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Emissions
Test Report

EUT Name: Wireless Access Point

Model No.: APIN0324 and APIN0325

CFR 47 Part 15.407 2014

Prepared for:

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Revisions

Revision No.	Date MM/DD/YYYY	Reason for Change	Author
0	06/10/2015	Original Document	N/A
1	07/14/2015	Revised to add test data for additional Antenna	SK

Note: Latest revision report will replace all previous reports.

Statement of Compliance

Manufacturer:	Aruba Networks 1344 Crossman Ave. Sunnyvale, CA 94089 (408) 990- 2557
Requester / Applicant:	Robert Hastings
Name of Equipment:	Wireless Access Point
Model No.	APIN0324 and APIN0325
Type of Equipment:	Intentional Radiator
Application of Regulations:	CFR 47 Part 15.407 2014
Test Dates:	22 Mar 2015 to 18 May 2015

Guidance Documents:

Emissions: ANSI C63.10-2009; 789033 D02 General UNII Test Procedures New Rules v01

Test Methods:

Emissions: ANSI C63.10-2009; 789033 D02 General UNII Test Procedures New Rules v01

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

Test Engineer Date June 10, 2015

A2LA Signatory Date June 30, 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 based on the results of testing performed on 22 Mar 2015 to 18 May 2015 on the Wireless Access Point Model APIN0324 and APIN0325 manufactured by Aruba Networks 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 (Measured)	Result
Spurious Emission in Transmitted Mode	CFR47 15.209, CFR47 15.407 (b) RSS 247 Sect. 6.2.1(2)	Limit: Class B; Measured 51.24dBuV/m at 15605MHz	**Complied**
Restricted Bands of Operation	CFR47 15.205, RSS -GEN Sect.8.10	Class B, see plots	**Complied**
AC Power Conducted Emission	CFR47 15.207, RSS-GEN Sect.8.8	Class B, see plots	**Complied**
Occupied Bandwidth (MHz)	CFR47 15.407 (a), RSS GEN Sect.6.6	11a: 19.47(26dB) 16.34(99%) HT20: 19.72(26dB) 17.05(99%) HT40: 36.12(26dB) 36.06(99%) VHT80: 83.08(26dB) 75.47(99%)	**Complied**
Maximum Output Power (dBm)	CFR47 15.407 (a), RSS 247 Sect. 6.1.1 (1)	Limit : 1 Watt Measured: 24.76 dBm (Max combined power 4x4)	**Complied**
Peak Power Spectral Density (dBm)	CFR47 15.407 (a), RSS 247 Sect. 6.2.1 (1)	Limit 17dBm Measured 10.67dBm	**Complied**
Conducted Emission – Antenna Port	CFR47 15.407 (b), RSS 247 Sect.6.2.2	30 MHz -40 GHz < 27 dBm/MHz see plots	**Complied**
Frequency Stability	CFR47 15.407 (g), RSS GEN Sect. 8.11	Limit ±20 ppm Measured: 10.89ppm	**Complied**
RF Exposure	CFR47 15.247 (i), 2.1091 RSS 102	General Population	**Complied**

Note: This test report covers 5150 MHz to 5250MHz 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 Aruba AP-320 Series wireless access points support IEEE 802.11ac standard for high-performance WLAN, and is equipped with two dual-band radios, which can provide access and monitor the network simultaneously. Multi-user Multiple-in, Multiple-output (MU-MIMO) technology allows this access point to deliver high-performance 802.11n 2.4 GHz and 802.11ac 5 GHz functionality, while also supporting 802.11a/b/g/n/ac wireless services.

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.

3.4.1 Results

The Wireless Access Point Model APIN0325 has 4 internal fixed antennas. Model: APIN0324 has four ports with reverse polarity SMA connector. List of antennas that can be used with this device is in Section 6.3.

4 Emissions

Testing was performed in accordance with CFR 47 Part 15.407: 2014 . 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):2014

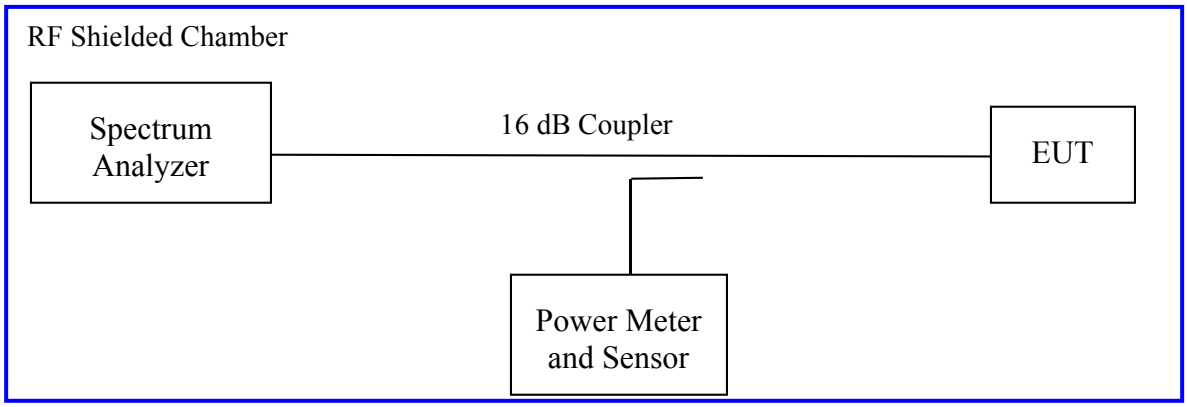
The maximum transmitted powers are

Band 5150-5250 MHz: 1 W

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; 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 & External				**Power Setting:** See test plan				
Min -Max. Directional Gain: +2dBi & +12 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]**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
5180	27.50	18.01	17.73	16.70	18.01	0.04	23.71	-3.79
5200	27.50	18.40	18.61	18.63	19.13	0.04	24.76	-2.74
5240	27.50	17.17	17.34	16.96	17.44	0.04	23.30	-4.20

Note: 1.The highest output power was observed at 802.11a mode 6.0mbps, 4 Data Streams.

2. All chains will be on at all time. RF output powers were summed per KDB 662911.

3. The highest gain for APIN0325 unit with internal Antennas is 5.5dBi.

4. The highest gain for APIN0324 with External Antennas is 8.5dBi.

5. No beam forming is considered for this mode As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi. The limit would be 27.5dBm. Lower is shown in the above table.

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 & External					**Power Setting:** See test plan			
Min-Max. Directional Gain: +2dBi & +12 dBi					**Signal State:** Modulated at 100%.			
Ambient Temp.: 23 °C					**Relative Humidity:**33%			
802.11n (HT20/ VHT20) Mode, 4x4;								
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
5180	24.00	8.41	8.12	9.63	9.48	0.34	15.32	-8.68
5200	24.00	9.27	9.53	9.50	9.53	0.34	15.82	-8.18
5240	24.00	9.58	9.35	8.73	6.80	0.34	15.10	-8.90

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 can be turned ON or OFF. RF output powers were summed per KDB 662911.

3. The total directional gain for APIN0325 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi

As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi. The limit would be 27.0dBm. Beam forming turned off the limit will be 30dBm.

5. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi. The Limit will be 24dBm with max antenna gain and beamforming.

6. **The power limit above is for Highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.3 of this report.

Note: Highlighted plots are available in this report

802.11n (HT40/VHT40) Mode, 4x4								
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
5190	24.00	11.51	11.87	11.79	10.10	0.46	17.86	-6.14
5230	24.00	11.38	11.92	11.52	11.99	0.46	18.19	-5.81

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. RF output powers were summed per KDB 662911.

3. The total directional gain for APIN0325 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi

As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi. The limit would be 27.0dBm for APIN0325 unit. the limit will be 30dBm with Beam forming turned off.

4. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi. The Limit will be 24dBm with max antenna gain and beamforming.

6. **The power limit above is for highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.4 of this report.

Note: Highlighted plots are available in this report

802.11AC (VHT80) Mode, 2x2								
Operating Channel	**Limit [dBm]**	**Ch0 [dBm]**	**Ch1 [dBm]**	**Ch2 [dBm]**	**Ch3 [dBm]**	**CF [dB]**	**Total Power [dBm]**	**Margin [dB]**
5210	24.00	9.02	9.48	10.53	10.91	1.22	17.29	-6.71

Note: 1.The highest output power was observed at HT80 Mbps, 4 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.
2. All chains will be on at all time. RF output powers were summed per KDB 662911.
3. The total directional gain for APIN03254 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi
As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi. The limit would be 27.0dBm. Beam forming turned off the limit will be 30dBm
4. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi. The Limit will be 24dBm with max antenna gain and beamforming.

6. **The power limit above is for Highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.3 of this report.

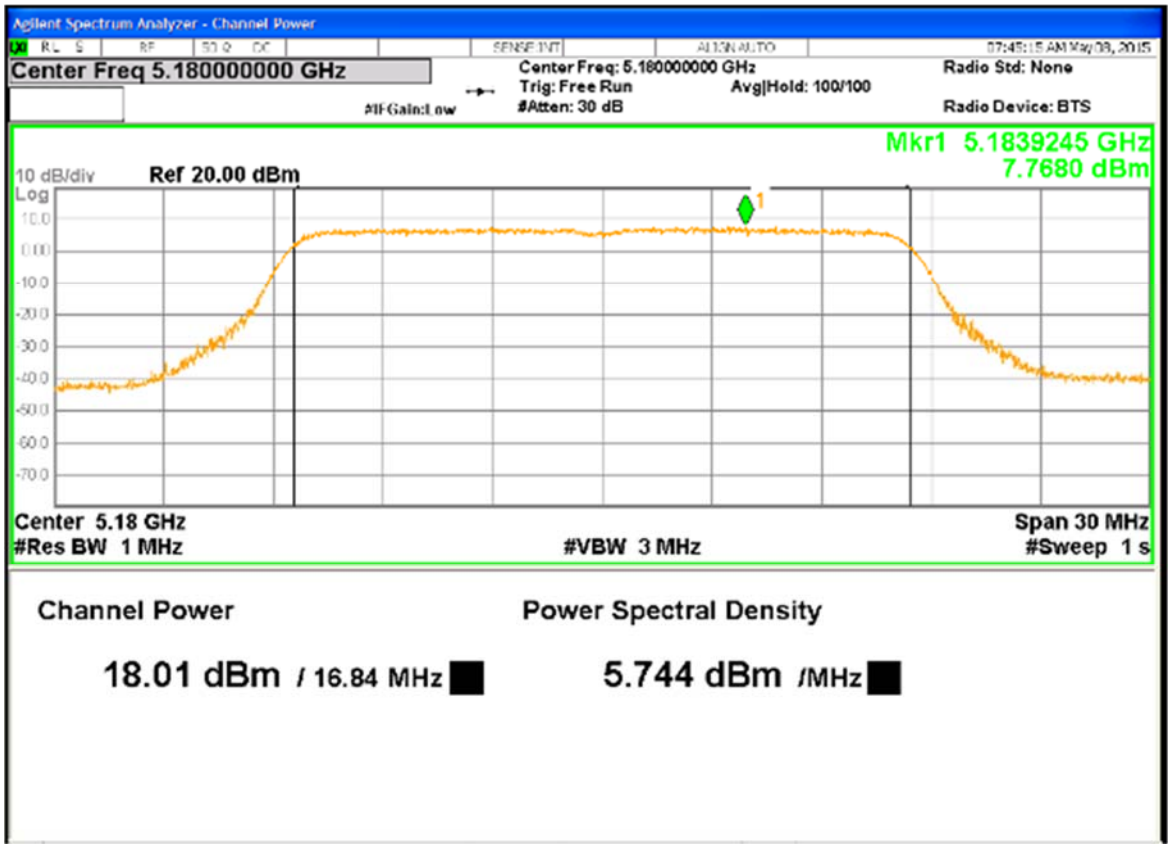


Figure 1: Maximum Transmitted Power, 5180 MHz at 11a, Chain 0

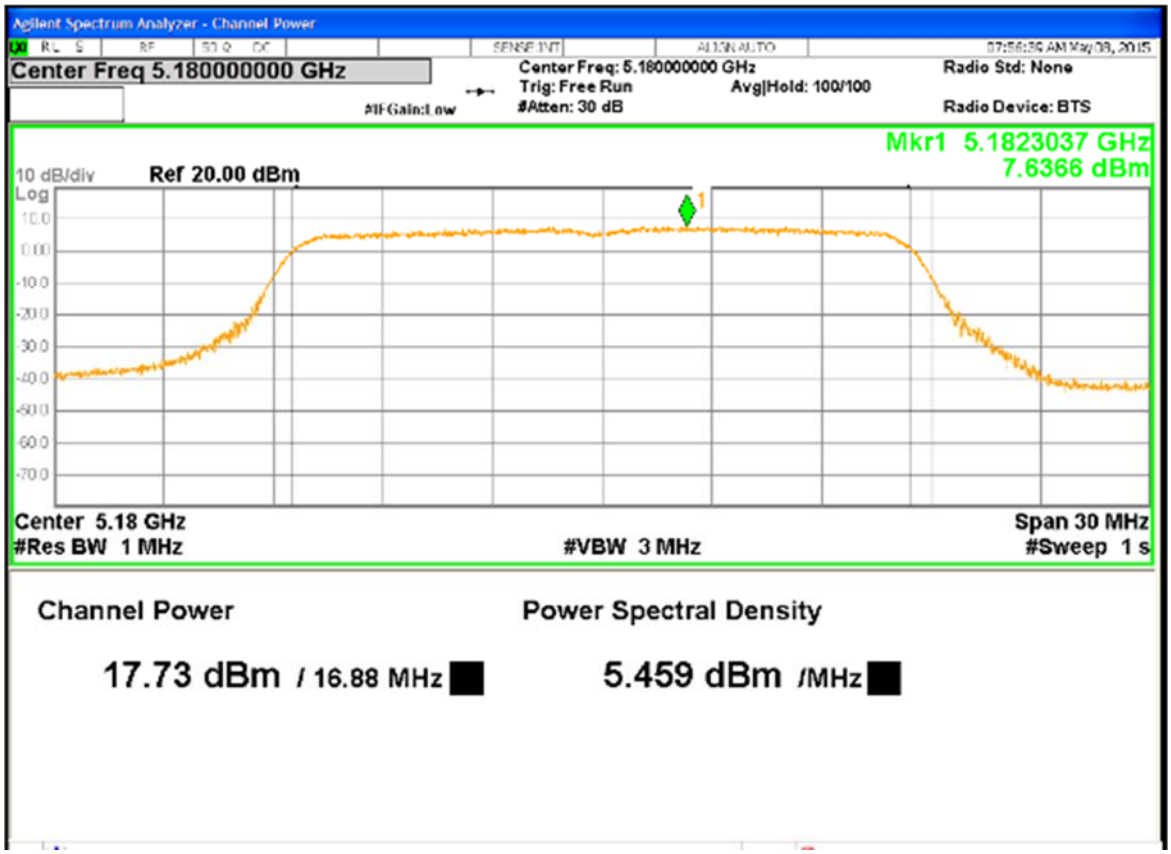


Figure 2: Maximum Transmitted Power, 5180 MHz at 11a, Chain 1

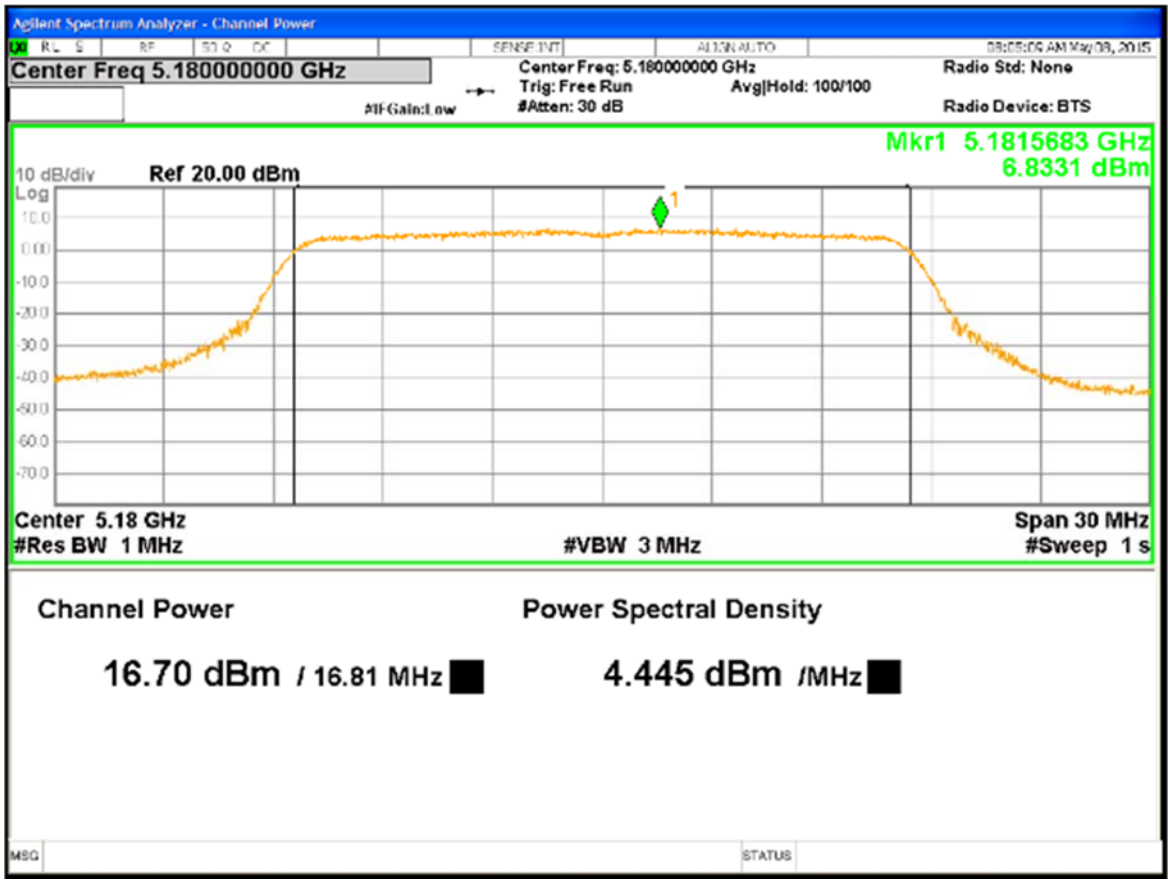


Figure 3: Maximum Transmitted Power, 5180MHz at 11a, Chain 2

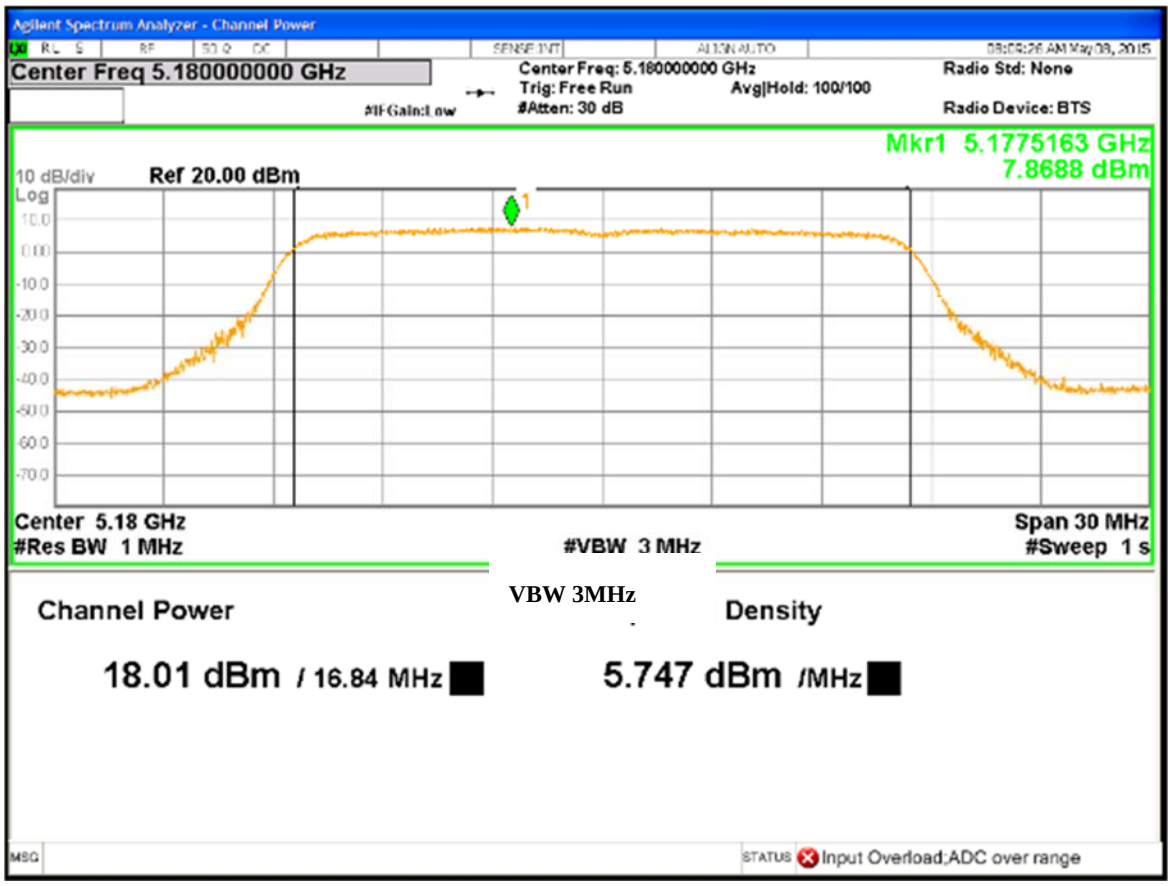


Figure 4: Maximum Transmitted Power, 5180MHz at 11a, Chain 3

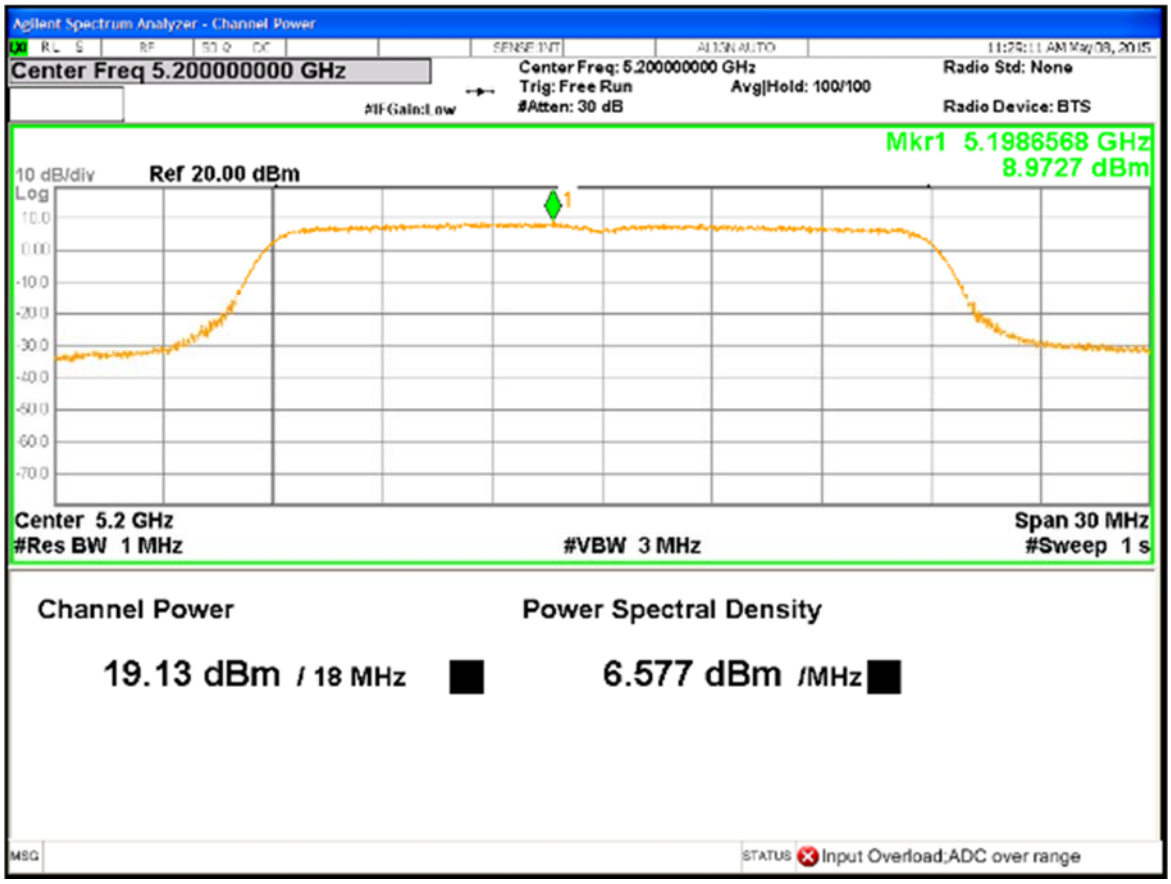


Figure 5: Maximum Transmitted Power, 5200MHz at 11a, Chain 3

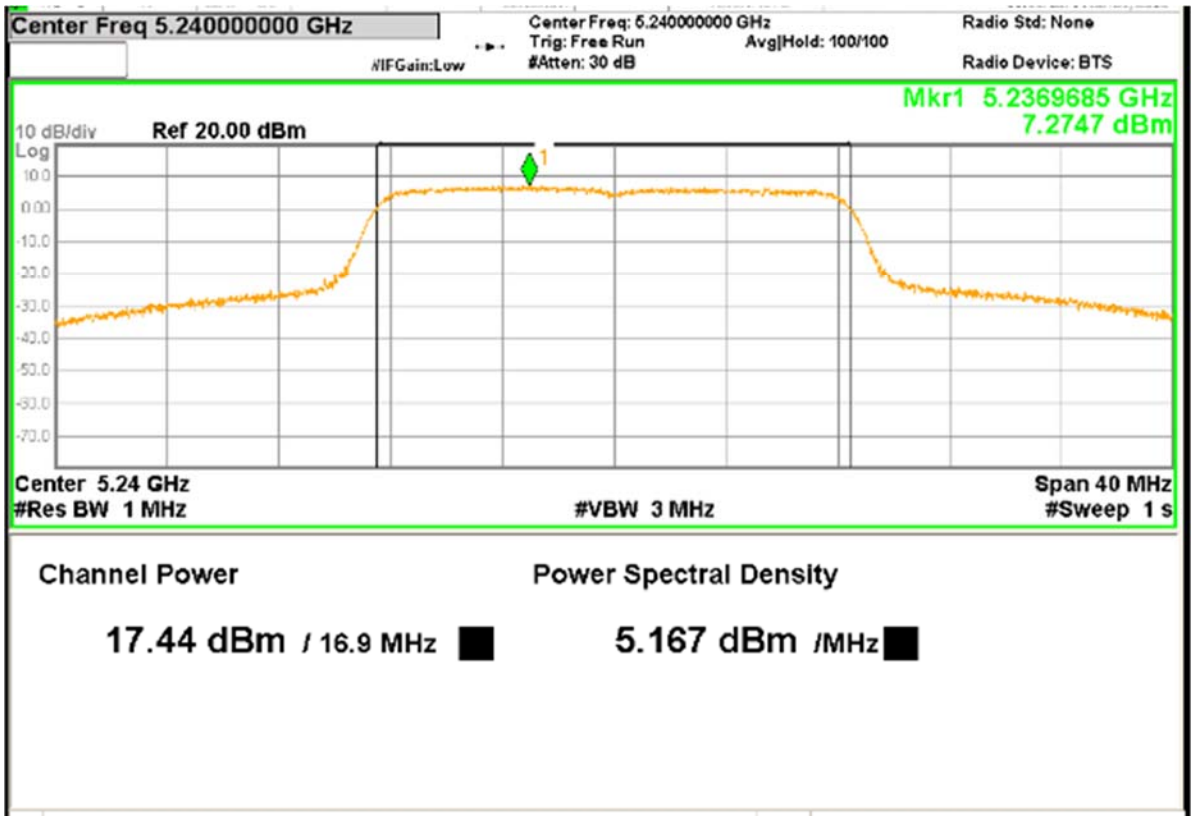


Figure 6: Maximum Transmitted Power, 5240MHz at 11a, Chain 3

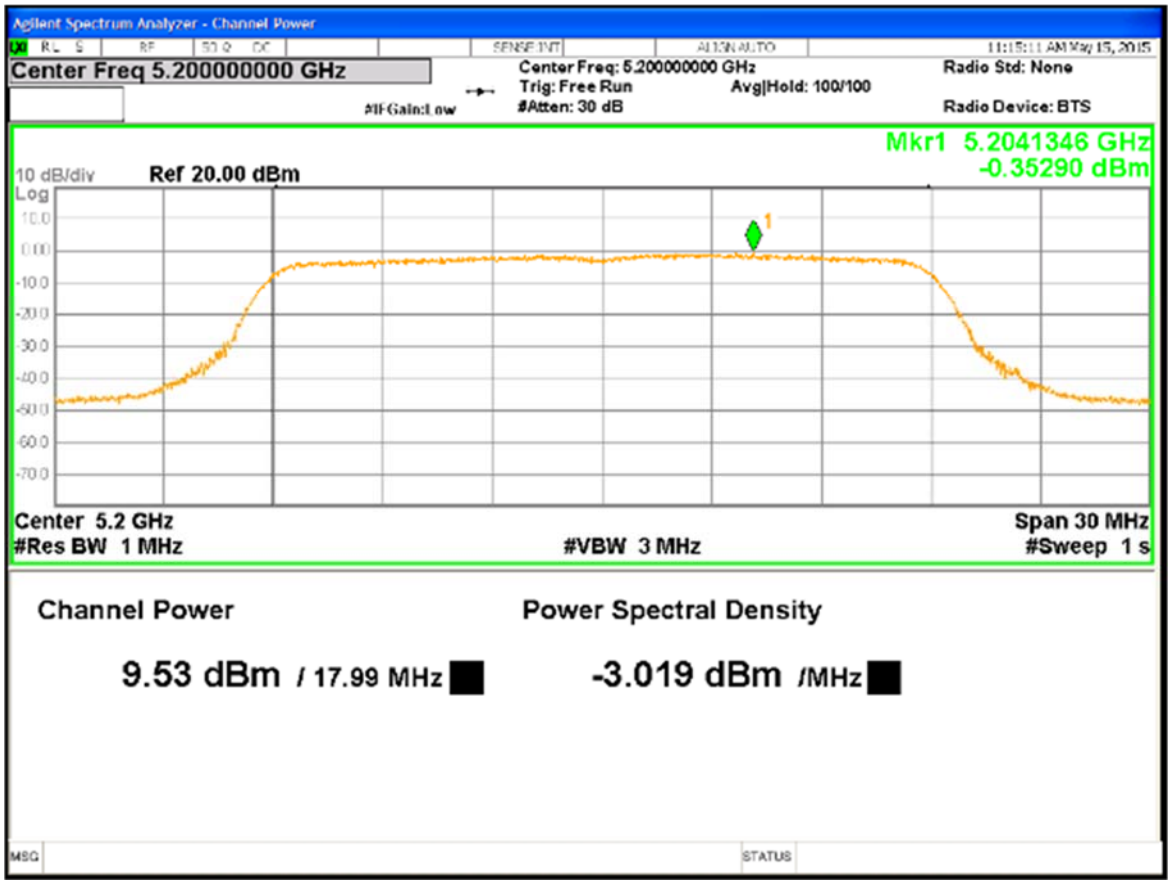


Figure 7: Maximum Transmitted Power, 5200MHz at 11a, Chain 1

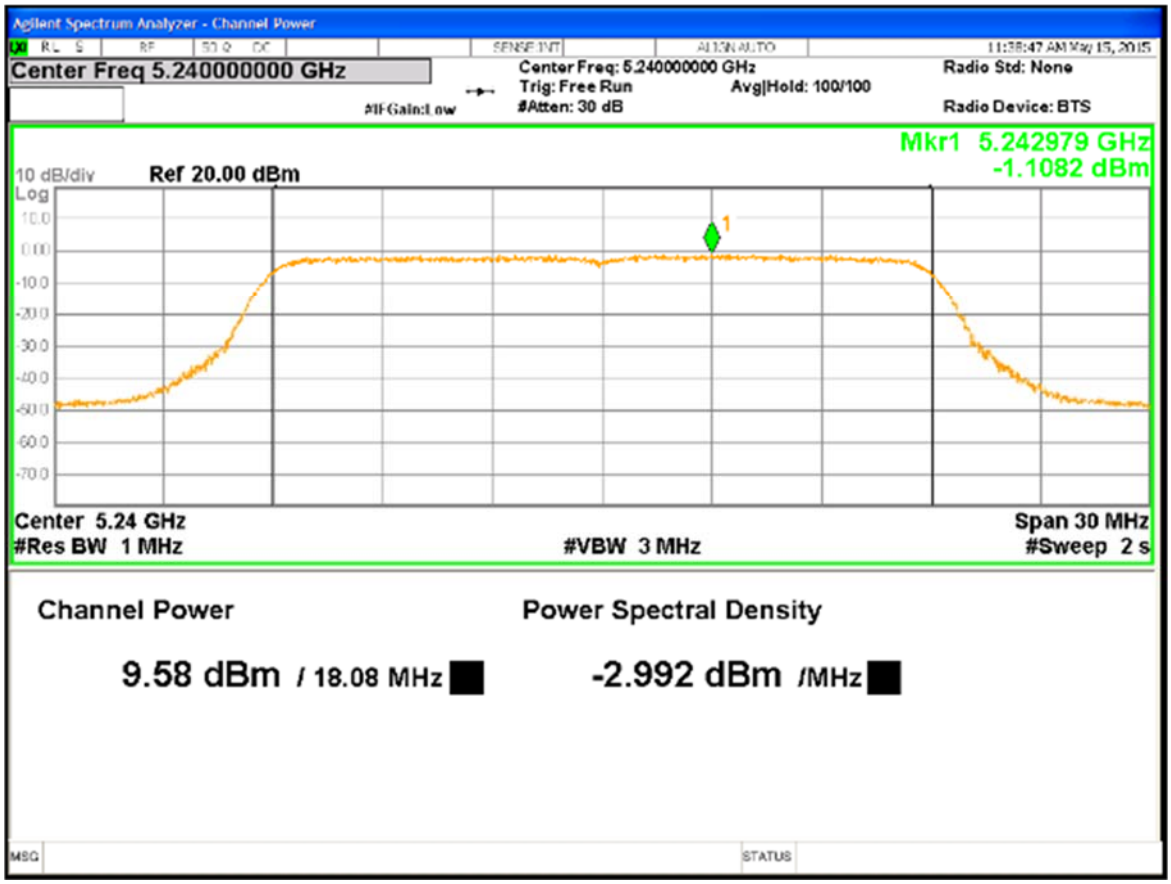


Figure 8: Maximum Transmitted Power, 5240MHz at HT20a, Chain 0

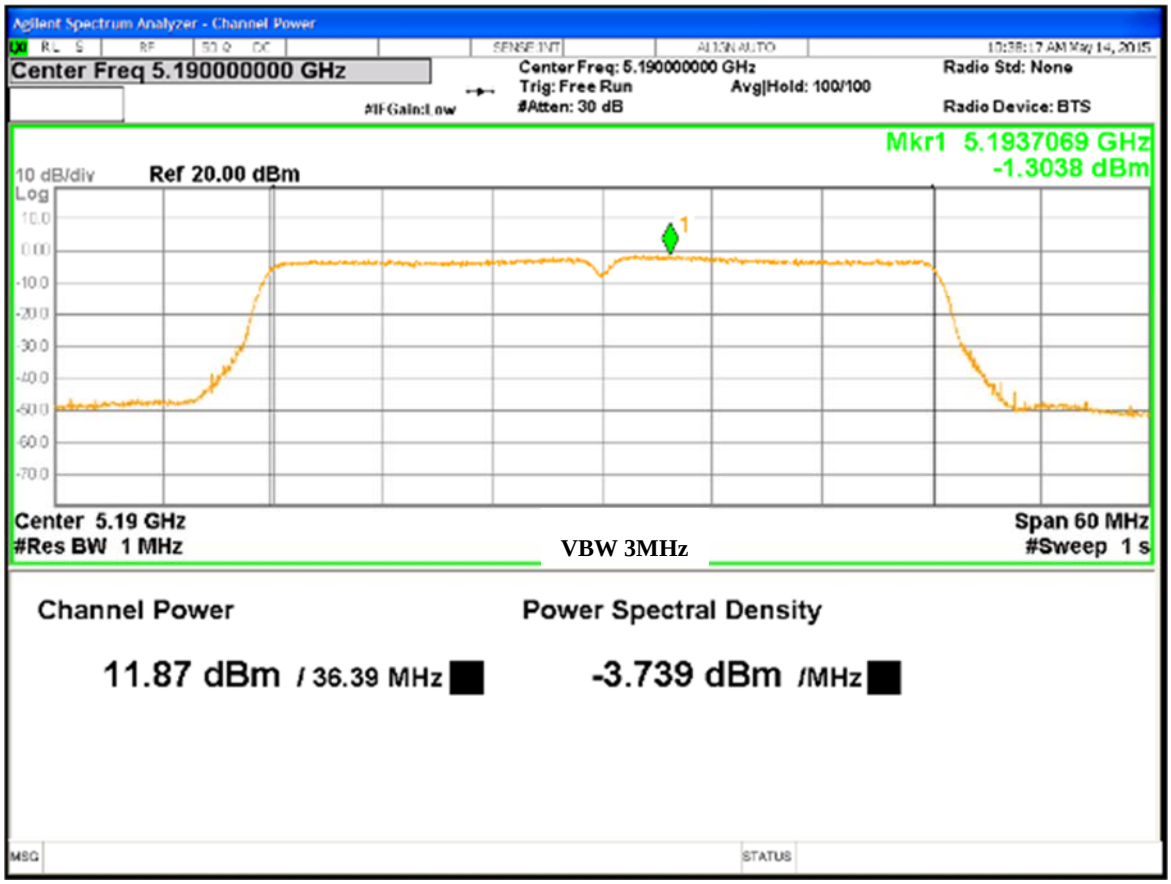


Figure 9: Maximum Transmitted Power, 5190MHz at HT40, Chain 1

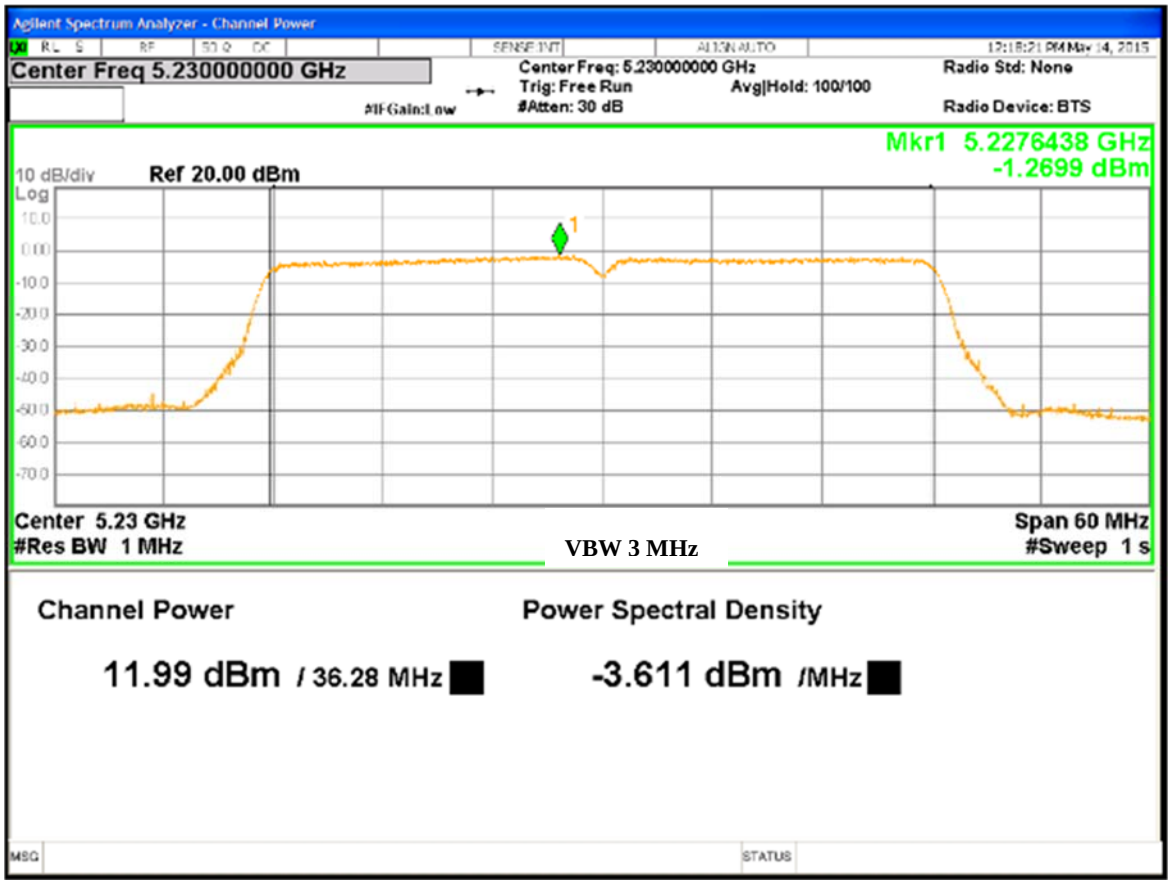


Figure 10: Maximum Transmitted Power, 5320MHz at 11a, Chain 1

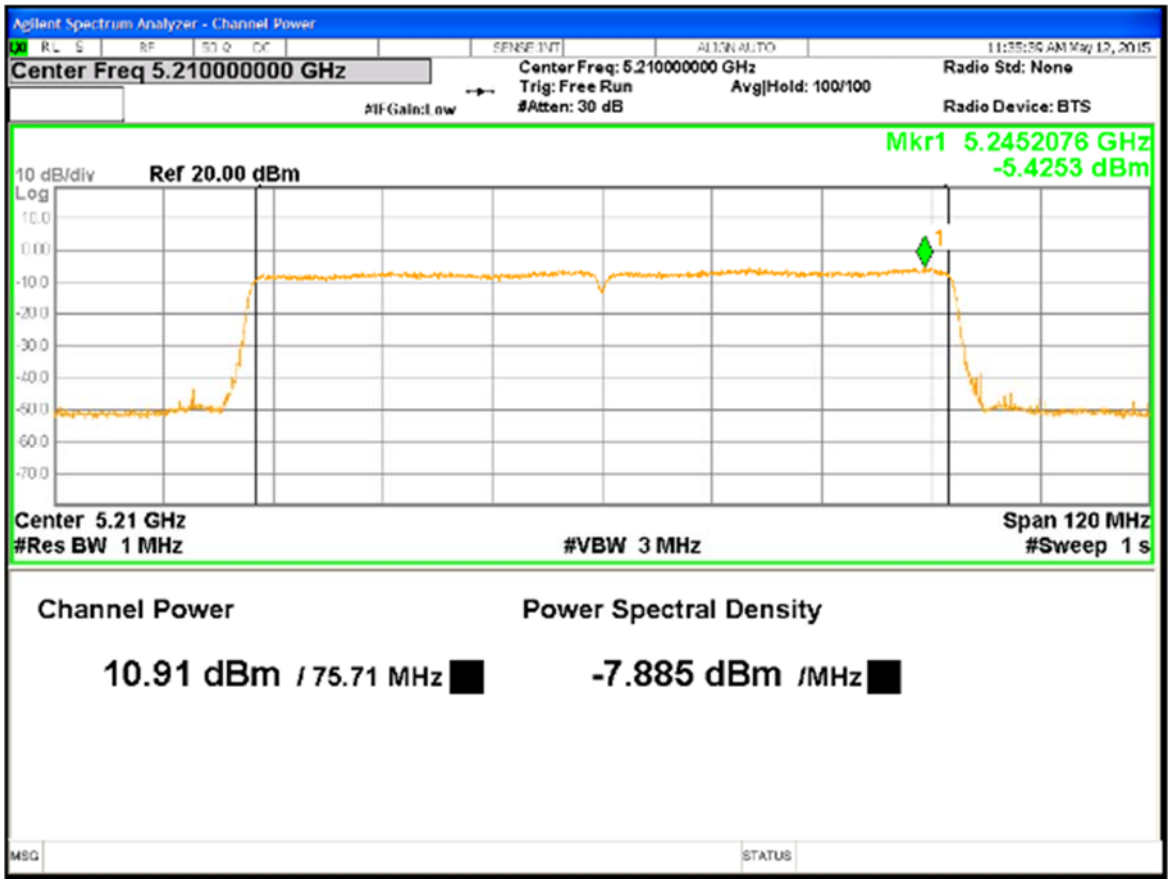


Figure 11: Maximum Transmitted Power, 5210 MHz at HT80, Chain 3

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.

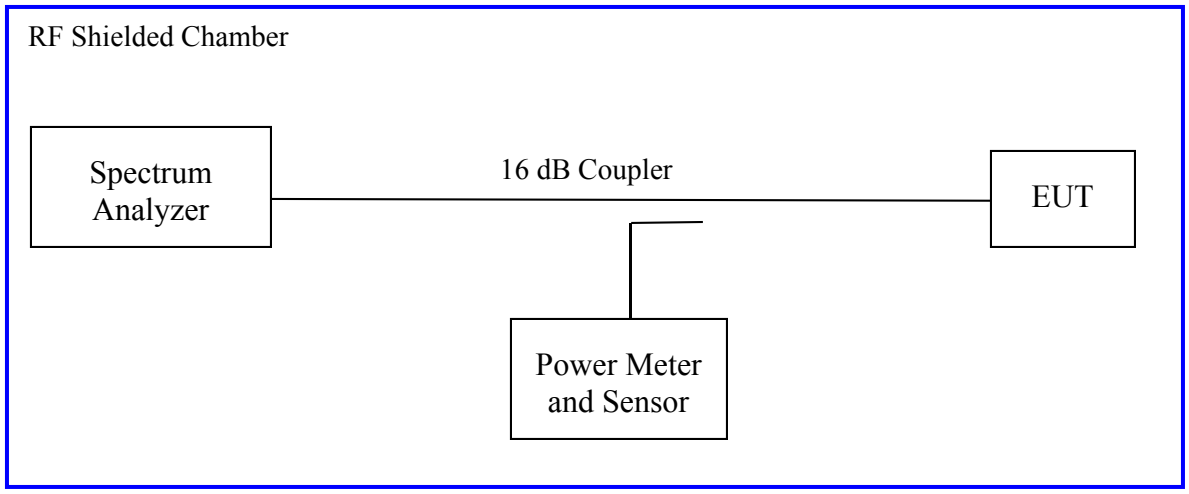
There is no restriction limits for the bandwidth. The 26 dB bandwidth was used to determine the limit for maximum conducted output power per CFR47 Part 15.407(a).

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) 2014. 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 & External				**Power Setting:** See Test Plan				
Min-Max. Directional Gain: +2dBi & +12 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**	**Ch2**	**Ch3**	**Ch0**	**Ch1**	**Ch2**	**Ch3**
5180	20.13	19.47	20.20	22.11	16.45	16.37	16.36	16.46
5200	20.55	19.80	19.80	19.08	16.46	16.34	16.37	16.41
5240	20.48	19.97	19.96	20.97	16.48	16.36	16.37	16.44
Bandwidth (MHz) for 802.11n HT20/ VHT20								
Freq. (MHz)	**26dB Bandwidth (MHz)**				**99% Bandwidth (MHz)**			
	Ch0	**Ch1**	**Ch2**	**Ch3**	**Ch0**	**Ch1**	**Ch2**	**Ch3**
5180	21.61	21.65	20.07	20.67	17.66	17.65	17.05	17.59
5200	20.51	19.72	20.02	20.04	17.60	17.51	17.45	17.58
5240	20.54	20.42	20.03	19.98	17.61	17.61	17.52	17.58
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	Ch2	Ch3	Ch0	Ch1	Ch2	Ch3
5190	40.15	40.17	39.74	39.64	36.12	36.25	36.37	36.06
5230	39.96	40.36	39.80	39.45	36.18	36.33	36.34	35.96
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	Ch2	Ch3	Ch0	Ch1	Ch2	Ch3
5210	87.21	93.60	86.10	83.08	75.64	75.65	75.80	75.47
Note: The bandwidth was measured at 56.5Mbps for 802.11AC VHT80 mode.								

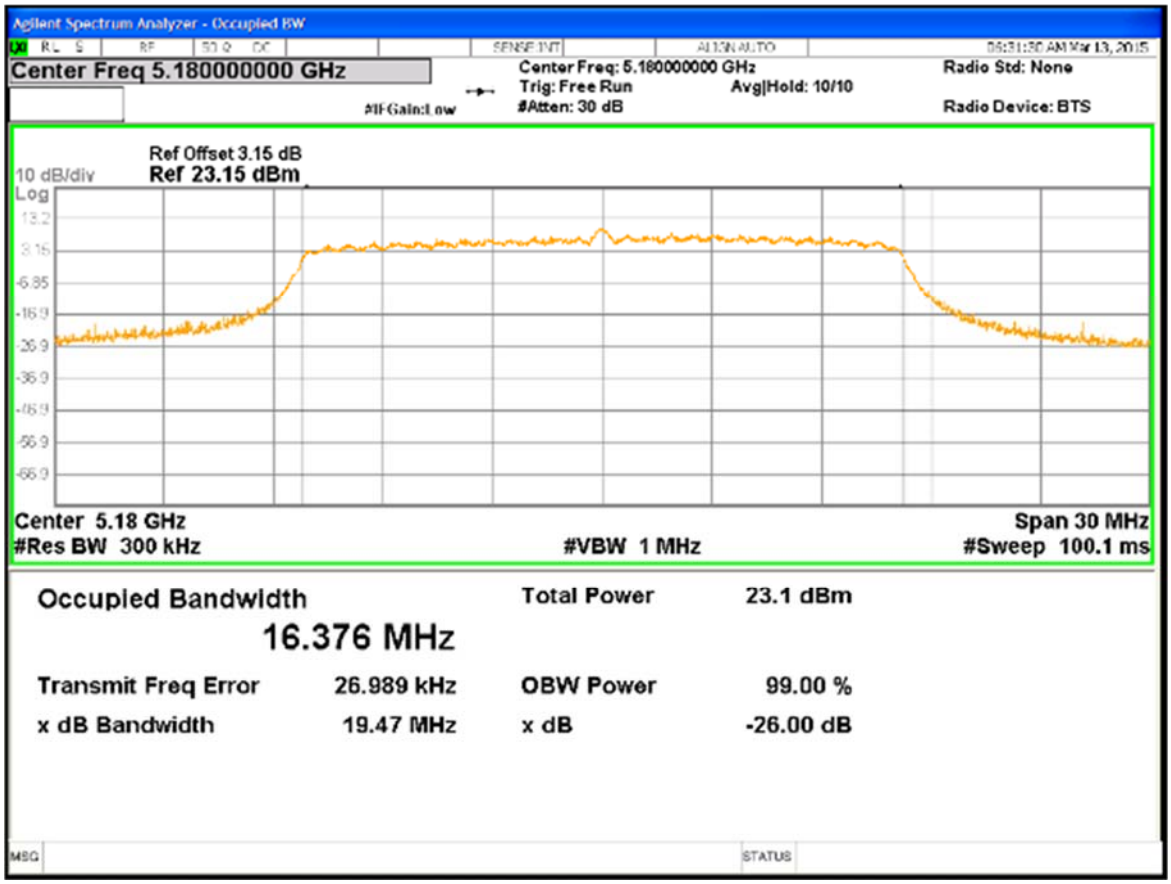


Figure 12: 26 dB and 99% Bandwidth at 5180 MHz, Chain 1

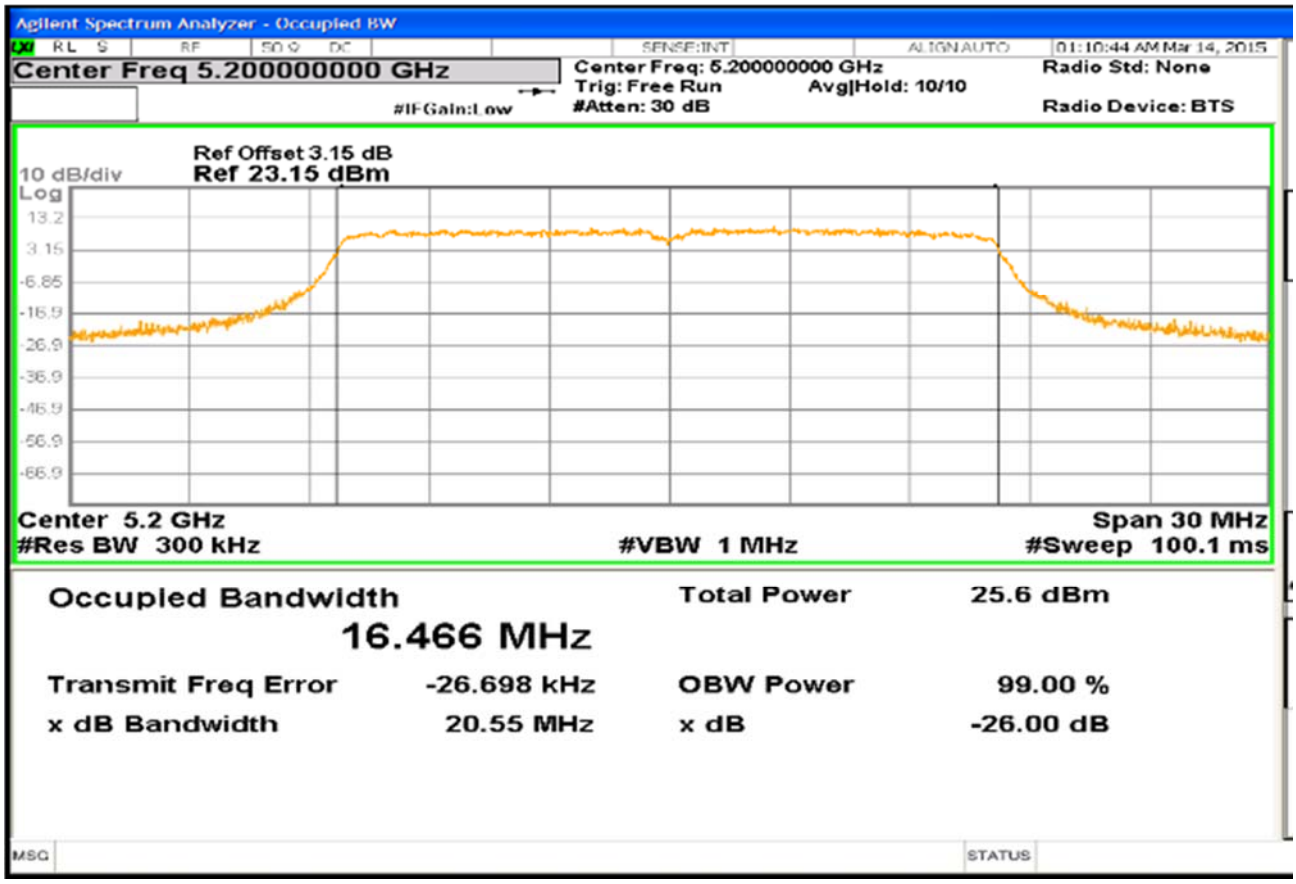


Figure 13: 26 dB and 99% Bandwidth at 5180 MHz, Chain 0, 11a mode

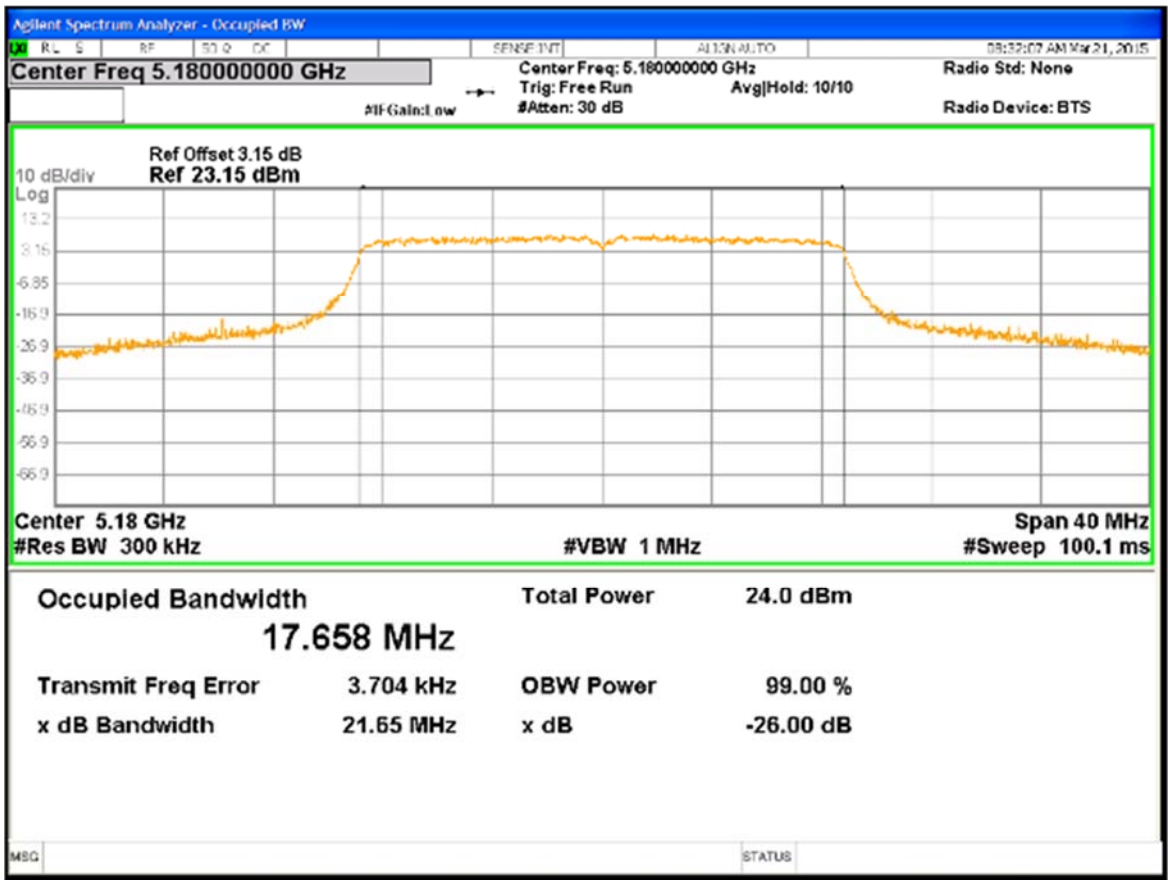


Figure 14: 26 dB and 99% Bandwidth at 5240 MHz, Chain 1 and HT20 mode at 6.5Mbps

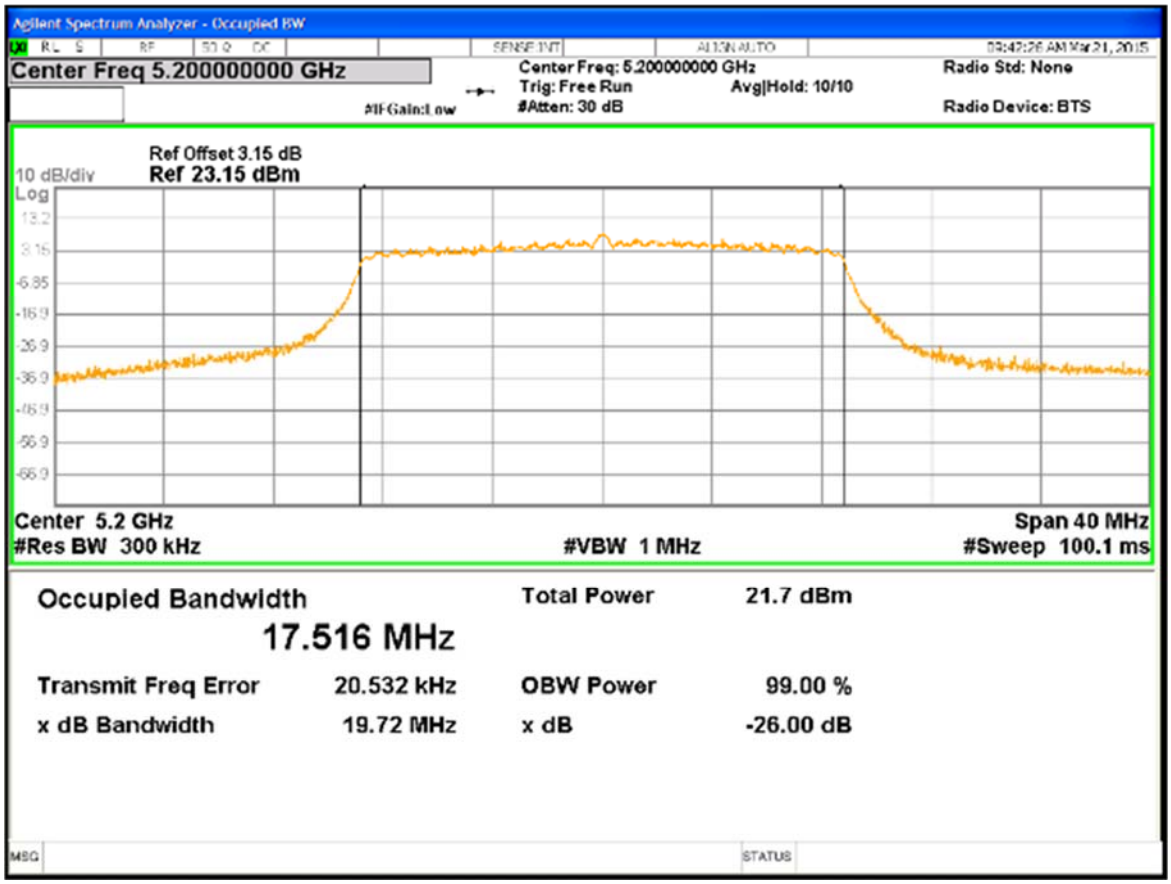


Figure 15: 26 dB and 99% Bandwidth at 5200 MHz, Chain 1 and HT mode at 6.5Mbps

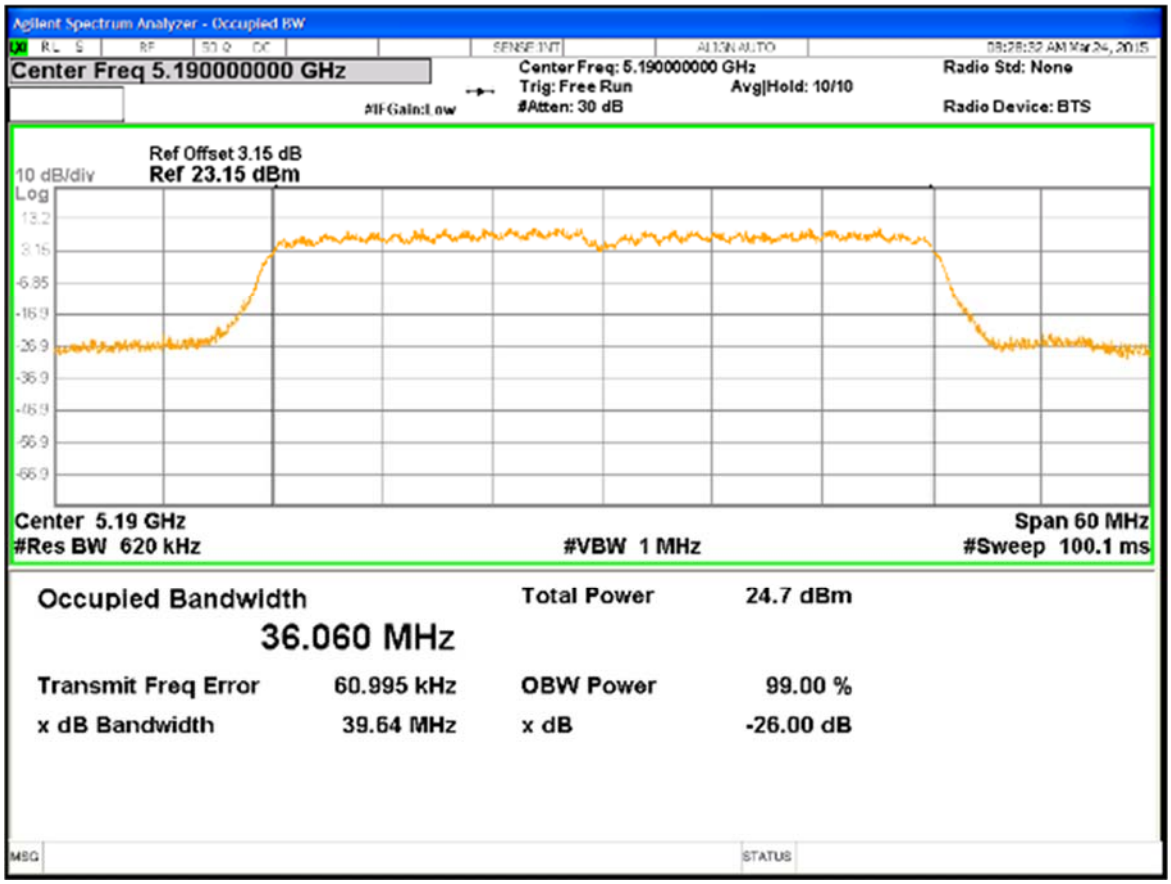


Figure 16: 26 dB and 99% Bandwidth at 5190 MHz, Chain 3 and HT40 Mode at 13.5Mbps

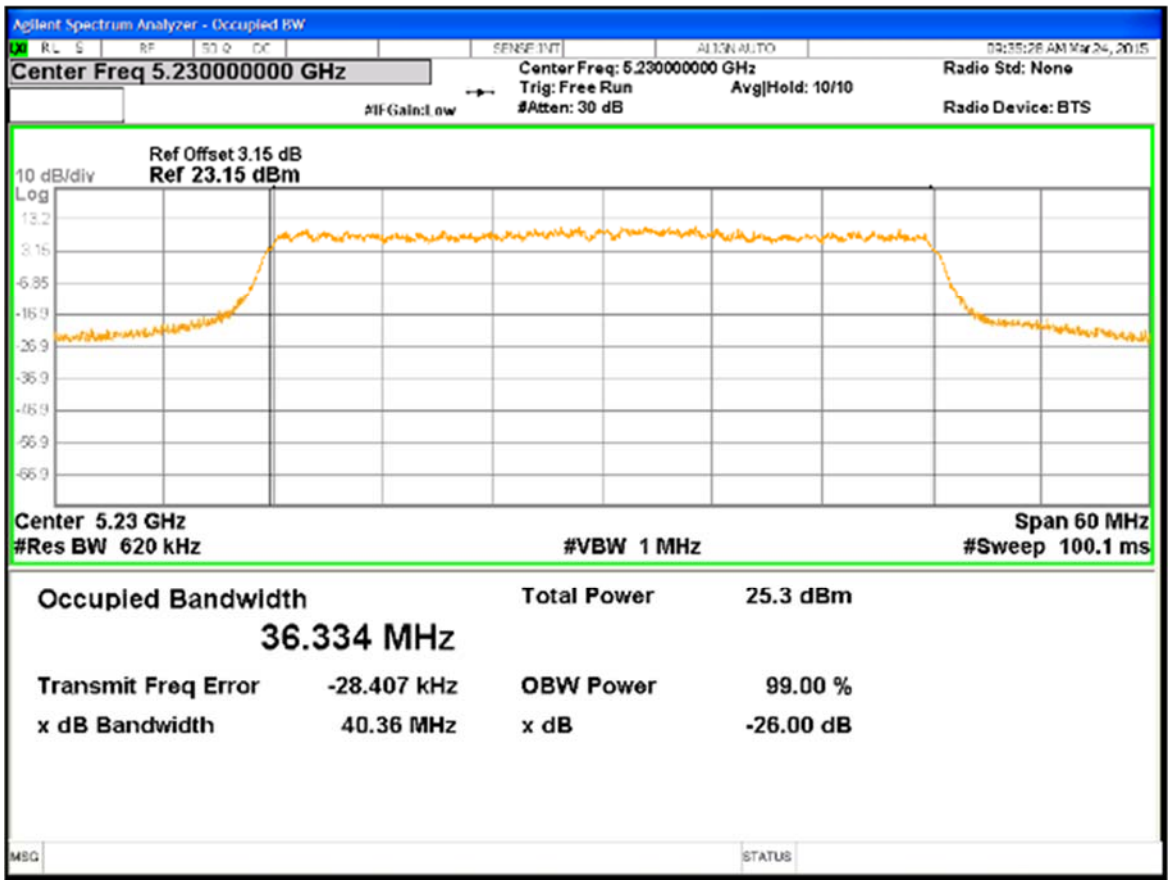


Figure 17: 26 dB and 99% Bandwidth at 5230 MHz, Chain 1 and HT40 mode at 13.5Mbps

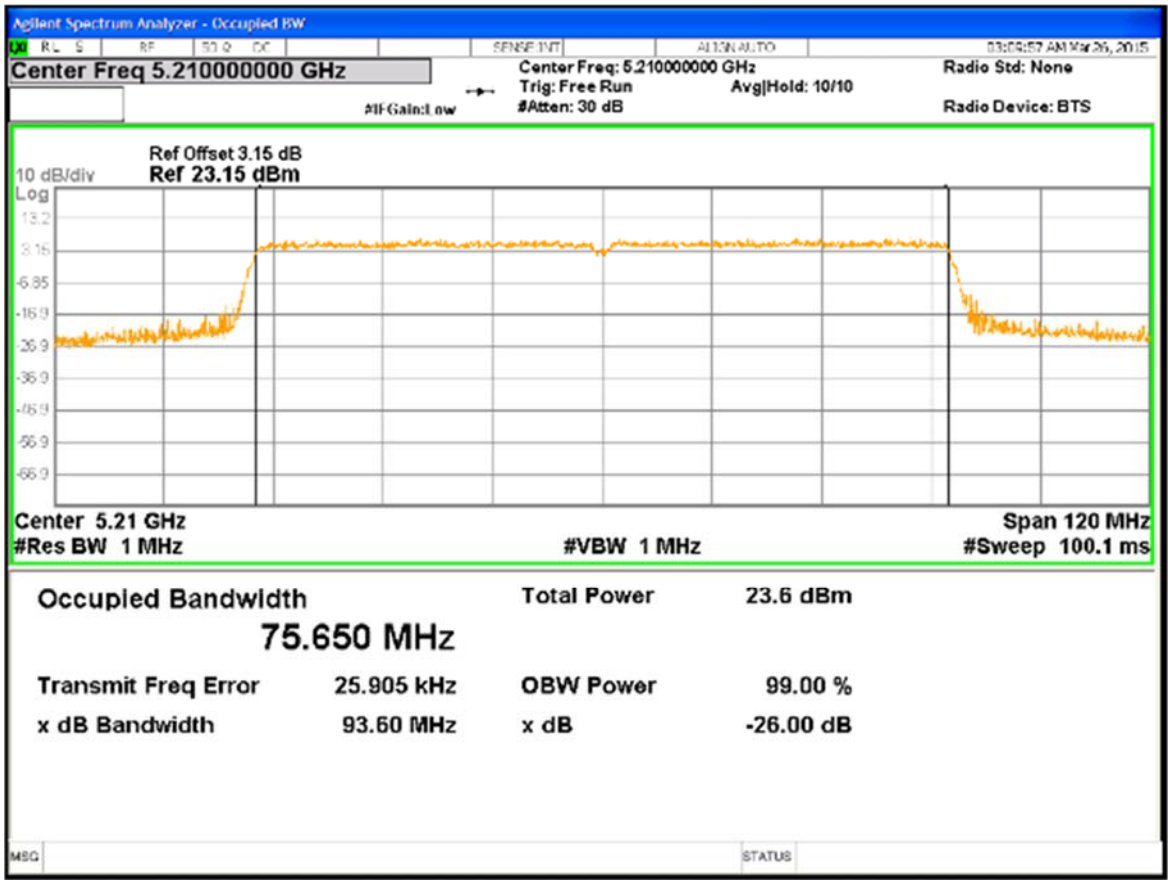


Figure 18: 26 dB and 99% Bandwidth at 5210 MHz, Chain 1 and VHT80 mode

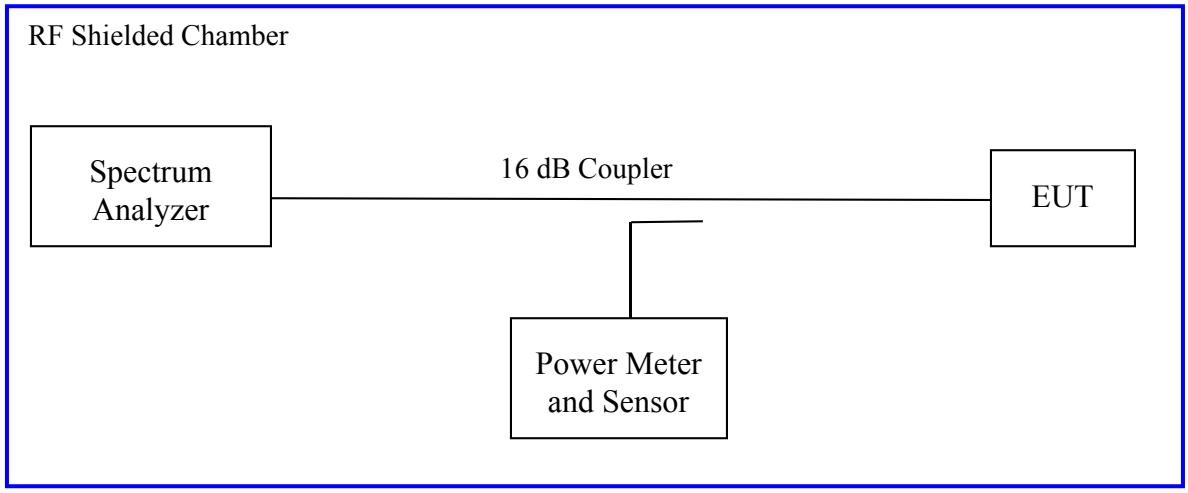
4.3 Peak Power Spectral Density

According to the CFR47 Part 15.407 (a), the spectral power density output of the antenna port shall be less than 17dBm 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), 3 channels in each operating frequency range of 5150 MHz to 5250MHz. 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 & External				**Power Setting:** See Test plan			
Min-Max. Directional Gain: +2dBi & 12 dBi				**Signal State:** Modulated at 100%.			
Ambient Temp.: 23° C				**Relative Humidity:**32%			
Peak Power Spectral Density							
802.11a Mode							
Freq. (MHz)	**CH0 [dBm]**	**CH1 [dBm]**	**CH2 [dBm]**	**CH3 [dBm]**	**Max PSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5180	8.115	7.633	5.148	6.123	8.115	15.50	-7.39
5200	7.719	6.929	5.809	10.53	10.53	15.50	-9.47
5240	6.832	7.412	6.934	7.424	7.424	15.50	-8.05

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. RF output powers were summed per KDB 662911.
3. The lowest antenna gain for APIN0325 with internal Antennas would be 5.5 dBi. The directional gain with Beam forming is 3.5dBi. Total directional gain will be 9 dBi.
4. For APIN0324 unit with External antennas minimum and maximum gains are 2dBi and 8.5dBi, and with Beam forming ON are 8.5dBi and 12dBi
5. NO beam forming is considered for this mode. List of antennas is given Section 6.3 of this report.
6. Highlighted 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	10.56	11.0	-0.44
5200	10.51	11.0	-0.49
5240	10.27	11.0	-0.73

Note: 1. The highest peak output power was observed at HT20 6.5Mbps per data stream.
2. All chains will be on at all time. RF output powers were summed per KDB 662911.
3. The total directional gain for APIN03254 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi
As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi.
4. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi.
5. **The Limit will be 11dBm with max antenna gain and beamforming**.
6. **The PSD limit above is for Highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.3 of this report.

Peak Power Spectral Density					
802.11 HT40/VHT40 Mode					
Freq. (MHz)	**Total PSD [dBm]**	**CF [dB]**	**Total PSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5190	9.87	0.46	10.33	11	-0.67
5230	10.21	0.46	10.67	11	-0.33

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. RF output powers were summed per KDB 662911.
3. The total directional gain for APIN03254 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi
As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi.
4. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi.
5. **The Limit will be 11dBm with max antenna gain and beamforming**. Total PSD is the combined worst case PSD.
6. **The PSD limit above is for Highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.4 of this report.

802.11n AC (VHT80) Mode					
Freq. (MHz)	**Total PSD [dBm]**	**CF [dB]**	**Max. PPSD [dBm]**	**Limit [dBm]**	**Margin [dB]**
5210	5.59	1.22	6.81	11	-4.19

Note: 1. The highest peak output power was observed at VHT80 58.5 Mbps per data stream.
2. All chains will be on at all time. RF output powers were summed per KDB 662911.
3. The total directional gain for APIN03254 Unit with internal Antennas would be 9.0dBi; Antenna gain: 5.5 dBi and directional gain 3.5dBi
As Per CFR47 Part 15.407 (a), the limit is reduced for every1 dB gain exceeding 6dBi.
4. For APIN0324 unit with External antennas minimum and maximum Antenna gains beam forming turned OFF are 2dBi and 8.5dBi, and with Beam forming ON are 8dBi and 12dBi.
5. The limit would be 11.0dBm for max gain antenna of 12dBi as shown on the plot.Total PSD is the combined worst case PSD.
6. **PSD limit above is for Highest gain antenna with Beam Forming turned ON**. Power should be reduced depending the type antenna and Beamforming condition. List of antennas is given Section 6.3 of this report.

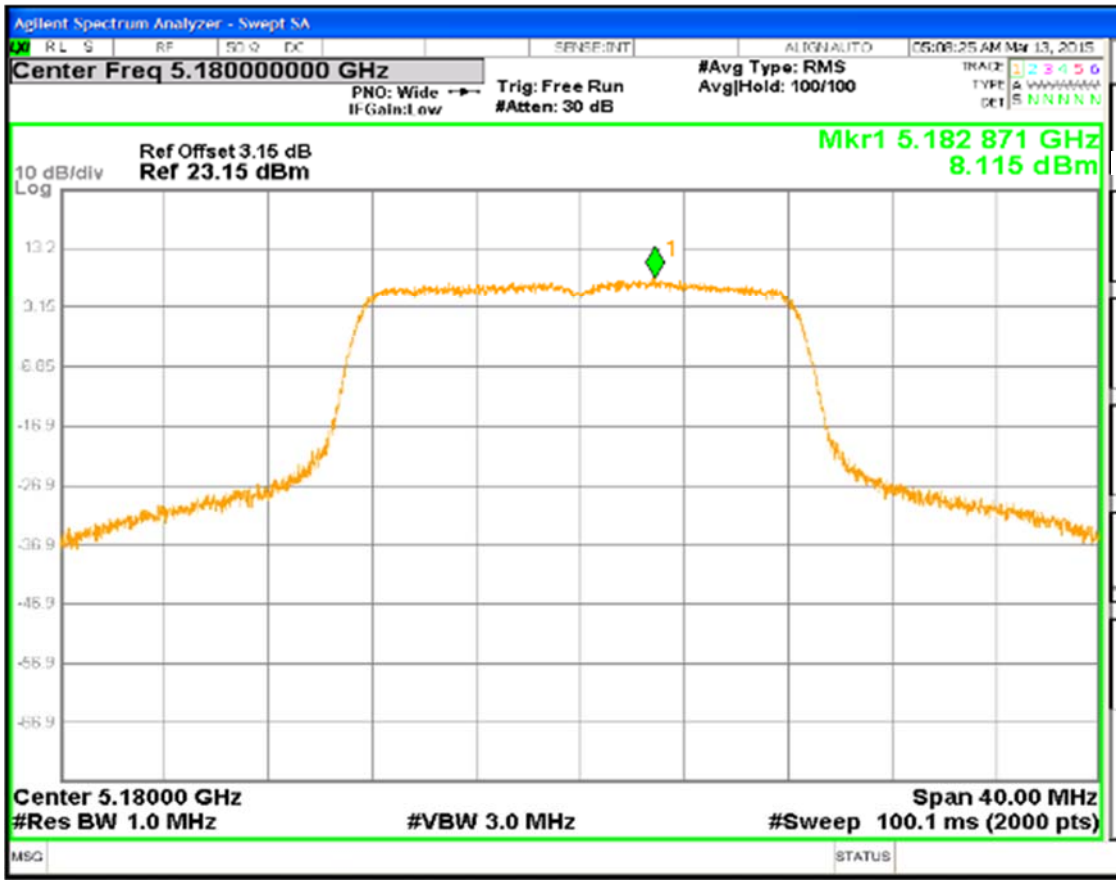


Figure 19: Power Spectral Density, 5180 MHz at 802.11a – 6.0 Mbps Chain 0

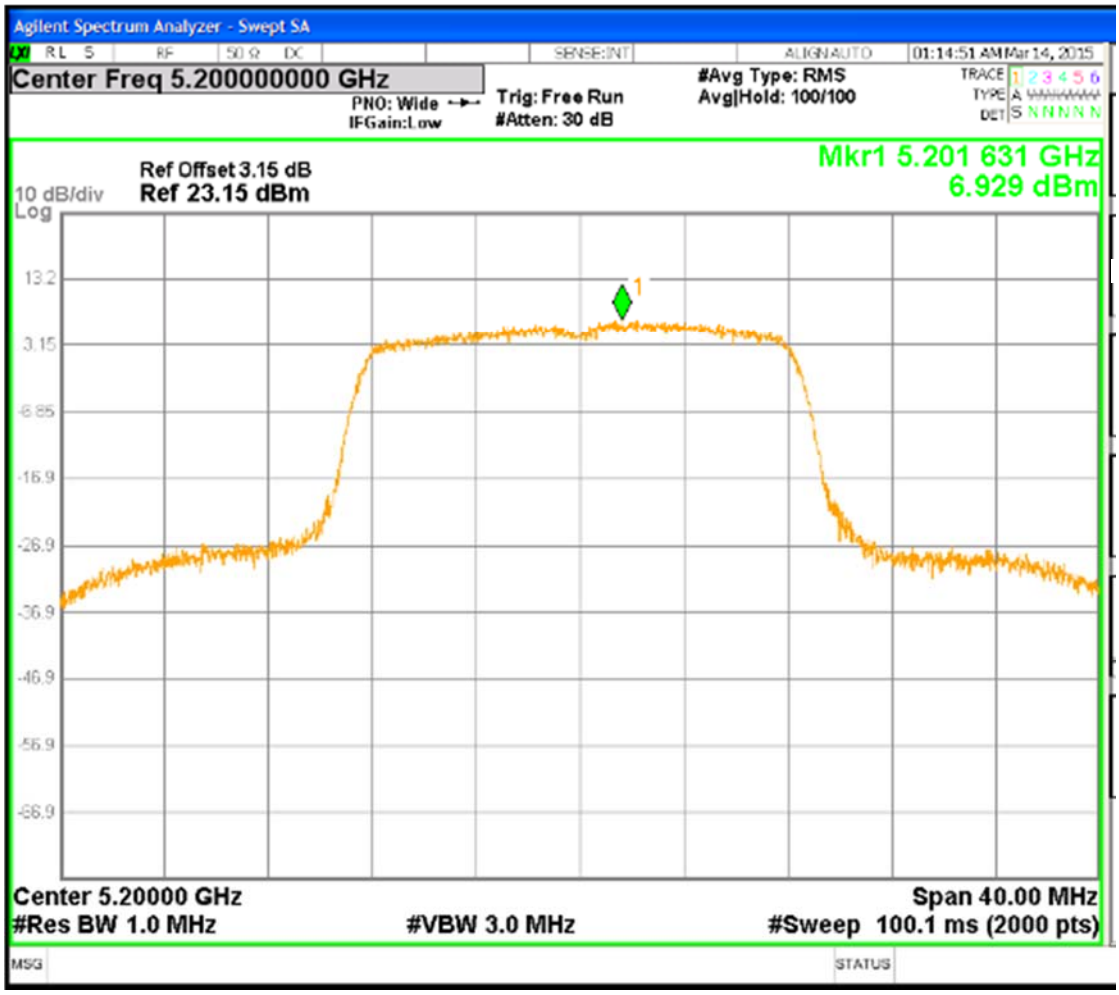


Figure 20: Power Spectral Density, 5200 MHz at 802.11a, Chain 1 – 6.0 Mbps

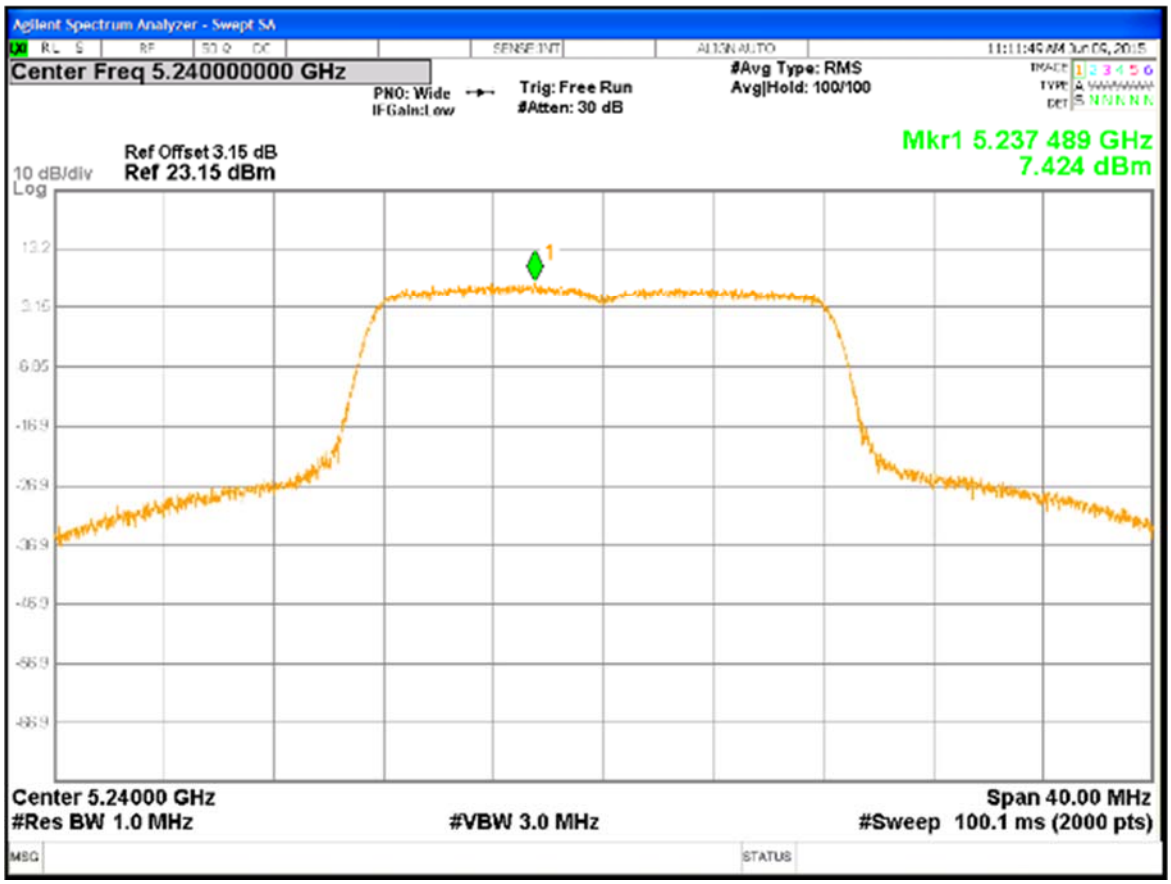


Figure 21: Power Spectral Density, 5240 MHz at 802.11a, 6.0 Mbps chain 3

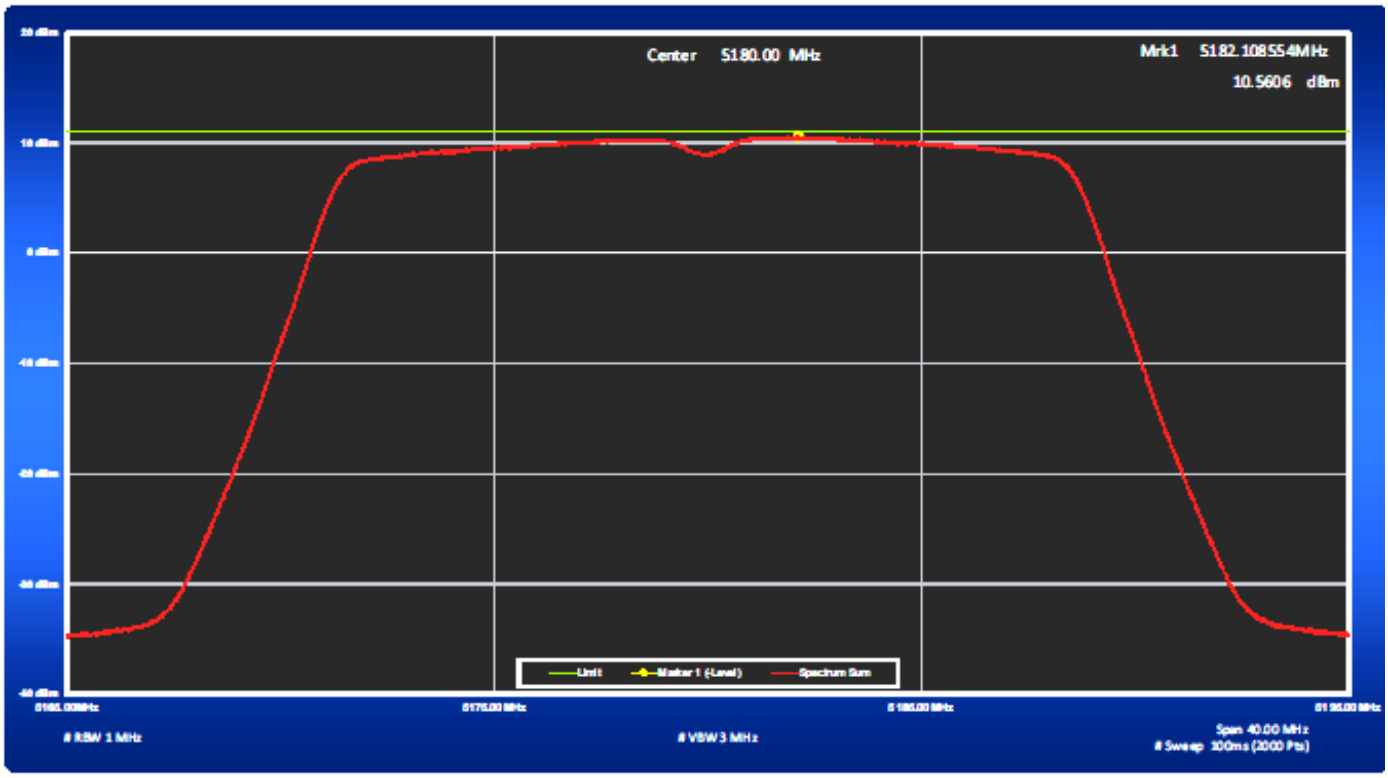


Figure 22: Combined Peak Power Spectral Density, 5180MHz at 802.11n, HT 20 and 6.5 Mbps

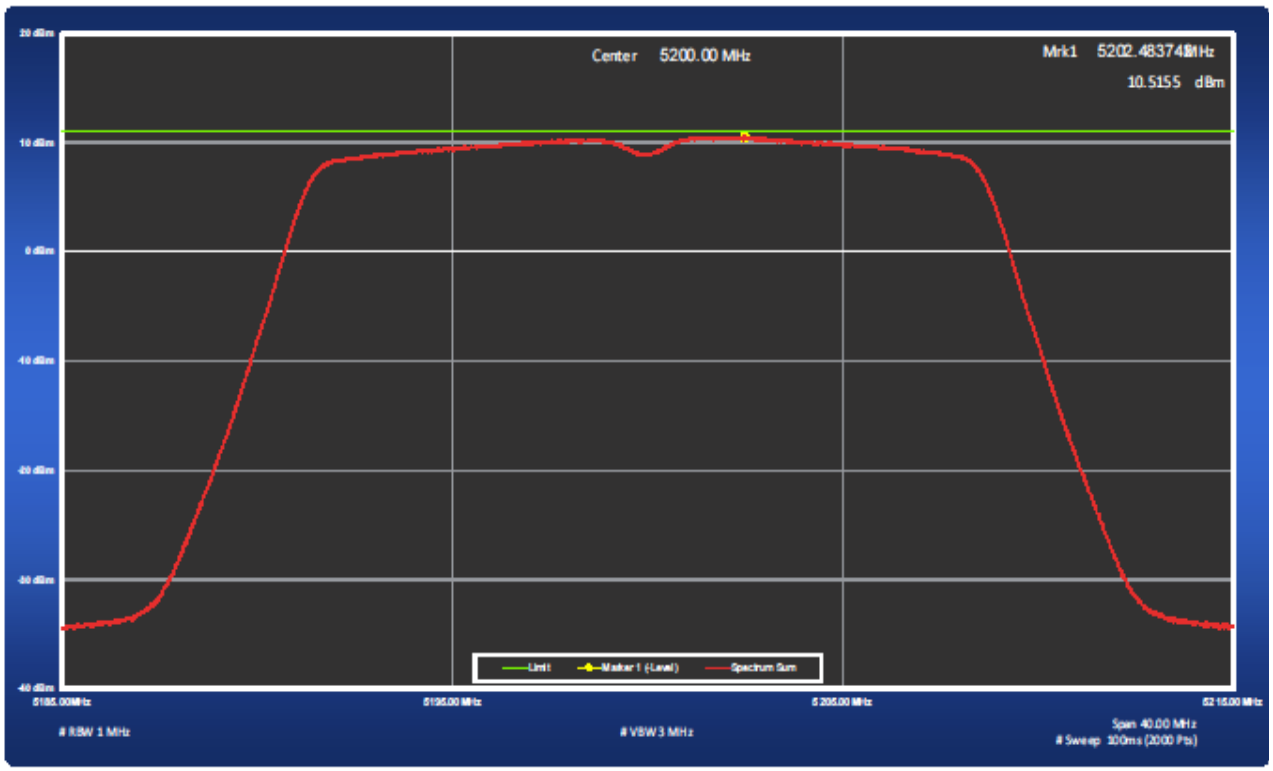


Figure 23: Peak Power Spectral Density, 5200 MHz at 802.11n, HT20 and 6.5 Mbps

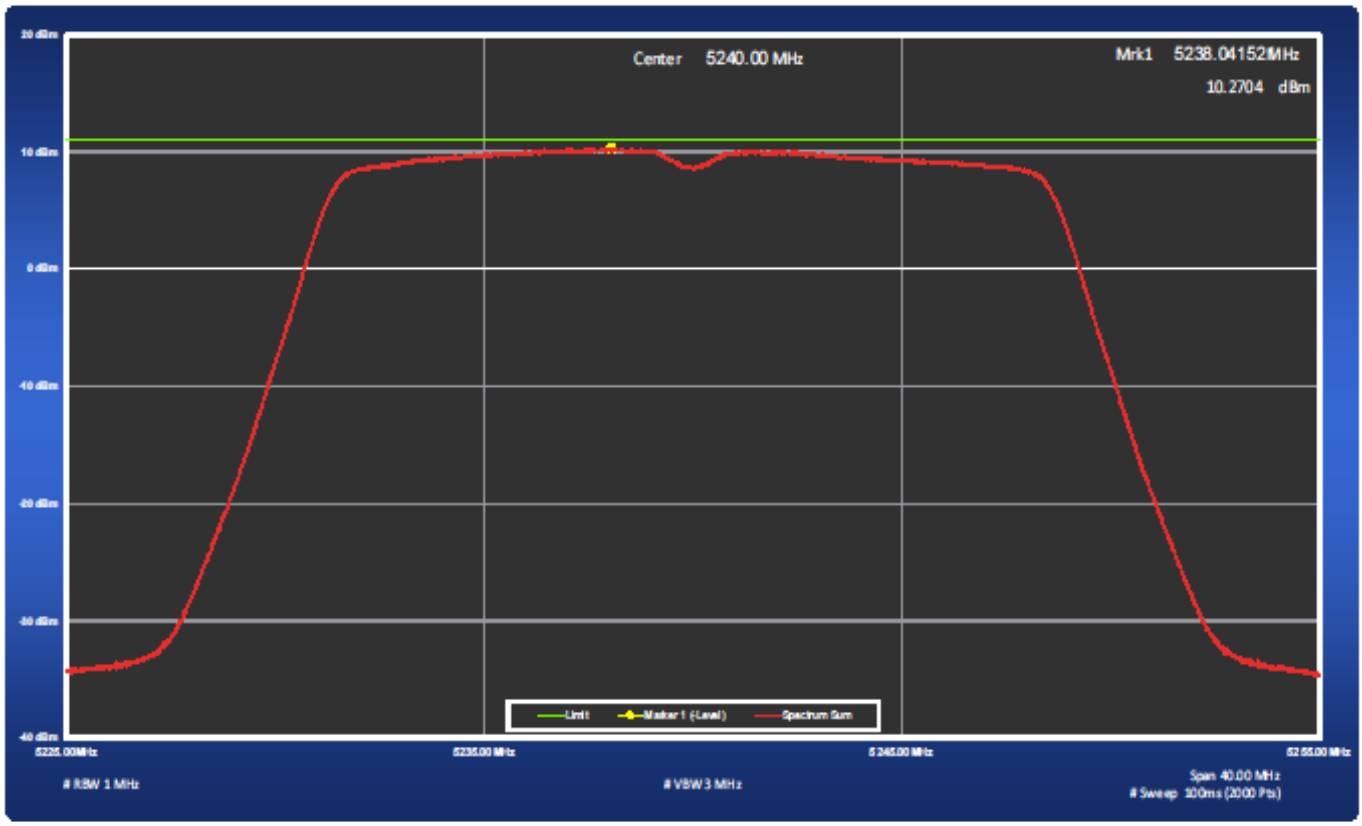


Figure 24: Peak Power Spectral Density, 5240 MHz at 802.11n, HT 20 and 6.5 Mbps

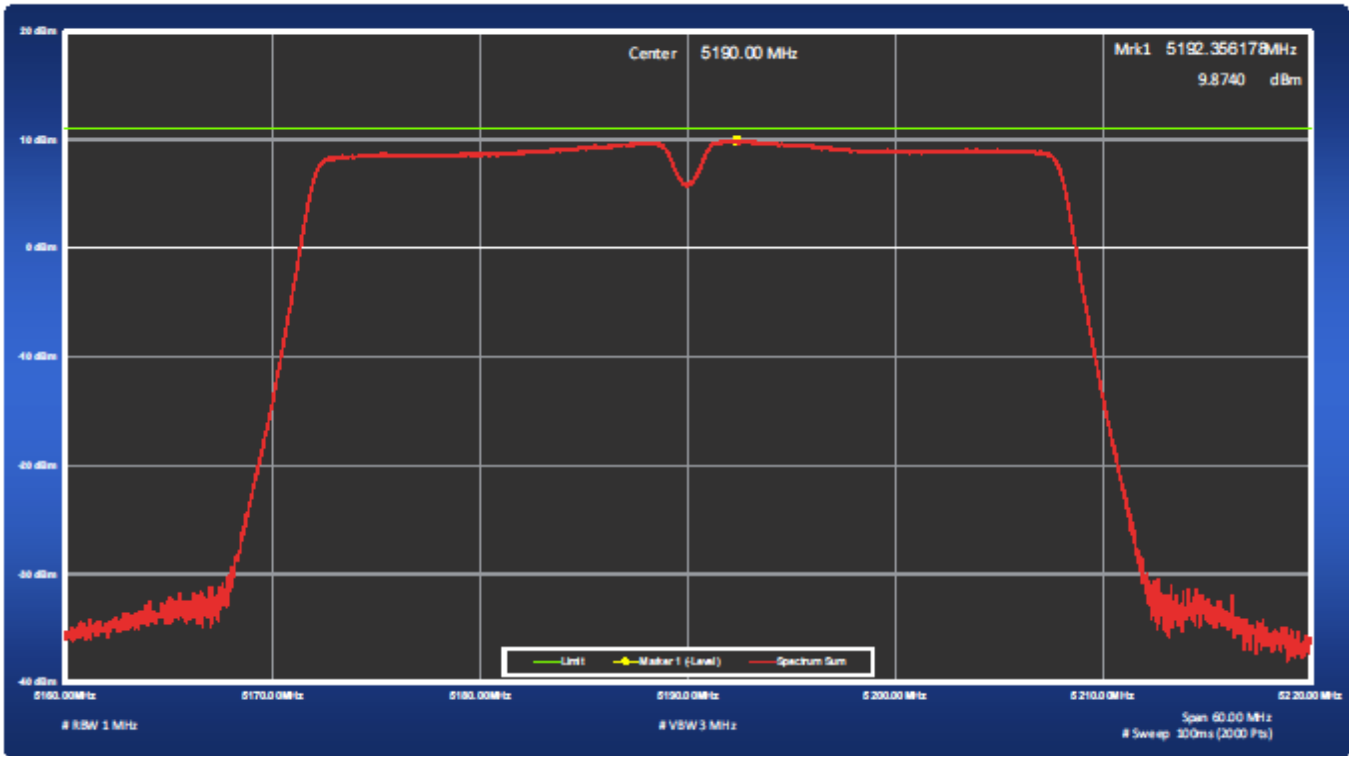


Figure 25: Peak Power Spectral Density, 5190 MHz at 802.11n, HT40– 13.5 Mbps

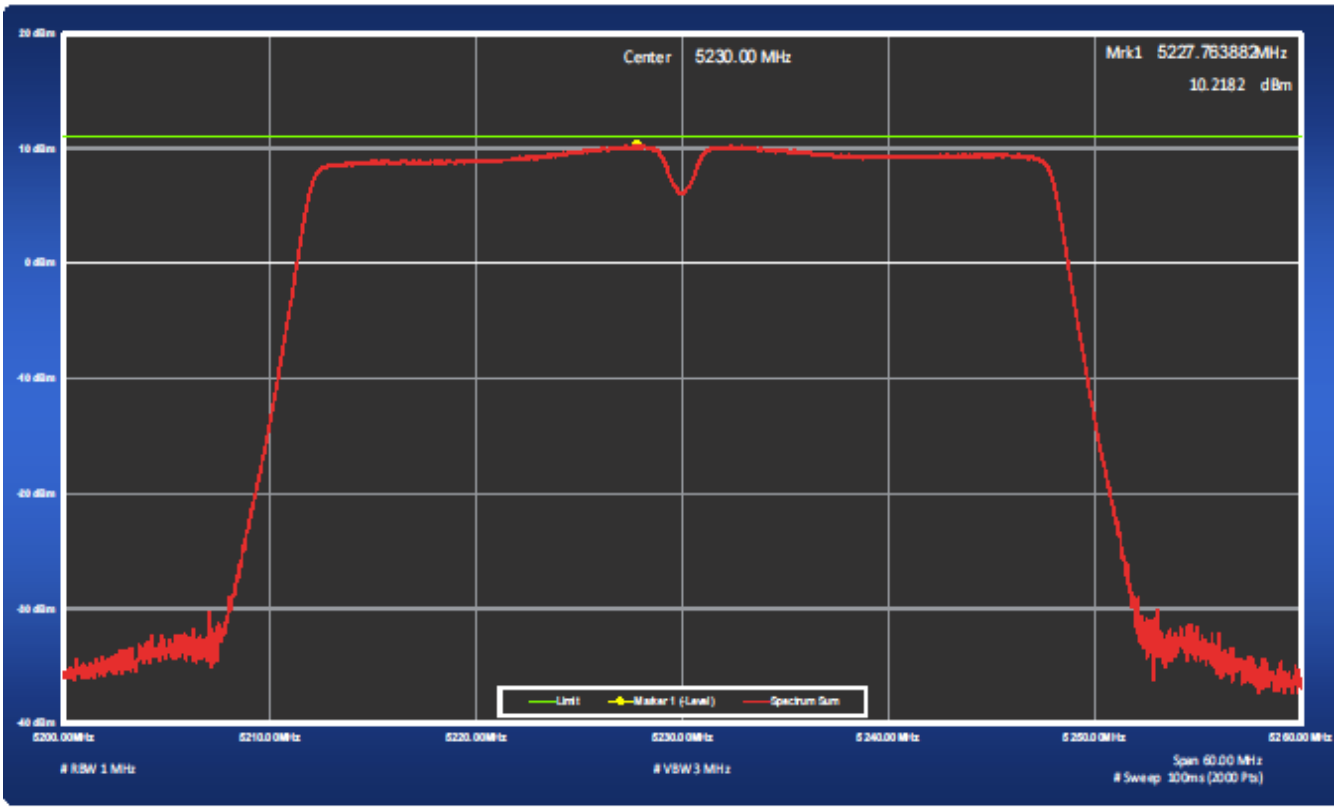


Figure 26: Peak Power Spectral Density, 5230 MHz at 802.11n, HT 40 mode-13.5Mbps

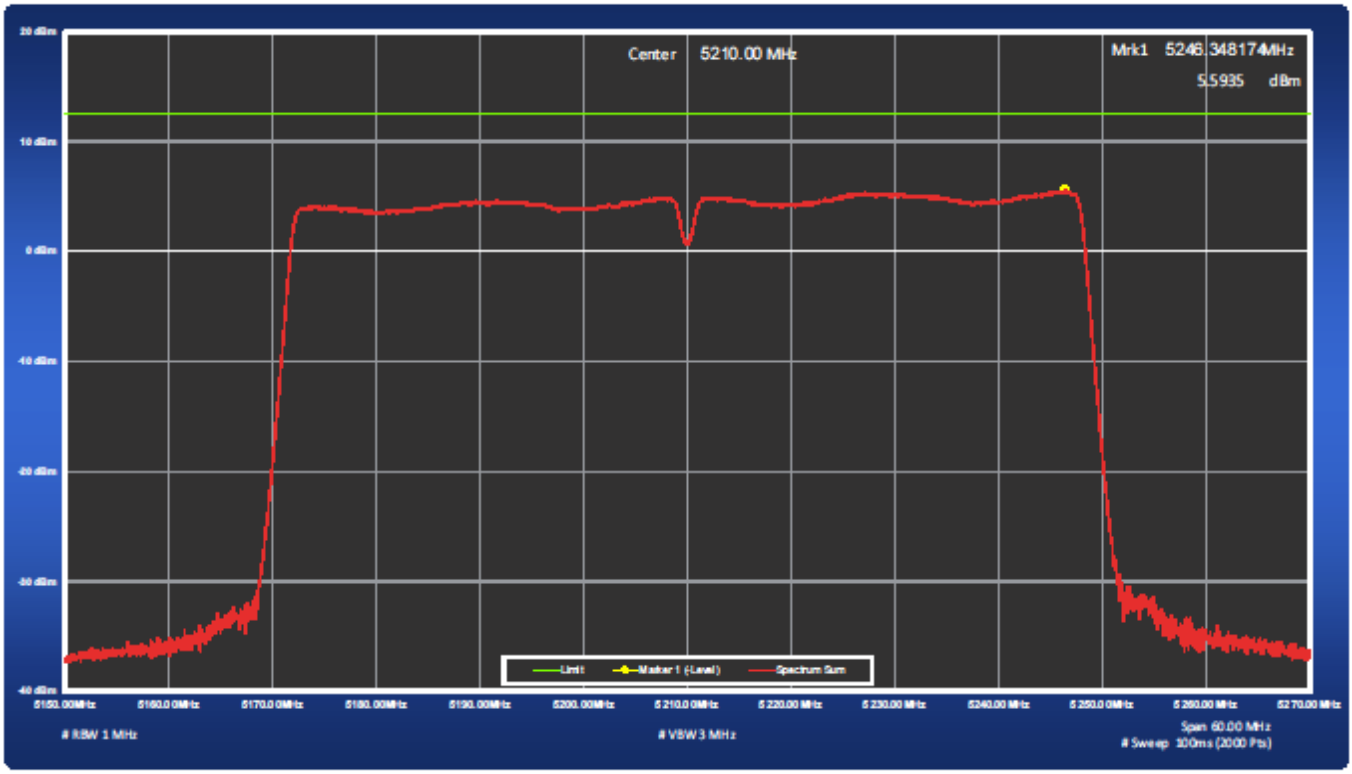


Figure 27: Peak Power Spectral Density, 5210 MHz at 802.11n AC, VHT 80 mode

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),

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 MHz

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

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

56.5Mbits/s for 802.11nAC VHT80 Mode 5210 MHz

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: 2014.

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 Unit APIN0325				**Power Setting:** See test plan				
Min-Max. Directional Gain: +2dBi & 12dBi				**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.	Table (deg)	Ant Ht (mts)	Note
5149.85	64.71	V	74	-9.29	Pk	9	230	TX 5180 MHz, 11a
5149.85	49.86	V	54	-4.14	Avg	9	230	TX 5180 MHz, 11a
5149.85	61.82	H	74	-12.18	Pk	5	250	TX 5180 MHz, 11a
5149.85	49.17	H	54	-4.83	Avg	5	250	TX 5180 MHz, 11a
5149.65	63.14	V	74	-10.86	PK	70	215	TX 5180 MHz HT20
5149.65	49.71	V	54	-4.29	Avg	70	215	TX 5180 MHz HT20
5149.85	70.02	V	74	-3.98	Pk	55	220	TX 5190 MHz HT40
5149.85	51.54	V	54	-2.46	Avg	55	220	TX 5190 MHz HT40
5149.55	56.72	H	74	-17.28	Pk	119	235	TX 5190MHz, HT40
5149.85	40.16	H	54	-13.84	Avg	119	235	TX 5190MHz, HT40
5149.20	70.81	V	74	-3.19	Pk	7	247	TX 5210MHz VHT80
5149.80	52.58	V	54	-1.42	Avg	7	247	TX 5210MHz VHT80

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).

4. Band edge measurement compliance at 5350 MHz is included in test report for 5250-5350MHz.

Test Conditions: Radiated Measurement, Normal Temperature and Voltage only

Antenna Type: External APIN0324 **Power Setting:** See test plan

Min-Max. Directional Gain: +2dBi & 12dBi **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.	Table (deg)	Ant Ht (mts)	Note
5149.09	68.38	V	74	-5.62	Pk	15	129	TX 5180 MHz, 11a, PS17
5150.00	52.30	V	54	-1.70	Avg	15	129	TX 5180 MHz, 11a, PS17
5145.49	66.90	V	74	-7.10	Pk	172	124	TX 5200 MHz, 11a, PS18
5150.00	50.54	V	54	-3.46	Avg	172	124	TX 5200 MHz, 11a, PS18
5150.00	68.93	V	74	-5.07	Pk	2	127	TX 5180MHz HT20, PS17
5150.00	53.13	V	54	-0.87	Avg	2	127	TX 5180MHz HT20, PS17
5149.24	67.40	V	74	-6.60	PK	76	126	TX 5200MHz HT20, PS18
5150.00	50.35	V	54	-3.65	Avg	76	126	TX 5200MHz HT20, PS18
5148.34	67.01	V	74	-6.99	PK	142	175	TX 5190MHz HT40, PS12
5149.24	51.67	V	54	-2.37	Avg	142	175	TX 5190MHz HT40, PS12
5144.73	69.88	V	74	-4.12	PK	-3	143	TX 5210MHz VHT80, PS10
5148.34	51.47	V	54	-2.53	Avg	-3	143	TX 5210MHz VHT80, PS10

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).

4. Band edge measurement compliance at 5350 MHz is included in test report for 5250-5350MHz Band.

Device under Test APIN0325 with Internal Antennas

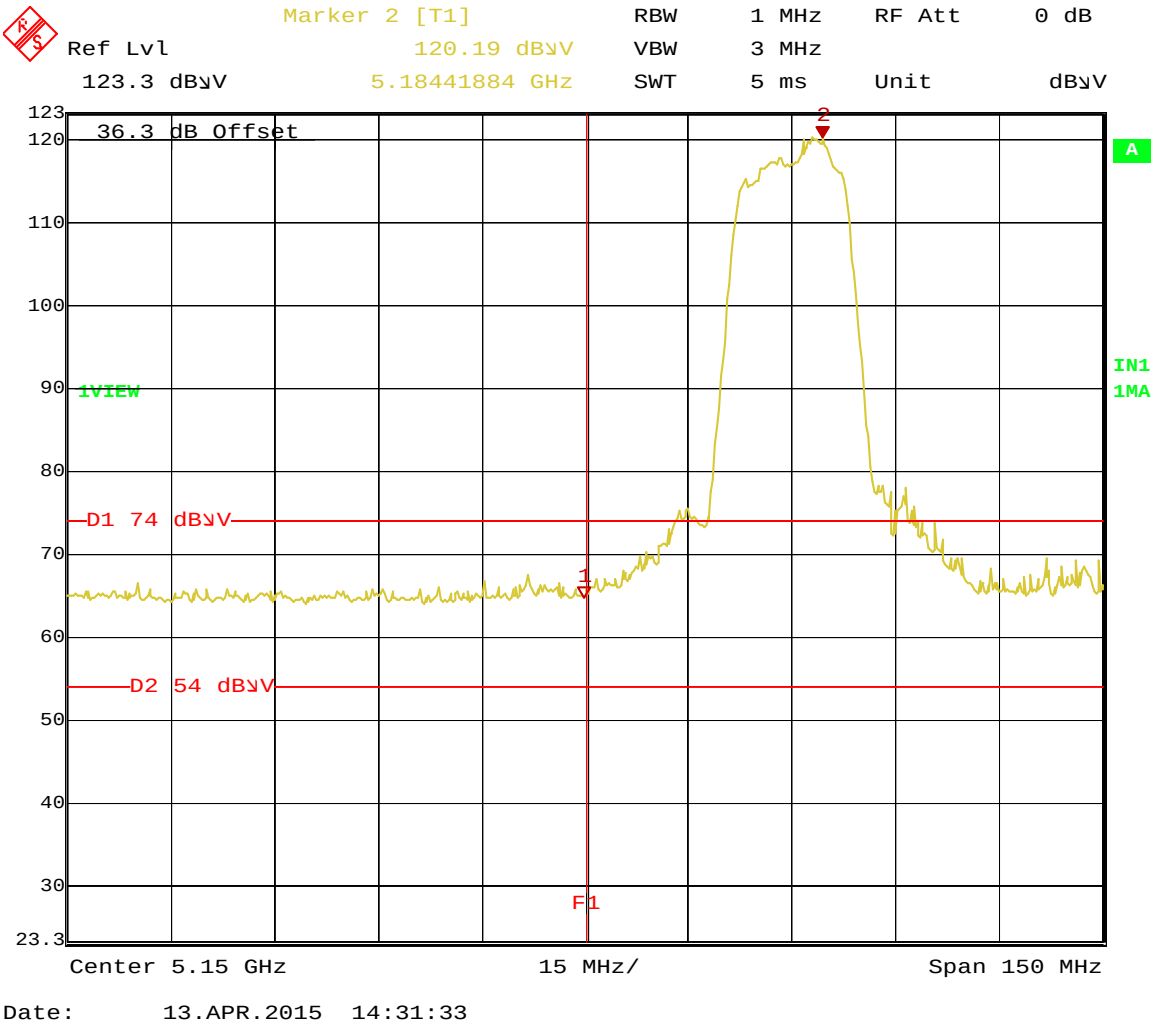


Figure 28: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Vert (Peak)

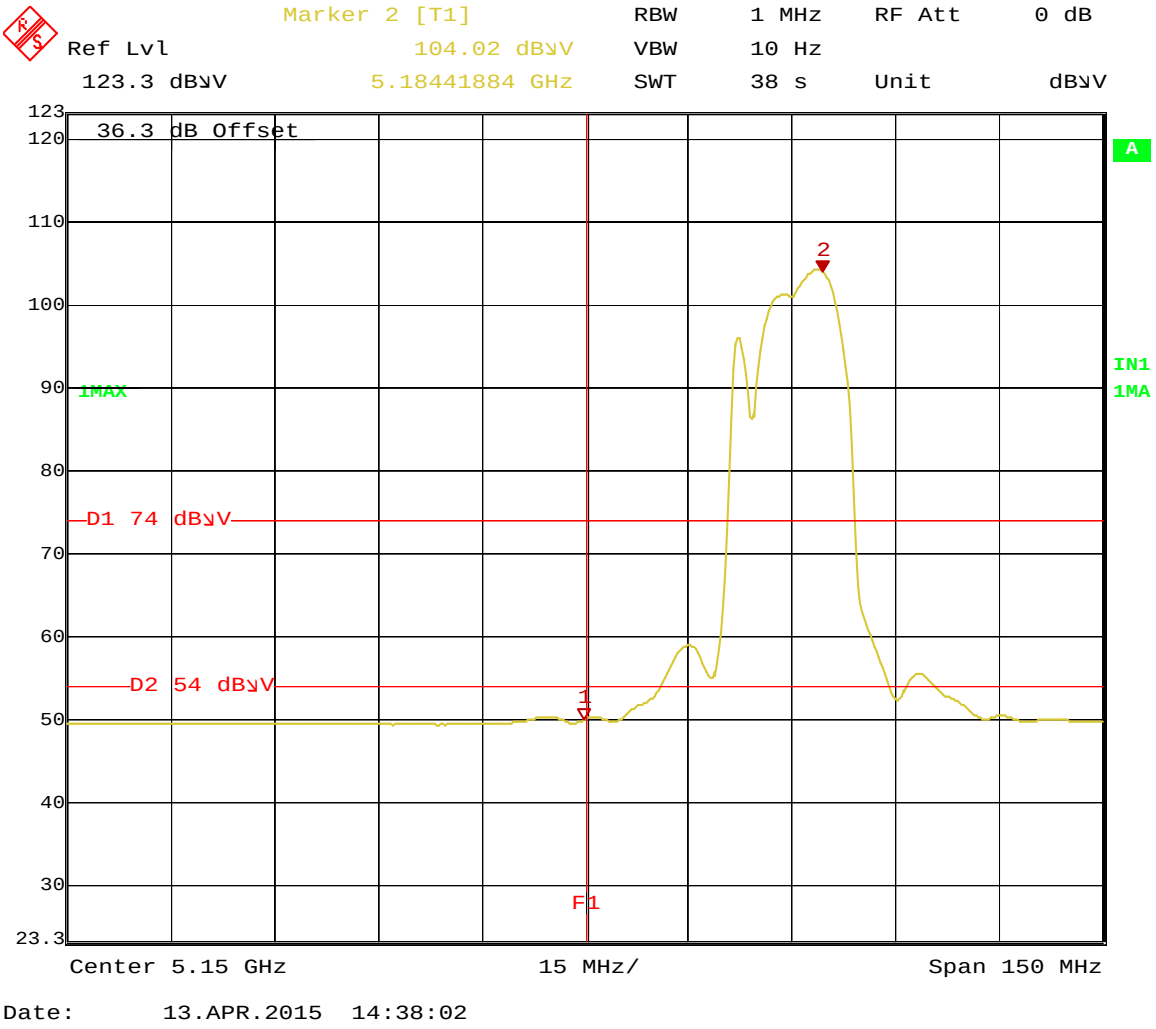


Figure 29: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Vert. (Ave.)

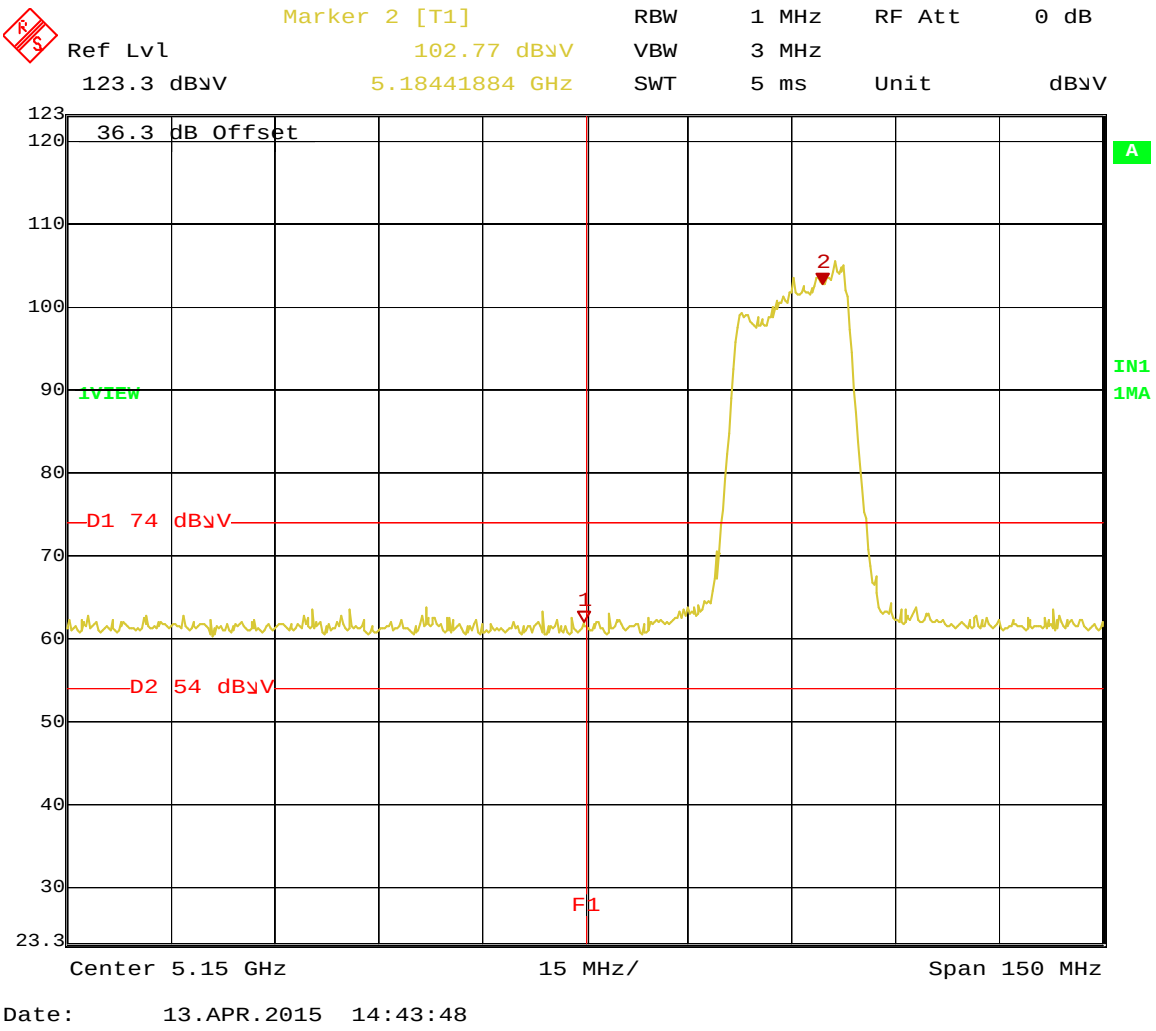


Figure 30: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Horz. (Peak)

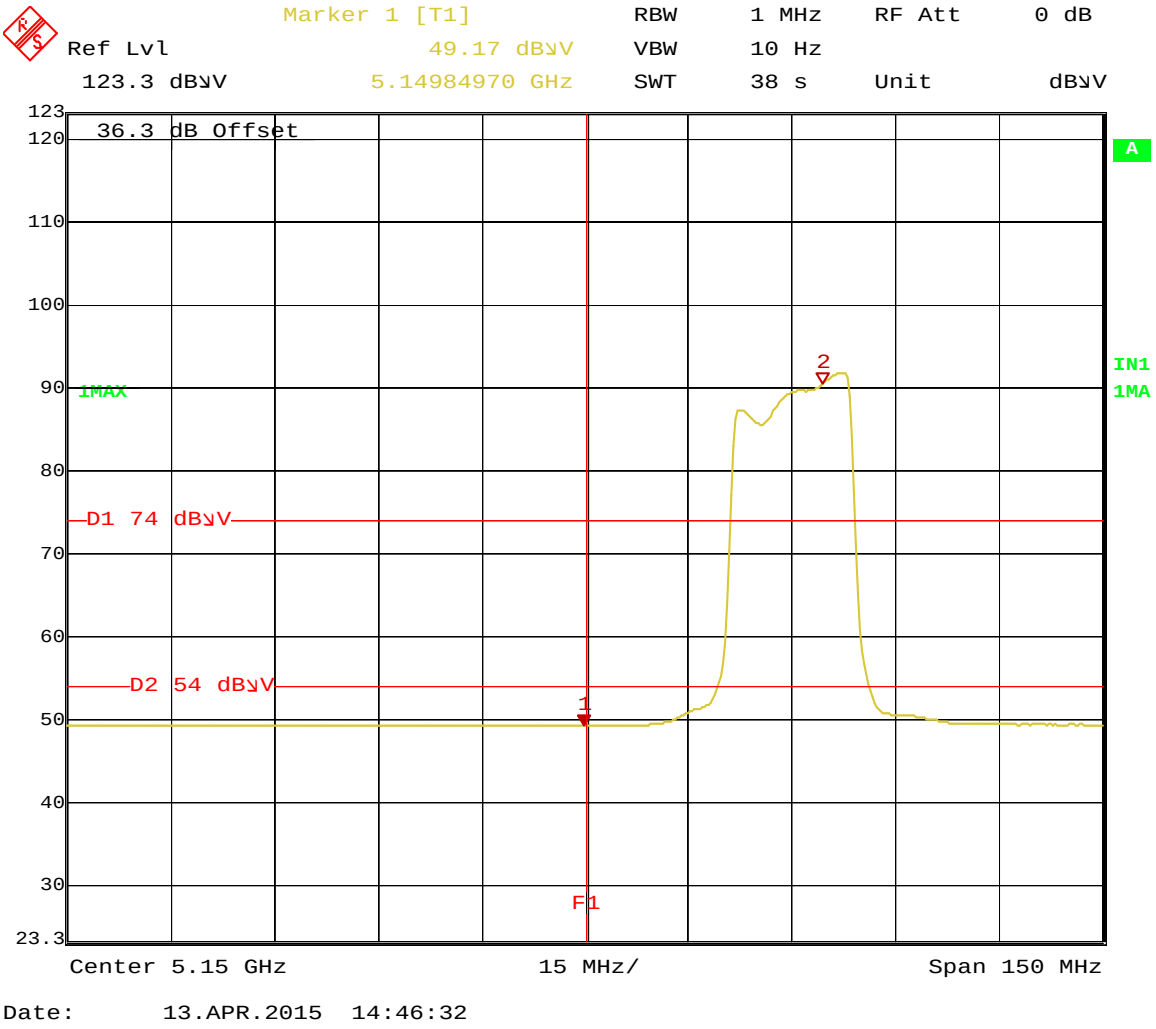


Figure 31: Radiated Emission at the Edge for Channel 5180 MHz at 6.0Mbps – Horz. (Ave.)

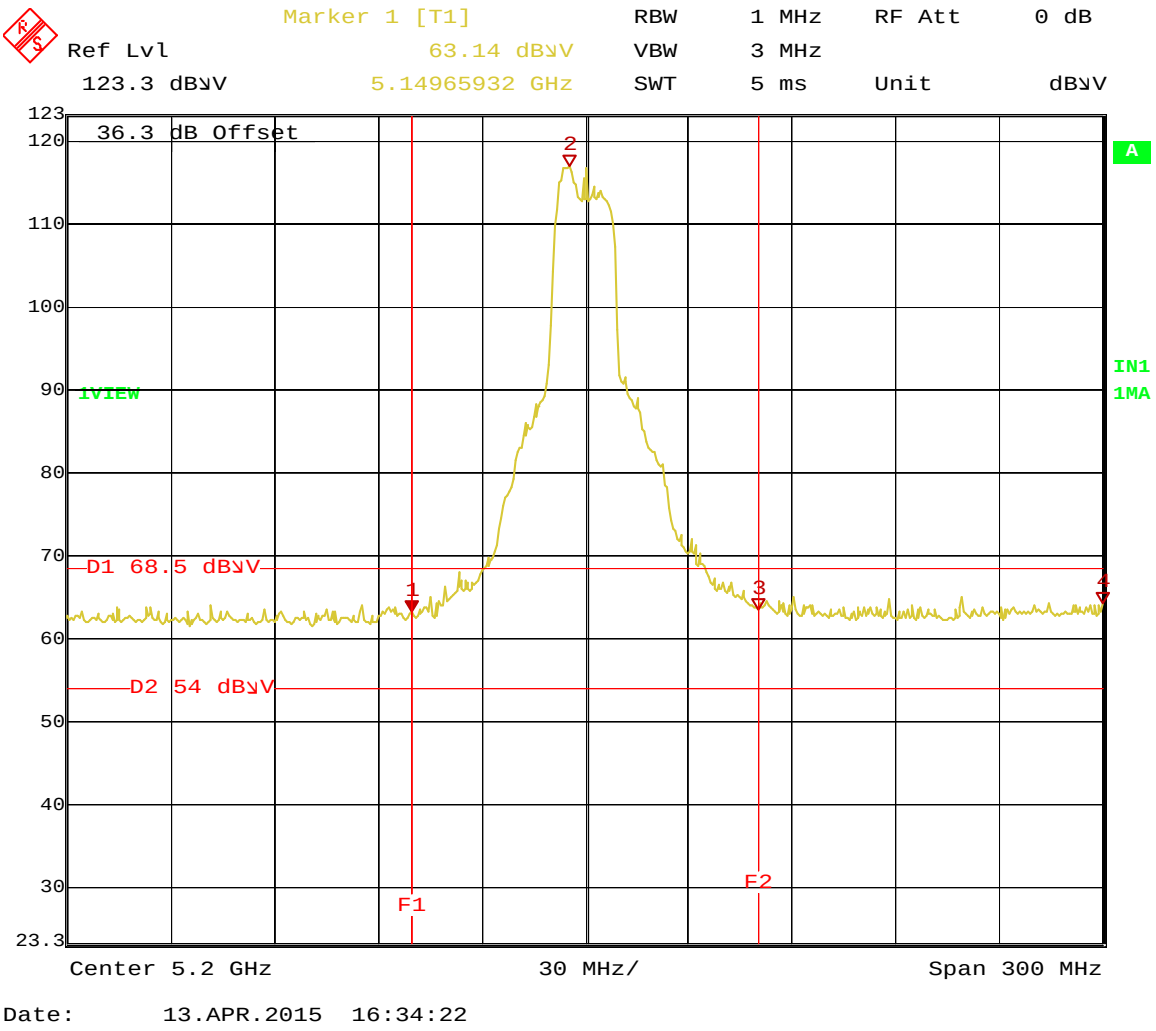


Figure 32: Radiated Emission at the Edge for TX 5180MHz at HT20 6.5Mbps– Vert. (Peak)

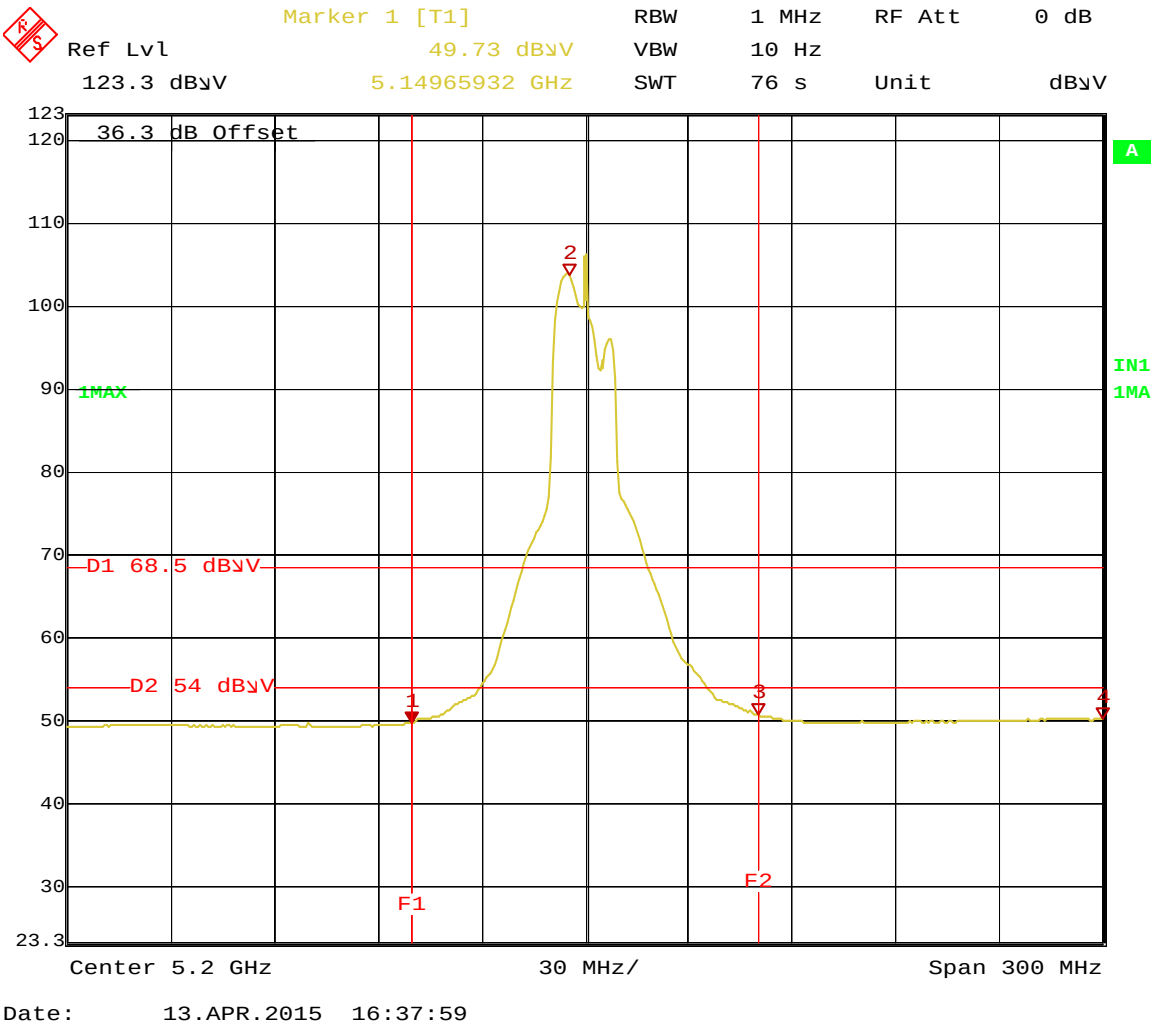


Figure 33: Radiated Emission at the Edge for TX 5180MHz at HT20 6.5 Mbps – vert. (Ave.)

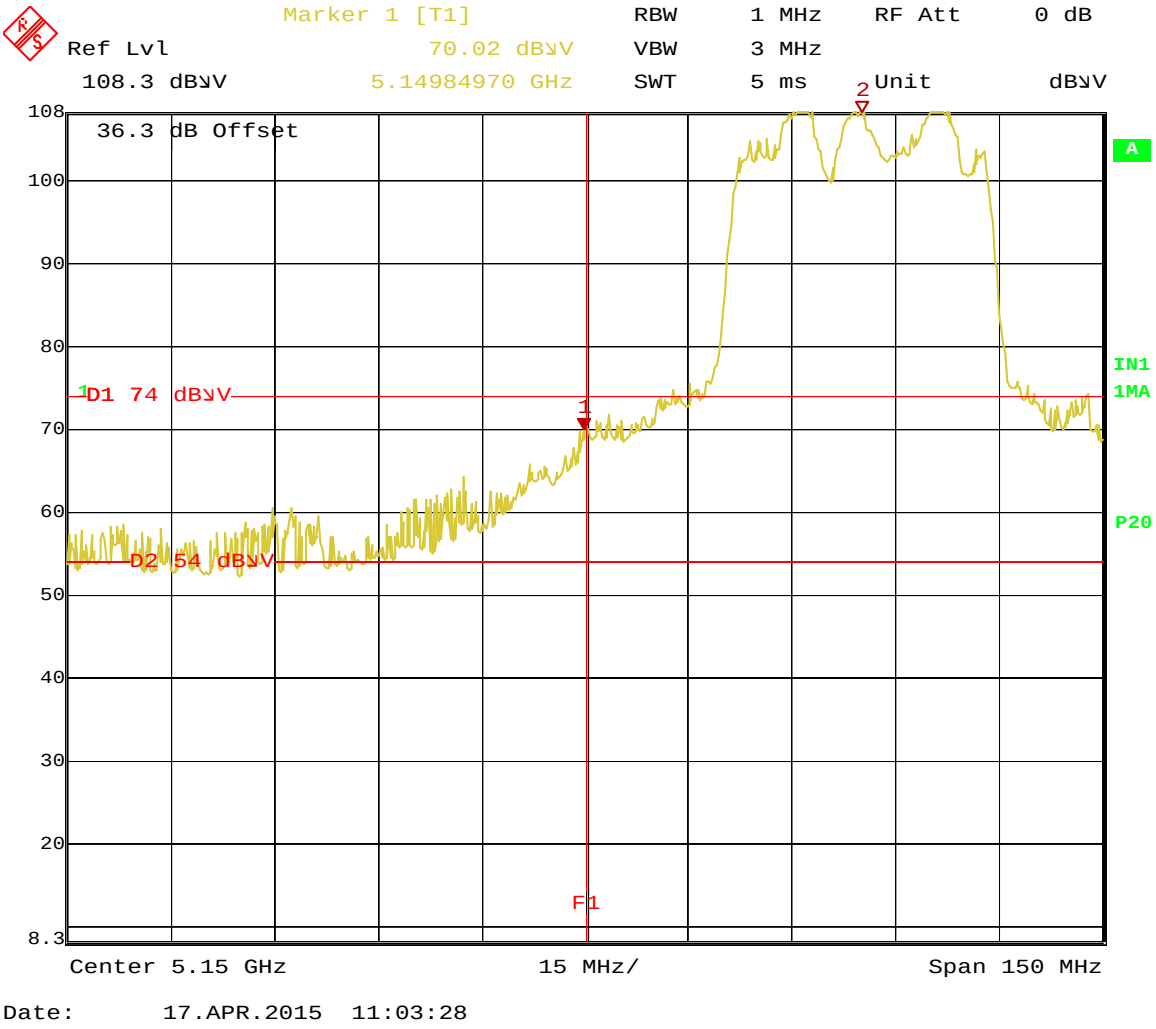


Figure 34: Radiated Emission at the Edge for 5190 MHz at HT40, 13.5Mbps – Vert. (Peak)

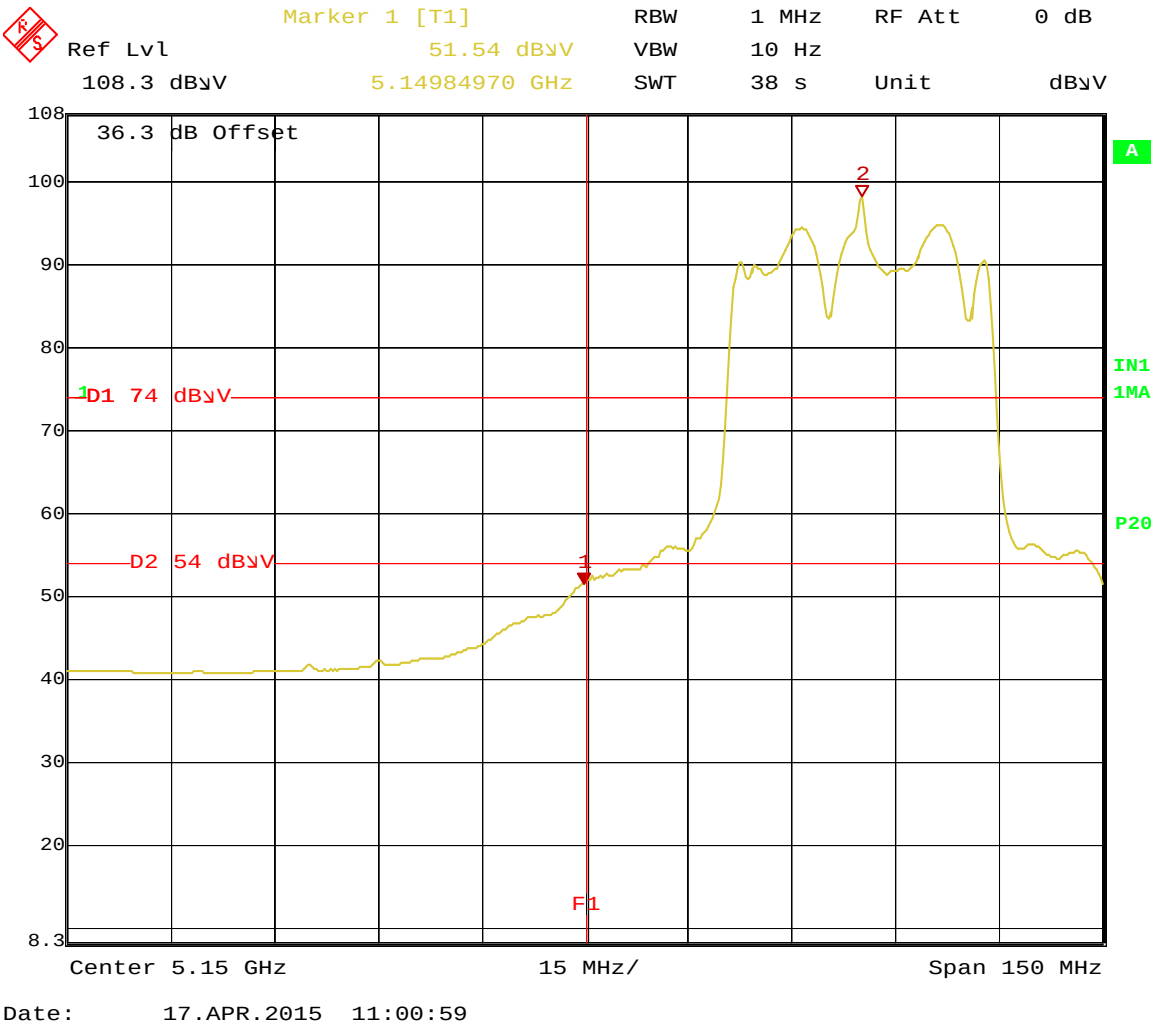


Figure 35: Radiated Emission at the Edge 5190 MHz at HT40, 13.5Mbps – Vert. (Ave.)

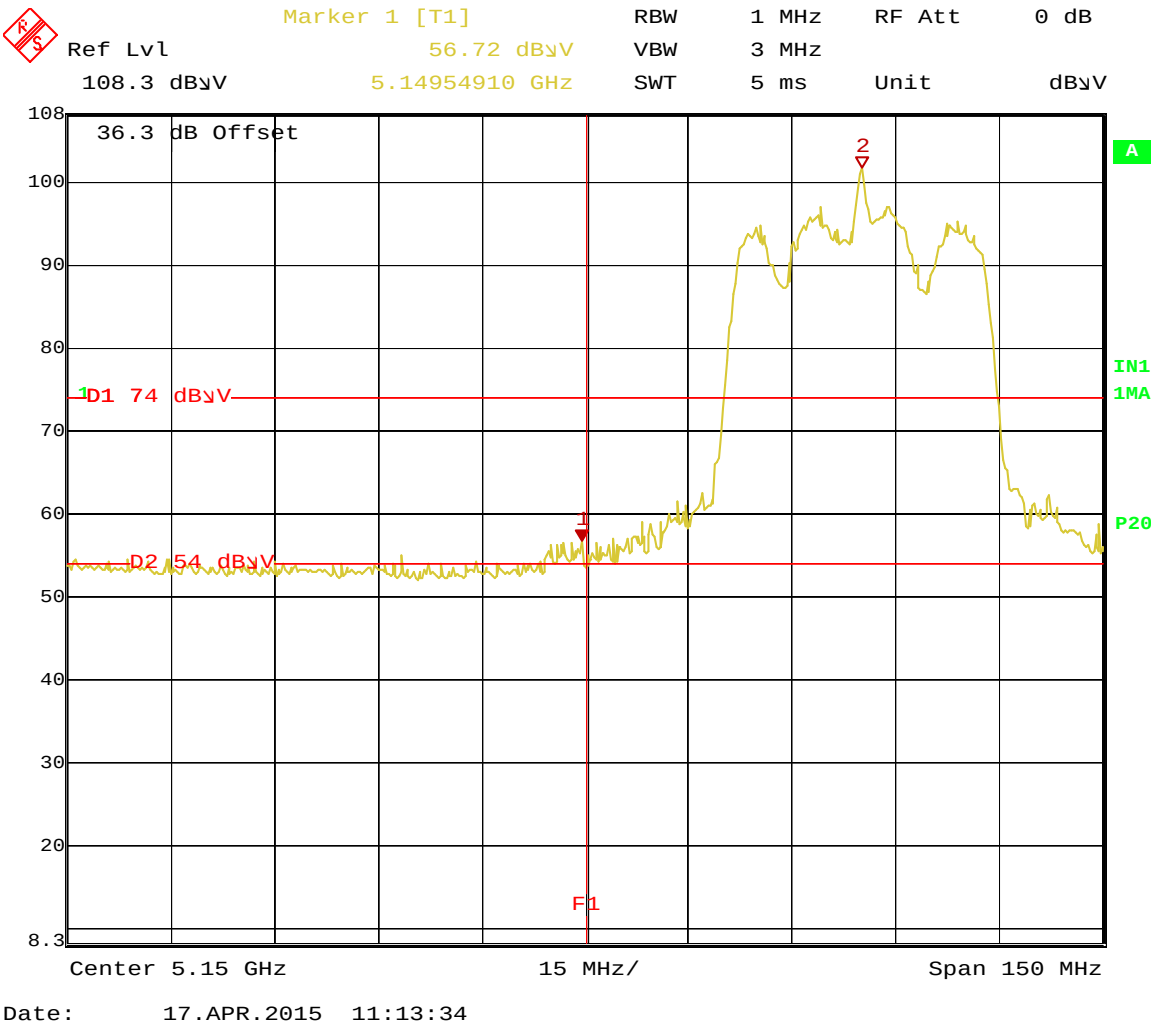


Figure 36: Radiated Emission at the Edge for 5190 MHz at HT40 13.5Mbps – Horz. (Peak)

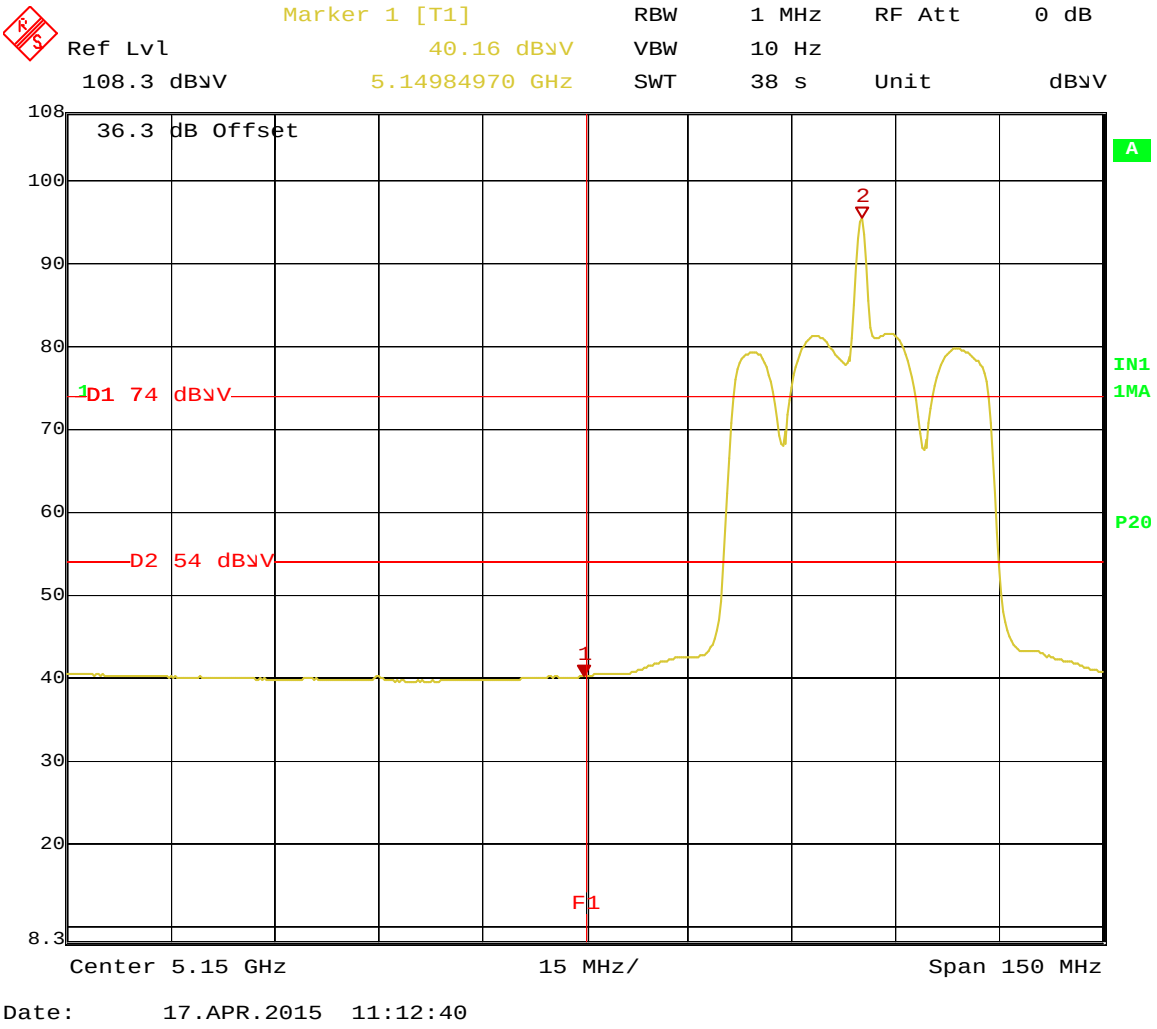


Figure 37: Radiated Emission at the Edge for 5190 MHz at HT40 13.5Mbps – Horz. (Avg)

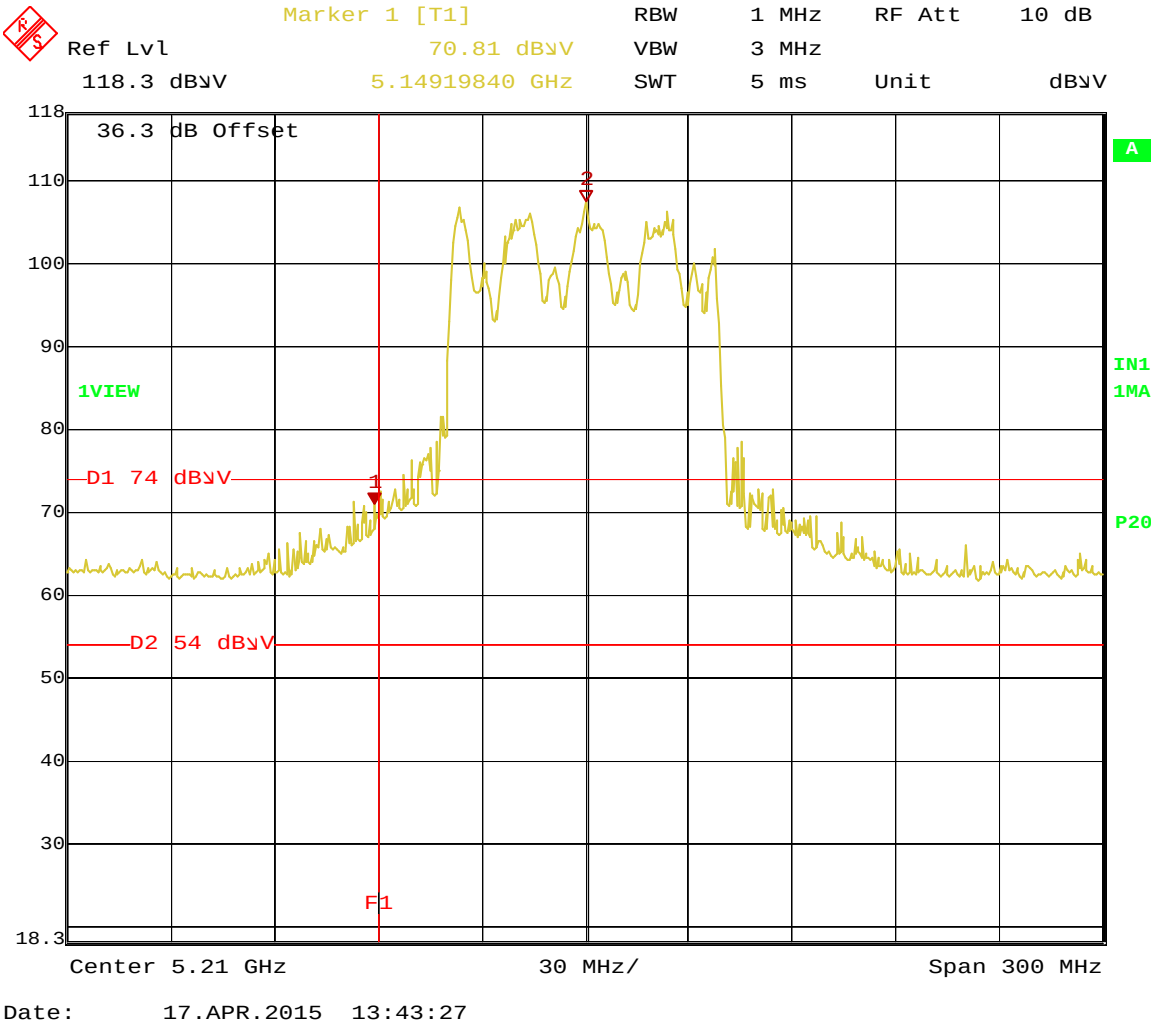


Figure 38: Radiated Emission at the Edge for 5210MHz V HT80– Vert. (pk)

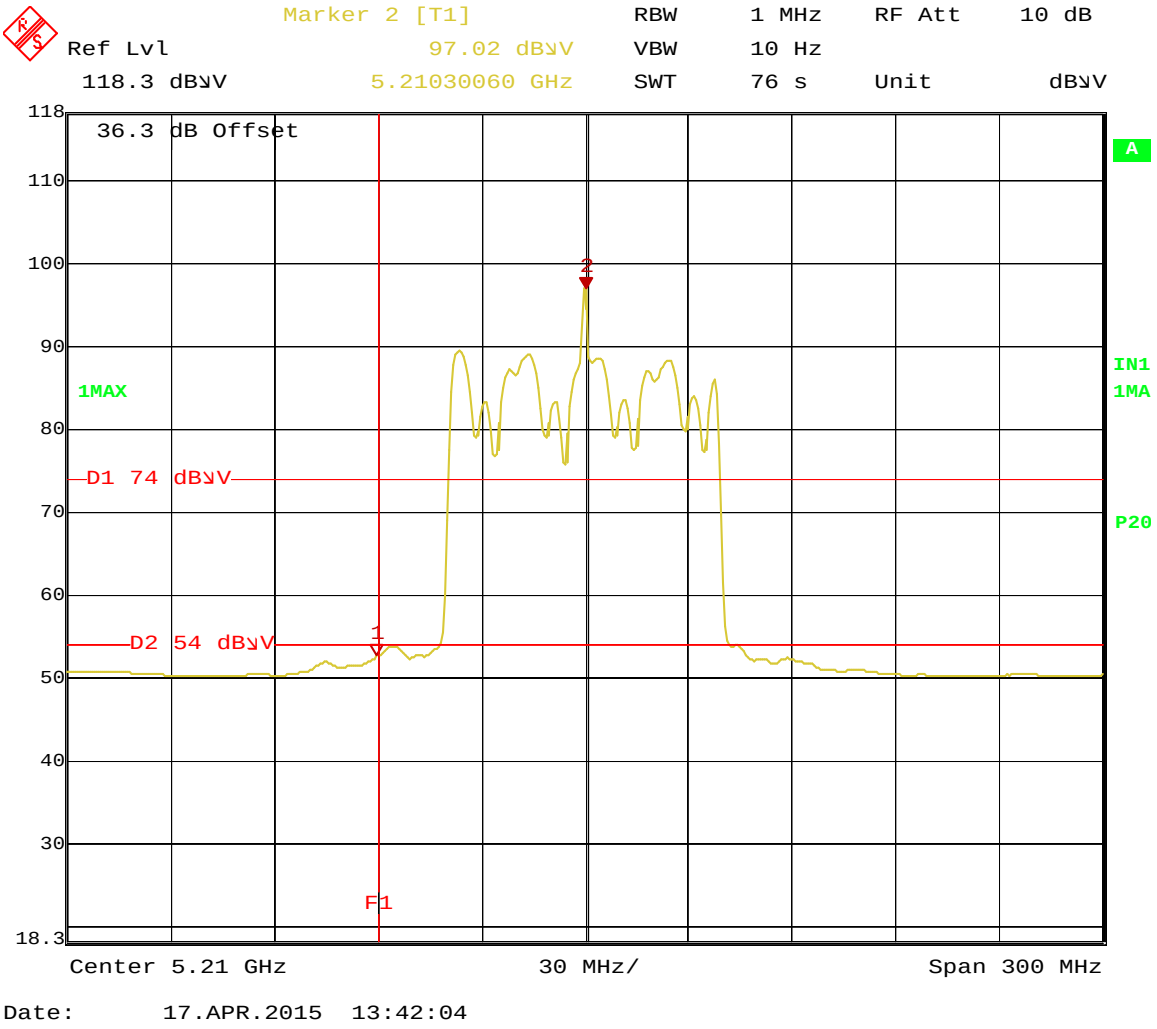


Figure 39: Radiated Emission at the Edge for 5210MHz V HT80– Vert. (Avg)

Device under Test APIN0324 with External Antennas

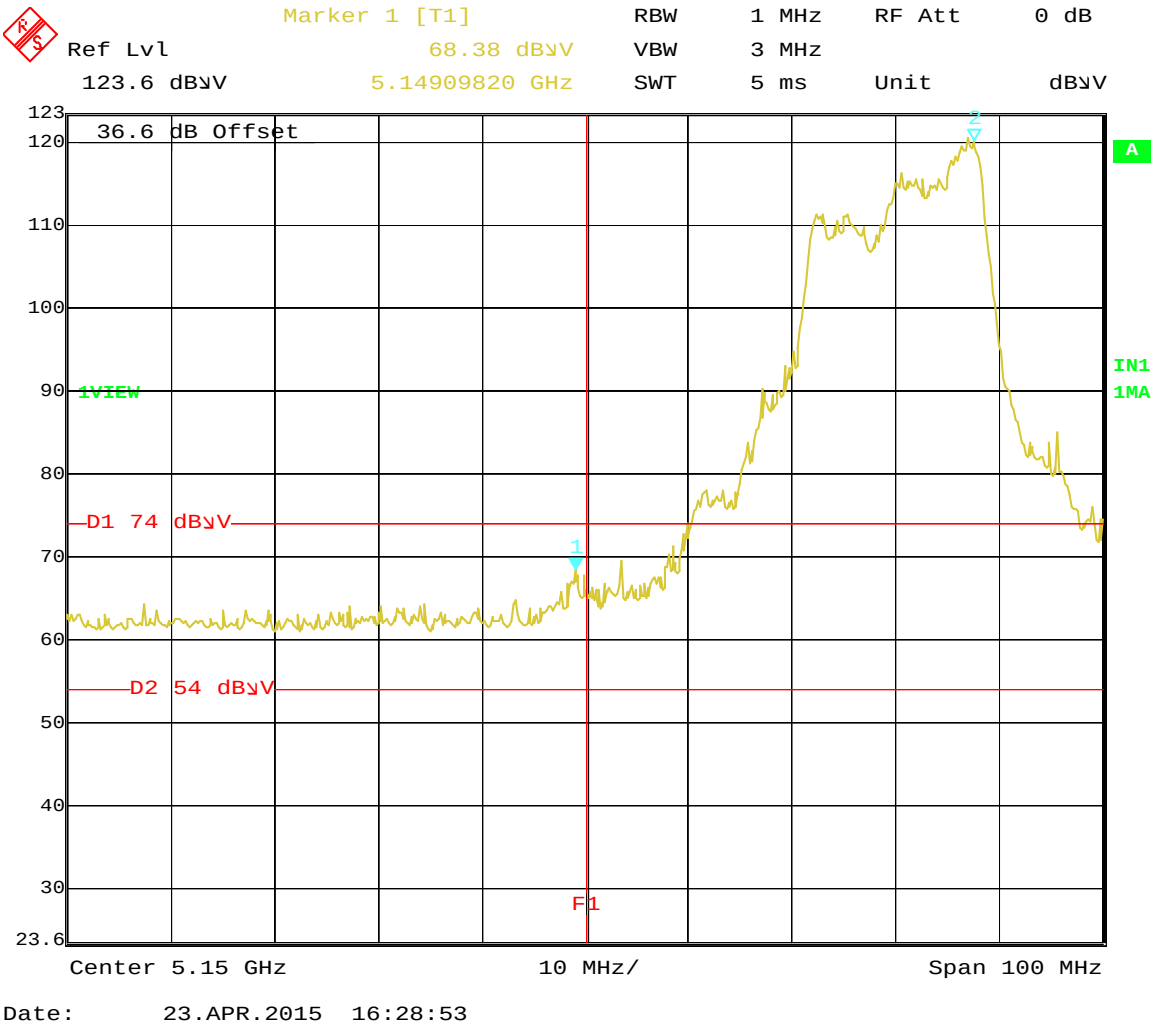


Figure 40: Radiated Emission at the Edge for 5180 MHz 11a at 6Mbps– Vert. (Peak)

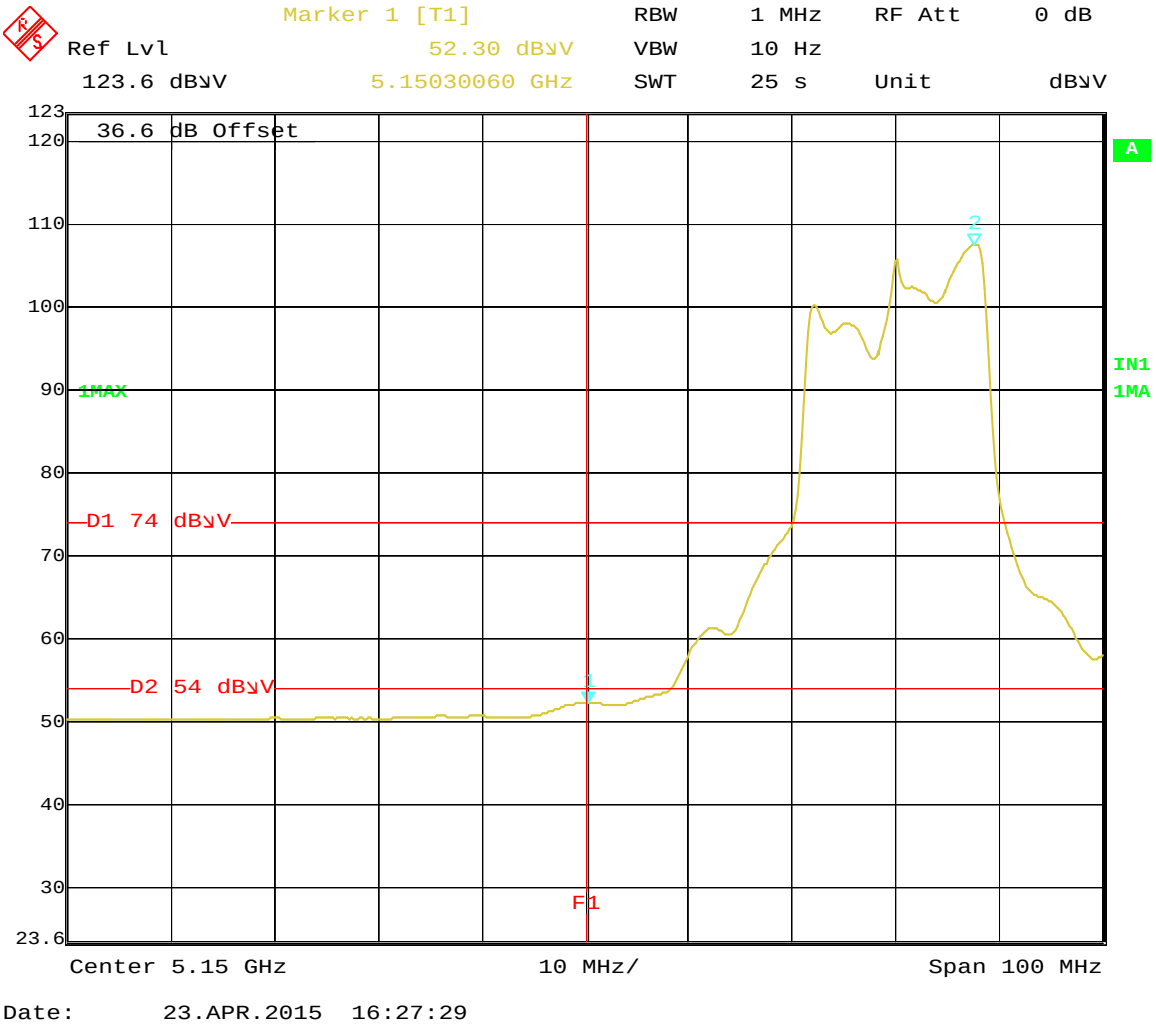


Figure 41: Radiated Emission at the Edge for 5180 MHz 11a at 6Mbps– Vert. (Ave.)

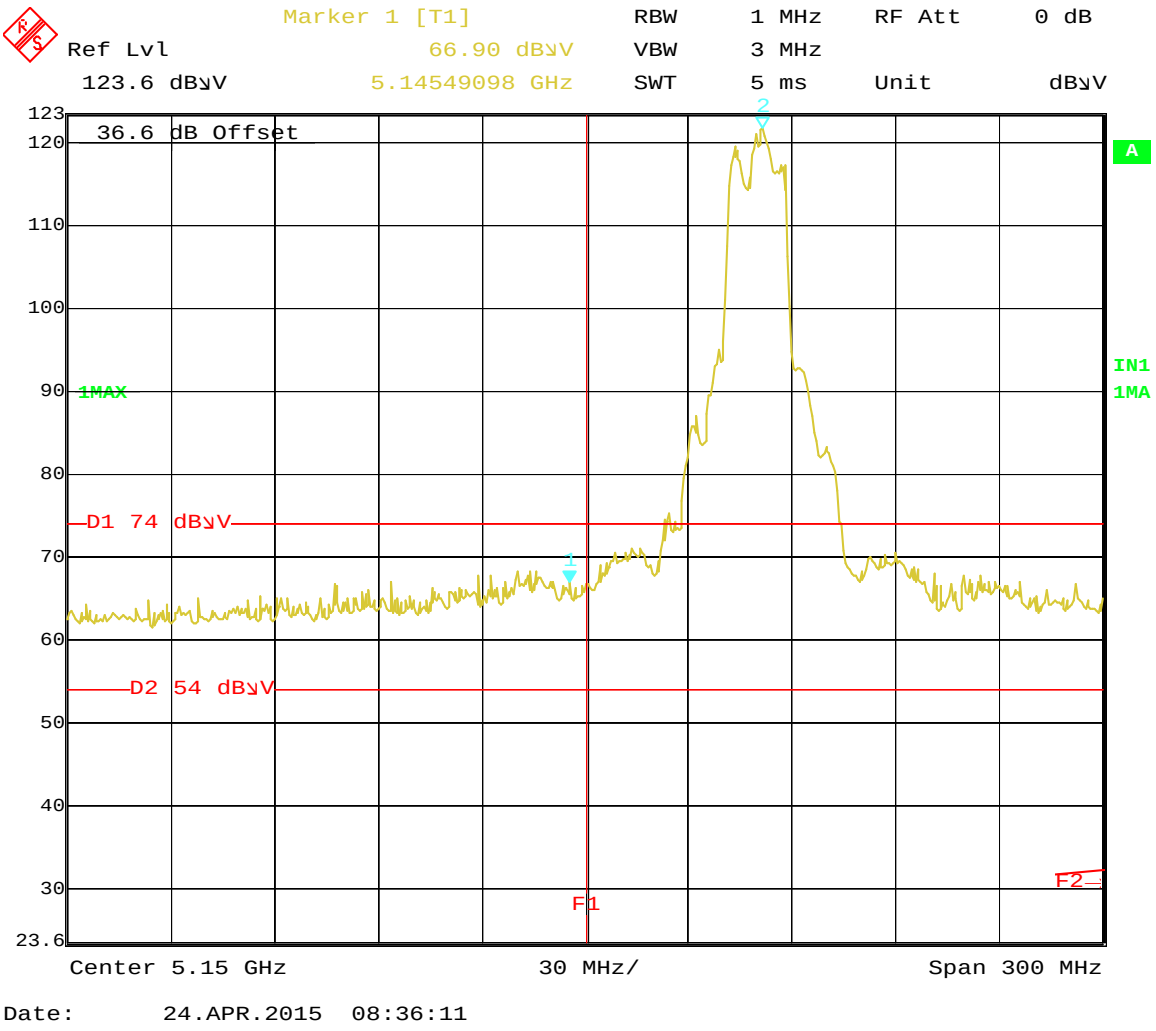


Figure 42: Radiated Emission at the Edge for 5200 MHz 11a at 6Mbps– Vert. (PK.)

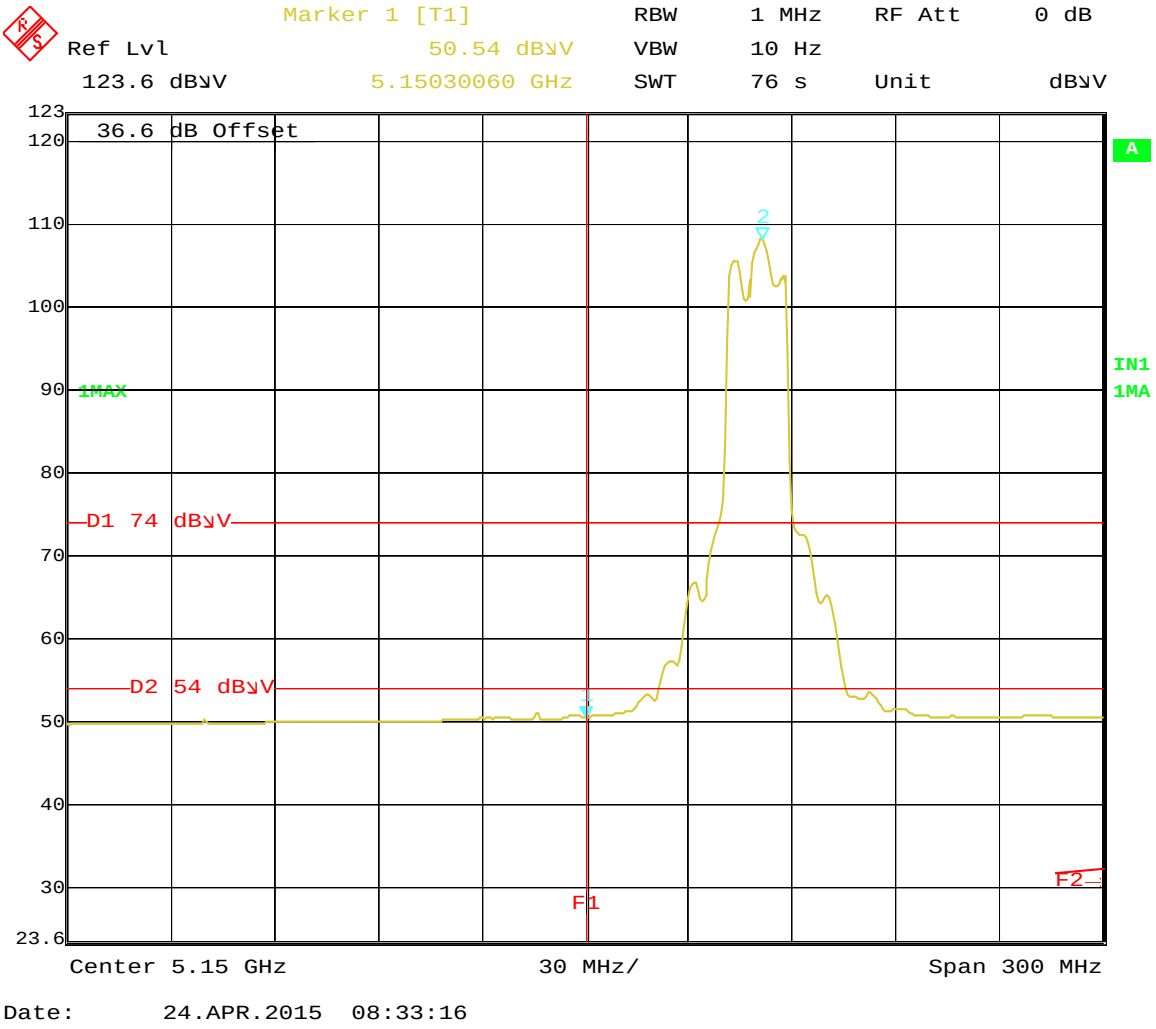


Figure 43: Radiated Emission at the Edge for 5200MHz 11a at 6Mbps– Vert. (Ave.)

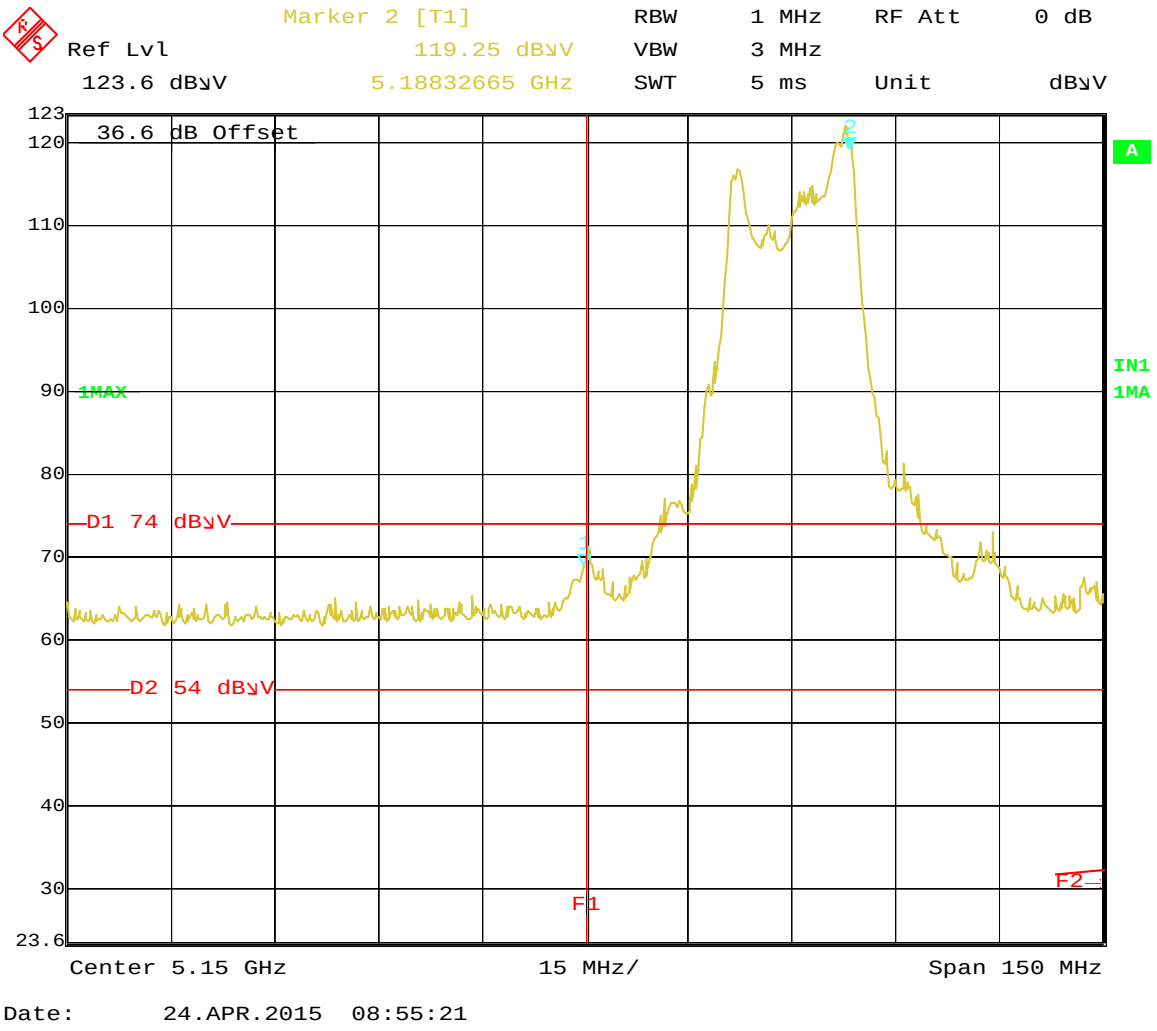


Figure 44: Radiated Emission at the Edge for 5180 MHz HT20 at 6.5Mbps – Vert. (Peak)

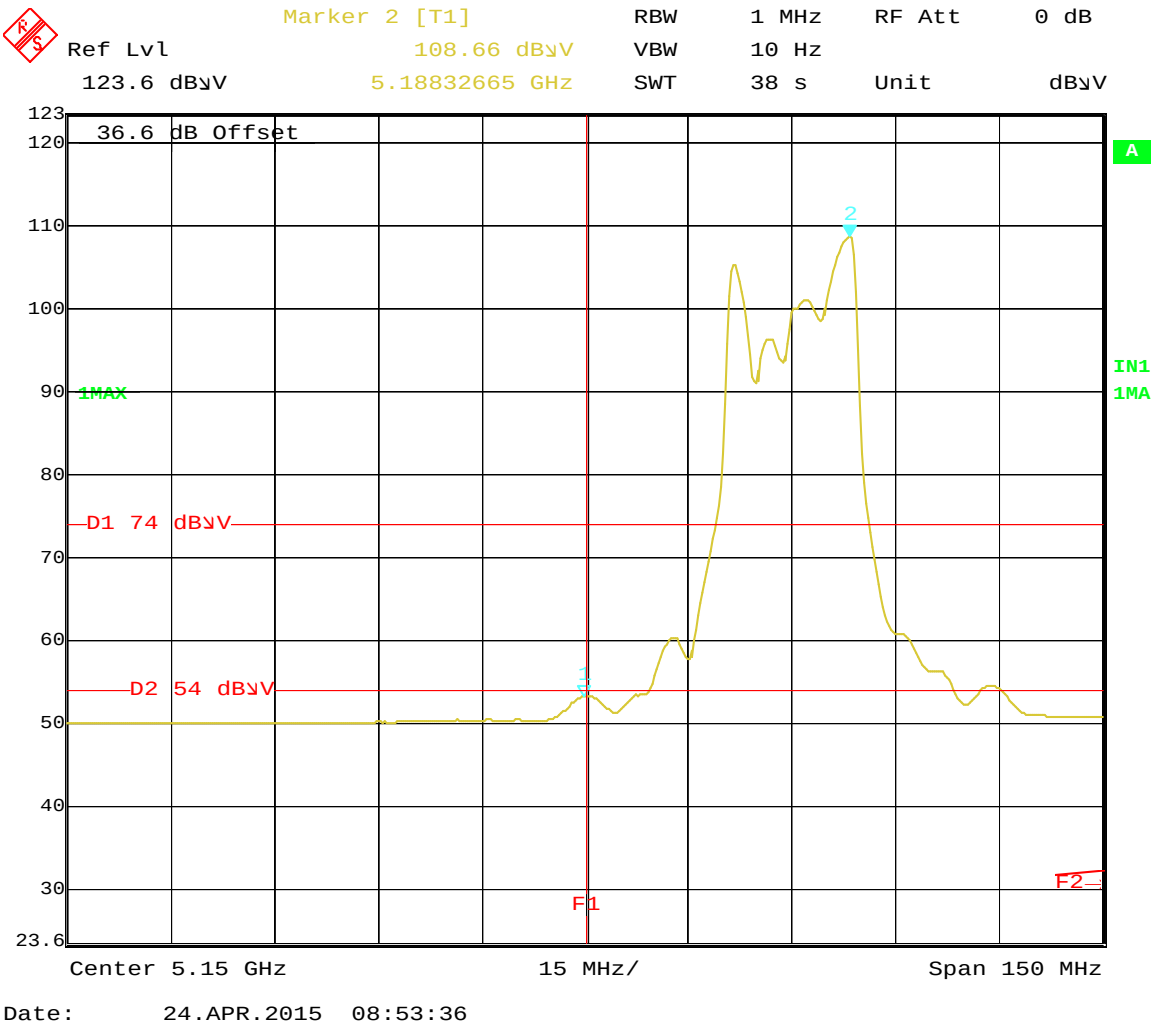


Figure 45: Radiated Emission at the Edge for 5180 MHz HT20 at 6.5Mbps – Vert. (Ave.)

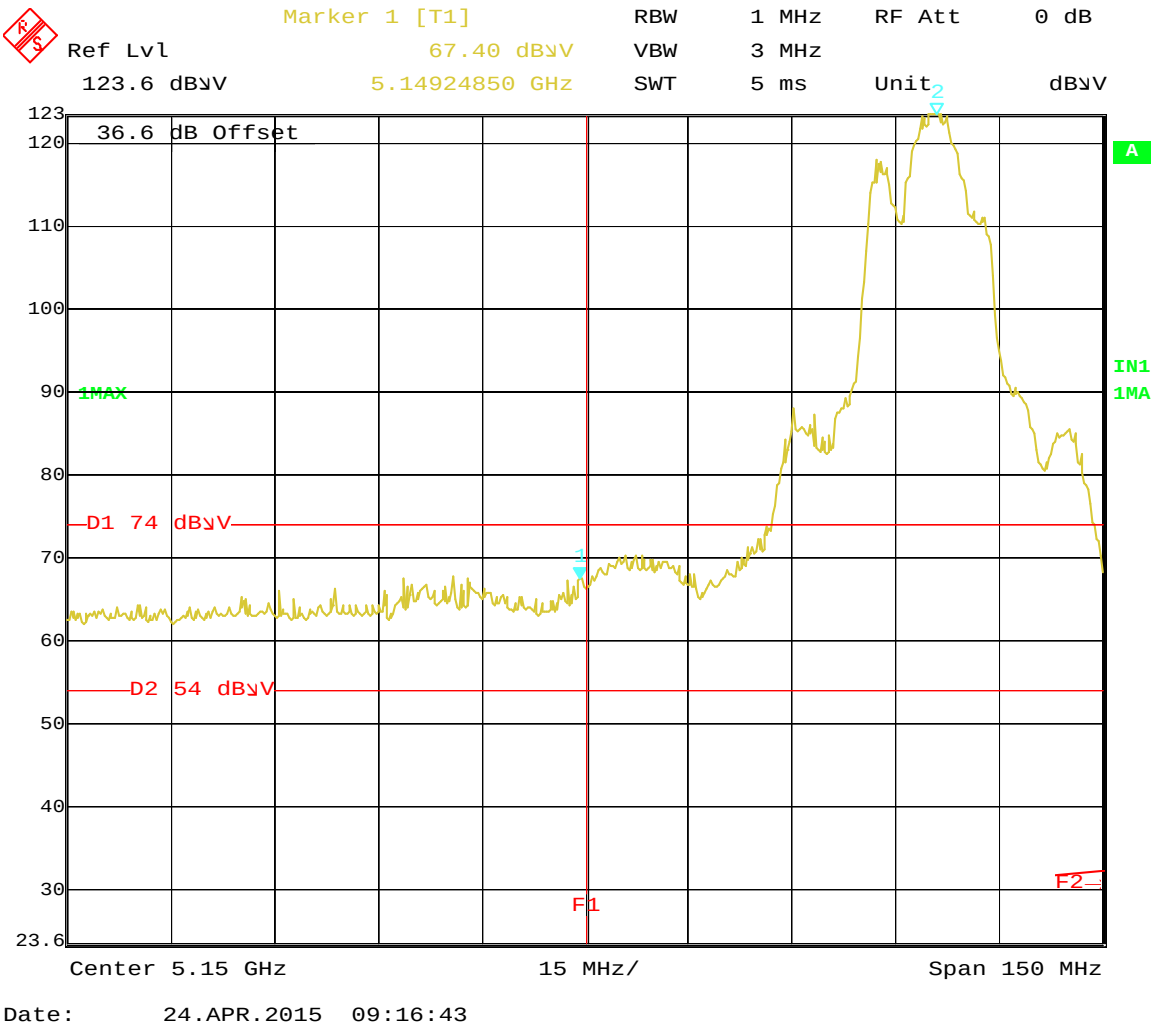


Figure 46: Radiated Emission at the Edge for 5200 MHz HT20 at 6.5Mbps – Vert. (Pk)

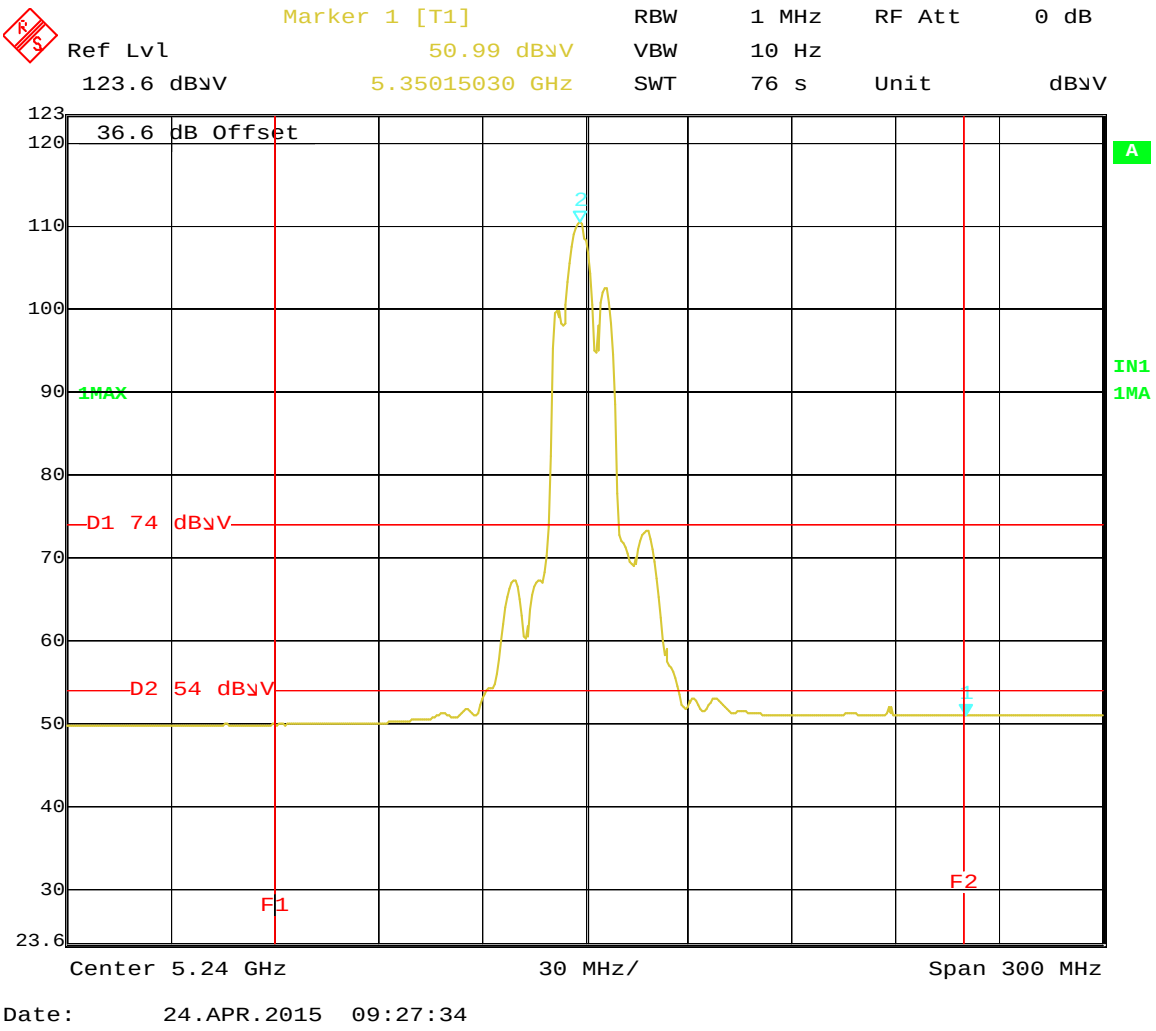


Figure 47: Radiated Emission at the Edge for 5200 MHz HT20 at 6.5Mbps – Vert. (Ave.)

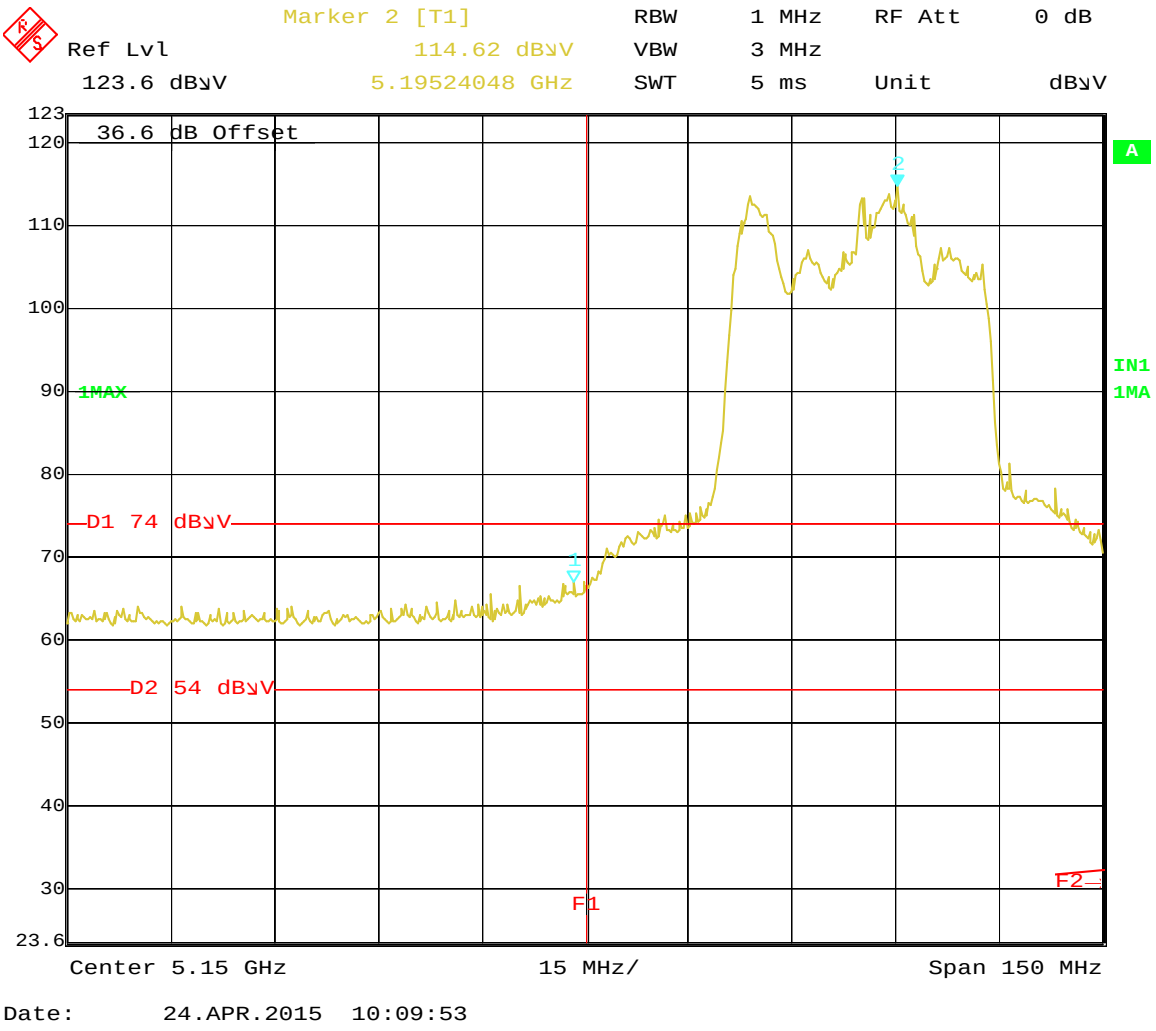


Figure 48: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Vert (Pk)

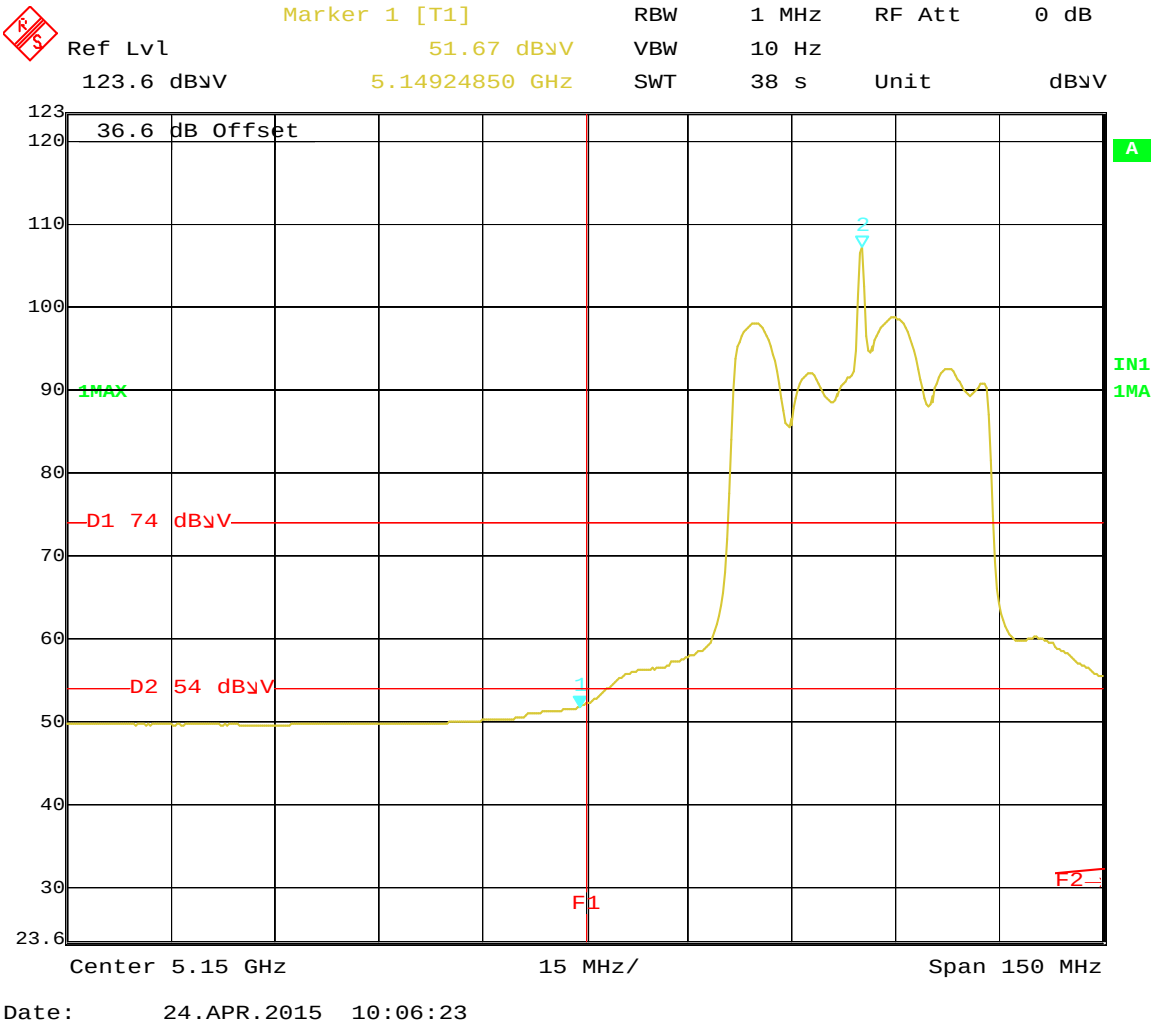


Figure 49: Radiated Emission at the Edge for Channel 5190 MHz at 13.5Mbps – Vert (Avg)

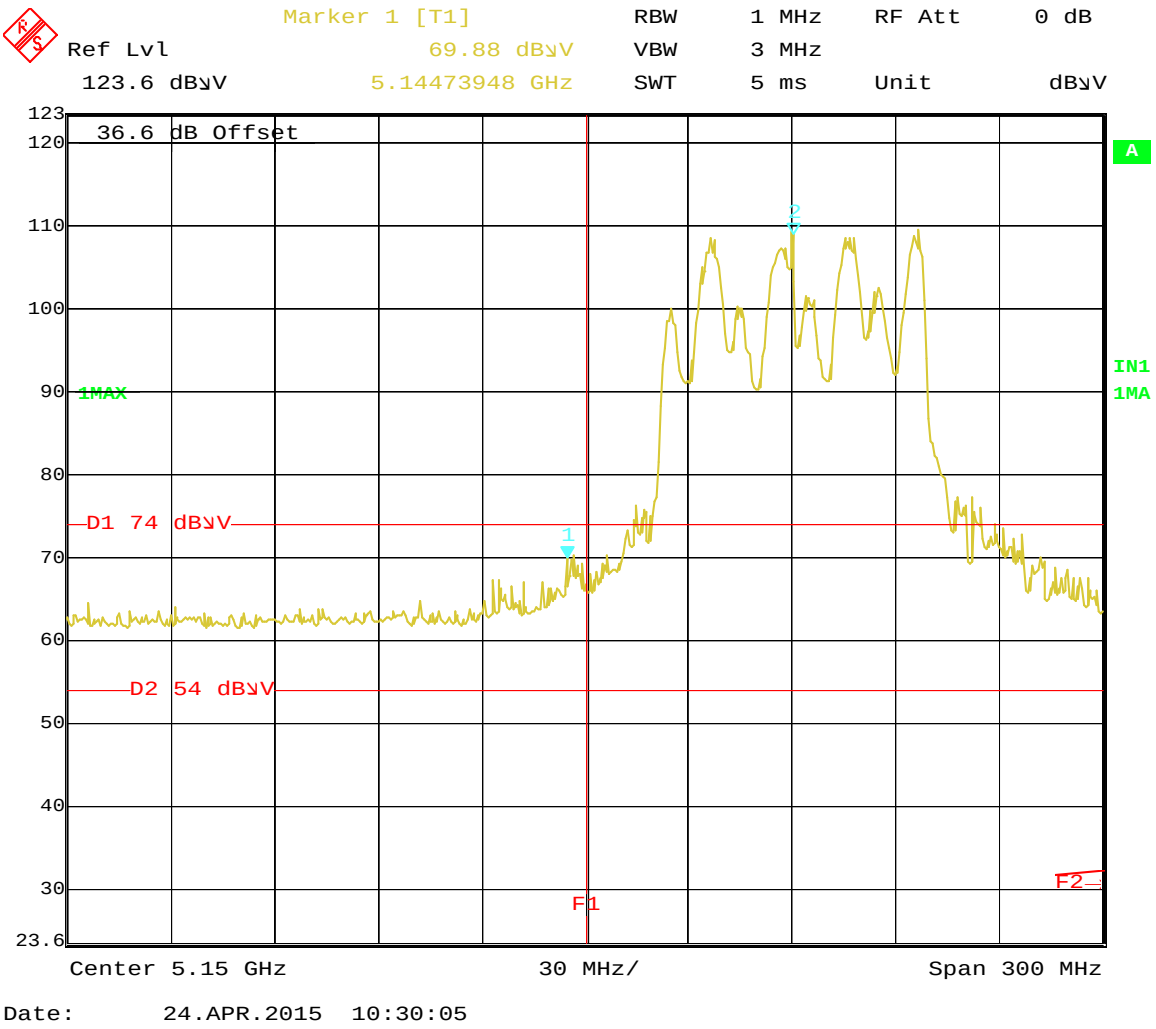


Figure 50: Radiated Emission at the Edge for 5210 MHz VHT 80 at Mbps – V (Pk.)

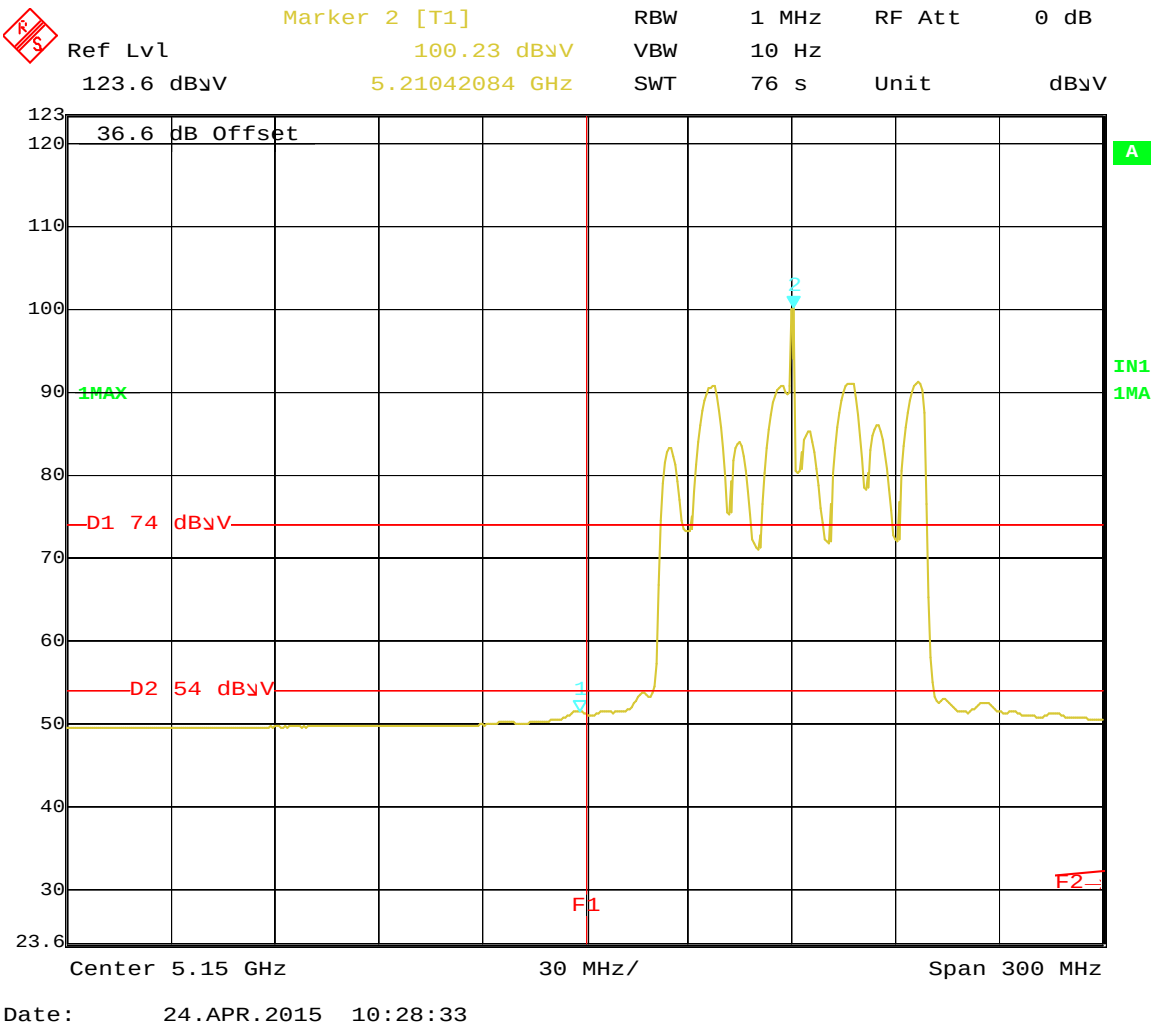


Figure 51: Radiated Emission at the Edge for 5210 MHz VHT 80 at Mbps – V (Ave.)

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000409 Internal antenna unit	**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 to 1 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5200MHz

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	
42.93	52.40	2.72	-20.40	34.71	QP	V	111	14	40.00	-5.29	Pass
47.80	54.68	2.76	-23.12	34.32	QP	V	127	356	40.00	-5.68	Pass
51.80	53.17	2.79	-24.52	31.44	QP	V	110	348	40.00	-8.56	Pass
60.03	54.41	2.85	-25.14	32.12	QP	V	108	48	40.00	-7.88	Pass
132.01	43.98	3.30	-18.90	28.37	QP	V	115	213	43.50	-15.13	Pass
37.57	47.22	2.67	-16.6	33.27	QP	V	108	132	40	-6.73	Pass
1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5180, 5200 and 5240MHz											
2425.67	46.08	1.25	-21.83	25.50	Avg	H	189	280	54.00	-28.50	Pass
2480.20	45.15	1.27	-21.86	24.56	Avg	H	109	78	54.00	-29.44	Pass
17841.12	36.63	3.98	-0.54	40.07	Avg	H	191	64	54.00	-13.93	Pass
5195.45	49.87	1.91	-15.59	36.18	Avg	V	155	332	54.00	-17.82	Pass
10356.47	49.23	2.75	-8.58	43.41	Avg	V	182	174	54.00	-10.59	Pass
15549.44	45.29	3.57	-9.69	39.17	Avg	V	182	-2	54.00	-14.83	Pass
5207.91	61.93	1.91	-15.64	48.19	Avg	H	198	260	54.00	-5.81	Pass
2402.24	44.51	1.24	-21.94	23.82	Avg	V	135	126	54.00	-30.18	Pass
2480.19	45.21	1.27	-21.86	24.62	Avg	V	145	352	54.00	-29.38	Pass
10395.88	47.66	2.79	-8.72	41.74	Avg	V	143	230	54.00	-12.27	Pass
12800.47	40.74	3.06	-9.73	34.06	Avg	V	153	2	54.00	-19.94	Pass
15609.47	46.13	3.55	-9.84	39.84	Avg	V	184	364	54.00	-14.16	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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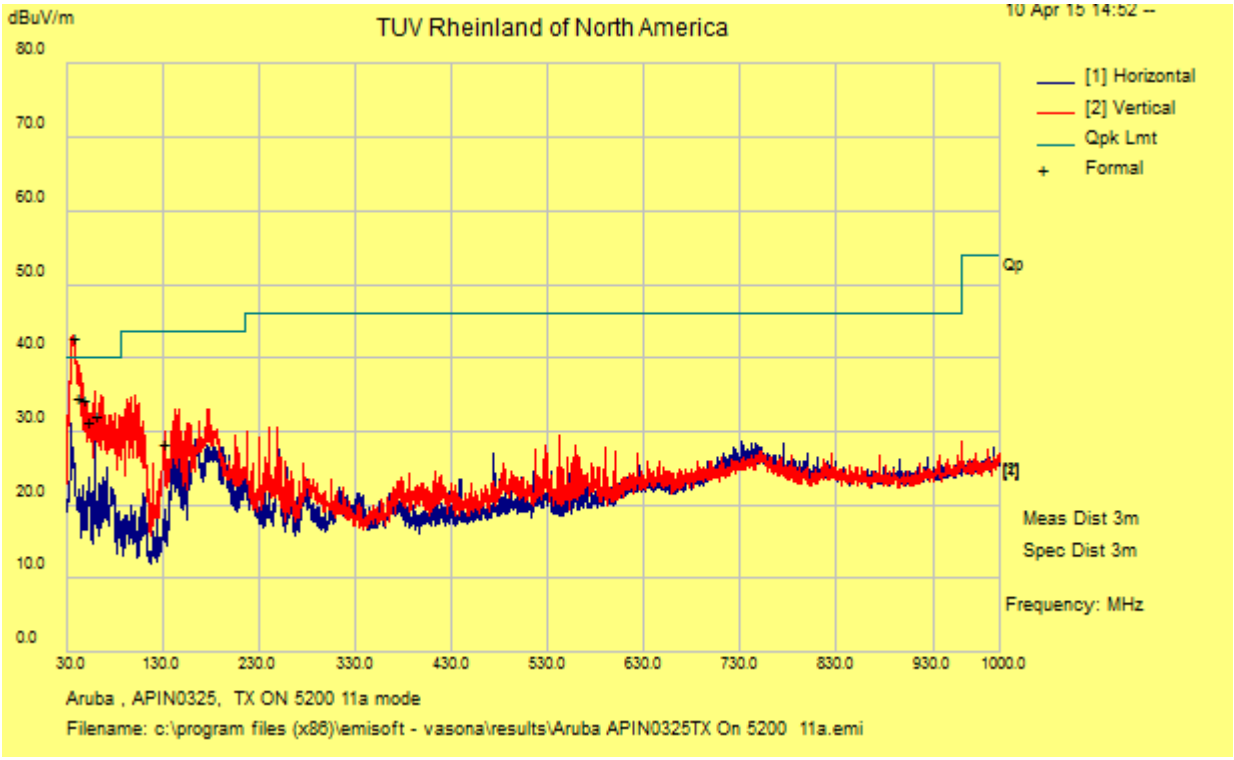
EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 Internal Antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

below 1 GHz Plots for Transmit Mode at 5200 MHz



SOP 1 Radiated Emissions

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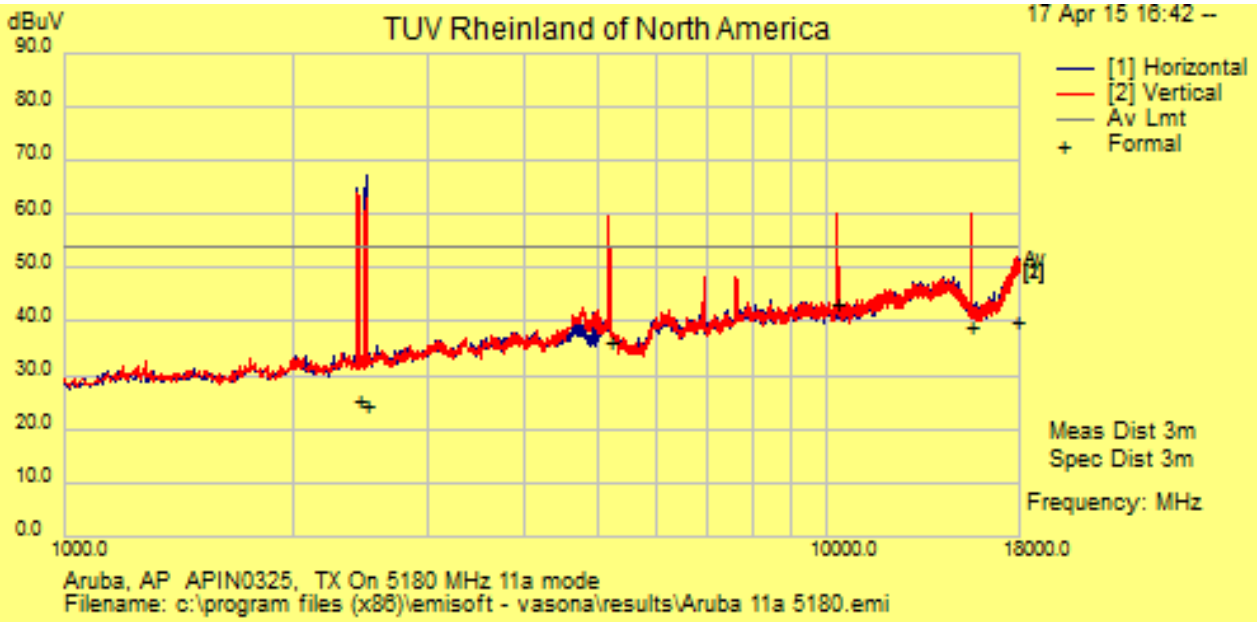
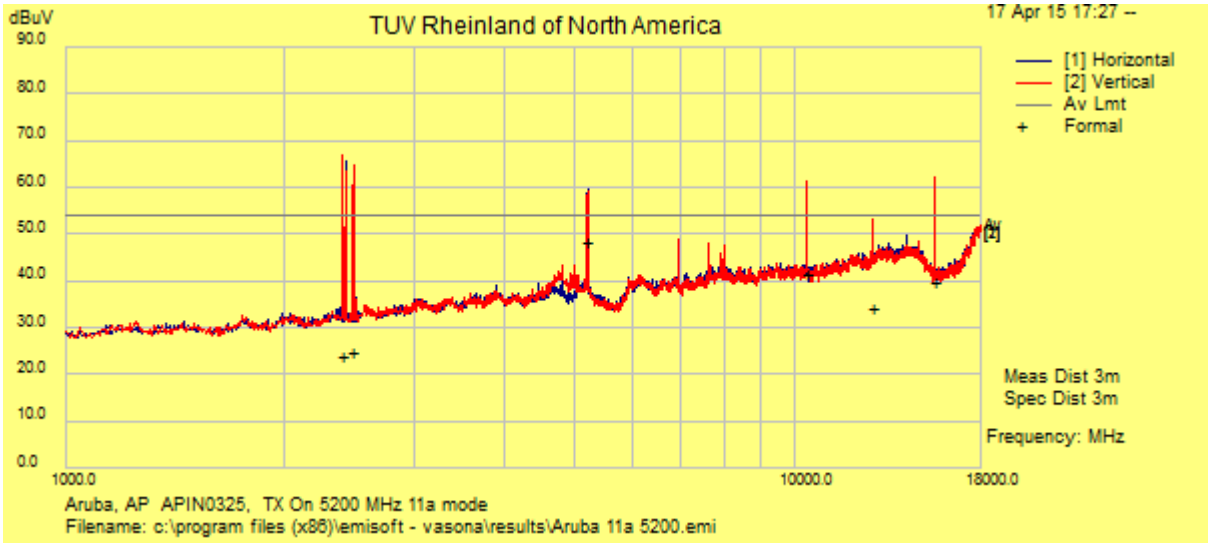
EUT Name	Wireless Access Point	**Date**	Apr 17, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 Internal Antennas	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

1-18 GHz Plots for Transmit Mode 11a at 5180 MHz



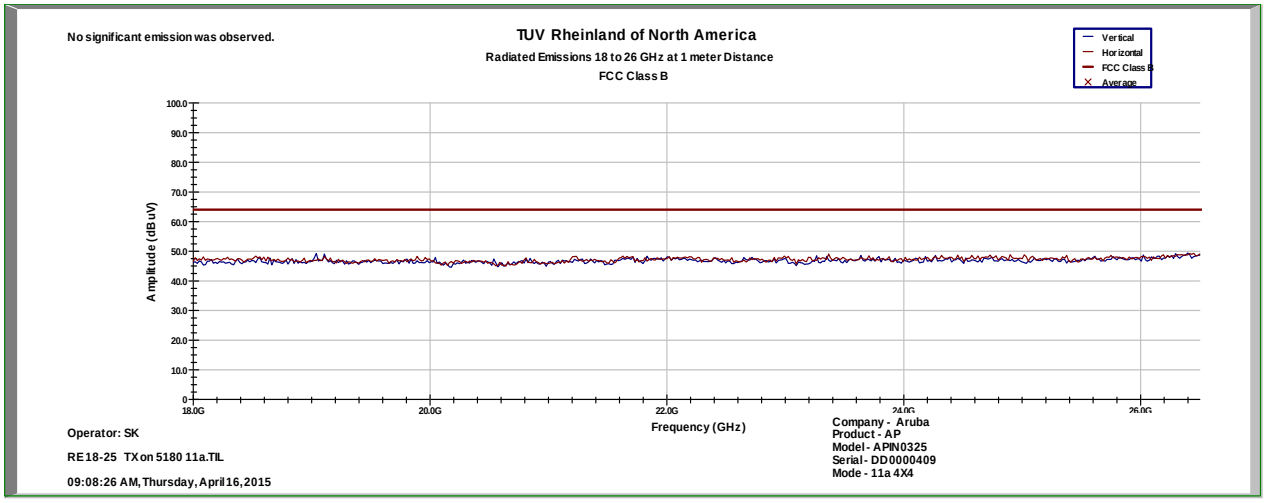
1-18 GHz Plots for Transmit Mode 11a at 5200 MHz



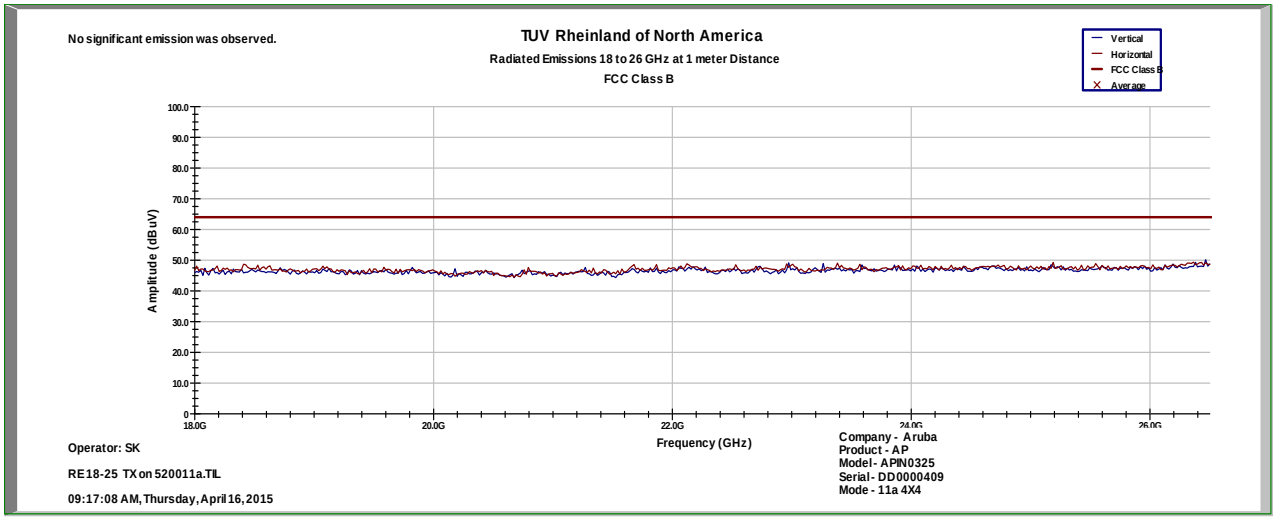
Notes:

SOP 1 Radiated Emissions		Tracking # 31560847.001 Page 4 of 32	
EUT Name	Wireless Access Point	**Date**	Apr 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 Internal Antennas	**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

18-26 GHz Plots for Transmit Mode 11a at 5180 MHz



18-26 GHz Plots for Transmit Mode 11a at 5200 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

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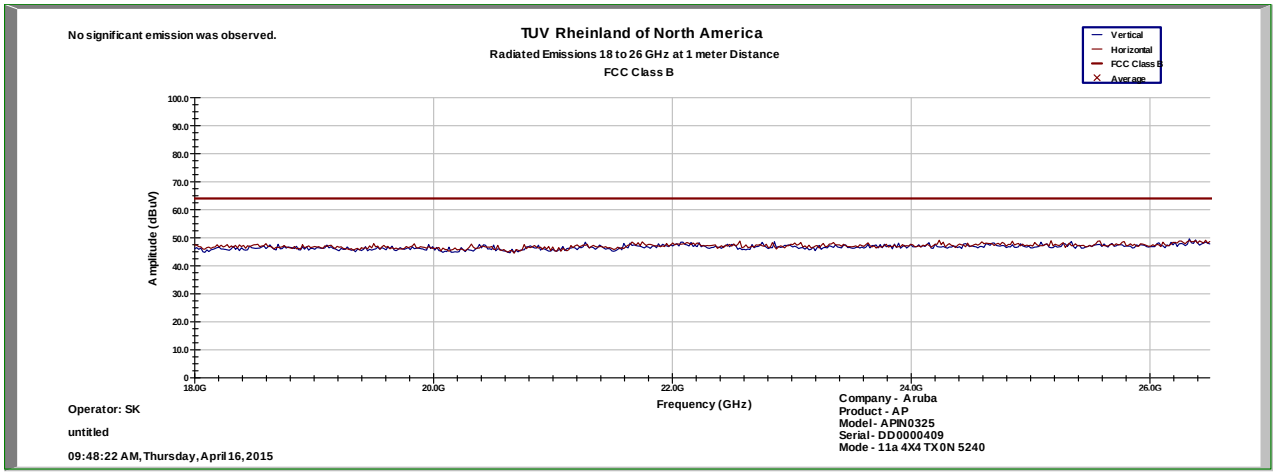
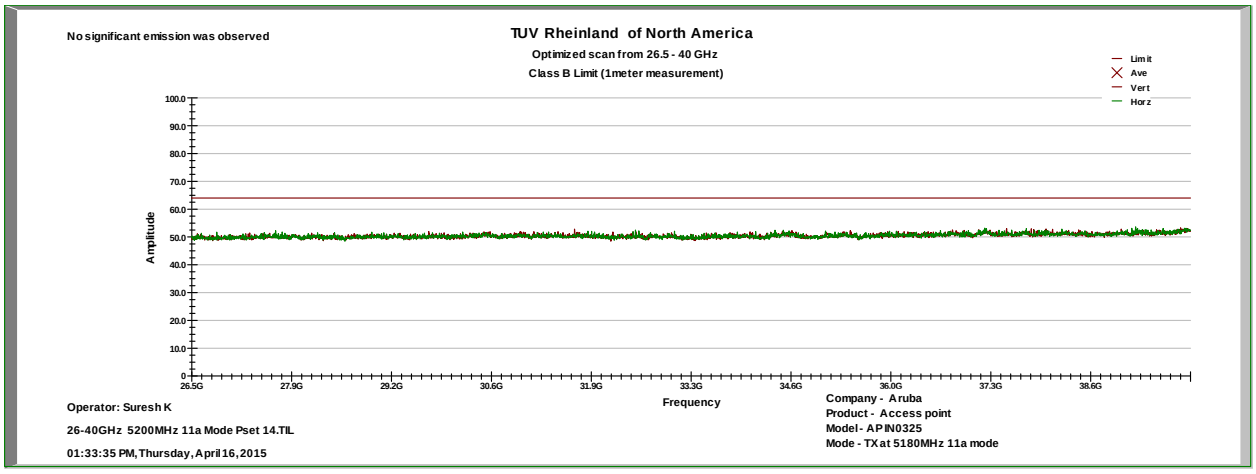
EUT Name	Wireless Access Point	**Date**	Apr 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6.0 Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

18-26 GHz Plots for Transmit Mode 11a at 5240 MHz



26-40 GHz Plots for Transmit Mode 11a at 5200 MHz



Note: Low, mid and high channels were investigated. Mid channel results are placed in the report.

SOP 1 Radiated Emissions		Tracking # 31560847.001 Page 6 of 32	
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD000409 Internal Antenna	**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 5180, 5200 and 5240MHz

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	
4771.17	55.00	1.87	-15.98	40.90	Avg	H	171	-8	54.00	-13.10	Pass
10389.19	54.97	2.79	-8.70	49.06	Avg	H	112	290	54.00	-4.94	Pass
14424.68	53.64	3.34	-7.25	49.73	Avg	H	151	148	54.00	-4.27	Pass
2393.41	56.34	1.24	-21.97	35.61	Avg	V	174	87	54.00	-18.39	Pass
3188.82	55.05	1.44	-19.29	37.20	Avg	V	125	-9	54.00	-16.80	Pass
15605.96	57.54	3.55	-9.85	51.24	Avg	V	146	262	54.00	-2.76	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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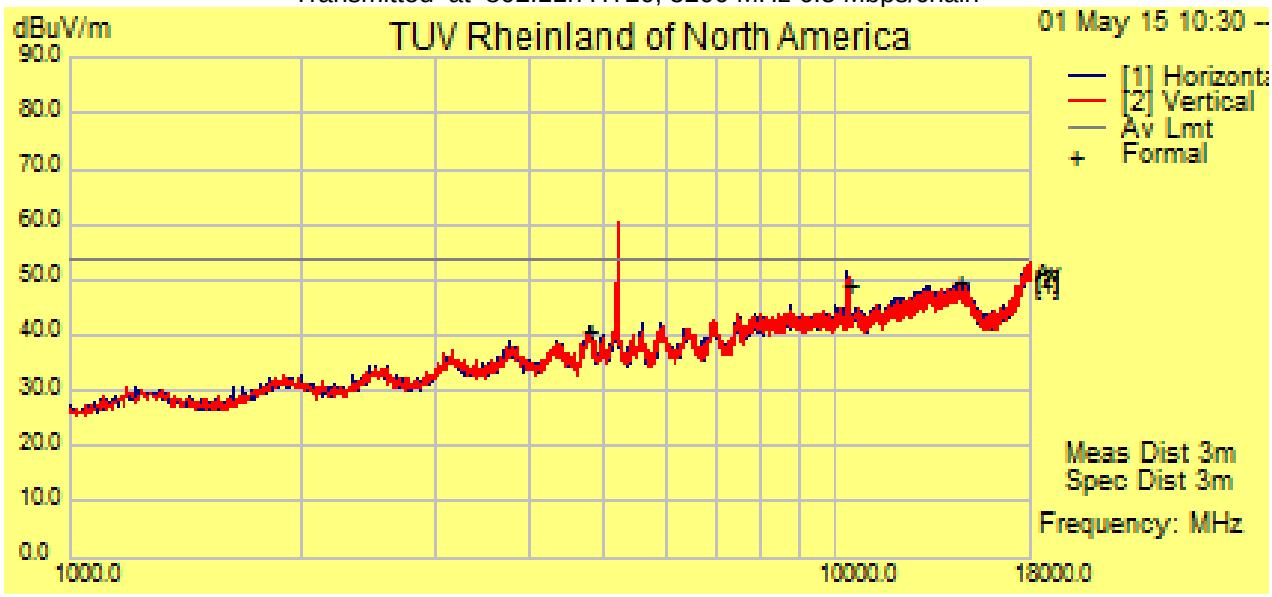
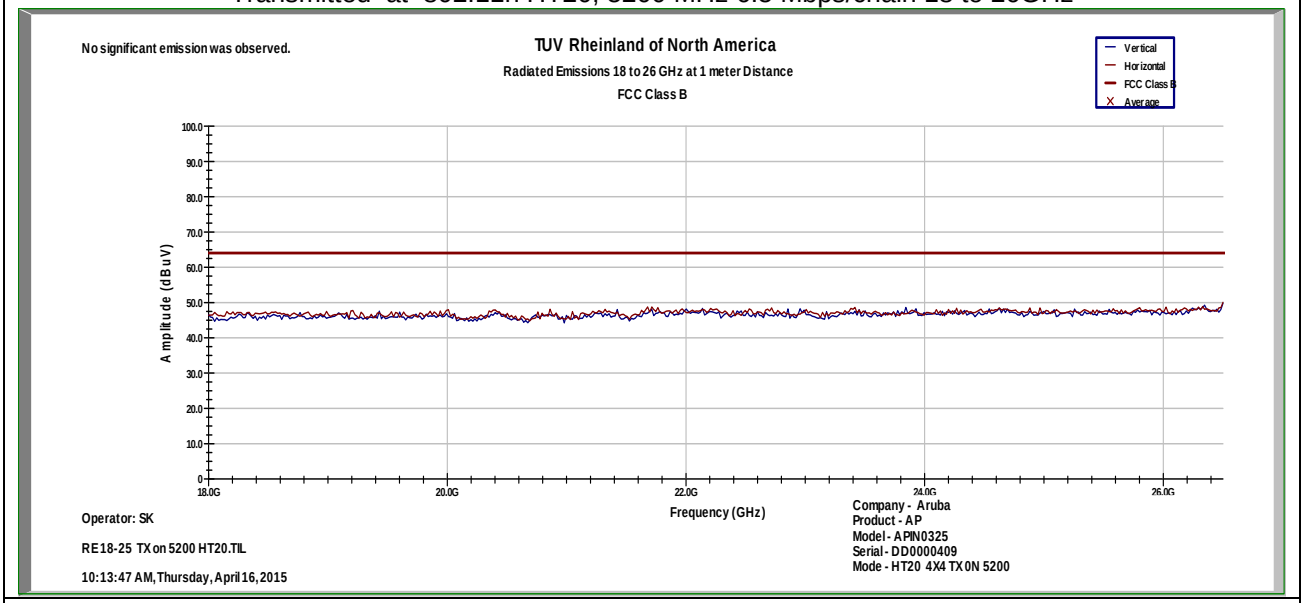
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD000409 Internal Antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT20 at 6.5 Mbps/ chain	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz / 300 kHz
Dist/Ant Used	3m – JB3	**Performed by**	Suresh K

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



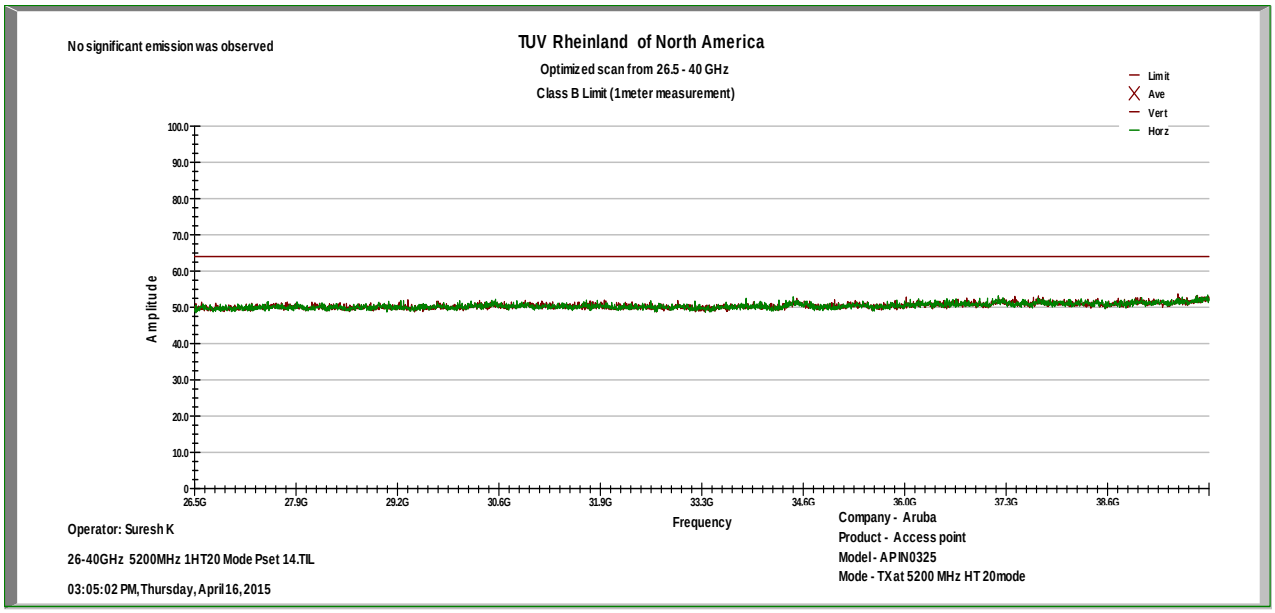
Transmitted at 802.11n HT20, 5200 MHz 6.5 Mbps/chain 18 to 26GHz



Notes: Low, mid and high channels were investigated. Mid channel results are placed in the report.

SOP 1 Radiated Emissions		Tracking # 31560847.001 Page 8 of 32	
EUT Name	Wireless Access Point	**Date**	Apr 16, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD000409	**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
26 to 40GHz



Notes: Low, mid and high channels were investigated. Mid channel results are placed in the report.

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EUT Name	Wireless Access Point	**Date**	Apr 10, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000409 Internal Antenna	**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

30 -1000 MHz Transmitted at 802.11 HT40 11Mbps/chain TX On 5190, 5230,

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	
30.61	43.16	2.60	-11.27	34.49	QP	V	100	220	40.00	-5.52	Pass
54.78	53.97	2.81	-25.10	31.68	QP	V	100	246	40.00	-8.32	Pass
68.22	53.43	2.91	-24.55	31.79	QP	V	100	242	40.00	-8.21	Pass
73.97	49.94	2.95	-24.50	28.39	QP	V	128	263	40.00	-11.62	Pass
86.05	48.64	3.04	-25.23	26.45	QP	V	142	164	40.00	-13.55	Pass
833.21	24.43	5.59	-10.91	19.11	QP	V	220	209	46.00	-26.89	Pass
1 -18GHz Transmitted at 802.11 HT40 11Mbps/chain TX On 5190, 5230											
6975.65	54.20	2.18	-12.80	43.58	Avg	H	153	54	54.00	-10.42	Pass
10472.75	51.32	2.83	-8.81	45.34	Avg	H	169	342	54.00	-8.66	Pass
13309.67	55.41	3.22	-8.92	49.71	Avg	H	163	54	54.00	-4.29	Pass
15689.56	51.20	3.51	-9.83	44.88	Avg	V	112	258	54.00	-9.12	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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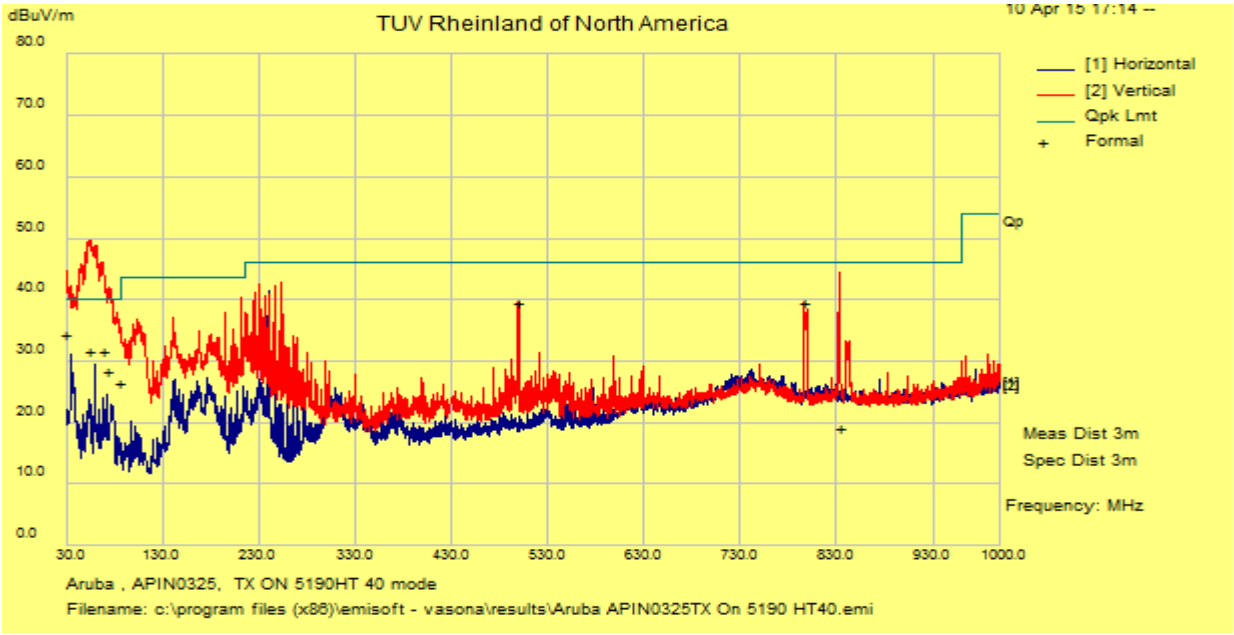
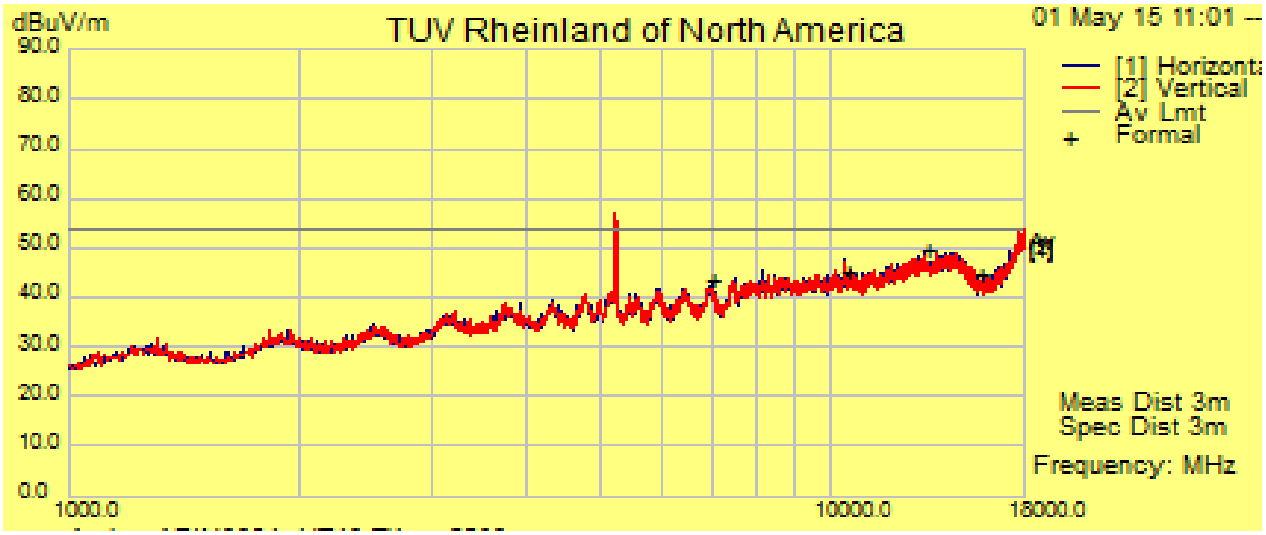
EUT Name	Wireless Access Point	**Date**	April 10 & May01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 Internal Antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT40/ VHT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh K

30 to 1000MHz Plots for HT40/VHT40 Transmit Mode at 5190 MHz



1 to 18GHz Plots for HT40/VHT40 Transmit Mode at 5230MHz



Notes:

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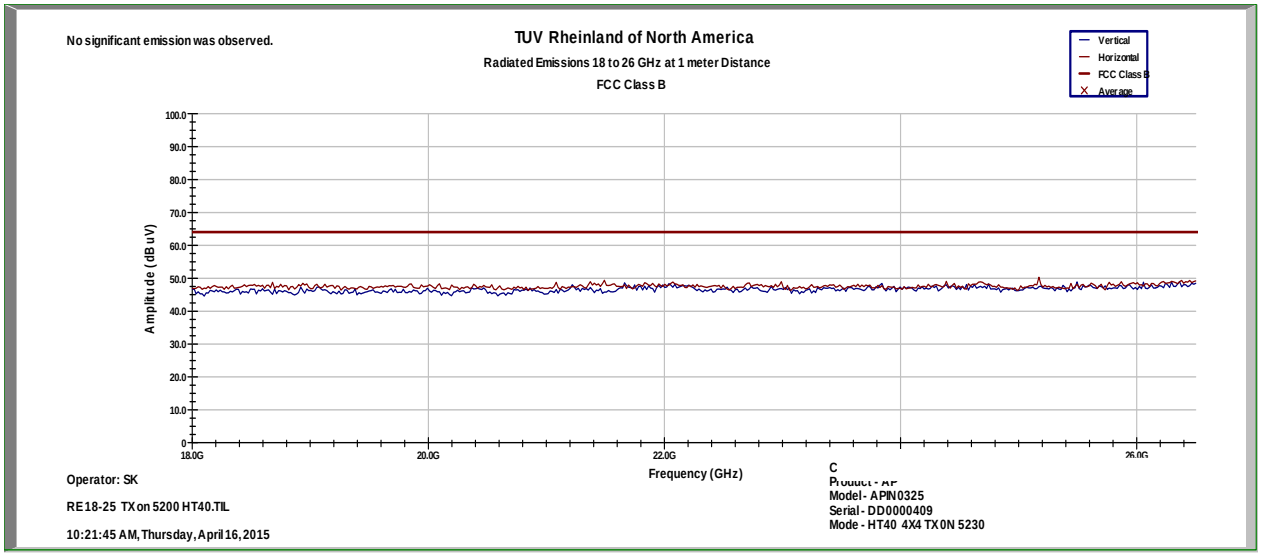
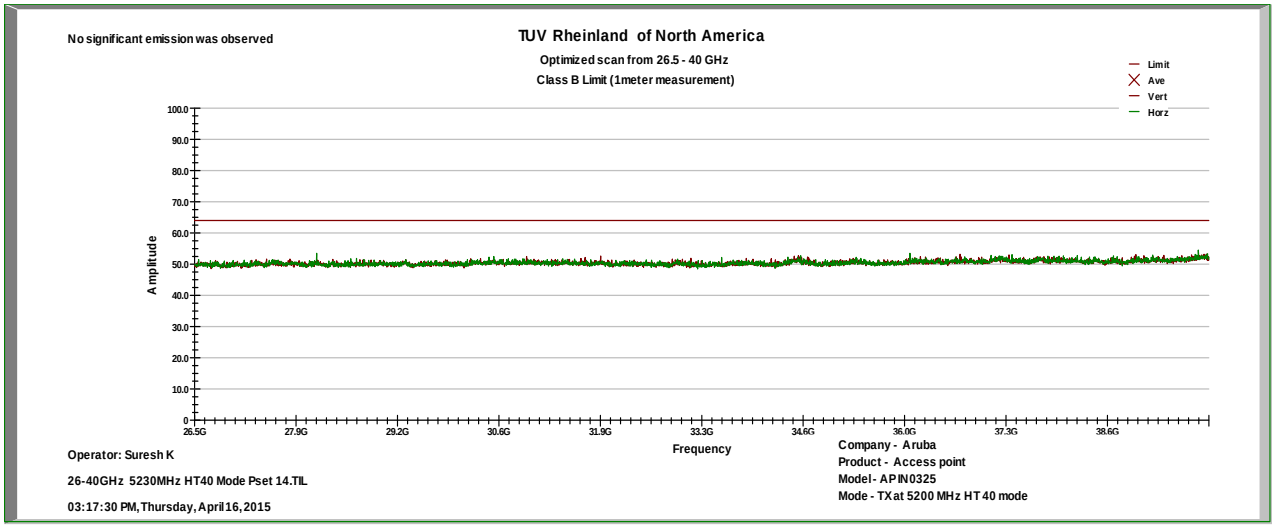
EUT Name	Wireless Access Point	**Date**	Apr 18, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11n HT40/VHT40 at 11Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant 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.
Note: Low, mid and high channels were investigated. Mid channel results are placed in the report.

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EUT Name	Wireless Access Point	**Date**	Apr 13, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000409 Internal antenna	**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

30 MHz- 1 GHz Transmitted at 802.11AC HT80 TX On 5210

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	
58.74	51.45	2.84	-25.14	29.15	QP	V	184	52	40.00	-10.85	Pass
66.28	50.58	2.90	-24.69	28.80	QP	V	104	162	40.00	-11.20	Pass
69.12	47.77	2.92	-24.48	26.21	QP	V	132	172	40.00	-13.79	Pass
90.91	47.31	3.06	-24.99	25.38	QP	V	121	264	43.50	-18.12	Pass
101.88	48.48	3.14	-21.83	29.79	QP	V	100	207	43.50	-13.71	Pass
206.55	36.51	3.66	-21.05	19.12	QP	V	105	130	43.50	-24.39	Pass
1 to 18 GHz Transmitted at 802.11AC HT80 TX On 5210											
5458.50	55.88	1.94	-15.52	42.30	Avg	V	198	274	54.00	-11.70	Pass
6971.94	54.50	2.18	-12.81	43.87	Avg	V	175	334	54.00	-10.13	Pass
10418.25	54.63	2.80	-8.84	48.59	Avg	V	165	290	54.00	-5.41	Pass
14569.15	54.11	3.41	-7.29	50.24	Avg	V	155	216	54.00	-3.76	Pass
15631.46	50.73	3.55	-9.79	44.49	Avg	V	164	22	54.00	-9.51	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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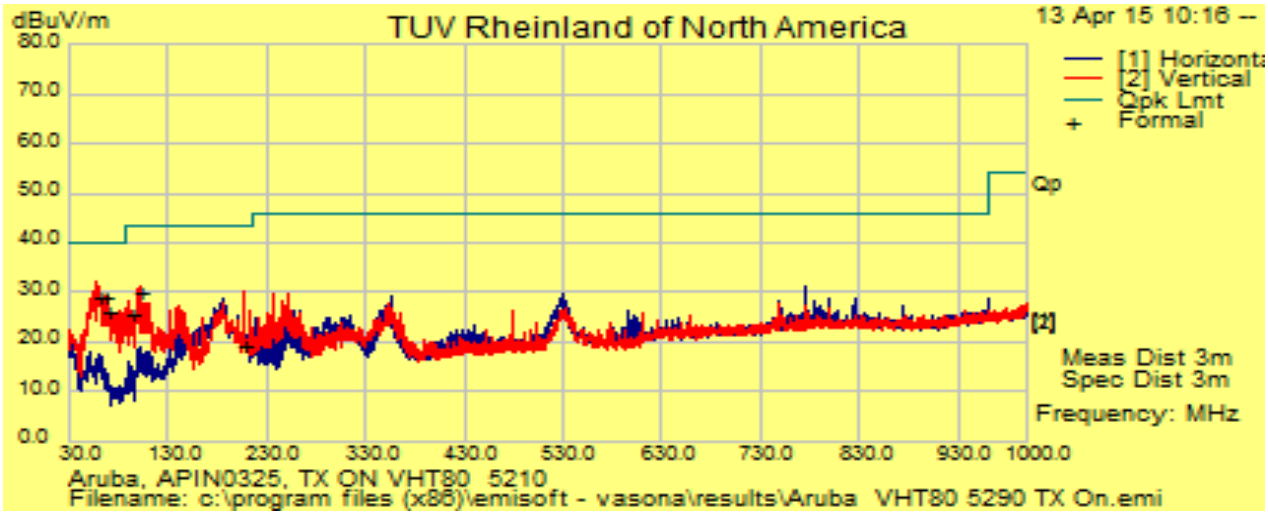
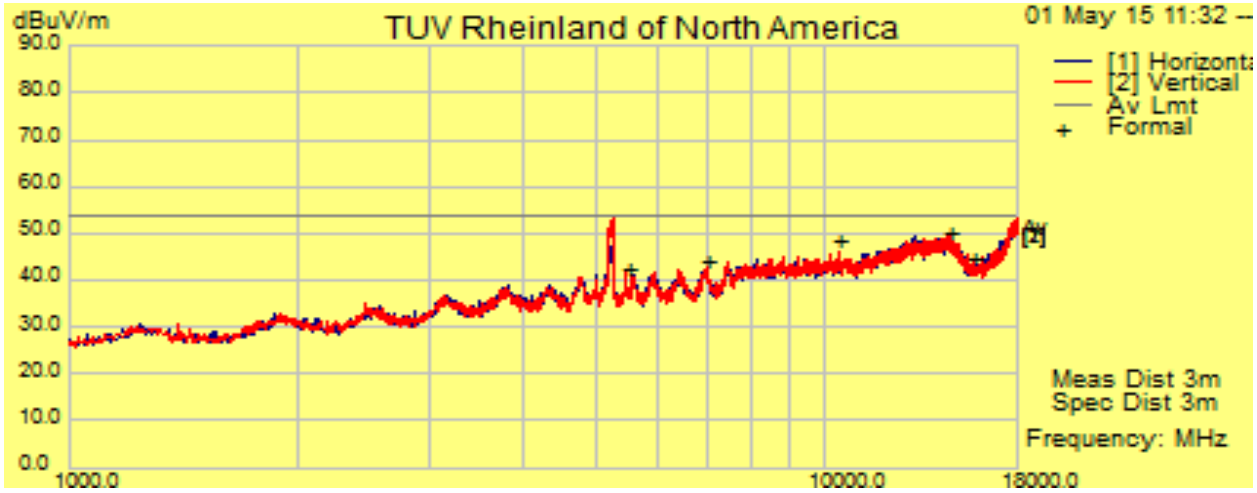
EUT Name	Wireless Access Point	**Date**	Apr 13, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 internal Antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11AC VHT80	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode at 5210 MHz



1 -18 GHz Plot for Transmit Mode at 5210 MHz



Notes

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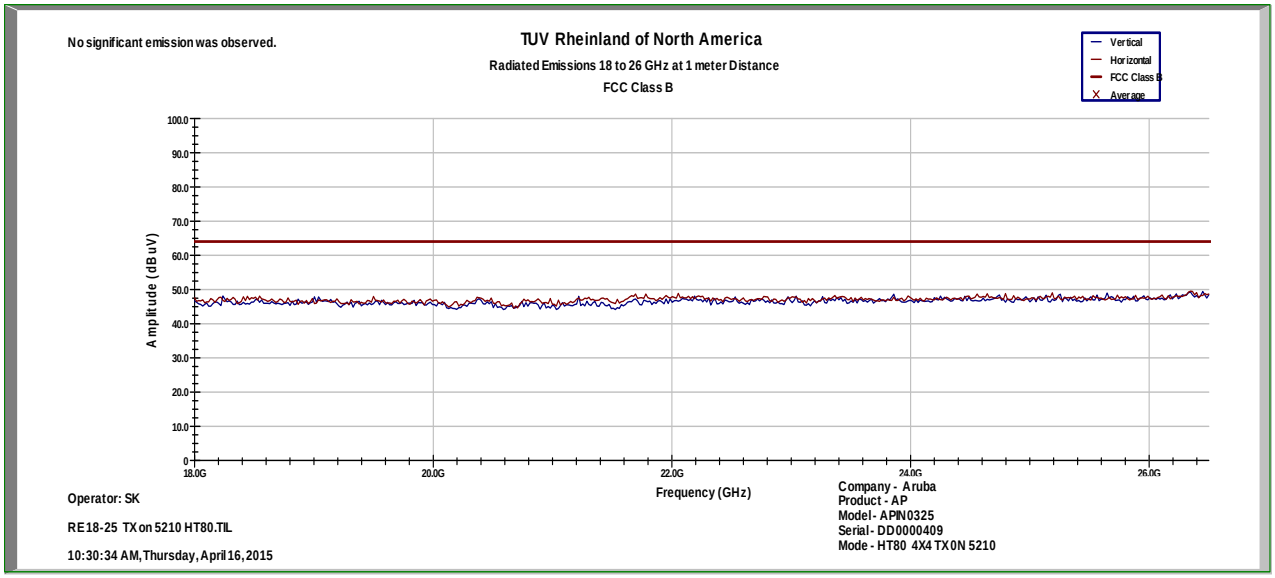
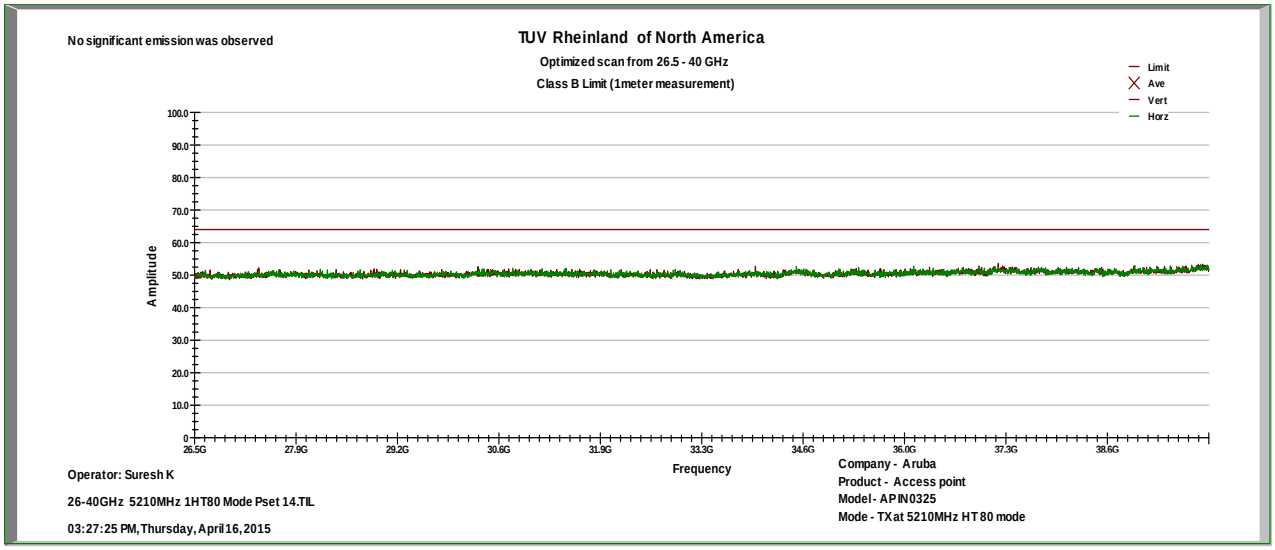
EUT Name	Wireless Access Point	**Date**	Apr 13, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000409 Internal antenna	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11AC VHT80	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

18 -26 GHz Plot for Transmit Mode at 5210 MHz



26 -40 GHz Plot for Transmit Mode at 5210 MHz



Notes: Limit was extrapolated to 1m distance for 18 GHz – 40 GHz range. No Emissions were found 18 to 40GHz range Low, mid and high channels were investigated. Mid channel results are placed in the report.

Radiated Emissions data with APIN0324 External Antennas

SOP 1 Radiated Emissions		Tracking # 31560847.001 Page 15 of 32	
EUT Name	Wireless Access Point	**Date**	Apr 13, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000501 External Antenna Ant 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a 6Mbps	**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

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	
1-18 GHz Transmitted at 802.11a TX On 5180											
2425.50	41.38	1.25	-21.83	20.81	Avg	H	174	222	65.20	-44.39	Pass
6906.77	47.80	2.16	-13.10	36.85	Avg	H	163	92	65.20	-28.35	Pass
14461.08	39.08	3.38	-7.34	35.13	Avg	H	114	68	65.20	-30.07	Pass
2480.31	41.56	1.27	-21.86	20.97	Avg	V	150	320	65.20	-44.23	Pass
10369.65	38.74	2.78	-8.64	32.87	Avg	V	145	168	65.20	-32.33	Pass
15534.33	36.65	3.58	-9.71	30.51	Avg	V	201	128	65.20	-34.69	Pass
1-18 GHz Transmitted at 802.11a TX On 5200											
14494.43	39.17	3.38	-7.40	35.16	Avg	H	155	208	65.20	-30.04	Pass
2402.06	41.95	1.24	-21.94	21.25	Avg	V	107	180	65.20	-43.95	Pass
10394.43	41.35	2.79	-8.71	35.43	Avg	V	139	50	65.20	-29.77	Pass
15589.05	37.53	3.56	-9.89	31.21	Avg	V	162	126	65.20	-33.99	Pass
1-18 GHz Transmitted at 802.11a TX On 5240											
14112.86	39.70	3.16	-8.22	34.63	Avg	H	118	194	65.20	-30.57	Pass
17839.11	36.47	3.98	-0.58	39.87	Avg	H	130	304	65.20	-25.33	Pass
2425.67	41.55	1.25	-21.83	20.98	Avg	V	121	172	65.20	-44.22	Pass
10474.07	44.62	2.83	-8.81	38.64	Avg	V	183	38	65.20	-26.56	Pass
15738.46	36.45	3.50	-9.70	30.25	Avg	V	103	232	65.20	-34.95	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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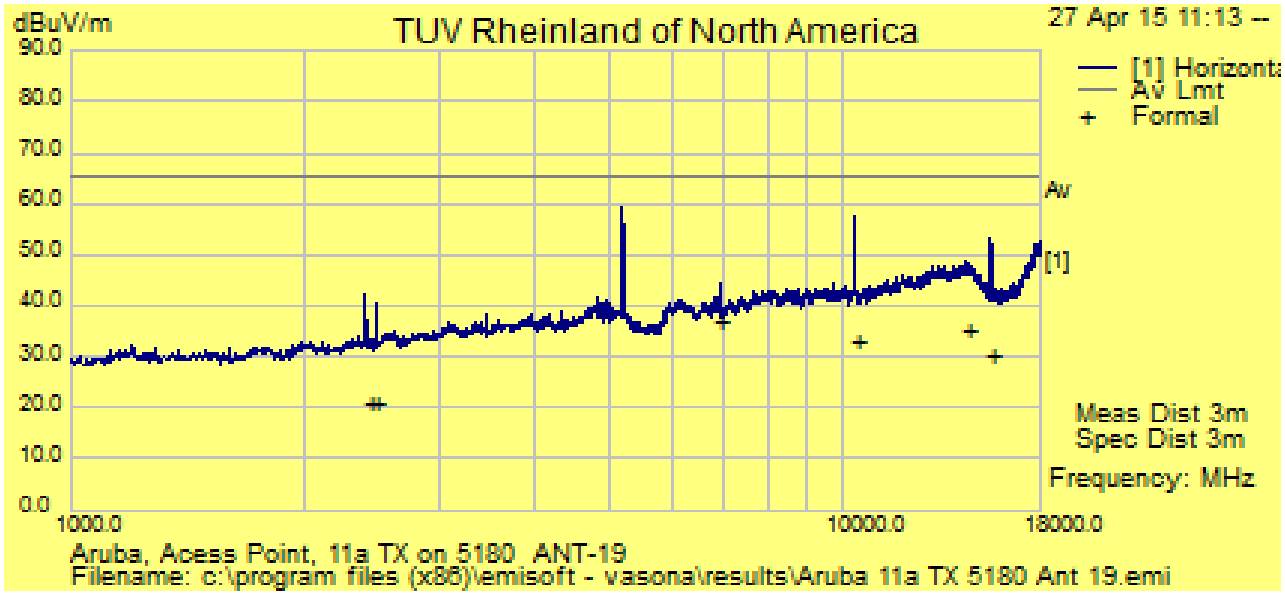
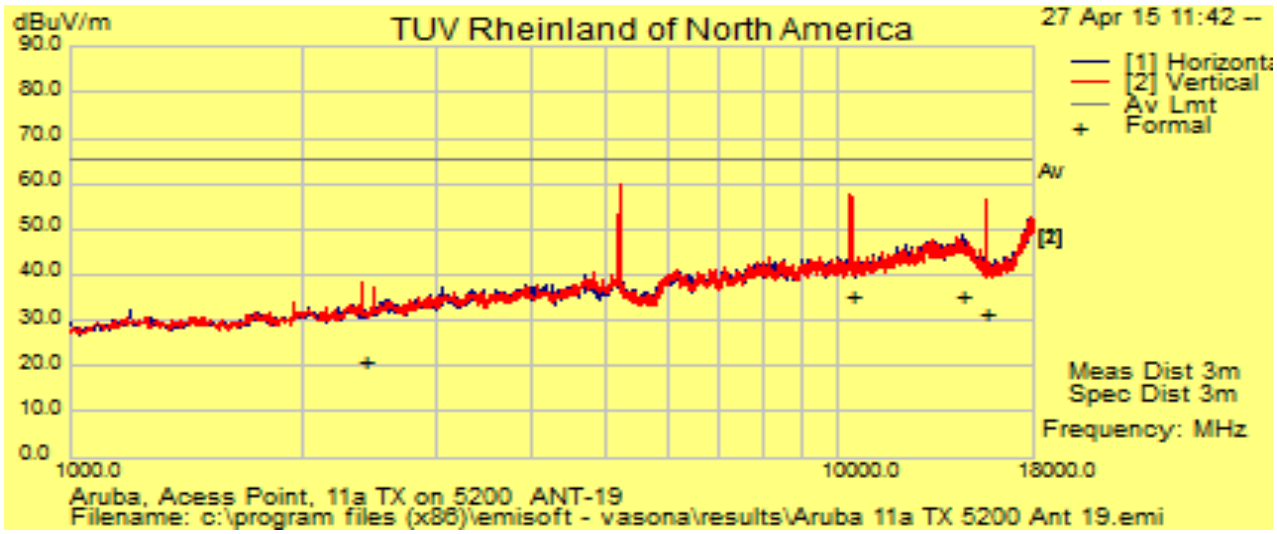
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000501 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode 11a at 5180 MHz



1 -18 GHz Plot for Transmit Mode at 5200 MHz



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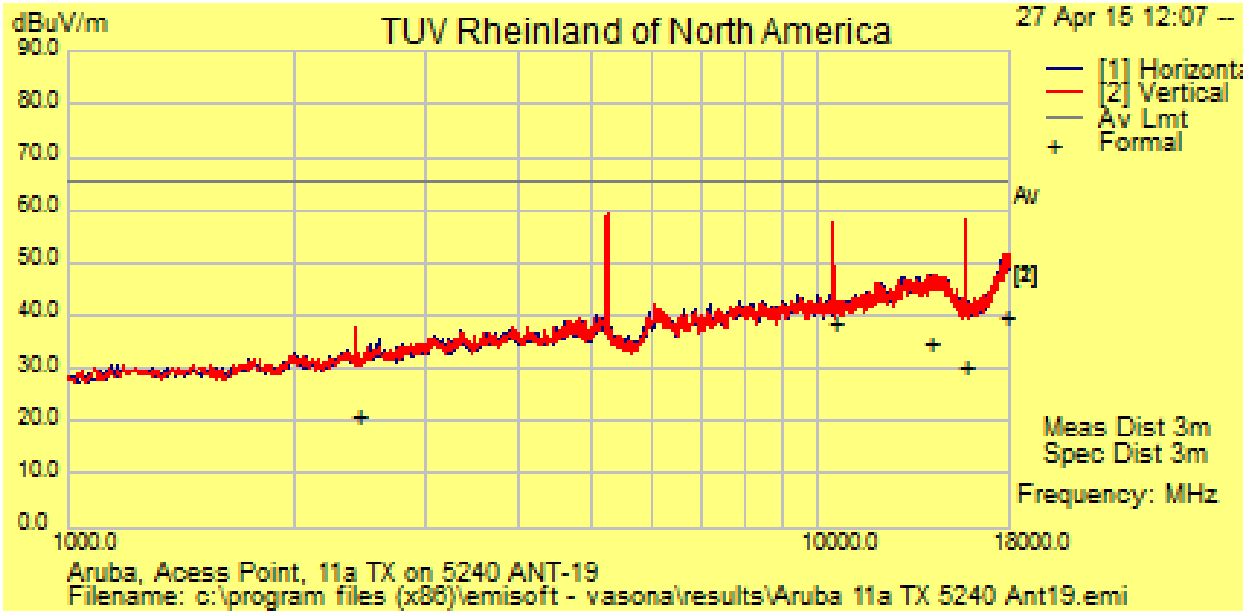
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000501 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

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



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EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 External Antenna ANT 48	**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 - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5180MHz

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	
2425.50	41.38	1.25	-21.83	20.81	Avg	H	174	222	65.20	-44.39	Pass
6906.77	47.80	2.16	-13.10	36.85	Avg	H	163	92	65.20	-28.35	Pass
14461.08	39.08	3.38	-7.34	35.13	Avg	H	114	68	65.20	-30.07	Pass
2480.31	41.56	1.27	-21.86	20.97	Avg	V	150	320	65.20	-44.23	Pass
10369.65	38.74	2.78	-8.64	32.87	Avg	V	145	168	65.20	-32.33	Pass
1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5200,											
14494.43	39.17	3.38	-7.40	35.16	Avg	H	155	208	65.20	-30.04	Pass
2402.06	41.95	1.24	-21.94	21.25	Avg	V	107	180	65.20	-43.95	Pass
10394.43	41.35	2.79	-8.71	35.43	Avg	V	139	50	65.20	-29.77	Pass
15589.05	37.53	3.56	-9.89	31.21	Avg	V	162	126	65.20	-33.99	Pass
1 to 18 GHz Transmitted at 802.11a MHz 6Mbps/chain TX On 5240,											
14112.86	39.70	3.16	-8.22	34.63	Avg	H	118	194	65.20	-30.57	Pass
17839.11	36.47	3.98	-0.58	39.87	Avg	H	130	304	65.20	-25.33	Pass
2425.67	41.55	1.25	-21.83	20.98	Avg	V	121	172	65.20	-44.22	Pass
10474.07	44.62	2.83	-8.81	38.64	Avg	V	183	38	65.20	-26.56	Pass
15738.46	36.45	3.50	-9.70	30.25	Avg	V	103	232	65.20	-34.95	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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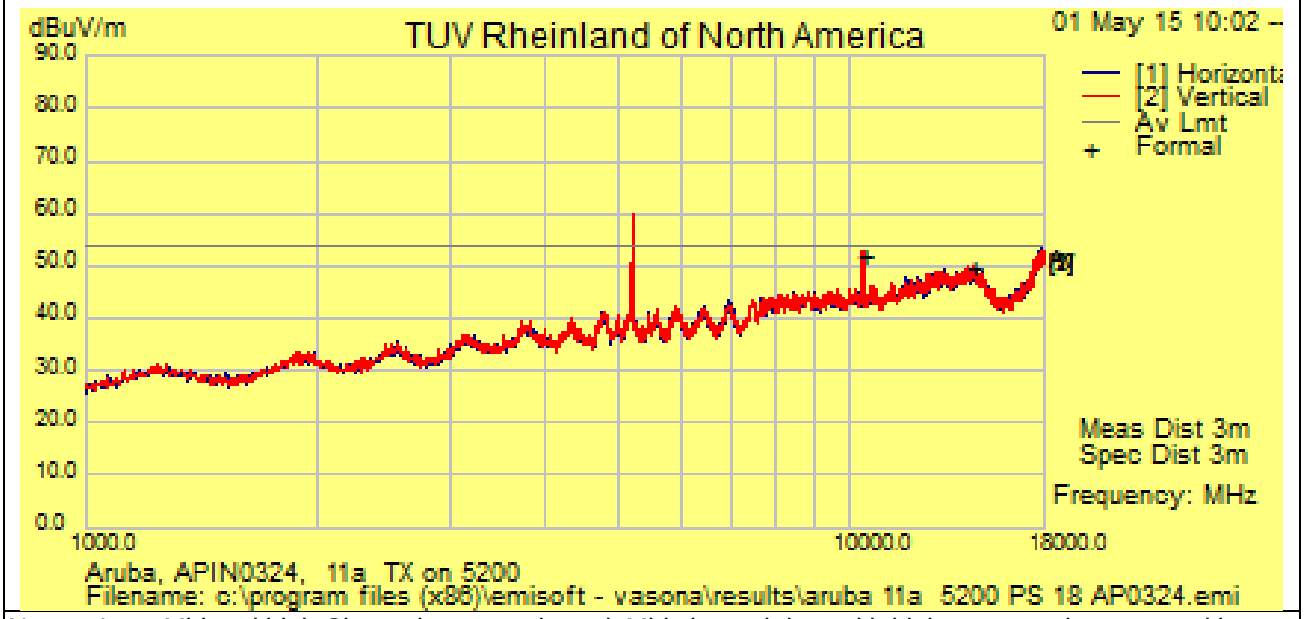
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000501 ANT 48	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11a at 6Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode 11a at 5200 MHz



Notes: Low, Mid and high Channel were evaluated. Mid channel data with highest power is presented here

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EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT 20 6.5Mbps	**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

1-18 GHz Transmitted at 802.11 HT20 TX On 5180

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	
13043.49	40.07	3.17	-8.89	34.35	Avg	H	127	50	65.20	-30.85	Pass
2483.46	41.43	1.27	-21.86	20.84	Avg	V	160	126	65.20	-44.36	Pass
6906.57	47.83	2.16	-13.10	36.89	Avg	V	116	204	65.20	-28.31	Pass
10372.00	37.51	2.78	-8.65	31.64	Avg	V	159	152	65.20	-33.56	Pass
15555.84	35.88	3.57	-9.74	29.71	Avg	V	156	151	65.20	-35.49	Pass
1-18 GHz Transmitted at 802.11 HT20 TX On 5200											
2480.21	41.65	1.27	-21.86	21.06	Avg	H	140	22	65.20	-44.14	Pass
14553.99	38.84	3.42	-7.42	34.84	Avg	H	145	186	65.20	-30.36	Pass
10407.03	46.90	2.79	-8.77	40.93	Avg	V	179	16	65.20	-24.28	Pass
15599.46	36.77	3.55	-9.87	30.45	Avg	V	141	66	65.20	-34.75	Pass
1-18 GHz Transmitted at 802.11 HT 20 TX On 5240											
2480.32	41.61	1.27	-21.86	21.02	Avg	H	189	200	65.20	-44.18	Pass
14376.21	38.96	3.32	-7.33	34.96	Avg	H	150	144	65.20	-30.25	Pass
2401.81	41.86	1.24	-21.94	21.17	Avg	V	189	218	65.20	-44.04	Pass
10491.63	42.78	2.83	-8.90	36.71	Avg	V	124	170	65.20	-28.49	Pass
15724.33	37.64	3.51	-9.75	31.39	Avg	V	158	32	65.20	-33.81	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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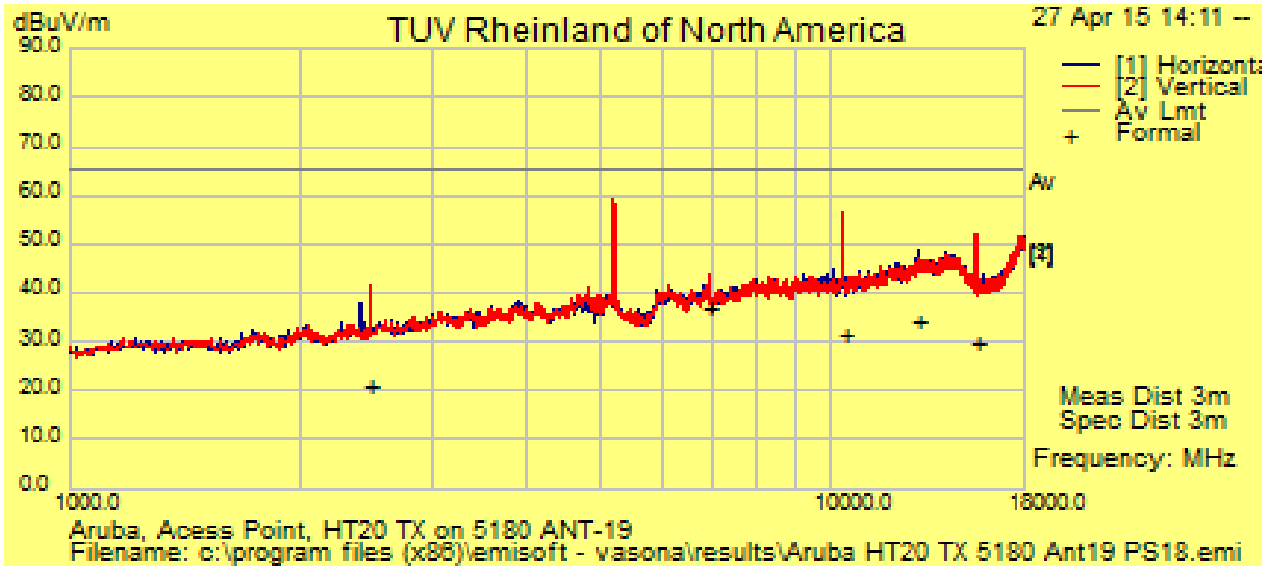
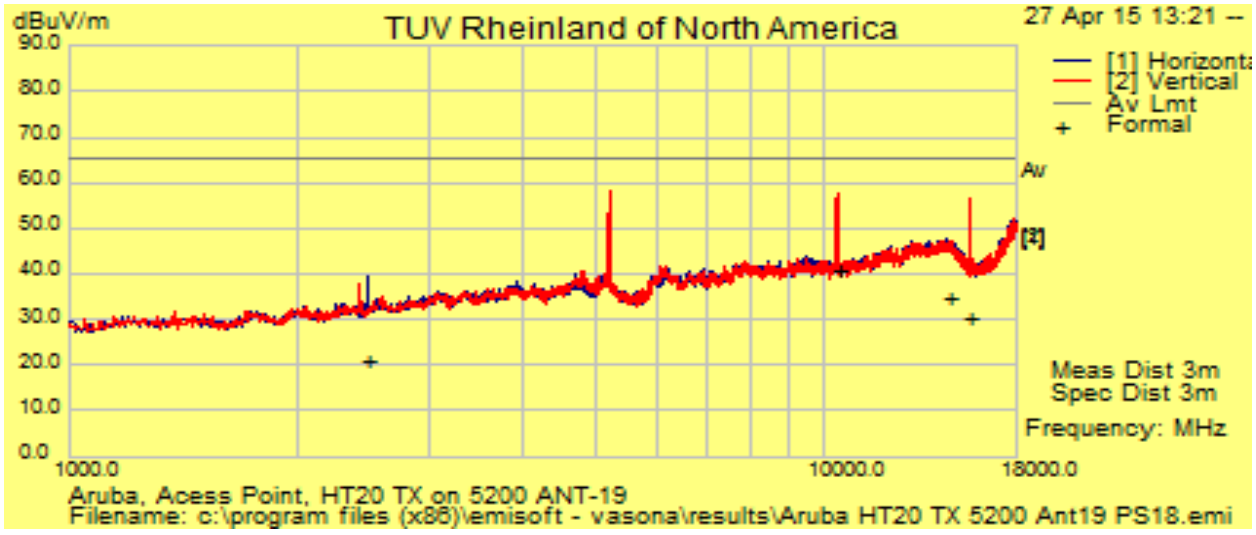
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT20 at 6.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode 11a at 5180 MHz



1 -18 GHz Plot for Transmit Mode at 5200 MHz



Notes:

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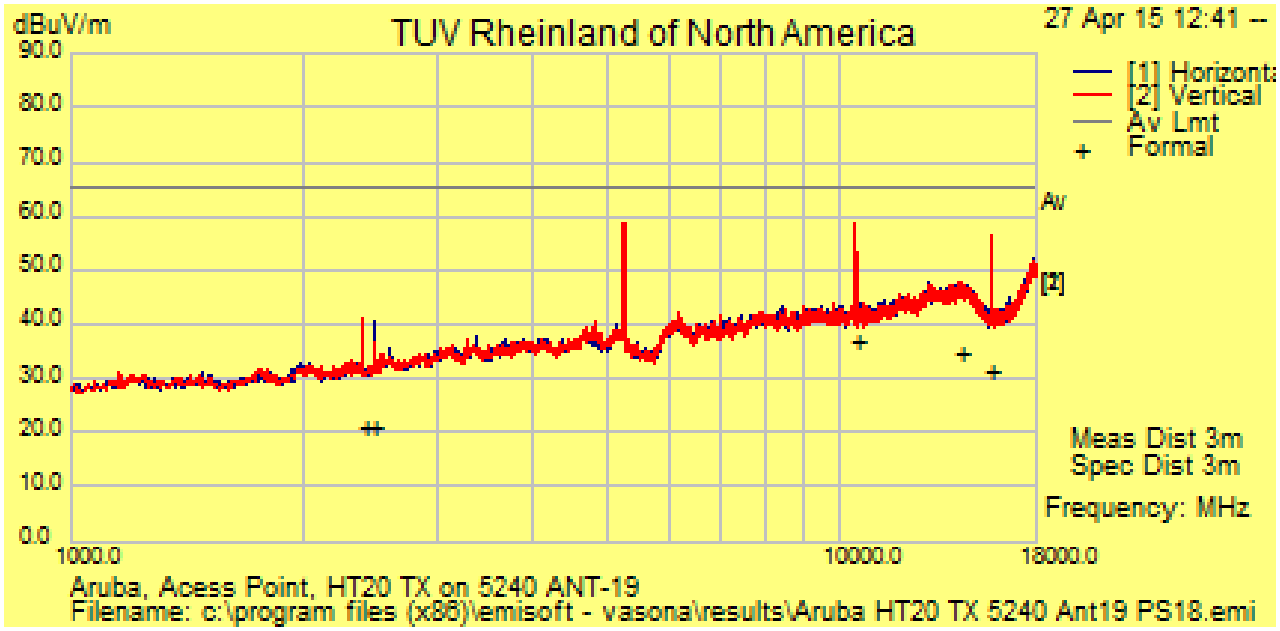
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT 20 at 6.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

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



Notes:

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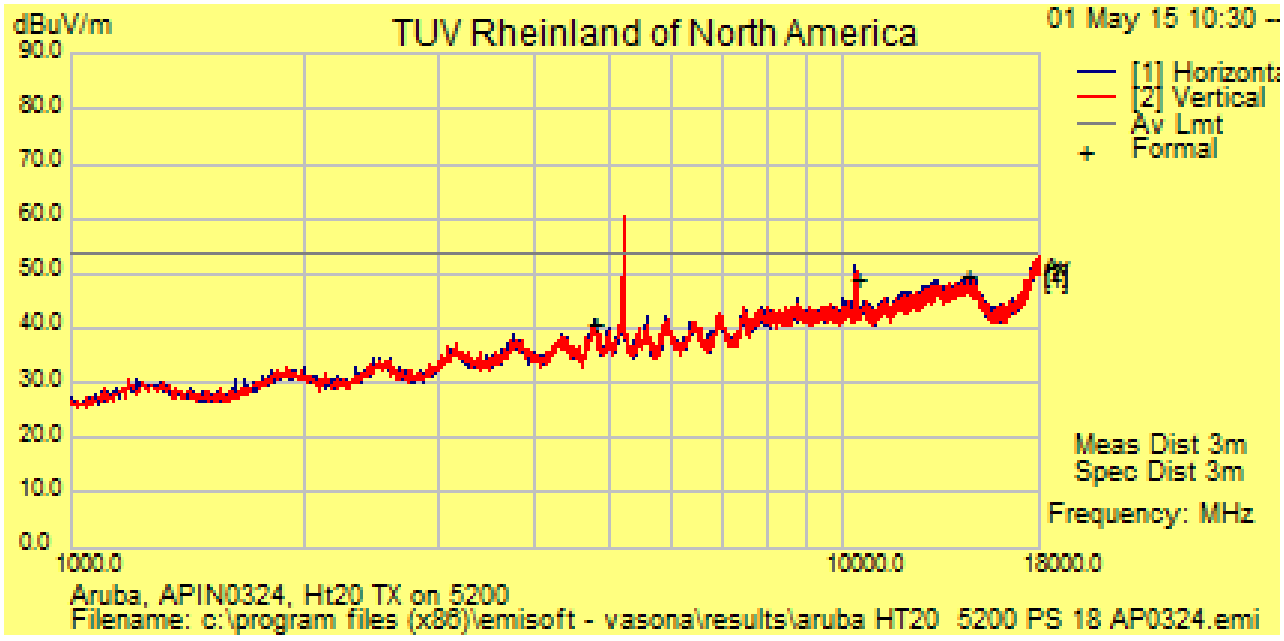
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 48	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT 20 6.5Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1-18 GHz Transmitted at 802.11 HT20 TX On 5200

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	
4771.17	55.00	1.87	-15.98	40.90	Avg	H	171	-8	54.00	-13.10	Pass
3188.82	55.05	1.44	-19.29	37.20	Avg	V	125	-9	54.00	-16.80	Pass
10389.19	54.97	2.79	-8.70	49.06	Avg	H	112	290	54.00	-4.94	Pass
15605.96	57.54	3.55	-9.85	51.24	Avg	V	146	262	54.00	-2.76	Pass
14508.53	53.67	3.39	-7.39	49.68	Avg	V	126	318	54.00	-4.33	Pass



Note: Low, mid and High channels were evaluated. Mod channel data with highest power is presented here.

SOP 1 Radiated Emissions

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EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT 40 13.5Mbps	**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

1-18 GHz Transmitted at 802.11 HT40 TX On 5190

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	
5222.40	42.91	1.91	-15.73	29.09	Avg	V	139	70	65.20	-36.11	Pass
10389.03	45.60	2.79	-8.70	39.69	Avg	V	177	52	65.20	-25.51	Pass
15590.00	37.84	3.56	-9.89	31.52	Avg	V	179	216	65.20	-33.68	Pass
15615.92	36.11	3.55	-9.82	29.84	Avg	V	108	184	65.20	-35.36	Pass
1-18 GHz Transmitted at 802.11 HT40 TX On 5230											
2425.66	41.47	1.25	-21.83	20.89	Avg	V	116	118	65.20	-44.31	Pass
10447.62	42.15	2.83	-8.82	36.16	Avg	V	151	236	65.20	-29.04	Pass
14447.87	38.84	3.38	-7.31	34.90	Avg	V	169	80	65.20	-30.30	Pass
15696.01	39.14	3.51	-9.86	32.80	Avg	V	177	72	65.20	-32.40	Pass
15733.40	36.28	3.51	-9.72	30.06	Avg	V	144	50	65.20	-35.14	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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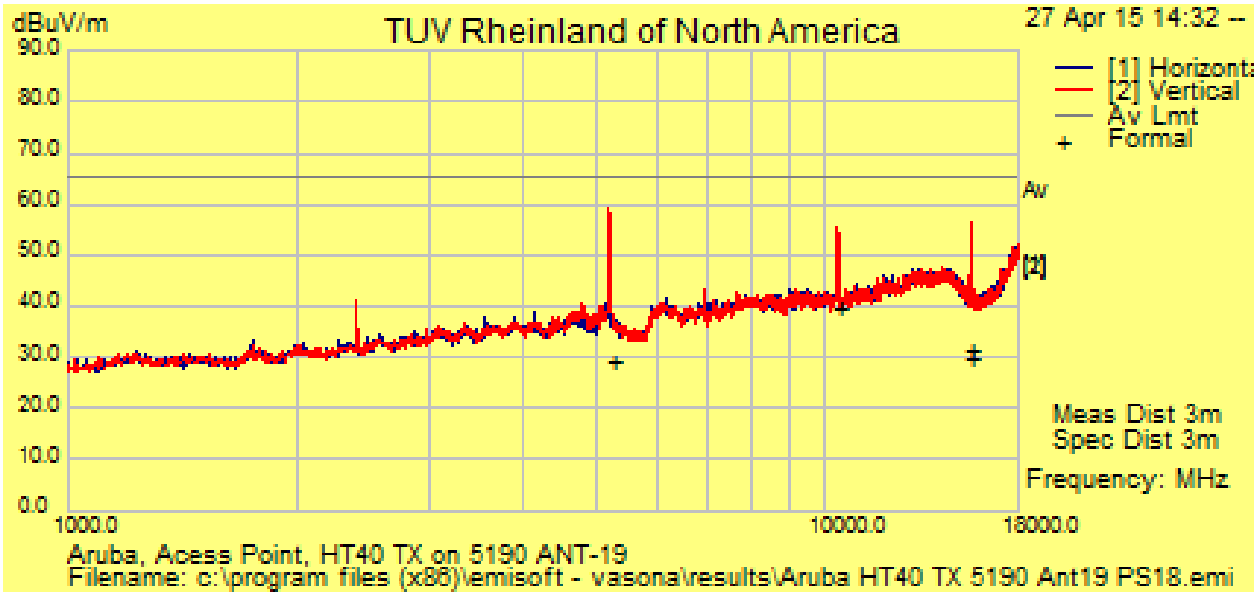
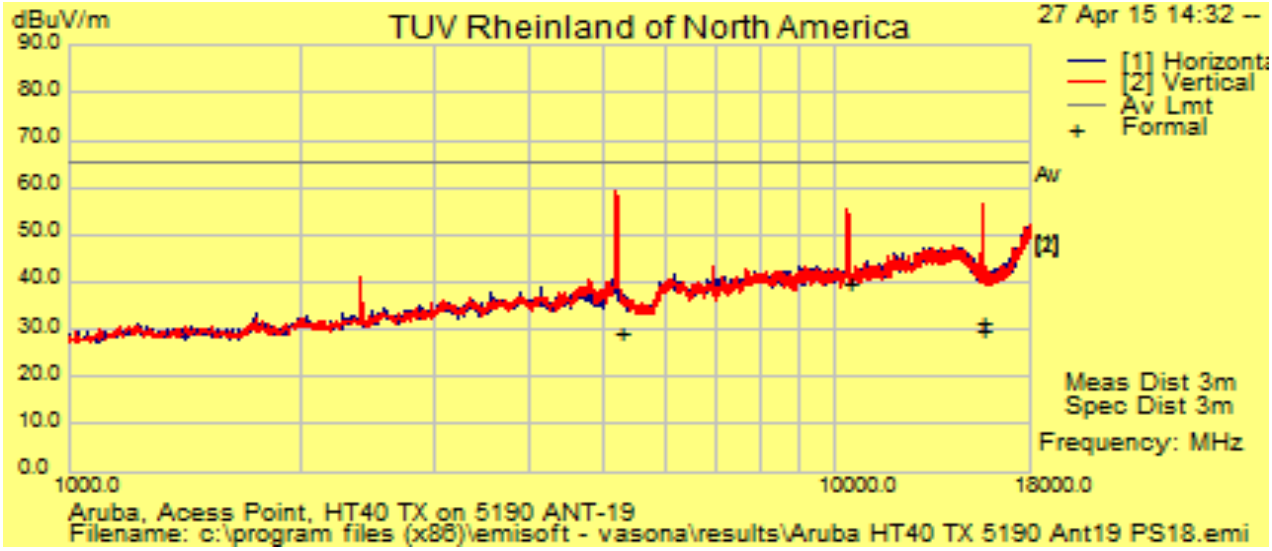
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT40 at 13.5Mbps	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode HT40 at 5190 MHz



1 -18 GHz Plot for Transmit Mode HT40 at 5230 MHz



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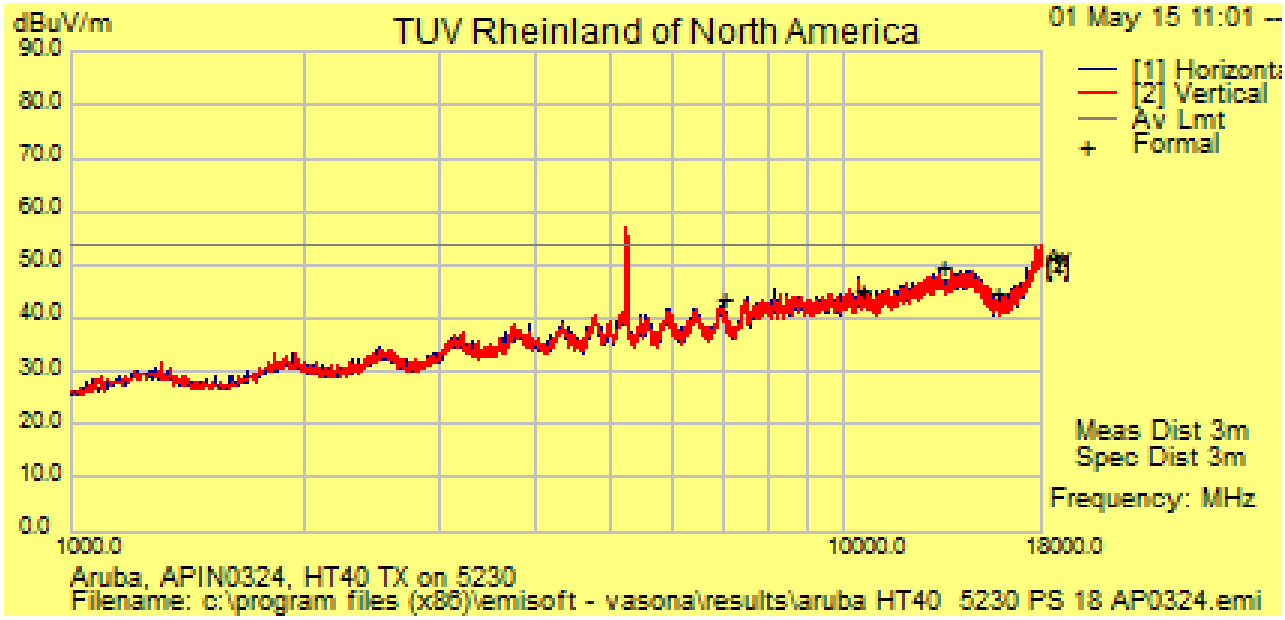
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 48	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 HT 20 6.5Mbps	**Line AC / Freq**	120Vac/60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	120 kHz/ 300 kHz
Dist/Ant Used	3m / JB3	**Performed by**	Suresh Kondapalli

1-18 GHz Transmitted at 802.11 HT40 TX On 5230

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	
6975.65	54.20	2.18	-12.80	43.58	Avg	H	153	54	54.00	-10.42	Pass
10472.75	51.32	2.83	-8.81	45.34	Avg	H	169	342	54.00	-8.66	Pass
13309.67	55.41	3.22	-8.92	49.71	Avg	H	163	54	54.00	-4.29	Pass
15689.56	51.20	3.51	-9.83	44.88	Avg	V	112	258	54.00	-9.12	Pass



Note: Low, mid and High channels were evaluated. Mod channel data with highest power is presented here.

SOP 1 Radiated Emissions

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EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 VHT 80	**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

1-18 GHz Transmitted at 802.11 HT80 TX On 5210

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	
5458.50	55.88	1.94	-15.52	42.30	Avg	V	198	274	54.00	-11.70	Pass
6971.94	54.50	2.18	-12.81	43.87	Avg	V	175	334	54.00	-10.13	Pass
10418.25	54.63	2.80	-8.84	48.59	Avg	V	165	290	54.00	-5.41	Pass
14569.15	54.11	3.41	-7.29	50.24	Avg	V	155	216	54.00	-3.76	Pass
15631.46	50.73	3.55	-9.79	44.49	Avg	V	164	22	54.00	-9.51	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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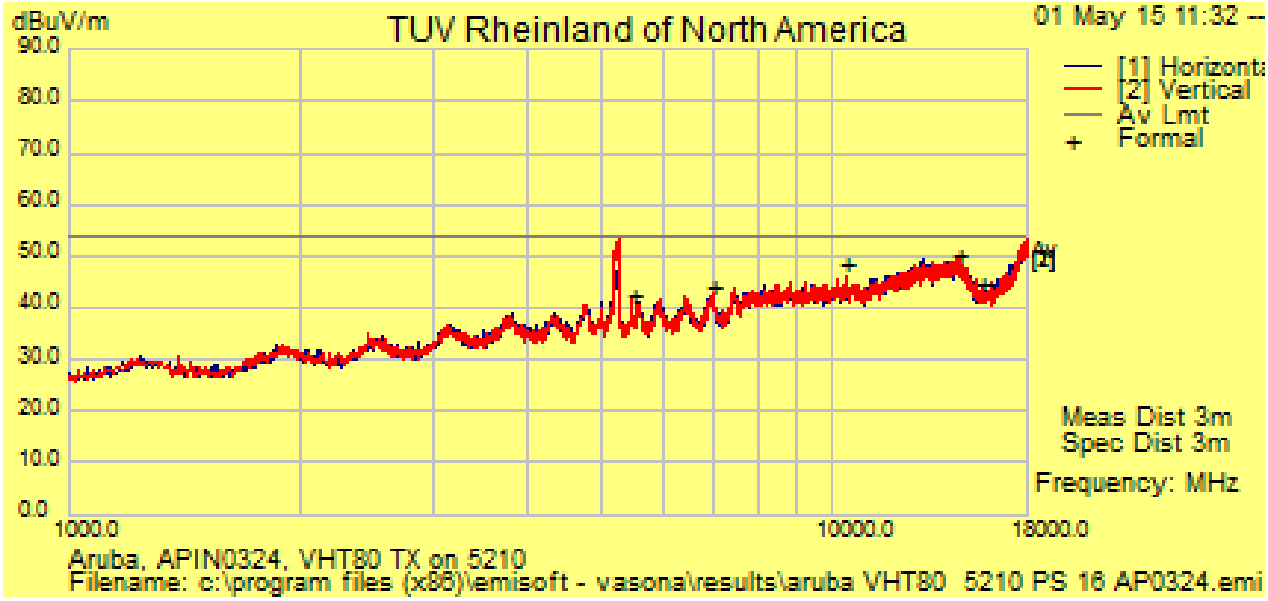
EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000510 ANT 19	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 VHT80	**Line AC**	120Vac 60Hz
Standard	CFR47 Part 15 Subpart C	**RBW / VBW**	1 MHz / 3 MHz
Dist/Ant Used	3m - EMCO3115 / 1m - RA42-K-F-4B-C	**Performed by**	Suresh Kondapalli

1 -18 GHz Plot for Transmit Mode HT80 at 5210MHz



Notes: No Emissions were found 18 to 40GHz range

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EUT Name	Wireless Access Point	**Date**	Apr 27, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 28%rh
EUT Serial	DD0000510 ANT 48	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 VHT 80	**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

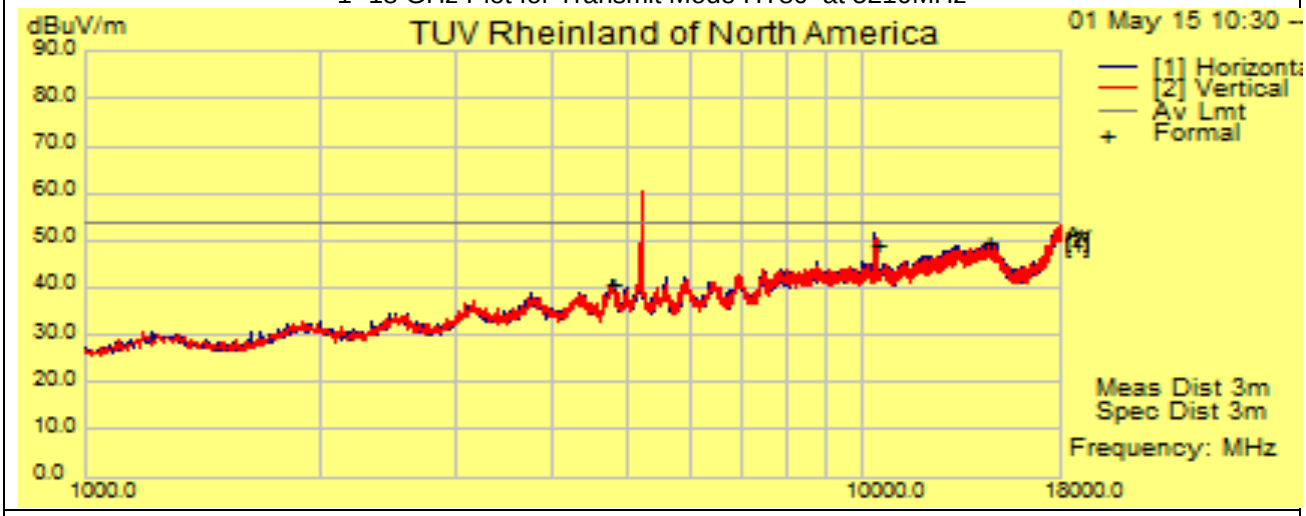
1-18 GHz Transmitted at 802.11 HT80 TX On 5210

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	
2425.19	41.61	1.25	-21.83	21.04	Avg	H	190	8	65.20	-44.17	Pass
14308.17	39.33	3.26	-7.54	35.05	Avg	H	121	364	65.20	-30.15	Pass
10406.54	42.84	2.79	-8.77	36.87	Avg	V	183	304	65.20	-28.34	Pass
15594.87	38.28	3.56	-9.88	31.96	Avg	V	165	225	65.20	-33.24	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		Tracking # 31560847.001 Page 32 of 32	
EUT Name	Wireless Access Point	**Date**	May 01, 2015
EUT Model	APIN0324 and APIN0325	**Temp / Hum in**	23° C / 33%rh
EUT Serial	DD0000510 ANT 48	**Temp / Hum out**	N/A
EUT Config.	X-Axis, 802.11 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 HT80 at 5210MHz



Notes: No Emissions were found 18 to 40GHz range

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: 2014. 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: 2014.

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).

Table 7: AC Conducted Emissions – Test Results

Test Conditions: Conducted Measurement at Normal Conditions only	
Antenna Type: Attached	**Power Level:** See Test Plan
AC Power: 120 Vac/60 Hz	**Configuration:** Tabletop
Ambient Temperature: 23° C	**Relative Humidity:** 31% RH

Configuration	Frequency Range	Test Result
Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

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EUT Name	Wireless Access Point	**Date**	Apr 20, 2015
EUT Model	APIN0324/0325	**Temp / Hum in**	23°C / 32%rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	TX On 5200MHz 11a mode	**Line AC / Freq**	120V 60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 1	**Performed by**	Suresh K

Frequency	Raw	Cable Loss	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV			dBuV	dB	
0.15	34.93	9.96	-0.10	44.79	QP	Live	66	-21.21	Pass
0.15	14.82	9.96	-0.10	24.68	Avg	Live	56	-31.32	Pass
0.20	44.09	9.97	-0.08	53.97	QP	Live	63.82	-9.85	Pass
0.20	26.00	9.97	-0.08	35.88	Avg	Live	53.82	-17.93	Pass
0.26	36.71	9.98	-0.06	46.63	QP	Live	61.37	-14.75	Pass
0.26	25.10	9.98	-0.06	35.02	Avg	Live	51.37	-16.36	Pass
0.34	28.92	9.98	-0.05	38.85	QP	Live	59.32	-20.47	Pass
0.34	19.75	9.98	-0.05	29.68	Avg	Live	49.32	-19.64	Pass
0.54	25.96	9.99	-0.04	35.92	QP	Live	56	-20.08	Pass
0.54	14.22	9.99	-0.04	24.17	Avg	Live	46	-21.83	Pass
17.16	22.84	10.19	0.10	33.13	QP	Live	60	-26.87	Pass
17.16	16.65	10.19	0.10	26.95	Avg	Live	50	-23.05	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT was setup as table top equipment and transmitted at 5580 MHz in HT20 at 6.5Mbps

SOP 2 Conducted Emissions

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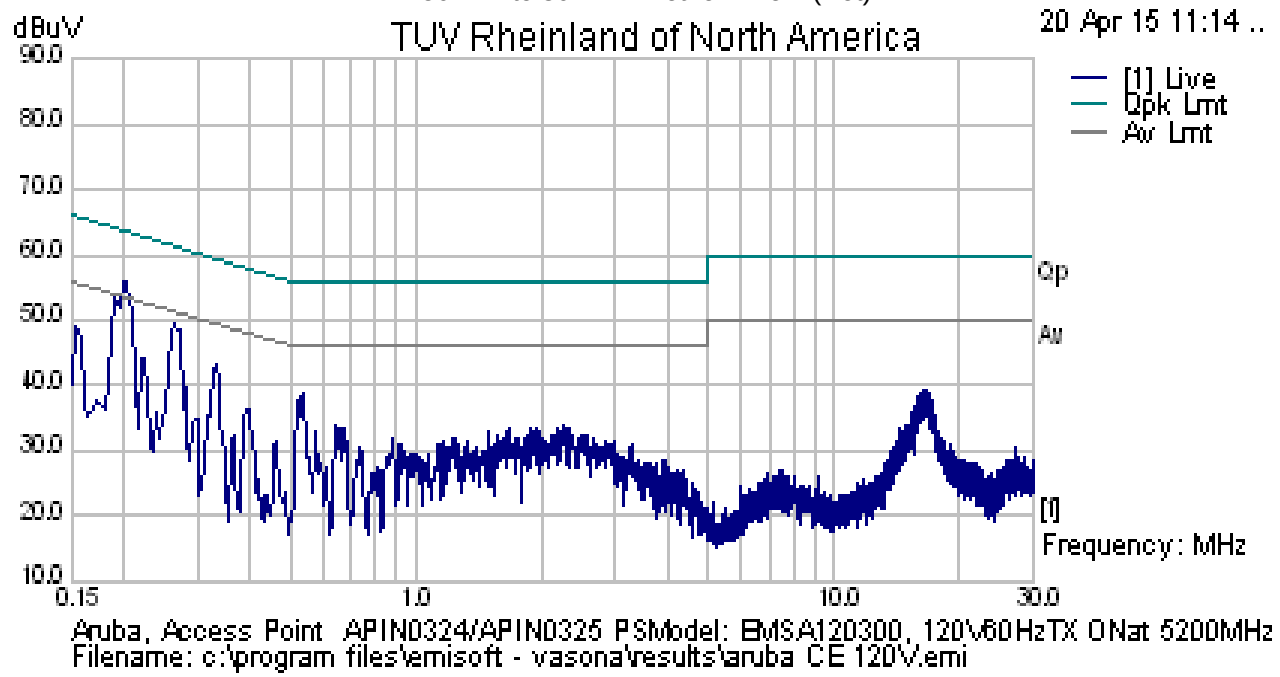
EUT Name	Wireless Access Point	**Date**	Apr 20, 2015
EUT Model	APIN0324/0325	**Temp / Hum in**	23°C / 32%rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	TX on 5200MHz 11a mode	**Line AC**	120V 60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 1	**Performed by**	Suresh K

150 kHz to 30 MHz Plot for Line 1 (Hot)



Notes: Meet FCC Class B limit.

SOP 2 Conducted Emissions

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EUT Name	Wireless Access Point	**Date**	Apr 20, 2015
EUT Model	APIN0324/0325	**Temp / Hum in**	23°C / 32%rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	TX on 5200MHz 11a mode	**Line AC / Freq**	120V/60Hz
Standard	CFR47 Part 15.207	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 2	**Performed by**	Suresh

Frequency	Raw	Cable Loss	Ins. Loss	Level	Detector	Line	Limit	Margin	Result
MHz	dBuV	dB	dB	dBuV			dBuV	dB	
0.15	33.24	9.96	-0.10	43.10	QP	Neutral	65.98	-22.88	Pass
0.15	13.66	9.96	-0.10	23.52	Avg	Neutral	55.98	-32.46	Pass
0.19	43.47	9.96	-0.08	53.35	QP	Neutral	63.86	-10.51	Pass
0.19	26.23	9.96	-0.08	36.11	Avg	Neutral	53.86	-17.75	Pass
0.26	36.01	9.98	-0.06	45.93	QP	Neutral	61.44	-15.51	Pass
0.26	20.65	9.98	-0.06	30.57	Avg	Neutral	51.44	-20.87	Pass
0.33	29.39	9.98	-0.05	39.31	QP	Neutral	59.55	-20.24	Pass
0.33	13.39	9.98	-0.05	23.32	Avg	Neutral	49.55	-26.23	Pass
0.58	21.82	10.00	-0.04	31.78	QP	Neutral	56.00	-24.22	Pass
0.58	12.54	10.00	-0.04	22.50	Avg	Neutral	46.00	-23.50	Pass
16.55	29.61	10.19	0.09	39.88	QP	Neutral	60.00	-20.12	Pass
16.55	22.35	10.19	0.09	32.62	Avg	Neutral	50.00	-17.38	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y)$ = ± 1.2 dB Expanded Uncertainty $U = ku_c(y)$ k = 2 for 95% confidence

Notes: EUT was setup as table top equipment and transmitted at 5580 MHz in HT20 at 6.5Mbps

SOP 2 Conducted Emissions

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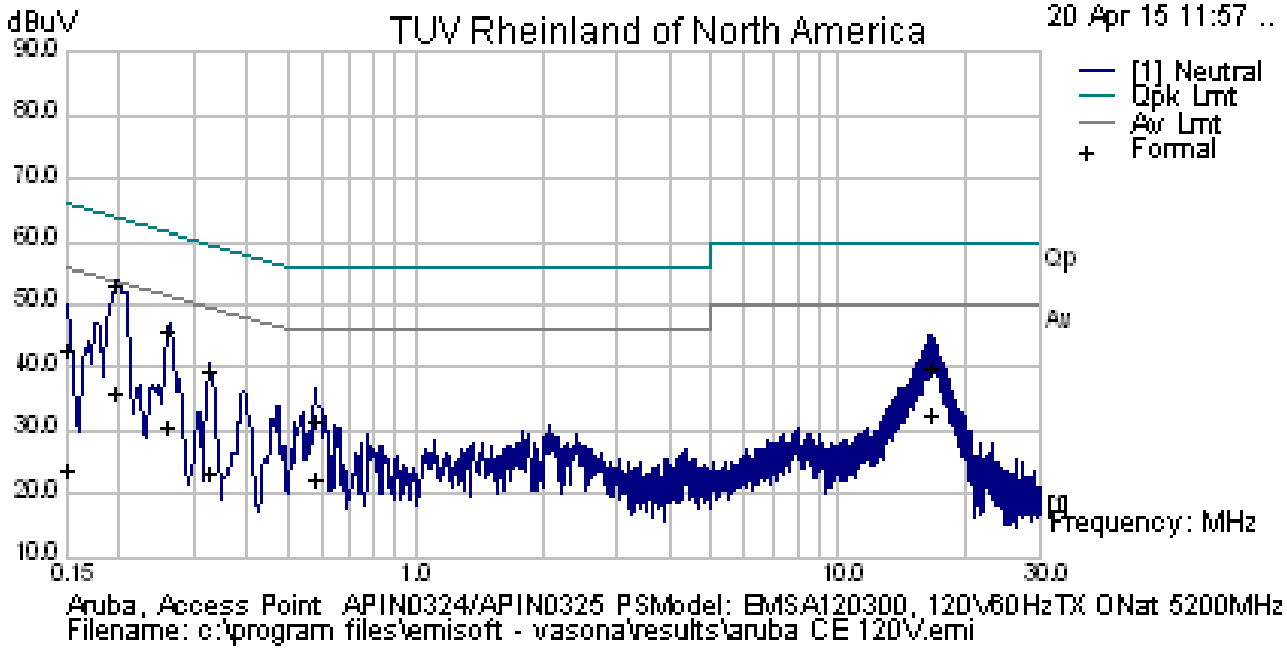
EUT Name	Wireless Access Point	**Date**	Apr 20, 2015
EUT Model	APIN0324/0325	**Temp / Hum in**	23°C / 32%rh
EUT Serial	DD0000510	**Temp / Hum out**	N/A
EUT Config.	TX on 5200MHz 11a mode	**Line AC**	120V/60Hz
Standard	CFR47 Part 15.107	**RBW / VBW**	9kHz / 30 kHz
Lab/LISN	Lab #2 /Com-Power, Line 2	**Performed by**	Suresh K

150 kHz to 30 MHz Plot for Line 2 (Neutral)



Note: Meet FCC Class B Limit.

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:

Temperature	Time	PPM
0°C	Start	5.76
	2 Min.	2.88
	5 Min	5.40
	10 min	3.24
10°C	Start	10.45
	2 Min.	6.12
	5 Min	3.24
	10 min	5.40
20°C	Start	1.44
	2 Min.	2.16
	5 Min	1.80
	10 min	5.40
30°C	Start	2.16
	2 Min.	8.65
	5 Min	1.08
	10 min	4.68
40°C	Start	2.88
	2 Min.	2.16
	5 Min	0.36
	10 min	9.73
50°C	Start	11.89
	2 Min.	1.80
	5 Min	2.52
	10 min	9.37

Note: 1. All frequency drifts were less than ±20 ppm. The worst frequency drift was 11.89 ppm/ 62kHz. 2. Channel 5200MHz was selected to frequency stability.

Figure 52: Frequency Stability at 5200MHz 11a mode at 6Mbps

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 12V DC by programmable power supply. The voltage was varied from 10.6VDC to 13.5VDC while the Center frequencies were observed and record for the maximum drift in ppm; part per millions.

4.6.2 Test results

Frequency MHz	Nominal (12VDC) MHz	Low Voltage (10.6 VDC) MHz	High Voltage (13.5VDC) MHz	Max Drift ppm
5200	5199.927	5199.996	5199.994	14.0 (73KHz)

Figure 53: Frequency Stability at 5200MHz 11a mode at 6Mbps

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 +12.00dBi or 15.84 (numeric).

These calculations based UNII -1 band power and antenna gains

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 +24.76 dBm or 299mW

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

Pd = (299*15.84) / (1600π) = 0.9422 mW/cm2, which is 0.057mW/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	07/08/2014	07/08/2016
Horn Antenna	EMCO	3115	9710-5301	09/04/2013	09/14/2015
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	04/30/2015	04/30/2017
Preamplifier	Milteq	TTA1800-30-4G	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	03/16/2015	03/16/2016
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/08/2015	01/08/2016
Spectrum Analyzer	Agilent	N9030A	MY51380689	01/19/2015	01/19/2016

* 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 8: Customer Information

Company Name	Aruba Networks
Address	1344 Crossman Ave.
City, State, Zip	Sunnyvale, CA 94089
Country	USA
Phone	(408) 990- 2557

Table 9: Technical Contact Information

Name	Robert Hastings
E-mail	rhastings@arubanetworks.com
Phone	(408) 990- 2557

6.3 Equipment Under Test (EUT)

Table 10: EUT Specifications

EUT Specifications	
Dimensions	180mm x 180mm x 45mm (W x D x H)
AC Adapter (EMSA120300, S/N:)	Input Voltage: 100-240Vac 50-60Hz Input Current: 1A Output Voltage: 12VDC Output Current: 3.0A Power over Ethernet (PoE): 48 Vdc (nominal)
Environment	Indoor ONLY
Operating Temperature Range:	0 to 50 degrees C
Multiple Feeds:	☒ Yes and how many 4 ☐ No
Hardware Version	3
Part Number	APIN0324 & APIN0325
RF Software Version	QSPR Version 5.0.0 RF Test Image used with QSPR: ipq806xrd_2gpcie11_78hex_5gpcie_50hex.ari
802.11-radio modules	
Operating Modes	802.11a, b, g, nHT 20, HT40, VHT20, VHT40, VHT80
Transmitter Frequency Band	2.4GHz 2400-2483.5MHz 5.15 GHz to 5.25 GHz 5.25GHz to 5.35GHz 5.47GHz to 5.725GHz 5.725 GHz to 5.85 GHz
Max. Rated Power Output	See Channel Planning Table.
Power Setting @ Operating Channel	See Channel Planning Table.
Antenna Type	4 integrated internal Antennas and several External Antennas see attached sheet
Antenna Gain	See details below
Modulation Type	☐ AM ☐ FM ☒ DSSS ☒ OFDM ☒ Other describe: 16-QAM, 64-QAM, 128-QAM
Data Rate	802.11b: 1, 2, 5.5, 11 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 802.11n: 6.5 to 450 (MCS0 to MCS23) 802.11ac: 6.5 to 1,733 (MCS0 to MCS9, NSS = 1 to 4)

EUT Specifications	
TX/RX Chain (s)	MIMO (4x4)
Directional Gain Type	☒ Correlated ☒ Beam-Forming ☐ Other describe:
Type of Equipment	☐ Table Top ☒ Wall-mount ☐ Floor standing cabinet ☒ Other Ceiling Mounted
Note: 1. All four chains will be on / transmitted at all time. 2.This report only documents the radio characteristics for 2400 – 2483.5MHz band	

Internal Antennas

Model:	Type	Gain dBi	Frequency MHz	Beam Forming Gain (dBi)
Metal Sheet	Omni	4	2400 - 2500	4.6
		5.5	5150 - 5875	3.5

External Antennas

Model:	Type	Gain dBi	Frequency MHz	Beam Forming Gain (dBi)
AP-ANT-1W	Omnidirectional	3.8	2400 - 2500	6
		5.8	4900 - 5875	
AP-ANT-13B	Downtilt Omni	4.4	2400 - 2500	6
		3.3	4900 - 5900	
AP-ANT-19	Dual Band Omnidirectional	3	2400 - 2500	6
		6	5150 - 5875	
AP-ANT-20W	Omnidirectional	2	2400 - 2500	6
		2	4900 - 5875	
AP-ANT-40	Downtilt Omni	3.9	2400 - 2500	3
		4.7	4900 - 5900	
AP-ANT-45	Multipolarized	5	2400 - 2500	3
		5	4900 - 6000	
AP-ANT-48	Multipolarized	8.5	2400 - 2500	3
		8.5	4900 - 6000	

Table 11: EUT Channel Power Specifications

APIN0324 with Highest gain External antenna AP-ANT-19

No.	Frequency (MHz)	Target Power Value dBm				
		802.11a	802.11n HT20/VHT20	802.11n HT40/VHT40	802.11AC VHT80	
36	5180	17	9			
38	5190			11		
40	5200	18	9			
42	5210				10	
44	5220	18	9			
46	5230			11		
48	5240	16	9			
149	5745	16	17			
151	5755			16		
153	5765					
155	5775				9	
157	5785	17	17			
159	5795			16		
161	5805					
165	5825	17	17			

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.

APIN0325 with Internal Antennas

No.	Frequency (MHz)	Target Power Value dBm				
		802.11a	802.11n HT20/VHT20	802.11n HT40/VHT40	802.11AC VHT80	
36	5180	17	9			
38	5190			9		
40	5200	18	9			
42	5210				7.5	
44	5220	18	9			
46	5230			9		
48	5240	18	9			
149	5745	16	17			
151	5755			16		
153	5765	17	17			
155	5775				16	
157	5785	17	17			
159	5795			16		
161	5805					
165	5825	17	17			

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 12: 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 13: Supported Equipment

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

Table 14: Description of Sample used for Testing

Device	Serial	RF Connection	CFR47 Part 15.247
APIN0325	DD0000409	Integrated Antenna	Radiated Emissions and Band edges
APIN0324	DD0000510	External Antennas	Radiated Emissions and Band edges Test was performed with AP-ANT-19 Dual Band Omnidirectional max gain 12dBi, with Beam forming) Highest spurious emissions were verified with highest gain antenna of each type. AP-ANT-48 Multi-polarized Antenna (max gain 11.5dBi, with beam forming) was used. Only highest spurious emissions are placed in the report.
		Direct via reverse SMA ports for External Antenna Connection	Output Power, Peak Power Spectral Density, Occupied Bandwidth Conducted Spurious Emissions

Table 15: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
APIN0325	Integrated	Transmit	 EUT laid flat.	 EUT UP Right	Na.
APIN0324	**AP-ANT-48** External Antennas **AP-ANT-19**	Transmit	 EUT laid flat Antennas configured for maximum gain. 	 EUT stood upright Antennas configured for maximum gain 	NA
Note: Pre-scans were performed in 2 supporting axis Wall mounted or Ceiling mounted and X-axis simulating ceiling mounted was worst.					

Table 16: Final Test Mode for 5180 – 5240MHz

Test	802.11a/ HT20/VHT20	802.11n HT40/VHT40	802.11n AC VHT80
Occupied Bandwidth FCC Part 15.407(a)	Band UNII 1: 5180, 5200, 5240 MHz 4Streams – 6.0 and 6.5Mbps/ stream	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream
Output Power FCC Part 15.407(a)(1-2)	Band UNII 1: 5180, 5200, 5240 MHz 4Streams – 6.0 and 6.5Mbps/ stream	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream
Power Spectral Density FCC Part 15.407(a)	Band UNII 1: 5180, 5200, 5240 MHz 4Streams – 6.0 and 6.5Mbps/ stream	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream
Band-Edge (Radiated) FCC Part 15.205, 15.209, 15.407(b)	Band UNII 1: 5180, 5200, 5240 MHz. 4Streams – 6.0 and 6.5Mbps/ stream Test performed with Highest gain Antenna	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream Test performed with Highest gain Antenna	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream Test performed with Highest gain Antenna
Transmitted Spurious Emission (30 MHz – 1GHz) FCC Part 15.205, 15.209, 15.407(b)	Band UNII 1: 5180, 5200, 5240 MHz 4Streams – 6.0 and 6.5Mbps/ stream Test performed highest power (mid channel) of each band	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream Test performed highest power (mid channel) of each band	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream Test performed highest power (mid channel) of each band
Transmitted Spurious Emission (Above 1GHz) FCC Part 15.205, 15.209, 15.407(b)	Band UNII 1: 5180, 5200, 5240 MHz 4Streams – 6.0 and 6.5Mbps/ stream Test performed with Highest gain Antenna of each type.	Band UNII 1 : 5190, 5230 4Streams –13.5Mbps/ stream Test performed with Highest gain Antenna of each type.	Band UNII 1: 5210 4Streams – 56.5Mbps/ stream Test performed with Highest gain Antenna of each type.
Conducted Spurious Emission (antenna port). FCC Part 15.407 (b)	According to CFR47 15.407 (b) EIPR shall not exceed -27 dBm/MHz. This is equivalent to the field strength of 68.2dBuV/m at 3 meter distance. The EUT is satisfied the requirement by meeting the limit under CFR47 Part 15.209.		
AC Conducted Emission FCC Part 15.207		5200 MHz at 4 Data Stream: 6.0Mbp	
Frequency Stability FCC Part 15.407 (g)	at 5200 MHz, 4 data streams HT20 mode 6.5Mbps		

Test	802.11a/ HT20/VHT20	802.11n HT40/VHT40	802.11n AC VHT80
Voltage Variation FCC Part 15.31 (e)	at 5200 MHz, 4 data streams HT20 mode 6.5Mbps,		

Note: 1. All radiated emission performed on X-Axis.
2. All four chains will be on at all time.
3. All tests were pre-scanned for worst case before final testing. Test report shows only final readings

6.4 Test Specifications

Testing requirements

Table 17: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.407: 2014	All

END OF REPORT