

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Sharp Corporation, Mobile Communication B.U.
2-13-1, Hachihonmatsu-lida, Higashi-hiroshima-shi,
Hiroshima, 739-0192, Japan

Manufacturer: Sharp Corporation
1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan

Product Name: Smart phone

Report Number: ER/2019/C0154

FCC ID: APYHRO00282

FCC Rule Part: §15.407, Cat: NII

Issue Date: Jan. 31, 2020

Date of Test: Dec. 09, 2019 ~ Jan. 17, 2020

Date of EUT Received: Dec. 09, 2019

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.

Approved By: _____

Vito Pei
Vito Pei/ Sr. Engineer



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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2019/C0154	Rev.00	Original.	Jan. 31, 2020	Revised By: Susan Lin

Note:

Test data is referenced from cross authorization(s)

Measurement results in the original test report ER/2019/C0078 under FCC ID: APYHRO00281 are fully leveraged in this test report with spot check on page 166-181 to demonstrate compliance.

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1. GENERAL INFORMATION

1.1 Product Description

Product Name:	Smart phone
Hardware Version:	DVT
Software Version:	N/A
Power Supply:	3.85V from Rechargeable Li-ion Battery

Wi-Fi 802.11	Frequency Range	Channels	Avg. Power (dBm)	Modulation Technology
a	5180~5240	4	14.99	OFDM
	5260~5320	4	14.98	
	5500~5720	12	14.93	
	5745~5825	5	14.87	
n_HT / ac_VHT 20M	5180~5240	4	HT: 14.76 (Worst Case)	OFDM
	5260~5320	4	HT: 14.74 (Worst Case)	
	5500~5720	12	HT: 14.82 (Worst Case)	
	5745~5825	5	HT: 14.57 (Worst Case)	
ax_HE20M	5180~5240	4	14.99	OFDMA
	5260~5320	4	14.94	
	5500~5720	12	14.96	
	5745~5825	5	14.99	
n_HT / ac_VHT 40M	5190~5230	2	HT: 14.84 (Worst Case)	OFDM
	5270~5310	2	HT: 14.74 (Worst Case)	
	5500~5710	6	HT: 14.92 (Worst Case)	
	5745~5825	5	HT: 14.68 (Worst Case)	
ax_HE40M	5190~5230	2	14.95	OFDMA
	5270~5310	2	14.97	
	5500~5710	6	14.94	
	5745~5825	5	14.85	
ac_VHT / ax_HE80M	5210	1	HE: 14.92 (Worst Case)	OFDM / OFDMA
	5290	1	HE: 14.96 (Worst Case)	
	5530~5690	3	HE: 14.84 (Worst Case)	
	5775	1	HE: 14.92 (Worst Case)	

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Modulation Type	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only 1024QAM for OFDMA in 802.11ax 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 802.11 ax_20MHz: 8 – 286.8Mbps 802.11 ax_40MHz: 16 – 573.6Mbps 802.11 ax_80MHz: 34 – 1201Mbps
Antenna Designation:	Inverted-F Antenna, 5150~5250MHz Gain: -5.3dBi (ANT0) / -1.7dBi (ANT1) 5250~5350MHz Gain: -5.3dBi (ANT0) / -1.7dBi (ANT1) 5470~5725MHz Gain: -4.5dBi (ANT0) / -2.2dBi (ANT1) 5725~5850MHz Gain: -8.6dBi (ANT0) / -2.2dBi (ANT1)

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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 v02r01

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

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 Designation number: TW0001

1.4 Special Accessories

There are no special accessories used while test was conducted.

1.5 Equipment Modifications

There was no modification incorporated into the EUT.

1.6 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.

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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 placed on a turn table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. 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 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 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 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.

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2.5 Configuration of Tested System

Fig. 2-1 Radiated Emission



Fig. 2-3 Conducted (Antenna Port) Emission

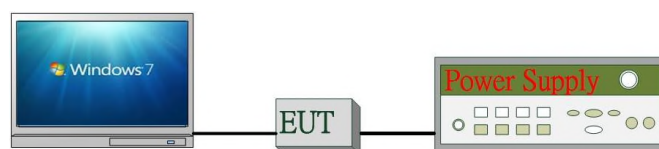


Fig. 2-2 AC Power Line Conducted Emission

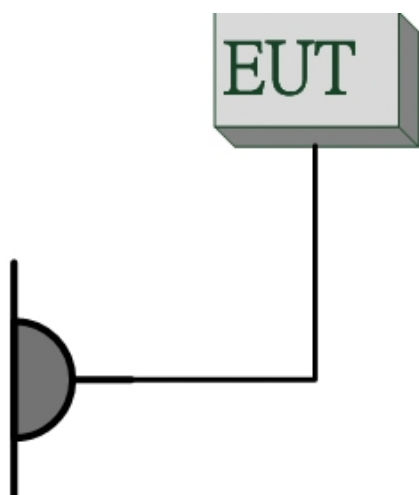


Table 2-1 Equipment Used in Tested System

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.	DC Power Supply	Agilent	E3640A	MY52410006	N/A	N/A
3.	Notebook	Lenovo	L430	R9-X11BG	N/A	N/A

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3. SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	26 dB & 6dB Emission Bandwidth	Compliant
§15.407(a)	Maximum Conducted Output Power	Compliant
§15.407(a)	Power Spectral Density	Compliant
§15.205 §15.209 §15.407(b)	Undesirable Radiated Emissions	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.203 §15.407(a)	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

4.1 802.11a/n/ac/ax 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
144	5720

40 M	
CH	Freq (MHz)
102	5510
110	5550
118	5590
126	5630
134	5670
142	5710

80 M	
CH	Freq (MHz)
106	5530
122	5610
138	5690

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				Multiple Transmission 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"/> 2TX
<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"/> 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"/> MIMO
<input checked="" type="checkbox"/> 802.11 ax	<input checked="" type="checkbox"/> Ch0	<input checked="" type="checkbox"/> Ch1	<input type="checkbox"/> Ch2	<input type="checkbox"/> Ch3	<input checked="" 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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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 144	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
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11ax_HE40	5190~5230	38 to 46	38,46	OFDMA	MCS0	MIMO
802.11ax_HE80	5210	42	42	OFDMA	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11ax_HE40	5270~5310	54 to 62	54,62	OFDMA	MCS0	MIMO
802.11ax_HE80	5290	58	58	OFDMA	MCS0	MIMO
802.11a	5500~5720	100 to 144	100,116,140,144	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11ax_HE40	5510~5710	102 to 142	102,110,134,142	OFDMA	MCS0	MIMO
802.11ax_HE80	5530~5690	106 to 138	106,122,138	OFDMA	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11ax_HE40	5755~5795	151 to 159	151,159	OFDMA	MCS0	MIMO
802.11ax_HE80	5775	155	155	OFDMA	MCS0	MIMO

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 Transmitter for channel Low, Mid and High, the worst case E1 position was reported.

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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				OFDM	MCS8	MIMO
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ax_HE40				OFDMA	MCS0	MIMO
802.11ax_HE80	5210	42	42	OFDMA	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ax_HE40				OFDMA	MCS0	MIMO
802.11ax_HE80	5290	58	58	OFDMA	MCS0	MIMO
802.11a	5500~5720	100 to 144	100,116,140,144	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11n_HT40	5510~5710	102 to 142	102,110,134,142	OFDM	MCS8	MIMO
802.11ax_HE40				OFDMA	MCS0	MIMO
802.11ax_HE80	5530~5690	106 to 138	106,122,138	OFDMA	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	2TX
802.11n_HT20				OFDM	MCS8	MIMO
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ax_HE40				OFDMA	MCS0	MIMO
802.11ax_HE80	5775	155	155	OFDMA	MCS0	MIMO

The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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Spot Check:

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	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11a	5260~5320	52 to 64	60, 64	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11a	5500~5720	100 to 144	140	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO
802.11a	5745~5825	149 to 165	157	OFDM	6	2TX
802.11ax_HE20				OFDMA	MCS0	MIMO

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 Transmitter for channel Low, Mid and High, the worst case E1 position was reported.

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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(μV)	
	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 7	1166.5950.07	07/04/2019	07/03/2020
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2019	11/25/2020
LISN	SCHWARZBECK	NSLK 8127	8127-649	04/02/2019	04/01/2020
Test Software	Farad	EZ-EMC	Ver. SGS-03A2	N.C.R	N.C.R

NOTE: N.C.R refers to Not Calibrated Required.

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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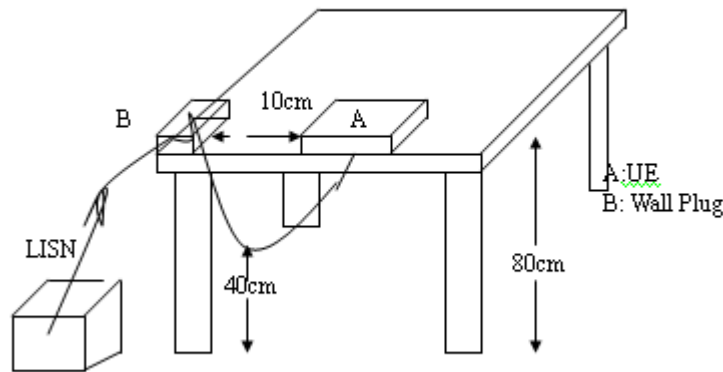
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6.4 Test SET-UP



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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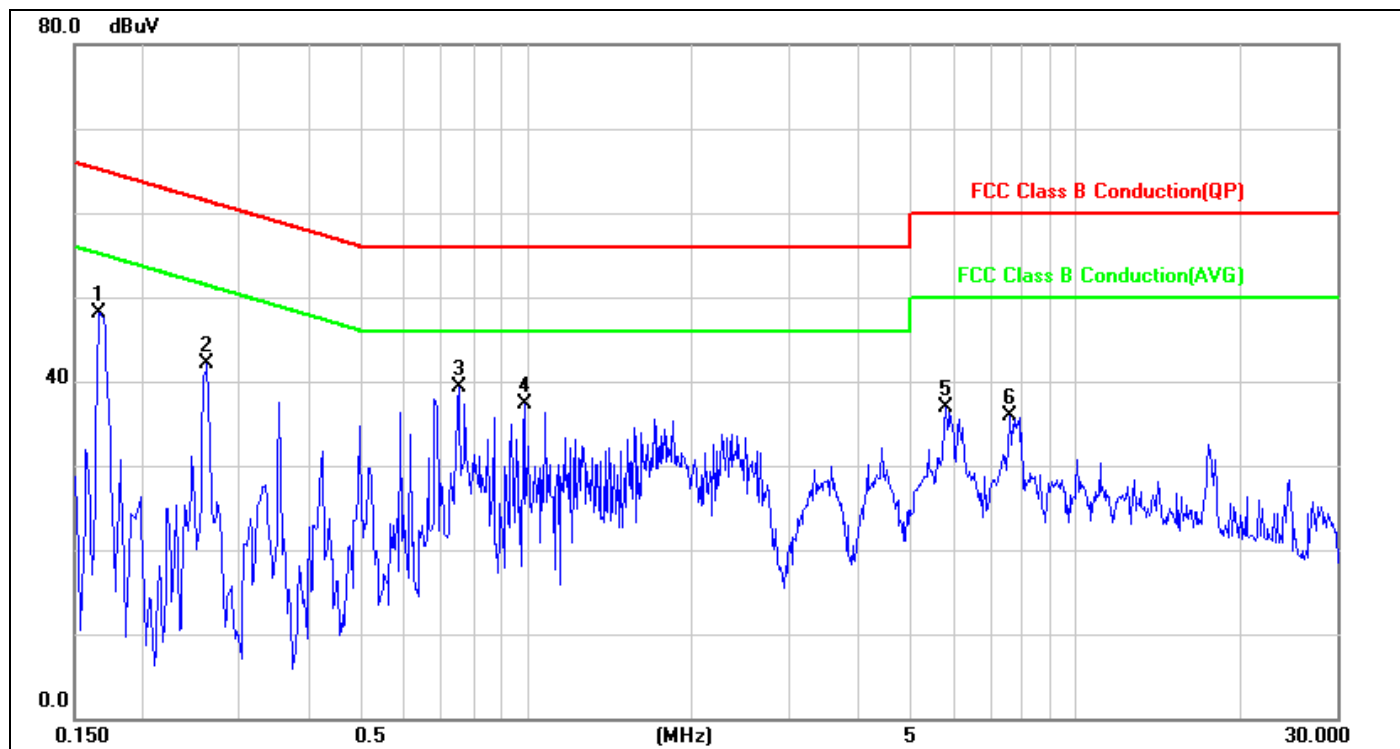
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Description: Operation
Line: L1
Test Voltage: AC 120V/60Hz
Report: ER-2019-C0078

Date: 2020/01/11
Temp.(°C)/Hum.(%): 23.6(°C)/62%
Test By: Kane



No.	Mk.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1660	48.15	0.00	48.15	65.16	-17.01	peak	
2		0.2620	42.14	0.01	42.15	61.37	-19.22	peak	
3	*	0.7540	39.37	0.02	39.39	56.00	-16.61	peak	
4		0.9900	37.27	0.02	37.29	56.00	-18.71	peak	
5		5.8260	36.77	0.20	36.97	60.00	-23.03	peak	
6		7.6300	35.68	0.24	35.92	60.00	-24.08	peak	

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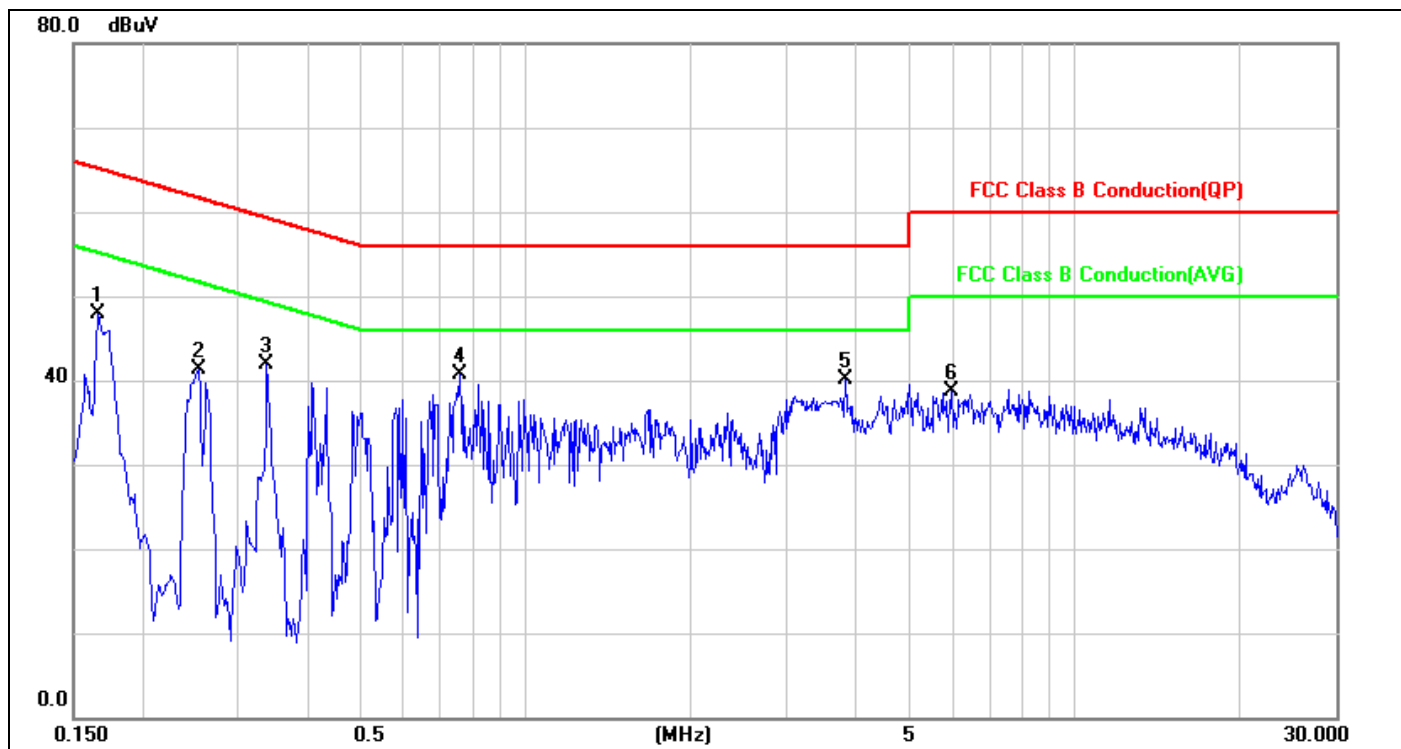
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Description: Operation
Line: N
Test Voltage: AC 120V/60Hz
Report: ER-2019-C0078

Date: 2020/01/11
Temp.(°C)/Hum.(%): 23.6(°C)/62%
Test By: Kane



No.	Mk.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Over (dB)	Detector	Comment
1		0.1660	47.85	0.03	47.88	65.16	-17.28	peak	
2		0.2540	41.18	0.03	41.21	61.63	-20.42	peak	
3		0.3380	41.93	0.03	41.96	59.25	-17.29	peak	
4	*	0.7620	40.61	0.04	40.65	56.00	-15.35	peak	
5		3.8340	39.91	0.14	40.05	56.00	-15.95	peak	
6		5.9780	38.52	0.22	38.74	60.00	-21.26	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

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Duty Cycle:

Formula:

$$\text{Duty Cycle} = \text{Ton} / (\text{Ton} + \text{Toff})$$

Mode	Duty Cycle (%) =Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	99.15	0.04	0.51	1.00
802.11n_20	98.85	0.05	0.69	1.00
802.11n_40	83.33	0.79	0.63	1.00
802.11ax_20	98.35	0.07	0.99	1.00
802.11ax_40	66.08	1.80	0.81	1.00
802.11ax_80	73.64	1.33	0.96	1.00

Duty Cycle Factor: $10 * \log(1/0.9915) = 0.04$

Duty Cycle Factor: $10 * \log(1/0.9885) = 0.05$

Duty Cycle Factor: $10 * \log(1/0.8333) = 0.79$

Duty Cycle Factor: $10 * \log(1/0.7884) = 1.03$

Duty Cycle Factor: $10 * \log(1/0.9835) = 0.07$

Duty Cycle Factor: $10 * \log(1/0.6608) = 1.8$

Duty Cycle Factor: $10 * \log(1/0.7364) = 1.33$

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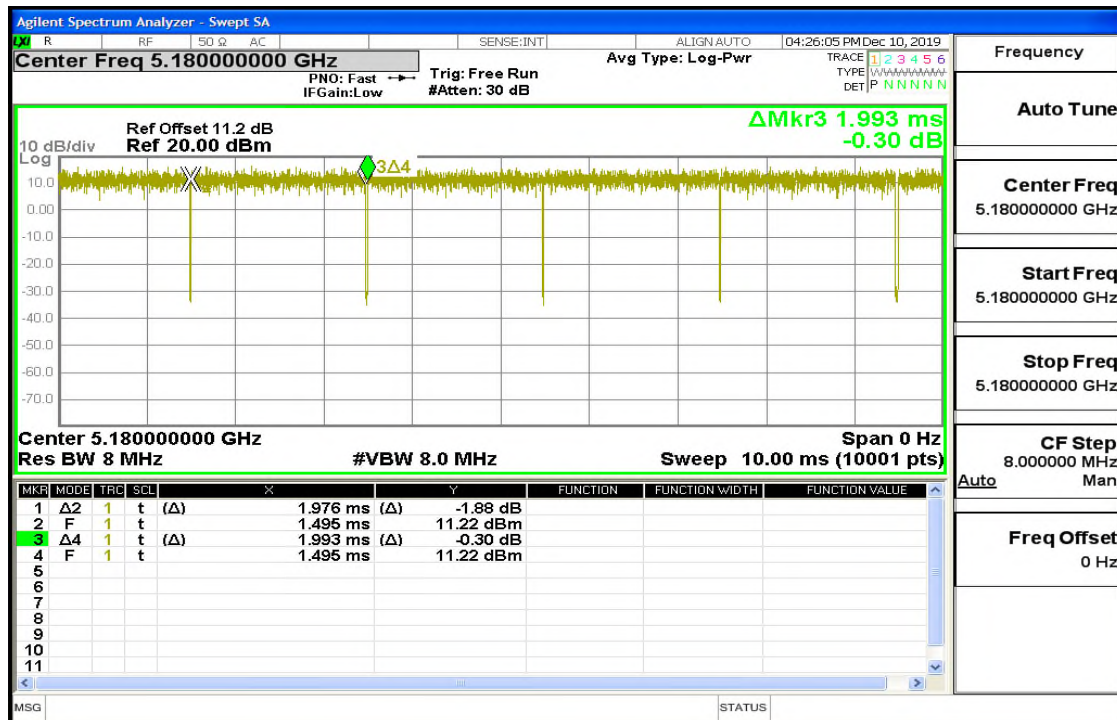
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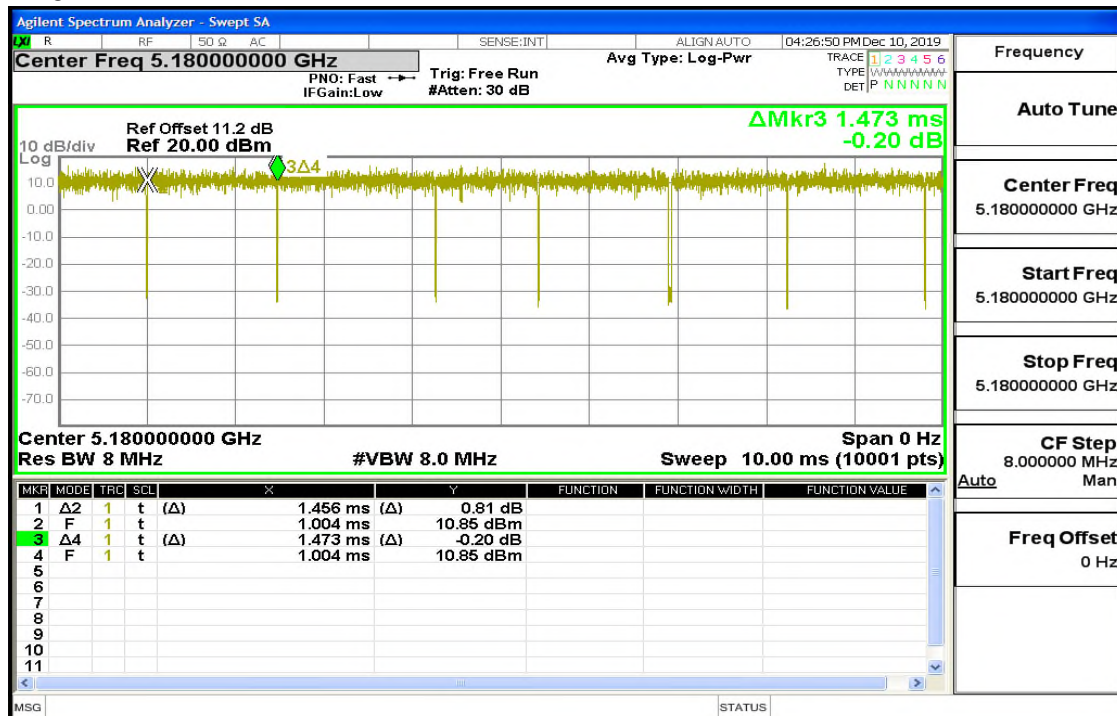
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7.2 Duty Cycle Test Plots

802.11a



802.11n HT20

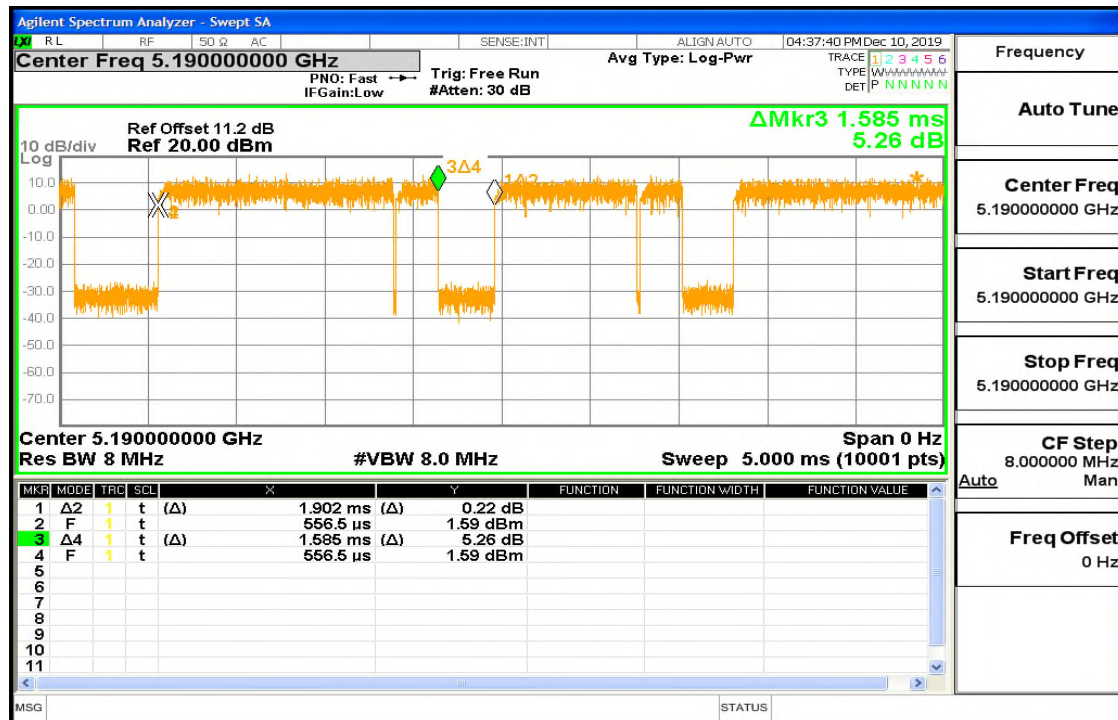


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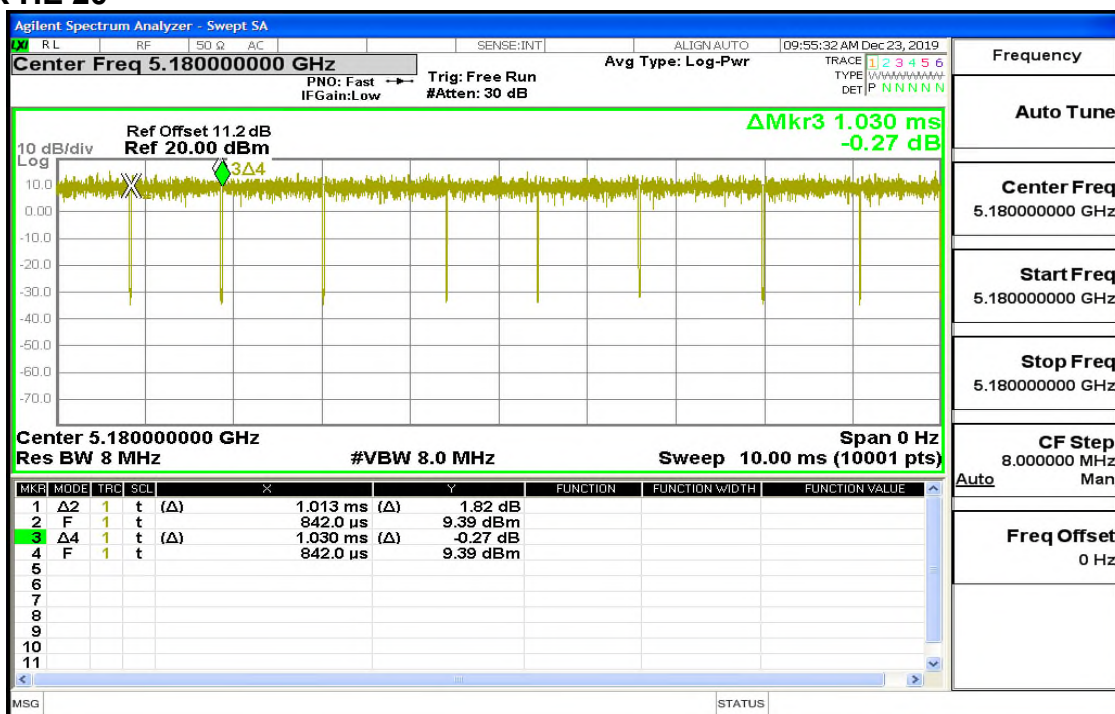
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802.11n HT 40



802.11ax HE 20

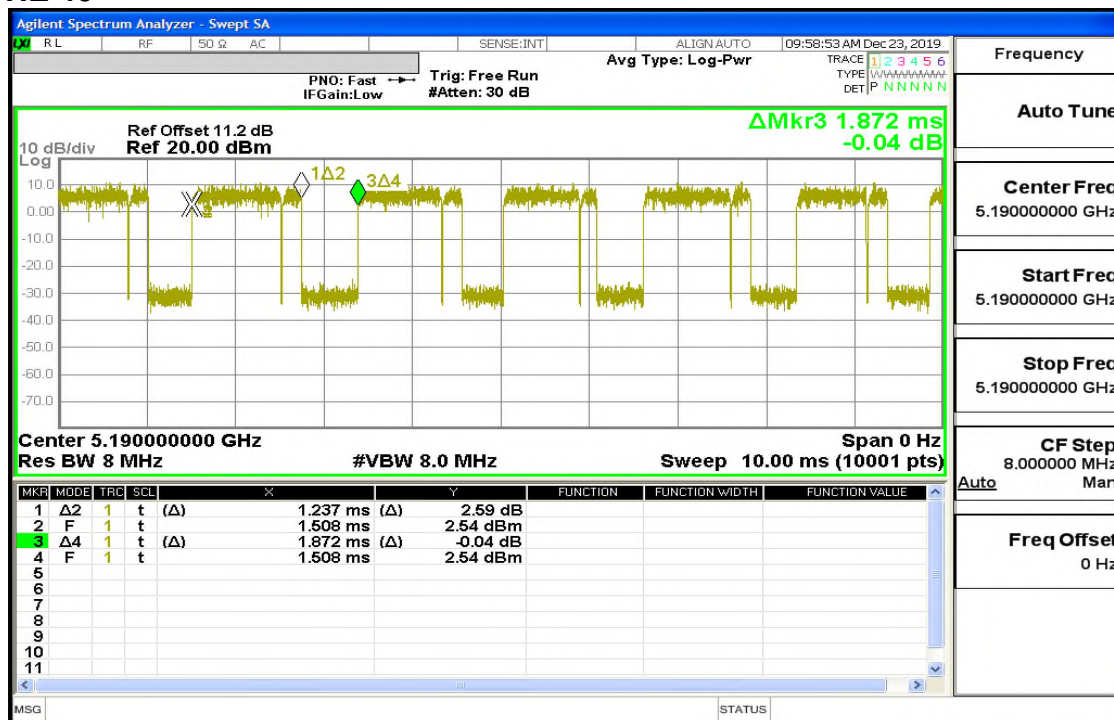


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802.11ax HE 40



802.11 ax HE 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.
 - 3a. 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.
 - 3b. 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 frequency of interest measured was complete.

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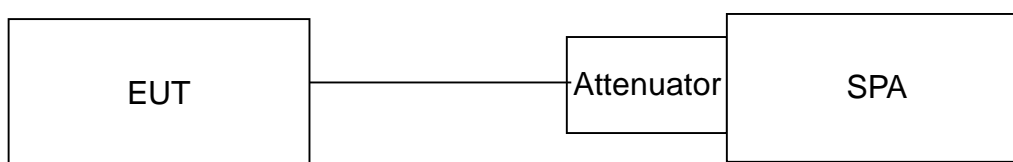
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8.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2020	01/01/2021

8.4 Test Set-up



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8.5 Measurement Result

26dB Bandwidth

802.11a_Ch0

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.66	12.709
5220	18.61	12.697
5240	18.62	12.700
5260	18.66	12.709
5300	18.66	12.709
5320	18.66	12.709
5500	18.72	12.723
5580	18.55	12.683
5700	18.49	12.669
5720	18.71	12.721

802.11a_Ch1

Freq. (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.77	12.735
5220	18.84	12.751
5240	18.83	12.749
5260	18.75	12.730
5300	18.62	12.700
5320	18.61	12.697
5500	18.59	12.693
5580	18.55	12.683
5700	18.46	12.662
5720	18.74	12.728

802.11ax_20_Ch0

Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)
5180	full	20.59	13.137
5220	full	20.74	13.168
5240	full	20.84	13.189
5260	full	20.7	13.160
5300	full	20.6	13.139
5320	full	20.73	13.166
5500	full	20.7	13.160
5580	full	20.67	13.153
5700	full	20.53	13.124
5720	full	20.59	13.137

802.11ax_20_Ch1

Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)
5180	full	20.69	13.158
5220	full	20.61	13.141
5240	full	20.67	13.153
5260	full	20.65	13.149
5300	full	20.67	13.153
5320	full	20.57	13.132
5500	full	20.52	13.122
5580	full	20.49	13.115
5700	full	20.6	13.139
5720	full	20.66	13.151

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802.11ax _40_Ch0

Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)
5190	full	40	16.021	5190	full	40.25	16.048
5230	full	40.23	16.046	5230	full	39.86	16.005
5270	full	40.18	16.040	5270	full	40.49	16.073
5310	full	39.94	16.014	5310	full	40.07	16.028
5510	full	39.88	16.008	5510	full	40	16.021
5550	full	40.23	16.046	5550	full	39.92	16.012
5670	full	40.11	16.033	5670	full	40.21	16.043
5710	full	39.97	16.017	5710	full	40.1	16.031

802.11ax _40_Ch1

802.11ax _80_Ch0

Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)	Freq. (MHz)	RU config	26dB BW (MHz)	10 Log (B) (dB)
5210	full	81.21	19.096	5210	full	81.45	19.109
5290	full	81.29	19.100	5290	full	81.75	19.125
5530	full	82.15	19.146	5530	full	81.38	19.105
5610	full	81.29	19.100	5610	full	81.74	19.124
5690	full	81.24	19.098	5690	full	81.95	19.135

802.11ax _80_Ch1

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802.11a_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.34	12.133
5785	16.16	12.084
5825	16.14	12.079

802.11a_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.02	12.047
5785	15.94	12.025
5825	15.95	12.028

802.11ax_20_Ch0

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5745	full	17.85	12.516
5785	full	18.29	12.622
5825	full	18.46	12.662

802.11ax_20_Ch1

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5745	full	18.37	12.641
5785	full	18.46	12.662
5825	full	17.56	12.445

802.11ax_40_Ch0

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5755	full	36.45	15.617
5795	full	37.11	15.695

802.11ax_40_Ch1

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5755	full	37.27	15.714
5795	full	36.76	15.654

802.11ax_80_Ch0

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5775	full	76.25	18.822

802.11ax_80_Ch1

Freq. (MHz)	RU config	6dB BW (MHz)	10 Log (B) (dB)
5775	full	75.6	18.785

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802.11a_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.15	< 5250
5745	5736.84	> 5725

802.11a_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5248.17	< 5250
5745	5736.84	> 5725

802.11ax_20_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5249.43	< 5250
5745	5735.58	> 5725

802.11ax_20_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5240	5249.44	< 5250
5745	5735.58	> 5725

802.11ax_40_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.81	< 5250
5755	5736.21	> 5725

802.11ax_40_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5230	5248.85	< 5250
5755	5736.25	> 5725

802.11ax_VHT80_Ch0

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5248.48	< 5250
5775	5736.54	> 5725

802.11ax_VHT80_Ch1

Freq. (MHz)	Measured Freq. (MHz)	Limit (MHz)
5210	5248.52	< 5250
5775	5736.63	> 5725

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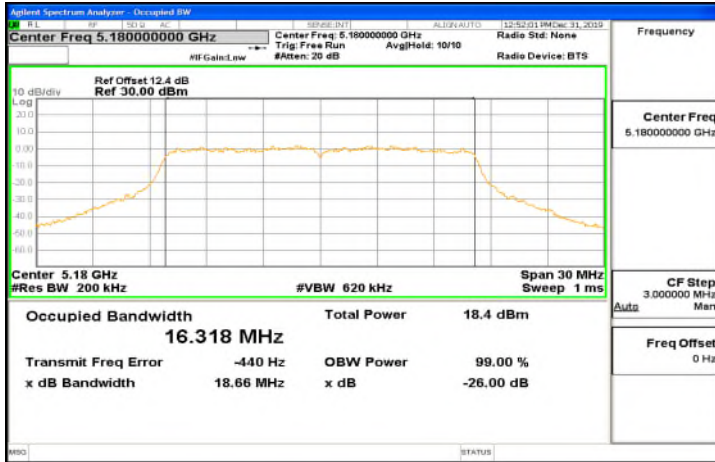
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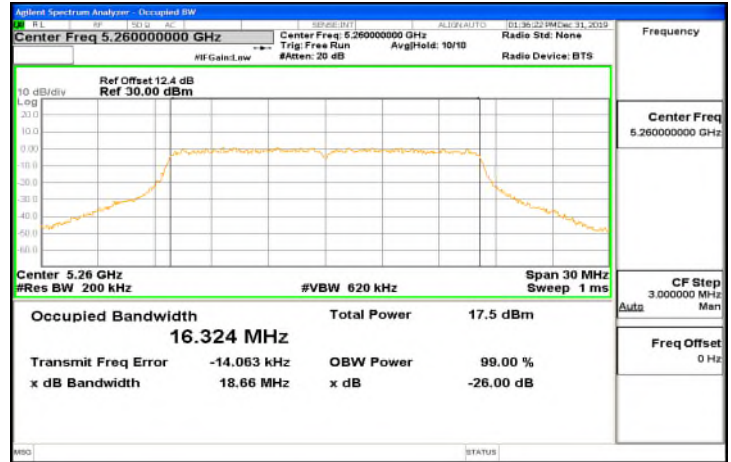
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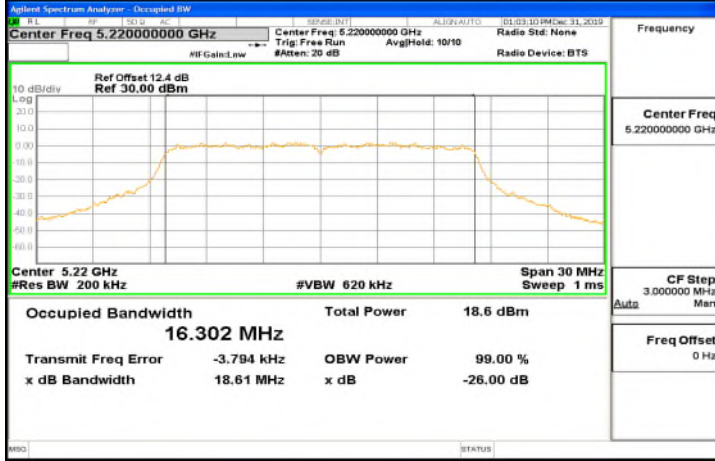
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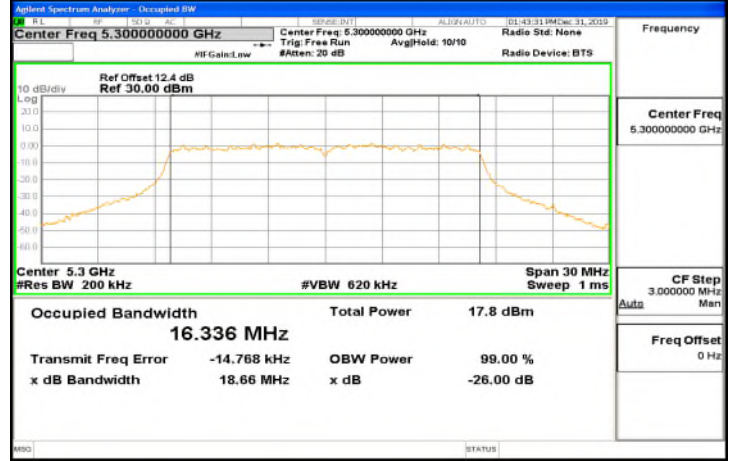
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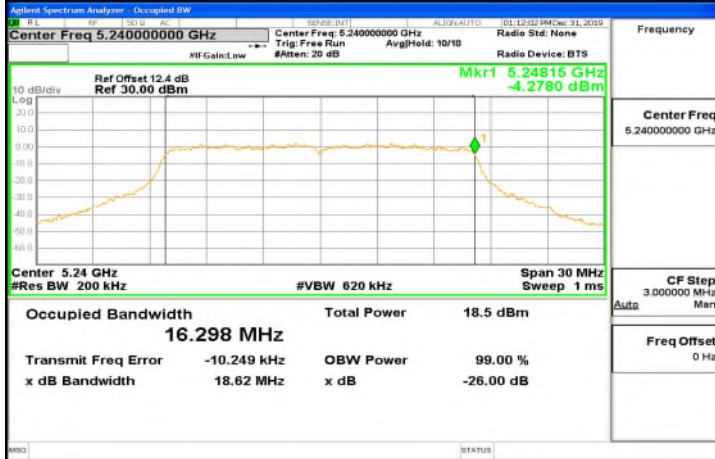
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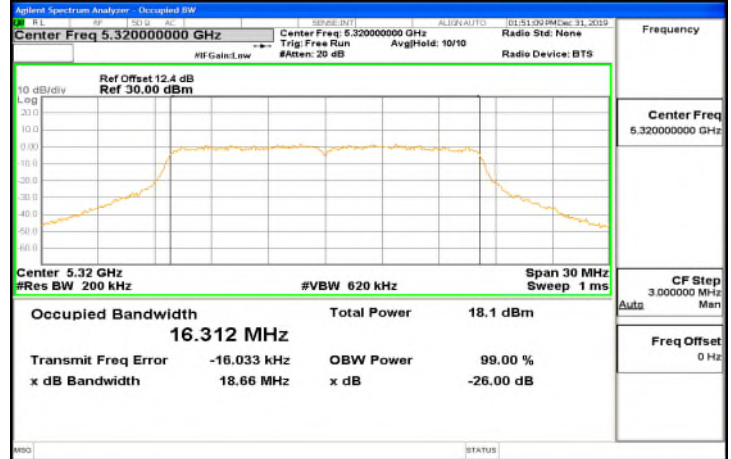
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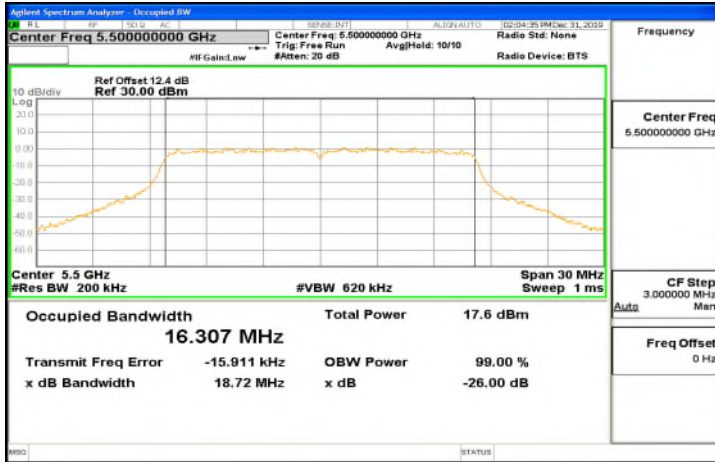


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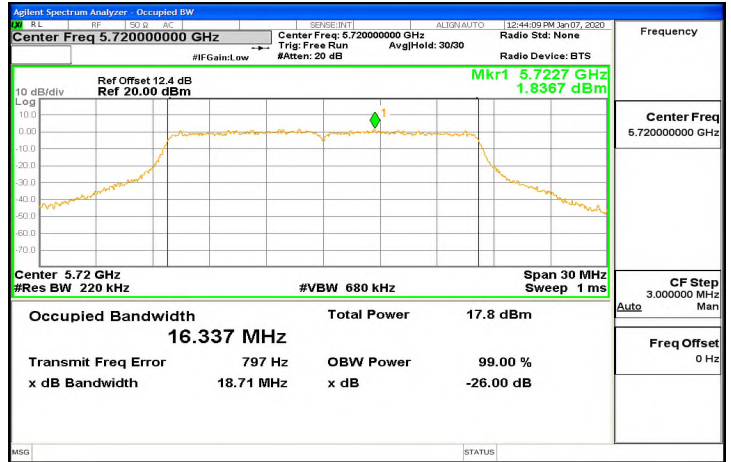
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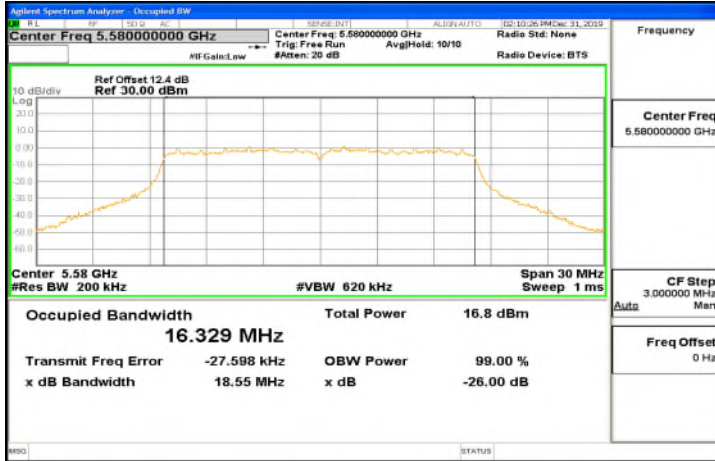
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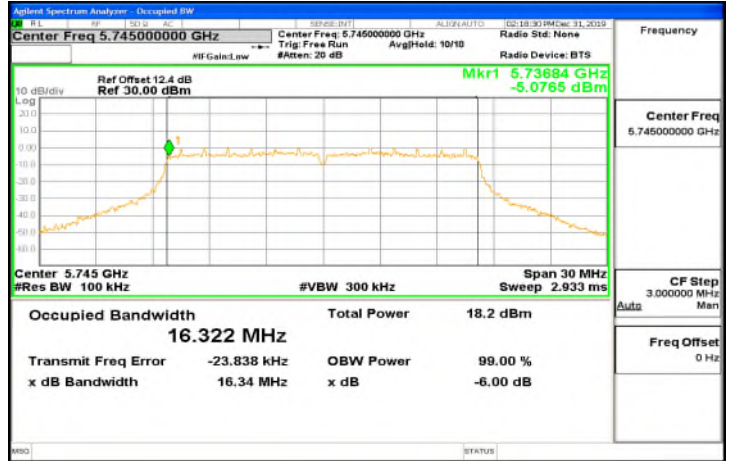
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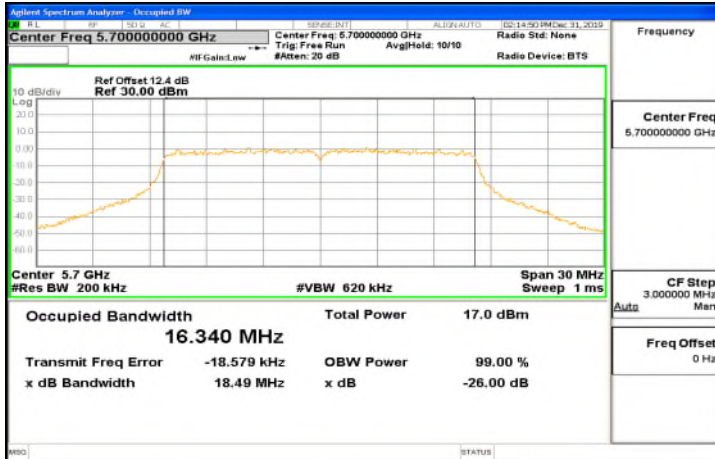
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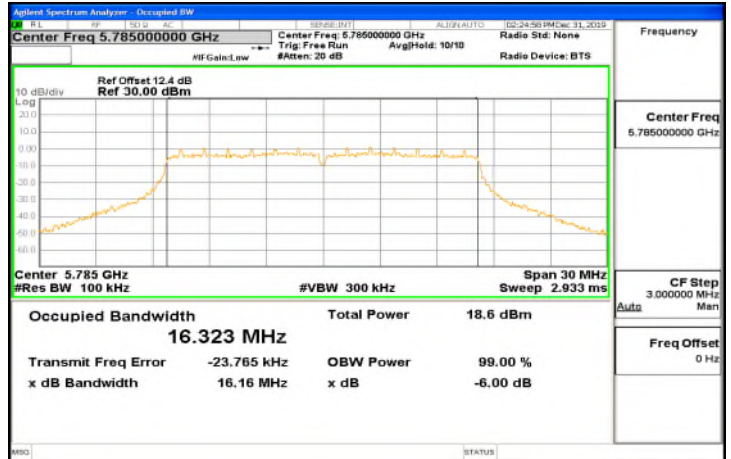
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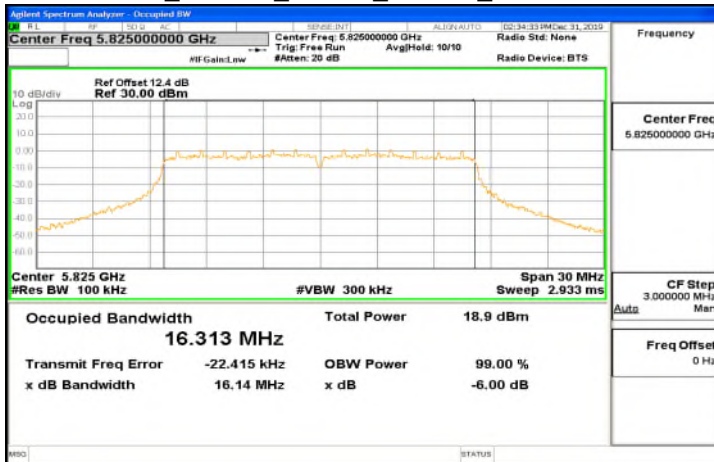


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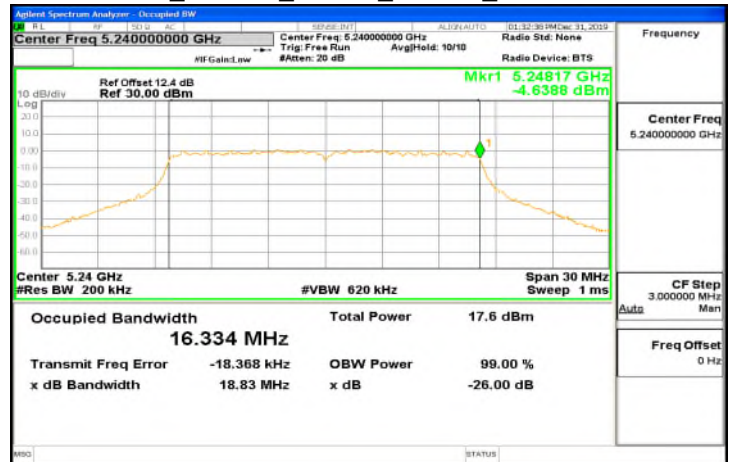
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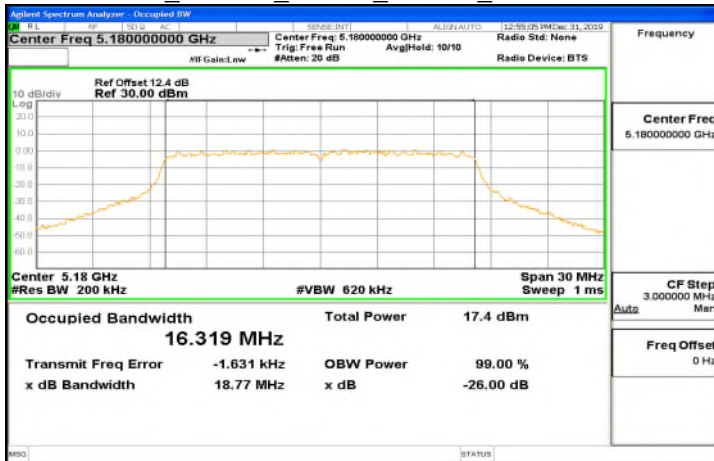
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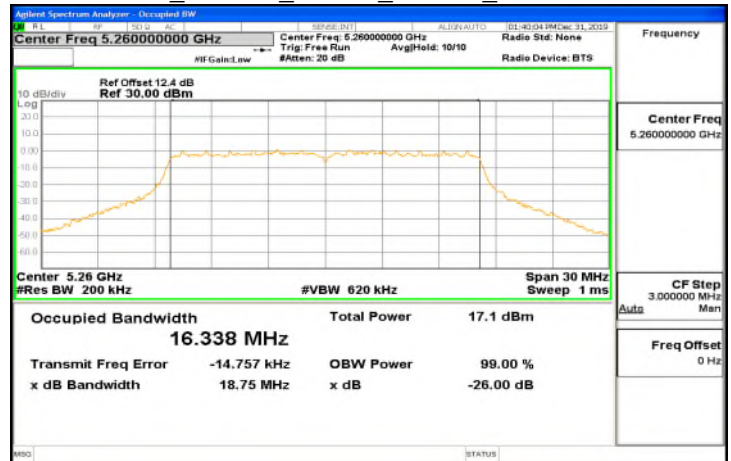
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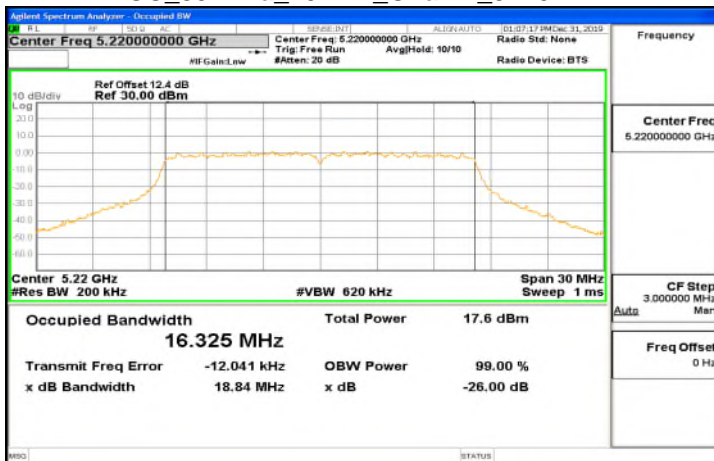
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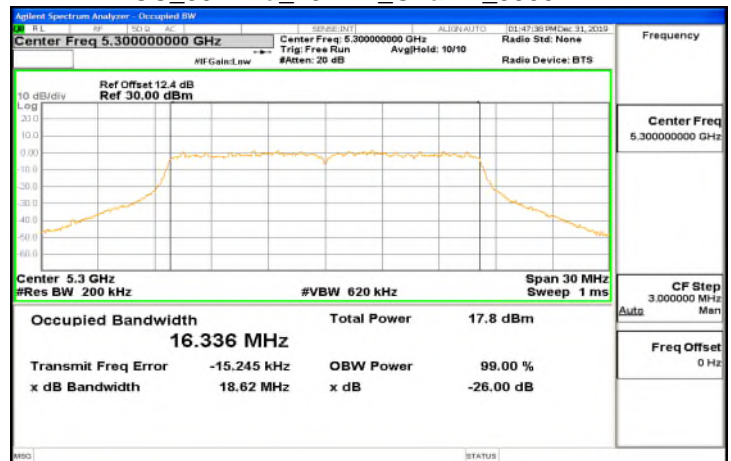
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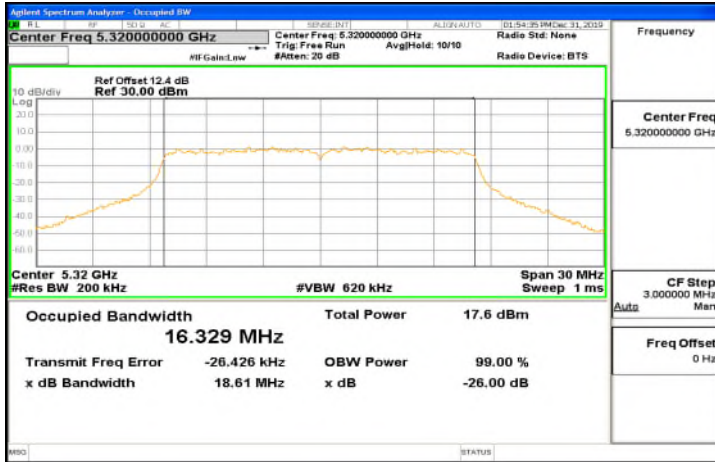


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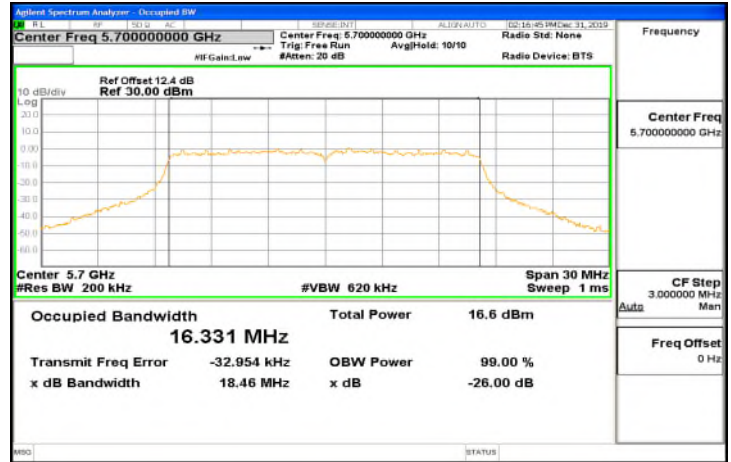
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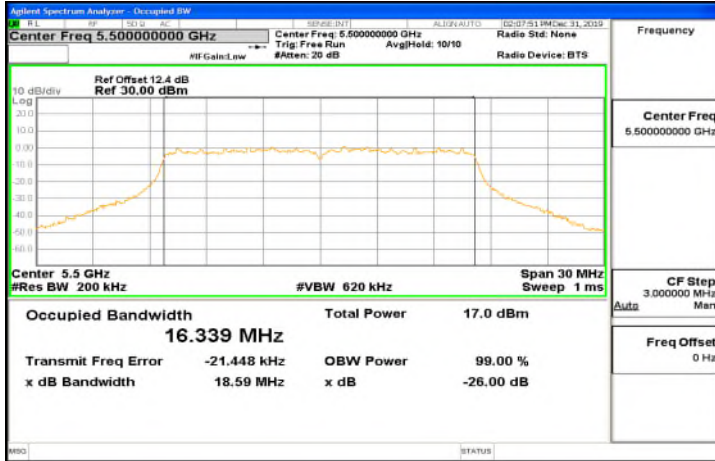
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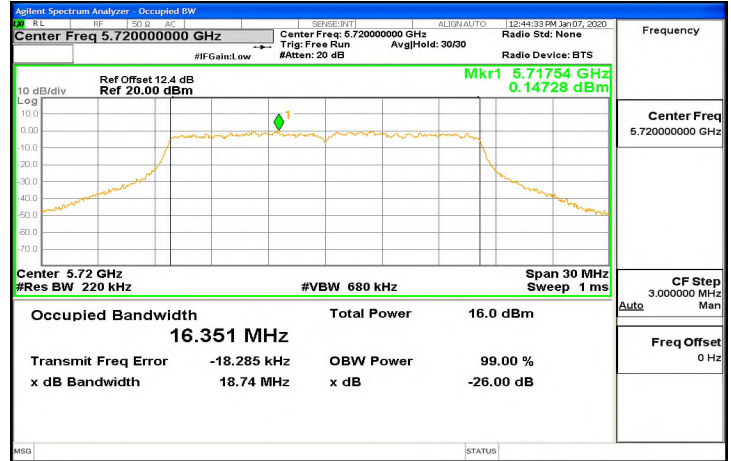
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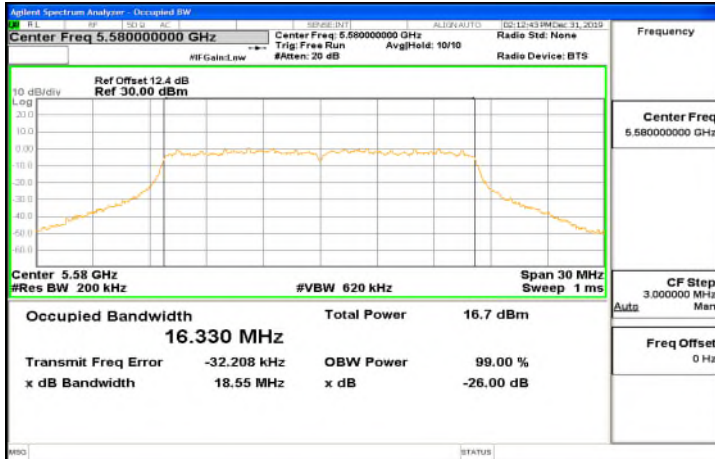
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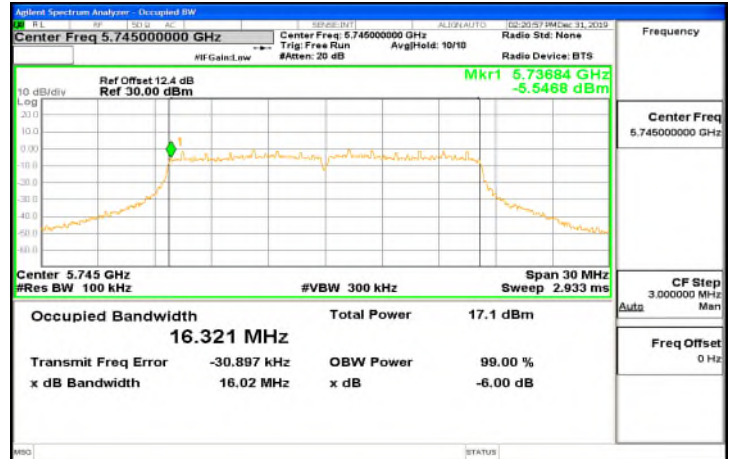
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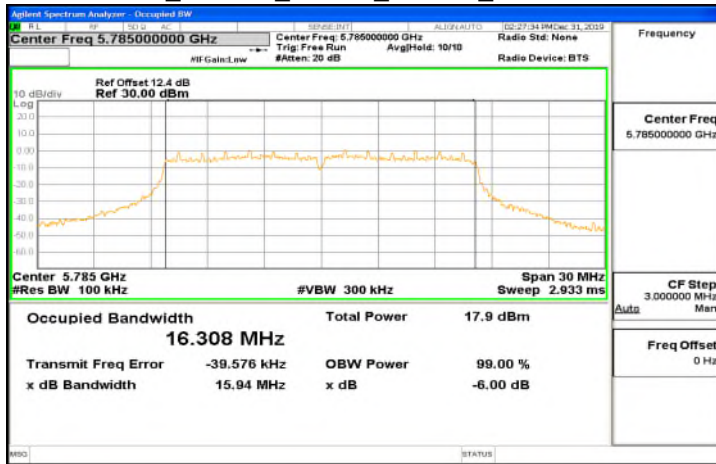


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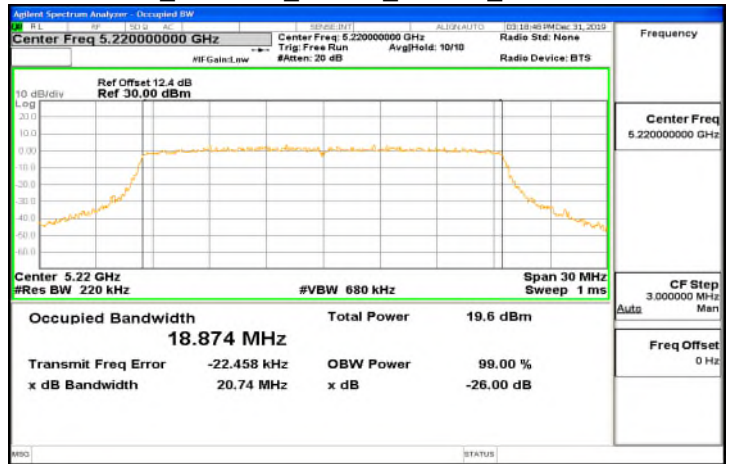
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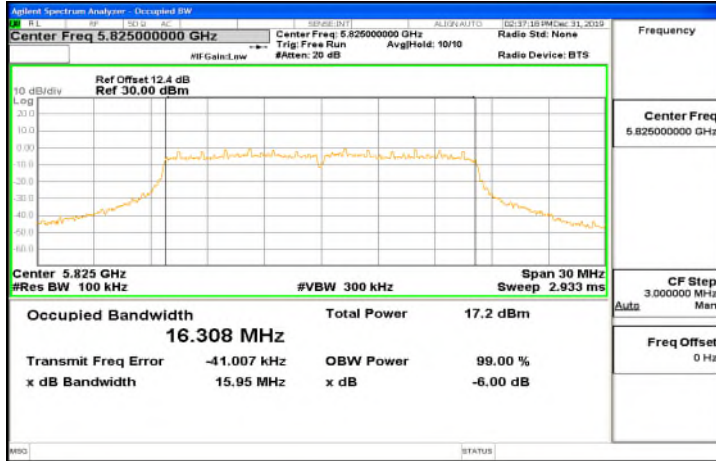
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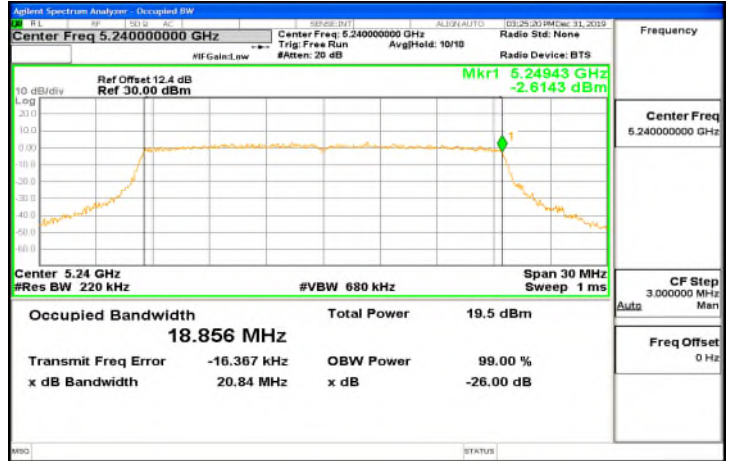
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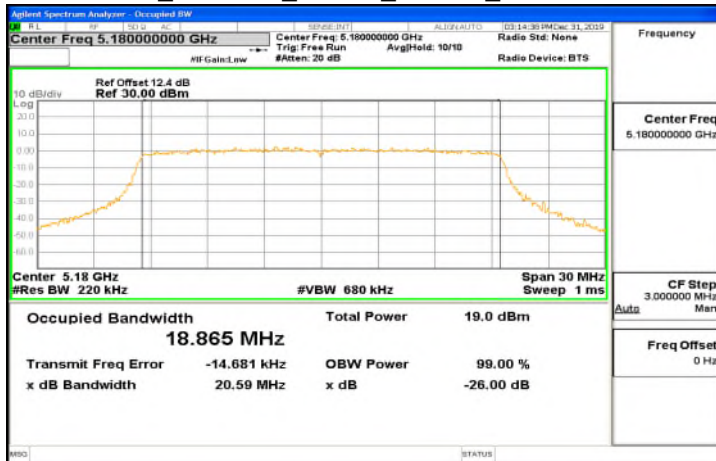
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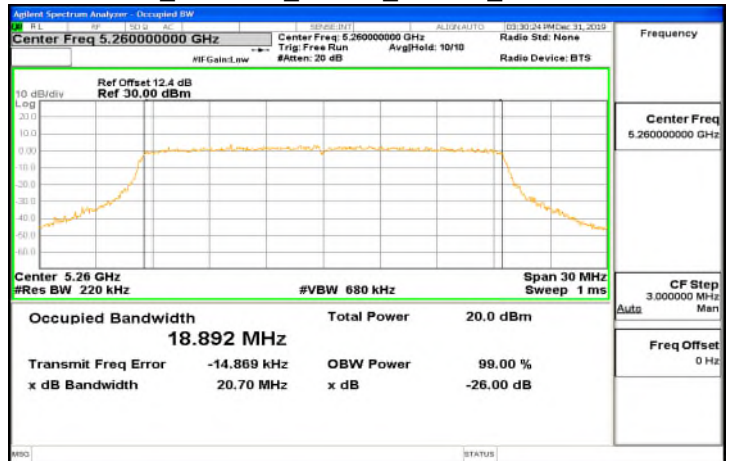
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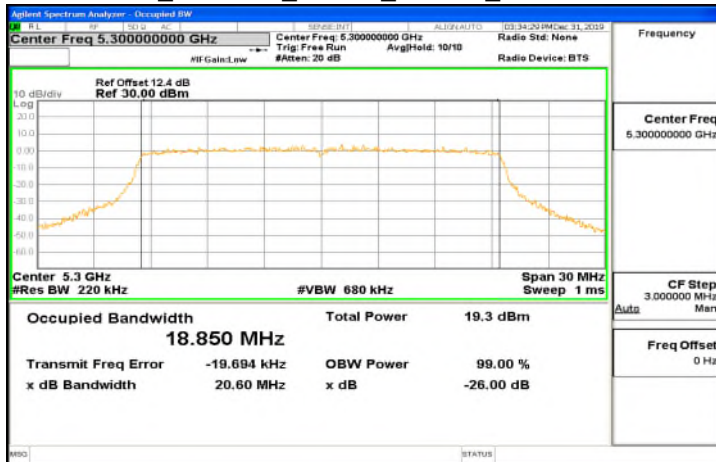


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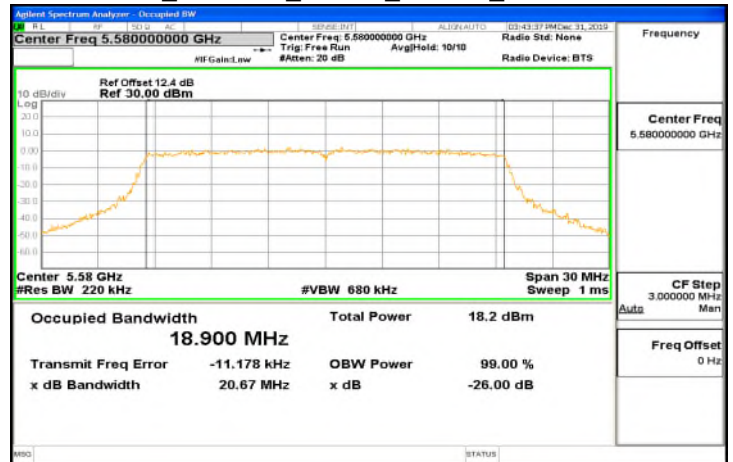
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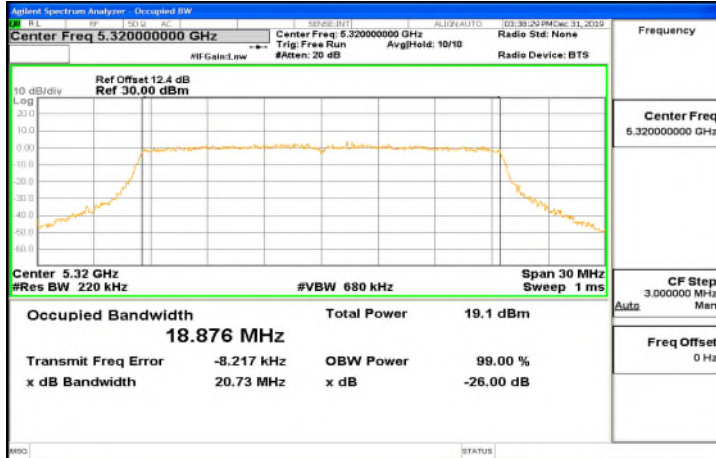
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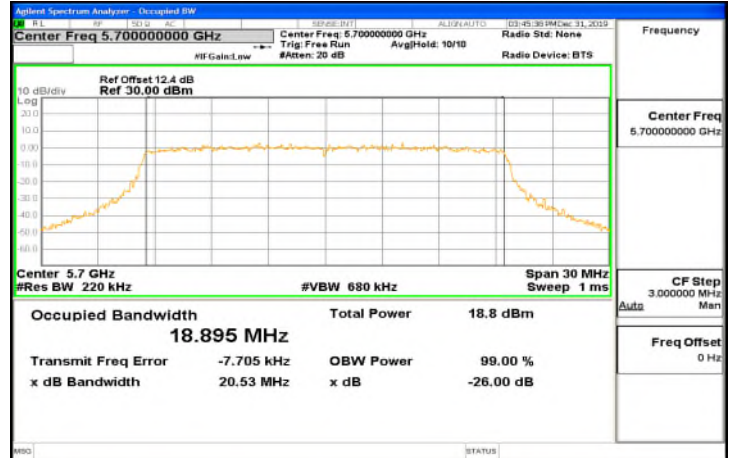
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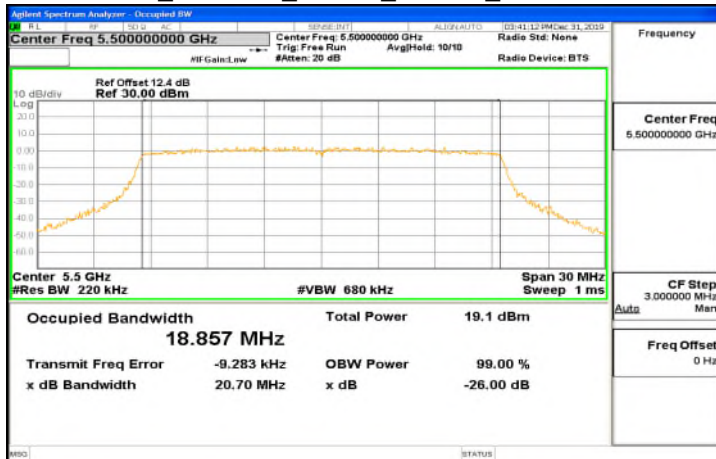
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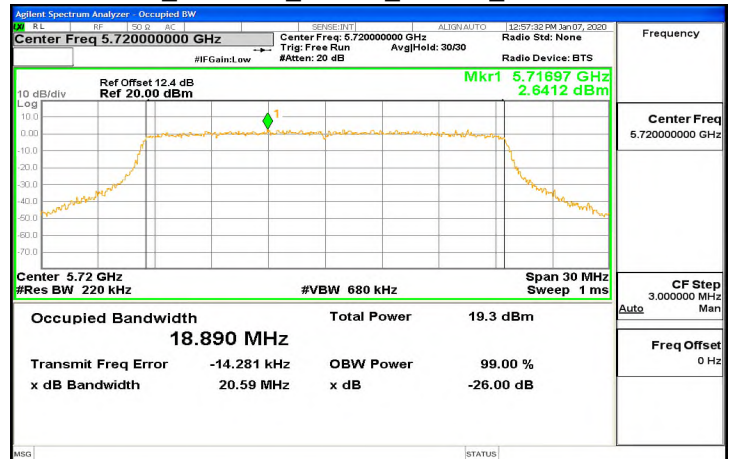
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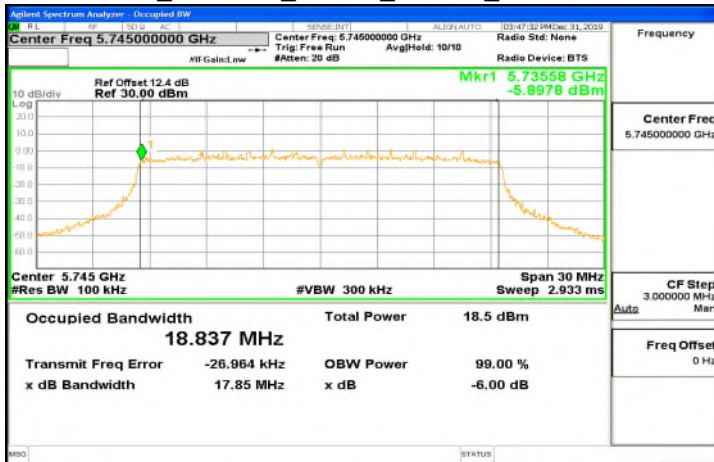


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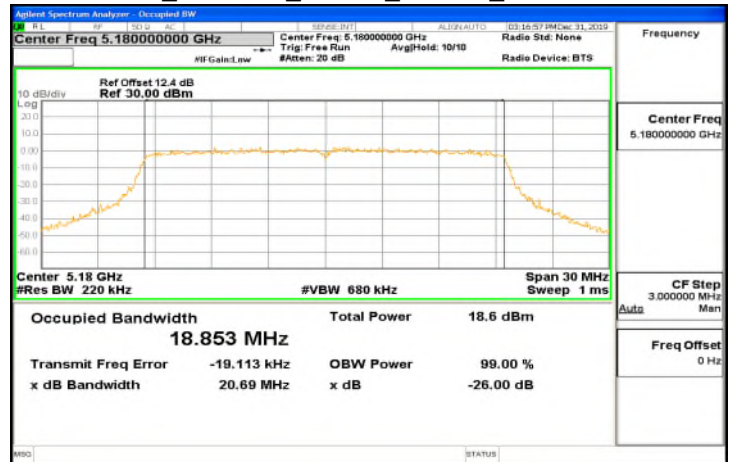
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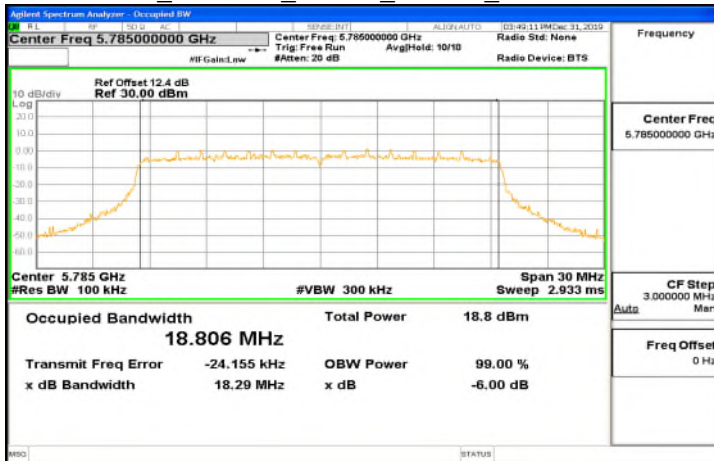
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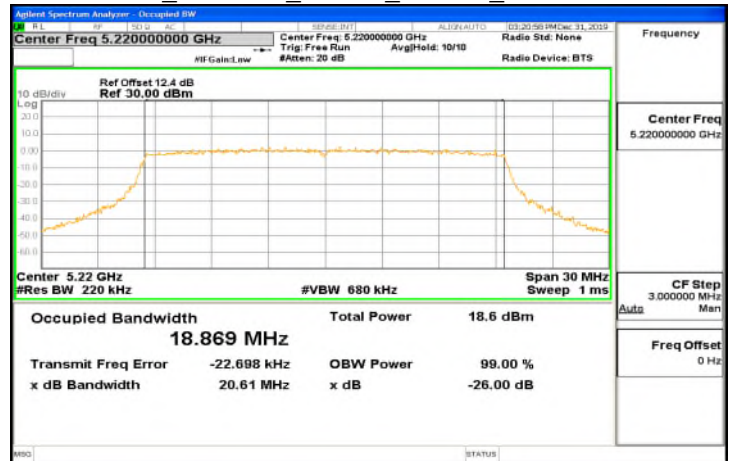
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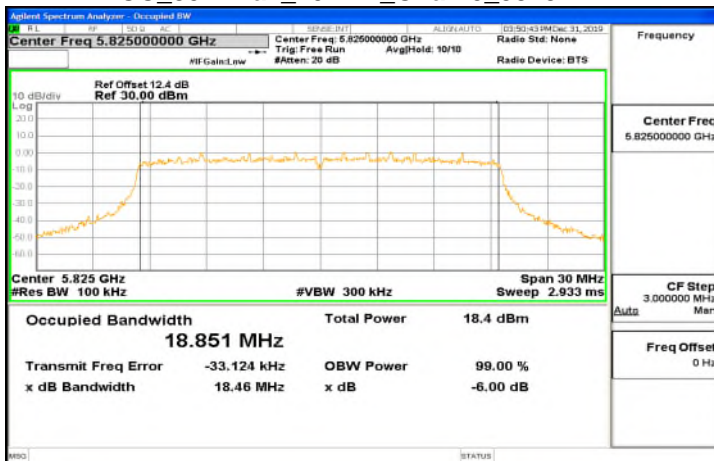
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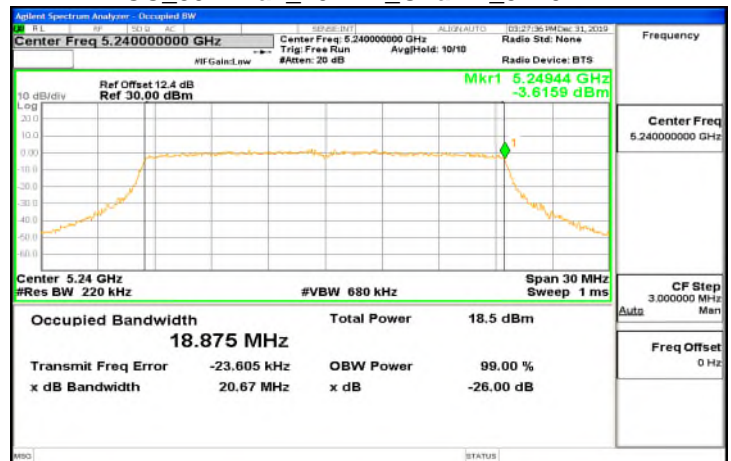
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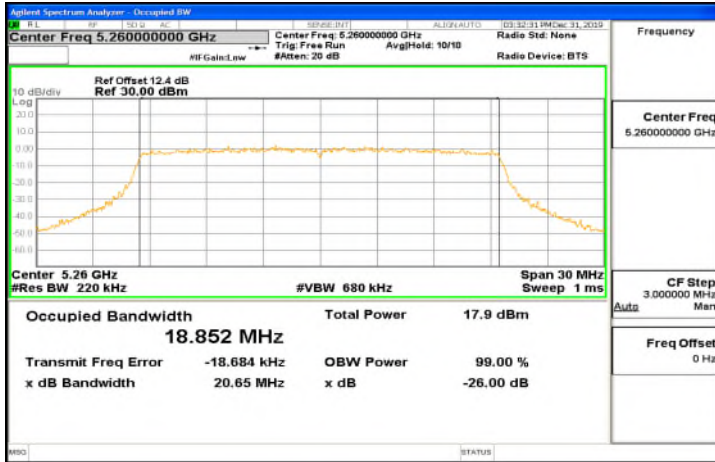


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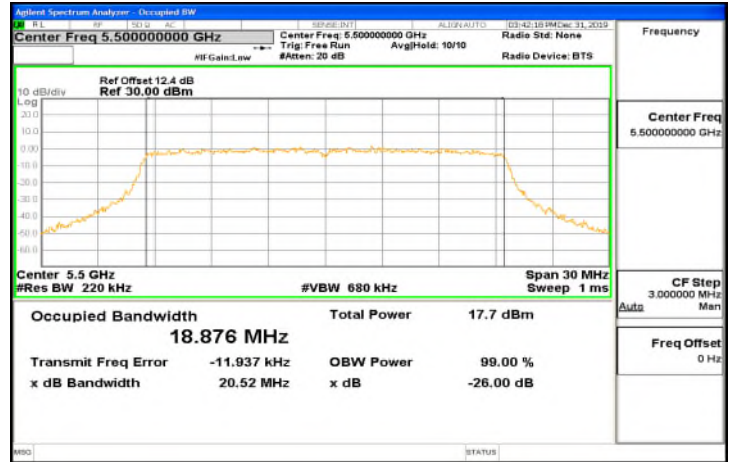
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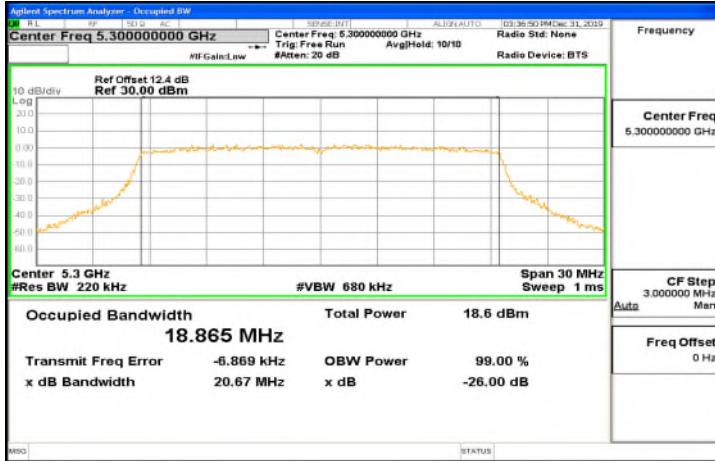
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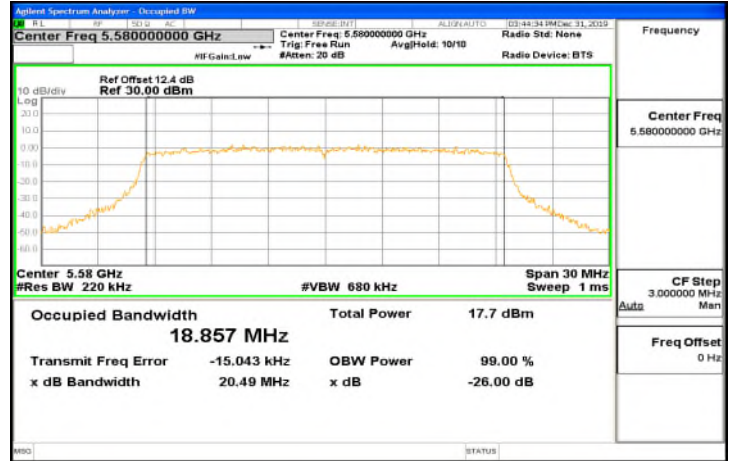
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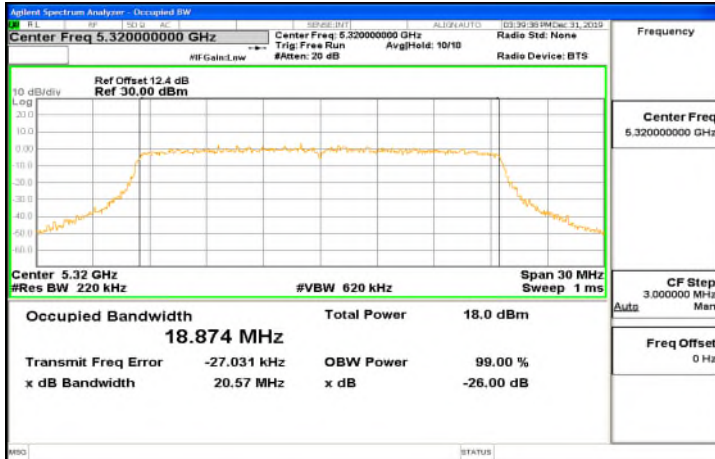
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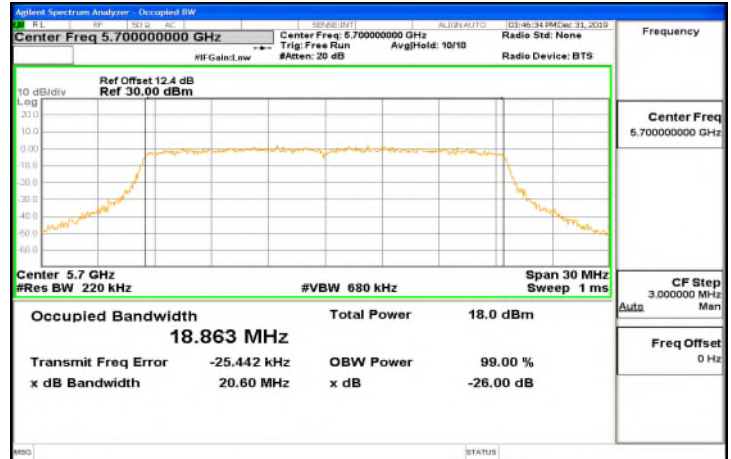
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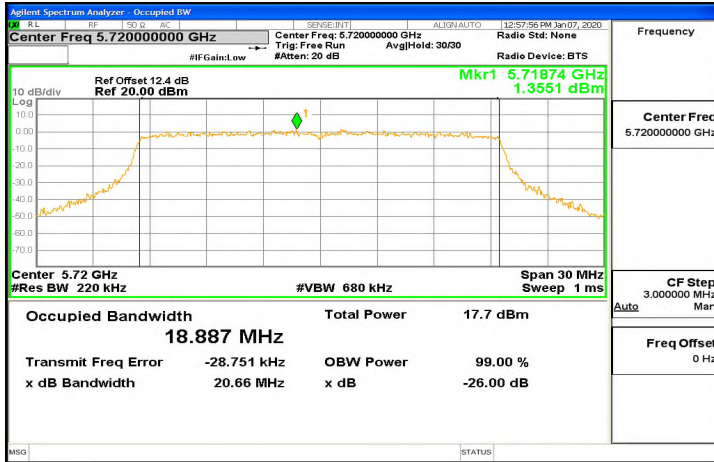


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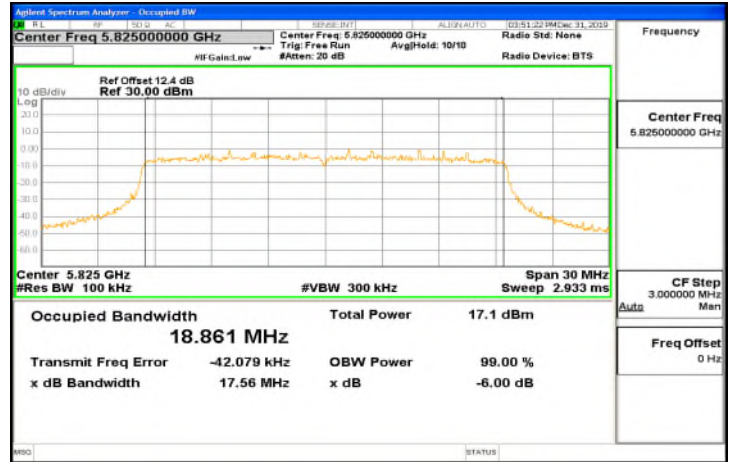
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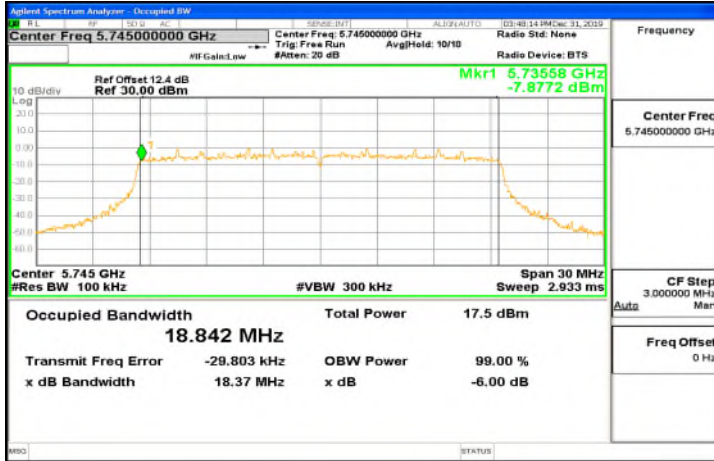
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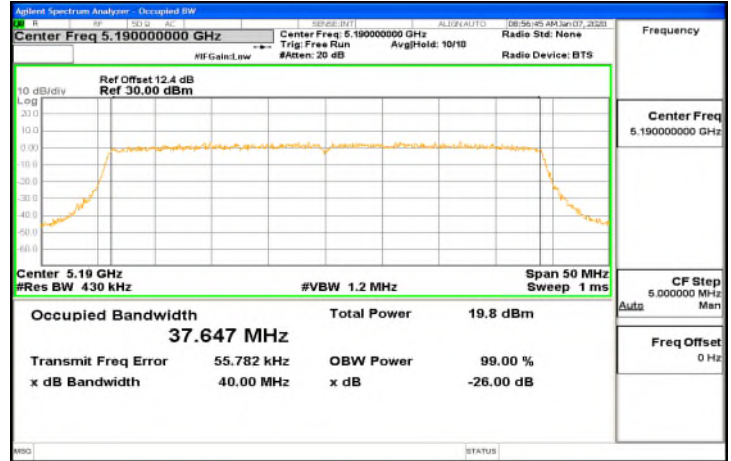
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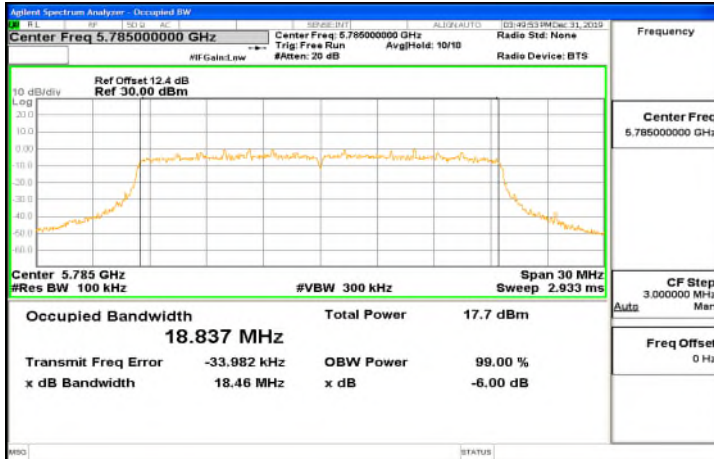
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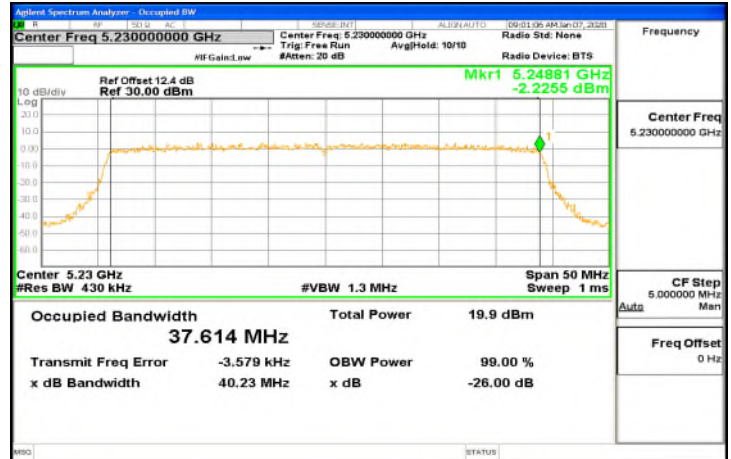
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FCC_802.11ax_20MHz_Chain1_5785MHz



FCC_802.11ax_40MHz_Chain0_5230MHz

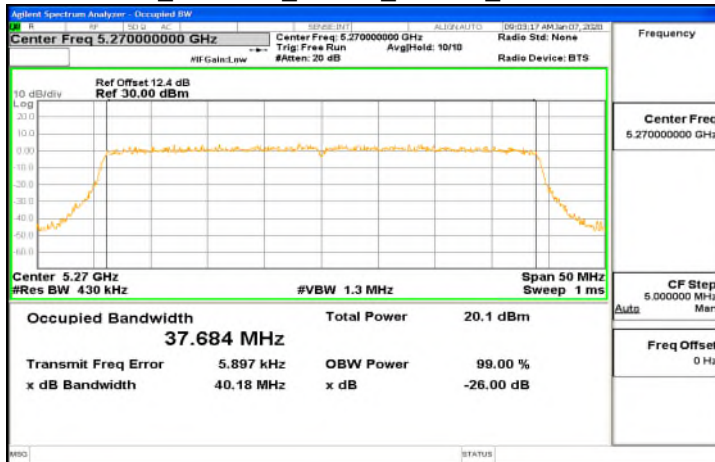


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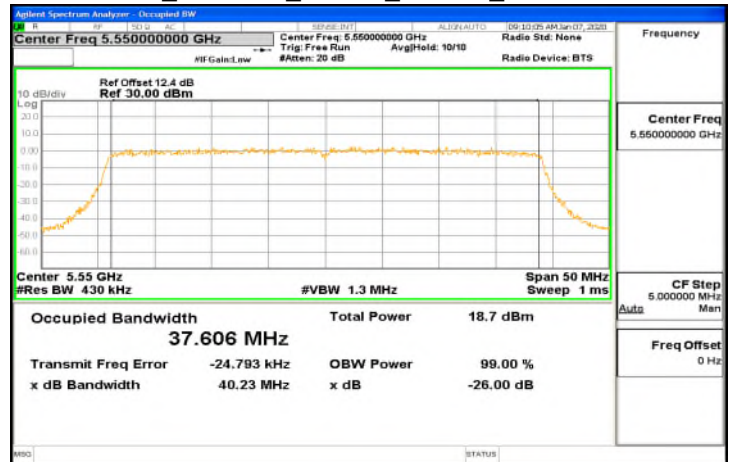
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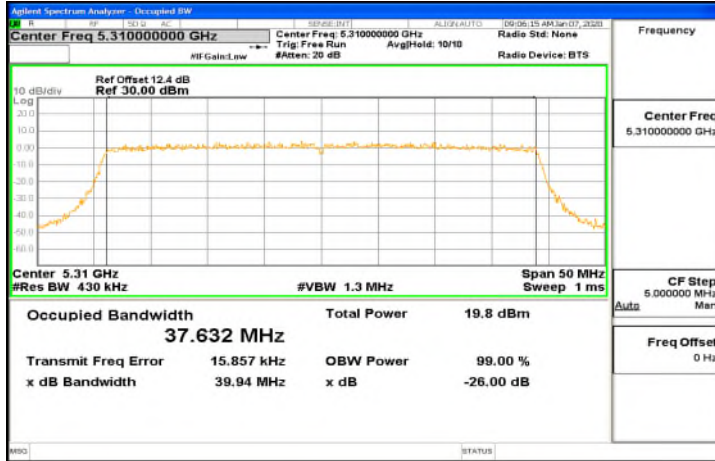
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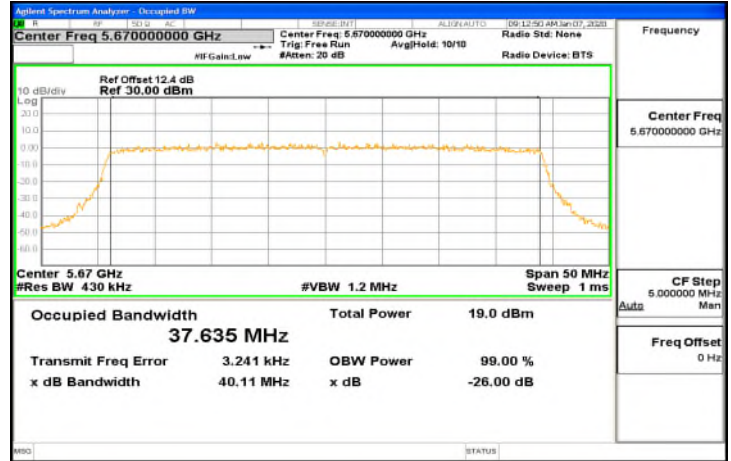
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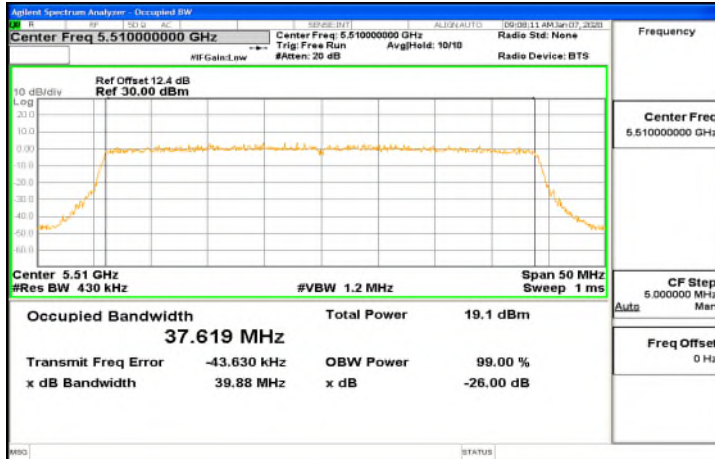
FCC_802.11ax_40MHz_Chain0_5310MHz



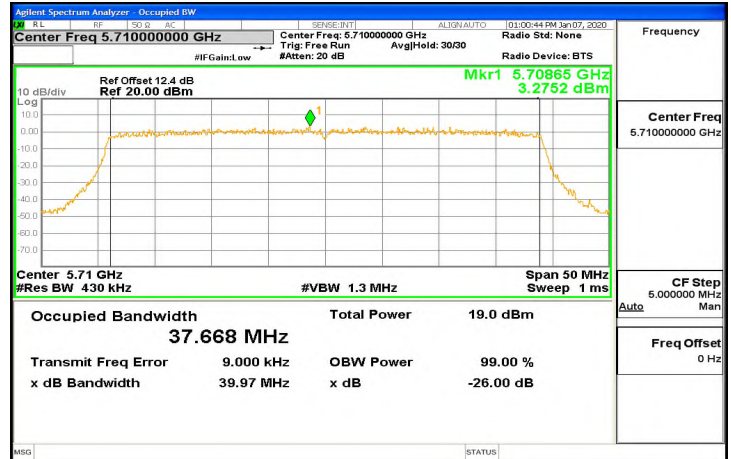
FCC_802.11ax_40MHz_Chain0_5670MHz



FCC_802.11ax_40MHz_Chain0_5510MHz



FCC_802.11ax_40MHz_Chain0_5710MHz

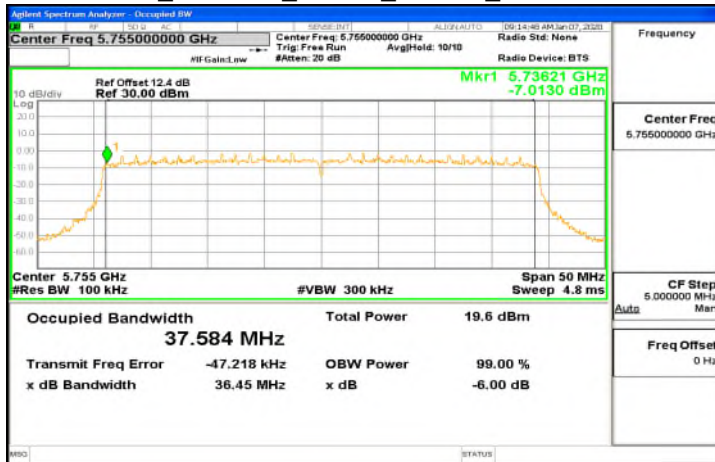


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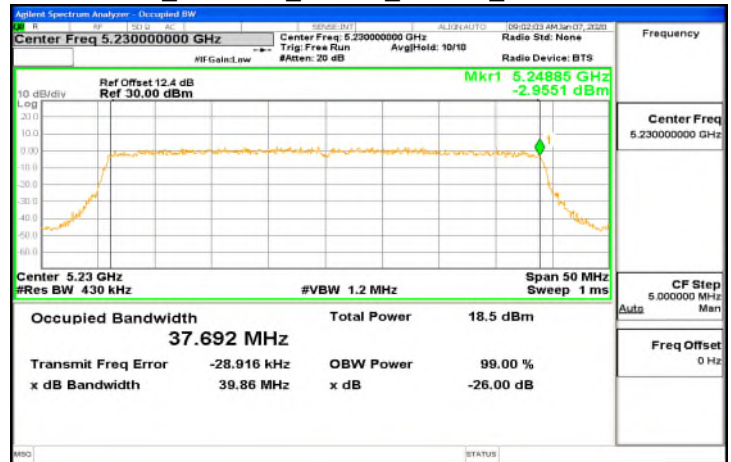
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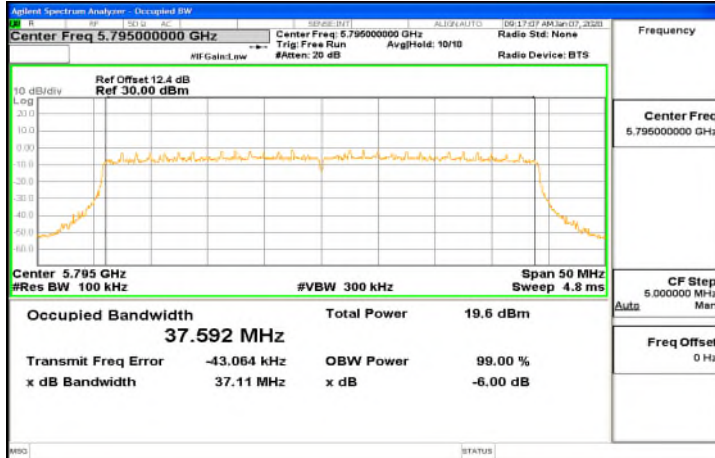
FCC_802.11ax_40MHz_Chain0_5755MHz



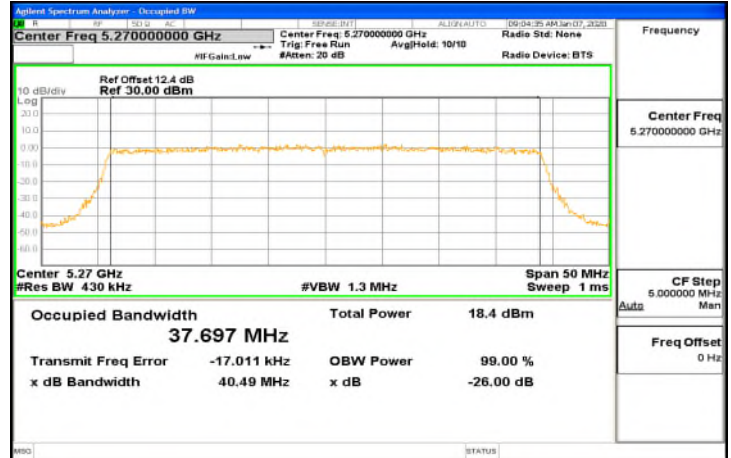
FCC_802.11ax_40MHz_Chain1_5230MHz



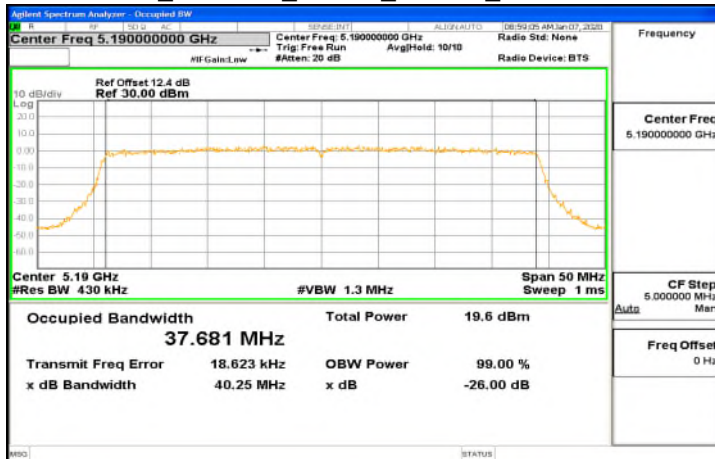
FCC_802.11ax_40MHz_Chain0_5795MHz



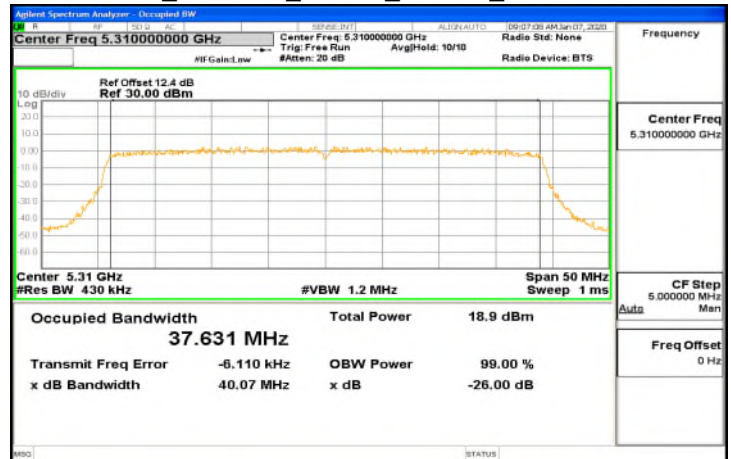
FCC_802.11ax_40MHz_Chain1_5270MHz



FCC_802.11ax_40MHz_Chain1_5190MHz



FCC_802.11ax_40MHz_Chain1_5310MHz

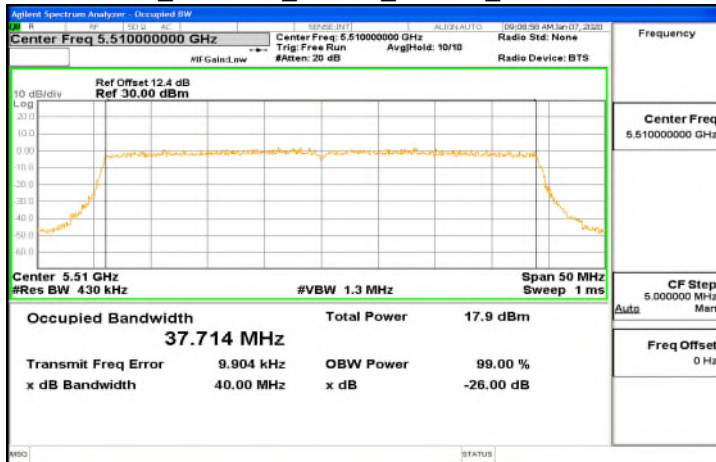


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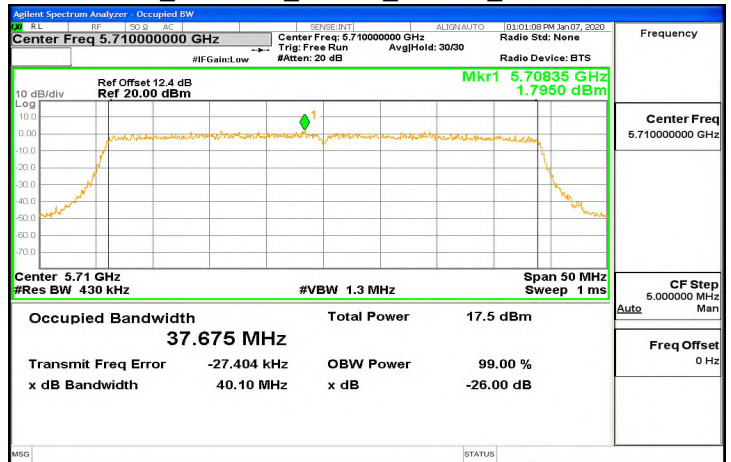
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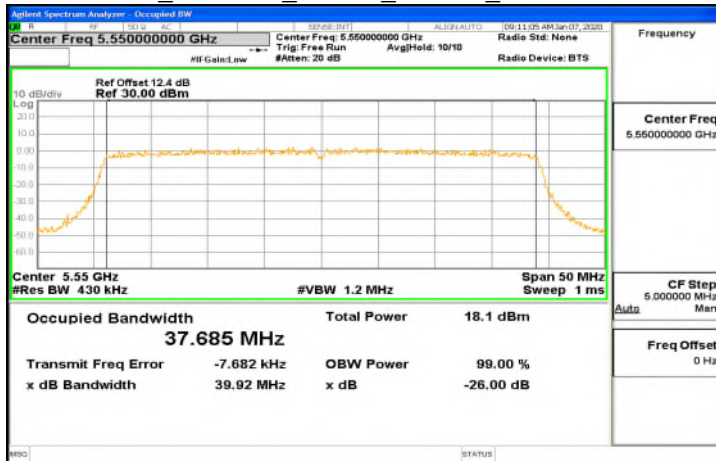
FCC_802.11ax_40MHz_Chain1_5510MHz



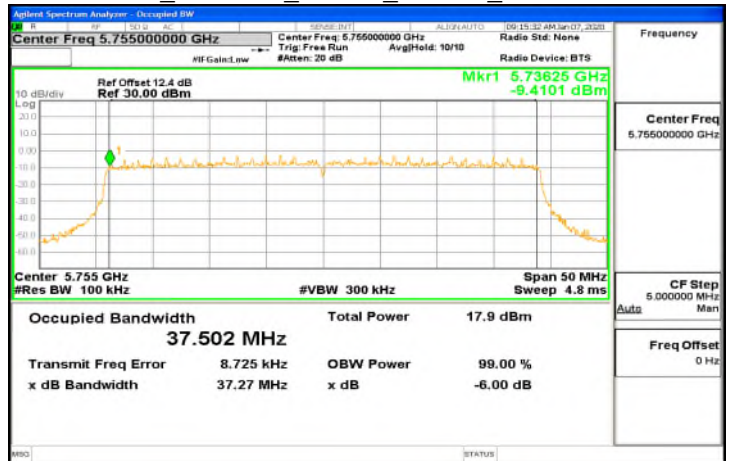
FCC_802.11ax_40MHz_Chain1_5710MHz



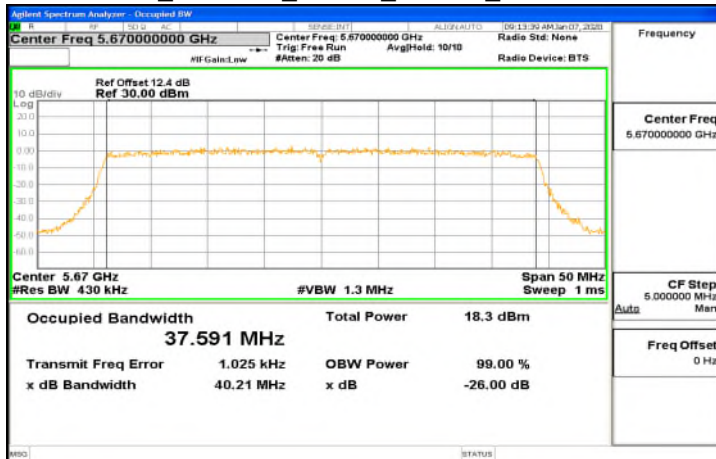
FCC_802.11ax_40MHz_Chain1_5550MHz



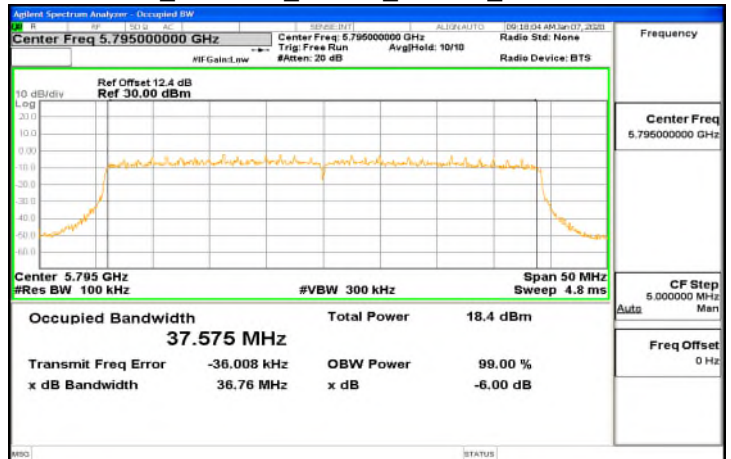
FCC_802.11ax_40MHz_Chain1_5755MHz



FCC_802.11ax_40MHz_Chain1_5670MHz



FCC_802.11ax_40MHz_Chain1_5795MHz

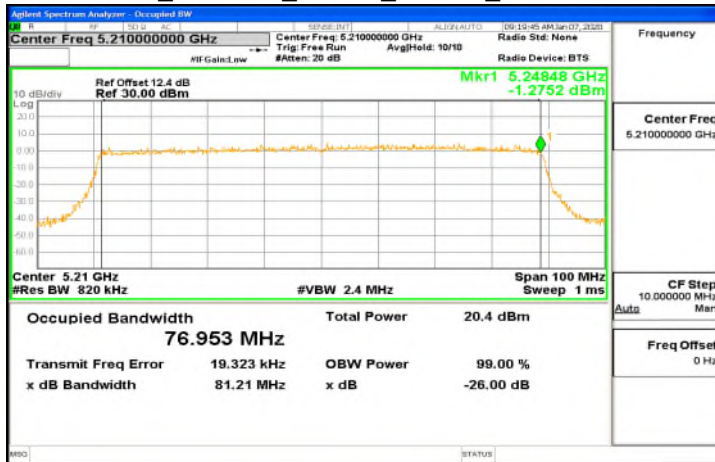


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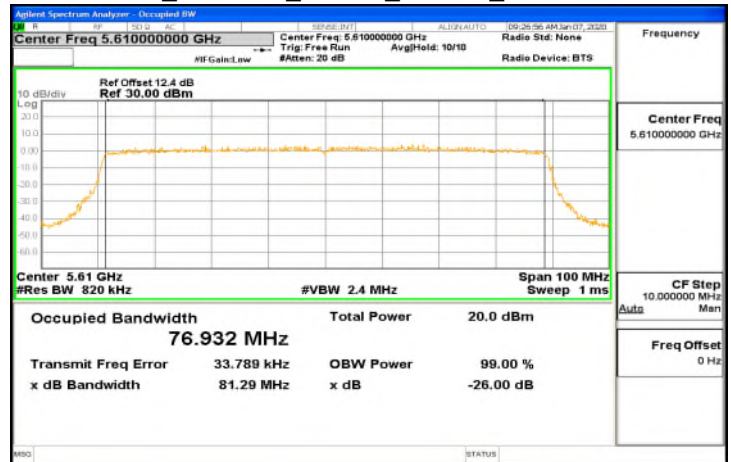
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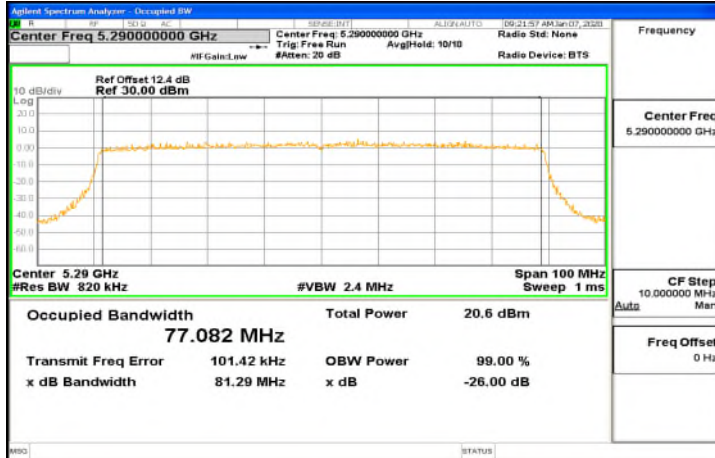
FCC_802.11ax_80MHz_Chain0_5210MHz



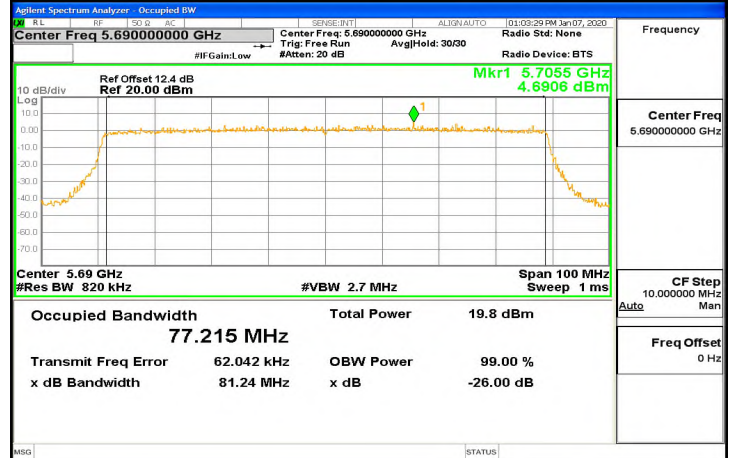
FCC_802.11ax_80MHz_Chain0_5610MHz



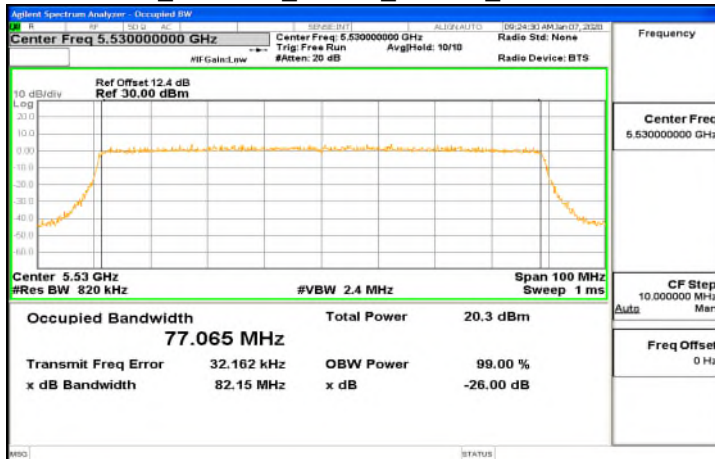
FCC_802.11ax_80MHz_Chain0_5290MHz



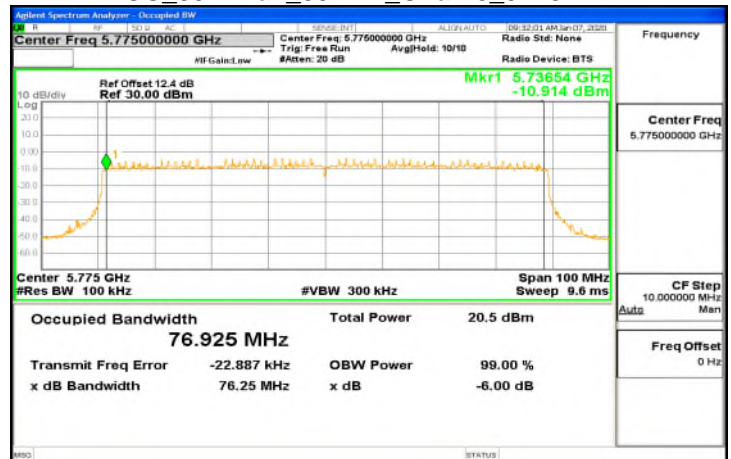
FCC_802.11ax_80MHz_Chain0_5690MHz



FCC_802.11ax_80MHz_Chain0_5530MHz



FCC_802.11ax_80MHz_Chain0_5775MHz

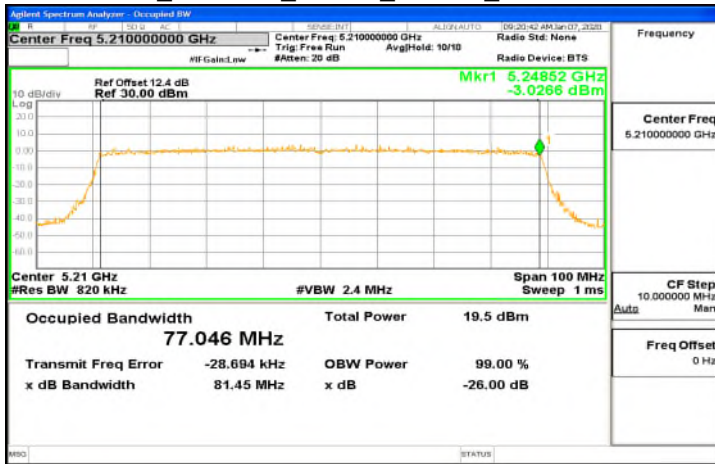


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FCC_802.11ax_80MHz_Chain1_5210MHz



9. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT

9.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Master device)	1 Watt(30dBm)
		Fixed point-to-point Access Point	1 Watt(30dBm)
	√	Mobile and portable client device	250mW(23.98dBm)
U-NII-2A	√		250mW(23.98dBm) or 11dBm+10 log B
U-NII-2C	√		250mW(23.98dBm) or 11dBm+10 log B
U-NII-3	√		1 Watt(30dBm)
If transmitting antennas of directional gain greater than 6 dBi are used, the Maximum transmit power shall be reduced by the amount in dB that the direction-al gain of the antenna exceeds 6 dBi.			

Note:

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain

$$= 10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$

[Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

The antenna gain is not granter than 6 dBi. Therefore, reduction of power is not required.

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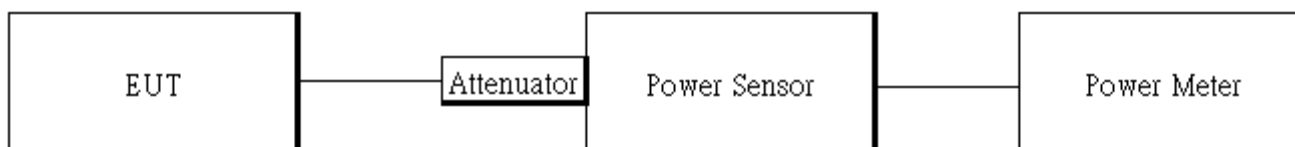
9.2 Measurement Procedure

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 power meter
4. Power Meter is used as the auxiliary test equipment to conduct the output power measurement.
5. Record the max. reading and add $10 \log(1/\text{duty cycle})$.
6. Repeat above procedures until all frequency (low, middle, and high channel) measured were complete.

9.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2496A	1804001	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726104	02/13/2019	02/12/2020
Power Sensor	Anritsu	MA2411B	1726107	02/13/2019	02/12/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021

9.4 Test Set-up



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9.5 Measurement Result

802.11a_2Tx

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	6	12.02	11.71	14.92	31.011	23.98	PASS
44	5220	6	12.26	11.61	14.99	31.583	23.98	PASS
48	5240	6	12.21	11.6	14.96	31.355	23.98	PASS
52	5260	6	12.33	11.5	14.98	31.493	23.98	PASS
60	5300	6	12.31	11.47	14.96	31.316	23.98	PASS
64	5320	6	12.06	11.13	14.67	29.290	23.98	PASS
100	5500	6	12.03	11.74	14.93	31.152	23.98	PASS
116	5580	6	11.85	11.28	14.62	28.985	23.98	PASS
140	5700	6	12.09	10.97	14.61	28.929	23.98	PASS
144	5720(U-NII 2C)	6	10.91	9.64	13.37	21.717	23.98	PASS
144	5720 (U-NII 3)	6	5.73	4.47	8.19	6.588	30	PASS
149	5745	6	12.05	10.78	14.51	28.240	30	PASS
157	5785	6	12.39	11.16	14.87	30.660	30	PASS
165	5825	6	12.42	11.03	14.83	30.393	30	PASS

802.11n_HT20_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
36	5180	MCS0	11.82	11.37	14.66	29.251	23.98	PASS
44	5220	MCS0	12.1	11.25	14.76	29.897	23.98	PASS
48	5240	MCS0	12.01	11.13	14.65	29.193	23.98	PASS
52	5260	MCS0	12.24	11.04	14.74	29.798	23.98	PASS
60	5300	MCS0	12.31	10.95	14.74	29.810	23.98	PASS
64	5320	MCS0	12.29	10.94	14.73	29.701	23.98	PASS
100	5500	MCS0	11.96	11.37	14.74	29.755	23.98	PASS
116	5580	MCS0	12.11	11.38	14.82	30.345	23.98	PASS
140	5700	MCS0	12.13	11.17	14.74	29.765	23.98	PASS
144	5720(U-NII 2C)	MCS0	10.83	9.74	13.37	21.728	23.98	PASS
144	5720 (U-NII 3)	MCS0	6.02	4.85	8.56	7.185	30	PASS
149	5745	MCS0	12.02	10.93	14.57	28.639	30	PASS
157	5785	MCS0	11.96	10.95	14.54	28.476	30	PASS
165	5825	MCS0	11.95	10.9	14.52	28.296	30	PASS

802.11n_HT40_MIMO

CH	Frequency (MHz)	Data Rate	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
			CH 0	CH 1				
38	5190	MCS0	11.22	10.84	14.84	30.454	23.98	PASS
46	5230	MCS0	11.24	10.66	14.76	29.936	23.98	PASS
54	5270	MCS0	11.41	10.41	14.74	29.792	23.98	PASS
62	5310	MCS0	11.47	10.31	14.73	29.723	23.98	PASS
102	5510	MCS0	11.24	10.75	14.80	30.229	23.98	PASS
110	5550	MCS0	11.37	10.84	14.92	31.012	23.98	PASS
134	5670	MCS0	11.13	10.48	14.62	28.970	23.98	PASS
142	5710(U-NII 2C)	MCS0	10.98	10.07	14.36	27.302	23.98	PASS
142	5720 (U-NII 3)	MCS0	2.22	1.52	5.60	3.633	30	PASS
151	5755	MCS0	11.47	10.18	14.68	29.343	30	PASS
159	5795	MCS0	11.27	10.28	14.61	28.876	30	PASS

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802.11ax_20_MIMO

CH	Frequency (MHz)	Data Rate	RU config.	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				CH 0	CH 1				
36	5180	MCS0	full	11.86	11.82	14.92	31.080	23.98	PASS
		MCS0	26/0	11.23	10.13	13.80	23.986	23.98	PASS
		MCS0	52/37	11.83	11.54	14.77	30.007	23.98	PASS
		MCS0	106/53	11.86	11.53	14.78	30.081	23.98	PASS
44	5220	MCS0	full	12.08	11.73	14.99	31.574	23.98	PASS
48	5240	MCS0	full	12.01	11.52	14.86	30.596	23.98	PASS
52	5260	MCS0	full	12.16	11.41	14.89	30.803	23.98	PASS
60	5300	MCS0	full	12.22	11.31	14.87	30.715	23.98	PASS
64	5320	MCS0	full	12.27	11.4	14.94	31.200	23.98	PASS
		MCS0	26/8	11.38	10.24	13.93	24.729	23.98	PASS
		MCS0	52/40	12.33	11.05	14.82	30.351	23.98	PASS
		MCS0	106/54	12.29	11.15	14.84	30.493	23.98	PASS
100	5500	MCS0	full	12.02	11.73	14.96	31.349	23.98	PASS
		MCS0	26/0	11.06	10.75	13.99	25.076	23.98	PASS
		MCS0	52/37	12.04	11.27	14.76	29.901	23.98	PASS
		MCS0	106/53	12.11	11.42	14.86	30.644	23.98	PASS
116	5580	MCS0	full	12.01	11.66	14.92	31.069	23.98	PASS
140	5700	MCS0	full	12.21	11.47	14.94	31.193	23.98	PASS
		MCS0	26/8	11.33	10.39	13.97	24.947	23.98	PASS
		MCS0	52/40	12.28	11.17	14.85	30.515	23.98	PASS
		MCS0	106/54	12.27	11.25	14.87	30.723	23.98	PASS
144	5720(U-NII 2C)	MCS0	full	10.83	10.01	13.53	22.530	23.98	PASS
144	5720 (U-NII 3)	MCS0	full	6.22	2.31	8.92	7.800	23.98	PASS
149	5745	MCS0	full	12.22	11.35	14.89	30.843	30	PASS
		MCS0	26/0	11.15	10.29	13.83	24.132	30	PASS
		MCS0	52/37	12.22	11.13	14.79	30.157	30	PASS
		MCS0	106/53	12.31	11.13	14.84	30.512	30	PASS
157	5785	MCS0	full	12.1	11.27	14.79	30.127	30	PASS
165	5825	MCS0	full	12.11	11.15	14.74	29.794	30	PASS
		MCS0	26/8	12.39	11.35	14.99	31.520	30	PASS
		MCS0	52/40	12.32	11.31	14.93	31.110	30	PASS
		MCS0	106/54	12.31	11.25	14.90	30.882	30	PASS

802.11ax_40_MIMO

CH	Frequency (MHz)	Data Rate	RU config.	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				CH 0	CH 1				
38	5190	MCS0	full	10.12	10.06	14.90	30.891	23.98	PASS
		MCS0	242/61	10.02	9.84	14.74	29.780	23.98	PASS
46	5230	MCS0	full	10.21	10.08	14.95	31.288	23.98	PASS
54	5270	MCS0	full	10.3	10.01	14.97	31.374	23.98	PASS
62	5310	MCS0	full	10.43	9.75	14.91	30.985	23.98	PASS
		MCS0	242/62	10.49	9.66	14.90	30.925	23.98	PASS
102	5510	MCS0	full	10.19	10.04	14.92	31.074	23.98	PASS
		MCS0	242/61	10.01	9.97	14.80	30.188	23.98	PASS
110	5550	MCS0	full	10.24	10.02	14.94	31.187	23.98	PASS
134	5670	MCS0	full	10.41	9.64	14.85	30.552	23.98	PASS
		MCS0	242/62	10.07	9.64	14.67	29.300	23.98	PASS
142	5710(U-NII 2C)	MCS0	full	9.99	9.00	14.33	27.120	23.98	PASS
142	5710 (U-NII 3)	MCS0	full	1.53	0.58	5.87	3.864	23.98	PASS
151	5755	MCS0	full	10.51	9.52	14.85	30.559	30	PASS
		MCS0	242/61	10.19	9.83	14.82	30.353	30	PASS
159	5795	MCS0	full	10.65	9.26	14.82	30.330	30	PASS
			242/62	10.35	9.44	14.73	29.697	30	PASS

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802.11ax_80_MIMO

CH	Frequency (MHz)	Data Rate	RU config.	Avg. POWER (dBm)		TOTAL POWER (dBm)	TOTAL POWER (mW)	REQUIRED LIMIT (dBm)	RESULT
				CH 0	CH 1				
42	5210	MCS0	full	10.79	10.36	14.92	31.059	23.98	PASS
		MCS0	484/65	6.87	6.37	10.97	12.499	23.98	PASS
58	5290	MCS0	full	10.85	10.38	14.96	31.354	23.98	PASS
		MCS0	484/66	7.08	6.02	10.92	12.370	23.98	PASS
106	5530	MCS0	full	10.66	10.33	14.84	30.477	23.98	PASS
		MCS0	484/65	6.47	6.31	10.73	11.837	23.98	PASS
122	5610	MCS0	full	10.6	10.04	14.67	29.313	23.98	PASS
138	5690(U-NII 2C)	MCS0	full	10.37	9.80	14.44	27.822	23.98	PASS
138	5690 (U-NII 3)	MCS0	full	-0.92	-1.24	3.15	2.068	23.98	PASS
155	5775	MCS0	full	10.85	10.28	14.92	31.016	30	PASS
		MCS0	484/65	6.72	6.48	10.94	12.426	30	PASS
		MCS0	484/66	7.33	5.68	10.92	12.372	30	PASS

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10. POWER SPECTRAL DENSITY

10.1 Standard Applicable

OPERZTION Band	EUT CATEGORY		LIMIT
U-NII-1		Access Point (Master device)	17dBm/ MHz
		Fixed point-to-point Access Point	
	√	Mobile and portable client device	11dBm/ MHz
U-NII-2A	√		11dBm/ MHz
U-NII-2C	√		11dBm/ MHz
U-NII-3	√		30dBm/ 500kHz
If transmitting antennas of directional gain greater than 6 dBi are used, the Maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.			

Note:

As per FCC KDB 662911 D01

Unequal antenna gains, with equal transmit powers. For antenna gains given by G1, G2, ..., GN dBi.

(i) If transmit signals are correlated, then Directional gain

$$= 10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

[Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

The antenna gain is not grater than 6 dBi. Therefore, reduction of power is not required.

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10.2 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 Spectrum.
4. **For U-NII1, U-NII-2A, U-NII-2C Band:**
Set RBW=1MHz, VBW=3MHz, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
For U-NII-3 Band:
Set RBW=500 kHz, VBW \geq 3RBW, where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
5. User the cursor on spectrum to peak search the highest level of trace
6. Record the max. reading and add 10 log(1/duty cycle).
7. Repeat above procedures until all default test channel (low, middle, and high) was complete.
8. 802.11n MIMO mode: offset is set following "measure and add 10 Log (N)" on spectrum to measure the PSD for MIMO mode. Offset = cable loss + 10 log (N), where N is number of transmitting antenna. N=2 for this given application.

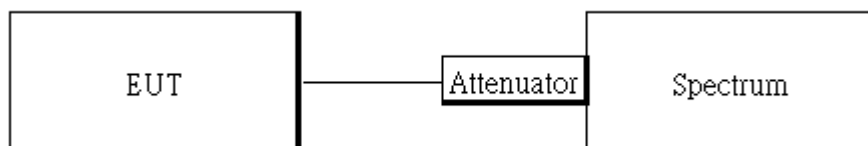
Note:

For the test of PSD at MIMO mode, the highest emission of worst case employing Measure and add 10 log (N) technical is reported on this report after the comparison between Main Antenna at single transmitting mode and Aux that yields the higher value. The MIMO transmitting mode produces higher value of outcome

10.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	05/02/2019	05/01/2020
DC Power Supply	Agilent	E3640A	MY52410006	12/10/2019	12/09/2020
Attenuator	Mini-Circuit	BW-S10W2+	2	01/02/2020	01/01/2021
DC Block	Mini-Circuits	BLK-18-S+	1	01/02/2020	01/01/2021

10.4 Test Set-up



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10.5 Measurement Result

POWER DENSITY 802.11a MODE 2TX					
Frequency (MHz)	PSD W/O Duty Factor (dBm)	Duty Factor	PSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180.00	3.69	-	3.69	11.00	-7.31
5220.00	4.12	-	4.12	11.00	-6.88
5240.00	3.91	-	3.91	11.00	-7.09
5260.00	4.03	-	4.03	11.00	-6.97
5300.00	3.71	-	3.71	11.00	-7.29
5320.00	3.25	-	3.25	11.00	-7.75
5500.00	3.04	-	3.04	11.00	-7.96
5580.00	2.94	-	2.94	11.00	-8.06
5700.00	3.10	-	3.10	11.00	-7.90
5720 (U-NII 2C)	3.43	-	3.43	11.00	-7.57
5720 (U-NII 3)	-0.56	-	-0.56	30.00	-30.56
5745.00	0.51	-	0.51	30.00	-29.49
5785.00	0.90	-	0.90	30.00	-29.10
5825.00	0.97	-	0.97	30.00	-29.03

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POWER DENSITY 802.11ax 20 MODE						
Frequency (MHz)	RU config.	PSD W/O Duty Factor (dBm)	Duty Factor	PSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5180	full	2.13	-	2.13	11	-8.87
	26/0	10.47	-	10.47	11	-0.53
	52/37	8.32	-	8.32	11	-2.68
	106/53	5.39	-	5.39	11	-5.61
5220	full	2.71	-	2.71	11	-8.29
5240	full	2.67	-	2.67	11	-8.33
5260	full	2.97	-	2.97	11	-8.03
5300	full	2.64	-	2.64	11	-8.36
5320	full	2.17	-	2.17	11	-8.83
	26/8	10.52	-	10.52	11	-0.48
	52/40	9.13	-	9.13	11	-1.87
	106/54	6.31	-	6.31	11	-4.69
5500	full	2.25	-	2.25	11	-8.75
	26/0	10.62	-	10.62	11	-0.38
	52/37	8.93	-	8.93	11	-2.07
	106/53	6.04	-	6.04	11	-4.96
5580	full	2.01	-	2.01	11	-8.99
5700	full	2.71	-	2.71	11	-8.29
	26/8	10.69	-	10.69	11	-0.31
	52/40	9.29	-	9.29	11	-1.71
	106/54	6.26	-	6.26	11	-4.74
5720 (U-NII 2C)	full	3.09	-	3.09	11	-7.91
5720 (U-NII 3)	full	-0.39	-	-0.39	30	-30.39
5745	full	-0.09	-	-0.09	30	-30.09
	26/0	8.03	-	8.03	30	-21.97
	52/37	6.19	-	6.19	30	-23.81
	106/53	3.57	-	3.57	30	-26.43
5785	full	-0.51	-	-0.51	30	-30.51
5825	full	-0.41	-	-0.41	30	-30.41
	26/8	8.71	-	8.71	30	-21.29
	52/40	5.96	-	5.96	30	-24.04
	106/54	2.89	-	2.89	30	-27.11

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POWER DENSITY 802.11ax 40 MODE						
Frequency (MHz)	RU config.	PSD W/O Duty Factor (dBm)	Duty Factor	PSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5190	full	-1.56	1.80	0.24	11	-10.76
	242/61	0.43	1.80	2.23	11	-8.77
5230	full	-1.02	1.80	0.78	11	-10.22
5270	full	0.01	1.80	1.81	11	-9.19
5310	full	-0.32	1.80	1.48	11	-9.52
	242/62	1.13	1.80	2.93	11	-8.07
5510	full	-0.91	1.80	0.89	11	-10.11
	242/61	0.32	1.80	2.12	11	-8.88
5550	full	-2.29	1.80	-0.49	11	-11.49
5670	full	-1.65	1.80	0.15	11	-10.85
	242/62	0.40	1.80	2.20	11	-8.80
5710 (U-NII 2C)	full	-1.63	1.80	0.17	11	-10.83
5710 (U-NII 3)	full	-5.73	1.80	-3.93	30	-33.93
5755	full	-3.86	1.80	-2.06	30	-32.06
	242/61	-2.62	1.80	-0.82	30	-30.82
5795	full	-4.26	1.80	-2.46	30	-32.46
	242/62	-2.36	1.80	-0.56	30	-30.56

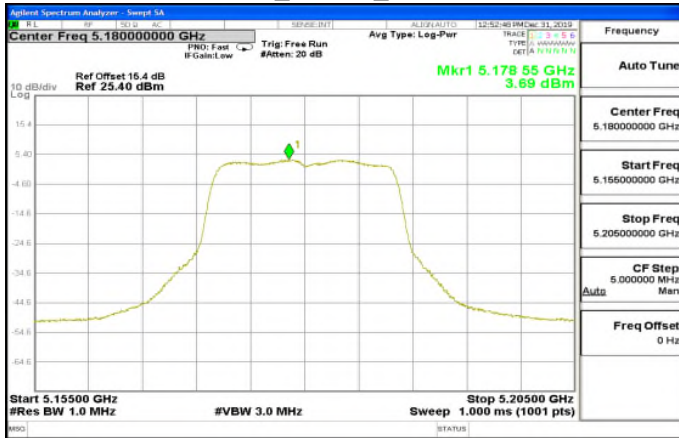
POWER DENSITY 802.11ax 80 MODE						
Frequency (MHz)	RU config.	PSD W/O Duty Factor (dBm)	Duty Factor	PSD With Duty Factor (dBm)	Limit (dBm)	Margin (dB)
5210	full	-2.93	1.33	-1.60	11	-12.60
	484/65	-7.32	1.33	-5.99	11	-16.99
5290	full	-2.95	1.33	-1.62	11	-12.62
	484/66	-6.49	1.33	-5.16	11	-16.16
5530	full	-4.21	1.33	-2.88	11	-13.88
	484/65	-6.39	1.33	-5.06	11	-16.06
5610	full	-3.84	1.33	-2.51	11	-13.51
5690 (U-NII 2C)	full	-4.33	1.33	-3.00	11	-14.00
5690 (U-NII 3)	full	-8.58	1.33	-7.25	30	-37.25
5775	full	-6.40	1.33	-5.07	30	-35.07
	484/65	-9.75	1.33	-8.42	30	-38.42
	484/66	-8.84	1.33	-7.51	30	-37.51

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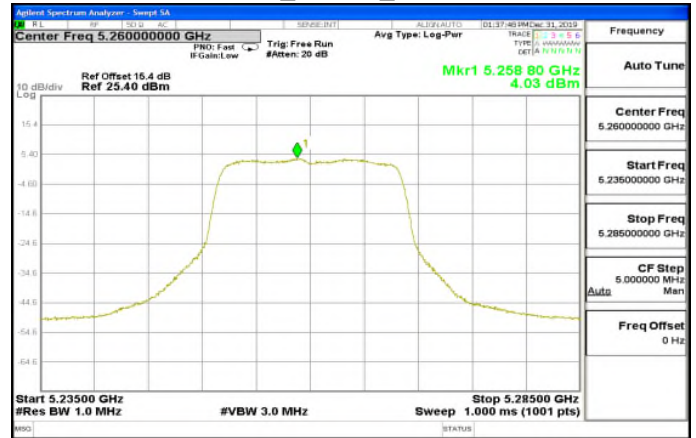
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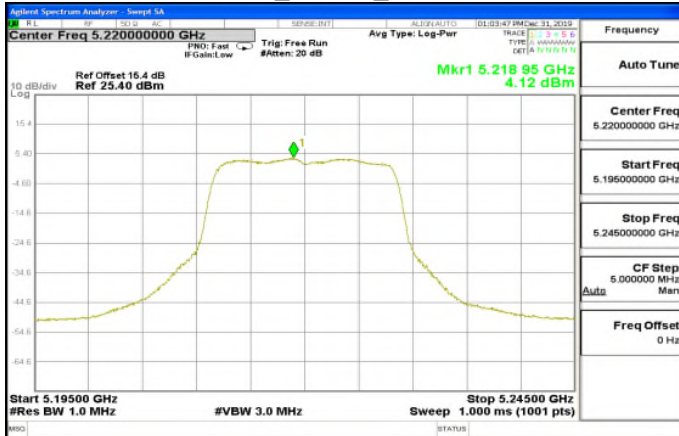
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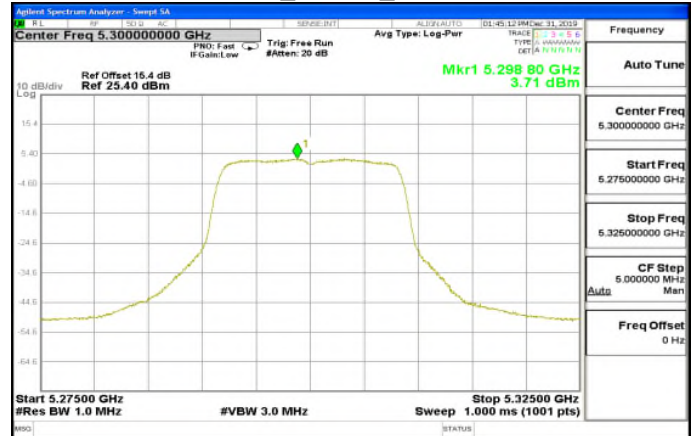
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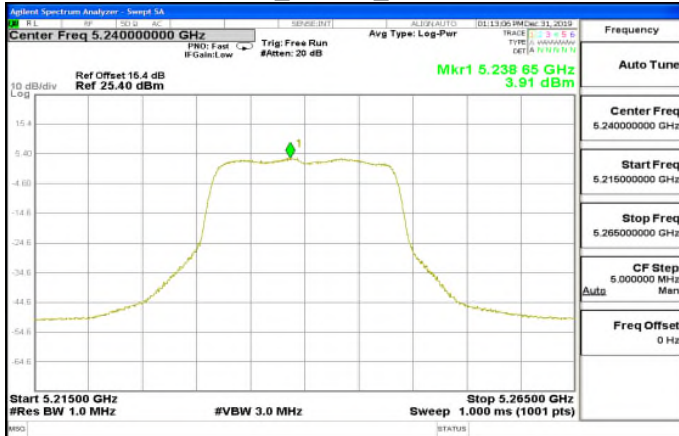
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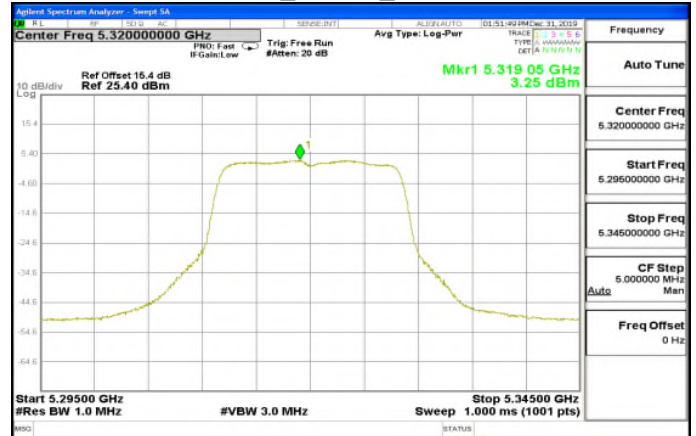
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802.11a_20MHz_5240MHz



802.11a_20MHz_5320MHz

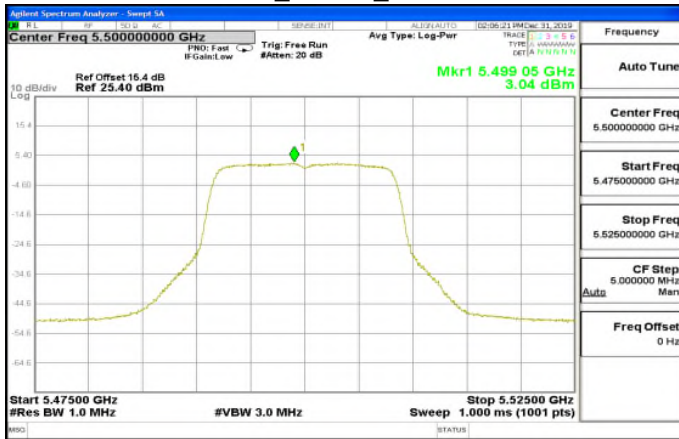


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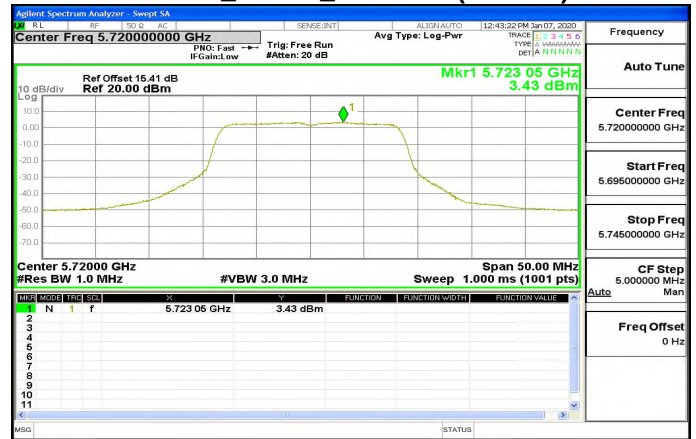
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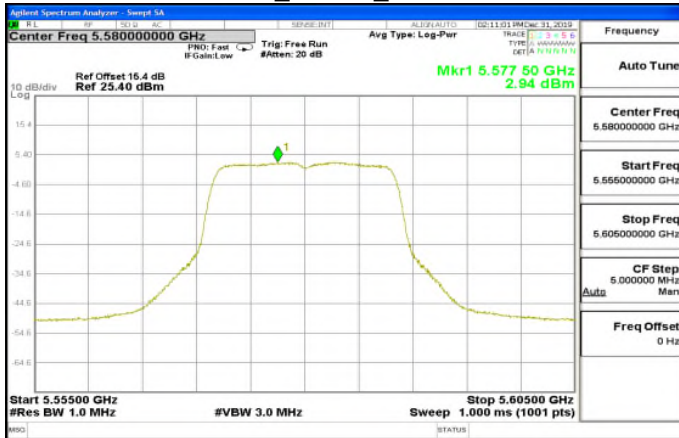
802.11a_20MHz_5500MHz



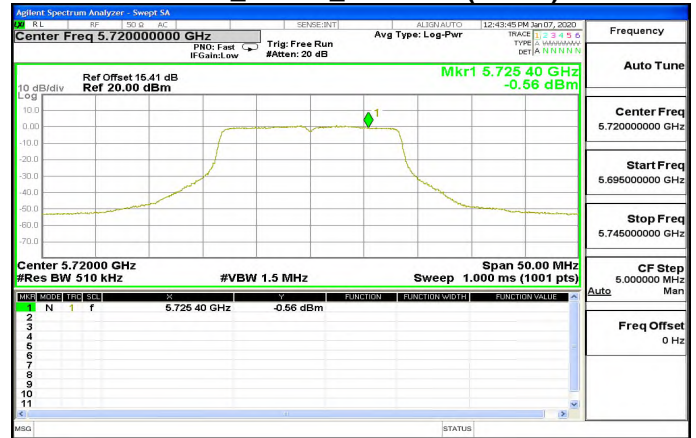
802.11a_20MHz_5720MHz (UNII 2C)



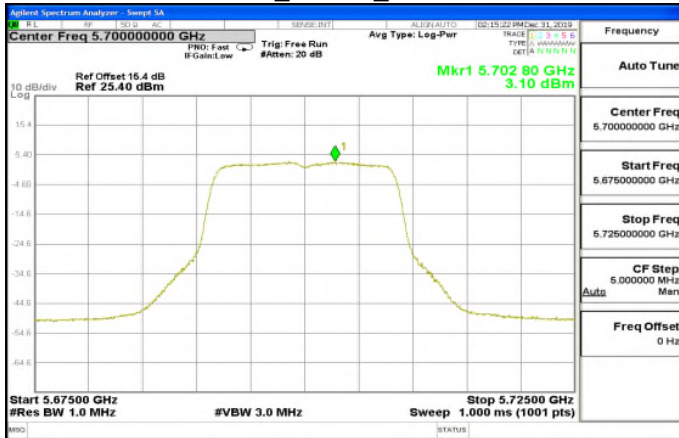
802.11a_20MHz_5580MHz



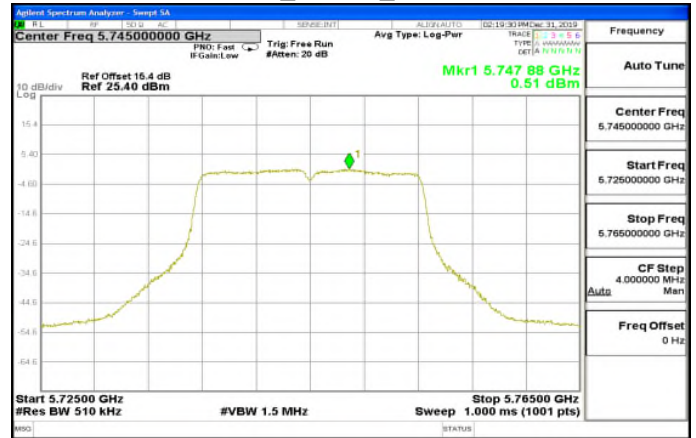
802.11a_20MHz_5720MHz (UNII 3)



802.11a_20MHz_5700MHz



802.11a_20MHz_5745MHz

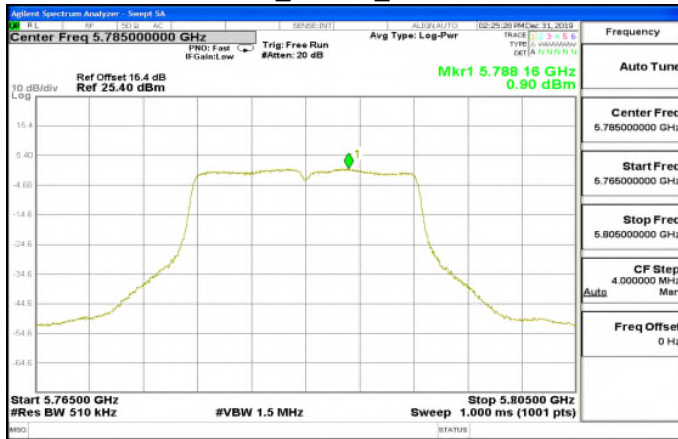


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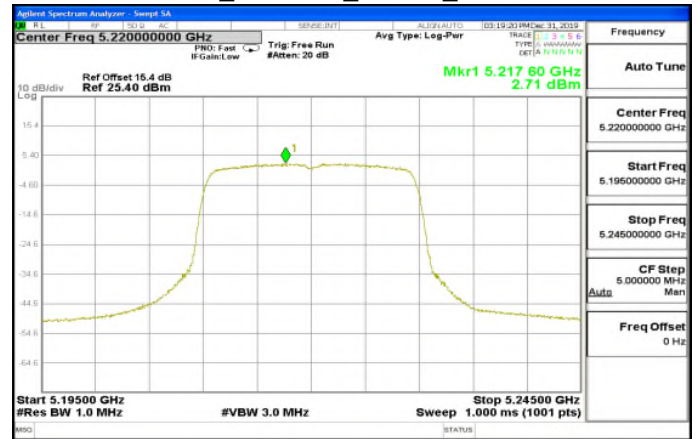
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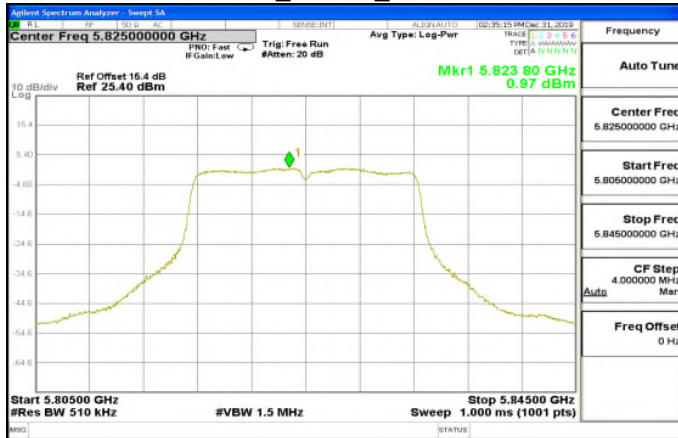
802.11a_20MHz_5785MHz



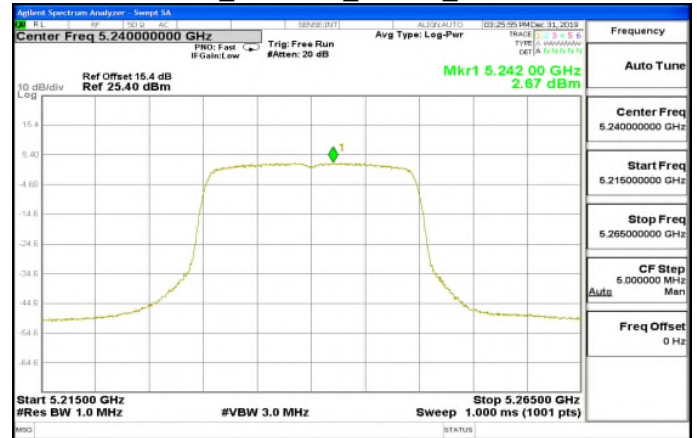
Full RU_802.11ax_20MHz_5220MHz



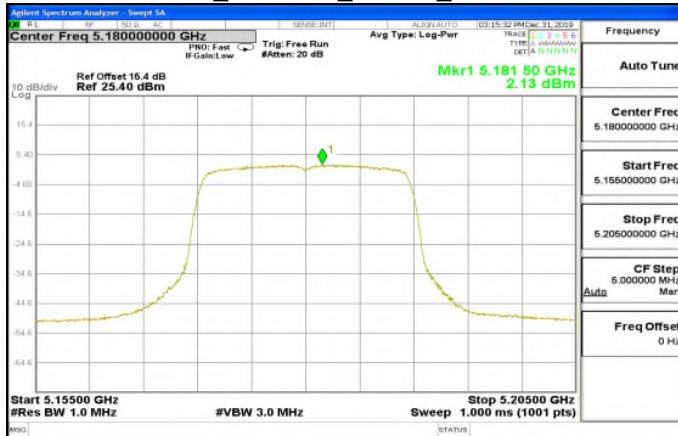
802.11a_20MHz_5825MHz



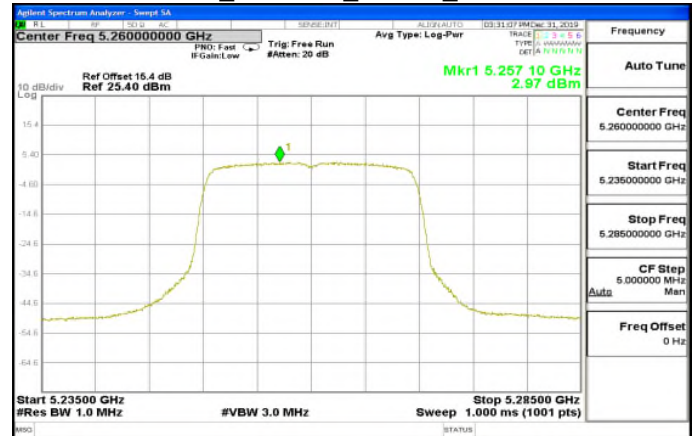
Full RU_802.11ax_20MHz_5240MHz



Full RU_802.11ax_20MHz_5180MHz



Full RU_802.11ax_20MHz_5260MHz

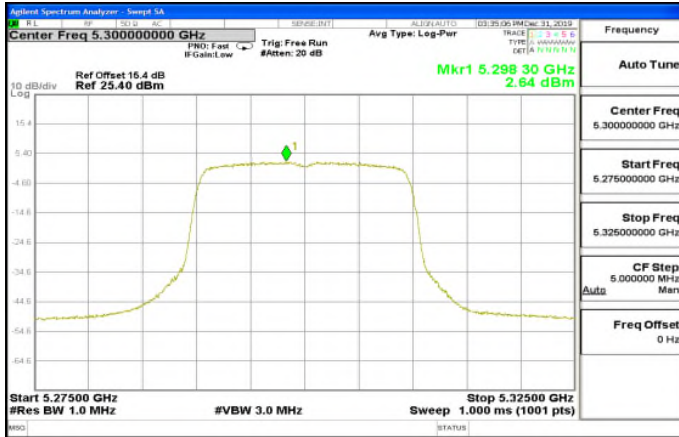


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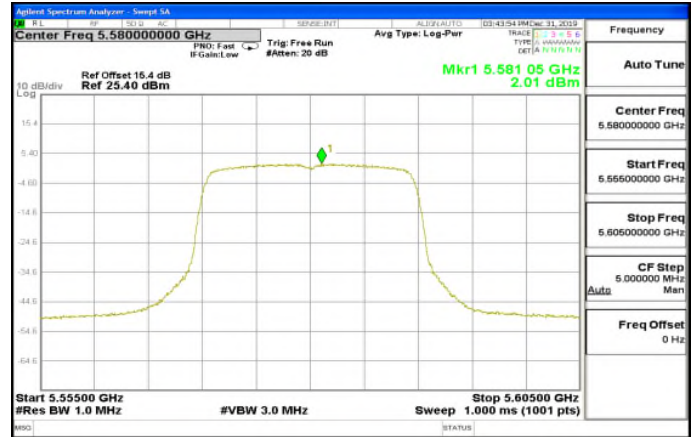
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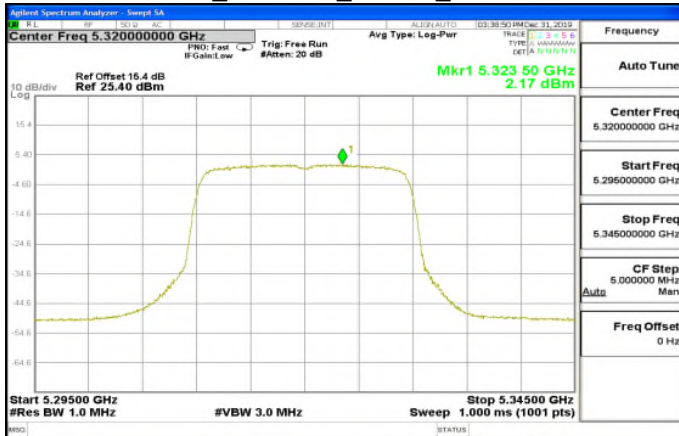
Full RU_802.11ax_20MHz_5300MHz



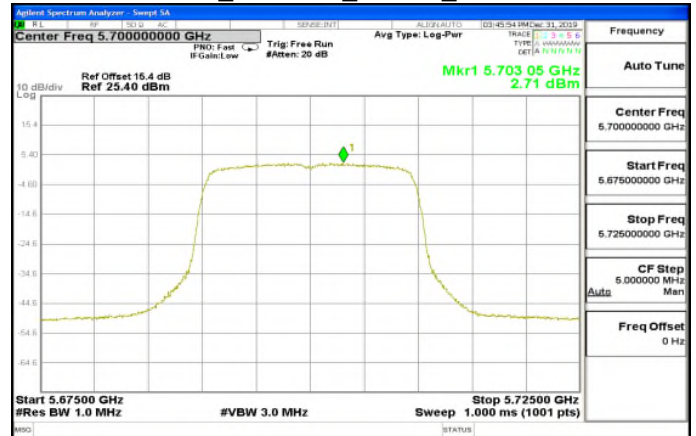
Full RU_802.11ax_20MHz_5580MHz



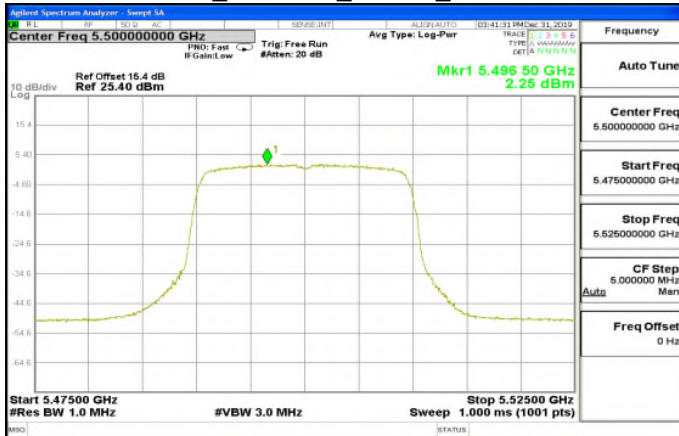
Full RU_802.11ax_20MHz_5320MHz



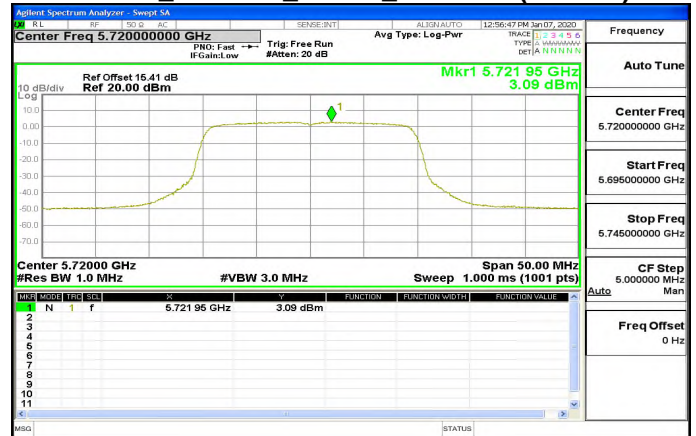
Full RU_802.11ax_20MHz_5700MHz



Full RU_802.11ax_20MHz_5500MHz



Full RU_802.11ax_20MHz_5720MHz (UNII 2C)

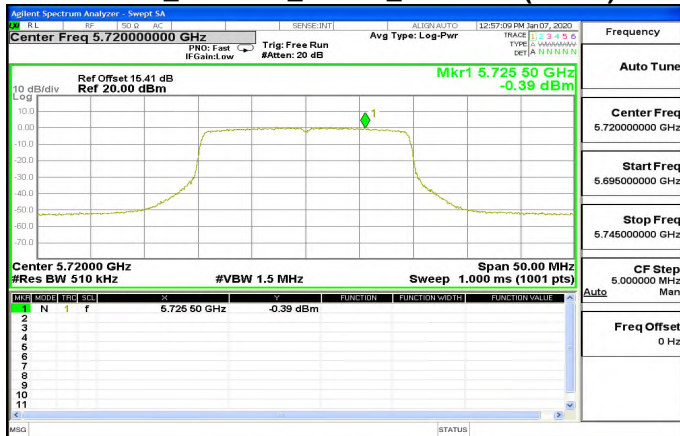


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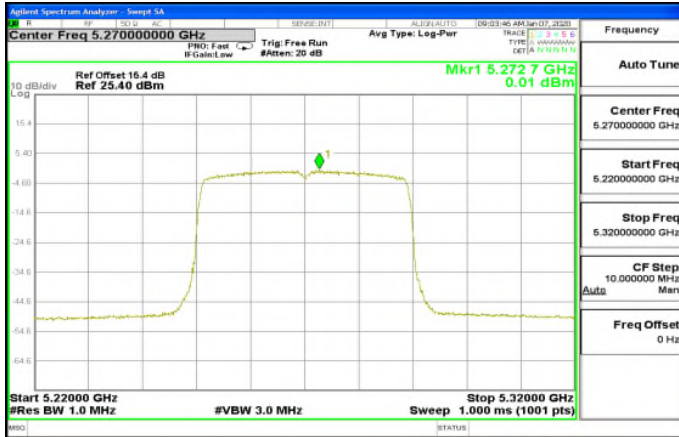
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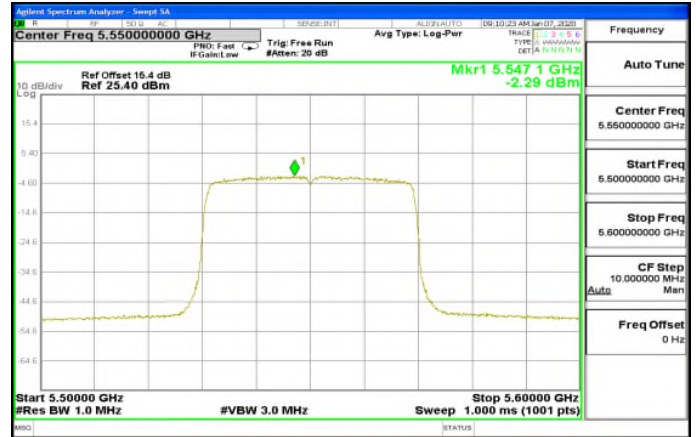
Full RU_802.11ax_20MHz_5720MHz (UNII 3)



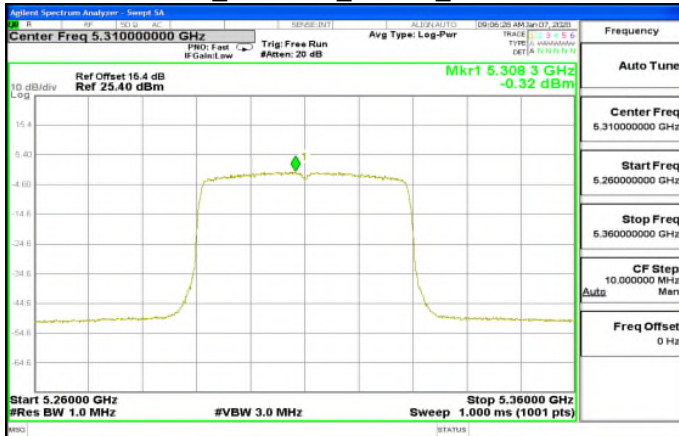
Full RU_802.11ax_40MHz_5270MHz



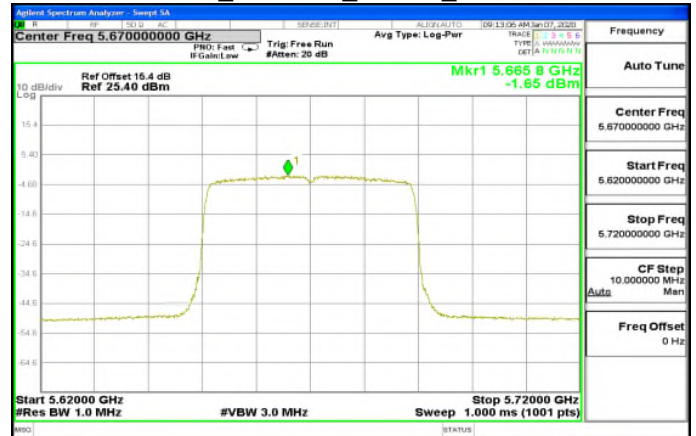
Full RU_802.11ax_40MHz_5550MHz



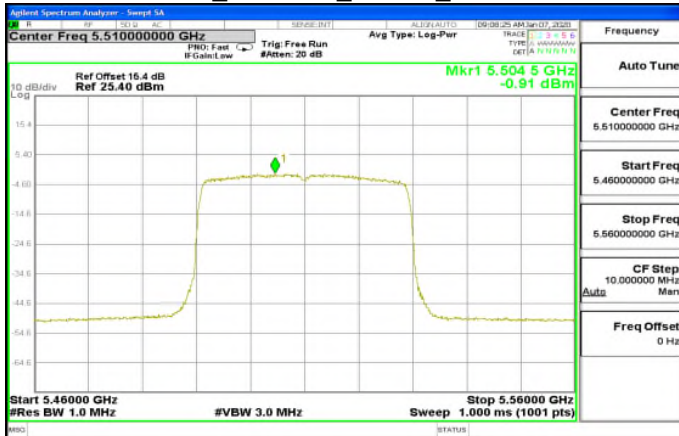
Full RU_802.11ax_40MHz_5310MHz



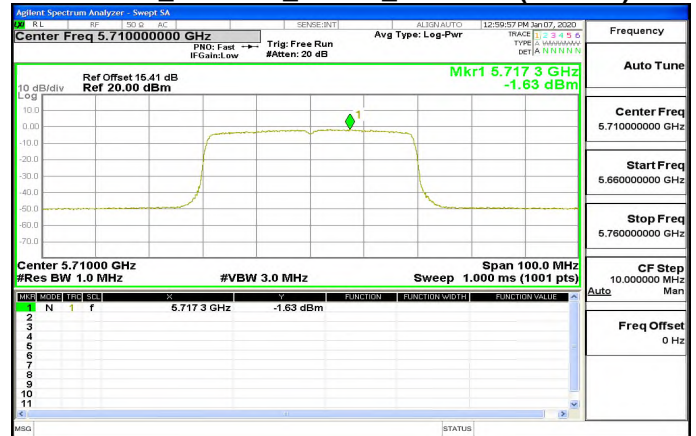
Full RU_802.11ax_40MHz_5670MHz



Full RU_802.11ax_40MHz_5510MHz



Full RU_802.11ax_40MHz_5710MHz (UNII 2C)

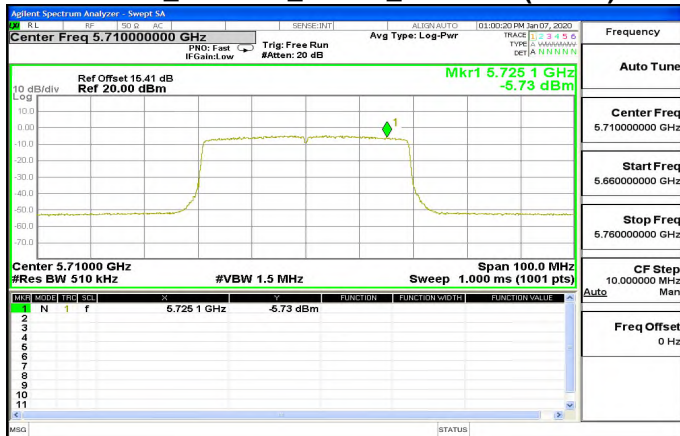


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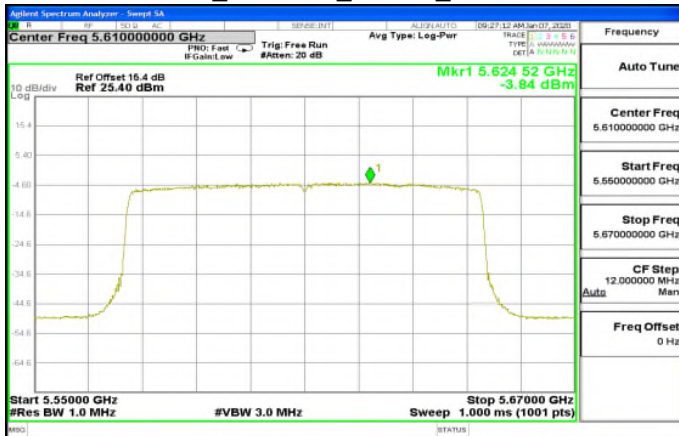
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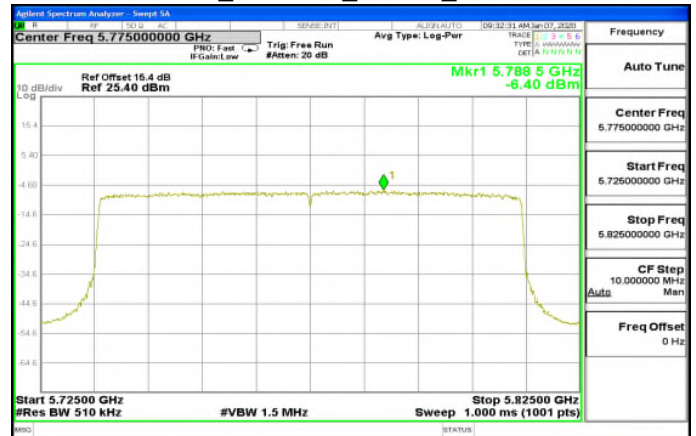
Full RU_802.11ax_40MHz_5710MHz (UNII 3)



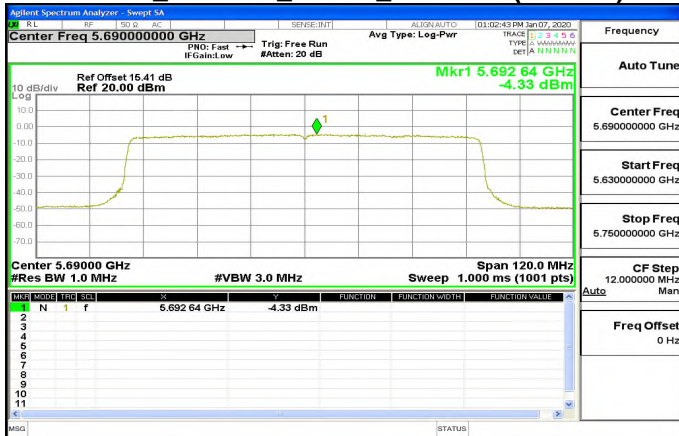
Full RU_802.11ax_80MHz_5610MHz



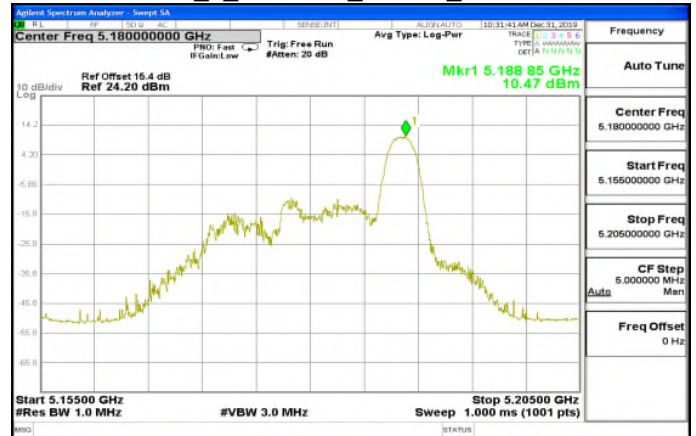
Full RU_802.11ax_80MHz_5775MHz



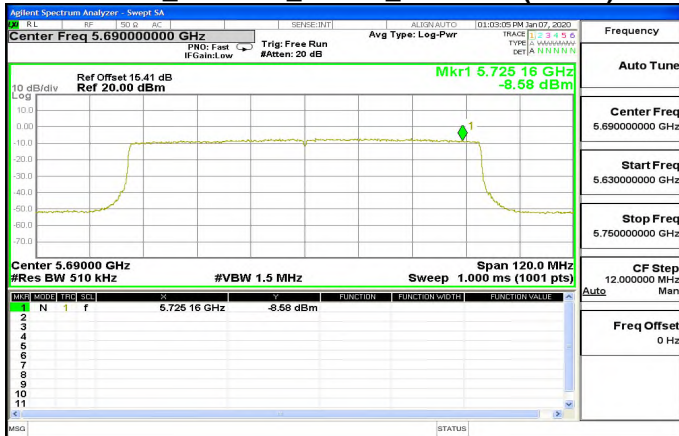
Full RU_802.11ax_80MHz_5690MHz (UNII 2C)



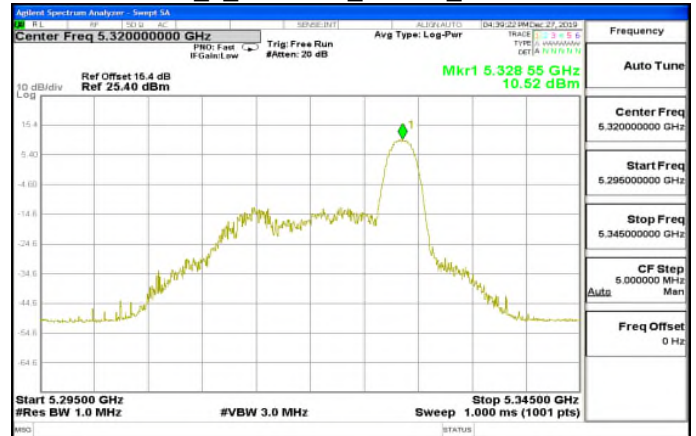
RU 26 0 802.11ax_20MHz_5180MHz



Full RU_802.11ax_80MHz_5690MHz (UNII 3)



RU 26 8 802.11ax_20MHz_5320MHz



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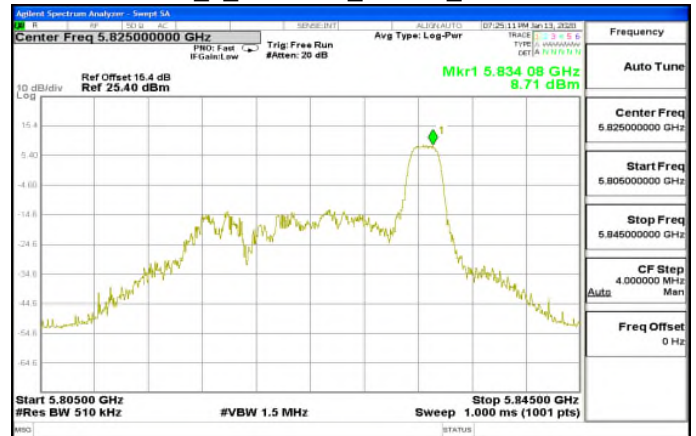
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RU 26_0_802.11ax_20MHz_5500MHz



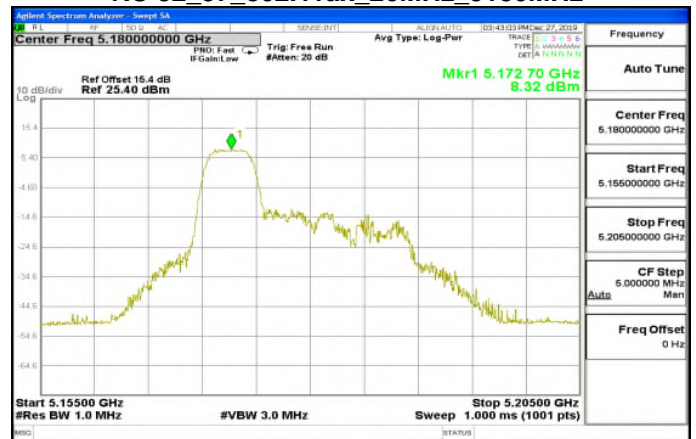
RU 26_8_802.11ax_20MHz_5825MHz



RU 26_8_802.11ax_20MHz_5700MHz



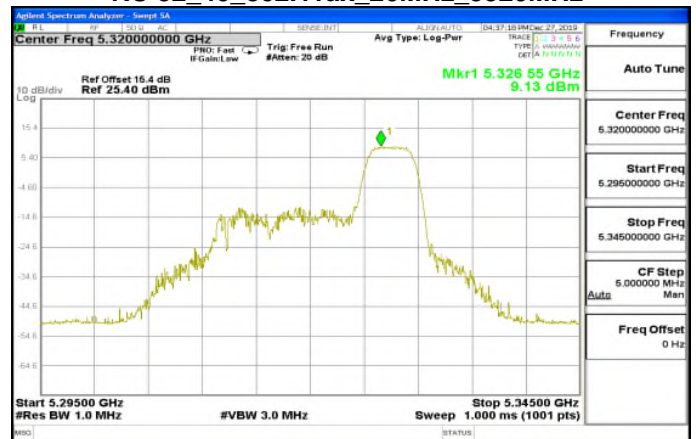
RU 52_37_802.11ax_20MHz_5180MHz



RU 26_0_802.11ax_20MHz_5745MHz



RU 52_40_802.11ax_20MHz_5320MHz

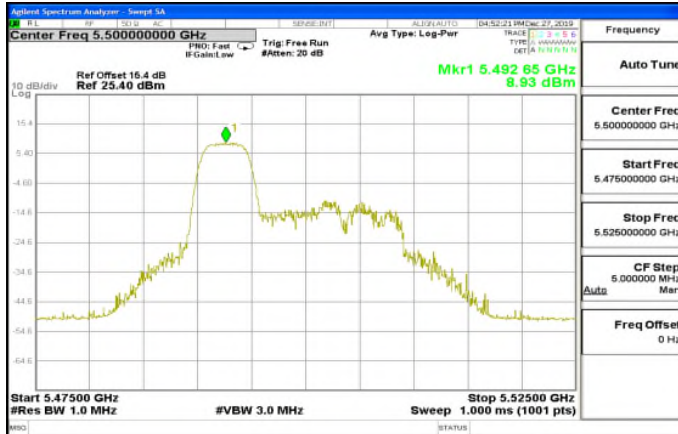


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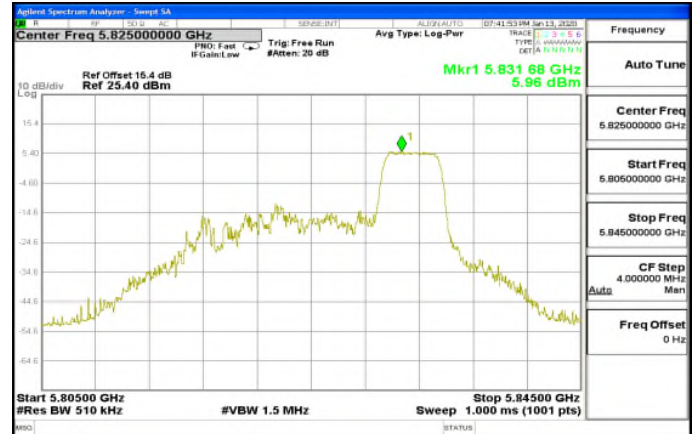
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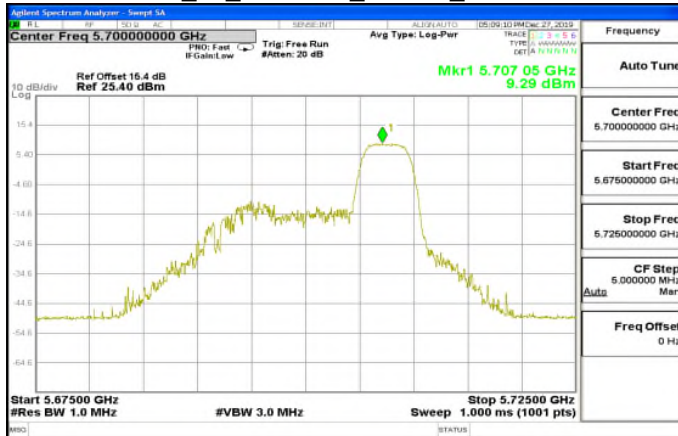
RU 52_37_802.11ax_20MHz_5500MHz



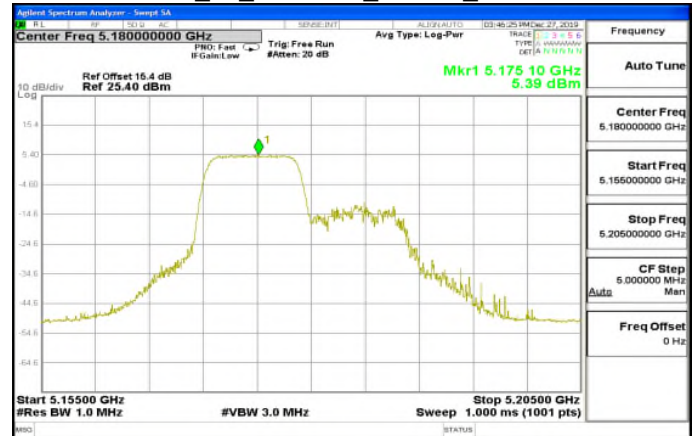
RU 52_37_802.11ax_20MHz_5825MHz



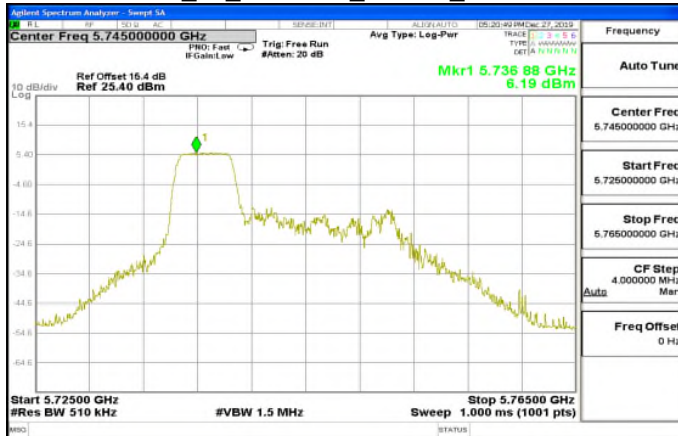
RU 52_40_802.11ax_20MHz_5700MHz



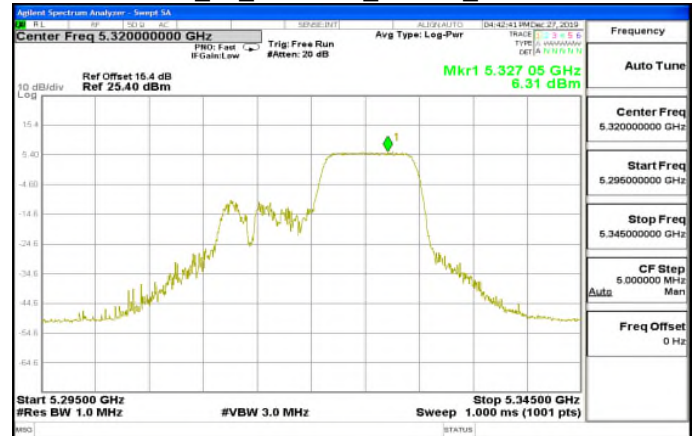
RU 106_53_802.11ax_20MHz_5180MHz



RU 52_37_802.11ax_20MHz_5745MHz



RU 106_54_802.11ax_20MHz_5320MHz

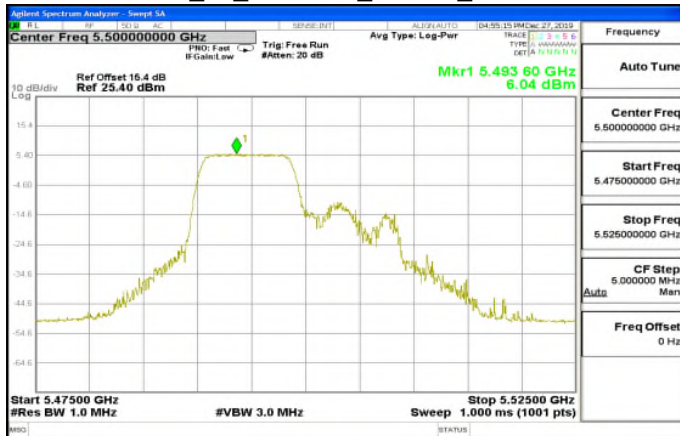


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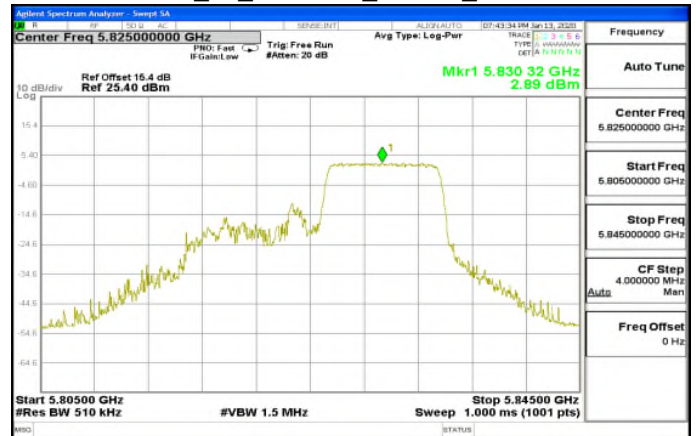
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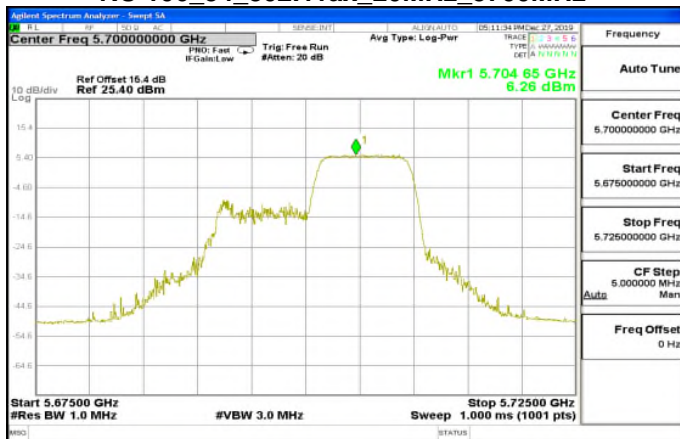
RU 106_53_802.11ax_20MHz_5500MHz



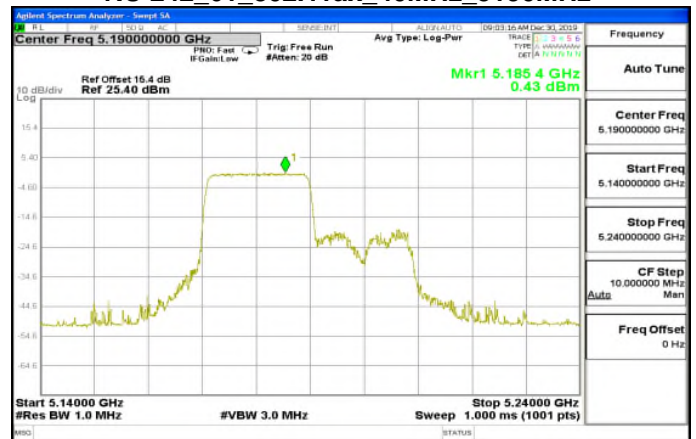
RU 106_54_802.11ax_20MHz_5825MHz



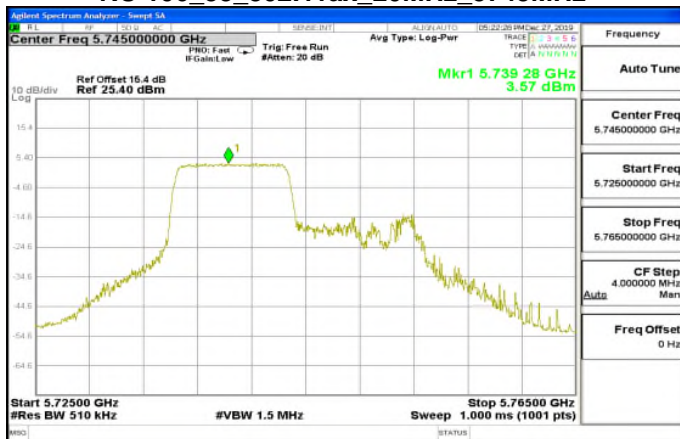
RU 106_54_802.11ax_20MHz_5700MHz



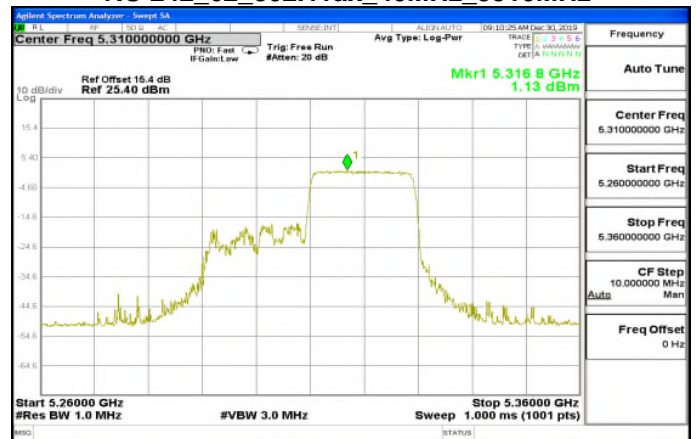
RU 242_61_802.11ax_40MHz_5190MHz



RU 106_53_802.11ax_20MHz_5745MHz



RU 242_62_802.11ax_40MHz_5310MHz



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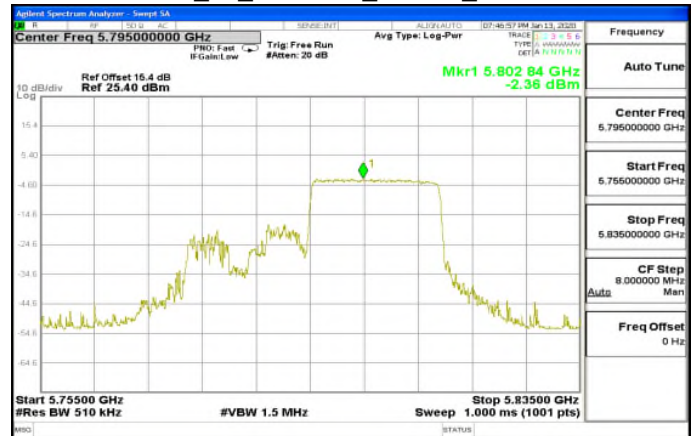
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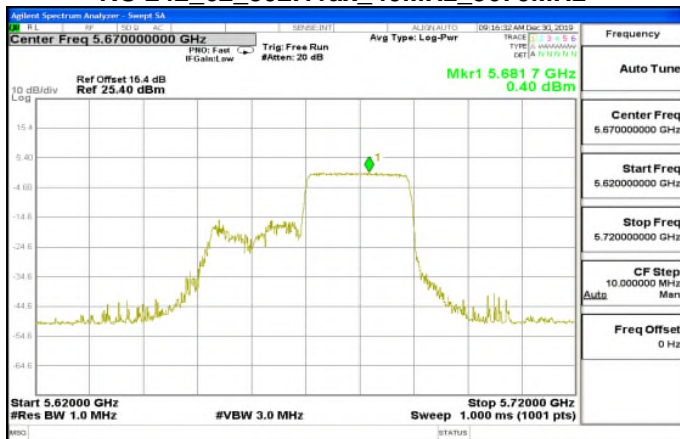
RU 242_61_802.11ax_40MHz_5510MHz



RU 242_62_802.11ax_40MHz_5795MHz



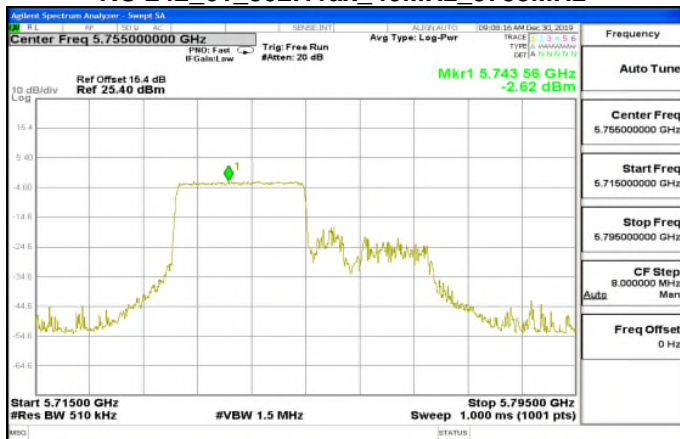
RU 242_62_802.11ax_40MHz_5670MHz



RU 484_65_802.11ax_80MHz_5210MHz



RU 242_61_802.11ax_40MHz_5755MHz



RU 484_66_802.11ax_80MHz_5290MHz



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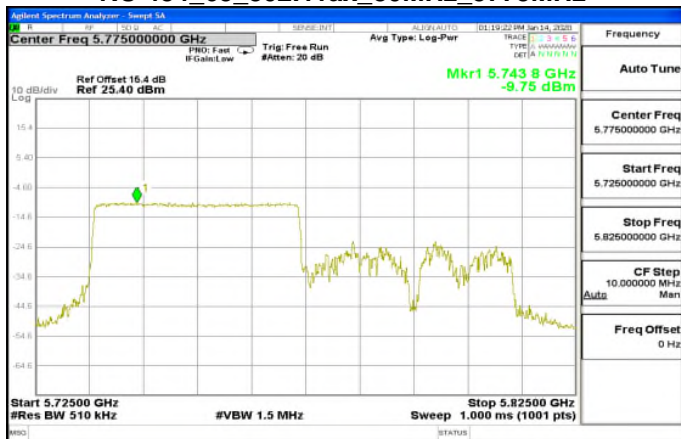
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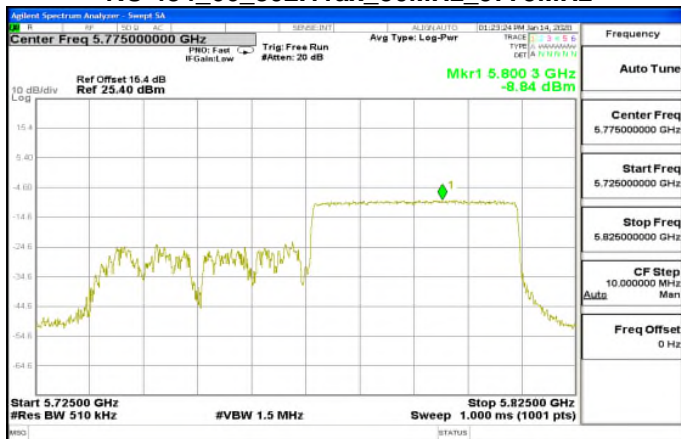
RU 484_65_802.11ax_80MHz_5530MHz



RU 484_65_802.11ax_80MHz_5775MHz



RU 484_66_802.11ax_80MHz_5775MHz



Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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