

RF TEST REPORT

Test item : Notebook Computer
Model No. : LG13Z95, 13Z950, 13ZB950, 13ZD950, 13ZV950,
LG13Z94, 13Z940, 13ZB940, 13ZD940, 13ZV940
Order No. : DTNC1503-01165
Date of receipt : 2015-03-17
Test duration : 2015-04-23 ~ 2015-05-06, 2015-06-18 ~ 2015-06-20
Date of issue : 2015-07-10
Use of report : FCC Original Grant

Applicant : LG Electronics USA, Inc.
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Test laboratory : DT&C Co., Ltd.
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Test specification : FCC Part 15.407 Subpart E

Test environment : See appended test report

Test result : Pass Fail

The test results presented in this test report are limited only to the sample supplied by applicant and the use of this test report is inhibited other than its purpose. This test report shall not be reproduced except in full, without the written approval of DT&C Co., Ltd.

Tested by:



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Test Report Version

Test Report No.	Date	Description
DRTFCC1507-0161	Jul. 06, 2015	Initial issue
DRTFCC1507-0161(1)	Jul. 10, 2015	Add the description of test plot

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1. EUT DESCRIPTION

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	Notebook Computer
Model Name	LG13Z95
Add Model Name	13Z950, 13ZB950, 13ZD950, 13ZV950, LG13Z94, 13Z940, 13ZB940, 13ZD940, 13ZV940
Hardware version	1.0
Software version	1.0
Power Supply	AC 120 V
Frequency Range	<p>U-NII 1(5150 ~ 5250 MHz)</p> <ul style="list-style-type: none"> ▪ 802.11a/n(HT20): 5180 ~ 5240 MHz ▪ 802.11n(HT40): 5190 ~ 5230 MHz ▪ 802.11ac(VHT80): 5210 MHz <p>U-NII 2A(5250 ~ 5350 MHz)</p> <ul style="list-style-type: none"> ▪ 802.11a/n(HT20): 5260 ~ 5320 MHz ▪ 802.11n(HT40): 5270 ~ 5310 MHz ▪ 802.11ac(VHT80): 5290 MHz <p>U-NII 2C(5470 ~ 5725 MHz)</p> <ul style="list-style-type: none"> ▪ 802.11a/n(HT20): 5500 ~ 5700 MHz ▪ 802.11n(HT40): 5510 ~ 5670 MHz ▪ 802.11ac(VHT80): 5530 MHz ▪ 802.11ac(VHT20): 5720 MHz ▪ 802.11ac(VHT40): 5710 MHz ▪ 802.11ac(VHT80): 5690 MHz <p>U-NII 3(5725 ~ 5850MHz)</p> <ul style="list-style-type: none"> ▪ 802.11a/n(HT20): 5745 ~ 5825 MHz ▪ 802.11n(HT40): 5755 ~ 5795 MHz ▪ 802.11ac(VHT80): 5775 MHz
Modulation type	OFDM
Antenna Specification	<p>Antenna type: Internal Antenna</p> <p>Antenna gain</p> <ul style="list-style-type: none"> ▪ U-NII 1 band: ANT 1: -0.83 dBi & ANT 2: 2.72 dBi ▪ U-NII 2A band: ANT 1: -0.83 dBi & ANT 2: 2.72 dBi ▪ U-NII 2C band: ANT 1: 0.09 dBi & ANT 2: 0.72 dBi ▪ U-NII 3 band: ANT 1: 2.67 dBi & ANT 2: -1.95 dBi <p>Antenna Configuration</p> <ul style="list-style-type: none"> ▪ 802.11a: Single Transmitting (ANT 1 or ANT 2) ▪ 802.11n(MCS 0 ~ 7, HT20/40) : Single Transmitting (ANT 1 or ANT 2) ▪ 802.11n(MCS 8 ~ 15, HT20/40) : Multiple Transmitting (ANT 1 and ANT 2) ▪ 802.11ac(NSS1 MCS 0 ~ 8, VHT20) : Single Transmitting (ANT 1 or ANT 2) ▪ 802.11ac(NSS2 MCS 0 ~ 8, VHT20) : Multiple Transmitting (ANT 1 and ANT 2) ▪ 802.11ac(NSS1 MCS 0 ~ 9, VHT40/80) : Single Transmitting (ANT 1 or ANT 2) ▪ 802.11ac(NSS2 MCS 0 ~ 9, VHT40/80) : Multiple Transmitting (ANT 1 and ANT 2)

Note: This device does not used TDWR band.

2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate	
		Single transmitting	Multiple transmitting
U-NII 1	802.11a	6Mbps	NA
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8
	802.11ac(VHT80)	NSS1 MCS 0	NSS2 MCS 0
U-NII 2A	802.11a	6Mbps	NA
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8
	802.11ac(VHT80)	NSS1 MCS 0	NSS2 MCS 0
U-NII 2C	802.11a	6Mbps	NA
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8
	802.11ac(VHT20)	NSS1 MCS 0	NSS2 MCS 0
	802.11ac(VHT40)	NSS1 MCS 0	NSS2 MCS 0
	802.11ac(VHT80)	NSS1 MCS 0	NSS2 MCS 0
U-NII 3	802.11a	6Mbps	NA
	802.11n(HT20)	MCS 0	MCS 8
	802.11n(HT40)	MCS 0	MCS 8
	802.11ac(VHT80)	NSS1 MCS 0	NSS2 MCS 0

Note 1: The worst case data rate is determined as above test mode according to the power measurements.
And all test items were performed at the worst case data rate.

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20)		802.11n(HT40)		802.11ac(VHT80)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 1	36	5180	38	5190	-	-
	40	5200	-	-	42	5210
	48	5240	46	5230	-	-
U-NII 2A	52	5260	54	5270	-	-
	60	5300	-	-	58	5290
	64	5320	62	5310	-	-
U-NII 2C	100	5500	102	5510	-	-
	116	5580	110	5550	106	5530
	140	5700	134	5670	-	-
U-NII 3	149	5745	151	5755	-	-
	157	5785	-	-	155	5775
	165	5825	159	5795	-	-

5GHz Band	802.11ac(VHT20)		802.11ac(VHT40)		802.11ac(VHT80)	
	Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
U-NII 2C	144	5720	142	5710	138	5690

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-

2.4 Tested environment

Temperature	: 21 °C ~ 24 °C
Relative humidity content	: 42 % ~ 49 % R.H.
Details of power supply	: AC 120 V

2.5 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. SUMMARY OF TESTS

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
15.407(a)	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C Note 2
15.407(e)	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5725 ~ 5850 MHz		C
15.407(a)	Maximum Conducted Output Power	5150 ~ 5250 MHz: < 30 dBm or < 23.97 dBm 5250 ~ 5350 MHz & 5470 ~ 5725 MHz: 250 mW or <11 + 10log ₁₀ (B) dBm 5725 ~ 5850 MHz: < 30 dBm		C Note 3
15.407(a)	Peak Power Spectral Density	5150 ~ 5250 MHz: 11 dBm/MHz or 17 dBm/MHz 5250 ~ 5350 MHz & 5470 ~ 5725 MHz: 11 dBm/MHz 5725 ~ 5850 MHz: 30 dBm/500 kHz		C Note 2,4
15.407(g)	Frequency Stability	N/A		C Note 2
15.407(b)	Undesirable Emissions	5150 ~ 5725 MHz: < -27 dBm/MHz EIRP 5725 ~ 5850 MHz: < -17 dBm/MHz EIRP and < -27 dBm/MHz EIRP	Radiated	C Note 5
15.205 15.209 15.407(b)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note 5
15.407(h)	Dynamic Frequency Selection	FCC 15.407(h)	Conducted	C Note 6
15.207	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C**=Comply **NC**=Not Comply **NT**=Not Tested **NA**=Not Applicable

Note 2: These test items were not performed because this device uses the granted module. Only tested U-NII 3 band and band-crossing channels.

FCC ID: PD97260NG, PD97260NGU

IC: 1000M-7260NG

Please refer to the test report of the granted module.

The module test report number: 12121201.fcc03

Note 3: (i) For access point operating in the band 5.15-5.25 GHz: < 30 dBm

(ii) For mobile and portable client devices in the 5.15-5.25 GHz band: < 23.97 dBm

Note 4: (i) For access point operating in the band 5.15-5.25 GHz: < 17 dBm/MHz

(ii) For mobile and portable client devices in the 5.15-5.25 GHz band: < 11 dBm/MHz

Note 5: These test items were performed in each axis and the worst case data was reported.

Note 6: Refer to the DFS test report.

Note 7: The test items were performed according to the KDB789033 D02 V01, KDB662911 D01 v02r01, KDB644545 D03 v01 and ANSI C63.10-2009

4. TEST METHODOLOGY

Generally the tests were performed according to the KDB789033 D02 v01. And ANSI C63.10-2009 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02 v01. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2009.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02 v01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2009 as stated on KDB789033 D02 v01.

The EUT is placed on a non-conductive table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 Description of test modes

A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.

5. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

6. FACILITIES AND ACCREDITATIONS

6.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements.

- Semi anechoic chamber registration Number: 165783 (FCC)

6.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7. ANTENNA REQUIREMENTS

7.1 According to FCC 47 CFR §15.203:

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The EUT used two non standard antenna connectors.

Therefore this module Complies with the requirement of §15.203

7.2 Directional antenna gain(Worst case):

Bands	ANT 1 [dBi]	ANT 2 [dBi]	Directional Gain [dBi]
U-NII 1	-0.83	2.72	1.30 ^{Note 2.}
U-NII 2A	-0.83	2.72	1.30 ^{Note 2.}
U-NII 2C	0.09	0.72	0.42 ^{Note 2.}
U-NII 3	2.67	-1.95	0.95 ^{Note 2.}

Note 1. Directional gain(correlated signal with unequal antenna gain and equal transmit power)
 $10 \log [(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N^{ANT}] \text{ dBi}$

Note 2. Directional gain(completely uncorrelated signal with unequal antenna gain and equal transmit power)
 $10 \log [(10^{G_1/10} + 10^{G_2/10} + \dots + 10^{G_N/10}) / N^{ANT}] \text{ dBi}$

Note 3. Directional gain(spatial multiplexing)
 $G_{ANT \text{ MAX}} + 10 \log (N_{ANT} / N_{SS}) \text{ dBi}$

8. TEST RESULT

8.1 Emission Bandwidth (26 dB Bandwidth)

■ Test Requirements

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26 dB bandwidth is used to determine the conducted output power limit.

■ Test Configuration

Refer to the APPENDIX I.

■ Test Procedure

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

1. Set resolution bandwidth (RBW) = approximately **1 %** of the EBW.
2. Set the video bandwidth (**VBW**) > **RBW**.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

■ Test Results: **Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11ac(VHT20) NSS1	U-NII 2C (Band-Crossing Channels)	144	5720	17.95	18.39
802.11ac(VHT40) NSS1		142	5710	36.03	36.32
802.11ac(VHT80) NSS1		138	5690	75.12	75.60
802.11ac(VHT20) NSS2		144	5720	17.12	18.35
802.11ac(VHT40) NSS2		142	5710	34.51	35.44
802.11ac(VHT80) NSS2		138	5690	74.96	74.88

RESULT PLOTS

26 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 1 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 2 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 1 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 2 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 1 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 2 & NSS 1



26 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 1 & NSS 2



26 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 2 & NSS 2



26 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 1 & NSS 2



26 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 2 & NSS 2



26 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 1 & NSS 2



26 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 2 & NSS 2



8.2 Minimum Emission Bandwidth (6 dB Bandwidth)

■ Test Requirements

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

■ Test Configuration

Refer to the APPENDIX I.

■ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth $\geq 3 \times \text{RBW}$.
3. Detector = **Peak**.
4. Trace mode = **max hold**.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

■ TEST RESULTS: **Comply**

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11a	U-NII 3	149	5745	16.35	16.37
		157	5785	16.39	16.37
		165	5825	16.42	16.35
802.11n(HT20)		149	5745	17.63	17.61
		157	5785	17.34	17.64
		165	5825	17.62	17.68
802.11n(HT40)		151	5755	35.19	35.04
		159	5795	35.11	35.09
802.11ac(VHT80)		155	5775	73.96	75.10

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]	
				ANT 1	ANT 2
802.11ac(VHT20) NSS1	U-NII 3 (Band-Crossing Channels)	144	5720	3.78	3.75
802.11ac(VHT40) NSS1		142	5710	2.52	2.52
802.11ac(VHT80) NSS1		138	5690	2.52	2.52
802.11ac(VHT20) NSS2		144	5720	3.72	3.76
802.11ac(VHT40) NSS2		142	5710	2.52	2.52
802.11ac(VHT80) NSS2		138	5690	2.52	2.52

RESULT PLOTS

6 dB Bandwidth

Test Mode: 802.11a & Ch.149 & ANT 1



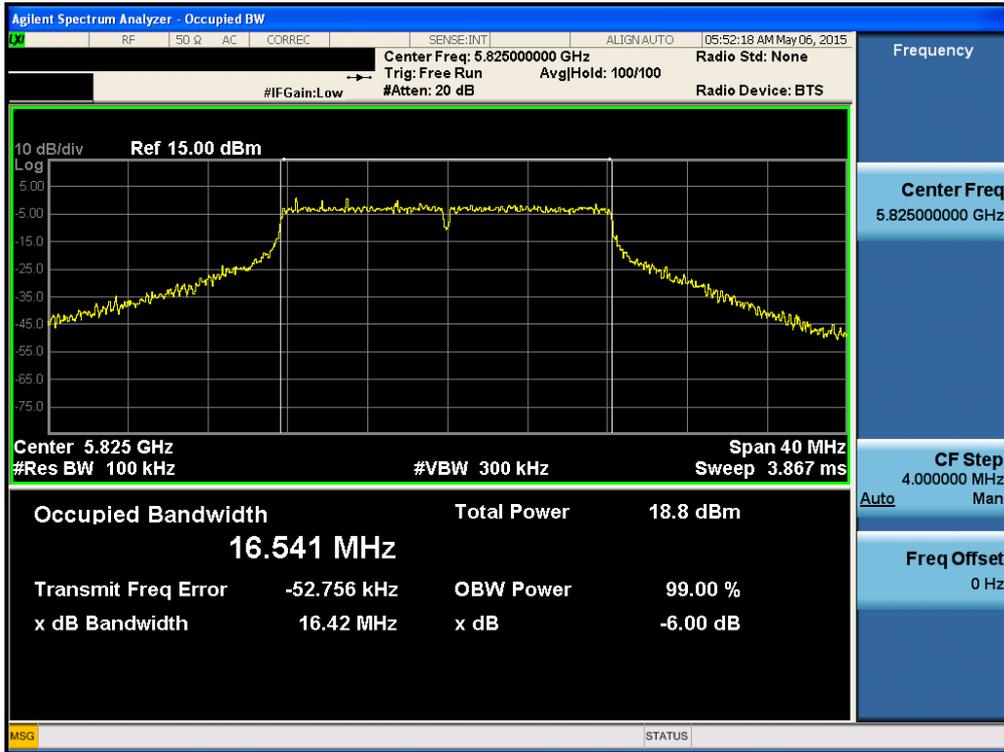
6 dB Bandwidth

Test Mode: 802.11a & Ch.157 & ANT 1



6 dB Bandwidth

Test Mode: 802.11a & Ch.165 & ANT 1



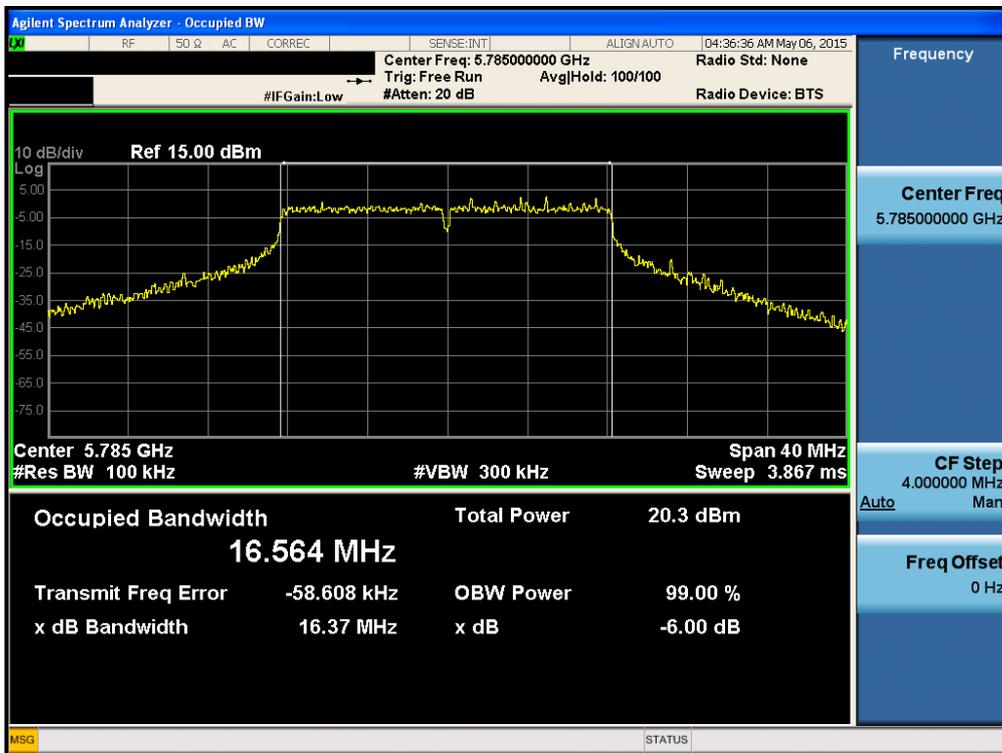
6 dB Bandwidth

Test Mode: 802.11a & Ch.149 & ANT 2



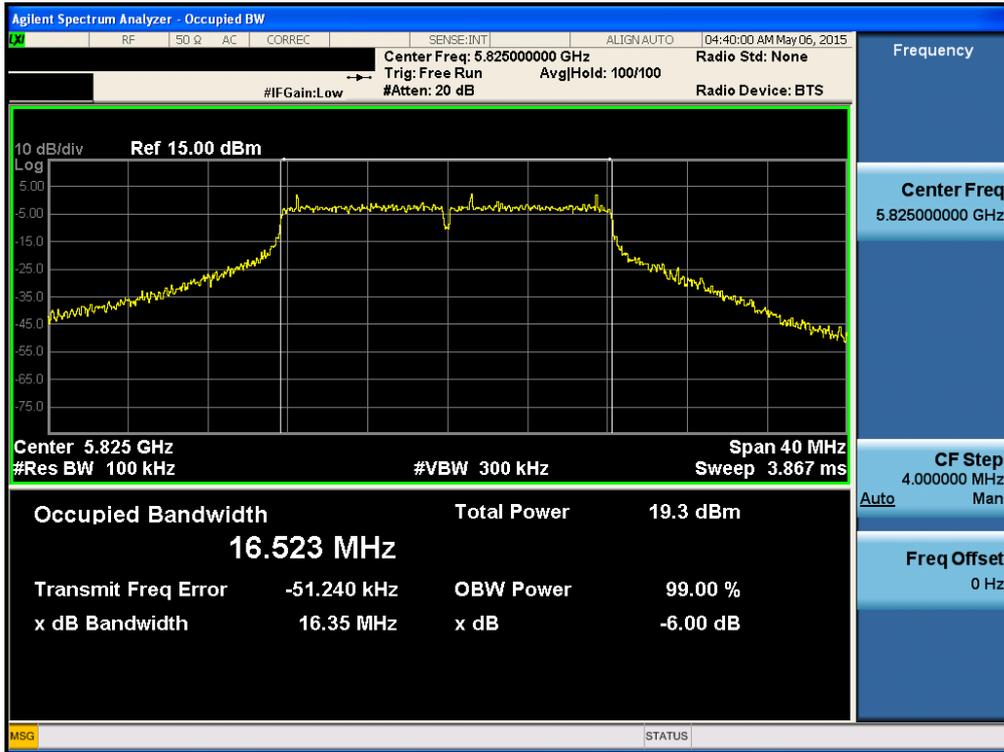
6 dB Bandwidth

Test Mode: 802.11a & Ch.157 & ANT 2



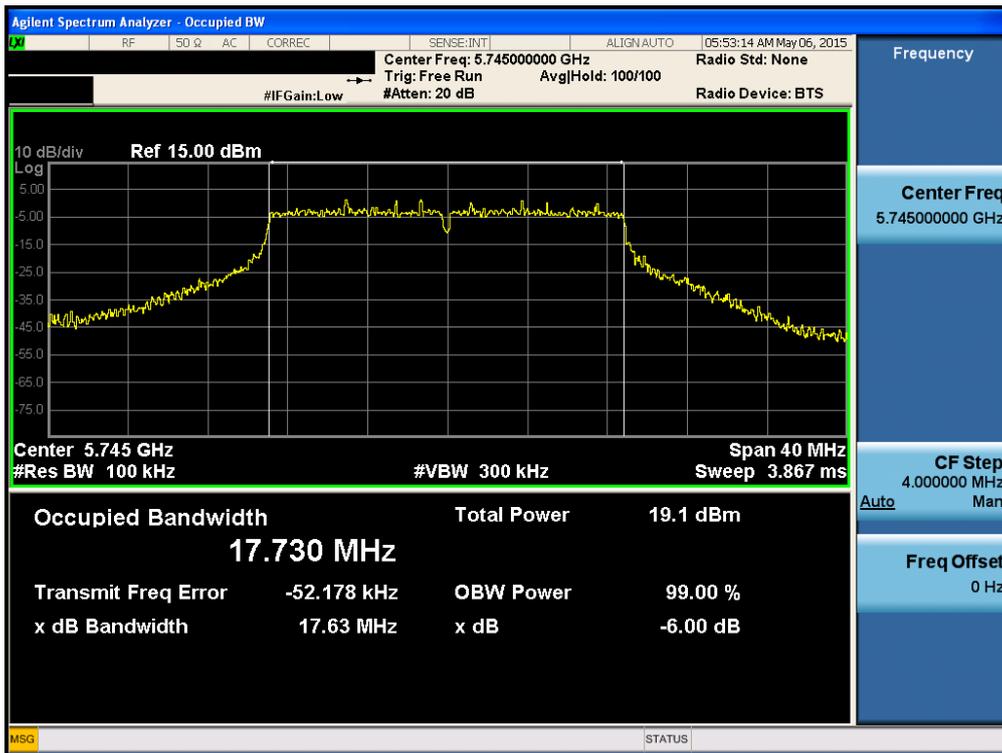
6 dB Bandwidth

Test Mode: 802.11a & Ch.165 & ANT 2



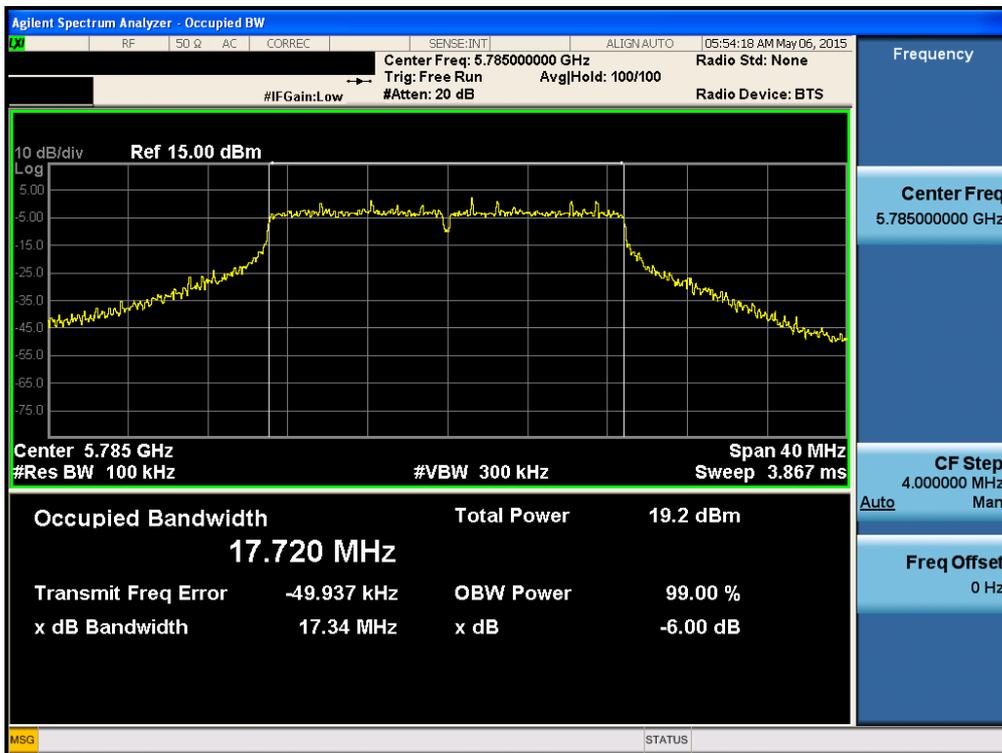
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.149 & ANT 1



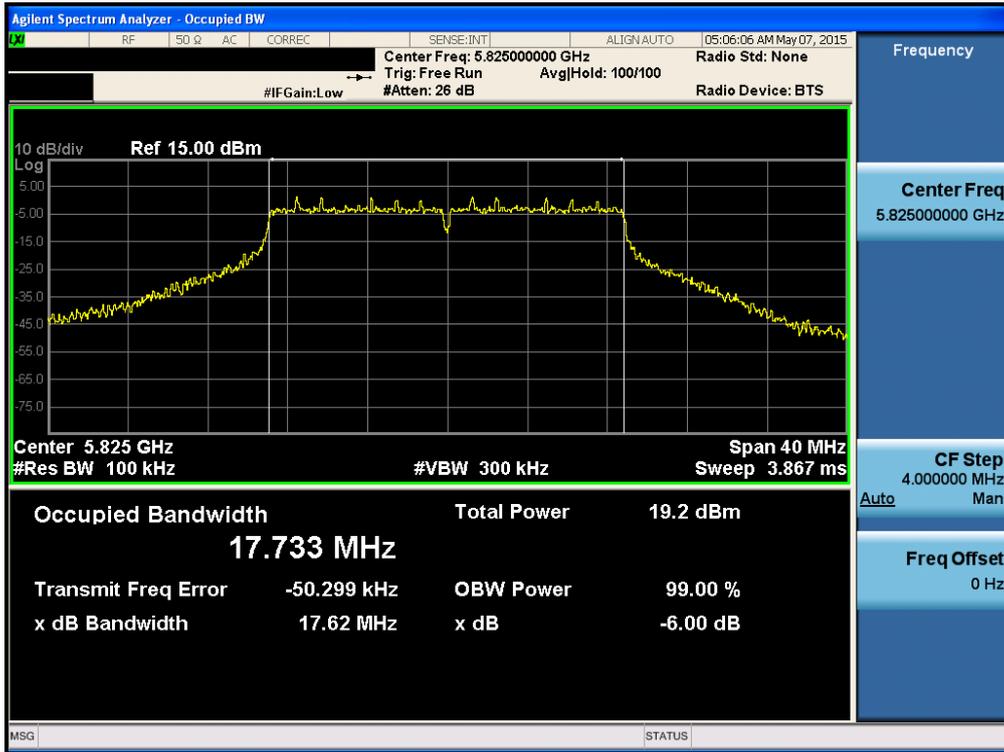
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.157 & ANT 1



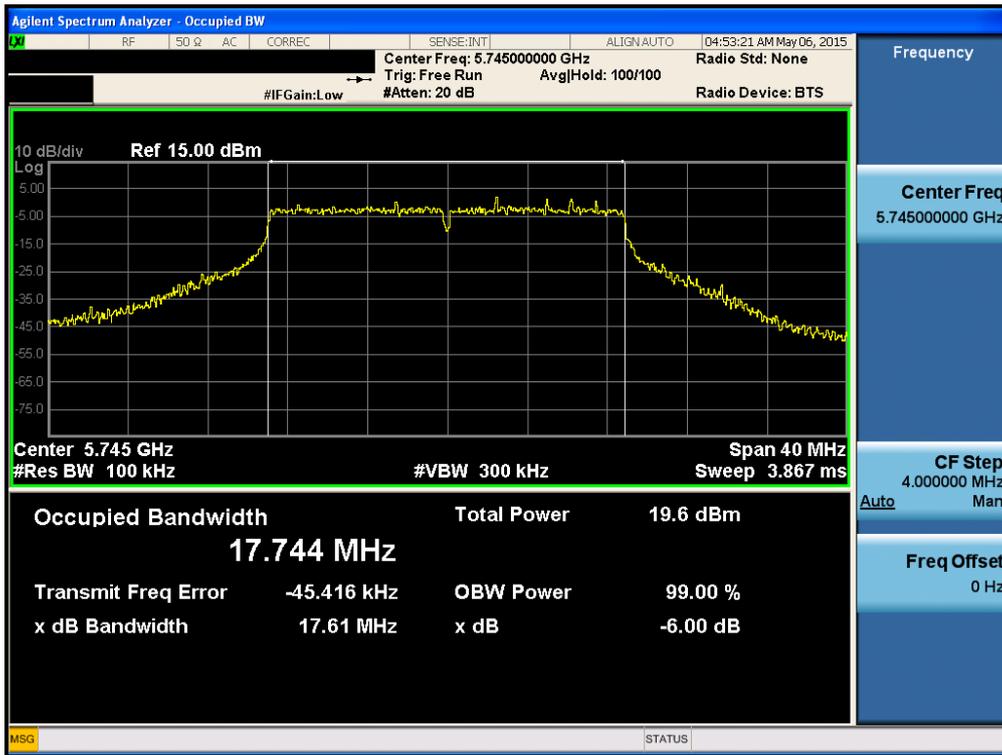
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.165 & ANT 1



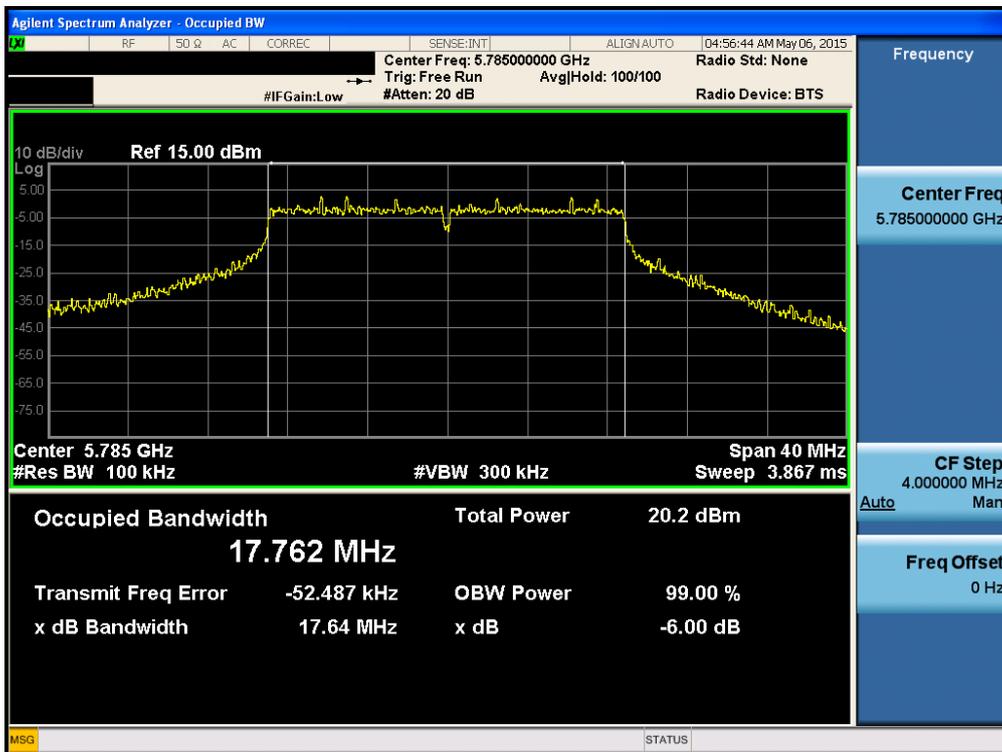
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.149 & ANT 2



6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.157 & ANT 2



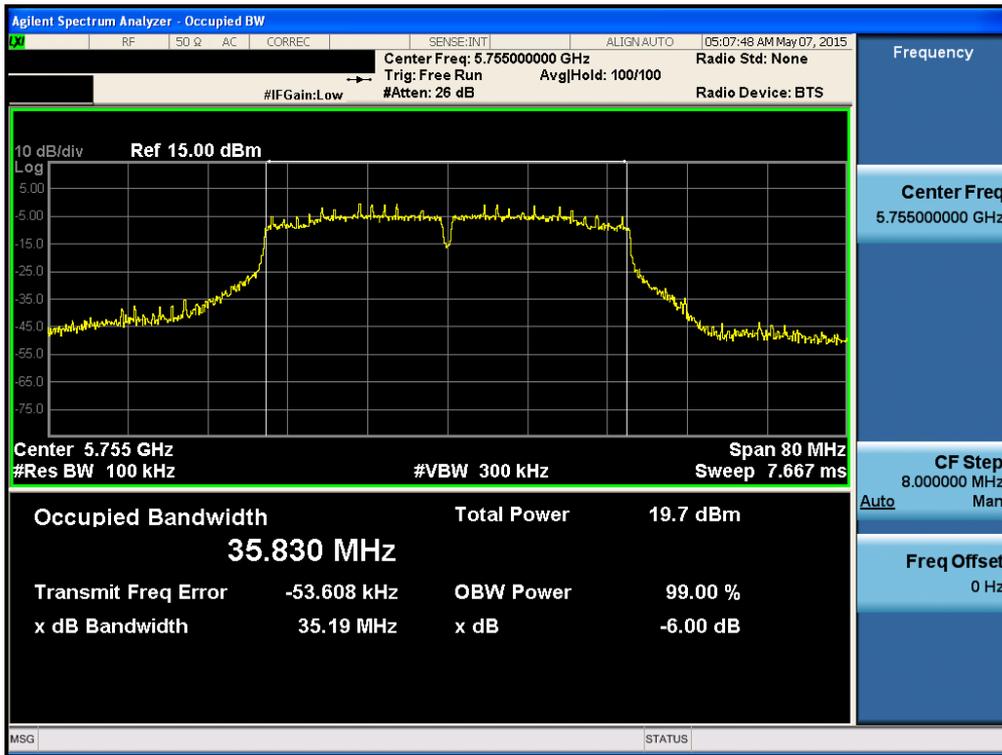
6 dB Bandwidth

Test Mode: 802.11n HT20 & Ch.165 & ANT 2



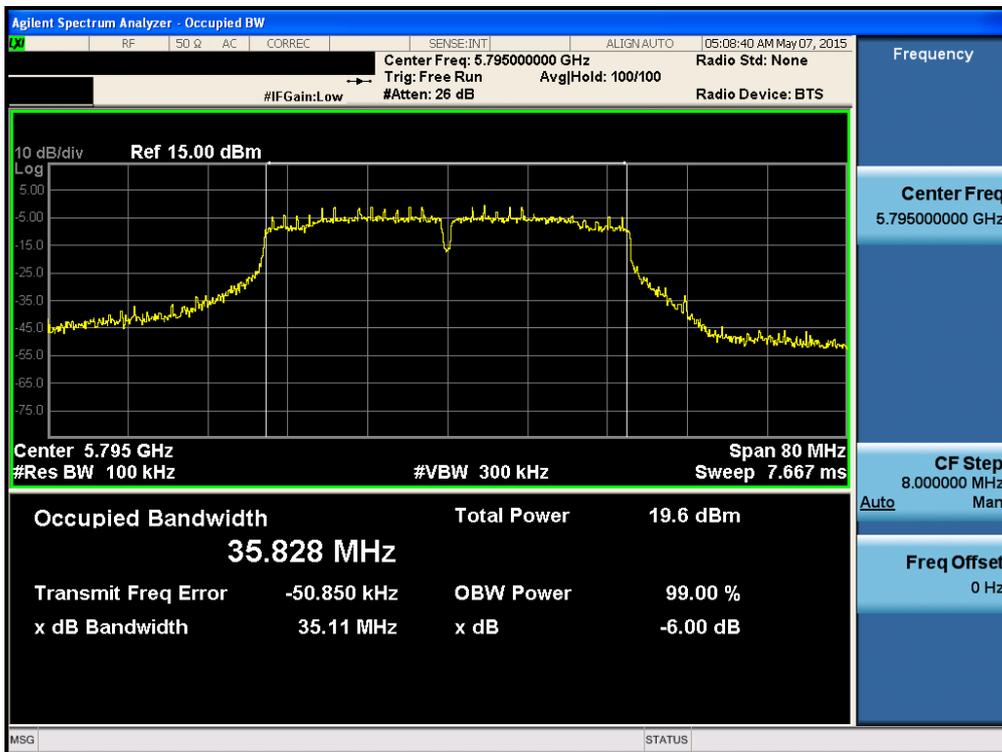
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.151 & ANT 1



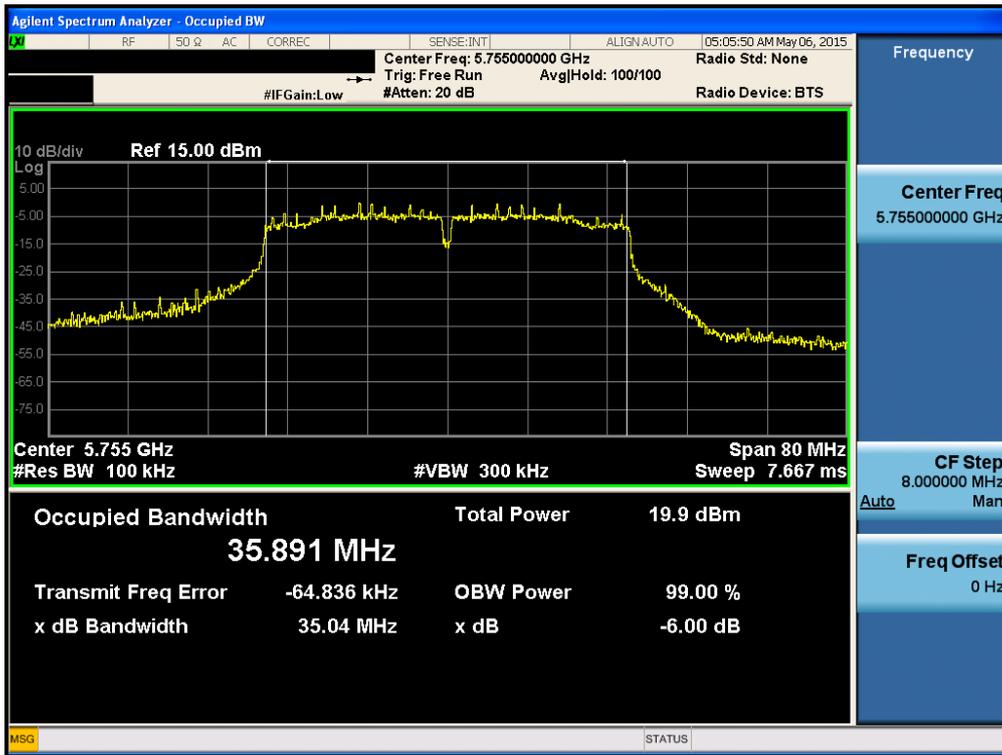
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.159 & ANT 1



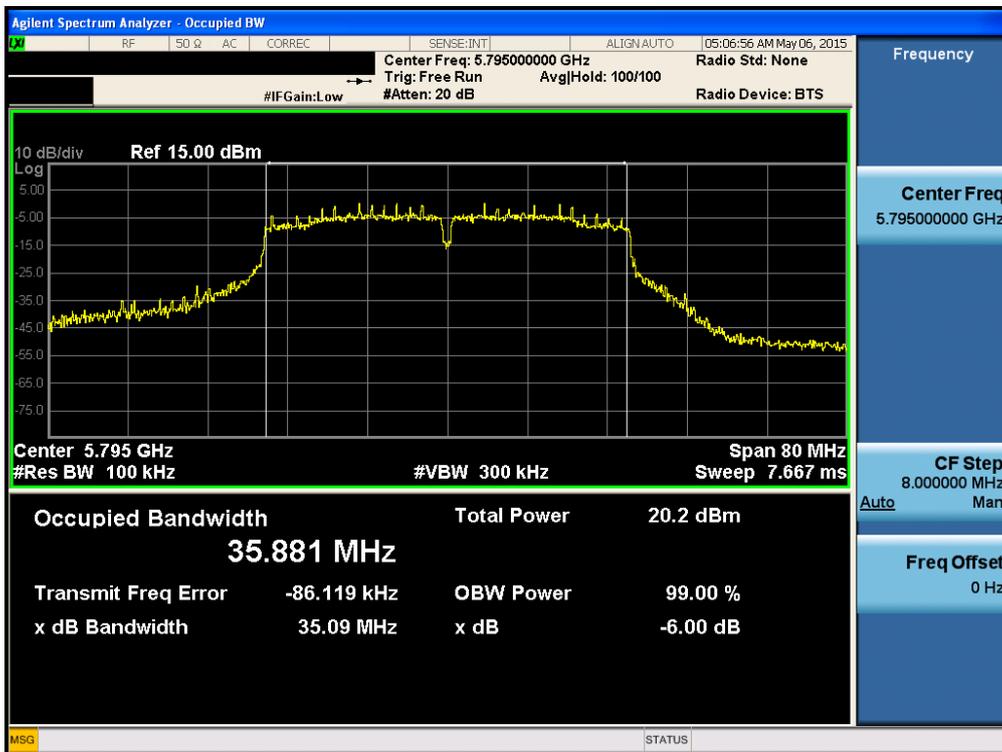
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.151 & ANT 2



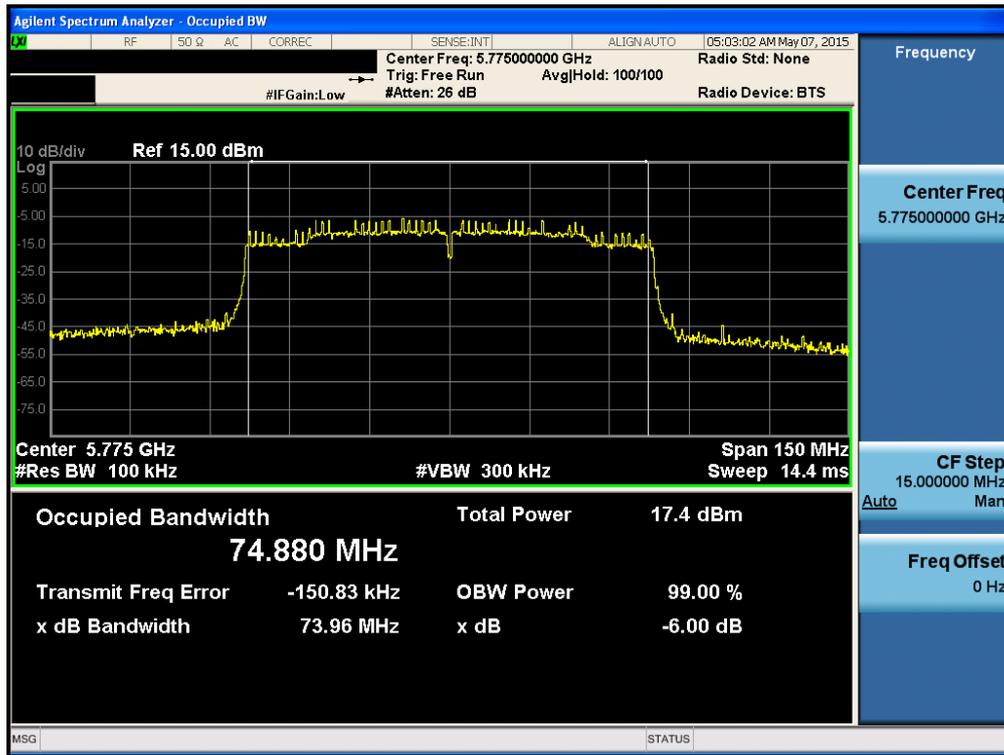
6 dB Bandwidth

Test Mode: 802.11n HT40 & Ch.159 & ANT 2



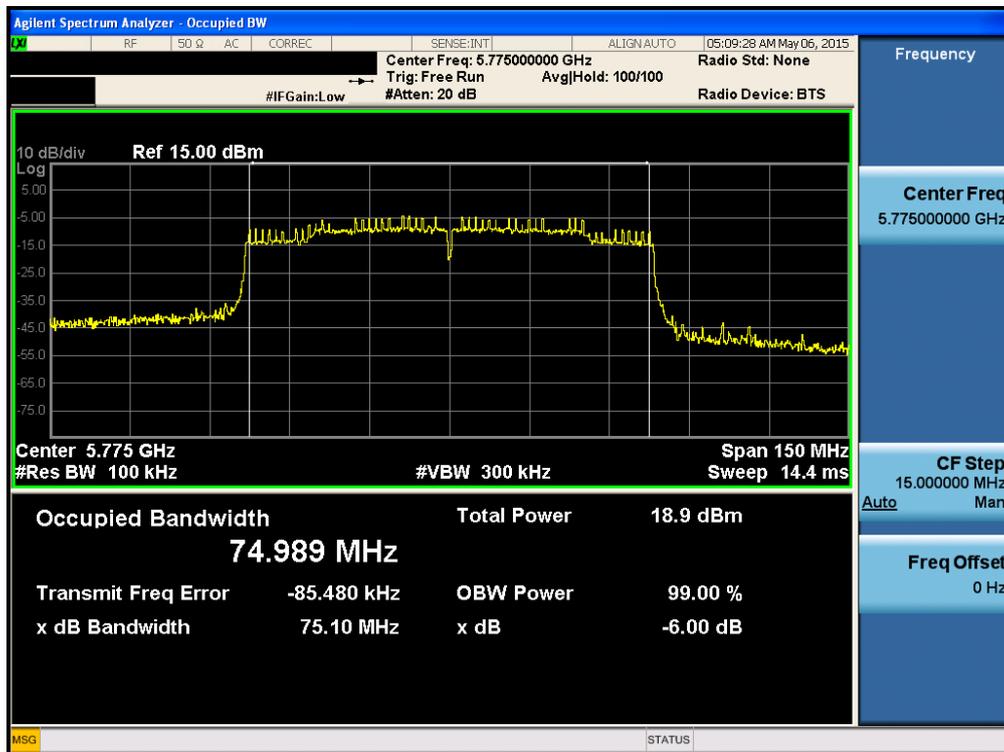
6 dB Bandwidth

Test Mode: 802.11ac VHT80 & Ch.155 & ANT 1



6 dB Bandwidth

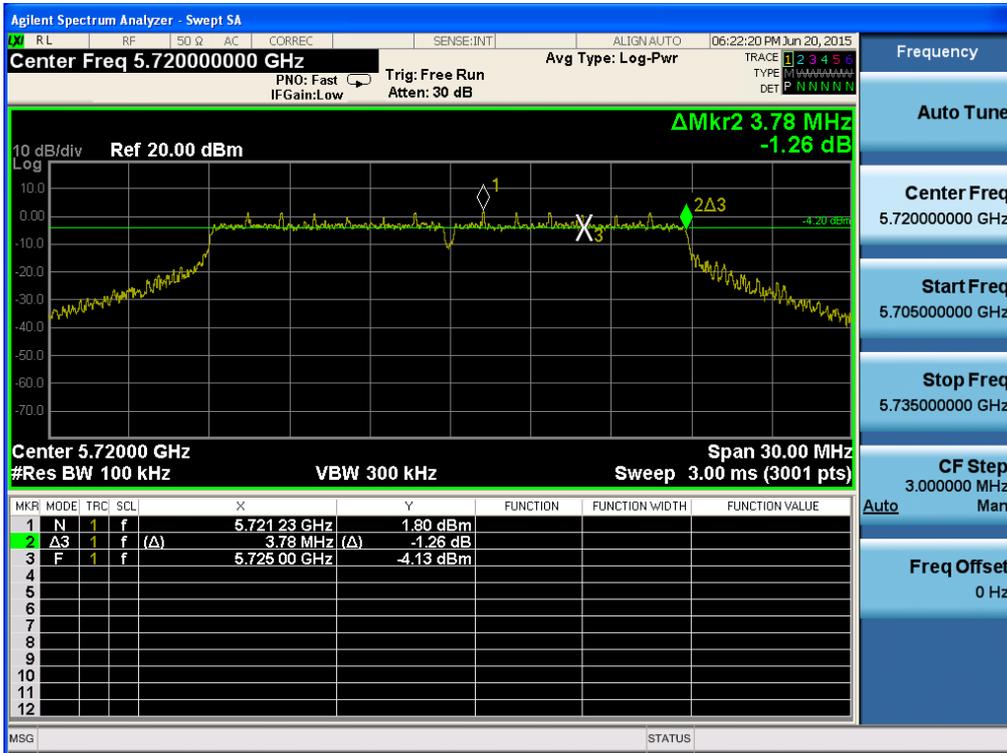
Test Mode: 802.11ac VHT80 & Ch.155 & ANT 2



RESULT PLOTS(Band-Crossing Channels)

6 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 1 & NSS 1



6 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 2 & NSS 1



6 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 1 & NSS 1



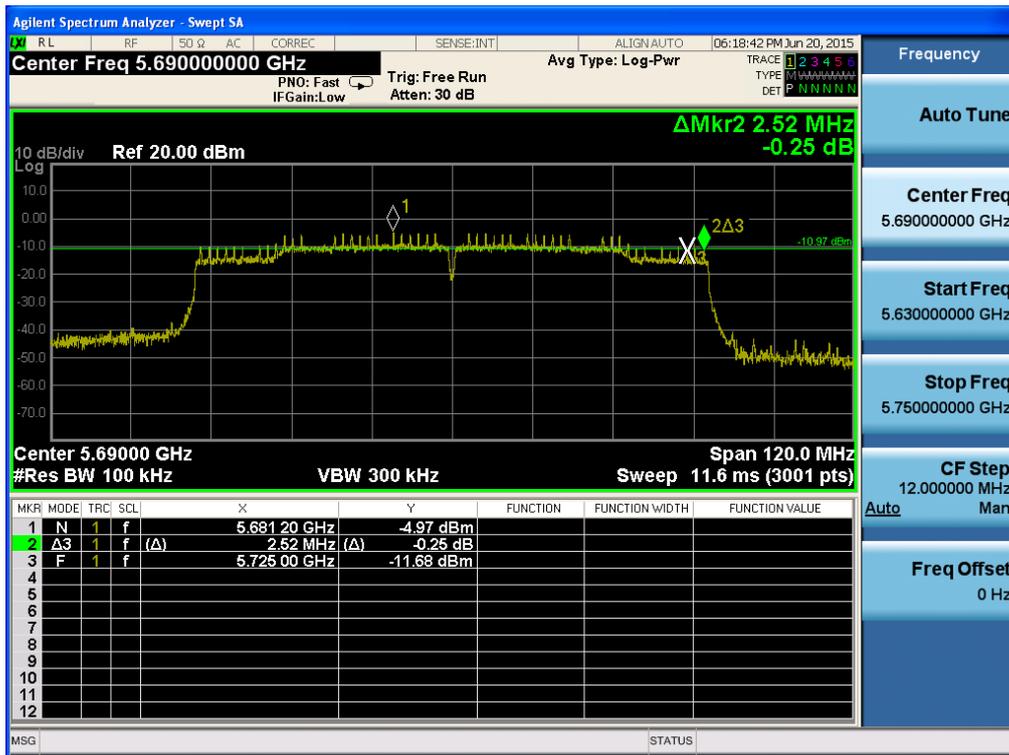
6 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 2 & NSS 1



6 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 1 & NSS 1



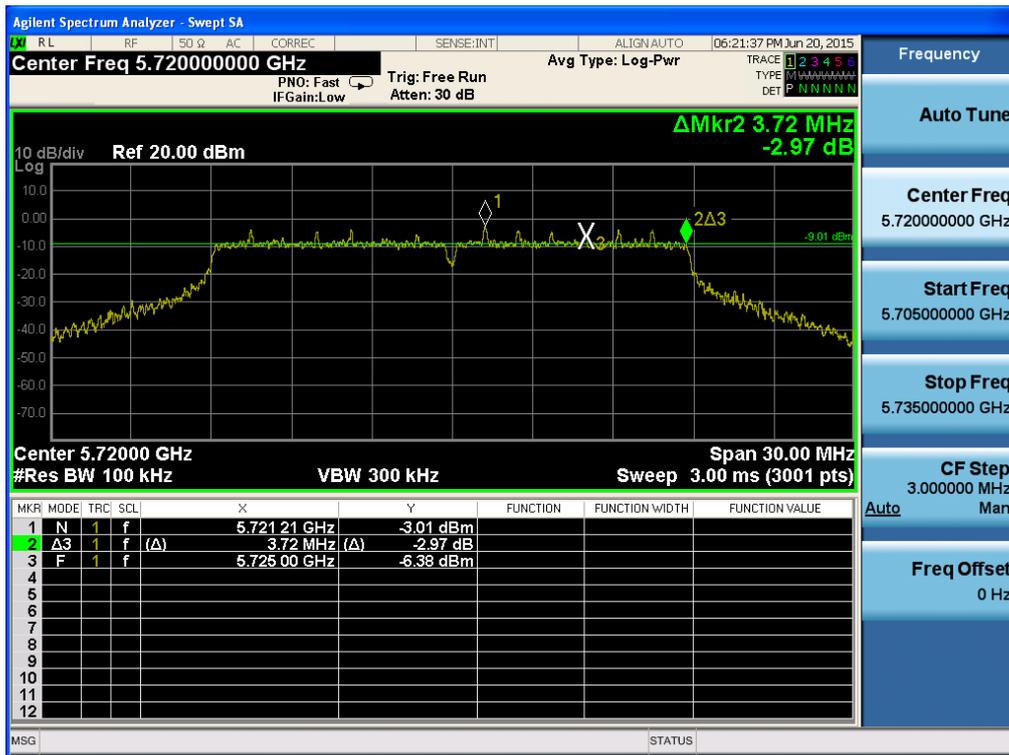
6 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 2 & NSS 1



6 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 1 & NSS 2



6 dB Bandwidth

Test Mode: 802.11ac(VH20) & Ch.144 & ANT 2 & NSS 2



6 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 1 & NSS 2



6 dB Bandwidth

Test Mode: 802.11ac(VH40) & Ch.142 & ANT 2 & NSS 2



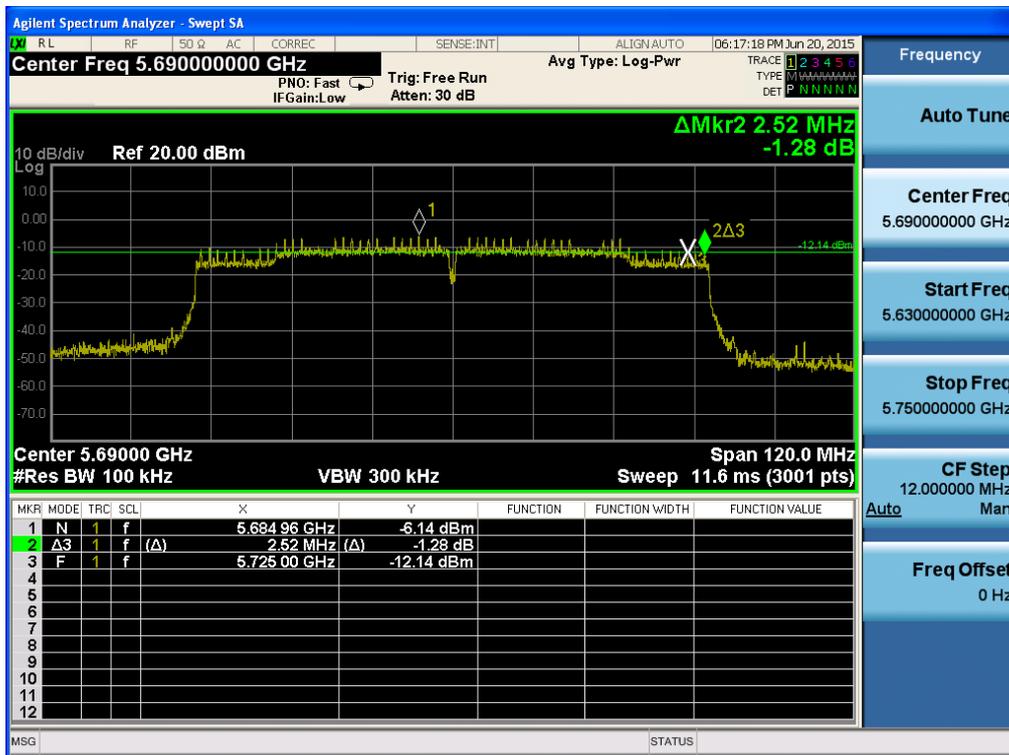
6 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 1 & NSS 2



6 dB Bandwidth

Test Mode: 802.11ac(VH80) & Ch.138 & ANT 2 & NSS 2



8.3 Maximum Conducted Output Power

■ Test Requirements

(1) For the band 5.15-5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. 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.

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) 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. 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.

(2) For the 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 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.

(3) 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, 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. However, fixed point-to-point U-NII 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-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

- Output power Limit Calculation

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 1	802.11a	250	23.97	2.72	23.97
	802.11n(HT20)				
	802.11n(HT40)				
	802.11ac(VHT80)				

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 26 dBc BW ^{Note*} [MHz]			
U-NII 2A	802.11a	250	23.97	2.72	23.97
		24.720	24.93		
	802.11n(HT20)	250	23.97		23.97
		23.025	24.62		
	802.11n(HT40)	250	23.97		23.97
		36.227	26.59		
802.11ac(VHT80)	250	23.97	23.97		
	80.880	30.08			
U-NII 2C	802.11a	250	23.97	0.72	23.97
		24.525	24.90		
	802.11n(HT20)	250	23.97		23.97
		23.025	24.62		
	802.11n(HT40)	250	23.97		23.97
		42.600	27.29		
	802.11ac(VHT20)	250	23.97		23.97
		23.025	24.62		
	802.11ac(VHT40)	250	23.97		23.97
		42.600	27.29		
802.11ac(VHT80)	250	23.97	23.97		
	81.000	30.08			

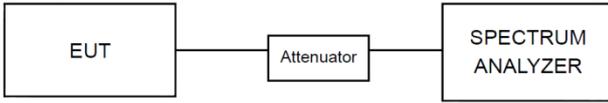
Note*: Refer to the test report of the granted module.

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
		Least 26 dBc BW ^{Note*} [MHz]			
U-NII 2C (band- crossing channels)	802.11ac(VHT20)	250	23.97	0.72	23.34
		17.12	23.34		
	802.11ac(VHT40)	250	23.97		23.97
		34.51	26.38		
	802.11ac(VHT80)	250	23.97		23.97
		74.88	29.74		

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	Antenna Gain (Worst case)	Determined Limit [dBm]
U-NII 3	802.11a	1000	30.00	2.67	30.00
	802.11n(HT20)				
	802.11n(HT40)				
	802.11ac(VHT80)				

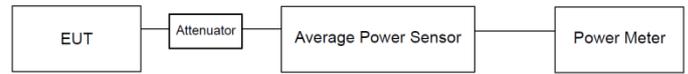
■ **Test Configuration**

For band-crossing channels (CH 144, 142, 138)



Method SA-2

For other channels



Method PM-G

■ **Test Procedure**

Method PM-G of KDB789033 D02 V01

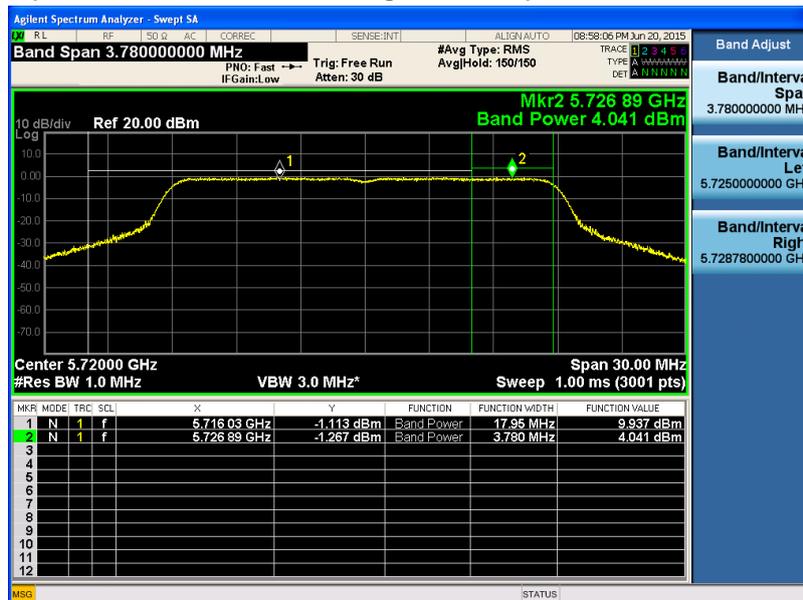
Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

Method SA-2 of KDB789033 D02 V01

1. Set span to encompass the emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz.
3. Set the VBW $\geq 3 \times$ RBW.
4. Number of points in sweep $\geq 2 \times$ Span / RBW.
5. Sweep time = auto.
6. Detector = RMS.
7. Trace average at least 100 traces in power averaging mode
8. Compute power by integrating the spectrum across the EBW of the signal.
9. Duty factor need added to measured value (duty cycle < 98 percent).

Note: The measure-and-sum technique is used for test mode with multiple transmitting.

■ **Description of test plot (U-NII 2C, 3 & Band-Crossing Channels)**



- Maker 1 Function Width (U-NII 2C Band):** 26 dB BW (17.95 MHz)
- Maker 1 Function Value (U-NII 2C Band):** Output power (9.94 dBm)
- Maker 2 Function Width (U-NII 3 Band):** 6 dB BW (3.78 MHz)
- Maker 2 Function Value (U-NII 3 Band):** Output power (4.041 dBm)

■ Test Results: **Comply**

Mode	CH	Freq. [MHz]	Test Result [dBm]	
			ANT 1	ANT 2
802.11a (Single Transmit)	36	5180	9.83	8.97
	40	5200	11.32	11.91
	48	5240	11.34	12.42
	52	5260	12.25	13.21
	60	5300	11.13	12.89
	64	5320	9.93	10.04
	100	5500	8.07	8.90
	116	5580	10.64	12.28
	140	5700	7.71	9.11
	149	5745	11.64	13.09
	157	5785	11.17	12.73
	165	5825	11.04	12.97

Mode	CH	Freq. [MHz]	Test Result [dBm]	
			ANT 1	ANT 2
802.11n(HT20) (Single Transmit)	36	5180	8.96	8.87
	40	5200	11.32	11.86
	48	5240	12.09	12.32
	52	5260	12.39	13.18
	60	5300	12.27	13.12
	64	5320	9.91	10.37
	100	5500	8.07	8.76
	116	5580	10.57	12.52
	140	5700	7.67	8.94
	149	5745	11.54	13.28
	157	5785	11.11	12.95
	165	5825	11.01	12.64

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT20) (Multiple Transmit)	36	5180	6.53	7.09	9.83
	40	5200	6.65	7.27	9.98
	48	5240	7.85	7.68	10.78
	52	5260	7.58	8.67	11.17
	60	5300	6.89	8.28	10.65
	64	5320	6.45	7.25	9.88
	100	5500	3.54	5.01	7.35
	116	5580	5.93	7.89	10.03
	140	5700	4.79	6.11	8.51
	149	5745	7.41	8.51	11.01
	157	5785	6.36	8.48	10.56
165	5825	6.73	8.36	10.63	

Mode	CH	Freq. [MHz]	Test Result [dBm]	
			ANT 1	ANT 2
802.11n(HT40) (Single Transmit)	38	5190	6.98	6.57
	46	5230	11.37	11.85
	54	5270	7.86	8.08
	62	5310	8.83	9.32
	102	5510	5.32	6.91
	110	5550	10.56	12.14
	134	5670	10.83	12.13
	151	5755	11.04	12.36
159	5795	11.29	13.15	

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11n(HT40) (Multiple Transmit)	38	5190	2.84	3.35	6.11
	46	5230	6.28	7.29	9.82
	54	5270	3.56	4.52	7.08
	62	5310	4.59	5.93	8.32
	102	5510	1.62	2.85	5.29
	110	5550	6.41	7.26	9.87
	134	5670	5.92	7.05	9.53
	151	5755	6.91	8.36	10.71
159	5795	6.53	9.18	11.06	

Mode	CH	Freq. [MHz]	Test Result [dBm]	
			ANT 1	ANT 2
802.11ac(VHT80) (Single Transmit)	42	5210	6.45	6.82
	58	5290	8.04	9.09
	106	5530	4.28	5.46
	155	5775	8.95	10.87

Mode	CH	Freq. [MHz]	Test Result [dBm]		
			ANT 1	ANT 2	SUM
802.11ac(VHT80) (Multiple Transmit)	42	5210	2.29	3.09	5.72
	58	5290	3.82	4.84	7.37
	106	5530	0.63	1.39	4.04
	155	5775	7.07	8.91	11.10

Band-Crossing Channels (U-NII 2C)

Mode	CH	Freq. [MHz]	Reading value [dBm]		DCF [dB]	Test Result [dBm]	
			ANT 1	ANT 2		ANT 1	ANT 2
802.11ac(VHT20) (Single Transmit)	144	5720	9.94	11.22	0.09	10.03	11.31
802.11ac(VHT40) (Single Transmit)	142	5710	10.59	11.68	0.13	10.72	11.81
802.11ac(VHT80) (Single Transmit)	138	5690	9.71	11.18	0.28	9.99	11.46

Mode	CH	Freq. [MHz]	Reading value [dBm]			DCF [dB]	Test Result [dBm]
			ANT 1	ANT 2	SUM		
802.11ac(VHT20) (Multiple Transmit)	144	5720	4.59	5.89	8.30	0.12	8.42
802.11ac(VHT40) (Multiple Transmit)	142	5710	5.50	7.01	9.33	0.24	9.57
802.11ac(VHT80) (Multiple Transmit)	138	5690	6.08	7.43	9.82	0.44	10.26

Note: Please refer to Appendix II for the duty correction factor

Band-Crossing Channels (U-NII 3)

Mode	CH	Freq. [MHz]	Reading value [dBm]		DCF [dB]	Test Result [dBm]	
			ANT 1	ANT 2		ANT 1	ANT 2
802.11ac(VHT20) (Single Transmit)	144	5720	4.04	5.28	0.09	4.13	5.37
802.11ac(VHT40) (Single Transmit)	142	5710	-3.52	-2.36	0.13	-3.39	-2.23
802.11ac(VHT80) (Single Transmit)	138	5690	-8.58	-7.11	0.28	-8.30	-6.83

Mode	CH	Freq. [MHz]	Reading value [dBm]			DCF [dB]	Test Result [dBm]
			ANT 1	ANT 2	SUM		
802.11ac(VHT20) (Multiple Transmit)	144	5720	-1.36	-0.06	2.35	0.12	2.47
802.11ac(VHT40) (Multiple Transmit)	142	5710	-8.43	-7.05	-4.68	0.24	-4.44
802.11ac(VHT80) (Multiple Transmit)	138	5690	-12.22	-10.73	-8.40	0.44	-7.96

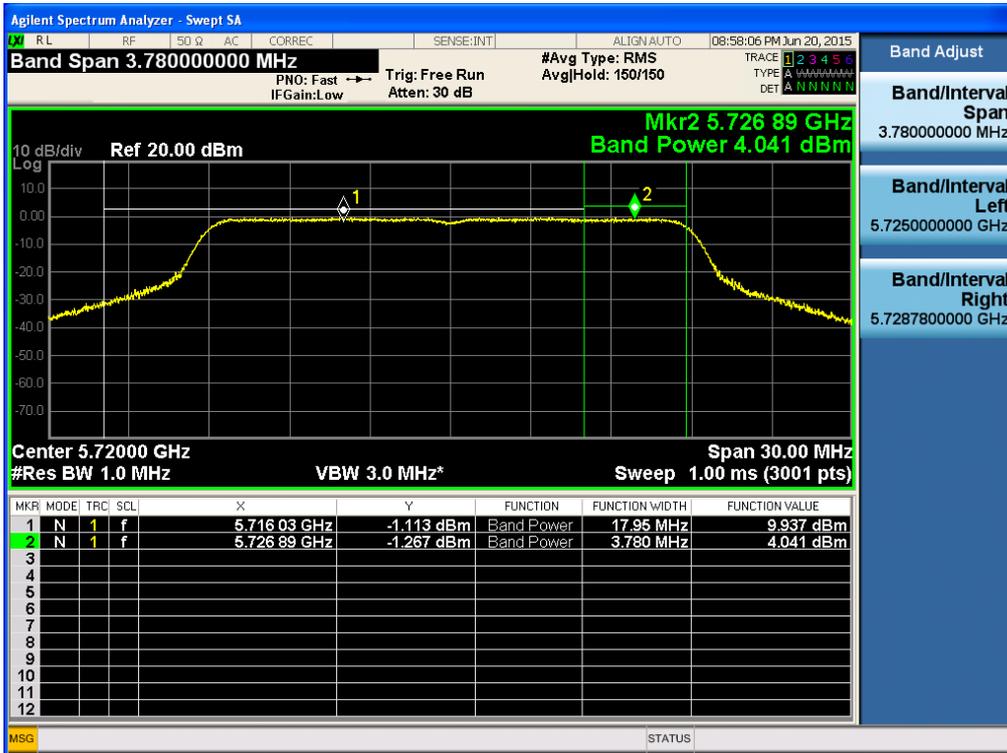
Note1: See next pages for actual measured spectrum plots.

Note2: Please refer to Appendix II for the duty correction factor

RESULT PLOTS (U-NII 2C, 3 & Band-Crossing Channels & Single Transmit)

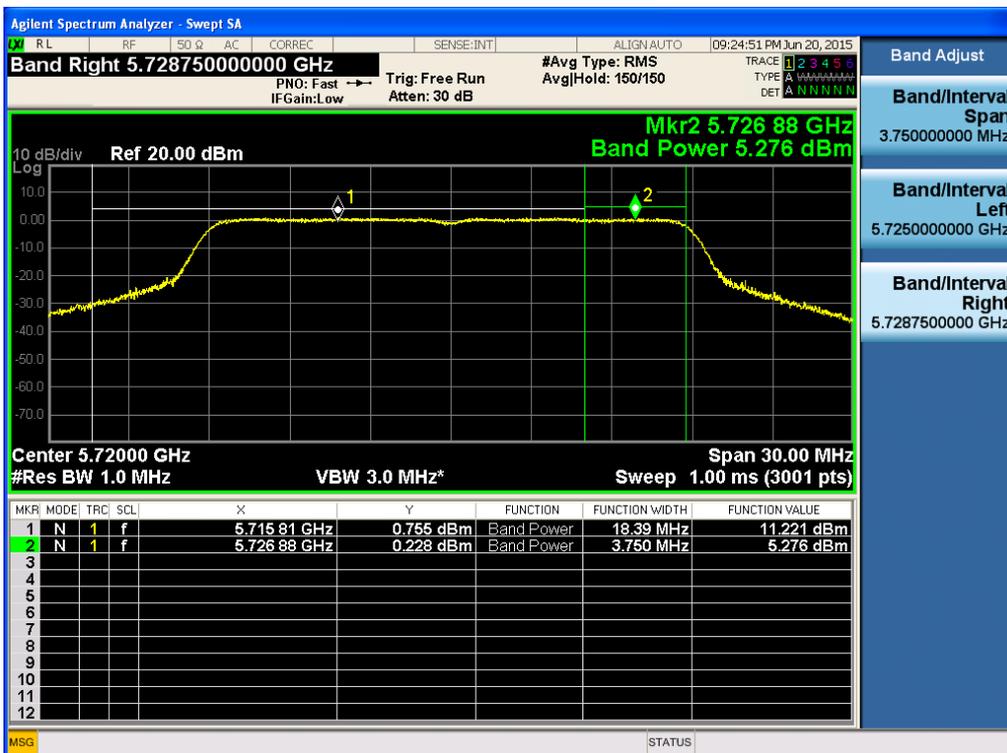
Maximum Conducted Output Power

Test Mode: 802.11ac VHT20 & Ch.144 & ANT 1



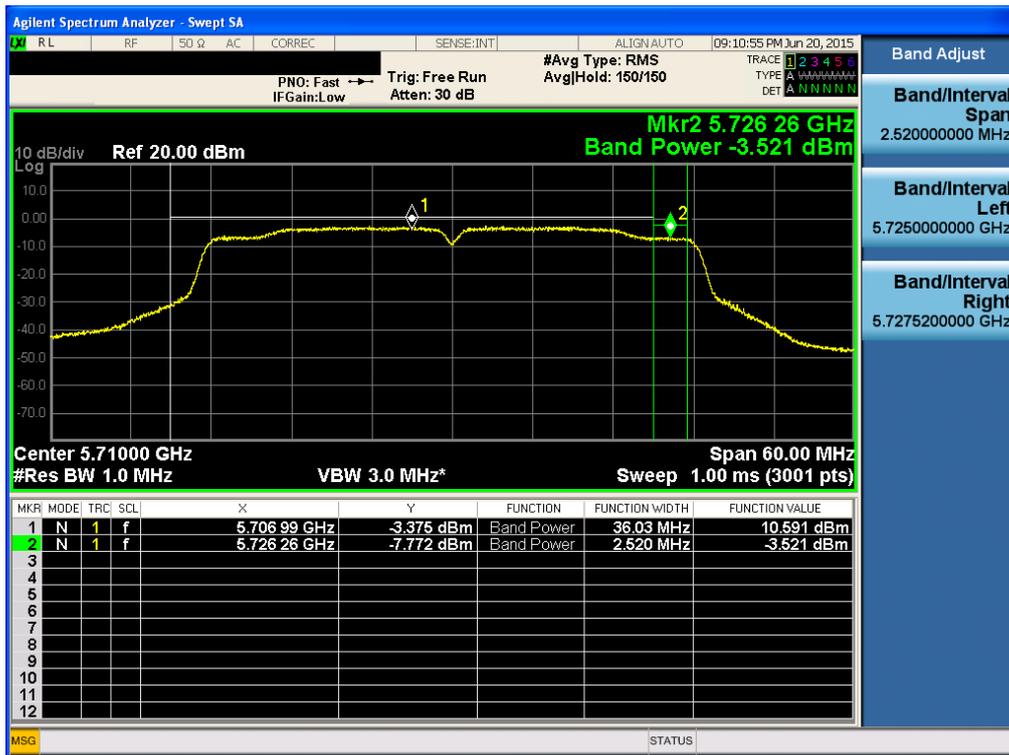
Maximum Conducted Output Power

Test Mode: 802.11 ac VHT20 & Ch.144 & ANT 2



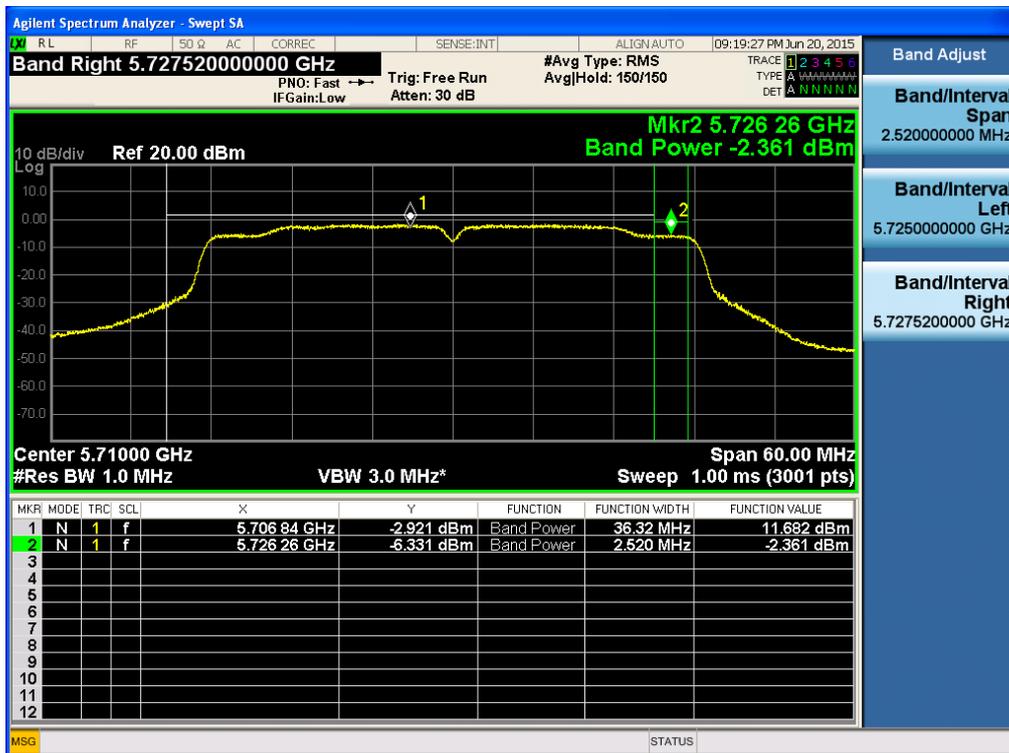
Maximum Conducted Output Power

Test Mode: 802.11ac VHT40 & Ch.142 & ANT 1



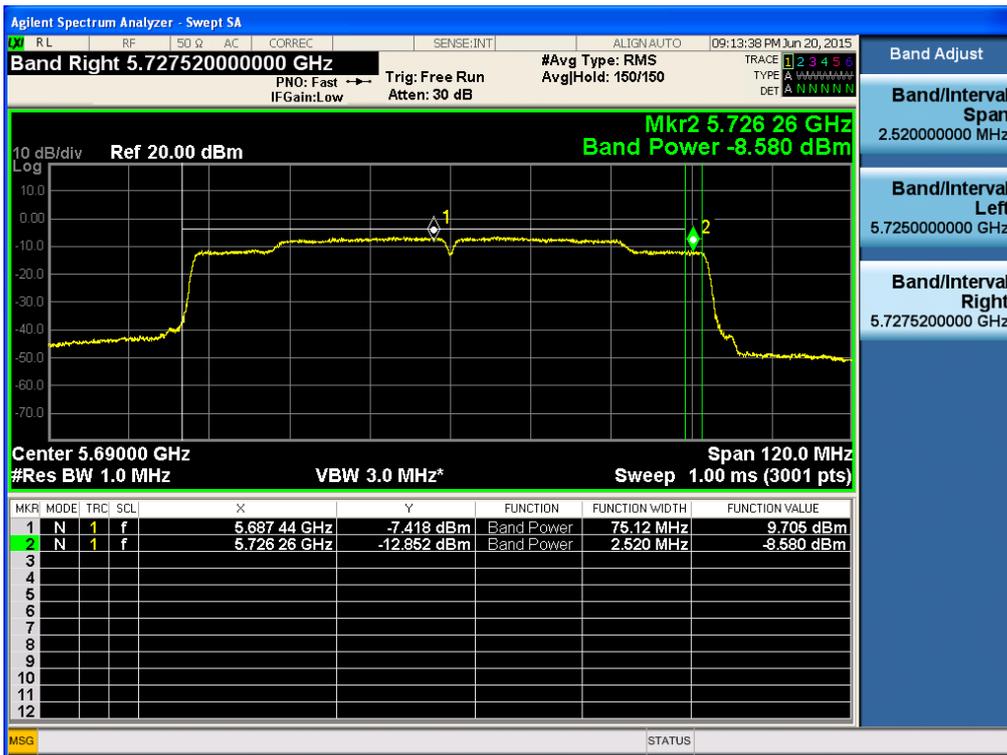
Maximum Conducted Output Power

Test Mode: 802.11 ac VHT40 & Ch.142 & ANT 2



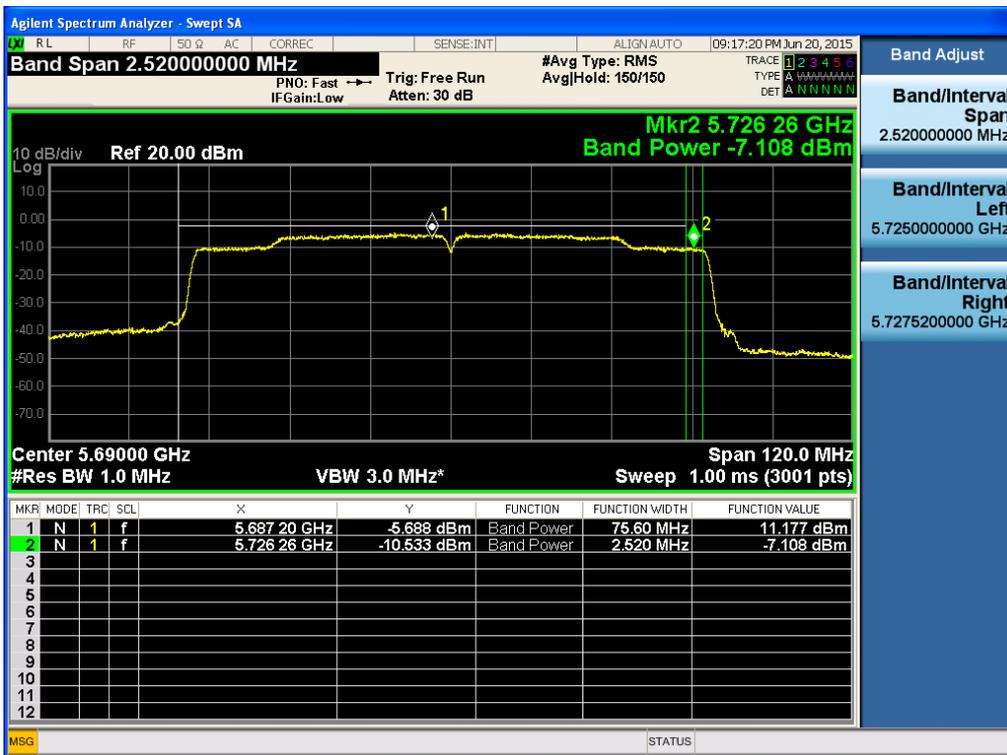
Maximum Conducted Output Power

Test Mode: 802.11ac VHT80 & Ch.138 & ANT 1



Maximum Conducted Output Power

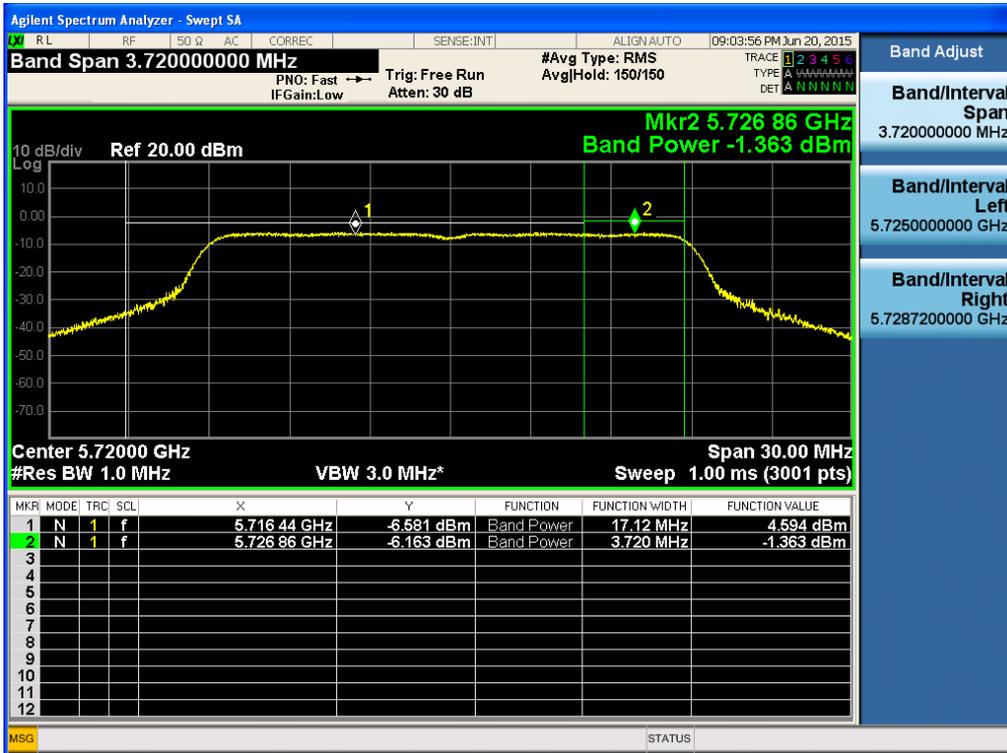
Test Mode: 802.11 ac VHT80 & Ch.138 & ANT 2



RESULT PLOTS(U-NII 2C, 3 & Band-Crossing Channels & Multiple Transmit)

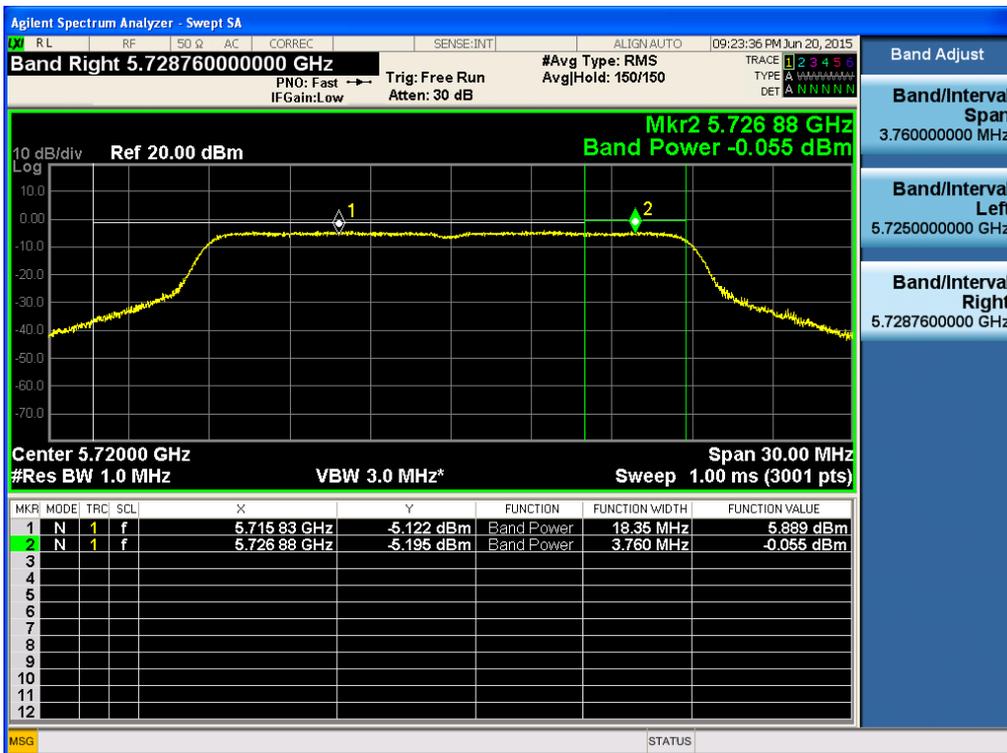
Maximum Conducted Output Power

Test Mode: 802.11ac VHT20 & Ch.144 & ANT 1



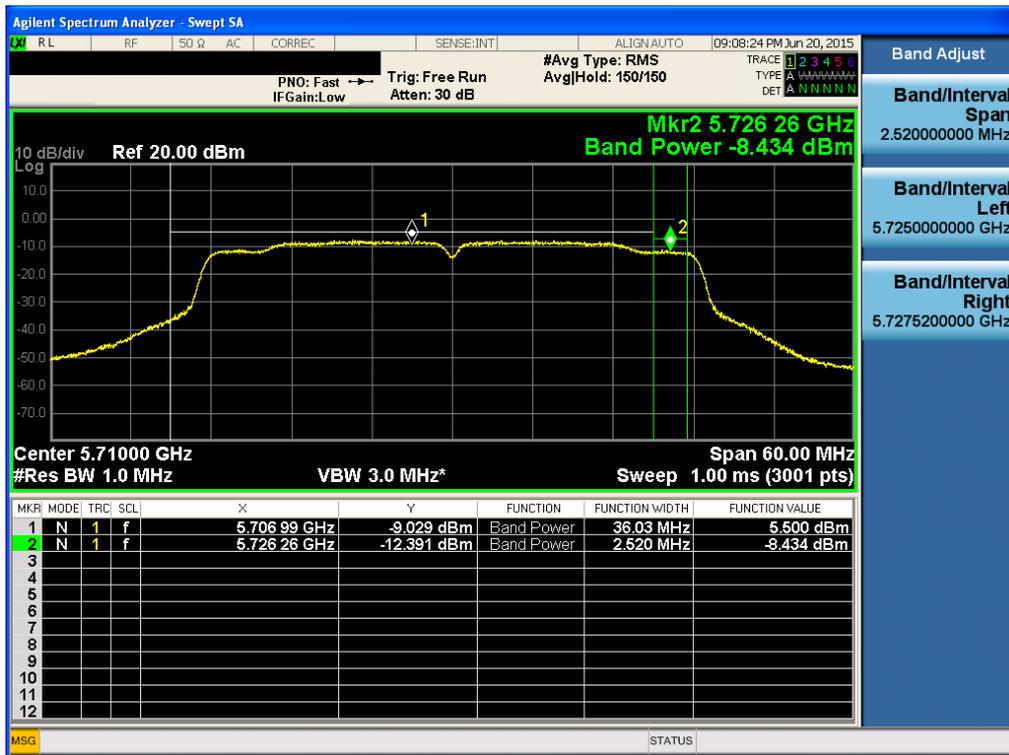
Maximum Conducted Output Power

Test Mode: 802.11 ac VHT20 & Ch.144 & ANT 2



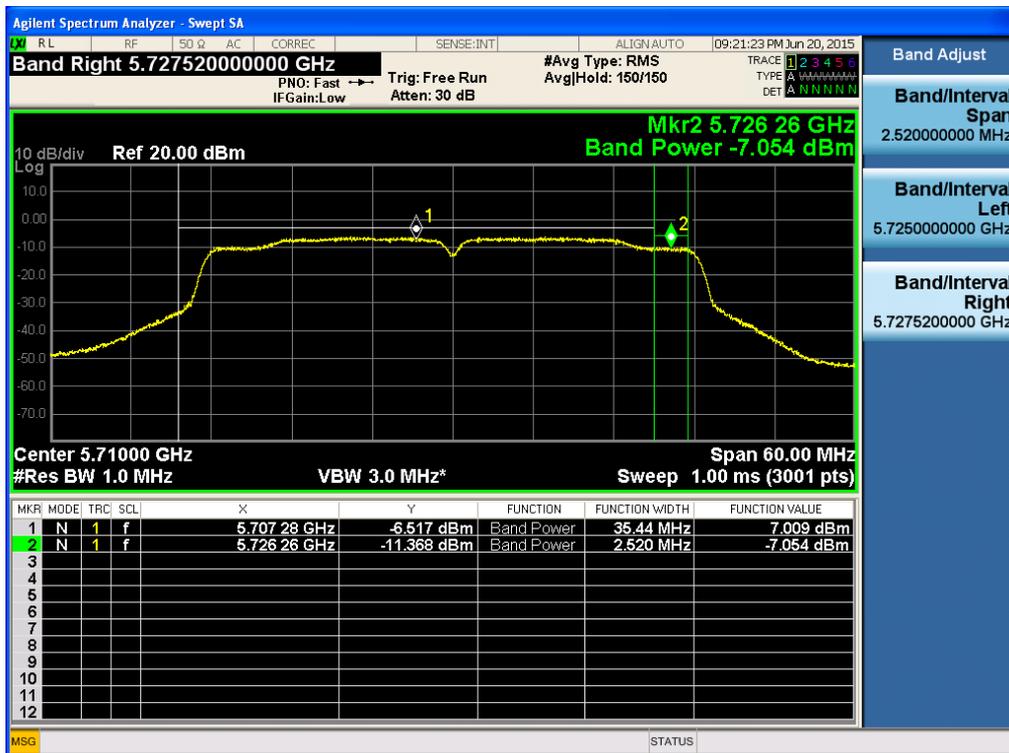
Maximum Conducted Output Power

Test Mode: 802.11ac VHT40 & Ch.142 & ANT 1



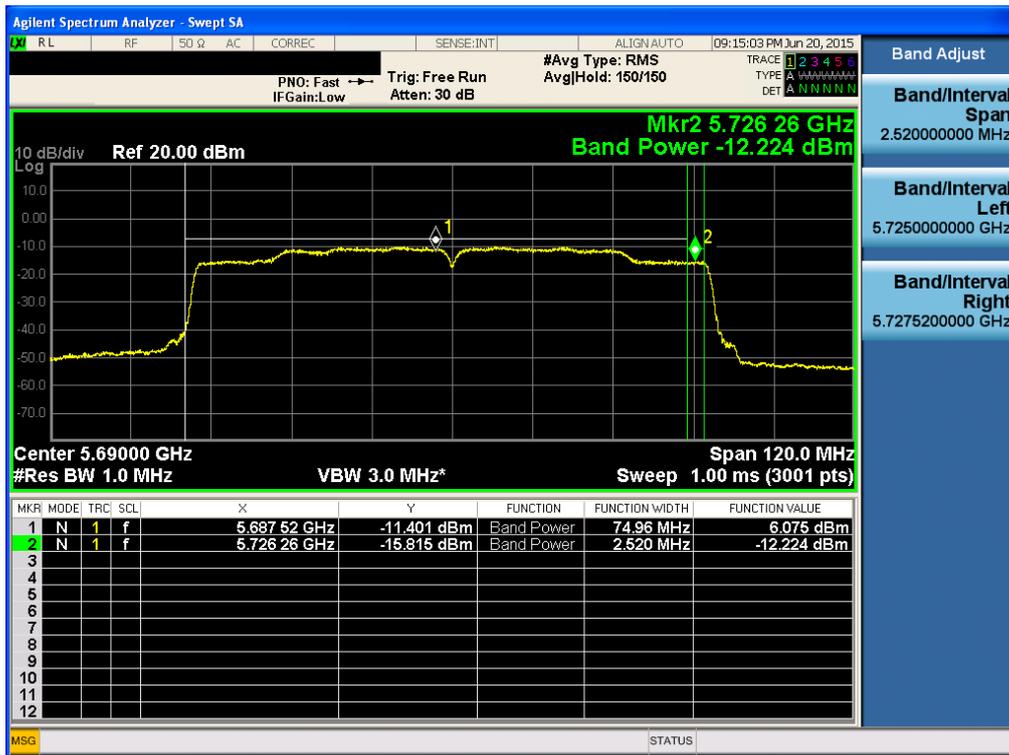
Maximum Conducted Output Power

Test Mode: 802.11 ac VHT40 & Ch.142 & ANT 2



Maximum Conducted Output Power

Test Mode: 802.11ac VHT80 & Ch.138 & ANT 1



Maximum Conducted Output Power

Test Mode: 802.11 ac VHT80 & Ch.138 & ANT 2

