



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 7  
CLASS II PERMISSIVE CHANGE  
CERTIFICATION TEST REPORT**

**FOR**

**802.11g/Draft 802.11n WLAN PCI-E Mini Card  
(Tested inside HP Laptop HSTNN-I77C)**

**MODEL NUMBER: BCM943225HM**

**FCC ID: QDS-BRCM1045**

**IC: 4324A-BRCM1045**

**REPORT NUMBER: 09U12887-1**

**ISSUE DATE: NOVEMBER 13, 2009**

*Prepared for*

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

*Prepared by*

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**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
---	11/13/09	Initial Issue	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 PCI-E Mini Card  
(Tested inside HP Laptop HSTNN-I77C)

**MODEL:** BCM943225HM

**SERIAL NUMBER:** 593837-001 P201

**DATE TESTED:** NOVEMBER 01 - 13, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS
RSS-210 Issue 7 Annex 8 and 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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

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

### 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 WLAN PCI-E Mini Card and installed inside HP tablet laptop. The radio module is manufactured by Broadcom.

### 5.2. MAXIMUM OUTPUT POWER

The test measurement passed within  $\pm 0.5$ dBm of the original output power.

### 5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding portable platform, HP Harbour PC1501ZAC000.

### 5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilize an 802.11 b/g antennas, with the following maximum gain

No	Antenna	Max Peak gain (2.4GHz)
1	802.11bgn	Aux: 1.62dBi (H)
2	802.11bgn	TX2: 1.58dBi (V)

### 5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.60.180.8. The test utility software used during testing was wl\_tool, rev. 5.60.180.8.

### 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**

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.

802.11n HT20 Mode: MCS0, 6.5 Mbps, 2 Spatial Streams.

802.11n HT40 Mode: MCS15, 270 Mbps, 2 Spatial Streams.

Worst-case mode and channel used for 30-1000 MHz radiated 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.

Based on the original CCS test report 09U12364, only the worst case Radiated Emissions such as band Edge, Harmonic and TX below 1GHz are performed.

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



## 5.8. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMEN

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	HP	HSTNN-177C	79913S034	DoC
Laptop	HP	HSTNN-177C	79816SI07J	DoC
AC Adapter	HP	HSTNN-DA17	WAYWUX2ARXW03K	N/A

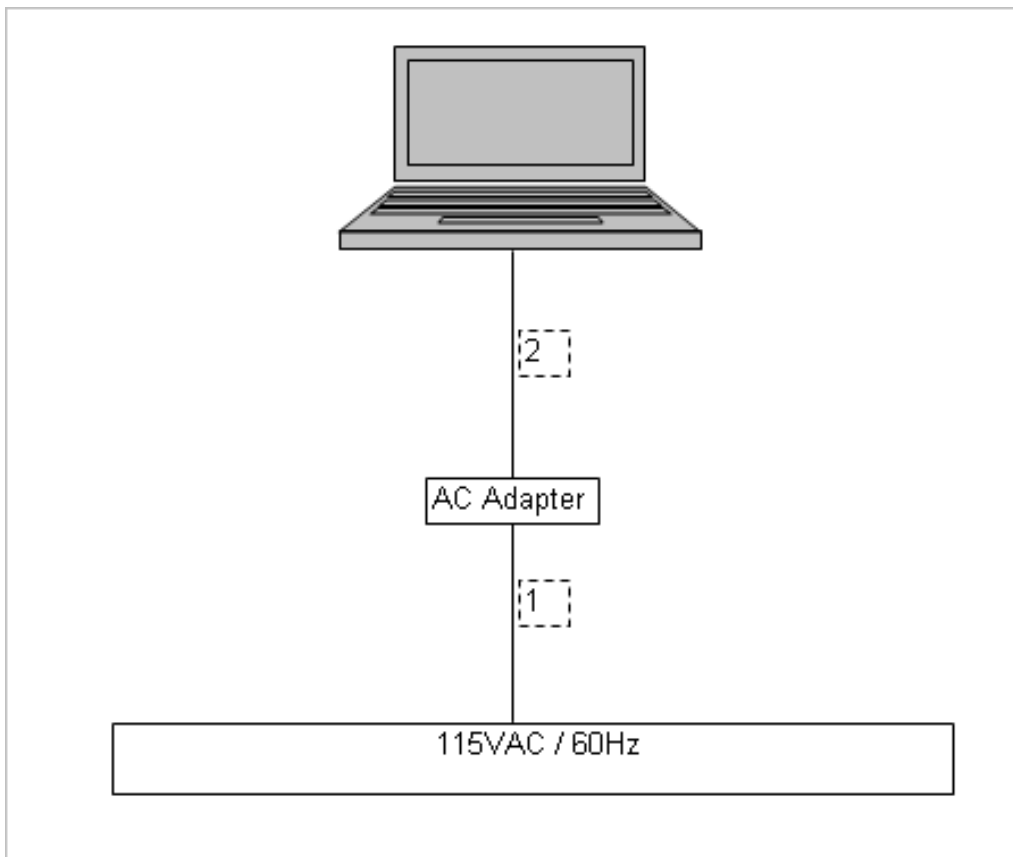
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Unshielded	1.5m	N/A
2	DC	1	DC	Unshielded	1.5m	N/A

### TEST SETUP

The EUT is installed inside a host laptop computer 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 Due
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
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	03/31/10
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/05/10
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. RADIATED TEST RESULTS

### 7.1. 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.

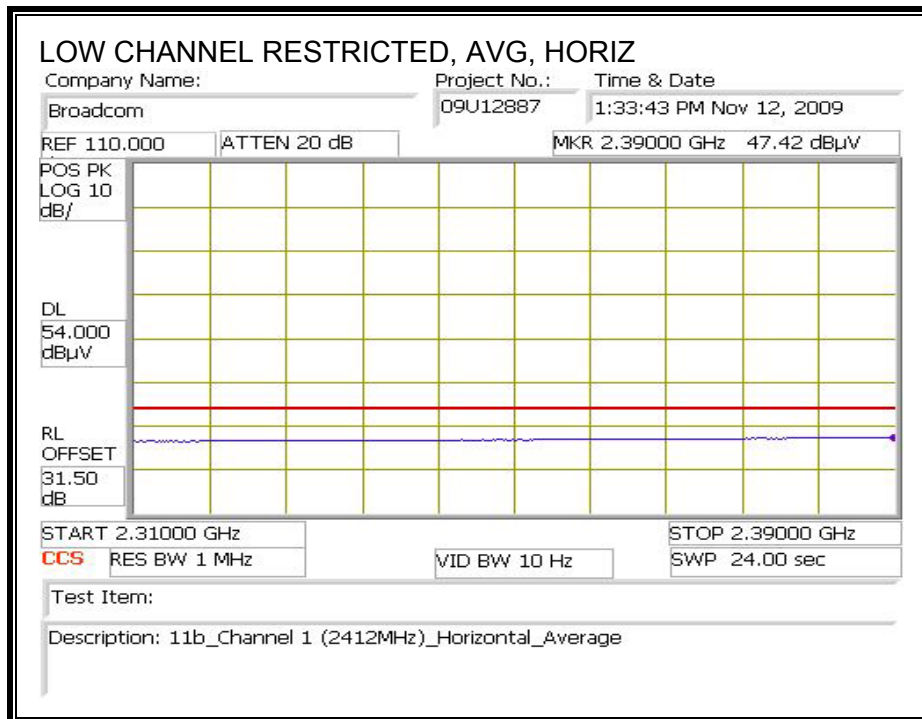
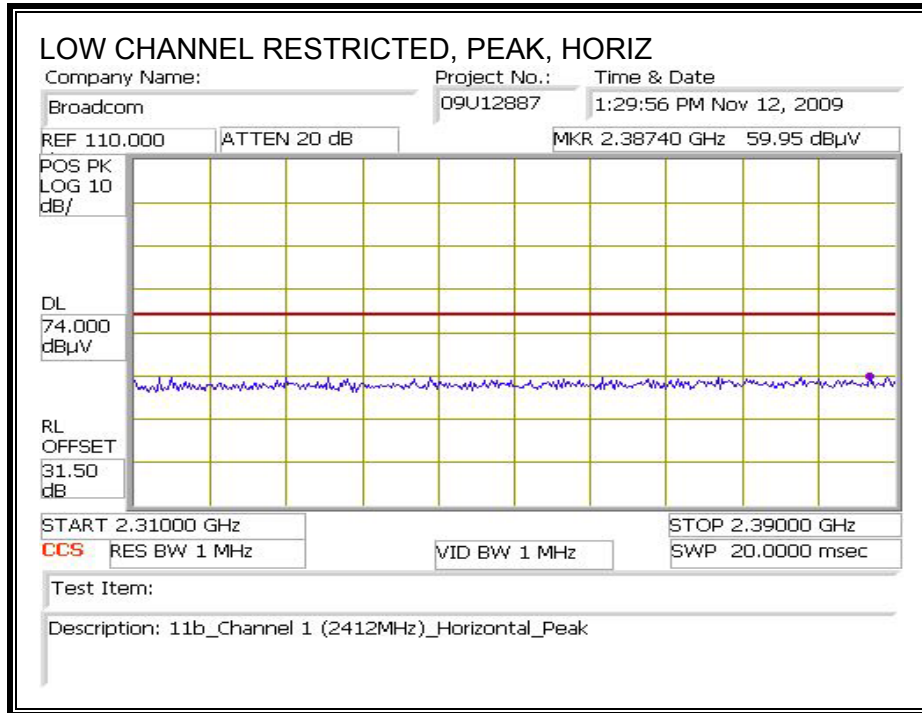
#### RESULTS

## 7.2. TRANSMITTER ABOVE 1 GHz

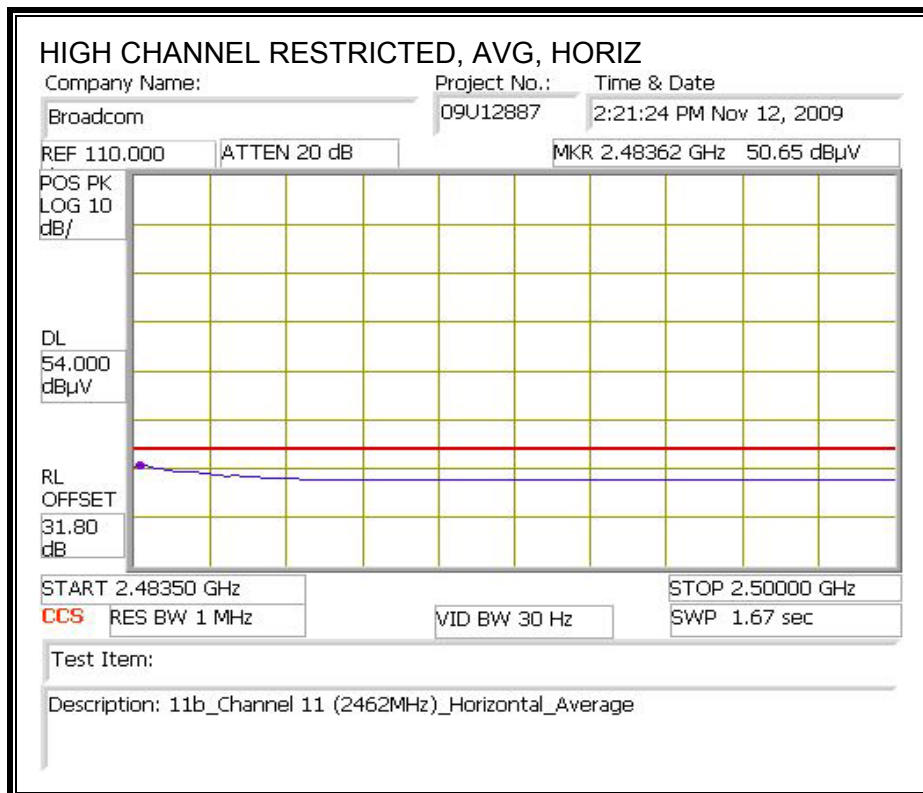
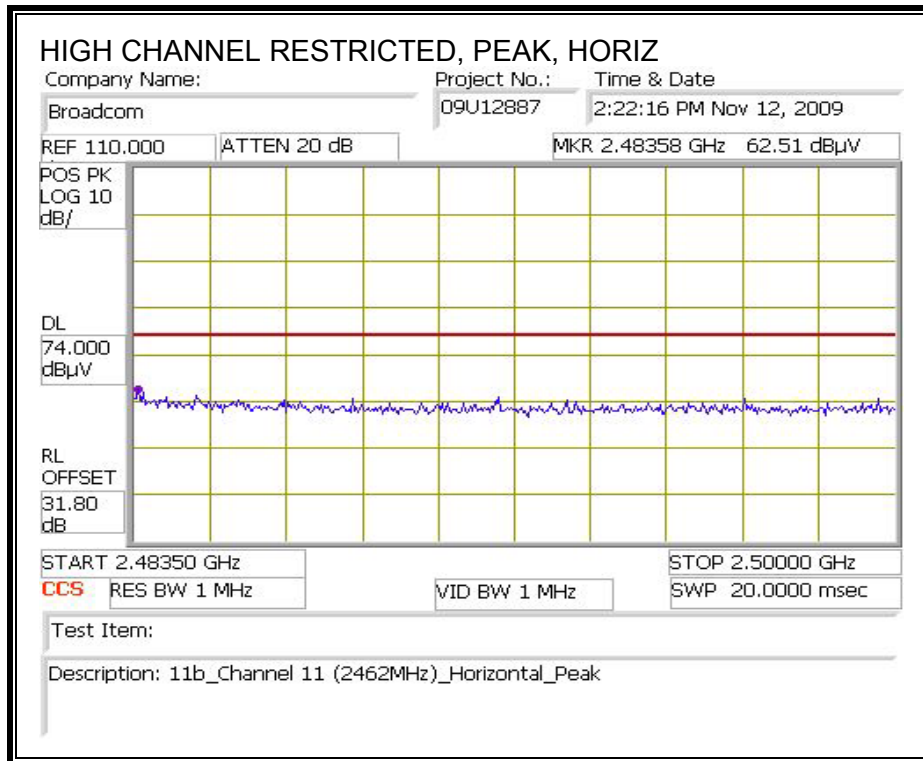
### WNC ANTENNA

#### 7.2.1. 802.11b MODE

#### RESTRICTED BANDEDGE (LOW CHANNEL 1, HORIZONTAL)



**RESTRICTED BANDEDGE (HIGH CHANNEL 11, HORIZONTAL)**

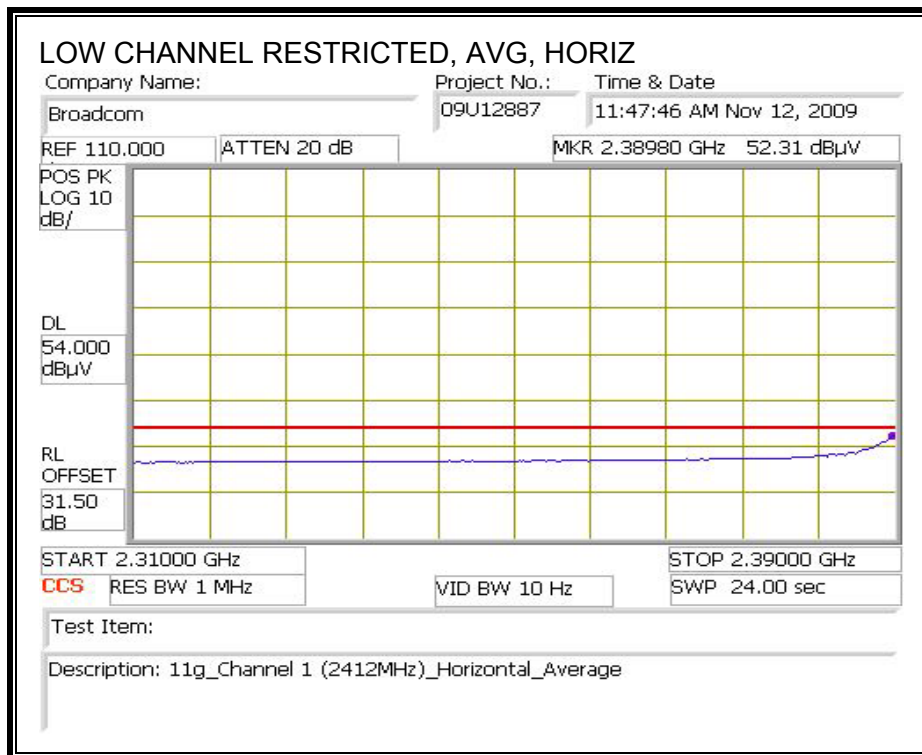
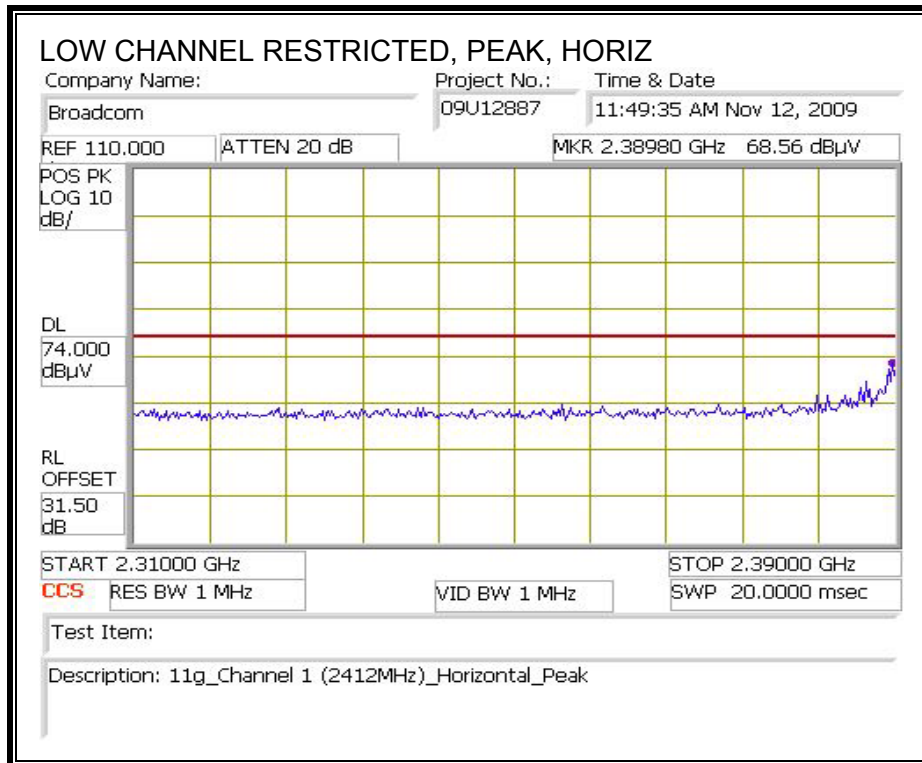


**HARMONICS AND SPURIOUS EMISSIONS, WORST-CASE: 11b Mode High Channel**

High Frequency Measurement													
Compliance Certification Services, Fremont 3m Chamber													
Test Engr:		Vien Tran											
Date:		11/12/09											
Project #:		09U12887											
Company:		Broadcom											
EUT Description:		802.11g/Draft 802.11n WLAN PCI-E Mini Card in Portable Tablet (S/N 799135034) with WNC Antenna											
EUT M/N:		BCM943225HM											
Test Target:		FCC Class B											
Mode Oper:		Tx 11b Mode_High Channel Worst Case											
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	Fitr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
<b>Horizontal</b>													
4.924	3.0	45.9	32.7	5.9	-34.8	0.0	0.0	49.7	74.0	-24.3	H	P	
4.924	3.0	42.7	32.7	5.9	-34.8	0.0	0.0	46.5	54.0	-7.5	H	A	
7.386	3.0	40.0	35.6	7.3	-34.1	0.0	0.0	48.8	74.0	-25.2	H	P	
7.386	3.0	33.5	35.6	7.3	-34.1	0.0	0.0	42.3	54.0	-11.7	H	A	
<b>Vertical</b>													
4.924	3.0	44.0	32.7	5.9	-34.8	0.0	0.0	47.8	74.0	-26.2	V	P	
4.924	3.0	41.0	32.7	5.9	-34.8	0.0	0.0	44.8	54.0	-9.2	V	A	
7.386	3.0	42.2	35.6	7.3	-34.1	0.0	0.0	51.0	74.0	-23.0	V	P	
7.386	3.0	36.7	35.6	7.3	-34.1	0.0	0.0	45.5	54.0	-8.5	V	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													

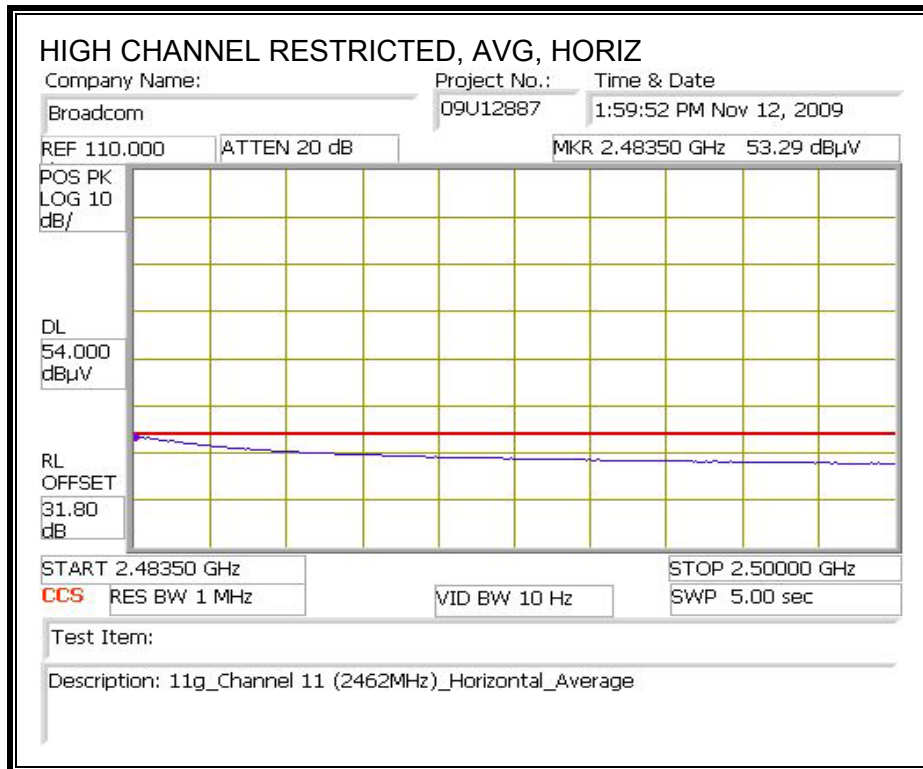
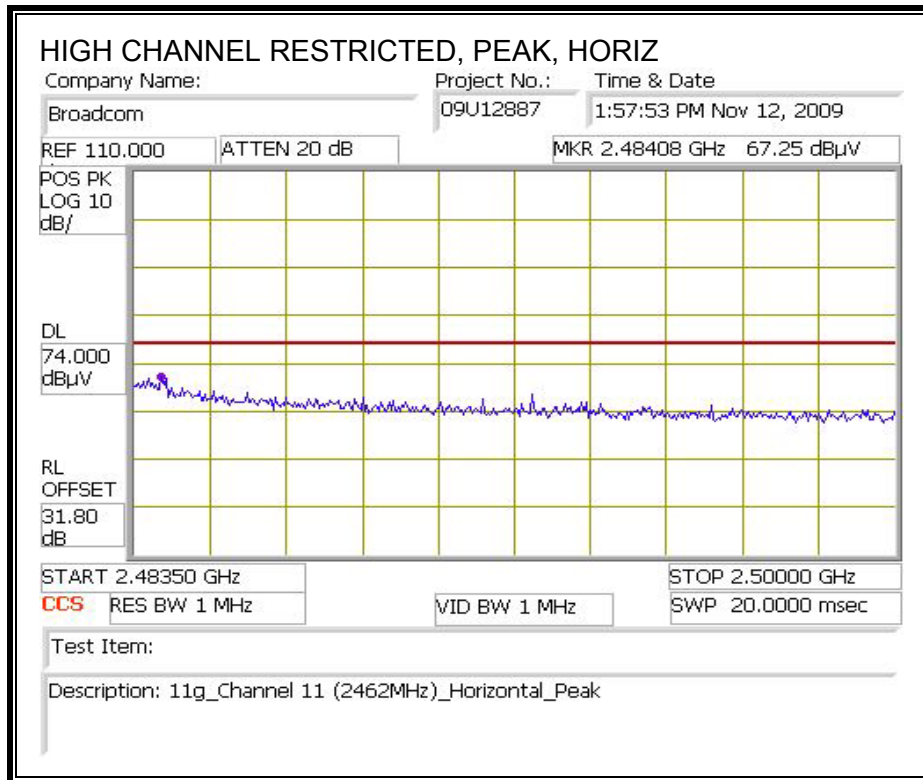
### 7.2.2. 802.11g MODE

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



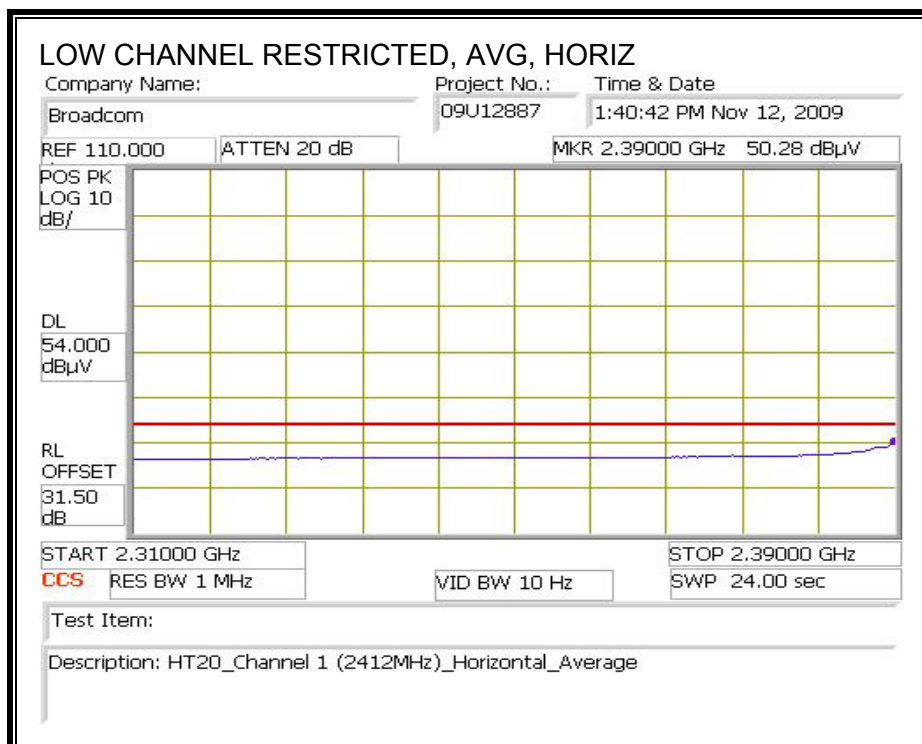
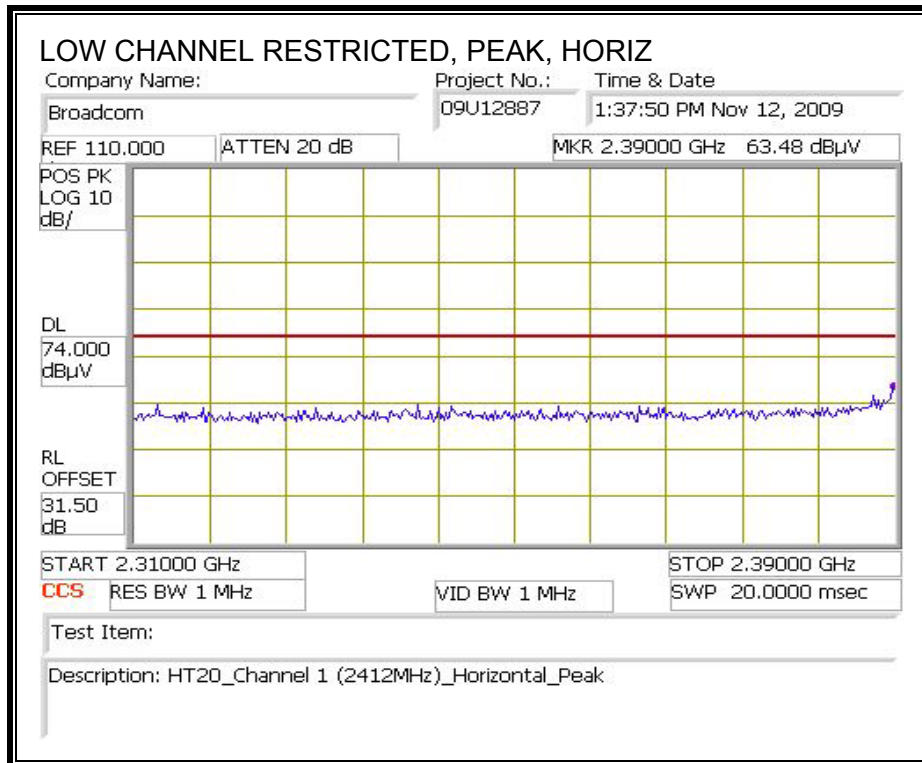


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

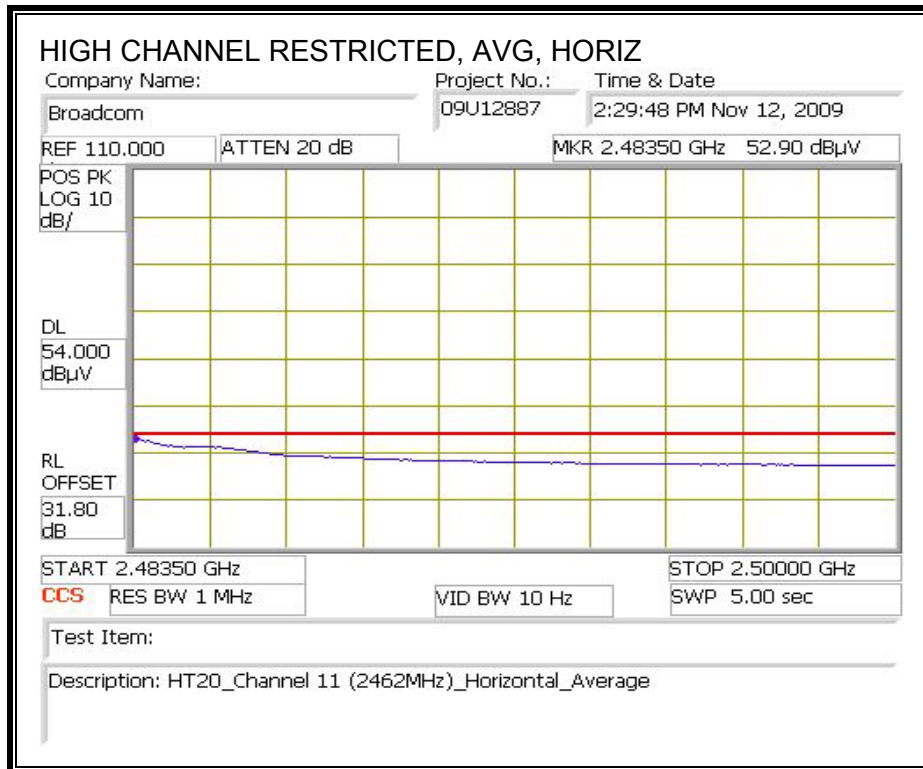
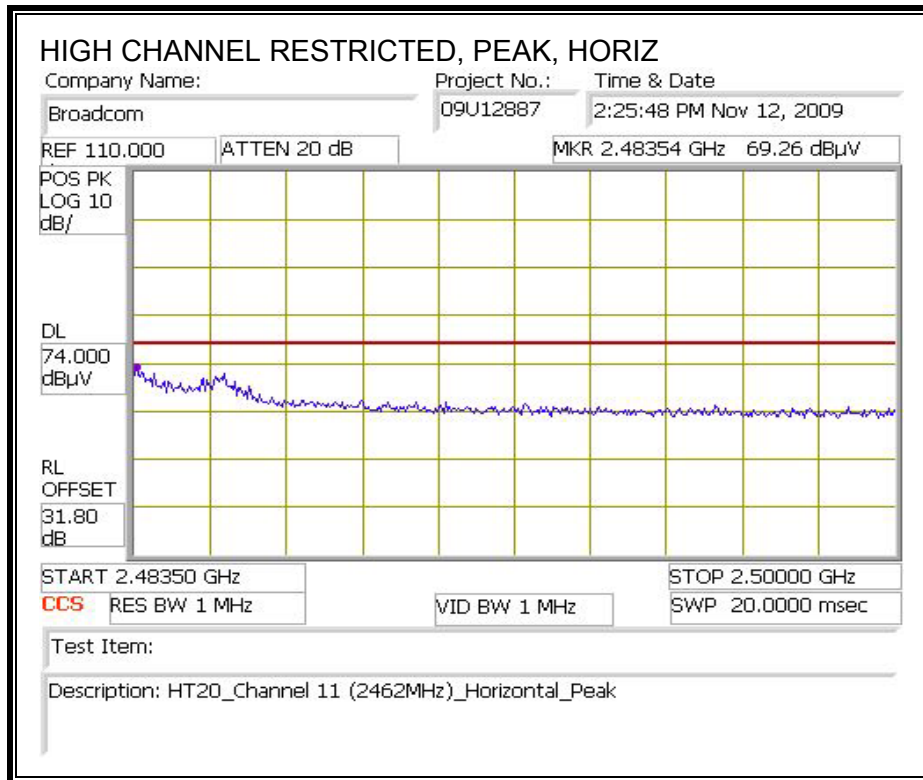


### 7.2.3. 802.11n HT20 MODE

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

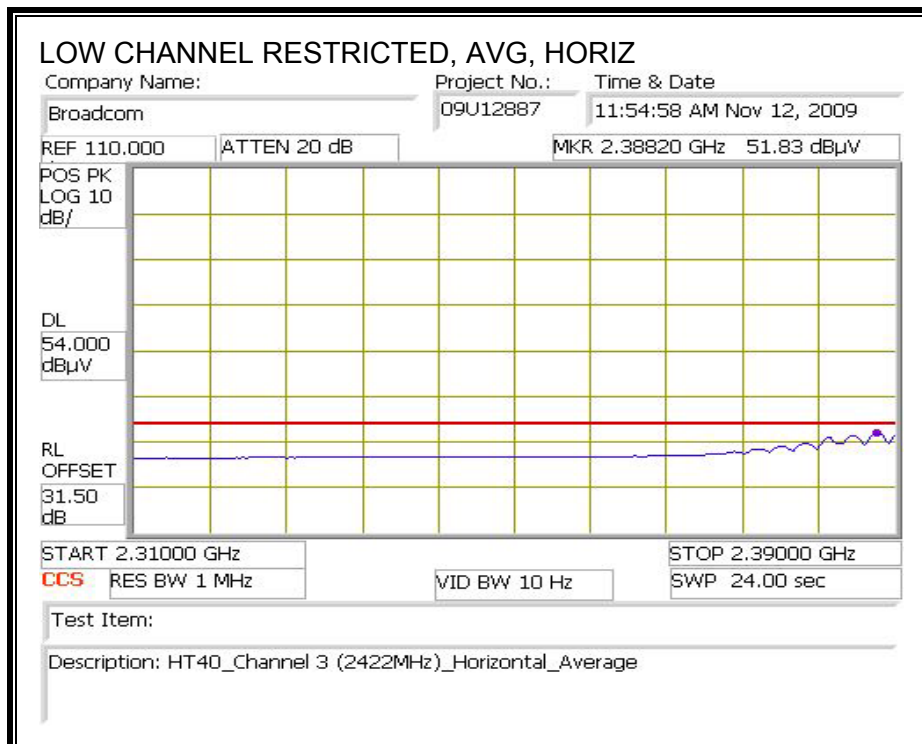
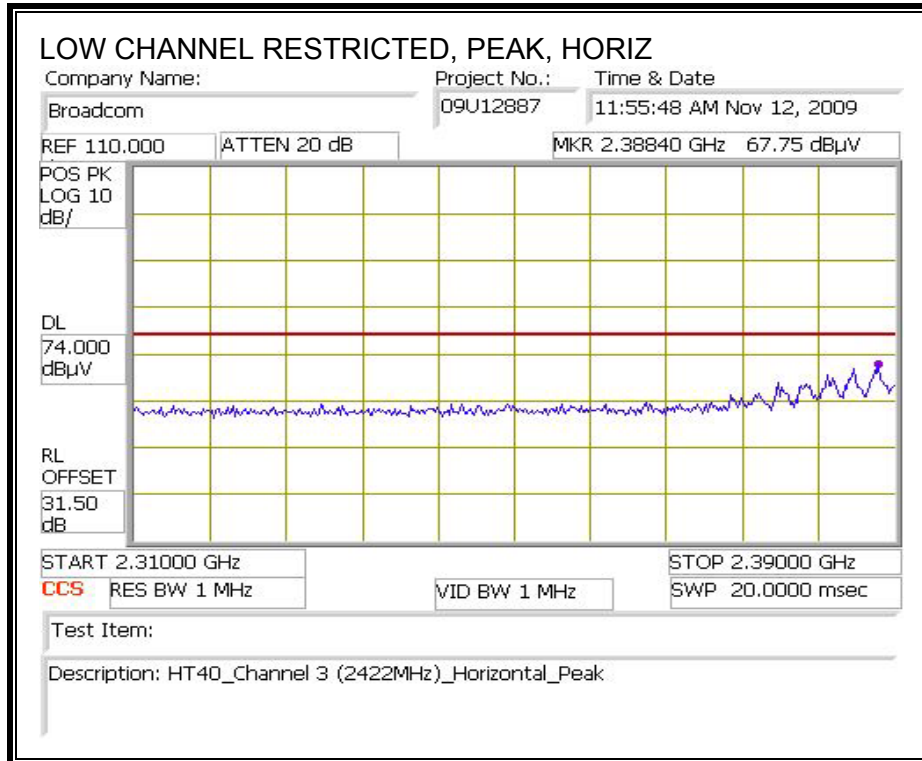


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

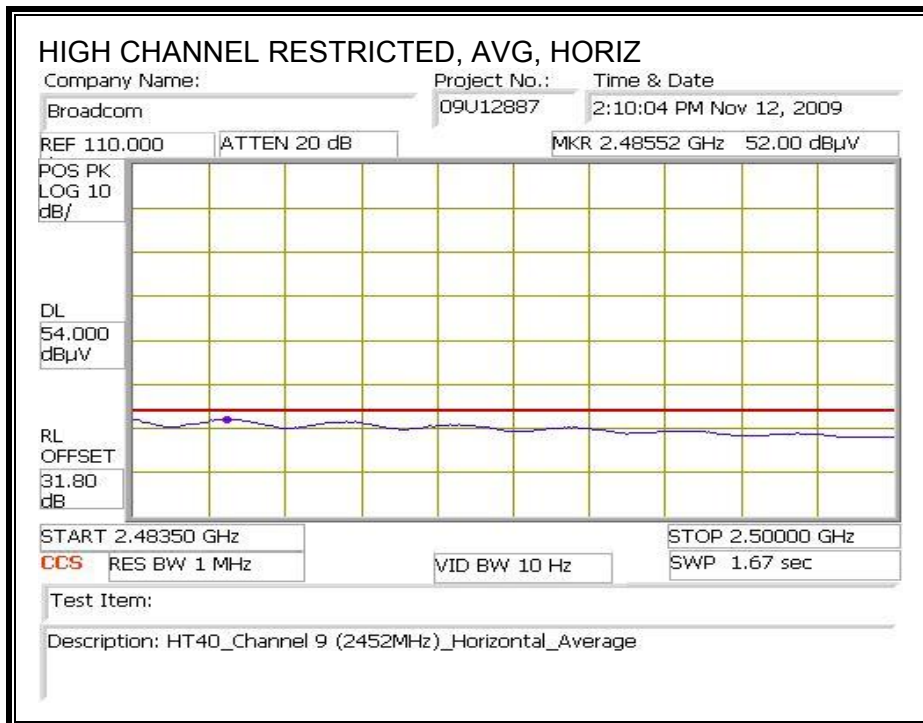
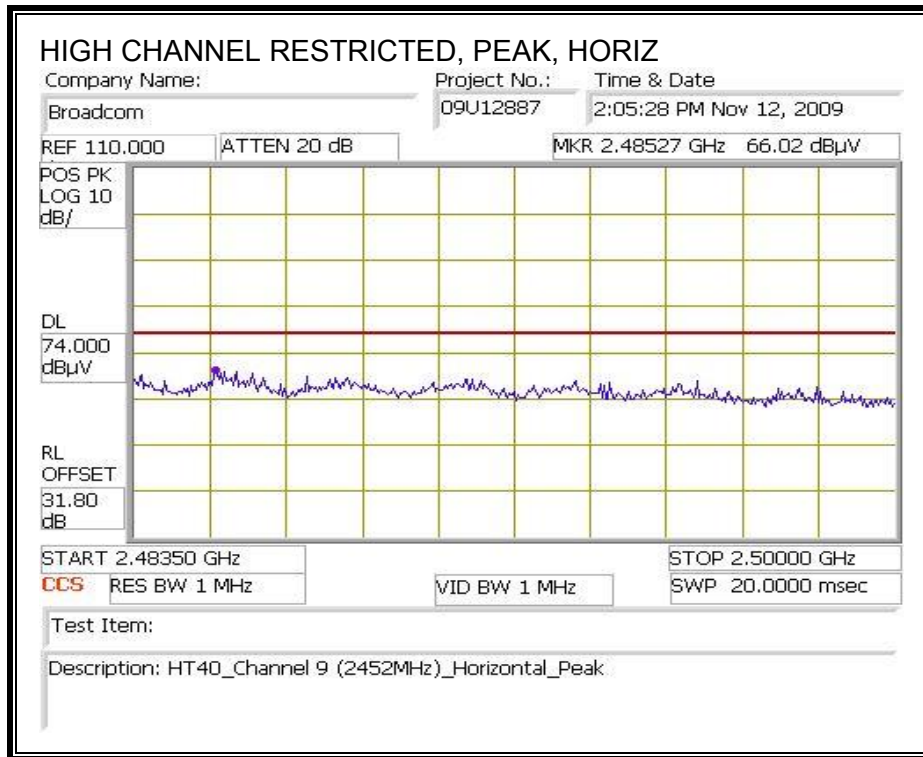


### 7.2.4. 802.11n HT40 MODE

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



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



**YAGEO ANTENNA**

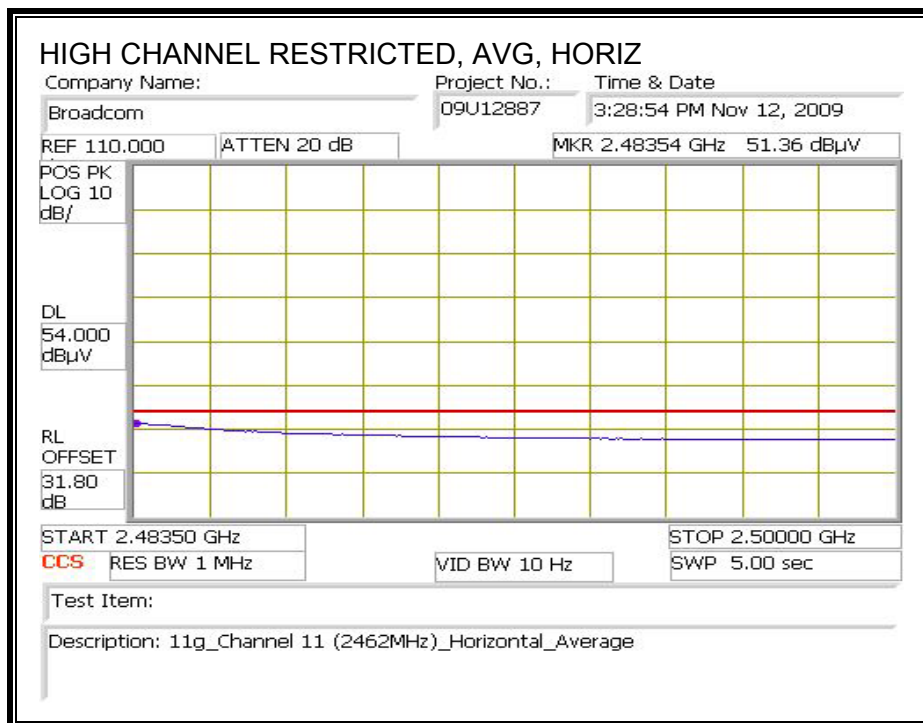
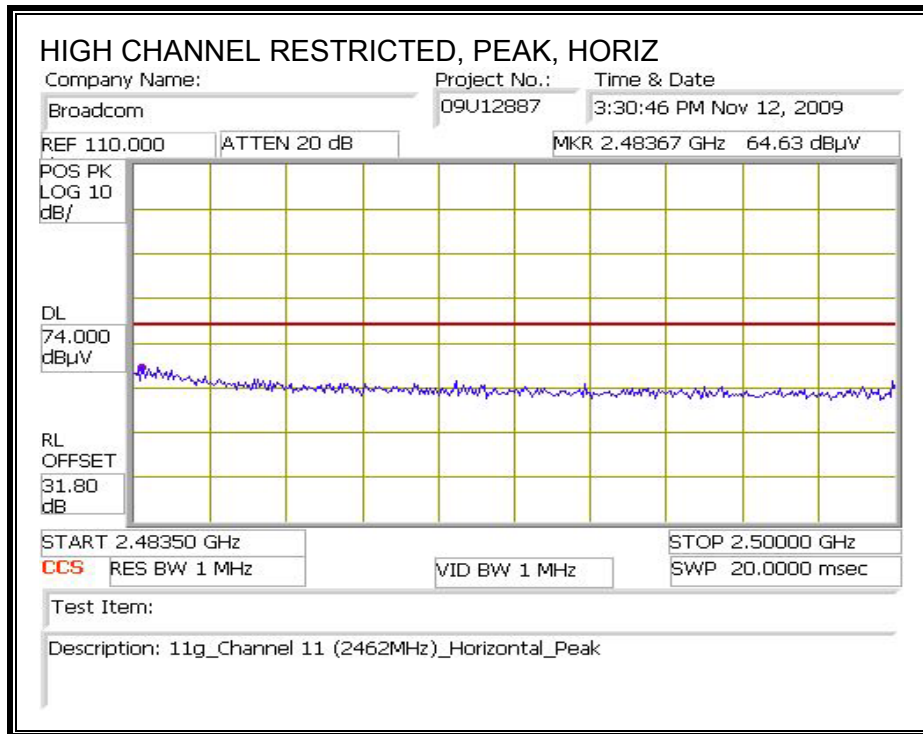
**7.2.5. 802.11b MODE**

High Frequency Measurement													
Compliance Certification Services, Fremont 3m Chamber													
Test Engr:		Vien Tran											
Date:		11/12/09											
Project #:		09U12887											
Company:		Broadcom											
EUT Description:		802.11g/Draft 802.11n WLAN PCI-E Mini Card in Portable Tablet (S/N 79816SI07J) with YAGEO Antenna											
EUT M/N:		BCM943225HM											
Test Target:		FCC Class B											
Mode Oper:		Tx 11b Mode_High Channel_Worst Case											
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	Dist	Read	AF	CL	Amp	D Corr	Fitr	Corr.	Limit	Margin	Ant. Pol.	Det.	Notes
GHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	
<b>Horizontal</b>													
4.924	3.0	42.0	32.7	5.9	-34.8	0.0	0.0	45.8	74.0	-28.2	V	P	
4.924	3.0	37.7	32.7	5.9	-34.8	0.0	0.0	41.5	54.0	-12.5	V	A	
7.386	3.0	43.0	35.6	7.3	-34.1	0.0	0.0	51.8	74.0	-22.2	V	P	
7.386	3.0	38.0	35.6	7.3	-34.1	0.0	0.0	46.7	54.0	-7.3	V	A	
<b>Vertical</b>													
4.924	3.0	42.4	32.7	5.9	-34.8	0.0	0.0	46.2	74.0	-27.8	H	P	
4.924	3.0	38.0	32.7	5.9	-34.8	0.0	0.0	41.8	54.0	-12.2	H	A	
7.386	3.0	41.0	35.6	7.3	-34.1	0.0	0.0	49.8	74.0	-24.2	H	P	
7.386	3.0	35.8	35.6	7.3	-34.1	0.0	0.0	44.5	54.0	-9.5	H	A	
Rev. 4.1.2.7													
Note: No other emissions were detected above the system noise floor.													



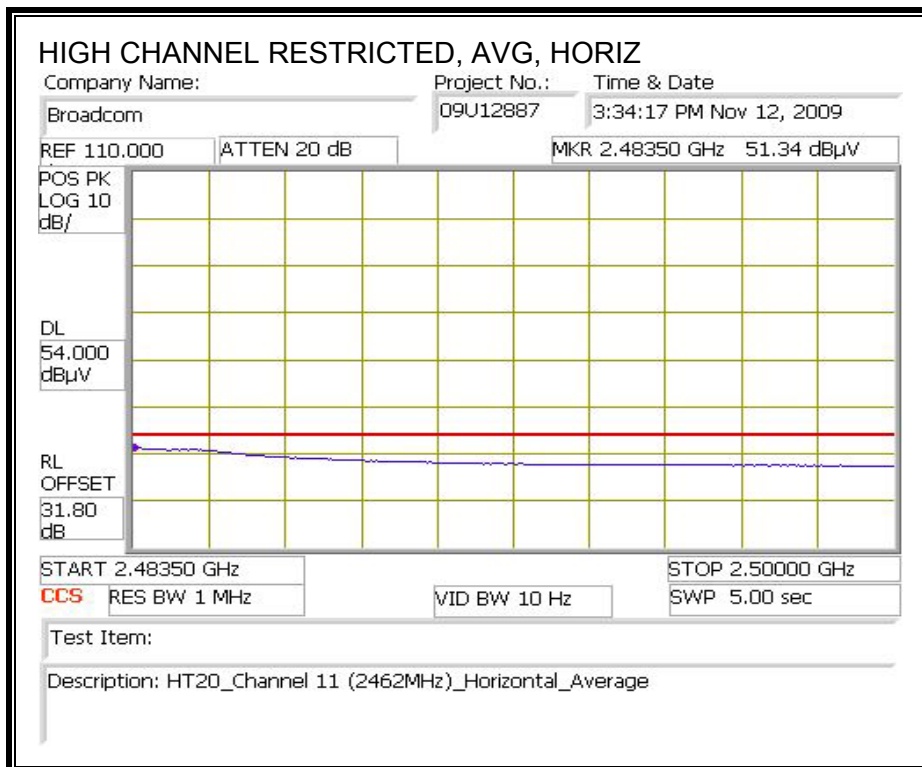
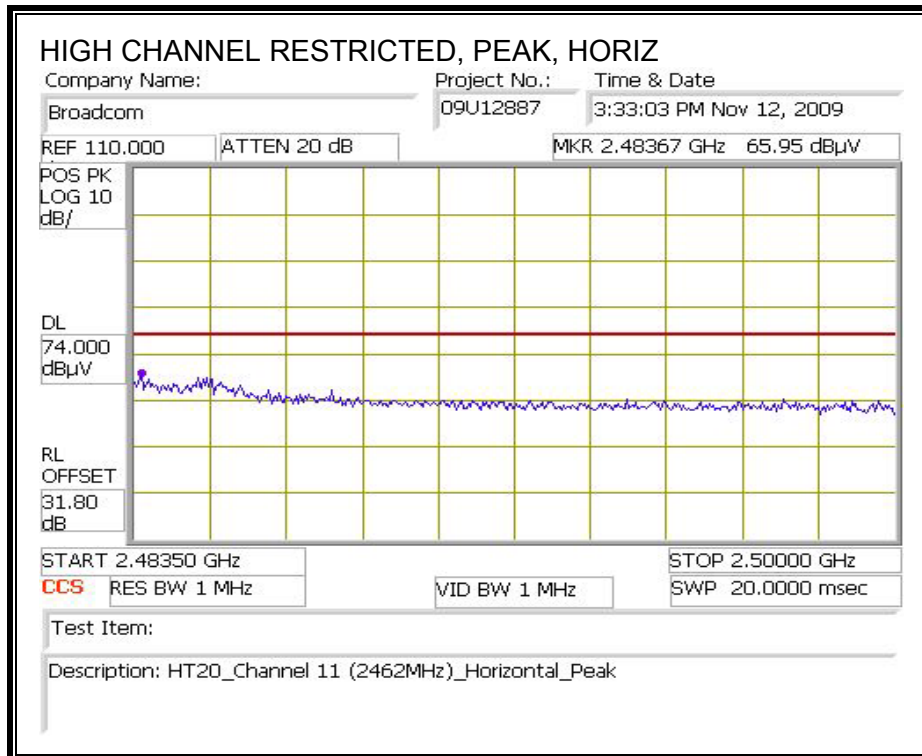
### 7.2.6. 802.11g MODE

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



### 7.2.7. 802.11n HT20 MODE

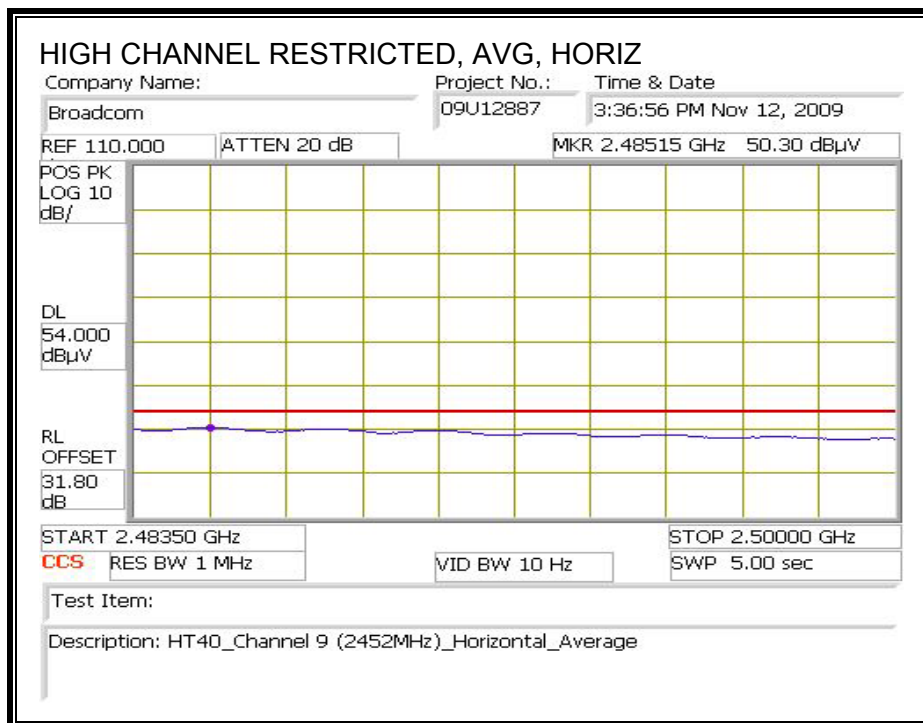
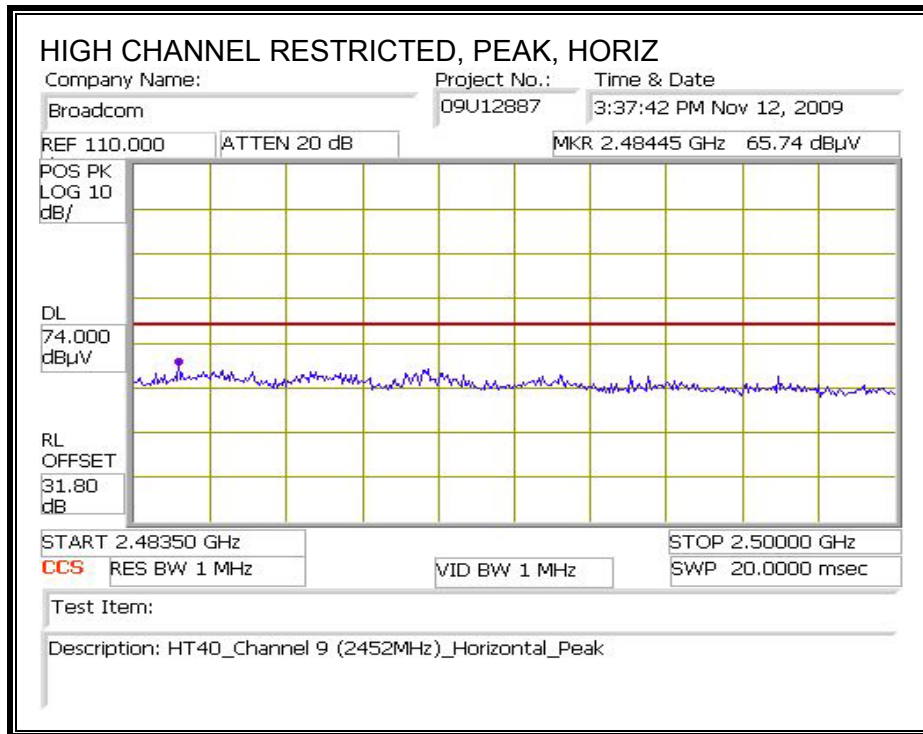
#### RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





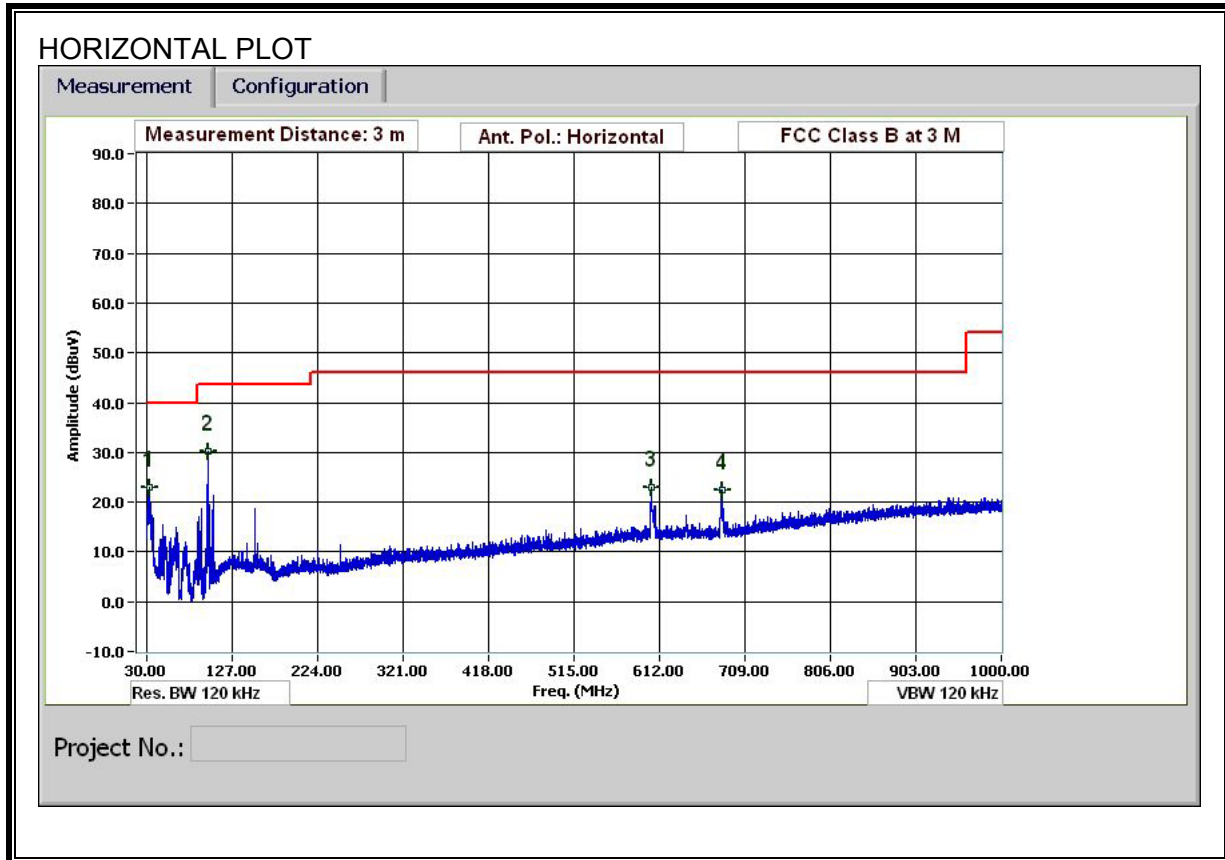
### 7.2.8. 802.11n HT40 MODE

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

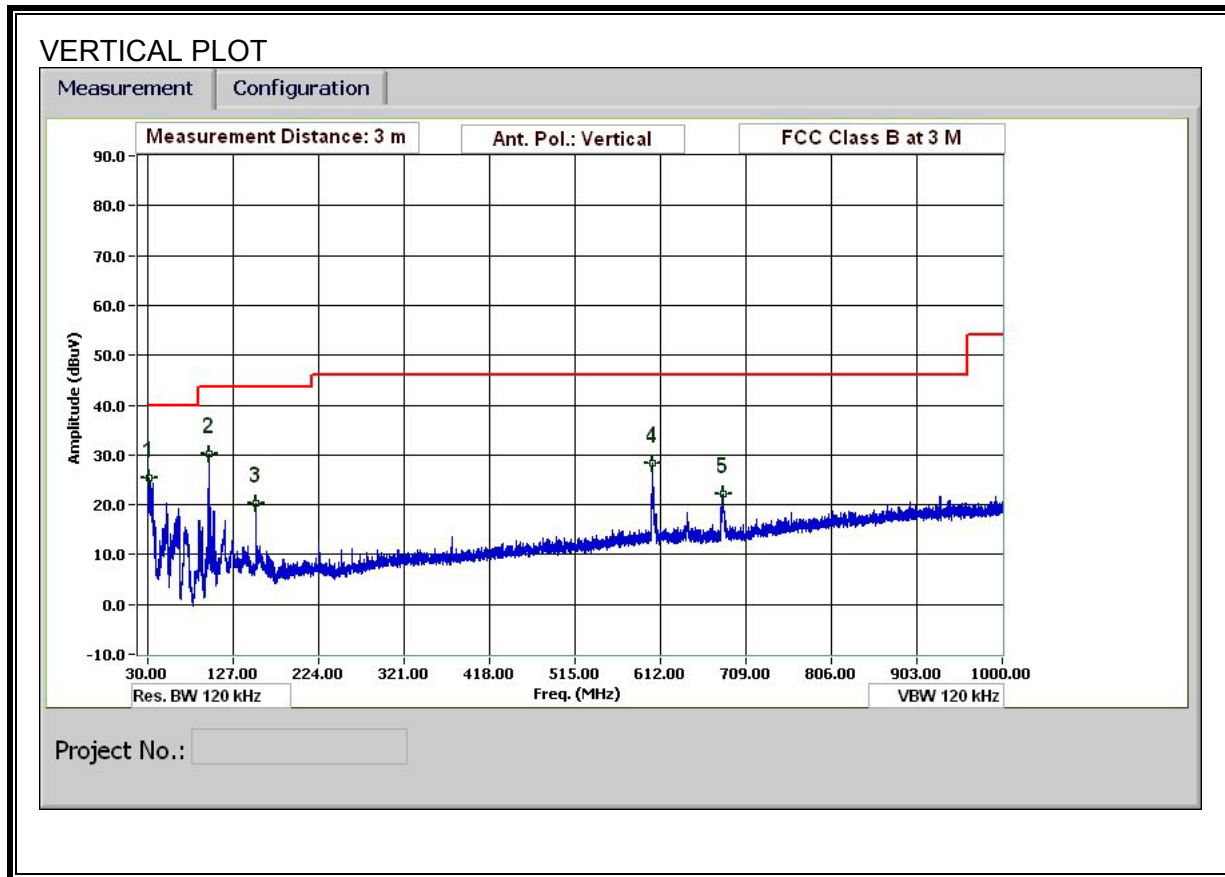


### 7.3. WORST-CASE BELOW 1 GHz

#### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)



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



**HORIZONTAL & VERTICAL DATA**

30-1000MHz Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber

Test Engr: Vien Tran  
 Date: 11/01/09  
 Project #: 09U12887  
 Company: Broadcom  
 EUT Description: 802.11g/Draft 802.11n WLAN PCI-E Mini Card in Portable tablet with WNC Antenna  
 EUT M/N: BCM943225HM  
 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>													
32.520	3.0	32.2	18.8	0.5	28.4	0.0	0.0	23.1	40.0	-16.9	H	P	
100.323	3.0	48.1	9.4	0.8	28.2	0.0	0.0	30.1	43.5	-13.4	H	P	
602.304	3.0	31.0	18.5	2.2	28.6	0.0	0.0	23.0	46.0	-23.0	H	P	
682.587	3.0	29.6	18.9	2.4	28.5	0.0	0.0	22.3	46.0	-23.7	H	P	
<b>Vertical</b>													
31.800	3.0	34.1	19.1	0.5	28.4	0.0	0.0	25.3	40.0	-14.7	V	P	
100.323	3.0	48.1	9.4	0.8	28.2	0.0	0.0	30.1	43.5	-13.4	V	P	
153.365	3.0	34.3	12.8	1.0	27.8	0.0	0.0	20.4	43.5	-23.1	V	P	
602.304	3.0	36.3	18.5	2.2	28.6	0.0	0.0	28.4	46.0	-17.6	V	P	
683.307	3.0	29.4	18.9	2.4	28.5	0.0	0.0	22.1	46.0	-23.9	V	P	

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