



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

TEST REPORT

FOR

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

MODEL NUMBER: BCM943602CS

**FCC ID: QDS-BRCM1080
IC: 4324A-BRCM1080**

REPORT NUMBER: 13U16561-72, Revision A

ISSUE DATE: JUNE 06, 2014

Prepared for
**BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.**

Prepared by
**UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888**



NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/02/14	Initial Issue	F. Ibrahim
A	06/06/14	Update set up photos	J. Wu

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	5
3. FACILITIES AND ACCREDITATION	5
4. CALIBRATION AND UNCERTAINTY	5
4.1. MEASURING INSTRUMENT CALIBRATION	5
4.2. SAMPLE CALCULATION	5
4.3. MEASUREMENT UNCERTAINTY	6
5. EQUIPMENT UNDER TEST	7
5.1. DESCRIPTION OF EUT	7
5.2. TEST CONFIGURATIONS	7
5.3. WORST CASE MODE OF OPERATION	7
5.4. SOFTWARE AND FIRMWARE	7
5.5. MODIFICATIONS	7
5.6. DETAILS OF TESTED SYSTEM	8
6. TEST AND MEASUREMENT EQUIPMENT	10
7. APPLICABLE LIMITS AND TEST RESULTS	11
7.1. RADIATED EMISSIONS	11
7.2. AC MAINS LINE CONDUCTED EMISSIONS	13
8. SETUP PHOTOS	16

1. ATTESTATION OF TEST RESULTS

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

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

MODEL: BCM943602CS

SERIAL NUMBER: 318

DATE TESTED: March 03 & April 07, 2014

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:



Joey Gomez
Lab 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.

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☒ Chamber A	☐ Chamber D
☐ Chamber B	☐ Chamber E
☐ Chamber C	☐ Chamber F

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

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/g/n/ac WLAN + Bluetooth PCI-E Custom Combination Card.

The radio module is manufactured by Broadcom.

5.2. TEST CONFIGURATIONS

EUT Configuration	Description
Typical Configuration (representing installation inside laptop PC)	EUT connected to host laptop via extender board, with 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 firmware installed in the EUT during testing was Broadcom, rev. 7.16.27.0.

The test utility software used during testing was BCM Internal, rev. 7.16.RC27.0.

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	FCC ID
Laptop	Dell	Latitude E6400	2477655473	DoC
AC Adapter	Dell	DA90PE3-00	CN-0WTC00V-48661	DoC
Catalyst PCIe. Board	Enterprises Inc.	NA	NA	DoC
X29T Adaptor Board	Broadcom	BCM94331C5AD	NA	DoC

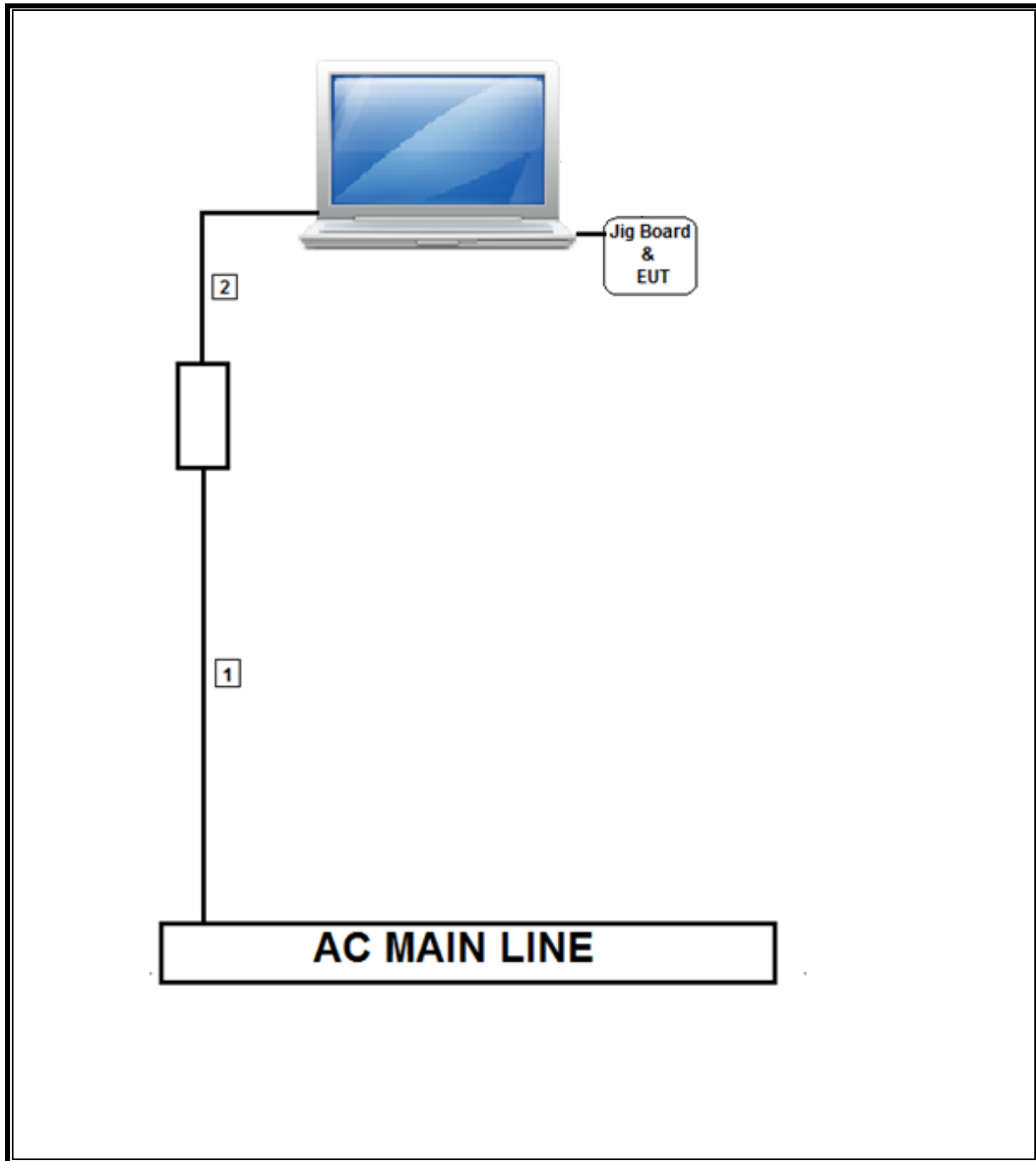
I/O CABLES

Cable No.	Port	No. of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US 115V	Un-Shielded	1.0m	NA
2	DC	1	DC	Un-Shielded	0.8m	NA

TEST SETUP

The EUT is attached to a jig board which is installed in the PCMCi slot of a host laptop computer during the tests. Test software exercised the radio card

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	S/N	Cal Date	Cal Due
EMI Test Receiver, 9kHz-7GHz	R&S	ESCI 7	1000741	07/13/13	07/13/14
PXA Signal Analyzer	Agilent	N9030A	T339	12/10/13	12/10/14
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01016	08/22/13	08/22/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/16/14	01/16/15
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/17/14	01/17/15

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 is 40 MHz; therefore the frequency range was investigated from 30 MHz to 1000MHz.

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

Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 133	55.3	PK	13.8	-30.4	38.7	43.52	-4.82	304	199	H
* 133.0766	54.3	QP	13.8	-30.4	37.7	43.52	-5.82	304	199	H
* 133.0766	49.69	PK	13.8	-30.4	33.09	43.52	-10.43	202	256	V
* 133.0806	48.4	QP	13.8	-30.4	31.8	43.52	-11.72	202	256	V
398.795	39.96	PK	15.6	-28.9	26.66	46.02	-19.36	87	225	V
398.8195	40.53	QP	15.6	-28.9	27.23	46.02	-18.79	87	225	V
398.9395	44.18	PK	15.6	-28.9	30.88	46.02	-15.14	313	101	H
398.9405	46.1	QP	15.6	-28.9	32.8	46.02	-13.22	313	101	H
698.1742	42.09	QP	20.3	-28.3	34.09	46.02	-11.93	177	112	H
698.27	43.62	PK	20.3	-28.3	35.62	46.02	-10.4	177	112	H
698.6088	39.62	QP	20.3	-28.3	31.62	46.02	-14.4	17	116	V
698.6342	39.92	PK	20.3	-28.3	31.92	46.02	-14.1	17	116	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

QP - Quasi-Peak detector

7.2. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

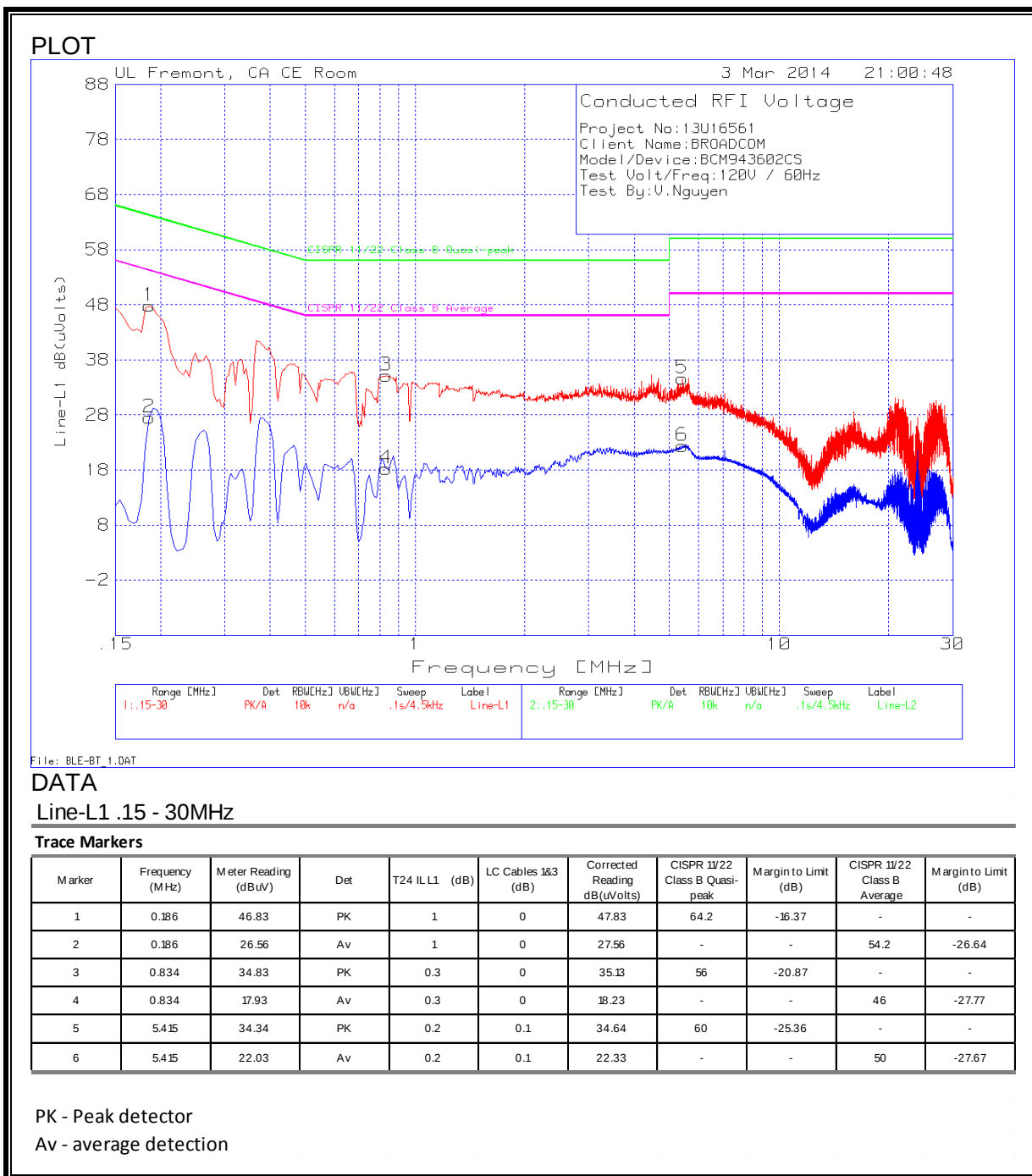
ANSI C63.4

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.		

LINE 1 RESULTS



LINE 2 RESULTS

