Certification Application Report
FCC Part 15.407

Test Lab:	Applicant:
Rhein Tech Laboratories, Inc. Phone: 703-689-0368 360 Herndon Parkway Fax: 703-689-2056 Suite 1400 www.rheintech.com Herndon, VA 20170 Email: atcbinfo@rheintech.com	HandEra, Inc. Phone:515-252-7522 x114 2859 104th Street Des Moines, IA 50322 Contact: Mark Kubovich

FCC ID	URZ-PHRPAD60	**Test Report Date**	November 9, 2018
Platform	N/A	**RTL Work Order #**	2018199
Model Number	PHRPAD60	**RTL Quote #**	QRTL18-199A

American National Standard Institute:	ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC Classification	NII-Unlicensed National Information Infrastructure TX
FCC Rule Part	Part 15.407: Unlicensed National Information Infrastructure Devices - General Technical Requirements
Digital Interface Information	Digital Interface was found to be compliant

Frequency Range (MHz)	Output Power Peak Conducted (mW)	Frequency Tolerance	Emission Designator
5150 – 5250	3.2	N/A	N/A
5725 – 5850	4.1	N/A	N/A

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this test report. No modifications were made to the equipment during testing in order to achieve compliance with these standards. Furthermore, there was no deviation from, additions to, or exclusions from, the applicable parts of FCC Part 2, FCC Part 15, and ANSI C63.10.

Signature:  Date: November 9, 2018

Typed/Printed Name: Desmond A. Fraser Position: President

These tests are accredited and meet the requirements of ISO/IEC 17025 as verified by ANAB. Refer to certificate and scope of accreditation AT-1445.

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1 General Information

1.1 Scope

Applicable Standards

- FCC Rules Part 15.407 (10-01-17): Unlicensed National Information Infrastructure Devices - General Technical Requirements

1.2 Description of EUT

Equipment Under Test	Wi-Fi Tablet
Model Number	PHRPAD60
Power Supply	Internal battery, charged in docking station
Modulation Type	OFDM (802.11 a/ac/n)
Frequency Range	5180 – 5240 MHz for U-NII1 5745 – 5825 MHz for U-NII3
Antenna Connector Type	Internal
Antenna Types	Internal

1.3 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing (ANSI C63.10-2013).

1.4 Related Submittal(s)/Grant(s)

This is an original FCC certification application for HandEra, Inc. Model PHRPAD60, FCC ID: URZ-PHRPAD60.

1.5 Modifications

No modifications were required for compliance.

2 Test Information

2.1 Description of Test Modes

In accordance with FCC 15.31(m), and because the EUT utilizes an operating band greater than 10 MHz, the following frequencies were tested.

Table 2-1: Channels Tested for Wi-Fi

Channel (#)	Frequency (MHz)
36 (U-NII1)	5180
40 (U-NII1)	5200
48 (U-NII1)	5240
149 (U-NII3)	5745
157 (U-NII3)	5785
165 (U-NII3)	5825

Table 2-2: Data Rates

Technology	Rate (Mbps)
802.11a	54
802.11ac	MCS8
802.11n	MCS7

2.2 Exercising the EUT

The EUT was tested in all three orthogonal planes in order to determine worst-case emissions. The EUT was provided with software to continuously transmit during testing. The carrier was also checked to verify that information was being transmitted, and all modes were investigated and the worst-case mode was used for final testing. There were no deviations from the test standard(s) and/or methods. The test results reported relate only to the item tested.

2.3 Test Result Summary

Table 2-3: Test Result Summary – FCC Part 15, Subpart C (Section 15.407)

FCC Reference	C63.10 Procedure	Test	Result
FCC 15.207	6.2	AC Power Conducted Emissions	Pass
FCC 15.209	6.5, 6.6	Radiated Emissions	Pass
FCC 15.407(a) and (e)	12.4	26 dB and 6dB Bandwidth	Pass
FCC 15.407(a)(1) and (a)(3)	12.3	Maximum Conducted Output Power	Pass
FCC 15.407(a)(1) and (a)(3)	12.5	Power Spectral Density	Pass
FCC 15.407(b)(1) and (b)(4)	12.7	Band Edge Measurement	Pass
FCC 15.407(b)(6)	12.7	Antenna Conducted Spurious Emissions	Pass
FCC 15.407(g)	6.8	Frequency Stability	Pass

2.4 Test System Details

The test samples were received on October 26, 2018. The FCC identifiers for all applicable equipment, plus descriptions of all cables used in the tested system, are identified in the following tables.

Table 2-4: Equipment Under Test

Part	Manufacturer	Model #	Serial Number	FCC ID	RTL Bar Code
Tablet Pad 6 (Conducted)	Phreesia	PHRPAD60	A16947600C07 0440FE0728E012	URZ-PHRPAD60	23118
Tablet Pad 6 (Conducted)	Phreesia	PHRPAD60	A16947600C07F54F FF07264C2	URZ-PHRPAD60	23119
Tablet Pad 6 (Radiated)	Phreesia	PHRPAD60	A16947600C07F54F FF07264C2	URZ-PHRPAD60	23120
Tablet Pad 6 (Radiated)	Phreesia	PHRPAD60	A16947600C07EFE FFD0732CAAC	URZ-PHRPAD60	22774
Charging Dock (USB)	Phreesia	N/A	N/A	N/A	23122
Charging Dock (Ethernet)	Phreesia	N/A	N/A	N/A	23124

Table 2-5: Auxiliary Equipment

Part	Manufacturer	Model #	Serial Number	FCC ID	RTL Bar Code
Power Adaptor	TZY	AP36-150240DP	1807-00114RoHS	N/A	23126
Ethernet Cable	N/A	N/A	N/A	N/A	23125

2.5 Configuration of Tested System

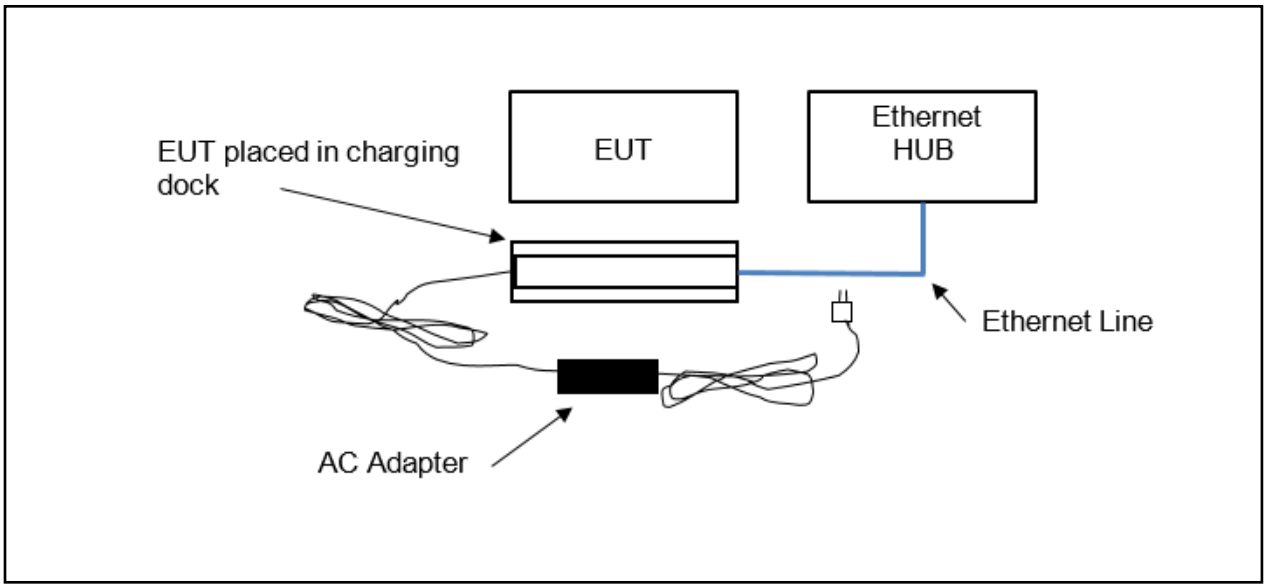


Figure 2-1: Configuration of System Under Test

Note: The charging dock with the RJ-45 connection was connected to an Ethernet HUB via an Ethernet cable for AC Conducted Emissions, Conducted Emissions on the Ethernet cable, and Unintentional Emissions.

3 Maximum Conducted Output Power – §15.407(a)(1) and (a)(3), C63.10 12.3

3.1 Maximum Conducted Output Power Test Procedure

A conducted power measurement of the EUT was taken using SA-1 method. The following settings were used:

RBW = 1 MHz
VBW = 3 MHz
Span = Encompass entire 26 dB EBW or 99 % OBW
Points = (2 x Span) / RBW
Detector = RMS
Sweep = Auto
Trace = 100 average

Table 3-1: Output Power Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901139	Weinschel Corp	48-20-34	Attenuator 20 dB, 100 W (DC – 18 GHz)	BK5859	4/23/19
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

3.2 Output Power Test Results

Table 3-2: Output Power Data - U-NII1

Modulation Scheme	Output Power (dBm)		
	Low - Channel 36 (5180 MHz)	Mid - Channel 40 (5200 MHz)	High - Channel 48 (5240 MHz)
802.11a (54 Mbps)	4.9	4.8	5.1
802.11ac (MCS8)	2.8	2.7	3.0
802.11n (MCS7)	3.0	2.8	3.0

Table 3-3: Output Power Data - U-NII1 – Worst Case

Channel (#)	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
36	5180	4.9	24.0	-19.1	Pass
40	5200	4.8	24.0	-19.2	Pass
48	5240	5.1	24.0	-18.9	Pass

Table 3-4: Output Power Data - U-NII3

Modulation Scheme	Output Power (dBm)		
	Low - Channel 149 (5745 MHz)	Mid - Channel 157 (5785 MHz)	High - Channel 165 (5825 MHz)
802.11a (54 Mbps)	6.1	5.3	4.6
802.11ac (MCS8)	4.6	4.0	3.1
802.11n (MCS7)	4.4	3.7	2.8

Table 3-5: Output Power Data - U-NII3 – Worst Case

Channel (#)	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
149	5745	6.1	30.0	-23.9	Pass
157	5785	5.3	30.0	-24.7	Pass
165	5825	4.6	30.0	-25.4	Pass

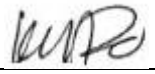
Highest conducted peak power measured: 5.1 dBm ≈ 3.2 mW for U-NII1
6.1 dBm ≈ 4.1 mW for U-NII3

$P(Watts) = 10^{(dBm / 10)} / 1000$

Measurement uncertainty: ±0.5 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		October 29, 2018
Test Engineer	Signature	Date of Test

4 Compliance with the Band Edge – §15.407(b)(1); §15.407(b)(4), C63.10 12.7

4.1 Band Edge Test Procedure

The transmitter output was connected to its appropriate antenna. 1 MHz integrated peak (100 kHz RBW / 300 kHz VBW) and 1 MHz integrated average (100 MHz RBW / 300 kHz VBW) corrected measurements were taken within the restricted band to show compliance.

Table 4-1: Band Edge Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

4.2 Band Edge Test Results

Conversion of dBm to dBµV/m at 3 m.

dBµV/m = dBm + 104.7 – (20 * LOG(3m)) = dBm + 95.2

802.11a (54 Mbps) was determined to be the worst case modulation scheme for both U-NII1 and U-NII3.

4.1 Band Edge Plots

Plot 4-1: Lower Band Edge: U-NII1 – 802.11a (54 Mbps) – Average

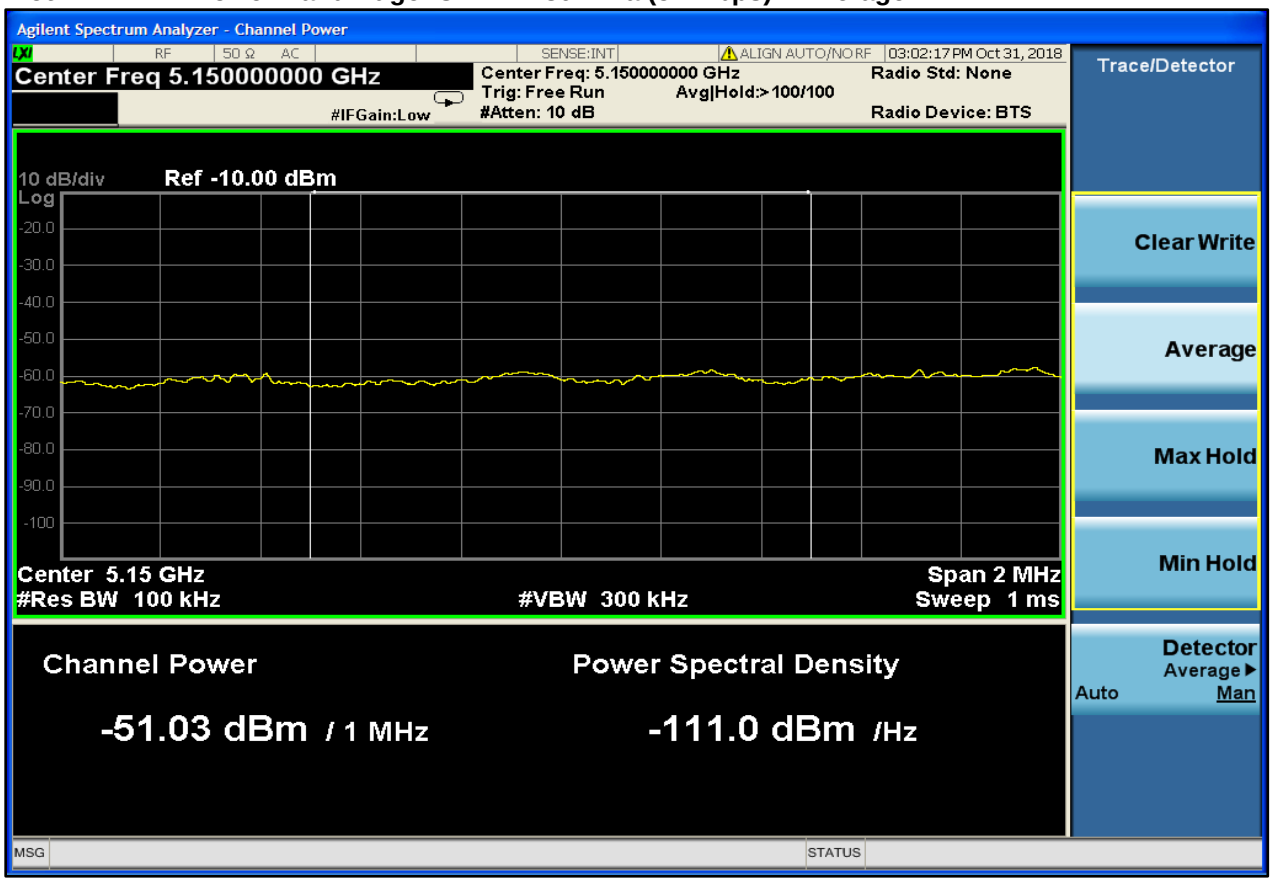


Table 4-2: Lower Band Edge: U-NII1 – 802.11a (54 Mbps) – Average

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
5150	-51.0	44.2	54.0	-9.8

Plot 4-2: Lower Band Edge: U-NII1 – 802.11a (54 Mbps) – Peak

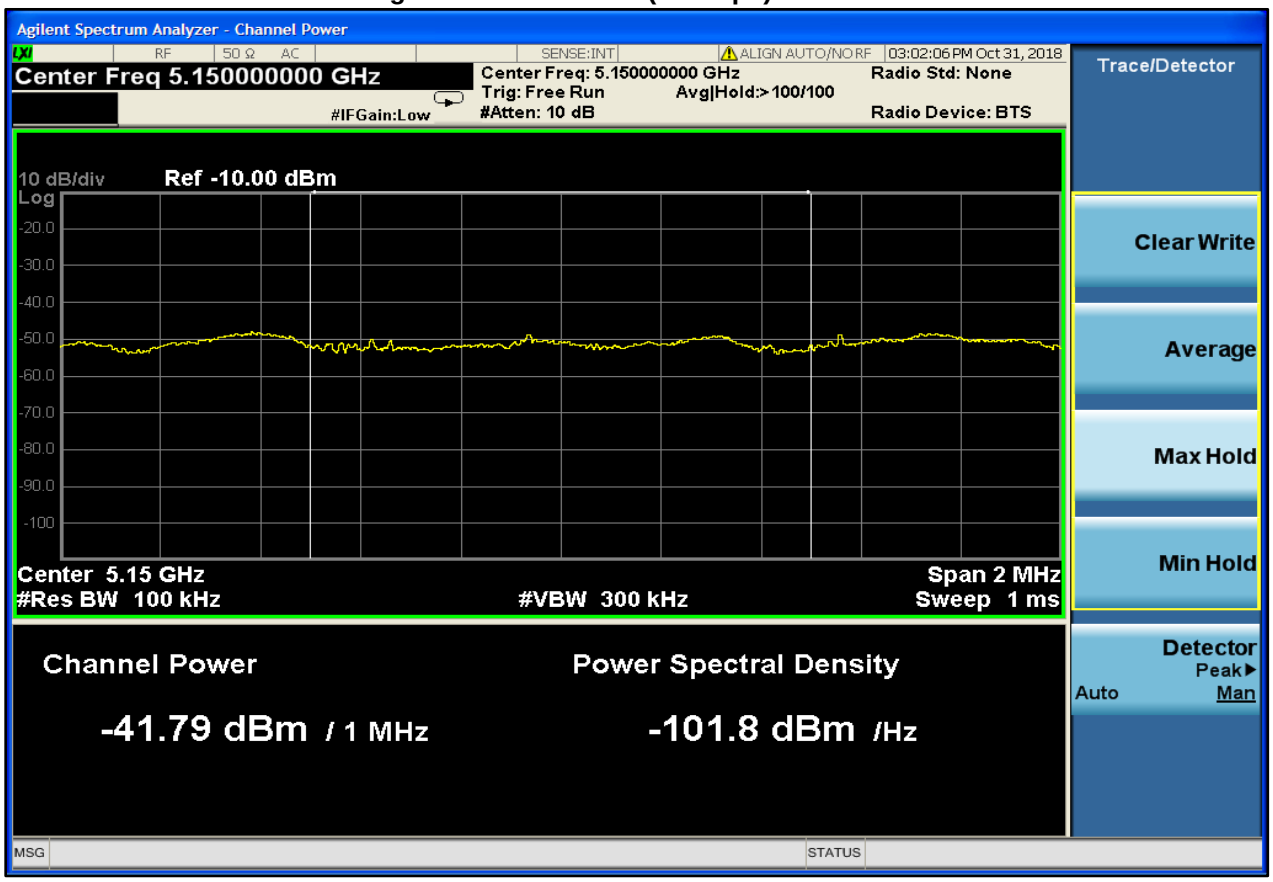


Table 4-3: Lower Band Edge: U-NII1 – 802.11a (54 Mbps) – Peak

Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
5150	-41.8	53.4	74.0	-20.6

Plot 4-3: Upper Band Edge: U-NII1 – 802.11a (54 Mbps) – Average

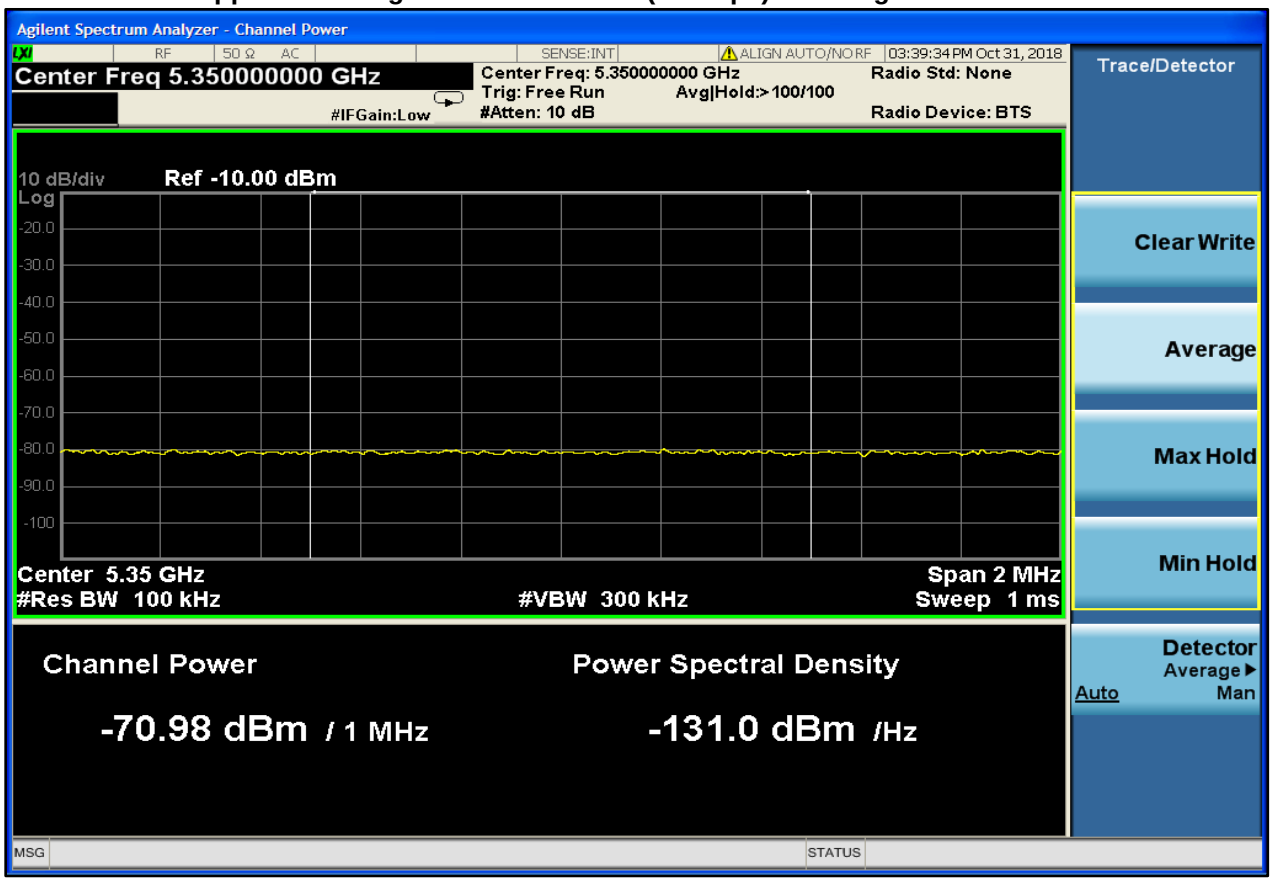


Table 4-4: Upper Band Edge: U-NII1 – 802.11a (54 Mbps) – Average

Frequency (MHz)	Measured Average Level (dBm)	Field Strength Conversion (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
5350	-71.0	24.2	54.0	-29.8

Plot 4-4: Upper Band Edge: U-NII1 – 802.11a (54 Mbps) – Peak

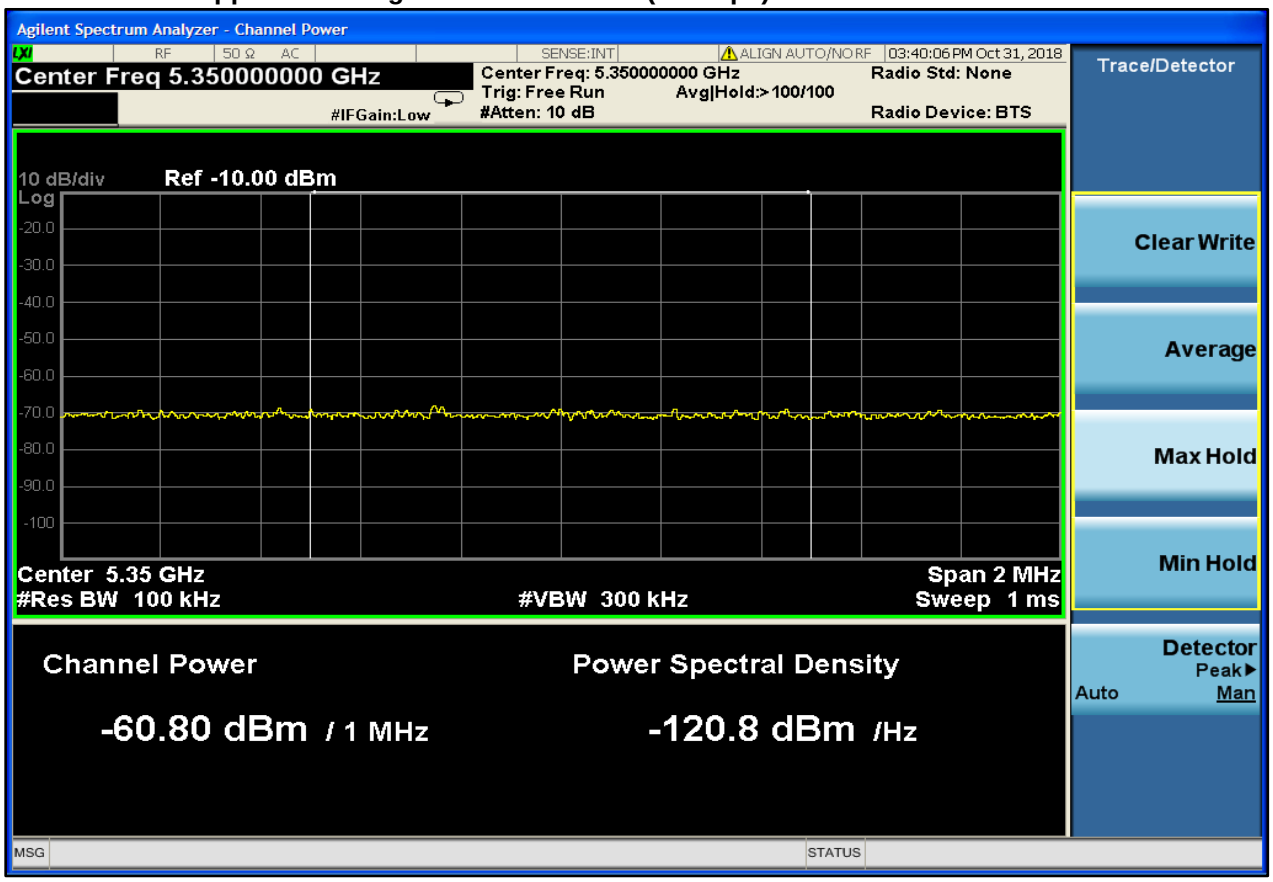
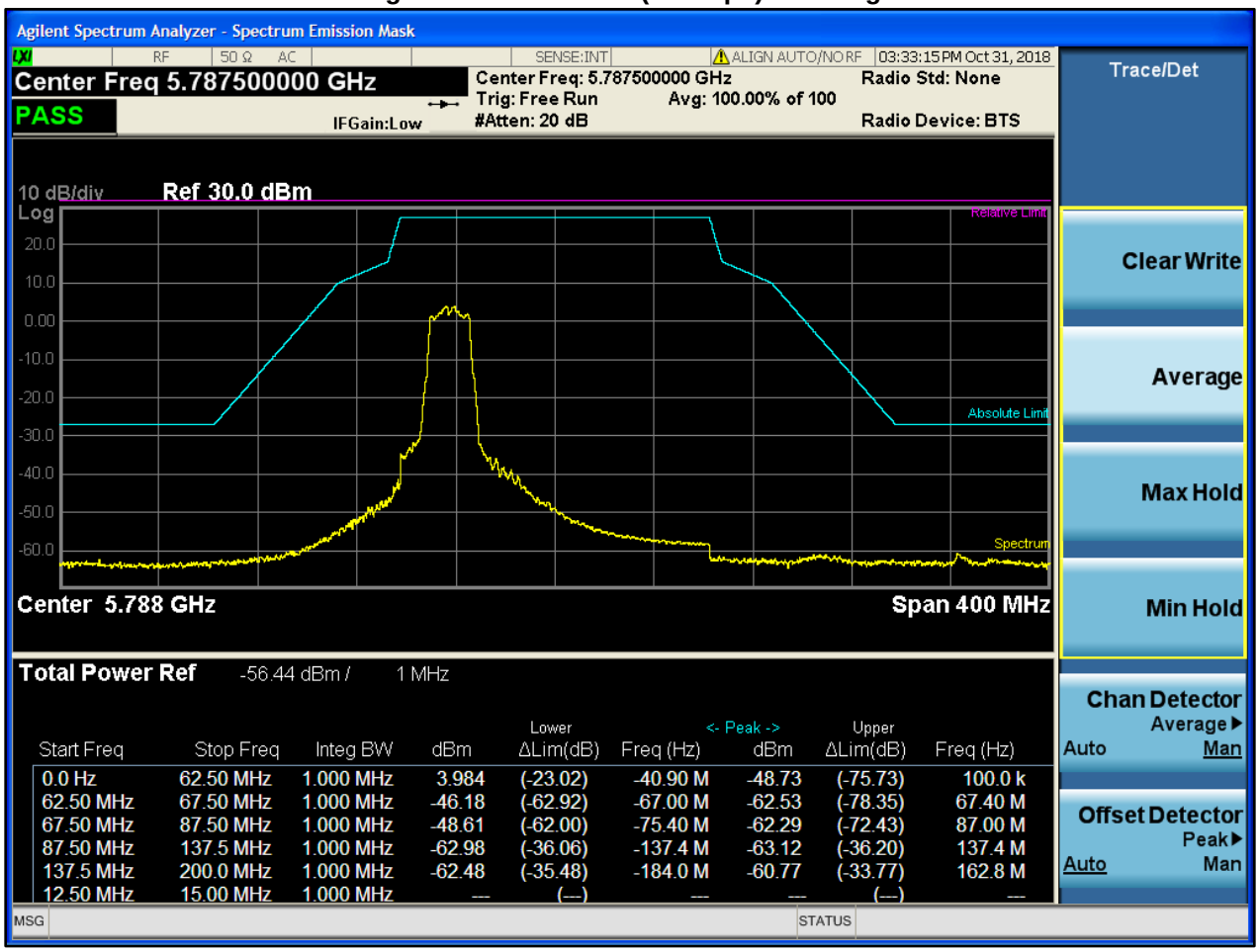


Table 4-5: Upper Band Edge: U-NII1 – 802.11a (54 Mbps) – Peak

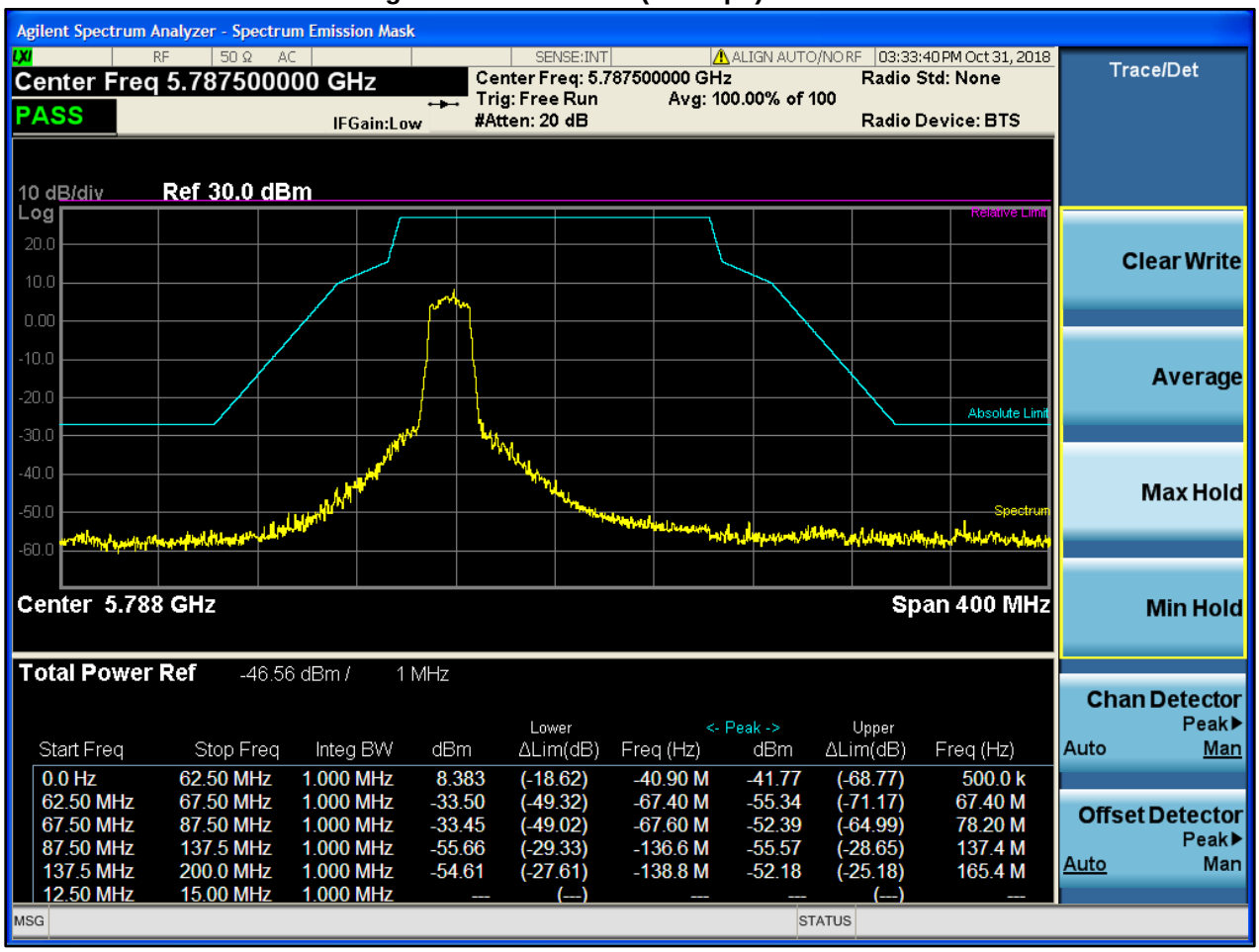
Frequency (MHz)	Measured Peak Level (dBm)	Field Strength Conversion (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
5350	-60.8	34.4	74.0	-39.6

Plot 4-5: Lower Band Edge: U-NII3 – 802.11a (54 Mbps) – Average



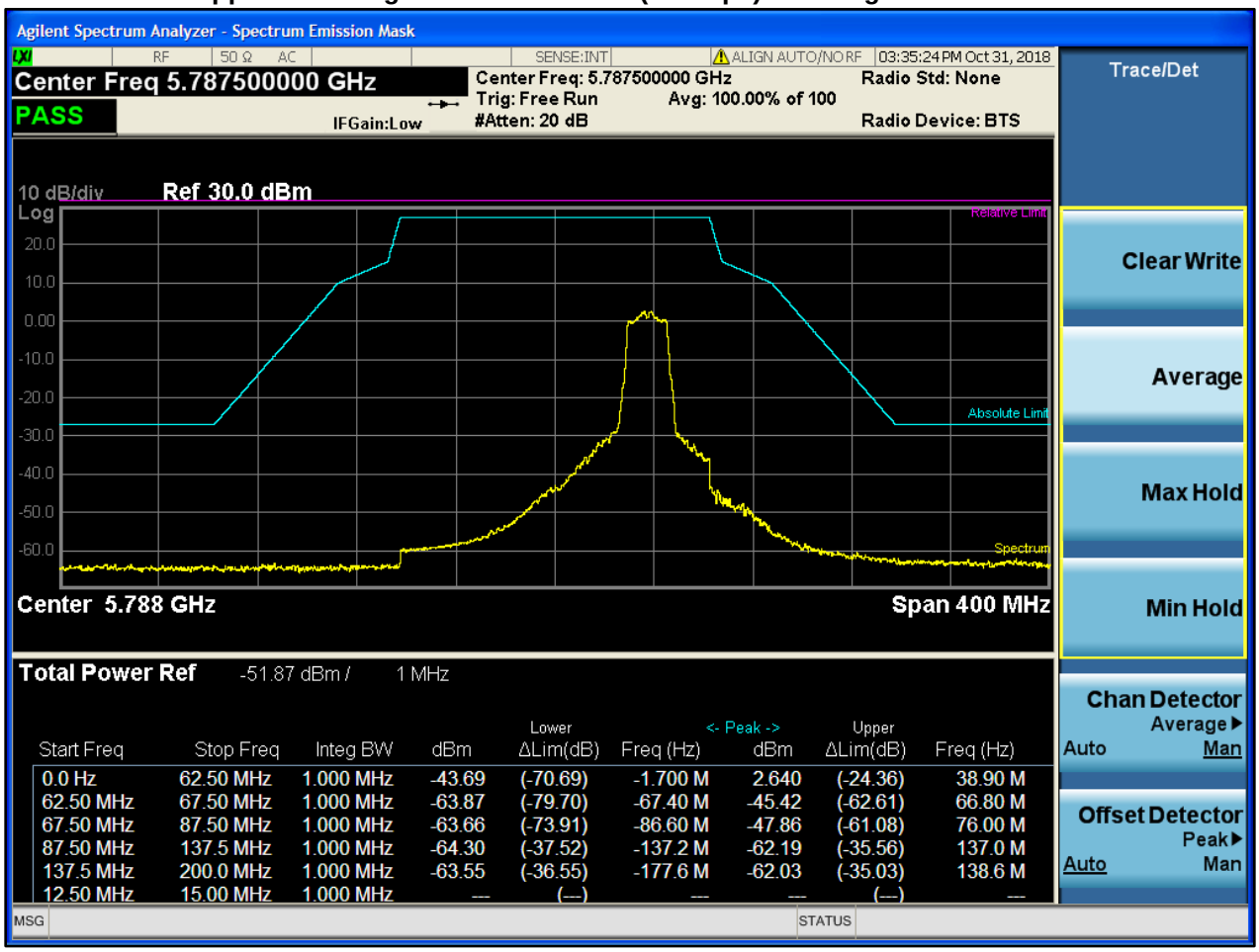
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	62.50 MHz	1.000 MHz	3.984	(-23.02)	-40.90 M	-48.73	(-75.73)	100.0 k
62.50 MHz	67.50 MHz	1.000 MHz	-46.18	(-62.92)	-67.00 M	-62.53	(-78.35)	67.40 M
67.50 MHz	87.50 MHz	1.000 MHz	-48.61	(-62.00)	-75.40 M	-62.29	(-72.43)	87.00 M
87.50 MHz	137.5 MHz	1.000 MHz	-62.98	(-36.06)	-137.4 M	-63.12	(-36.20)	137.4 M
137.5 MHz	200.0 MHz	1.000 MHz	-62.48	(-35.48)	-184.0 M	-60.77	(-33.77)	162.8 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Plot 4-6: Lower Band Edge: U-NII3 – 802.11a (54 Mbps) – Peak



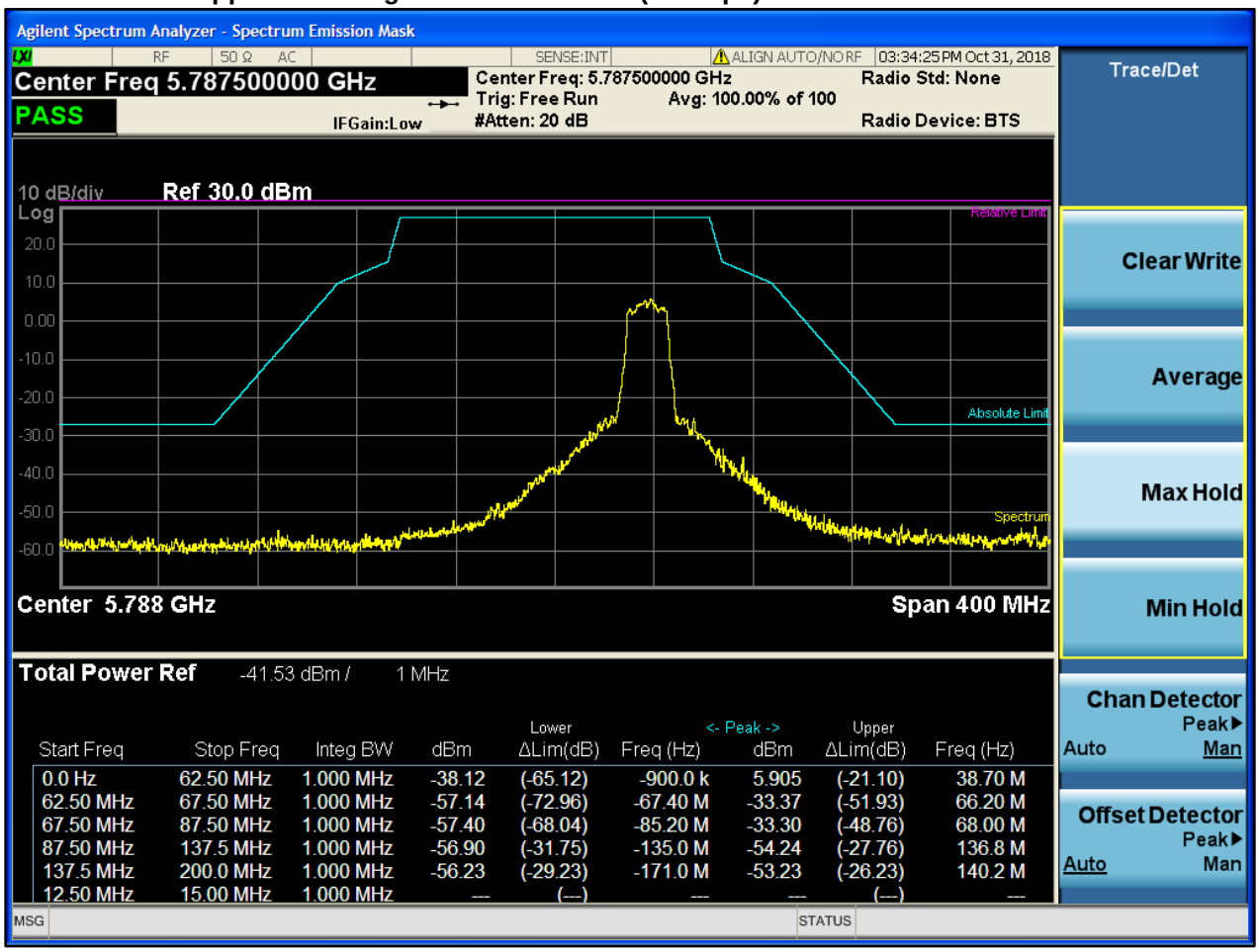
Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	62.50 MHz	1.000 MHz	8.383	(-18.62)	-40.90 M	-41.77	(-68.77)	500.0 k
62.50 MHz	67.50 MHz	1.000 MHz	-33.50	(-49.32)	-67.40 M	-55.34	(-71.17)	67.40 M
67.50 MHz	87.50 MHz	1.000 MHz	-33.45	(-49.02)	-67.60 M	-52.39	(-64.99)	78.20 M
87.50 MHz	137.5 MHz	1.000 MHz	-55.66	(-29.33)	-136.6 M	-55.57	(-28.65)	137.4 M
137.5 MHz	200.0 MHz	1.000 MHz	-54.61	(-27.61)	-138.8 M	-52.18	(-25.18)	165.4 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Plot 4-7: Upper Band Edge: U-NII3 – 802.11a (54 Mbps) – Average



Start Freq	Stop Freq	Integ BW	Lower dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	62.50 MHz	1.000 MHz	-43.69	(-70.69)	-1.700 M	2.640	(-24.36)	38.90 M
62.50 MHz	67.50 MHz	1.000 MHz	-63.87	(-79.70)	-67.40 M	-45.42	(-62.61)	66.80 M
67.50 MHz	87.50 MHz	1.000 MHz	-63.66	(-73.91)	-86.60 M	-47.86	(-61.08)	76.00 M
87.50 MHz	137.5 MHz	1.000 MHz	-64.30	(-37.52)	-137.2 M	-62.19	(-35.56)	137.0 M
137.5 MHz	200.0 MHz	1.000 MHz	-63.55	(-36.55)	-177.6 M	-62.03	(-35.03)	138.6 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Plot 4-8: Upper Band Edge: U-NII3 – 802.11a (54 Mbps) – Peak



Start Freq	Stop Freq	Integ BW	dBm	Lower ΔLim(dB)	Lower Freq (Hz)	<- Peak -> dBm	Upper ΔLim(dB)	Upper Freq (Hz)
0.0 Hz	62.50 MHz	1.000 MHz	-38.12	(-65.12)	-900.0 k	5.905	(-21.10)	38.70 M
62.50 MHz	67.50 MHz	1.000 MHz	-57.14	(-72.96)	-67.40 M	-33.37	(-51.93)	66.20 M
67.50 MHz	87.50 MHz	1.000 MHz	-57.40	(-68.04)	-85.20 M	-33.30	(-48.76)	68.00 M
87.50 MHz	137.5 MHz	1.000 MHz	-56.90	(-31.75)	-135.0 M	-54.24	(-27.76)	136.8 M
137.5 MHz	200.0 MHz	1.000 MHz	-56.23	(-29.23)	-171.0 M	-53.23	(-26.23)	140.2 M
12.50 MHz	15.00 MHz	1.000 MHz	---	(---)	---	---	(---)	---

Measurement uncertainty: ±0.5 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		October 31, 2018
Test Engineer	Signature	Date of Test

5 Antenna Conducted Spurious Emissions – §15.407(b)(6), C63.10 12.7

5.1 Antenna Conducted Spurious Emissions Test Procedures

Antenna conducted spurious emissions per FCC 15.407(b)(6) were measured from the EUT antenna port using a 50-ohm spectrum analyzer with the resolution bandwidth set at 1 MHz, and the video bandwidth set at > 3 x RBW.

Table 5-1: Antenna Conducted Spurious Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

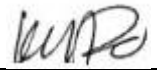
5.2 Antenna Conducted Spurious Emissions Test Results

No harmonics or spurs were found within 20 dB (note that we are reporting power as peak) of the carrier level from the carrier to the 10th harmonic of the carrier frequency.

Measurement uncertainty: ±0.5 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		October 31, 2018
Test Engineer	Signature	Date of Test

6 Bandwidths – §15.407(a) and (e), C63.10 12.4

6.1 Bandwidth Test Procedure

The minimum 6 dB, 26 dB and 99% bandwidths per FCC 15.407(a) and (e) were measured using a 50-ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at ≥ 3 x RBW. The device was modulated, (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Table 6-1: Bandwidth Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901139	Weinschel Corp	48-20-34	Attenuator 20 dB, 100 W (DC – 18 GHz)	BK5859	4/23/19
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

6.2 Modulated Bandwidth Test Results

Table 6-2: 99% Bandwidth Test Data - U-NII1

Modulation Scheme	99% Bandwidth (MHz)		
	Low - Channel 36 (5180 MHz)	Mid - Channel 40 (5200 MHz)	High - Channel 48 (5240 MHz)
802.11a (54 Mbps)	16.470	16.473	16.472
802.11ac (MCS8)	17.724	17.722	17.723
802.11n (MCS7)	17.769	17.738	17.742

Table 6-3: 99% Bandwidth Test Data - U-NII3

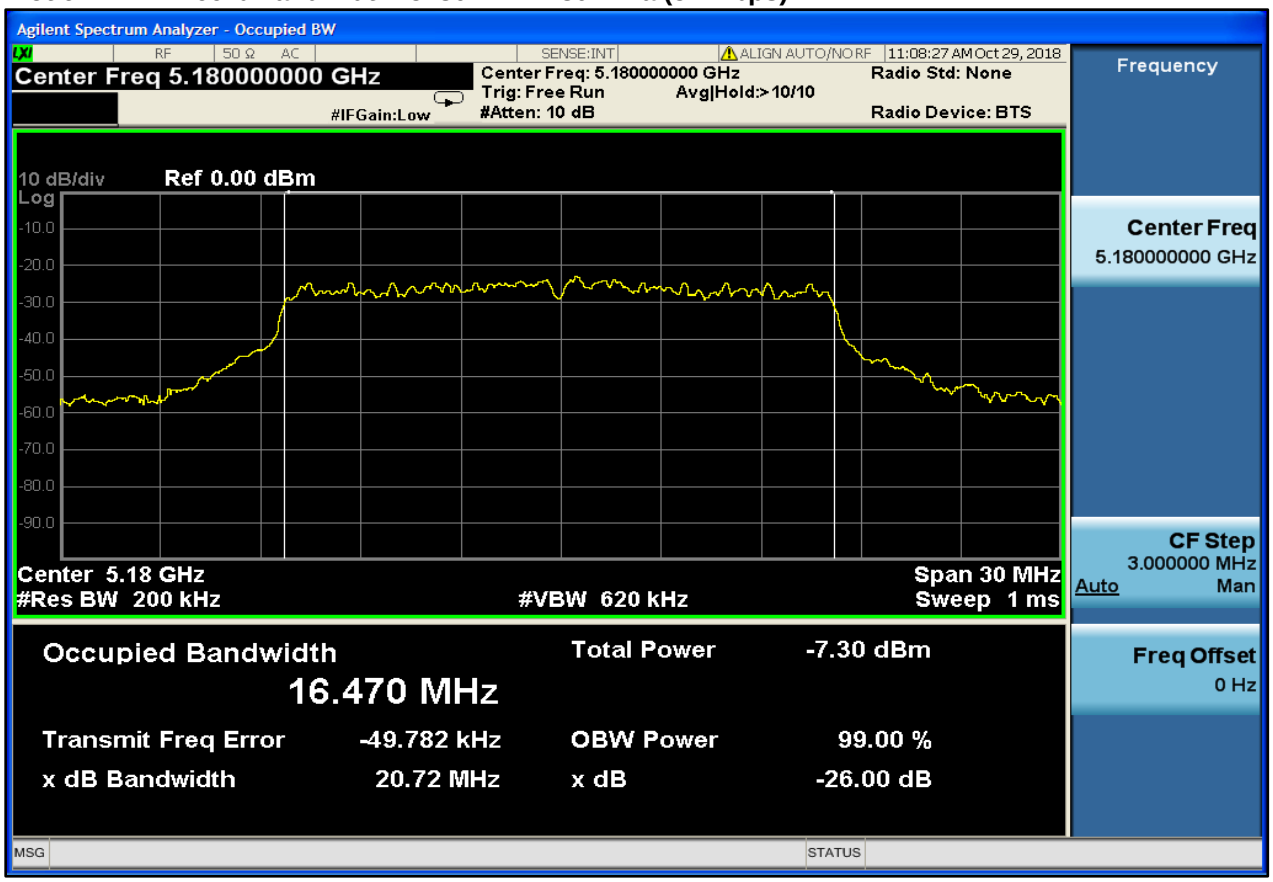
Modulation Scheme	99% Bandwidth (MHz)		
	Low - Channel 149 (5745 MHz)	Mid - Channel 157 (5785 MHz)	High - Channel 165 (5825 MHz)
802.11a (54 Mbps)	16.448	16.495	16.503
802.11ac (MCS8)	17.741	17.753	17.883
802.11n (MCS7)	17.736	17.746	17.740

Table 6-4: 6 dB Bandwidth Test Data - U-NII3

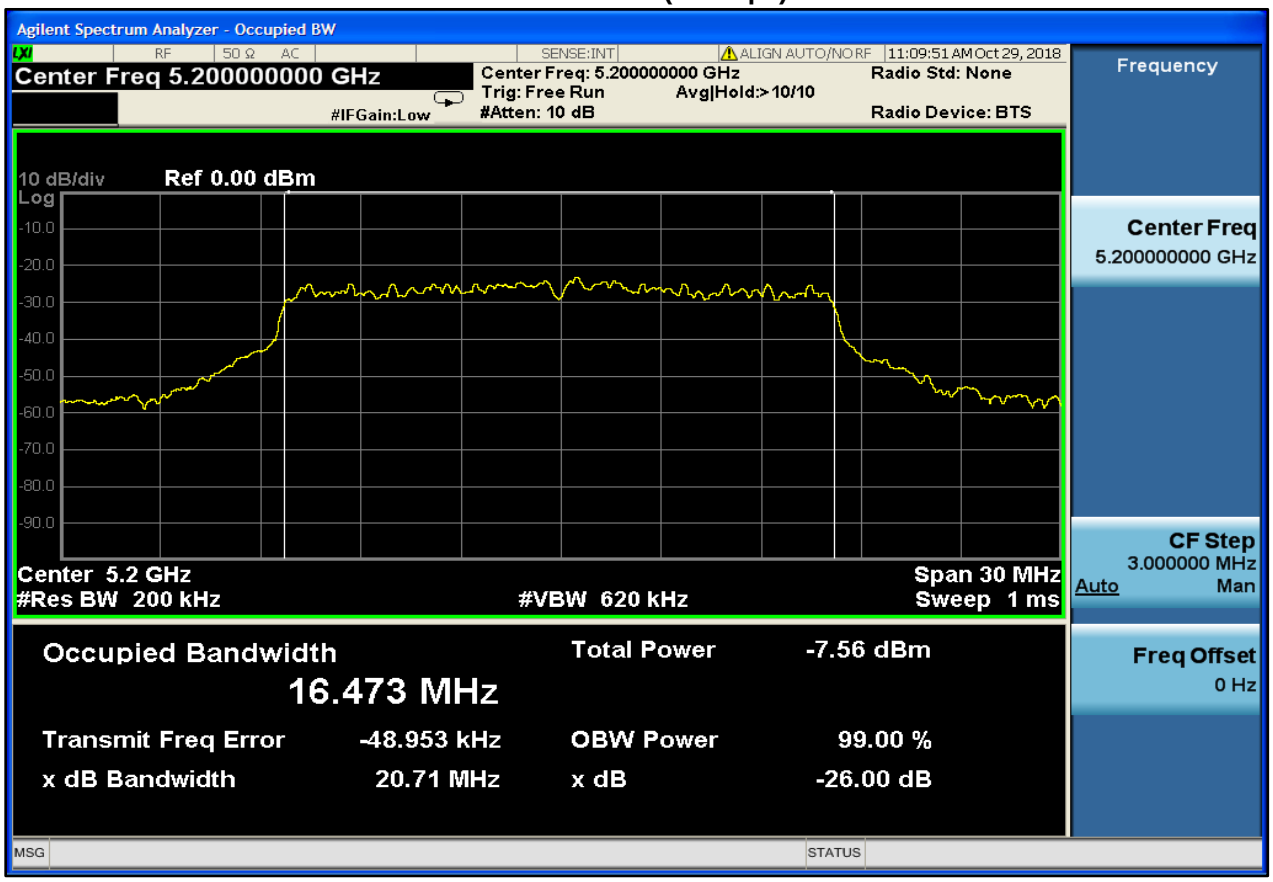
Modulation Scheme	6 dB Bandwidth (MHz)				
	Low - Channel 149 (5745 MHz)	Mid - Channel 157 (5785 MHz)	High - Channel 165 (5825 MHz)	Limit (MHz)	Result (Pass / Fail)
802.11a (54 Mbps)	16.19	16.26	16.25	≥ 0.500	Pass
802.11ac (MCS8)	17.68	17.66	17.40	≥ 0.500	Pass
802.11n (MCS7)	17.56	17.70	17.67	≥ 0.500	Pass

6.3 Bandwidth Plots – U-NII1

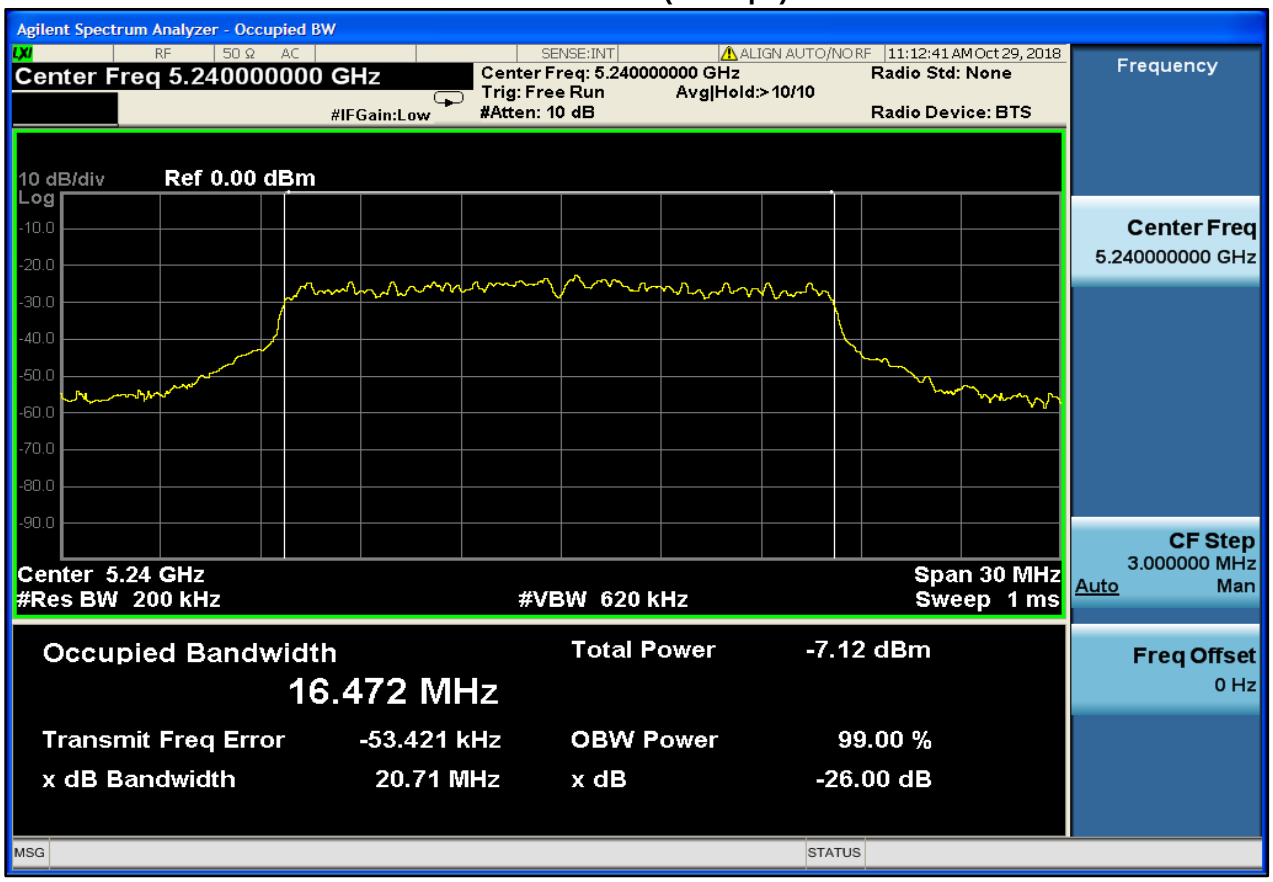
Plot 6-1: 99% Bandwidth: 5180 MHz – 802.11a (54 Mbps)



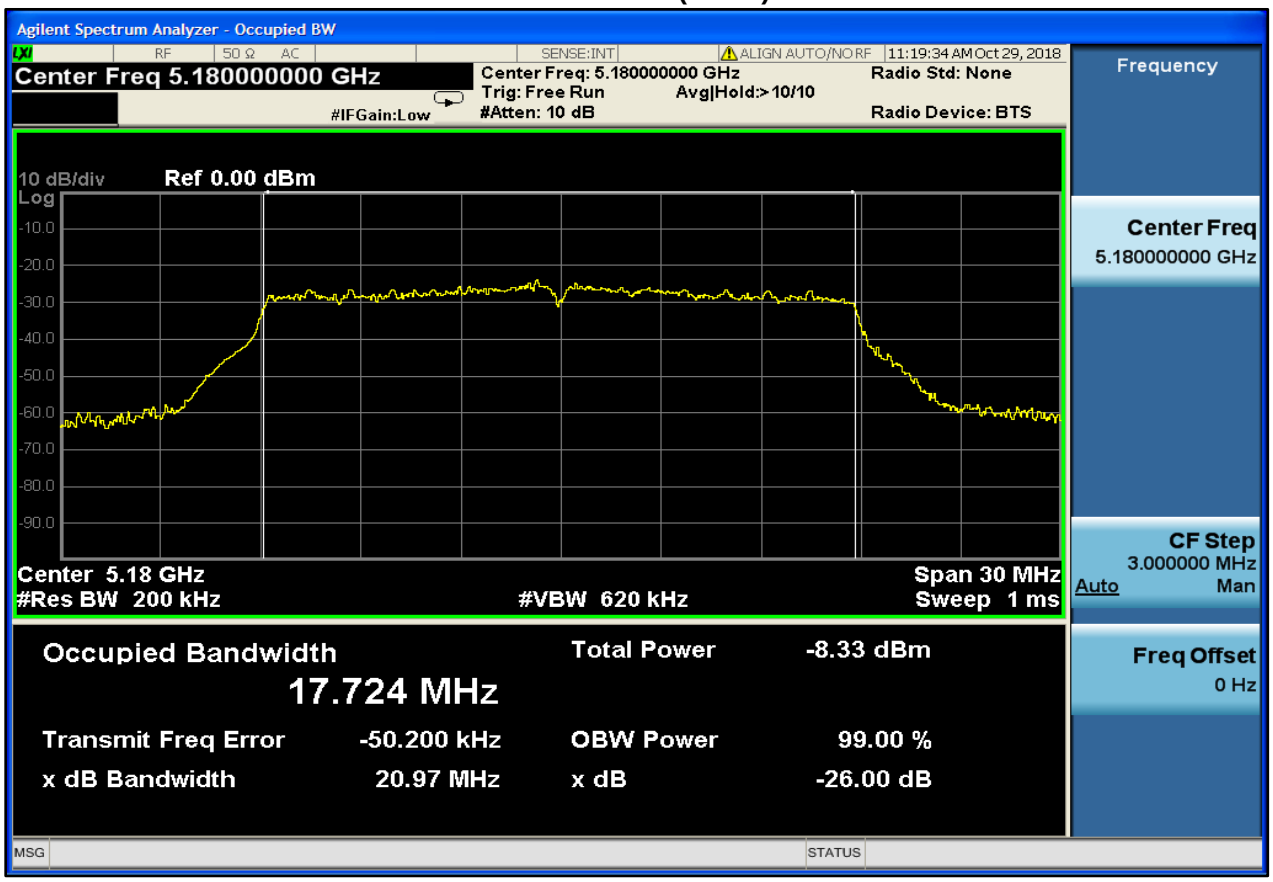
Plot 6-2: 99% Bandwidth: 5200 MHz – 802.11a (54 Mbps)



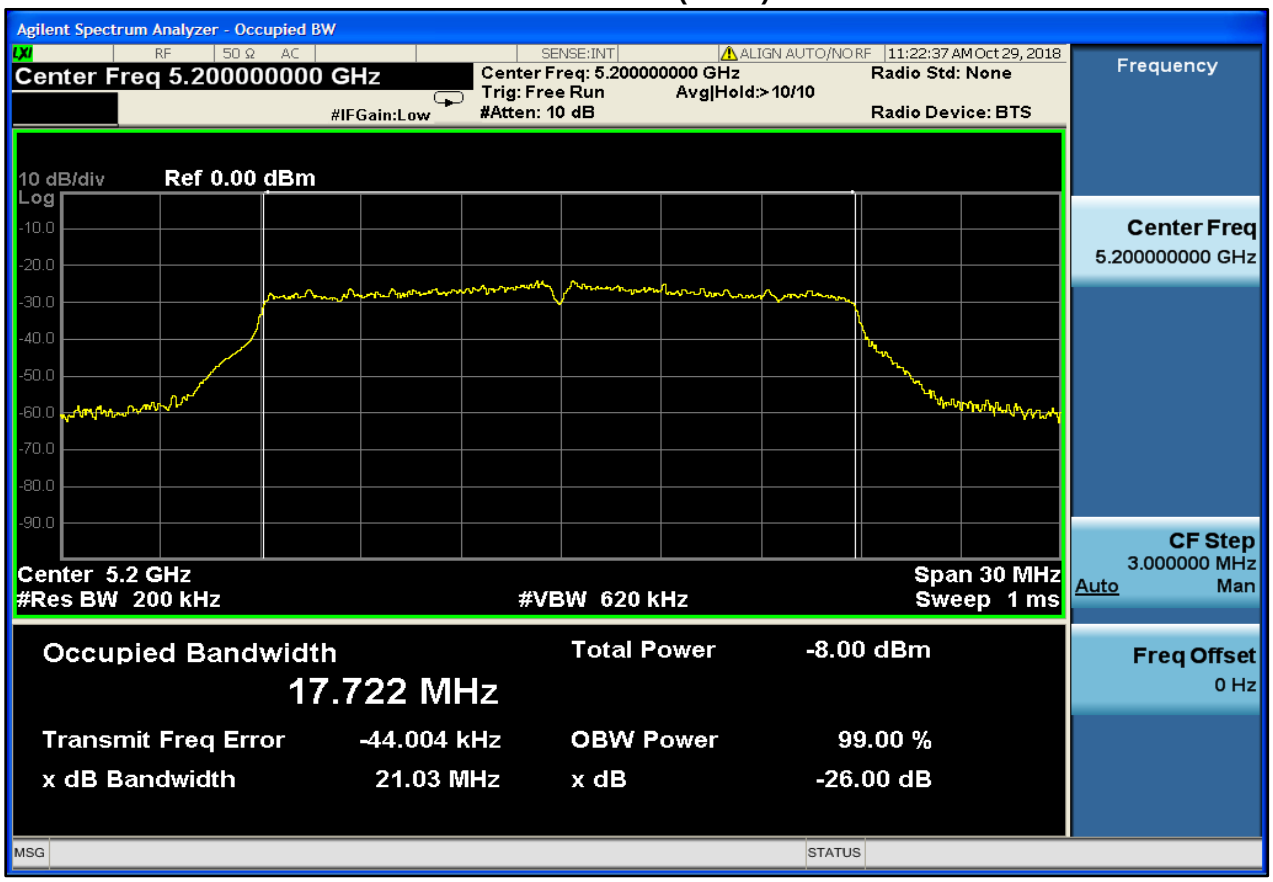
Plot 6-3: 99% Bandwidth: 5240 MHz – 802.11a (54 Mbps)



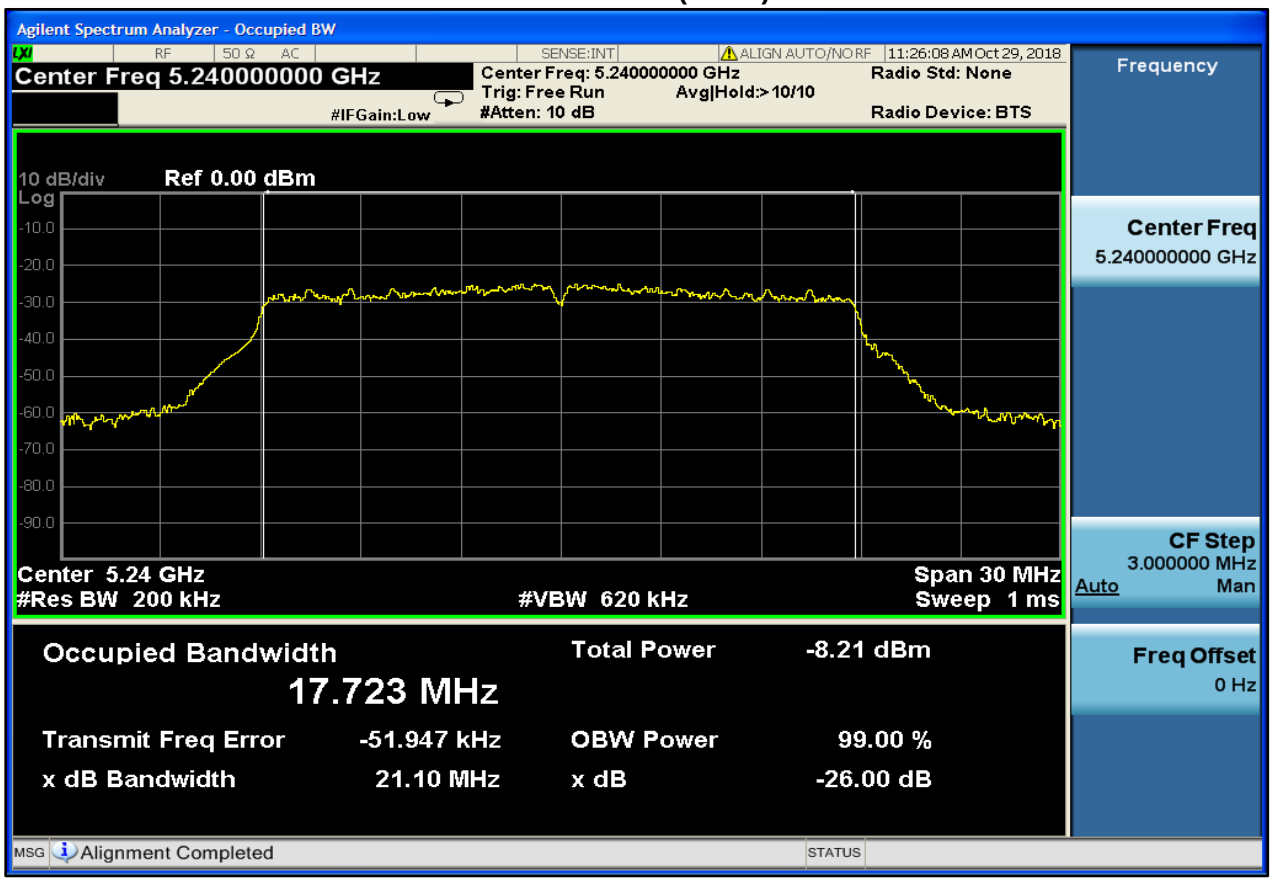
Plot 6-4: 99% Bandwidth: 5180 MHz – 802.11ac (MCS8)



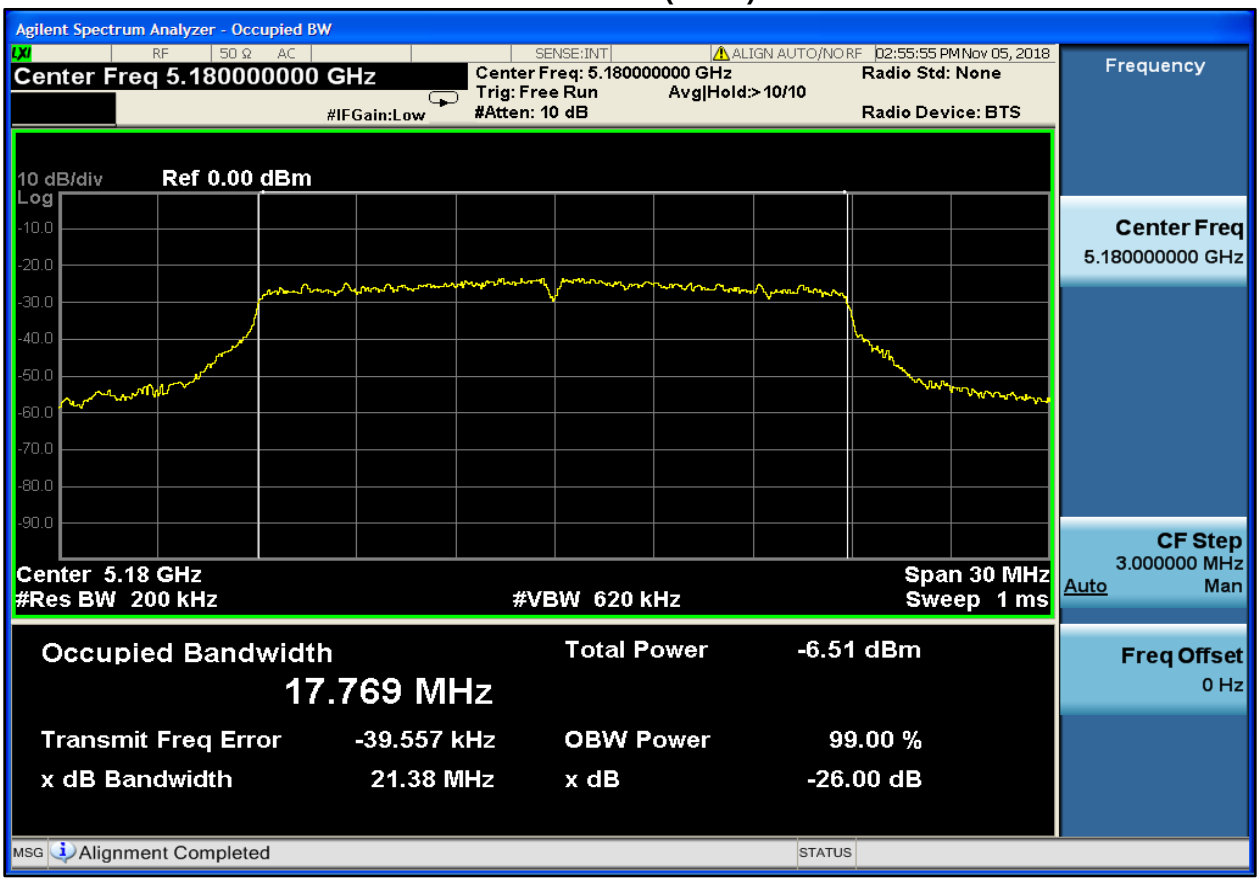
Plot 6-5: 99% Bandwidth: 5200 MHz – 802.11ac (MCS8)



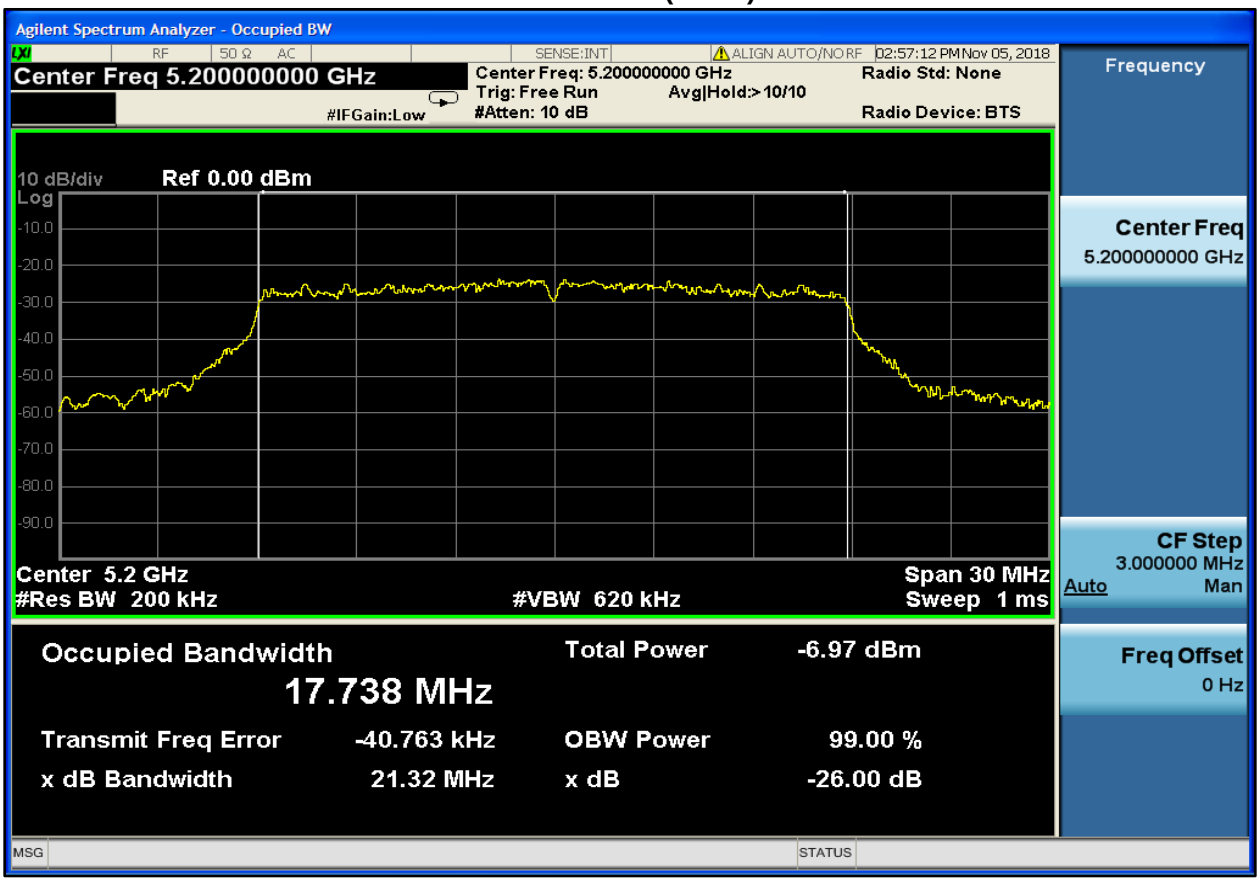
Plot 6-6: 99% Bandwidth: 5240 MHz – 802.11ac (MCS8)



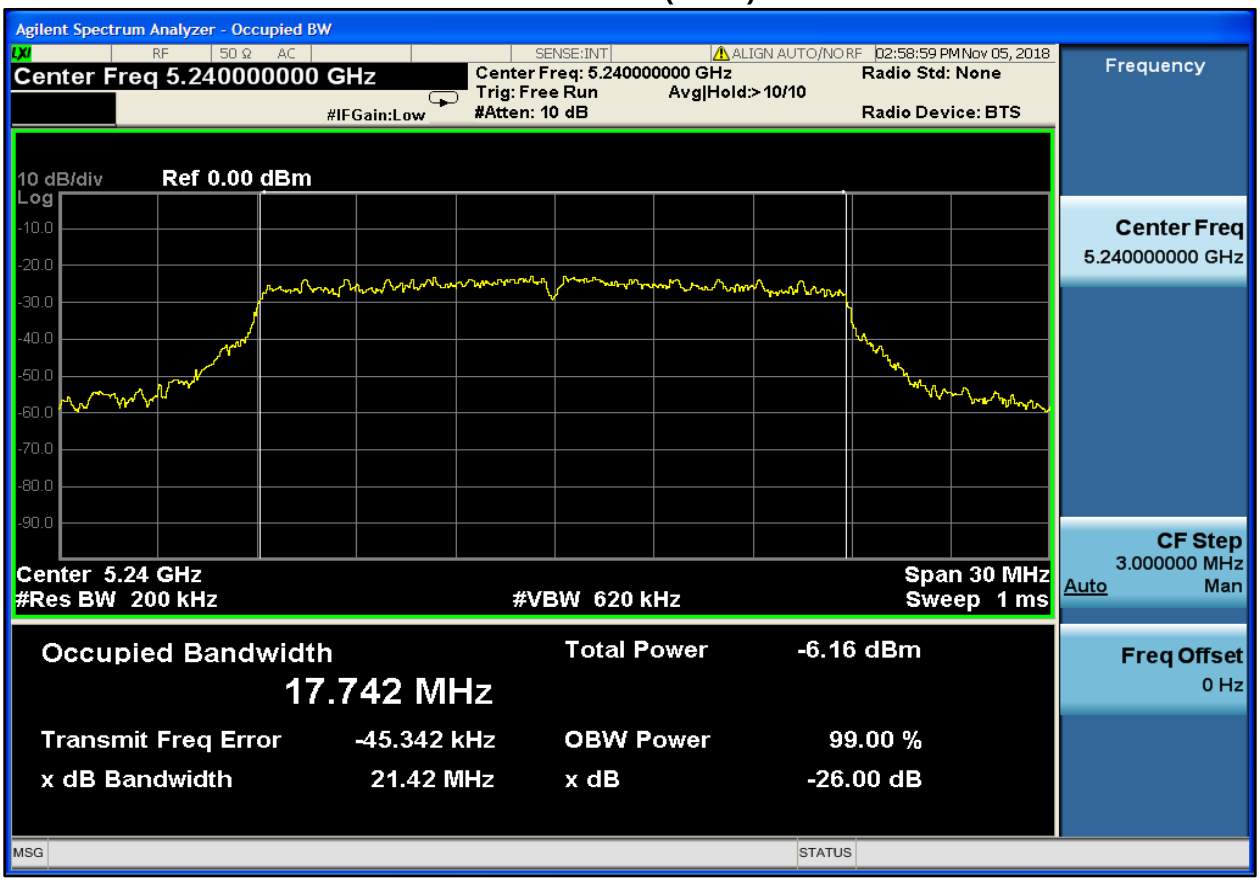
Plot 6-7: 99% Bandwidth: 5180 MHz – 802.11n (MCS7)



Plot 6-8: 99% Bandwidth: 5200 MHz – 802.11n (MCS7)

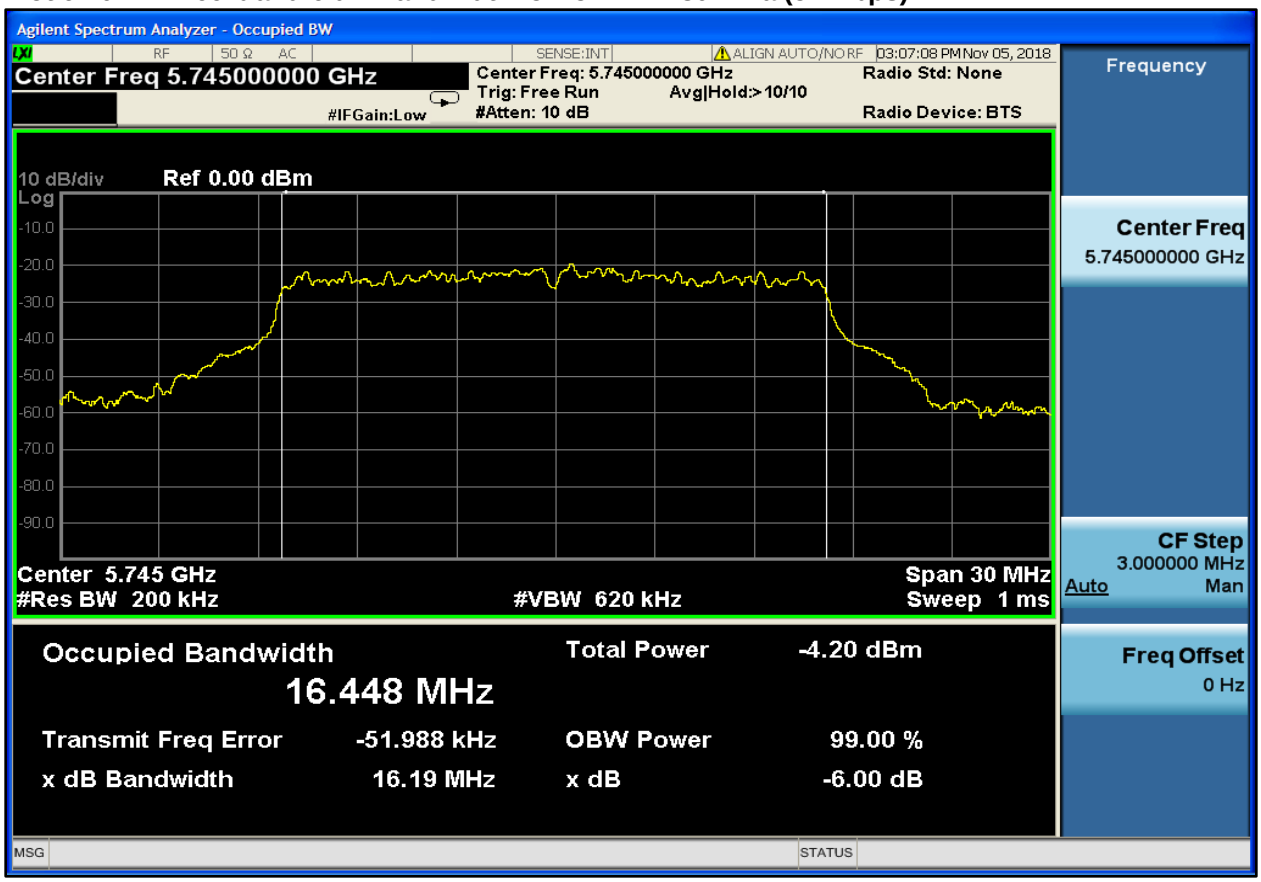


Plot 6-9: 99% Bandwidth: 5240 MHz – 802.11n (MCS7)

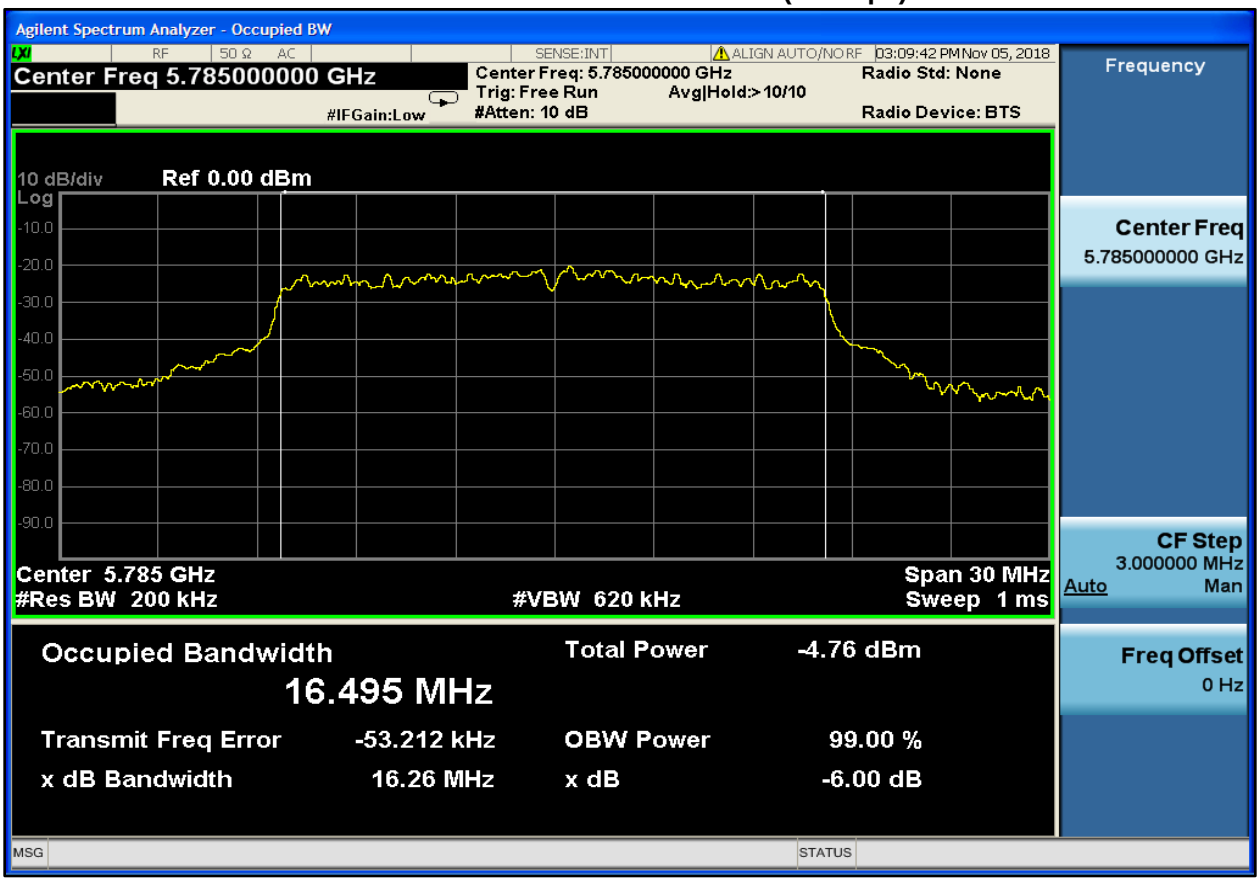


6.4 Bandwidth Plots – U-NII3

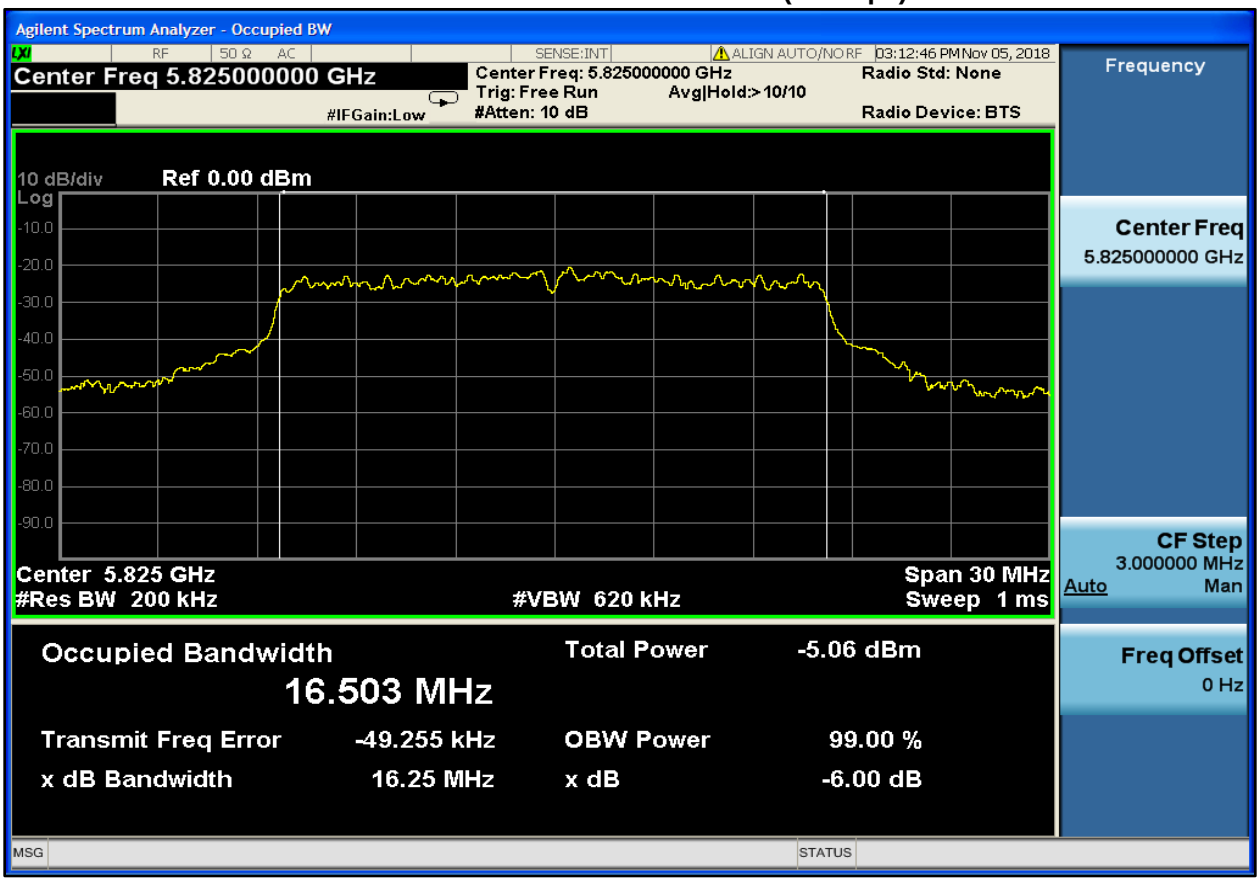
Plot 6-10: 99% and 6 dB Bandwidth: 5745 MHz – 802.11a (54 Mbps)



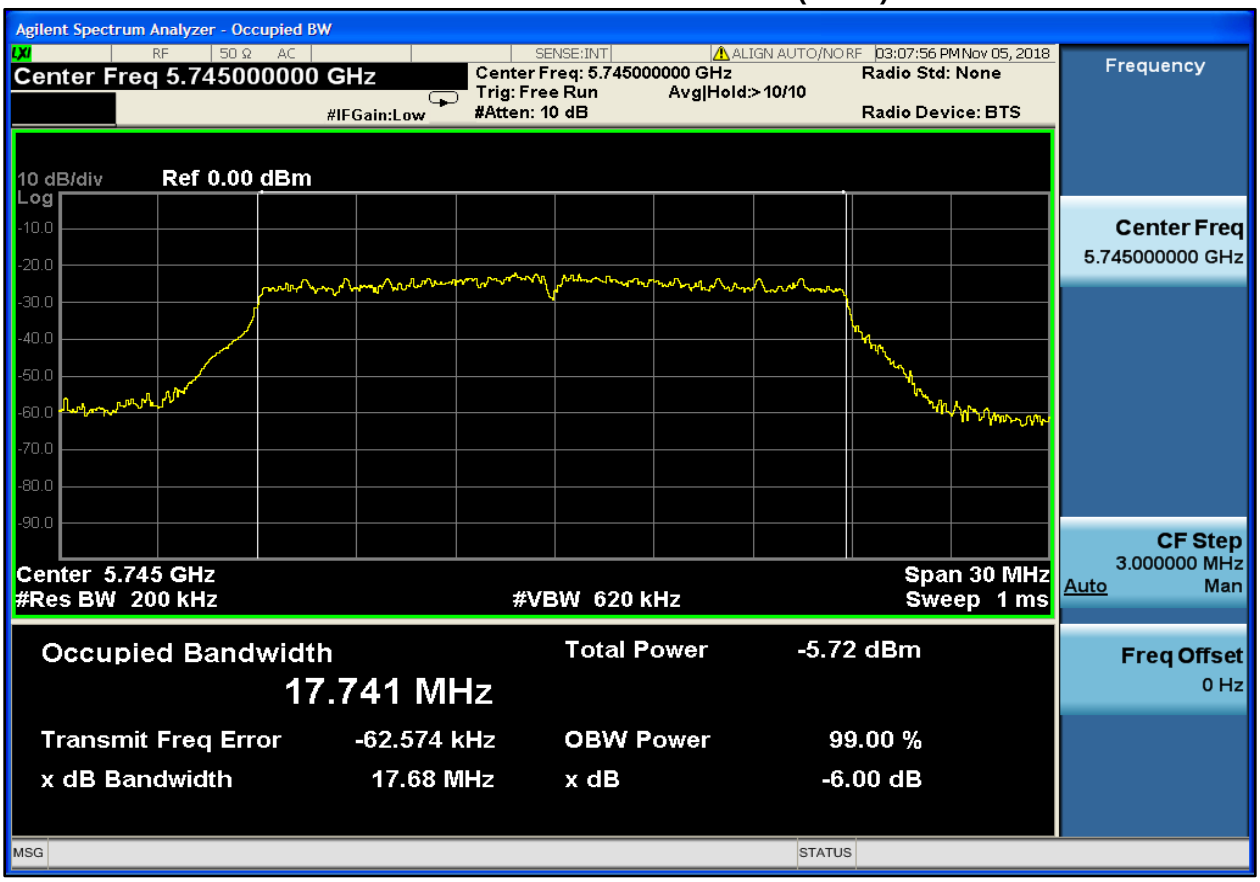
Plot 6-11: 99% and 6 dB Bandwidth: 5785 MHz – 802.11a (54 Mbps)



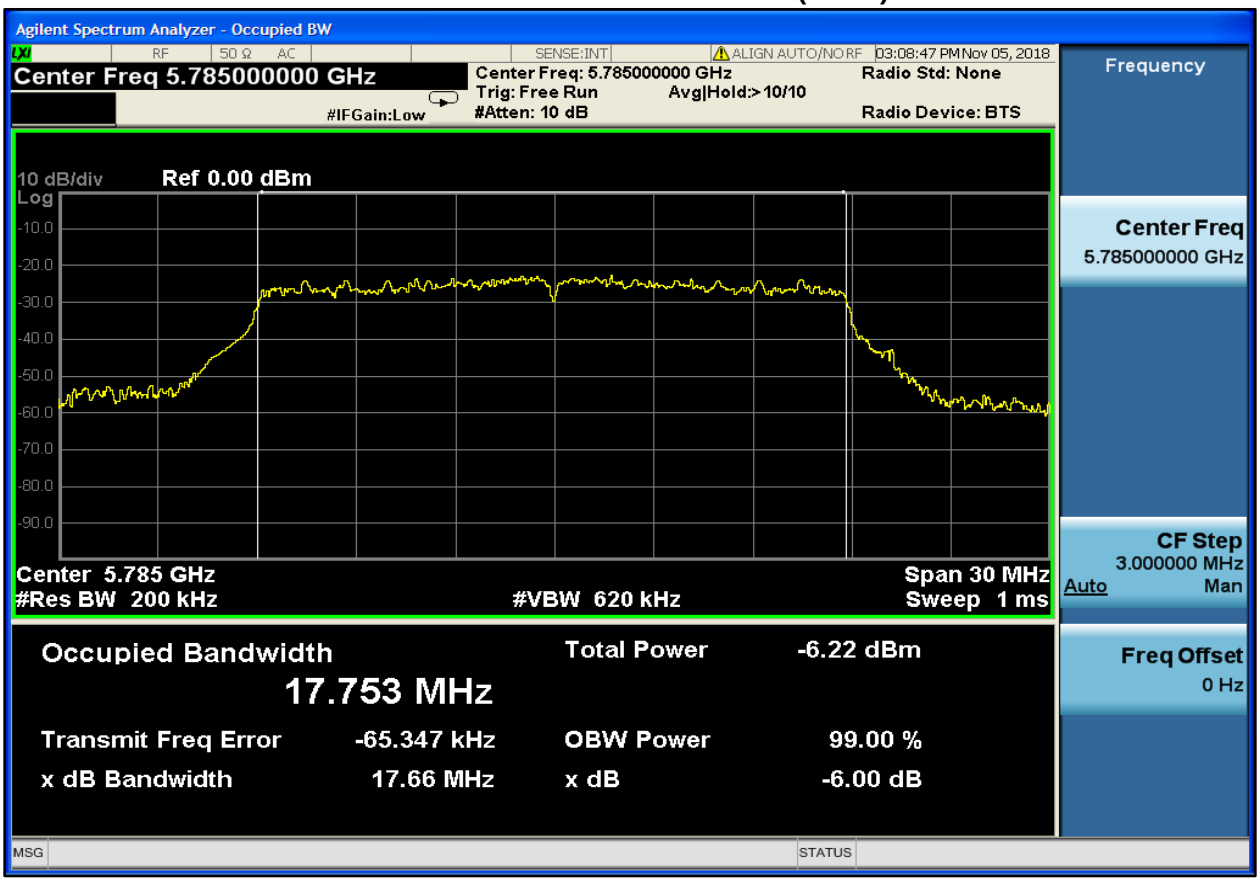
Plot 6-12: 99% and 6 dB Bandwidth: 5825 MHz – 802.11a (54 Mbps)



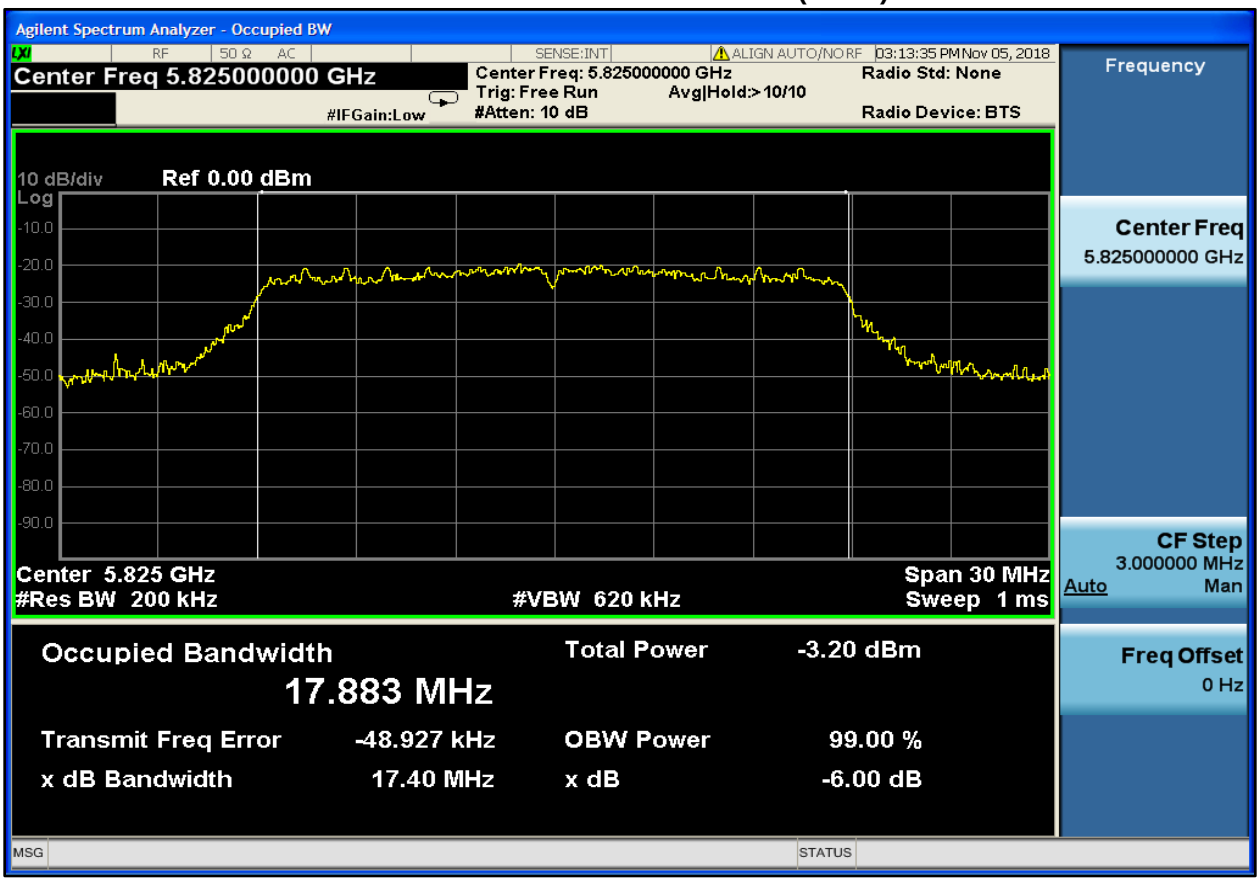
Plot 6-13: 99% and 6 dB Bandwidth: 5745 MHz – 802.11ac (MCS8)



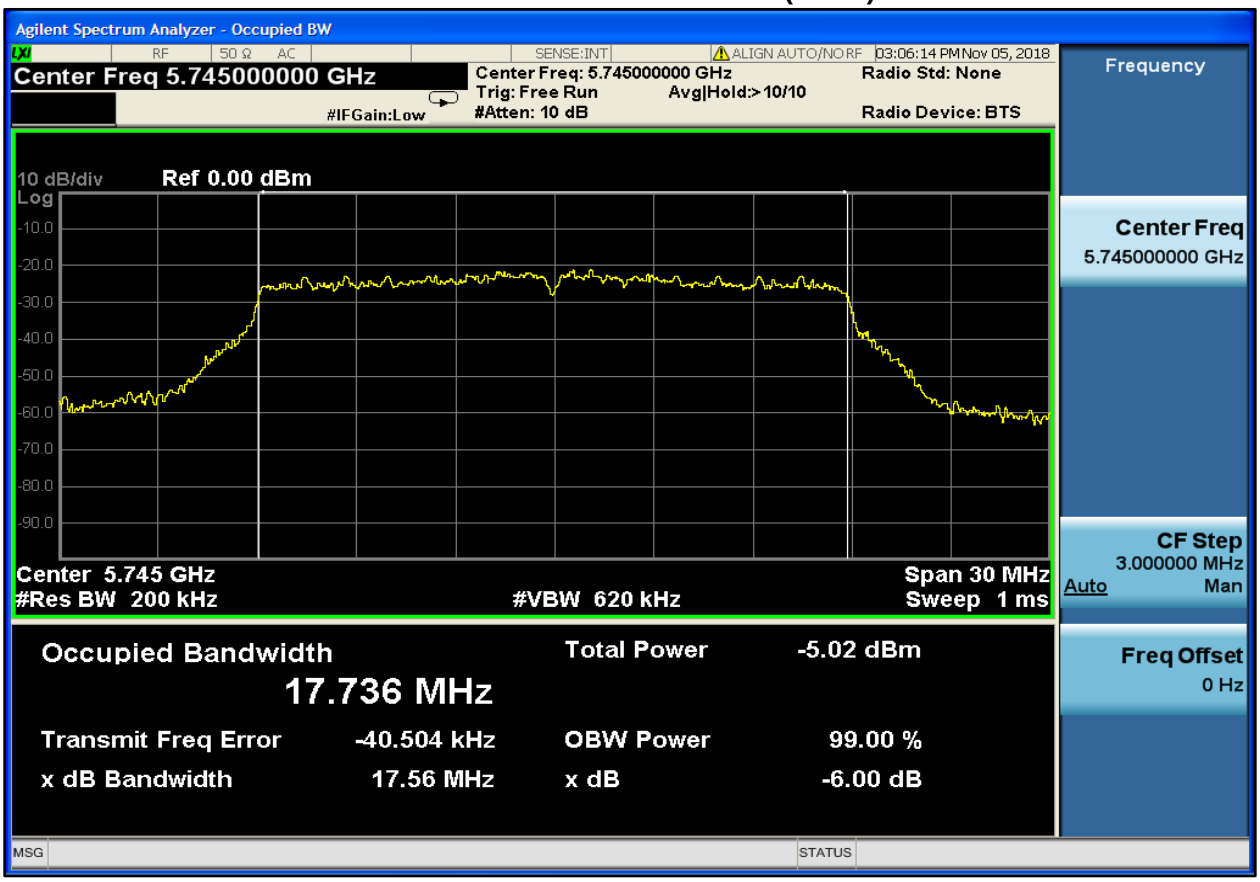
Plot 6-14: 99% and 6 dB Bandwidth: 5785 MHz – 802.11ac (MCS8)



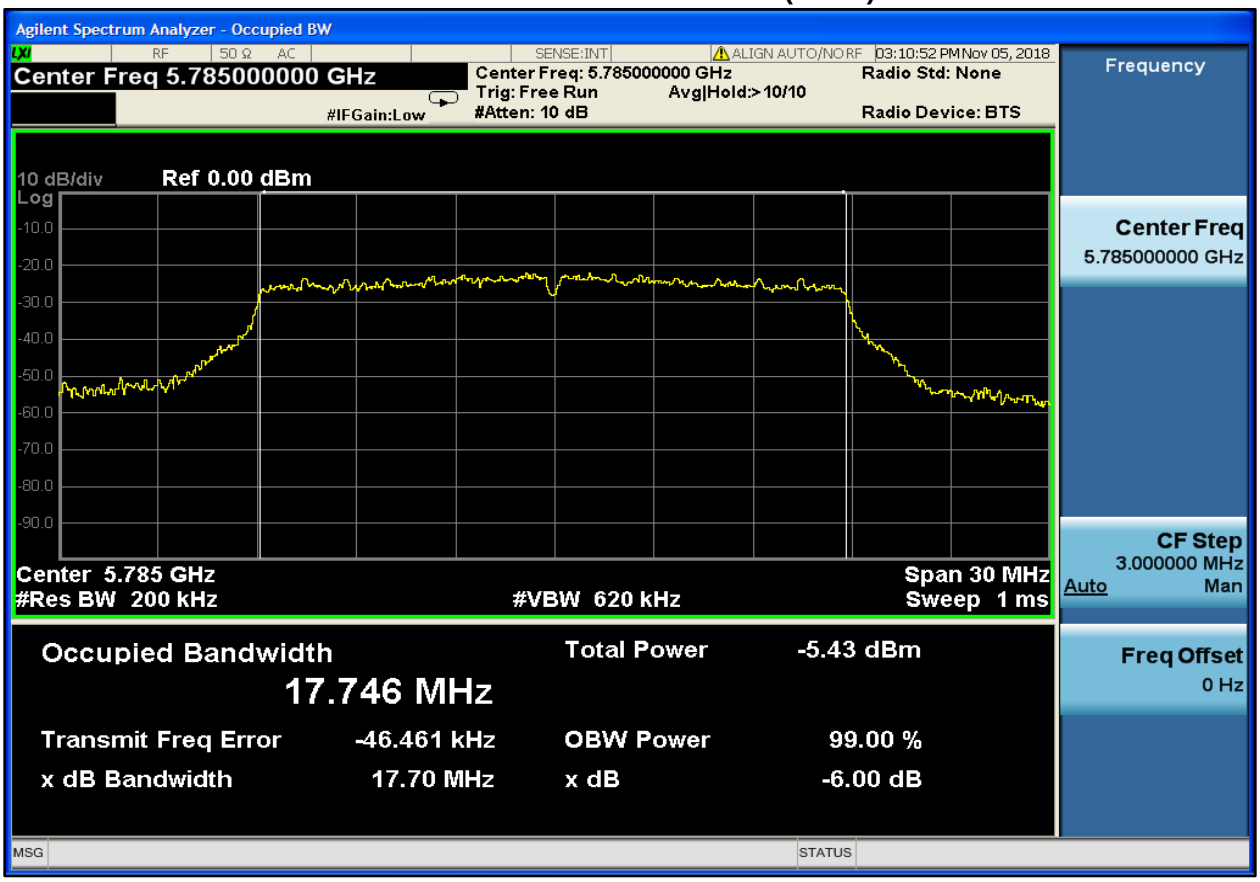
Plot 6-15: 99% and 6 dB Bandwidth: 5825 MHz – 802.11ac (MCS8)



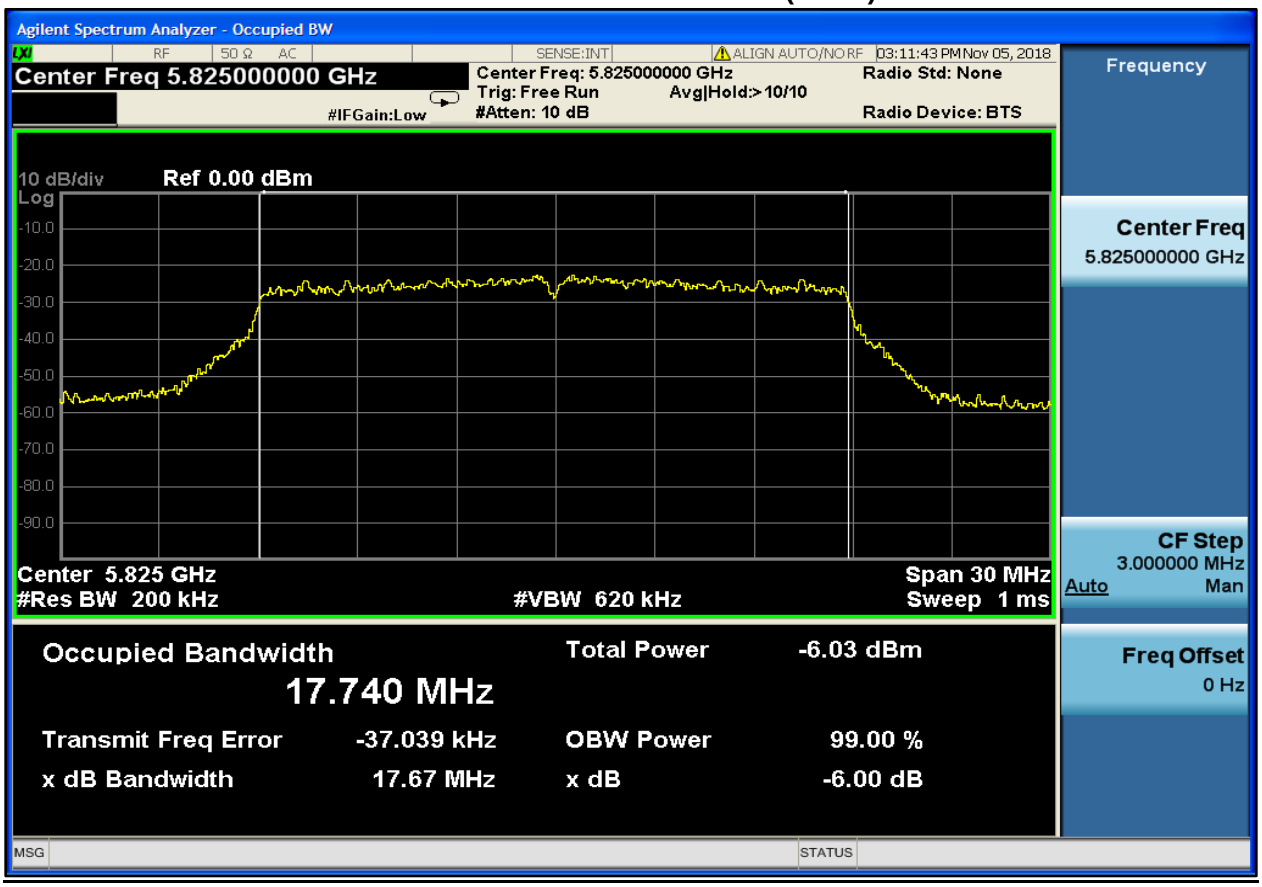
Plot 6-16: 99% and 6 dB Bandwidth: 5745 MHz – 802.11n (MCS7)



Plot 6-17: 99% and 6 dB Bandwidth: 5785 MHz – 802.11n (MCS7)

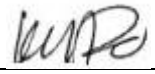


Plot 6-18: 99% and 6 dB Bandwidth: 5825 MHz – 802.11n (MCS7)



Measurement uncertainty: ±1 x 10^{-6} Hz. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Test Personnel:

Khue Do		October 29, 2018 and November 5, 2018
Test Engineer	Signature	Dates of Test

7 Power Spectral Density – §15.407(a)(1) and §15.407(a)(3), C63.10 12.5

7.1 Power Spectral Density Test Procedure

The power spectral density per FCC 15.407(a)(1)(3) was measured using a 50-ohm spectrum analyzer. The spectral lines were resolved for the modulated carriers. These levels are below the limits.

Table 7-1: Power Spectral Density Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz-26.5 GHz)	MY51250846	2/6/20

7.2 Power Spectral Density Test Results

Table 7-2: PSD Test Data: U-NII1

Modulation Scheme	PSD (dBm)		
	Low - Channel 36 (5180 MHz)	Mid - Channel 40 (5200 MHz)	High - Channel 48 (5240 MHz)
802.11a (54 Mbps)	-3.7	-3.8	-3.4
802.11ac (MCS8)	-5.2	-5.4	-5.0
802.11n (MCS7)	-6.4	-6.4	-6.9

Table 7-3: PSD Test Data: U-NII1 – Worst Case

Channel (#)	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
36	5180	-3.7	11.0	-14.7	Pass
40	5200	-3.8	11.0	-14.8	Pass
48	5240	-3.4	11.0	-14.4	Pass

Table 7-4: PSD Test Data: U-NII3

Modulation Scheme	PSD (dBm)		
	Low - Channel 149 (5745 MHz)	Mid - Channel 157 (5785 MHz)	High - Channel 165 (5825 MHz)
802.11b (11 Mbps)	-4.4	-4.9	-5.6
802.11g (54 Mbps)	-6.6	-7.2	-8.1
802.11n (MCS7)	-6.4	-6.9	-7.7

Table 7-5: PSD Test Data: U-NII3 – Worst Case

Channel (#)	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)	Result (Pass / Fail)
149	5745	-4.4	30.0	-34.4	Pass
157	5785	-4.9	30.0	-34.9	Pass
165	5825	-5.6	30.0	-35.6	Pass

7.3 Power Spectral Density Plots – U-NII1

Plot 7-1: PSD: 5180 MHz – 802.11a (54 Mbps)

Plot 7-2: PSD: 5200 MHz – 802.11a (54 Mbps)

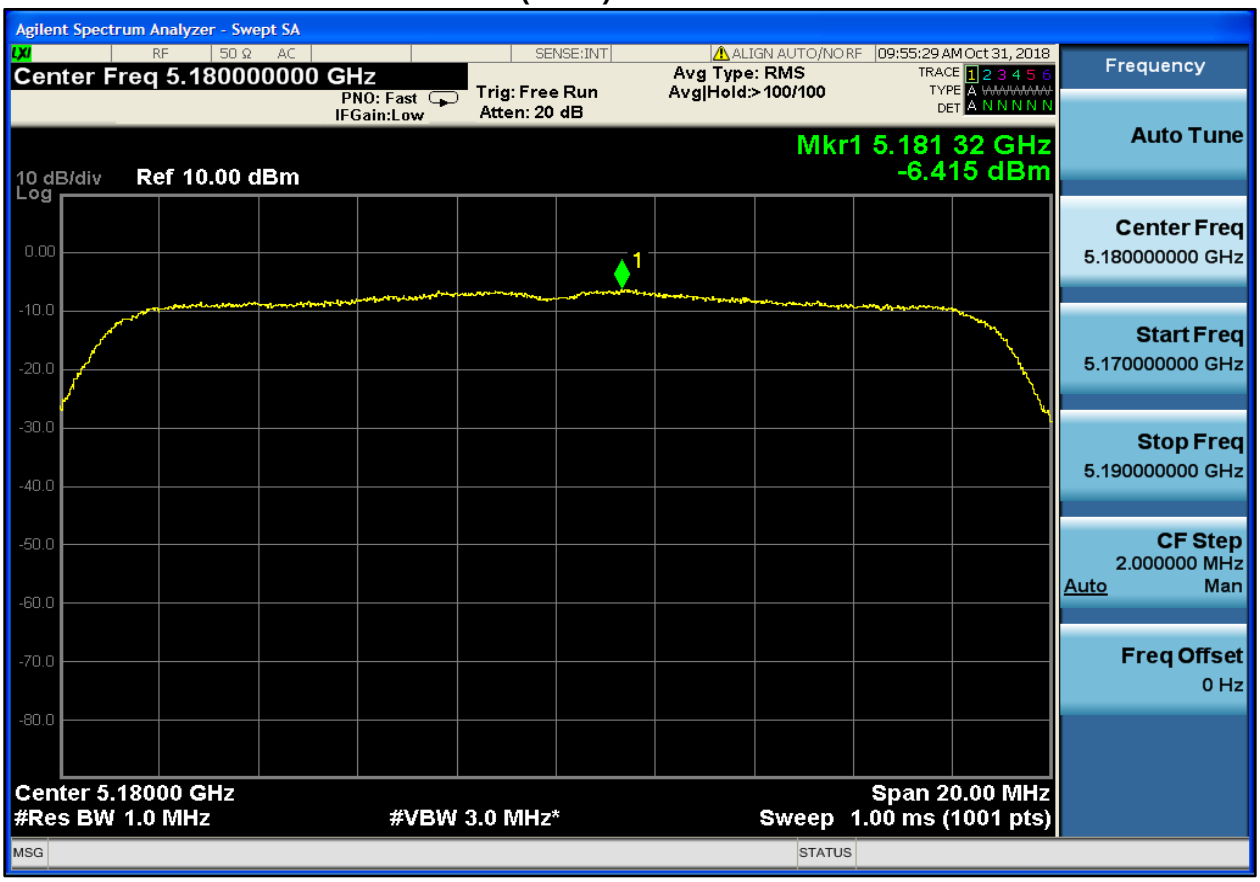
Plot 7-3: PSD: 5240 MHz – 802.11a (54 Mbps)

Plot 7-4: PSD: 5180 MHz – 802.11ac (MCS8)

Plot 7-5: PSD: 5200 MHz – 802.11ac (MCS8)

Plot 7-6: PSD: 5240 MHz – 802.11ac (MCS8)

Plot 7-7: PSD: 5180 MHz – 802.11n (MCS7)

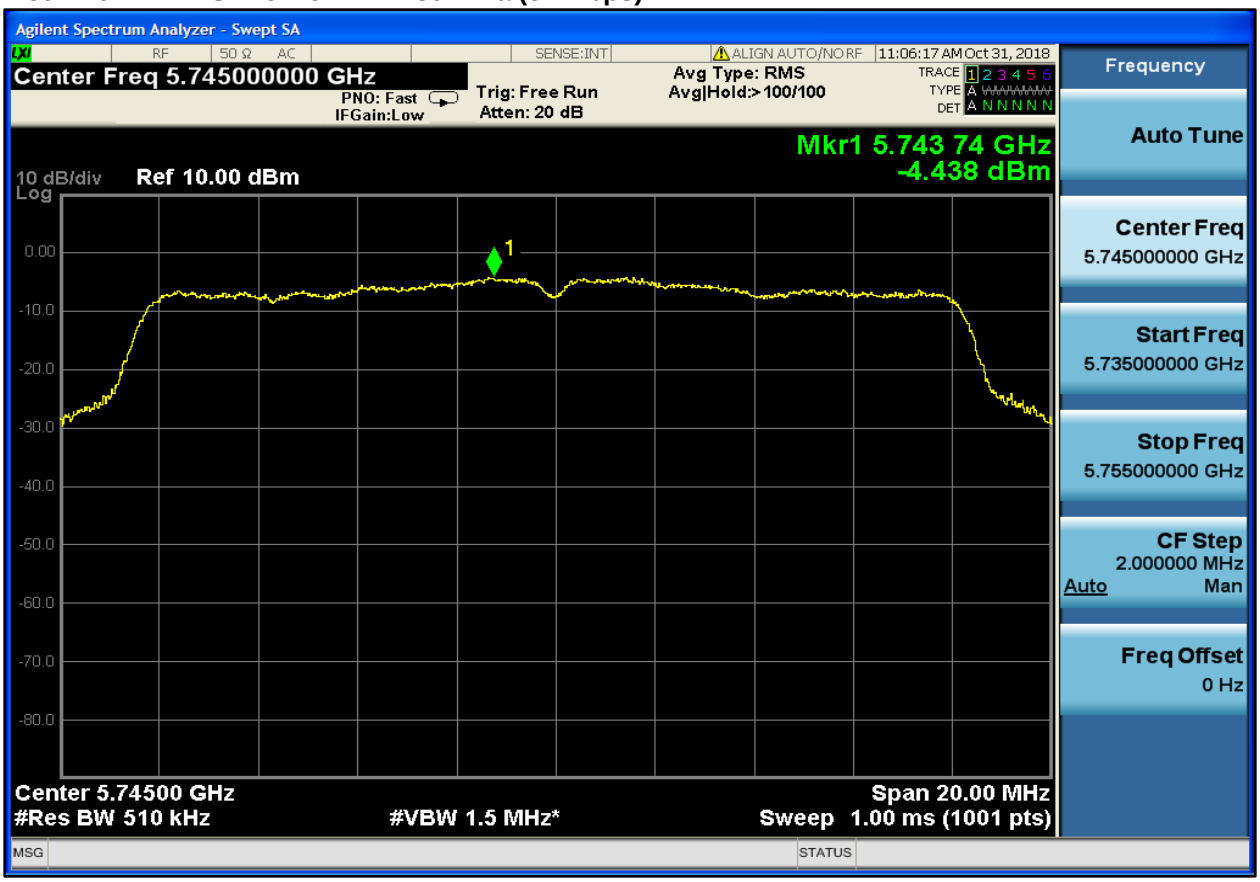


Plot 7-8: PSD: 5200 MHz – 802.11n (MCS7)

Plot 7-9: PSD: 5240 MHz – 802.11n (MCS7)

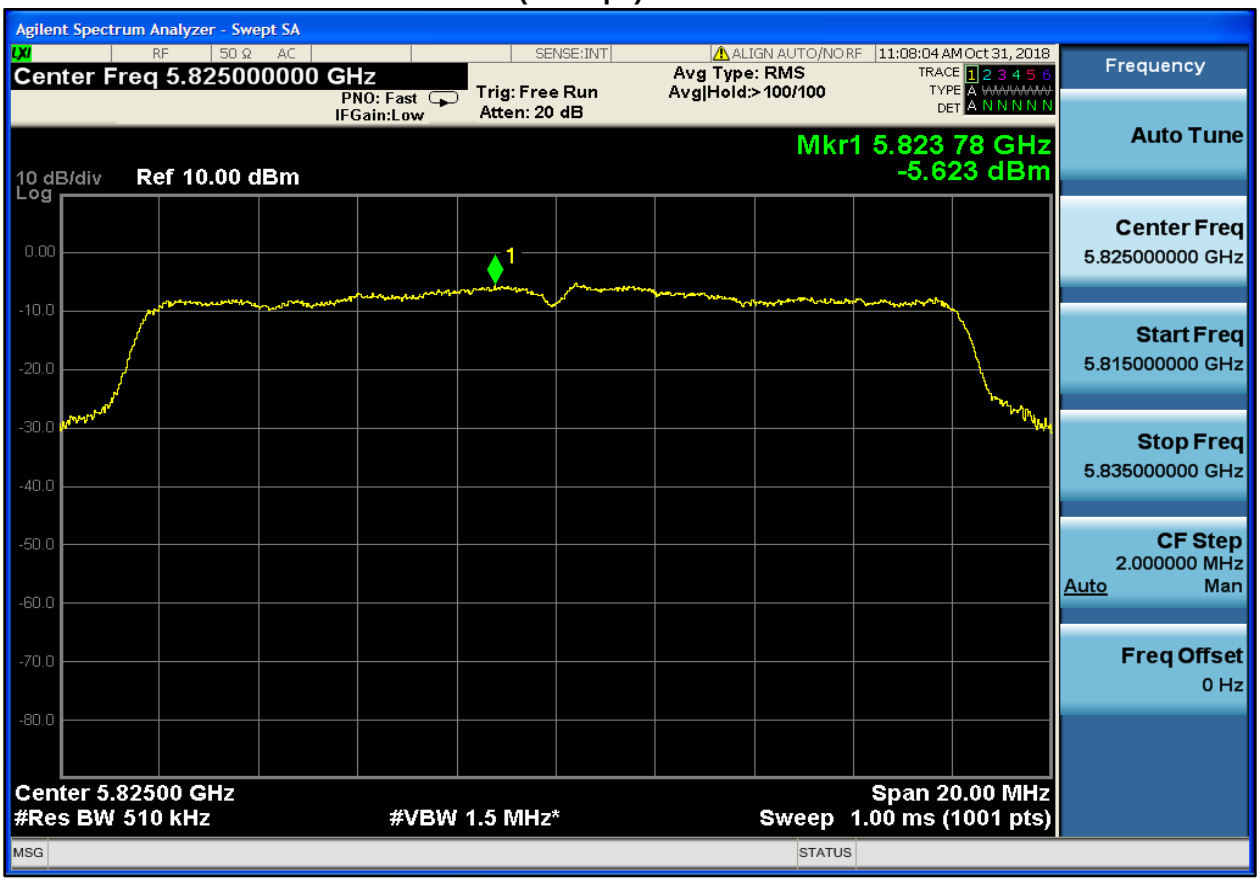
7.4 Power Spectral Density Plots – U-NII3

Plot 7-10: PSD: 5745 MHz – 802.11a (54 Mbps)

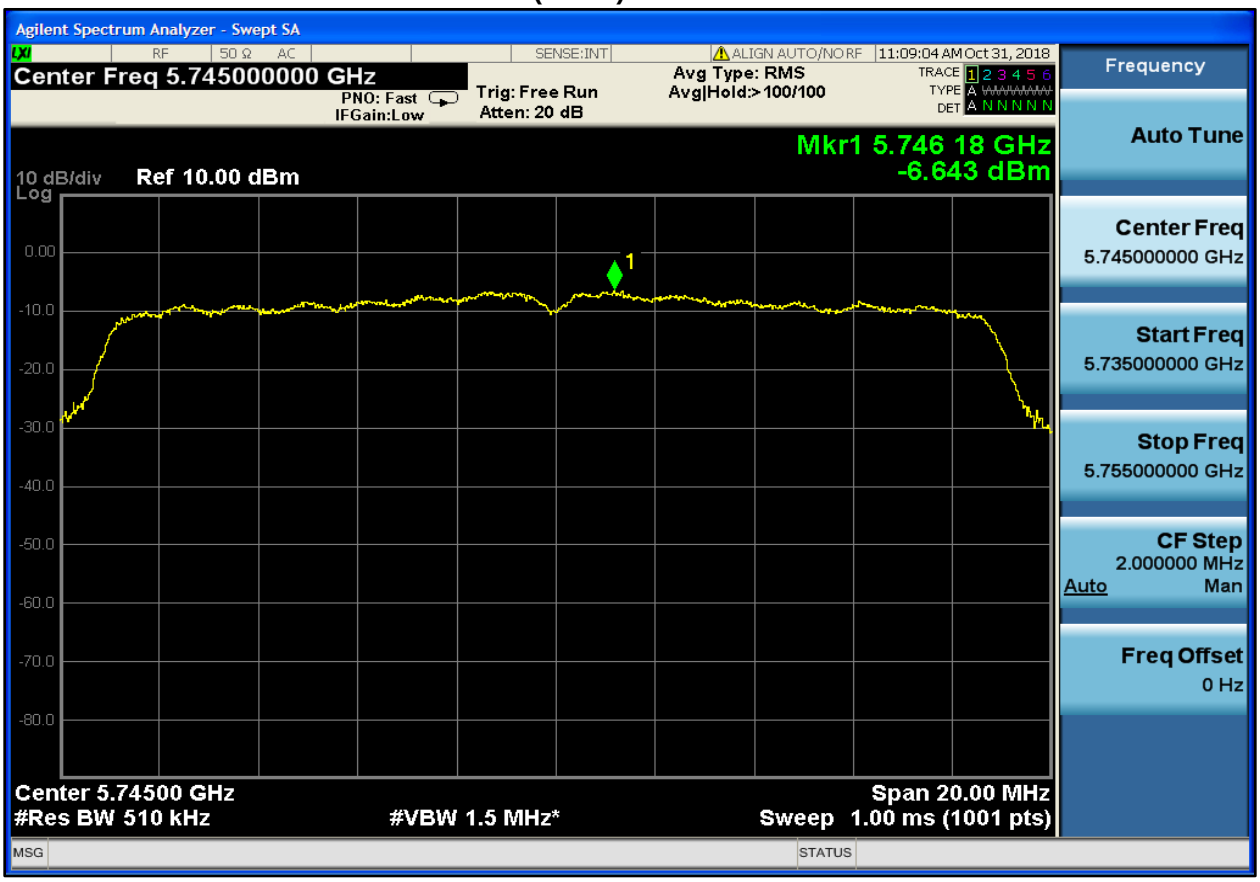


Plot 7-11: PSD: 5785 MHz – 802.11a (54 Mbps)

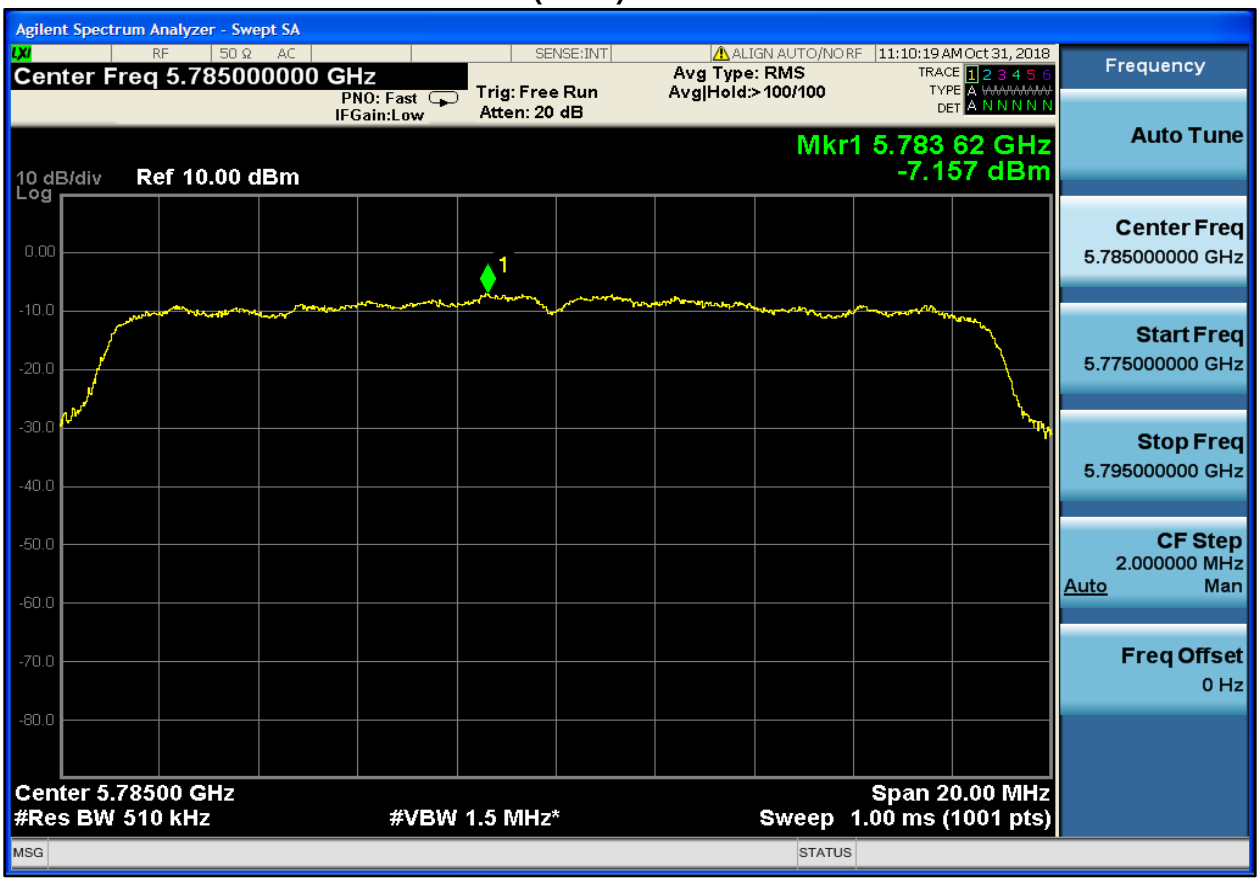
Plot 7-12: PSD: 5825 MHz – 802.11a (54 Mbps)



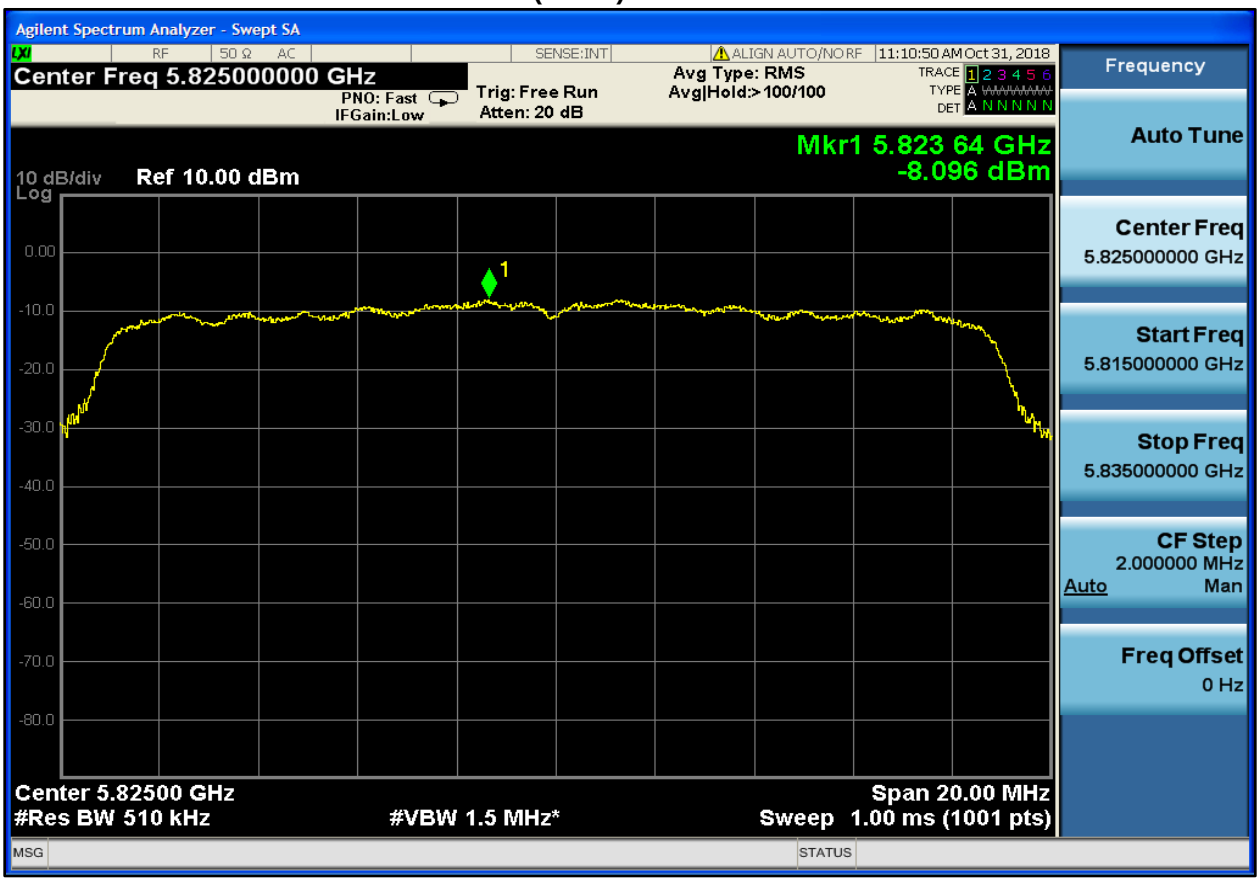
Plot 7-13: PSD: 5745 MHz – 802.11ac (MCS8)



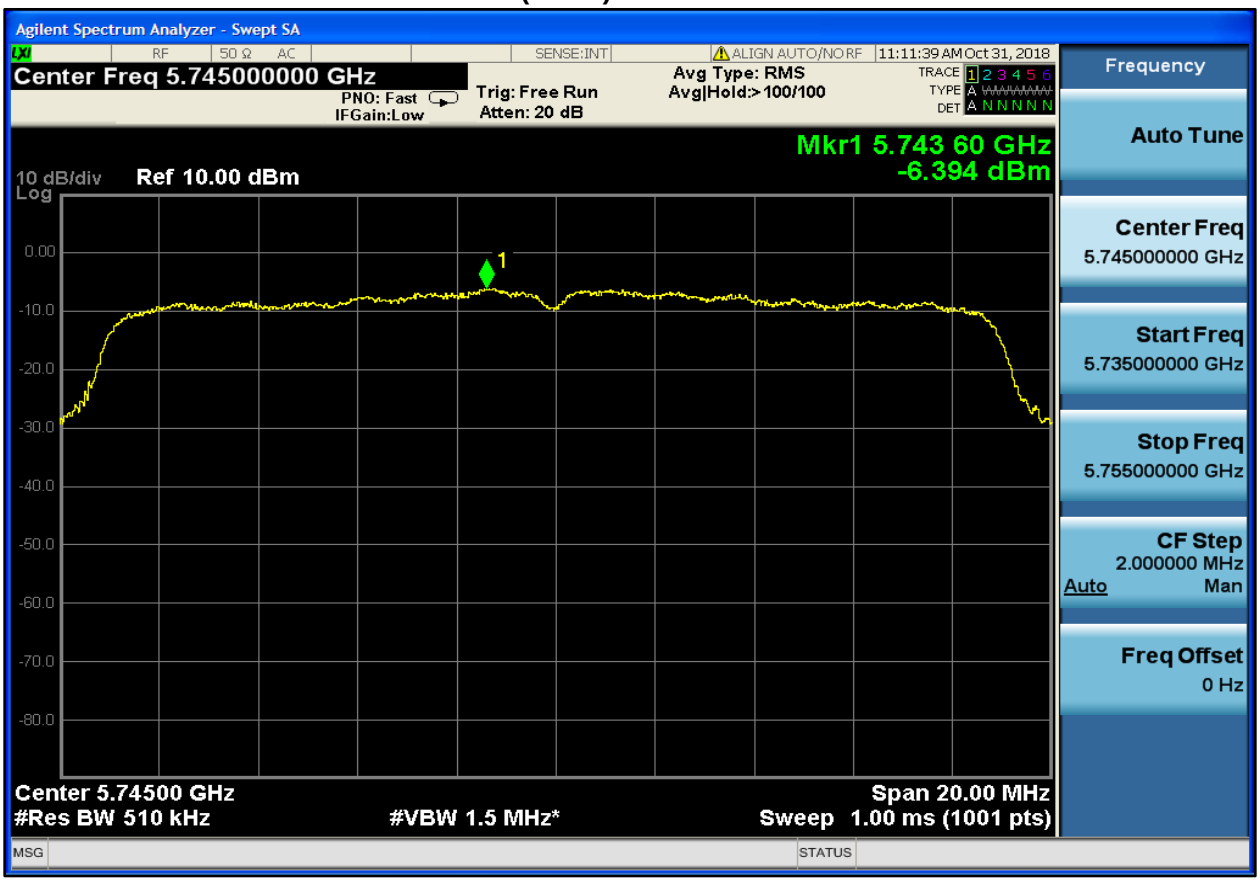
Plot 7-14: PSD: 5785 MHz – 802.11ac (MCS8)



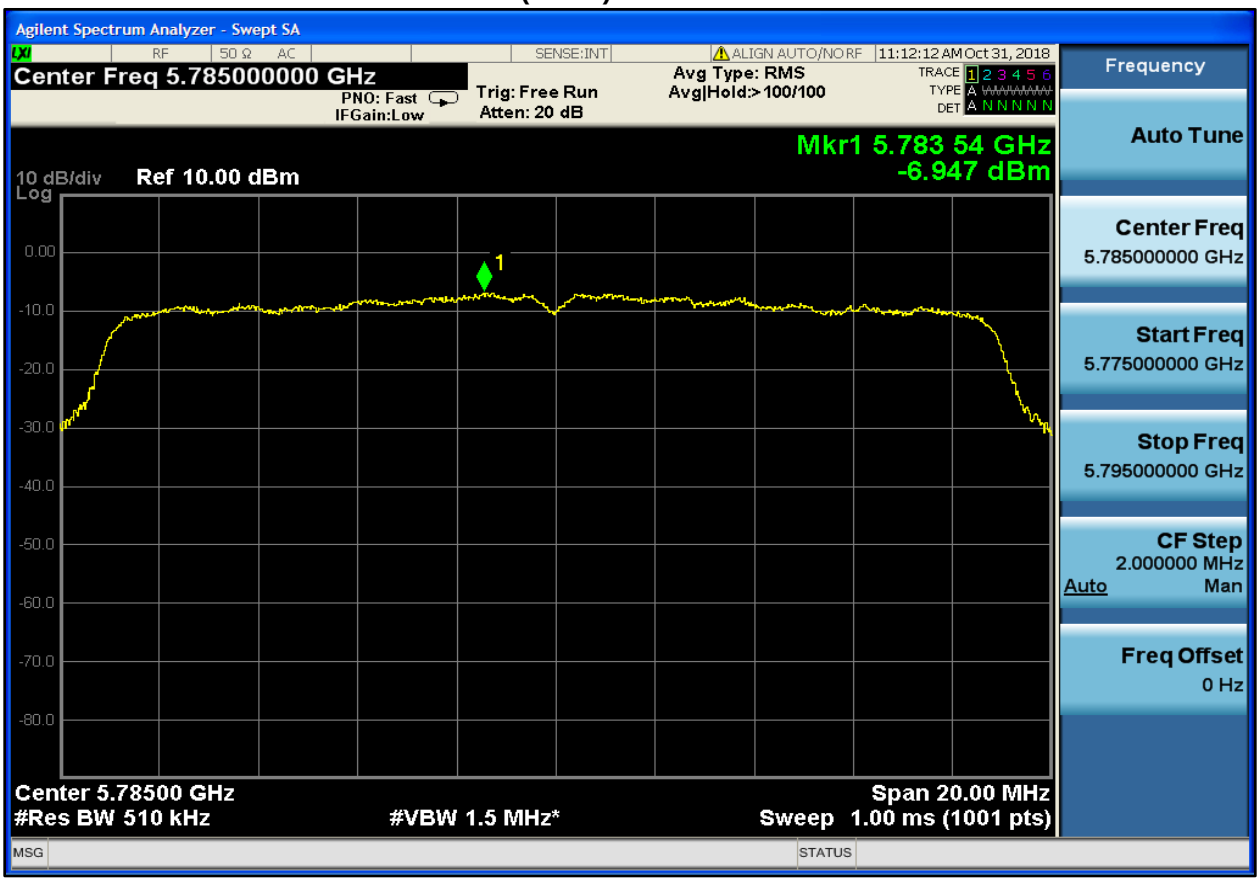
Plot 7-15: PSD: 5825 MHz – 802.11ac (MCS8)



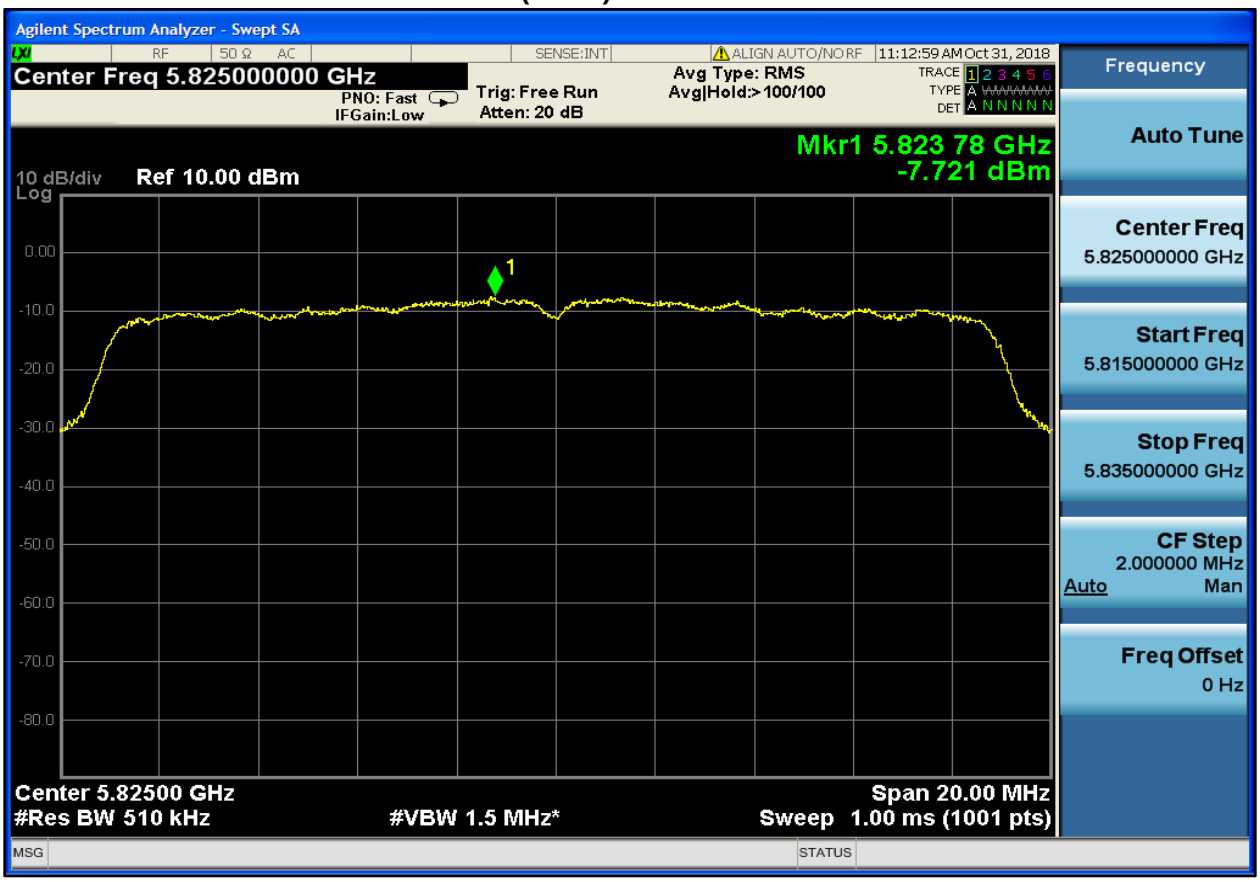
Plot 7-16: PSD: 5745 MHz – 802.11n (MCS7)



Plot 7-17: PSD: 5785 MHz – 802.11n (MCS7)



Plot 7-18: PSD: 5825 MHz – 802.11n (MCS7)



Measurement uncertainty: ±0.5 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		October 31, 2018
Test Engineer	Signature	Date of Test

8 Frequency Stability – §15.407(g), C63.10 6.8

8.1 Frequency Stability Test Procedure

The EUT was placed inside the temperature chamber. The EUT was connected to an analyzer which was located outside of the chamber. The temperature was set to the lowest level of -20.0°C and the EUT was allowed to stabilize with power off for a period of 1 hour. The EUT was then powered up and the frequency was measured. This was continued up to +50.0°C with increments of +10.0°C. The chamber was allowed to stabilize between measurements for approximately 30 minutes.

Table 8-1: Frequency Stability Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900946	Tenney Engineering, Inc.	TH65	Temperature Chamber with Humidity Control	11380	3/26/19
901139	Weinschel Corp	48-20-34	Attenuator 20 dB, 100 W (DC – 18 GHz)	BK5859	4/23/19
901583	Agilent	N9010A	EXA Signal Analyzer	MY51250846	2/06/20

8.2 Frequency Stability Test Result

Table 8-2: Frequency Stability at Extreme Temperatures: U-NII1 – 5180 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5179.980	-3.861
-10.0	5179.980	-3.861
0.0	5179.980	-3.861
10.0	5179.960	-7.722
20.0	5180.040	7.722
30.0	5179.960	-7.722
40.0	5179.960	-7.722
50.0	5179.960	-7.722

Table 8-3: Frequency Stability at Extreme Temperatures: U-NII1 – 5200 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5199.940	-11.538
-10.0	5199.940	-11.538
0.0	5199.980	-3.846
10.0	5199.960	-7.692
20.0	5199.960	-7.692
30.0	5199.960	-7.692
40.0	5199.960	-7.692
50.0	5199.960	-7.692

Table 8-4: Frequency Stability at Extreme Temperatures: U-NII1 – 5240 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5239.940	-11.450
-10.0	5239.940	-11.450
0.0	5239.940	-11.450
10.0	5240.040	7.634
20.0	5239.960	-7.634
30.0	5239.960	-7.634
40.0	5239.960	-7.634
50.0	5239.960	-7.634

Table 8-5: Frequency Stability at Extreme Temperatures: U-NII3 – 5745 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5744.940	-10.444
-10.0	5744.980	-3.481
0.0	5744.980	-3.481
10.0	5745.040	6.963
20.0	5744.960	-6.963
30.0	5744.960	-6.963
40.0	5744.960	-6.963
50.0	5744.960	-6.963

Table 8-6: Frequency Stability at Extreme Temperatures: U-NII3 – 5785 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5784.980	-3.457
-10.0	5784.980	-3.457
0.0	5784.940	-10.372
10.0	5784.960	-6.914
20.0	5784.960	-6.914
30.0	5784.960	-6.914
40.0	5784.960	-6.914
50.0	5785.040	6.914

Table 8-7: Frequency Stability at Extreme Temperatures: U-NII3 – 5825 MHz

Temperature (°C)	Measured Frequency (MHz)	ppm
-20.0	5825.020	3.433
-10.0	5824.980	-3.433
0.0	5824.940	-10.300
10.0	5824.960	-6.867
20.0	5825.040	6.867
30.0	5824.960	-6.867
40.0	5825.040	6.867
50.0	5824.960	-6.867

Measurement uncertainty: ±0.5 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		November 1–2, 2018
Test Engineer	Signature	Dates of Test

9 AC Conducted Emissions – §15.207, C63.10 6.2

9.1 Limits of Conducted Emissions Measurement

Table 9-1: AC Conducted Emissions Limits

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	66-56	56-46
0.5 – 5.0	56	46
5.0 – 30.0	60	50

9.2 Conducted Emissions Measurement Test Procedure

The power line conducted emission measurements were performed in a type shielded enclosure. The EUT was placed on a wooden table. Power was fed to the EUT through a 50-ohm/50 microhenry Line Impedance Stabilization Network (LISN). The EUT LISN was fed power through an AC filter box mounted on the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT's auxiliary equipment. This peripheral LISN was also fed AC power.

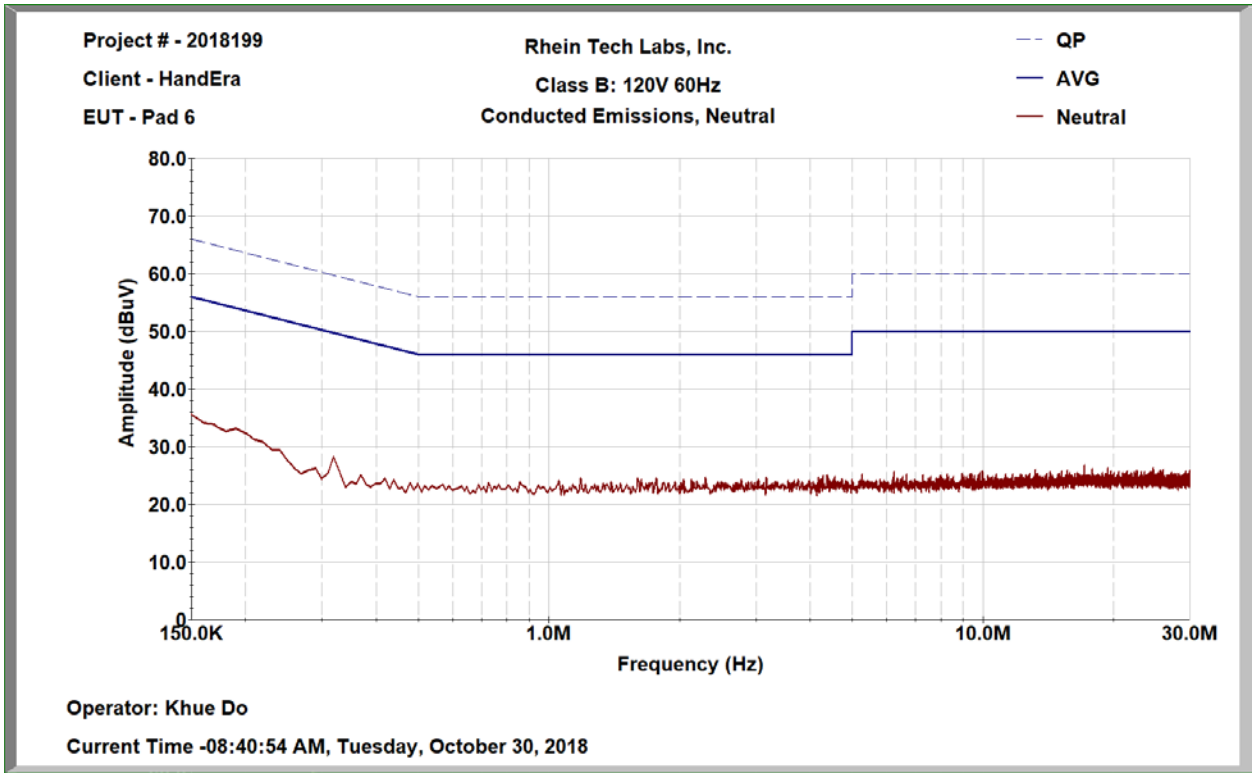
The spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 100 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 100 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. Video filter less than 10 times the resolution bandwidth is not used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from 150 kHz to 30 MHz.

Table 9-2: AC Conducted Emissions Test Equipment

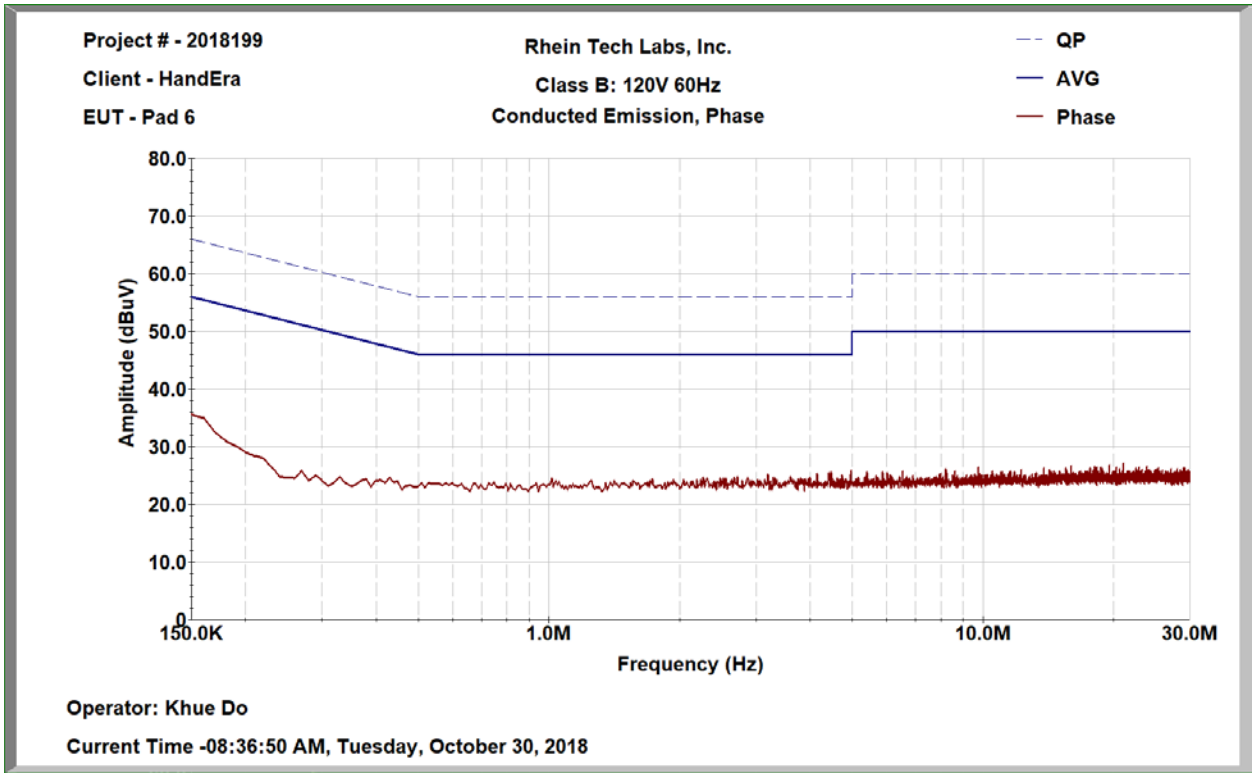
RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900339	Hewlett Packard	85650A	Quasi-Peak Adapter	2521A00743	4/26/19
900728	Solar	Type 8130-7.0	Filter	N/A	4/24/20
900930	Hewlett Packard	85662A	Spectrum Analyzer Display	3144A20839	4/16/19
900931	Hewlett Packard	8566B	Spectrum Analyzer (100 Hz–22 GHz)	3138A07771	4/26/19
901083	AFJ International	LS16/110VAC	16A LISN	16010020080	2/13/21
901636	Fischer Custom Communications	F-52	RF Current Probe (10 kHz-500 MHz)	130484	2/8/19
N/A	ETS-Lindgren	Tile! 7	Test Software	7.1.3.20	N/A

9.3 Conducted Emissions Test Results

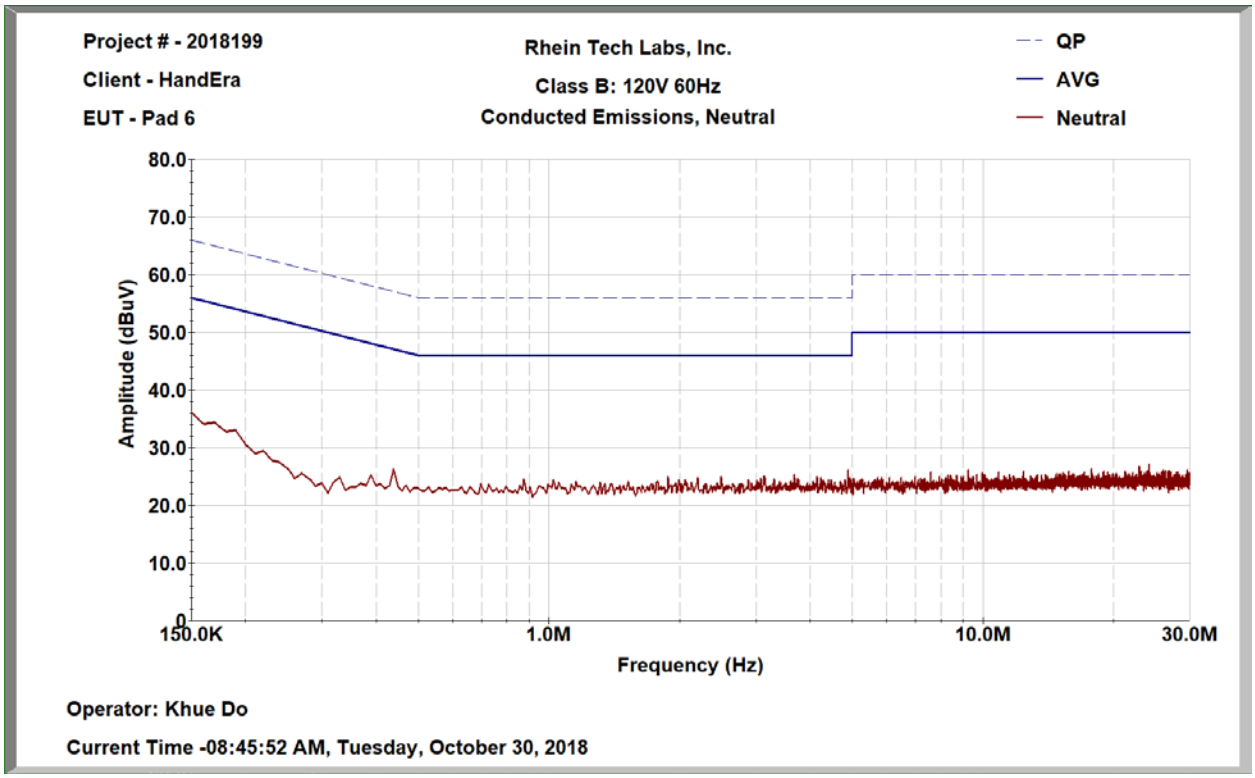
Plot 9-1: AC Conducted Emissions: Ethernet Dock – Neutral – RX Mode



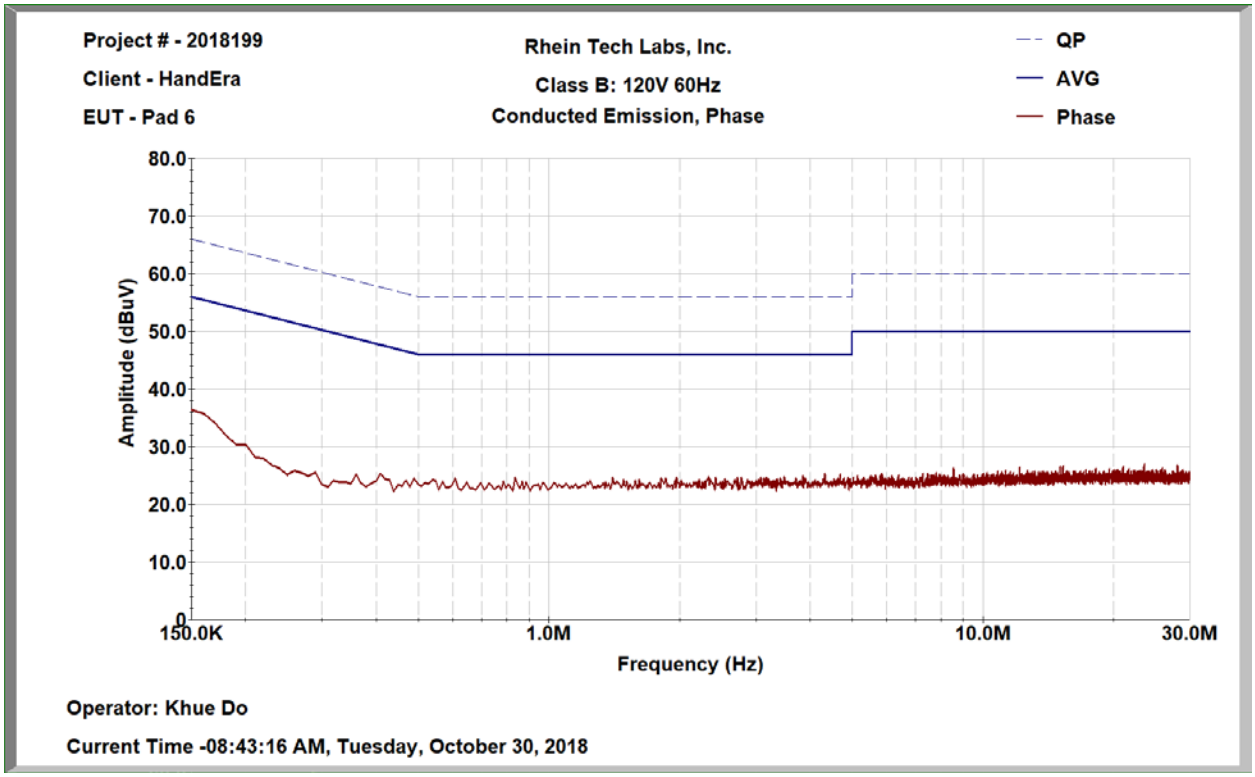
Plot 9-2: AC Conducted Emissions: Ethernet Dock – Phase – RX Mode



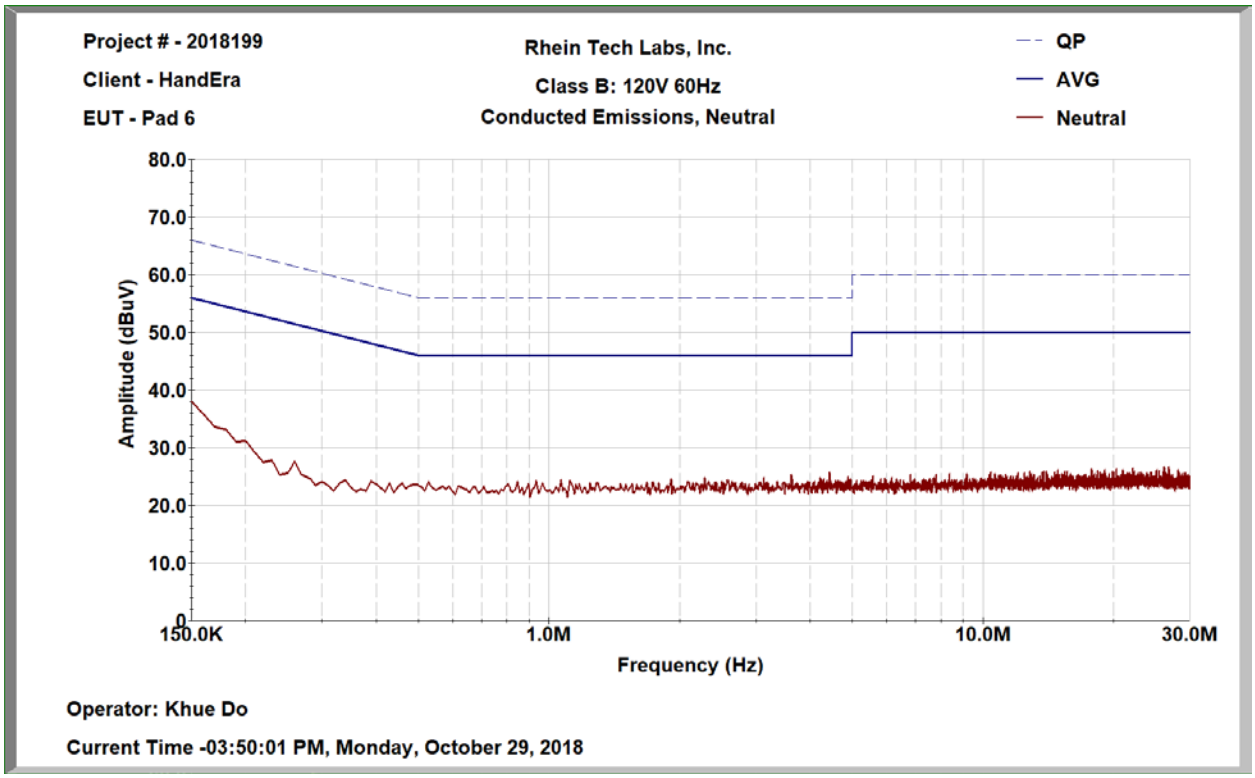
Plot 9-3: AC Conducted Emissions: Ethernet Dock – Neutral – TX Mode



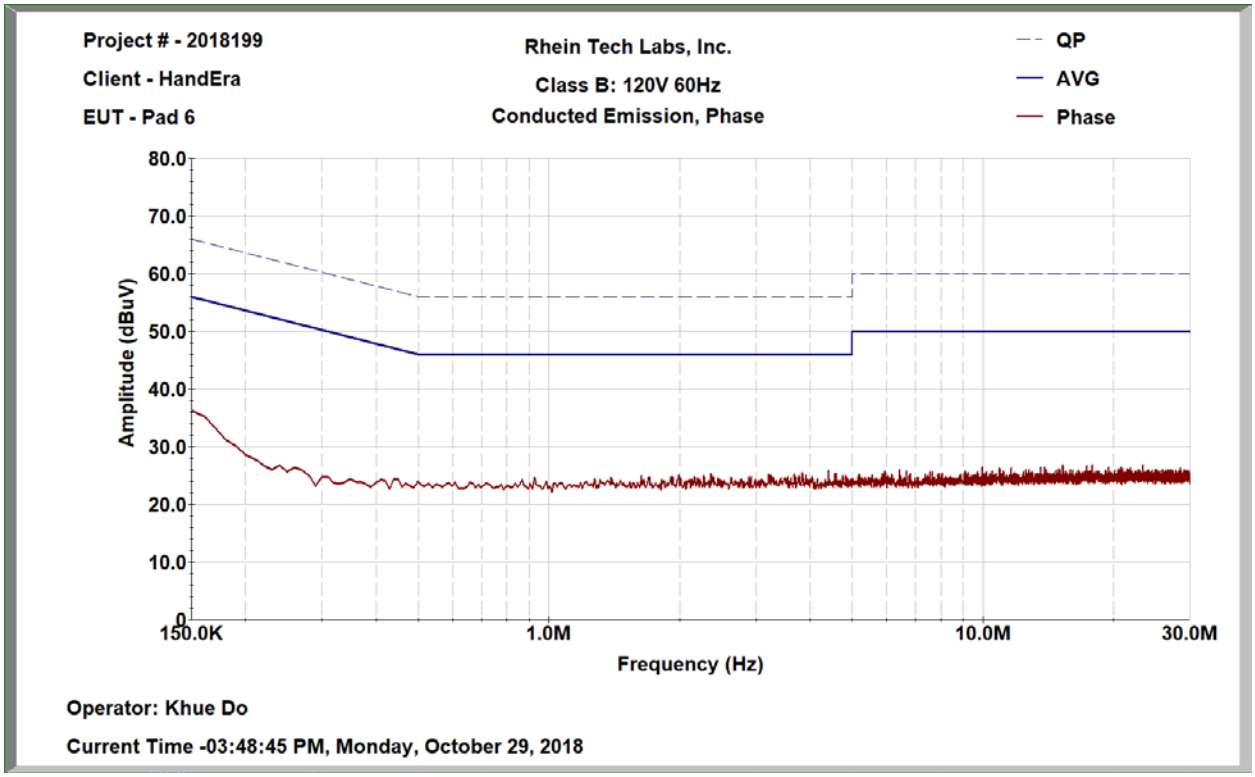
Plot 9-4: AC Conducted Emissions: Ethernet Dock – Phase – TX Mode



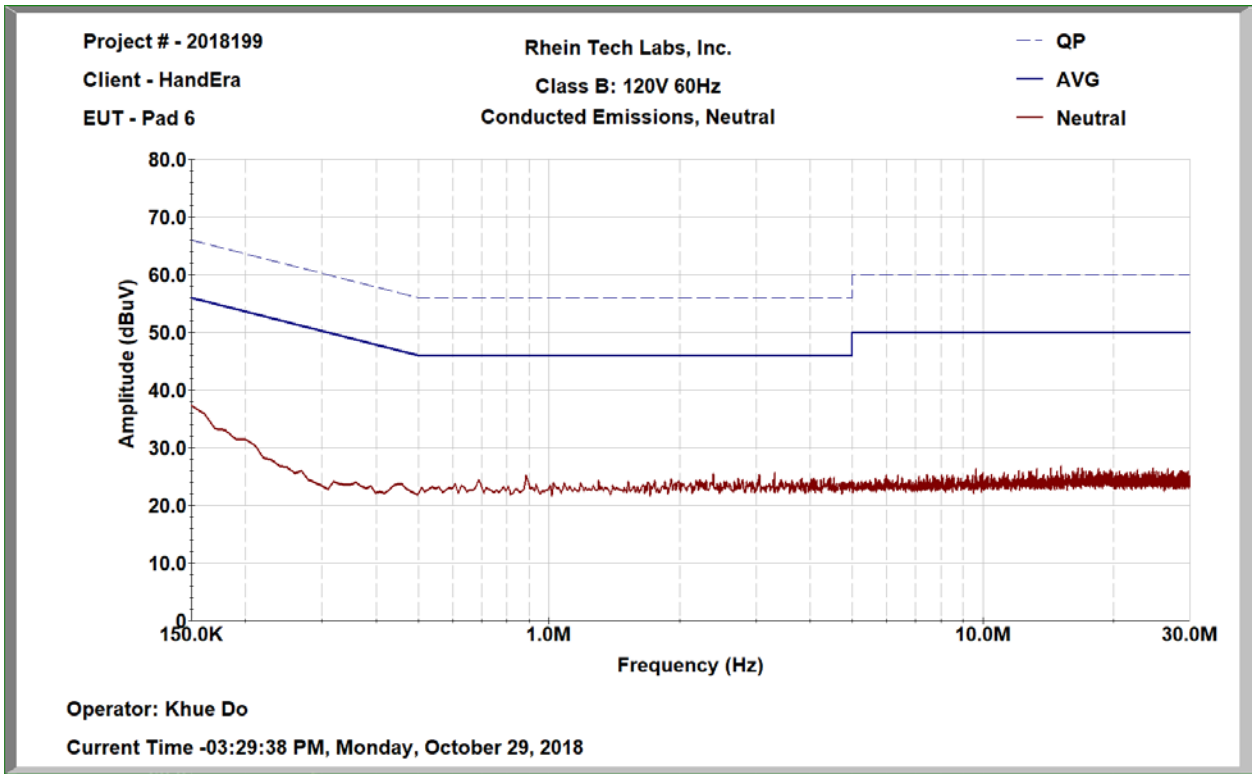
Plot 9-5: AC Conducted Emissions: USB Dock – Neutral – RX Mode



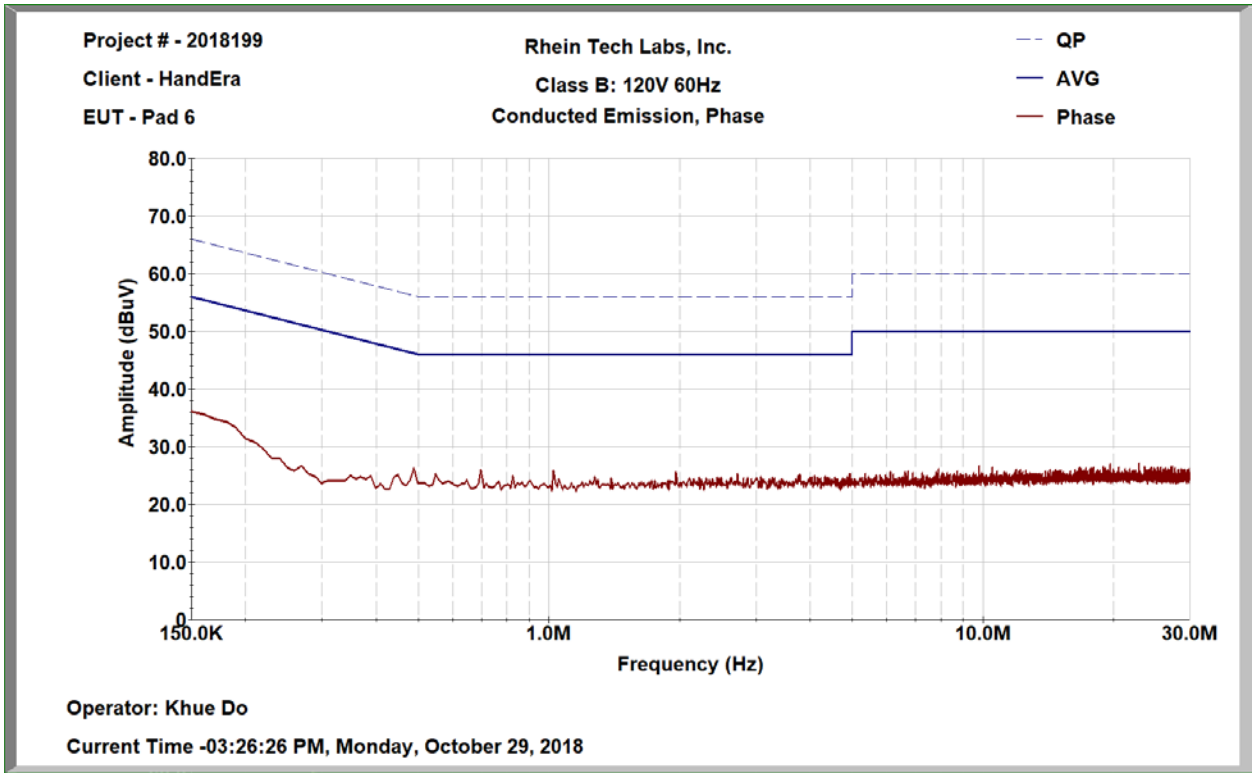
Plot 9-6: AC Conducted Emissions: USB Dock – Phase – RX Mode



Plot 9-7: AC Conducted Emissions: USB Dock – Neutral – TX Mode



Plot 9-8: AC Conducted Emissions: USB Dock – Phase – TX Mode



Plot 9-9: Conducted Emissions: Ethernet Line

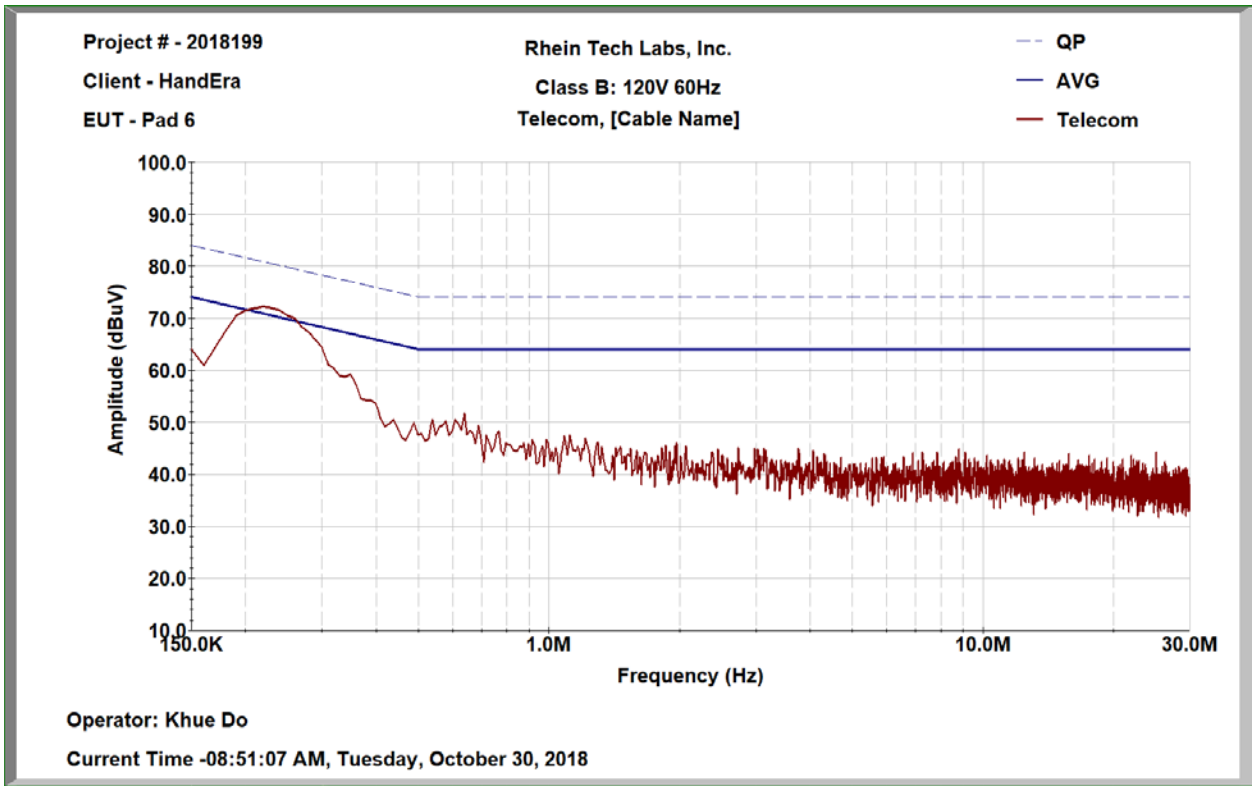


Table 9-3: Conducted Emissions: Ethernet Line Data

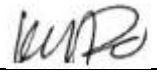
Frequency (MHz)	Detector	Raw (dBµV)	SCF (dB)	Corrected (dBµV)	Limit (dBµV)	Margin (dB)	Result (Pass / Fail)
0.250	QPK	23.4	35.4	58.8	80.5	-21.7	Pass
0.250	AVG	2.6	35.4	38.0	70.5	-32.5	Pass

Note: SCF – Site Correction Factor

Measurement uncertainty: ±3.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue Do		October 29–30, 2018
Test Engineer	Signature	Dates of Test

10 Radiated Emissions – §15.209, C63.10 6.5, 6.6

10.1 Limits of Radiated Emissions Measurement

Table 10-1: Radiated Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009-0.490	2400/f (kHz)	300
0.490-1.705	2400/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

As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any circumstances of modulation.

10.2 Radiated Emissions Measurement Test Procedure

Before final measurements of radiated emissions were made on the open-field three/ten meter range, the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to ensure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three/ten-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 9 kHz to the 10th harmonic of the highest fundamental transmitter frequency (24.8 GHz).

At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations. For frequencies between 30 and 1000 MHz, the spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. For emissions above 1000 MHz, emissions are measured using the average detector function with a minimum resolution bandwidth of 1 MHz. No video filter less than 10 times the resolution bandwidth was used. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Table 10-2: Radiated Emissions Test Equipment

RTL Asset #	Manufacturer	Model	Part Type	Serial Number	Calibration Due Date
900772	EMCO	3161-02	Horn Antenna (2.0–4.0 GHz)	9804-1044	4/9/19
900321	EMCO	3161-03	Horn Antennas (4.0–8.2 GHz)	9508-1020	4/9/19
900323	EMCO	3160-7	Horn Antennas (8.2–12.4 GHz)	9605-1054	4/9/19
900356	EMCO	3160-08	Horn Antenna (12.4–18.0 GHz)	9607-1044	4/9/19
901218	EMCO	3160-09	Horn Antenna (18.0–26.5 GHz)	960281-003	4/14/19
900791	Chase	CBL6111B	Bilog Antenna (30–2000 MHz)	N/A	10/4/20
900905	Rhein Tech Laboratories, Inc.	PR-1040	Preamplifier (10–2000 MHz)	1006	8/20/19
901723	Hewlett Packard	8449B	Preamplifier (1–26.5 GHz)	3008A00762	5/22/19
901583	Agilent Technologies	N9010A	EXA Signal Analyzer (10 Hz–26.5 GHz)	MY51250846	2/6/20
900913	Hewlett Packard	85462A	EMI Receiver RF Section (9 kHz–6.5 GHz)	3325A00159	4/4/19
900914	Hewlett Packard	8546OA	RF Filter Section (100 kHz-6.5 GHz)	3330A00107	4/4/19

10.3 Radiated Emissions Test Results

802.11g (54 Mbps) was determined to be the worst case modulation scheme.

Frequencies above the fundamental were measured at 1 m instead of 3 m.

Correction = 20 * LOG(1 m / 3 m) = -9.5 dB

Note: SCF – Site Correction Factor

Table 10-3: Radiated Emissions Harmonics/Spurious: 5180 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
15510	53.0	-6.7	46.3	74.0	-27.7
20680	54.0	-17.2	36.8	74.0	-37.2

Table 10-4: Radiated Emissions Harmonics/Spurious: 5180 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
15510	50.4	-6.7	43.7	54.0	-10.3
20680	52.0	-17.2	34.8	54.0	-19.2

Table 10-5: Radiated Emissions Harmonics/Spurious: 5200 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
15600	52.7	-6.7	46.0	74.0	-28.0
20800	53.7	-17.4	36.3	74.0	-37.7

Table 10-6: Radiated Emissions Harmonics/Spurious: 5200 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
15600	50.0	-6.7	43.3	54.0	-10.7
20800	51.3	-17.4	33.9	54.0	-20.1

Table 10-7: Radiated Emissions Harmonics/Spurious: 5240 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
15720	52.5	-6.9	45.6	74.0	-28.4
20960	53.7	-17.3	36.4	74.0	-37.6

Table 10-8: Radiated Emissions Harmonics/Spurious: 5240 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
15720	49.7	-6.9	42.8	54.0	-11.2
20960	51.7	-17.3	34.4	54.0	-19.6

Table 10-9: Radiated Emissions Harmonics/Spurious: 5745 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
11490	49.0	-10.8	38.2	74.0	-35.8
22980	54.3	-17.0	37.3	74.0	-36.7

Table 10-10: Radiated Emissions Harmonics/Spurious: 5745 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
11490	47.0	-10.8	36.2	54.0	-17.8
20680	52.0	-17.0	35.0	54.0	-19.0

Table 10-11: Radiated Emissions Harmonics/Spurious: 5785 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
11570	49.1	-10.7	38.4	74.0	-35.6

Table 10-12: Radiated Emissions Harmonics/Spurious: 5785 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
11570	46.9	-10.7	36.2	54.0	-17.8

Table 10-13: Radiated Emissions Harmonics/Spurious: 5825 MHz Peak

Frequency (MHz)	Peak Raw Analyzer (dBµV/m)	SCF (dB/m)	Peak Corrected (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)
11650	49.1	-10.6	38.5	74.0	-35.5

Table 10-14: Radiated Emissions Harmonics/Spurious: 5825 MHz Average

Frequency (MHz)	Average Raw Analyzer (dBµV/m)	SCF (dB/m)	Average Corrected (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
11650	46.9	-10.6	36.3	54.0	-17.7

Table 10-15: Unintentional Emissions Test Data: Ethernet Dock

Temperature: 67.0°F Humidity: 86%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (°)	Antenna Height (m)	Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/ Fail
74.150	QPK	V	135	1.0	52.9	-20.9	32.0	40.0	-8.0	PASS
112.498	QPK	H	225	3.0	43.9	-15.1	28.7	43.5	-14.8	PASS
225.041	QPK	H	225	1.0	56.8	-16.1	40.6	46.0	-5.4	PASS
237.525	QPK	H	225	1.0	57.3	-14.4	42.9	46.0	-3.1	PASS
245.300	QPK	H	225	1.0	51.8	-13.6	38.2	46.0	-7.8	PASS
333.602	QPK	H	180	1.0	39.9	-11.2	28.6	46.0	-17.4	PASS
393.600	QPK	H	180	1.0	39.0	-8.9	30.1	46.0	-15.9	PASS
395.995	QPK	H	180	1.0	43.4	-8.8	34.6	46.0	-11.4	PASS

Table 10-16: Unintentional Emissions Test Data: USB Dock

Temperature: 62.0°F Humidity: 75%										
Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (°)	Antenna Height (m)	Analyzer Reading (dBµV)	Site Correction Factor (dB/m)	Emission Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pass/ Fail
60.000	QPK	H	90	4.0	47.2	-22.1	25.1	40.0	-14.9	PASS
72.250	QPK	H	90	2.0	43.5	-21.1	22.3	40.0	-17.7	PASS
113.500	QPK	H	90	3.0	40.3	-15.1	25.2	43.5	-18.3	PASS
223.925	QPK	H	90	1.0	39.5	-16.2	23.2	46.0	-22.8	PASS
243.250	QPK	H	180	1.0	37.4	-13.8	23.6	46.0	-22.4	PASS
333.325	QPK	H	135	2.0	35.0	-11.2	23.7	46.0	-22.3	PASS
648.625	QPK	H	90	1.0	35.8	-3.1	32.7	46.0	-13.3	PASS

Measurement uncertainty: ±4.6 dB. This measurement uncertainty is an expanded uncertainty for 95% confidence level received with a coverage factor k=2.

Results: Pass

Test Personnel:

Khue N. Do		October 30–November 1, 2018
Test Engineer	Signature	Dates of Test

11 Conclusion

The data in this NII measurement report shows that the EUT as tested HandEra Model PHRPAD60, FCC ID: URZ-PHRPAD60, complies with the applicable requirements of FCC Parts 2 and 15.