

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

802.11a/b/g/n PCIExpress Minicard

MODEL NUMBER: AR5BXB72

FCC ID: PPD-AR5BXB72P

REPORT NUMBER: 06U10379-1

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Prepared for

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Prepared by

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Revision History

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Rev.	Date	Revisions	Revised By
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ATHEROS COMMUNICATIONS, INC.

> 5480 Great America Parkway Santa Clara, CA 95054, USA

802.11a/b/g/n PCIExpress Minicard **EUT DESCRIPTION:**

MODEL TESTED: AR5BXB72

SERIAL NUMBER: XB72-060-L0416

DATE TESTED: JUNE 23-26, 2006

APPLICABLE STANDARDS

STANDARD TEST RESULTS

FCC PART 15 SUBPART C NO NON-COMPLIANCE NOTED

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.

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DATE: JULY 5, 2006

FCC ID: PPD-AR5BXB72P

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 561F Monterey Road, Morgan Hill, 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 AR5BXB72 is designed for 802.11a/b/g/n applications using the AR541X/51XX chipset with a PCIExpress Minicard interface. It has three receive chains and two transmit chains (2x3 configuration).

5.2. DESCRIPTION OF CLASS II CHANGE

The changes filed under this application include the addition of a new antenna model and the installation of the radio module in a laptop, constituting a portable configuration.

5.3. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

2400 to 2483.5 MHz Authorized Band

Frequency Range	Mode	Total Output Power	Total Output Power
(MHz)		(dBm)	(mW)
2412 - 2462	802.11b	20.70	117.49
2412 - 2462	802.11g	23.63	230.67
2412 - 2462	802.11 HT20	23.70	234.42
2422 - 2452	802.11 HT40	21.80	151.36

5725 to 5850 MHz Authorized Band

Frequency Range	Mode	Output Power	Output Power
(MHz)		(dBm)	(mW)
5745 - 5825	802.11a	20.22	105.20
5745 - 5825	802.11n HT20	20.22	105.20
5755 - 5815	802.11n HT40	20.20	104.71

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes a set of three identical PIFA antennas, manufactured by WNC, with amaximum gain of -1.6 dBi in the 2.4 GHz band and 2.0 dBi in the 5.8 GHz band.

5.5. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was AR5002, ANWI Diagnostic Kernel Drive.

The test utility software used during testing was Art Software Revision 0.3 Build #4 Art 11n

5.6. WORST-CASE CONFIGURATION AND MODE

The worst-case modes from the original filing, as determined by the highest spurious emissions levels, are 802.11b in the 2.4 GHz band and 802.11a in the 5.8 GHz band.

5.7. **DESCRIPTION OF TEST SETUP**

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST								
Description Manufacturer Model Serial Number FCC ID								
Laptop	Apple	A150	AOU25941	DoC				
AC Adapter	Apple	A1172	MV6132GLSCNA	DoC				

I/O CABLES

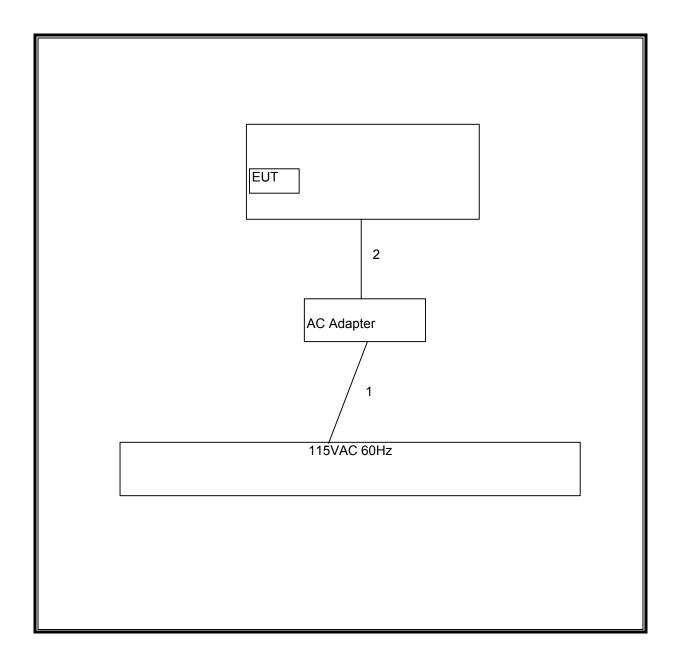
	I/O CABLE LIST								
Cable	Port	Remarks							
No.		Identical	Type	Type	Length				
		Ports							
1	AC	1	US 115V	Un-shielded	2m	NA			
2	DC	1	DC	Un-shielded	2m	NA			

TEST SETUP

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

DATE: JULY 5, 2006

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	Serial Number	Cal Due		
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	9/3/2006		
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/2007		
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/2007		
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	4/22/2007		
Antenna, Horn, 18 ~ 26 GHz	ARA	MWH-1826/B	1013	9/12/2006		
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00369	8/17/2006		
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	4/13/2007		
Preamplifier, 26 ~ 40 GHz	Miteq	NSP4000-SP2	924343	8/18/2006		
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY45300064	12/19/2006		
Peak / Average Power Sensor	Agilent	E9327A	US40440755	12/2/2007		
Peak Power Meter	Agilent / HP	E4416A	GB41291160	12/2/2007		
EMI Test Receiver	R&S	ESHS 20	827129/006	11/3/2006		
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/2006		

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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
¹ 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			

¹ 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.

² 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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

^{**} 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.

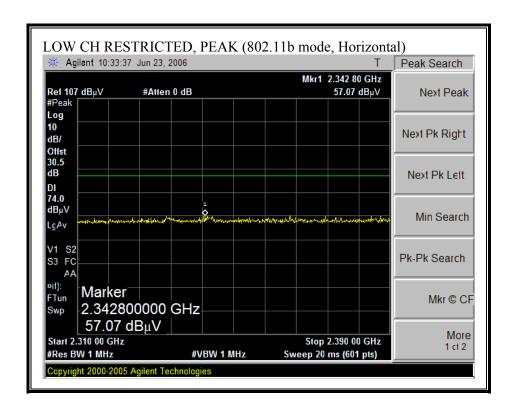
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

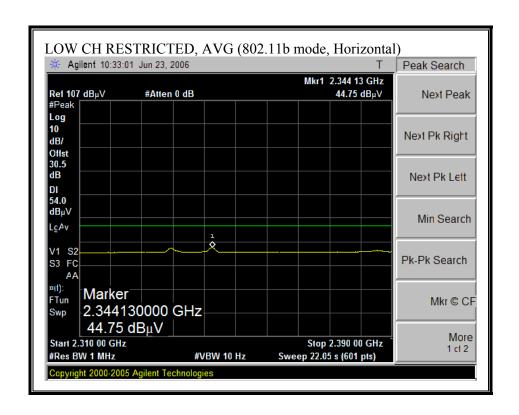
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

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.

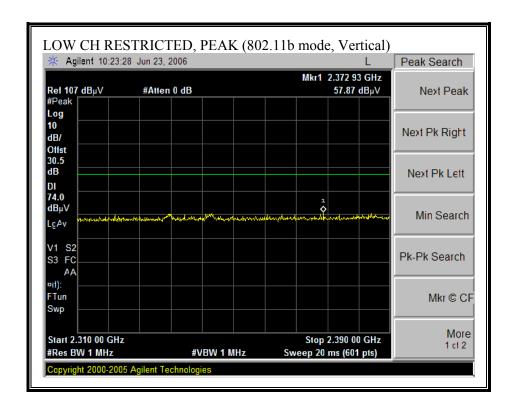
7.1.2. TRANSMITTER ABOVE 1 GHz FOR THE 2400 TO 2483.5 MHz BAND

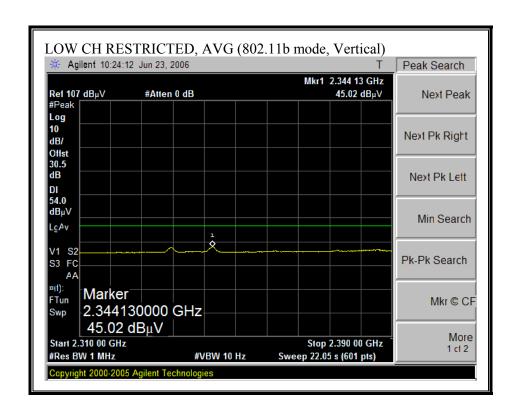
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)



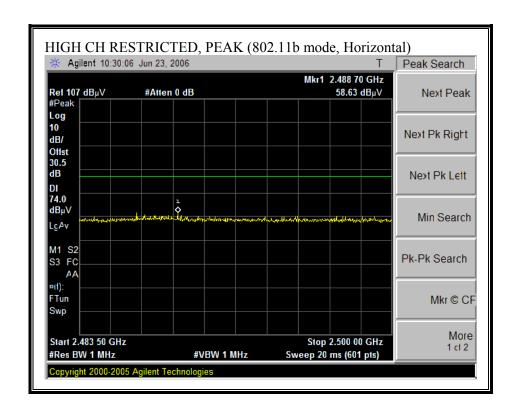


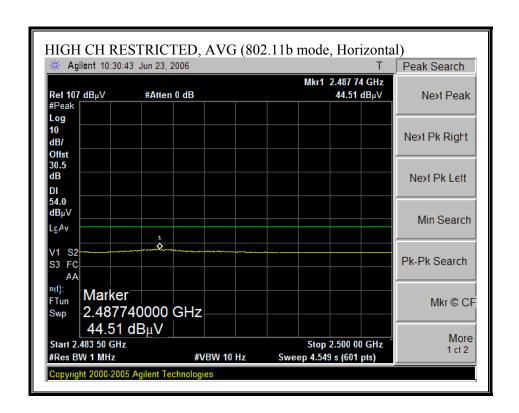
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



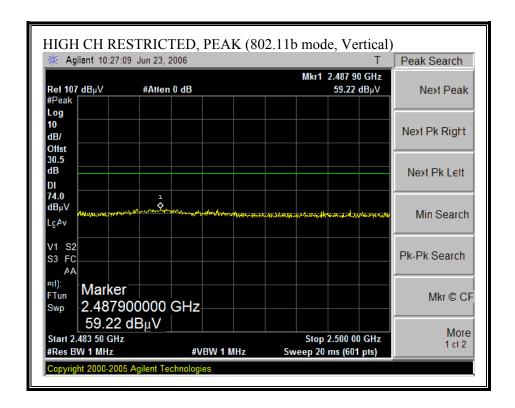


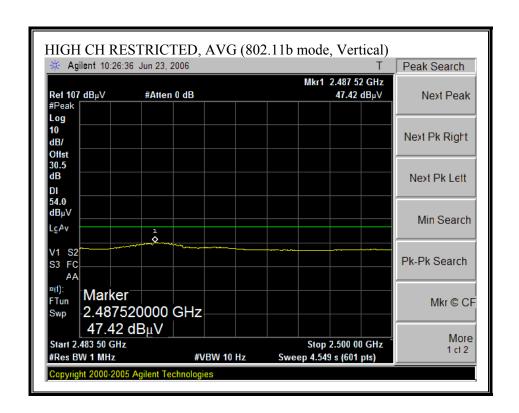
RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)



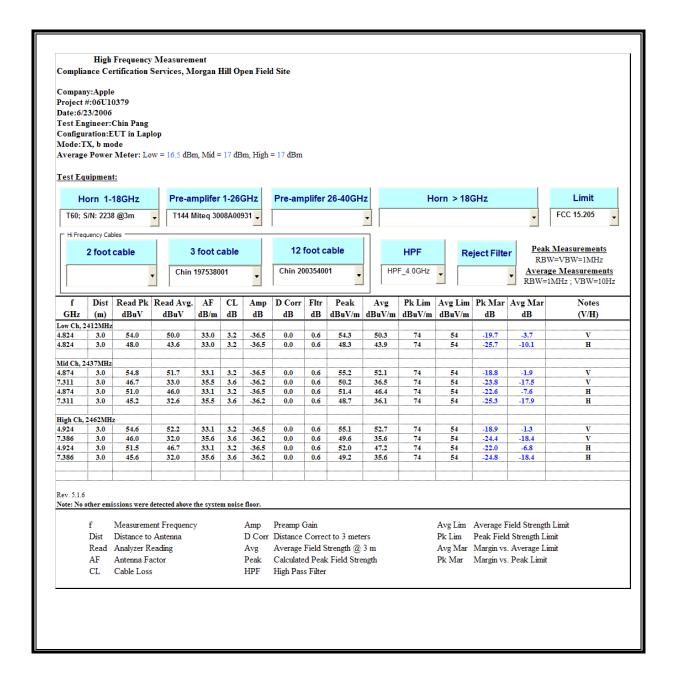


RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)



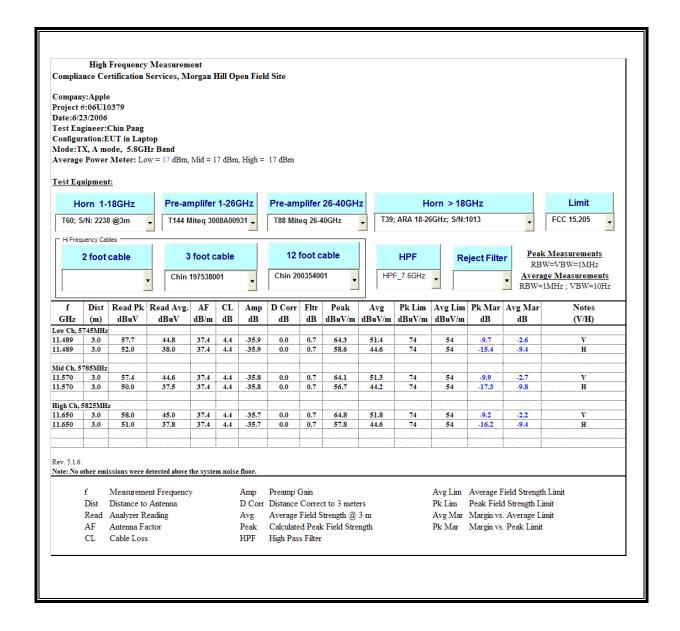


HARMONICS AND SPURIOUS EMISSIONS (b MODE)



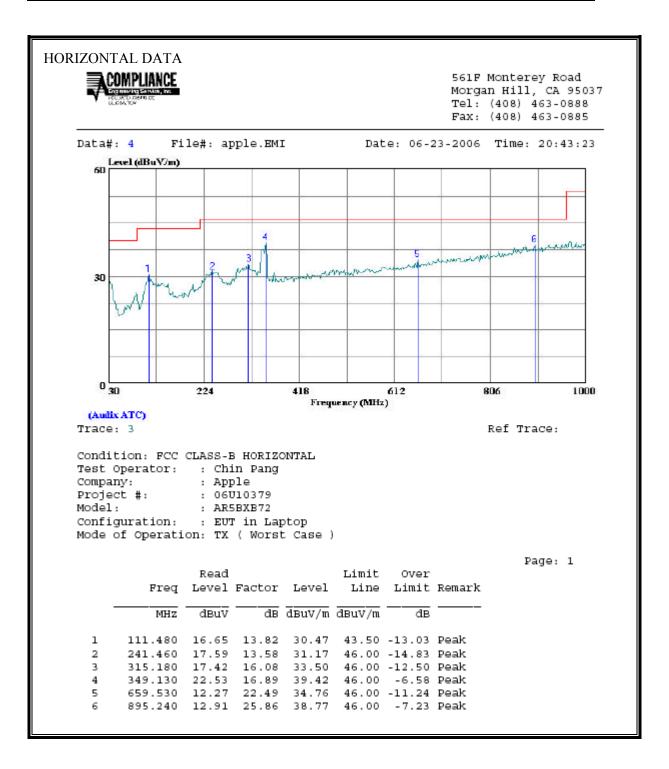
7.1.3. TRANSMITTER ABOVE 1 GHz FOR 5745 TO 5825 MHz BAND

HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)



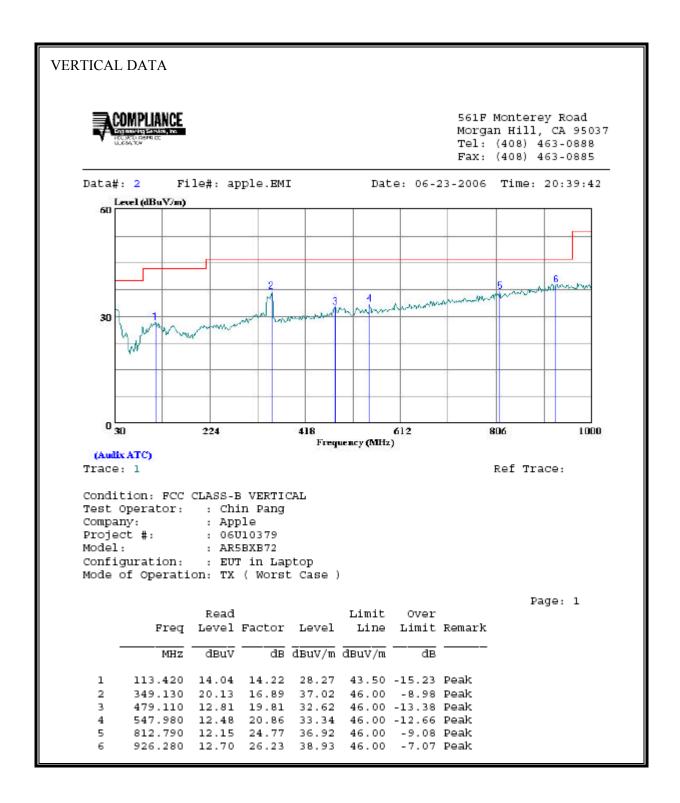
7.1.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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



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



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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 μ 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 I	imit (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.

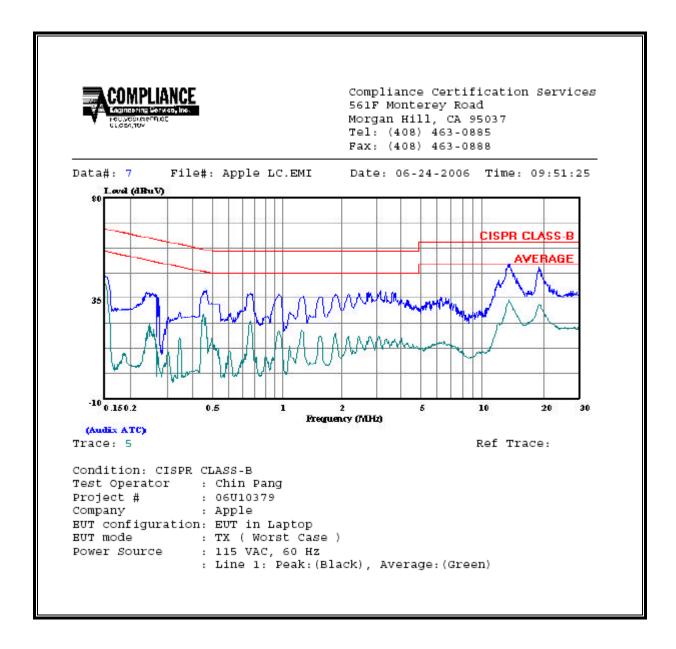
RESULTS

No non-compliance noted:

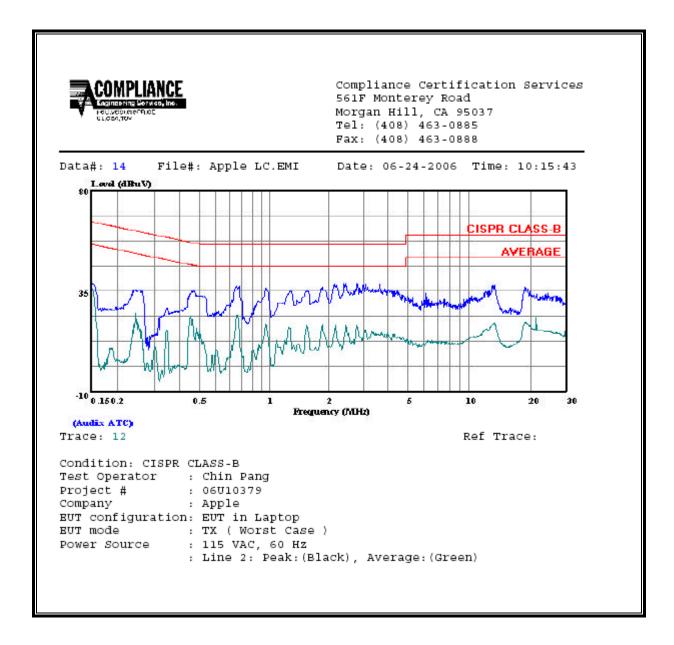
6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	DIZ (ID V)	Reading	ANZ (ID. NO	Closs	Limit	4.37	Marg		Remark
(MHz)	PK (aBuv)	QP (dBuV)	AV (aBuv)	(dB)	QP	AV	QP (aB)	AV (dB)	L1 / L2
0.15	44.88		41.54	0.00	65.89	55.89	-21.01	-14.35	L1
0.46	37.68		27.77	0.00	56.67	46.67	-18.99	-18.90	L1
13.77	50.58		33.91	0.00	60.00	50.00	-9.42	-16.09	L1
0.15	38.16		34.64	0.00	65.89	55.89	-27.73	-21.25	L2
0.74	36.56		23.77	0.00	56.00	46.00	-19.44	-22.23	L2
13.48	37.48		20.59	0.00	60.00	50.00	-22.52	-29.41	L2
6 Worst I	Data								

LINE 1 RESULTS



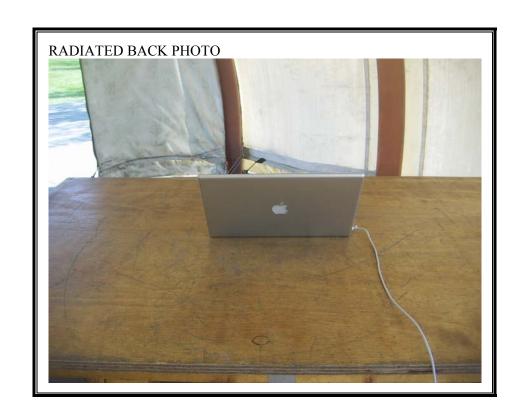
LINE 2 RESULTS



8. SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP WITH PIFA ANTENNAS





POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP





END OF REPORT