

FCC Test Report

Product Name : Wireless-AC2600 Dual WAN VPN Wireless Router
Trade Name : ASUS
Model No. : BRT-AC828/M2, BRT-AC828
FCC ID. : MSQ-RT0V00

Applicant : ASUSTeK COMPUTER INC.

Address : 4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan

Date of Receipt : Feb. 17, 2016

Issued Date : Aug. 01, 2016

Report No. : 1620268R-RFUSP56V00-B

Report Version : V1.0



The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.

Test Report Certification

Issued Date : Aug. 01, 2016

Report No. : 1620268R-RFUSP56V00-B



Product Name : Wireless-AC2600 Dual WAN VPN Wireless Router
Applicant : ASUSTeK COMPUTER INC.
Address : 4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan
Manufacturer : ASUSTeK COMPUTER INC.
Model No. : BRT-AC828/M2, BRT-AC828
FCC ID. : MSQ-RT0V00
EUT Voltage : AC 100-240V, 50-60Hz
Testing Voltage : AC 120V/60Hz
Trade Name : ASUS
Applicable Standard : FCC CFR Title 47 Part 15 Subpart E Section 15.407:2014
ANSI C63.10: 2013
Test Lab : Quietek Hsin Chu Laboratory
Test Result : Complied

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quietek Corporation.

Documented By :

A handwritten signature in blue ink, appearing to read "Carol Tsai", written over a horizontal line.

(Carol Tsai / Senior Engineering Adm. Specialist)

Tested By :

A handwritten signature in blue ink, appearing to read "Bruno Tsai", written over a horizontal line.

(Bruno Tsai / Engineer)

Approved By :

A handwritten signature in blue ink, appearing to read "Roy Wang", written over a horizontal line.

(Roy Wang / Director)

Revision History

Report No.	Version	Description	Issued Date
15B0233R-RFUSP56V00	V1.0	Initial issue of report	Nov. 23, 2015
1620125R-RFUSP57V00	V1.0	Change components part of the EUT, modify the emission (under the 1GHz) and internal photo. Add one TX/RX Antenna (ASC / RFDPA151300SBLB803_V01 (Gold)), this antenna gain is less than original.	Feb. 17, 2016
1620268R-RFUSP56V00	V1.0	Add the test data of Beamforming Mode.	Mar. 04, 2016
1620268R-RFUSP56V00-B	V1.0	1. Add description in chapter 1.1 note 8 for clarify this device support 80 + 80MHz channels and MU-MIMO function. Add MU-MIMO test data in Attachment 1. 2. Change antenna external shell design (ASC / RFDPA151300SBLB803_V01 (Gold)), and update antenna photo, this change doesn't affect the antenna gain. 3. Add M/N: BRT-AC828	Aug. 01, 2016

Laboratory Information

We, **QuieTek Corporation**, are an independent RF consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted (audited or listed) by the following related bodies in compliance with ISO 17025 specified testing scopes:

Taiwan R.O.C.	: TAF, Accreditation Number: 3024
USA	: FCC, Registration Number: 834100
Canada	: IC, Submission No: 181665 / IC Registration Number: 4075C-4

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site:<http://www.quietek.com/english/about/certificates.aspx?bval=5>

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site :
http://www.quietek.com/index_en.aspx

If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

HsinChu Testing Laboratory:

No.75-2, 3rd Lin, Wangye Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan, R.O.C.

TEL:+886-3-592-8858 / FAX:+886-3-592-8859

E-Mail : service@quietek.com

LinKou Testing Laboratory:

No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.

TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789

E-Mail : service@quietek.com

TABLE OF CONTENTS

Description	Page
1. General Information.....	6
1.1. EUT Description	6
Attachment 1	15
MU-MIMO Test	15
Attachment 2	18
Antenna External Photo	18
Attachment 3	19
Original Report	19

1. General Information

1.1. EUT Description

Product Name	Wireless-AC2600 Dual WAN VPN Wireless Router	
Trade Name	ASUS	
Model No.	BRT-AC828/M2, BRT-AC828	
Product Type	WLAN (4TX, 4RX)	
Frequency Range/ Channel Number	IEEE 802.11a/ IEEE 802.11n	5180~5240MHz / 4 Channels
	IEEE 802.11n (40MHz)	5190~5230MHz / 2 Channels
	IEEE 802.11ac (80MHz)	5210~5210MHz / 1 Channel
Type of Modulation	IEEE 802.11a/n/ac	Orthogonal Frequency Division Multiplexing
Data Speed	IEEE 802.11a	6Mbps,9Mbps,12Mbps,18Mbps,24Mbps,36Mbps,48Mbps,54Mbps
	IEEE 802.11n	Support a subset of the combination of GI, MCS 0~MCS 7 and bandwidth defined in 802.11n
	IEEE 802.11ac	Support a subset of the combination of GI, MCS 0~MCS 9 and bandwidth defined in 802.11ac

Antenna Information		
Antenna Type	Dipole	
Antenna Gain	MFR. / Model	Antenna Gain
	ASC / RFDPA171300SBLB814_V01 (Red)	3.19dBi
	ASC / RFDPA151300SBLB803_V01 (Gold)	3.16dBi

Accessories Information	
Antenna	3 PCS
LAN Cable	Shielded, 1.5m
Power Adatper 1	ASUS., ADP-45BW B I/P: 100-240V~ 50-60Hz 1.2A O/P : 19V ===2.37A Cable Out: Non-Shielded, 2.2m
Power Adatper 2	ASUS., ADP-65DW B I/P: 100-240V~ 50-60Hz 1.5A O/P : 19V ===3.42A Cable Out: Non-Shielded, 2.2m
Power Adatper 3	ASUS., AD883J20 I/P: 100-240V~ 50/60Hz 1.0A O/P : 19V ===2.37A Cable Out: Non-Shielded, 2.0m
Power Adatper 4	ASUS., AD887320 I/P: 100-240V~ 50/60Hz 1.5A O/P : 19V ===3.42A Cable Out: Non-Shielded, 2.0m

ANT-TX / RX & Bandwidth

ANT-TX / RX	TX			RX		
Mode/ Channel Bandwidth	20MHz	40MHz	80MHz	20MHz	40MHz	80MHz
IEEE802.11a	✓			✓		
IEEE802.11n	✓	✓		✓	✓	
IEEE802.11ac	✓	✓	✓	✓	✓	✓

IEEE 802.11n

MCS Index	Modulation	R	N _{BPSCS}	N _{CBPS}		N _{DBPS}		Data Rate(Mb/s)			
				20MHz	40MHz	20MHz	40MHz	800ns GI		400ns GI	
								20MHz	40MHz	20MHz	40MHz
0	BPSK	1/2	1	52	108	26	54	6.5	13.5	7.2	15.0
1	QPSK	1/2	2	104	216	52	108	13.0	27.0	14.4	30.0
2	QPSK	3/4	2	104	216	78	162	19.5	40.5	21.7	45.0
3	16-QAM	1/2	4	208	432	104	216	26.0	54.0	28.9	60.0
4	16-QAM	3/4	4	208	432	156	324	39.0	81.0	43.3	90.0
5	64-QAM	2/3	6	312	648	208	432	52.0	108.0	57.8	120.0
6	64-QAM	3/4	6	312	648	234	486	58.5	121.5	65.0	135.0
7	64-QAM	5/6	6	312	648	260	540	65.0	135.0	72.2	150.0

Note 1: Support of 400ns GI is optional on transmit and receive.

Table 1 – MCS parameters for TX Antenna number = 1

MCS Index	Modulation	R	N _{BPSCS}	N _{CBPS}		N _{DBPS}		Data Rate(Mb/s)			
				20MHz	40MHz	20MHz	40MHz	800ns GI		400ns GI	
								20MHz	40MHz	20MHz	40MHz
8	BPSK	1/2	1	104	216	52	108	13.0	27.0	14.4	30.0
9	QPSK	1/2	2	208	432	104	216	26.0	54.0	28.9	60.0
10	QPSK	3/4	2	208	432	156	324	39.0	81.0	43.3	90.0
11	16-QAM	1/2	4	416	864	208	432	52.0	108.0	57.8	120.0
12	16-QAM	3/4	4	416	864	312	648	78.0	162.0	86.7	180.0
13	64-QAM	2/3	6	624	1296	416	864	104.0	216.0	115.6	240.0
14	64-QAM	3/4	6	624	1296	468	972	117.0	243.0	130.0	270.0
15	64-QAM	5/6	6	624	1296	520	1080	130.0	270.0	144.4	300.0

Note 1: Support of 400ns GI is optional on transmit and receive.

Table 2 – MCS parameters for TX Antenna number = 2

MCS Index	Modulation	R	N _{BPSCS}	N _{CBPS}		N _{DBPS}		Data Rate(Mb/s)			
				20MHz	40MHz	20MHz	40MHz	800ns GI		400ns GI	
								20MHz	40MHz	20MHz	40MHz
16	BPSK	1/2	1	156	324	78	162	19.5	40.5	21.7	45.0
17	QPSK	1/2	2	312	648	156	324	39.0	81.0	43.3	90.0
18	QPSK	3/4	2	312	648	234	486	58.5	121.5	65.0	135.0
19	16-QAM	1/2	4	624	1296	312	648	78.0	162.0	86.7	180.0
20	16-QAM	3/4	4	624	1296	468	972	117.0	243.0	130.0	270.0
21	64-QAM	2/3	6	936	1944	624	1296	156.0	324.0	173.3	360.0
22	64-QAM	3/4	6	936	1944	702	1458	175.5	364.5	195.0	405.0
23	64-QAM	5/6	6	936	1944	780	1620	195.0	405.0	216.7	450.0

Note 1: Support of 400ns GI is optional on transmit and receive.

Table 3 – MCS parameters for TX Antenna number = 3

MCS Index	Modulation	R	N _{BPSCS}	N _{CBPS}		N _{DBPS}		Data Rate(Mb/s)			
				20MHz	40MHz	20MHz	40MHz	800ns GI		400ns GI	
								20MHz	40MHz	20MHz	40MHz
24	BPSK	1/2	1	208	432	104	216	26.00	54.00	28.80	60.00
25	QPSK	1/2	2	416	864	208	432	52.00	108.00	57.60	120.00
26	QPSK	3/4	2	416	864	312	648	78.00	162.00	86.80	180.00
27	16-QAM	1/2	4	832	1728	416	864	104.00	216.00	115.60	240.00
28	16-QAM	3/4	4	832	1728	624	1296	156.00	324.00	172.20	360.00
29	64-QAM	2/3	6	1248	2592	832	1728	208.00	432.00	231.20	480.00
30	64-QAM	3/4	6	1248	2592	936	1944	234.00	486.00	260.00	540.00
31	64-QAM	5/6	6	1248	2592	1040	2040	260.00	540.00	288.80	600.00

Note 1: Support of 400ns GI is optional on transmit and receive.

Table 4 – MCS parameters for TX Antenna number = 4

Symbol	Explanation
R	Code rate
N_{BPSC}	Number of coded bits per single carrier
N_{CBPS}	Number of coded bits per symbol
N_{DBPS}	Number of data bits per symbol
GI	guard interval

IEEE 802.11ac Data Rate

Spatial Streams (Note1)	MCS Index	Modulation type	Coding rate	Data Rate(Mb/s)							
				20 MHz		40 MHz		80 MHz		160 MHz	
				Guard Interval		Guard Interval		Guard Interval		Guard Interval	
				800ns	400ns	800ns	400ns	800ns	400ns	800ns	400ns
1	0	BPSK	1/2	6.5	7.2	13.5	15	29.3	32.5	58.5	65
	1	QPSK	1/2	13	14.4	27	30	58.5	65	117	130
	2	QPSK	3/4	19.5	21.7	40.5	45	87.8	97.5	175.5	195
	3	16-QAM	1/2	26	28.9	54	60	117	130	234	260
	4	16-QAM	3/4	39	43.3	81	90	175.5	195	351	390
	5	64-QAM	2/3	52	57.8	108	120	234	260	468	520
	6	64-QAM	3/4	58.5	65	121.5	135	263.3	292.5	526.5	585
	7	64-QAM	5/6	65	72.2	135	150	292.5	325	585	650
	8	256-QAM	3/4	78	86.7	162	180	351	390	702	780
	9	256-QAM	5/6	N/A	N/A	180	200	390	433.3	780	866.7
2	0	BPSK	1/2	13	14.4	27	30	58.6	65	117	130
	1	QPSK	1/2	26	28.8	54	60	117	130	234	260
	2	QPSK	3/4	39	43.4	81	90	175.6	195	351	390
	3	16-QAM	1/2	52	57.8	108	120	234	260	468	520
	4	16-QAM	3/4	78	86.6	162	180	351	390	702	780
	5	64-QAM	2/3	104	115.6	216	240	468	520	936	1040
	6	64-QAM	3/4	117	130	243	270	526.6	585	1053	1170
	7	64-QAM	5/6	130	144.4	270	300	585	650	1170	1300
	8	256-QAM	3/4	156	173.4	324	360	702	780	1404	1560
	9	256-QAM	5/6	N/A	N/A	360	400	780	866.6	1560	1733.4
3	0	BPSK	1/2	13	14.4	27	30	58.6	65	117	130
	1	QPSK	1/2	26	28.8	54	60	117	130	234	260
	2	QPSK	3/4	39	43.4	81	90	175.6	195	351	390
	3	16-QAM	1/2	52	57.8	108	120	234	260	468	520
	4	16-QAM	3/4	78	86.6	162	180	351	390	702	780
	5	64-QAM	2/3	104	115.6	216	240	468	520	936	1040
	6	64-QAM	3/4	117	130	243	270	526.6	585	1053	1170
	7	64-QAM	5/6	130	144.4	270	300	585	650	1170	1300
	8	256-QAM	3/4	156	173.4	324	360	702	780	1404	1560
	9	256-QAM	5/6	N/A	N/A	360	400	780	866.6	1560	1733.4

4	0	BPSK	1/2	26.0	28.9	54.0	60.0	117.0	130.0	234.0	260.0
	1	QPSK	1/2	52.0	57.8	108.0	120.0	234.0	260.0	468.0	520.0
	2	QPSK	3/4	78.0	86.7	162.0	180.0	351.0	390.0	702.0	780.0
	3	16-QAM	1/2	104.0	115.6	216.0	240.0	468.0	520.0	936.0	1040.0
	4	16-QAM	3/4	156.0	173.3	342.0	360.0	702.0	780.0	1404.0	1560.0
	5	64-QAM	2/3	208.0	231.1	432.0	480.0	936.0	1040.0	1872.0	2080.0
	6	64-QAM	3/4	234.0	260.0	486.0	540.0	1053.0	1170.0	2106.0	2340.0
	7	64-QAM	5/6	260.0	288.9	540.0	600.0	1170.0	1300.0	N/A	N/A
	8	256-QAM	3/4	312.0	346.7	648.0	720.0	1404.0	1560.0	2808.0	3120.0
	9	256-QAM	5/6	N/A	N/A	720.0	800.0	1560.0	1733.3	3120.0	3466.7

IEEE 802.11a & IEEE 802.11n (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

IEEE 802.11n (40MHz)

Working Frequency of Each Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz				

IEEE 802.11ac (80MHz)

Working Frequency of Each Channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz						

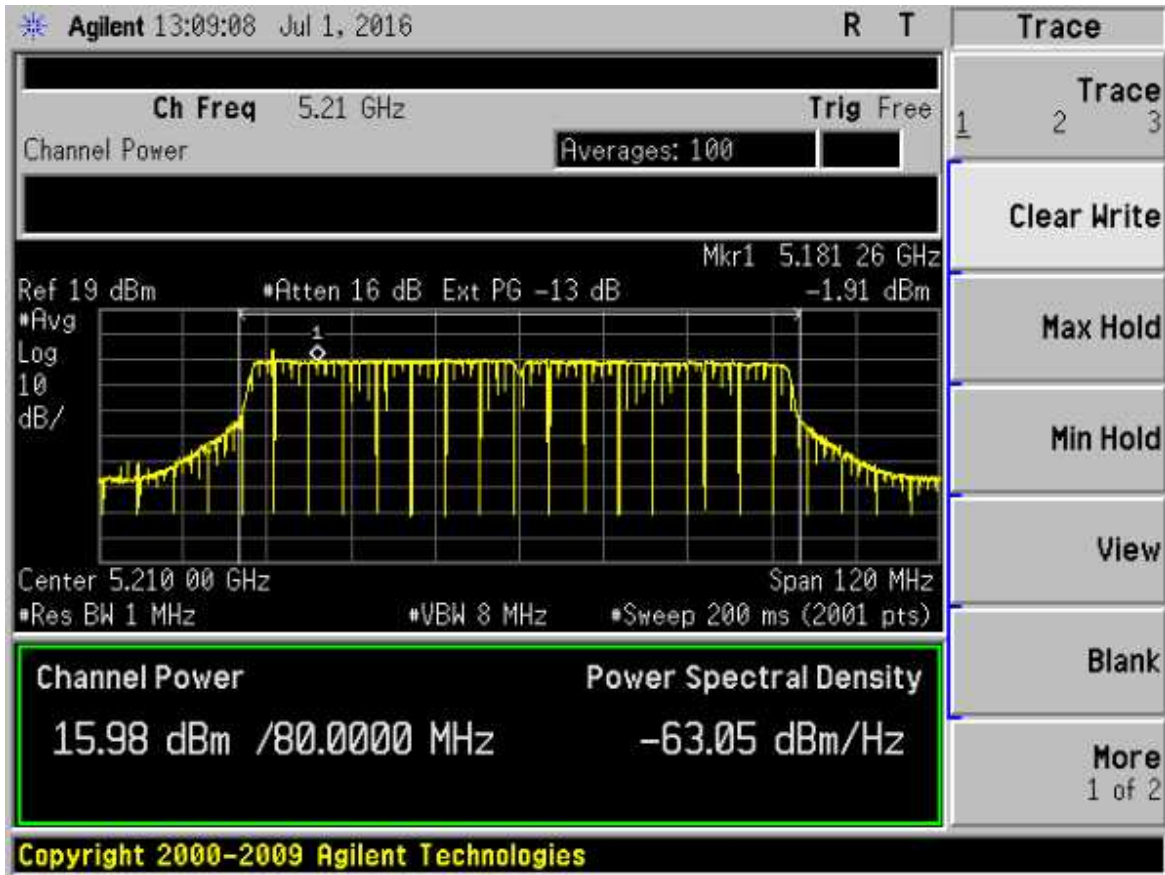
Note:

1. This device is an Wireless-AC2600 Dual WAN VPN Wireless Router including 2.4GHz b/g/n (4x4) and 5GHz a/n/ac (4x4) transmitting and receiving function.
2. The variation of model number is for different strategy of marketing.
3. These test results on a sample of the device are for the purpose of demonstrating Compliance with Part 15 Subpart E Paragraph 15.407.
4. Regards to the frequency band operation; the lowest , middle and highest frequency of channel were selected to perform the test, and then shown on this report.
5. The 5.2GHz is performed according to the UNII Test Procedures New Rules.
6. The function of the 2.4GHz & 5.8GHz transmitting is measured and makes a test report of the report number: 1620125R-RFUSP37V00 & 1620268R-RFUSP56V00-C.
7. This device is a composite device in accordance with Part 15 regulations. The receiving function receiving was tested and its test report number is 1620125R-RFUSP01V00.
8. This device can optional transmission in non-contiguous 80MHz channels(80+80 MHz mode) and supports 802.11ac Wave 1 and Wave 2. 802.11ac Wave 2 of BRT-AC828 uses downlink MU-MIMO (multi-user MIMO) to send data to up to three clients .

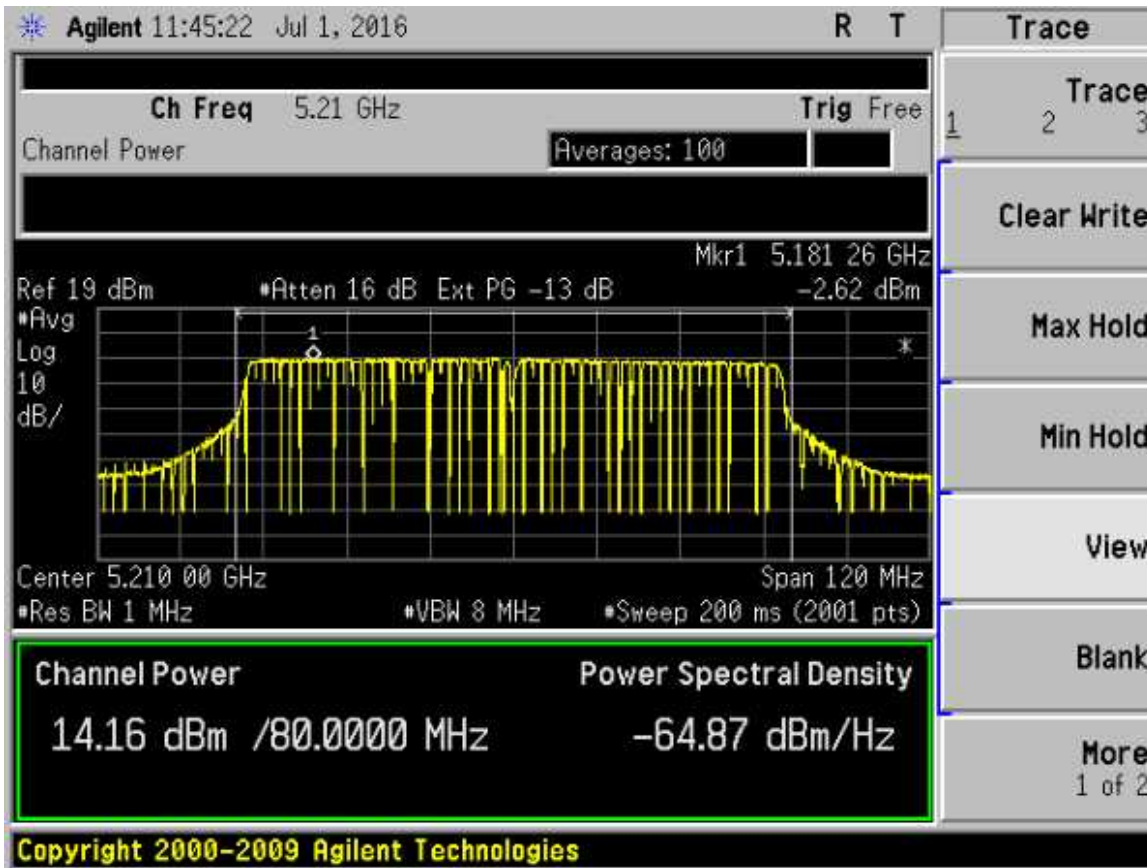
Attachment 1

➤ MU-MIMO Test

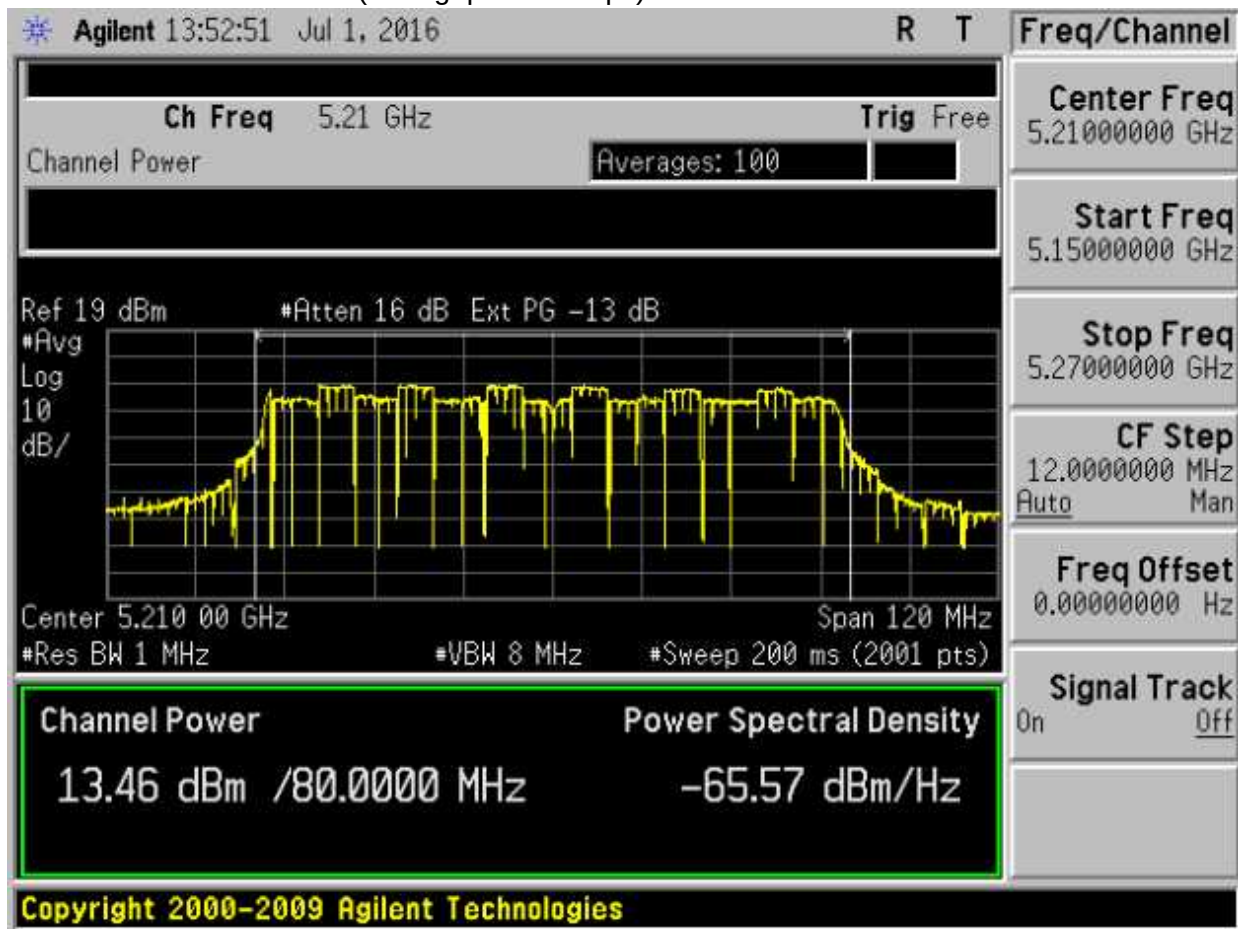
1. One Client: 1x1 MU-MIMO(throughput:230Mbps)



2. Two Clients:1x1 MU-MIMO+1x1 MU-MIMO(throughput:360Mbps)



3.Three Clients: MU-MIMO(throughput:390Mbps)



Channel power (EIRP)	One client MU-MIMO	Two clients MU-MIMO	Three clients MU-MIMO
	15.98(dBm)	14.16(dBm)	13.46(dBm)

The result can prove the possibility of independent beams overlapping which can not result in higher EIRP than a single user MIMO mode can generate and potentially exceeding the limit.

Attachment 2

➤ Antenna External Photo

(1) EUT Photo (Antenna: ASC_RFDPA171300SBLB814_V01)



(2) EUT Photo (Antenna: ASC_RFDPA151300SBLB803_V01)



Attachment 3

➤ **Original Report**