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

CERTIFICATION TEST REPORT

FOR

802.11ag / Draft 802.11n WLAN + BLUETOOTH PCI-E MINICARD
(*Adding a higher antenna gain*)

MODEL NUMBER: BCM943224PCIEBT

FCC ID: QDS-BRCM1047
IC: 4324A-BRCM1047

REPORT NUMBER: 10U13103-1, Revision A

ISSUE DATE: MARCH 25, 2010

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/22/10	Initial Issue	T. Chan
A	03/25/10	Revised The Worst Case 30-1000MHz Statement To 11n HT20 Mode On Page 7; Added Explanation For The Worst Case Spurious Harmonic On Page 7 Added Note On Page 39	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	BROADCOM CORPORATION 190 MATHILDA PLACE SUNNYVALE, CA 94086, USA
EUT DESCRIPTION:	802.11ag / Draft 802.11n WLAN + Bluetooth PCI-E Minicard
MODEL:	BCM943224PCIEBT
SERIAL NUMBER:	8516097JADS0B
DATE TESTED:	MARCH 16 -19, 2010

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA 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:

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

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 an 802.11ag / Draft 802.11n WLAN + Bluetooth PCI-E Minicard.
The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

The test measurement passed within ± 0.5dBm of the original output power.

For MIMO HT20 MCS0 Mode at mid channel, the output power is reduced ~0.2dB as table shown below in order to pass the output power limit due to the higher antenna gain.

2400 to 2483.5 MHz Authorized Band

Frequency Range (MHz)	Mode	Peak Power Chain 0 (dBm)	Peak Power Chain 1 (dBm)	Total Peak Power (dBm)	Output Power (mW)
2412 - 2462	802.11n 20MHz CDD	25.22	24.67	27.96	625.75

5.3. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The major change filed under this application is adding higher antenna gains as showing in section below.

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes with two different types of antenna, with the maximum gain as table below:

Antenna Type	Model	2.4GHz Peak gain (dBi)
802.11bgn WLAN Antenna	631-1355	1.66
802.11bgn WLAN Antenna	631-1333	6.77

The highest gains of each type of antennas for all legacy / SISO modes test.

Band	Antenna 1 (631-1355) • (dBi))	Antenna 2 (631-1333) (dBi))
2.4 GHz	1.66	***6.77***

The antennas combinations for 2x2 (CCD) modes test.

Frequency Band	Antennas conbination	• Antenna 1 Gain	• Antenna 2 Gain	10^(Ant Main /10)	10^(Ant Aux/10)	10^(ant main/10)+ 10^(ant aux/10)	10*log[10^(ant main/10)+ 10^(ant aux/10)] (dBi)
2.4 GHz HT20 & HT40	Antenna 1 / Antenna 2	1.66	6.77	1.466	4.753	6.219	**7.94**

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.10.131.7.
The test utility software used during testing was BCM Internal, rev. 5.10.RC131.7.

5.6. NUMBER OF TRANSMIT CHAINS

For legacy / SISO modes, selected measurements were performed on the Main and Auxiliary chains; however only one of these chains will be transmitting at any time. Under this report the Main chain were used as highest gain.

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 MIMO HT20 Mode: MCS0, 6.5 Mbps, 2 Spatial Streams.
802.11n SISO HT40 Mode: MCS0, 13.5 Mbps, 2 Spatial Streams.
802.11n MIMO HT40 Mode: MCS15, 270 Mbps, 2 Spatial Streams.

Since the EUT was certified as modular approval with highest antenna; therefore only investigate on radiated band-edges, worst case of harmonic and below 1GHz.

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 11n HT20 mode, mid channel.

For radiated spurious harmonic, from the previous testing data showed that b-mode is worst-case compared to other modes; therefore final measurement was performed only on b-mode.

All legacy/SISO modes were measured with the highest gain for each type of antenna.

All MIMO modes were measured with the highest combination of gains for each type of antenna. Note that this combination of antennas will not be implemented in the end product. This combination was selected for testing purposes only, to accommodate the highest gain of each antenna type in one single test configuration. The combined gain of this test configuration is higher than any combined gain that will be implemented in the end product.

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	Lenovo	4446	R8-CAC56	DoC
AC Adapter	Lenovo	ADP-65-YB B	11S42T4458Z1ZF4K96V9S9	N/A
Adapter Board	Broadcom	BCRM943224PCI	1261490	N/A

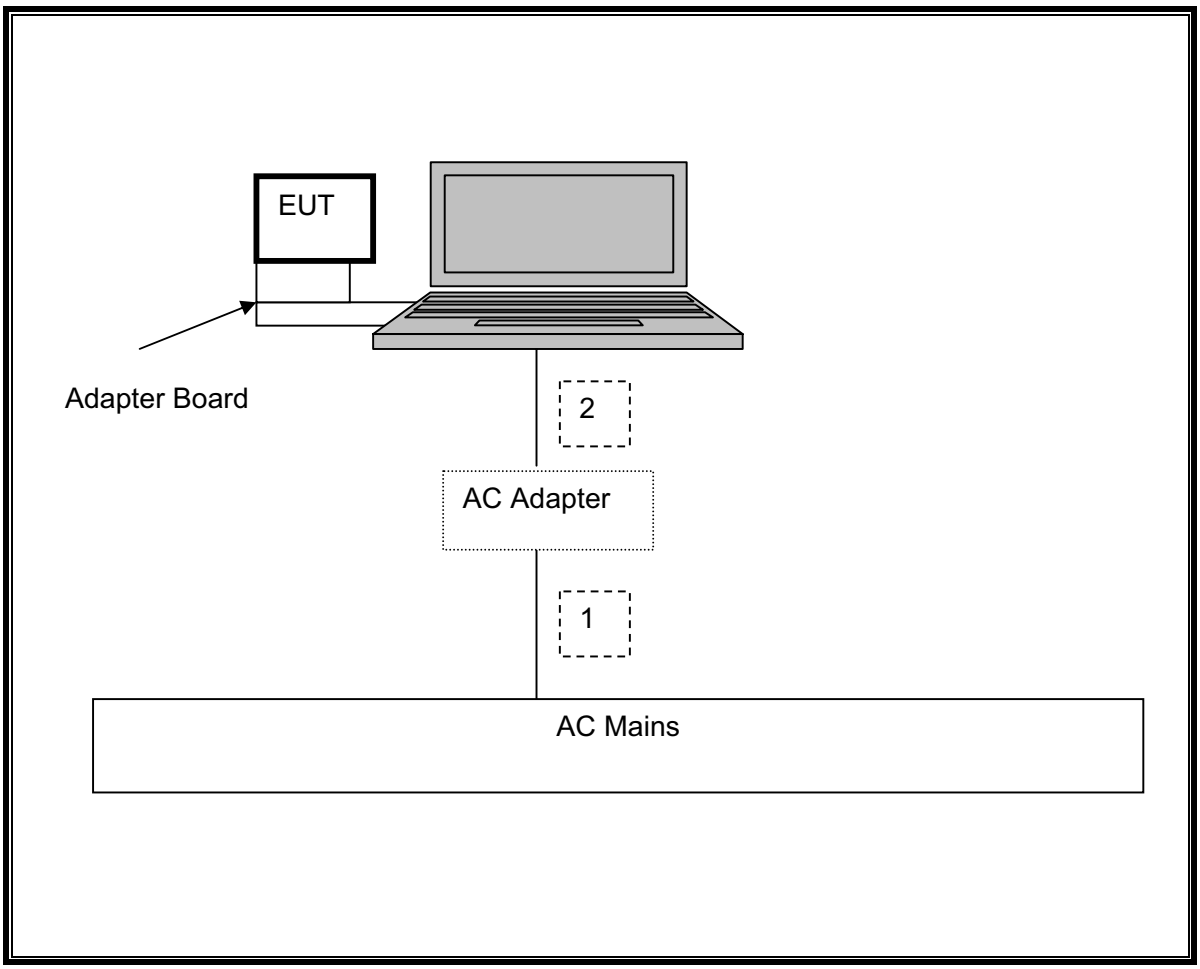
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.8 m	N/A
2	DC	1	DC	Unshielded	1.8 m	Ferrite on laptop's end

TEST SETUP

The EUT is connected to a host laptop computer via Express card to MiniPCI-E adapter board during the test. Test software exercised the radio card.

SETUP DIAGRAM



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**
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	02/06/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/11
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00945	04/22/10
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	11/28/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	03/31/10
Preamplifier, 1-26GHz	Agilent / HP	8449B	C01052	07/05/11
Peak Power Meter	Boonton	4541	C01186	02/26/11
Peak Power Sensor	Boonton	4541	C01189	02/23/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/10

7. ANTENNA PORT TEST RESULTS

7.1. 802.11n HT20 MODE IN THE 2.4 GHz BAND

7.1.1. OUTPUT POWER

LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The highest combination of antenna gains is equal to 7.94dBi, therefore the limit is 28.06dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

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

Channel	Frequency (MHz)	Limit (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Margin (dB)
Mid	2437	28.06	25.22	24.67	27.96	-0.10

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.

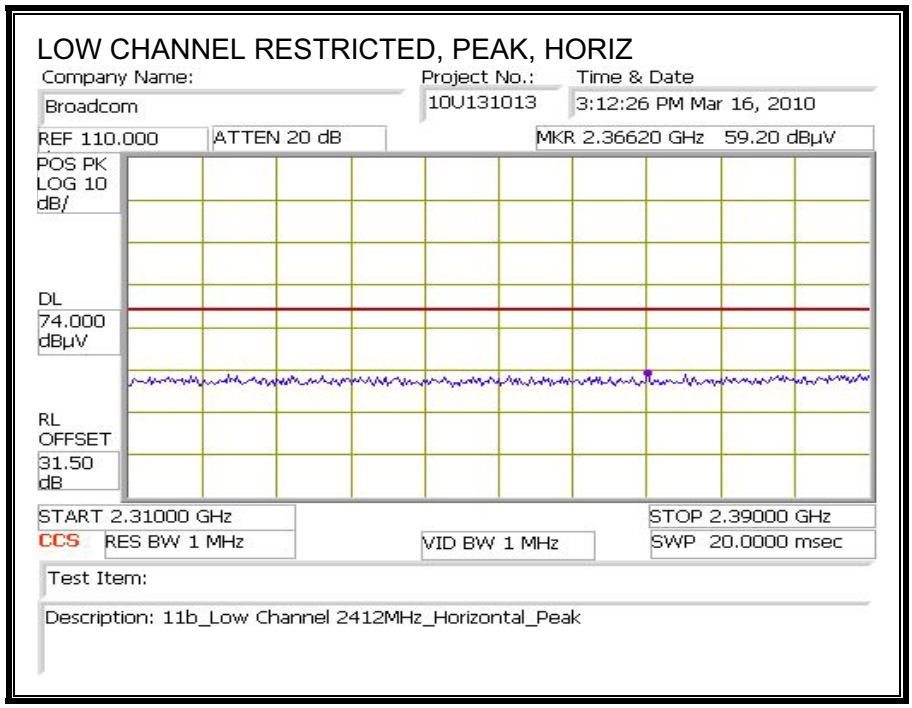
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

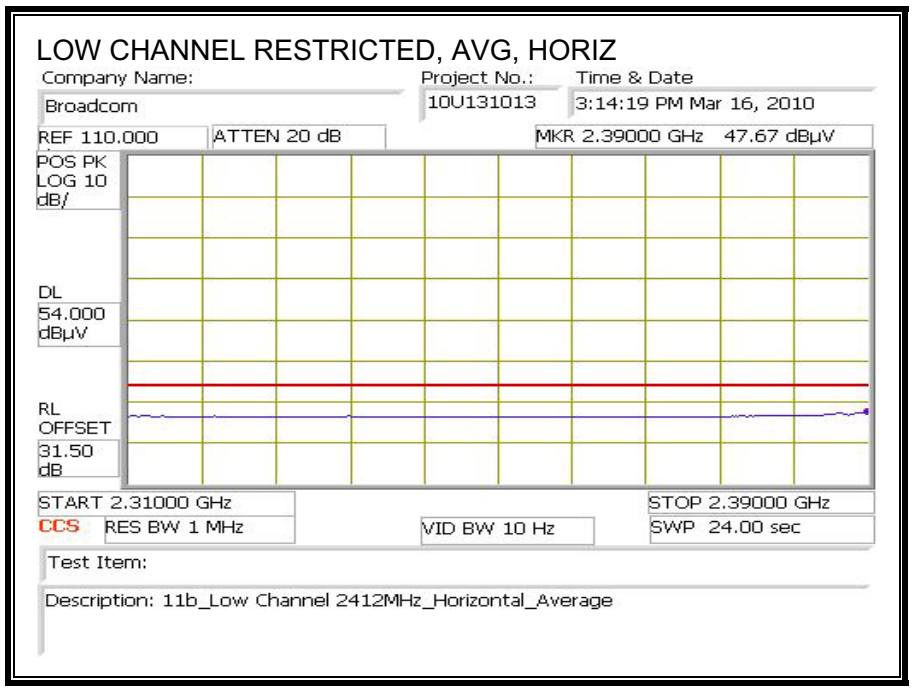
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

8.2. TRANSMITTER ABOVE 1 GHz

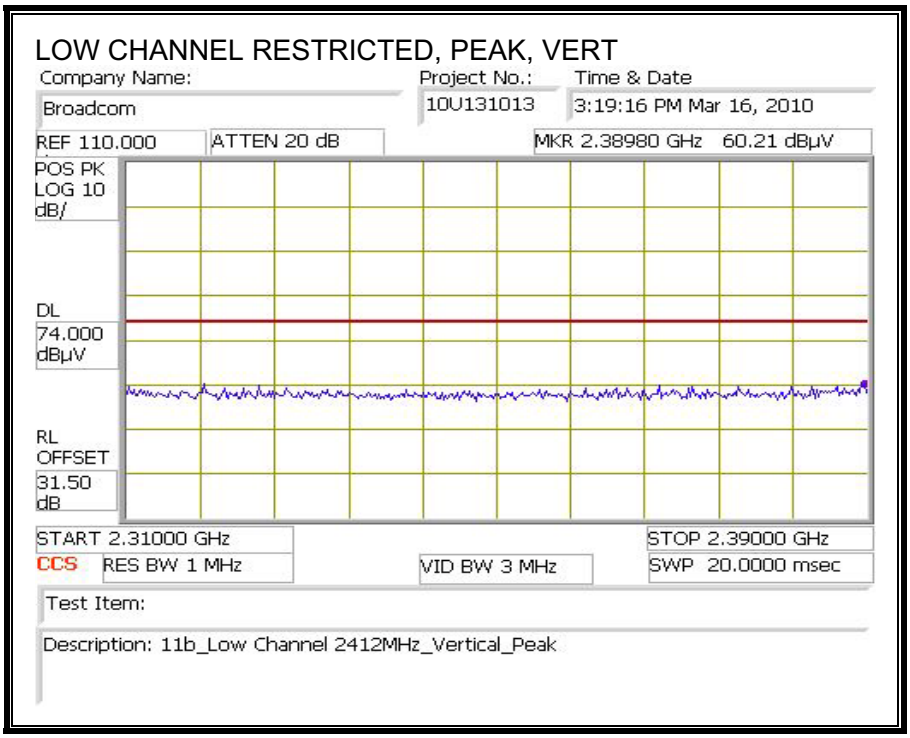
8.2.1. 802.11b MODE IN THE 2.4 GHz BAND

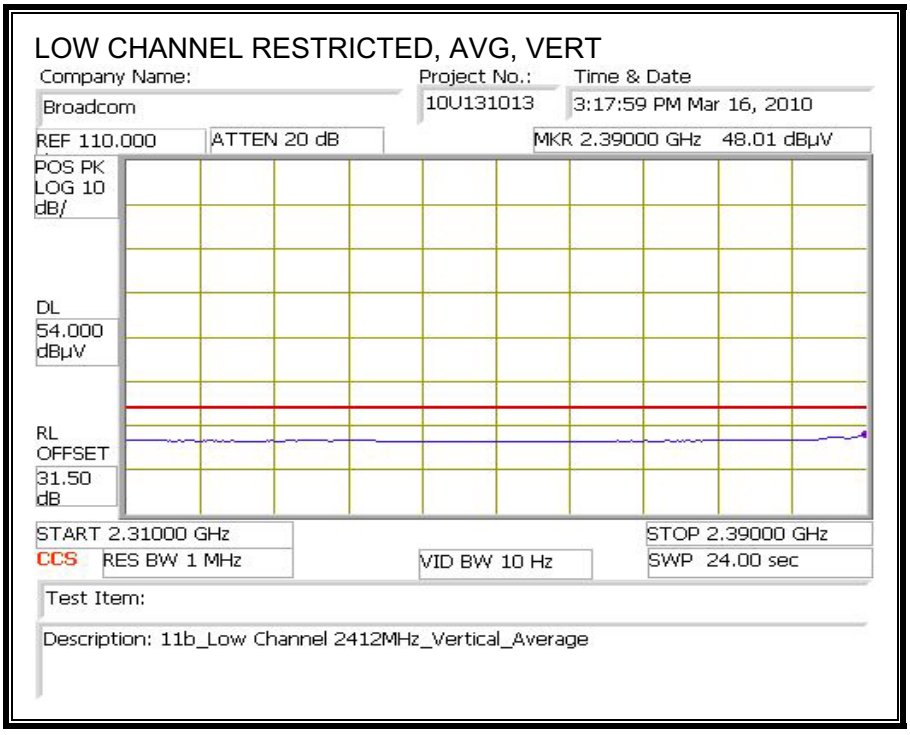
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



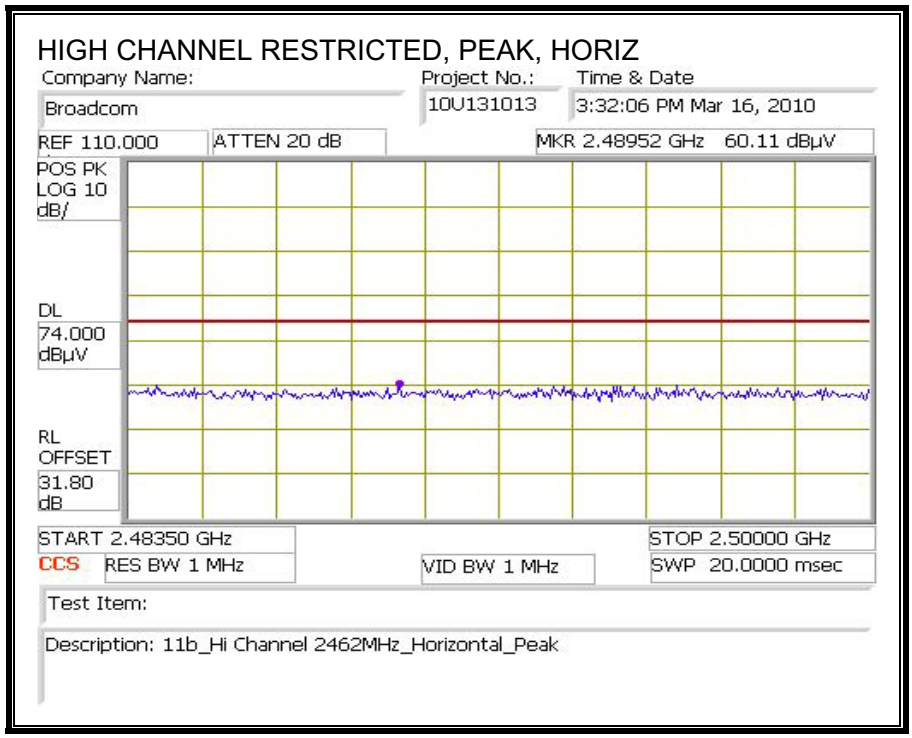


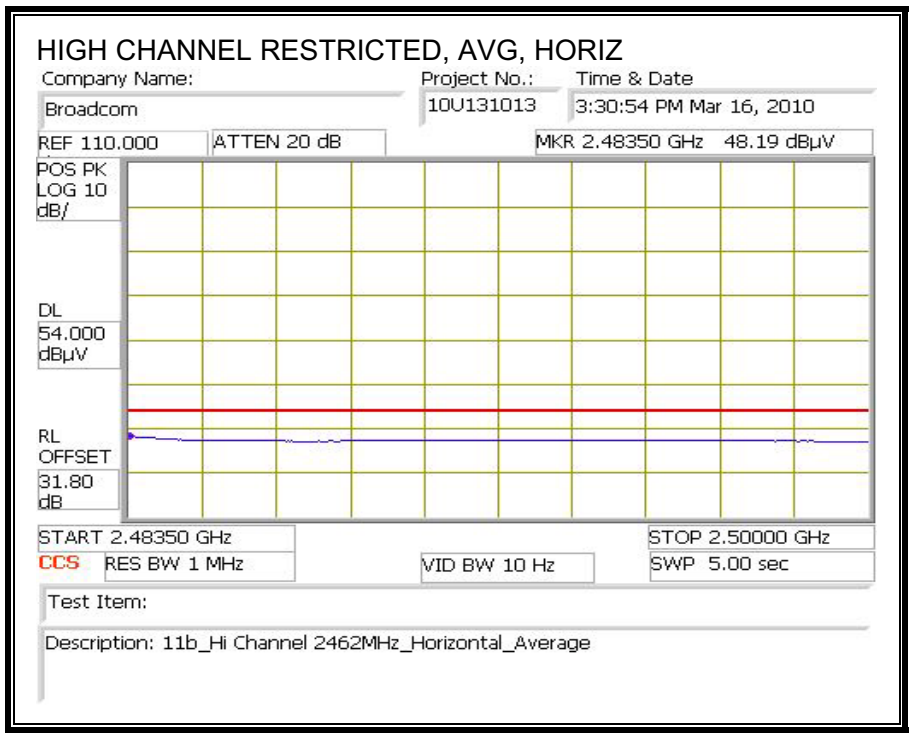
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



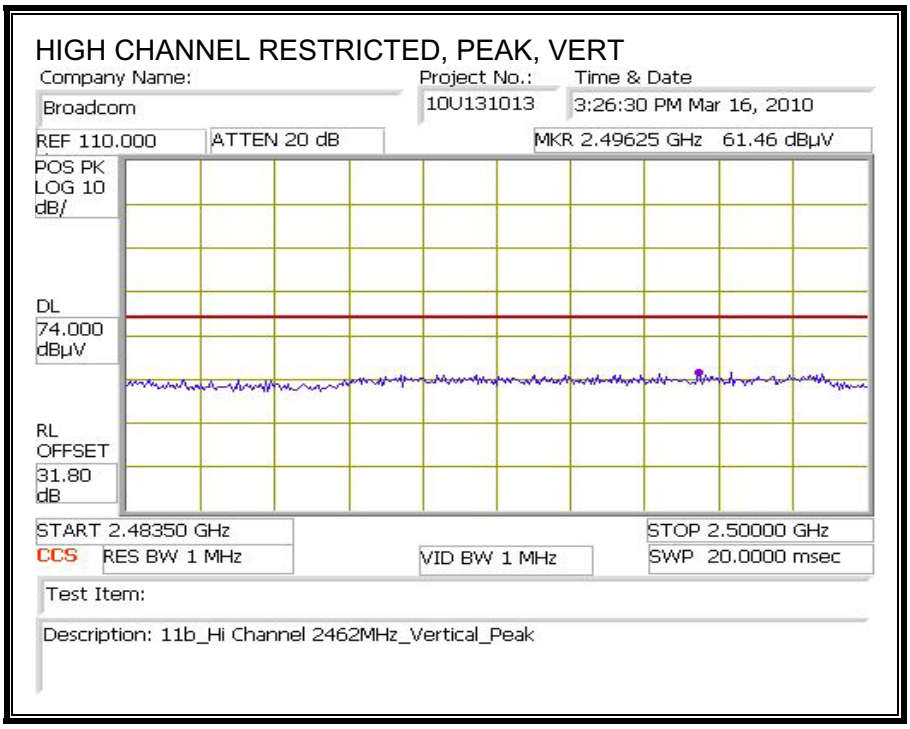


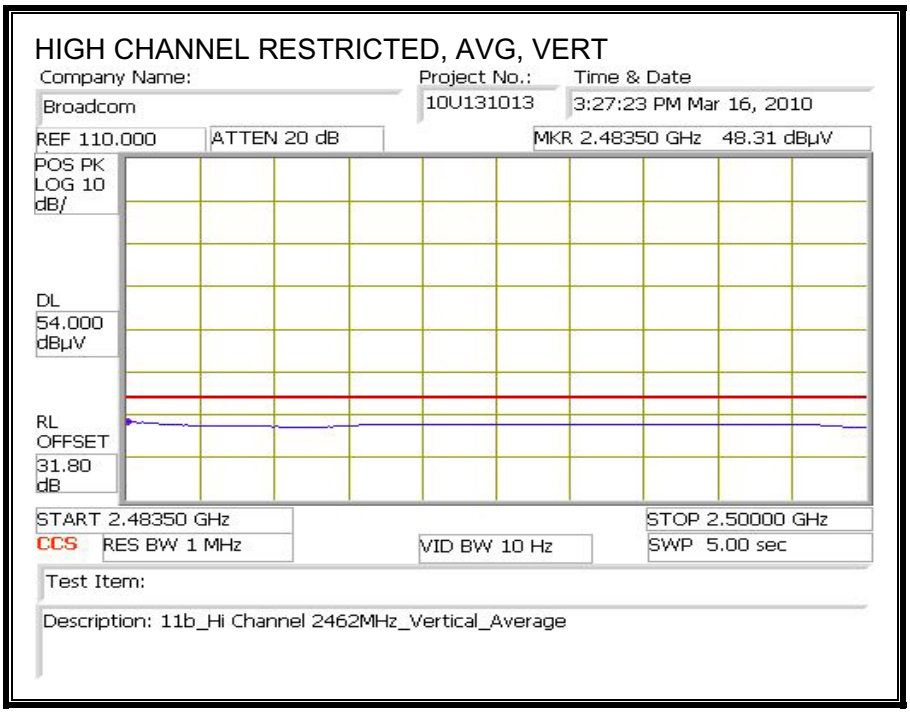
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Vien Tran
Date: 03/18/10
Project #: 10U13103
Company: Broadcom
EUT Description: 802.22ag/Draft 802.11n WLAN + Bluetooth PCI-E Mini Card
EUT M/N: BCM94322PCIEBT
Test Target: FCC Class B
Mode Oper: Tx 2.4GHz Band

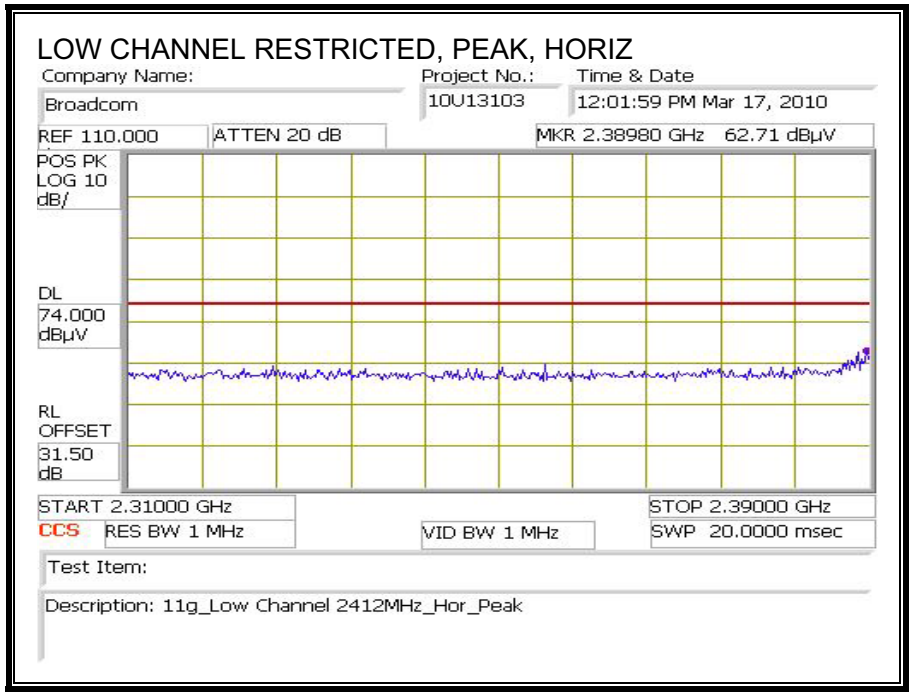
f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin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

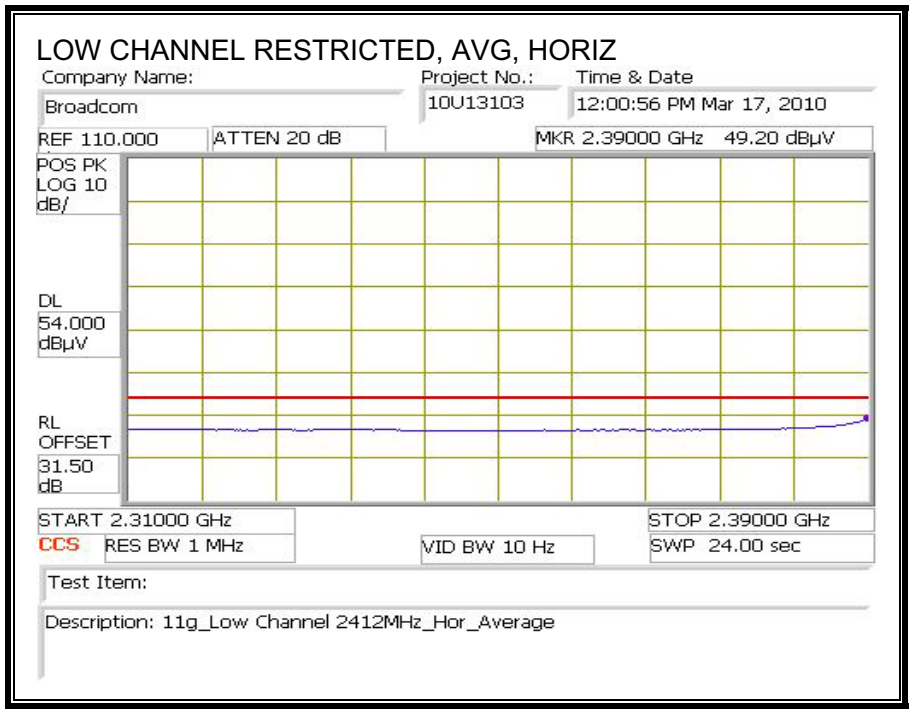
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
Low Channel, 2412MHz													
4.824	3.0	40.4	32.7	5.8	-34.8	0.0	0.0	44.0	74.0	-30.0	V	P	
4.824	3.0	34.7	32.7	5.8	-34.8	0.0	0.0	38.3	54.0	-15.7	V	A	
12.060	3.0	35.2	38.5	9.8	-32.5	0.0	0.0	51.0	74.0	-23.0	V	P	
12.060	3.0	25.2	38.5	9.8	-32.5	0.0	0.0	41.0	54.0	-13.0	V	A	
4.824	3.0	42.0	32.7	5.8	-34.8	0.0	0.0	45.7	74.0	-28.3	H	P	
4.824	3.0	36.2	32.7	5.8	-34.8	0.0	0.0	39.8	54.0	-14.2	H	A	
12.060	3.0	35.3	38.5	9.8	-32.5	0.0	0.0	51.1	74.0	-22.9	H	P	
12.060	3.0	25.0	38.5	9.8	-32.5	0.0	0.0	40.8	54.0	-13.2	H	A	
Mid Channel, 2437MHz													
4.874	3.0	42.9	32.7	5.8	-34.8	0.0	0.0	46.6	74.0	-27.4	V	P	
4.874	3.0	38.8	32.7	5.8	-34.8	0.0	0.0	42.5	54.0	-11.5	V	A	
7.311	3.0	43.5	35.5	7.3	-34.1	0.0	0.0	52.2	74.0	-21.8	V	P	
7.311	3.0	37.5	35.5	7.3	-34.1	0.0	0.0	46.1	54.0	-7.9	V	A	
12.185	3.0	35.1	38.5	9.8	-32.5	0.0	0.0	50.9	74.0	-23.1	V	P	
12.185	3.0	25.5	38.5	9.8	-32.5	0.0	0.0	41.3	54.0	-12.7	V	A	
4.874	3.0	41.8	32.7	5.8	-34.8	0.0	0.0	45.5	74.0	-28.5	H	P	
4.874	3.0	37.7	32.7	5.8	-34.8	0.0	0.0	41.4	54.0	-12.6	H	A	
7.311	3.0	40.5	35.5	7.3	-34.1	0.0	0.0	49.1	74.0	-24.9	H	P	
7.311	3.0	33.5	35.5	7.3	-34.1	0.0	0.0	42.1	54.0	-11.9	H	A	
12.185	3.0	35.0	38.5	9.8	-32.5	0.0	0.0	50.8	74.0	-23.2	H	P	
12.185	3.0	24.1	38.5	9.8	-32.5	0.0	0.0	40.0	54.0	-14.0	H	A	
High Channel, 2462MHz													
4.924	3.0	43.0	32.7	5.9	-34.8	0.0	0.0	46.8	74.0	-27.2	V	P	
4.924	3.0	38.6	32.7	5.9	-34.8	0.0	0.0	42.4	54.0	-11.6	V	A	
7.386	3.0	43.6	35.6	7.3	-34.1	0.0	0.0	52.3	74.0	-21.7	V	P	
7.386	3.0	37.5	35.6	7.3	-34.1	0.0	0.0	46.3	54.0	-7.7	V	A	
12.310	3.0	33.9	38.5	9.9	-32.5	0.0	0.0	49.8	74.0	-24.2	V	P	
12.310	3.0	23.0	38.5	9.9	-32.5	0.0	0.0	38.9	54.0	-15.1	V	A	
4.924	3.0	43.3	32.7	5.9	-34.8	0.0	0.0	47.1	74.0	-26.9	H	P	
4.924	3.0	39.2	32.7	5.9	-34.8	0.0	0.0	43.0	54.0	-11.0	H	A	
7.386	3.0	40.3	35.6	7.3	-34.1	0.0	0.0	49.1	74.0	-24.9	H	P	
7.386	3.0	33.7	35.6	7.3	-34.1	0.0	0.0	42.5	54.0	-11.5	H	A	
12.310	3.0	34.0	38.5	9.9	-32.5	0.0	0.0	49.9	74.0	-24.1	H	P	
12.310	3.0	22.4	38.5	9.9	-32.5	0.0	0.0	38.3	54.0	-15.7	H	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

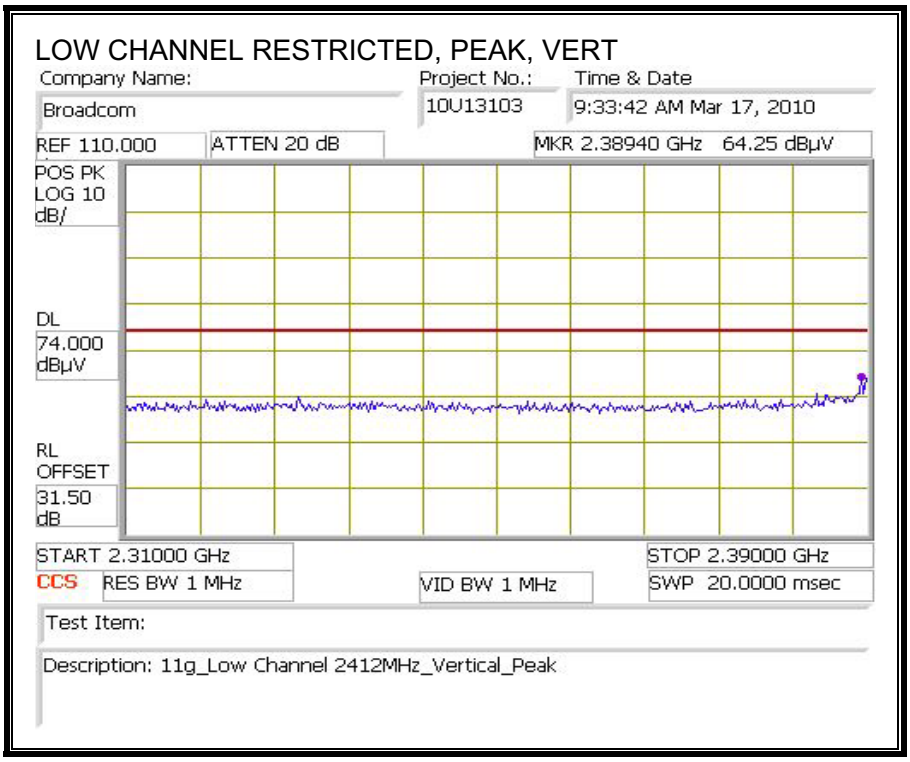
8.2.2. 802.11g MODE IN THE 2.4 GHz BAND

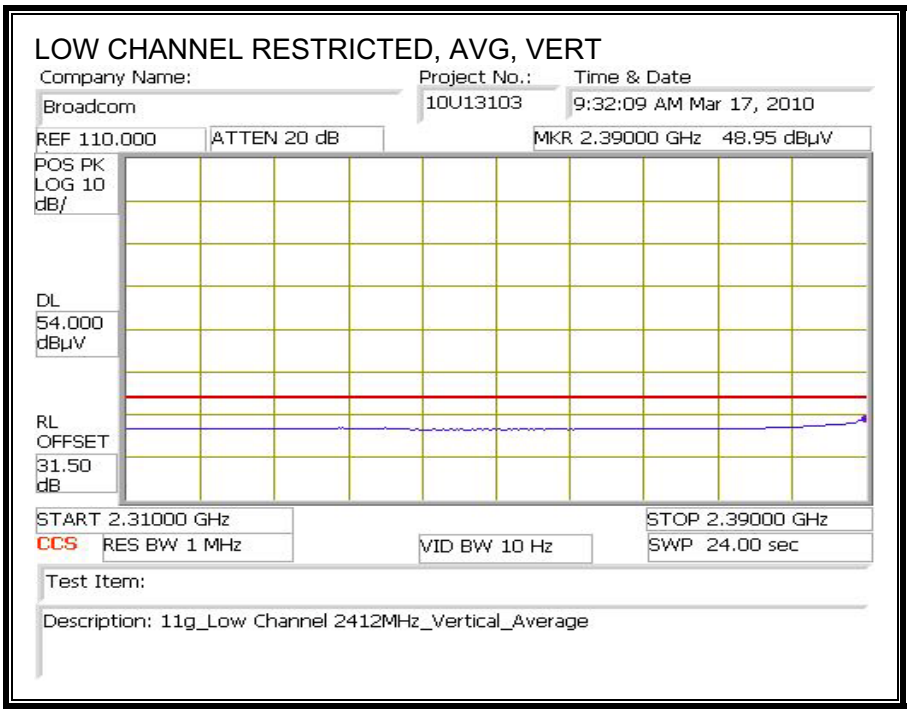
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



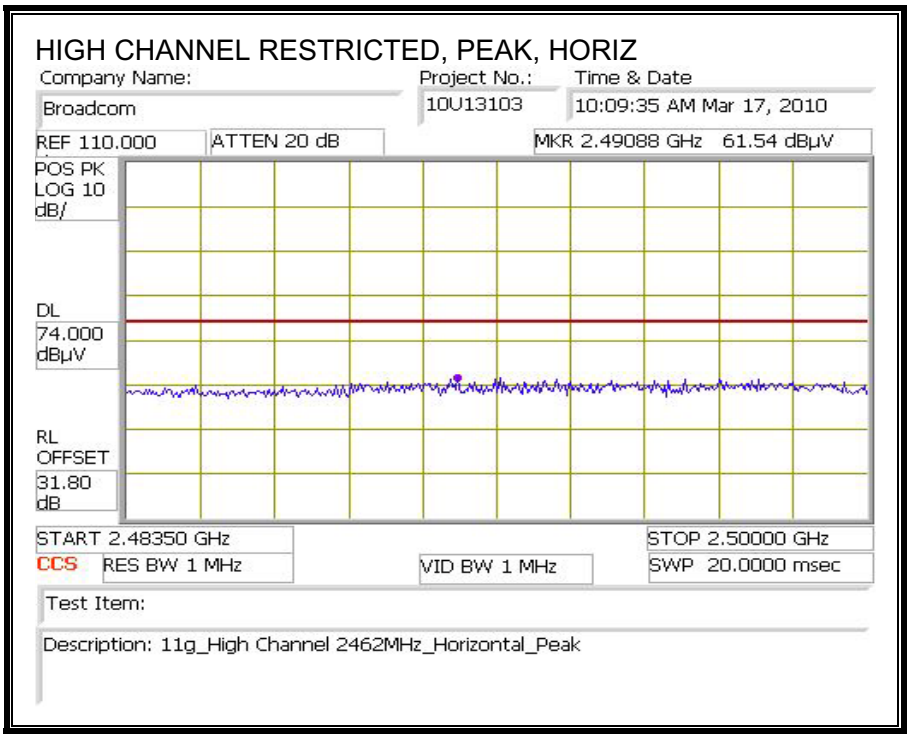


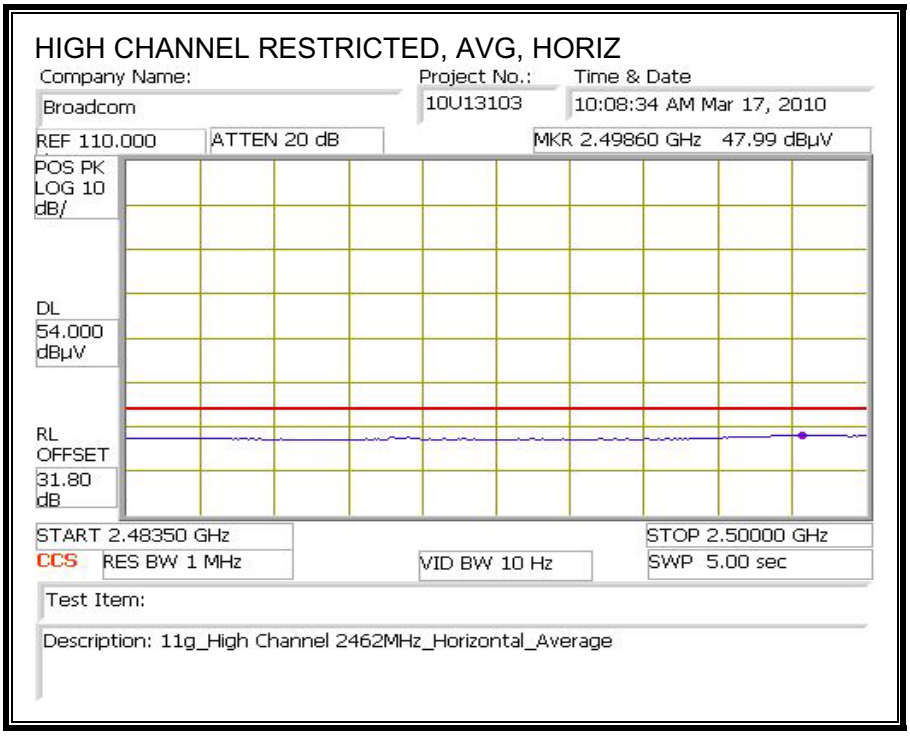
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



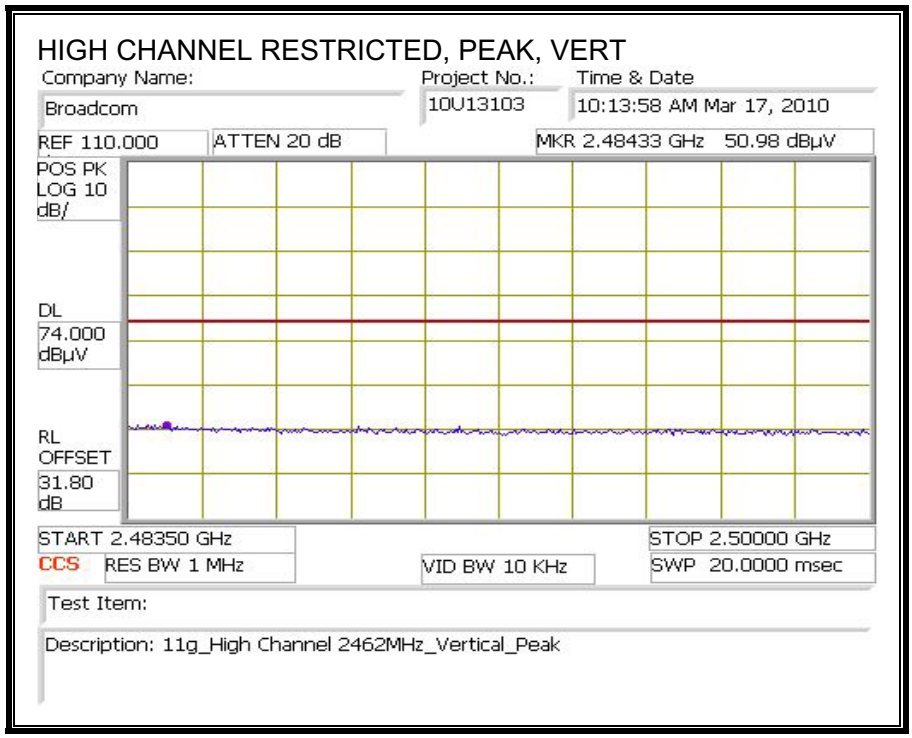


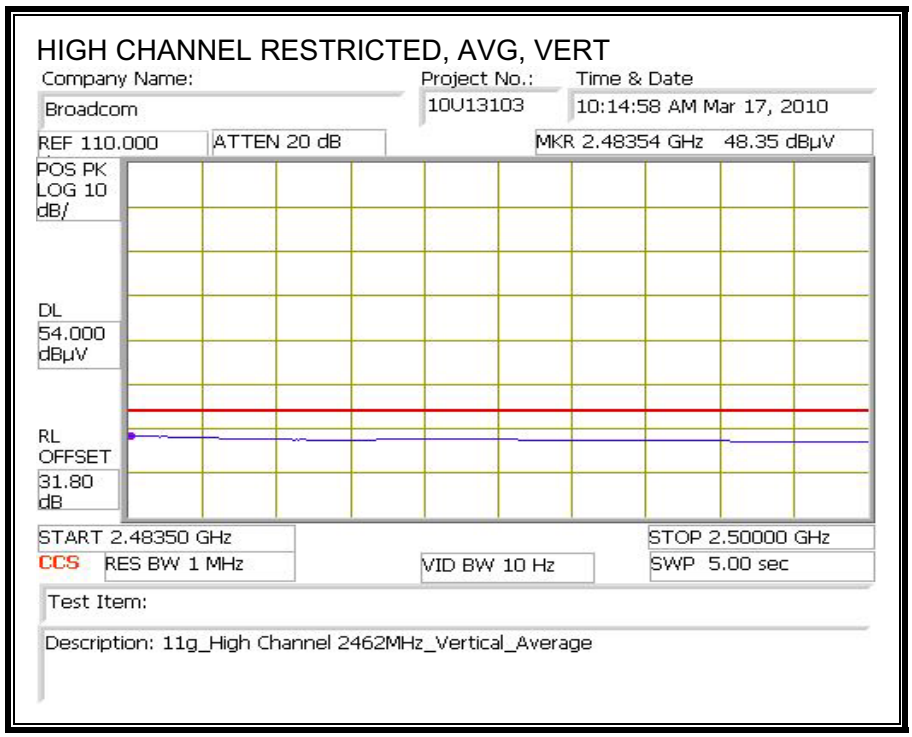
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





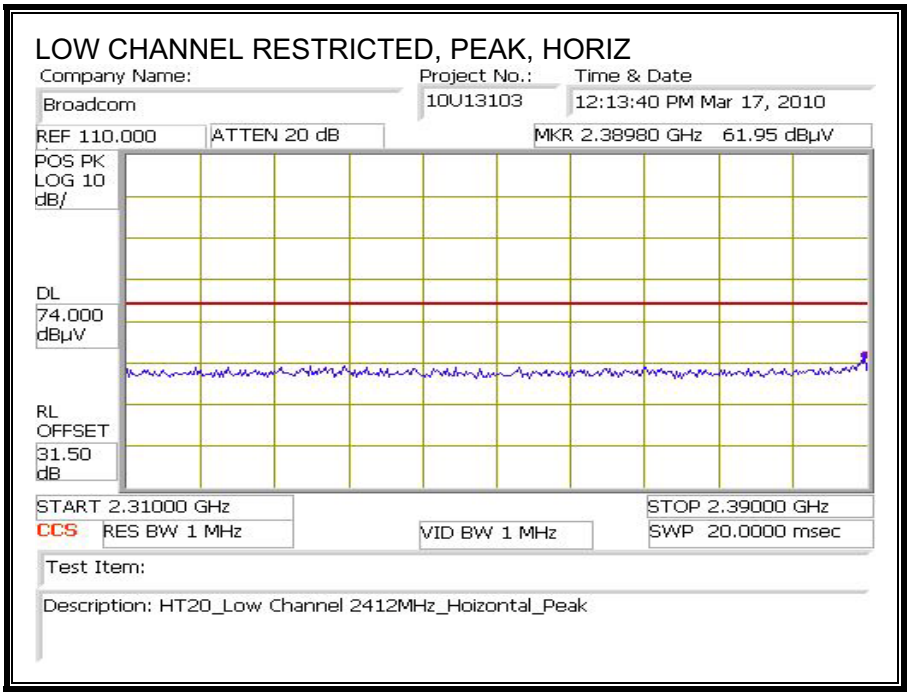
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

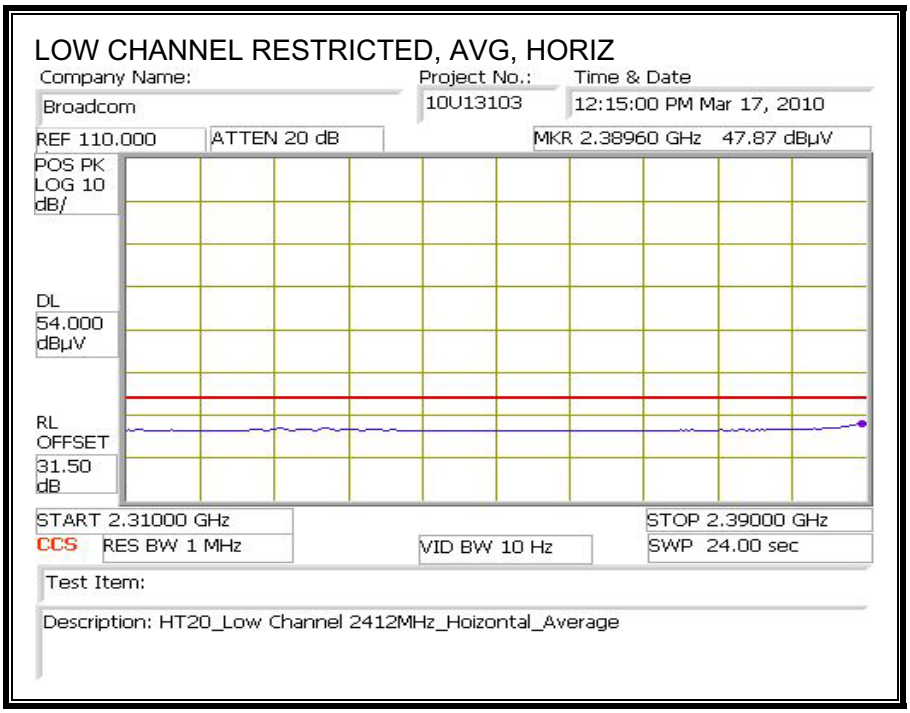




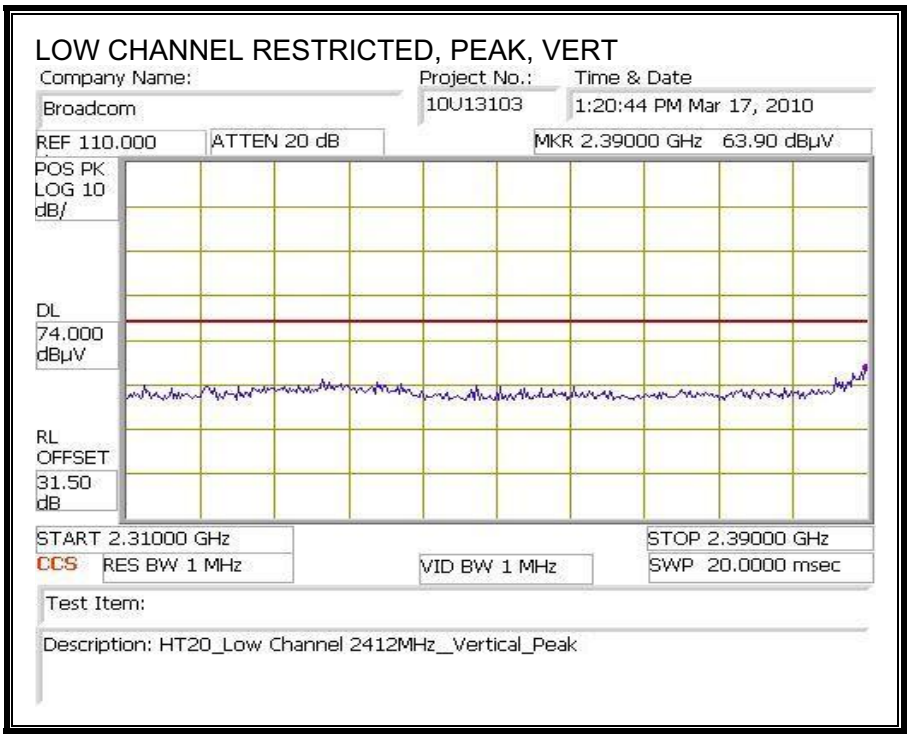
8.2.3. 802.11n HT20 MODE MCS0 IN THE 2.4 GHz BAND

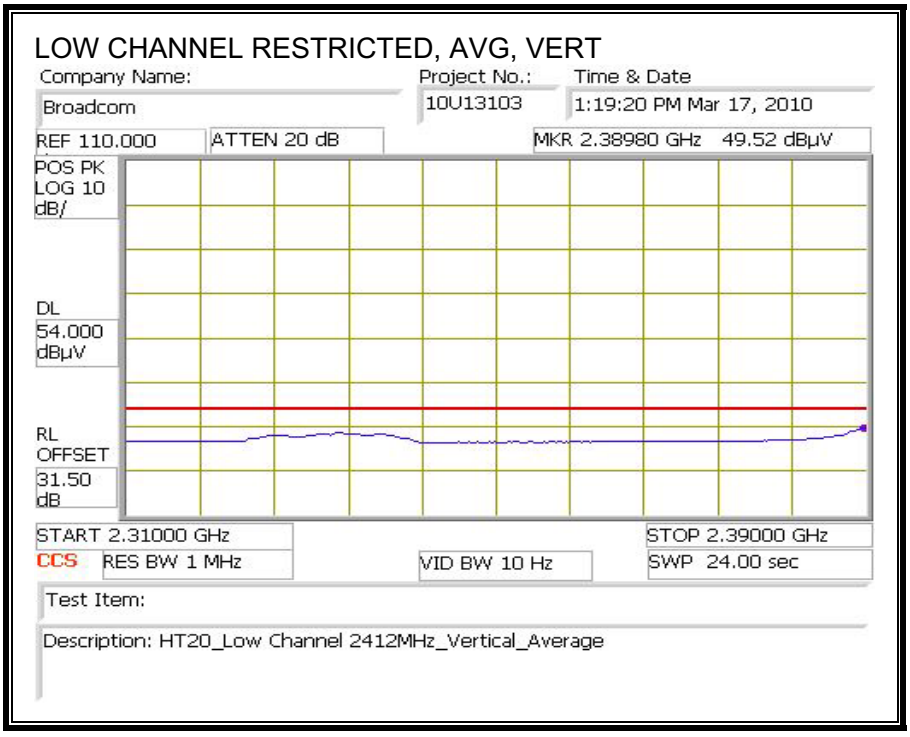
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



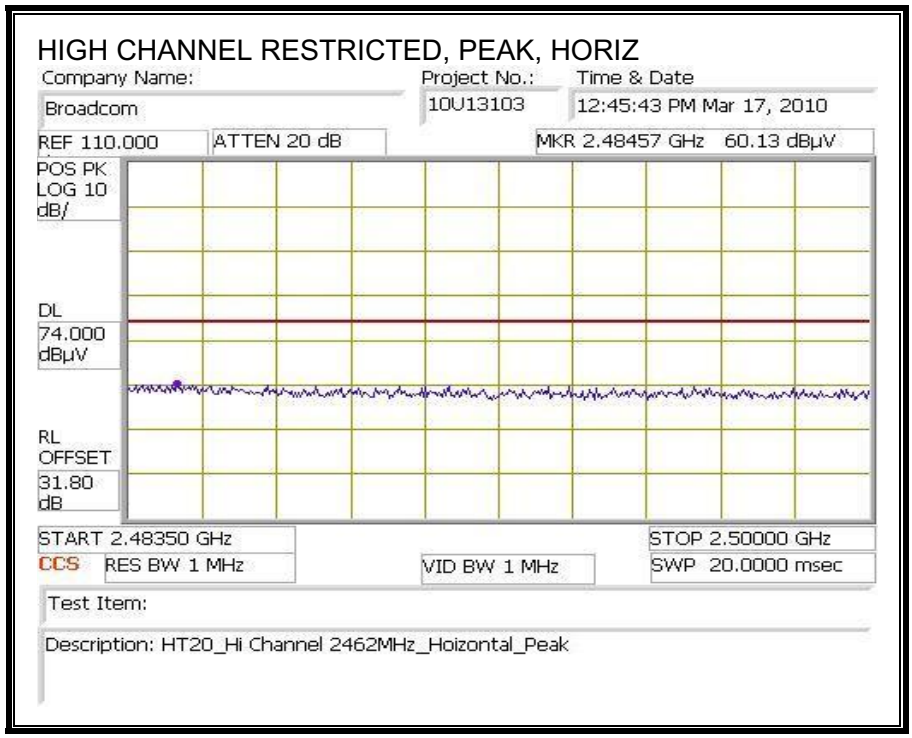


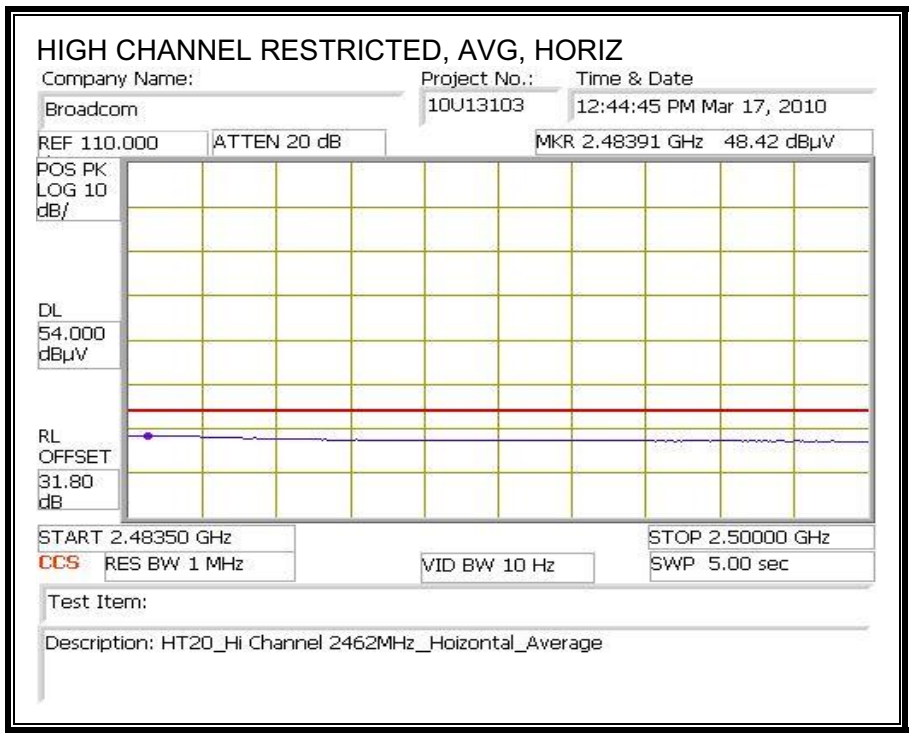
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



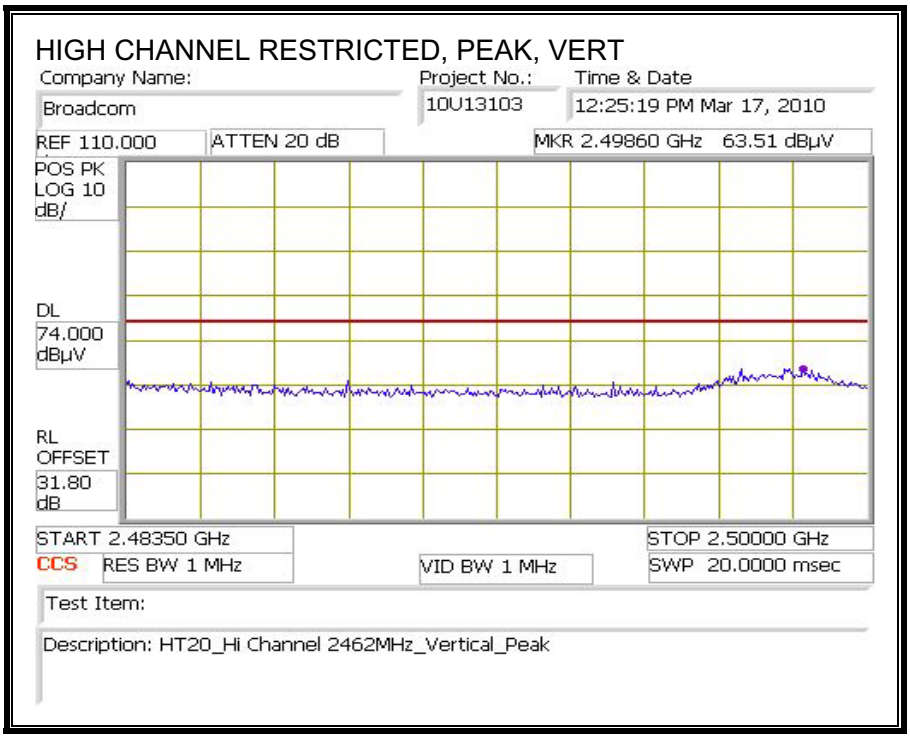


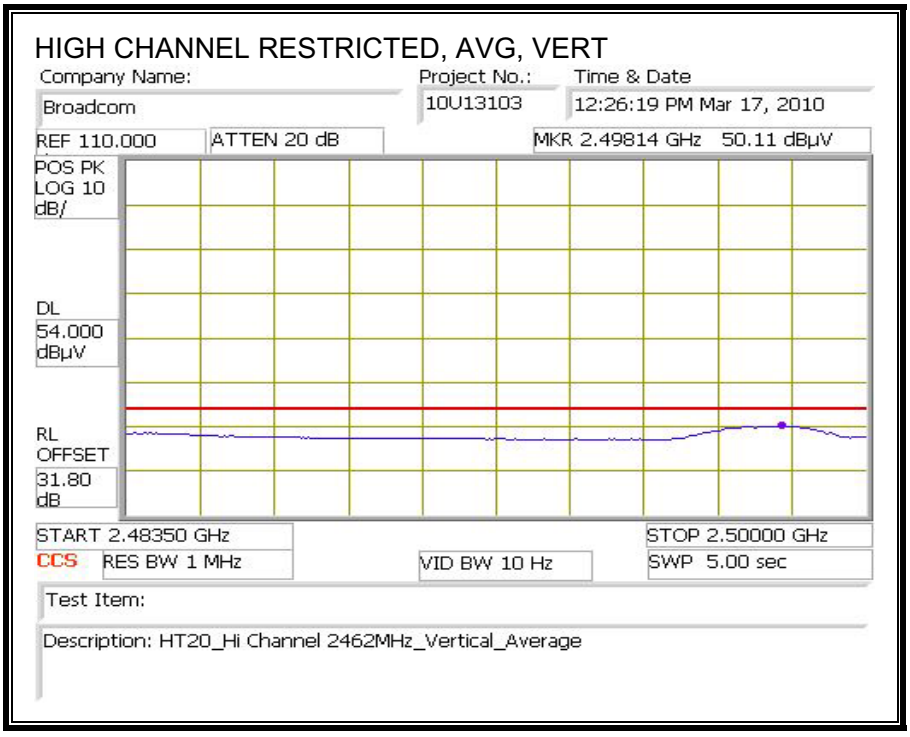
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





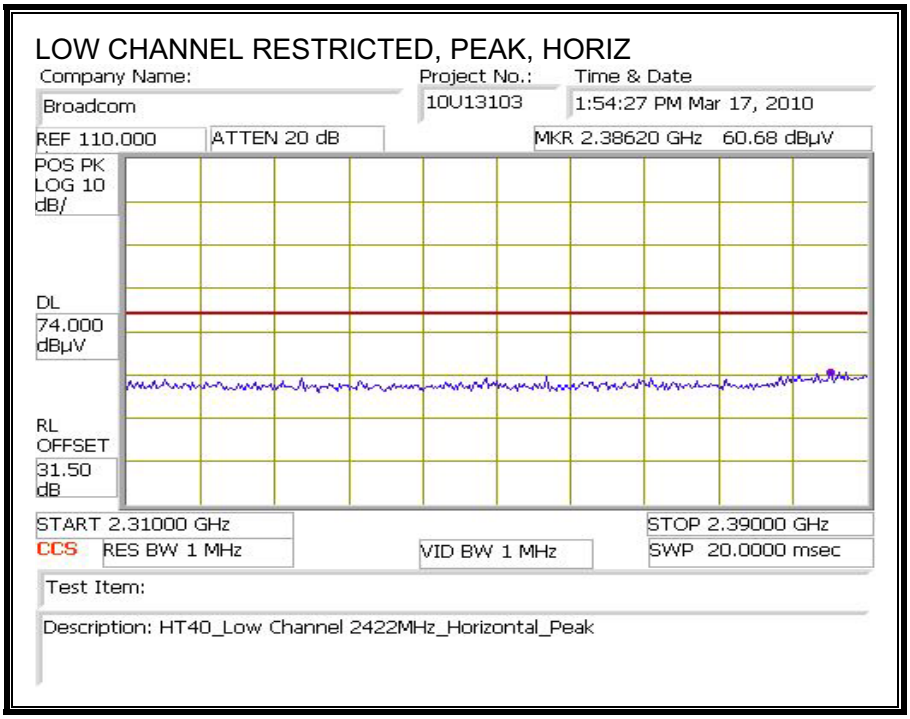
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

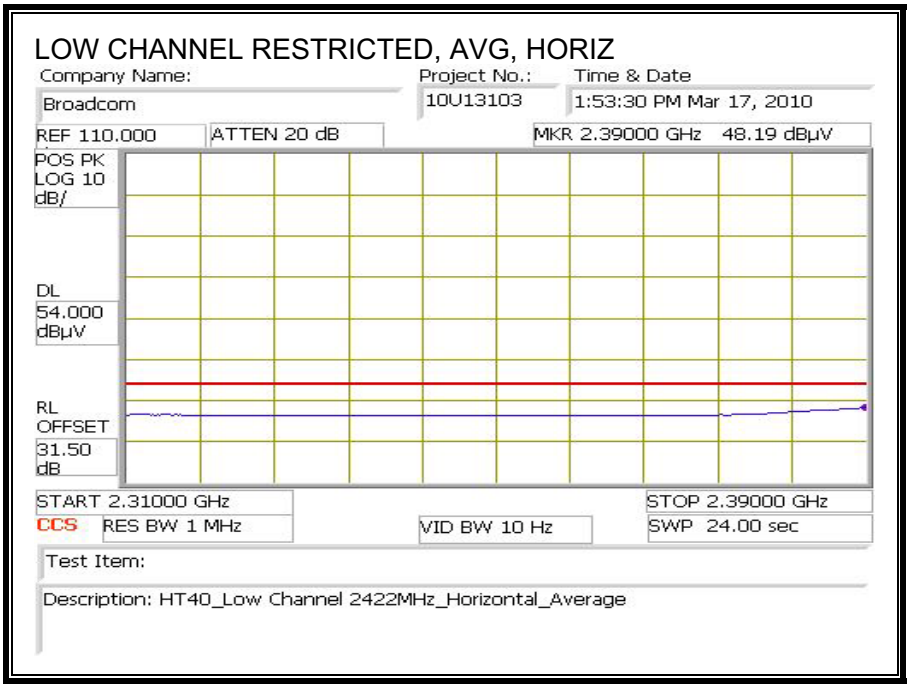




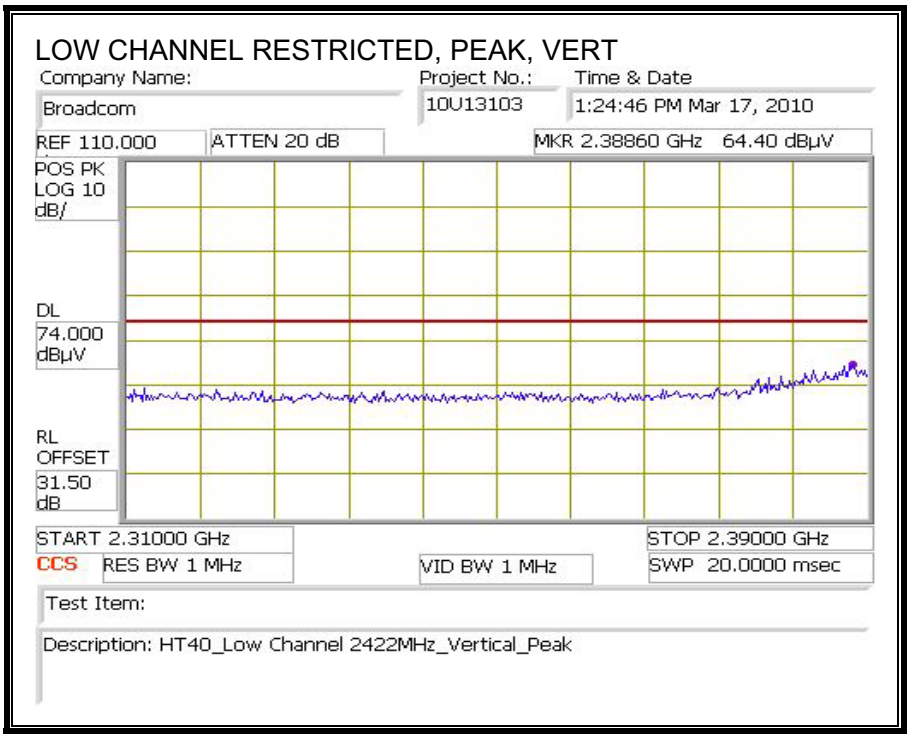
8.2.4. 802.11n HT40 MODE SISO IN THE 2.4 GHz BAND

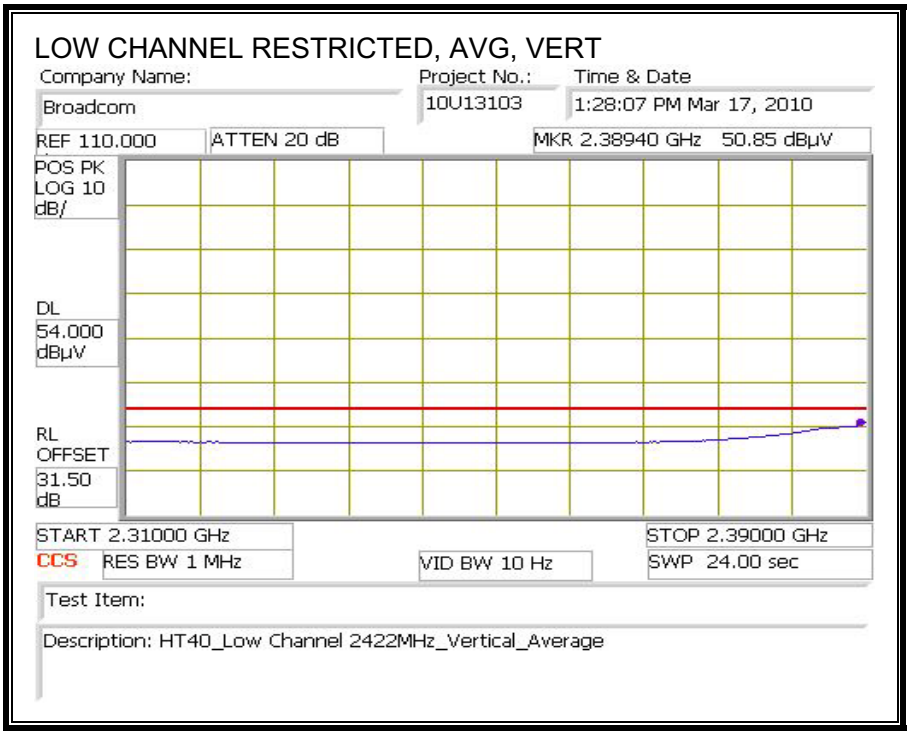
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



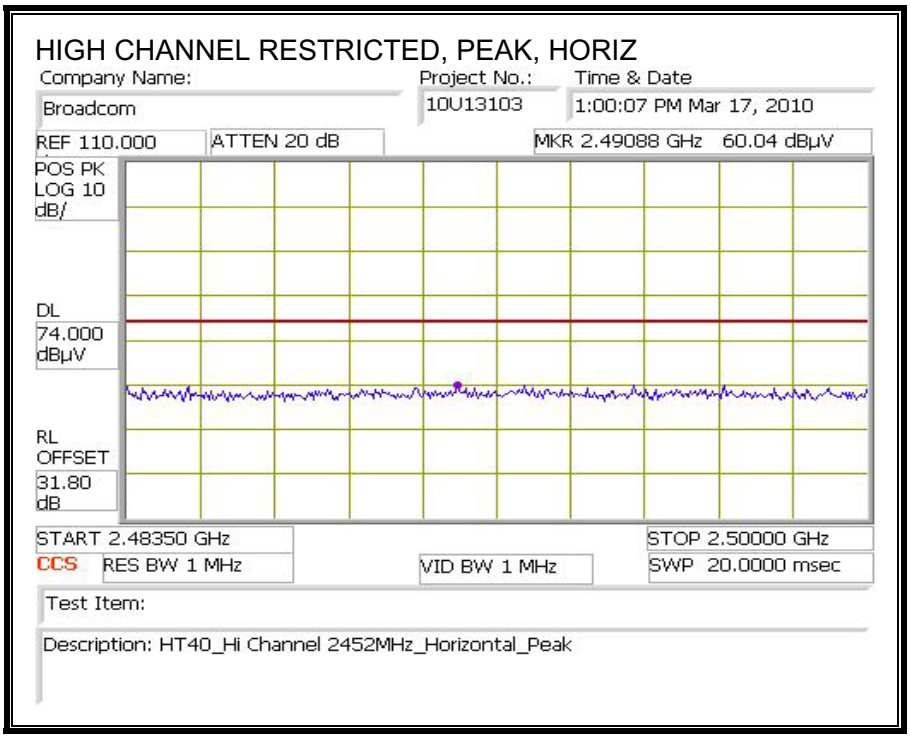


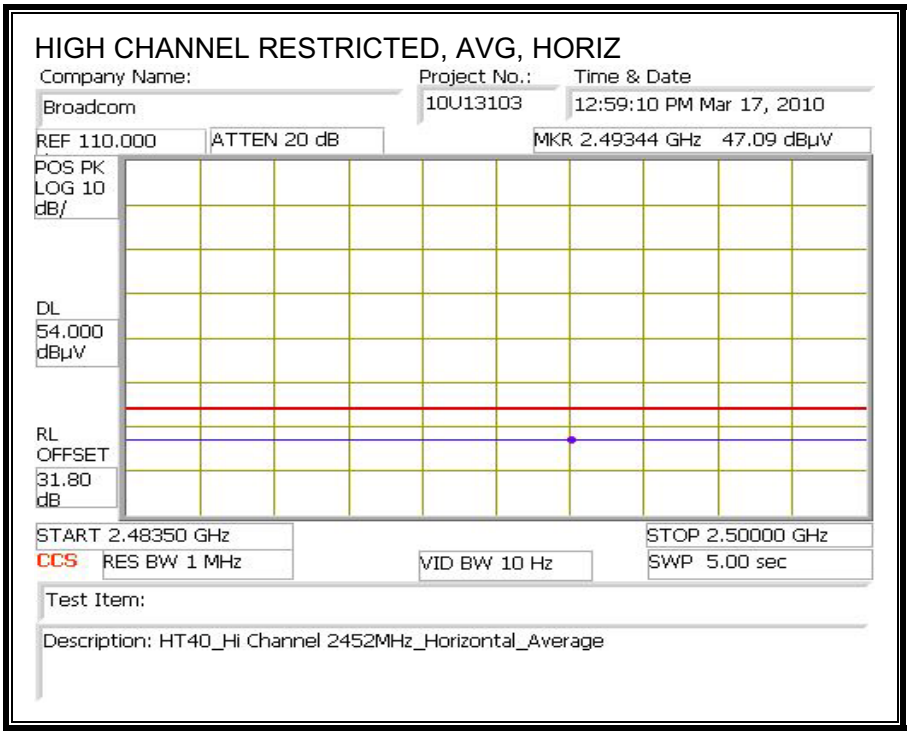
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



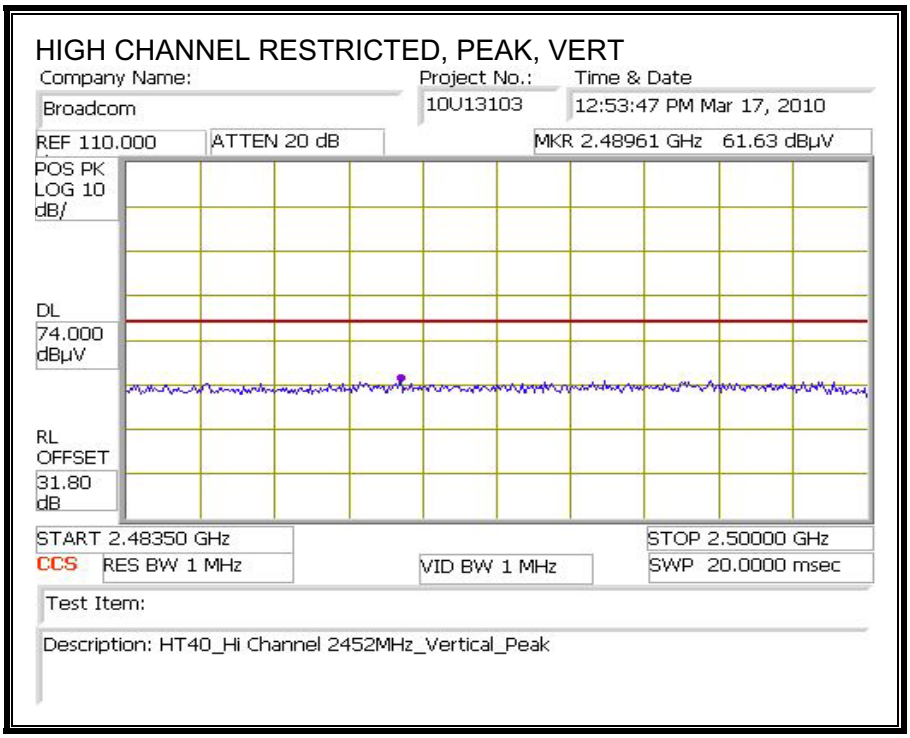


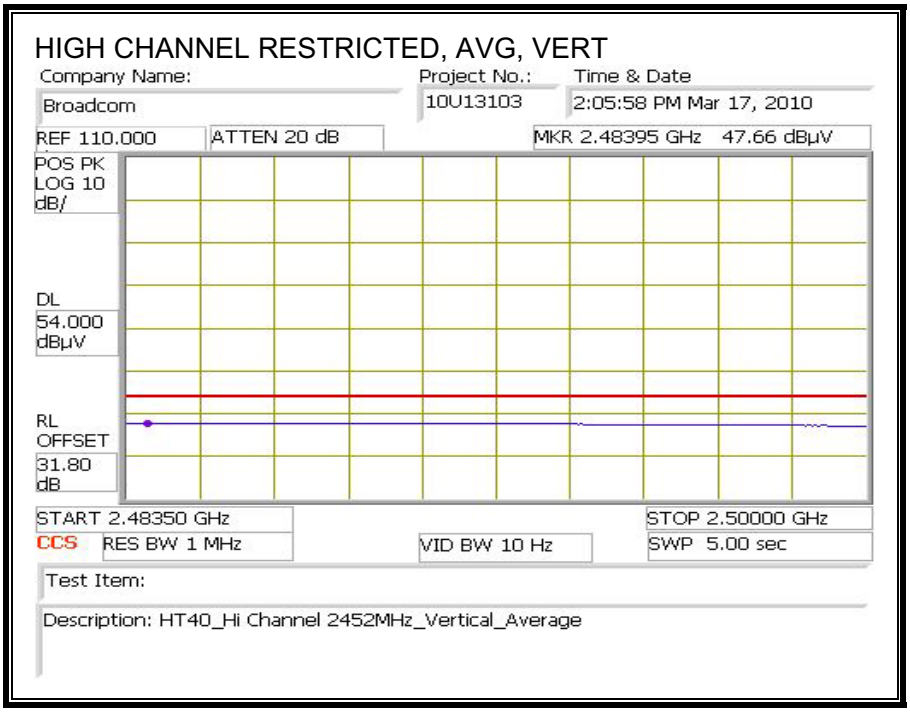
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





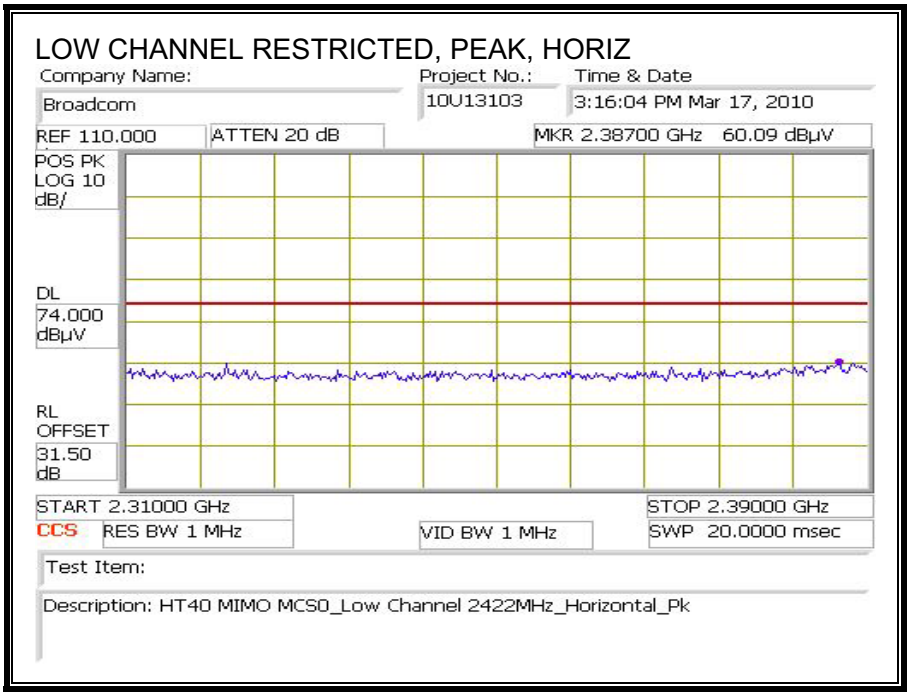
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

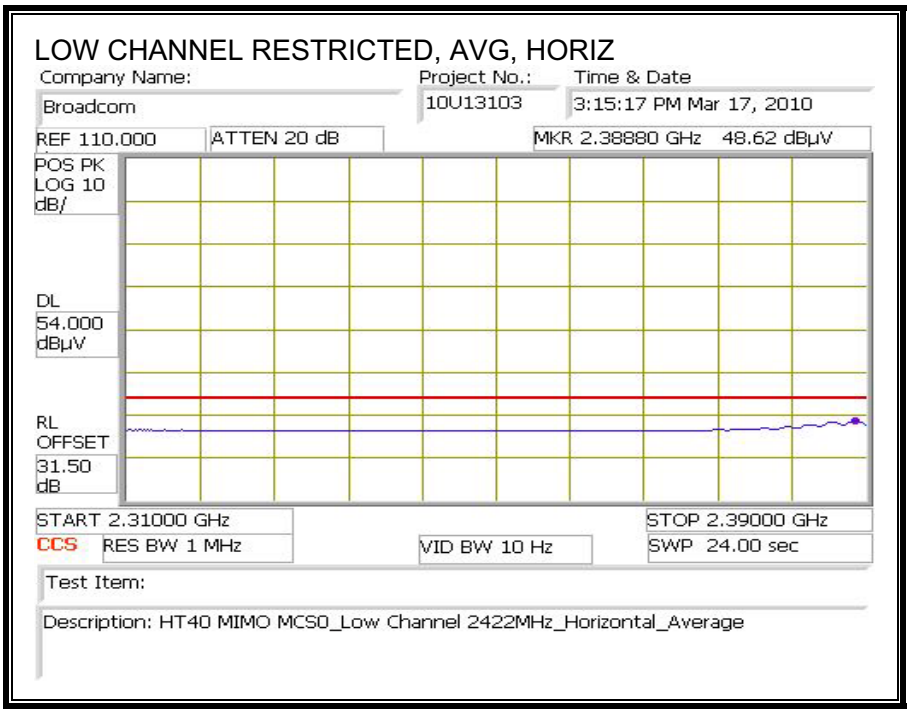




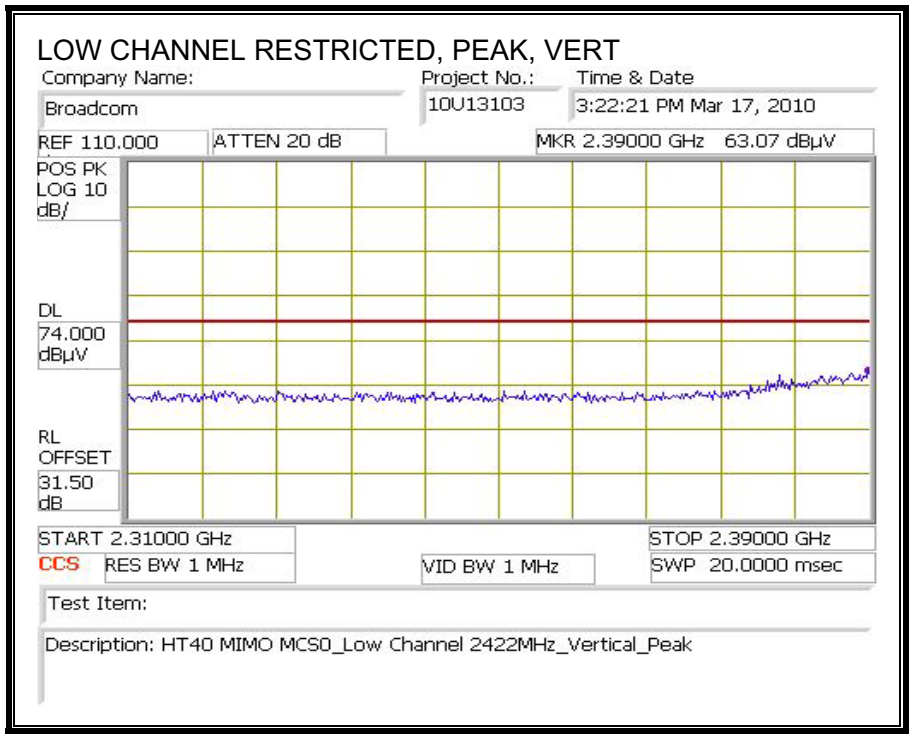
8.2.5. 802.11n HT40 MODE MIMO MCS0 IN THE 2.4 GHz BAND

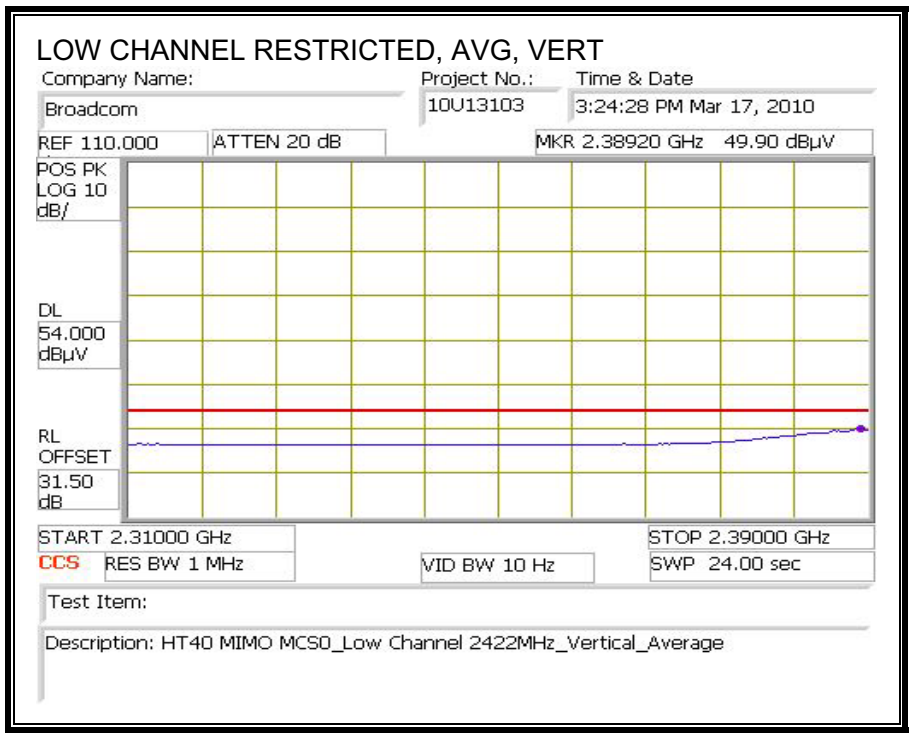
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



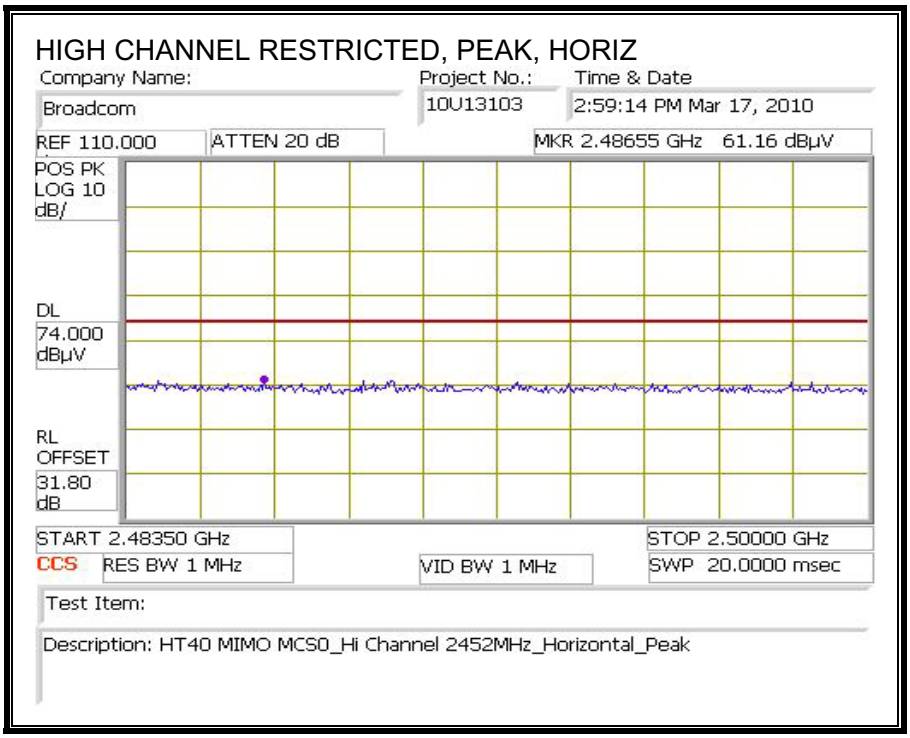


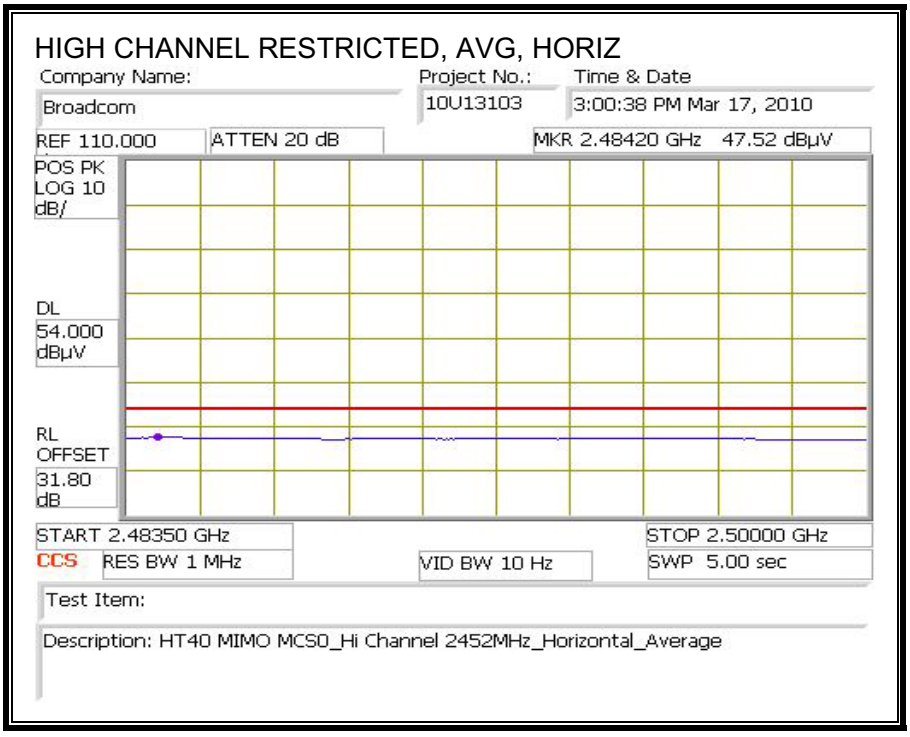
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



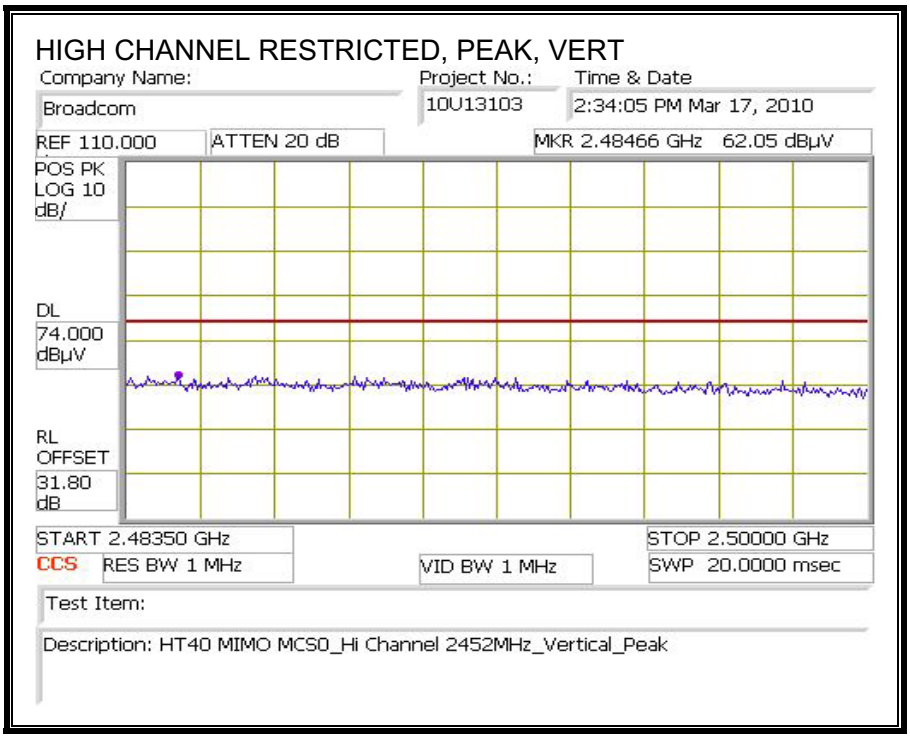


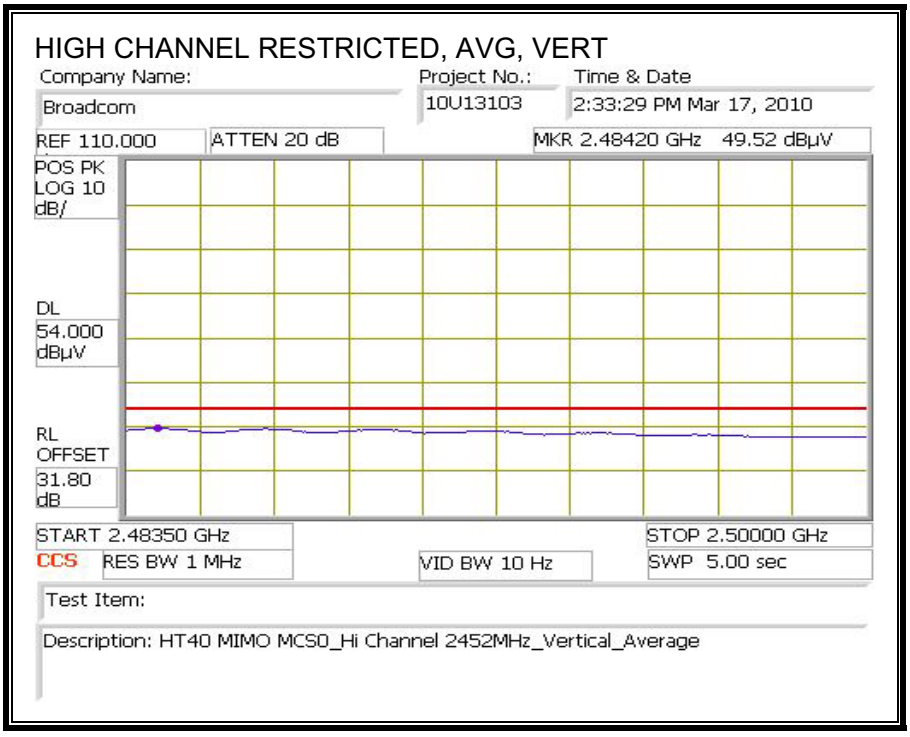
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





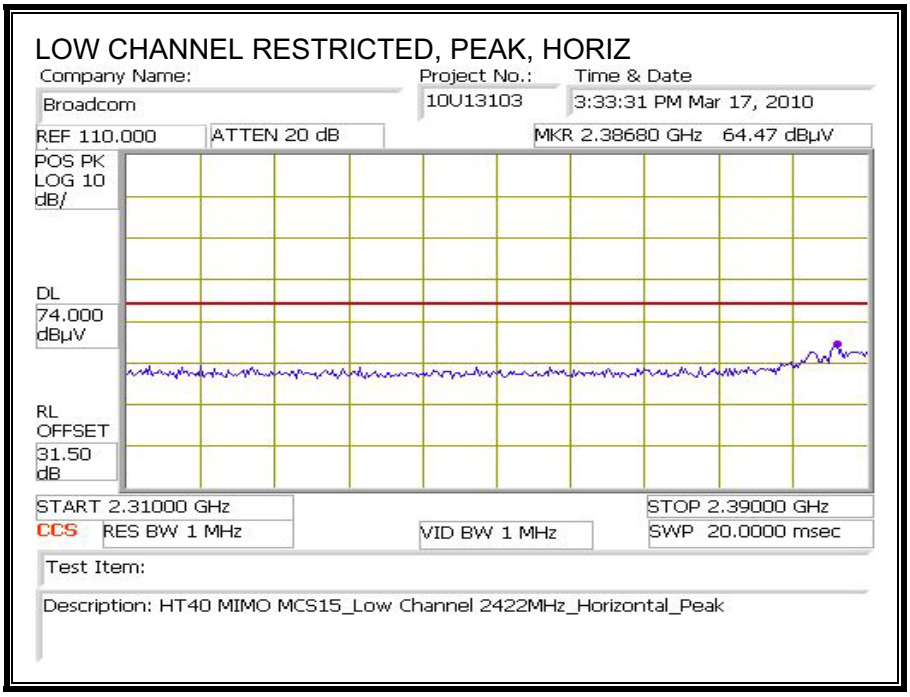
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

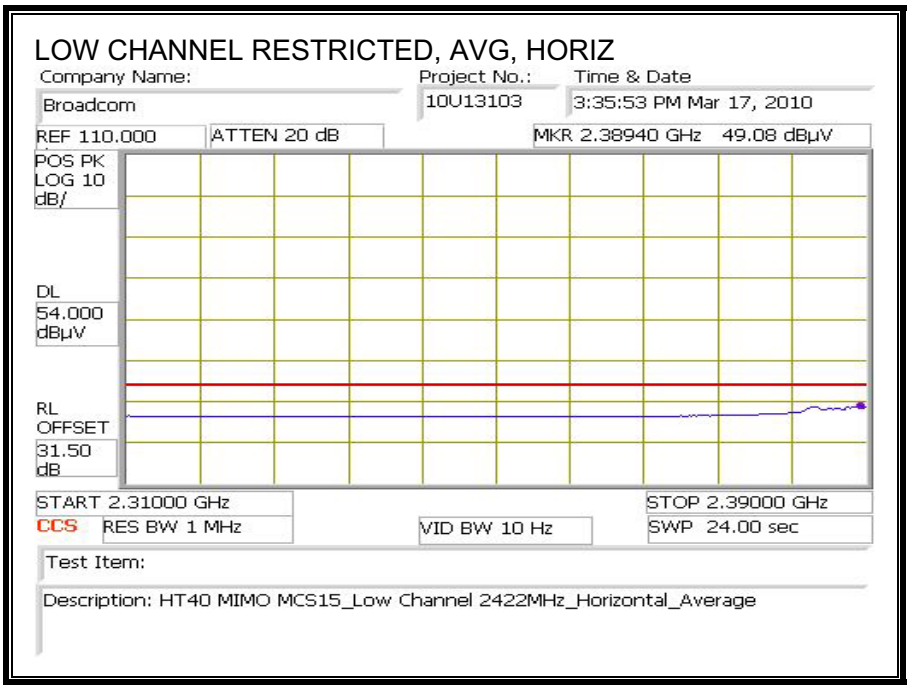




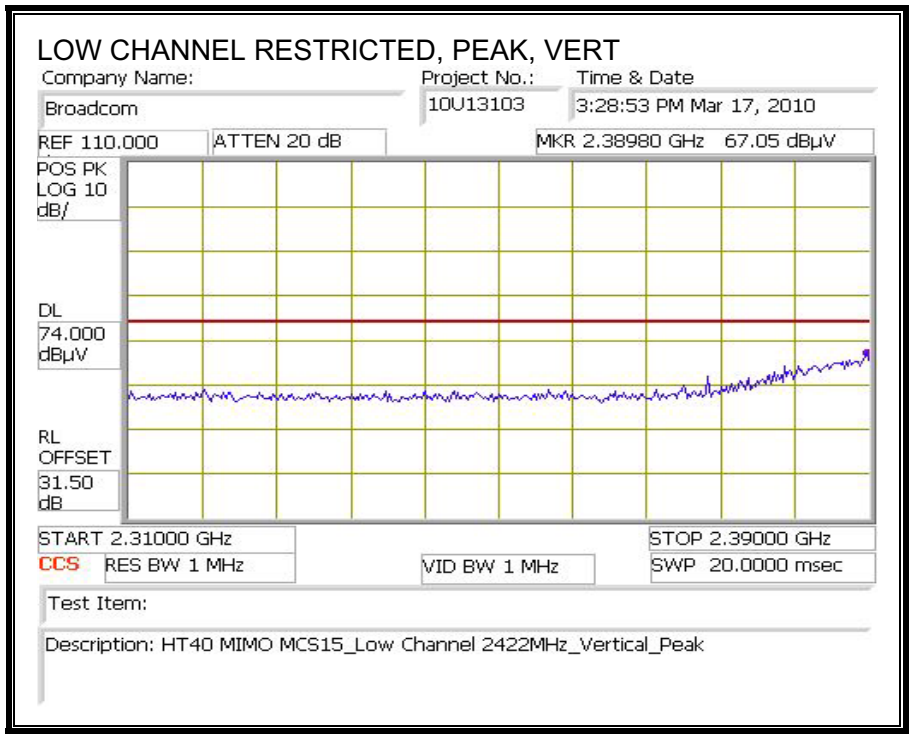
8.2.6. 802.11n HT40 MODE MIMO MCS15 IN THE 2.4 GHz BAND

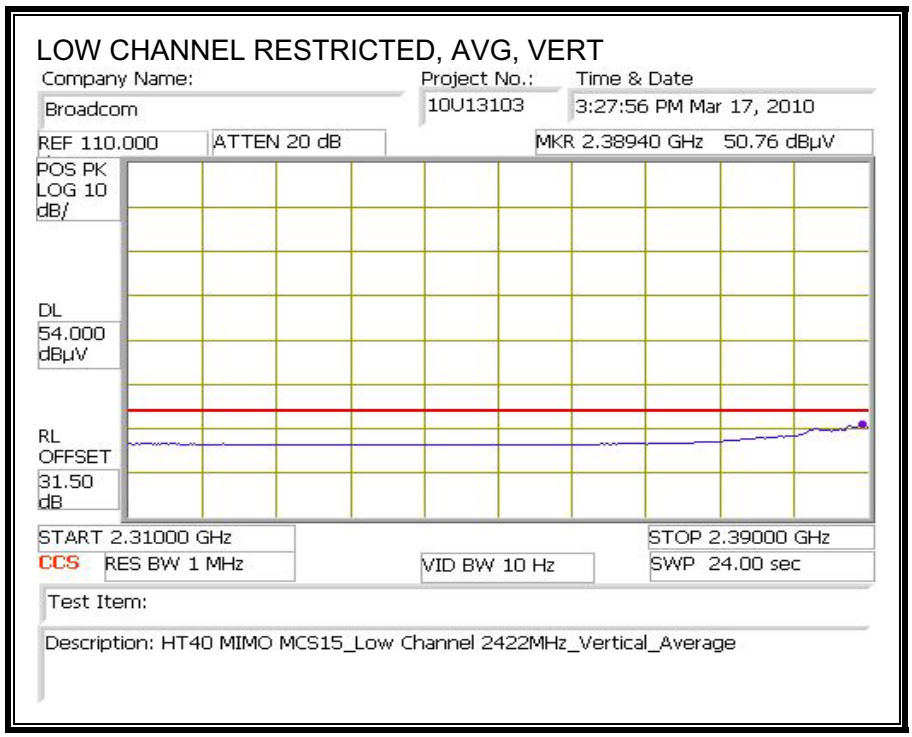
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



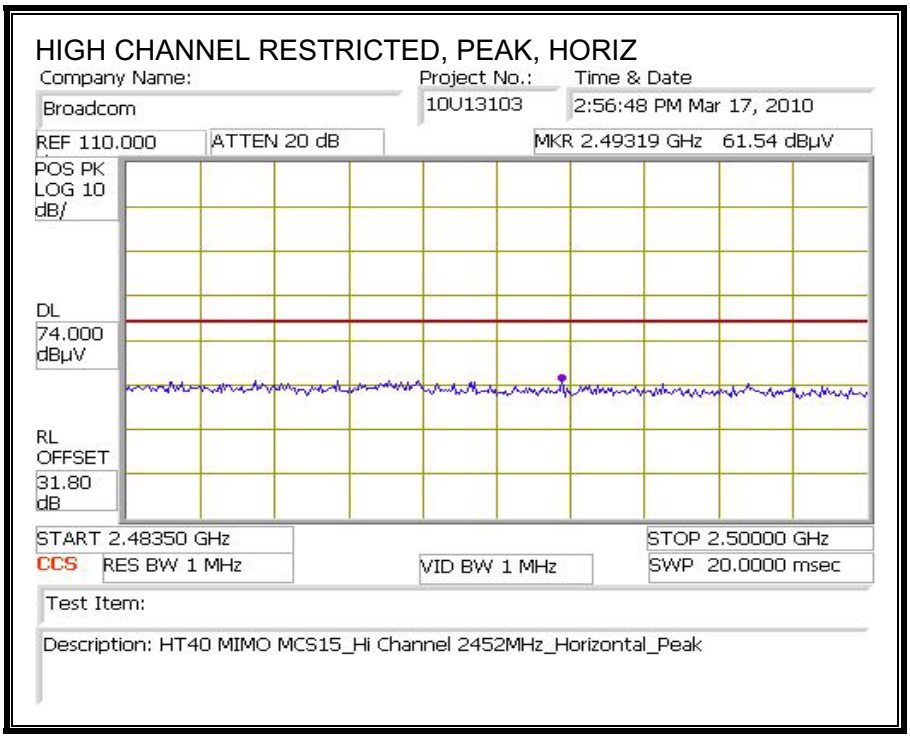


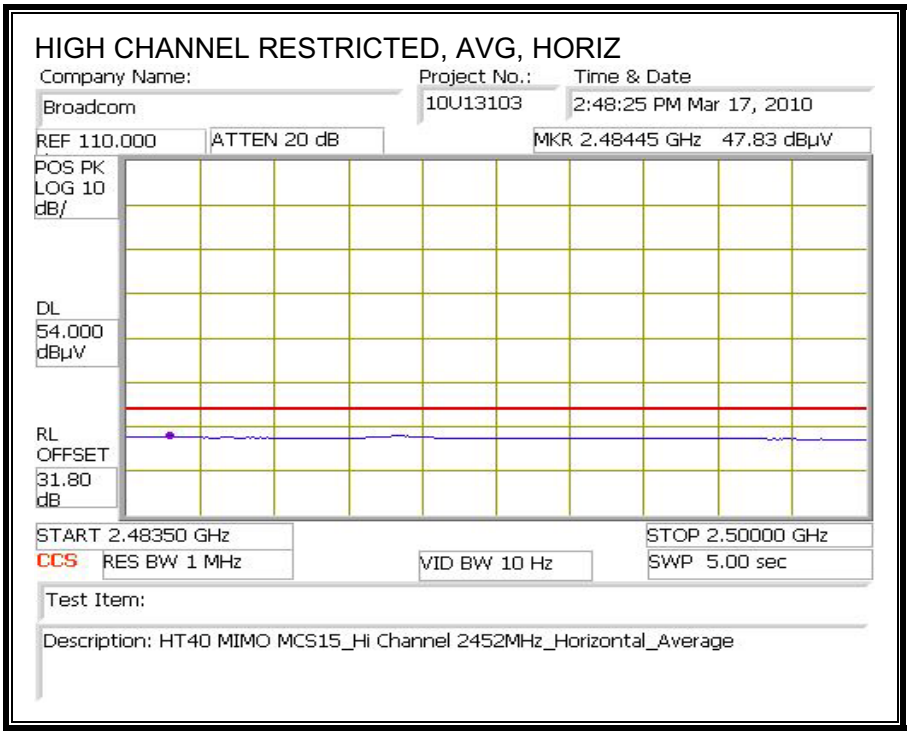
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



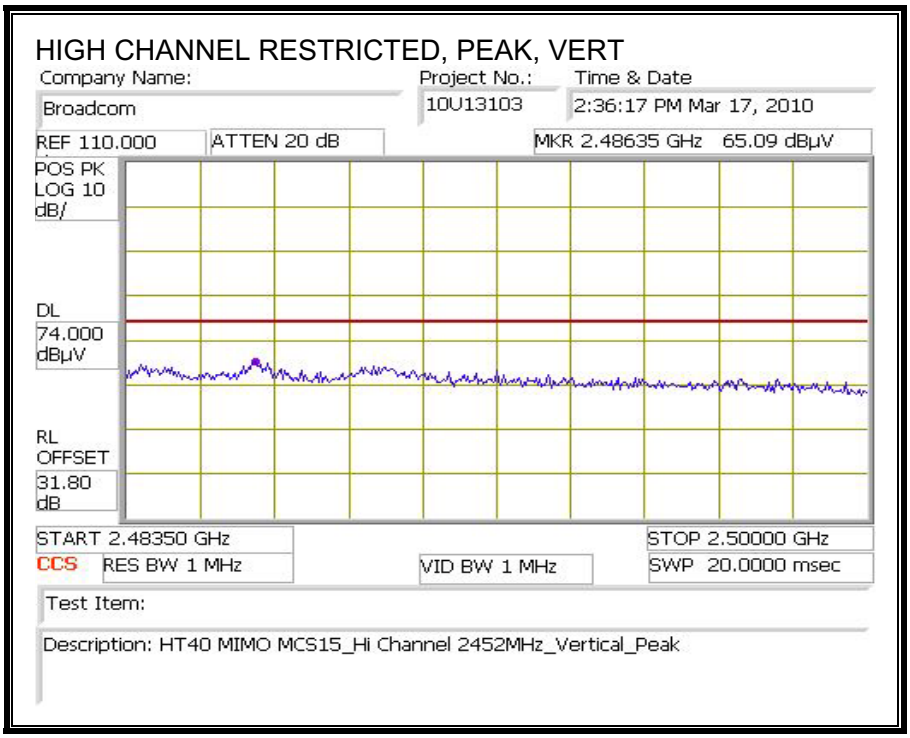


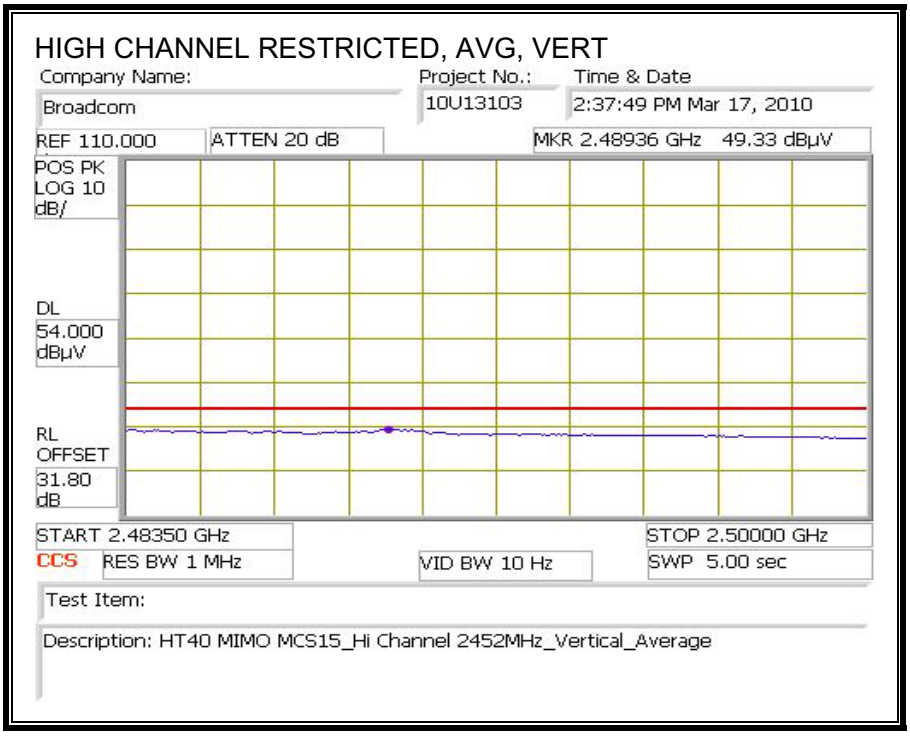
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





8.3. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Test Engr:	Vien Tran
Date:	03/18/10
Project #:	10U13103
Company:	Broadcom
EUT Description:	802.22ag/Draft 802.11n WLAN + Bluetooth PCI-E Mini Card
EUT M/N:	BCM94322PCIEBT
Test Target:	FCC Class B
Mode Oper:	Rx 2.4GHz Band (No significant change from the readings between 20MHz & 40MHz Bandwidth)

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T34 HP 8449B			RX RSS 210

Hi Frequency Cables

3' cable 22807700	12' cable 22807600	20' cable 22807500	HPF	Reject Filter
3' cable 22807700	12' cable 22807600	20' cable 22807500		

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)
1.197	3.0	57.1	42.7	25.1	2.6	-38.0		0.0	46.8	32.4	74	54	-27.2	-21.6	V
1.497	3.0	54.1	40.4	26.1	2.9	-37.6		0.0	45.6	31.9	74	54	-28.4	-22.1	V
1.197	3.0	56.6	42.3	25.1	2.6	-38.0		0.0	46.3	32.0	74	54	-27.7	-22.0	H
1.497	3.0	53.2	39.9	26.1	2.9	-37.6		0.0	44.7	31.4	74	54	-29.3	-22.6	H

No other emissions were detected above system noise floor

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		

8.4. WORST-CASE BELOW 1 GHz

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

High Frequency Measurement
Compliance Certification Services, Fremont 3m Chamber

Test Engr: Vien Tran
Date: 03/18/10
Project #: 10U13103
Company: Broadcom
EUT Description: 802.22ag/Draft 802.11n WLAN + Bluetooth PCI-E Mini Card
EUT M/N: BCM94322PCIEBT
Test Target: FCC Class B
Mode Oper: Tx 2.4GHz Band

f	Measurement Frequency	Amp	Preamp Gain
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

Margin — Margin vs. 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
Horizontal													
184.446	3.0	51.9	11.0	1.1	27.5	0.0	0.0	36.5	43.5	-7.0	H	P	
276.610	3.0	54.7	12.7	1.4	27.4	0.0	0.0	41.4	46.0	-4.6	H	P	
368.894	3.0	52.3	14.5	1.7	27.8	0.0	0.0	40.7	46.0	-5.4	H	P	
414.976	3.0	48.9	15.3	1.8	28.1	0.0	0.0	37.9	46.0	-8.1	H	P	
432.017	3.0	49.4	15.6	1.8	28.2	0.0	0.0	38.6	46.0	-7.4	H	P	
836.553	3.0	40.3	21.3	2.6	28.1	0.0	0.0	36.1	46.0	-9.9	H	P	
Vertical													
144.005	3.0	50.9	12.9	1.0	27.9	0.0	0.0	36.9	43.5	-6.6	V	P	
184.446	3.0	44.5	11.0	1.1	27.5	0.0	0.0	29.2	43.5	-14.3	V	P	
192.007	3.0	48.2	11.4	1.1	27.4	0.0	0.0	33.3	43.5	-10.2	V	P	
299.771	3.0	53.2	13.5	1.5	27.4	0.0	0.0	40.8	46.0	-5.2	V	P	
322.932	3.0	51.3	13.8	1.5	27.5	0.0	0.0	39.1	46.0	-6.9	V	P	
398.295	3.0	52.9	15.0	1.7	28.0	0.0	0.0	41.7	46.0	-4.3	V	P	

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

Note: Observed and there was no significant change between b-mode and HT20 mode for 30 – 1000MHz scan.

9. 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).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power * Gain product (in linear units) of each transmitter.

Total EIRP = (P1 * G1) + (P2 * G2) + ... + (Pn * Pn)

where

Px = Power of transmitter x
Gx = Numeric gain of antenna x

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for 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

Band (MHz)	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2412 - 2462	g-mode Legacy	0.20	25.58	6.77	3.42	0.342
2412 - 2462	HT20	0.20	27.96	7.94	7.74	0.774
2422 - 2452	HT40 SISO	0.20	24.16	6.77	2.47	0.247
2422 - 2452	HT40	0.20	26.50	7.94	5.53	0.553