ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E AND INDUSTRY CANADA RSS 247 REQUIREMENT

OF

Applicant:	Microsoft Corporation One Microsoft Way, Redmond, WA 98052-6399 USA
Product Name:	Portable Computing Device
Brand Name:	Microsoft
Model No.:	1825
Model Difference:	N/A
FCC ID:	C3K1825
IC:	3048A-1825
Report Number:	E2/2018/70120
FCC Rule Part:	§15.407, Cat: NII
IC Rule:	RSS-247 issue 2 Feb. 2017
Issue Date:	Sep. 10, 2018
Date of Test:	Jun. 26, 2018 ~ Sep. 10, 2018
Date of EUT Received:	Jun. 26, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits.

The test results of this report relate only to the tested sample identified in this report.

Tested By: _____

Vito Pei / Sr. Engineer

Approved By: _____

Jim Chang / Manager

Testing Laboratory
0513

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Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
E2/2018/70120	Rev.00	Initial creation of document	All	Sep. 10, 2018	Violetta Tang

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1 GENERAL INFORMATIOQN

1.1 Product Description

General:

Product Name:	Portable Computing Device	
Brand Name:	Microsoft	
Model No.:	1825	
Model Difference:	N/A	
Product SW/HW version:	Windows 10 Pro / EV2.7	
Radio SW/HW version:	18.33.105.6 / EV2.7	
Test SW Version:	3.0.271.0	
Power Supply:	7.66Vdc from Rechargeable Li-ion Battery or 15V from AC/DC Adapter	
	Battery:	Model No.: G16QA043H, Supplier: SMP
	Adapter:	Model No.: 1735, Supplier: LITEON

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FCC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. Power (dBm)	Modulation Technology
11a_20	5150~5250	4	15.99	OFDM
	5250~5350	4	15.98	
	5470~5725	12	15.86	
	5725-5850	5	15.84	
11n_HT / ac_VHT 20M	5150~5250	4	HT: 15.99	OFDM
	5250~5350	4	HT: 15.97	
	5470~5725	12	HT: 15.98	
	5725-5850	5	HT: 15.99	
11n_HT / ac_VHT 40M	5150~5250	2	HT: 15.99	OFDM
	5250~5350	2	HT: 15.90	
	5470~5725	6	HT: 15.96	
	5725-5850	2	HT: 15.94	
11ac VHT80M	5150~5250	1	15.47	OFDM
	5250~5350	1	15.63	
	5470~5725	3	15.85	
	5725-5850	1	15.99	
Antenna Designation:	PIFA Antenna, Main Antenna: 5150~5250MHz Peak Gain: 0.43dBi 5250~5350MHz Peak Gain: 0.43dBi 5470~5725MHz Peak Gain: 2.25dBi 5725~5850MHz Peak Gain: 2.25dBi Aux Antenna: 5150~5250MHz Peak Gain: 1.26dBi 5250~5350MHz Peak Gain: 2.46dBi 5470~5725MHz Peak Gain: 2.02dBi 5725~5850MHz Peak Gain: 1.21dBi			

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IC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. or EIRP	Rated Power(dBm)	Modulation Technology
11a	5180~5240	4	EIRP	19.86	OFDM
	5260~5320	4	Avg.	15.98	
	5500~5580	5	Avg.	15.86	
	5660~5700	3	Avg.	15.74	
	5745~5825	5	Avg.	15.84	
11n_HT / ac_VHT 20M	5180~5240	4	EIRP	HT: 19.85	OFDM
	5260~5320	4	Avg.	HT: 15.97	
	5500~5580	5	Avg.	HT: 15.82	
	5660~5720	3	Avg.	HT: 15.98	
	5745~5825	5	Avg.	HT: 15.99	
11n_HT / ac_VHT 40M	5190~5230	2	EIRP	HT: 19.85	OFDM
	5270~5310	2	Avg.	HT: 15.90	
	5510~5550	2	Avg.	HT: 15.88	
	5670~5710	1	Avg.	HT: 15.96	
	5755~5795	2	Avg.	HT: 15.94	
11ac VHT80M	5210~5210	1	EIRP	19.34	OFDM
	5290~5290	1	Avg.	15.63	
	5530~5530	1	Avg.	14.01	
	5690~5775	1	Avg.	15.99	
Modulation type		64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only			
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 - 300.0Mbps 802.11 ac_20MHz: 6.5 –144.4Mbps 802.11 ac_40MHz: 13.5 -300.0Mbps 802.11 ac_80MHz: 29.3 – 650Mbps			

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules

KDB 789033 D02 v01r04 General UNII Test Procedures New Rules

KDB 644545 D03 v01 Guidance for IEEE 802.11ac

FCC KDB 662911 D01 Multiple Transmitter Output

789033 D02 General UNII Test Procedures New Rules v02r01

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5 Apr. 2018

ANSI C63.10:2013

Note: All test items have been performed and record as per the above standards.

1.3 Test Facility

SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803. (TAF code 0513)

FCC Registration Numbers are: 735305 / TW0002

Canada Registration Number: 4620A-5

1.4 Special Accessories

AC Adapter is used while the test is conducted and there is no other accessory attached. This is the worst case condition.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT is configured to operate in a continuous transmission mode. EUT placement and various angles were checked to find worst mode where the emission characteristics are maximized.

2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plan. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

Note:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Following shows an offset computation example with cable loss and attenuator.

Offset:

= RF cable loss (dB)+ attenuation factor(dB) =10.6 (dB) for SISO / 13.6 (dB) for MIMO

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

Fig.2-3 Conducted Emission (Antenna Port) Configuration

Fig. 2-2 Conducted Emission (AC Power Line) Configuration

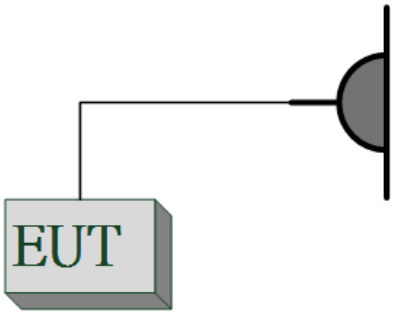

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L420	S0011721	Shielded	Unshielded

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3 SUMMARY OF TEST RESULT

FCC Rules	IC Rules	Description Of Test	Result
§15.207	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	RSS-247 §6.2.1~ 4 (1) RSS-Gen §6.7	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Power Spectral Density	Compliant
§15.407(b)	RSS-247 §6.2.1~ 4 (2)	Undesirable Radiated Emissions	Compliant
§15.407(c)	RSS-247 §6.4	Transmission in case of Absence of Information	Compliant
§15.407(g)	RSS-Gen §6.11	Frequency Stability	Compliant
§15.203	RSS- Gen §6.8	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

4 channels are provided for 802.11a, 802.11n_HT20, 802.11ac_VHT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
42	5210 MHz

Operated band in 5250 MHz ~5350 MHz:

4 channels are provided for 802.11a, 802.11n_HT20, 802.11ac_VHT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
58	5290 MHz

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Operated band in 5470 MHz ~5725 MHz:

11 channels are provided for 802.11a, 802.11n_HT20, 802.11ac_VHT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
100	5500 MHz	124	5620 MHz
104	5520 MHz	128	5640 MHz
108	5540 MHz	132	5660 MHz
112	5560 MHz	136	5680 MHz
116	5580 MHz	140	5700 MHz
120	5600 MHz	144	5720 MHz

5 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
102	5510 MHz	126	5630 MHz
110	5550 MHz	134	5670 MHz
118	5590 MHz	142	5710 MHz

3 channels are provided for 802.11ac_VHT80

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
106	5530 MHz	138	5690 MHz
122	5610 MHz		

Operated band in 5725 MHz ~5850 MHz:

5 channels are provided for 802.11a, 802.11n_HT20, 802.11ac_VHT20

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745 MHz	161	5805 MHz
153	5765 MHz	165	5825 MHz
157	5785 MHz		

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
155	5775 MHz

Remark:

1. The device will not operate in 5600~5650MHz band for IC.

2. Channel 144 will be disabled initially and will be enabled in future builds.

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4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting mode is pro grammed.
3. Investigation has been done on all the possible configurations for searching the worst case.
4. For 802.11n HT and VHT modes, the HT emission testing was considered as a worst case scenario and was performed at power levels, per transimit chain, greater than or equal to the maximum power in any HT mode.
5. For MIMO modes, the 2TX emission testing was considered as a worst case scenario and was performed at power levels, per transimit chain, greater than or equal to the maximum power in any 1TX mode.

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	44	OFDM	6	2TX
802.11a	5260~5320	52 to 64	60	OFDM	6	2TX
802.11a	5500~5720	100 to 140	116	OFDM	6	2TX
802.11a	5745~5825	149 to 165	157	OFDM	6	2TX
RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT80	5290	58	58	OFDM	MCS0	MIMO

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MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5500~5720	100 to 144	100,116,140	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5510~5710	102 to 142	102,110,134	OFDM	MCS8	MIMO
802.11ac_VHT80	5530~5690	106 to 138	106,122,138	OFDM	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT80	5775	155	155	OFDM	MCS0	MIMO

Note:
The field strength of radiation emission was measured as EUT stand-up position (H, E1 mode) and lie down position (E2 mode) for 802.11a/n/ac WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT80	5290	58	58	OFDM	MCS0	MIMO
802.11a	5500~5720	100 to 144	100,116,140,144	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5510~5710	102 to 142	102,110,134,142	OFDM	MCS8	MIMO
802.11ac_VHT80	5530~5690	106 to 138	106,122,138	OFDM	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11n_HT20 802.11ac_VHT20				OFDM	MCS8	MIMO
802.11n_HT40 802.11ac_VHT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT80	5775	155	155	OFDM	MCS0	MIMO

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
26dB & 6dB Emission Bandwidth	+/- 123.36 Hz
The Maximum Output Power Measurement	+/- 0.96 dB
Peak Power Spectral Density Measurement	+/- 1.67 dB
Frequency Stability	+/- 123.36 Hz
Temperature	+/- 0.65 °C
Humidity	+/- 4.6 %
DC / AC Power Source	DC= +/- 0.13%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : **Vertical**)	9kHz-30MHz: +/-2.87dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : **Horizontal**)	9kHz-30MHz: +/-2.87dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

Frequency range within 150 kHz to 30 MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note
1.The lower limit shall apply at the transition frequencies
2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
LISN	TESEQ	NNB 51	36076	2018/02/14	2019/02/13
EMI Test Receiver	R&S	ESCI	101300	2017/11/02	2018/11/01
Coaxial Cable	EMC Instruments Corp	EMC5D-BM-BM-3000	1401004	2018/05/25	2019/05/24

6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz power source.

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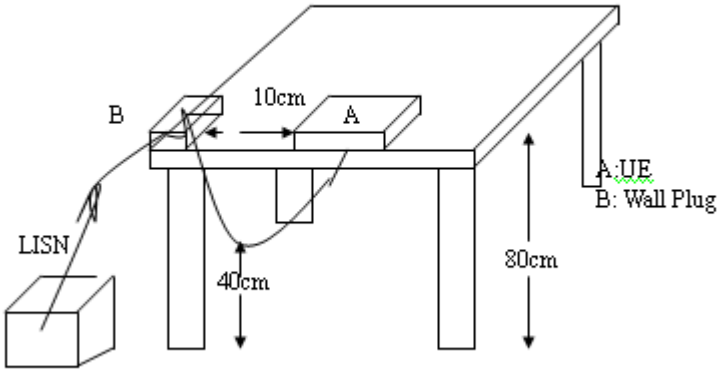
6.4 Test SET-UP



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed.

6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation mode	Test By:	Jerry

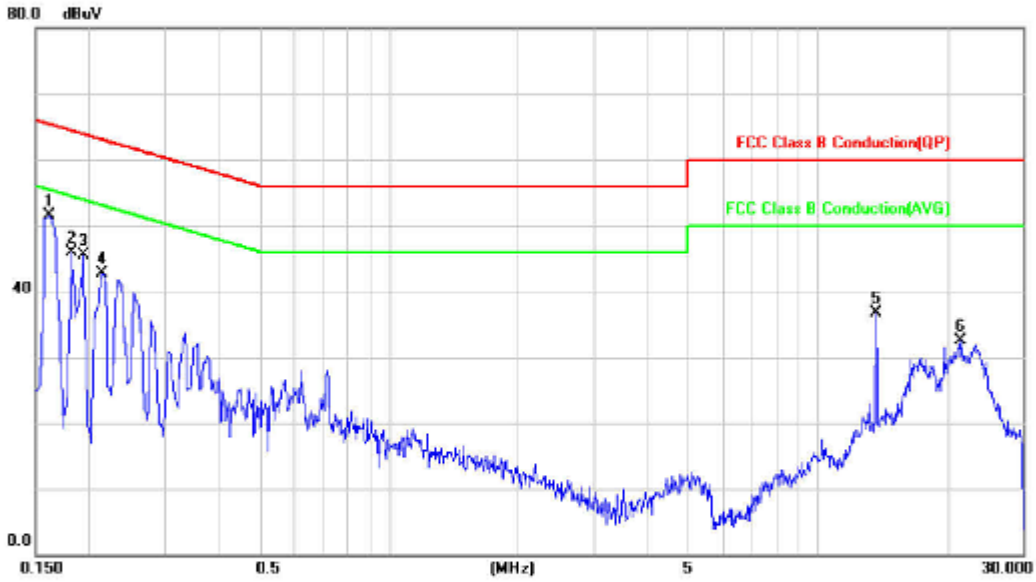
Site : Conduction Room
Limit: FCC Class B Conduction(QP)
Mode:
Note:

Phase: L1
Power: AC 120V/60Hz

Temperature: 22 ℃
Humidity: 70 %

Conducted Emission

File :Condution Data :#886 Date: 2018/9/10 Time: 下午 03:49:42



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1620	51.41	0.04	51.45	65.36	-13.91	peak	
2		0.1820	45.96	0.03	45.99	64.39	-18.40	peak	
3		0.1940	45.43	0.03	45.46	63.86	-18.40	peak	
4		0.2140	42.65	0.03	42.68	63.05	-20.37	peak	
5		13.6900	36.08	0.60	36.68	60.00	-23.32	peak	
6		21.3780	31.54	0.90	32.44	60.00	-27.56	peak	

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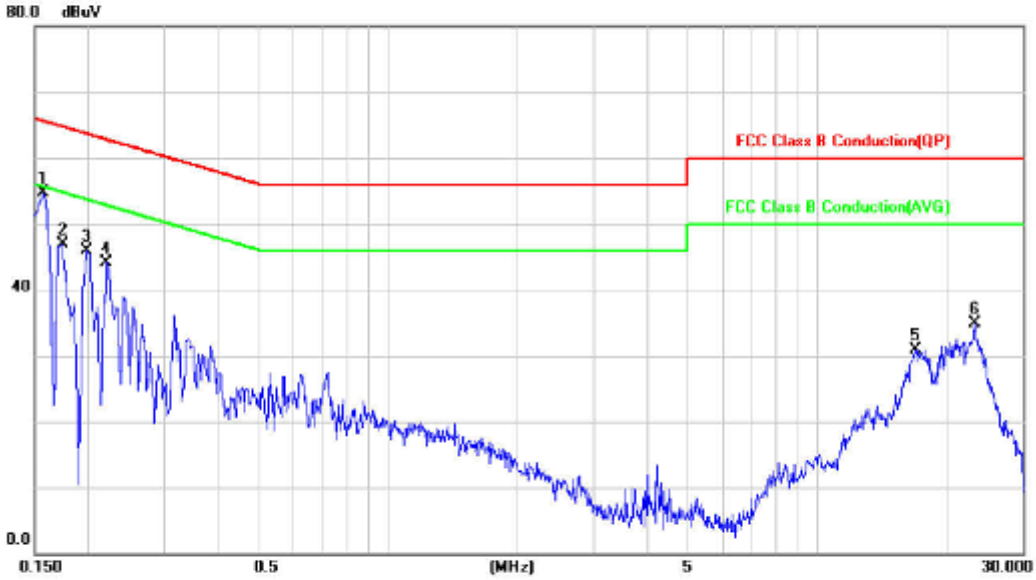
Site : Conduction Room
Limit: FCC Class B Conduction(QP)
Mode:
Note:

Phase: N
Power: AC 120V/60Hz

Temperature: 22 ℃
Humidity: 70 %

Conducted Emission

File :Condution Data :#887 Date: 2018/9/10 Time: 下午 03:51:15



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	54.71	0.04	54.75	65.57	-10.82	peak	
2		0.1740	46.95	0.04	46.99	64.77	-17.78	peak	
3		0.1980	45.83	0.04	45.87	63.69	-17.82	peak	
4		0.2220	43.99	0.05	44.04	62.74	-18.70	peak	
5		16.8460	30.37	0.54	30.91	60.00	-29.09	peak	
6		23.1940	34.20	0.71	34.91	60.00	-25.09	peak	

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7 DUTY CYCLE TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

Duty Cycle = Ton / (Ton+Toff)

Measurement Procedure:

1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

Duty Cycle:

Mode	Duty Cycle (%)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	94.87	0.23	0.48	1.00
802.11n_20	89.95	0.46	1.02	2.00
802.11ac_20	94.74	0.23	0.52	1.00
802.11n_40	82.61	0.83	2.02	3.00
802.11ac_40	90.15	0.45	1.05	2.00
802.11ac_80	81.53	0.89	2.16	3.00

Duty Cycle Factor: 10 * log(1/0.9487) = 0.23
Duty Cycle Factor: 10 * log(1/0.8995) = 0.46
Duty Cycle Factor: 10 * log(1/0.9474) = 0.23
Duty Cycle Factor: 10 * log(1/0.8261) = 0.83
Duty Cycle Factor: 10 * log(1/0.9015) = 0.45
Duty Cycle Factor: 10 * log(1/0.8153) = 0.89

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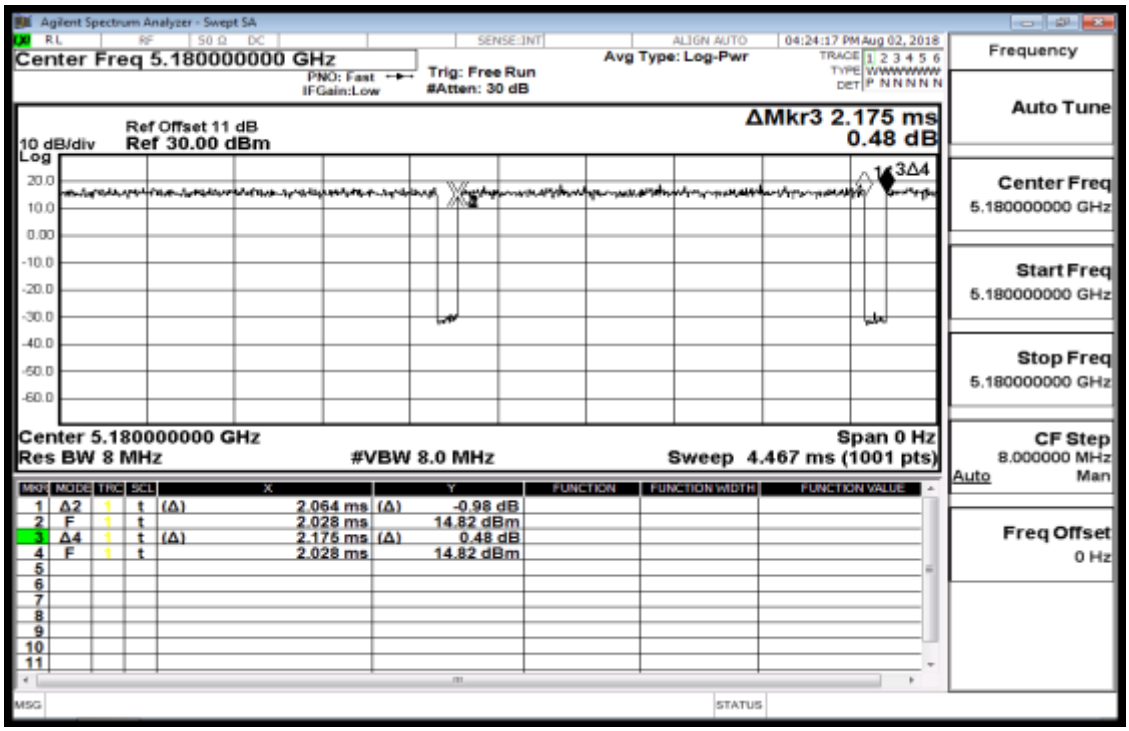
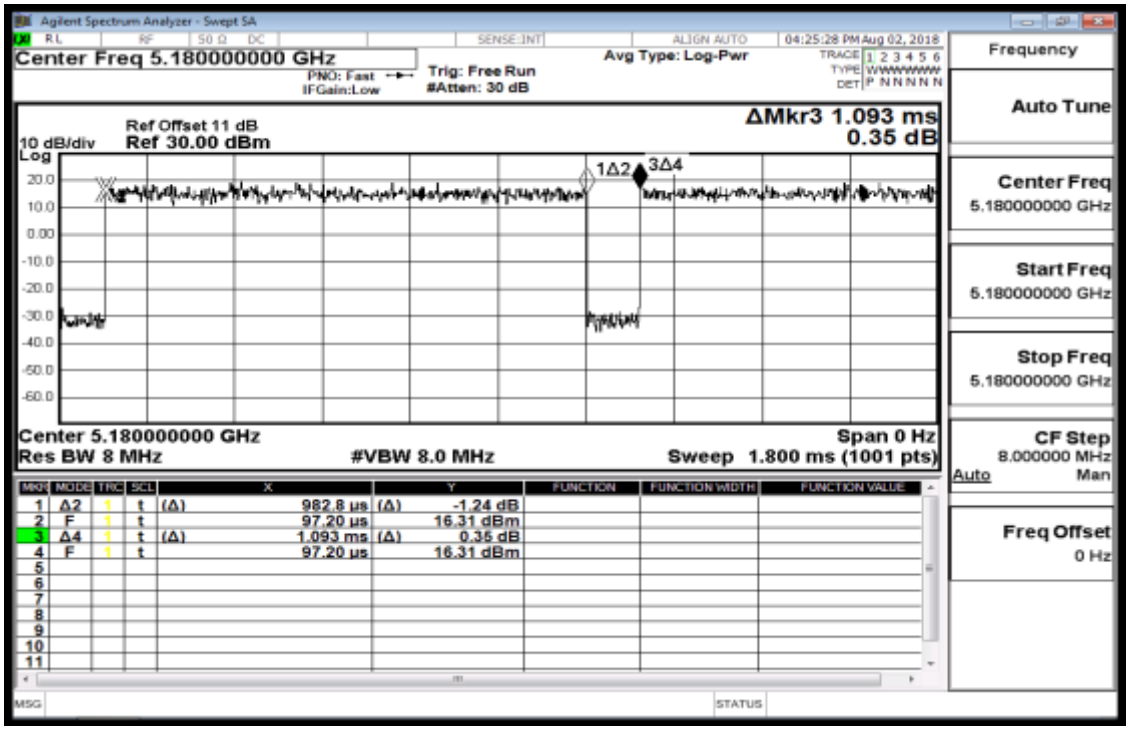
DUTY CYCLE TEST SIGNAL Measurement Result

802.11a



802.11n HT20



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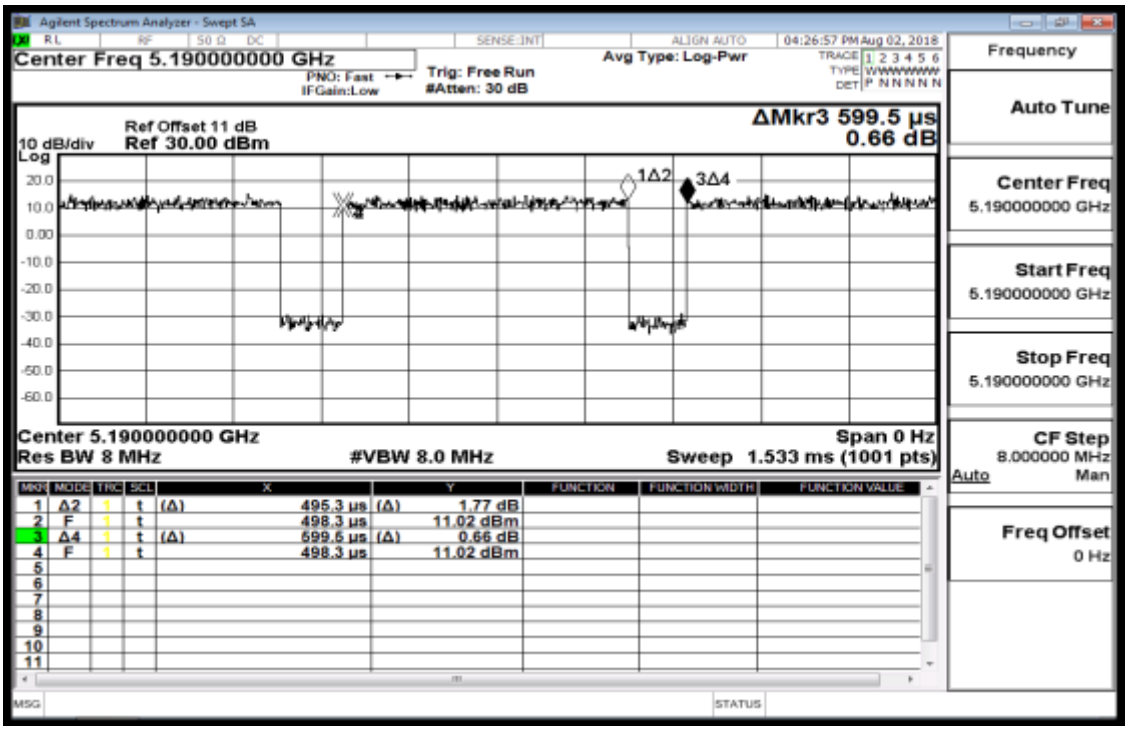
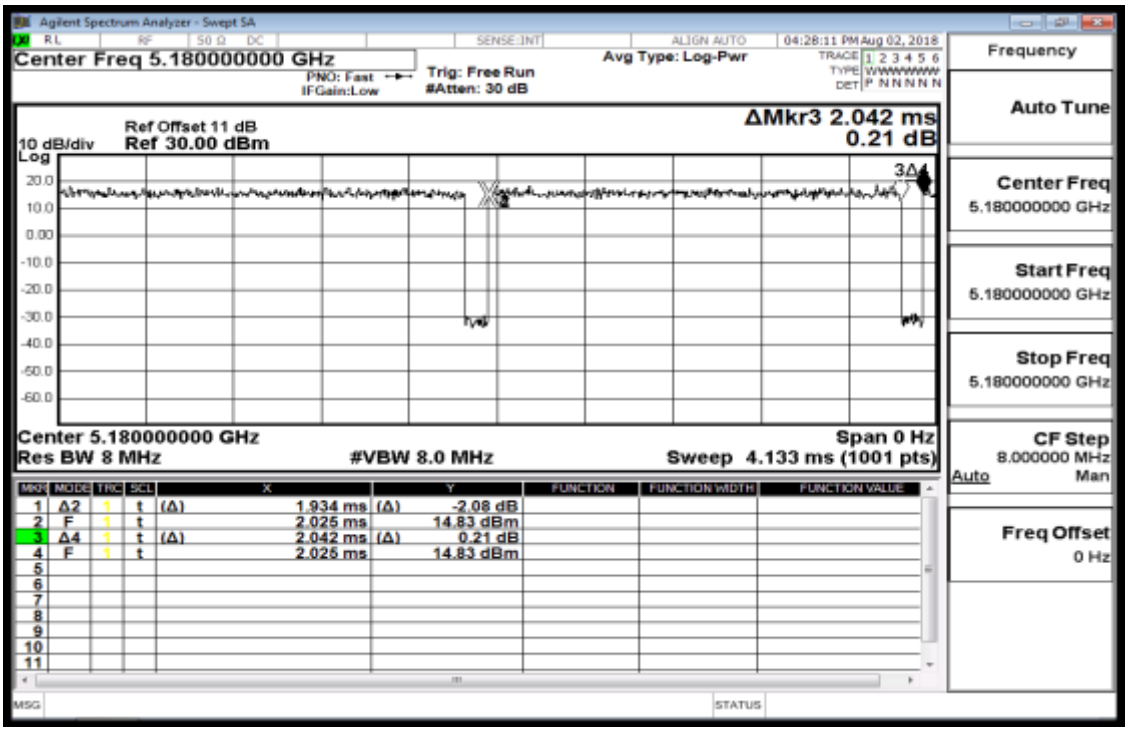
802.11n HT 40



802.11ac VHT20



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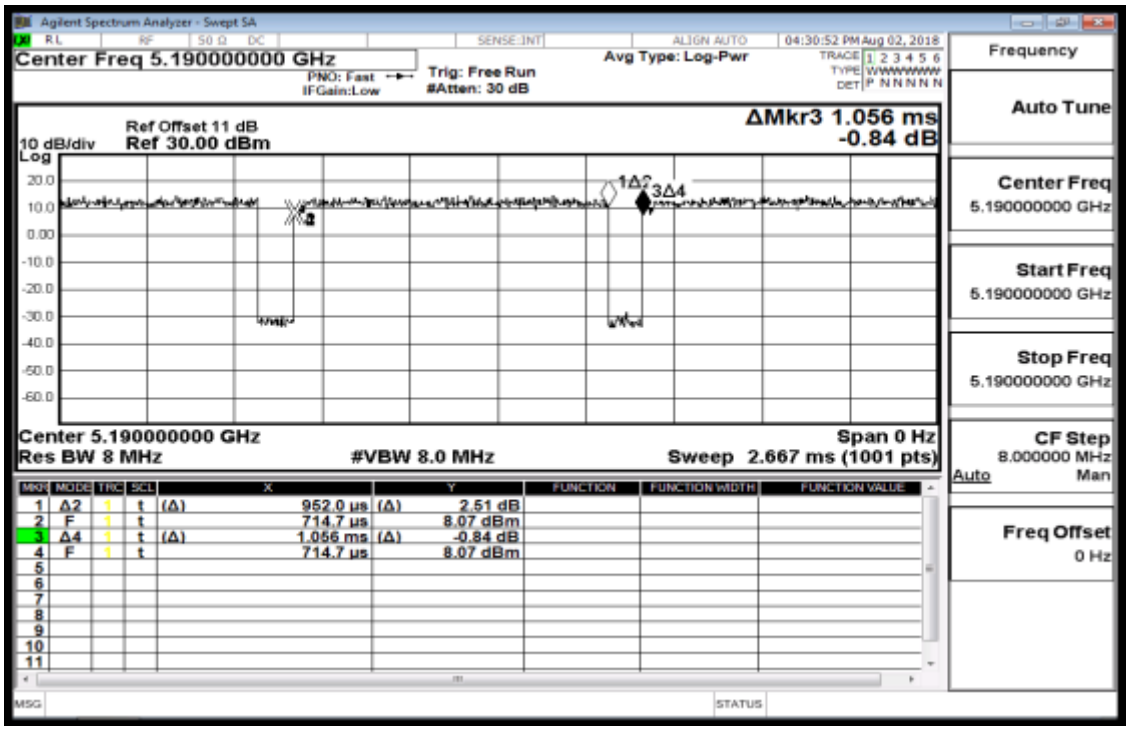
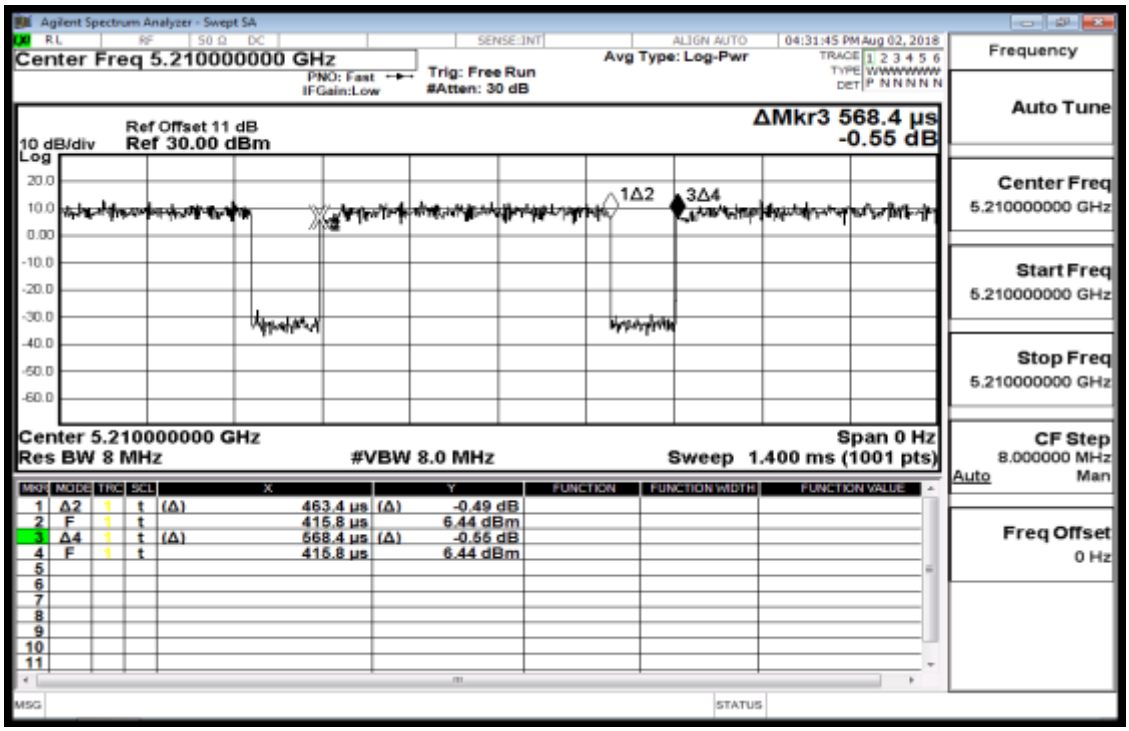
802.11ac VHT 40



802.11 ac VHT 80



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8 26DB & 6DB EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum of 6dB Bandwidth measurement is 0.5 MHz for U-NII-3

8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
   a. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
   b. Mark the peak frequency and –26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
5. Minimum Emission Bandwidth for the band 5.725-5.850GHz.
   a. Set the spectrum analyzer as RBW = 100 kHz, VBW = 3*RBW, Span = 30M/50MHz, Detector=Peak,
   Sweep=auto
   b. Mark the peak frequency and –6dB (upper and lower) frequency.
6. Repeat above procedures until all test default channel measured were complete.

Note: according 789033 D02 General UNII Test Procedures New Rules v02r01
Some IEEE Std 802.11 channels operate under two U-NII sub-bands. For example, IEEE Std 802.11 Channels 42+138 (80+80 MHz) is distributed over the U-NII-1 and U-NII-2C bands. Some of these channels that operate in more than one U-NII band are deemed “straddle” channels. The following channels are considered to be straddle channels: Channel 50 (160 MHz channel) Channel 138 (80 MHz channel) Channel 142 (40 MHz channel) Chanel 144 (20 MHz channel).

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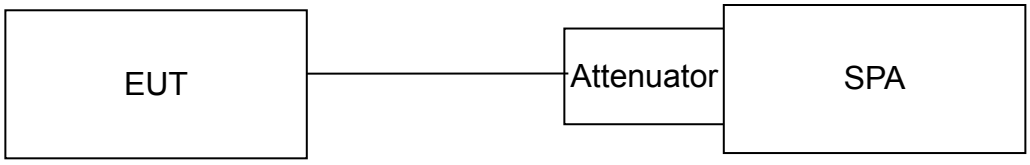
8.3 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	N9010A	MY51440113	2018/06/20	2019/06/19
Power Meter	Anritsu	ML2496A	1326001	2018/08/09	2019/08/02
Power Sensor	Anritsu	MA2411B	1315048	2018/08/09	2019/08/02
Power Sensor	Anritsu	MA2411B	1315049	2018/08/09	2019/08/02
Attenuator	Marvelous	MVE2213-10	RF30	2017/12/26	2018/12/25
Attenuator	Marvelous	MVE2213-10	RF31	2017/12/26	2018/12/25
DC Block	PASTERNACK	PE8210	RF29	2017/12/26	2018/12/25
Notebook	Lenovo	L420	S0011721	N/A	N/A

8.4 Test Set-up



8.5 Measurement Result

26dB and 6dB Bandwidth

802.11a_CH0			802.11a_CH1		
Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.48	12.666	5180	18.88	12.760
5220	18.39	12.646	5220	18.51	12.673
5240	18.45	12.661	5240	18.42	12.652
5260	18.49	12.669	5260	18.37	12.641
5300	18.96	12.779	5300	19.01	12.791
5320	18.17	12.593	5320	18.49	12.670
5500	18.83	12.748	5500	19.09	12.808
5580	18.34	12.635	5580	18.80	12.742
5700	18.58	12.691	5700	18.45	12.660

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802.11a_CH0 **802.11a_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.52	11.909	5745	14.97	11.751
5785	15.32	11.852	5785	15.11	11.792
5825	15.15	11.805	5825	15.33	11.855

802.11n_HT20_CH0 **802.11n_HT20_CH1**

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.83	12.973	5180	19.87	12.982
5220	19.55	12.911	5220	19.94	12.998
5240	19.44	12.886	5240	19.59	12.920
5260	19.71	12.948	5260	19.53	12.907
5300	19.42	12.883	5300	19.59	12.921
5320	19.44	12.886	5320	19.64	12.932
5500	19.64	12.931	5500	19.44	12.887
5580	19.43	12.885	5580	19.45	12.888
5700	19.56	12.913	5700	19.88	12.984
5720(U-NII 2C)	14.50	11.614	5720(U-NII 2C)	15.14	11.801
5720 (U-NII 3)	4.31	6.344	5720 (U-NII 3)	4.50	6.532

802.11n_HT20_CH0 **802.11n_HT20_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	14.98	11.756	5745	14.56	11.633
5785	15.45	11.890	5785	14.96	11.750
5825	14.14	11.504	5825	15.08	11.785

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802.11n _HT40_CH0 **802.11n _HT40_CH1**

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	40.23	16.045	5190	39.87	16.006
5230	40.61	16.086	5230	39.59	15.975
5270	39.87	16.006	5270	39.55	15.971
5310	39.74	15.992	5310	39.95	16.015
5510	39.54	15.971	5510	39.68	15.986
5550	**40.19**	16.041	5550	**40.28**	16.051
5670	40.67	16.092	5670	40.18	16.040
5710 (U-NII 2C)	**36.24**	15.592	5710 (U-NII 2C)	**35.81**	15.540
5710 (U-NII 3)	4.43	6.459	5710 (U-NII 3)	4.37	6.407

802.11n_HT40_CH0 **802.11n_HT40_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	33.59	15.261	5755	32.99	15.183
5795	33.84	15.295	5795	33.92	15.304

802.11ac _VHT80_CH0 **802.11ac _VHT80_CH1**

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	82.89	19.185	5210	82.69	19.174
5290	82.00	19.138	5290	81.77	19.126
5530	83.12	19.197	5530	82.35	19.157
5610	82.45	19.162	5610	83.81	19.233
5690 (U-NII 2C)	79.47	19.002	5690 (U-NII 2C)	78.73	18.961
5690 (U-NII 3)	4.28	6.313	5690 (U-NII 3)	4.24	6.272

802.11ac _VHT80_CH0 **802.11ac _VHT80_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.12	18.758	5775	72.73	18.617

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99% Bandwidth

802.11a_CH0 802.11a_CH1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.311	12.125	5180	16.286	12.118
5220	16.284	12.118	5220	16.289	12.119
5240	16.280	12.117	5240	16.290	12.119
5260	16.298	12.121	5260	16.303	12.123
5300	16.274	12.115	5300	16.258	12.111
5320	16.287	12.118	5320	16.273	12.115
5500	16.302	12.122	5500	16.267	12.113
5580	16.268	12.113	5580	16.317	12.126
5700	16.311	12.125	5700	16.291	12.119

802.11a_CH0 802.11a_CH1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.21	12.099	5745	15.63	11.940
5785	16.00	12.042	5785	16.01	12.043
5825	15.70	11.959	5825	15.71	11.960

802.11n_HT20_CH0 802.11n_HT20_CH1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.466	12.422	5180	17.398	12.405
5220	17.436	12.414	5220	17.411	12.408
5240	17.381	12.401	5240	17.425	12.412
5260	17.416	12.409	5260	17.431	12.413
5300	17.388	12.402	5300	17.432	12.413
5320	17.445	12.417	5320	17.418	12.410
5500	17.414	12.409	5500	17.431	12.413
5580	17.416	12.409	5580	17.415	12.409
5700	17.434	12.414	5700	17.436	12.414
5720(U-NII 2C)	13.418	11.277	5720(U-NII 2C)	13.428	11.280
5720 (U-NII 3)	3.988	6.007	5720 (U-NII 3)	3.991	6.011

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802.11n_HT20_CH0 **802.11n_HT20_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.10	12.329	5745	16.97	12.297
5785	16.86	12.270	5785	17.13	12.337
5825	16.92	12.283	5825	17.08	12.325

802.11n _HT40_CH0 **802.11n _HT40_CH1**

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	35.738	15.531	5190	35.766	15.535
5230	35.734	15.531	5230	35.708	15.528
5270	35.748	15.533	5270	35.707	15.528
5310	35.680	15.524	5310	35.686	15.525
5510	35.709	15.528	5510	35.739	15.531
5550	35.689	15.525	5550	35.732	15.531
5670	35.750	15.533	5670	35.704	15.527
5710(U-NII 2C)	31.860	15.032	5710(U-NII 2C)	31.819	15.027
5710 (U-NII 3)	3.890	5.899	5710 (U-NII 3)	3.885	5.894

802.11n _HT40_CH0 **802.11n _HT40_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.12	15.456	5755	35.53	15.506
5795	35.17	15.461	5795	35.26	15.472

802.11ac _VHT80_CH0 **802.11ac _VHT80_CH1**

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.028	18.752	5210	74.971	18.749
5290	74.909	18.745	5290	75.016	18.752
5530	74.984	18.750	5530	75.038	18.753
5610	75.087	18.756	5610	74.945	18.747
5690(U-NII 2C)	71.144	18.521	5690(U-NII 2C)	71.197	18.525
5690 (U-NII 3)	3.830	5.832	5690 (U-NII 3)	3.833	5.835

802.11ac _VHT80_CH0 **802.11ac _VHT80_CH1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	74.93	18.746	5775	75.57	18.783

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802.11a_CH0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.13	< 5250
5745	5736.81	> 5725

802.11a_CH1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.13	< 5250
5745	5736.81	> 5725

802.11n_HT20_CH0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.73	< 5250
5745	5736.27	> 5725

802.11n_HT20_CH1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.73	< 5250
5745	5736.27	> 5725

802.11n _HT40_CH0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5247.83	< 5250
5755	5737.11	> 5725

802.11n _HT40_CH1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5247.83	< 5250
5755	5737.11	> 5725

802.11ac _VHT80_CH0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5210	5247.53	< 5250
5775	5737.51	> 5725

802.11n _HT80_CH1

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5210	5247.53	< 5250
5775	5737.41	> 5725

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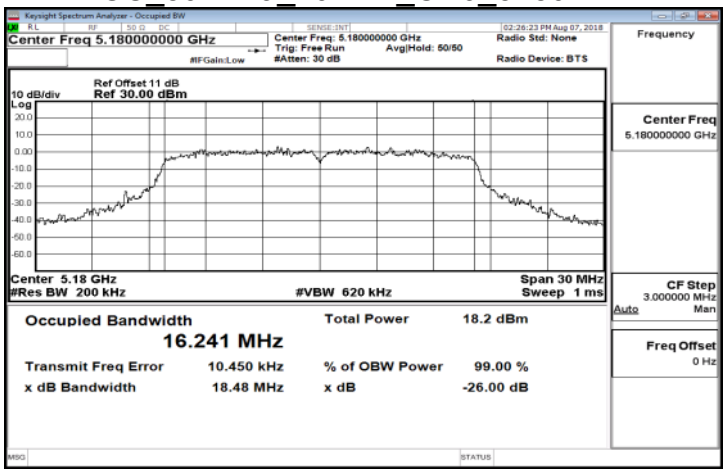
FCC_802.11a_20MHz_CH0_5180MHz



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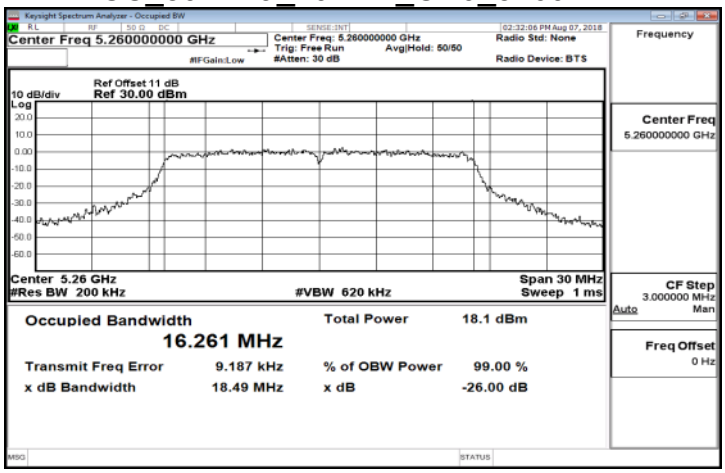

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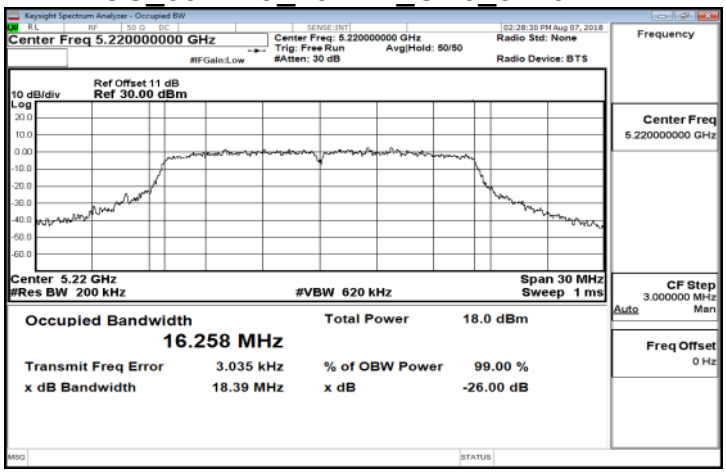

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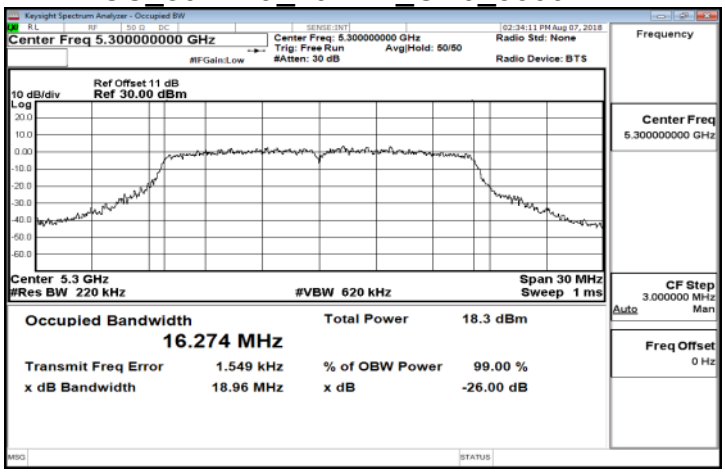
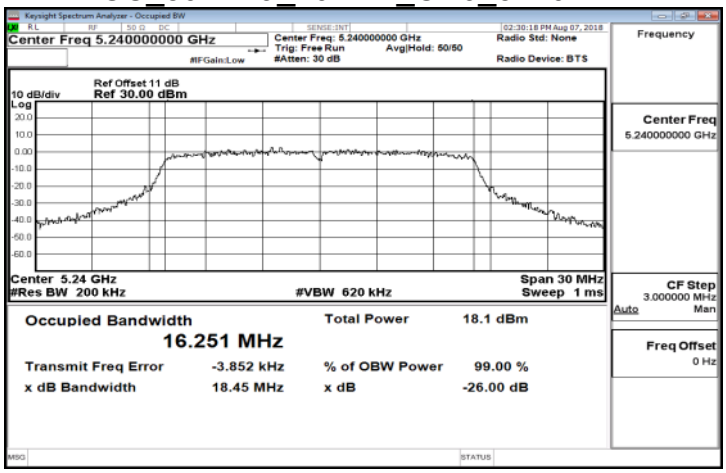
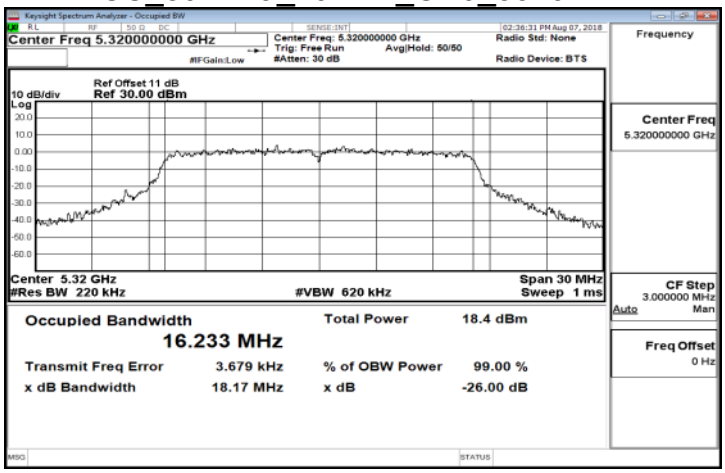


FCC_802.11a_20MHz_CH0_5240MHz



FCC_802.11a_20MHz_CH0_5320MHz



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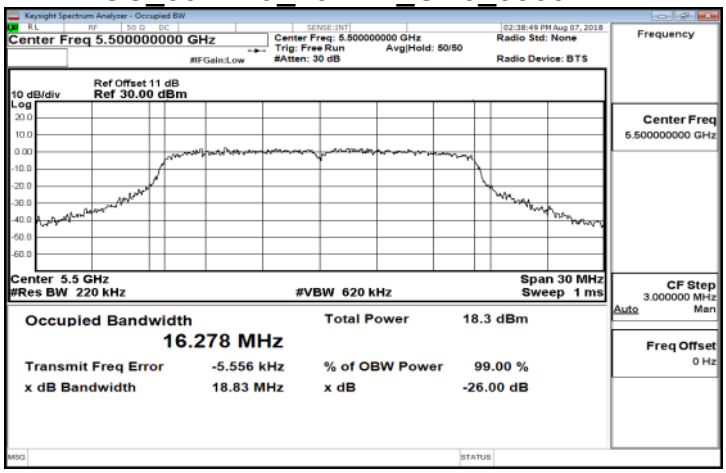
FCC_802.11a_20MHz_CH0_5500MHz



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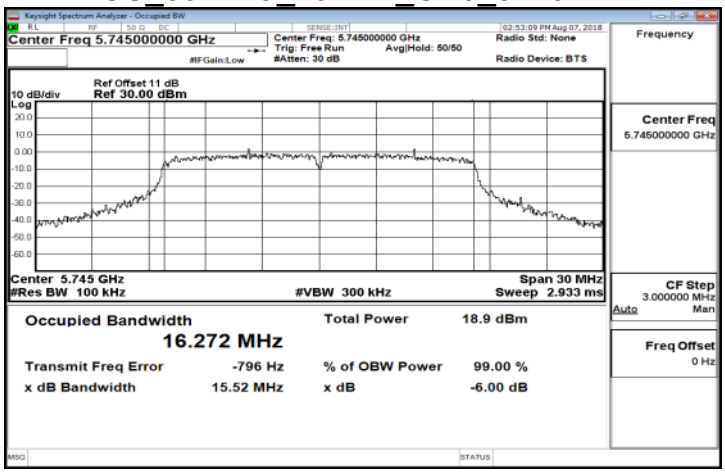
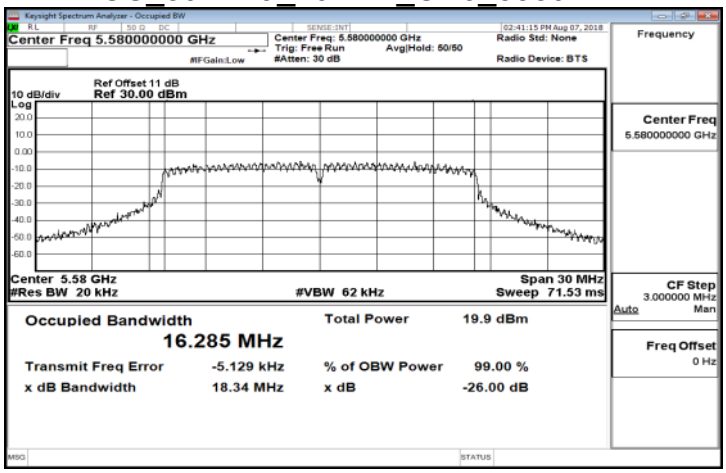


FCC_802.11a_20MHz_CH0_5580MHz



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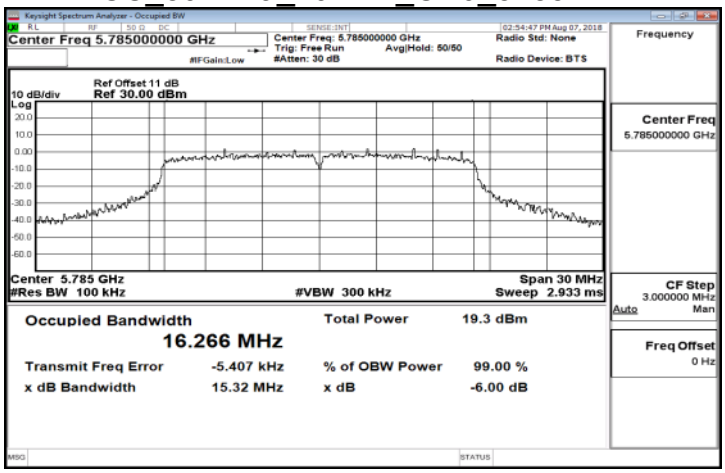
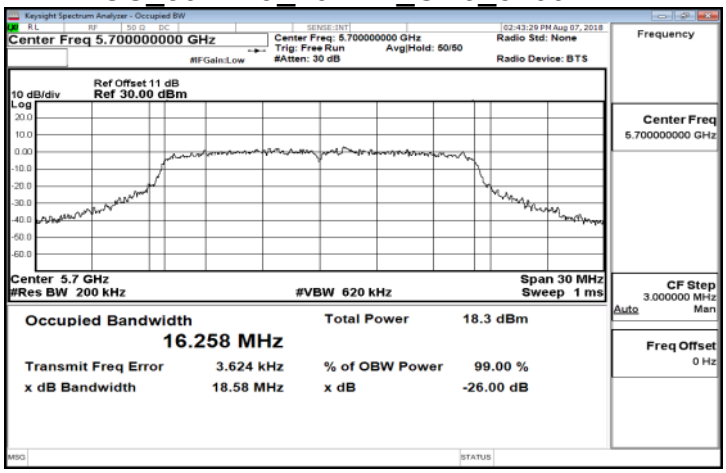
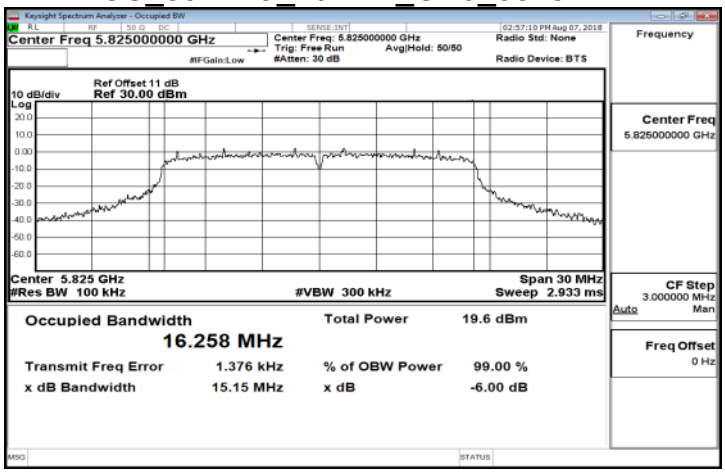


FCC_802.11a_20MHz_CH0_5700MHz



FCC_802.11a_20MHz_CH0_5825MHz



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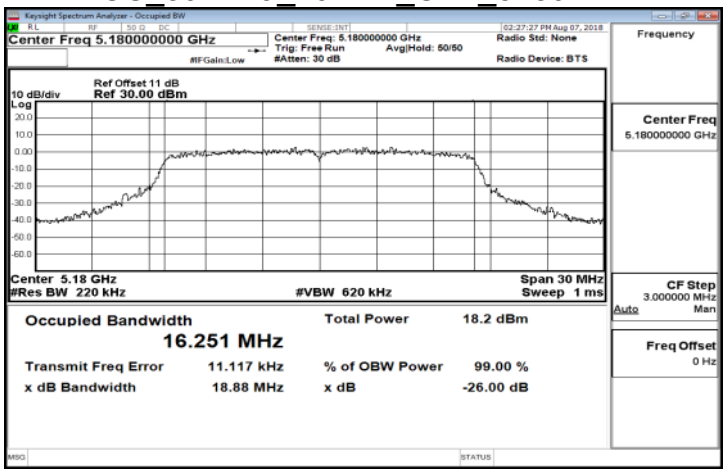
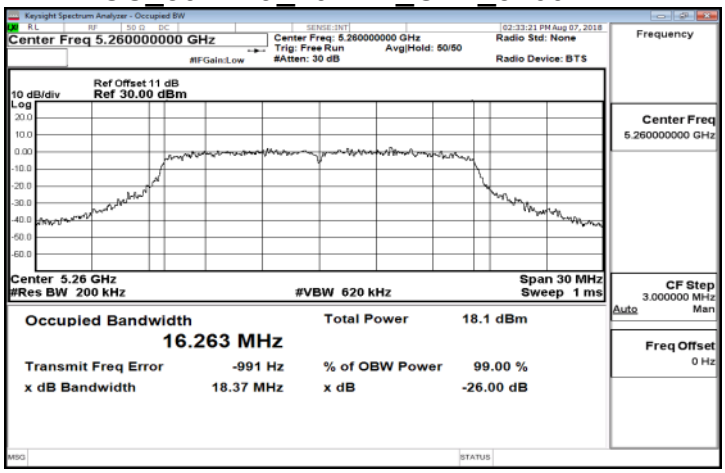
FCC_802.11a_20MHz_CH1_5180MHz



FCC_802.11a_20MHz_CH1_5260MHz



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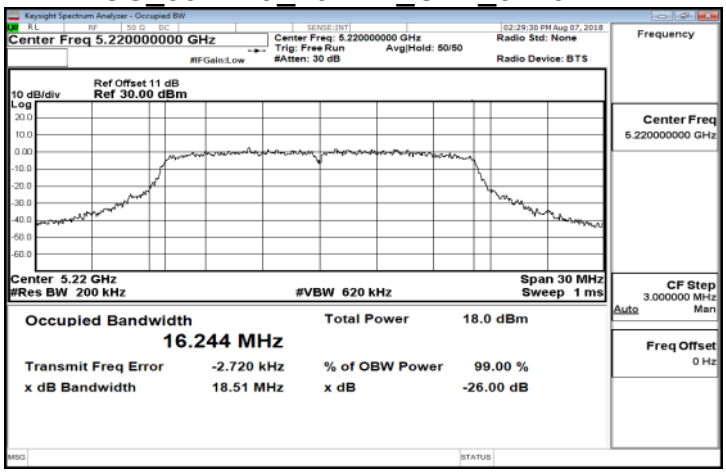
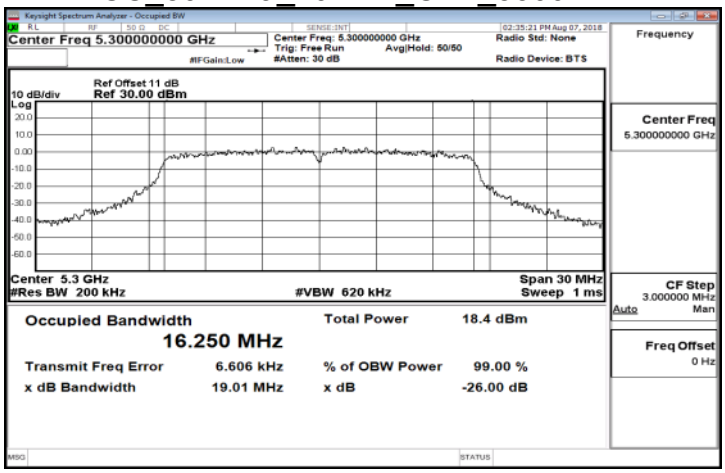
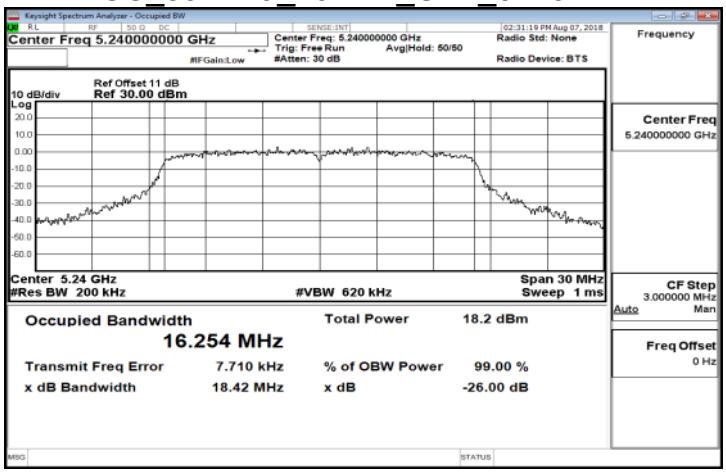


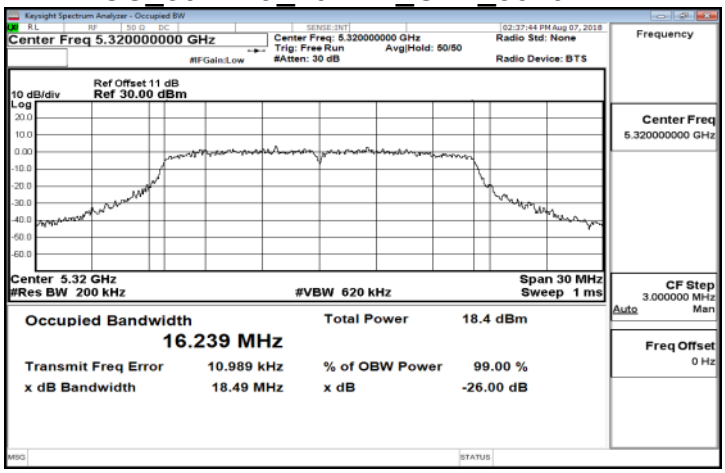
FCC_802.11a_20MHz_CH1_5300MHz



FCC_802.11a_20MHz_CH1_5240MHz



FCC_802.11a_20MHz_CH1_5320MHz



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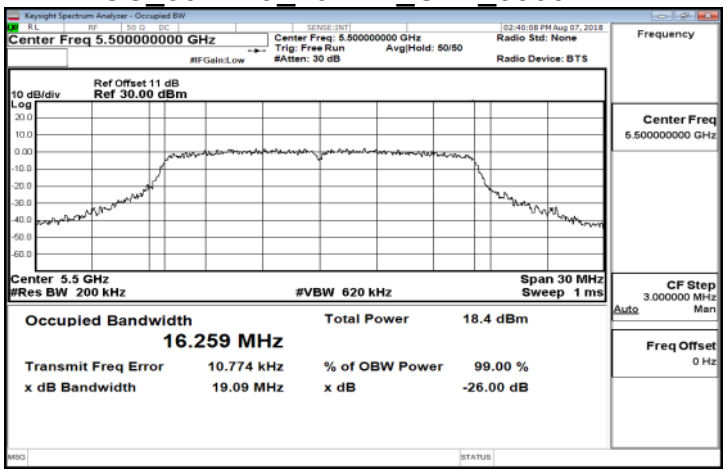
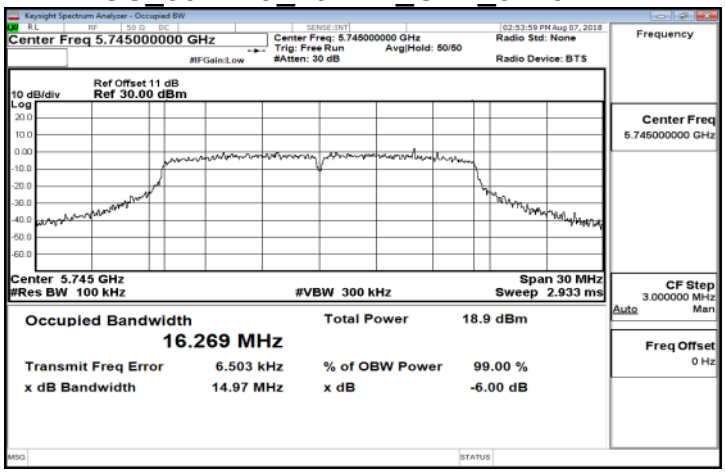
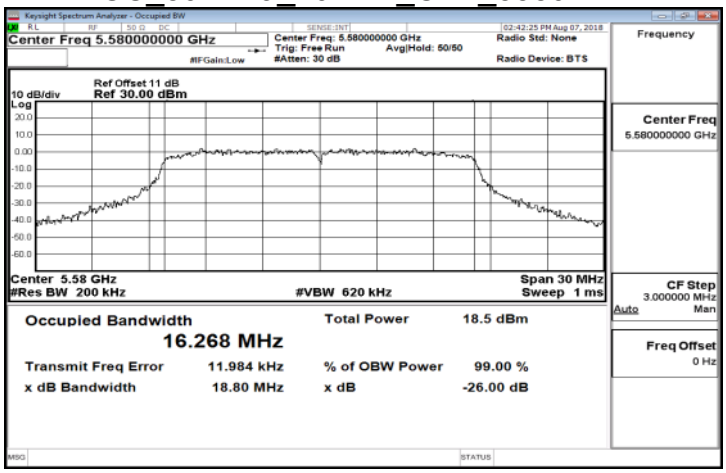
FCC_802.11a_20MHz_CH1_5500MHz



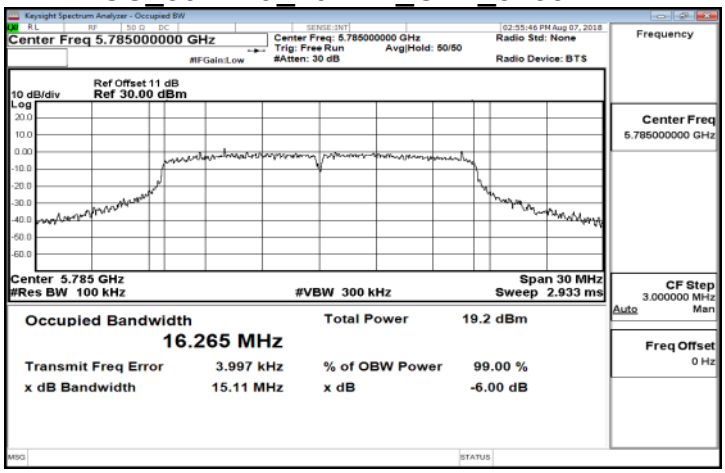
FCC_802.11a_20MHz_CH1_5745MHz



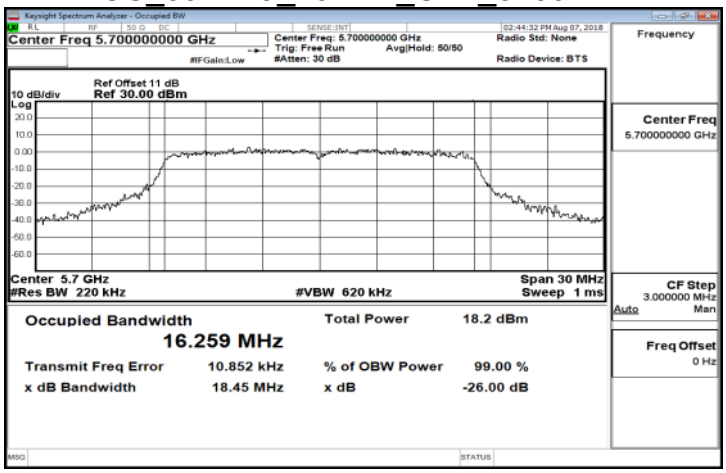
FCC_802.11a_20MHz_CH1_5580MHz



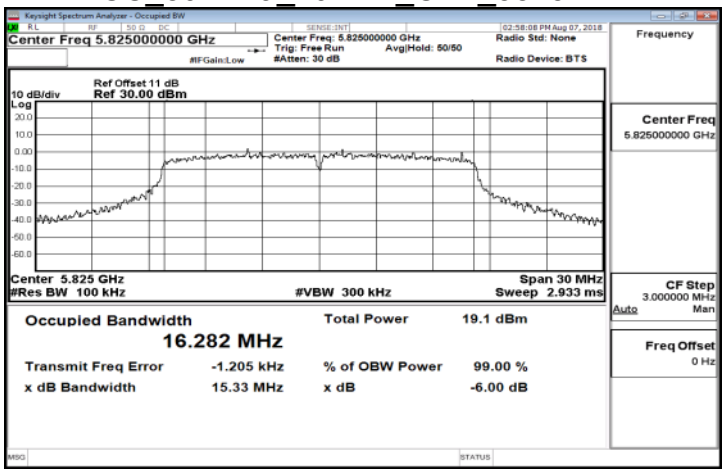
FCC_802.11a_20MHz_CH1_5785MHz



FCC_802.11a_20MHz_CH1_5700MHz



FCC_802.11a_20MHz_CH1_5825MHz



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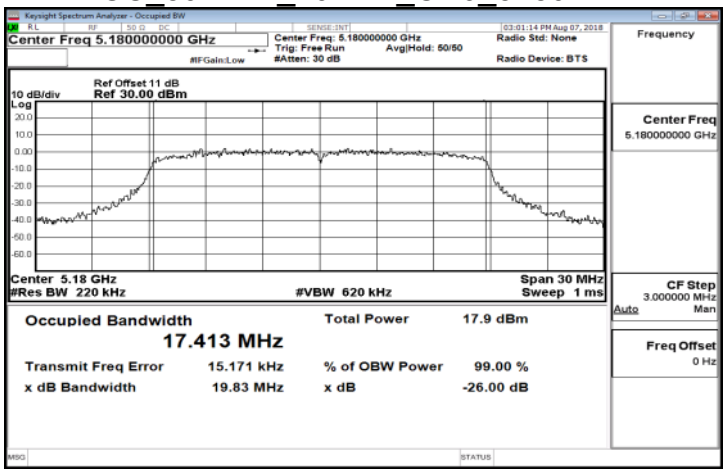
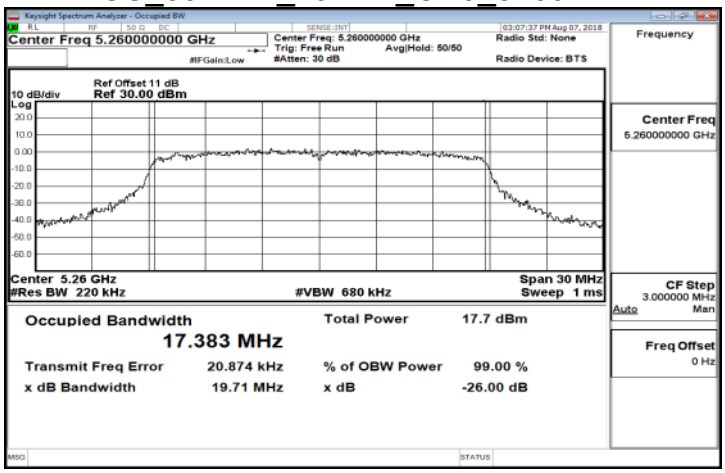
FCC_802.11n_20MHz_CH0_5180MHz



FCC_802.11n_20MHz_CH0_5260MHz



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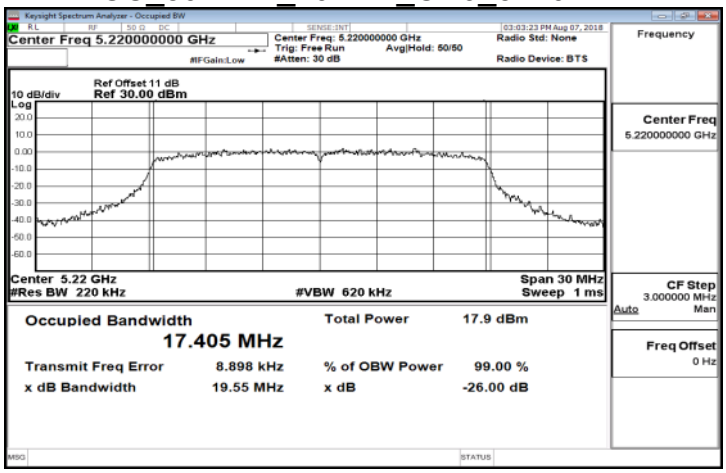
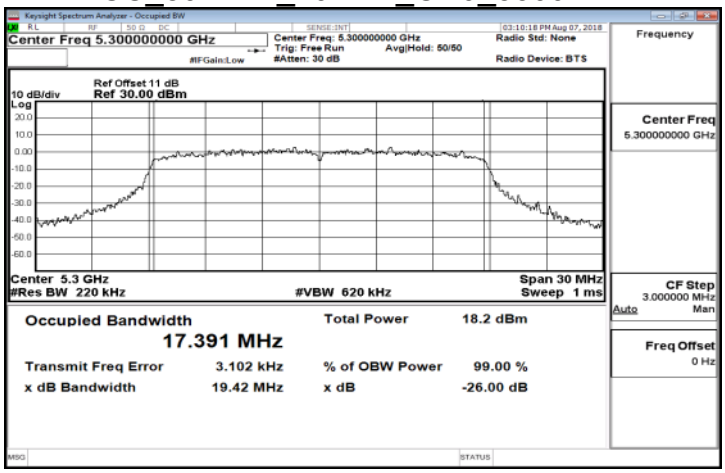
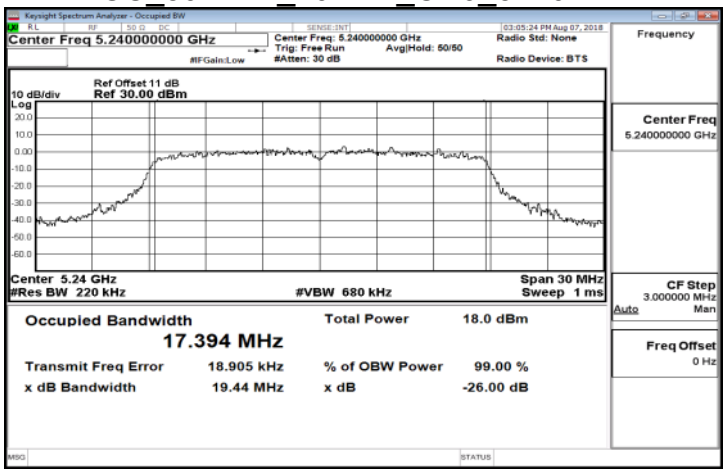


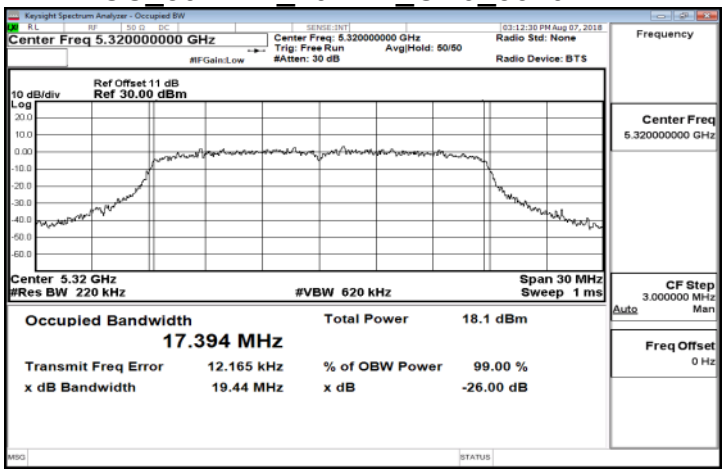
FCC_802.11n_20MHz_CH0_5300MHz



FCC_802.11n_20MHz_CH0_5240MHz



FCC_802.11n_20MHz_CH0_5320MHz



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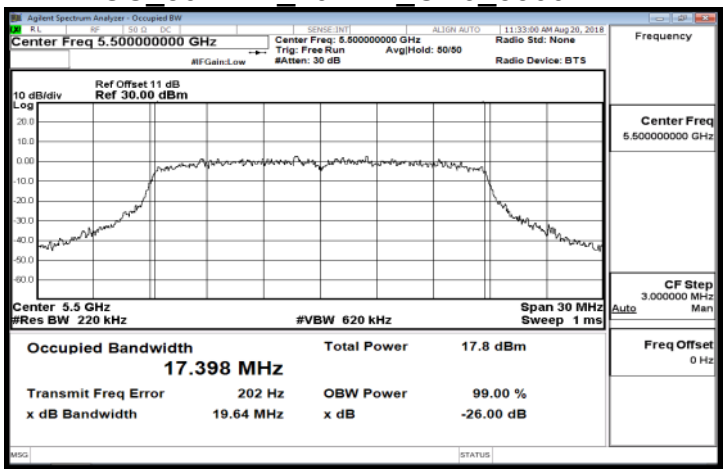
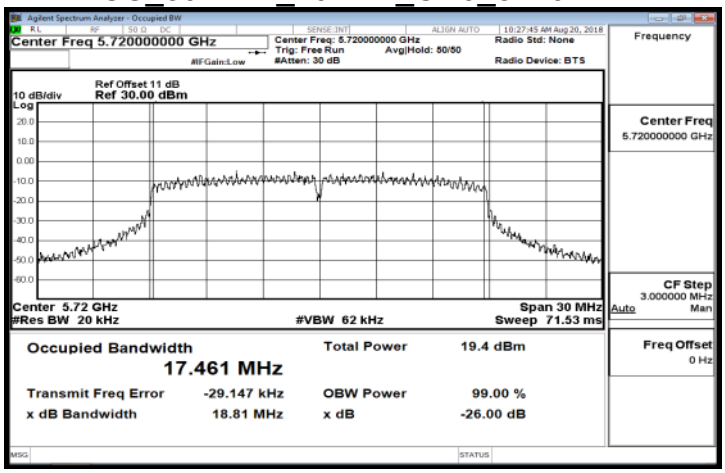
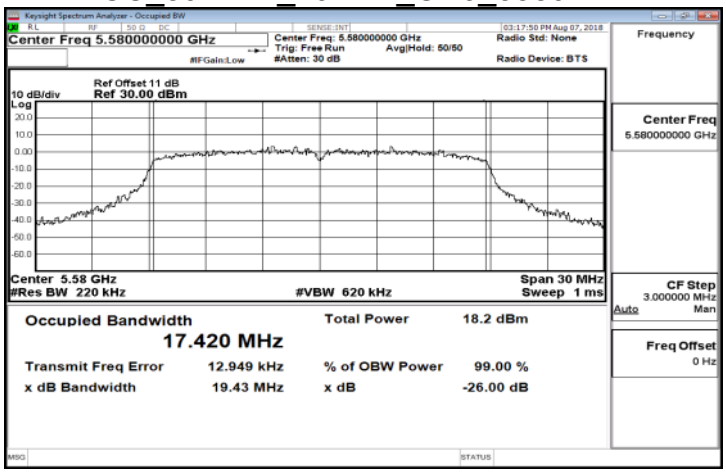
FCC_802.11n_20MHz_CH0_5500MHz



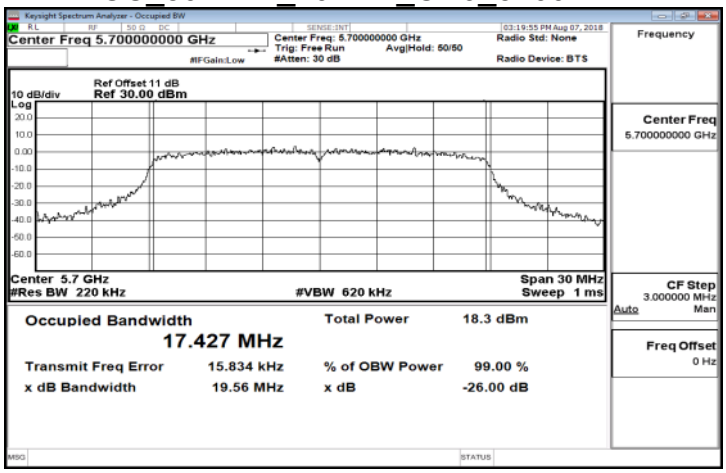
FCC_802.11n_20MHz_CH0_5720MHz



FCC_802.11n_20MHz_CH0_5580MHz



FCC_802.11n_20MHz_CH0_5700MHz



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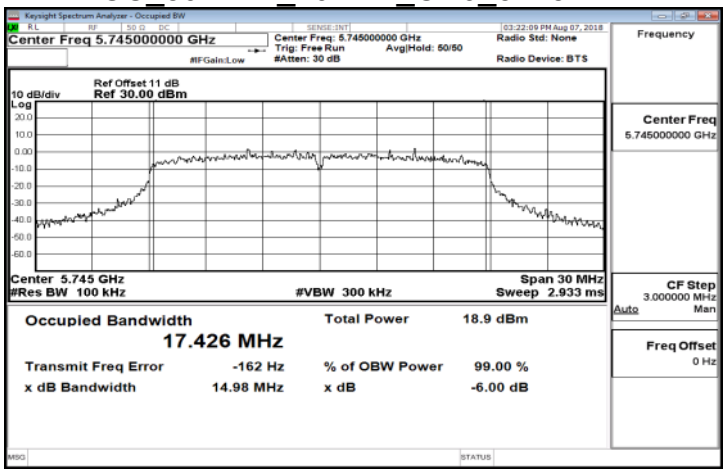
FCC_802.11n_20MHz_CH0_5745MHz



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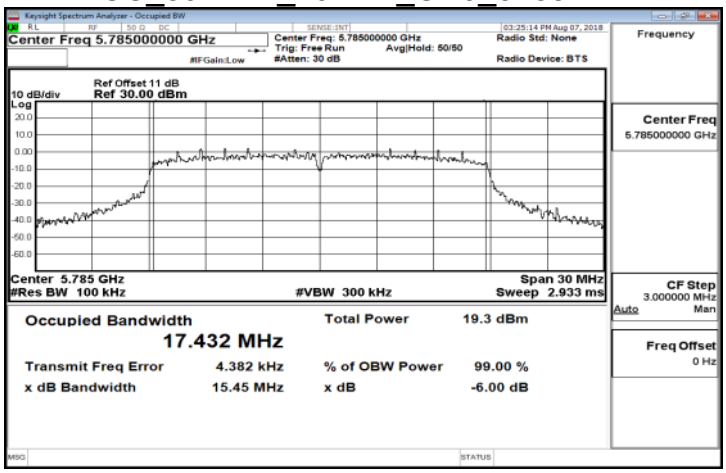

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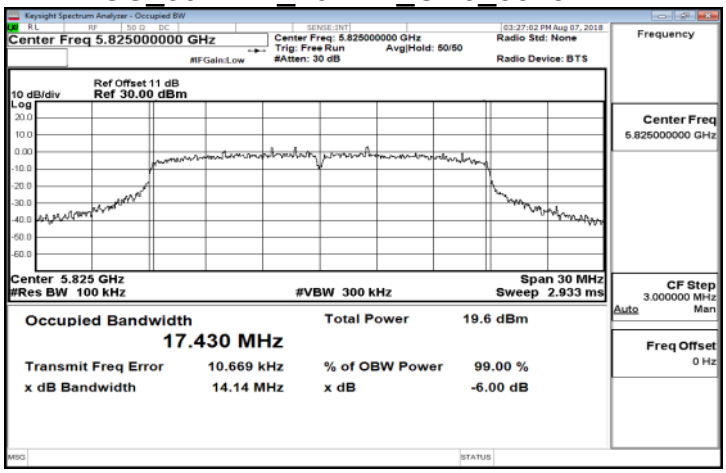

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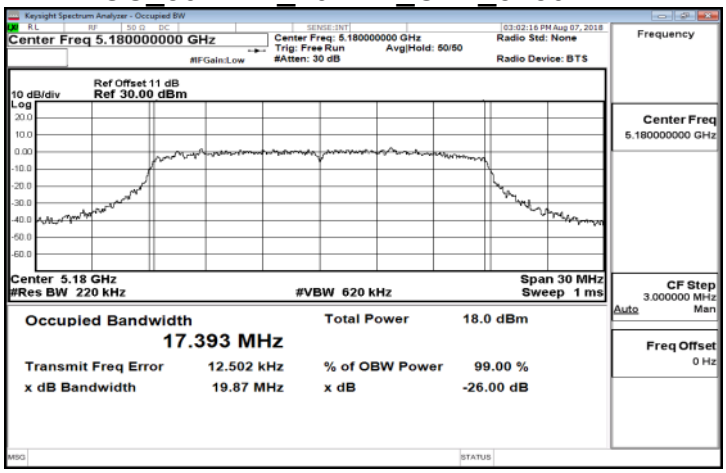
FCC_802.11n_20MHz_CH1_5180MHz



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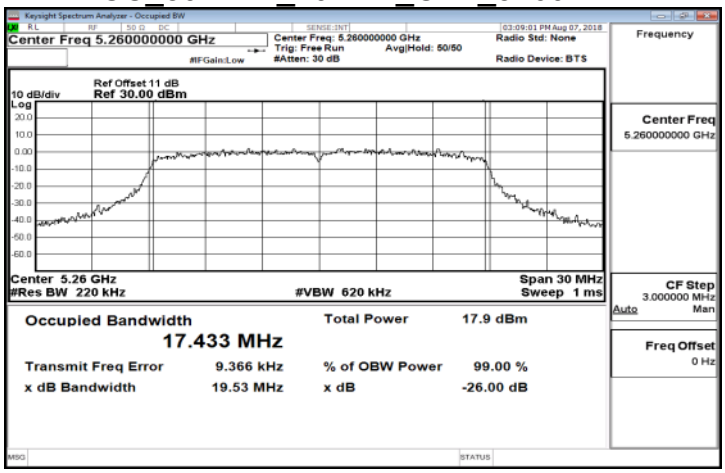

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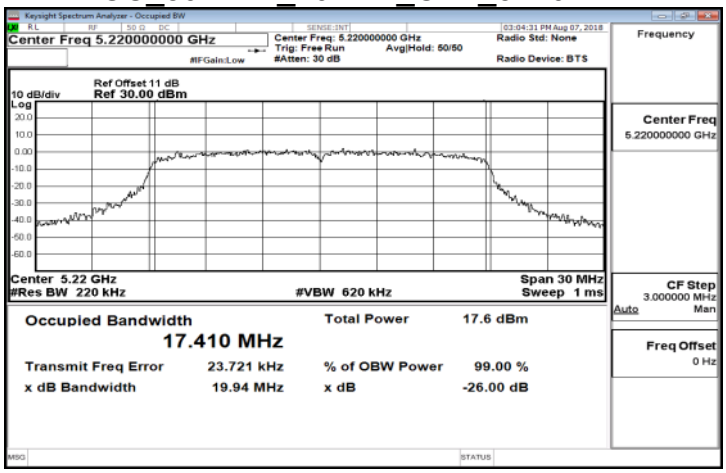
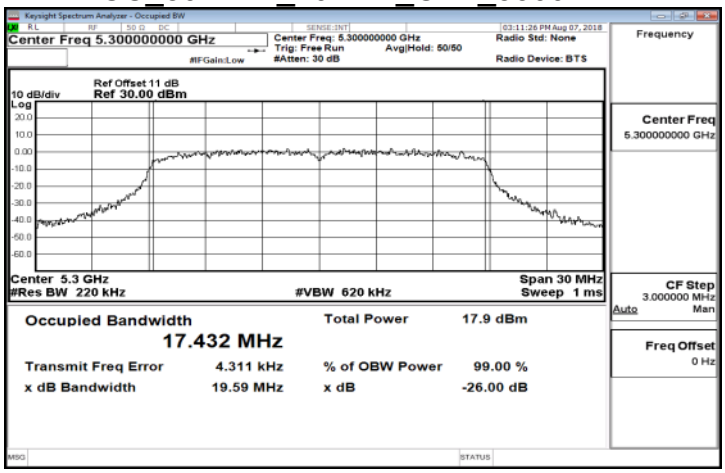
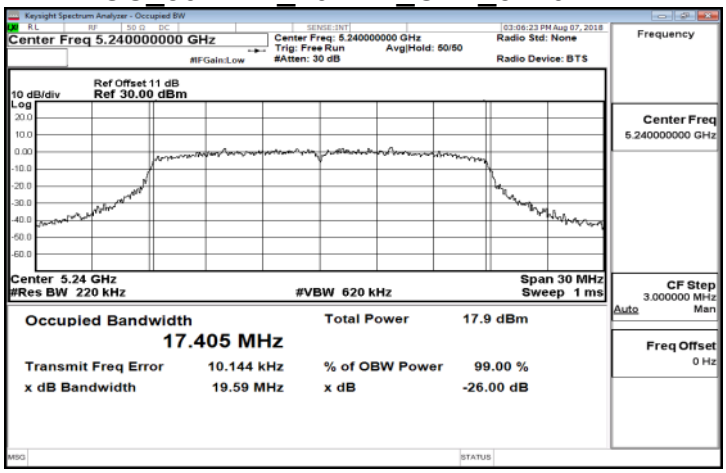


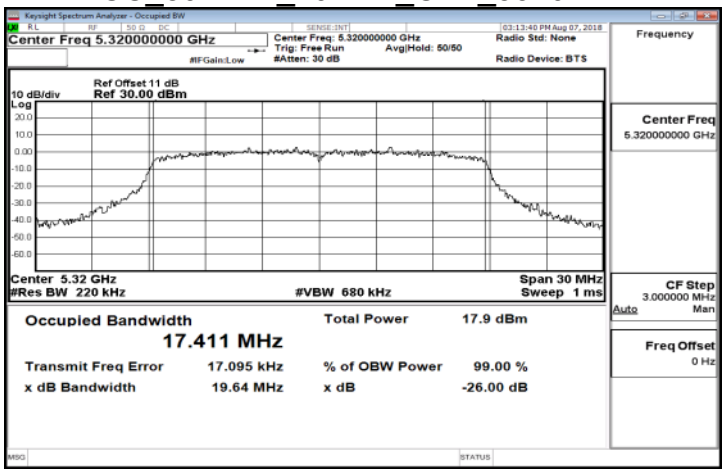
FCC_802.11n_20MHz_CH1_5300MHz



FCC_802.11n_20MHz_CH1_5240MHz



FCC_802.11n_20MHz_CH1_5320MHz



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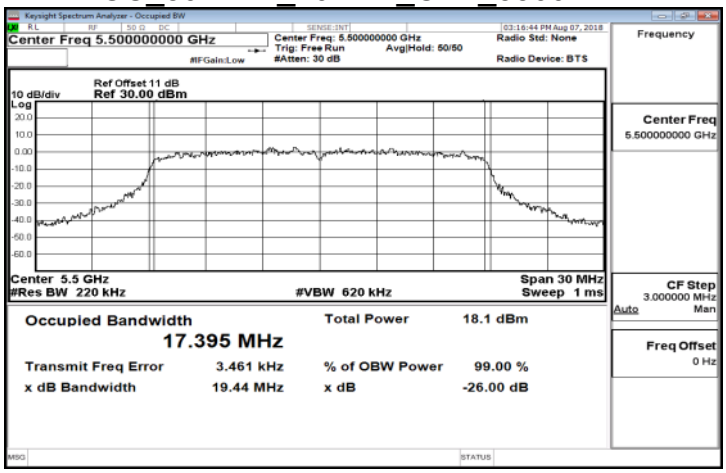
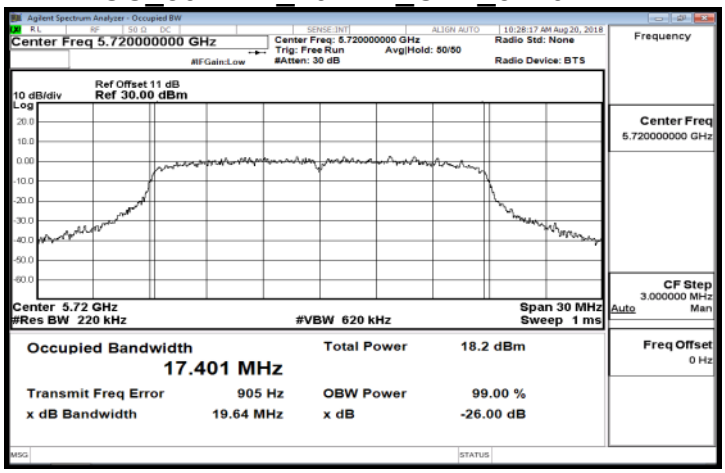
FCC_802.11n_20MHz_CH1_5500MHz



FCC_802.11n_20MHz_CH1_5720MHz



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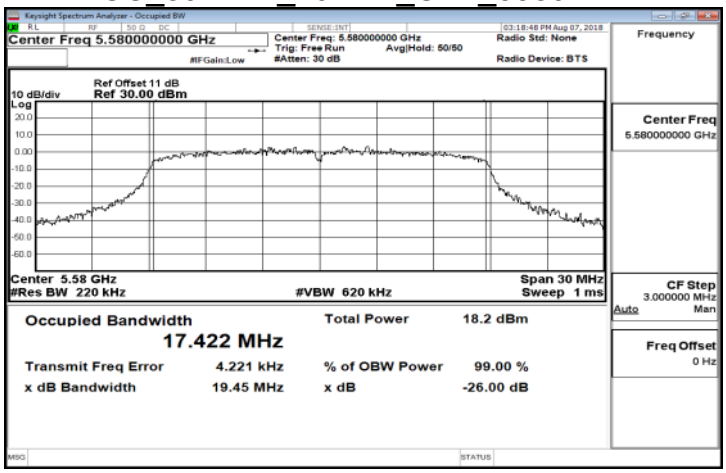
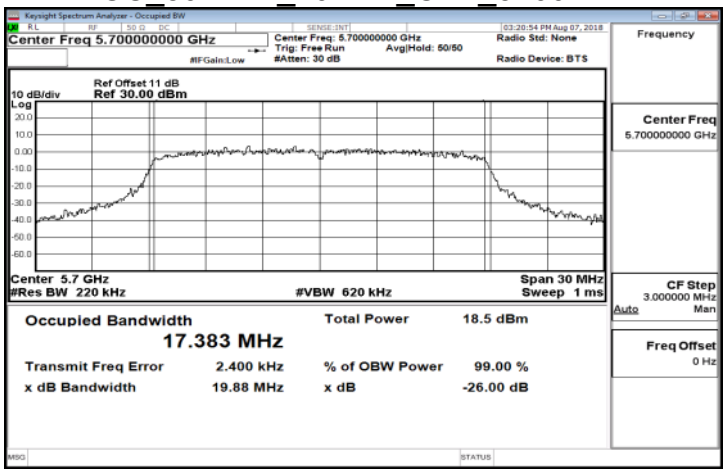


FCC_802.11n_20MHz_CH1_5700MHz



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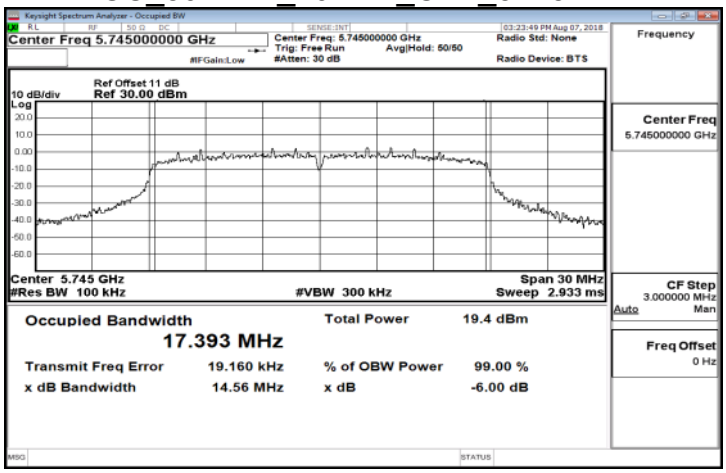
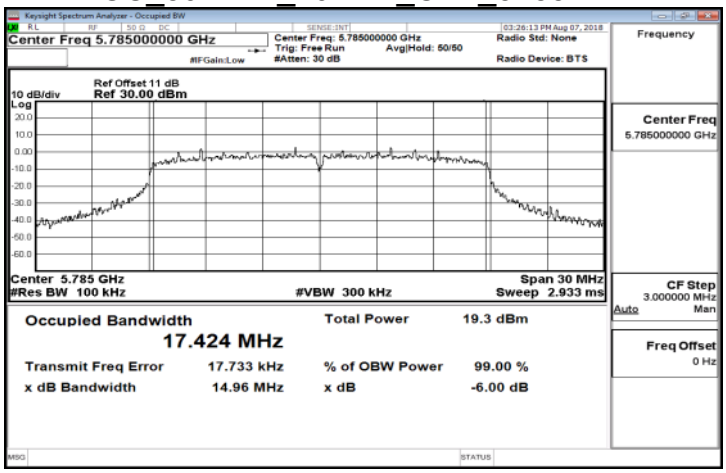
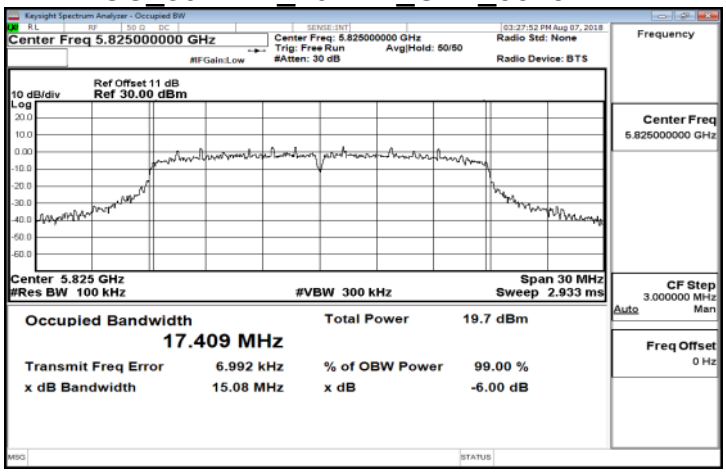
FCC_802.11n_20MHz_CH1_5745MHz



FCC_802.11n_20MHz_CH1_5785MHz



FCC_802.11n_20MHz_CH1_5825MHz



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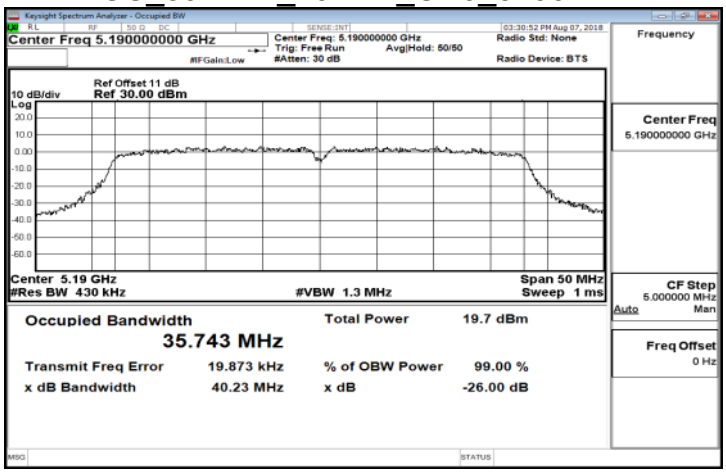
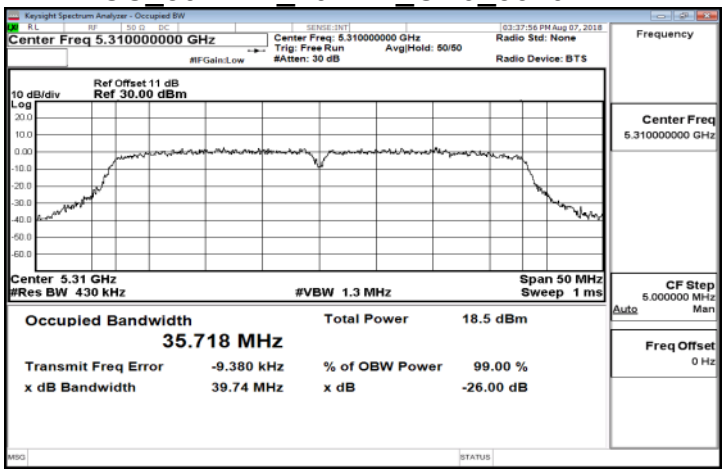
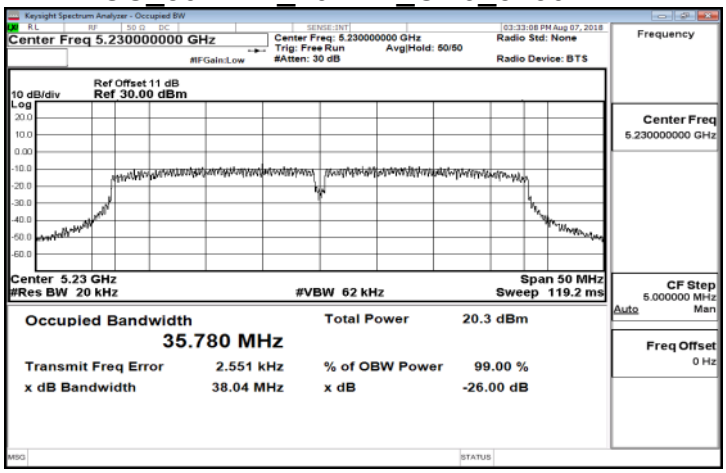
FCC_802.11n_40MHz_CH0_5190MHz



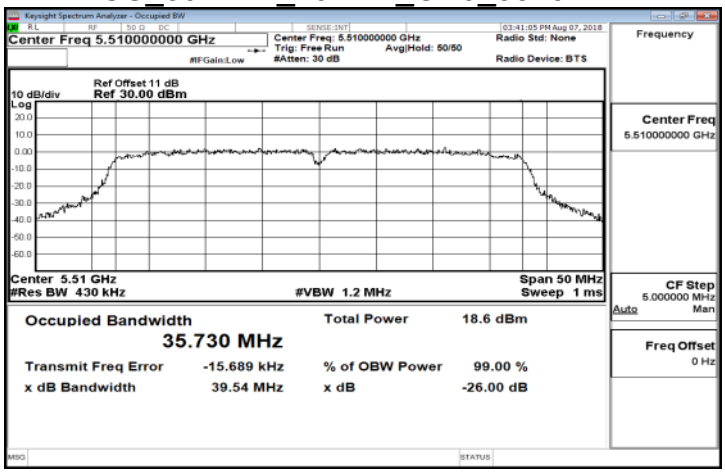
FCC_802.11n_40MHz_CH0_5310MHz



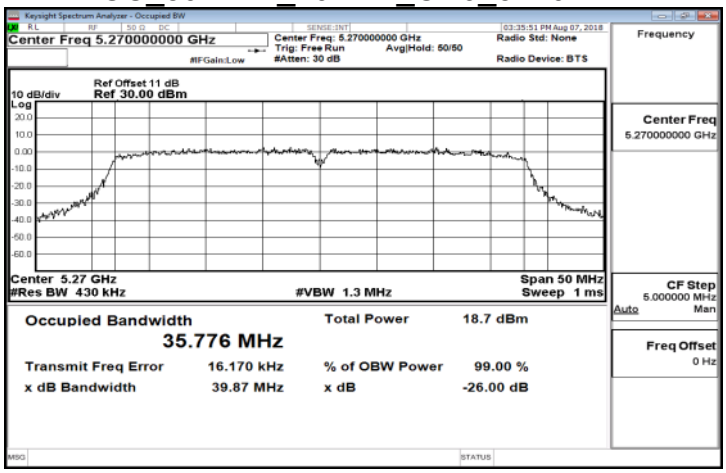
FCC_802.11n_40MHz_CH0_5230MHz



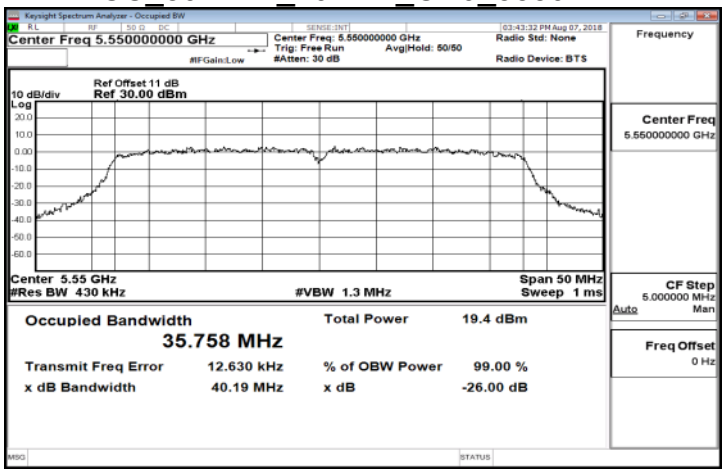
FCC_802.11n_40MHz_CH0_5510MHz



FCC_802.11n_40MHz_CH0_5270MHz



FCC_802.11n_40MHz_CH0_5550MHz



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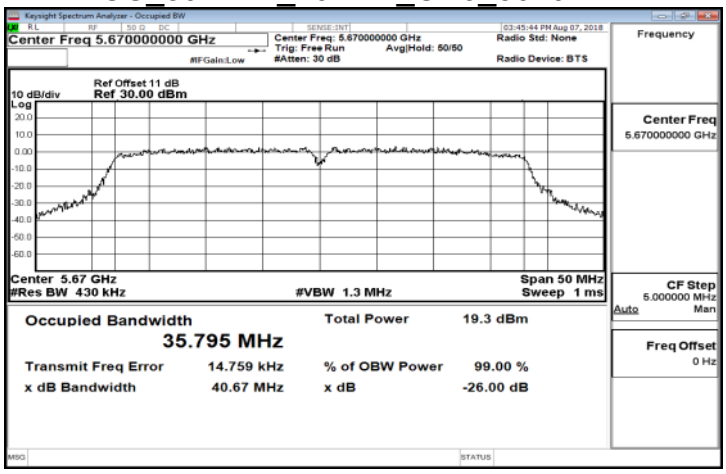
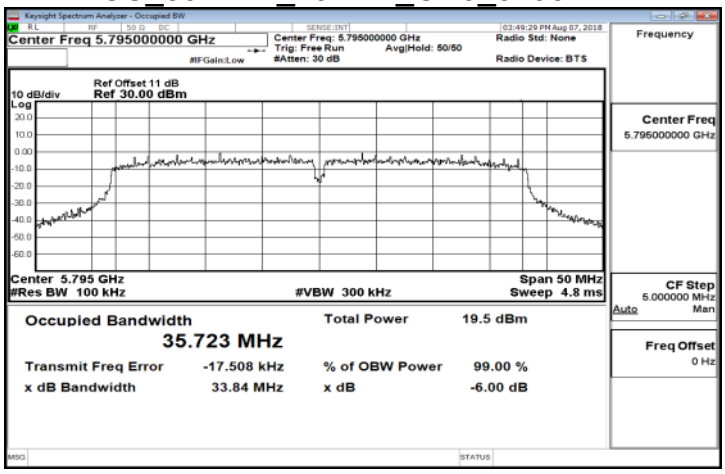
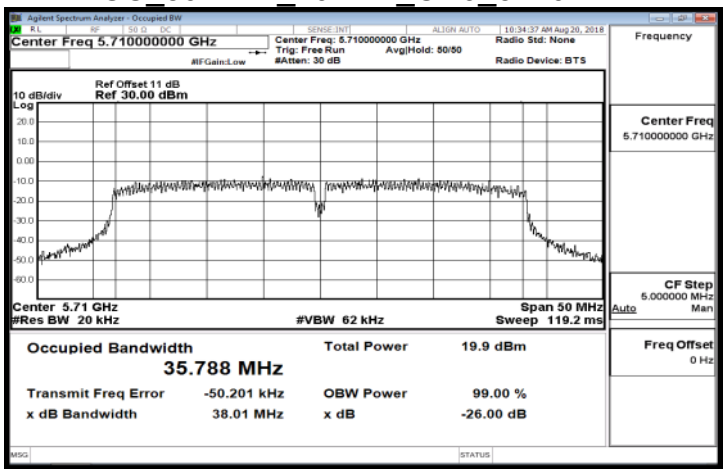
FCC_802.11n_40MHz_CH0_5670MHz



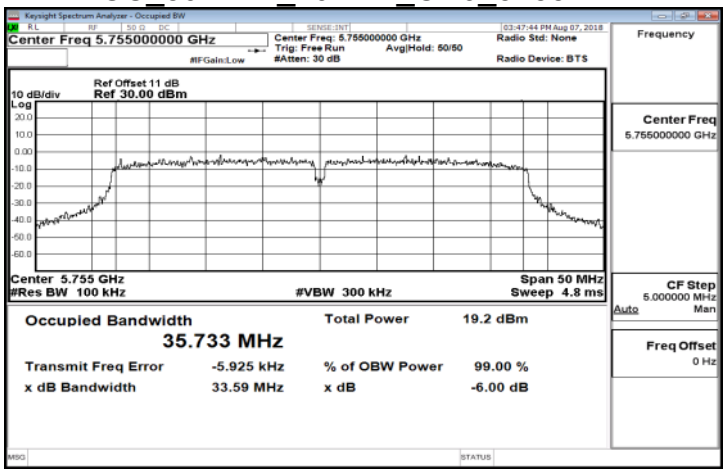
FCC_802.11n_40MHz_CH0_5795MHz



FCC_802.11n_40MHz_CH0_5710MHz



FCC_802.11n_40MHz_CH0_5755MHz



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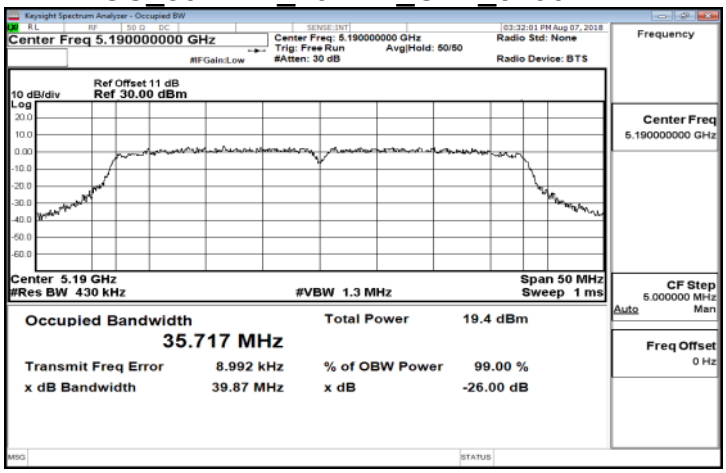
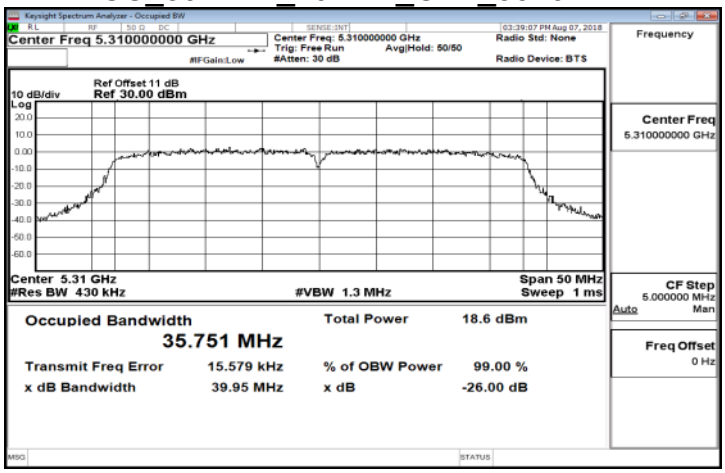
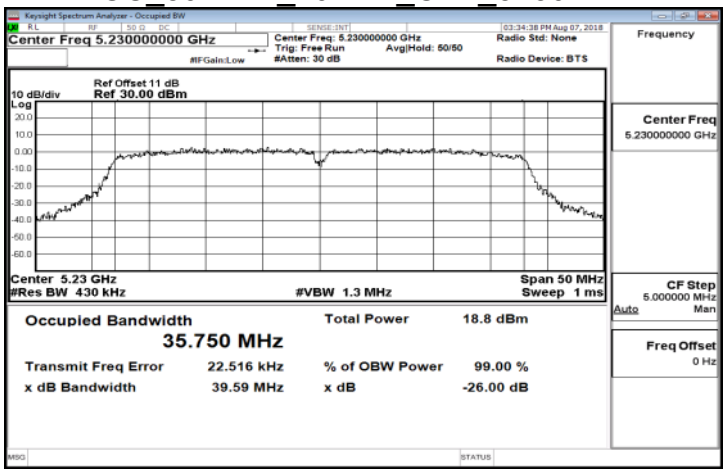
FCC_802.11n_40MHz_CH1_5190MHz



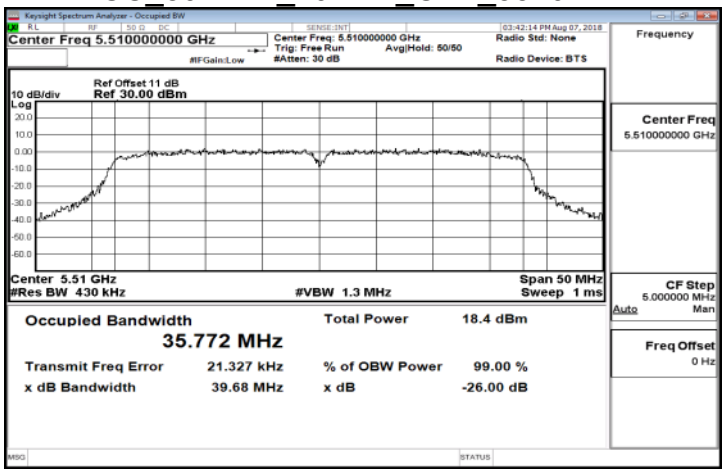
FCC_802.11n_40MHz_CH1_5310MHz



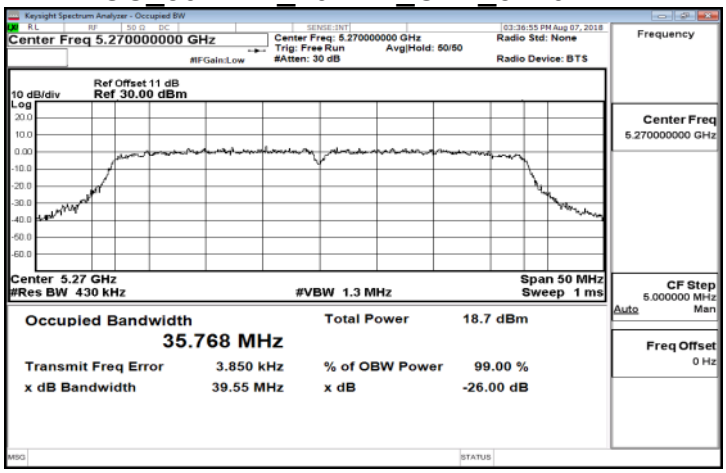
FCC_802.11n_40MHz_CH1_5230MHz



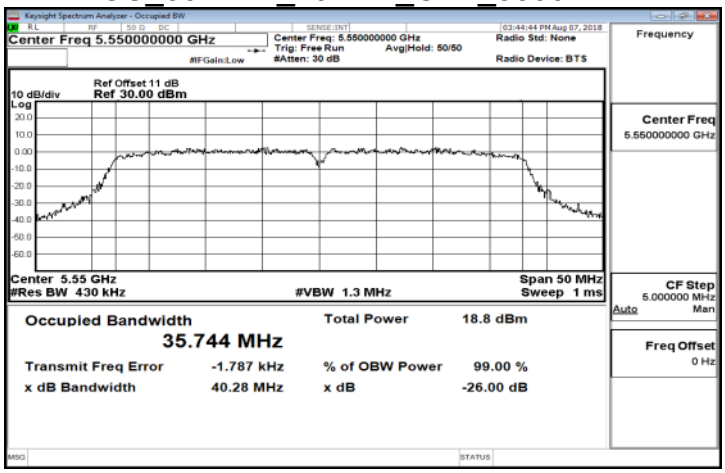
FCC_802.11n_40MHz_CH1_5510MHz



FCC_802.11n_40MHz_CH1_5270MHz



FCC_802.11n_40MHz_CH1_5550MHz



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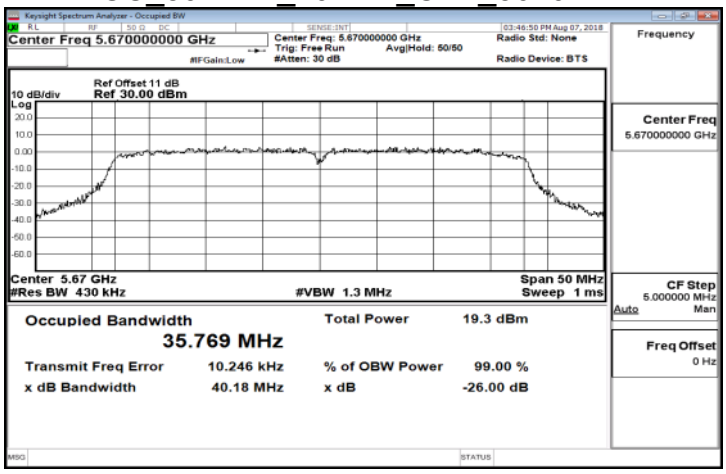
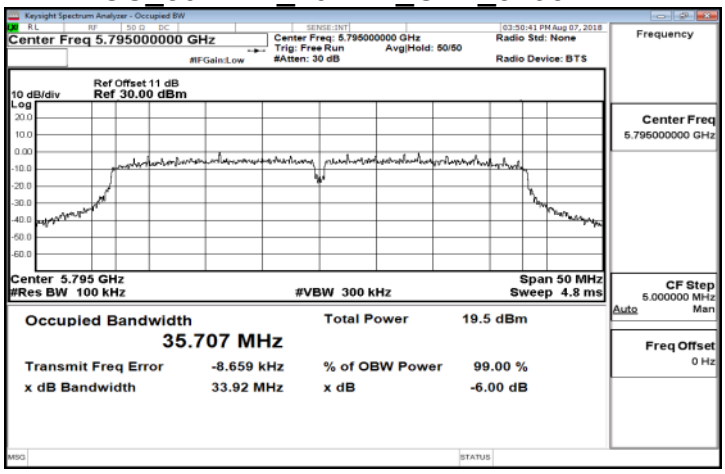
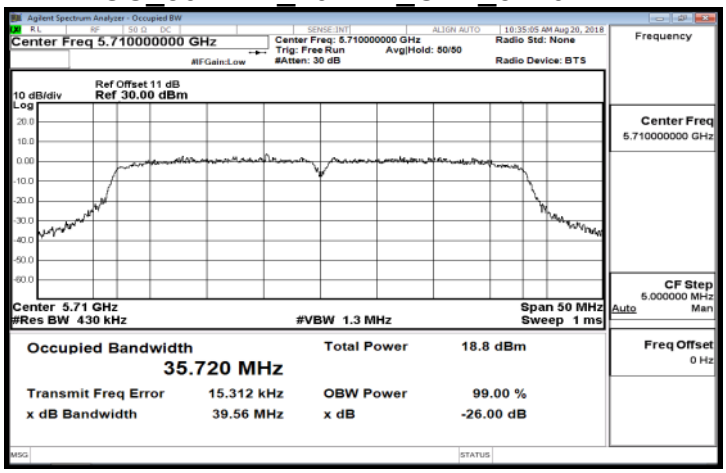
FCC_802.11n_40MHz_CH1_5670MHz



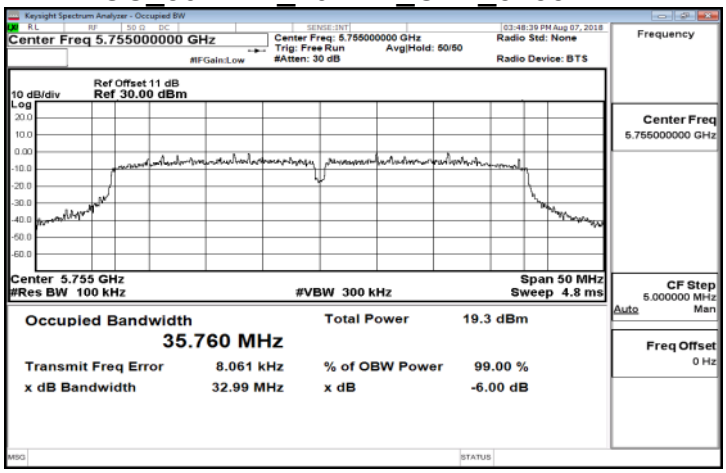
FCC_802.11n_40MHz_CH1_5795MHz



FCC_802.11n_40MHz_CH1_5710MHz



FCC_802.11n_40MHz_CH1_5755MHz



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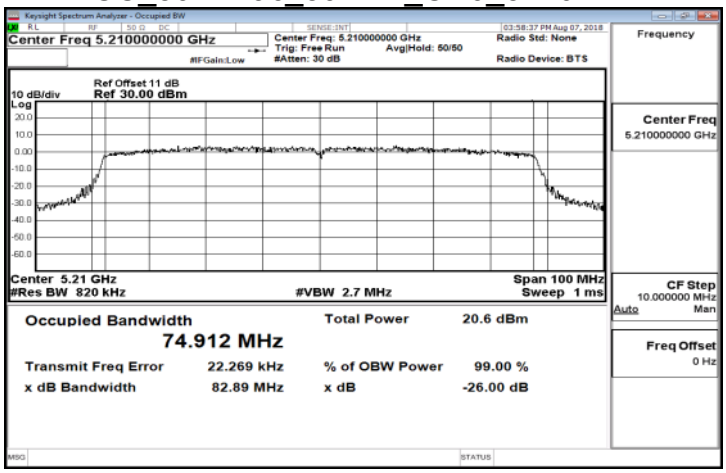
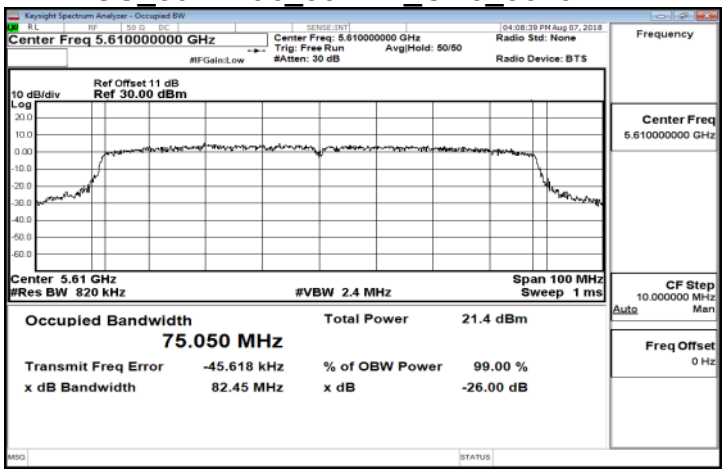
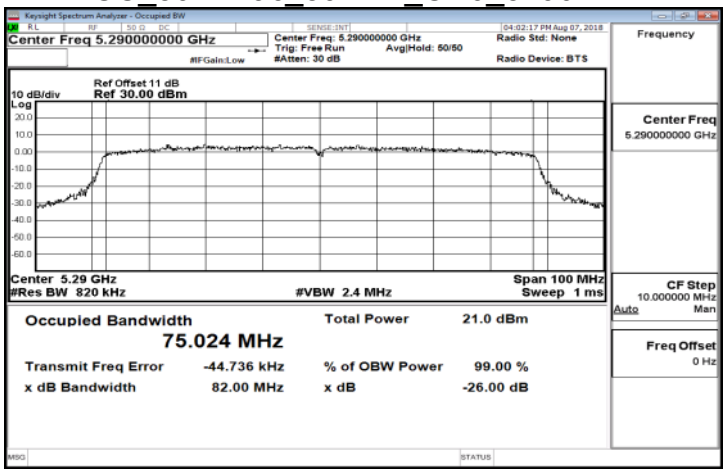
FCC_802.11ac_80MHz_CH0_5210MHz



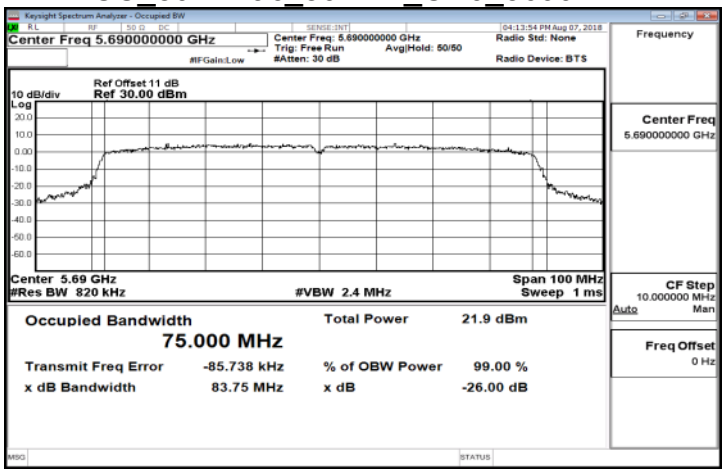
FCC_802.11ac_80MHz_CH0_5610MHz



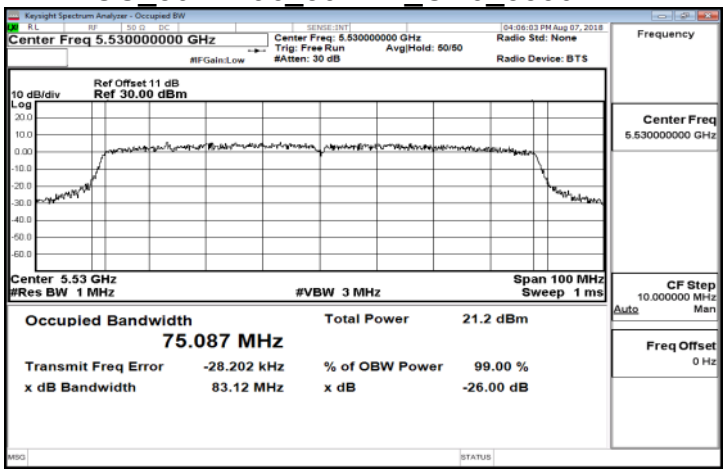
FCC_802.11ac_80MHz_CH0_5290MHz



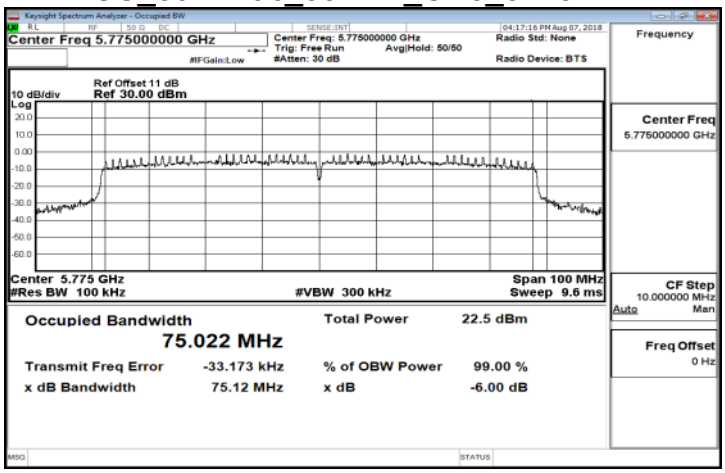
FCC_802.11ac_80MHz_CH0_5690MHz



FCC_802.11ac_80MHz_CH0_5530MHz



FCC_802.11ac_80MHz_CH0_5775MHz



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