.37. The test utility software used during testing was Broadcom version 5.60.18.31.

### 5.5. NUMBER OF TRANSMIT CHAINS

Selected measurements were performed on the Main and Auxiliary chains for 802.11b/g mode; however only one of these chains will be transmitting at any time.

### 5.6. 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 11g 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.

## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Inspiron 630m	814C40100252200122KS00	Doc
AC Adapter	Dell	HP-0Q065B83	CN-0N2765-47890-43-S-1042	N/A
Laptop	Lenovo	4446	R8-CAC56 09/08	Doc
AC Adapter	Lenovo	ADP 65YB B	N/A	N/A
Adapter Board	Broadcom	BCRM943224PCIEBTAD	1261490	N/A

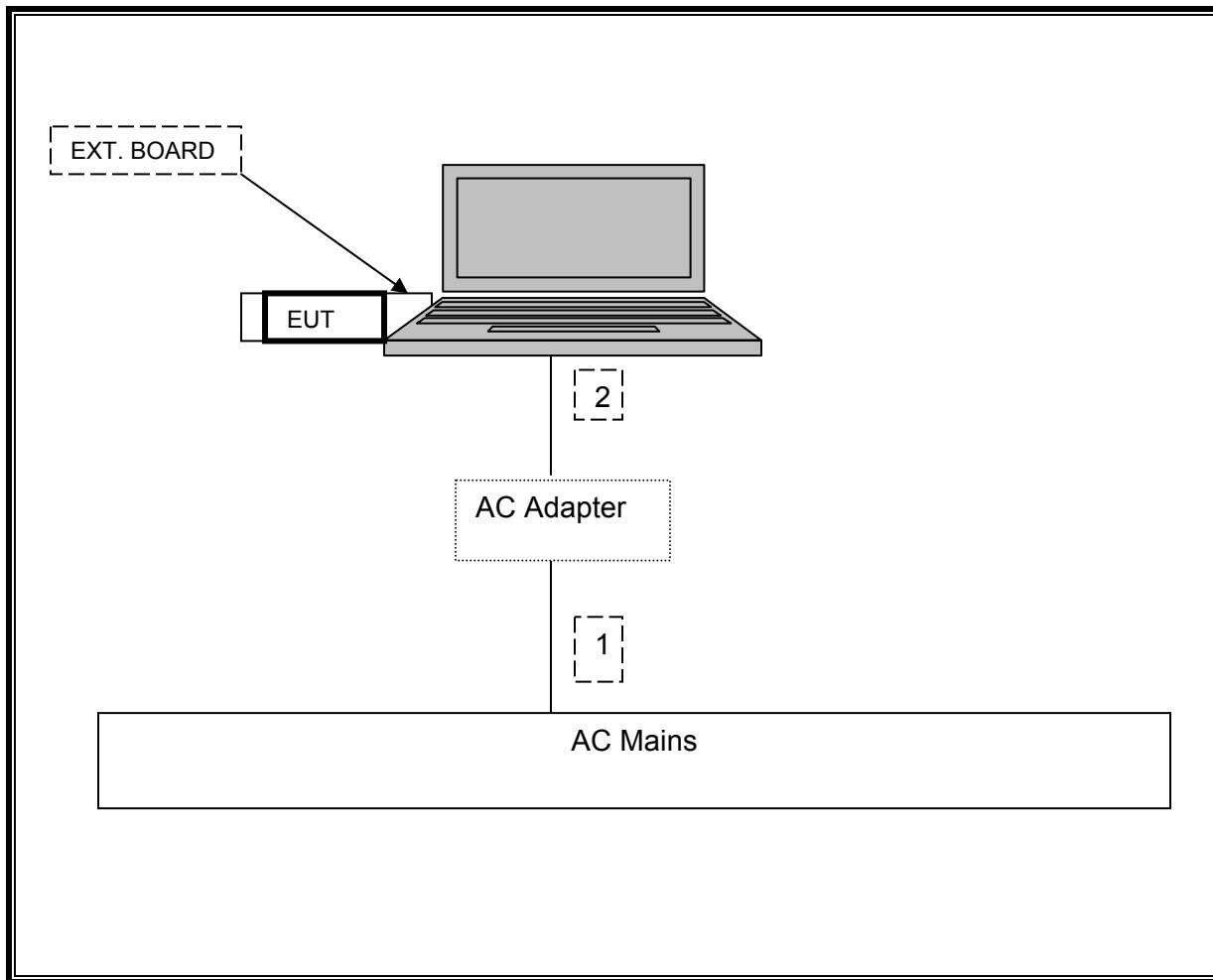
### I/O CABLES

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
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/10
Antenna, Biolog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/22/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	03/31/10
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/05/10
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/05/10
Peak Power Meter	Boonton	4541	C01186	01/19/10
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	10/29/10
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	02/06/10

## 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.

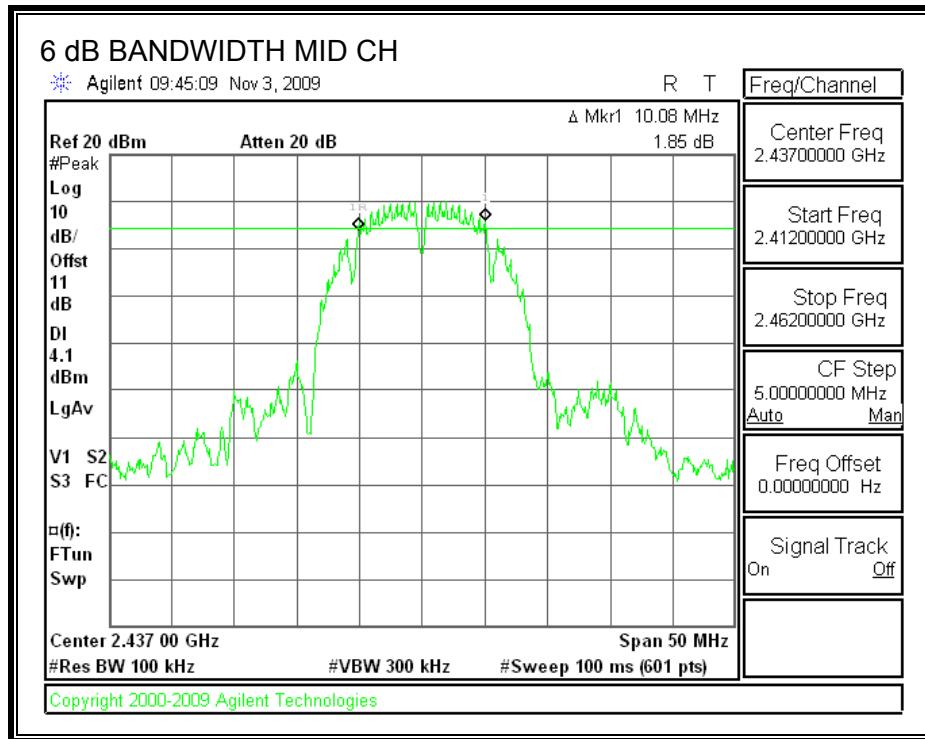
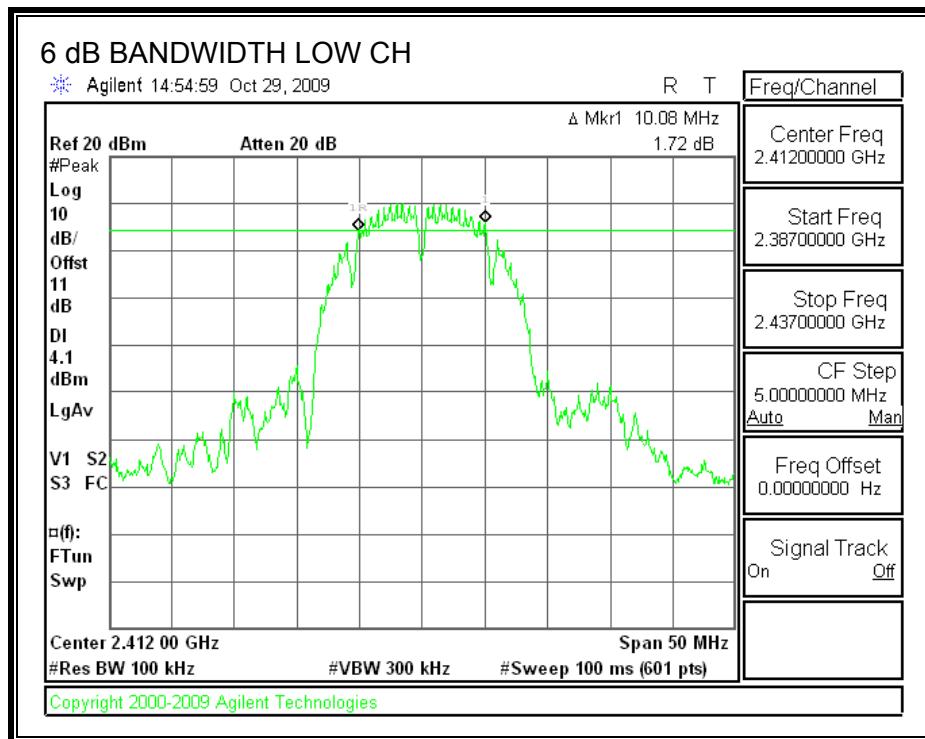
##### TEST PROCEDURE

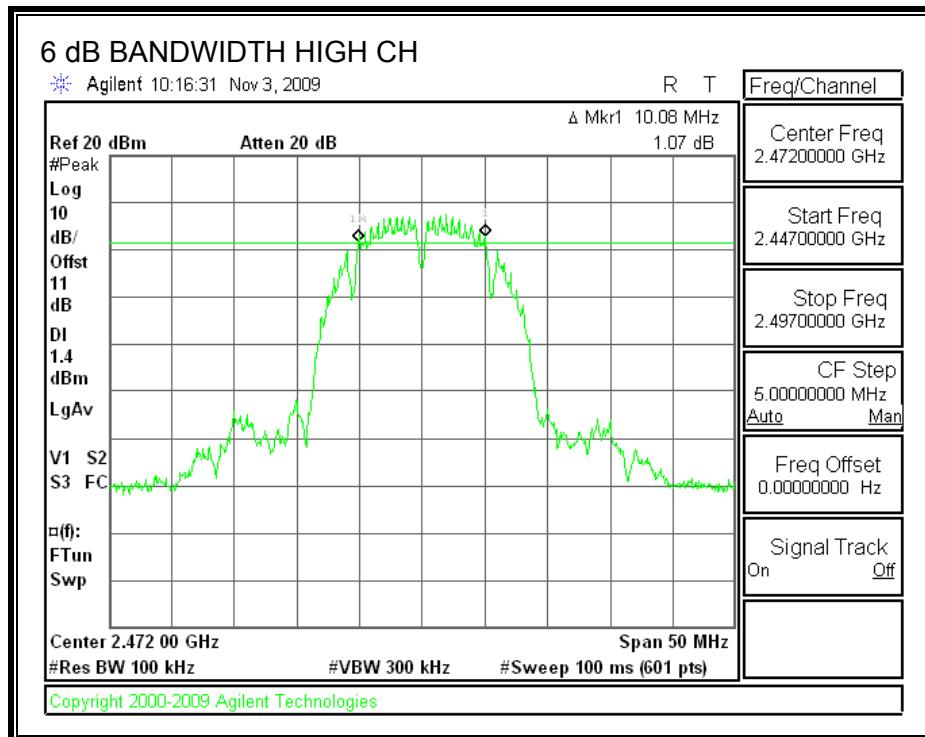
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

##### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	10.08	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.

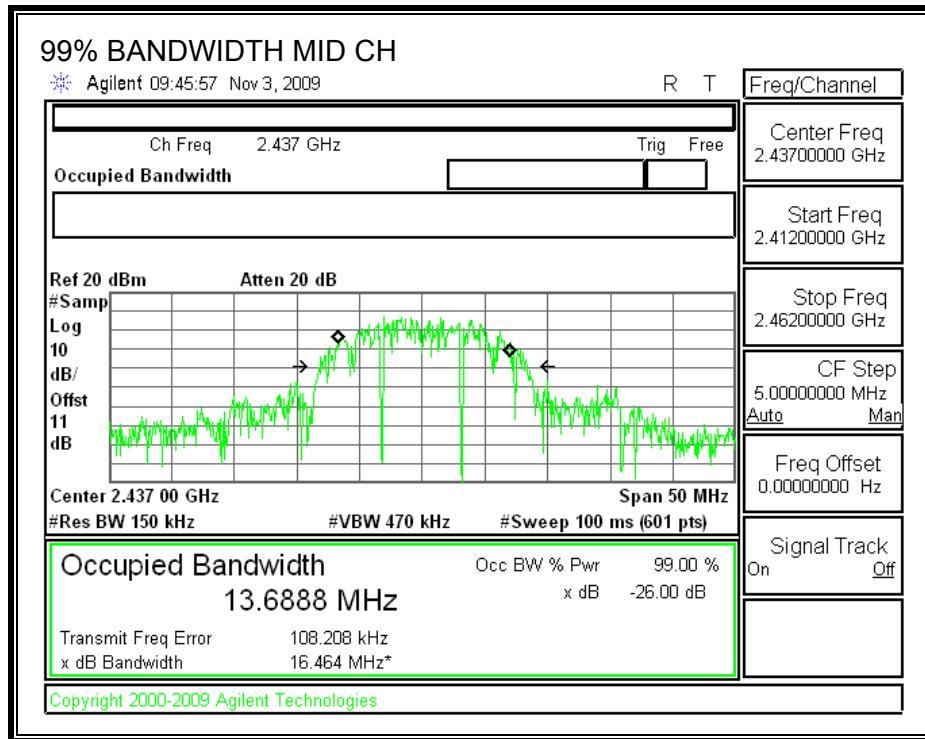
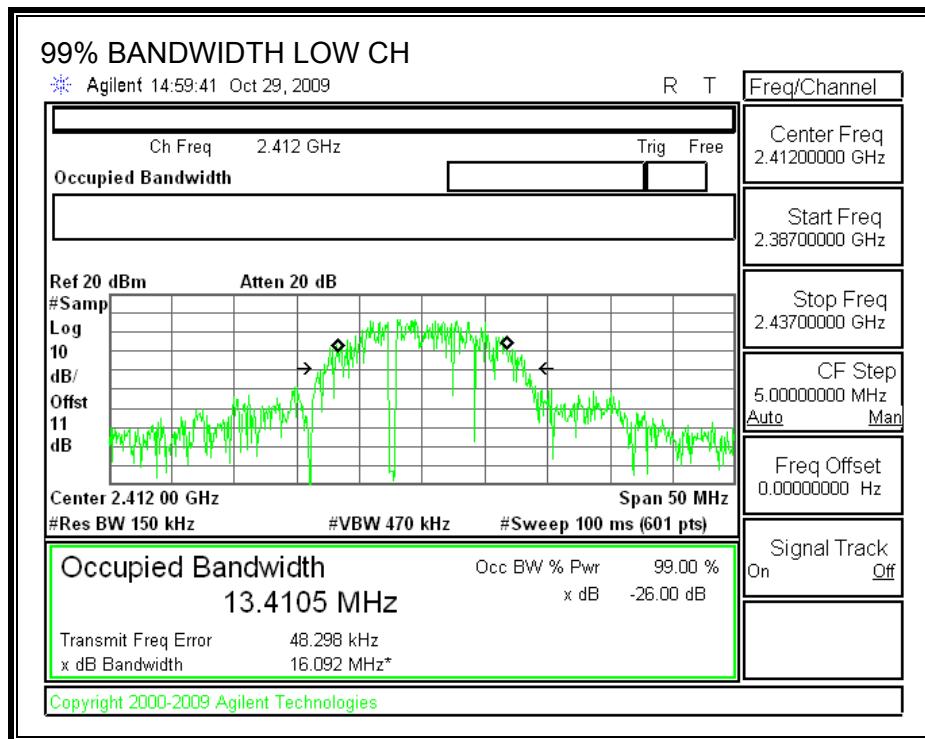
#### TEST PROCEDURE

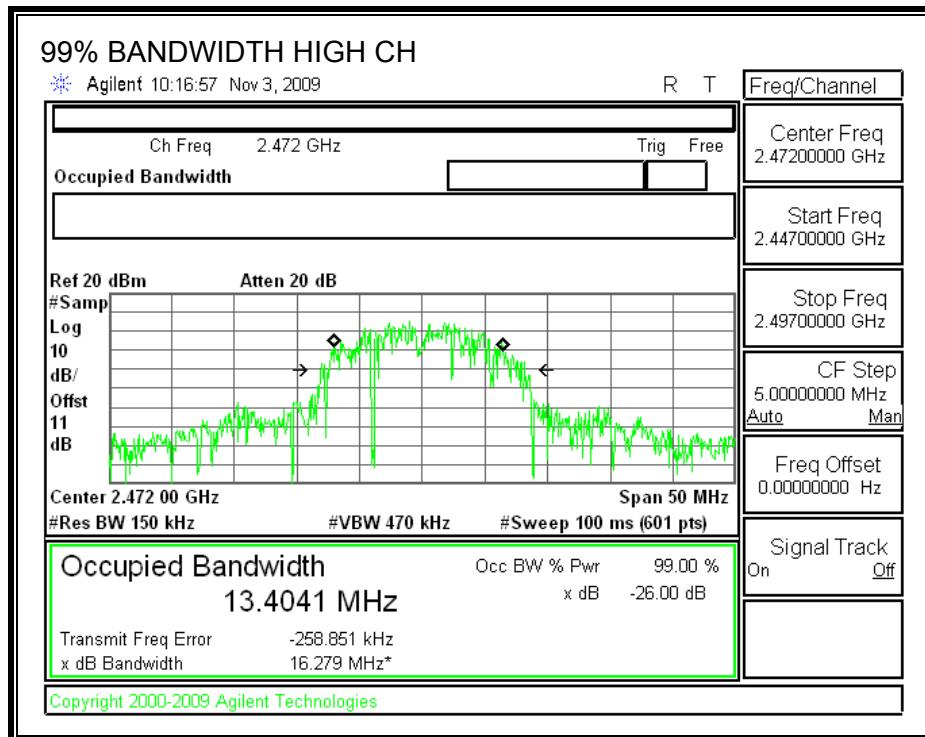
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	13.4105
Middle	2437	13.6888
High	2472	13.4014

**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	22.58	30	-7.42
Middle	2437	22.93	30	-7.07
High	2472	20.47	30	-9.53

#### 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.

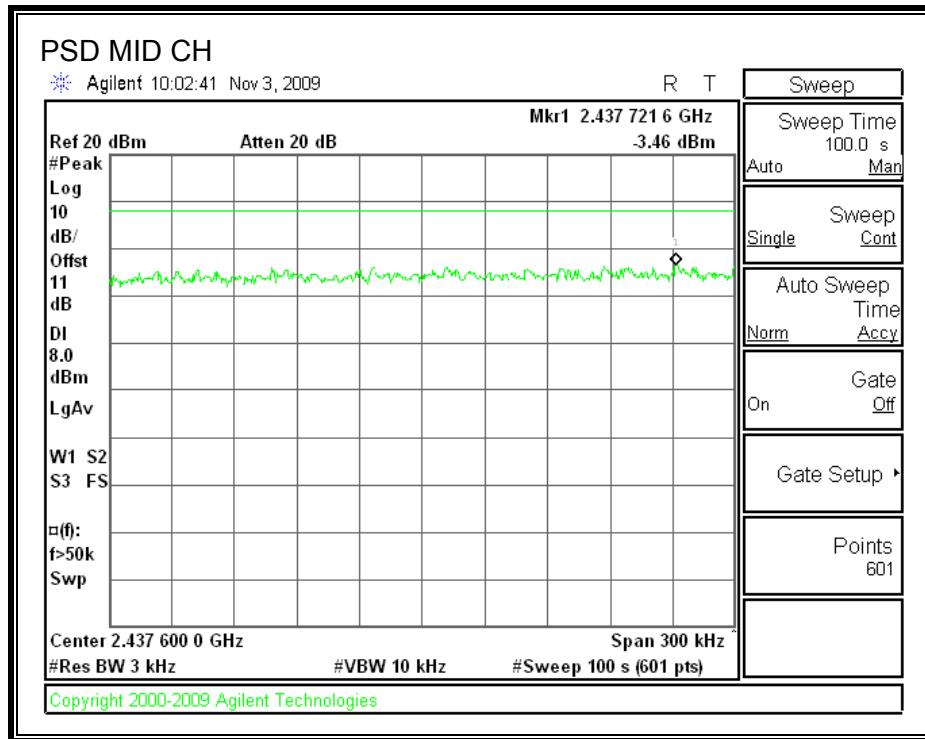
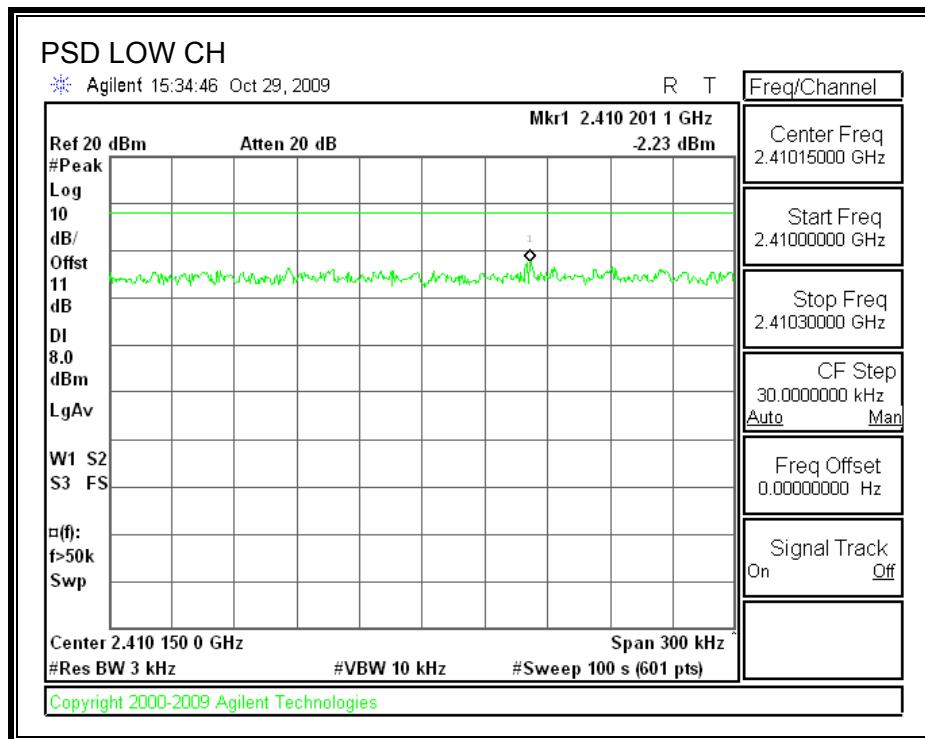
##### TEST PROCEDURE

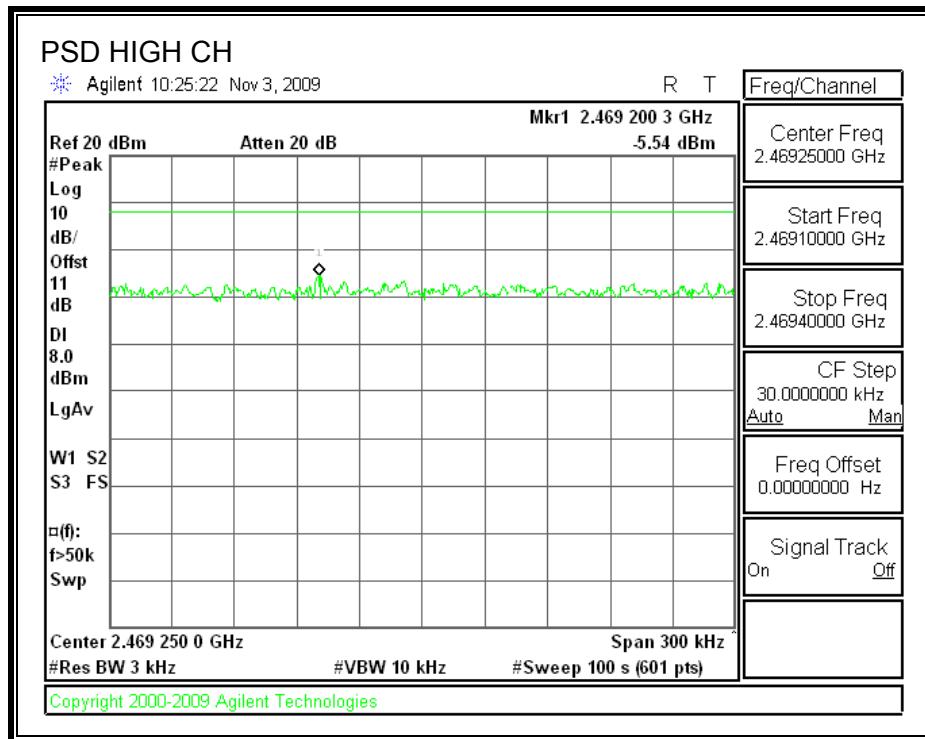
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

##### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-2.23	8	-10.23
Middle	2437	-3.46	8	-11.46
High	2472	-5.54	8	-13.54

**POWER SPECTRAL DENSITY**





### 7.1.5. CONDUCTED SPURIOUS EMISSIONS

#### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

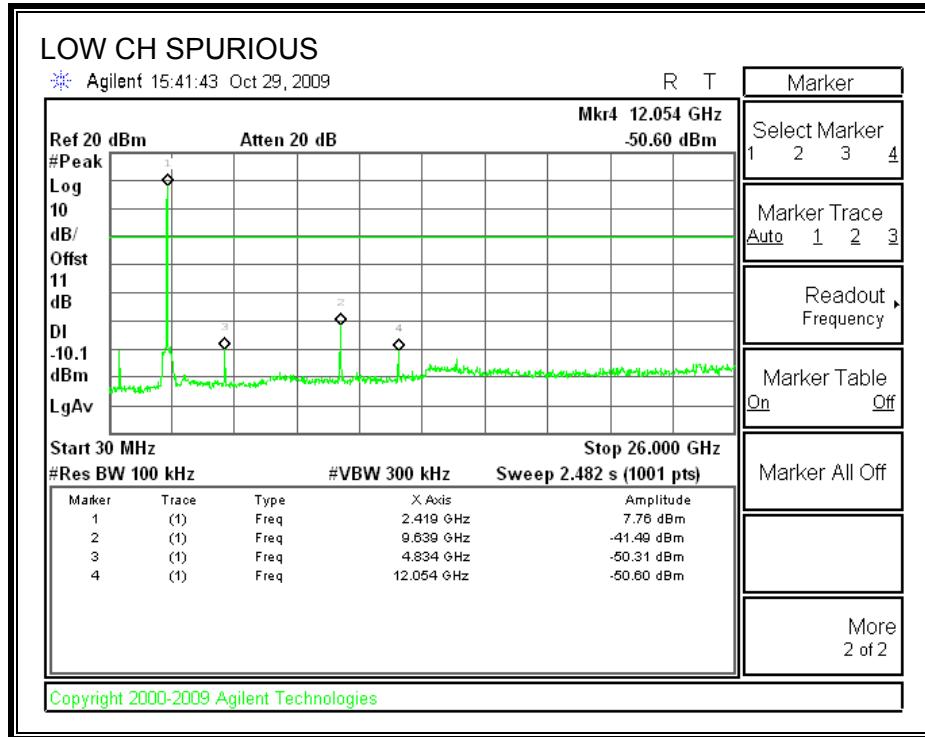
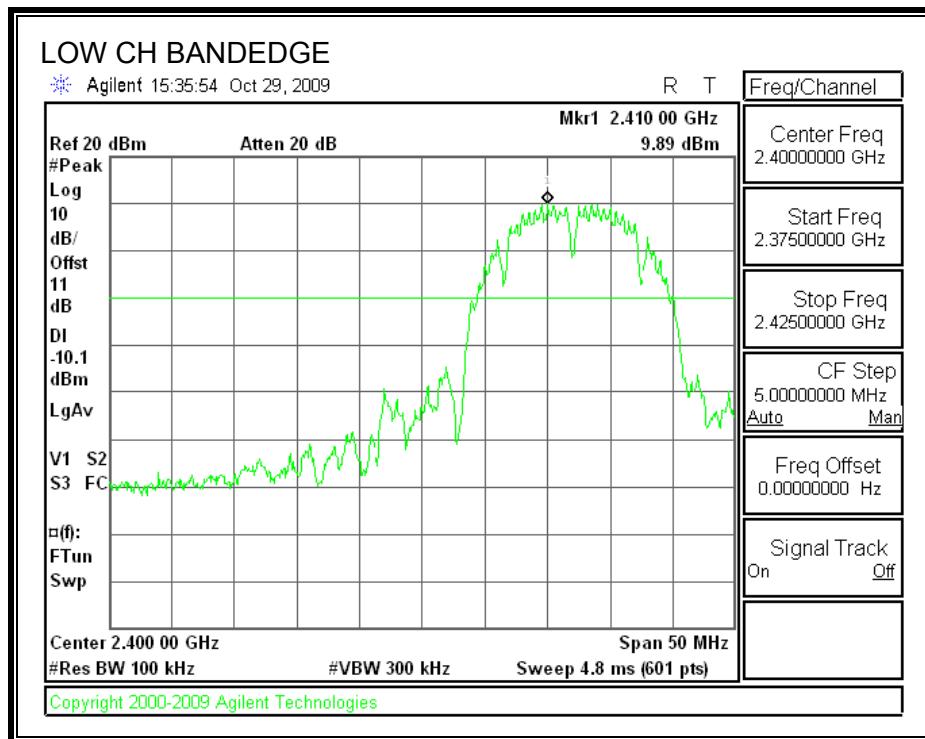
Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

#### TEST PROCEDURE

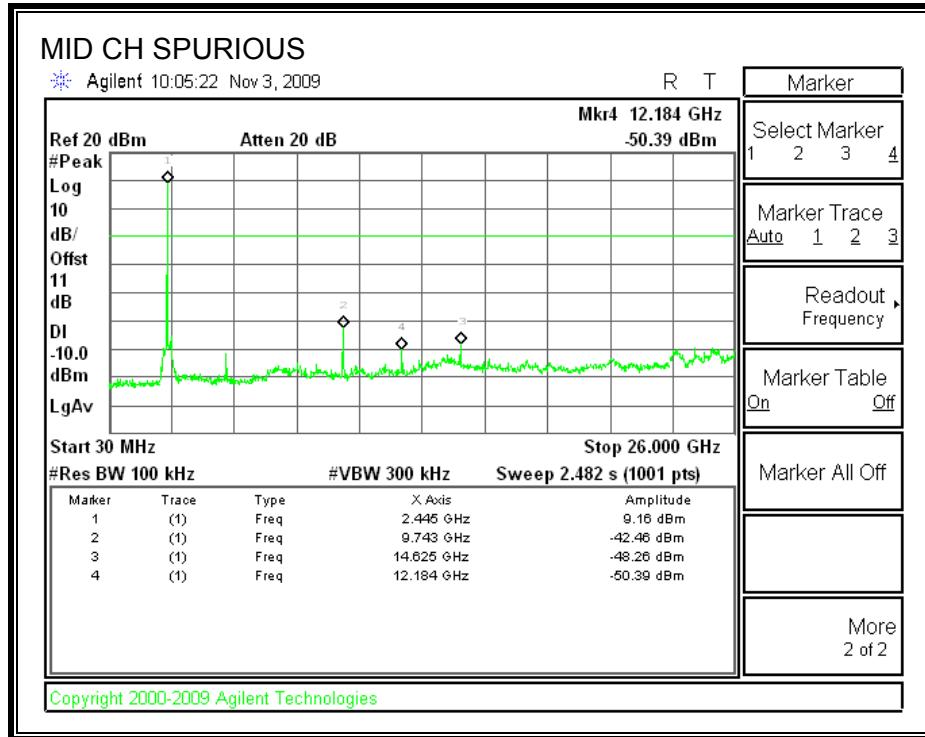
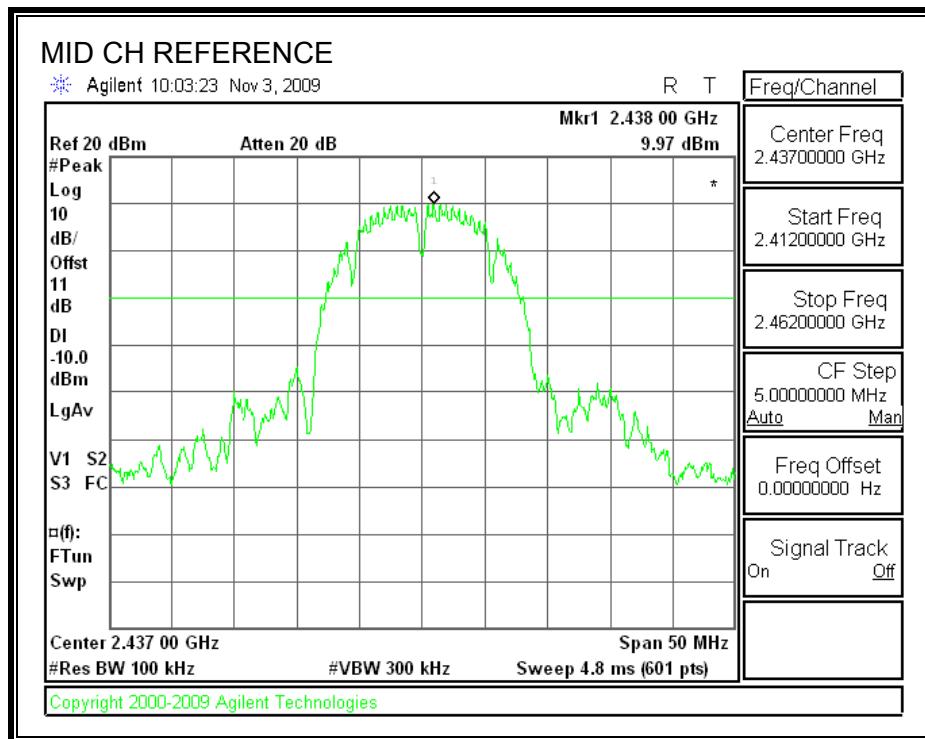
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

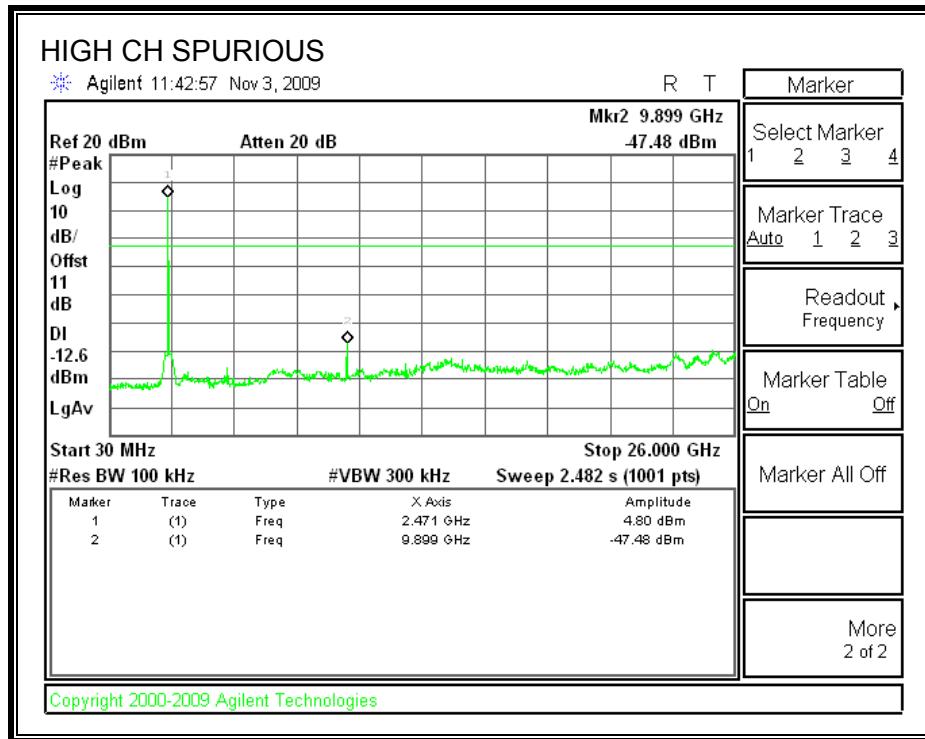
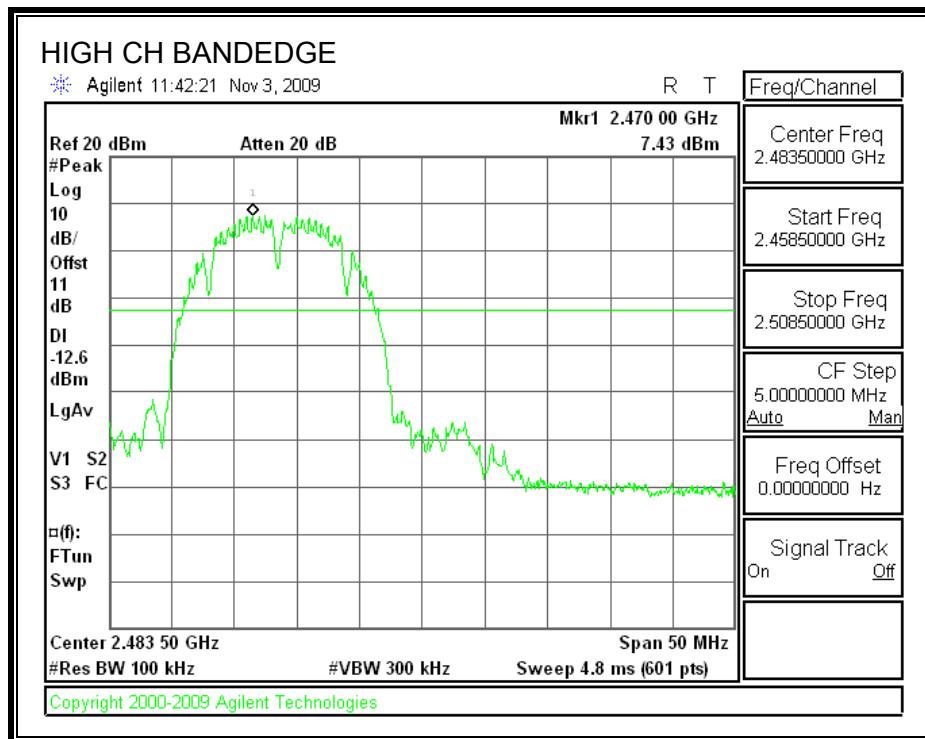
SPURIOUS EMISSIONS, LOW CHANNEL



## 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.

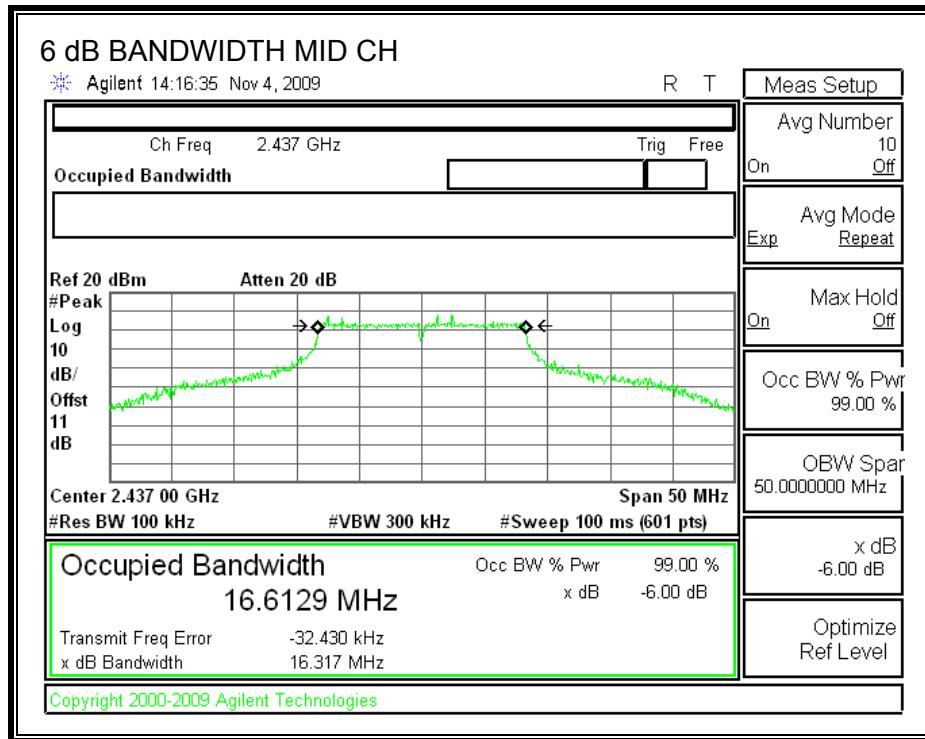
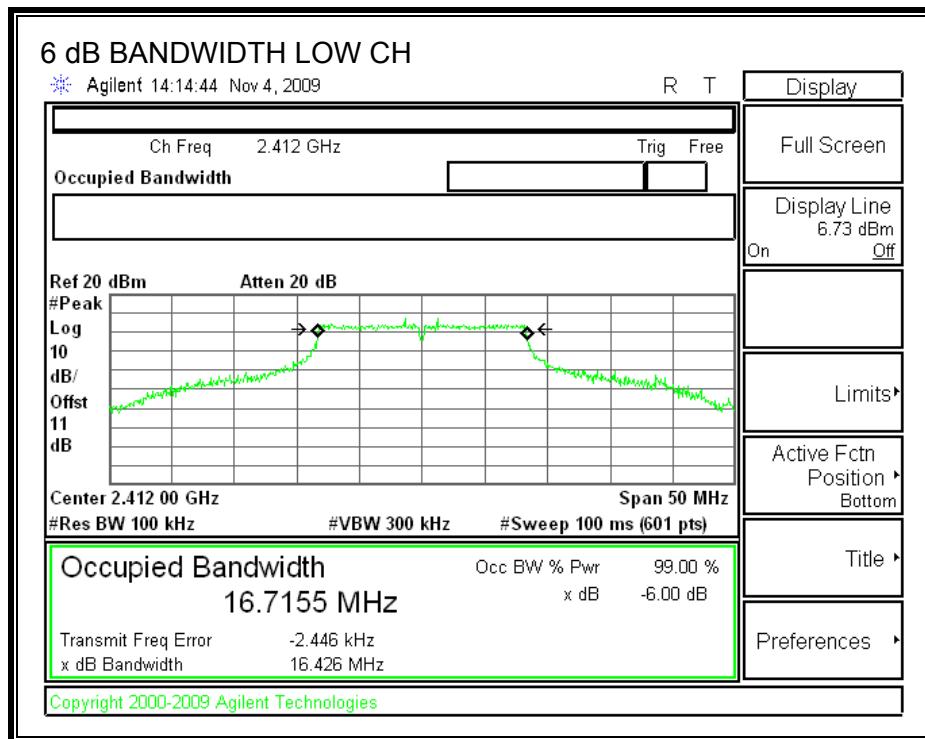
#### TEST PROCEDURE

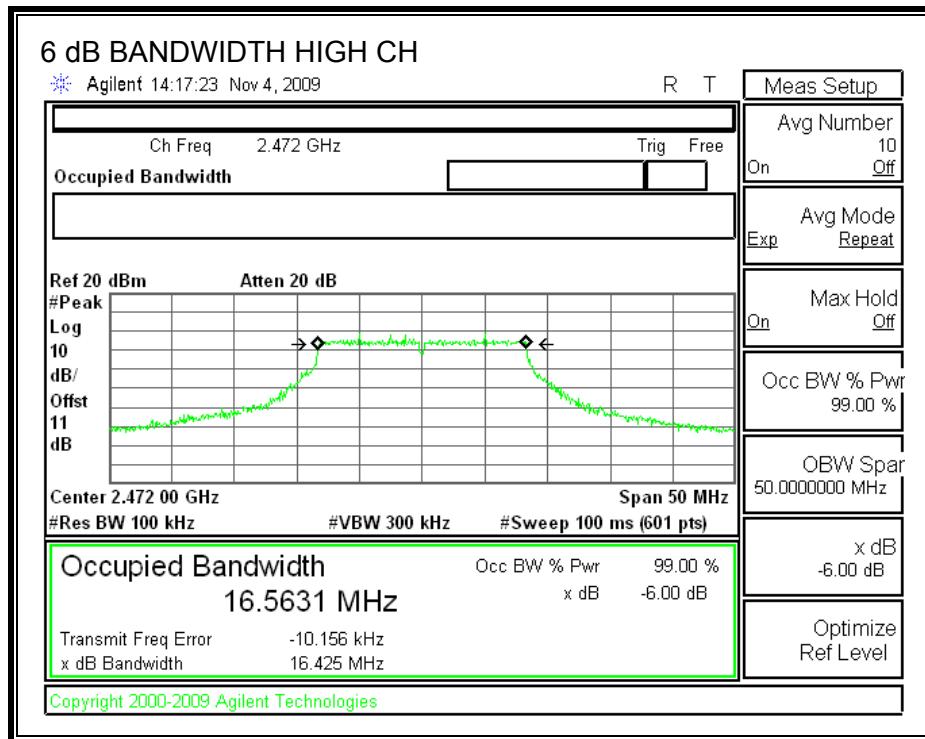
The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

#### RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.426	0.5
Middle	2437	16.317	0.5
High	2472	16.425	0.5

## 6 dB BANDWIDTH





### 7.2.2. 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

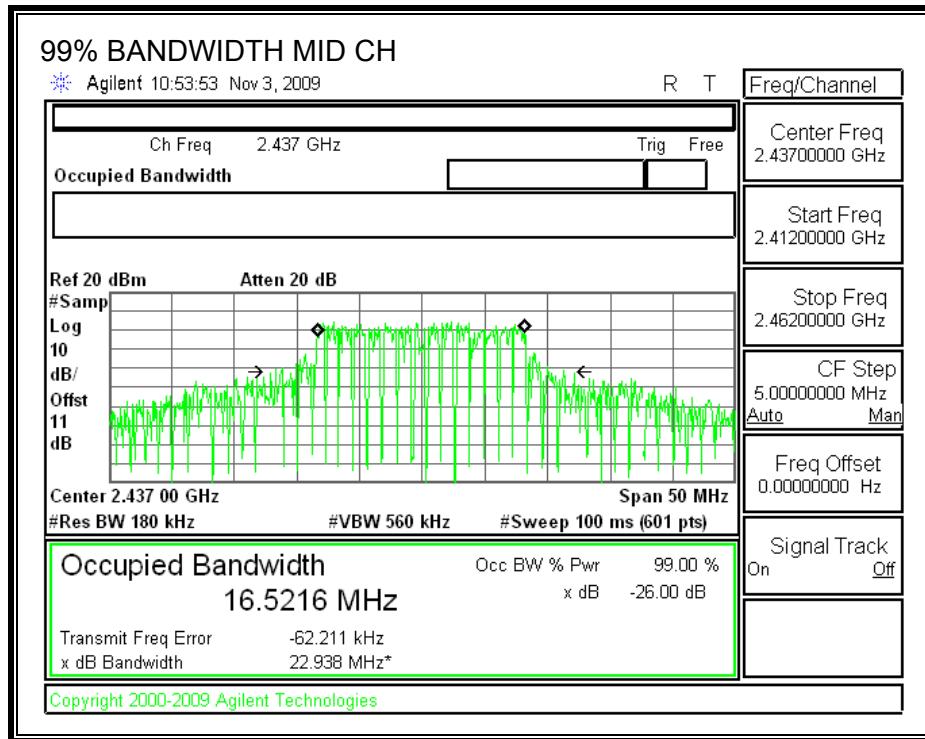
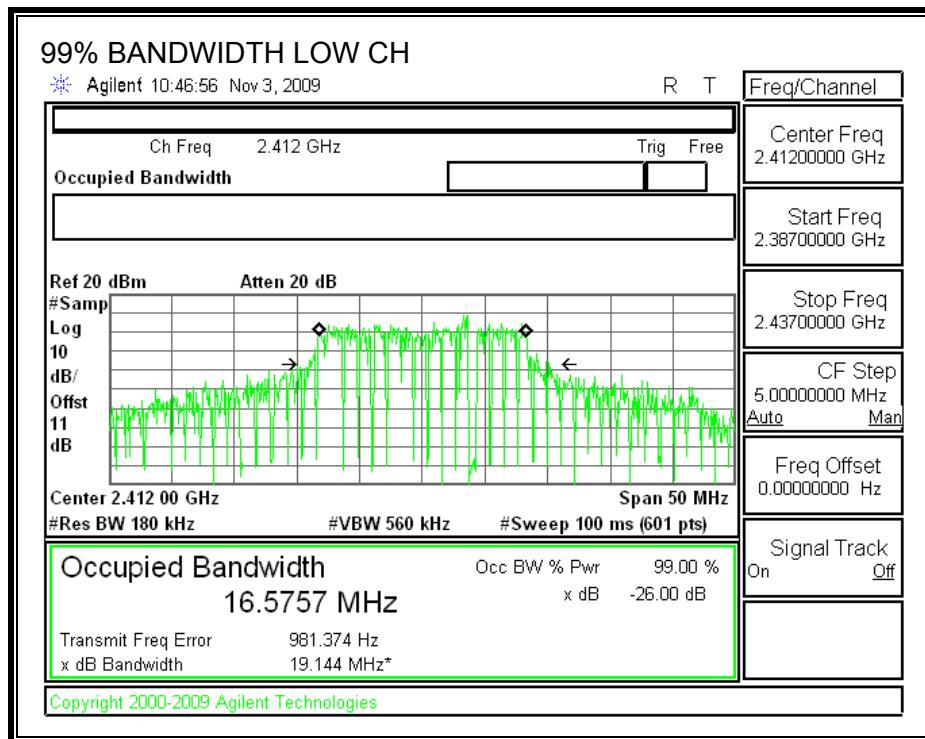
#### TEST PROCEDURE

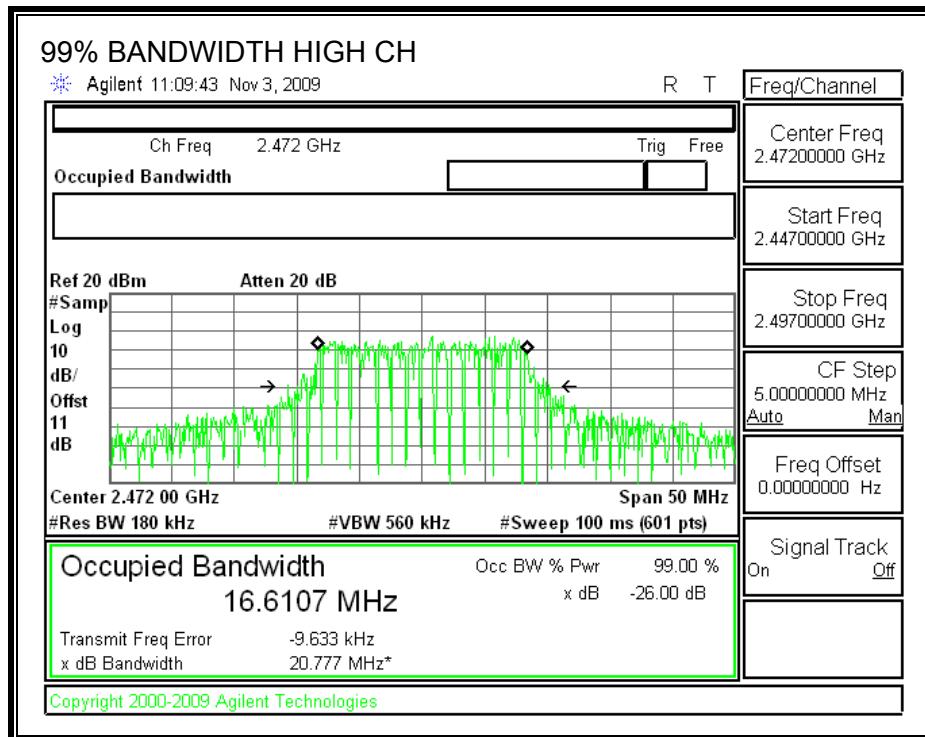
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.5757
Middle	2437	16.5216
High	2472	16.6107

**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	26.11	30	-3.89
Middle	2437	26.15	30	-3.85
High	2472	20.49	30	-9.51

## 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.

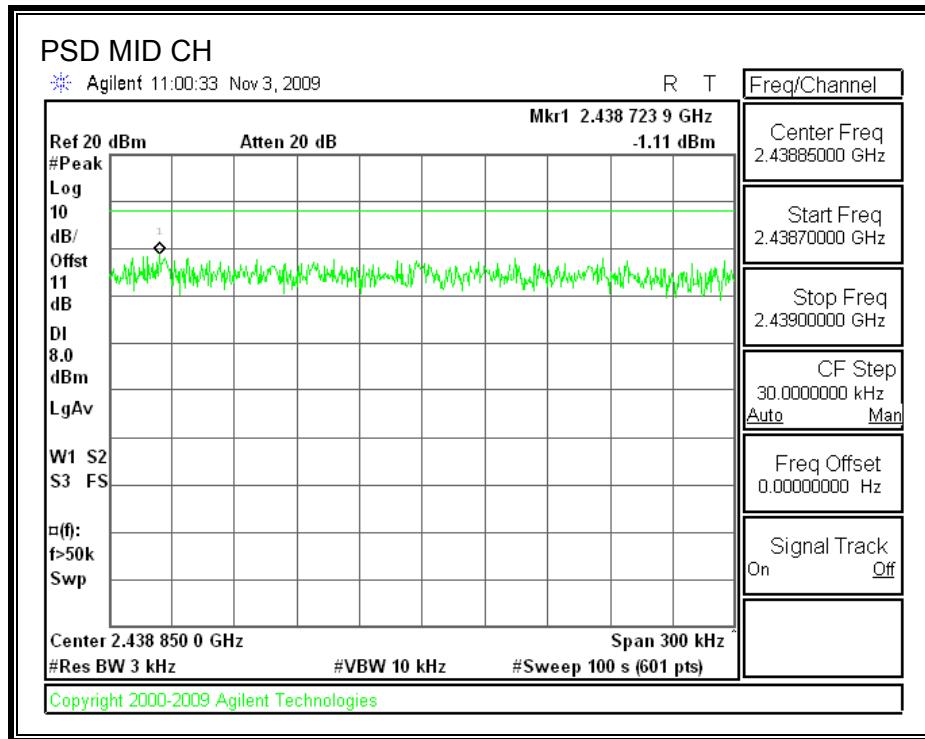
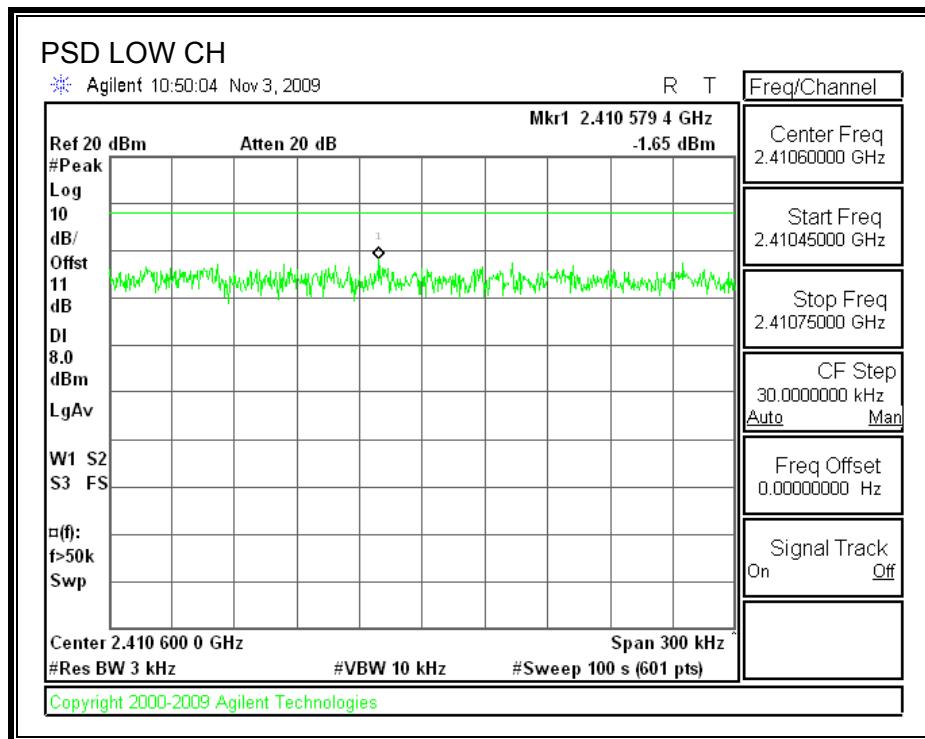
### TEST PROCEDURE

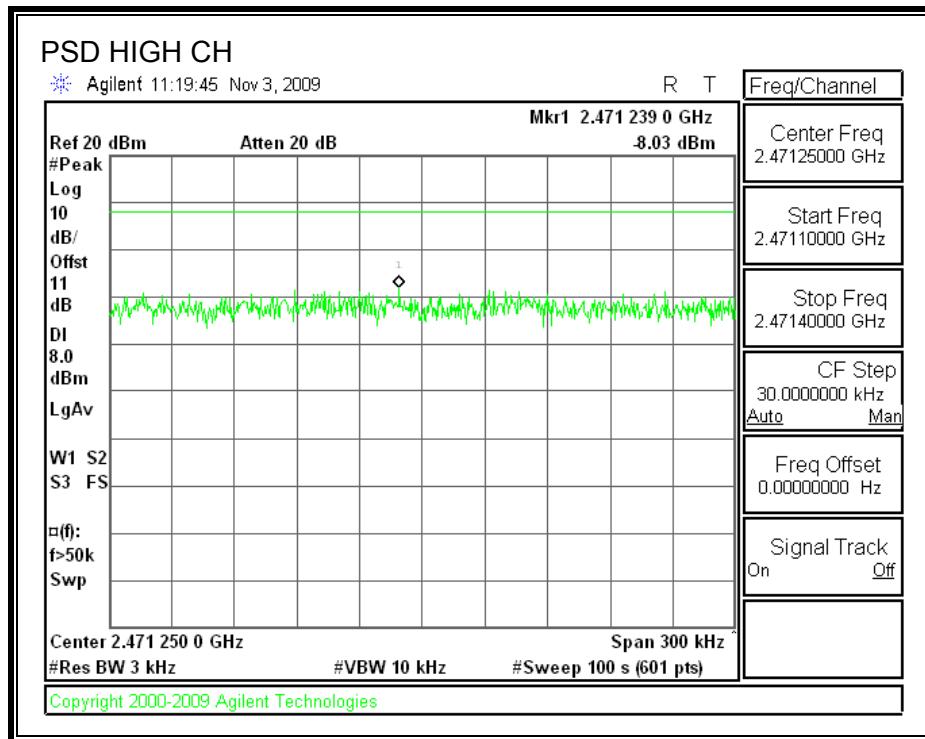
Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-1.65	8	-9.65
Middle	2437	-1.11	8	-9.11
High	2472	-8.03	8	-16.03

**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.

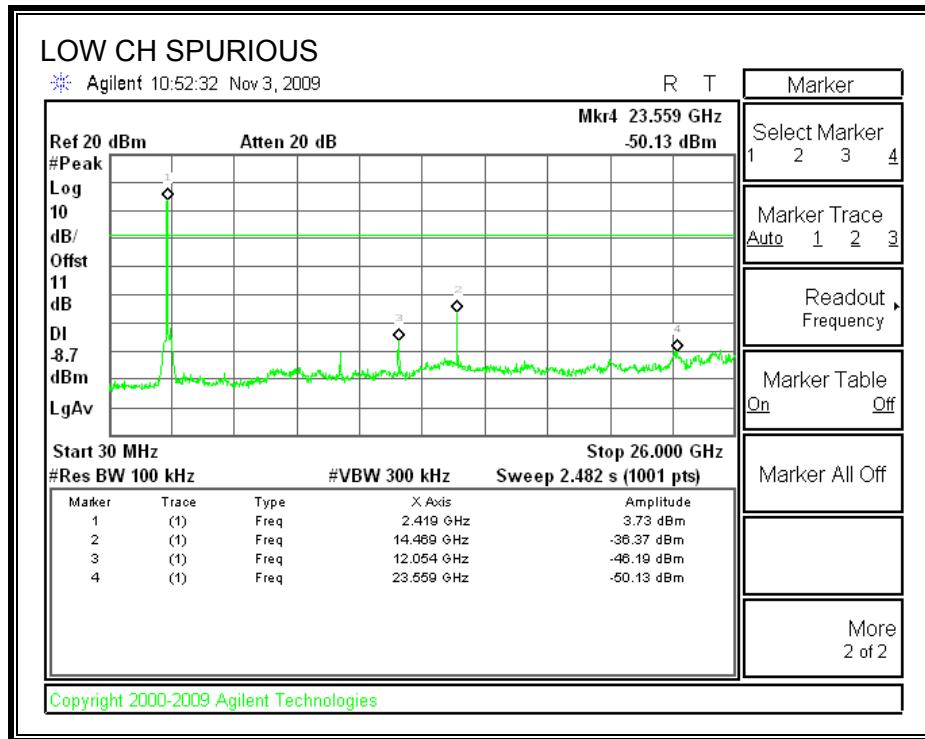
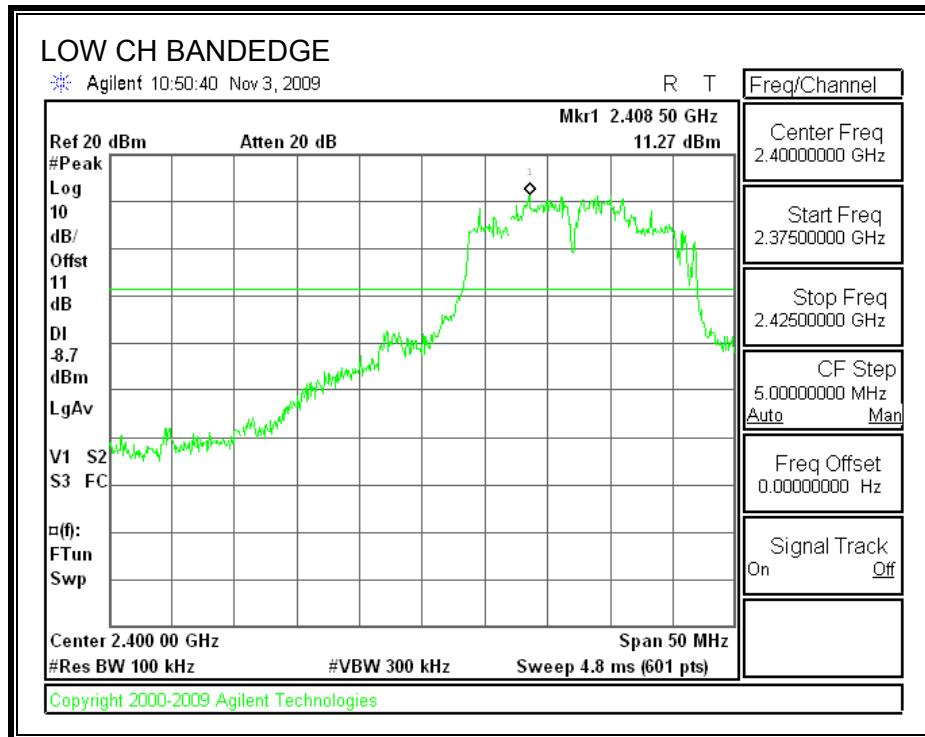
#### TEST PROCEDURE

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.

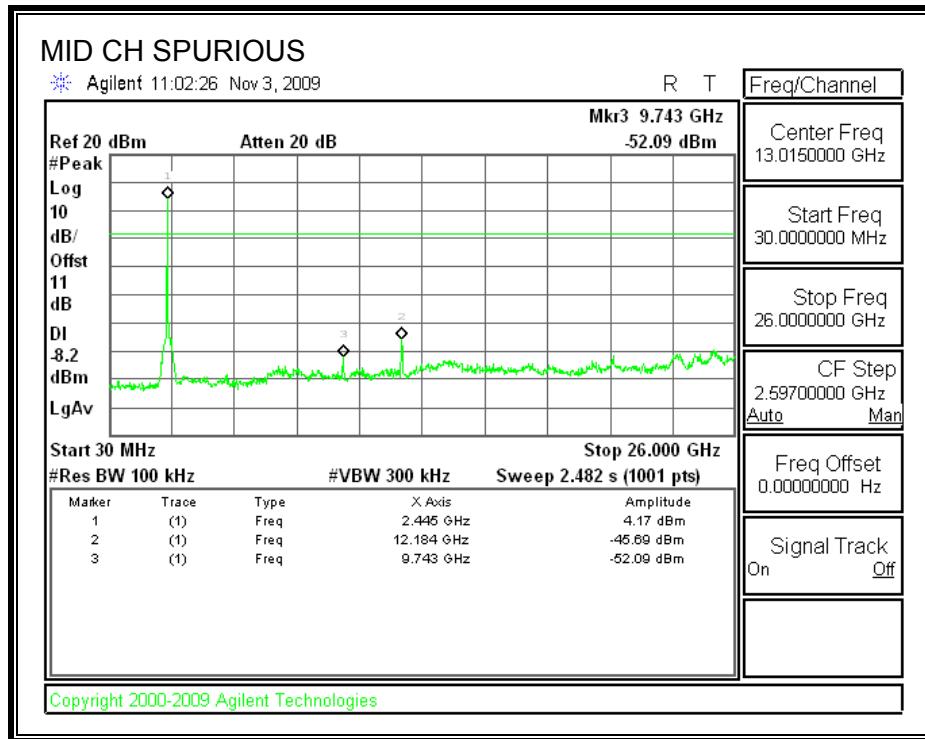
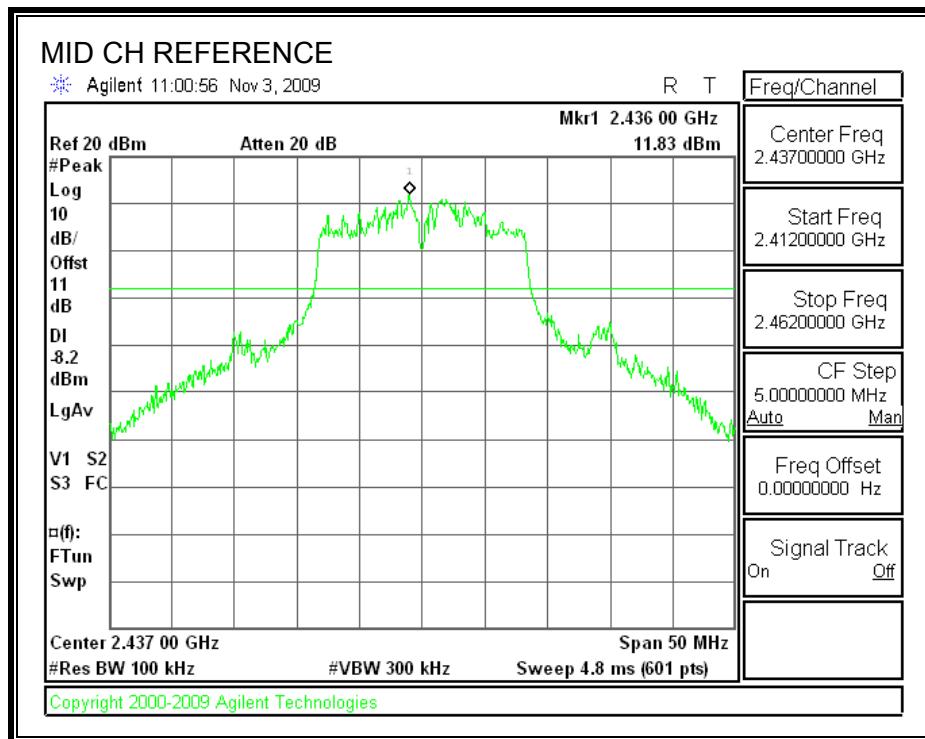
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

#### RESULTS

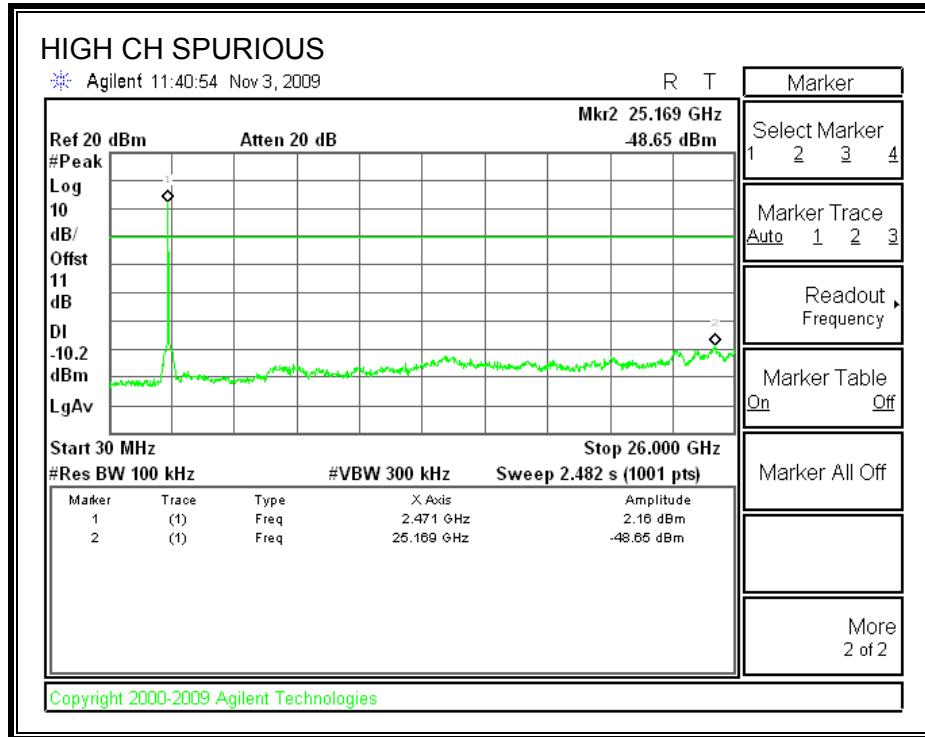
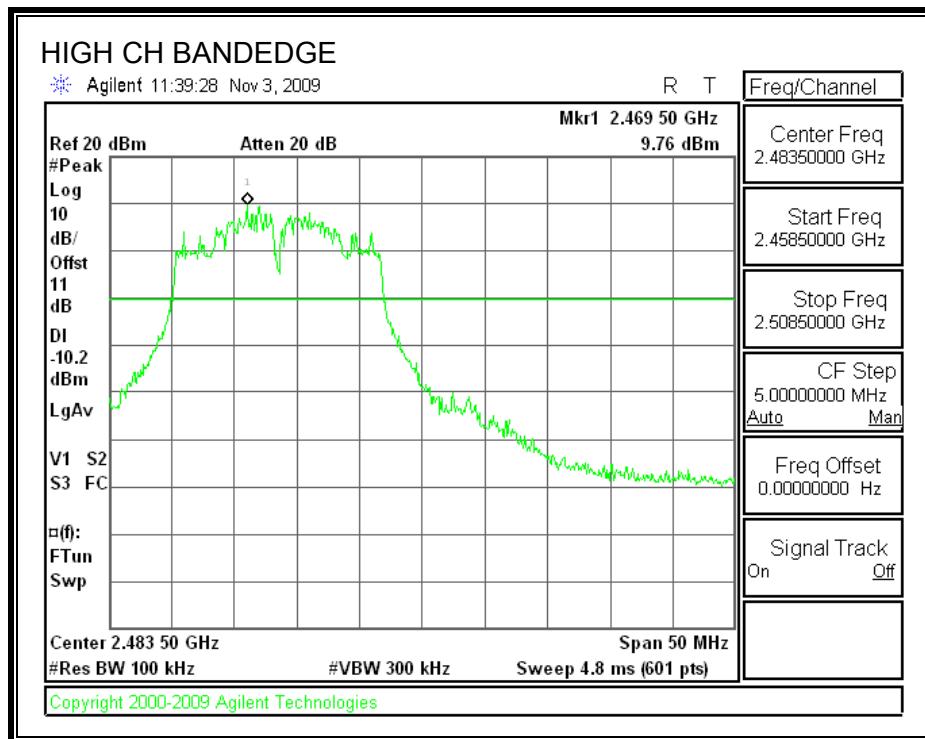
SPURIOUS EMISSIONS, LOW CHANNEL



**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.

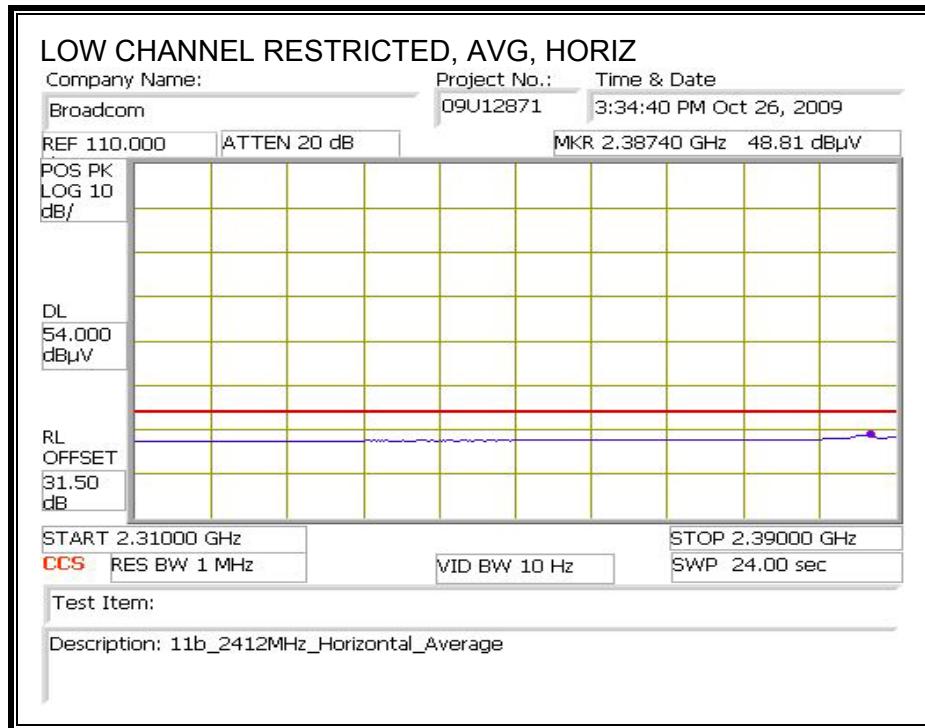
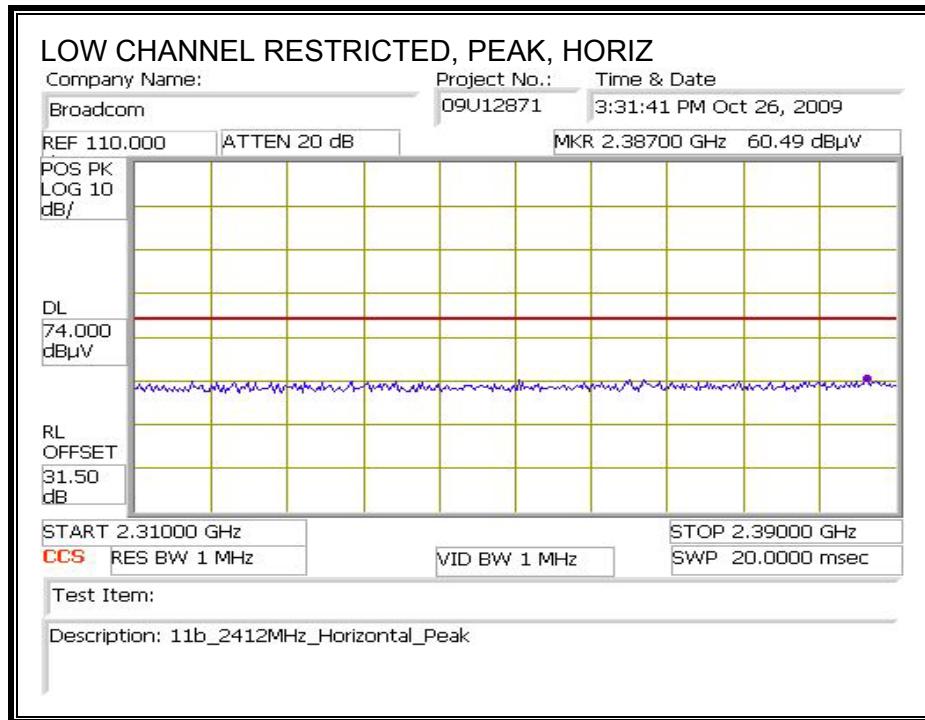
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

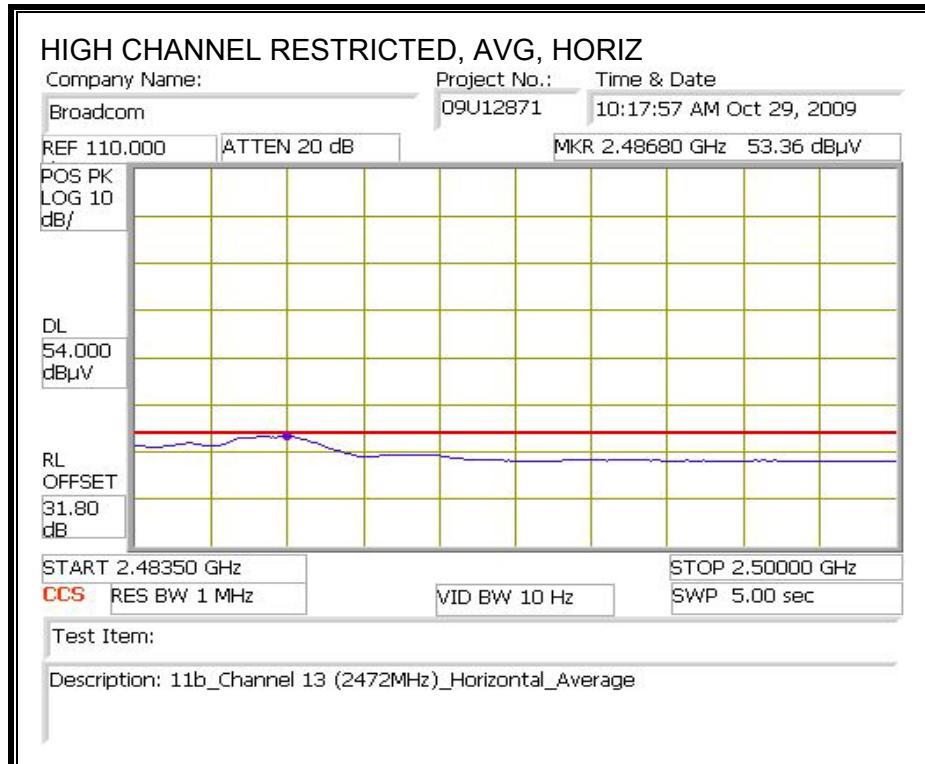
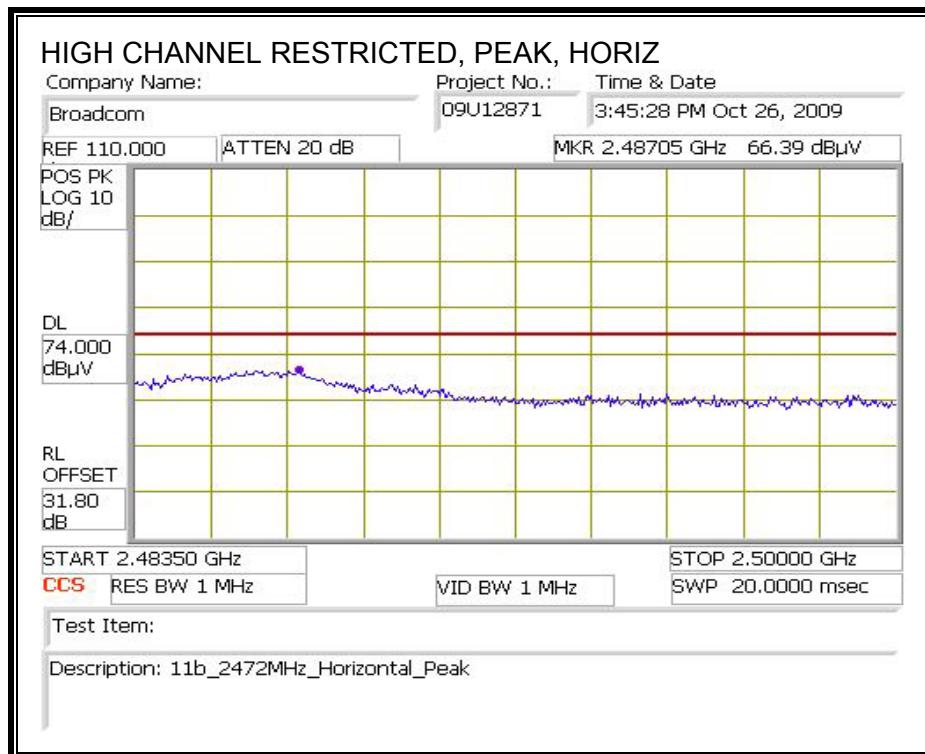
#### RESULTS

### 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

**High Frequency Measurement**  
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Vien Tran  
Date: 10/29/09  
Project #: 09U12871  
Company: Broadcom  
EUT Description: 802.11g/Draft 802.11n WLAN + BT PCI-E MINICARD  
EUT M/N: BCM94313HMGB  
Test Target: FCC Class B  
Mode Oper: Tx 1lb Mode\_Harmonic

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

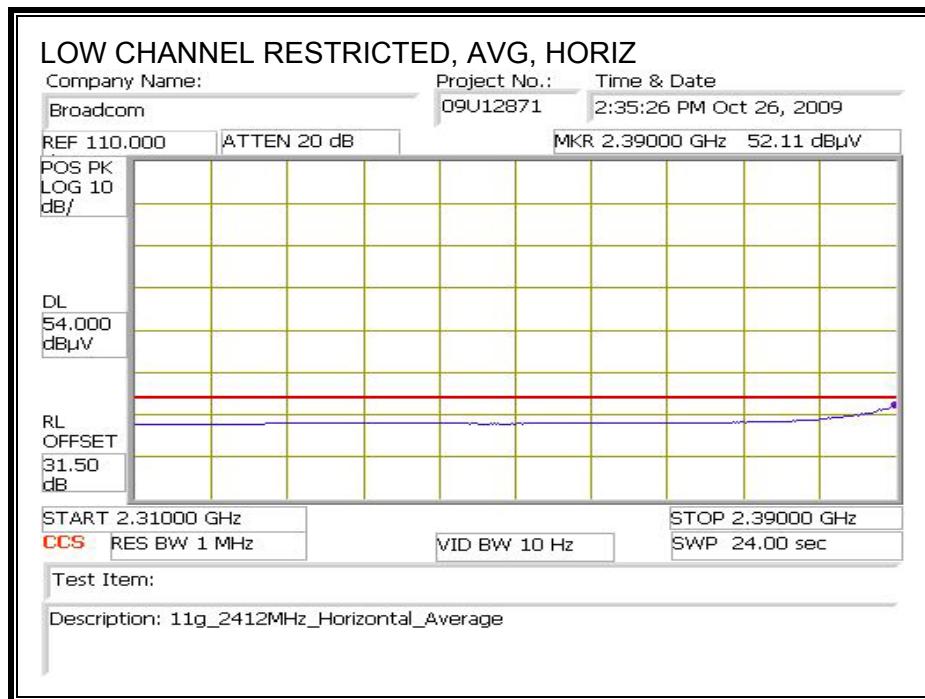
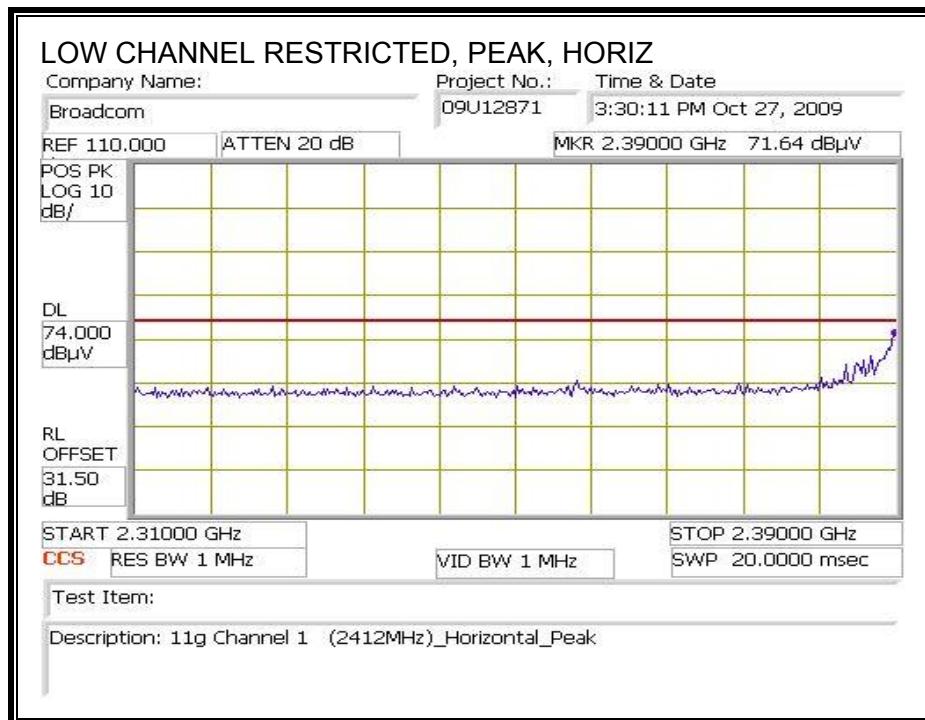
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
<b>1lb Main 2412MHz</b>															
4.824	3.0	43.7	32.7	5.8	-34.8	0.0	0.0	47.3	74.0	-26.7	H	P	146.0	115.0	
4.824	3.0	39.2	32.7	5.8	-34.8	0.0	0.0	42.9	54.0	-11.1	H	A	146.0	115.0	
4.824	3.0	40.4	32.7	5.8	-34.8	0.0	0.0	44.1	74.0	-29.9	V	P	99.0	289.0	
4.824	3.0	37.0	32.7	5.8	-34.8	0.0	0.0	40.7	54.0	-13.3	V	A	99.0	289.0	
<b>1lb Main 2437MHz</b>															
4.874	3.0	48.1	32.7	5.8	-34.8	0.0	0.0	51.9	74.0	-22.1	H	P	100.0	135.0	
7.311	3.0	35.5	35.5	7.3	-34.1	0.0	0.0	44.1	74.0	-29.9	H	P	152.0	44.0	
4.874	3.0	39.9	32.7	5.8	-34.8	0.0	0.0	43.6	54.0	-10.4	H	A	100.0	135.0	
7.311	3.0	26.6	35.5	7.3	-34.1	0.0	0.0	35.3	54.0	-18.7	H	A	152.0	44.0	
4.874	3.0	48.0	32.7	5.8	-34.8	0.0	0.0	51.7	74.0	-22.3	V	P	100.0	140.0	
7.311	3.0	35.1	35.5	7.3	-34.1	0.0	0.0	43.7	74.0	-30.3	V	P	100.0	240.0	
4.874	3.0	38.7	32.7	5.8	-34.8	0.0	0.0	42.4	54.0	-11.6	V	A	100.0	140.0	
7.311	3.0	25.4	35.5	7.3	-34.1	0.0	0.0	34.0	54.0	-20.0	V	A	100.0	240.0	
<b>1lb Main 2472MHz</b>															
4.944	3.0	43.5	32.8	5.9	-34.8	0.0	0.0	47.3	74.0	-26.7	H	P	99.0	65.0	
7.416	3.0	38.9	35.6	7.3	-34.1	0.0	0.0	47.7	74.0	-26.3	H	P	143.0	149.0	
4.944	3.0	39.0	32.8	5.9	-34.8	0.0	0.0	42.8	54.0	-11.2	H	A	99.0	55.0	
7.416	3.0	27.2	35.6	7.3	-34.1	0.0	0.0	36.1	54.0	-17.9	H	A	143.0	149.0	
4.944	3.0	43.4	32.8	5.9	-34.8	0.0	0.0	47.2	74.0	-26.8	V	P	100.0	141.0	
7.416	3.0	37.9	35.6	7.3	-34.1	0.0	0.0	46.8	74.0	-27.2	V	P	100.0	21.0	
4.944	3.0	39.4	32.8	5.9	-34.8	0.0	0.0	43.2	54.0	-10.8	V	A	100.0	141.0	
7.416	3.0	27.1	35.6	7.3	-34.1	0.0	0.0	36.0	54.0	-18.0	V	A	100.0	21.0	

Rev. 4.1.2.7

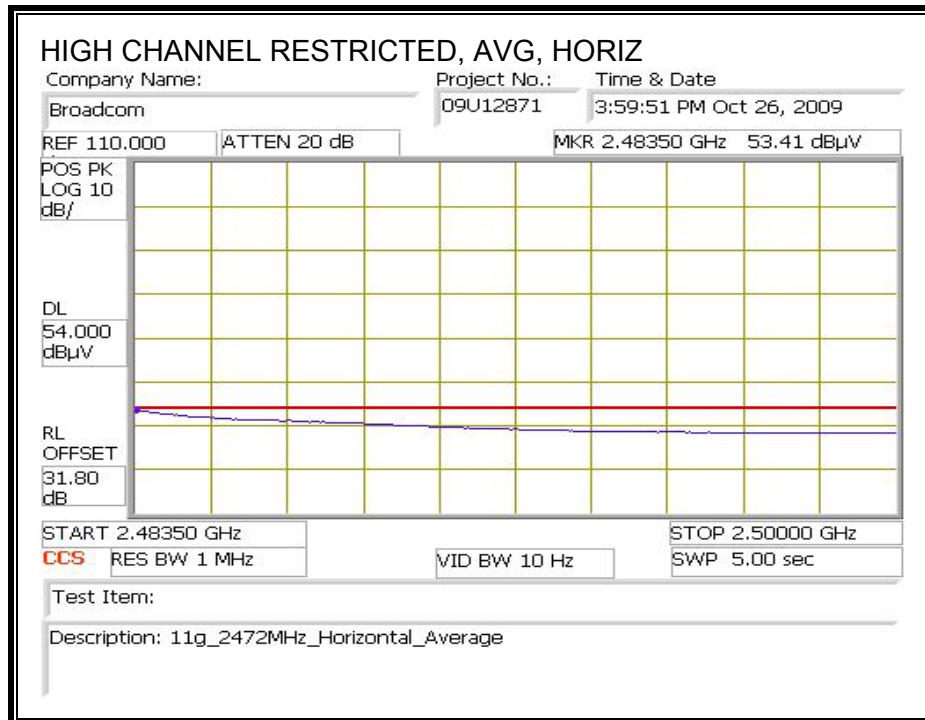
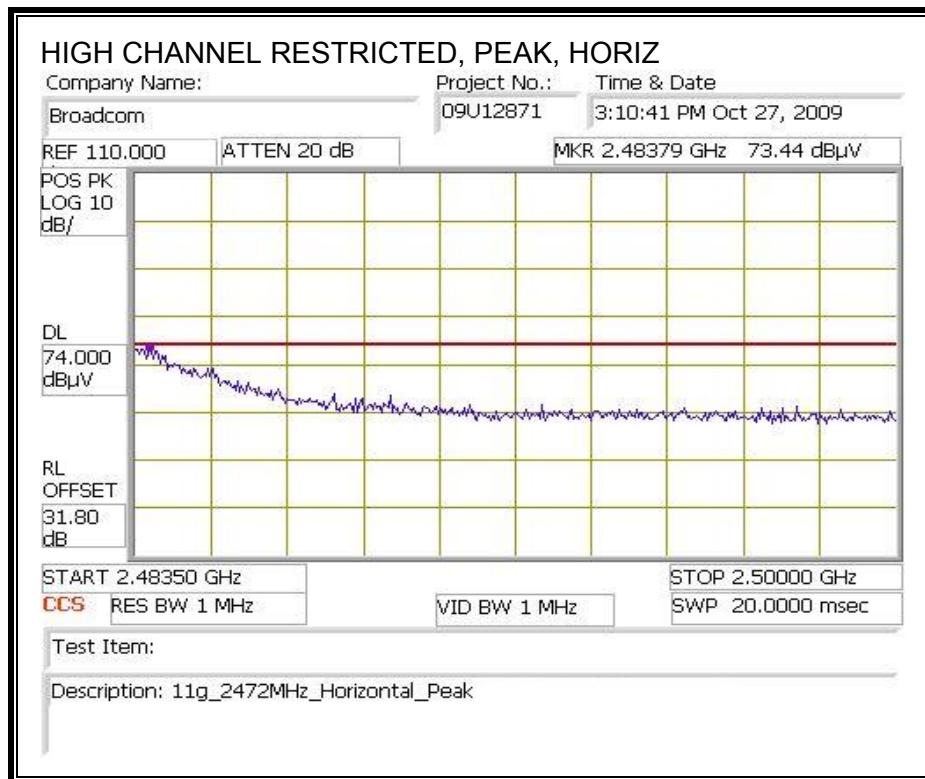
Note: No other emissions were detected above the system noise floor.

### 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																																												
Test Engr:	Vien Tran																																											
Date:	10/19/08																																											
Project #:	09U12871																																											
Company:	Broadcom																																											
EUT Description:	802.11g/Draft 802.11n WLAN + BT PCI-E MINICARD																																											
EUT M/N:	BCM94313HMGB																																											
Test Target:	FCC Class B																																											
Mode Oper:	Tx 11g Mode_Harmonic																																											
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																																		
3' cable 22807700		12' cable 22807600		20' cable 22807500				R_001		Average Measurements RBW=1MHz ; VBW=10Hz																																		
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)																													
11b_Main 2412MHz																																												
4.824	3.0	50.5	37.0	32.7	5.8	-34.8	0.0	0.0	54.1	40.6	74	54	-19.9	-13.4	H																													
4.824	3.0	50.9	38.1	32.7	5.8	-34.8	0.0	0.0	54.5	41.7	74	54	-19.5	-12.3	V																													
11b_Main 2437MHz																																												
4.874	3.0	48.3	34.5	32.7	5.8	-34.8	0.0	0.0	52.0	38.2	74	54	-22.0	-15.8	H																													
4.874	3.0	51.8	38.2	32.7	5.8	-34.8	0.0	0.0	55.5	41.9	74	54	-18.5	-12.1	V																													
11b_Main 2472MHz																																												
4.944	3.0	46.3	32.3	32.8	5.9	-34.8	0.0	0.0	50.1	36.1	74	54	-23.9	-17.9	H																													
4.944	3.0	47.3	36.3	32.8	5.9	-34.8	0.0	0.0	51.1	40.1	74	54	-22.9	-13.9	V																													
<table> <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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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																																									

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 5m Chamber																																																																																																																																																																																																																															
<p>Test Engr: Vien Tran Date: 10/27/09 Project #: 09U12871 Company: Broadcom EUT Description: 802.11g/Draft 802.11n WLAN + BT PCI-E MINICARD EUT M/N: BCM94313HMGB Test Target: FCC Class B Mode Oper: Rx Mode_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="3">Horn &gt; 18GHz</td> <td>Limit</td> </tr> <tr> <td>T60; S/N: 2238 @3m</td> <td>T34 HP 8449B</td> <td></td> <td></td> <td></td> <td></td> <td>RX RSS 210</td> </tr> <tr> <td colspan="7">Hi Frequency Cables</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td>HPF</td> <td>Reject Filter</td> <td colspan="2">Peak Measurements RBW=VBW=1MHz</td> </tr> <tr> <td>3' cable 22807700</td> <td>12' cable 22807600</td> <td>20' cable 22807500</td> <td></td> <td></td> <td colspan="2">Average Measurements RBW=1MHz, VBW=10Hz</td> </tr> </table> <table border="1"> <thead> <tr> <th>f GHz</th> <th>Dist (m)</th> <th>Read Pk dBuV</th> <th>Read Avg dBuV</th> <th>AF dB/m</th> <th>CL dB</th> <th>Amp dB</th> <th>D Corr dB</th> <th>Fltr dB</th> <th>Peak dBuV/m</th> <th>Avg dBuV/m</th> <th>Pk Lim dBuV/m</th> <th>Avg Lim dBuV/m</th> <th>Pk Mar dB</th> <th>Avg Mar dB</th> <th>Notes (V/H)</th> </tr> </thead> <tbody> <tr> <td>1.196</td> <td>3.0</td> <td>47.8</td> <td>34.6</td> <td>25.1</td> <td>2.6</td> <td>-38.0</td> <td>0.0</td> <td>0.0</td> <td>37.5</td> <td>24.3</td> <td>74</td> <td>54</td> <td>-36.5</td> <td>-29.7</td> <td>H</td> </tr> <tr> <td>1.333</td> <td>3.0</td> <td>53.2</td> <td>42.5</td> <td>25.6</td> <td>2.8</td> <td>-37.8</td> <td>0.0</td> <td>0.0</td> <td>43.7</td> <td>33.0</td> <td>74</td> <td>54</td> <td>-30.3</td> <td>-21.0</td> <td>H</td> </tr> <tr> <td>1.793</td> <td>3.0</td> <td>49.5</td> <td>33.2</td> <td>27.1</td> <td>3.2</td> <td>-37.2</td> <td>0.0</td> <td>0.0</td> <td>42.7</td> <td>26.4</td> <td>74</td> <td>54</td> <td>-31.3</td> <td>-27.6</td> <td>H</td> </tr> <tr> <td>2.493</td> <td>3.0</td> <td>54.5</td> <td>34.5</td> <td>28.3</td> <td>3.9</td> <td>-36.3</td> <td>0.0</td> <td>0.0</td> <td>50.5</td> <td>30.5</td> <td>74</td> <td>54</td> <td>-23.5</td> <td>-23.5</td> <td>H</td> </tr> <tr> <td>1.196</td> <td>3.0</td> <td>52.8</td> <td>36.4</td> <td>25.1</td> <td>2.6</td> <td>-38.0</td> <td>0.0</td> <td>0.0</td> <td>42.5</td> <td>26.1</td> <td>74</td> <td>54</td> <td>-31.5</td> <td>-27.9</td> <td>V</td> </tr> <tr> <td>1.333</td> <td>3.0</td> <td>50.0</td> <td>36.3</td> <td>25.6</td> <td>2.8</td> <td>-37.8</td> <td>0.0</td> <td>0.0</td> <td>40.5</td> <td>26.8</td> <td>74</td> <td>54</td> <td>-33.5</td> <td>-27.2</td> <td>V</td> </tr> <tr> <td>1.793</td> <td>3.0</td> <td>52.5</td> <td>35.6</td> <td>27.1</td> <td>3.2</td> <td>-37.2</td> <td>0.0</td> <td>0.0</td> <td>45.7</td> <td>28.8</td> <td>74</td> <td>54</td> <td>-28.3</td> <td>-25.2</td> <td>V</td> </tr> <tr> <td>2.493</td> <td>3.0</td> <td>62.5</td> <td>38.9</td> <td>28.3</td> <td>3.9</td> <td>-36.3</td> <td>0.0</td> <td>0.0</td> <td>58.5</td> <td>34.9</td> <td>74</td> <td>54</td> <td>-15.5</td> <td>-19.1</td> <td>V</td> </tr> </tbody> </table> <p><u>Definitions:</u></p> <table> <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>															Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz			Limit	T60; S/N: 2238 @3m	T34 HP 8449B					RX RSS 210	Hi Frequency Cables							3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz		3' cable 22807700	12' cable 22807600	20' cable 22807500			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)	1.196	3.0	47.8	34.6	25.1	2.6	-38.0	0.0	0.0	37.5	24.3	74	54	-36.5	-29.7	H	1.333	3.0	53.2	42.5	25.6	2.8	-37.8	0.0	0.0	43.7	33.0	74	54	-30.3	-21.0	H	1.793	3.0	49.5	33.2	27.1	3.2	-37.2	0.0	0.0	42.7	26.4	74	54	-31.3	-27.6	H	2.493	3.0	54.5	34.5	28.3	3.9	-36.3	0.0	0.0	50.5	30.5	74	54	-23.5	-23.5	H	1.196	3.0	52.8	36.4	25.1	2.6	-38.0	0.0	0.0	42.5	26.1	74	54	-31.5	-27.9	V	1.333	3.0	50.0	36.3	25.6	2.8	-37.8	0.0	0.0	40.5	26.8	74	54	-33.5	-27.2	V	1.793	3.0	52.5	35.6	27.1	3.2	-37.2	0.0	0.0	45.7	28.8	74	54	-28.3	-25.2	V	2.493	3.0	62.5	38.9	28.3	3.9	-36.3	0.0	0.0	58.5	34.9	74	54	-15.5	-19.1	V	f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit	Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit	Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit	AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit	CL	Cable Loss	HPF	High Pass Filter		
Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz			Limit																																																																																																																																																																																																																									
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1.793	3.0	49.5	33.2	27.1	3.2	-37.2	0.0	0.0	42.7	26.4	74	54	-31.3	-27.6	H																																																																																																																																																																																																																
2.493	3.0	54.5	34.5	28.3	3.9	-36.3	0.0	0.0	50.5	30.5	74	54	-23.5	-23.5	H																																																																																																																																																																																																																
1.196	3.0	52.8	36.4	25.1	2.6	-38.0	0.0	0.0	42.5	26.1	74	54	-31.5	-27.9	V																																																																																																																																																																																																																
1.333	3.0	50.0	36.3	25.6	2.8	-37.8	0.0	0.0	40.5	26.8	74	54	-33.5	-27.2	V																																																																																																																																																																																																																
1.793	3.0	52.5	35.6	27.1	3.2	-37.2	0.0	0.0	45.7	28.8	74	54	-28.3	-25.2	V																																																																																																																																																																																																																
2.493	3.0	62.5	38.9	28.3	3.9	-36.3	0.0	0.0	58.5	34.9	74	54	-15.5	-19.1	V																																																																																																																																																																																																																
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit																																																																																																																																																																																																																										
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit																																																																																																																																																																																																																										
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit																																																																																																																																																																																																																										
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Pk Mar	Margin vs. Peak Limit																																																																																																																																																																																																																										
CL	Cable Loss	HPF	High Pass Filter																																																																																																																																																																																																																												

### 8.3. WORST-CASE BELOW 1 GHz

#### WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL

#### HORIZONTAL & VERTICAL DATA

**High Frequency Measurement**  
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Vien Tran  
Date: 10/27/09  
Project #: 09U12871  
Company: Broadcom  
EUT Description: 802.11g/Draft 802.11n WLAN + BT PCI-E MINICARD  
EUT M/N: BCM94313HMGB  
Test Target: FCC Class B  
Mode Oper: Tx 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
<b>HORIZONTAL</b>													
31.320	3.0	42.7	19.3	0.5	28.4	0.0	0.0	34.1	40.0	-5.9	H	P	
99.963	3.0	57.2	9.3	0.8	28.2	0.0	0.0	39.1	43.5	-4.4	H	P	
245.409	3.0	50.1	11.8	1.3	27.4	0.0	0.0	35.8	46.0	-10.2	H	P	
366.614	3.0	48.1	14.5	1.7	27.8	0.0	0.0	36.4	46.0	-9.6	H	P	
499.939	3.0	46.3	16.8	2.0	28.6	0.0	0.0	36.5	46.0	-9.5	H	P	
998.560	3.0	36.2	22.7	2.9	27.6	0.0	0.0	34.3	54.0	-19.8	H	P	
<b>VERTICAL</b>													
99.963	3.0	55.4	9.3	0.8	28.2	0.0	0.0	37.3	43.5	-6.2	V	P	
285.251	3.0	49.5	13.0	1.4	27.4	0.0	0.0	36.5	46.0	-9.5	V	P	
364.814	3.0	46.1	14.5	1.7	27.8	0.0	0.0	34.4	46.0	-11.6	V	P	
437.777	3.0	49.0	15.7	1.8	28.2	0.0	0.0	38.3	46.0	-7.7	V	P	
999.880	3.0	37.3	22.7	2.9	27.6	0.0	0.0	35.3	54.0	-18.7	V	P	

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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 <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

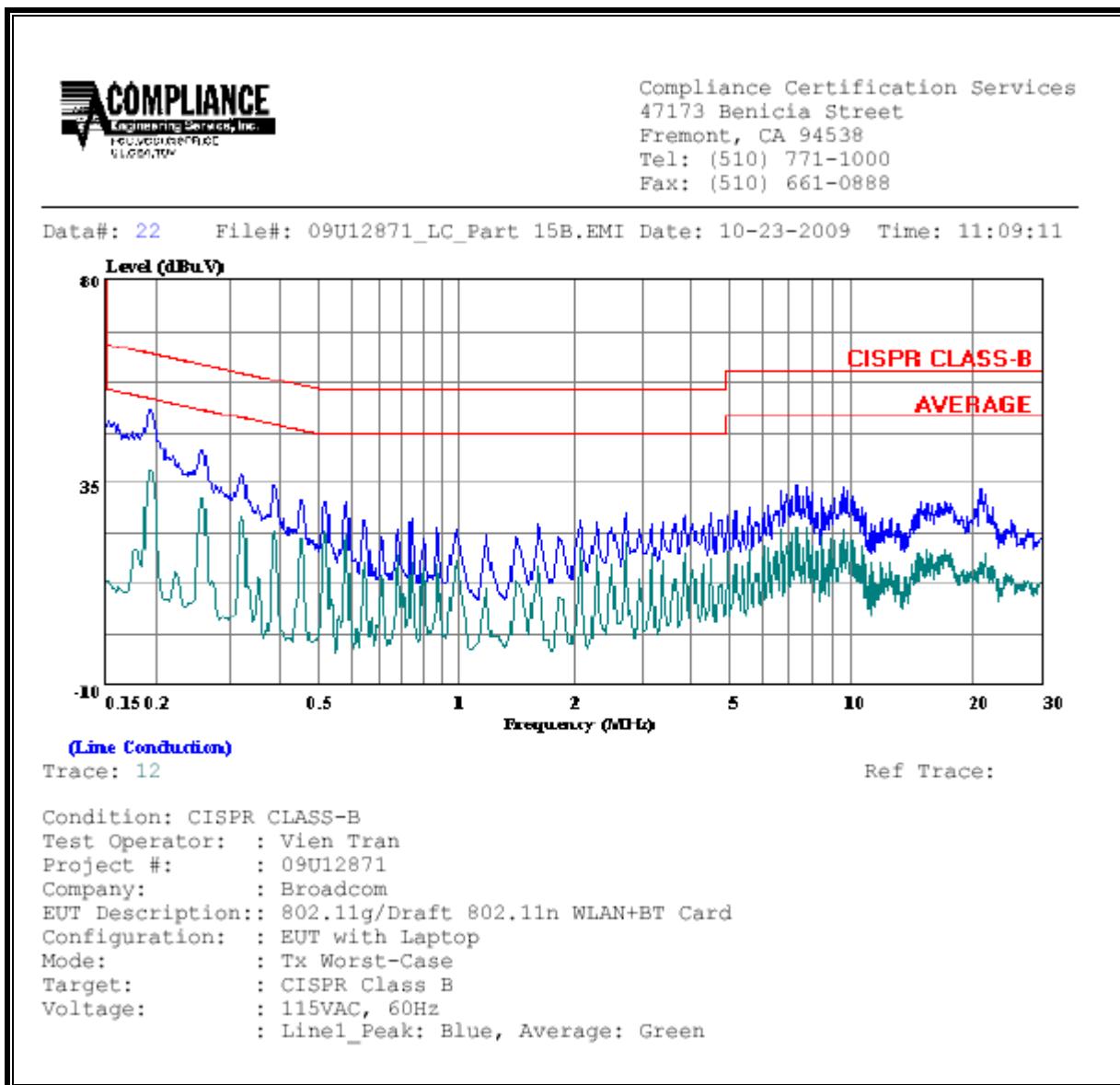
ANSI C63.4

### RESULTS

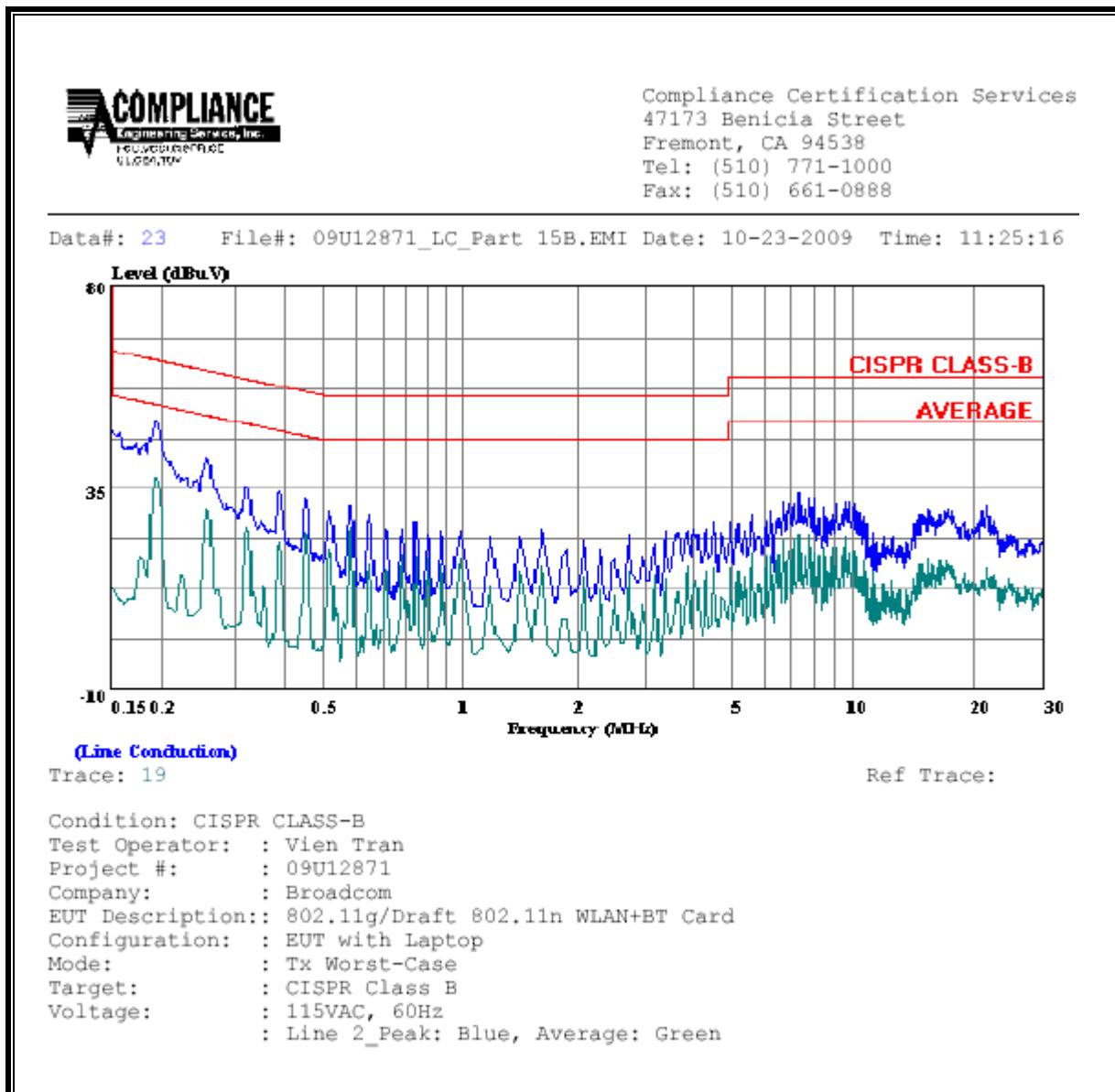
**6 WORST EMISSIONS**

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)	
0.19	51.43	--	38.09	0.00	63.91	53.91	-12.48	-15.82	L1
0.59	30.76	--	26.20	0.00	56.00	46.00	-25.24	-19.80	L1
9.65	34.07	--	24.65	0.00	60.00	50.00	-25.93	-25.35	L1
0.19	50.30	--	37.63	0.00	63.91	53.91	-13.61	-16.28	L2
0.59	31.13	--	25.33	0.00	56.00	46.00	-24.87	-20.67	L2
9.65	33.99	--	22.70	0.00	60.00	50.00	-26.01	-27.30	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 <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 ( $\mu$ T) or 12.57 milligauss (mG).

## EQUATIONS

Power density is given by:

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

where

S = Power density in W/m<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

Power density in units of W/m<sup>2</sup> is converted to units of mWc/m<sup>2</sup> 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/m<sup>2</sup>

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<sub>x</sub> = Power of transmitter x

G<sub>x</sub> = 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/cm<sup>2</sup>

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

## RESULTS

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4 GHz	WLAN	0.20	26.15	3.90	2.01	0.201