# FCC 47 CFR PART 15 SUBPART C
# CLASS II PERMISSIVE CHANGE

## CERTIFICATION TEST REPORT

**FOR**

**802.11abgn/ac/ad+BT MODULE**

**MODEL NUMBER: QCA9008-TBD1**

**FCC ID: PPD-QCA9008-TBD1**

**REPORT NUMBER: 16U22770-E2V1**

**ISSUE DATE: APRIL 15, 2016**

*Prepared for*
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**1700 TECHNOLOGY DRIVE**
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NVLAP LAB CODE 200065-0

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1 | 04/15/2016 | Initial Issue | Michael Heckrotte |

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** QUALCOMM ATHEROS, INC.
1700 TECHNOLOGY DRIVE
SAN JOSE, CA 95110, U.S.A.

**EUT DESCRIPTION:** 802.11abgn/ac/ad+BT MODULE

**MODEL:** QCA9008-TBD1

**SERIAL NUMBER:** 04CE14074736

**DATE TESTED:** MARCH 29, APRIL 4, 2016

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| CFR 47 Part 15 Subpart C | Pass |

UL Verification Services Inc. 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 Verification Services Inc. 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 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.

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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

# 3. FACILITIES AND ACCREDITATION

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

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| ☐ Chamber A | ☐ Chamber D |
| ☐ Chamber B | ☐ Chamber E |
| ☐ Chamber C | ☐ Chamber F |
| | ☐ Chamber G |
| | ☐ Chamber H |

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.

# 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. 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 |
| Radiated Disturbance, 1 to 6 GHz | ±3.86 dB |
| Radiated Disturbance, 6 to 18 GHz | ±4.23 dB |
| Radiated Disturbance, 18 to 26 GHz | ±5.30 dB |
| Radiated Disturbance, 26 to 40 GHz | ±3.23 dB |
| Radiated Disturbance, 40 GHz above | ±3.50dB |

Uncertainty figures are valid to a confidence level of 95%.

# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

The EUT is a Qualcomm QCA9008-TBD1 802.11abgn/ac/ad+BT Module mounted in an ACER Aspire Laptop Model N15W8.

The WLAN and Bluetooth technologies are not covered under this report.

## 5.1. DESCRIPTION OF CLASS II PERMISSIVE CHANGE

The EUT is installed in a portable configuration, in host laptop ACER model N15W8.

## 5.2. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 7105 Rev. wmi only

The test utility software used during testing was DMTools v1.2 Build 5861 and Metlab R2015b.

## 5.3. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| PERIPHERAL SUPPORT EQUIPMENT LIST | | | |
|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** |
| Support Laptop | HP | Elite 1040G | BCG4410FPK |
| Support Laptop Power Supply | HP | HSTNN-LA40 | WDUUV0B3U7CND4 |
| HMC to M2 Adapter | Bplus Technology Inc. | X000Q7M7LD | 60038363 |
| Laptop Platform with 802.11ad antenna | Acer | N15W8 | N8G7AWW00359210872 6600 |

**I/O CABLES**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No** | **Port** | **# of identical ports** | **Connector Type** | **Cable Type** | **Cable Length** | **Remarks** |
| 1 | AC | 1 | AC | Unshielded | 1.2m | None |
| 2 | DC | 1 | DC | Shielded | 1.6m | None |
| 3 | Data | 1 | Signal | Shielded Ribbon | 20cm | Shielded |
| 4 | RF | 1 | U.FL-R | Shielded | 10cm | None |

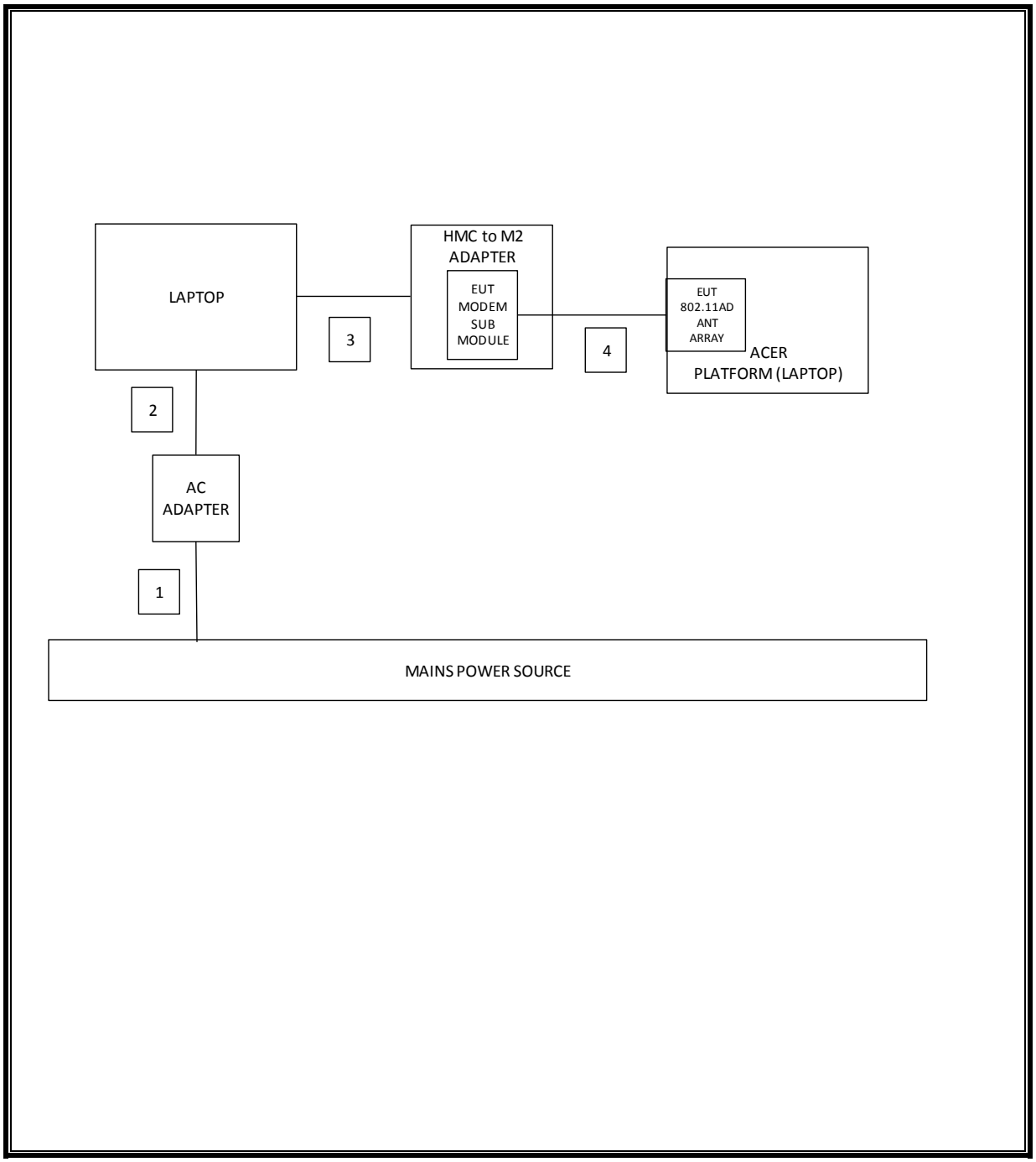
**TEST SETUP**

The 802.11ad Antenna Module located on the base of the Acer Laptop platform was connected to an external QCA-9008-TBD1 Modem sub module and external Laptop to set the RF mode for testing.

**TEST MODE**

Testing was conducted using a data rate of MCS1 for channels 1, 2, and 3.

**SETUP DIAGRAM FOR TESTS**



# 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** | **S/N** | **Local ID (T No.)** | **Cal Due** |
| 50-75 GHz RF Detector | Millitech | DET-15-RPFWI | 41 | CNR | CNR |
| 50-75 GHz Isolator | Millitech | FBI-15-RSES0 | 1734 | CNR | CNR |
| 50-75 GHz Low Noise Amplifier | VIVAtech | VTLN-018-FB | 51 | CNR | CNR |
| 50-75 GHz Waveguide Switch | mi-Wave | 530V/387 | 1332 | CNR | CNR |
| 50-75 GHz Horn Antenna | CMI | HO15R | N/A | CNR | CNR |
| Low Pass Filter, 10MHz | Solar Electronics | 6623-10 | 136101 | 417 | 5/4/2016 |
| Oscilloscope 8 GHz 4 Ch DSO | Agilent | DSA90804A | MY51420139 | 215 | 6/16/2016 |
| Analog Signal Generator, 40 GHz | Agilent | E8257D | MY48050681 | 181 | 10/1/2016 |
| mmWave Source 50 - 75 GHz | OML | S15MS-AG | 80708-4 | 613 | CNR |
| Single Average Power Meter | Agilent | N1913A | MY53100006 | 412 | 5/7/2016 |
| 50-75 GHz Waveguide Power Sensor | Agilent | V8486A-H02 | MY52300008 | 433 | 7/30/2016 |

# 7. APPLICABLE LIMITS AND TEST RESULTS

## 7.1. PEAK AND AVERAGE POWER

**LIMITS**

§ 15.255(b)(1)(i) Except as indicated in paragraph (b)(1)(ii) of this section, the average power of any emission shall not exceed 40 dBm and the peak power of any emission shall not exceed 43 dBm.

**TEST PROCEDURE**

ANSI C63.10

Measurements are made at a distance greater than or equal to the far field boundary distance. The measured power level is converted to EIRP using the Friis equation:

$EIRP = P_T * G_T = (P_R / G_R) * (4 * Pi * D / \lambda)^2$

where:
$G_R$ is the net assembly gain of the receive measurement antenna, including waveguide feed loss
D is the measurement distance
$\lambda$ is the wavelength

The EIRP is converted to Power using the equation:

$P_D = EIRP / (4 * Pi * D_S^2)$

where:
$D_S$ is the specification distance

Note: Calculations were made in the log form equivalent to the linear form listed above.
Measured Peak and Average voltages are only a reference value used in the RF detection measurement and are not part of the EIRP calculations.

## FAR FIELD BOUNDARY CALCULATIONS

The far-field boundary is given as:

$R_{far\ field} = (2 * L^2) / \lambda$

where:

L = Largest Antenna Dimension, including the reflector, in meters
$\lambda$ = wavelength in meters

| Frequency (GHz) | L (m) | Lambda (m) | R (Far Field) (m) |
|---|---|---|---|
| 58.32 | 0.01924 | 0.0051 | 0.14 |
| 60.48 | 0.01924 | 0.0050 | 0.15 |
| 62.64 | 0.01924 | 0.0048 | 0.15 |

## RESULTS

### Low Channel (WiGig Channel 1)

**PEAK POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Peak Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 58.32 | 1.0 | 28.04 | -23.55 | 23.00 | 0.30 |

| EIRP (dBm) | Limit (dBm) | Margin (dBm) |
|---|---|---|
| 21.5 | 43.0 | -21.5 |

**AVERAGE POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Average Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 58.32 | 1.0 | 23.57 | -24.44 | 23.00 | 0.30 |

| EIRP (dBm) | Limit (dBm) | Margin (dBm) |
|---|---|---|
| 20.6 | 40.0 | -19.4 |

## Mid Channel (WiGig Channel 2)

**PEAK POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Peak Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 60.48 | 1.0 | 29.61 | -22.31 | 23.00 | 0.30 |
| **EIRP (dBm)** | **Limit (dBm)** | **Margin (dBm)** | | | |
| 23.1 | 43.0 | -19.9 | | | |

**AVERAGE POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Average Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 60.48 | 1.0 | 24.78 | -23.30 | 23.00 | 0.30 |
| **EIRP (dBm)** | **Limit (dBm)** | **Margin (dBm)** | | | |
| 22.1 | 40.0 | -17.9 | | | |

## High Channel (WiGig Channel 3)

**PEAK POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Peak Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 62.64 | 1.0 | 19.79 | -24.23 | 23.00 | 0.30 |
| **EIRP (dBm)** | **Limit (dBm)** | **Margin (dBm)** | | | |
| 21.4 | 43.0 | -21.6 | | | |

**AVERAGE POWER**

| Frequency (GHz) | Measurement Distance (m) | Measured Average Voltage (mV) | Measured Power (dBm) | Rx Antenna Gain (dBi) | Rx Waveguide Loss (dB) |
|---|---|---|---|---|---|
| 62.64 | 1.0 | 15.78 | -25.36 | 23.00 | 0.30 |
| **EIRP (dBm)** | **Limit (dBm)** | **Margin (dBm)** | | | |
| 20.3 | 40.0 | -19.7 | | | |