



**FCC CFR47 PART 15 SUBPART C  
CLASS II PERMISSIVE CHANGE  
CERTIFICATION TEST REPORT**

**FOR**

**802.11n 2X2 PCIE MINICARD TRANSCEIVER**

**FCC MODEL NUMBER: AR5BHB92**

**IC MODEL NUMBER: AR5BHB92-D**

**FCC ID: PPD-AR5BHB92-D**

**IC ID: 4104A-ARBHB92D**

**REPORT NUMBER: 08U11791-1**

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**NVLAP LAB CODE 200065-0**

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## TABLE OF CONTENTS

<b>1. ATTESTATION OF TEST RESULTS</b> .....	<b>5</b>
<b>2. TEST METHODOLOGY</b> .....	<b>6</b>
<b>3. FACILITIES AND ACCREDITATION</b> .....	<b>6</b>
<b>4. CALIBRATION AND UNCERTAINTY</b> .....	<b>6</b>
4.1. <i>MEASURING INSTRUMENT CALIBRATION</i> .....	6
4.2. <i>MEASUREMENT UNCERTAINTY</i> .....	6
<b>5. EQUIPMENT UNDER TEST</b> .....	<b>7</b>
5.1. <i>DESCRIPTION OF EUT</i> .....	7
5.2. <i>MAXIMUM OUTPUT POWER</i> .....	7
5.3. <i>DESCRIPTION OF CLASS II CHANGE</i> .....	7
5.4. <i>DESCRIPTION OF AVAILABLE ANTENNAS</i> .....	8
5.5. <i>SOFTWARE AND FIRMWARE</i> .....	8
5.6. <i>WORST-CASE CONFIGURATION AND MODE</i> .....	8
5.7. <i>DESCRIPTION OF TEST SETUP</i> .....	9
<b>6. TEST AND MEASUREMENT EQUIPMENT</b> .....	<b>11</b>
<b>7. ANTENNA PORT TEST RESULTS</b> .....	<b>12</b>
7.1. <i>802.11b DUAL CHAIN LEGACY MODE IN THE 2.4 GHz BAND</i> .....	12
7.1.1. <i>AVERAGE POWER</i> .....	12
7.2. <i>802.11g DUAL CHAIN LEGACY MODE IN THE 2.4 GHz BAND</i> .....	13
7.2.1. <i>AVERAGE POWER</i> .....	13
7.3. <i>802.11n HT20 MODE IN THE 2.4 GHz BAND</i> .....	14
7.3.1. <i>AVERAGE POWER</i> .....	14
7.4. <i>802.11n HT40 MODE IN THE 2.4 GHz BAND</i> .....	15
7.4.1. <i>AVERAGE POWER</i> .....	15
7.5. <i>802.11a MODE IN THE 5.8 GHz BAND</i> .....	16
7.5.1. <i>OUTPUT POWER</i> .....	16
7.5.2. <i>AVERAGE POWER</i> .....	23
7.6. <i>802.11n HT20 MODE IN THE 5.8 GHz BAND</i> .....	24
7.6.1. <i>OUTPUT POWER</i> .....	24
7.6.2. <i>AVERAGE POWER</i> .....	31
7.7. <i>802.11n HT40 MODE IN THE 5.8 GHz BAND</i> .....	32

7.7.1. OUTPUT POWER ..... 32

7.7.2. AVERAGE POWER ..... 37

**8. RADIATED TEST RESULTS ..... 38**

8.1. LIMITS AND PROCEDURE ..... 38

8.1.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND .. 40

8.1.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND .. 49

8.1.3. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz  
BAND 58

8.1.4. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 2.4 GHz  
BAND 67

8.1.5. TRANSMITTER ABOVE 1 GHz FOR 802.11a MODE IN THE 5.8 GHz BAND .. 76

8.1.6. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz  
BAND 77

8.1.7. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz  
BAND 78

8.2. RECEIVER ABOVE 1 GHz ..... 79

**9. MAXIMUM PERMISSIBLE EXPOSURE ..... 80**

**10. SETUP PHOTOS ..... 84**

# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ATHEROS COMMUNICATION, INC  
5480 GREAT AMERICA PARKWAY  
SANTA CLARA, CA 95054 USA

**EUT DESCRIPTION:** 802.11n 2X2 PCIE MINICARD TRANSCEIVER

**FCC MODEL NUMBER:** AR5BHB92

**IC MODEL NUMBER:** AR5BHB92-D

**SERIAL NUMBER:** DB92-010-S0015

**DATE TESTED:** APRIL 29-MAY 02, 2008

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
RSS-210 Issue 7 Annex 8 and RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All 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 Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services 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:

Tested By:



THU CHAN  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

CHIN PANG  
EMC ENGINEER  
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## 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 an 802.11n 2x2 PCIe minicard transceiver, model AR5BHB92/AR5BHB92-D. The radio module is manufactured by Atheros Communications, Inc.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)	Total Power (mW)
2412 - 2462	802.11b	22.58	22.12	25.37	344.06
2412 - 2462	802.11g	26.44	26.69	29.58	907.21
2412 - 2462	802.11n HT20	26.50	26.55	29.54	898.54
2422 - 2452	802.11n HT40	21.58	22.21	24.92	310.22
*5745 - 5825	802.11a	24.06	24.09	27.09	511.13
*5745 - 5825	802.11n HT20	24.27	24.22	27.26	531.54
*5755 - 5795	802.11n HT40	24.07	23.91	27.00	501.31

\*The output powers of 5.8GHz band have been reduced with new higher antenna gain.

### 5.3. DESCRIPTION OF CLASS II CHANGE

The change filed under this application as follows:

1. Addition of two passive high pass filter components placed between the switch and antenna ports.
2. Modified PCB layout to accommodate the new components.
3. New PIFA Antennas with higher gain in 2.4GHz and 5.725-5.850GHz bands

## **5.4. DESCRIPTION OF AVAILABLE ANTENNAS**

The 2x2 configuration utilizes a set of PIFA antennas with maximum gain of 3.0 dBi from 2400 - 2483.5 MHz, and 5.8 dBi from 5725 - 5850 MHz.

## **5.5. SOFTWARE AND FIRMWARE**

The test utility and driver software used during testing was Art ANWI 1.4 and Devlib Revision 0.7 Build #1 Art\_11n.

## **5.6. WORST-CASE CONFIGURATION AND MODE**

The 2x2 configuration was used for all testing in this report..

All emissions tests were made with following data rates:

- 802.11b mode, 20 MHz Channel Bandwidth, 1 Mb/s, CCK Modulation, Spatial Stream 1.
- 802.11g mode, 20 MHz Channel Bandwidth, 9 Mb/s, OFDM Modulation, Spatial Stream 1.
- 802.11a mode, 20 MHz Channel Bandwidth, 9 Mb/s, OFDM Modulation, Spatial Stream 1.
- 802.11n HT20 mode, 20 MHz Channel Bandwidth, MCS0, 6.5 Mb/s, OFDM Modulation, Spatial Stream 1.
- 802.11n HT40 mode, 40 MHz Channel Bandwidth, MCS0, 13.5 Mb/s, OFDM Modulation, Spatial Stream 1.

For 2.4GHz Band, HT20 mode, at horizontal polarization, in order to pass band edge, power is reduced to 13.5dBm for low channel and 13.3dBm for high channel, no change on midband channels.

For 2.4GHz Band, HT40 mode, at horizontal polarization, in order to pass band edge, power is reduced to 9 dBm for low channel and 12 dBm for high channel, no change on midband channels.



## 5.7. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	769	L3-BE247	DoC
AC Adapter	Lenovo	92P1180	11S92P1180Z1ZBGH7CM99	DoC

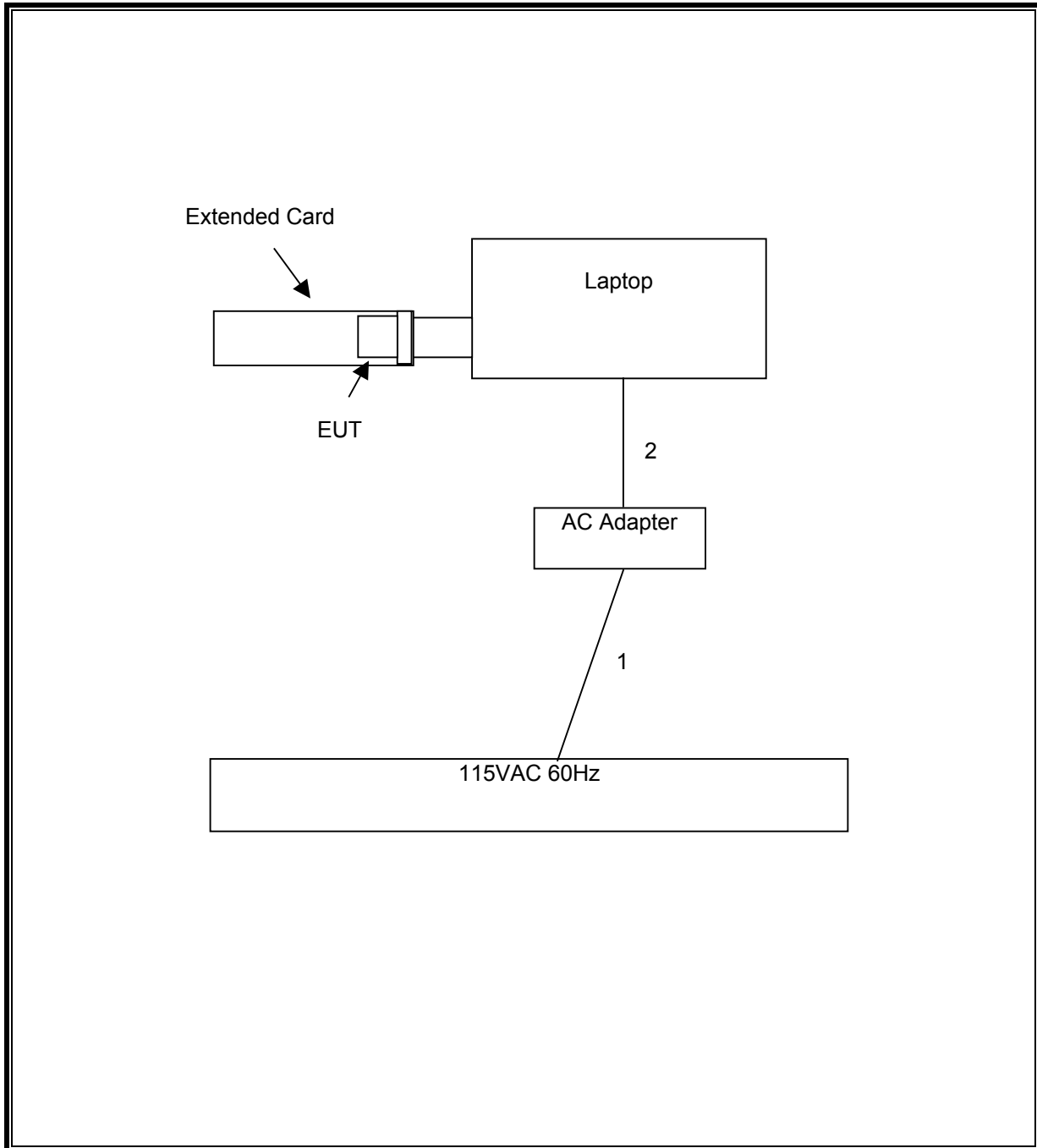
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Un-shielded	2m	No
2	DC	1	DC	Un-shielded	2m	No

### TEST SETUP

The EUT is installed in a host laptop computer via an extended card 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	C01012	3/3/2009
Peak Power Meter	Agilent / HP	E4416A	C00963	12/4/2009
Peak / Average Power Sensor	Agilent	E9327A	C00964	12/7/2009
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	9/28/2008
Antenna, Horn, 18 GHz	ETS	3117	C01022	4/22/2009
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	9/27/2008
Antenna, Horn, 26.5 GHz	ARA	MMH-1826/B	C00589	9/29/2008
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	10/11/2008
2.4-2.5GHz Reject Filter	Micro Tronics	BRM50702	N02685	CNR
High Pass Filter 7.6GHz	Micro Tronics	HPM13195	N02681	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. 802.11b DUAL CHAIN LEGACY MODE IN THE 2.4 GHz BAND

#### 7.1.1. 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 17 dB (including 16 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)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2412	17.73	17.62	20.69
Middle	2437	16.81	17.05	19.94
High	2462	17.91	17.88	20.91

## 7.2. 802.11g DUAL CHAIN LEGACY MODE IN THE 2.4 GHz BAND

### 7.2.1. 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 17 dB (including 16 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)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	2412	16.27	15.23	18.79
Middle	2437	21.29	21.35	24.33
High	2462	15.83	15.91	18.88

### 7.3. 802.11n HT20 MODE IN THE 2.4 GHz BAND

#### 7.3.1. 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 1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
*Low	2412	13.30	13.30	16.31
Middle	2437	21.50	22.00	24.77
*High	2462	13.20	13.20	16.21

\*For 2.4GHz Band, HT20 mode, at horizontal polarization, in order to pass band edge, power is reduced to 13.3dBm for low channel and 13.2dBm for high channel, no change on midband channels.

## 7.4. 802.11n HT40 MODE IN THE 2.4 GHz BAND

### 7.4.1. 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 10 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)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
*Low	2422	9.00	8.80	11.91
Middle	2437	16.30	16.50	19.41
*High	2452	12.10	12.14	15.13

\*For 2.4GHz Band, HT40 mode, at horizontal polarization, in order to pass band edge, power is reduced to 9 dBm for low channel and 12 dBm for high channel, no change on midband channels.

## 7.5. 802.11a MODE IN THE 5.8 GHz BAND

### 7.5.1. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

Effective Legacy Gain (dBi)
8.81

The maximum antenna gain is 8.81 dBi for P-To-M; therefore the limit is 27.19 dBm.

#### TEST PROCEDURE

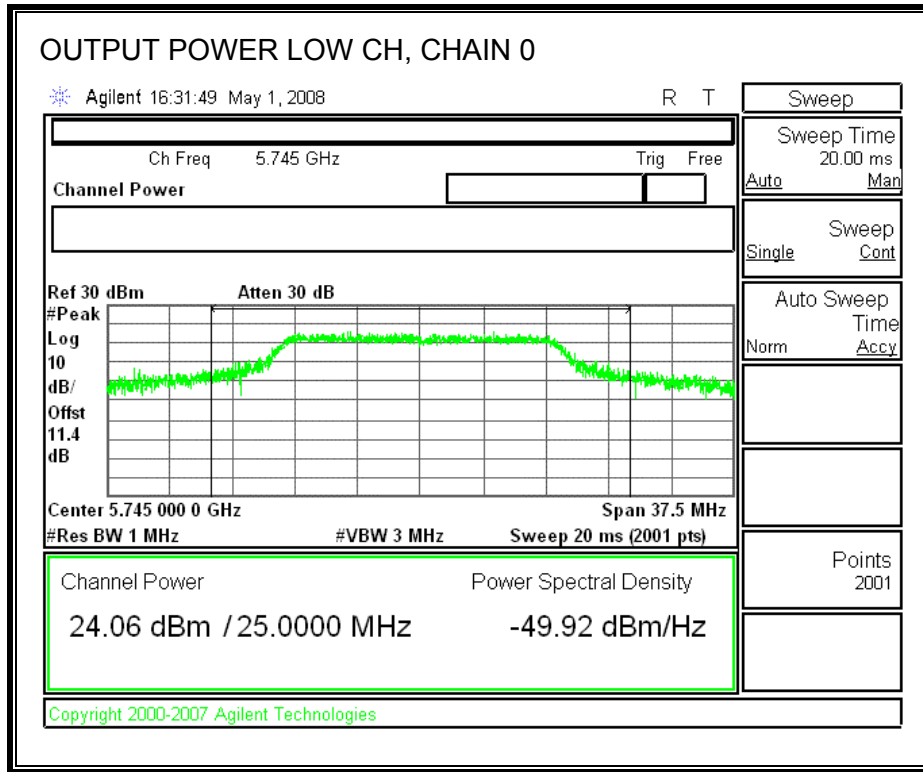
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

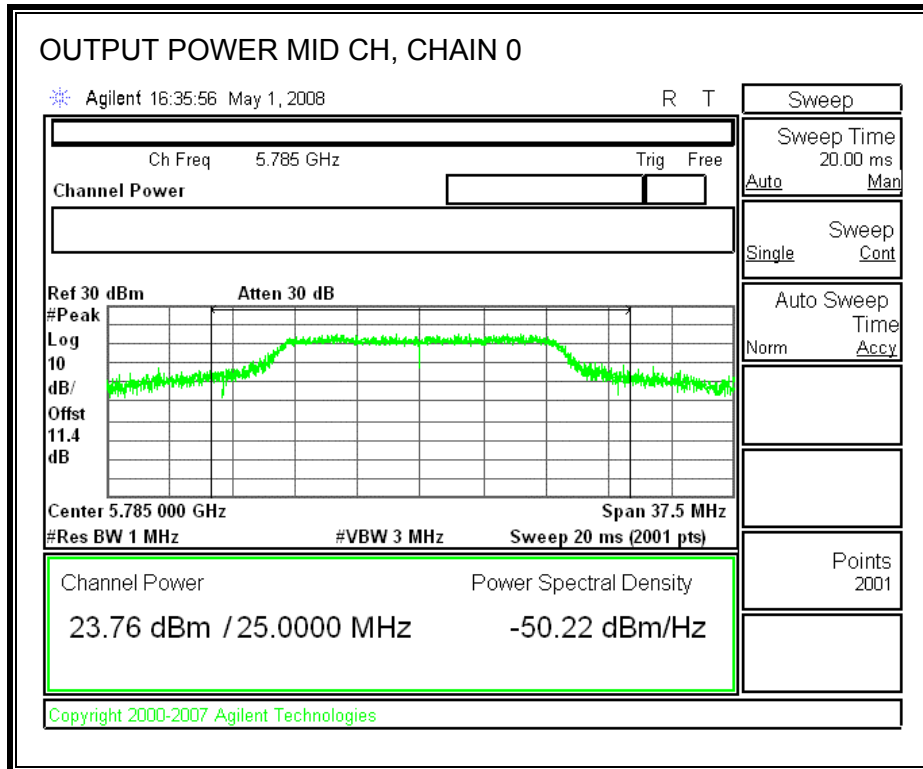
#### RESULTS

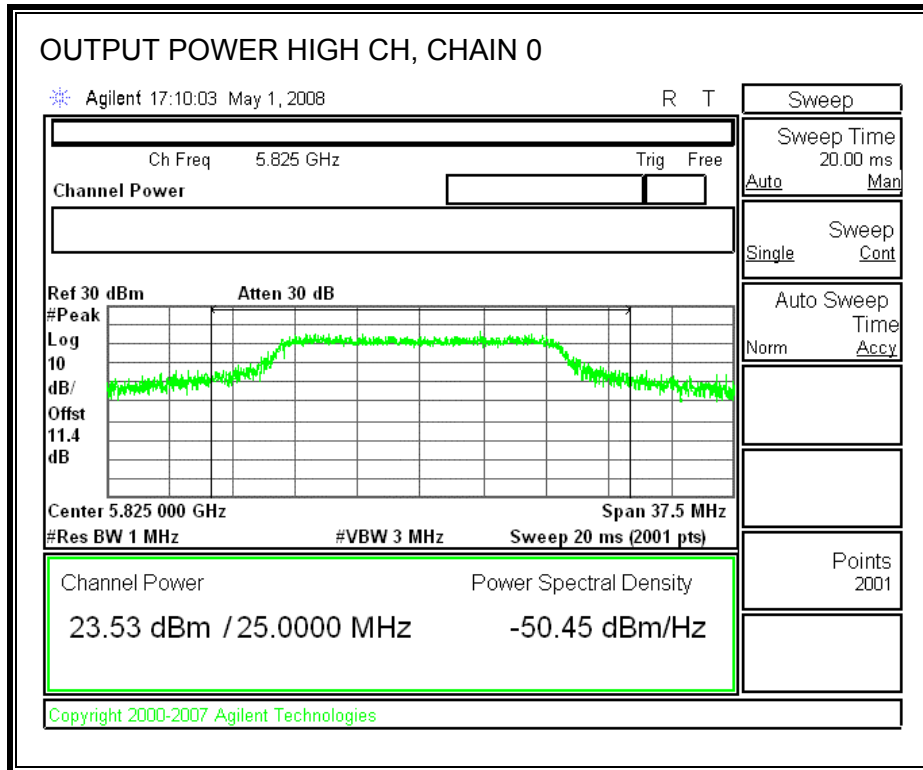
Channel	Frequency (MHz)	Limit (dBm)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)	Margin (dB)
Low	5745	27.19	24.06	24.09	27.09	-0.10
Mid	5785	27.19	23.76	23.59	26.69	-0.50
High	5825	27.19	23.53	23.84	26.70	-0.49



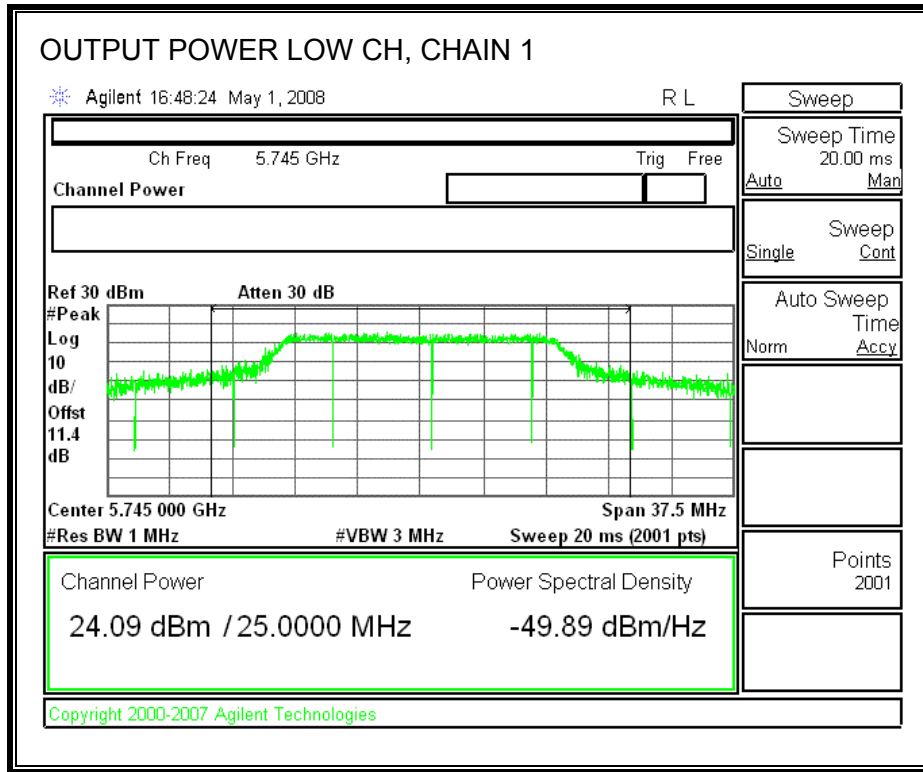
**CHAIN 0 OUTPUT POWER**

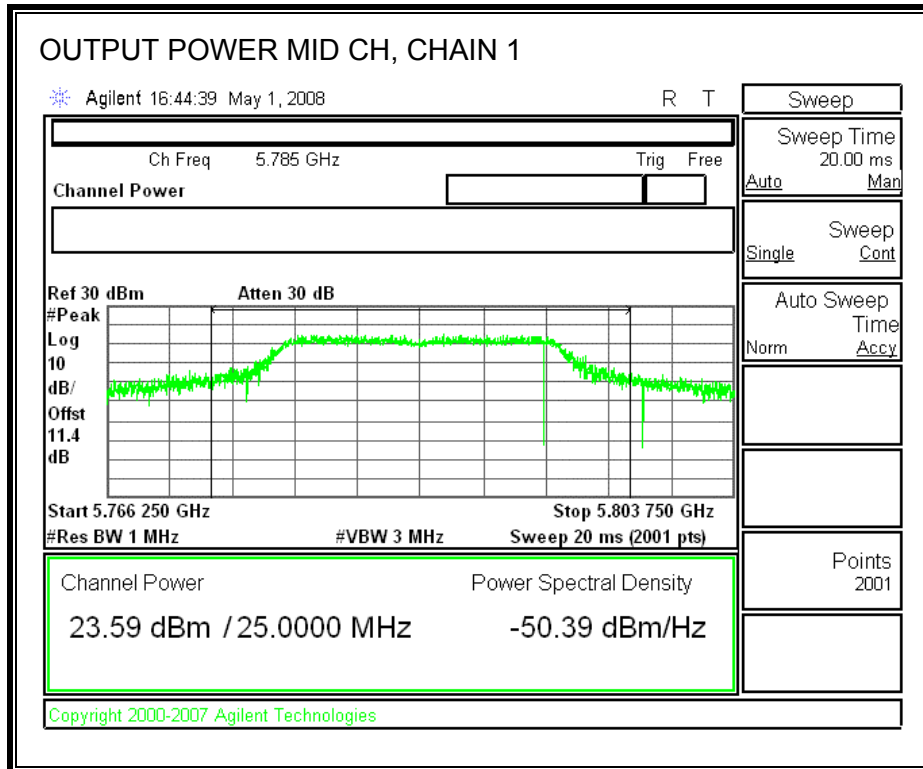


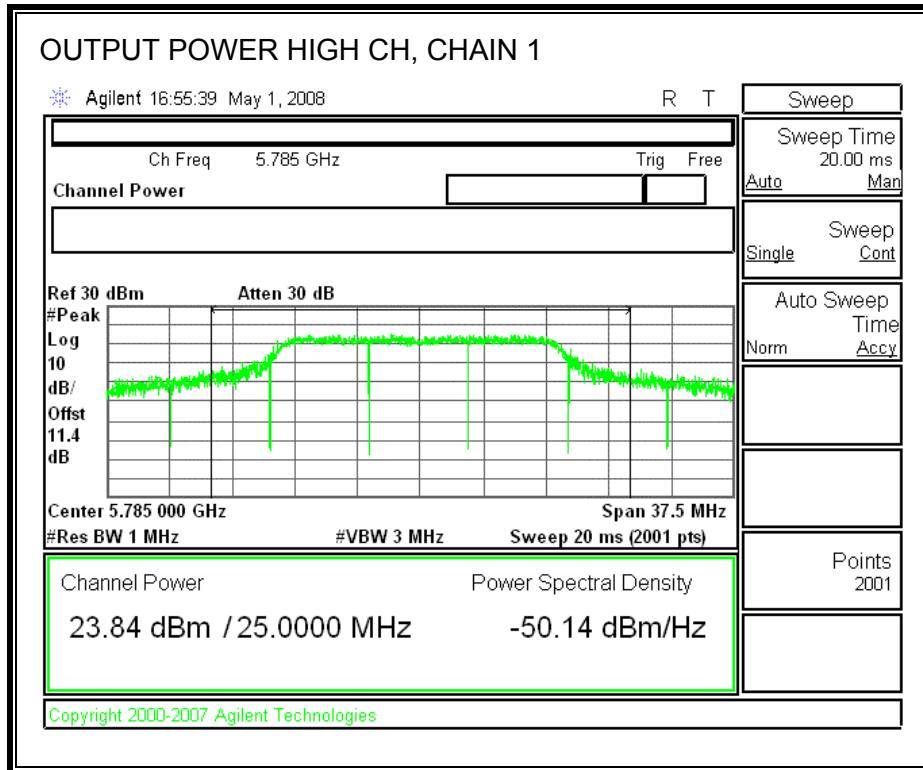




**CHAIN 1 OUTPUT POWER**







## 7.5.2. 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 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5745	17.60	17.60	20.61
Middle	5785	17.40	17.50	20.46
High	5825	17.30	17.50	20.41

## 7.6. 802.11n HT20 MODE IN THE 5.8 GHz BAND

### 7.6.1. 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

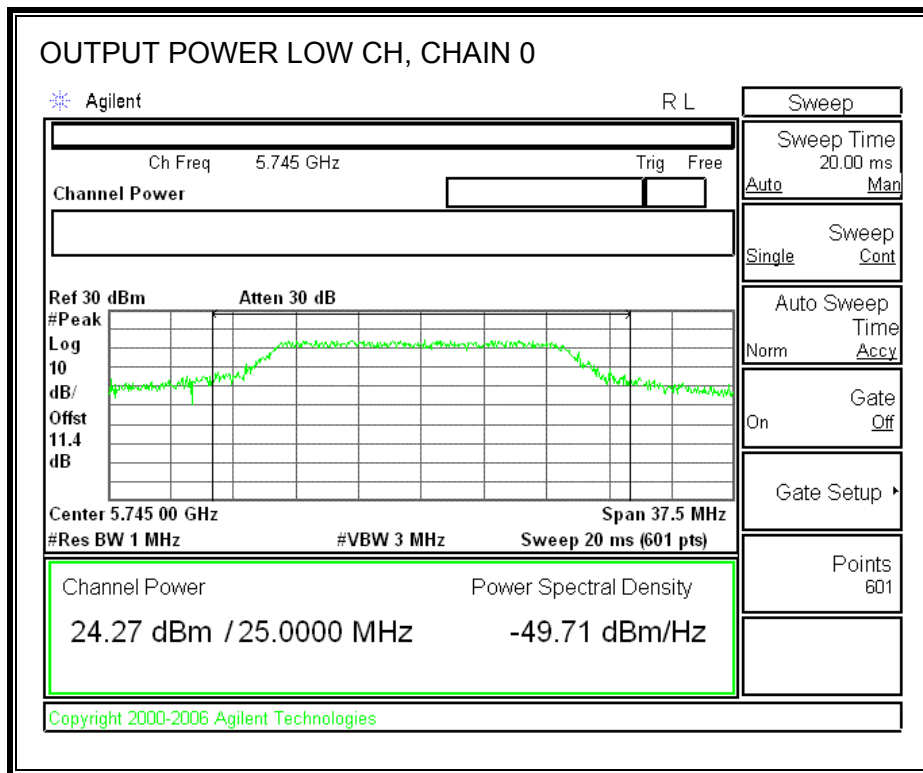
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

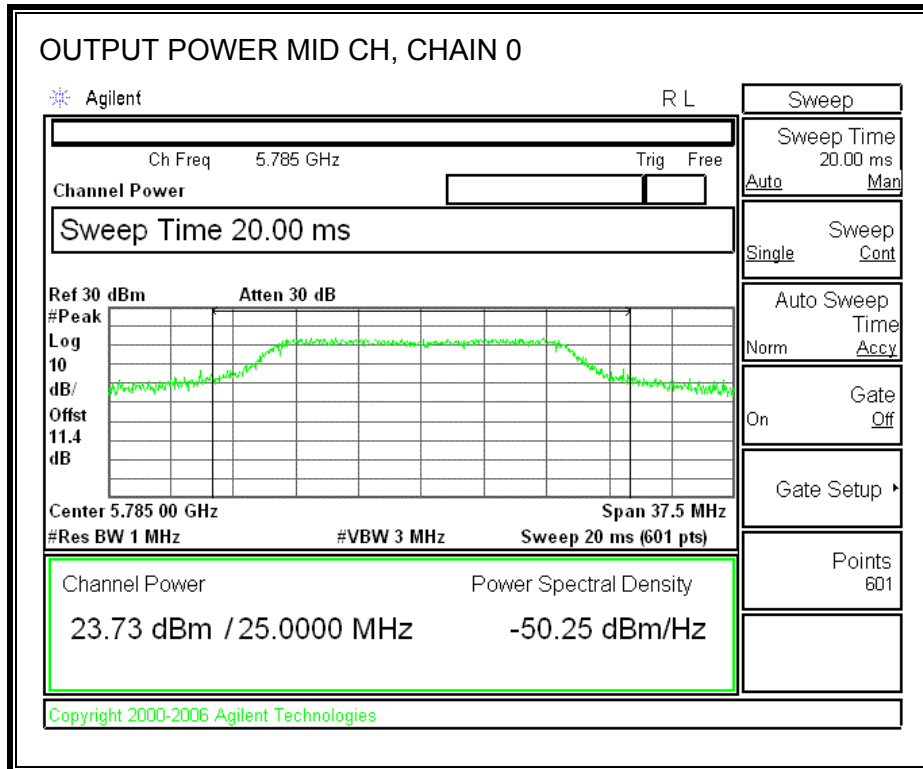
#### RESULTS

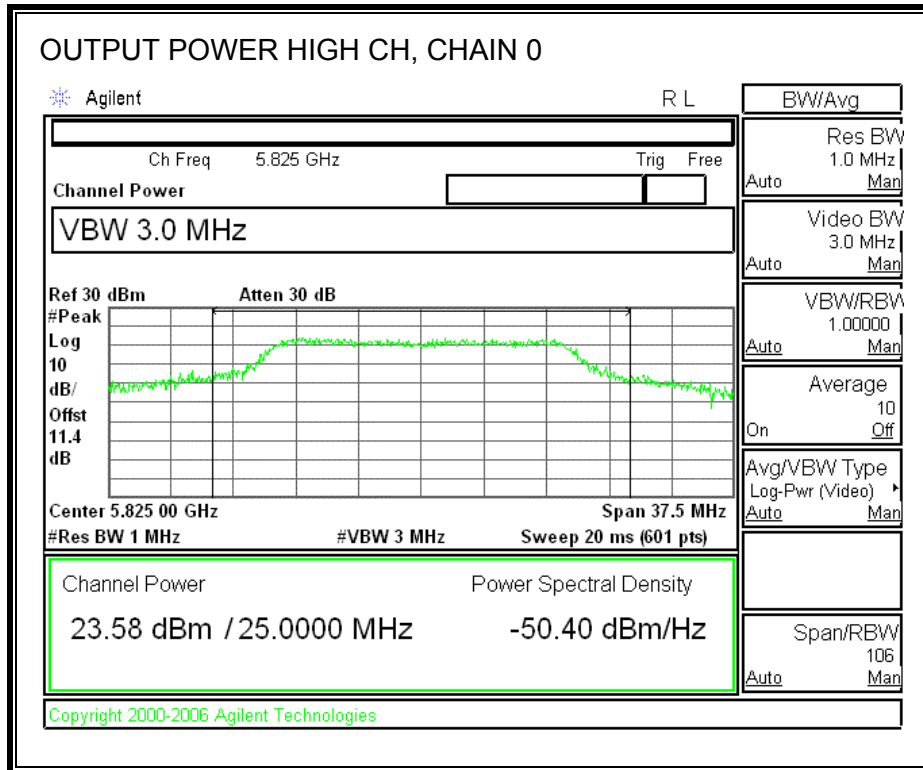
Channel	Frequency (MHz)	Limit (dBm)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)	Margin (dB)
Low	5745	30.00	24.27	24.22	27.26	-2.74
Mid	5785	30.00	23.73	23.84	26.80	-3.20
High	5825	30.00	23.58	23.47	26.54	-3.46



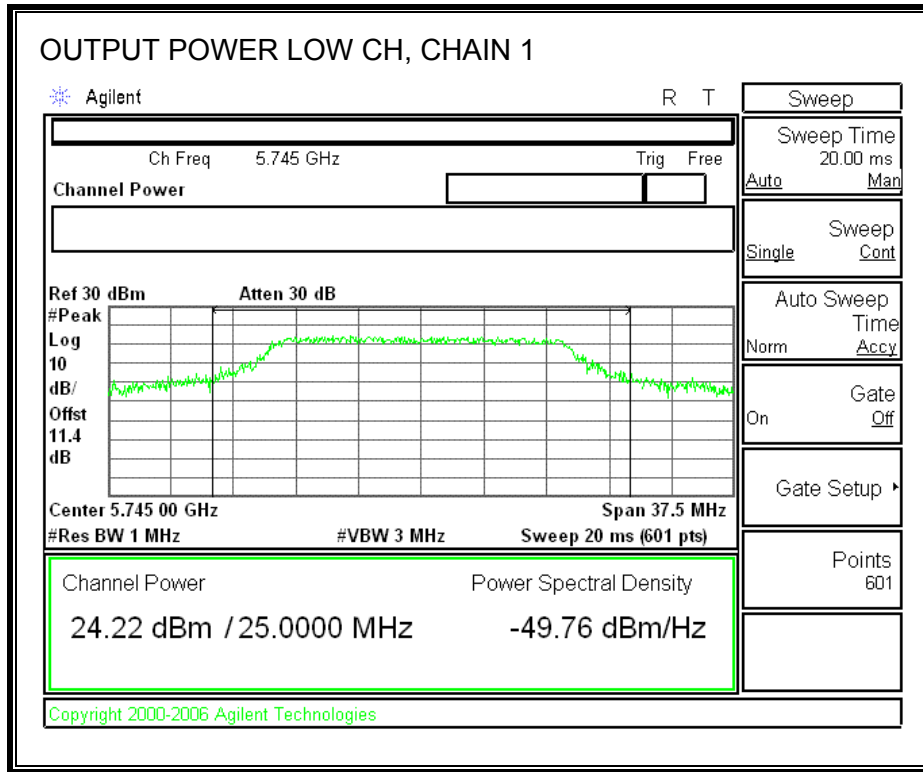
**CHAIN 0 OUTPUT POWER**

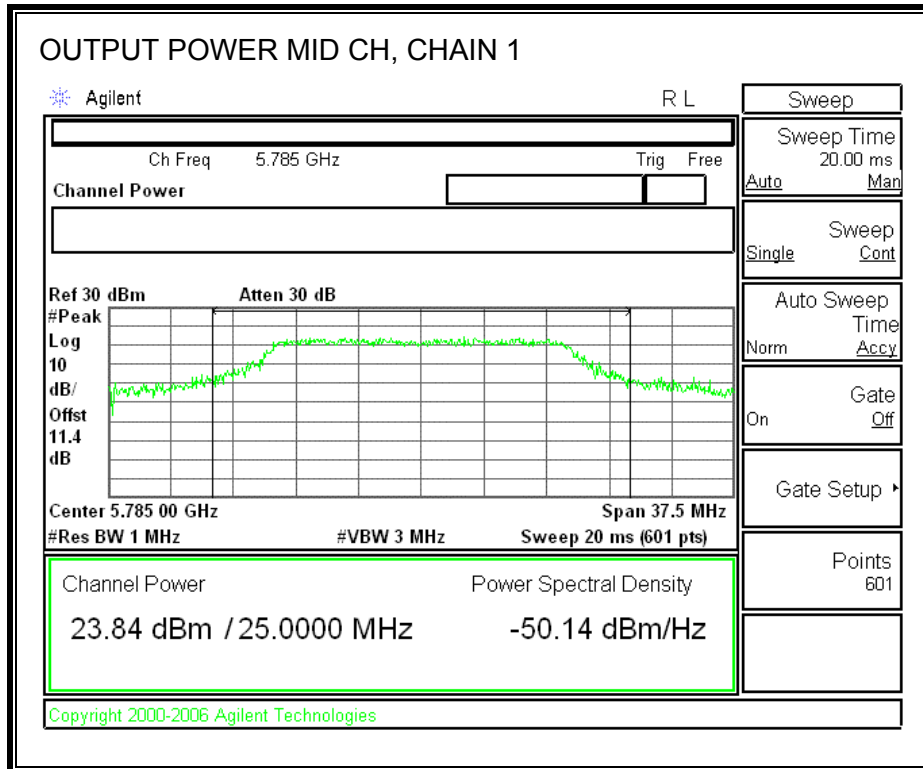


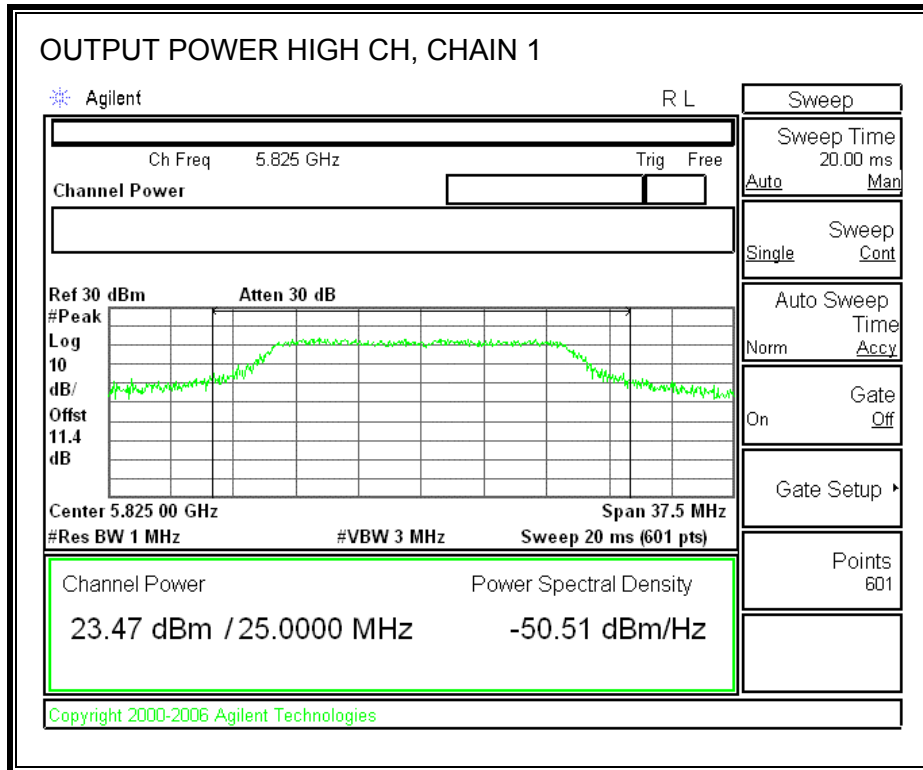




**CHAIN 1 OUTPUT POWER**







## 7.6.2. 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 11.45 dB (including 10 dB pad and 1.45 dB cable) entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5745	17.50	17.60	20.56
Middle	5785	17.40	17.50	20.46
High	5825	17.20	17.50	20.36

## 7.7. 802.11n HT40 MODE IN THE 5.8 GHz BAND

### 7.7.1. 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

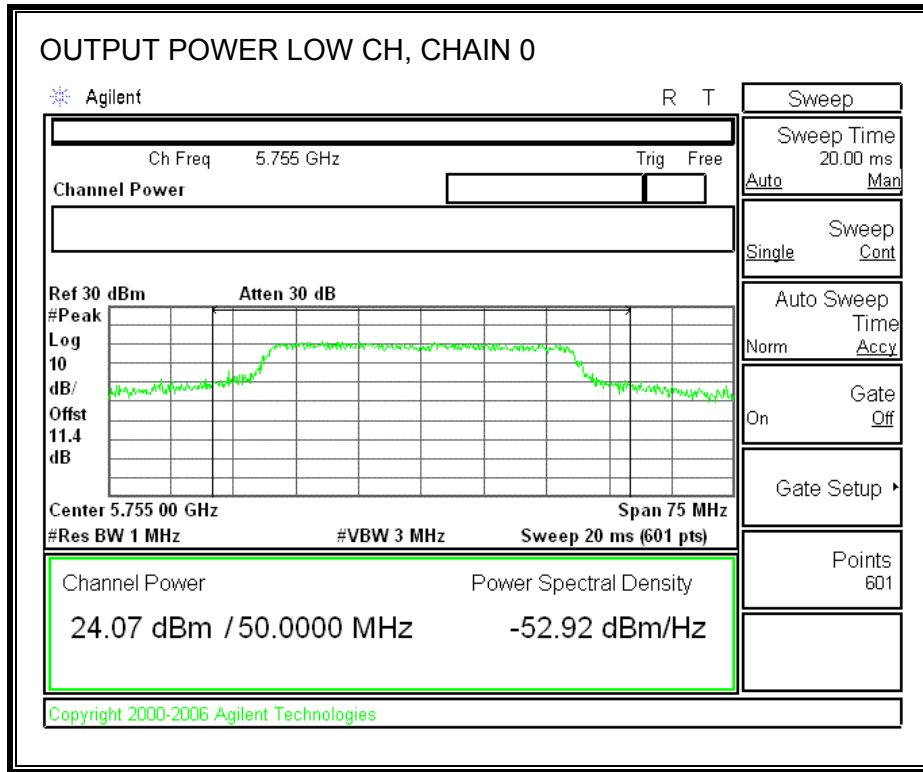
Peak power is measured using the spectrum analyzer's internal channel power integration function. Power is integrated over a bandwidth greater than or equal to the 99% bandwidth.

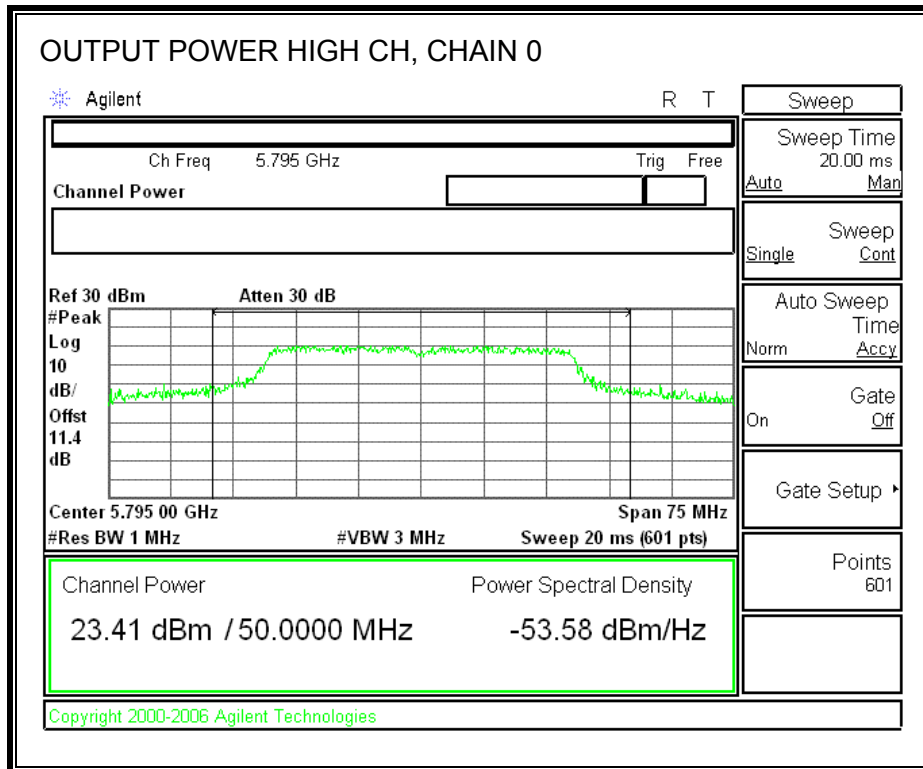
#### RESULTS

Channel	Frequency (MHz)	Limit (dBm)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)	Margin (dB)
Low	5755	30.00	24.07	23.91	27.00	-3.00
High	5795	30.00	23.41	23.52	26.48	-3.52

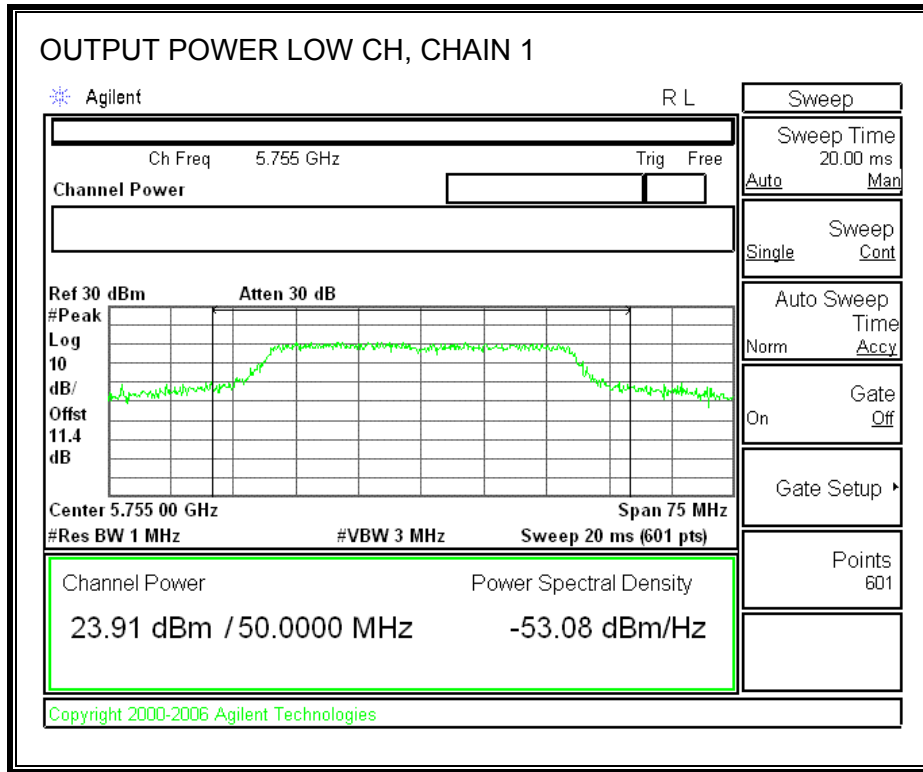


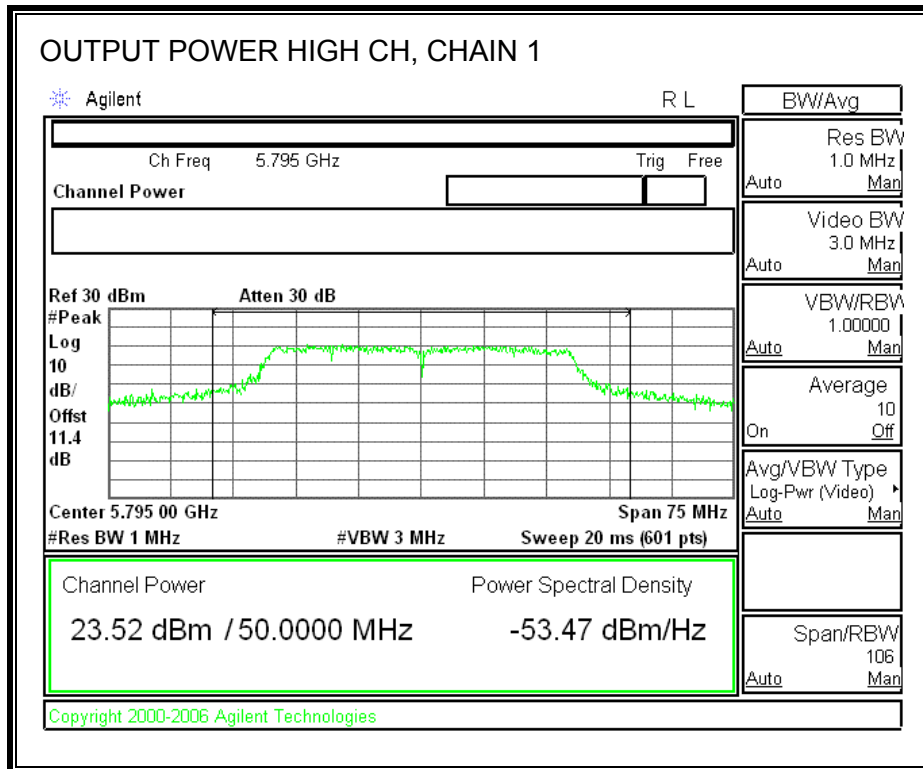
**CHAIN 0 OUTPUT POWER**





**CHAIN 1 OUTPUT POWER**





## 7.7.2. 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 11.45 dB (including 10 dB pad and 1.45 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Total Power (dBm)
Low	5755	18.00	17.90	20.96
High	5795	18.00	17.90	20.96

## 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 ( $\mu\text{V}/\text{m}$ ) at 3 m	Field Strength Limit (dB $\mu\text{V}/\text{m}$ ) 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.

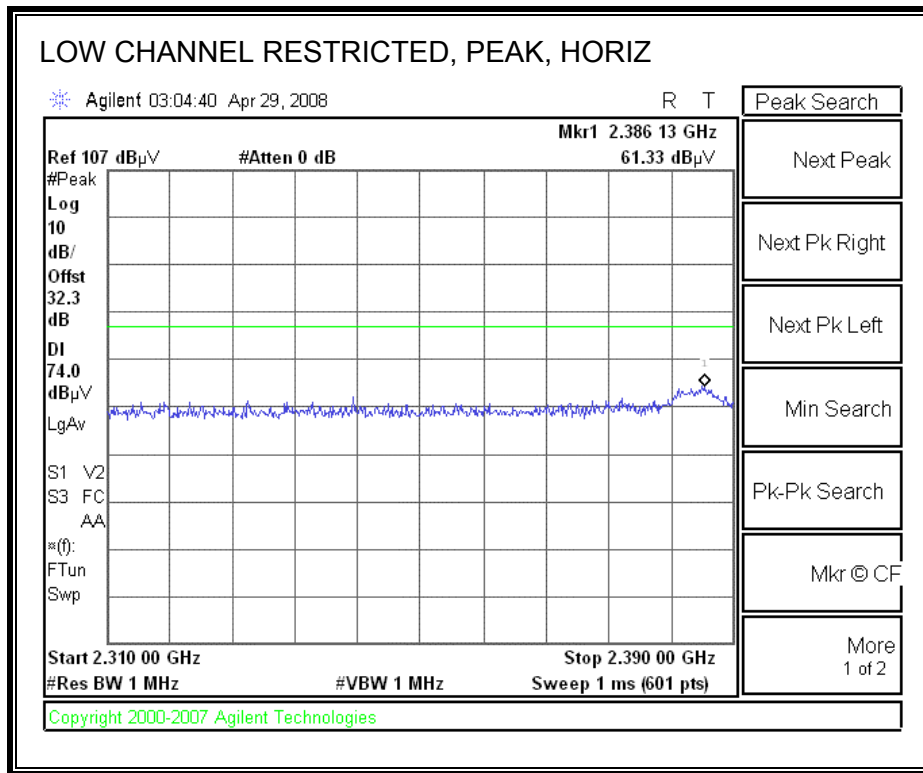
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

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.

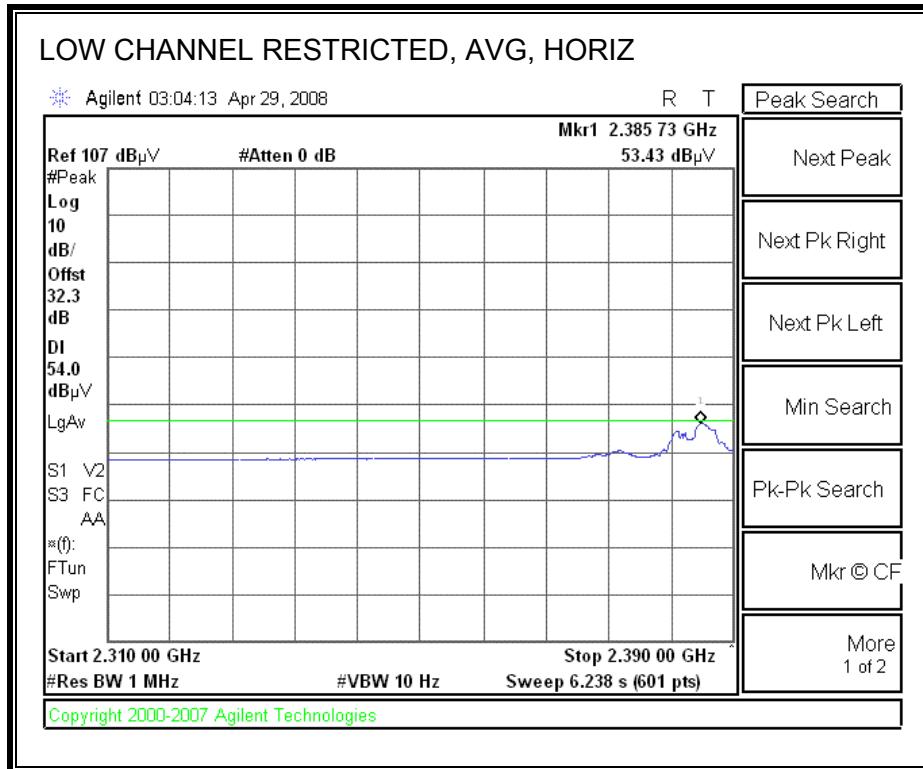
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

### 8.1.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

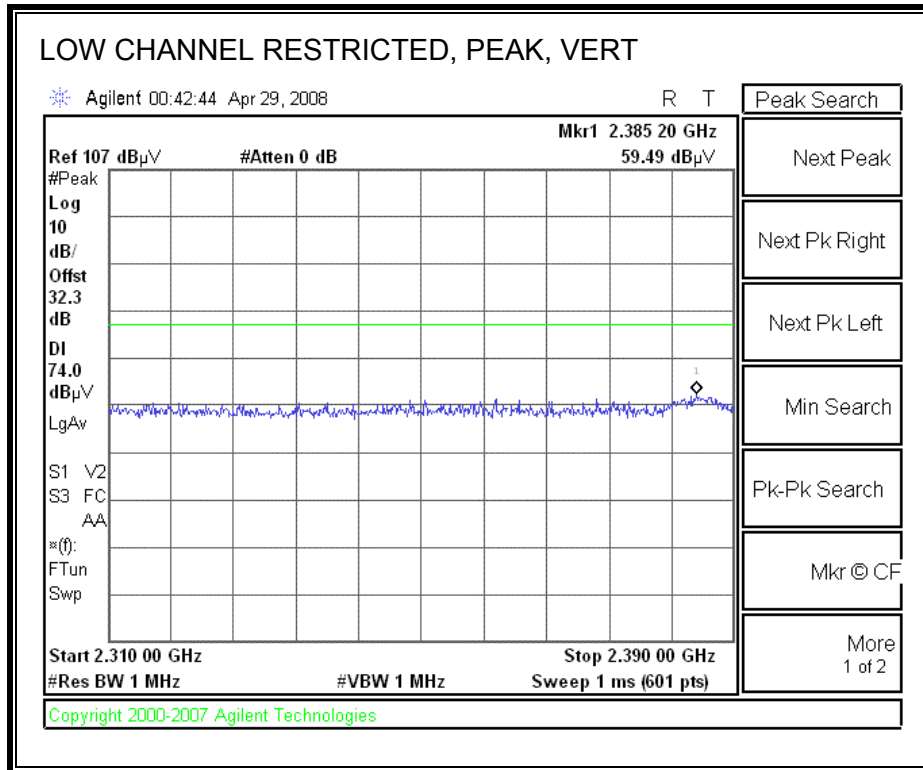
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

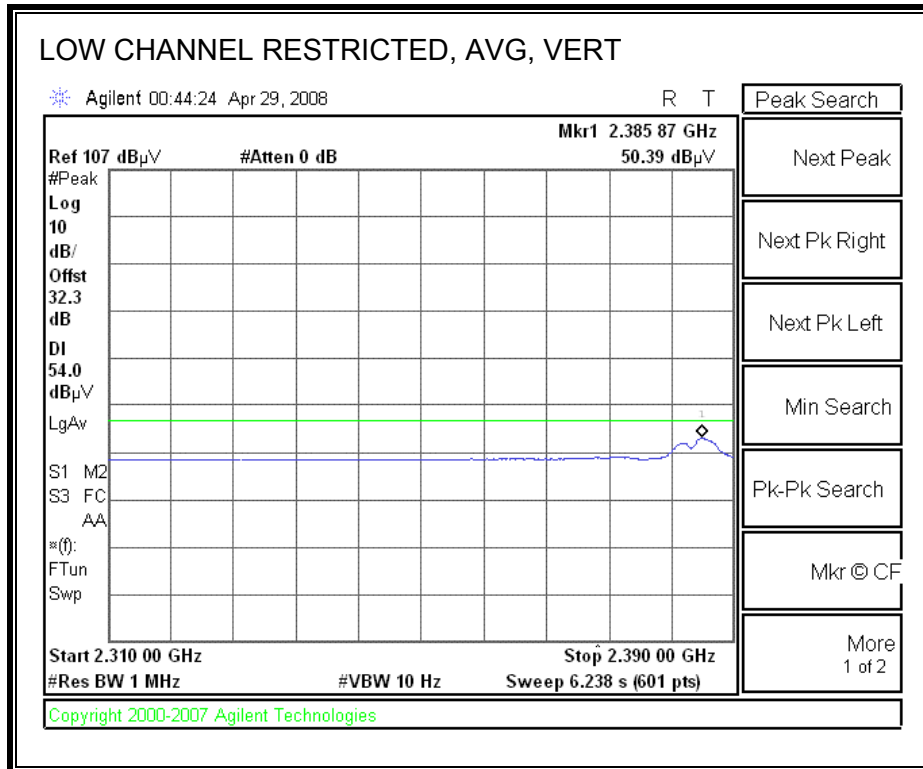




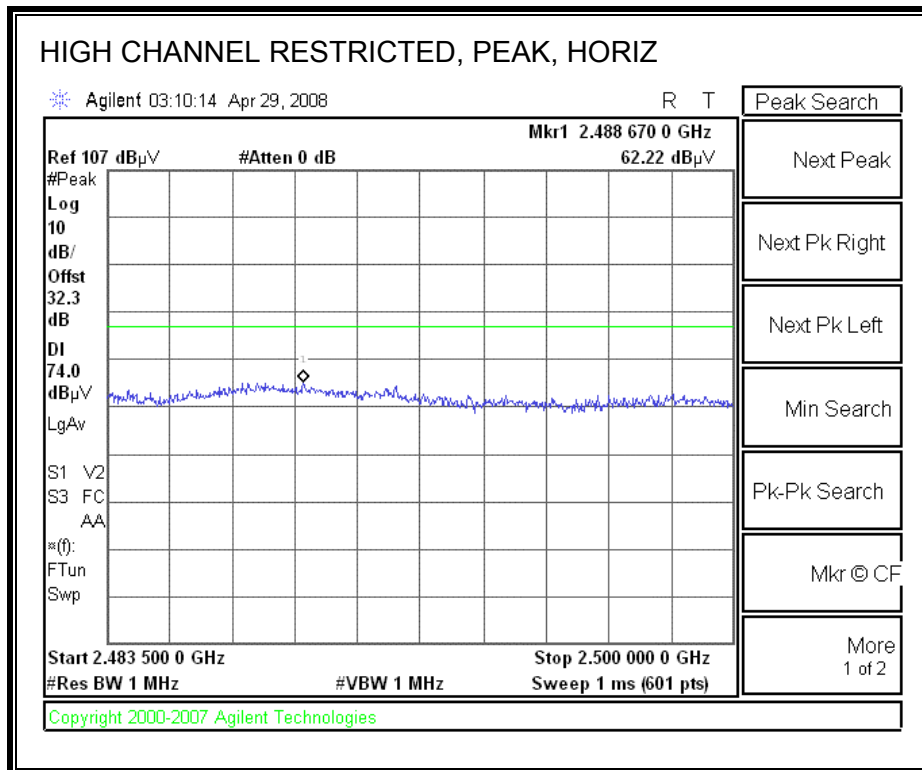


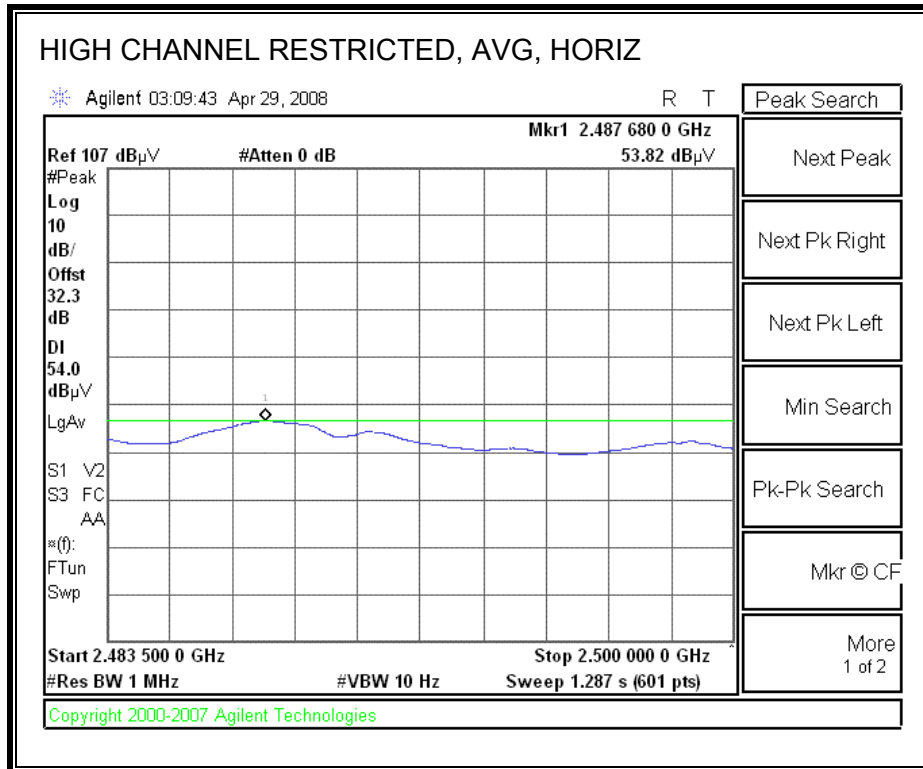
**RESTRICTED BANDEGE (LOW CHANNEL, VERTICAL)**



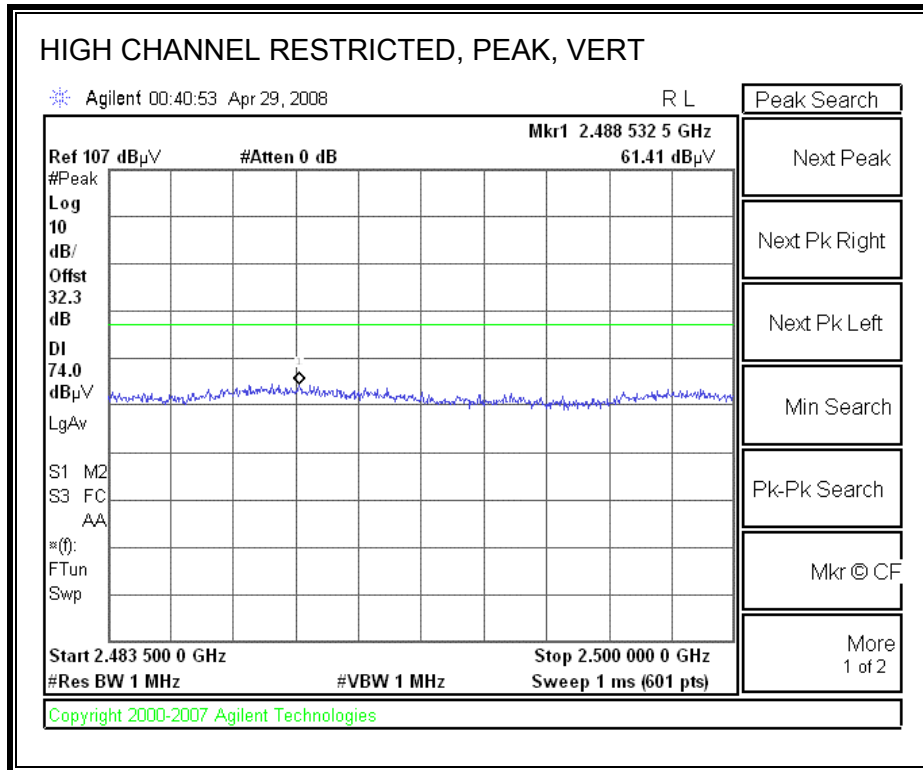


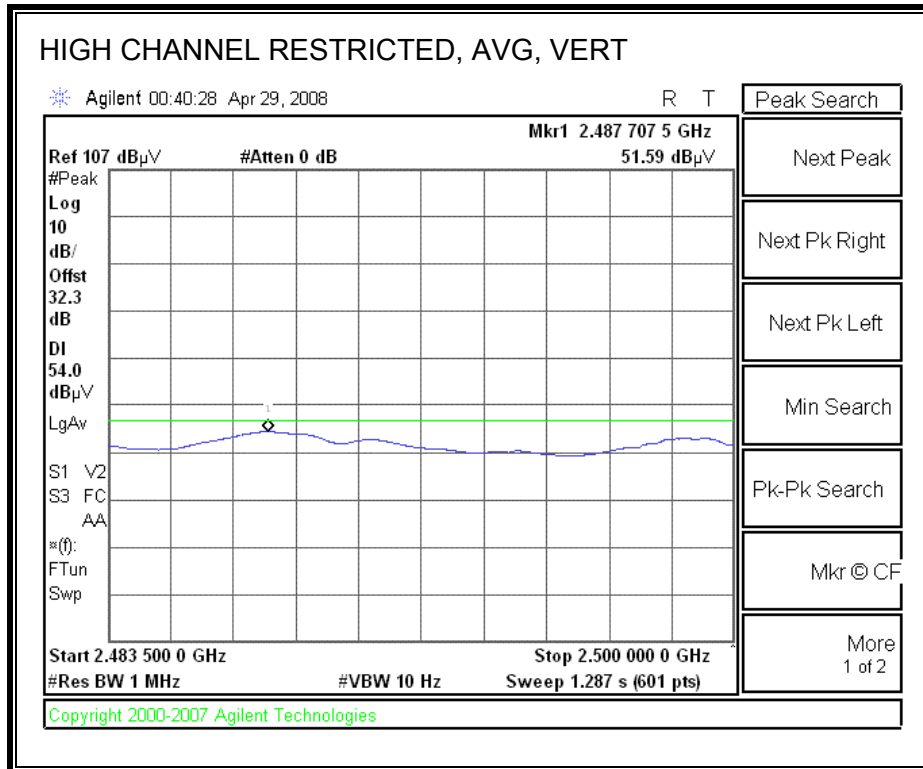
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





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





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 4/29/2008  
 Test Engineer: Chin Pang  
 Configuration: EUT/Dell Laptop/Key Largo Antenna  
 Mode: TX, 2.4GHz b mode

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T145 Agilent 3008A005			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Thanh 187215003	C-5m Chamber	HPF_4.0GHz		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	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>Low Ch, 2412MHz</b>															
4.824	3.0	51.0	48.0	32.6	2.6	-34.8	0.0	0.6	52.0	49.0	74	54	-22.0	-5.0	H
4.824	3.0	52.0	49.5	32.6	2.6	-34.8	0.0	0.6	53.0	50.5	74	54	-21.0	-3.5	V
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	51.0	48.0	32.6	2.6	-34.9	0.0	0.6	52.0	49.0	74	54	-22.0	-5.0	H
7.311	3.0	49.0	42.0	34.6	3.7	-34.7	0.0	0.6	53.2	46.2	74	54	-20.8	-7.8	H
4.874	3.0	50.8	47.8	32.6	2.6	-34.9	0.0	0.6	51.8	48.8	74	54	-22.2	-5.2	V
7.311	3.0	49.5	42.2	34.6	3.7	-34.7	0.0	0.6	53.7	46.4	74	54	-20.3	-7.6	V
<b>High Ch, 2462MHz</b>															
4.924	3.0	50.0	46.1	32.6	2.7	-34.9	0.0	0.6	51.1	47.2	74	54	-22.9	-6.8	H
7.386	3.0	50.1	41.9	34.6	3.7	-34.6	0.0	0.6	54.4	46.2	74	54	-19.6	-7.8	H
4.924	3.0	51.5	48.0	32.6	2.7	-34.9	0.0	0.6	52.6	49.1	74	54	-21.4	-4.9	V
7.386	3.0	51.4	45.2	34.6	3.7	-34.6	0.0	0.6	55.7	49.5	74	54	-18.3	-4.5	V

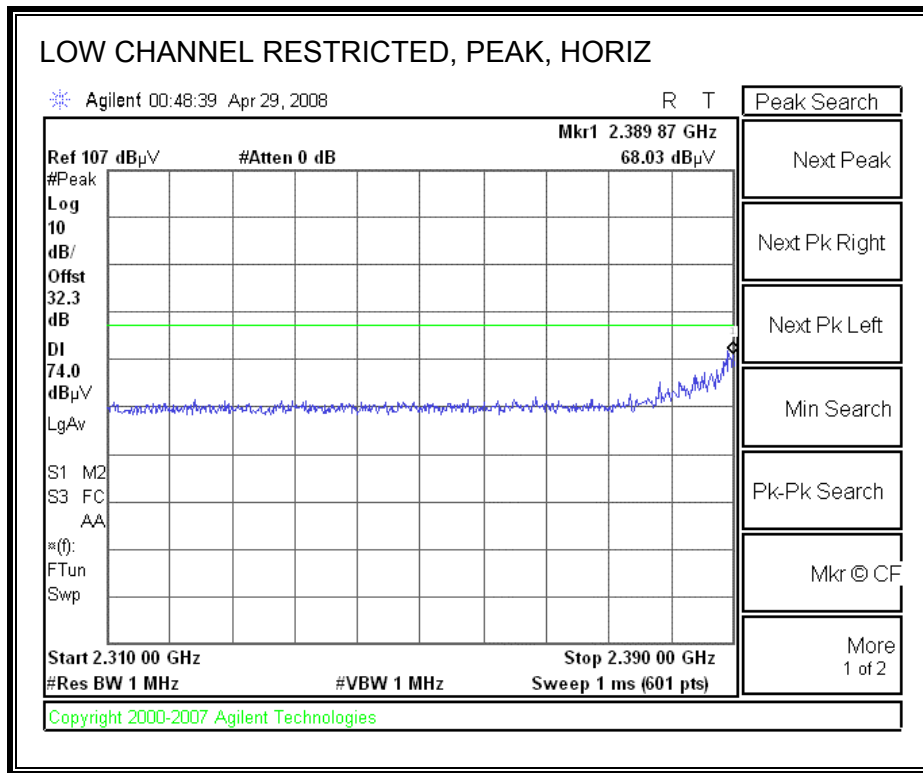
Rev. 4.12.7

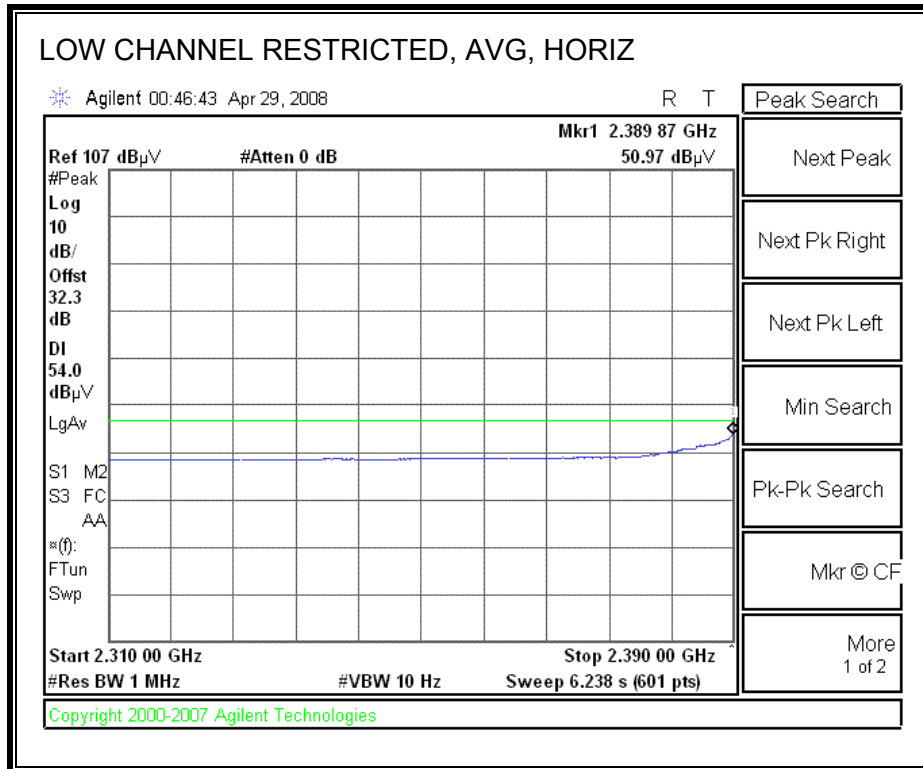
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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



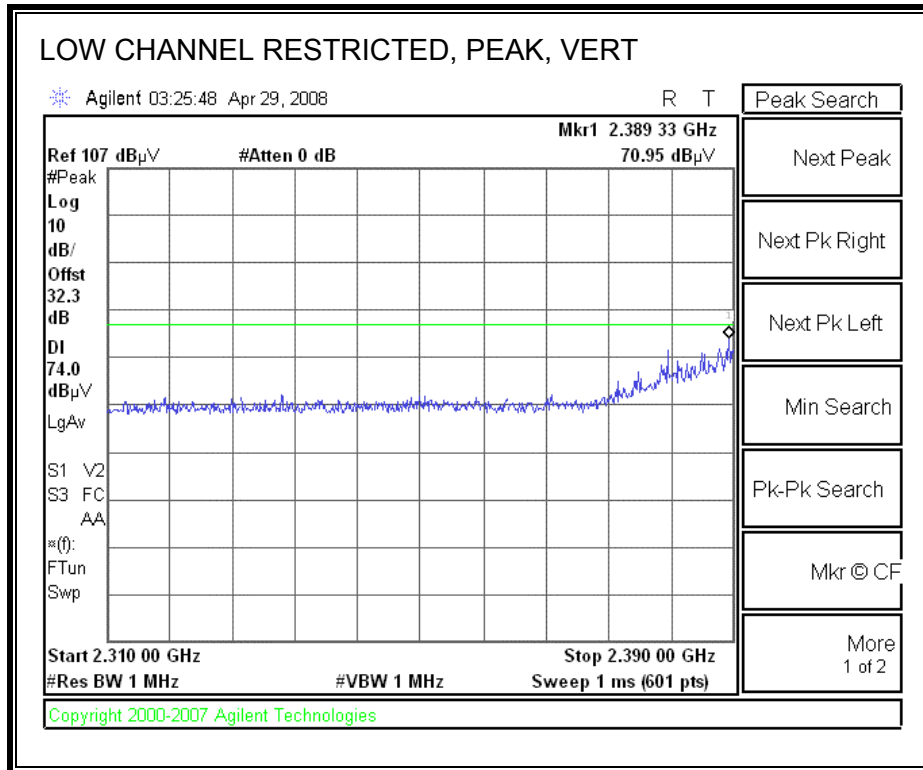
### 8.1.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

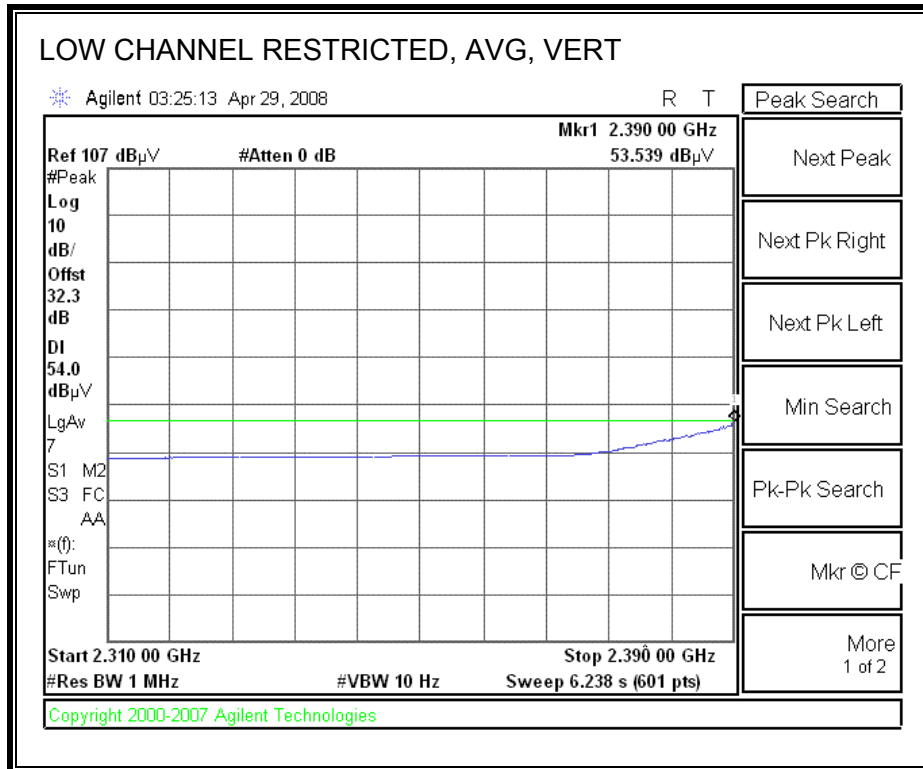
#### RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



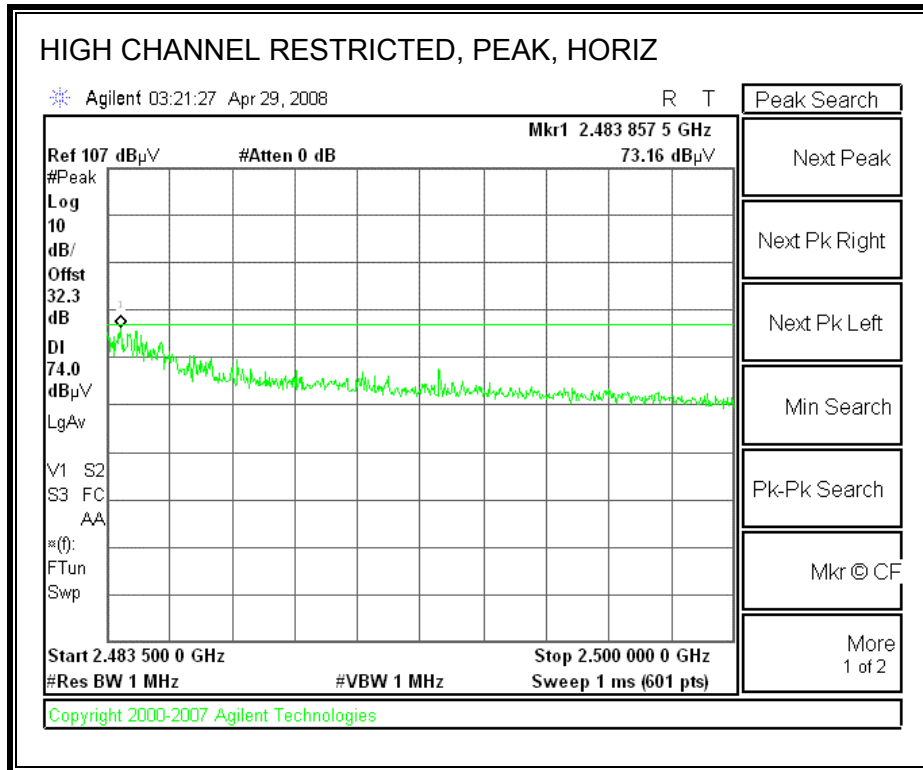


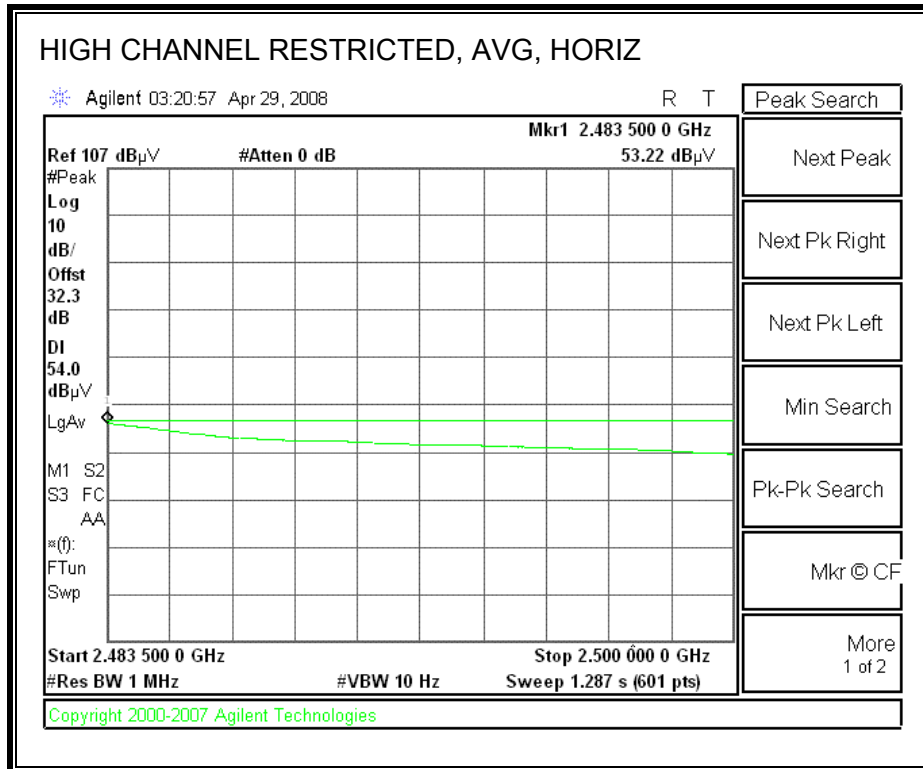
**RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)**



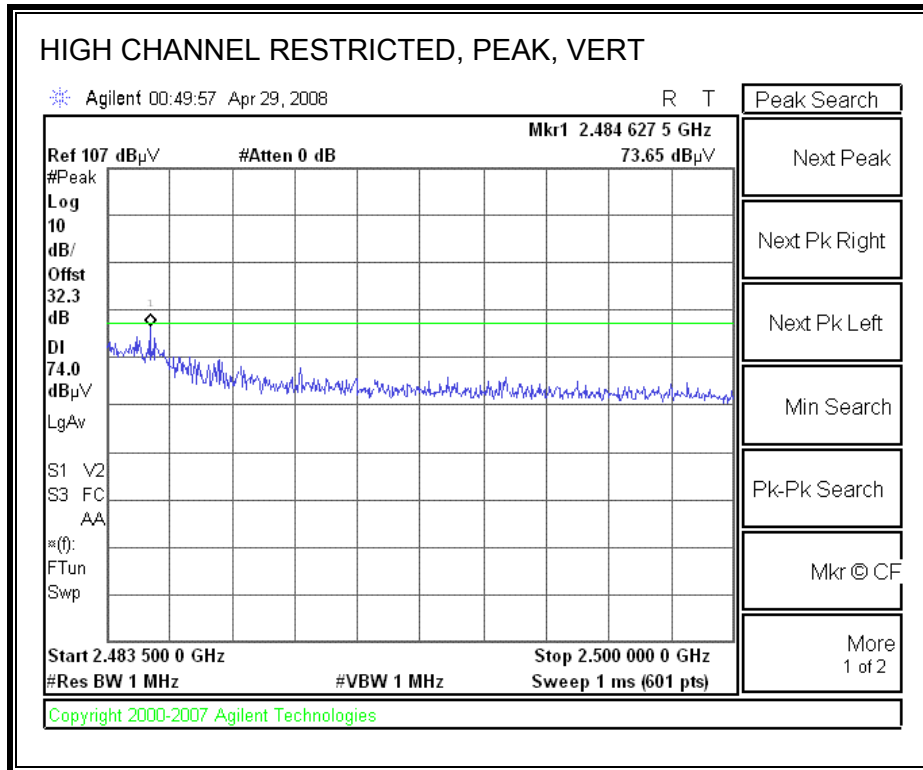


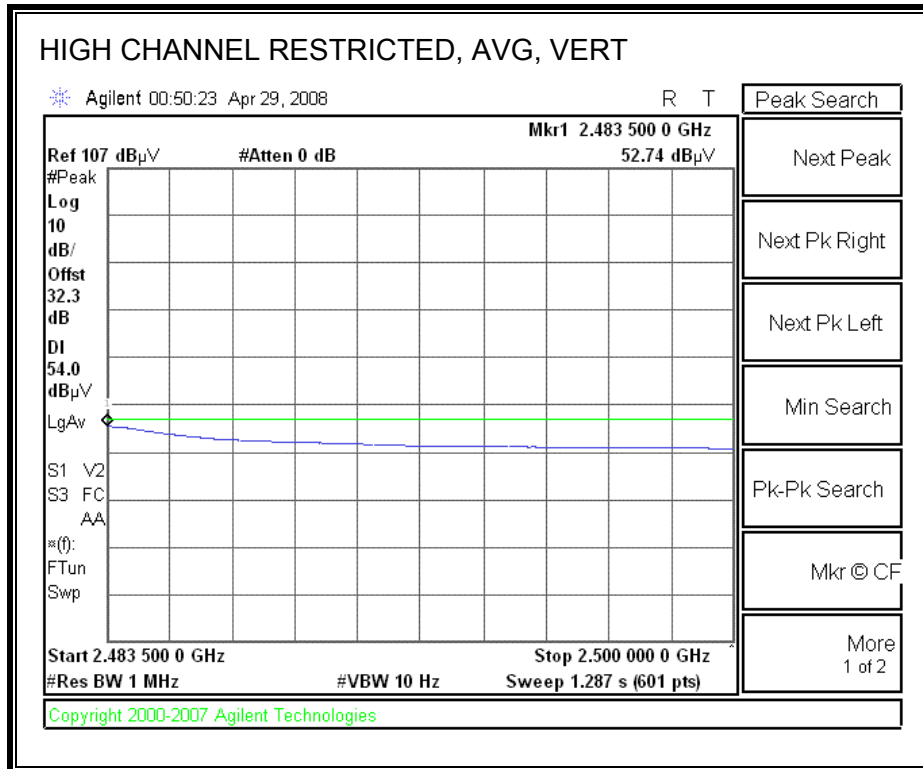
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**





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







**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 4/29/2008  
 Test Engineer: Chin Pang  
 Configuration: EUT/Lenovo Laptop/Antennas  
 Mode: TX, 2.4GHz g mode

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T145 Agilent 3008A005			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Thanh 187215003	C-5m Chamber	HPF_4.0GHz		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>Low Ch, 2412MHz</b>															
4.824	3.0	48.0	35.2	32.6	2.6	-34.8	0.0	0.6	49.0	36.2	74	54	-25.0	-17.8	H
4.824	3.0	50.0	36.0	32.6	2.6	-34.8	0.0	0.6	51.0	37.0	74	54	-23.0	-17.0	V
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	53.0	41.5	32.6	2.6	-34.9	0.0	0.6	54.0	42.5	74	54	-20.0	-11.5	H
7.311	3.0	55.5	42.0	34.6	3.7	-34.7	0.0	0.6	59.7	46.2	74	54	-14.3	-7.8	H
4.874	3.0	56.0	44.0	32.6	2.6	-34.9	0.0	0.6	57.0	45.0	74	54	-17.0	-9.0	V
7.311	3.0	63.0	48.5	34.6	3.7	-34.7	0.0	0.6	67.2	52.7	74	54	-6.8	-1.3	V
<b>High Ch, 2462MHz</b>															
4.924	3.0	51.7	37.6	32.6	2.7	-34.9	0.0	0.6	52.8	38.7	74	54	-21.2	-15.3	H
7.386	3.0	52.0	38.3	34.6	3.7	-34.6	0.0	0.6	56.3	42.6	74	54	-17.7	-11.4	H
4.924	3.0	53.0	40.5	32.6	2.7	-34.9	0.0	0.6	54.1	41.6	74	54	-19.9	-12.4	V
7.386	3.0	56.2	42.0	34.6	3.7	-34.6	0.0	0.6	60.5	46.3	74	54	-13.5	-7.7	V

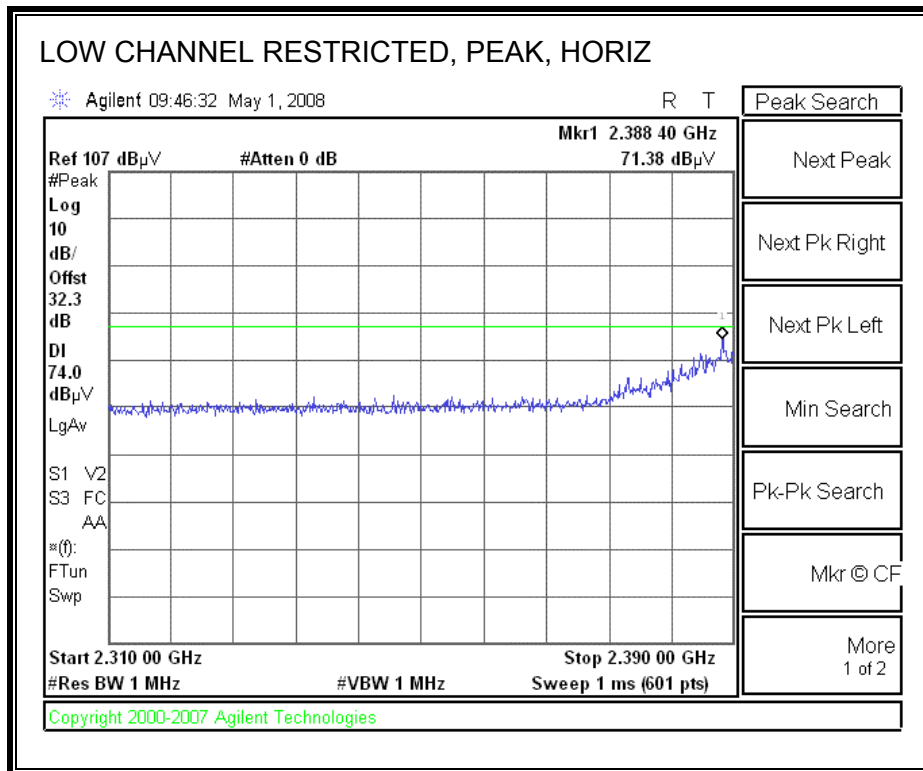
Rev. 4127

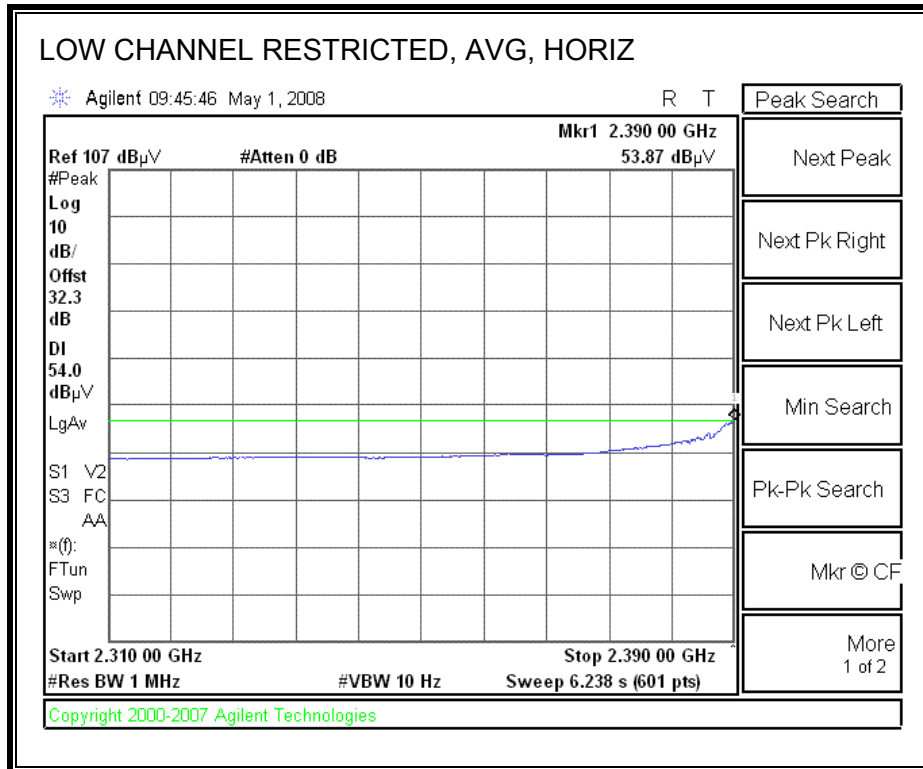
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

### 8.1.3. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND

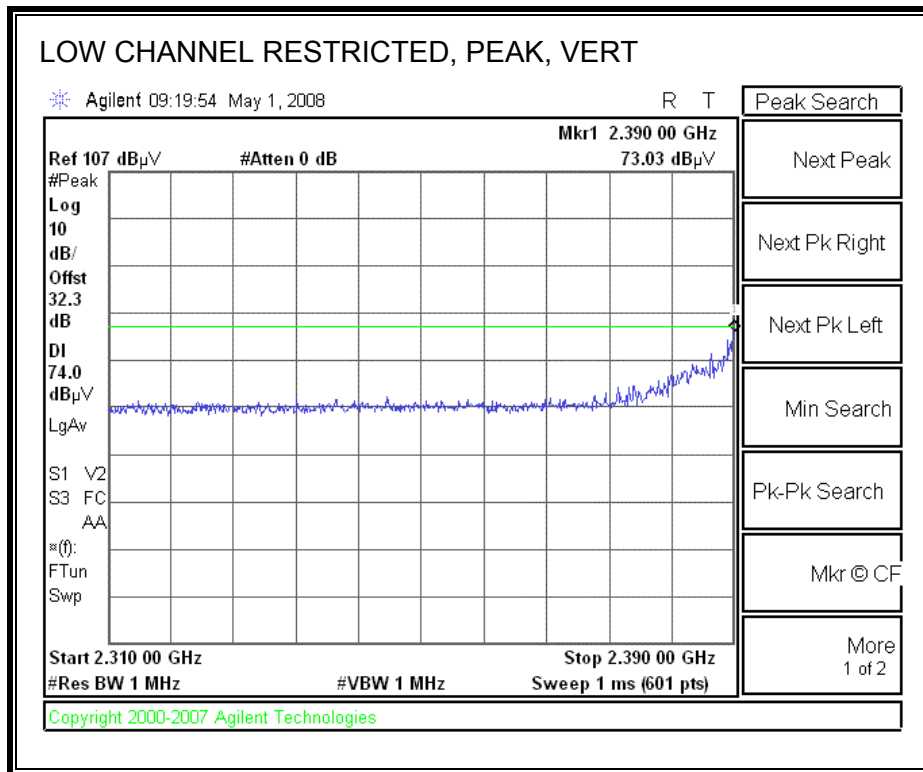
**NOTE:** At horizontal polarization, in order to pass band edge, power is reduced to 13.5dBm for low channel and 13.3dBm for high channel

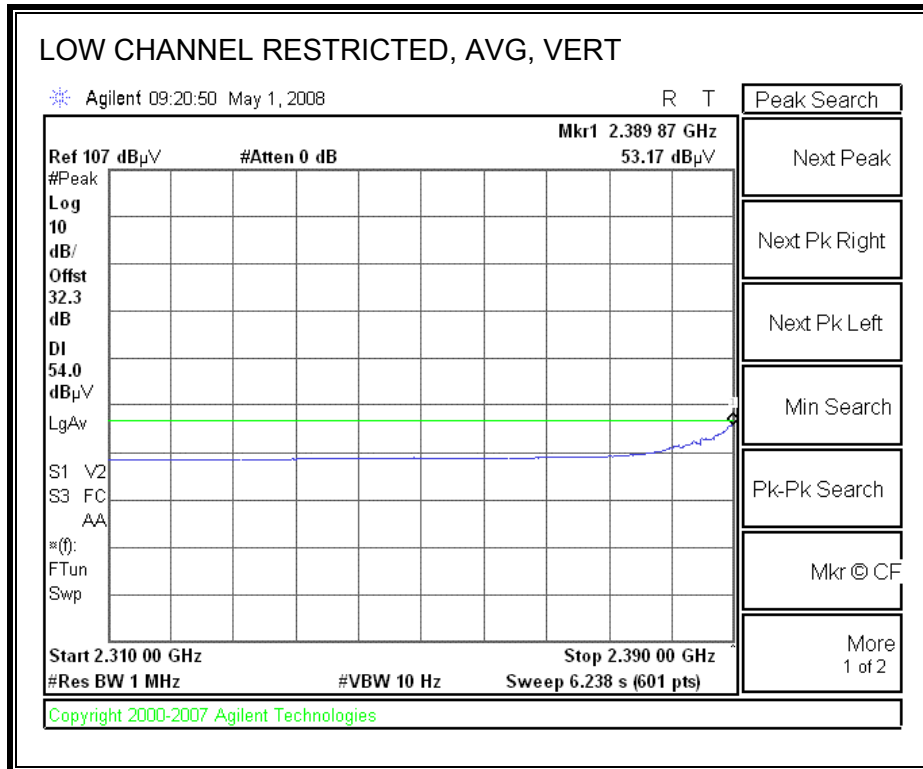
#### RESTRICTED BANEDGE (LOW CHANNEL, HORIZONTAL)



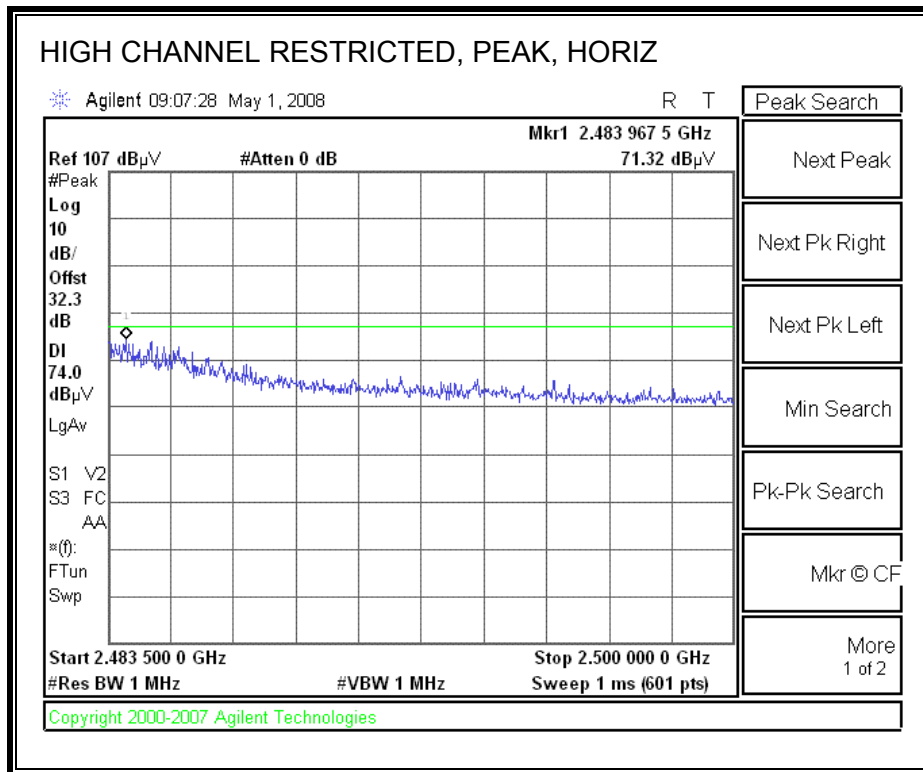


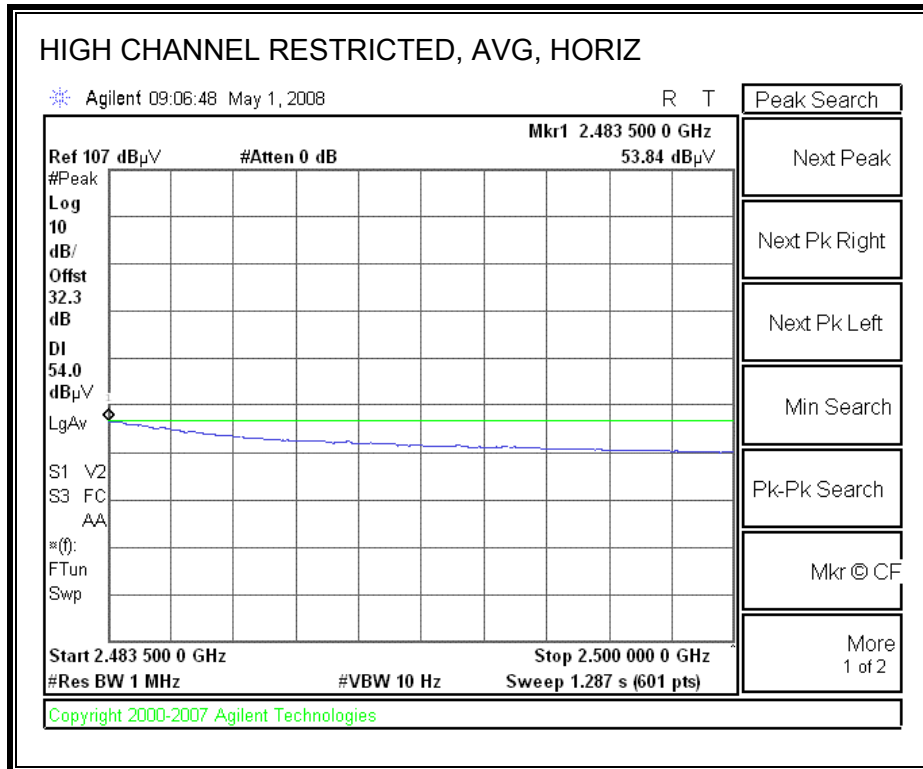
**RESTRICTED BANDEGE (LOW CHANNEL, VERTICAL)**



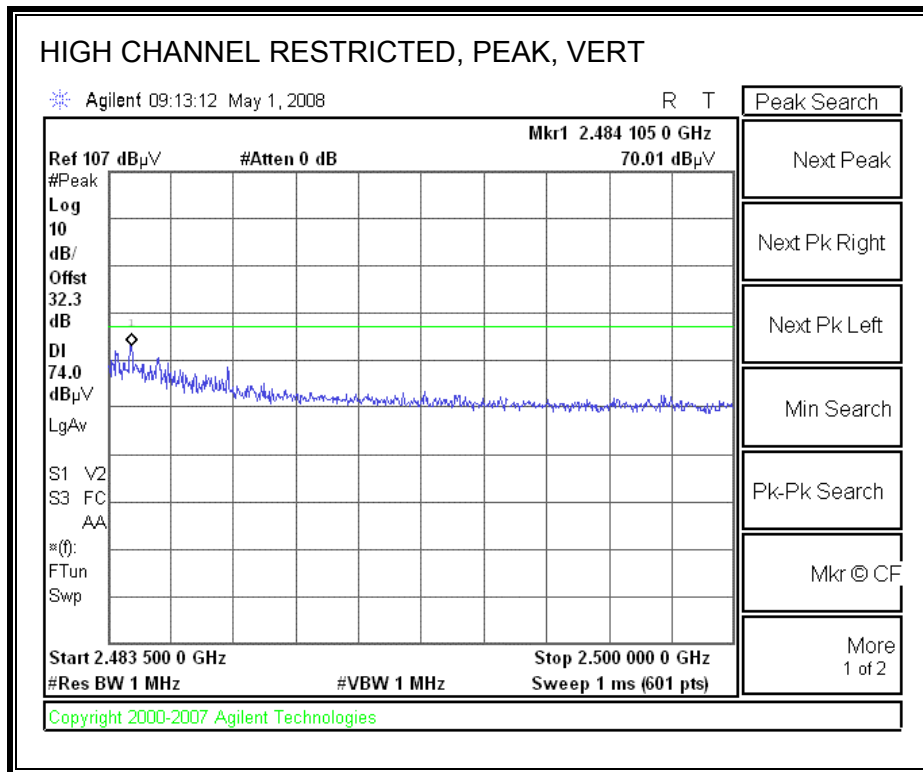


**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

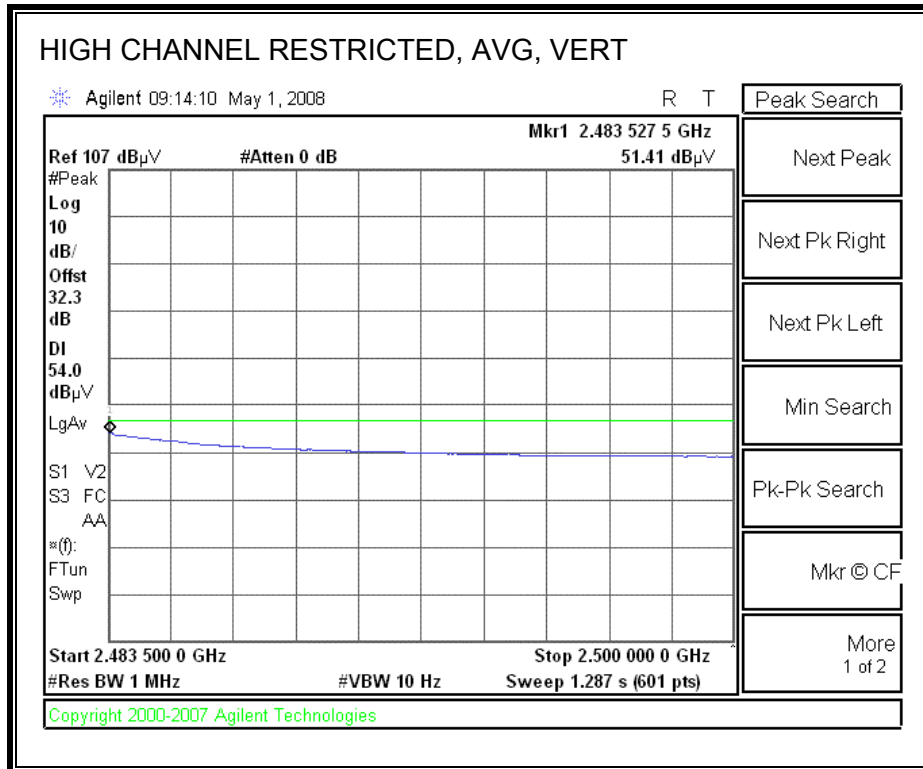




**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**







**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 5/1/208  
 Test Engineer: Chin Pang  
 Configuration: EUT/Lenovo Laptop/Antenna  
 Mode: TX, HT20 2.4GHz Band

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T145 Agilent 3008A005			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Thanh 187215003	C-5m Chamber		R_001	<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	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>Low Ch, 2412MHz</b>															
4.824	3.0	50.0	36.0	32.6	2.6	-34.8	0.0	0.0	50.4	36.4	74	54	-23.6	-17.6	H
4.824	3.0	47.5	35.0	32.6	2.6	-34.8	0.0	0.0	47.9	35.4	74	54	-26.1	-18.6	V
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	58.0	44.7	32.6	2.6	-34.9	0.0	0.0	58.4	45.1	74	54	-15.6	-8.9	H
7.311	3.0	58.8	45.0	34.6	3.7	-34.7	0.0	0.0	62.4	48.6	74	54	-11.6	-5.4	H
4.874	3.0	57.4	45.0	32.6	2.6	-34.9	0.0	0.0	57.8	45.4	74	54	-16.2	-8.6	V
7.311	3.0	52.0	38.4	34.6	3.7	-34.7	0.0	0.0	55.6	42.0	74	54	-18.4	-12.0	V
<b>High Ch, 2462MHz</b>															
4.924	3.0	50.0	36.0	32.6	2.7	-34.9	0.0	0.0	50.5	36.5	74	54	-23.5	-17.5	H
7.386	3.0	48.4	36.2	34.6	3.7	-34.6	0.0	0.0	52.1	39.9	74	54	-21.9	-14.1	H
4.924	3.0	48.0	35.7	32.6	2.7	-34.9	0.0	0.0	48.5	36.2	74	54	-25.5	-17.8	V
7.386	3.0	56.0	40.8	34.6	3.7	-34.6	0.0	0.0	59.7	44.5	74	54	-14.3	-9.5	V

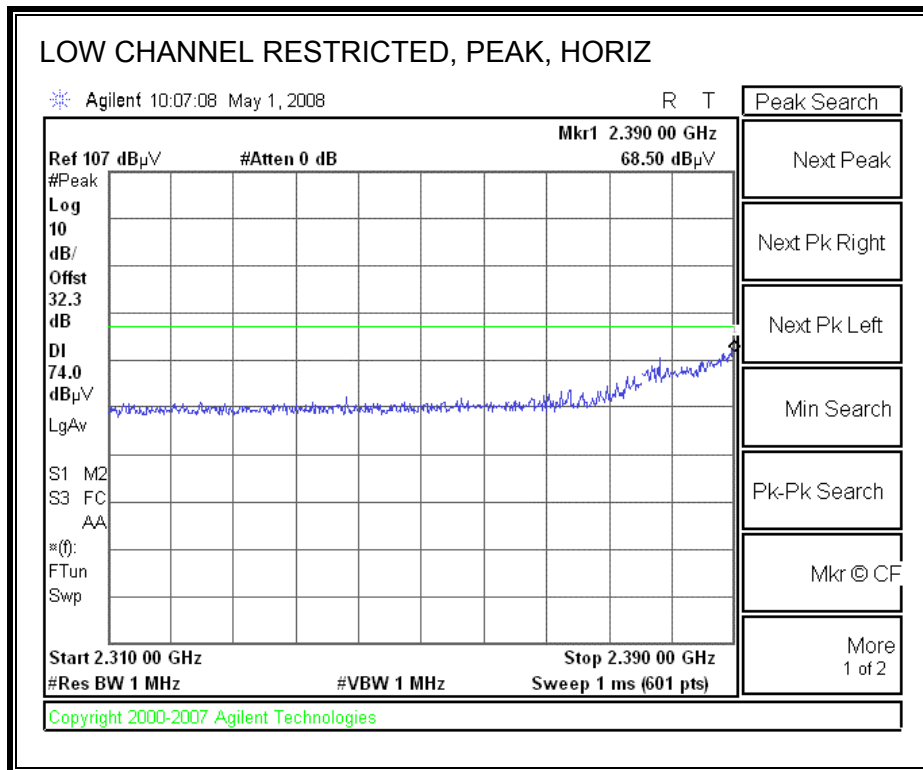
Rev. 4127

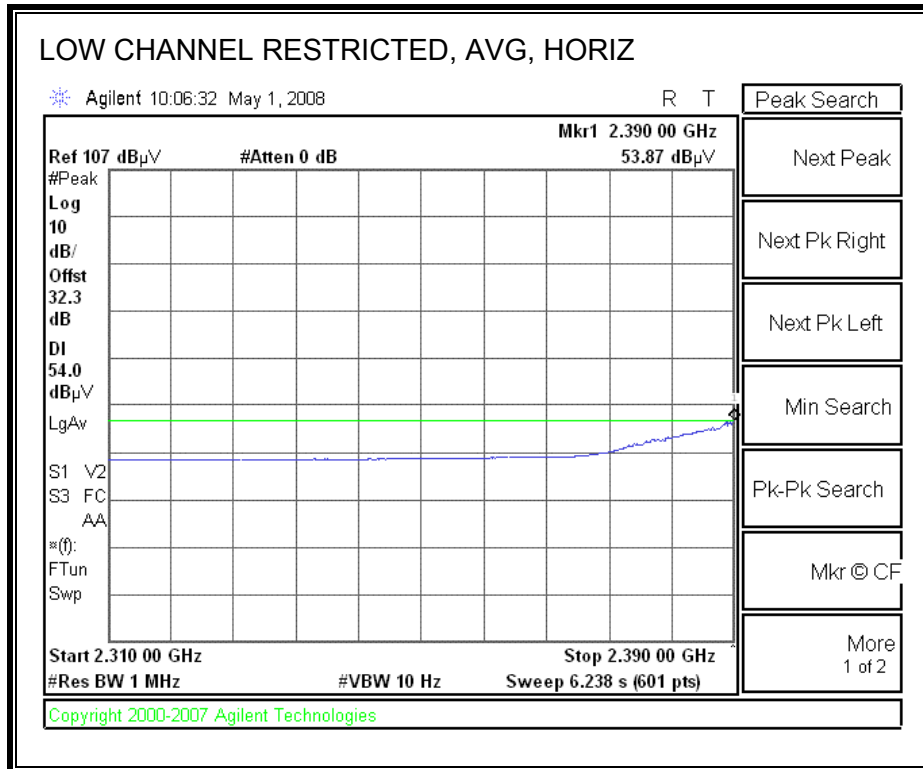
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

### 8.1.4. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 2.4 GHz BAND

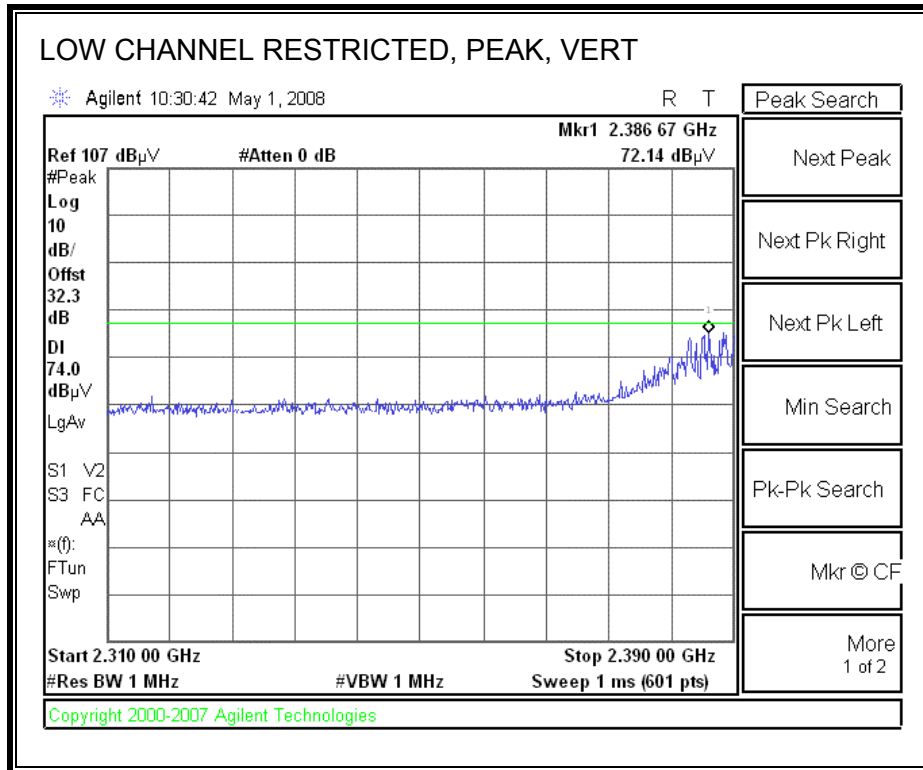
**NOTE:** At horizontal polarization, in order to pass band edge, power is reduced to 9 dBm for low channel and 12 dBm for high channel.

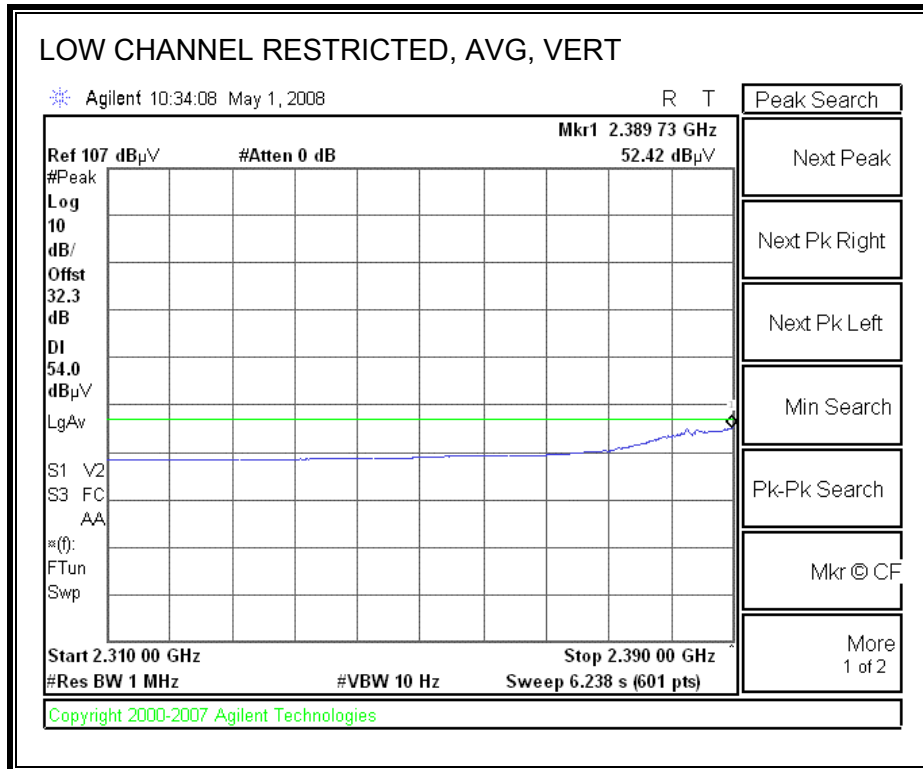
#### RESTRICTED BANDEGE (LOW CHANNEL, HORIZONTAL)



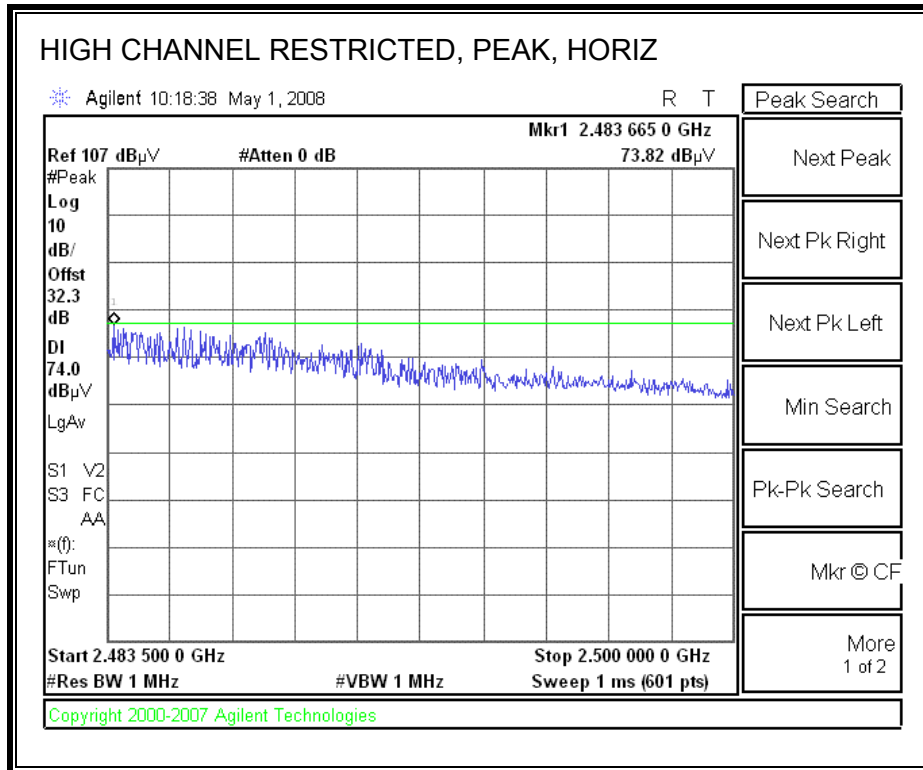


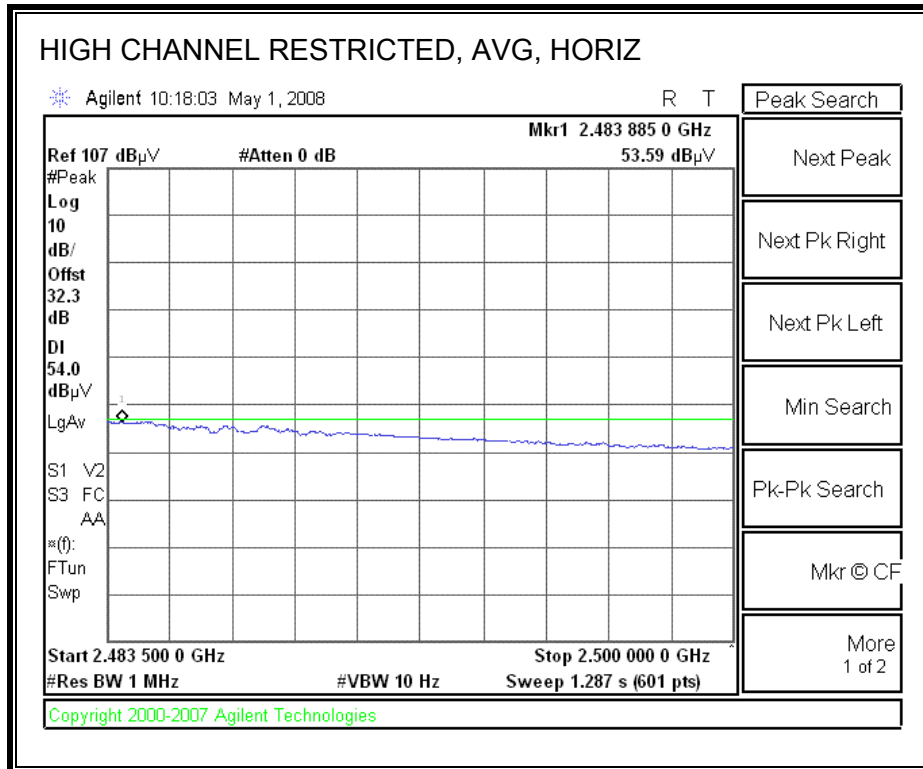
**RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)**





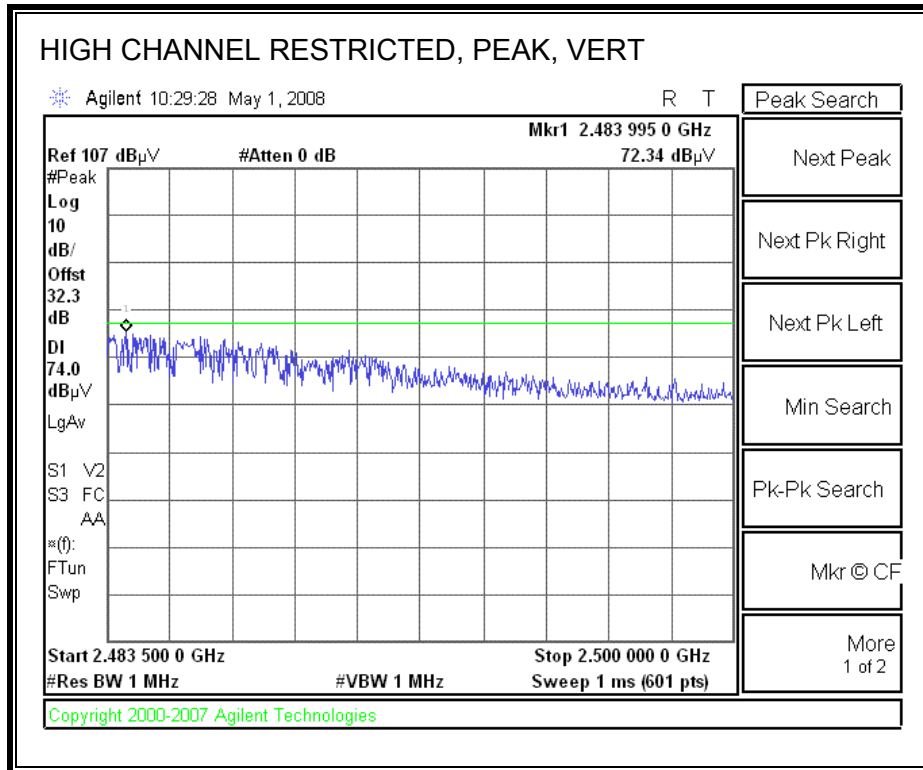
**RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)**

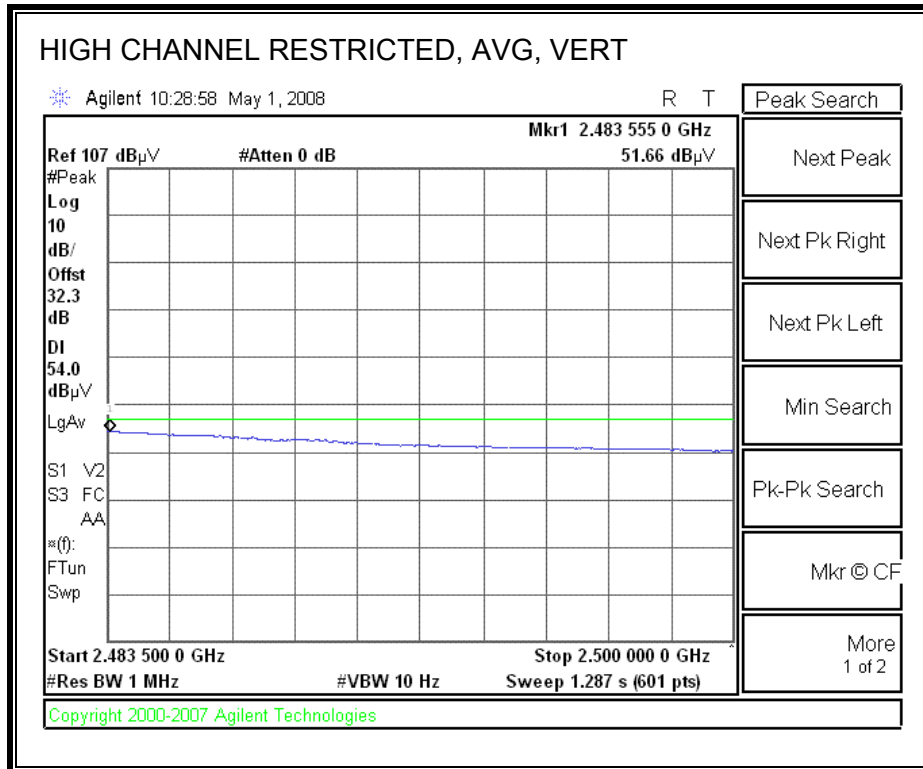






**RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)**





**HARMONICS AND SPURIOUS EMISSIONS**

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 5/1/208  
 Test Engineer: Chin Pang  
 Configuration: EUT/Lenovo Laptop/Antenna  
 Mode: TX, HT40 2.4GHz Band

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T145 Agilent 3008A005			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	
	Thanh 187215003	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	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>Low Ch, 2422MHz</b>															
4.844	3.0	47.0	34.7	32.6	2.6	-34.8	0.0	0.0	47.4	35.1	74	54	-26.6	-18.9	H
4.844	3.0	48.0	34.0	32.6	2.6	-34.8	0.0	0.0	48.4	34.4	74	54	-25.6	-19.6	V
<b>Mid Ch, 2437MHz</b>															
4.874	3.0	47.5	34.6	32.6	2.6	-34.9	0.0	0.0	47.9	35.0	74	54	-26.1	-19.0	H
7.311	3.0	48.0	35.2	34.6	3.7	-34.7	0.0	0.0	51.6	38.8	74	54	-22.4	-15.2	H
4.874	3.0	48.5	35.0	32.6	2.6	-34.9	0.0	0.0	48.9	35.4	74	54	-25.1	-18.6	V
7.311	3.0	51.6	37.4	34.6	3.7	-34.7	0.0	0.0	55.2	41.0	74	54	-18.8	-13.0	V
<b>High Ch, 2452MHz</b>															
4.904	3.0	47.0	35.6	32.6	2.7	-34.9	0.0	0.0	47.4	36.0	74	54	-26.6	-18.0	H
7.356	3.0	46.5	33.6	34.6	3.7	-34.6	0.0	0.0	50.1	37.2	74	54	-23.9	-16.8	H
4.904	3.0	48.4	34.5	32.6	2.7	-34.9	0.0	0.0	48.8	34.9	74	54	-25.2	-19.1	V
7.356	3.0	49.4	36.0	34.6	3.7	-34.6	0.0	0.0	53.0	39.6	74	54	-21.0	-14.4	V

Rev. 4127

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		

### 8.1.5. TRANSMITTER ABOVE 1 GHz FOR 802.11a MODE IN THE 5.8 GHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 4/30/2008  
 Test Engineer: Chin Pang  
 Configuration: EUT ( HB92)/Lenovo Laptop/Antenna  
 Mode: TX, 5.8GHz Band, a mode

**Test Equipment:**

<b>Horn 1-18GHz</b>	<b>Pre-amplifier 1-26GHz</b>	<b>Pre-amplifier 26-40GHz</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T136; M/N: 3117 @3m	T145 Agilent 3008A005	T88 Miteq 26-40GHz	T39; ARA 18-26GHz; S/N:1013	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	C.5m Chamber	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	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>Low Ch, 5745MHz</b>															
11.490	3.0	55.0	41.0	35.9	4.3	-33.1	0.0	0.7	62.7	48.7	74	54	-11.3	-5.3	V
11.490	3.0	48.5	35.6	35.9	4.3	-33.1	0.0	0.7	56.2	43.3	74	54	-17.8	-10.7	H
<b>Mid Ch, 5785MHz</b>															
11.570	3.0	55.0	41.0	35.9	4.3	-33.0	0.0	0.7	62.9	48.9	74	54	-11.1	-5.1	V
11.570	3.0	48.5	35.6	35.9	4.3	-33.0	0.0	0.7	56.4	43.5	74	54	-17.6	-10.5	H
<b>High Ch, 5825MHz</b>															
11.650	3.0	54.0	40.0	36.0	4.3	-32.9	0.0	0.7	62.0	48.0	74	54	-12.0	-6.0	V
11.650	3.0	50.0	36.0	36.0	4.3	-32.9	0.0	0.7	58.0	44.0	74	54	-16.0	-10.0	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		

### 8.1.6. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 4/30/2008  
 Test Engineer: Chin Pang  
 Configuration: EUT ( HB92)/Lenovo Laptop/Antenna  
 Mode: TX, 5.8GHz Band, HT20 mode

**Test Equipment:**

Horn 1-18GHz	Pre-amplifier 1-26GHz	Pre-amplifier 26-40GHz	Horn > 18GHz	Limit
T136; M/N: 3117 @3m	T145 Agilent 3008A005	T88 Miteq 26-40GHz	T39; ARA 18-26GHz; S/N:1013	FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter	Peak Measurements RBW=VBW=1MHz
	Thanh 187215003	C.5m Chamber	HPF_7.6GHz		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	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)
<b>Low Ch, 5745MHz</b>															
11.490	3.0	61.3	44.7	35.9	4.3	-33.1	0.0	0.7	69.0	52.4	74	54	-5.0	-1.6	V
11.490	3.0	55.0	41.0	35.9	4.3	-33.1	0.0	0.7	62.7	48.7	74	54	-11.3	-5.3	H
<b>Mid Ch, 5785MHz</b>															
11.570	3.0	62.0	45.0	35.9	4.3	-33.0	0.0	0.7	69.9	52.9	74	54	-4.1	-1.1	V
11.570	3.0	54.6	40.6	35.9	4.3	-33.0	0.0	0.7	62.5	48.5	74	54	-11.5	-5.5	H
<b>High Ch, 5825MHz</b>															
11.650	3.0	58.8	43.1	36.0	4.3	-32.9	0.0	0.7	66.8	51.1	74	54	-7.2	-2.9	V
11.650	3.0	52.0	38.4	36.0	4.3	-32.9	0.0	0.7	60.0	46.4	74	54	-14.0	-7.6	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		

### 8.1.7. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 5.8 GHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS

**High Frequency Measurement**  
 Compliance Certification Services, Fremont 5m Chamber

Company: Atheros  
 Project #: 08U11791  
 Date: 4/30/2008  
 Test Engineer: Chin Pang  
 Configuration: EUT ( HB92)/Lenovo Laptop/Antenna  
 Mode: TX, 5.8GHz Band, HT40

**Test Equipment:**

<b>Horn 1-18GHz</b>	<b>Pre-amplifier 1-26GHz</b>	<b>Pre-amplifier 26-40GHz</b>	<b>Horn &gt; 18GHz</b>	<b>Limit</b>
T136; M/N: 3117 @3m	T145 Agilent 3008A005	T88 Miteq 26-40GHz	T39; ARA 18-26GHz; S/N:1013	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	C.5m Chamber	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	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>Low Ch, 5755MHz</b>															
11.510	3.0	55.0	41.0	35.9	4.3	-33.1	0.0	0.7	62.8	48.8	74	54	-11.2	-5.2	V
11.510	3.0	48.5	35.6	35.9	4.3	-33.1	0.0	0.7	56.3	43.4	74	54	-17.7	-10.6	H
<b>High Ch, 5795MHz</b>															
11.590	3.0	54.0	40.0	35.9	4.3	-33.0	0.0	0.7	61.9	47.9	74	54	-12.1	-6.1	V
11.590	3.0	50.0	36.0	35.9	4.3	-33.0	0.0	0.7	57.9	43.9	74	54	-16.1	-10.1	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		

## 8.2. RECEIVER ABOVE 1 GHz

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber																	
Company: Atheros																	
Project #:																	
Date: 5/2/2008																	
Test Engineer: Chin Pang																	
Configuration: EUT/Lenovo Laptop/Antenna																	
Mode: RX Mode, HT40, 2.4GHz (worst Case)																	
Test Equipment:																	
Horn 1-18GHz			Pre-amplifer 1-26GHz			Pre-amplifer 26-40GHz			Horn > 18GHz			Limit					
T136; M/N: 3117 @3m			T145 Agilent 3008A005t									FCC 15.209					
Hi Frequency Cables																	
2 foot cable			3 foot cable			12 foot cable			HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz				
			Thanh 187215003			C-5m Chamber							Average Measurements RBW=1MHz, VBW=10Hz				
f	Dist	Read Pk	Read Avg	AF	CL	Amp	D Corr	Fln	Peak	Avg	Pk Lim	Avg Lim	Pk Mar	Avg Mar	Notes		
GHz	(m)	dBuV	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB	dB	(V/H)		
1.331	3.0	55.3	36.7	28.3	1.7	-35.9	0.0	0.0	49.4	30.8	74	54	-24.6	-23.2	V		
1.600	3.0	54.6	36.0	29.2	1.8	-35.7	0.0	0.0	49.9	31.3	74	54	-24.1	-22.7	V		
2.490	3.0	56.7	36.4	30.8	2.1	-35.1	0.0	0.0	54.5	34.2	74	54	-19.5	-19.8	V		
4.980	3.0	51.4	35.0	32.6	2.7	-34.9	0.0	0.0	51.9	35.5	74	54	-22.1	-18.5	V		
1.098	3.0	55.5	38.5	27.5	1.6	-36.1	0.0	0.0	48.6	31.6	74	54	-25.4	-22.4	H		
1.600	3.0	54.2	37.2	29.2	1.8	-35.7	0.0	0.0	49.5	32.5	74	54	-24.5	-21.5	H		
2.490	3.0	56.7	36.4	30.8	2.1	-35.1	0.0	0.0	54.5	34.2	74	54	-19.5	-19.8	H		
4.980	3.0	53.8	34.7	32.6	2.7	-34.9	0.0	0.0	54.3	35.2	74	54	-19.7	-18.8	H		
Rev. 412.7																	
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										

## 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 <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.

**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>

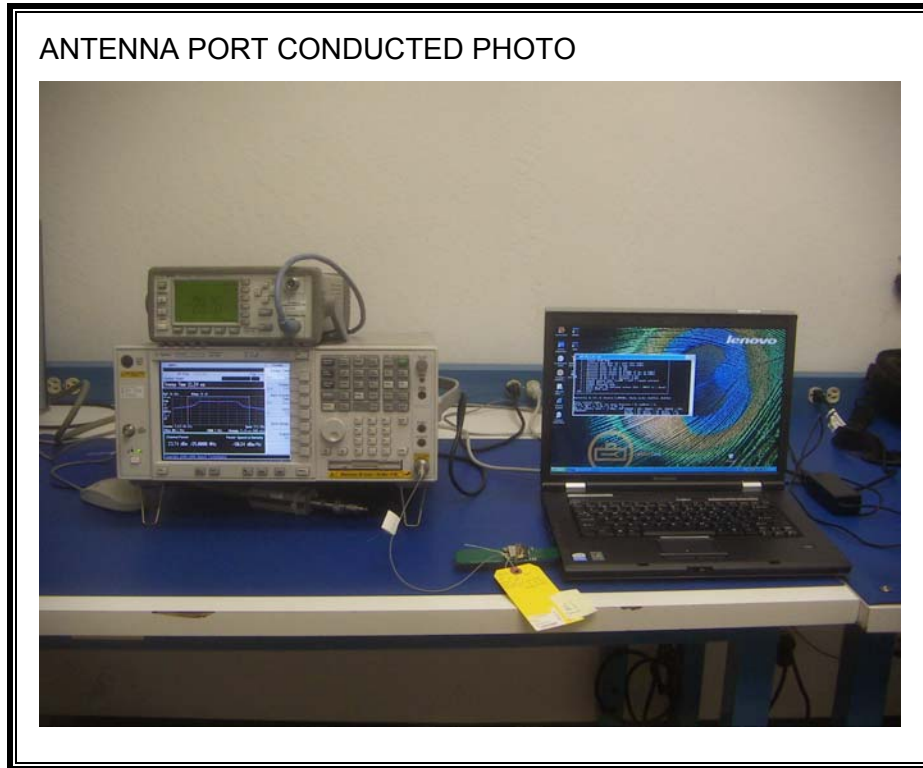
**RESULTS**

(MPE distance equals 20 cm)

Mode	Band	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm <sup>2</sup> )	IC Power Density (W/m <sup>2</sup> )
WLAN	2.4 GHz	20.0	29.58	6.00	0.72	7.18
WLAN	5.8 GHz	20.0	27.26	8.81	0.80	8.04

## 10. SETUP PHOTOS

### ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP

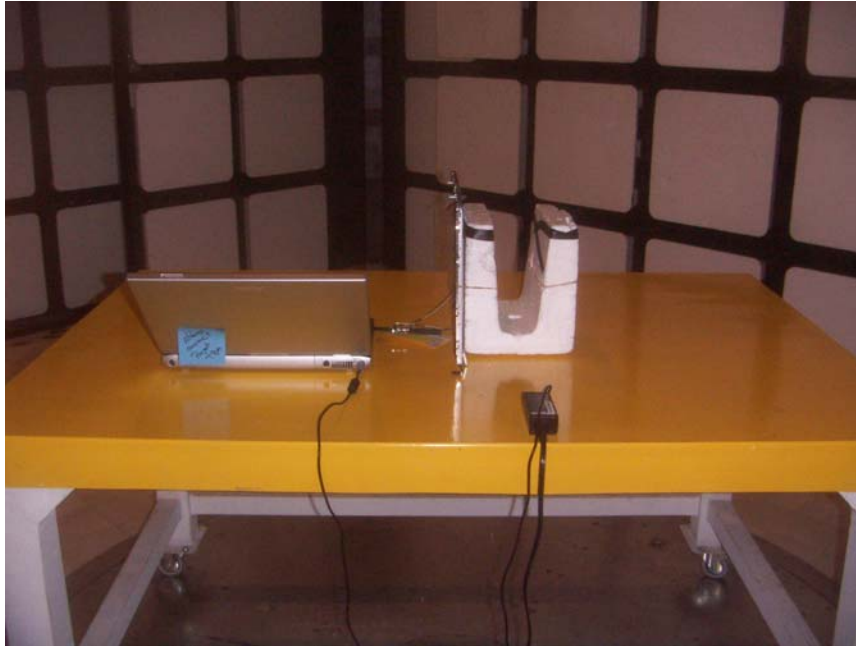


**RADIATED RF MEASUREMENT SETUP**

RADIATED FRONT PHOTO



RADIATED BACK PHOTO



**END OF REPORT**