



EN 301 489-17 v1.2.1

TEST REPORT

FOR

802.11ag/Draft 802.11n WLAN PCI-E Mini Card

MODEL NUMBER: BCM94322MC

REPORT NUMBER: 07U11529-5

ISSUE DATE: JANUARY 29, 2008

Prepared for

**BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA**

Prepared by

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NVLAP LAB CODE 200065-0

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	1-29-08	Initial Issue	Hsin Fu Shih

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORP.
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.

EUT DESCRIPTION: 802.11ag/Draft 802.11n WLAN PCI-E Mini Card

MODEL: BCM94322MC

SERIAL NUMBER: S/N 354 & 356

DATE TESTED: JANUARY 09 – 26, 2008


APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
EN 301 489-17 v1.2.1	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:



HSIN FU SHIH
EMC SUPERVISOR
COMPLIANCE CERTIFICATION SERVICES

VIEN TRAN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

All tests were performed in accordance with the procedures documented in EN 301 489-1 v1.6.1 (2005-09) as an undated reference in 489-17 v1.2.1 (2002-08).

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
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 802.11ag/Draft 802.11n Wireless LAN Transceiver module and manufactured by Broadcom. Model number is BCM94322MC.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes dual antennas with a maximum gain of 3.90dBi and 5.80dBi for the frequency band 2.4GHz and 5GHz respectively..

5.3. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was BCMWL5, rev. 4.170.63.0.

The test utility software used during testing was wl_tool, rev. 4.150 RC27.0.

The EUT was tested in the following manner:

- "epi_tcp.exe" was used to transmit UDP packets to a broadcast IP address (192.168.66.255) – i.e. no ACK required. This test mode sends a continuous packetized data stream with duty cycles that vary dependant upon data rate/MCS Index selected.
- "wl_ampdu" and "frameburst" were enabled to ensure worst case data packet transfer and duty cycle.
- Worst case packet length have also been used to ensure max duty cycle

5.4. WORST-CASE MODE FOR EMISSIONS TESTS

The worst-case channel is determined as the channel with the highest output power, based on the radio test reports for this product. The highest measured output power was at 2437 MHz and 5795 MHz

The worst-case data rate for this channel is based on previous experience with 802.11ag and 802.n products design architectures.

Thus all emissions tests were made in the 802.11g mode, 2437 MHz, 6Mbpsfor 2.4 GHz band.

Thus all emissions tests were made in the 802.11n 40 MHz mode, 5795 MHz for 5.8 GHz band.

5.5. WORST-CASE MODE FOR IMMUNITY TESTS

For radiated immunity tests requiring a wireless link, tests are performed at one channel and mode in the 2.4 GHz band and in the 5 GHz band.

The worst-case frequency in each band is determined as the lowest channel, based on the frequency that is closest to the interfering signal frequency.

The worst-case data rate for this channel is assumed to be the maximum data rate, since it will have the highest probability of intercept by an RF interference signal.

Thus the 2.4 GHz band link is made in the 802.11n 40 MHz mode, 2437 MHz, and the 5 GHz band link is made in the 802.11n 40 MHz mode, 5190 MHz.

6. DESCRIPTION OF TEST SETUP

SETUP DIAGRAM FOR EMISSION TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Inspiron 1526	CN-0SE2C2-70166-77L-0011	DoC
AC Adapter	Dell	HP-0Q065B83	CN-0N2765-7890-421-0063	DoC

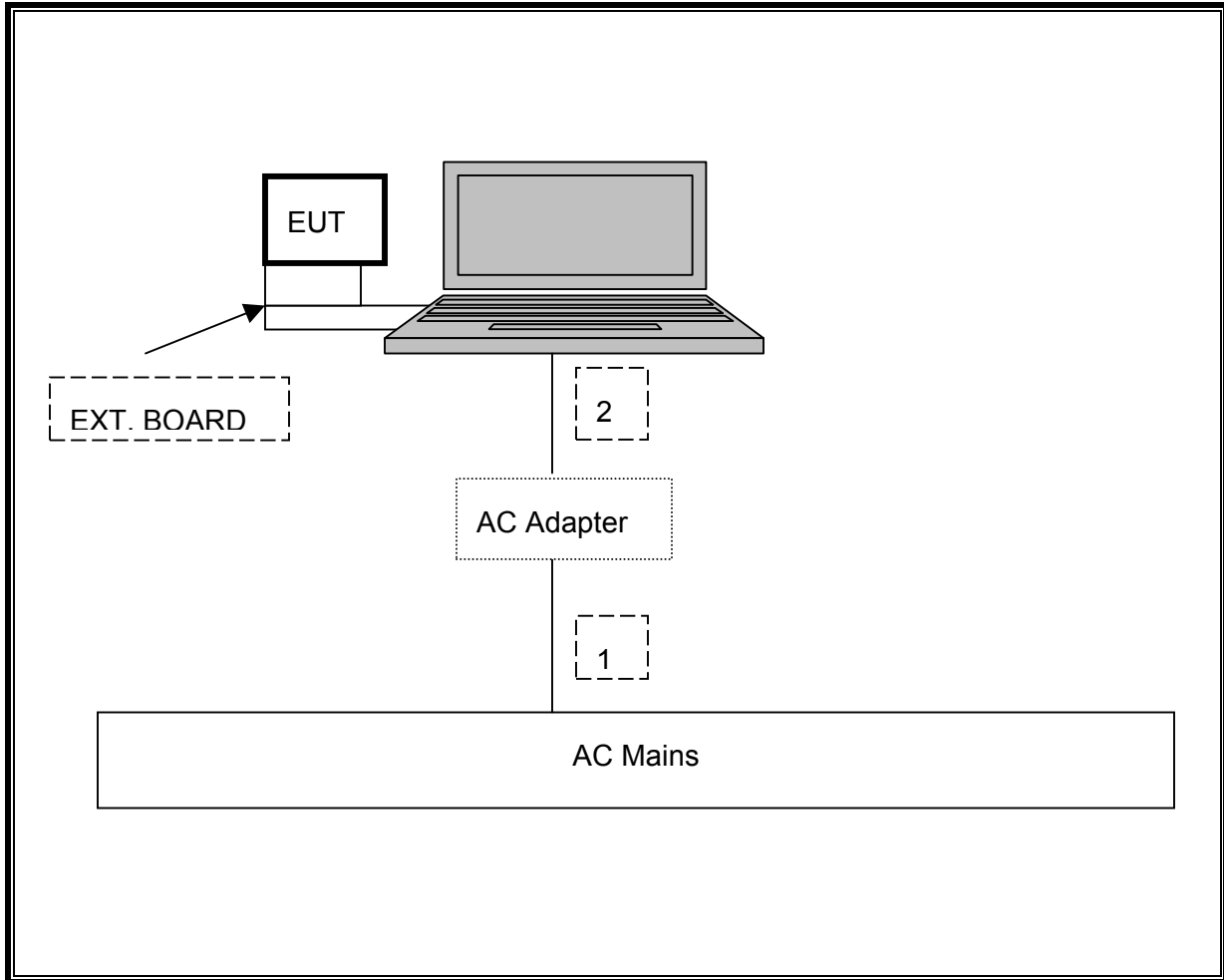
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.2 m	N/A
2	DC	1	DC	Unshielded	1.2 m	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



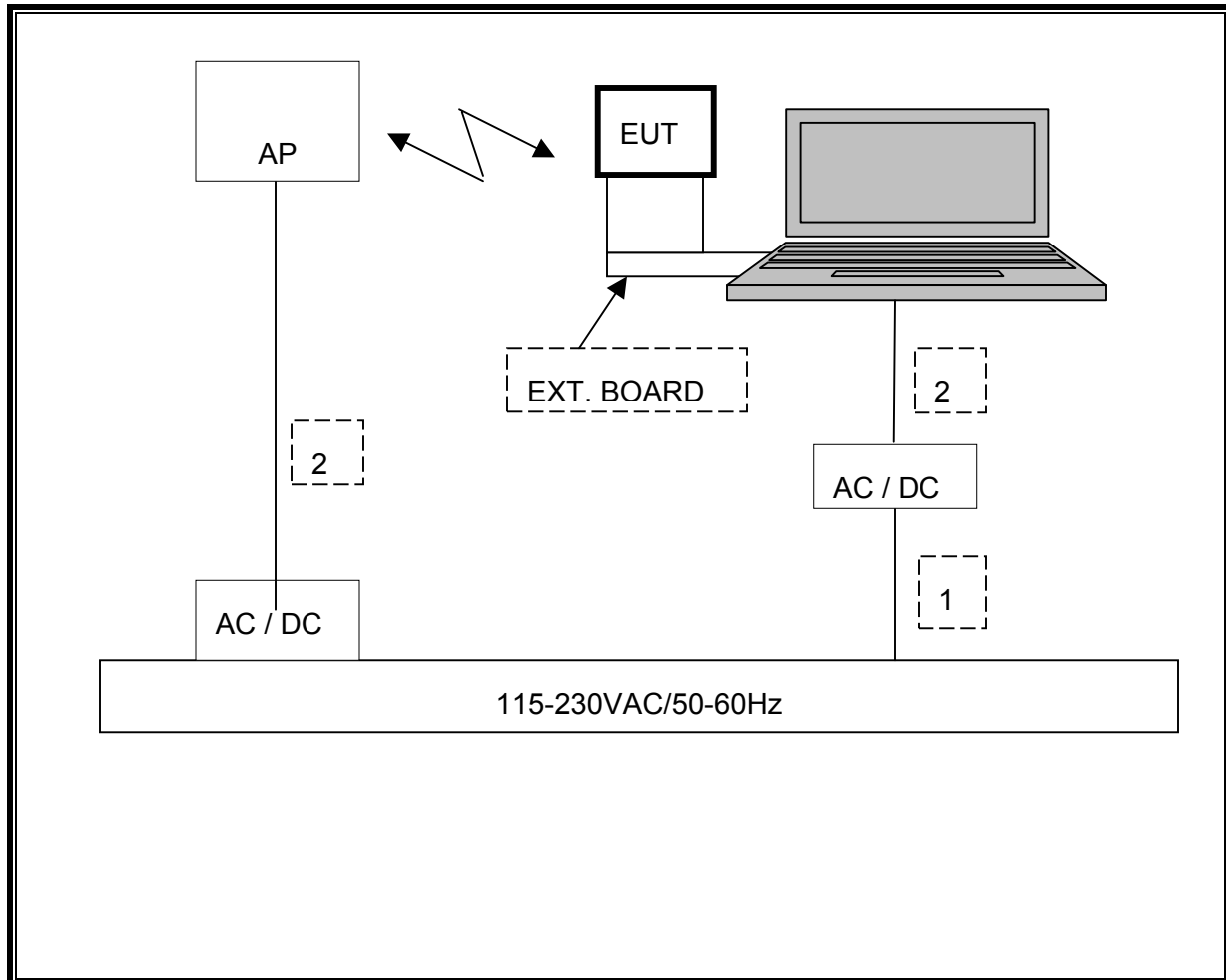
SETUP FOR TESTS REQUIRING AN OPERATING WIRELESS COMMUNICATIONS LINK
ADDITIONAL ANCILLARY SUPPORT EQUIPMENT

ADDITIONAL ANCILLARY SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
ACCESS POINT (AP)	BROADCOM	BCM94705	1129297

TEST SETUP

The EUT and the ancillary support equipment are configured to create an operating communications link. Traffic is sent forward across this link, acknowledgements are sent back, and the performance of the link is monitored.

SETUP DIAGRAM



7. EMISSIONS LIMITS AND RESULTS

7.1. RADIATED EMISSION

LIMIT

EN 301 489-1 Clause 8.2.3, Table 4

TEST PROCEDURE

EN 55022

TEST AND MEASUREMENT EQUIPMENT

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Calibration Due
<input checked="" type="checkbox"/> RF Filter Section	HP	85420E	3705A00256	3/29/08
<input checked="" type="checkbox"/> EMI Receiver, 9 kHz ~ 2.9 GHz	HP	8542E	3942A00286	9/29/08
<input checked="" type="checkbox"/> Bilog Antenna	Sunol Sciences	JB1	A121003	9/22/08


RESULTS

No non-compliance noted:

2.4 GHz BAND

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

HORIZONTAL



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

Data#: 16 File#: 30-1000M.EMI Date: 01-09-2008 Time: 11:36:34


Condition: FCC CLASS-B HORIZONTAL
Test Operator: Vien Tran
Project # : 07U11529
Company : Broadcom
Config : EUT on extended card
Mode : Tx, 2.4 GHz (worst case)
Target : CISPR CLASS B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	124.090	48.51	-13.05	35.46	43.50	-8.04	Peak
2	147.370	50.70	-13.67	37.03	43.50	-6.47	Peak
3	341.370	53.09	-11.24	41.85	46.00	-4.15	Peak
4	487.840	47.09	-7.60	39.49	46.00	-6.51	Peak
5	906.880	41.77	-1.05	40.72	46.00	-5.28	Peak

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

VERTICAL



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

Data#: 10 File#: 30-1000M.EMI Date: 01-09-2008 Time: 12:09:06

Condition: CISPR CLASS-B VERTICAL
Test Operator: Vien Tran
Project # : 07U11529
Company : Broadcom
Config : EUT on extended card
Mode : TX, 2.4 GHz (worst case)
Target : CISPR CLASS B


Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	32.910	28.32	-6.60	21.72	30.00	-8.28	Peak
2	148.340	33.84	-13.74	20.10	30.00	-9.90	Peak
3	342.340	37.40	-11.22	26.18	37.00	-10.82	Peak
4	507.240	34.65	-7.20	27.45	37.00	-9.55	Peak
5	906.880	29.70	-1.05	28.65	37.00	-8.35	Peak

5 GHz BAND

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

HORIZONTAL



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

Data#: 14 File#: 30-1000M.EMI Date: 01-09-2008 Time: 13:06:04


Condition: CISPR CLASS-B HORIZONTAL
Test Operator: Vien Tran
Project # : 07U11529
Company : Broadcom
Config : EUT on extended card
Mode : Tx, 5 GHz Band (worst case)
Target : CISPR CLASS B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	138.640	38.25	-13.21	25.03	30.00	-4.97	Peak
2	342.340	42.59	-11.22	31.37	37.00	-5.63	Peak
3	455.830	36.23	-8.40	27.83	37.00	-9.17	Peak
4	633.340	33.94	-4.77	29.17	37.00	-7.83	Peak
5	906.880	29.72	-1.05	28.67	37.00	-8.33	Peak

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

VERTICAL



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

Data#: 12 File#: 30-1000M.EMI Date: 01-09-2008 Time: 12:56:01

Condition: CISPR CLASS-B VERTICAL
Test Operator: Vien Tran
Project # : 07U11529
Company : Broadcom
Config : EUT on extended card
Mode : Tx, 5 GHz Band (worst case)
Target : CISPR CLASS B

Page: 1

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
1	124.090	33.07	-13.05	20.02	30.00	-9.98	Peak
2	148.340	33.70	-13.74	19.96	30.00	-10.04	Peak
3	368.530	34.05	-10.59	23.46	37.00	-13.54	Peak
4	552.830	36.23	-6.30	29.93	37.00	-7.07	Peak
5	906.880	29.53	-1.05	28.48	37.00	-8.52	Peak

7.2. AC MAINS LINE CONDUCTED EMISSIONS

LIMIT

EN 301 489-1 Clause 8.4.3, Table 8

The lower limit applies at the boundary between the frequencies 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

EN 55022

TEST AND MEASUREMENT EQUIPMENT

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	Calibration Due
<input checked="" type="checkbox"/> EMI Test Receiver	R & S	ESHS 20	827129/006	1/27/2008
<input checked="" type="checkbox"/> LISN, 10 kHz - 30 MHz	FCC	LISN50/250-25-2	2023	9/27/2008
<input checked="" type="checkbox"/> LISN, 10 kHz - 30 MHz	Solar	8012-50-R-24-BNC	8379443	9/27/2008

RESULTS

No non-compliance noted:

6 WORST EMISSIONS

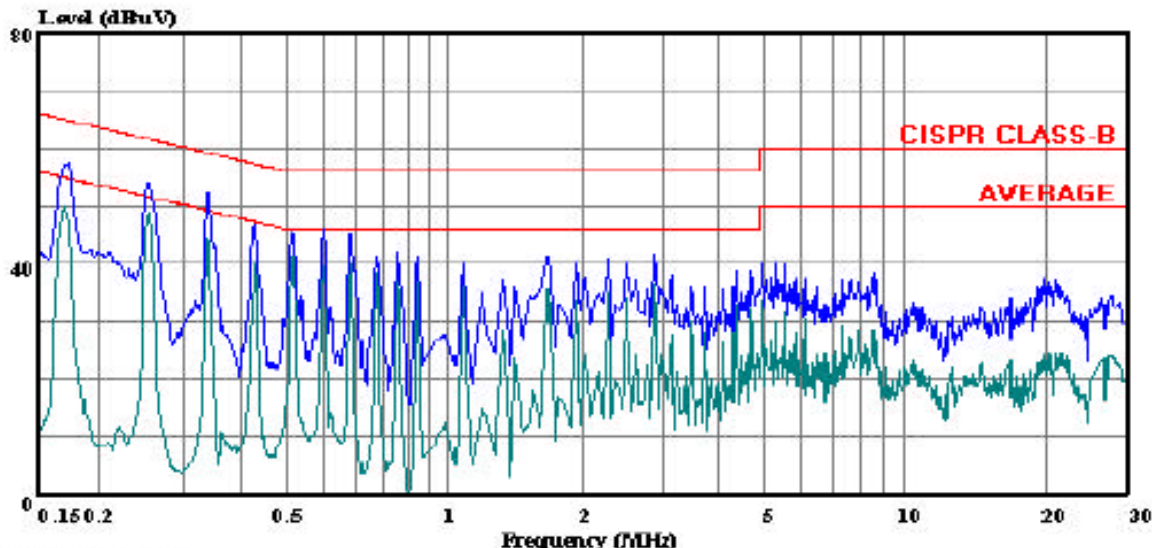
CONDUCTED EMISSIONS DATA (230VAC 50Hz)										
Freq. (MHz)	Reading			Class (dB)	Limit QP	EN B		Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)			AV	QP (dB)	AV (dB)		
0.18	57.25	--	49.17	0.00	64.72	54.72	-7.47	-5.55	L1	
0.26	54.10	--	48.96	0.00	61.56	51.56	-7.46	-2.60	L1	
3.39	52.30	--	44.48	0.00	56.00	46.00	-3.70	-1.52	L1	
0.18	58.58	--	49.65	0.00	64.72	54.72	-6.14	-5.07	L2	
0.26	54.58	--	45.04	0.00	61.56	51.56	-6.98	-6.52	L2	
3.39	49.98	--	39.67	0.00	56.00	46.00	-6.02	-6.33	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#: 21 File#: 115v.emi Date: 12-20-2007 Time: 13:52:46



(Line Conduction)

Trace: 19

Ref Trace:

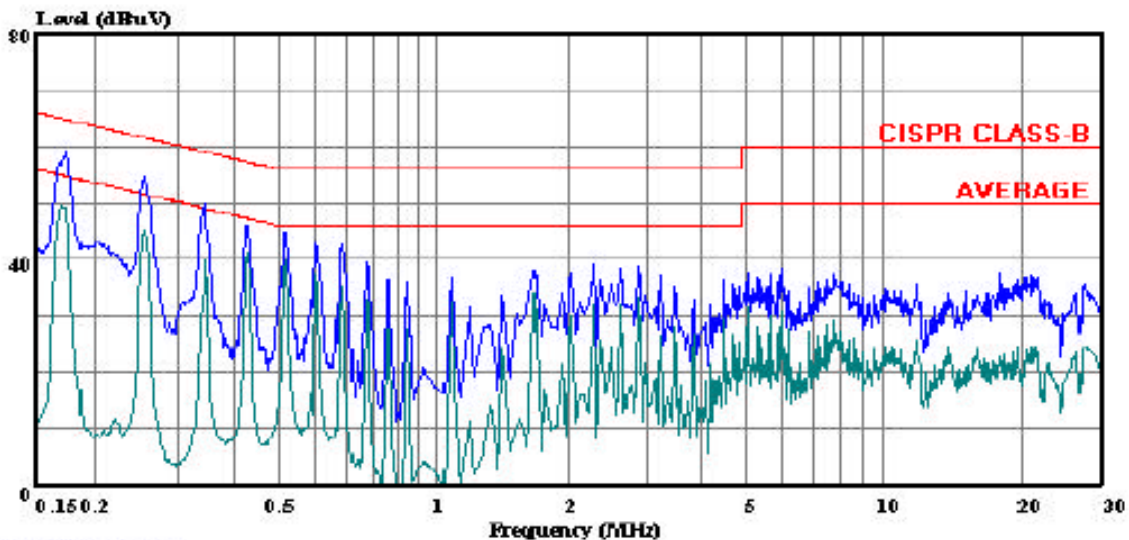
Condition: CISPR CLASS-B
Test Operator:: Vien Tran
Project #: : 07U11529
Company: : Broadcom
Configuration:: BUT & 3.9dBi antenna
Mode: : Normal
Target: : CISPR Class B
Voltage: : 230VAC/50Hz
: L1: Peak (Blue); Average (Green)

LINE 2 RESULTS



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

Data#: 28 File#: 115v.emi Date: 12-20-2007 Time: 14:01:28



(Line Conduction)

Trace: 26

Ref Trace:

Condition: CISPR CLASS-B
Test Operator:: Vien Tran
Project #: : 07U11529
Company: : Broadcom
Configuration:: BUT & 3.9dBi antenna
Mode: : Normal
Target: : CISPR Class B
Voltage: : 230VAC/50Hz
: L2: Peak (Blue); Average (Green)

8. IMMUNITY LIMITS AND RESULTS

8.1. ELECTROSTATIC DISCHARGE

TEST PROCEDURE

EN 301 489-1 Clause 9.3.2 and EN 61000-4-2

TEST LEVEL

EN 301 489-1 Clause 9.3.2 and EN 61000-4-2

Contact Discharge: +/- 2 kV to +/- 4 kV

TEST EQUIPMENT

Test Equipment List				
Description	Manufacturer	Model	Serial Number	Calibration Due
<input checked="" type="checkbox"/> ESD Simulator	Schaffner	NSG 435	5960	02/20/08
<input type="checkbox"/> ESD Simulator	KeyTek	MZ-15/EC	9603516	2/8/08
<input type="checkbox"/> Static Charge Monitor	Wescorp	W210A	CCS 01658	3/8/07

ENVIRONMENTAL CONDITIONS

Parameter	Value
Temperature	23.1 °C
Humidity	38 %
Pressure	1015 mbar

TEST INFORMATION

EUT: 802.11ag/Draft 802.11n WLAN PCI-E Mini card
Model No: BCM943122MC
S/N: P304, S/N 356
EUT Test Mode: Pinging to Access Point

Date: 1/28/2008
Project No: 07U11529
Tester: Vien Tran

RESULTS

No non-compliance noted:

Required Passing Criterion: A B C
Actual Performance: A B C

Notes:

ESD TEST RESULTS

Indirect Contact Discharge To Horizontal Coupling Plane					
Side of EUT	Test Level			Results	
	± 2 kV	± 4 kV	± 8 kV	Pass	Fail
Front	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Back	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Left	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Right	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Indirect Contact Discharge To Vertical Coupling Plane					
Side of EUT	Test Level			Results	
	± 2 kV	± 4 kV	± 8 kV	Pass	Fail
Front	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Back	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Left	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Right	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

8.2. RADIO FREQUENCY ELECTROMAGNETIC FIELD IMMUNITY

TEST PROCEDURE

EN 301 489-1 Clause 9.2.2 and EN 61000-4-3

TEST LEVEL

EN 301 489-1 Clause 9.2.2 and EN 61000-4-3

3 V/m with 1000 Hz Sinusoidal AM at 80 % depth
80 to 1000 MHz in 1 % increments, and
1400 to 2000 MHz in 1 % increments

TEST EQUIPMENT FOR FIELD GENERATING SYSTEM

Test Equipment List				
Description	Manufacturer	Model	Serial Number	Calibration Due
<input checked="" type="checkbox"/> Signal Generator	HP	8648C	3623A03025	5/8/08
<input type="checkbox"/> RF Amplifier	Amplifier Research	500A100AM2	304057	C.N.R
<input checked="" type="checkbox"/> RF Amplifier	Amplifier Research	150W1000M2	303370	C.N.R
<input checked="" type="checkbox"/> RF Amplifier	Amplifier Research	30S1G3	303877	C.N.R
<input checked="" type="checkbox"/> Directional Coupler	Werlatone	C6021	8576	C.N.R
<input checked="" type="checkbox"/> Directional Coupler	Amplifier Research	DC7144A	305089	C.N.R
<input checked="" type="checkbox"/> Power Meter	HP	437B	3125U11347	10/18/08
<input checked="" type="checkbox"/> Power Sensor	HP	8482A	2349A08568	4/18/09
<input checked="" type="checkbox"/> Log Periodic Antenna	Rohde & Schwarz	HL 046	358714/003	C.N.R
<input checked="" type="checkbox"/> Horn Antenna	EMCO	3115	9001-3245	C.N.R
<input checked="" type="checkbox"/> Field Probe	Holaday	HI 6105	62873	5/29/08
<input checked="" type="checkbox"/> Field Monitor	Amplifier Research	FM5501	25356	C.N.R

ENVIRONMENTAL CONDITIONS

Parameter	Value
Temperature	20.3 °C
Humidity	36 %
Pressure	1018 mbar

TEST INFORMATION

EUT: 802.11ag/Draft 802.11n WLAN PCI-E Mini card
Model No: BCM943122MC
S/N: P2304, S/N 356
EUT Test Mode: Pinging to Access Point

Date: 1/28/2008
Project No: 07U11529
Tester: Vien Tran

RESULTS

No non-compliance noted:

80 to 1000 MHz Results								
Antenna Polarization	Front Side		Back Side		Left Side		Right Side	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Horizontal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Vertical	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

1.4 to 2.0 GHz Results								
Antenna Polarization	Front Side		Back Side		Left Side		Right Side	
	Pass	Fail	Pass	Fail	Pass	Fail	Pass	Fail
Horizontal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Vertical	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Required Passing Criterion: A B C
Actual Performance: A B C

Notes: This Test was conducted for both 2.4 and 5 GHz band.

9. SETUP PHOTOS

9.1. EMISSIONS SETUP PHOTOS

Front



Back

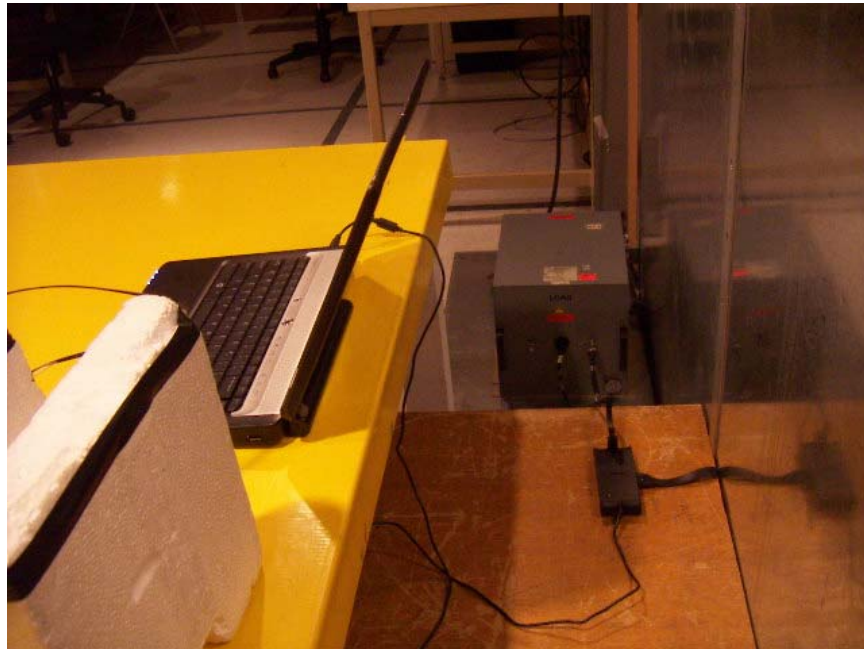


AC MAINS LINE CONDUCTED EMISSIONS

Front

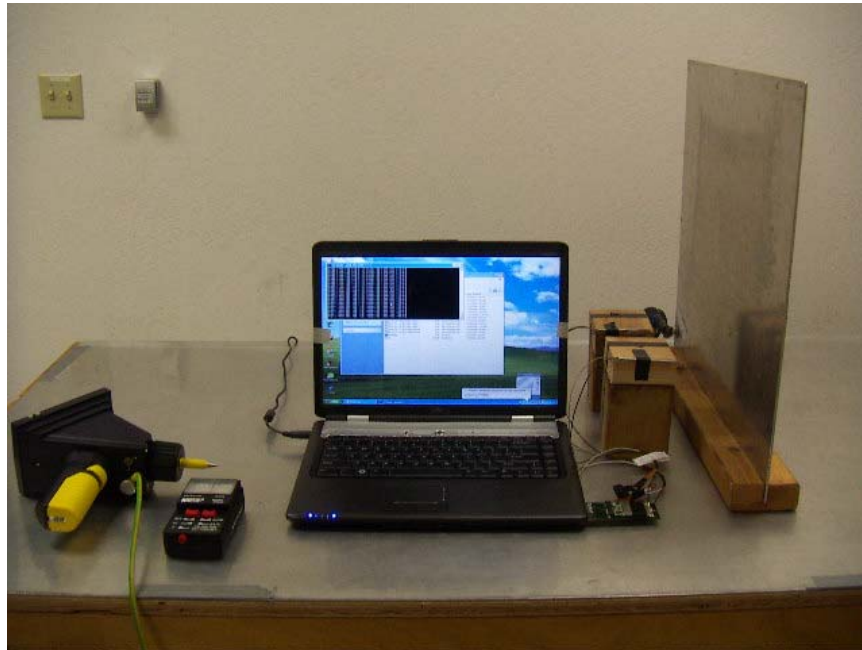


Back



9.2. IMMUNITY SETUP PHOTOS

ELECTROSTATIC DISCHARGE



RADIATED IMMUNITY

Front

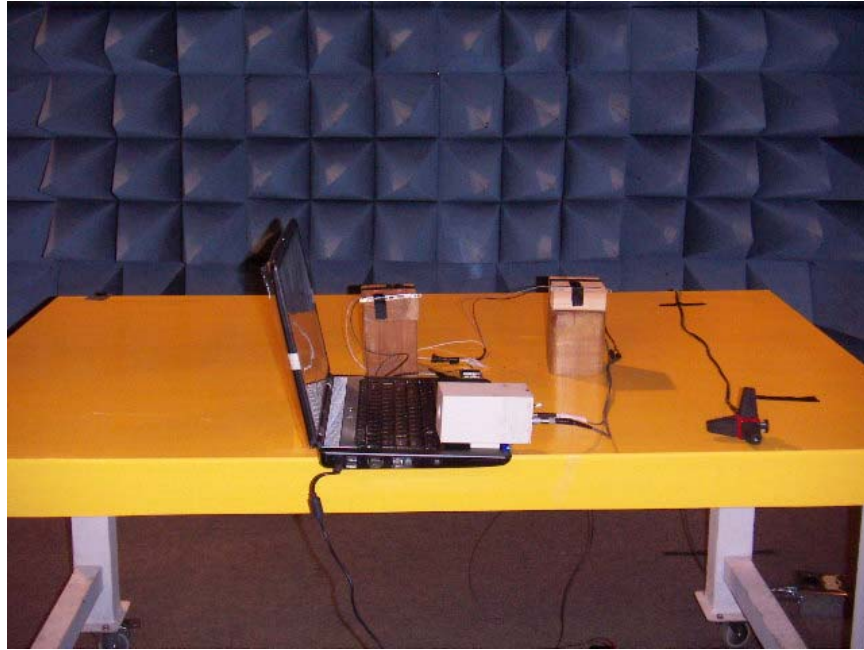


Back

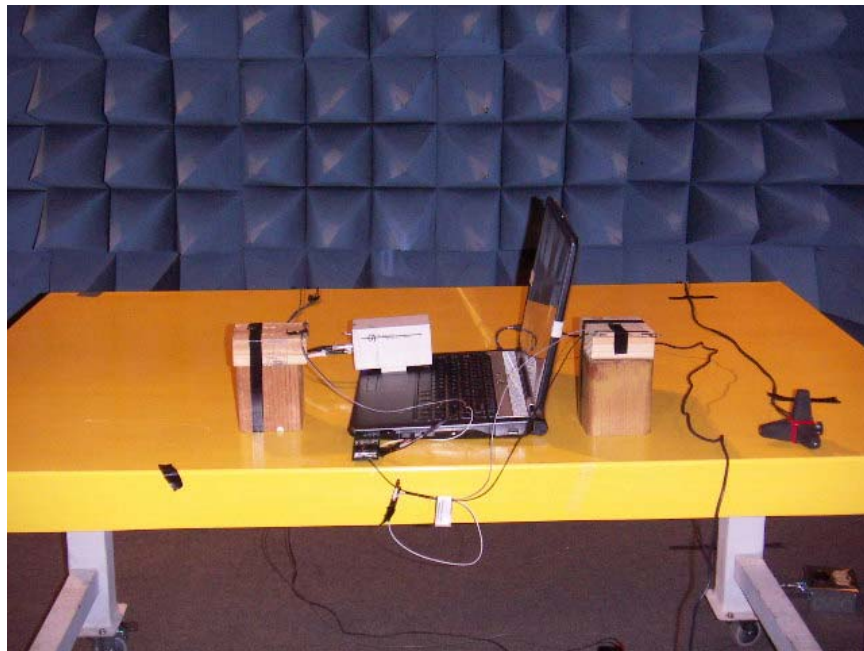


RADIATED IMMUNITY

Left



Right



END OF REPORT