



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

FOR

**802.11n 2x2 PCIE MINICARD
(INSTALLED IN DELL LAPTOP, MODEL NUMBER: PP24L)**

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

**IC: 4104A-ARBHB92D
IC MODEL: AR5BHB92-D**

REPORT NUMBER: 08U11860-1B

ISSUE DATE: JULY 15, 2008

Prepared for
**ATHEROS COMMUNICATIONS, INC.
5480 GREAT AMERICA PARKWAY
SANTA CLARA, CA 95054, U.S.A**

Prepared by
**COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/13/08	Initial Issue	T. Chan
A	06/30/08	Per Client's request, added host model number	A. Zaffar
B	07/15/08	Changed IC model due to typo	A. Zaffar

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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
(INSTALLED IN DELL LAPTOP, MODEL NUMBER: PP24L)

FCC MODEL: AR5BHB92
IC MODEL: AR5BHB92-D

SERIAL NUMBER: 001644CF9517

DATE TESTED: JUNE 04-09, 2008

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. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For CCS By:

Tested By:



THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

CHIN PANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11n 2x2 PCIe minicard transceiver, FCC Model AR5BHB92/ IC Model AR5BHB92-D (installed in a Dell laptop, model number: PP24L)

5.2. DESCRIPTION OF CLASS II CHANGE

The module installed inside a Dell laptop with two PIFA antennas.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two PIFA antennas with a maximum peak gain of 2.7dBi for 2.4GHz and 2.3dBi for 5.8GHz bands.

5.4. SOFTWARE AND FIRMWARE

The test utility and driver software used during testing was Art ANWI 1.4 and Devlib Revision 0.6 Build #18 Art_11n.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case data rates are determined to be as follows for each mode, based on the previous investigations by measuring the average power, peak power and PPSD across all the data rates, bandwidths, modulations and spatial stream modes.

Thus 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.
- 802.11n 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.

All radiated emissions were performed at FEM1 board.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Inspiron	20311221G0I0Q	DoC
AC Adapter	Dell	LA90PSI	CN-ODF315-71615-814-3092	DoC

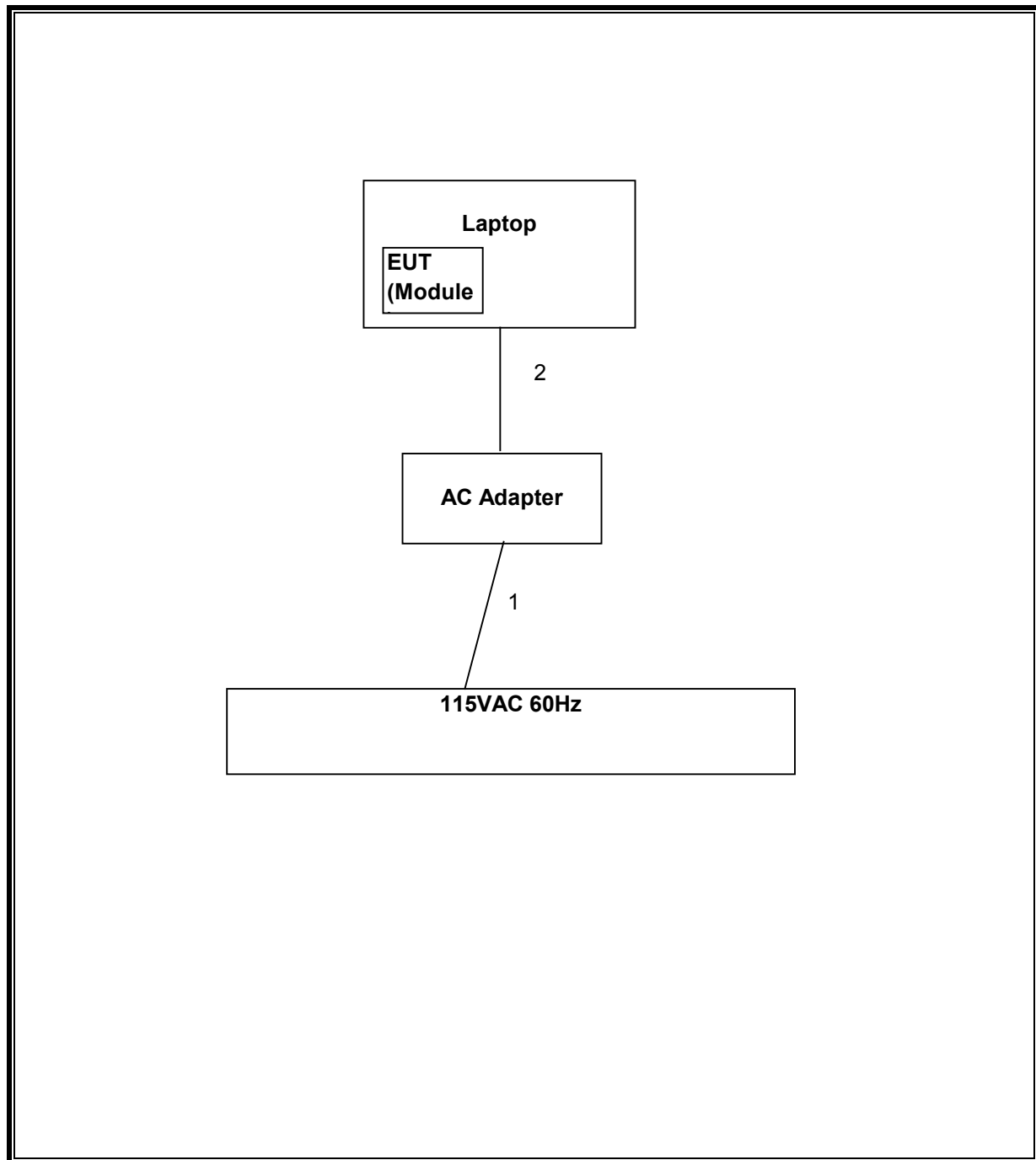
I/O CABLES

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	NA
2	DC	1	DC	Un-shielded	2m	NA

TEST SETUP

The EUT is installed in a host laptop computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST					
Description	Manufacturer	Model	Asset	Cal Date	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	12/3/2007	3/3/2009
Peak Power Meter	Agilent / HP	E4416A	C00963	12/4/2007	12/4/2009
Peak / Average Power Sensor	Agilent	E9327A	C00964	12/7/2007	12/7/2009
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	9/28/2007	9/28/2008
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	9/27/2007	9/27/2008
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00589	9/29/2007	9/29/2008
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	10/11/2007	10/11/2008
EMI Receiver, 2.9 GHz	Agilent / HP	8542E	C00957	2/6/2007	6/12/2008
RF Filter Section, 2.9 GHz	Agilent / HP	85420E	C00958	2/6/2007	6/12/2008
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	2/6/2008	8/6/2009
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/25/2007	10/25/2008
2.4-2.5GHz Reject Filter	Micro Tronics	BRM50702	N02685	CNR	CNR
High Pass Filter 7.6GHz	Micro Tronics	HPM13195	N02681	CNR	CNR
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02679	CNR	CNR
Reject Filter, 5.725-5.85 GHz	Micro-Tronics	BRC13192	N02676	CNR	CNR
Antenna, Horn, 18 GHz	EMCO	3115	C00945	4/22/2008	4/22/2009
Antenna, Horn, 18 GHz	EMCO	3115	C00872	4/22/2008	4/22/2009

7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

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

TEST PROCEDURE

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

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

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

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

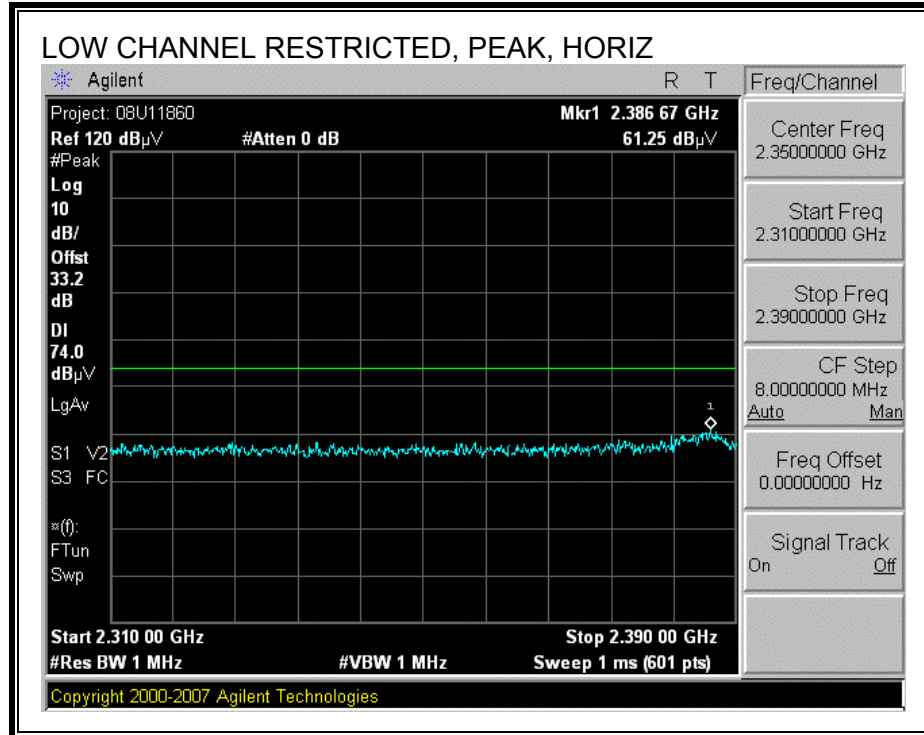
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

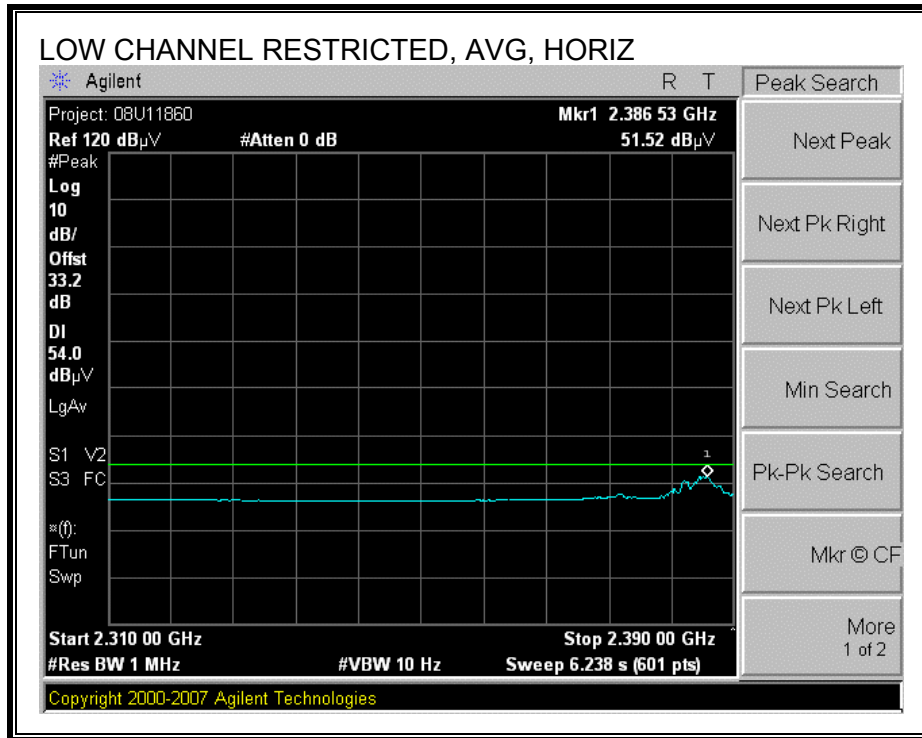
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

7.2. TRANSMITTER ABOVE 1 GHz

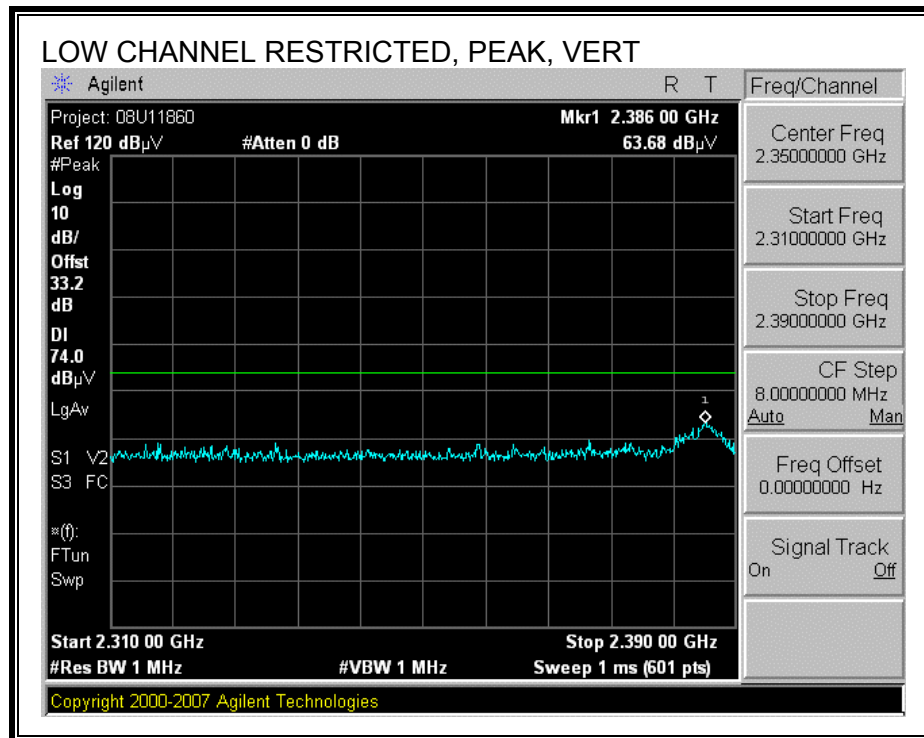
7.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11b MODE IN THE 2.4 GHz BAND

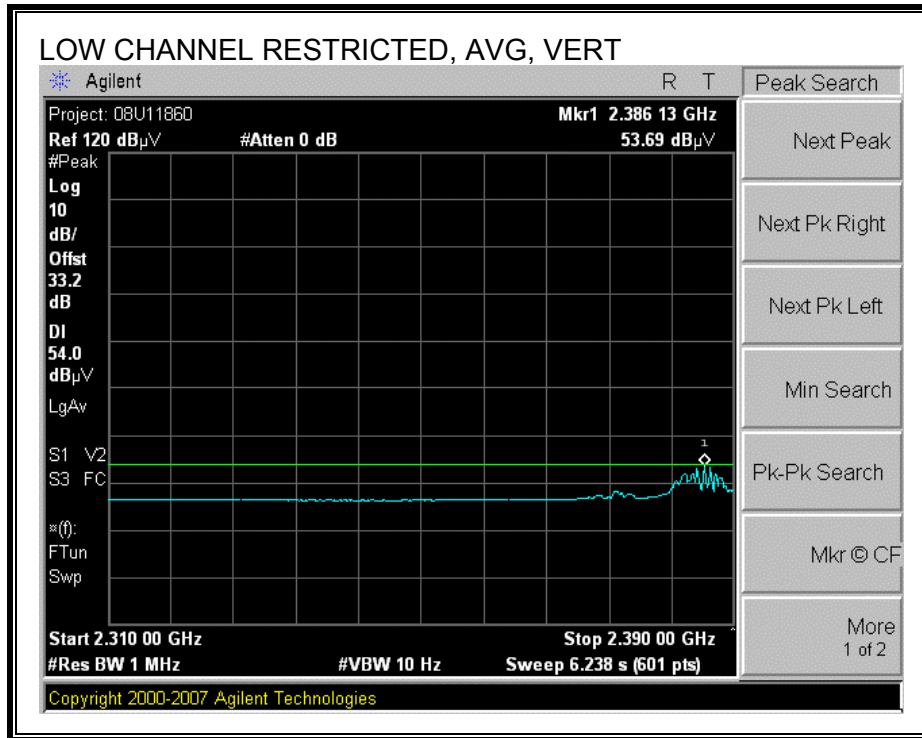
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



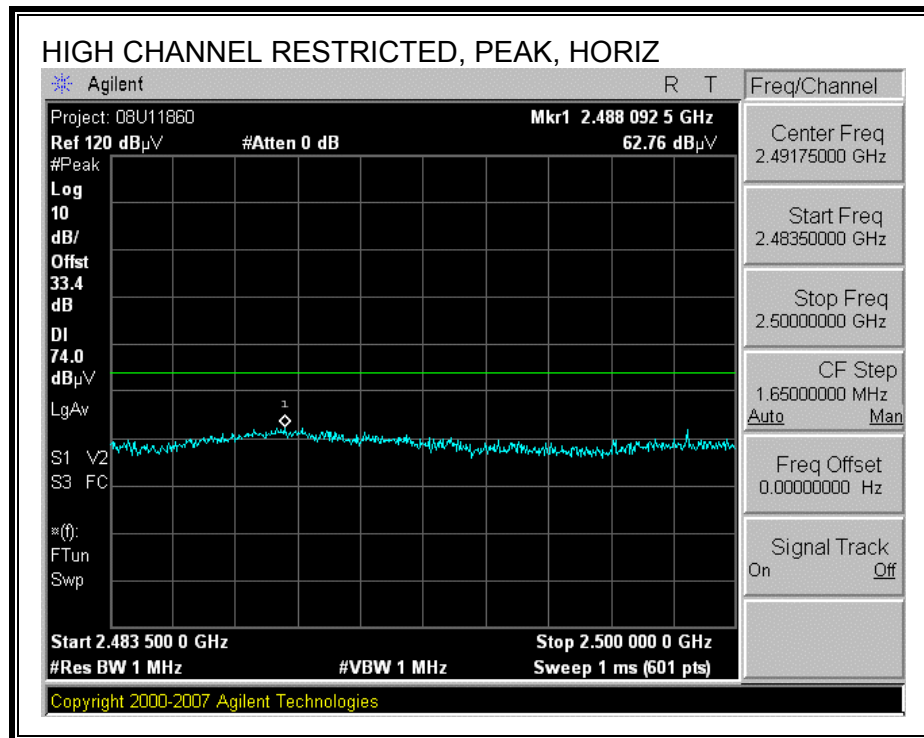


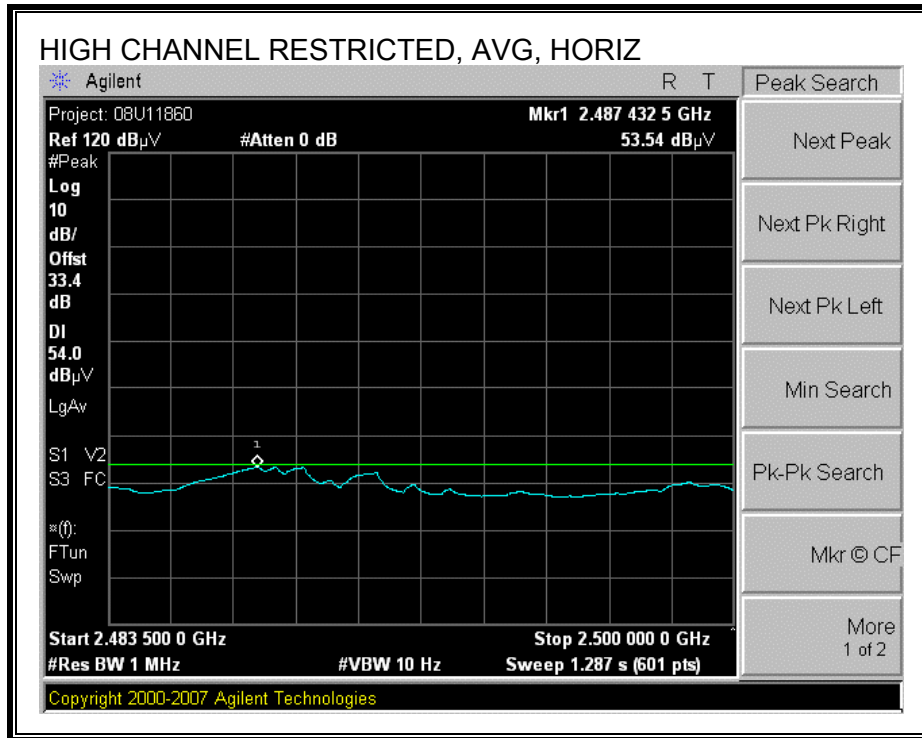
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



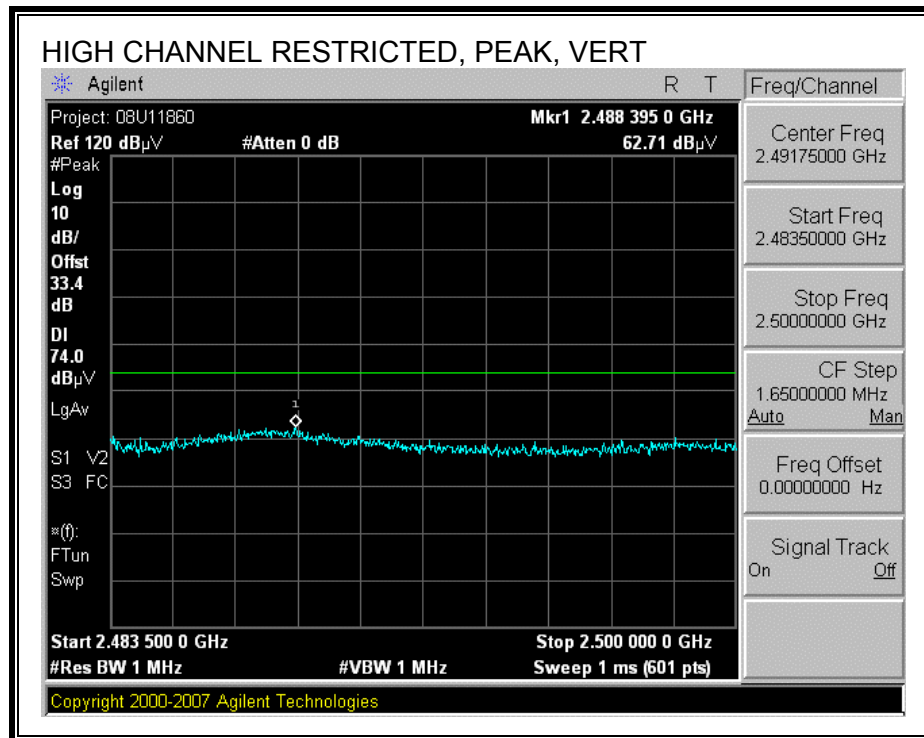


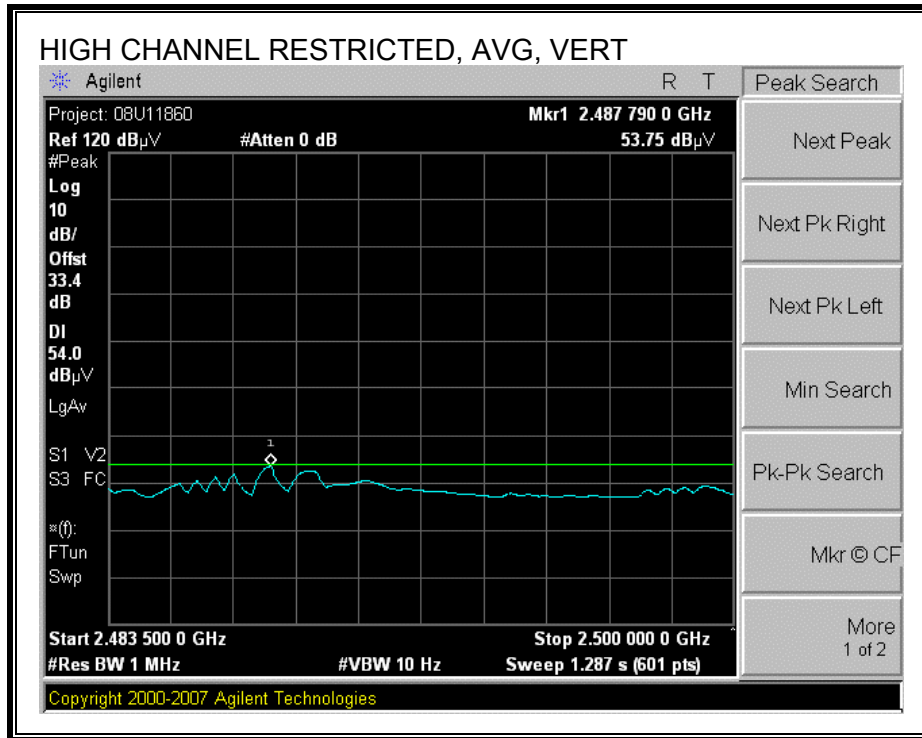
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

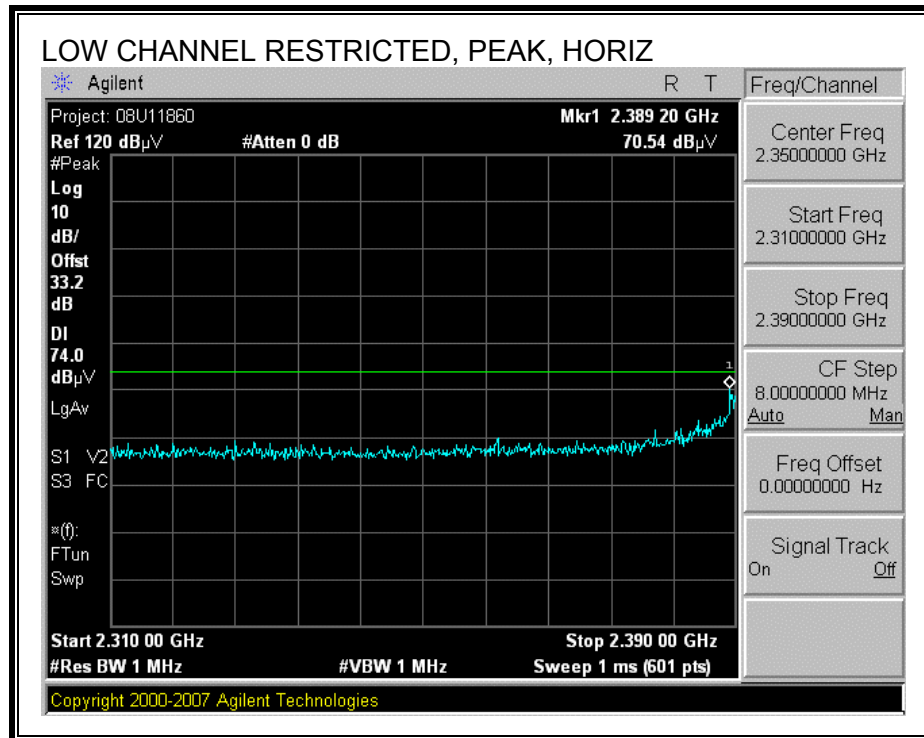


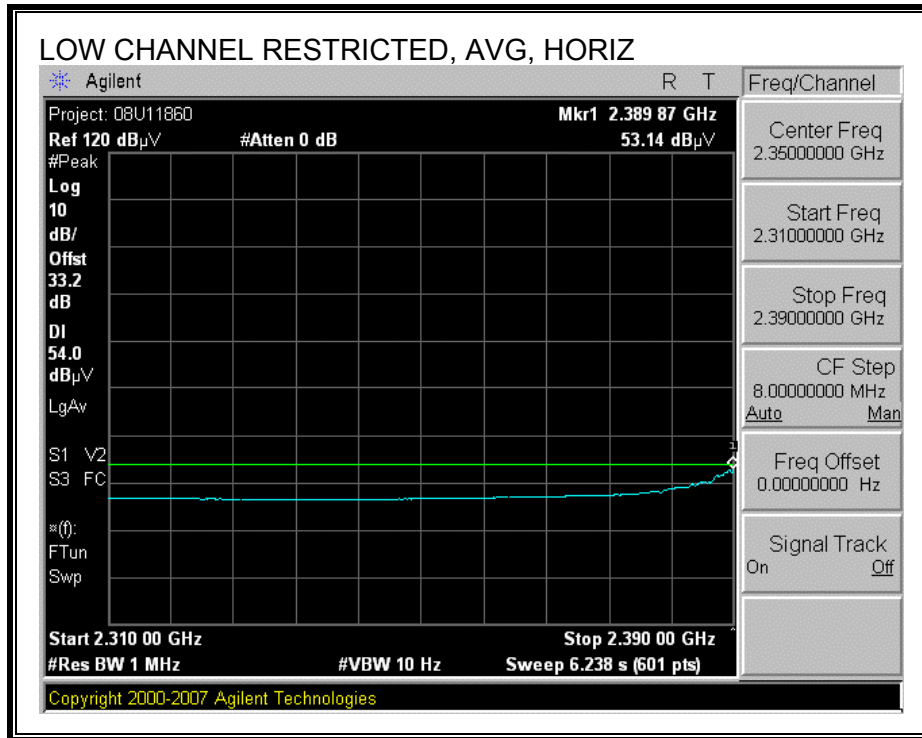


High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Atheros Communication Inc.															
Project #: 08U11860															
Date: 6/5/2008															
Test Engineer: William Zhuang															
Configuration: EUT with Laptop															
Mode: Tx on, b Mode															
Test Equipment:															
Horn 1-18GHz T73; S/N: 6717 @3m		Pre-amplifier 1-26GHz T144 Miteq 3008A00931		Pre-amplifier 26-40GHz		Horn > 18GHz				Limit FCC 15.205					
Hi Frequency Cables															
2 foot cable		3 foot cable		12 foot cable A-5m Chamber		HPF HPF_4.0GHz		Reject Filter		<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	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)
Low Ch.															
4824	3.0	43.1	38.8	33.3	6.9	-36.5	0.0	0.6	47.4	43.1	74	54	-26.6	-10.9	V
4824	3.0	41.8	38.1	33.3	6.9	-36.5	0.0	0.6	46.1	42.4	74	54	-27.9	-11.6	H
Mid Ch.															
4874	3.0	44.8	40.4	33.4	6.9	-36.5	0.0	0.6	49.2	44.8	74	54	-24.8	-9.2	V
7311	3.0	36.9	27.1	35.0	8.4	-36.2	0.0	0.6	44.7	34.9	74	54	-29.3	-19.1	V
4874	3.0	41.5	38.5	33.4	6.9	-36.5	0.0	0.6	45.9	42.9	74	54	-28.1	-11.1	H
7311	3.0	36.5	26.4	35.0	8.4	-36.2	0.0	0.6	44.3	34.2	74	54	-29.7	-19.8	H
High Ch.															
4924	3.0	46.1	44.2	33.4	7.0	-36.5	0.0	0.6	50.6	48.7	74	54	-23.4	-5.3	V
7386	3.0	38.0	28.6	35.0	8.4	-36.2	0.0	0.6	45.9	36.5	74	54	-28.1	-17.5	V
4924	3.0	43.9	40.2	33.4	7.0	-36.5	0.0	0.6	48.4	44.7	74	54	-25.6	-9.3	H
7386	3.0	37.6	29.2	35.0	8.4	-36.2	0.0	0.6	45.5	37.0	74	54	-28.5	-17.0	H
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											

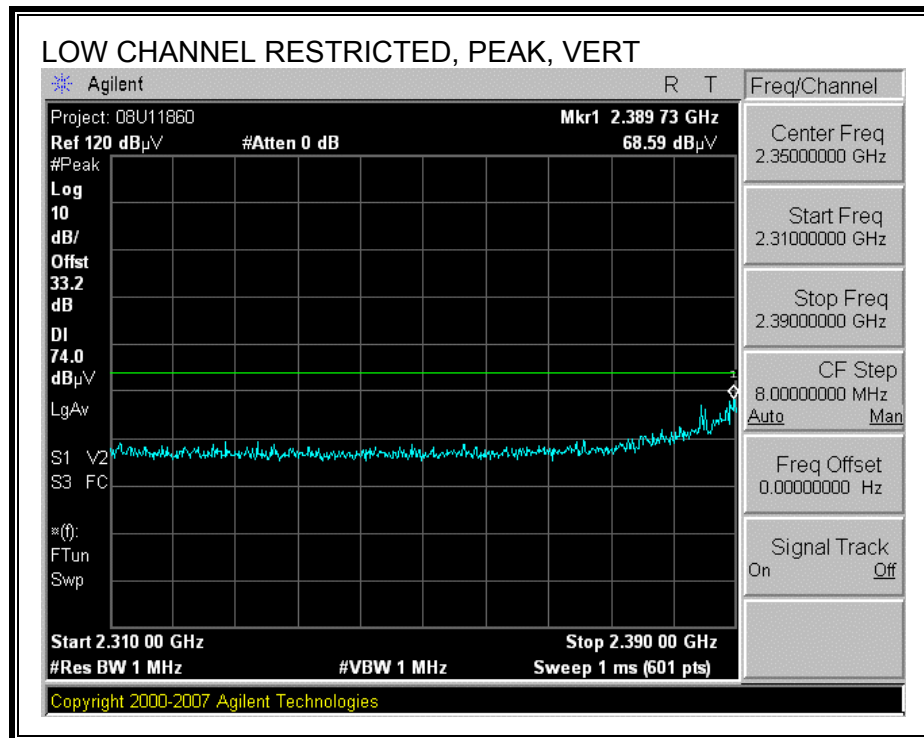
7.2.2. TRANSMITTER ABOVE 1 GHz FOR 802.11g MODE IN THE 2.4 GHz BAND

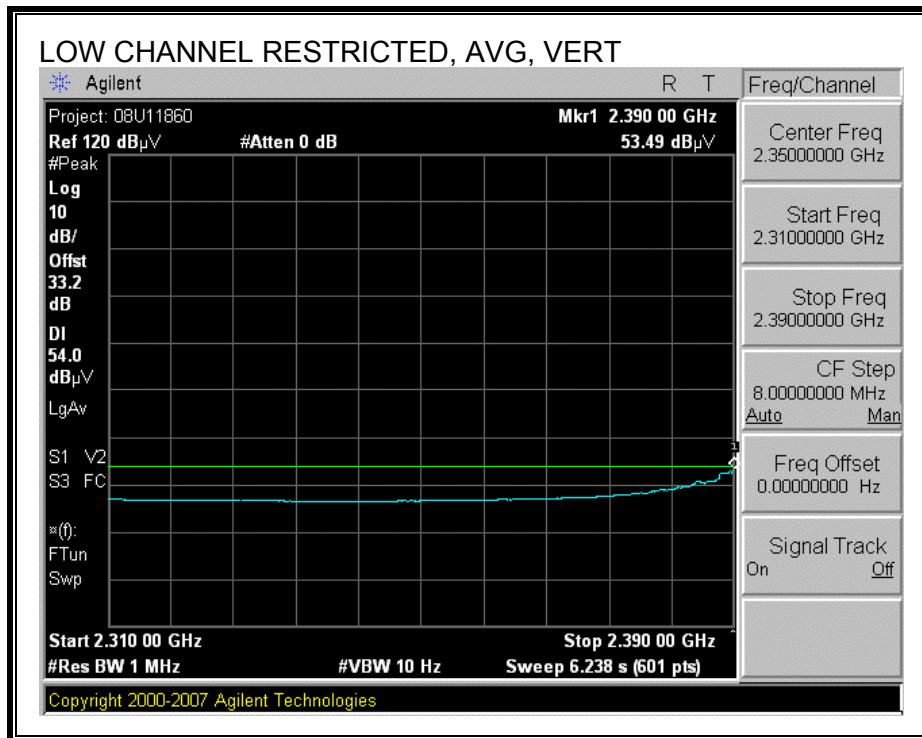
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



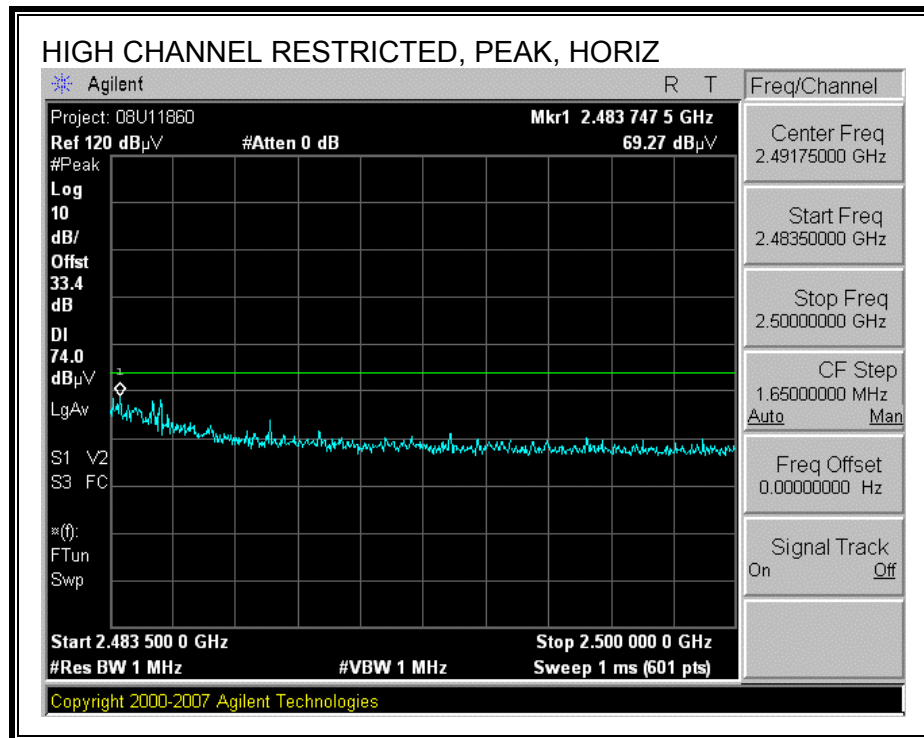


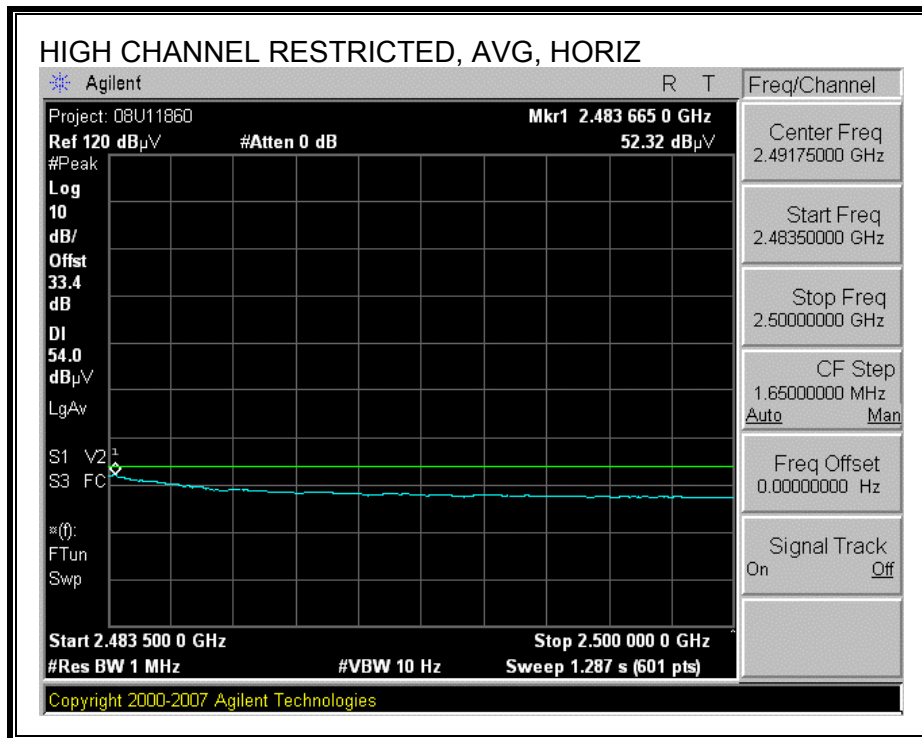
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



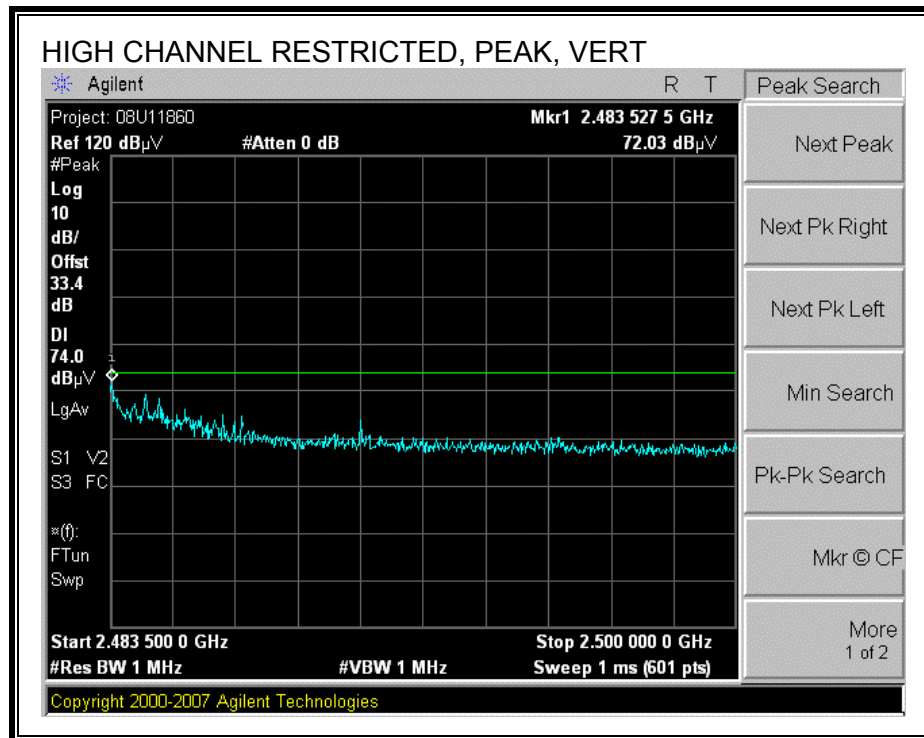


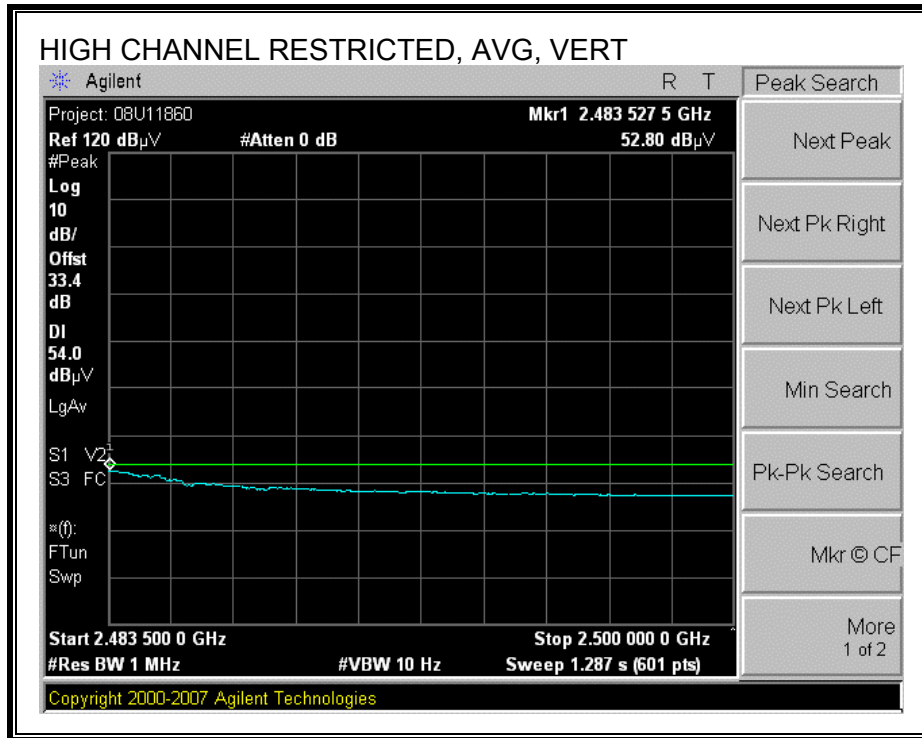
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





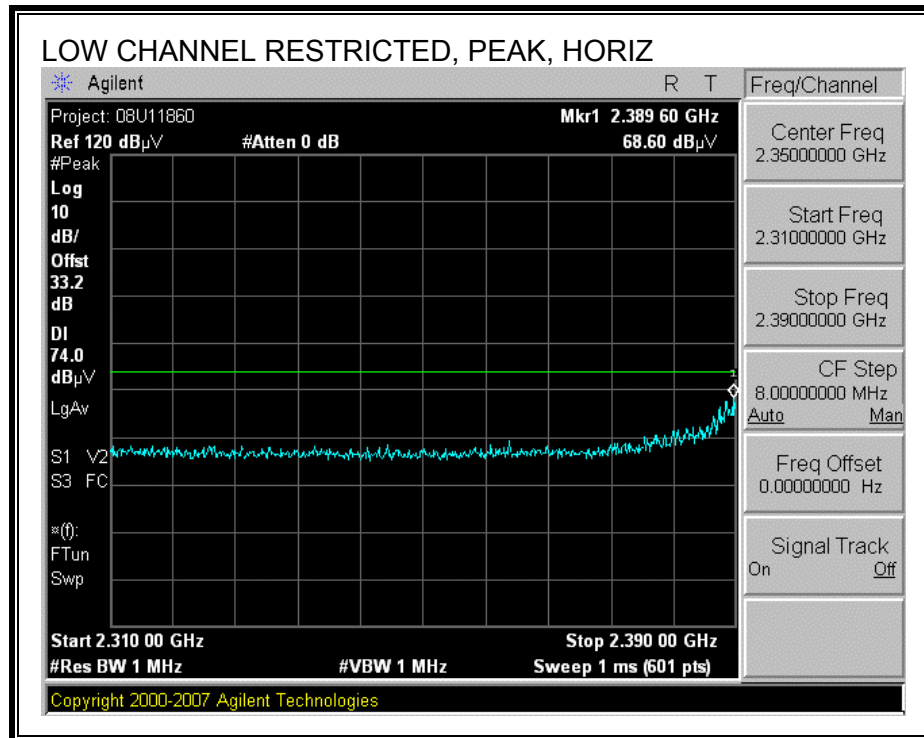
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

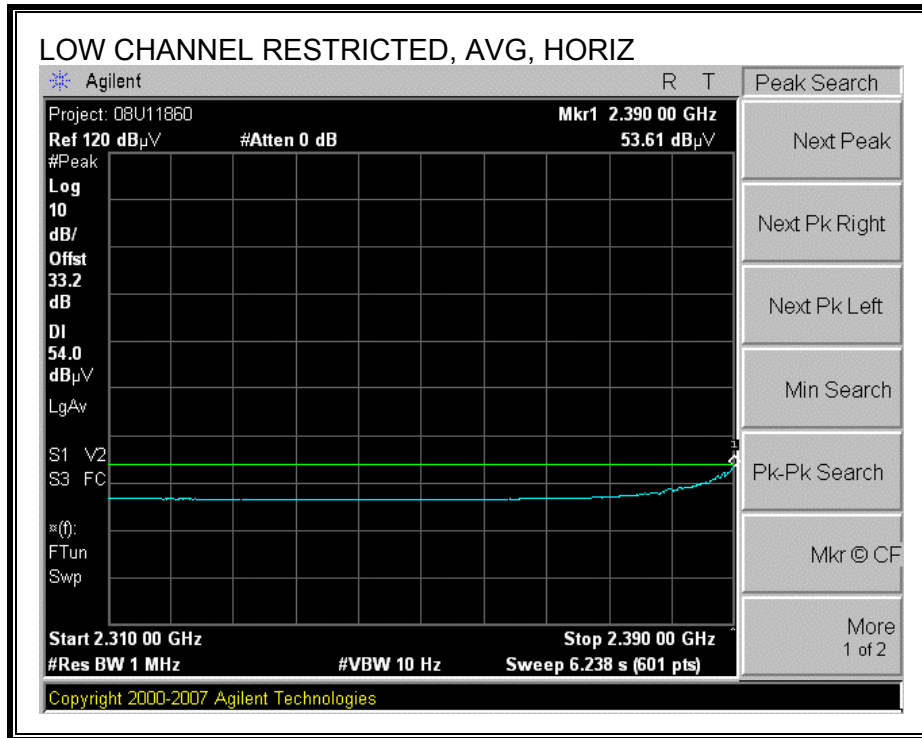




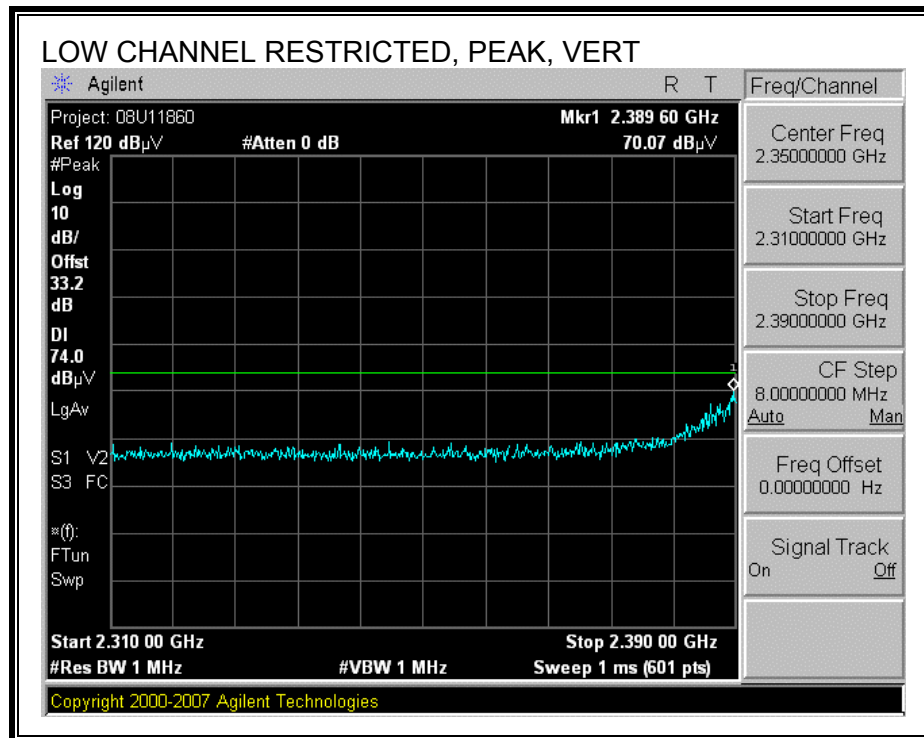
7.2.3. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 2.4 GHz BAND

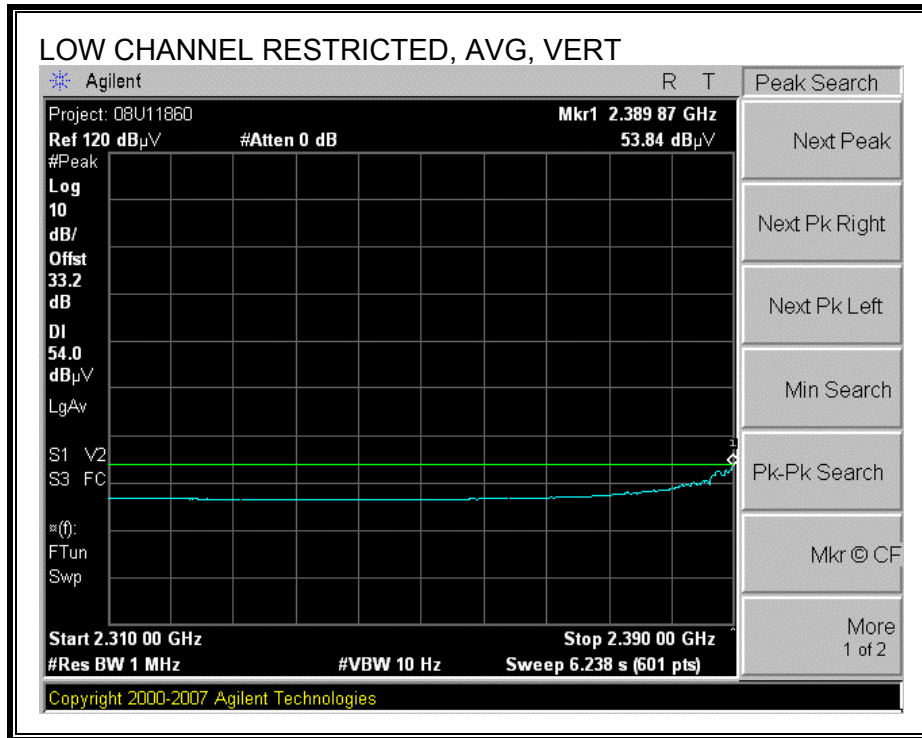
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



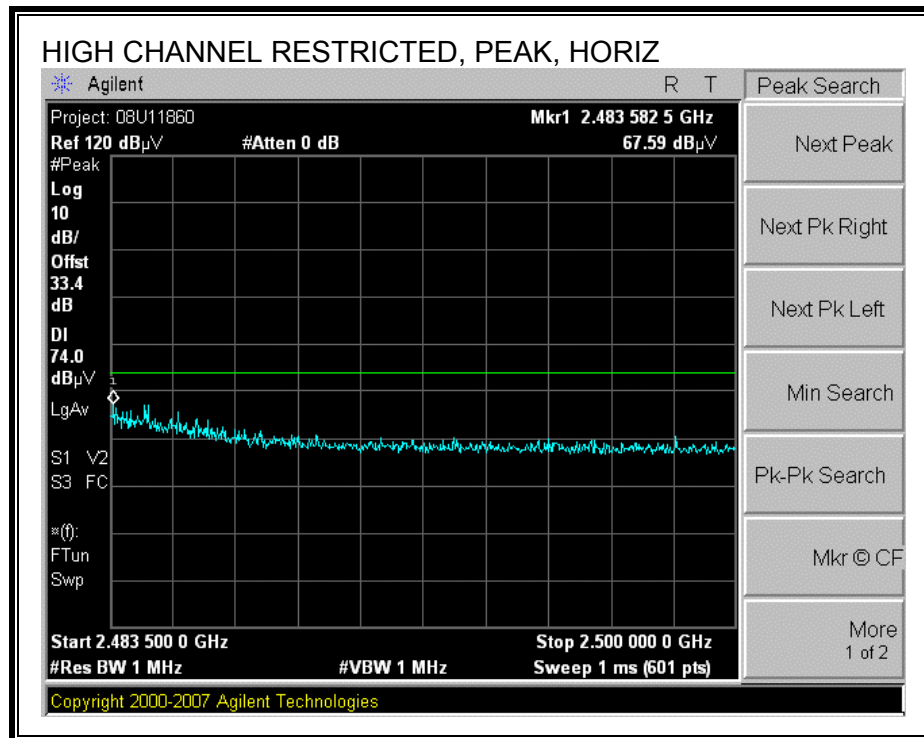


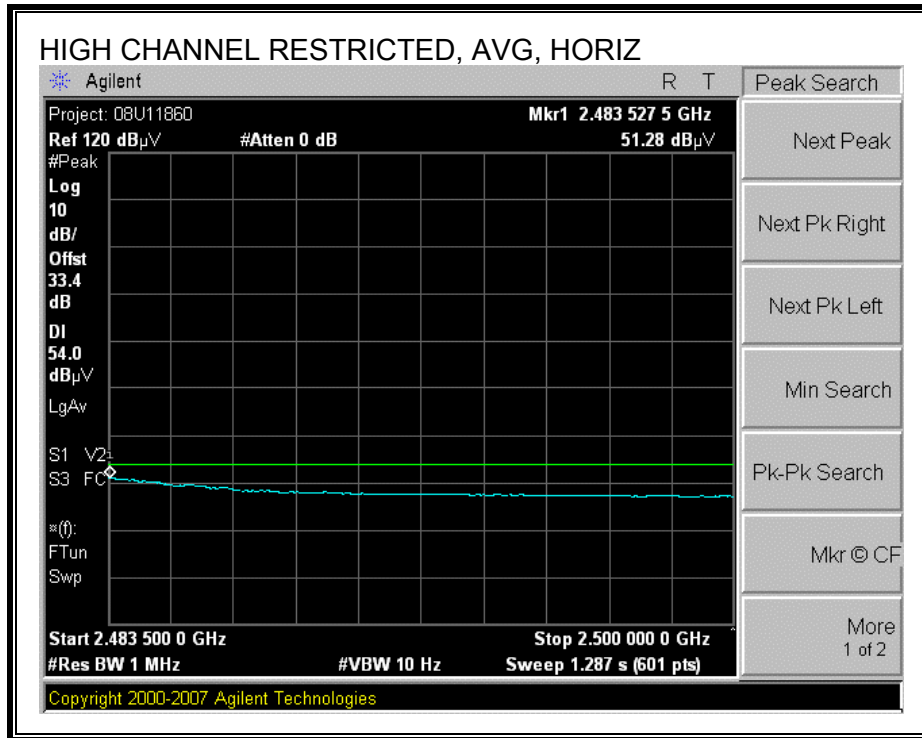
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



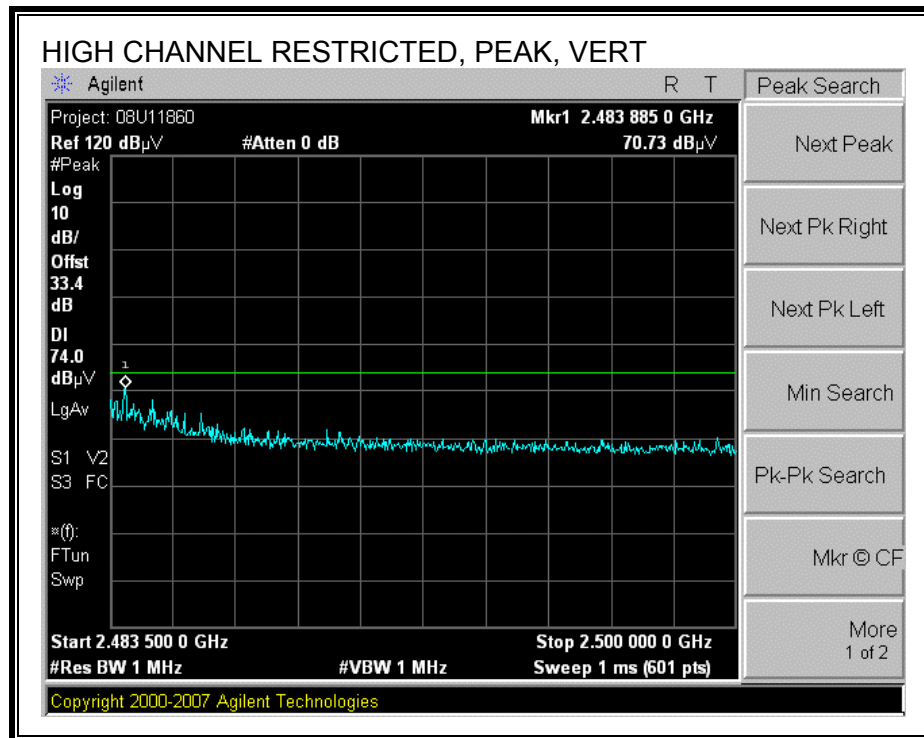


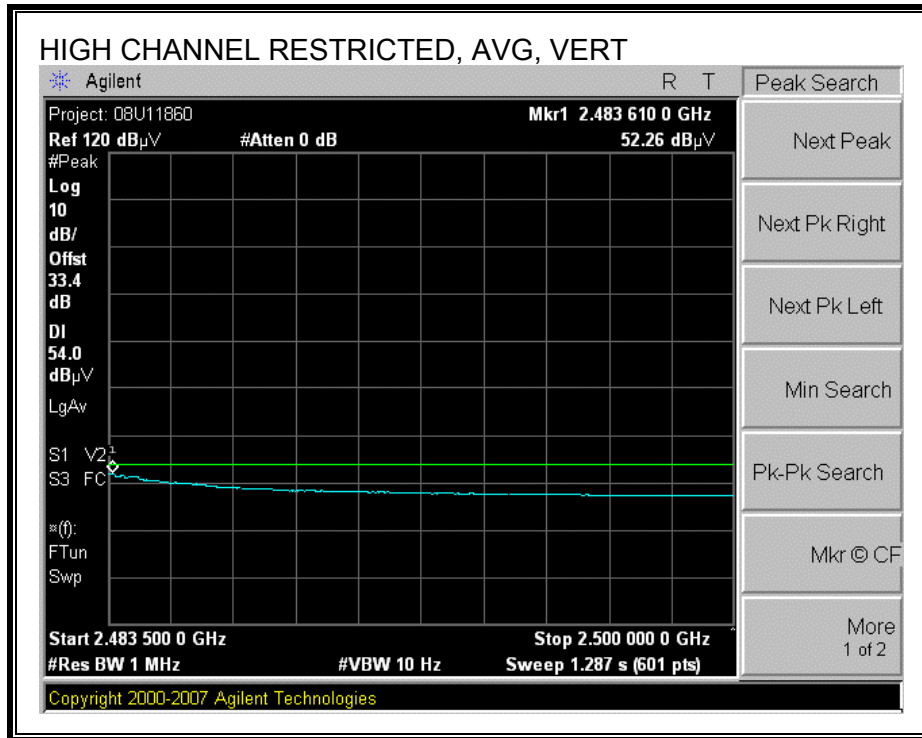
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



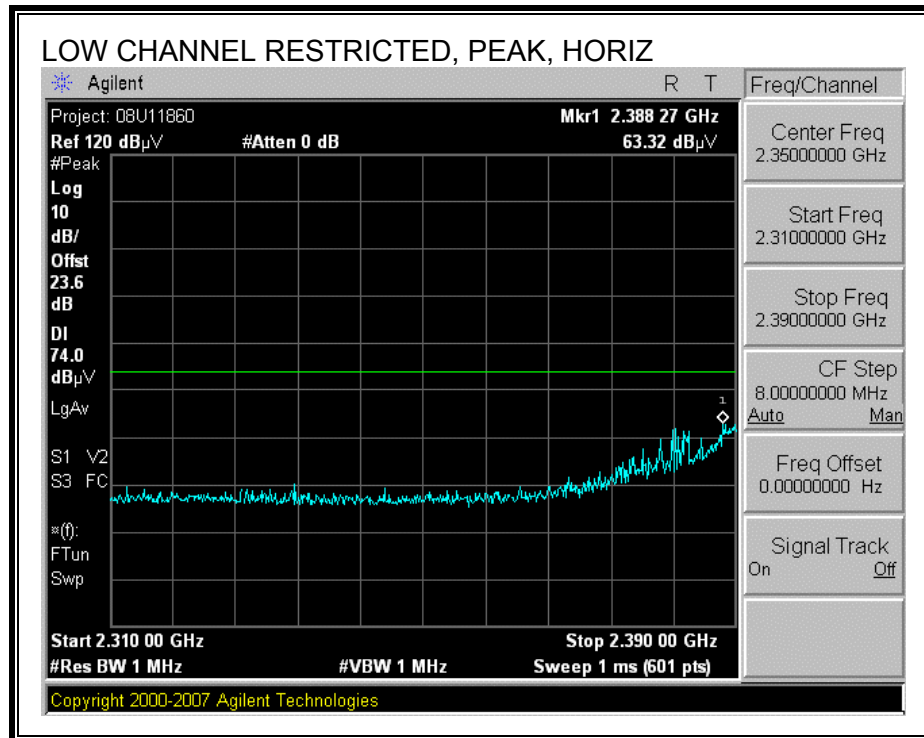


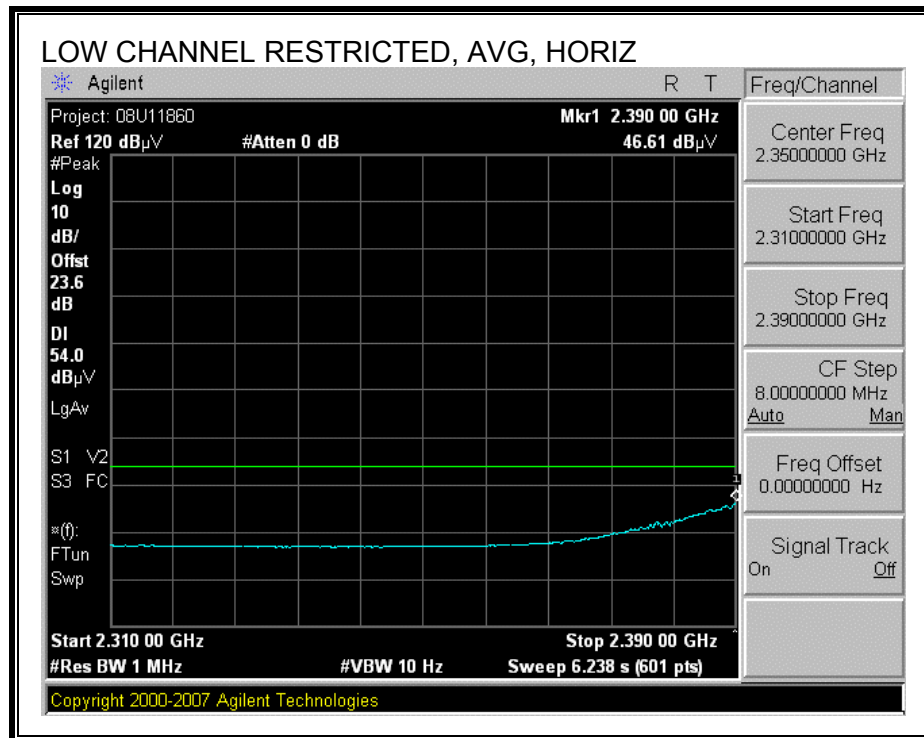
HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Atheros Communication Inc. Project #: 08U11860 Date: 6/6/2008 Test Engineer: William Zhuang Configuration: EUT with Laptop Mode: Tx on, HT20 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 15.205							
<div style="display: flex; justify-content: space-between;"> <div> <div>Hi Frequency Cables</div> <div> <div>2 foot cable</div> <div>3 foot cable</div> <div>12 foot cable</div> </div> </div> <div> <div>HPF</div> <div>Reject Filter</div> </div> <div> <div>Peak Measurements</div> <div>RBW=VBW=1MHz</div> <div>Average Measurements</div> <div>RBW=1MHz ; VBW=10Hz</div> </div> </div>															
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)
Low Ch.															
4.824	3.0	38.7	25.5	33.3	6.9	-36.5	0.0	0.6	43.0	29.8	74	54	-31.0	-24.2	V
4.824	3.0	37.9	25.3	33.3	6.9	-36.5	0.0	0.6	42.2	29.6	74	54	-31.8	-24.4	H
Mid Ch.															
4.874	3.0	39.5	26.0	33.4	6.9	-36.5	0.0	0.6	43.9	30.4	74	54	-30.1	-23.6	V
7.311	3.0	38.0	24.6	35.0	8.4	-36.2	0.0	0.6	45.8	32.4	74	54	-28.2	-21.6	V
4.874	3.0	37.8	25.2	33.4	6.9	-36.5	0.0	0.6	42.3	29.6	74	54	-31.7	-24.4	H
7.311	3.0	36.7	24.3	35.0	8.4	-36.2	0.0	0.6	44.5	32.1	74	54	-29.5	-21.9	H
High Ch.															
4.924	3.0	38.5	25.1	33.4	7.0	-36.5	0.0	0.6	43.0	29.6	74	54	-31.0	-24.4	V
7.386	3.0	37.0	24.3	35.0	8.4	-36.2	0.0	0.6	44.9	32.2	74	54	-29.1	-21.8	V
4.924	3.0	38.0	25.2	33.4	7.0	-36.5	0.0	0.6	42.5	29.7	74	54	-31.5	-24.3	H
7.386	3.0	37.6	23.9	35.0	8.4	-36.2	0.0	0.6	45.5	31.8	74	54	-28.5	-22.2	H
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										

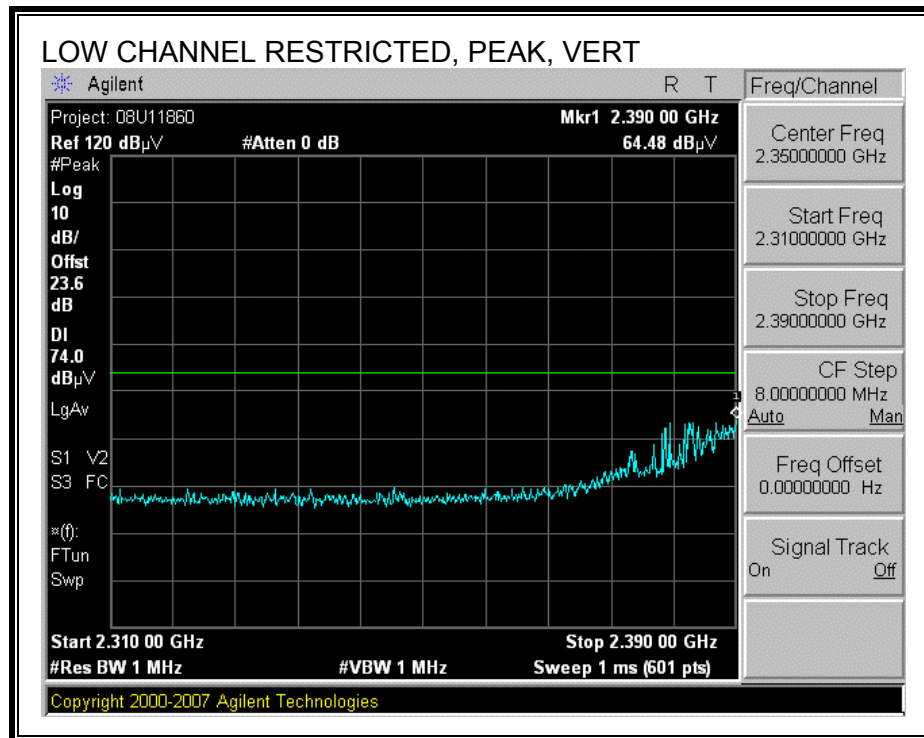
7.2.4. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT40 MODE IN THE 2.4 GHz BAND

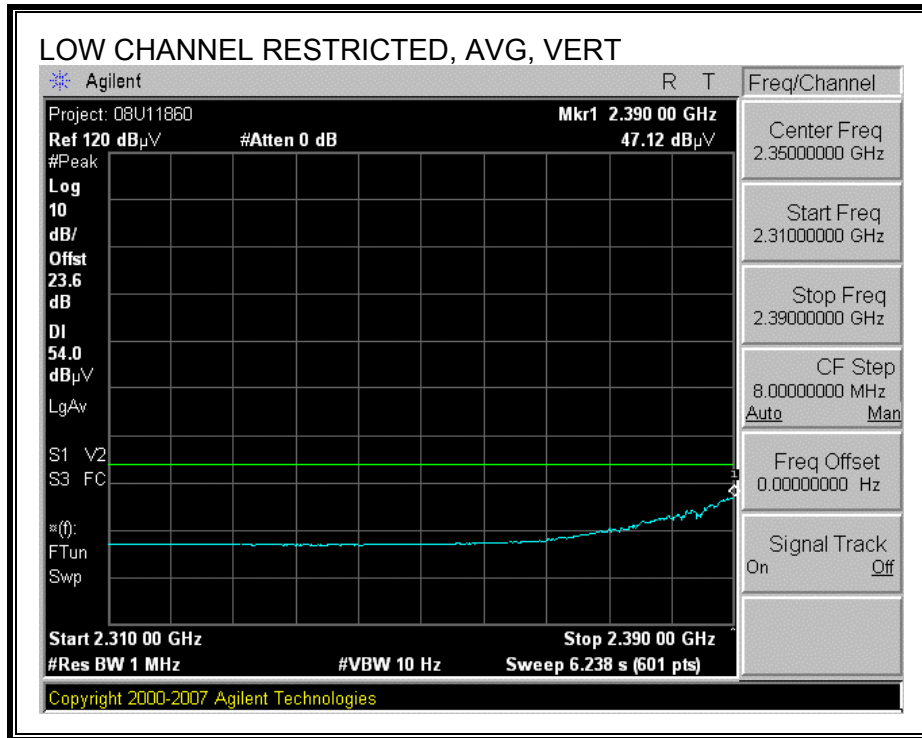
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



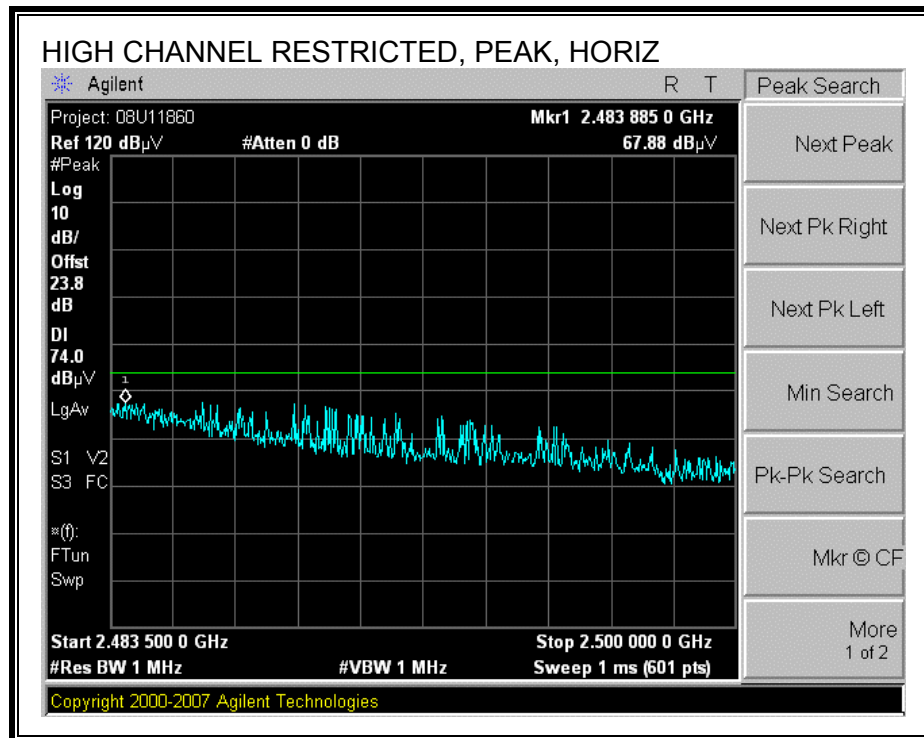


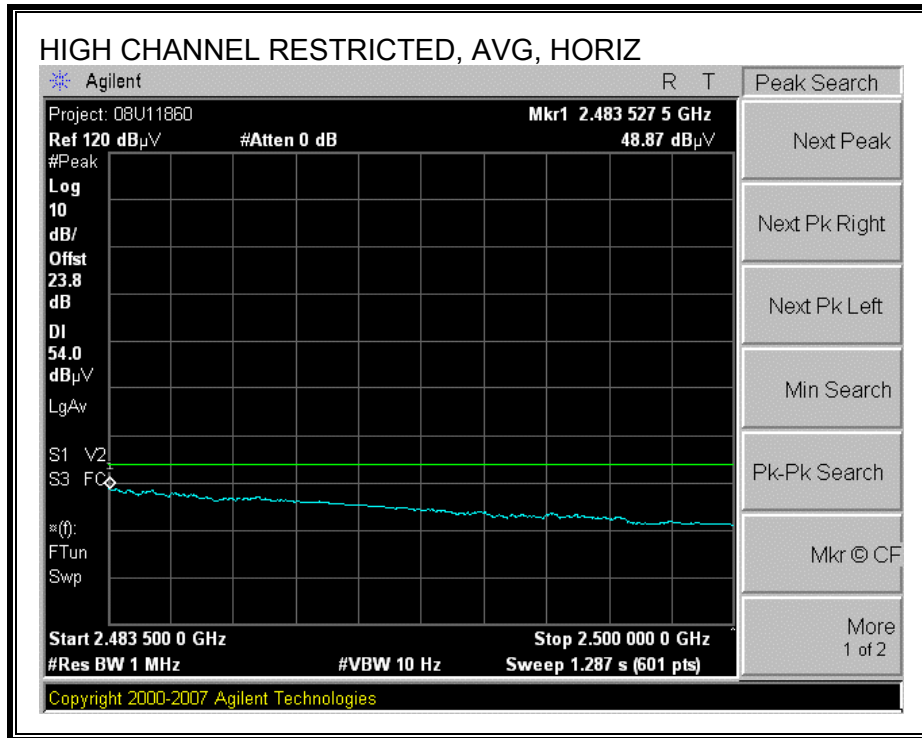
RESTRICTED BANEDGE (LOW CHANNEL, VERTICAL)



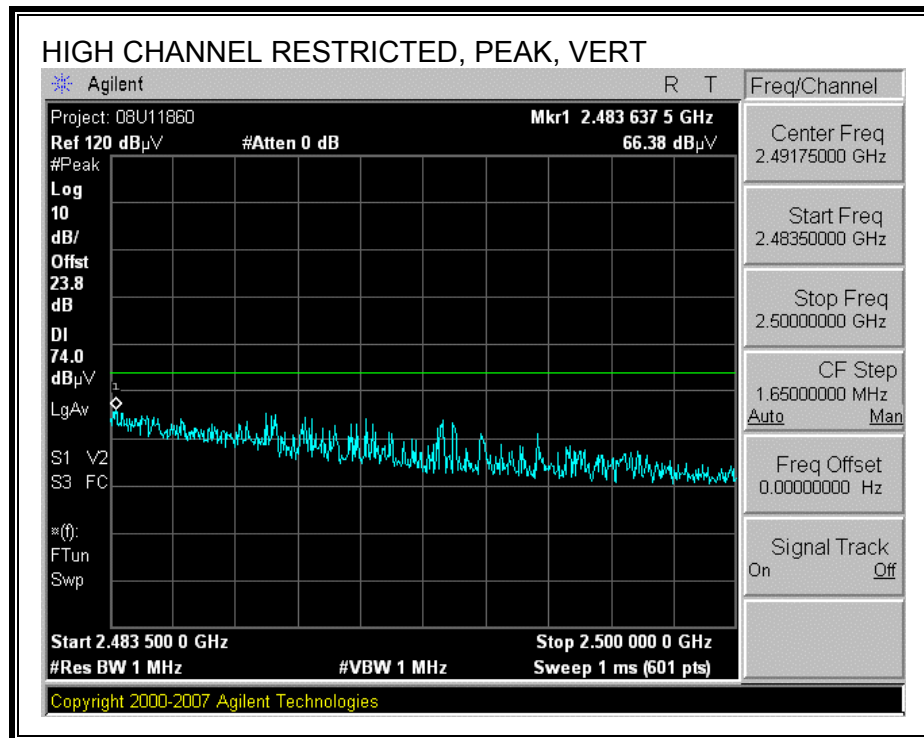


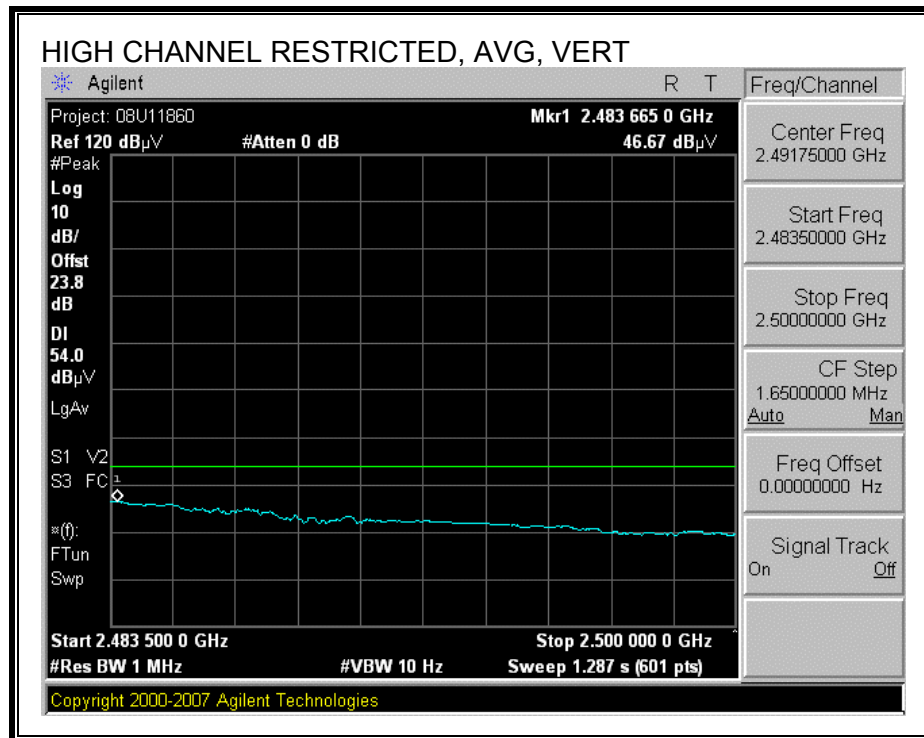
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Atheros Communication Inc. Project #: 08U11860 Date: 6/6/2008 Test Engineer: William Zhuang Configuration: EUT with Laptop Mode: Tx on, HT40 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 15.205							
Hi Frequency Cables															
2 foot cable		3 foot cable		12 foot cable		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz					
				A-5m Chamber		HPF_4.0GHz									
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)
Low Ch.															
4.834	3.0	38.5	25.3	33.3	6.9	-36.5	0.0	0.6	42.8	29.6	74	54	-31.2	-24.4	V
7.251	3.0	38.4	24.5	35.0	8.4	-36.2	0.0	0.6	46.2	32.3	74	54	-27.8	-21.7	V
4.834	3.0	38.1	25.2	33.3	6.9	-36.5	0.0	0.6	42.4	29.6	74	54	-31.6	-24.4	H
7.251	3.0	36.5	24.2	35.0	8.4	-36.2	0.0	0.6	44.2	32.0	74	54	-29.8	-22.0	H
Mid Ch.															
4.874	3.0	38.0	26.5	33.4	6.9	-36.5	0.0	0.6	42.4	30.9	74	54	-31.6	-23.1	V
7.311	3.0	36.9	24.2	35.0	8.4	-36.2	0.0	0.6	44.7	32.1	74	54	-29.3	-21.9	V
4.874	3.0	37.7	25.2	33.4	6.9	-36.5	0.0	0.6	42.1	29.6	74	54	-31.9	-24.4	H
7.311	3.0	36.1	24.3	35.0	8.4	-36.2	0.0	0.6	43.9	32.1	74	54	-30.1	-21.9	H
High Ch.															
4.914	3.0	38.5	25.4	33.4	7.0	-36.5	0.0	0.6	43.0	29.9	74	54	-31.0	-24.1	V
7.371	3.0	38.0	24.3	35.0	8.4	-36.2	0.0	0.6	45.9	32.2	74	54	-28.1	-21.8	V
4.914	3.0	37.9	25.1	33.4	7.0	-36.5	0.0	0.6	42.4	29.6	74	54	-31.6	-24.4	H
7.371	3.0	37.6	23.9	35.0	8.4	-36.2	0.0	0.6	45.4	31.8	74	54	-28.6	-22.2	H
Rev. 4.12.7															
f	Measurement Frequency			Amp	Preamp Gain			Avg Lim	Average Field Strength Limit						
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters			Pk Lim	Peak Field Strength Limit						
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m			Avg Mar	Margin vs. Average Limit						
AF	Antenna Factor			Peak	Calculated Peak Field Strength			Pk Mar	Margin vs. Peak Limit						
CL	Cable Loss			HPF	High Pass Filter										

7.2.5. 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 Communication Inc. Project #: 08U11860 Date: 6/5/2008 Test Engineer: William Zhuang Configuration: EUT with Laptop Mode: Tx on, a 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 15.205							
Hi Frequency Cables															
2 foot cable		3 foot cable		12 foot cable		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz					
				A-5m Chamber		HPF_7.6GHz									
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)
Low Ch.															
11.490	3.0	37.4	24.0	37.5	11.6	-35.9	0.0	0.7	51.3	37.9	74	54	-22.7	-16.1	V
11.490	3.0	36.4	23.7	37.5	11.6	-35.9	0.0	0.7	50.3	37.6	74	54	-23.7	-16.4	H
Mid Ch.															
11.570	3.0	36.2	23.9	37.5	11.7	-35.8	0.0	0.7	50.3	38.0	74	54	-23.7	-16.0	V
11.570	3.0	36.1	23.8	37.5	11.7	-35.8	0.0	0.7	50.2	37.9	74	54	-23.8	-16.1	H
High Ch.															
11.650	3.0	37.0	24.3	37.5	11.8	-35.7	0.0	0.7	51.3	38.6	74	54	-22.7	-15.4	V
11.650	3.0	36.9	23.8	37.5	11.8	-35.7	0.0	0.7	51.2	38.1	74	54	-22.8	-15.9	H
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										

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

HARMONICS AND SPURIOUS EMISSIONS

Compliance Certification Services, Fremont 5m Chamber

Company: Atheros Communication Inc.
Project #: 08U11860
Date: 6/5/2008
Test Engineer: William Zhuang
Configuration: EUT with Laptop
Mode: Tx on, HT20 Mode

Test Equipment:

Horn 1-18GHz
T73; S/N: 6717 @3m

Pre-amplifier 1-26GHz
T144 Miteq 3008A00931

Pre-amplifier 26-40GHz

Horn > 18GHz

Limit
FCC 15.205

HI Frequency Cables

2 foot cable

3 foot cable

12 foot cable
A5m Chamber

HPF
HPF_7.6GHz

Reject Filter

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	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)
Low Ch.															
11.490	3.0	37.0	23.7	37.5	11.6	-35.9	0.0	0.7	50.9	37.6	74	54	-23.1	-16.4	V
11.490	3.0	37.5	23.9	37.5	11.6	-35.9	0.0	0.7	51.4	37.8	74	54	-22.6	-16.2	H
Mid Ch.															
11.570	3.0	37.2	23.8	37.5	11.7	-35.8	0.0	0.7	51.3	37.9	74	54	-22.7	-16.1	V
11.570	3.0	38.0	24.0	37.5	11.7	-35.8	0.0	0.7	52.1	38.1	74	54	-21.9	-15.9	H
High Ch.															
11.650	3.0	36.8	23.6	37.5	11.8	-35.7	0.0	0.7	51.1	37.9	74	54	-22.9	-16.1	V
11.650	3.0	37.0	23.7	37.5	11.8	-35.7	0.0	0.7	51.3	38.0	74	54	-22.7	-16.0	H

Rev. 412.7

f Measurement Frequency
Dist Distance to Antenna
Read Analyzer Reading
AF Antenna Factor
CL Cable Loss

Amp Preamp Gain
D Corr Distance Correct to 3 meters
Avg Average Field Strength @ 3 m
Peak Calculated Peak Field Strength
HPF High Pass Filter

Avg Lim Average Field Strength Limit
Pk Lim Peak Field Strength Limit
Avg Mar Margin vs. Average Limit
Pk Mar Margin vs. Peak Limit

7.2.7. 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 Communication Inc. Project #: 08U11860 Date: 6/5/2008 Test Engineer: William Zhuang Configuration: EUT with Laptop Mode: Tx on, HT40 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 15.205				
Hi Frequency Cables																
2 foot cable			3 foot cable			12 foot cable			HPF			Reject Filter			Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz	
						A-5m Chamber			HPF_7.6GHz							
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)	
Low Ch.																
11.510	3.0	37.0	23.8	37.5	11.6	-35.8	0.0	0.7	51.0	37.8	74	54	-23.0	-16.2	V	
11.510	3.0	37.3	24.0	37.5	11.6	-35.8	0.0	0.7	51.3	38.0	74	54	-22.7	-16.0	H	
High Ch.																
11.590	3.0	26.9	22.7	37.5	11.7	-35.8	0.0	0.7	41.1	36.9	74	54	-32.9	-17.1	V	
11.590	3.0	37.4	22.9	37.5	11.7	-35.8	0.0	0.7	51.6	37.1	74	54	-22.4	-16.9	H	
Rev. 4.12.7																
f	Measurement Frequency		Amp	Preamp Gain		Avg Lim	Average Field Strength Limit									
Dist	Distance to Antenna		D Corr	Distance Correct to 3 meters		Pk Lim	Peak Field Strength Limit									
Read	Analyzer Reading		Avg	Average Field Strength @ 3 m		Avg Mar	Margin vs. Average Limit									
AF	Antenna Factor		Peak	Calculated Peak Field Strength		Pk Mar	Margin vs. Peak Limit									
CL	Cable Loss		HPF	High Pass Filter												

7.3.2. RECEIVER ABOVE 1 GHz IN THE 5.8 GHz BAND

High Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Company: Atheros Project #: 08U11860 Date: 6/9/2008 Test Engineer: Chin Pang Configuration: EUT with Laptop Mode: RX, 5.8GHz Band (Worst Case)															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T60; S/N: 2238 @3m		T145 Agilent 3008A0050						FCC 15.209							
Hi Frequency Cables															
2 foot cable		3 foot cable		12 foot cable		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz					
Thanh 177079008				C-5m Chamber											
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)
1.333	3.0	54.0	38.0	27.3	1.4	-35.9	0.0	0.0	46.8	30.8	74	54	-27.2	-23.2	V
1.595	3.0	53.5	37.6	28.0	1.6	-35.7	0.0	0.0	47.4	31.5	74	54	-26.6	-22.5	V
2.500	3.0	50.5	34.7	29.7	2.1	-35.1	0.0	0.0	47.2	31.4	74	54	-26.8	-22.6	V
1.333	3.0	52.3	36.8	27.3	1.4	-35.9	0.0	0.0	45.1	29.6	74	54	-28.9	-24.4	H
1.595	3.0	51.4	36.3	28.0	1.6	-35.7	0.0	0.0	45.3	30.2	74	54	-28.7	-23.8	H
1.992	3.0	52.3	35.0	29.0	1.8	-35.4	0.0	0.0	47.8	30.5	74	54	-26.2	-23.5	H
Rev. 4.12.7															
Note: No other emissions were detected above the 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											

7.4. WORST-CASE BELOW 1 GHz

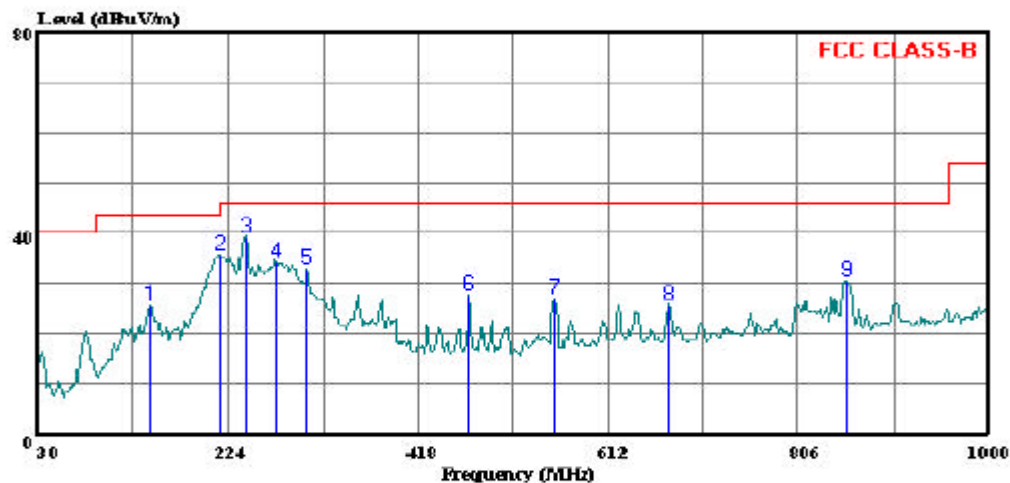
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

Data#: 4 File#: 08u11860.EMI Date: 06-04-2008 Time: 10:07:01



Trace: 3

Ref Trace:

Condition: FCC CLASS-B HORIZONTAL
Test Operator:: William Zhuang
Project #: 08U11860
Company: Atheros
Model: AR5BHB92/AR5BHB92-D
Configuration:: BUT w/Laptop Acon Antenna
Mode: Transmit at worst case
Target: FCC Class B

HORIZONTAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	145.430	42.74	-17.02	25.72	43.50	-17.78	Peak
2	216.240	54.25	-18.74	35.51	46.00	-10.49	Peak
3	241.460	57.30	-18.06	39.24	46.00	-6.76	Peak
4	272.500	51.30	-17.03	34.27	46.00	-11.73	Peak
5	305.480	48.56	-15.50	33.06	46.00	-12.94	Peak
6	470.380	39.55	-11.79	27.76	46.00	-18.24	Peak
7	557.680	37.39	-10.49	26.90	46.00	-19.10	Peak
8	673.110	34.64	-8.92	25.72	46.00	-20.28	Peak
9	855.470	36.23	-5.88	30.35	46.00	-15.65	Peak

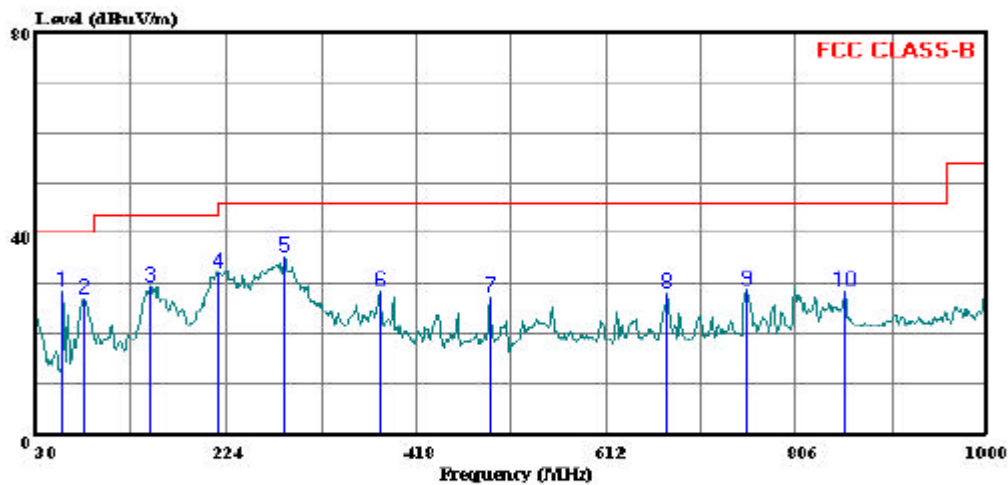
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



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

Data#: 2 File#: 08u11860.EMI Date: 06-04-2008 Time: 09:52:48



Trace: 1

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: William Zhuang
Project #: 08U11860
Company: Atheros
Model: AR5BHB92/AR5BHB92-D
Configuration: EUT w/Laptop Acon Antenna
Mode: Transmit at worst case
Target: FCC Class B

VERTICAL DATA

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	58.130	51.28	-23.02	28.27	40.00	-11.74	Peak
2	77.530	49.69	-22.79	26.90	40.00	-13.10	Peak
3	148.340	46.65	-17.23	29.42	43.50	-14.08	Peak
4	216.240	51.12	-18.74	32.38	46.00	-13.62	Peak
5	284.140	51.70	-16.53	35.17	46.00	-10.83	Peak
6	381.140	42.15	-13.74	28.41	46.00	-17.59	Peak
7	492.690	38.66	-11.41	27.25	46.00	-18.75	Peak
8	674.080	36.90	-8.88	28.02	46.00	-17.98	Peak
9	754.590	36.27	-7.68	28.59	46.00	-17.41	Peak
10	856.440	34.29	-5.92	28.37	46.00	-17.63	Peak

8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

6 WORST EMISSIONS

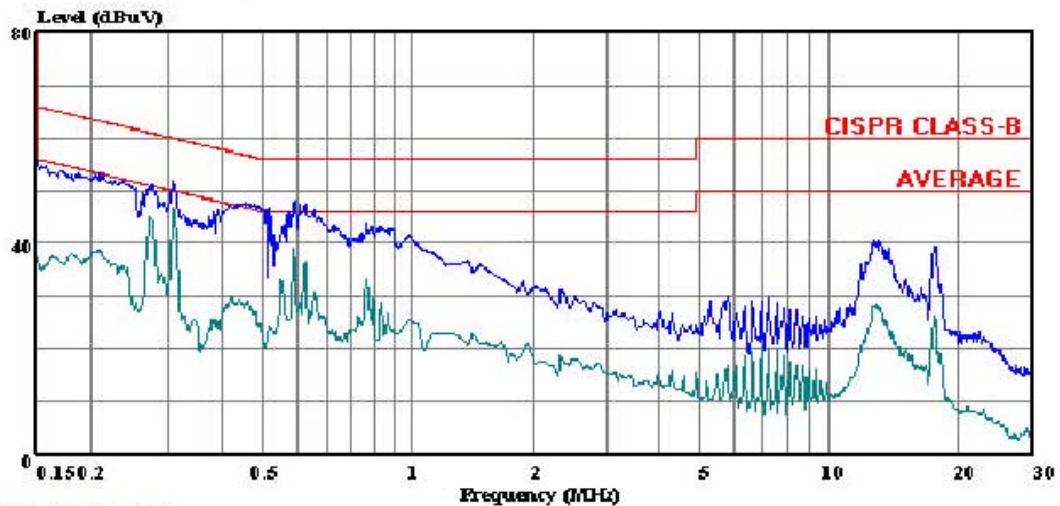
CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.28	51.23	--	44.92	0.00	60.91	50.91	-9.68	-5.99	L1
0.31	51.78	--	46.67	0.00	59.97	49.97	-8.19	-3.30	L1
0.59	48.16	--	39.09	0.00	56.00	46.00	-7.84	-6.91	L1
0.28	51.64	--	45.74	0.00	60.91	50.91	-9.27	-5.17	L2
0.31	51.16	--	46.35	0.00	59.97	49.97	-8.81	-3.62	L2
0.59	47.70	--	39.05	0.00	56.00	46.00	-8.30	-6.95	L2
6 Worst Data									

LINE 1 RESULTS



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

Data#: 7 File#: 08U11860.EMI Date: 06-06-2008 Time: 10:47:41



(Line Conduction)

Trace: 5

Ref Trace:

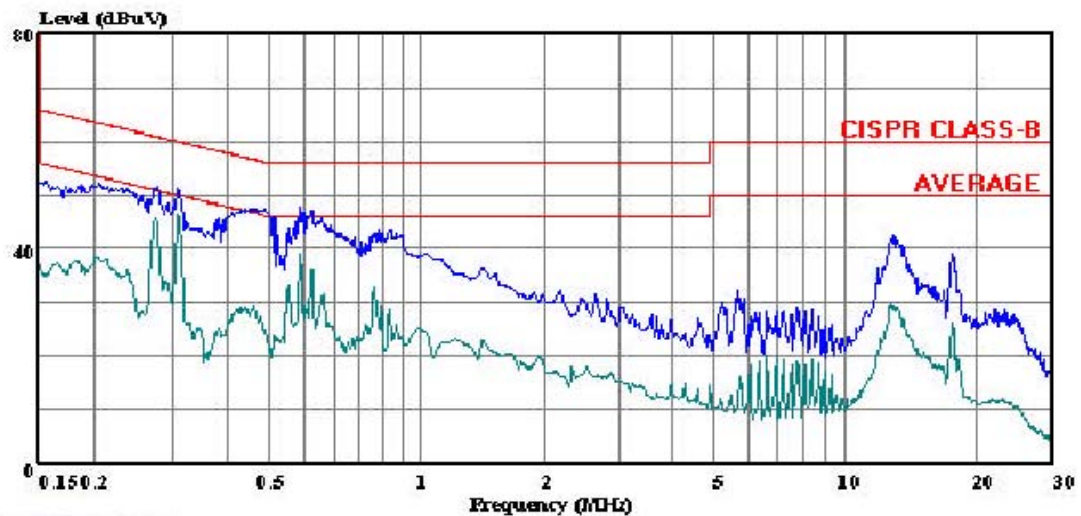
Condition: CISPR CLASS-B
Test Operator:: William Zhuang
Project #: 08U11860
Company: Atheros Communication Inc.
Configuration: EUT w/Laptop
Mode: Tx, worst case
Target: CISPR Class B
Voltage: 115VAC / 60Hz
: L1: Peak (Blue); Avg (Green)

LINE 2 RESULTS



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

Data#: 14 File#: 08U11860.EMI Date: 06-06-2008 Time: 10:56:17



(Line Conduction)

Trace: 12

Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: William Zhuang
Project #: 08U11860
Company: Atheros Communication Inc.
Configuration:: EUT w/Laptop
Mode: Tx, worst case
Target: CISPR Class B
Voltage: 115VAC / 60Hz
L2: Peak (Blue); Avg (Green)

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/m² is equivalent to 1 mW/cm².
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/cm²

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/cm² is converted to units of W/m² by multiplying by a factor of 10.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of $S = 1.0 \text{ mW/cm}^2$

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

RESULTS

Mode	Band (MHz)	MPE Distance (cm)	Output Power (dBm)	Antenna Gain (dBi)	FCC Power Density (mW/cm ²)	IC Power Density (W/m ²)
802.11b	2400 - 2483.5	20.0	25.37	5.28	0.23	2.31
802.11g	2400 - 2483.5	20.0	29.58	5.28	0.61	6.09
802.11n HT20	2400 - 2483.5	20.0	29.54	2.70	0.33	3.33
802.11n HT40	2400 - 2483.5	20.0	24.92	2.70	0.11	1.15
802.11a	5725 - 5850	20.0	28.98	3.84	0.38	3.80
802.11n HT20	5725 - 5850	20.0	29.21	2.30	0.28	2.81
802.11n HT40	5725 - 5850	20.0	29.85	2.30	0.33	3.26