FCC CFR47 PART 15 SUBPART C

CLASS II PERMISSIVE CHANGE

INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

Broadcom 802.11g WLAN PCI-E Mini Card

(Dell Hepburn PP33L with BCM94312MHG Inside)

MODEL NUMBER: BCM94312HMG

FCC ID: QDS-BRCM1030

IC: 4324A-BRCM1030

REPORT NUMBER: 08U11716-2A

ISSUE DATE: May 8, 2008

Prepared for

BROADCOM CORPORATION

190 MATHILDA PLACE

SUNNYVALE, CA 94086, U.S.A.

Prepared by

COMPLIANCE CERTIFICATION SERVICES
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	4-17-08	Initial Issue	Sunny Shih
A	5-8-08	1. Updated sec. 5.2 Description of class II permissive change. 2. Added Co-located MPE calculations	Sunny Shih

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

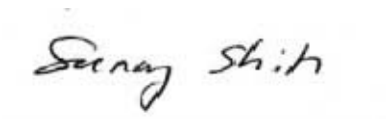
COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, USA
EUT DESCRIPTION:	Broadcom 802.11g WLAN PCI-E Mini Card (Dell Hebburn PP33L with BCM94312HMG inside)
MODEL:	BCM94312HMG
SERIAL NUMBER:	COY7C00134
DATE TESTED:	APRIL 8 - 14, 2008

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.

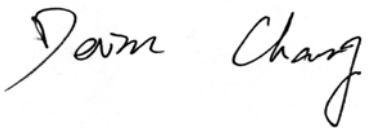
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:



DEVIN CHANG
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 802.11g WLAN PCI-E Mini Card inside Dell Hepburn.

The radio module is manufactured by Broadcom.

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

Antenna tested	Manufacture	Model	f (MHz)	Main (dBi), Tx 1	MIMO (dBi), Tx 3 (Used as Aux)
☐	Advance-Connectek, Inc (ACON)	APP8P-700045 (Main/Aux) / APP8P-700046 (MIMO)	2412 - 2462	0.31	-1.45
☐	Amphenol	QT0932-11-001-R (Tx1-2) & QT0932-11-004-R (Tx3)	2412 - 2462	1.12	-0.49
☒	SmartAnt	PE-080000	2412 - 2462	1.51	1.02

5.4. SOFTWARE AND FIRMWARE

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

The test utility software used during testing was wl_tool

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 07U11426.

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-	N/A

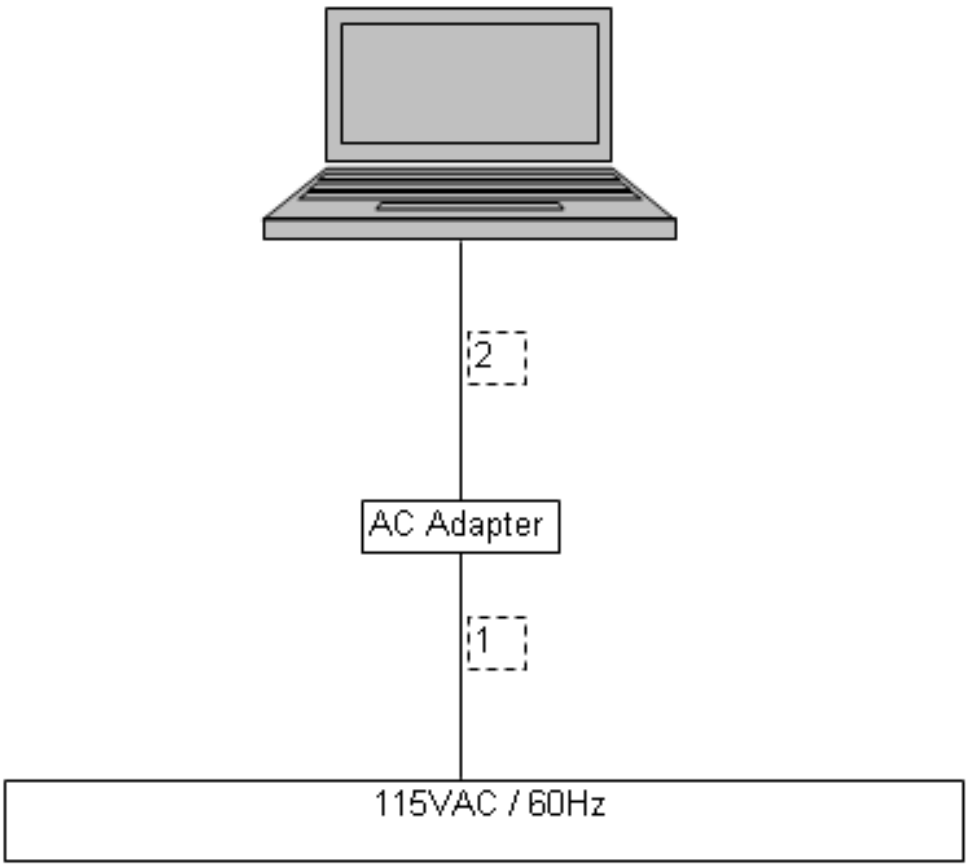
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identica 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	4/15/2008
Bilog Antenna	Sunol 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
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.

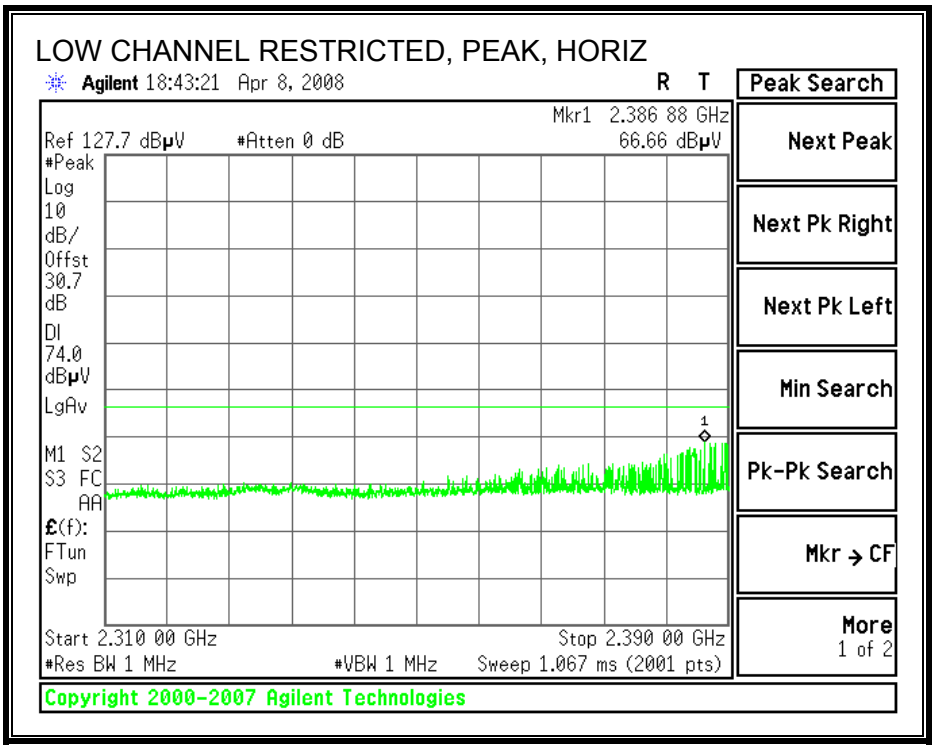
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

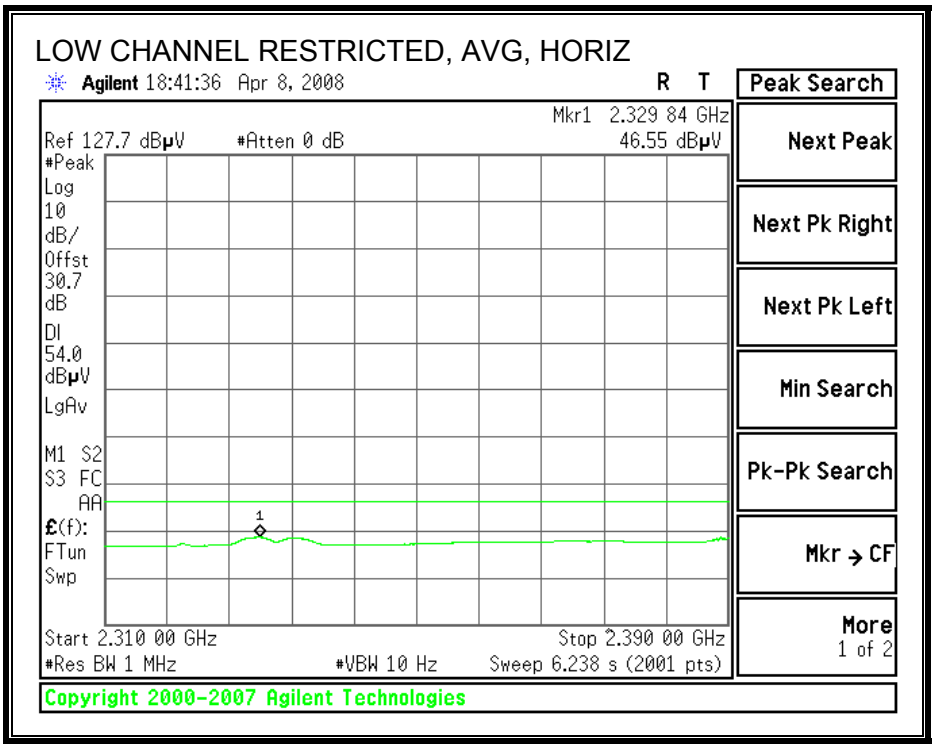
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

7.2. TRANSMITTER ABOVE 1 GHz

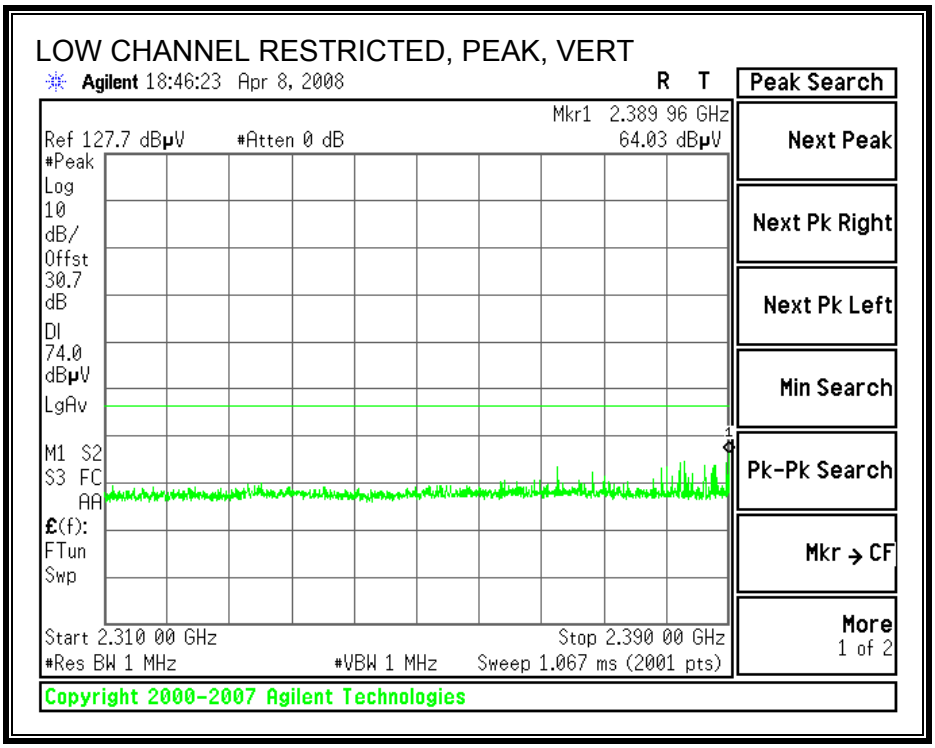
7.2.1. 802.11b MODE

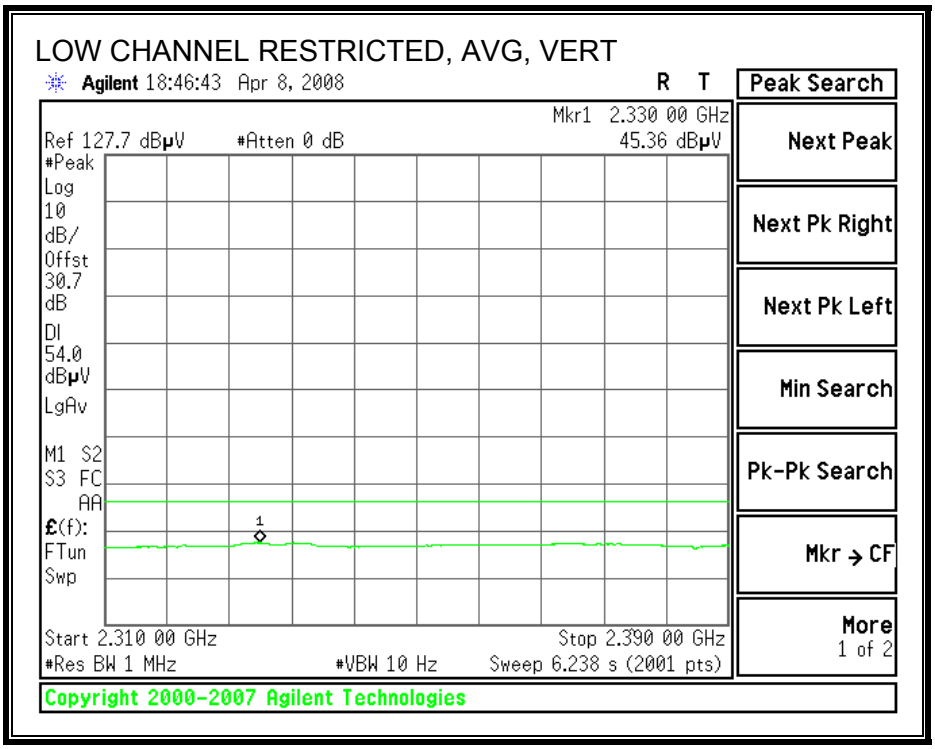
RESTRICTED BANDEDGE (LOW CHANNEL 1, HORIZONTAL)



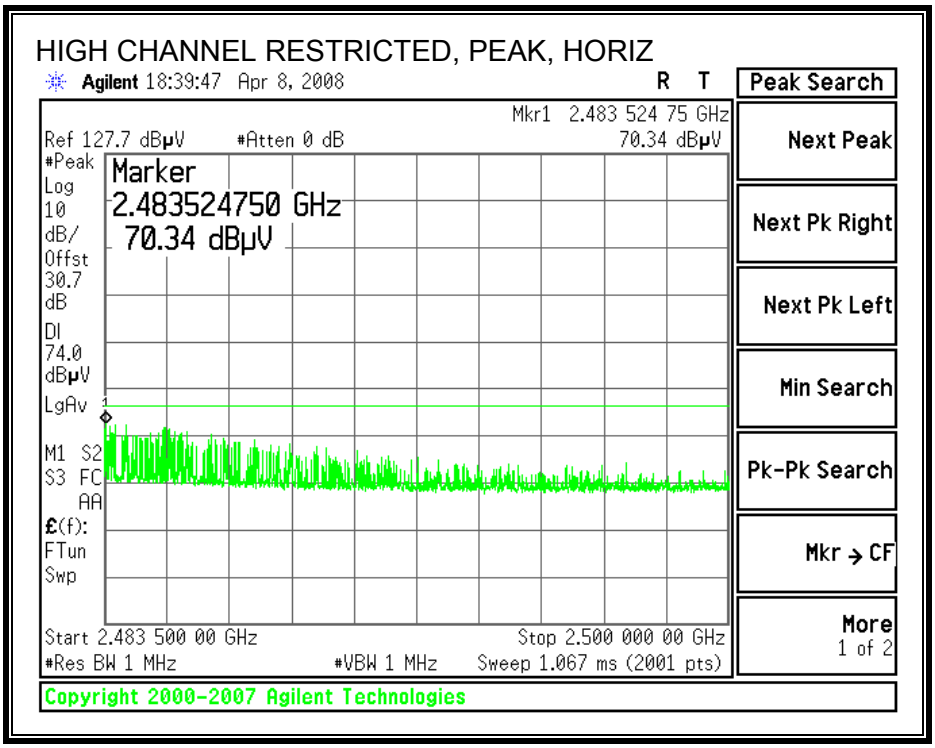


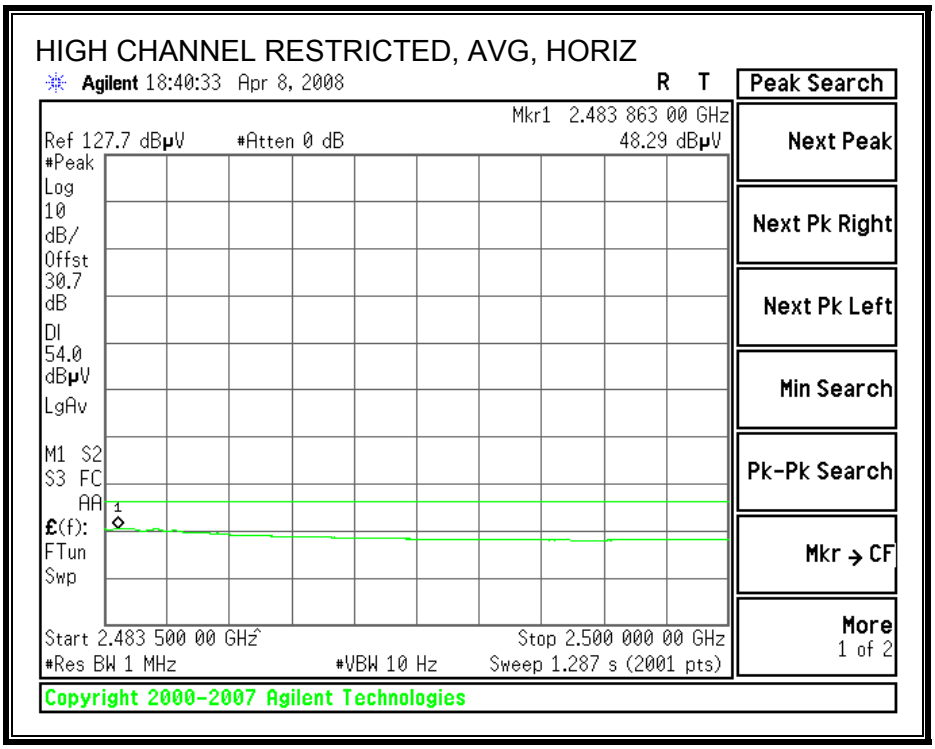
RESTRICTED BANDEDGE (LOW CHANNEL 1, VERTICAL)



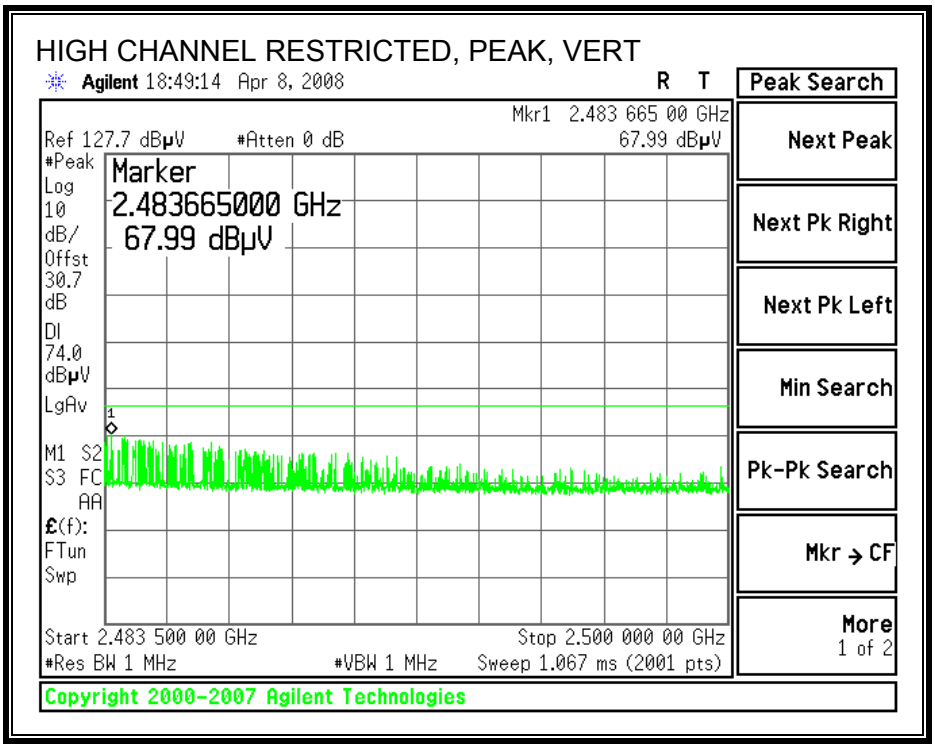


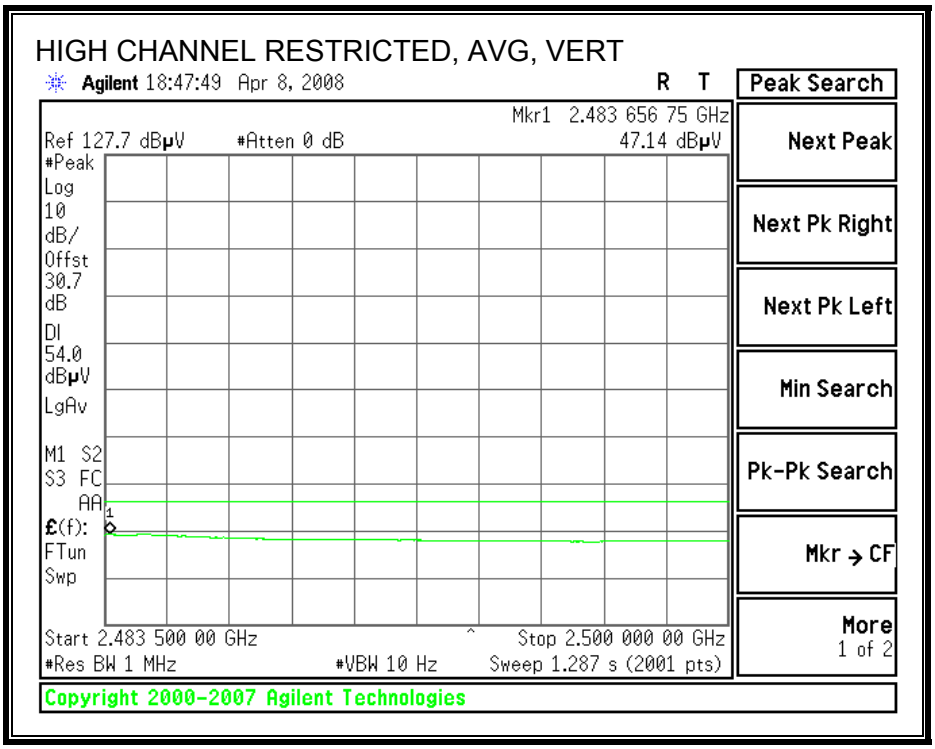
RESTRICTED BANDEDGE (HIGH CHANNEL 11, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL 11, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom
Project #: 08U11716
Date: 04/11/08
Test Engineer: Devin Chang
Configuration: Hepburn with Smart antenna
Mode: Tx 11b

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
		C-5m Chamber		R_001

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW, 2412 MHz															
3.216	3.0	54.2	49.3	30.9	0.0	-35.1	0.0	0.0	50.0	45.1	74	54	-24.0	-8.9	V
4.824	3.0	47.6	40.3	33.0	0.0	-34.8	0.0	0.0	45.8	38.5	74	54	-28.2	-15.5	V
3.216	3.0	52.5	47.9	30.9	0.0	-35.1	0.0	0.0	48.3	43.6	74	54	-25.7	-10.4	H
4.824	3.0	47.2	40.2	33.0	0.0	-34.8	0.0	0.0	45.4	38.4	74	54	-28.6	-15.6	H
MID, 2437 MHz															
3.249	3.0	52.2	47.2	31.0	0.0	-35.1	0.0	0.0	48.1	43.0	74	54	-25.9	-11.0	V
4.874	3.0	47.0	36.5	33.1	0.0	-34.9	0.0	0.0	45.2	34.7	74	54	-28.8	-19.3	V
3.249	3.0	52.1	47.6	31.0	0.0	-35.1	0.0	0.0	48.0	43.4	74	54	-26.0	-10.6	H
4.874	3.0	48.3	39.9	33.1	0.0	-34.9	0.0	0.0	46.5	38.1	74	54	-27.5	-15.9	H
HIGH. 2462 MHz															
3.283	3.0	52.0	46.6	31.0	0.0	-35.1	0.0	0.0	48.0	42.6	74	54	-26.0	-11.4	V
4.924	3.0	45.5	33.7	33.1	0.0	-34.9	0.0	0.0	43.7	31.9	74	54	-30.3	-22.1	V
3.283	3.0	53.1	48.1	31.0	0.0	-35.1	0.0	0.0	49.0	44.0	74	54	-25.0	-10.0	H
4.924	3.0	46.2	35.4	33.1	0.0	-34.9	0.0	0.0	44.4	33.7	74	54	-29.6	-20.3	H

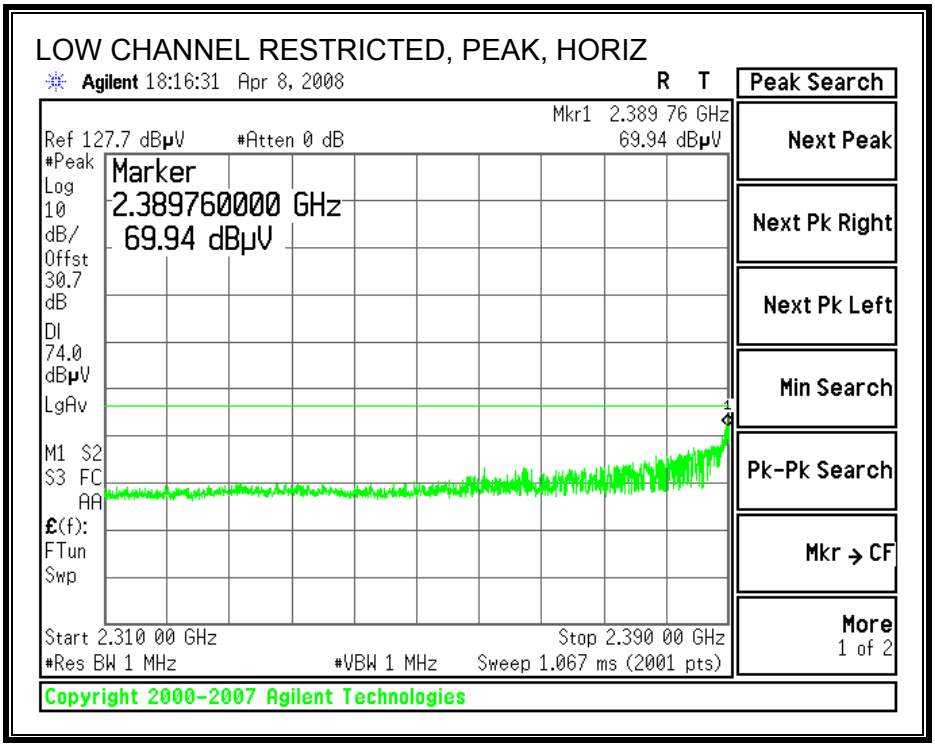
Rev. 4.12.7

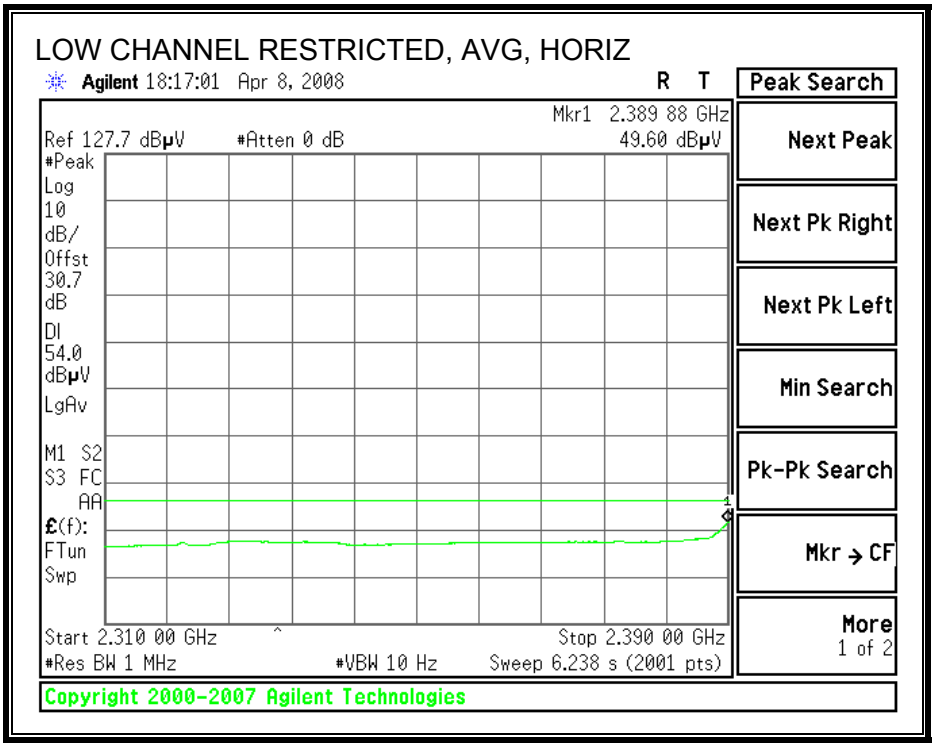
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

7.2.2. 802.11g MODE

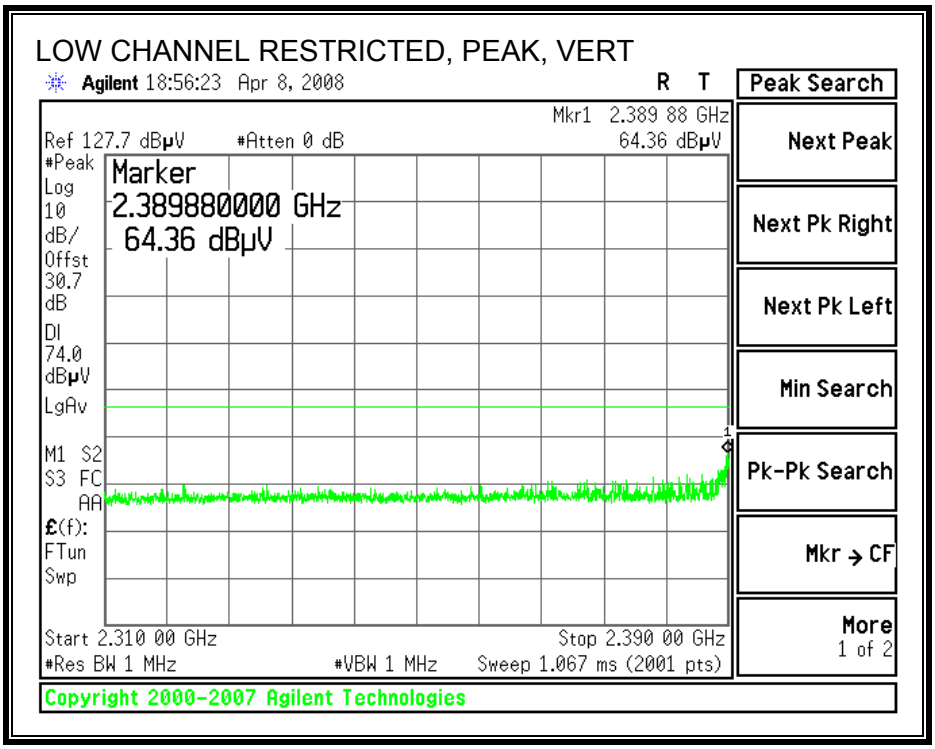
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

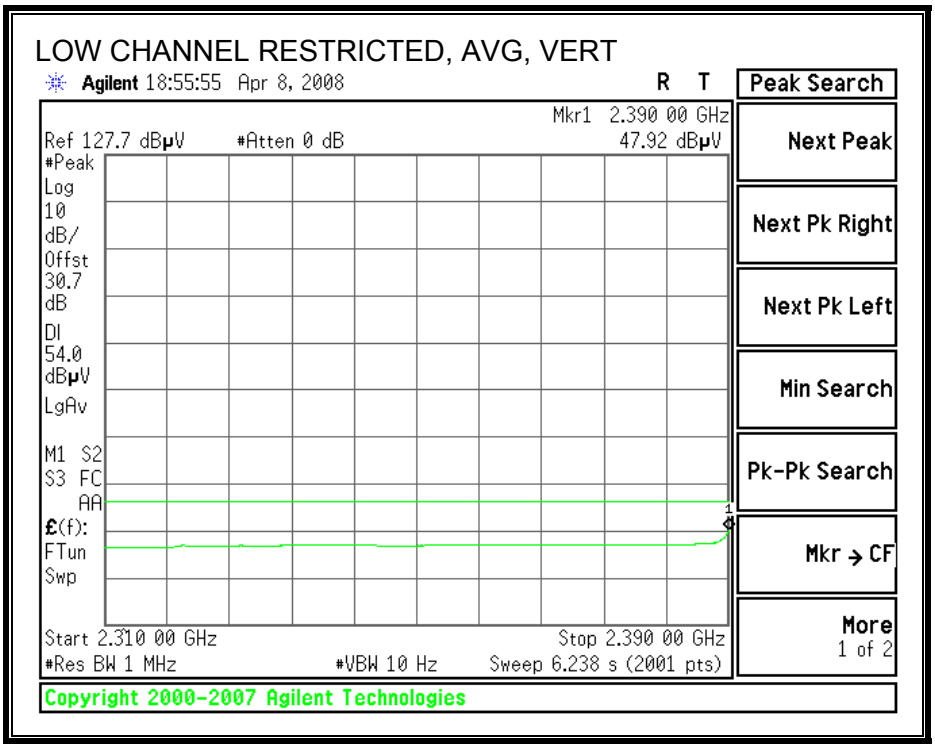
Channel 1, 2412MHz





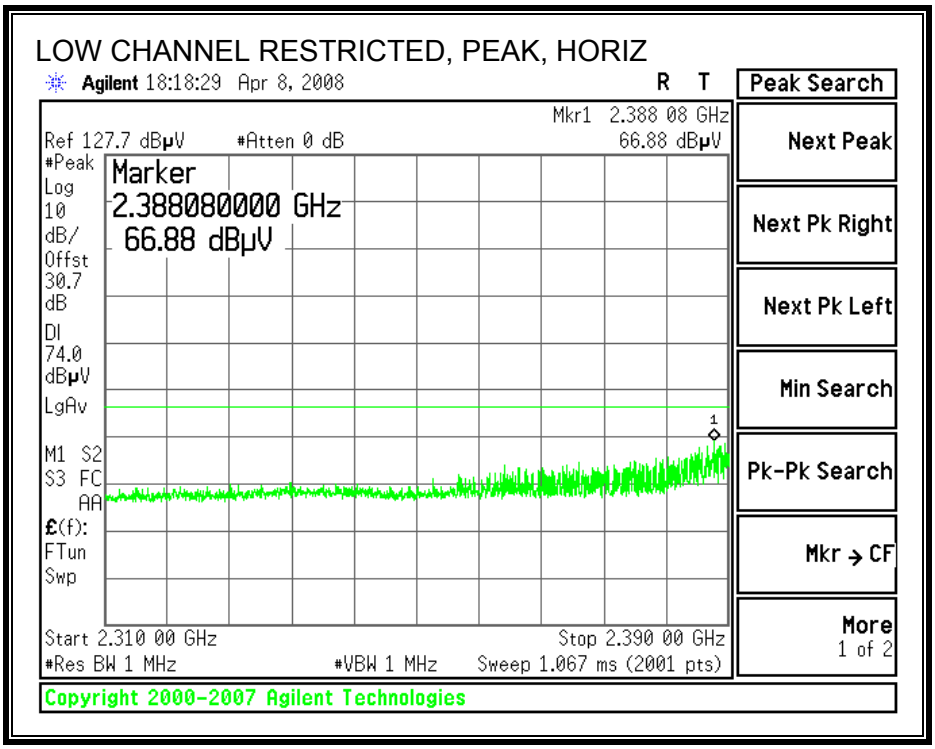
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

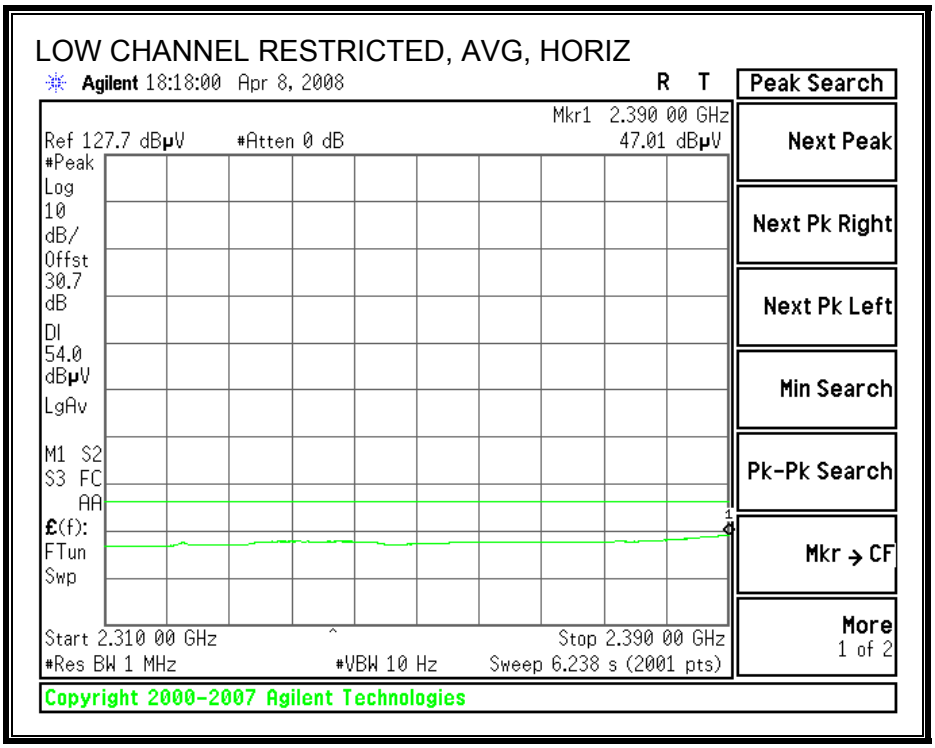




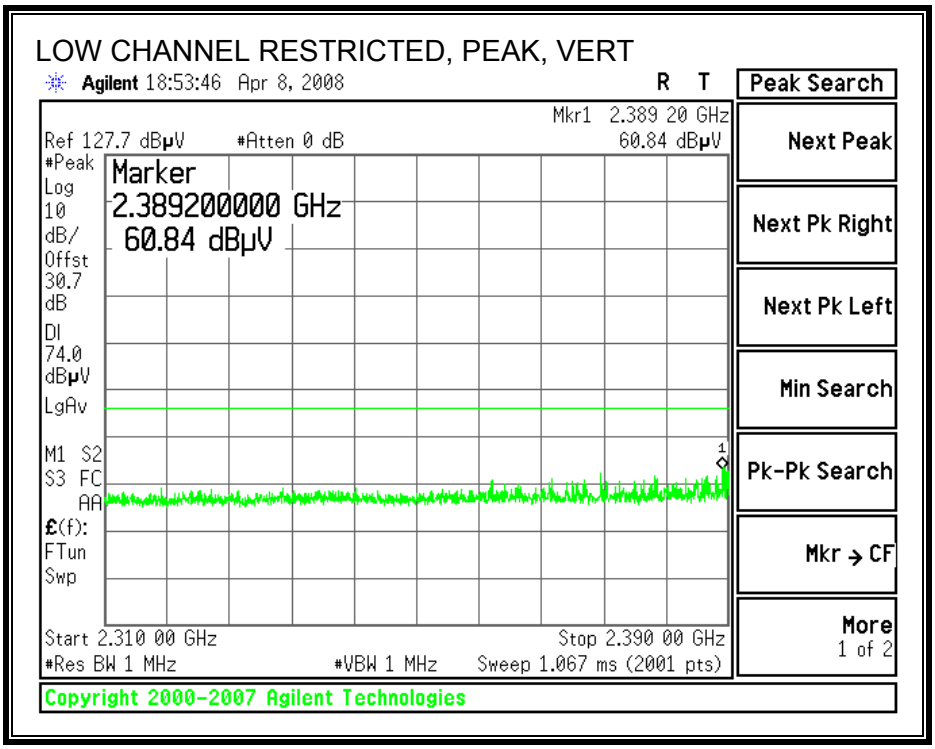
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

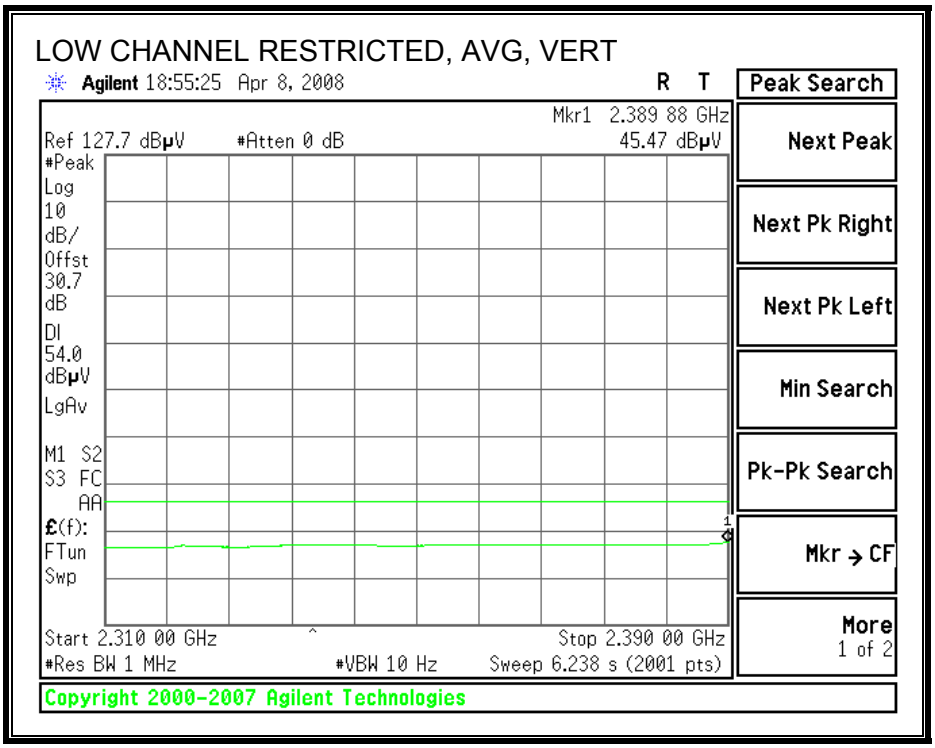
Channel 2, 2417MHz





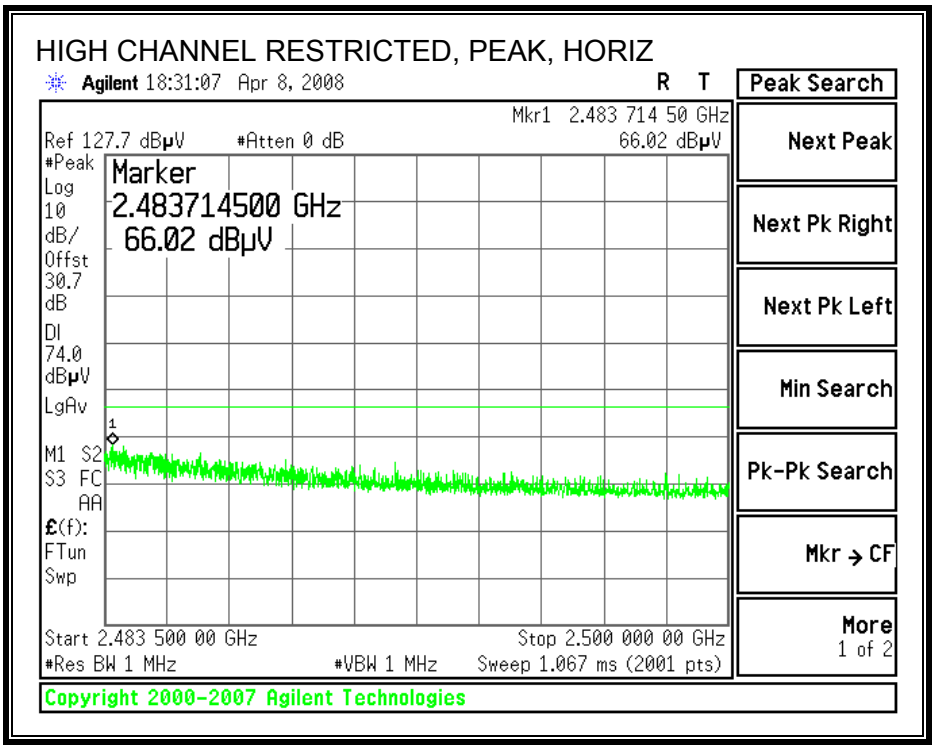
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

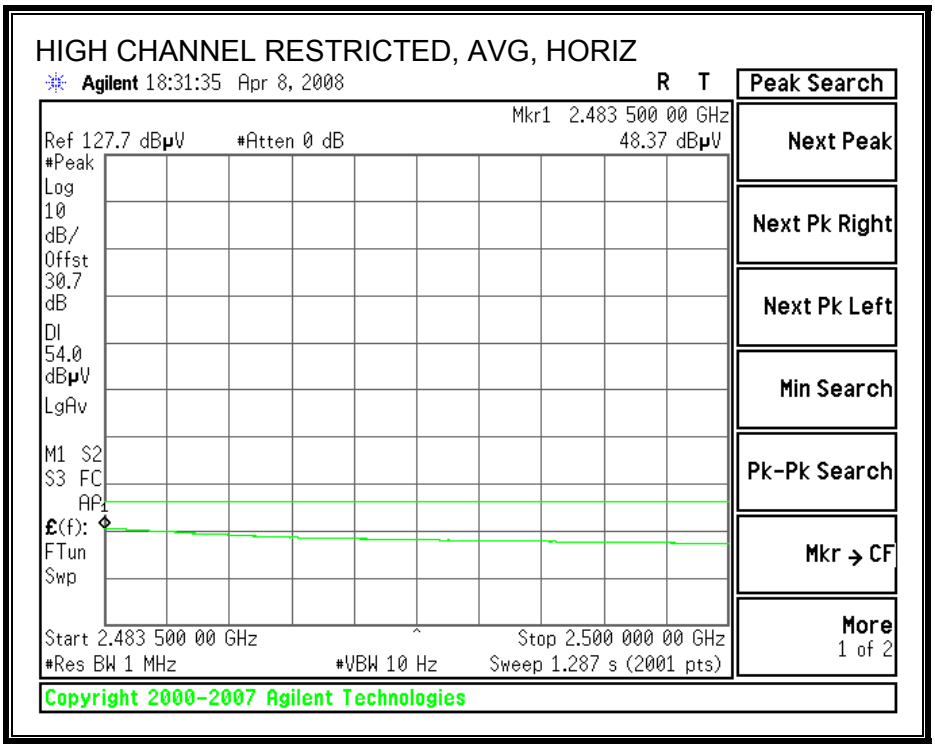




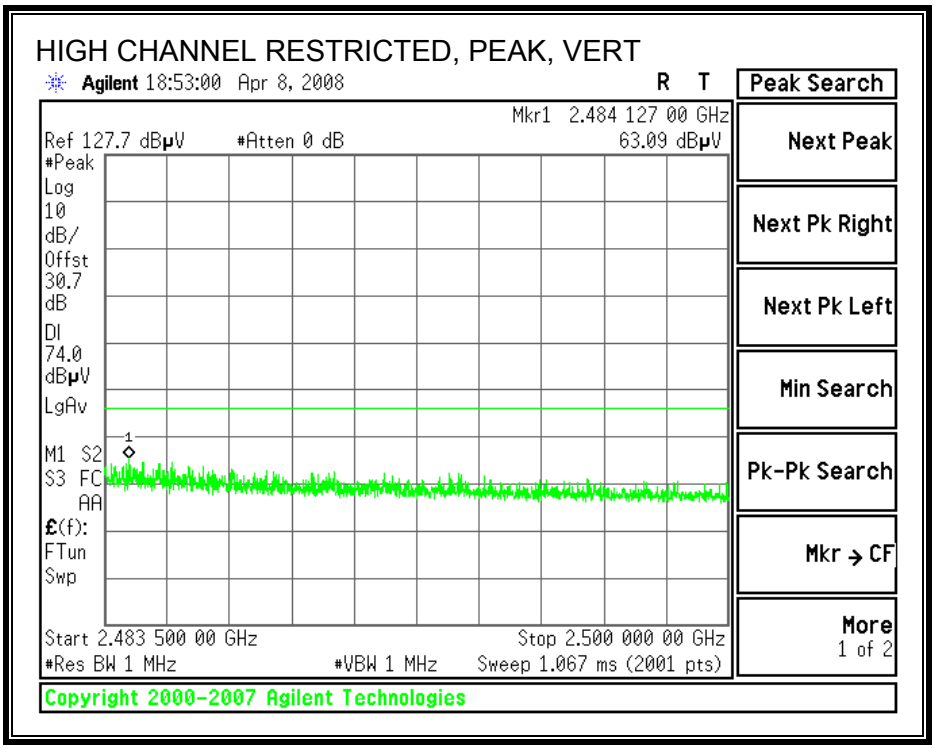
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

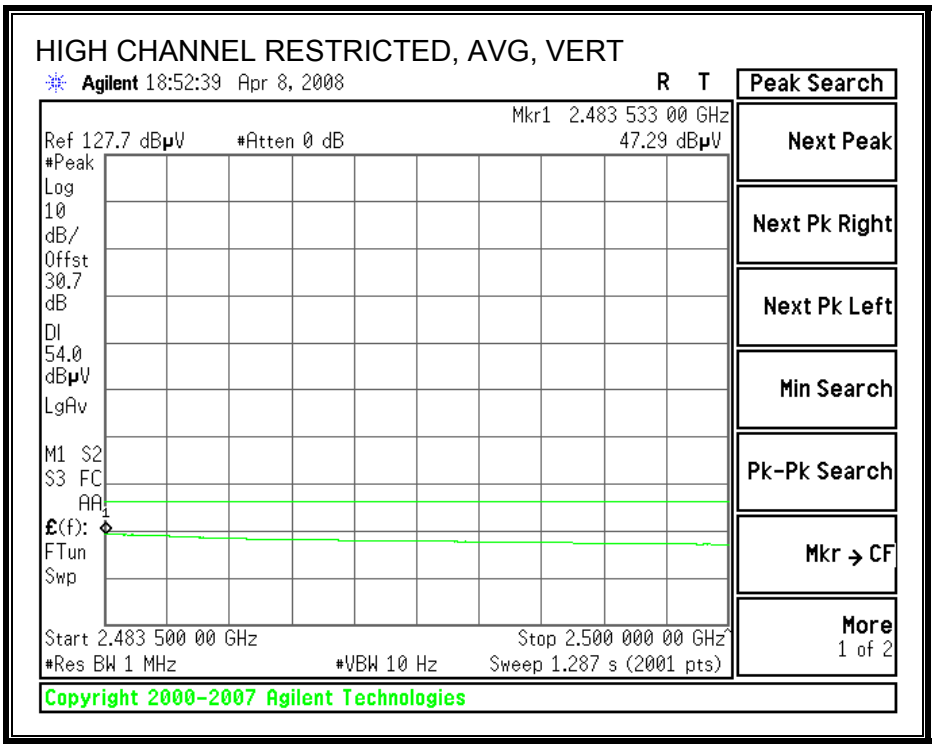
Channel 10, 2457MHz





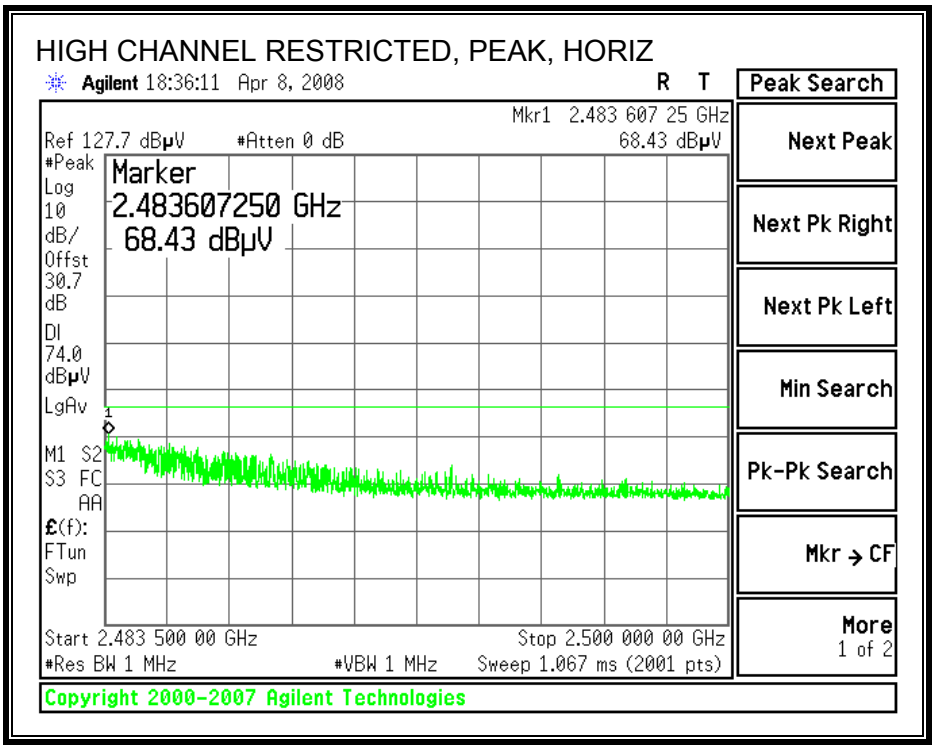
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

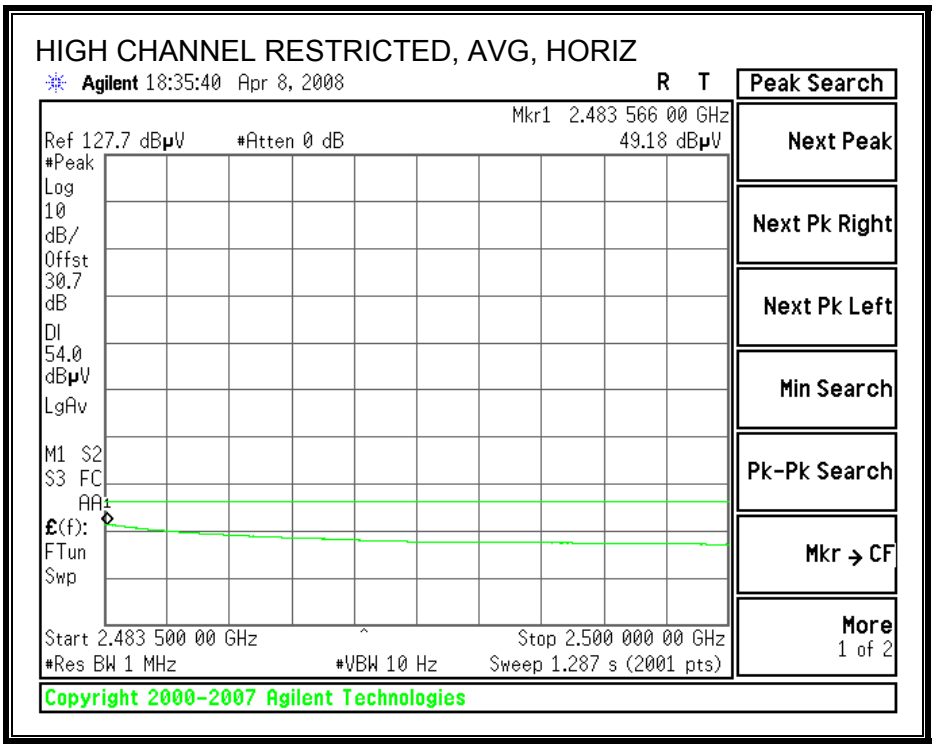




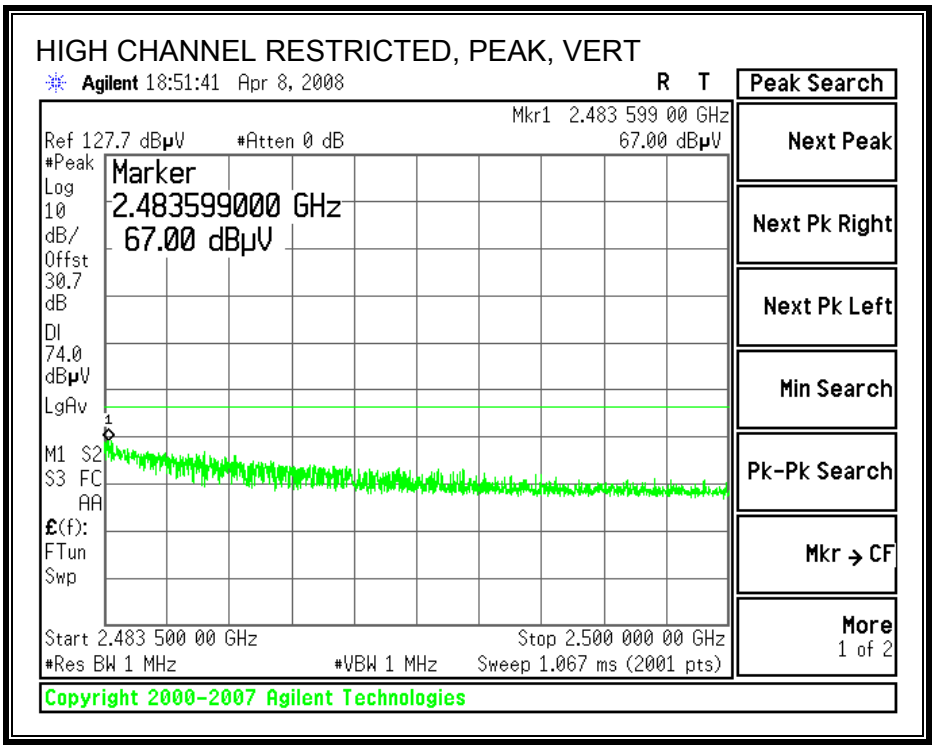
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

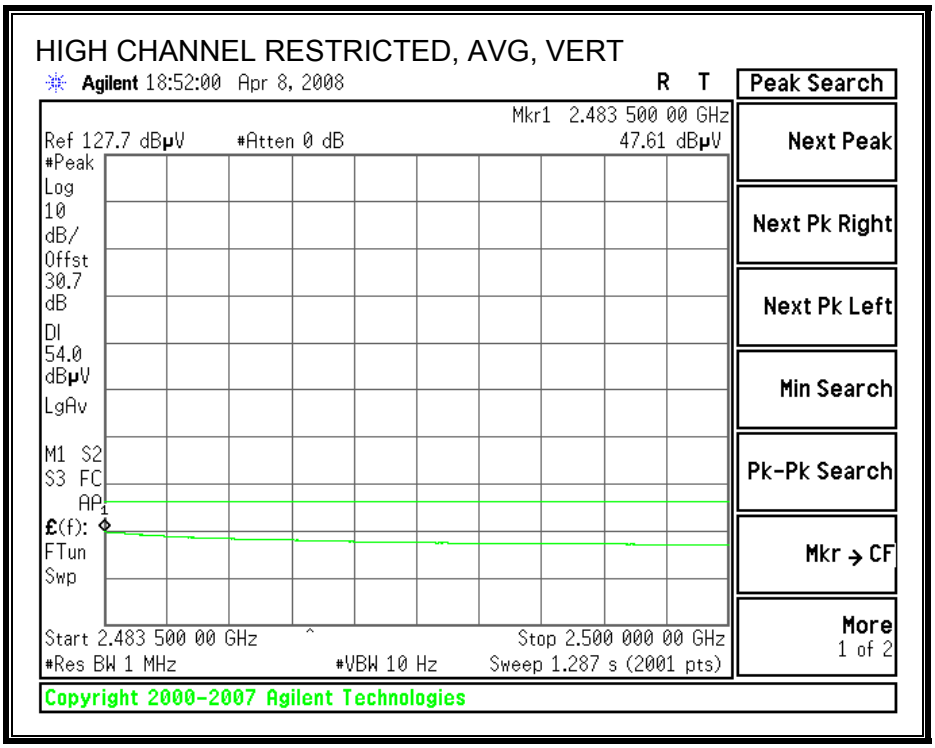
Channel 11, 2462MHz





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom
Project #: 08U11716
Date: 04/11/08
Test Engineer: Devin Chang
Configuration: Hepburn with Smart antenna
Mode: Tx 11g

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			FCC 15.209

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
		C-5m Chamber		R_001

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CH, 2412 MHz															
3.216	3.0	54.2	49.3	30.9	0.0	-35.1	0.0	0.0	50.0	45.1	74	54	-24.0	-8.9	V
4.824	3.0	47.6	40.3	33.0	0.0	-34.8	0.0	0.0	45.8	38.5	74	54	-28.2	-15.5	V
3.216	3.0	52.5	47.9	30.9	0.0	-35.1	0.0	0.0	48.3	43.6	74	54	-25.7	-10.4	H
4.824	3.0	47.2	40.2	33.0	0.0	-34.8	0.0	0.0	45.4	38.4	74	54	-28.6	-15.6	H
MID CH, 2437 MHz															
3.249	3.0	52.2	47.2	31.0	0.0	-35.1	0.0	0.0	48.1	43.0	74	54	-25.9	-11.0	V
4.874	3.0	47.0	36.5	33.1	0.0	-34.9	0.0	0.0	45.2	34.7	74	54	-28.8	-19.3	V
3.249	3.0	52.1	47.6	31.0	0.0	-35.1	0.0	0.0	48.0	43.4	74	54	-26.0	-10.6	H
4.874	3.0	48.3	39.9	33.1	0.0	-34.9	0.0	0.0	46.5	38.1	74	54	-27.5	-15.9	H
HI CH, 2462 MHz															
3.283	3.0	52.0	46.6	31.0	0.0	-35.1	0.0	0.0	48.0	42.6	74	54	-26.0	-11.4	V
4.924	3.0	45.5	33.7	33.1	0.0	-34.9	0.0	0.0	43.7	31.9	74	54	-30.3	-22.1	V
3.283	3.0	53.1	48.1	31.0	0.0	-35.1	0.0	0.0	49.0	44.0	74	54	-25.0	-10.0	H
4.924	3.0	46.2	35.4	33.1	0.0	-34.9	0.0	0.0	44.4	33.7	74	54	-29.6	-20.3	H

Rev. 4.12.7

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

7.3.1. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom
Project #: 08U11716
Date: 4/11/2008
Test Engineer: Devin Chang
Configuration: Hepburn with Smart antenna
Mode: Rx mode

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			RX RSS 210

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
		C-5m Chamber		

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
1.194	3.0	55.2	40.4	25.9	0.0	-36.0	0.0	0.0	45.1	30.3	74	54	-28.9	-23.7	V
1.495	3.0	57.9	41.6	26.7	0.0	-35.8	0.0	0.0	48.8	32.5	74	54	-25.2	-21.5	V
2.994	3.0	53.0	38.2	30.5	0.0	-35.2	0.0	0.0	48.3	33.4	74	54	-25.7	-20.6	V
1.080	3.0	55.4	50.8	25.6	0.0	-36.1	0.0	0.0	44.9	40.3	74	54	-29.1	-13.7	H
1.495	3.0	56.9	42.9	26.7	0.0	-35.8	0.0	0.0	47.8	33.8	74	54	-26.2	-20.2	H
2.390	3.0	47.2	34.2	28.5	0.0	-35.1	0.0	0.0	40.6	27.7	74	54	-33.4	-26.3	H

Rev. 4.12.7

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)

HORIZONTAL DATA

Trace: 13 Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: Devin Chang
Project #: : 08U11617
Company: : Broadcom
Model: : BCM94312HMG
Configuration:: Dell Hepburn_Smart antenna
Mode : : worst case mode
Target: : FCC Class B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	148.340	52.66	-13.74	38.92	43.50	-4.58	Peak
2	250.190	51.61	-14.23	37.38	46.00	-8.62	Peak
3	328.760	49.46	-11.62	37.84	46.00	-8.16	Peak
4	340.400	46.43	-11.36	35.07	46.00	-10.93	Peak
5	562.530	38.57	-6.31	32.26	46.00	-13.74	Peak
6	589.690	41.59	-5.21	36.38	46.00	-9.62	Peak

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

VERTICAL DATA

Trace: 9 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator:: Devin Chang
Project #: : 08U11617
Company: : Broadcom
Model: : BCM94312HMG
Configuration:: Dell Hepburn_Smart antenna
Mode : : worst case mode
Target: : FCC Class B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	149.310	49.15	-13.87	35.28	43.50	-8.22	QP
2	149.310	54.43	-13.81	40.63	43.50	-2.87	Peak
3	329.730	50.61	-11.57	39.04	46.00	-6.96	Peak
4	521.790	46.70	-6.96	39.74	46.00	-6.26	Peak
5	588.720	39.09	-5.25	33.84	46.00	-12.16	QP
6	588.720	50.53	-5.25	45.29	46.00	-0.71	Peak
7	618.790	45.53	-4.94	40.59	46.00	-5.41	Peak
8	672.140	37.66	-4.30	33.36	46.00	-12.64	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^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500	.....	.....	f/300	6
1500–100,000	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

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

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

f = frequency in MHz
* = Plane-wave equivalent power density

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

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

IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
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^2

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^2 is converted to units of W/m^2 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

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

where

d = distance in cm
Px = Power of transmitter x in mW
Gx = Numeric gain of antenna x
S = Power Density in mW/cm^2

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^2

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

RESULTS

(MPE distance equals 20 cm)

Mode	Band	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	FCC Power Density (mW/cm^2)	IC Power Density (W/m^2)
Bluetooth	2.4 GHz	0.70	3.15			
WLAN	2.4 GHz	23.05	1.51			
Combined				20.0	0.06	0.57

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

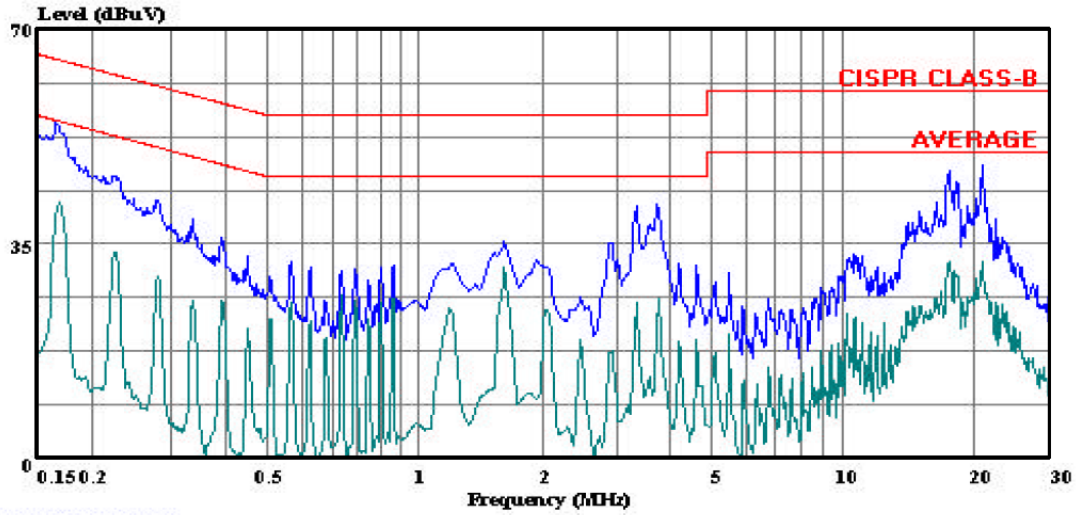
CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.17	54.88	--	41.53	0.00	65.21	55.21	-10.33	-13.68	L1
17.66	46.83	--	32.09	0.00	60.00	50.00	-13.17	-17.91	L1
21.04	47.94	--	32.10	0.00	60.00	50.00	-12.06	-17.90	L1
0.17	54.33	--	41.15	0.00	65.21	55.21	-10.88	-14.06	L2
17.66	46.37	--	31.88	0.00	60.00	50.00	-13.63	-18.12	L2
21.04	47.59	--	31.64	0.00	60.00	50.00	-12.41	-18.36	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#: 08u11716.emi Date: 04-08-2008 Time: 15:16:15



(Line Conduction)

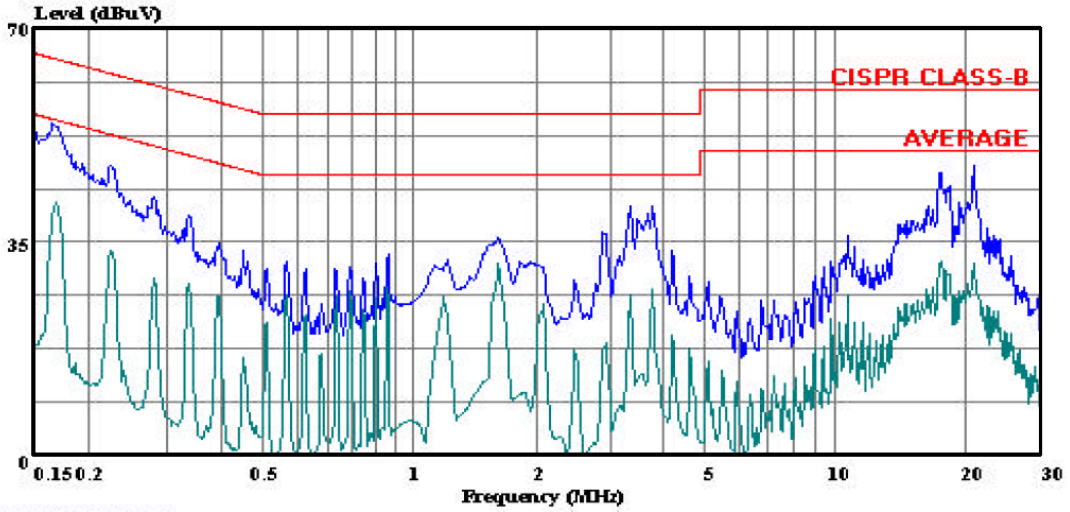
Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Vien Tran
Project #: : 08U11716
Company: : Broadcom
Configuration:: EUT_Dell Amphenol (COY7C00194)
Mode: : Normal
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#: 14 File#: 08u11716.emi Date: 04-08-2008 Time: 15:30:56



(Line Conduction)

Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Vien Tran
Project #: : 08U11716
Company: : Broadcom
Configuration:: EUT_Dell Amphenol (COY7C00194)
Mode: : Normal
Target: : FCC Class B
Voltage: : 115VAC / 60Hz
: Line 2: Peak (Blue); Average (Green)