



FCC 47 CFR PART 15 SUBPART B
DECLARATION OF CONFORMITY TEST REPORT
FOR
BROADCOM 802.11a/b/g/n WLAN + BLUETOOTH PCI-E MINI CARD

MODEL NUMBER: BCM943228HMB

REPORT NUMBER: 11U13795-4

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Revision History

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: BROADCOM 802.11a/b/g/n WLAN + BLUETOOTH PCI-E MINI CARD

MODEL: BCM943228HMB

SERIAL NUMBER: DEV-01089P305

DATE TESTED: MAY 16 –JUNE 3, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 15 SUBPART B	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.

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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 Mini Card manufactured by Broadcom.

GENERAL INFORMATION

Power Requirements	3.3 VDC
List of frequencies generated or used by the EUT	20 MHz

5.2. PRELIMINARY TEST CONFIGURATIONS

The following configurations were investigated during preliminary testing:

EUT Configuration	Description
Typical Configuration	EUT connected to laptop via extender board with minimum configuration such as printer & USB mouse.

5.3. MODE(S) OF OPERATION

Mode	Description
EMC Test & 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. 5.100.82.54.

The test utility software used during testing was BCM Internal, rev. 5.100.RC82.54.

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
Laptop	Lenovo	4446-38U	R8-CAD03	DoC
AC Adapter	Lenovo	ADP-65YB	11S42T4458Z1F4	DoC
Adapter Board	Broadcom	BRCM05	N/A	N/A
USB Printer	Microline 186	D22300A	AE5A048148A0	DoC
USB Mouse	Dell	M-UK Del 3	HC6450G18J1	DoC

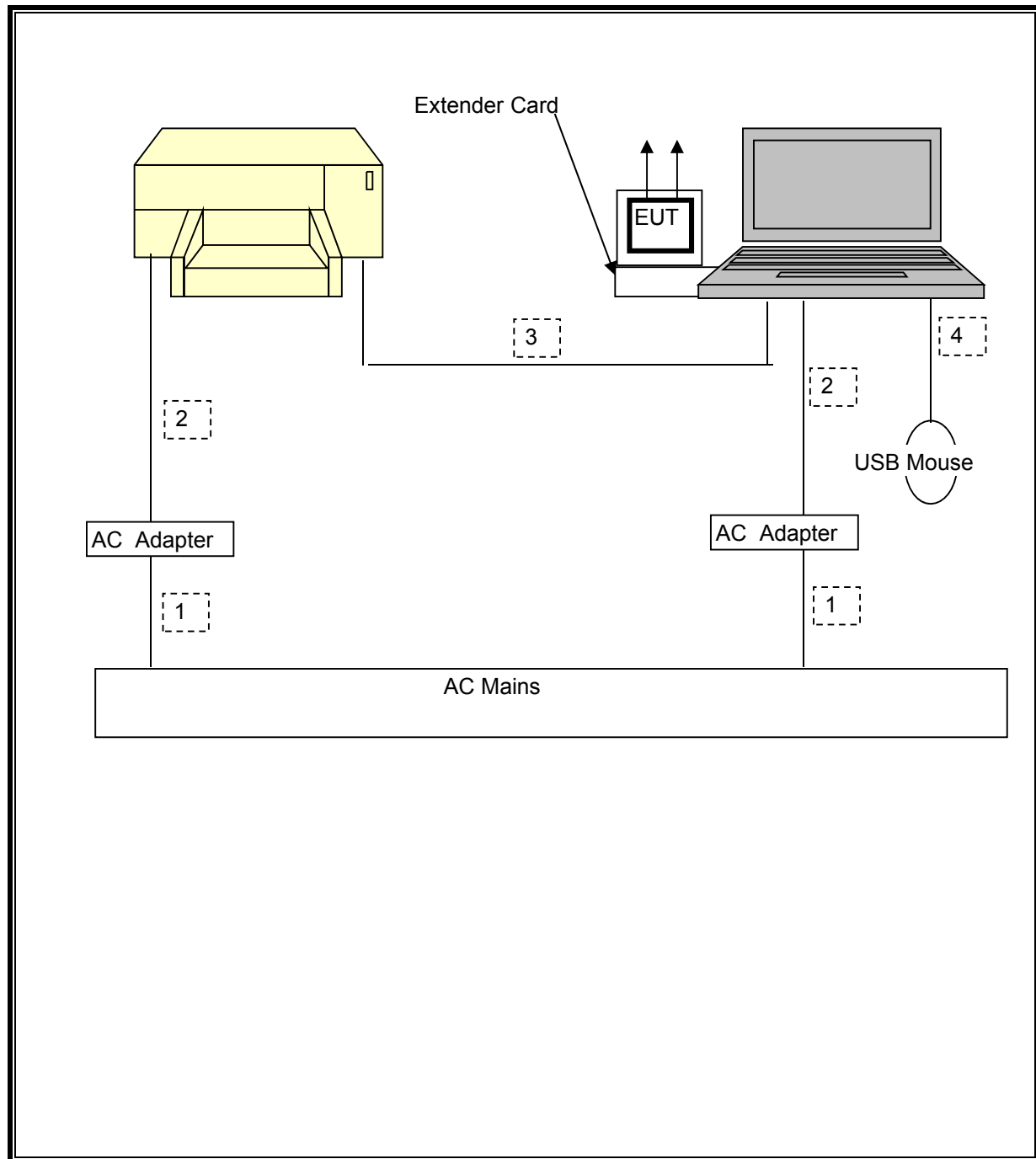
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Shielded	1.5 m	Not available
2	DC	1	DC	Unshielded	1.5 m	Ferrite at laptop end
3	USB	1	USB	Unshielded	2.0 m	Bundled
4	USB	1	USB	Unshielded	2.0 m	USB Mouse

TEST SETUP

The EUT was attached to a jig board which is installed in the Mini PCI Express 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	Asset	Cal Due
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	10/29/11
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	07/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00872	07/29/11
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	07/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	01/26/12
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	08/04/11
Peak Power Meter	Agilent / HP	E9327A	C00964	12/04/11
Peak Power Sensor	Agilent / HP	E4416A	C00963	12/04/11
EMI Receiver, 6.5 GHz	Agilent / HP	8546A	1963	08/19/11
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRM50702	N02685	CNR
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	05/06/12
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	06/05/11

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 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

HORIZONTAL AND VERTICAL DATA

30-1000 MHz HORIZONTAL											
Test Frequency	Meter Reading	Detector	3m below 1GHz Cable.TX T [dB]	3m T15 PreAmp below 1GHz.TX T [dB]	3m Bilog T185 below 1GHz.TX T [dB]	10m to 3m Conversion [dB]	dB[uVolt s/meter]	CFR 47 Part 15 Class B 10m	Margin	Height [cm]	Polarity
64.9317	52.94	QP	0.9	-28.2	8.1	-10.5	23.24	29.6	-6.36	138	Horz
98.1283	52.19	QP	1	-28.1	9	-10.5	23.59	33.1	-9.51	168	Horz
143.1853	42.2	QP	1.2	-27.9	13	-10.5	18	33.1	-15.1	201	Horz
182.5837	48.76	PK	1.5	-27.5	11.8	-10.5	22.76	33.1	-10.34	99	Horz
240.2398	53.66	PK	2.1	-28.1	15.6	-10.5	29.06	35.6	-6.54	99	Horz
299.6669	52.54	PK	2.2	-28.5	16.8	-10.5	30.04	35.6	-5.56	99	Horz
499.8001	50.1	PK	3.3	-27.3	22.7	-10.5	30.1	35.6	-5.5	151	Horz
699.4004	46.93	PK	0.6	-28.3	17.2	-10.5	29.73	35.6	-5.87	99	Horz
597.6016	47.35	PK	0.8	-28.2	8.6	-10.5	29.35	35.6	-6.25	99	Horz
30-1000 MHz VERTICAL											
Test Frequency	Meter Reading	Detector	3m below 1GHz Cable.TX T [dB]	3m T15 PreAmp below 1GHz.TX T [dB]	3m Bilog T185 below 1GHz.TX T [dB]	10m to 3m Conversion [dB]	dB[uVolt s/meter]	CFR 47 Part 15 Class B 10m	Margin	Height [cm]	Polarity
35.6922	45.37	PK	0.8	-28.2	8.2	-10.5	24.27	29.6	-5.33	100	Vert
57.6962	53.89	PK	0.9	-28.1	8.2	-10.5	24.19	29.6	-5.41	100	Vert
99.8351	53.74	PK	1	-28.1	9.3	-10.5	25.44	33.1	-7.66	100	Vert
144.013	46.48	PK	1.4	-27.7	11.9	-10.5	22.18	33.1	-10.92	100	Vert
230.3797	50.74	PK	2.1	-27.9	15	-10.5	26.04	35.6	-9.56	251	Vert
498.7342	49.46	PK	2.1	-28.1	15.6	-10.5	29.46	35.6	-6.14	151	Vert
597.6016	47.13	PK	3.1	-27.7	22	-10.5	29.13	35.6	-6.47	101	Vert
697.002	45.18	PK	3.3	-27.3	22.7	-10.5	27.98	35.6	-7.62	101	Vert
899.0007	43.24	PK	3.2	-27.7	22.1	-10.5	30.34	35.6	-5.26	101	Vert

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-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	LISN [dB]	Conducted Emission Cable [dB]	dB[uVolts]	Class B QP Limit	Margin	Class B Avg Limit	Margin
0.195	46.84	PK	0	0	46.84	63.8	-16.96	53.8	-6.96
0.195	34.56	Av	0	0	34.56	63.8	-29.24	53.8	-19.24
0.5865	34.25	PK	0	0	34.25	56	-21.75	46	-11.75
0.5865	29.01	Av	0	0	29.01	56	-26.99	46	-16.99
4.749	32.05	PK	0	0	32.05	56	-23.95	46	-13.95
4.749	22.87	Av	0	0	22.87	56	-33.13	46	-23.13
Line-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	LISN [dB]	Conducted Emission Cable [dB]	dB[uVolts]	Class B QP Limit	Margin	Class B Avg Limit	Margin
0.195	48.51	PK	0	0	48.51	63.8	-15.29	53.8	-5.29
0.195	35.39	Av	0	0	35.39	63.8	-28.41	53.8	-18.41
0.5235	35.05	PK	0	0	35.05	56	-20.95	46	-10.95
0.5235	24.28	Av	0	0	24.28	56	-31.72	46	-21.72
4.749	35.15	PK	0	0	35.15	56	-20.85	46	-10.85
4.749	19.59	Av	0	0	19.59	56	-36.41	46	-26.41

LINE 1 RESULTS

