

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

#### **FOR**

# 802.11B/G TRANSCEIVER WITH A PCIEXPRESS MINICARD INTERFACE

**MODEL NUMBER: AR5BXB63** 

FCC ID: PPD-AR5BXB63

REPORT NUMBER: 07U11119-1, Revision B

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Prepared for

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Prepared by

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# **Revision History**

	Issue		
Rev.	Date	Revisions	Revised By
	07/11/07	Initial Issue	Thu Chan
В	07/17/07	Removed incorrect reference to BT collocation.	S. Radecki

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** ATHEROS COMMUNICATIONS, INC.

5480 GREAT AMERICA PARKWAY SANTA CLARA, CA 95054, U.S.A.

**EUT DESCRIPTION:** 802.11B/G TRANSCEIVER WITH A PCIEXPRESS MINICARD

**INTERFACE** 

MODEL: AR5BXB63

**SERIAL NUMBER:** XB63-050-D0423, XB63-050-D0423

**DATE TESTED:** JUNE 28 – JULY 7, 2007

#### APPLICABLE STANDARDS

STANDARD

**TEST RESULTS** 

FCC PART 15 SUBPART C

NO NON-COMPLIANCE NOTED

(CLASS II PERMISSIVE CHANGE)

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. 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

FRANK IBRAHIM 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 and FCC CFR 47 Part 15.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

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
Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

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

## 5. EQUIPMENT UNDER TEST

#### 5.1. DESCRIPTION OF EUT

The EUT is an 802.11b/g transceiver with a PCIExpress Minicard Interface.

The radio module is manufactured by Atheros Communications, Inc.

#### 5.2. DESCRIPTION OF CLASS II CHANGE

1. Added one antenna with new type (Dipole).

#### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The following antenna was added:

Dipole Antenna, composed of two parts, part 1 is manufactured by SmartAnt and part2 is manufactured by Foxconn, Part Number for part 1 is FXN06-220360 and part number for part 2 is 1-833-851-11, peak gain with cable loss is 1.1 dBi, peak gain without cable loss is 3.4 dBi.

#### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was AR5007, ANWI 1.3 Diagnostic Kernel Drive.

The test utility software used during testing was ART Software revision 5.3 Build # 38.

#### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power. The highest measured output power was at 2437 MHz in 11g mode; therefore, radiated emissions, below 1 GHz, was performed at this channel and mode.

Date rate for this mode is 6 Mbps, based on previous experience with Atheros WLAN product design architectures.

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#### 5.6. **DESCRIPTION OF TEST SETUP**

#### **SUPPORT EQUIPMENT**

PERIPHERAL SUPPORT EQUIPMENT LIST								
Description   Manufacturer   Model/ PN   Serial Number   FCC ID								
Host Laptop PC	IBM	ThinkPad	L3-N5577	DoC				
AC/DC Adapter	Lenovo	92P1160	CHCCVVO	N/A				
Extension Card	Atheros	250-01337-020	94V0 02-05	N/A				

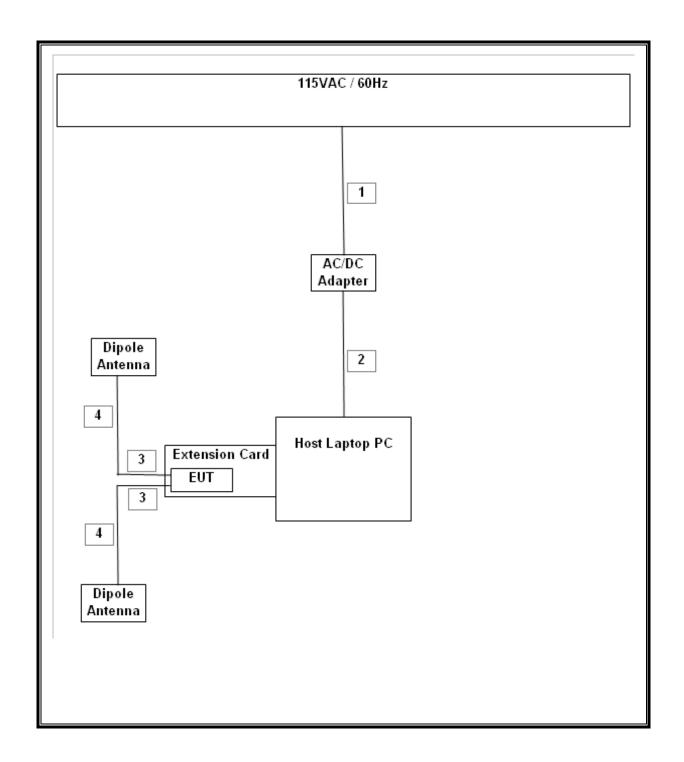
## **I/O CABLES**

	I/O CABLE LIST								
Cable No.				Cable Type	Cable Length	Remarks			
1	AC	1	AC	Unshielded	1m	N/A			
2	DC	1	DC	Unshielded	1.8m	Ferrite on Laptop PC side			
3	RF	2	Hirose U.FL-LP-088	Shielded	0.19	N/A			
4	RF	2	SMA	Shielded	1.5	N/A			

#### **TEST SETUP**

The EUT is installed in a host laptop computer via a cardbus-to-miniPCI adapter / extension board during the tests. Test software exercised the radio card.

#### **SETUP DIAGRAM FOR TESTS**



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# **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	S/N	Cal Due				
Power Meter	Agilent / HP	438B	3125U09516	06/02/08				
Power Sensor 10MHz - 18GHz	Agilent / HP	8481A	2237A31744	04/30/08				
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42070220	11/26/07				
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	04/15/08				
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/03/07				
2.4-2.5 GHz Reject Filter	Micro-Tronics	BRM50702	1	CNR				
Quasi-Peak Adaptor	Agilent / HP	85650A	3145A01654	01/21/08				
SA RF Section, 1.5 GHz	Agilent / HP	85680B	2814A04227	01/07/08				
SA Display Section 2	Agilent / HP	85662A	2816A16696	04/07/08				
Antenna, Bilog 30 MHz ~ 2 GHz	Sunol Sciences	JB1	A121003	08/13/07				
Preamp 30-1000MHz	Sonoma	310N	185623	01/20/08				
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	04/15/08				
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00931	08/01/07				
EMI Test Receiver	R & S	ESHS 20	827129/006	01/27/08				
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	09/15/07				

#### 7. LIMITS AND RESULTS

#### 7.1. RADIATED EMISSIONS

#### 7.1.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

#### **LIMITS**

§15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	$\binom{2}{}$
13.36 - 13.41			

<sup>&</sup>lt;sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

§15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

<sup>&</sup>lt;sup>2</sup> Above 38.6

§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency Field Strength (MHz) (microvolts/meter)		Measurement Distance (meters)			
30 - 88	100 **	3			
88 - 216	150 **	3			
216 - 960	200 **	3			
Above 960	500	3			

<sup>\*\*</sup> Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

#### **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.

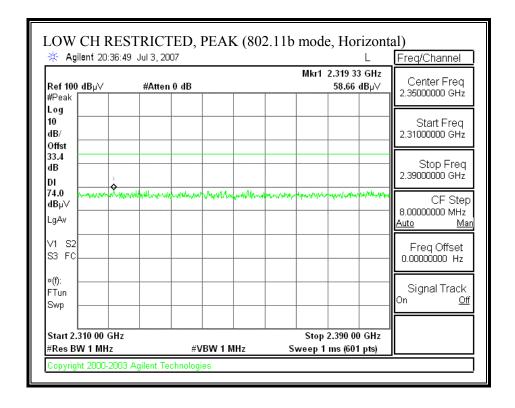
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

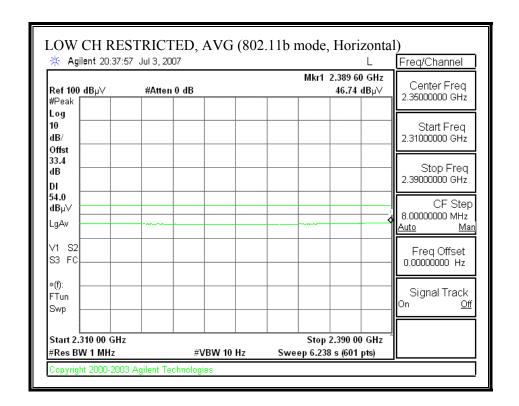
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

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

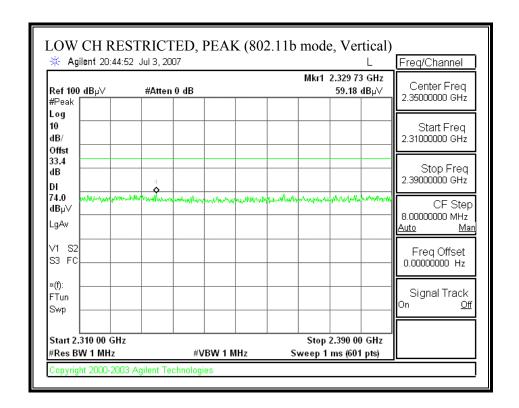
#### 7.1.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

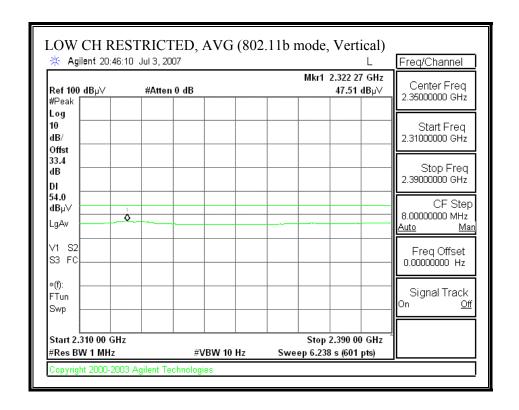
## RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)



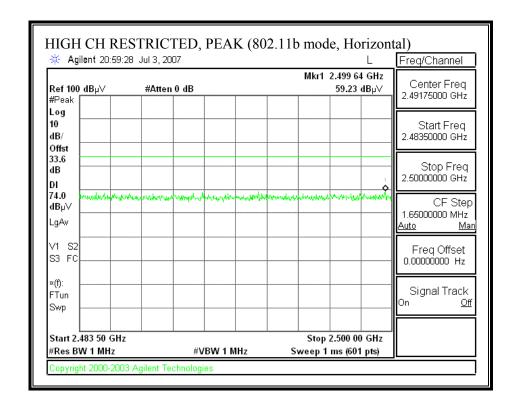


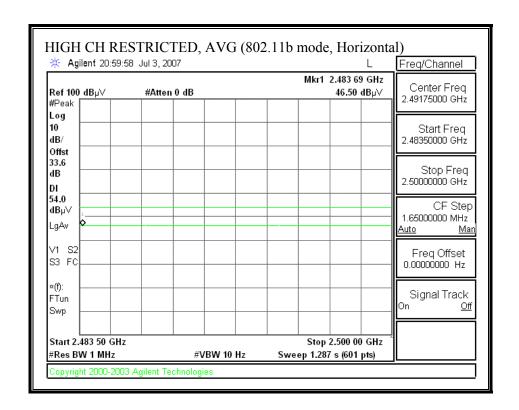
#### RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



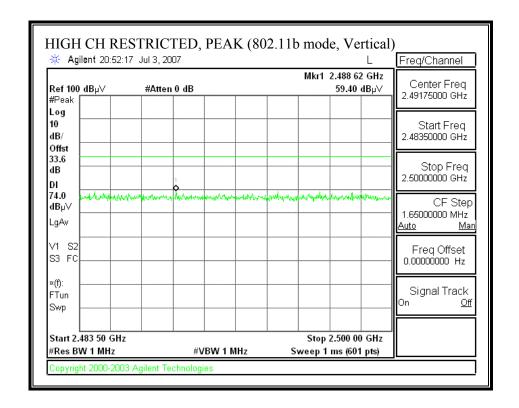


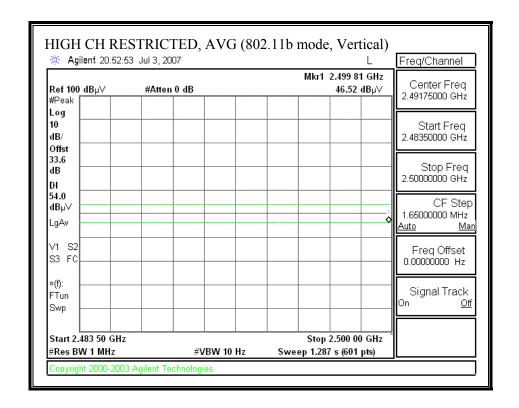
#### RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)



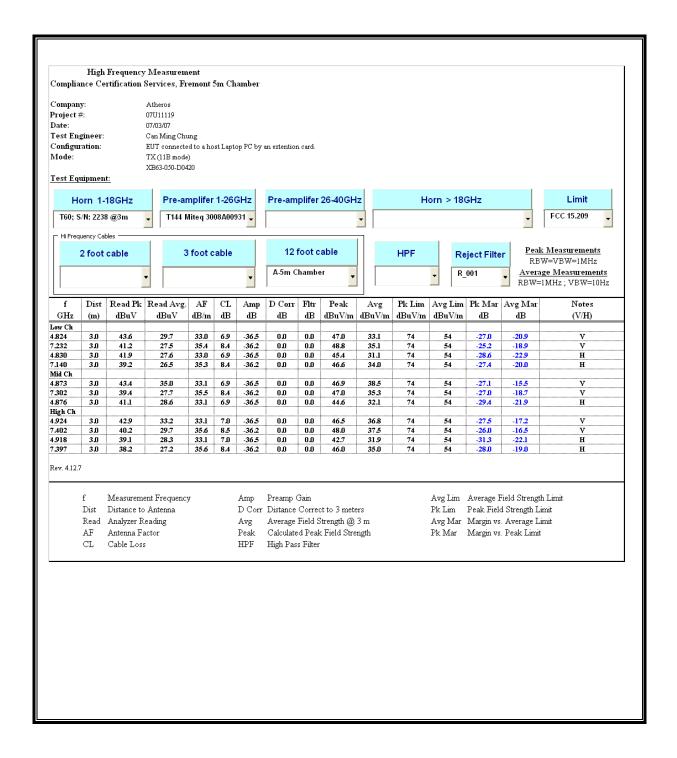


#### RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)

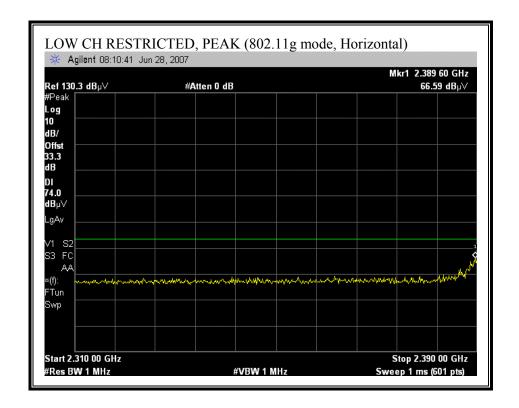


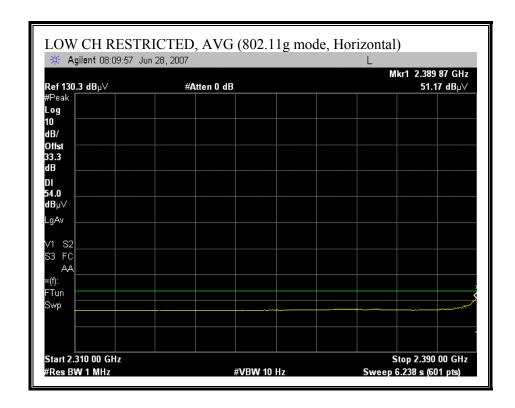


#### **HARMONICS AND SPURIOUS EMISSIONS (b MODE)**

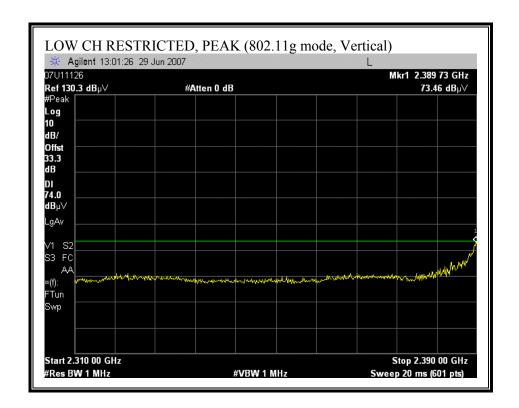


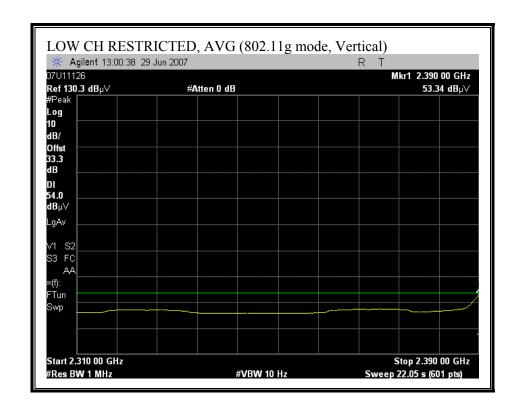
## RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, HORIZONTAL)



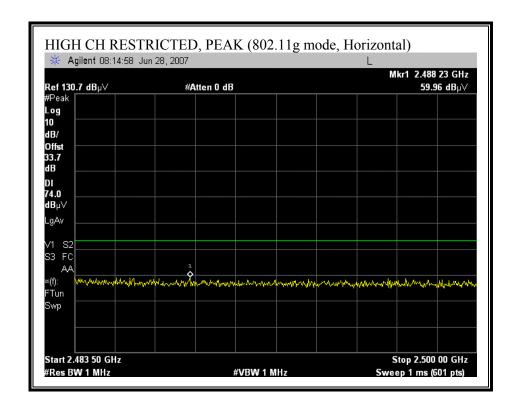


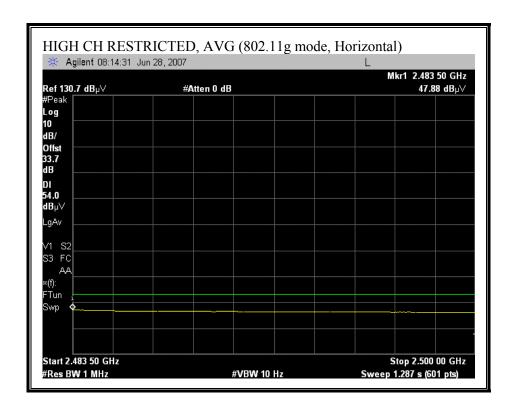
## RESTRICTED BANDEDGE (g MODE, LOW CHANNEL, VERTICAL)



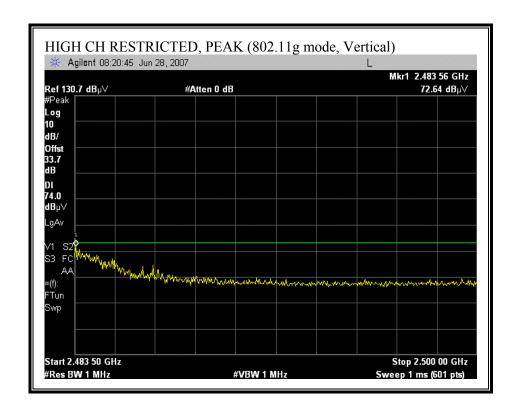


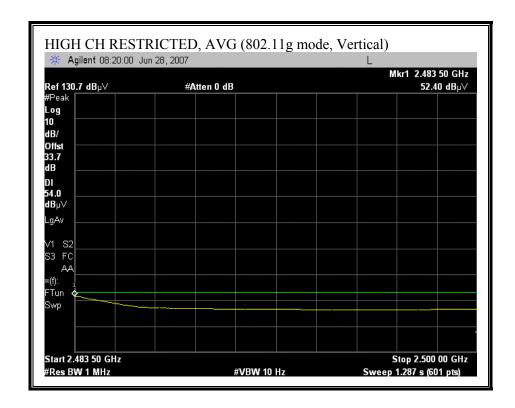
#### RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, HORIZONTAL)



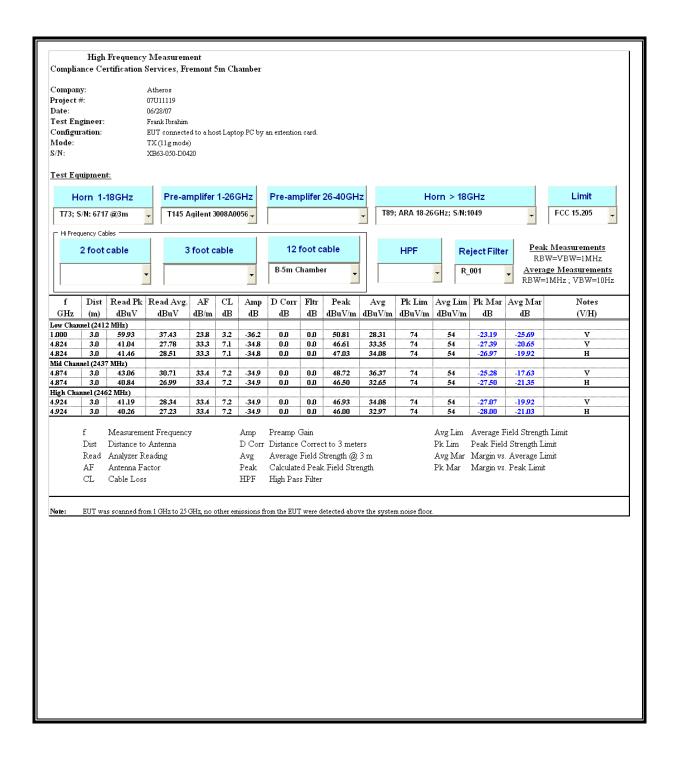


#### RESTRICTED BANDEDGE (g MODE, HIGH CHANNEL, VERTICAL)



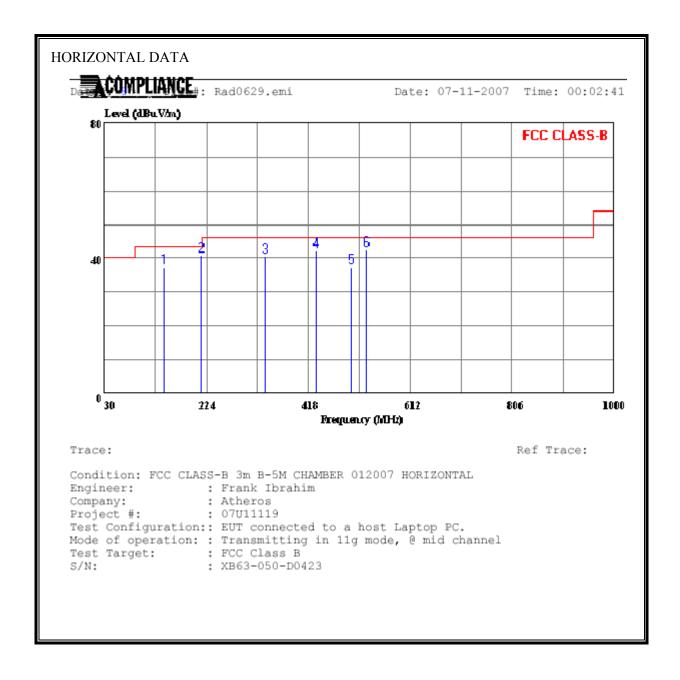


#### **HARMONICS AND SPURIOUS EMISSIONS (g MODE)**

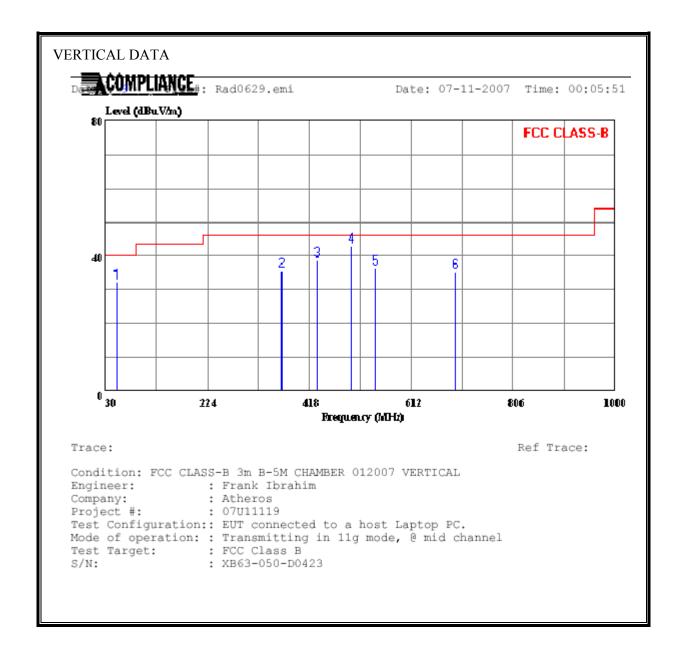


#### 7.1.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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



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



#### 7.2. POWERLINE CONDUCTED EMISSIONS

#### **LIMIT**

 $\S15.207$  (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal

The lower limit applies at the boundary between the frequency ranges.

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**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both peak detection and quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

Line conducted data is recorded for both NEUTRAL and HOT lines.

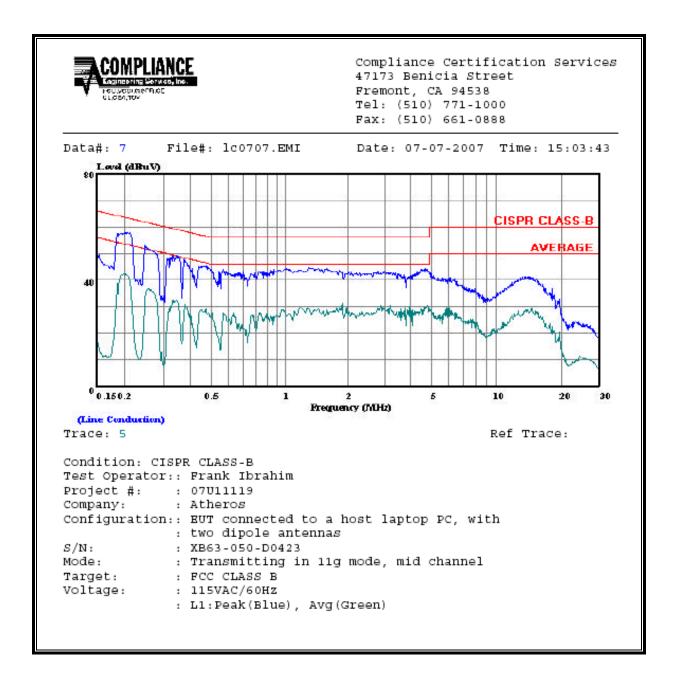
#### **RESULTS**

No non-compliance noted:

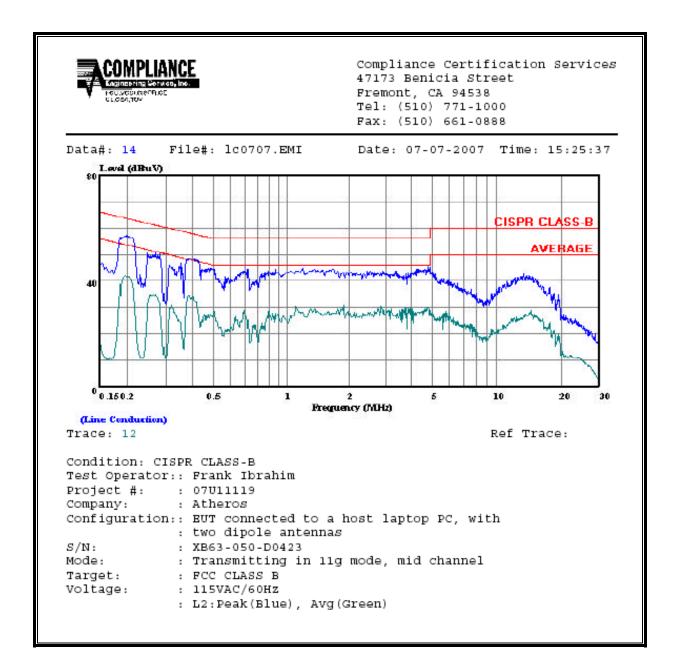
## **6 WORST EMISSIONS**

	CONDUCTED EMISSIONS DATA (115VAC 60Hz)								
Freq.	Reading			Closs	Limit	EN_B	Marg	ri:	Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV(dB)	L1/L2
0.20	57.67		42.24	0.00	63.53	53.53	-5.86	-11.29	L1
0.25	52.84		36.58	0.00	61.79	51.79	-8.95	-15.21	L1
0.35	49.16		32.43	0.00	58.96	48.96	-9.80	-16.53	L1
0.20	57.08		41.77	0.00	63.69	53.69	-6.61	-11.92	L2
0.27	50.76		34.51	0.00	61.06	51.06	-10.30	-16.55	L2
0.41	48.40		33.86	0.00	57.73	47.73	-9.33	-13.87	L2
6 Worst	Data								

#### **LINE 1 RESULTS**

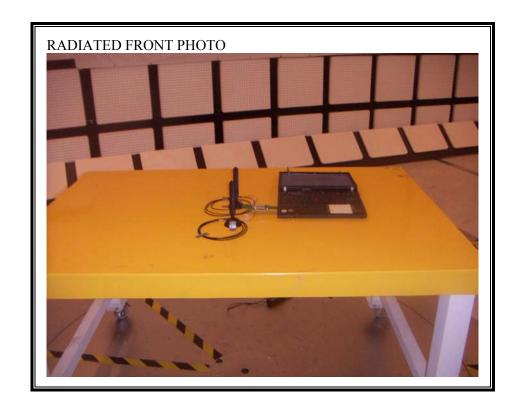


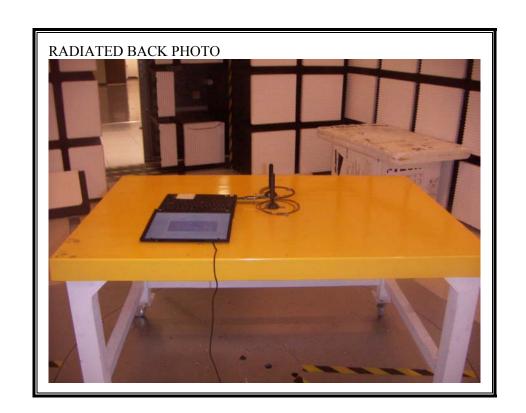
#### **LINE 2 RESULTS**



# 8. SETUP PHOTOS

#### RADIATED RF MEASUREMENT SETUP





## POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP





**END OF REPORT**