



**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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Prepared for
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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

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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: 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.

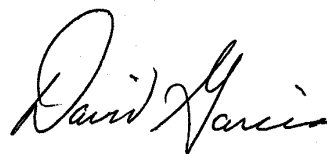
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:

Tested By:



STEVE LEITNER
ENGINEERING SUPERVISOR
UL CCS



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

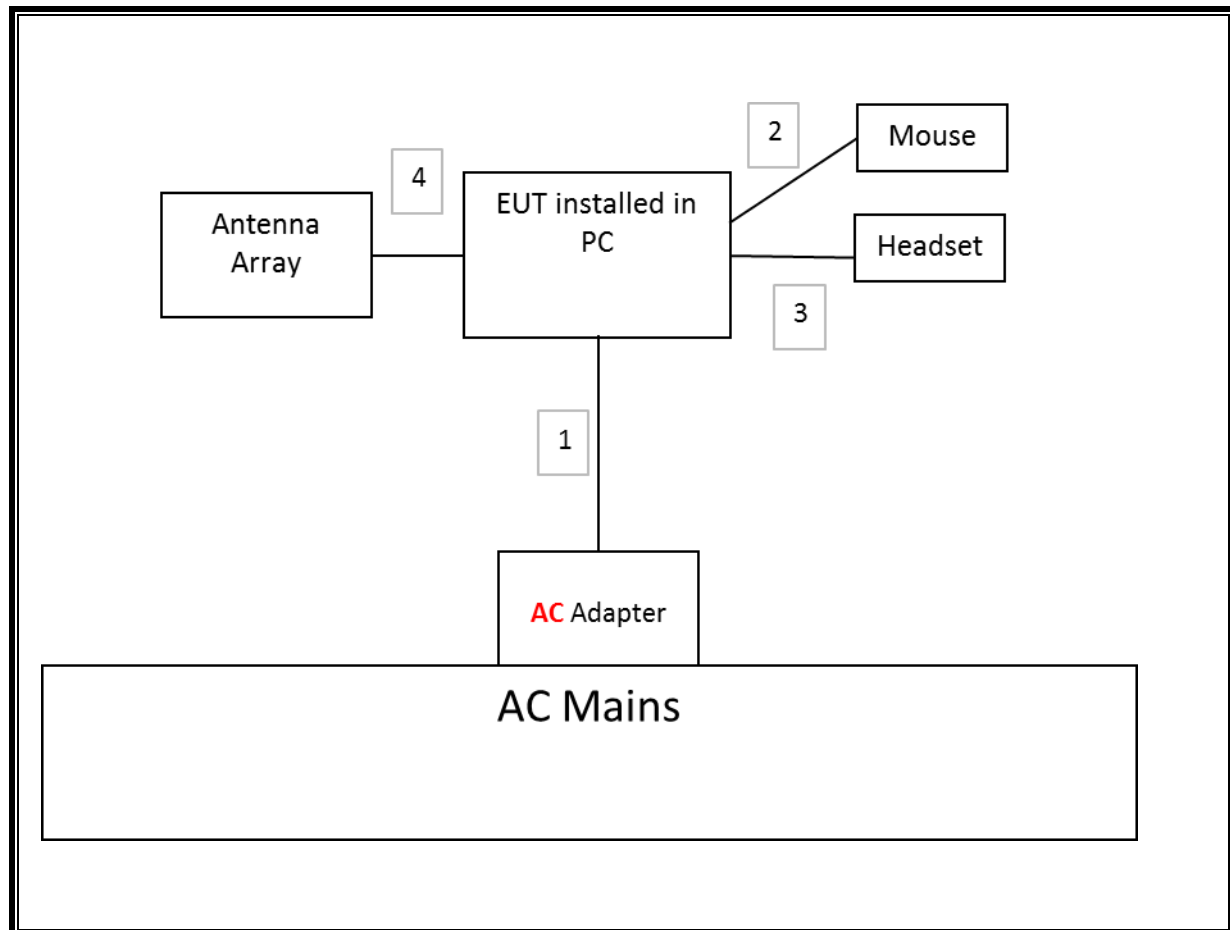
I/O CABLES

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.

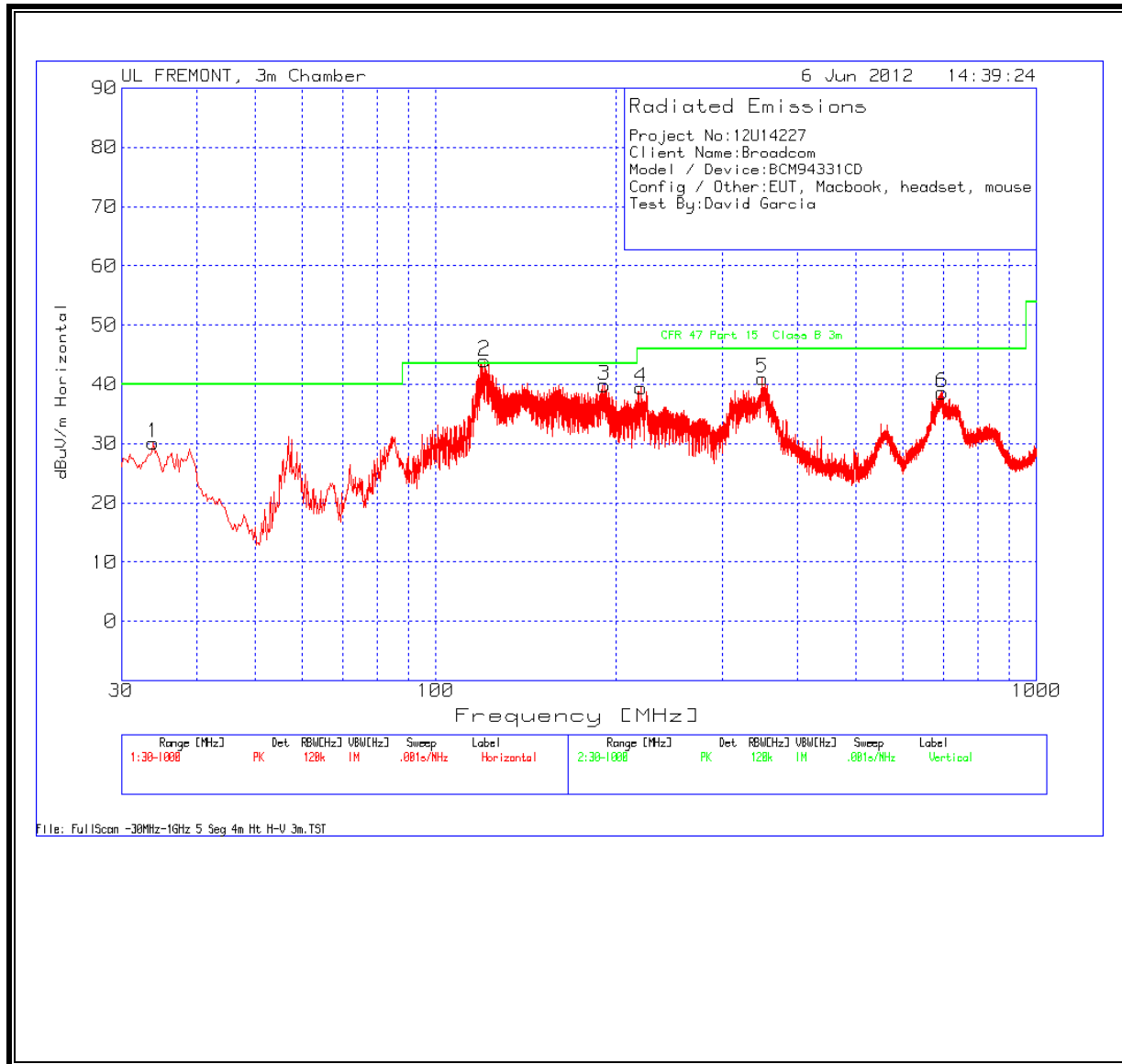
LIMIT

§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:

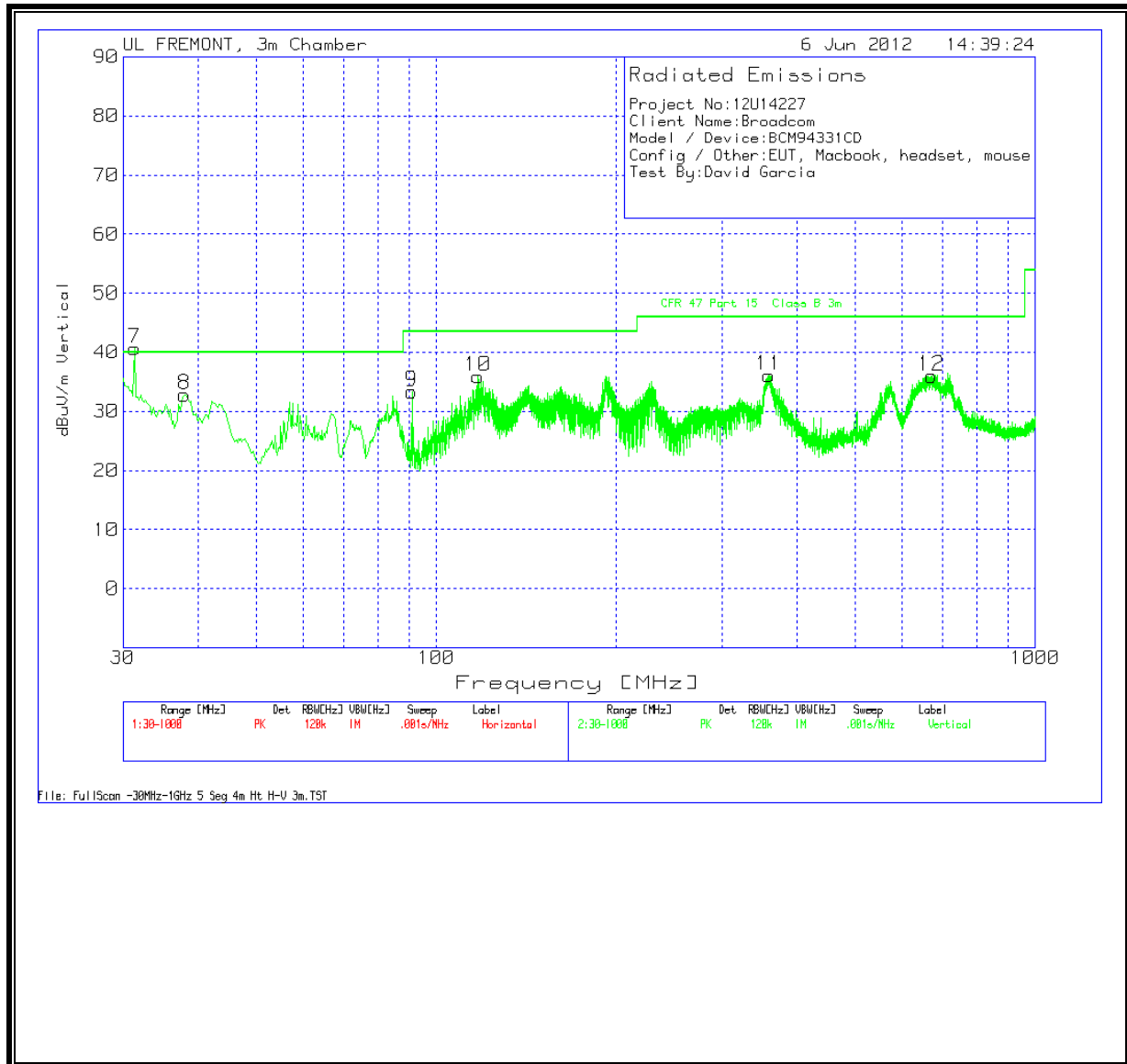
Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54
Note: The lower limit shall apply at the transition frequency.	

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(μV)	Detector	Chambr 3m Amplified dB	Antenna T185 dB	Corrected dB(μV/m)	Class B 3m limit dB(μV/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]	dBμV	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

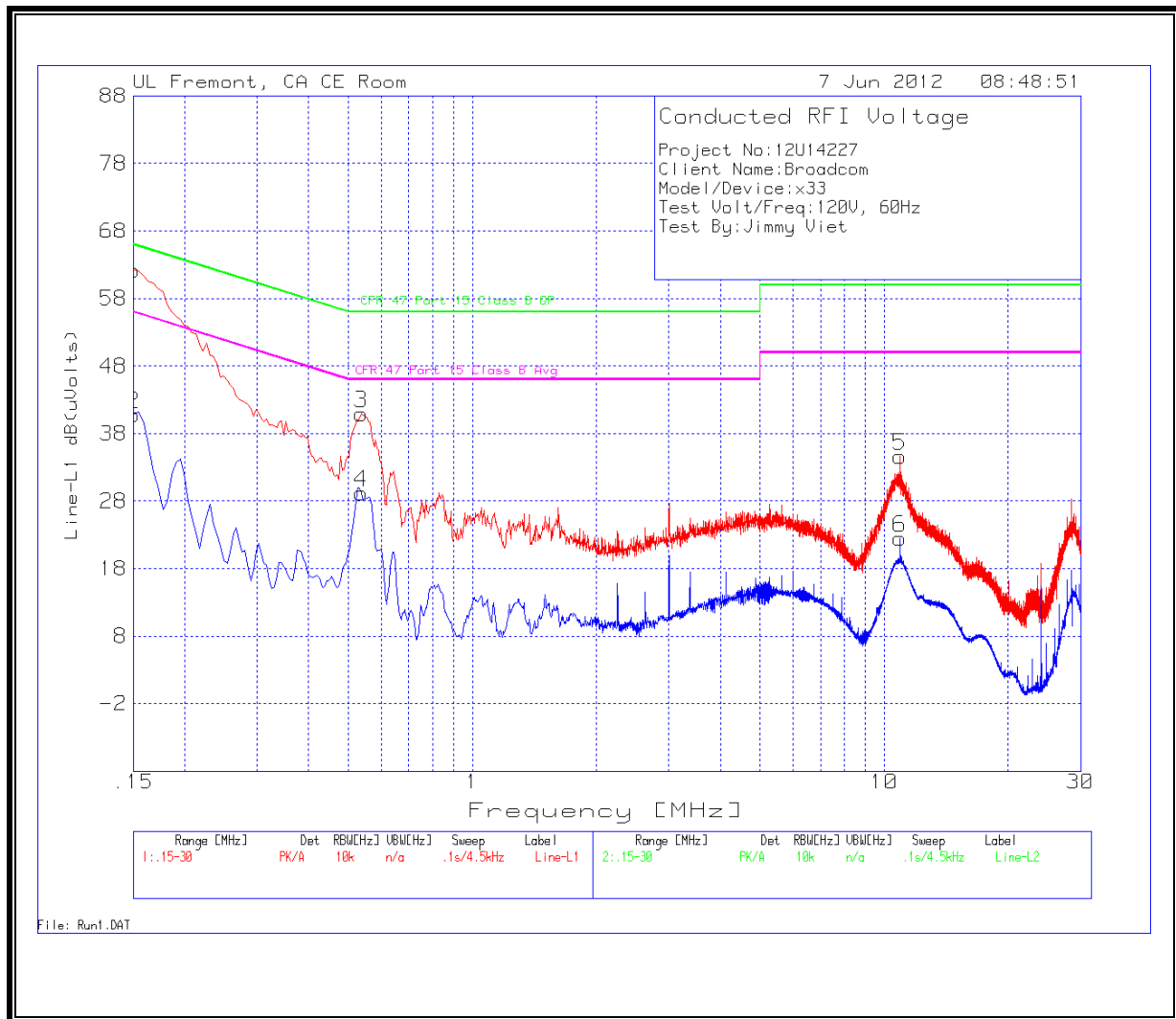
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT [dB]	LC Cables 1&3.TXT [dB]	dBμV	Class B QP	Margin	Class B Av	Margin
0.164	54.87	PK	0.1	0	54.97	65.3	-10.33	-	-
0.164	35.78	Av	0.1	0	35.88	-	-	55.3	-19.42
4.232	36.83	PK	0.1	0.1	37.03	56	-18.97	-	-
4.232	19.17	Av	0.1	0.1	19.37	-	-	46	-26.63
12.539	41.39	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

