



**FCC CFR47 PART 15 SUBPART B**

**DECLARATION OF CONFORMITY TEST REPORT**

**FOR**

**802.11ag/DRAFT 802.11n WLAN + BLUETOOTH PCI-E MINICARD**

**MODEL NUMBER: BCM943224PCIEBT**

**REPORT NUMBER: 09U12658-10**

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**NVLAP LAB CODE 200065-0**

Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
--	08/07/09	Initial Issue	F. Ibrahim

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# 1. ATTESTATION OF TEST RESULTS

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

**EUT DESCRIPTION:** 802.11ag/DRAFT 802.11n WLAN + BLUETOOTH  
 PCI-E MINICARD

**MODEL:** BCM943224PCIEBT

**SERIAL NUMBER:** 7C92500A9A6GE

**DATE TESTED:** JULY 22 and AUGUST 03, 2009

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	Pass

Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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 CCS By:

Tested By:




FRANK IBRAHIM  
 EMC SUPERVISOR  
 COMPLIANCE CERTIFICATION SERVICES

DOUG ANDERSON  
 EMC ENGINEER  
 COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

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:

$$\text{Field Strength (dBuV/m)} = \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)} - \text{Preamp Gain (dB)}$$

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

### 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 a 802.11a/b/n WLAN plus Bluetooth 2.1 PCI-E mini-card radio module

#### GENERAL INFORMATION

Power Requirements	100-240 VAC / 50-60 Hz
List of frequencies generated or used by the EUT	20 MHz

### 5.2. TEST CONFIGURATIONS

The following configurations were investigated during preliminary testing:

EUT Configuration	Description
Typical Configuration	EUT installed inside a host laptop PC

### 5.3. MODE(S) OF OPERATION

Mode	Description
Worst Case Tx	Continuous transmit on the low channel of the 2.4GHz band at 20MHz bandwidth.

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.10.112.0.

The test utility software used during testing was wl\_tool, rev. 5.10 RC112.0.

The test utility software used during testing was EU\_batchfiles2.4GHz.

### 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	Serial Number	FCC ID
Notebook PC	Dell	Inspiron 1526	CN-0SE2C4-70166-77Q-04V6	DoC
AC Adapter 1	Delta Electronics	DA65NS0-00	CN-0CF745-48661-741-2P2E	DoC
Printer	HP	7850	MY56K1304B	DoC
AC Adapter 3	HP	0951-2084	5715480604	DoC
Mouse	Logitech	M-UK DELS	HC7030C0C86	DoC

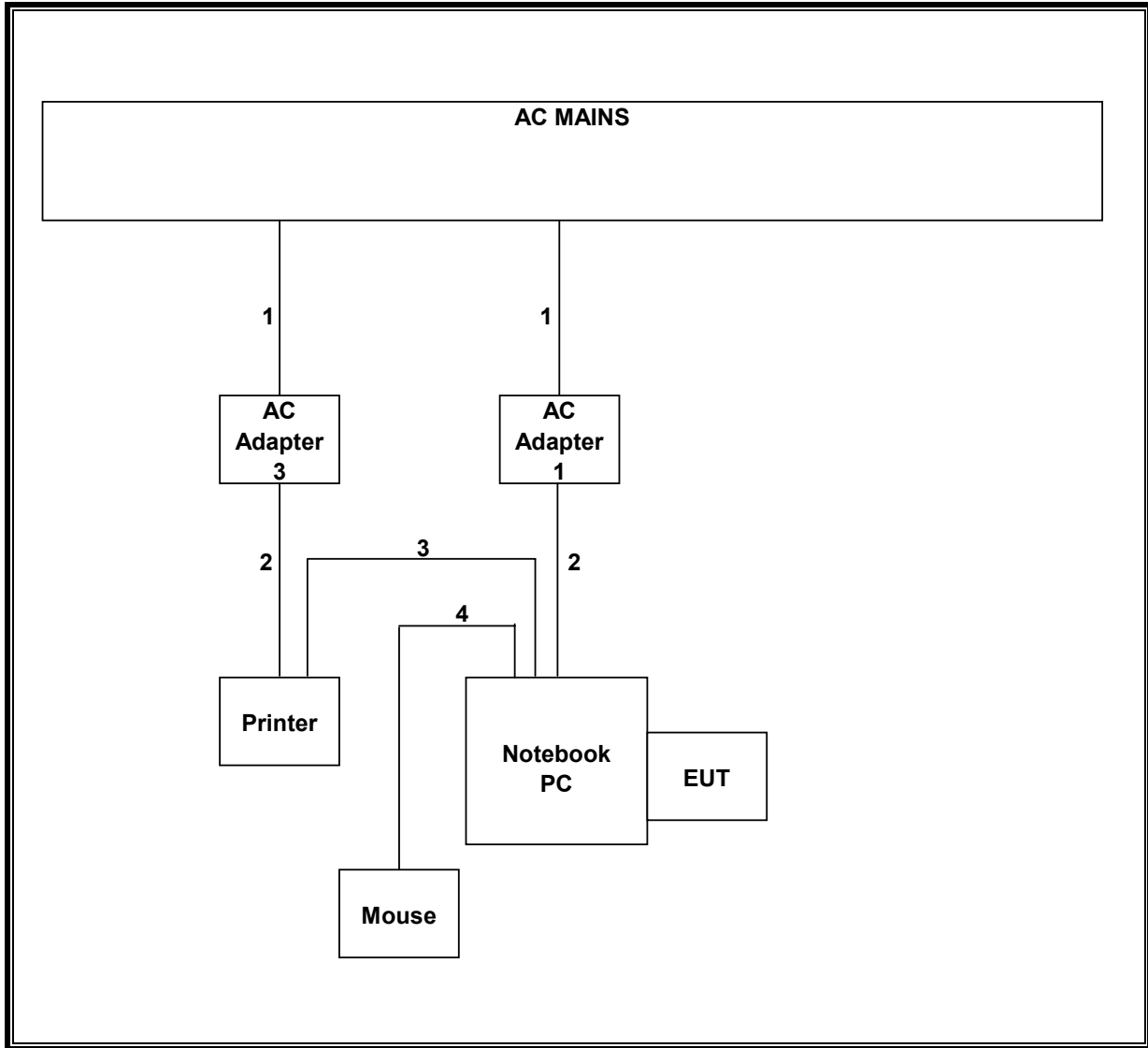
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC Input	2	N. America	Un-Shielded	1.5m	
2	DC Input	2	Mini-Jack	Un-Shielded	2m	
3	USB	1	USB	Shielded	2m	
4	USB	1	USB	Shielded	1.5m	

### TEST SETUP

The EUT is installed in a typical configuration. Test software exercised 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	Asset Number	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	01/14/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/09
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/09
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	10/29/09

## 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 is 20 MHz, therefore the frequency range was investigated from 30 MHz to 1000 MHz.

#### LIMIT

§15.109 (g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment—Radio Disturbance Characteristics—Limits and Methods of Measurement" (incorporated by reference, see §15.38). In addition:

- (1) The test procedure and other requirements specified in this part shall continue to apply to digital devices.
- (2) If, in accordance with §15.33 of this part, measurements must be performed above 1000 MHz, compliance above 1000 MHz shall be demonstrated with the emission limit in paragraph (a) or (b) of this section, as appropriate. Measurements above 1000 MHz may be performed at the distance specified in the CISPR 22 publications for measurements below 1000 MHz provided the limits in paragraphs (a) and (b) of this section are extrapolated to the new measurement distance using an inverse linear distance extrapolation factor (20 dB/decade), e.g., the radiated limit above 1000 MHz for a Class B digital device is 150  $\mu\text{V}/\text{m}$ , as measured at a distance of 10 meters.
- (3) The measurement distances shown in CISPR Pub. 22, including measurements made in accordance with this paragraph above 1000 MHz, are considered, for the purpose of §15.31(f)(4) of this part, to be the measurement distances specified in this part.
- (4) If the radiated emissions are measured to demonstrate compliance with the alternative standards in this paragraph, compliance must also be demonstrated with the conducted limits shown in §15.107(e).

Limits for radiated disturbance of Class B ITE at measuring distance of 10 m	
Frequency range (MHz)	Quasi-peak limits (dB $\mu\text{V}/\text{m}$ )
30 to 230	30
230 to 1000	37

Note: The lower limit shall apply at the transition frequency.

**RESULTS**

**7.1.1. RADIATED EMISSIONS 30 to 1000 MHz**

**RADIATED EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)**

TABULATED DATA															
30-1000MHz Frequency Measurement															
Compliance Certification Services, Fremont 5m Chamber															
Test Engr: Doug Anderson															
Date: 08/03/09															
Project #: 09U12658															
Company: Broadcom															
EUT Description: 802.11a/b/n WLAN + BT 2.1 PCI-E Minicard															
EUT M/N: BCM943224PCIEBT															
Test Target: EN55022 Class B															
Mode Oper: Continuous Tx: HT20 Low Channel															
f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit										
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters												
Read	Analyzer Reading	Filter	Filter Insert Loss												
AF	Antenna Factor	Corr.	Calculated Field Strength												
CL	Cable Loss	Limit	Field Strength Limit												
f	Dist	Read	AF	CL	Amp	D Corr	Filter	Corr.	Limit	Margin	Ant. Pol	Det.	Ant. High	Table Angle	Notes
MHz	(m)	dBuV	dB/m	dB	dB	dB	dB	dBuV/m	dBuV/m	dB	V/H	P/A/QP	cm	Degree	
<b>Continuous Tx: Horizontal</b>															
129.364	3.0	49.8	13.6	1.1	28.3	-10.5	0.0	25.7	30.0	-4.3	H	P	100.0	358.7	
240.009	3.0	56.8	11.8	1.3	28.2	-10.5	0.0	31.3	37.0	-5.7	H	P	104.7	360.0	
624.024	3.0	48.3	18.7	2.3	27.4	-10.5	0.0	31.4	37.0	-5.6	H	P	110.6	2.4	
642.145	3.0	48.8	18.9	2.3	27.4	-10.5	0.0	32.2	37.0	-4.8	H	P	112.0	360.0	
680.307	3.0	48.5	19.4	2.4	27.3	-10.5	0.0	32.5	37.0	-4.5	H	P	103.0	13.3	
845.794	3.0	46.2	21.4	2.7	27.6	-10.5	0.0	32.2	37.0	-4.8	H	P	107.4	352.7	
<b>Continuous Tx: Vertical</b>															
336.013	3.0	53.8	14.0	1.6	28.1	-10.5	0.0	30.8	37.0	-6.2	V	P	101.7	2.8	
400.935	3.0	54.7	14.9	1.8	28.1	-10.5	0.0	32.9	37.0	-4.1	V	P	115.0	353.7	
501.259	3.0	49.3	16.8	2.0	27.8	-10.5	0.0	29.8	37.0	-7.2	V	P	108.6	360.0	
598.583	3.0	47.5	18.4	2.2	27.5	-10.5	0.0	30.1	37.0	-6.9	V	P	102.3	2.1	
601.464	3.0	48.8	18.4	2.2	27.5	-10.5	0.0	31.5	37.0	-5.5	V	P	100.0	11.3	
624.024	3.0	47.4	18.7	2.3	27.4	-10.5	0.0	30.5	37.0	-6.5	V	P	100.0	0.0	
Rev. 1.27.09															
Note: No other emissions were detected above the system noise floor.															

## 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  $\mu$ 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 $\mu$ 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:

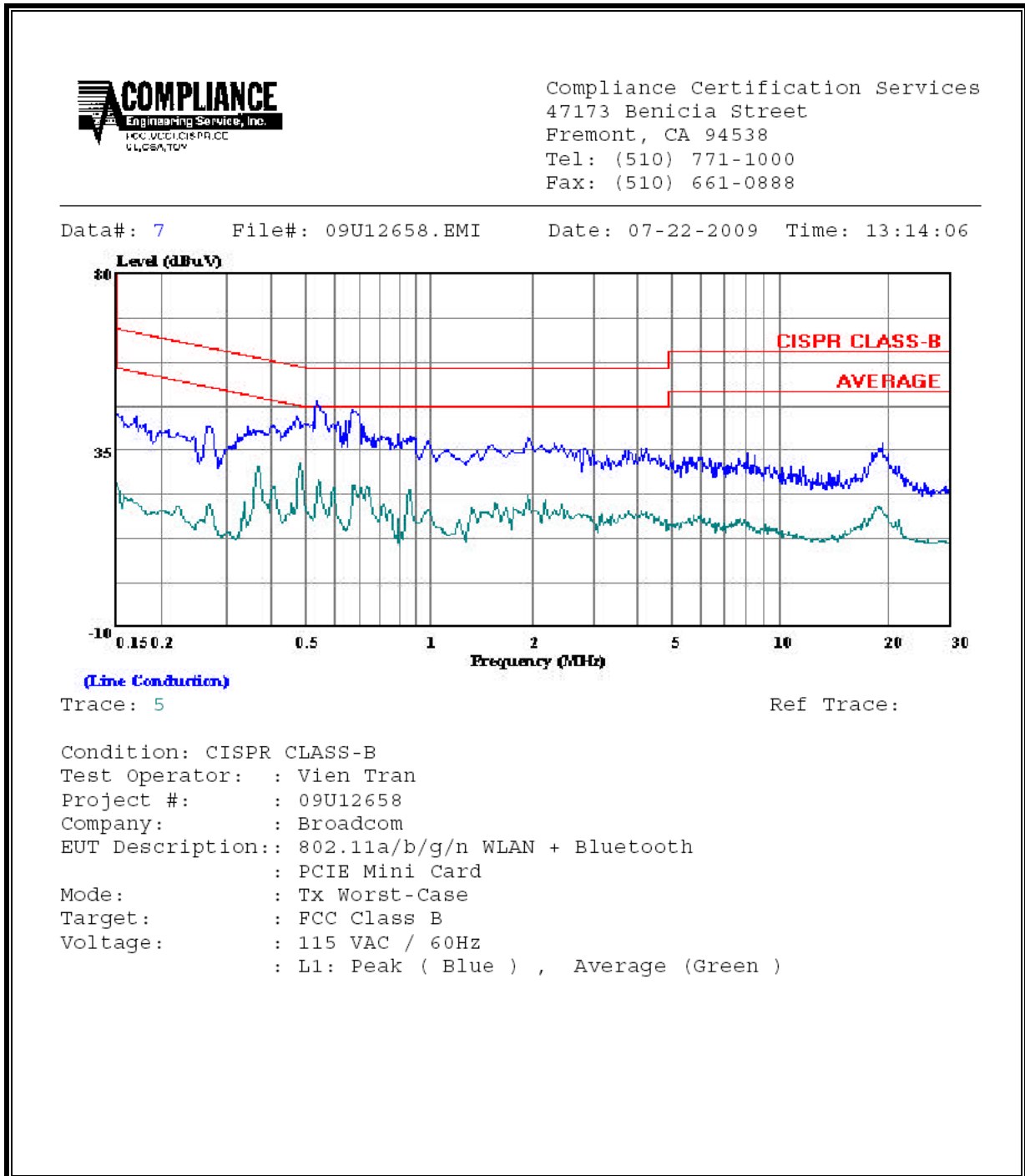
1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

**RESULTS**

**6 WORST EMISSIONS**

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq. (MHz)	Reading			Class (dB)	Limit QP	EN B AV	Margin		Remark L1 / L2
	PK (dBuV)	QP (dBuV)	AV (dBuV)				QP (dB)	AV (dB)	
0.37	41.31	--	30.48	0.00	58.61	48.61	-17.30	-18.13	L1
5.32	47.77	--	31.51	0.00	60.00	50.00	-12.23	-18.49	L1
19.33	36.67	--	20.50	0.00	60.00	50.00	-23.33	-29.50	L1
0.37	43.52	--	31.21	0.00	58.61	48.61	-15.09	-17.40	L2
0.48	45.24	--	32.02	0.00	56.27	46.27	-11.03	-14.25	L2
19.33	32.95	--	20.87	0.00	60.00	50.00	-27.05	-29.13	L2
6 Worst Data									

**LINE 1 RESULTS**

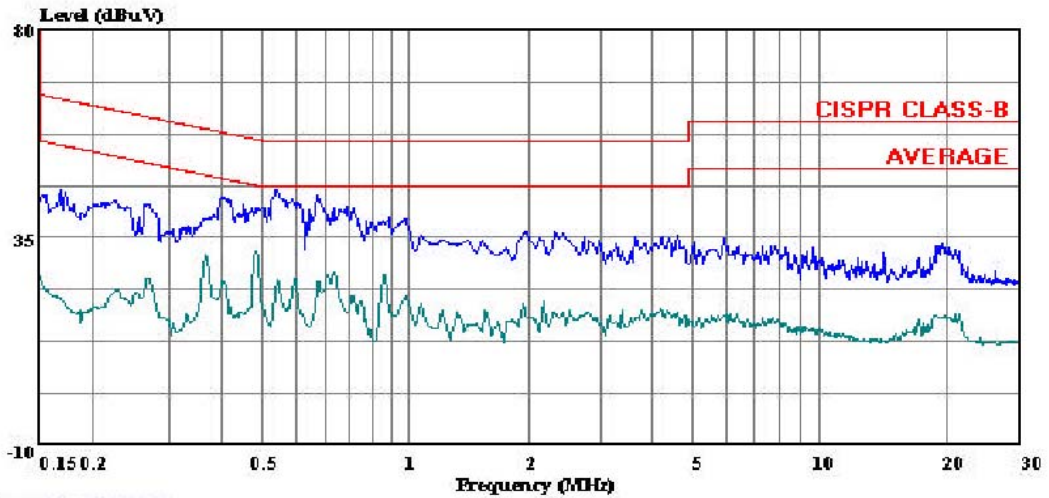


**LINE 2 RESULTS**



Compliance Certification Services  
 47173 Benicia Street  
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 Tel: (510) 771-1000  
 Fax: (510) 661-0888

Data#: 14 File#: 09U12658.EMI Date: 07-22-2009 Time: 13:22:50



(Line Conduction)

Trace: 12

Ref Trace:

Condition: CISPR CLASS-B  
 Test Operator: : Vien Tran  
 Project #: : 09U12658  
 Company: : Broadcom  
 EUT Description: : 802.11a/b/g/n WLAN + Bluetooth  
 : PCIE Mini Card  
 Mode: : Tx Worst-Case  
 Target: : FCC Class B  
 Voltage: : 115 VAC / 60Hz  
 : L2: Peak ( Blue ) , Average (Green )