



FCC/ IC TEST REPORT

According to

FCC CFR Title 47 Part 15 Subpart E (15.407) & RSS-247 Issue 1

Applicant	:	Qualcomm Atheros, Inc.
Address	:	1700 Technology Drive, San Jose, CA 95110
Manufacturer	:	Qualcomm Atheros, Inc.
Address	:	1700 Technology Drive, San Jose, CA 95110
Equipment	:	Single Stream 802.11a/b/g/n/ac + BT 4.1 M.2 Type Card
Brand	:	Qualcomm Atheros
Model No.	:	QCNFA435
FCC ID	:	PPD-QCNFA435
IC ID	:	4104A-QCNFA435

■ The test result refers exclusively to the test presented test model / sample.,

■ Without written approval of **Cerpass Technology (Suzhou) Co.,Ltd.** the test report shall not be reproduced except in full.

■ The test was carried out on Mar.06,2017~ Mar.13,2017 at **Cerpass Technology(Suzhou) Corp.**

I HEREBY CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.10**. The equipment was **passed** the test performed according to **FCC Rules and Regulations Part 15 Subpart E (15.407) and RSS-247 Issue 1**.

Prepared By:

Kerry Zhou

Approved by:

Miro Chueh (EMC/RF Manager)

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory



NVLAP LAB Code:	200954-0
TAF LAB Code:	1439

Cerpass Technology (SuZhou) Co., Ltd.



NVLAP LAB Code:	200814-0
CNAS LAB Code:	L5515



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History of this test report

Report No.	Version	Issue Date	Description
SEDL1701087	Rev.01	2017-03-15	Initial release



1. Test Configuration of Equipment under Test

1.1 Feature of Equipment under Test

WLAN Module	QCNFA435
Frequency Range	802.11a/n/ac(20MHz): 5180~5320MHz, 5500~5720MHz,5725~5850MHz 802.11n/ac(40MHz): 5190~5310MHz, 5510~5710,5755~5795MHz 802.11ac(80MHz): 5210MHz,5290MHz,5530MHz,5610MHz,5690MHz,5775MHz
Type of Modulation	802.11a/g/n/ac: OFDM
Data Rate	802.11a: 6/9/12/18/24/36/48/54 Mbps 802.11ac: up to 433.3 Mbps
Channel Control	Auto
Antenna Delivery	1*Tx + 1*Rx for 5GHz

Host Details,

Host Manufacture	Host Type	Host Model
Lenovo	Notebook Computer	Lenovo ideapad 520-15IKB



1.2 Antenna Construction and Directional Gain

Antenna	Manufacturer	Ant Type	Ant Part number	Peak Gain
Main(chain 0)	Amphenol	PIFA	DC33001GX00	-1.00dBi for 2.40~2.50GHz band -1.73dBi for 5.15~5.35GHz band -0.68dBi for 5.47~5.725GHz band -1.81dBi for 5.725~5.85GHz band
Aux(chain 1)			DC33001GX10	-1.63dBi for 2.40~2.50GHz band -3.79dBi for 5.15~5.35GHz band -3.24dBi for 5.47~5.725GHz band -4.66dBi for 5.725~5.85GHz band
Main(chain 0)	SPEED	PIFA	DC33001GV00	0.65dBi for 2.40~2.50GHz band 0.86dBi for 5.15~5.35GHz band -1.29dBi for 5.47~5.725GHz band -3dBi for 5.725~5.85GHz band
Aux(chain 1)			DC33001GV10	-0.14dBi for 2.40~2.50GHz band -1.73dBi for 5.15~5.35GHz band -1.57dBi for 5.47~5.725GHz band -3.87dBi for 5.725~5.85GHz band

Note: The EUT will collocation two kinds of antenna, we choose one of the high peak gain antenna for all RF testing.



1.3 Channels

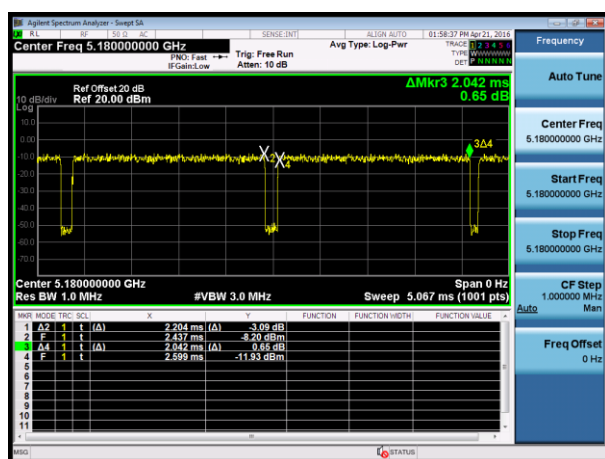
802.11a/n/ac(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz	48	5240 MHz
52	5260 MHz	56	5280 MHz	60	5300 MHz	64	5320 MHz
100	5500 MHz	104	5520 MHz	108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz	144	5720 MHz
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	N/A	N/A	N/A	N/A	N/A	N/A
802.11n/ac(40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz	62	5310 MHz
102	5510 MHz	110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	142	5710 MHz	151	5755 MHz	159	5795 MHz
802.11ac(80MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530 MHz	122	5610 MHz
138	5690 MHz	155	5775 MHz	N/A	N/A	N/A	N/A



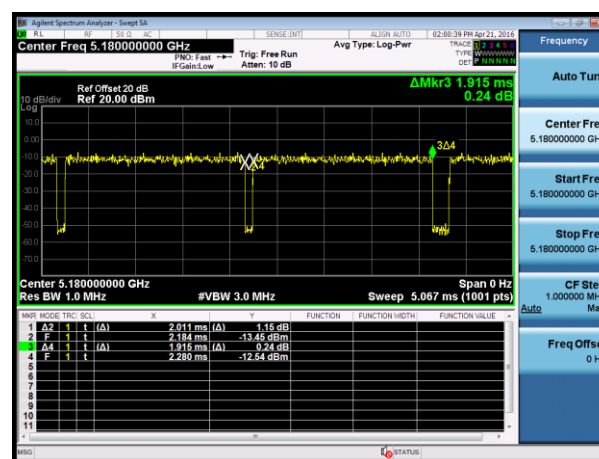
1.4 Duty Cycle

Test Mode	Frequency (MHz)	Duty Cycle
802.11a	5180	92.60%
802.11n(20MHz)	5180	95.20%
802.11n(40MHz)	5190	84.20%
802.11ac(80MHz)	5210	77.30%

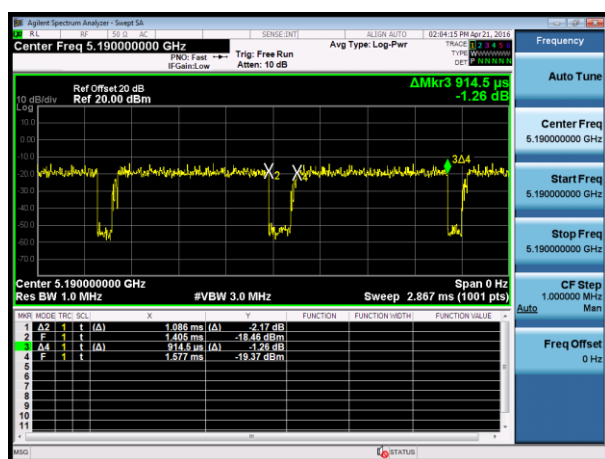
Transmit at 5180MHz by 802.11a



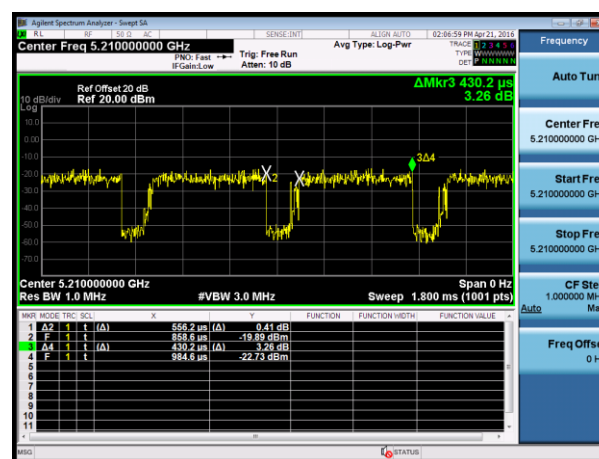
Transmit at 5180MHz by 802.11 n(20MHz)



Transmit at 5190MHz by 802.11 n(40MHz)



Transmit at 5210MHz by 802.11 ac(80MHz)





1.5 Test Manner

Test Manner	
a	During testing, the interface cables and equipment positions were varied according to ANSI C63.10
b	Adjust the EUT at the test mode and the test channel. Then test.

Test Mode
Mode 1: Transmit by 802.11 a
Mode 2: Transmit by 802.11n(20MHz)
Mode 3: Transmit by 802.11n(40MHz)
Mode 4: Transmit by 802.11ac (80MHz)

Note: Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.



2. Technical Test

2.1 Summary of Test Result

☒ No deviations from the test standards

☐ Deviations from the test standards as below description:

RSS-247, Issue 1 Section(s)	Test Description	Test Result	Reference
FCC 15.407(h)(1) RSS-247 Issue 1 May 2015 Section 6.2.1.1& 6.2.2.1&6.2.3.1&6.2.4.1	Maximum Conducted Output Power	Pass	Section 7.4

ANSI C63.10: 2013; RSS-247 Issue 1; RSS-Gen issue 4

IC Rule	. Description of Test	Result
Item 6	. Maximum Peak Output Power	Pass



2.2 General Information of Test

Test Site	Cerpass Technology (Suzhou) Co.,Ltd
Test Site Location	No.66,Tangzhuang Road, Suzhou Industrial Park, Jiangsu 215006, China
NVLAP LAB Code	200814-0
FCC Registration Number	916572, 331395
IC Registration Number	7290A-1, 7290A-2
VCCI Registration Number	T-1945 for Telecommunication Test C-2919 for Conducted emission test R-2670 for Radiated emission test below 1GHz G-227 for Radiated emission test above 1GHz
Frequency Range Investigated	Conducted: from 150kHz to 30MHz Radiation: from 30MHz to 40000MHz
Test Distance	The test distance of radiated emission from antenna to EUT is 3 M.

2.3 Measurement Uncertainty

Measurement Item	Measurement Frequency	Polarization	Uncertainty
Radiated Emission	30 MHz ~ 40GHz	Vertical	± 4.11 dB
		Horizontal	± 4.10 dB
Maximum Peak Output Power	---	---	± 1.4 dB
Conducted Band Edges	---	---	± 2.2 dB



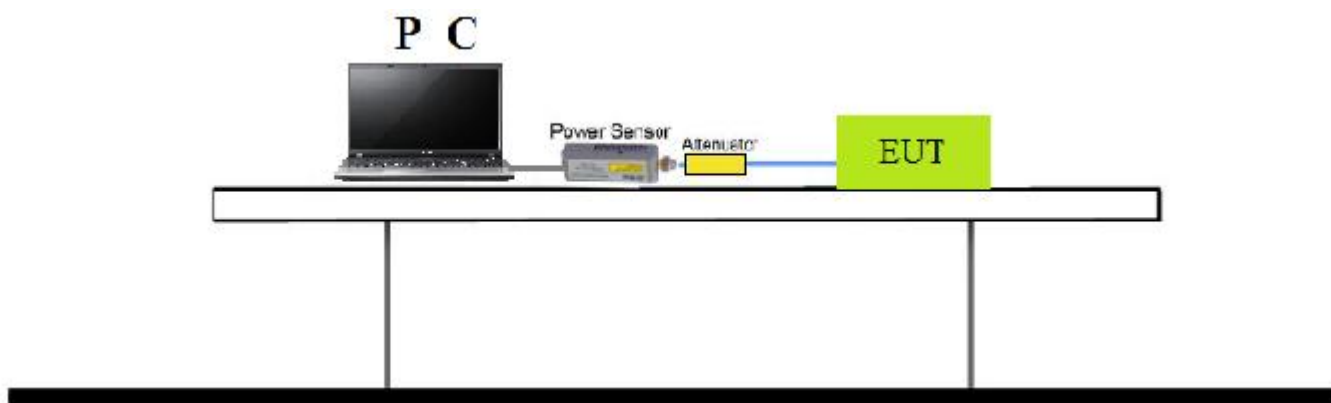
3. Power Output

3.1 Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Calibration Date	Valid Date.
PC	Lenovo	E40-70	MP078UQV	N/A	N/A
POWER SENSOR	Agilent	U2021XA	MY53260020	2016.03.27	2017.03.26
Temperature/ Humidity Meter	Zhicheng	ZC1-11	CEP-TH-003	2016.03.31	2017.03.30

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2 Test Setup





3.3 Limit

For FCC 15.407 Power Limit:

- 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 provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 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 provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi..
- For the band 5.25-5.35 GHz and 5.47-5.725 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. If transmitting antenna of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

**For RSS-247 Power Limit:**

Frequency Band 5150-5250 MHz: The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

Frequency Band 5250-5350 MHz: The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that 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.

Frequency Bands 5470-5600 MHz and 5650-5725 MHz: The maximum e.i.r.p. shall not exceed 1.0 W or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that 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.

Frequency Band 5725-5850 MHz: The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

3.4 Test Procedure

The EUT was tested according to KDB 789033 D02v01r03 Section E.3.b) for compliance to FCC 47CFR 15.407 requirements.

Use the wideband power meter to test RMS power and record the result.

Refer to RSS-247 Clause 6.



3.5 Test Result

Power output test was verified over all data rates of each mode shown as below, and then choose the maximum power output (yellow marker) for final test of each channel.

MCS Index for 802.11n	Spatial Streams	Data Rate (Mbps)				
		802.11a	20MHz Bandwidth		40MHz Bandwidth	
			800ns GI	400ns GI	800ns GI	400ns GI
0	1	6	6.5	7.2	13.5	15.0
1	1	9	13.0	14.4	27.0	30.0
2	1	12	19.5	21.7	40.5	45.0
3	1	18	26.0	28.9	54.0	60.0
4	1	24	39.0	43.3	81.0	90.0
5	1	36	52.0	57.8	108.0	120.0
6	1	48	58.5	65.0	121.5	135.0
7	1	54	65.0	72.2	135.0	150.0
8	2	---	13.0	14.4	27.0	30.0
9	2	---	26.0	28.9	54.0	60.0
10	2	---	39.0	43.3	81.0	90.0
11	2	---	52.0	57.8	108.0	120.0
12	2	---	78.0	86.7	162.0	180.0
13	2	---	104.0	115.6	216.0	240.0
14	2	---	117.0	130.0	243.0	270.0
15	2	---	130.0	144.0	270.0	300.0

Spatial Streams	MCS Index	Modulation type	Coding rate	Data Rate(Mb/s)					
				20MHz		40MHz		80MHz	
				Guard Interval		Guard Interval		Guard Interval	
				800ns	400ns	800ns	400ns	800ns	400ns
1	0	BPSK	1/2	6.5	7.2	13.5	15	29.3	32.5
	1	QPSK	1/2	13	14.4	27	30	58.5	65
	2	QPSK	3/4	19.5	21.7	40.5	45	87.8	97.5
	3	16-QAM	1/2	26	28.9	54	60	117	130
	4	16-QAM	3/4	39	43.3	81	90	175.5	195
	5	64-QAM	2/3	52	57.8	108	120	234	260



	6	64-QAM	3/4	58.5	65	121.5	135	263.3	292.5
	7	64-QAM	5/6	65	72.2	135	150	292.5	325
	8	256-QAM	3/4	78	86.7	162	180	351	390
	9	256-QAM	5/6	N/A	N/A	180	200	390	433.3

Power output at various data rates

Test Mode	Bandwidth	Frequency (MHz)	Channel	Data Rate	Average Power (dBm)
802.11a	20	5180	36	6	14.90
				24	14.56
				54	14.38
802.11n(20MHz)	20	5180	36	MCS0	14.72
				MCS5	14.41
				MCS7	14.26
802.11n(40MHz)	40	5190	38	MCS0	10.76
				MCS5	10.55
				MCS7	10.17
802.11ac(80MHz)	80	5210	42	MCS0NSS1	12.89
				MCS5NSS1	12.48
				MCS9NSS1	12.27



Configurations	Mode			
	Channel / Frequency (MHz)			
5.2GHz WLAN Average Power	802.11a			
	36/5180	40/5200	44/5220	48/5240
	14.90	16.24	15.53	15.87
	802.11n(HT20)			
	36/5180	40/5200	44/5220	48/5240
	14.72	16.10	16.45	15.86
	802.11ac(VHT20)			
	36/5180	40/5200	44/5220	48/5240
	14.97	16.29	16.46	15.50
	802.11n(HT40)			
	38/5190		46/5230	
	10.76		15.22	
	802.11ac(VHT40)			
	38/5190		38/5230	
	11.04		15.17	
	802.11ac(VHT80)			
	42/5210			
	12.89			

Configurations	Mode			
	Channel / Frequency (MHz)			
5.3GHz WLAN Average Power	802.11a			
	52/5260	56/5280	60/5300	64/5320
	16.46	16.25	16.47	14.03
	802.11n(HT20)			
	52/5260	56/5280	60/5300	64/5320
	16.45	15.02	16.15	14.38
	802.11ac(VHT20)			
	52/5260	56/5280	60/5300	64/5320
	16.32	15.15	16.22	14.01
	802.11n(HT40)			



	54/5270				62/5310			
	15.16				11.03			
	802.11ac(VHT40)							
	54/5270				62/5310			
	15.17				12.28			
	802.11ac(VHT80)							
	58/5290							
	10.99							
5.6GHz WLAN Average Power	802.11a							
	100/5500	112/5560	116/5580	128/5640	132/5660	136/5680	140/5700	144/5720
	14.33	16.39	16.41	16.28	16.23	16.45	13.79	16.12
	802.11n(HT20)							
	100/5500	112/5560	116/5580	128/5640	132/5660	136/5680	140/5700	144/5720
	14.42	15.92	16.03	16.37	16.32	16.19	14.36	16.16
	802.11ac(VHT20)							
	100/5500	112/5560	116/5580	128/5640	132/5660	136/5680	140/5700	144/5720
	13.85	15.87	16.09	16.37	16.20	16.25	14.31	16.24
	802.11n(HT40)							
	102/5510	110/5550	118/5590	126/5630	134/5670	142/5710		
	12.15	15.18	15.03	15.47	14.89	15.35		
	802.11ac(VHT40)							
	102/5510	110/5550	118/5590	126/5630	134/5670	142/5710		
	12.08	15.29	15.35	15.29	14.95	15.27		
	802.11ac(VHT80)							
	106/5530			122/5610			138/5690	
	11.08			15.06			15.22	

Configurations	Mode				
	Channel / Frequency (MHz)				
5.8GHz WLAN Average Power	802.11a				
	149/5745	153/5765	157/5785	161/5805	165/5825
	16.69	16.17	16.83	16.73	16.68
	802.11n(HT20)				
	149/5745	153/5765	157/5785	161/5805	165/5825
	16.51	16.64	16.44	16.62	16.53



	802.11ac(VHT20)				
	149/5745	153/5765	157/5785	161/5805	165/5825
	16.63	16.77	16.52	16.73	16.64
	802.11n(HT40)				
	151/5755			159/5795	
	14.30			14.94	
	802.11ac(VHT40)				
	151/5755			159/5795	
	14.47			15.02	
	802.11ac(VHT80)				
	155/5775				
	13.52				

Result	PASS
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--End--