

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Digi International Inc
 9350 Excelsior Blvd., Suite 700 Hopkins, MN 55343
Product Name: ConnectCore 8X
Brand Name: Digi
Model No.: CC8X
Model Difference: N/A
Report Number: ER/2019/B0067
FCC ID: MCQ-CCIMX8
IC: 1846A-CCIMX8
FCC Rule Part: §15.407, Cat: NII
ISED RSS: RSS-247 issue 2 Feb. 2017
Issue Date: Jul. 13, 2020
Date of Test: Dec. 04, 2019 ~ Feb 07, 2020
Date of EUT Received: Dec. 04, 2019

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab 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.

Approved By:

CHUN-CHIEH, CHEN

**CHUN-CHIEH, CHEN /
Supervisor**



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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2019/B0067	Rev.00	Original.	Jun. 13, 2020	Revised By: Susan Lin

Note:

1、Disclaimer

Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

2、The test data in this test report is fully leveraged from the TAF code 0513. Since the laboratory's TAF code has been updated to 3702, this test report is being issued by the laboratory of TAF code 3702.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	ConnectCore 8X	
Brand Name:	Digi	
Model No.:	CC8X	
Model Difference:	N/A	
Hardware Version:	55001984-02 rev 4P	
Software Version:	82004286 rev 4P	
EUT Serial Number:	F191001000424	
Power Supply:	5Vdc from AC/DC Adapter	
	Adapter:	Model No.: GT-46180-1605, Supplier: GlobTek, Inc.
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 – 173.3Mbps 802.11 ac_40MHz: 13.5 – 400.0Mbps 802.11 ac_80MHz: 29.3 – 866.7Mbps

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1.2 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Directional Gain (dBi)	Worst Antenna Gain
PCB	YAGEO	ANTX100P001B24553	5150~5250	4.9	7.91	
			5250~5350	3.9	6.91	
			5470~5725	5.1	8.11	
			5725~5850	5.1	8.11	
PCB	TAOGLAS	FXP830.07.0100C	5150~5250	6.11	9.12	V
			5250~5350	6.11	9.12	V
			5470~5725	6.11	9.12	V
			5725~5850	6.11	9.12	V
Dipole	TAOGLAS	GW.48.A151	5150~5250	4.56	7.57	
			5250~5350	4.56	7.57	
			5470~5725	4.56	7.57	
			5725~5850	4.56	7.57	
PCB	TAOGLAS	FXP522.A.07.A.001	5150~5250	4.63 (Port 1) 4.61 (Port 2)	7.64	
			5250~5350	4.63 (Port 1) 4.61 (Port 2)	7.64	
			5470~5725	4.63 (Port 1) 4.61 (Port 2)	7.64	
			5725~5850	4.63 (Port 1) 4.61 (Port 2)	7.64	
Dipole	Linx	ANT-DB1-RAF-RPS	5150~5250	4.6	7.61	V
			5250~5350	4.6	7.61	V
			5470~5725	4.6	7.61	V
			5725~5850	4.6	7.61	V
PCB	ether-tronic	1001932	5150~5250	5	8.01	
			5250~5350	5	8.01	
			5470~5725	5	8.01	
			5725~5850	5	8.01	
PCB	TAOGLAS	FXP831.07.0100C	5150~5250	5.5	8.51	
			5250~5350	5.5	8.51	
			5470~5725	5.5	8.51	
			5725~5850	5.5	8.51	

Note: Pre-scanned was done on the above 7 antennas, the PCB (FXP830.07.0100C) and Dipole (ANT-DB1-RAF-RPS) results higher emission at 5GHz. Therefore, the completed set of measurement was done on the antenna to be presented on this test report.

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1.3 FCC worst power

Wi-Fi 802.11	Frequency Range	Channels	Rated Power (Avg.) (dBm) (Worst case)	Modulation Technology
a	5150~5250	4	11.99	OFDM
	5250~5350	4	16.55	
	5470~5725	12	16.16	
	5725-5850	5	16.24	
n_HT ac_VHT 20M	5150~5250	4	HT: 12.49	OFDM
	5250~5350	4	HT: 15.56	
	5470~5725	12	HT: 15.49	
	5725-5850	5	HT: 15.22	
n_HT ac_VHT 40M	5150~5250	2	HT: 13.67	OFDM
	5250~5350	2	HT: 15.74	
	5470~5725	5	HT: 15.81	
	5725-5850	2	HT: 15.48	
ac_VHT 80M	5150~5250	1	VHT: 11.01	OFDM
	5250~5350	1	VHT: 10.22	
	5470~5725	2	VHT: 14.42	
	5725-5850	1	VHT: 13.87	

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1.4 ISED worst power

Wi-Fi 802.11	Frequency Range	Channels	Avg. or EIRP	Rated Power(dBm) (Worst Case)	Modulation Technology
11a	5150~5250	4	EIRP	21.11	OFDM
	5250~5350	4	Avg.	16.55	
	5470~5725	12	Avg.	16.16	
	5725-5850	5	Avg.	16.24	
11n_HT / ac_VHT 20M	5150~5250	4	EIRP	HT: 21.61	OFDM
	5250~5350	4	Avg.	HT: 15.56	
	5470~5725	12	Avg.	HT: 15.49	
	5725-5850	5	Avg.	HT: 15.22	
11n_HT / ac_VHT 40M	5150~5250	2	EIRP	HT: 22.79	OFDM
	5250~5350	2	Avg.	HT: 15.74	
	5470~5725	6	Avg.	HT: 15.81	
	5725-5850	2	Avg.	HT: 15.48	
11ac VHT80M	5150~5250	1	EIRP	20.13	OFDM
	5250~5350	1	Avg.	10.22	
	5470~5725	2	Avg.	14.42	
	5725-5850	1	Avg.	13.87	

Note:

As per guidance in presentation 2018-04-10-03 IC Certification updates of April 2018 TCB workshop, Client (Slave mode) devices without active scanning function, but with the capability of operating in 5600-5650 MHz solely under the control of a certified master device meeting the requirement of RSS-247, are allowed in Canada.

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1.5 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5, Amendment 1, March 2019

ANSI C63.10:2013

1.6 Test Facility

SGS Taiwan Ltd. Central RF Lab (TAF code 3702)

No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803

FCC Designation number: TW0027

ISED CAB identifier: TW3702

1.7 Special Accessories

There are no special accessories used while test was conducted.

1.8 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

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 a 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. The two LISNs provide 50uH/50 ohm 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 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. 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.

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2.4 Measurement Results Explanation Example

2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*9m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

2.4.2 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.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (AC powerline) Emission

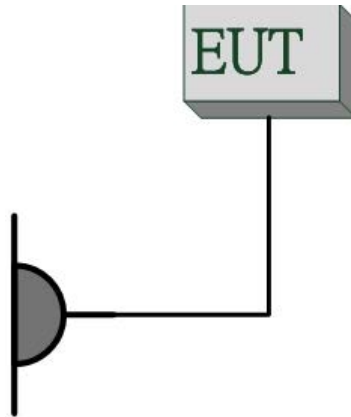


Fig. 2-3 Conducted (Antenna Port) Emission



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	L430	R9-X11BG	Unshielded	Shielded

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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-Gen §6.7 RSS-247 §6.2.4.1	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
§15.205 §15.209 §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 §15.407(a)	RSS- Gen §6.8	Antenna Requirement	Compliant

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4 DESCRIPTION OF TEST MODES

4.1 802.11a/n/ac operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

20 M	
CH	Freq (MHz)
36	5180
40	5200
44	5220
48	5240

40 M	
CH	Freq (MHz)
38	5190
46	5230

80 M	
CH	Freq (MHz)
42	5210

Operated band in 5250 MHz ~5350 MHz:

20 M	
CH	Freq (MHz)
52	5260
56	5280
60	5300
64	5320

40 M	
CH	Freq (MHz)
54	5270
62	5310

80 M	
CH	Freq (MHz)
58	5290

Operated band in 5470 MHz ~5725 MHz:

20 M	
CH	Freq (MHz)
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700

40 M	
CH	Freq (MHz)
102	5510
110	5550
118	5590
126	5630
134	5670

80 M	
CH	Freq (MHz)
106	5530
122	5610

Operated band in 5745 MHz ~5850 MHz:

20 M	
CH	Freq (MHz)
149	5745
153	5765
157	5785
161	5805
165	5825

40 M	
CH	Freq (MHz)
151	5755
159	5795

80 M	
CH	Freq (MHz)
155	5775

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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 programmed.
3. Investigation has been done on all the possible configurations for searching the worst case. The given UE is pre-scanned among below modes.

Modulation	Transmission Chain				Single Transmission	Multiple Transmission
					Spatial	Spatial
<input checked="" type="checkbox"/> 802.11 a	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" type="checkbox"/> 1TX	<input checked="" type="checkbox"/> TX
<input checked="" type="checkbox"/> 802.11 n	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" type="checkbox"/> SISO	<input checked="" type="checkbox"/> MIMO
<input checked="" type="checkbox"/> 802.11 ac	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" type="checkbox"/> SISO	<input checked="" type="checkbox"/> MIMO
<input type="checkbox"/> 802.11 ax	<input type="checkbox"/> Ch0	<input type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input type="checkbox"/> SISO	<input type="checkbox"/> MIMO

4. Therefore, below summary is the modes of test configuration that yield the highest reading and generate the highest emission chosen to carry out the relevantly mandatory test items.

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4.2.1 RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	AN-TENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140,			
	5745~5825	149 to 165	149,157,165			
802.11ac_VHT80	5210	42	42		MCS0	MIMO
	5290	58	58			
	5530~5610	106 to 122	106,122			
	5775	155	155			

RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	AN-TENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48		MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46		MCS8	MIMO
	5270~5310	54 to 62	54,62			
	5510~5670	102 to 134	102,110,134			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	MCS0	MIMO	
	5290	58	58			
	5530~5610	106 to 122	106,122			
	5775	155	155			

Note:

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

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4.2.2 ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	AN-TENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	2TX
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48		MCS8	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	5745~5825	149 to 165	149,157,165			
802.11ac_VHT20	5180~5240	36 to 48	36,44,48		MCS0	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5700	100 to 140	100,116,140			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46		MCS8	MIMO
	5270~5310	54 to 62	54,62			
	5510~5670	102 to 134	102,110,134			
	5755~5795	151 to 159	151,159			
802.11ac_VHT40	5190~5230	38 to 46	38,46	MCS0	MIMO	
	5270~5310	54 to 62	54,62			
	5510~5670	102 to 134	102,110,134			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42	MCS0	MIMO	
	5290	58	58			
	5530~5610	106 to 122	106,122			
	5775	155	155			

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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: +/-2.3dB
	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB
Polarization: Horizontal	9kHz~30MHz: +/-2.3dB
	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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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.
EMI Test Receiver	R&S	ESCI 3	100335	02/12/2019	02/11/2020
LISN	SCHWARZ-BECK	NSLK 8127	8127-649	04/02/2019	04/01/2020
Coaxial Cables	N/A	WK CE Cable	N/A	01/02/2020	01/01/2021
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R	N.C.R

6.3 EUT Setup

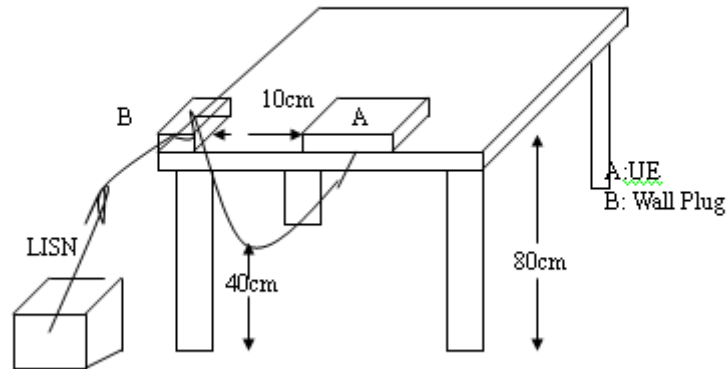
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz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

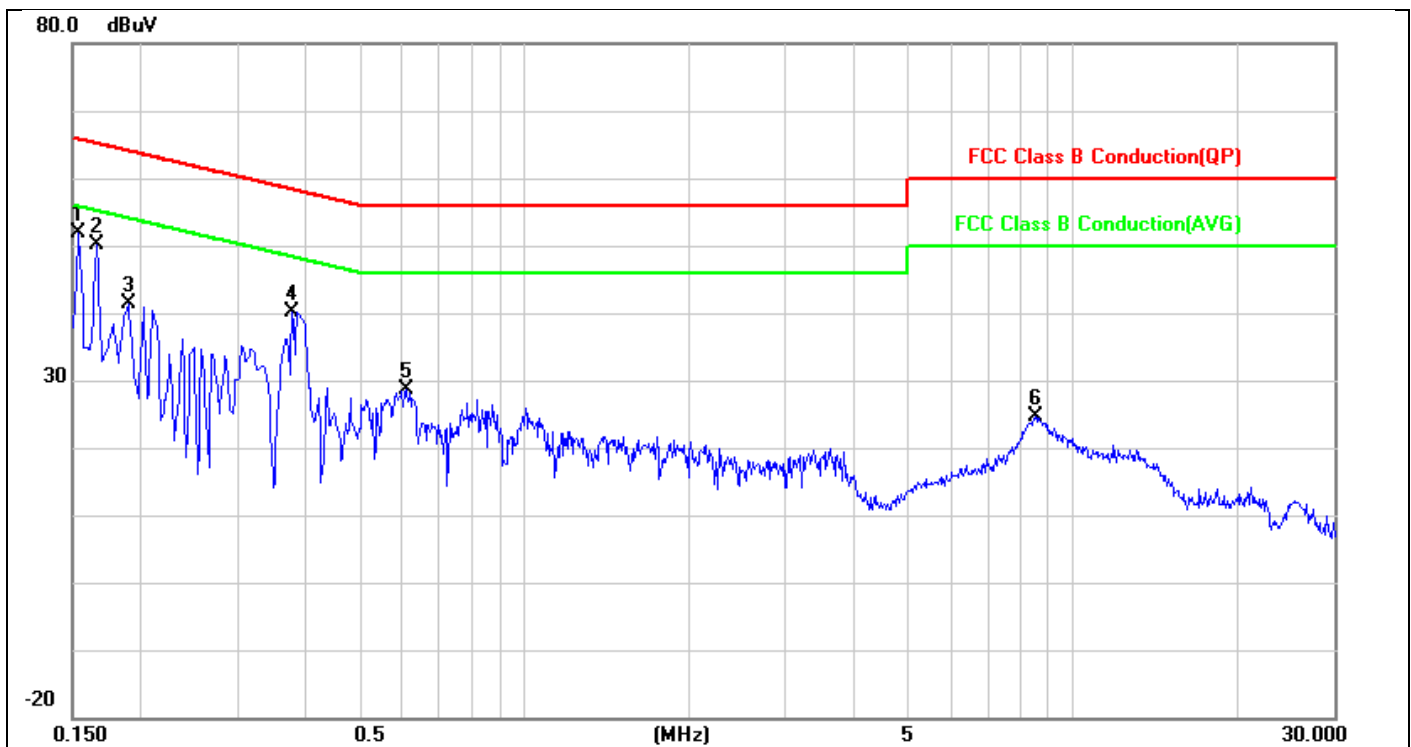
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Dipole Antenna (Part No.: ANT-DB1-RAF-RPS)

Description:	Operation	Date:	2020/02/06
Line:	L1	Temp.(°C)/Hum.(%):	20.5(°C)/67%
Test Voltage:	AC 120V/60Hz	Test By:	Thomas
Report Number:	ER-2019-B0067		



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1540	51.88	0.00	51.88	65.78	-13.90	peak	
2		0.1660	50.05	0.00	50.05	65.16	-15.11	peak	
3		0.1900	41.38	0.01	41.39	64.04	-22.65	peak	
4		0.3780	40.20	0.01	40.21	58.32	-18.11	peak	
5		0.6100	28.71	0.01	28.72	56.00	-27.28	peak	
6		8.5740	24.40	0.25	24.65	60.00	-35.35	peak	

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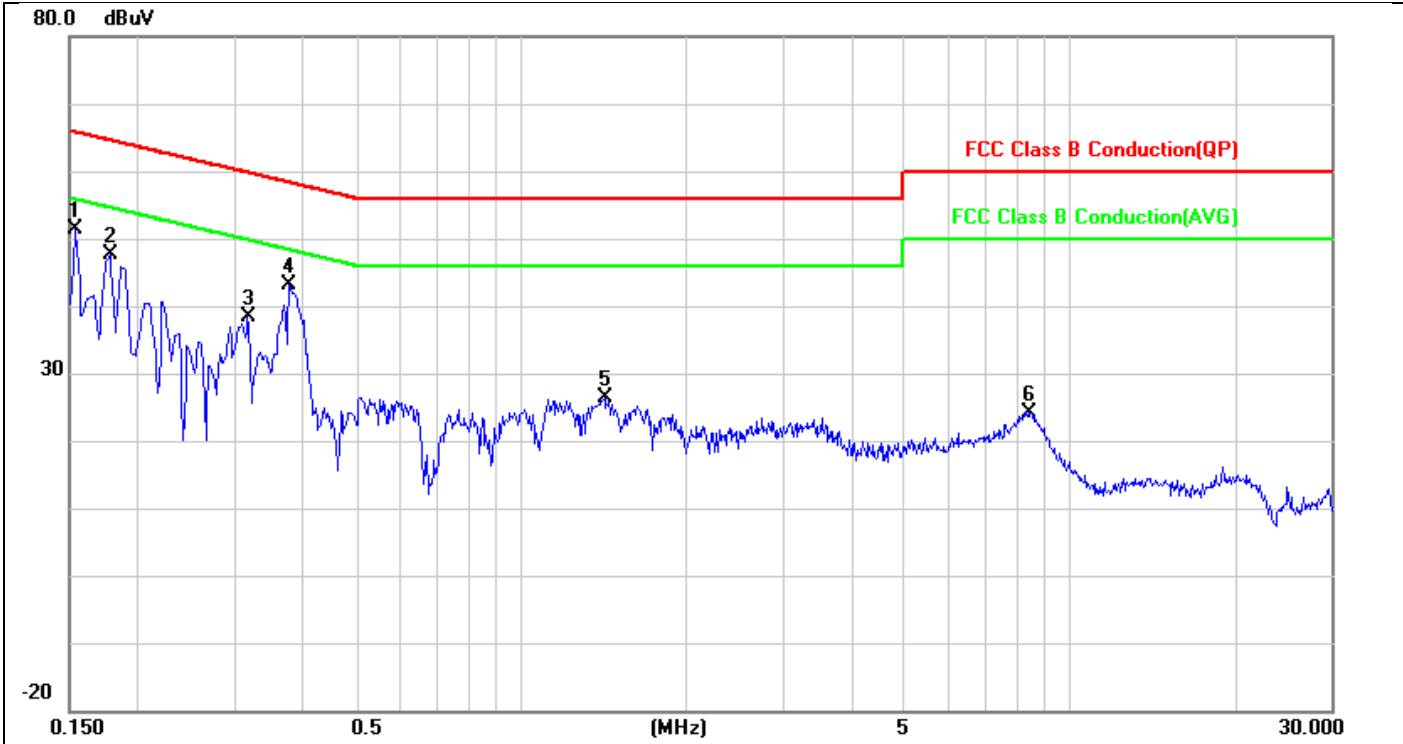
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Description:	Operation	Date:	2020/02/06
Line:	N	Temp.(°C)/Hum.(%):	20.5(°C)/67%
Test Voltage:	AC 120V/60Hz	Test By:	Thomas
Report Number:	ER-2019-B0067		



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
1	*	0.1540	51.34	0.00	51.34	65.78	-14.44	peak	
2		0.1780	47.60	0.01	47.61	64.58	-16.97	peak	
3		0.3180	38.36	0.01	38.37	59.76	-21.39	peak	
4		0.3780	43.22	0.01	43.23	58.32	-15.09	peak	
5		1.4220	26.29	0.03	26.32	56.00	-29.68	peak	
6		8.4180	23.84	0.25	24.09	60.00	-35.91	peak	

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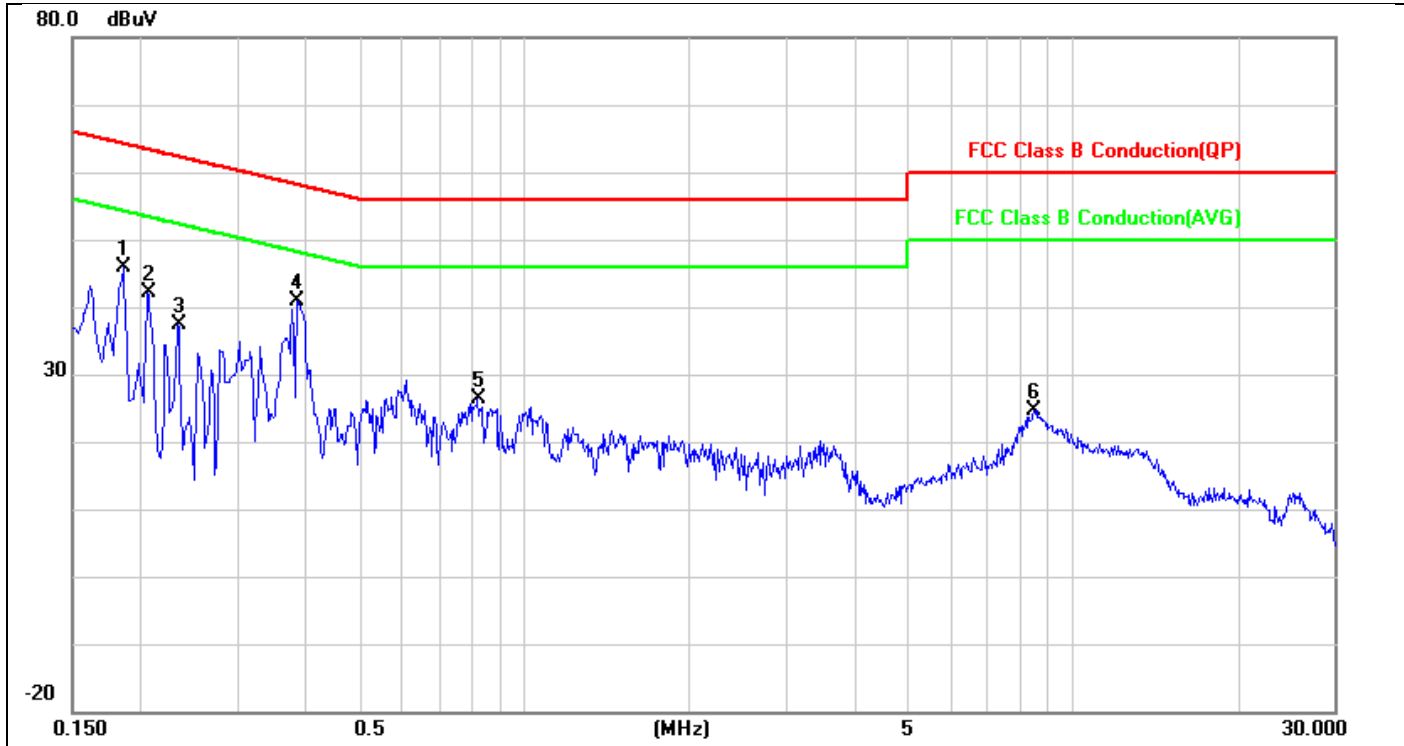
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PCB Antenna (Part No.: FXP830.07.0100C)

Description:	Operation	Date:	2020/02/06
Line:	L1	Temp.(°C)/Hum.(%):	20.5(°C)/67%
Test Voltage:	AC 120V/60Hz	Test By:	Thomas
Report Number:	ER-2019-B0067		



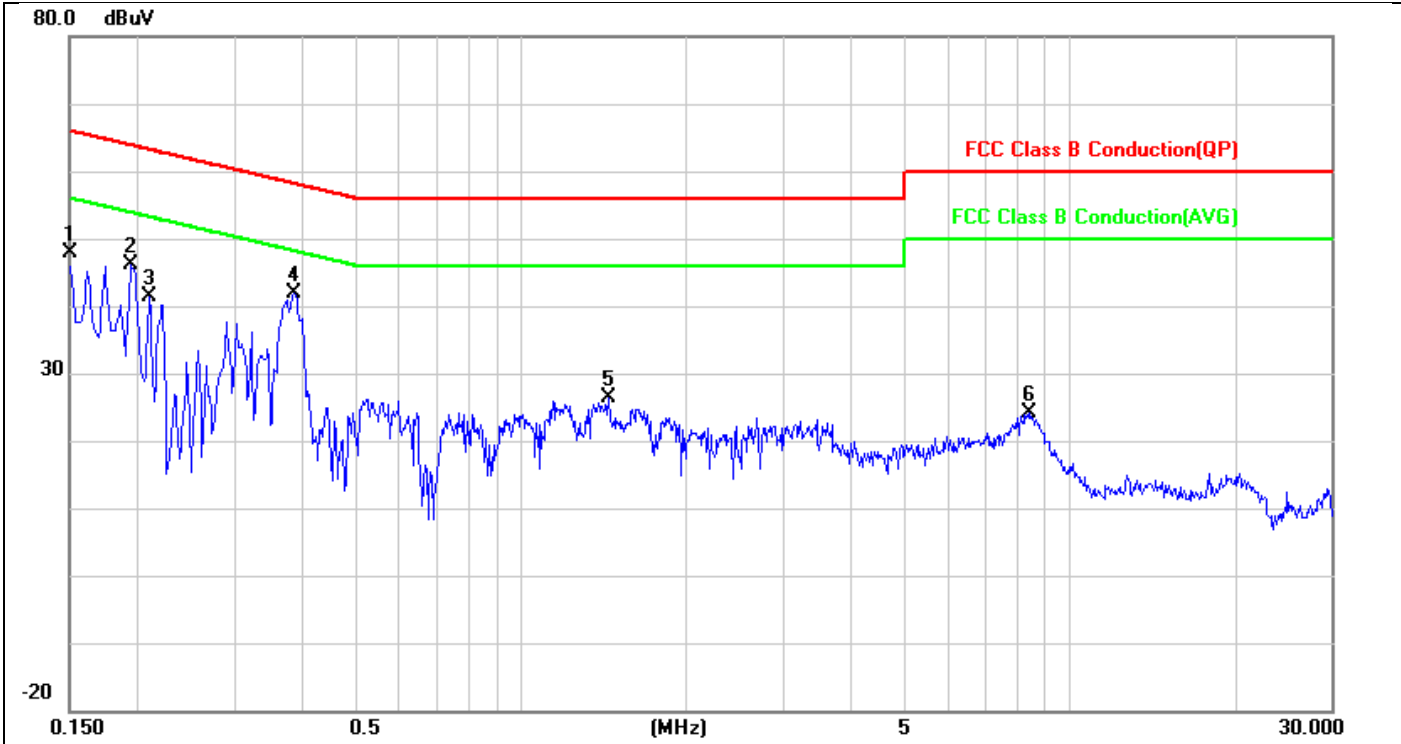
No.	Mk.	Freq.	Reading	Factor	Measure-ment	Limit	Over	Detector	Comment
		(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1860	45.77	0.01	45.78	64.21	-18.43	peak	
2		0.2060	42.00	0.01	42.01	63.37	-21.36	peak	
3		0.2340	37.45	0.01	37.46	62.31	-24.85	peak	
4	*	0.3860	40.92	0.01	40.93	58.15	-17.22	peak	
5		0.8260	26.42	0.02	26.44	56.00	-29.56	peak	
6		8.5220	24.42	0.25	24.67	60.00	-35.33	peak	

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Description:	Operation	Date:	2020/02/06
Line:	N	Temp.(°C)/Hum.(%):	20.5(°C)/67%
Test Voltage:	AC 120V/60Hz	Test By:	Thomas
Report Number:	ER-2019-B0067		



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Comment
		(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)		
1		0.1500	47.86	0.00	47.86	66.00	-18.14	peak	
2		0.1940	46.08	0.01	46.09	63.86	-17.77	peak	
3		0.2100	41.42	0.01	41.43	63.21	-21.78	peak	
4	*	0.3860	41.77	0.01	41.78	58.15	-16.37	peak	
5		1.4460	26.32	0.03	26.35	56.00	-29.65	peak	
6		8.4740	23.98	0.25	24.23	60.00	-35.77	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.

7.1 Measurement Procedure:

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

Duty Cycle:

Mode	Duty Cycle (%) =Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	95.00	0.22	0.49	1.00
802.11n_20	92.19	0.35	0.53	1.00
802.11ac_20	94.62	0.24	0.53	1.00
802.11n_40	90.61	0.43	1.08	2.00
802.11ac_40	86.82	0.61	1.07	2.00
802.11ac_80	78.57	1.05	2.20	3.00

- █ Duty Cycle Factor: $10 * \log(1/0.95) = 0.22$
- █ Duty Cycle Factor: $10 * \log(1/0.9219) = 0.35$
- █ Duty Cycle Factor: $10 * \log(1/0.9462) = 0.24$
- █ Duty Cycle Factor: $10 * \log(1/0.9061) = 0.43$
- █ Duty Cycle Factor: $10 * \log(1/0.8682) = 0.61$
- █ Duty Cycle Factor: $10 * \log(1/0.7857) = 1.05$

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7.2 DUTY CYCLE TEST SIGNAL MEASUREMENT RESULT

802.11a



802.11n HT20



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802.11ac VHT20



802.11n HT 40



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802.11ac VHT 40



802.11ac VHT 80



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8 26DB, 99% & 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.
 - 3.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.
 - 3.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. For 99% Bandwidth: Set the spectrum analyzer as
RBW=1%,
VBW = 3*RBW,
Span = 30M/50MHz,
Detector=Sample,
Sweep=auto.
7. Turn on the 99% bandwidth function, max reading.
8. Repeat above procedures until all frequency of interest measured was complete.

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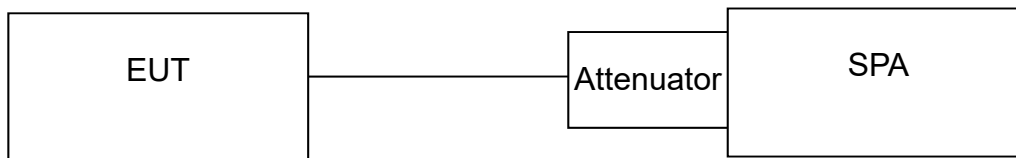
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8.3 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/05/2020	01/04/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/05/2020	01/04/2021

8.4 Test Set-up



8.5 Measurement Result

8.5.1 FCC 26dB Bandwidth

802.11a_Ch0			802.11a_Ch1		
Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.43	12.885	5180	19.92	12.993
5220	19.48	12.896	5220	25.61	14.084
5240	19.17	12.826	5240	20.99	13.220
5260	18.78	12.737	5260	22.15	13.454
5300	19.58	12.918	5300	20.18	13.049
5320	19.26	12.847	5320	18.88	12.760
5500	18.93	12.772	5500	19.32	12.860
5580	21.84	13.393	5580	21.52	13.328
5700	19.05	12.799	5700	19.22	12.838

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802.11n_HT20_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.84	12.975	5180	20.07	13.025
5220	19.88	12.984	5220	20.13	13.038
5240	19.75	12.956	5240	19.76	12.958
5260	19.79	12.964	5260	19.79	12.964
5300	19.75	12.956	5300	19.84	12.975
5320	19.82	12.971	5320	19.8	12.967
5500	19.82	12.971	5500	19.77	12.960
5580	21.03	13.228	5580	20.98	13.218
5700	19.81	12.969	5700	19.83	12.973

802.11n_HT20_Ch1

802.11n_HT40_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	41.93	16.225	5190	42.56	16.290
5230	42.21	16.254	5230	40.87	16.114
5270	42.93	16.328	5270	40.28	16.051
5310	41.61	16.192	5310	42.63	16.297
5510	42.98	16.333	5510	43.17	16.352
5550	48.95	16.898	5550	49.46	16.943
5670	42.52	16.286	5670	41.69	16.200

802.11n_HT40_Ch1

802.11ac_VHT80_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	80.99	19.084	5210	82.21	19.149
5290	82.01	19.139	5290	82.86	19.183
5530	81.85	19.130	5530	81.09	19.090
5610	81.16	19.093	5610	83.4	19.212

802.11ac_VHT80_Ch1

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8.5.2 6dB Bandwidth (5725 MHz~ 5850 MHz) measure with Peak detector for FCC
802.11a_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.31	11.850	5745	14.47	11.605
5785	15.07	11.781	5785	14.51	11.617
5825	14.85	11.717	5825	15.09	11.787

802.11a_Ch1
802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.12	11.796	5745	15.16	11.807
5785	15.18	11.813	5785	15.17	11.810
5825	15.17	11.810	5825	15.13	11.798

802.11n_HT20_Ch1
802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	33.89	15.301	5755	35.12	15.456
5795	35.08	15.451	5795	35.15	15.459

802.11n_HT40_Ch1
802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.18	18.761	5775	75.19	18.762

802.11ac_VHT80_Ch1

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8.5.3 ISED 99% Bandwidth
802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.339	12.132	5180	16.363	12.139
5220	16.334	12.131	5220	16.383	12.144
5240	16.301	12.122	5240	16.384	12.144
5260	16.306	12.123	5260	16.358	12.137
5300	16.333	12.131	5300	16.354	12.136
5320	16.335	12.131	5320	16.346	12.134
5500	16.291	12.119	5500	16.321	12.127
5580	16.416	12.153	5580	16.411	12.151
5700	16.332	12.130	5700	16.291	12.119

802.11a_Ch1
802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.417	12.410	5180	17.425	12.412
5220	17.421	12.411	5220	17.436	12.414
5240	17.421	12.411	5240	17.427	12.412
5260	17.412	12.408	5260	17.426	12.412
5300	17.43	12.413	5300	17.416	12.409
5320	17.42	12.410	5320	17.413	12.409
5500	17.402	12.406	5500	17.418	12.410
5580	17.489	12.428	5580	17.489	12.428
5700	17.421	12.411	5700	17.416	12.409

802.11n_HT20_Ch1

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802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	35.759	15.534	5190	35.751	15.533
5230	35.745	15.532	5230	35.786	15.537
5270	35.797	15.538	5270	35.79	15.538
5310	35.766	15.535	5310	35.744	15.532
5510	35.762	15.534	5510	35.76	15.534
5550	35.898	15.551	5550	35.932	15.555
5670	35.787	15.537	5670	35.776	15.536

802.11n_HT40_Ch1

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	74.93	18.747	5210	74.936	18.747
5290	74.98	18.749	5290	74.95	18.748
5530	75.048	18.753	5530	74.96	18.748
5610	74.882	18.744	5610	74.901	18.745

802.11ac_VHT80_Ch1

8.5.4 6dB Bandwidth (5725 MHz~ 5850 MHz) measure with sample detector for ISED

802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	15.94	12.025	5745	16.12	12.074
5785	16.08	12.063	5785	16.02	12.047
5825	16.13	12.076	5825	15.88	12.009

802.11a_Ch1

802.11n_HT20_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.94	12.289	5745	17.07	12.322
5785	17.07	12.322	5785	17	12.304
5825	17.03	12.312	5825	17.13	12.338

802.11n_HT20_Ch1

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802.11n_HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.72	15.529	5755	35.68	15.524
5795	35.84	15.544	5795	35.93	15.555

802.11n_HT40_Ch1

802.11ac_VHT80_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	74.95	18.748	5775	75.57	18.783

802.11ac_VHT80_Ch1

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8.5.5 99% BW Verification for DFS Function

802.11a_Ch0			802.11a_Ch1		
Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)	Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.14	< 5250	5240	5248.19	< 5250
5745	5736.81	> 5725	5745	5736.82	> 5725

802.11n_HT20_Ch0			802.11n_HT20_Ch1		
Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)	Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.68	< 5250	5240	5248.68	< 5250
5745	5736.27	> 5725	5745	5736.28	> 5725

802.11n_HT40_Ch0			802.11n_HT40_Ch1		
Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)	Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5247.95	< 5250	5230	5247.94	< 5250
5755	5737.09	> 5725	5755	5737.10	> 5725

802.11ac_VHT80_Ch0			802.11ac_VHT80_Ch1		
Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)	Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5247.47	< 5250	5210	5247.45	< 5250
5775	5737.43	> 5725	5775	5737.40	> 5725

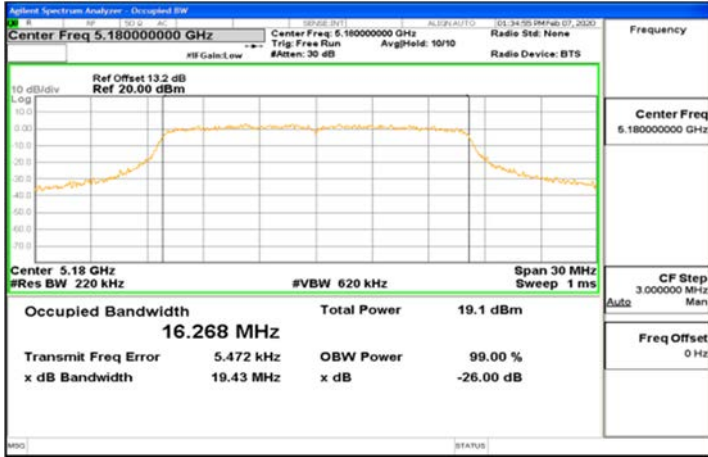
Please see next page for test plots.

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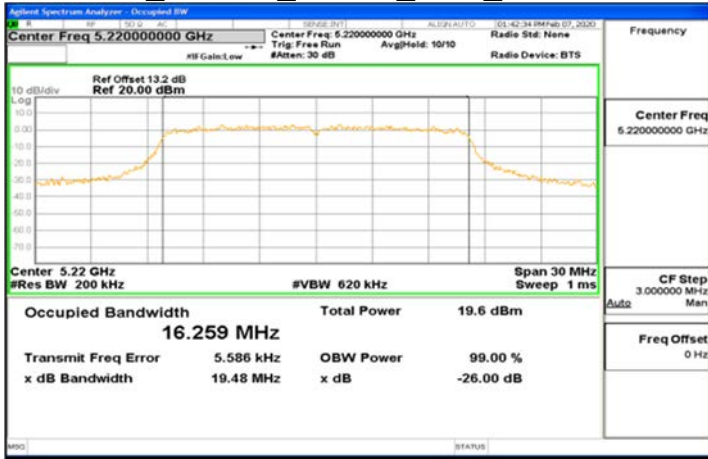
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FCC 802.11a 20MHz_Main_5260MHz



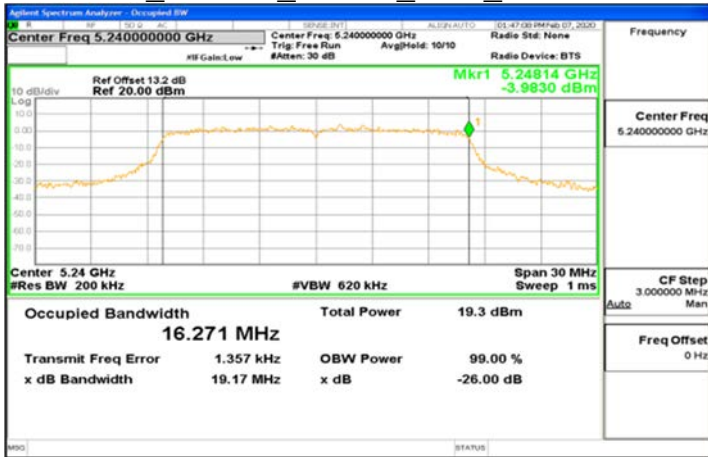
FCC 802.11a 20MHz_Main_5220MHz



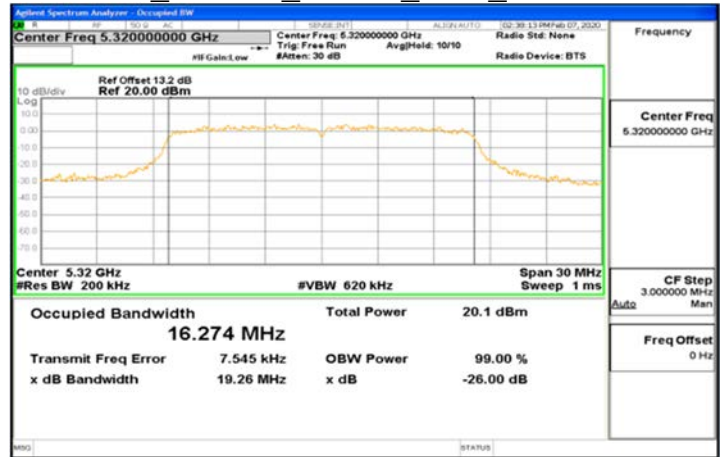
FCC 802.11a 20MHz_Main_5300MHz



FCC 802.11a 20MHz_Main_5240MHz



FCC 802.11a 20MHz_Main_5320MHz

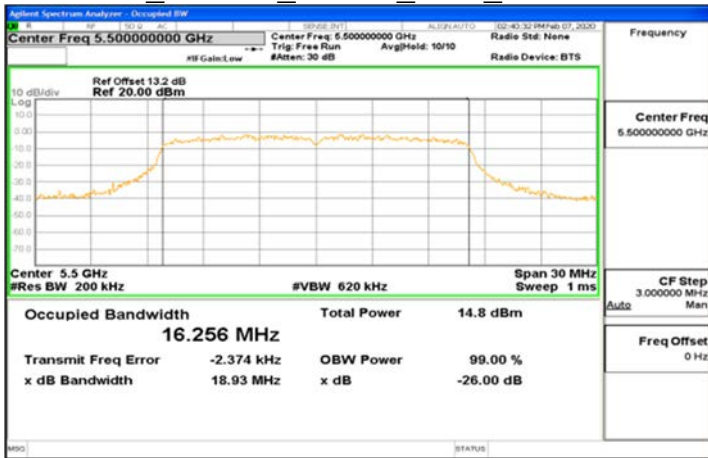


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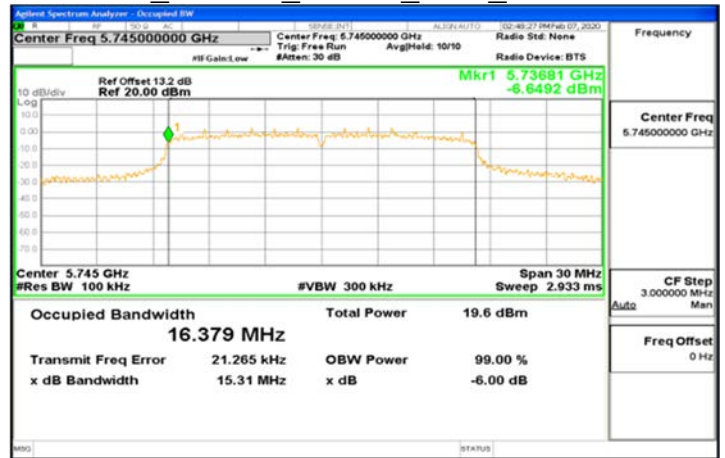
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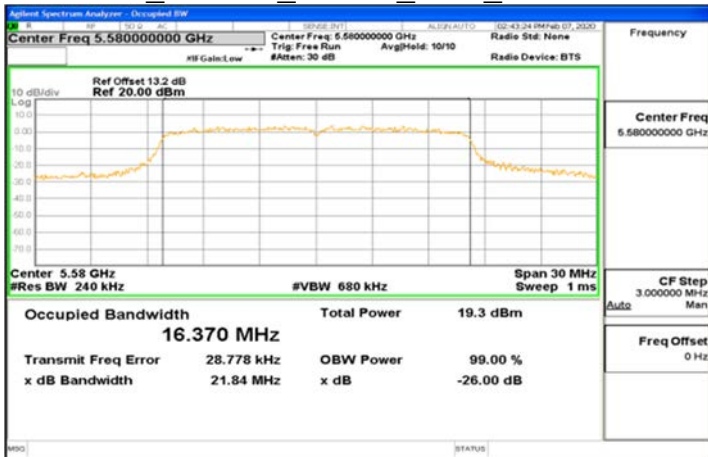
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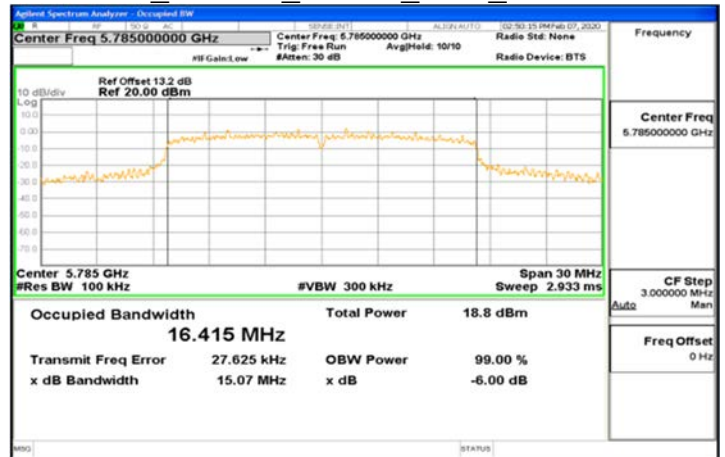
FCC 802.11a 20MHz_Main_5745MHz



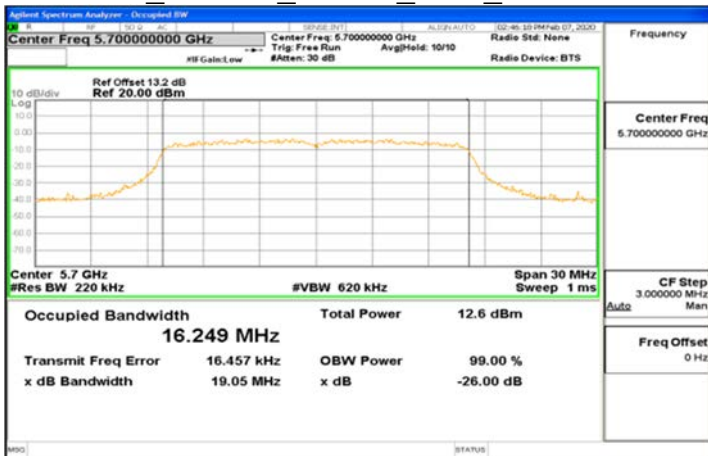
FCC 802.11a 20MHz_Main_5580MHz



FCC 802.11a 20MHz_Main_5785MHz



FCC 802.11a 20MHz_Main_5700MHz



FCC 802.11a 20MHz_Main_5825MHz

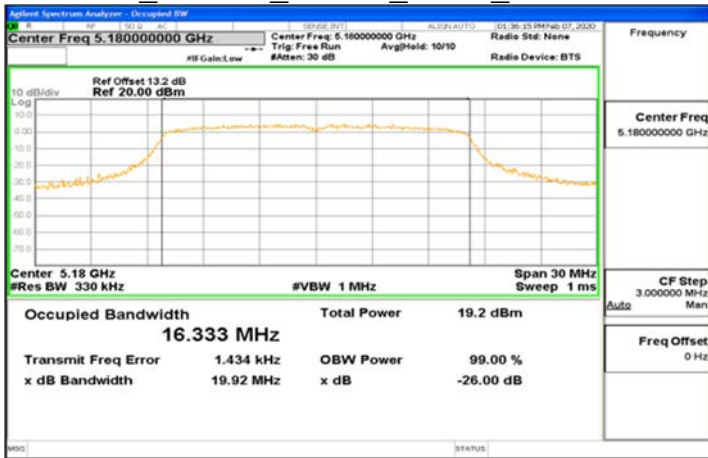


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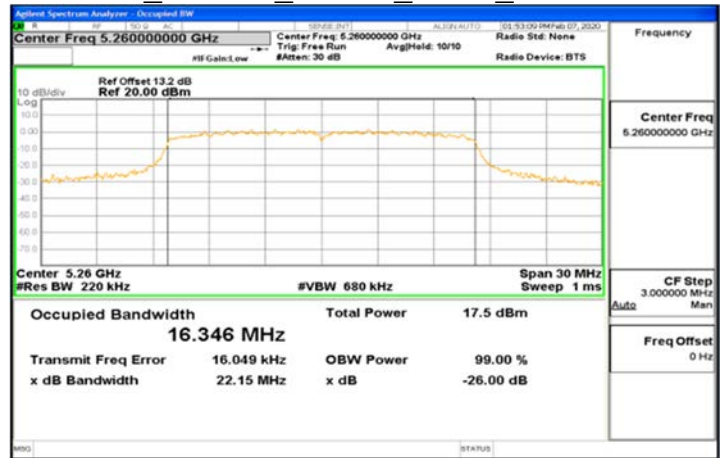
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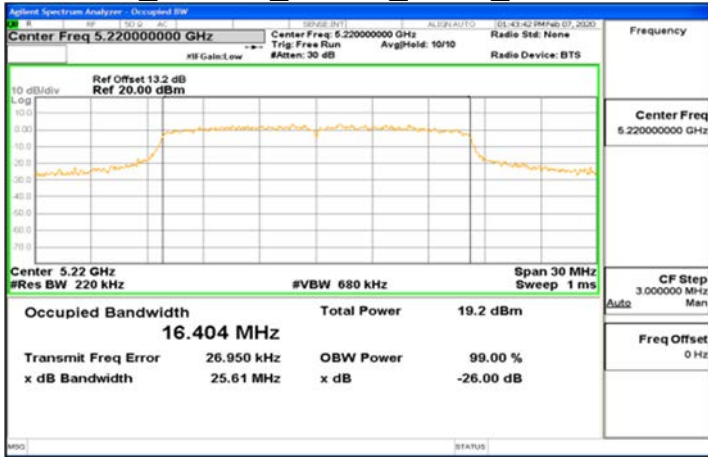
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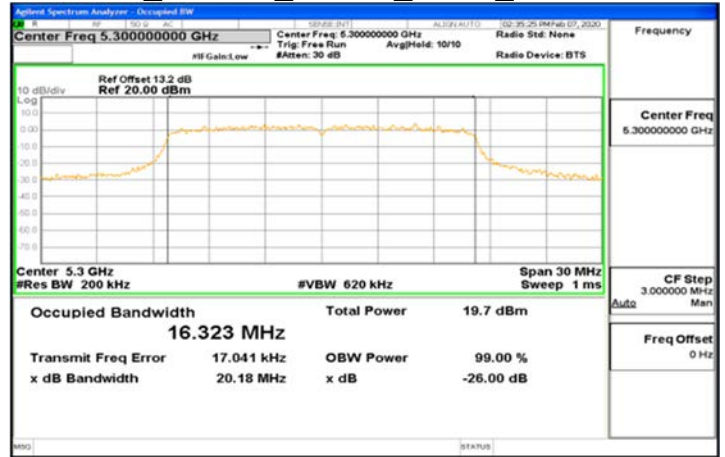
FCC 802.11a_20MHz_AUX1_5260MHz



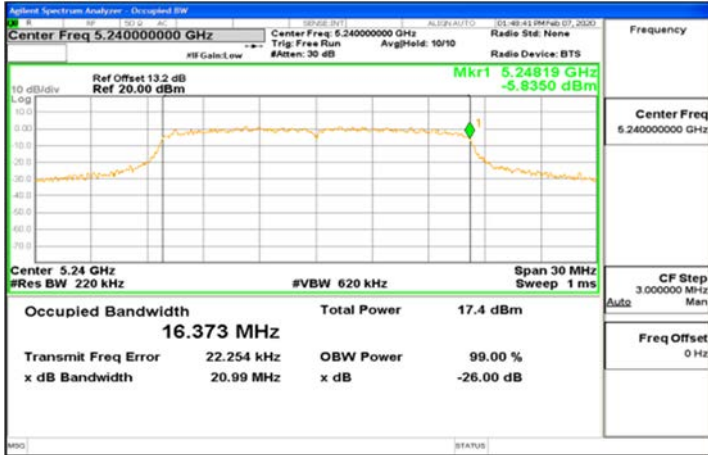
FCC 802.11a_20MHz_AUX1_5220MHz



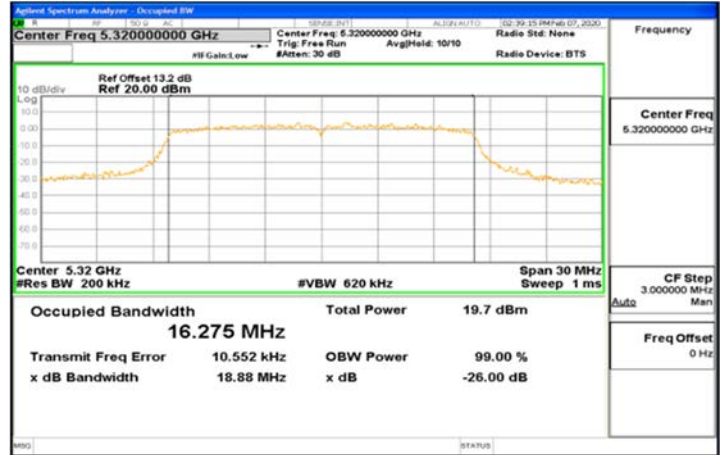
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FCC 802.11a_20MHz_AUX1_5240MHz



FCC 802.11a_20MHz_AUX1_5320MHz

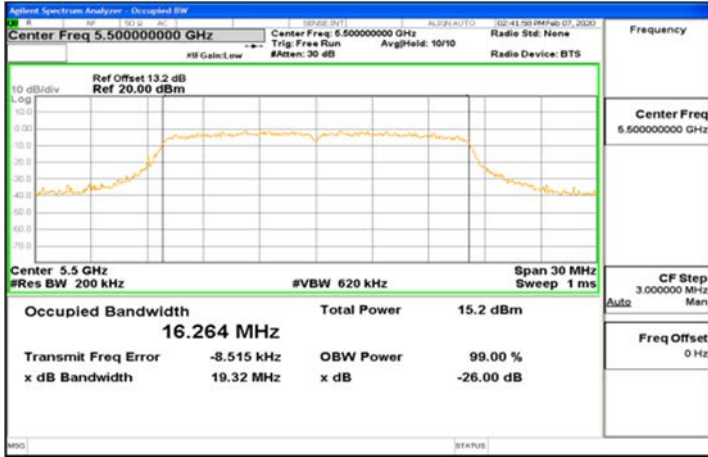


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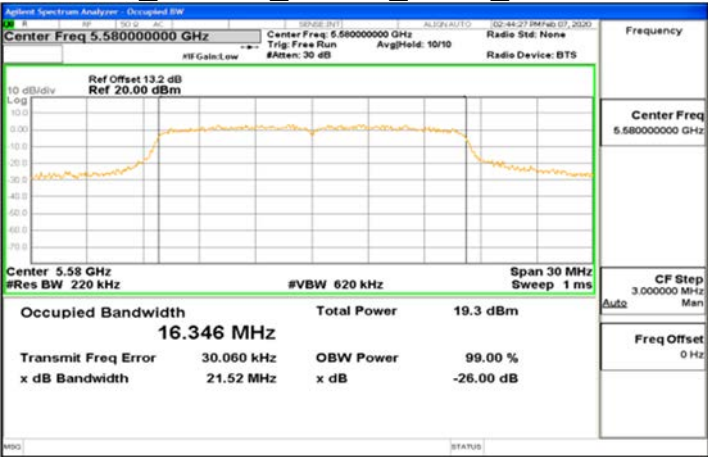
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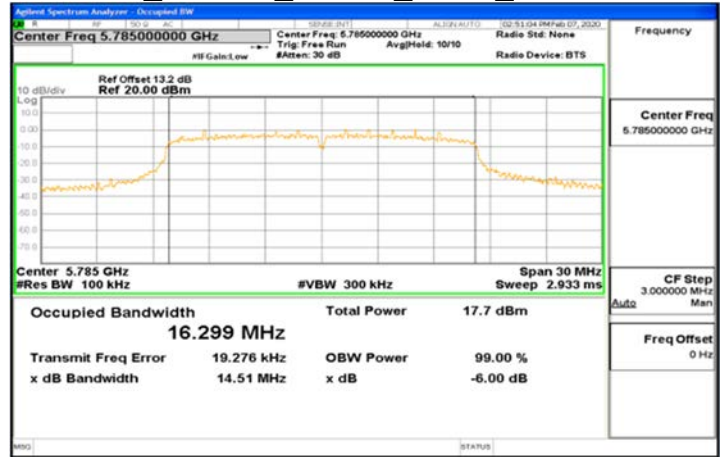
FCC 802.11a_20MHz_AUX1_5745MHz



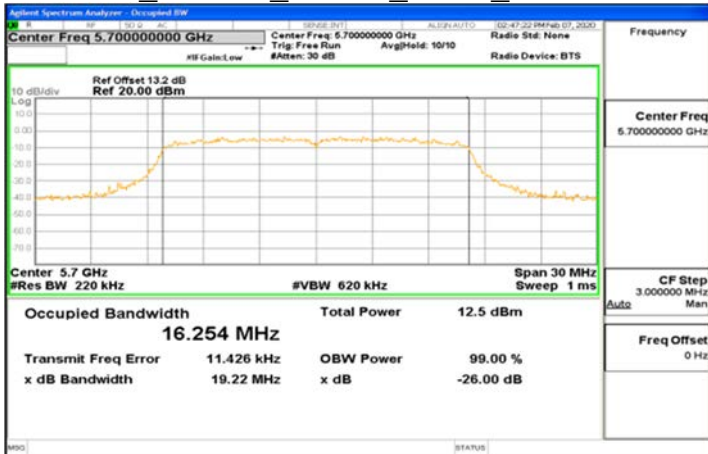
FCC 802.11a_20MHz_AUX1_5580MHz



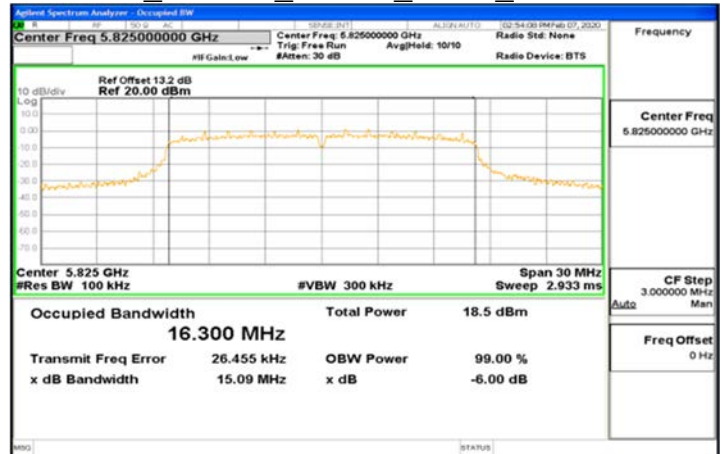
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FCC 802.11a_20MHz_AUX1_5700MHz



FCC 802.11a_20MHz_AUX1_5825MHz

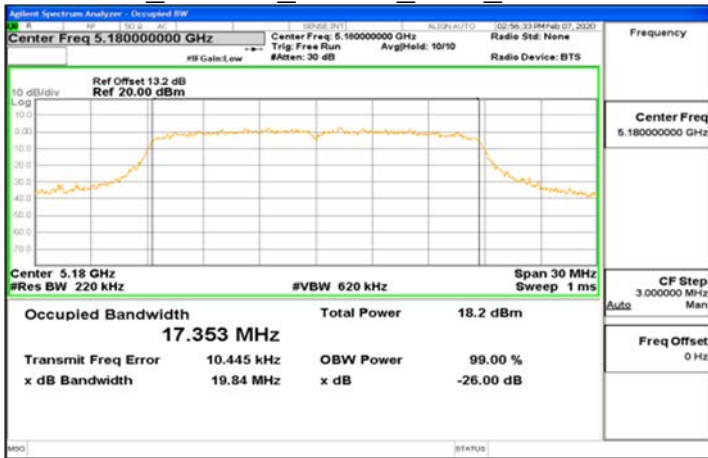


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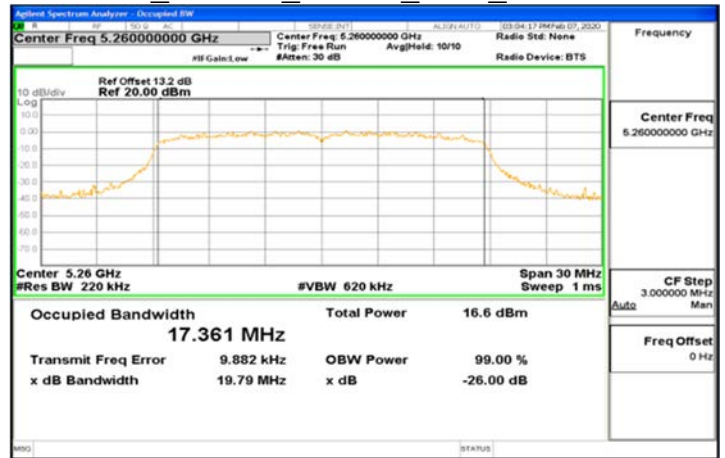
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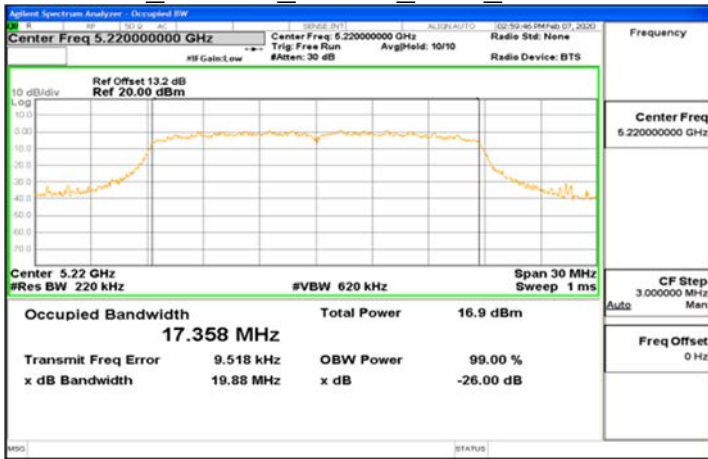
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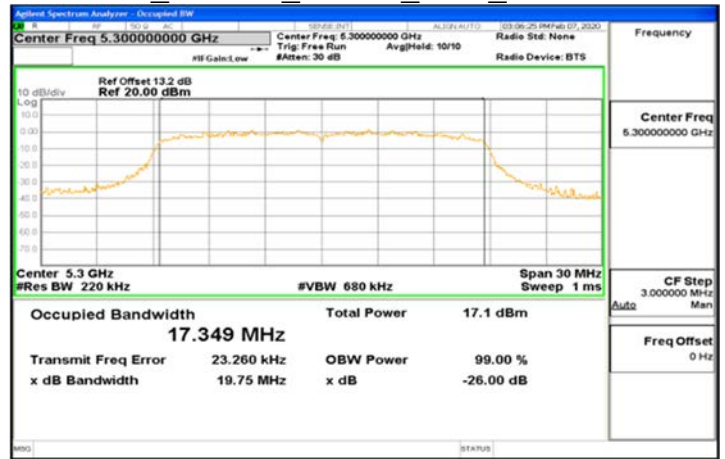
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FCC 802.11n 20MHz_Main_5220MHz



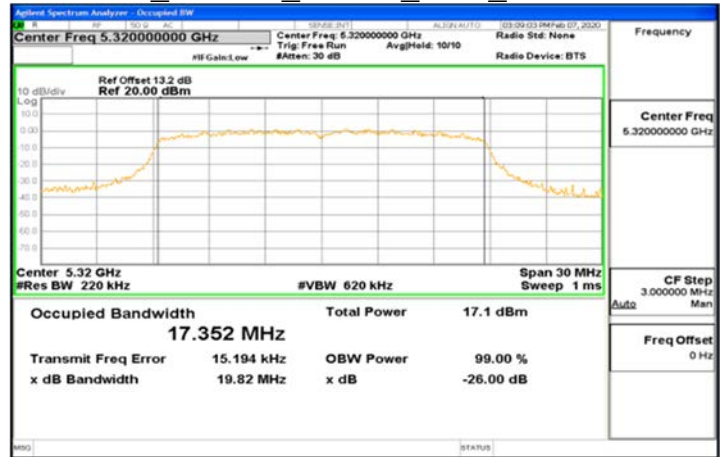
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FCC 802.11n 20MHz_Main_5240MHz



FCC 802.11n 20MHz_Main_5320MHz

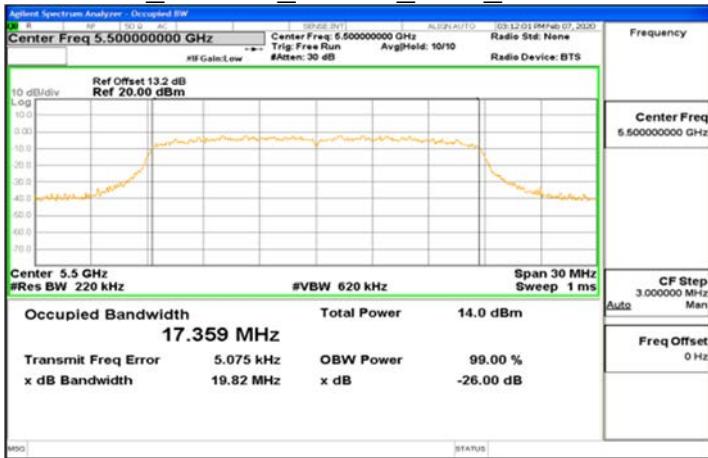


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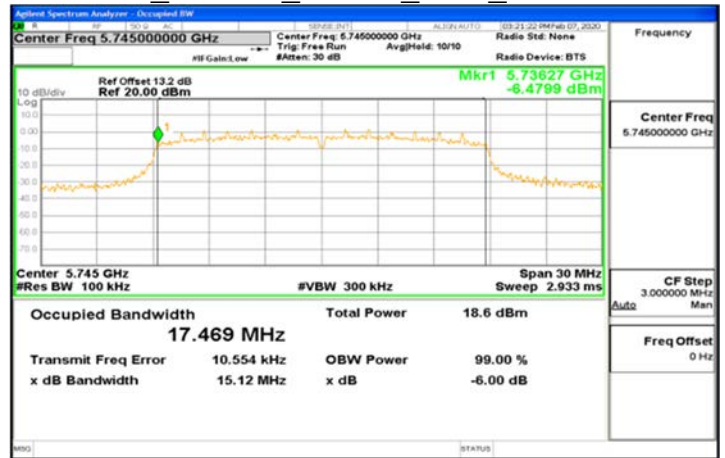
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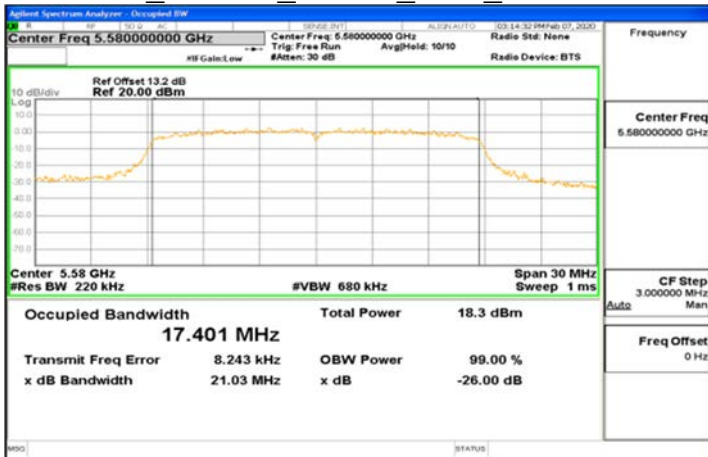
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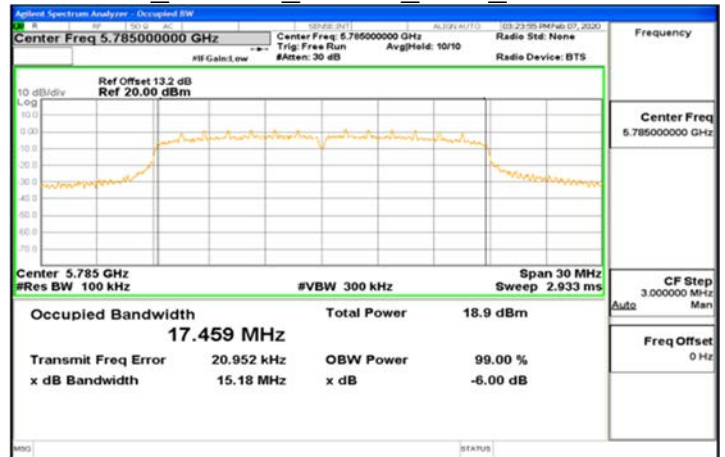
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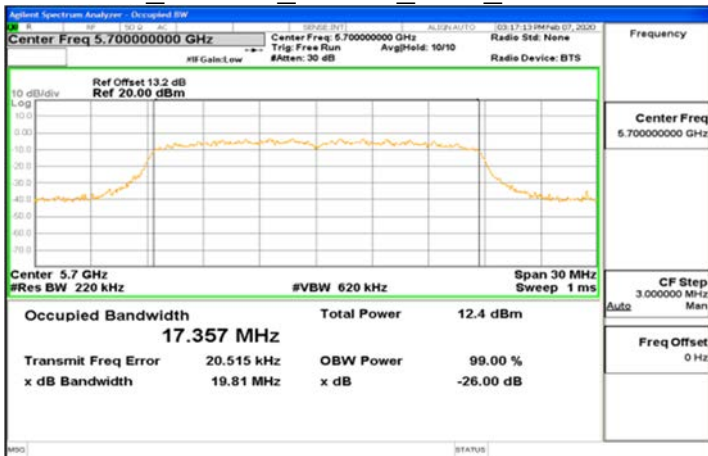
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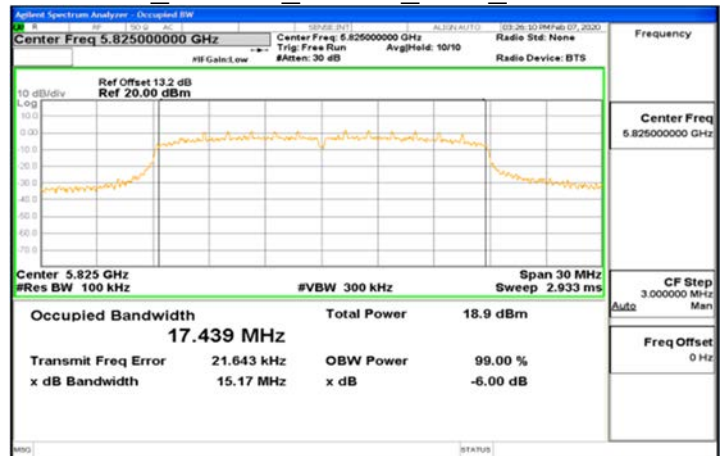
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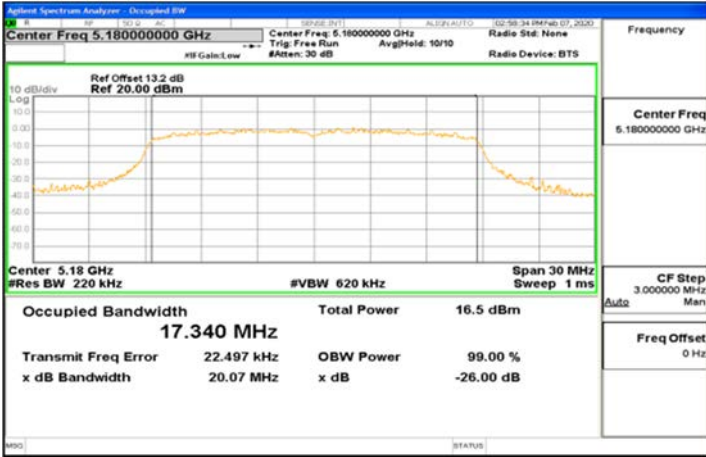


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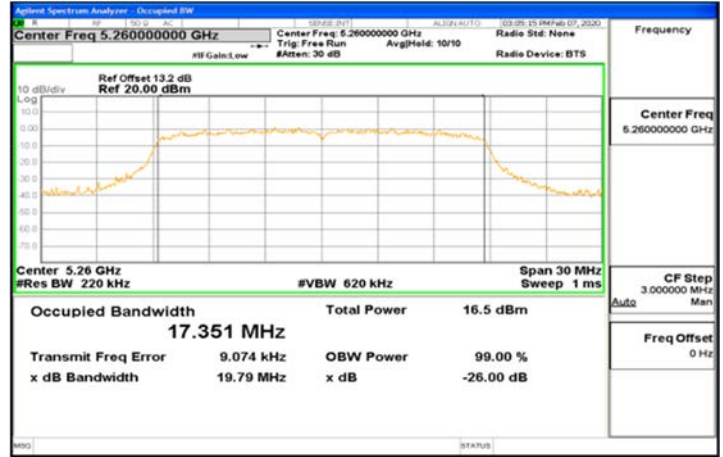
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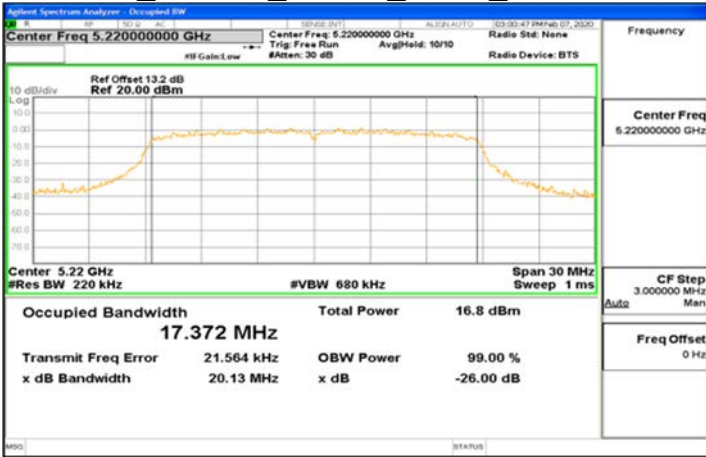
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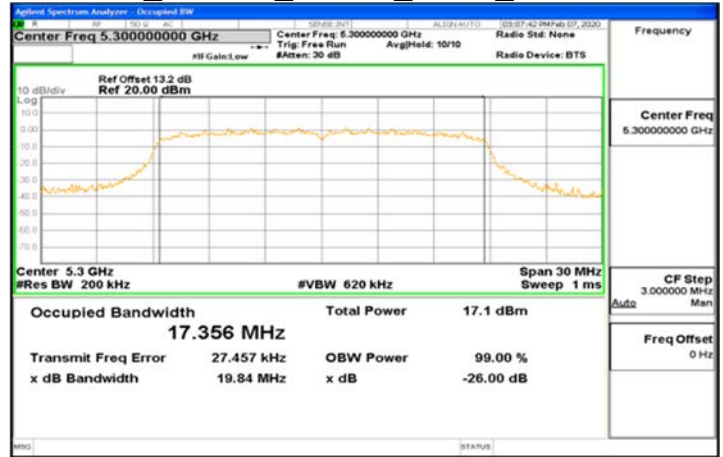
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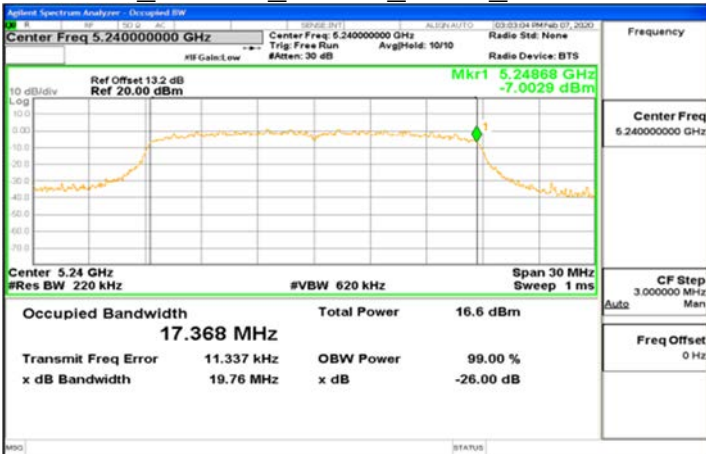
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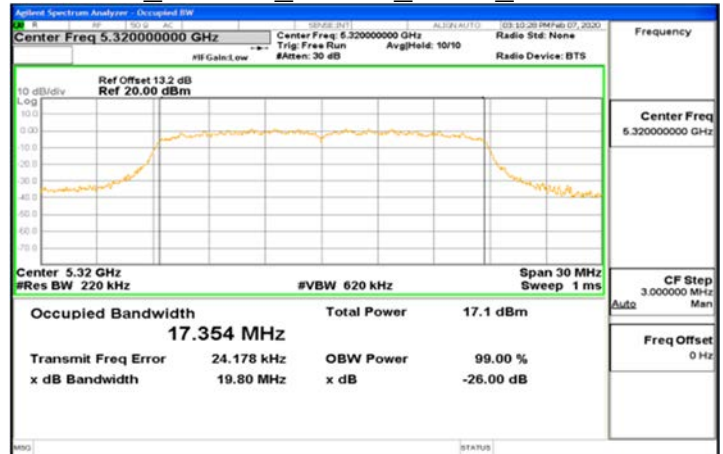
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FCC 802.11n_20MHz_AUX1_5240MHz



FCC 802.11n_20MHz_AUX1_5320MHz

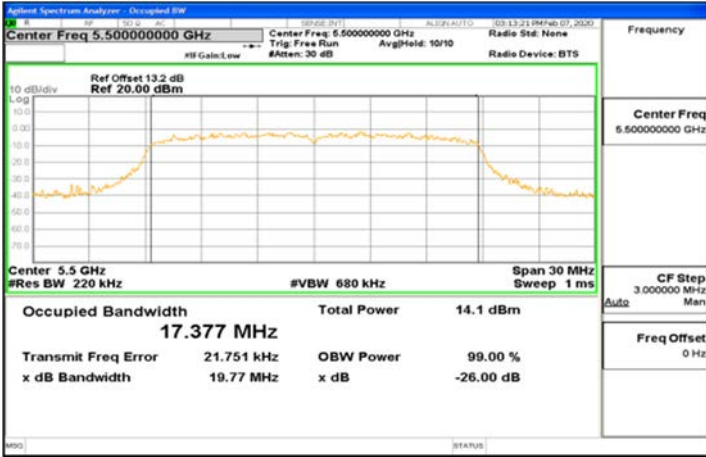


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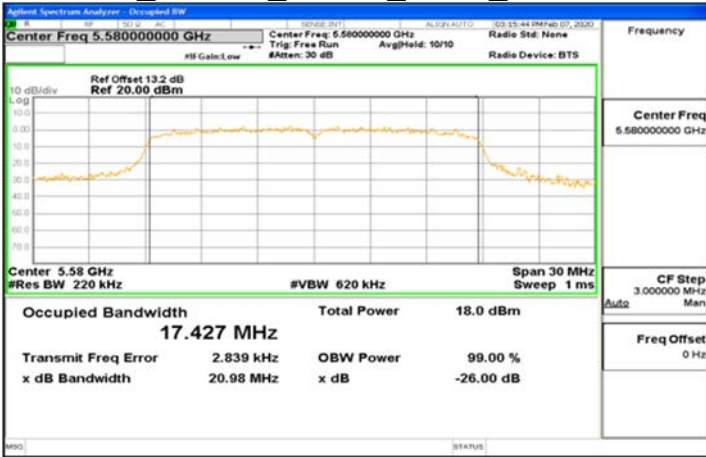
FCC 802.11n_20MHz_AUX1_5500MHz



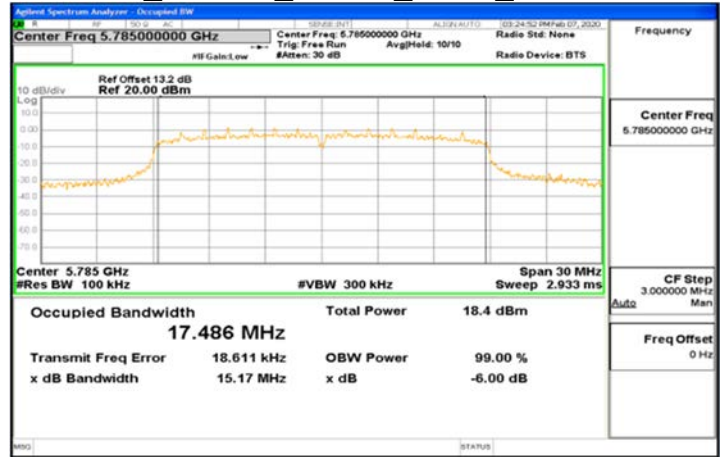
FCC 802.11n_20MHz_AUX1_5745MHz



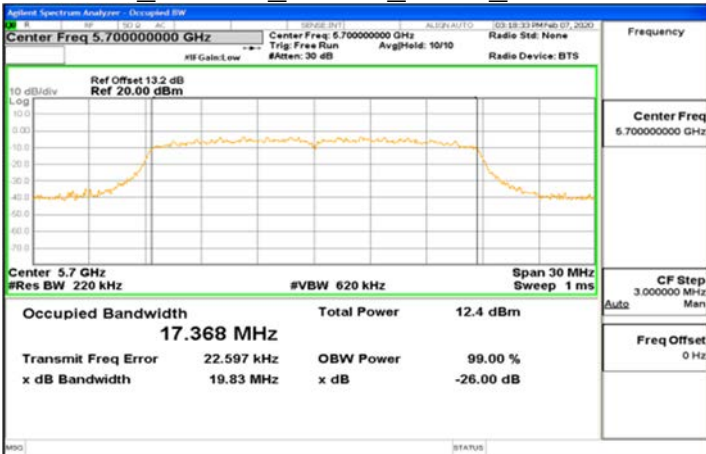
FCC 802.11n_20MHz_AUX1_5580MHz



FCC 802.11n_20MHz_AUX1_5785MHz



FCC 802.11n_20MHz_AUX1_5700MHz



FCC 802.11n_20MHz_AUX1_5825MHz

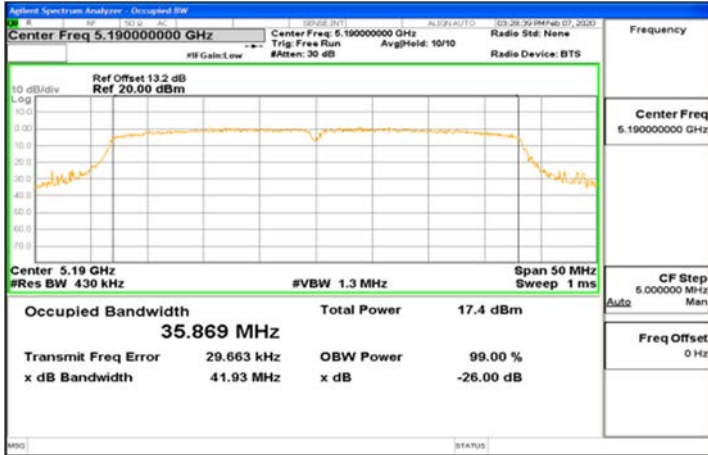


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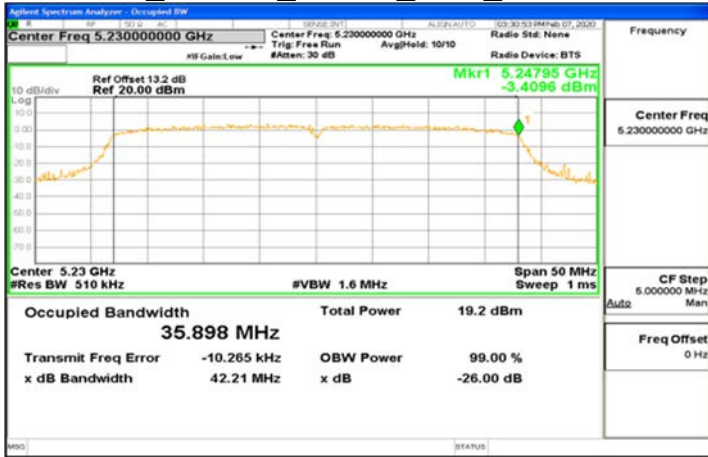
FCC 802.11n_40MHz_Main_5190MHz



FCC 802.11n_40MHz_Main_5310MHz



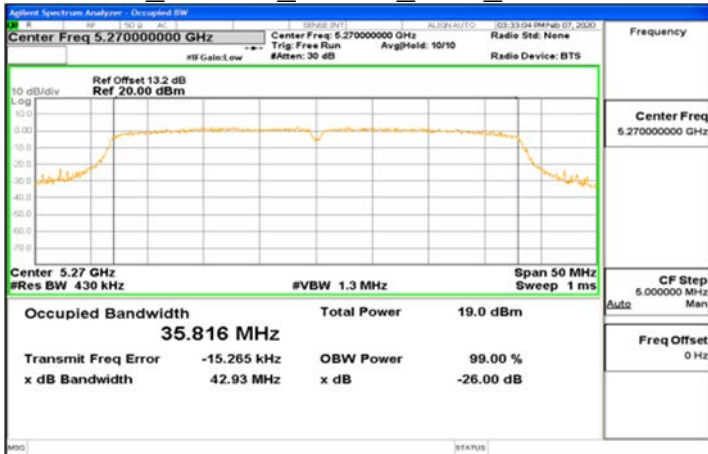
FCC 802.11n_40MHz_Main_5230MHz



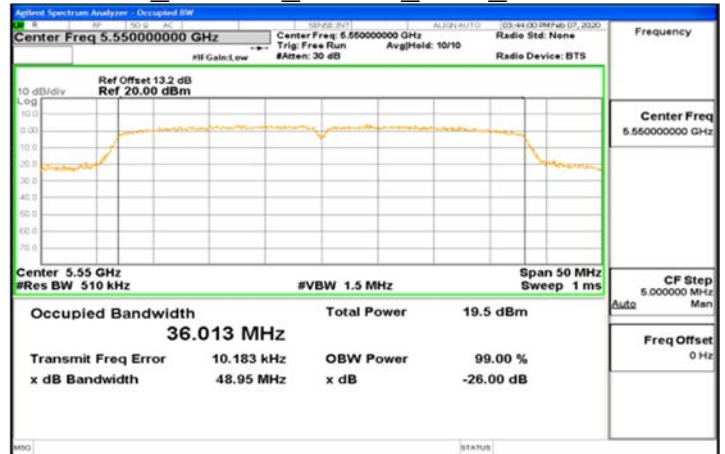
FCC 802.11n_40MHz_Main_5510MHz



FCC 802.11n_40MHz_Main_5270MHz



FCC 802.11n_40MHz_Main_5550MHz

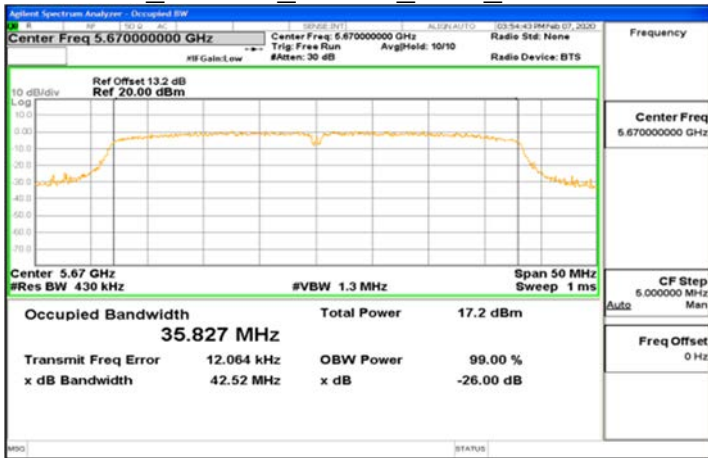


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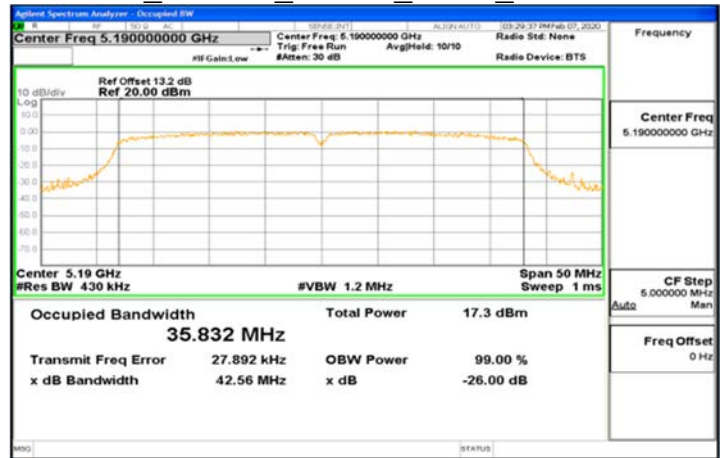
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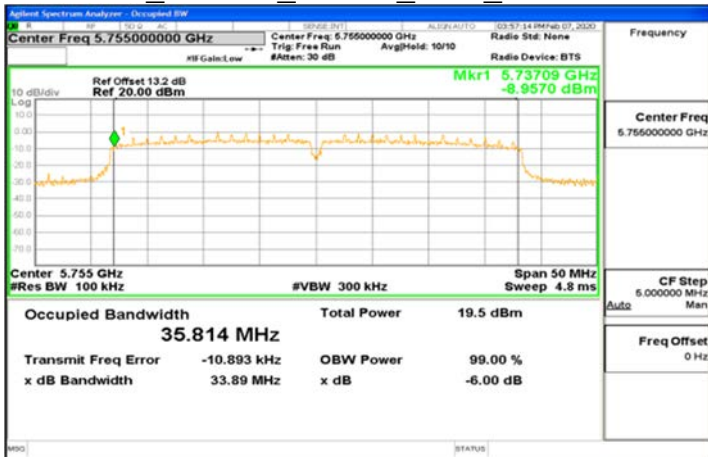
FCC 802.11n_40MHz_Main_5670MHz



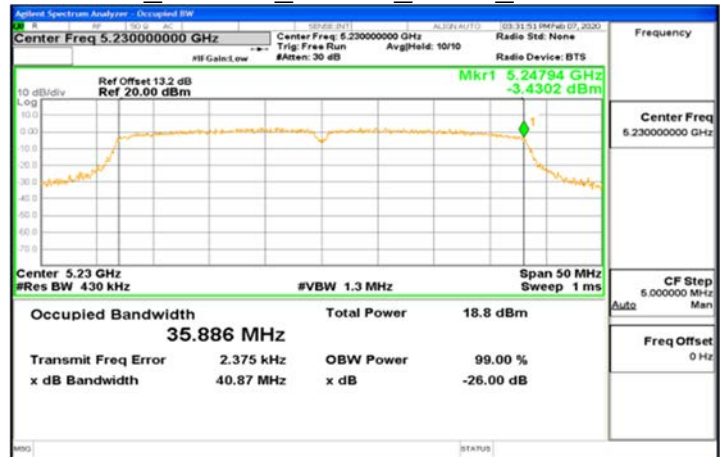
FCC 802.11n_40MHz_AUX1_5190MHz



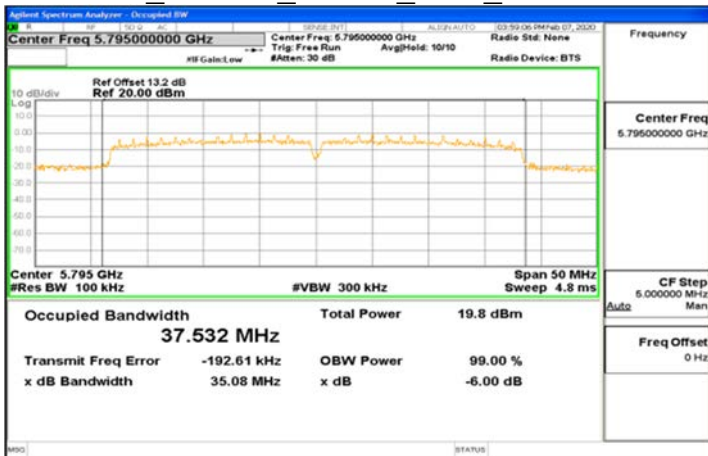
FCC 802.11n_40MHz_Main_5755MHz



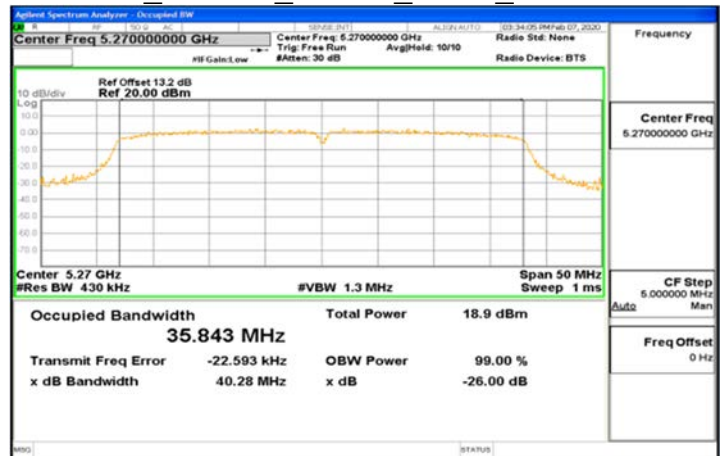
FCC 802.11n_40MHz_AUX1_5230MHz



FCC 802.11n_40MHz_Main_5795MHz



FCC 802.11n_40MHz_AUX1_5270MHz

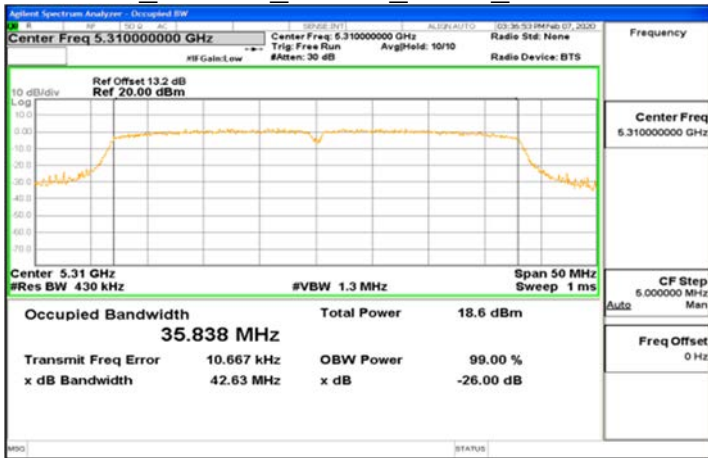


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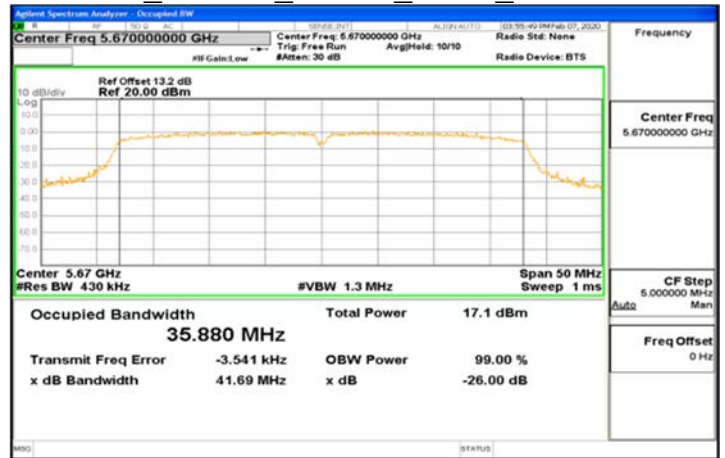
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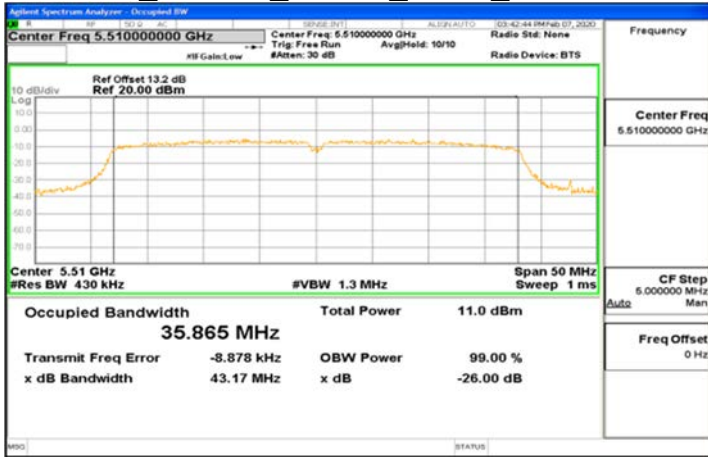
FCC 802.11n_40MHz_AUX1_5310MHz



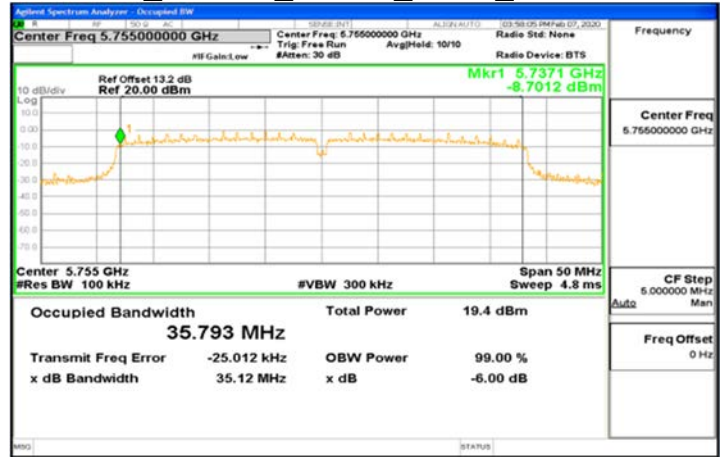
FCC 802.11n_40MHz_AUX1_5670MHz



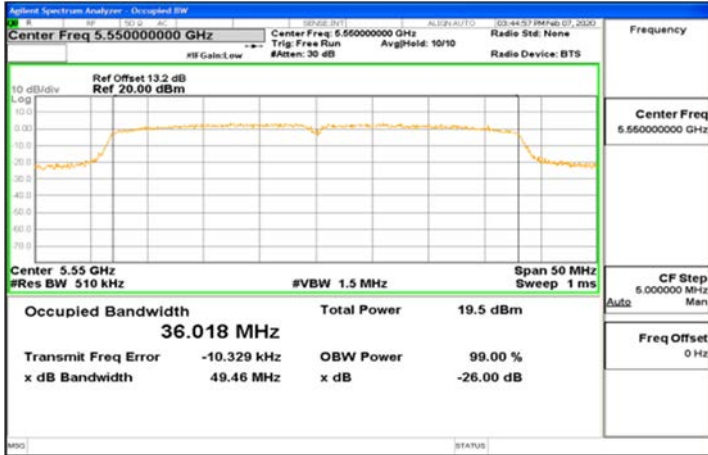
FCC 802.11n_40MHz_AUX1_5510MHz



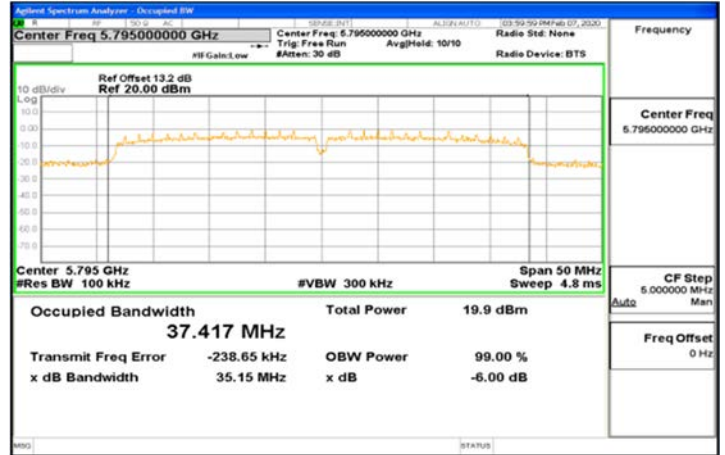
FCC 802.11n_40MHz_AUX1_5755MHz



FCC 802.11n_40MHz_AUX1_5550MHz



FCC 802.11n_40MHz_AUX1_5795MHz

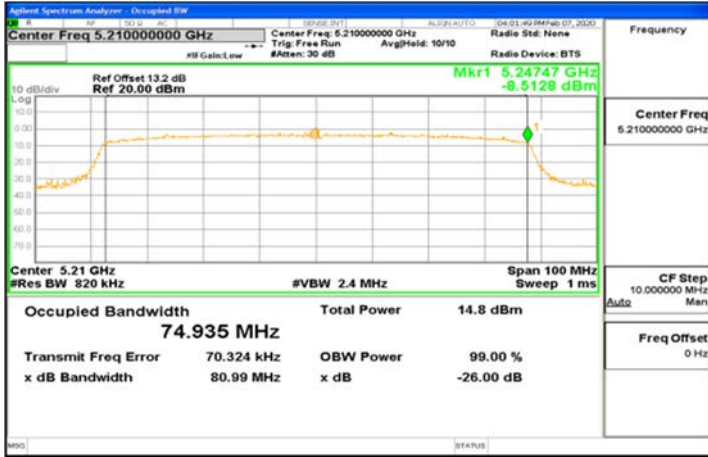


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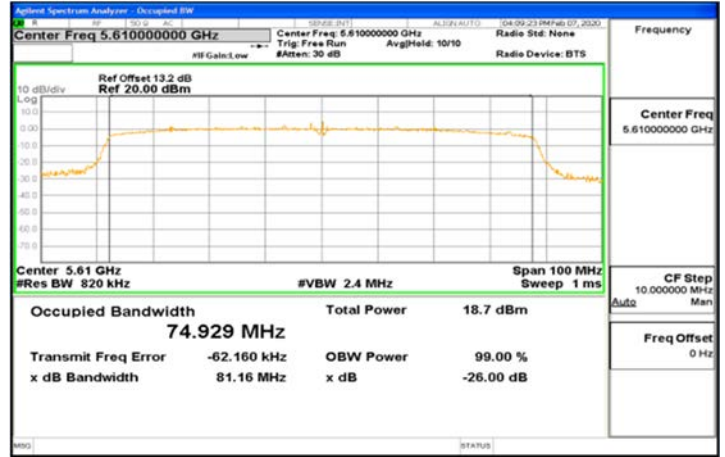
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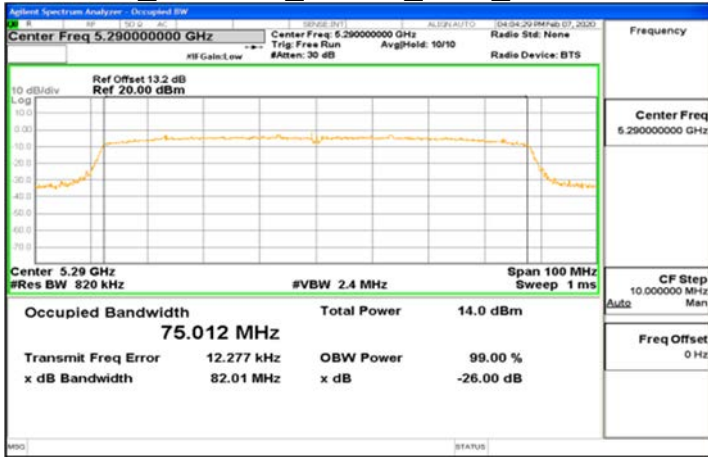
FCC 802.11ac_80MHz_Main_5210MHz



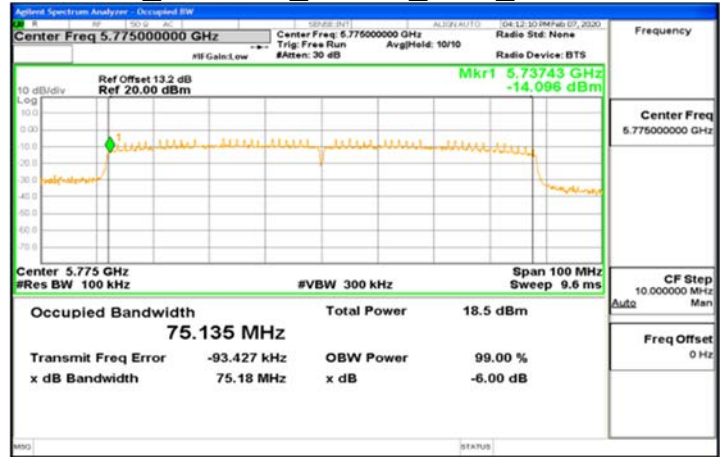
FCC 802.11ac_80MHz_Main_5610MHz



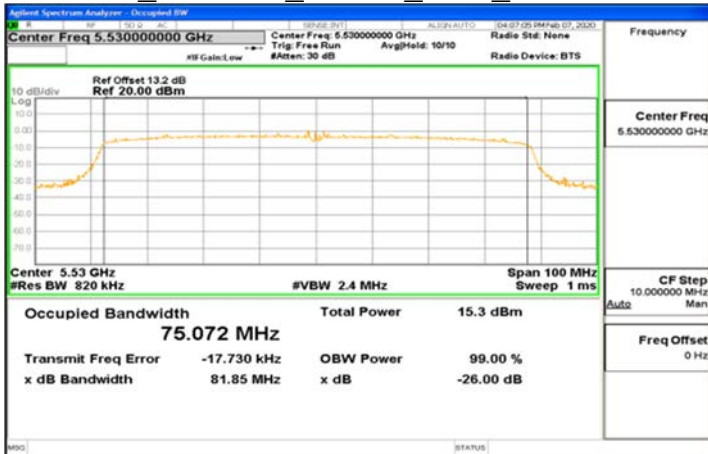
FCC 802.11ac_80MHz_Main_5290MHz



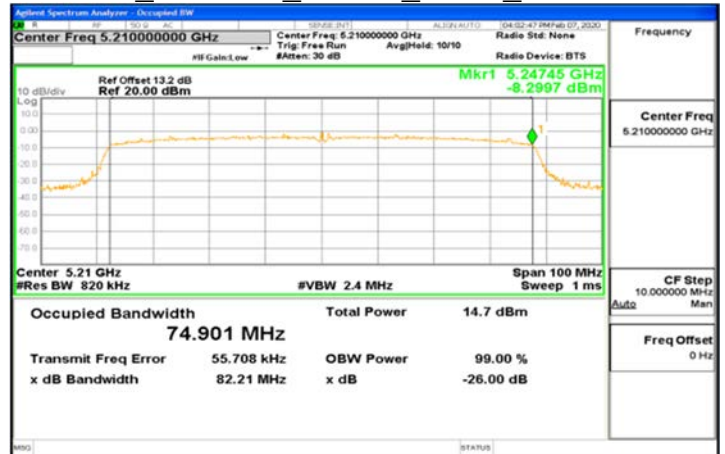
FCC 802.11ac_80MHz_Main_5775MHz



FCC 802.11ac_80MHz_Main_5530MHz



FCC 802.11ac_80MHz_AUX1_5210MHz



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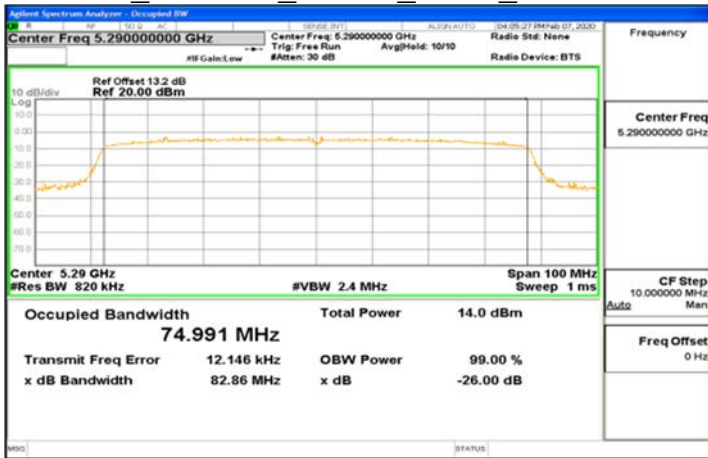
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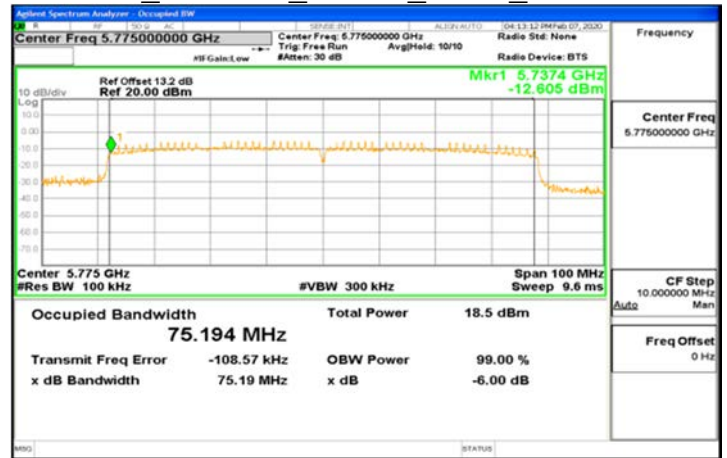
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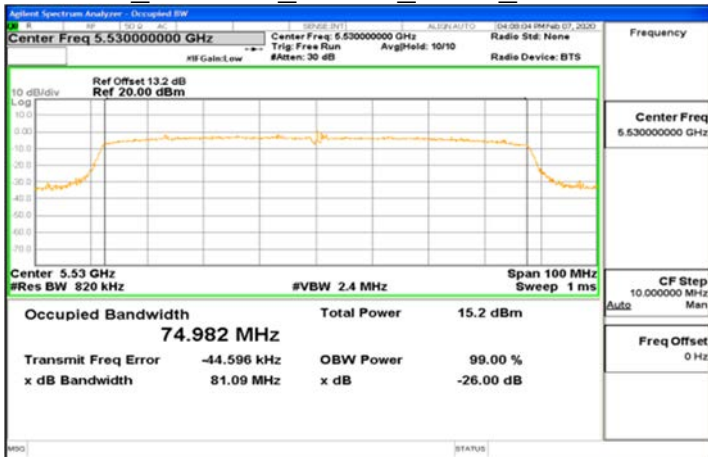
FCC_802.11ac_80MHz_AUX1_5290MHz



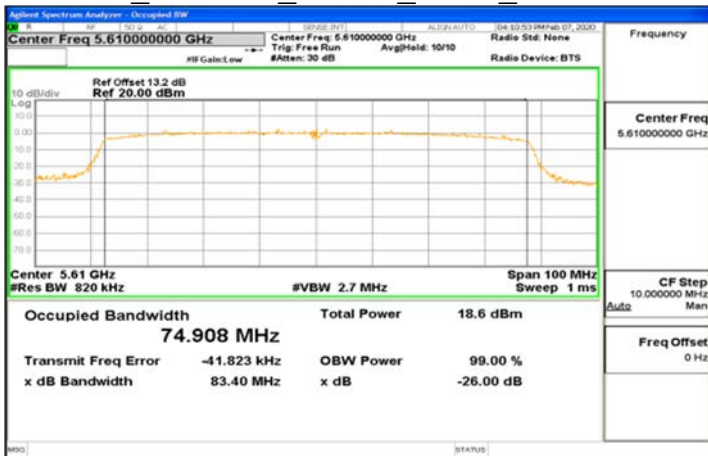
FCC_802.11ac_80MHz_AUX1_5775MHz



FCC_802.11ac_80MHz_AUX1_5530MHz



FCC_802.11ac_80MHz_AUX1_5610MHz

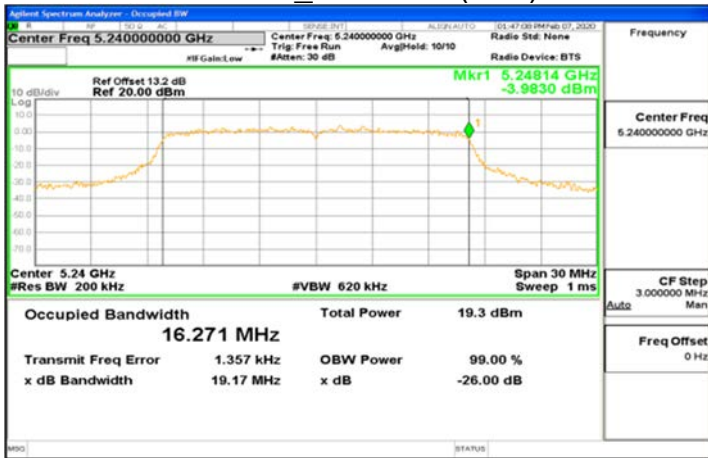


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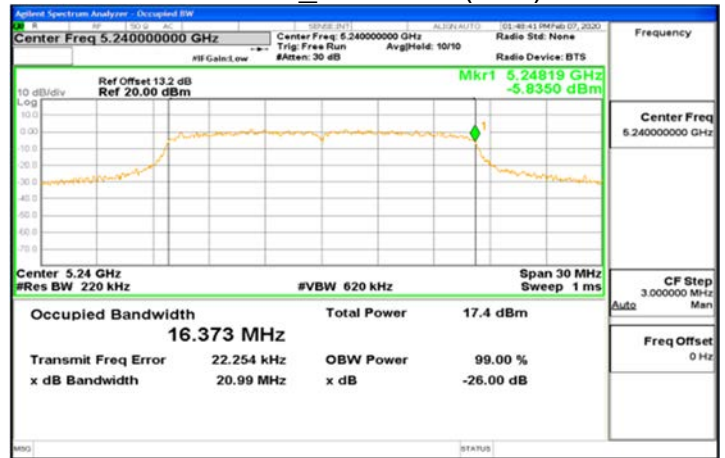
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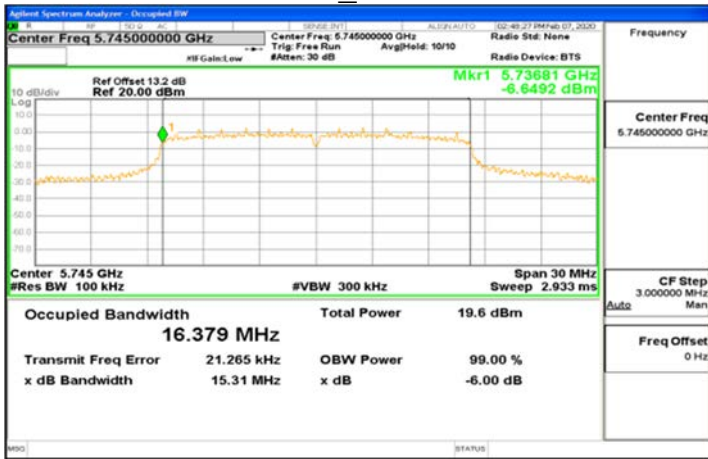
802.11a_5240MHz (Ch0)



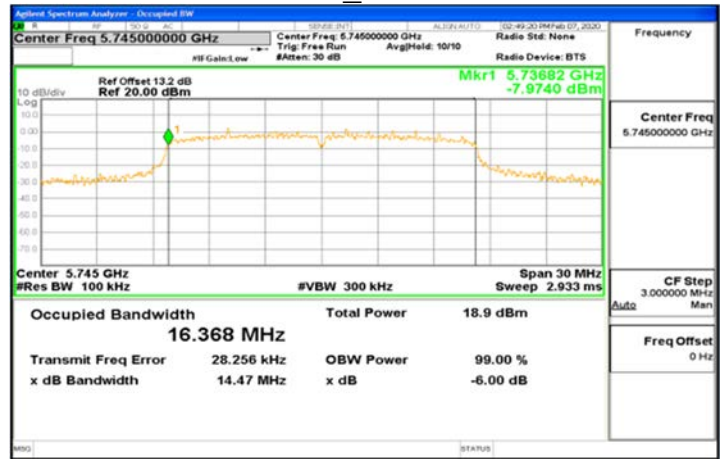
802.11a_5240MHz (Ch1)



802.11a_5745MHz



802.11a_5745MHz

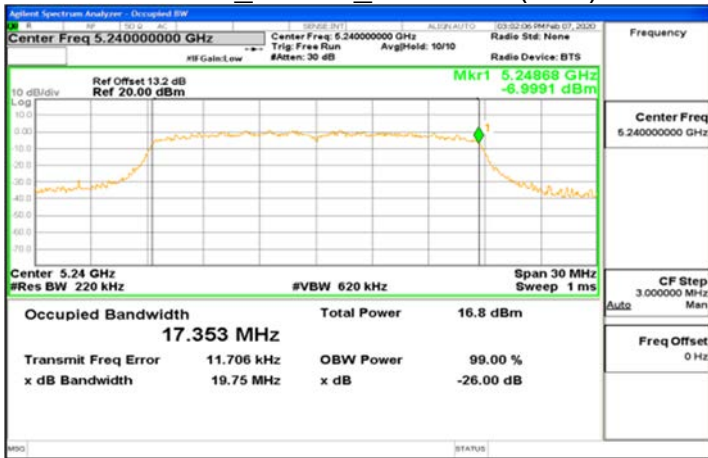


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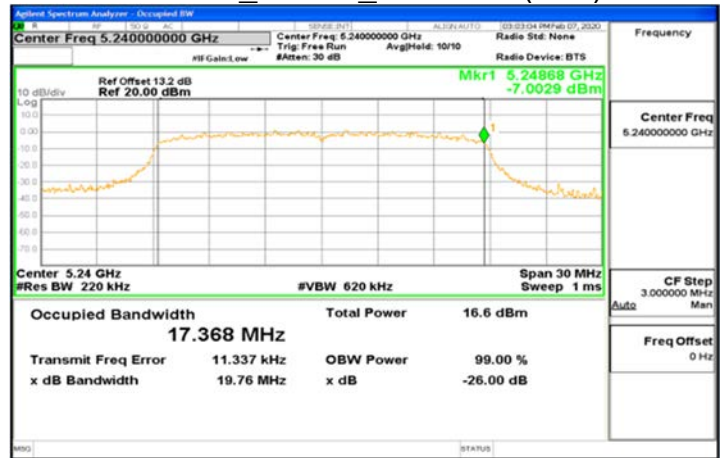
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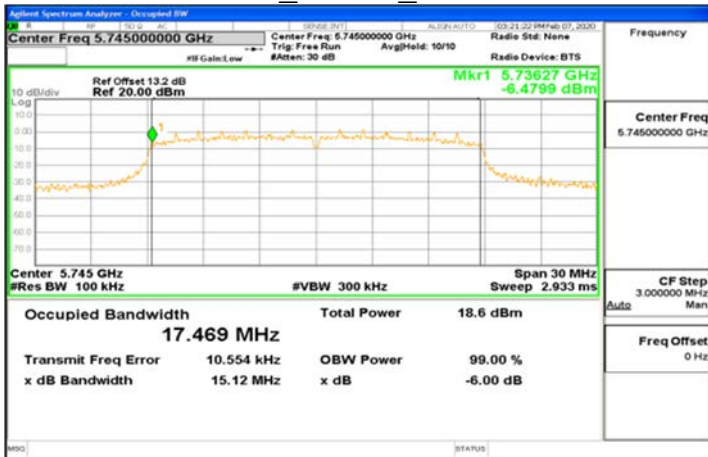
802.11n_20MHz_5240MHz (Ch0)



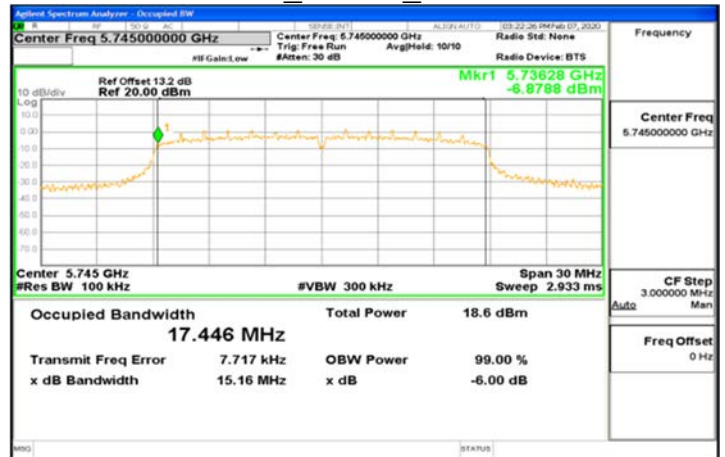
802.11n_20MHz_5240MHz (Ch1)



802.11n_20MHz_5745MHz



802.11n_20MHz_5745MHz

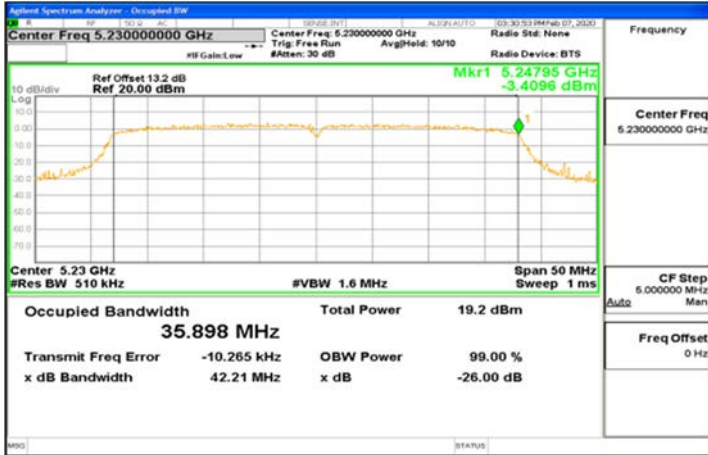


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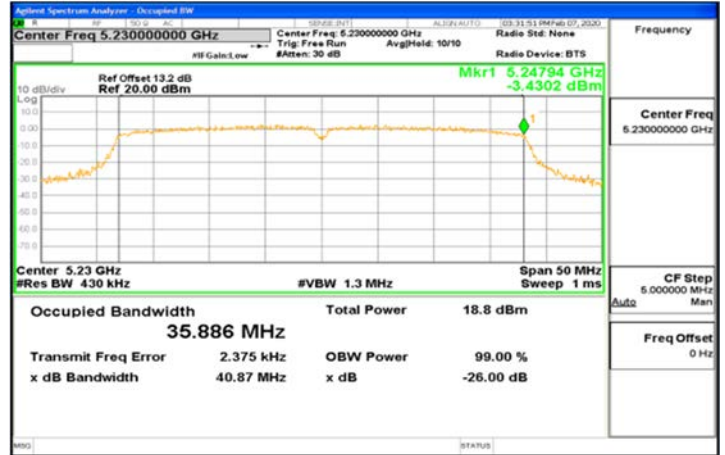
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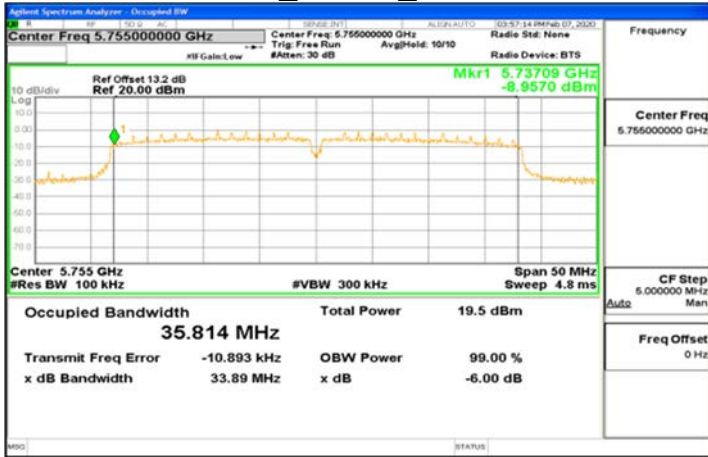
802.11n_40MHz_5230MHz (Ch0)



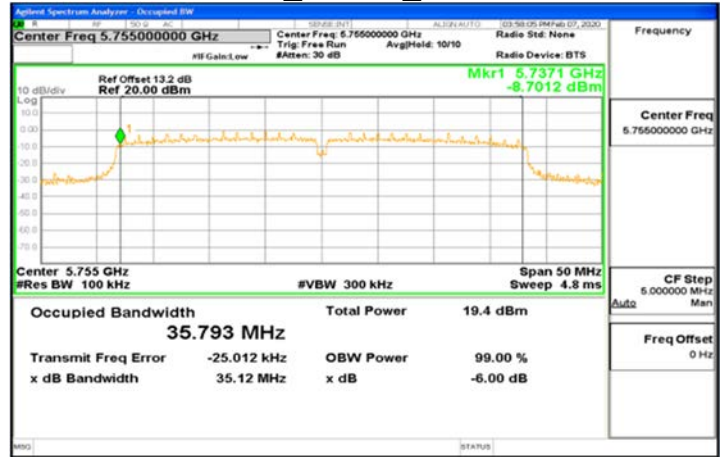
802.11n_40MHz_5230MHz (Ch1)



802.11n_40MHz_5755MHz



802.11n_40MHz_5755MHz

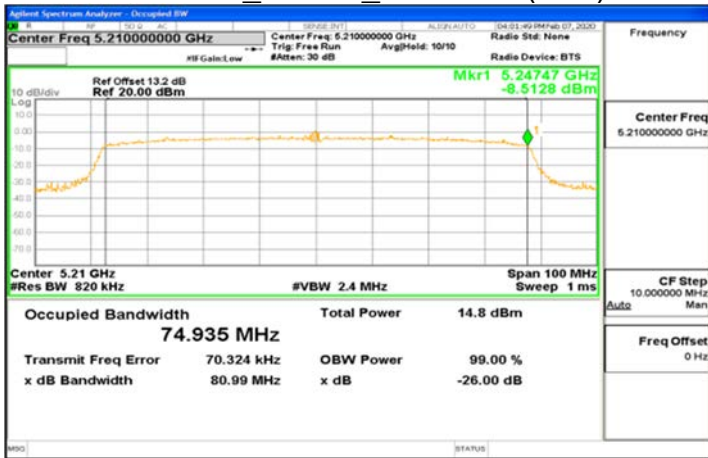


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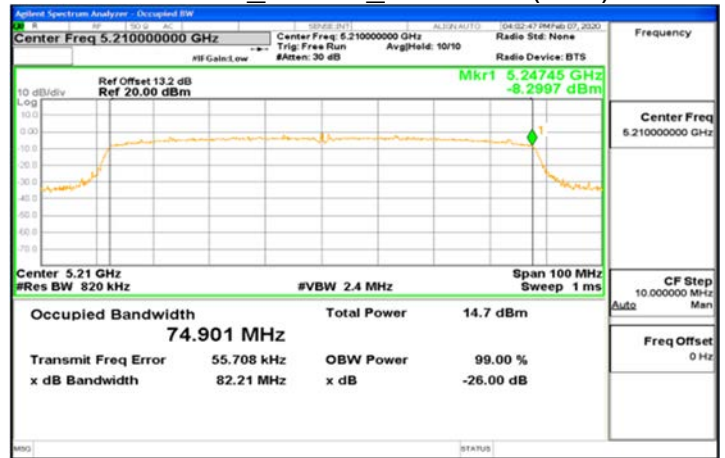
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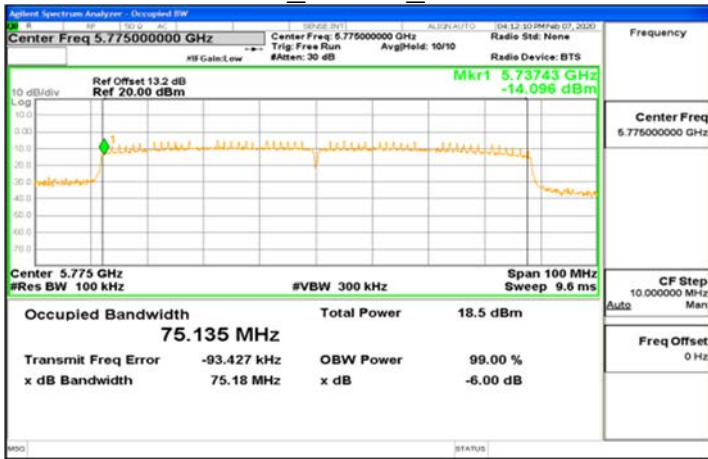
802.11ac_80MHz_5210MHz (Ch0)



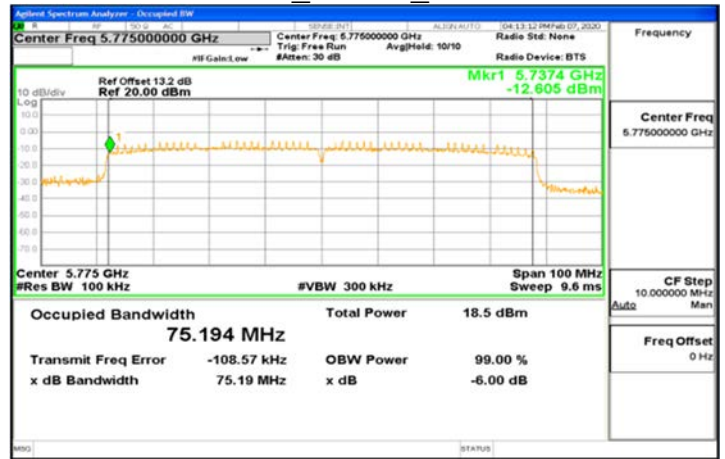
802.11ac_80MHz_5210MHz (Ch1)



802.11ac_80MHz_5775MHz



802.11ac_80MHz_5775MHz

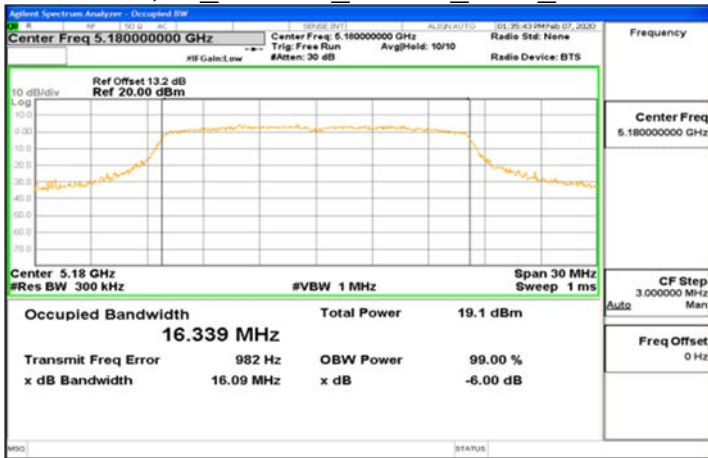


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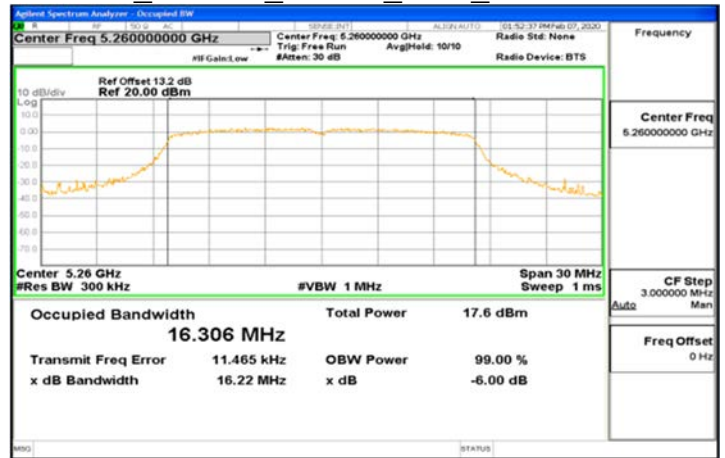
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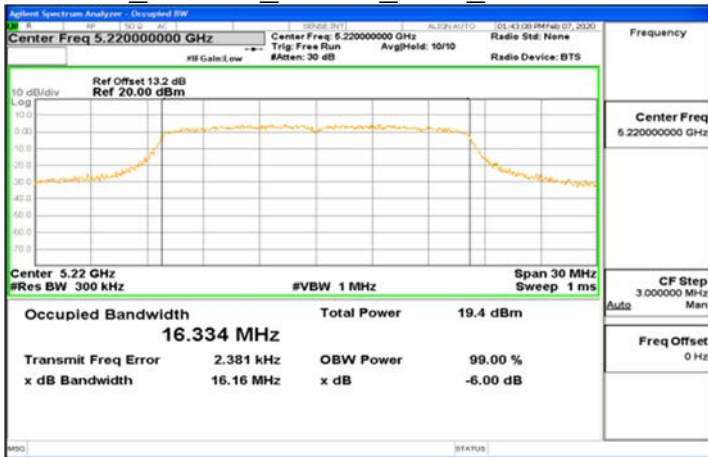
For 99%, IC_802.11a_20MHz_Main_5180MHz



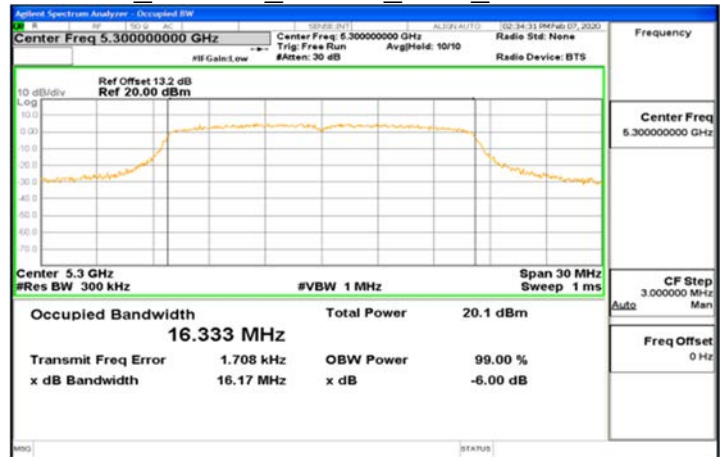
IC_802.11a_20MHz_Main_5260MHz



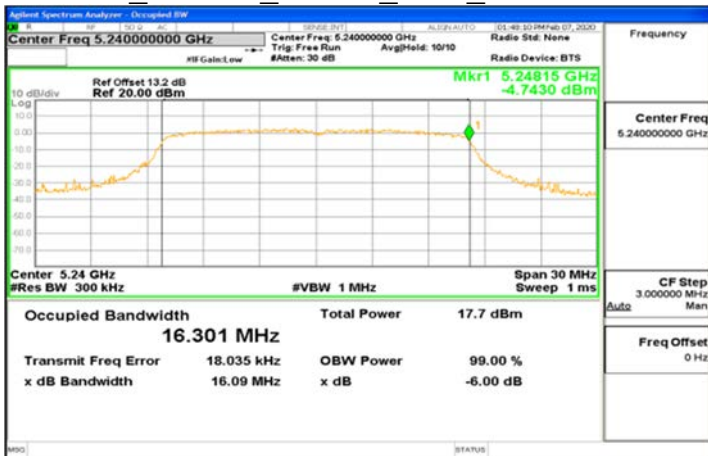
IC_802.11a_20MHz_Main_5220MHz



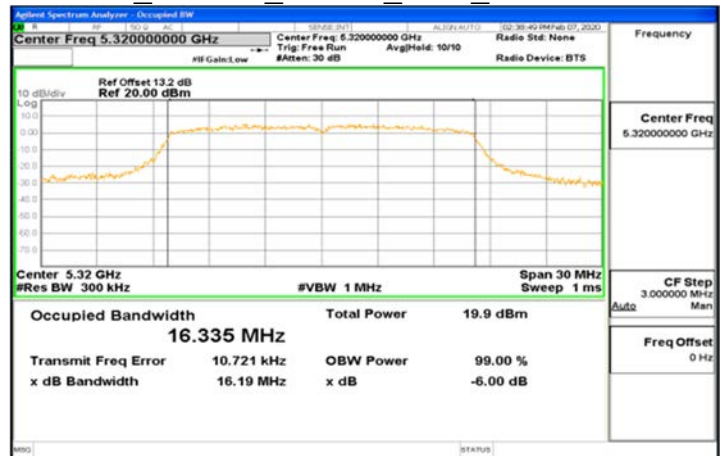
IC_802.11a_20MHz_Main_5300MHz



IC_802.11a_20MHz_Main_5240MHz



IC_802.11a_20MHz_Main_5320MHz

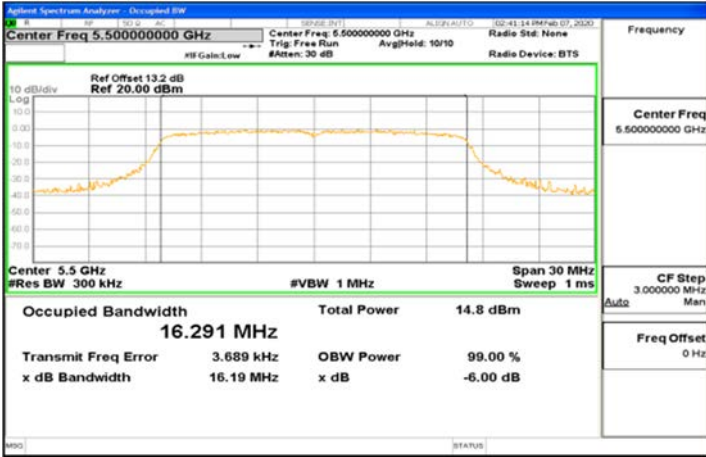


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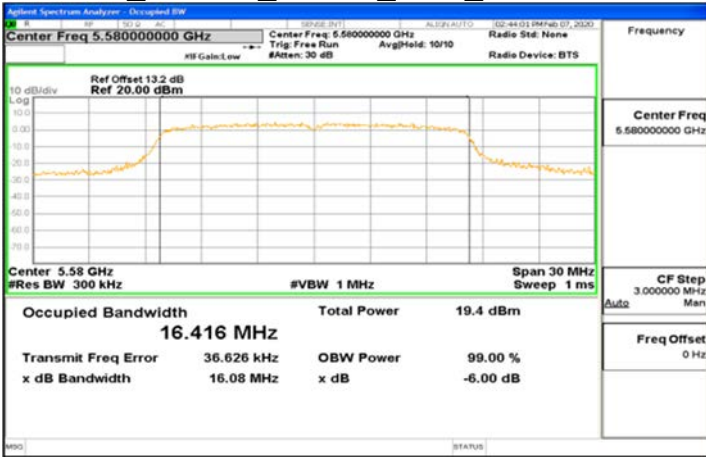
IC 802.11a 20MHz Main 5500MHz



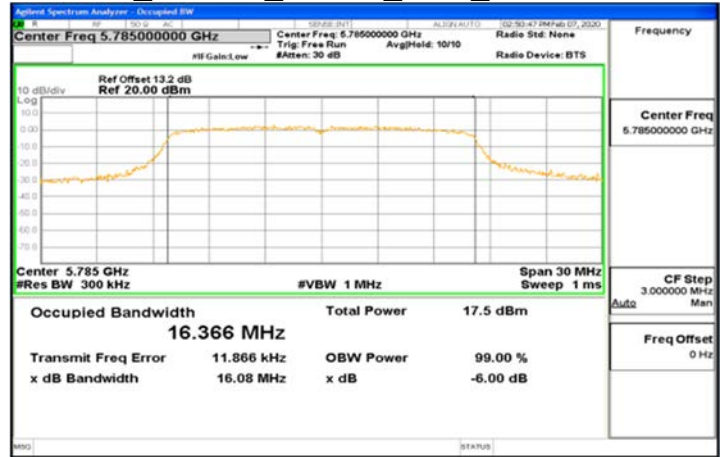
IC 802.11a 20MHz Main 5745MHz



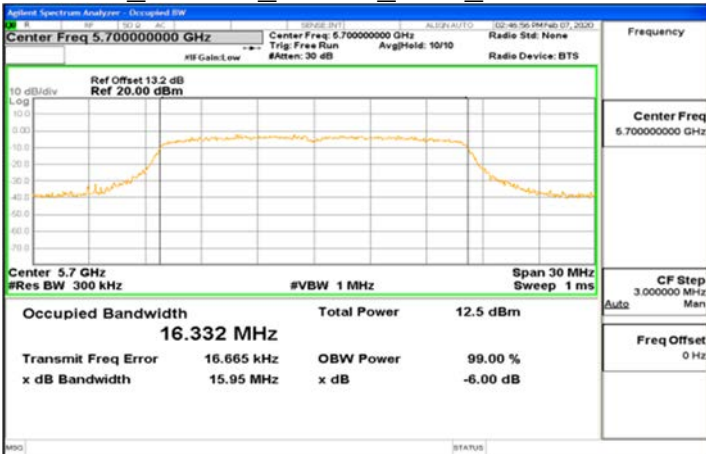
IC 802.11a 20MHz Main 5580MHz



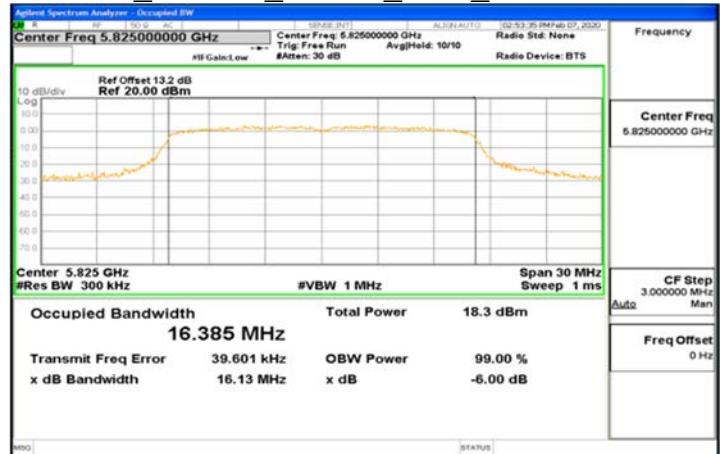
IC 802.11a 20MHz Main 5785MHz



IC 802.11a 20MHz Main 5700MHz



IC 802.11a 20MHz Main 5825MHz

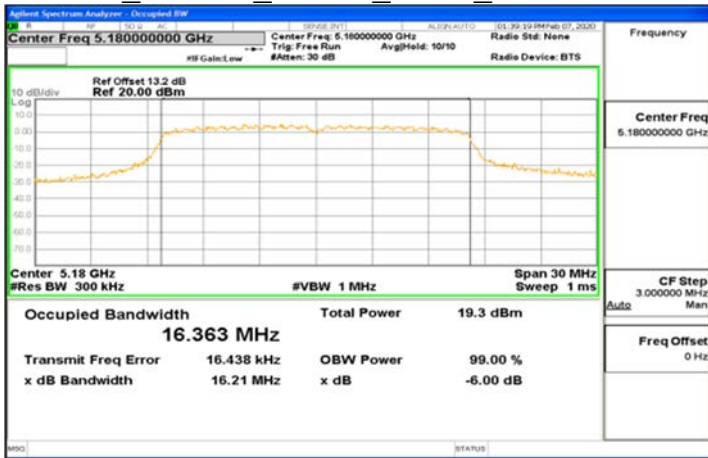


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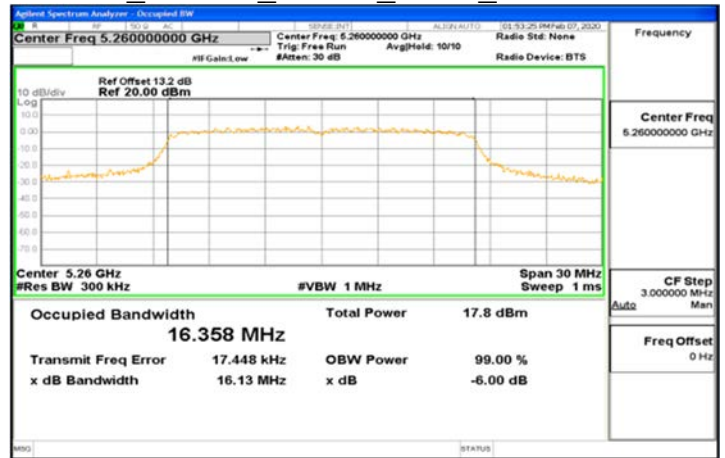
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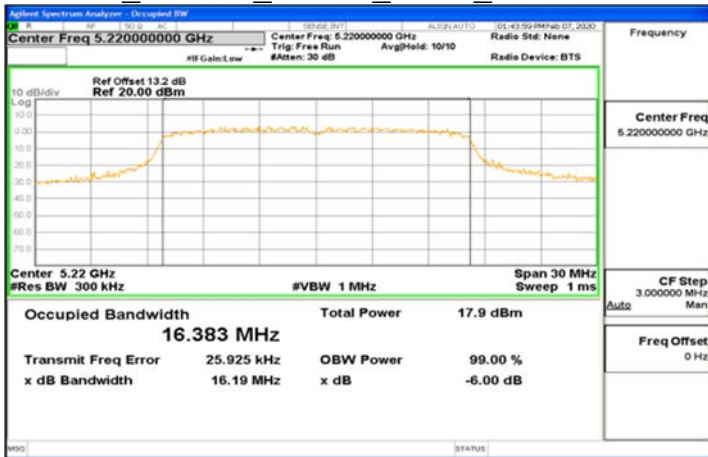
IC_802.11a_20MHz_AUX1_5180MHz



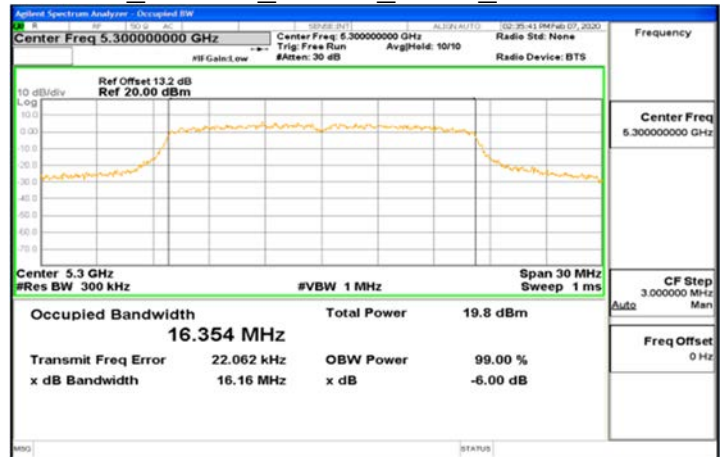
IC_802.11a_20MHz_AUX1_5260MHz



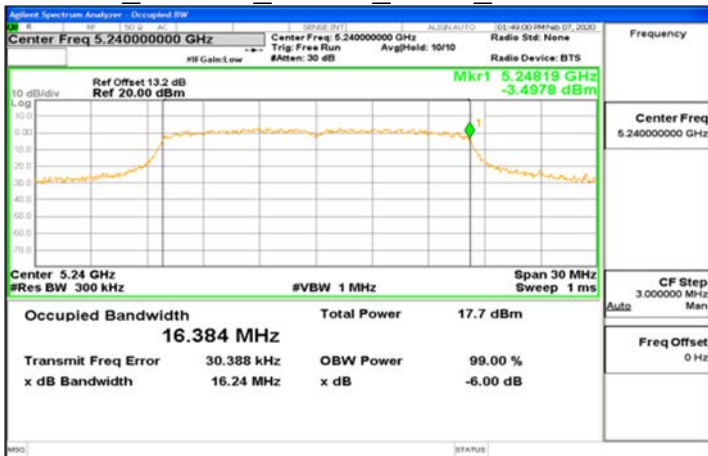
IC_802.11a_20MHz_AUX1_5220MHz



IC_802.11a_20MHz_AUX1_5300MHz



IC_802.11a_20MHz_AUX1_5240MHz



IC_802.11a_20MHz_AUX1_5320MHz

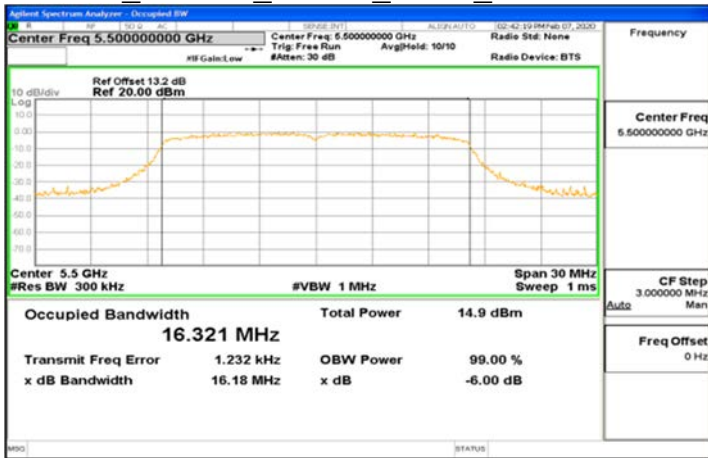


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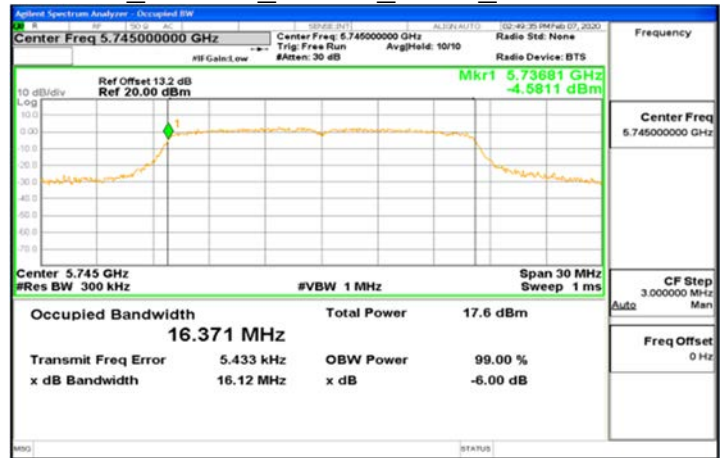
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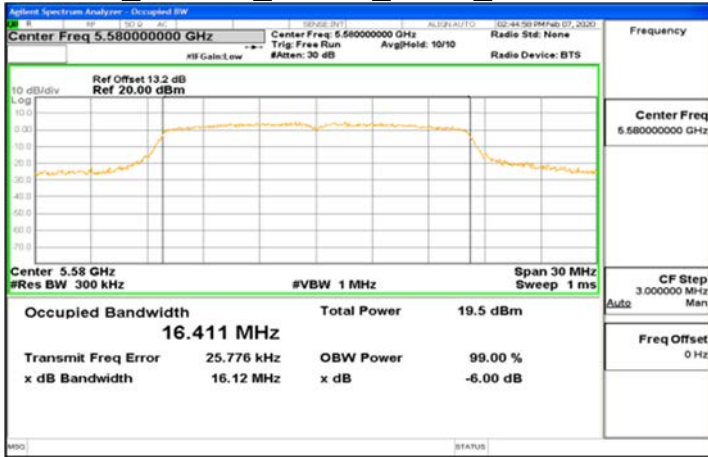
IC_802.11a_20MHz_AUX1_5500MHz



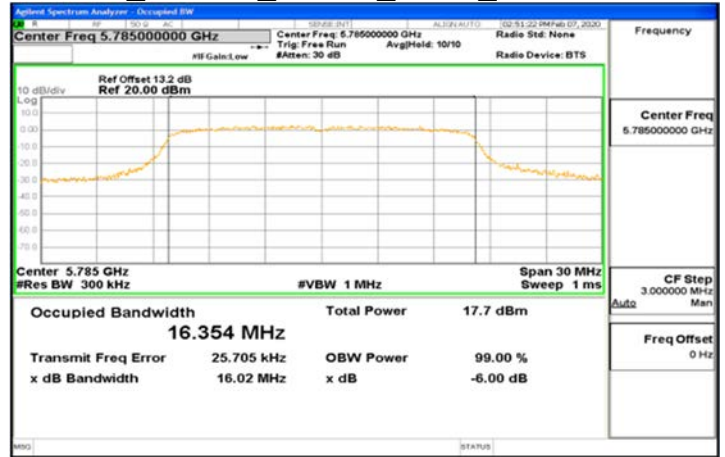
IC_802.11a_20MHz_AUX1_5745MHz



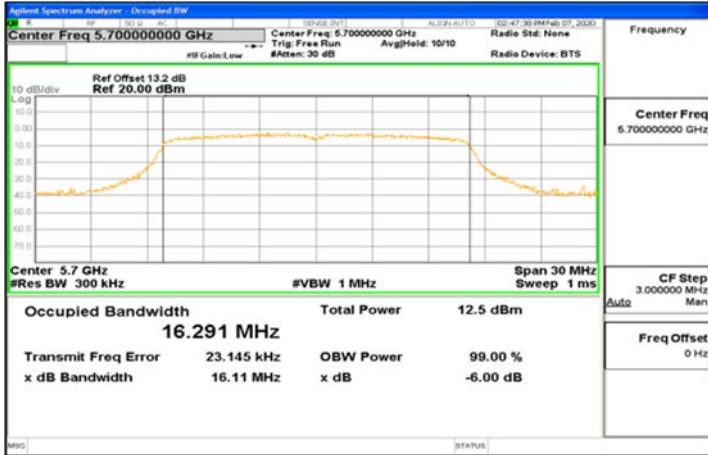
IC_802.11a_20MHz_AUX1_5580MHz



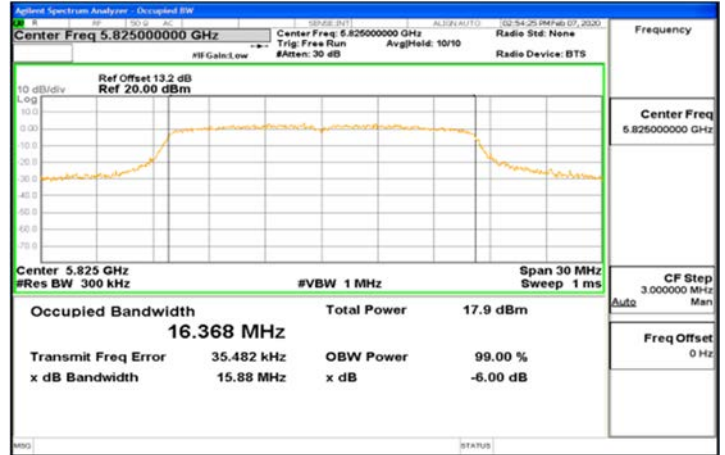
IC_802.11a_20MHz_AUX1_5785MHz



IC_802.11a_20MHz_AUX1_5700MHz



IC_802.11a_20MHz_AUX1_5825MHz

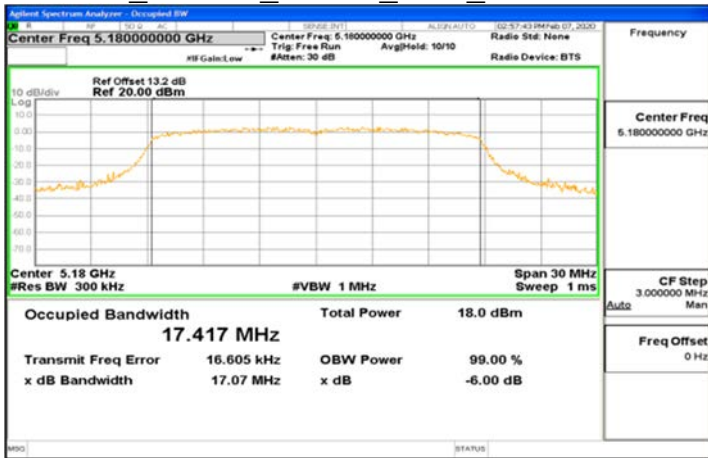


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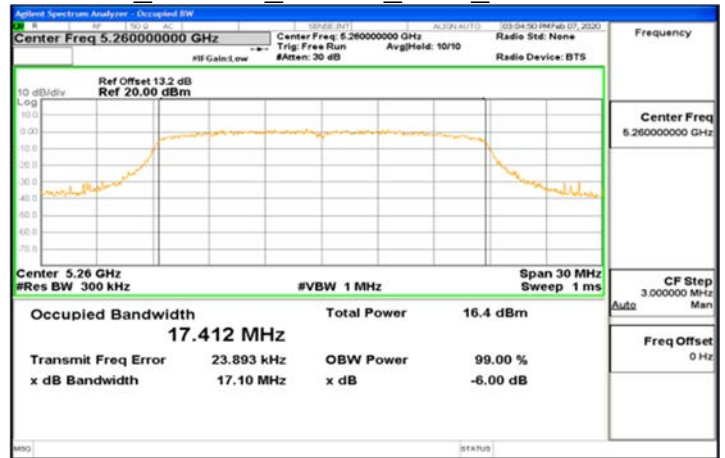
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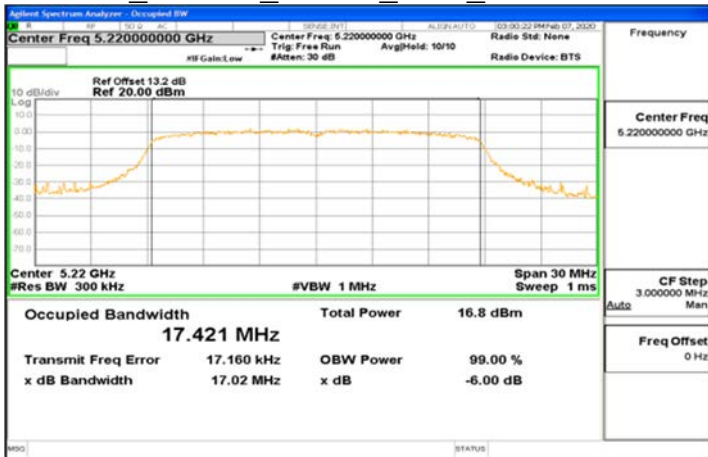
IC_802.11n_20MHz_Main_5180MHz



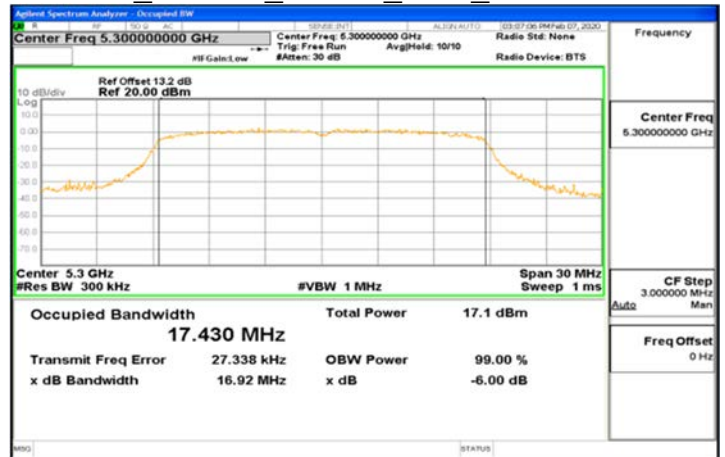
IC_802.11n_20MHz_Main_5260MHz



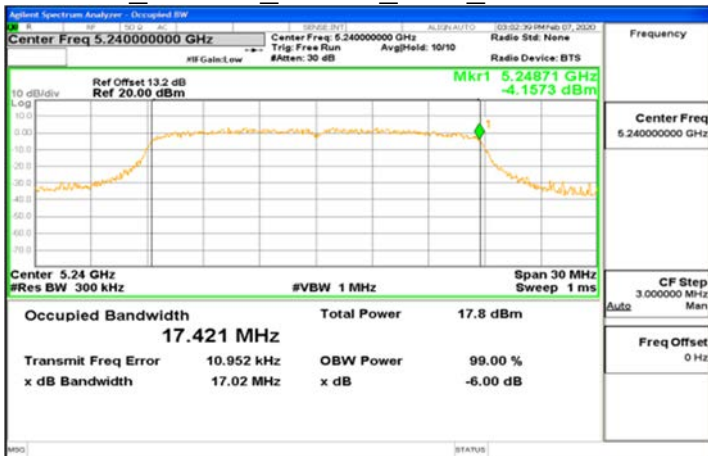
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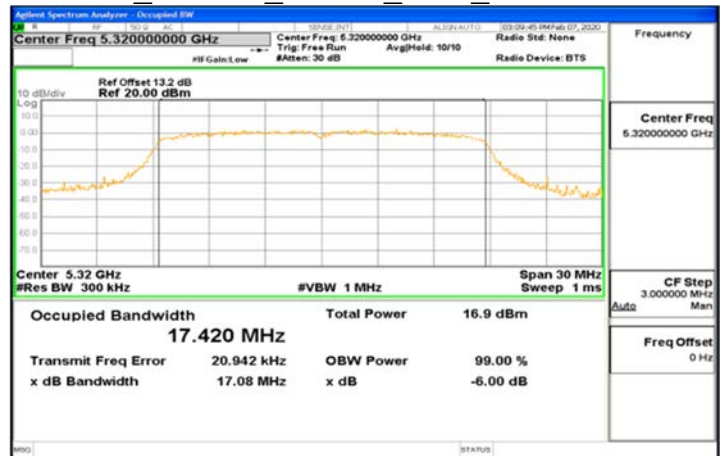
IC_802.11n_20MHz_Main_5300MHz



IC_802.11n_20MHz_Main_5240MHz



IC_802.11n_20MHz_Main_5320MHz

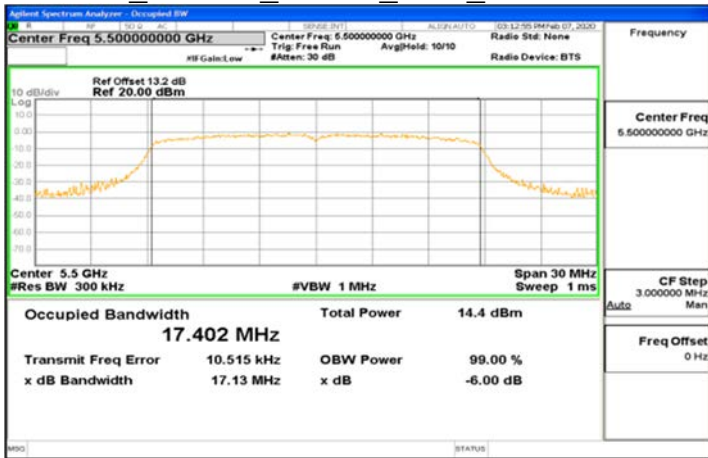


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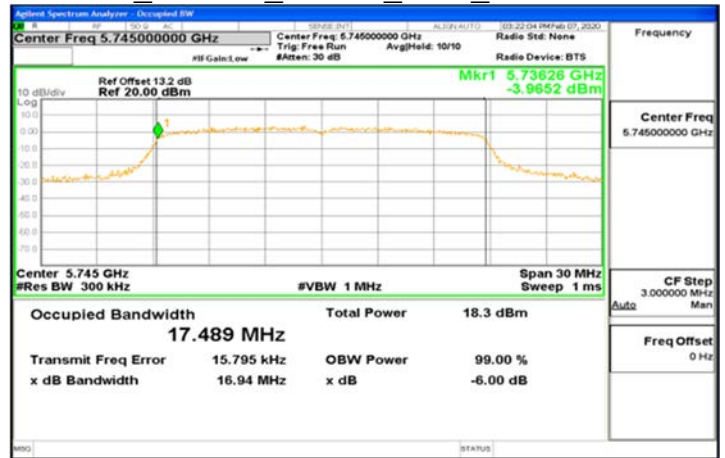
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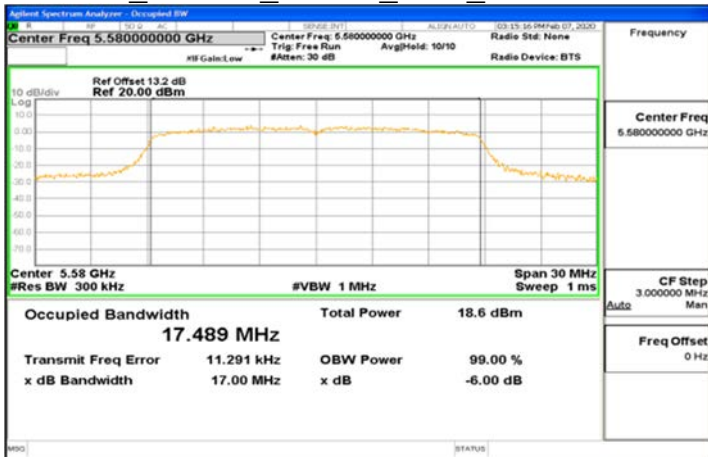
IC_802.11n_20MHz_Main_5500MHz



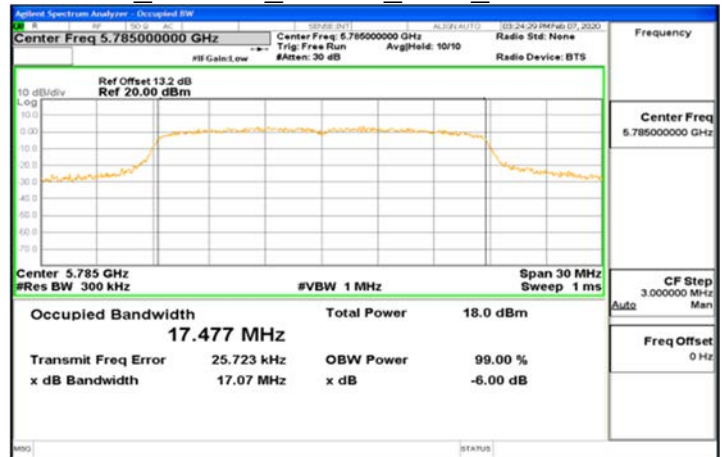
IC_802.11n_20MHz_Main_5745MHz



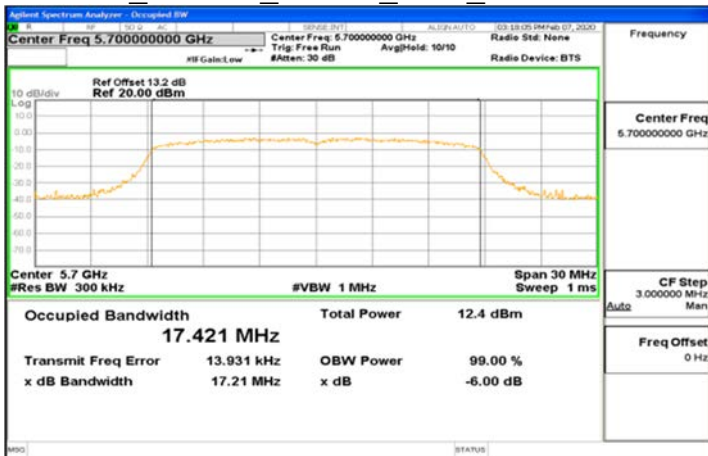
IC_802.11n_20MHz_Main_5580MHz



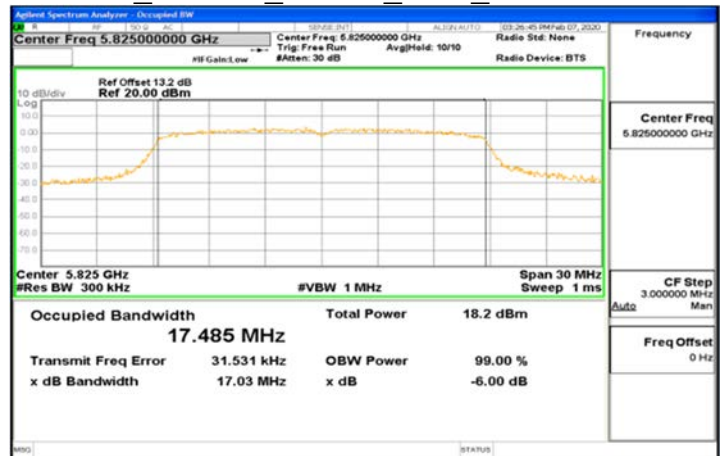
IC_802.11n_20MHz_Main_5785MHz



IC_802.11n_20MHz_Main_5700MHz



IC_802.11n_20MHz_Main_5825MHz



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