



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

**FOR  
802.11ag/Draft 802.11n WLAN PCI-E Mini Card  
(Dell Hepburn PP33L with BCM94322MH8L Inside)**

**MODEL NUMBER: BCM94322MH8L**

**FCC ID: QDS-BRCM1031**

**IC: 4324A-BRCM1031**

**REPORT NUMBER: 08U11720-2A**

**ISSUE DATE: May 9, 2008**

*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>
--	4-28-08	Initial Issue	Sunny Shih
A	5-9-08	1. Updated sec. 5.2 Description of class II permissive change. 2. Added Co-located MPE calculations	Sunny Shih

## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS</b> .....	<b>4</b>
<b>2. TEST METHODOLOGY</b> .....	<b>5</b>
<b>3. FACILITIES AND ACCREDITATION</b> .....	<b>5</b>
<b>4. CALIBRATION AND UNCERTAINTY</b> .....	<b>5</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	5
4.2. <i>MEASUREMENT UNCERTAINTY</i> .....	5
<b>5. EQUIPMENT UNDER TEST</b> .....	<b>6</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	6
5.2. <i>DESCRIPTION OF CLASS II PERMISSIVE CHANGE</i> .....	6
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> .....	6
5.4. <i>SOFTWARE AND FIRMWARE</i> .....	6
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i> .....	6
5.6. <i>DESCRIPTION OF TEST SETUP</i> .....	7
<b>6. TEST AND MEASUREMENT EQUIPMENT</b> .....	<b>9</b>
<b>7. RADIATED TEST RESULTS</b> .....	<b>10</b>
7.1. <i>LIMITS AND PROCEDURE</i> .....	10
7.2. <i>TRANSMITTER ABOVE 1 GHz</i> .....	11
7.2.1. 802.11b MODE.....	11
7.2.2. 802.11g MODE.....	14
7.2.3. 802.11 HT40 MODE IN THE 2.4 GHZ BAND.....	18
7.2.4. 802.11a MODE.....	22
7.2.5. 802.11n HT20 MODE IN THE 5.8 GHz BAND .....	23
7.2.6. 802.11n HT40 MODE IN THE 5.8 GHz BAND .....	24
7.3. <i>RECEIVER ABOVE 1 GHz</i> .....	25
7.4. <i>WORST-CASE BELOW 1 GHz</i> .....	26
<b>8. AC POWER LINE CONDUCTED EMISSIONS</b> .....	<b>32</b>
<b>9. SETUP PHOTOS</b> .....	<b>35</b>

# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** 802.11ag / Draft 802n WLAN PCI-E MINI CARD  
(Dell Hepburn PP33L with BCM94322HM8L inside)

**MODEL:** BCM94322HM8L

**SERIAL NUMBER:** COY7C00134

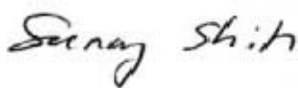
**DATE TESTED:** APRIL 24 - 26, 2008

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C and Subpart E	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 expressions of Pass/Fail in this report are opinions expressed by CCS based on interpretations of the test results. 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:



SUNNY SHIH  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



THANH NGUYEN  
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. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 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 802.11ag /Draft WLAN PCI-E Mini Card inside Dell Hepburn, model PP33L.

The radio module is manufactured by Broadcom, model BCM94322HM8L.

### 5.2. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major changes filed under this application are:

- Adding portable platform, model Dell PP33L.
- Add co-location of UWB+BT module FCC ID: QDS-BRCM1035

Only the Radiated Emission and AC mains line conduction tests are performed.

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency (MHz)	Antenna Manufacture	Model	Main (dBi), Tx 1	MIMO (dBi), Tx 3 (Used as Aux)	Antenna Tested
2412 - 2462	Advance-Connectek, Inc (ACON)	APP8P-700045 (Main & Aux) & APP8P-700046 (MIMO)	0.31	-1.45	<input type="checkbox"/>
	Amphenol	QT0932-11-001-R (Tx1-2) & QT0932-11-004-R (Tx3)	1.12	-0.49	<input type="checkbox"/>
	<b>SmartAnt</b>	<b>PE-080000</b>	<b>1.51</b>	<b>1.15</b>	<input checked="" type="checkbox"/>
5725 - 5850	Advance-Connectek, Inc (ACON)	APP8P-700045 (Main & Aux) & APP8P-700046 (MIMO)	-1.05	0.39	<input type="checkbox"/>
	Amphenol	QT0932-11-001-R (Tx1-2) & QT0932-11-004-R (Tx3)	-1.39	-1.51	<input type="checkbox"/>
	<b>SmartAnt</b>	<b>PE-080000</b>	<b>1.33</b>	<b>1.5</b>	<input checked="" type="checkbox"/>

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was BCMWL5.SYS, rev. 4.170.75.0.

The test utility software used during testing was wl\_tool, rev. 4.170 RC75.0

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rate for each mode is determined to be as follows, based on original test report and CCS DTS Test Plan.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	DELL	HEPBURN	COY7C00134	N/A
AC Adapter	DELL	LA90PS0-00	CN-0DF266-71615-67J-05BB	N/A

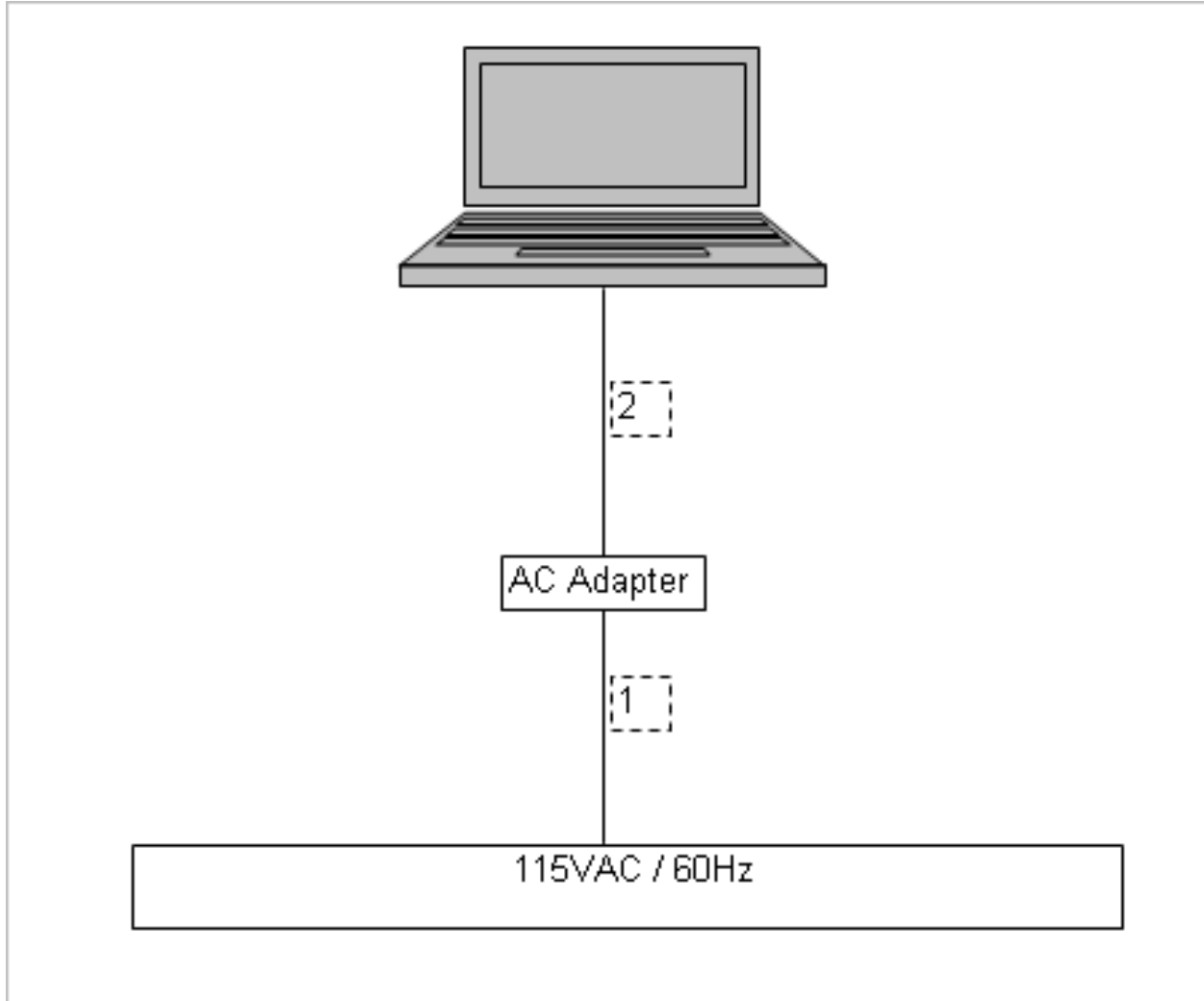
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Unshielded	2.0m	N/A
2	DC	1	DC	Unshielded	2.0m	N/A

### TEST SETUP

The EUT is installed in 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 Date	Cal Due
Antenna, Horn, 18 GHz	EMCO	3115	C00945	4/15/2007	4/15/2009
Bilog Antenna	Sundt Sciences	JB1	C01016	10/13/2007	10/13/2008
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	8/3/2007	9/27/2008
Preamplifier, 1300 MHz	Agilent / HP	8447D	C01064	5/9/2007	5/9/2008
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	2/6/2007	6/12/2008
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	2/6/2007	6/12/2008
Peak Power Meter	Agilent / HP	E4416A	C00963	2/14/2007	12/2/2008
Peak / Average Power Sensor	Agilent	E9327A	C00964	2/14/2007	12/2/2008
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	10/16/2007	1/27/2009
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	9/15/2006	9/15/2008
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	9/15/2006	9/15/2008
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	5/2/2006	8/7/2008

## 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, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

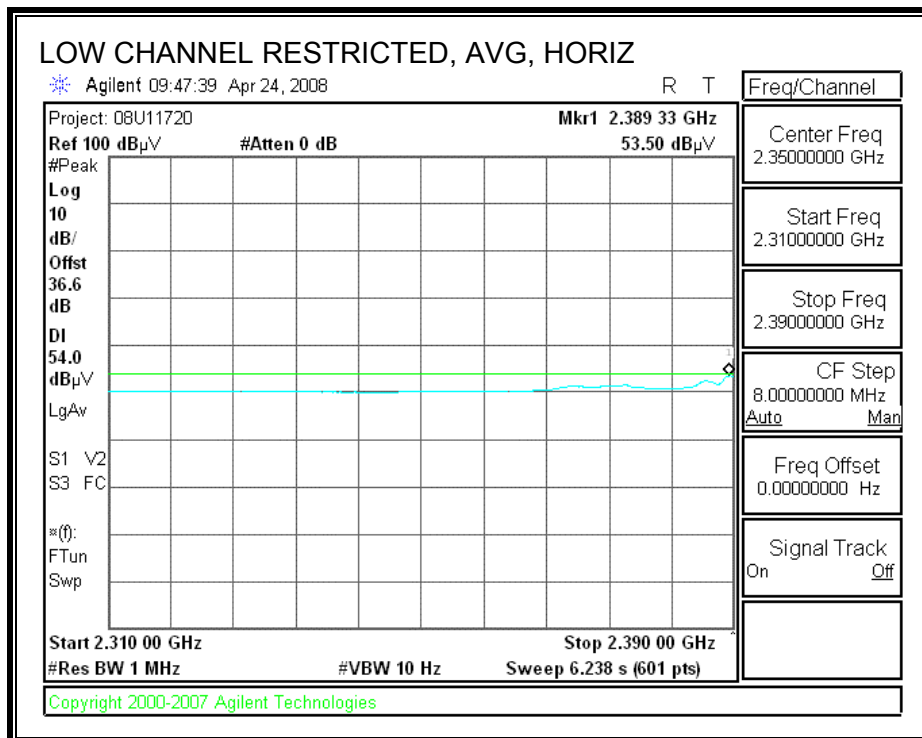
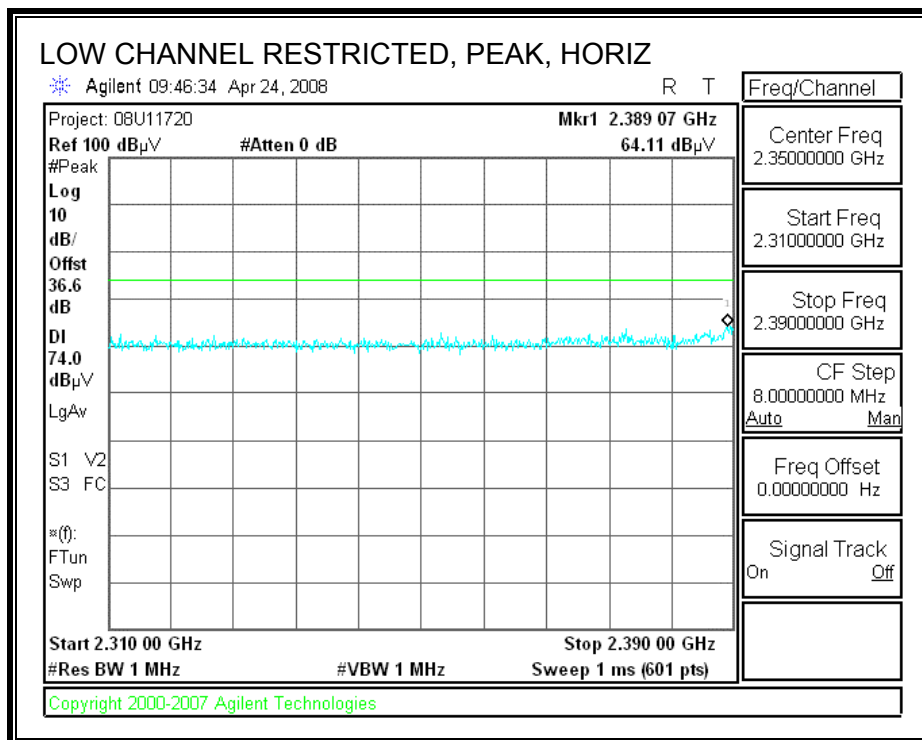
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

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.

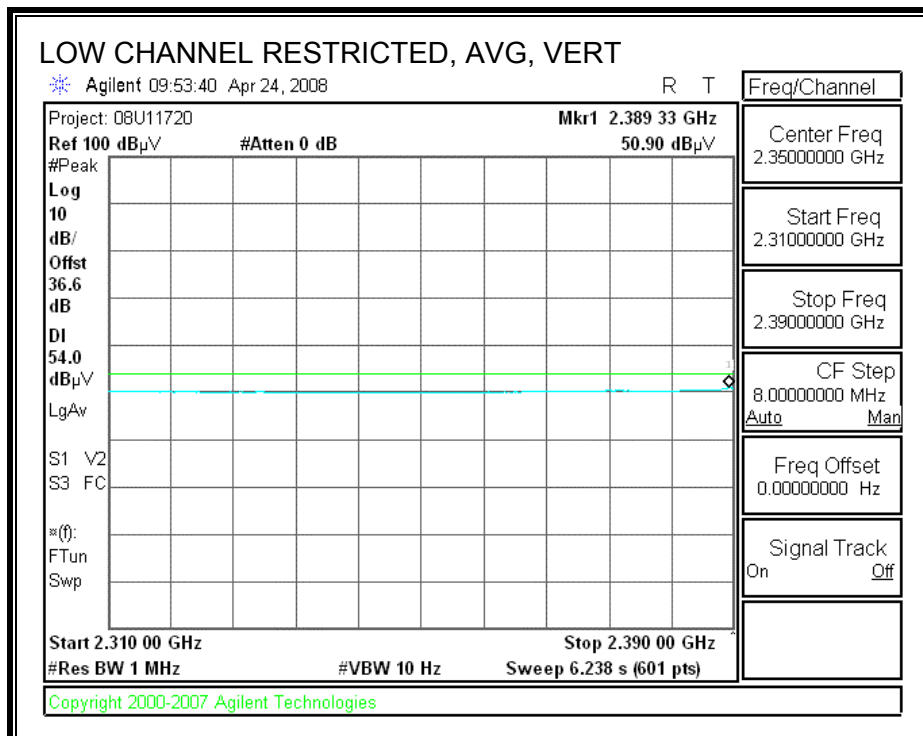
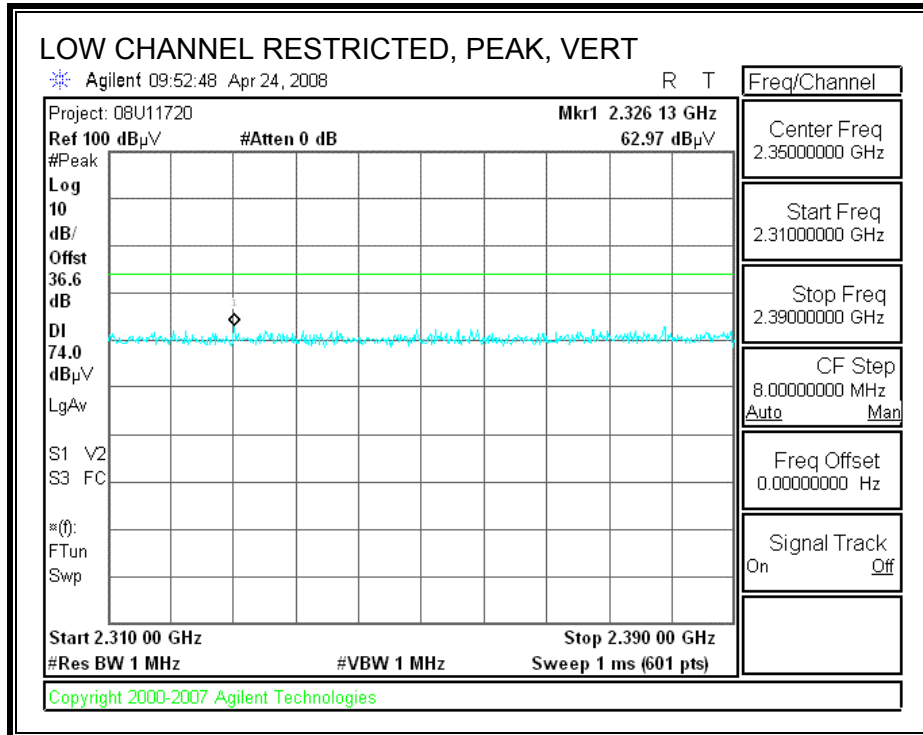
## 7.2. TRANSMITTER ABOVE 1 GHz

### 7.2.1. 802.11b MODE

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



**RESTRICTED BANDEDGE (LOW CHANNEL 1, VERTICAL)**



**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

Company: BroadCom Corporation  
 Project #: 08U11720  
 Date: April 24, 2008  
 Test Engineer: Thanh Nguyen  
 Configuration: EUT inside Dell HELBURN PP33L  
 Mode: Transmit b mode

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T145 Agilent 3008A0050			FCC 15.205

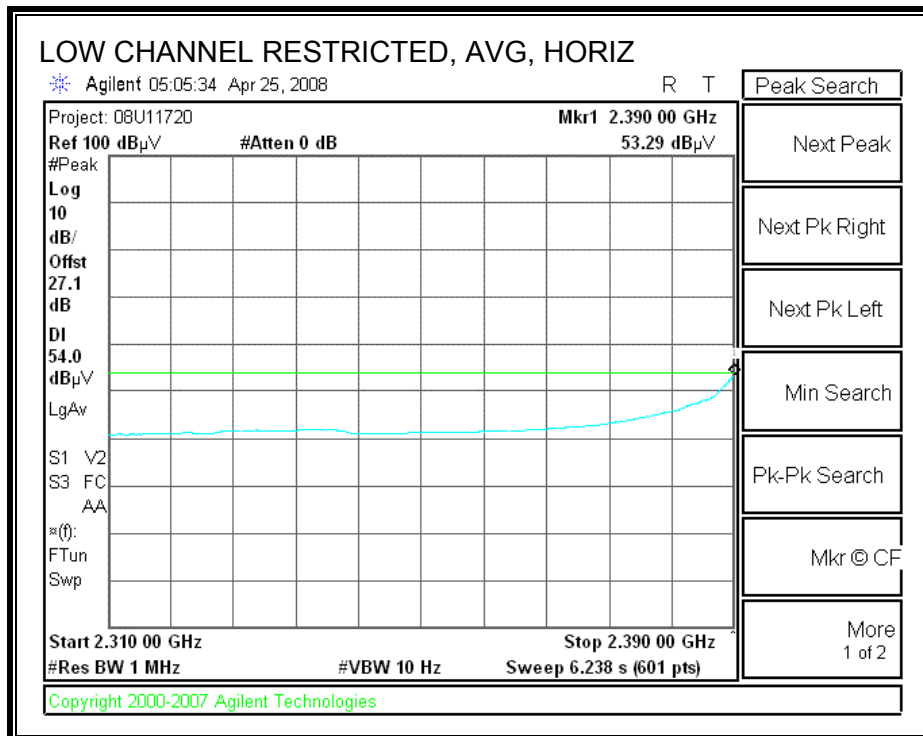
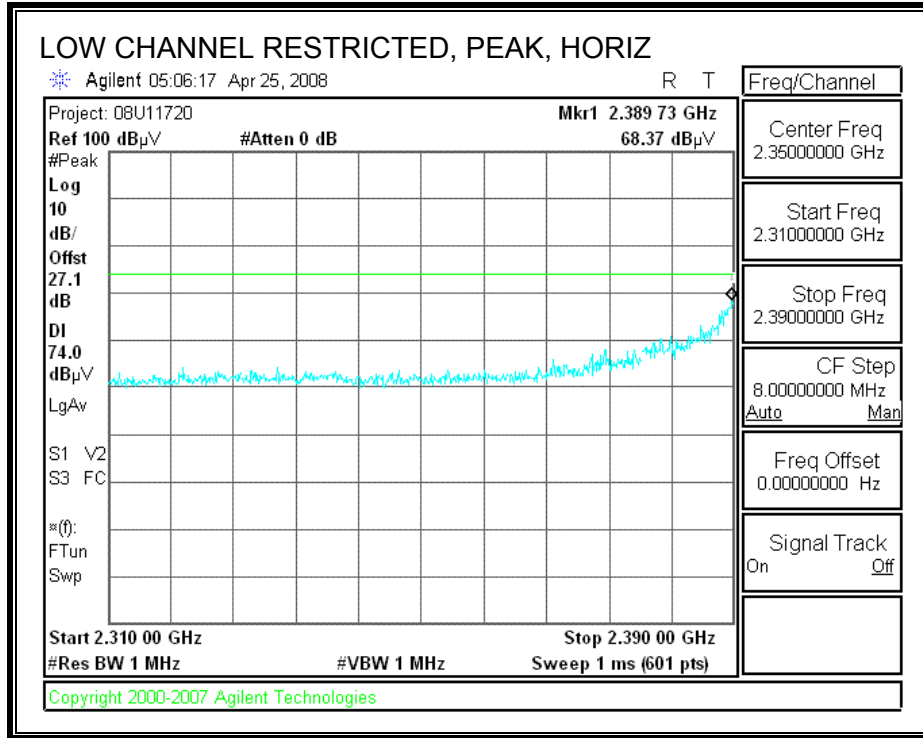
Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Thanh 187215003	Ninous 208946002			<u>Peak Measurements</u> RBW=VBW=1MHz <u>Average Measurements</u> RBW=1MHz ; VBW=10Hz

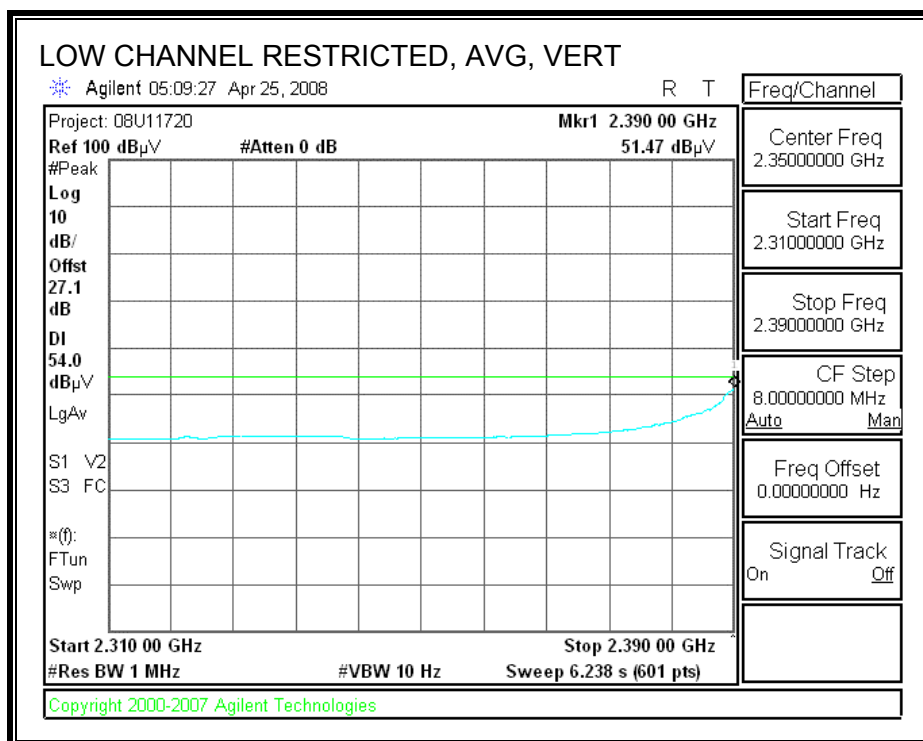
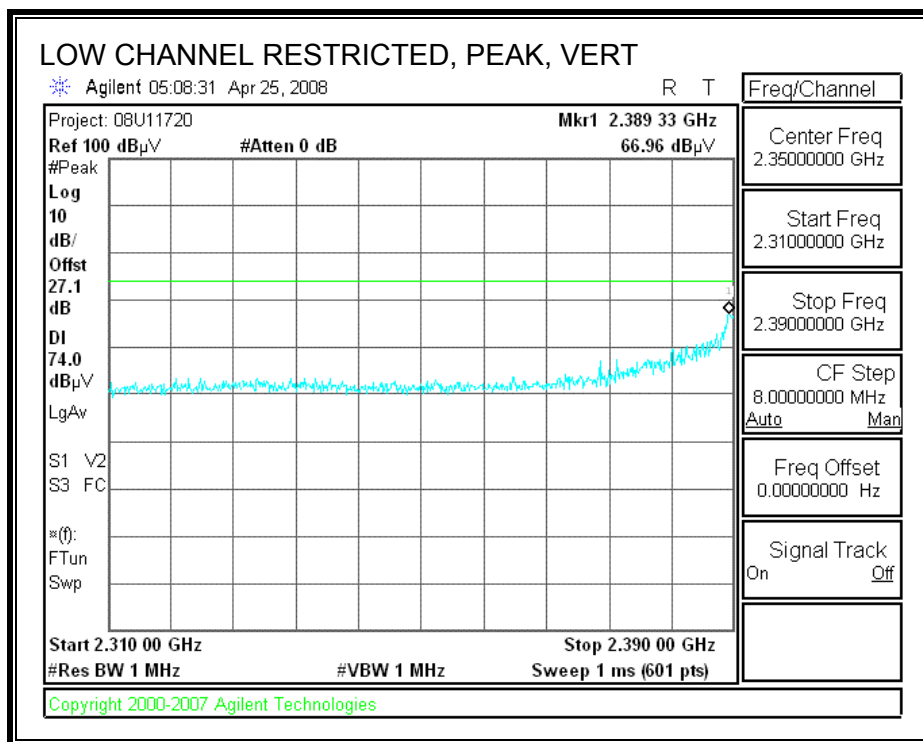
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low CH															
4.824	3.0	51.6	47.9	33.3	2.5	-34.8	0.0	0.0	52.6	48.9	74	54	-21.4	-5.1	V
4.824	3.0	54.2	51.8	33.3	2.5	-34.8	0.0	0.0	55.2	52.8	74	54	-18.8	-1.2	H

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		

**7.2.2. 802.11g MODE**  
**RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)**  
 Channel 1, 2412MHz

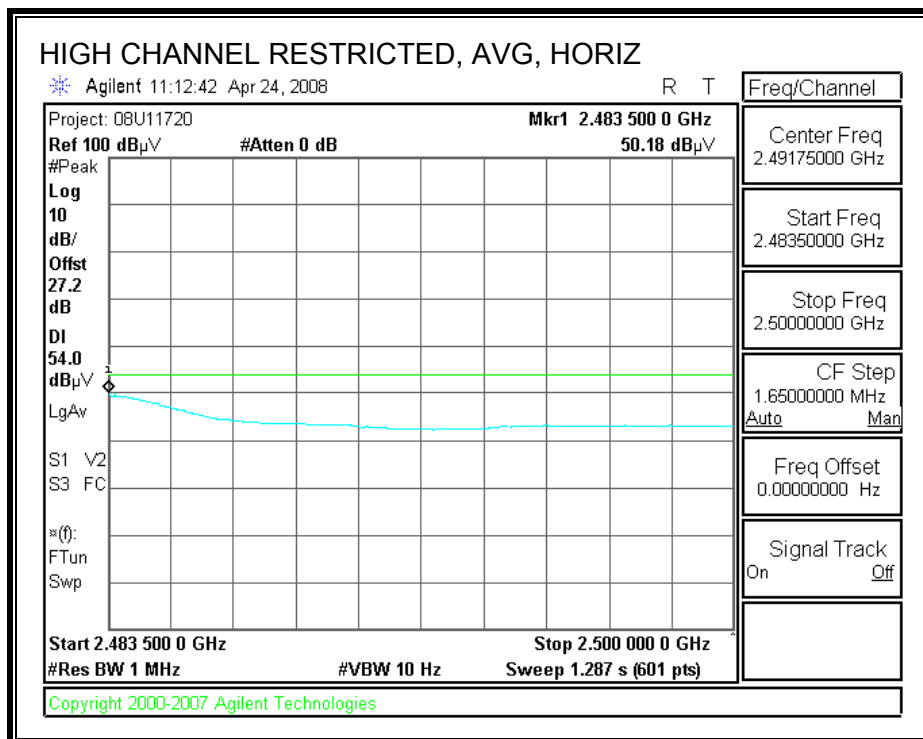
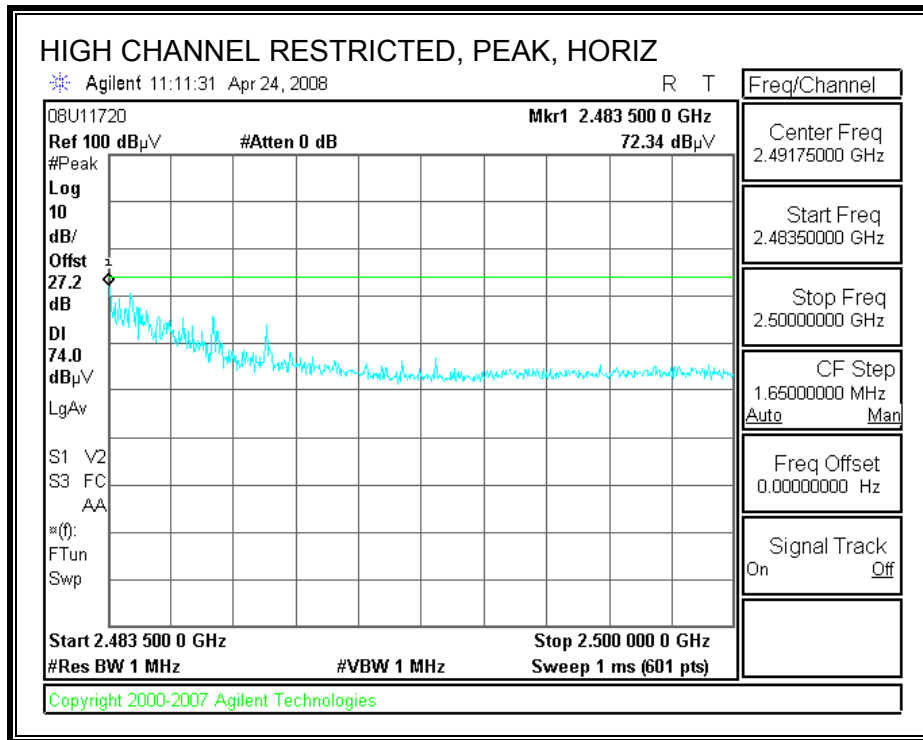


**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



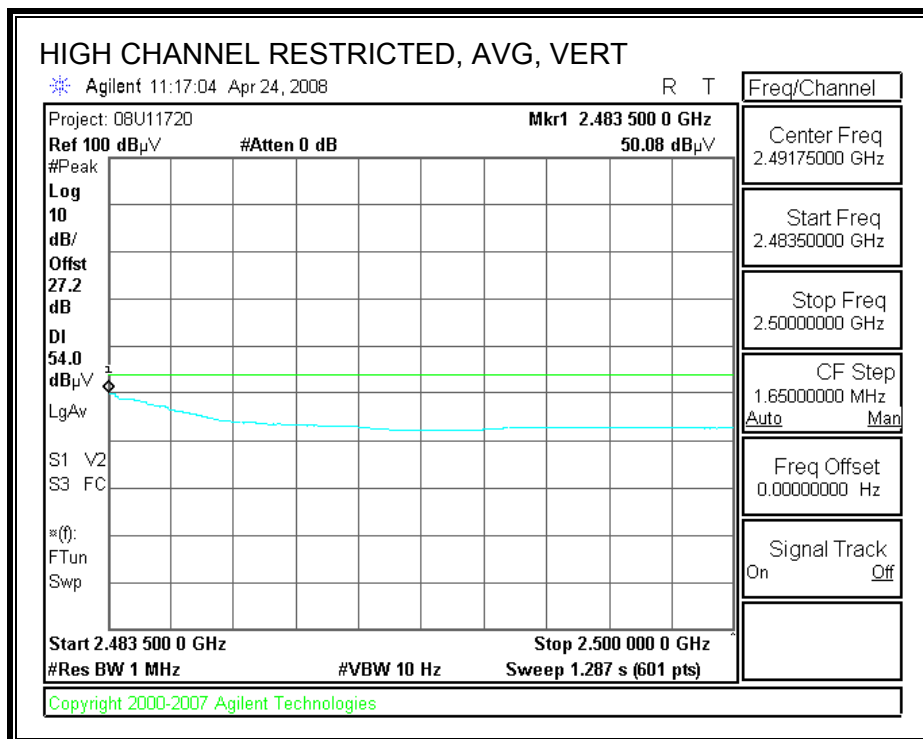
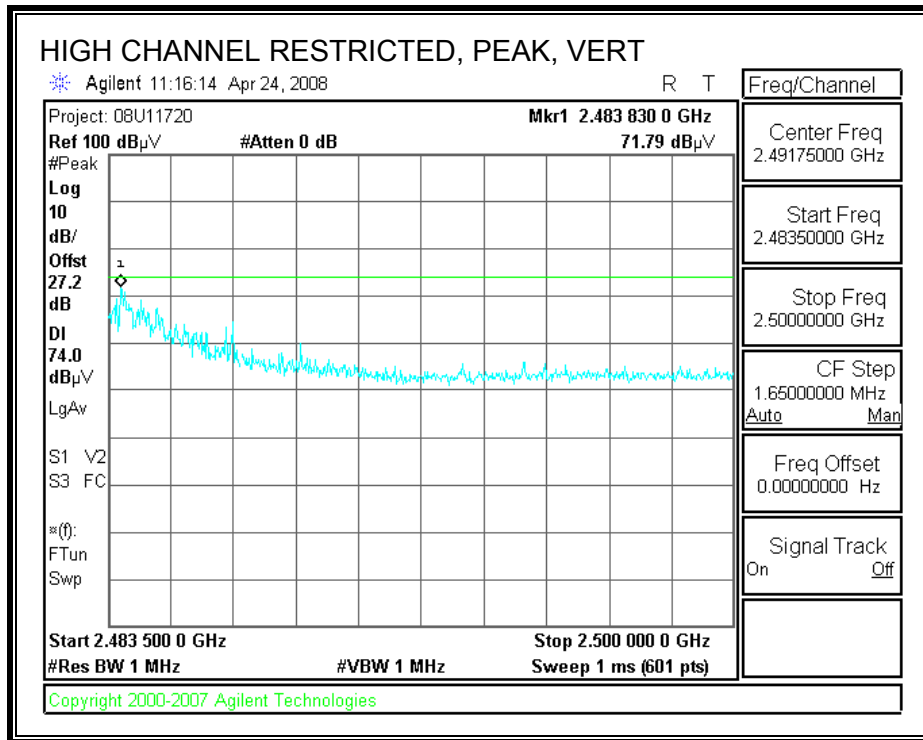
**RESTRICTED BANDEGE (HIGH CHANNEL, HORIZONTAL)**

Channel 11, 2462MHz

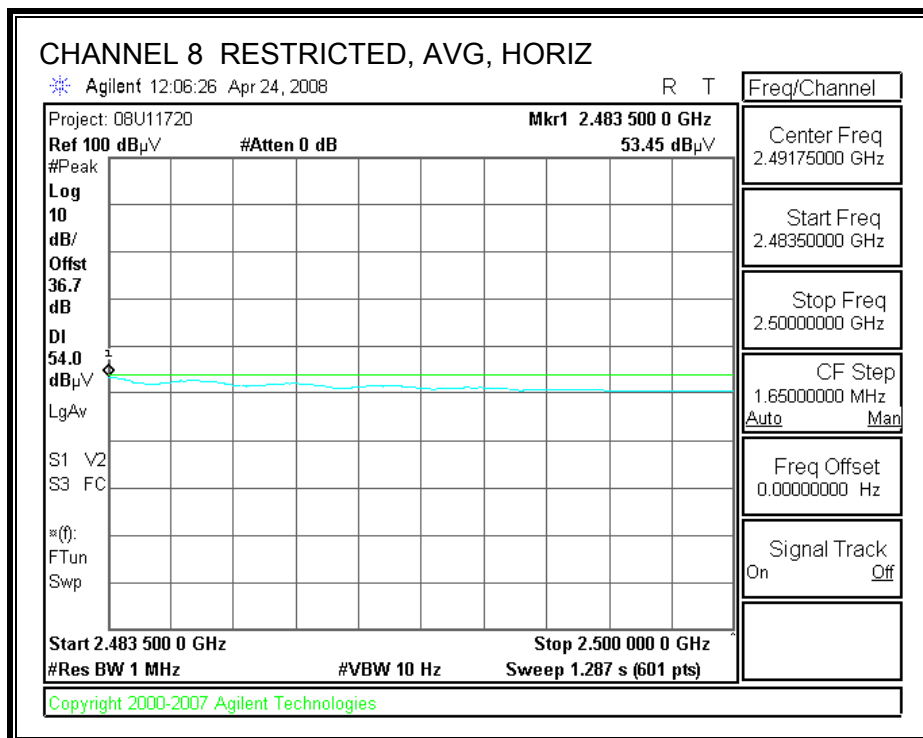
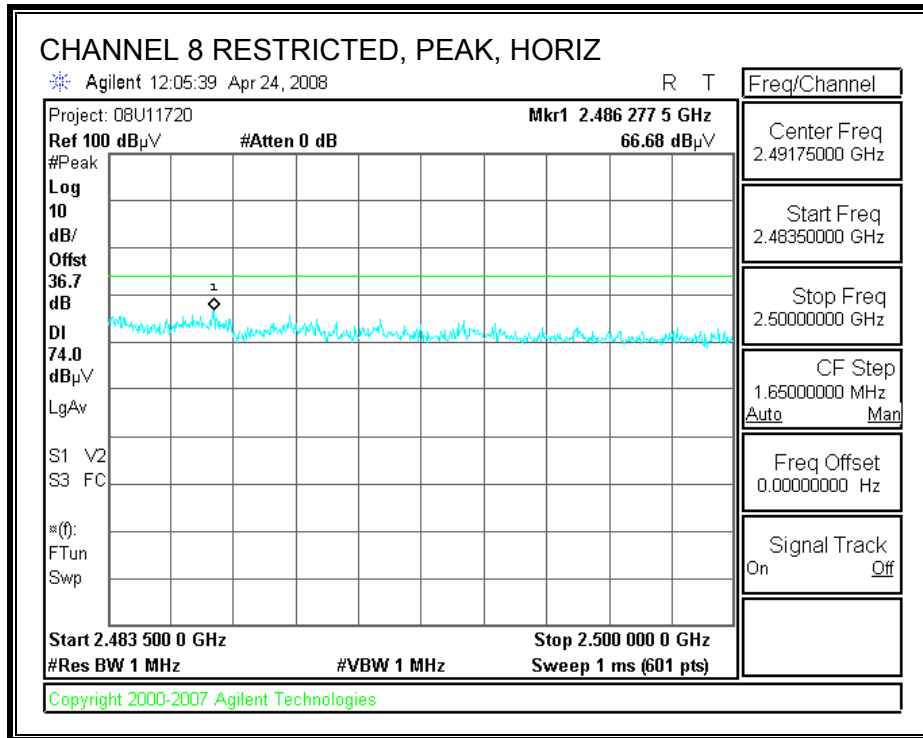




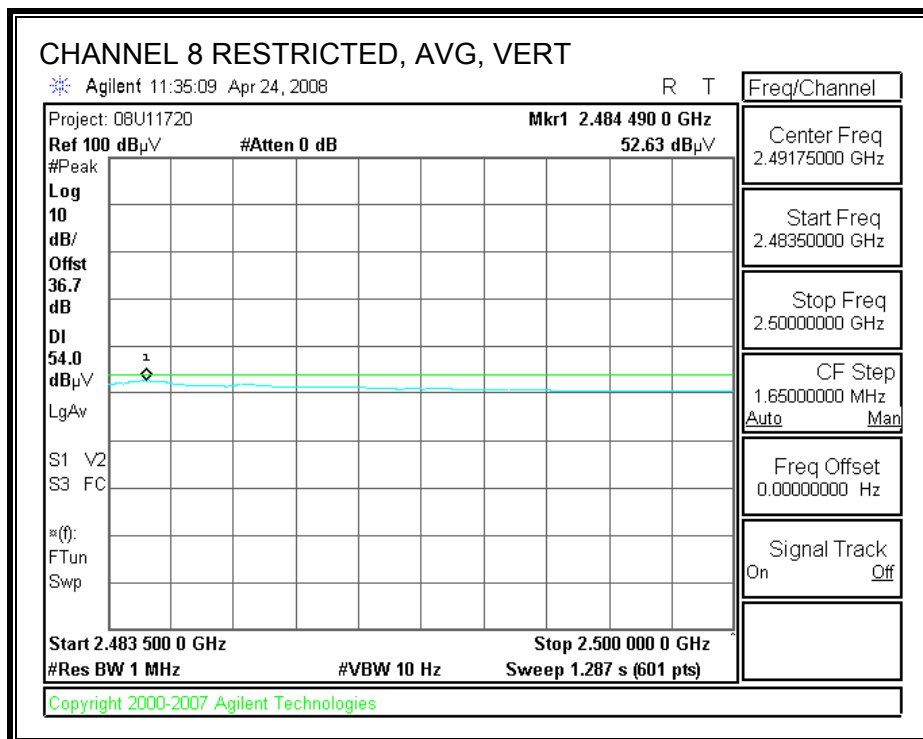
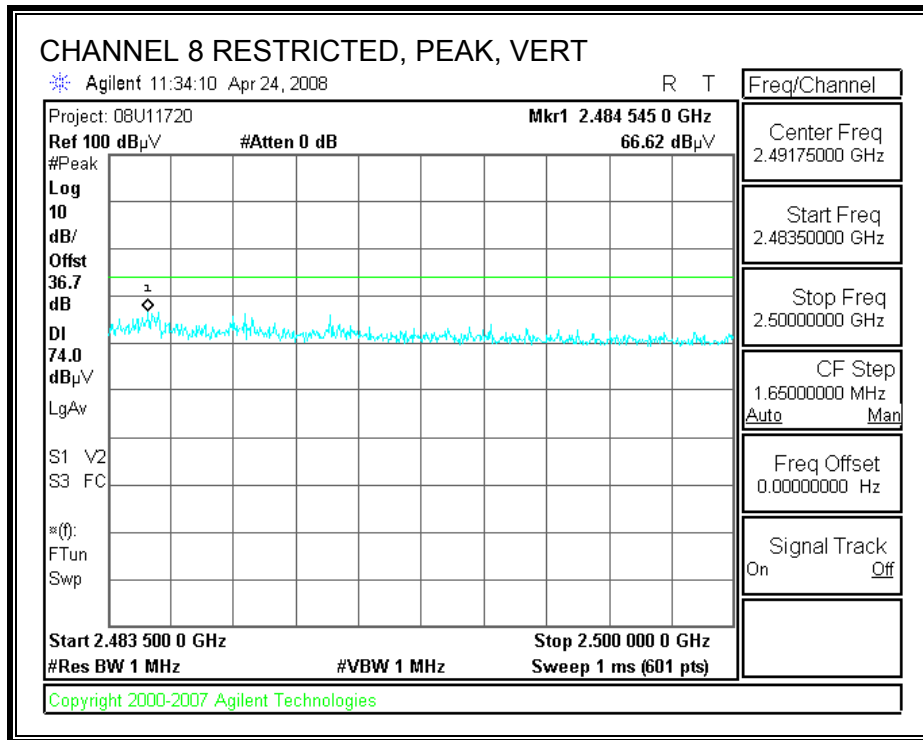
**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**



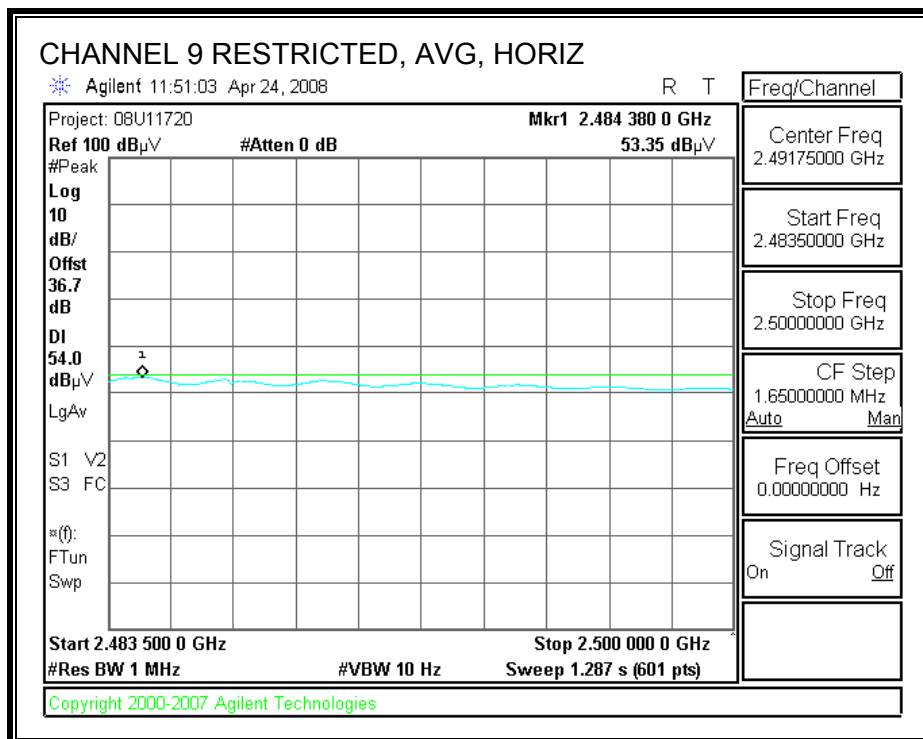
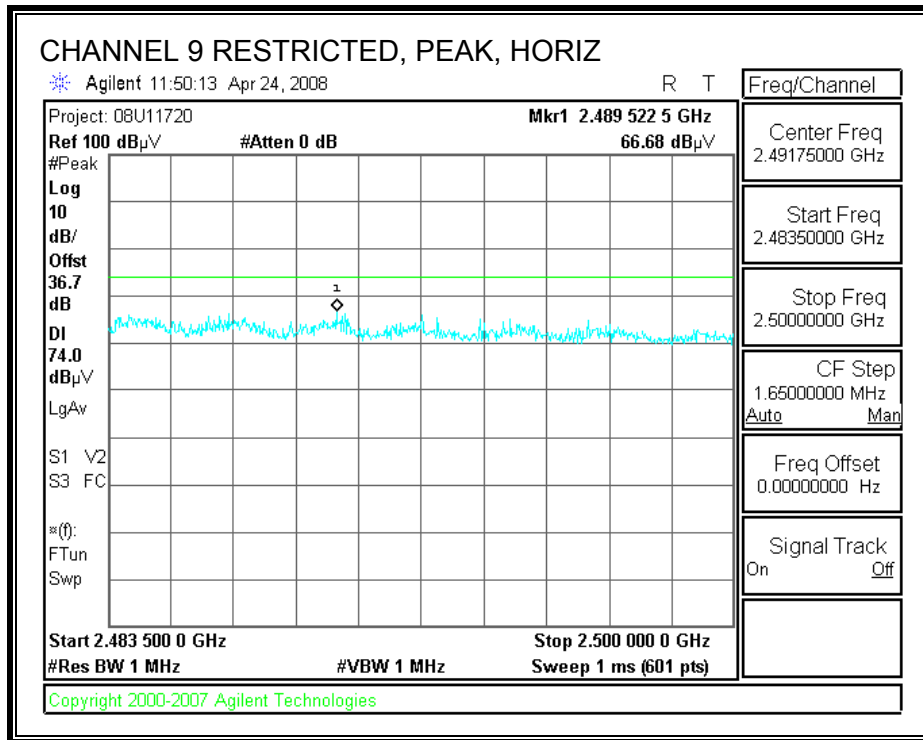
**7.2.3. 802.11 HT40 MODE IN THE 2.4 GHZ BAND  
 RESTRICTED BANDEGE (CHANNEL8, HORIZONTAL)**



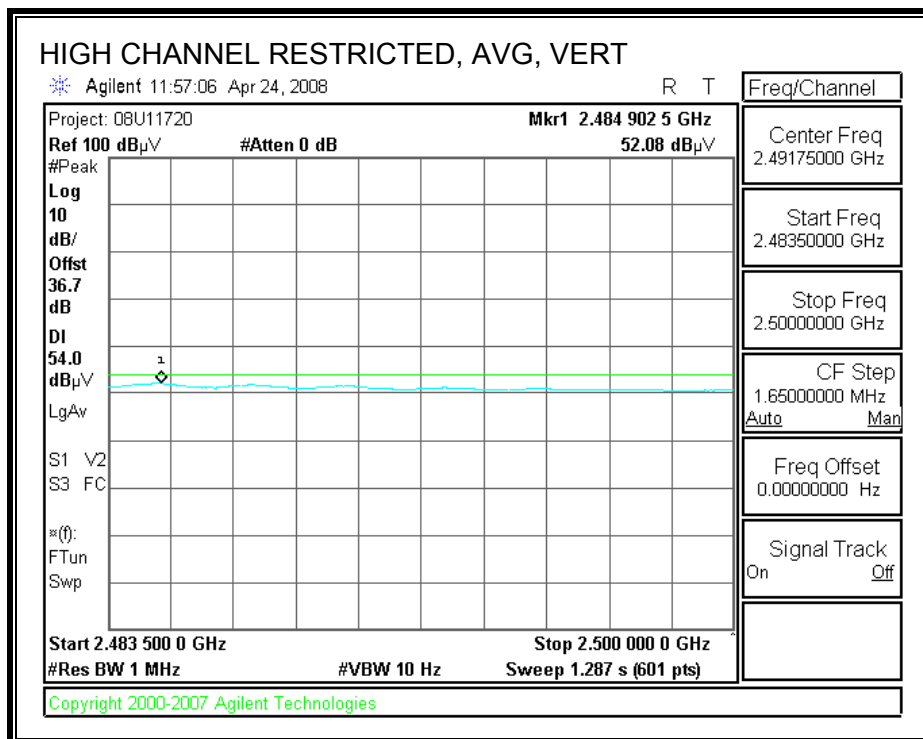
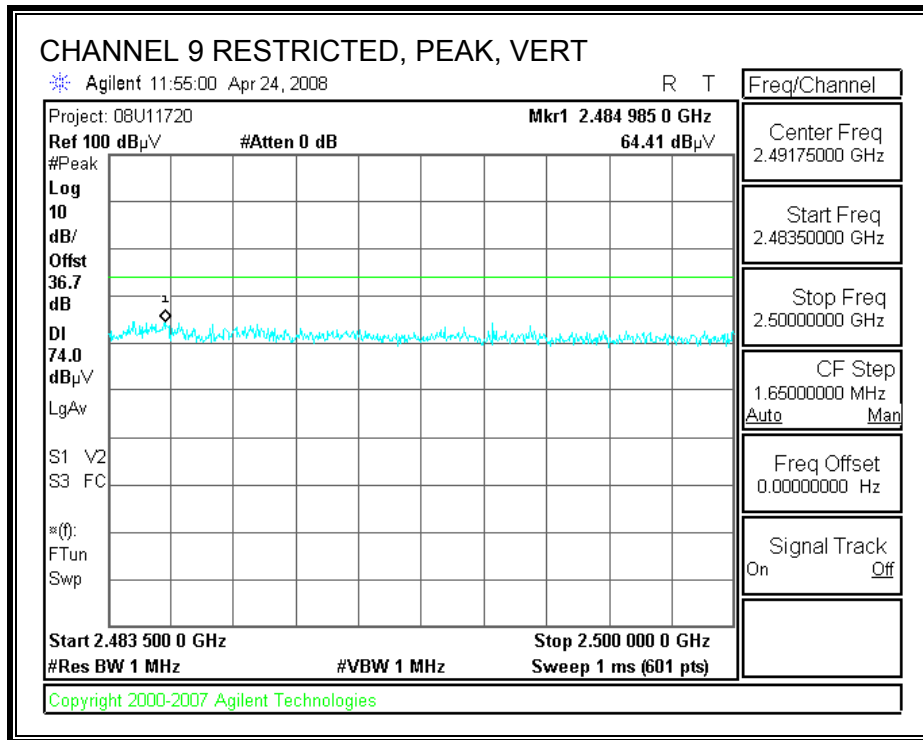
**RESTRICTED BANDEDGE (CHANNEL8, VERTICAL)**



**RESTRICTED BANDEDGE (CHANNEL 9, HORIZONTAL)**



**RESTRICTED BANDEDGE (CHANNEL 9, VERTICAL)**



**7.2.4. 802.11a MODE**

**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

Company: BroadCom Corporation  
 Project #: 08U11720  
 Date: April 24, 2008  
 Test Engineer: Thanh Nguyen  
 Configuration: EUT inside Dell HELBURN PP33L  
 Mode: Transmit

**Test Equipment:**

<b>Horn 1-18GHz</b>	<b>Pre-amplifer 1-26GHz</b>	<b>Pre-amplifer 26-40GHz</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T73; S/N: 6717 @3m	T145 Agilent 3008A005t			FCC 15.205

Hi Frequency Cables

<b>2 foot cable</b>	<b>3 foot cable</b>	<b>12 foot cable</b>	<b>HPF</b>	<b>Reject Filter</b>	<b>Peak Measurements</b> RBW=VBW=1MHz
	Thanh 187215003	Ninous 208946002	HPF_7.6GHz		<b>Average Measurements</b> RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fldr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>CH 157,5785MHz</b>															
11.570	3.0	43.7	31.2	37.5	3.9	-33.0	0.0	0.7	52.8	40.3	74	54	-21.2	-13.7	V
11.570	3.0	43.6	31.5	37.5	3.9	-33.0	0.0	0.7	52.7	40.6	74	54	-21.3	-13.4	H

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		

**7.2.5. 802.11n HT20 MODE IN THE 5.8 GHz BAND**

**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Morgan Hill Open Field Site

Company: BroadCom Corporation  
 Project #: 08U11720  
 Date: April 24, 2008  
 Test Engineer: Thanh Nguyen  
 Configuration: EUT inside Dell HELBURN PP33L  
 Mode: Transmit HT 20

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T145 Agilent 3008A005			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	<b>Peak Measurements</b> RBW=VBW=1MHz <b>Average Measurements</b> RBW=1MHz ; VBW=10Hz
	Thanh 187215003	Ninous 208946002	HPF_7.6GHz		

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Ftr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>CH 157, 5785MHz, HT 20</b>															
11.570	3.0	43.6	31.4	37.5	3.9	-33.0	0.0	0.7	52.7	40.5	74	54	-21.3	-13.5	V
11.570	3.0	43.7	31.3	37.5	3.9	-33.0	0.0	0.7	52.8	40.5	74	54	-21.2	-13.5	H

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		

**7.2.6. 802.11n HT40 MODE IN THE 5.8 GHz BAND**

**HARMONICS AND SPURIOUS EMISSIONS**

High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site																
Company: BroadCom Corporation Project #: 08U11720 Date: April 24, 2008 Test Engineer: Thanh Nguyen Configuration: EUT inside Dell HELBURN PP33L Mode: Transmit HT 40																
Test Equipment:																
Horn 1-18GHz			Pre-amplifier 1-26GHz			Pre-amplifier 26-40GHz			Horn > 18GHz			Limit				
T73; S/N: 6717 @3m			T145 Agilent 3008A0056									FCC 15.205				
Hi Frequency Cables																
2 foot cable			3 foot cable			12 foot cable			HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz; VBW=10Hz			
			Thanh 187215003			Ninous 208946002			HPF_7.6GHz							
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filt dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)	
CH 151, 5755MHz, HT 40																
11.510	3.0	43.5	31.0	37.5	3.9	-33.1	0.0	0.7	52.5	40.1	74	54	-21.5	-13.9	Y	
11.570	3.0	44.0	31.2	37.5	3.9	-33.0	0.0	0.7	53.1	40.4	74	54	-20.9	-13.6	H	
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								



### 7.3. RECEIVER ABOVE 1 GHz

**High Frequency Measurement**

Compliance Certification Services, Morgan Hill Open Field Site

Company: BroadCom Corporation  
 Project #: 08U11720  
 Date: April 25, 2008  
 Test Engineer: Thanh Nguyen  
 Configuration: EUT inside Dell HELBURN PP33L  
 Mode: Receive

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T145 Agilent 3008A005			RX RSS 210

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Thanh 187215003	Ninous 208946002		

**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	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
<b>Mid CH HT20</b>															
1.063	3.0	51.2	38.2	24.0	1.6	-36.1	0.0	0.0	40.7	27.7	74	54	-33.3	-26.3	H
1.960	3.0	50.9	38.3	27.3	1.9	-35.4	0.0	0.0	44.6	32.0	74	54	-29.4	-22.0	H
3.000	3.0	47.8	34.9	30.0	2.1	-35.2	0.0	0.0	44.7	31.7	74	54	-29.3	-22.3	H
1.828	3.0	50.6	38.6	26.8	1.8	-35.5	0.0	0.0	43.7	31.7	74	54	-30.3	-22.3	V
2.557	3.0	50.5	38.4	28.7	2.0	-35.1	0.0	0.0	46.1	34.0	74	54	-27.9	-20.0	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		

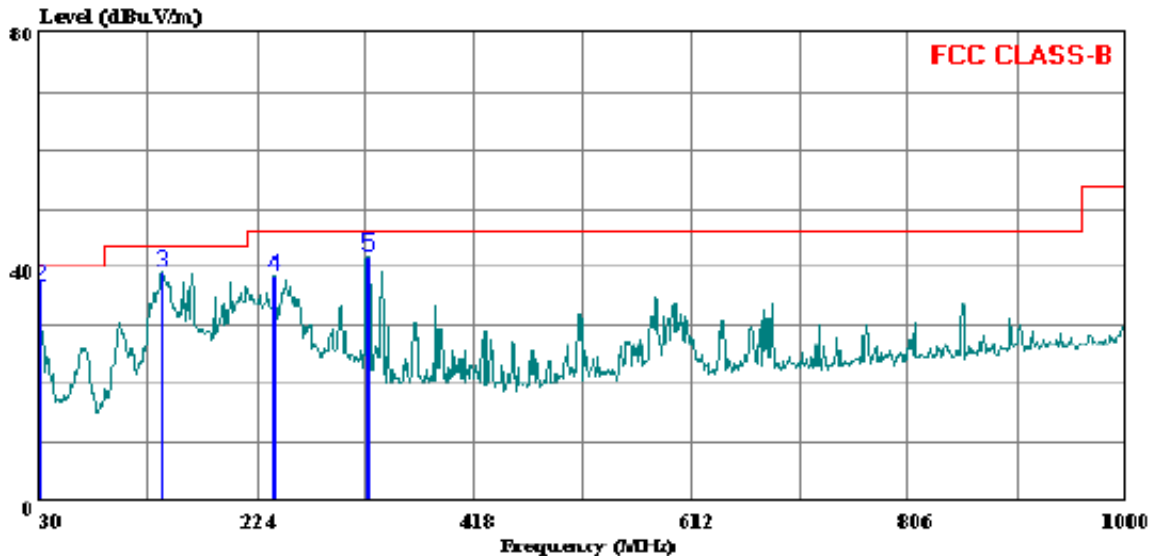
### 7.4. WORST-CASE BELOW 1 GHz

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



Compliance Certification Services  
 47173 Benicia Street  
 Fremont, CA 94538  
 Tel: (510) 771-1000  
 Fax: (510) 661-0888

Data#: 11 File#: 08U11720\_Hepburn.EMI Date: 04-25-2008 Time: 16:37:55



Trace: 8

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL  
 Test Operator: Thanh Nguyen  
 Project #: 08U11720  
 Company: Broadcom  
 Configuration: EUT inside Hepburn laptop  
 Mode: Transmit worst case  
 Target: FCC Class B

Page: 1

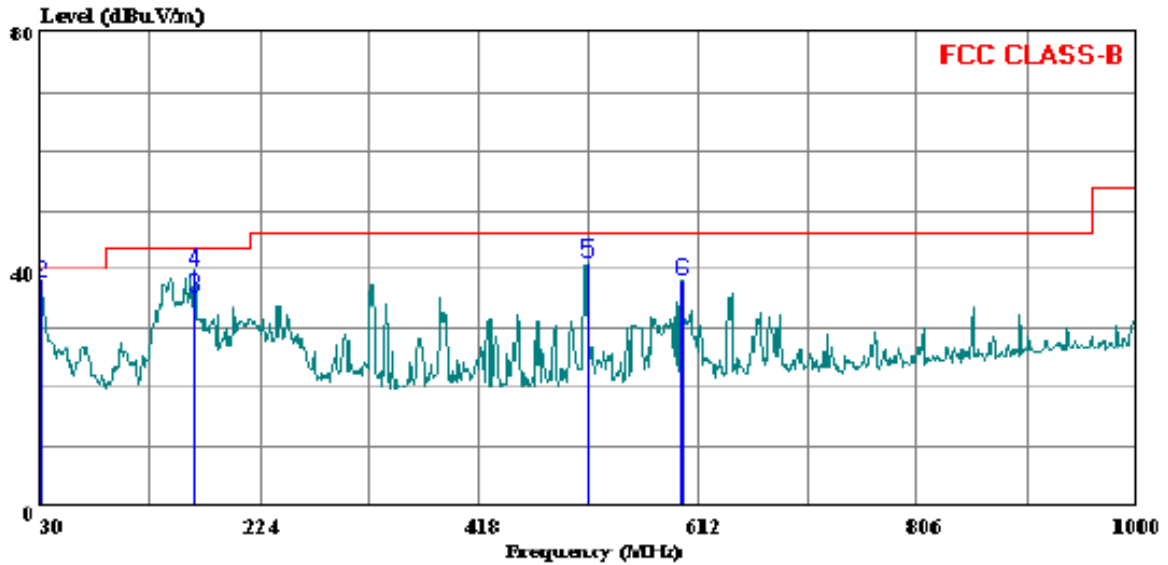
	Read		Limit	Over		
Freq	Level	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	42.76	-9.13	33.63	40.00	-6.37 QP
2	30.000	45.83	-9.13	36.70	40.00	-3.30 Peak
3	138.640	55.70	-16.73	38.97	43.50	-4.53 Peak
4	239.520	56.67	-18.16	38.51	46.00	-7.49 Peak
5	322.940	57.00	-15.24	41.76	46.00	-4.24 Peak

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



Compliance Certification Services  
 47173 Benicia Street  
 Fremont, CA 94538  
 Tel: (510) 771-1000  
 Fax: (510) 661-0888

Data#: 7 File#: 08U11720\_Hepburn.EMI Date: 04-25-2008 Time: 16:27:45



Trace: 4

Ref Trace:

Condition: FCC CLASS-B VERTICAL  
 Test Operator: Thanh Nguyen  
 Project #: 08U11720  
 Company: Broadcom  
 Configuration: EUT inside Hepburn laptop  
 Mode: Transmit worst case  
 Target: FCC Class B

Page: 1

	Read Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	43.25	-9.13	34.12	40.00	-5.88	QP
2	30.000	47.00	-9.13	37.87	40.00	-2.13	Peak
3	166.770	53.36	-17.97	35.39	43.50	-8.11	QP
4	166.770	57.83	-17.97	39.86	43.50	-3.64	Peak
5	513.060	52.33	-11.11	41.22	46.00	-4.78	Peak
6	597.450	48.00	-9.91	38.09	46.00	-7.91	Peak

## 8. 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/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* 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 (μT) or 12.57 milligauss (mG).

**CALCULATIONS**

Given

$$E = \sqrt{(30 * P * G) / d}$$

and

$$S = E^2 / 3770$$

where

E = Field Strength in Volts/meter

P = Power in Watts

G = Numeric antenna gain

d = Distance in meters

S = Power Density in milliwatts/square centimeter

Combining equations, rearranging the terms to express the distance as a function of the remaining variables, changing to units of Power to mW and Distance to cm, and substituting the logarithmic form of power and gain yields:

$$d = 0.282 * 10^{((P + G) / 20)} / \sqrt{S}$$

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm<sup>2</sup>

Rearranging terms to calculate the power density at a specific distance yields

$$S = 0.0795 * 10^{((P + G) / 10)} / (d^2)$$

The power density in units of mW/cm<sup>2</sup> is converted to units of W/m<sup>2</sup> by multiplying by a factor of 10.

**CO-LOCATED MPE CALCULATIONS for Mobile configuration**

For multiple colocated transmitters operating simultaneously the total power density can be calculated by summing the Power \* Gain product (in linear units) of each transmitter.

yields

$$d = 0.282 * \sqrt{((P1 * G1) + (P2 * G2) + \dots + (Pn * Gn)) / S}$$

where

- d = distance in cm
- Px = Power of transmitter x in mW
- Gx = Numeric gain of antenna x
- S = Power Density in mW/cm<sup>2</sup>

In the table below, Power and Gain are entered in units of dBm and dBi respectively, then converted to their linear forms for the purpose of 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**

(MPE distance equals 20 cm)

Mode	Band	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
Bluetooth	2.4 GHz	0.70	3.15			
WLAN	2.4 GHz	22.00	1.51			
Combined				20.0	0.05	0.45

Mode	Band	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
Bluetooth	2.4 GHz	0.70	3.15			
WLAN	5.8 GHz	19.90	1.51			
Combined				20.0	0.03	0.28

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

## 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			Class (dB)	Limit QP	EN_B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.17	53.62	--	39.31	0.00	64.77	54.77	-11.15	-15.46	L1
1.99	35.99	--	33.47	0.00	56.00	46.00	-20.01	-12.53	L1
4.01	39.27	--	27.24	0.00	56.00	46.00	-16.73	-18.76	L1
0.17	53.04	--	40.13	0.00	64.82	54.82	-11.78	-14.69	L2
2.33	36.19	--	24.66	0.00	56.00	46.00	-19.81	-21.34	L2
4.01	42.46	--	23.22	0.00	56.00	46.00	-13.54	-22.78	L2
6 Worst Data									

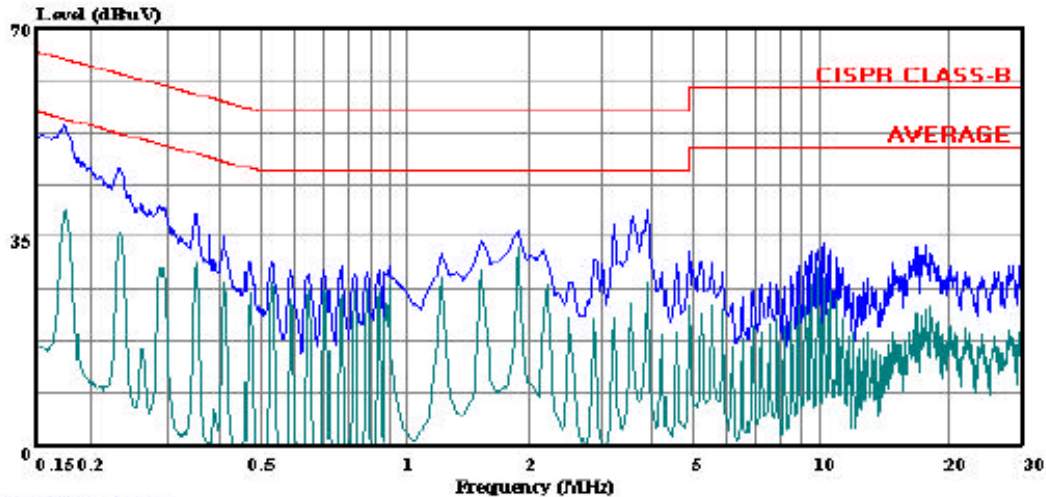


**LINE 1 RESULTS**



Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538  
Tel: (510) 771-1000  
Fax: (510) 661-0888

Data#: 7 File#: LC.EMI Date: 04-25-2008 Time: 13:21:18



(Line Conduction)

Trace: 5

Ref Trace:

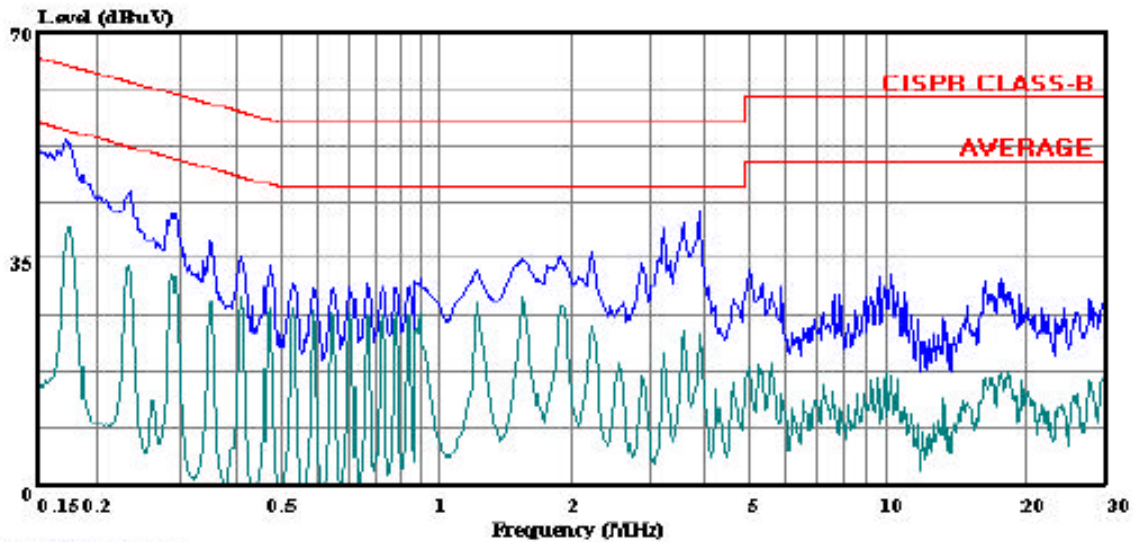
Condition: CISPR CLASS-B  
Test Operator:: Thanh Nguyen  
Project #: : 0811720  
Company: : BroadCom Cotporation  
Configuration:: BUT inside Dell Hepburn laptop  
Mode: : TX worst case  
Target: : FCC Class B  
Voltage: : 115VAC / 60HZ  
: Line 1: Peak (Blue); Average (Green)

**LINE 2 RESULTS**



Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538  
Tel: (510) 771-1000  
Fax: (510) 661-0888

Data#: 21 File#: LC.EMI Date: 04-25-2008 Time: 13:55:55



(Line Conduction)

Trace: 19

Ref Trace:

Condition: CISPR CLASS-B  
Test Operator:: Thanh Nguyen  
Project #: : 0811720  
Company: : BroadCom Cotporation  
Configuration:: BUT inside Dell Hepburn laptop  
Mode: : TX worst case  
Target: : FCC Class B  
Voltage: : 115VAC / 60Hz  
: Line 2: Peak (Blue); Average (Green)