FCC Part 1 Subpart I
FCC Part 2 Subpart J

RF EXPOSURE REPORT

802.11a/b/g/n WLAN PCI-E Mini Card

MODEL NUMBER: BCM943228HM4L

FCC ID: QDS- BRCM1054

REPORT NUMBER: 15U21619- E2V2

ISSUE DATE: FEBRUARY 16, 2016

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2/9/16	Initial Issue	H. Mustapha
V2	2/16/16	Updated antenna gain for 5.8 GHz band in section 6	H. Mustapha

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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 PCI-E Mini Card

MODEL: BCM943228HM4L

SERIAL NUMBER: Radiated and Conducted ID: 2202015196-04

DATE TESTED: JANUARY 20 – 28, 2016
                          NOVEMBER 19 – DECEMBER 1, 2010

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 1 SUBPART I & PART 2 SUBPART J	Pass

UL Verification Services Inc. calculated the RF Exposure of the above equipment in accordance with the requirements set forth in the above standards, using test results reported in the test report documents referenced below and/or documentation furnished by the applicant. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations of these calculations. The results show that the equipment 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 Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. 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 Verification Services Inc. By: Calculated By:

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PROJECT LEAD   WISE LAB TECHNICIAN
UL Verification Services Inc.   UL Verification Services Inc.

_____

FRANK IBRAHIM
PROGRAM MANAGER
UL Verification Services Inc.

2. TEST METHODOLOGY

All calculations were made in accordance with FCC OET Bulletin 65 Edition 97-01.

3. REFERENCES

All measurements were made as documented in test report UL Verification Services Inc. Document 10U13394-1 for operation in the 2.4 GHz band and UL Verification Services Inc. Document15U22568-E1V2 for operation in the 5 GHz bands.

Output power, Duty cycle and Antenna gain data is excerpted from the applicable test reports.

4. FACILITIES AND ACCREDITATION

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

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

5. MAXIMUM PERMISSIBLE RF EXPOSURE

5.1. FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density
NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

5.2.   EQUATIONS

POWER DENSITY

Power density is given by:

$$S = EIRP / (4 * Pi * D^2)$$

Where

S = Power density in mW/cm^2
EIRP = Equivalent Isotropic Radiated Power in mW
D = Separation distance in cm

Power density in units of mW/cm^2 is converted to units of W/m^2 by multiplying by 10.

DISTANCE

Distance is given by:

$$D = SQRT (EIRP / (4 * Pi * S))$$

Where

D = Separation distance in cm
EIRP = Equivalent Isotropic Radiated Power in mW
S = Power density in mW/cm^2

SOURCE-BASED DUTY CYCLE

Where applicable (for example, multi-slot cell phone applications) a duty cycle factor may be applied.

Source-based time-averaged EIRP = (DC / 100) * EIRP

Where

DC = Duty Cycle in %, as applicable
EIRP = Equivalent Isotropic Radiated Power in W

MIMO AND COLOCATED TRANSMITTERS (IDENTICAL LIMIT FOR ALL TRANSMITTERS)

For multiple chain devices, and colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the EIRP (in linear units) of each transmitter.

Total EIRP = (EIRP1) + (EIRP2) + ... + (EIRPn)

where

EIRPx = Source-based time-averaged EIRP of chain x or transmitter x

The total EIRP is then used to calculate the Power Density or the Distance as applicable.

MIMO AND COLOCATED TRANSMITTERS

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply:

The Power Density at the specified separation distance is calculated for each transmitter chain or transmitter.

The fraction of the exposure limit is calculated for each chain or transmitter as
(Power Density of chain or transmitter) / (Limit applicable to that chain or transmitter).

The fractions are summed.

Compliance is established if the sum of the fractions is less than or equal to one.

5.3. LIMITS

VARIABLE LIMITS

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency:

824 MHz / 1500 = 0.55 mW/cm^2 (FCC)
824 MHz / 150 = 5.5 W/m^2 (IC).

FIXED LIMITS

For operation in the PCS band, the 2.4 GHz band and the 5 GHz bands:

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2
From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

6. RF EXPOSURE RESULTS

Multiple chain or colocated transmitters									
Band	**Mode**	**Chain** **for** **MIMO**	**Separation** **Distance** **(cm)**	**Output** **AVG Power** **(dBm)**	**Antenna** **Gain** **(dBi)**	**Duty** **Cycle** **(%)**	**EIRP** **(mW)**	**FCC** **Power** **Density** **(mW/cm^2)**	**IC** **Power** **Density** **(W/m^2)**
2.4 GHz	WLAN	1		25.17	3.90	100.0	807.2		
2.4 GHz	WLAN	2		25.24	3.90	100.0	820.4		
5 GHz	WLAN	1		18.98	5.80	100.0	300.6		
5 GHz	WLAN	2		18.40	5.80	100.0	263.0		
Combined			20				2199.3	0.438	4.38

Notes:

1) The manufacturer configures output power so that the maximum power, after accounting for manufacturing tolerances, will never exceed the maximum power level measured.

2) The output power in the tables above is the maximum power per chain among various channels and various modes within the specific band.

3) The antenna gain in the tables above is the maximum antenna gain among various channels within the specified band.

4) There is no colocation, based on the client. The values above were used in combination as worst-case scenario to show compliant results.

END OF REPORT