



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

TEST REPORT

FOR

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

MODEL NUMBER: BCM94331CD

**FCC ID: QDS-BRCM1064
IC: 4324A-BRCM1064**

REPORT NUMBER: 12U14227-6 Revision A

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NVLAP LAB CODE 200065-0

Revision History

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|--|------------|
| -- | 05/31/12 | Initial Issue | S. Leitner |
| A | 06/07/12 | Correct support equipment table, update test configuration and results | S. Leitner |

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. <i>MEASURING INSTRUMENT CALIBRATION</i> | 5 |
| 4.2. <i>SAMPLE CALCULATION.....</i> | 5 |
| 4.3. <i>MEASUREMENT UNCERTAINTY</i> | 5 |
| 5. EQUIPMENT UNDER TEST | 6 |
| 5.1. <i>DESCRIPTION OF EUT.....</i> | 6 |
| 5.2. <i>TEST CONFIGURATION</i> | 6 |
| 5.3. <i>WORST CASE MODE OF OPERATION.....</i> | 6 |
| 5.4. <i>SOFTWARE AND FIRMWARE</i> | 6 |
| 5.5. <i>MODIFICATIONS</i> | 6 |
| 5.6. <i>DETAILS OF TESTED SYSTEM.....</i> | 7 |
| 6. TEST AND MEASUREMENT EQUIPMENT | 9 |
| 7. APPLICABLE LIMITS AND TEST RESULTS | 10 |
| 7.1. <i>RADIATED EMISSIONS</i> | 10 |
| 7.2. <i>AC MAINS LINE CONDUCTED EMISSIONS</i> | 14 |
| 8. SETUP PHOTOS..... | 18 |

1. ATTESTATION OF TEST RESULTS

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

MODEL: BCM94331CD

SERIAL NUMBER: C8Y2104004NDRJVE4 (P508)

DATE TESTED: JUNE 6 and 7, 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
ENGINEERING SUPERVISOR
UL CCS

Tested By:



DAVID GARCIA
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 | 5 Vdc |
| List of frequencies generated or used by the EUT | 20 MHz |

5.2. TEST CONFIGURATION

| EUT Configuration | Description |
|-----------------------|--|
| Typical Configuration | EUT installed inside a laptop computer with minimum configuration including earphones 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. 5.106.98.65.

The test utility software used during testing was BCM Internal, rev. 5.106.RC98.65.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT & PERIPHERALS

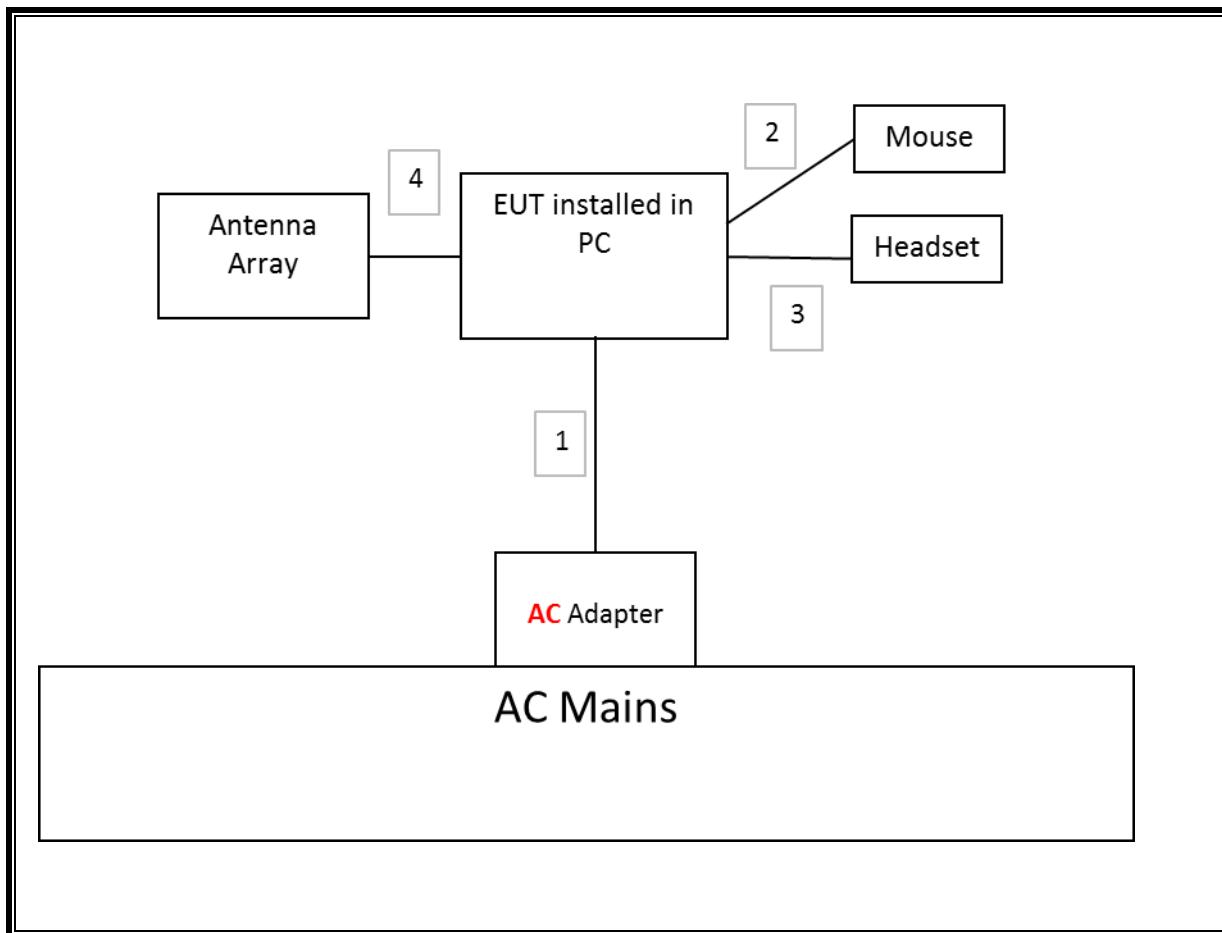
| SUPPORT EQUIPMENT LIST | | | | |
|------------------------|--------------|----------------|---------------|--------|
| Description | Manufacturer | Model | Serial number | FCC ID |
| Laptop PC | Apple | Mac Book A1370 | C02GT12HDJYD | DoC |
| AC Adapter | Apple | A1374 | N/A | N/A |
| Earphones | N/A | N/A | N/A | N/A |
| USB Mouse | HP | MOAFUO | N/A | DoC |

I/O CABLES

| I/O CABLE LIST | | | | | |
|----------------|-----------|----------------------|----------------|------------|--------------|
| Cable No. | Port | # of Identical Ports | Connector Type | Cable Type | Cable Length |
| 1 | DC | 1 | magnetic | Unshielded | 1.5 m |
| 2 | USB Mouse | 1 | USB | Shielded | 1.9m |
| 3 | Audio | 1 | 3.5mm Audio | Unshielded | 1.25m |
| 4 | Antenna | 1 | UFL | Shielded | 0.2 m |

TEST SETUP

The EUT was installed in the PCI-E mini card connector in the base of a laptop computer that was set up in a minimum configuration. Test software exercised the radio card. The bottom cover was removed from the computer throughout the testing.

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 | Serial Number | Cal Due |
| Preamplifier, 1300 MHz | Agilent / HP | 8447D | C00558 | 11/11/2012 |
| BiLog Antenna | Sunol | JB1 | C01171 | 1/26/2013 |
| Spectrum Analyzer | Agilent / HP | E4446A | C01012 | 9/2/2012 |
| LISN | FCC | 50/250-25-2 | C00626 | 12/13/2012 |
| LISN | Solar | 8012-50-R-24-BNC | N02486 | 3/7/2013 |
| Test receiver | R&S | ESHS 20 | N02396 | 8/19/2013 |

7. APPLICABLE LIMITS AND TEST RESULTS

7.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

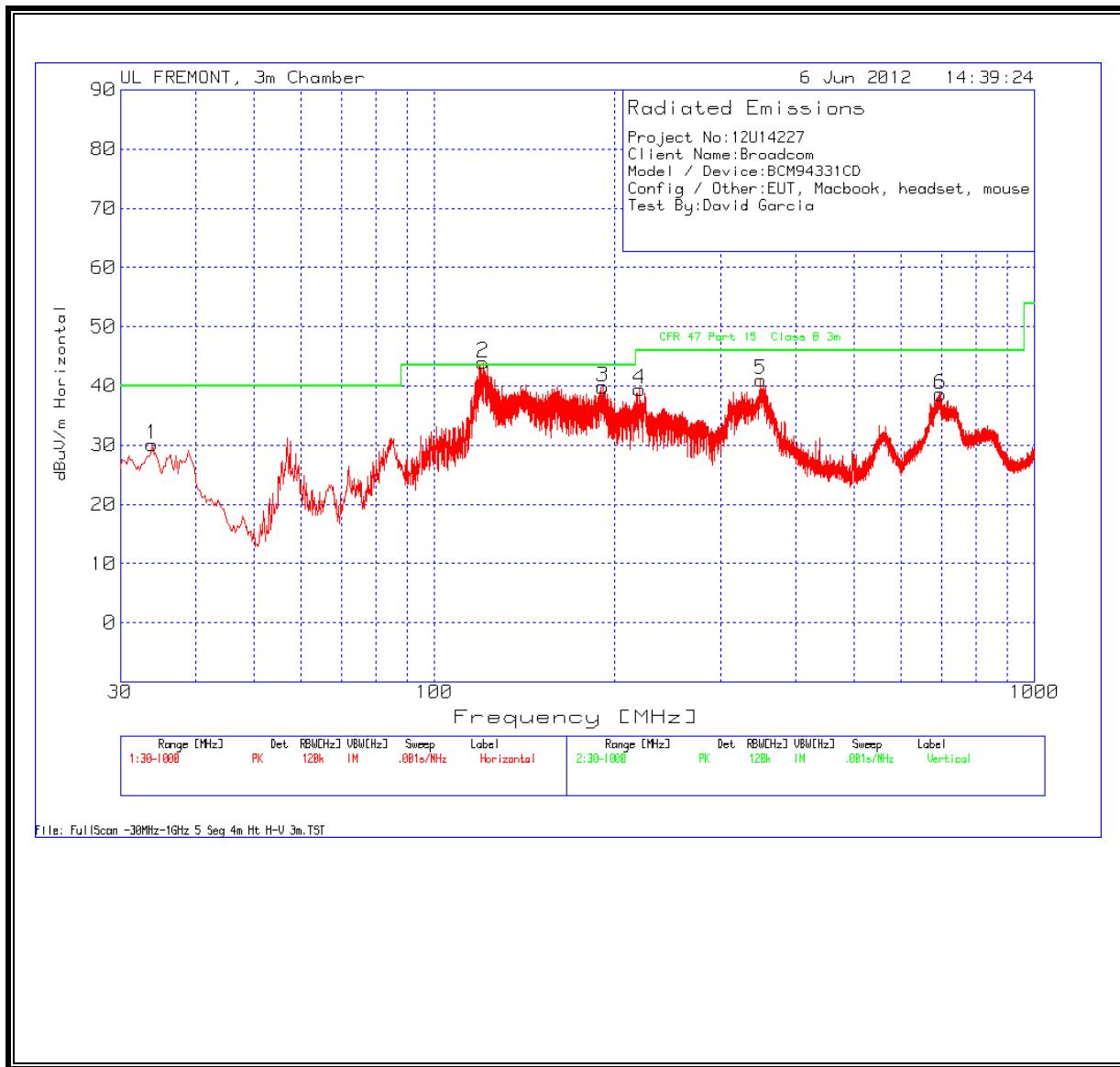
The highest clock frequency generated or used in the EUT (except for the intended fundamental) was 20 MHz; therefore the frequency range was investigated from 30 MHz to 1000 MHz.

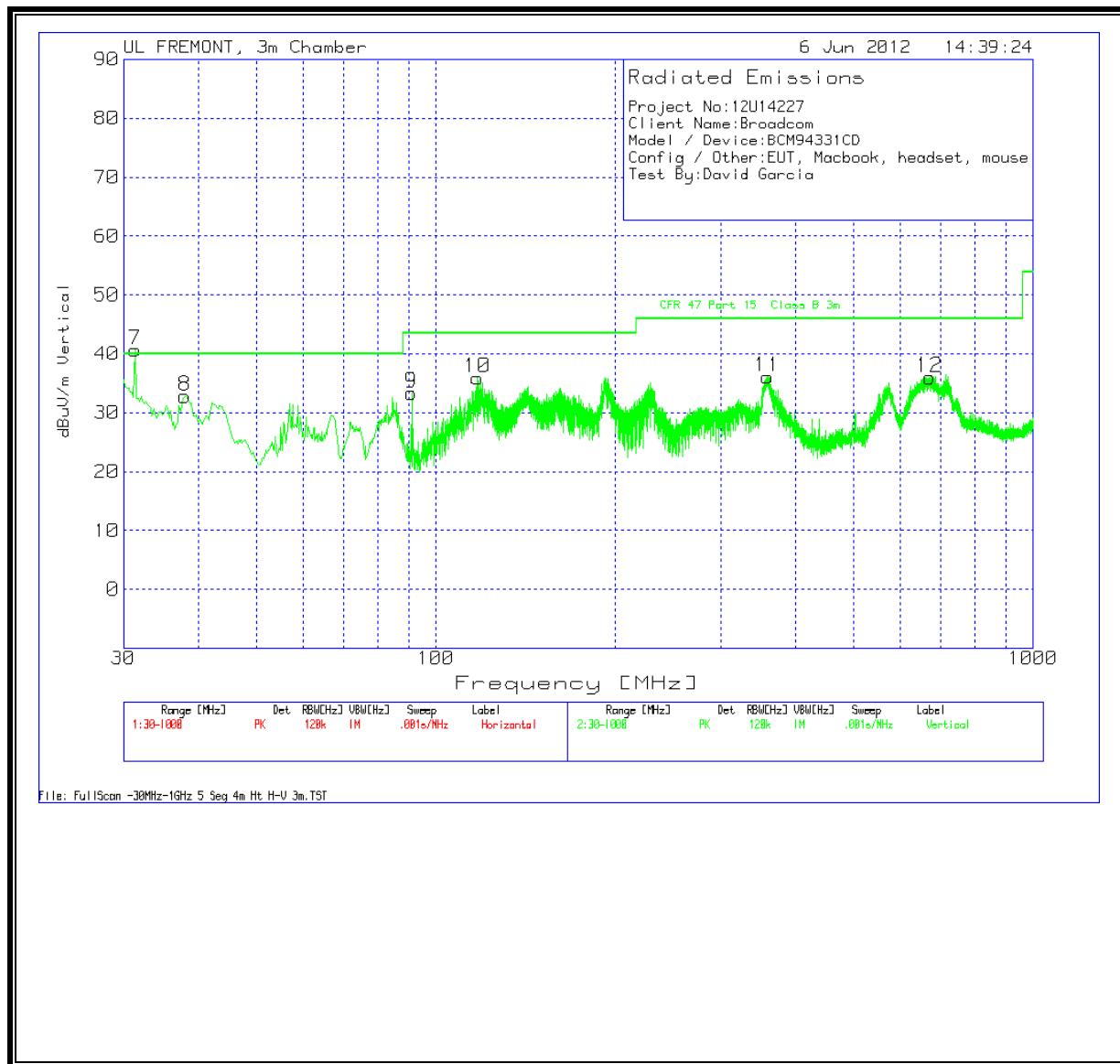
LIMIT

§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**RADIATED EMISSIONS 30 TO 1000 MHz - HORIZONTAL**

RADIATED EMISSIONS 30 TO 1000 MHz - VERTICAL

HORIZONTAL AND VERTICAL DATA

| Project No: | 12U14227 | | | | | | | | |
|--------------------------|------------------------------|----------|------------------------|-----------------|--------------------------|---------------------------------|-----------|-----------|----------|
| Client Name: | Broadcom | | | | | | | | |
| Model / Device: | BCM94331CD | | | | | | | | |
| Config / Other: | EUT, Macbook, headset, mouse | | | | | | | | |
| Test By: | David Garcia | | | | | | | | |
| Test Frequency MHz | Meter Reading dB(μ V) | Detector | Chambr 3m Amplified dB | Antenna T185 dB | Corrected dB(μ V/m) | Class B 3m limit dB(μ V/m) | Margin dB | Height cm | Polarity |
| 33.8769 | 39.24 | PK | -27.5 | 18.4 | 30.14 | 40 | -9.86 | 99 | Horz |
| 120.6336 | 54.36 | QP | -26.6 | 13.8 | 41.56 | 43.5 | -1.94 | 253 | Horz |
| 191.0851 | 54.65 | PK | -25.9 | 11.1 | 39.85 | 43.5 | -3.65 | 99 | Horz |
| 220.1619 | 54.46 | PK | -25.7 | 10.7 | 39.46 | 46 | -6.54 | 99 | Horz |
| 350.2318 | 52.01 | PK | -25.3 | 14.3 | 41.01 | 46 | -4.99 | 99 | Horz |
| 697.4081 | 43.72 | PK | -25.2 | 20.1 | 38.62 | 46 | -7.38 | 99 | Horz |
| 31.3569 | 35.47 | QP | -27.5 | 20.3 | 28.27 | 40 | -11.73 | 122 | Vert |
| 37.9476 | 44.93 | PK | -27.4 | 15.3 | 32.83 | 40 | -7.17 | 100 | Vert |
| 91.0612 | 52.56 | PK | -26.9 | 7.7 | 33.36 | 43.5 | -10.14 | 100 | Vert |
| 117.4241 | 49.01 | PK | -26.6 | 13.5 | 35.91 | 43.5 | -7.59 | 100 | Vert |
| 359.3425 | 46.76 | PK | -25.4 | 14.7 | 36.06 | 46 | -9.94 | 100 | Vert |
| 672.0144 | 41.63 | PK | -25.3 | 19.7 | 36.03 | 46 | -9.97 | 100 | 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.

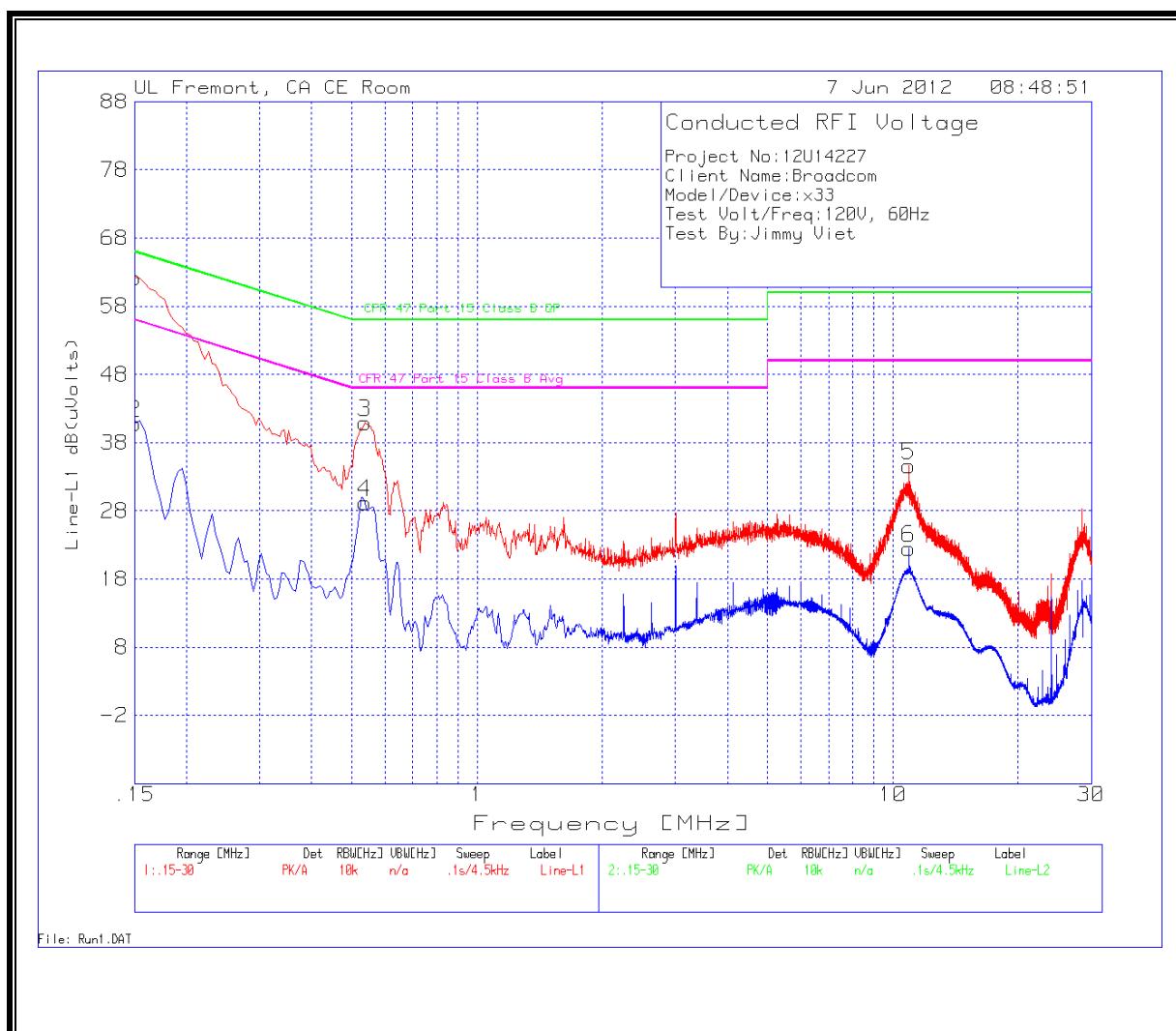
| Frequency range (MHz) | Limits (dB μ V) | |
|--------------------------|---------------------|----------|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

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:12U14227 | | | | | | | | | |
| Client Name:Broadcom | | | | | | | | | |
| Model/Device:802.11a/g/n 3x3 MIMO WLAN + BT | | | | | | | | | |
| Test Volt/Freq:120 Vac / 60Hz | | | | | | | | | |
| Test By:Vien Tran | | | | | | | | | |
| Line-L1 .15 - 30MHz | | | | | | | | | |
| Test Frequency | Meter Reading | Detector | T24 IL L1.TXT [dB] | LC Cables 1&3.TXT [dB] | dB μ V | Class B QP | Margin | Class B Av | Margin |
| 0.155 | 58.27 | PK | 0.1 | 0.00 | 58.37 | 65.8 | -7.43 | - | - |
| 0.155 | 27.73 | Av | 0.1 | 0.00 | 27.83 | - | - | 55.80 | -27.97 |
| 4.308 | 36.5 | PK | 0.1 | 0.10 | 36.70 | 56 | -19.30 | - | - |
| 4.308 | 18.47 | Av | 0.1 | 0.10 | 18.67 | - | - | 46.00 | -27.33 |
| 12.615 | 40.75 | PK | 0.2 | 0.20 | 41.15 | 60 | -18.85 | - | - |
| 12.615 | 29.67 | Av | 0.2 | 0.20 | 30.07 | - | - | 50.00 | -19.93 |
| Line-L2 .15 - 30MHz | | | | | | | | | |
| Test Frequency | Meter Reading | Detector | T24 IL L1.TXT [dB] | LC Cables 1&3.TXT [dB] | dB μ V | Class B QP | Margin | Class B Av | Margin |
| 0.164 | 54.87 | PK | 0.1 | 0 | 54.97 | 65.3 | -10.33 | - | - |
| 0.164 | 35.78 | Av | 0.1 | 0 | 35.88 | - | - | 55.3 | -19.42 |
| 4.232 | 36.83 | PK | 0.1 | 0.1 | 37.03 | 56 | -18.97 | - | - |
| 4.232 | 19.17 | Av | 0.1 | 0.1 | 19.37 | - | - | 46 | -26.63 |
| 12.539 | 41.39 | PK | 0.2 | 0.2 | 41.79 | 60 | -18.21 | - | - |
| 12.539 | 29.68 | Av | 0.2 | 0.2 | 30.08 | - | - | 50 | -19.92 |
| PK - Peak detector | | | | | | | | | |
| QP - Quasi-Peak detector | | | | | | | | | |
| Av - Average detector | | | | | | | | | |

LINE 1 RESULTS

LINE 2 RESULTS