

# RF EXPOSURE REPORT

**REPORT NO.:** SA130221E04B

**MODEL NO.:** CUS227

**FCC ID:** PPD-CUS227

**IC:** 4104A-CUS227

**RECEIVED:** Dec. 25, 2013

**TESTED:** Jan. 10 and Feb. 06, 2014

**ISSUED:** Feb. 06, 2014

**APPLICANT:** Qualcomm Atheros, Inc.

**ADDRESS:** 1700 Technology Drive, San Jose, CA 95110

**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.)  
Ltd., Taoyuan Branch Hsin Chu Laboratory

**LAB ADDRESS :** No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,  
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan,  
R.O.C.

This report should not be used by the client to claim product certification, approval, or endorsement by any government agencies.

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification

## TABLE OF CONTENTS

|  |   |
|--|---|
| RELEASE CONTROL RECORD.....                            | 3 |
| 1. CERTIFICATION.....                                  | 4 |
| 2. RF EXPOSURE LIMIT .....                             | 5 |
| 3. MPE CALCULATION FORMULA.....                        | 5 |
| 4. CLASSIFICATION.....                                 | 5 |
| 5. ANTENNA GAIN .....                                  | 6 |
| 6. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER ..... | 7 |


## RELEASE CONTROL RECORD

| ISSUE NO.    | REASON FOR CHANGE | DATE ISSUED   |
|--------------|-------------------|---------------|
| SA130221E04B | Original release  | Feb. 06, 2014 |

## 1. CERTIFICATION

**PRODUCT:** 802.11a/b/g/n 2x2 WLAN card  
**BRAND NAME:** Qualcomm Atheros  
**MODEL NO.:** CUS227  
**TEST SAMPLE:** ENGINEERING SAMPLE  
**APPLICANT:** Qualcomm Atheros, Inc.  
**STANDARDS:** FCC Part 2 (Section 2.1091)  
FCC OET Bulletin 65, Supplement C (01-01)  
IEEE C95.1

The above equipment (Model: CUS227) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY :** , **DATE:** Feb. 06, 2014  
( Lori Chung, Specialist )

**APPROVED BY :** , **DATE:** Feb. 06, 2014  
( May Chen, Manager )

## 2. RF EXPOSURE LIMIT

### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

| FREQUENCY RANGE (MHz)                                 | ELECTRIC FIELD STRENGTH (V/m) | MAGNETIC FIELD STRENGTH (A/m) | POWER DENSITY (mW/cm <sup>2</sup> ) | AVERAGE TIME (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|------------------------|
| LIMITS FOR GENERAL POPULATION / UNCONTROLLED EXPOSURE |                               |                               |                                     |                        |
| 300-1500  | ...                           | ...                           | F/1500                              | 30                     |
| 1500-100,000  | ...                           | ...                           | 1.0                                 | 30                     |

F = Frequency in MHz

### 3. MPE CALCULATION FORMULA

$$P_d = (P_{out} \cdot G) / (4 \cdot \pi \cdot r^2)$$

where

$P_d$  = power density in mW/cm<sup>2</sup>

$P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

$\pi$  = 3.1416

r = distance between observation point and center of the radiator in cm

### 4. CLASSIFICATION

The antenna of this product, under normal use condition, is at least 20cm away from the body of the user. So, this device is classified as **Mobile Device**.

## 5. ANTENNA GAIN

The antennas provided to the EUT, please refer to the following table:

| Internal antenna |          |              |                        |                |                          |                        |                      |                   |
|------------------|----------|--------------|------------------------|----------------|--------------------------|------------------------|----------------------|-------------------|
| No.              | Brand    | Model        | Antenna Type           | Connector Type | Cable Loss (dB)          | Antenna gain 2.4G(dBi) | Antenna gain 5G(dBi) | Cable Length (mm) |
| 1                | Qualcomm | CUS227 V03-2 | Integrated PCB antenna | NA             | NA                       | 2                      | 3                    | NA                |
| External antenna |          |              |                        |                |                          |                        |                      |                   |
| No.              | Brand    | Model        | Antenna Type           | Connector Type | Freq. Range (MHz to MHz) | Cable Loss (dB)        | Net Gain (dBi)       | Cable Length (mm) |
| 2                | WNC      | 81EAAY15.G05 | PIFA                   | IPEX           | 2400~2483.5              | -0.20                  | 3.25                 | 100               |
|                  |          |              |                        |                | 5150~5250                | -0.28                  | 4.42                 |                   |
|                  |          |              |                        |                | 5250~5350                | -0.28                  | 4.27                 |                   |
|                  |          |              |                        |                | 5470~5725                | -0.28                  | 4.50                 |                   |
|                  |          |              |                        |                | 5725~5850                | -0.28                  | 4.59                 |                   |
| 3                | WNC      | 81EAAY15.G06 | MONOPOLE               | IPEX           | 2400~2483.5              | -0.20                  | 3.15                 | 100               |
|                  |          |              |                        |                | 5150~5250                | -0.28                  | 2.89                 |                   |
|                  |          |              |                        |                | 5250~5350                | -0.28                  | 3.46                 |                   |
|                  |          |              |                        |                | 5470~5725                | -0.28                  | 3.79                 |                   |
|                  |          |              |                        |                | 5725~5850                | -0.28                  | 3.50                 |                   |
| 4                | WNC      | 81EAAY15.G07 | DIPOLE                 | IPEX           | 2400~2483.5              | -0.20                  | 3.14                 | 100               |
|                  |          |              |                        |                | 5150~5250                | -0.28                  | 3.95                 |                   |
|                  |          |              |                        |                | 5250~5350                | -0.28                  | 4.51                 |                   |
|                  |          |              |                        |                | 5470~5725                | -0.28                  | 4.98                 |                   |
|                  |          |              |                        |                | 5725~5850                | -0.28                  | 4.78                 |                   |

Note: 1. The EUT incorporates beam forming function

## 6. CALCULATION RESULT OF MAXIMUM CONDUCTED POWER

**For 2.4GHz:**

**With Internal antenna:**

**802.11b**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 100.237             | 5.01               | 20            | 0.06321                              | 1.00                        |

**NOTE:** 1. Directional gain = 2dBi + 10log(2) = 5.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11g**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 89.337              | 5.01               | 20            | 0.05633                              | 1.00                        |

**NOTE:** 1. Directional gain = 2dBi + 10log(2) = 5.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n (HT20)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 89.337              | 5.01               | 20            | 0.05633                              | 1.00                        |

**NOTE:** 1. Directional gain = 2dBi + 10log(2) = 5.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n (HT40)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2422-2452            | 44.774              | 5.01               | 20            | 0.02823                              | 1.00                        |

**NOTE:** 1. Directional gain = 2dBi + 10log(2) = 5.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**With External antenna:**  
**802.11b**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 100.237             | 6.26               | 20            | 0.08429                              | 1.00                        |

**NOTE:** 1. Directional gain = 3.25dBi + 10log(2) = 6.26dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11g**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 89.337              | 6.26               | 20            | 0.07512                              | 1.00                        |

**NOTE:** 1. Directional gain = 3.25dBi + 10log(2) = 6.26dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n (HT20)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2412-2462            | 89.337              | 6.26               | 20            | 0.07512                              | 1.00                        |

**NOTE:** 1. Directional gain = 3.25dBi + 10log(2) = 6.26dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n (HT40)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 2422-2452            | 44.774              | 6.26               | 20            | 0.03765                              | 1.00                        |

**NOTE:** 1. Directional gain = 3.25dBi + 10log(2) = 6.26dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

### For 15.247(5GHz):

With Internal antenna:

#### 802.11a

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5745 ~ 5825          | 251.785             | 6.01               | 20            | 0.19988                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

#### 802.11n(HT20)

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5745 ~ 5825          | 251.785             | 6.01               | 20            | 0.19988                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

#### 802.11n(HT40)

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5755 ~ 5795          | 141.589             | 6.01               | 20            | 0.11240                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**With External antenna:**  
**802.11a**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5745 ~ 5825          | 224.404             | 7.79               | 20            | 0.26839                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.78dBi + 10log(2) = 7.79dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n(HT20)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5745 ~ 5825          | 224.404             | 7.79               | 20            | 0.26839                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.78dBi + 10log(2) = 7.79dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n(HT40)**

| FREQUENCY BAND (MHz) | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|----------------------|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5755 ~ 5795          | 141.589             | 7.79               | 20            | 0.16934                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.78dBi + 10log(2) = 7.79dBi  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

### For 15.407(5GHz):

With Internal antenna:

#### 802.11a

| FREQUENCY BAND (MHz)                               | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|--|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5180-5240<br>5260-5320<br>5500-5580 &<br>5660-5700 | 282.508             | 6.01               | 20            | 0.22426                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

#### 802.11n(HT20)

| FREQUENCY BAND (MHz)                               | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|--|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5180-5240<br>5260-5320<br>5500-5580 &<br>5660-5700 | 251.785             | 6.01               | 20            | 0.19988                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

#### 802.11n(HT40)

| FREQUENCY BAND (MHz)                          | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|---|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5190-5230<br>5270-5310<br>5510-5550 &<br>5670 | 158.866             | 6.01               | 20            | 0.12611                              | 1.00                        |

**NOTE:** 1. Directional gain = 3dBi + 10log(2) = 6.01dBi

2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**With External antenna:**  
**802.11a**

| FREQUENCY BAND (MHz)                               | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|--|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5180-5240<br>5260-5320<br>5500-5580 &<br>5660-5700 | 224.404             | 7.99               | 20            | 0.28103                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.98dBi + 10log(2) = 7.99dB  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n(HT20)**

| FREQUENCY BAND (MHz)                               | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|--|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5180-5240<br>5260-5320<br>5500-5580 &<br>5660-5700 | 224.404             | 7.52               | 20            | 0.28103                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.98dBi + 10log(2) = 7.99dB  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**802.11n(HT40)**

| FREQUENCY BAND (MHz)                          | MAX POWER AVG. (mW) | ANTENNA GAIN (dBi) | DISTANCE (cm) | POWER DENSITY (mW/ cm <sup>2</sup> ) | LIMIT (mW/cm <sup>2</sup> ) |
|---|---------------------|--------------------|---------------|--------------------------------------|-----------------------------|
| 5190-5230<br>5270-5310<br>5510-5550 &<br>5670 | 141.589             | 7.99               | 20            | 0.17732                              | 1.00                        |

**NOTE:** 1. Directional gain = 4.98dBi + 10log(2) = 7.99dB  
 2. This power include tune-up tolerance range that specified in QCA CUS227 Tune Up power table

**--- END ---**