



**FCC 47 CFR PART 15 SUBPART B
ICES-003 Issue 4**

TEST REPORT

FOR

802.11a/g/n WLAN + Bluetooth PCI-E Custom Combination Card

MODEL NUMBER: BCM94331PCIEBT3B

**FCC ID: QDS-BRCM1066
IC: 4324A-BRCM1066**

REPORT NUMBER: 12U14373-4

ISSUE DATE: JUNE 26, 2012

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/26/12	Initial Issue	S. Leitner

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11a/b/g/n WLAN + Bluetooth PCI-E Custom Combination Card

MODEL: BCM94331PCIEBT3B

SERIAL NUMBER: C96215016AF2GQBL (P101)

DATE TESTED: JUNE 20 - 25, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass
ICES-003 Issue 4	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

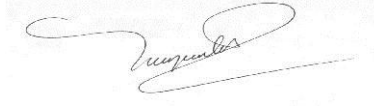
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:



STEVE LEITNER
EMC SUPERVISOR
UL CCS

Tested By:



VIEN TRAN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL 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. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned}\text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m}\end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 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/n WLAN + Bluetooth PCI-E Custom Combination Card.

The radio module is manufactured by Broadcom.

GENERAL INFORMATION

Power Requirements	100-240 VAC / 50-60 Hz
List of frequencies generated or used by the EUT	20 MHz

5.2. PRELIMINARY TEST CONFIGURATIONS

The following configuration was investigated during testing:

EUT Configuration	Description
Typical Configuration	EUT connected to laptop via extended board with minimum configuration (Ethernet hub and USB mouse).

5.3. WORST CASE MODE OF OPERATION

Mode	Description
EMC Test S/W and WLAN TX	All I/O ports activated, scrolling "H" pattern on the laptop screen, TX on.

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.106.98.77.

The test utility software used during testing was BCM Internal, rev. 5.106.RC98.77.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT

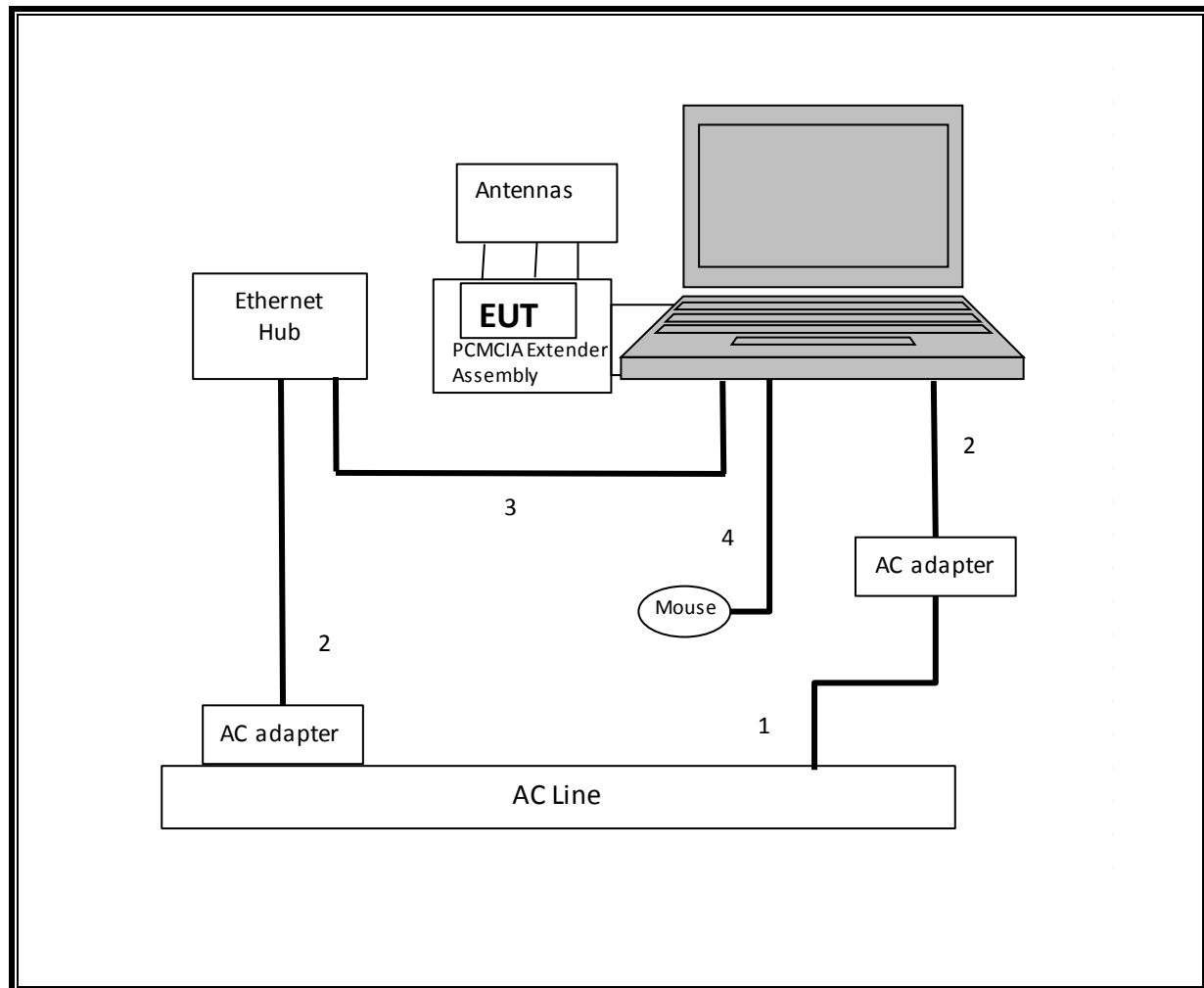
SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	G560	CPU4495771	DoC
AC Adapter	Lenovo	PA-1650-56LC	11S36001646ZZ400008KCM8	DoC
Extender	Catalyst	MINI2EXP	BRCM 02	N/A
Adapter Board	Broadcom	BCM94331PCIBT4HAD	93	N/A
Mouse	HP	5184-1244	LZE01650057	N/A
Ethernet Hub	Netgear	EN106	ENT6A99003602	N/A
AC Adapter	Netgear	PWR-002-001	9908	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	Parallel blade	Unshielded	1.5 m	NA
2	DC	1	DC	Unshielded	1.5 m	Ferrite at laptop's end
3	Ethernet	1	RJ-45	Cat 5 UTP	2 m	
4	USB	1	USB	Unshielded	2 m	USB Mouse

TEST SETUP

The EUT was mounted to an extender board assembly which is installed in the PCMCIA slot of a host laptop computer during the tests. 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
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00558	11/11/12
BiLog Antenna	Sunol	JB1	C01171	01/26/13
Spectrum Analyzer	Agilent / HP	E4446A	C01012	09/02/12
LISN	FCC	50/250-25-2	C00626	12/13/12
LISN	Solar	8012-50-R-24-BNC	N02486	03/07/13
Test receiver	R&S	ESHS 20	N02396	08/19/13

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

The highest clock frequency generated or used in the EUT (except for the intended fundamental) was 20 MHz; therefore the frequency range was investigated from 30 MHz to 1000 MHz.

LIMIT

§15.109 (a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54
Note: The lower limit shall apply at the transition frequency.	

RESULTS**HORIZONTAL AND VERTICAL DATA**

Project No:12U14373									
Client Name:BROADCOM									
Model / Device:X28B									
Config / Other:WORST CASE									
Test By:John Nguyen									
Test Frequency MHz	Meter Reading dB(μV)	Detector	ChmbrA Amplified dB	T243 Bilog dB	Corrected dB(μV/m)	Class B 3m limit dB(μV/m)	Margin dB	Height cm	Polarity
152.3161	39.36	PK	-26.6	12.1	24.86	43.5	-18.64	200	Horz
213.02	47.25	PK	-26.1	10.6	31.75	46	-14.25	100	Horz
300.755	39.8	PK	-25.8	13.3	27.30	46	-18.70	100	Horz
497.06	44.0	PK	-24.8	17.5	36.70	46	-9.30	100	Horz
530.929	40.29	QP	-24.9	18.2	33.59	46	-12.41	100	Horz
896.034	45.04	QP	-23.3	22.1	43.84	46	-2.16	115	Horz
152.51	52.82	PK	-26.6	12	38.22	43.5	-5.28	200	Vert
223.6511	53.47	PK	-26.0	10.6	38.07	46	-7.93	200	Vert
300.755	38.00	PK	-25.8	13.3	25.50	46	-20.5	100	Vert
433.0036	47.21	PK	-25.1	16.6	38.71	46	-7.29	100	Vert
497.06	44.00	PK	-24.8	17.5	36.70	46	-9.30	100	Vert
899.7822	41.92	PK	-23.4	22.2	40.72	46	-5.28	200	Vert
PK - Peak detector									
QP - Quasi-Peak detector									

7.2. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

LIMIT

§15.107 (a) Except for Class A digital devices, for equipment 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 band edges.

Frequency range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

RESULTS**6 WORST EMISSIONS****LINE CONDUCTED DATA**

Project No:12U14373

Client Name:BROADCOM

Model/Device:X28B

Test Volt/Freq:120AC/60Hz

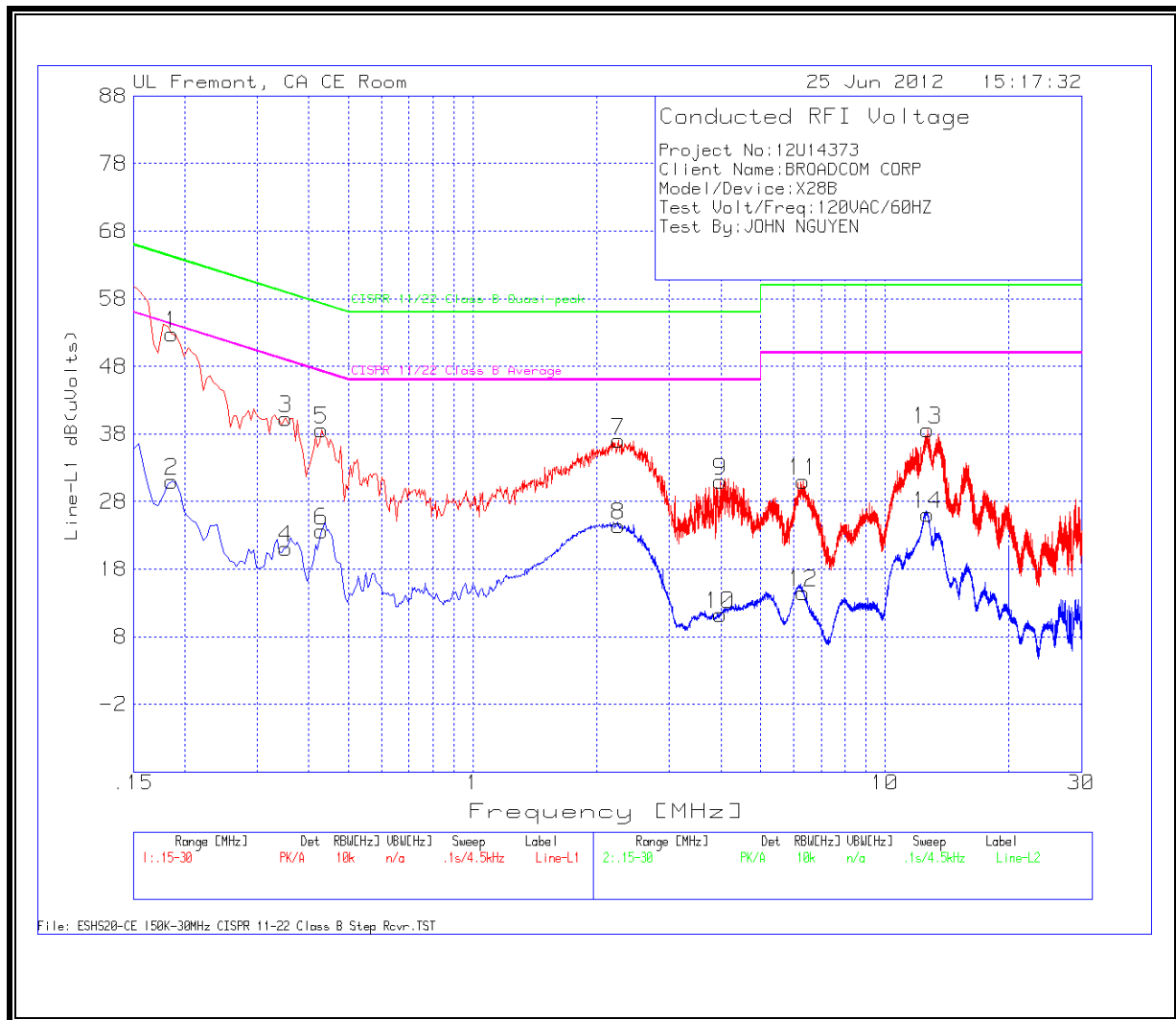
Test By:John Nguyen

Test Freq. MHz	Meter Reading dB(μV)	Detector Type	LISN Factor dB	Path Loss dB	Corrected Reading dB(μV)	Class B QP Limit dB(μV)	QP Margin dB	Class B Av Limit dB(μV)	Av Margin dB
Line-L1 .15 - 30MHz									
0.1635	59.96	PK	0.1	0	60.06	65.3	-5.24	-	-
0.1635	24.35	Av	0.1	0	24.45	-	-	55.3	-30.85
2.6925	40.50	PK	0.1	0.1	40.70	56	-15.3	-	-
2.6925	26.96	Av	0.1	0.1	27.16	-	-	46	-18.84
4.299	41.04	PK	0.1	0.1	41.24	56	-14.76	-	-
4.299	19.20	Av	0.1	0.1	19.40	-	-	46	-26.6
4.9155	39.99	PK	0.1	0.1	40.19	56	-15.81	-	-
4.9155	19.65	Av	0.1	0.1	19.85	-	-	46	-26.15
12.3675	41.44	PK	0.2	0.2	41.84	60	-18.16	-	-
12.3675	27.03	Av	0.2	0.2	27.43	-	-	50	-22.57
15.8595	35.78	PK	0.2	0.2	36.18	60	-23.82	-	-
15.8595	22.91	Av	0.2	0.2	23.31	-	-	50	-26.69
Line-L2 .15 - 30MHz									
0.177	54.67	PK	0.1	0	54.77	64.6	-9.83	-	-
0.177	30.00	Av	0.1	0	30.10	-	-	54.6	-24.5
0.42	38.92	PK	0.1	0	39.02	57.4	-18.38	-	-
0.42	24.35	Av	0.1	0	24.45	-	-	47.4	-22.95
2.2065	38.30	PK	0.1	0.1	38.50	56	-17.5	-	-
2.2065	25.99	Av	0.1	0.1	26.19	-	-	46	-19.81
4.155	37.19	PK	0.1	0.1	37.39	56	-18.61	-	-
4.155	18.03	Av	0.1	0.1	18.23	-	-	46	-27.77
12.6645	37.85	PK	0.2	0.2	38.25	60	-21.75	-	-
12.6645	24.77	Av	0.2	0.2	25.17	-	-	50	-24.83
15.657	32.00	PK	0.2	0.2	32.40	60	-27.6	-	-
15.657	15.76	Av	0.2	0.2	16.16	-	-	50	-33.84

PK - Peak detector

QP - Quasi-Peak detector

Av - Average detector

LINE 1 RESULTS

LINE 2 RESULTS