Emissions
Test Report

EUT Name: WiFi 802.11AC 2x2 5GHz Wireless Adapter

Model No.: AW500

CFR 47 Part 15.407 2014 and RSS 210: 2010

Prepared for:

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Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	03/10/2015	Original Document	N/A

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:	WiFi 802.11AC 2x2 5GHz Wireless Adapter
Model No.	AW500
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407 2014 and RSS 210: 2010
Test Dates:	22 Dec 2014 to 20 Feb 2015

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.

Suresh Kondapalli		Sarbjit Shelopal	
Test Engineer	Date March 10, 2015	A2LA Signatory	Date March 0, 2015

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 2014 and RSS 210: 2010 based on the results of testing performed on 22 Dec 2014 to 20 Feb 2015 on the WiFi 802.11AC 2x2 5GHz Wireless Adapter Model AW500 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 5350 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 (Measured)	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	See plots	**Complied**
Maximum Output Power	CFR47 15.407 (a), RSS 210 Sect. A.9.2	16.75 dBm (A mode) 16.74dBm HT/VHT 20 15.46 dBm HT/VHT 40 15.28 dBm VHT80	**Complied**
Peak Power Spectral Density	CFR47 15.407 (a), RSS 210 Sect. A.9.2	11 dBm/MHz	**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 covers 5150 MHz to 5350MHz 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 NIST / 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 17025:1999 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). 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 NIST / 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

2.3.1 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 Model AW500 wireless 802.11ac 2x2 (5 GHz) a radio module (Limited modular approval) that can be installed into a Pace Model IPW9000 series digital STB cable product line. This Wi-Fi adapter is a custom, fully enclosed, USB type optional accessory designed to be installed into a Pace Model IPW9000 series digital STB cable product line. This accessory is used to seamlessly connect the IPW9000 series Set Top Box to the service provider's broadband network via a Wi-Fi Protected Setup (WPS) wireless network connection in the home.

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 WiFi 802.11AC 2x2 5GHz Wireless Adapter has 2 internal fixed antennas, stamped metal loop antenna. Front antenna has the maximum gain of 3.8dBi and side antenna has gain of 5.2dBi. The total directional gain is 7.56dBi. 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

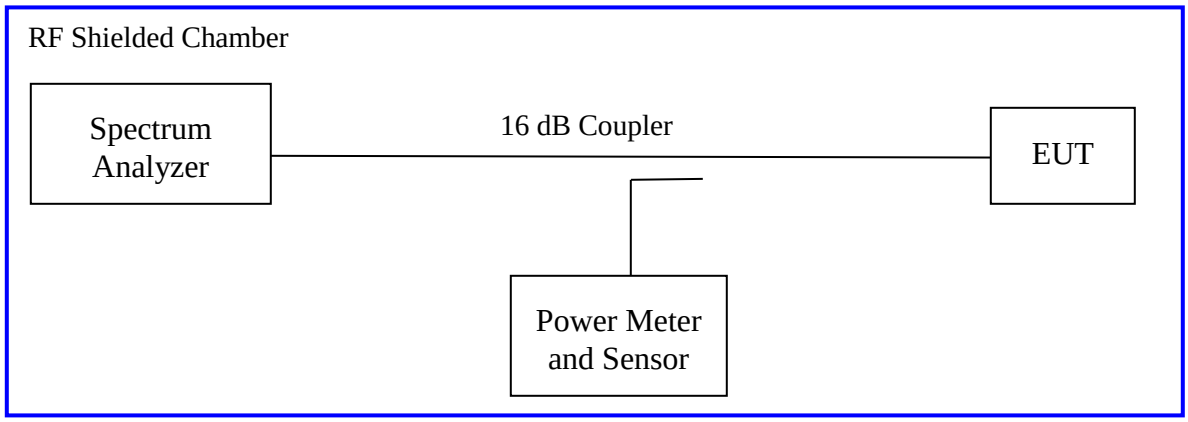
Band 5150-5250 MHz:250 mW

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

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): 2014 and RSS 210 A.9.2; 5150 MHz to 5350 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: + 7.56 dBi			**Signal State:** Modulated at 100%.		
Ambient Temp.: 23° C			**Relative Humidity:**33%		
802.11a Mode, 2x2					
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Total Power [dBm]**	**Margin [dB]**
5180	22. 44	13.65	13.82	16.75	-5.69
5200	22.44	13.29	13.64	16.47	-5.97
5240	22.44	12.52	12.85	15.68	-6.76
5260	22. 44	12.29	12.27	15.29	-7.15
5280	22.44	12.14	11.93	15.04	-7.06
5320	22.44	11.88	11.60	14.74	-7.7

Note: 1.The highest output power was observed at 802.11a mode 6.0mbps , 2 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 7.56dBi;

Antenna 1: 3.8 dBi and Antenna 2 : 5.2dBi

Directional gain = 10 log[(10G1 /20 + 10G2 /20 + … + 10GN /20)2 /NANT]dBi [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently. = 5.70 linear gain = 7.56dBi.

4. As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi. The limit would be 22.10dBm.

Note: Highlighted plots are available in this report

Table 3: Output Power at the Antenna Port –

Test Conditions: Conducted Measurement, Normal Temperature						
Antenna Type: Integrated				**Power Setting:** See test plan		
Max. Directional Gain: + 7.56 dBi				**Signal State:** Modulated at 100%.		
Ambient Temp.: 23 °C				**Relative Humidity:**33%		
802.11n (HT20/ VHT20) Mode, 2x2; HT20 was tested						
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1[dBm]**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
5180	22. 44	13.32	13.74	0.19	16.74	-5.48
5200	22.44	13.64	13.15	0.19	16.58	-5.86
5240	22.44	12.43	13.00	0.19	15.92	-6.25
5260	22. 44	12.06	12.37	0.19	15.42	-7.03
5280	22.44	11.85	12.02	0.19	15.14	-7.31
5320	22.44	11.93	11.33	0.19	14.84	-7.61
Note: The highest output power was observed at HT20 6.5 Mbps, 2 Data Streams.						
802.11n (HT40/VHT40) Mode, 2x2						
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1[dBm]**	**CF [dB]]**	**Total Power [dBm]**	**Margin [dB]**
5190	22.10	11.51	11.98	0.25	15.01	-6.81
5230	22.10	12.39	12.01	0.25	15.46	-6.64
5270	22.10	10.16	10.66	0.25	13.68	-8.05
5310	22.10	9.95	10.09	0.25	13.28	-8.05
Note: The highest output power was observed at HT40 13.5 Mbps, 2 Data Streams.						
802.11AC (VHT80) Mode, 2x2						
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1[dBm]**	**CF [dB]]**	**Total Power [dBm]**	**Margin [dB]**
5210	22.10	9.05	9.44	2.53	14.79	-6.82
5290	22.10	7.93	8.08	2.53	13.55	-7.91
Note: The highest output power was observed at HT80 Mbps, 2 Data Streams. Plots for all the measurements stated above were taken, to reduce complexity and bulkiness of the report Highlighted Plots are placed in the report.						

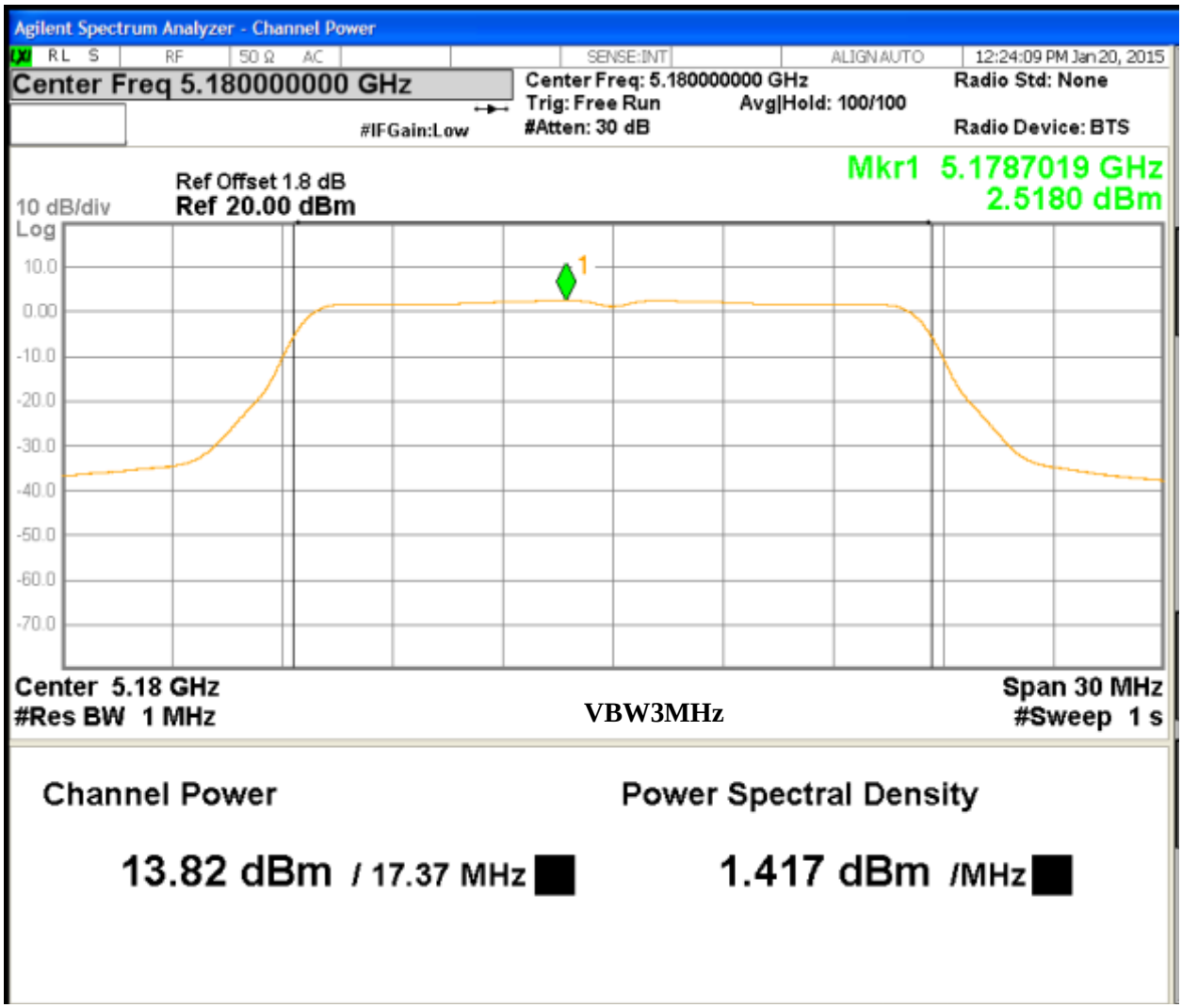


Figure 1: Maximum Transmitted Power, 5180 MHz at 11a, Chain 1

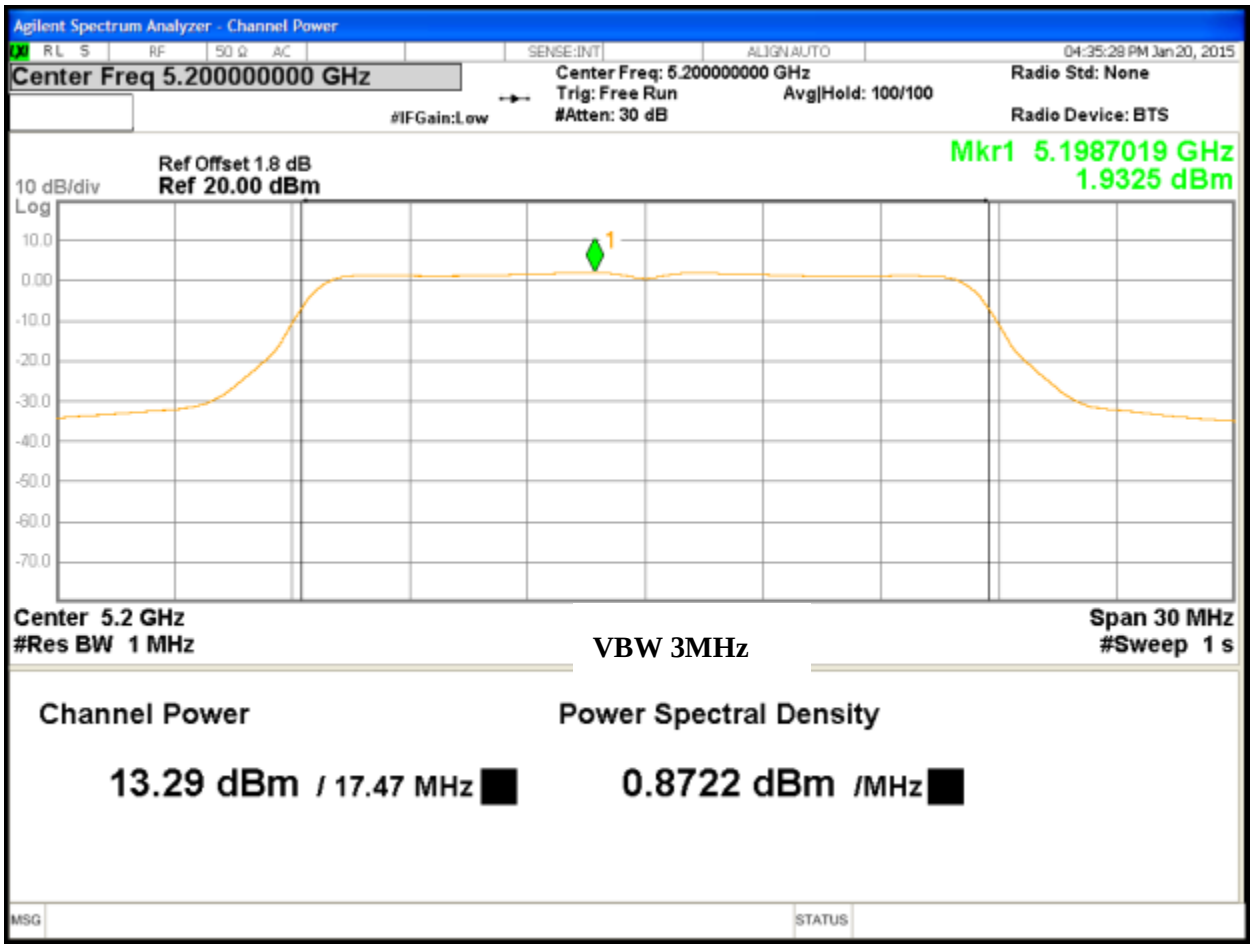


Figure 2: Maximum Transmitted Power, 5200MHz at 11a, Chain 0

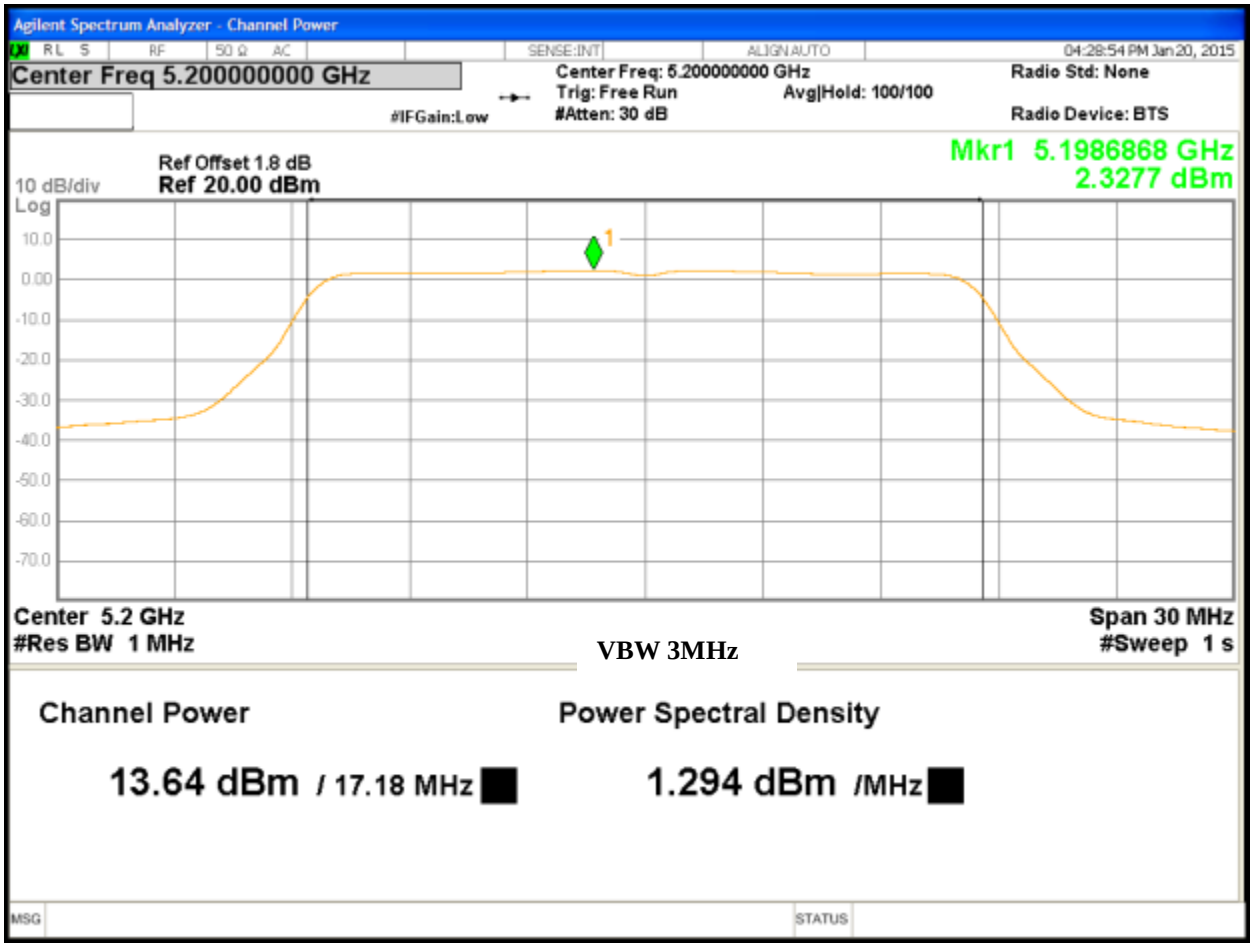


Figure 3: Maximum Transmitted Power, 5200MHz at 11a, Chain 1

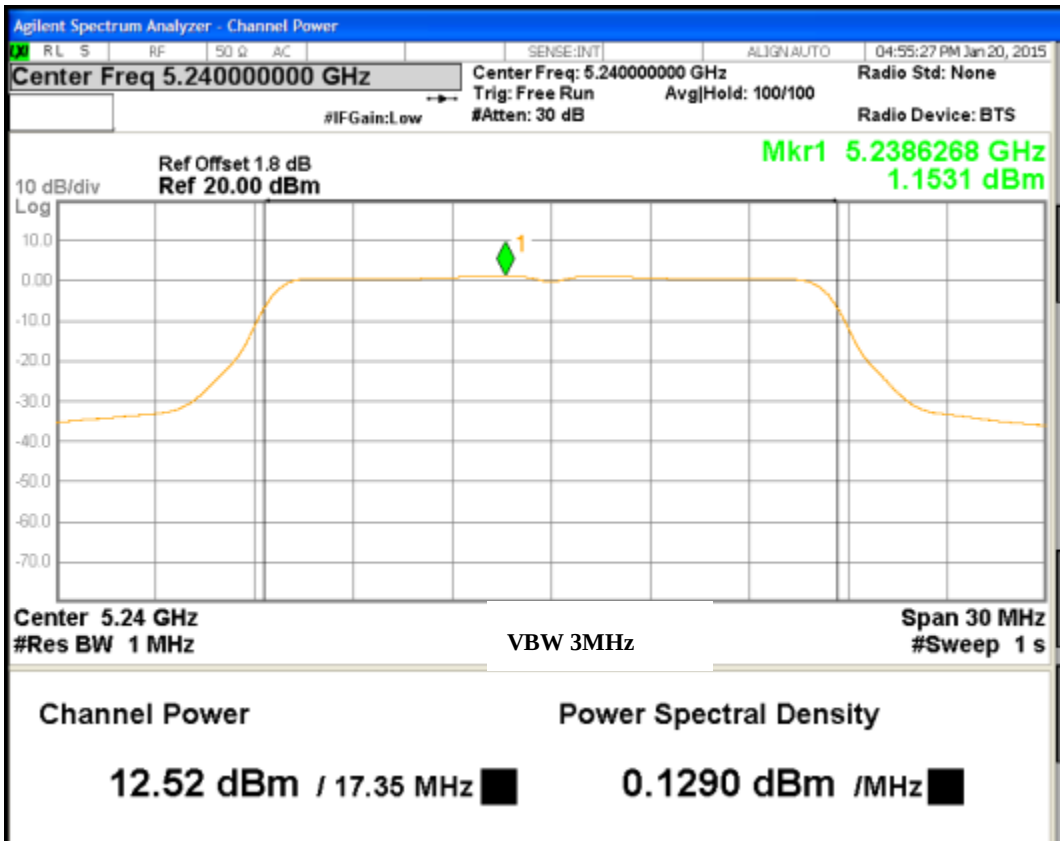


Figure 4: Maximum Transmitted Power, 5240MHz at 11a, Chain 0

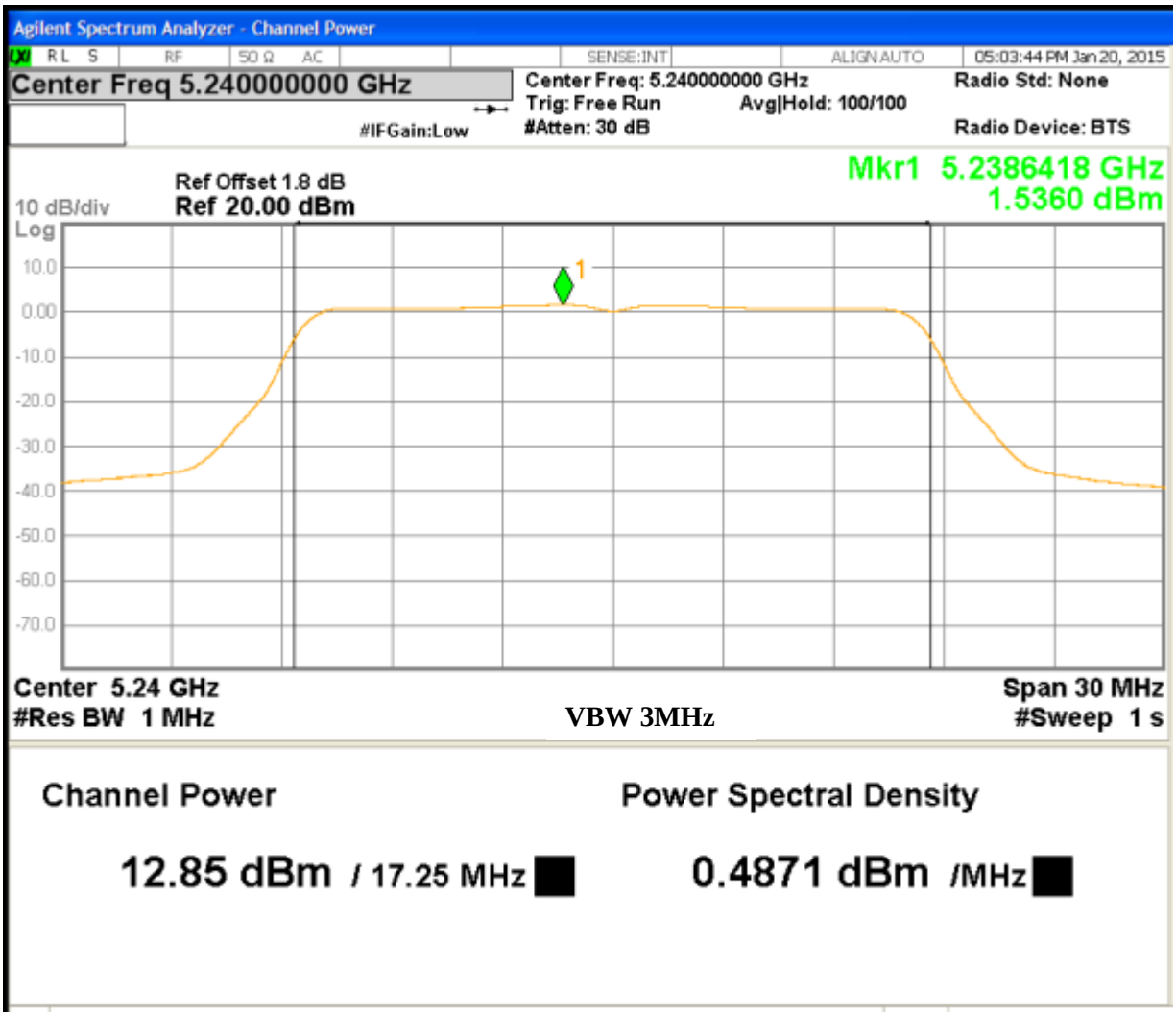


Figure 5: Maximum Transmitted Power, 5240MHz at 11a, Chain 1

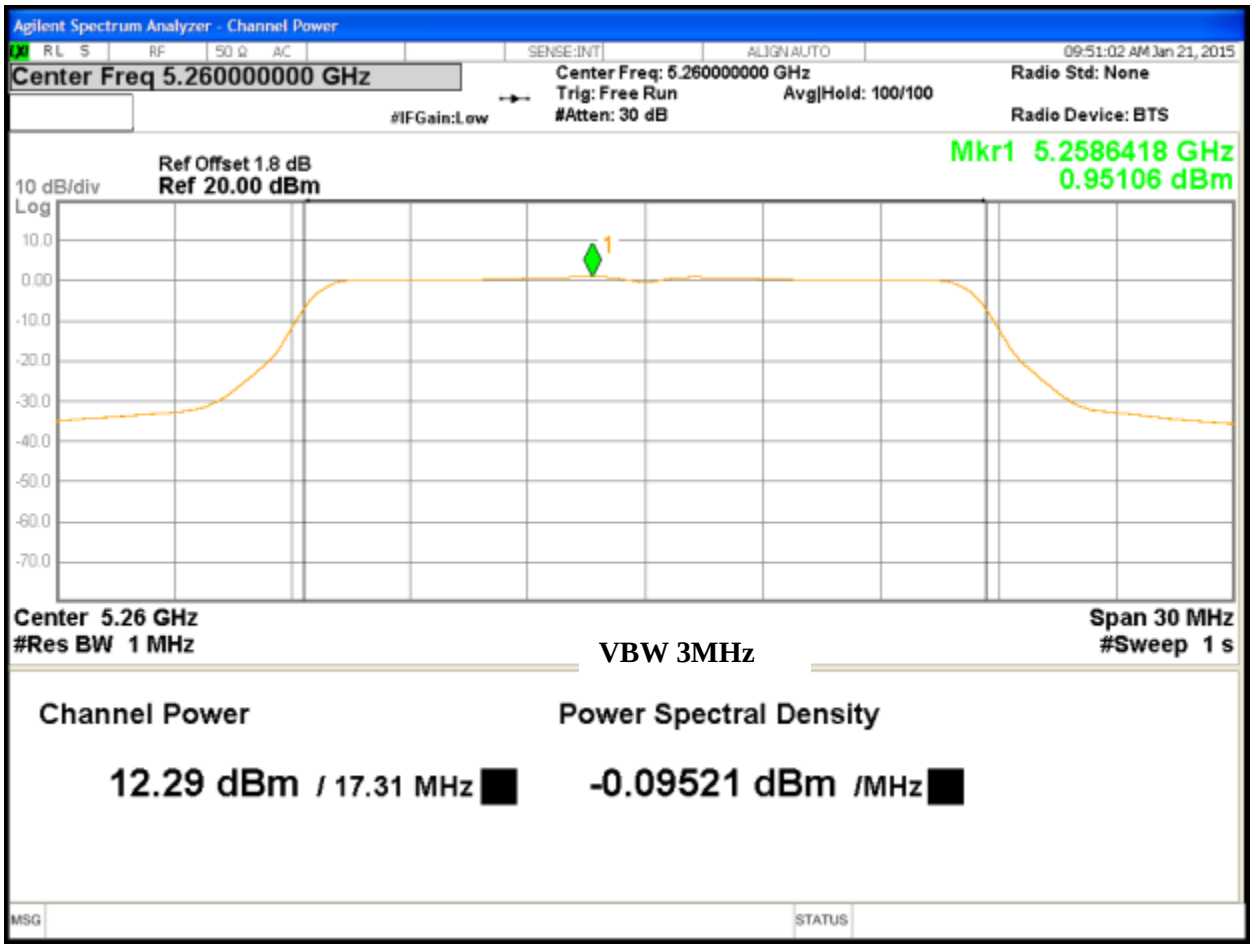


Figure 6: Maximum Transmitted Power, 5260MHz at 11a, Chain 0

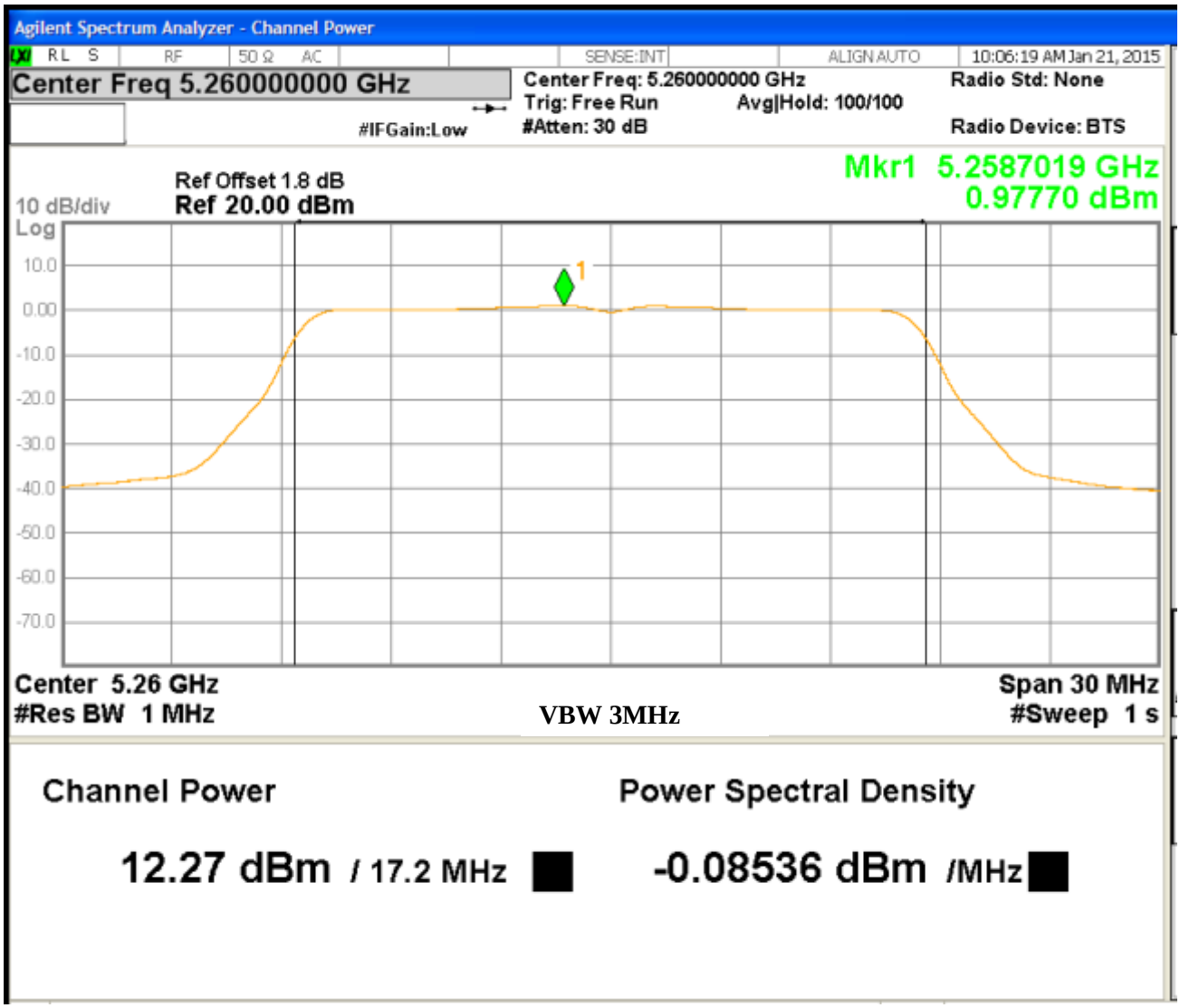


Figure 7: Maximum Transmitted Power, 5260MHz at 11a, Chain 1

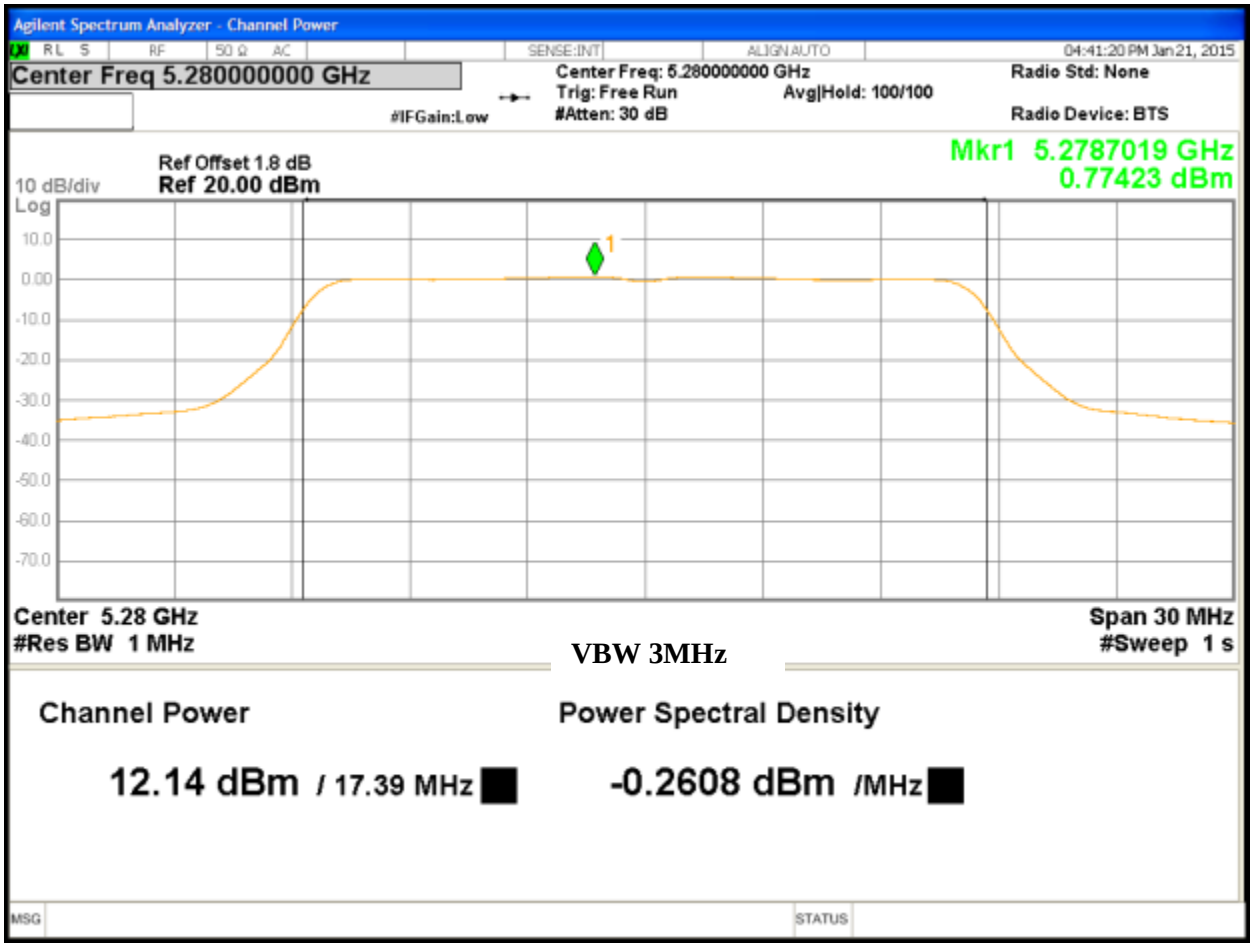


Figure 8: Maximum Transmitted Power, 5280MHz at 11a, Chain 0

Figure 9: Maximum Transmitted Power, 5280MHz at 11a, Chain 1

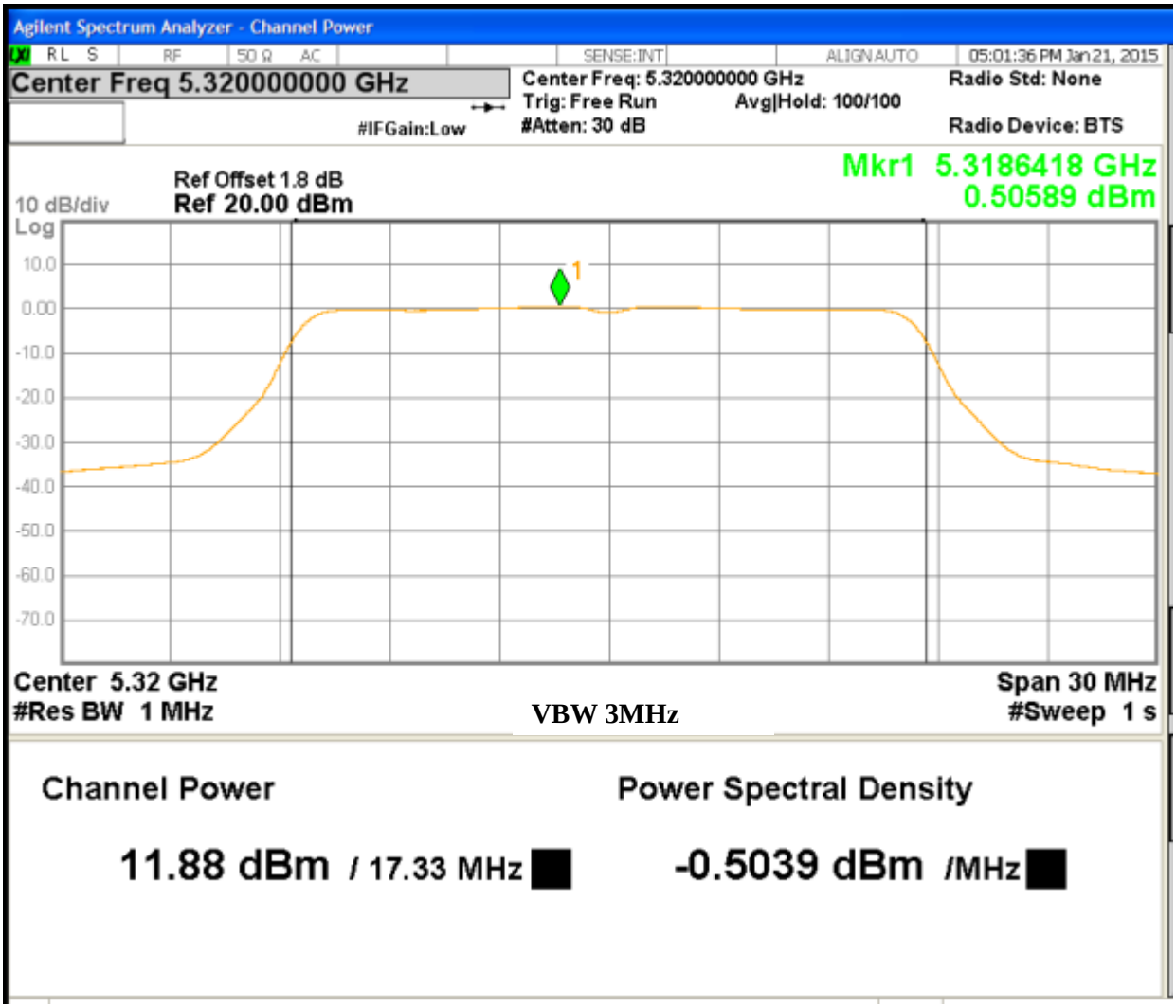


Figure 10: Maximum Transmitted Power, 5320MHz at 11a, Chain 0

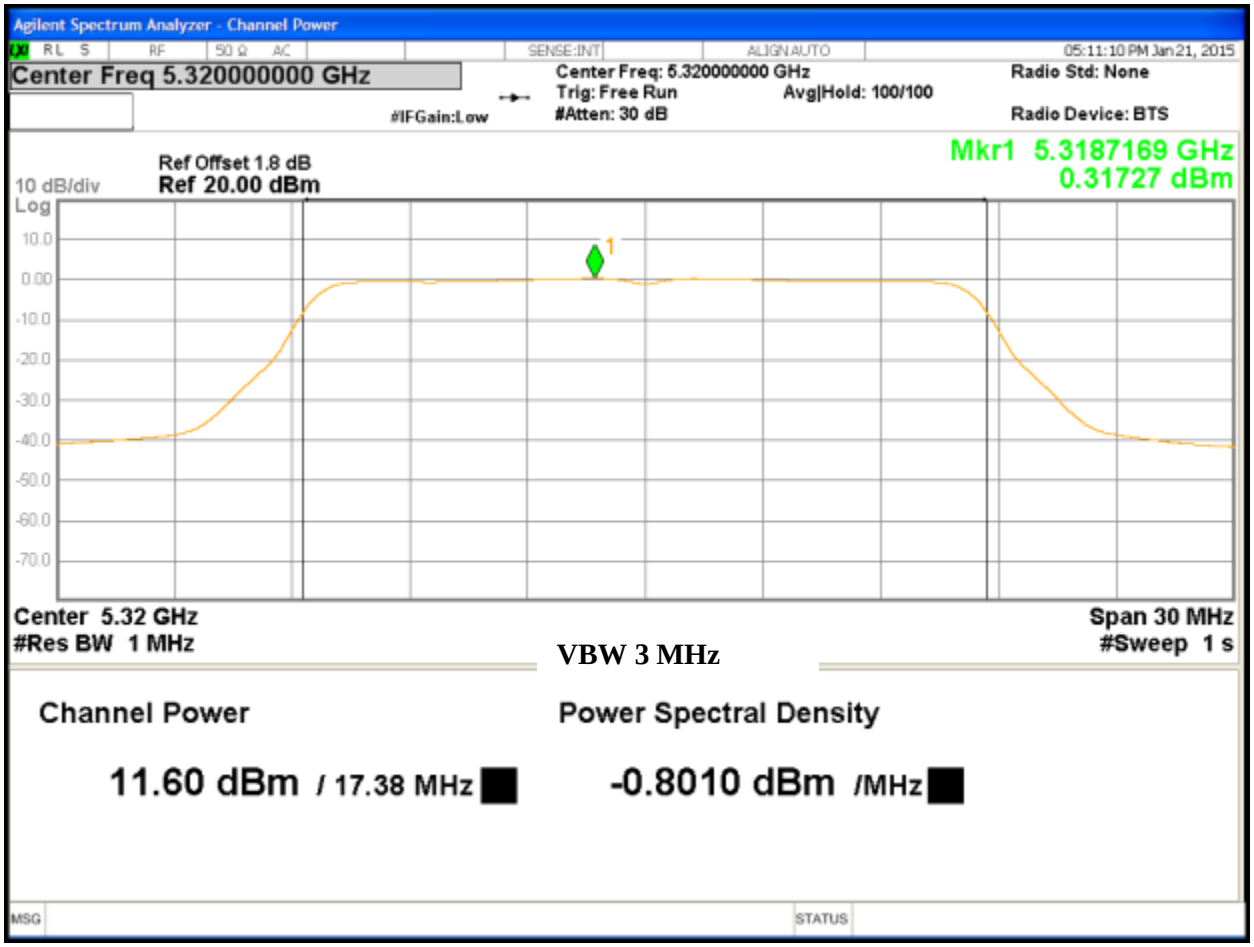


Figure 11: Maximum Transmitted Power, 5320MHz at 11a, Chain 1

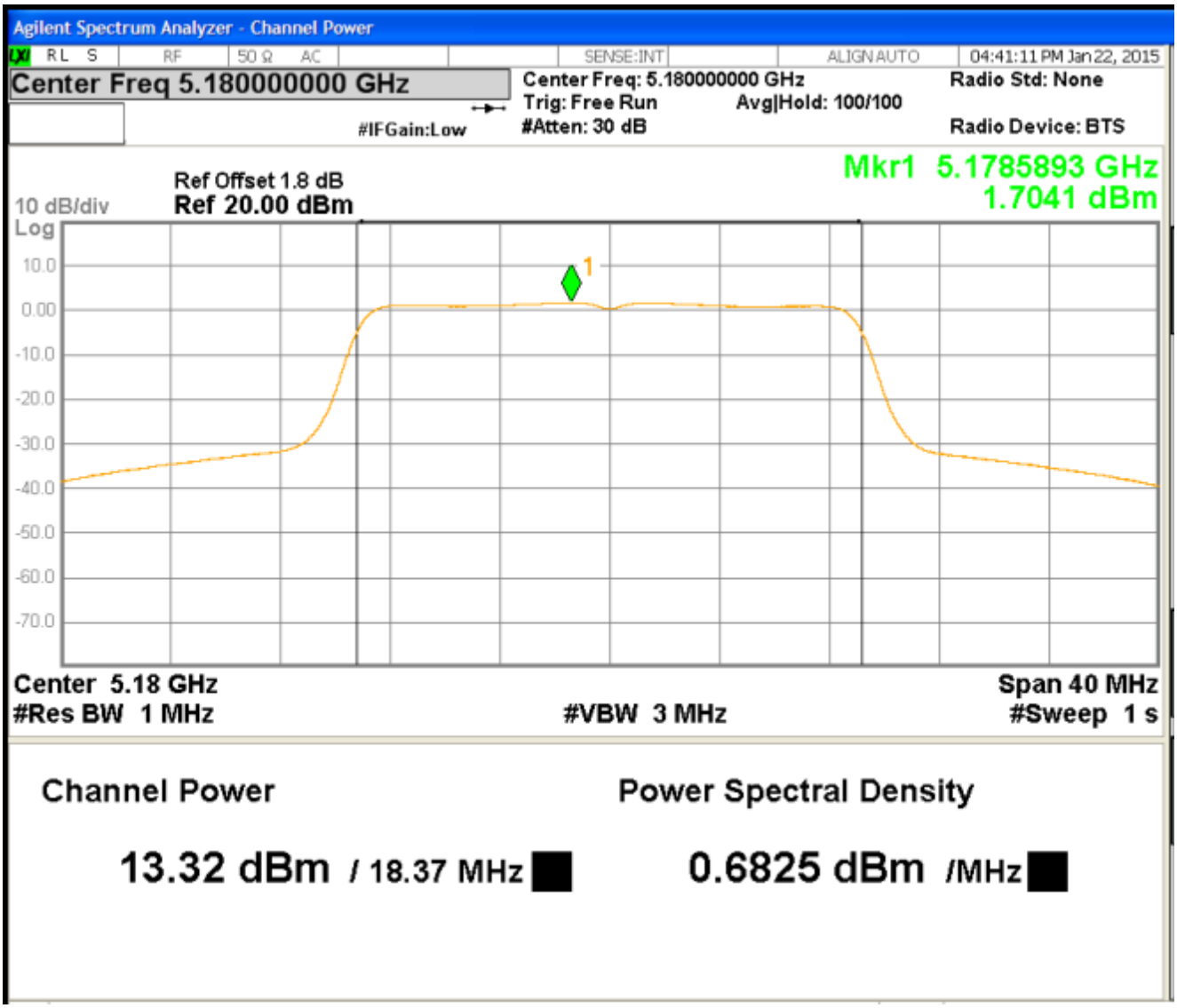


Figure 12: Maximum Transmitted Power, 5180 MHz at HT20, Chain 0

Figure 13: Maximum Transmitted Power, 5180 MHz at HT20, Chain 1

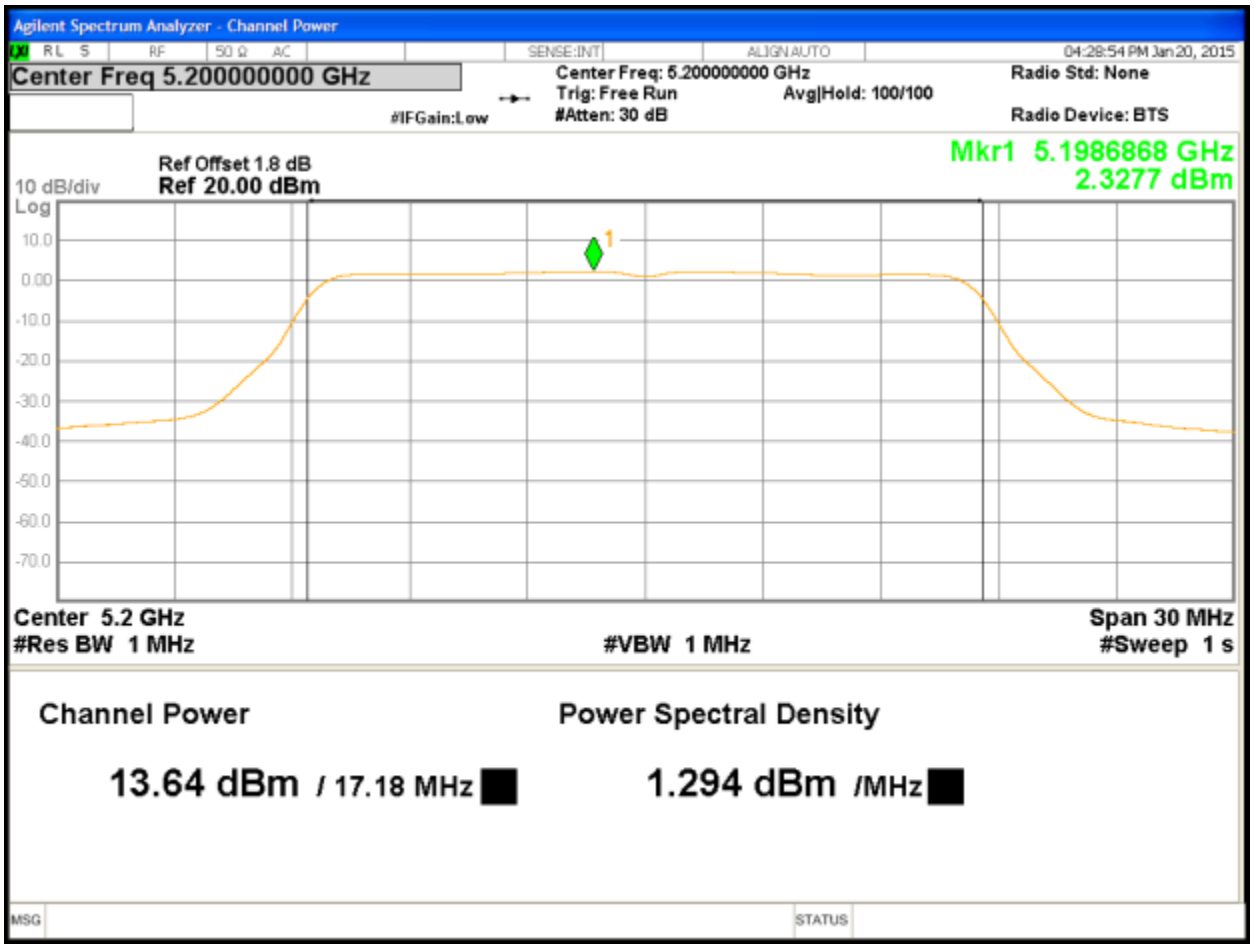


Figure 14: Maximum Transmitted Power, 5200 MHz at HT20, Chain 0

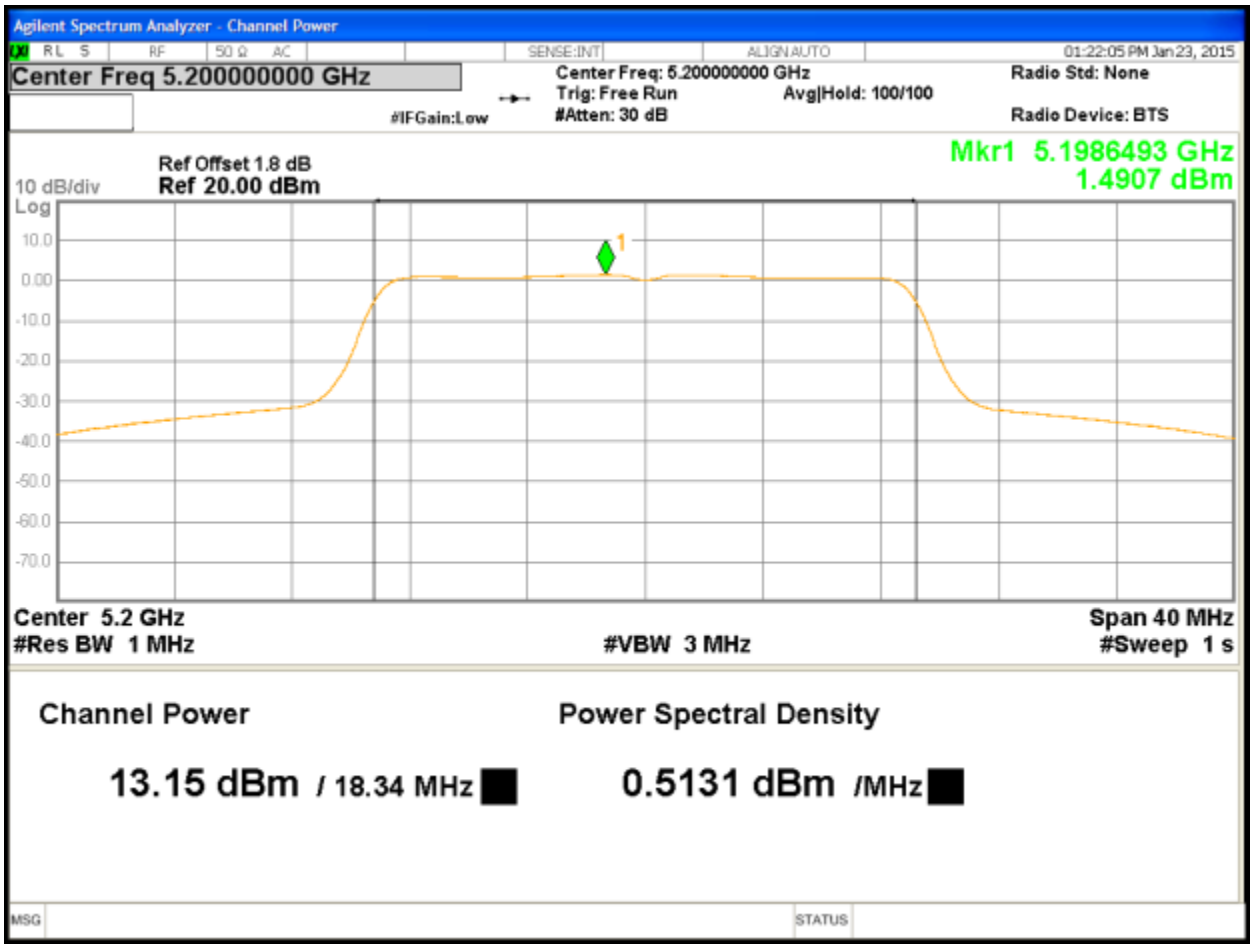


Figure 15: Maximum Transmitted Power, 5200 MHz at HT20, Chain 1

Figure 16: Maximum Transmitted Power, 5240 MHz at HT20, Chain 0

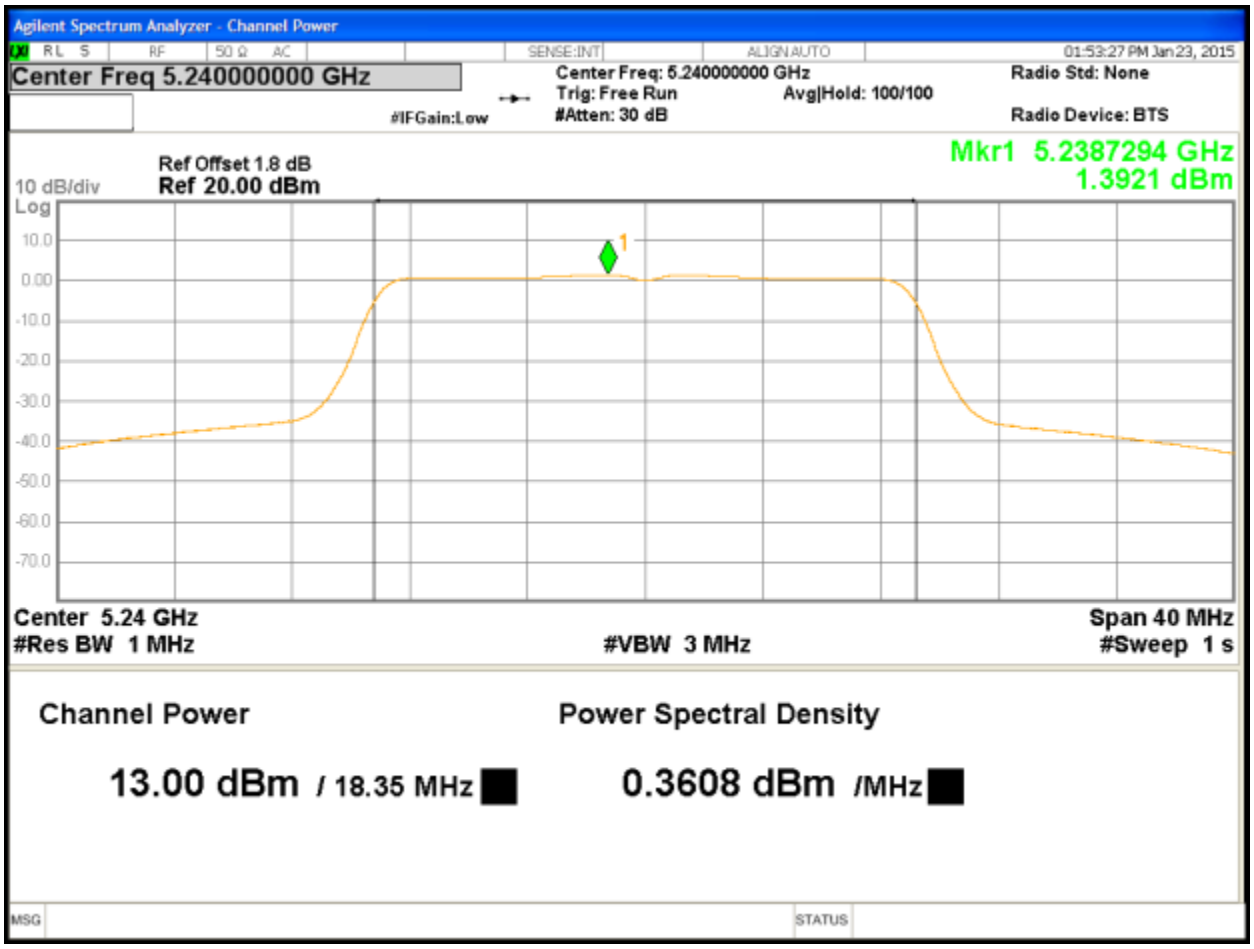


Figure 17: Maximum Transmitted Power, 5240 MHz at HT20, Chain 1

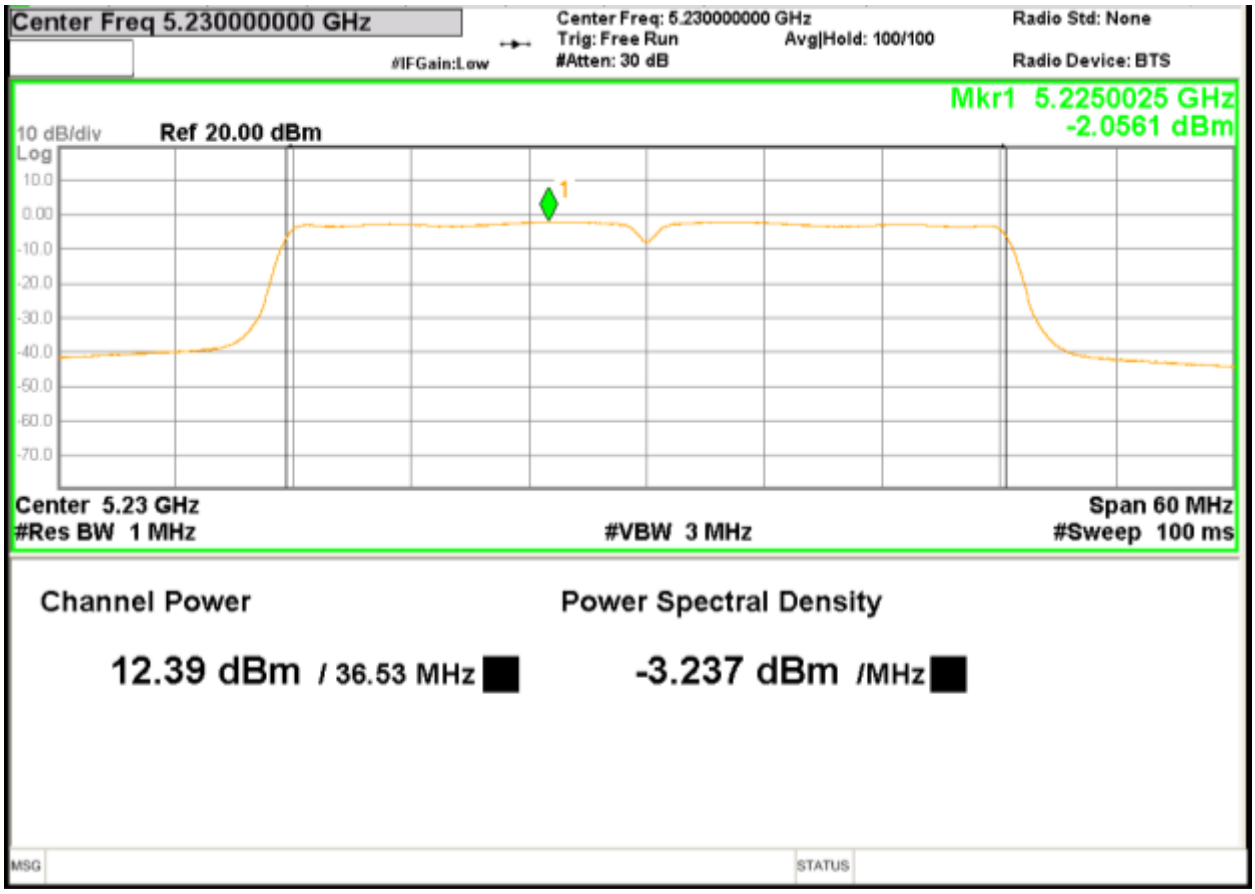


Figure 18: Maximum Transmitted Power, 5230 MHz at HT40, Chain 0

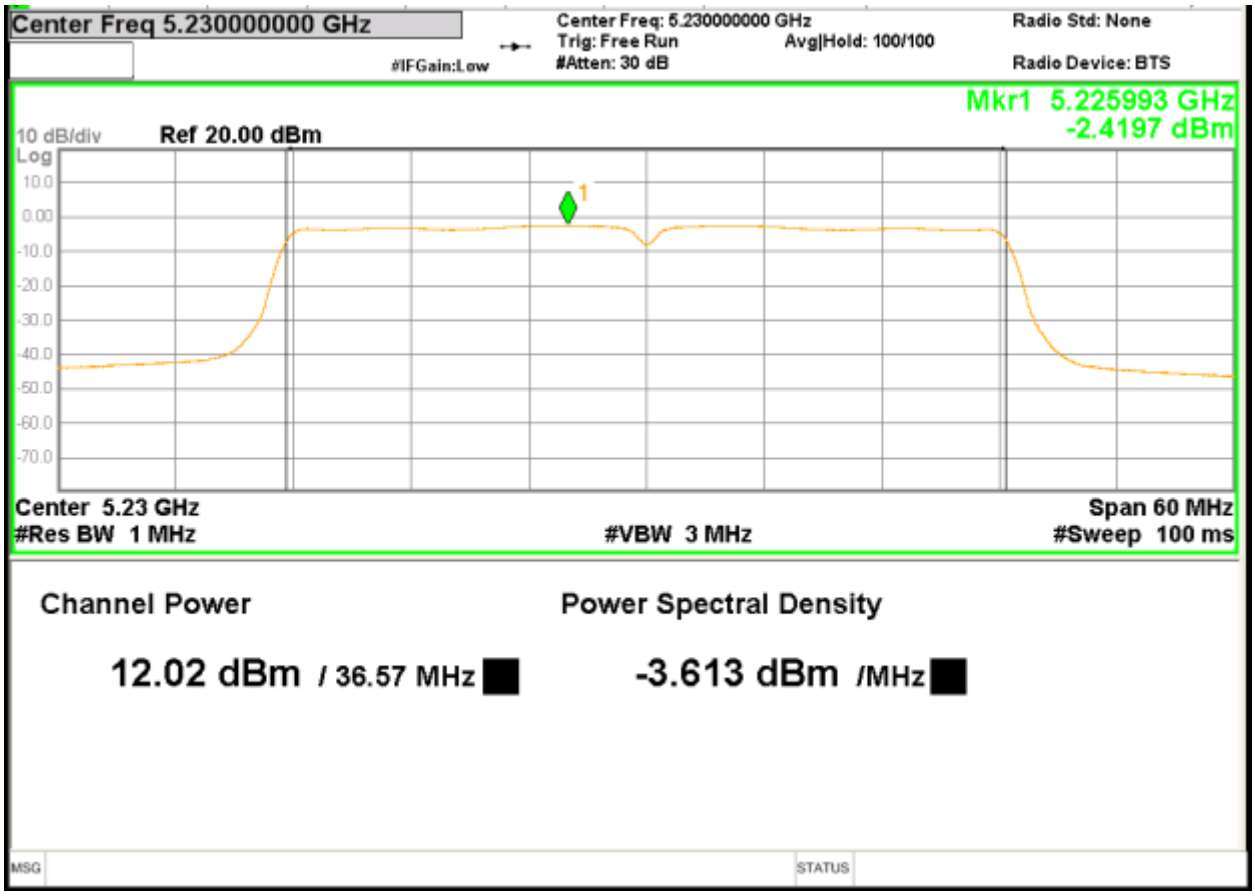


Figure 19: Maximum Transmitted Power, 5230 MHz at HT40, Chain 1

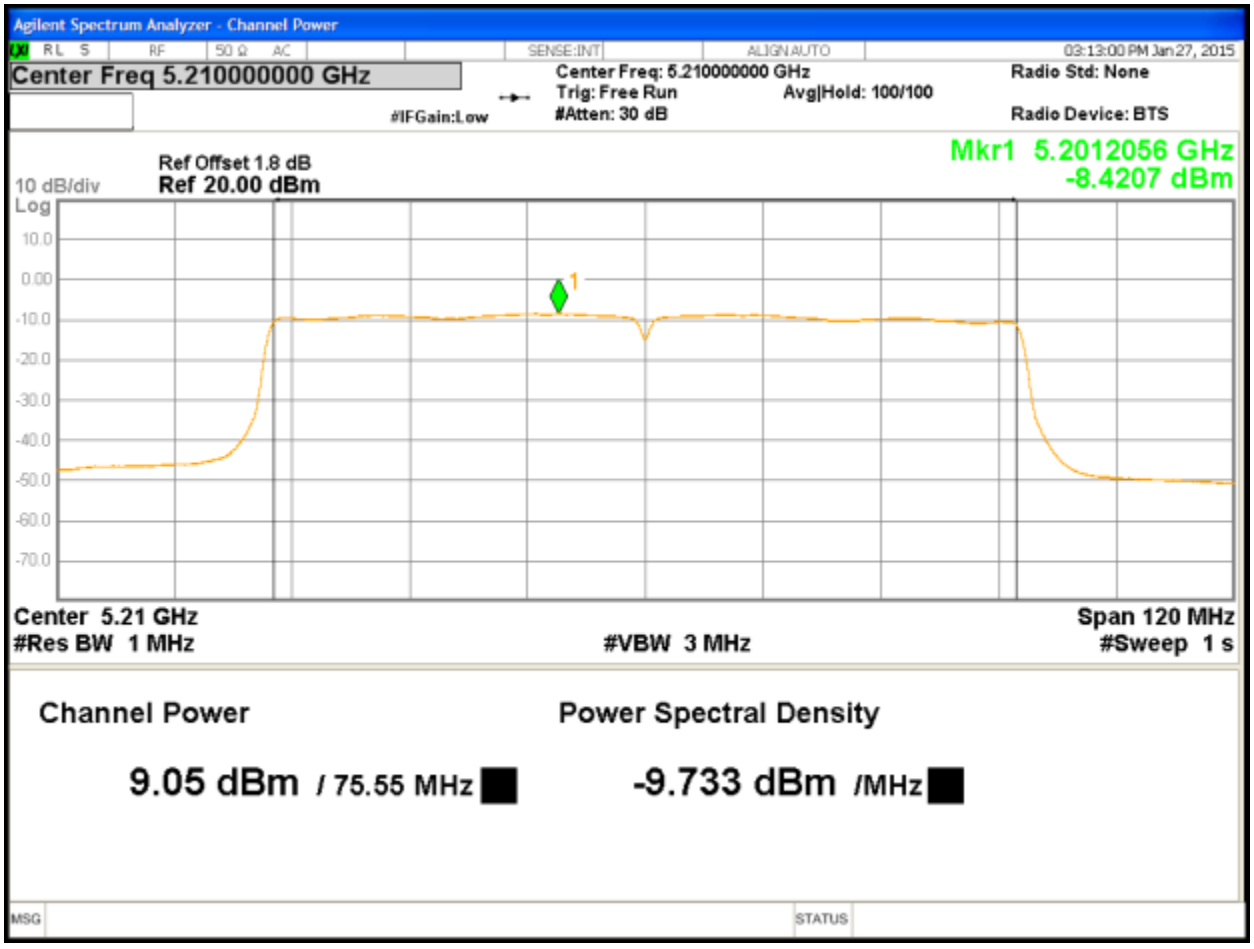


Figure 20: Maximum Transmitted Power, 5210 MHz at HT80, Chain 0

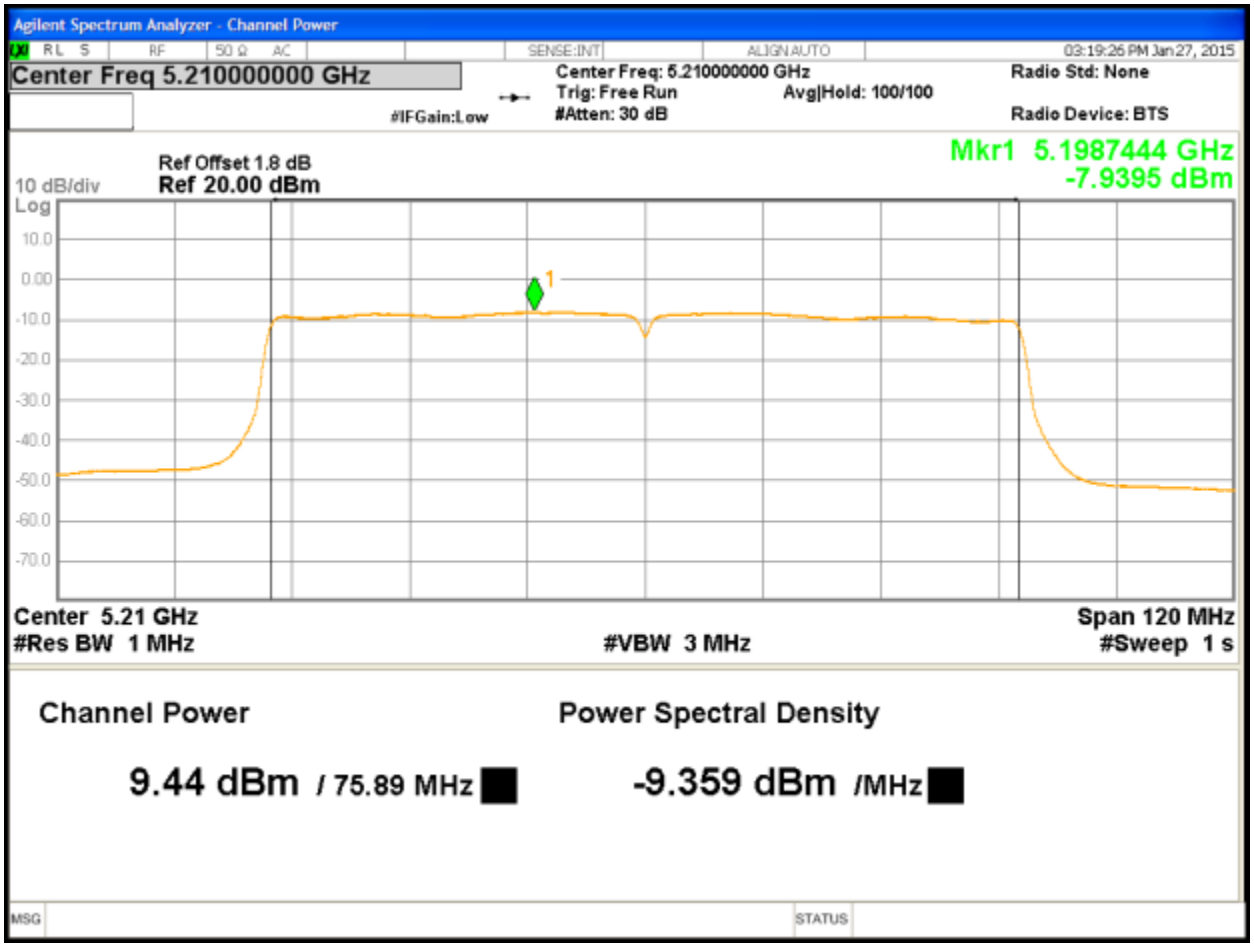


Figure 21: Maximum Transmitted Power, 5210 MHz at HT80, Chain 1

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.

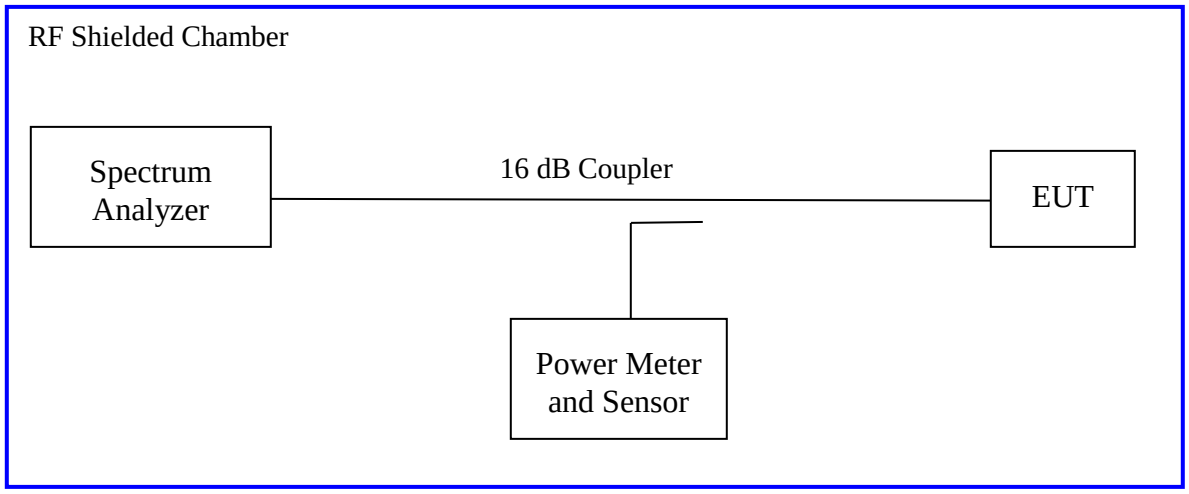
There is no restriction limits for the bandwidth. The 26 dB bandwidth was used to determine the limit for maximum conducted output power per CFR47 Part 15.407(a).

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: + 7.56 dBi		**Signal State:** Modulated at 100%.	
Ambient Temp.: 21 °C		**Relative Humidity:**33%	
Bandwidth (MHz) for 802.11a			
Freq. (MHz)	**26dB Bandwidth (MHz)**		**99% Bandwidth (MHz)**
	Ch0	**Ch1**	**Ch0**	**Ch1**
5180	20.22	20.04	16.60	16.57
5200	20.17	19.99	16.59	16.58
5240	20.16	19.98	16.59	16.57
5260	20.19	19.93	16.59	16.57
5280	20.18	19.93	16.60	16.57
5320	20.15	20.00	16.59	16.57
Bandwidth (MHz) for 802.11n HT20/ VHT20			
Freq. (MHz)	**26dB Bandwidth (MHz)**		**99% Bandwidth (MHz)**
	Ch0	**Ch1**	**Ch0**	**Ch1**
5180	20.48	20.27	17.84	17.82
5200	20.47	20.34	17.84	17.82
5240	20.38	20.31	17.84	17.82
5260	20.45	20.26	17.85	17.81
5280	20.48	20.33	17.85	17.81
5320	20.40	20.30	17.84	17.81
Note: The bandwidth was measured at 6.0 Mbps for 802.11a **Note**: The bandwidth was measured at 6.5 Mbps for 802.11n HT20			

Bandwidth (MHz) for 802.11n HT40 / VHT40				
Freq. (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
	Ch0	Ch1	Ch0	Ch1
5190	39.15	39.11	36.33	36.32
5230	39.13	39.09	36.33	36.31
5270	39.13	39.06	36.33	36.31
5310	39.18	39.14	33.34	36.32
Note: The bandwidth was measured at 13.5Mbps for 802.11n HT40 mode.				

Bandwidth (MHz) for 802.11AC VHT80				
Freq. (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
	Ch0	Ch1	Ch0	Ch1
5210	80.32	80.08	75.73	75.70
5290	80.51	80.24	75.77	75.74
Note: The bandwidth was measured at 56.5Mbps for 802.11AC VHT80 mode.				

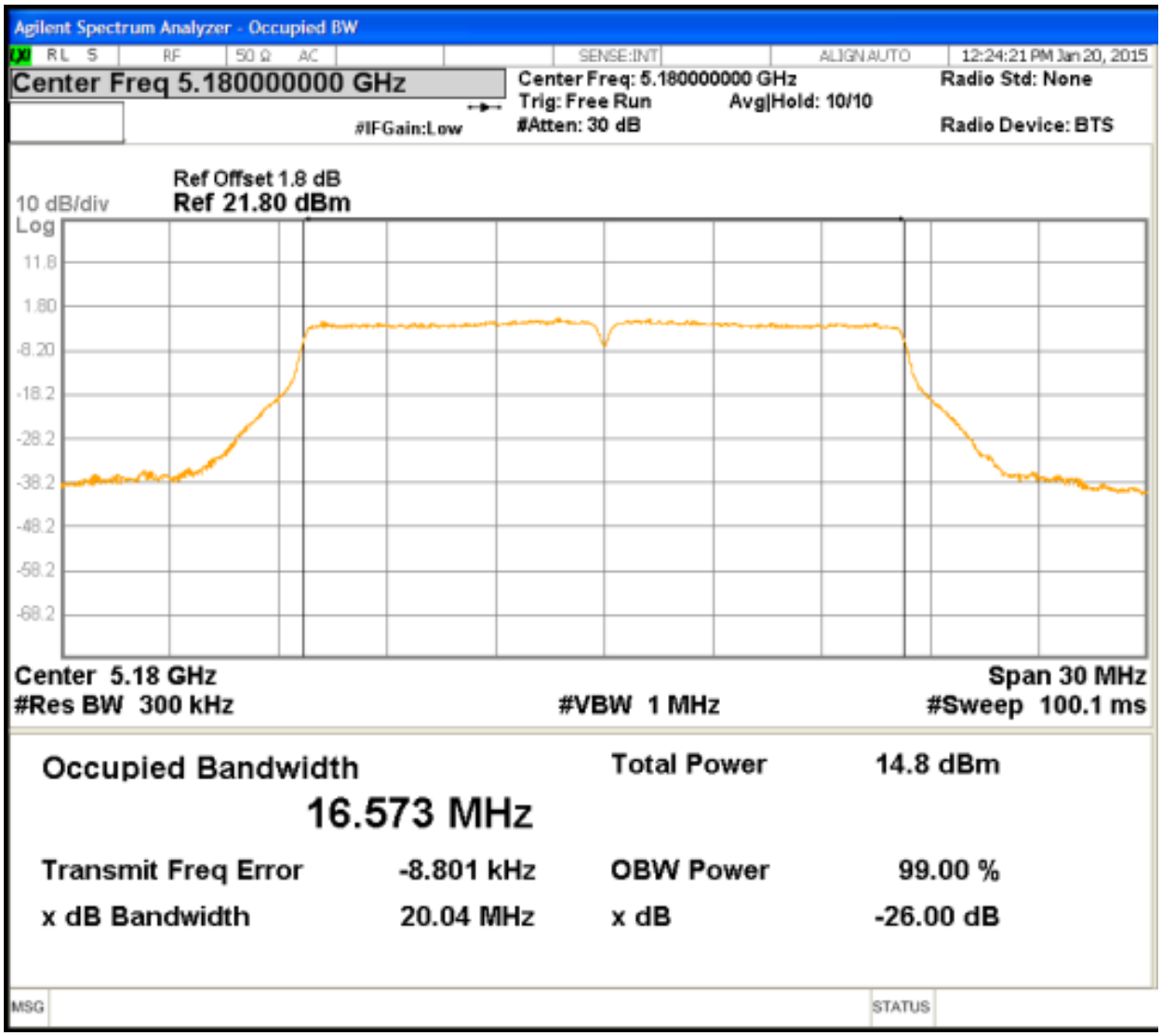


Figure 22: 26 dB and 99% Bandwidth at 5180 MHz, Chain 1

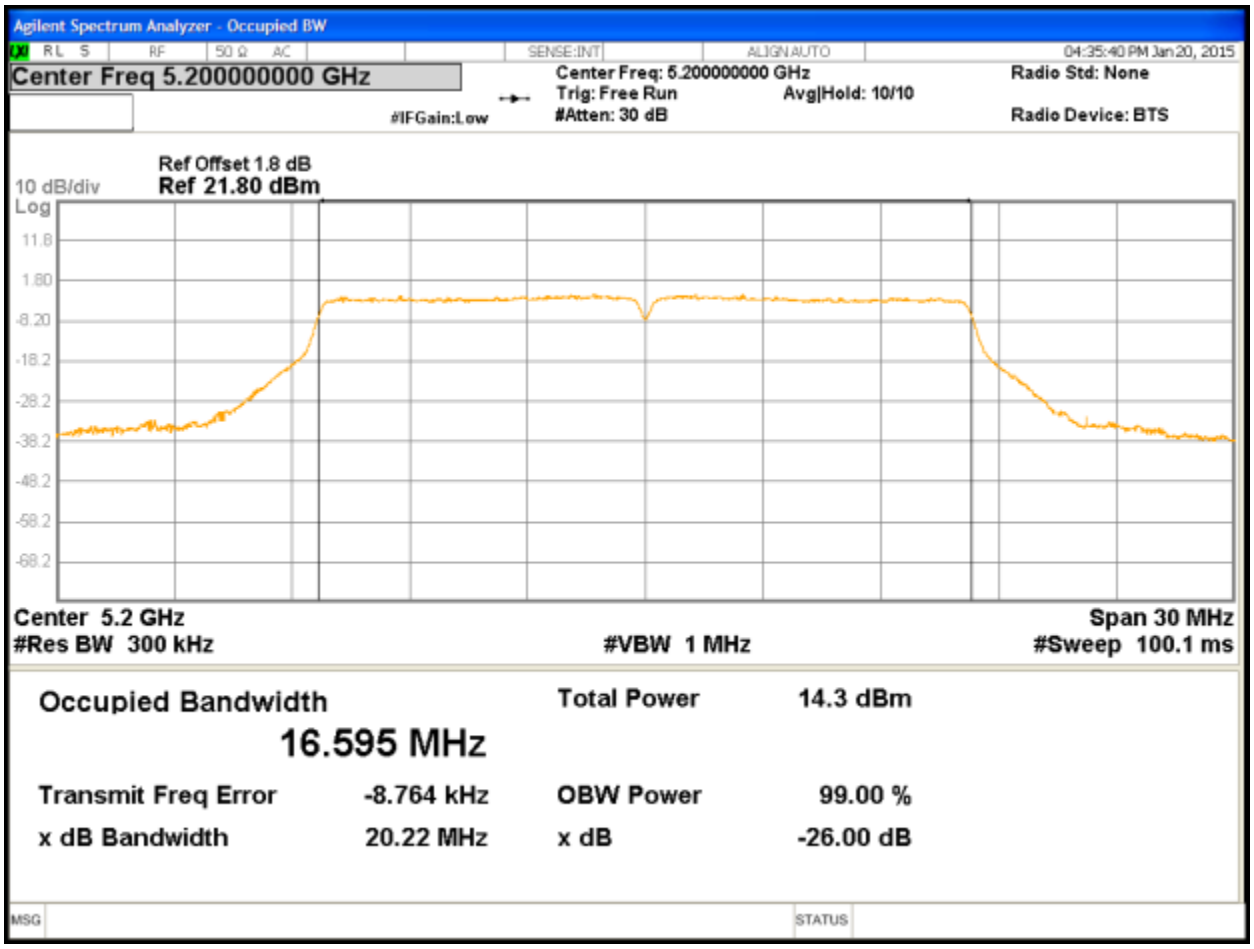


Figure 23: 26 dB and 99% Bandwidth at 5180 MHz, Chain 0 11a mode

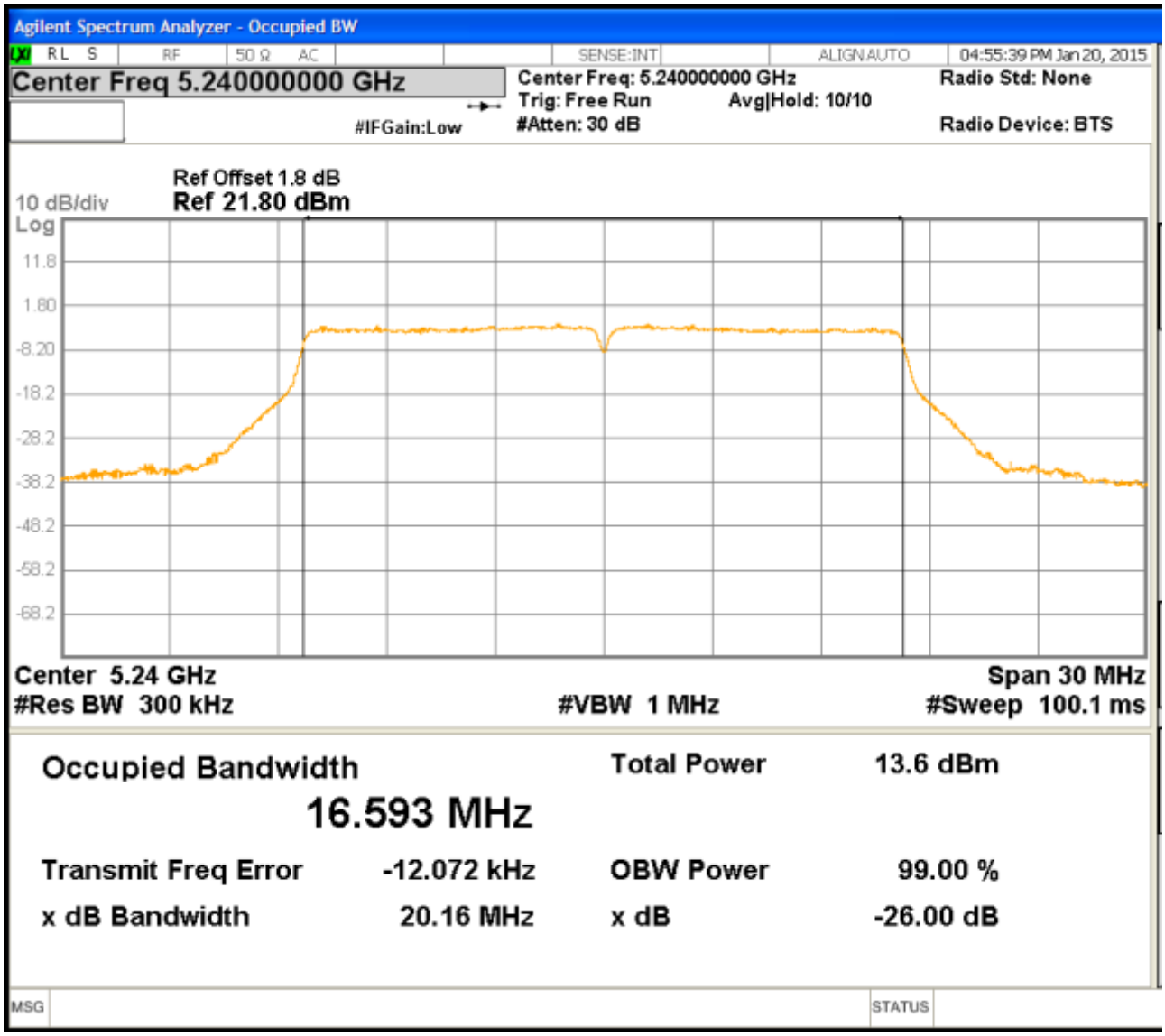


Figure 24: 26 dB and 99% Bandwidth at 5240 MHz, Chain 0

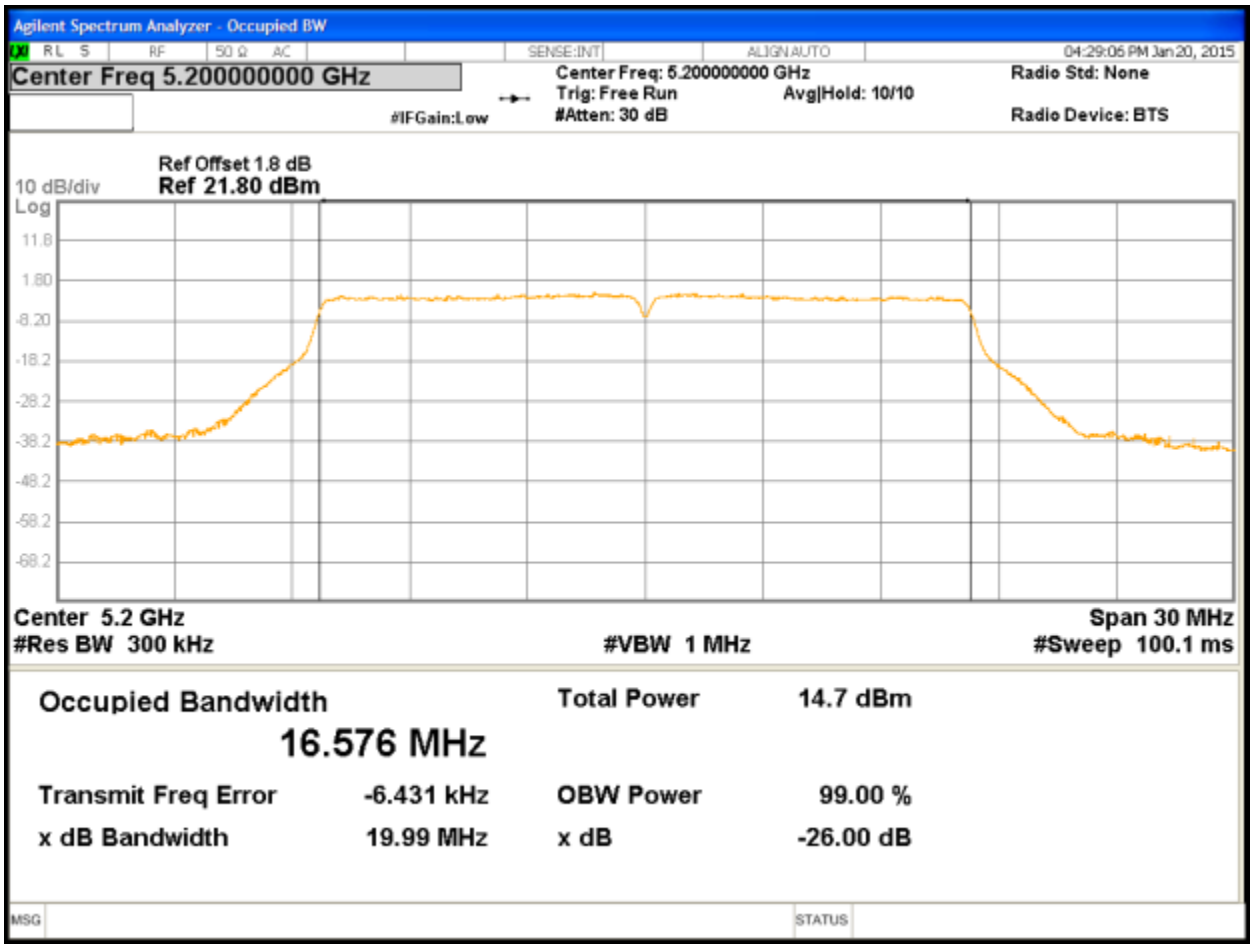


Figure 25: 26 dB and 99% Bandwidth at 5180 MHz, Chain 1

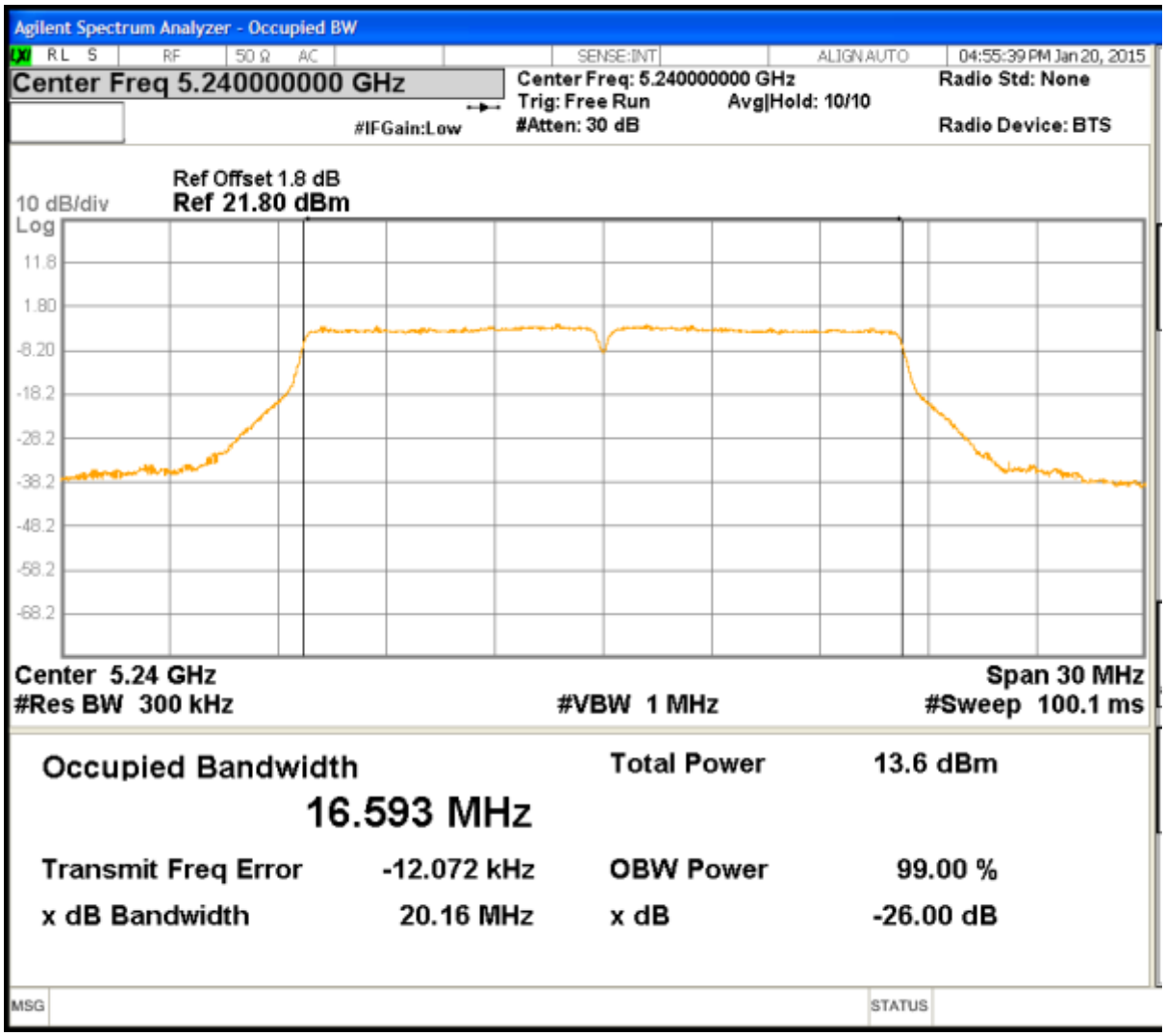


Figure 26: 26 dB and 99% Bandwidth at 5240 MHz, Chain 0

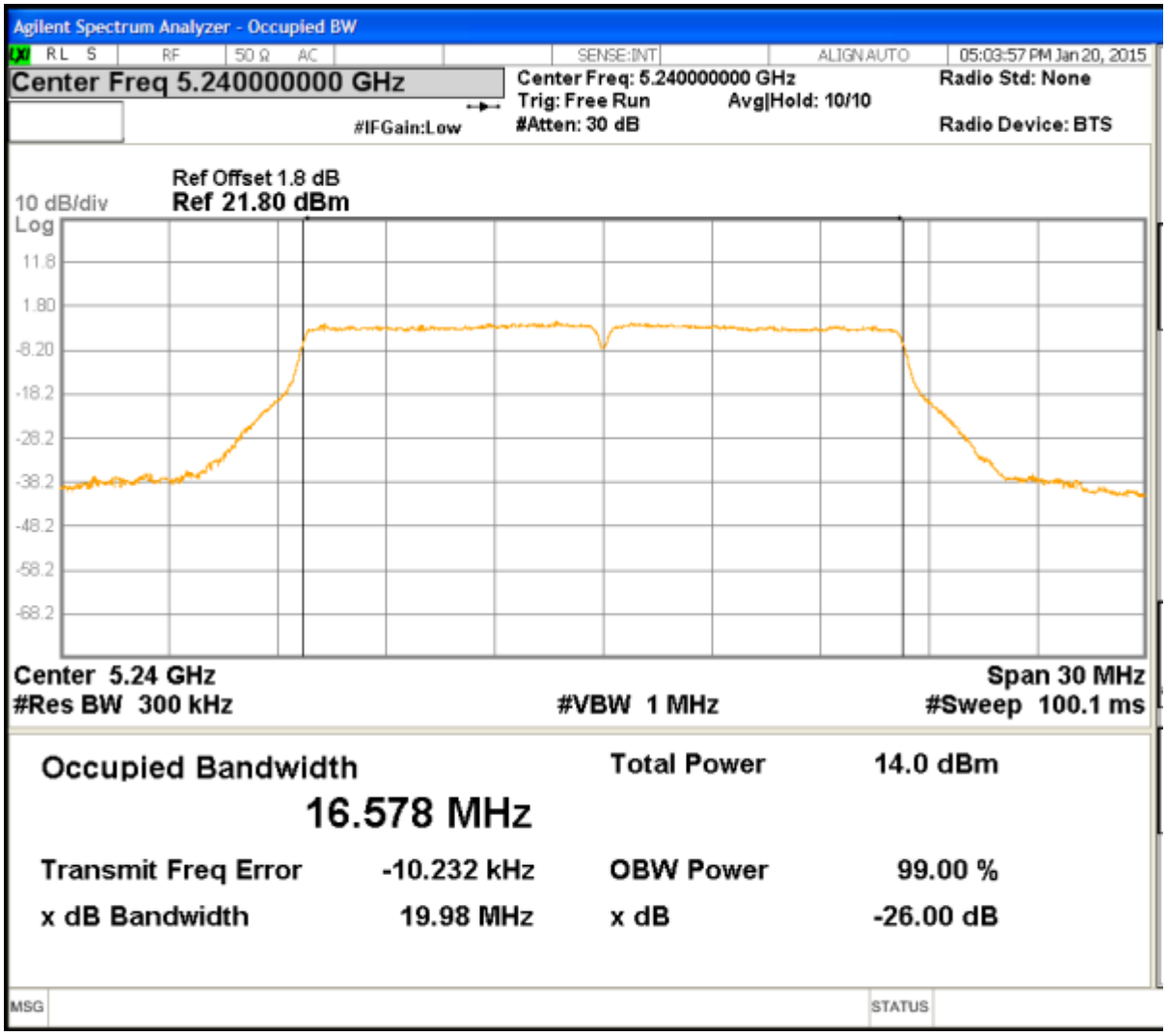


Figure 27: 26 dB and 99% Bandwidth at 5240 MHz, Chain 1

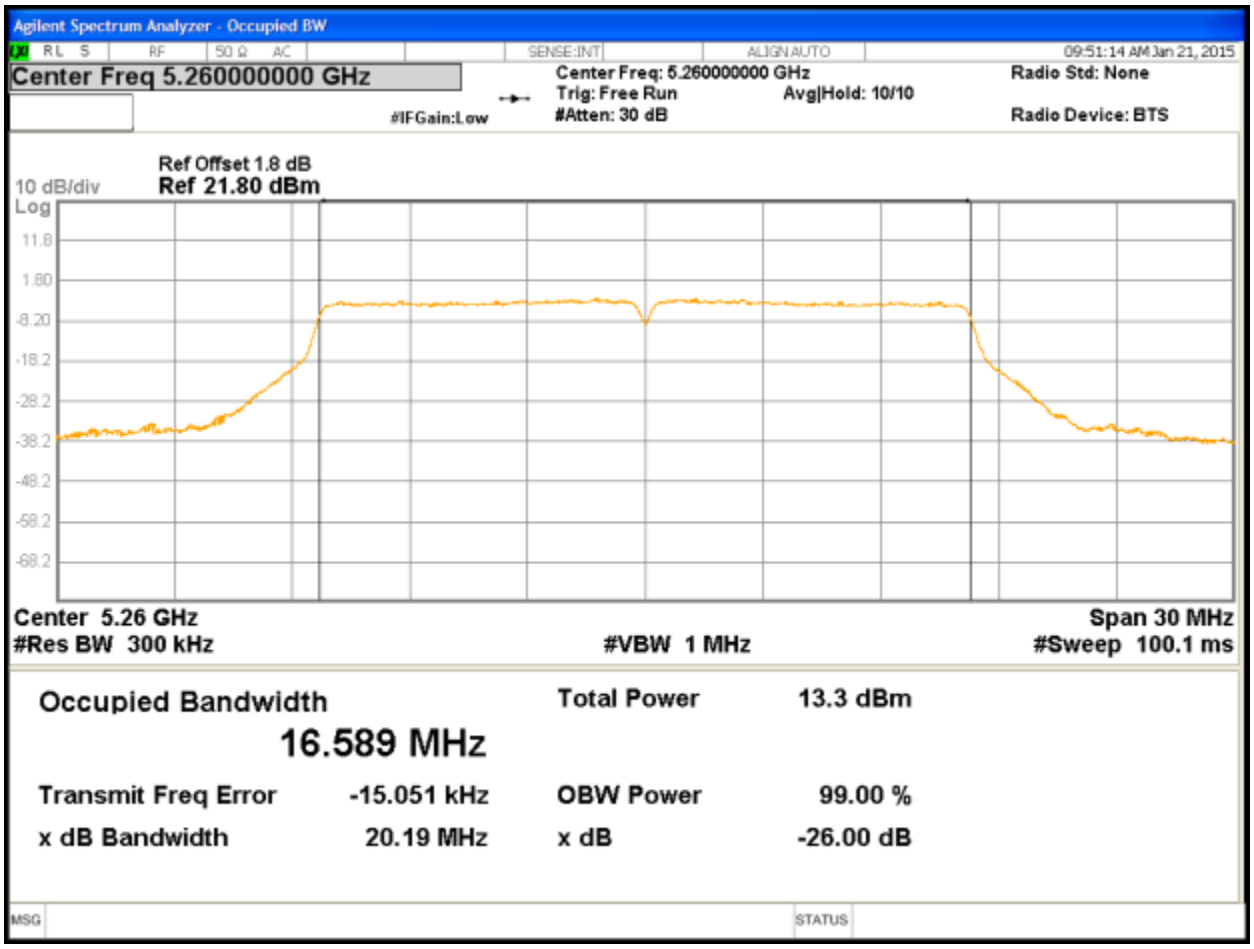


Figure 28: 26 dB and 99% Bandwidth at 5260 MHz, Chain 0

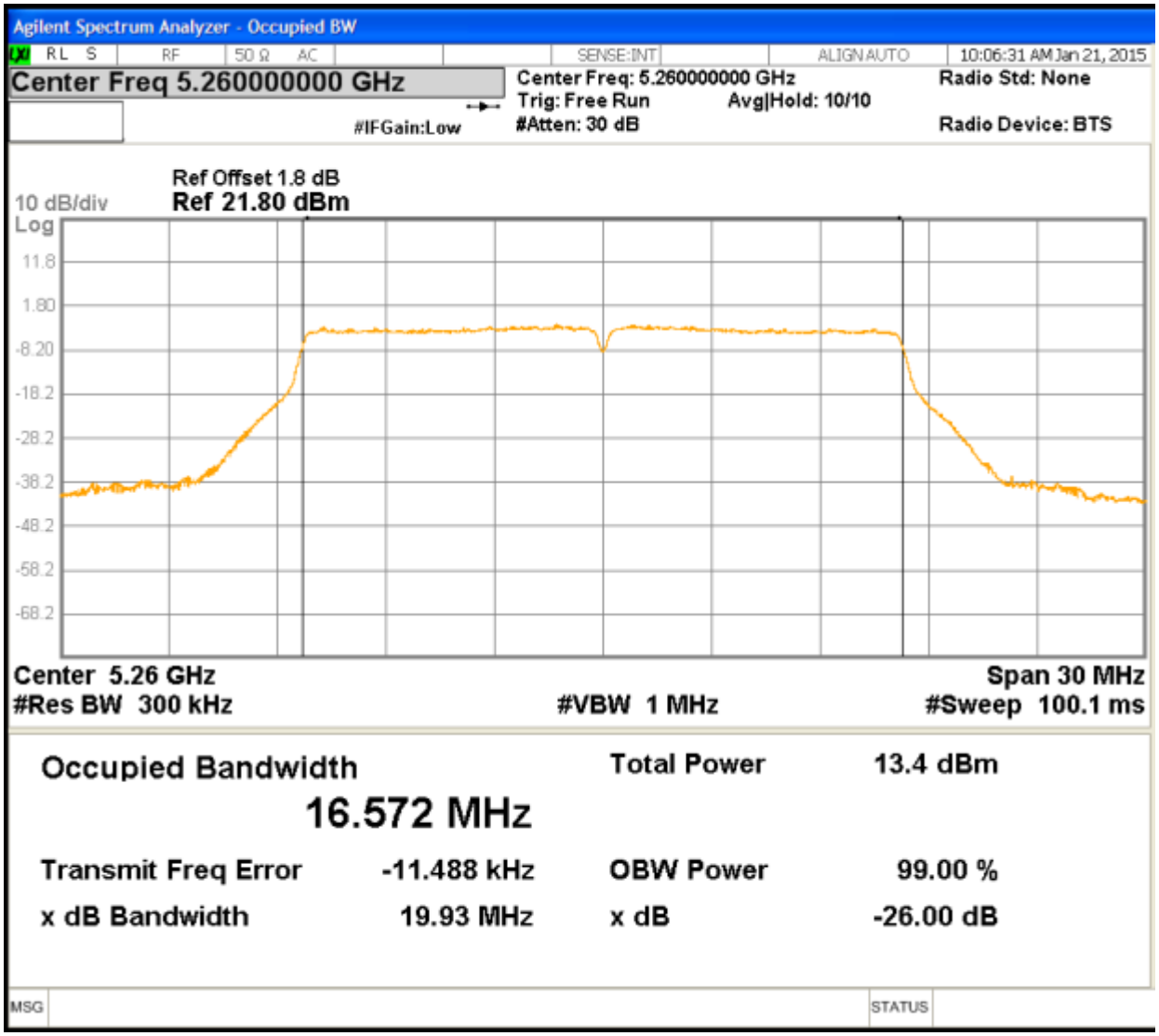


Figure 29: 26 dB and 99% Bandwidth at 5260 MHz, Chain 1

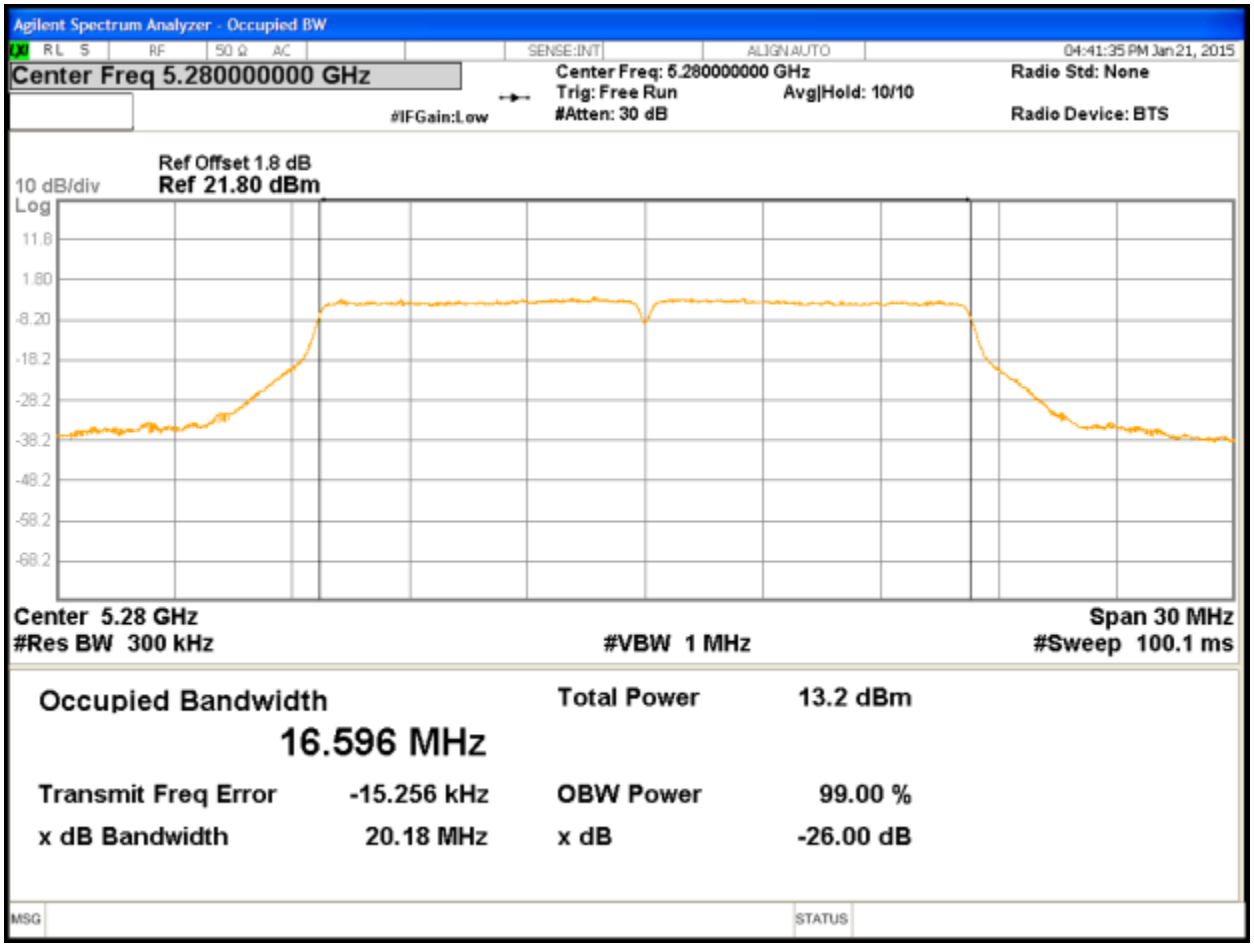


Figure 30: 26 dB and 99% Bandwidth at 5280 MHz, Chain 0

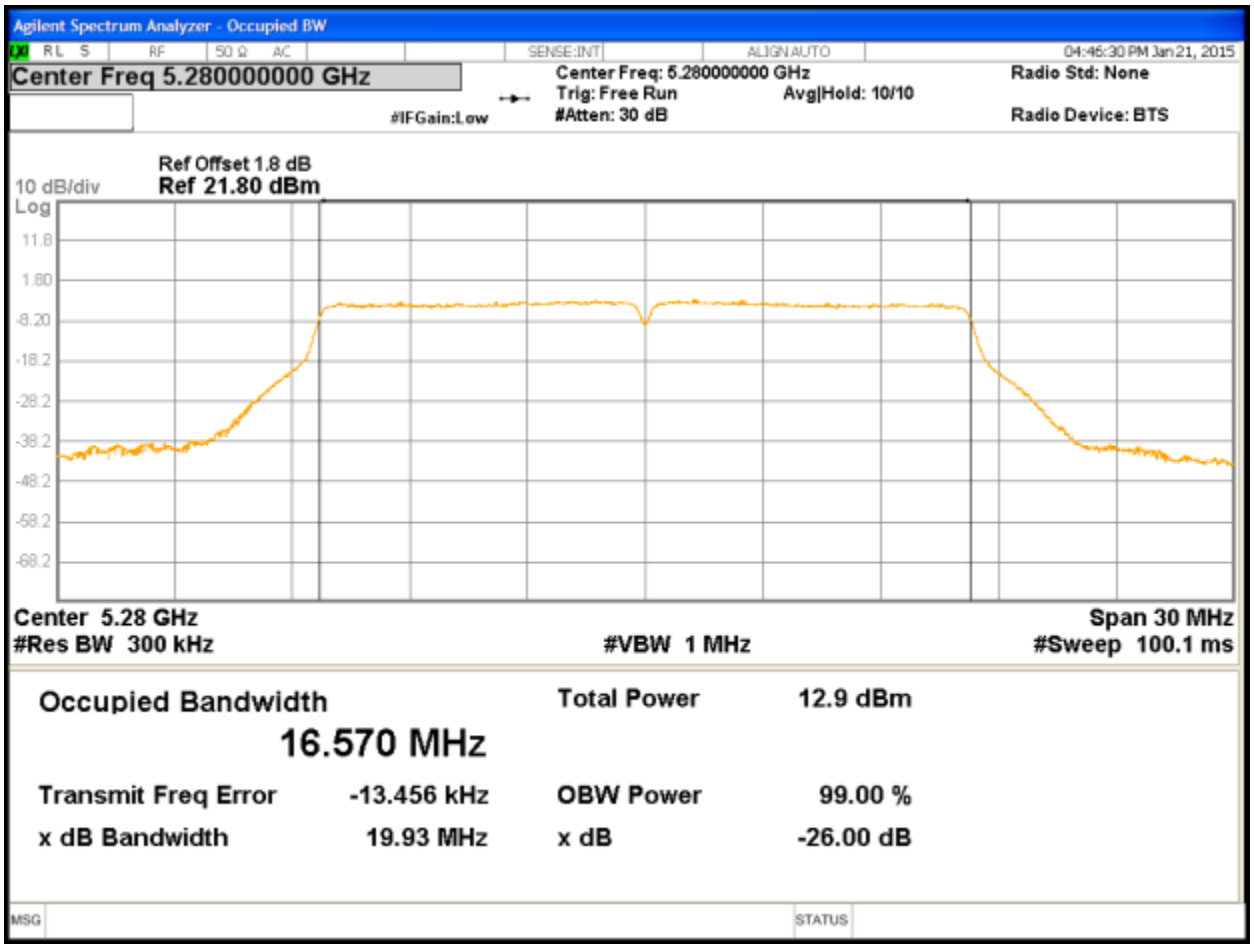


Figure 31: 26 dB and 99% Bandwidth at 5280 MHz, Chain 1

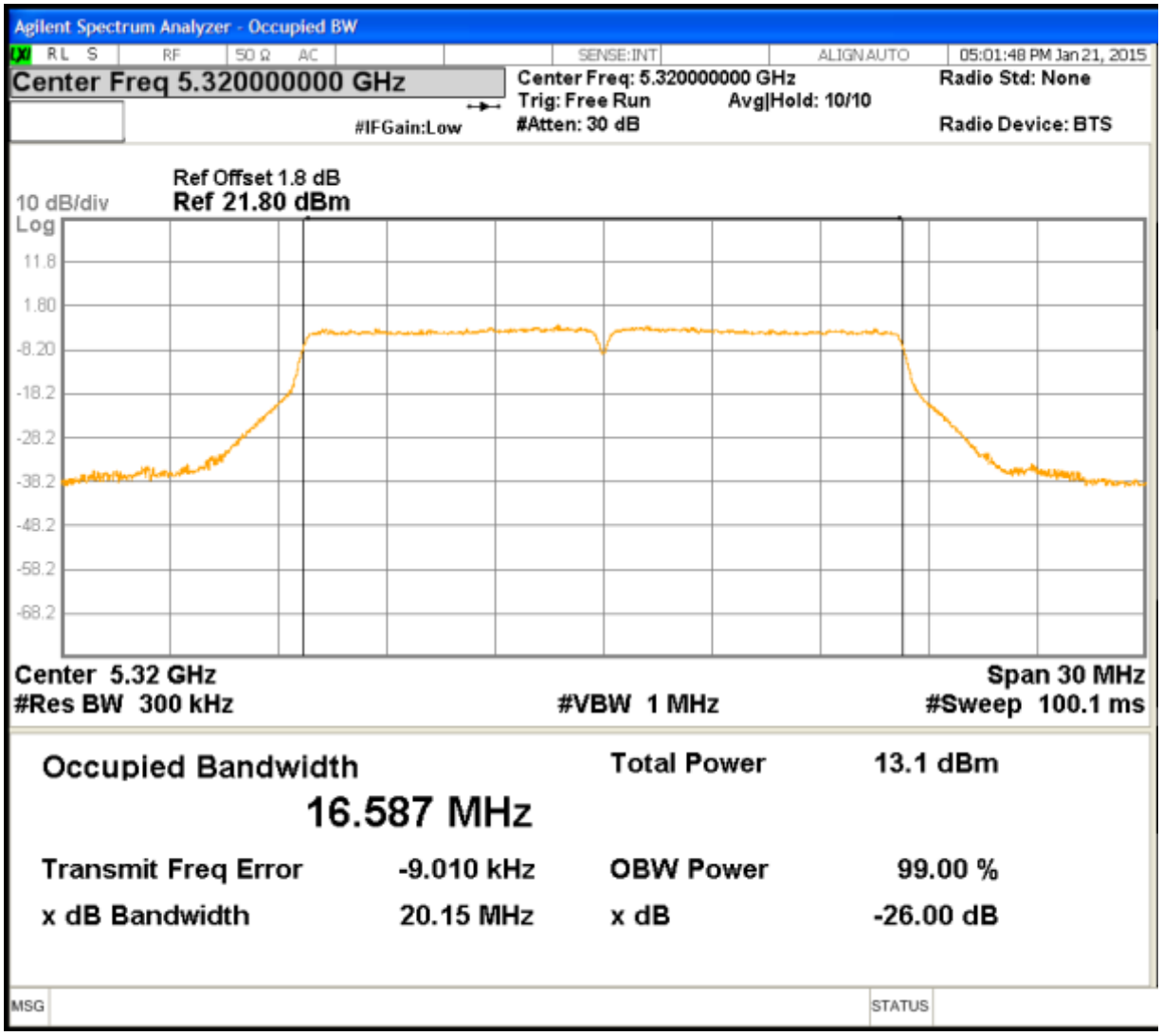


Figure 32: 26 dB and 99% Bandwidth at 5320 MHz, Chain 0

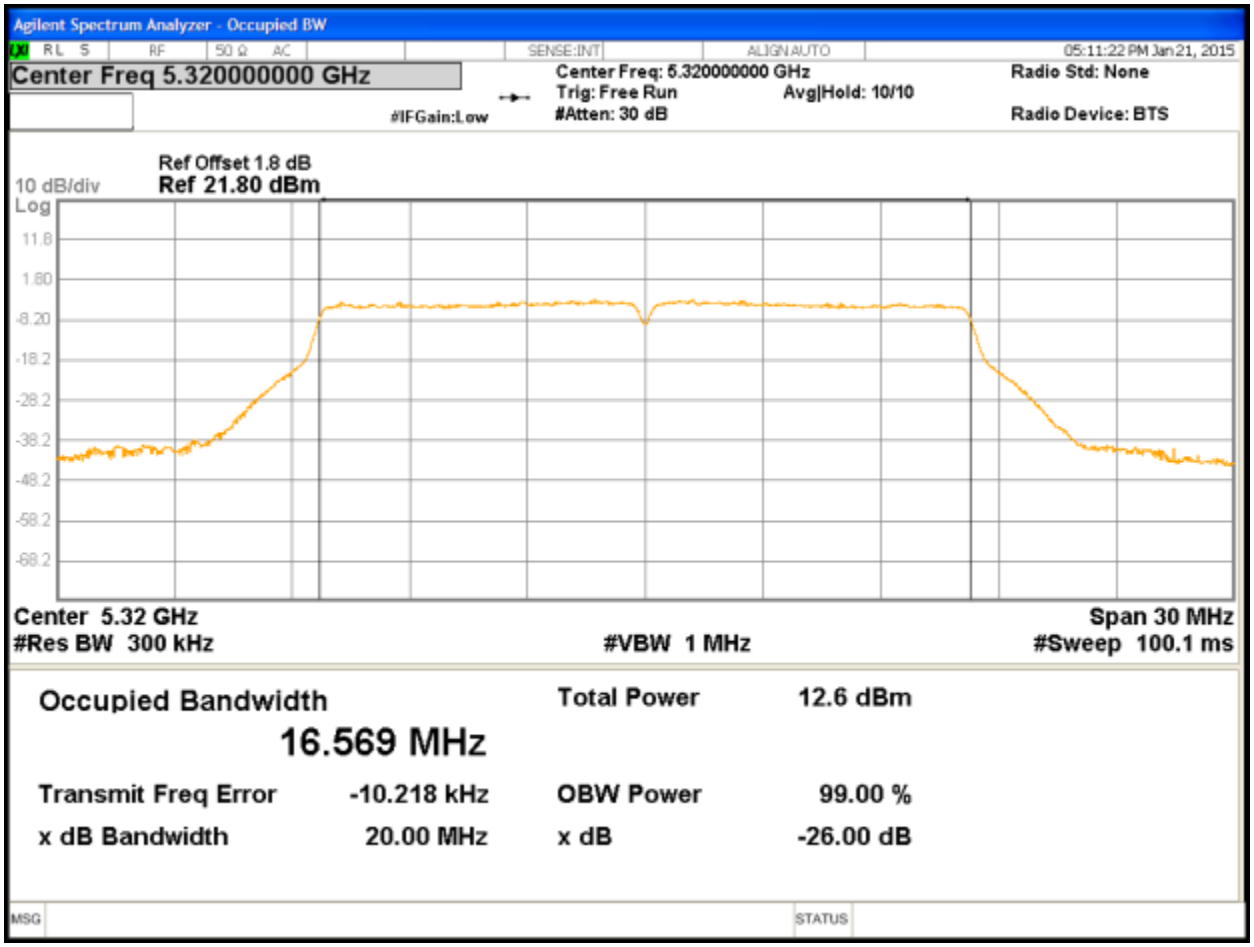


Figure 33: 26 dB and 99% Bandwidth at 5320 MHz, Chain 1

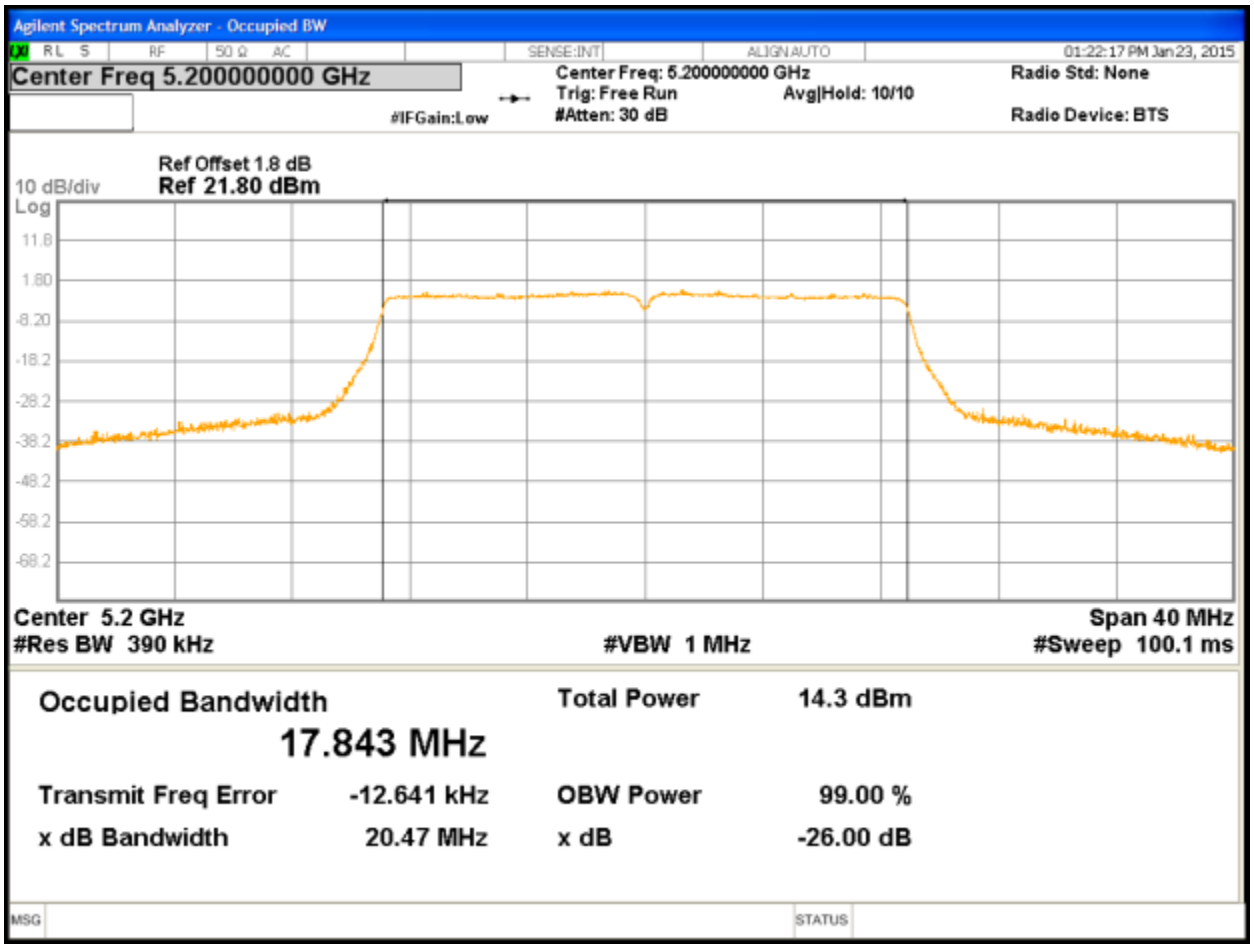


Figure 34: 26 dB and 99% Bandwidth at 5200 MHz, HT20 Chain 0

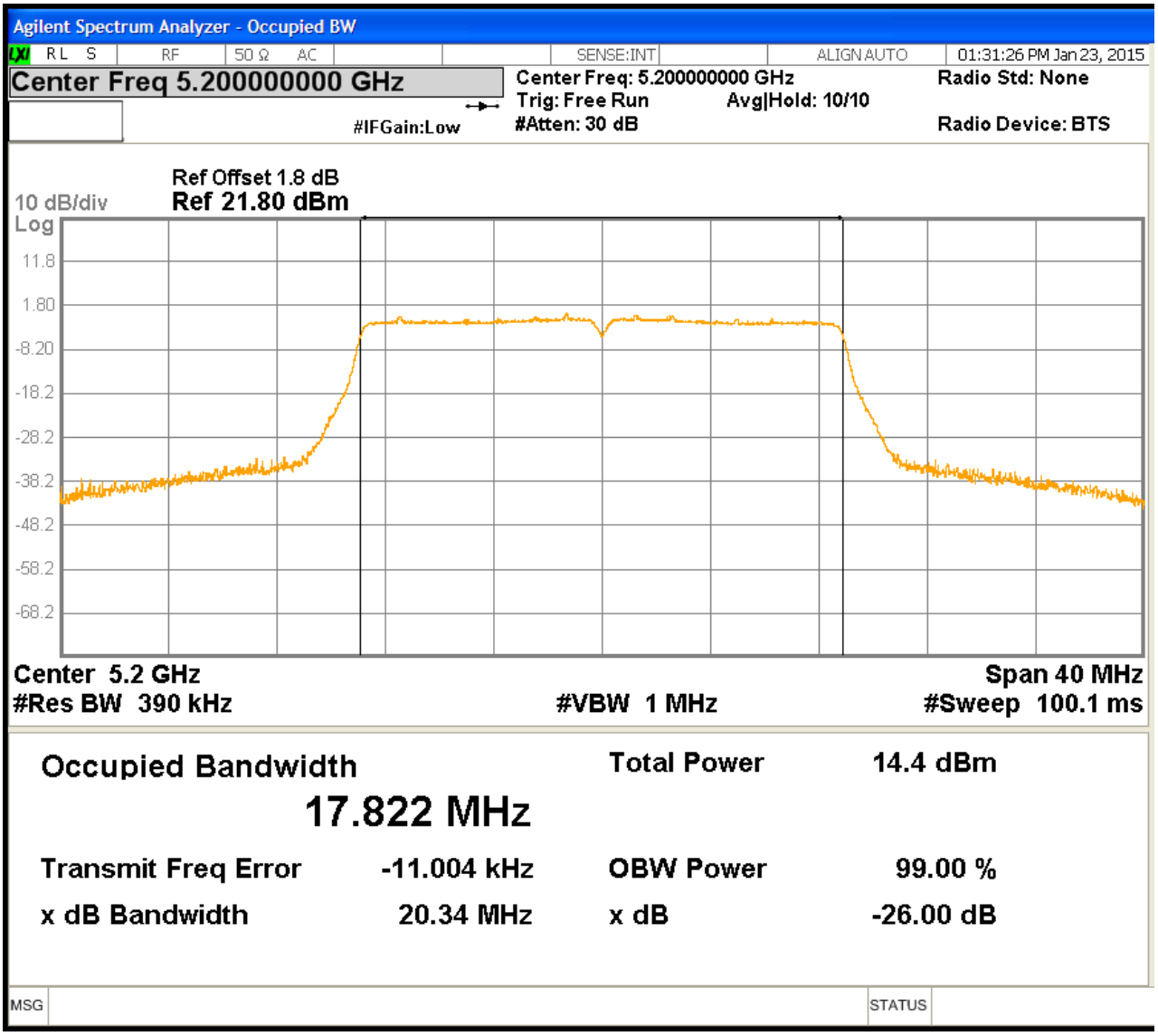


Figure 35: 26 dB and 99% Bandwidth at 5200 MHz, Chain 1

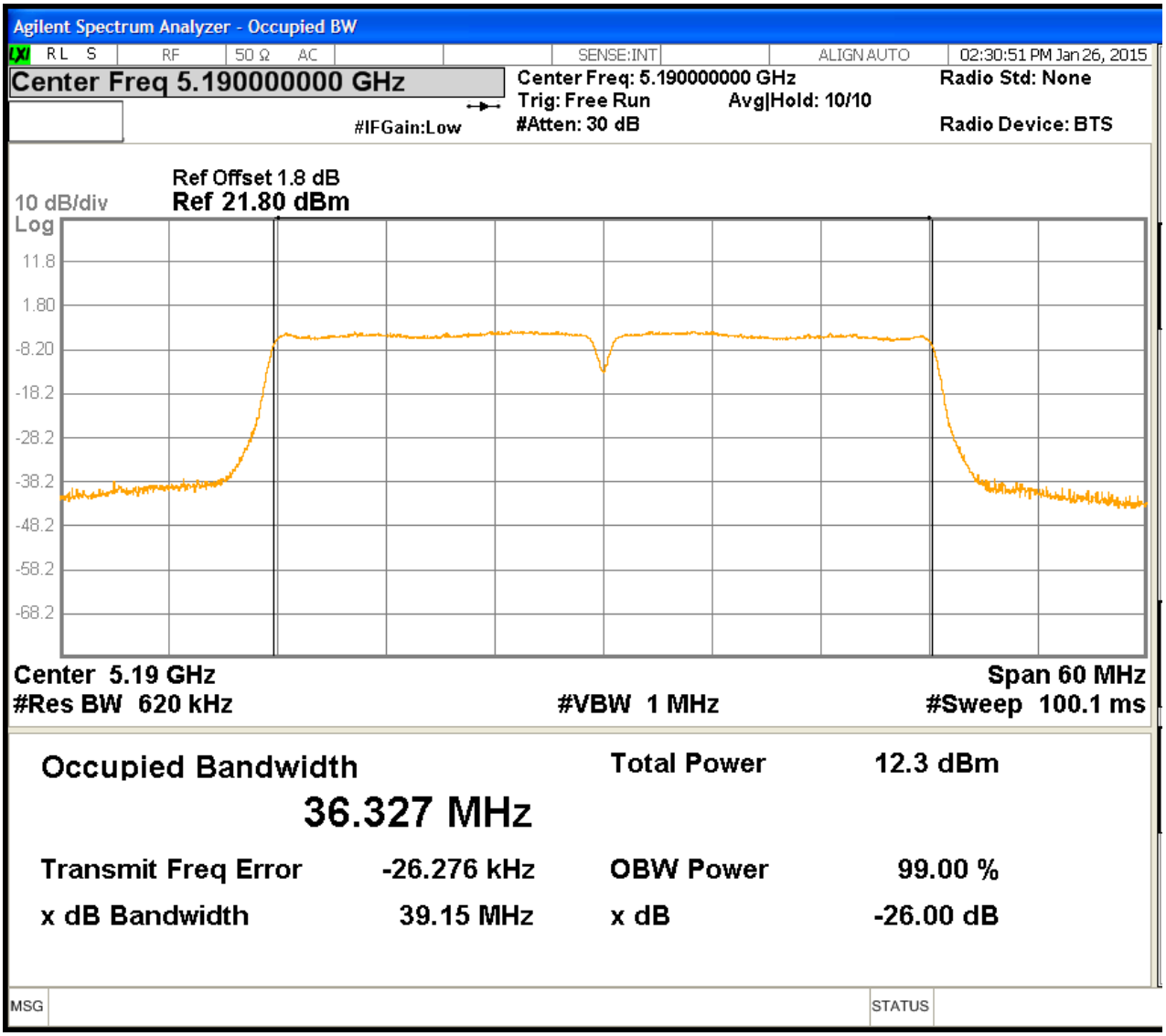


Figure 36: 26 dB and 99% Bandwidth at 5190 MHz, Chain 0

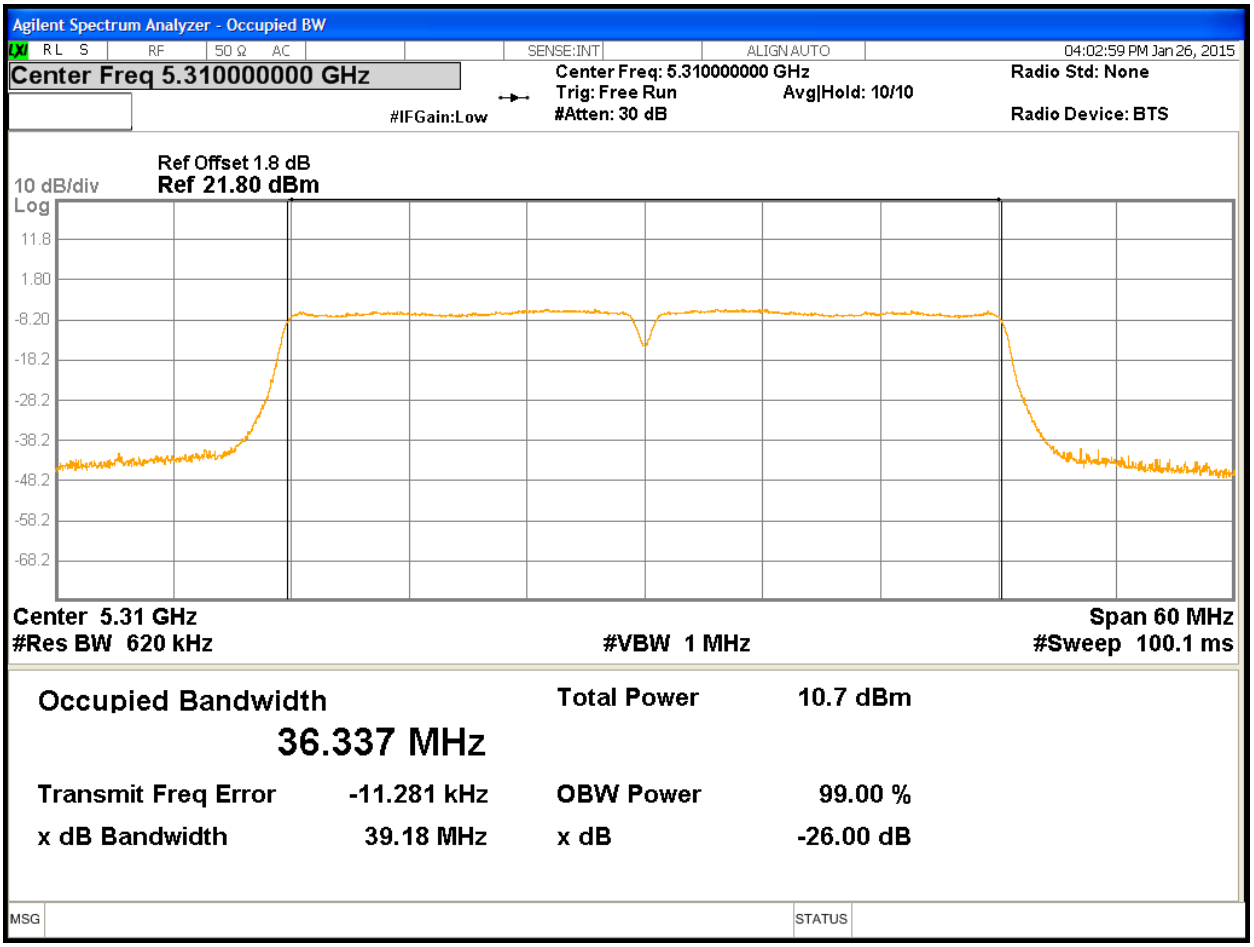


Figure 37: 26 dB and 99% Bandwidth at 5310MHz, Chain 0

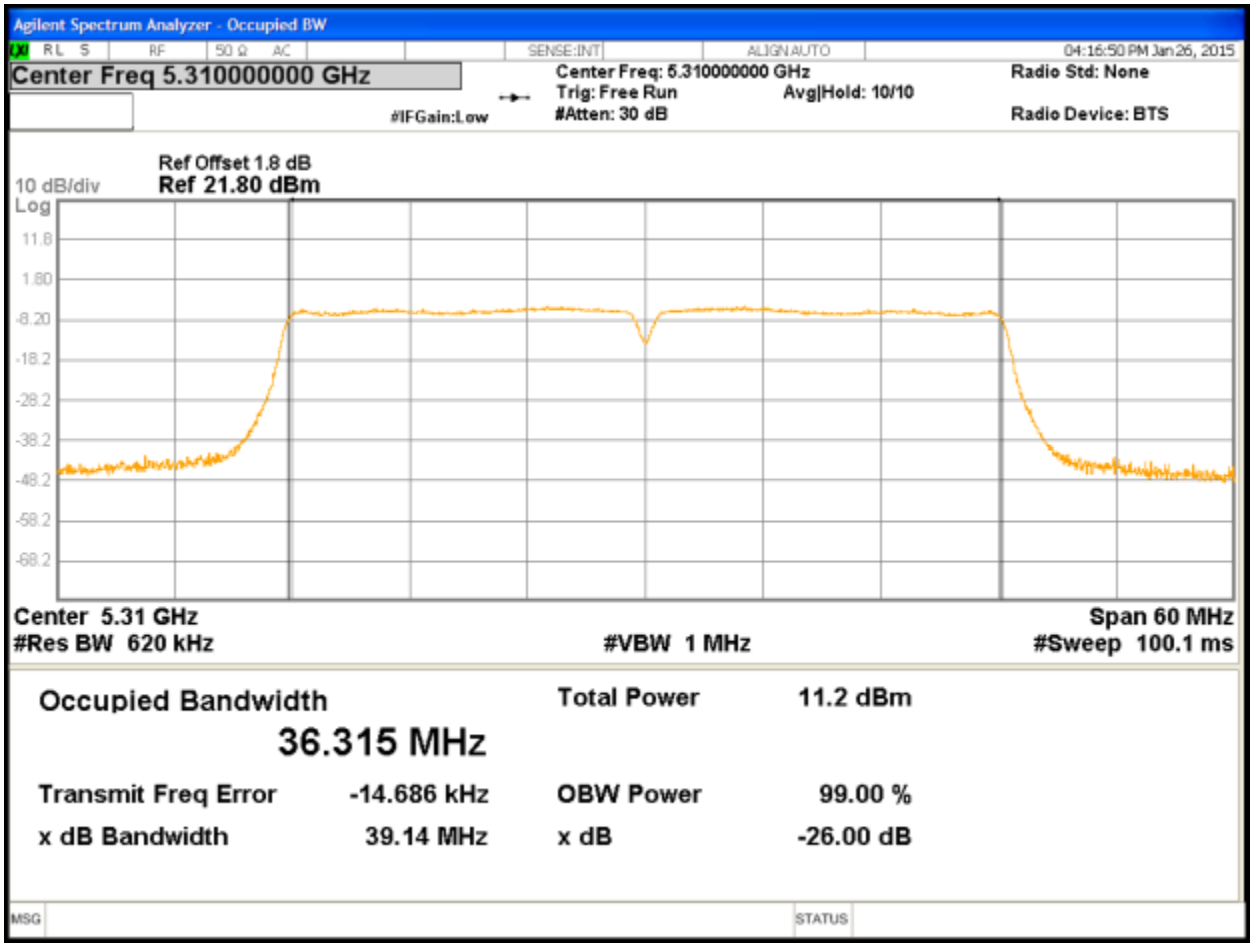


Figure 38: 26 dB and 99% Bandwidth at 5310 MHz, Chain 1

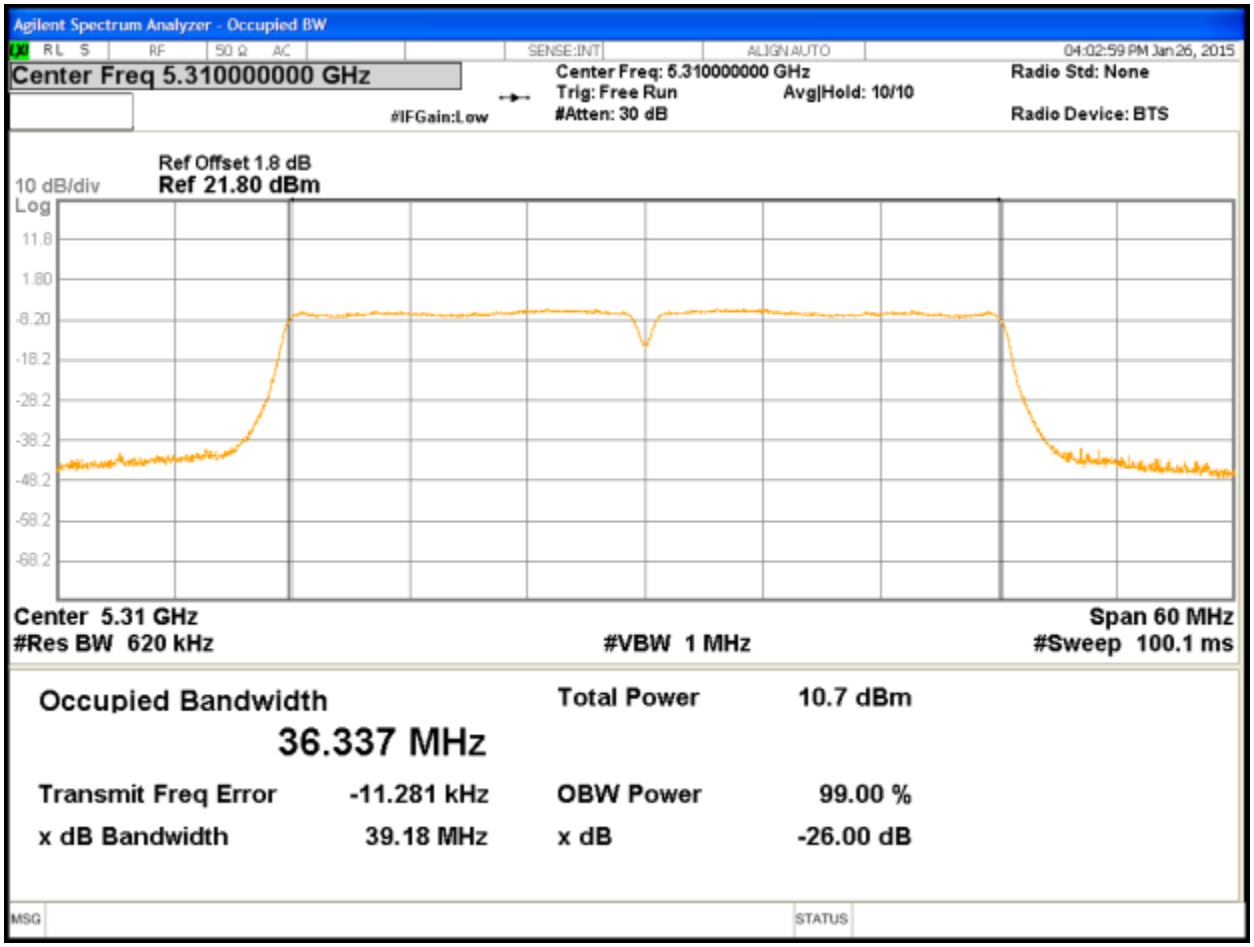


Figure 39: 26 dB and 99% Bandwidth at 5230 MHz, Chain 1

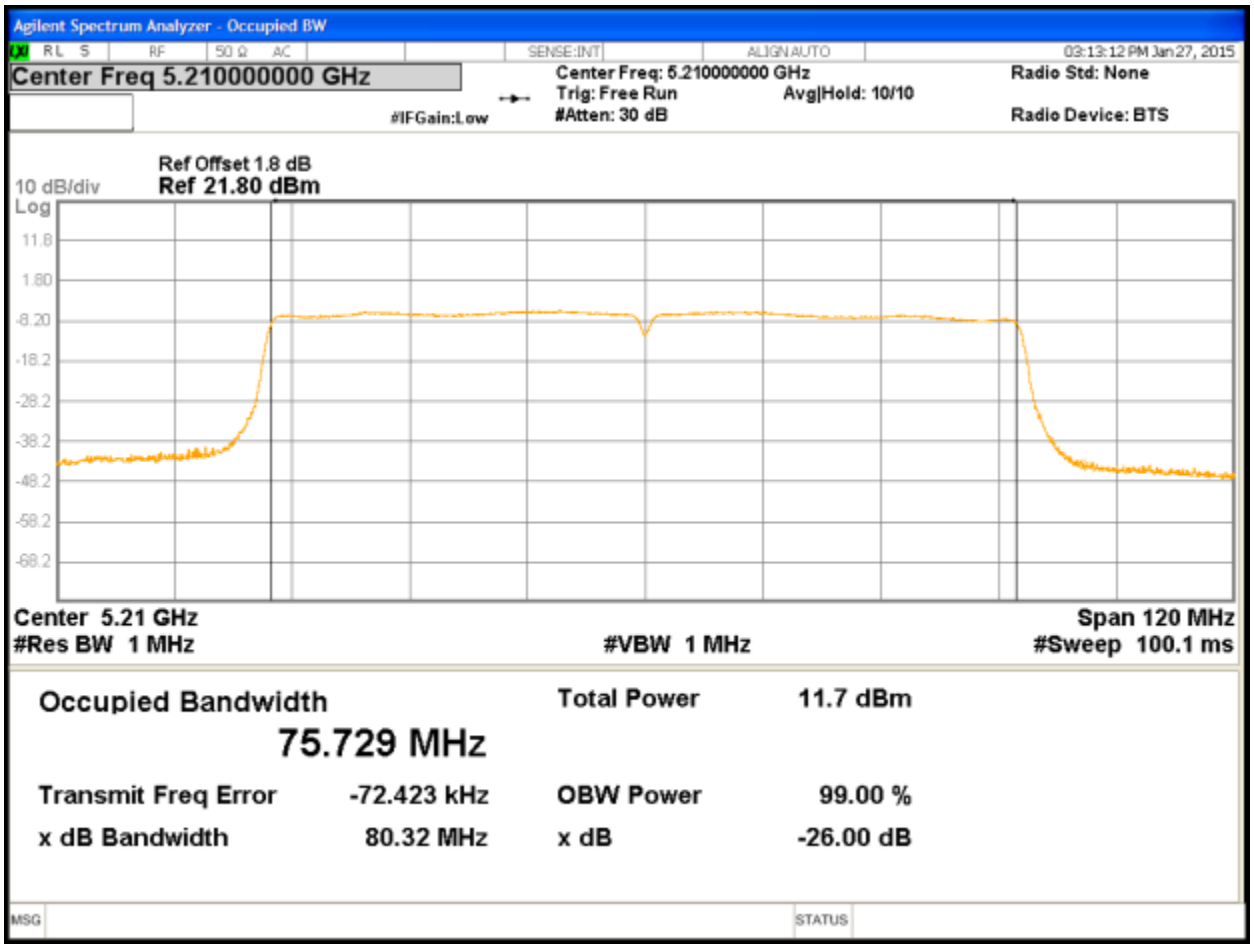


Figure 40: 26 dB and 99% Bandwidth at 5210 MHz, VHT 80 Chain 0

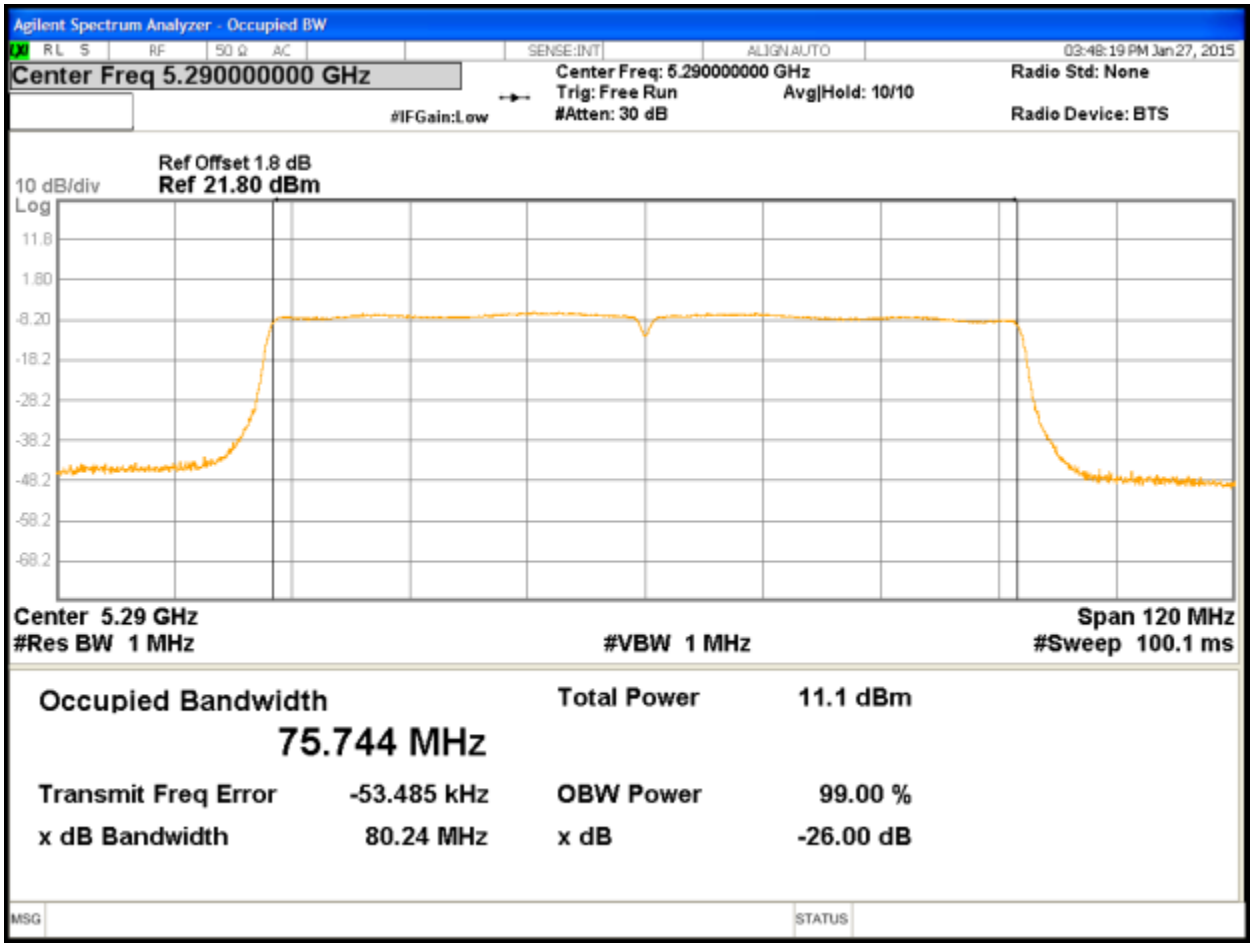


Figure 41: 26 dB and 99% Bandwidth at 5290 MHz,
VHT 80 Chain 1

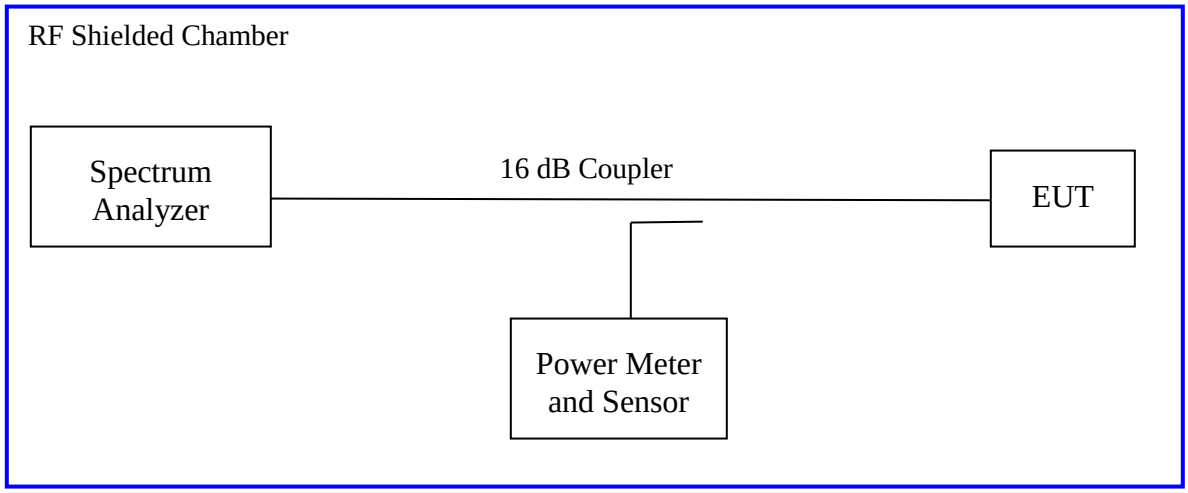
4.3 Peak Power Spectral Density

According to the CFR47 Part 15.407 (a) and RSS 210 (A9.2), the spectral power density output of the antenna port shall be less than 11dBm in any 1 MHz band during any time interval of continuous transmission.

4.3.1 Test Method

The conducted method was used to measure the channel power output per ANSI C63.10-2009 Section 6.11.2. The measurement was performed with modulation per CFR47 Part 15.407 (a) and RSS 210 (A9.2). The pre-evaluation was performed to find the worst modes. The worst findings were conducted on 3 channels in each operating frequency range of 5150 MHz to 5350MHz. 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 Power Spectral Density – Test Results

Test Conditions: Conducted Measurement, Normal Temperature and Voltage only			
Antenna Type: Integrated		**Power Setting:** See Test plan	
Max. Directional Gain: + 7.56 dBi		**Signal State:** Modulated at 100%.	
Ambient Temp.: 23° C		**Relative Humidity:**32%	
Peak Power Spectral Density			
802.11a Mode			
Freq. (MHz)	**Total PSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5180	4.377	9.44	-5.06
5200	4.075	9.44	-5.37
5240	3.71	9.44	-5.37
5260	6.11	9.44	-3.33
5280	5.99	9.44	-3.45
5320	5.86	9.44	-3.58

Note: 1. The highest peak output power was observed at 11 a 6.0 MBps per data stream.
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 7.56dBi;
Antenna 1: 3.8 dBi and Antenna 2 : 5.2dBi
Directional gain = 10 log[(10G1 /20 + 10G2 /20 + … + 10GN /20)2 /NANT] dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently. = 5.70 linear gain = 7.56 dBi.
4. As Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 9.44dBi.
Note: 5. Total PSD is the combined worst case PSD. Limited number of plots are placed in the report

Peak Power Spectral Density			
802.11 HT20/VHT20 Mode			
Freq. (MHz)	**Total PSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5180	7.189	9.44	-2.25
5260	6.728	9.44	-2.72
5320	1.322	9.44	-8.11

Note: 1. The highest peak output power was observed at HT20 6.5 Mbps per data stream.
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 7.56dBi;
Antenna 1: 3.8 dBi and Antenna 2 : 5.2dBi
Directional gain = 10 log[(10G1 /20 + 10G2 /20 + … + 10GN /20)2 /NANT] dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently. = 5.70 linear gain = 7.56 dBi.
4. As Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 9.44dBi.

Peak Power Spectral Density					
802.11 HT40/VHT40 Mode					
Freq. (MHz)	**Total PSD [dBm]**	**CF[dB]**	**Total PSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5190	-1.30	0.25	-1.05	9.44	-10.49
5230	-1.90	0.25	-1.65	9.44	-11.09
5310	-3.18	0.25	-2.93	9.44	-12.37

Note: 1. The highest peak output power was observed at HT40 13.5Mbps per data stream.
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 7.56dBi;
Antenna 1: 3.8 dBi and Antenna 2 : 5.2dBi
Directional gain = 10 log[(10G1 /20 + 10G2 /20 + … + 10GN /20)2 /NANT] dBi [Note the "20"s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently. = 5.70 linear gain = 7.56 dBi.
4. As Per CFR47 Part 15.407 (a), the limit is reduced for every dBi gain exceeding 6dBi. The limit would be 9.44dBi.

802.11n AC (VHT80) Mode					
Freq. (MHz)	**Total PSD [dBm]**	**CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5210	-6.90	2.53	-4.37	9.44	-13.81
5290	-8.19	2.53	-5.66	9.44	-15.10

Note: 1. The highest peak output power was observed at VHT80 58.5 Mbps per data stream.

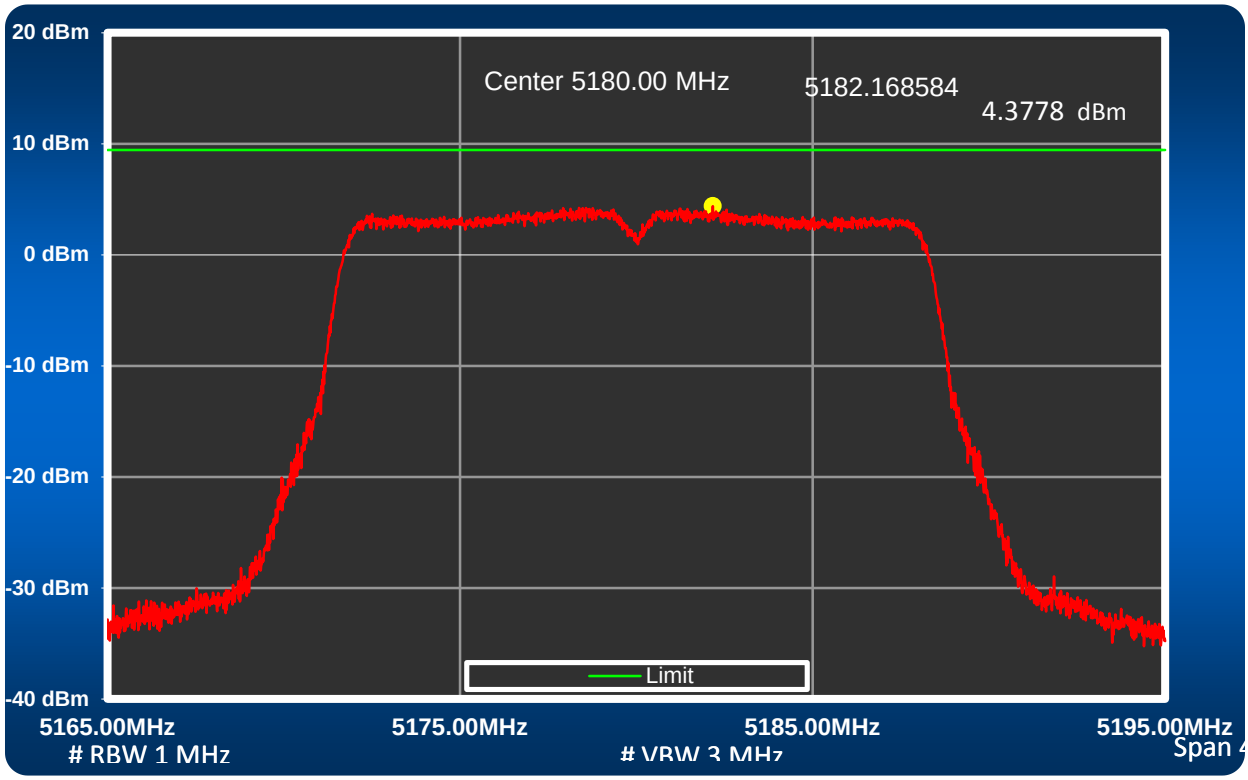


Figure 42: Combined Power Spectral Density, 5180 MHz at 802.11a – 6.0 Mbps

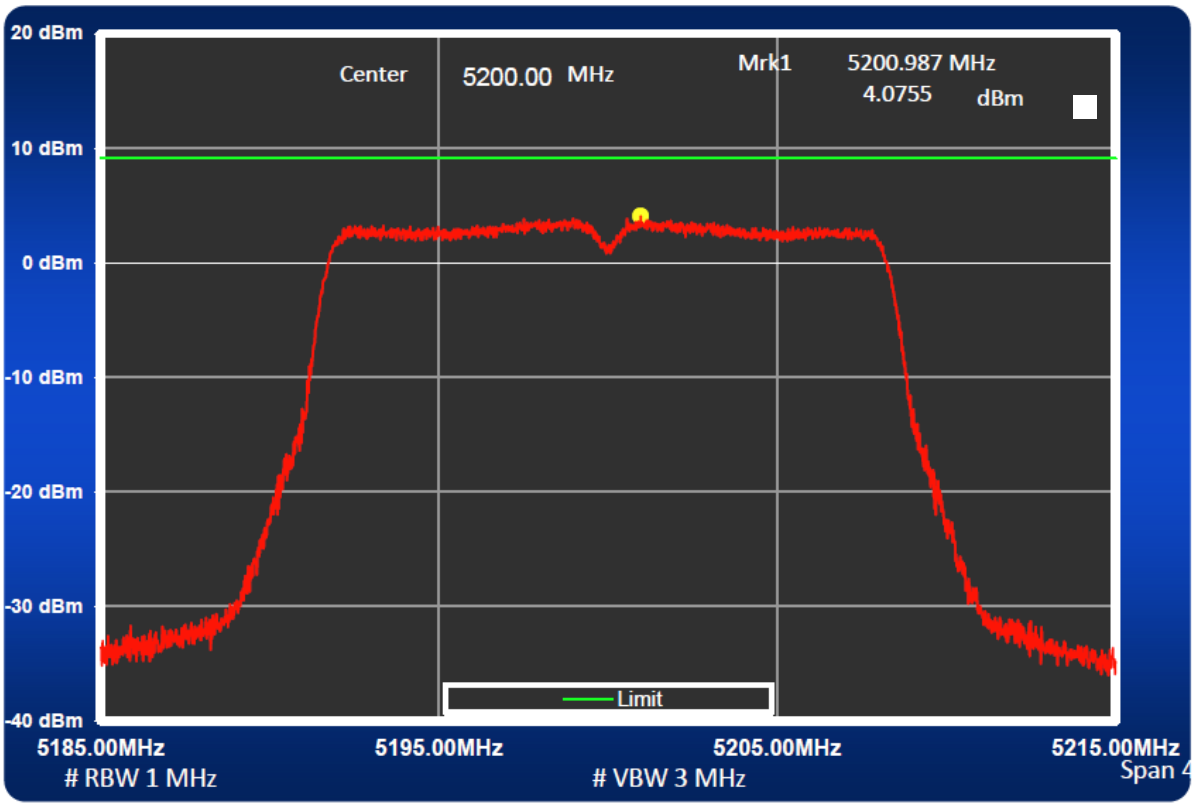


Figure 43: Power Spectral Density, 5200 MHz at 802.11a, Chain 1 – 6.0 Mbps

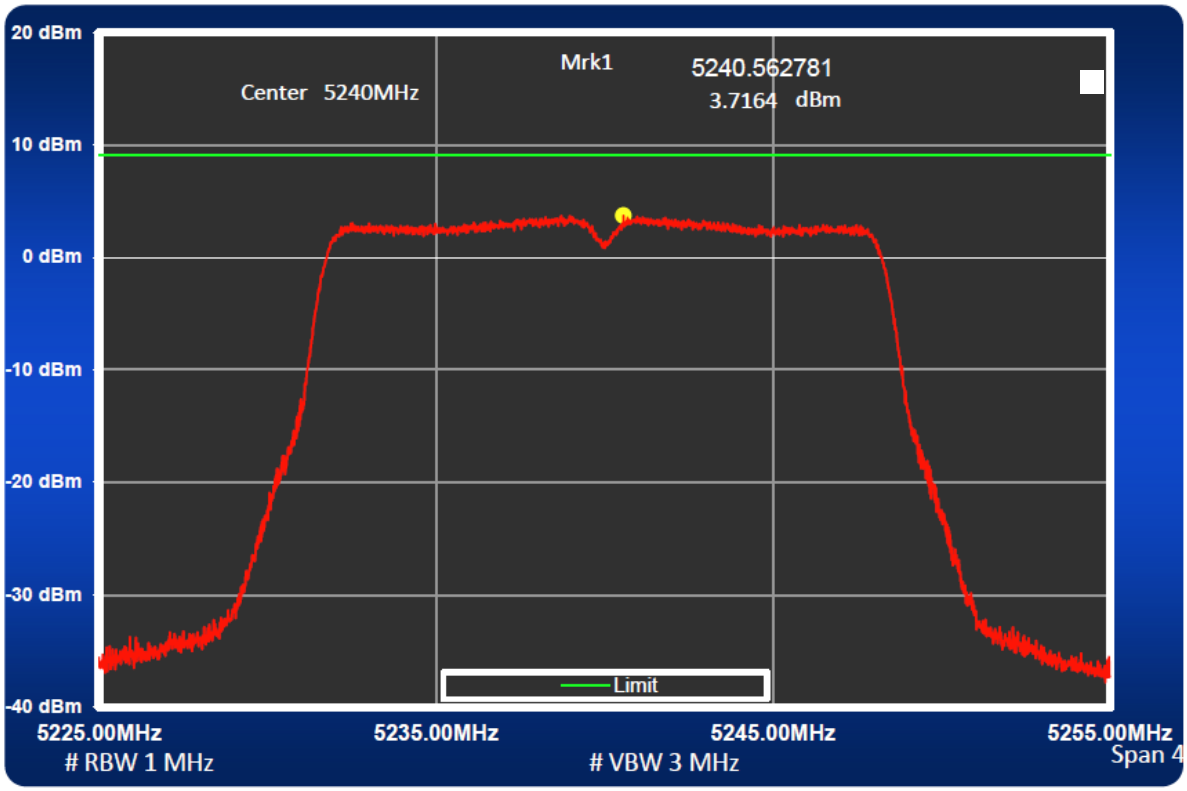


Figure 44: Power Spectral Density, 5240 MHz at 802.11a, 6.0 Mbps

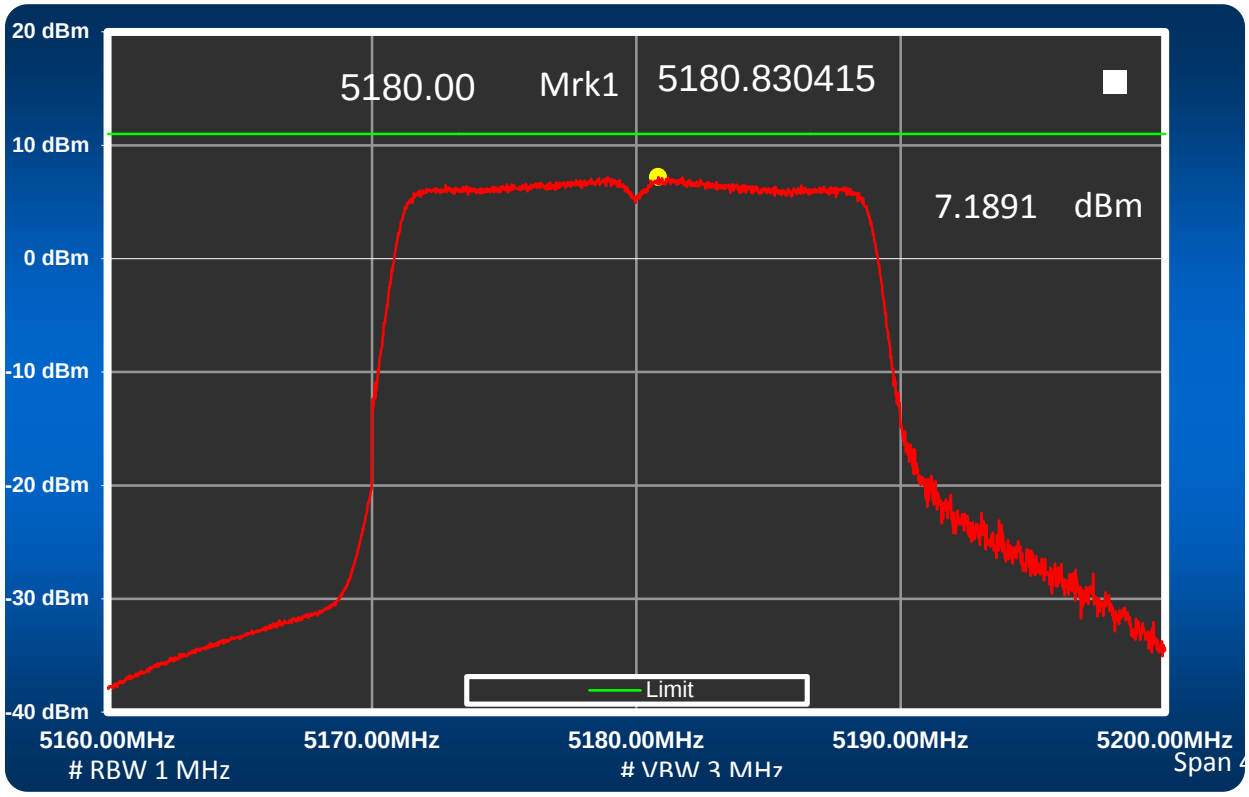


Figure 45: Peak Power Spectral Density, 5180MHz at 802.11n, HT 20, 6.5 Mbps

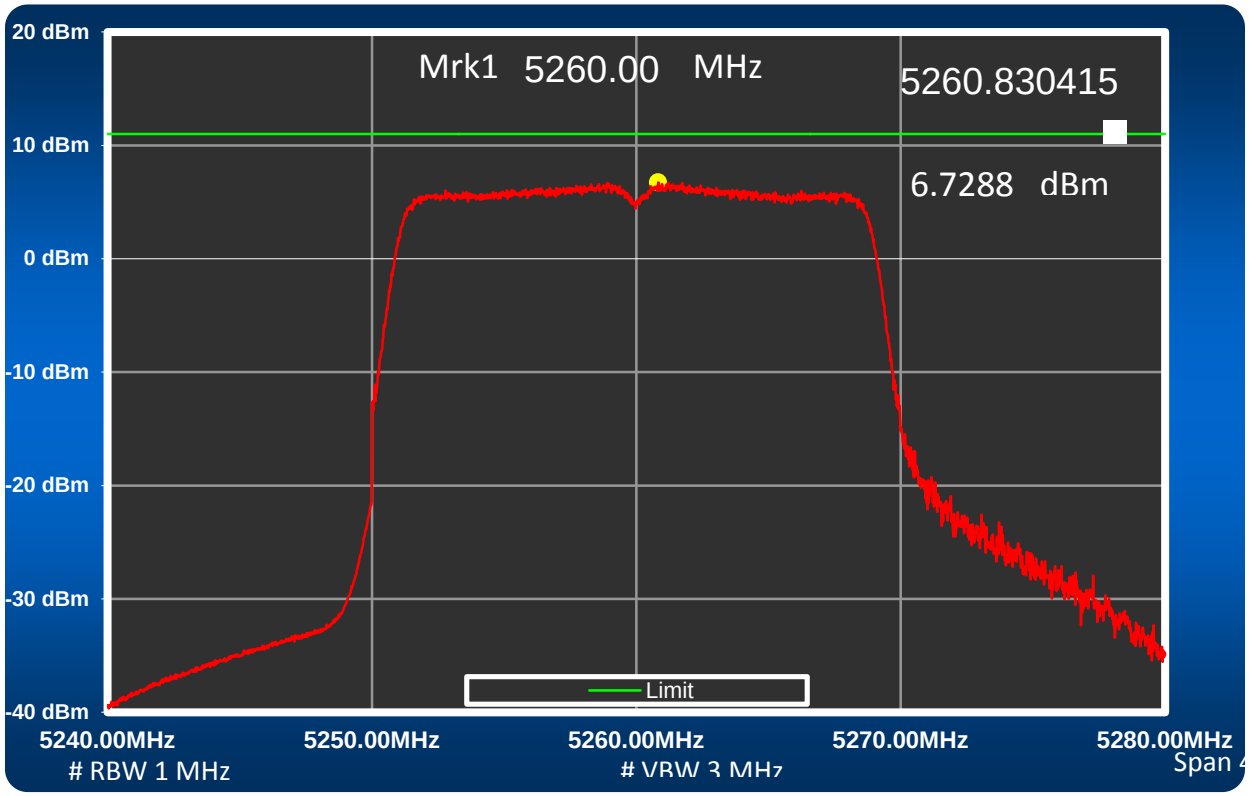


Figure 46: Peak Power Spectral Density, 5260 MHz at 802.11n, HT20 6.5 Mbps

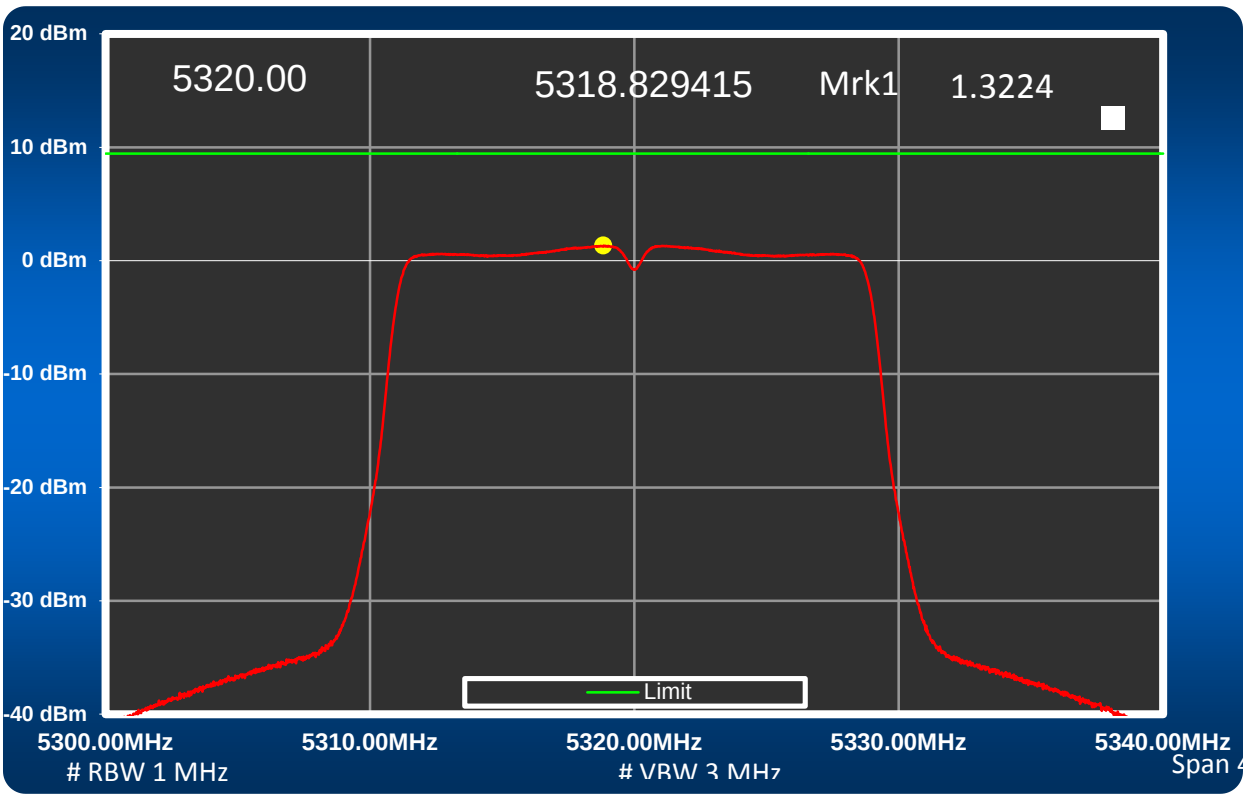


Figure 47: Peak Power Spectral Density, 5320 MHz at 802.11n, HT 20 6.5 Mbps

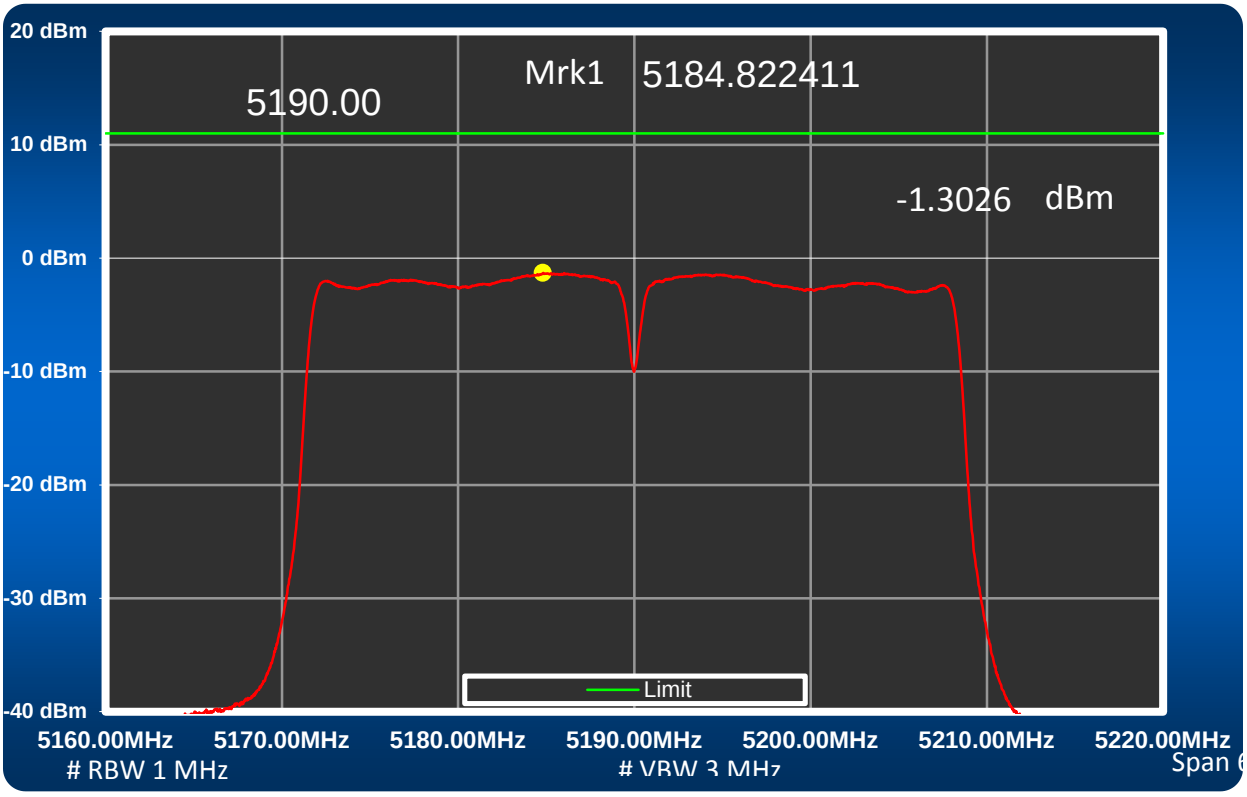


Figure 48: Peak Power Spectral Density, 5190 MHz at 802.11n, HT40 – 13.5 Mbps

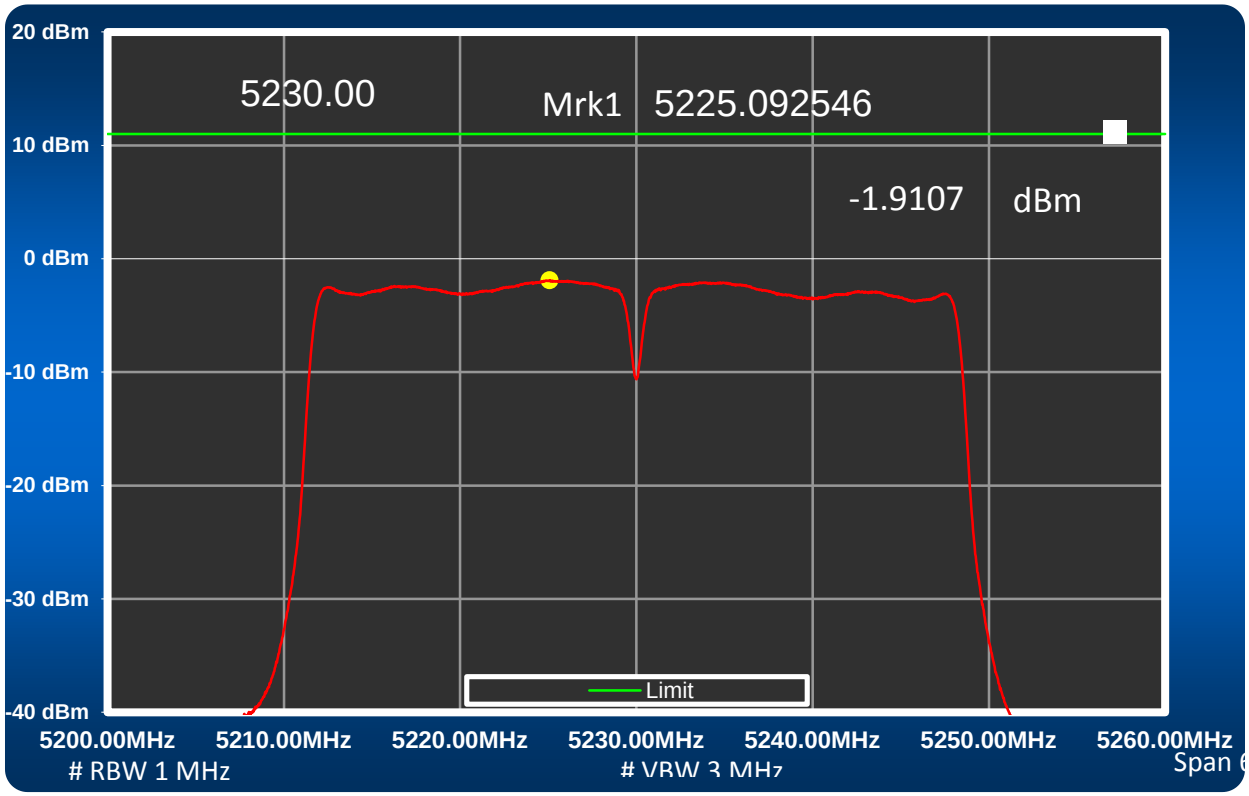


Figure 49: Peak Power Spectral Density, 5230 MHz at 802.11n, HT40– 13.5 Mbps

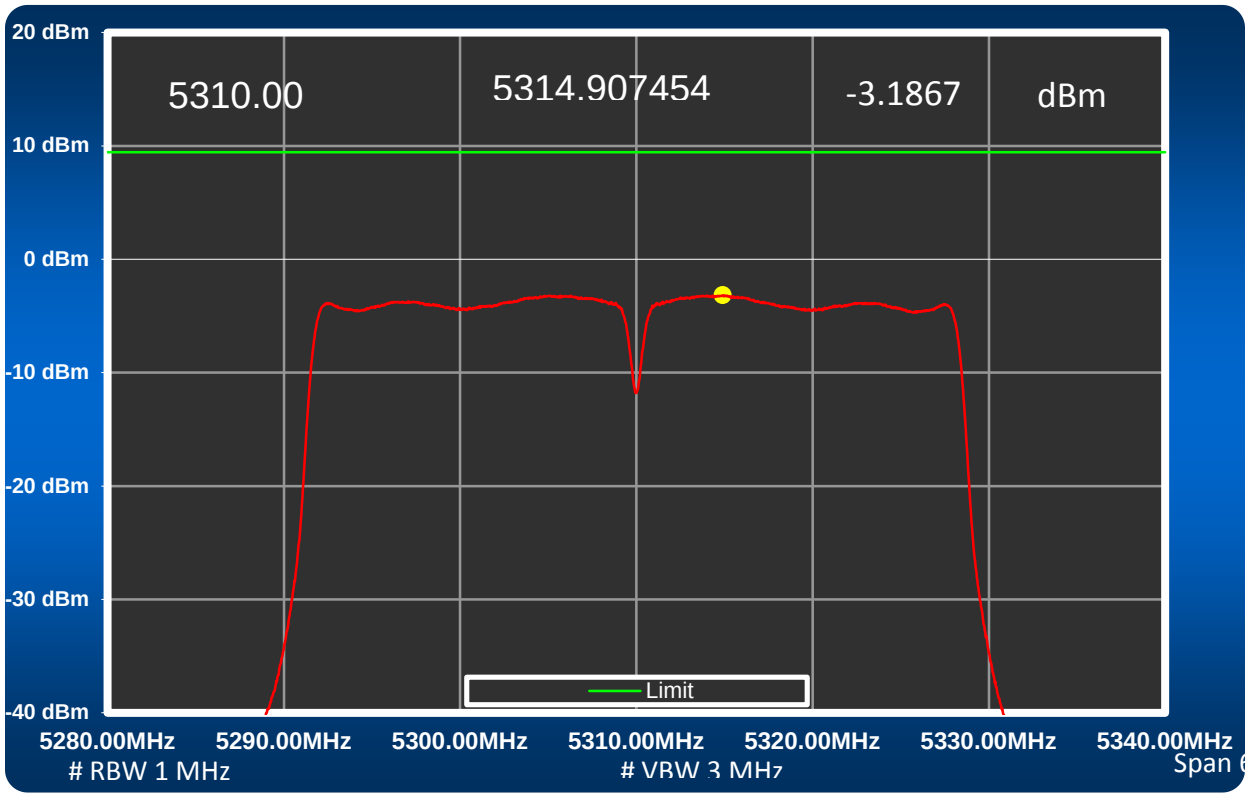


Figure 50: Peak Power Spectral Density, 5310 MHz at 802.11n, HT 40 mode

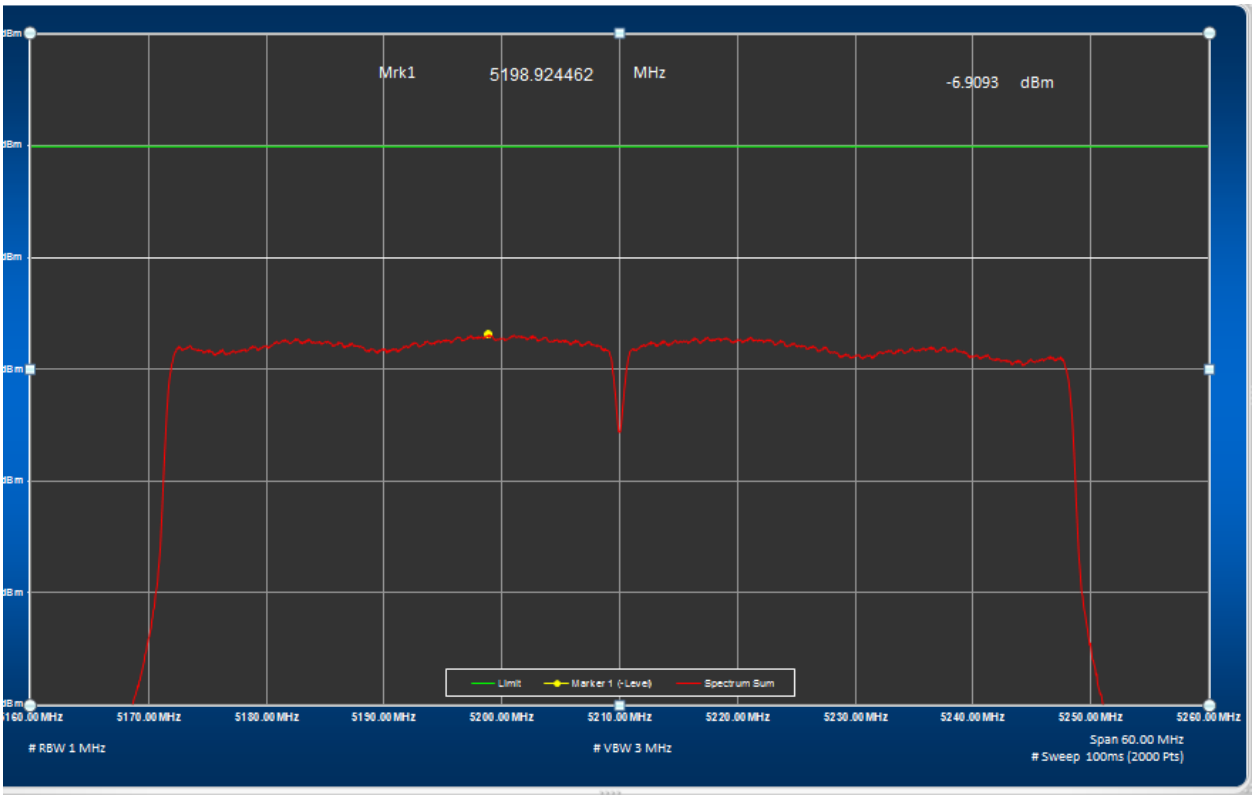


Figure 51: Peak Power Spectral Density, 5210 MHz at 802.11n AC, VHT 80 mode

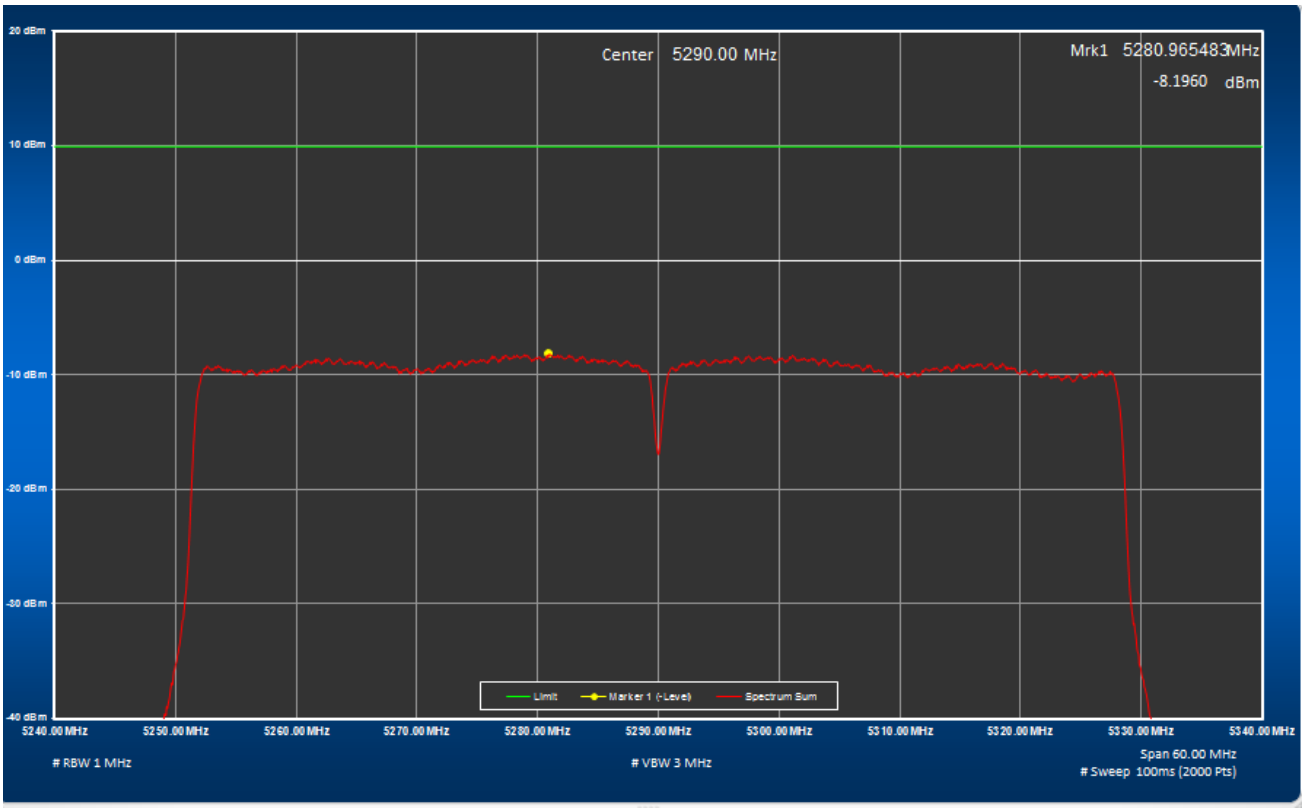


Figure 52: Peak Power Spectral Density, 5290 MHz at 802.11n AC, VHT 80 mode

Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.407(b), RSS 210 Sect. A.9.2

4.3.3 Test Methodology

4.3.3.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pres-scans were performed to determine the worst axis, data rate/ chains.

4.3.3.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

The final scans performed on the worst axis, X-Axis, for three operating channels;

6.0 Mbits/s for 802.11a 5180, 5200, 5240, 5280 and 5320MHz

6.5 Mbit/s for 802.11n HT20/VHT20 Mode: 5180, 5200, 5240, 5240, 5280 and 5320MHz

13.5 Mbit/s for 802.11n HT40/VHT20 Mode: 5190, 5230, 5270 and 5310MHz

56.5Mbits/s for 802.11nAC VHT80 Mode 5210 and 5290MHz

4.3.3.3 Deviations

None.

4.3.4 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2009 and RSS 210 A1.1.2 2007.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490.....	2400/F(kHz)	300
0.490-1.705.....	24000/F(kHz)	30
1.705-30.0.....	30	30
30-88.....	100 **	3
88-216.....	150 **	3
216-960.....	200 **	3
Above 960.....	500	3

According to CFR47 15.407 (b), all harmonics and spurious emissions which are outside the 5150 MHz - 5250 MHz, 5250 MHz – 5350 MHz, or 5470 MHz – 5725 MHz shall not exceed -27 dBm/MHz. This is equivalent to 68.2 dBuV/m at 3 meter distance.

4.3.5 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

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

Table 6: Transmit Spurious Emission at Band-Edge Requirements

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated				**Power Setting:** See test plan			
Max. Directional Gain: + 7.56 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23° C				**Relative Humidity:**33%			
Band-Edge Results							
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.		Note
5150.00	56.00	H	74.00	-18.00	Pk		5180 MHz, 14dBm
5150.00	45.42	H	54.00	-8.58	Ave		5180 MHz, 14dBm
5150.00	57.14	V	74.00	-16.86	Pk		5180 MHz, 14dBm
5150.00	45.63	V	54.00	-8.37	Ave		5180 MHz, 14dBm
5350.00	62.33	H	74.00	-11.67	Pk		5320 MHz, 14dBm
5350.00	48.61	H	54.00	-5.39	Ave		5320 MHz, 14dBm
5350.00	66.25	V	74.00	-7.75	Pk		5320 MHz, 14dBm
5350.00	48.88	V	54.00	-5.12	Ave		5320 MHz, 14dBm
5150.00	63.37	H	74.00	-10.63	Pk		HT20, 5180 MHz, 14 dBm
5150.00	53.13	H	54.00	-0.87	Ave		HT20, 5180 MHz, 14 dBm
5150.00	67.61	V	74.00	-6.39	Pk		HT20, 5180 MHz, 14 dBm
5150.00	53.15	V	54.00	-0.85	Ave		HT20, 5180 MHz, 14 dBm
5150.00	73.47	H	74.00	-0.53	Pk		HT40, 5180 MHz, 12 dBm
5150.00	53.62	H	54.00	-0.38	Ave		HT40, 5190 MHz, 12 dBm
5150.00	67.24	V	74.00	-6.76	Pk		HT40, 5190 MHz, 12 dBm
5150.00	53.60	V	54.00	-0.40	Ave		HT40, 5190 MHz, 12 dBm
5350.00	64.54	H	74.00	-9.46	Pk		HT40, 5310MHz, 12 dBm
5350.00	48.30	H	54.00	-5.70	Ave		HT40, 5310 MHz, 12 dBm
5350.00	61.48	V	74.00	-12.52	Pk		HT40, 5310 MHz, 12 dBm
5350.00	47.92	V	54.00	-6.08	Ave		HT40, 5310MHz, 12 dBm
Note: 1. Band-edge frequencies were taken at 5150 MHz since 5250-5350 MHz band is not a restricted band. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205. 3. It is also complied with the -27 dBm/MHz (68.2dBuV/m at 3m) requirements as stated in CFR47 15.407 (b) (1) to 15.407 (b) (3).							

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only							
Antenna Type: Integrated				**Power Setting:** See test plan			
Max. Directional Gain: + 7.56 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23° C				**Relative Humidity:**33%			
Band-Edge Results							
Freq. (MHz)	Level (dBuV/m)	Polarity (H/V)	Limit (dBuV/m)	Margin (dB)	Det.		Note
5150.00	62.04	V	74.00	-11.96	Pk		HT40, 5230 MHz, 14 dBm
5150.00	49.86	V	54.00	-4.14	Ave		HT40, 5230 MHz, 14 dBm
5350.00	64.58	V	74.00	-9.42	Pk		HT40, 5270 MHz, 14 dBm
5350.00	53.04	V	54.00	-0.96	Ave		HT40, 5270 MHz, 14 dBm
5150.00	62.62	H	74.00	-11.38	Pk		VHT80, 5210 MHz, 12 dBm
5150.00	52.78	H	54.00	-1.22	Ave		VHT80, 5210 MHz, 12 dBm
5350.00	65.08	V	74.00	-8.92	Pk		VHT80, 5210 MHz, 12 dBm
5350.00	51.50	V	54.00	-2.50	Ave		VHT80, 5210 MHz, 12 dBm
5350.00	67.64	H	74.00	-6.36	Pk		VHT80, 5270 MHz, 12 dBm
5350.00	53.44	H	54.00	-0.56	Ave		VHT80, 5270 MHz, 12 dBm
5350.00	67.40	V	74.00	-6.60	Pk		VHT80, 5270 MHz, 12 dBm
5350.00	53.55	V	54.00	-0.45	Ave		VHT80, 5270 MHz, 12 dBm
Note: 1. Band-edge frequencies were taken at 5150 MHz since 5250-5350 MHz band is not a restricted band. 2. All the band-edge measurements met the restricted band requirements of CFR47 15.205. 3. It is also complied with the -27 dBm/MHz (68.2dBuV/m at 3m) requirements as stated in CFR 15.407 (b) (1) to 15.407 (b) (3).							

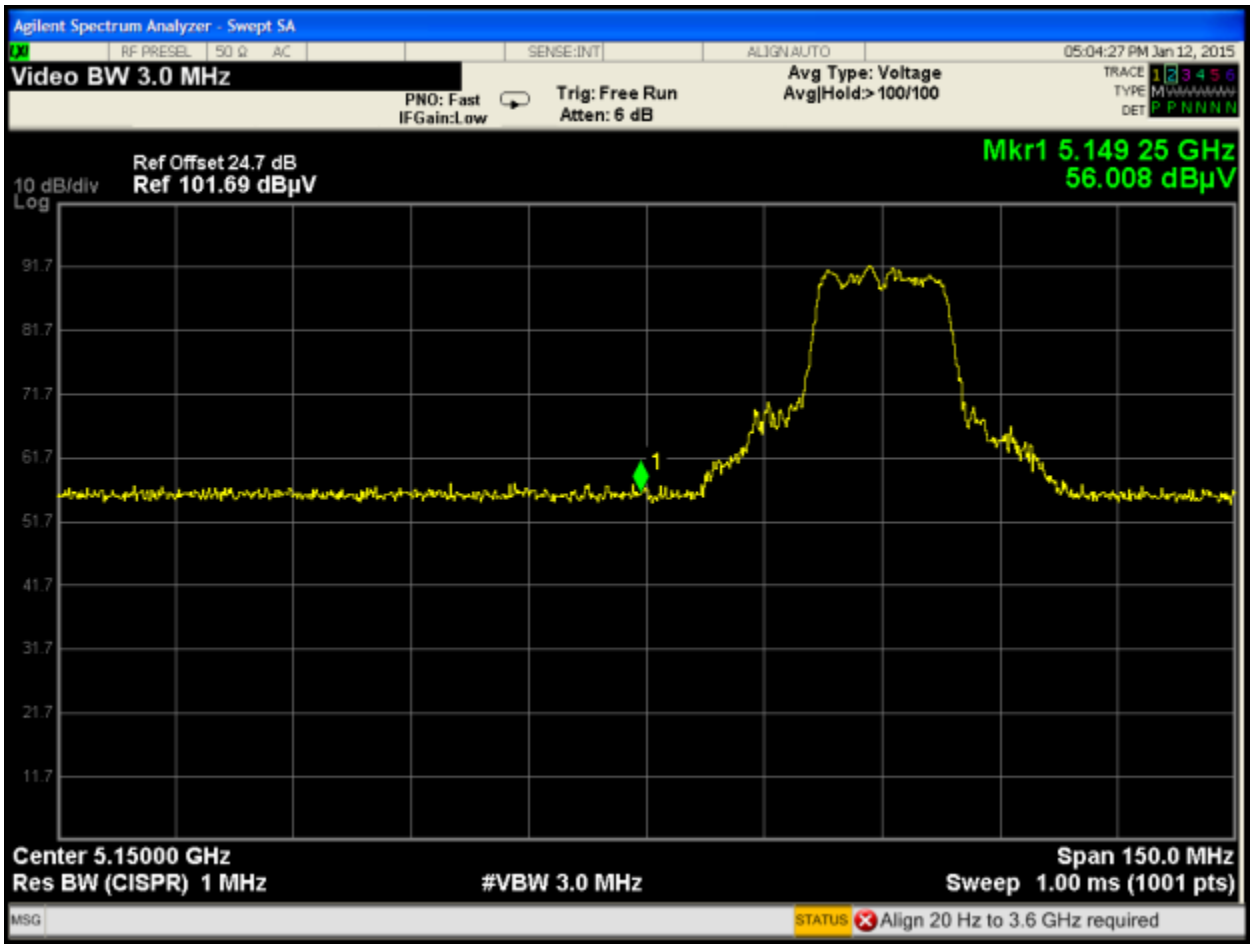


Figure 53: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Horz. (Peak)

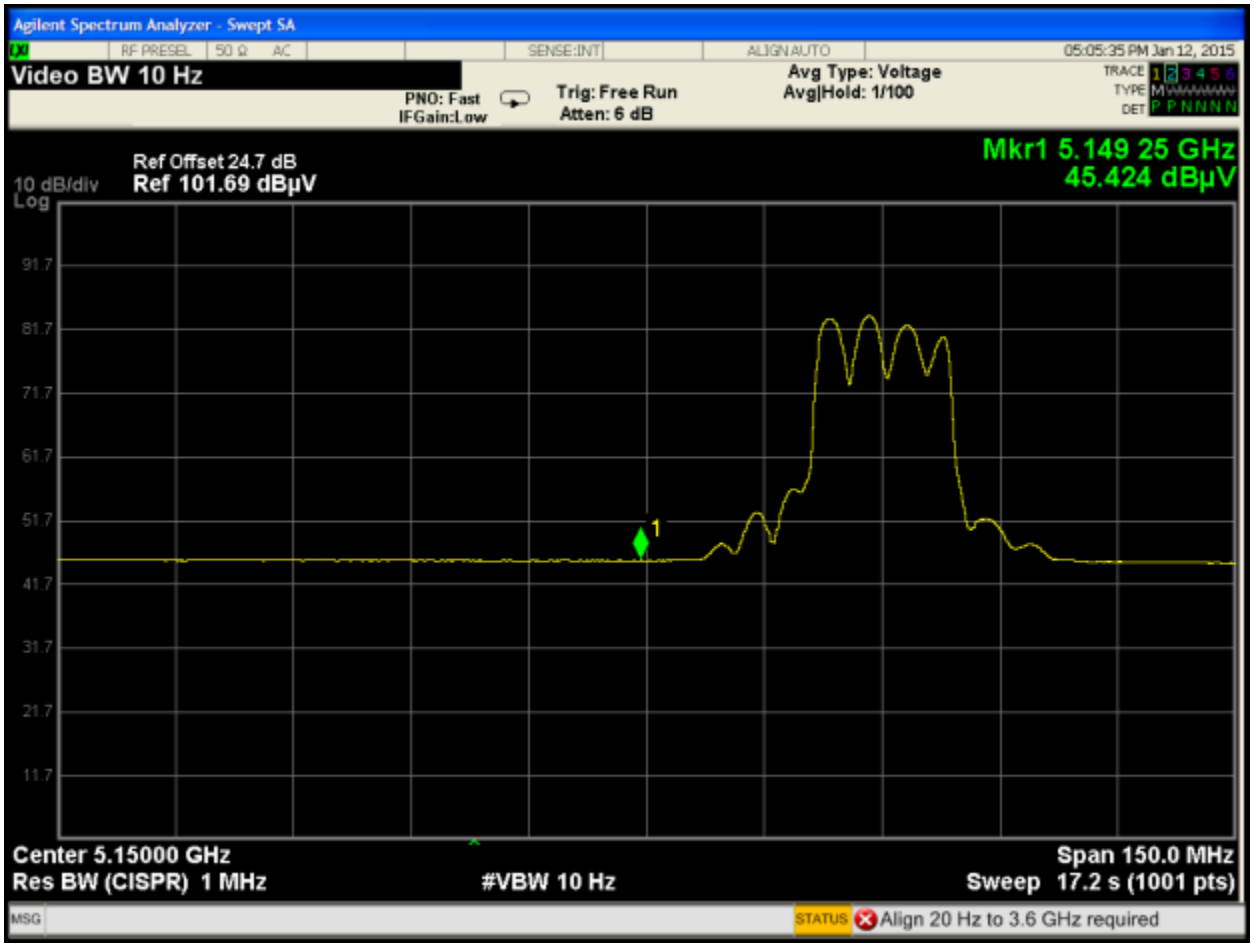


Figure 54: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Horz. (Ave.)

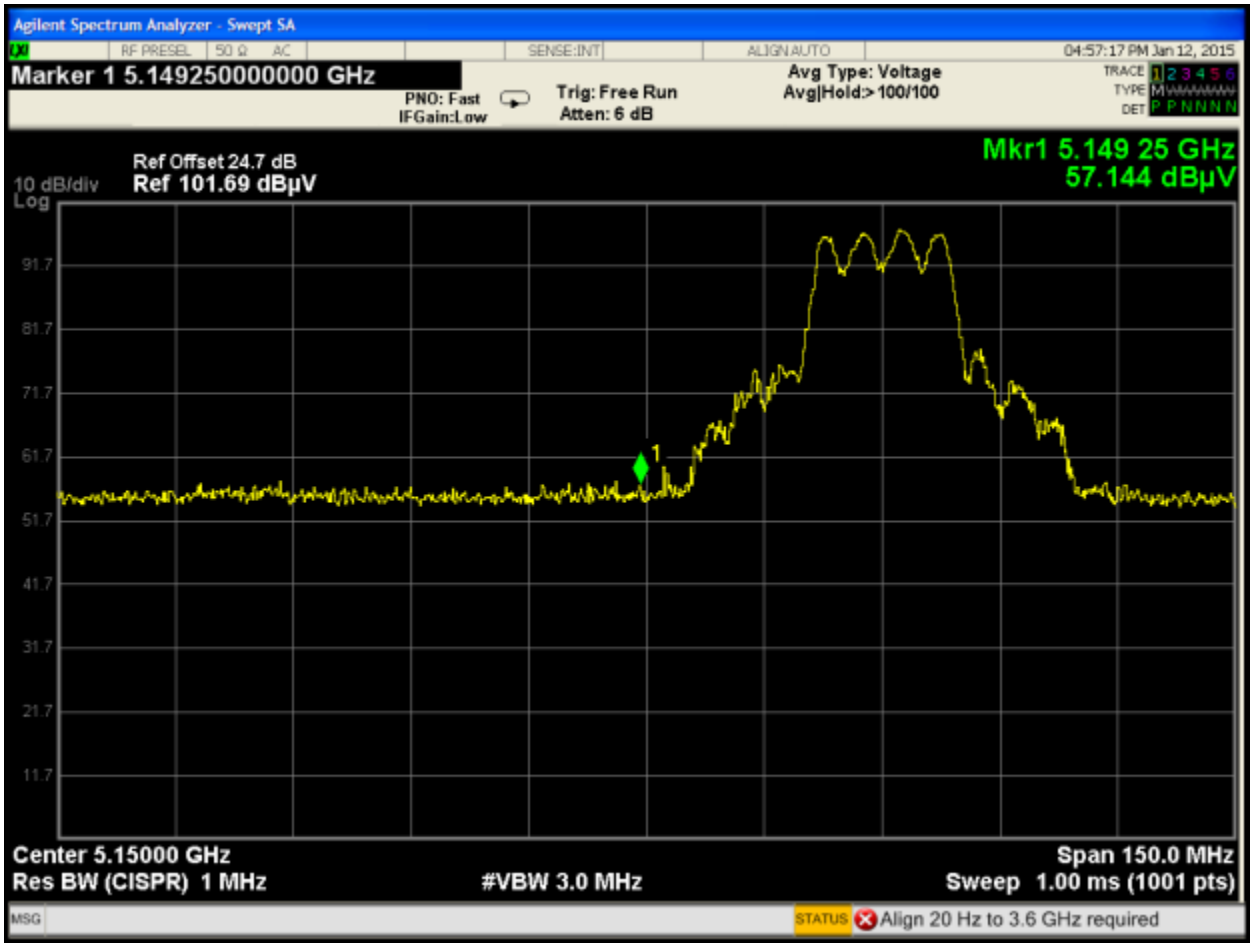


Figure 55: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Vert. (Peak)

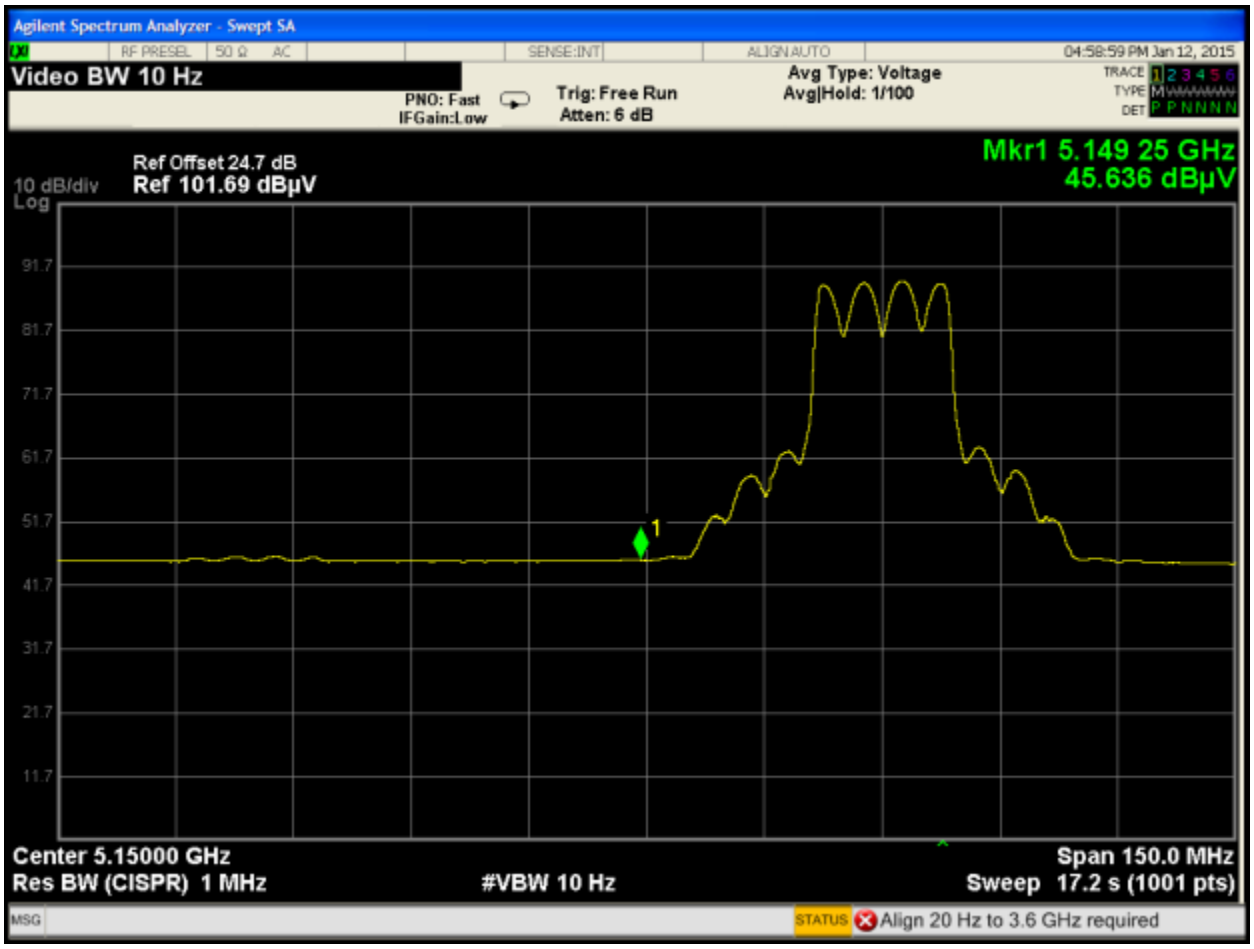


Figure 56: Radiated Emission at the Edge for Channel 5180 MHz at 6.5Mbps – Vert. (Ave.)

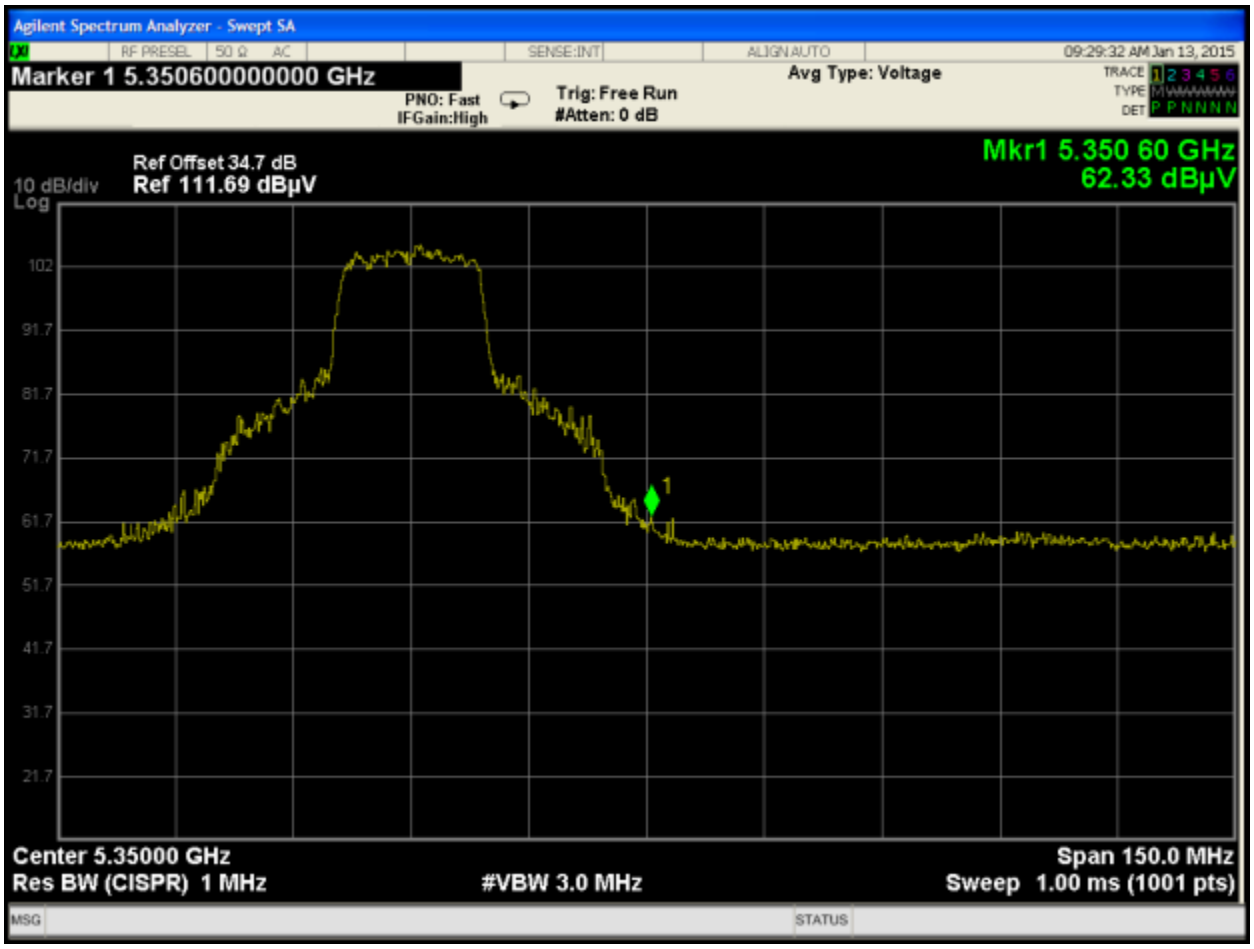


Figure 57: Radiated Emission at the Edge for Channel 5320 MHz at 6.0 Mbps– Horz. (Peak)

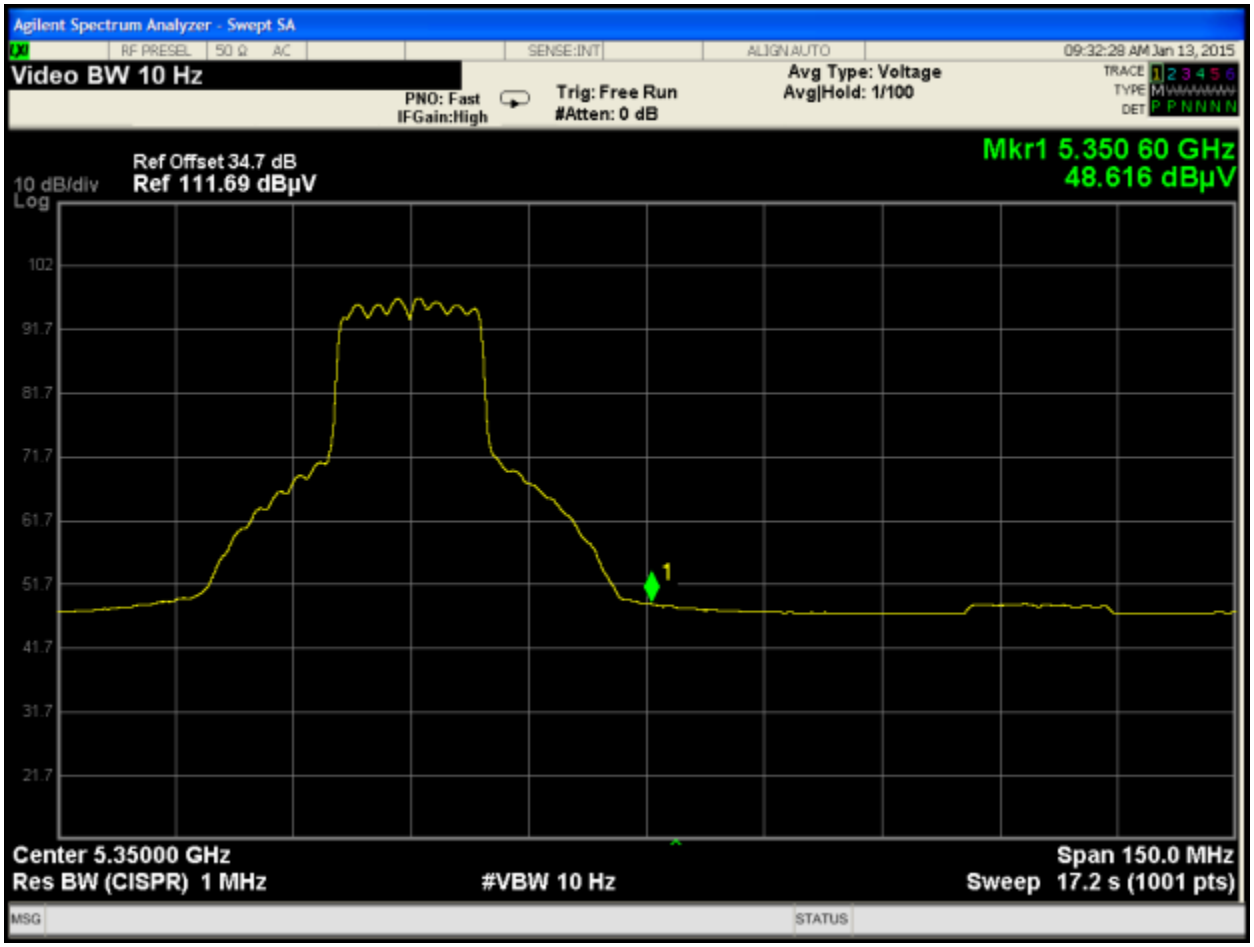


Figure 58: Radiated Emission at the Edge for Channel 5320 MHz at 6.0 Mbps – Horz. (Ave.)

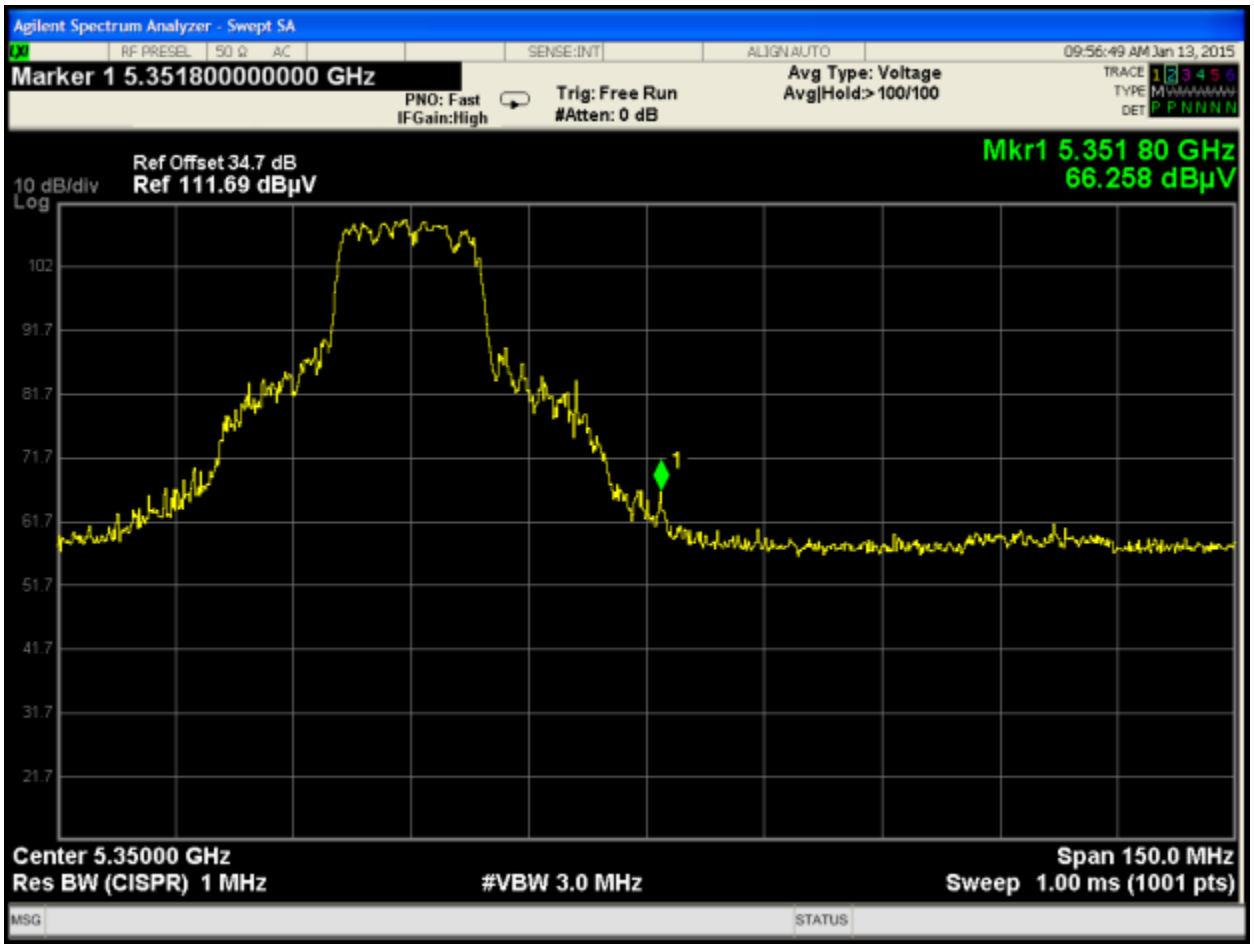


Figure 59: Radiated Emission at the Edge for Channel 5320 MHz at 6.5Mbps – Vert. (Peak)

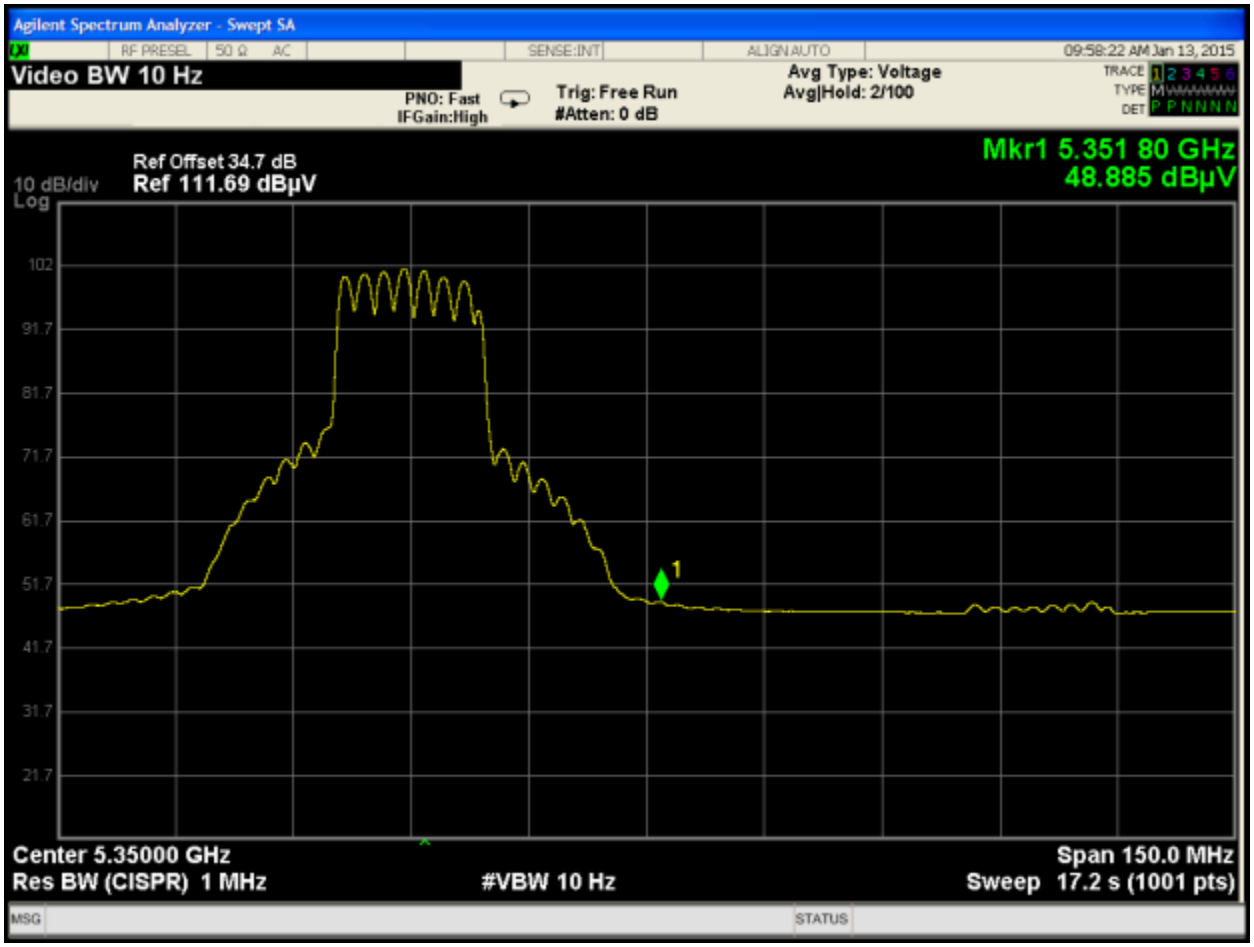


Figure 60: Radiated Emission at the Edge for Channel 5320 MHz at 6.0 Mbps– Vert. (Ave.)

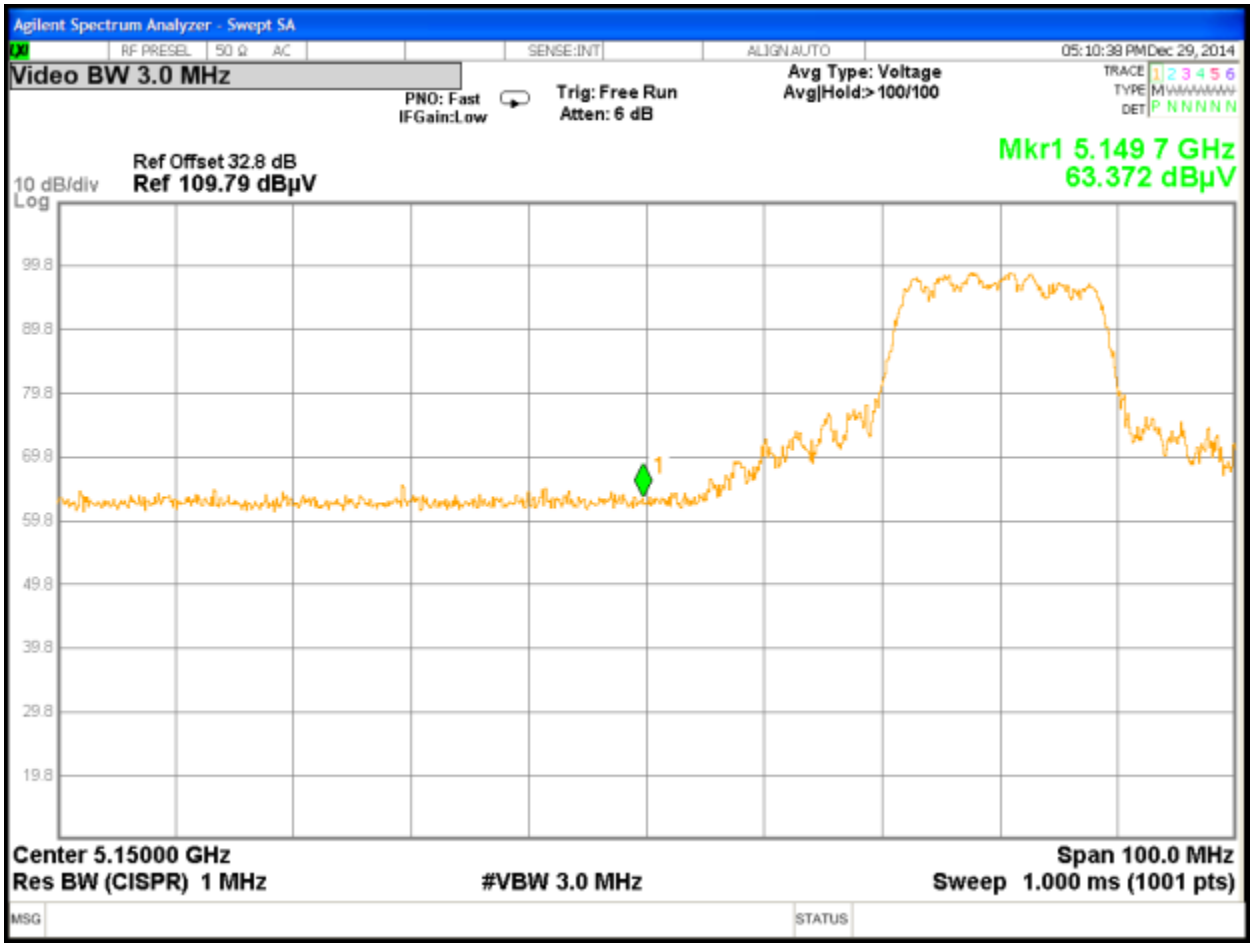


Figure 61: Radiated Emission at the Edge for Channel 5180 MHz at 6.5Mbps – Horz. (Peak)

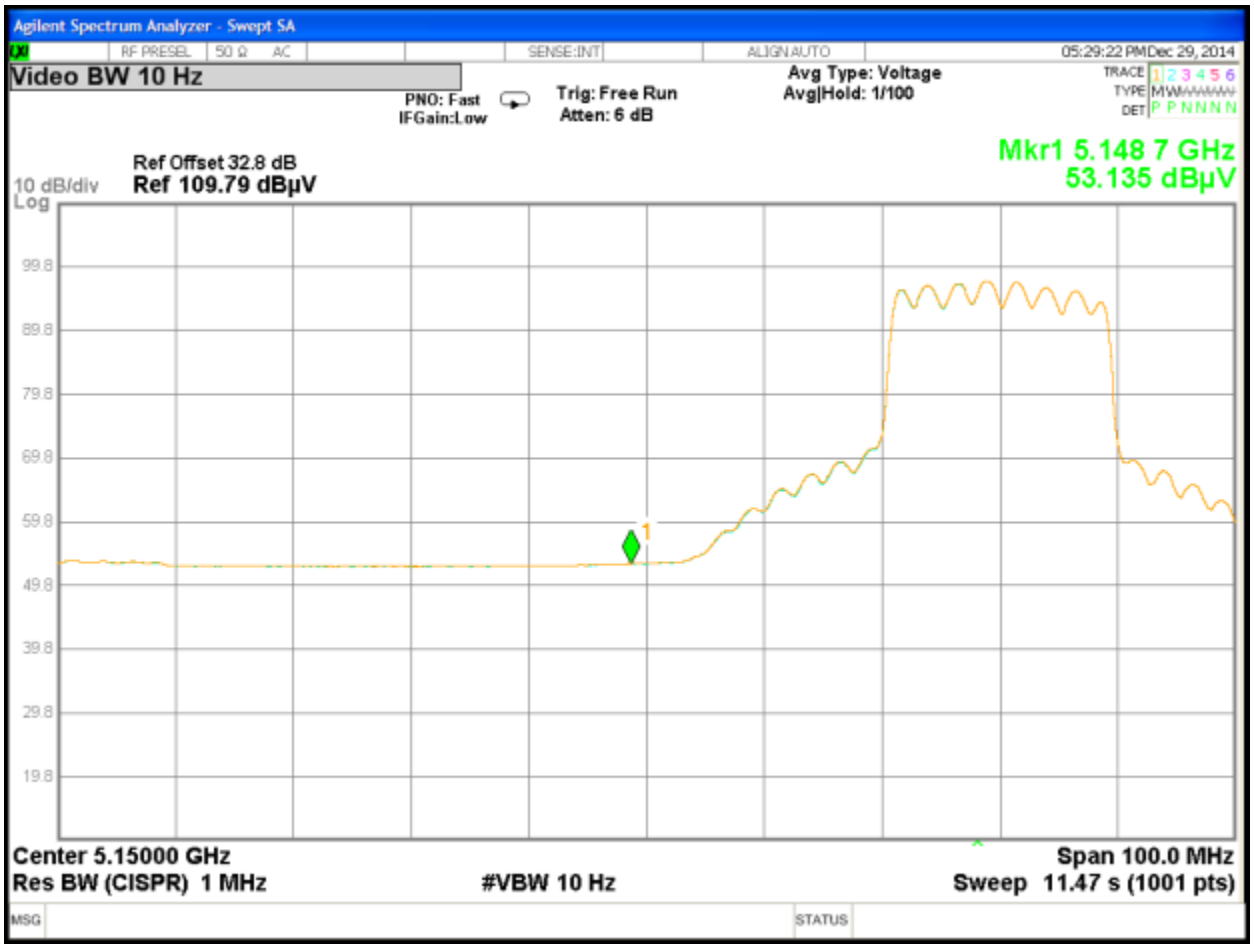


Figure 62: Radiated Emission at the Edge for Channel 5180 MHz at 6.5Mbps – Horz. (Avg)

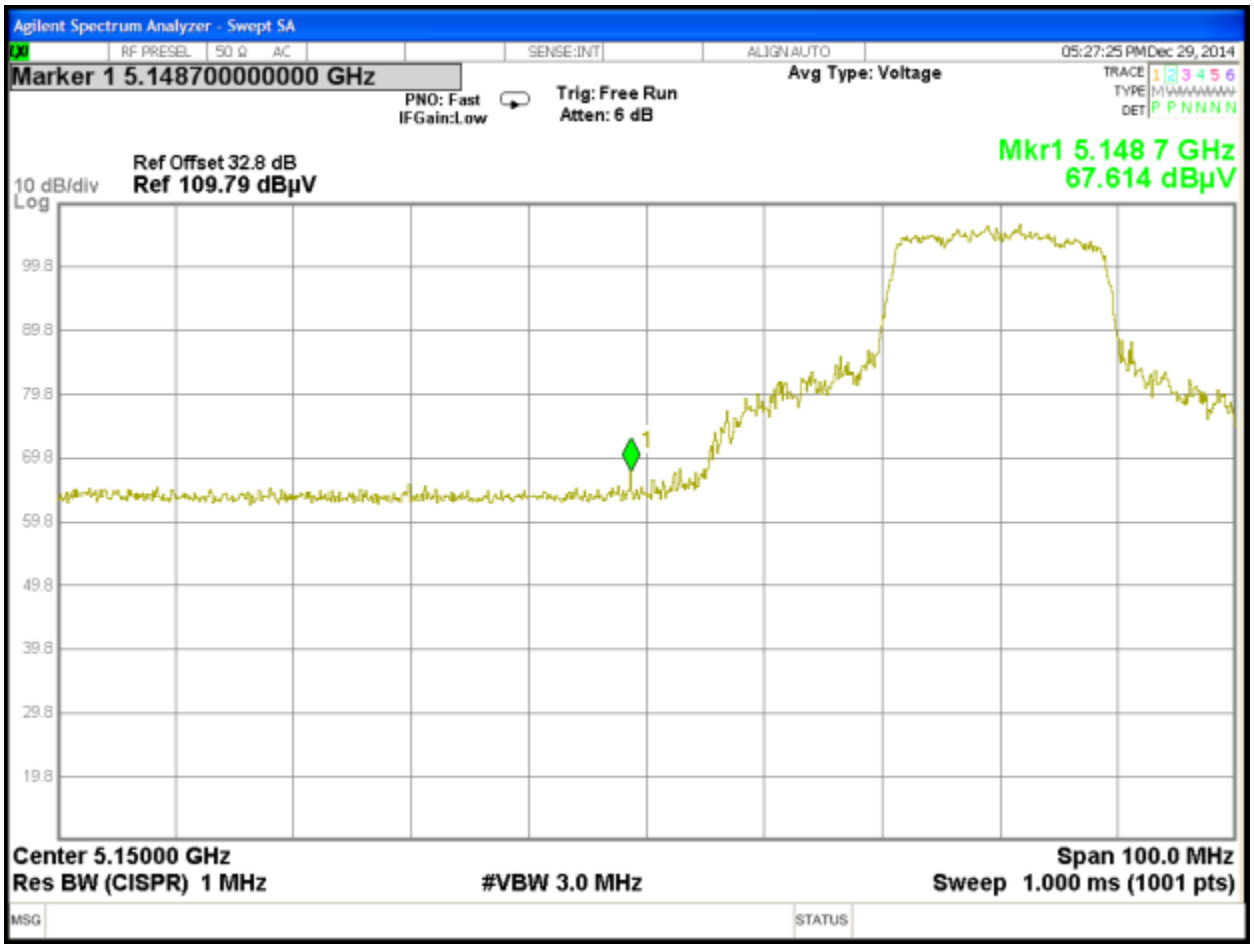


Figure 63: Radiated Emission at the Edge for Channel 5180 MHz at 6.5Mbps – vert. (pk)

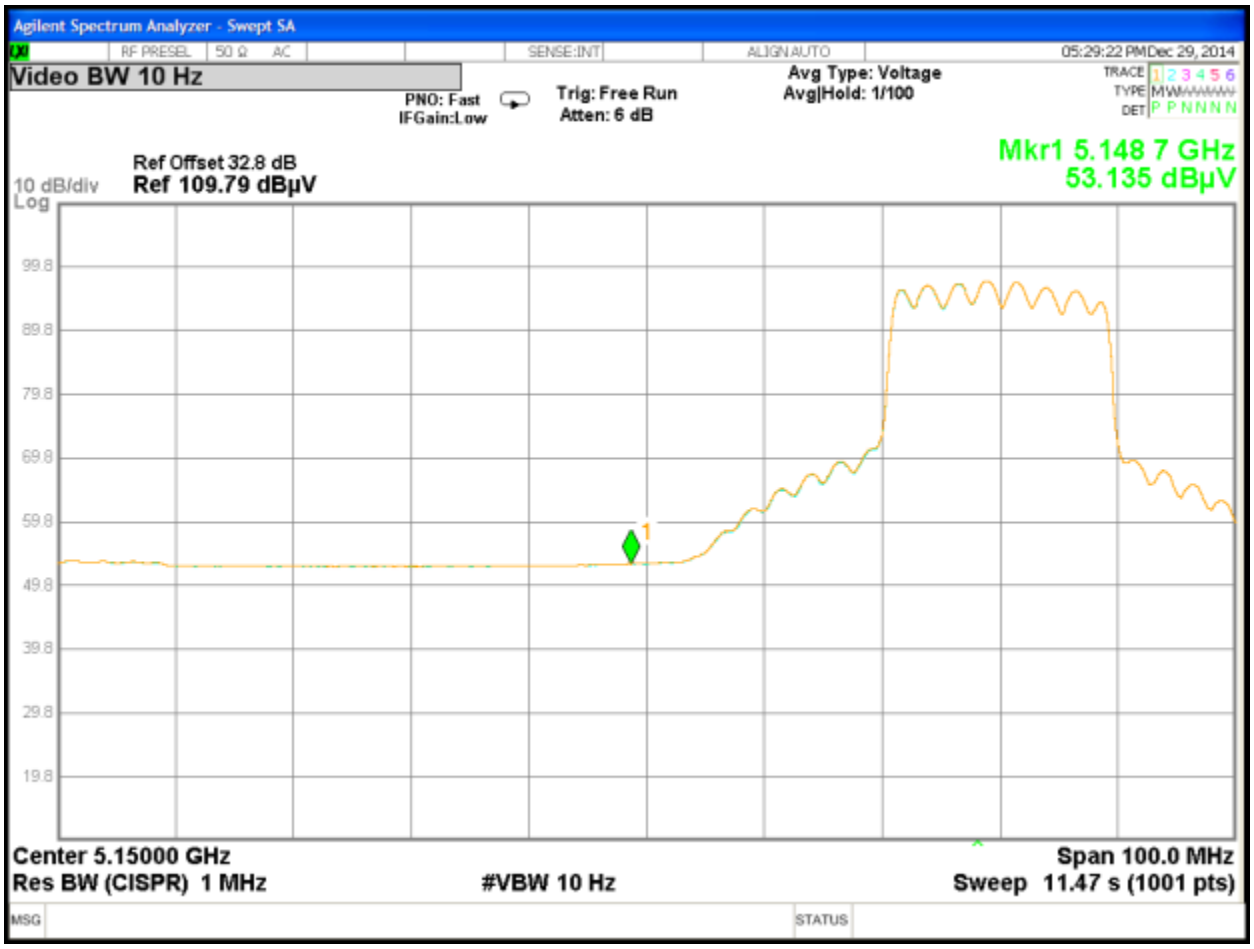


Figure 64: Radiated Emission at the Edge for Channel 5180 MHz at 6.5Mbps – vert. (Avg)

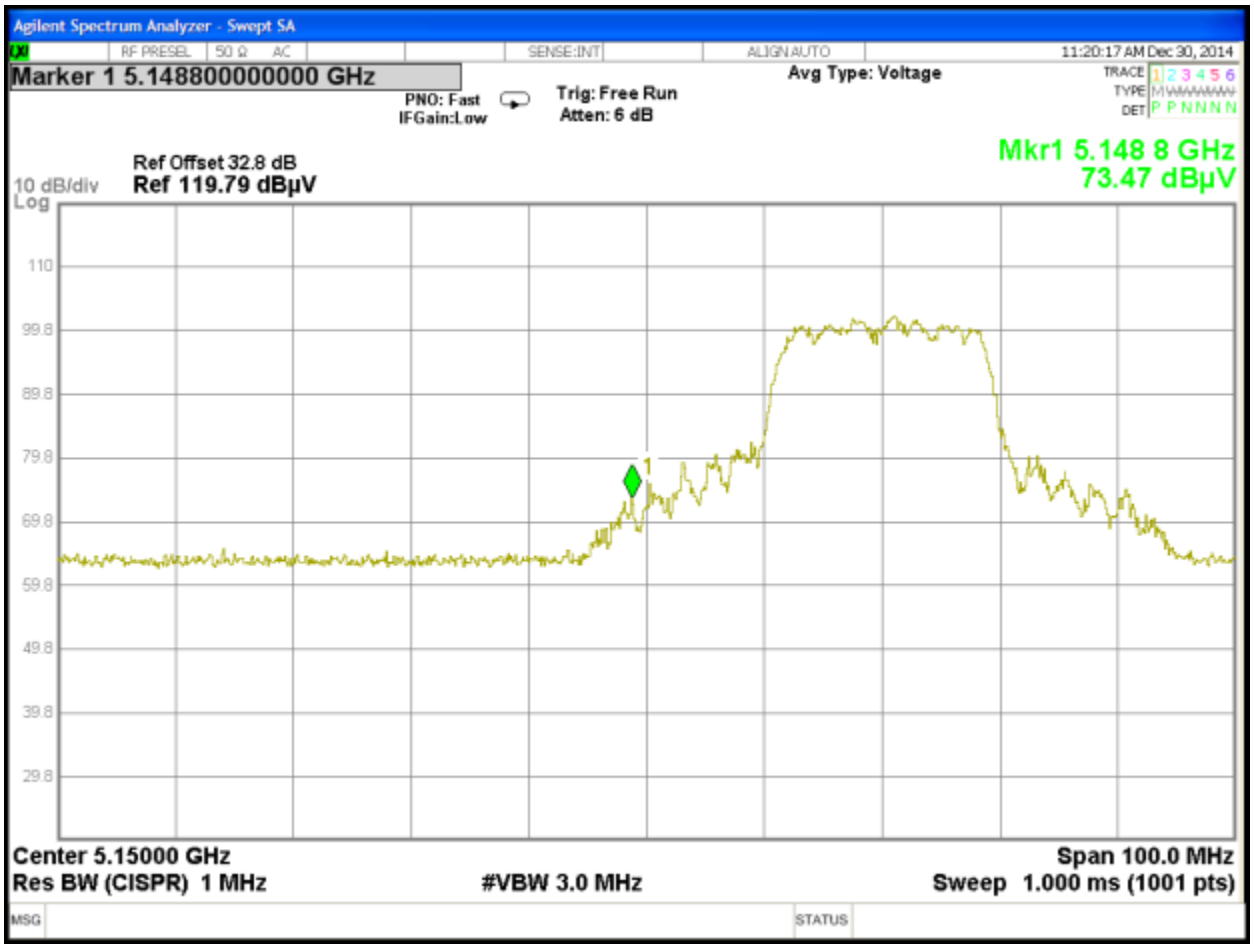


Figure 65: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Horz. (Peak)

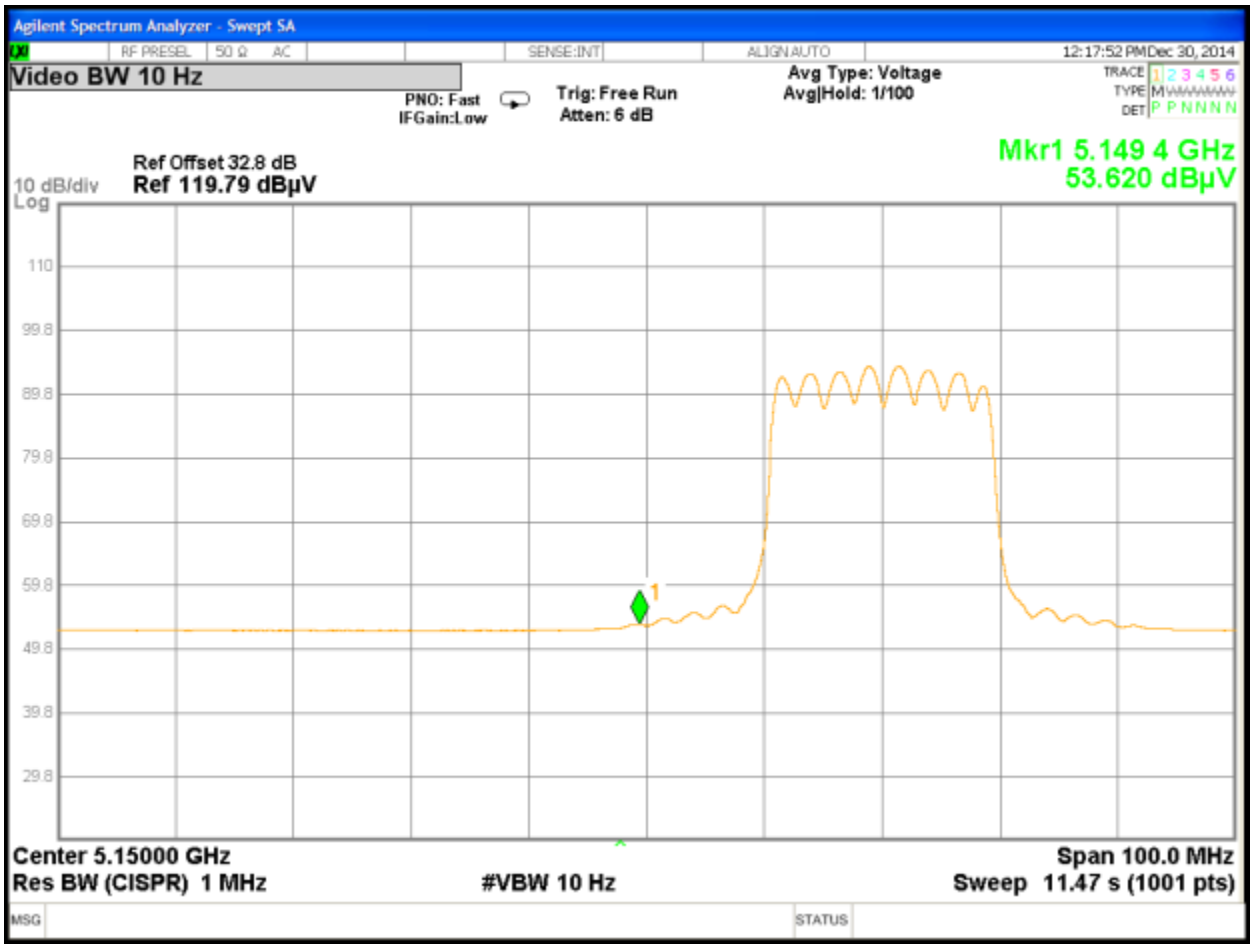


Figure 66: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Horz. (Ave.)

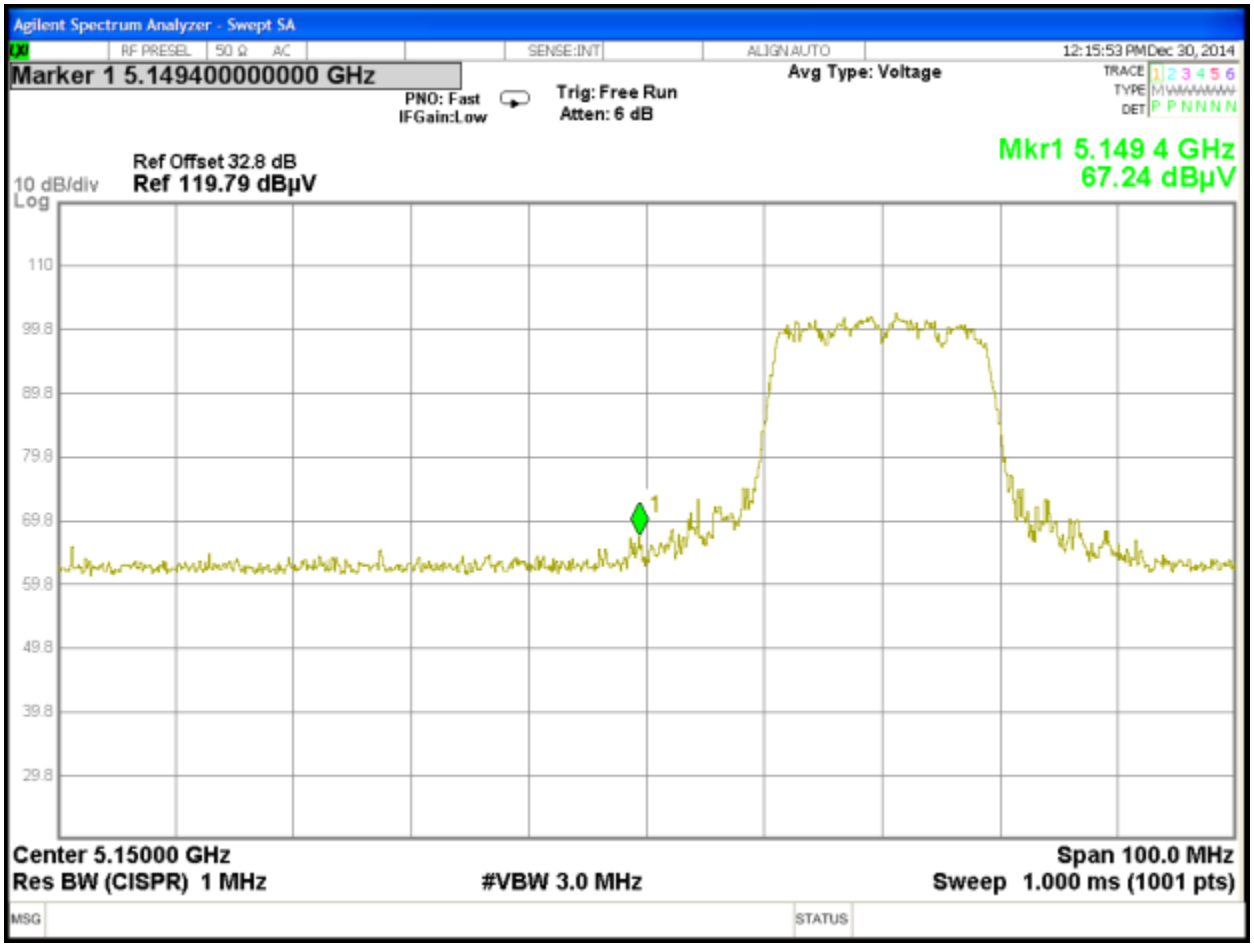


Figure 67: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Vert. (Peak)

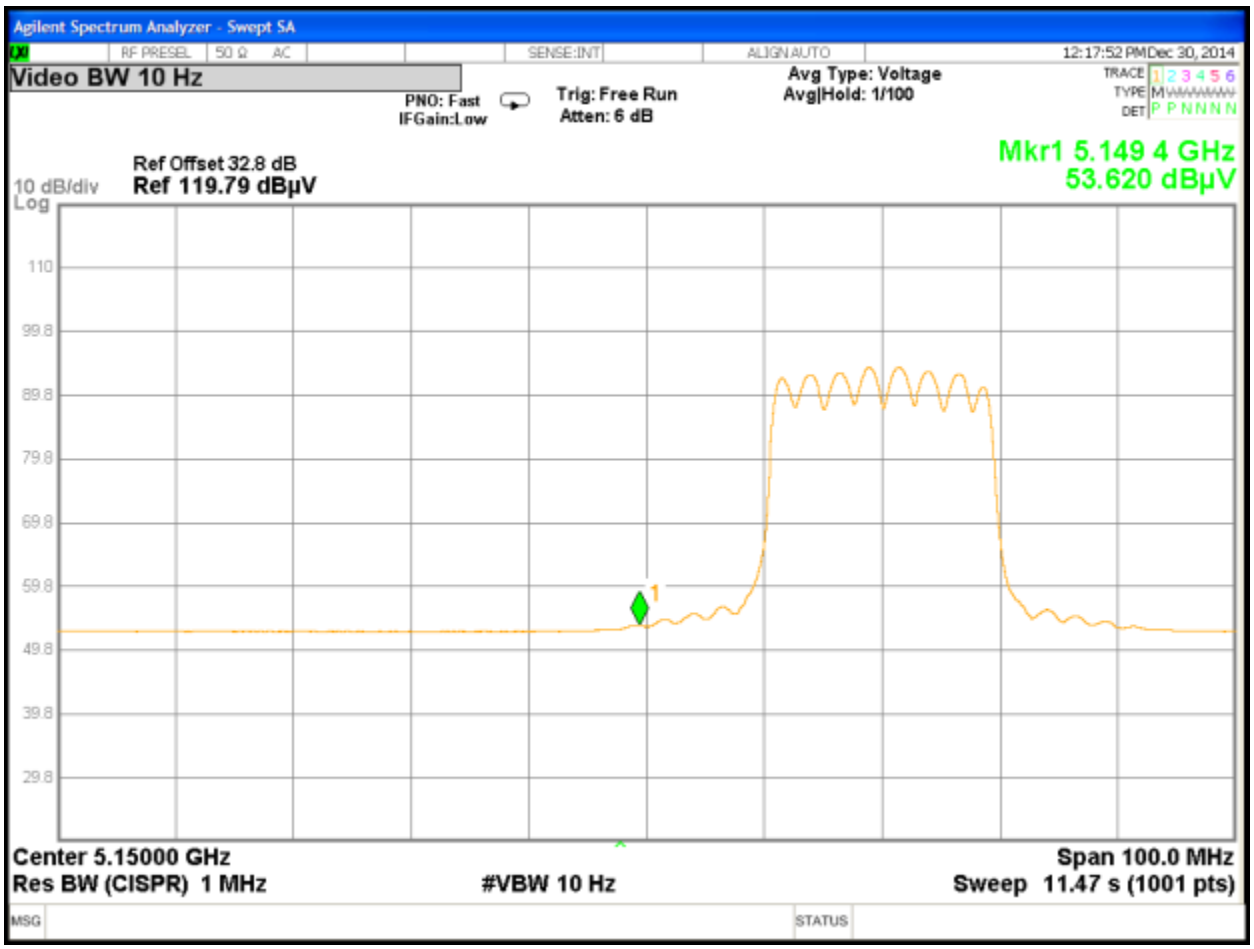


Figure 68: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Vert. (Ave.)

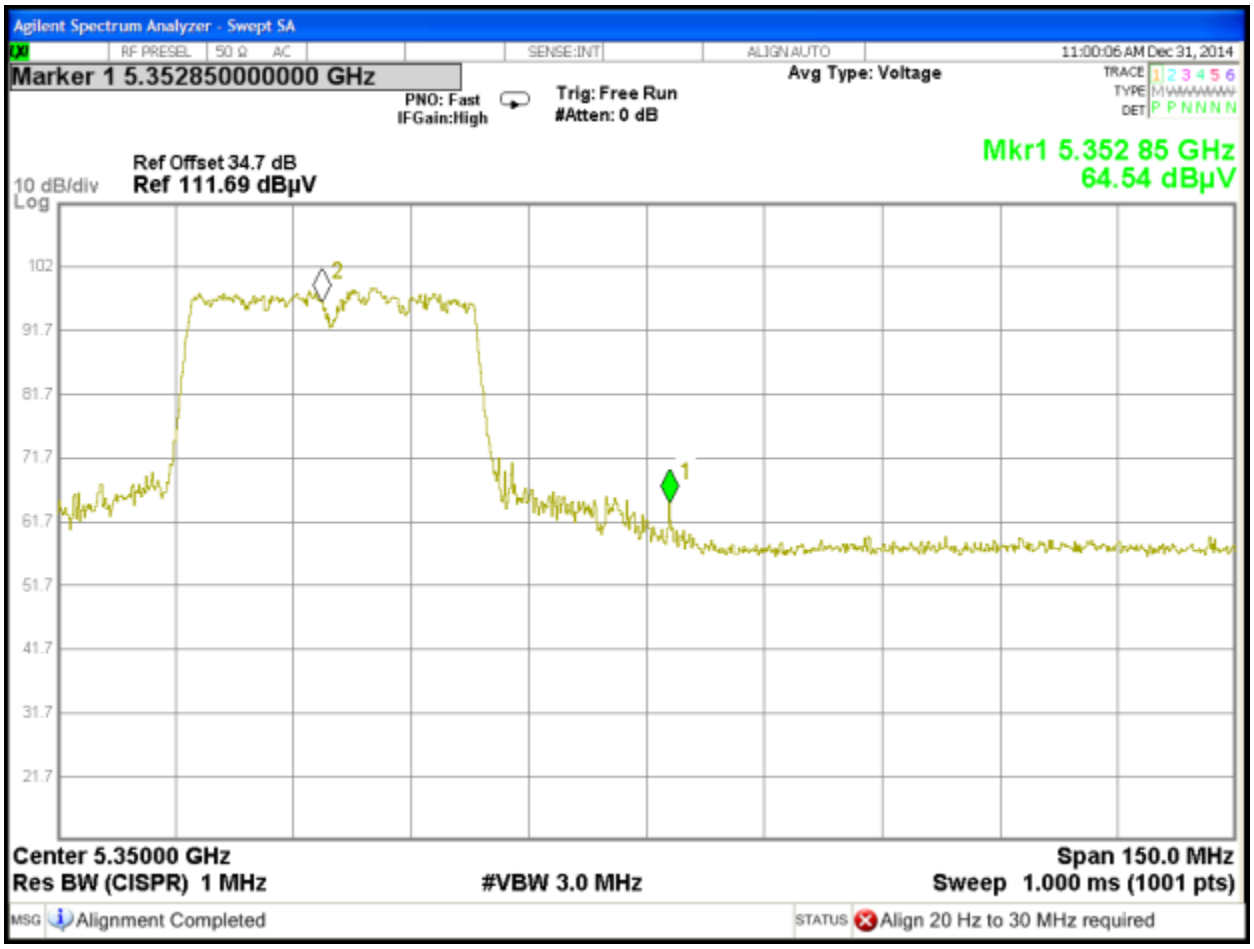


Figure 69: Radiated Emission at the Edge for Channel 5310 MHz at 13.5Mbps – Horz (Peak)

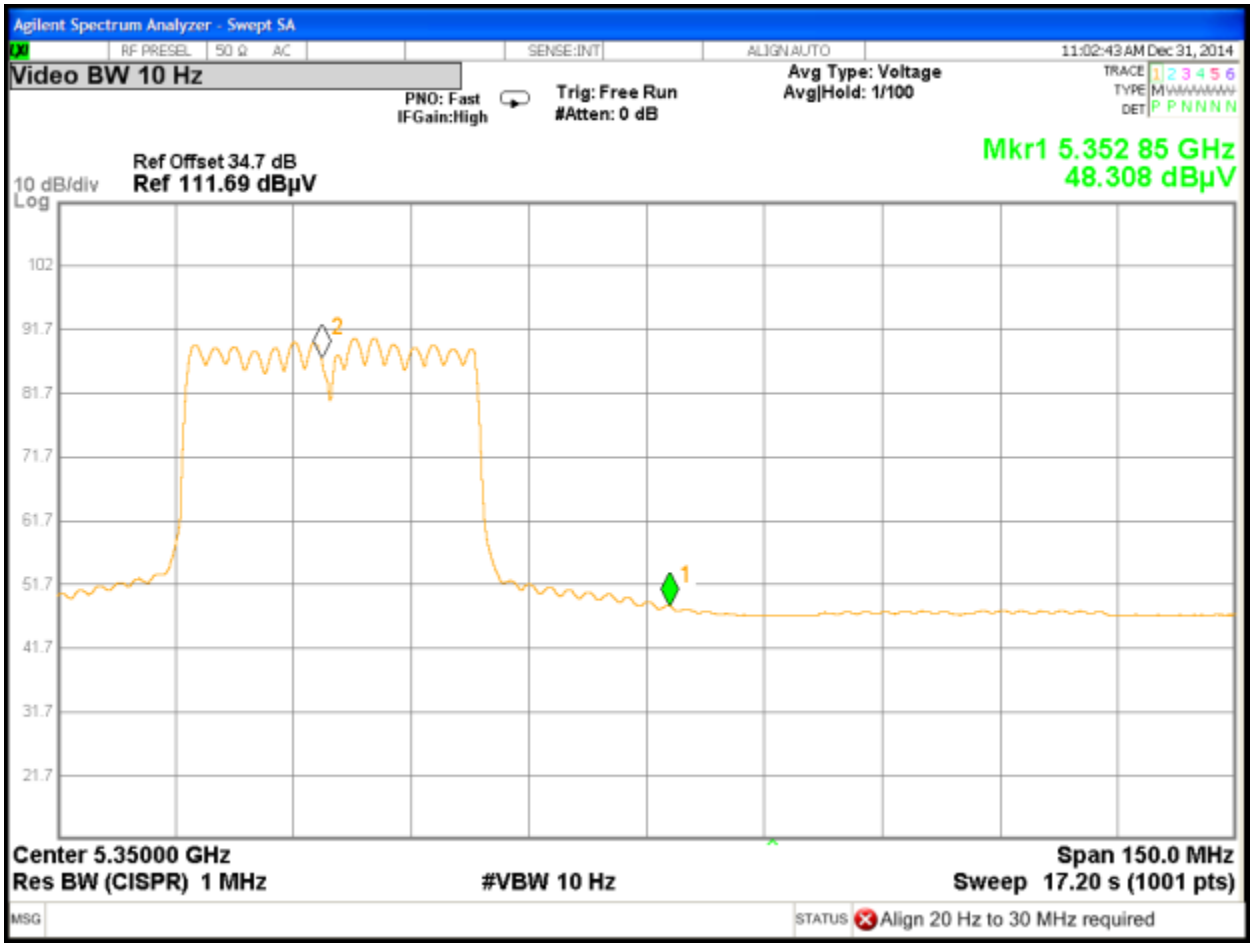


Figure 70: Radiated Emission at the Edge for Channel 5310 MHz at 13.5Mbps – Horz (Ave.)

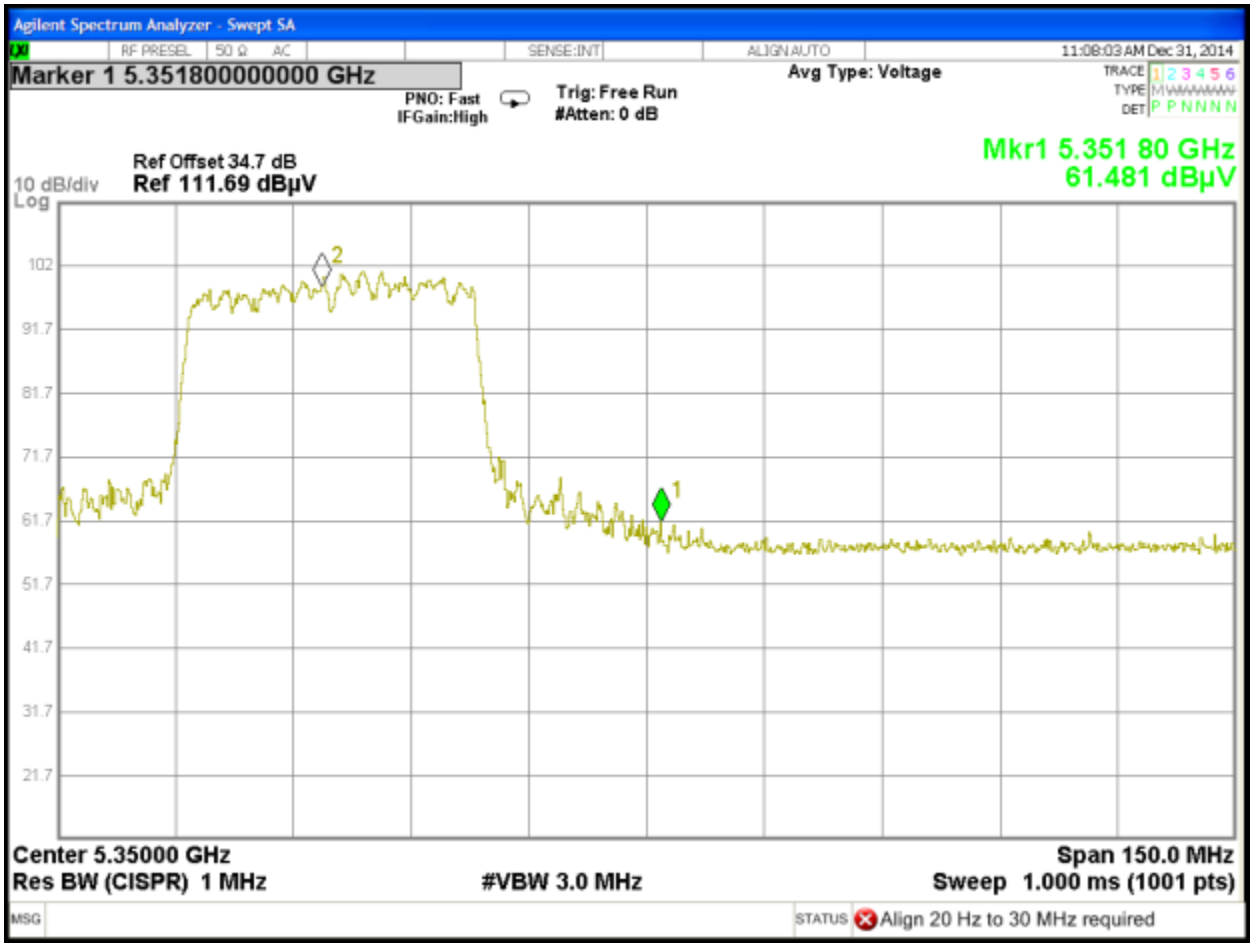


Figure 71: Radiated Emission at the Edge for Channel 5310MHz at 13.5Mbps – Vert (Peak)

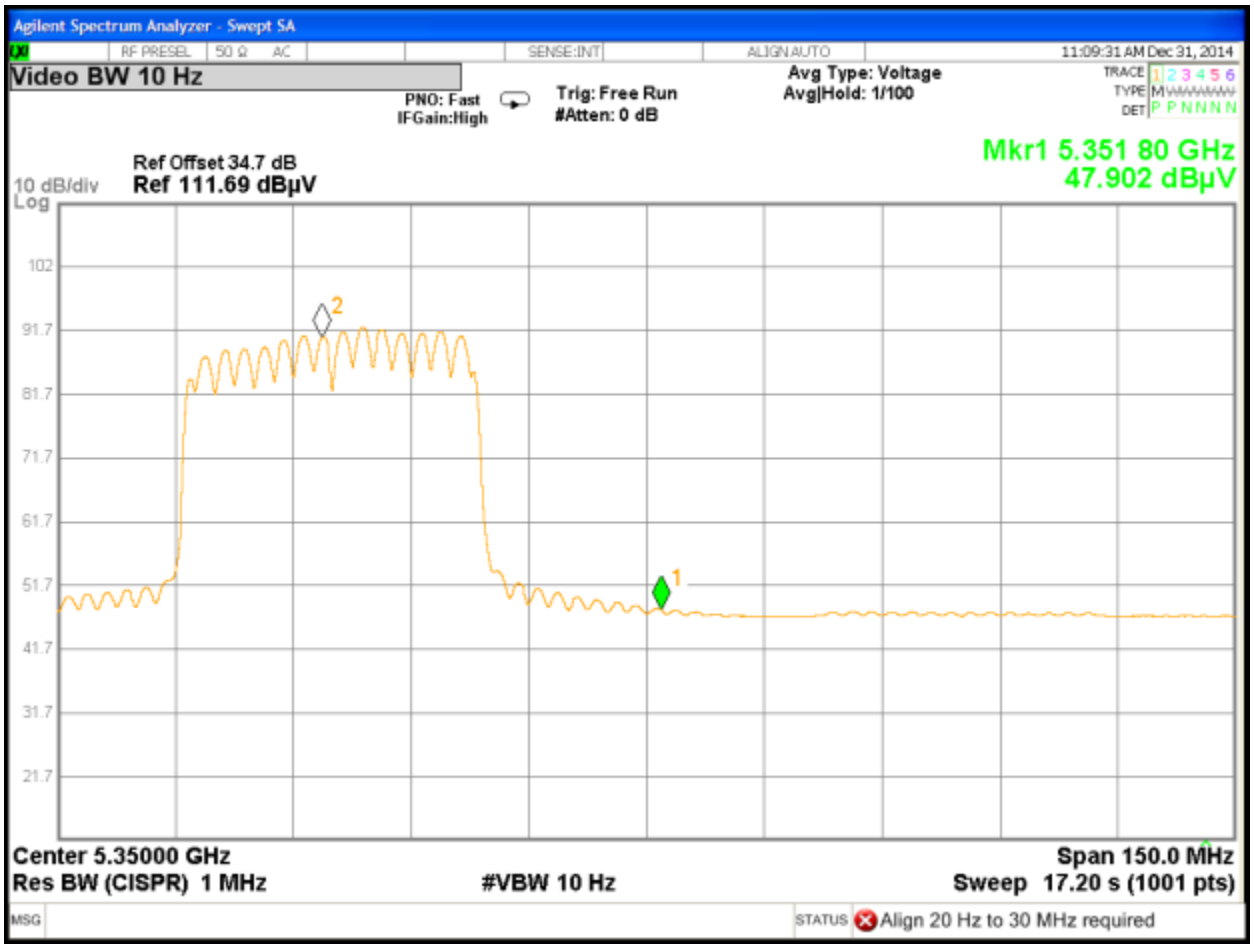


Figure 72: Radiated Emission at the Edge for Channel 5310 MHz at 13.5Mbps – Vert (Peak)

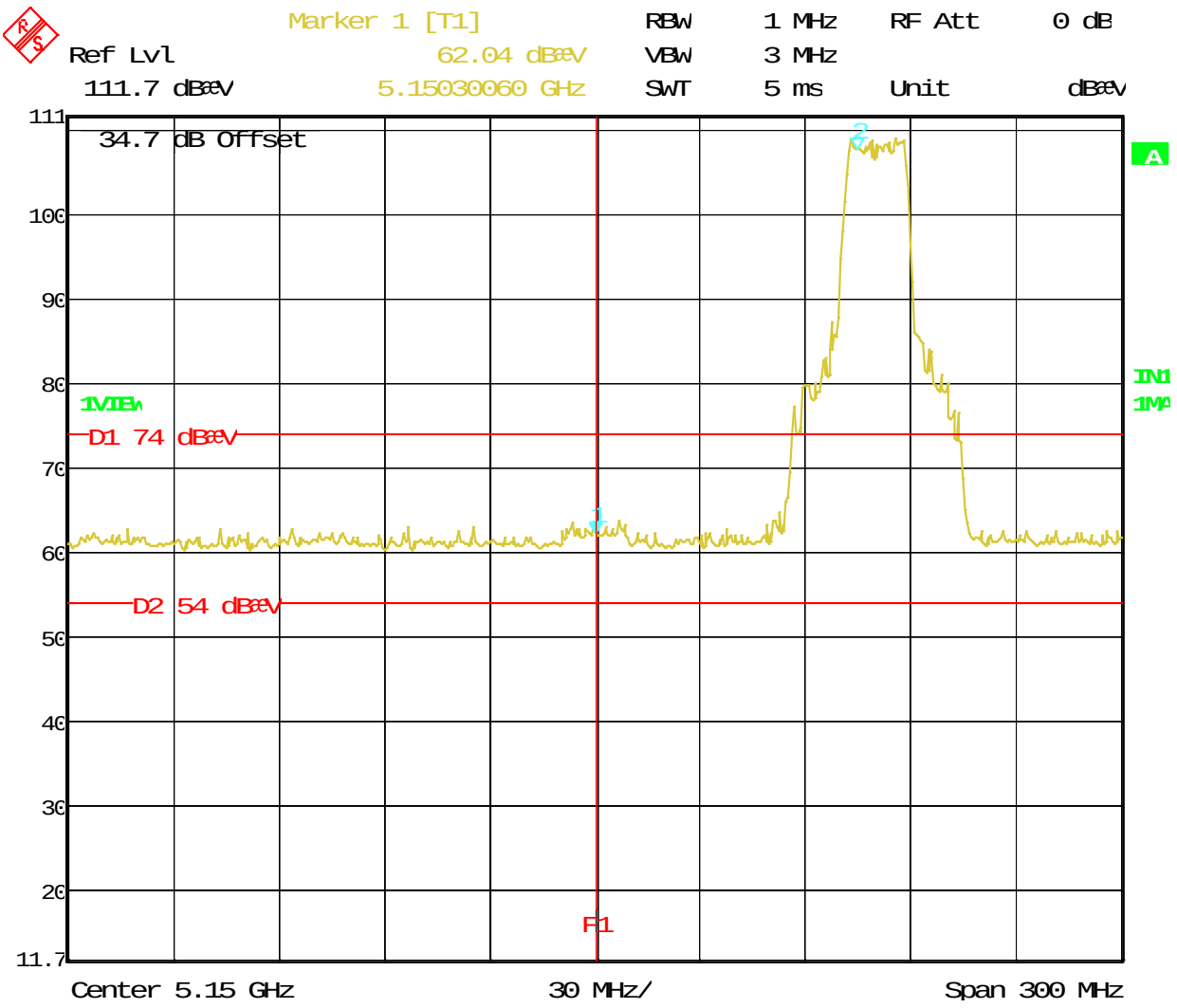


Figure 73: Radiated Emission at the Edge for Channel 5230 MHz at 13.5Mbps – Vert (Peak) 14dBm

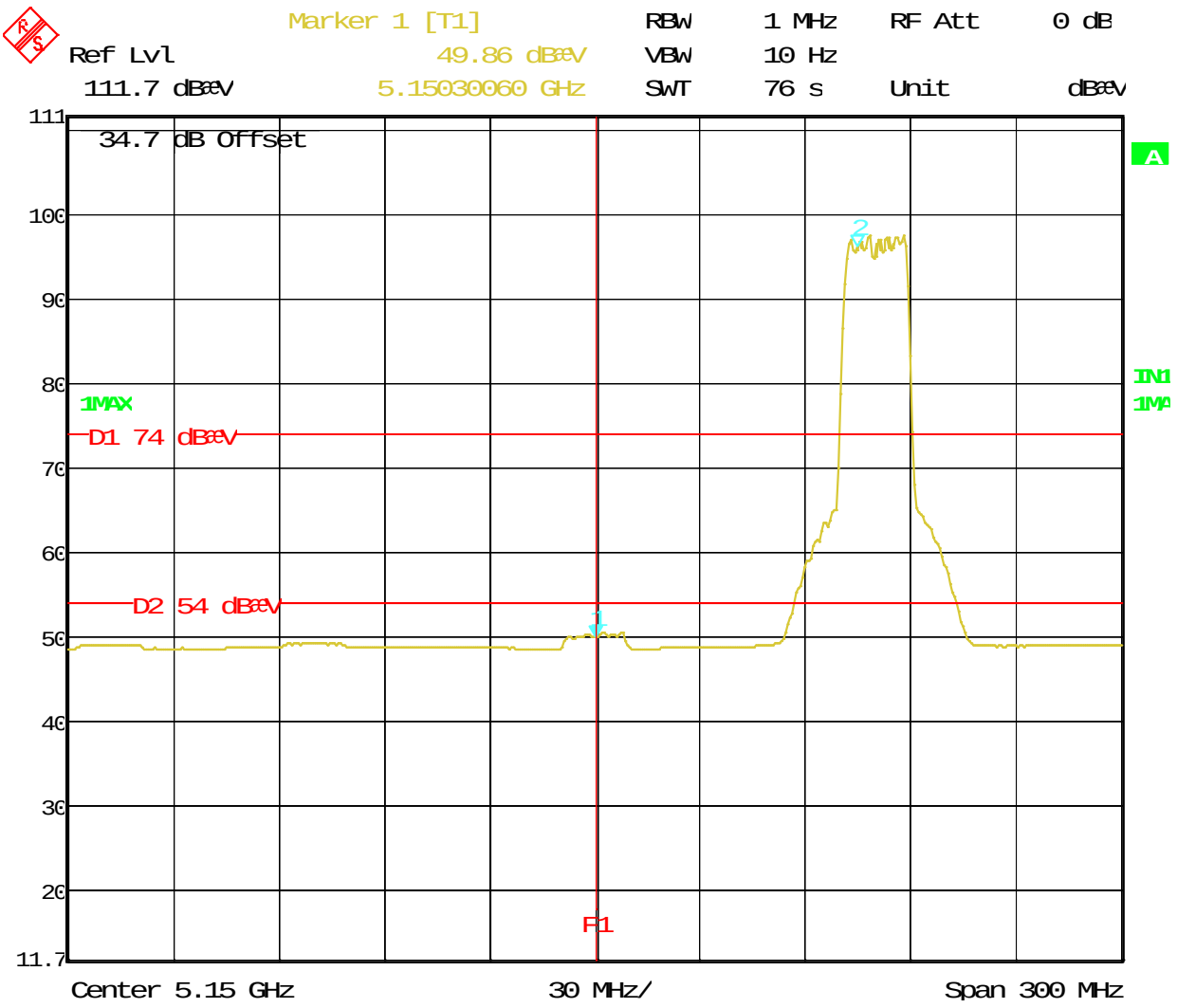


Figure 74: Radiated Emission at the Edge for Channel 5230 MHz at 13.5Mbps – Vert (Avg) 14dBm

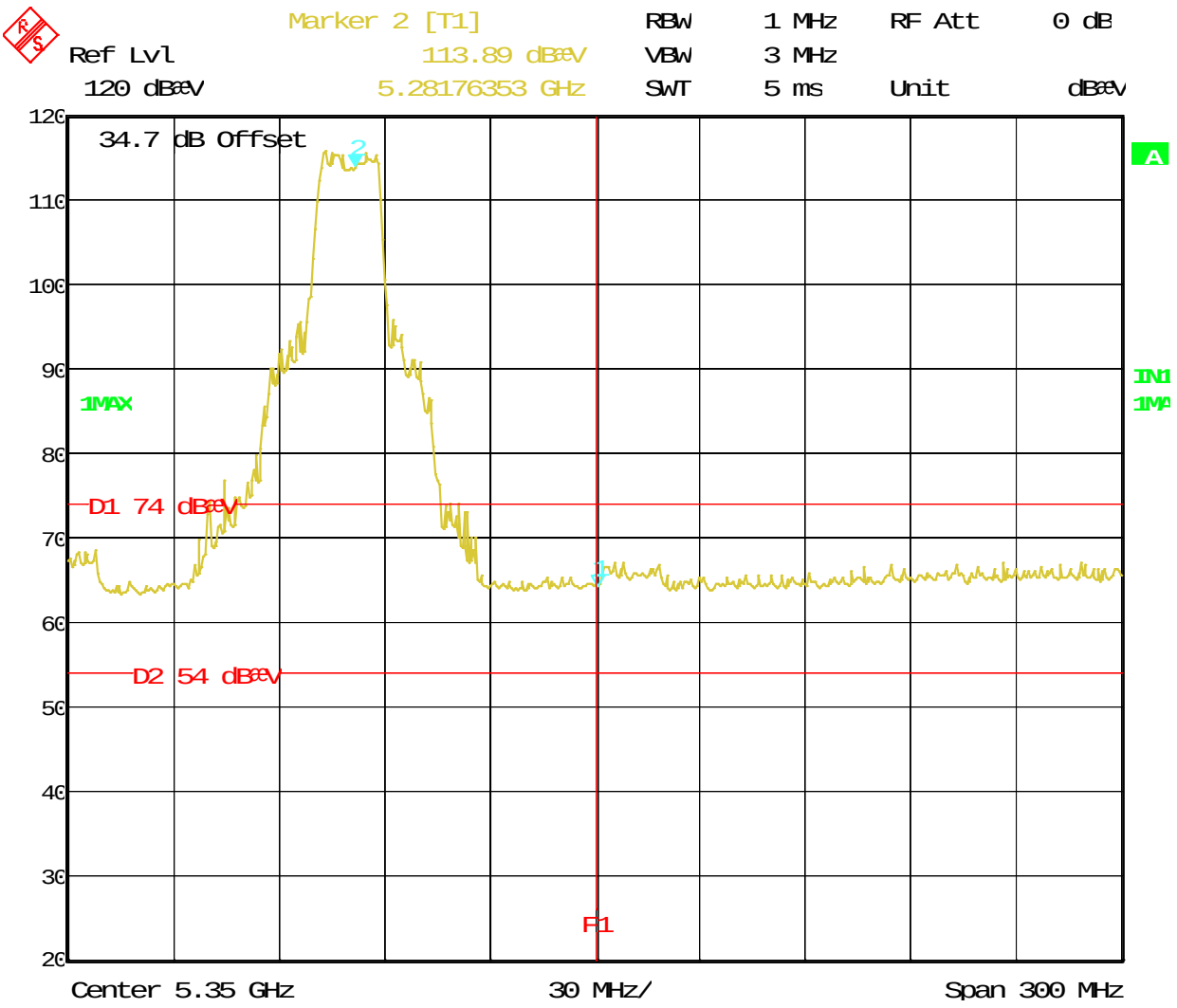


Figure 75: Radiated Emission at the Edge for Channel 5270 MHz at 13.5Mbps – Vert (Pk) 14dBm

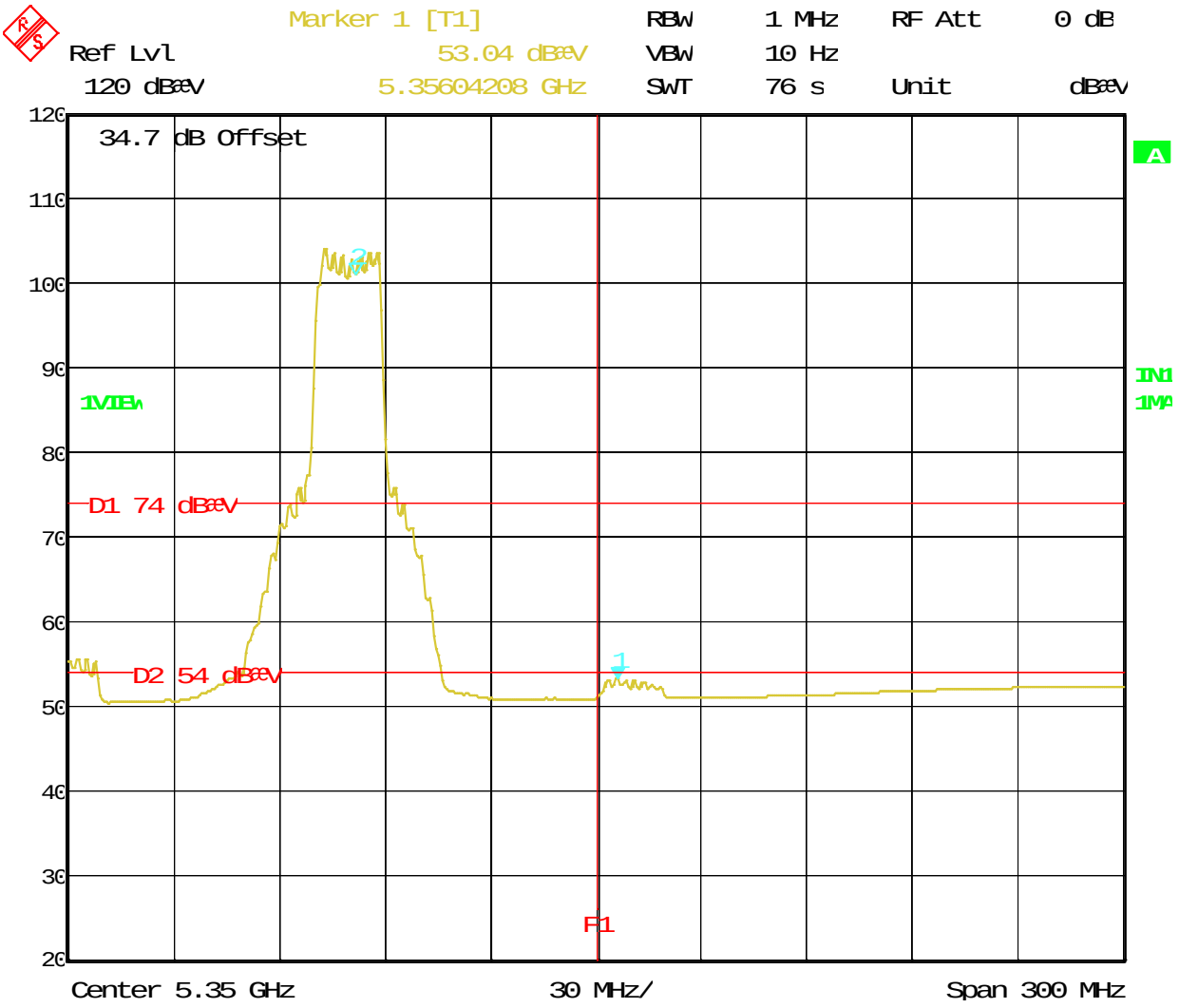


Figure 76: Radiated Emission at the Edge for Channel 5270 MHz at 13.5Mbps – Vert (Pk) 14dBm

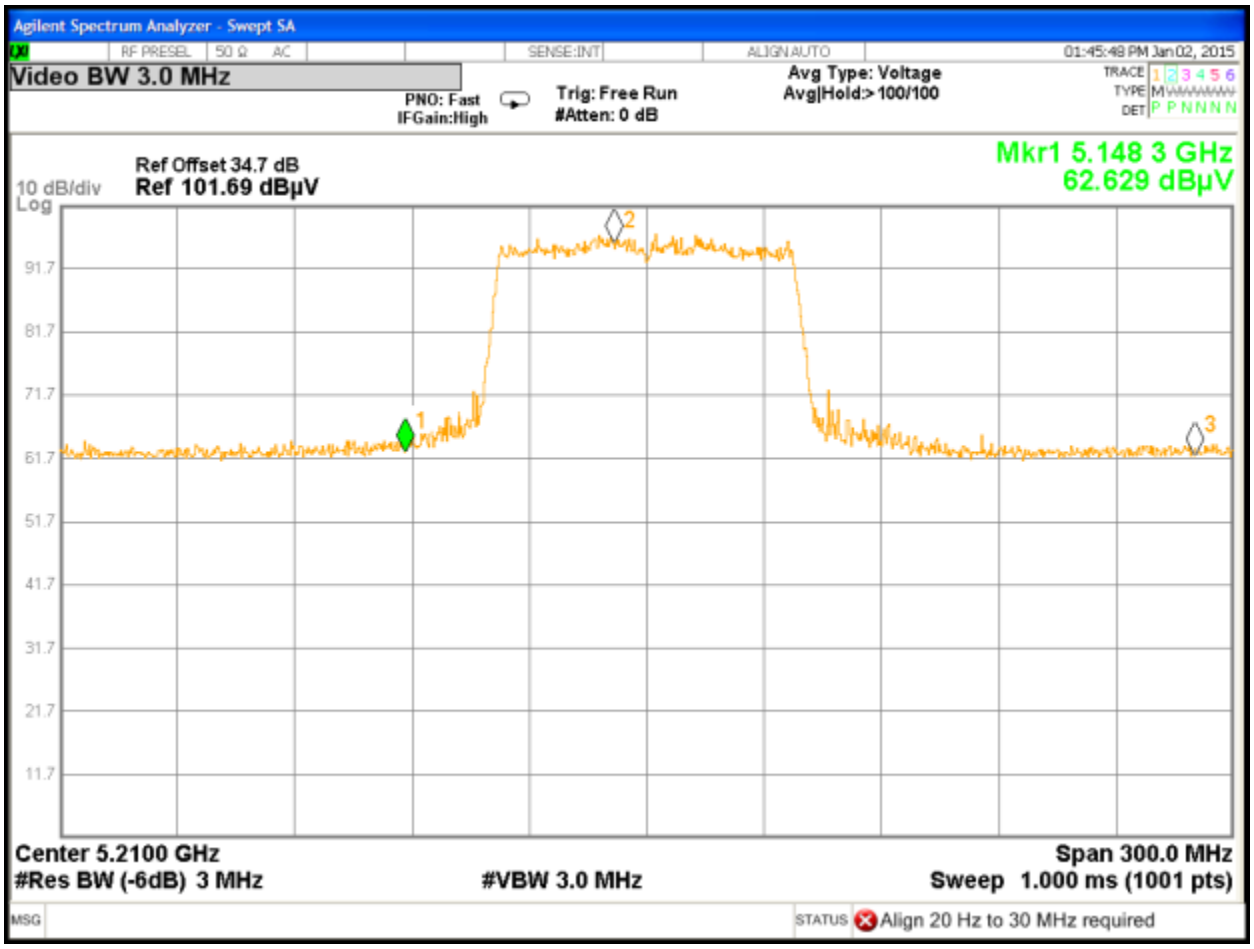


Figure 77: Radiated Emission at the Edge at 5150 MHz at 13.5Mbps – H (Ave.)VHT 80

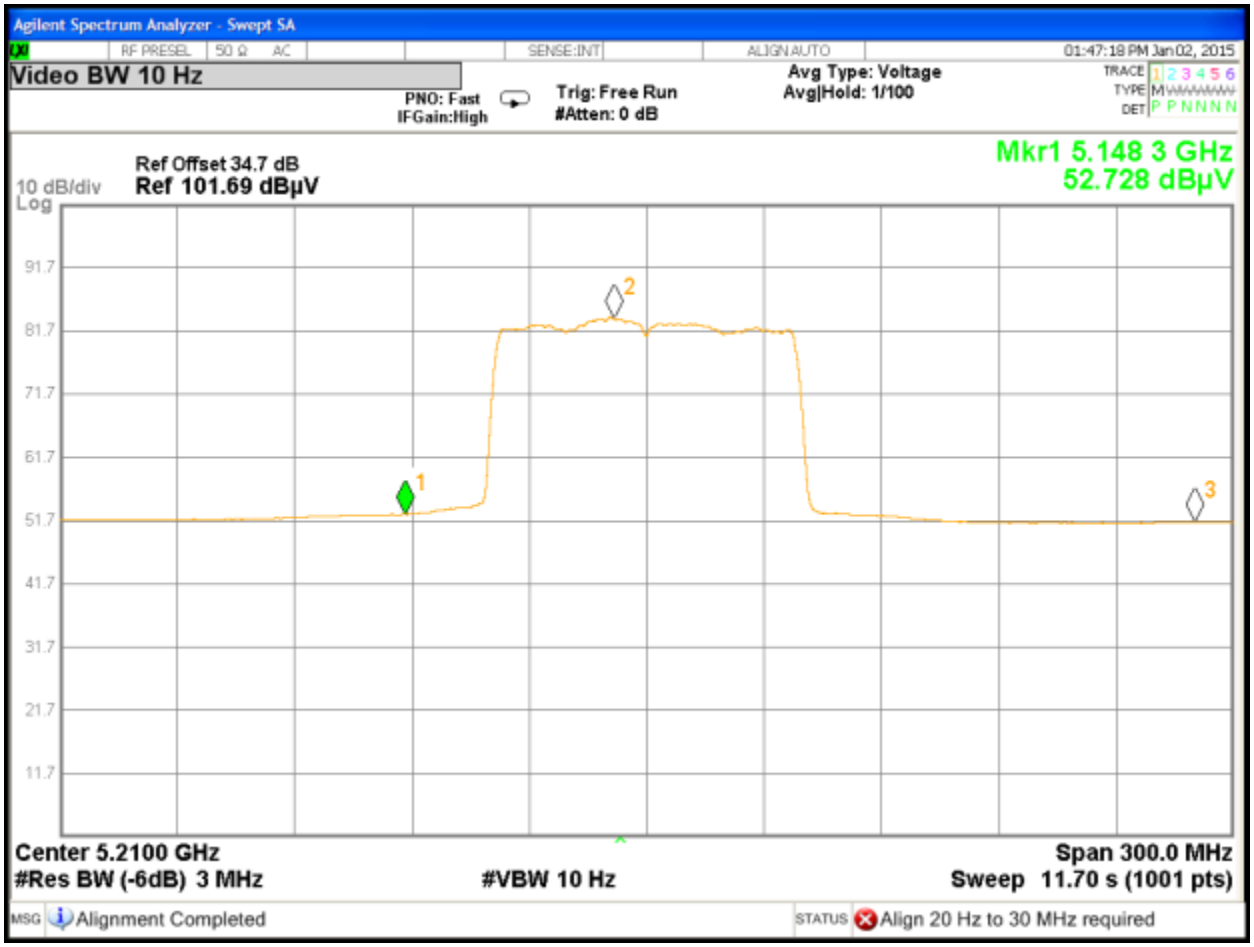


Figure 78: Radiated Emission at the Edge at 5150 MHz at 13.5Mbps – H (Ave.) VHT 80

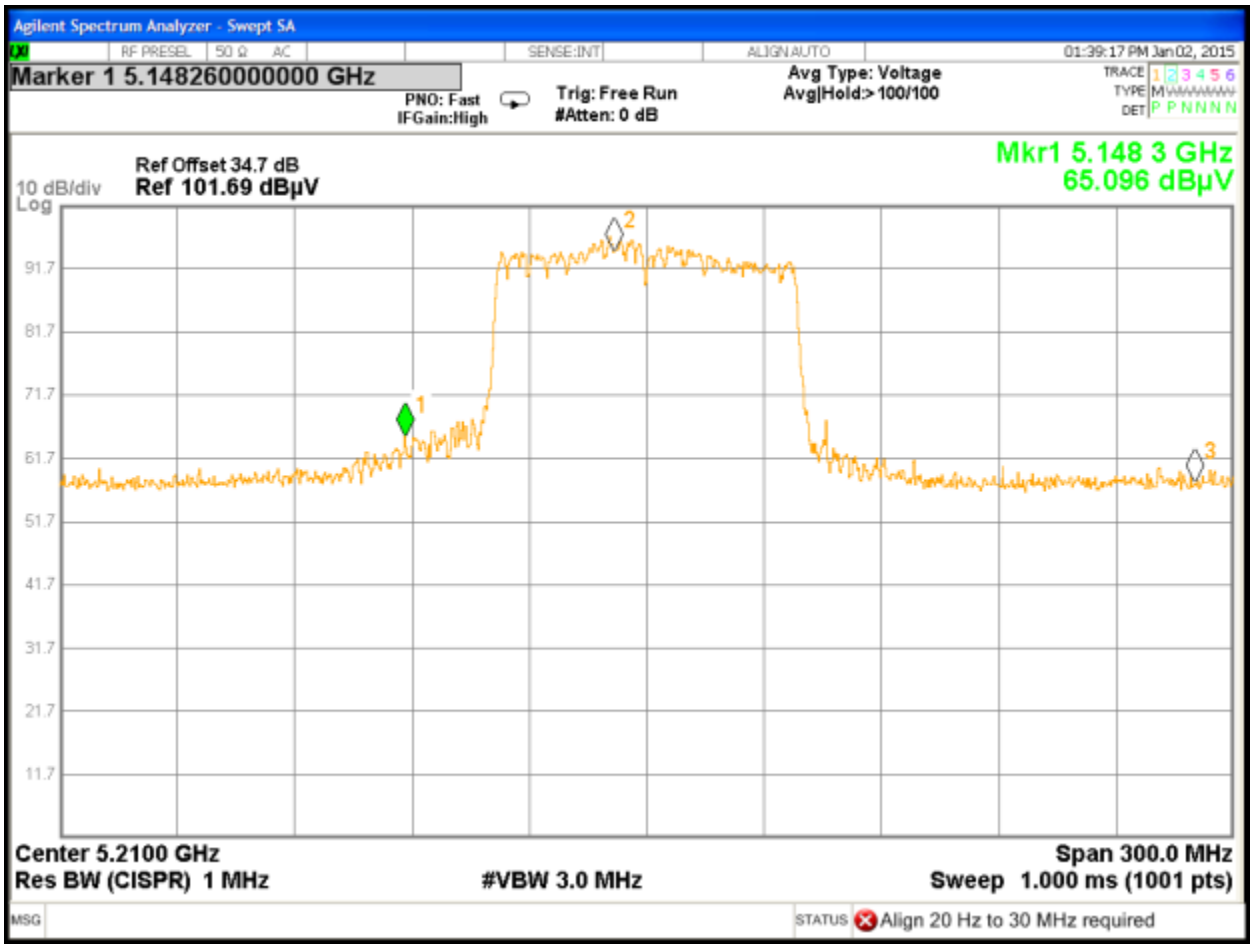


Figure 79: Radiated Emission at the Edge at 5150 MHz at 565Mbps – V (PK.) VHT 80

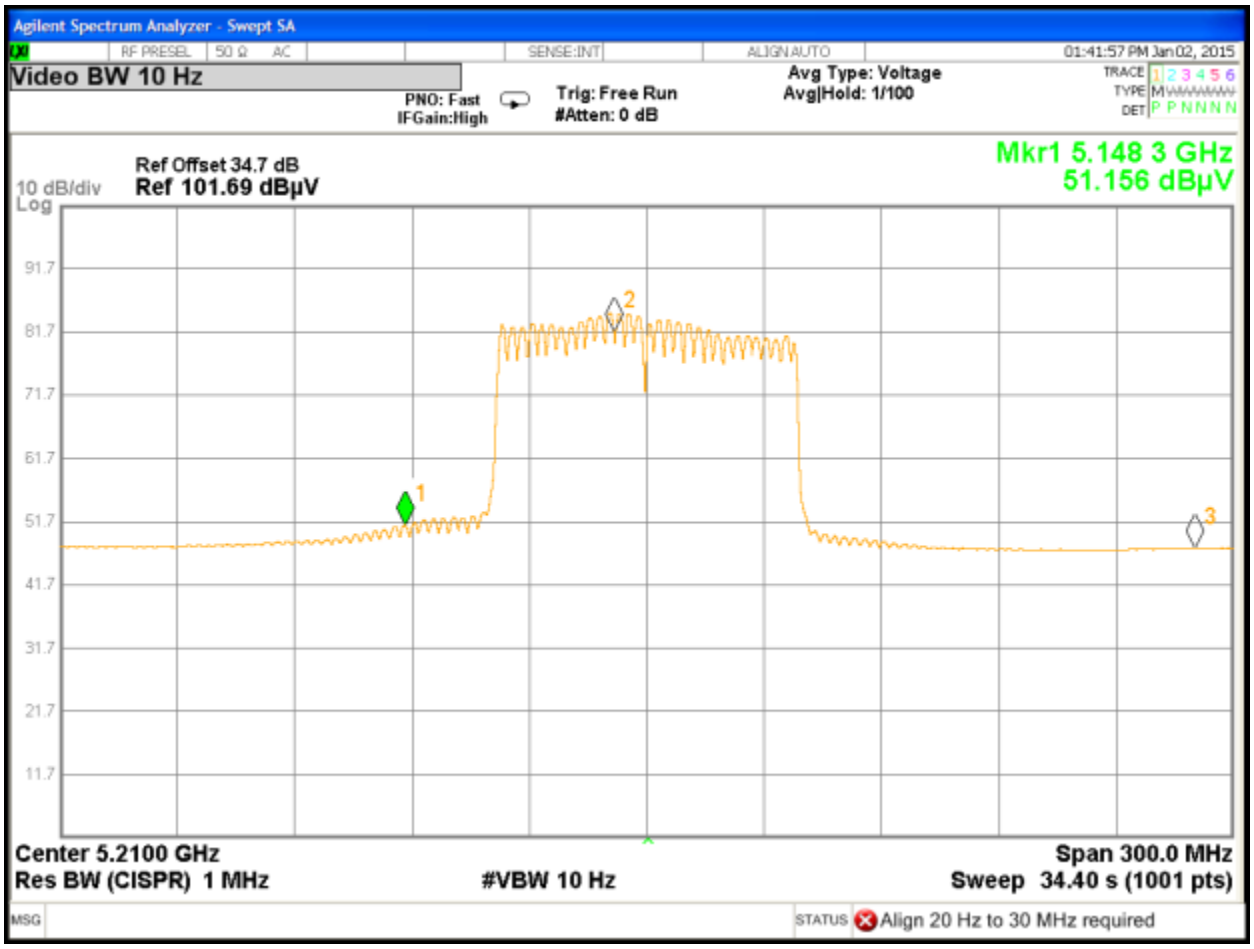


Figure 80: Radiated Emission at the Edge at 5150 MHz at 56.5Mbps– V (Avg.) HT 80

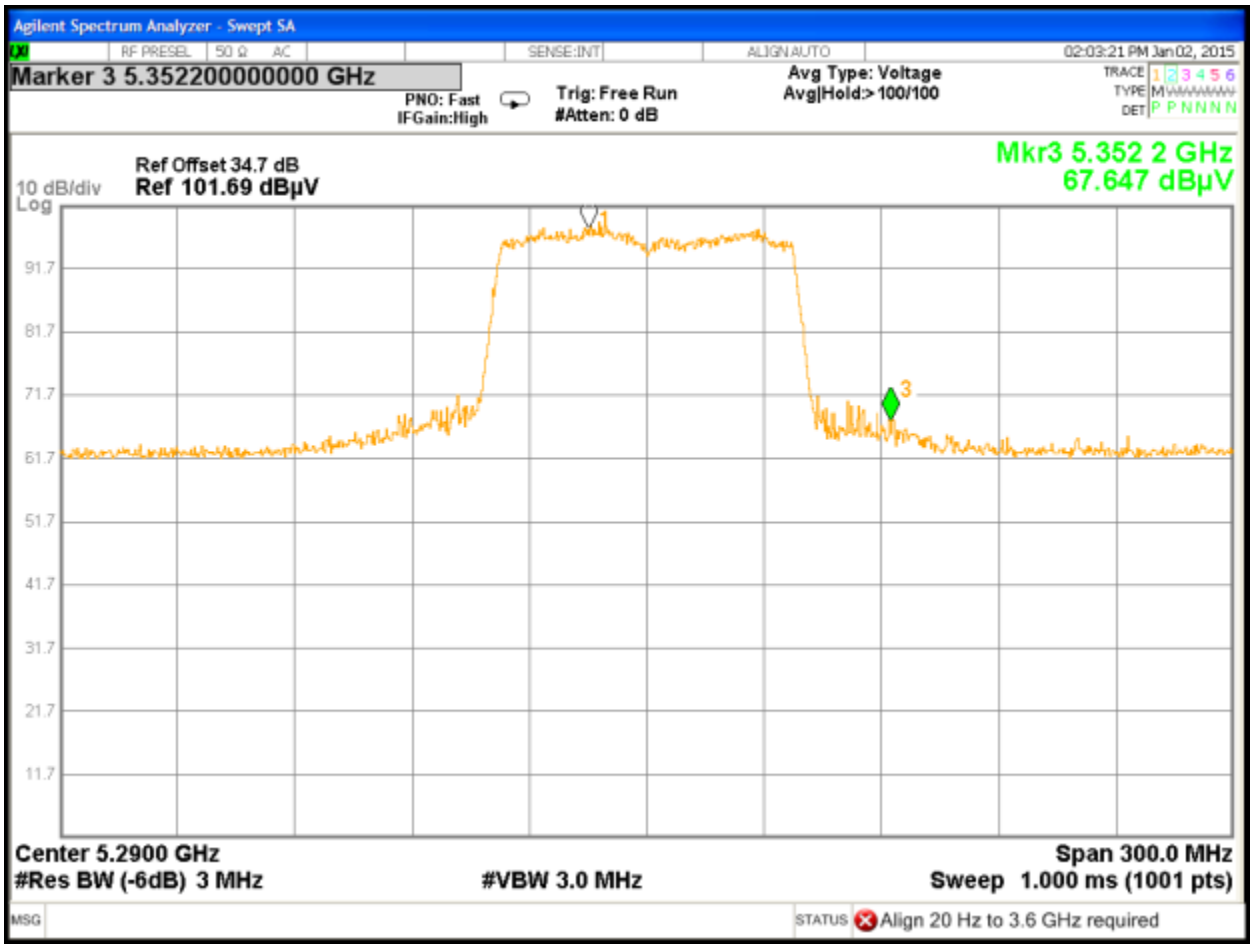


Figure 81: Radiated Emission at the Edge at 5350 MHz at 56.5Mbps – H (PK)VHT 80

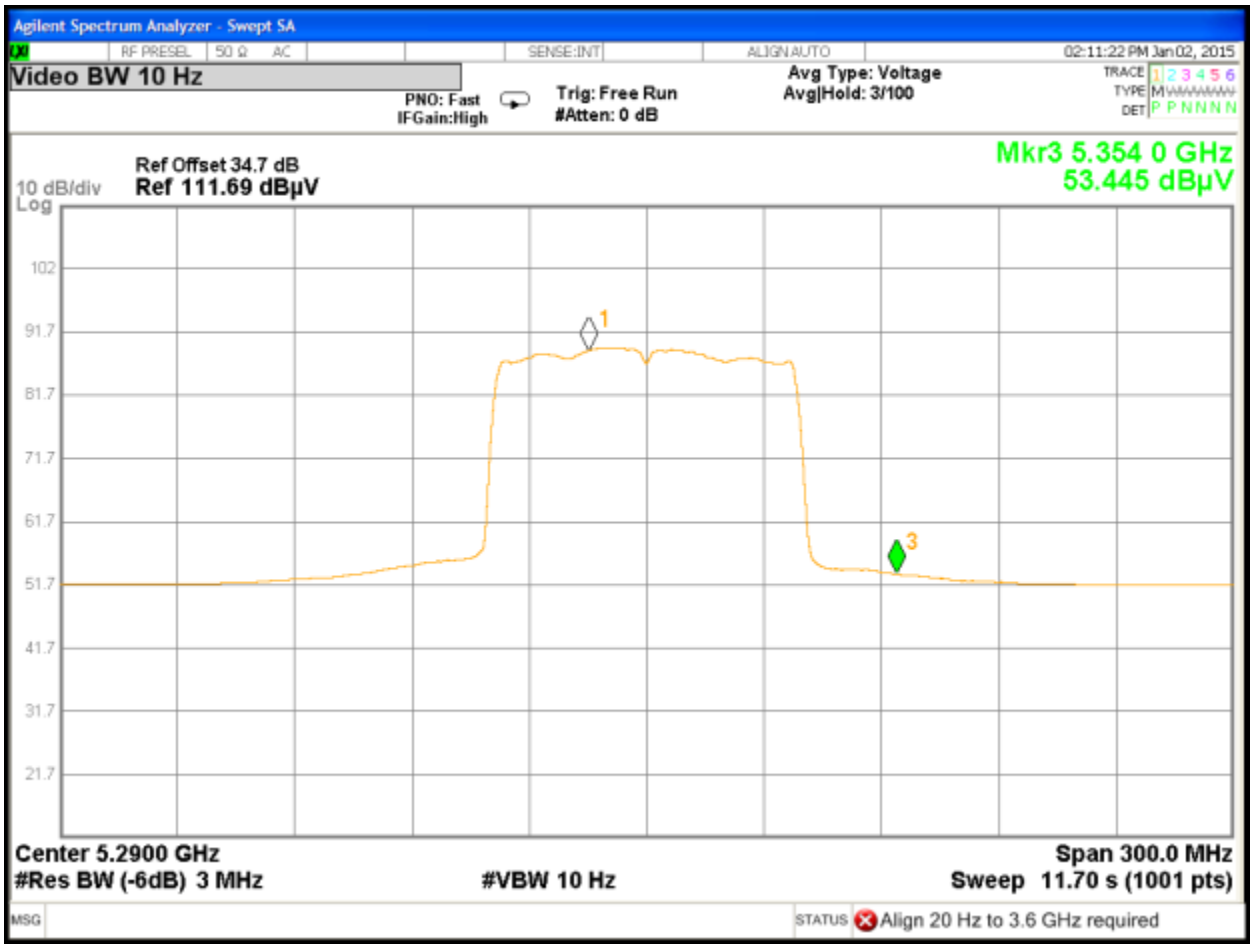


Figure 82: Radiated Emission at the Edge at 5350 MHz at 56.5Mbps – H(Avg) VHT 80

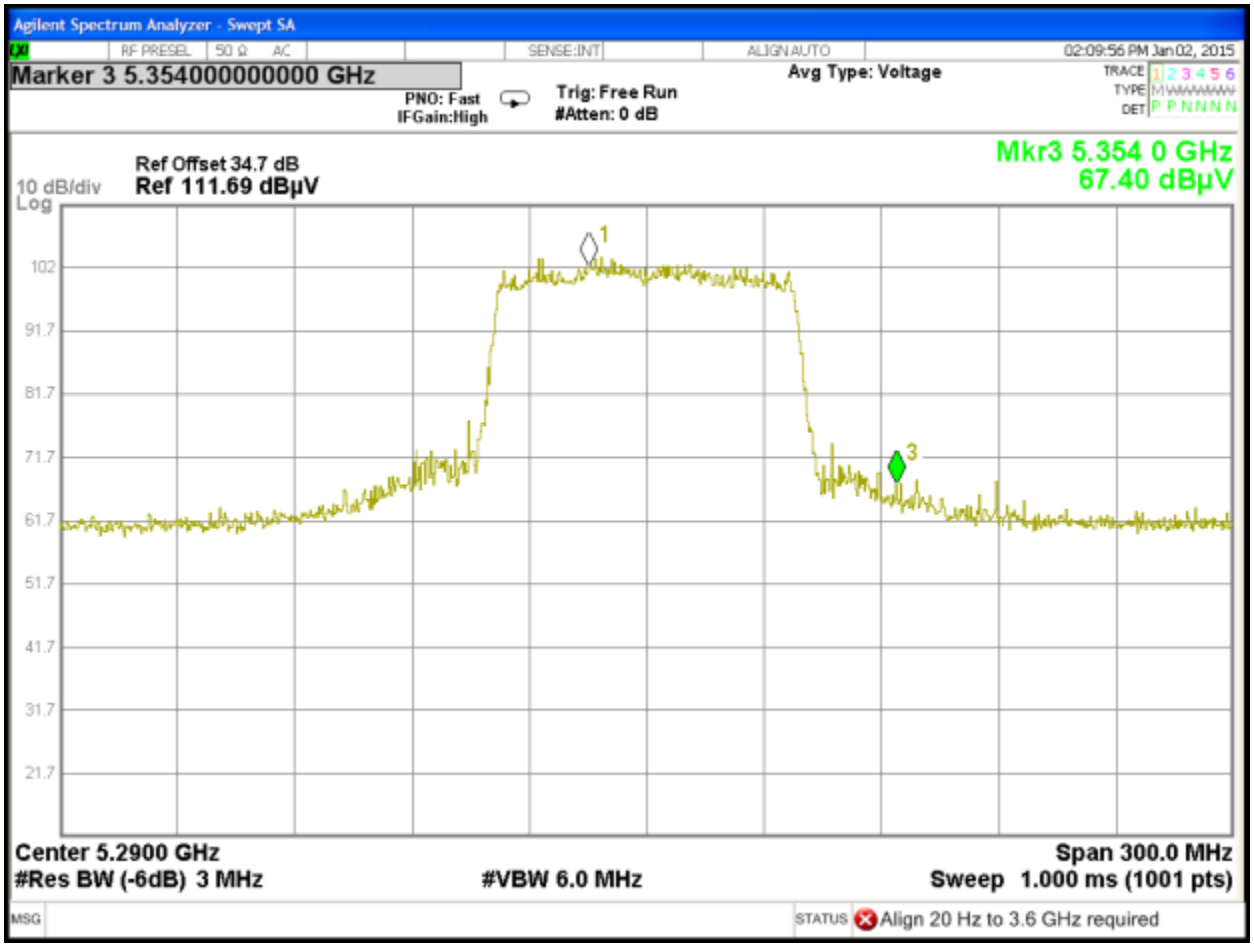


Figure 83: Radiated Emission at the Edge at 5350 MHz at 56.5Mbps – V(Avg) VHT 80

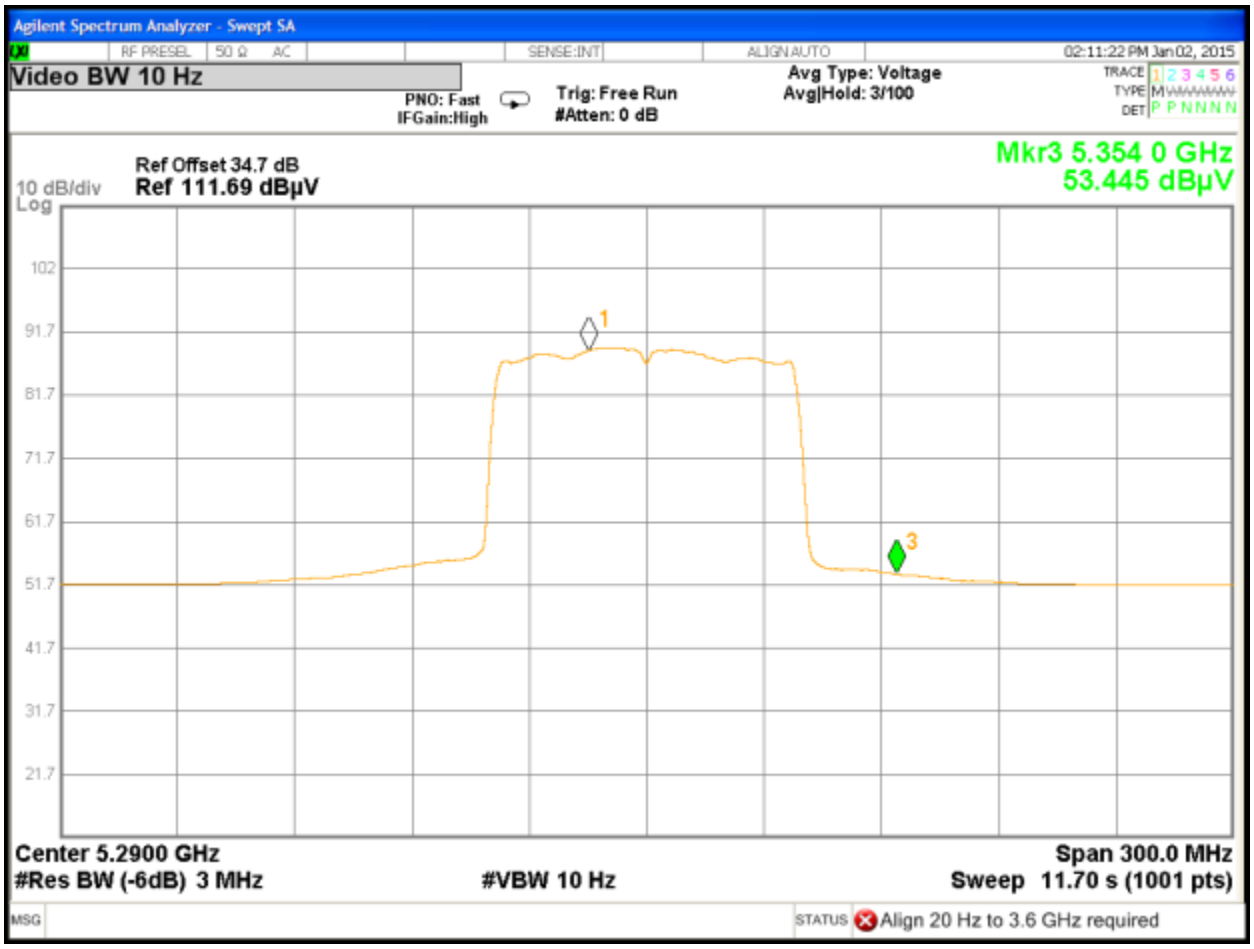


Figure 84: Radiated Emission at the Edge at 5350 MHz at 56.5Mbps – V(Avg) VHT 80

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EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a mode at 6.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

30 MHz 1 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5150-5350MHz Band

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
121.63	27.59	1.59	-18.78	10.40	QP	H	229	233	43.50	-33.10	Pass
465.73	28.02	2.26	-15.37	14.91	QP	H	195	362	46.00	-31.09	Pass
824.87	28.23	2.77	-10.78	20.22	QP	H	170	174	46.00	-25.78	Pass
43.76	56.70	1.33	-20.95	37.09	QP	V	104	32	40.00	-2.91	Pass
52.27	52.49	1.37	-24.61	29.24	QP	V	111	0	40.00	-10.76	Pass
56.91	48.90	1.38	-25.14	25.13	QP	V	107	2	40.00	-14.87	Pass
1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5180, 5200 and 5240MHz											
1040.59	47.28	0.75	-26.31	21.72	Avg	H	126	356	54.00	-32.28	Pass
1660.97	56.80	0.95	-24.84	32.91	Avg	H	160	356	54.00	-21.09	Pass
4599.97	41.59	1.61	-16.91	26.29	Avg	H	189	284	54.00	-27.71	Pass
4965.30	54.68	1.69	-16.40	39.97	Avg	H	143	282	54.00	-14.03	Pass
6906.59	60.72	2.01	-13.57	49.15	Avg	H	177	48	54.00	-4.85	Pass
5173.18	60.28	1.72	-16.15	45.84	Avg	V	102	36	54.00	-8.16	Pass
10355.83	39.62	2.52	-8.81	33.34	Avg	H	143	279	54.00	-20.67	Pass
15538.87	37.22	3.15	-10.43	29.93	Avg	H	174	132	54.00	-24.07	Pass
1665.90	53.76	0.95	-24.79	29.92	Avg	V	151	-8	54.00	-24.08	Pass
3329.68	43.22	1.36	-19.35	25.23	Avg	V	195	48	54.00	-28.78	Pass
10484.15	37.27	2.53	-9.19	30.61	Avg	H	164	266	54.00	-23.39	Pass
15718.94	40.62	3.17	-10.44	33.35	Avg	H	185	142	54.00	-20.65	Pass
3316.73	45.64	1.36	-19.40	27.60	Avg	V	132	48	54.00	-26.40	Pass
6986.53	57.34	2.02	-13.46	45.90	Avg	V	185	36	54.00	-8.10	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

SOP 1 Radiated Emissions

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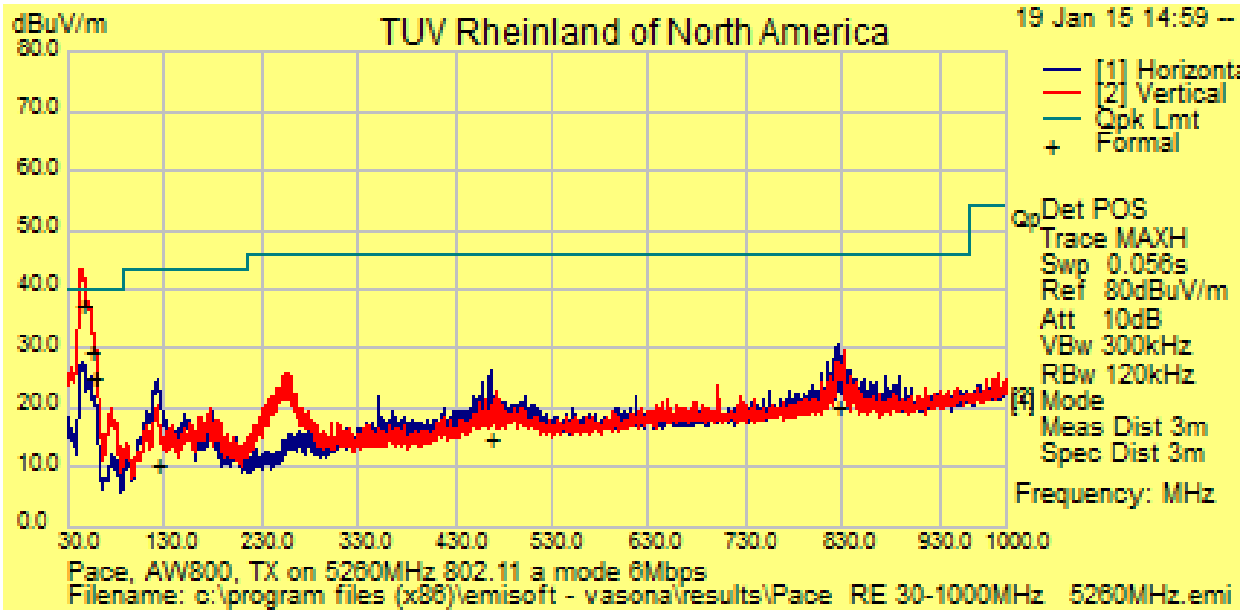
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 19, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

below 1 GHz Plots for Transmit Mode at 5260 MHz

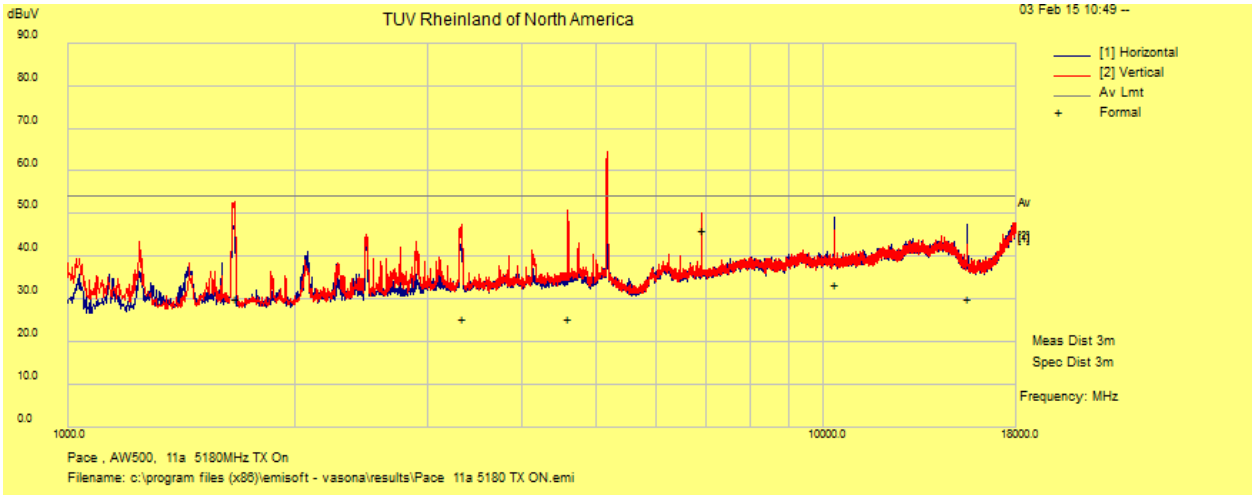


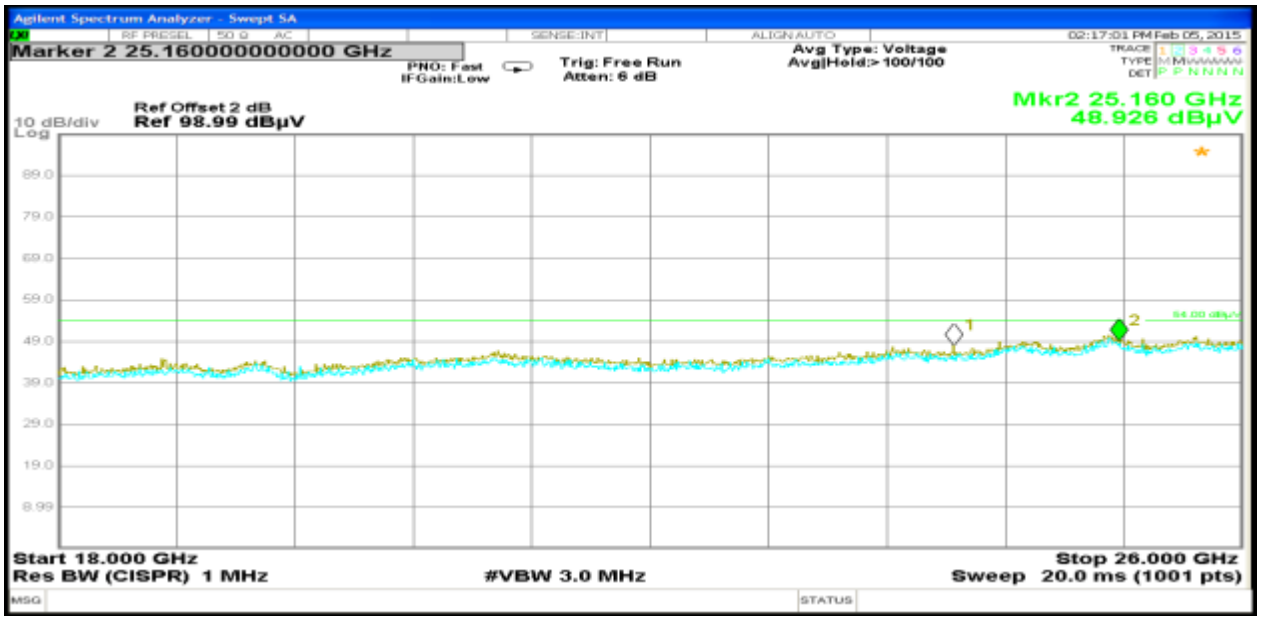
Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No emissions were found 26 to 40GHz

SOP 1 Radiated Emissions — Tracking # 31560164.001 Page 3 of 13

EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Feb 03, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

1-18 GHz Plots for Transmit Mode at 5180 MHz





Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No emissions were found 26 to 40GHz

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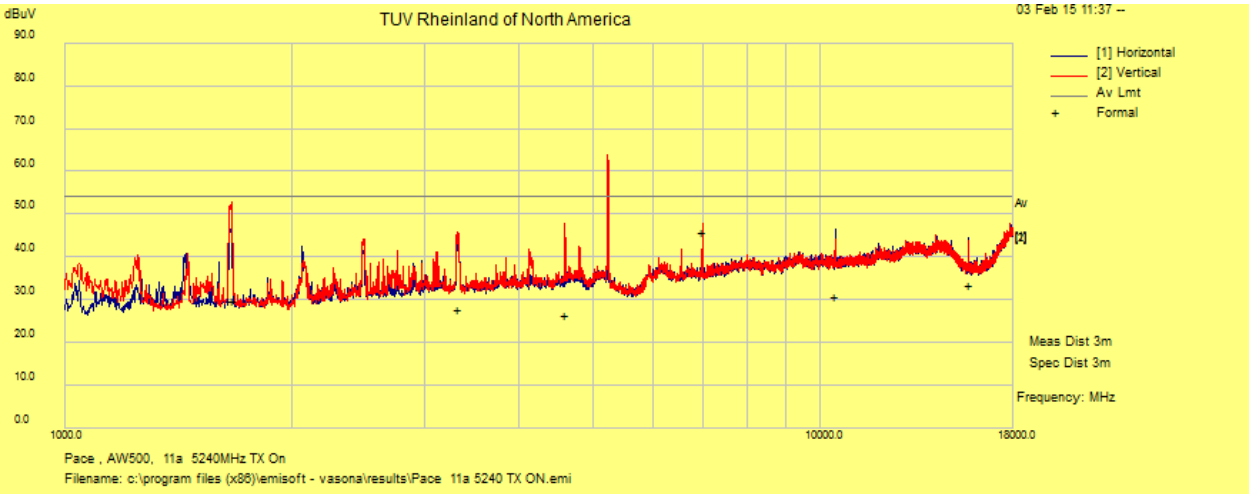
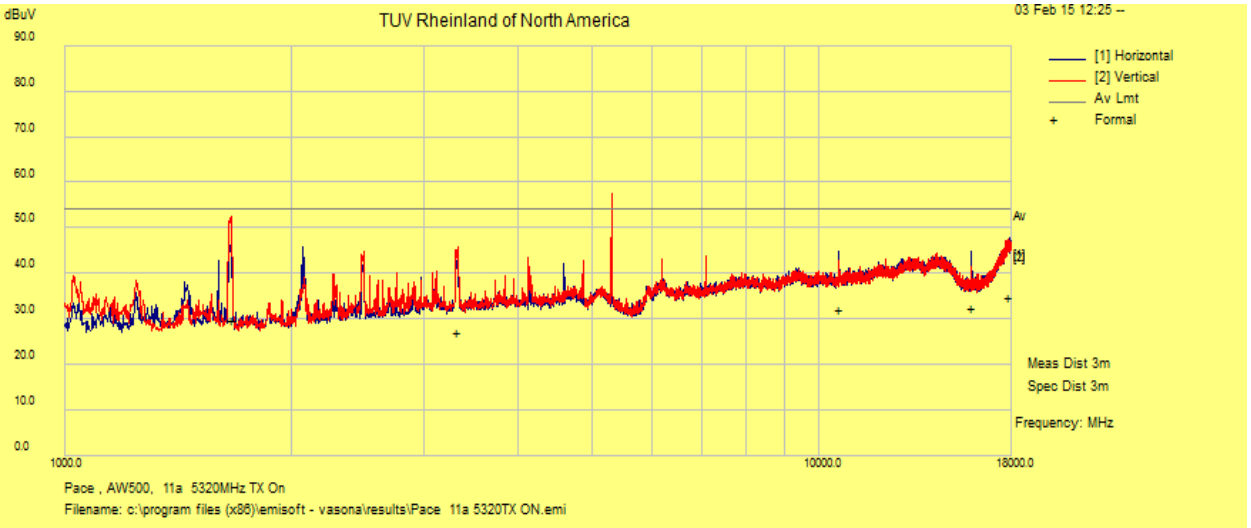
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Feb 03, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

1 -18GHz Plots for Transmit 11a Mode at 5240 MHz



1 -18GHz Plots for Transmit 11a Mode at 5320 MHz



Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No emissions were found 26 to 40GHz

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EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a mode at 6.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5260, 5300 and 5320MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
10639.55	38.95	2.55	-9.62	31.88	Avg	H	129	276	54.00	-22.12	Pass
15954.76	39.45	3.20	-10.25	32.40	Avg	H	198	144	54.00	-21.60	Pass
17901.32	32.30	3.44	-1.15	34.59	Avg	H	150	262	54.00	-19.41	Pass
1665.95	53.50	0.95	-24.79	29.67	Avg	V	152	356	54.00	-24.34	Pass
3323.01	44.93	1.36	-19.38	26.91	Avg	V	127	338	54.00	-27.09	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

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EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n mode HT20 at 6.0 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11 HT20 6.5Mbps/chain TX On 5260, 5300 and 5320MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
1040.59	47.28	0.75	-26.31	21.72	Avg	H	126	356	54.00	-32.28	Pass
1660.97	56.80	0.95	-24.84	32.91	Avg	H	160	356	54.00	-21.09	Pass
4599.97	41.59	1.61	-16.91	26.29	Avg	H	189	284	54.00	-27.71	Pass
4965.30	54.68	1.69	-16.40	39.97	Avg	H	143	282	54.00	-14.03	Pass
6906.59	60.72	2.01	-13.57	49.15	Avg	H	177	48	54.00	-4.85	Pass
5173.18	60.28	1.72	-16.15	45.84	Avg	V	102	36	54.00	-8.16	Pass
10363.74	40.70	2.52	-8.85	34.37	Avg	V	100	334	54.00	-19.63	Pass
3883.47	62.23	1.47	-17.45	46.25	Avg	H	116	-8	54.00	-7.75	Pass
1651.93	57.32	0.95	-24.94	33.33	Avg	V	139	356	54.00	-20.67	Pass
2498.77	47.48	1.17	-22.29	26.36	Avg	V	130	356	54.00	-27.64	Pass
3312.60	45.47	1.36	-19.42	27.41	Avg	V	163	50	54.00	-26.59	Pass
5981.34	57.45	1.86	-15.74	43.57	Avg	V	100	178	54.00	-10.43	Pass
11648.66	37.47	2.68	-11.86	28.29	Avg	V	197	-8	54.00	-25.71	Pass
17474.83	31.05	3.39	-3.71	30.73	Avg	V	181	-8	54.00	-23.27	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

SOP 1 Radiated Emissions

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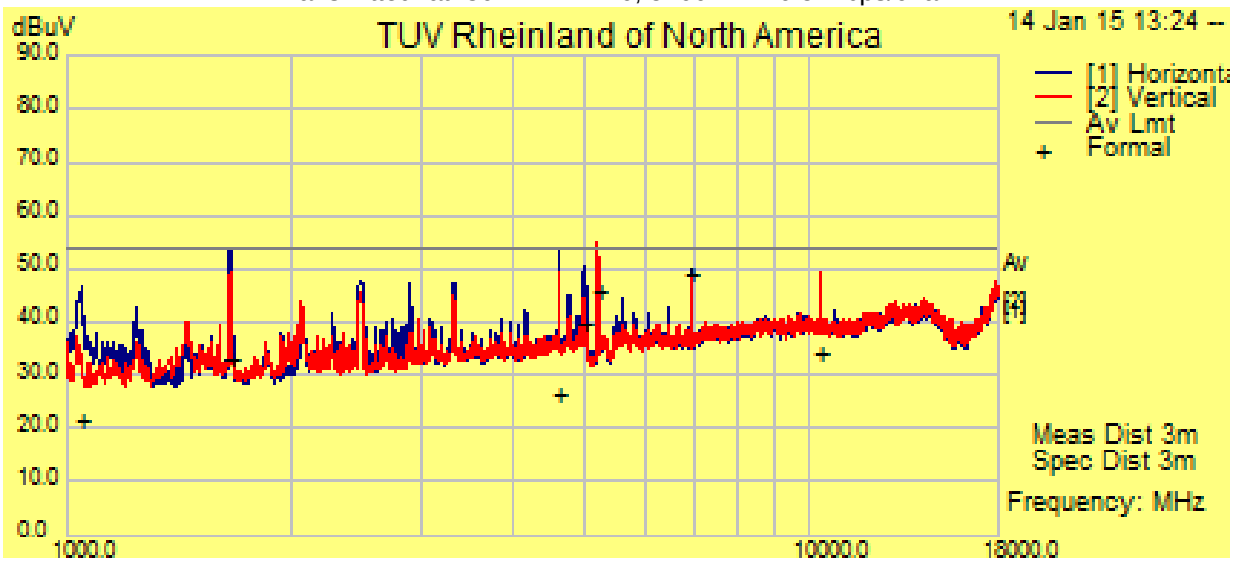
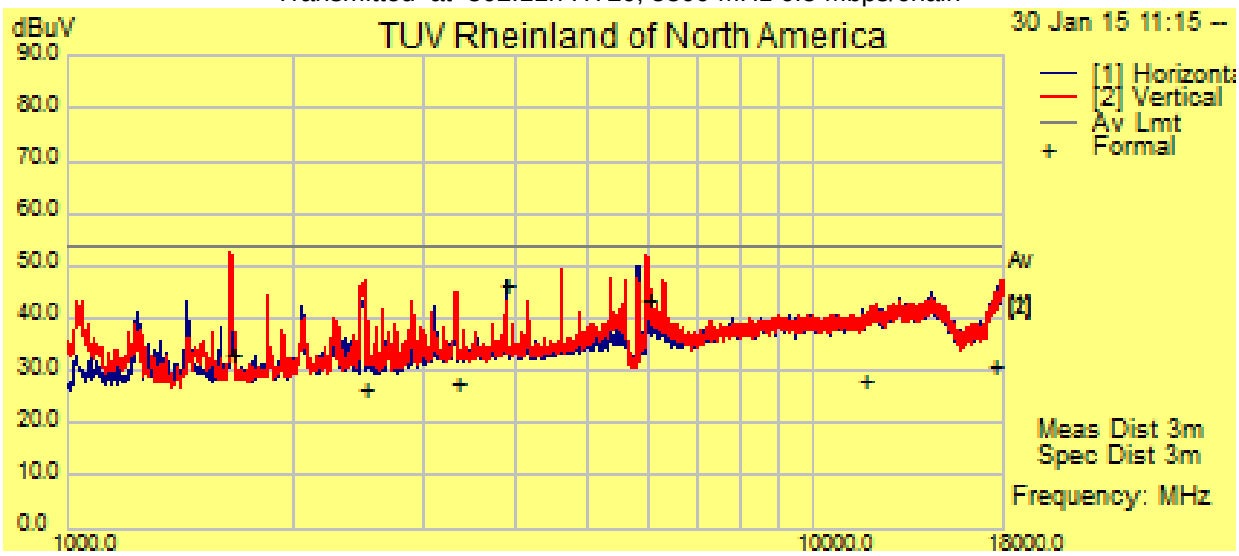
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Ja 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT20 at 6.5 Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh K

Transmitted at 802.11n HT20, 5200 MHz 6.5 Mbps/chain



Transmitted at 802.11n HT20, 5300 MHz 6.5 Mbps/chain



Notes:

SOP 1 Radiated Emissions — Tracking # 31560164.001 Page 8 of 13

EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT40mode at 13.5 Mbps/ chain	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11 HT40 11Mbps/chain TX On 5190, 5230, 5270 and 5310MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
4599.92	40.26	1.61	-16.91	24.95	Avg	H	185	356	54.00	-29.05	Pass
5506.49	59.83	1.77	-15.97	45.63	Avg	H	101	25	54.00	-8.37	Pass
1655.88	58.54	0.95	-24.90	34.59	Avg	V	137	352	54.00	-19.42	Pass
3323.37	45.87	1.36	-19.38	27.85	Avg	V	154	52	54.00	-26.15	Pass
10380.95	35.98	2.61	-10.77	27.82	Avg	V	119	-8	54.00	-26.18	Pass
16529.91	31.14	3.27	-8.25	26.17	Avg	V	114	-8	54.00	-27.83	Pass
3863.37	59.21	1.47	-17.45	43.23	Avg	H	103	348	54.00	-10.77	Pass
1657.99	56.60	0.95	-24.88	32.67	Avg	V	136	352	54.00	-21.33	Pass
3323.49	45.44	1.36	-19.38	27.42	Avg	V	120	46	54.00	-26.58	Pass
4829.17	60.27	1.66	-16.38	45.55	Avg	V	195	288	54.00	-8.45	Pass
11591.24	36.43	2.67	-11.71	27.38	Avg	V	174	-8	54.00	-26.62	Pass
17385.27	30.86	3.39	-4.45	29.80	Avg	V	147	-8	54.00	-24.20	Pass
10620.31	36.14	2.65	-11.52	27.27	Avg	V	104	-8	54	-26.73	Pass
15930.28	31.68	3.36	-5.91	29.13	Avg	V	130	-8	54	-24.87	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

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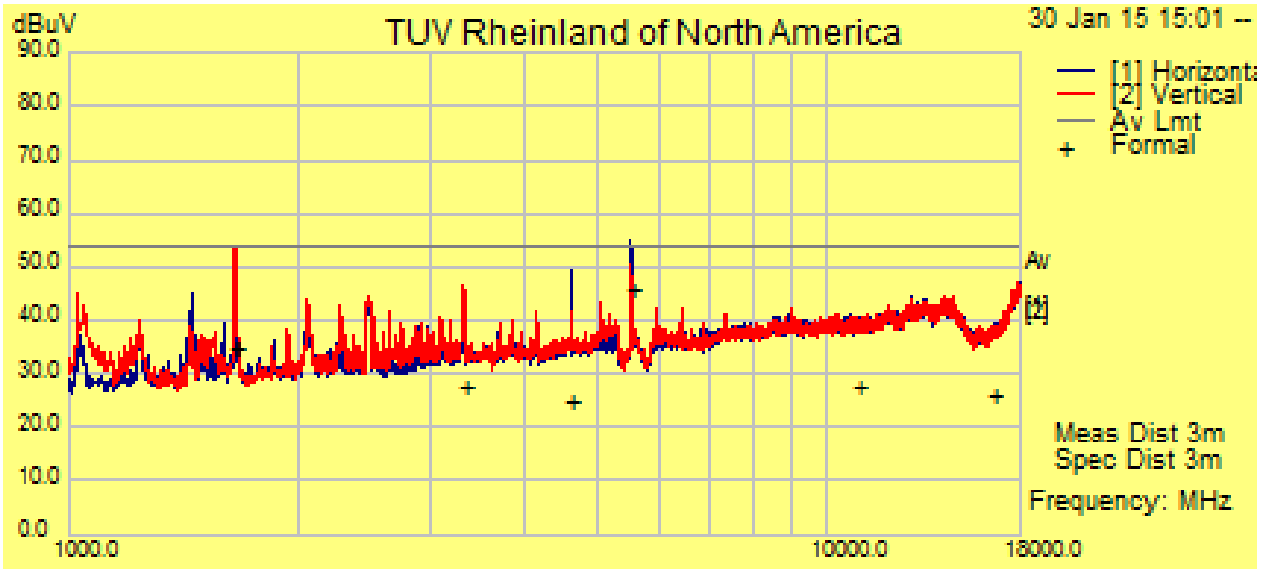
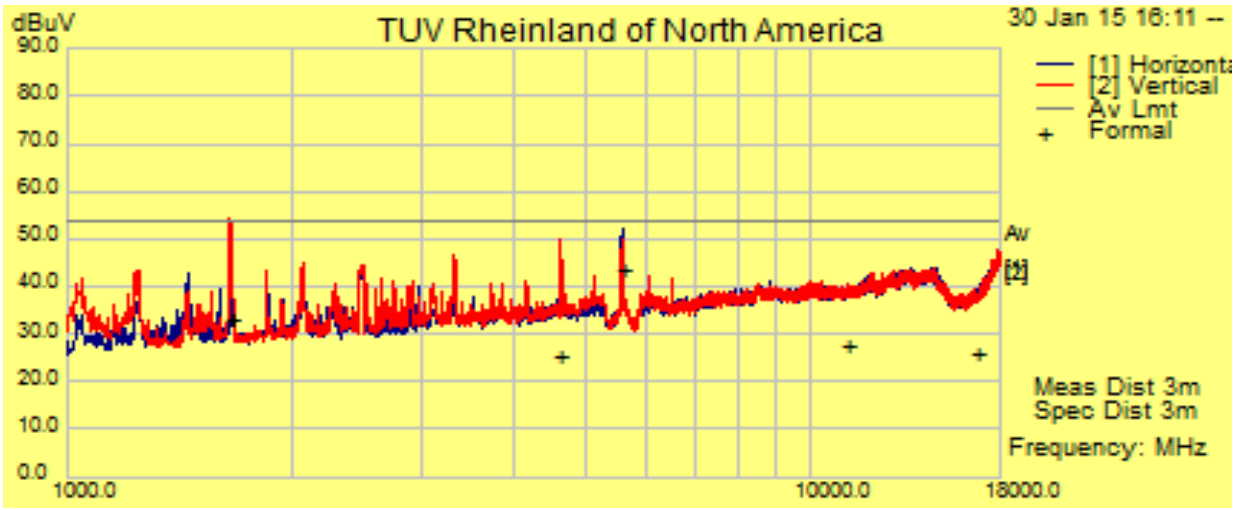
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Feb 03, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT40/ VHT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

1 to 18GHz Plots for HT40/VHT40 Transmit Mode at 5190 MHz



1 to 18GHz Plots for HT40/VHT40 Transmit Mode at 5310MHz



Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No emissions were found 26 to 40GHz

SOP 1 Radiated Emissions

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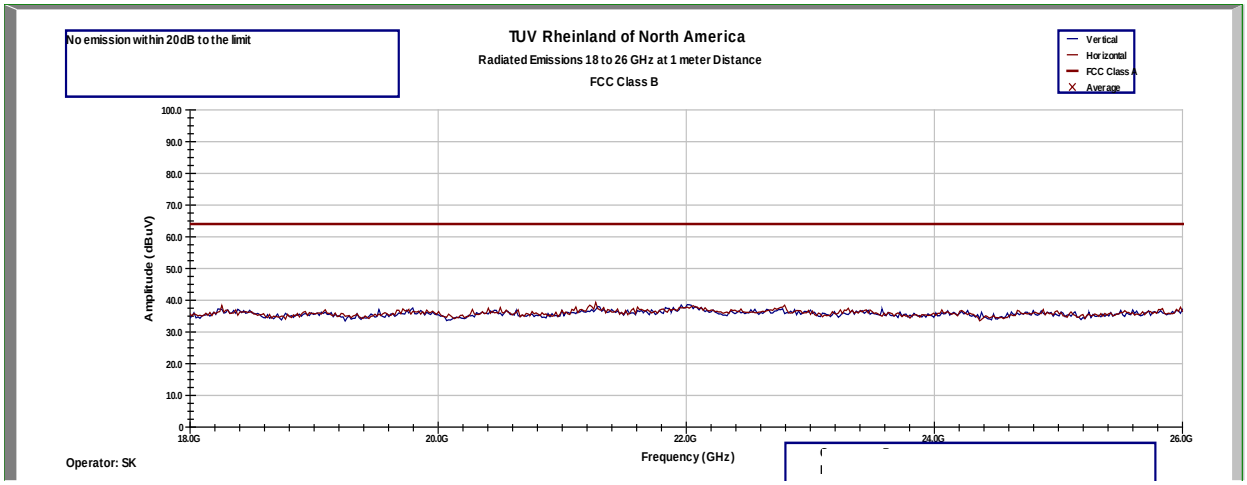
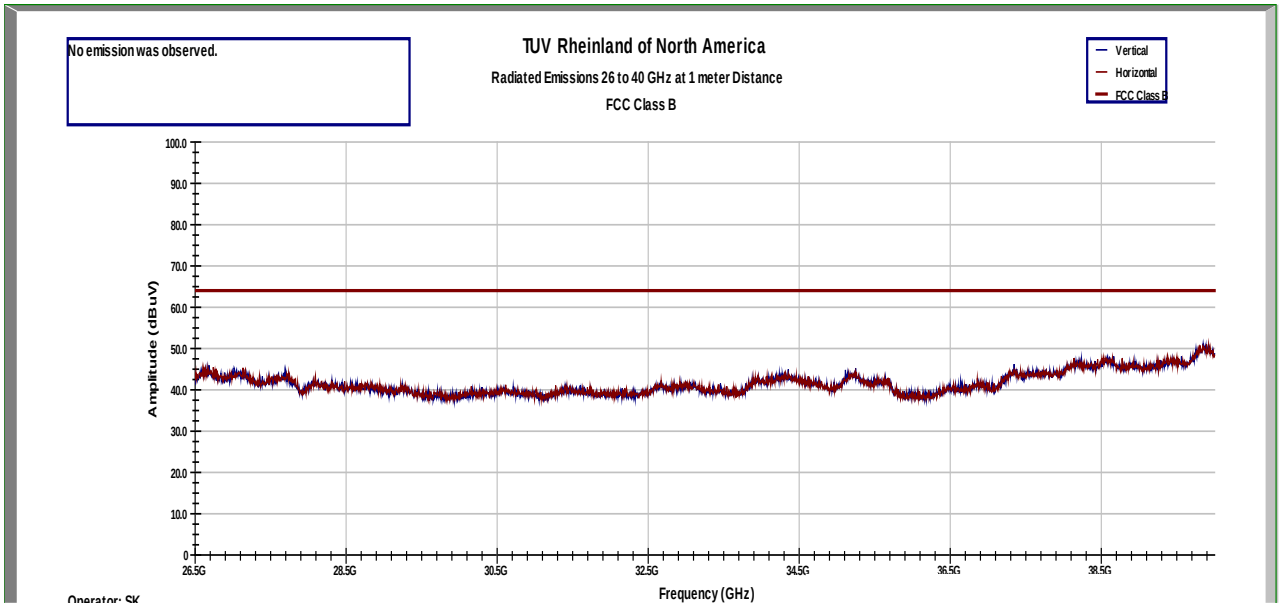
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Feb 05, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT40/VHT40 at 11Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	1m - RA42-K-F-4B-C	**Performed by**	Suresh K

18 to 26 GHz Plots for HT/VHT40 Transmit Mode





Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range.

SOP 1 Radiated Emissions

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EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Jan 14, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 28%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 AC VT80	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11AC HT80 TX On 5210 and 5290MHz

Frequency	Raw	Cable Loss	AF	Level	Detector	Polarity	Height	Azimuth	Limit	Margin	
MHz	dBuV/m	dB	dB	dBuV/m		H/V	cm	deg	dBuV/m	dB	
1659.37	56.58	0.95	-24.86	32.67	Avg	V	125	356	54.00	-21.33	Pass
3306.51	47.19	1.35	-19.44	29.11	Avg	V	113	44	54.00	-24.90	Pass
5313.78	50.34	1.75	-16.13	35.96	Avg	V	150	46	54.00	-18.04	Pass
7053.27	51.23	2.03	-13.34	39.92	Avg	V	160	28	54.00	-14.08	Pass
10579.05	34.42	2.54	-9.39	27.57	Avg	V	144	-8	54.00	-26.43	Pass
15870.85	32.72	3.19	-10.24	25.68	Avg	V	113	-8	54.00	-28.32	Pass

Spec Margin = E-Field QP - Limit, E-Field QP = FIM QP+ Total CF ± Uncertainty
Total CF= AF+ Cable Loss AF= Antenna factor + Preamp

SOP 1 Radiated Emissions

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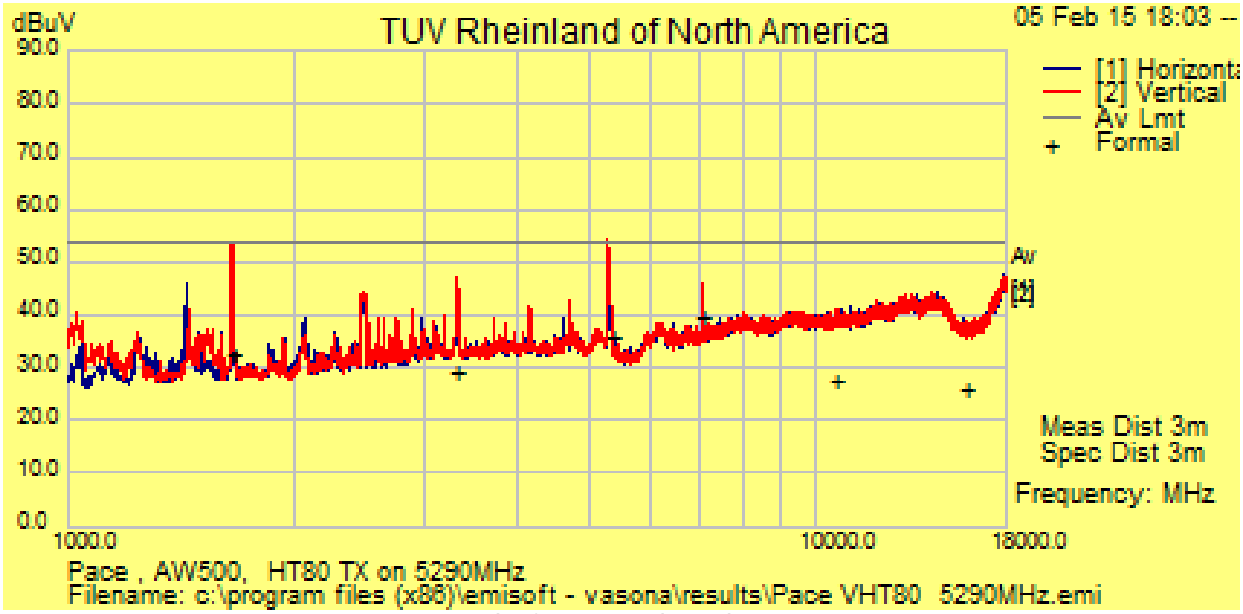
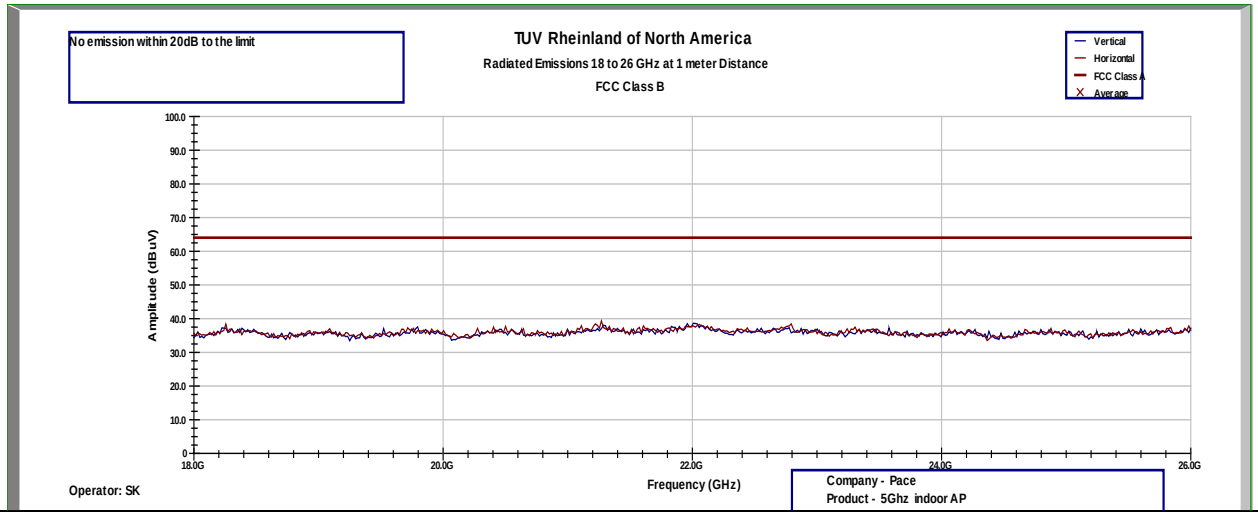
EUT Name	WiFi 802.11AC 2x2 5GHz Wireless Adapter	**Date**	Feb 05, 2015
EUT Model	AW500	**Temp / Hum in**	23° C / 33%rh
EUT Serial	Prototype	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11AC VHT80	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode at 5290 MHz



18 -26 GHz Plot for Transmit Mode at 5290 MHz



Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No Emissions were found 26 to 40GHz range

4.3.6 Sample Calculation

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) = FIM - AMP + CBL + ACF

Where: FIM = Field Intensity Meter (dBμV)
AMP = Amplifier Gain (dB)
CBL = Cable Loss (dB)
ACF = Antenna Correction Factor (dB/m)

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

4.4 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2010. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207: 2012 and RSS 210: 2010.

4.4.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is either performed in Lab 2. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

4.4.1.1 Deviations

There were no deviations from this test methodology.

4.4.2 Test Results

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

Test Not applicable EUT is DC powered device from Host

4.5 Frequency Stability

In accordance with 47 CFR Part 15.407(g) the frequency stability of U-NII devices must be such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual. The Manufacturer calls out operating temperature ranges of +0º to +40º C

4.5.1 Test Methodology

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions. This test performs according to ANSI C63.10-2009 Section 6.8

4.5.2 Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signal should have ±20 ppm stability.

This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

Worst case:
5.200 GHz - ±20 ppm/104 kHz

±20 ppm at 5 GHz translates to a maximum frequency shift of ±103 kHz. As the edge of the channels are at least one MHz from either of the band edges, ±103 kHz is more than sufficient to guarantee that the intentional emission will remain in the band over the entire operating range of the radio.

4.5.3 Limit

CFR47 Part 407(g) - Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

4.5.4 Test results:

Frequency stability test results are available in test report # 31560164.003

4.6 Voltage Variation

In accordance with 47 CFR Part 15.31 (e) intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.6.1 Test Methodology

The ac supply voltage was varied between 85% and 115% of the nominal rated supply voltage. The fundamental frequency was observed during the variation. The access point was powered 120V/60Hz by programmable power supply. The voltage was varied from 102Vac to 138Vac mean while the fundamental frequencies were observed and record for the maximum drift in ppm; part per millions.

4.6.2 Test results

Test results are available in test report # 31560164.003

4.7 Maximum Permissible Exposure

4.7.1 Test Methodology

In this document, we try to prove the safety of radiation harmfulness to the human body for our product. The limit for Maximum Permissible Exposure (MPE) specified in FCC 1.1310 is followed. The Gain of the antenna used in this calculation is declared by the manufacturer, and the maximum total power input to the antenna is measured. Through the Friis transmission formula and the maximum gain of the antenna, we can calculate the distance, away from the product, where the limit of MPE is reached.

Although the Friis transmission formula is a far field assumption, the calculated result of that is an over-prediction for near field power density. We will take that as the worst case to specify the safety range.

4.7.2 RF Exposure Limit

According to FCC 1.1310 table 1: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b)

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm_2)	Average Time (minutes)
(A)Limits For Occupational / Control Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	…	…	1.0	6
300 - 1500	…	…	f/300	6
1500 - 100,000	…	…	5	6
(B)Limits For General Population / Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/ f^2$)	30
30–300	27.5	0.037	0.2	30
300 - 1500	…	…	f/1500	30
1500 - 100,000	…	…	1.0	30

F = Frequency in MHz
* = Plane-wave equivalent power density

4.7.3 EUT Operating Condition

The software provided by Manufacturer enabled the EUT to transmit data at lowest, middle and highest channel individually.

4.7.4 Classification

The antenna of the product, under normal use condition, is at least 20cm away from the body of the user. Warning statement to the user for keeping at least 20cm or more separation distance with the antenna should be included in user's manual. So, this device is classified as a **Mobile Device**.

4.7.5 Test Results

4.7.5.1 Antenna Gain

The transmitting antenna was integrated. The directional antenna gain was +7.56 dBi or 5.70 (numeric).

4.7.5.2 Output Power into Antenna & RF Exposure value at distance 20cm:

Calculations for this report are based on highest power measurement.

Limit for MPE (from FCC part 1.1310 table1) is 1.0 mW/cm^2

The highest measured total power is +16.75 dBm or 47.4mW

Using the Friss transmission formula, the EIRP is Pout*G, and R is 20cm.

Pd = (48*5.7) / (1600π) = 0.0544 mW/cm2, which is 0.945mW/cm2 below to the limit.

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

4.7.6 Sample Calculation

The Friss transmission formula: $Pd = (Pout*G) / (4*\pi*R^2)$

Where;

Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
$\pi \approx 3.1416$
R = distance between observation point and center of the radiator in cm

Ref. : David K. Cheng, *Field and Wave Electromagnetics*, Second Edition, Page 640, Eq. (11-133).

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yy	Next Cal mm/dd/yy
Bilog Antenna	Sunol Sciences	JB3	A102606	05/15/2014	05/15/2016
Horn Antenna	EMCO	3115	9211-3969	03/18/2013	03/18/2015
Antenna (18-26GHz)	CMT	RA42-K-F-4B-C	020131-004	07/24/2014	07/24/2015
Antenna (26-40 GHz)	CMT	RA28-K-F-4B-C	011469R-003	01//11/2015	01/11/2016
Preamplifier	Sonoma Instrument	310	213221	09/30/2014	09/30/2015
Bilog Antenna	Sunol Sciences	JB3	A020502	04/12/2013	04/12/2015
Preamplifier	Milteq	TIA-30-HG-	1842452	01/13/2015	01/13/2016
Spectrum Analyzer	Rhode Schwarz	ESIB	832427/002	01/08/2015	01/08/2016
Amplifier	Rohde & Schwarz	TS-PR26	100011	07/24/2014	07/24/2015
Amplifier	Rohde & Schwarz	TS-PR40	100012	01//11/2015	01/11/2016
Signal Generator	Anritsu	MG3694A	42803	01/13/2015	01/13/2016
Notch Filter	Micro-Tronics	BRM50702	37	07/18/2014	07/18/2015
Notch Filter	Micro-Tronics	BRC50703	11	07/18/2014	07/18/2015
Notch Filter	Micro-Tronics	BRC50704	8	07/18/2014	07/18/2015
Notch Filter	Micro-Tronics	BRC50705	9	07/18/2014	07/18/2015
High Pass Filter (8.5 GHz)	Micro-Tronics	HPM50107	4	01/16/2015	01/16/2016
Power Meter	Agilent	E4418B	MY45103902	01/09/2015	01/09/2016
Power Sensor	Hewlett Packard	8482A	55-5131	01/09/2015	01/09/2016
Thermo Chamber	Espec	BTZ-133	0613436	03/11/2014	03/11/2015
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/08/2015	01/08/2016

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 7: Customer Information

Company Name	Pace Americas
Address	310 Providence Mine Road, Ste. 200
City, State, Zip	Nevada City, CA 95959
Country	USA
Phone	(530) 274 5440
Fax	(530) 273 6340

Table 8: Technical Contact Information

Name	Mark Rieger
E-mail	Mark.Rieger@pace.com
Phone	(530) 274 5440
Fax	(530) 273 6340

6.3 Equipment Under Test (EUT)

Table 9: EUT Specifications

EUT Specifications	
Dimensions	87x42x20cm
Module AC Adapter for the Host (Pace)	N/A (DC power supplied by host)
Environment	Indoor and Outdoor
Operating Temperature Range:	0 to 40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Hardware Version	PD12-2230A1C
Part Number	E4282C20400
RF Software Version	Version 1.43.4.5 (IPW9001)
802.11-radio modules	
Operating Mode	802.11AC, HT20, HT40 and HT80
Transmitter Frequency Band	5.150 GHz – 5.250GHz, U-NII-1band 5.250 GHz – 5.350 GHz, U-NII-2A band 5.470 GHz – 5.725 GHz, U-NII-2C band 5.725 GHz – 5.850 GHz, U-NII-3 band
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	Qty 2 – Proprietary, stamped metal, vertically PCB mounted 5GHz antennas
Antenna Gain	. ~ 3.7 to 5.5 dBi
Modulation Type	☐ AM ☐ FM ☐ DSSS ☒ OFDM ☐ Other describe: 16QAM and 64 QAM
Data Rate	802.11n/ac HT20/VHT20: 2 Spatial Streams: 13, 26, 39, 52, 78, 104, 117, 130 /156 Mbps (LGI) 802.11n/ac HT40/VHT40: 2 Spatial Streams: 27, 54, 81, 108, 162, 216, 243, 270 / 324, 370 Mbps (LGI) 802.11ac VHT 80: 2 Spatial Streams: 58.5, 117, 175.5, 234, 351, 468, 526.5, 585, 702, 780 Mbps (LGI)

EUT Specifications	
TX/RX Chain (s)	MIMO (2x2)
Directional Gain Type	☒ Correlated ☒ Beam-Forming ☐ Other describe:
Type of Equipment	☒ Table Top ☒ Wall-mount ☐ Floor standing cabinet ☐ Other
Note: 1. All 2 chains will be on / transmitted at all time.	

Table 10: EUT Channel Power Specifications

No.	Frequency (MHz)	Target Power Value dBm				
		802.11a	802.11n HT20/VHT20	802.11n HT40/VHT40	802.11AC VHT80	
36	5180	14	14			
38	5190			12		
40	5200	14	14			
42	5210				12	
44	5220	14	14			
46	5230			14		
48	5240	14	14			
52	5260	14	14			
54	5270			14		
56	5280	14	14			
58	5290				12	
60	5300	14	14			
62	5310			12		
64	5320	14	14			
100	5500	14	14			
102	5510			12		
104	5520	14	14			
106	5530				12	
108	5540	14	14			
110	5550			14		
112	5560	14	14			
116	5580	14	14			
118	5590			14		
120	5600	14	14			
122	5610				14	
124	5620	14	14			

126	5630			14		
128	5640	14	14			
132	5660	14	14			
134	5670			14		
136	5680	14	14			
138	5690				14	
140	5700	14	14			
142	5710			14		
149	5745	14	14			
151	5755			14		
153	5765	14	14			
155	5775				14	
157	5785	14	14			
159	5795	14	14	14		
161	5805	14	14			
165	5825	14	14			

Note: 1. The center operating frequency is shifted upward by 10 MHz for HT40.
2. The adjusted power target values are updated at the evaluated frequencies.

Table 11: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
RJ45	CAT-5 Ethernet	☐ No	☒ Metric: 10 m	☒ M

Table 12: Supported Equipment

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Dell	PP23LB	9271001233	Setup EUT operating channel
Note: None.				

Table 13: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
AW500	7 and 28	Integrated Antenna	TX Emission, AC Conducted Emission
		Direct Connection	Peak Transmit Power, Peak Power Spectral Density, Peak Excursion Ratio Occupied Bandwidth Frequency Stability Voltage Variation

Table 14: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
AW500	Integrated	Transmit	EUT laid flat.	EUT stood upright	EUT onside
Note: Pre-scans were performed in 2 supporting axis, and Y-axis was worst.					

6.4 Test Specifications

Testing requirements

Table 15: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.407: 2013	All
RSS 210 Issue 8, 2010	All

END OF REPORT