



**FCC 47 CFR PART 15 SUBPART B
ICES-003 ISSUE 5**

TEST REPORT

FOR

802.11b/g/n/a/ac WLAN + Bluetooth PCI-E NGFF 2230 Card

MODEL NUMBER: BCM94350ZAE

**FCC ID: QDS-BRCM1087
IC ID: 4324A-BRCM1087**

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Prepared for
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NVLAP LAB CODE 200065-0

Revision History

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: 802.11b/g/n/a/ac WLAN + Bluetooth PCI-E NGFF 2230 Card

MODEL: BCM94350ZAE

SERIAL NUMBER: 397

DATE TESTED: MAY 16 to MAY 18, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass
ICES – 003 ISSUE 5	Pass

UL Verification Services Inc. 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 Verification Services Inc. 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By:



FRANK IBRAHIM
PROGRAM MANAGER
UL Verification Services Inc.

Tested By:



Lionel Lara
EMC ENGINEER
UL Verification Services Inc.

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.

47173 Benicia Street	47266 Benicia Street
<input checked="" type="checkbox"/> Chamber A	<input type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input type="checkbox"/> Chamber F
	<input type="checkbox"/> Chamber G
	<input type="checkbox"/> Chamber H

The above test sites and facilities are covered under FCC Test Firm Registration # 208313.

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2000650.htm>.

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
Radiated Disturbance, 1 to 6 GHz	± 3.86 dB
Radiated Disturbance, 6 to 18 GHz	± 4.23 dB
Radiated Disturbance, 18 to 26 GHz	± 5.30 dB
Radiated Disturbance, 26 to 40 GHz	± 5.23 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11b/g/n/a/ac WLAN + Bluetooth PCI-E NGFF 2230 Card.

The radio module is manufactured by Broadcom.

5.2. TEST CONFIGURATIONS

EUT Configuration	Description
Typical Configuration	EUT connected to a host laptop via PCIe board. The laptop used a mouse and router as minimum configuration.

5.3. WORST CASE MODE OF OPERATION

Mode	Description
Radio powered ON	Radio card connected to host PC and powered

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, Ver. 5.6.0.9020.

The firmware installed in the EUT during testing was 7.35.180.50 (r BRCMINT)

The test utility software used during testing was Broadcom Bluetooth, Ver. 1.9.0.8.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	S/N
Laptop	Lenovo	Lenovo G560	CB06123814
AC Adapter	Lenovo	PA1650-56LC	N/A
Ethernet Hub	Netgear	EN106	ENT6A99003602
AC Adapter	Netgear	LPS421-480508E	N/A
Mouse	Dell	330-9456	N/A
Catalyst PCIe. Board	Enterprises Inc.	NA	NA

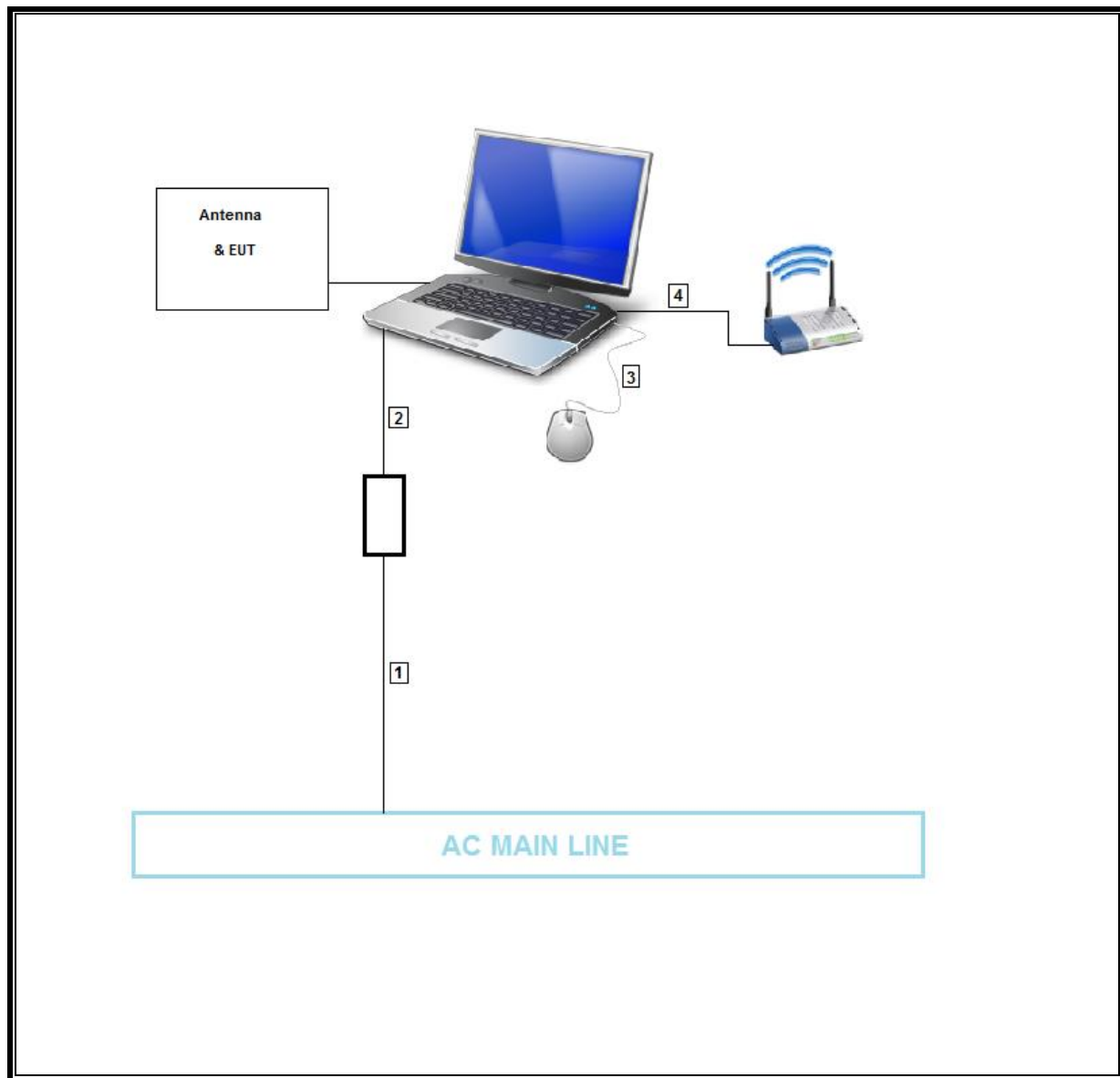
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	No. of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US115V	Unshielded	1	
2	DC	1	VDC	Unshielded	1.5	
3	USB	1	USB	Unshielded	2	
3	Ethernet	1	RJ45	Unshielded	2	

TEST SETUP

External antennas were used and the EUT was connected to a laptop computer that was set up in a minimum configuration with a USB mouse and router connected. Radio was not transmitting.

TEST 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	T No.	Cal Date	Cal Due
Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014		
Line Conducted Software	UL	UL EMC	Ver 9.5, May 17, 2012		
Spectrum Analyzer, 3 Hz-44GHz	Agilent	N9030A	T907	07/05/14	07/05/15
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T243	12/08/14	12/08/15
Preamplifier, 1300 MHz	Agilent / HP	8447D	T10	11/01/14	11/01/15
EMI Test Receiver, 9KHz to 7GHz	Rohde & Schwarz	ESCI 7	284	9/16/2014	9/16/2015
LISN	Solar	8012-50-R-24-BNC	29	7/21/2014	7/21/2015
LISN	FCC	50/250-25-2	24	1/16/2015	1/16/2016

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 for the digital portion was 40 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

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	Class B QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	30.4238	46.22	QP	20.8	-31.2	35.82	40	-4.18	155	111	V
6	43.4137	56.52	QP	11.7	-31.1	37.12	40	-2.88	219	108	V
1	55.974	54.83	QP	7.1	-30.9	31.03	40	-8.97	291	395	H
7	62.5221	54.18	QP	7.8	-30.8	31.18	40	-8.82	221	113	V
8	94.2585	60.83	QP	8.6	-30.6	38.83	43.52	-4.69	12	106	V
2	119.6075	46.64	QP	13.8	-30.4	30.04	43.52	-13.48	200	178	H
9	143.3422	49.37	QP	13.2	-30.3	32.27	43.52	-11.25	235	114	V
3	166.5167	59.53	QP	11.7	-30.2	41.03	43.52	-2.49	303	144	H
4	199.8282	58.56	QP	12.6	-29.9	41.26	43.52	-2.26	302	132	H
10	250	56.95	PK	11.4	-29.6	38.75	46.02	-7.27	0-360	101	H
11	277.1	52.77	PK	13.3	-29.5	36.57	46.02	-9.45	0-360	200	V
12	692.9	42.78	PK	20	-28.2	34.58	46.02	-11.44	0-360	101	V

PK - Peak detector

QP - Quasi-Peak detector

7.2. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

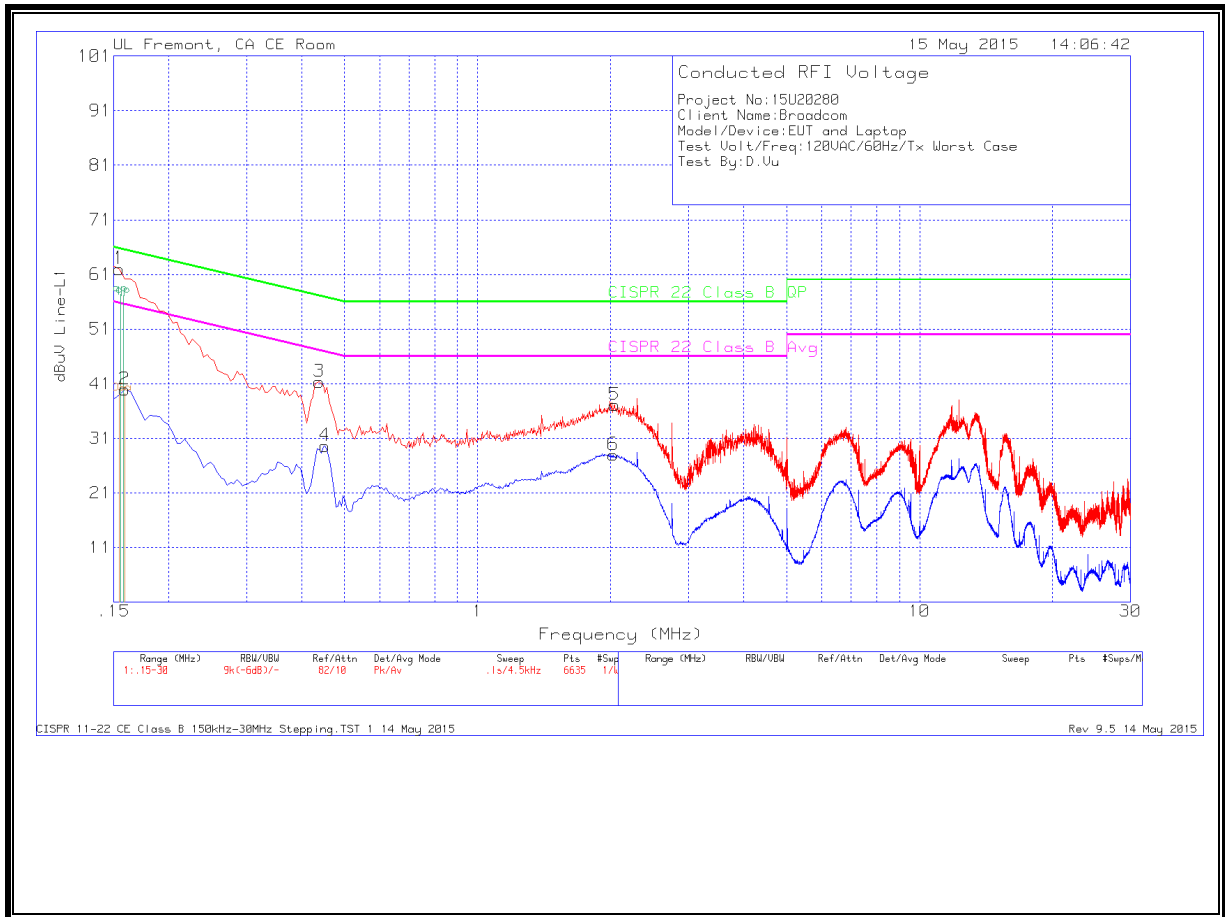
LIMIT

§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

LINE 1 RESULTS



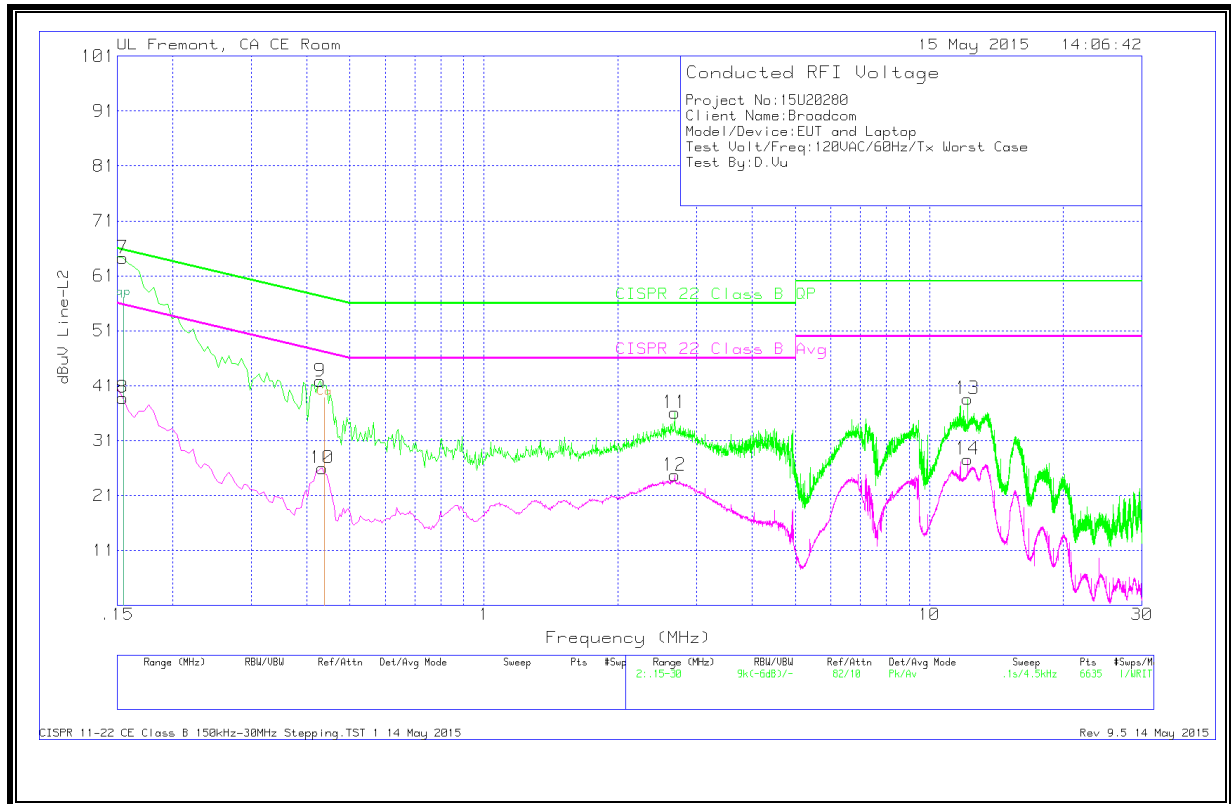
Trace Markers

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.15563	56.1	Qp	1.3	0	57.4	65.69	-8.29	-	-
2	.15563	37.86	Ca	1.3	0	39.16	-	-	55.69	-16.53
3	.438	39.98	Pk	.4	0	40.38	57.1	-15.72	47.1	-6.72
4	.4515	29.2	Av	.4	0	29.6	-	-	46.85	-17.25
5	2.04	36.82	Pk	.2	.1	37.12	56	-18.88	46	-8.88
6	2.0265	27.67	Av	.2	.1	27.97	-	-	46	-18.03

Pk - Peak detector
Av - Average detection
Qp - Quasi-Peak detector
Ca - CISPR average detection

LINE 2 RESULTS



Trace Markers

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
8	.15518	55.68	Qp	1.4	0	57.08	65.72	-8.64	-	-
8	.15518	37.45	Ca	1.4	0	38.85	-	-	55.72	-16.87
9	.429	40.43	Pk	.4	0	40.83	57.27	-15.44	47.27	-6.44
10	.4335	25.59	Av	.4	0	25.99	-	-	47.19	-21.2
11	2.679	35.75	Pk	.2	.1	36.05	56	-19.95	46	-9.95
12	2.679	24.37	Av	.2	.1	24.67	-	-	46	-21.33
13	12.183	38.2	Pk	.2	.2	38.6	60	-21.4	50	-11.4
14	12.1875	27.18	Av	.2	.2	27.58	-	-	50	-22.42

Pk - Peak detector
Av - Average detection
Qp - Quasi-Peak detector
Ca - CISPR average detection