TÜVRheinland®
Precisely Right.

Emissions
Test Report

EUT Name: Wireless Video Access Point

Model No.: 405

CFR 47 Part 15.407 2012 and RSS 210: 2010

Prepared for:

Mark Rieger
Pace Americas
310 Providence Mine Road, Ste. 200
Nevada City, CA 95959
Tel: (530) 274 5440
Fax: (530) 273 6340

Prepared by:

TUV Rheinland of North America, Inc.
1279 Quarry Lane
Pleasanton, CA 94566
Tel: (925) 249-9123
Fax: (925) 249-9124
http://www.tuv.com/

Report/Issue Date:	May 9, 2013
Report Number:	31360999.001
Revision Number	2
Job #	0000110737

Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	05/09/2013	Original Document	N/A
1	05/29/2013	Update RF Power Output and PSD.	J. Luong
2	09/09/2013	Added 802.11a data.	J. Luong

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Pace Americas 310 Providence Mine Road, Ste. 200 Nevada City, CA 95959 (530) 274 5440
Requester / Applicant:	Mark Rieger
Name of Equipment:	Wireless Video Access Point
Model No.	405
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407 2012 and RSS 210: 2010
Test Dates:	April 8, 2013 to August 27, 2013

Guidance Documents:

Emissions: ANSI C63.10-2009

Test Methods:

Emissions: ANSI C63.10-2009

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that the equipment described above has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by A2LA or any agency of the U.S. Government. This report contains data that are not covered by A2LA accreditation. This report shall not be reproduced except in full, without the written authorization of TUV Rheinland of North America.

Jeremy Luong	September 9, 2013	Conan Boyle	September 9, 2013
Test Engineer	Date	A2LA Signatory	Date

Testing Cert #3331.02 **US5254** **2932M-1**

1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the CFR 47 Part 15.407 2012 and RSS 210: 2010 based on the results of testing performed on April 8, 2013 to August 27, 2013 on the Wireless Video Access Point Model 405 manufactured by Pace Americas This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report. The 5150 MHz to 5250 MHz frequency band is covered in this document.

1.3 Summary of Test Results

Table 1: Summary of Test Results

Test	Test Method ANSI C63.4	Test Parameters (from Standard)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.407 (b) RSS-GEN Sect.7.2.3, RSS 210 Sect. A.9.2	Class B	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS 210 Sect.2.6	Class B	**Complied**
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.7.2.2	Class B	**Complied**
Occupied Bandwidth	CFR47 15.407 (a), RSS GEN Sect.4.4.1	≥ 500 kHz	**Complied**
Maximum Output Power	CFR47 15.407 (a), RSS 210 Sect. A.9.2	Band 1: 16.97 dBm	**Complied**
Peak Power Spectral Density	CFR47 15.407 (a), RSS 210 Sect. A.9.2	Band 1: 4 dBm/MHz	**Complied**
Peak Excursion Ratio	CFR47 15.407 (a)(6)	< 13 dB	**Complied**
Conducted Emission – Antenna Port	CFR47 15.407 (b), RSS 210 Sect.6.2.2	30 MHz -40 GHz < 27 dBm/MHz	**Complied**
Frequency Stability	CFR47 15.407 (g), RSS GEN Sect. 4.7.	±20 ppm	**Complied**
RF Exposure	CFR47 15.247 (i), 2.1091	General Population	**Complied**

Note: This test report is covered for 5150 MHz to 5250 MHz band.

1.4 Special Accessories

No special accessories were necessary in order to achieve compliance.

1.5 Equipment Modifications

None

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 is recognized by the commission for performing testing services for the general public on a fee basis. These laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (US5254). The laboratory scope of accreditation includes: Title 47 CFR Parts 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 A2LA

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:2005 and ISO 9002 (Lab Code Testing Cert #3331.02). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Canada – Industry Canada

TUV Rheinland of North America at the 1279 Quarry Ln, Pleasanton, CA 94566 address is accredited by Industry Canada for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by Industry Canada (File Number 2932M-1). This reference number is the indication to the Industry Canada Certification Officers that the site meets the requirements of RSS 212, Issue 1 (Provisional). The accreditation is updated every 3 years.

2.1.4 Japan – VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at 1279 Quarry Ln, Pleasanton, CA 94566 has been assessed and approved in accordance with the Regulations for Voluntary Control Measures.

VCCI Registration No. for Pleasanton: A-0031

VCCI Registration No. for Santa Clara: A-0032

2.1.5 Acceptance by Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland at 1279 Quarry Ln, Pleasanton, CA 94566 test results and test reports within the scope of the laboratory A2LA accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 1279 Quarry Lane, Pleasanton, California 94566, USA. The 2305 Mission College, Santa Clara, 95054, USA location is considered a Pleasanton annex.

2.2.1 Emission Test Facility

The Semi-Anechoic chamber and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2009, at a test distance of 3 and 5 meters. The site is listed with the FCC and accredited by A2LA (Lab Code Testing Cert #3331.02). The 3/5-meter semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4-2009, at a test distance of 3 meter and 5 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7 m x 4.8 m x 3.175 mm thick aluminum floor connected to PE ground.

For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6 m x 0.8 m x 0.8 m high non-conductive table with a 3.175 mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50 cm x 50 cm x 3.175 mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470-kΩ resistors.

For EFT, Surge, PQF, the HCP and VCP are removed.

RF Field Immunity testing is performed in a 7.3m x 4.3m x 4.1m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.8m x 3.7m x 3.175mm thick aluminum ground plane.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st Edition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities; it is equal to the positive square root of

the sum of the variances or co-variances of these other quantities, weighted according to how the measurement result varies with changes in these quantities. The term *standard uncertainty* is the result of a measurement expressed as a standard deviation.

2.3.1 Sample Calculation – radiated & conducted emissions

The field strength is calculated by subtracting the Amplifier Gain and adding the Cable Loss and Antenna Correction Factor to the measured reading. The basic equation is as follows:

Field Strength (dBμV/m) = RAW - AMP + CBL + ACF

Where: RAW = Measured level before correction (dBμV)

AMP = Amplifier Gain (dB)

CBL = Cable Loss (dB)

ACF = Antenna Correction Factor (dB/m)

$$\mu V/m = 10^{\frac{dB\mu V/m}{20}}$$

Sample radiated emissions calculation @ 30 MHz

Measurement +Antenna Factor–Amplifier Gain+Cable loss=Radiated Emissions (dBuV/m)

25 dBuV/m + 17.5 dB – 20 dB + 1.0 dB = 23.5 dBuV/m

2.3.2 Measurement Uncertainty

Per CISPR 16-4-2	**U_{lab}**	**U_{cispr}**
Radiated Disturbance @ 10 meters		
30 – 1,000 MHz	2.25 dB	4.51 dB
Radiated Disturbance @ 3 meters		
30 – 1,000 MHz	2.26 dB	4.52 dB
1 – 6 GHz	2.12 dB	4.25 dB
6 – 18 GHz	2.47 dB	4.93 dB
Conducted Disturbance @ Mains Terminals		
150 kHz – 30 MHz	1.09 dB	2.18 dB
Disturbance Power		
30 MHz – 300 MHz	3.92 dB	4.3 dB

Voltech PM6000A

The estimated combined standard uncertainty for harmonic current and flicker measurements is ± 5.0%.	Per CISPR 16-4-2 Methods

2.3.3 Measurement Uncertainty Immunity

The estimated combined standard uncertainty for ESD immunity measurements is ± 8.2%.	Per IEC 61000-4-2
The estimated combined standard uncertainty for radiated immunity measurements is ± 4.10 dB.	Per IEC 61000-4-3
The estimated combined standard uncertainty for conducted immunity measurements with CDN is ± 3.66 dB	Per IEC 61000-4-6
The estimated combined standard uncertainty for power frequency magnetic field immunity is ± 2.9%.	Per IEC 61000-4-8

Thermo KeyTek EMC Pro

The estimated combined standard uncertainty for EFT fast transient immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for surge immunity measurements is ± 2.6%.
The estimated combined standard uncertainty for voltage variation and interruption measurements is ± 1.74%.

The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Standard 17025:2005. Equipment calibration records are kept on file at the test facility.

3 Product Information

3.1 Product Description

The Pace 405 wireless video access point allows service providers to securely deliver high quality HD video to any location in a subscriber home. Using state of the art wireless technology including digital beam forming, customers retain traditional "wired" levels of service and quality while service providers enjoy the benefits of shortened installation times and more flexibility in how they deploy their IPTV or OTT services

Key Feature:

- 5GHz 802.11n wireless access point
- 4x4 MIMO (up to 600Mbps phy rate)
- High-Power Transmit For Maximum Coverage
- Gigabit Ethernet port
- Robust quality of service (QoS) and traffic management features
- Simple, push-button wireless setup for wireless set-tops
- TR-069 Management Client
- LEDs: Power, Wireless Signal Quality, Operational Mode (AP/STA), Ethernet Link, Wireless Pairing Indicator

3.2 Equipment Configuration

A description of the equipment configuration is given in the Test Plan Section. The EUT was tested as called for in the test standard and was configured and operated in a manner consistent with its intended use. The EUT was connected to rated power and allowed to reach intended operating conditions. The placement of the EUT system components was guided by the test standard and selected to represent typical installation conditions.

In the case of an EUT that can operate in more than one configuration, preliminary testing was performed to determine the configuration that produced maximum radiation.

The final configuration was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.3 Operating Mode

A description of the operation mode is given in the Test Plan Section. In the case of an EUT that can operate in more than one state, preliminary testing was performed to determine the operating mode that produced maximum radiation.

The final operating mode was selected to produce the worst case radiation for emissions testing and to place the EUT in the most susceptible state for immunity testing.

3.4 Unique Antenna Connector

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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 manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of CFR47 Parts 15.211, 15.213, 15.217, 15.219, or 15.221.

3.4.1 Results

The Wireless Video Access Point has 4 internal fixed antennas, 3 onboard PCB dipole antennas and 1 stamped metal loop antenna. Each antenna has the maximum gain of 2 dBi. The total directional gain is 8 dBi. All antennas are integrated on the PCB. There is no external antenna connection available.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.407: 2012 and RSS 210 Annex 9: 2010. These test methods are listed under the laboratory's A2LA Scope of Accreditation. This test measures the levels emanating from the EUT, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices. Procedures described in section 8 of the standard were used.

4.1 Output Power Requirements

The maximum output power requirement is the maximum equivalent isotropic radiated power delivering at the transmitting antenna under specified conditions of measurements in the presence of modulation.

The maximum output power and harmonics shall not exceed CFR47 Part 15.407 (a):2012 and RSS 210 A9.2: 2010.

The maximum transmitted powers are

Band 5150-5250 MHz:50 mW or 4 dBm + 10Log B.

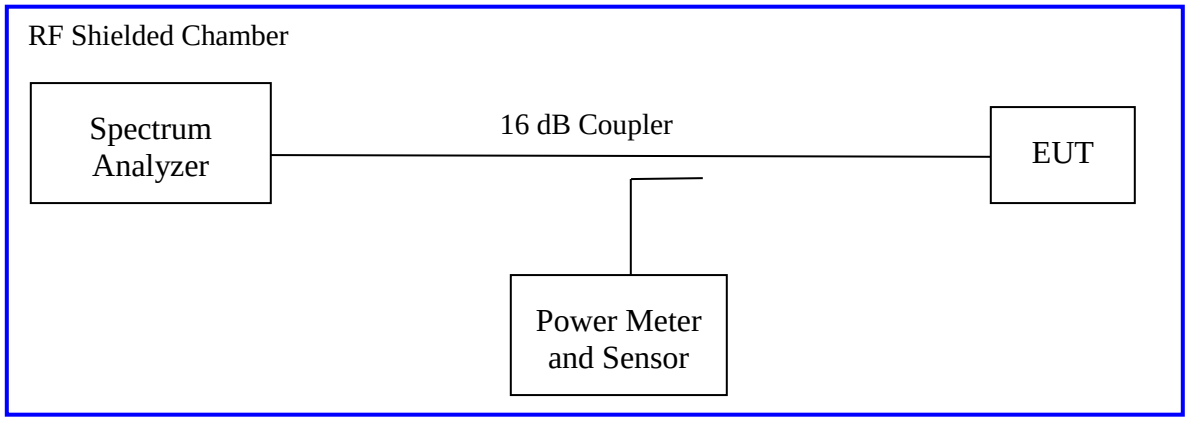
Band 5250-5350 MHz, 5470-5725 MHz:250 mW or 11 dBm + 10Log B.

Band 5725-5825 MHz:1 W or 17 dBm + 10Log B. Where B is 26 dB Bandwidth.

4.1.1 Test Method

The ANSI C63.10-2009 Section 6.10.3.1 conducted method was used to measure the channel power output. The preliminary investigation was performed at different data rate/ chain to determine the highest power output for each mode. The worst findings were conducted on 3 channels in each operating range per CFR47 Part 15.407(a): 2012 and RSS 210 A.9.2; 5150 MHz to 5250 MHz. The worst mode results indicated below.

Test Setup:



Method SA-1 of "Guidelines for Complance Testing of Unlicensed National Information Infrastructure (U-NII) Devices"applies since the EUT continuously transmit; where duty cycle is greater than 98%. Sample detector was used.

Each chain was measured individually and applied the measure-and-sum approach per KDB66291.

4.1.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 2: RF Output Power at the Antenna Port – Test Results

Test Conditions: Conducted Measurement, Normal Temperature							
Antenna Type: Integrated				**Power Setting:** See test plan			
Max. Directional Gain: + 8 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23° C				**Relative Humidity:**33%			
802.11a Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5180	14.97	6.87	7.19	6.92	7.12	13.05	-1.92
5200	14.97	5.37	6.51	5.74	6.02	11.95	-3.00
5240	14.97	4.19	6.22	5.02	6.04	11.46	-3.49
Note: 1.The highest output power was observed at 6 Mbps, 4 Data Streams. 2. All chains will be on at all time and beam performing. RF output powers were summed per KDB 662911. 3. The total directional gain would be 8 dBi; 2 dBi +10*Log(4). Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6 dBi. The limit would be 14.97 dBm.							
802.11n (HT20) Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5180	14.97	6.19	8.04	6.78	7.05	13.09	-1.88
5200	14.97	4.43	6.90	5.63	5.65	11.76	-3.21
5240	14.97	4.51	6.73	5.24	5.65	11.63	-3.34
Note: 1.The highest output power was observed at HT20 6.5 Mbps, 4 Data Streams. 2. All chains will be on at all time and beam performing. RF output powers were summed per KDB 662911. 3. The total directional gain would be 8 dBi; 2 dBi +10*Log(4). Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6 dBi. The limit would be 14.97 dBm.							

802.11n (HT40) Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5190	14.97	8.13	9.80	8.63	7.94	14.71	-0.26
5230	14.97	7.69	9.83	8.43	9.15	14.87	-0.10

Note: 1.The highest output power was observed at HT40 13.5 Mbps, 4 Data Streams.
2. All chains will be on at all time and beam performing. RF output powers were summed per KDB 662911.

3. The total directional gain would be 8 dBi; 2 dBi +10*Log(4). Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6 dBi. The limit would be 14.97 dBm

Table 3: Average Output Power at the Antenna Port – Reference Only

Test Conditions: Conducted Measurement, Normal Temperature							
Antenna Type: Integrated				**Power Setting:** See test plan			
Max. Directional Gain: + 8 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C				**Relative Humidity:**33%			
802.11a Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5180		6.81	7.15	6.84	7.06	12.99	
5200		5.30	6.47	5.68	5.94	11.89	
5240		3.91	5.95	4.72	5.76	11.18	
802.11n (HT20) Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5180		6.83	8.68	7.44	7.75	13.75	
5200		5.14	7.53	6.28	6.31	12.42	
5240		4.91	7.18	5.66	6.07	12.06	
Note: The highest output power was observed at HT20 6.5 Mbps, 4 Data Streams.							
802.11n (HT40) Mode, 4x4							
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5190		8.47	10.13	8.94	8.30	15.04	
5230		7.78	9.94	8.56	9.31	14.99	
Note: The highest output power was observed at HT40 13.5 Mbps, 4 Data Streams.							

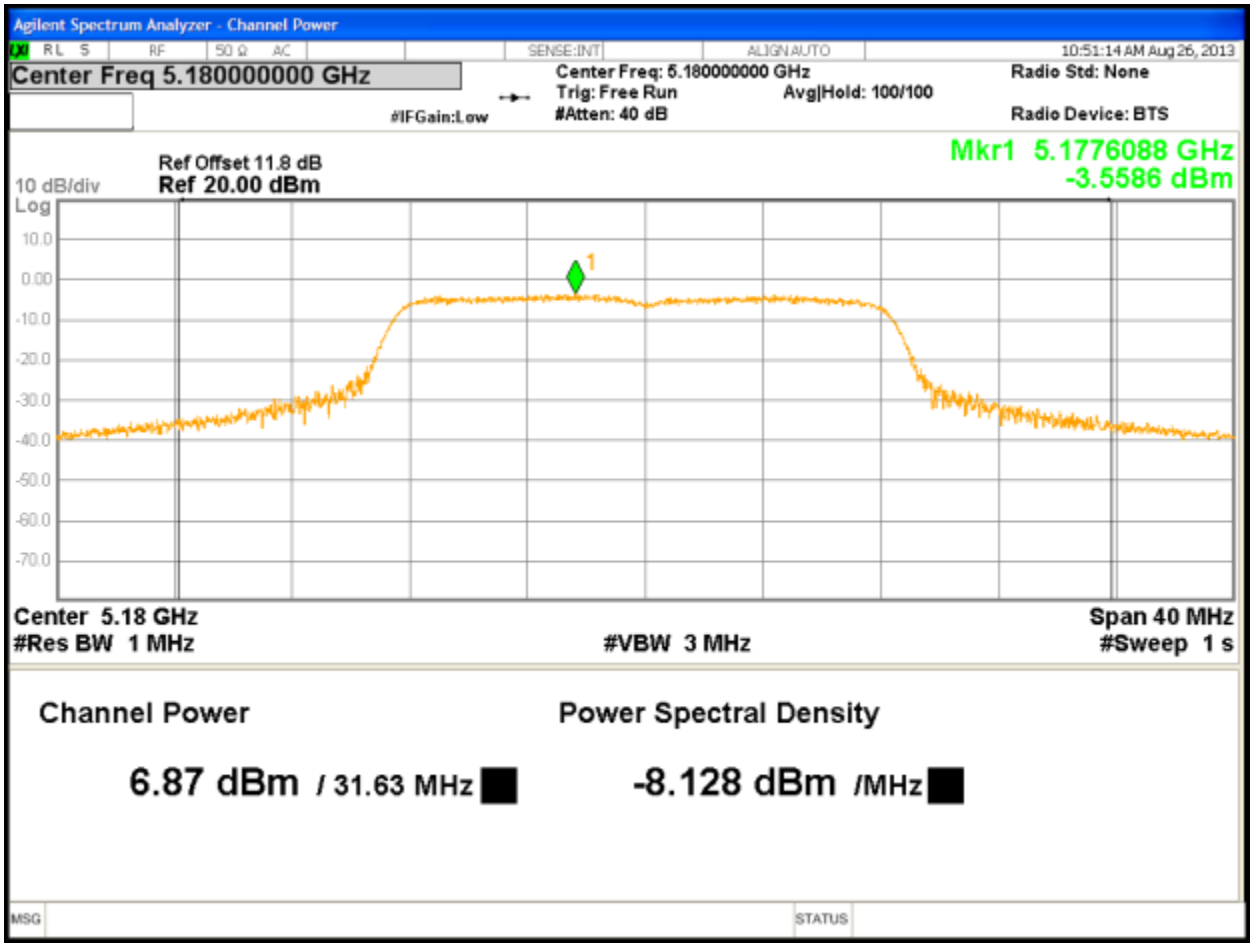


Figure 1: Maximum Transmitted Power, 5180 MHz at 802.11a, Chain 0

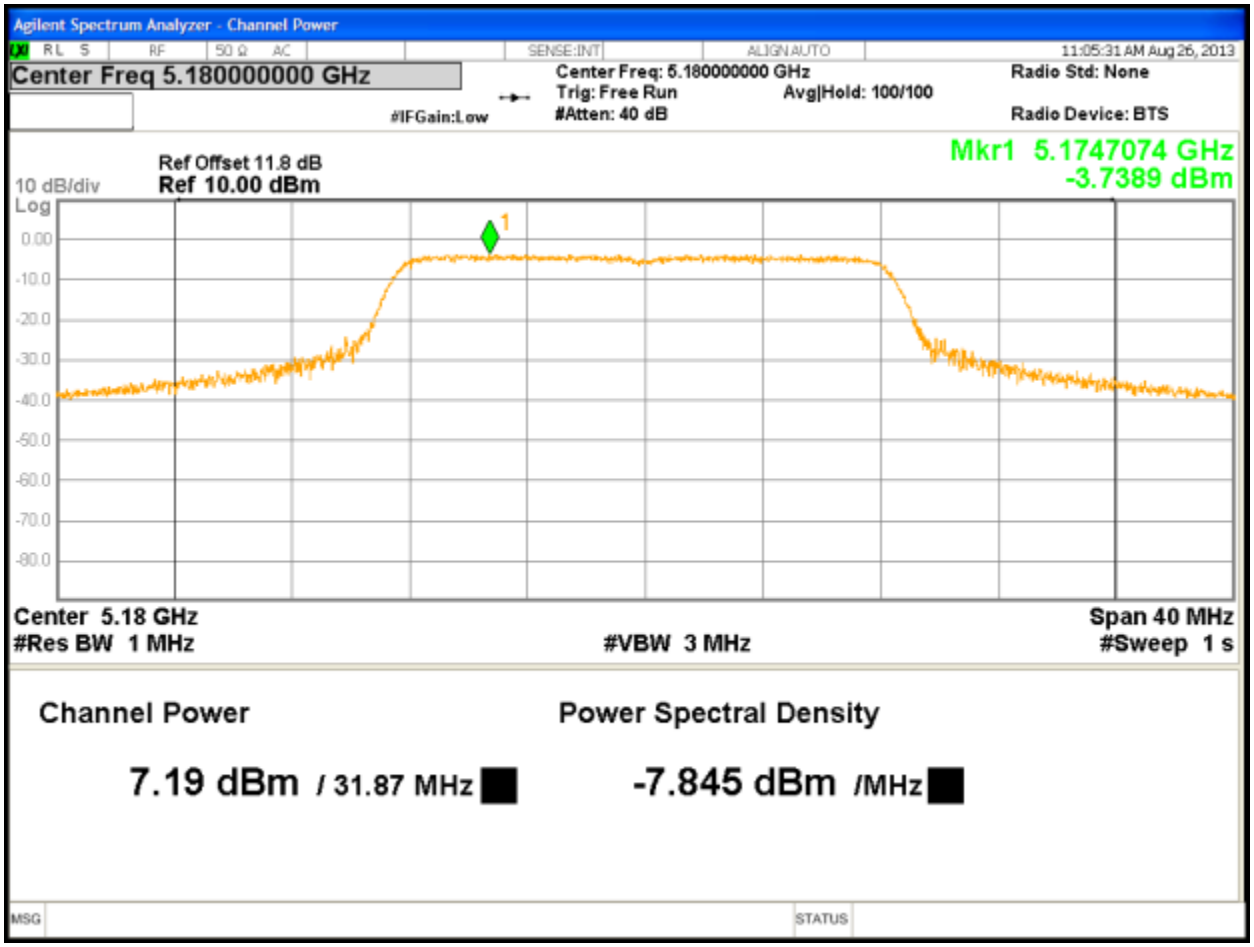


Figure 2: Maximum Transmitted Power, 5180 MHz at 802.11a, Chain 1

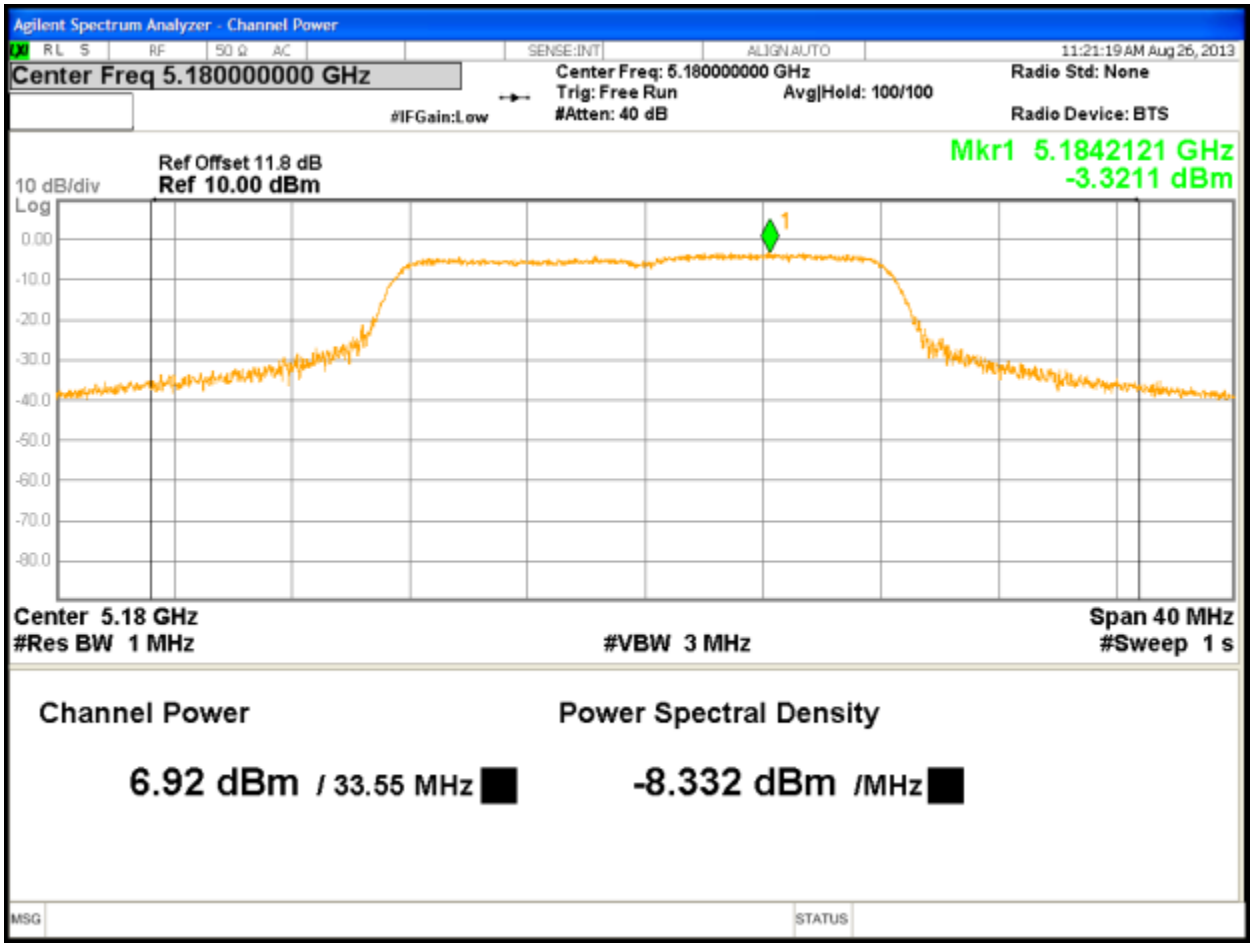


Figure 3: Maximum Transmitted Power, 5180 MHz at 802.11a, Chain 2

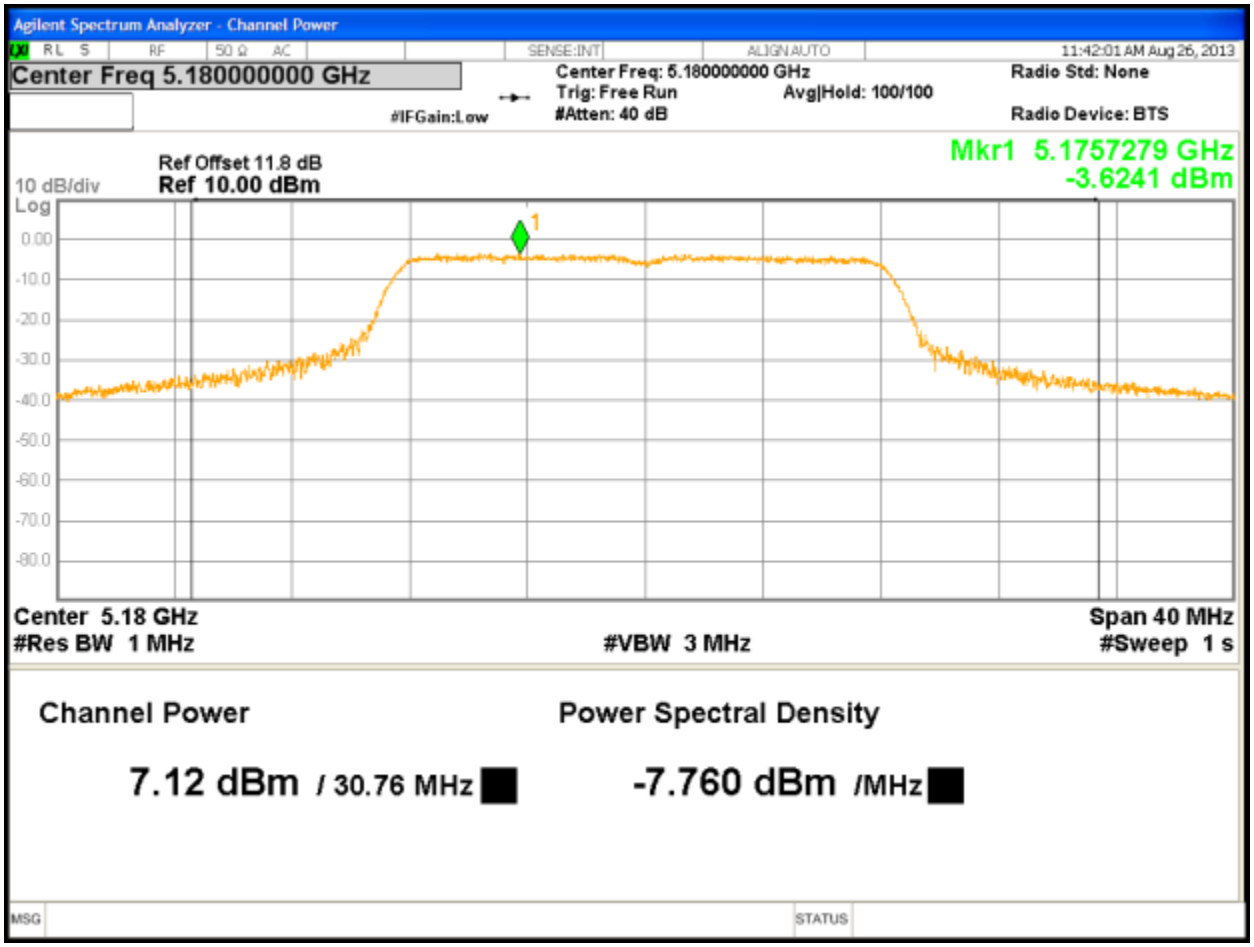


Figure 4: Maximum Transmitted Power, 5180 MHz at 802.11a, Chain 3

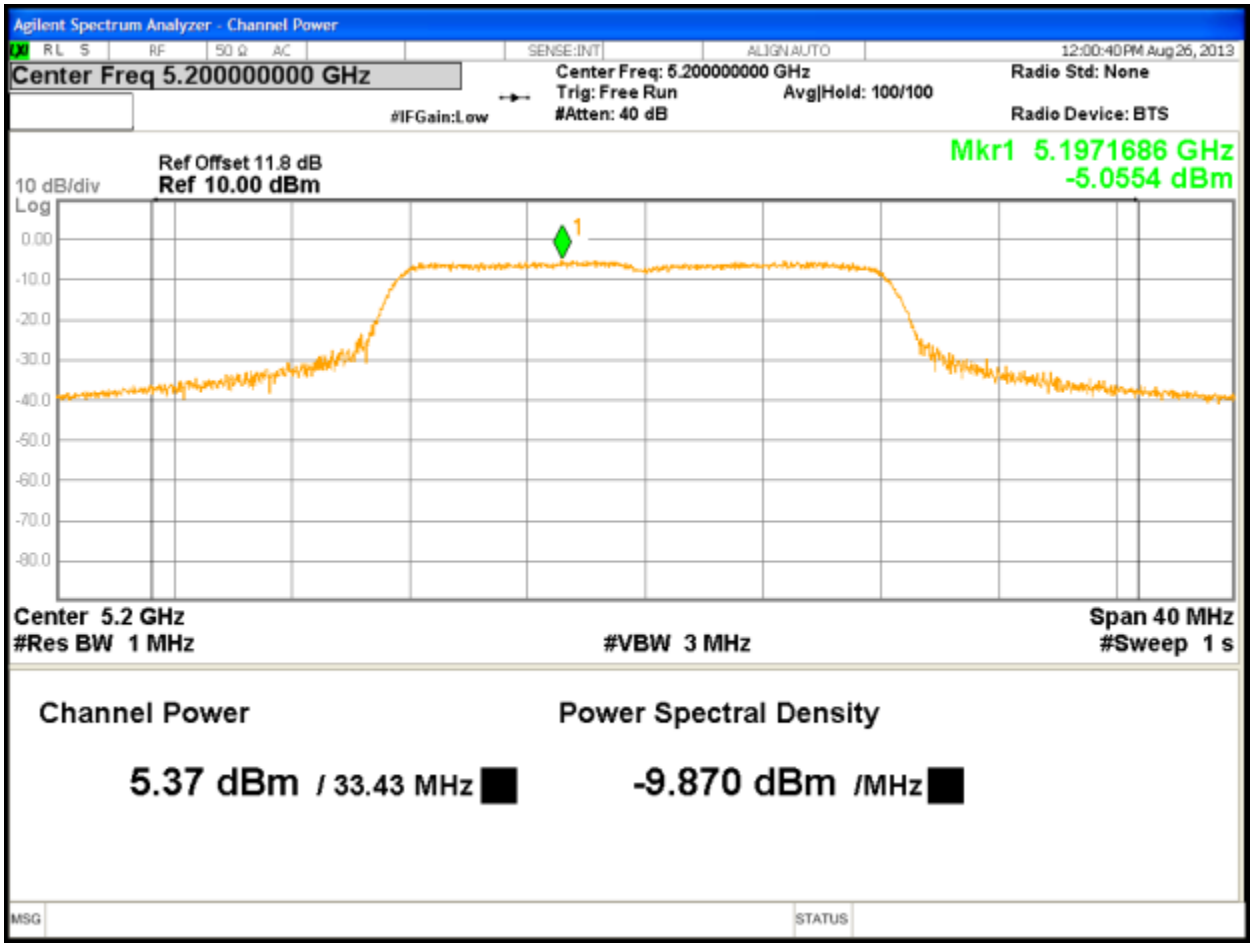


Figure 5: Maximum Transmitted Power, 5200 MHz at 802.11a, Chain 0

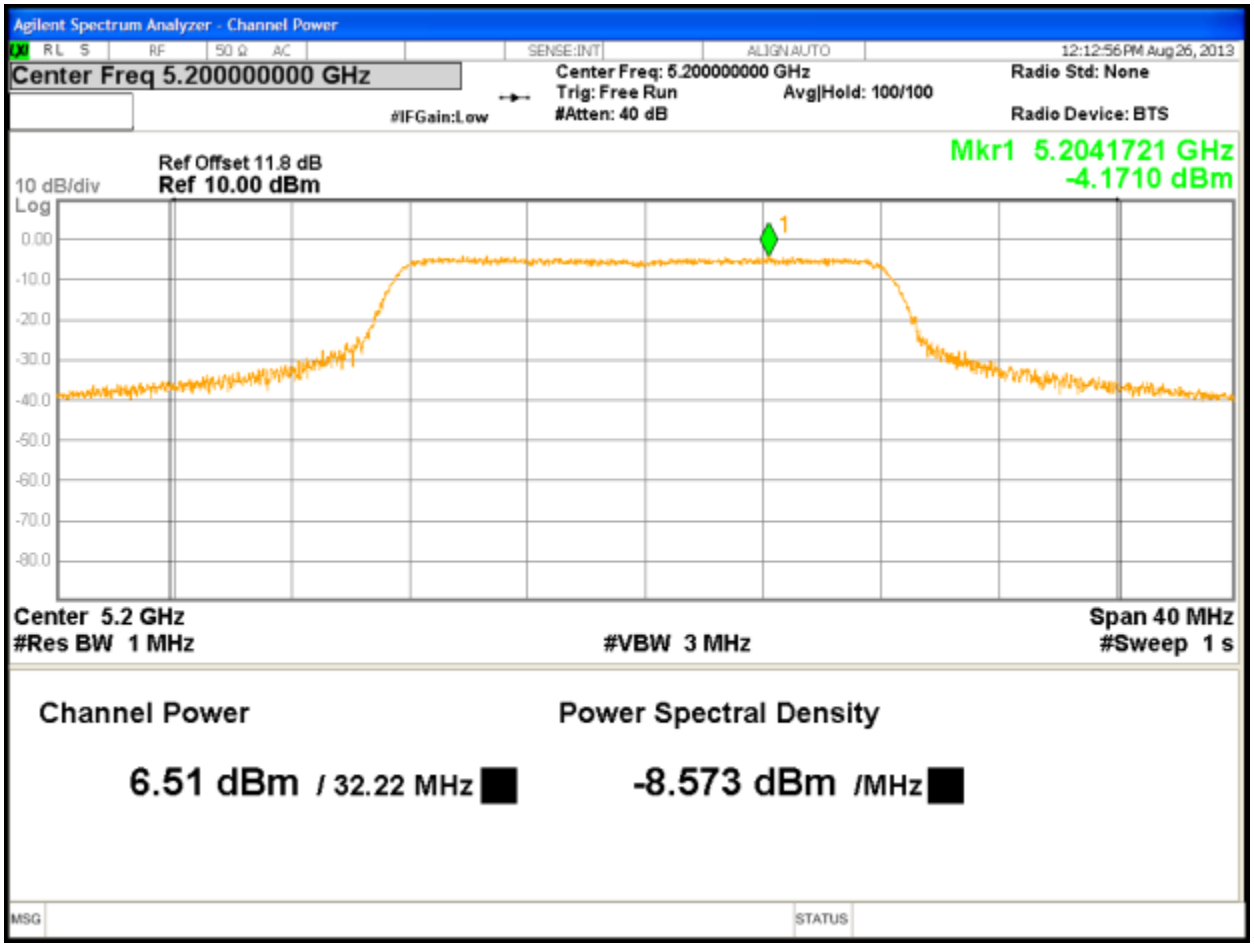


Figure 6: Maximum Transmitted Power, 5200 MHz at 802.11a, Chain 1

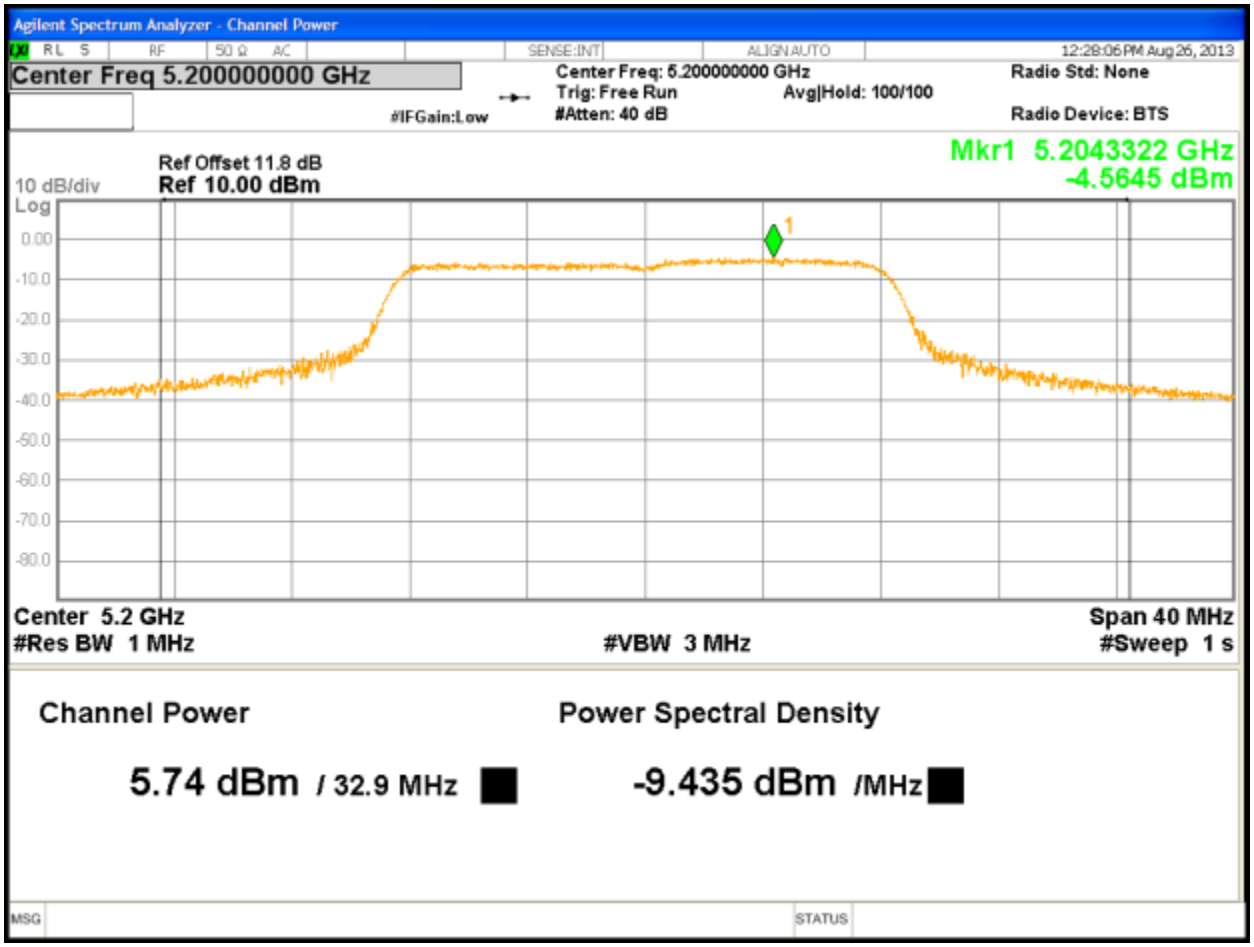


Figure 7: Maximum Transmitted Power, 5200 MHz at 802.11a, Chain 2

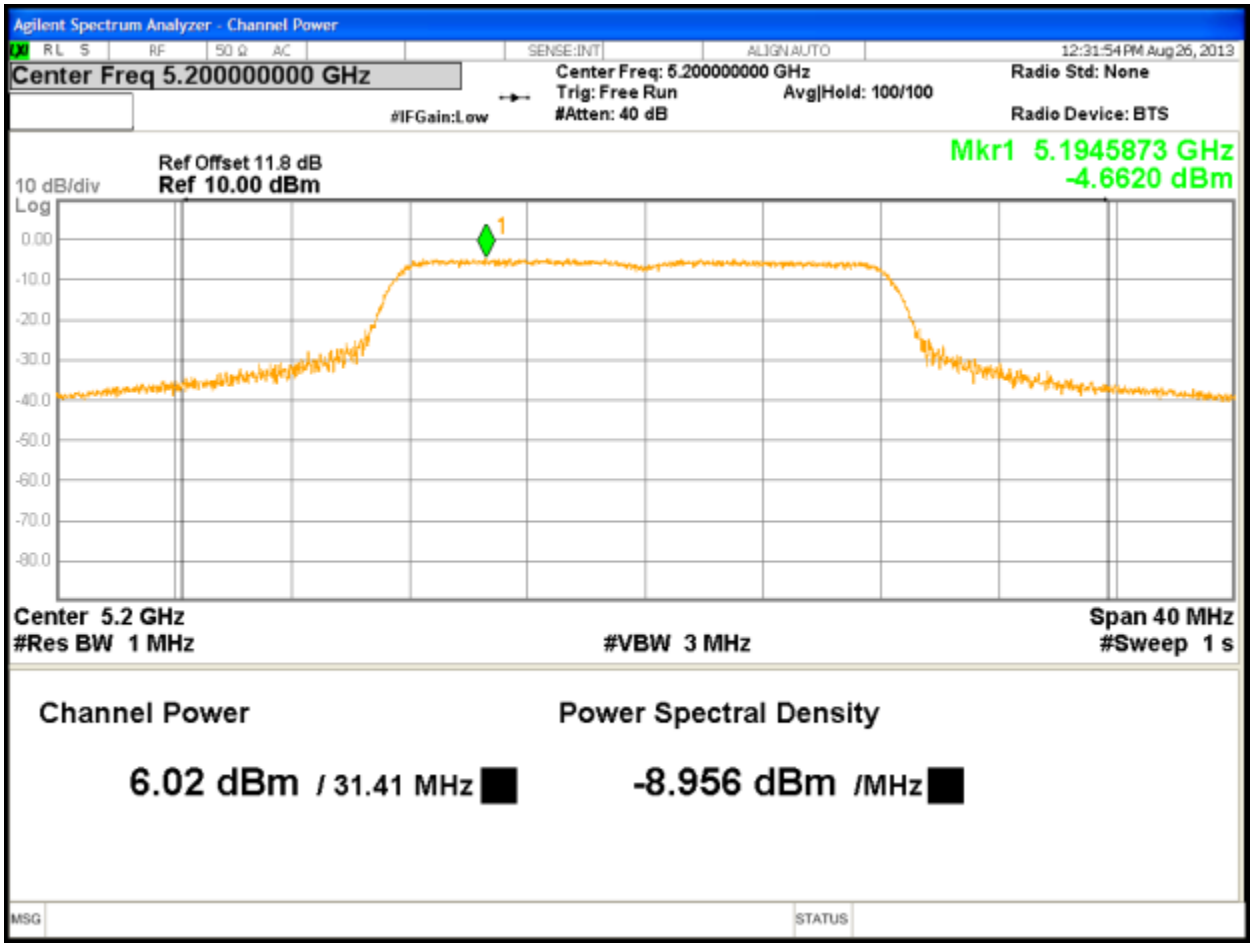


Figure 8: Maximum Transmitted Power, 5200 MHz at 802.11a, Chain 3

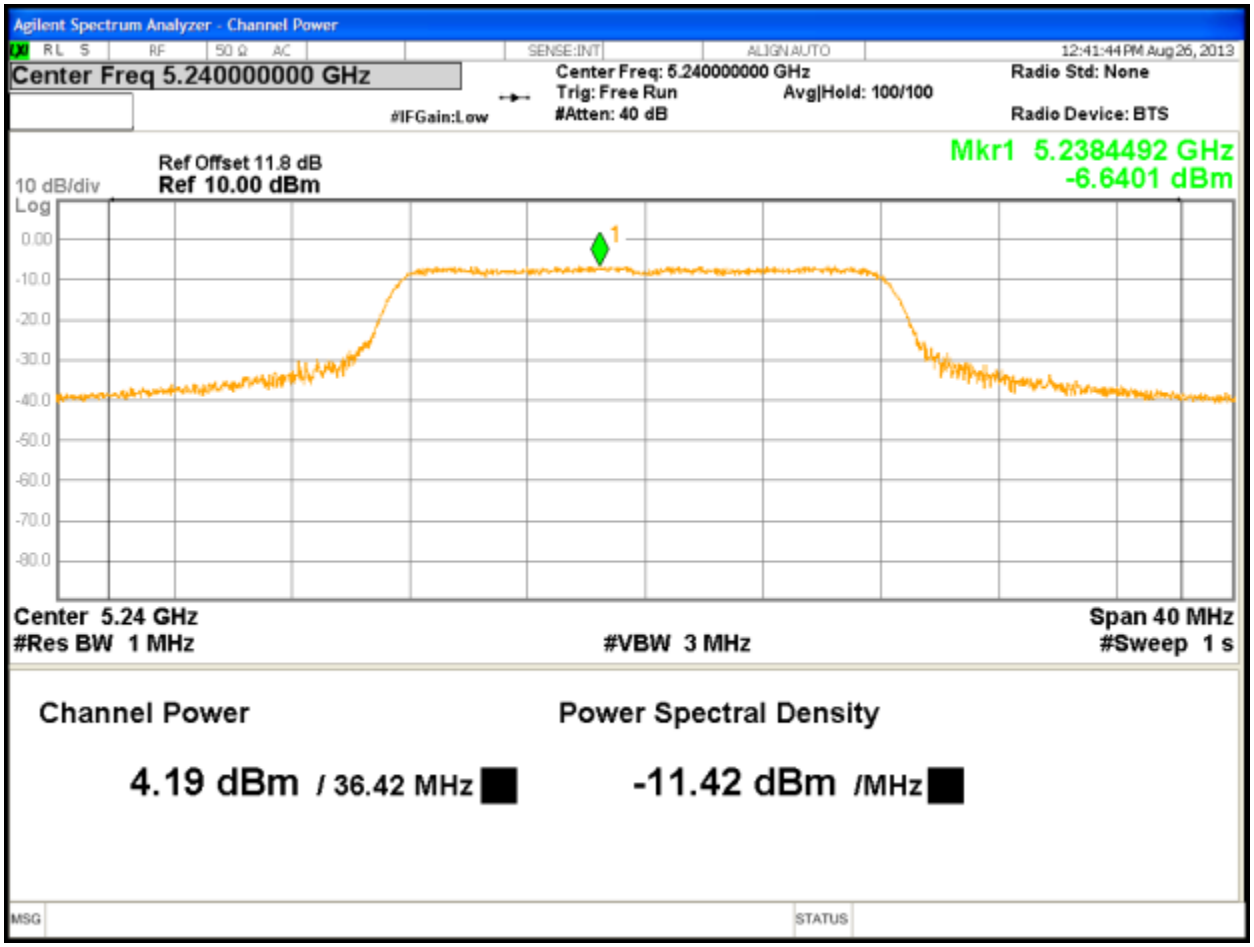


Figure 9: Maximum Transmitted Power, 5240 MHz at 802.11a, Chain 0

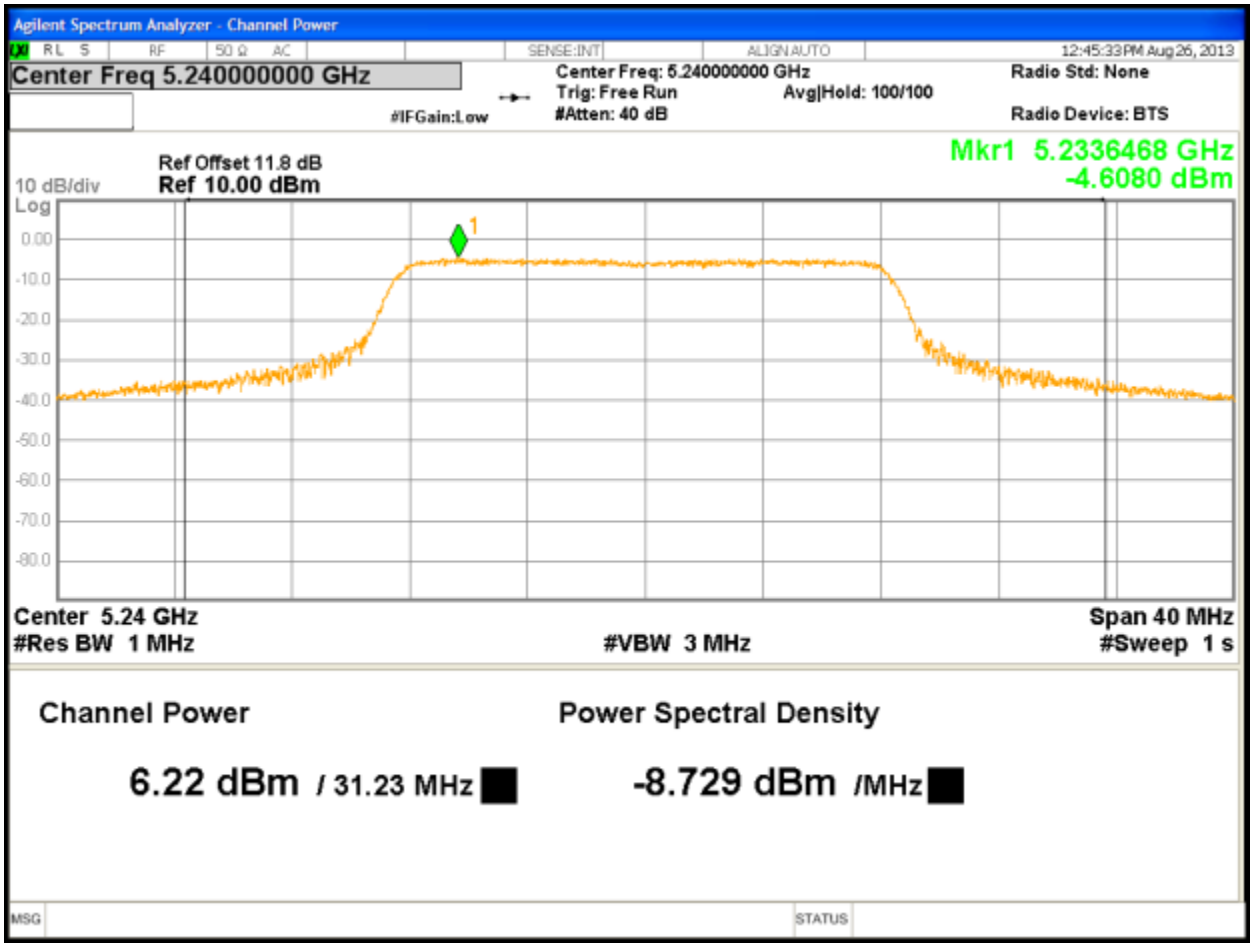


Figure 10: Maximum Transmitted Power, 5240 MHz at 802.11a, Chain 1

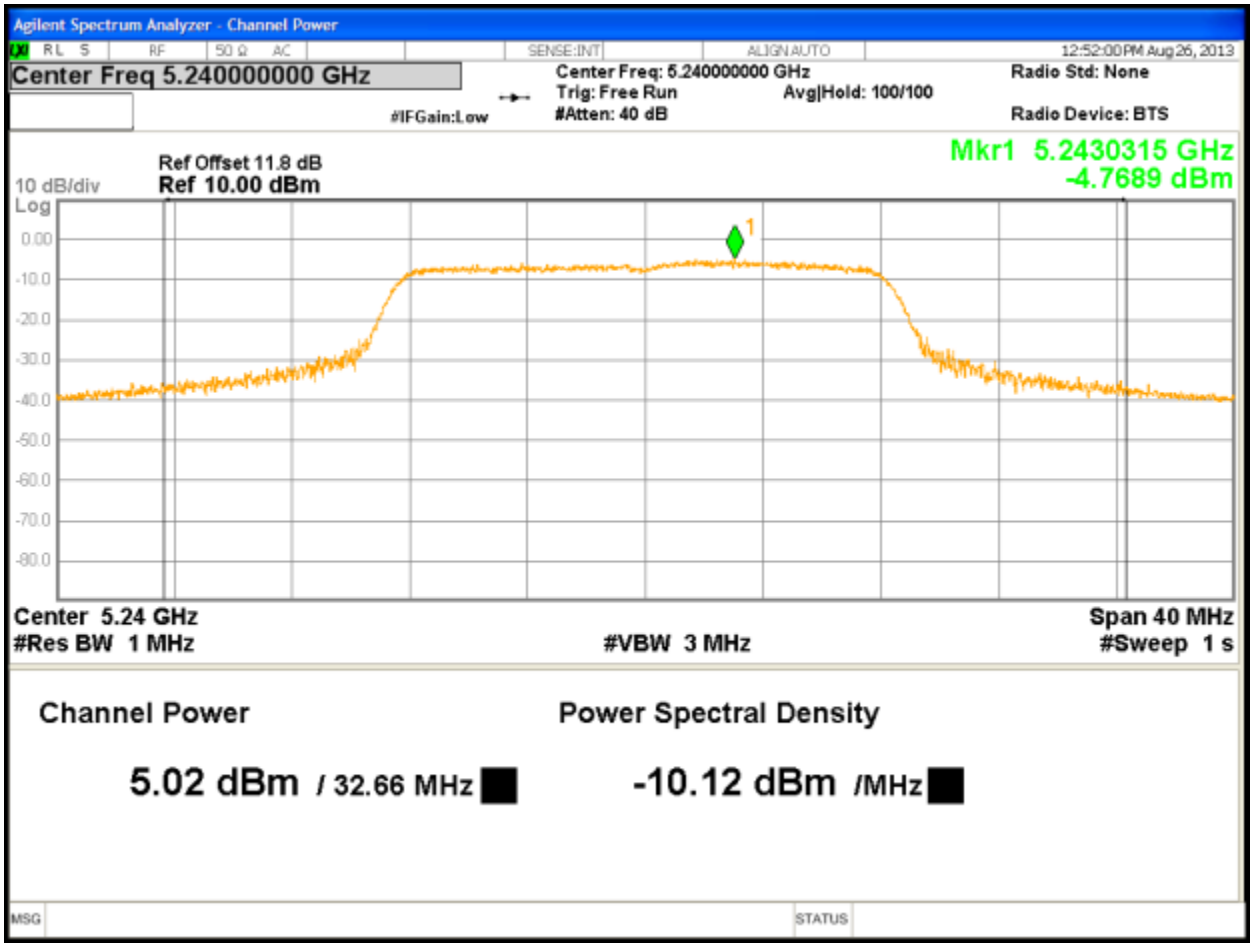


Figure 11: Maximum Transmitted Power, 5240 MHz at 802.11a, Chain 2

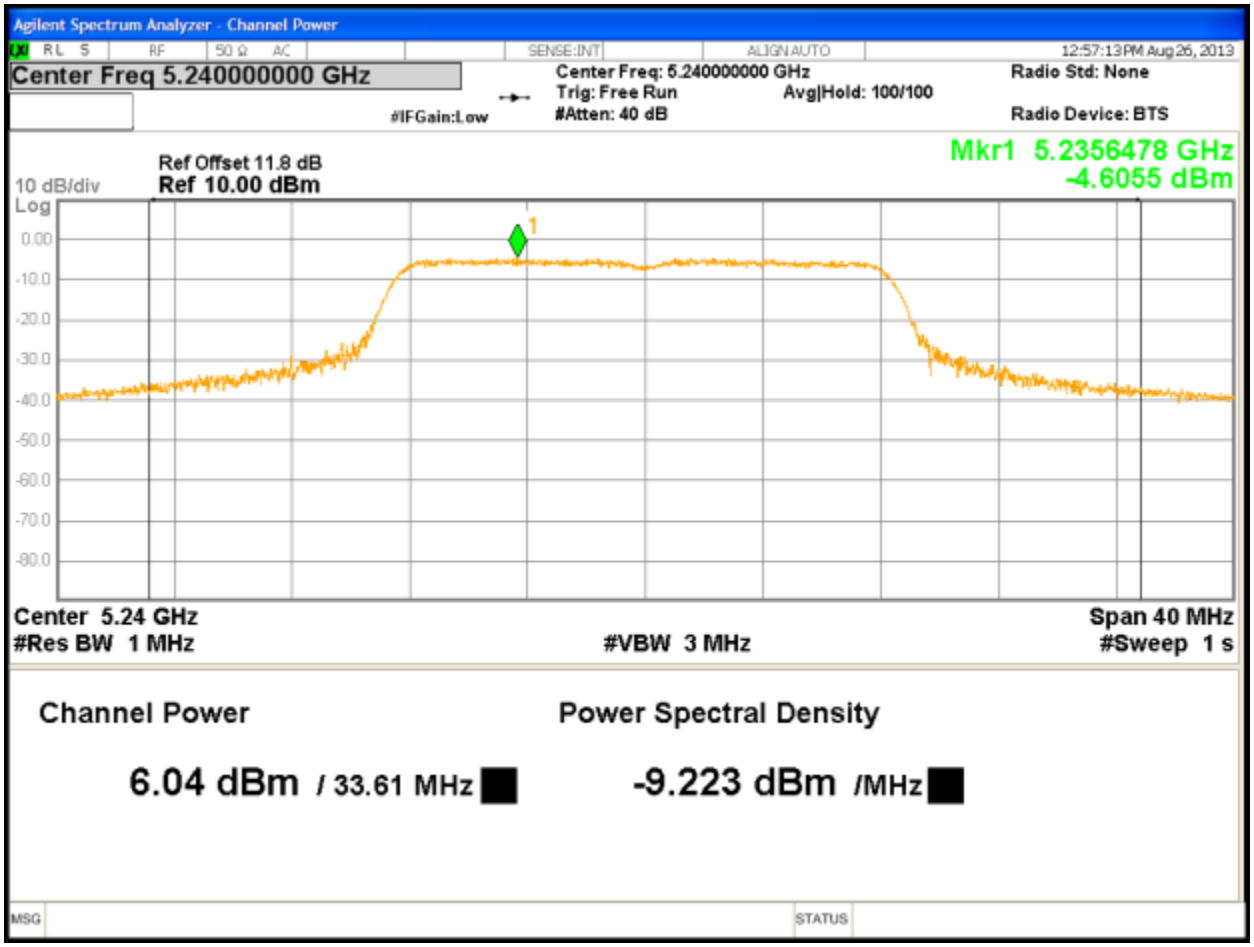


Figure 12: Maximum Transmitted Power, 5240 MHz at 802.11a, Chain 3

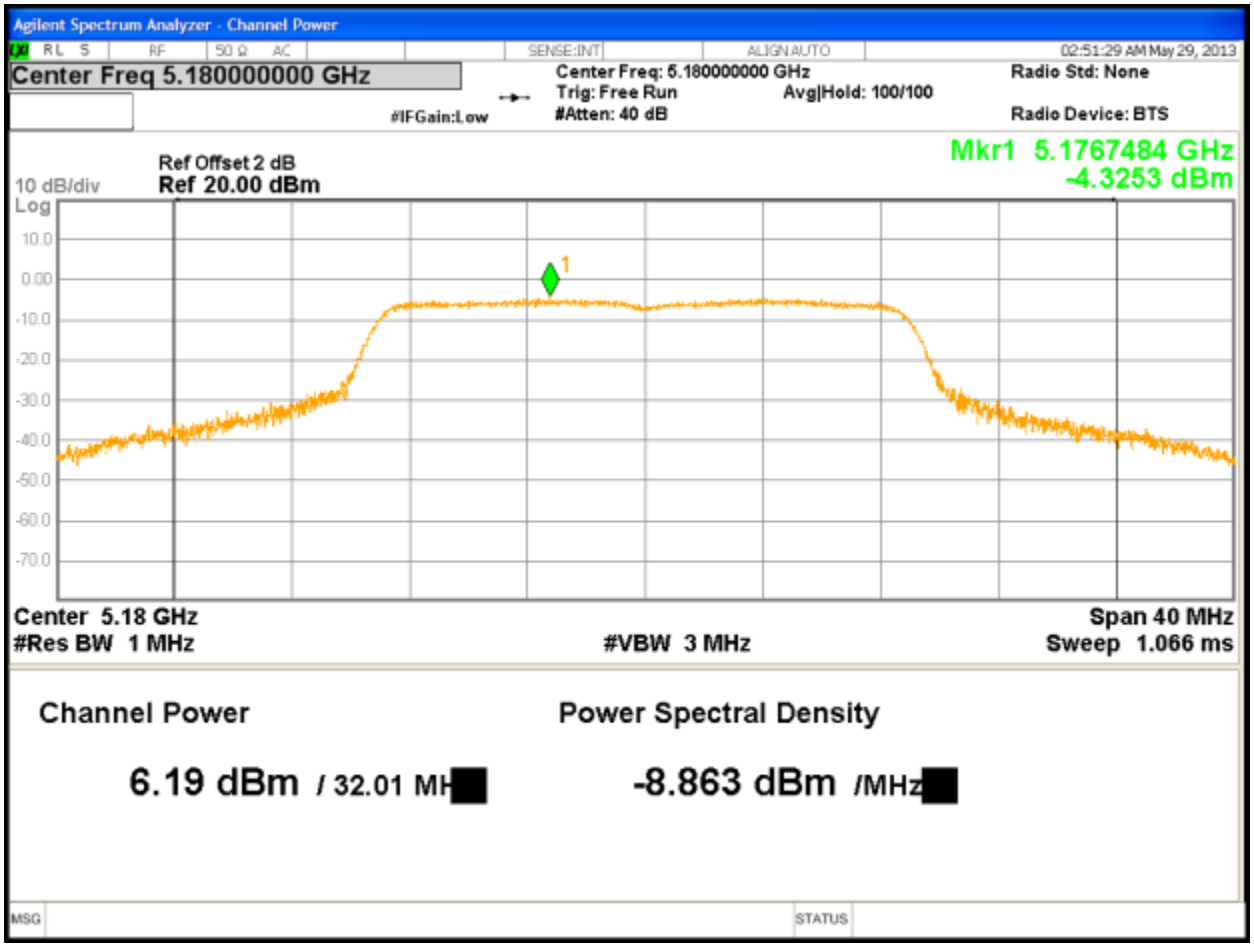


Figure 13: Maximum Transmitted Power, 5180 MHz at HT20, Chain 0

Figure 14: Maximum Transmitted Power, 5180 MHz at HT20, Chain 1

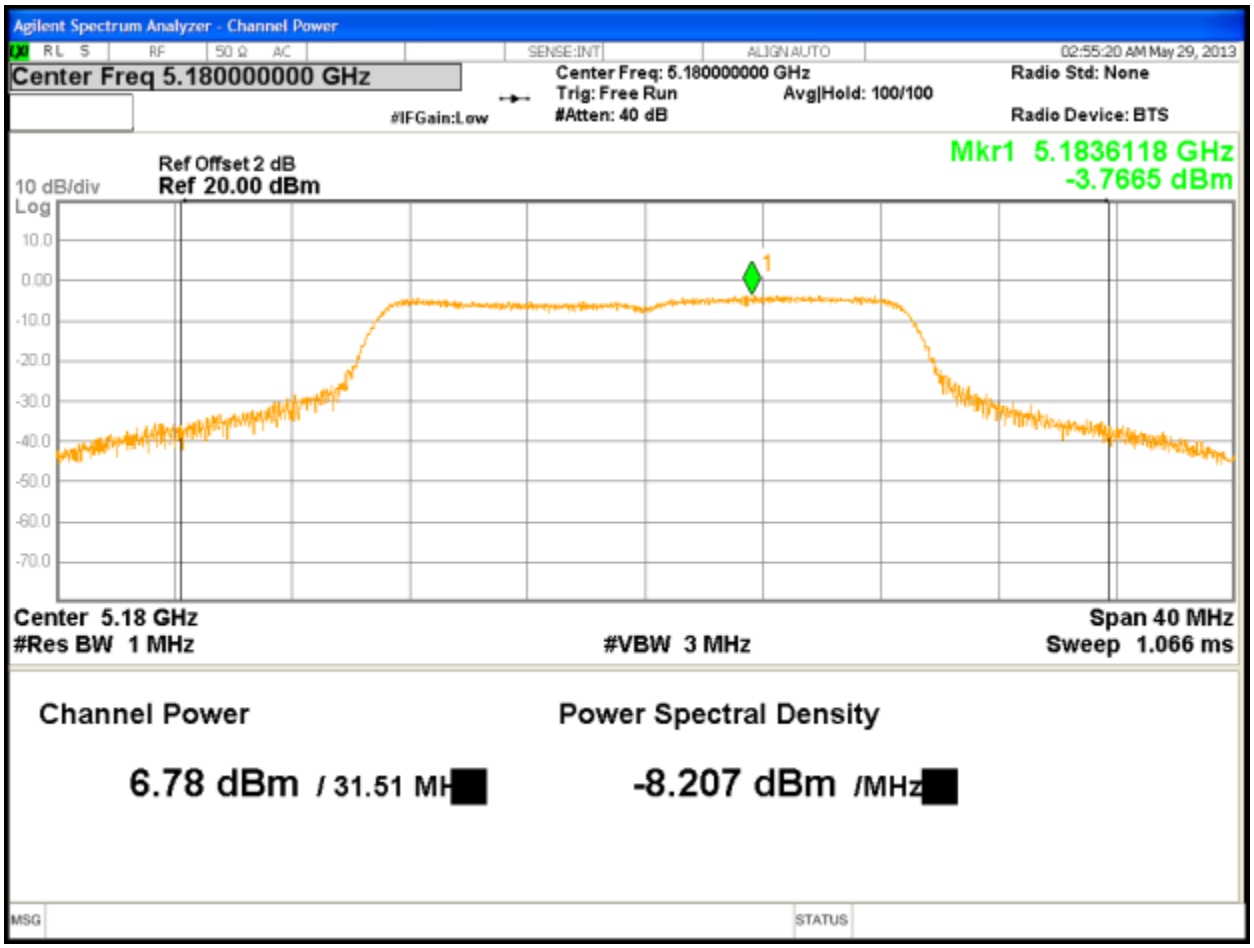


Figure 15: Maximum Transmitted Power, 5180 MHz at HT20, Chain 2

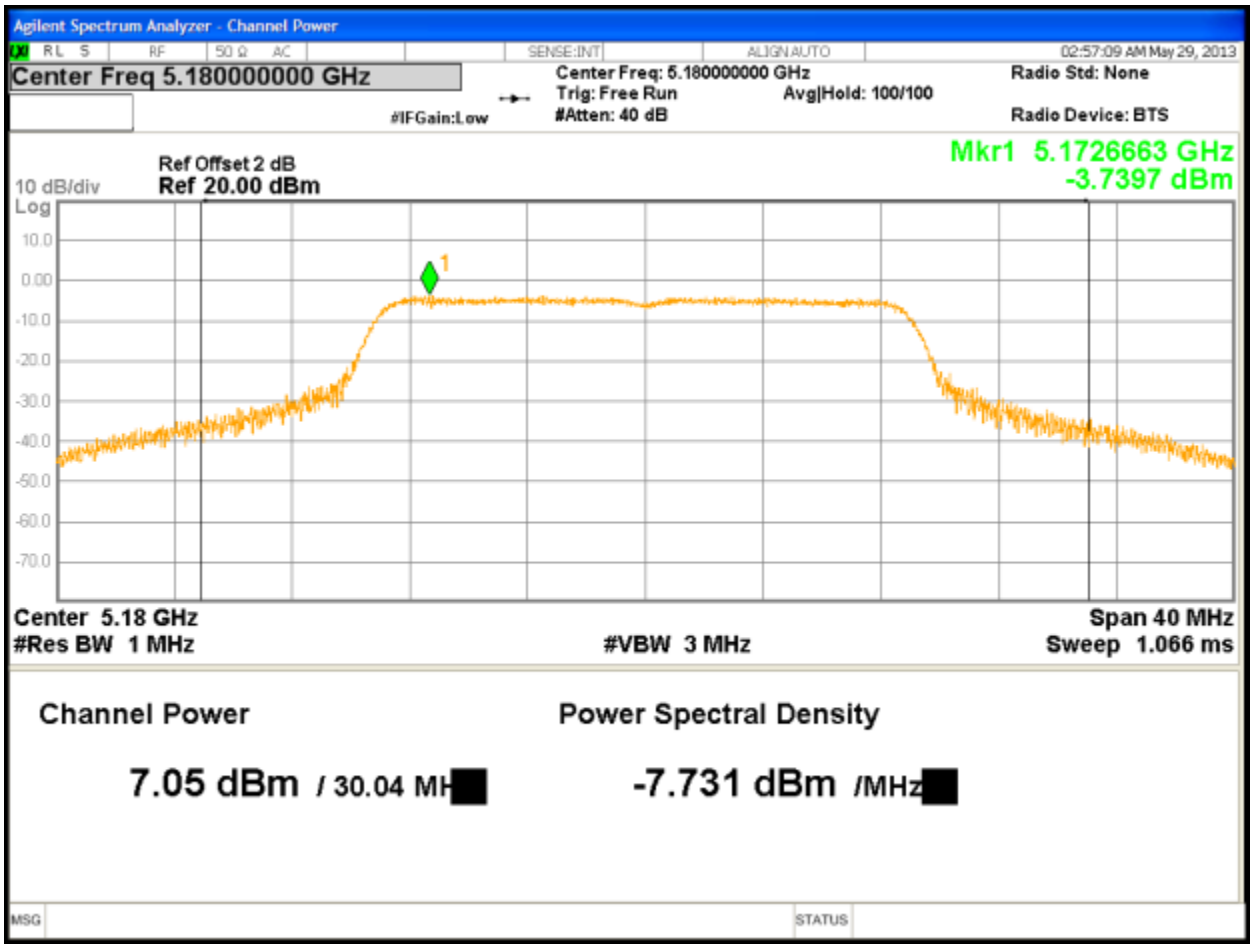


Figure 16: Maximum Transmitted Power, 5180 MHz at HT20, Chain 3

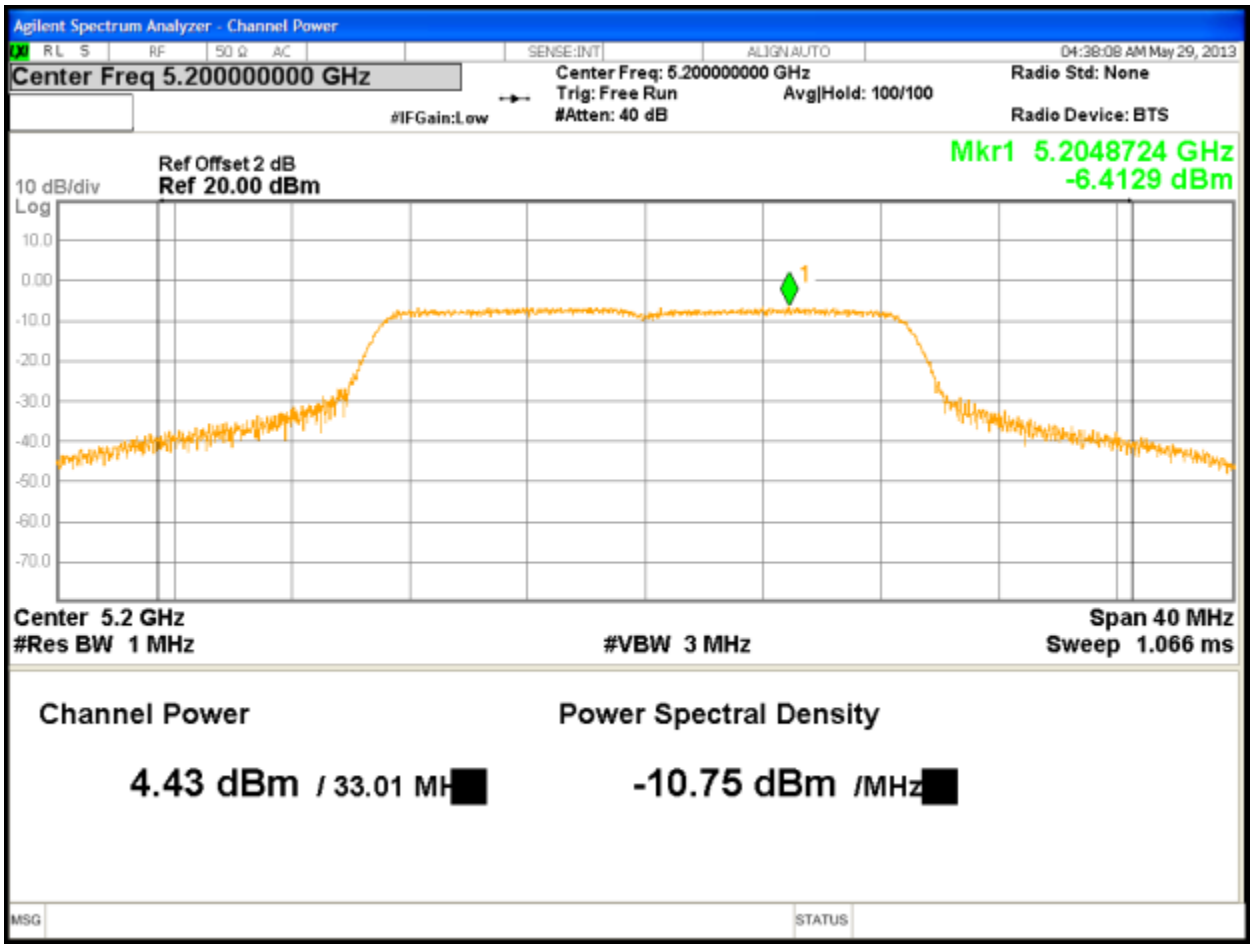


Figure 17: Maximum Transmitted Power, 5200 MHz at HT20, Chain 0

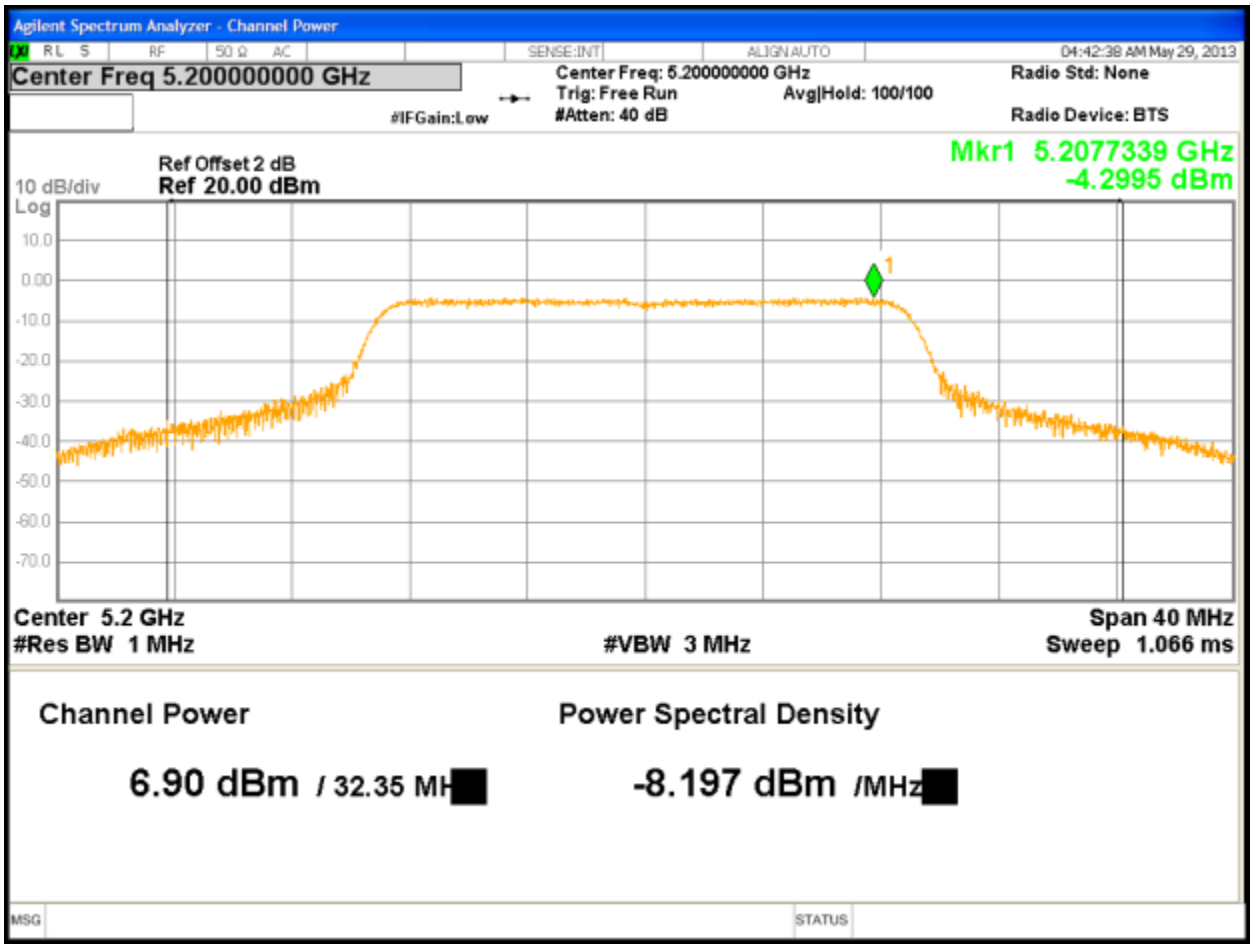


Figure 18: Maximum Transmitted Power, 5200 MHz at HT20, Chain 1

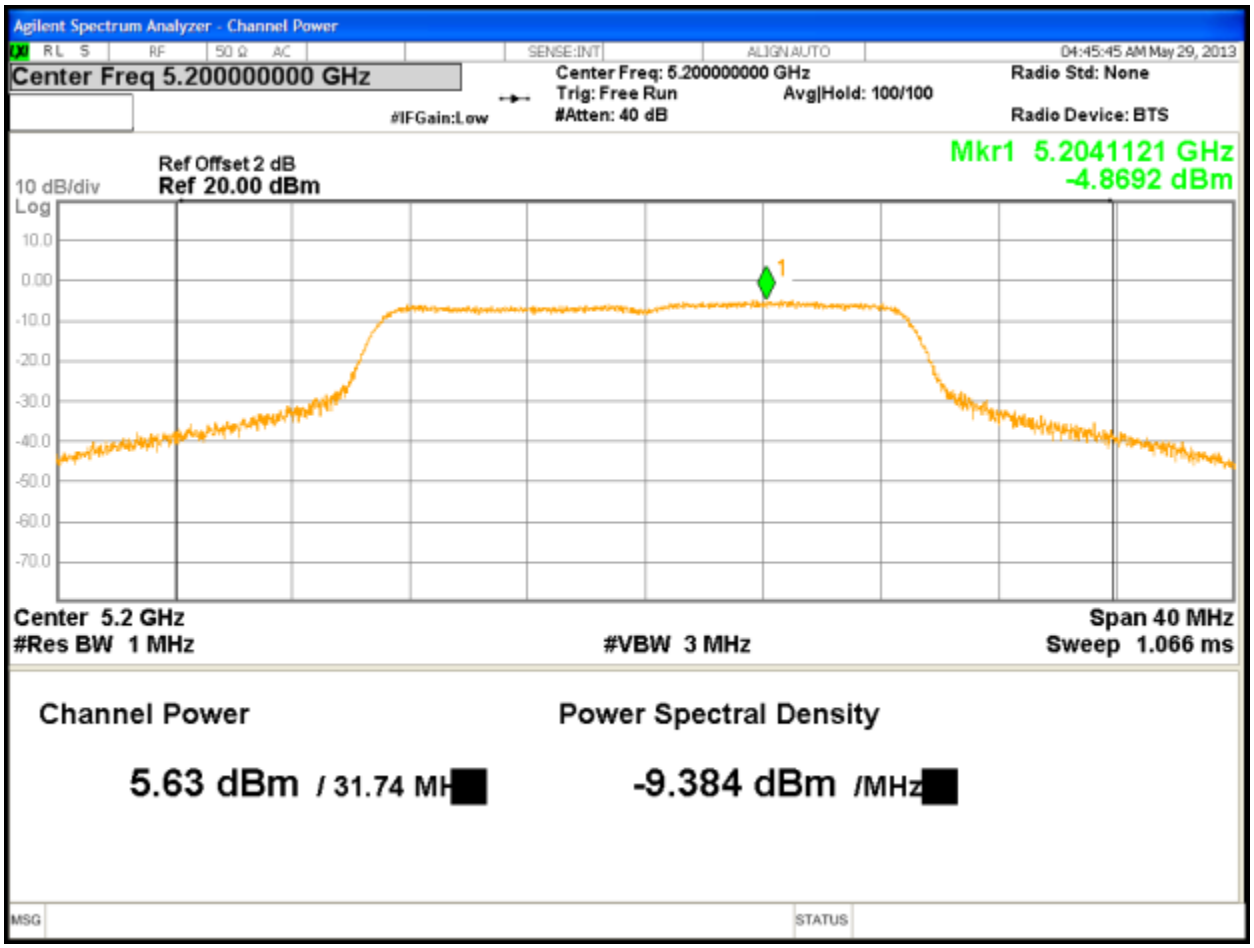


Figure 19: Maximum Transmitted Power, 5200 MHz at HT20, Chain 2

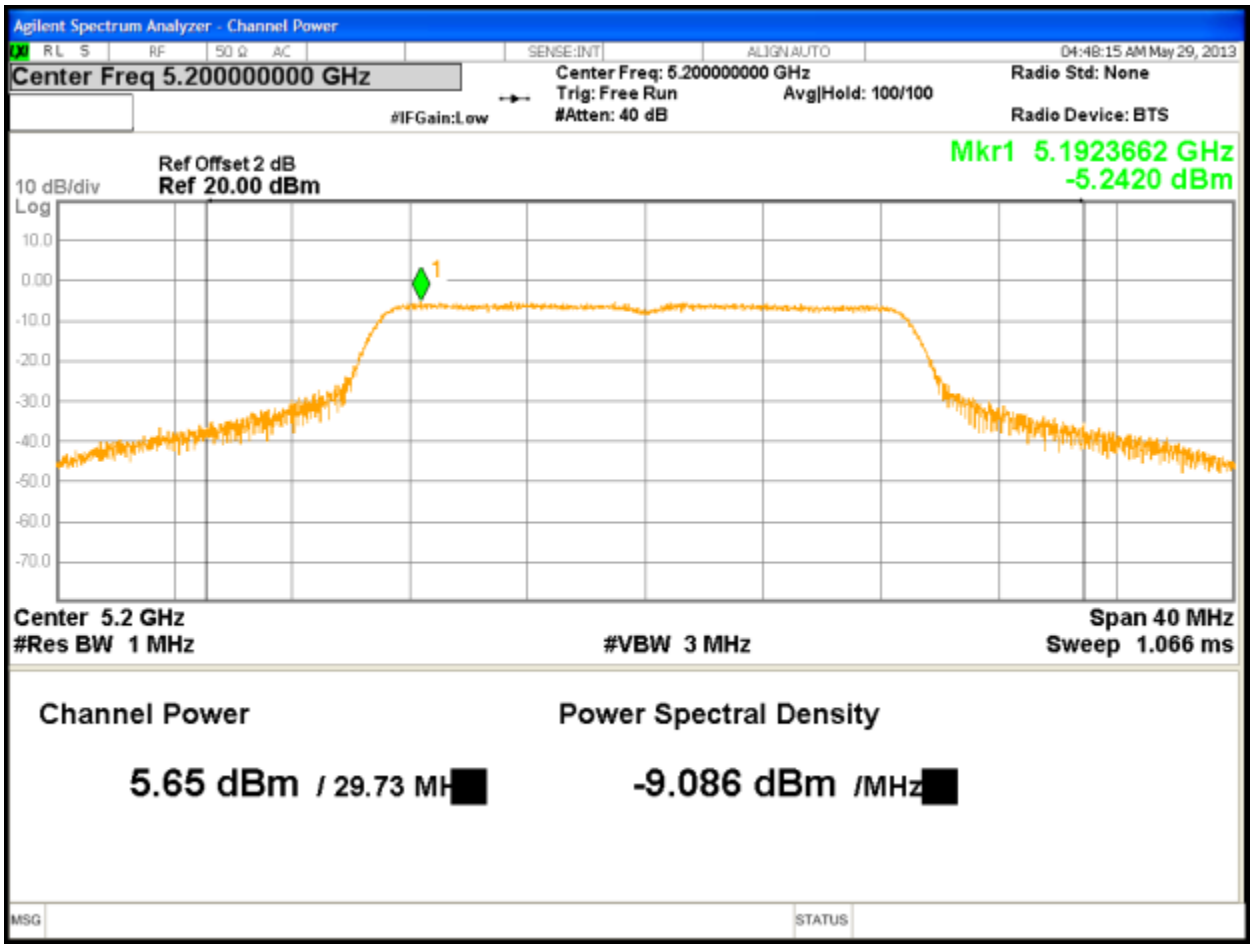


Figure 20: Maximum Transmitted Power, 5200 MHz at HT20, Chain 3

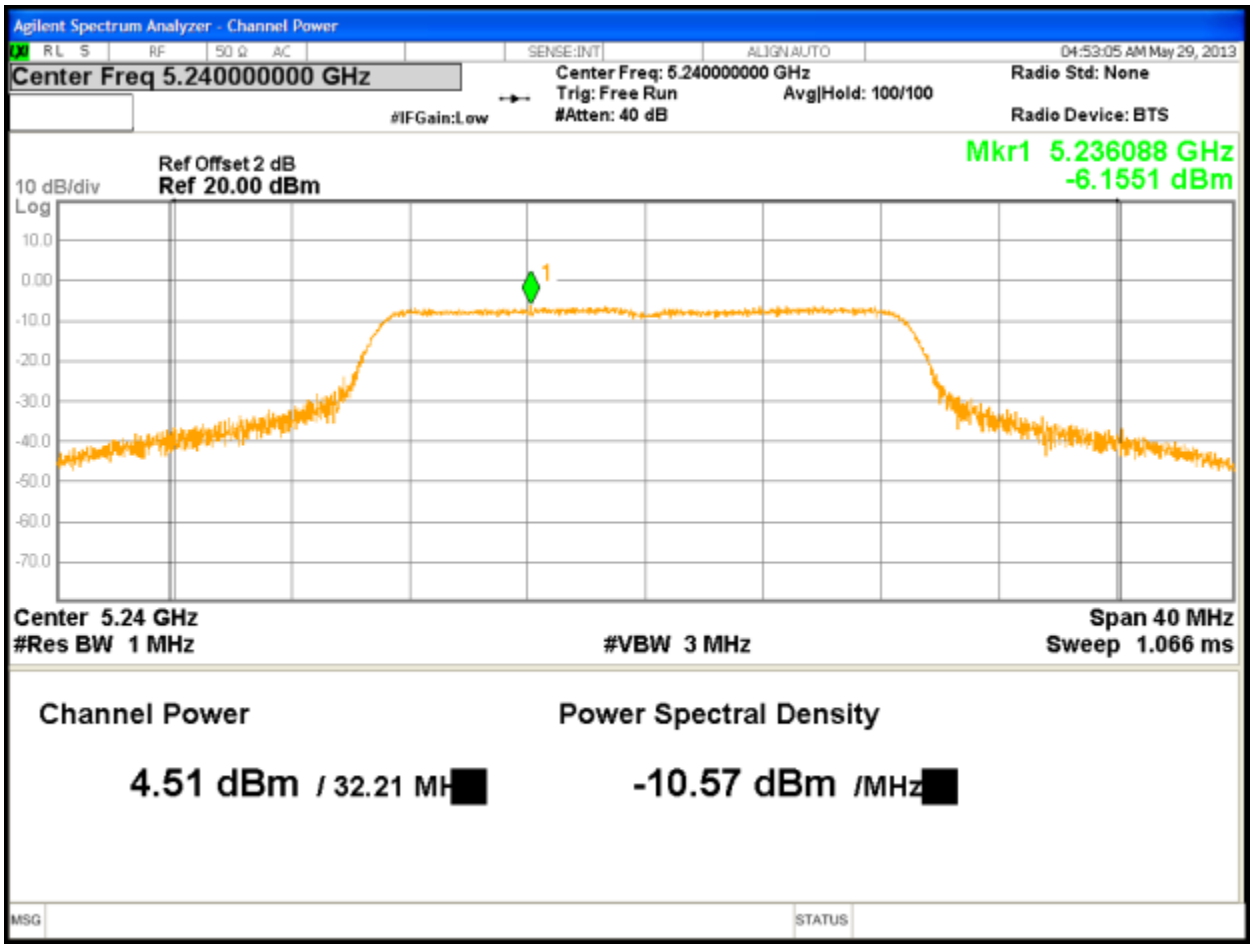


Figure 21: Maximum Transmitted Power, 5240 MHz at HT20, Chain 0

Figure 22: Maximum Transmitted Power, 5240 MHz at HT20, Chain 1

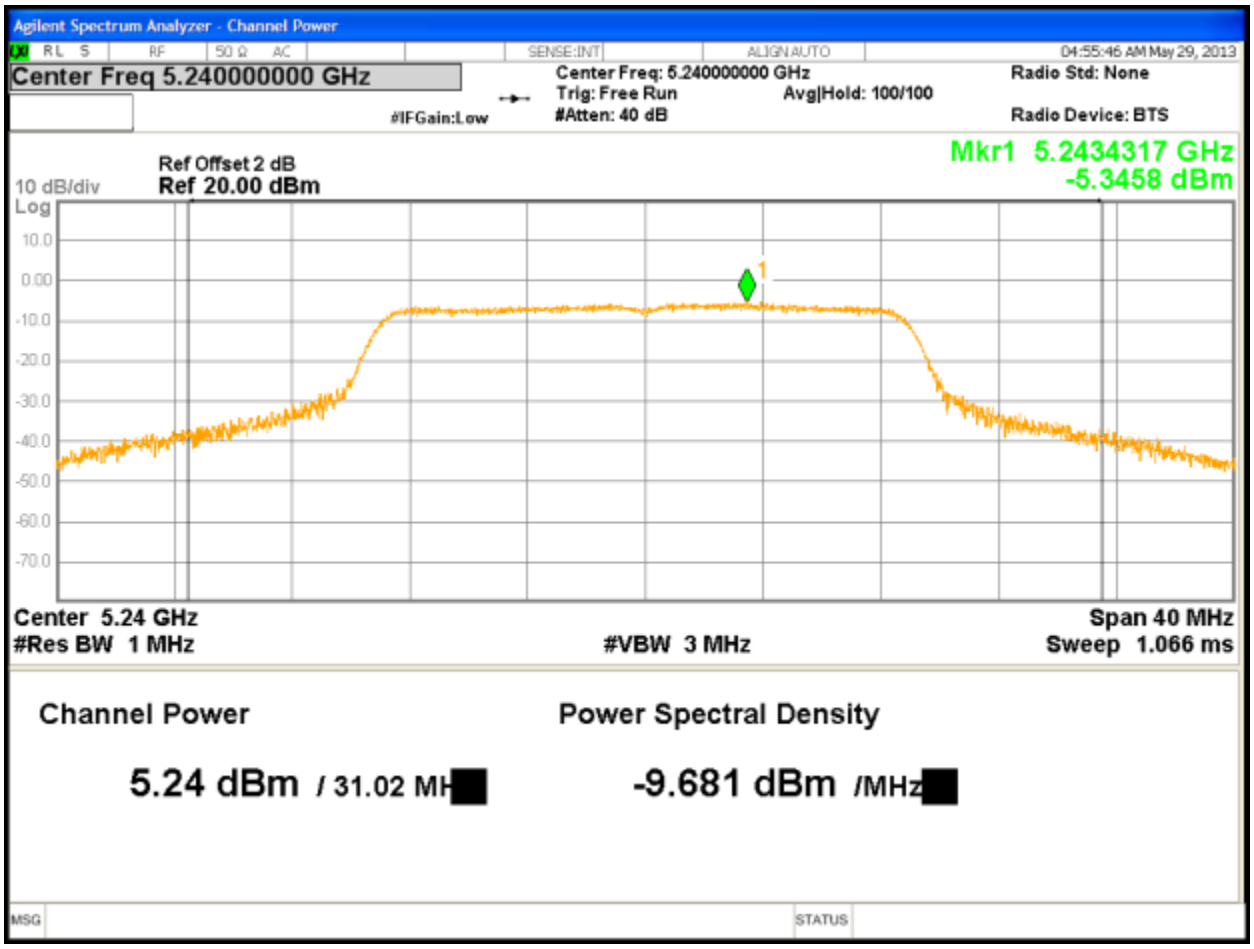


Figure 23: Maximum Transmitted Power, 5240 MHz at HT20, Chain 2

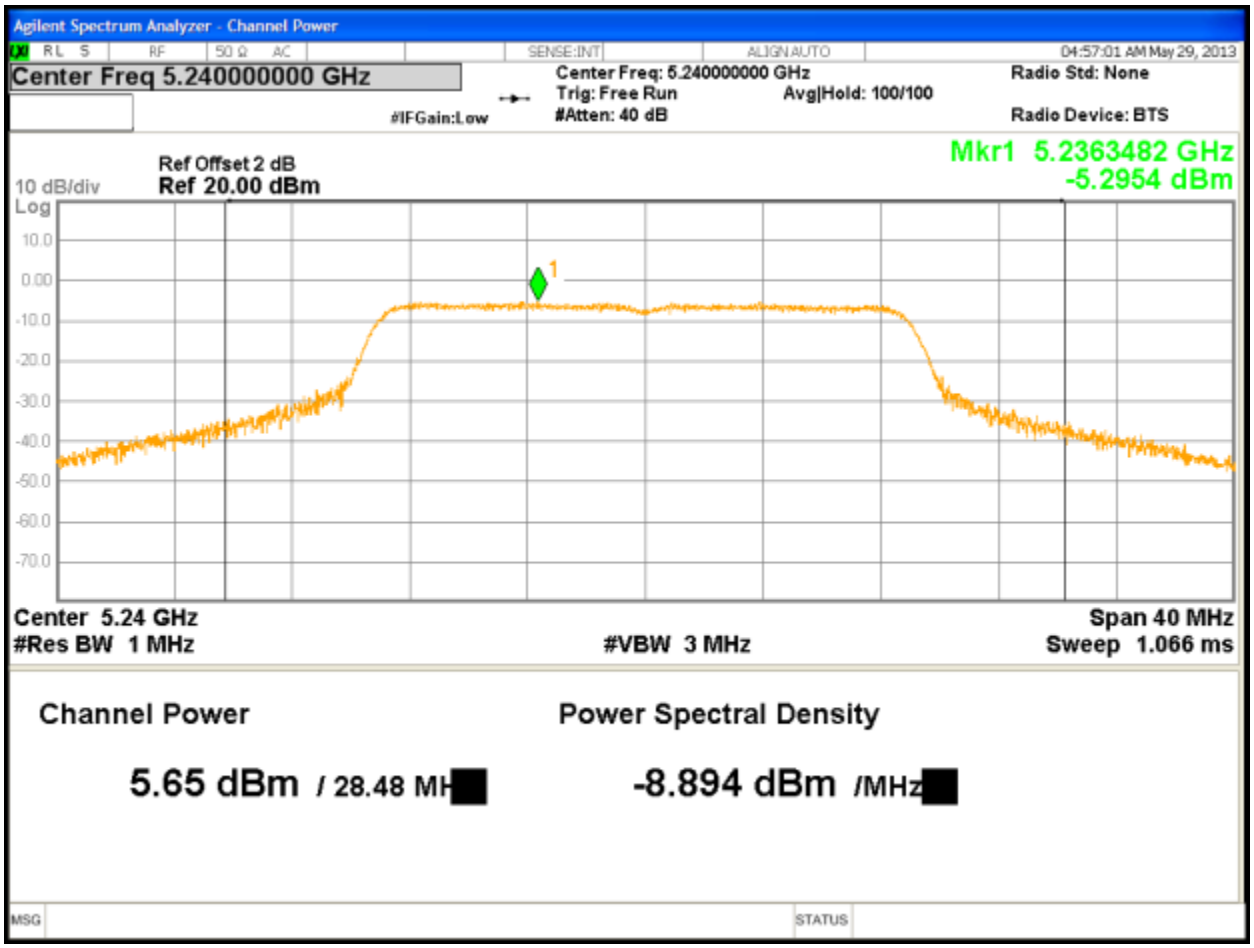


Figure 24: Maximum Transmitted Power, 5240 MHz at HT20, Chain 3

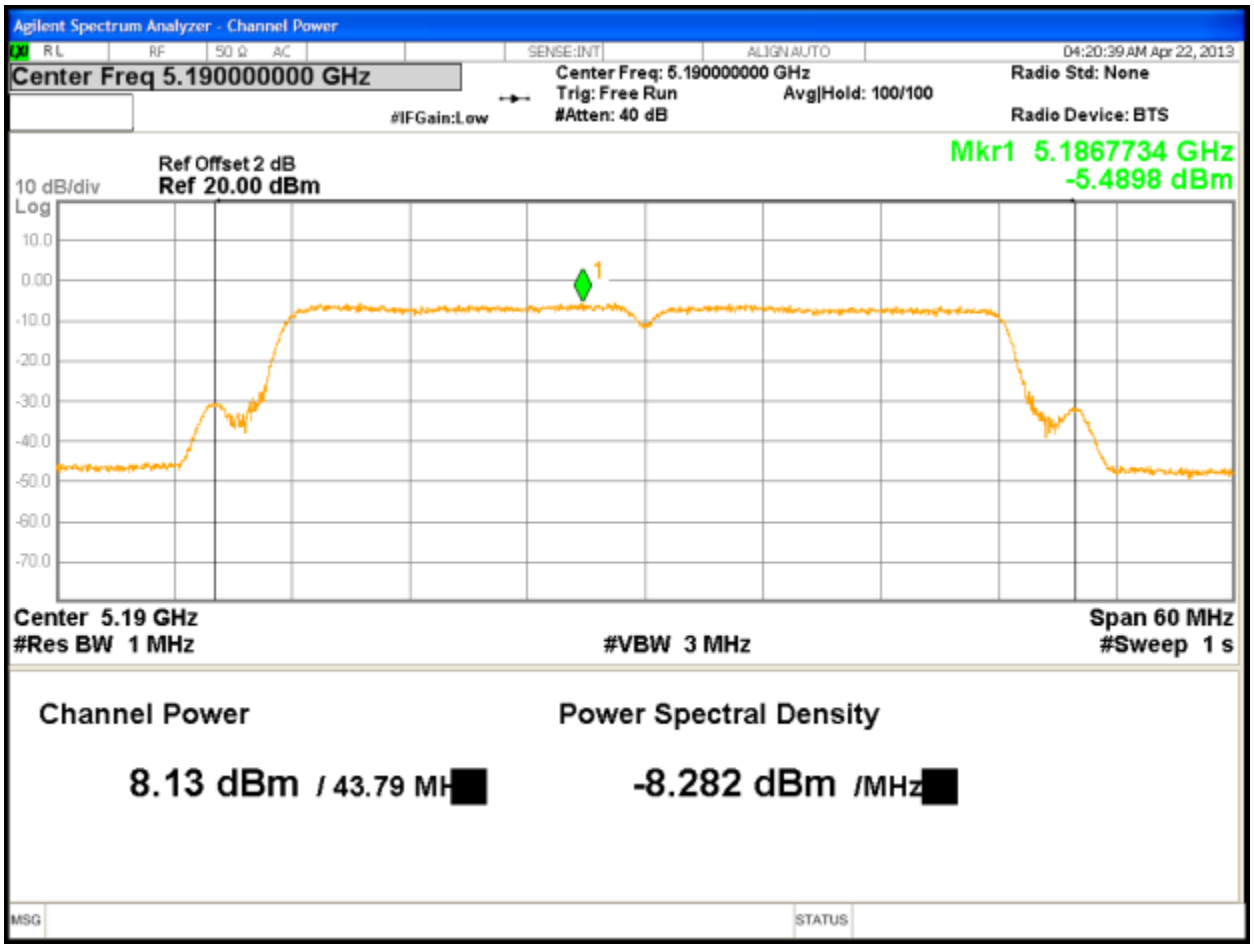


Figure 25: Maximum Transmitted Power, 5190 MHz at HT40, Chain 0

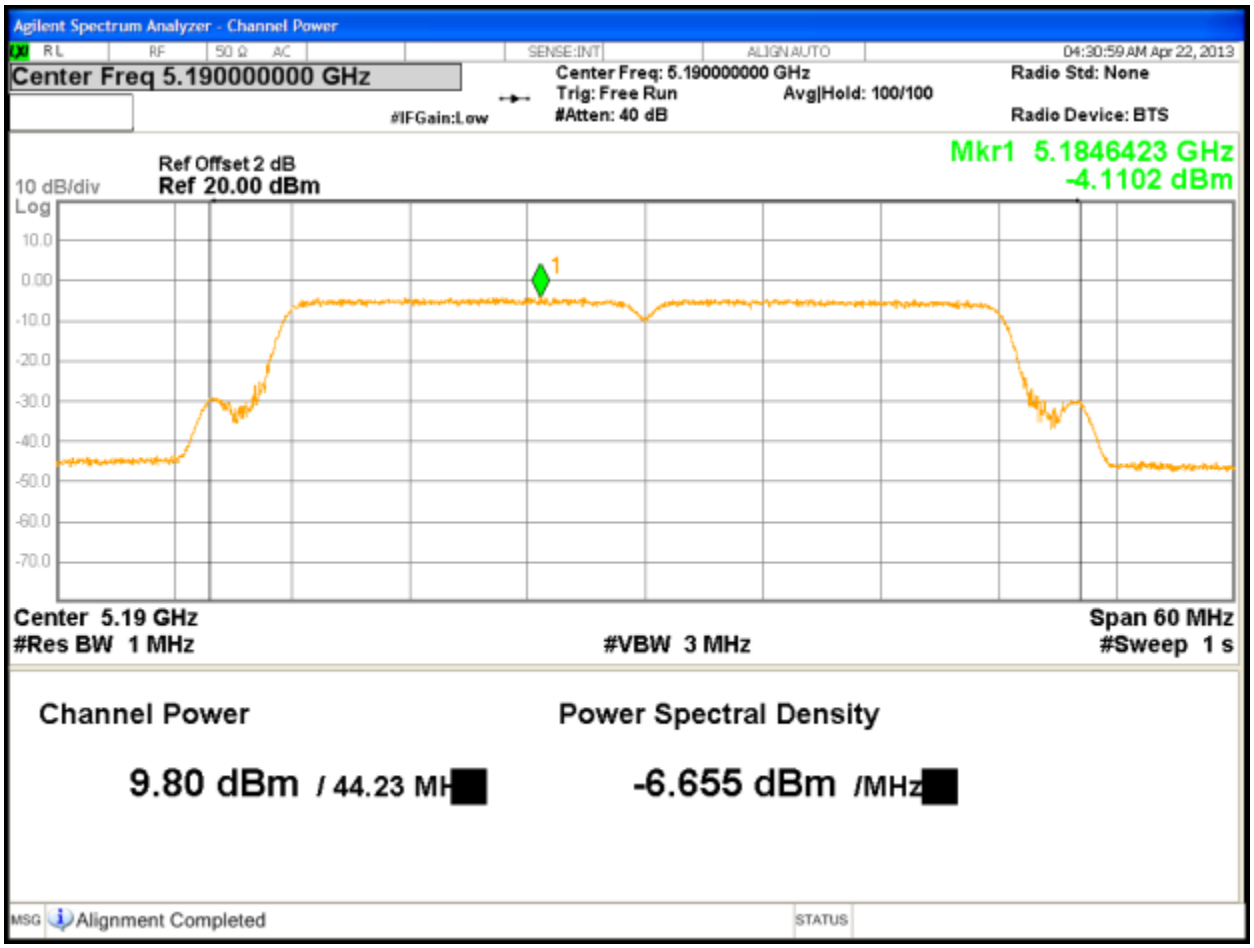


Figure 26: Maximum Transmitted Power, 5190 MHz at HT40, Chain 1

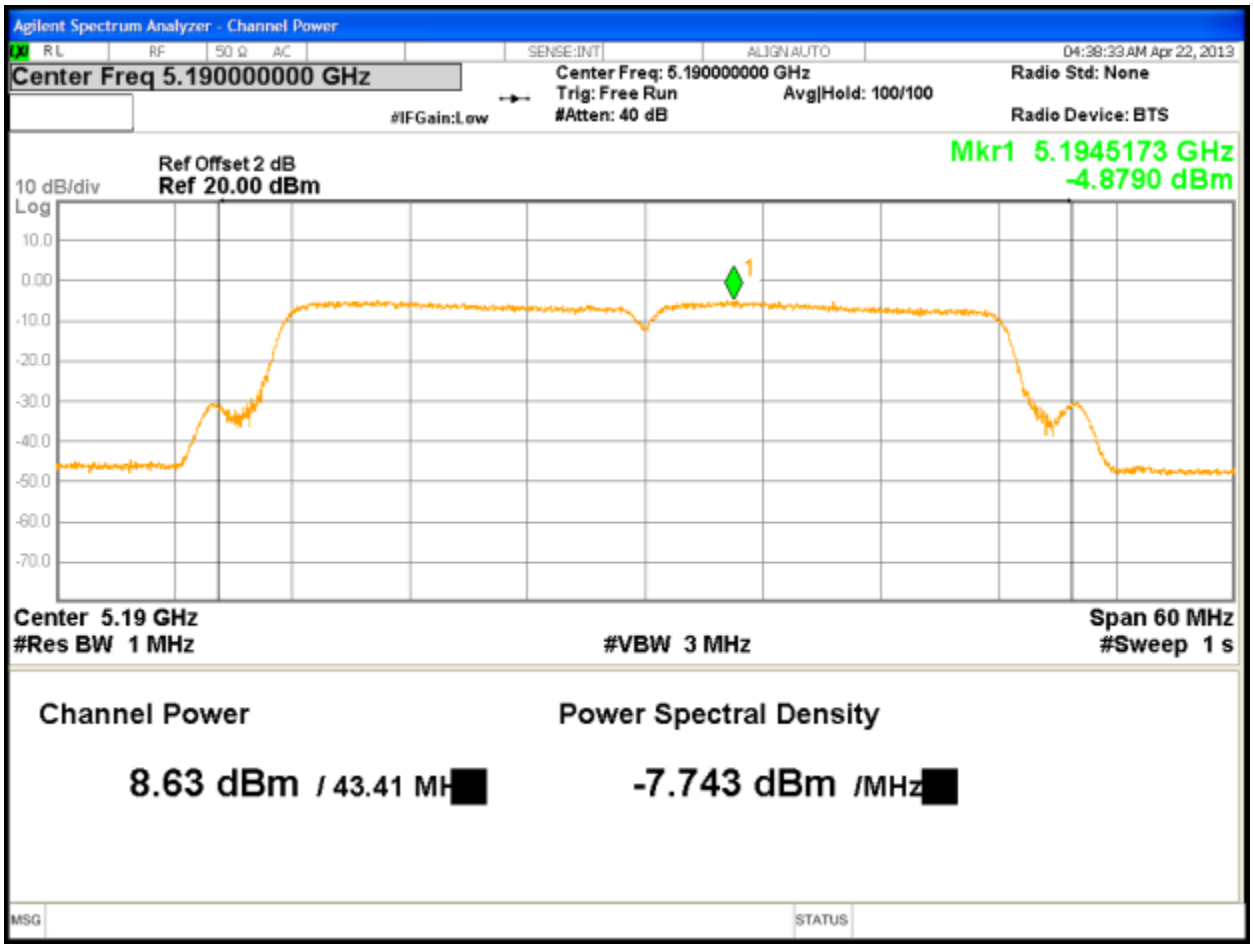


Figure 27: Maximum Transmitted Power, 5190 MHz at HT40, Chain 2

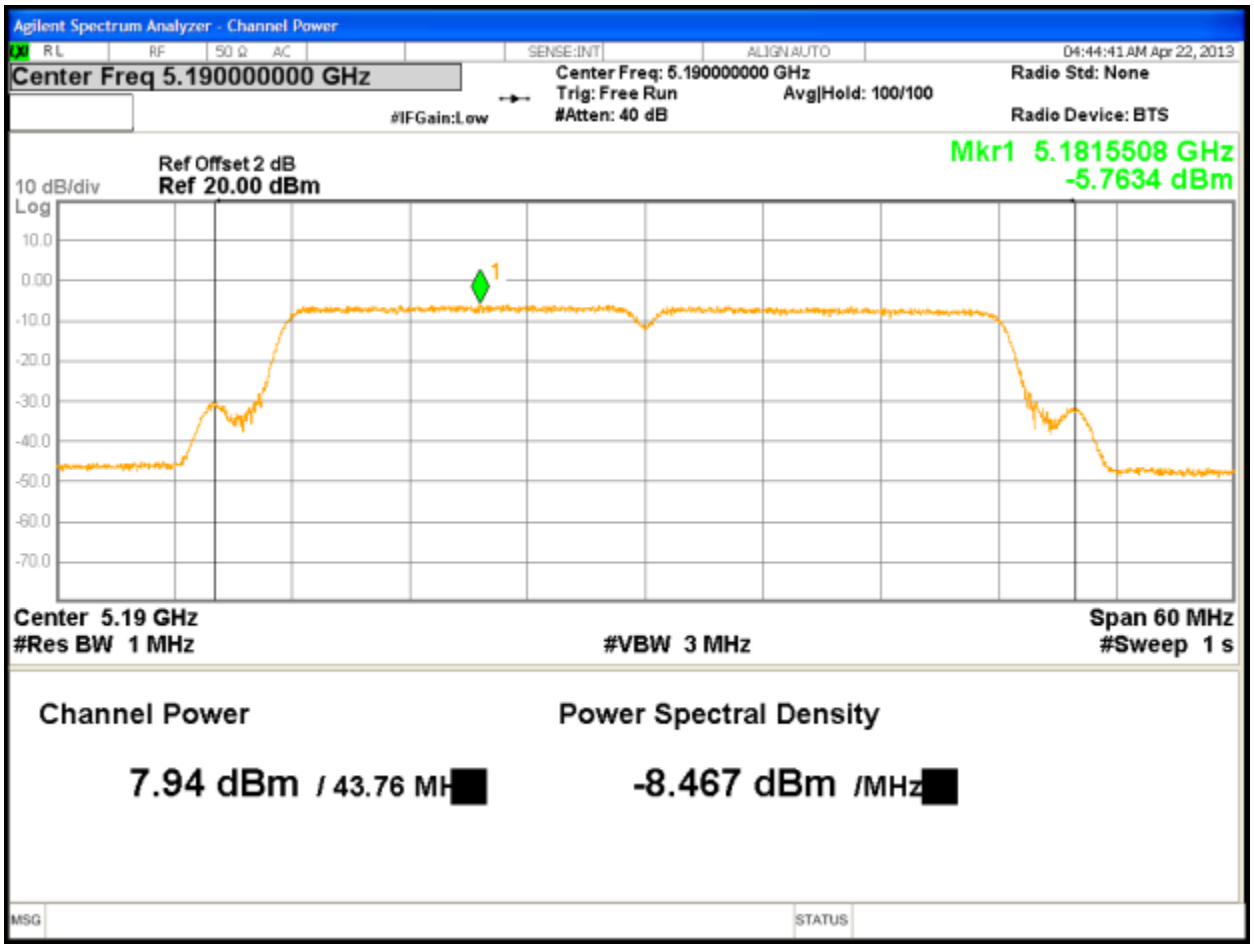


Figure 28: Maximum Transmitted Power, 5190 MHz at HT40, Chain 3

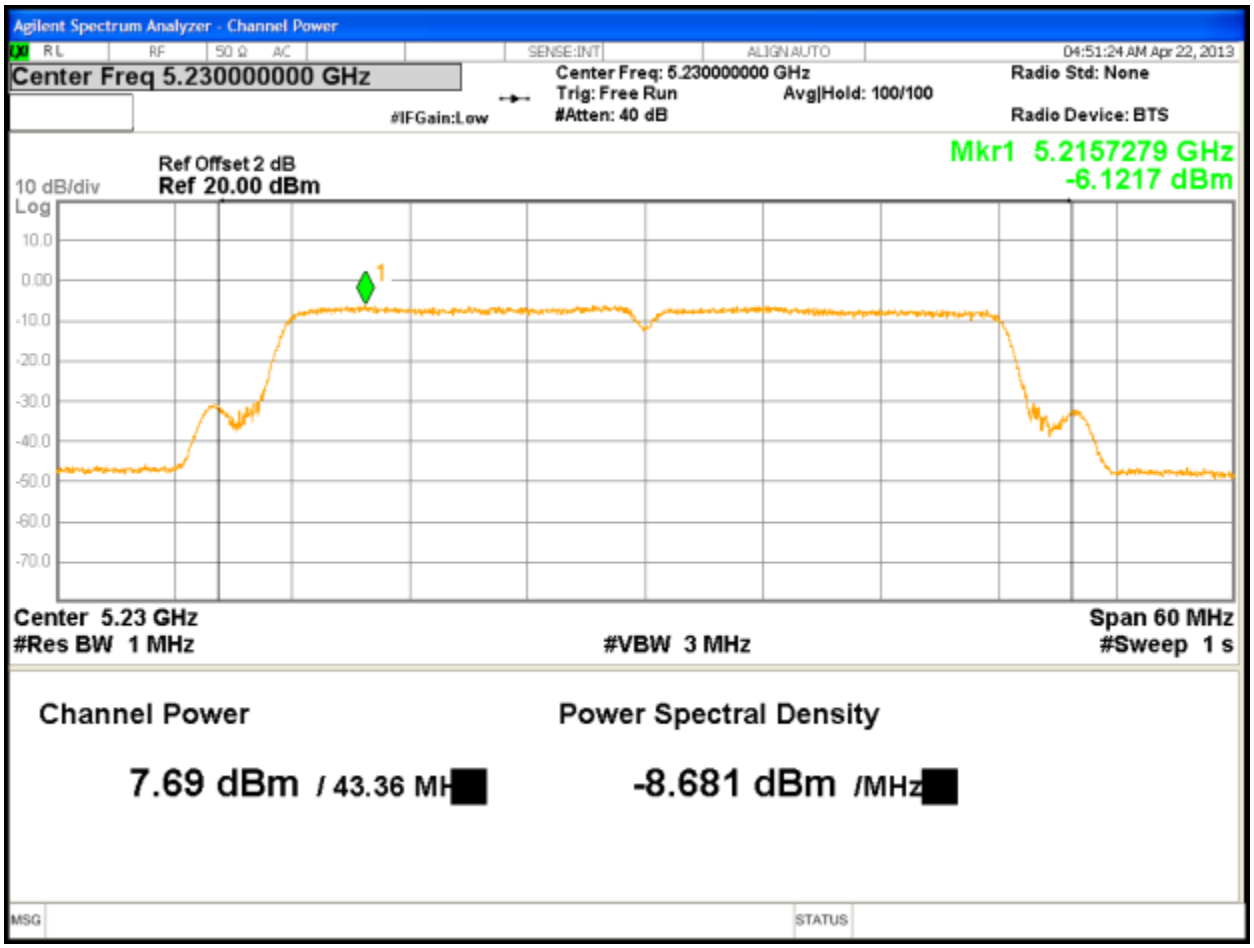


Figure 29: Maximum Transmitted Power, 5230 MHz at HT40, Chain 0

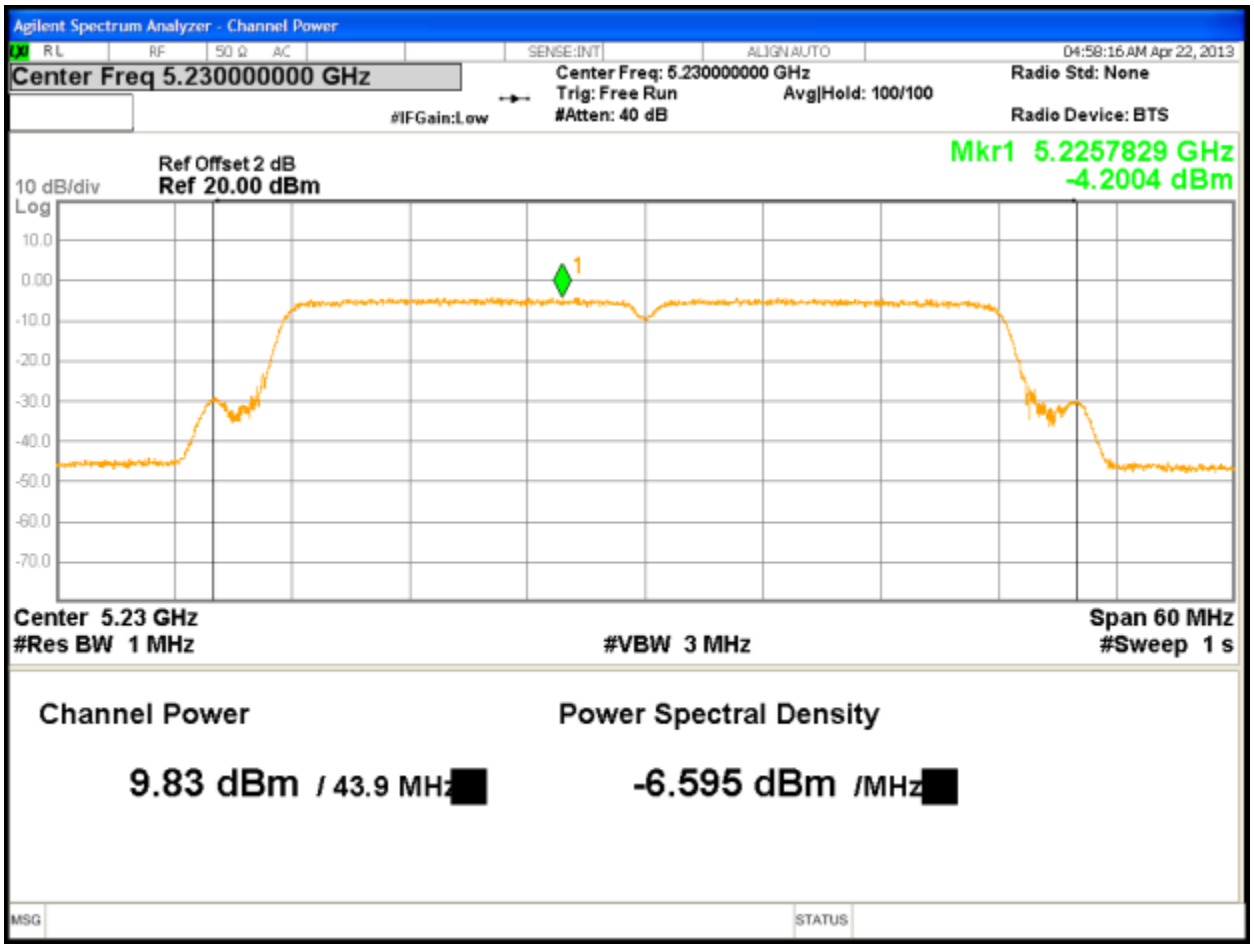


Figure 30: Maximum Transmitted Power, 5230 MHz at HT40, Chain 1

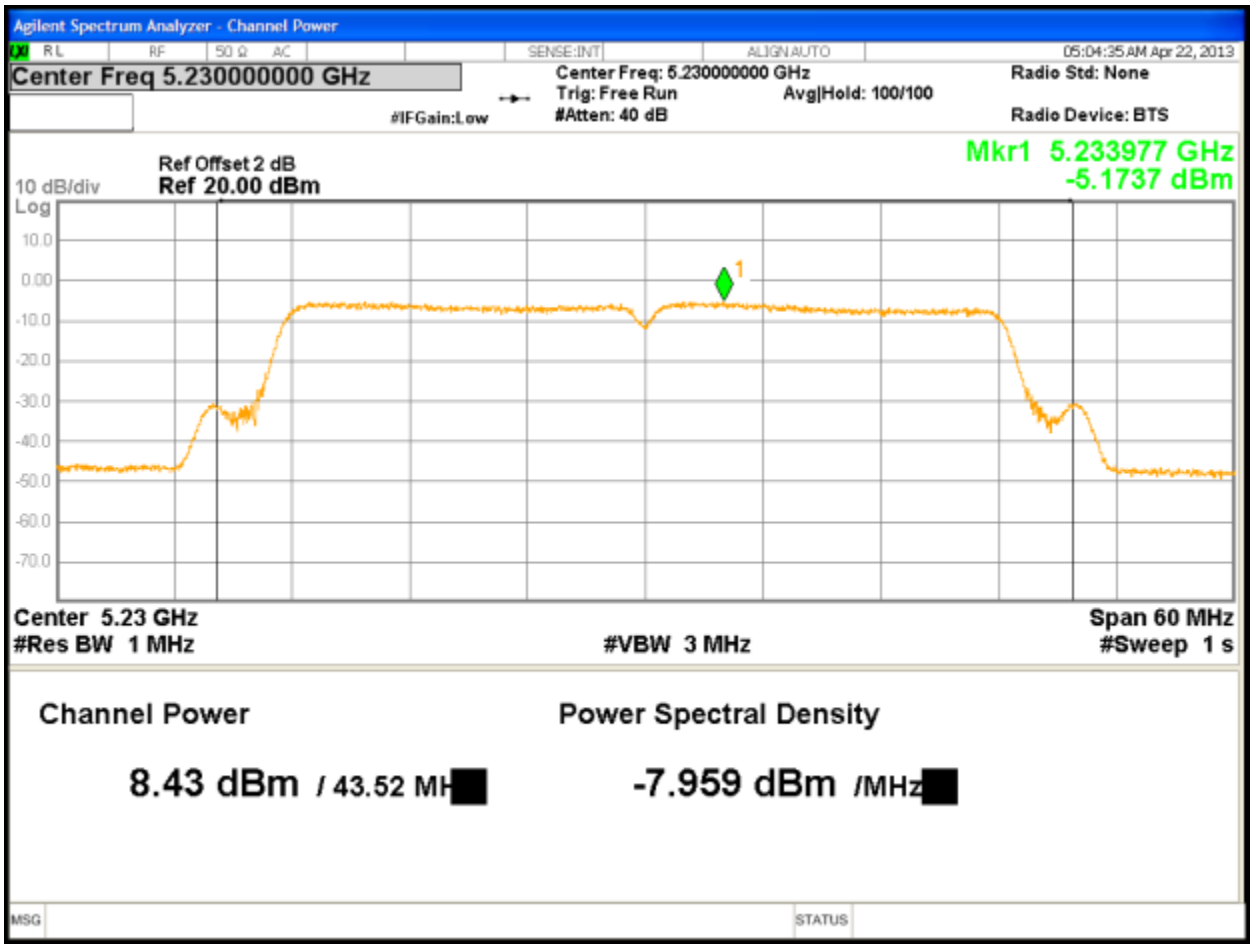


Figure 31: Maximum Transmitted Power, 5230 MHz at HT40, Chain 2

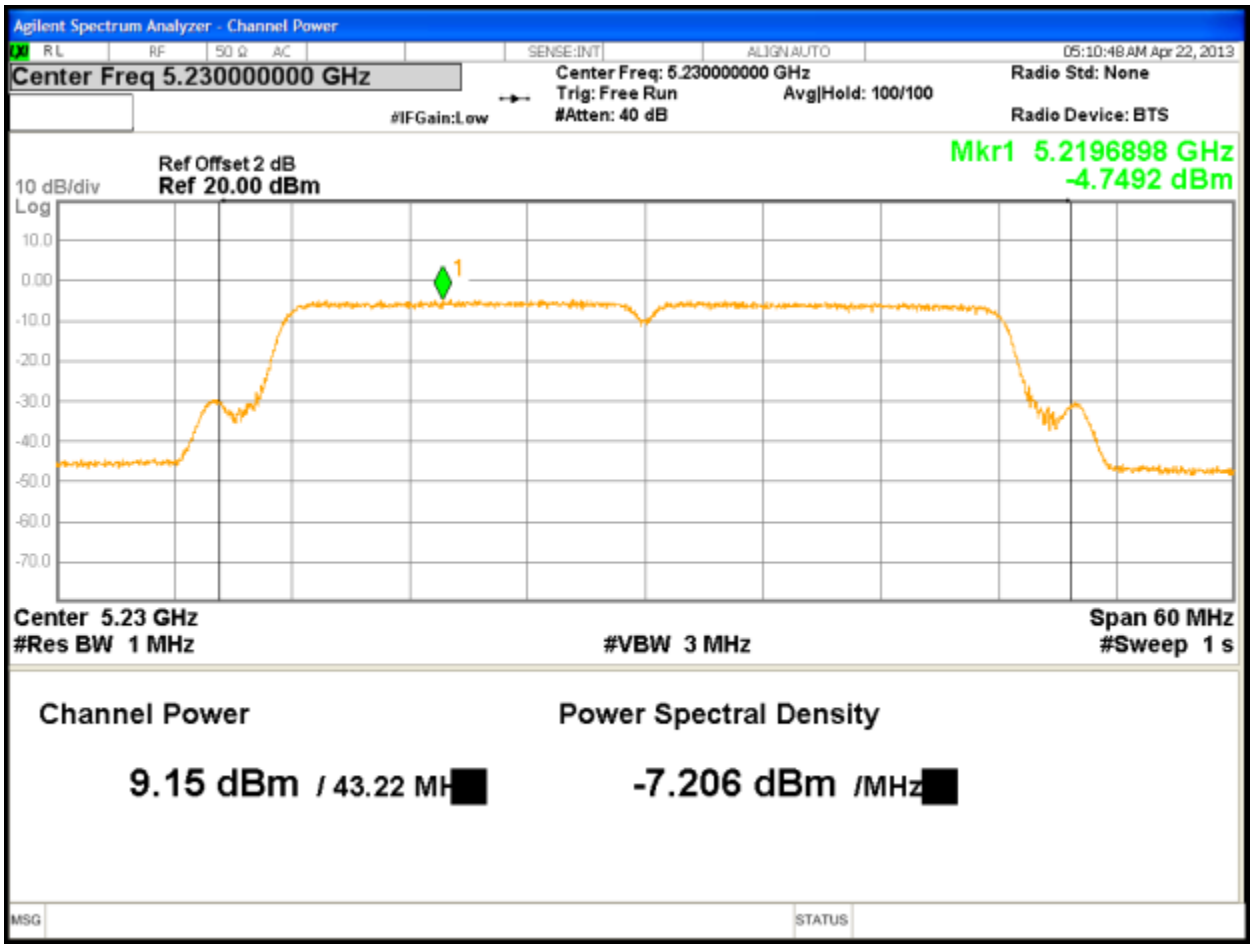


Figure 32: Maximum Transmitted Power, 5230 MHz at HT40, Chain 3

4.2 Occupied Bandwidth

The occupied bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency.

The 99% bandwidth is the bandwidth in which 99% of the transmitted power occupied.

The 26 dB bandwidth is defined the bandwidth of 26 dBr from highest transmitted level of the fundamental frequency.

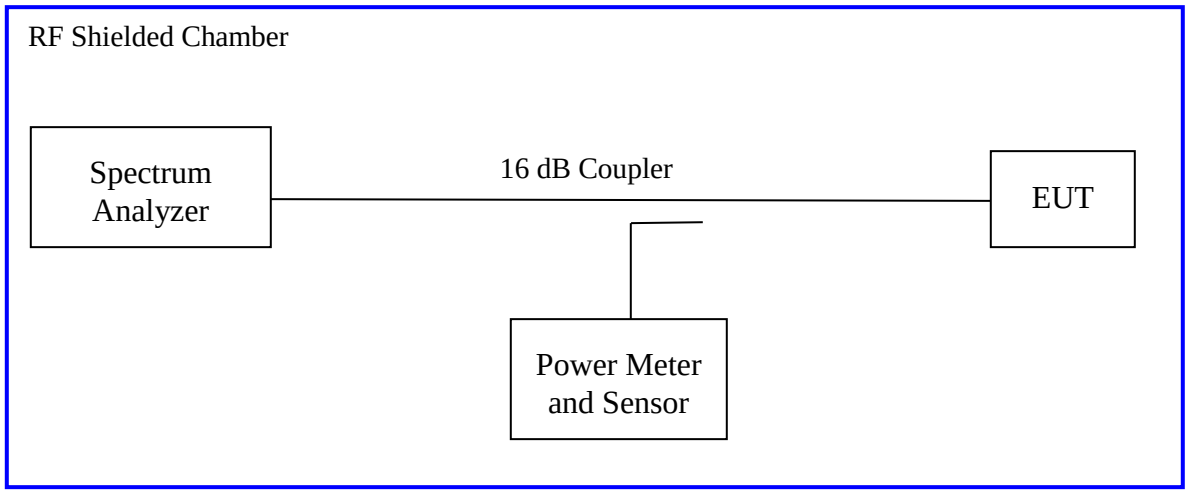
There is no restriction limits for the bandwidth. The 26 dB bandwidth was used to determine the limit for maximum conducted output power per CFR47 Part 15.407(a).

To obtain the tighter limit,

4.2.1 Test Method

The conducted method was used to measure the occupied bandwidth. The measurement was performed with modulation per CFR47 15.407(a) 2012 and RSS Gen Sect. 4.4.1:2010. The preliminary investigation was performed to find the narrowest 26 dB bandwidth for each operational mode at different data rates. This worst finding was performed on 3 channels in each operating frequency range; 5150 MHz to 5250 MHz. The worst results indicated below.

Test Setup:



4.2.2 Results

These occupied bandwidth measurements were taken for references only.

Table 4: Occupied Bandwidth – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only								
Antenna Type: Integrated				**Power Setting:** See Test Plan				
Max. Directional Gain: + 8 dBi				**Signal State:** Modulated at 100%.				
Ambient Temp.: 21 °C				**Relative Humidity:**33%				
Bandwidth (MHz) for 802.11a								
Freq. (MHz)	**26 dB Bandwidth (MHz)**				**99% Bandwidth (MHz)**			
	Ch0	**Ch1**	**Ch2**	**Ch3**	**Ch0**	**Ch1**	**Ch2**	**Ch3**
5180	27.789	28.512	28.025	27.886	17.317	17.147	17.384	17.169
5200	28.472	27.937	28.038	28.728	17.394	17.196	17.371	17.217
5240	29.433	28.722	29.071	28.268	17.442	17.179	17.257	17.201
Note: The bandwidth was measured at 6 Mbps for 802.11a mode.								
Bandwidth (MHz) for 802.11n HT20								
Freq. (MHz)	**26 dB Bandwidth (MHz)**				**99% Bandwidth (MHz)**			
	Ch0	**Ch1**	**Ch2**	**Ch3**	**Ch0**	**Ch1**	**Ch2**	**Ch3**
5180	26.859	27.807	25.955	26.119	18.165	18.401	18.112	18.141
5200	27.076	27.658	25.640	26.029	18.163	18.403	18.103	18.136
5240	26.993	27.812	25.100	25.993	18.185	18.408	18.023	18.136
Note: The bandwidth was measured at 6.5 Mbps for 802.11n HT20 mode.								
Bandwidth (MHz) for 802.11n HT40								
Freq. (MHz)	**26 dB Bandwidth (MHz)**				**99% Bandwidth (MHz)**			
	Ch0	**Ch1**	**Ch2**	**Ch3**	**Ch0**	**Ch1**	**Ch2**	**Ch3**
5190	43.833	44.234	43.946	43.712	36.460	36.655	36.470	36.260
5230	43.842	44.300	44.026	43.159	36.417	36.618	36.510	36.222
Note: The bandwidth was measured at 13 Mbps for 802.11n HT40 mode.								

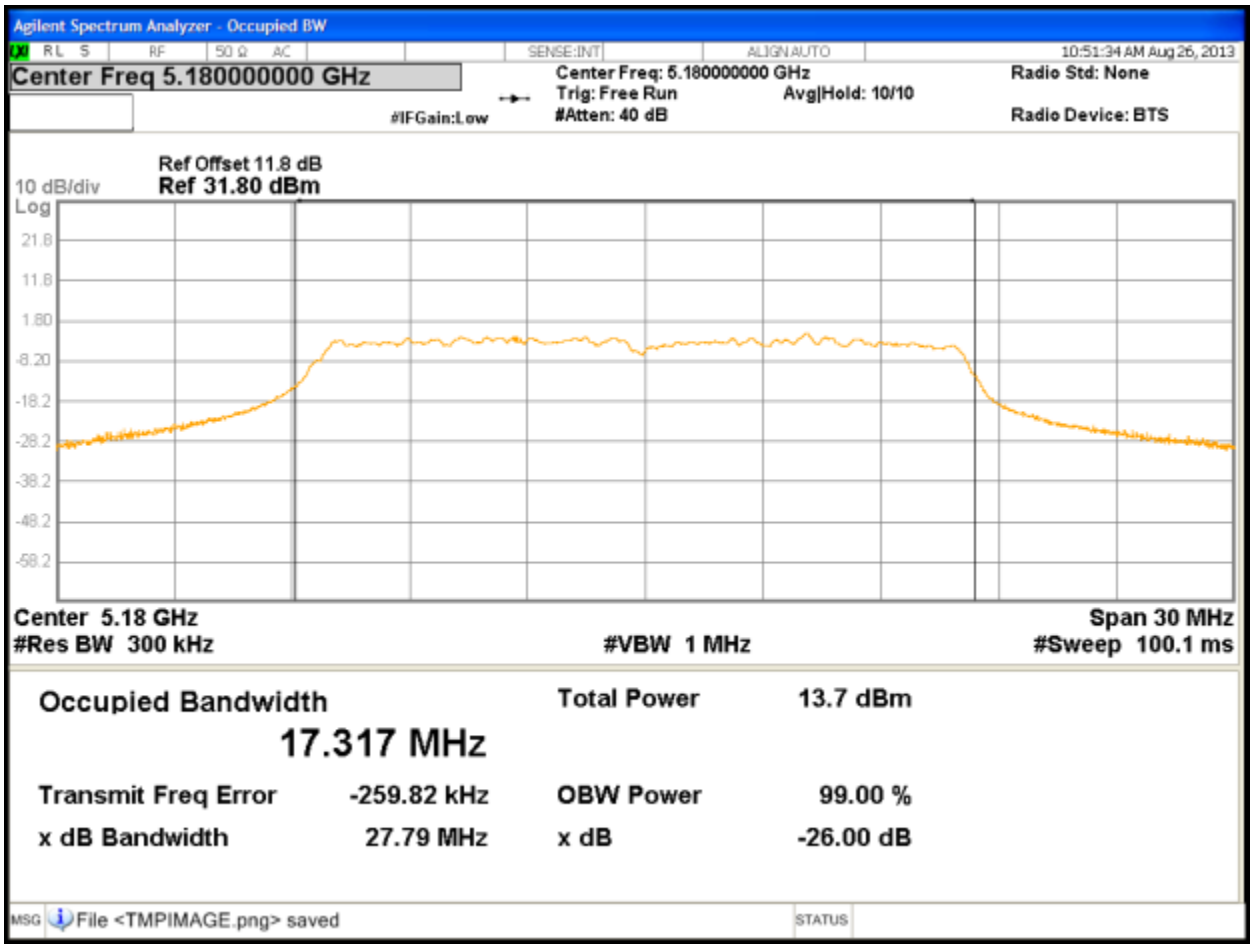


Figure 33: 26 dB and 99% Bandwidth at 802.11A, 5180 MHz, Chain 0

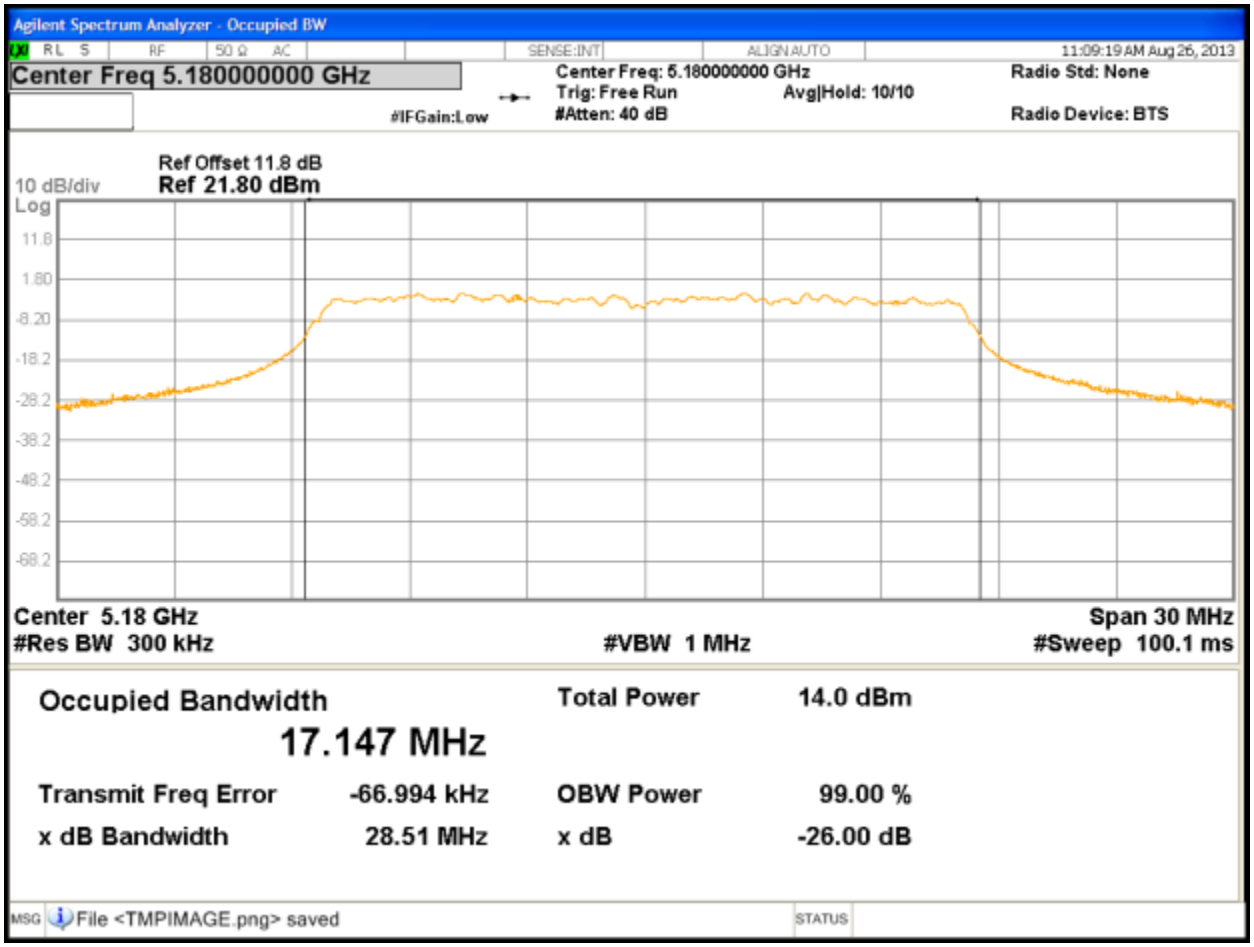


Figure 34: 26 dB and 99% Bandwidth at 802.11A, 5180 MHz, Chain 1

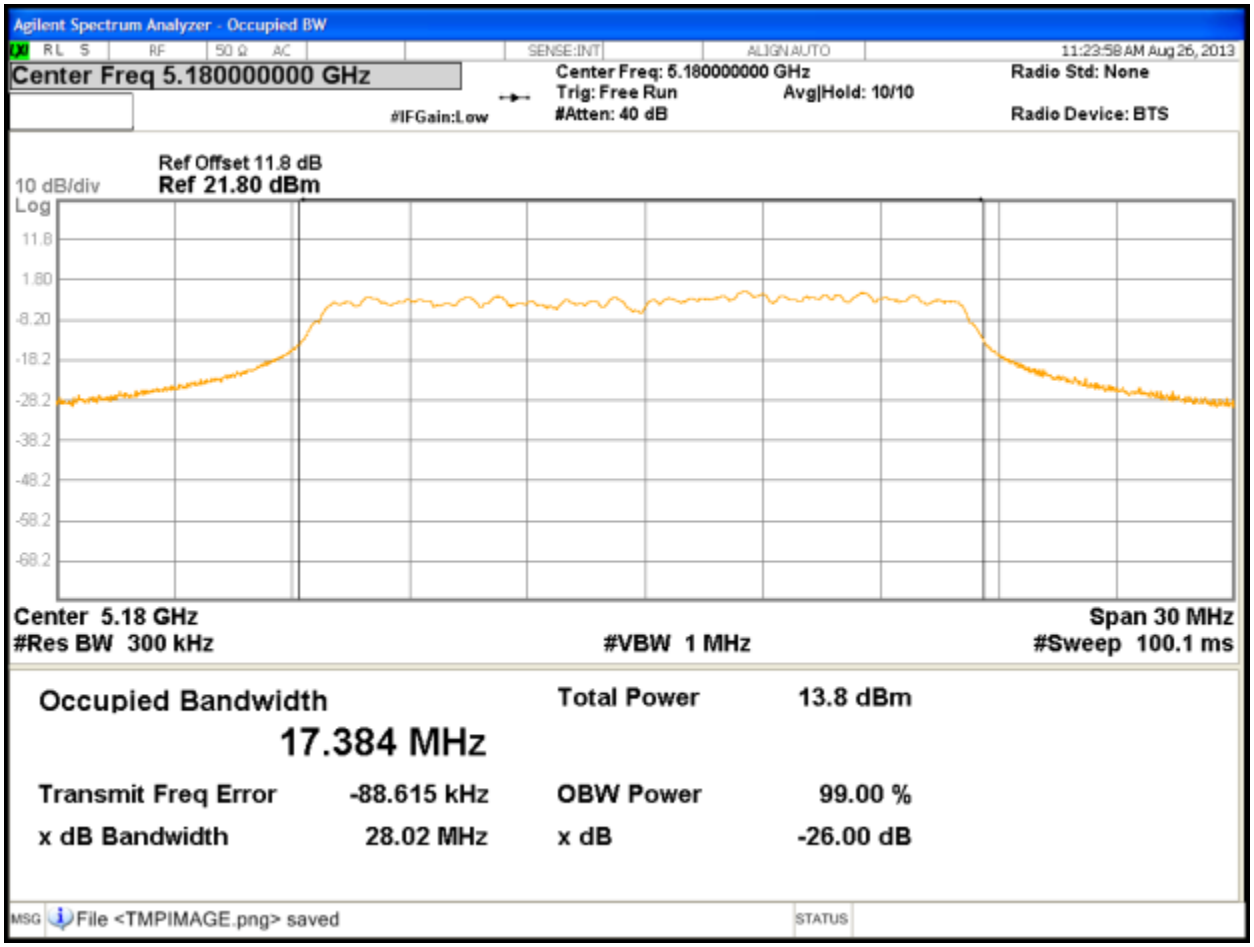


Figure 35: 26 dB and 99% Bandwidth at 802.11A, 5180 MHz, Chain 2

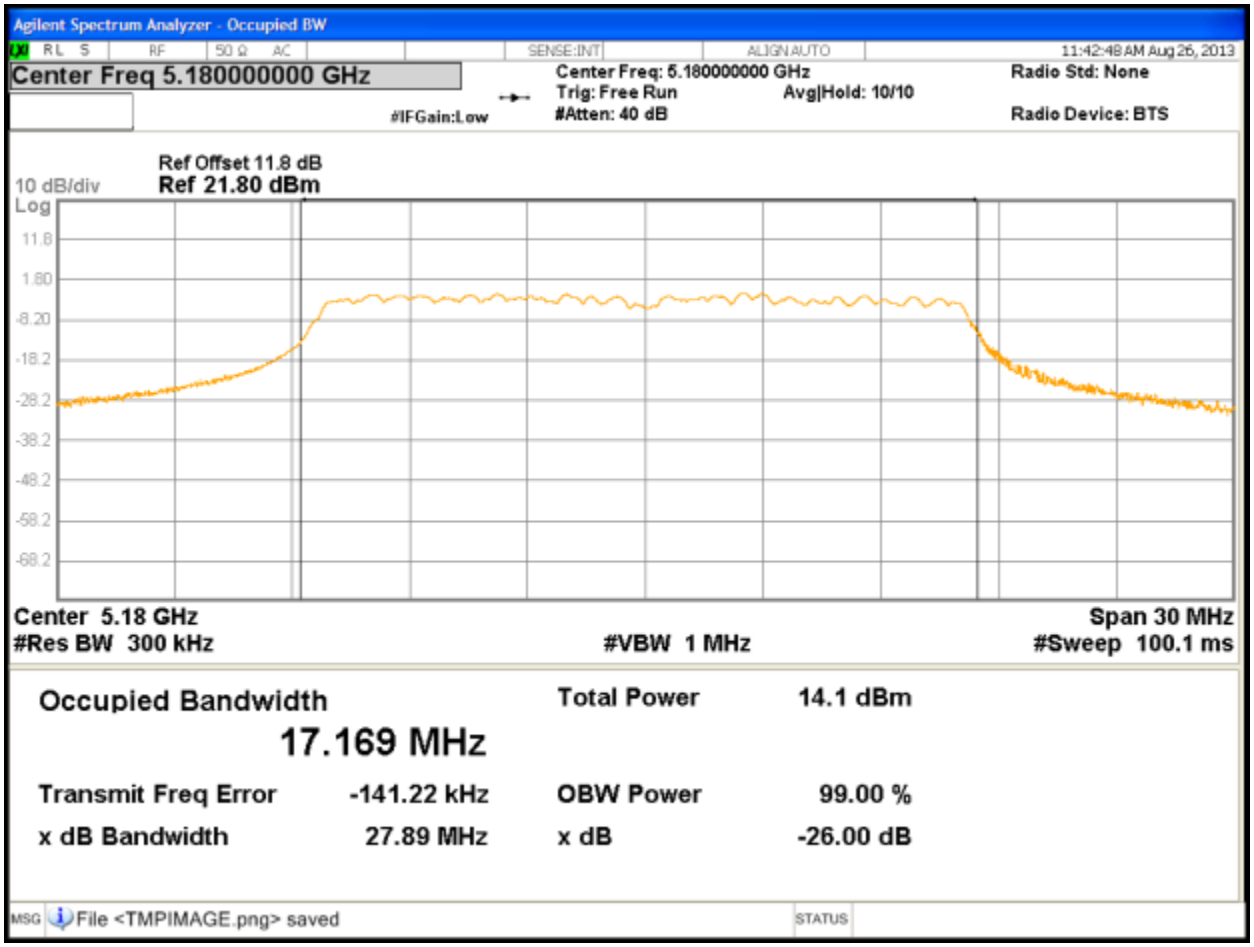


Figure 36: 26 dB and 99% Bandwidth at 802.11A, 5180 MHz, Chain 3

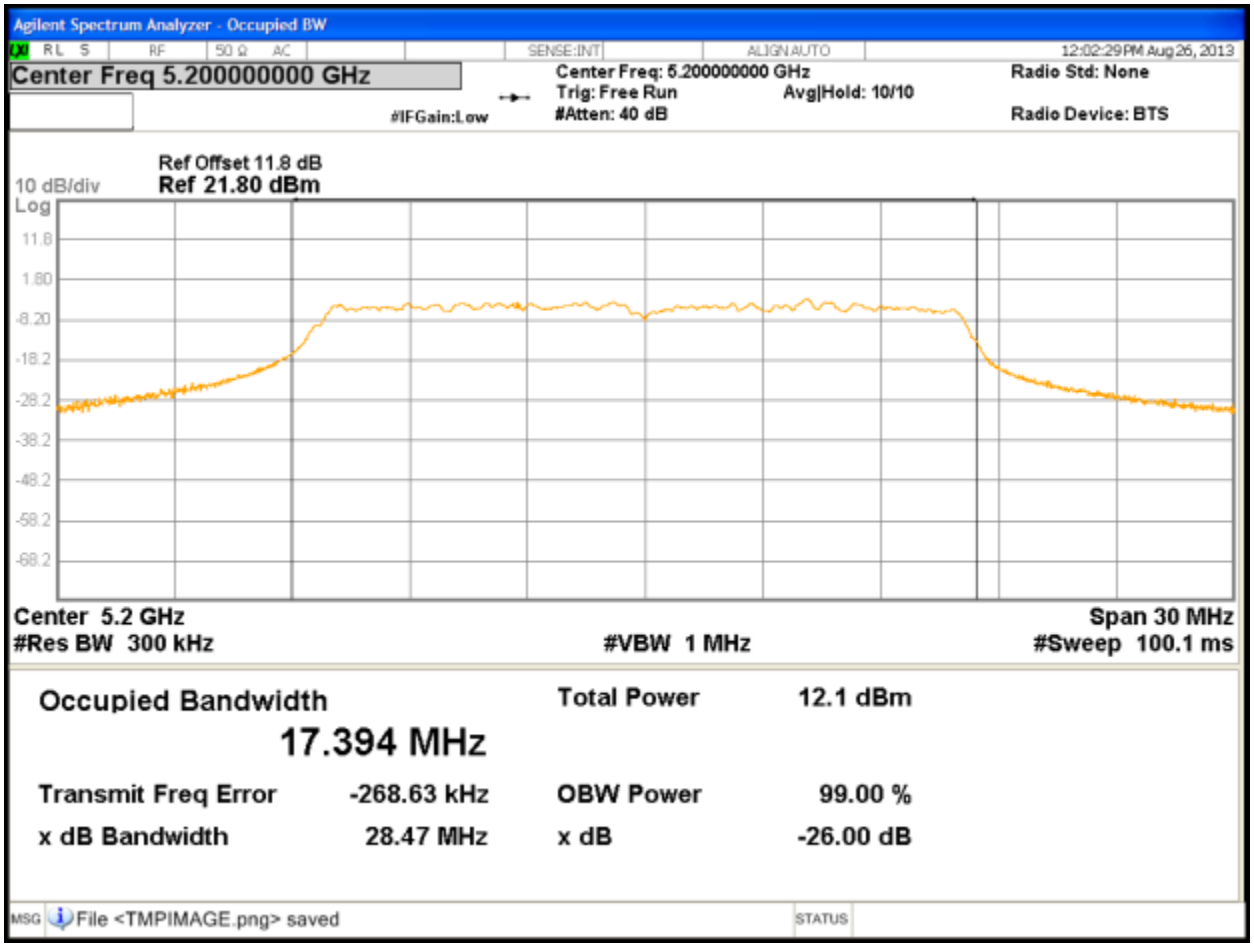


Figure 37: 26 dB and 99% Bandwidth at 802.11A, 5200 MHz, Chain 0

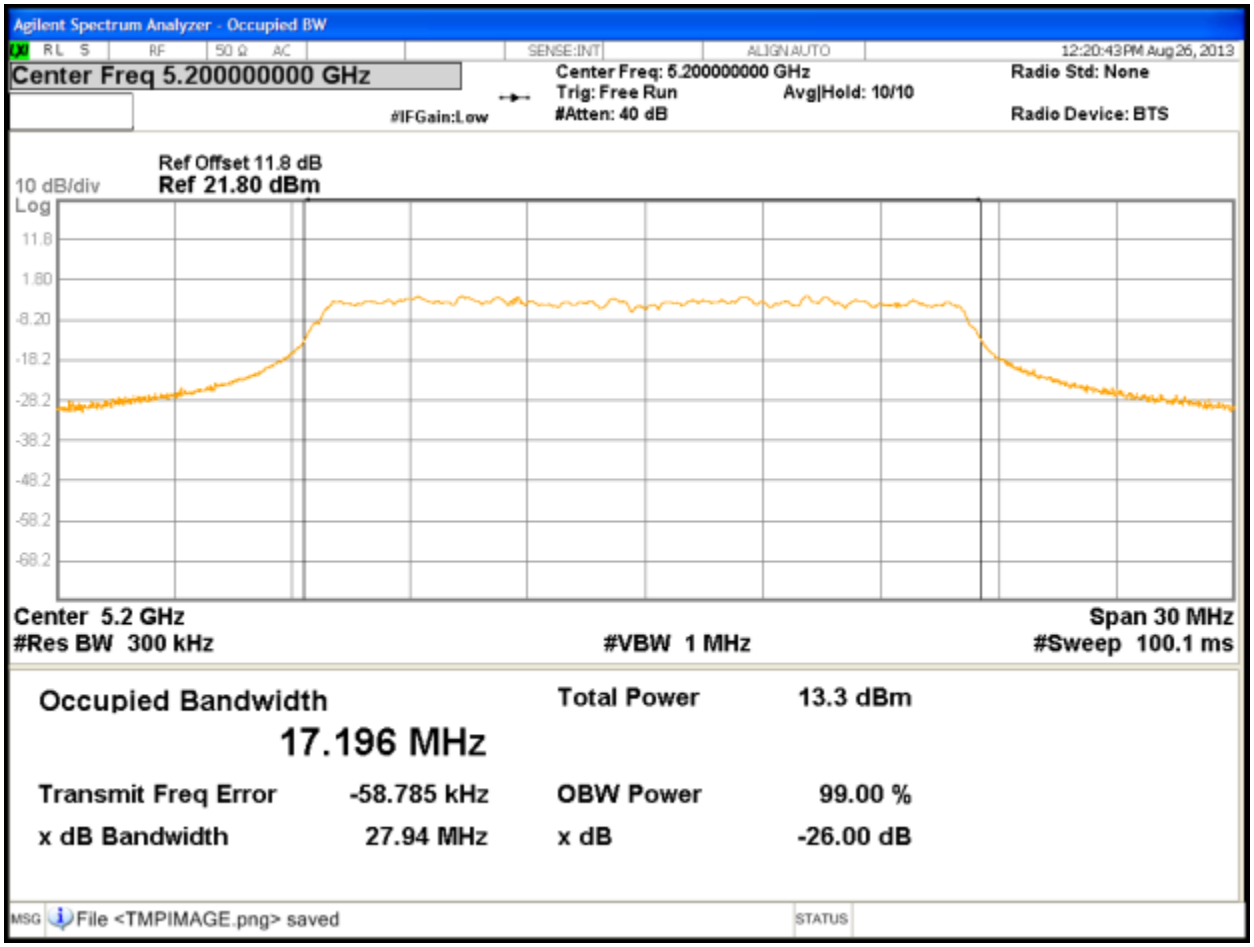


Figure 38: 26 dB and 99% Bandwidth at 802.11A, 5200 MHz, Chain 1

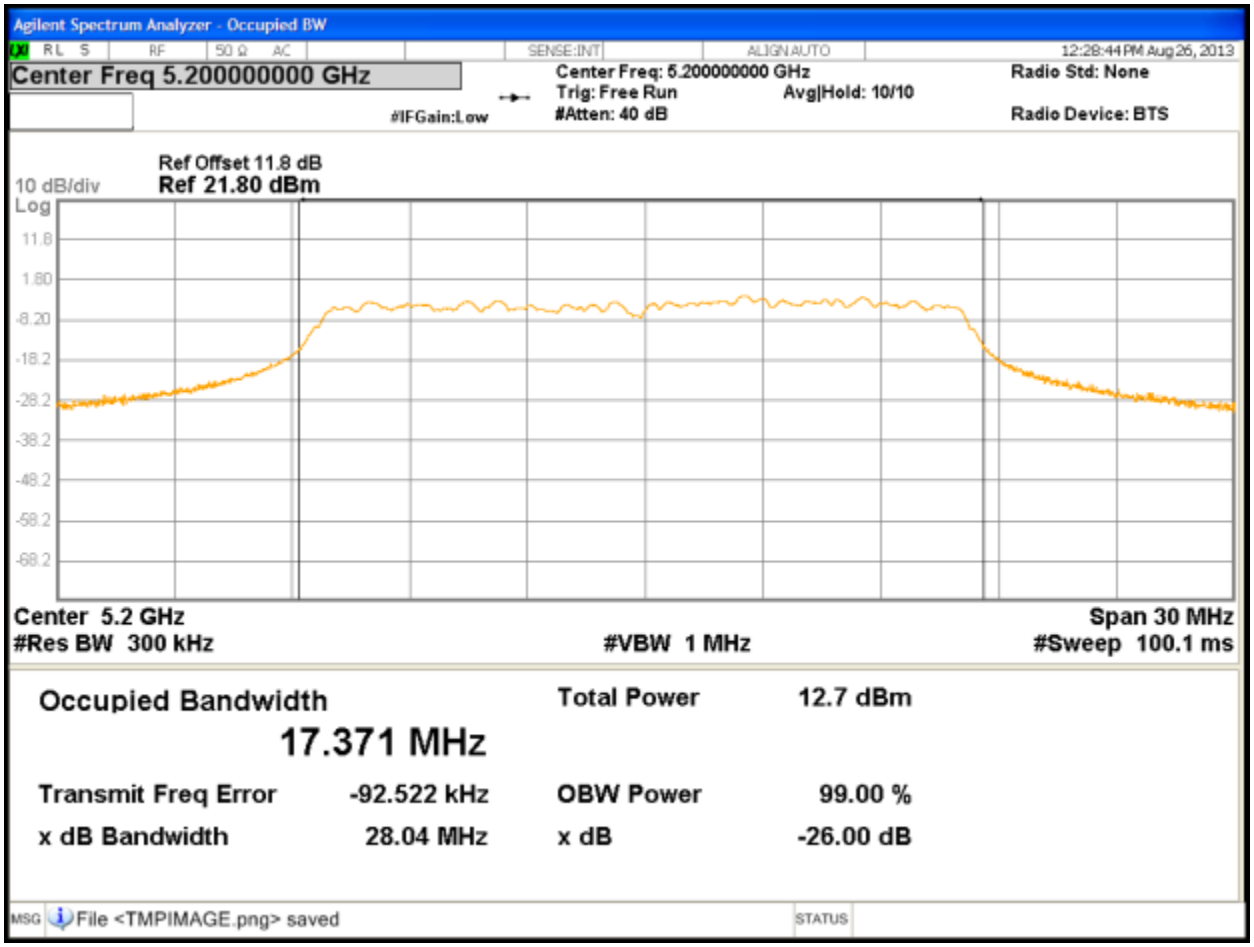


Figure 39: 26 dB and 99% Bandwidth at 802.11A, 5200 MHz, Chain 2

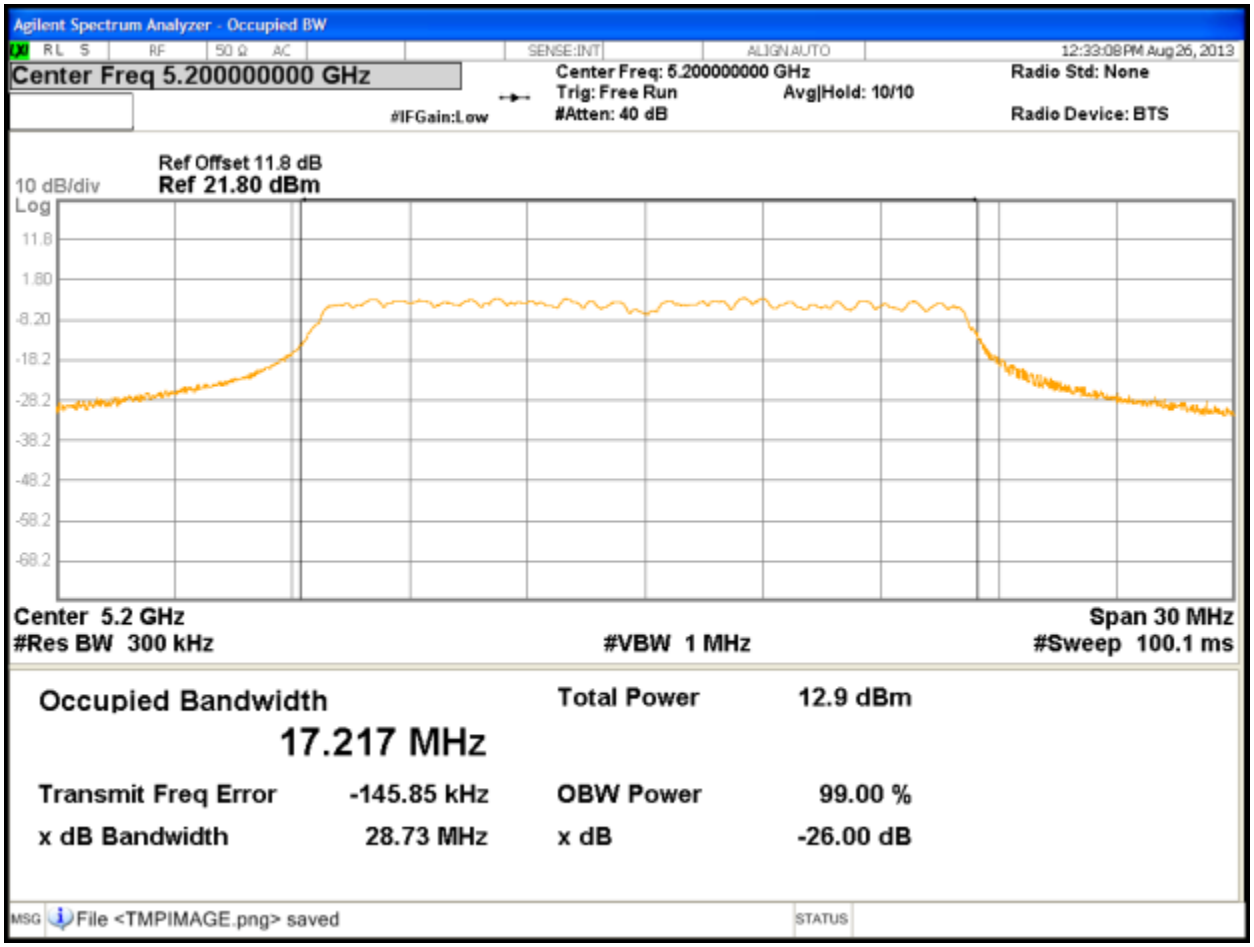


Figure 40: 26 dB and 99% Bandwidth at 802.11A, 5200 MHz, Chain 3

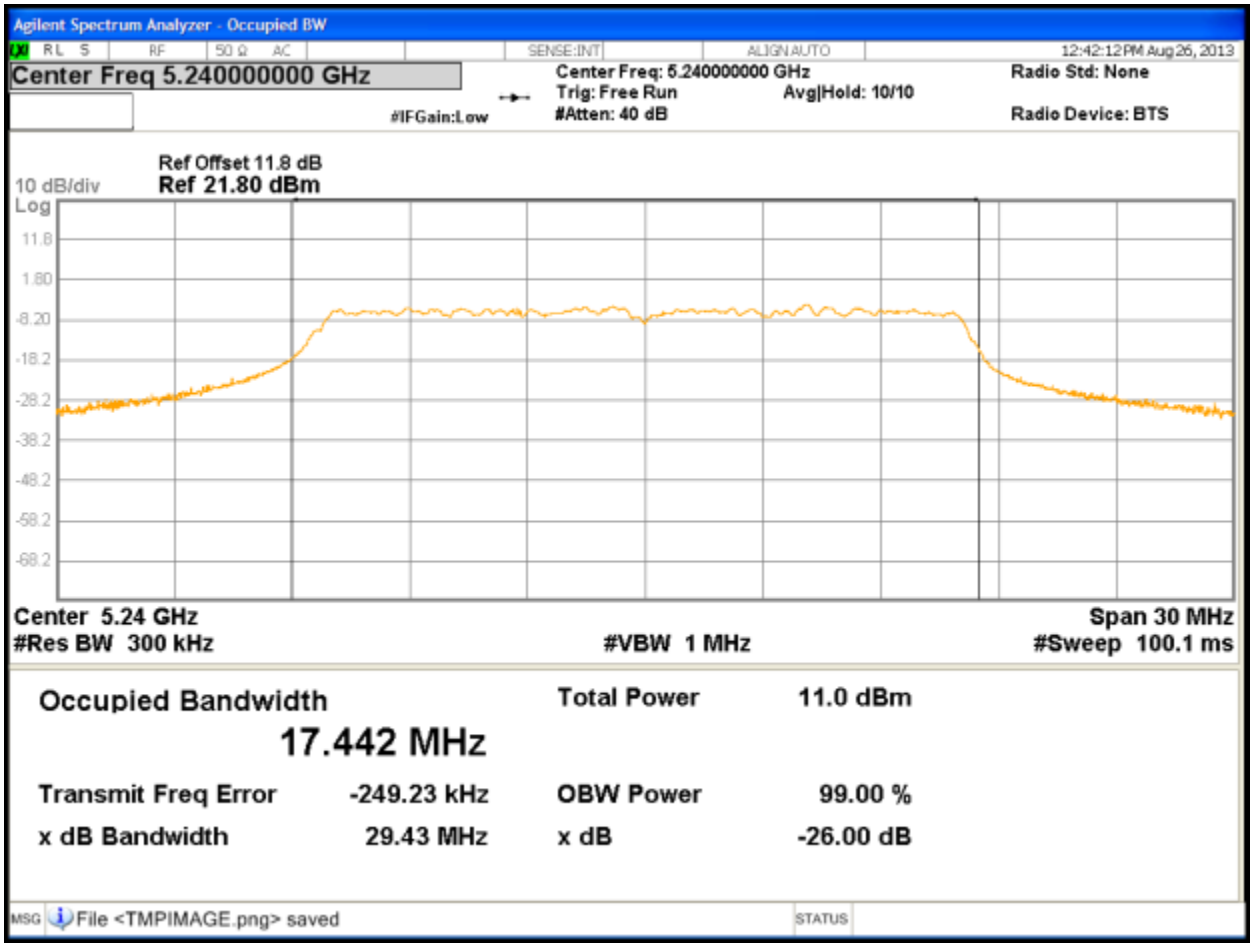


Figure 41: 26 dB and 99% Bandwidth at 802.11A, 5240 MHz, Chain 0

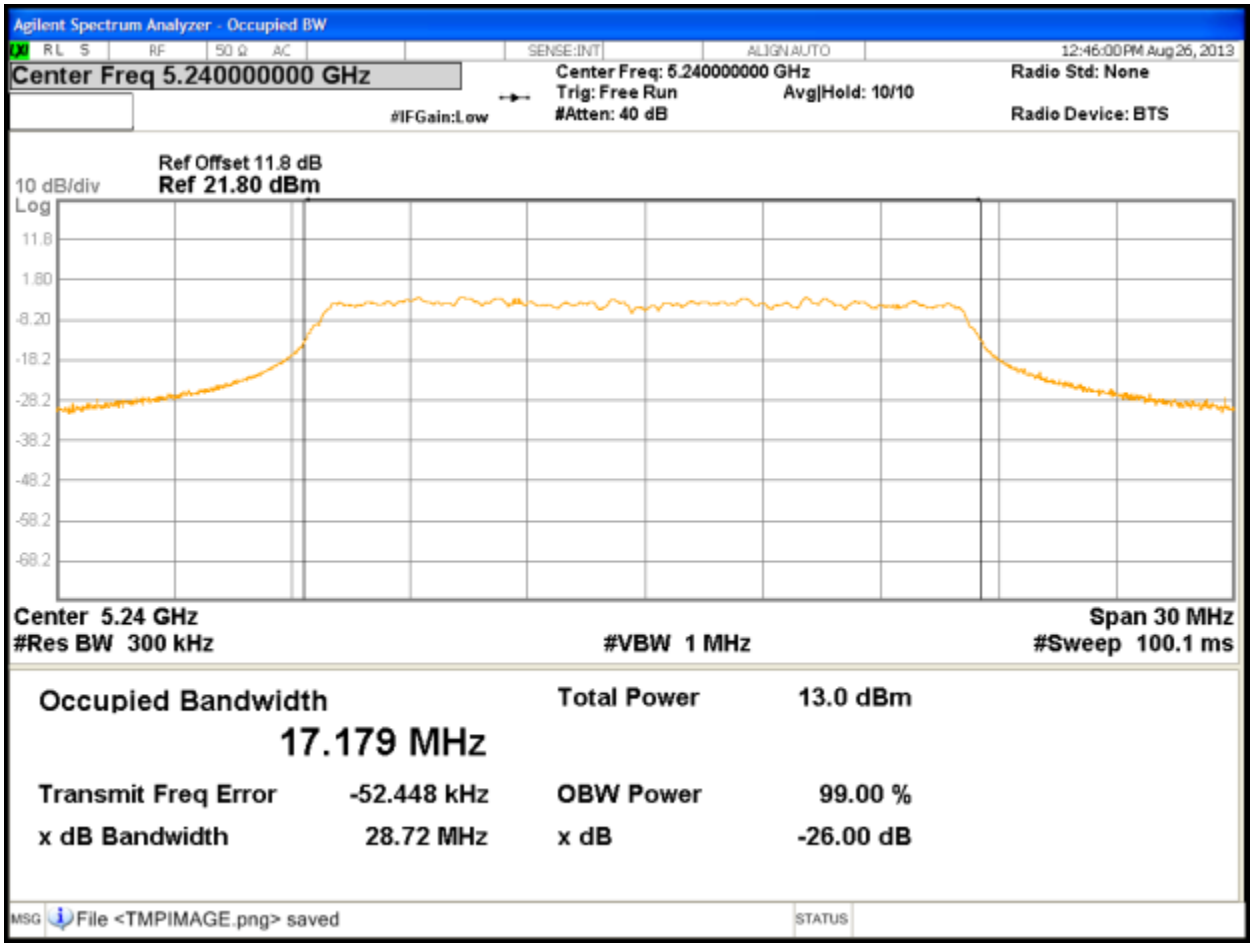


Figure 42: 26 dB and 99% Bandwidth at 802.11A, 5240 MHz, Chain 1

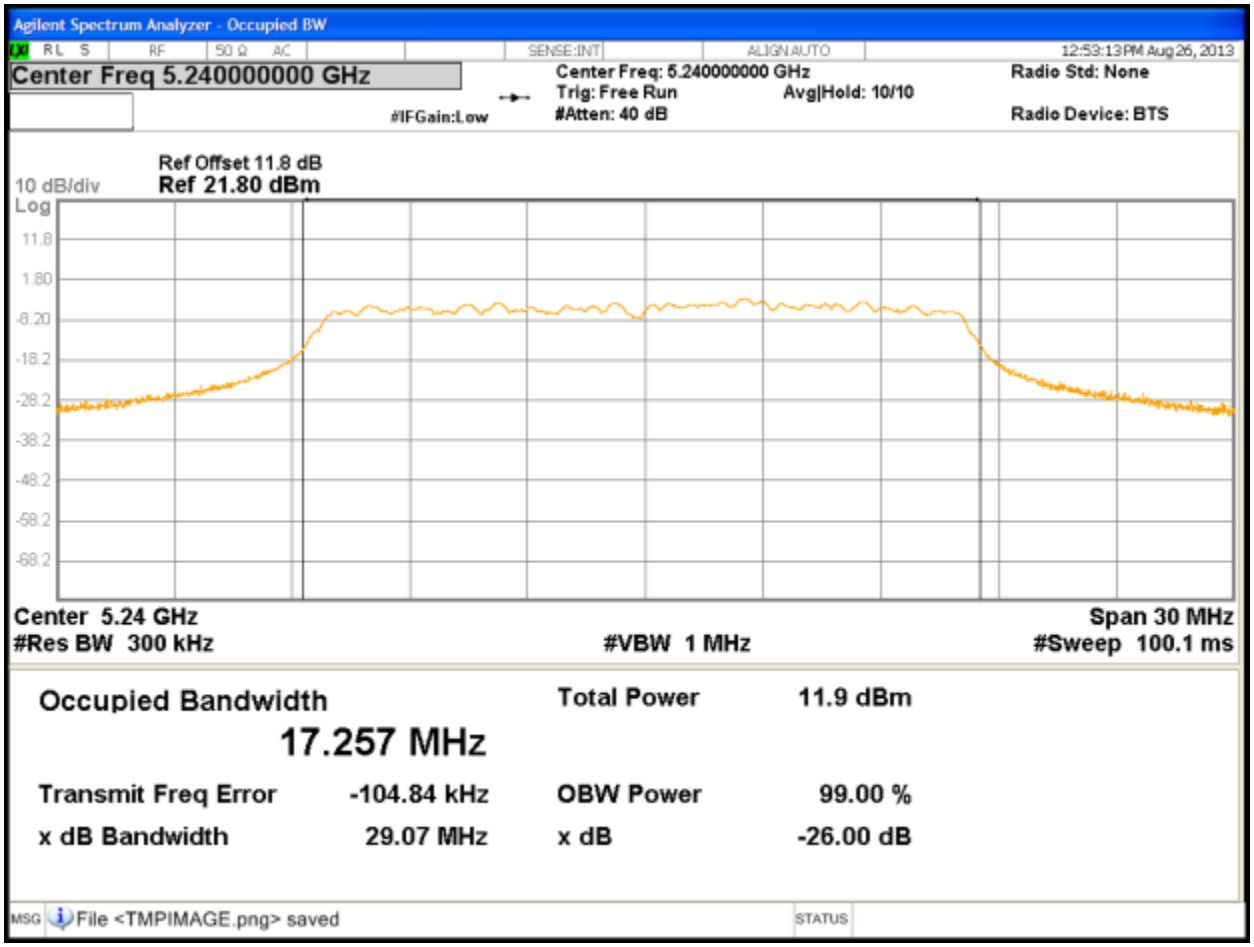


Figure 43: 26 dB and 99% Bandwidth at 802.11A, 5240 MHz, Chain 2

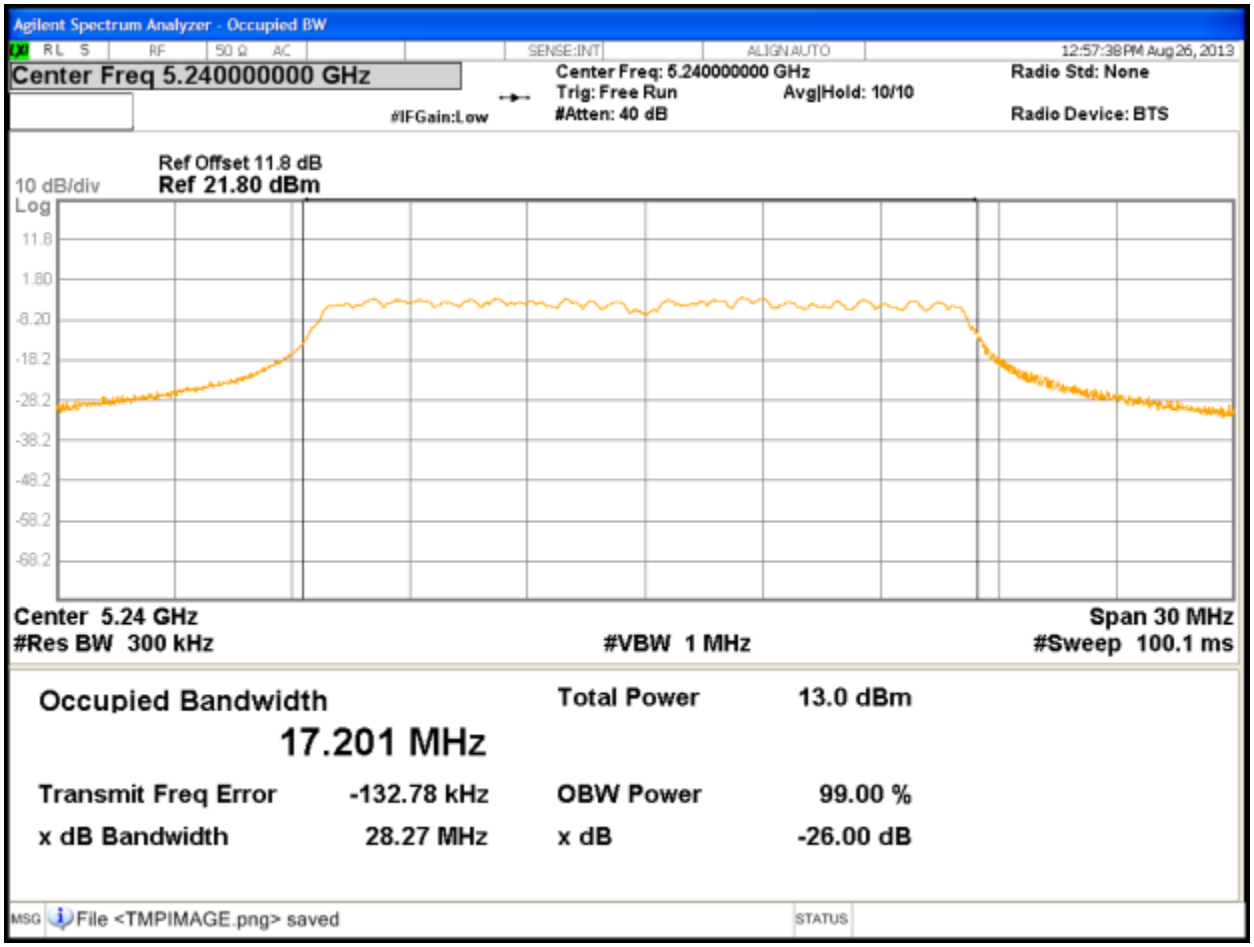


Figure 44: 26 dB and 99% Bandwidth at 802.11A, 5240 MHz, Chain 3

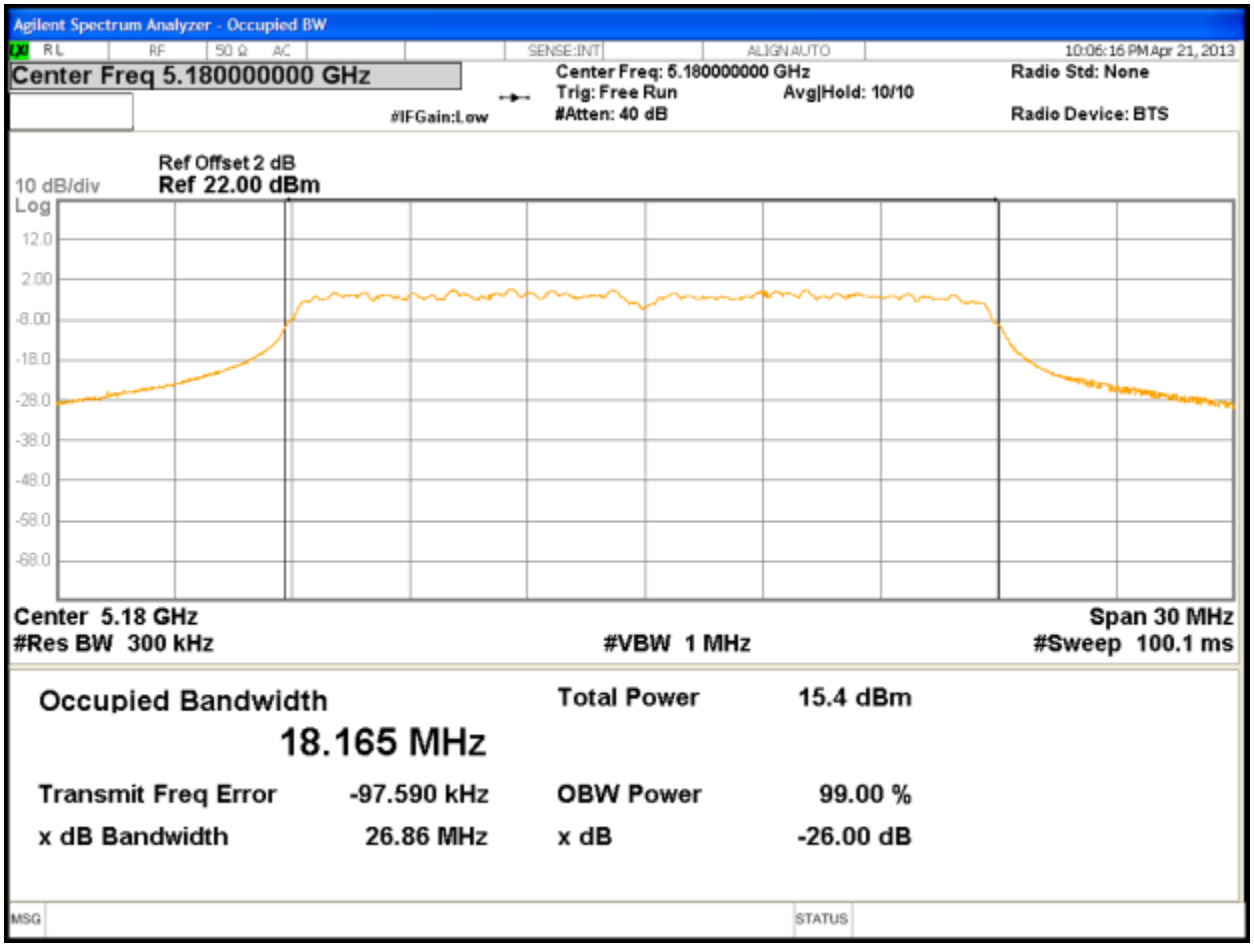


Figure 45: 26 dB and 99% Bandwidth at HT20, 5180 MHz, Chain 0

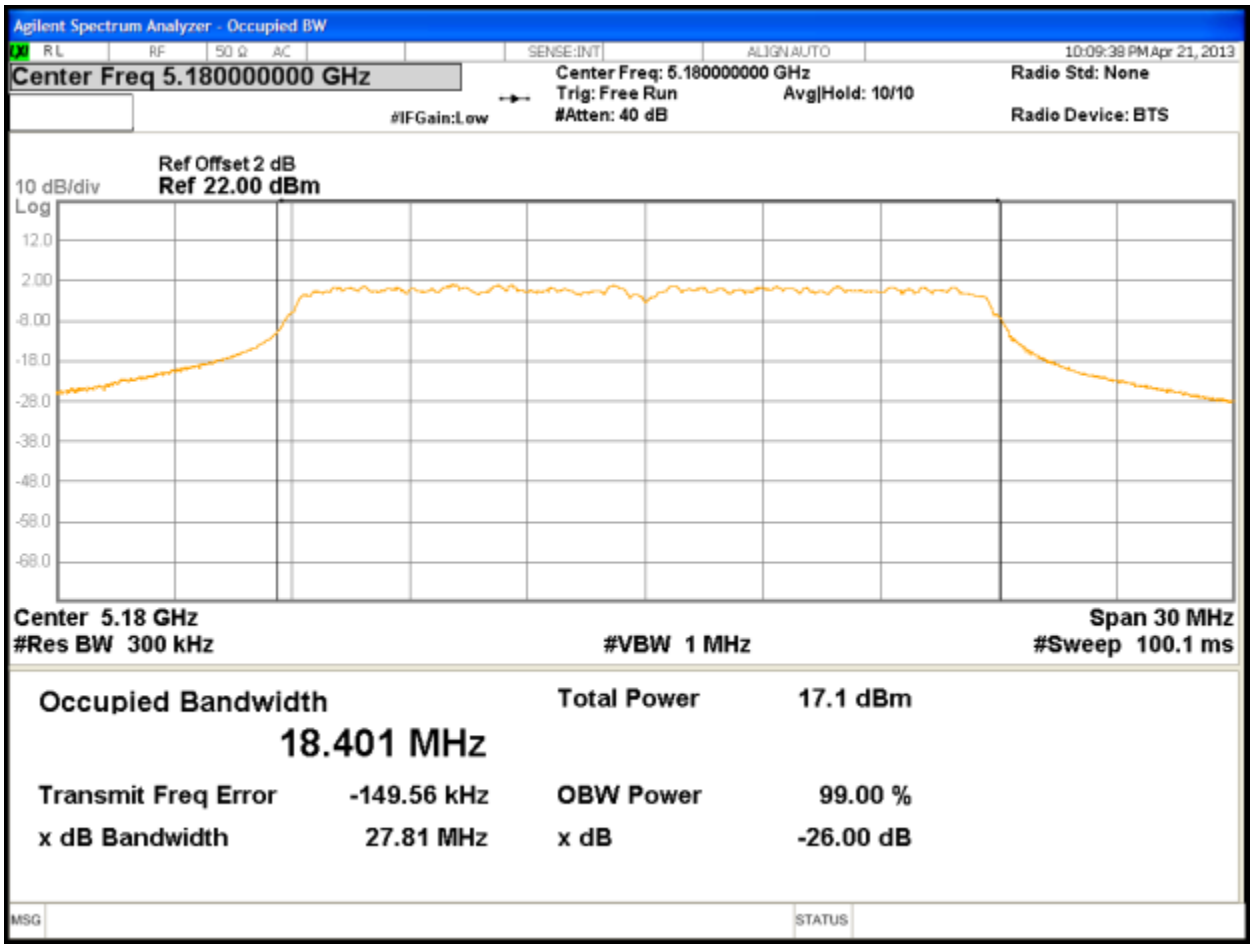


Figure 46: 26 dB and 99% Bandwidth at HT20, 5180 MHz, Chain 1

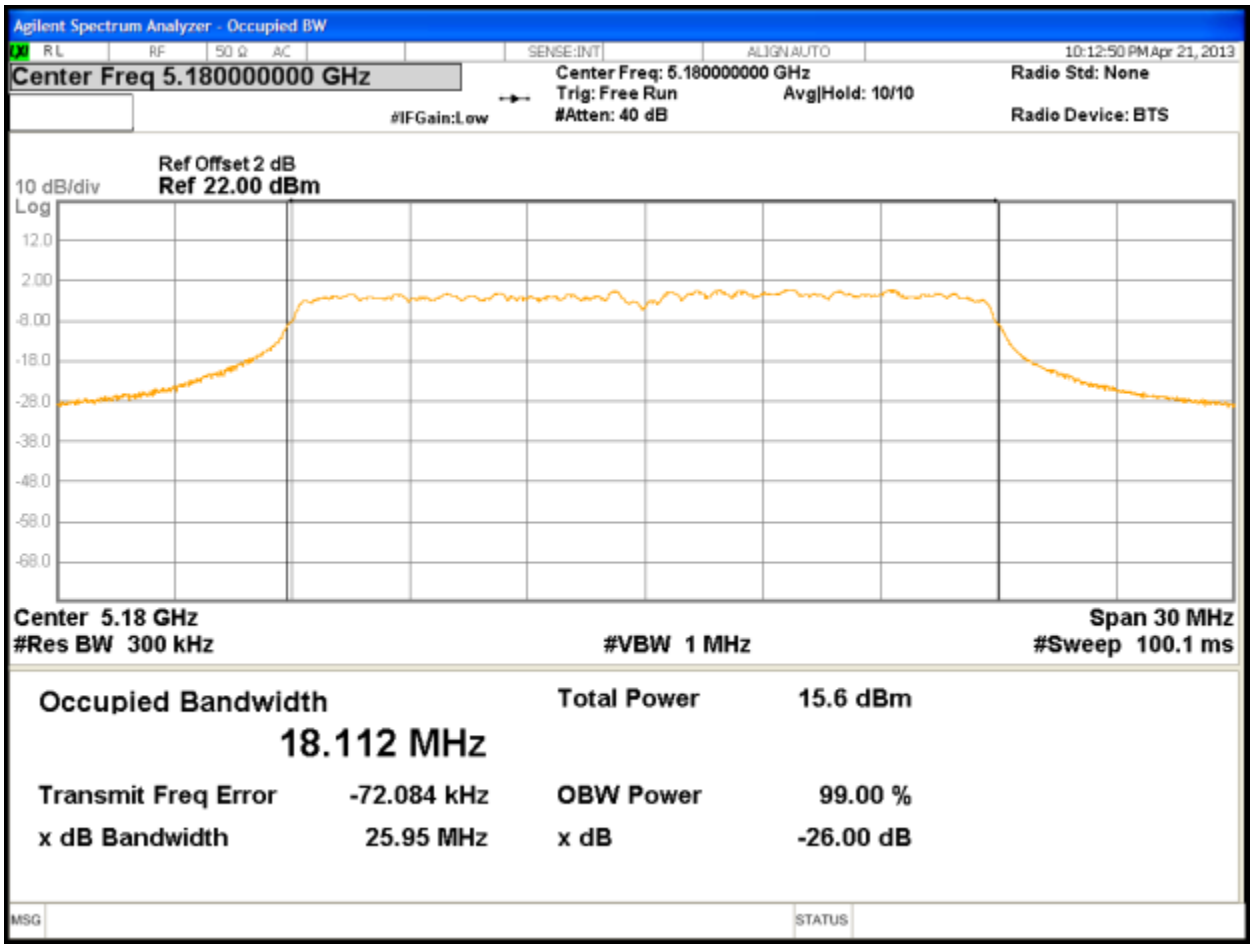


Figure 47: 26 dB and 99% Bandwidth at HT20, 5180 MHz, Chain 2

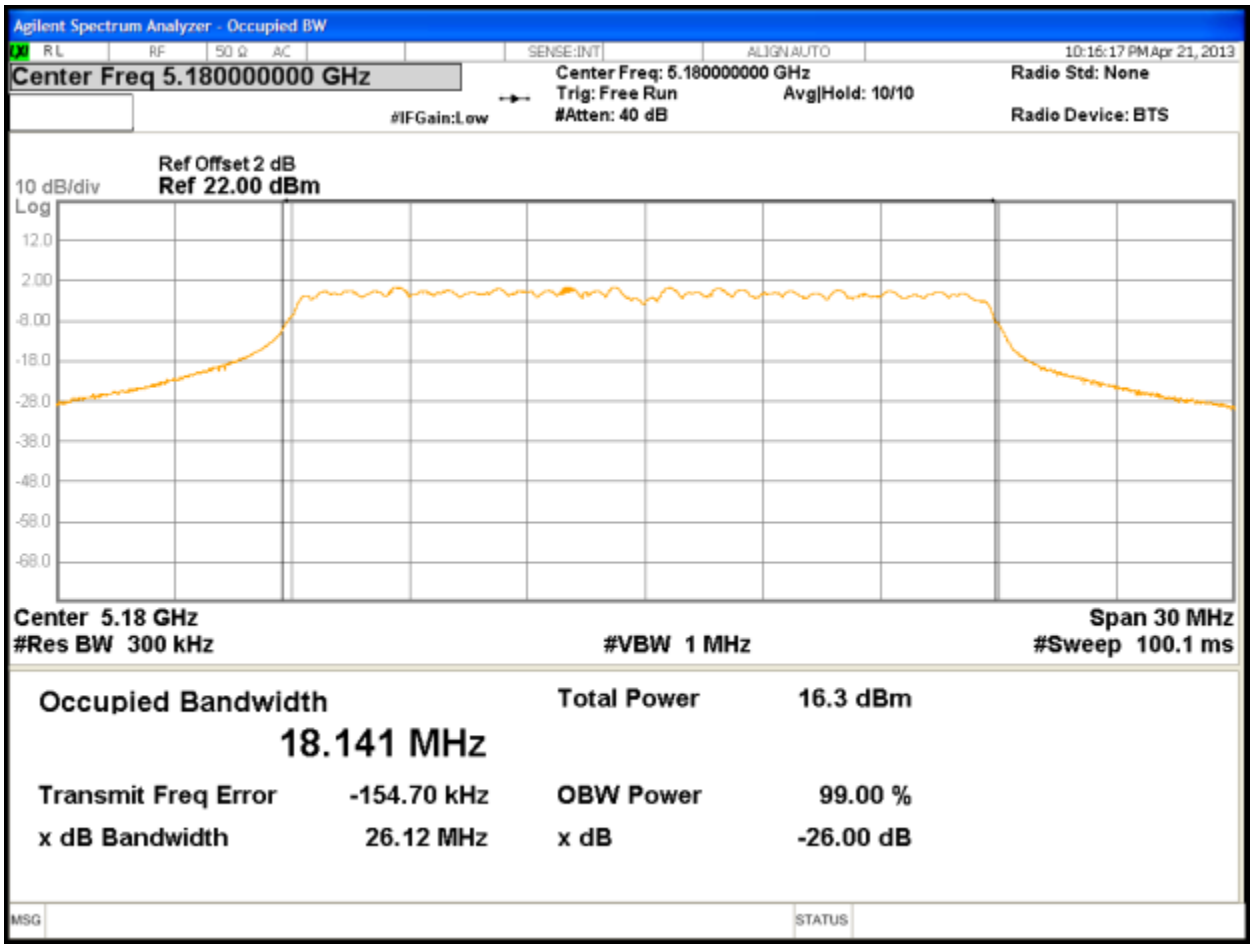


Figure 48: 26 dB and 99% Bandwidth at HT20, 5180 MHz, Chain 3

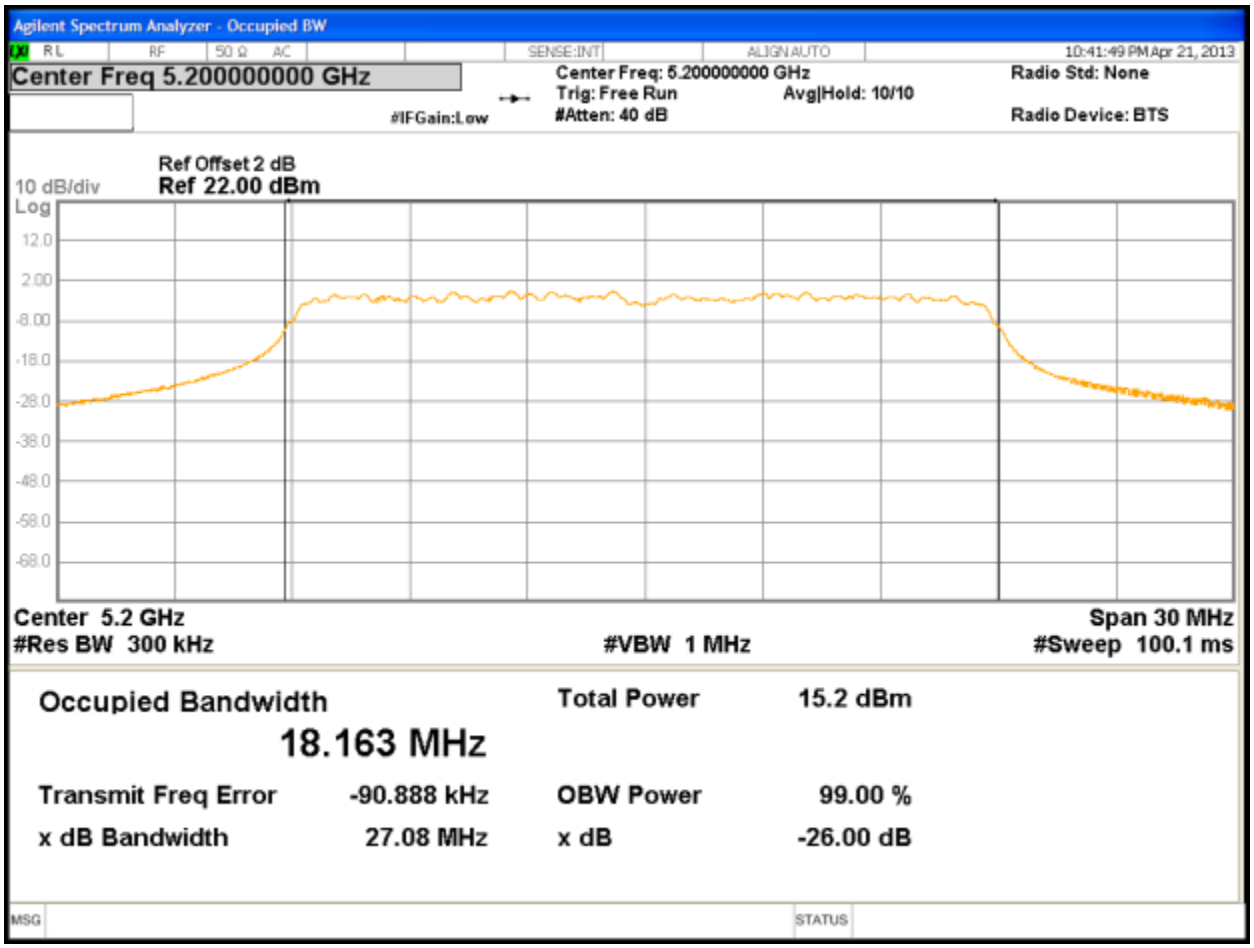


Figure 49: 26 dB and 99% Bandwidth at HT20, 5200 MHz, Chain 0

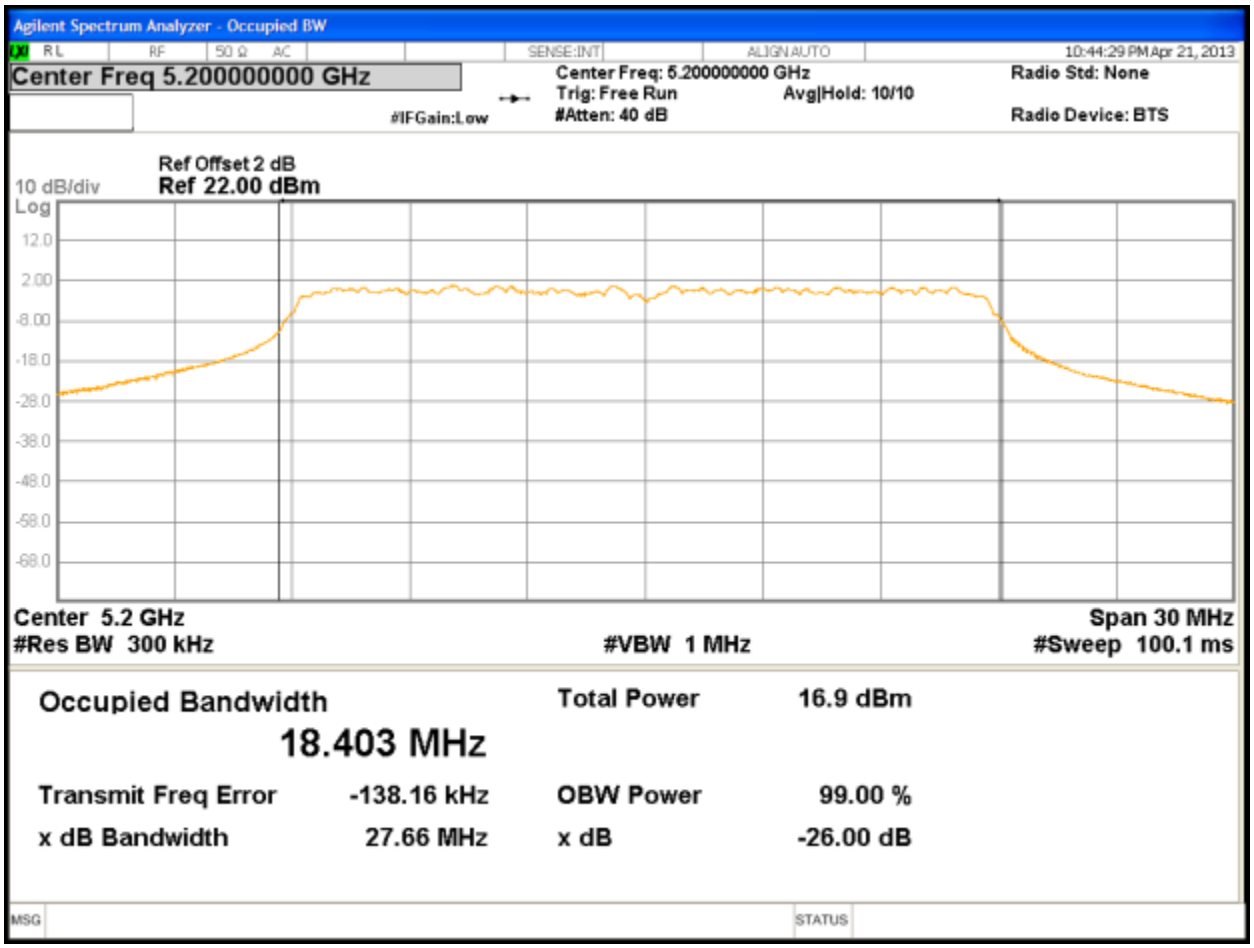


Figure 50: 26 dB and 99% Bandwidth at HT20, 5200 MHz, Chain 1

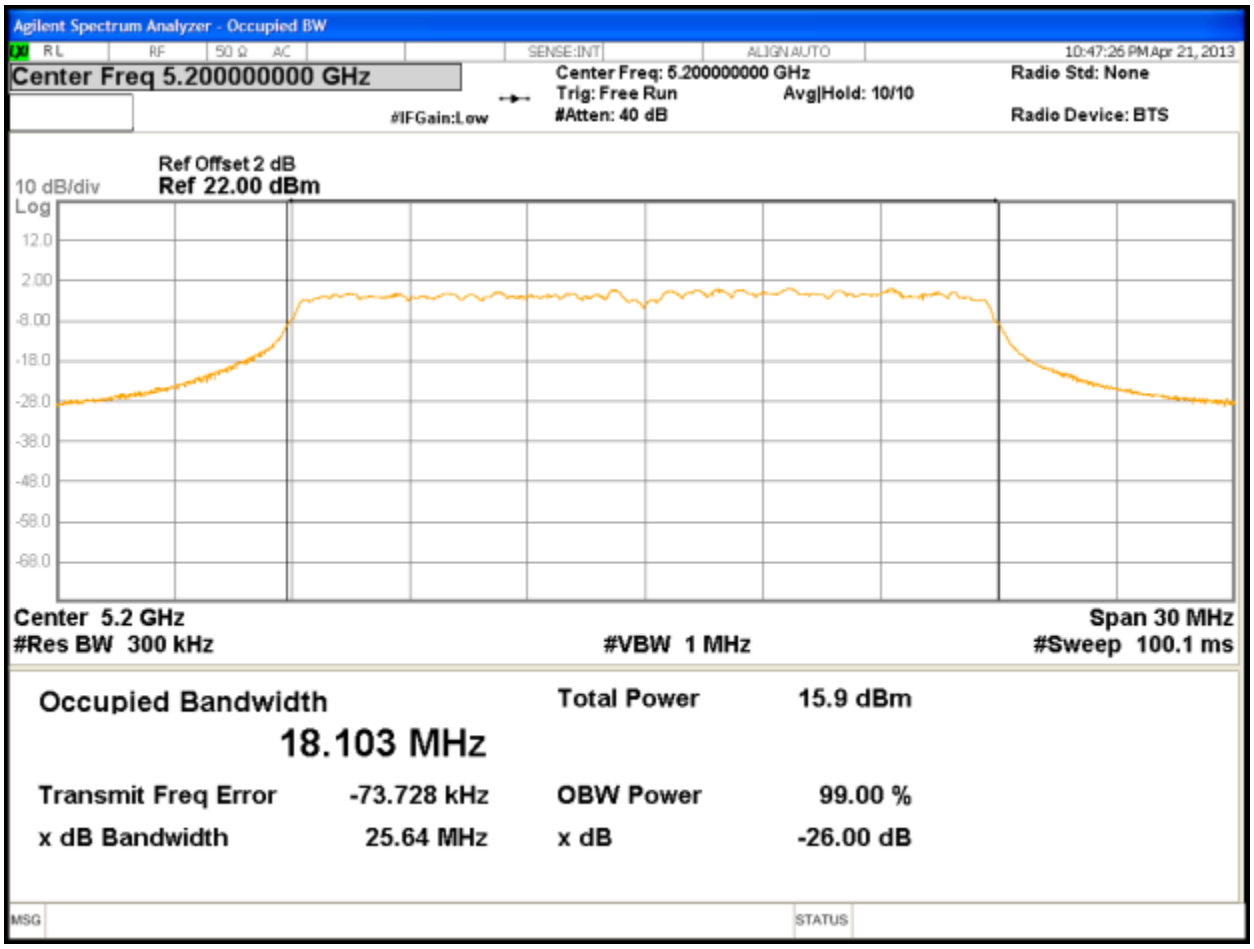


Figure 51: 26 dB and 99% Bandwidth at HT20, 5200 MHz, Chain 2

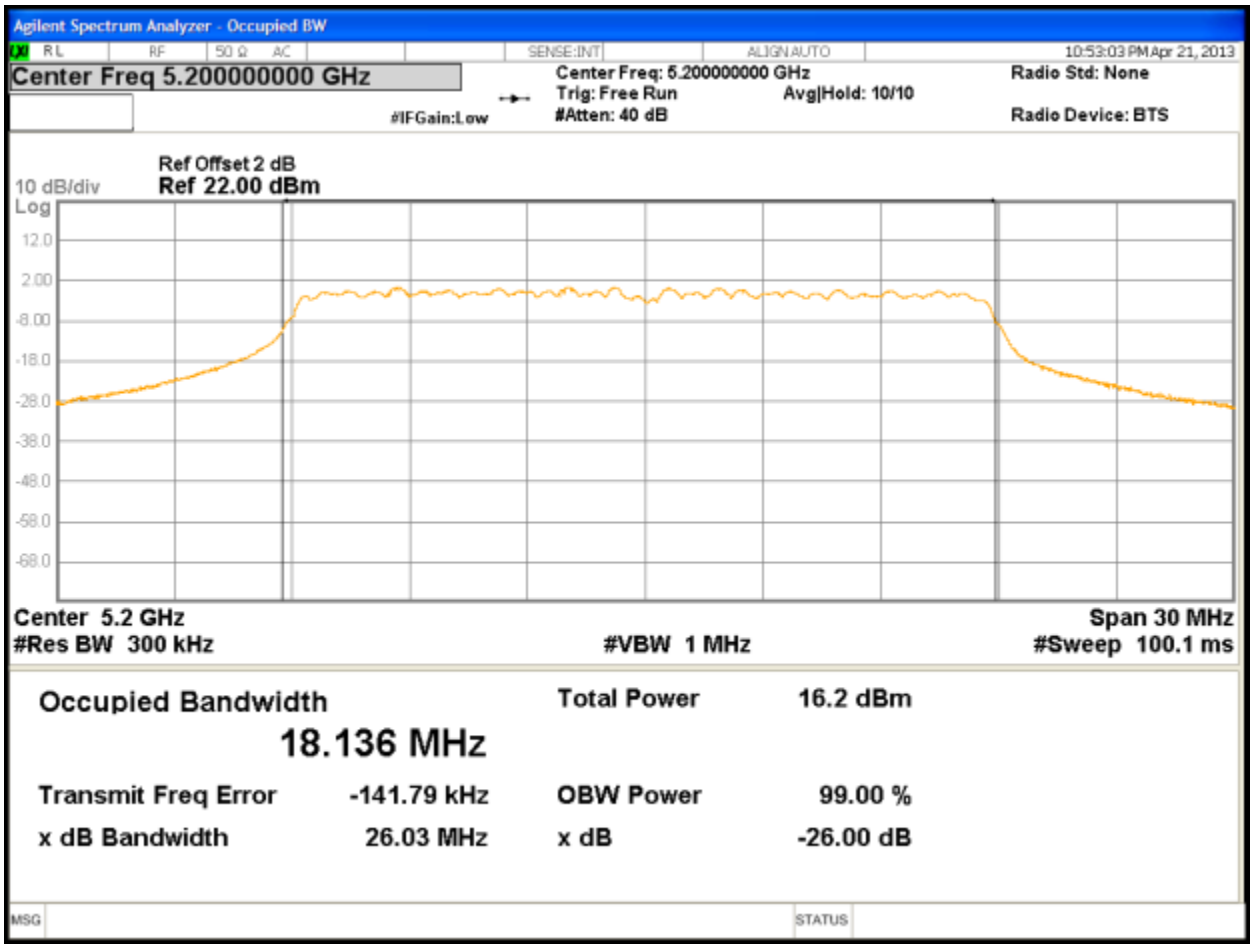


Figure 52: 26 dB and 99% Bandwidth at HT20, 5200 MHz, Chain 3

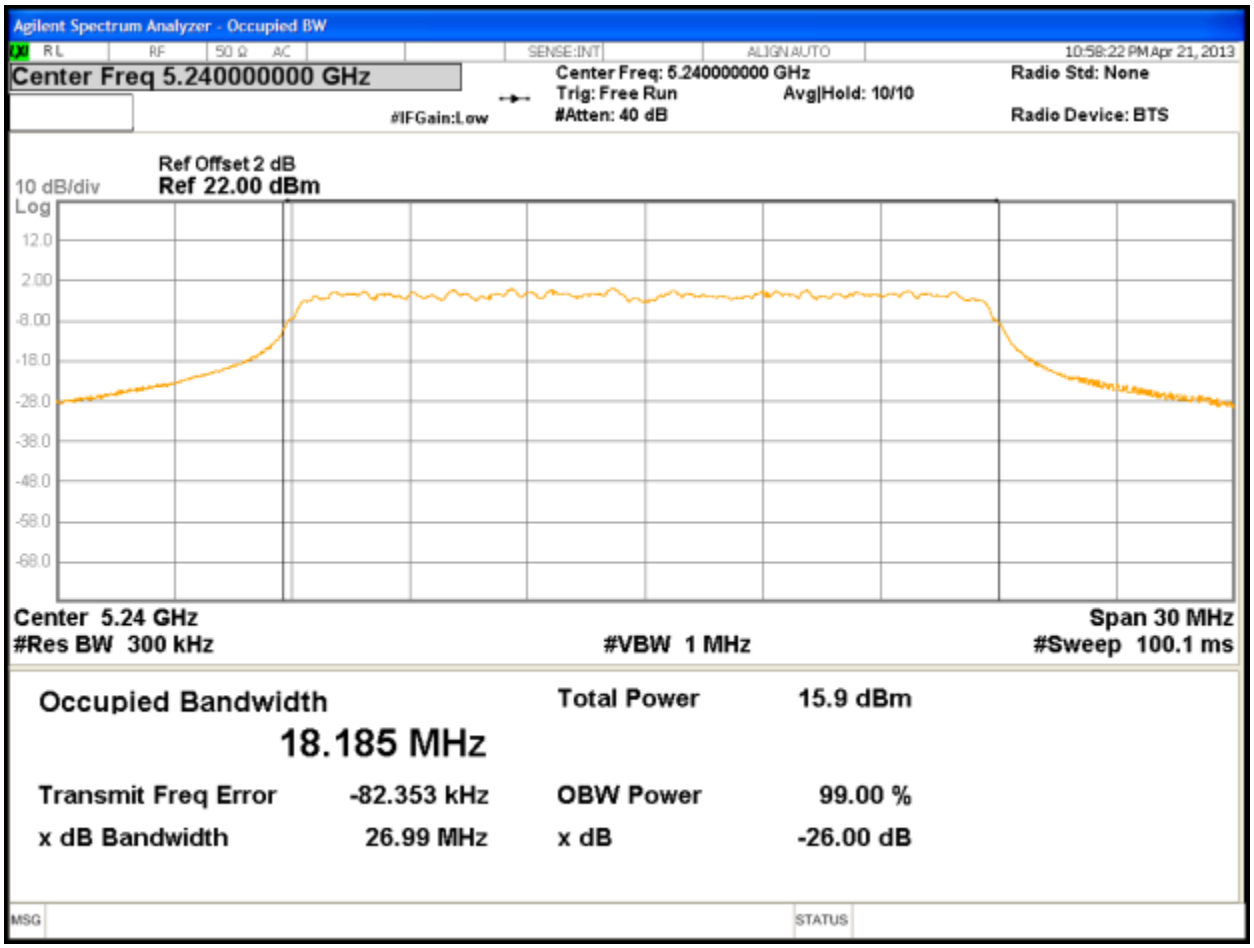


Figure 53: 26 dB and 99% Bandwidth at HT20, 5240 MHz, Chain 0

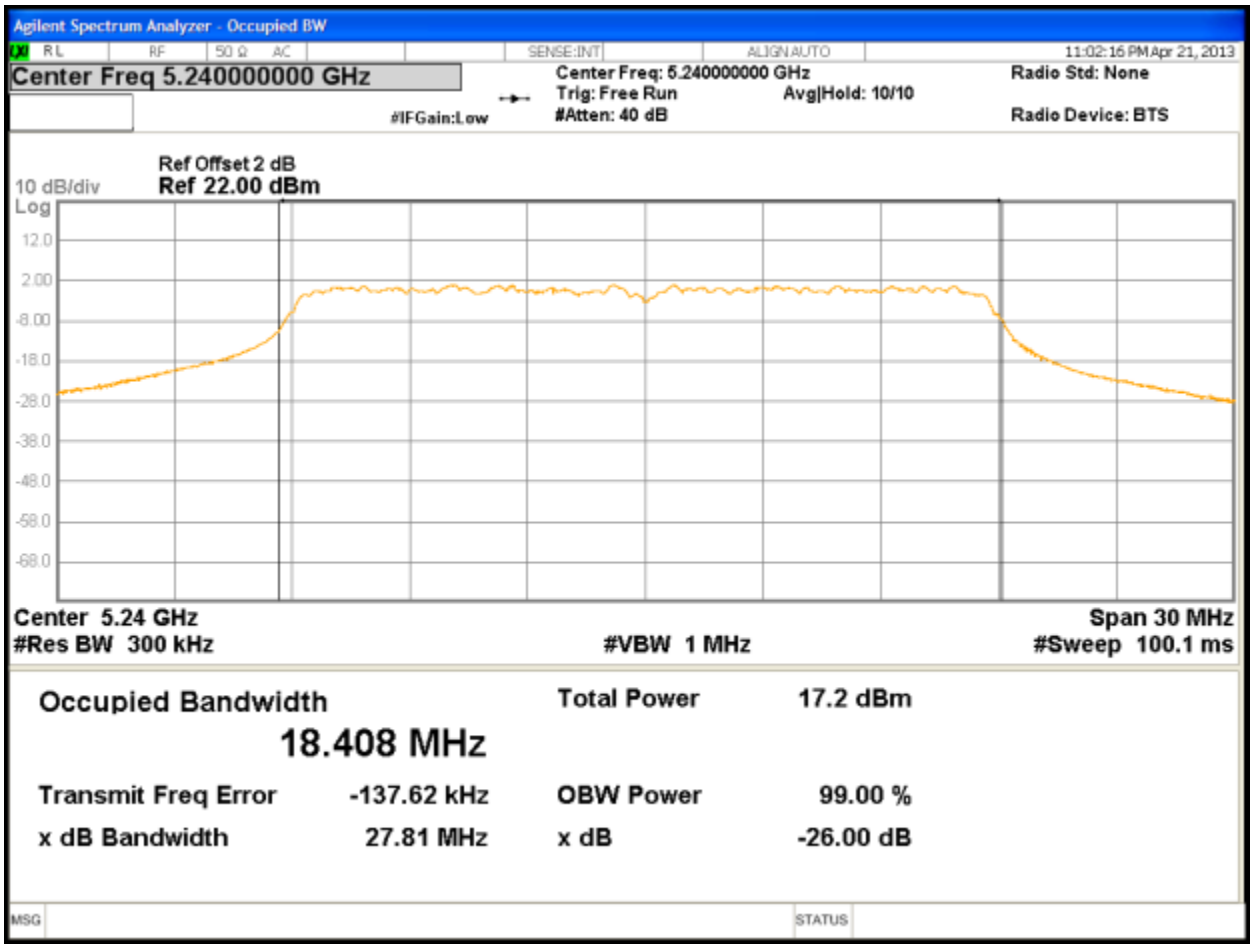


Figure 54: 26 dB and 99% Bandwidth at HT20, 5240 MHz, Chain 1

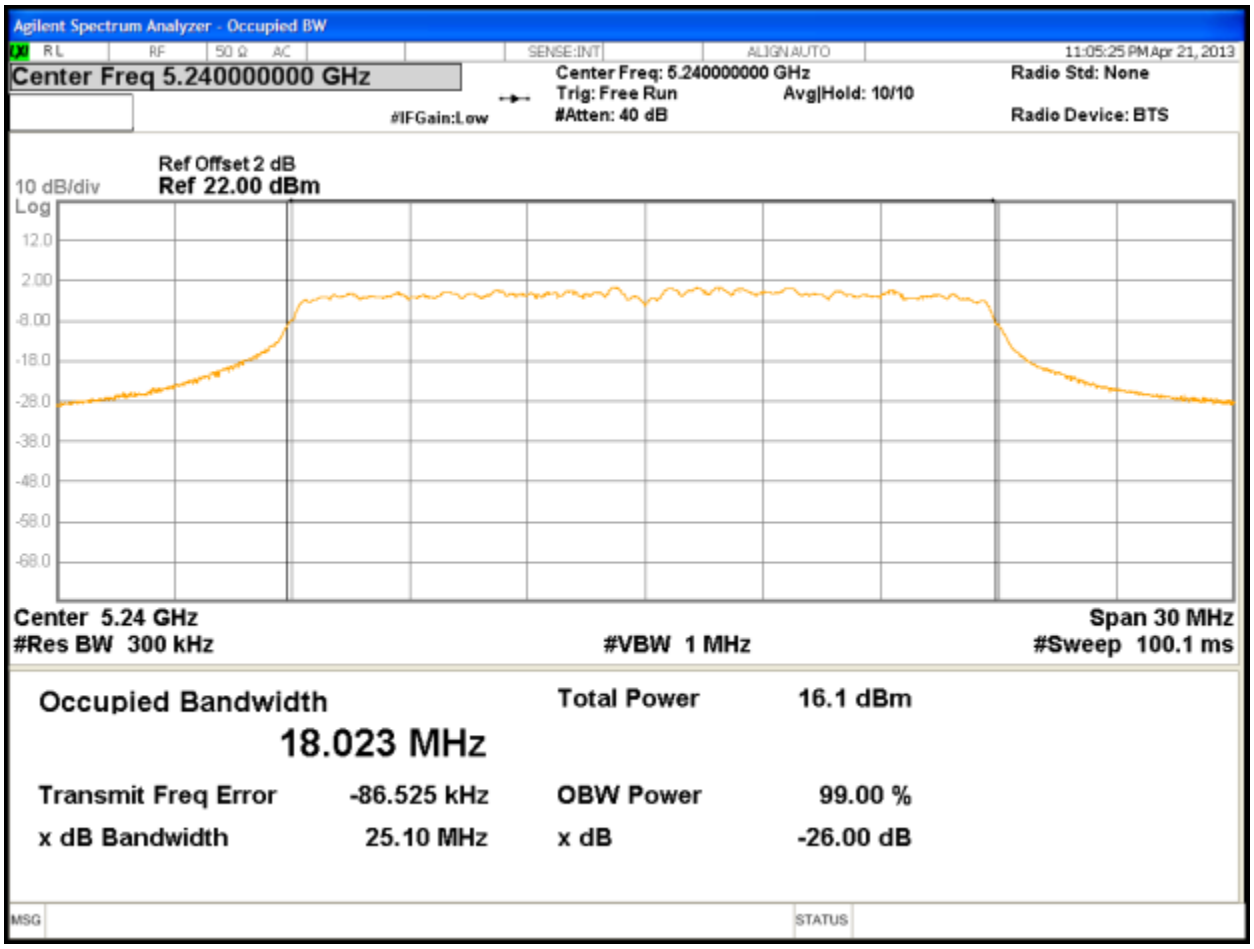


Figure 55: 26 dB and 99% Bandwidth at HT20, 5240 MHz, Chain 2

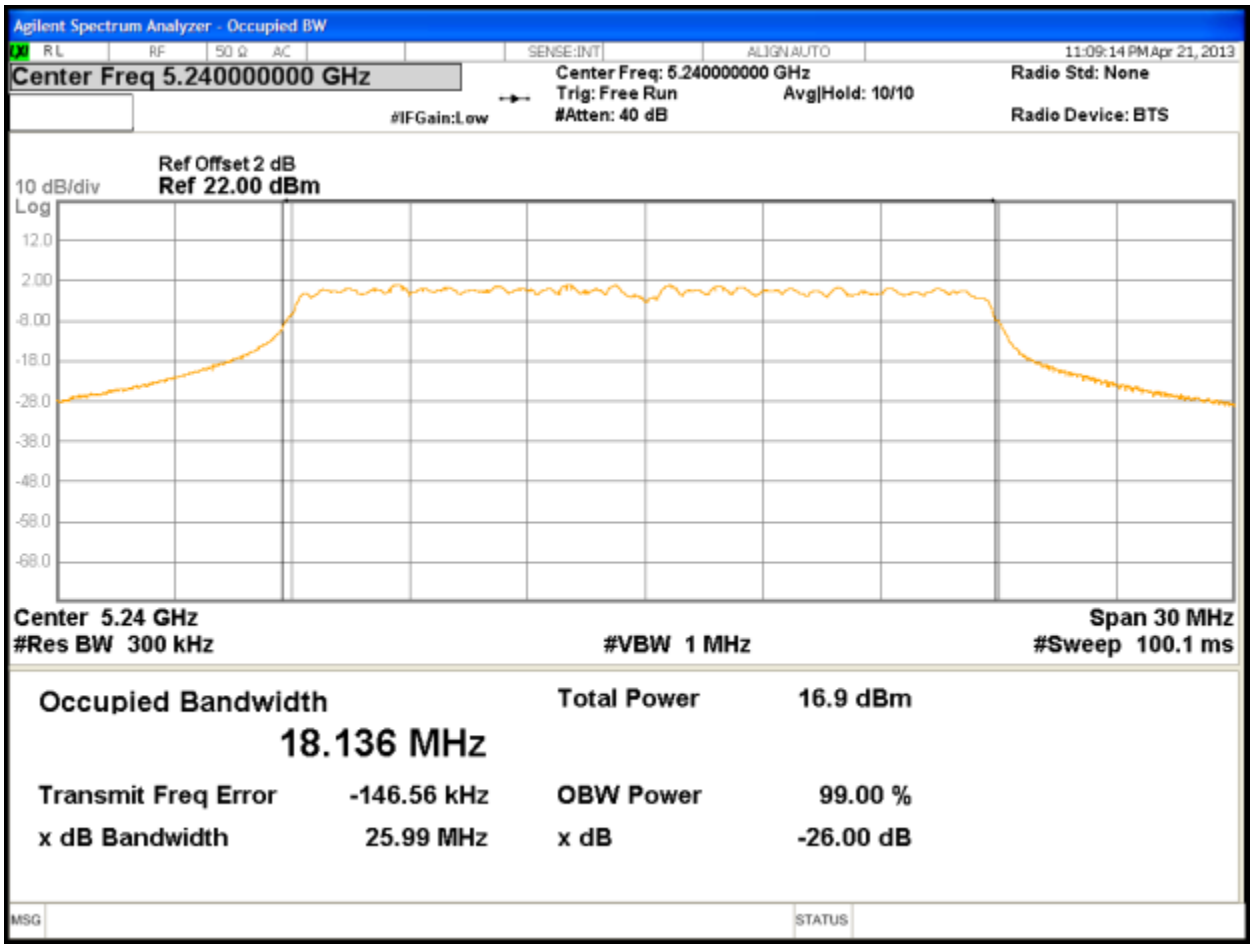


Figure 56: 26 dB and 99% Bandwidth at HT20, 5240 MHz, Chain 3

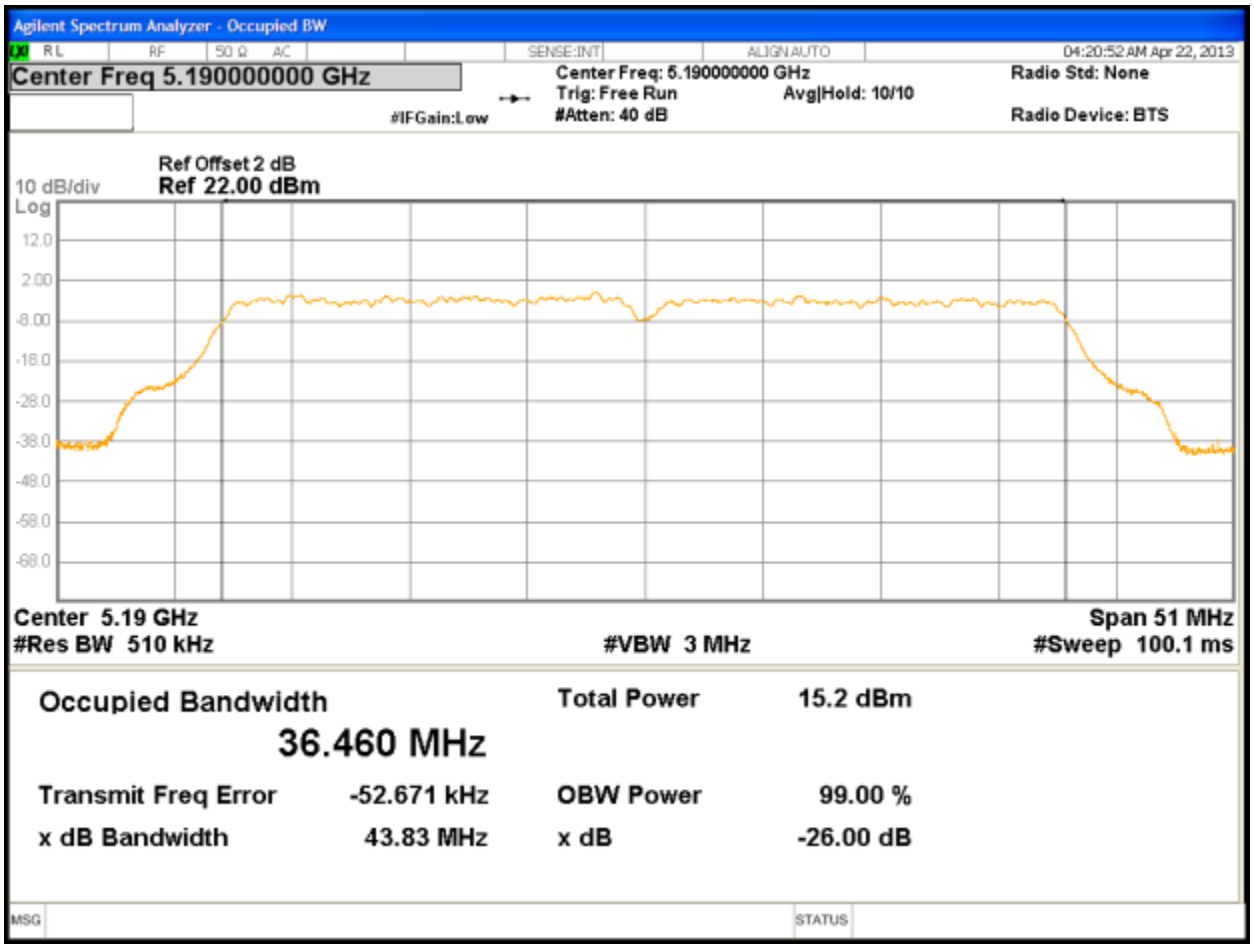


Figure 57: 26 dB and 99% Bandwidth at HT40, 5190 MHz, Chain 0

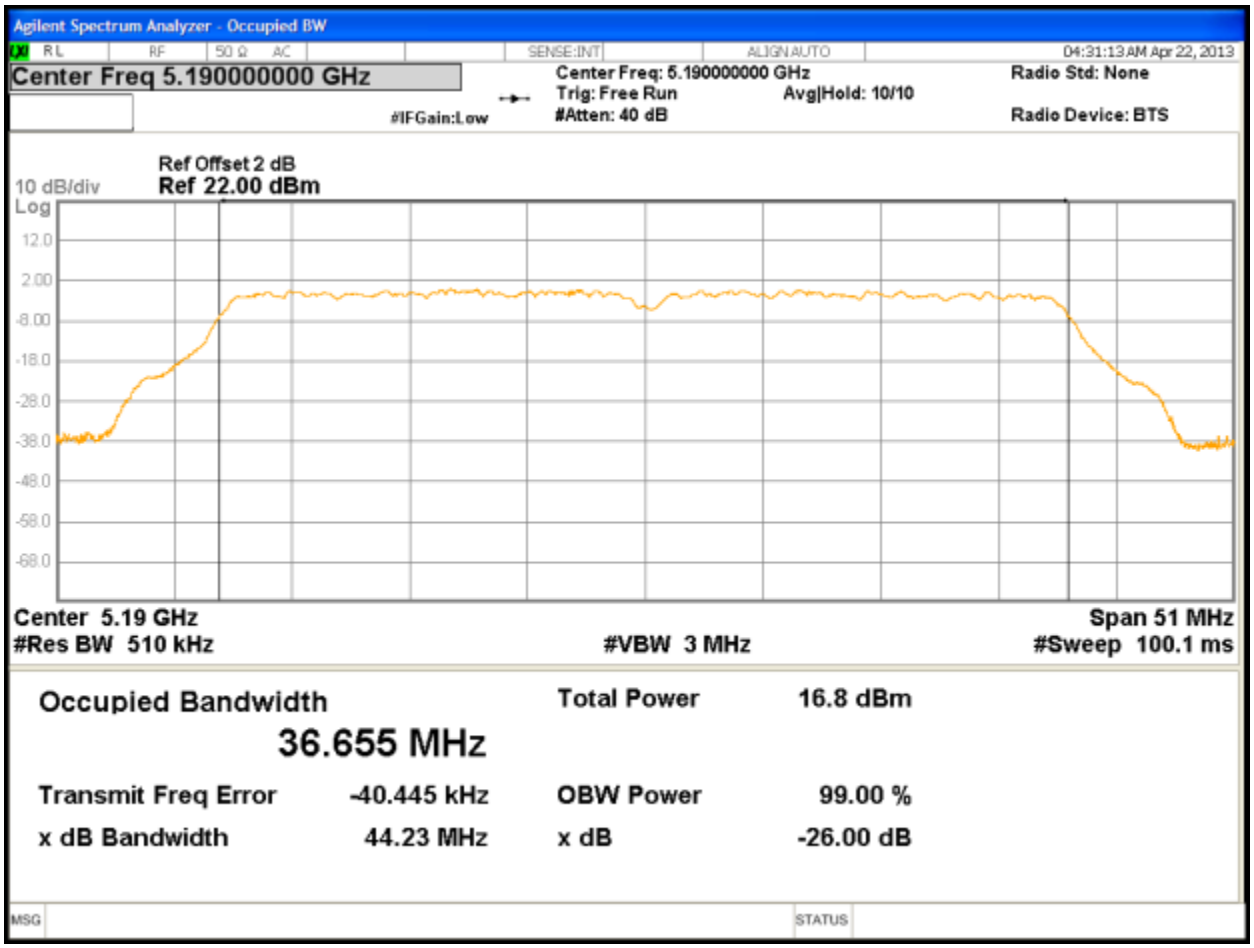


Figure 58: 26 dB and 99% Bandwidth at HT40, 5190 MHz, Chain 1

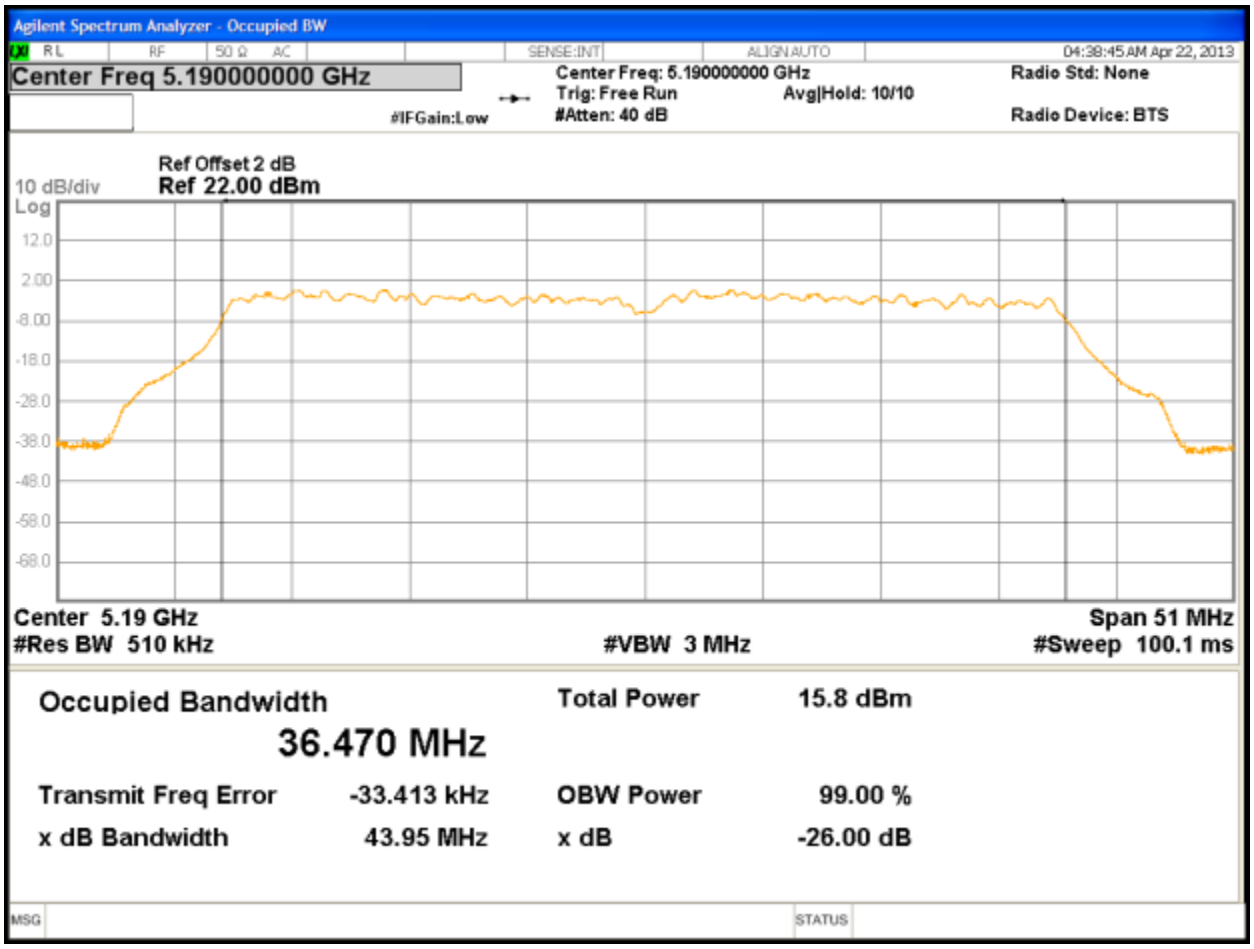


Figure 59: 26 dB and 99% Bandwidth at HT40, 5190 MHz, Chain 2

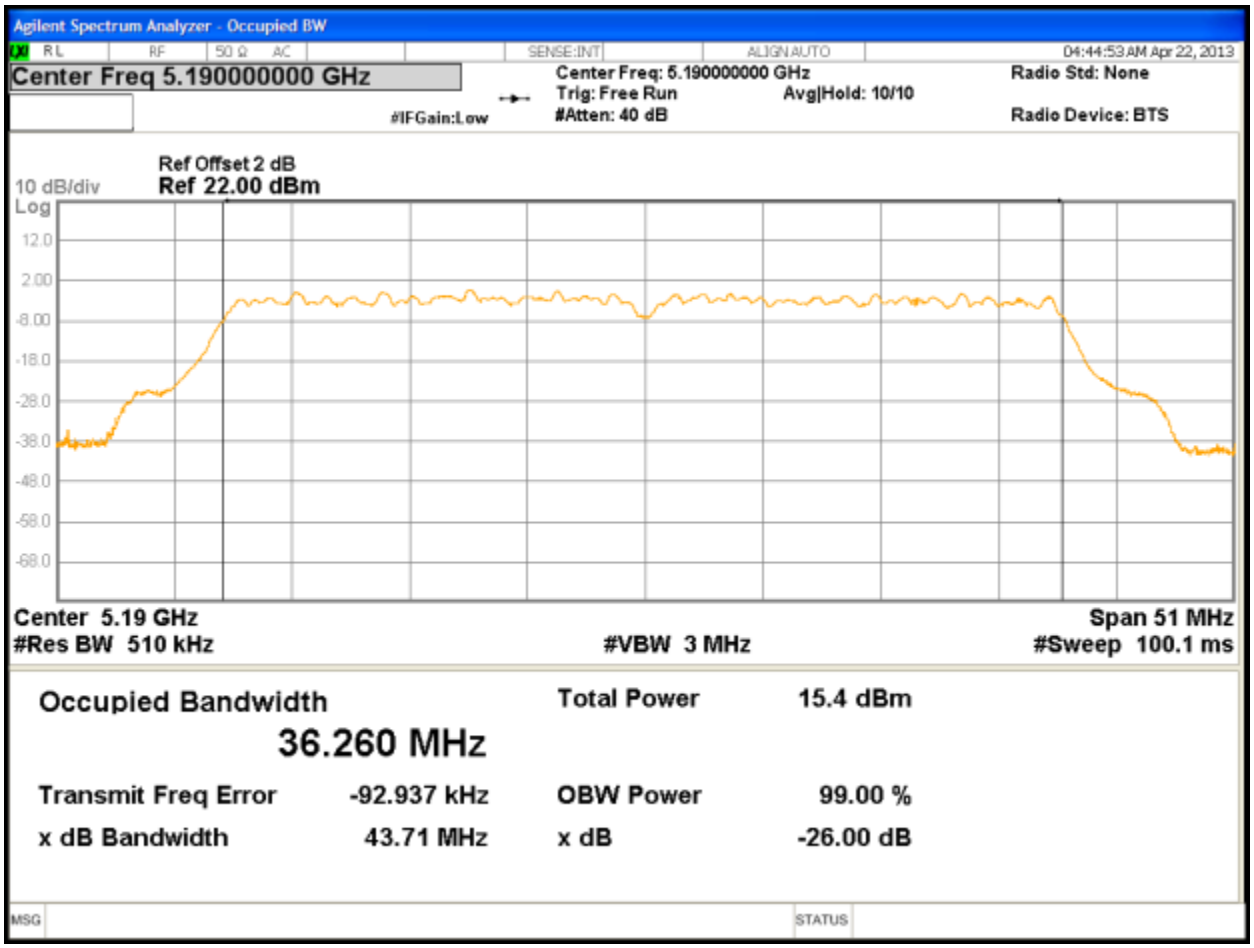


Figure 60: 26 dB and 99% Bandwidth at HT40, 5190 MHz, Chain 3

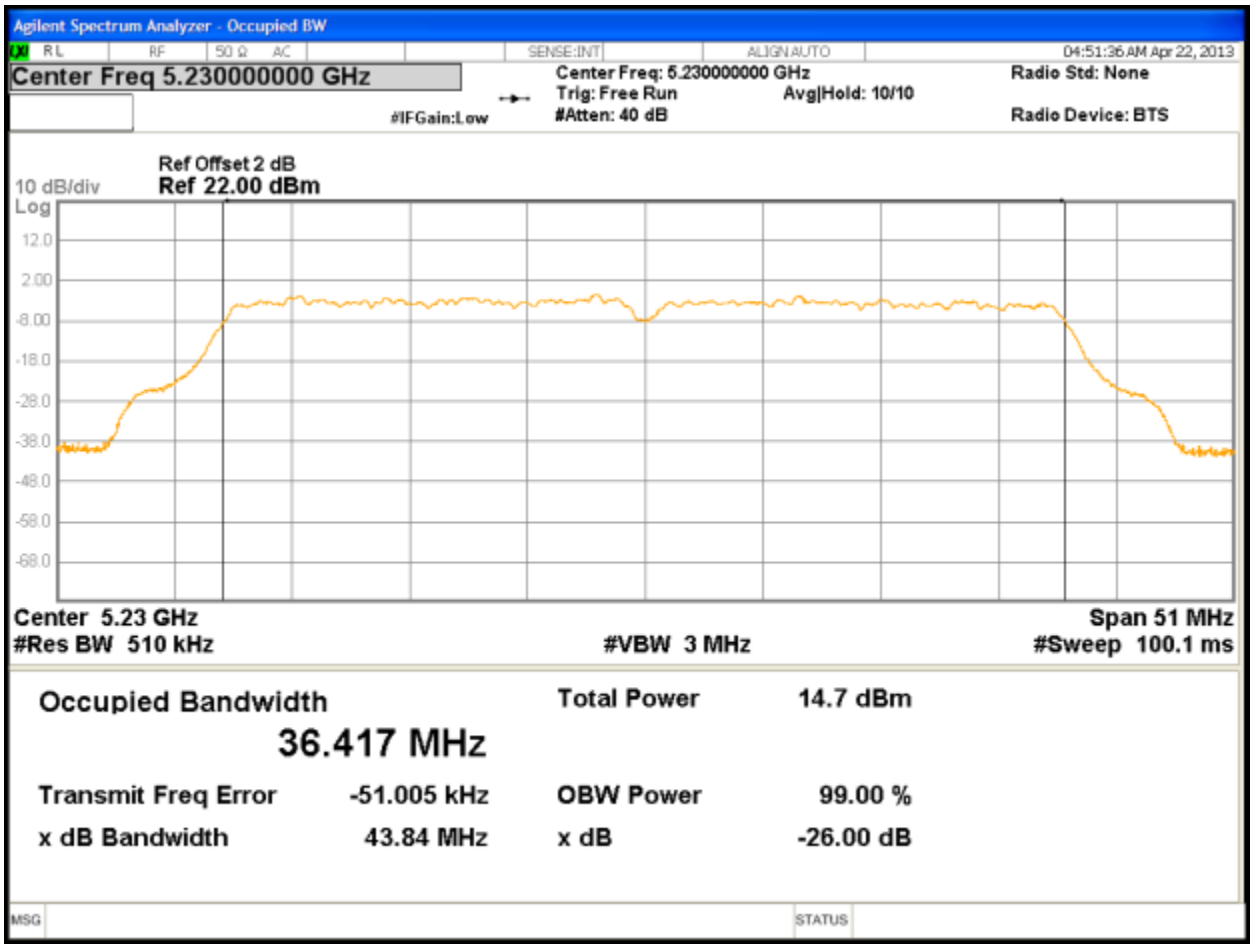


Figure 61: 26 dB and 99% Bandwidth at HT40, 5230 MHz, Chain 0

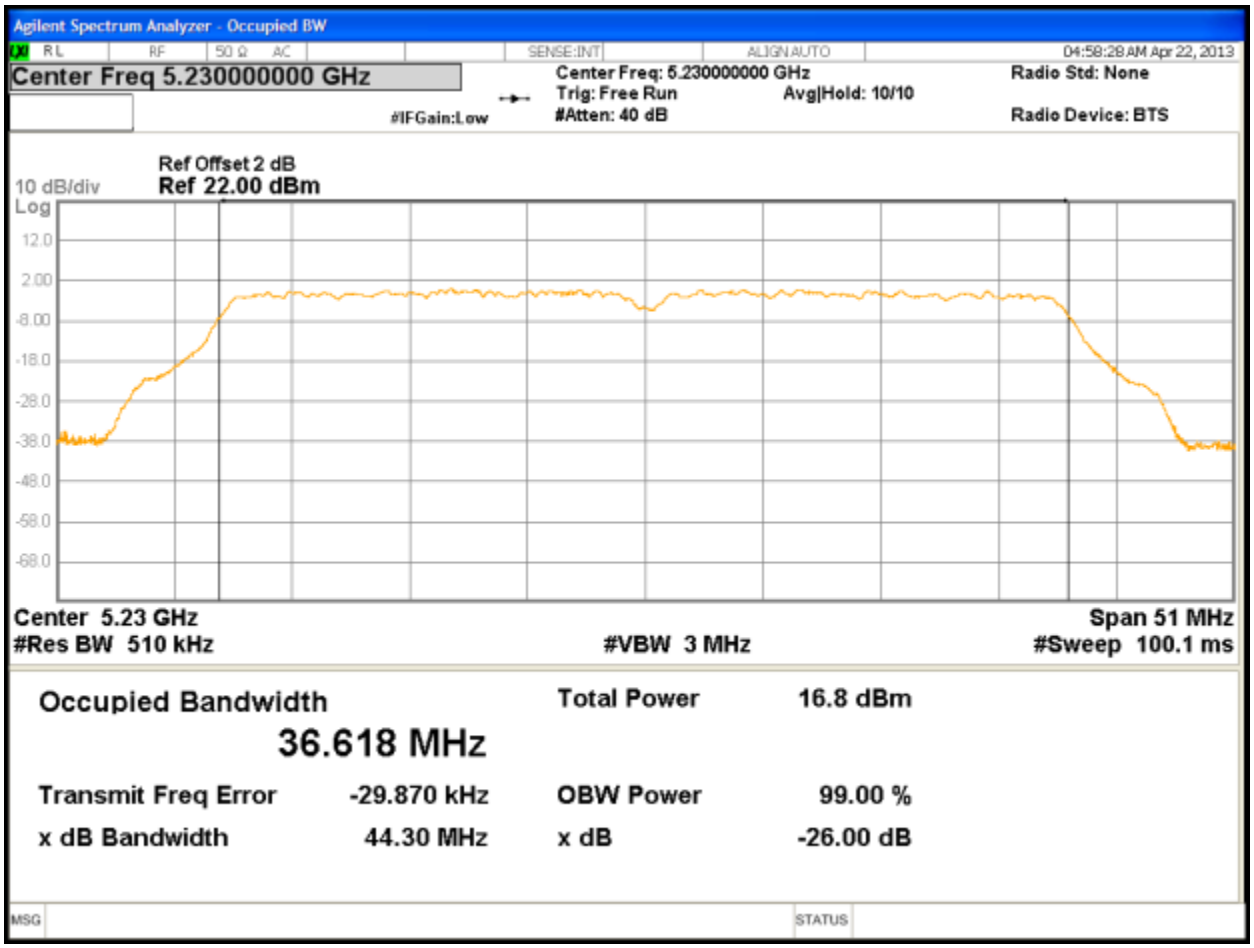


Figure 62: 26 dB and 99% Bandwidth at HT40, 5230 MHz, Chain 1

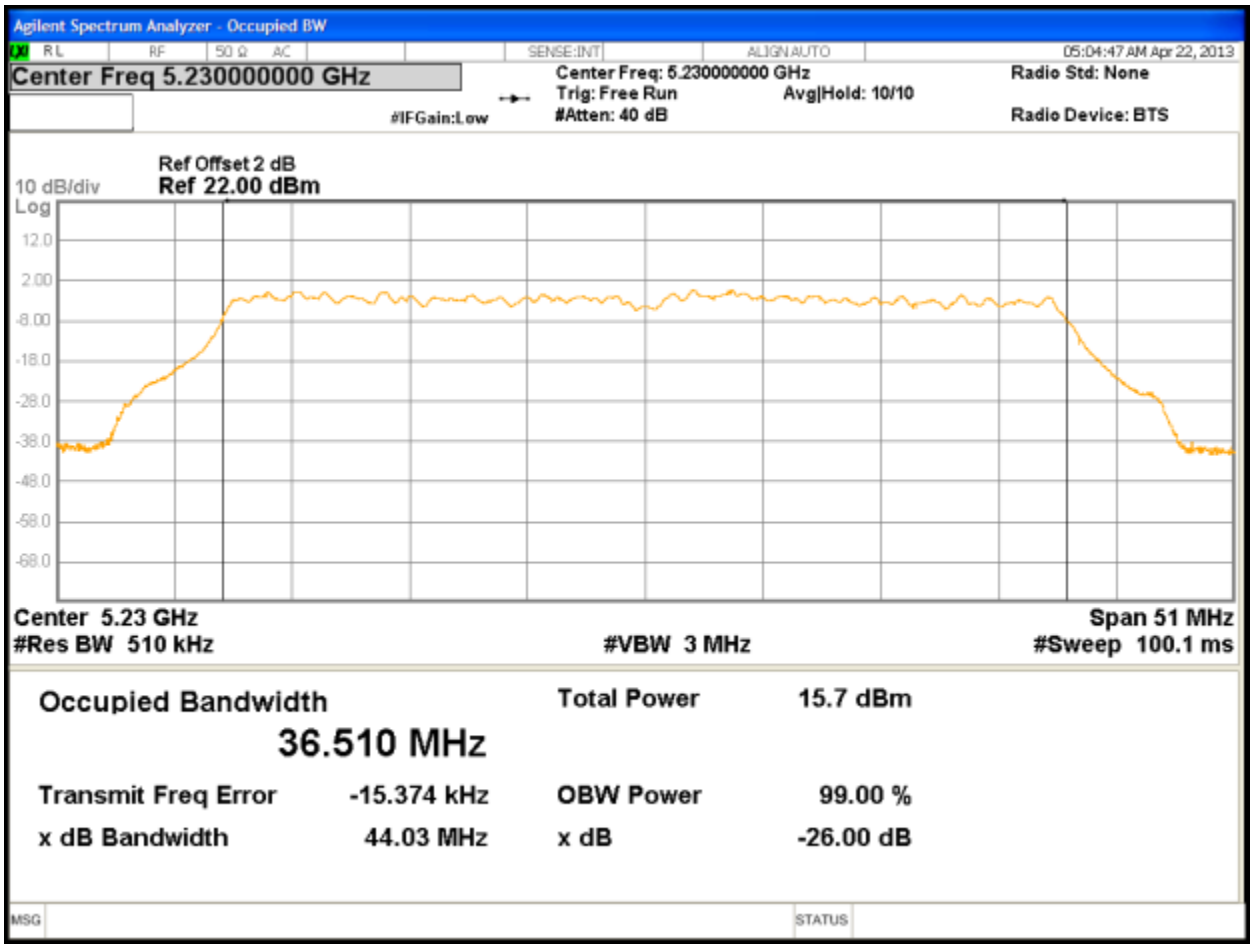


Figure 63: 26 dB and 99% Bandwidth at HT40, 5230 MHz, Chain 2

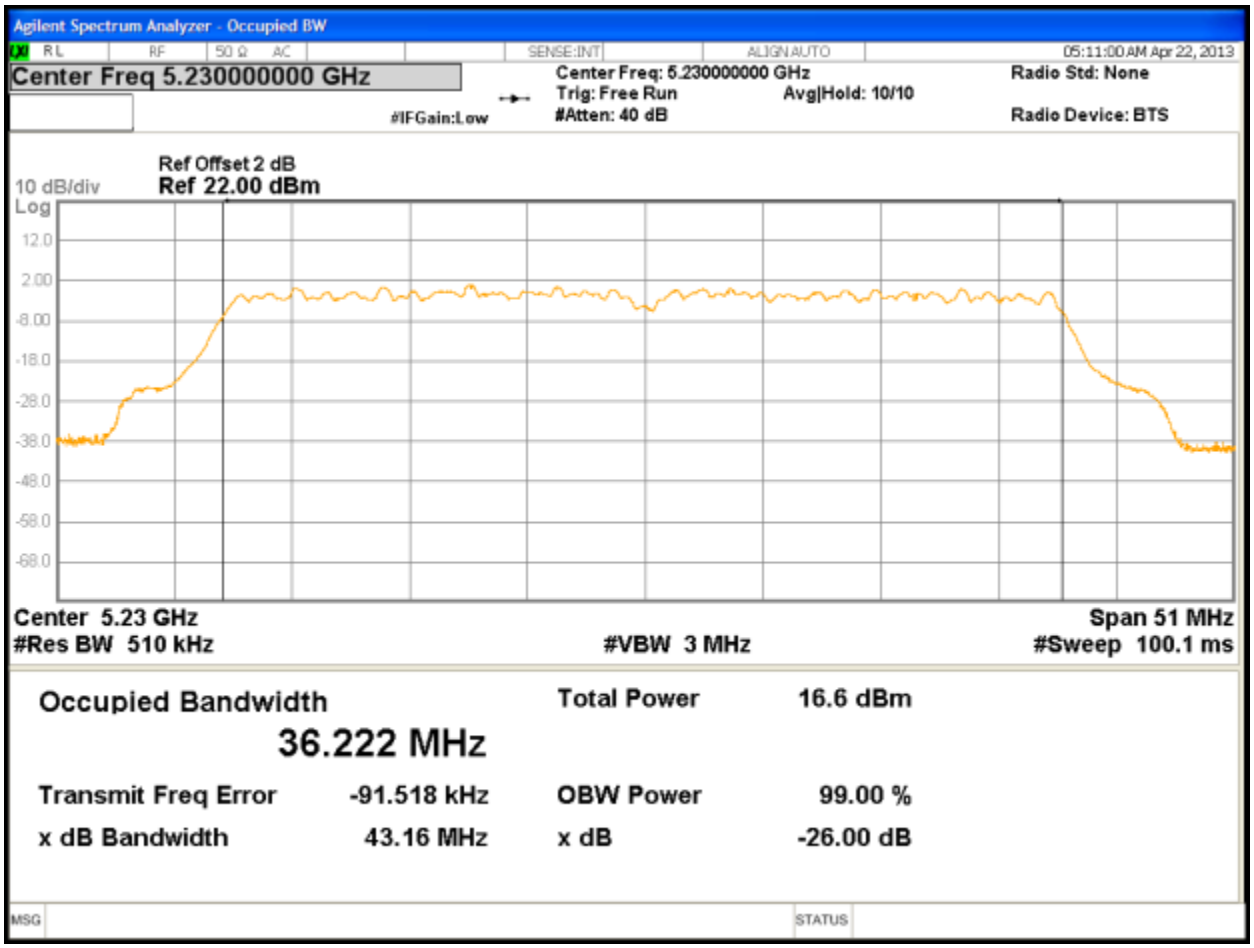


Figure 64: 26 dB and 99% Bandwidth at HT40, 5230 MHz, Chain 3

4.3 Peak Excursion

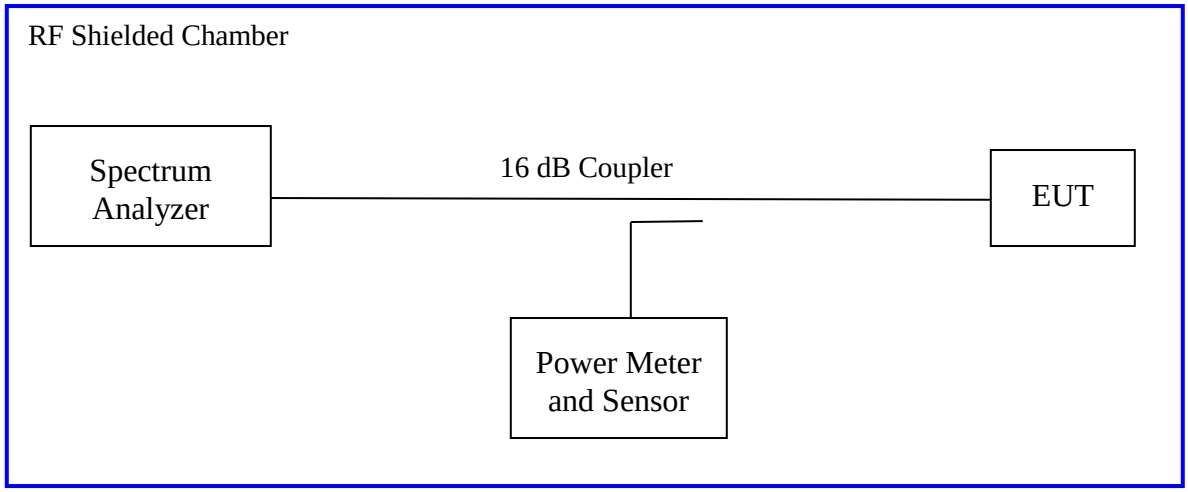
According to the CFR47 Part 15.407 (a)(6), the ratio of the peak excursion of the modulation envelope(measured suing a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

4.3.1 Test Method

The ANSI C63.10-2009 Section 6.10.4 conducted method was used to measure the peak excursion.

The measurement was performed with modulation per CFR47 Part 15.407 (a) (6) This test was conducted on 3 channels in each operating frequency range of 5150 MHz to 5250 MHz. The worst sample result indicated below.

Test Setup:



4.3.2 Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 5: Peak Excursion – Test Results

Test Conditions: Conducted Measurement, Normal Temperature						
Antenna Type: Integrated			**Power Setting:** see test plan			
Max. Directional Gain: + 8 dBi			**Signal State:** Modulated at 100%.			
Ambient Temp.: 23° C			**Relative Humidity:**32%			
802.11a Mode						
Operating Channel	**Limit [dB]**	**Ch0 [dB]**	**Ch1 [dB]**	**Ch2 [dB]**	**Ch3 [dB]**	**Margin [dB]**
5180	13.0	-6.52	-6.91	-7.56	-7.49	-5.44
5200	13.0	-7.21	-7.03	-7.44	-7.41	-5.56
5240	13.0	-7.16	-7.12	-7.66	-7.49	-5.34
Note: The peak excursion was observed at 802.11a 6 Mbps per Data Stream.						
802.11n (HT20) Mode						
Operating Channel	**Limit [dB]**	**Ch0 [dB]**	**Ch1 [dB]**	**Ch2 [dB]**	**Ch3 [dB]**	**Margin [dB]**
5180	13.0	7.58	7.58	7.80	7.81	-5.19
5200	13.0	7.48	7.67	7.72	8.27	-4.73
5240	13.0	7.17	7.42	8.29	8.36	-4.64
Note: The peak excursion was observed at HT20 6.5 Mbps per Data Stream.						
802.11n (HT40) Mode						
Operating Channel	**Limit [dB]**	**Ch0 [dB]**	**Ch1 [dB]**	**Ch2 [dB]**	**Ch3 [dB]**	**Margin [dB]**
5190	13.0	7.19	7.21	7.61	7.75	-5.25
5230	13.0	7.33	7.10	7.32	8.41	-4.59
Note: The peak excursion was observed at HT40 13.5 Mbps per Data Stream						

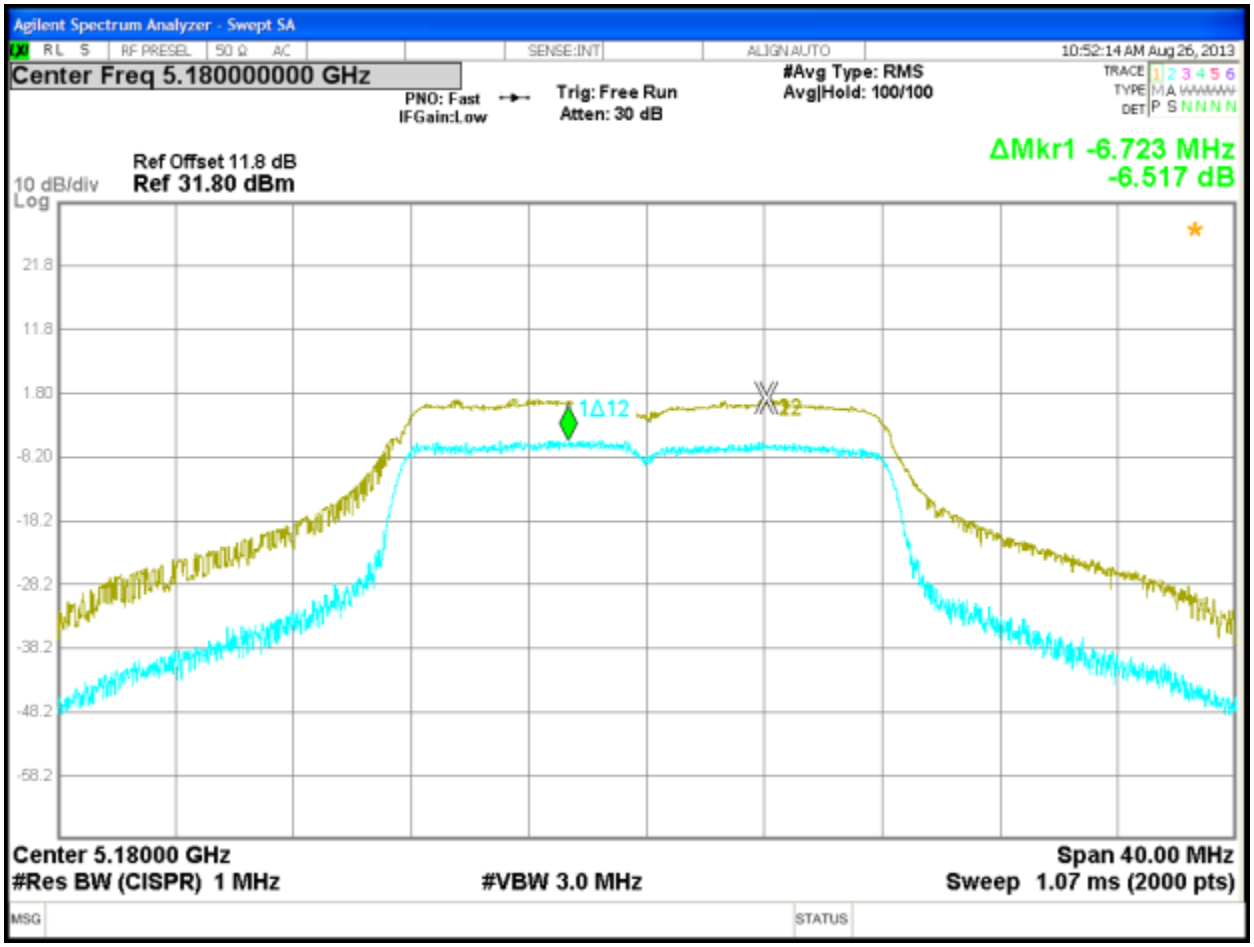


Figure 65: Peak Excursion, 5180 MHz at 802.11a, Chain 0 – 6 Mbps

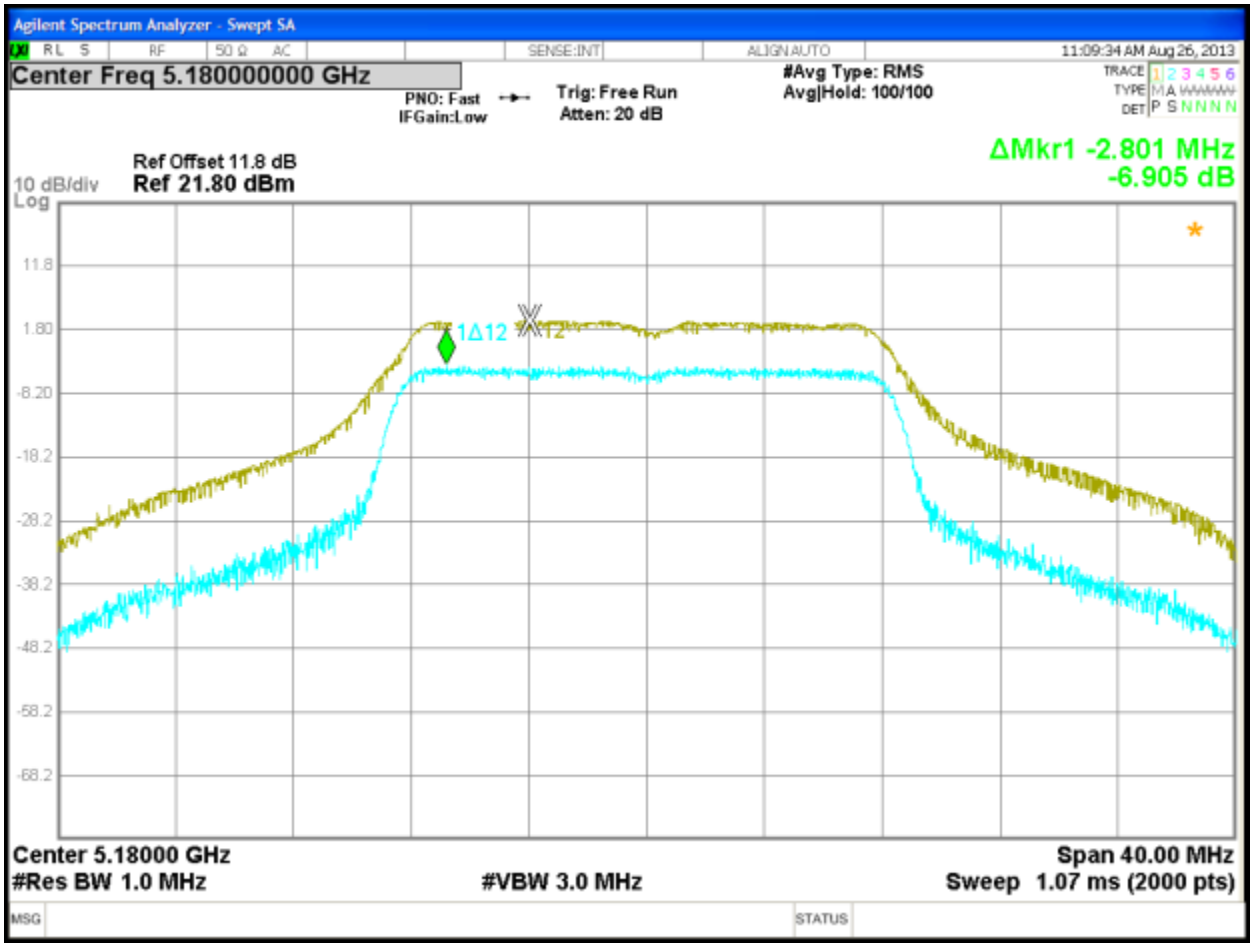


Figure 66: Peak Excursion, 5180 MHz at 802.11a, Chain 1 – 6 Mbps

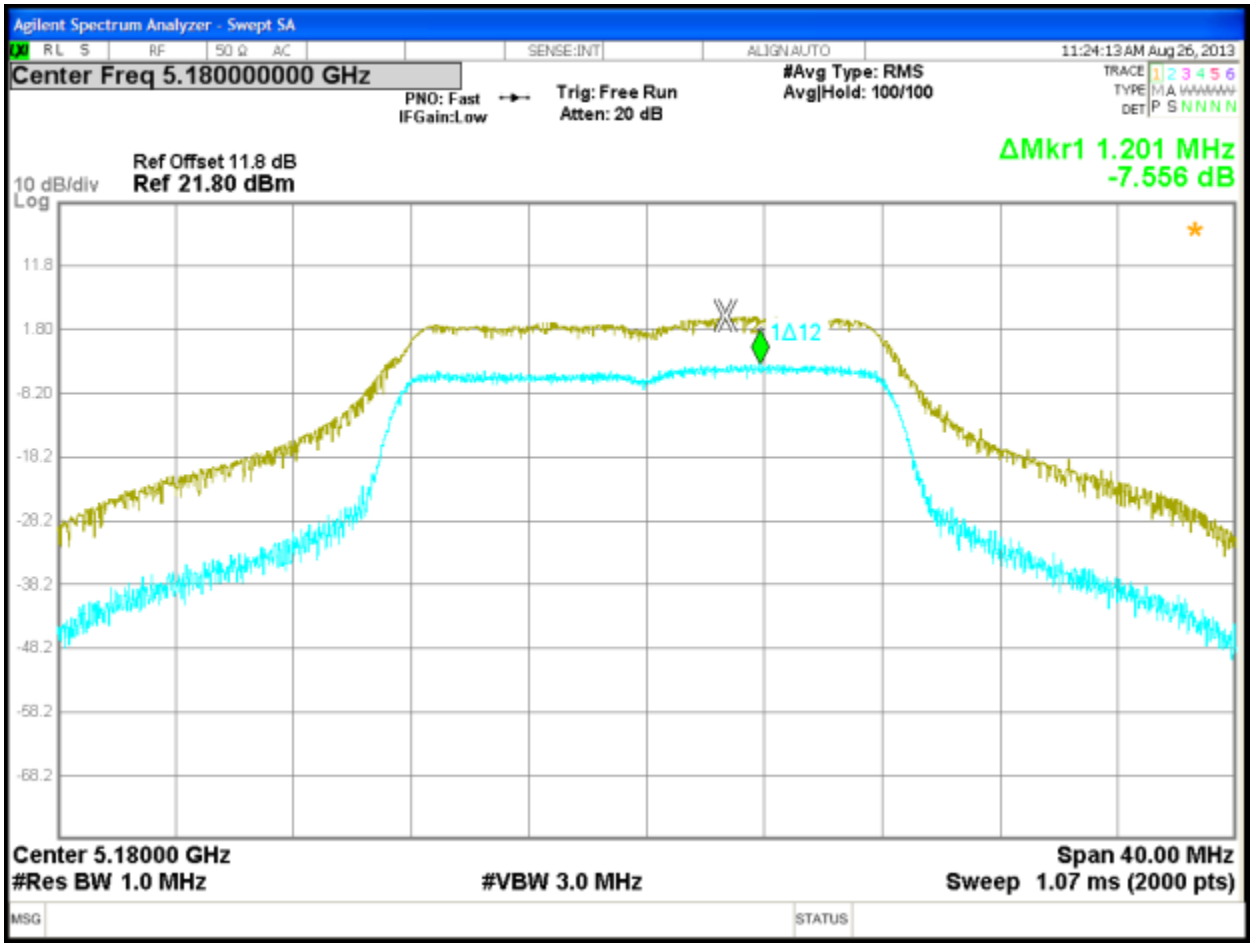


Figure 67: Peak Excursion, 5180 MHz at 802.11a, Chain 2 – 6 Mbps

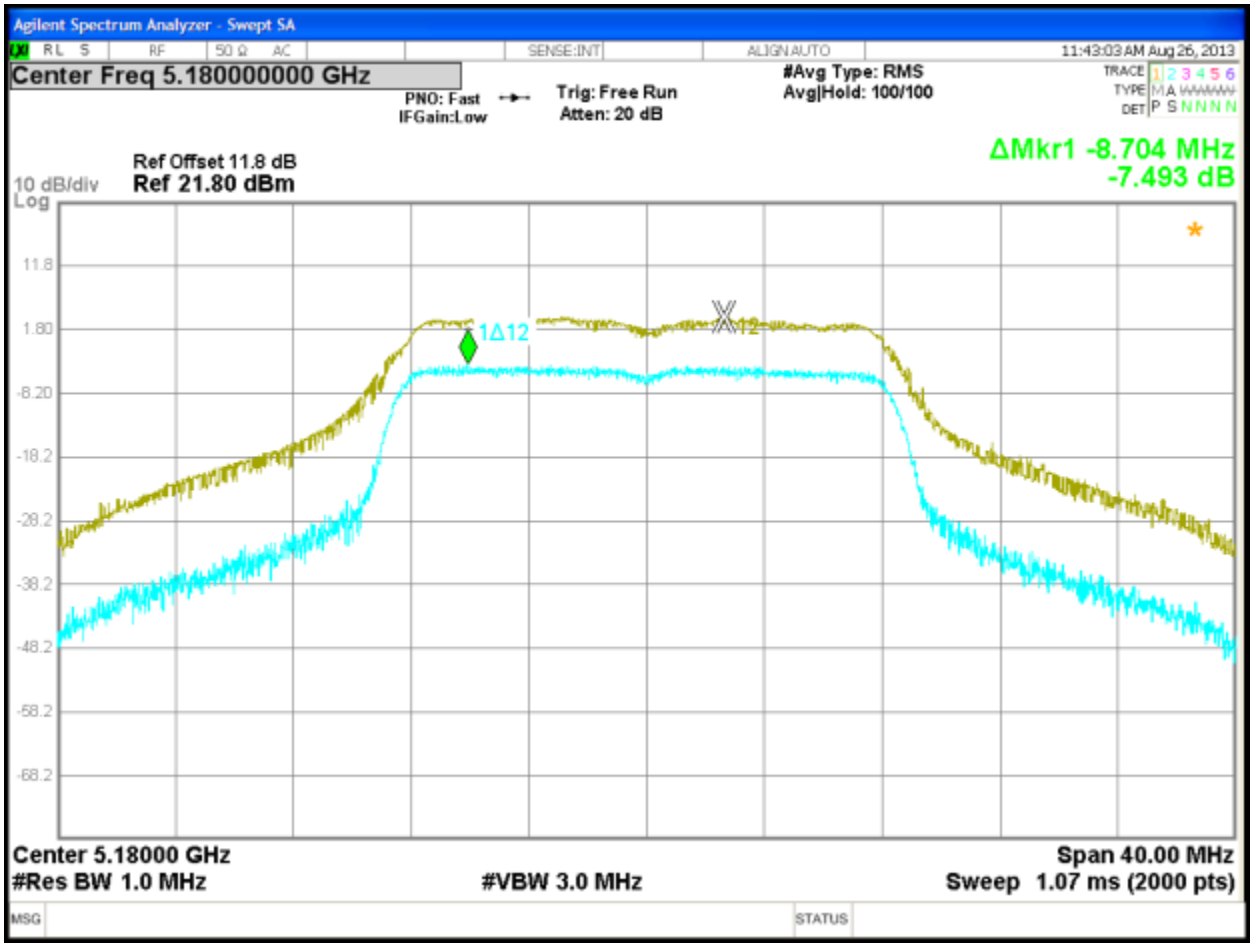


Figure 68: Peak Excursion, 5180 MHz at 802.11a, Chain 3 – 6 Mbps

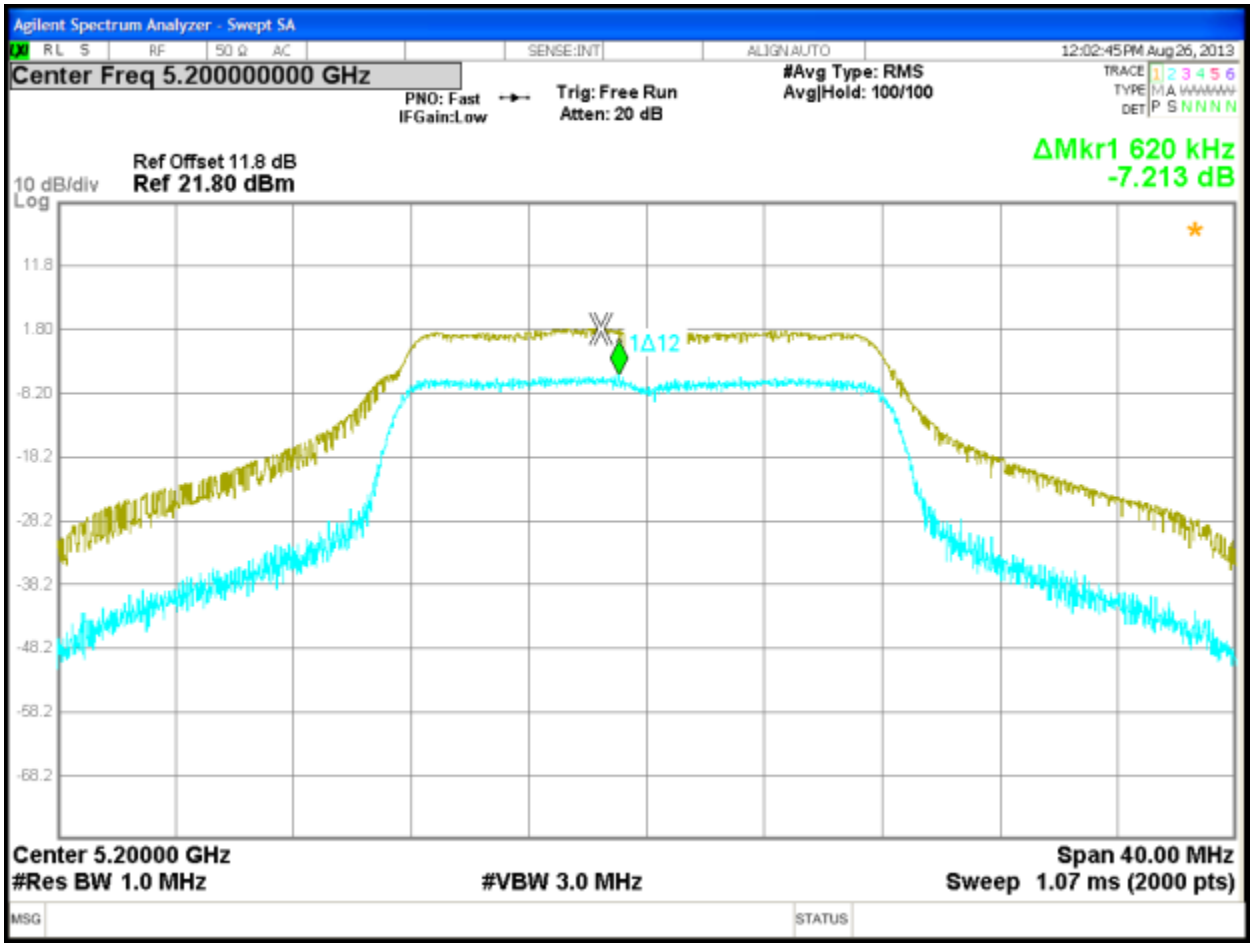


Figure 69: Peak Excursion, 5200 MHz at 802.11a, Chain 0 – 6 Mbps

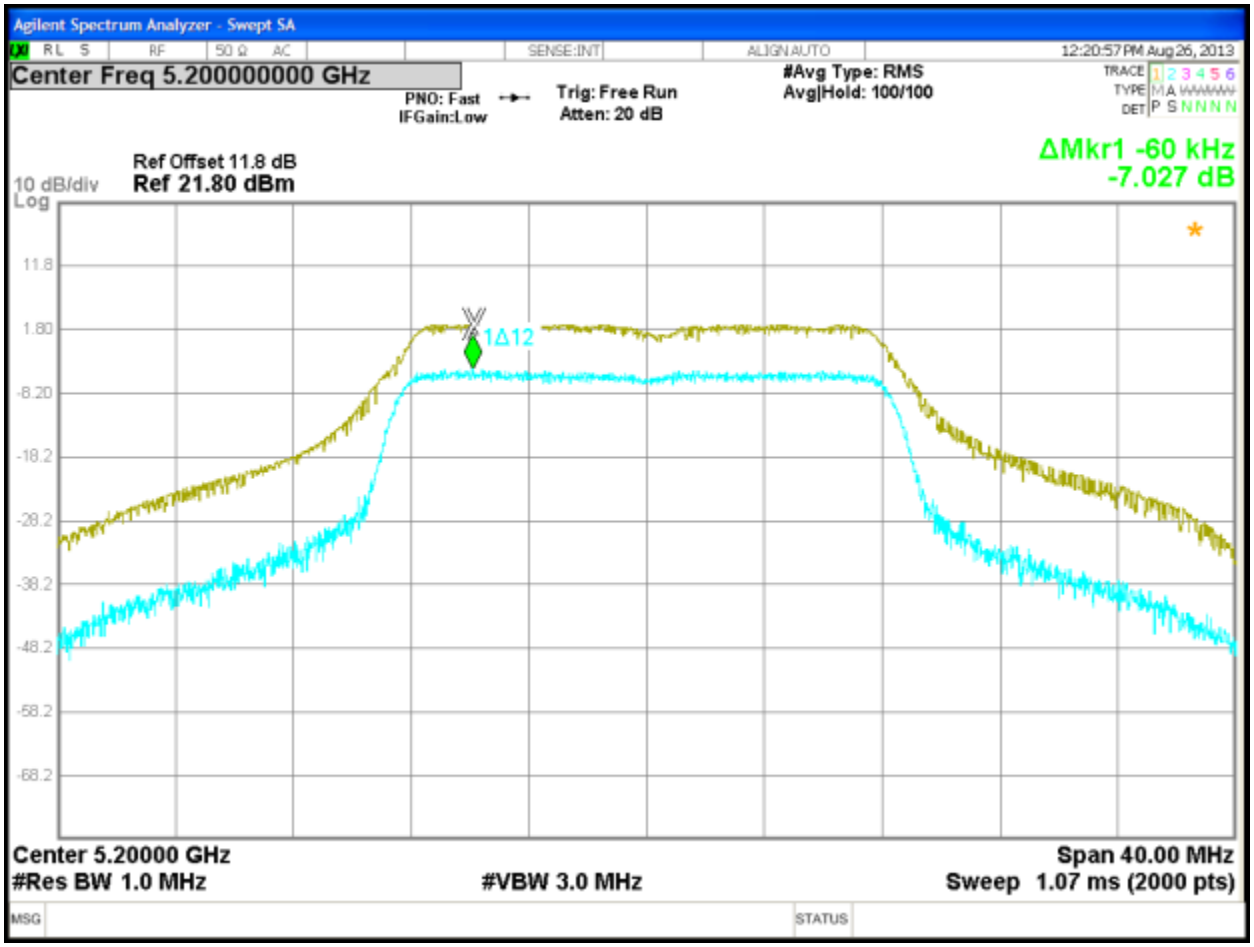


Figure 70: Peak Excursion, 5200 MHz at 802.11a, Chain 1 – 6 Mbps

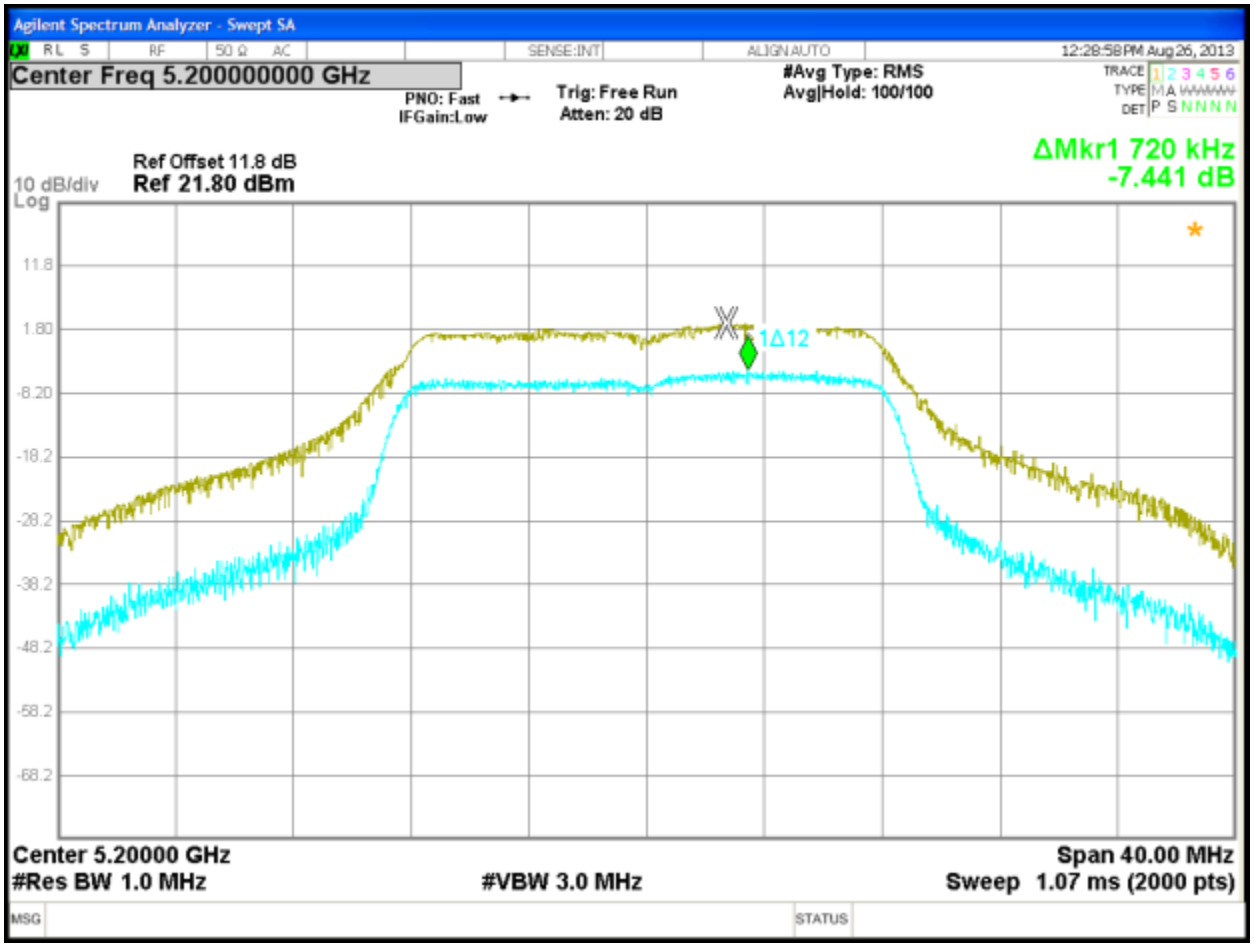


Figure 71: Peak Excursion, 5200 MHz at 802.11a, Chain 2 – 6 Mbps

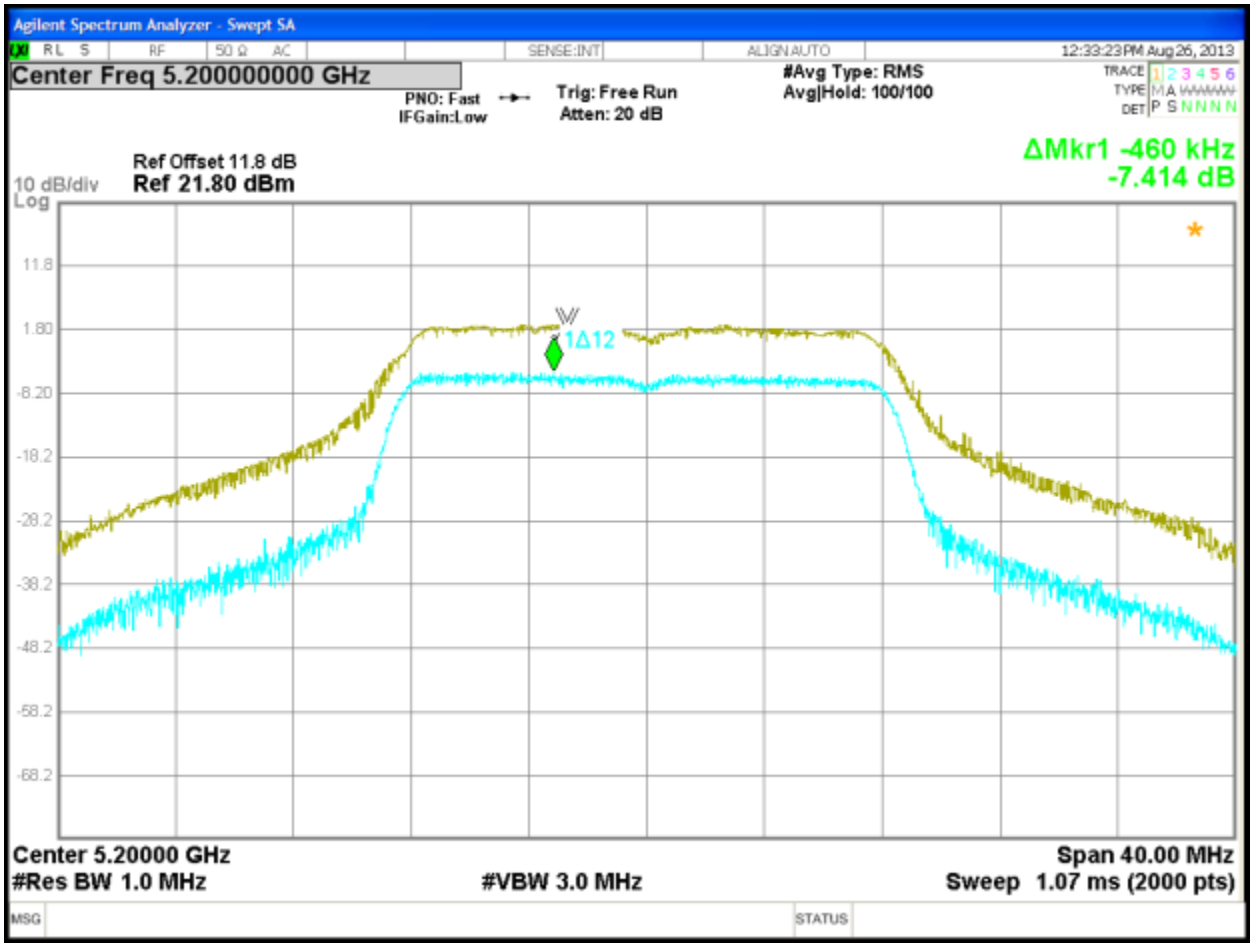


Figure 72: Peak Excursion, 5200 MHz at 802.11a, Chain 1 – 6 Mbps

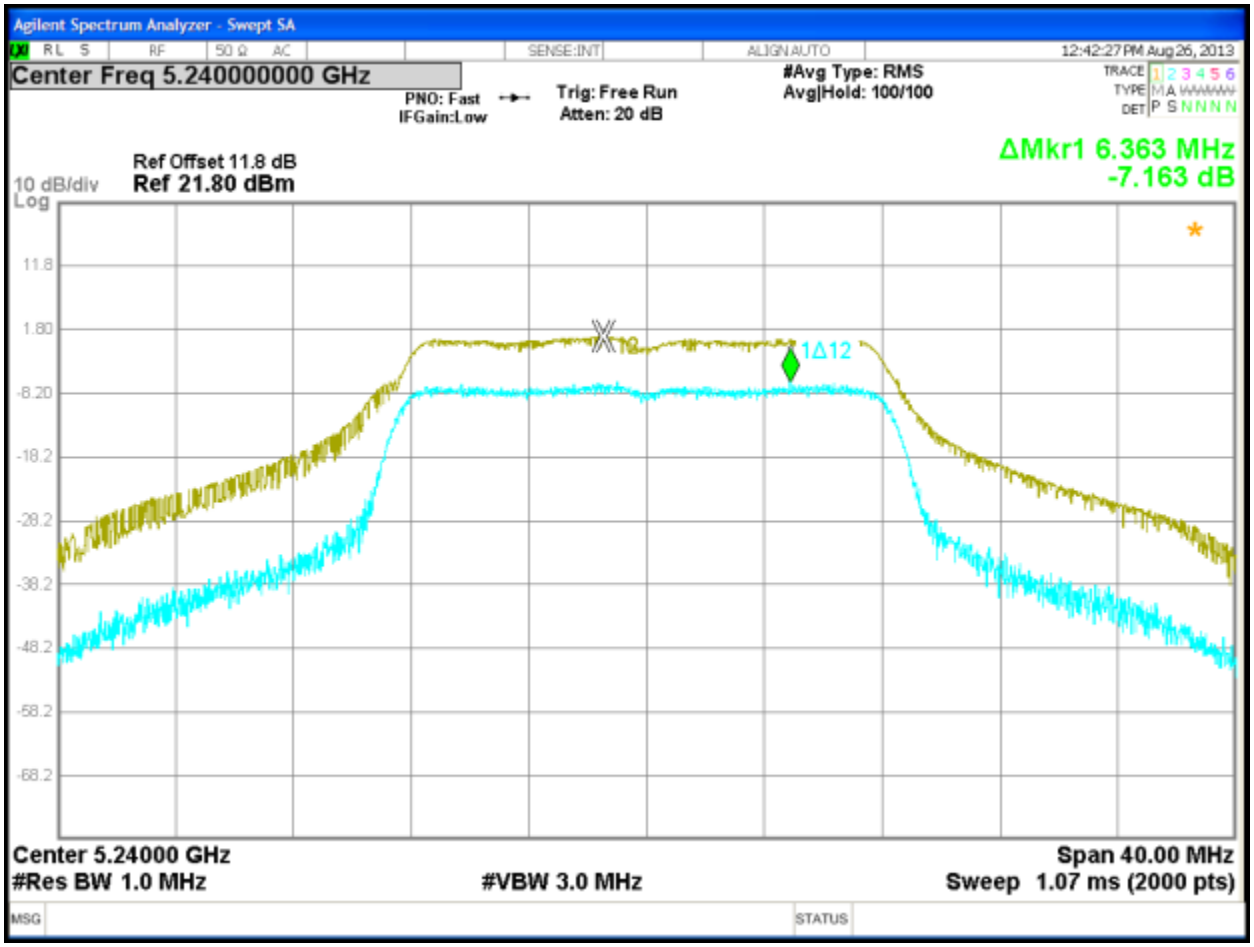


Figure 73: Peak Excursion, 5240 MHz at 802.11a, Chain 0 – 6 Mbps

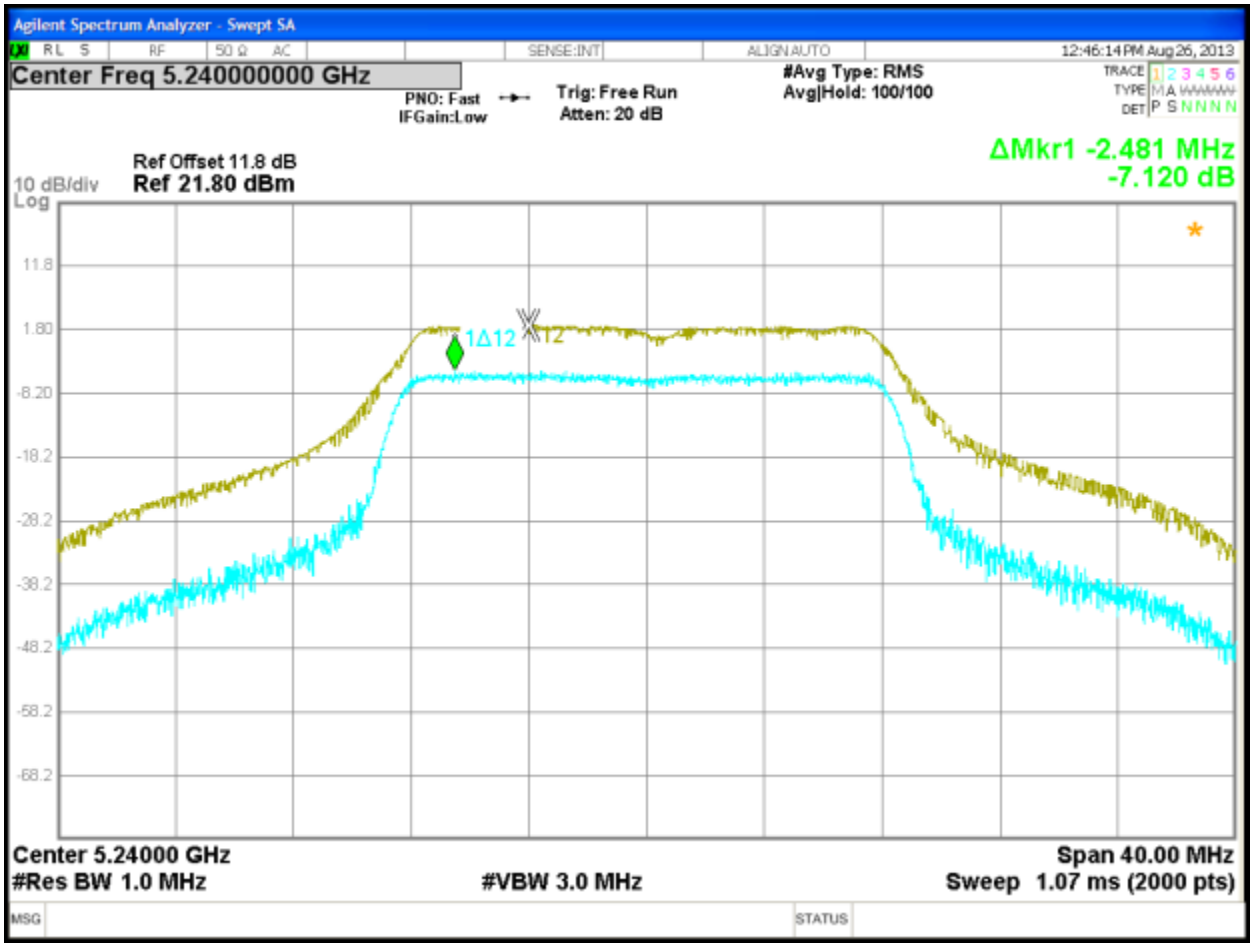


Figure 74: Peak Excursion, 5240 MHz at 802.11a, Chain 1 – 6 Mbps

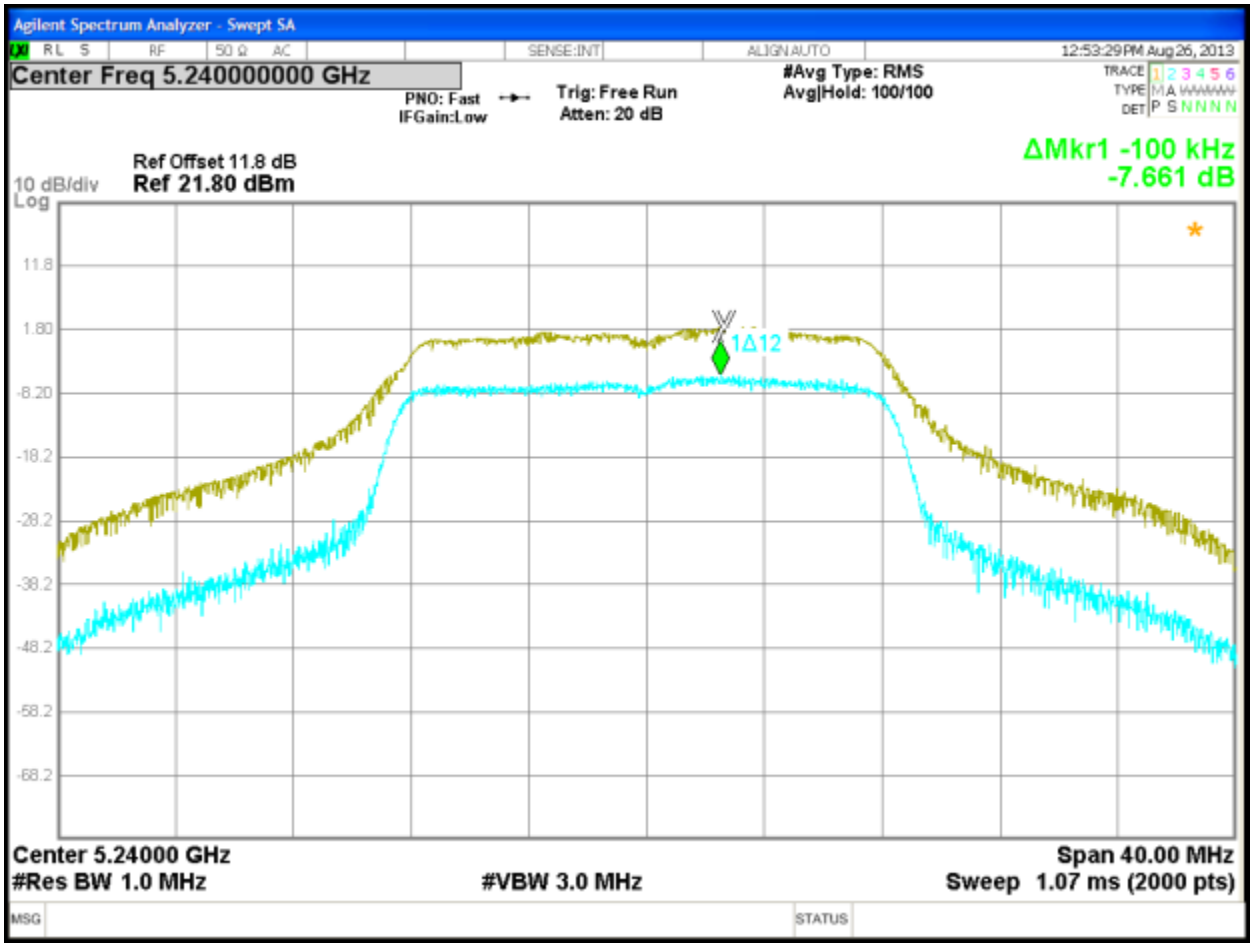


Figure 75: Peak Excursion, 5240 MHz at 802.11a, Chain 2 – 6 Mbps

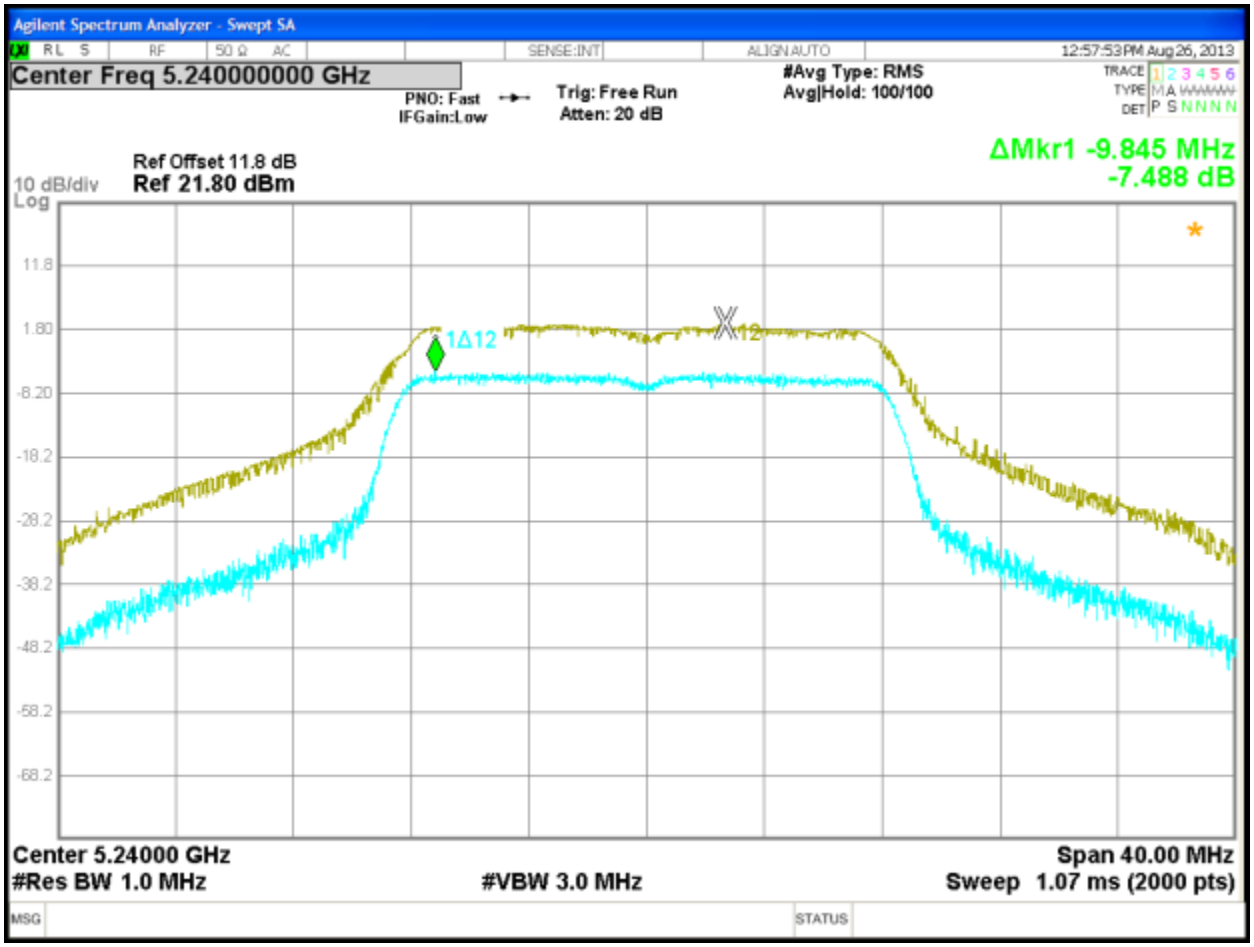


Figure 76: Peak Excursion, 5240 MHz at 802.11a, Chain 3 – 6 Mbps

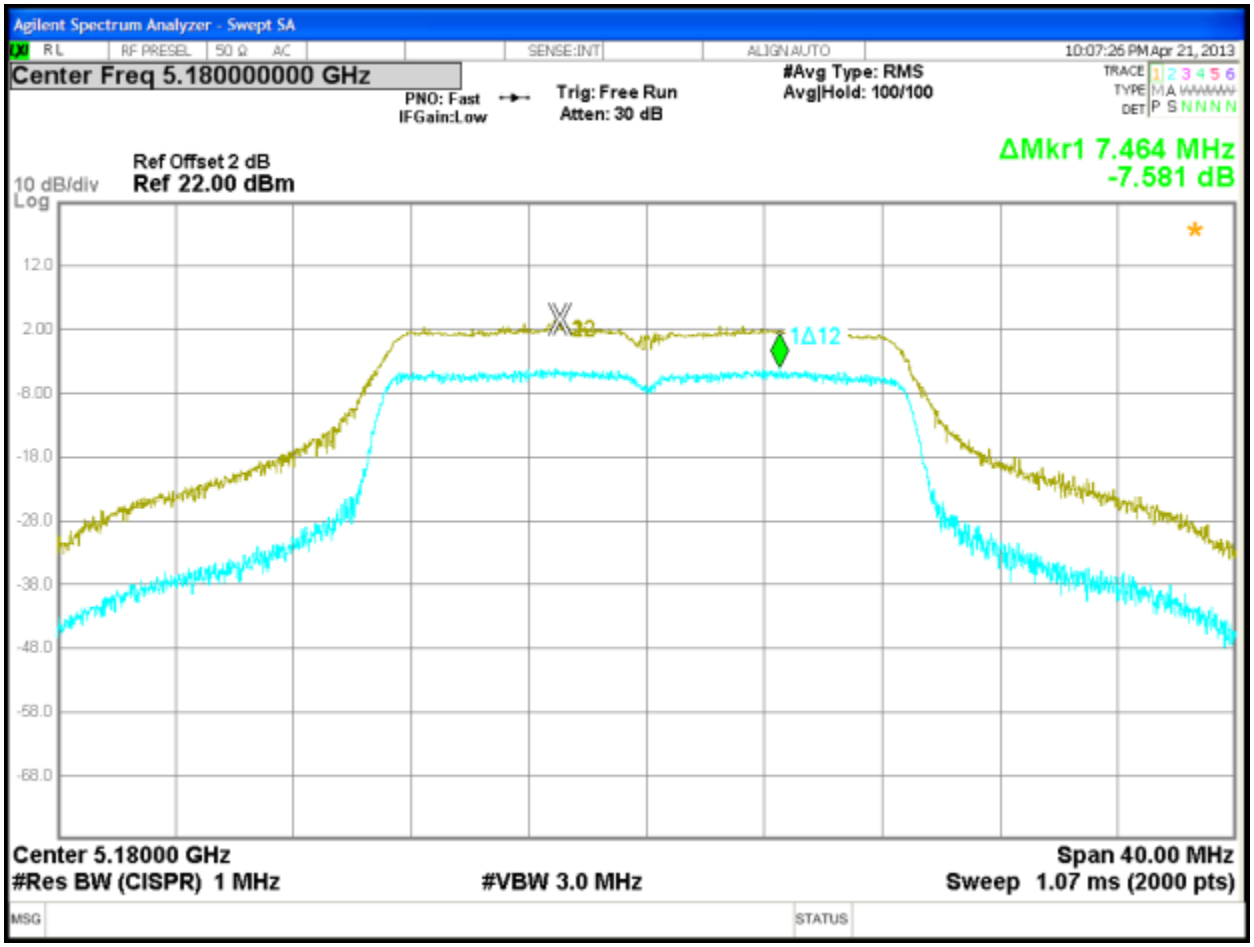


Figure 77: Peak Excursion, 5180 MHz at 802.11n HT20, Chain 0 – 6.5 Mbps

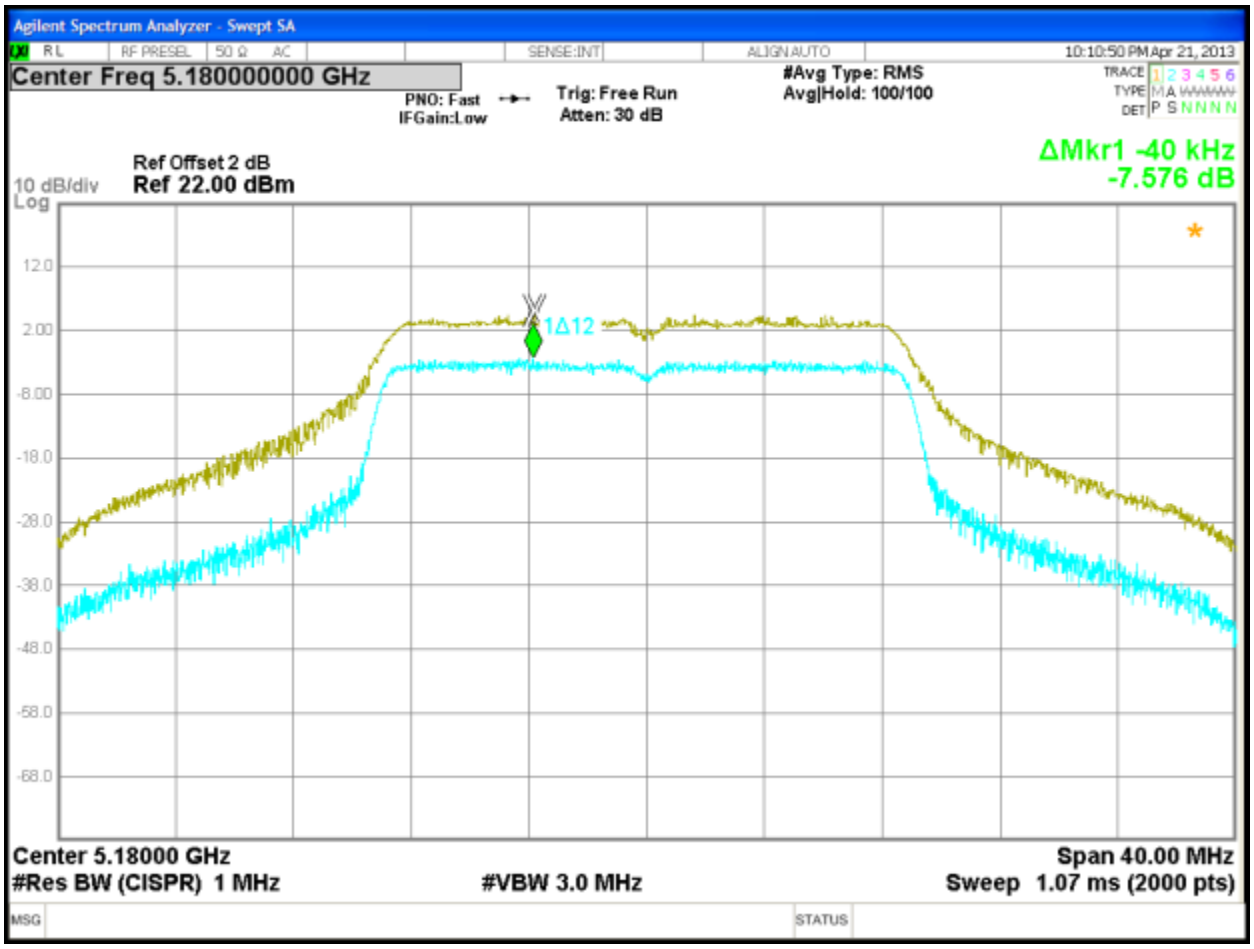


Figure 78: Peak Excursion, 5180 MHz at 802.11n HT20, Chain 1 – 6.5 Mbps

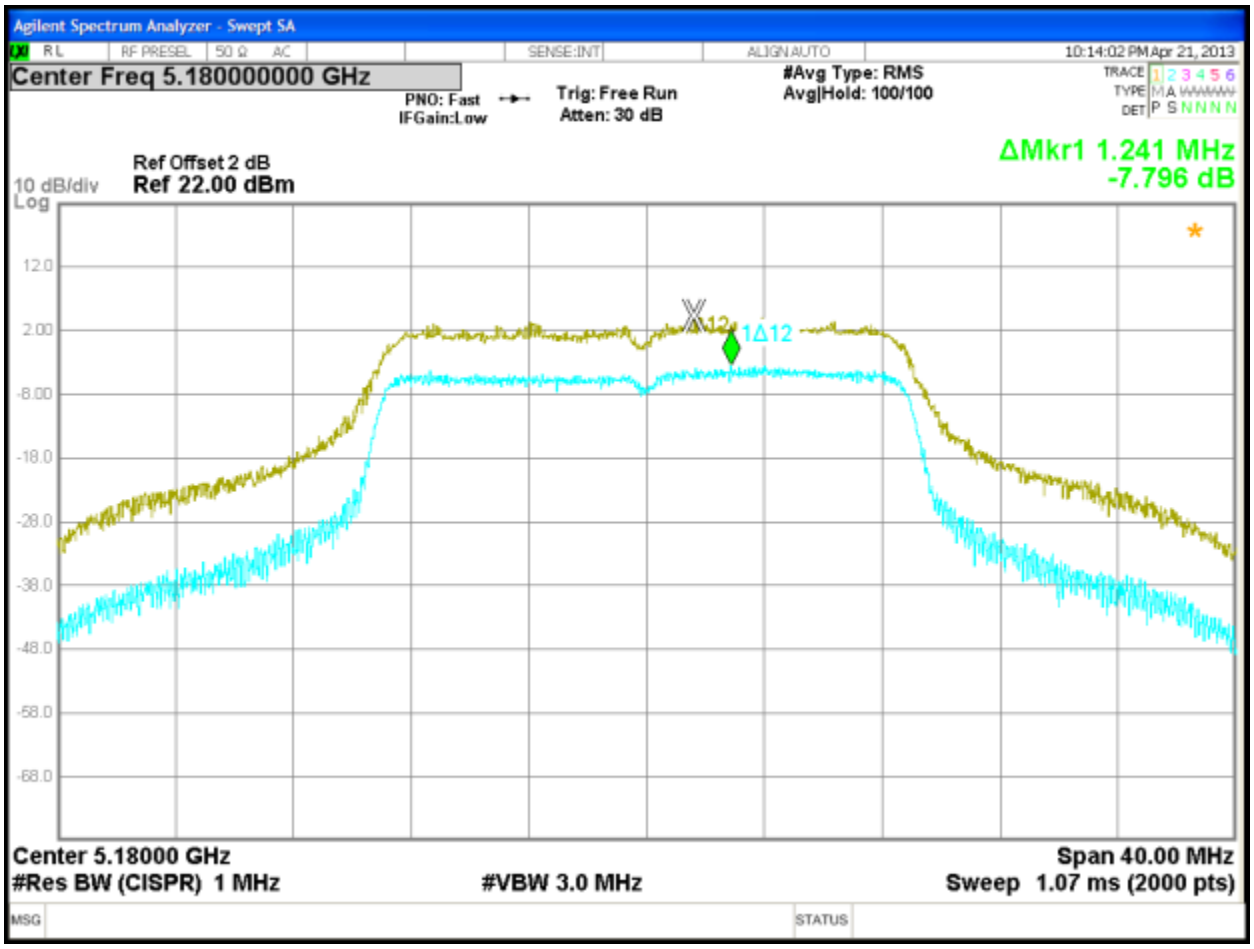


Figure 79: Peak Excursion, 5180 MHz at 802.11n HT20, Chain 2 – 6.5 Mbps

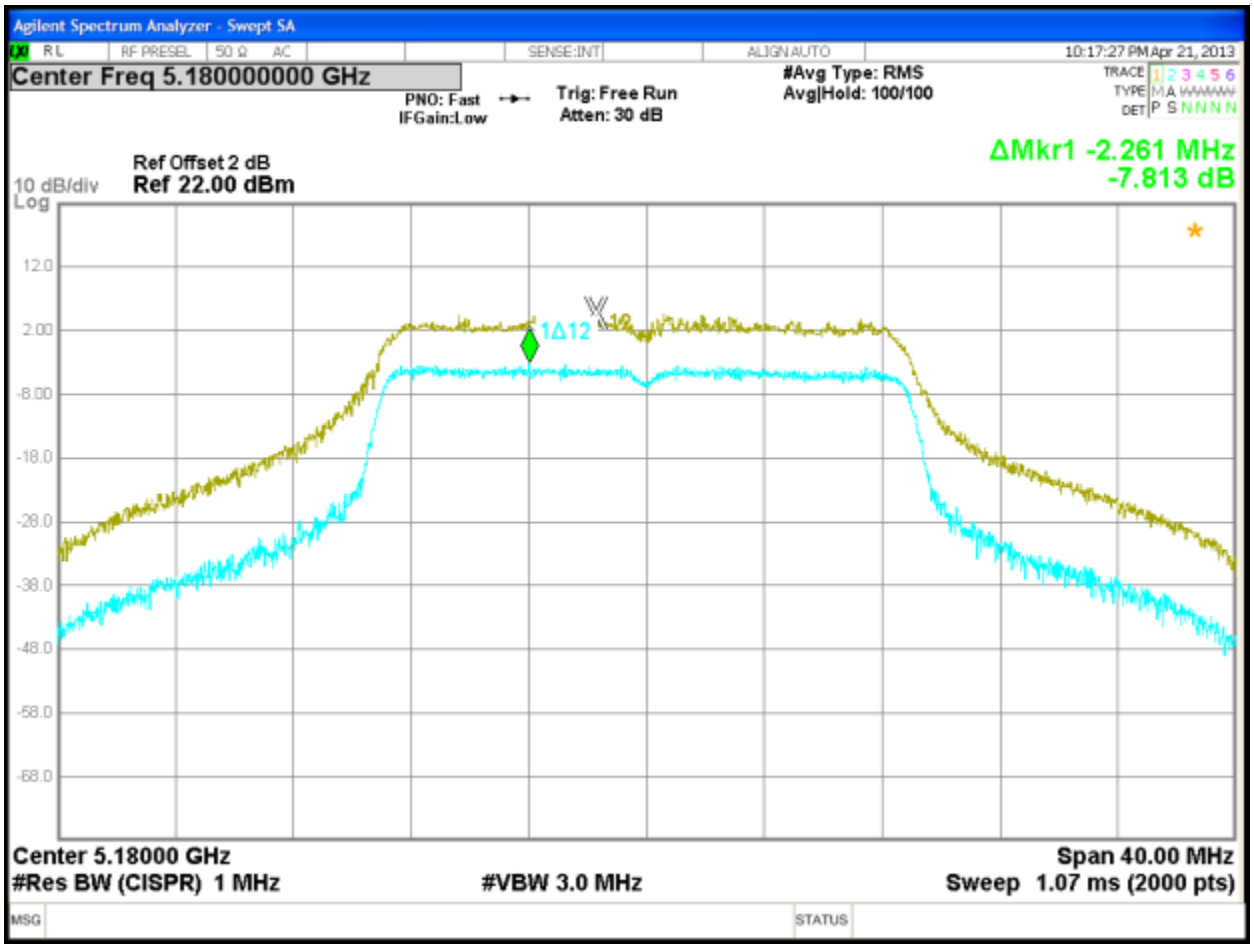


Figure 80: Peak Excursion, 5180 MHz at 802.11n HT20, Chain 3 – 6.5 Mbps

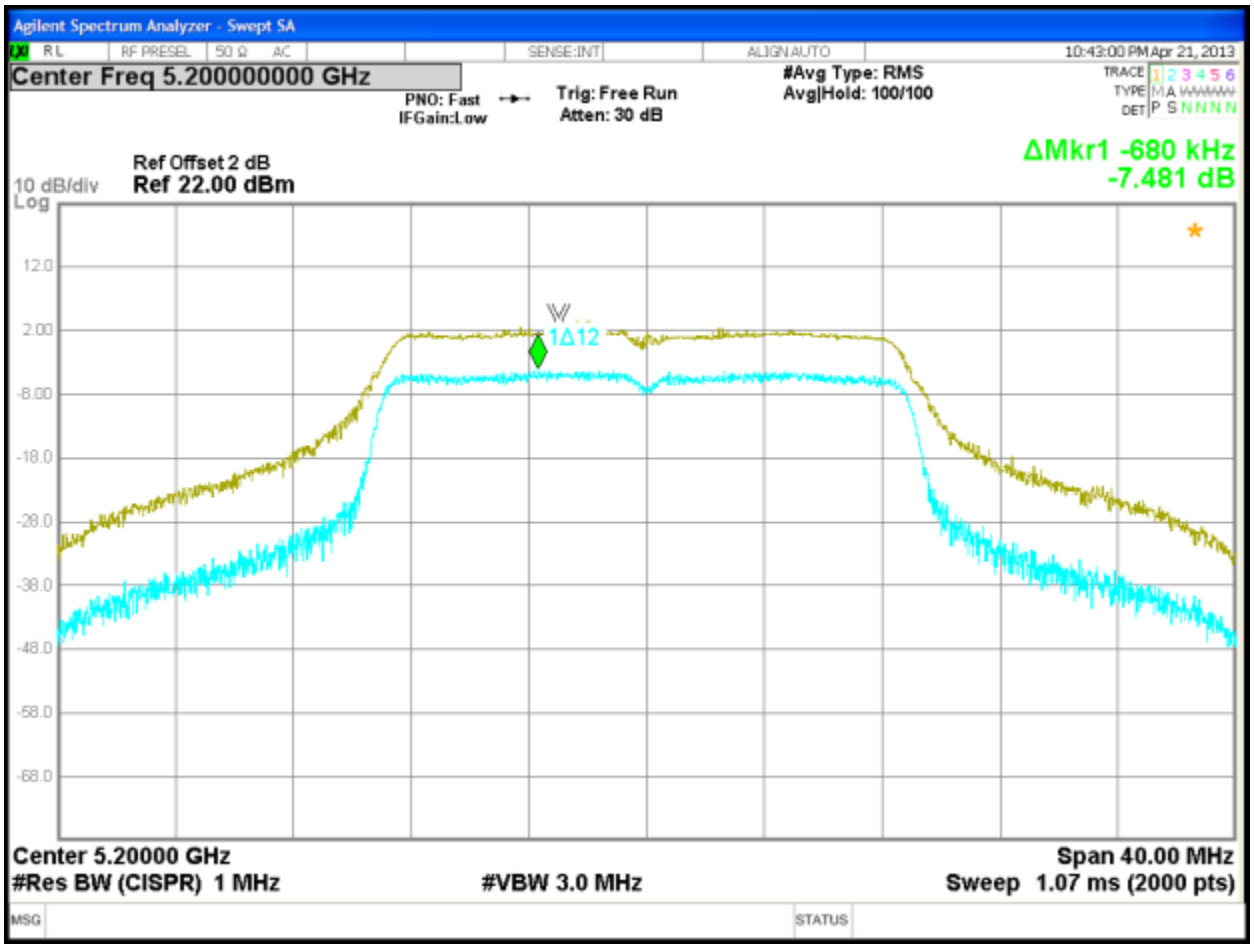


Figure 81: Peak Excursion, 5200 MHz at 802.11n HT20, Chain 0 – 6.5 Mbps

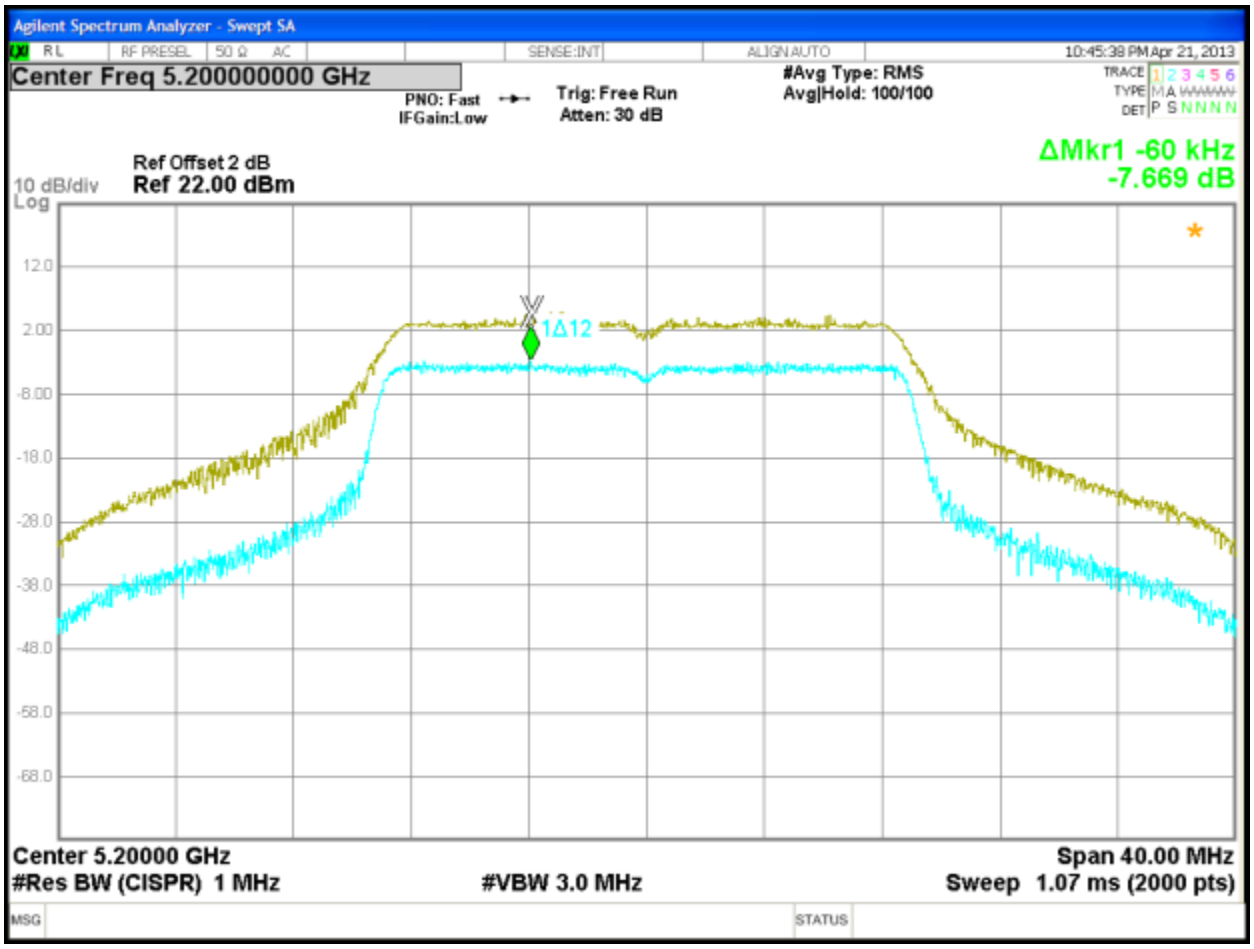


Figure 82: Peak Excursion, 5200 MHz at 802.11n HT20, Chain 1 – 6.5 Mbps

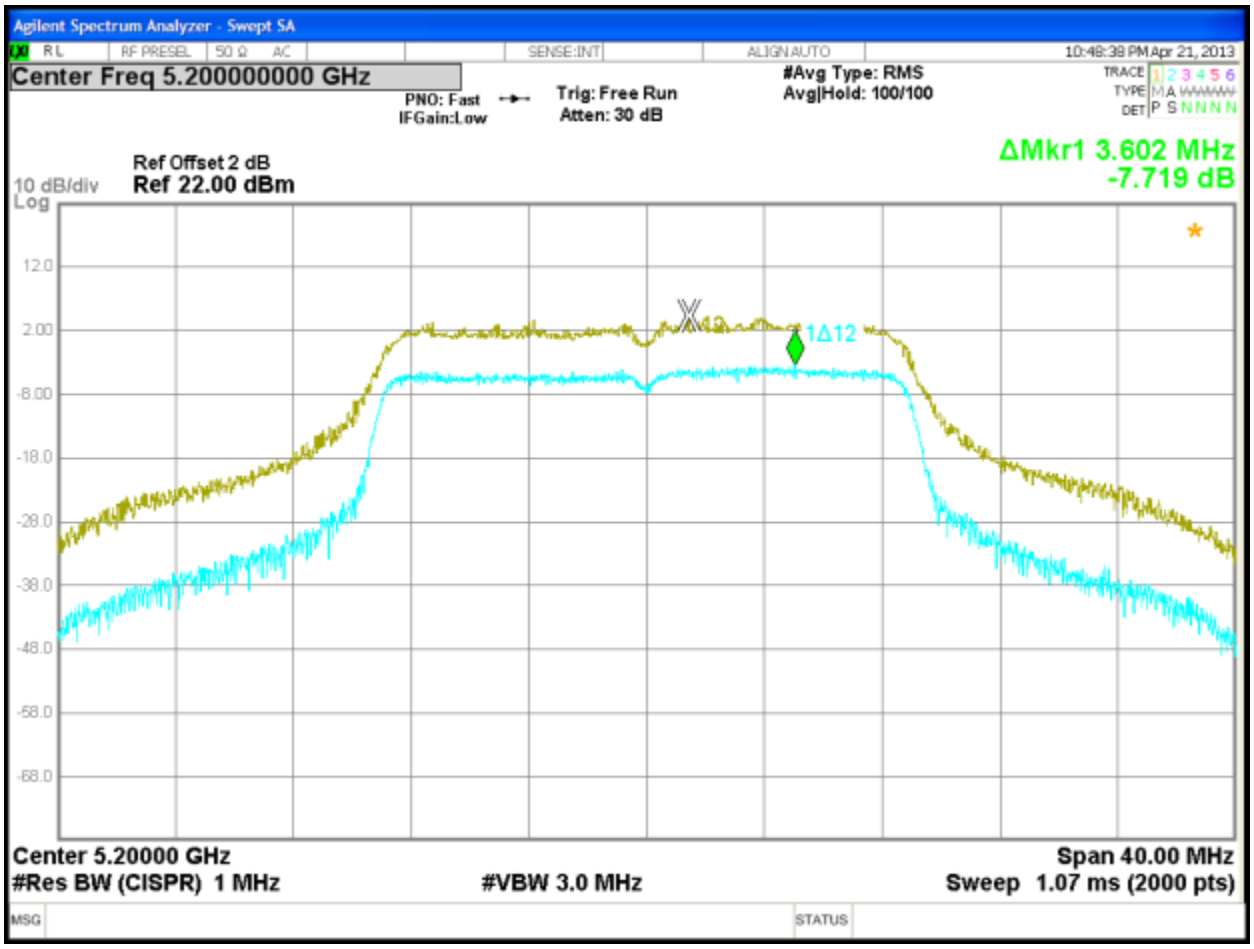


Figure 83: Peak Excursion, 5200 MHz at 802.11n HT20, Chain 2 – 6.5 Mbps

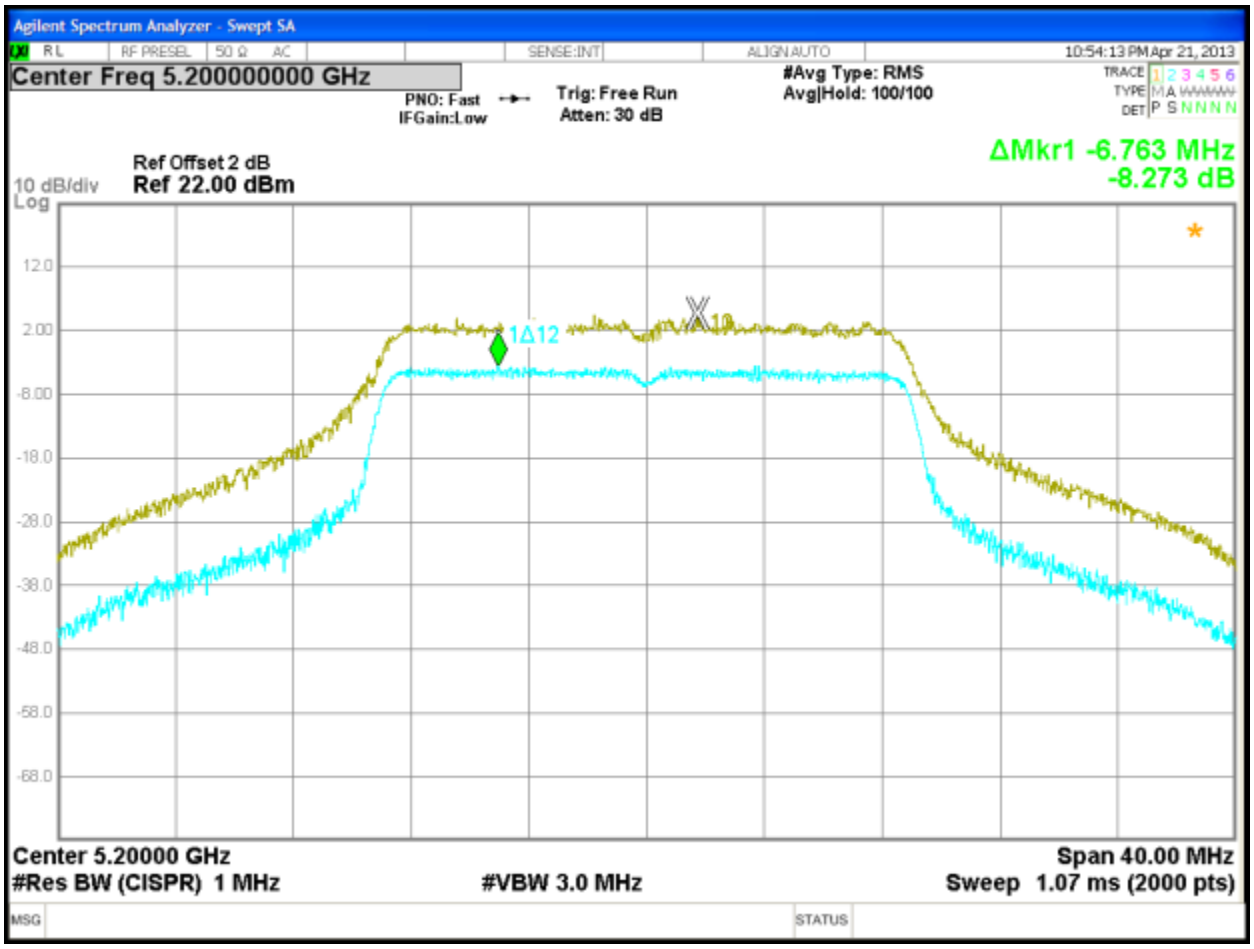


Figure 84: Peak Excursion, 5200 MHz at 802.11n HT20, Chain 1 – 6.5 Mbps