



FCC RF Test Report

APPLICANT : Qualcomm Atheros, Inc.
EQUIPMENT : Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 Type Card
BRAND NAME : Qualcomm
MODEL NAME : QCNFA435
FCC ID : PPD-QCNFA435
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was installed into Notebook (Brand Name Lenovo, Model Name: TP00066D) during test. This is a partial report which is included the RF conducted power, conduction emission and radiated emission test items. The product was received on Nov. 15, 2016 and testing was completed on Dec. 13, 2016. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



SPORTON INTERNATIONAL INC.
No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.



TABLE OF CONTENTS

| | |
|--|-----------|
| SUMMARY OF TEST RESULT | 4 |
| 1 GENERAL DESCRIPTION | 5 |
| 1.1 Applicant | 5 |
| 1.2 Manufacturer..... | 5 |
| 1.3 Product Feature of Equipment Under Test..... | 5 |
| 1.4 Product Specification of Equipment Under Test..... | 6 |
| 1.5 Modification of EUT | 6 |
| 1.6 Testing Location | 7 |
| 1.7 Applicable Standards..... | 7 |
| 2 TEST CONFIGURATION OF EQUIPMENT UNDER TEST | 8 |
| 2.1 Test Mode..... | 8 |
| 2.2 Connection Diagram of Test System..... | 9 |
| 2.3 Support Unit used in test configuration and system | 9 |
| 3 TEST RESULT..... | 10 |
| 3.1 Maximum Conducted Output Power Measurement | 10 |
| 3.2 AC Conducted Emission Measurement..... | 11 |
| 3.4 Antenna Requirements | 15 |
| 4 LIST OF MEASURING EQUIPMENT | 16 |
| 5 UNCERTAINTY OF EVALUATION | 17 |

APPENDIX A. CONDUCTED TEST RESULTS

APPENDIX B. SETUP PHOTOGRAPHS



REVISION HISTORY



SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|----------------|-----------------------|--------------------------------|-----------|--------|---|
| 3.1 | 15.407(a) | Maximum Conducted Output Power | ≤ 30 dBm | Pass | - |
| 3.2 | 15.207 | AC Conducted Emission | 15.207(a) | Pass | Under limit 14.90 dB at 0.190 MHz |
| 3.4 | 15.203 & 15.407(a) | Antenna Requirement | N/A | Pass | - |



1 General Description

1.1 Applicant

Qualcomm Atheros,Inc.

1700 Technology Dr., San Jose, California, United States 95110

1.2 Manufacturer

Qualcomm Atheros,Inc.

1700 Technology Dr., San Jose, California, United States 95110

1.3 Product Feature of Equipment Under Test

| Product Feature | |
|--|--|
| Equipment | Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 Type Card |
| Brand Name | Qualcomm |
| Model Name | QCNFA435 |
| FCC ID | PPD-QCNFA435 |
| Sample 1 | EUT with Antenna 1 |
| Sample 2 | EUT with Antenna 2 |
| Installed into Notebook | Brand Name: Lenovo Model Name: TP00066D |
| EUT supports Radios application | WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE |
| EUT Stage | Production Unit |

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



| Antenna Information | | | |
|----------------------|---------------------|---|--|
| Antenna 1 (touch) | Manufacturer | TONGDA | |
| | Antenna Type | Main: PIFA Antenna | Aux: PIFA Antenna |
| | Part number | DQ690210902 | DQ690210903 |
| | Peak gain | Main Antenna : WLAN(2.4GHz):0.71 WLAN(5GHz):-0.04 | Aux Antenna : WLAN(2.4GHz):-0.6 Bluetooth :-0.6 WLAN(5GHz):0.29 |
| | Manufacturer | WNC | |
| Antenna 2 (touch) | Antenna Type | Main: PIFA Antenna | Aux: PIFA Antenna |
| | Part number | DQ6G15G9100 | DQ6G15G9200 |
| | Peak gain | Main Antenna : WLAN(2.4GHz):-1.26 WLAN(5GHz):1.35 | Aux Antenna : WLAN(2.4GHz):-1.85 Bluetooth :-1.85 WLAN(5GHz):-1.6 |

1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|---|
| Tx/Rx Channel Frequency Range | 5745 MHz ~ 5825 MHz |
| Maximum Output Power | <5745 MHz ~ 5825 MHz> 802.11a : 16.67 dBm / 0.0465 W 802.11n HT20 : 16.69 dBm / 0.0467 W 802.11n HT40 : 15.78 dBm / 0.0378 W 802.11ac VHT20: 16.66 dBm / 0.0463 W 802.11ac VHT40: 15.77 dBm / 0.0378 W 802.11ac VHT80: 13.37 dBm / 0.0217 W |
| Type of Modulation | 802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM) |

Note: MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.



1.6 Testing Location

Sportun Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

| | | |
|---------------------------|---|---------|
| Test Site | SPORTON INTERNATIONAL INC. | |
| Test Site Location | No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-327-3456 FAX: +886-3-328-4978 | |
| Test Site No. | Sportun Site No. | |
| | TH05-HY | CO05-HY |

Note: The test site complies with ANSI C63.4 2014 requirement.

1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r03
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB 644545 D03 Guidance for IEEE 802 11ac New Rules v01
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.



2 Test Configuration of Equipment Under Test

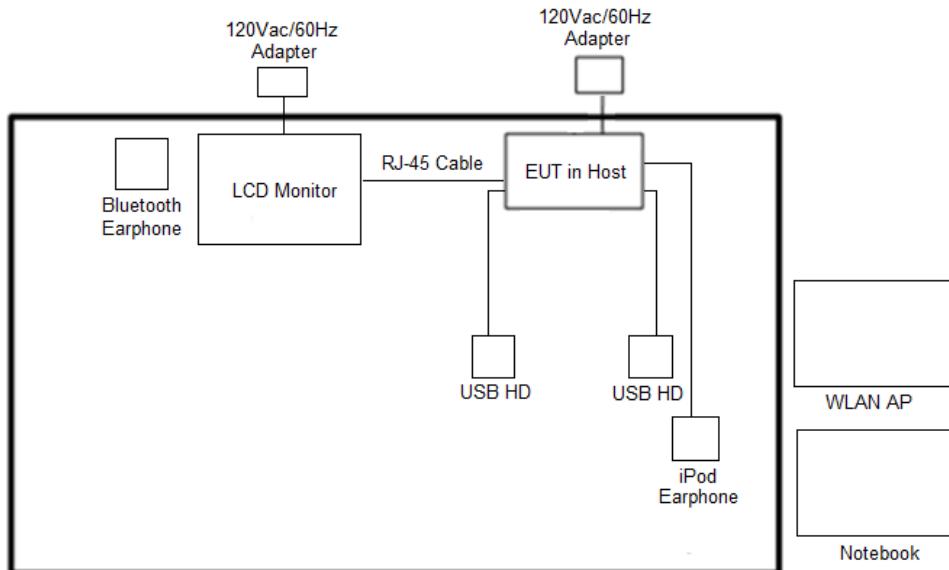
The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz).

2.1 Test Mode

| | |
|--|--|
| AC Conducted Emission | Mode 1 : Bluetooth Link + WLAN (5GHz) Link + TC + TF |
| Remark: | |
| <ol style="list-style-type: none">1. TC stands for Test Configuration, and consists of Earphone, USB HD, HDMI Cable, Adapter, SD Card, and RJ-45.2. TF stands for Test Configuration, and consists of MPEG4 and Camera.3. HDMI Cable means media application transferred between EUT and external display. | |

2.2 Connection Diagram of Test System

<AC Conducted Emission Mode>



2.3 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|--------------------|---------------|----------------|--|------------------|--|
| 1. | WLAN AP | D-Link | DIR-628 | KA2DIR628A2 | N/A | Unshielded, 1.8 m |
| 2. | Notebook | DELL | P20G | FCC DoC/ Contains FCC ID: QDS-BRCM1051 | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 3. | Notebook | DELL | Latitude E6320 | FCC DoC/ Contains FCC ID: QDS-BRCM1054 | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 4. | LCD Monitor | DELL | U2410 | FCC DoC | Shielded, 1.6 m | Unshielded, 1.8 m |
| 5. | Bluetooth Earphone | Sony Ericsson | MW600 | PY7DDA-2029 | N/A | N/A |
| 6. | iPod | Apple | A1285 | FCC DoC | Shielded, 1.0 m | N/A |
| 7. | USB HD | PQI | H568V | FCC DoC | Unshielded, 0.5m | N/A |
| 8. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |

3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

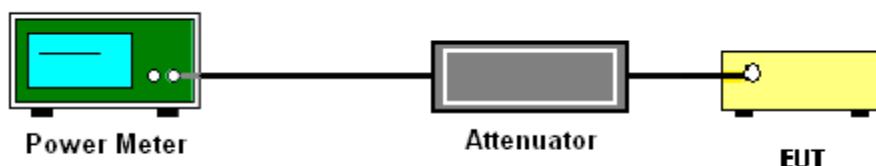
3.1.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r03.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.



3.2 AC Conducted Emission Measurement

3.2.1 Limit of AC Conducted Emission

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.

| Frequency of emission (MHz) | Conducted limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

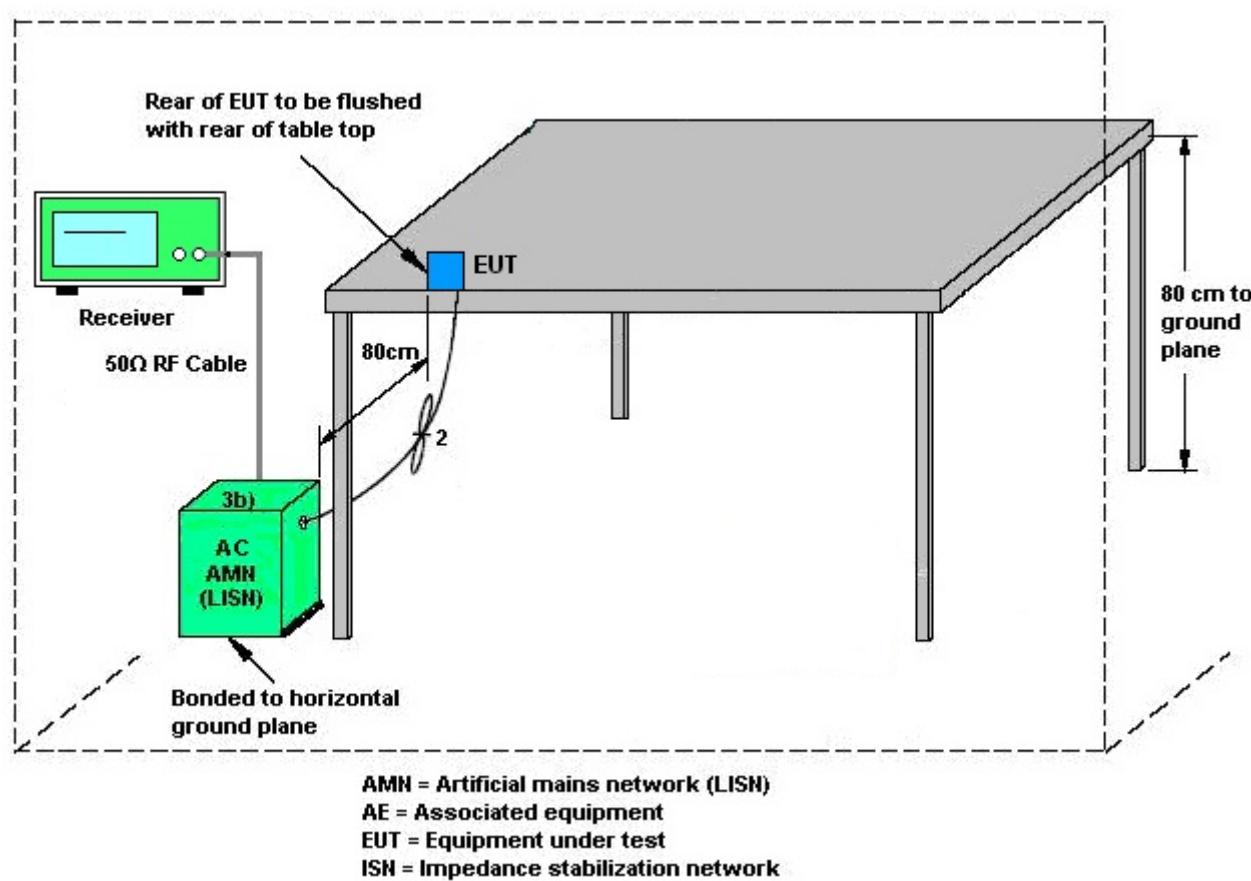
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

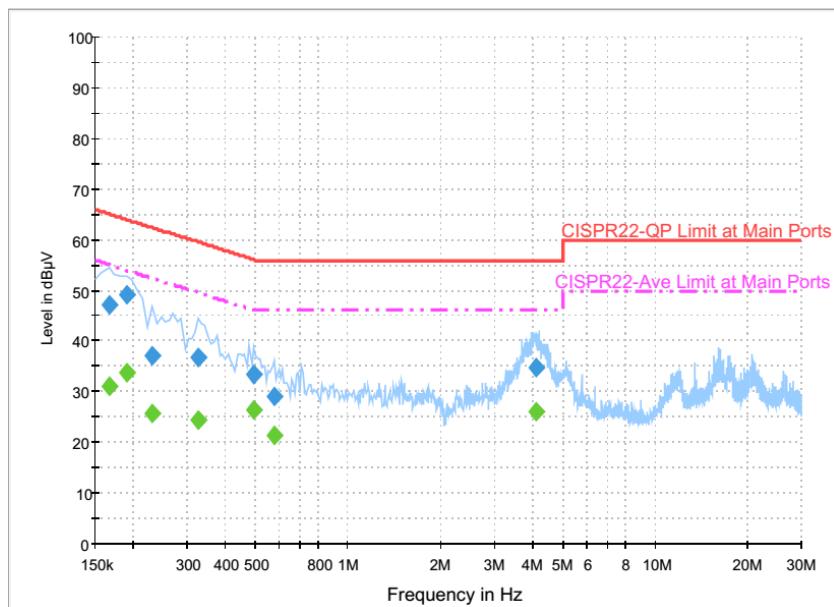
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.2.4 Test Setup



3.2.5 Test Result of AC Conducted Emission

| | | | |
|-----------------|---|---------------------|---------|
| Test Mode : | Mode 1 | Temperature : | 21~24°C |
| Test Engineer : | Arthur Hsieh | Relative Humidity : | 51~53% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Line |
| Function Type : | Bluetooth Link + WLAN (5GHz) Link + TC + TF | | |



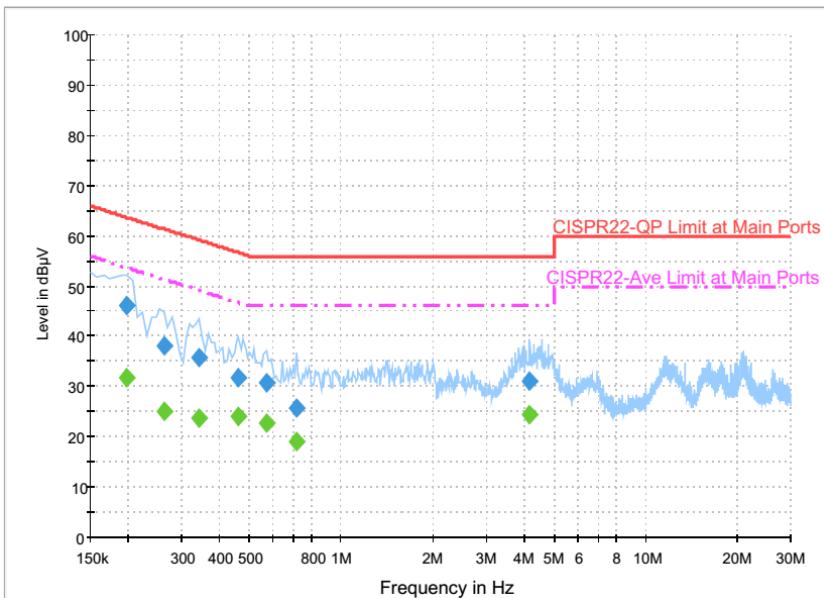
Final Result : QuasiPeak

| Frequency (MHz) | QuasiPeak (dBμV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|--------|------|------------|-------------|--------------|
| 0.166000 | 47.2 | Off | L1 | 19.6 | 18.0 | 65.2 |
| 0.190000 | 49.1 | Off | L1 | 19.6 | 14.9 | 64.0 |
| 0.230000 | 37.0 | Off | L1 | 19.6 | 25.4 | 62.4 |
| 0.326000 | 36.7 | Off | L1 | 19.6 | 22.9 | 59.6 |
| 0.494000 | 33.4 | Off | L1 | 19.6 | 22.7 | 56.1 |
| 0.574000 | 29.1 | Off | L1 | 19.6 | 26.9 | 56.0 |
| 4.094000 | 34.7 | Off | L1 | 19.8 | 21.3 | 56.0 |

Final Result : Average

| Frequency (MHz) | Average (dBμV) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|----------------|--------|------|------------|-------------|--------------|
| 0.166000 | 31.0 | Off | L1 | 19.6 | 24.2 | 55.2 |
| 0.190000 | 33.6 | Off | L1 | 19.6 | 20.4 | 54.0 |
| 0.230000 | 25.9 | Off | L1 | 19.6 | 26.5 | 52.4 |
| 0.326000 | 24.5 | Off | L1 | 19.6 | 25.1 | 49.6 |
| 0.494000 | 26.6 | Off | L1 | 19.6 | 19.5 | 46.1 |
| 0.574000 | 21.6 | Off | L1 | 19.6 | 24.4 | 46.0 |
| 4.094000 | 26.1 | Off | L1 | 19.8 | 19.9 | 46.0 |

| | | | |
|------------------------|---|----------------------------|---------|
| Test Mode : | Mode 1 | Temperature : | 21~24°C |
| Test Engineer : | Arthur Hsieh | Relative Humidity : | 51~53% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Neutral |
| Function Type : | Bluetooth Link + WLAN (5GHz) Link + TC + TF | | |

**Final Result : QuasiPeak**

| Frequency (MHz) | QuasiPeak (dB μ V) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) |
|-----------------|------------------------|--------|------|------------|-------------|--------------------|
| 0.198000 | 46.2 | Off | N | 19.6 | 17.5 | 63.7 |
| 0.262000 | 38.2 | Off | N | 19.6 | 23.2 | 61.4 |
| 0.342000 | 35.8 | Off | N | 19.6 | 23.4 | 59.2 |
| 0.462000 | 31.8 | Off | N | 19.6 | 24.9 | 56.7 |
| 0.566000 | 30.7 | Off | N | 19.6 | 25.3 | 56.0 |
| 0.710000 | 25.8 | Off | N | 19.6 | 30.2 | 56.0 |
| 4.174000 | 31.1 | Off | N | 19.7 | 24.9 | 56.0 |

Final Result : Average

| Frequency (MHz) | Average (dB μ V) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dB μ V) |
|-----------------|----------------------|--------|------|------------|-------------|--------------------|
| 0.198000 | 31.6 | Off | N | 19.6 | 22.1 | 53.7 |
| 0.262000 | 25.1 | Off | N | 19.6 | 26.3 | 51.4 |
| 0.342000 | 23.6 | Off | N | 19.6 | 25.6 | 49.2 |
| 0.462000 | 24.0 | Off | N | 19.6 | 22.7 | 46.7 |
| 0.566000 | 22.7 | Off | N | 19.6 | 23.3 | 46.0 |
| 0.710000 | 18.9 | Off | N | 19.6 | 27.1 | 46.0 |
| 4.174000 | 24.5 | Off | N | 19.7 | 21.5 | 46.0 |



3.4 Antenna Requirements

3.4.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,if transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

The antenna gain is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-------------------|-----------------|-----------|------------|-----------------|------------------|---------------|---------------|----------------------|
| Power Meter | Anritsu | ML2495A | 0932001 | 300MHz~40GHz | Sep. 29, 2016 | Dec. 02, 2016 | Sep. 28, 2017 | Conducted (TH05-HY) |
| Power Sensor | Anritsu | MA2411B | 0846202 | 300MHz~40GHz | Sep. 29, 2016 | Dec. 02, 2016 | Sep. 28, 2017 | Conducted (TH05-HY) |
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | Dec. 13, 2016 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESCI 7 | 100724 | 9kHz~7GHz | Aug. 30, 2016 | Dec. 13, 2016 | Aug. 29, 2017 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Nov. 29, 2016 | Dec. 13, 2016 | Nov. 28, 2017 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Dec. 06, 2016 | Dec. 13, 2016 | Dec. 05, 2017 | Conduction (CO05-HY) |



5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

| | |
|---|------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$) | 2.70 |
|---|------|

