



**FCC CFR47 PART 15 SUBPART C  
CLASS II PERMISSIVE CHANGE**

**CERTIFICATION TEST REPORT**

**FOR**

**802.11g/DRAFT 802.11n WLAN PCI-E MINICARD  
(Tested inside Dell tablet, K08T-K08T001)**

**MODEL NUMBER: BCM94313HMG2L**

**FCC ID: QDS-BRCM1050**

**IC: 4324A-BRCM1050**

**REPORT NUMBER: 10U13410-1**

**ISSUE DATE: NOVEMBER 9, 2010**

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SUNNYVALE, CA 94086, U.S.A.**

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**NVLAP®**

**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
---	11/09/10	Initial Issue	F. Ibrahim

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** BROADCOM CORPORATION  
190 MATHILDA PLACE  
SUNNYVALE, CA 94086, U.S.A.

**EUT DESCRIPTION:** 802.11g/Draft 802.11n WLAN PCI-E Mini Card  
(Tested inside Dell tablet, K08T-K08T001)

**MODEL:** BCM94313HMG2L

**SERIAL NUMBER:** 22

**DATE TESTED:** SEPTEMBER 08 – OCTOBER 30, 2010

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

Compliance Certification Services (UL 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 UL 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 UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL 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 UL CCS By:



FRANK IBRAHIM  
EMC SUPERVISOR  
UL CCS

Tested By:



VIEN TRAN  
EMC ENGINEER  
UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

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

UL 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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) +  
Cable Loss (dB) – Preamp Gain (dB)

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

### 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 a Broadcom 802.11g/Draft 802.11n WLAN PCI-E Minicard and installed inside Dell Sparta P08T tablet laptop. 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	19.83	96.16
2412 - 2472	802.11g	22.91	195.43

### 5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding tablet platform, Dell Sparta, K08T-K08T001.

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bg WLAN antenna, with a maximum gain of 2.28dBi at tablet mode.

### 5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.60.48.37. The test utility software used during testing was wl\_tool, rev. 5.60.48.37.

### 5.6. 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.

## 5.7. WORST-CASE CONFIGURATION AND MODE

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.

Since the EUT was certified as modular approval with highest antenna gain of 3.9dBi; therefore only the tablet laptop mode was selected to investigate on band edge, worst case of harmonic, worst case of receiver, and below 1GHz.

The tablet laptop was investigated under potable positions (X, Y, and Z) to determine the worst case and the Y-axis position was the worse case to test.

## 5.8. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	, K08T-K08T001.	1	DoC
AC Adapter	APD	WA-30B19U	CN-08830M-12961	N/A

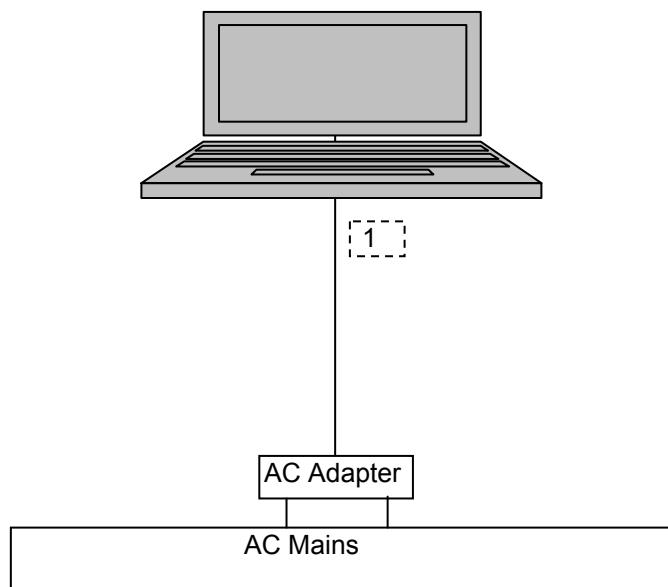
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	DC	Unshielded	1.5m	AC Adapter 100-240VAC

### TEST SETUP

The EUT is installed inside a host tablet PC during the tests. Test software exercised the radio card.

### **SETUP DIAGRAM FOR TESTS**



## **6. TEST AND MEASUREMENT EQUIPMENT**

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

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	01/14/09	07/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00872	01/29/09	07/29/11
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	01/29/09	07/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	01/06/10	07/06/11
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	02/04/09	08/04/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	08/10/10	08/10/11
Peak Power Meter	Boonton	4541	C01186	03/01/10	03/01/11
Peak Power Sensor	Boonton	57318	0	02/24/10	02/24/11
Peak Power Meter	Agilent / HP	E9327A	C00964	01/07/10	12/04/11
Peak Power Sensor	Agilent / HP	E4416A	C00963	12/04/09	12/04/11
EMI Receiver, 6.5 GHz	Agilent / HP	8546A	1963	05/19/10	08/19/11
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	01/00/00	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. 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

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

### 7.2. 802.11b MODE

Channel	Frequency (MHz)	Peak Power Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	19.81	30	-10.19
Middle	2437	19.83	30	-10.17
High	2472	16.26	30	-13.74

### 7.3. 802.11g MODE

Channel	Frequency (MHz)	Peak Power Meter Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2412	22.78	30	-7.22
Middle	2437	22.91	30	-7.09
High	2472	16.55	30	-13.45

## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

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.

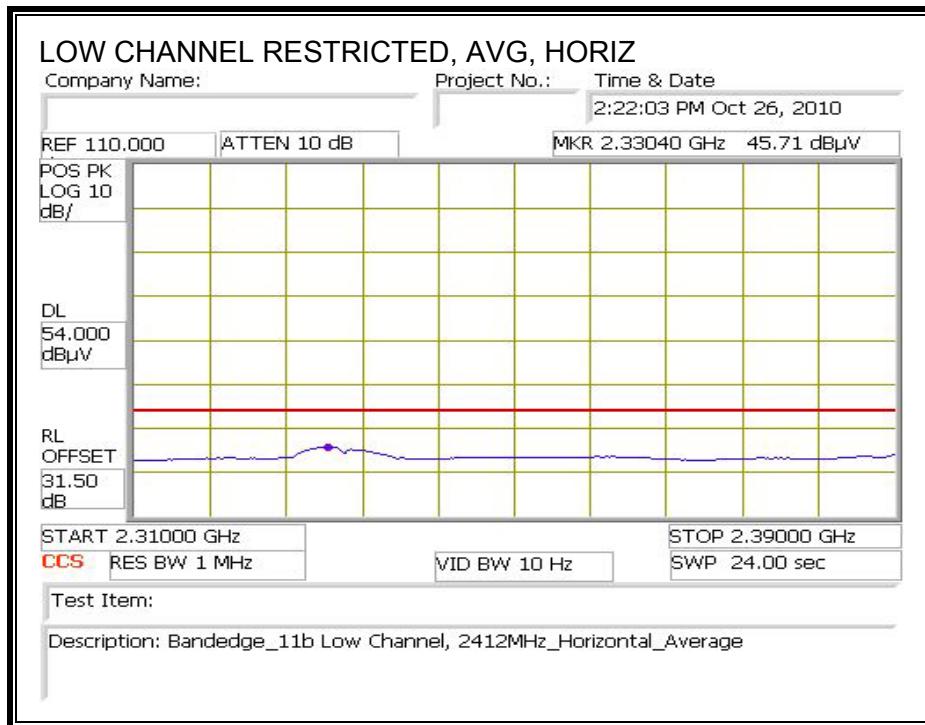
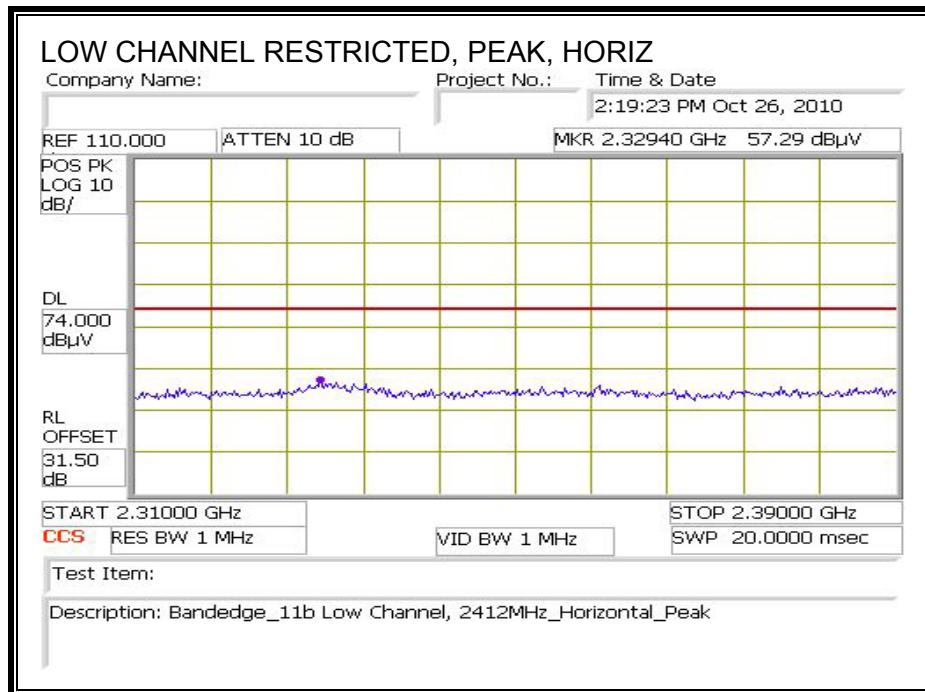
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

## RESULTS

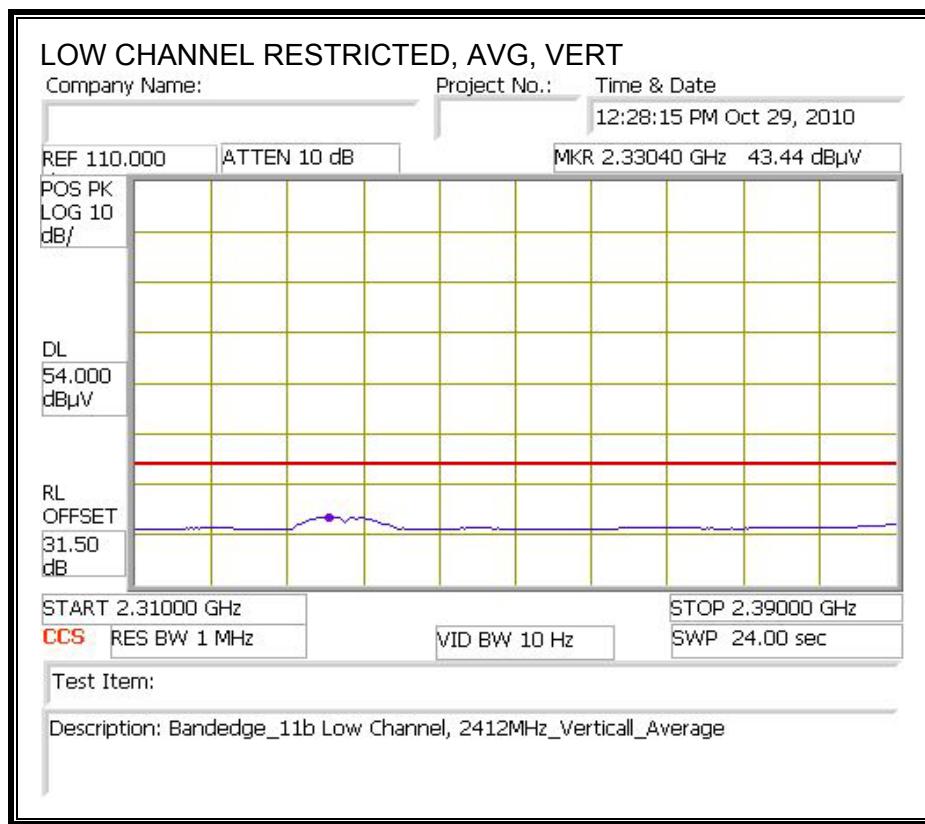
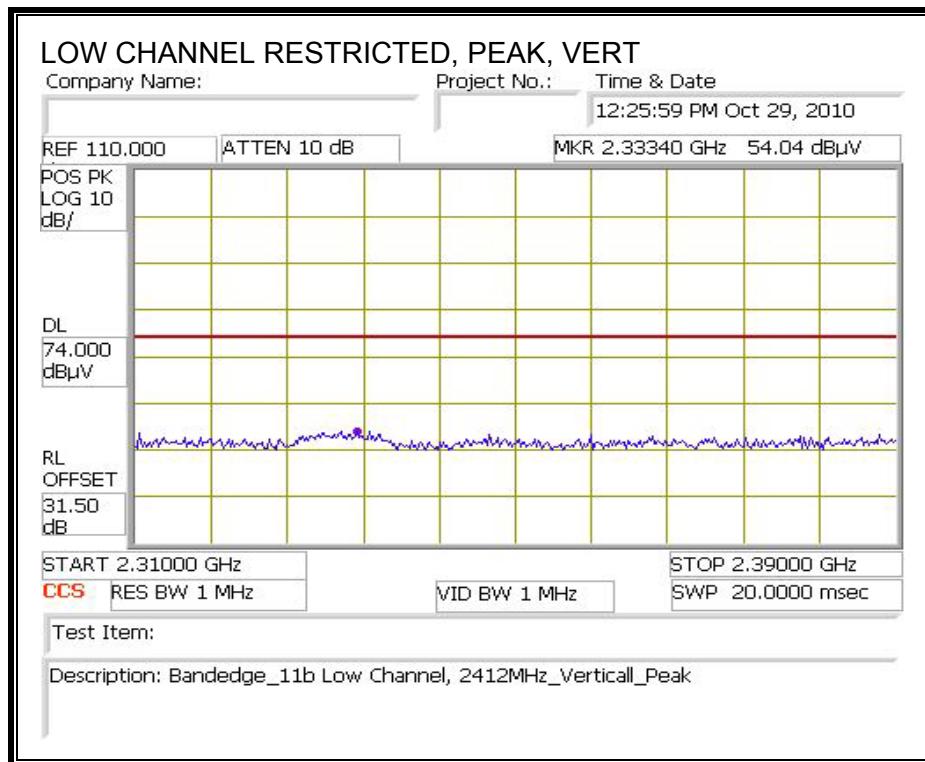
### 8.2. TRANSMITTER ABOVE 1 GHz

#### 8.2.1. 802.11b MODE

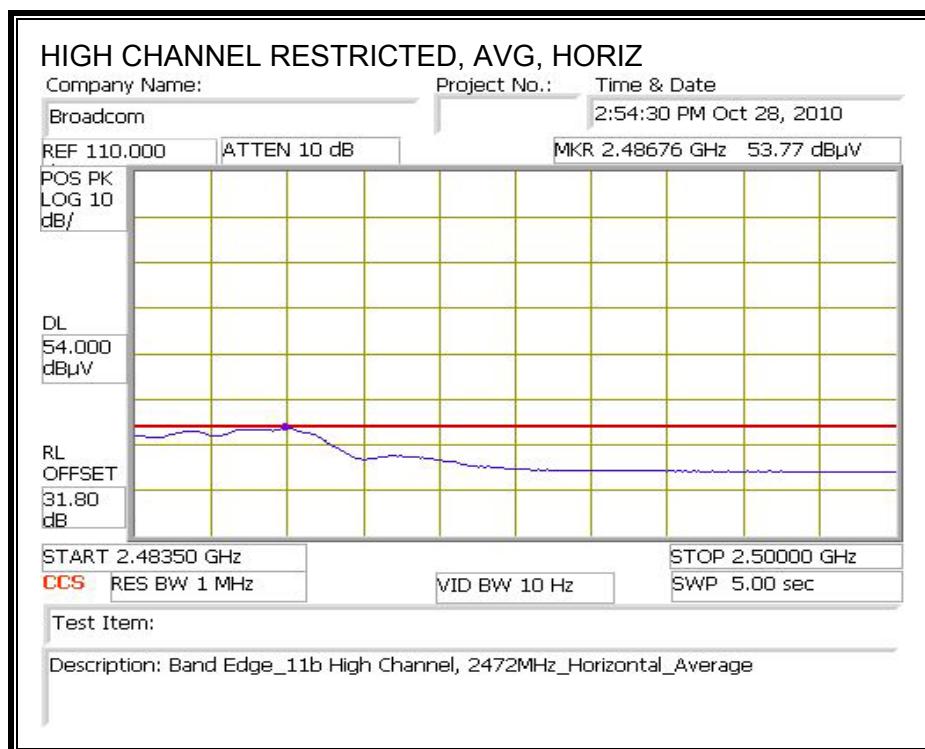
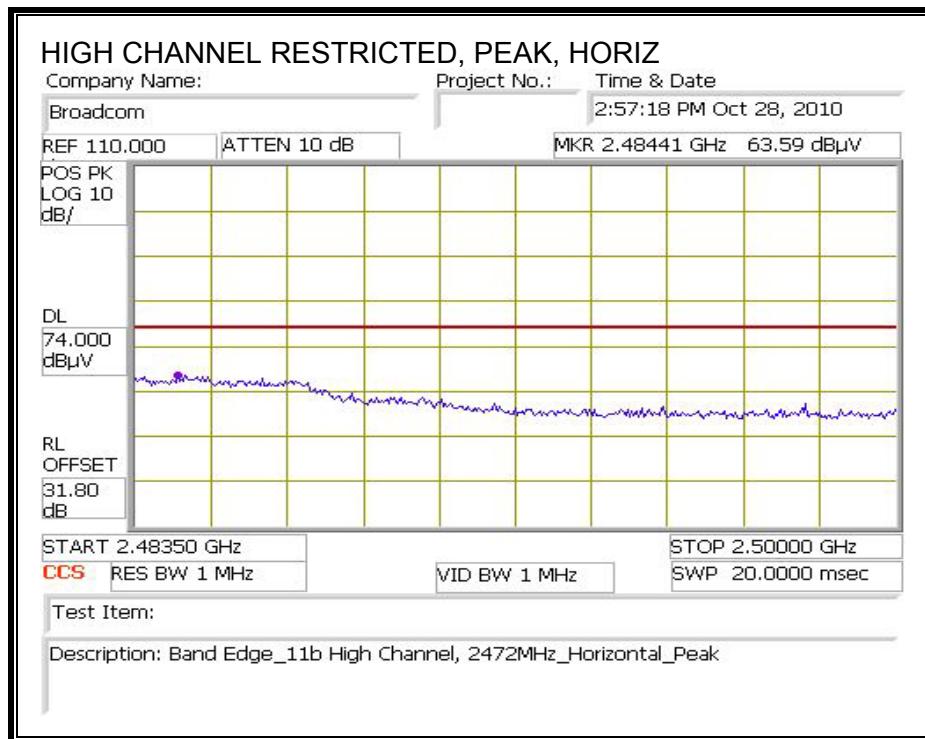
##### RESTRICTED BANDEdge (LOW CHANNEL, HORIZONTAL)



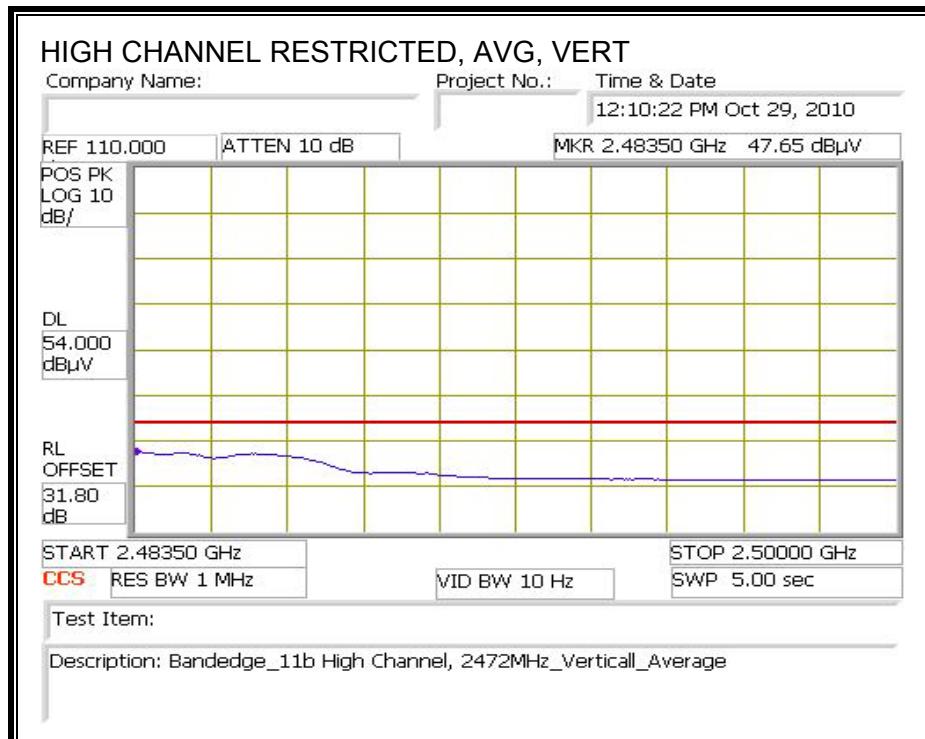
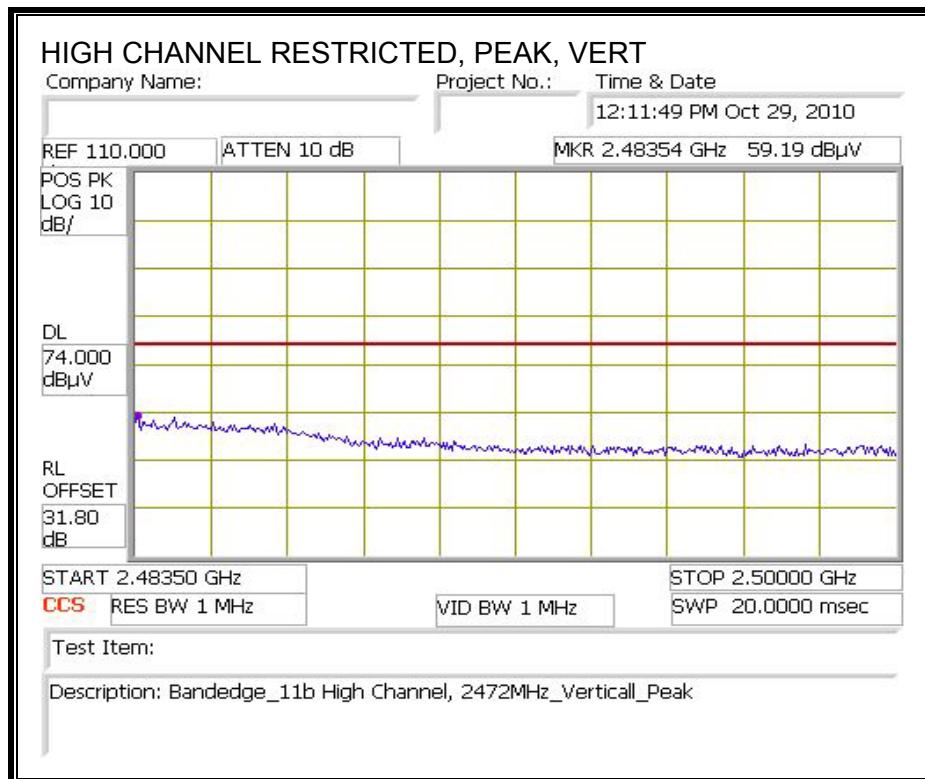
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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



## HARMONICS AND SPURIOUS EMISSIONS

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

Test Engr: **Vien Tran**  
Date: **10/28/10**  
Project #: **10U13410**  
Company: **Broadcom**  
Test Target: **FCC B**  
Mode Oper: **Tx 1lb**

<b>f</b>	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	

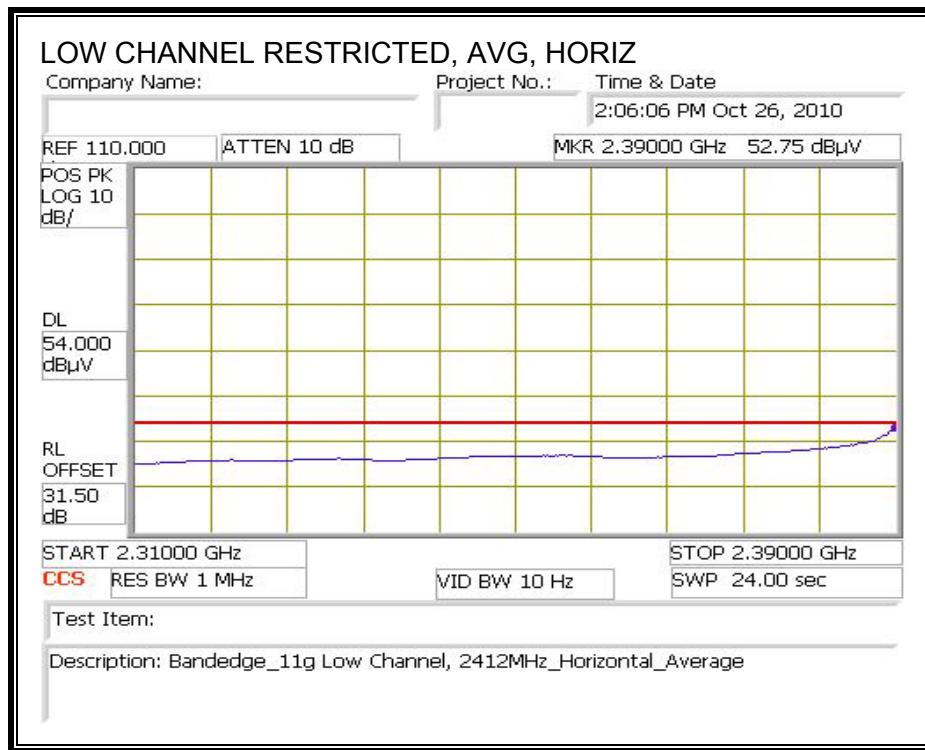
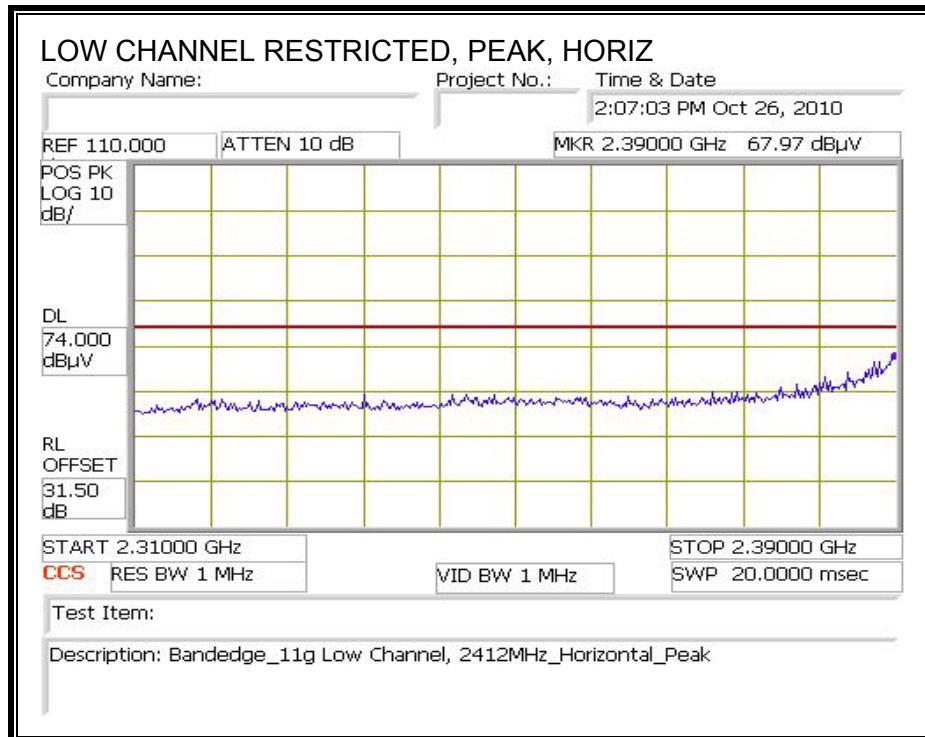
<b>f</b> <b>GHz</b>	<b>Dist</b> <b>(m)</b>	<b>Read</b> <b>dBuV</b>	<b>AF</b> <b>dB/m</b>	<b>CL</b> <b>dB</b>	<b>Amp</b> <b>dB</b>	<b>D Corr</b> <b>dB</b>	<b>Fltr</b> <b>dB</b>	<b>Corr.</b> <b>dBuV/m</b>	<b>Limit</b> <b>dBuV/m</b>	<b>Margin</b> <b>dB</b>	<b>Ant. Pol.</b> <b>V/H</b>	<b>Det.</b> <b>P/A/QP</b>	<b>Notes</b>
<b>LOW CHANNEL, 2412MHz</b>													
4.824	3.0	41.2	32.7	5.8	-34.8	0.0	10.0	54.9	74.0	-19.1	V	P	
4.824	3.0	37.4	32.7	5.8	-34.8	0.0	10.0	51.1	54.0	-2.9	V	A	
4.824	3.0	41.0	32.7	5.8	-34.8	0.0	10.0	54.7	74.0	-19.3	H	P	
4.824	3.0	36.6	32.7	5.8	-34.8	0.0	10.0	50.2	54.0	-3.8	H	A	
<b>MID CHANNEL, 2437MHz</b>													
4.874	3.0	40.0	32.7	5.8	-34.8	0.0	10.0	53.7	74.0	-20.3	V	P	
4.874	3.0	34.7	32.7	5.8	-34.8	0.0	10.0	48.4	54.0	-5.6	V	A	
7.311	3.0	37.1	35.5	7.3	-34.1	0.0	10.0	55.8	74.0	-18.2	V	P	
7.311	3.0	26.4	35.5	7.3	-34.1	0.0	10.0	45.0	54.0	-9.0	V	A	
4.874	3.0	39.0	32.7	5.8	-34.8	0.0	10.0	52.7	74.0	-21.3	H	P	
4.874	3.0	34.3	32.7	5.8	-34.8	0.0	10.0	48.0	54.0	-6.0	H	A	
7.311	3.0	37.0	35.5	7.3	-34.1	0.0	10.0	55.6	74.0	-18.4	H	P	
7.311	3.0	27.2	35.5	7.3	-34.1	0.0	10.0	45.8	54.0	-8.2	H	A	
<b>HIGH CHANNEL, 2472MHz</b>													
4.944	3.0	37.5	32.8	5.9	-34.8	0.0	10.0	51.3	74.0	-22.7	V	P	
4.944	3.0	27.1	32.8	5.9	-34.8	0.0	10.0	41.0	54.0	-13.0	V	A	
7.416	3.0	35.6	35.6	7.3	-34.1	0.0	10.0	54.4	74.0	-19.6	V	P	
7.416	3.0	23.8	35.6	7.3	-34.1	0.0	10.0	42.6	54.0	-11.4	V	A	
4.944	3.0	36.1	32.8	5.9	-34.8	0.0	10.0	49.9	74.0	-24.1	H	P	
4.944	3.0	26.8	32.8	5.9	-34.8	0.0	10.0	40.6	54.0	-13.4	H	A	
7.416	3.0	35.8	35.6	7.3	-34.1	0.0	10.0	54.7	74.0	-19.3	H	P	
7.416	3.0	22.9	35.6	7.3	-34.1	0.0	10.0	41.8	54.0	-12.2	H	A	

Rev. 4.1.2.7

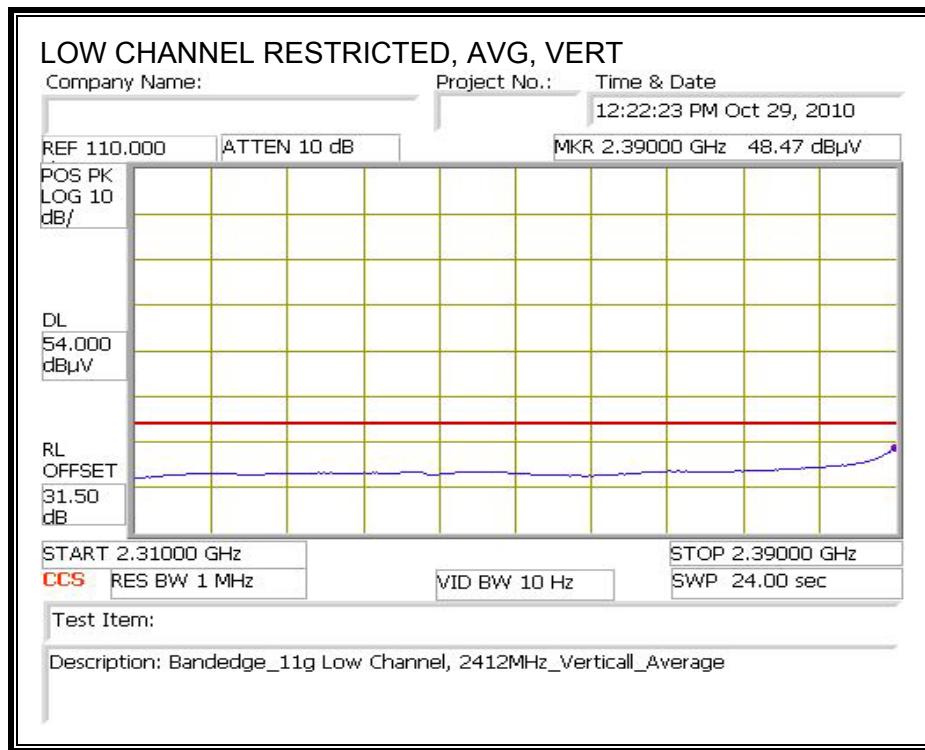
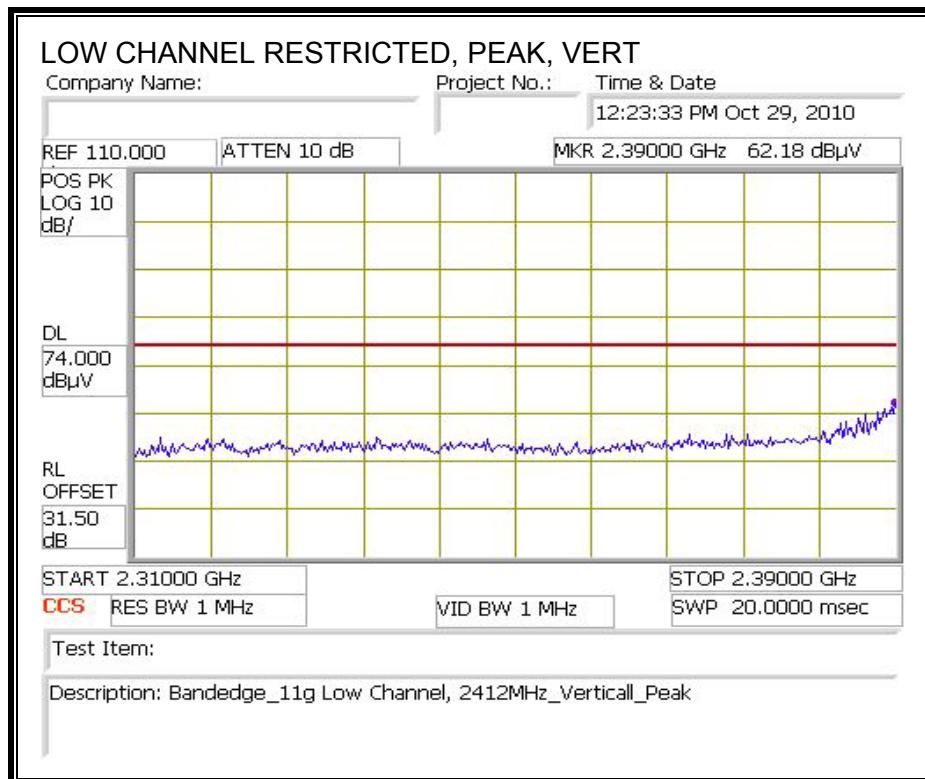
Note: No other emissions were detected above the system noise floor.

### 8.2.2. 802.11g MODE

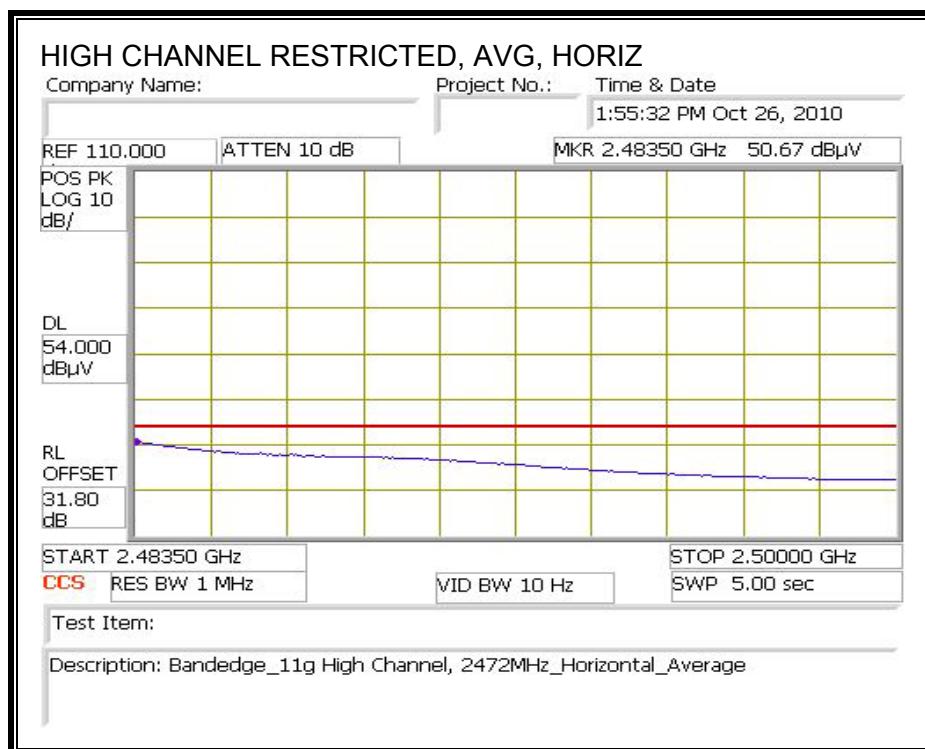
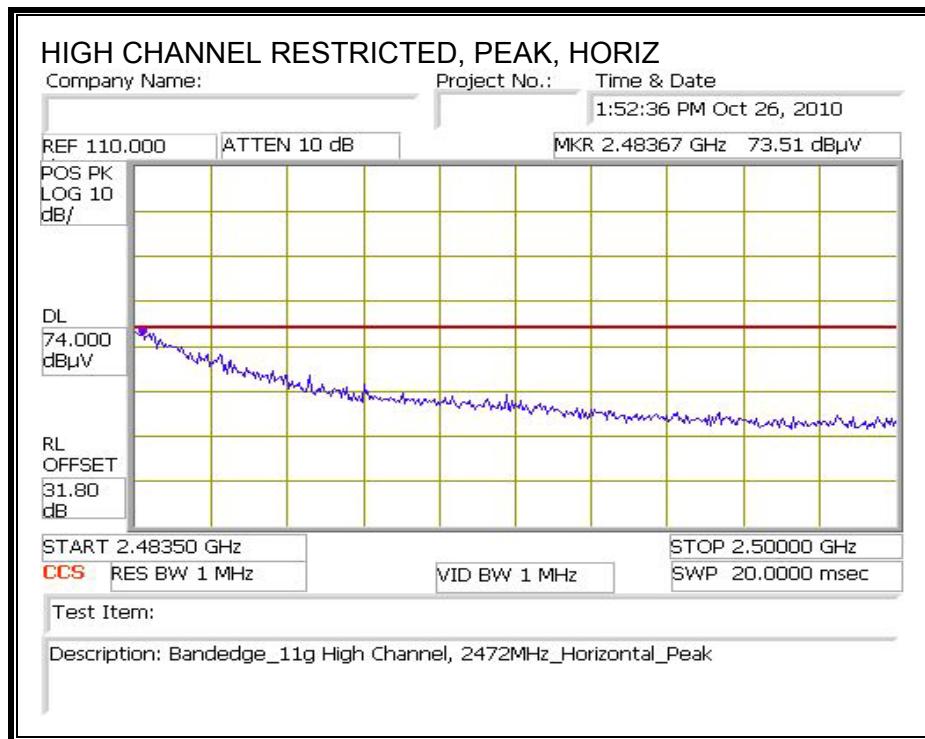
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



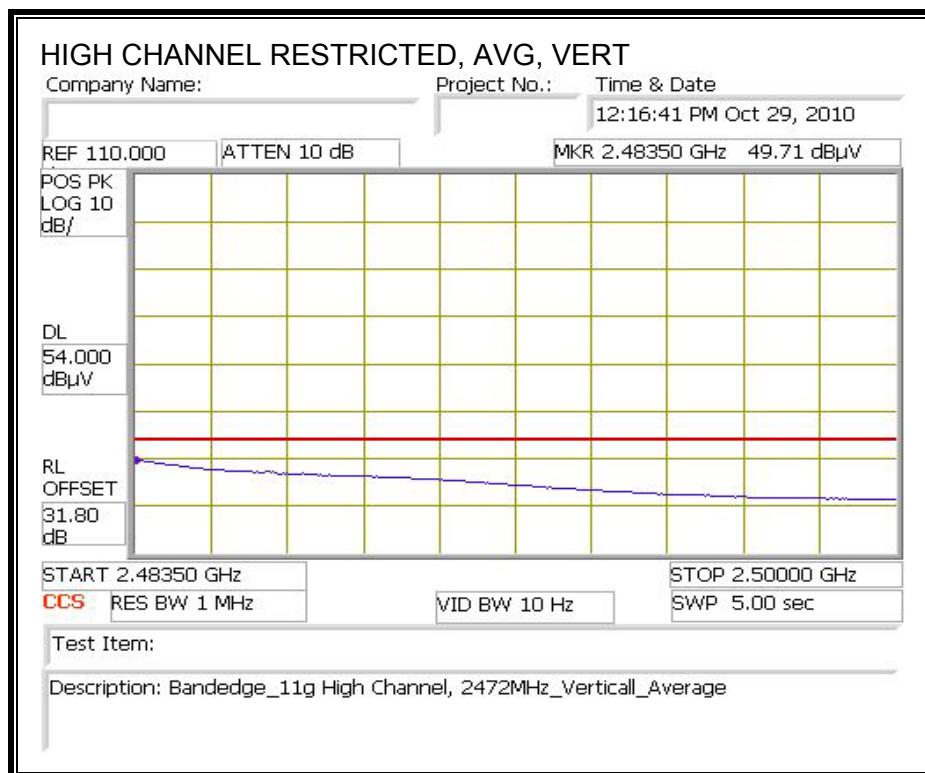
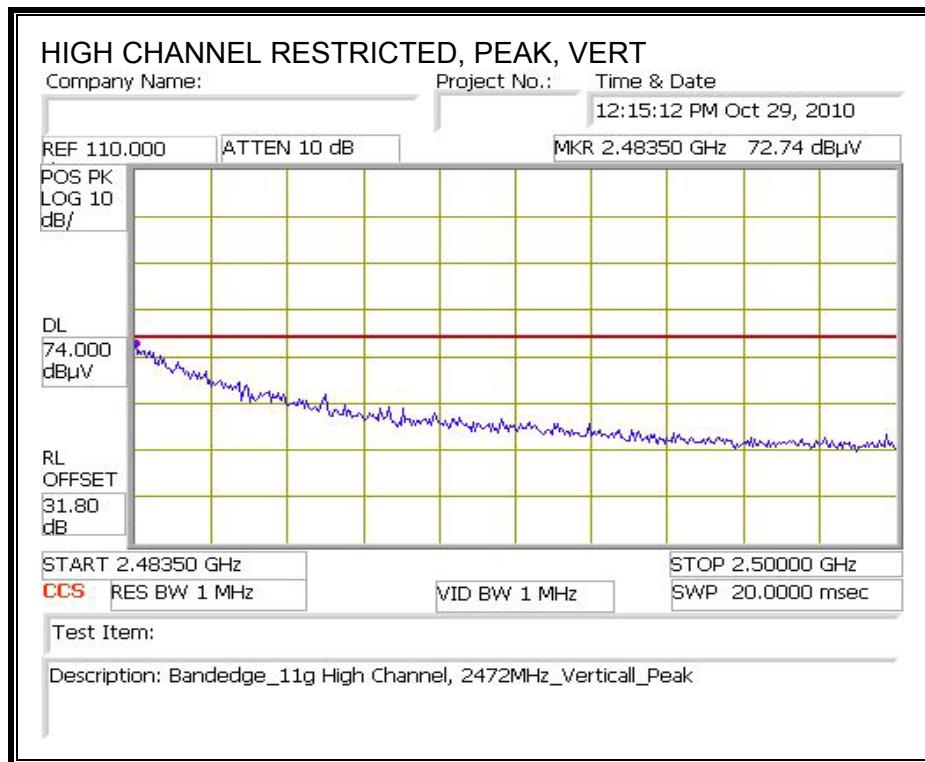
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



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



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



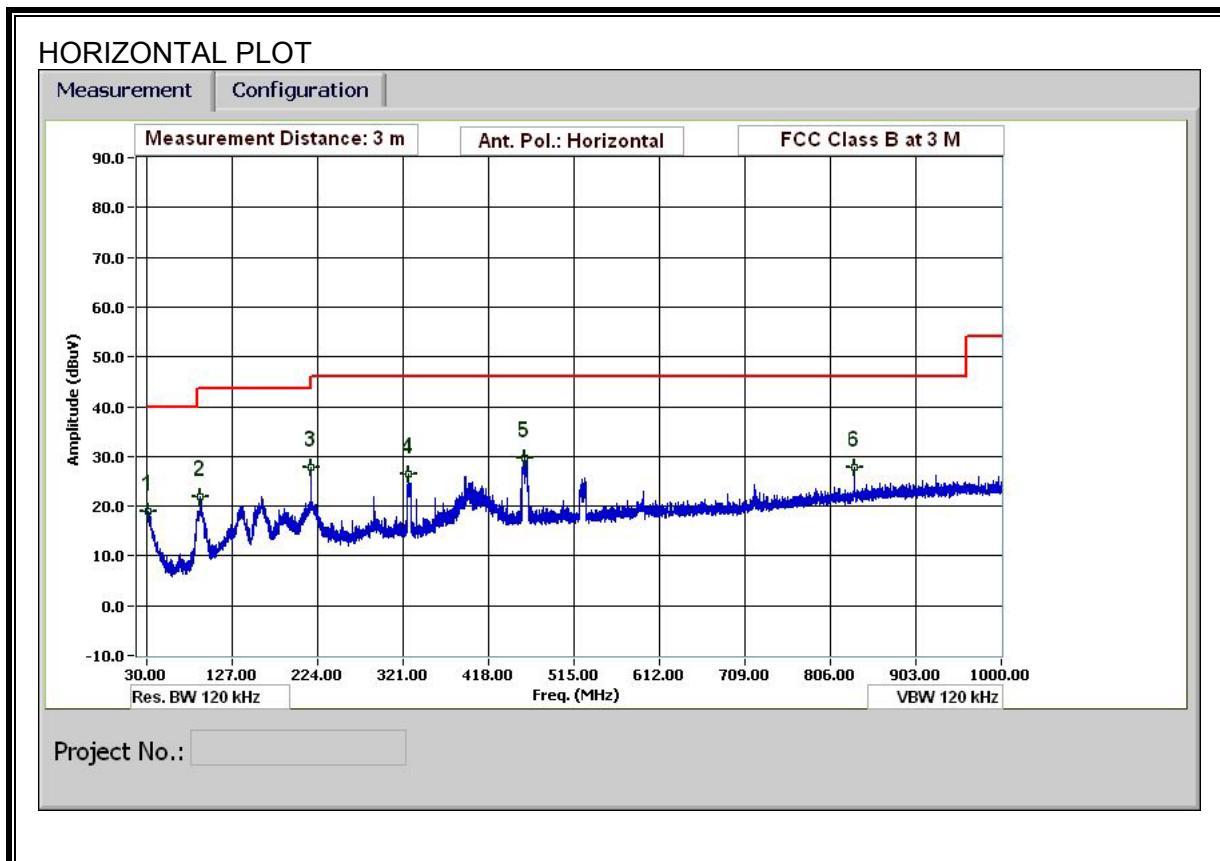
## HARMONICS AND SPURIOUS EMISSIONS

### **WORST-CASE**

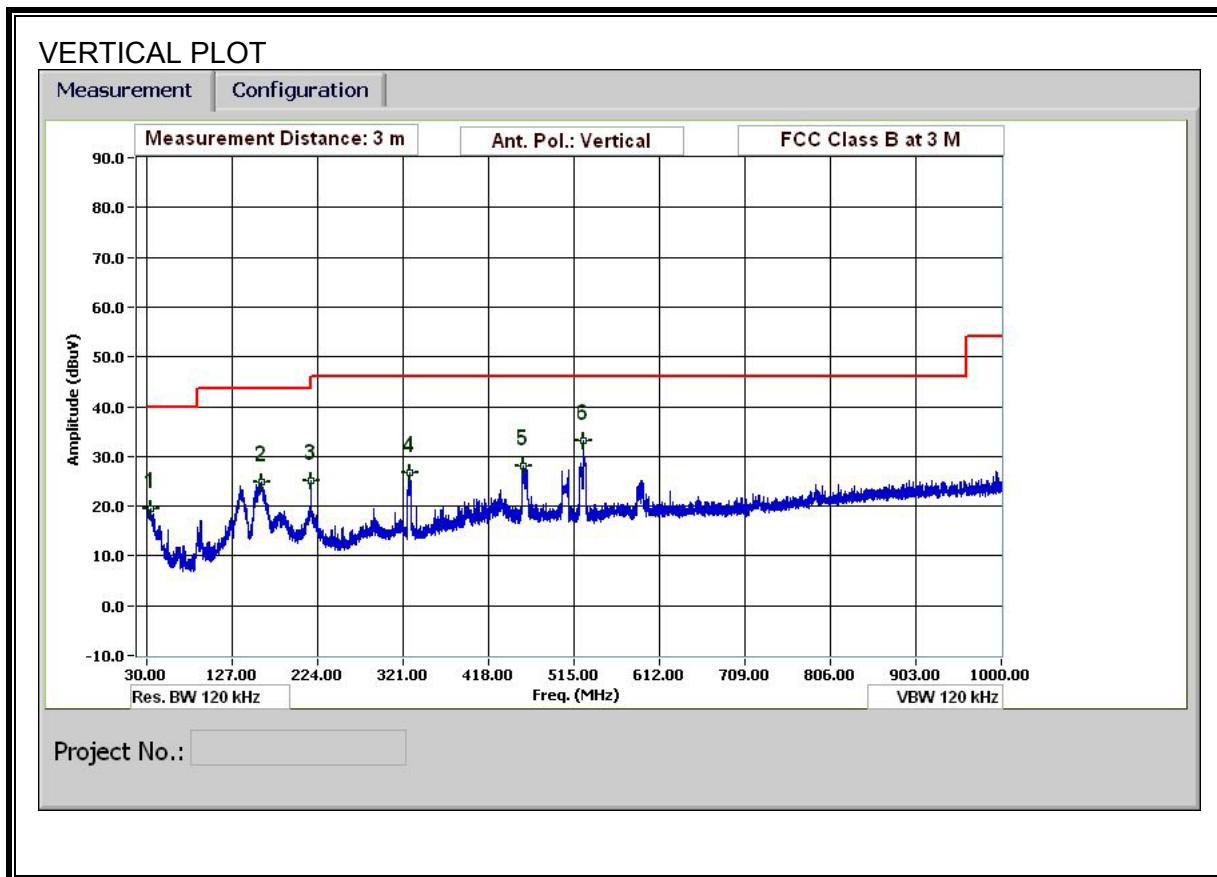
<b>High Frequency Measurement</b> <b>Compliance Certification Services, Fremont 3m Chamber</b>														
Test Engr:	Vien Tran													
Date:	10/28/10													
Project #:	10U13410													
Company:	Broadcom													
Test Target:	FCC B													
Mode Oper:	Tx 11g_Spot Check Mid Channel Only													
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		Notes
<b>MID CHANNEL, 2437MHz</b>														
4.874	3.0	40.3	32.7	5.8	-34.8	0.0	10.0	54.0	74.0	-20.0	V	P		
4.874	3.0	25.3	32.7	5.8	-34.8	0.0	10.0	39.0	54.0	-15.0	V	A		
7.311	3.0	37.2	35.5	7.3	-34.1	0.0	10.0	55.8	74.0	18.2	V	P		
7.311	3.0	24.4	35.5	7.3	-34.1	0.0	10.0	43.0	54.0	-11.0	V	A		
4.874	3.0	35.5	32.7	5.8	-34.8	0.0	10.0	49.3	74.0	-24.7	H	P		
4.874	3.0	24.2	32.7	5.8	-34.8	0.0	10.0	37.9	54.0	-16.1	H	A		
7.311	3.0	35.6	35.5	7.3	-34.1	0.0	10.0	54.2	74.0	-19.8	H	P		
7.311	3.0	23.2	35.5	7.3	-34.1	0.0	10.0	41.8	54.0	-12.2	H	A		
Rev. 4.1.2.7														
Note: No other emissions were detected above the system noise floor.														

### 8.3. WORST-CASE BELOW 1 GHz

#### **2.4GHz BAND SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)**



## 2.4GHz BAND SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)



## HORIZONTAL & VERTICAL DATA

High Frequency Measurement  
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Vien Tran  
Date: 10/28/10  
Project #: 10U13410  
Company: Broadcom  
Test Target: FCC 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	Pad dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Horizontal</b>													
31.56	3.0	27.6	19.2	0.5	28.4	0.0	0.0	18.9	40.0	-21.1	H	P	
91.083	3.0	41.9	7.6	0.8	28.2	0.0	0.0	22.0	43.5	-21.5	H	P	
216.008	3.0	42.2	11.9	1.2	27.4	0.0	0.0	27.9	46.0	-18.1	H	P	
326.772	3.0	38.4	13.9	1.6	27.6	0.0	0.0	26.3	46.0	-19.7	H	P	
458.658	3.0	40.2	16.1	1.9	28.4	0.0	0.0	29.8	46.0	-16.2	H	P	
833.433	3.0	32.1	21.3	2.6	28.1	0.0	0.0	27.9	46.0	-18.1	H	P	
<b>Vertical</b>													
34.44	3.0	29.5	17.8	0.5	28.4	0.0	0.0	19.5	40.0	20.5	V	P	
159.965	3.0	38.2	13.2	1.1	27.7	0.0	0.0	24.7	43.5	-18.8	V	P	
216.008	3.0	39.5	11.9	1.2	27.4	0.0	0.0	25.3	46.0	-20.7	V	P	
328.092	3.0	38.8	13.9	1.6	27.6	0.0	0.0	26.7	46.0	-19.3	V	P	
458.058	3.0	38.6	16.1	1.9	28.4	0.0	0.0	28.2	46.0	-17.8	V	P	
525.5	3.0	42.6	17.3	2.0	28.6	0.0	0.0	33.2	46.0	-12.8	V	P	

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