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

FOR

Broadcom 802.11ag/Draft 802.11n Wireless LAN PCI-E

MODEL NUMBER: BCM94321CM

FCC ID: QDS-BRCM1024

REPORT NUMBER: 06U10375-1

ISSUE DATE: JULY 06, 2006

Prepared for
BOARDCOM CORP.
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA

Prepared by
COMPLIANCE CERTIFICATION SERVICES
561F MONTEREY ROAD
MORGAN HILL, CA 95037, USA
TEL: (408) 463-0885
FAX: (408) 463-0888

LAB CODE:200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/06/06	Initial Issue	Thu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	Broadcom Corp. 190 Mathilda Place Sunnyvale, CA 94086, USA
EUT DESCRIPTION:	Broadcom 802.11ag/Draft 802.11n Wireless LAN PCI-E
MODEL:	BCM94321MC
SERIAL NUMBER:	APPLE LAPTOP #AOU257940, CARD #376
DATE TESTED:	JUNE 17 TO 21, 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.

Approved & Released For CCS By:

THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

Tested By:

VIEN TRAN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2 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 EUT is an 802.11n MIMO transceiver chip and installed inside Apple laptop, operating in 2400-2483.5 MHz band & 5150-5850 MHz band.

The EUT name and Applicant name were changed after testing commenced. All data in this report is applicable to the EUT name and Applicant name documented in Section 1 above.

5.2. MAXIMUM OUTPUT POWER

Please refer to CCS project 06U10233-1C report.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna manufacturer is Tyco
The antenna model is 056-1579
The Peak Gain is:

2440 MHz -1.6 dBi
5130 MHz -4.12 dBi
5360 MHz +4.06 dBi
5590 MHz +7.44 dBi
5825 MHz +2.02 dBi

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was BCM94321, version. 4.80.9.2.

The test utility software used during testing was wl_tools.

5.5. WORST-CASE CONFIGURATION AND MODE

Please refer to CCS project 06U10233-1C report.

All the RF conducted emissions were performed under the previous CCS project 06U10233-1C report. This report only confirmed on the output power & performed on all radiated emissions, e.g. spurious emissions, harmonic, bandedge, and LC tests for the worst case of portable configuration.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Apple	A1150	AOU257940	DoC
AC Adapter	Apple	A1152	N/A	N/A
Mouse	Delta Electronic	ADP-90UBC	N/A	N/A

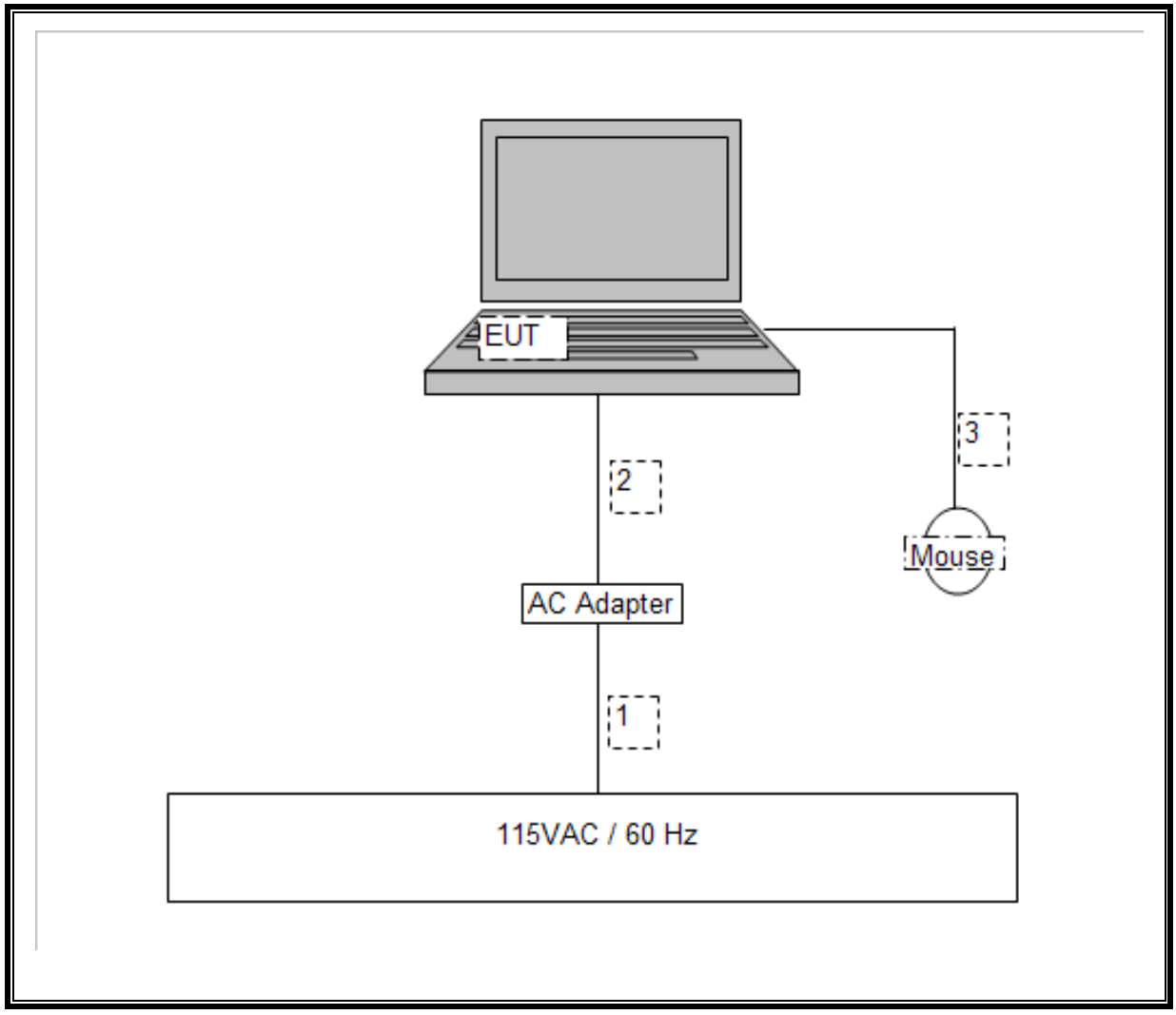
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US115	Shielded	1.2m	No
2	DC	1	DC	Unshielded	.8m	No
3	USB	1	USB	Unshielded	.5m	Yes

TEST SETUP

The EUT is installed in a host laptop computer 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**	**Serial Number**	**Cal Due**
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	2/4/2007
RF Filter Section	Agilent / HP	85420E	3705A00256	2/4/2007
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	9/3/2006
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	8/30/2006
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	8/30/2006
EMI Test Receiver	R & S	ESHS 20	827129/006	11/3/2006
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	4/22/2007
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00561	10/3/2007
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	MY43360112	4/28/2007
4.0 Highpass Filter	Micro-Tronics	HPM13351	4	CNR
7.6 Highpass Filter	Micro-Tronics	HPM13195	1	CNR

7. LIMITS AND RESULTS

7.1. AVERAGE POWER

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

No non-compliance noted:

The cable assembly insertion loss of 21.50dB (including 20.55 dB attenuator and 0.95dB connectors) was entered as an offset in the power meter to allow for direct reading of average power.

Conducted average power:

802.11b (1 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	2412	18.3	18.3
Middle	2437	19.2	19.6
High	2462	16.2	16.5

802.11g (6 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	2412	17.0	17.2
Middle	2437	18.0	17.9
High	2462	15.8	15.8

802.11n HT20 (6.5 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	2412	14.6	14.4
Middle	2437	16.0	15.8
High	2462	13.9	13.7

802.11n HT40 (13.5 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	2422	12.8	12.7
Middle	2437	13.5	13.3
High	2452	12.5	12.4

The cable assembly insertion loss of 19.24dB (including 19.14 dB attenuator and 0.1dB connectors) was entered as an offset in the power meter to allow for direct reading of average power.

Conducted average power:

802.11a (6 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	5745	17.9	18.0
Middle	5785	17.9	17.4
High	5825	17.8	17.3

802.11n HT20 (6.5 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	5745	15.6	15.6
Middle	5785	15.6	15.5
High	5825	15.5	15.5

802.11n HT40 (13.5 Mbs)

Channel	Frequency (MHz)	Main (dBm)	AUX (dBm)
Low	5755	15.3	15.4
High	5795	15.3	15.4

7.2. CHANNEL TESTS FOR THE 2400 TO 2483.5 MHz BAND

Please refer to CCS project 06U10233-1C reports.

7.3. CHANNEL TESTS FOR THE 5725 TO 5850 MHz BAND

Please refer to CCS project 06U10233-1C reports.

7.4. RADIATED EMISSIONS

7.4.1. 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	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

§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.

§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 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

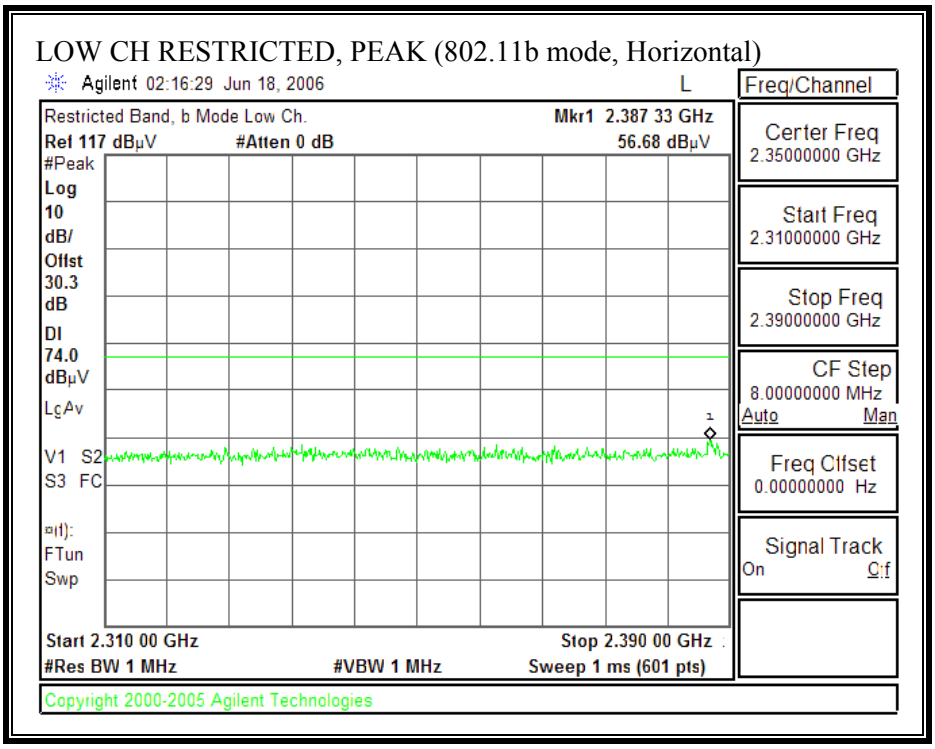
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.

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.

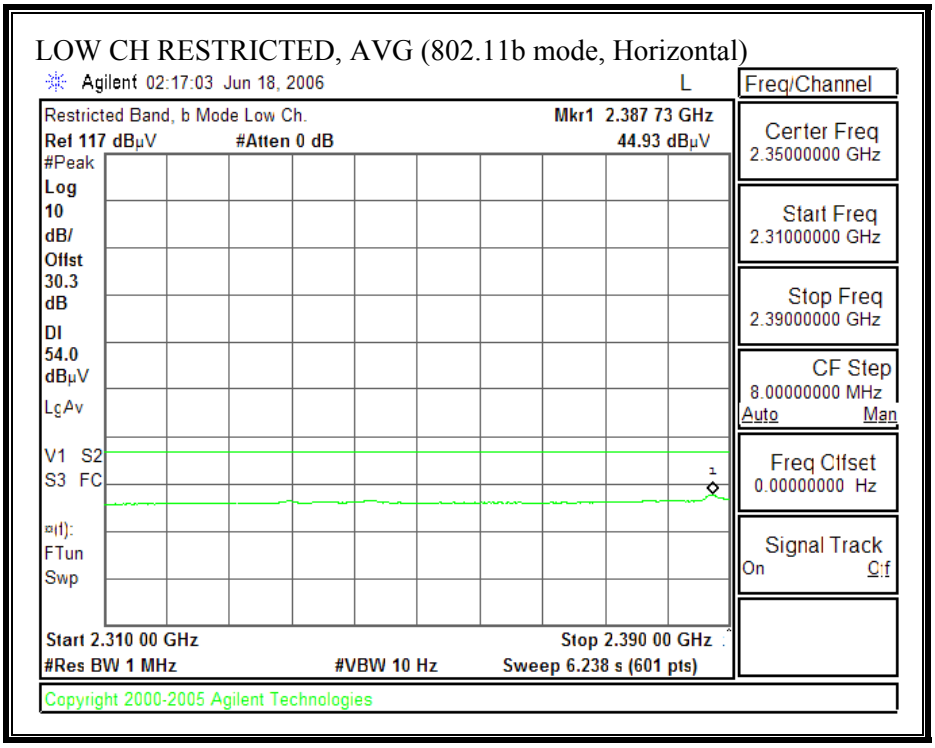
7.4.2. TRANSMITTER ABOVE 1 GHz FOR 2400 TO 2483.5 MHz BAND

LEGACY - 2.4 GHz BAND 11b Mode – WORST CASE

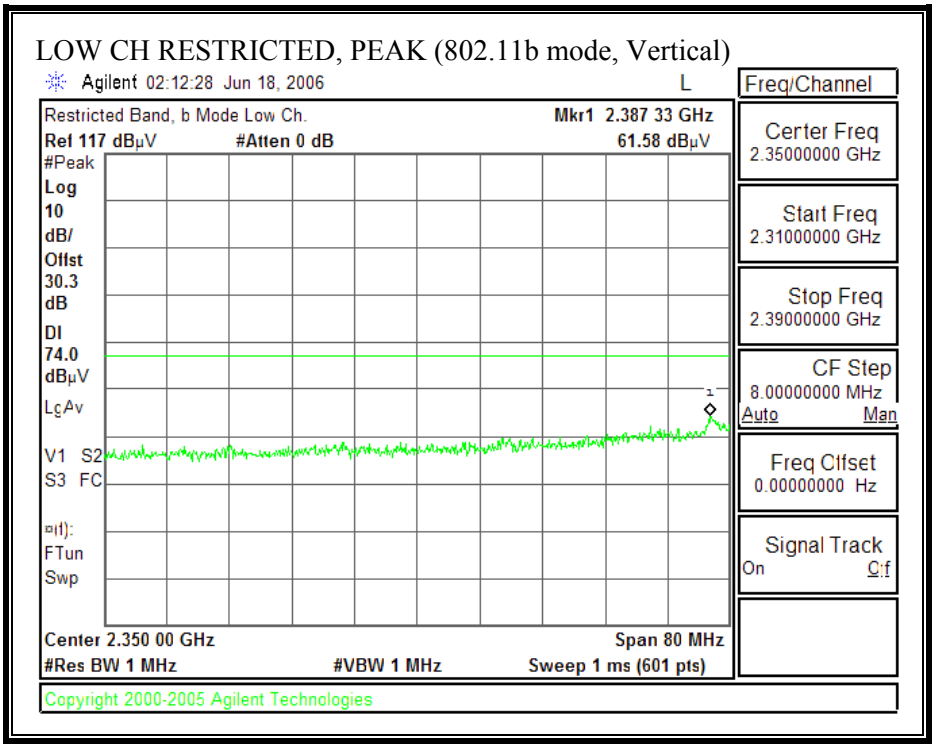
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, HORIZONTAL)



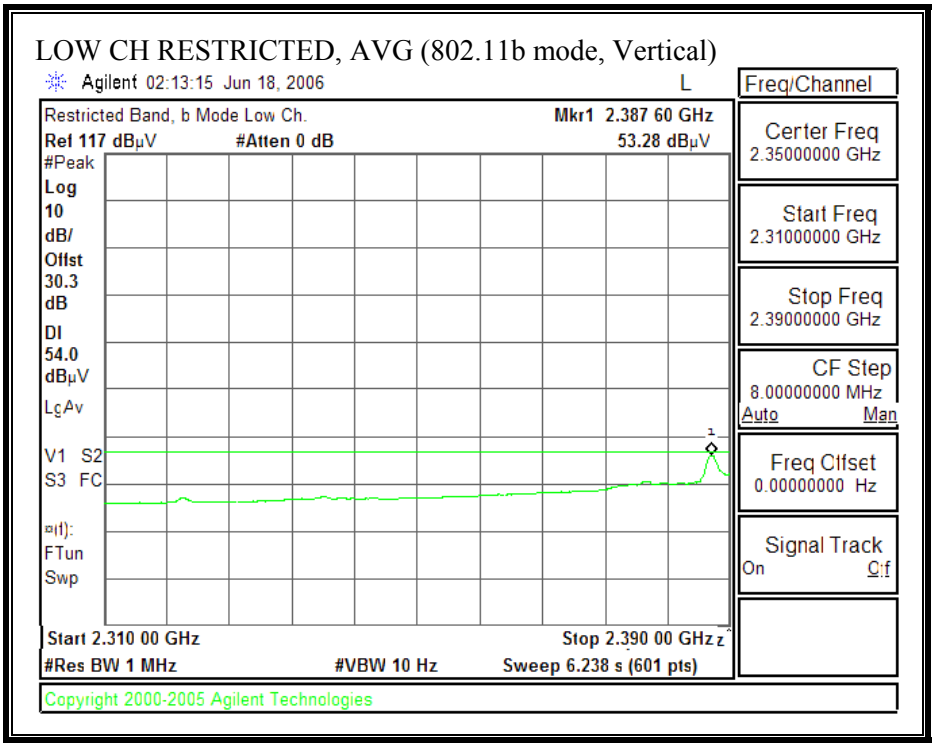
LOW CH RESTRICTED, AVG (802.11b mode, Horizontal)



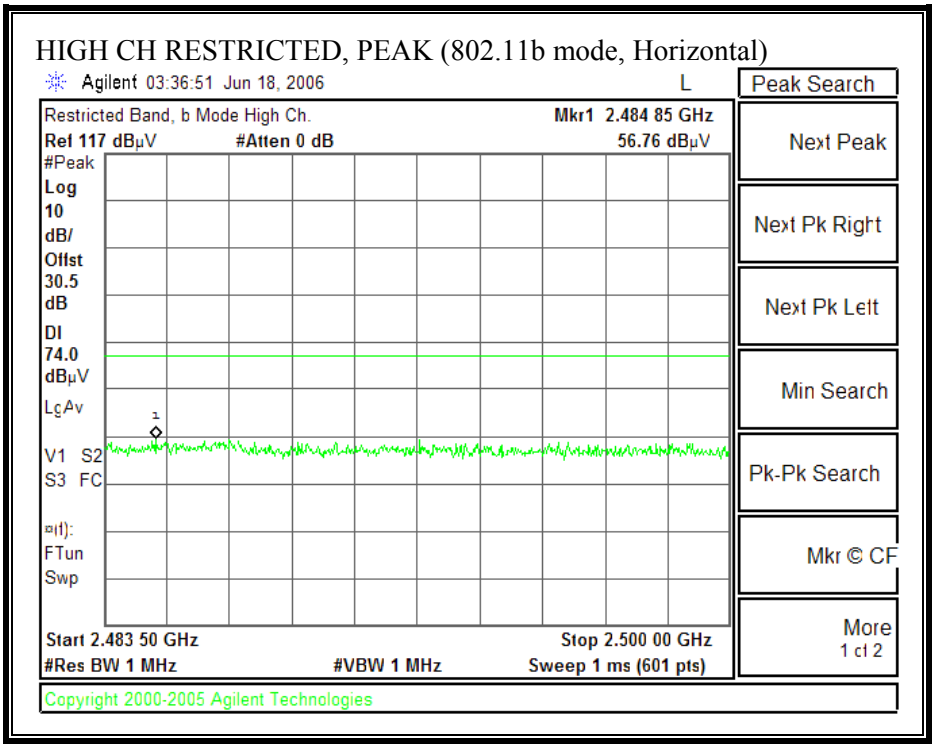
RESTRICTED BANDEDGE (b MODE, LOW CHANNEL, VERTICAL)



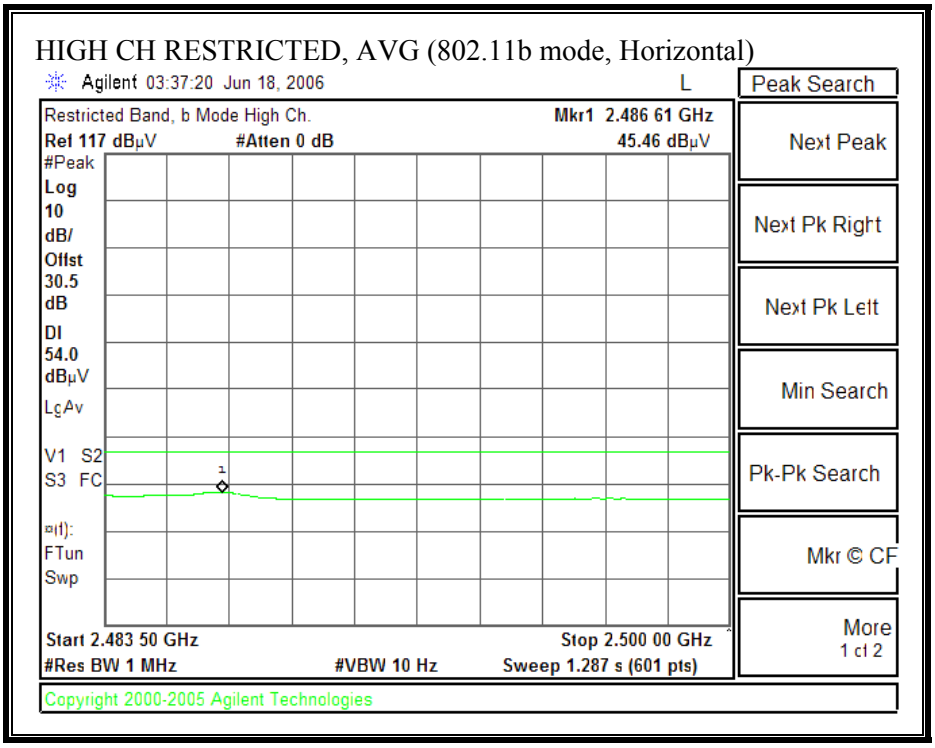
LOW CH RESTRICTED, AVG (802.11b mode, Vertical)



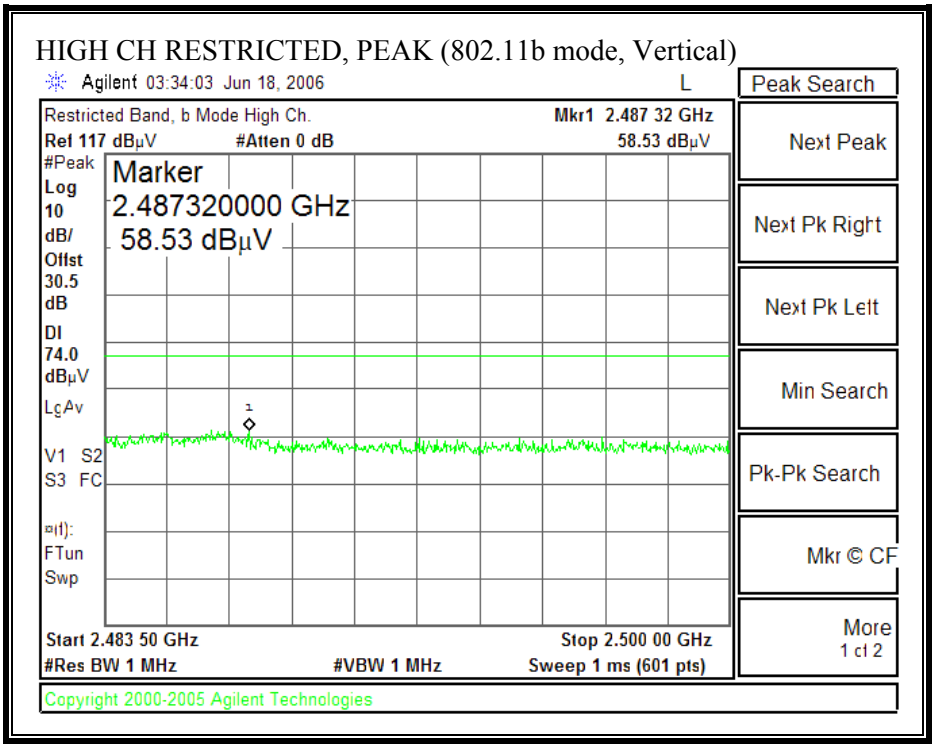
RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, HORIZONTAL)



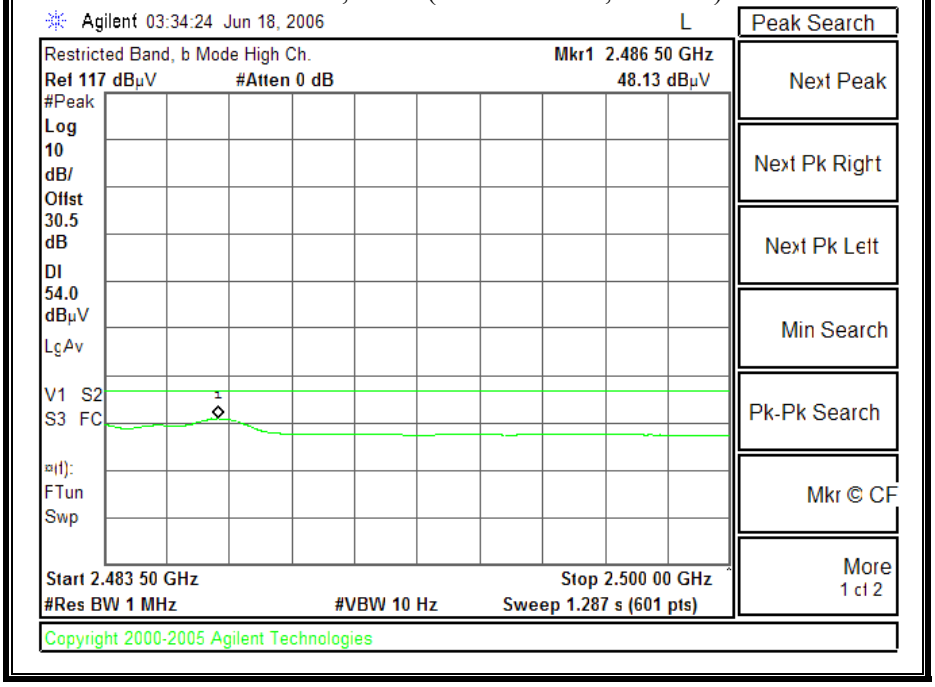
HIGH CH RESTRICTED, AVG (802.11b mode, Horizontal)



RESTRICTED BANDEDGE (b MODE, HIGH CHANNEL, VERTICAL)



HIGH CH RESTRICTED, AVG (802.11b mode, Vertical)



HARMONICS AND SPURIOUS EMISSIONS (b MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Apple Computer Inc.
Project #: 06U10375
Date: 06/20/06
Test Engineer: Vien Tran
Configuration: 802.11abgn Wireless LAN Card (Card #376 - Shielded)
Mode: Tx Legacy 11b Mode
Average Power Meter: Low = 19 dBm, Mid = 19 dBm, High = 19 dBm

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Vien 187215002	Vien 197209005	HPF_4.0GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

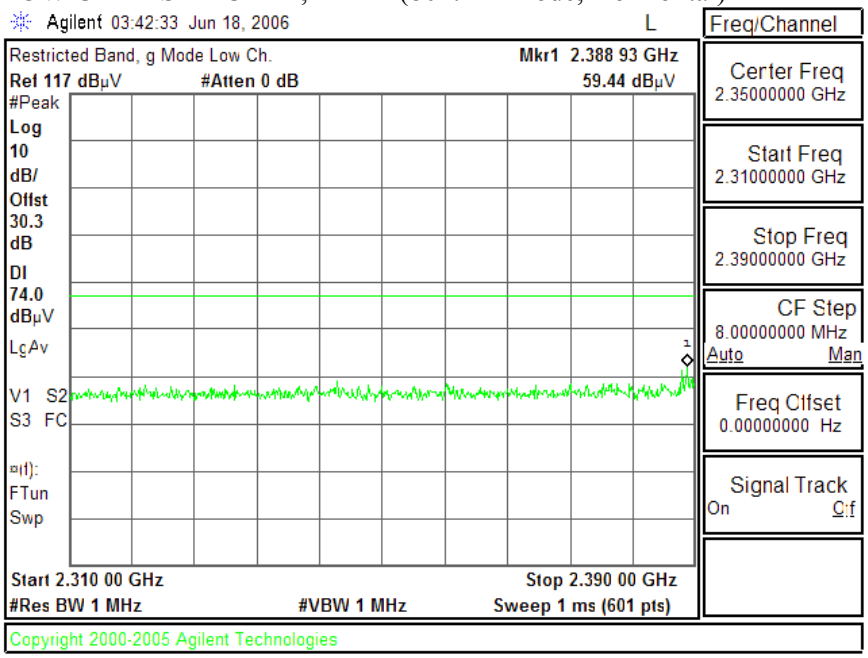
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel, 2412 MHz															
4.824	3.0	51.2	48.3	33.0	2.9	-34.8	0.0	0.6	52.9	50.0	74	54	-21.1	-4.0	V
12.060	3.0	42.5	32.5	37.4	4.8	-32.4	0.0	0.9	53.3	43.3	74	54	-20.7	-10.7	V
4.824	3.0	47.6	45.1	33.0	2.9	-34.8	0.0	0.6	49.3	46.8	74	54	-24.7	-7.2	H
12.060	3.0	42.6	31.3	37.4	4.8	-32.4	0.0	0.9	53.4	42.1	74	54	-20.6	-11.9	H
Mid Channel, 2437 MHz															
4.874	3.0	50.6	48.1	33.1	3.0	-34.9	0.0	0.6	52.4	49.9	74	54	-21.6	-4.1	V
7.311	3.0	45.1	35.2	35.5	4.2	-34.7	0.0	0.6	50.7	40.8	74	54	-23.3	-13.2	V
12.185	3.0	43.1	31.2	37.4	4.9	-32.4	0.0	0.9	53.9	42.0	74	54	-20.1	-12.0	V
4.874	3.0	49.2	46.3	33.1	3.0	-34.9	0.0	0.6	51.0	48.1	74	54	-23.0	-5.9	H
7.311	3.0	44.5	33.2	35.5	4.2	-34.7	0.0	0.6	50.1	38.8	74	54	-23.9	-15.2	H
12.185	3.0	41.6	32.4	37.4	4.9	-32.4	0.0	0.9	52.4	43.2	74	54	-21.6	-10.8	H
High Channel, 2462 MHz															
4.924	3.0	52.9	48.9	33.1	3.1	-34.9	0.0	0.6	54.8	50.8	74	54	-19.2	-3.2	V
7.386	3.0	46.7	38.8	35.6	4.2	-34.6	0.0	0.6	52.5	44.6	74	54	-21.5	-9.4	V
12.310	3.0	43.8	33.0	37.4	4.9	-32.4	0.0	0.9	54.6	43.8	74	54	-19.4	-10.2	V
4.924	3.0	52.5	48.6	33.1	3.1	-34.9	0.0	0.6	54.4	50.5	74	54	-19.6	-3.5	H
7.386	3.0	44.0	36.1	35.6	4.2	-34.6	0.0	0.6	49.8	41.9	74	54	-24.2	-12.1	H
12.310	3.0	42.8	32.3	37.4	4.9	-32.4	0.0	0.9	53.6	43.1	74	54	-20.4	-10.9	H
		No other emission were detected above system noise floor.													

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

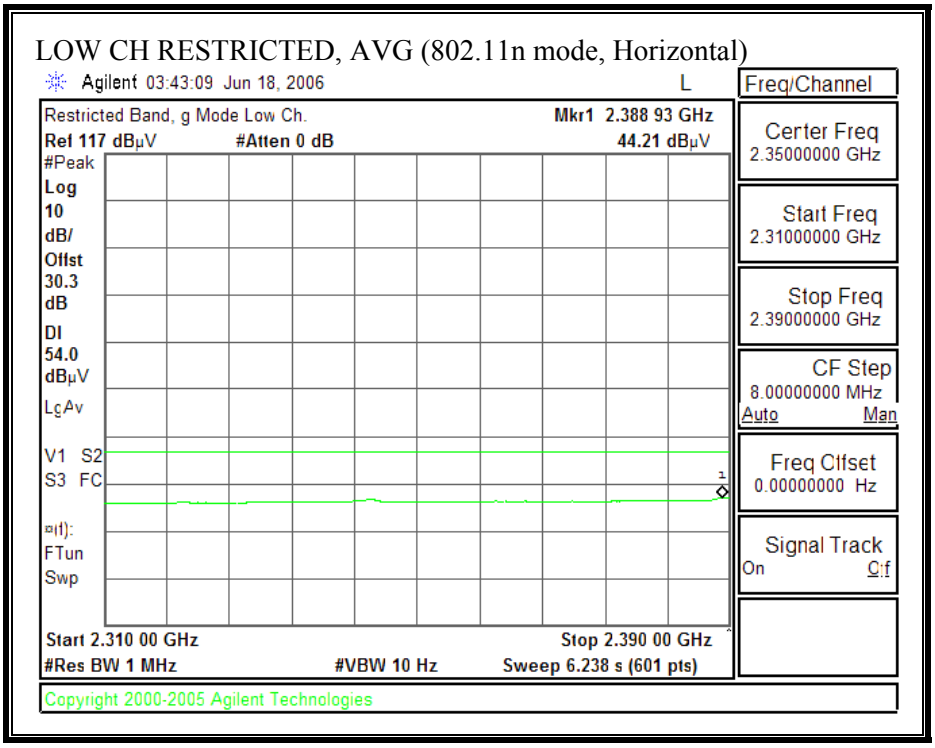
MIMO 20 MHz BANDWIDTH - 2.4 GHz BAND – WORST CASE

RESTRICTED BANDEDGE (n MODE, LOW CHANNEL, HORIZONTAL)

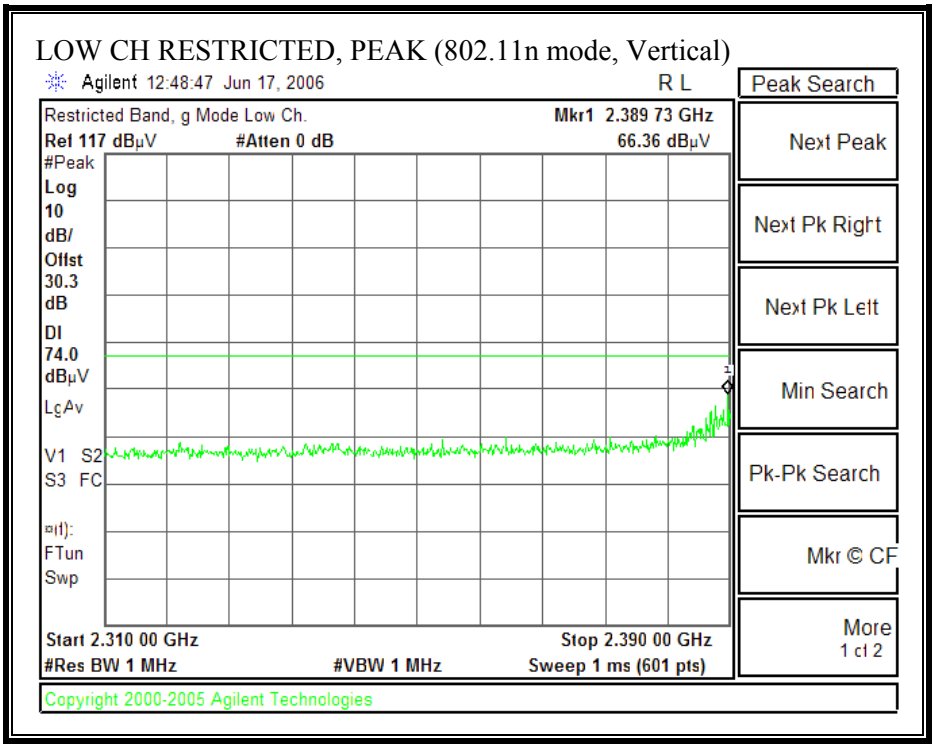
LOW CH RESTRICTED, PEAK (802.11n mode, Horizontal)



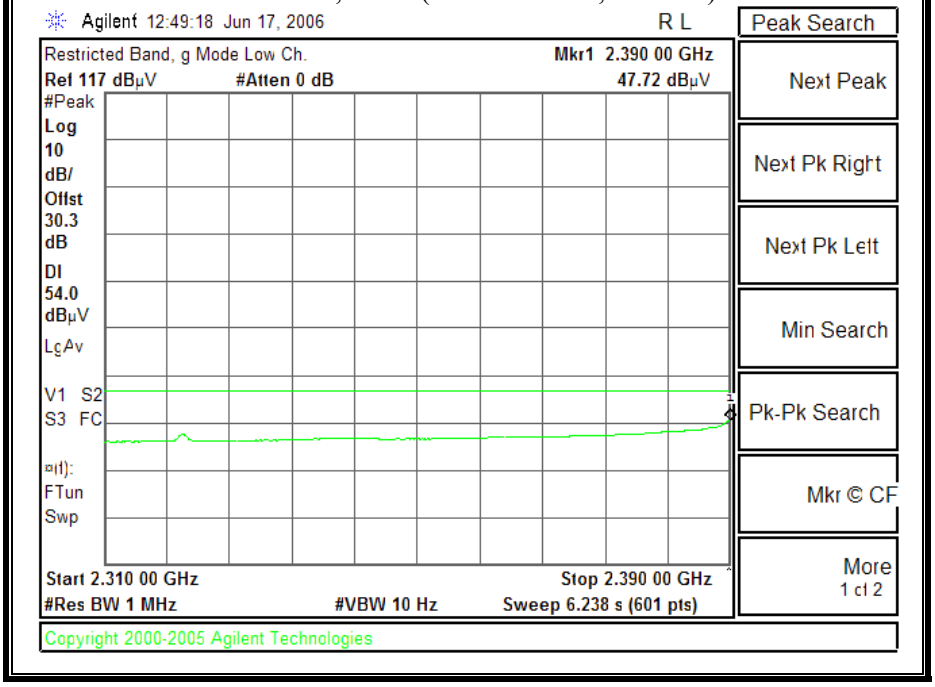
LOW CH RESTRICTED, AVG (802.11n mode, Horizontal)



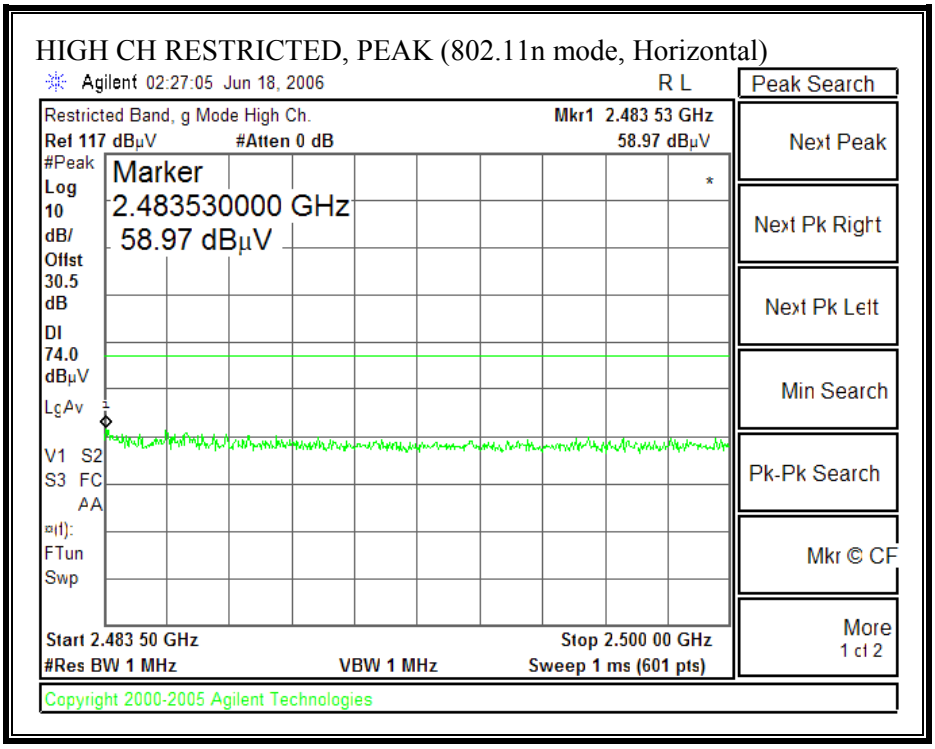
RESTRICTED BANDEDGE (n MODE, LOW CHANNEL, VERTICAL)



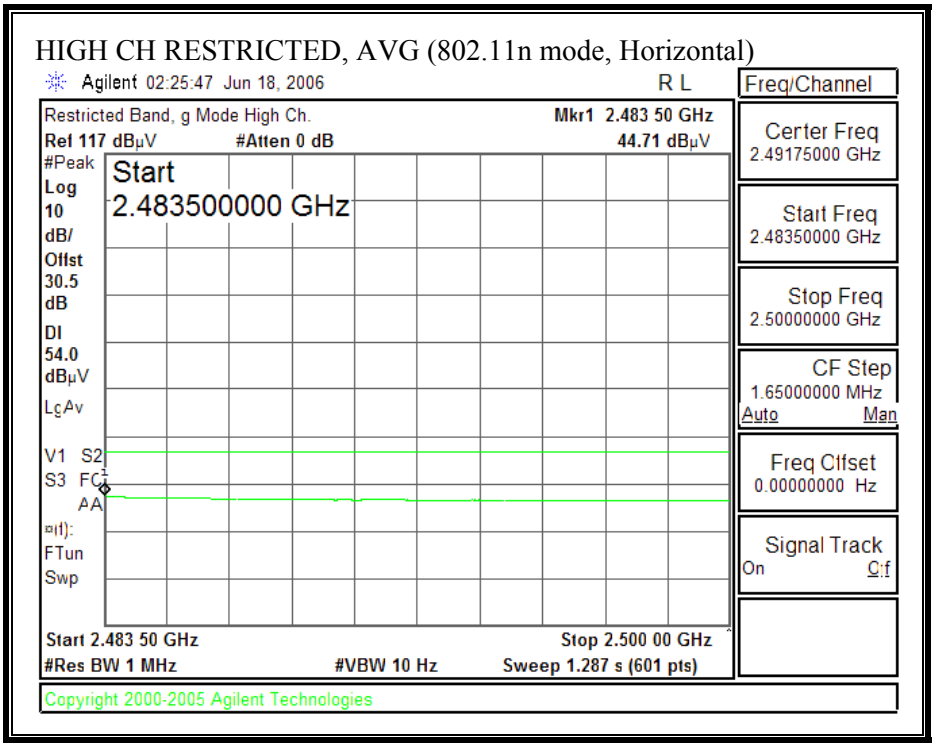
LOW CH RESTRICTED, AVG (802.11n mode, Vertical)



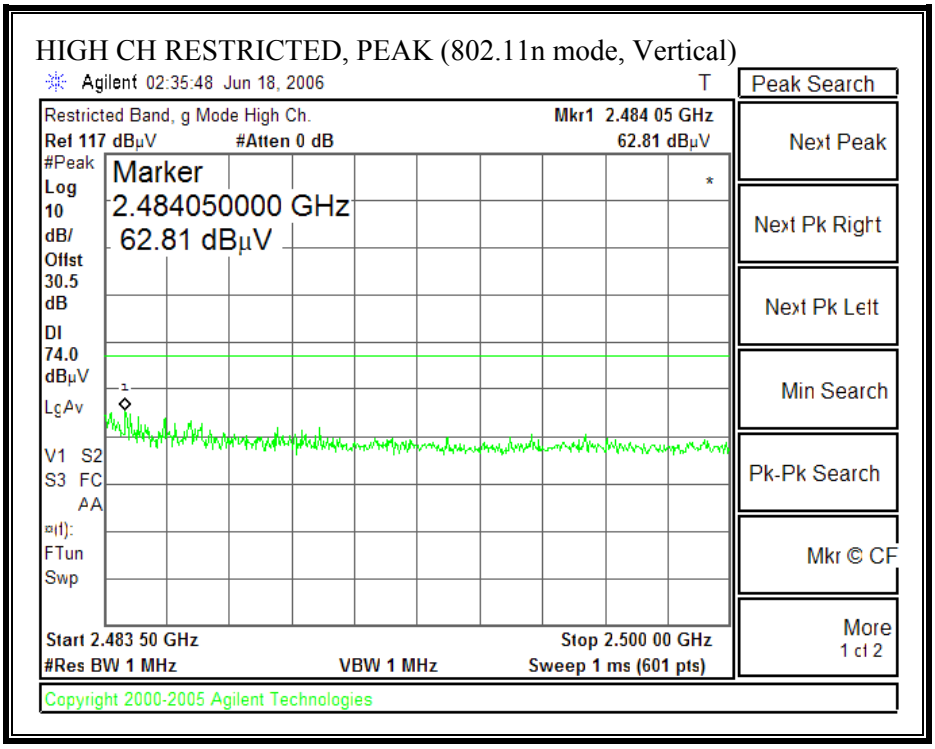
RESTRICTED BANDEDGE (n MODE, HIGH CHANNEL, HORIZONTAL)



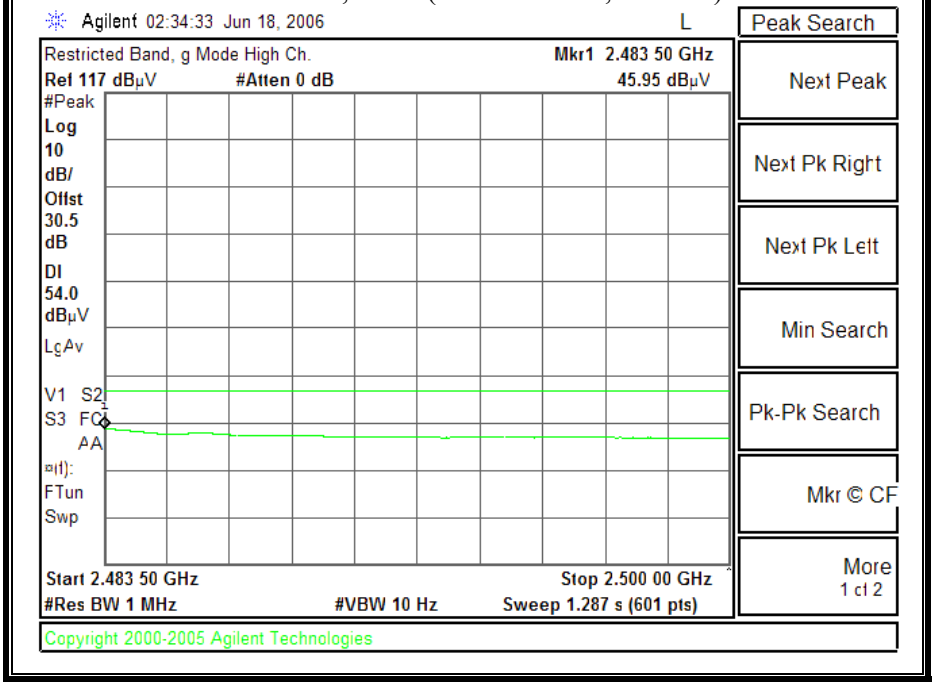
HIGH CH RESTRICTED, AVG (802.11n mode, Horizontal)



RESTRICTED BANDEDGE (n MODE, HIGH CHANNEL, VERTICAL)



HIGH CH RESTRICTED, AVG (802.11n mode, Vertical)



HARMONICS AND SPURIOUS EMISSIONS (n MODE)

High Frequency Measurement
Compliance Certification Services, Morgan Hill Open Field Site

Company: Apple Computer Inc.
Project #: 06U10375
Date: 06/20/06
Test Engineer: Vien Tran
Configuration: 802.11abgn Wireless LAN Card (Card #376 - Shielded)
Mode: Tx MIMO 20 MHz Bandwidth_2.4 GHz Band
Average Power Meter: Low = 14 dBm, Mid = 15.5 dBm, High = 13.5 dBm

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Vien 187215002	Vien 197209005	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	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel, 2412 MHz															
4.824	3.0	50.5	47.2	33.0	2.9	-34.8	0.0	0.6	52.2	48.9	74	54	-21.8	-5.1	V
12.060	3.0	42.5	32.5	37.4	4.8	-32.4	0.0	0.9	53.3	43.3	74	54	-20.7	-10.7	V
4.824	3.0	44.1	32.5	33.0	2.9	-34.8	0.0	0.6	45.8	34.2	74	54	-28.2	-19.8	H
12.060	3.0	41.8	31.3	37.4	4.8	-32.4	0.0	0.9	52.6	42.1	74	54	-21.4	-11.9	H
Mid Channel, 2437 MHz															
4.874	3.0	53.1	48.4	33.1	3.0	-34.9	0.0	0.6	54.9	50.2	74	54	-19.1	-3.8	V
7.311	3.0	43.8	32.9	35.5	4.2	-34.7	0.0	0.6	49.4	38.5	74	54	-24.6	-15.5	V
12.185	3.0	42.6	31.7	37.4	4.9	-32.4	0.0	0.9	53.4	42.5	74	54	-20.6	-11.5	V
4.874	3.0	46.3	34.4	33.1	3.0	-34.9	0.0	0.6	48.1	36.2	74	54	-25.9	-17.8	H
7.311	3.0	45.5	34.0	35.5	4.2	-34.7	0.0	0.6	51.1	39.6	74	54	-22.9	-14.4	H
12.185	3.0	44.1	33.5	37.4	4.9	-32.4	0.0	0.9	54.9	44.3	74	54	-19.1	-9.7	H
High Channel, 2462 MHz															
4.924	3.0	52.6	48.8	33.1	3.1	-34.9	0.0	0.6	54.5	50.7	74	54	-19.5	-3.3	V
7.386	3.0	44.2	32.3	35.6	4.2	-34.6	0.0	0.6	50.0	38.1	74	54	-24.0	-15.9	V
12.310	3.0	43.8	33.0	37.4	4.9	-32.4	0.0	0.9	54.6	43.8	74	54	-19.4	-10.2	V
4.924	3.0	44.7	32.8	33.1	3.1	-34.9	0.0	0.6	46.6	34.7	74	54	-27.4	-19.3	H
7.386	3.0	43.9	32.4	35.6	4.2	-34.6	0.0	0.6	49.7	38.2	74	54	-24.3	-15.8	H
12.310	3.0	42.5	31.9	37.4	4.9	-32.4	0.0	0.9	53.3	42.7	74	54	-20.7	-11.3	H
		No other emission were detected above system noise floor.													

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

7.4.3. TRANSMITTER ABOVE 1 GHz FOR 5725 TO 5850 MHz BAND

HARMONICS AND SPURIOUS EMISSIONS (802.11a MIMO 20MHz MODE)

Company: Apple Computer Inc.
Project #: 06U10375
Date: 06/17/06
Test Engineer: Vien Tran
Configuration: 802.11abgn Wireless LAN Card (Card #376)
Mode: MIMO 20MHz Tx BW 11a Mode_5.8 GHz Band
Average Power Meter: Low = 15dBm, Mid = 15dBm, High = 15dBm

Test Equipment:

Horn 1-18GHz	Pre-amplifer 1-26GHz	Pre-amplifer 26-40GHz	Horn > 18GHz	Limit
T60; S/N: 2238 @3m	T145 Agilent 3008A0056			FCC 15.205

Hi Frequency Cables

2 foot cable	3 foot cable	12 foot cable	HPF	Reject Filter
	Vien 187215002	Vien 197209005	HPF_7.6GHz	

Peak Measurements
RBW=VBW=1MHz
Average Measurements
RBW=1MHz ; VBW=10Hz

f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CH, 5745 MHz															
11.490	3.0	42.0	30.9	37.4	4.8	-33.1	0.0	0.7	51.8	40.7	74	54	-22.2	-13.3	V
11.490	3.0	43.0	31.2	37.4	4.8	-33.1	0.0	0.7	52.8	41.0	74	54	-21.2	-13.0	H
MID CH, 5785 MHz															
11.570	3.0	42.2	31.2	37.4	4.8	-33.0	0.0	0.7	52.1	41.1	74	54	-21.9	-12.9	V
11.570	3.0	43.3	32.1	37.4	4.8	-33.0	0.0	0.7	53.2	42.0	74	54	-20.8	-12.0	H
HI CH, 5825 MHz															
11.650	3.0	42.4	31.3	37.4	4.8	-32.9	0.0	0.7	52.4	41.3	74	54	-21.6	-12.7	V
11.650	3.0	43.3	32.5	37.4	4.8	-32.9	0.0	0.7	53.3	42.5	74	54	-20.7	-11.5	H
No other emissions were detected above system noise floor.															

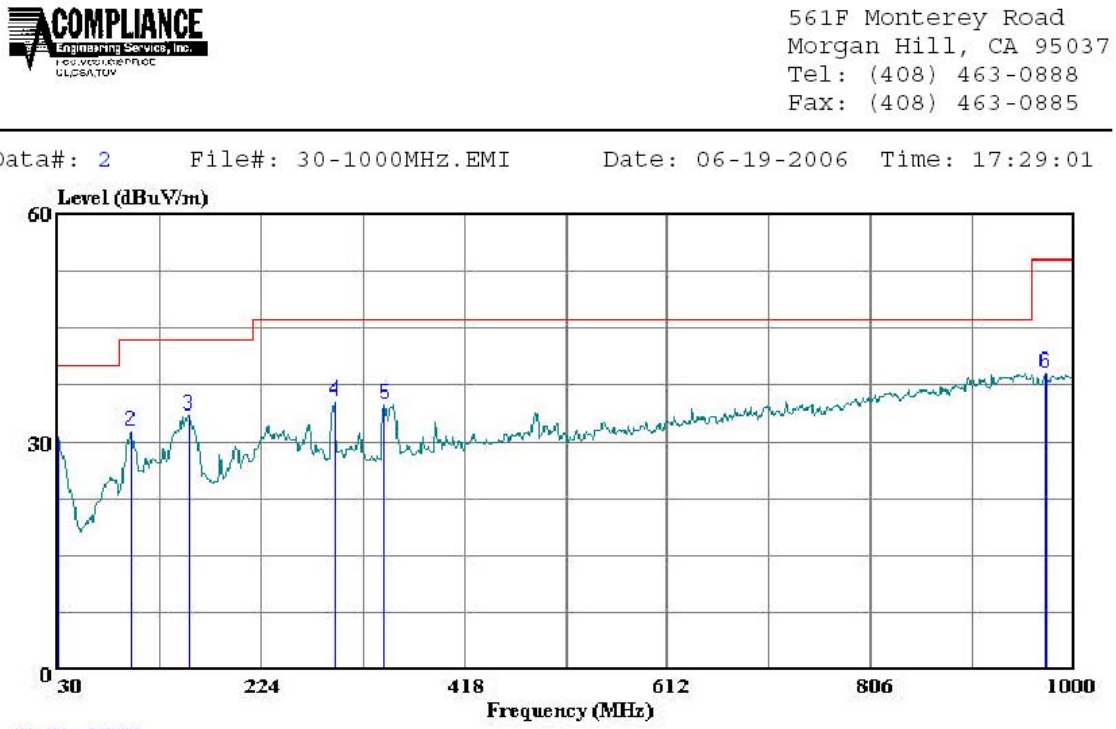
f	Measurement Frequency	Amp	Preamp Gain	Avg Lim	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Pk Lim	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Avg Mar	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field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

7.4.4. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

2.4 GHz BAND @ WORST CASE

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

HORIZONTAL PLOT



HORIZONTAL DATA

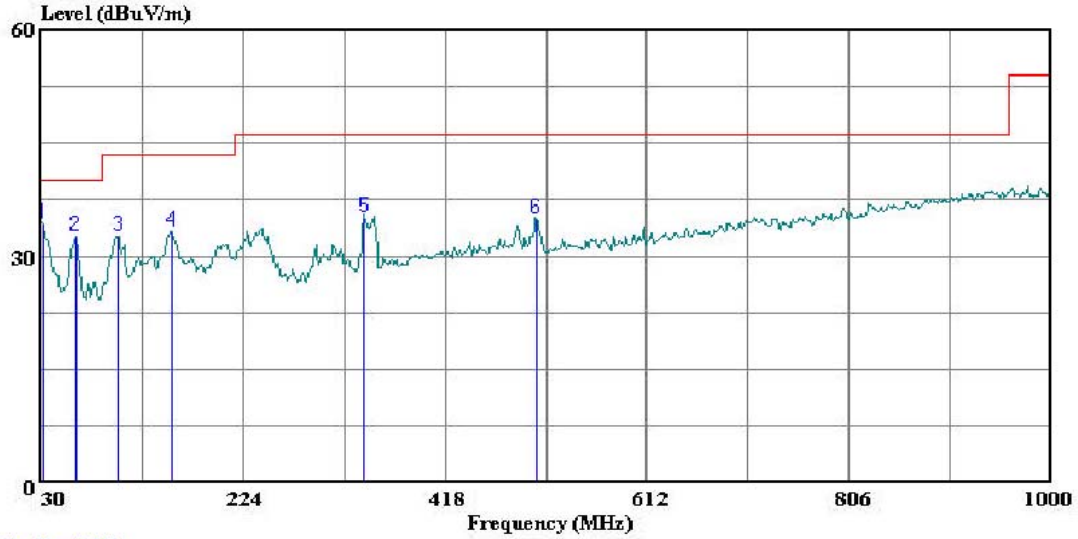
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	10.08	20.45	30.53	40.00	-9.47	Peak
2	99.840	20.05	11.38	31.43	43.50	-12.07	Peak
3	155.130	19.53	13.95	33.48	43.50	-10.02	Peak
4	293.840	19.80	15.42	35.22	46.00	-10.78	Peak
5	342.340	18.17	16.68	34.85	46.00	-11.15	Peak
6	972.840	12.31	26.69	39.00	54.00	-15.01	Peak

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

VERTICAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 4 File#: 30-1000MHz.EMI Date: 06-19-2006 Time: 17:36:10



(Audix ATC)

Trace: 3 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Vien Tran
Company: : Apple Computers Inc.
Project #: : 06U10375
Model: : BCM94321CM
Configuration: : EUT installed inside laptop
Mode of Operation: TX 2.4GHz worst case

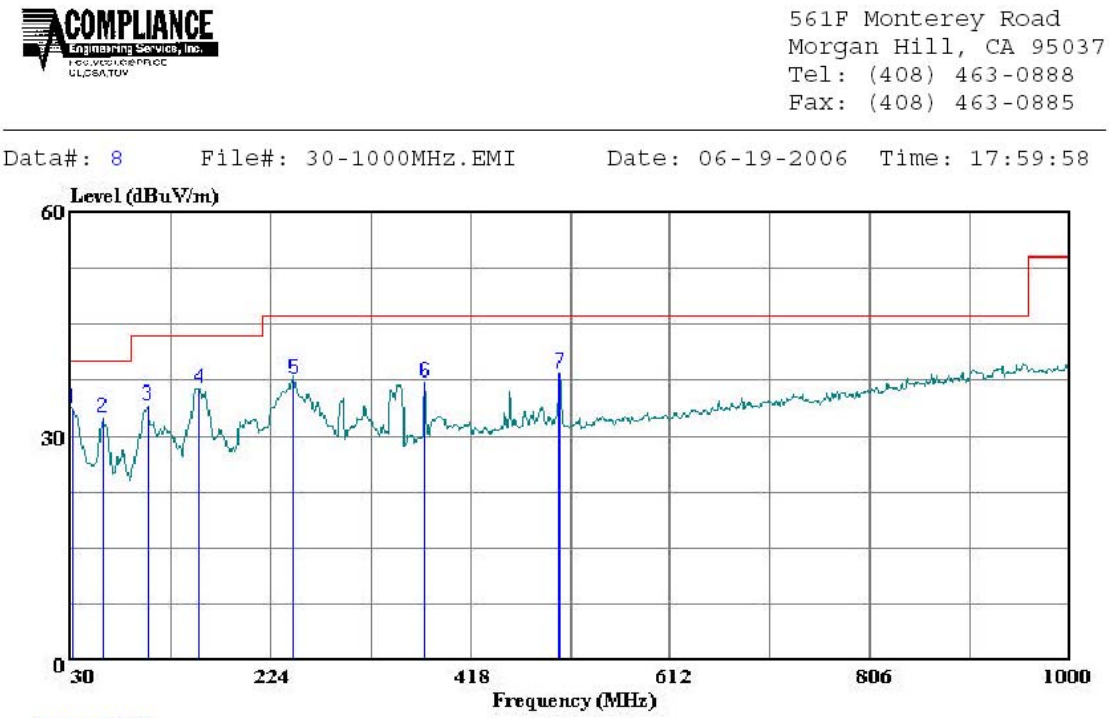
VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.970	13.88	20.45	34.33	40.00	-5.67	Peak
2	62.980	23.60	8.90	32.50	40.00	-7.50	Peak
3	103.720	20.48	12.23	32.70	43.50	-10.80	Peak
4	155.130	19.32	13.95	33.27	43.50	-10.23	Peak
5	340.400	18.55	16.64	35.19	46.00	-10.81	Peak
6	505.300	14.71	20.28	34.98	46.00	-11.02	Peak

5 GHz BAND @ WORST CASE

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

HORIZONTAL PLOT



HORIZONTAL DATA

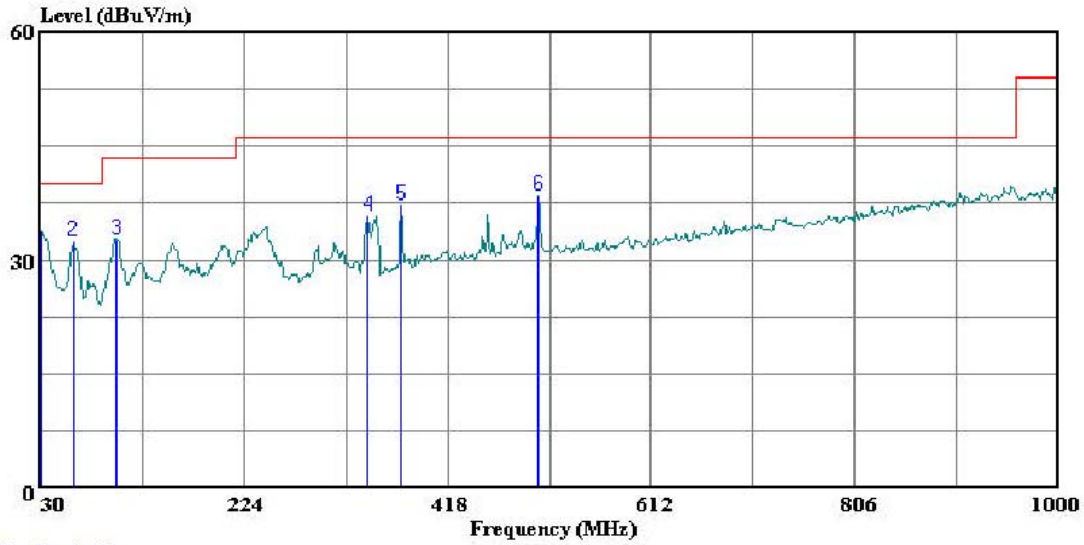
	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.970	13.22	20.45	33.67	40.00	-6.33	Peak
2	61.040	23.67	8.78	32.45	40.00	-7.55	Peak
3	104.690	21.62	12.38	34.00	43.50	-9.50	Peak
4	154.160	22.38	13.99	36.37	43.50	-7.13	Peak
5	246.310	23.75	13.75	37.49	46.00	-8.51	Peak
6	373.380	19.77	17.46	37.23	46.00	-8.77	Peak
7	504.330	18.15	20.26	38.41	46.00	-7.59	Peak

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

VERTICAL PLOT

561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0888
Fax: (408) 463-0885

Data#: 6 File#: 30-1000MHz.EMI Date: 06-19-2006 Time: 17:44:53



(Audix ATC)

Trace: 5 Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Vien Tran
Company: : Apple Computers Inc.
Project #: : 06U10375
Model: : BCM94321CM
Configuration: : EUT installed inside laptop
Mode of Operation: TX 5GHz worst case

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	30.000	13.30	20.45	33.75	40.00	-6.25	Peak
2	61.040	23.67	8.78	32.45	40.00	-7.55	Peak
3	102.750	20.71	12.00	32.70	43.50	-10.80	Peak
4	342.340	18.99	16.68	35.67	46.00	-10.33	Peak
5	373.380	19.77	17.46	37.23	46.00	-8.77	Peak
6	504.330	18.15	20.26	38.41	46.00	-7.59	Peak

7.5. POWERLINE CONDUCTED EMISSIONS

LIMIT

§15.207 (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 µH/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

2.4 GHz BAND – WORST CASE

2.4 GHz BAND

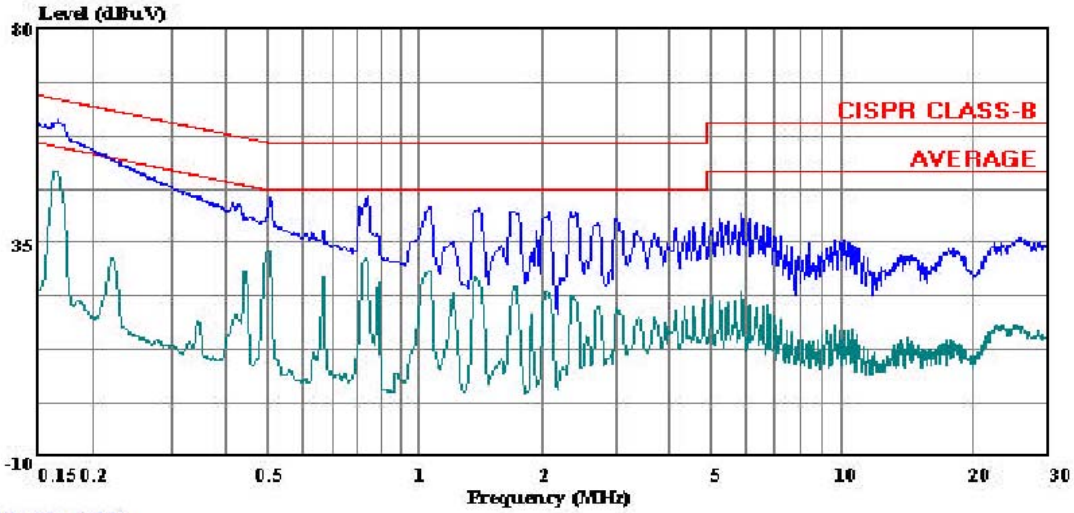
CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.16	60.22	--	50.05	0.00	65.46	55.46	-5.24	-5.41	L1
0.51	44.48	--	33.17	0.00	56.00	46.00	-11.52	-12.83	L1
0.84	44.84	--	31.27	0.00	56.00	46.00	-11.16	-14.73	L1
0.16	60.10	--	48.90	0.00	65.46	55.46	-5.36	-6.56	L2
0.51	44.86	--	33.26	0.00	56.00	46.00	-11.14	-12.74	L2
0.84	45.02	--	31.84	0.00	56.00	46.00	-10.98	-14.16	L2
6 Worst Data									

LINE 1 RESULTS

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 21 File#: 06u10375.emi Date: 06-17-2006 Time: 17:44:40



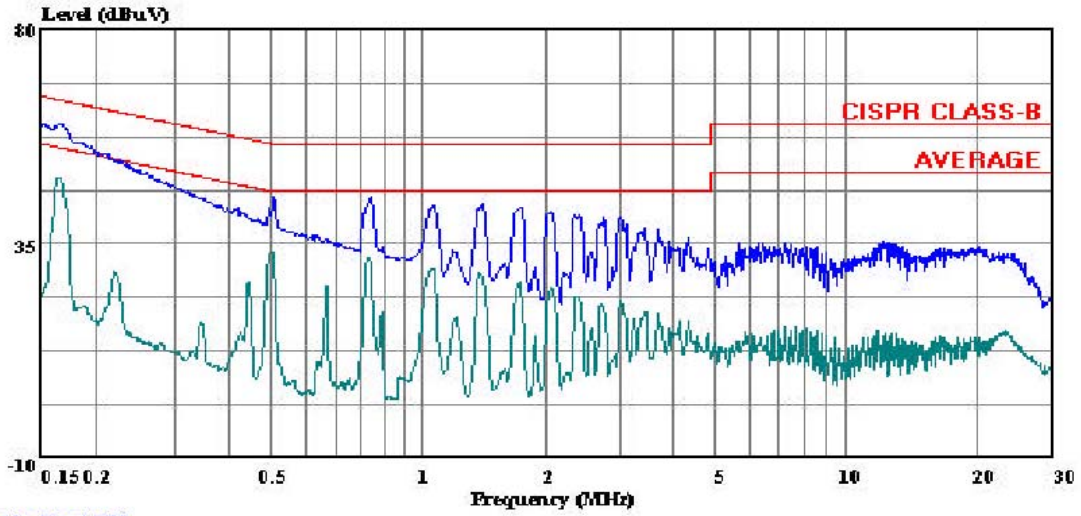
(Audix ATC)
Trace: 19 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10375
Company : Aplle Computers Inc.
EUT configuration: Card (#376) inside laptop
EUT mode : Tx_2.4 GHz Band_Worstcase
Power Source : 115 VAC, 60 Hz
: Line 1: Peak:(Black), Average:(Green)

LINE 2 RESULTS

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 28 File#: 06u10375.emi Date: 06-17-2006 Time: 18:00:27



Trace: 26 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10375
Company : Aplle Computers Inc.
EUT configuration: Card (#376) inside laptop
EUT mode : Tx_2.4 GHz Band_Worstcase
Power Source : 115 VAC, 60 Hz
: Line 2: Peak:(Black), Average:(Green)

6 WORST EMISSIONS

5 GHz BAND – WORST CASE

5 GHz BAND

CONDUCTED EMISSIONS DATA (115VAC 60Hz)

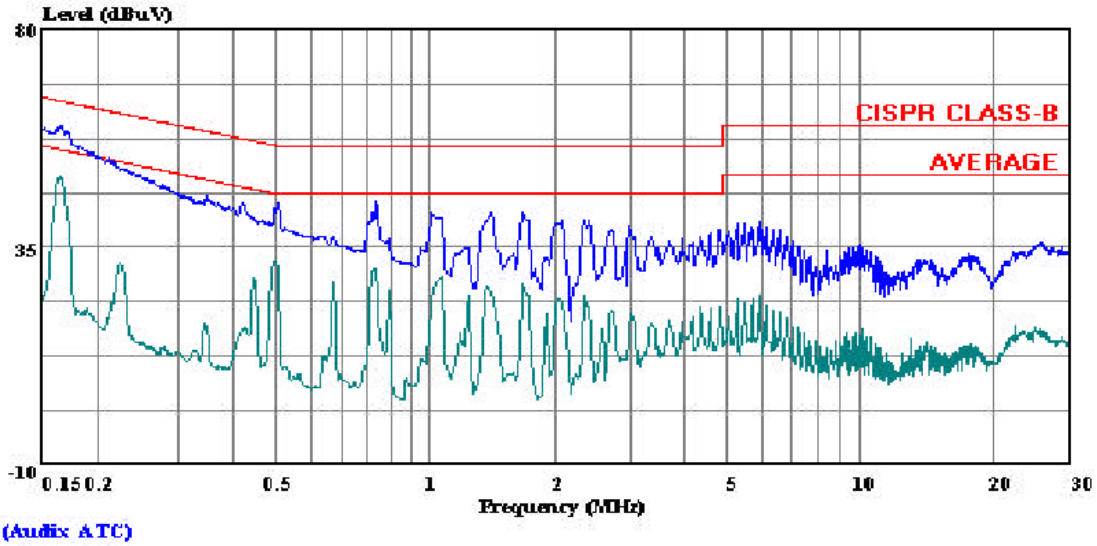
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.16	59.89	--	49.42	0.00	65.26	55.26	-5.37	-5.84	L1
0.51	44.24	--	33.32	0.00	56.00	46.00	-11.76	-12.68	L1
0.84	44.54	--	30.31	0.00	56.00	46.00	-11.46	-15.69	L1
0.16	59.98	--	48.81	0.00	65.26	55.26	-5.28	-6.45	L2
0.51	45.10	--	33.10	0.00	56.00	46.00	-10.90	-12.90	L2
0.84	44.62	--	31.69	0.00	56.00	46.00	-11.38	-14.31	L2

6 Worst Data

LINE 1 RESULTS

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 7 File#: 06u10375.emi Date: 06-17-2006 Time: 17:01:14



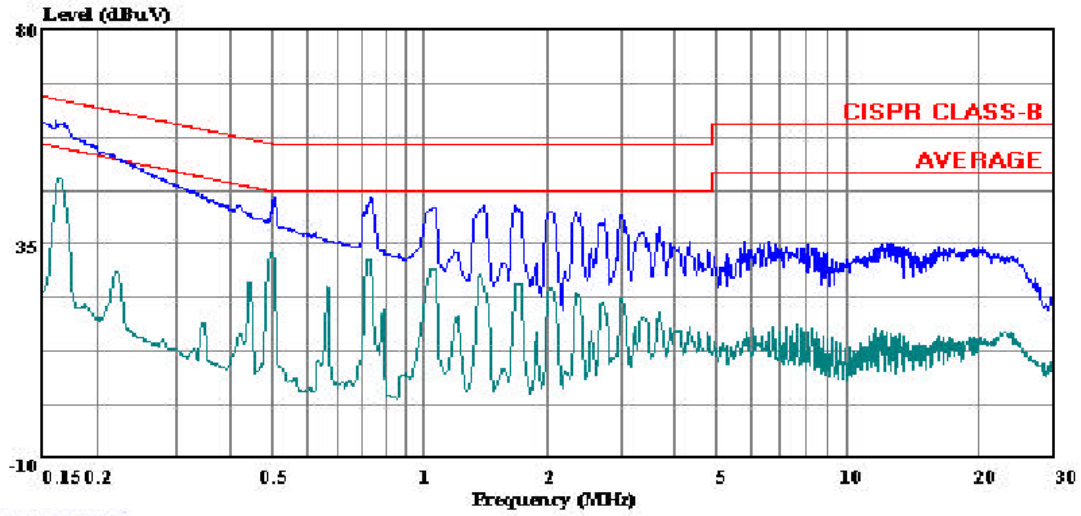
Trace: 5 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10375
Company : Aplle Computers Inc.
EUT configuration: Card (#376) inside laptop
EUT mode : Tx_5 GHz Band_Worstcase
Power Source : 115 VAC, 60 Hz
: Line 1: Peak:(Black), Average:(Green)

LINE 2 RESULTS

Compliance Certification Services
561F Monterey Road
Morgan Hill, CA 95037
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 14 File#: 06u10375.emi Date: 06-17-2006 Time: 17:23:32



Trace: 12 Ref Trace:

Condition: CISPR CLASS-B
Test Operator : Vien Tran
Project # : 06U10375
Company : Aplle Computers Inc.
EUT configuration: Card (#376) inside laptop
EUT mode : Tx_5 GHz Band_Worstcase
Power Source : 115 VAC, 60 Hz
: Line 2: Peak:(Black), Average:(Green)

8. SETUP PHOTOS

RADIATED RF MEASUREMENT SETUP

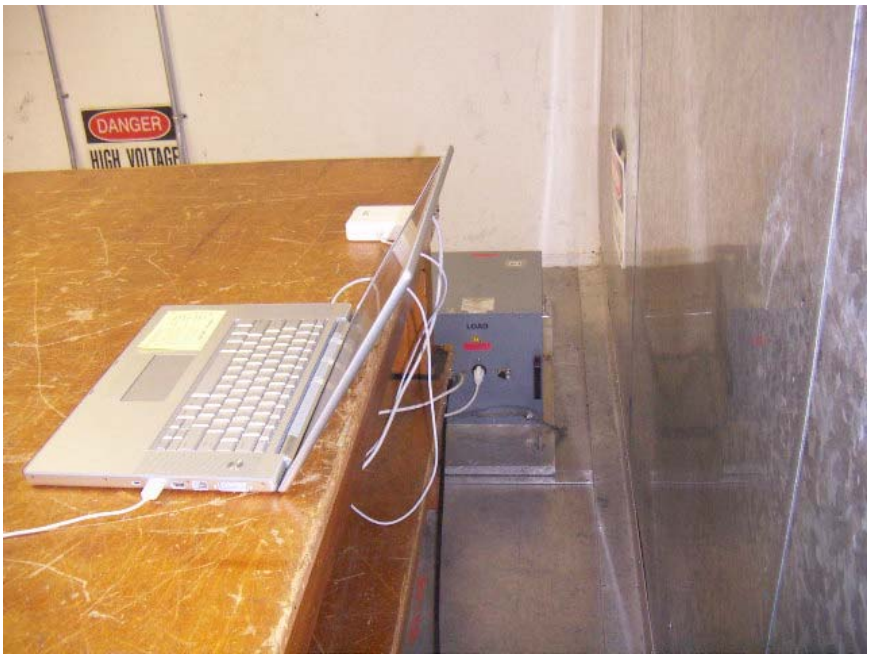
RADIATED FRONT PHOTO

RADIATED BACK PHOTO

POWERLINE CONDUCTED EMISSIONS MEASUREMENT SETUP

LINE CONDUCTED FRONT PHOTO

LINE CONDUCTED BACK PHOTO



END OF REPORT