RF TEST REPORT

Report No.: FCC_SL17072501-RUC-022A3_W5258
Supersede Report No.:

Applicant	:	Ruckus Wireless, Inc.
Product Name	:	E510 Access Point
Model No.	:	E510
Test Standard	:	47 CFR 15.407
Test Method	:	ANSI C63.4: 2014 789033 D02 General UNII Test Procedures New Rules v01r02
FCC ID	:	S9GE510
IC ID	:	5912A-E510
Dates of test	:	10/24/2017-02/08/2018
Issue Date	:	02/09/2018
Test Result	:	☒ Pass ☐ Fail
Equipment complied with the specification [X] Equipment did not comply with the specification [ ]		

This Test Report is Issued Under the Authority of:	
Gary Chou	
Gary Chou	**Chen Ge**
Test Engineer	Engineer Reviewer
This test report may be reproduced in full only **Test result presented in this test report is applicable to the tested sample only**	

Issued By:
SIEMIC Laboratories
775 Montague Expressway, Milpitas, 95035 CA

ACCREDITED
TESTING CERT # 2742-01

Laboratory Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC, RF/Wireless, Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless, Telecom
Taiwan	BSMI, NCC, NIST	EMC, RF, Telecom, Safety
Hong Kong	OFTA, NIST	RF/Wireless, Telecom
Australia	NATA, NIST	EMC, RF, Telecom, Safety
Korea	KCC/RRA, NIST	EMI, EMS, RF, Telecom, Safety
Japan	VCCI, JATE, TELEC, RFT	EMI, RF/Wireless, Telecom
Mexico	NOM, COFETEL, Caniety	Safety, EMC, RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom, Safety
Israel	MOC, NIST	EMC, RF, Telecom, Safety

Accreditations for Product Certifications

Country	Accreditation Body	Scope
USA	FCC TCB, NIST	EMC, RF, Telecom
Canada	IC FCB, NIST	EMC, RF, Telecom
Singapore	iDA, NIST	EMC, RF, Telecom
EU	NB	EMC & R&TTE Directive
Japan	MIC (RCB 208)	RF, Telecom
Hong Kong	OFTA (US002)	RF, Telecom

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1 Report Revision History

Report No.	Report Version	Description	Issue Date
FCC_SL17072501-RUC-022A3_W5258	None	Original	02/09/2018

2 Executive Summary

The purpose of this test program was to demonstrate compliance of following product

Company: Ruckus Wireless, Inc.
Product: E510 Access Point
Model: E510

against the current Stipulated Standards. The specified model product stated above has demonstrated compliance with the Stipulated Standard listed on 1st page.

3 Customer information

Applicant Name	:	Ruckus Wireless, Inc.
Applicant Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A
Manufacturer Name	:	Ruckus Wireless, Inc.
Manufacturer Address	:	350 West Java Drive, Sunnyvale, California 94089 U.S.A

4 Test site information

Lab performing tests	SIEMIC Laboratories
Lab Address	775 Montague Expressway, Milpitas, CA 95035
FCC Test Site No.	881796
IC Test Site No.	4842D-2
VCCI Test Site No.	A0133

5 Modification

Index	Item	Description	Note
-	-	-	-

6 EUT Information

6.1 EUT Description

Product Name	E510 Access Point
Model No.	E510
Trade Name	Ruckus
Serial No.	361706000066
Host Model No.	N/A
Input Power	48VDC (PoE)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Date of EUT received	10/20/2017
Equipment Class/ Category	DTS, UNII
Port/Connectors	PoE, Ethernet

6.2 Radio Description

Radio Type	802.11a	802.11n-20M	802.11n-40M	802.11ac-80M
Operating Frequency	5180-5240MHz 5745-5825MHz	5180-5240MHz 5745-5825MHz	5190-5230MHz 5755-5795MHz	5210MHz 5775MHz
Modulation	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM)	OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)
Channel Spacing	20MHz	20MHz	40MHz	80MHz
Number of Channels	9	9	4	2
Antenna Type	Internal Omni PCB Antenna			
Antenna Gain (Peak)	5GHz: 5dBi			
Antenna Connector Type	U.FL			
Note	2.4GHz and 5GHz Radio transmit simultaneously			

EUT Power level setting

Mode	Frequency	ART Power Setting
802.11-a	5180	42
802.11-a	5200	46
802.11-a	5240	46
802.11-n-20	5180	40
802.11-n-20	5200	46
802.11-n-20	5240	46
802.11-n-40	5190	38
802.11-n-40	5230	46
802.11-ac-80	5210	38
802.11-a	5745	46
802.11-a	5785	46
802.11-a	5825	46
802.11-n-20	5745	46
802.11-n-20	5785	46
802.11-n-20	5825	46
802.11-n-40	5755	46
802.11-n-40	5795	46
802.11-ac-80	5775	46

Note: All data rate has been verified and worst case was used for all test items.

7 Supporting Equipment/Software and cabling Description

7.1 Supporting Equipment

Item	Supporting Equipment Description	Model	Serial Number	Manufacturer	Note
1	Laptop	PP01L Latitude E5440	F1WPF12	Dell	-
2	POE Adapter	740-64211-001	133279963	Ruckus	-

7.2 Cabling Description

Name	Connection Start		Connection Stop		Length / shielding Info		Note
	From	I/O Port	To	I/O Port	Length (m)	Shielding	
RJ45	EUT	RJ45	POE	RJ45	2	Unshielded	-
RJ45	POE	RJ45	Laptop	RJ45	3	Unshielded	-

7.3 Test Software Description

Test Item	Software	Description
RF Testing	Command Line in windows	Set the EUT to transmit continuously in diferent test modes and channels

8 Test Summary

Test Item	Test standard		Test Method/Procedure	Pass / Fail
Restricted Band of Operation	FCC	15.205	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
AC Conducted Emissions Voltage	FCC	15.207(a)	ANSI C63.4 – 2014	☒ Pass* ☐ N/A

Test Item	Test standard		Test Method/Procedure	Pass / Fail
26 & 6 dB Emission Bandwidth	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass* ☐ N/A
Maximum conducted Output Power	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Power reduction (Antenna Gain > 6 dBi)	FCC	15.407 (a) (2)	-	☐ Pass ☒ N/A
Band Edge and Radiated Spurious Emissions	FCC	15.407(b)(2), 15.407(b)(6)	ANSI C63.4 – 2014 789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass* ☐ N/A
Power Spectral Density	FCC	15.407 (a) (2)	789033 D02 General UNII Test Procedures New Rules v01r02	☒ Pass ☐ N/A
Frequency Stability	FCC	15.407 (g)	-	☐ Pass ☒ N/A
Transmit Power Control (TPC)	FCC	15.407 (h)(1)	-	☐ Pass ☒ N/A
User Manual	FCC	-	-	☒ Pass ☐ N/A
Remark	1. All measurement uncertainties are not taken into consideration for all presented test result. 2. The applicant shall ensure frequency stability by showing that an emission is maintained within the band of operation under all normal operating conditions as specified in the user's manual. 3. Pass*: Please refer to report FCC_SL17072501-RUC-022_W5258.			

9 Measurement Uncertainty

9.1 Conducted Emissions

The test is to measure the conducted emissions to the mains port of the EUT.
Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the LISN
- Uncertainty of cables
- Uncertainty due to the mismatches
- Etc, see the below table for details

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
LISN Insertion Loss	0.40	Normal	2	1	0.20
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch LISN - Receiver	0.25	U-Shape	1.414	1	0.1768033
LISN Impedance	2.5	Triangular	2.449	1	1.0208248
Combined Standard Uncertainty					1.928133
Expanded Uncertainty (K=2)					**3.856266**

The total derived measurement uncertainty is +/- 3.86 dB.

9.2 Radiated Emissions (30MHz to 1GHz)

The test is to measure the radiated emissions of the EUT.
Some error sources that can contribute to the total uncertainty:

- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- NSA Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Filter Insertion Loss	0.25	Normal	2	1	0.125
Antenna Factor	0.65	Normal	2	1	0.325
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.86605081
PRF Response	1.5	Rectangular	1.732	1	0.86605081
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
NSA Calibration	4.0	U-Shape	1.414	1	2.8288543
Combined Standard Uncertainty					3.0059131
Expanded Uncertainty (K=2)					**6.0118262**

The total derived measurement uncertainty is +/- 6.00 dB.

9.3 Radiated Emissions (1GHz to 40GHz)

The test is to measure the radiated emissions of the EUT.

Some error sources that can contribute to the total uncertainty:
- Uncertainty of the receiver
- Uncertainty of the antenna
- Uncertainty of cables
- Uncertainty due to the mismatches
- VSWR Calibration
- Etc., details see the below table

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Receiver Reading	0.12	Rectangular	1.732	1	0.0692840
Cable Insertion Loss	0.21	Normal	2	1	0.1050000
Filter Insertion Loss	0.25	Normal	2	1	0.1250000
Antenna Factor	0.65	Normal	2	1	0.3250000
Receiver CW accuracy	0.5	Rectangular	1.732	1	0.2886836
Pulse Amplitude Response	1.5	Rectangular	1.732	1	0.8660508
PRF Response	1.5	Rectangular	1.732	1	0.8660508
Mismatch Filter - Receiver	0.25	U-Shape	1.414	1	0.1768033
VSWR Calibration	2.0	U-Shape	1.414	1	1.4144272
Combined Standard Uncertainty					4.2363
Expanded Uncertainty (K=2)					**8.4726**

The total derived measurement uncertainty is +/- 8.47 dB.

9.4 RF conducted measurement

The test is to measure the RF output power from the EUT.

Some error sources that can contribute to the total uncertainty:

- Uncertainty of the Reference Level Uncertainty
- Uncertainty of variable attenuators
- Uncertainty of cables
- Uncertainty due to the mismatches

Source of Uncertainty	Value (dB)	Probability Distribution	Division	Sensitivity Coefficient	Expanded Uncertainty
Reference Level	0.12	Rectangular	1.732	1	0.069284
Cable Insertion Loss	0.21	Normal	2	1	0.105
Attenuator	0.25	Normal	2	1	0.125
Mismatch	0.25	U-Shape	1.414	1	0.1768033
Combined Standard Uncertainty					0.476087
Expanded Uncertainty (K=2)					**0.952174**

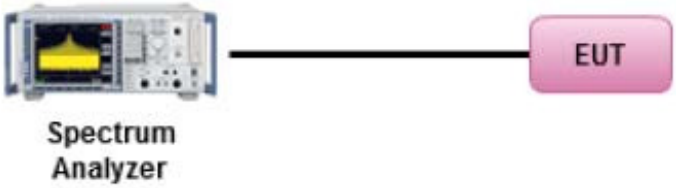
The total derived measurement uncertainty is +/- 0.95 dB.

10 Measurements, Examination and Derived Results

10.1 Output Power

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(ii)	For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.	☒
	a)(3)	For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.	☒

Test Setup				
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01r02 Measurement using a Spectrum Analyzer or EMI Receiver (SA) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. (ii) Set RBW = 1 MHz (iii) Set VBW = 3 MHz (iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.) (v) Sweep time = auto. (vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode. (vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run." (viii) Trace average at least 100 traces in power averaging (rms) mode. (ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.			
Test Date	10/24/2017 – 02/08/2018	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	21°C 40% 1019mbar
Remark	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =5dBi.			
Result	☒ Pass ☐ Fail			

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

Output Power measurement result for 5.2GHz

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 0	Chain 1	Combined Power		
Output Power	802.11a	5180	Low	19.465	19.412	24.319	30	Pass
		5200	Mid	21.219	21.396	24.551	30	Pass
		5240	High	21.684	21.392	23.096	30	Pass
	802.11n-20M	5180	Low	20.172	19.997	24.529	30	Pass
		5200	Mid	21.590	21.447	24.653	30	Pass
		5240	High	21.651	21.635	20.970	30	Pass
	802.11n-40M	5190	Low	17.824	18.092	25.225	30	Pass
		5230	High	22.193	22.237	24.319	30	Pass
	802.11ac-80M	5210	-	14.386	14.257	17.332	30	Pass

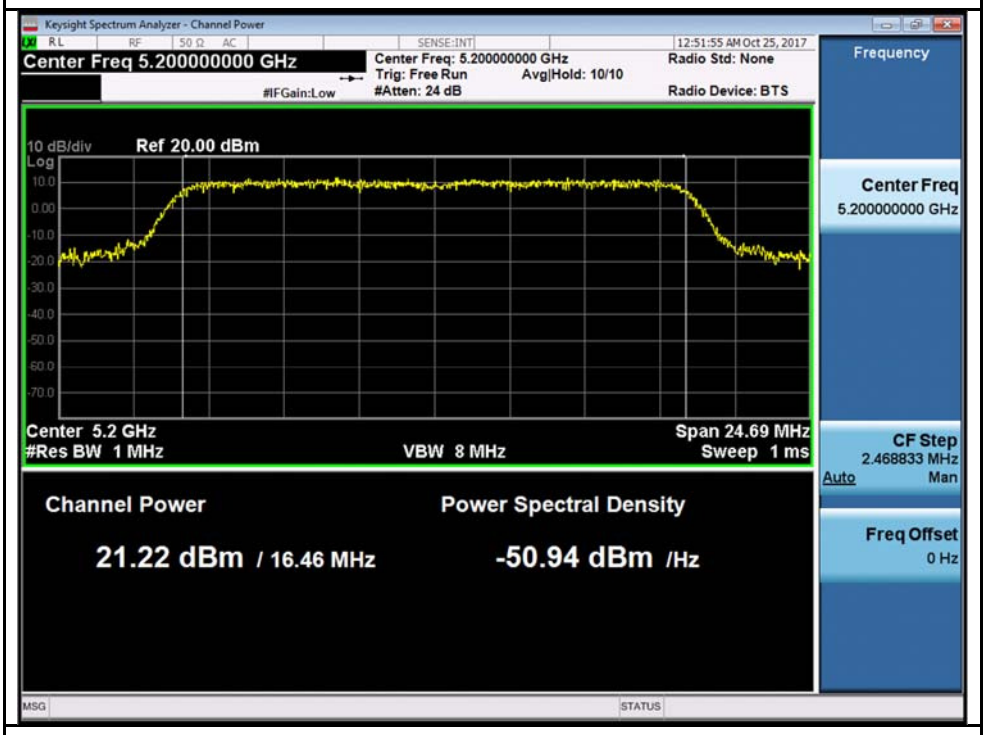
Output Power Measurement Results for 5.8GHz

Type	Test mode	Freq (MHz)	CH	Conducted Power (dBm)			Limit (dBm)	Result
				Chain 0	Chain 1	Combined Power		
Output Power	802.11a	5745	Low	21.529	21.468	24.509	30	Pass
		5785	Mid	21.297	21.323	24.321	30	Pass
		5825	High	21.029	21.233	24.142	30	Pass
	802.11n-20M	5745	Low	21.506	21.317	24.423	30	Pass
		5785	Mid	21.195	20.927	24.073	30	Pass
		5825	High	21.068	20.886	23.988	30	Pass
	802.11n-40M	5755	Low	21.786	22.083	24.948	30	Pass
		5795	Mid	21.889	21.710	24.811	30	Pass
	802.11ac-80M	5775	-	20.208	21.097	23.686	30	Pass

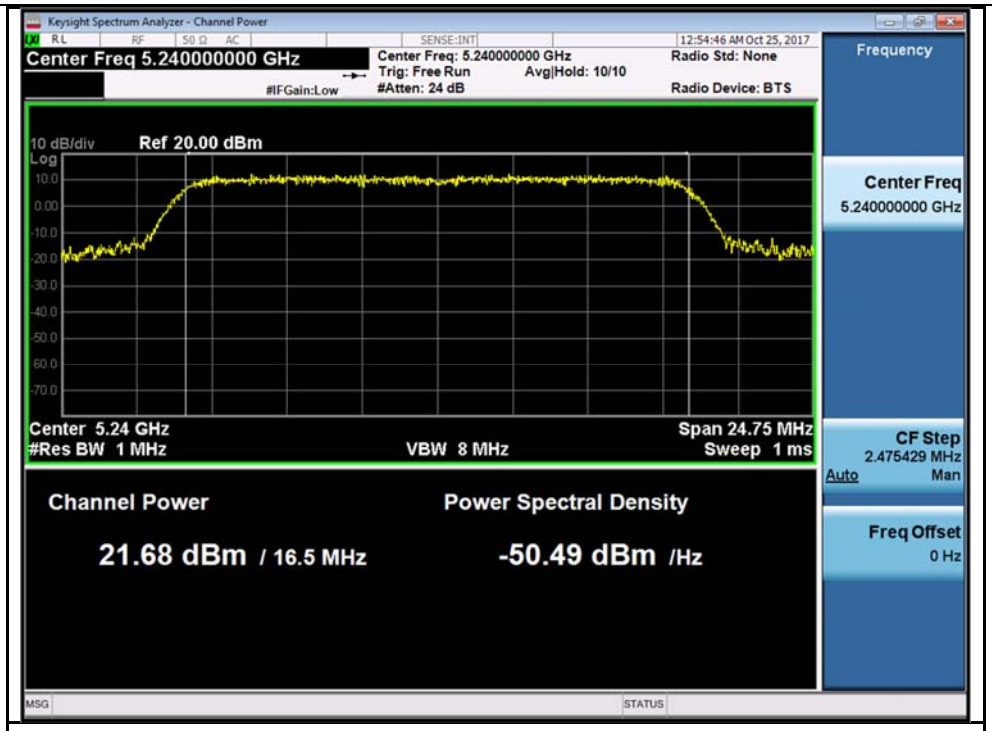
Test Plot for W52:

Chain 0:

802.11a-5180M

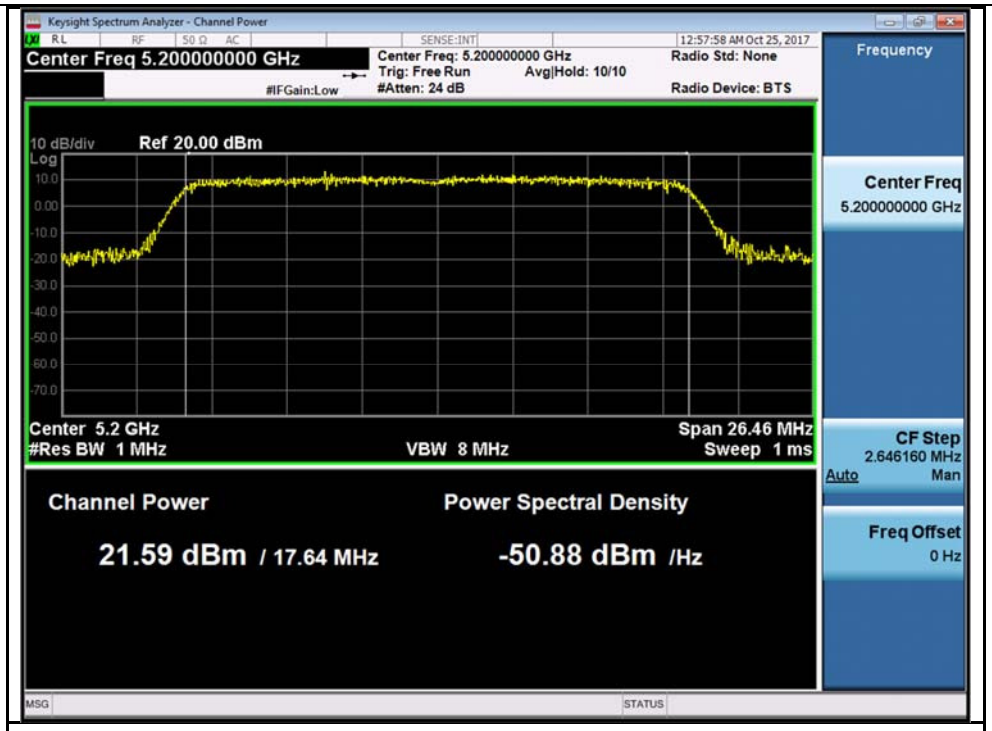


802.11a-5200M

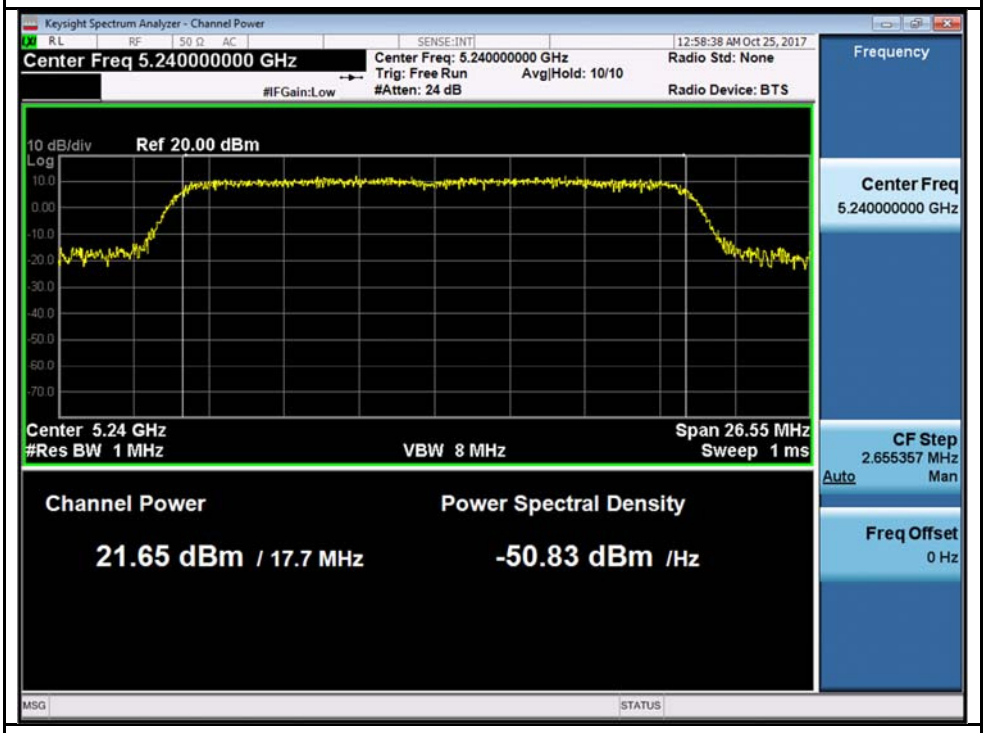


802.11a-5240M

802.11n-HT20 5180M

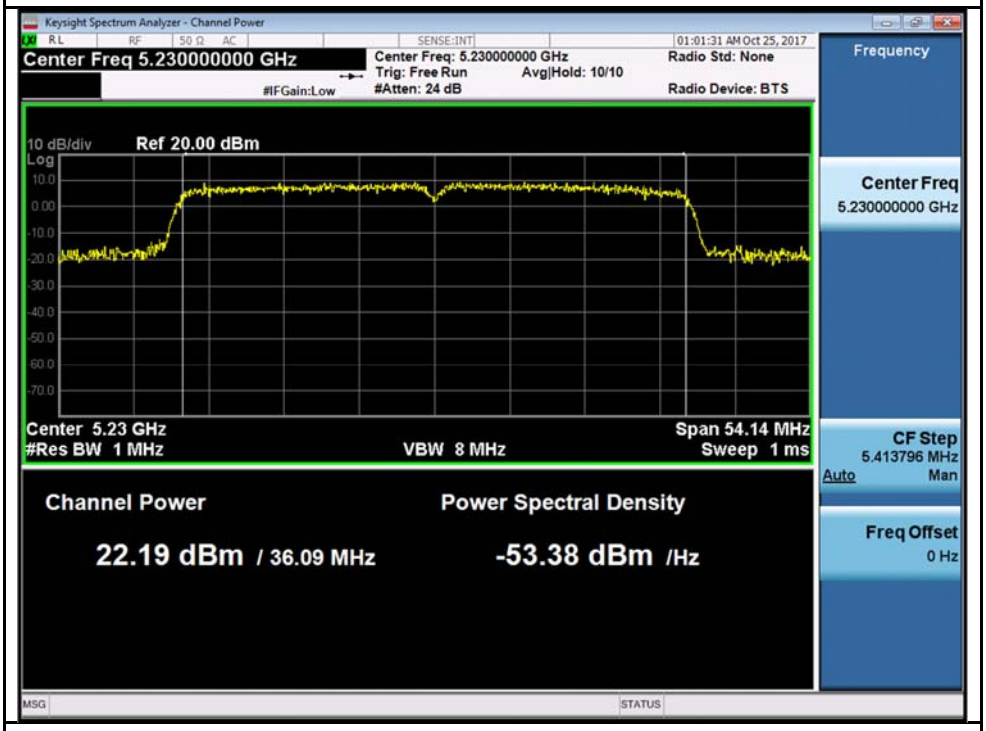


802.11n-HT20 5200M



802.11n-HT20 5240M

802.11n-HT40 5190M

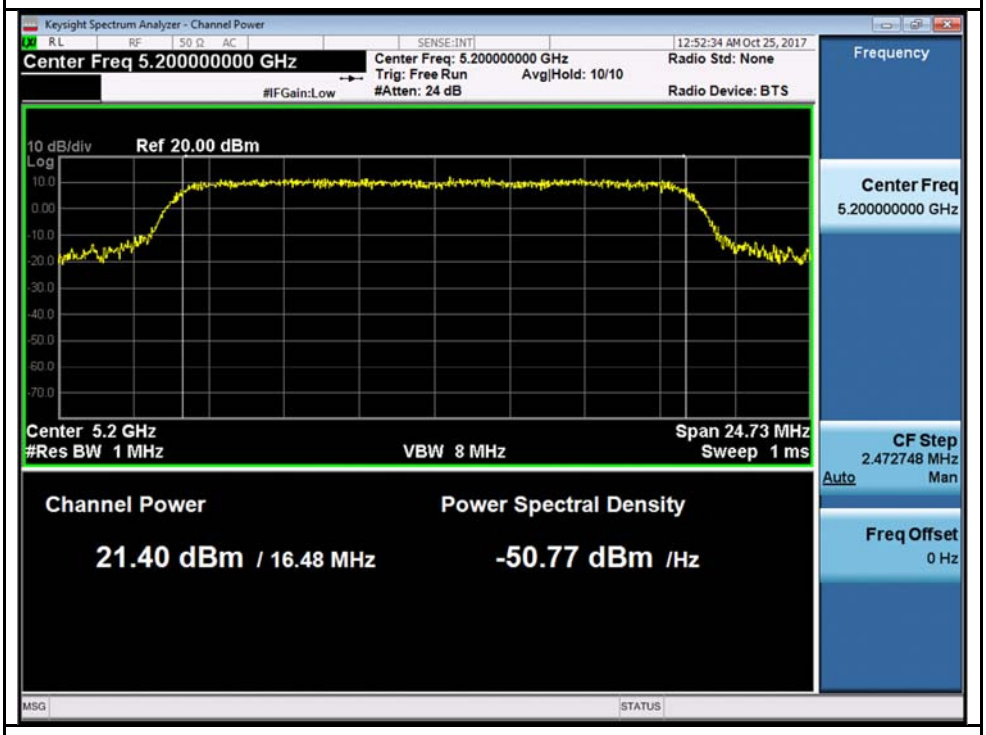


802.11n-HT40 5230M

802.11ac-VHT80 5210M

Chain 1:

802.11a-5180M



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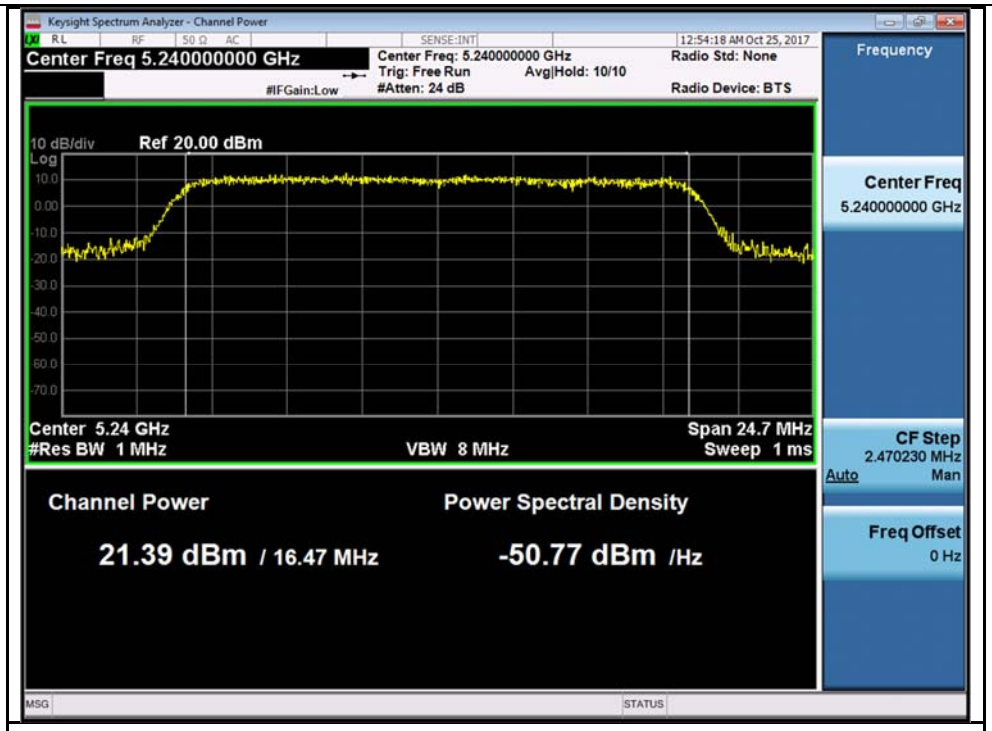
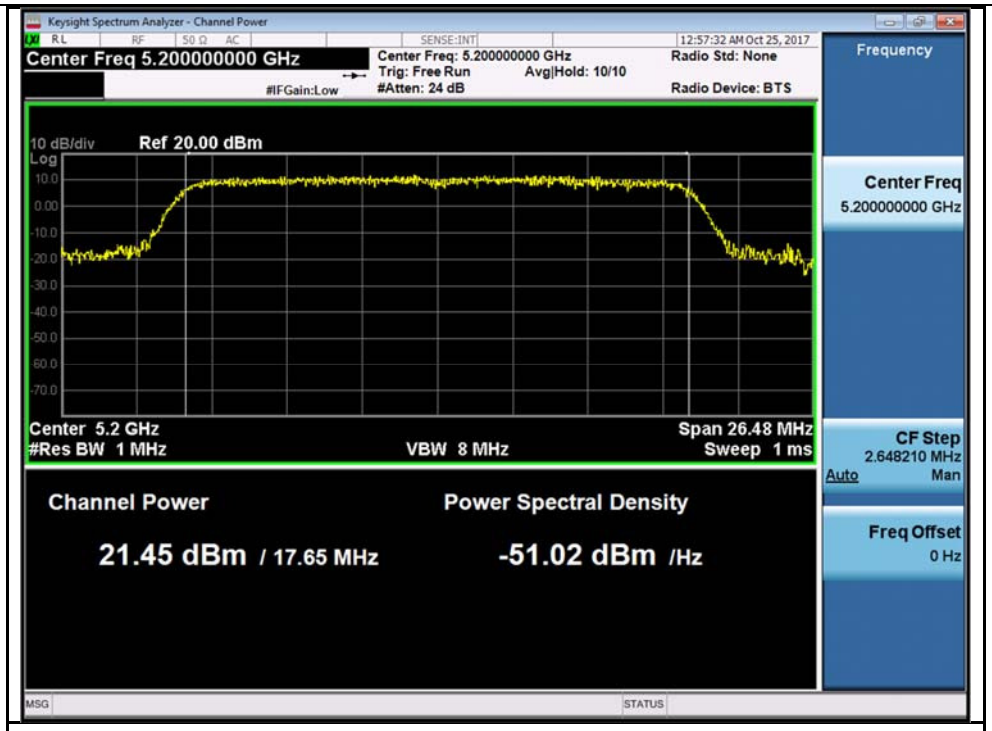
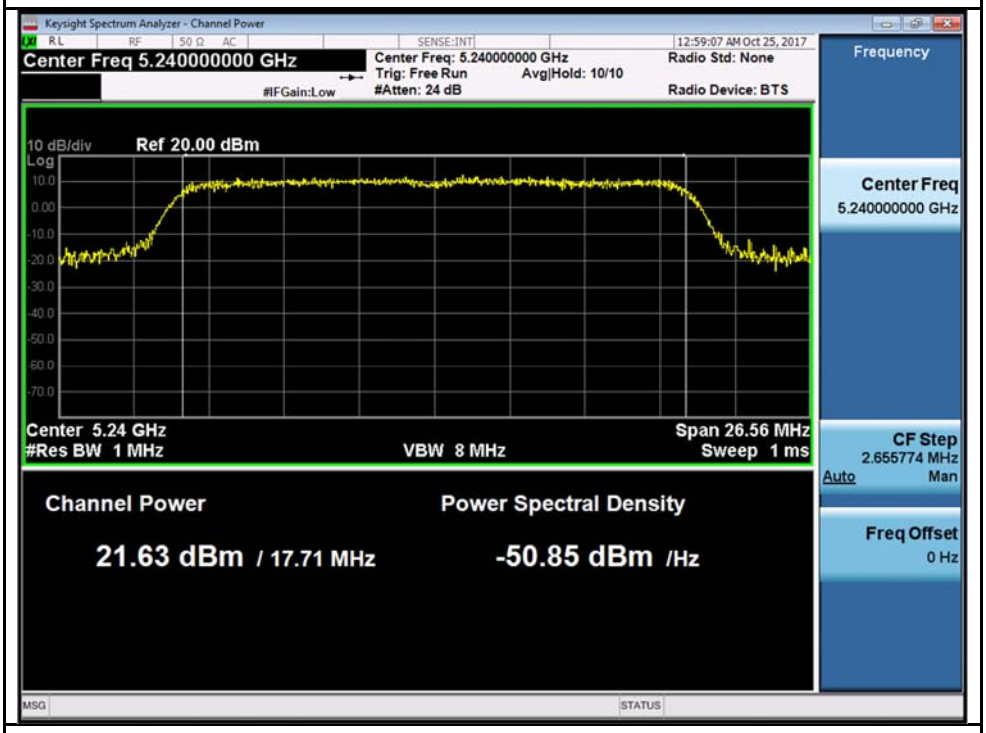


802.11a-5240M

802.11n-HT20 5180M

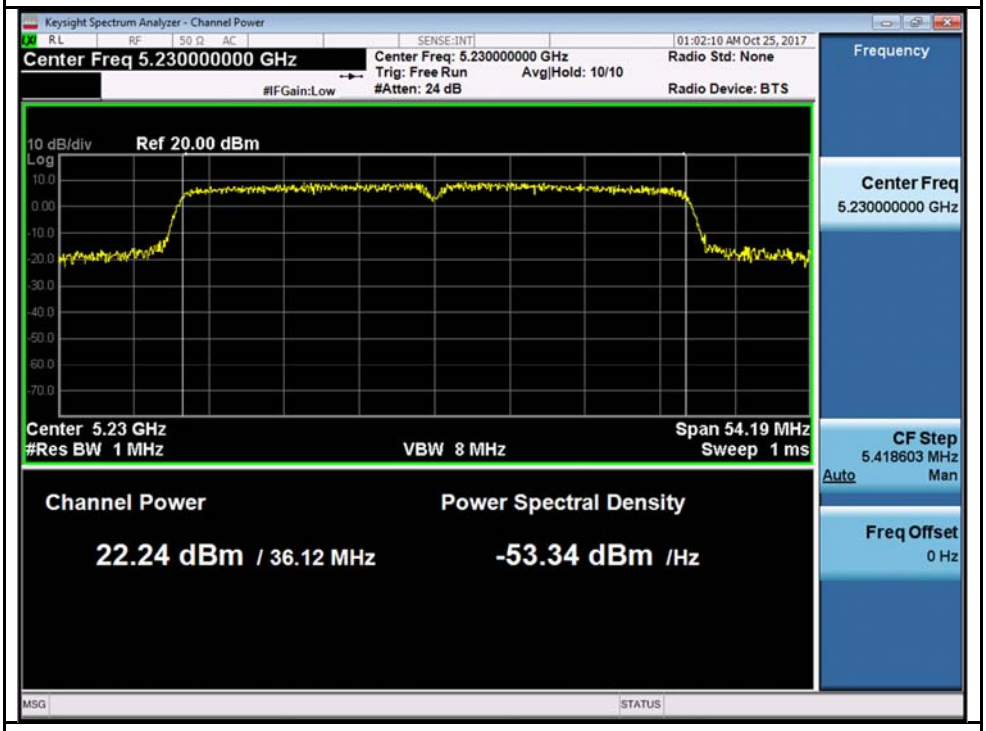


802.11n-HT20 5200M



802.11n-HT20 5240M

802.11n-HT40 5190M

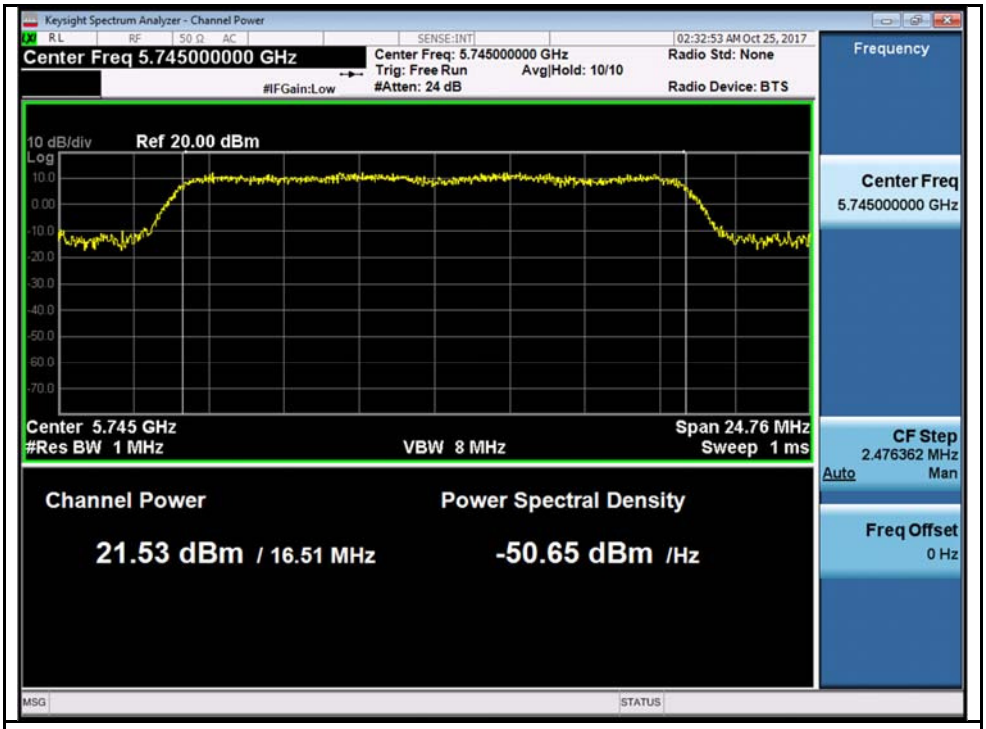


802.11n-HT40 5230M

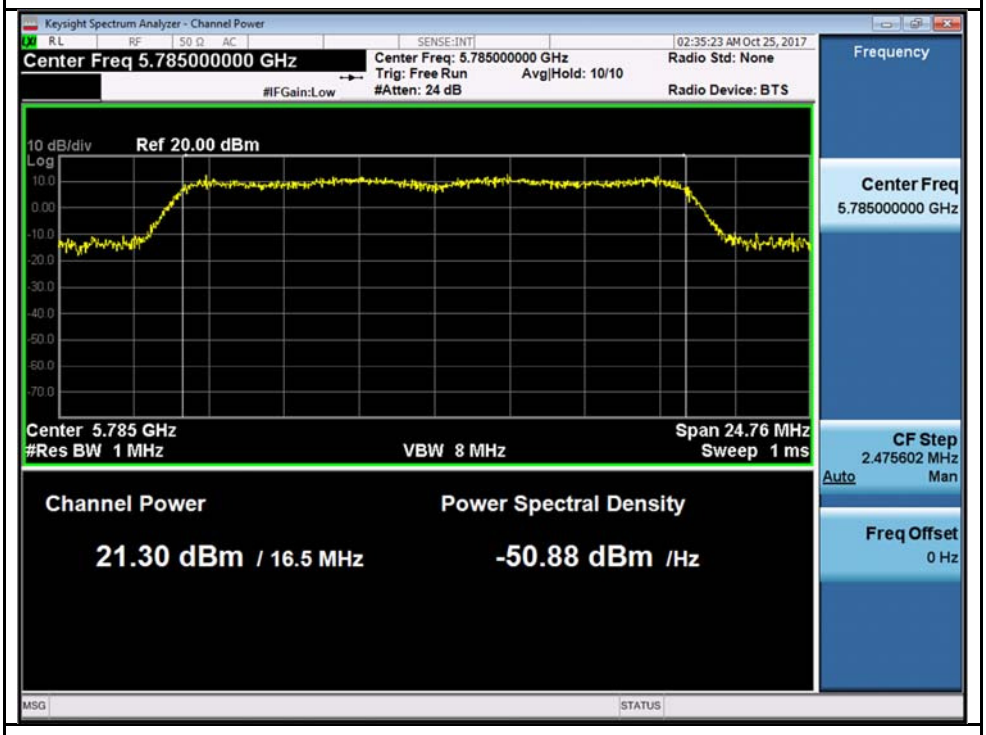
802.11ac-VHT80 5210M

Test Plot for W58:

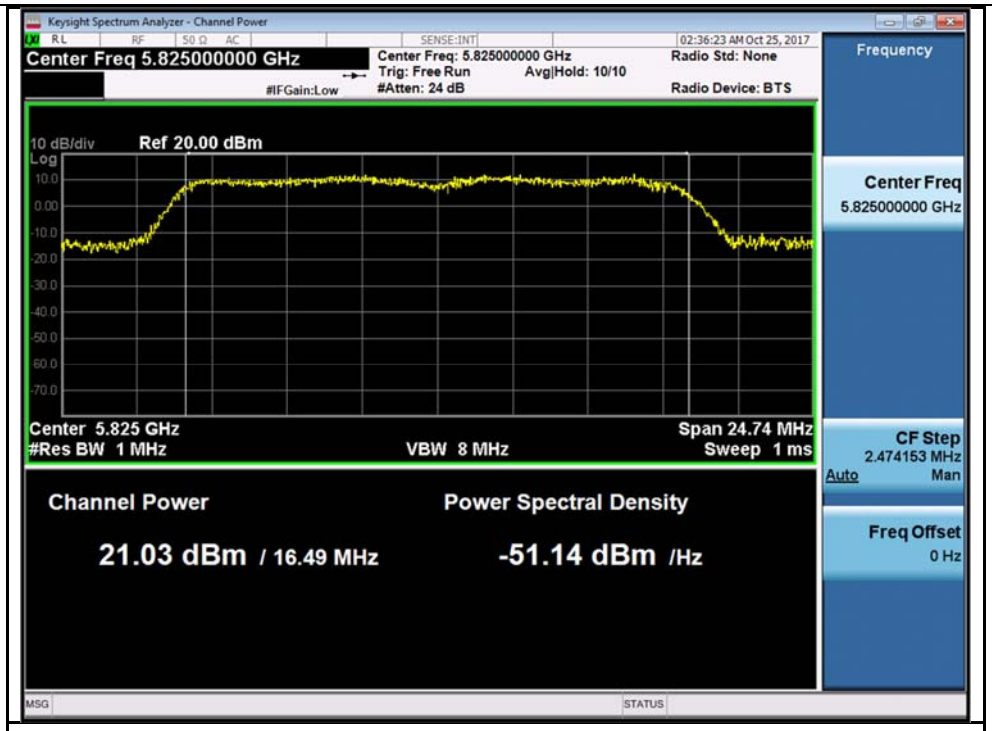
Chain 0:



802.11a-5745M



802.11a-5785M



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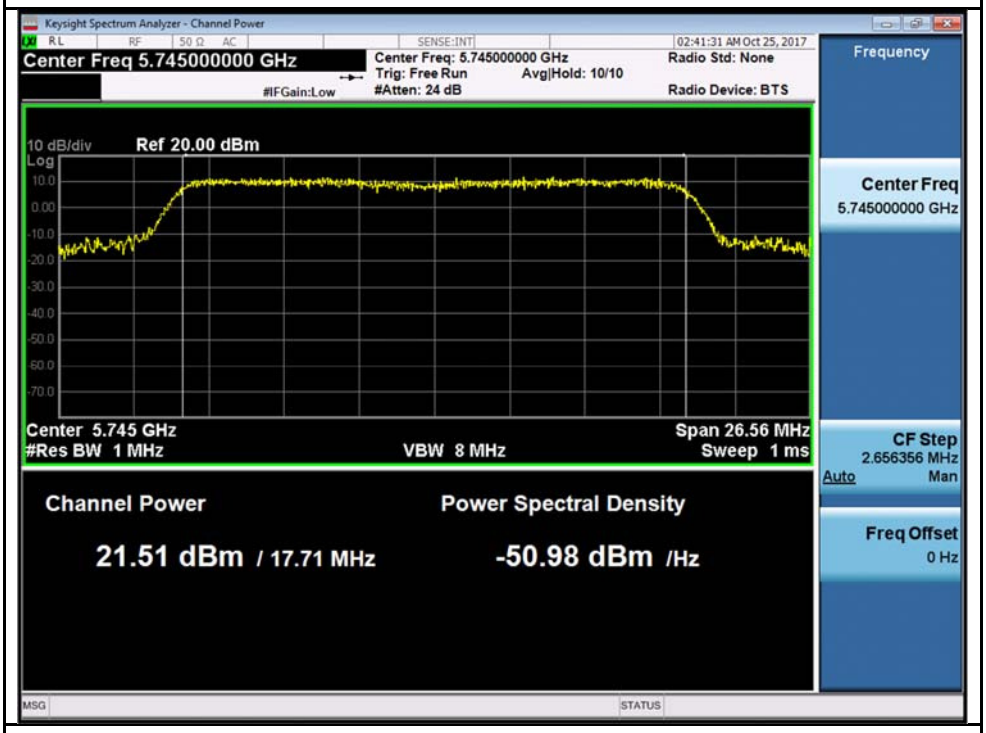
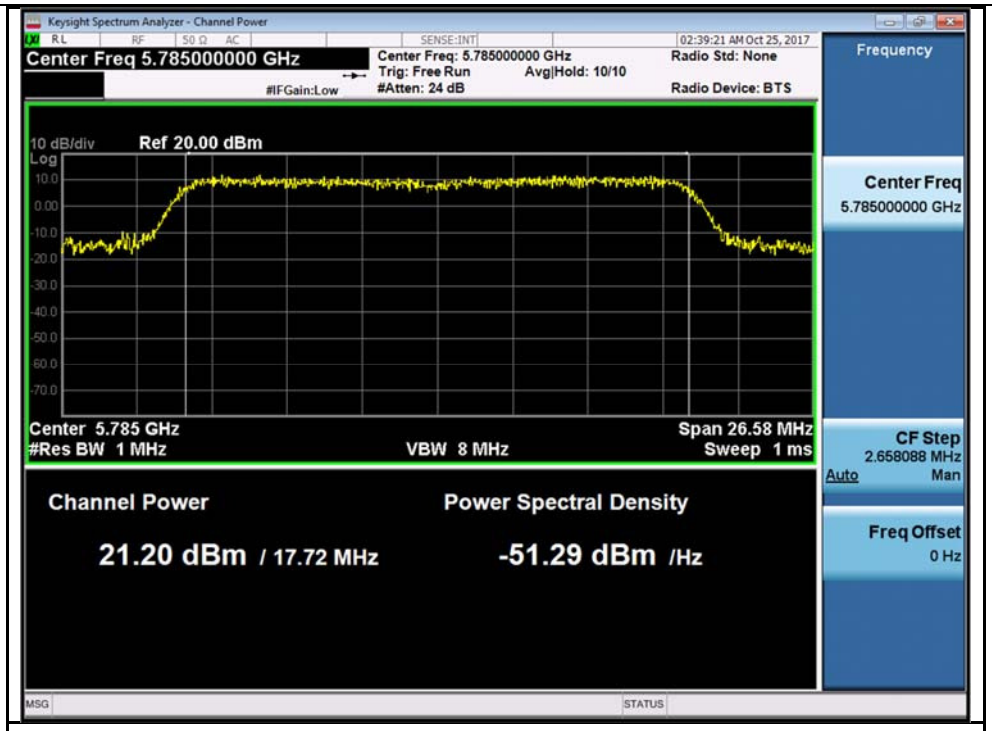
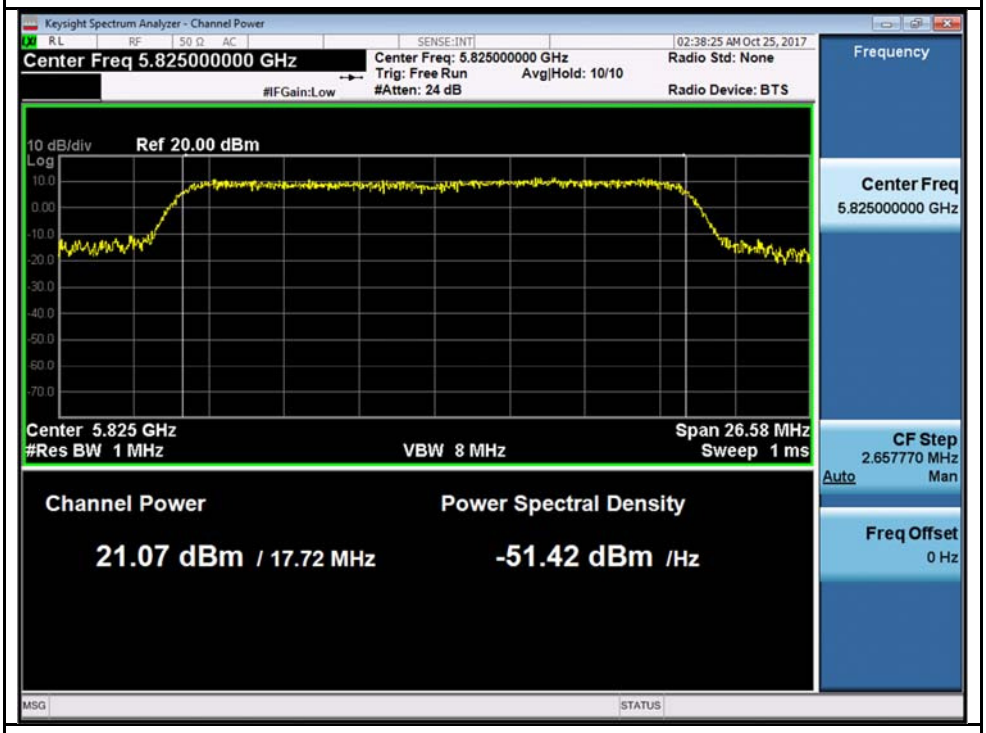


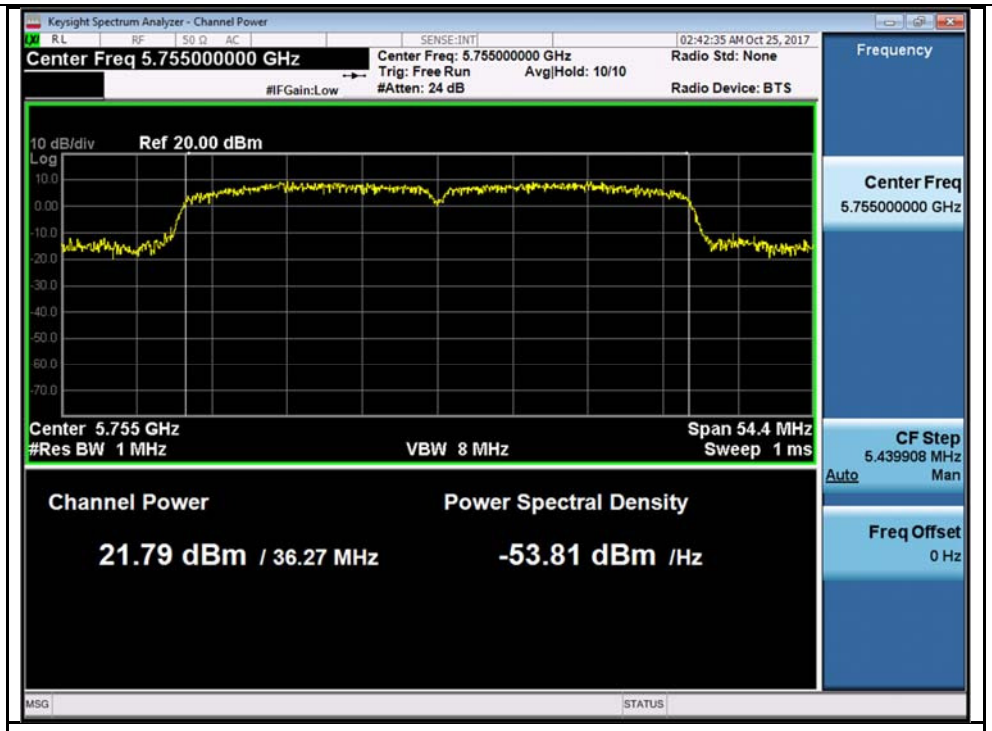
802.11n-HT20 5745M



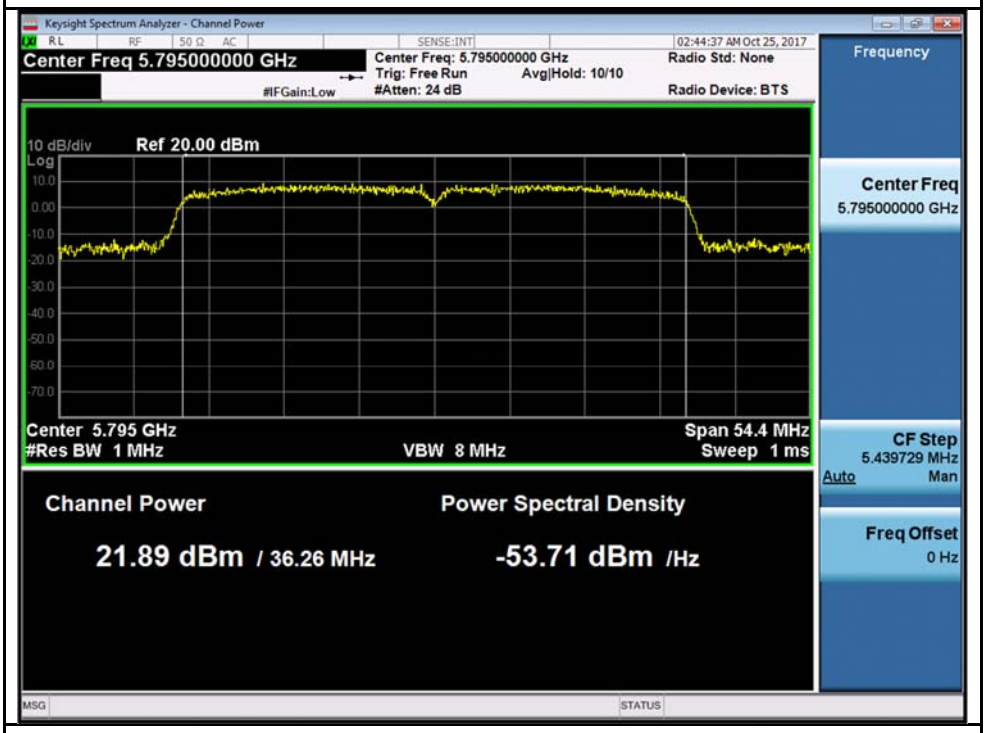
802.11n-HT20 5785M



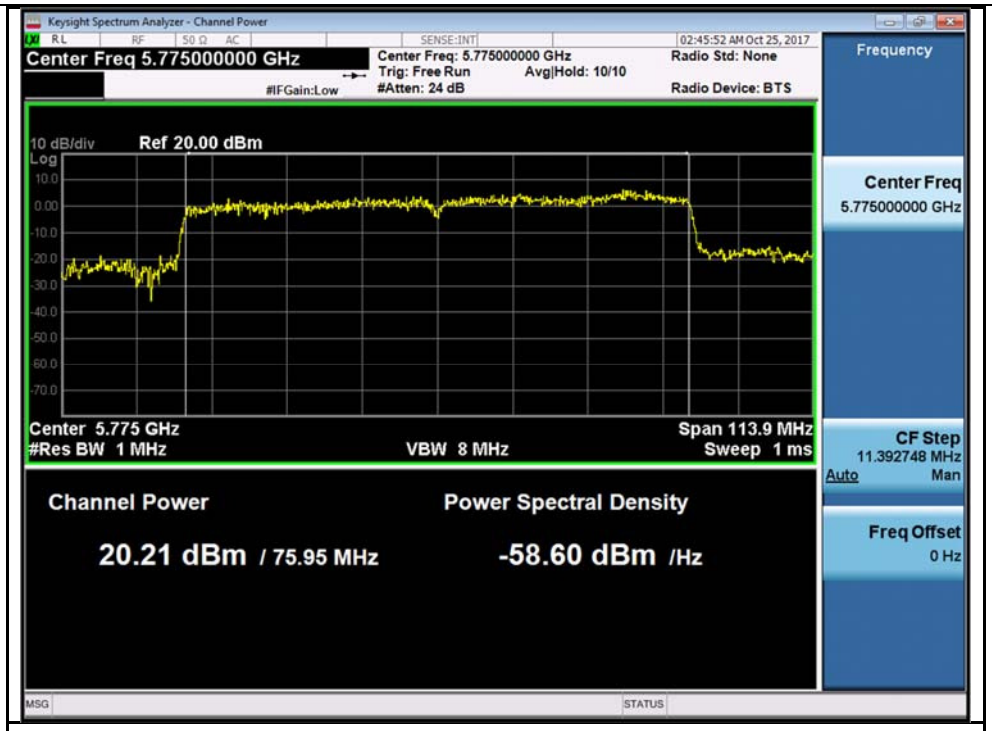
802.11n-HT20 5825M



802.11n-HT40 5755M



802.11n-HT40 5795M



802.11ac-VHT80 5775M

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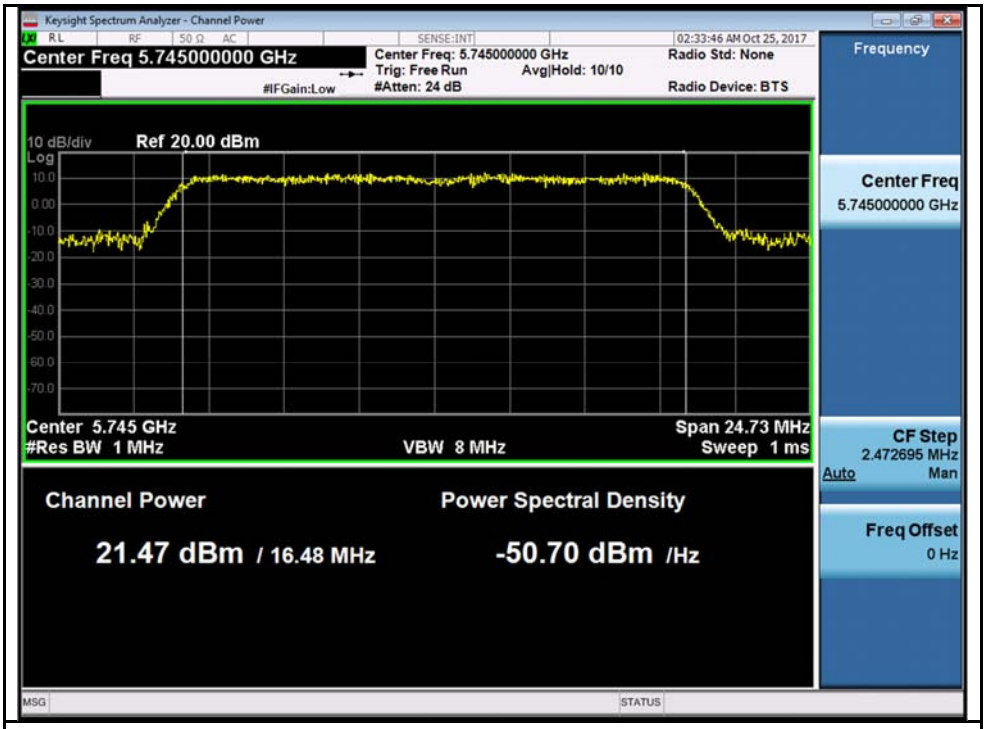
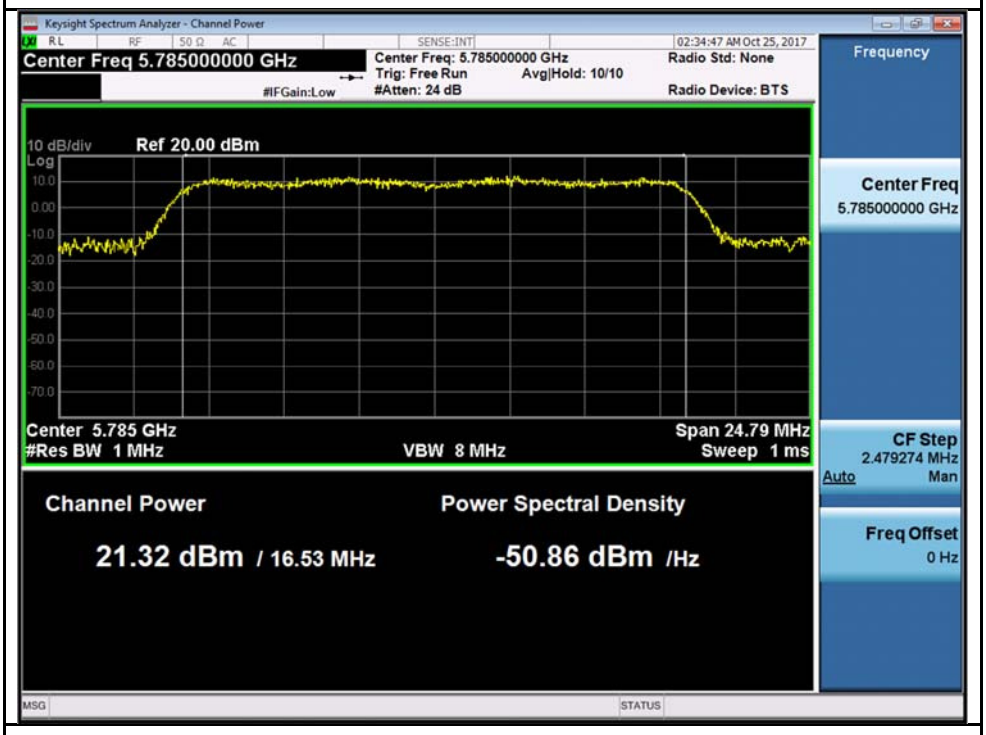
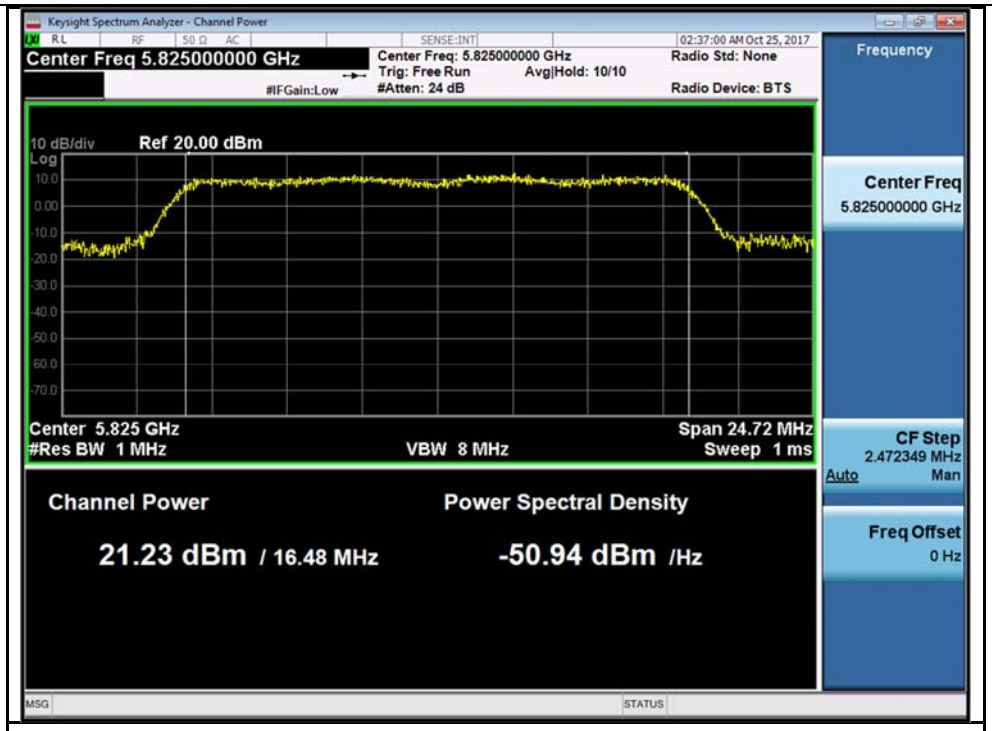


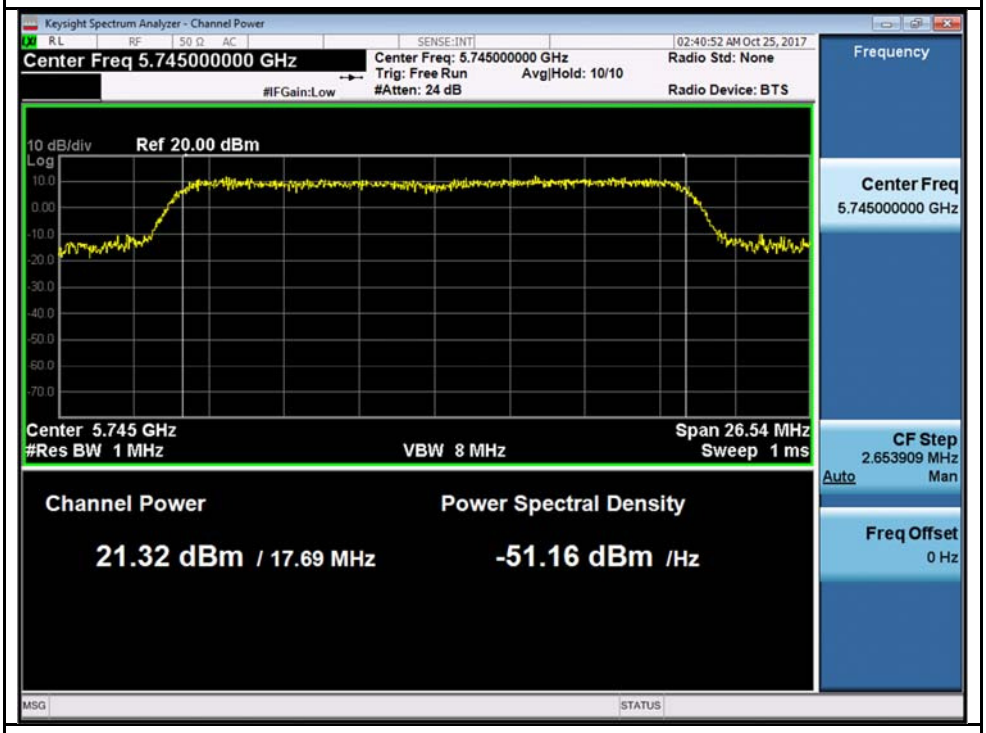
802.11a-5745M



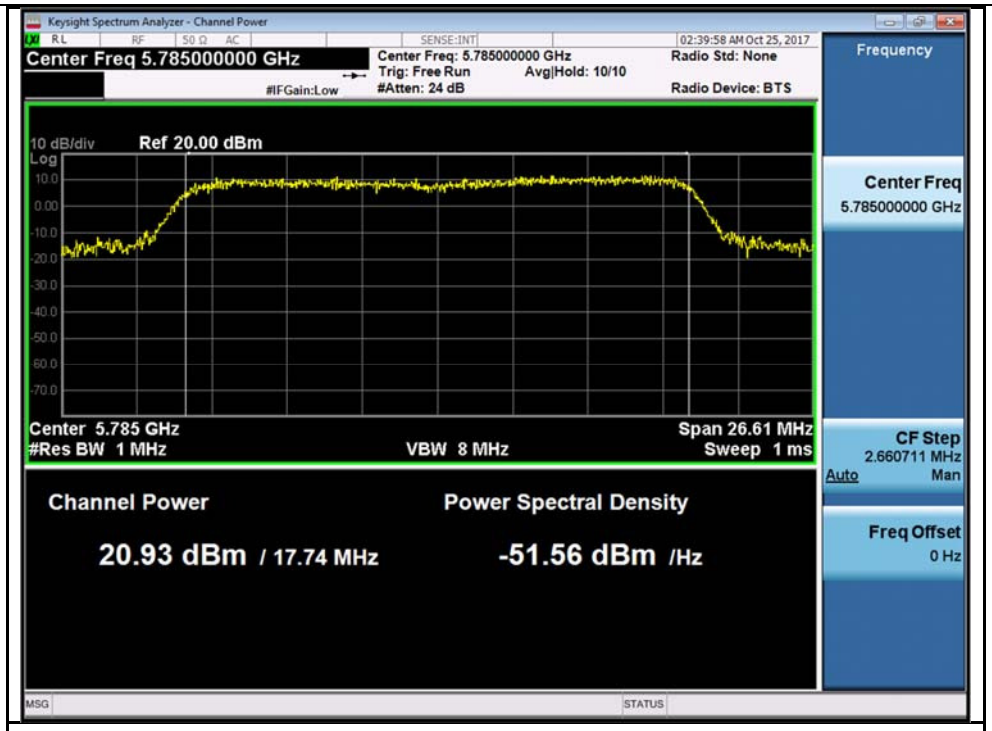
802.11a-5785M



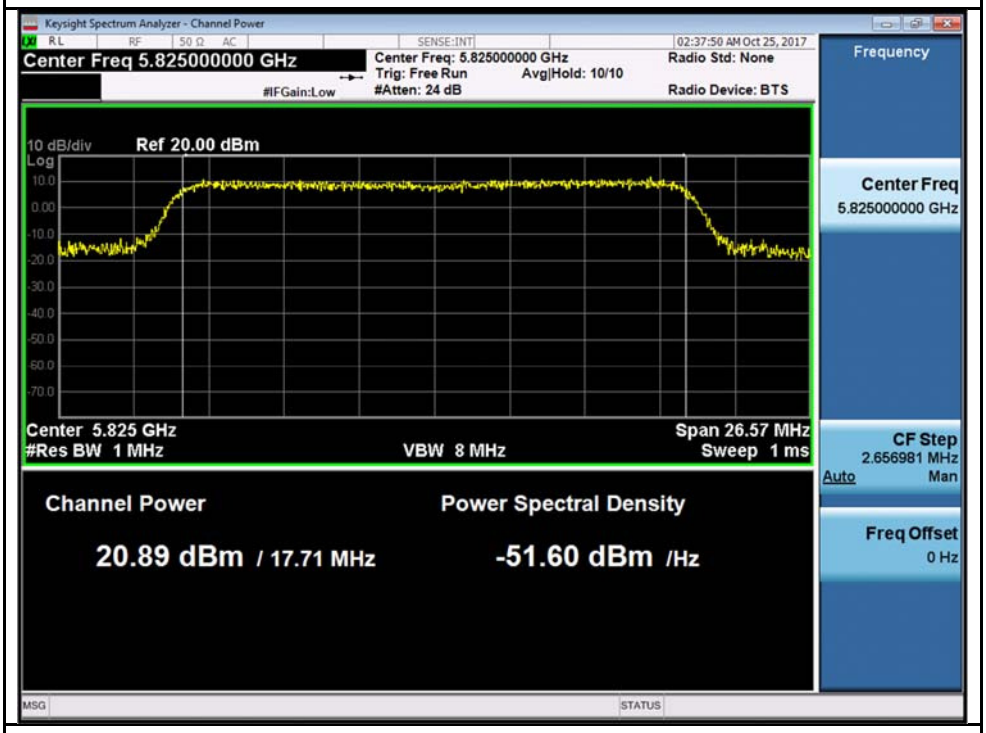
802.11a-5825M



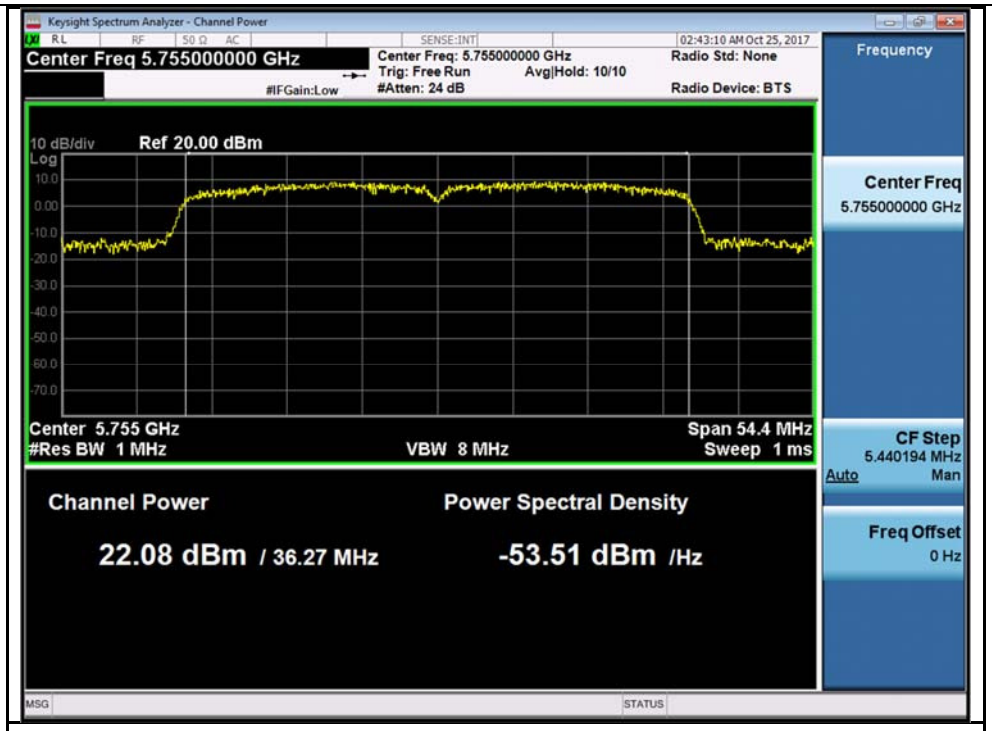
802.11n-HT20 5745M



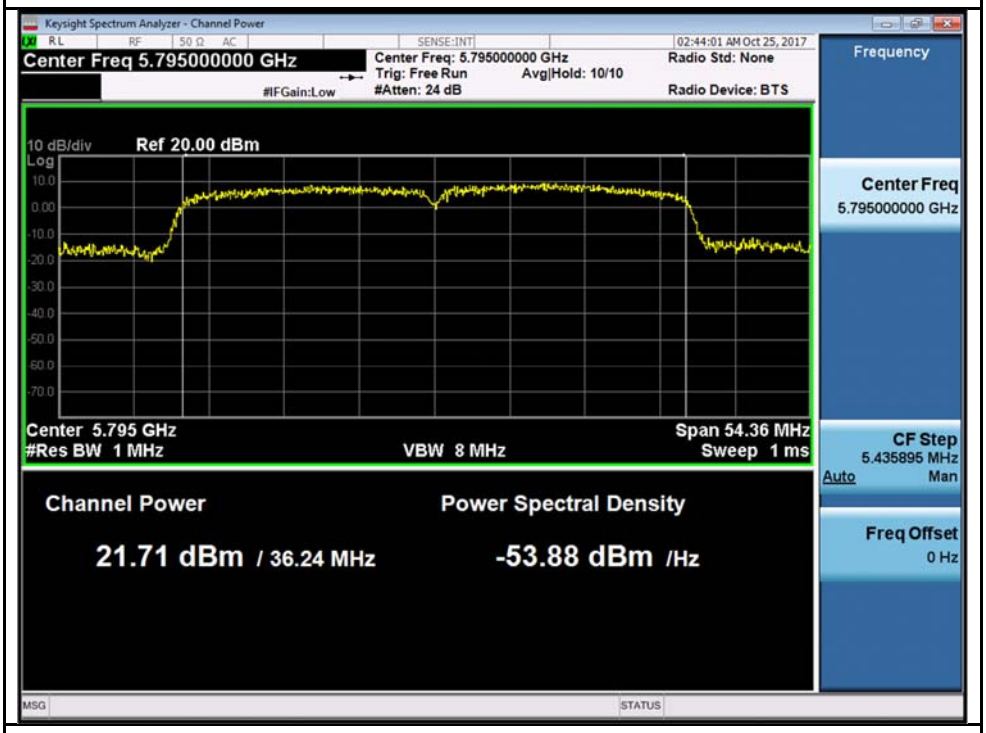
802.11n-HT20 5785M



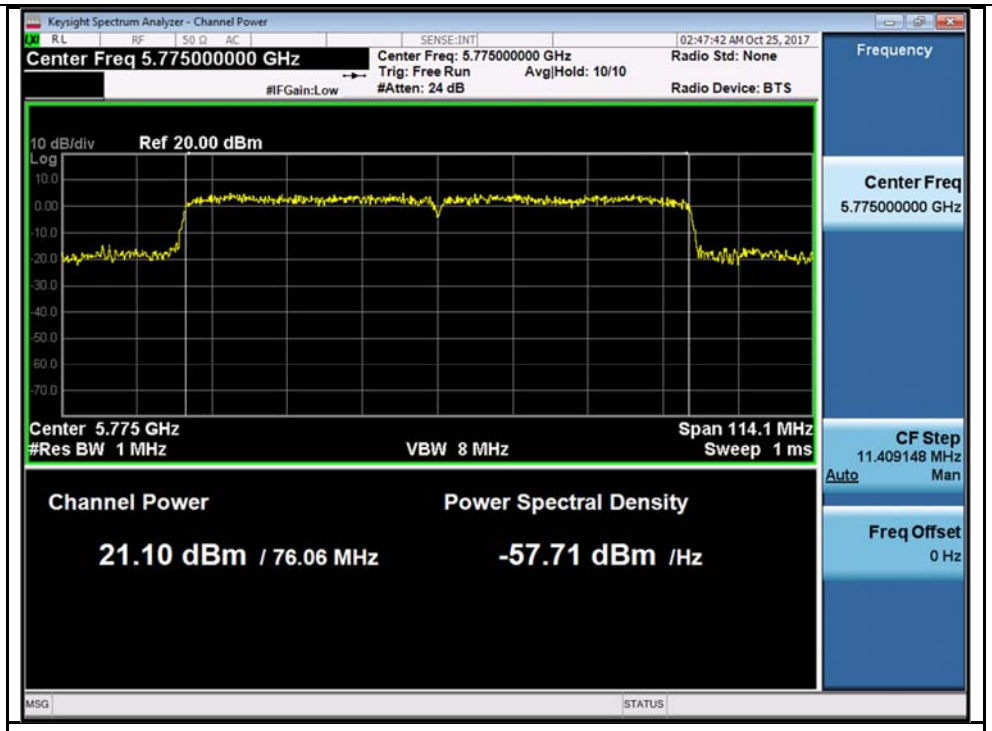
802.11n-HT20 5825M



802.11n-HT40 5755M



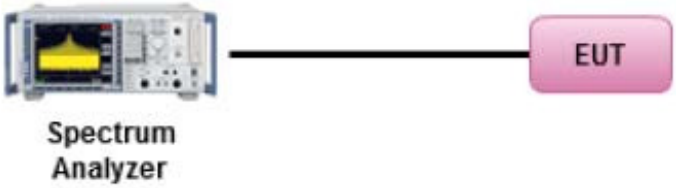
802.11n-HT40 5795M



802.11ac-VHT80 5775M

10.2 Peak Spectral Density

Requirement(s):

Spec	Item	Requirement	Applicable
§ 15.407	a)(1)(i)	For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.	☒
	a)(3)	For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.	☒
Test Setup			
Test Procedure	789033 D02 General UNII Test Procedures New Rules v01r02, II.F. Method SA-1 Maximum spectral density measurement procedure - Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal. - Set RBW = 1 MHz - Set VBW ≥ 3 MHz - Detector = RMS. - Sweep time = auto couple. - Trace mode = max hold. - Trace average at least 100 traces in power averaging - Use the peak marker function to determine the maximum amplitude level within the RBW. Apply correction to the result if different RBW is used.		
Test Date	10/24/2017 – 02/08/2018	Environmental condition	Temperature 22ºC Relative Humidity 42% Atmospheric Pressure 1020mbar
Remark	The EUT has two antennas which are cross-polarized, the directional gain=individual gain of each antenna =5dBi.		
Result	☒ Pass ☐ Fail		

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF test site.

PSD measurement result

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/MHz)			Limit (dBm/MHz)	Result
				Chain 0	Chain 1	Combined PSD		
PSD	802.11a	5180	Low	7.631	7.827	10.740	17	Pass
		5200	Mid	9.186	9.290	12.249	17	Pass
		5240	High	9.300	9.341	12.331	17	Pass
	802.11n-20	5180	Low	7.536	7.815	10.688	17	Pass
		5200	Mid	9.274	9.037	12.167	17	Pass
		5240	High	9.126	9.206	12.176	17	Pass
	802.11n-40	5190	Low	2.724	3.220	5.989	17	Pass
		5230	High	6.640	6.822	9.742	17	Pass
	802.11ac-80	5210	-	-3.711	-4.160	-0.919	17	Pass

Type	Test mode	Freq (MHz)	CH	Conducted PSD (dBm/100kHz)			Combined PSD(dBm/500kHz)	Limit (dBm/500kHz)	Result
				Chain 0	Chain 1	correction factor (dB)			
PSD	802.11a	5745	Low	1.834	1.769	6.99	11.802	30	Pass
		5785	Mid	1.676	1.683	6.99	11.680	30	Pass
		5825	High	1.880	1.627	6.99	11.756	30	Pass
	802.11n-20	5745	Low	1.468	1.276	6.99	11.373	30	Pass
		5785	Mid	1.183	1.302	6.99	11.243	30	Pass
		5825	High	1.471	1.264	6.99	11.369	30	Pass
	802.11n-40	5755	Low	-0.934	-0.784	6.99	9.142	30	Pass
		5795	High	-1.003	-0.977	6.99	9.010	30	Pass
	802.11ac-80	5775	Mid	-4.629	-4.883	6.99	5.246	30	Pass
Note	BW correction factor = 10log(500kHz/RBW), RBW was set to 100kHz during test.								

Test Plot for W52:

Chain 0:

802.11a-5180M

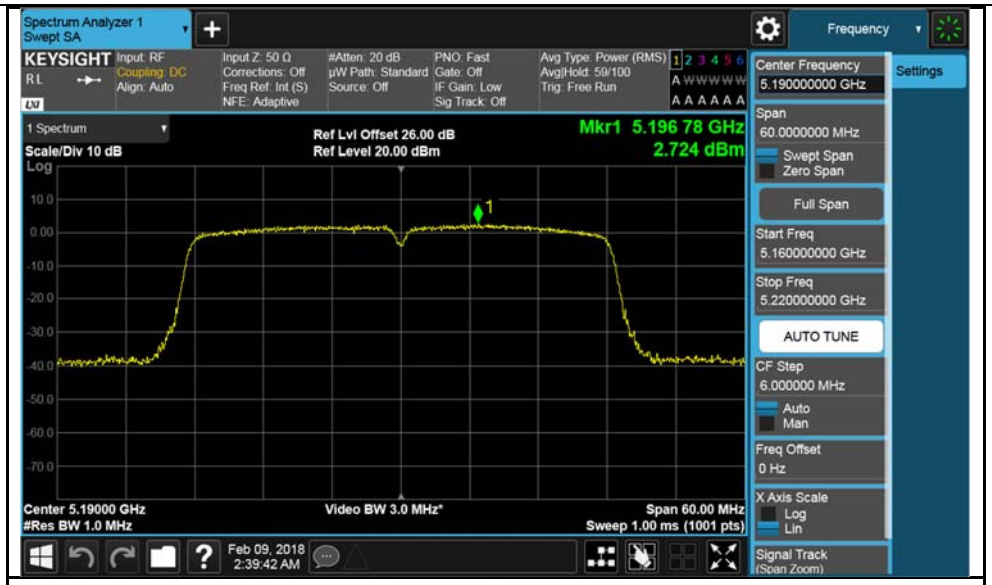
802.11a-5200M

802.11a-5240M

802.11n-HT20 5180M

802.11n-HT20 5200M

802.11n-HT20 5240M



802.11n-HT40 5190M

802.11n-HT40 5230M

802.11ac-VHT80 5210M

Chain 1:

802.11a-5180M

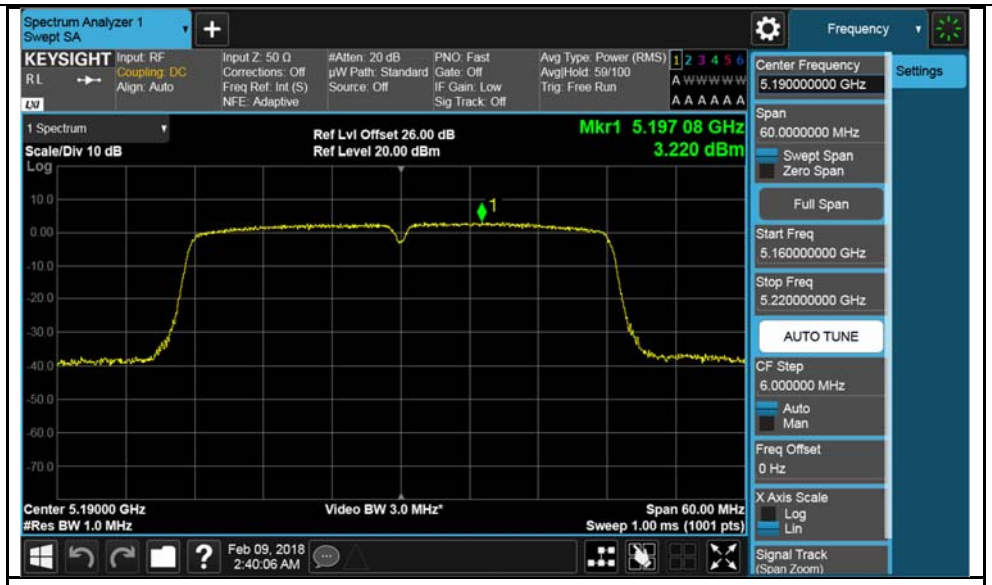
802.11a-5200M

802.11a-5240M

802.11n-HT20 5180M

802.11n-HT20 5200M

802.11n-HT20 5240M



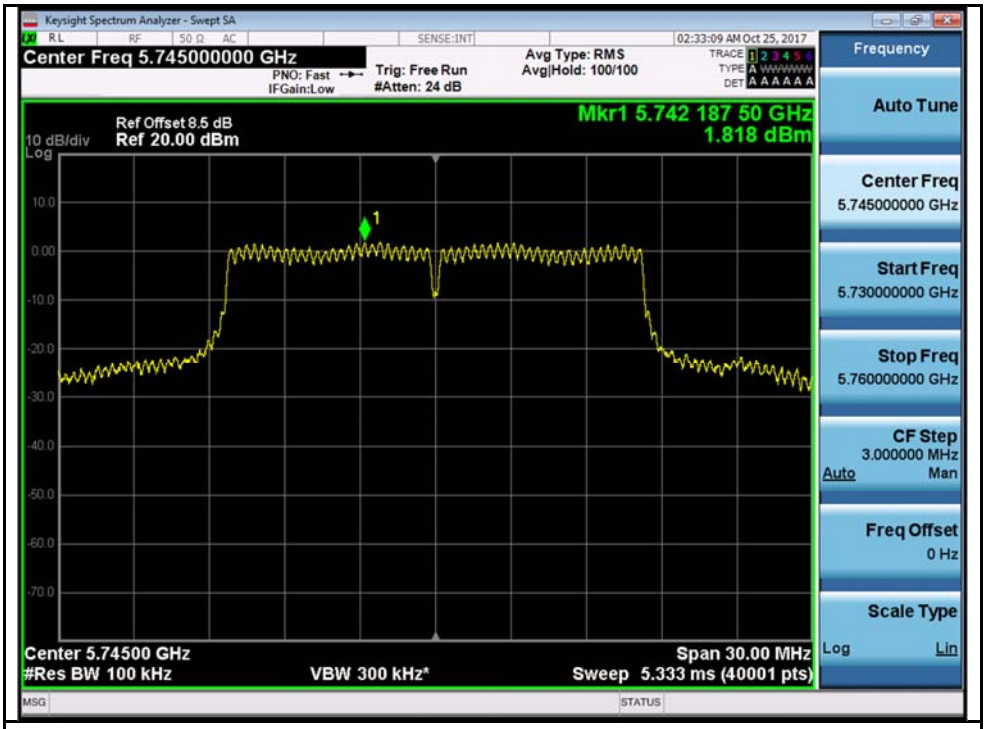
802.11n-HT40 5190M

802.11n-HT40 5230M

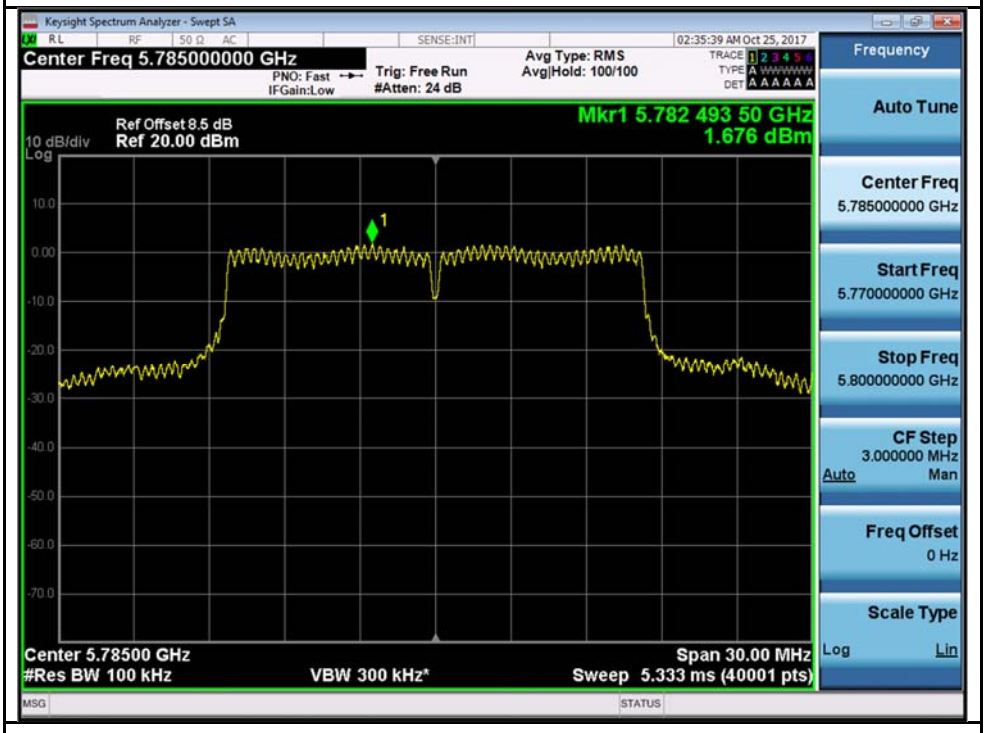
802.11ac-VHT80 5210M

Test Plot for W58:

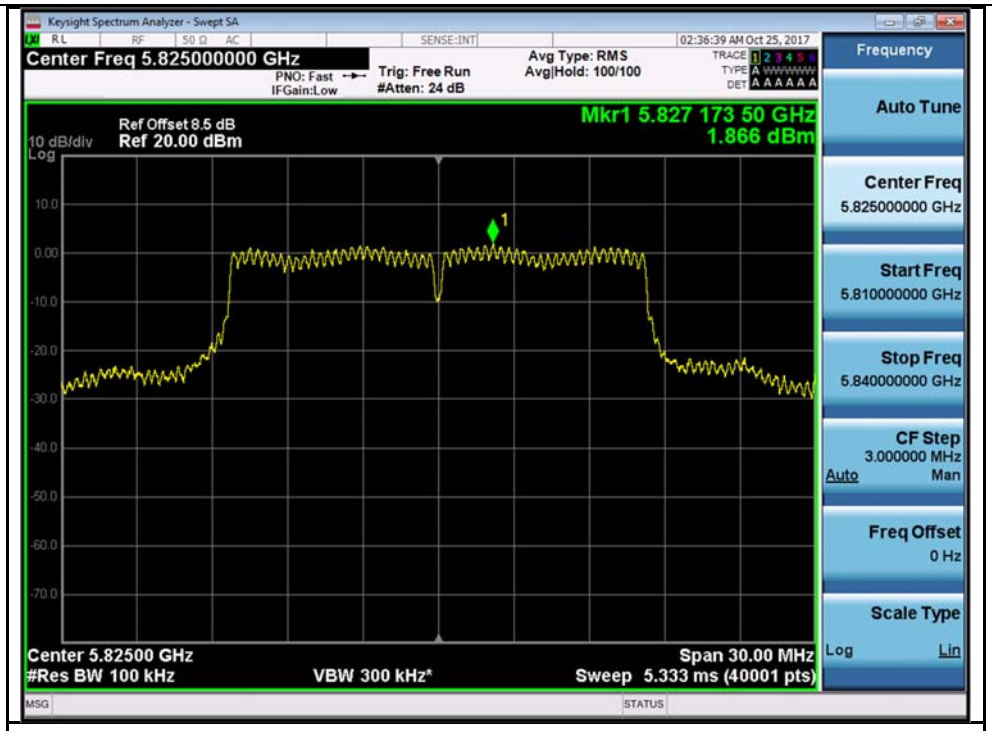
Chain 0:



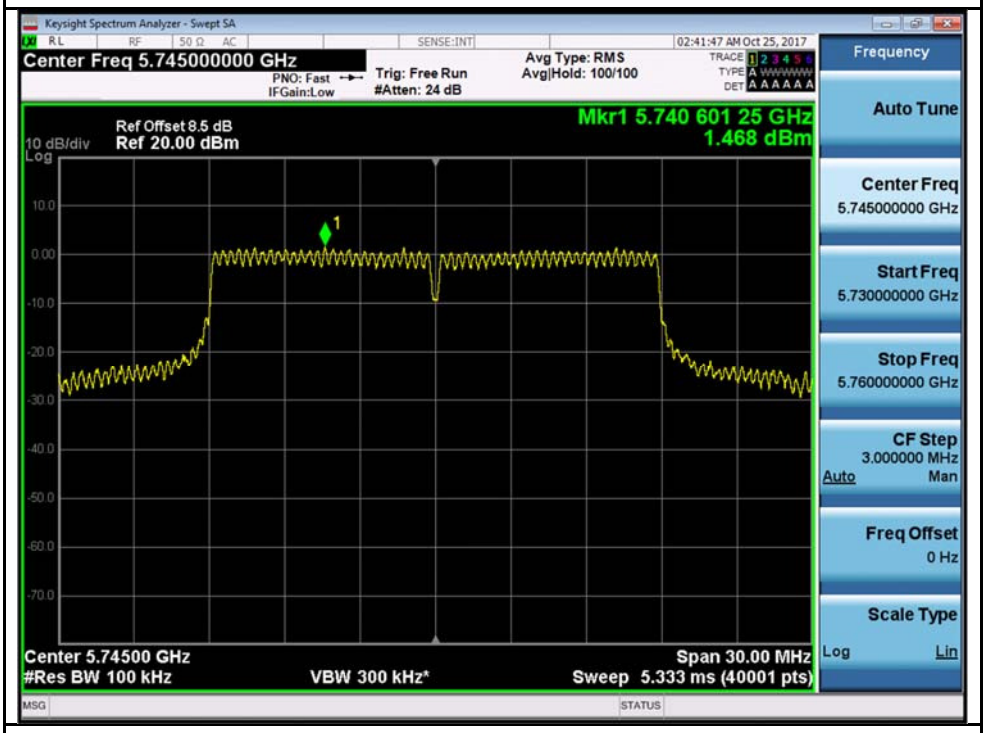
802.11a-5745M



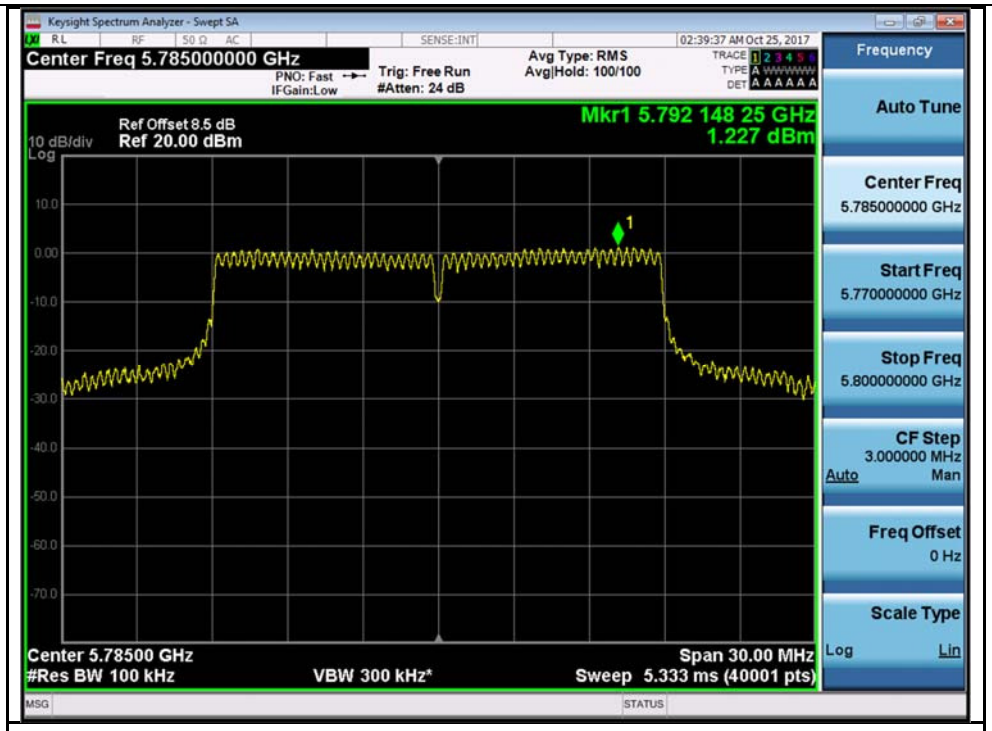
802.11a-5785M



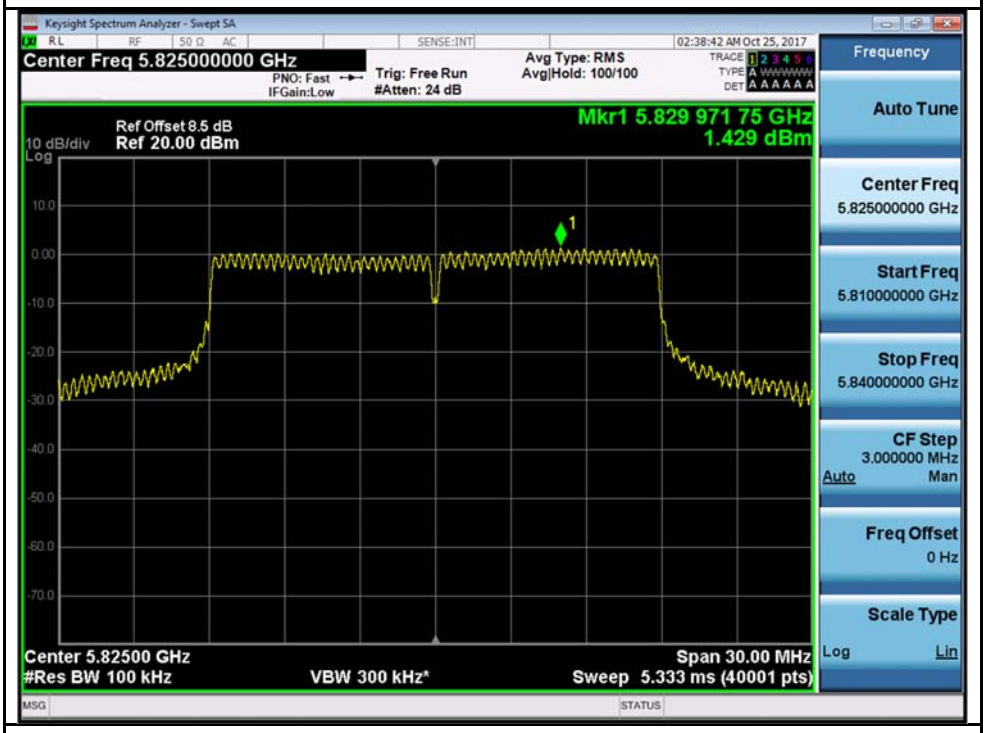
802.11a-5825M



802.11n-HT20 5745M



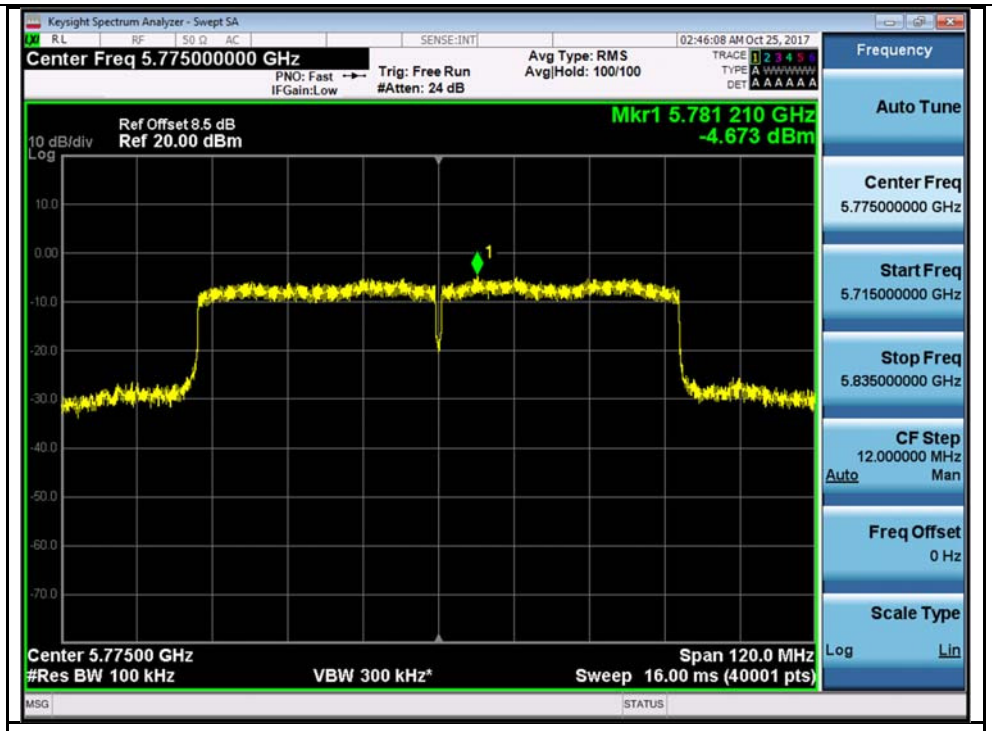
802.11n-HT20 5785M



802.11n-HT20 5825M

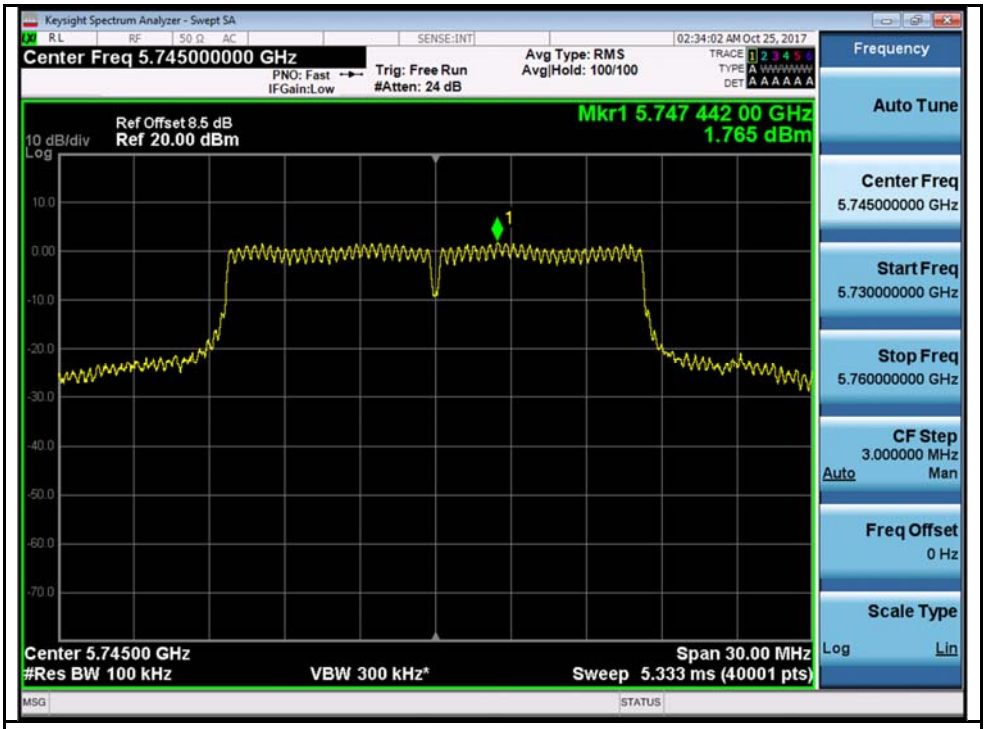
802.11n-HT40 5755M

802.11n-HT40 5795M

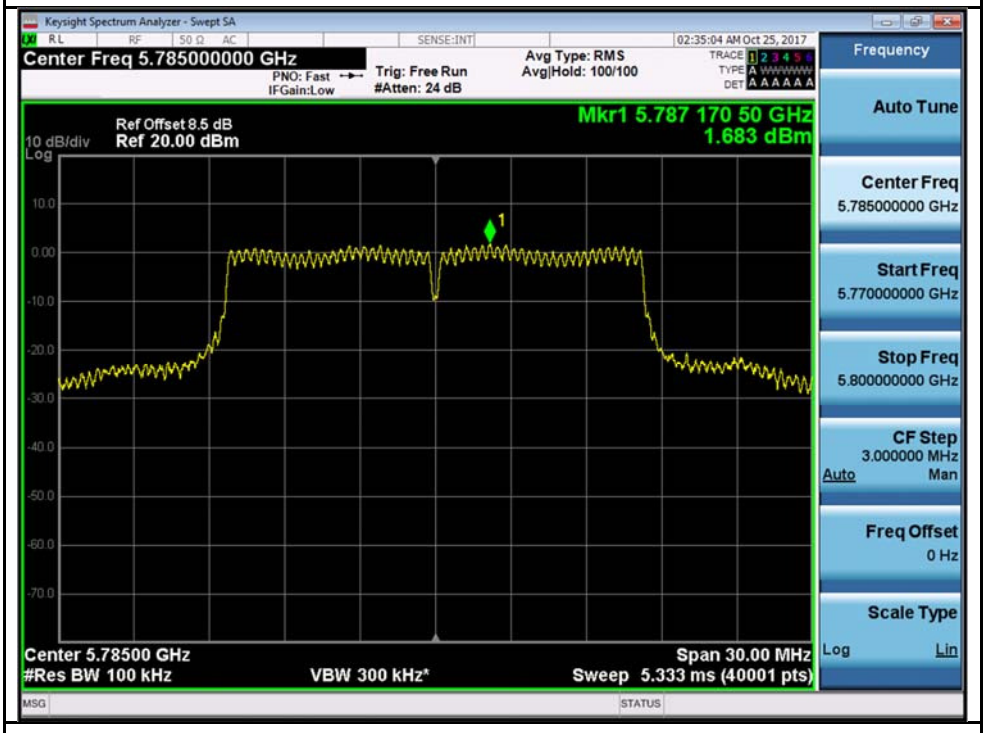


802.11ac-VHT80 5775M

Chain 1:

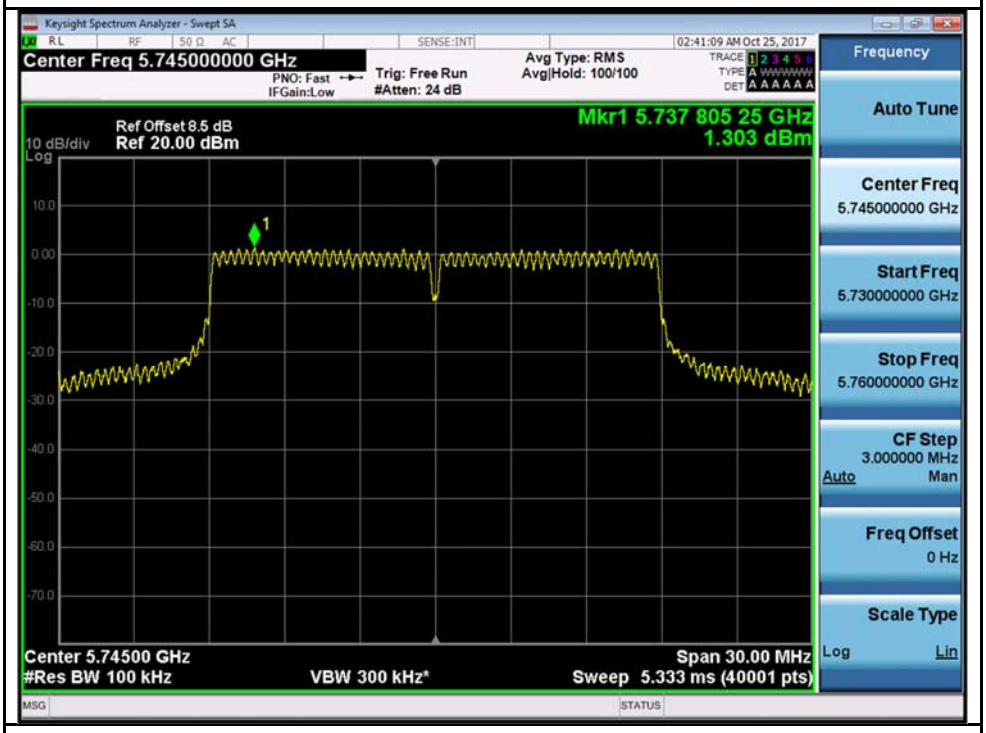


802.11a-5745M

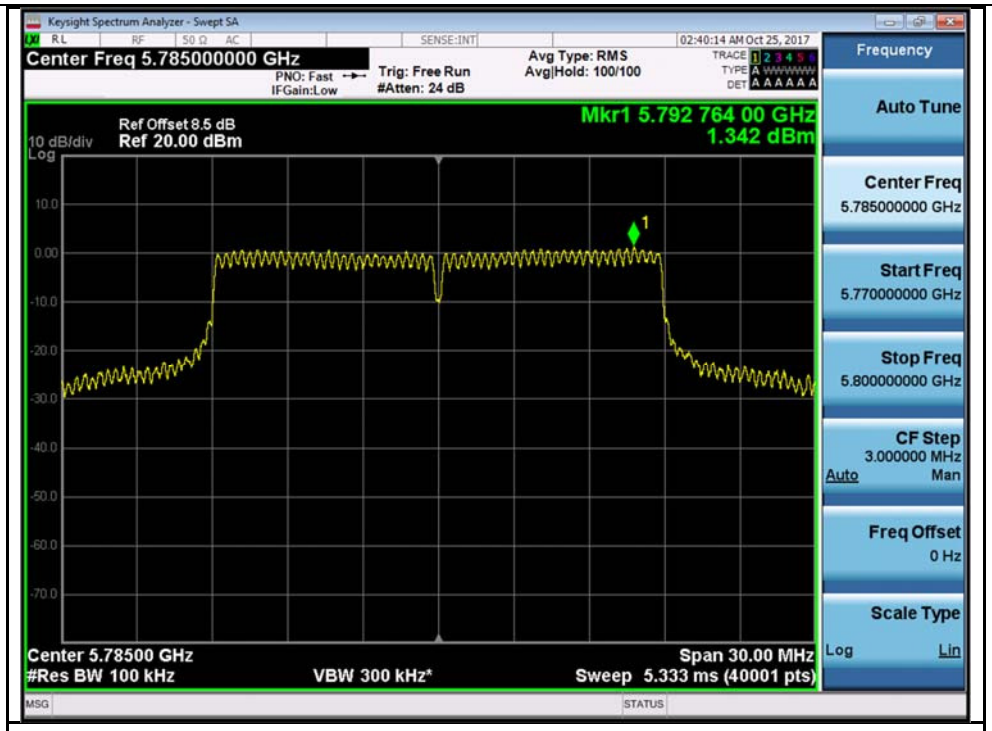


802.11a-5785M

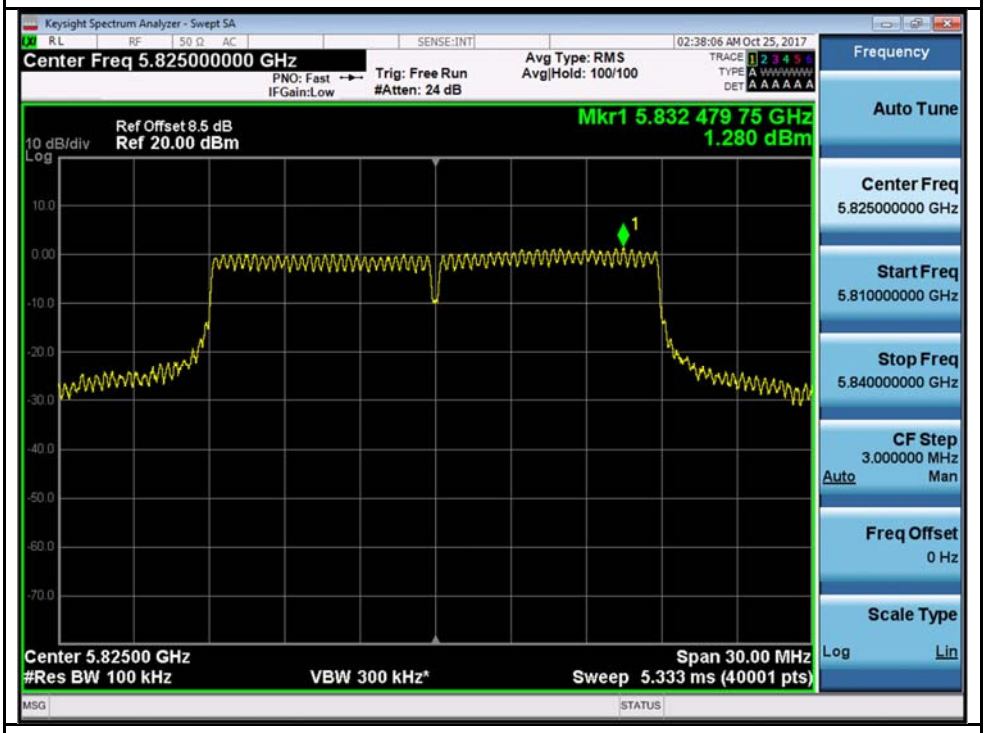
802.11a-5825M



802.11n-HT20 5745M



802.11n-HT20 5785M



802.11n-HT20 5825M

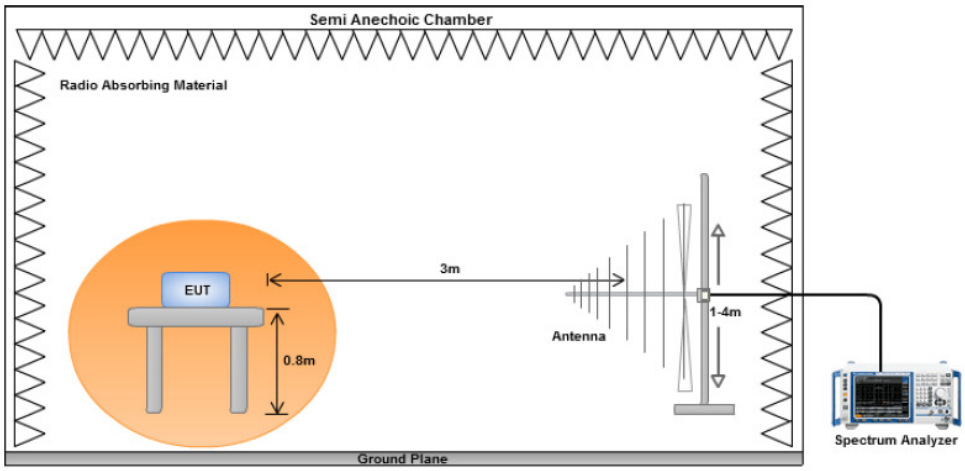
802.11n-HT40 5755M

802.11n-HT40 5795M

802.11ac-VHT80 5775M

10.3 Radiated Emissions below 1GHz

Requirement(s):

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>47CFR§
15.407(b)
15.209 (a)</td><td>Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges
<table>
<tr><th>Frequency range (MHz)</th><th>Field Strength (uV/m)</th></tr>
<tr><td>30 – 88</td><td>100</td></tr>
<tr><td>88 – 216</td><td>150</td></tr>
<tr><td>216 960</td><td>200</td></tr>
<tr><td>Above 960</td><td>500</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="2"> 
</td></tr>
<tr><td>Procedure</td><td colspan="2">1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. A Quasi-peak measurement was then made for that frequency point.
4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.</td></tr>
<tr><td>Remark</td><td colspan="2">The EUT was scanned up to 1GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.</td></tr>
<tr><td>Result</td><td colspan="2">☒ Pass ☐ Fail</td></tr>
</table>

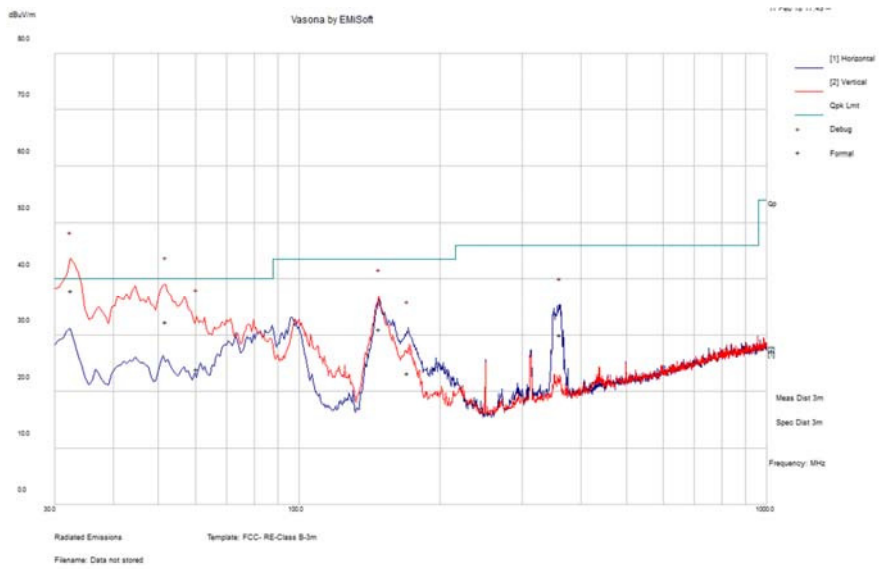
Test Data ☒ Yes (See below) ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Below 1GHz)

Test specification	below 1GHz			
Environmental Conditions:	Temp (°C):	26	Result	Pass
	Humidity (%)	47		
	Atmospheric (mbar):	1020		
Mains Power:	120VAC, 60Hz			
Tested by:	Gary Chou			
Test Date:	10/24/2017-02/08/2018			
Remarks:	2.4GHz and 5GHz Transmit Simultaneously			

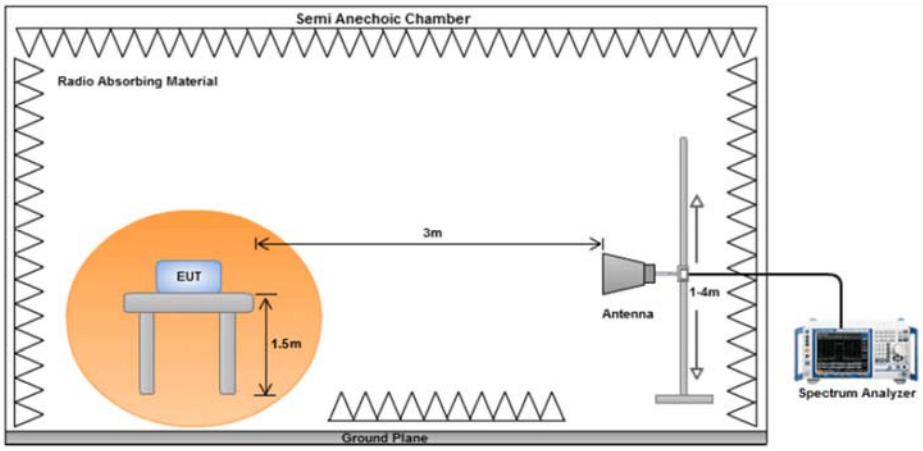


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
30.00	36.44	11.29	-13.86	33.87	Quasi Max	V	105	135	40	-6.13	Pass
66.23	46.49	11.69	-28.35	29.83	Quasi Max	V	179	315	40	-10.17	Pass
94.96	47.33	12	-27.27	32.06	Quasi Max	H	291	176	43.5	-11.44	Pass
35.83	34.62	11.38	-18.72	27.28	Quasi Max	V	122	73	40	-12.72	Pass
49.02	42.27	11.57	-26.59	27.25	Quasi Max	V	100	65	40	-12.75	Pass
143.93	35	12.4	-23.89	23.50	Quasi Max	H	199	273	43.5	-20.00	Pass

Note: Both horizontal and vertical polarities were investigated. The results above show only the worst case.

10.4 Radiated Spurious Emissions above 1GHz

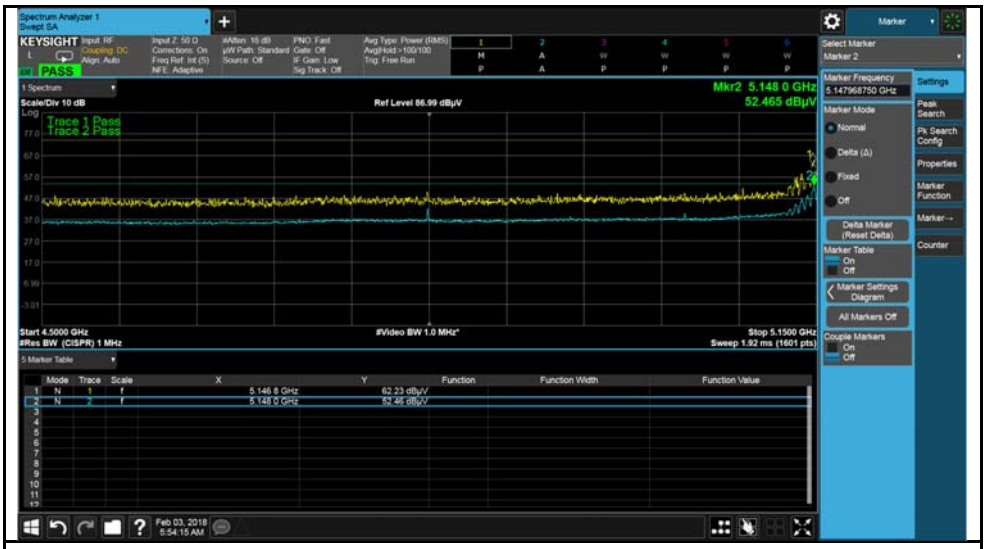
Requirement(s):

Spec	Item	Requirement	Applicable
47CFR§ 15.205	1	Restricted band, emission must also comply with the radiated emission limits specified in 15.209	☒
Test Setup			
Procedure	1. The EUT was switched on and allowed to warm up to its normal operating condition. 2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. An average measurement was then made for that frequency point. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.		
Remark	The EUT was scanned up to 40GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.		
Result	☒ Pass ☐ Fail		

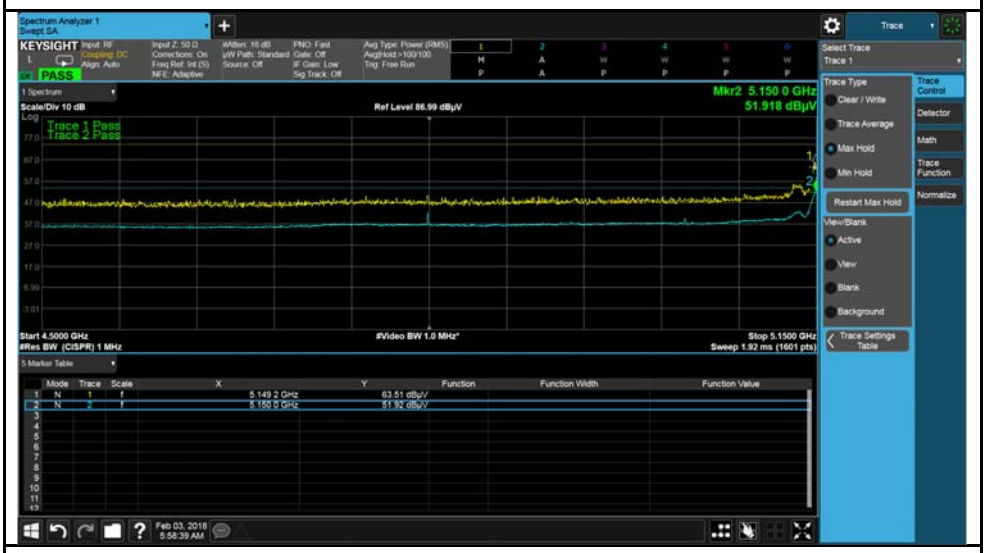
Test Data ☐ Yes (See below) ☒ N/A
Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Gary Chou at 10m chamber.

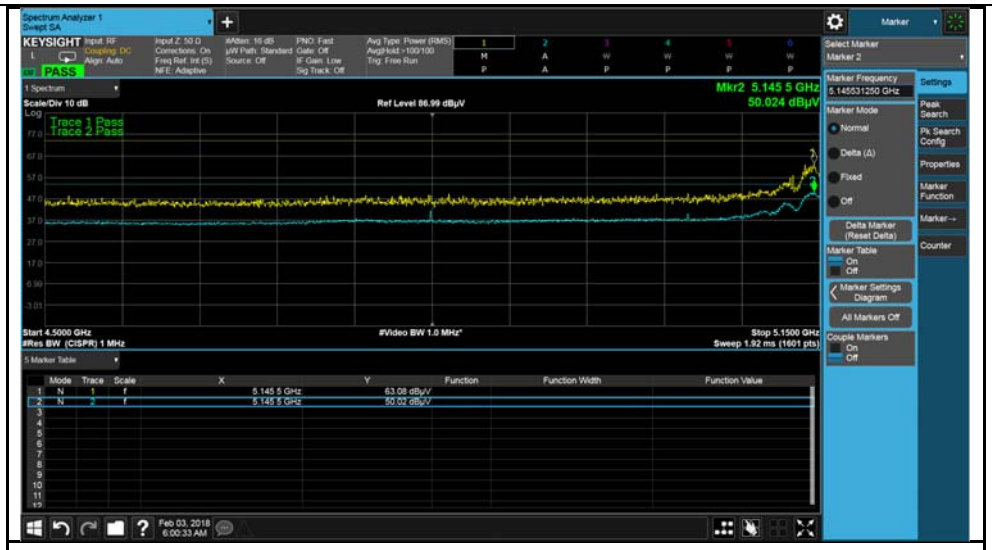
Restricted Band Measurement Plots:



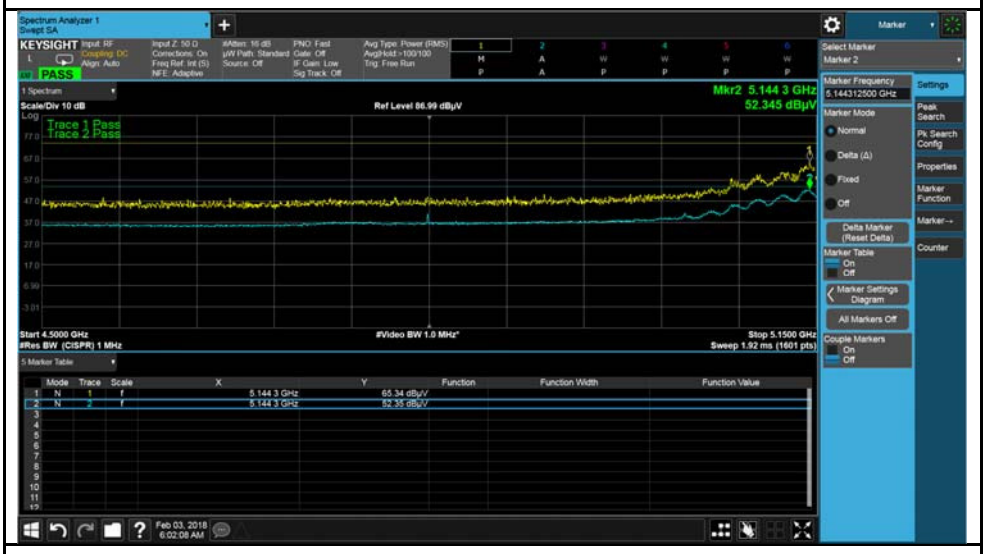
802.11a-5180MHz



802.11n-HT20 5180MHz



802.11n-HT40 5190MHz



802.11ac-VHT80 5210MHz

Radiated Emission Test Results (Above 1GHz)

1GHz-40GHz – 802.11a – 5180MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7264.108	40.59	5.16	-0.33	45.42	Peak Max	V	273	304	74	-28.58	Pass
10360.98	44.19	6	1.5	51.69	Peak Max	V	233	49	74	-22.31	Pass
13285.87	46.09	7.01	4.55	57.65	Peak Max	H	167	162	74	-16.35	Pass
7264.108	22.63	5.16	-0.33	27.46	Average Max	V	273	304	54	-26.54	Pass
10360.98	26.67	6	1.5	34.17	Average Max	V	233	49	54	-19.83	Pass
13285.87	28.24	7.01	4.55	39.8	Average Max	H	167	162	54	-14.2	Pass

1GHz-40GHz – 802.11a – 5200MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7360.601	41.86	5.15	-0.37	46.64	Peak Max	H	273	296	74	-27.36	Pass
10399.15	44.64	6.02	1.61	52.27	Peak Max	H	230	43	74	-21.73	Pass
13704.86	46.48	7.11	4.6	58.19	Peak Max	H	168	156	74	-15.81	Pass
7360.601	24.4	5.15	-0.37	29.18	Average Max	H	273	296	54	-24.82	Pass
10399.15	26.98	6.02	1.61	34.61	Average Max	H	230	43	54	-19.39	Pass
13704.86	28.78	7.11	4.6	40.49	Average Max	V	168	156	54	-13.51	Pass

1GHz-40GHz – 802.11a – 5240MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7786.214	42.53	5.25	-0.32	47.46	Peak Max	V	270	303	74	-26.54	Pass
10480	44.59	6.07	1.83	52.49	Peak Max	H	225	48	74	-21.51	Pass
13323.85	46.09	7.01	4.56	57.66	Peak Max	V	169	162	74	-16.34	Pass
7786.214	25.22	5.25	-0.32	30.15	Average Max	V	270	303	54	-23.85	Pass
10480	27.58	6.07	1.83	35.48	Average Max	H	225	48	54	-18.52	Pass
13323.85	28.3	7.01	4.56	39.87	Average Max	V	169	162	54	-14.13	Pass

1GHz-40GHz – 802.11n-20M – 5180MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7770.214	41.54	5.24	-0.32	46.46	Peak Max	V	271	301	74	-27.54	Pass
10360.69	44.17	6	1.5	51.67	Peak Max	V	225	45	74	-22.33	Pass
13038.13	46.23	6.92	4.54	57.69	Peak Max	H	166	156	74	-16.31	Pass
7770.214	24.06	5.24	-0.32	28.98	Average Max	V	271	301	54	-25.02	Pass
10360.69	26.22	6	1.5	33.72	Average Max	H	225	45	54	-20.28	Pass
13038.13	28.76	6.92	4.54	40.22	Average Max	V	166	156	54	-13.78	Pass

1GHz-40GHz – 802.11n-20M – 5200MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7101.119	42.45	5.11	-0.28	47.28	Peak Max	V	265	299	74	-26.72	Pass
10399.33	44.61	6.02	1.61	52.24	Peak Max	H	228	44	74	-21.76	Pass
13460.16	46.24	7.04	4.52	57.8	Peak Max	H	169	159	74	-16.2	Pass
7101.119	24.63	5.11	-0.28	29.46	Average Max	H	265	299	54	-24.54	Pass
10399.33	27.14	6.02	1.61	34.77	Average Max	V	228	44	54	-19.23	Pass
13460.16	28.93	7.04	4.52	40.49	Average Max	V	169	159	54	-13.51	Pass

1GHz-40GHz – 802.11n-20M – 5240MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7111.429	41.21	5.12	-0.29	46.04	Peak Max	H	273	295	74	-27.96	Pass
10480.51	44.57	6.07	1.83	52.47	Peak Max	H	234	50	74	-21.53	Pass
13718.07	45.96	7.11	4.58	57.65	Peak Max	V	162	155	74	-16.35	Pass
7111.429	23.61	5.12	-0.29	28.44	Average Max	V	273	295	54	-25.56	Pass
10480.51	27.14	6.07	1.83	35.04	Average Max	V	234	50	54	-18.96	Pass
13718.07	28.6	7.11	4.58	40.29	Average Max	V	162	155	54	-13.71	Pass

1GHz-40GHz – 802.11n-40M – 5190MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7580.263	41.22	5.16	-0.41	45.97	Peak Max	H	272	299	74	-28.03	Pass
10379.43	43.77	6.01	1.55	51.33	Peak Max	H	233	45	74	-22.67	Pass
13223.35	46.55	6.99	4.47	58.01	Peak Max	V	166	161	74	-15.99	Pass
7580.263	23.28	5.16	-0.41	28.03	Average Max	H	272	299	54	-25.97	Pass
10379.43	26.57	6.01	1.55	34.13	Average Max	H	233	45	54	-19.87	Pass
13223.35	29.43	6.99	4.47	40.89	Average Max	V	166	161	54	-13.11	Pass

1GHz-40GHz – 802.11n-40M – 5230MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7667.244	42.1	5.19	-0.32	46.97	Peak Max	H	267	299	74	-27.03	Pass
10460.63	44.77	6.06	1.77	52.6	Peak Max	H	227	42	74	-21.4	Pass
13498.92	46.78	7.05	4.49	58.32	Peak Max	H	161	156	74	-15.68	Pass
7667.244	24.17	5.19	-0.32	29.04	Average Max	H	267	299	54	-24.96	Pass
10460.63	27.15	6.06	1.77	34.98	Average Max	H	227	42	54	-19.02	Pass
13498.92	29.64	7.05	4.49	41.18	Average Max	H	161	156	54	-12.82	Pass

1GHz-40GHz – 802.11ac-80M – 5210MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7826.581	41.62	5.28	-0.32	46.58	Peak Max	H	267	297	74	-27.42	Pass
10419.67	43.99	6.04	1.66	51.69	Peak Max	H	234	44	74	-22.31	Pass
13163.37	46.57	6.97	4.44	57.98	Peak Max	H	168	157	74	-16.02	Pass
7826.581	24.29	5.28	-0.32	29.25	Average Max	H	267	297	54	-24.75	Pass
10419.67	26.69	6.04	1.66	34.39	Average Max	H	234	44	54	-19.61	Pass
13163.37	29.08	6.97	4.44	40.49	Average Max	H	168	157	54	-13.51	Pass

1GHz-40GHz – 802.11a – 5745MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7374.498	41.67	5.15	-0.37	46.45	Peak Max	V	271	299	74	-27.55	Pass
11490.5	45.05	6.07	2.64	53.76	Peak Max	H	226	45	74	-20.24	Pass
13775.76	47.15	7.14	4.53	58.82	Peak Max	H	169	158	74	-15.18	Pass
7374.498	24.32	5.15	-0.37	29.1	Average Max	V	271	299	54	-24.9	Pass
11490.5	27.08	6.07	2.64	35.79	Average Max	H	226	45	54	-18.21	Pass
13775.76	30	7.14	4.53	41.67	Average Max	V	169	158	54	-12.33	Pass

1GHz-40GHz - 802.11a– 5785MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7869.835	42.22	5.32	-0.32	47.22	Peak Max	H	269	296	74	-26.78	Pass
11569.02	44.41	6.13	2.75	53.29	Peak Max	V	231	49	74	-20.71	Pass
13122.88	46.96	6.95	4.43	58.34	Peak Max	H	165	153	74	-15.66	Pass
7869.835	24.86	5.32	-0.32	29.86	Average Max	V	269	296	54	-24.14	Pass
11569.02	26.7	6.13	2.75	35.58	Average Max	H	231	49	54	-18.42	Pass
13122.88	29.83	6.95	4.43	41.21	Average Max	V	165	153	54	-12.79	Pass

1GHz-40GHz - 802.11a - 5825MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7359.655	41.8	5.15	-0.37	46.58	Peak Max	V	268	297	74	-27.42	Pass
11650.9	45.38	6.2	2.93	54.51	Peak Max	H	234	50	74	-19.49	Pass
13628.61	46.63	7.09	4.6	58.32	Peak Max	H	163	156	74	-15.68	Pass
7359.655	24.57	5.15	-0.37	29.35	Average Max	V	268	297	54	-24.65	Pass
11650.9	27.91	6.2	2.93	37.04	Average Max	V	234	50	54	-16.96	Pass
13628.61	29.19	7.09	4.6	40.88	Average Max	V	163	156	54	-13.12	Pass

1GHz-40GHz – 802.11n-20M – 5745MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7113.496	41.48	5.12	-0.29	46.31	Peak Max	H	273	302	74	-27.69	Pass
11490.88	45	6.07	2.64	53.71	Peak Max	H	231	46	74	-20.29	Pass
13311.56	46.06	7.01	4.56	57.63	Peak Max	H	164	159	74	-16.37	Pass
7113.496	24.38	5.12	-0.29	29.21	Average Max	V	273	302	54	-24.79	Pass
11490.88	27.49	6.07	2.64	36.2	Average Max	H	231	46	54	-17.8	Pass
13311.56	28.81	7.01	4.56	40.38	Average Max	H	164	159	54	-13.62	Pass

1GHz-40GHz - 802.11n-20M– 5785MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7795.612	41.08	5.26	-0.32	46.02	Peak Max	H	266	304	74	-27.98	Pass
11569.34	44.39	6.13	2.75	53.27	Peak Max	V	234	42	74	-20.73	Pass
13192.95	46.52	6.98	4.44	57.94	Peak Max	H	162	161	74	-16.06	Pass
7795.612	23.97	5.26	-0.32	28.91	Average Max	V	266	304	54	-25.09	Pass
11569.34	26.94	6.13	2.75	35.82	Average Max	V	234	42	54	-18.18	Pass
13192.95	29.39	6.98	4.44	40.81	Average Max	V	162	161	54	-13.19	Pass

1GHz-40GHz - 802.11n-20M - 5825MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7547.149	41.88	5.15	-0.41	46.62	Peak Max	V	270	303	74	-27.38	Pass
11650.67	45.38	6.2	2.93	54.51	Peak Max	V	225	48	74	-19.49	Pass
13424.99	46.6	7.03	4.56	58.19	Peak Max	H	163	157	74	-15.81	Pass
7547.149	24.73	5.15	-0.41	29.47	Average Max	V	270	303	54	-24.53	Pass
11650.67	27.82	6.2	2.93	36.95	Average Max	H	225	48	54	-17.05	Pass
13424.99	28.73	7.03	4.56	40.32	Average Max	H	163	157	54	-13.68	Pass

1GHz-40GHz – 802.11n-40M – 5755MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7634.786	42.05	5.18	-0.35	46.88	Peak Max	V	268	298	74	-27.12	Pass
11509.25	45.24	6.08	2.66	53.98	Peak Max	H	229	47	74	-20.02	Pass
13963.22	47.56	7.26	4.85	59.67	Peak Max	V	163	155	74	-14.33	Pass
7634.786	24.34	5.18	-0.35	29.17	Average Max	H	268	298	54	-24.83	Pass
11509.25	27.58	6.08	2.66	36.32	Average Max	V	229	47	54	-17.68	Pass
13963.22	30.47	7.26	4.85	42.58	Average Max	V	163	155	54	-11.42	Pass

1GHz-40GHz - 802.11n-40M– 5795MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7179.299	41.38	5.14	-0.31	46.21	Peak Max	H	272	303	74	-27.79	Pass
11590.5	46.19	6.15	2.79	55.13	Peak Max	H	230	46	74	-18.87	Pass
13783.74	46.47	7.14	4.53	58.14	Peak Max	V	170	162	74	-15.86	Pass
7179.299	23.96	5.14	-0.31	28.79	Average Max	V	272	303	54	-25.21	Pass
11590.5	29.05	6.15	2.79	37.99	Average Max	V	230	46	54	-16.01	Pass
13783.74	29.17	7.14	4.53	40.84	Average Max	H	170	162	54	-13.16	Pass

1GHz-40GHz - 802.11ac-80M - 5775MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
7203.774	41.33	5.15	-0.32	46.16	Peak Max	H	272	301	74	-27.84	Pass
11549.71	44.84	6.11	2.72	53.67	Peak Max	V	230	50	74	-20.33	Pass
13463.57	45.76	7.04	4.52	57.32	Peak Max	H	167	154	74	-16.68	Pass
7203.774	23.33	5.15	-0.32	28.16	Average Max	V	272	301	54	-25.84	Pass
11549.71	27.12	6.11	2.72	35.95	Average Max	V	230	50	54	-18.05	Pass
13463.57	28.56	7.04	4.52	40.12	Average Max	V	167	154	54	-13.88	Pass

1GHz-40GHz –2.4G and 5G transmit simultaneously

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
4824.825	40.87	4.12	-0.81	44.19	Peak Max	H	141	184	74	-29.81	Pass
9585.605	39.73	5.62	0.29	45.64	Peak Max	V	259	61	74	-28.36	Pass
7805.368	38.63	5.27	-0.32	43.57	Peak Max	V	218	93	74	-30.43	Pass
4824.825	28.12	4.12	-0.81	31.44	Average Max	H	141	184	54	-22.56	Pass
9585.605	26.92	5.62	0.29	32.83	Average Max	V	259	61	54	-21.18	Pass
7805.368	26.51	5.27	-0.32	31.46	Average Max	V	218	93	54	-22.54	Pass

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Conducted Emissions						
R & S Receiver	ESIB 40	100179	06/08/2017	1 Year	06/08/2018	☑
CHASE LISN	MN2050B	1018	08/07/2017	1 Year	08/07/2018	☑
Radiated Emissions						
R & S Receiver	ESIB 40	1018	08/07/2017	1 Year	08/07/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/12/2017	1 Year	08/12/2018	☑
Horn Antenna (1GHz~26GHz)	3115	100059	08/25/2017	1 Year	08/25/2018	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	10SL0219	08/20/2017	1 Year	08/20/2018	☑
R & S Receiver	ESIB 40	100179	06/08/2017	1 Year	06/08/2018	☑
ETS-Lingren USB RF Power Sensor	7002-006	10SL0190	09/03/2017	1 Year	09/03/2018	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
Hong Kong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio**: A1. Terminal equipment for purpose of calling **Telecom**: B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI **EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measurement
Australia CAB Recognition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radio communications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2