



# 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.

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Reviewed by: Joseph Lin / Supervisor

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Approved by: Jones Tsai / Manager

**SPORTON INTERNATIONAL INC.**

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## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR6N1538D	Rev. 01	Initial issue of report	Jan. 25, 2017



## SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.407(a)	Maximum Conducted Output Power	FCC $\leq 24$ dBm (depend on band)	Pass	-
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 14.90 dB at 0.190 MHz
3.3	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			
<b>Antenna 1 (touch)</b>	<b>Manufacturer</b>	TONGDA	
	<b>Antenna Type</b>	Main: PIFA Antenna	Aux: PIFA Antenna
	<b>Part number</b>	DQ690210902	DQ690210903
	<b>Peak gain</b>	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
<b>Antenna 2 (touch)</b>	<b>Manufacturer</b>	WNC	
	<b>Antenna Type</b>	Main: PIFA Antenna	Aux: PIFA Antenna
	<b>Part number</b>	DQ6G15G9100	DQ6G15G9200
	<b>Peak gain</b>	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	
<b>Tx/Rx Frequency Range</b>	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5720 MHz
<b>Maximum Output Power to Antenna</b>	<b>&lt;5180 MHz ~ 5240 MHz&gt;</b> 802.11a : 16.92 dBm / 0.0492 W 802.11n HT20 : 16.94 dBm / 0.0494 W 802.11n HT40 : 15.83 dBm / 0.0383 W 802.11ac VHT20 : 16.86 dBm / 0.0485 W 802.11ac VHT40 : 15.77 dBm / 0.0378 W 802.11ac VHT80 : 9.18 dBm / 0.0083 W <b>&lt;5260 MHz ~ 5320 MHz&gt;</b> 802.11a : 16.83 dBm / 0.0482 W 802.11n HT20 : 16.85 dBm / 0.0484 W 802.11n HT40 : 15.89 dBm / 0.0388 W 802.11ac VHT20 : 16.79 dBm / 0.0478 W 802.11ac VHT40 : 15.87 dBm / 0.0386 W 802.11ac VHT80 : 11.01 dBm / 0.0126 W <b>&lt;5500 MHz ~ 5700 MHz &gt;</b> 802.11a : 16.74 dBm / 0.0472 W 802.11n HT20 : 16.76 dBm / 0.0474 W 802.11n HT40 : 15.66 dBm / 0.0368 W 802.11ac VHT20 : 16.75 dBm / 0.0473 W 802.11ac VHT40 : 15.61 dBm / 0.0364 W 802.11ac VHT80 : 15.85 dBm / 0.0385 W
<b>Maximum Output Power to Antenna for Straddle Channel</b>	802.11a : 16.50 dBm / 0.0447 W 802.11n HT20 : 16.52 dBm / 0.0449 W 802.11n HT40 : 15.73 dBm / 0.0374 W 802.11ac VHT20 : 16.51 dBm / 0.0448 W 802.11ac VHT40 : 15.71 dBm / 0.0372 W 802.11ac VHT80 : 15.72 dBm / 0.0373 W
<b>Type of Modulation</b>	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

## 1.5 Modification of EUT

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

## 1.6 Testing Location

Sporton 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 <sup>st</sup> 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.	Sporton 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 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

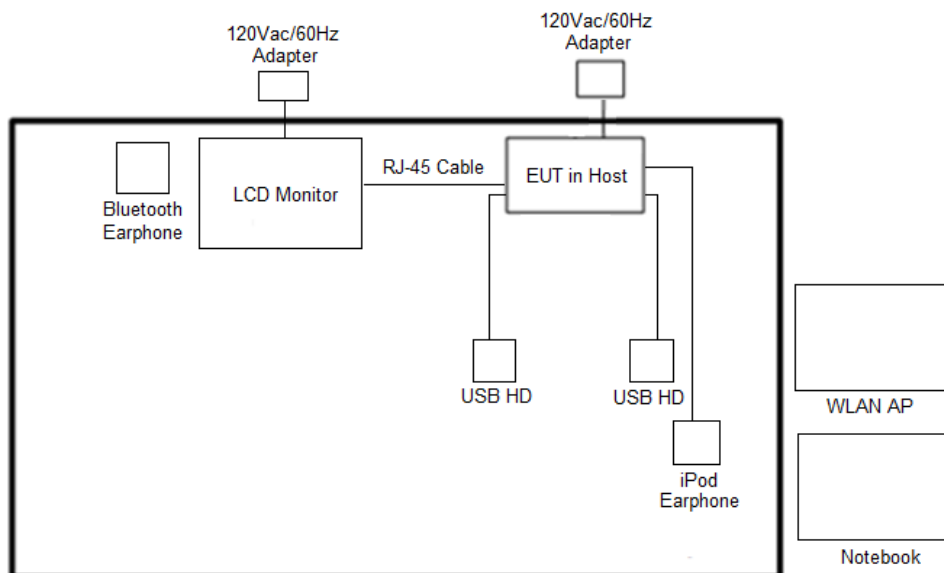
The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conducted emission (150 kHz to 30 MHz).

### 2.1 Test Mode

Test Cases	
AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN (5GHz) Link + TC + TF
<b>Remark:</b> <ol style="list-style-type: none"><li>1. TC stands for Test Configuration, and consists of Earphone, USB HD, HDMI Cable, Adapter, SD Card, and RJ-45.</li><li>2. TF stands for Test Configuration, and consists of MPEG4 and Camera.</li><li>3. HDMI Cable means media application transferred between EUT and external display.</li></ol>	

## 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 mobile and portable client devices in the 5.15–5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW.

For the 5.25–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz.

For Straddle Channel, U-NII procedures and limits were applied for operations in the frequency band in accordance with FCC KDB 644545 D03.

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.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

##### **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):

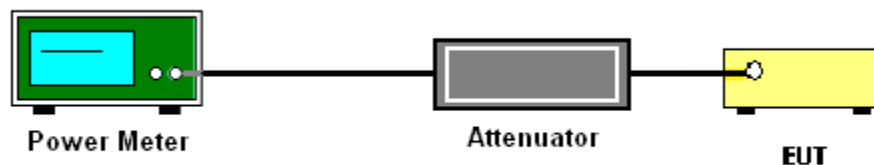
1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor,  $10 \log(1/x)$ , where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

For straddle channel, the testing follows Method SA-3 (RMS detection with max hold) of FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r03.

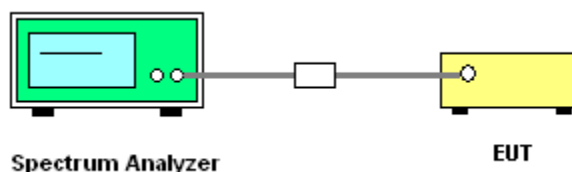
Compute power by integrating the spectrum across the 99% occupied bandwidth of the signal using the instrument's band power measurement function.

### 3.1.4 Test Setup

For normal channel:



For straddle channel:



### 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 $\mu$ 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.

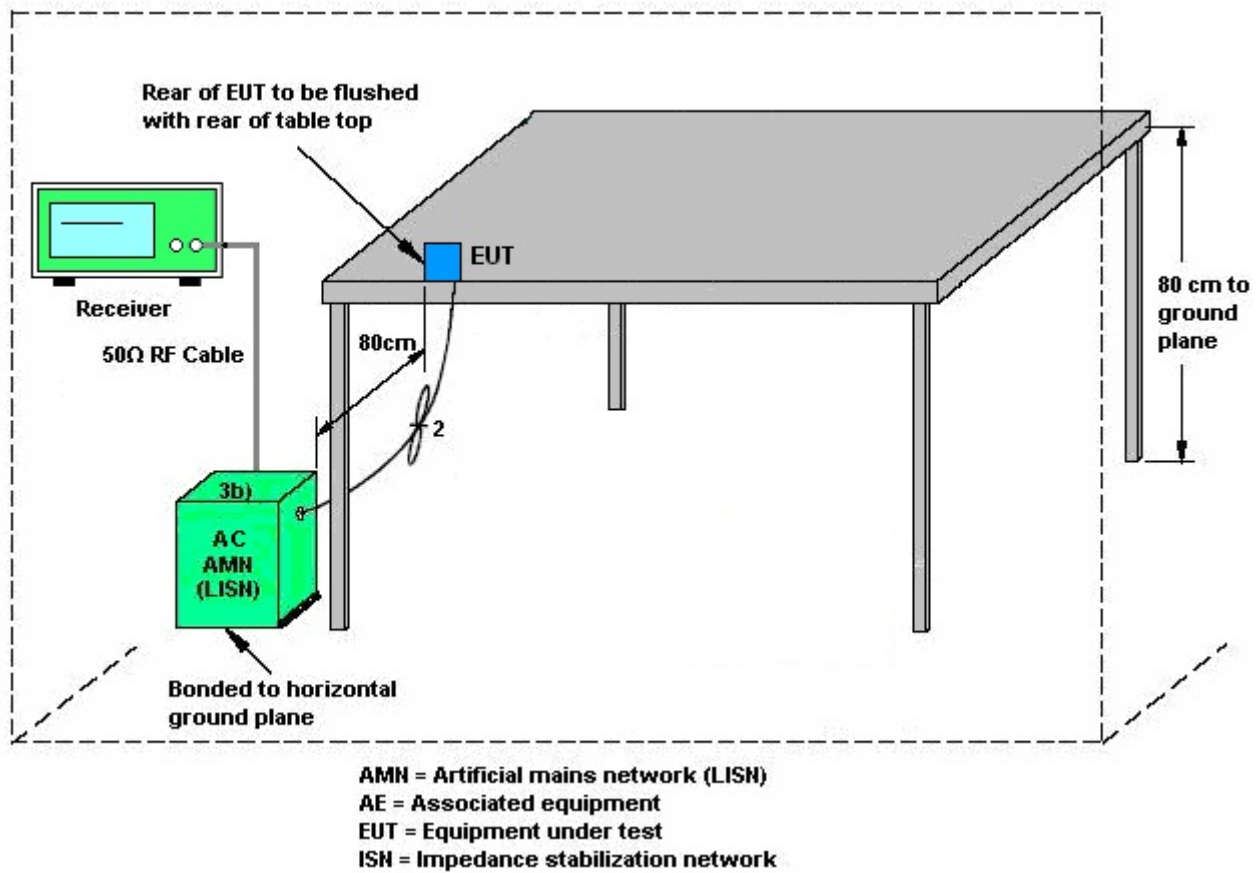
### 3.2.2 Measuring Instruments

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

### 3.2.3 Test Procedures

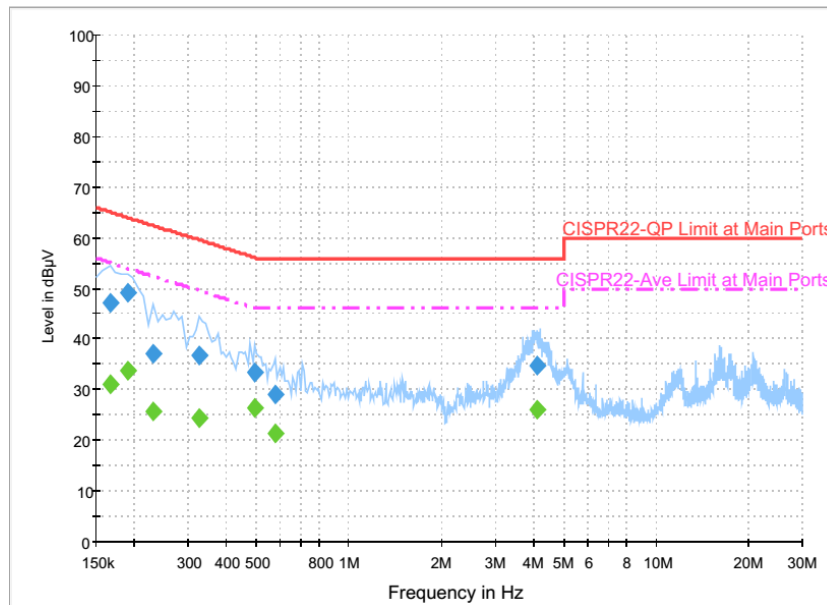
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
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

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



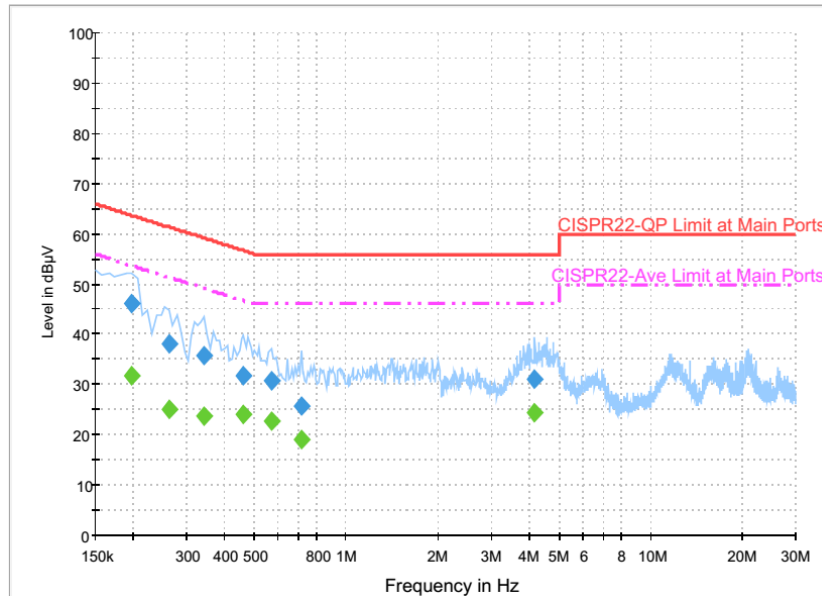
#### Final Result : QuasiPeak

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

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


**Final Result : QuasiPeak**

Frequency (MHz)	QuasiPeak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
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 (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
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



### **3.3 Antenna Requirements**

#### **3.3.1 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.

#### **3.3.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

#### **3.3.3 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 Equipments

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% ( $U = 2Uc(y)$ )	2.70
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