



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

CERTIFICATION TEST REPORT

FOR

**802.11ag/Draft 802.11n WLAN PCI-E Minicard
(Tested inside of HP HSTNN-W82C)**

MODEL NUMBER: BCM943224HMS

FCC ID: QDS-BRCM1041

IC: 4324A-BRCM1041

REPORT NUMBER: 10U13561-1

ISSUE DATE: APRIL 04, 2011

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>
---	04/04/11	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11ag/Draft 802.11n WLAN PCI-E Minicard
(Installed inside HP Tablets HP HSTNN-W82C)

MODEL: BCM943224HMS

SERIAL NUMBER: ABC04490071

DATE TESTED: March 16-19, 2011

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

Compliance Certification Services, Inc. (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 CCS By:



THU CHAN
ENGINEERING MANAGER
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:

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

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

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 802.11ag/Draft 802.11n WLAN PCI-E Minicard and installed inside HP portable tablet. The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

In order to pass Bandedge measurement, g-mode low channel must be reduced from the peak output powers as table shown below:

MODE / CHANNEL	Measured Peak Output Power (dBm)
2.4GHz Band	
11g	
Low Ch, 2412MHz	23.93

5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding portable platform, HSTNN-W82C.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an 802.11bg WLAN antenna, with a maximum gain of 1.88 dBi.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, wl_tool, ver. 5.100.RC82.34

5.6. 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.
- 802.11n HT20 Mode: MCS0, 6.5 Mbps, 1 Spatial Stream.
- 802.11n HT40 Mode: MCS0, 13.5 Mbps, 1 Spatial Stream.

The tests were performed on worst-case channel with highest antennas gain on HP laptop @ 2.4GHz and 5GHz Bands.

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

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMEN

Frequency Channel (M H z)	Mode	Power (d B m)
5 5 0 0	8 0 2 . 1 1 a	1 4 . 8
5 7 0 0	8 0 2 . 1 1 a	1 3 . 8
5 5 0 0	8 0 2 . 1 1 n H T 2 0	1 3 . 3
5 7 0 0	8 0 2 . 1 1 n H T 2 0	1 2 . 7
5 5 1 0	8 0 2 . 1 1 n H T 4 0	1 0 . 2
5 6 7 0	8 0 2 . 1 1 n H T 4 0	1 3 . 8

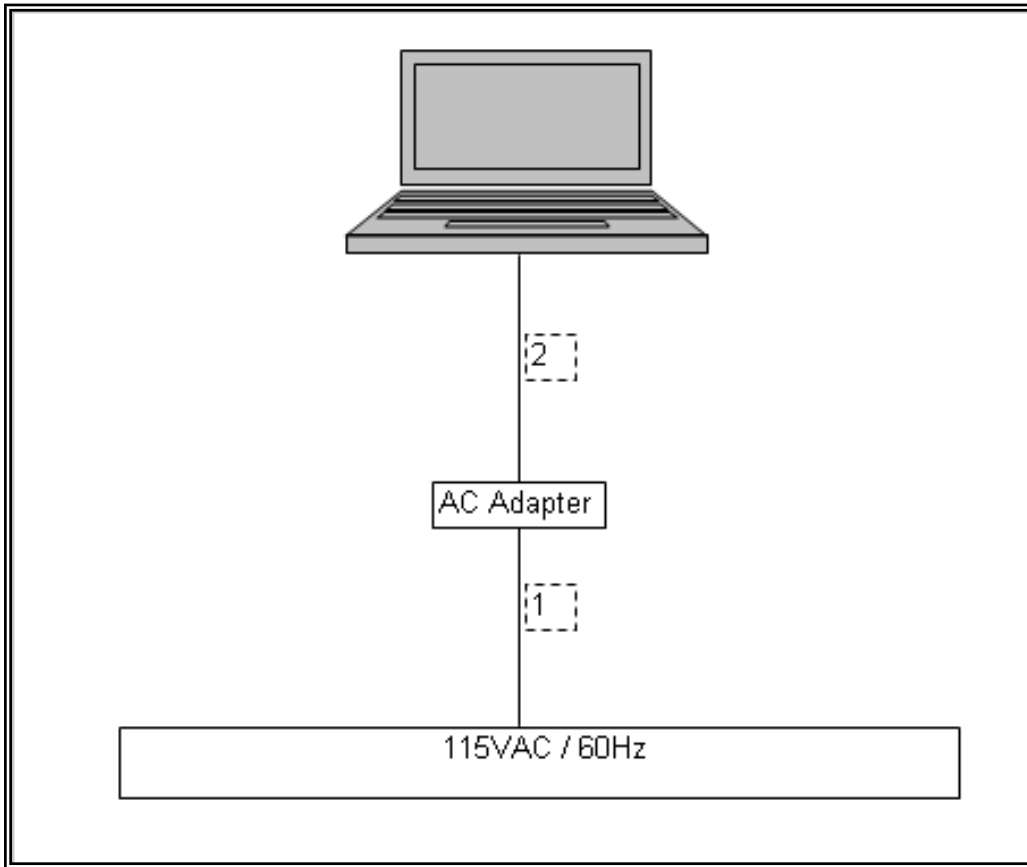
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Unshielded	2m	N/A
2	DC	1	DC	Unshielded	1m	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	04/05/11
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/12/11
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	127/2012
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/14/11
Peak Power Meter	Boonton	4541	C01186	03/14/12
Peak Power Sensor	Boonton	57318	NA	03/14/12
Highpass Filter, 7.6 GHz	Micro-Tronics	HPM13195	N02601	CNR
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	06/25/11
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	07/15/11

7. ANTENNA PORT TEST RESULTS

7.1. 802.11g MODE IN THE 2.4 GHz BAND

7.1.1. 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

Peak power is measured using the Channel bandwidth Alternative peak output power procedure specified in "TCB Training for Devices covered under Scopes A1 - A4" by Joe Dichoso, May 2003.

RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Attenuator and Cable Offset (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	12.93	11	23.93	30	-6.07

7.1.2. AVERAGE POWER

LIMITS

None; for reporting purposes only.

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 1dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Frequency Channel (MHz)	Mode	Power (dBm)
5500	802.11a	14.8
5700	802.11a	13.8
5500	802.11n HT20	13.3
5700	802.11n HT20	12.7
5510	802.11n HT40	10.2
5670	802.11n HT40	13.8

8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, 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 spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

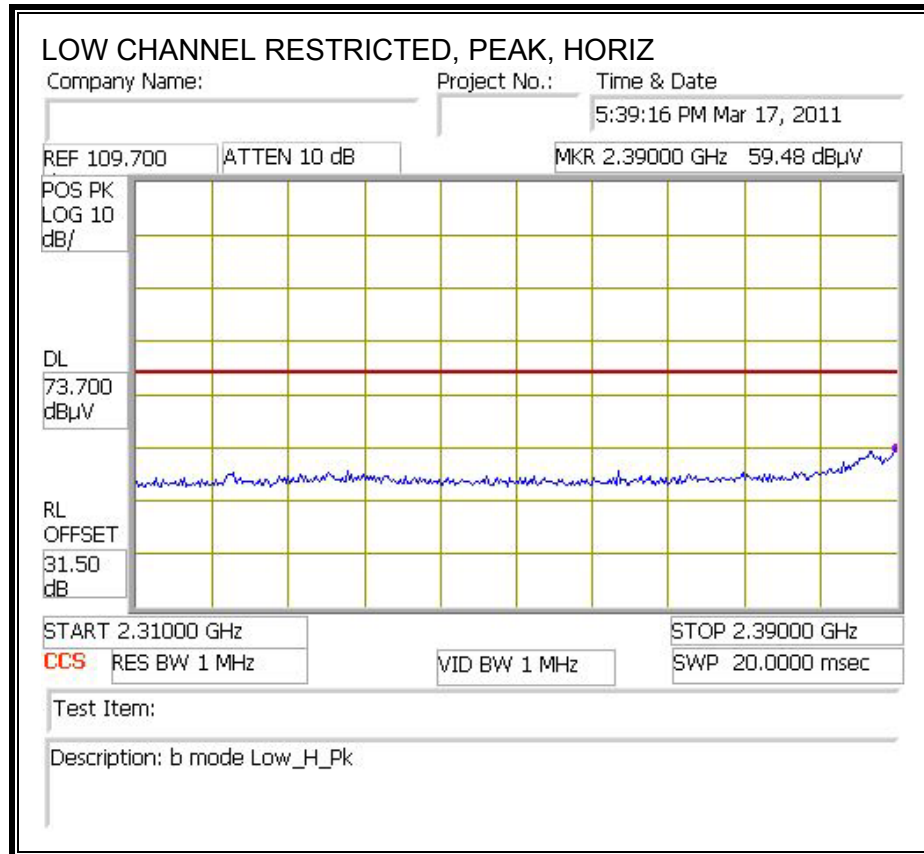
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

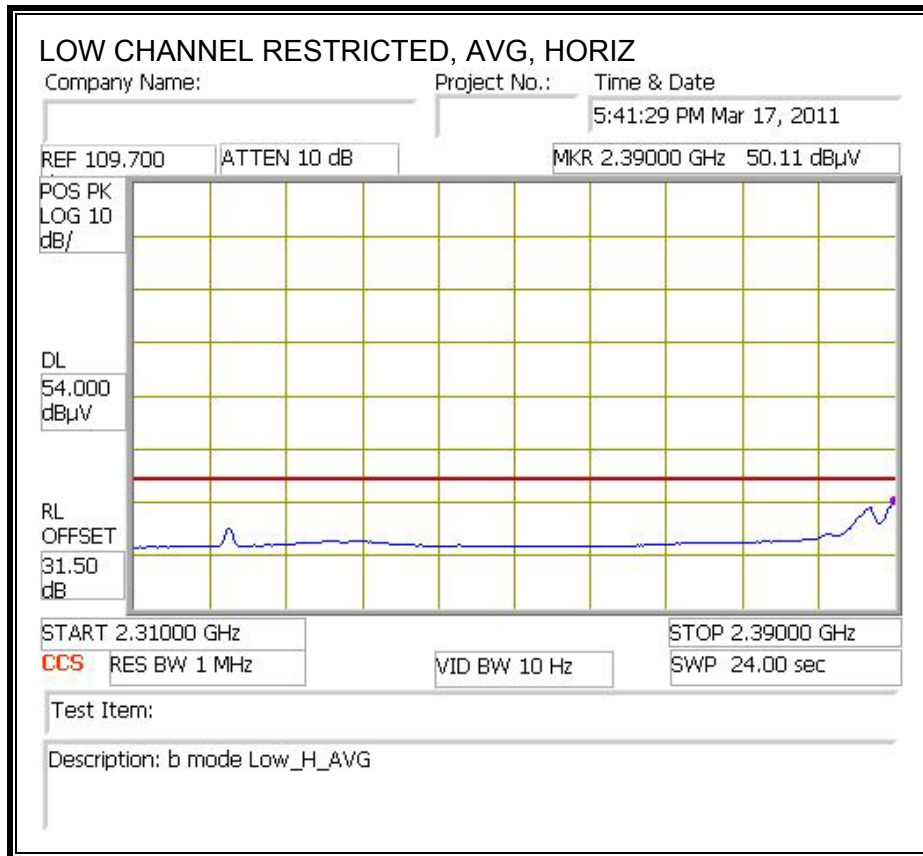
RESULTS

8.2. TRANSMITTER ABOVE 1 GHz

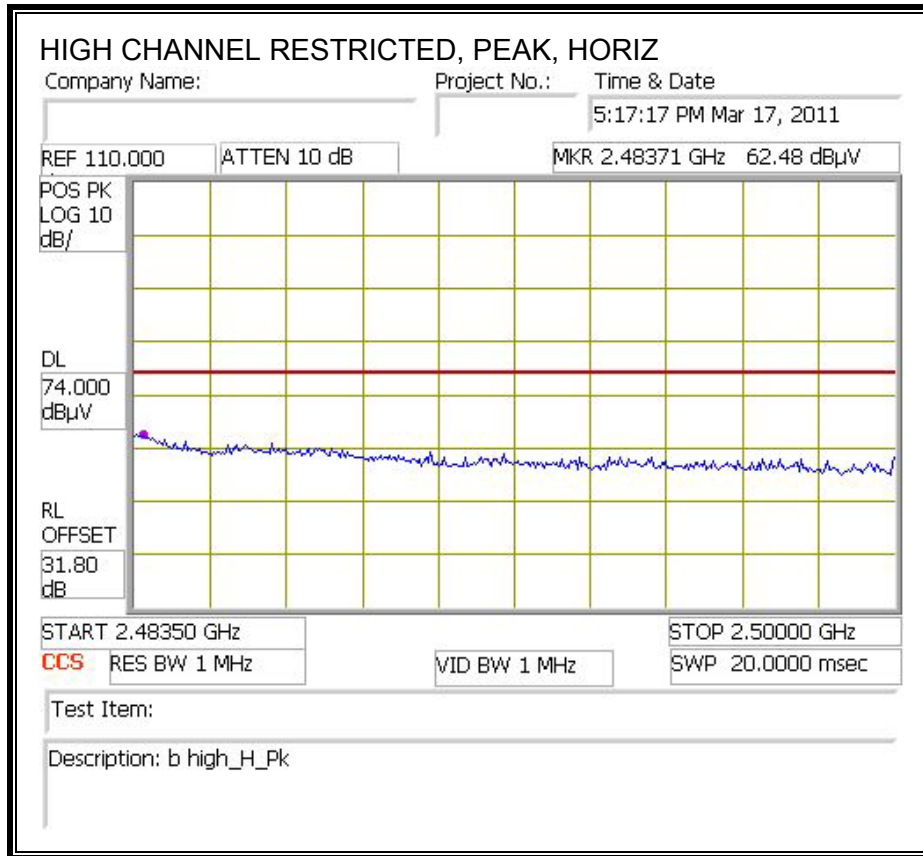
8.2.1. 802.11b MODE

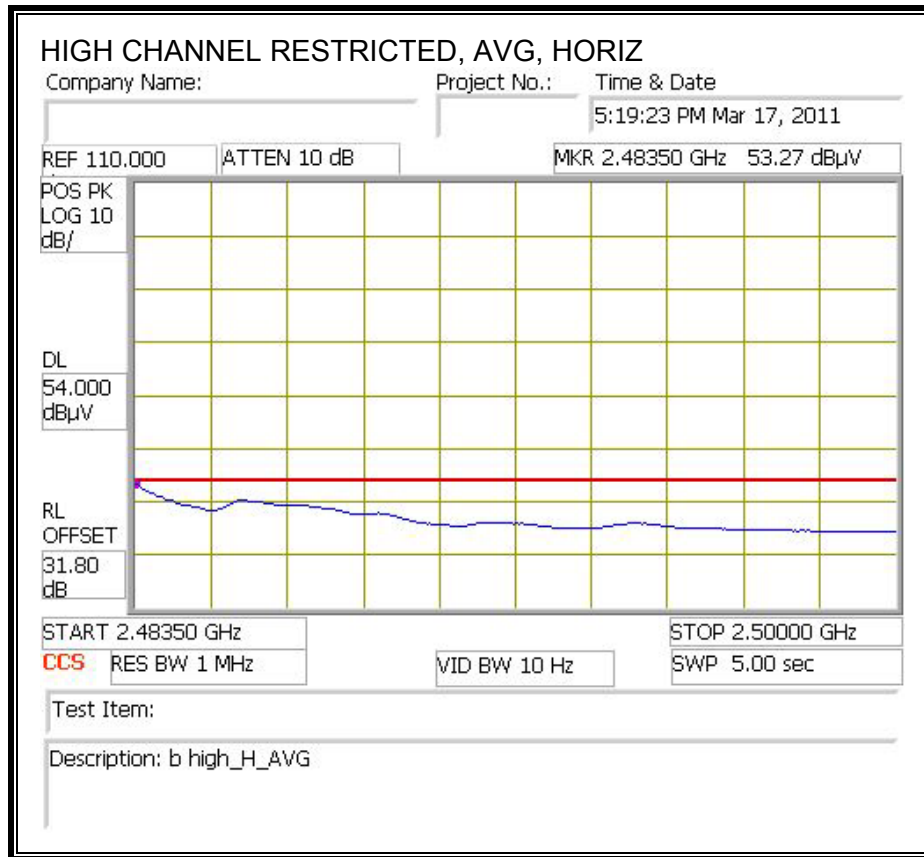
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





HARMONICS AND SPURIOUS EMISSIONS, 11b Mode

High Frequency Measurement
 Compliance Certification Services, Fremont 5m Chamber

Company: Broadcom
 Project #: 10U13561
 Date: 3/19/2011
 Test Engineer: Thanh Nguyen
 Configuration: EUT inside HP tablet Outfield SI-2 SANDY
 Mode: Tx 11b Mode

Test Equipment:

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T73; S/N: 6717 @3m	T144 Miteq 3008A00931			FCC Class B

Hi Frequency Cables

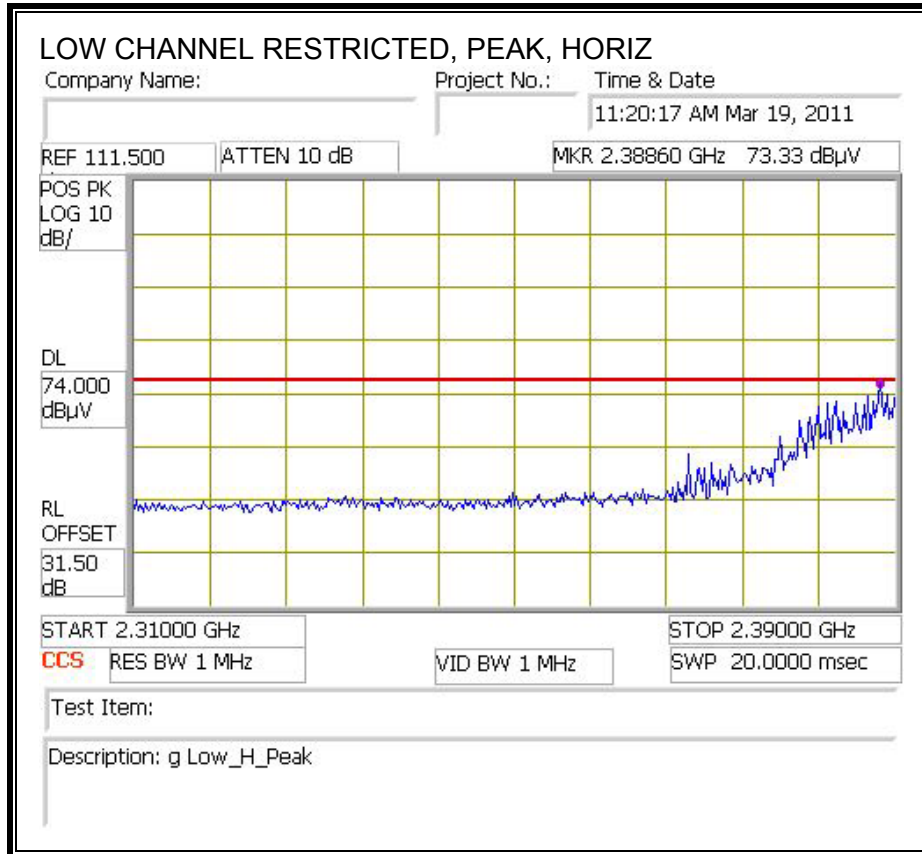
3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
3' cable 22807700	12' cable 22807600	20' cable 22807500		R_001	Average Measurements RBW=1MHz; VBW=10Hz

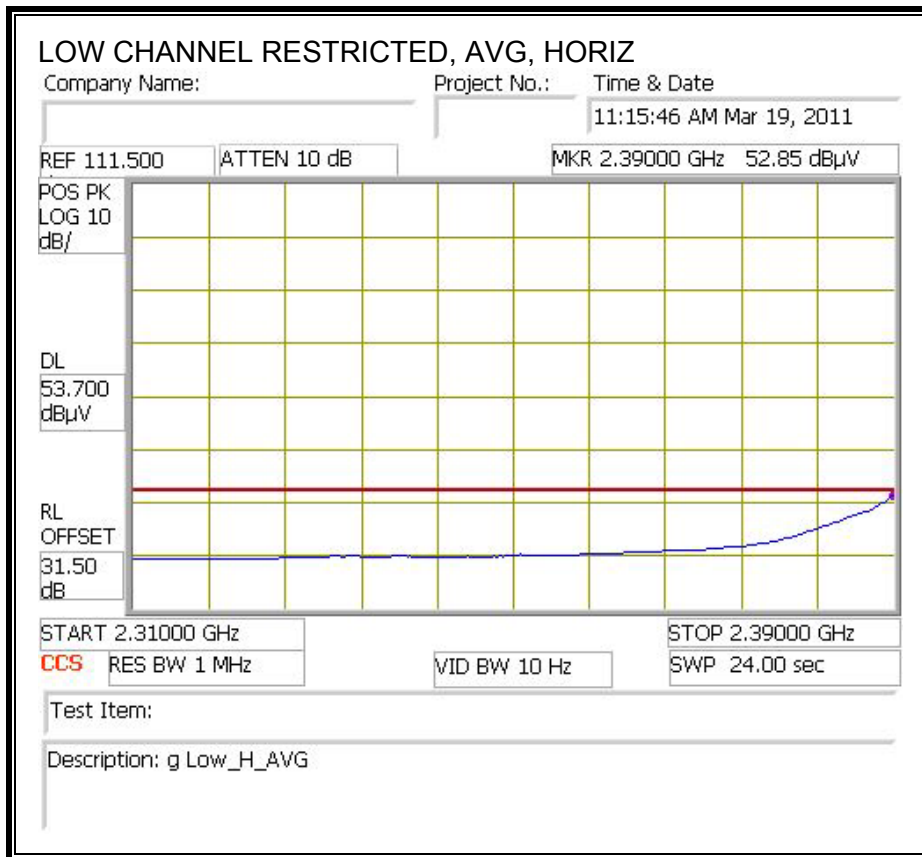
f GHz	Dist (m)	Read Pk dBuV	Read Avg dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
High ch															
4.924	3.0	51.1	48.0	33.1	5.9	-36.5	0.0	0.0	53.7	50.5	74	54	-20.3	-3.5	H
7.386	3.0	43.3	32.8	35.4	7.3	-36.2	0.0	0.0	49.8	39.3	74	54	-24.2	-14.7	H
9.848	3.0	39.0	26.5	37.5	8.7	-37.0	0.0	0.0	48.1	35.6	74	54	-25.9	-18.4	Noise floor
4.924	3.0	53.5	48.4	33.1	5.9	-36.5	0.0	0.0	56.1	51.0	74	54	-17.9	-3.0	V
7.386	3.0	43.3	31.0	35.4	7.3	-36.2	0.0	0.0	49.8	37.5	74	54	-24.2	-16.5	V
9.848	3.0	38.6	26.5	37.5	8.7	-37.0	0.0	0.0	47.7	35.6	74	54	-26.3	-18.4	Noise floor
Mid Ch															
4.874	3.0	47.7	43.2	33.1	5.8	-36.5	0.0	0.0	50.2	45.7	74	54	-23.8	-8.3	V
7.311	3.0	43.4	34.7	35.3	7.3	-36.2	0.0	0.0	49.7	41.0	74	54	-24.3	-13.0	V
9.748	3.0	38.7	27.0	37.4	8.6	-37.0	0.0	0.0	47.8	36.0	74	54	-26.2	-18.0	Noise floor
4.874	3.0	47.2	43.0	33.1	5.8	-36.5	0.0	0.0	49.7	45.4	74	54	-24.3	-8.6	H
7.311	3.0	42.0	29.4	35.3	7.3	-36.2	0.0	0.0	48.3	35.7	74	54	-25.7	-18.3	H
9.748	3.0	38.4	26.4	37.4	8.6	-37.0	0.0	0.0	47.5	35.4	74	54	-26.5	-18.6	H
Low Ch															
4.824	3.0	42.0	34.0	33.0	5.8	-36.5	0.0	0.0	44.3	36.3	74	54	-29.7	-17.7	H
7.236	3.0	42.2	30.7	35.2	7.2	-36.2	0.0	0.0	48.4	36.9	74	54	-25.6	-17.1	H
9.648	3.0	39.0	26.4	37.4	8.5	-37.0	0.0	0.0	48.0	35.4	74	54	-26.0	-18.6	Noise floor
4.824	3.0	44.1	37.3	33.0	5.8	-36.5	0.0	0.0	46.4	39.7	74	54	-27.6	-14.3	V
7.236	3.0	43.3	34.3	35.2	7.2	-36.2	0.0	0.0	49.5	40.5	74	54	-24.5	-13.5	Noise floor
9.648	3.0	38.4	26.3	37.4	8.5	-37.0	0.0	0.0	47.4	35.3	74	54	-26.6	-18.7	V
No other emissions above noise floor.															

Rev. 07.22.09

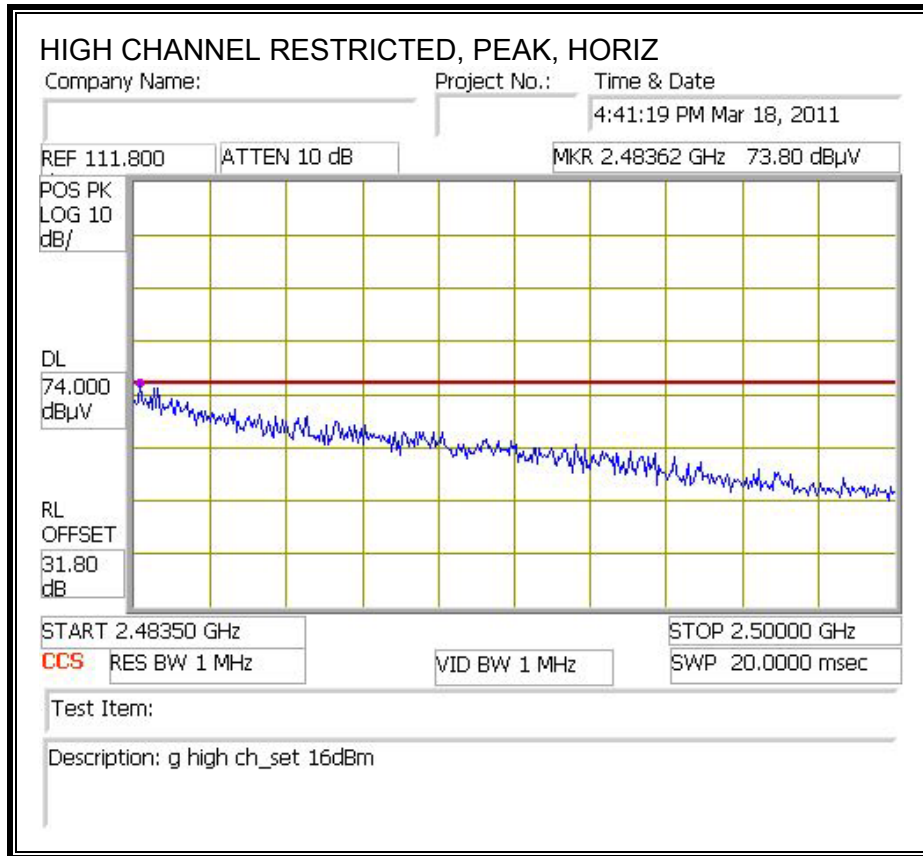
8.2.2. 802.11g MODE

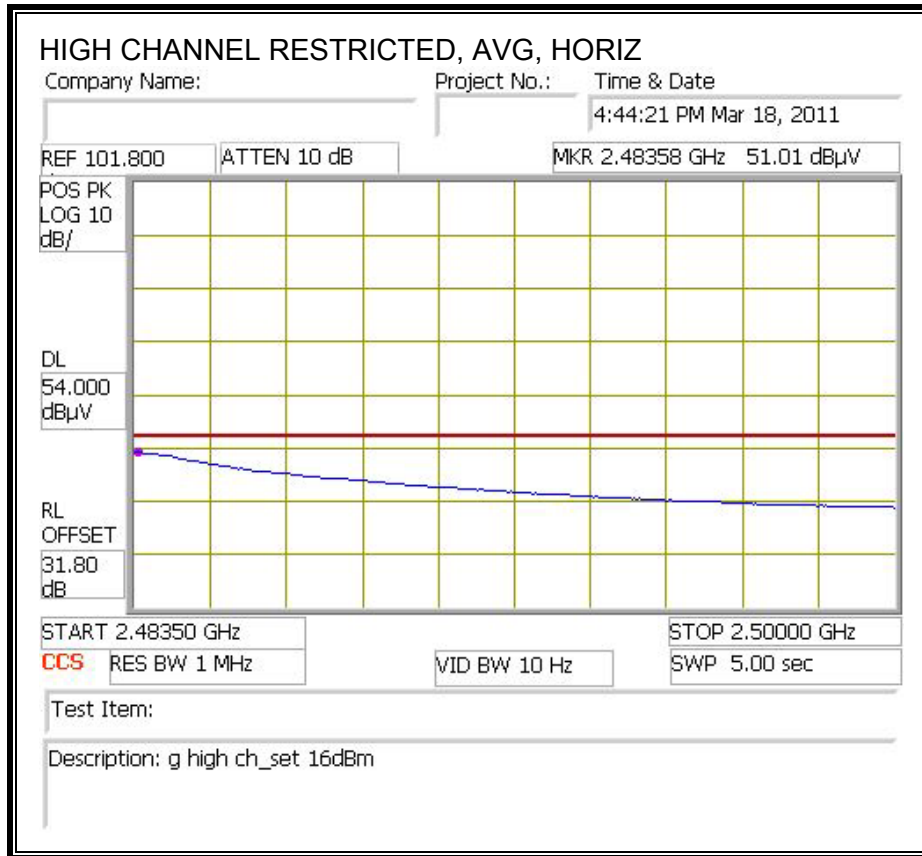
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





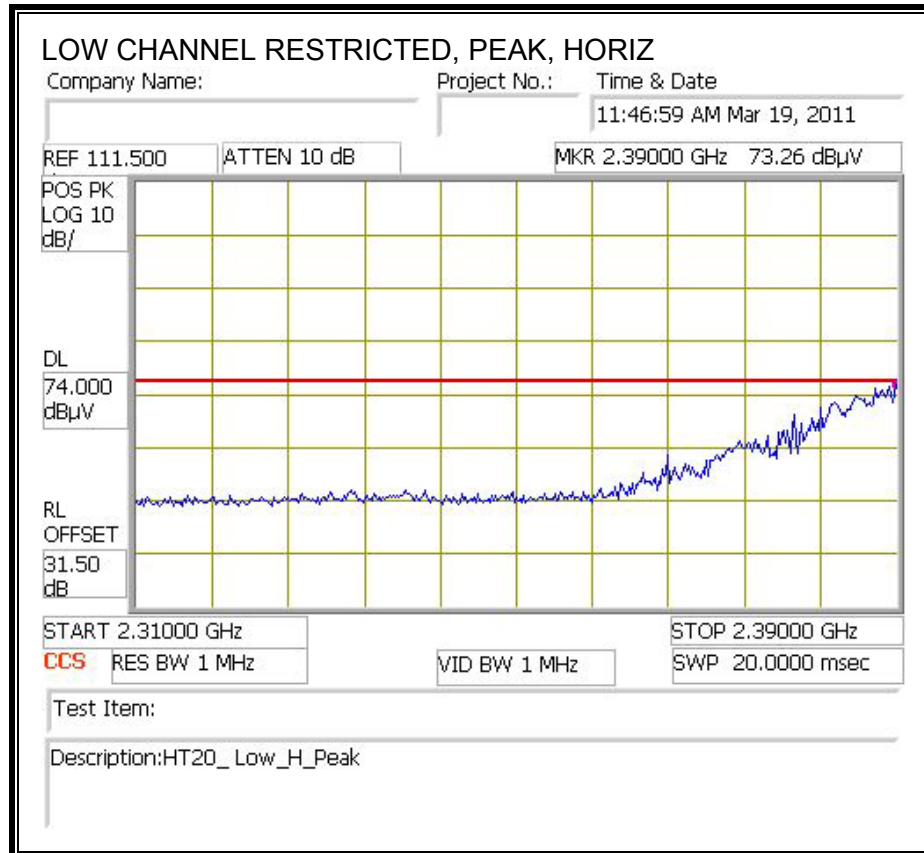
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

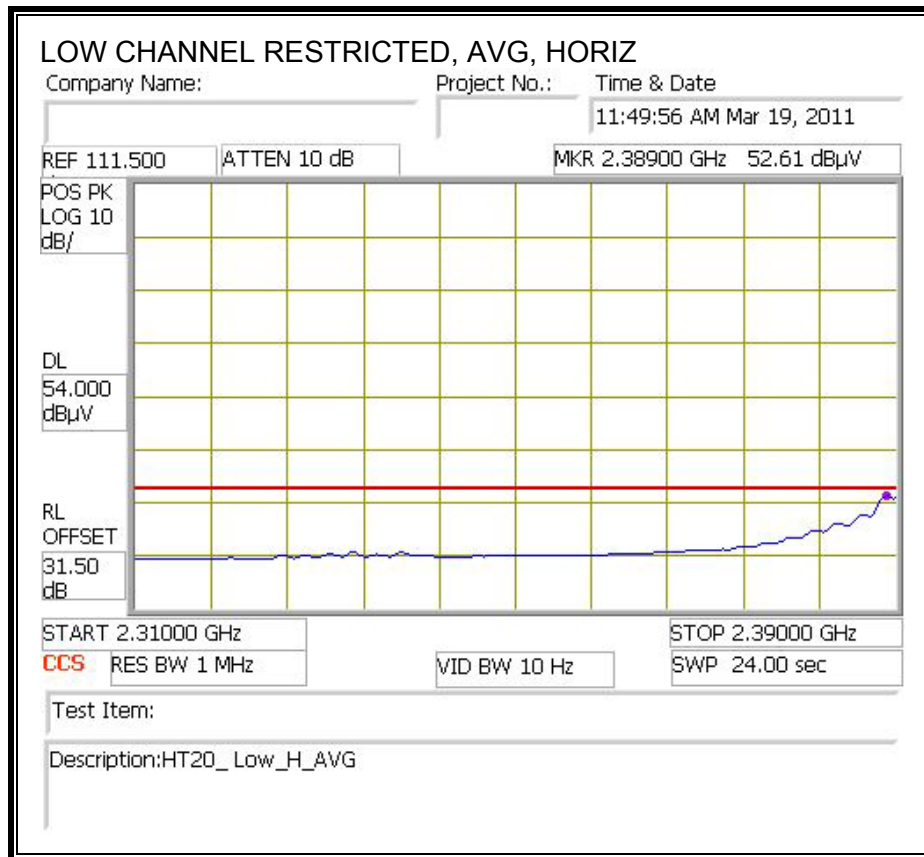




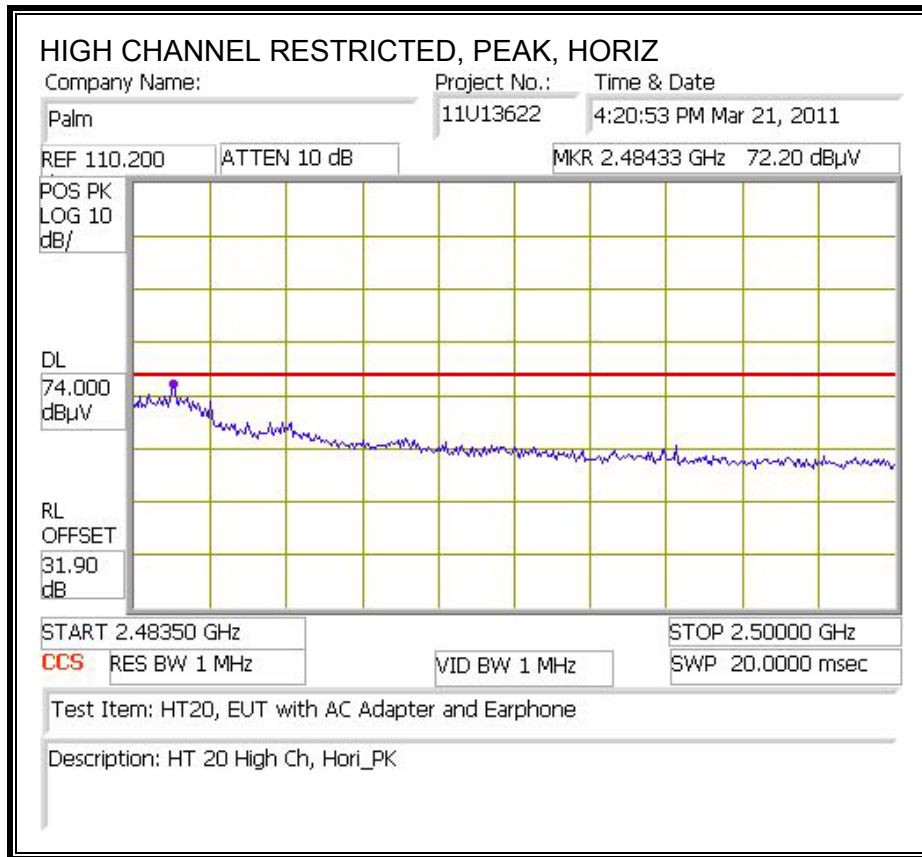
8.2.3. 802.11n HT20 MODE

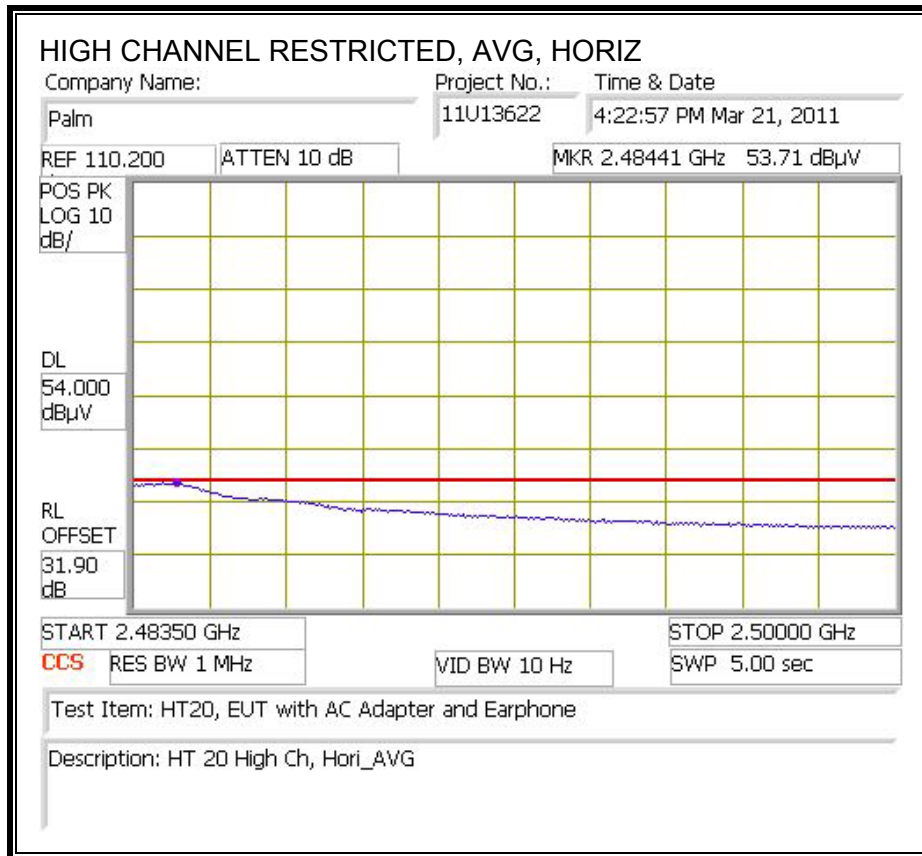
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





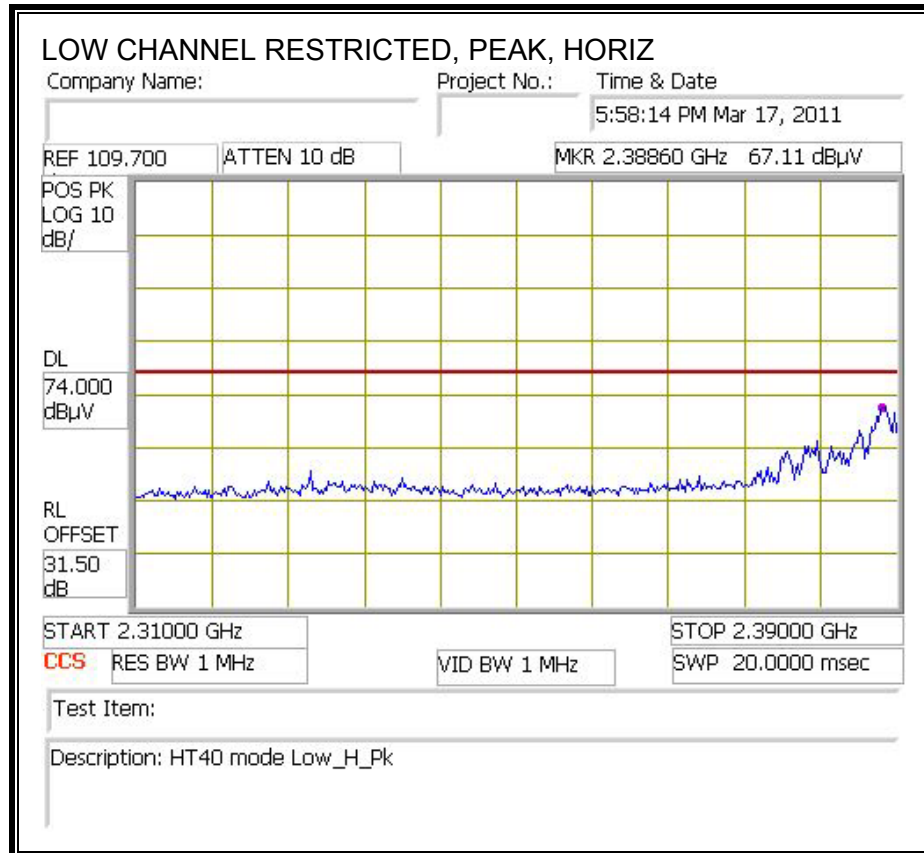
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

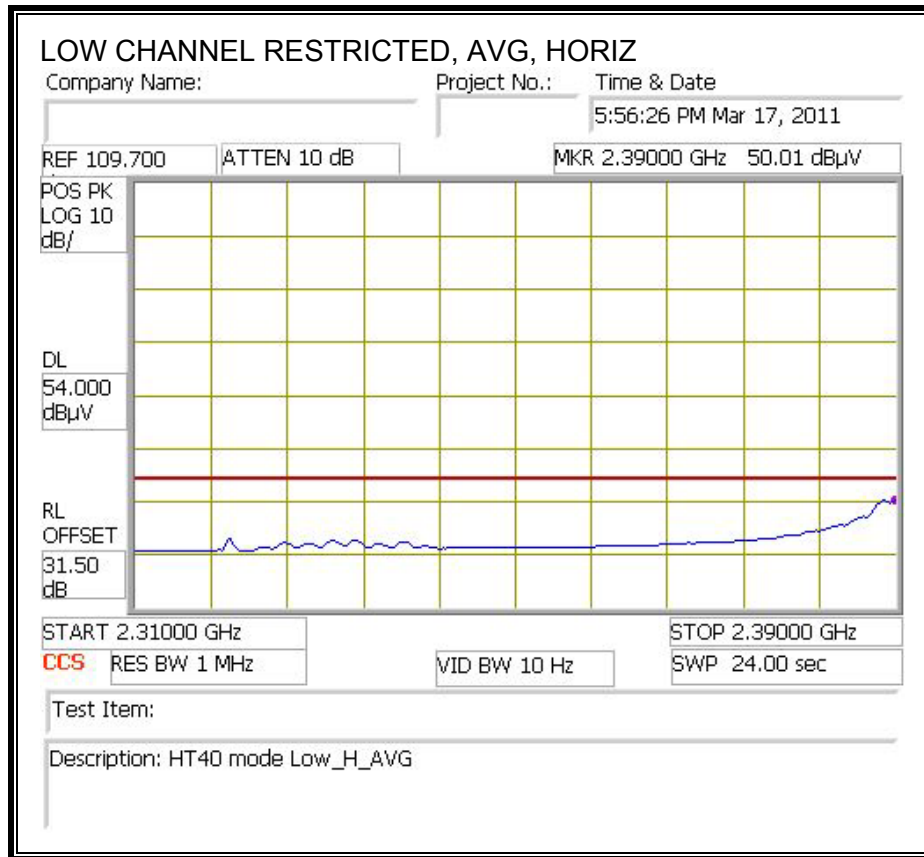




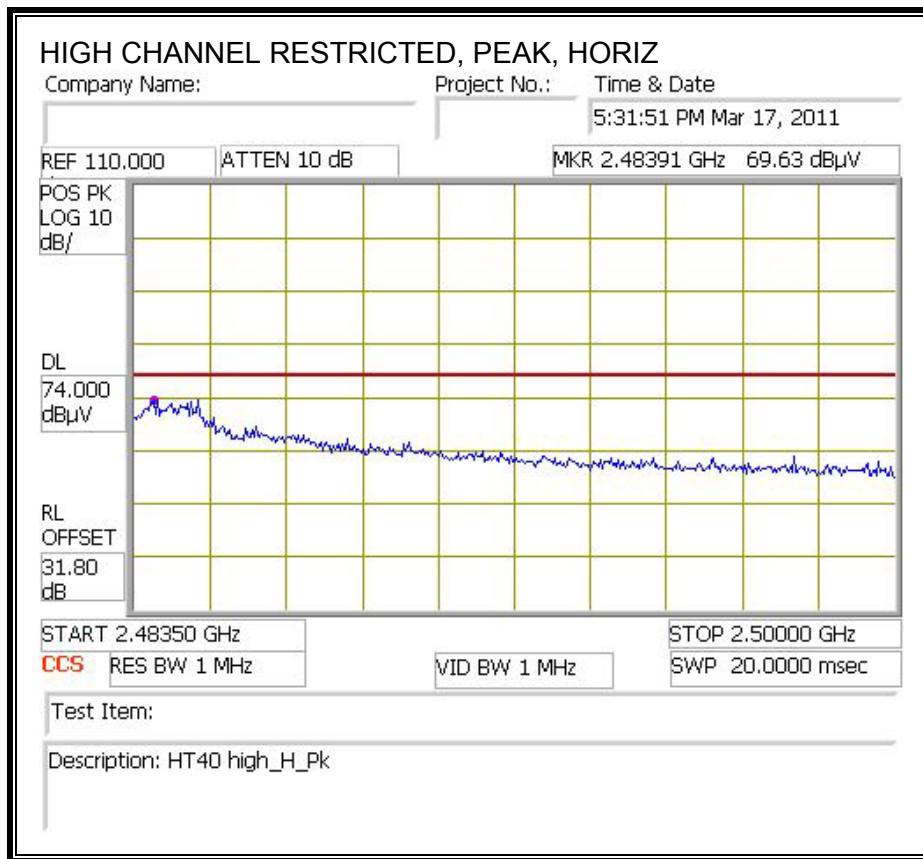
8.2.4. 802.11n HT40 MODE

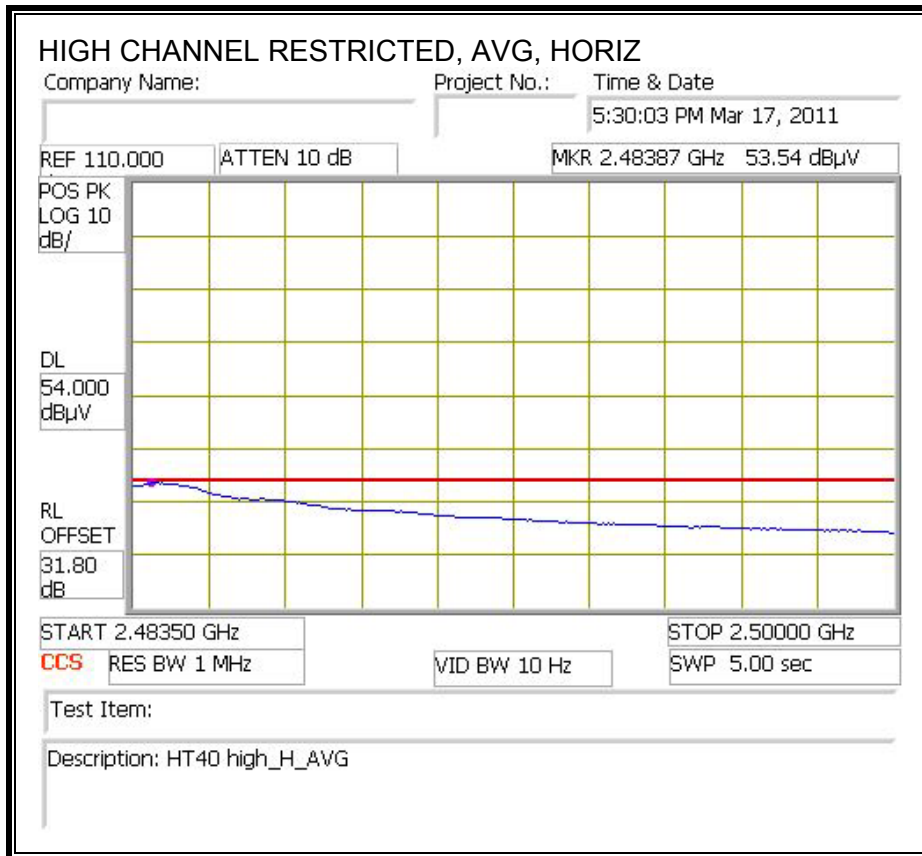
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



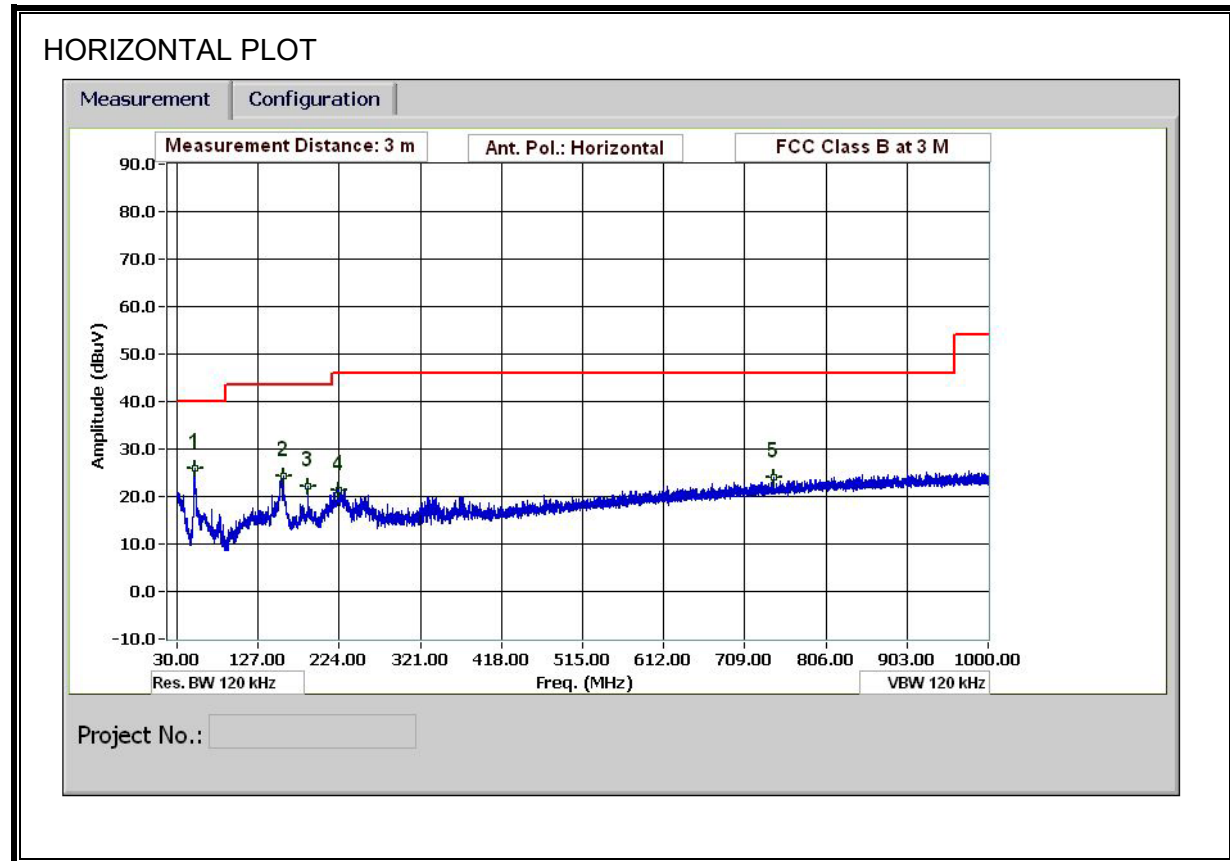


5.8GHz BAND - HARMONICS AND SPURIOUS EMISSIONS (WORST CASE)

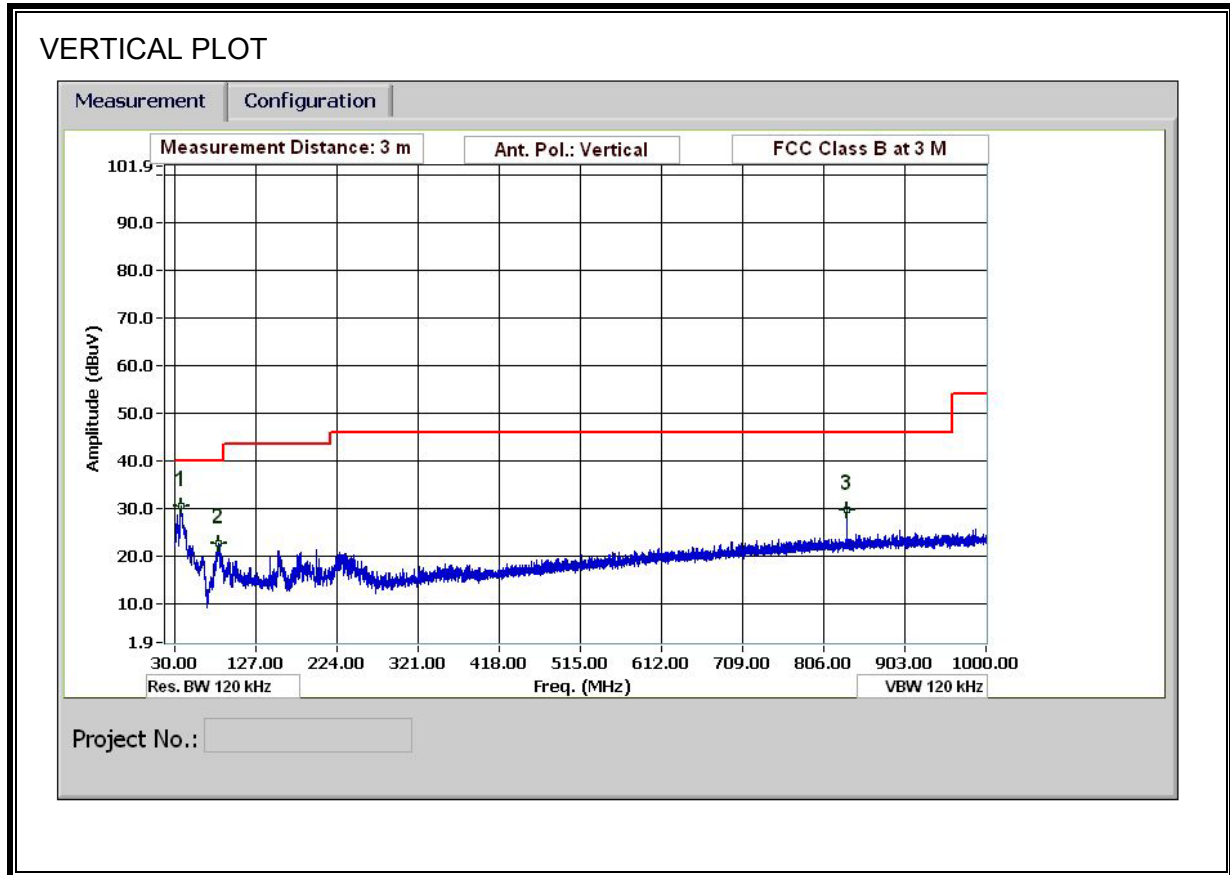
High Frequency Measurement													
Compliance Certification Services, Fremont 5m Chamber													
Test Engr:		Chin Pang											
Date:		12/21/09											
Project #:		09U12939											
Company:		Broadcom											
EUT Description:		802.11ag/Draft 802.11n WLAN PCI-E Minicard											
EUT M/N:		BCM943224HMS											
Test Target:		FCC 15.247											
Mode Oper:		TX, 5.8GHz Band, HT20											
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
Low Ch, 5745MHz													
11.490	3.0	35.6	38.0	9.5	-32.5	0.0	0.0	50.6	74.0	-23.4	V	P	
11.490	3.0	22.3	38.0	9.5	-32.5	0.0	0.0	37.2	54.0	-16.8	V	A	
11.490	3.0	30.6	38.0	9.5	-32.5	0.0	0.0	45.6	74.0	-28.4	H	P	
11.490	3.0	18.7	38.0	9.5	-32.5	0.0	0.0	33.7	54.0	-20.3	H	A	
Mid Ch, 5785MHz													
11.570	3.0	39.4	38.1	9.5	-32.5	0.0	0.0	54.5	74.0	-19.5	V	P	
11.570	3.0	26.9	38.1	9.5	-32.5	0.0	0.0	42.0	54.0	-12.0	V	A	
11.570	3.0	37.8	38.1	9.5	-32.5	0.0	0.0	52.9	74.0	-21.1	H	P	
11.570	3.0	25.0	38.1	9.5	-32.5	0.0	0.0	40.1	54.0	-13.9	H	A	
High Ch, 5825MHz													
11.650	3.0	38.2	38.2	9.6	-32.5	0.0	0.0	53.4	74.0	-20.6	V	P	
11.650	3.0	26.2	38.2	9.6	-32.5	0.0	0.0	41.4	54.0	-12.6	V	A	
11.650	3.0	35.8	38.2	9.6	-32.5	0.0	0.0	51.0	74.0	-23.0	H	P	
11.650	3.0	23.9	38.2	9.6	-32.5	0.0	0.0	39.1	54.0	-14.9	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)



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: Thanh Nguyen
 Date: 03/19/11
 Project #: 10U13561-1
 Company: BroadCom
 Test Target: FCC Class B
 Mode Oper: Transmit 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	Ant. High cm	Table Angle Degree	Notes
Ix worst case															
37.08	3.0	42.2	16.3	0.6	28.4	0.0	0.0	30.7	40.0	-9.3	V	P	100.0	0 - 360	
81.842	3.0	43.0	7.4	0.8	28.3	0.0	0.0	22.8	40.0	-17.2	V	P	100.0	0 - 360	
833.433	3.0	33.3	21.3	2.7	27.6	0.0	0.0	29.7	46.0	-16.3	V	P	100.0	0 - 360	
50.881	3.0	45.3	8.3	0.6	28.4	0.0	0.0	25.9	40.0	-14.1	H	P	100.0	0 - 360	
157.445	3.0	39.5	11.9	1.1	28.3	0.0	0.0	24.3	43.5	-19.2	H	P	100.0	0 - 360	
186.126	3.0	37.8	11.3	1.2	28.2	0.0	0.0	22.0	43.5	-21.5	H	P	100.0	0 - 360	
223.328	3.0	36.3	11.9	1.3	28.2	0.0	0.0	21.3	46.0	-24.7	H	P	100.0	0 - 360	
744.029	3.0	28.6	20.2	2.5	27.3	0.0	0.0	24.0	46.0	-22.0	H	P	100.0	0 - 360	

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