



Test Report

Product Name	Router
Model No	Z1
FCC ID	UDX-60024010

Applicant	Meraki Inc.
Address	660 Alabama St., San Francisco, CA, 94110

Date of Receipt	Aug. 30, 2012
Issued Date	Sep. 12, 2012
Report No.	129065R-RFUSP32V01
Report Version	V1.0



The test results relate only to the samples tested.

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Test Report Certification

Issued Date: Sep. 12, 2012

Report No.: 129065R-RFUSP32V01



Product Name	Router
Applicant	Meraki Inc.
Address	660 Alabama St., San Francisco, CA, 94110
Manufacturer	Meraki Inc.
Model No.	Z1
FCC ID.	UDX-60024010
EUT Rated Voltage	AC 100-240V, 50-60Hz
EUT Test Voltage	AC 120V/60Hz
Trade Name	Meraki
Applicable Standard	FCC CFR Title 47 Part 15 Subpart E: 2010 ANSI C63.4: 2003; FCC KDB-789033
Test Result	Complied

The Test Results relate only to the samples tested.

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(Engineer / Vincent Chu)

Approved By :

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(Manager / Vincent Lin)

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Router
Trade Name	Meraki
FCC ID.	UDX-60024010
Model No.	Z1
Frequency Range	802.11a/n-20MHz: 5180-5240MHz 802.11n-40MHz: 5190-5230MHz
Number of Channels	802.11a/n-20MHz: 4, n-40MHz: 2
Data Rate	802.11a/g: 6-54Mbps, 802.11n: up to 300Mbps
Channel Control	Auto
Type of Modulation	802.11a/n:OFDM, BPSK, QPSK, 16QAM, 64QAM
Antenna type	PIFA
Antenna Gain	Refer to the table “Antenna List”
Adapter	MFR: Powertron Electronics Corp., M/N: PA1015-2HU Input: 100-240V, 0.4A, 50-60Hz Output: 12V, 1.5A 18W Max Cable out: Non-Shielded, 1.5m

Antenna List

No.	Manufacturer	Part No.	Peak Gain
1.	MAGLAYERS	MSA-1610-5G0C4-A1 MSA-1610-5G0C4-A2	2dBi for 5GHz

Note: The antenna of EUT is conform to FCC 15.203

802.11a/n-20MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 36:	5180 MHz	Channel 40:	5200 MHz	Channel 44:	5220 MHz	Channel 48:	5240 MHz

802.11n-40MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency
Channel 38:	5190 MHz	Channel 46:	5230 MHz

Note:

1. This device is a Router with a built-in 2.4GHz and 5GHz WLAN transceiver, this report for 5GHz.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
3. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report.
(802.11a is 6Mbps, 802.11n-20BW is 14.4Mbps and 802.11n-40BW are 30Mbps)
4. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart E for Unlicensed National Information Infrastructure devices.

Test Mode	Mode 1: Transmitter (802.11a-6Mbps) Mode 2: Transmitter (802.11n-20BW 14.4Mbps) Mode 3: Transmitter (802.11n-40BW 30Mbps)
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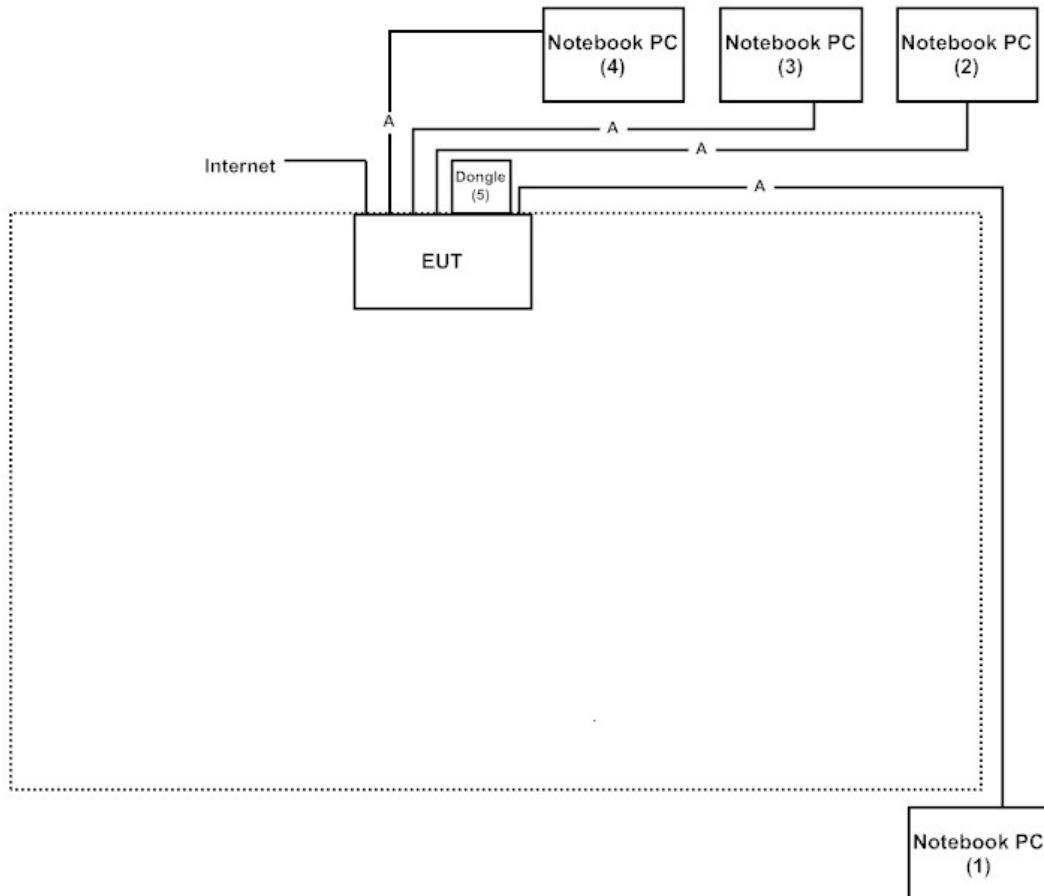
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
(1) Notebook PC	DELL	PPT	N/A	Non-Shielded, 0.8m
(2) Notebook PC	DELL	PP04X	N/A	Non-Shielded, 0.8m
(3) Notebook PC	DELL	PP04X	N/A	Non-Shielded, 0.8m
(4) Notebook PC	DELL	D630	N/A	Non-Shielded, 0.8m
(5) Dongle	Transend	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
A RJ-45 Cable	Non-Shielded, 3.0m

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Execute “Art.exe” program on the Notebook
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press “OK” to start the continuous transmission.
- (5) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : <http://tw.quietek.com/modules/myalbum/>

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

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Accreditation on NVLAP
NVLAP Lab Code: 200533-0

Site Name: Quietek Corporation
Site Address: No. 5-22, Ruei-Shu Valley, Ruei-Ping Tsuen,
Lin-Kou Shiang, Taipei,
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TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

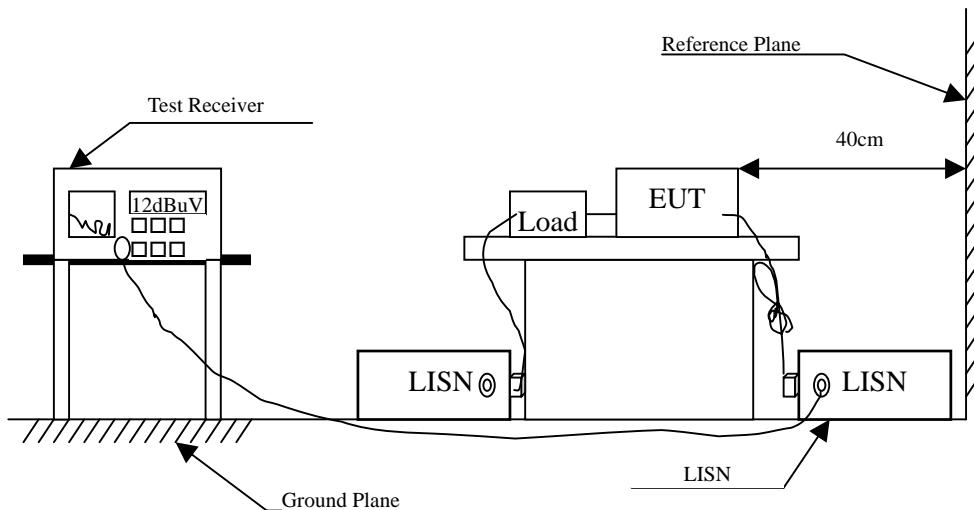
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2012	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2012	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2012	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2012	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2012	
	No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by “X” are used to measure the final test results.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks : In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

The EUT was setup to ANSI C63.4, 2003; tested to DTS test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Product : Router
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 3: Transmitter (802.11n-40BW 30Mbps) (5190MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.170	9.830	46.910	56.740	-8.689	65.429
0.216	9.830	40.340	50.170	-13.944	64.114
0.248	9.830	37.050	46.880	-16.320	63.200
0.338	9.830	30.530	40.360	-20.269	60.629
0.466	9.830	28.410	38.240	-18.731	56.971
12.107	10.040	27.590	37.630	-22.370	60.000
Average					
0.170	9.830	36.360	46.190	-9.239	55.429
0.216	9.830	27.590	37.420	-16.694	54.114
0.248	9.830	25.170	35.000	-18.200	53.200
0.338	9.830	23.480	33.310	-17.319	50.629
0.466	9.830	22.420	32.250	-14.721	46.971
12.107	10.040	22.430	32.470	-17.530	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Router
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 3: Transmitter (802.11n-40BW 30Mbps) (5190MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV

LINE 2**Quasi-Peak**

0.162	9.839	45.420	55.259	-10.398	65.657
0.212	9.830	41.030	50.860	-13.369	64.229
0.302	9.837	28.550	38.387	-23.270	61.657
0.502	9.840	35.000	44.840	-11.160	56.000
1.705	9.860	28.910	38.770	-17.230	56.000
4.408	9.880	31.290	41.170	-14.830	56.000

Average

0.162	9.839	30.750	40.589	-15.068	55.657
0.212	9.830	29.750	39.580	-14.649	54.229
0.302	9.837	17.090	26.927	-24.730	51.657
0.502	9.840	29.880	39.720	-6.280	46.000
1.705	9.860	22.660	32.520	-13.480	46.000
4.408	9.880	26.200	36.080	-9.920	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Maximum conducted output power

3.1. Test Equipment

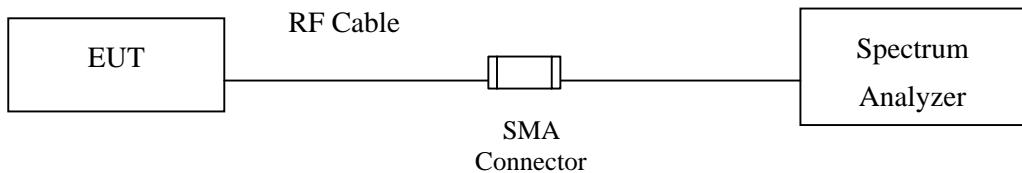
Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X Power Meter	Anritsu	ML2495A/6K00003357	May, 2012
X Power Sensor	Anritsu	MA2411B/0738448	Jun, 2012
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2012

Note:

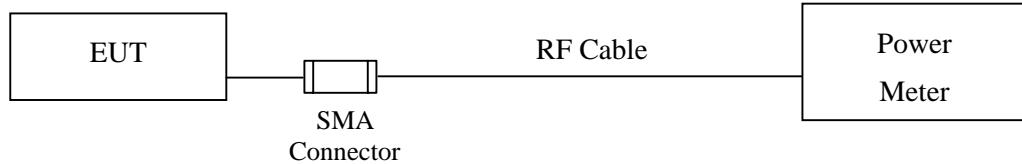
1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

3.2. Test Setup

26dBc Occupied Bandwidth



Conduction Power Measurement



3.3. Limits

- (1) For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (2) For the band 5.25-5.35 GHz, the maximum conducted output power over the frequency band 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 MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1W or $17 \text{ dBm} + 10\log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

3.4. Test Procedure

As an alternative to FCC KDB-789033, the EUT maximum conducted output power was measured with an average power meter employing a video bandwidth greater than 6dB BW of the emission under test. Maximum conducted output power was read directly from the meter across all data rates, and across three channels within each sub-band. Special care was used to make sure that the EUT was transmitting in continuous mode. This method exceeds the limitations of FCC KDB-789033, and provides more accurate measurements.

3.5. Uncertainty

± 1.27 dB

3.6. Test Result of Maximum conducted output power

Product : Router
 Test Item : Maximum conducted output power
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmitter (802.11a-6Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		6	9	12	18	24	36	48	54	
		Measurement Level (dBm)								
36	5180	13.74	--	--	--	--	--	--	--	<17dBm
44	5220	13.81	13.7	13.57	13.51	13.47	13.41	13.24	13.19	<17dBm
48	5240	13.74	--	--	--	--	--	--	--	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		6	9	12	18	24	36	48	54	
		Measurement Level (dBm)								
36	5180	13.71	--	--	--	--	--	--	--	<17dBm
44	5220	13.73	13.7	13.68	13.6	13.49	13.42	13.3	13.19	<17dBm
48	5240	13.77	--	--	--	--	--	--	--	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

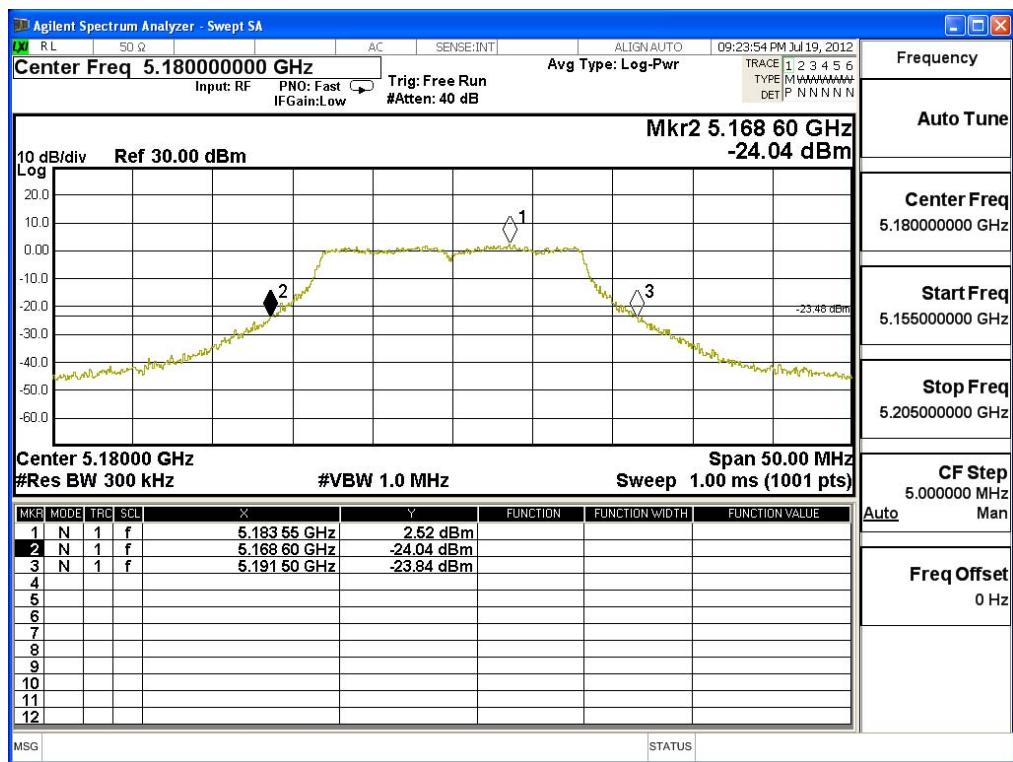
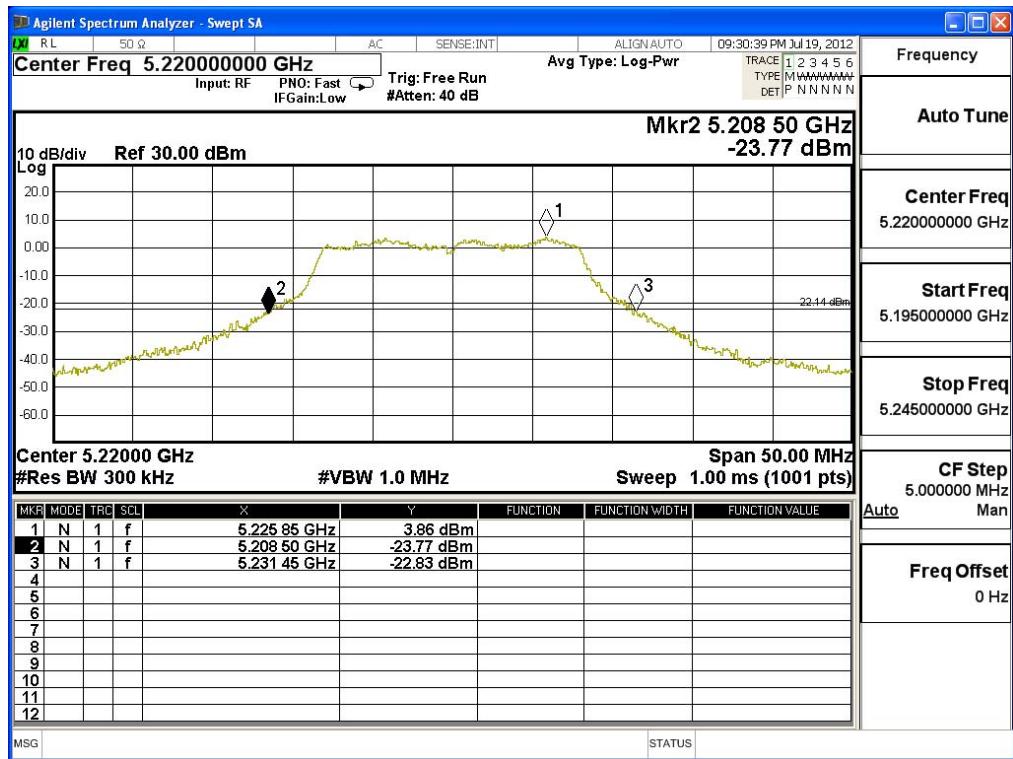
Maximum conducted output power Measurement:

(CHAIN A+ B)

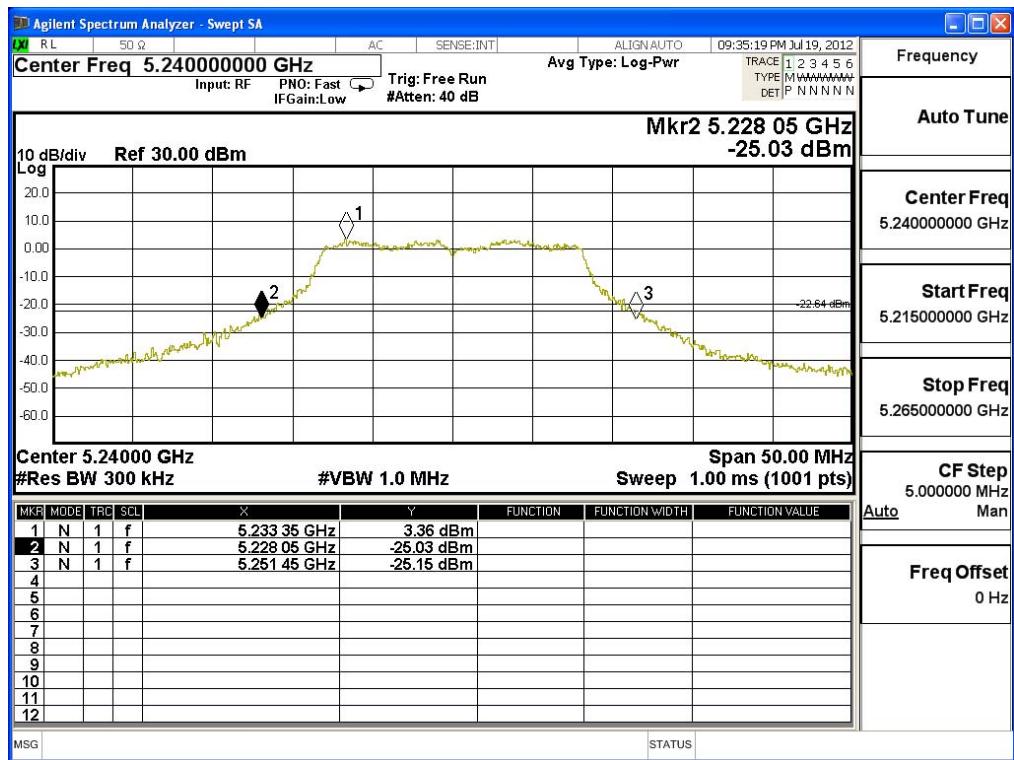
Channel Number	Frequency (MHz)	26dB Bandwidth (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Output Power (dBm)	Output Power Limit	
						(dBm)	(dBm+10log(BW))
36	5180	21.950	13.74	13.71	16.74	17	17.41
44	5220	22.950	13.81	13.73	16.78	17	17.61
48	5240	22.550	13.74	13.77	16.77	17	17.53

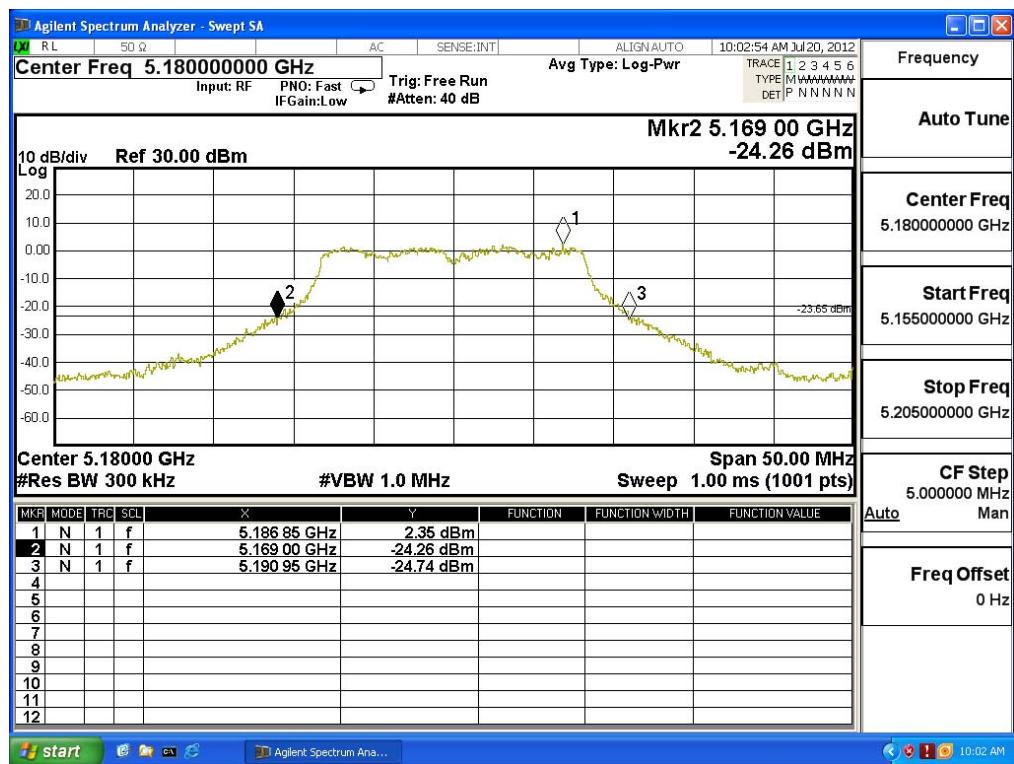
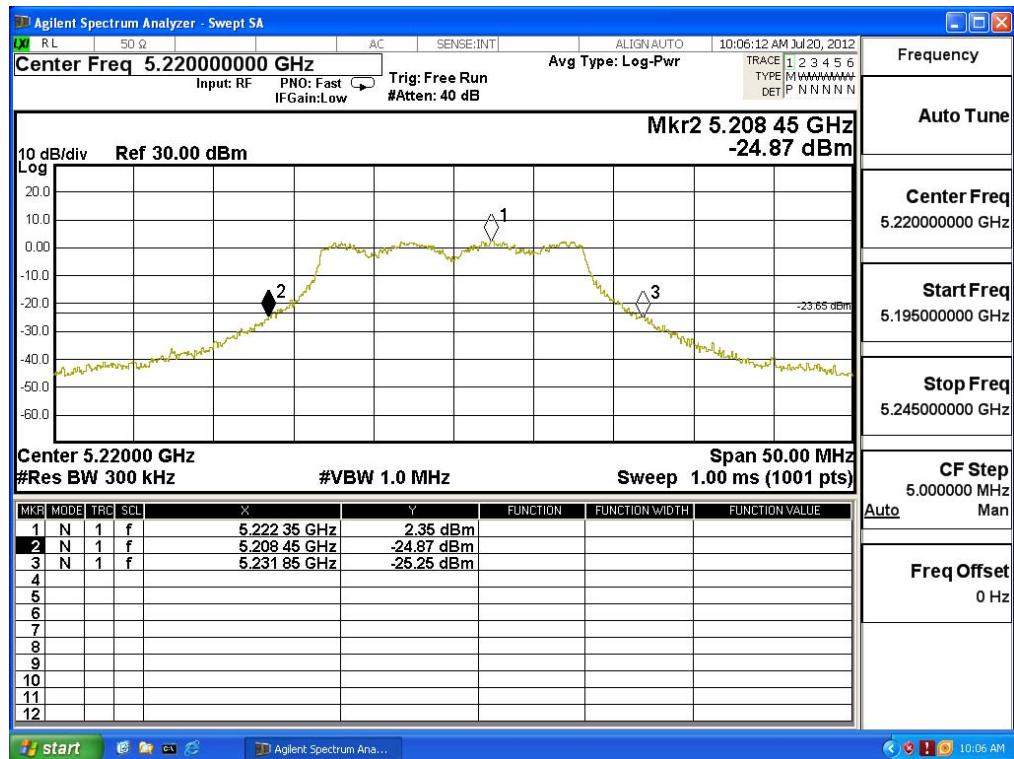
Note:

- Power Output Value =Reading value on average power meter + cable loss
- Output Power (dBm) = $10\log(\text{Chain A Power (mW}) + \text{Chain B Power (mW)})$
- 26 dB Bandwidth is the bandwidth of chain A or chain B whichever is less bandwidth, output power limitation is more stringent.

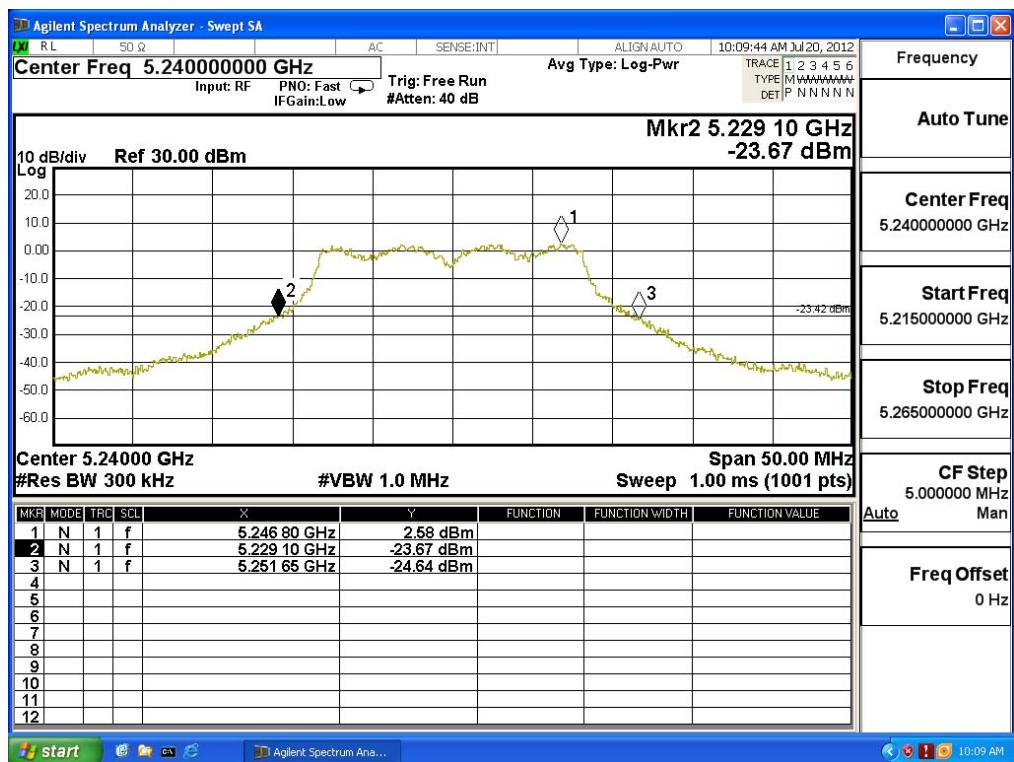
26dBc Occupied Bandwidth:
Channel 36: CHAIN A

Channel 40: CHAIN A


Channel 48: CHAIN A



26dBc Occupied Bandwidth:
Channel 36: CHAIN B

Channel 40: CHAIN B


Channel 48: CHAIN B



Product : Router
 Test Item : Maximum conducted output power
 Test Site : No.3 OATS
 Test Mode : Mode 2: Transmitter (802.11n-20BW 14.4Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		14.4	28.9	43.3	57.8	86.7	115.6	130	144.4	
		Measurement Level (dBm)								
36	5180	13.58	--	--	--	--	--	--	--	<17dBm
44	5220	13.6	13.57	13.41	13.39	13.31	13.24	13.19	13.1	<17dBm
48	5240	13.43	--	--	--	--	--	--	--	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		14.4	28.9	43.3	57.8	86.7	115.6	130	144.4	
		Measurement Level (dBm)								
36	5180	13.61	--	--	--	--	--	--	--	<17dBm
44	5220	13.63	13.58	13.47	13.41	13.28	13.21	13.17	13.1	<17dBm
48	5240	13.41	--	--	--	--	--	--	--	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

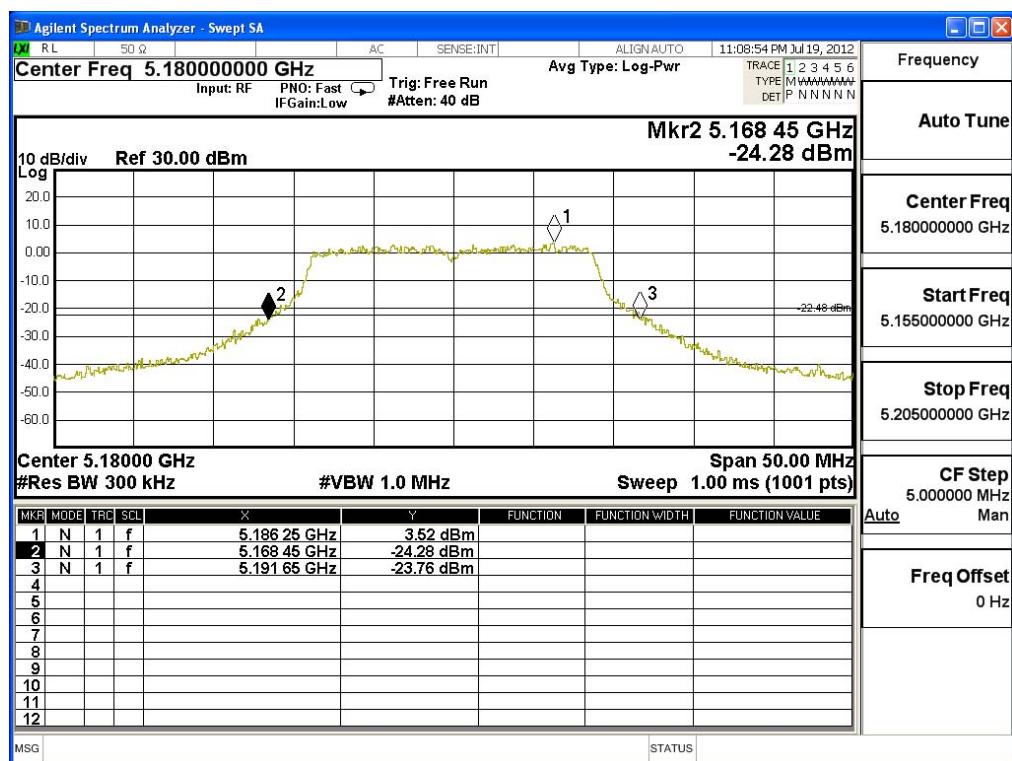
Maximum conducted output power Measurement:**(CHAIN A+ B)**

Channel Number	Frequency (MHz)	26dB Bandwidth (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Output Power (dBm)	Output Power Limit	
						(dBm)	(dBm)+10log(BW)
36	5180	23.200	13.58	13.61	16.61	17	17.65
44	5220	23.150	13.60	13.63	16.63	17	17.65
48	5240	22.800	13.43	13.41	16.43	17	17.58

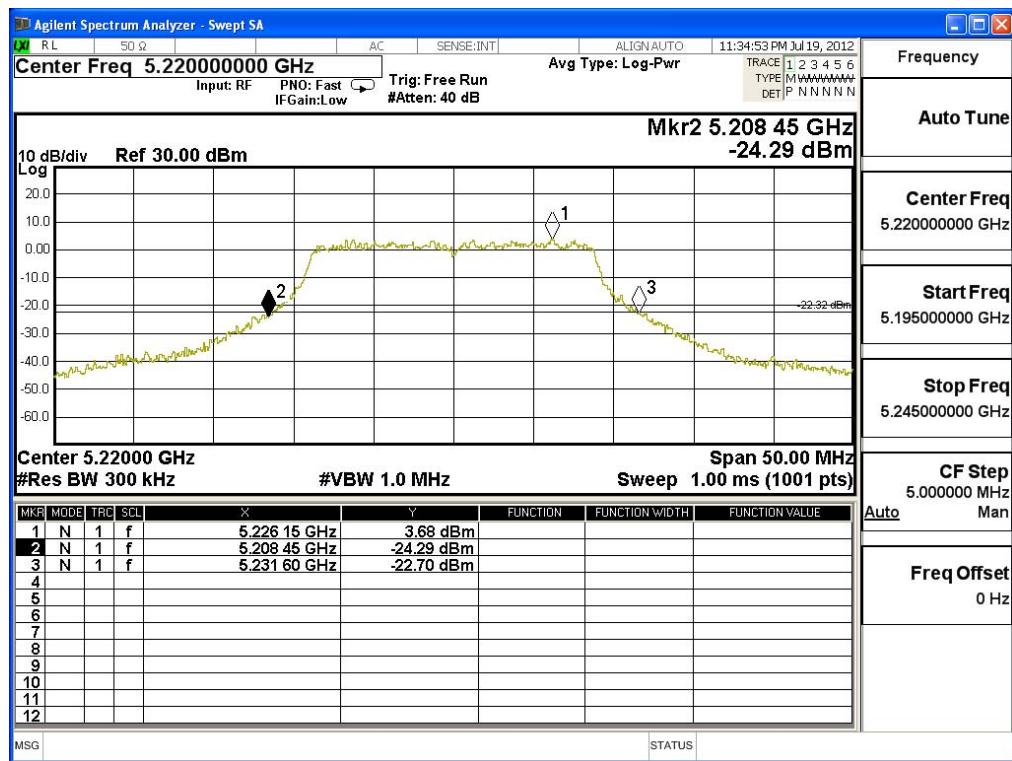
Note:

- Power Output Value =Reading value on average power meter + cable loss
- Output Power (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))
- 26 dB Bandwidth is the bandwidth of chain A or chain B whichever is less bandwidth, output power limitation is more stringent.

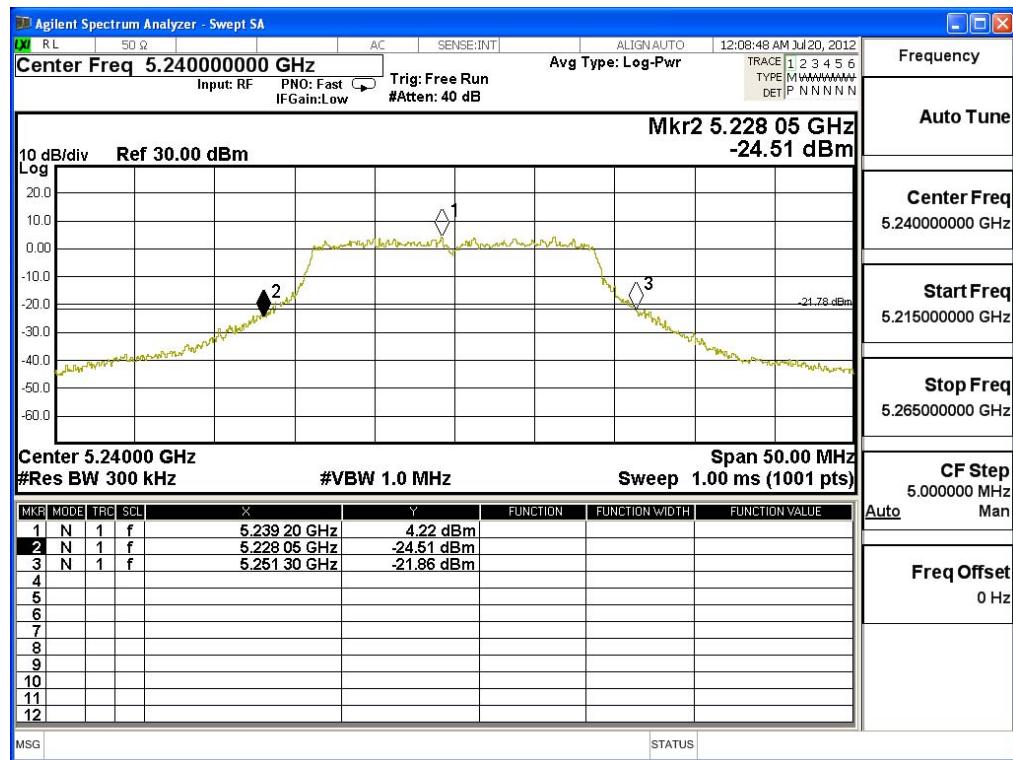
26dBc Occupied Bandwidth:
Channel 36 -Chain A

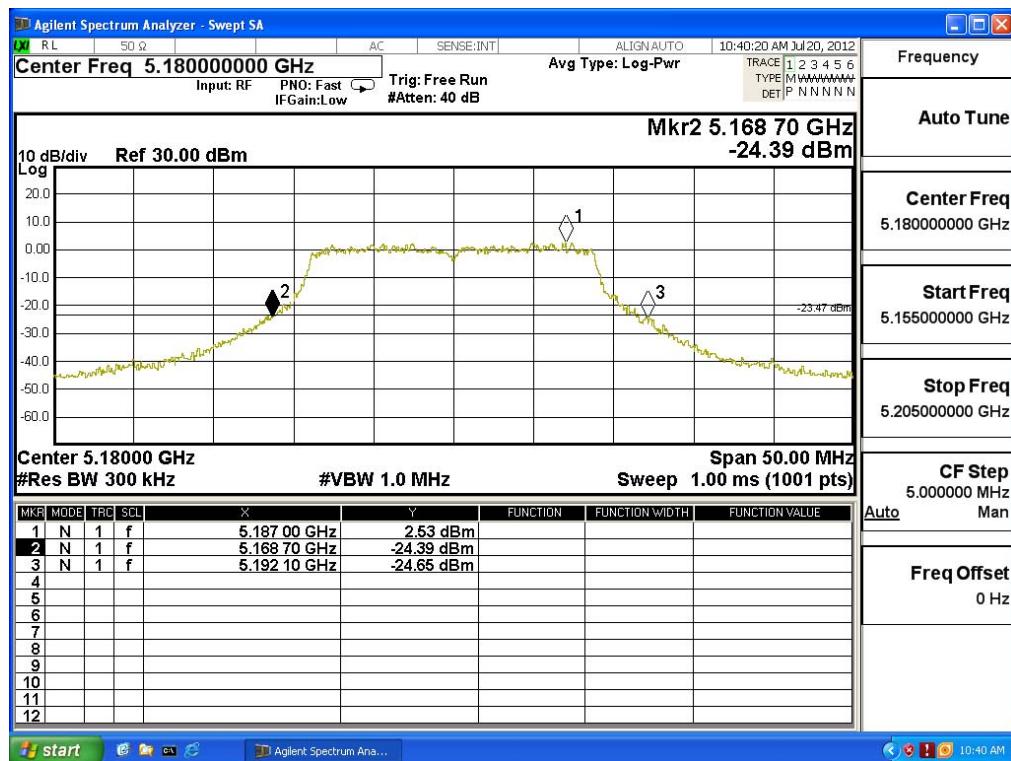
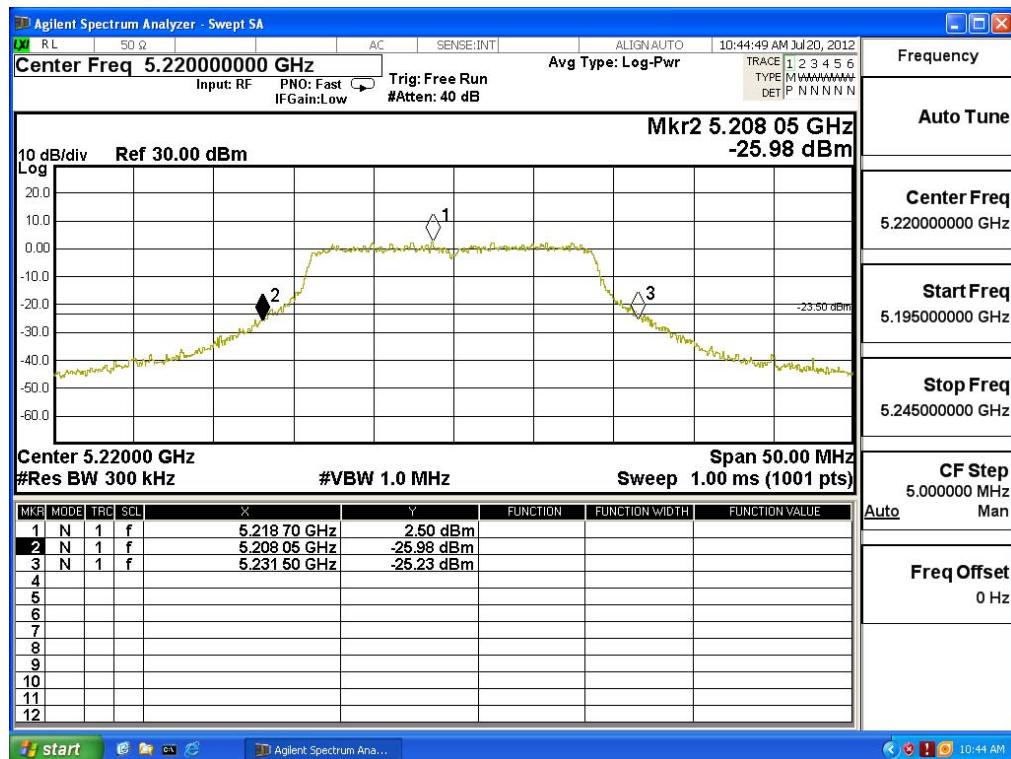


Channel 44 -Chain A

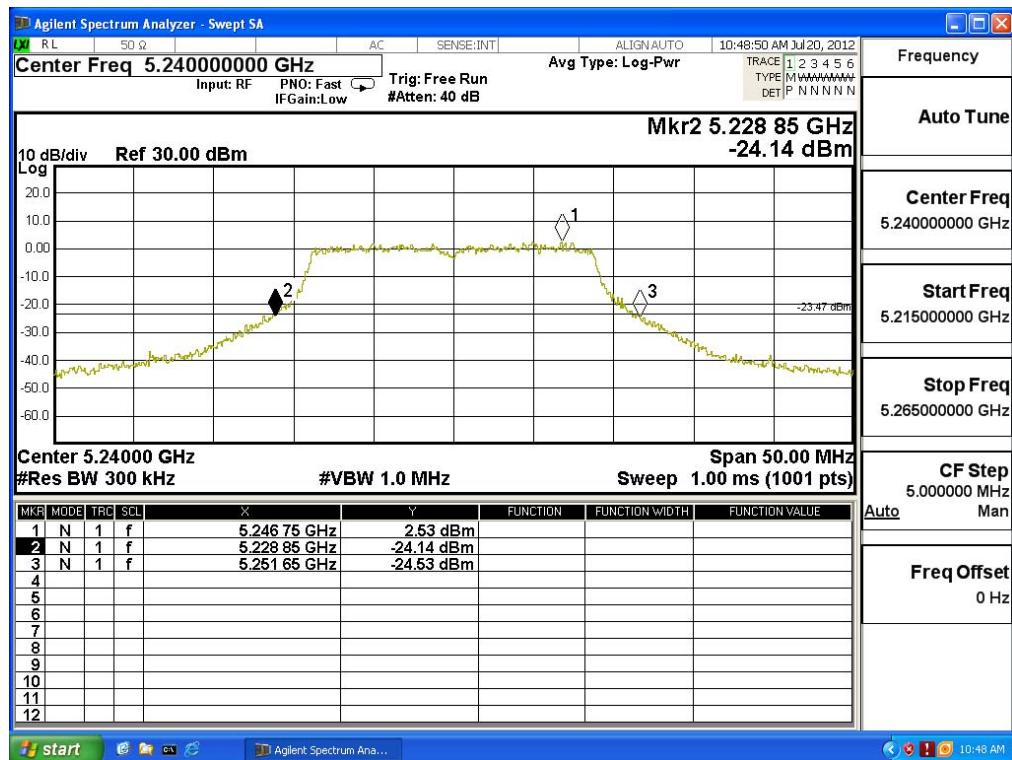


Channel 48 -Chain A



26dBc Occupied Bandwidth:
Channel 36 -Chain B

Channel 44 -Chain B


Channel 48 -Chain B



Product : Router
 Test Item : Maximum conducted output power
 Test Site : No.3 OATS
 Test Mode : Mode 3: Transmitter (802.11n-40BW 30Mbps)

CHAIN A

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		30	60	90	120	180	240	270	300	
		Measurement Level (dBm)								
38	5190	13.83	--	--	--	--	--	--	--	<17dBm
46	5230	13.47	13.39	13.24	13.18	13.08	12.92	12.89	12.81	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

CHAIN B

Cable loss=1dB		Maximum conducted output power								
Channel No.	Frequency (MHz)	Data Rate (Mbps)								Required Limit
		30	60	90	120	180	240	270	300	
		Measurement Level (dBm)								
38	5190	13.97	--	--	--	--	--	--	--	<17dBm
46	5230	13.51	13.44	13.4	13.32	13.28	13.14	13.02	12.97	<17dBm

Note: Maximum conducted output power Value =Reading value on average power meter + cable loss

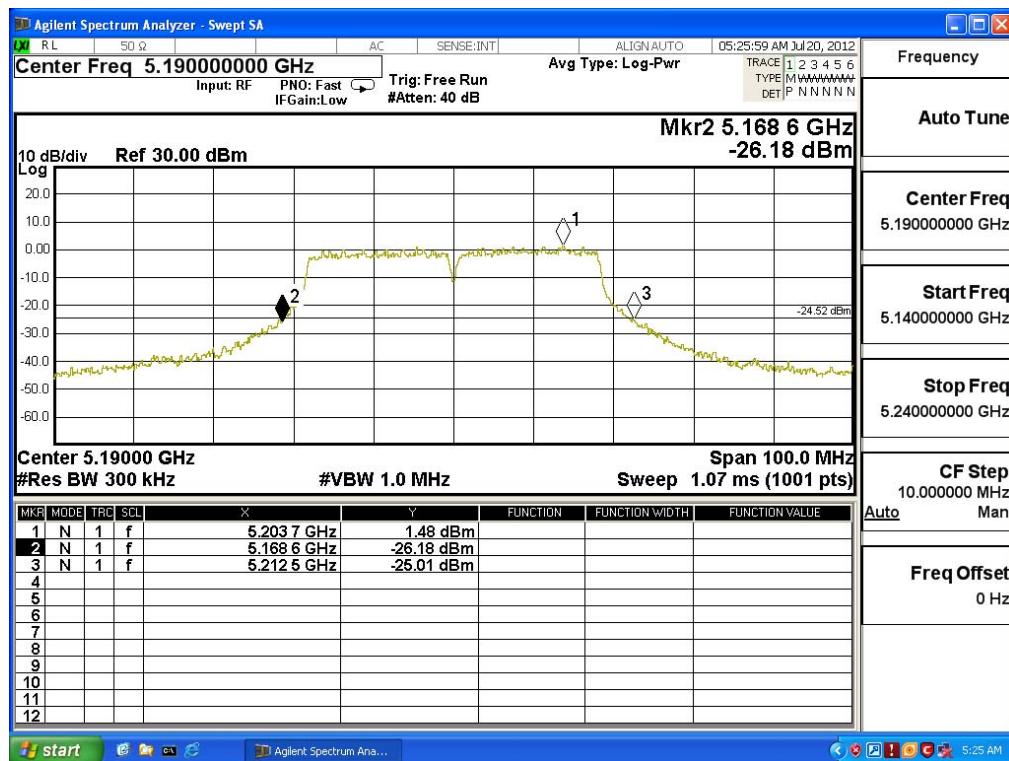
Maximum conducted output power Measurement:**(CHAIN A+ B)**

Channel Number	Frequency (MHz)	26dB Bandwidth (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Output Power (dBm)	Output Power Limit	
						(dBm)	(dBm)+10log(BW)
38	5190	42.800	13.83	13.97	16.91	17	20.31
46	5230	44.700	13.47	13.51	16.50	17	20.50

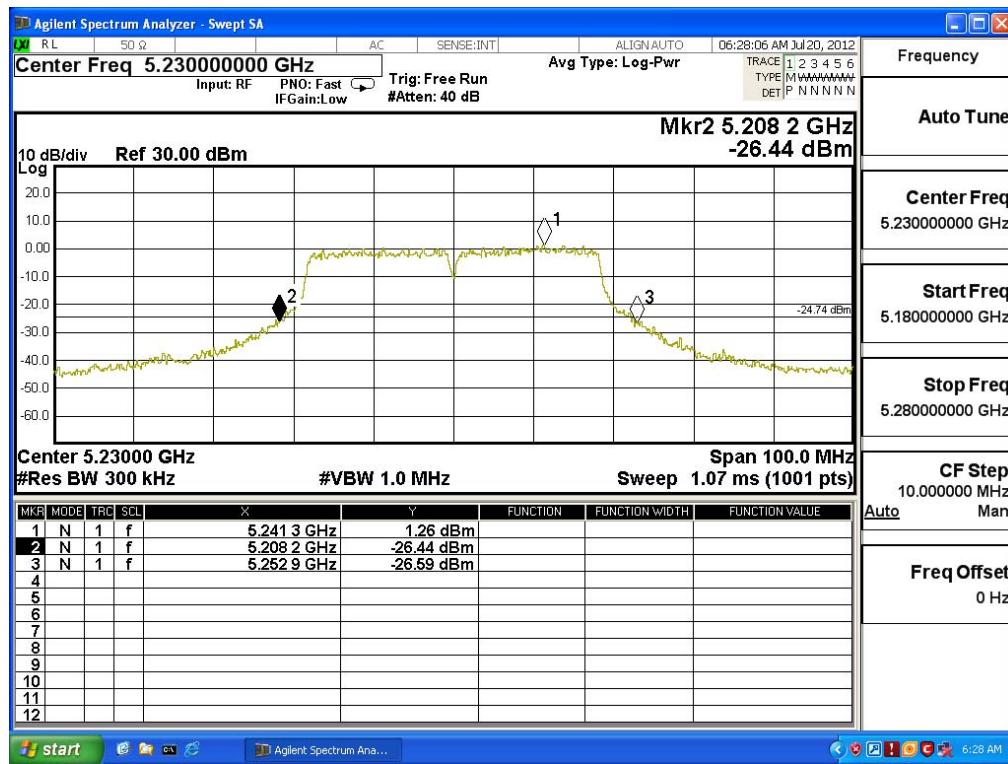
Note:

- Power Output Value =Reading value on average power meter + cable loss
- Output Power (dBm) = $10\log(\text{Chain A Power (mW)} + \text{Chain B Power (mW)})$
- 26 dB Bandwidth is the bandwidth of chain A or chain B whichever is less bandwidth, output power limitation is more stringent.

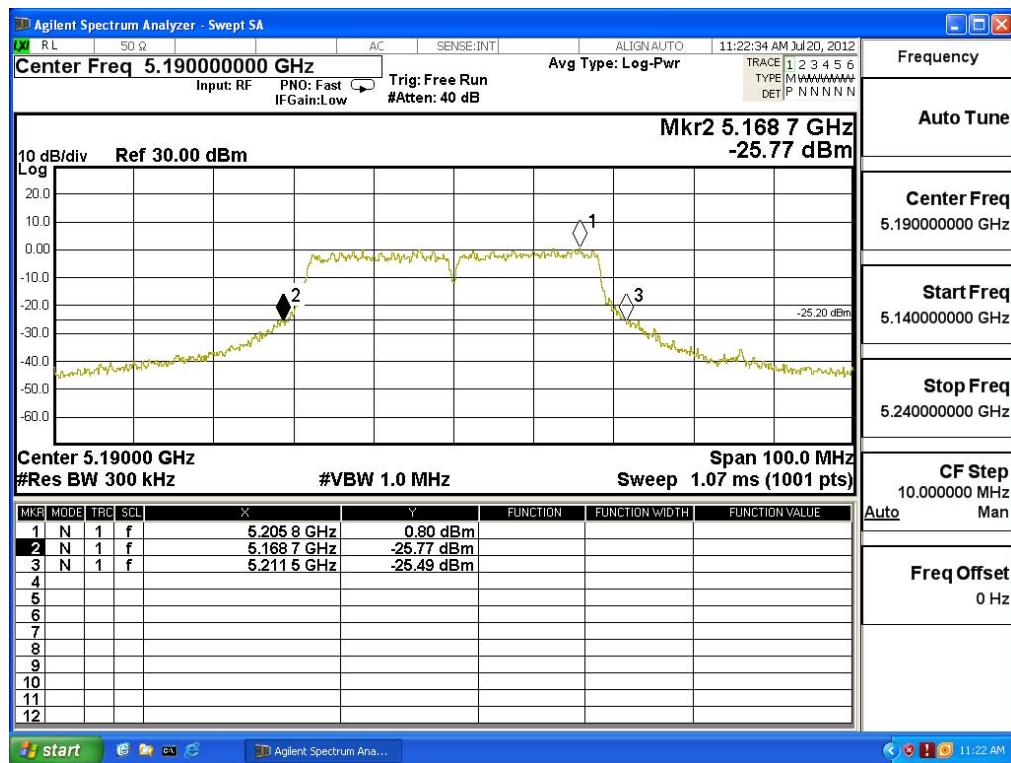
26dBc Occupied Bandwidth:
Channel 38 – Chain A



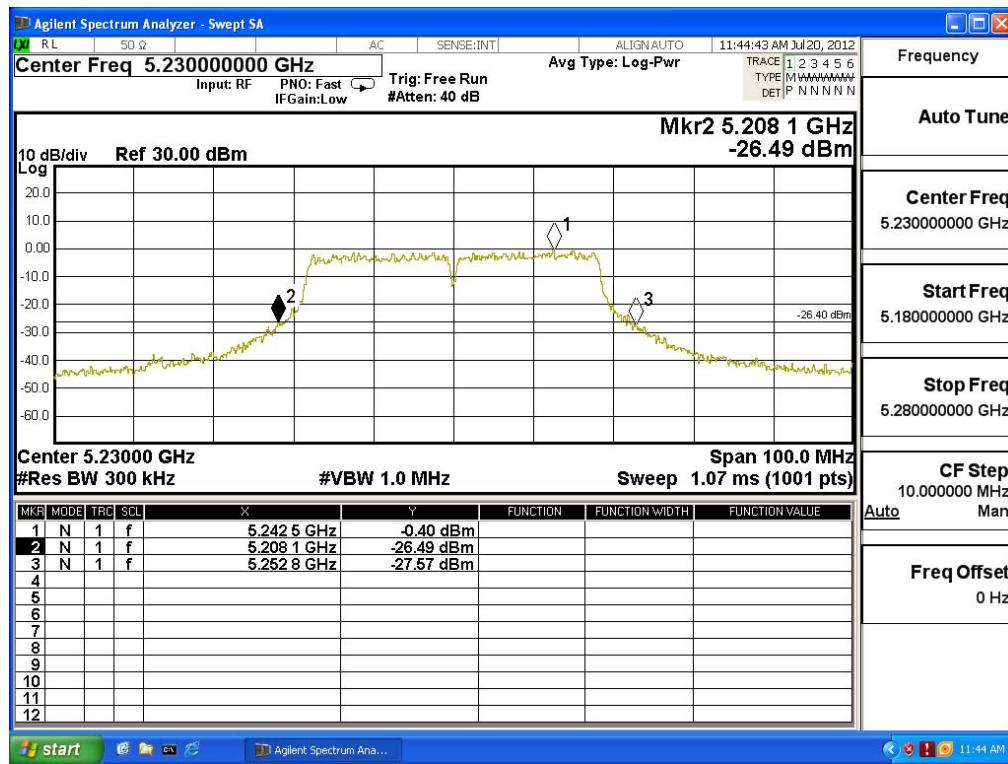
Channel 46 – Chain A



26dBc Occupied Bandwidth:
Channel 38 – Chain B



Channel 46 – Chain B



4. Peak Power Spectral Density

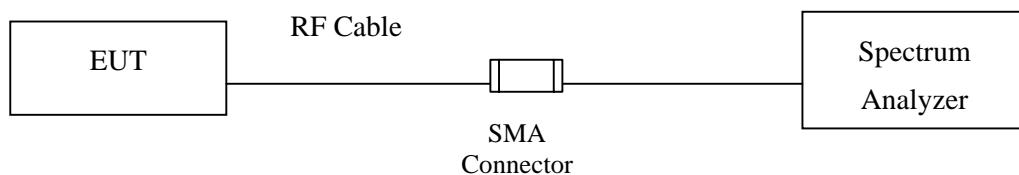
4.1. Test Equipment

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2012
Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2012
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2012

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

4.2. Test Setup



4.3. Limits

- (4) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (5) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (6) For the band 5.725-5.825 GHz, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

4.4. Test Procedure

The EUT was setup to ANSI C63.4, 2003; tested to DTS test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

4.5. Uncertainty

± 1.27 dB

4.6. Test Result of Peak Power Spectral Density

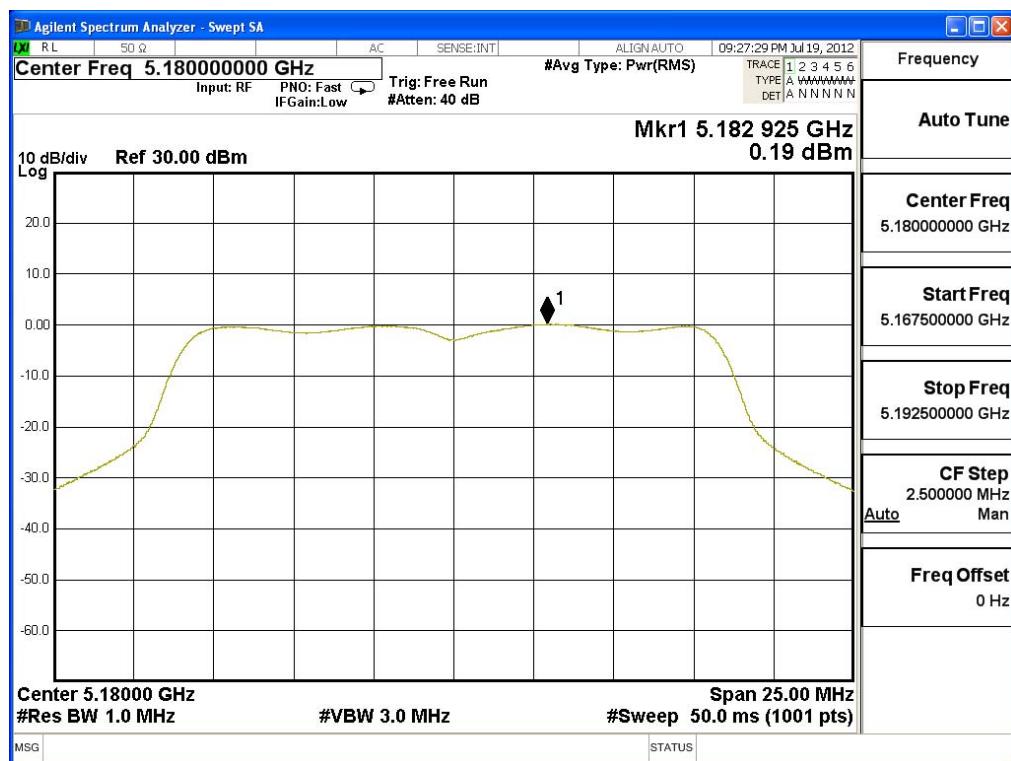
Product : Router
Test Item : Peak Power Spectral Density
Test Site : No.3 OATS
Test Mode : Mode 1: Transmitter (802.11a-6Mbps)

Channel Number	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Measurement Level (dBm)	Required Limit (dBm)	Result
36	5180	0.190	-0.185	3.017	<4	Pass
44	5220	0.960	-0.160	3.446	<4	Pass
48	5240	0.580	-0.190	3.222	<4	Pass

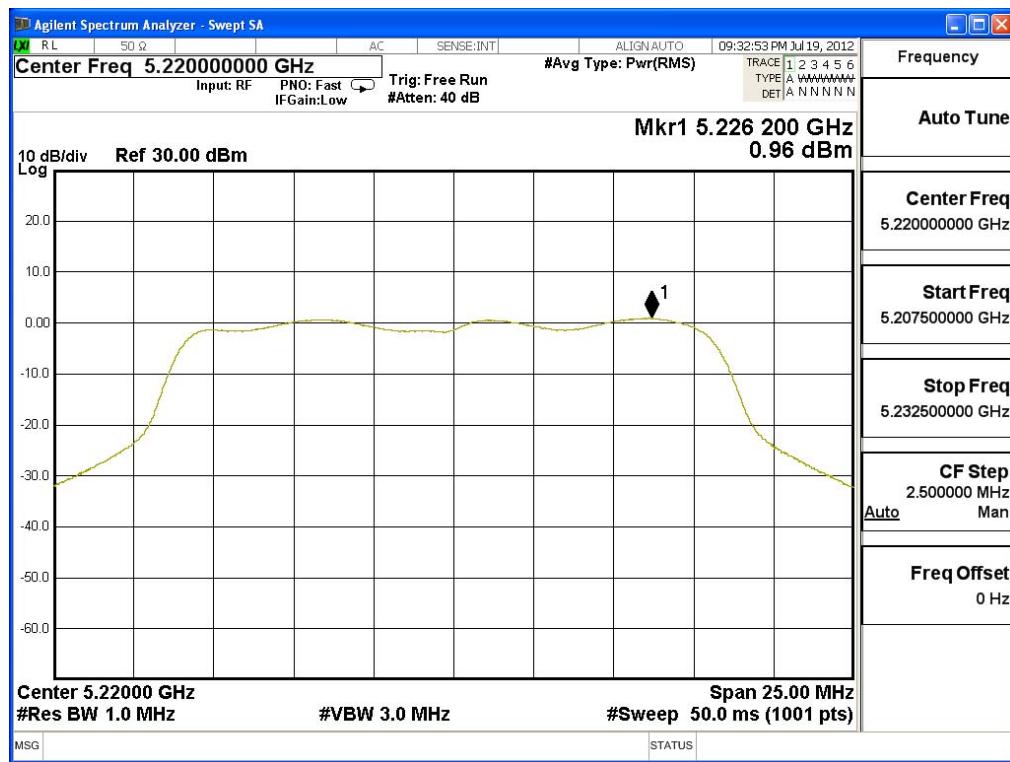
Note:

1. Measurement Level (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))

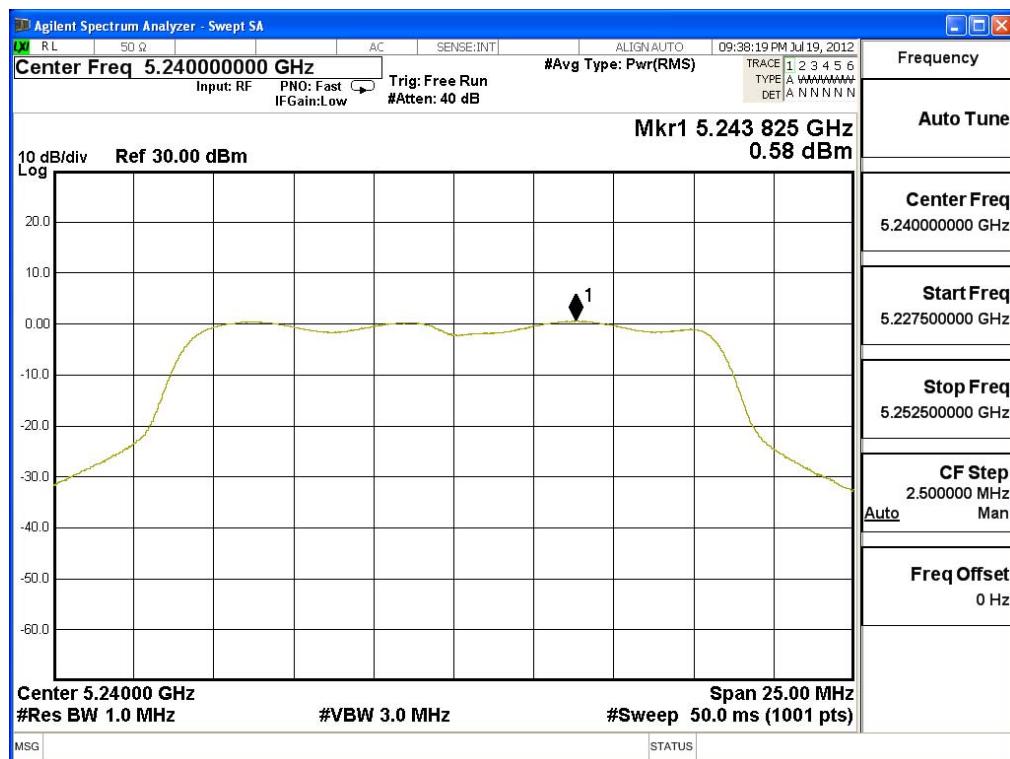
Channel 36: CHAIN A



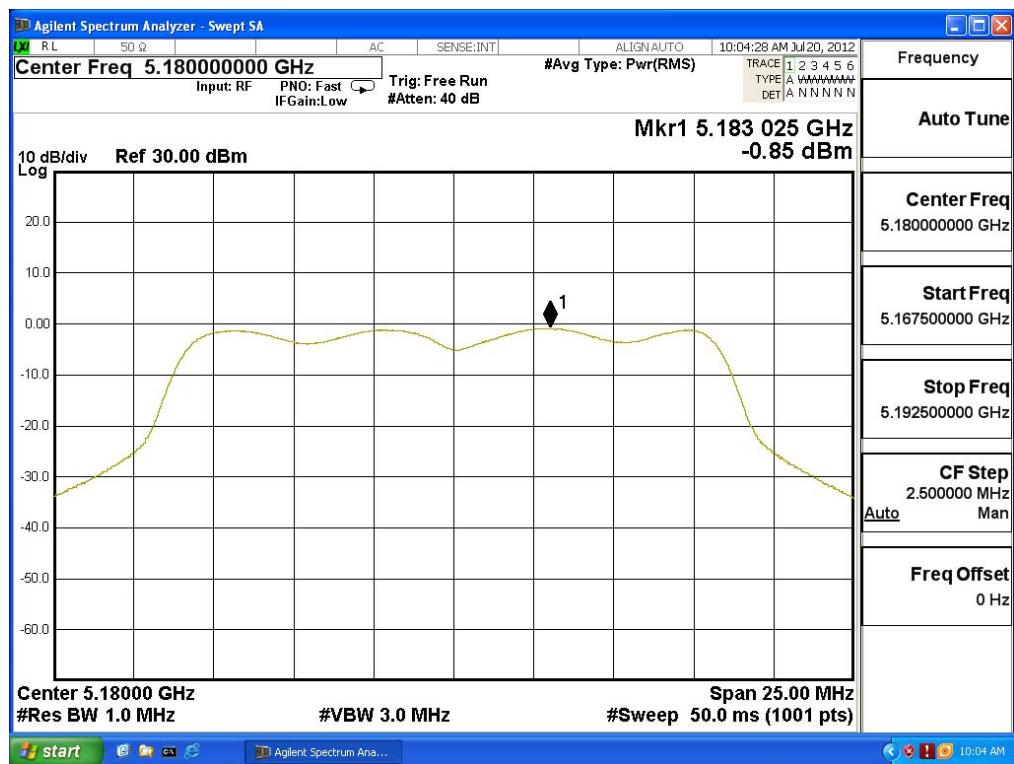
Channel 44: CHAIN A



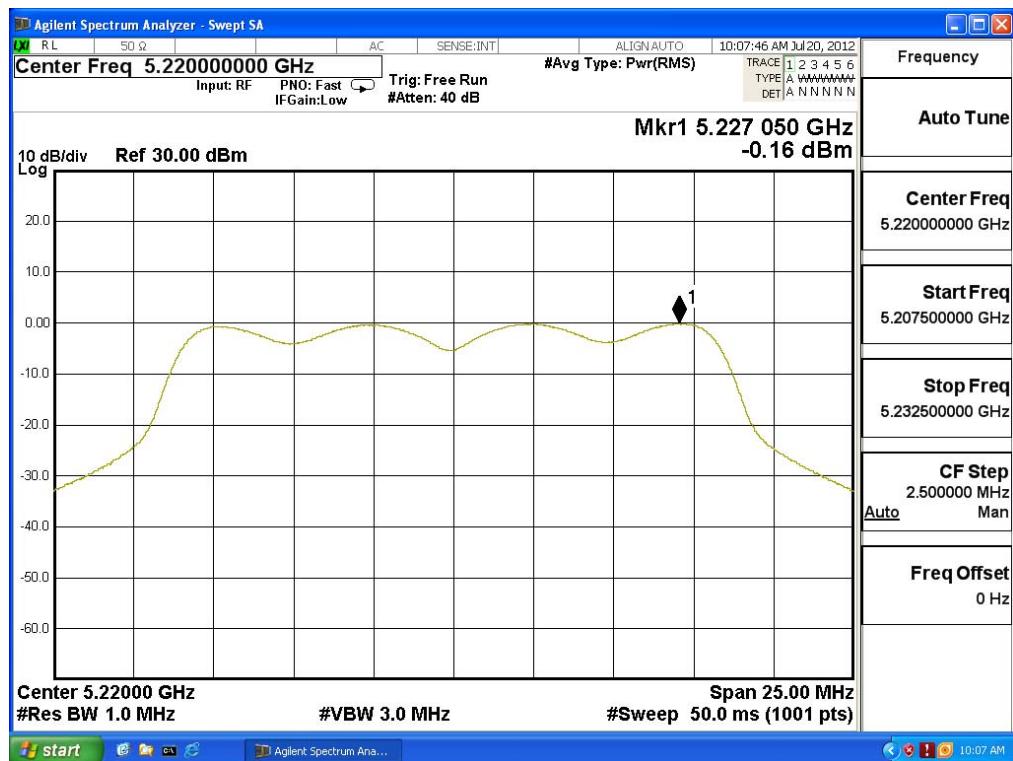
Channel 48: CHAIN A



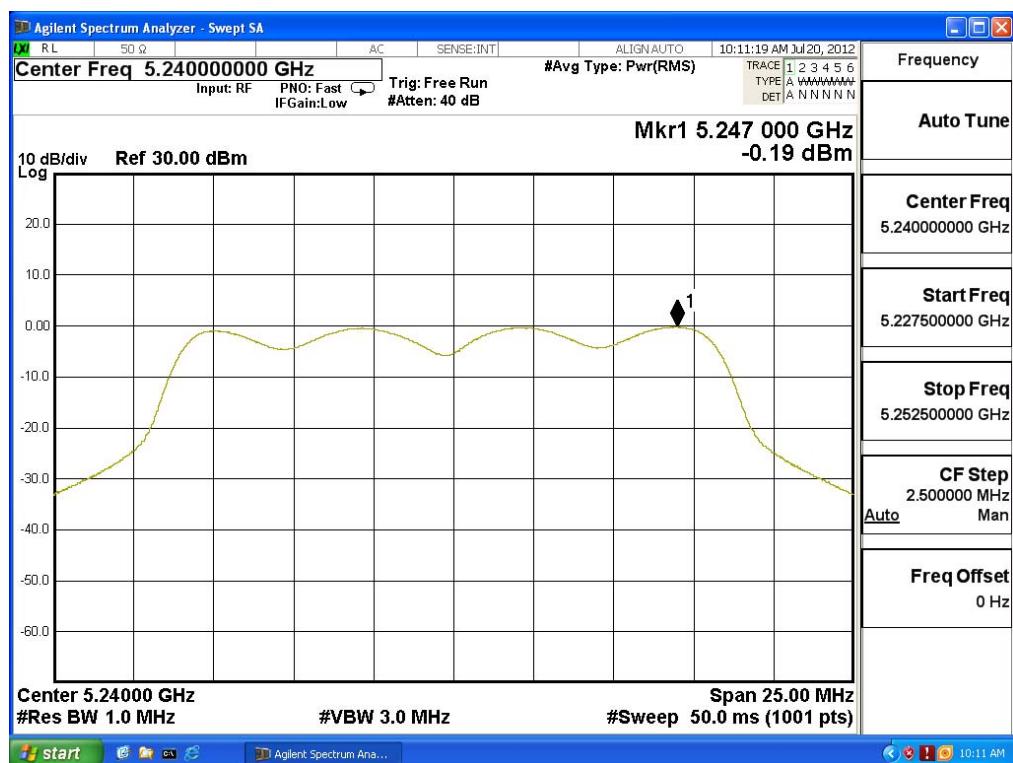
Channel 36: CHAIN B



Channel 44: CHAIN B



Channel 48: CHAIN B



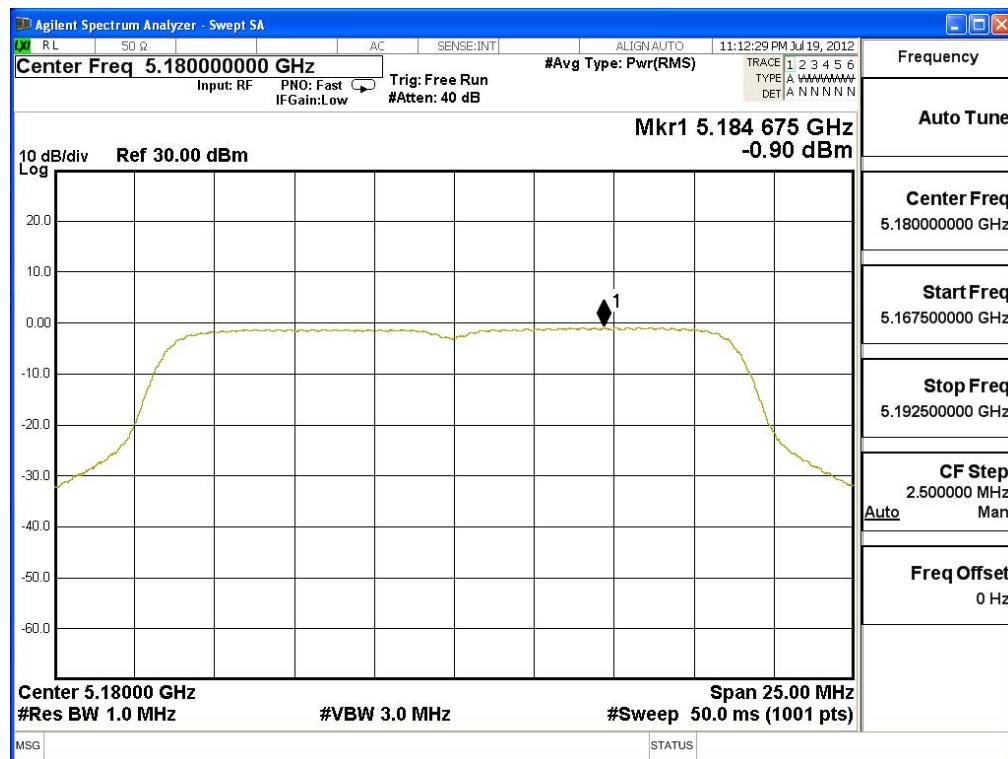
Product : Router
Test Item : Peak Power Spectral Density
Test Site : No.3 OATS
Test Mode : Mode 2: Transmitter (802.11n-20BW 14.4Mbps)

Channel Number	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Measurement Level (dBm)	Required Limit (dBm)	Result
36	5180	-0.900	-1.780	1.693	<4	Pass
44	5220	-0.620	-2.020	1.746	<4	Pass
48	5240	-0.640	-1.960	1.760	<4	Pass

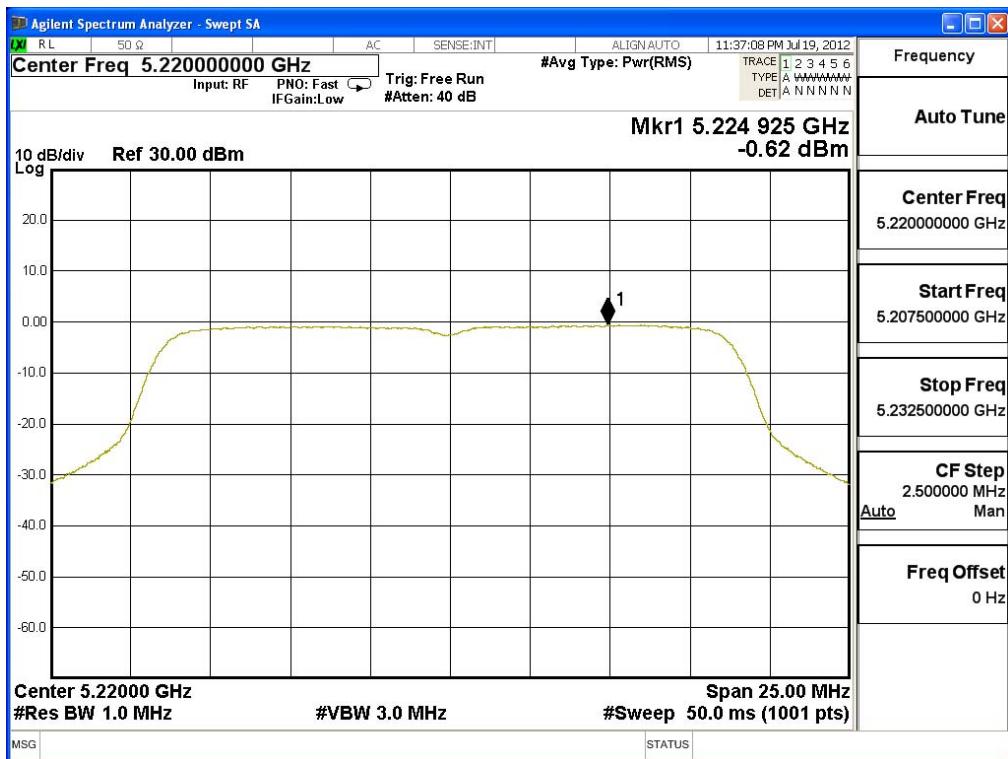
Note:

1. Measurement Level (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))

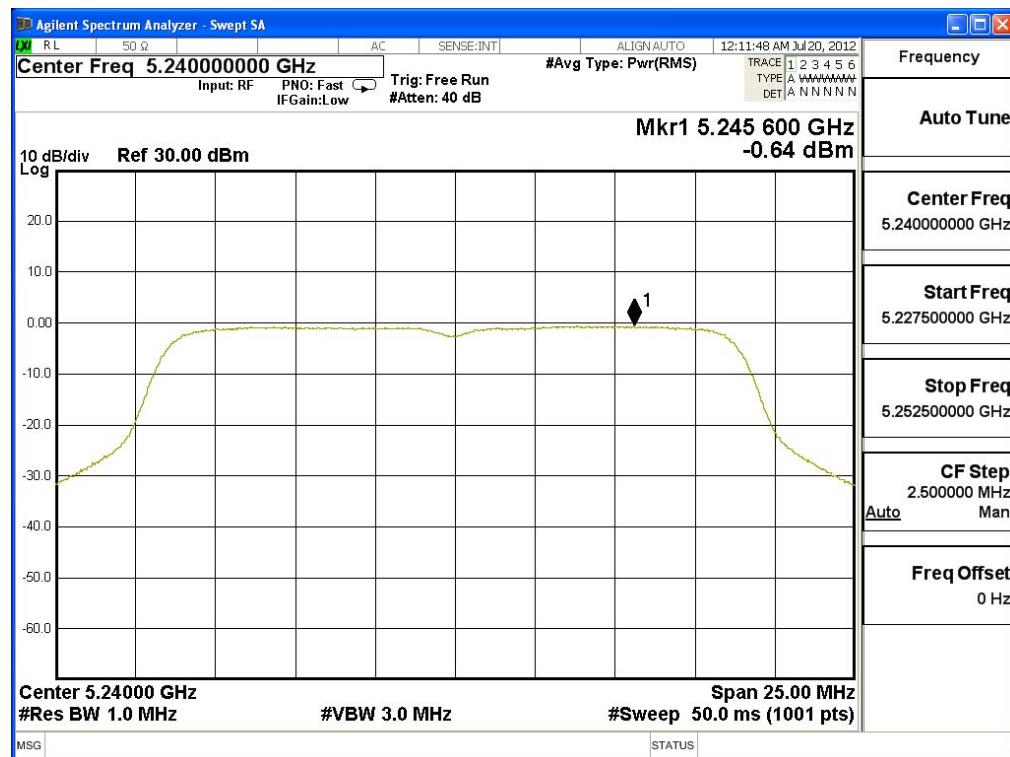
Channel 36 – Chain A



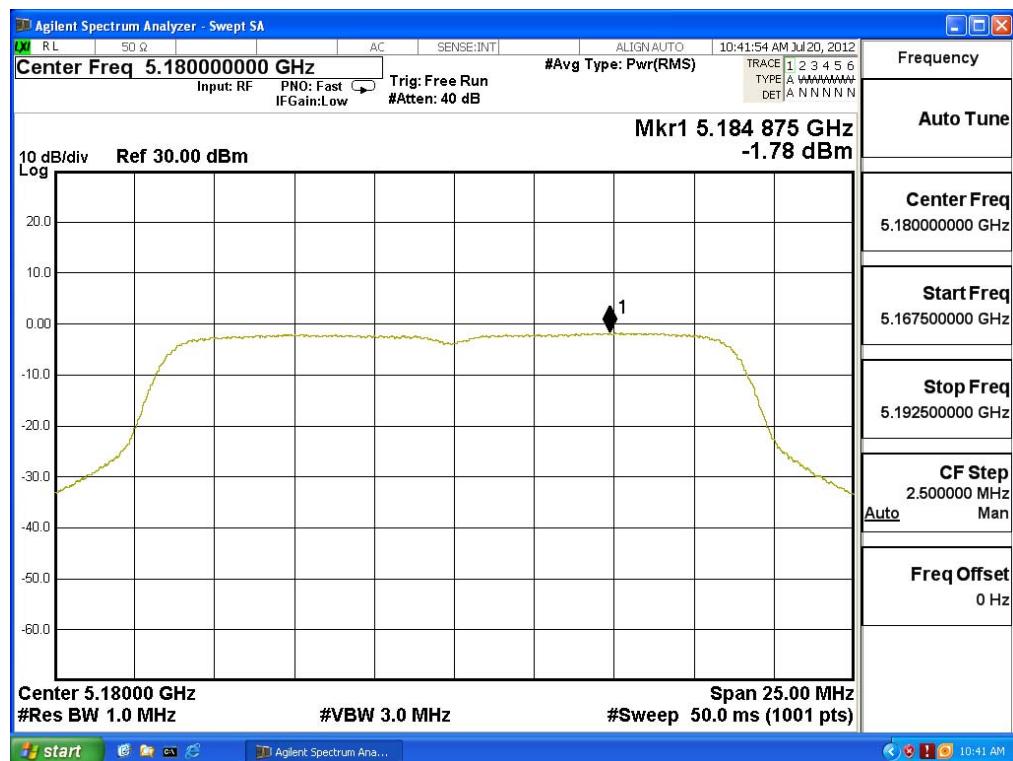
Channel 44 – Chain A



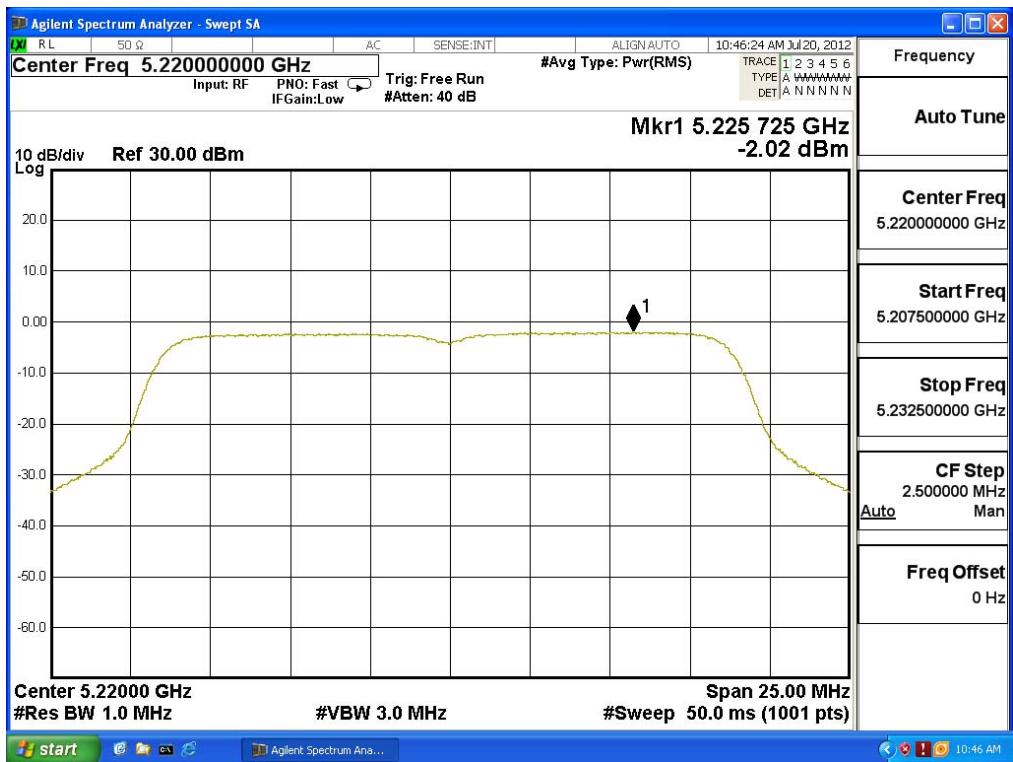
Channel 48 – Chain A



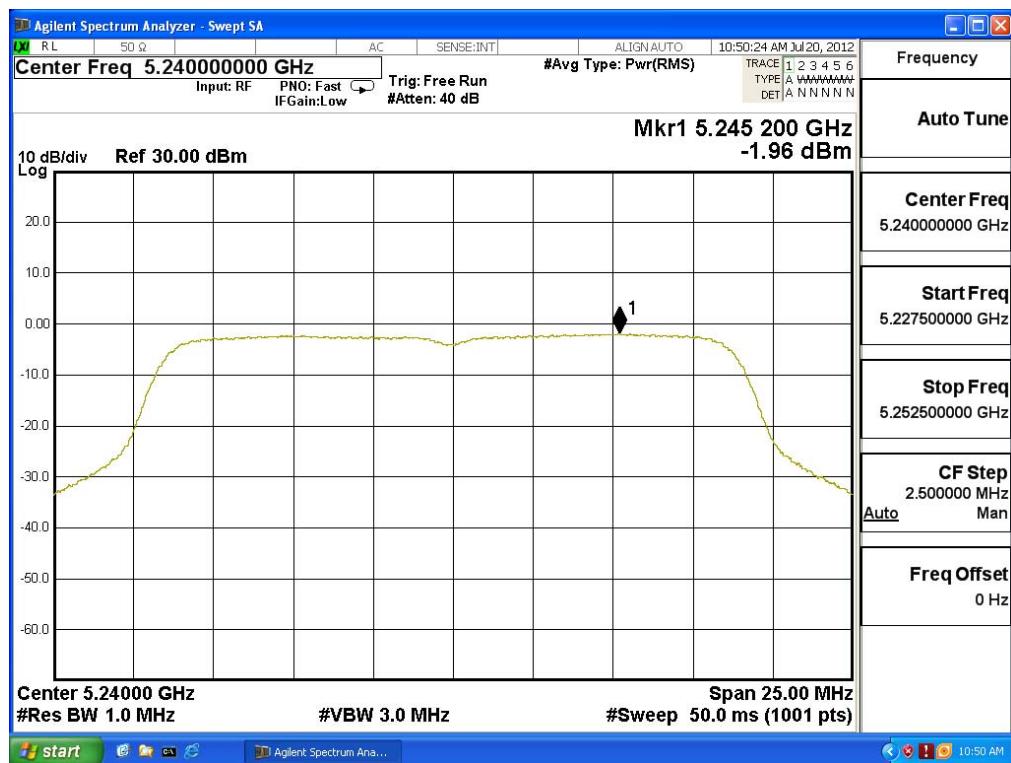
Channel 36 – Chain B



Channel 44 – Chain B



Channel 48 – Chain B



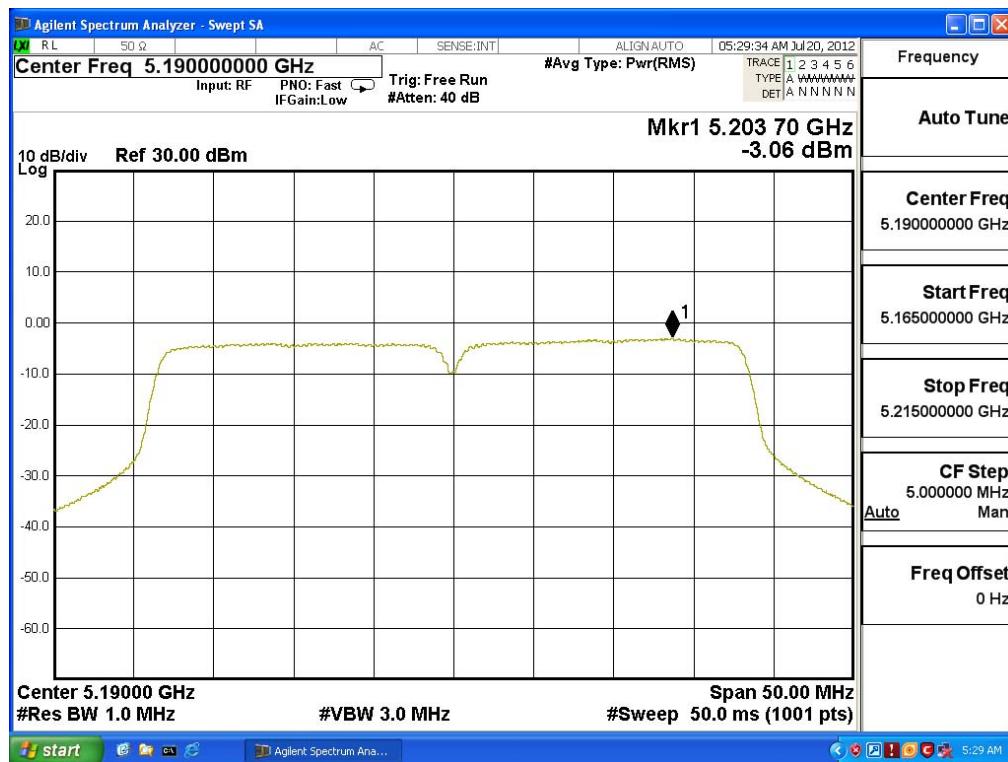
Product : Router
Test Item : Peak Power Spectral Density
Test Site : No.3 OATS
Test Mode : Mode 3: Transmitter (802.11n-40BW 30Mbps)

Channel Number	Frequency (MHz)	Chain A Power (dBm)	Chain B Power (dBm)	Measurement Level (dBm)	Required Limit (dBm)	Result
38	5190	-3.060	-3.890	-0.445	<4	Pass
46	5230	-3.760	-4.790	-1.234	<4	Pass

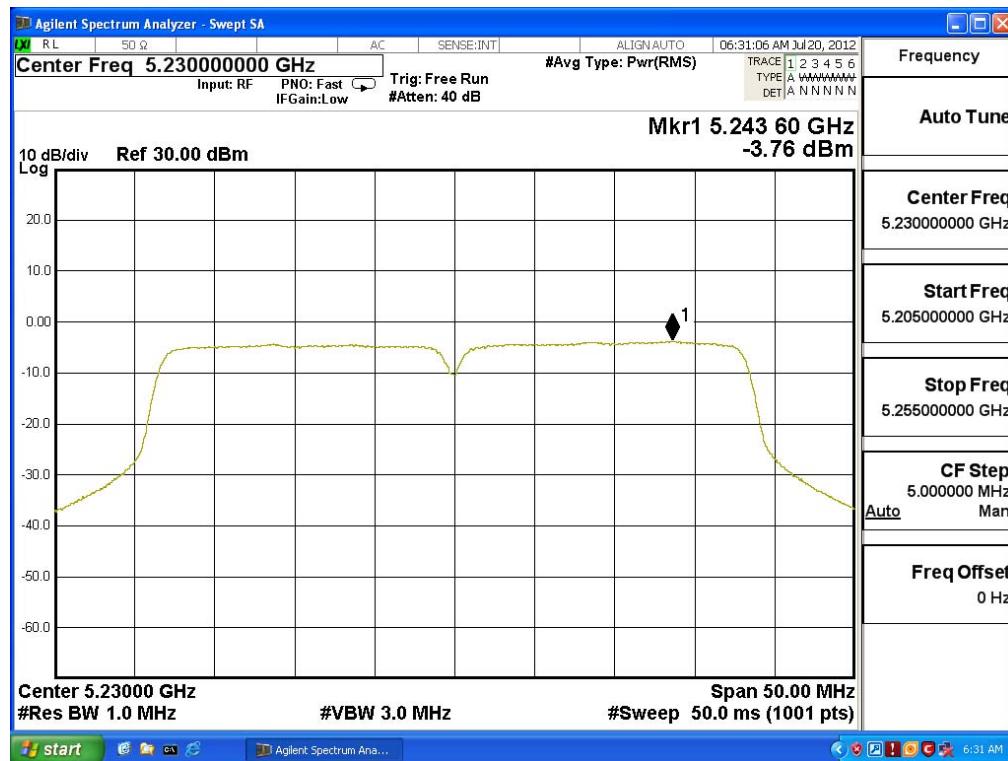
Note:

1. Measurement Level (dBm) = 10LOG (Chain A Power (mW)+ Chain B Power (mW))

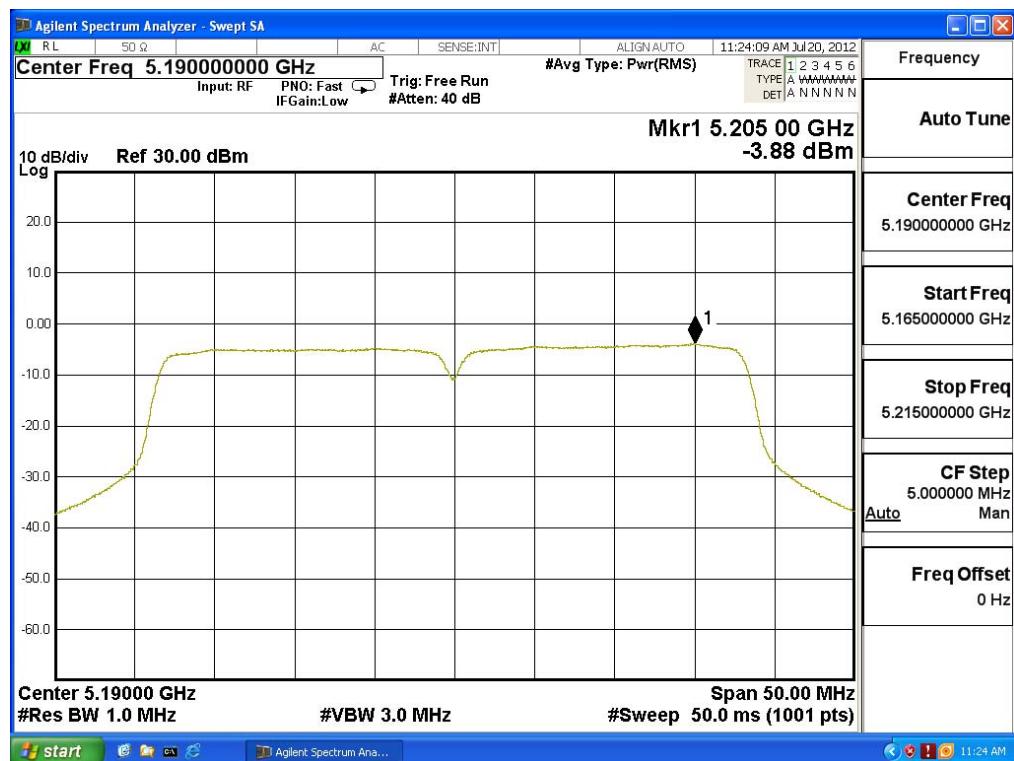
Channel 38 – Chain A



Channel 46 – Chain A



Channel 38 – Chain B



Channel 46 – Chain B

