



FCC 47 CFR PART 15 SUBPART B

CERTIFICATION TEST REPORT

FOR

802.11a/b/g/n/ac 3X3 WLAN + Bluetooth Combo PCI-E Mini Card

MODEL NUMBER: BCM94360CS

FCC ID: QDS-BRCM1069

IC: 4324A-BRCM1069

REPORT NUMBER: 12U14668-5

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Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	01/25/13	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/ac 3X3 WLAN + Bluetooth
Combo PCI-E Mini Card

MODEL: BCM94360CS

SERIAL NUMBER: C8Y2382001EF563E5

DATE TESTED: JANUARY 24, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass

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. 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. No part of this report may be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any government agency.

Approved & Released For UL CCS By:

Tested By:



STEVE LEITNER
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F. DE ANDA
PROJECT LEAD
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:

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

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 3x3 MIMO (with beam forming) WLAN + BT combo PCI-E Module.

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 (Mac Book Air) and the laptop connected with a USB mouse and a Headset as minimum configuration.

5.3. MODE(S) OF OPERATION

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

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 6.30.118.23.

The test utility software used during testing was BCM Internal, rev. 6.30.RC118.23.

5.5. MODIFICATIONS

No modifications were made during testing.

5.6. DETAILS OF TESTED SYSTEM

SUPPORT EQUIPMENT & PERIPHERALS

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	F8GSDR	Serial Number	FCC ID
Laptop	Apple	Mac Book Air A1465	C02JF8GSDRV6	DoC
AC Adapter	Lite-On	PA1450-8 NSW25804	C0623350GF4F6V7AR	N/A
USB Mouse	Microsoft	X80-7118-P1D 56180-576	4502	N/A
Headphone	LG	N/A	N/A	N/A

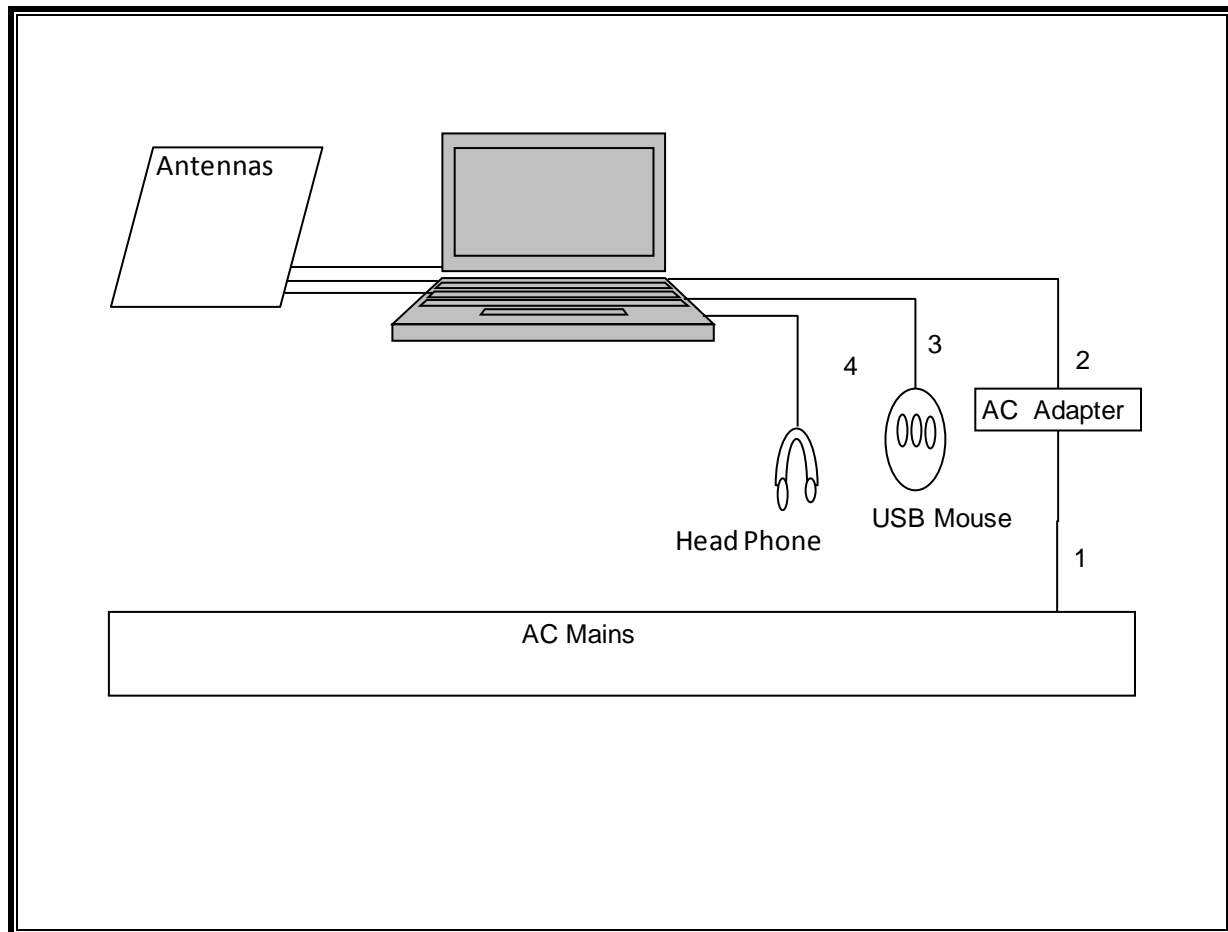
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	3 Prong	Unshielded	1.5 m	AC adapter
2	DC	1	MagSafe	Unshielded	1.5 m	AC adapter out
3	USB Mouse	1	USB	Shielded	1.0 m	Mouse
4	Headphone	1	Mini jack	Shielded	1.2 m	Headphone

TEST SETUP

The EUT was installed in the base of a laptop computer that was set up in a minimum configuration with a USB mouse and headset. External antennas were used. Test software exercised video and peripherals. Radio was not transmitting. The bottom cover was removed from the computer during testing in order to expose the EUT.

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
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	A121003	03/23/13
Preamplifier, 1300 MHz	Agilent / HP	8447D	2944A06589	01/16/14
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	MY48250925	11/21/13
LISN, 30 MHz	FCC	LISN-50/250-25-2	114	12/13/13
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	837990	03/07/13
EMI Test Receiver, 30 MHz	R & S	ESHS 20	827129/006	08/18/13

APPLICABLE LIMITS AND TEST RESULTS

6.1. RADIATED EMISSIONS

TEST PROCEDURE

ANSI C63.4

The highest clock frequency generated or used in the EUT for the digital portion was 20 MHz; therefore the frequency range was investigated from 30 MHz to 1000 MHz.

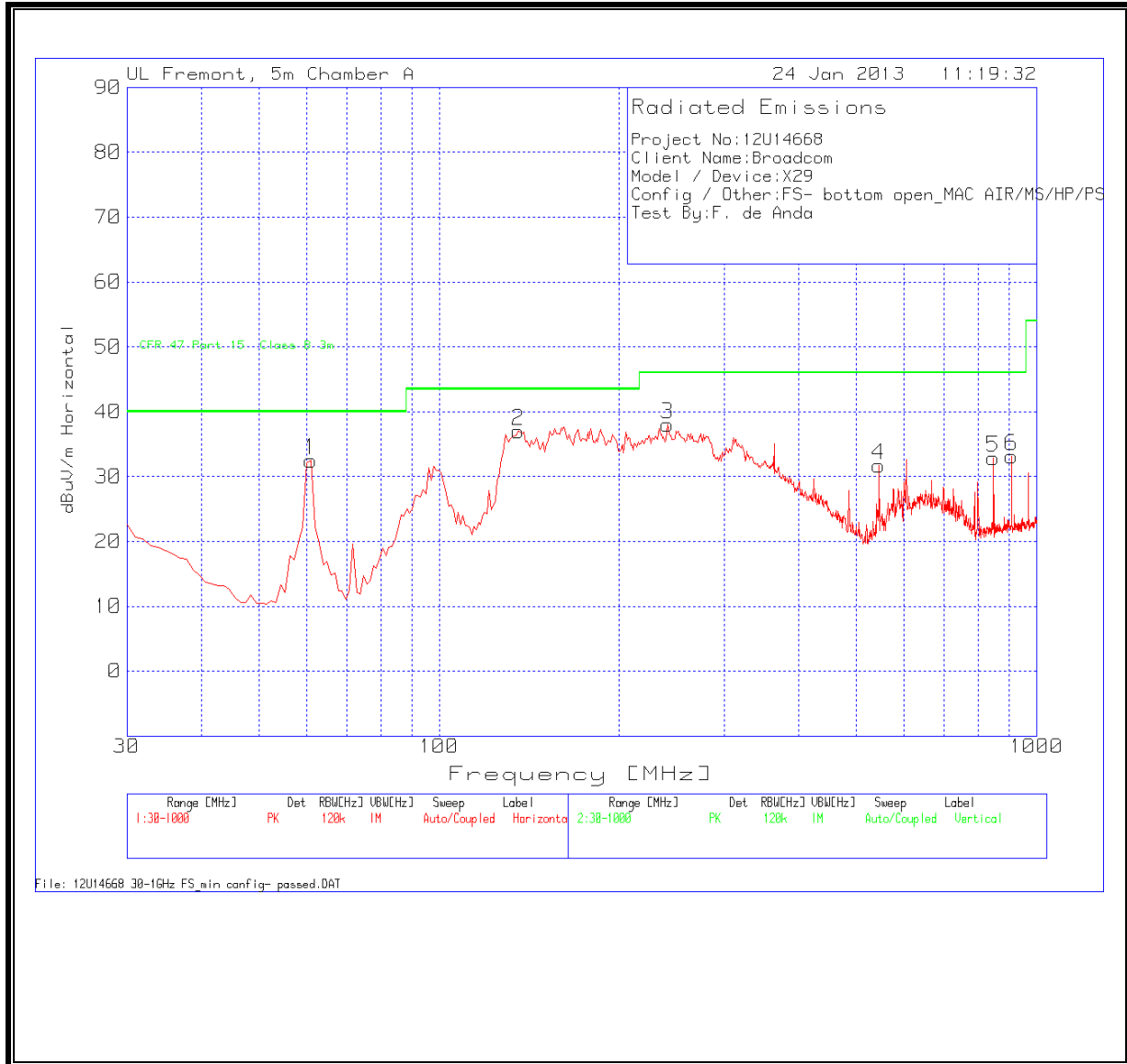
LIMIT

§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:

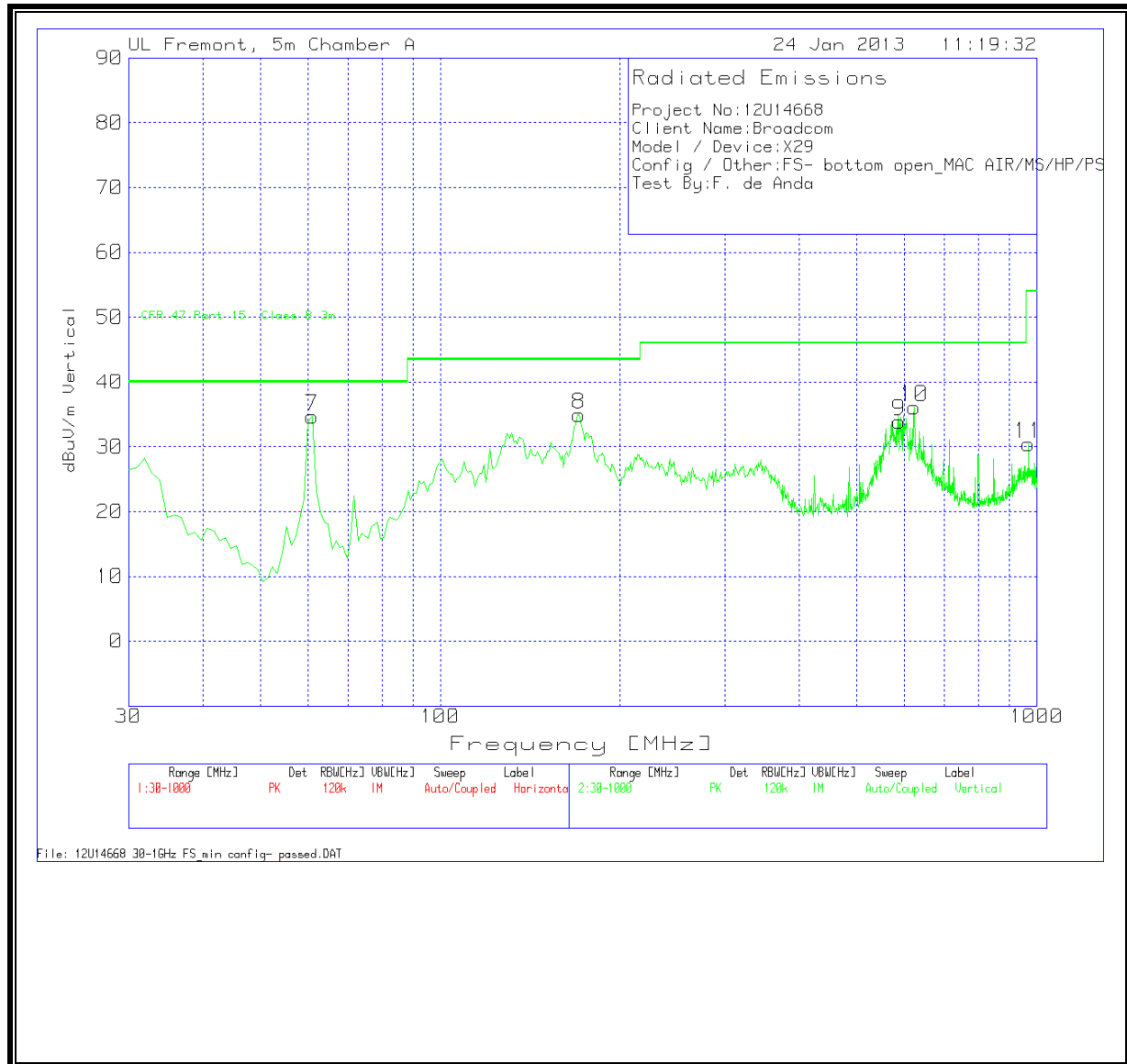
Limits for radiated disturbance of Class B ITE at measuring distance of 3 m	
Frequency range (MHz)	Quasi-peak limits (dB μ V/m)
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960 MHz	54
Note: The lower limit shall apply at the transition frequency.	

RESULTS

RADIATED EMISSIONS 30 TO 1000 MHz - HORIZONTAL



RADIATED EMISSIONS 30 TO 1000 MHz - VERTICAL



WORST EMISSIONS

HORIZONTAL AND VERTICAL DATA

Project No:12U14668										
Client Name:Broadcom										
Model / Device:BCM94360CS(X29) Module										
Config / Other:Laptop bottom open. MAC AIR/MouseS/HeadPhone and AC PS Supply										
Test By:F. de Anda										
Marker No.	Test Frequency MHz	Meter Reading dB	Detector	Antenna Factor dB	Amp Factor dB	Corrected dBμV/m	CFR 47 Part 15 Class B 3m	Margin dB	Height cm	Polarity
Horizontal 30 - 1000MHz										
1	61.04	53.32	PK	7.4	-28.2	32.52	40	-7.48	200	Horz
2	135.73	52.09	PK	13	-28.1	36.99	43.5	-6.51	200	Horz
3	241.46	54.62	PK	11.4	-28	38.02	46	-7.98	100	Horz
4	545.07	41.3	PK	17.8	-27.4	31.7	46	-14.3	200	Horz
5	847.71	38.63	PK	21.5	-27.2	32.93	46	-13.07	100	Horz
6	908.82	38.45	PK	22	-27.3	33.15	46	-12.85	100	Horz
Vertical 30 - 1000MHz										
7	61.04	55.5	PK	7.4	-28.2	34.7	40	-5.3	100	Vert
8	170.65	51.33	PK	11.6	-28	34.93	43.5	-8.57	100	Vert
9	588.72	42.51	PK	18.5	-27.1	33.91	46	-12.09	100	Vert
10	623.64	44.22	PK	18.9	-27	36.12	46	-9.88	100	Vert
11	968.96	35.49	PK	22.4	-27.5	30.39	54	-23.61	100	Vert
PK - Peak detector										
QP - Quasi-Peak detector										

6.2. AC MAINS LINE CONDUCTED EMISSIONS

TEST PROCEDURE

ANSI C63.4

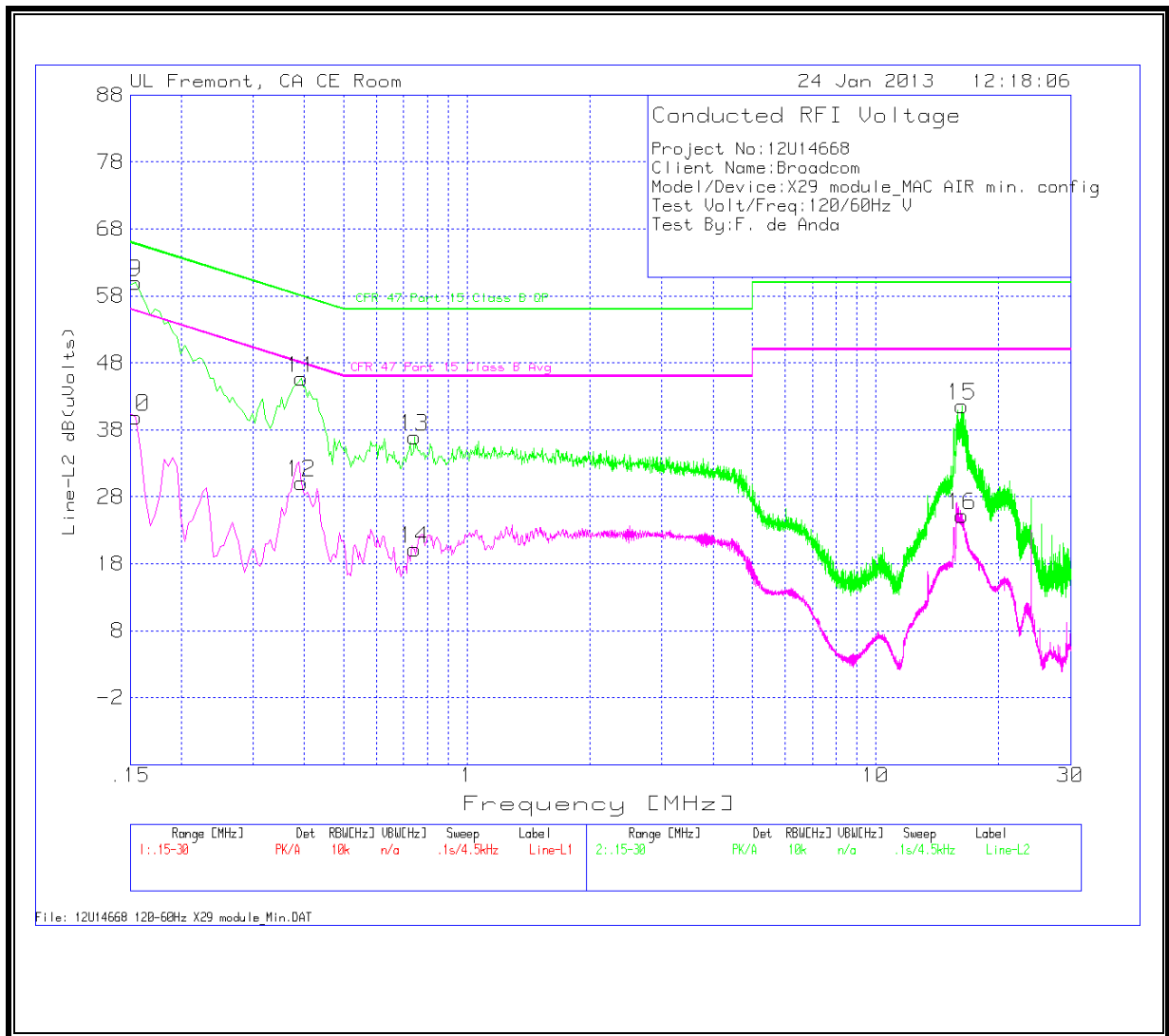
LIMIT

§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 2 RESULTS



WORST EMISSIONS

HORIZONTAL AND VERTICAL DATA

Project No:12U14668									
Client Name:Broadcom									
Model / Device:BCM94360CS(X29) Module									
Config / Other:Laptop bottom open. MAC AIR/MouseS/HeadPhone and AC PS Supply									
Test Volt/Freq:120/60Hz V									
Test By:F. de Anda									
Test Frequency MHz	Meter Reading dB	Detector	LISN dB	Cables Loss dB	Corrected dB(μVolts)	CFR 47 Part 15 Class B QP	Margin dB	CFR 47 Part 15 Class B Avg	Margin dB
Line-L1 .15 - 30MHz									
0.151	57.05	QP	0.1	0	57.15	65.94	-8.79	-	-
0.15	35.28	Av	0.1	0	35.38	-	-	56	-20.62
0.4155	44.38	PK	0.1	0	44.48	57.5	-13.02	-	-
0.4155	28.24	Av	0.1	0	28.34	-	-	47.5	-19.16
4.6185	34.41	PK	0.1	0.1	34.61	56	-21.39	-	-
4.6185	23.62	Av	0.1	0.1	23.82	-	-	46	-22.18
16.179	43.47	PK	0.2	0.2	43.87	60	-16.13	-	-
16.179	29.97	Av	0.2	0.2	30.37	-	-	50	-19.63
Line-L2 .15 - 30MHz									
0.1545	59.9	PK	0.1	0	60	65.8	-5.8	-	-
0.1545	39.76	Av	0.1	0	39.86	-	-	55.8	-15.94
0.393	45.55	PK	0.1	0	45.65	58	-12.35	-	-
0.393	30.05	Av	0.1	0	30.15	-	-	48	-17.85
0.744	36.84	PK	0.1	0	36.94	56	-19.06	-	-
0.744	20.05	Av	0.1	0	20.15	-	-	46	-25.85
16.269	41.2	PK	0.2	0.2	41.6	60	-18.4	-	-
16.269	24.82	Av	0.2	0.2	25.22	-	-	50	-24.78
PK - Peak detector									
Av - Average detector									