



A D T

RF Exposure Report

Report No.: SA150107E07H

FCC ID: PPD-QCNFA364AH

Test Model: QCNFA364A

Received Date: Aug. 18, 2015

Test Date: Sep. 23 to Oct. 01, 2015

Issued Date: Dec. 04, 2015

Applicant: Qualcomm Atheros, Inc.

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Release Control Record

| Issue No. | Description | Date Issued |
|--------------|-------------------|---------------|
| SA150107E07H | Original release. | Dec. 04, 2015 |



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1 Certificate of Conformity

Product: 802.11a/b/g/n/ac + BT 4.1 M.2 2230 Type Card

Brand: Qualcomm Atheros

Test Model: QCNFA364A

Sample Status: ENGINEERING SAMPLE

Applicant: Qualcomm Atheros, Inc.

Test Date: Sep. 23 to Oct. 01, 2015

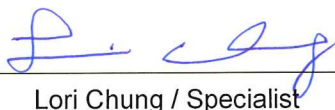
Standards: FCC Part 2 (Section 2.1091)

KDB 447498 D01

IEEE C95.1

The above equipment 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 :


Lori Chung / Specialist

Date: Dec. 04, 2015

Approved by :


May Chen / Manager

Date: Dec. 04, 2015

2 RF Exposure

2.1 Limits For Maximum Permissible Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm ²) | Average Time (minutes) |
|-------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|------------------------|
| Limits For General Population / Uncontrolled Exposure | | | | |
| 300-1500 | ... | ... | F/1500 | 30 |
| 1500-100,000 | ... | ... | 1.0 | 30 |

F = Frequency in MHz

2.2 MPE Calculation Formula

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

where

P_d = power density in mW/cm²

P_{out} = output power to antenna in mW

G = gain of antenna in linear scale

π = 3.1416

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

2.3 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**.

3 Antenna Gain

This report is prepared for FCC class II change. The difference compared with the original design is as the following:

- ◆ Add new antennas (Antenna Set 2) as following table:

| Original | | | | | | | | | |
|---------------------|-------|-----------------------|-----------|-----------------------------------|---------------------------------|-------------------------|-----------------------|----------------|-------------------|
| Antenna Set 1 | | | | | | | | | |
| Transmitter Circuit | Brand | Model | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi) | 5GHz Cable Loss (dBi) | Connector Type | Cable Length (mm) |
| Chain (0) | WNC | 81-EBJ15.005 | PIFA | 3.00 | Band 1&2: 2.56 | 1.15 | Band 1&2: 1.70 | IPEX | 300 |
| | | | | | Band 3: 4.76 | | Band 3: 1.74 | | |
| | | | | | Band 4: 4.76 | | Band 4: 1.79 | | |
| Chain (1) | WNC | 81-EBJ15.005 | PIFA | 3.62 | Band 1&2: 3.08 | 1.15 | Band 1&2: 1.70 | IPEX | 300 |
| | | | | | Band 3: 3.31 | | Band 3: 1.74 | | |
| | | | | | Band 4: 2.42 | | Band 4: 1.79 | | |
| Newly | | | | | | | | | |
| Antenna Set 2 | | | | | | | | | |
| Transmitter Circuit | Brand | Model | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi) | 5GHz Cable Loss (dBi) | Connector Type | Cable Length (mm) |
| Chain (0) | INPAQ | DAM-I6-H-DB-800-10-17 | Dipole | 1.13 | Band 1&2: 1.33 | NA | NA | SMA RP Plug | 900 |
| | | | | | Band 3: -0.63 | | | | |
| | | | | | Band 4: -0.97 | | | | |
| Chain (1) | INPAQ | DAM-I6-H-DB-800-10-17 | Dipole | 1.29 | Band 1&2: 1.94 | NA | NA | SMA RP Plug | 900 |
| | | | | | Band 3: -0.49 | | | | |
| | | | | | Band 4: -0.93 | | | | |

4 Calculation Result Of Maximum Conducted Power

For WLAN: 15.247 (2.4GHz):

802.11b

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2412-2472 | 23.51 | 224.404 | 4.22 | 20 | 0.11797 | 1.00 |

NOTE: 1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.22\text{dBi}$
 2. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

802.11g

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2412-2472 | 22.51 | 178.25 | 4.22 | 20 | 0.09370 | 1.00 |

NOTE: 1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.22\text{dBi}$
 2. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

VHT20

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2412-2472 | 22.51 | 178.25 | 4.22 | 20 | 0.09370 | 1.00 |

NOTE: 1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.22\text{dBi}$
 2. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

VHT40

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2422-2462 | 21.51 | 141.59 | 4.22 | 20 | 0.07443 | 1.00 |

NOTE: 1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.22\text{dBi}$
 2. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

For WLAN: 15.407 (5GHz):

802.11a

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|--------------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 5180 - 5240, 5260 - 5320 | 22.01 | 158.866 | 4.65 | 20 | 0.09221 | 1.00 |
| 5500 - 5720 | 22.01 | 158.866 | 2.45 | 20 | 0.05556 | 1.00 |
| 5745 - 5825 | 23.01 | 200 | 2.06 | 20 | 0.06394 | 1.00 |

- NOTE: 1. 5150~5250MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
2. 5250~5350MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
3. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.45\text{dBi}$
4. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.06\text{dBi}$
5. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

802.11ac (VHT20)

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|--------------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 5180 - 5240, 5260 - 5320 | 22.01 | 158.866 | 4.65 | 20 | 0.09221 | 1.00 |
| 5500 - 5720 | 22.01 | 158.866 | 2.45 | 20 | 0.05556 | 1.00 |
| 5745 - 5825 | 23.01 | 200 | 2.06 | 20 | 0.06394 | 1.00 |

- NOTE: 1. 5150~5250MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
2. 5250~5350MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
3. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.45\text{dBi}$
4. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.06\text{dBi}$
5. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

802.11ac (VHT40)

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|--------------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 5190 - 5230, 5270 - 5310 | 22.01 | 158.866 | 4.65 | 20 | 0.09221 | 1.00 |
| 5510 - 5710 | 22.01 | 158.866 | 2.45 | 20 | 0.05556 | 1.00 |
| 5755 - 5795 | 23.01 | 200 | 2.06 | 20 | 0.06394 | 1.00 |

- NOTE: 1. 5150~5250MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
2. 5250~5350MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
3. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.45\text{dBi}$
4. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.06\text{dBi}$
5. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

802.11ac (VHT80)

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 5210 - 5290 | 18.01 | 63.246 | 4.65 | 20 | 0.03671 | 1.00 |
| 5530 - 5690 | 21.01 | 126.192 | 2.45 | 20 | 0.04413 | 1.00 |
| 5775 | 22.01 | 158.866 | 2.06 | 20 | 0.05079 | 1.00 |

NOTE: 1. 5150~5250MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
2. 5250~5350MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 4.65\text{dBi}$
3. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.45\text{dBi}$
4. 5470~5725MHz: Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 2.06\text{dBi}$
5. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

For BT-EDR:

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480 | 11.50 | 14.125 | 1.29 | 20 | 0.00378 | 1.00 |

NOTE: 1. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

For BT-LE:

| Frequency Band (MHz) | Max power Avg. (dBm) | Max power Avg. (mW) | Antenna gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------|---------------------|--------------------|---------------|-------------------------------------|-----------------------------|
| 2402-2480 | 3 | 1.995 | 1.29 | 20 | 0.00053 | 1.00 |

NOTE: 1. This power include tune-up tolerance range that specified in QCNFA364A Tune Up power table

Conclusion:

Both of the Bluetooth and WLAN (5GHz) can transmit simultaneously, the formula of calculated the MPE is:

$$CPD_1 / LPD_1 + CPD_2 / LPD_2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

Therefore, the worst-case situation is $0.09221 / 1 + 0.00378 / 1 = 0.096$, which is less than "1".

--- END ---