



**FCC CFR47 PART 15 SUBPART E
CLASS II PERMISSIVE CHANGE**

**TEST REPORT
FOR**

WIRELESS LAN MINI-PCI EXPRESS, 802.11a/b/g

MODEL NUMBER: PA3489U-1MPC, PA3441U-1MPC

FCC ID: CJ6UPA3489WL

REPORT NUMBER: 05U3857-2

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Prepared for
**TOSHIBA CORPORATION
DIGITAL MEDIA NETWORK COMPANY
2-9 SUEHIRO-CHO, OME
TOKYO, 198-8710, JAPAN**

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



Revision History

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: TOSHIBA CORPORATION
DIGITAL MEDIA NETWORK COMPANY
2-9 SUEHIRO-CHO, OME
TOKYO, 198-8710, JAPAN

EUT DESCRIPTION: WIRELESS LAN MINI-PCI EXPRESS, 802.11a/b/g

MODEL: CJ6UPA3489WL, PA3441U-1MPC

SERIAL NUMBER: 05B-012

DATE TESTED: DECEMBER 01 to 08, 2005

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART E	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:

Tested By:



THU CHAN
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

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 802.11a/b/g transceiver WLAN transceiver.

5.2. CLASS II PERMISSIVE CHANGE DESCRIPTION

The major change filed under this application is as follows:

Change #1: The approved module is being used in a different host;

Change #2: Additional antennas of the same type as tested under original grant are used.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes two PIFA antennas for diversity which manufactured by Hitachi Cable, P/N HTL017, with a maximum gain of 1.0 dBi at 5150-5350 MHz band.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host support equipment during testing was Intel(R)PRO/Wireless 3945ABG Network Connection rev. xVT #3.

The test utility software used during testing was CRTU, rev. 4.0.18.0000.

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 5260 MHz for 11a mode.

The worst-case data rate for this channel is determined to be 11a mode, based on previous experience with 802.11abg WLAN product design architectures.

Thus all emissions tests were made in the 802.11a mode, 5260 MHz, 6 Mb/s.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Aspen 10	CS-B	05B-012	DoC
AC Adapter	HP	ADP75HB	MVT0243196915	DoC

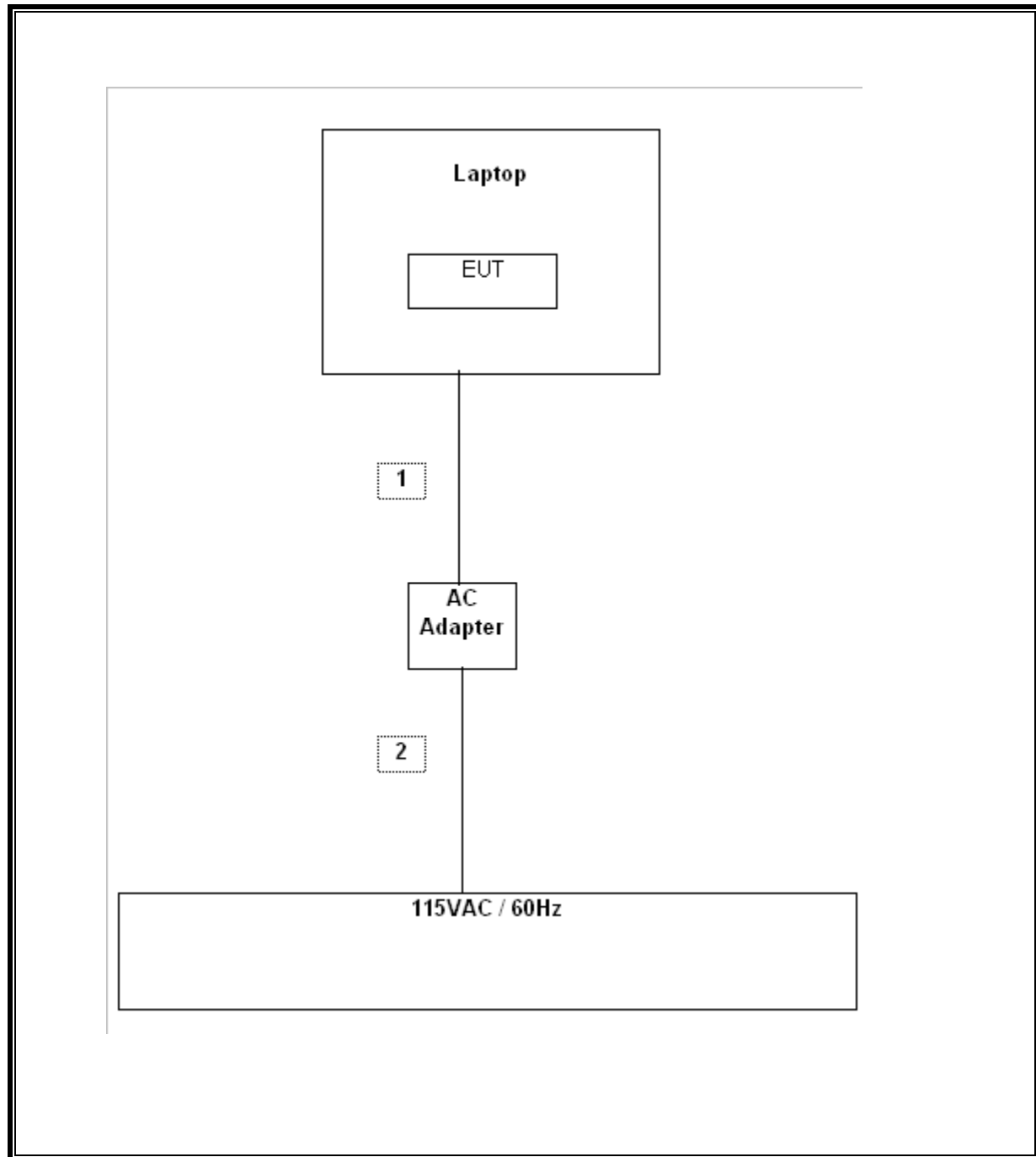
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Shielded	2.0m	
2	DC	1	DC	Shielded	1.7m	

TEST SETUP

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

SETUP DIAGRAM



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
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent	E4446A	MY43360112	03/28/2006
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	2238	04/22/2006
Preamplifier, 1 ~ 26 GHz	Miteq	NSP2600-SP	924342	09/02/2006
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	08/30/2006
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	8379443	08/30/2006
EMI Test Receiver	R & S	ESHS 20	827129/006	06/03/2006
EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	03/29/2006
RF Filter Section	HP	85420E	3705A00256	03/29/2006
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A121003	03/03/2006

7. LIMITS AND RESULTS

7.1. CHANNEL TESTS FOR THE 5150 TO 5350 MHz BAND

7.1.1. 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:

802.11a Mode

Channel	Frequency (MHz)	Average Power (dBm)
Low	5180	15.90
Middle	5260	17.50
High	5320	17.40

7.2. RADIATED EMISSIONS

7.2.1. 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.

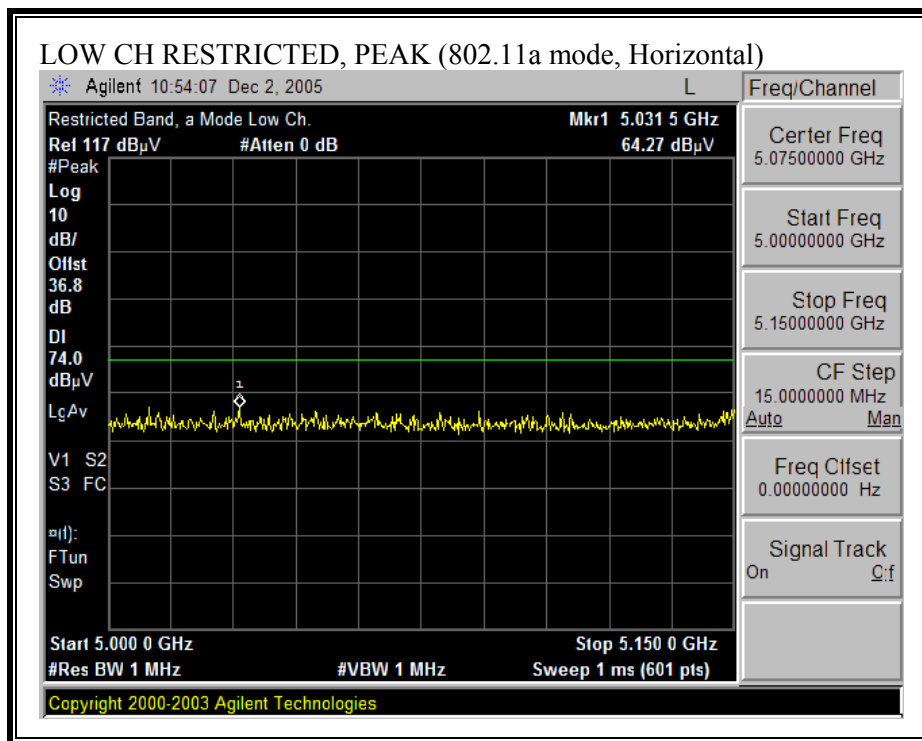
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

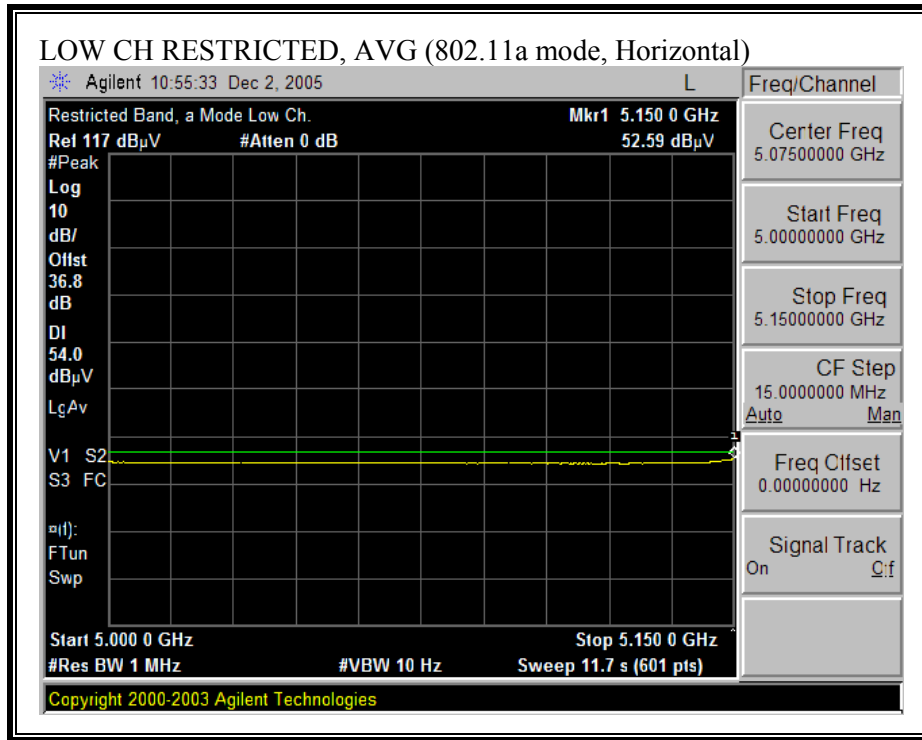
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each band.

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.

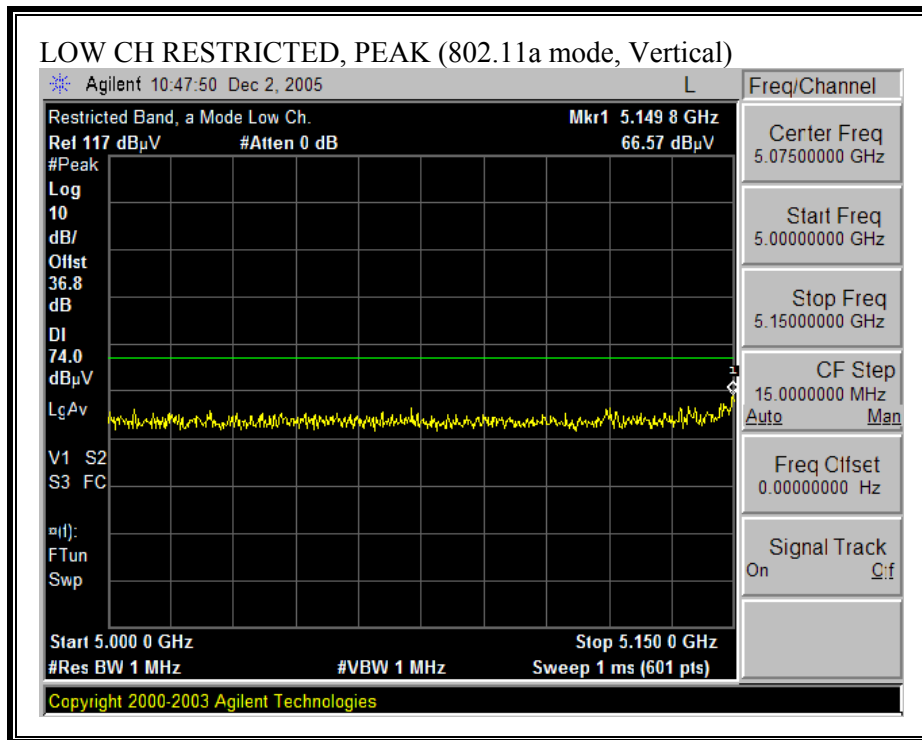
7.2.2. TRANSMITTER ABOVE 1 GHZ FOR 5150 TO 5350 MHz BAND

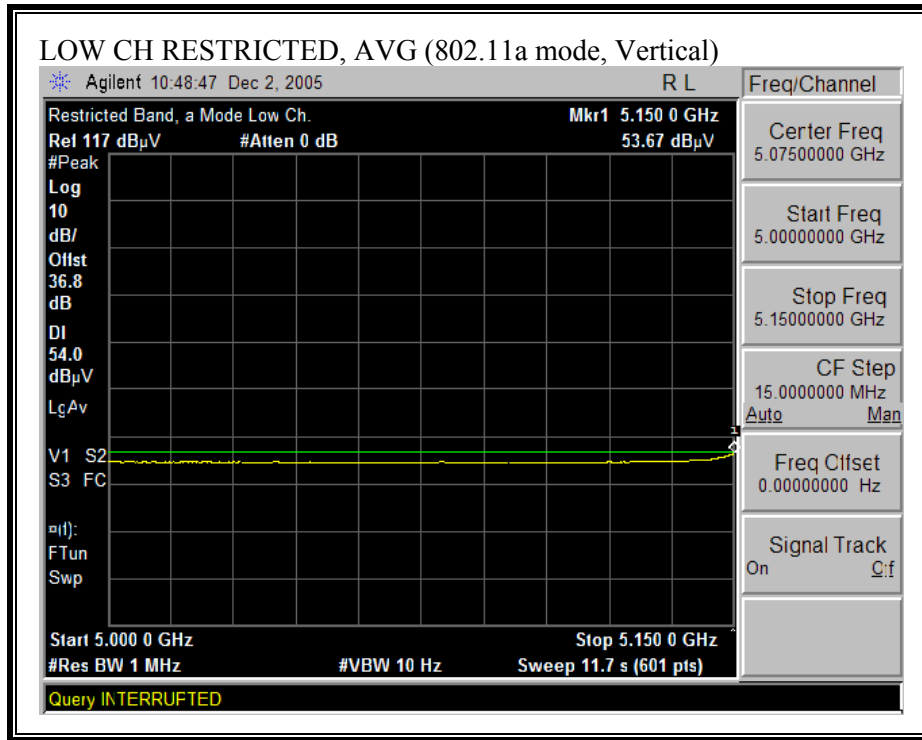
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, HORIZONTAL)



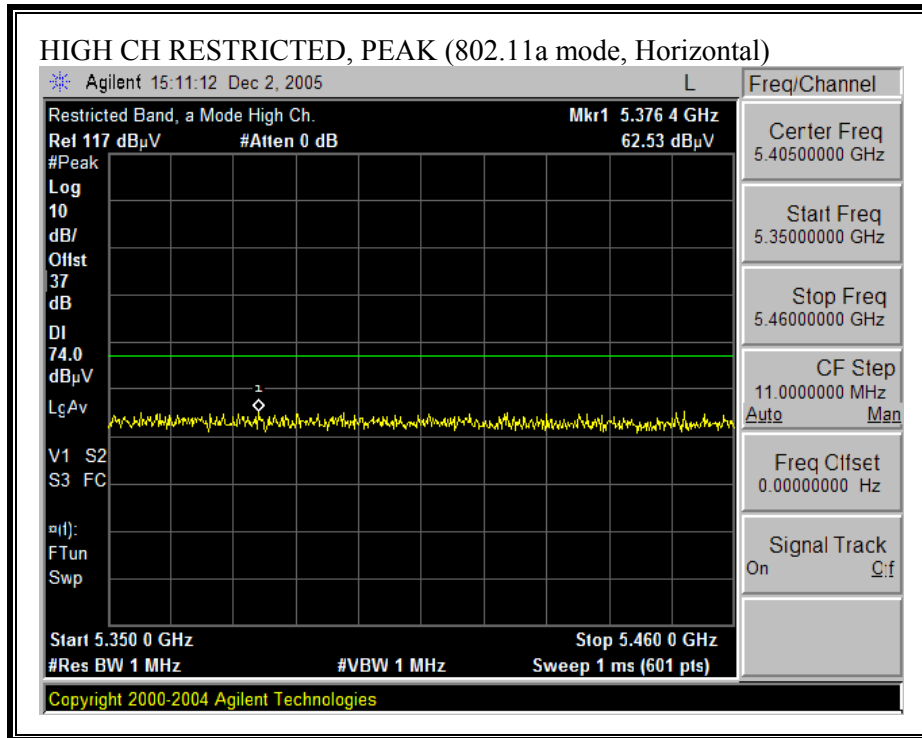


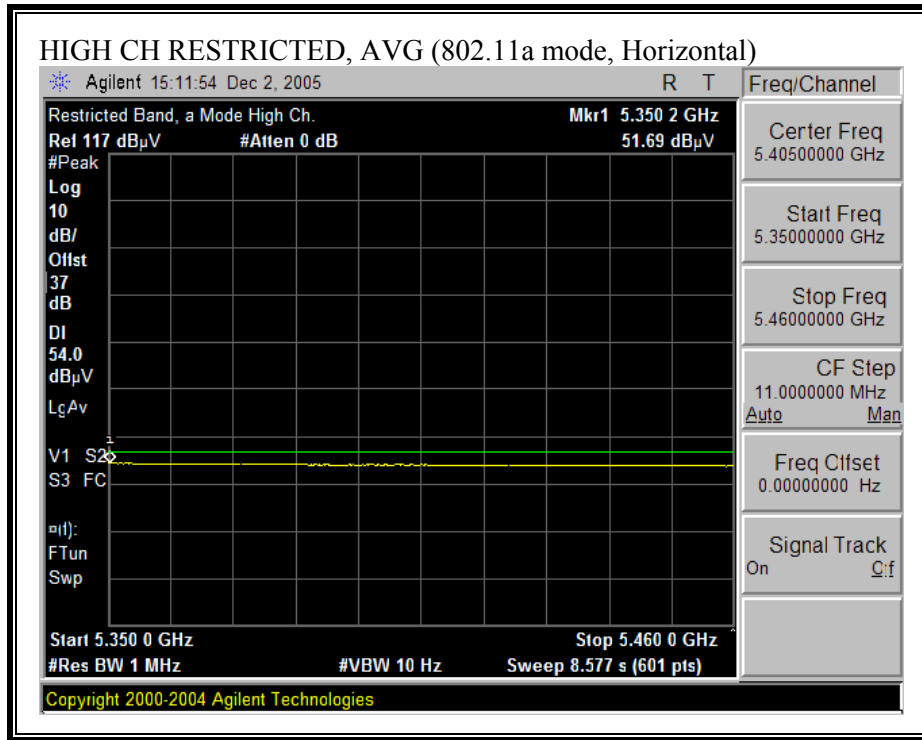
RESTRICTED BANDEDGE (802.11a MODE, LOW CHANNEL, VERTICAL)



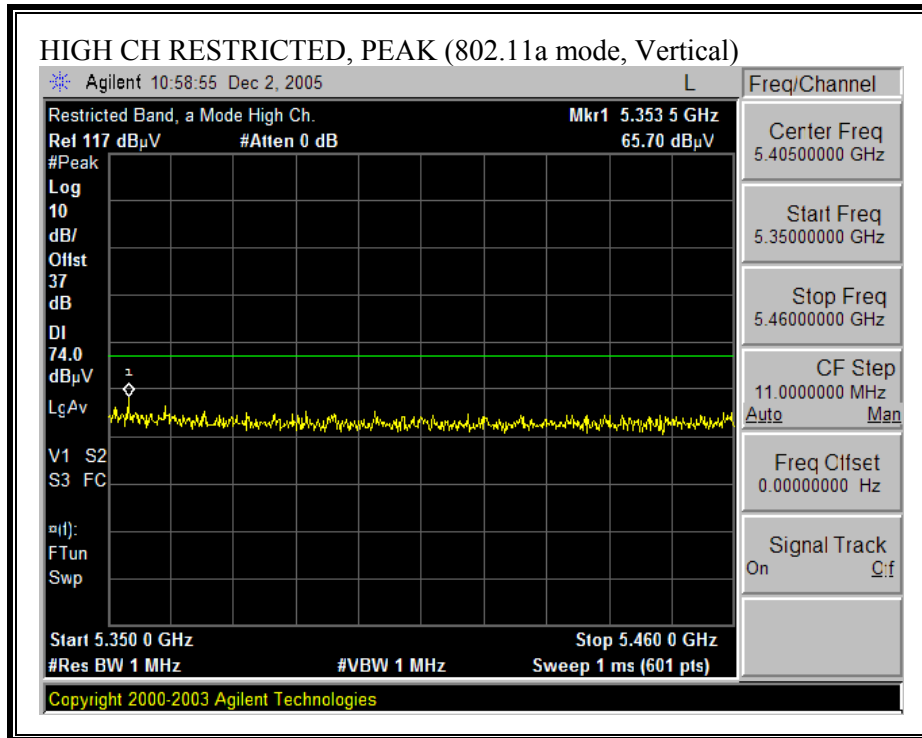


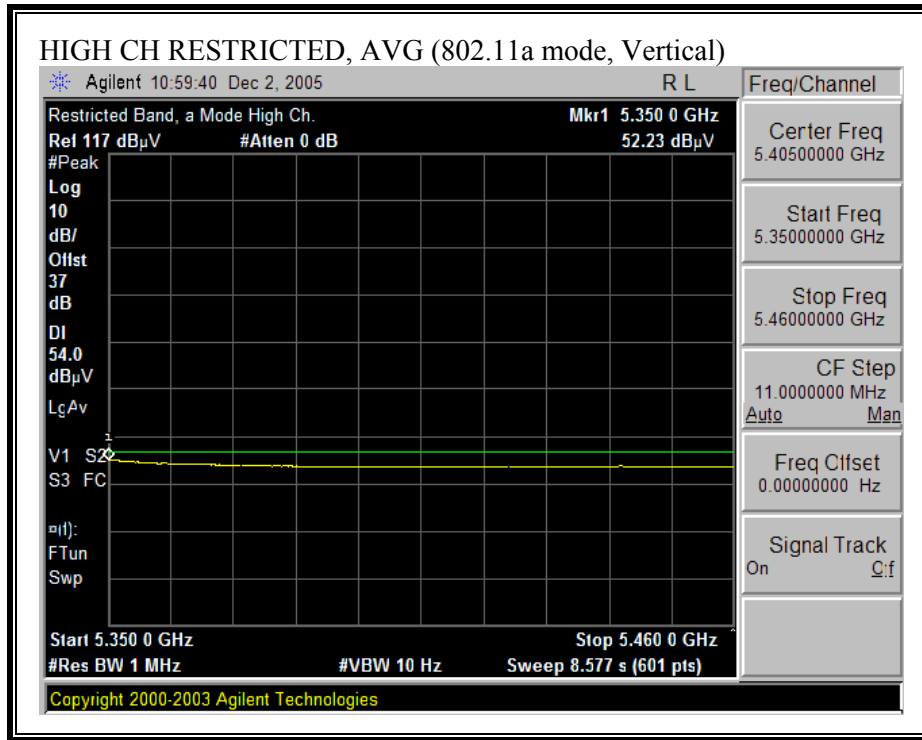
RESTRICTED BANDEDGE (802.11a MODE, HIGH CHANNEL, HORIZONTAL)





RESTRICTED BANDEGE (802.11a MODE, HIGH CHANNEL, VERTICAL)



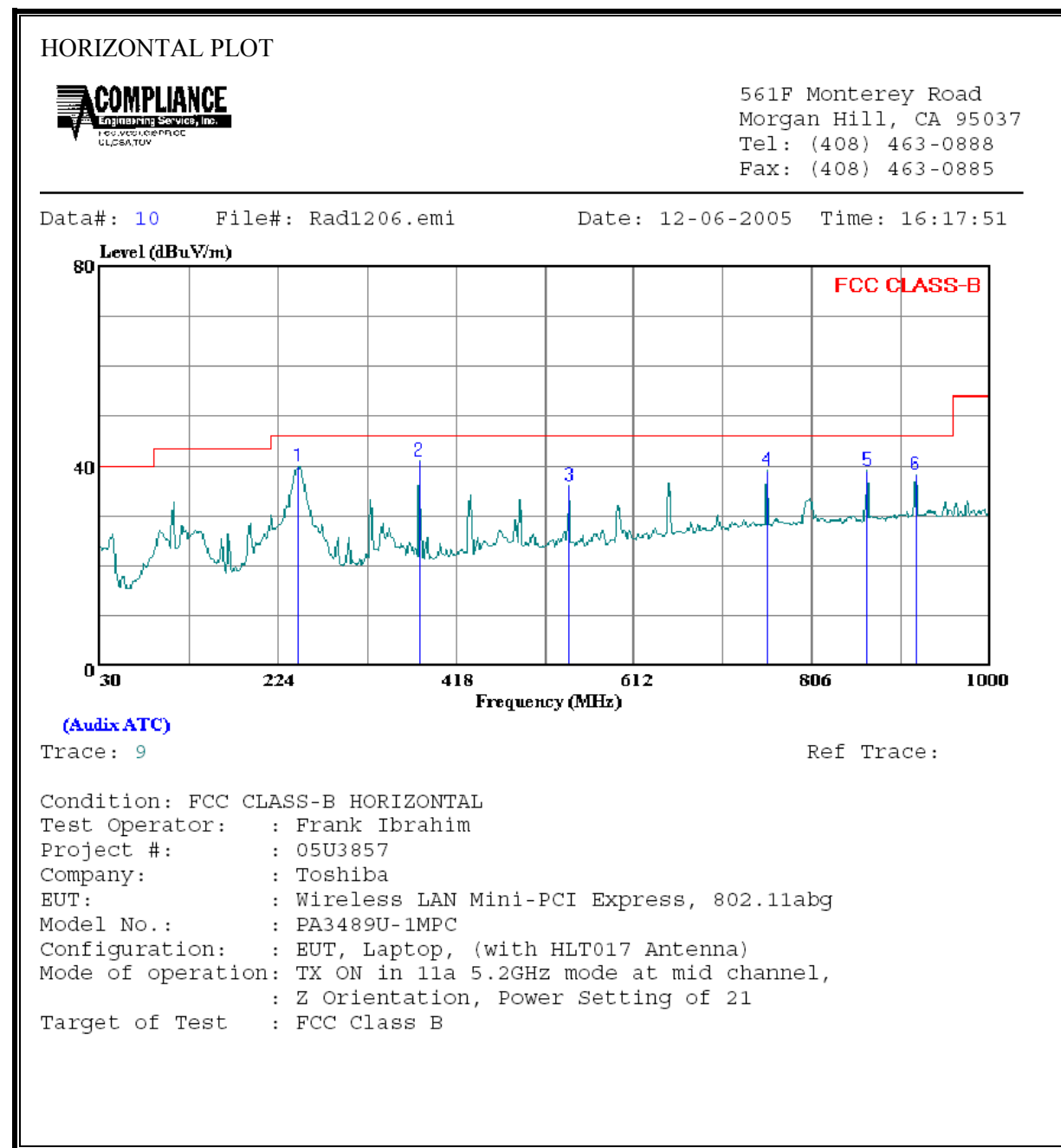


HARMONICS AND SPURIOUS EMISSIONS (802.11a MODE)

12/02/05 High Frequency Measurement Compliance Certification Services, Morgan Hill Open Field Site															
Test Engr: Vien Tran Project #: 05U3857 Company: Toshiba EUT Descrip.: 802.11abg Wireless LAN Mini-PCI Express EUT M/N: PA3489U-1MPC Test Target: FCC 15.407 Mode Oper: Tx 11a_5.2 GHz Mode_Low, Mid & Hi channels_with HTL017 Antenna_EUT AT Z POSITION Average Power Meter: Low = 15.9dBm, Mid = 17.5 dBm, High = 17.4 dBm															
Test Equipment:															
Horn 1-18GHz T60; S/N: 2238 @3m		Pre-amplifier 1-26GHz T87 Miteq 924342		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit FCC 15.205							
Hi Frequency Cables															
2 foot cable		3 foot cable Vien 187215002		12 foot cable Vien 197209005		HPF HPF_7.6GHz		Reject Filter R_001		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz					
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
LOW CH, 5180 MHz															
15.540	3.0	50.6	40.1	39.0	5.8	-41.3	0.0	0.7	54.8	44.3	74	54	-19.2	-9.7	H
15.540	3.0	50.2	39.6	39.0	5.8	-41.3	0.0	0.7	54.4	43.8	74	54	-19.6	-10.2	V
MID CH, 5260 MHz															
15.780	3.0	51.0	39.9	38.8	5.8	-41.2	0.0	0.7	55.2	44.1	74	54	-18.8	-9.9	H
15.780	3.0	50.0	39.8	38.8	5.8	-41.2	0.0	0.7	54.2	44.0	74	54	-19.8	-10.0	V
HI CH, 5320 MHz															
10.640	3.0	62.7	48.7	38.2	4.8	-39.4	0.0	0.8	67.0	53.0	74	54	-7.0	-1.0	H
15.960	3.0	52.3	40.5	38.7	5.9	-41.1	0.0	0.7	56.4	44.6	74	54	-17.6	-9.4	H
10.640	3.0	58.7	45.4	38.2	4.8	-39.4	0.0	0.8	63.0	49.7	74	54	-11.0	-4.3	V
15.960	3.0	51.4	39.8	38.7	5.9	-41.1	0.0	0.7	55.5	43.9	74	54	-18.5	-10.1	V
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										

7.2.3. WORST-CASE RADIATED EMISSIONS BELOW 1 GHz

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



HORIZONTAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	246.310	53.62	-13.84	39.78	46.00	-6.22	Peak
2	378.230	50.92	-10.00	40.92	46.00	-5.08	Peak
3	541.190	42.49	-6.54	35.95	46.00	-10.05	Peak
4	756.530	41.61	-2.47	39.14	46.00	-6.86	Peak
5	866.140	40.19	-1.25	38.94	46.00	-7.06	Peak
6	919.490	39.04	-0.83	38.21	46.00	-7.79	Peak

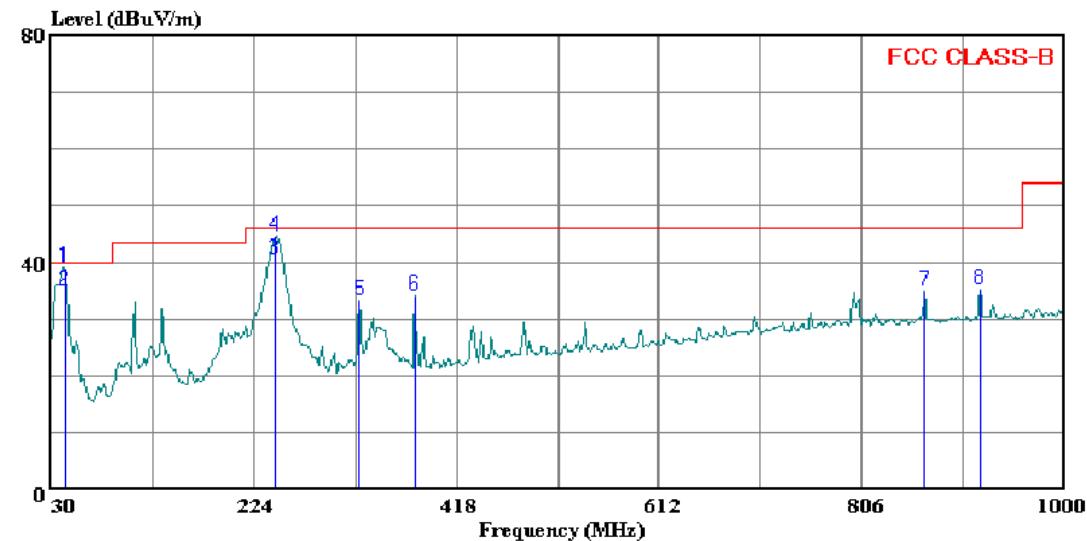
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



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

Data#: 15 File#: Rad1206.emi Date: 12-06-2005 Time: 16:44:35



(Audix ATC)

Trace: 11

Ref Trace:

Condition: FCC CLASS-B VERTICAL
Test Operator: : Frank Ibrahim
Project #: : 05U3857
Company: : Toshiba
EUT: : Wireless LAN Mini-PCI Express, 802.11abg
Model No.: : PA3489U-1MPC
Configuration: : EUT, Laptop, (with HLT017 Antenna)
Mode of operation: TX ON in 11a 5.2GHz mode at mid channel,
: Z Orientation, Power Setting of 21
Target of Test : FCC Class B

VERTICAL DATA

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	43.050	52.03	-13.02	39.01	40.00	-0.99	Peak
2	43.050	49.10	-14.33	34.77	40.00	-5.23	QP
3	243.900	54.40	-13.95	40.45	46.00	-5.55	QP
4	243.900	58.57	-13.86	44.71	46.00	-1.29	Peak
5	324.880	44.48	-11.18	33.30	46.00	-12.70	Peak
6	378.230	43.99	-10.00	33.99	46.00	-12.01	Peak
7	866.140	36.14	-1.25	34.89	46.00	-11.11	Peak
8	919.490	36.12	-0.83	35.29	46.00	-10.71	Peak

7.3. 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 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 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	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.32	47.86	--	31.96	0.00	59.71	49.71	-11.85	-17.75	L1
0.44	45.32	--	30.73	0.00	57.12	47.12	-11.80	-16.39	L1
0.55	42.68	--	24.94	0.00	56.00	46.00	-13.32	-21.06	L1
0.32	42.80	--	32.00	0.00	59.71	49.71	-16.91	-17.71	L2
0.44	41.20	--	30.10	0.00	57.12	47.12	-15.92	-17.02	L2
0.55	37.50	--	23.46	0.00	56.00	46.00	-18.50	-22.54	L2
6 Worst Data									

LINE 1 RESULTS

