

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

Applicant: Murata Manufacturing Co., Ltd.
1-10-1, Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Product Name: Communication Module
Brand Name: muRata
Model No.: LBEE5XV1YM
Model Difference: N/A
Report Number: ER/2020/C0065
FCC ID: VPYLB1YM
IC: 772C-LB1YM
FCC Rule Part: §15.407, Cat: NII
ISED RSS: RSS-247 issue 2 Feb. 2017
Issue Date: Dec. 30, 2020
Date of Test: Aug. 19, 2020 ~ Oct. 08, 2020
Date of EUT Received: Aug. 19, 2020

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:

Jay Lin
Jay Lin / Asst. Supervisor



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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2020/C0065	Rev.00	Original.	Dec. 30, 2020	Revised By: Elle Chang

Note:

1、Disclaimer

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

2、Measurement results in the original test report ER/2020/80122 are fully leveraged in this test report without further verification test.

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Contents

1	GENERAL INFORMATION	4
2	SYSTEM TEST CONFIGURATION	8
3	SUMMARY OF TEST RESULT	11
4	DESCRIPTION OF TEST MODES	12
5	MEASUREMENT UNCERTAINTY	16
6	CONDUCTED EMISSION TEST	17
7	DUTY CYCLE TEST SIGNAL	21
8	26dB, 99% & 6dB EMISSION BANDWIDTH MEASUREMENT	25
9	MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT	61
10	MAXIMUM POWER SPECTRAL DENSITY	78
11	UNDESIRABLE RADIATED EMISSION MEASUREMENT	92
12	TRANSMISSION IN THE ABSENCE OF DATA	244
13	FREQUENCY STABILITY	245
14	ANTENNA REQUIREMENT	249

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEE5XV1YM
Model Difference:	N/A
Hardware Version:	1.0
Software Version:	1.0
Power Supply:	3.3Vdc
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

1.2 Antenna Designation

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dipole	Molex	146153	5150~5250	4.25	
			5250~5350	4.25	
			5470~5725	4.25	
			5725~5850	4.25	
Dipole	Molex	146187	5150~5250	4.75	V
			5250~5350	4.75	V
			5470~5725	4.75	V
			5725~5850	4.75	V

Note: Pre-scanned was done on the above 2 antennas, the peak gain 4.75dBi 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	12.74		OFDM
	5250~5350	4	18.89		
	5470~5725	12	18.82		
	5725-5850	5	19.98		
n_HT ac_VHT 20M	5150~5250	4	HT:	12.79	OFDM
	5250~5350	4	HT:	18.97	
	5470~5725	12	HT:	18.94	
	5725-5850	5	HT:	19.56	
n_HT ac_VHT 40M	5150~5250	2	HT:	14.86	OFDM
	5250~5350	2	HT:	17.83	
	5470~5725	6	HT:	17.84	
	5725-5850	2	HT:	18.98	
ac_VHT 80M	5150~5250	1	VHT:	9.59	OFDM
	5250~5350	1	VHT:	9.86	
	5470~5725	3	VHT:	16.98	
	5725-5850	1	VHT:	17.97	

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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	20.50	OFDM
	5250~5350	4	Avg.	18.89	
	5470~5725	9	Avg.	18.82	
	5725-5850	5	Avg.	19.98	
n_HT ac_VHT 20M	5150~5250	4	EIRP	HT: 20.55	OFDM
	5250~5350	4	Avg.	HT: 18.97	
	5470~5725	9	Avg.	HT: 18.94	
	5725-5850	5	Avg.	HT: 19.56	
n_HT ac_VHT 40M	5150~5250	2	EIRP	HT: 25.60	OFDM
	5250~5350	2	Avg.	HT: 17.83	
	5470~5725	4	Avg.	HT: 17.84	
	5725-5850	2	Avg.	HT: 18.98	
ac_VHT 80M	5150~5250	1	EIRP	VHT: 17.35	OFDM
	5250~5350	1	Avg.	VHT: 9.86	
	5470~5725	2	Avg.	VHT: 16.10	
	5725-5850	1	Avg.	VHT: 17.97	

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.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333

FCC Designation number: TW0028

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 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 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50 μ H/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 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 Configuration

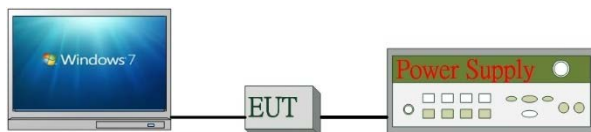


Fig. 2-2 Conducted (Antenna Port) Emission Configuration

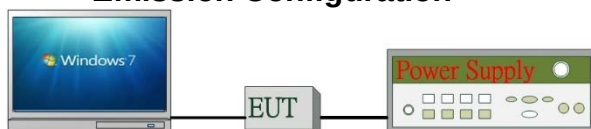


Fig. 2-3 Conducted (AC powerline) Emission Configuration

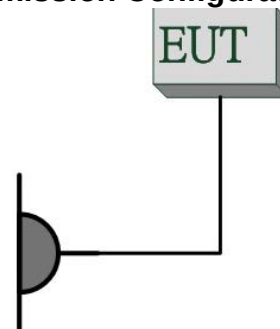


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L420	S0011721	N/A	N/A
3.	DC Power Supply	DHA	DPS-3003	9411005787	N/A	N/A

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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:						Operated band in 5250 MHz ~5350 MHz:					
20 M		40 M		80 M		20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
36	5180	38	5190	42	5210	52	5260	54	5270	58	5290
40	5200	46	5230			56	5280	62	5310		
44	5220					60	5300				
48	5240					64	5320				
Operated band in 5470 MHz ~5725 MHz:						Operated band in 5745 MHz ~5850 MHz:					
20 M		40 M		80 M		20 M		40 M		80 M	
CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)	CH	Freq (MHz)
100	5500	102	5510	106	5530	149	5745	151	5755	155	5775
104	5520	110	5550	122	5610	153	5765	159	5795		
108	5540	118	5590	138	5690	157	5785				
112	5560	126	5630			161	5805				
116	5580	134	5670			165	5825				
120	5600	142	5710								
124	5620										
128	5640										
132	5660										
136	5680										
140	5700										
144	5720										

Note: EUT serial number is 1617633250 and sample number is DUT No. 20.

Note: EUT disable CH 120/124/128

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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
☒ 802.11 a	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 2TX
☒ 802.11 n	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ MIMO
☒ 802.11 ac	☒ Ch0	☒ Ch1	☐ Ch2	☐ Ch3	☒ 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	44	OFDM	6	2TX
	5260~5320	52 to 64	60			
	5500~5720	100 to 144	116			
	5745~5825	149 to 165	157			
802.11ac_VHT80	5210	42	42		MCS0	MIMO
	5290	58	58			
	5530~5690	106 to 138	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			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48		MCS0	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46		MCS0	MIMO
	5270~5310	54 to 62	54,62			
	5510~5710	102 to 142	102,110,134,142			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42		MCS0	MIMO
	5290	58	58			
	5530~5690	106 to 138	106,122,138			
	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			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT20	5180~5240	36 to 48	36,44,48		MCS0	MIMO
	5260~5320	52 to 64	52,60,64			
	5500~5720	100 to 144	100,116,140,144			
	5745~5825	149 to 165	149,157,165			
802.11n_HT40	5190~5230	38 to 46	38,46		MCS0	MIMO
	5270~5310	54 to 62	54,62			
	5510~5710	102 to 142	102,110,134,142			
	5755~5795	151 to 159	151,159			
802.11ac_VHT80	5210	42	42		MCS0	MIMO
	5290	58	58			
	5530~5690	106 to 138	106,122,138			
	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(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/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	974	03/25/2020	03/24/2021
EMI Test Receiver	R&S	ESCI	101342	04/28/2020	04/27/2021
Test Software	audix	e3	Ver. 6.11- 20180419c	N.C.R	N.C.R

6.3 EUT Setup

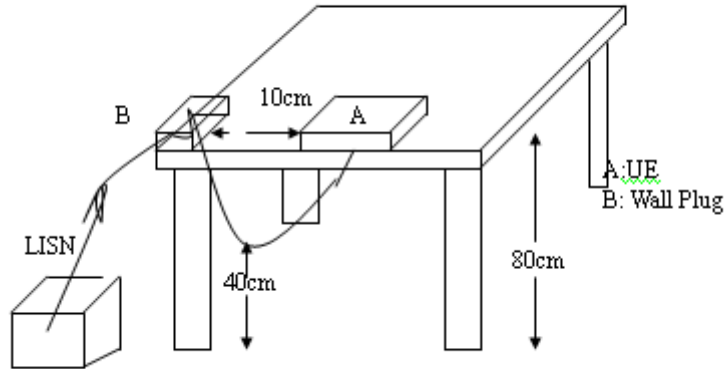
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz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

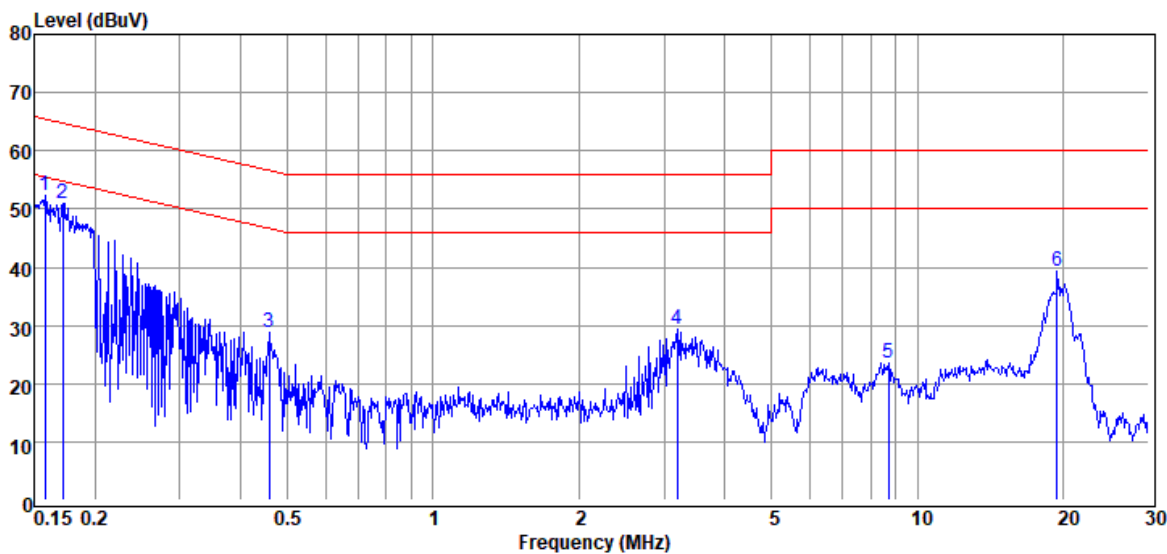
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:ER/2020/80122	Test Site	:Conduction Room C
Test Mode	:WLAN 5G	Test Date	:2020-09-04
Power	:120V/60Hz	Temp./Humi.	:25.1/68
Probe	:L1	Engineer	:Kailin Lee
Note:	: Adapter: FSP065-REB		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.16	Peak	42.00	10.22	52.22	65.56	-13.34
0.17	Peak	40.79	10.22	51.01	64.86	-13.85
0.46	Peak	18.55	10.22	28.77	56.71	-27.94
3.19	Peak	18.83	10.47	29.30	56.00	-26.70
8.73	Peak	12.91	10.66	23.57	60.00	-36.43
19.43	Peak	28.56	10.84	39.40	60.00	-20.60

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Report Number :ER/2020/80122

Test Site :Conduction Room C

Test Mode :WLAN 5G

Test Date :2020-09-04

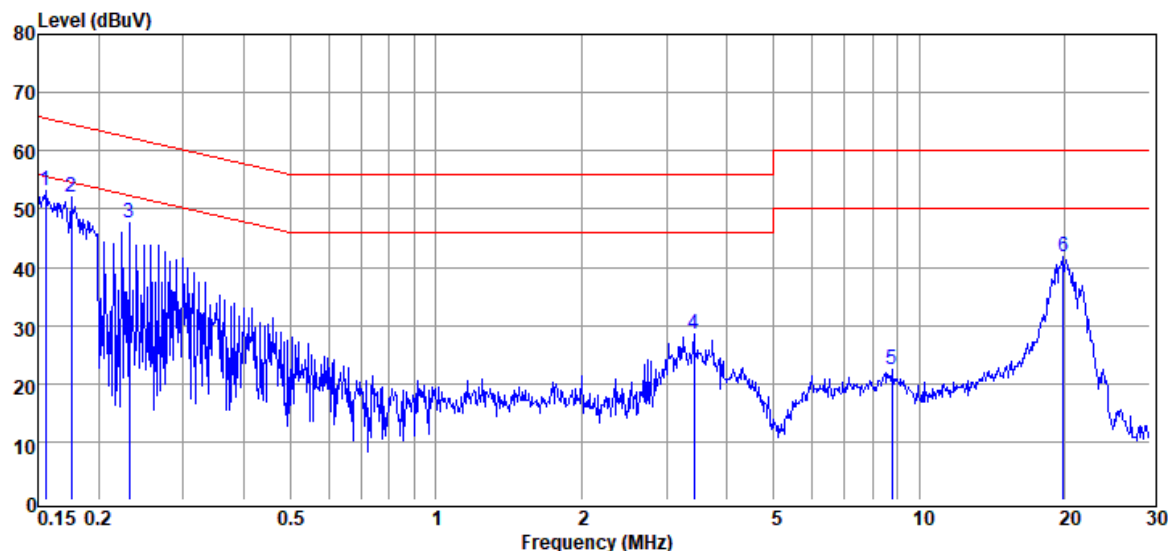
Power :120V/60Hz

Temp./Humi. :25.1/68

Probe :N

Engineer :Kailin Lee

Note: : Adapter: FSP065-REB



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.16	Peak	42.93	10.21	53.14	65.69	-12.55
0.18	Peak	41.84	10.21	52.05	64.68	-12.63
0.23	Peak	37.47	10.21	47.68	62.39	-14.71
3.42	Peak	17.90	10.48	28.38	56.00	-27.62
8.78	Peak	11.63	10.67	22.30	60.00	-37.70
19.85	Peak	31.03	10.86	41.89	60.00	-18.11

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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	96.49	0.16	0.32	1.00
802.11n_20	97.98	0.09	0.21	1.00
802.11ac_20	97.91	0.09	0.21	1.00
802.11n_40	95.94	0.18	0.43	1.00
802.11ac_40	95.94	0.18	0.43	1.00
802.11ac_80	91.50	0.39	0.91	1.00

Duty Cycle Factor: $10 * \log(1/0.9649) = 0.16$

Duty Cycle Factor: $10 * \log(1/0.9798) = 0.09$

Duty Cycle Factor: $10 * \log(1/0.9791) = 0.09$

Duty Cycle Factor: $10 * \log(1/0.9594) = 0.18$

Duty Cycle Factor: $10 * \log(1/0.9594) = 0.18$

Duty Cycle Factor: $10 * \log(1/0.915) = 0.39$

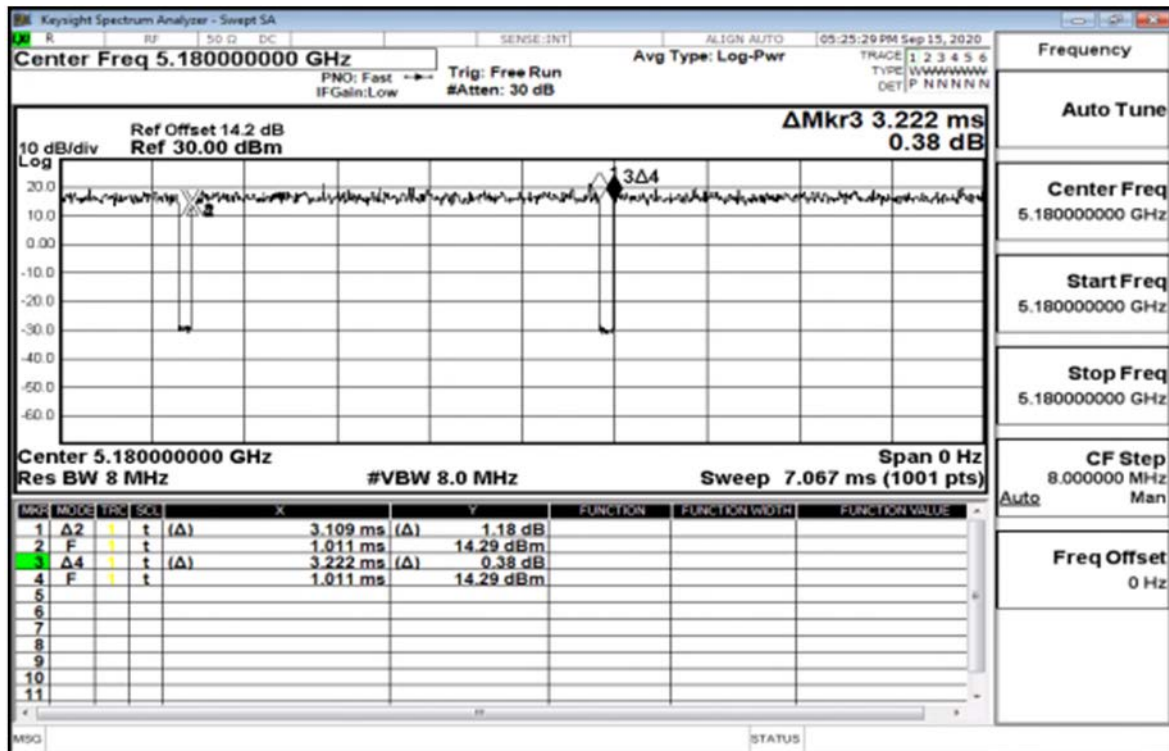
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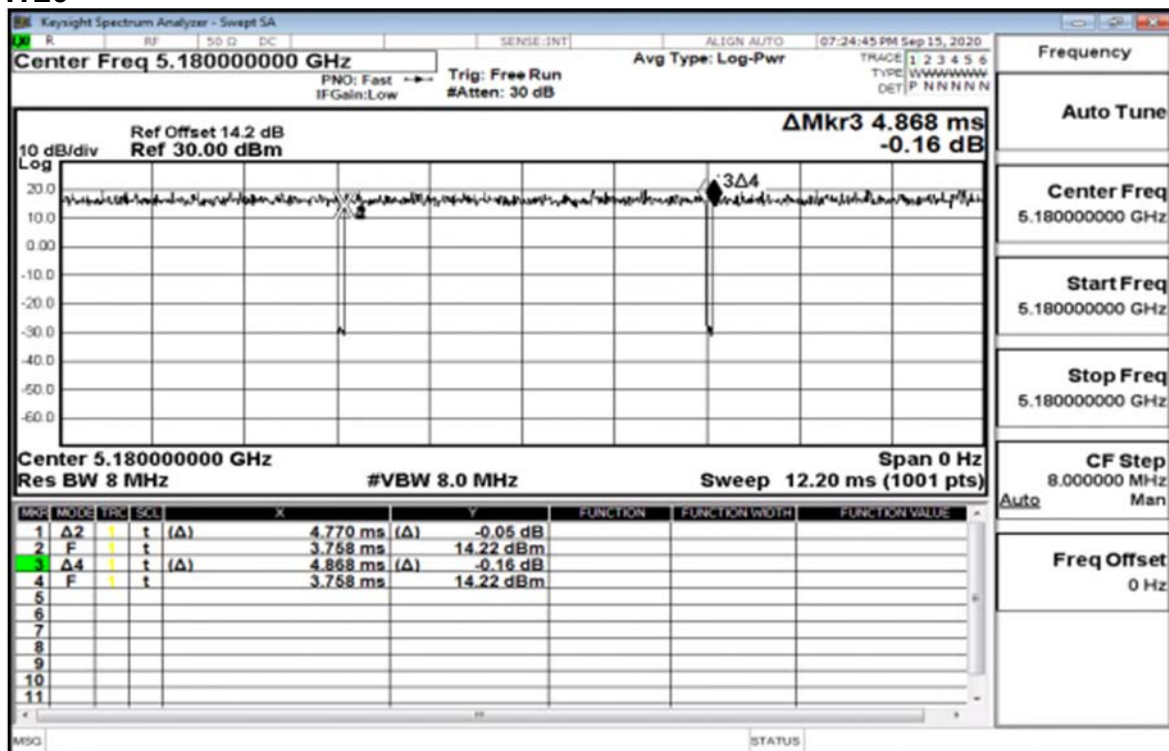
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7.2 DUTY CYCLE TEST SIGNAL MEASUREMENT RESULT

802.11a



802.11n HT20

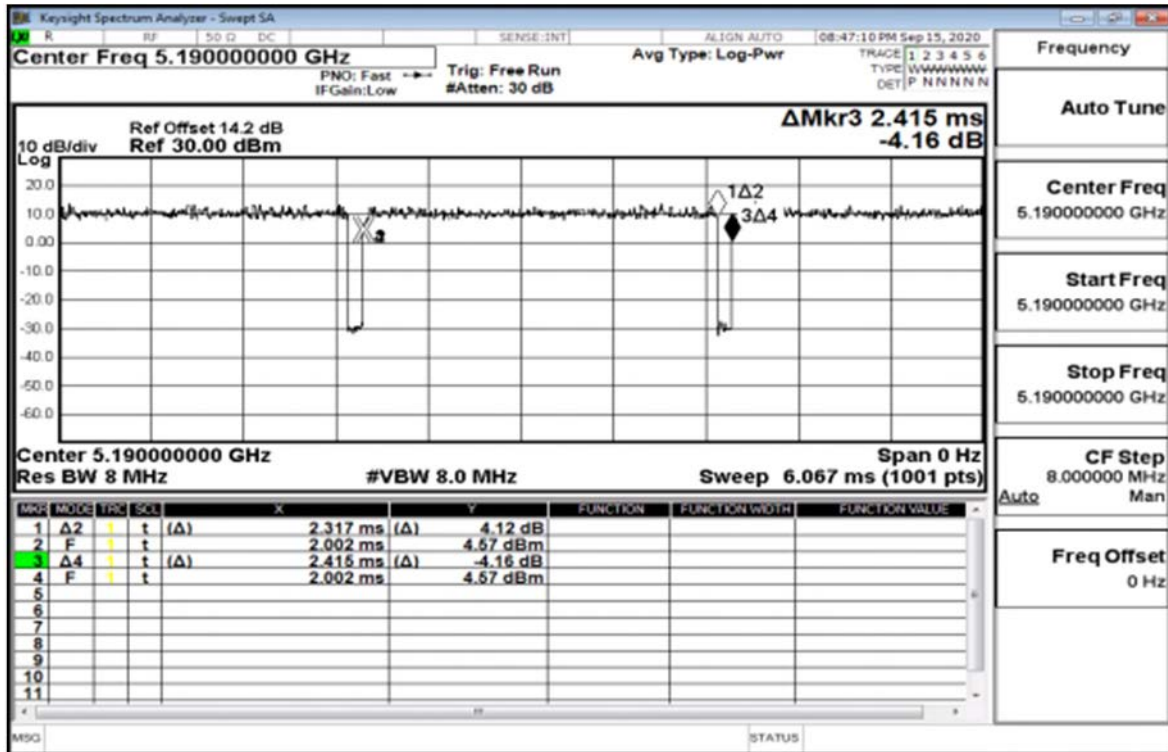


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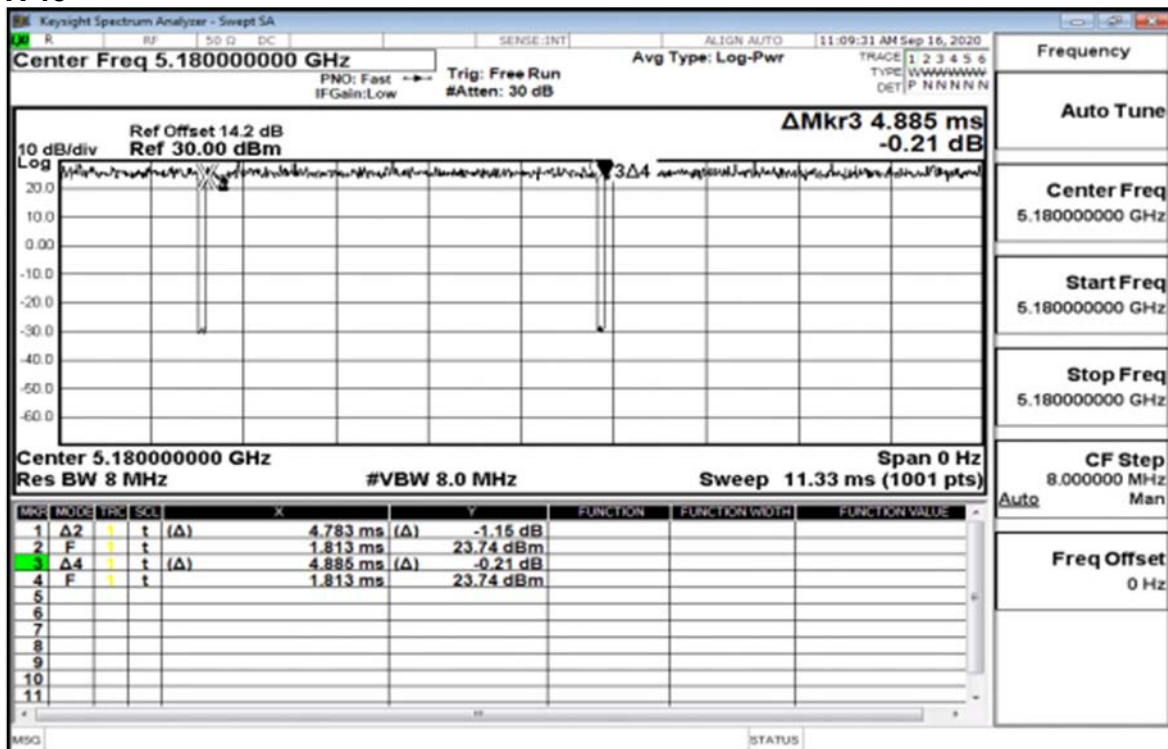
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802.11ac VHT20



802.11n HT40

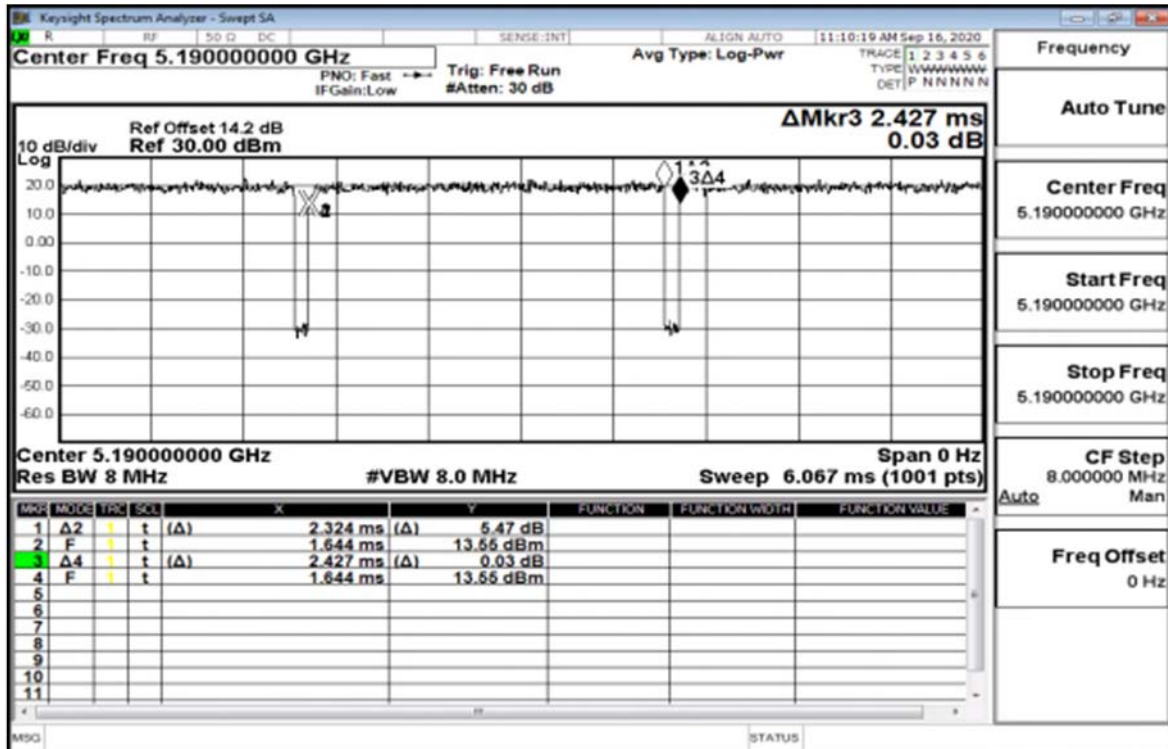


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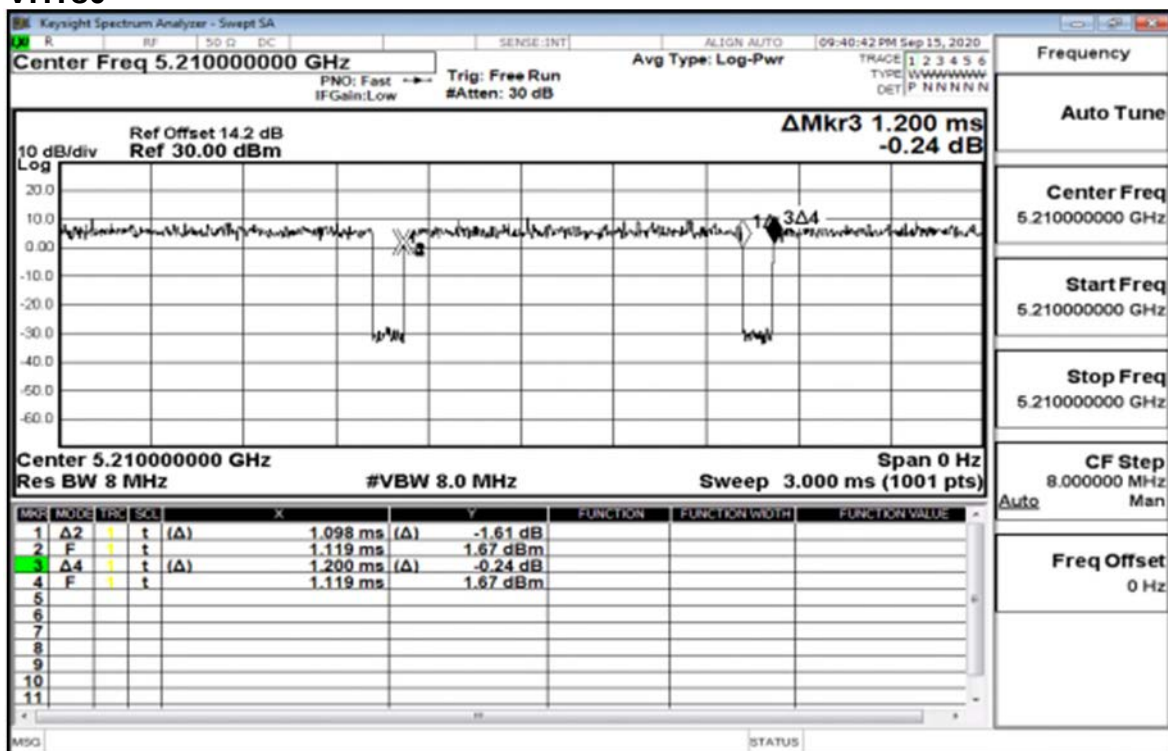
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802.11ac VHT40



802.11ac VHT80



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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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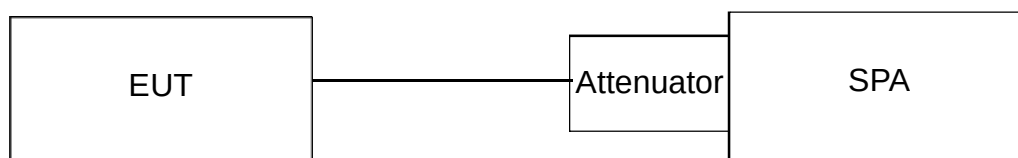
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8.3 Measurement Equipment Used

SGS Conducted Room					
EQUIPMENT TYPE	MFR/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY57120200	03/17/2020	03/16/2021
DC Power Supply	DHA	DPS-3003	9411005787	08/19/2020	08/18/2021
DC Block	PASTERNAK	PE8210	RF256	11/20/2019	11/19/2020
Attenuator	Marvelous	WATT-218FS-10	RF245	11/20/2019	11/19/2020

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	19.51	12.903	5180	19.74	12.953
5220	19.91	12.991	5220	22.54	13.530
5240	22.27	13.477	5240	20.02	13.015
5260	21.05	13.233	5260	24.3	13.856
5300	20.8	13.181	5300	24.12	13.824
5320	19.37	12.871	5320	19.66	12.936
5500	19.39	12.876	5500	19.61	12.925
5580	23.17	13.649	5580	22.99	13.615
5700	20.24	13.062	5700	21.5	13.324
5720	19.85	12.978	5720	20.48	13.113

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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	19.71	12.947	5180	19.97	13.004
5220	24.88	13.959	5220	29.64	14.719
5240	28.99	14.622	5240	27.83	14.445
5260	28.9	14.609	5260	26.87	14.293
5300	23.39	13.690	5300	27.73	14.429
5320	19.98	13.006	5320	20.03	13.017
5500	19.99	13.008	5500	19.94	12.997
5580	24.63	13.915	5580	25.67	14.094
5700	25.7	14.099	5700	25.15	14.005
5720	26.07	14.161	5720	25.13	14.002

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	40.45	16.069	5190	40.4	16.064
5230	40.35	16.058	5230	40.34	16.057
5270	40.98	16.126	5270	40.35	16.058
5310	40.57	16.082	5310	40.46	16.070
5510	40.31	16.054	5510	40.29	16.052
5550	40.28	16.051	5550	40.53	16.078
5670	41.28	16.157	5670	41.44	16.174
5710	40.47	16.071	5710	40.37	16.061

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	81.35	19.104	5210	81.22	19.097
5290	80.89	19.079	5290	81.26	19.099
5530	81.33	19.103	5530	80.81	19.075
5610	89.03	19.495	5610	97.78	19.903
5690	91.23	19.601	5690	93.17	19.693

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)
5745	16.38	12.143
5785	16.36	12.138
5825	16.39	12.146

802.11a_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.35	12.135
5785	16.42	12.154
5825	16.41	12.151

802.11n_HT20_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.58	12.450
5785	17.57	12.448
5825	17.64	12.465

802.11n_HT20_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.57	12.448
5785	17.58	12.450
5825	17.61	12.458

802.11n_HT40_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.54	15.507
5795	36.04	15.568

802.11n_HT40_Ch1

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.66	15.522
5795	35.33	15.481

802.11ac_VHT80_Ch0

Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.94	18.805

802.11ac_VHT80_Ch1

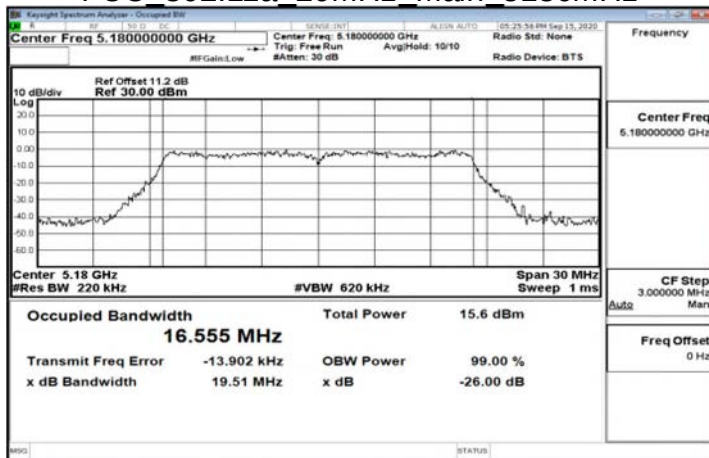
Freq. (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.64	18.788

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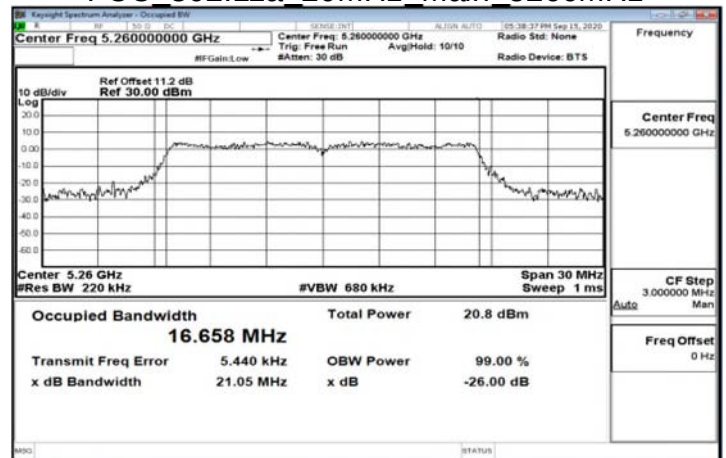
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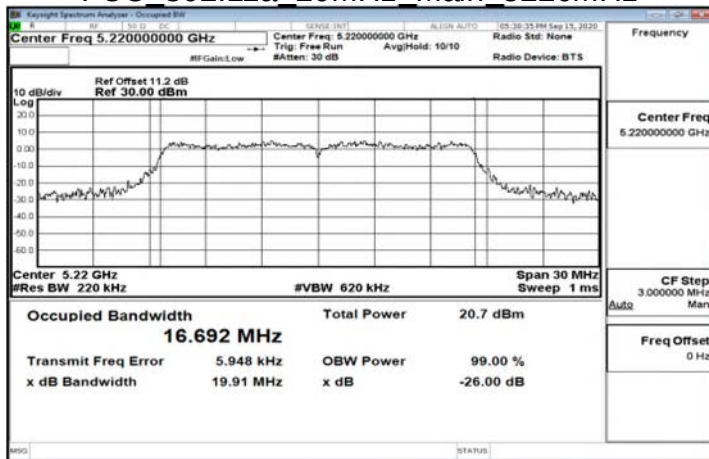
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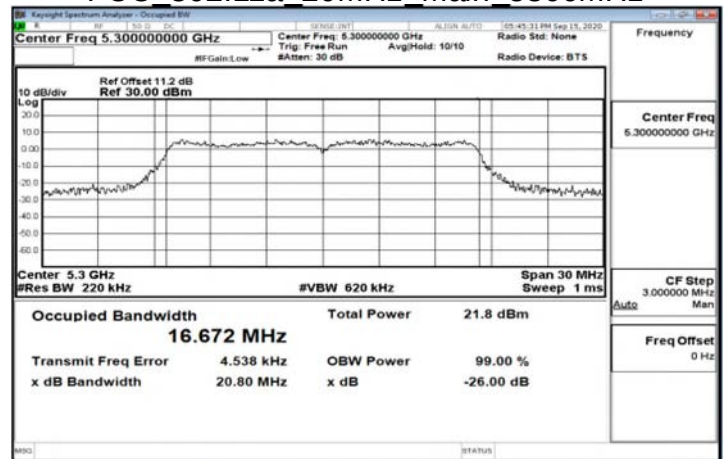
FCC_802.11a_20MHz_Main_5260MHz



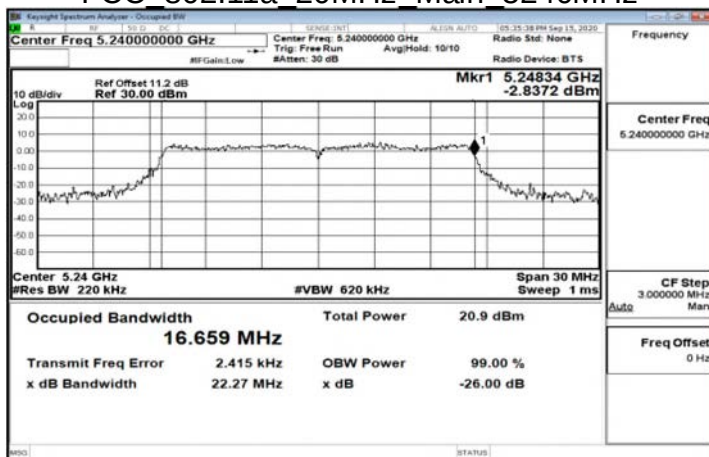
FCC 802.11a 20MHz Main 5220MHz



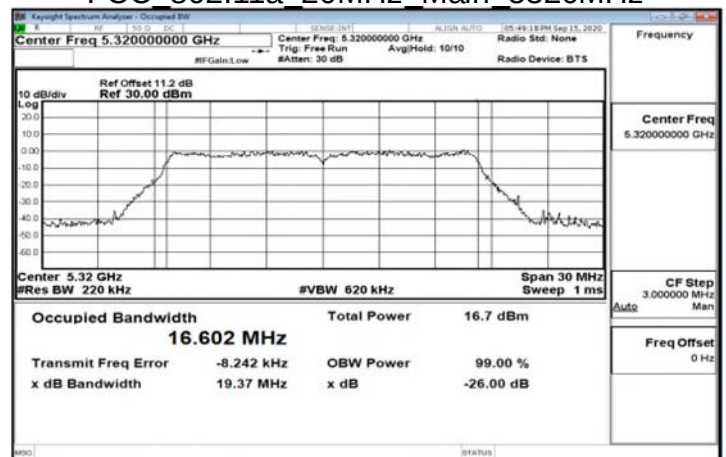
FCC 802.11a 20MHz Main 5300MHz



FCC 802.11a 20MHz Main 5240MHz



FCC 802.11a 20MHz Main 5320MHz

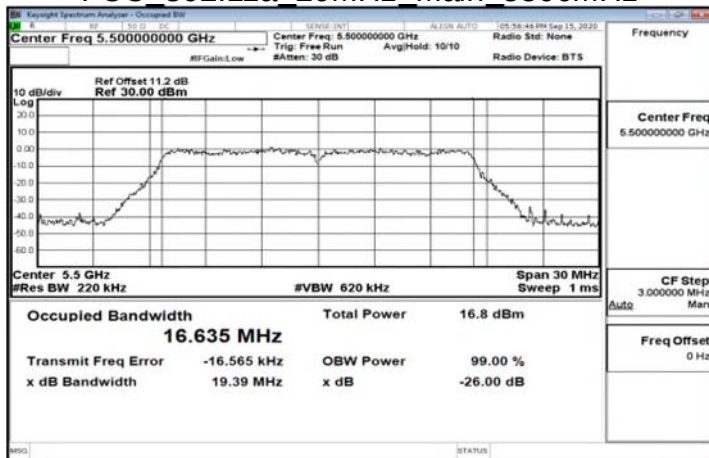


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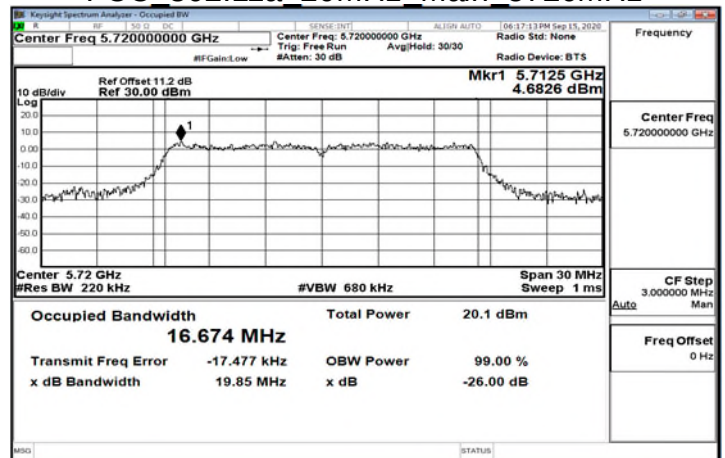
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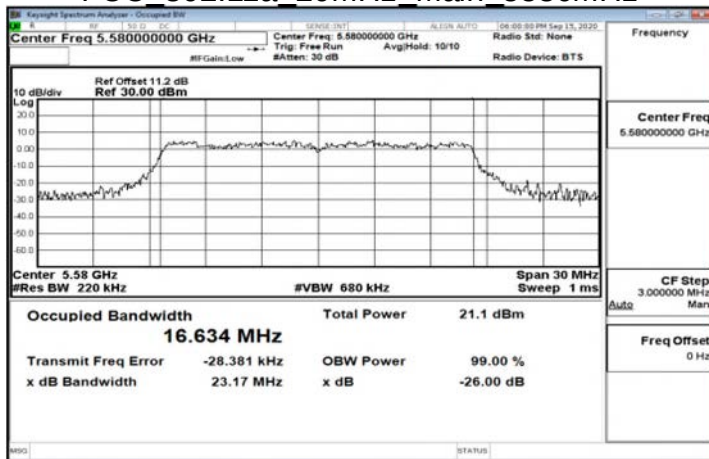
FCC 802.11a 20MHz Main 5500MHz



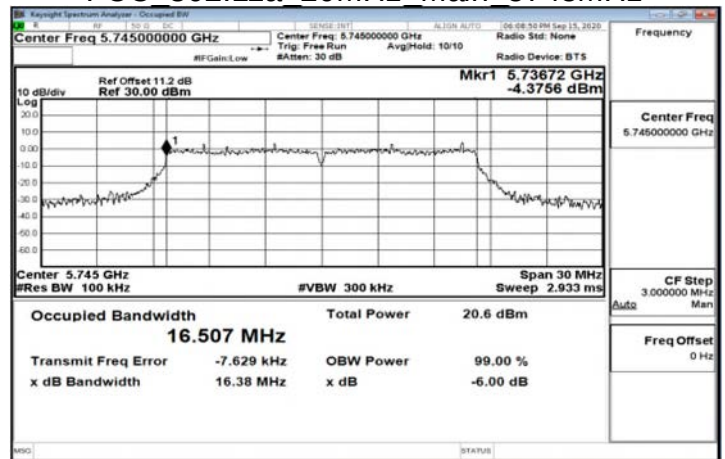
FCC 802.11a 20MHz Main 5720MHz



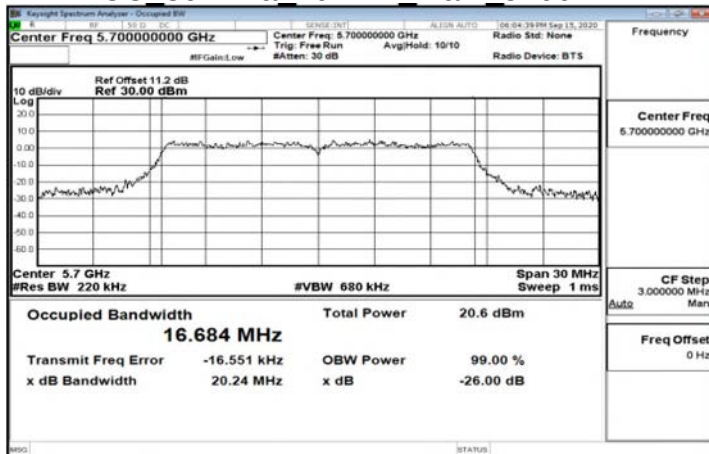
FCC 802.11a 20MHz Main 5580MHz



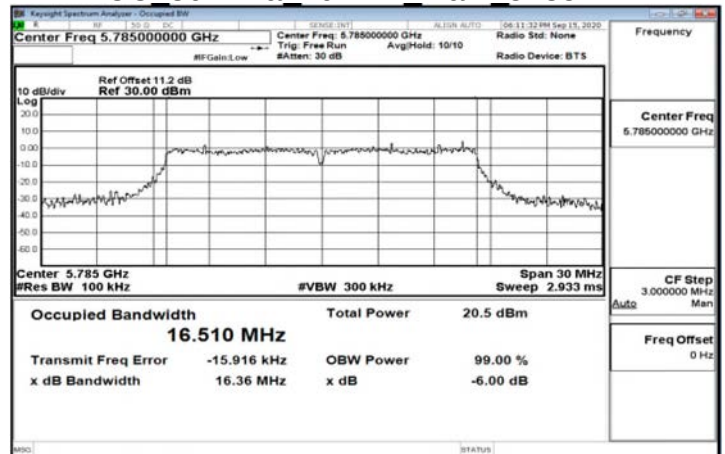
FCC 802.11a 20MHz Main 5745MHz



FCC 802.11a 20MHz Main 5700MHz



FCC 802.11a 20MHz Main 5785MHz

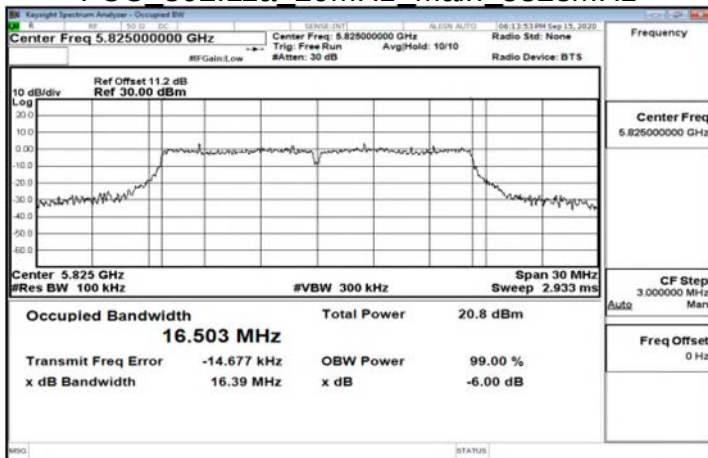


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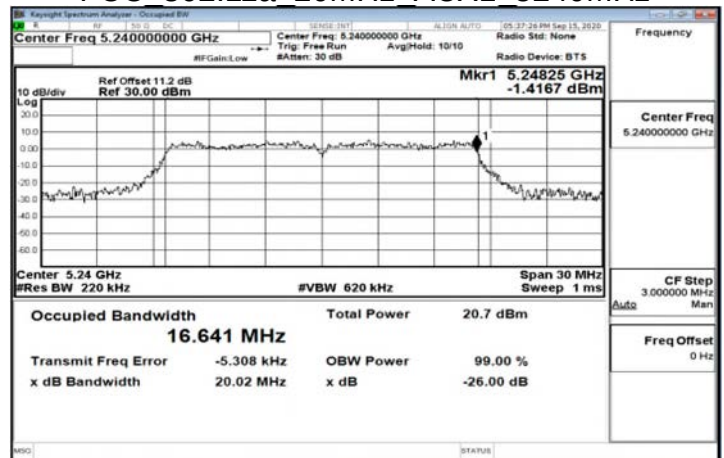
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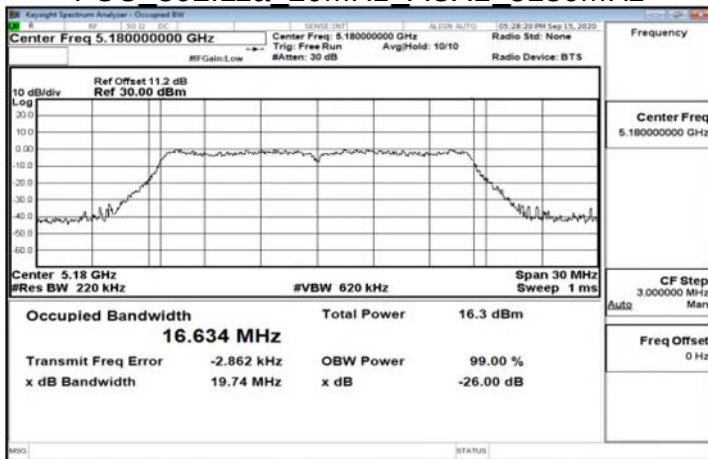
FCC 802.11a 20MHz Main 5825MHz



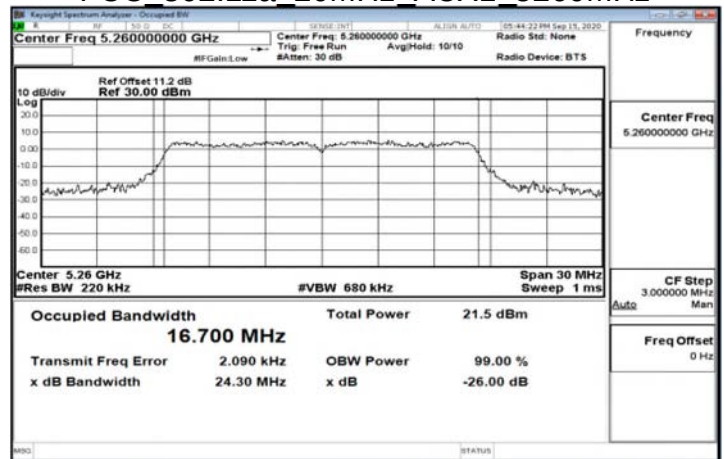
FCC 802.11a 20MHz AUX1 5240MHz



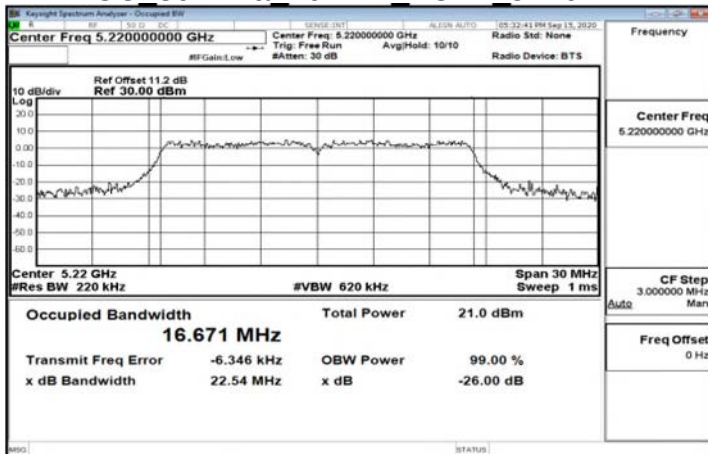
FCC 802.11a 20MHz AUX1 5180MHz



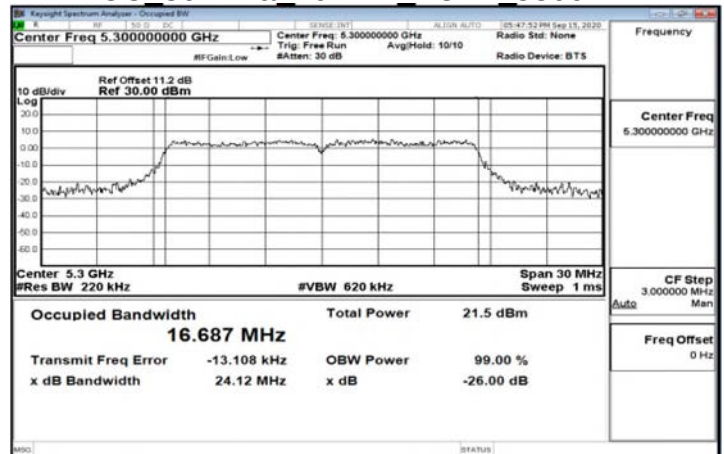
FCC 802.11a 20MHz AUX1 5260MHz



FCC 802.11a 20MHz AUX1 5220MHz



FCC 802.11a 20MHz AUX1 5300MHz

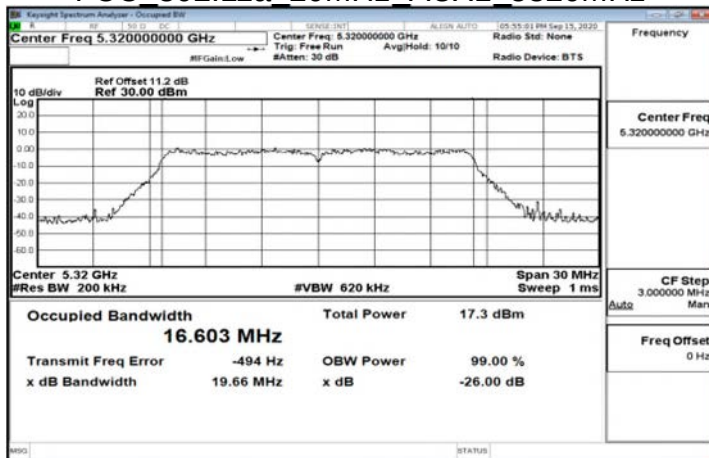


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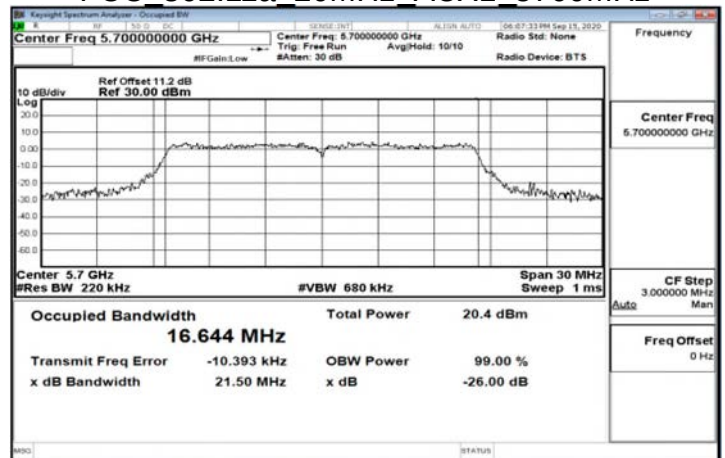
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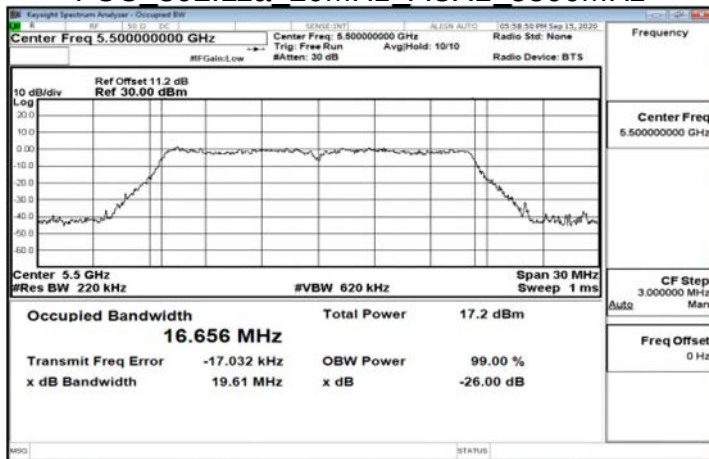
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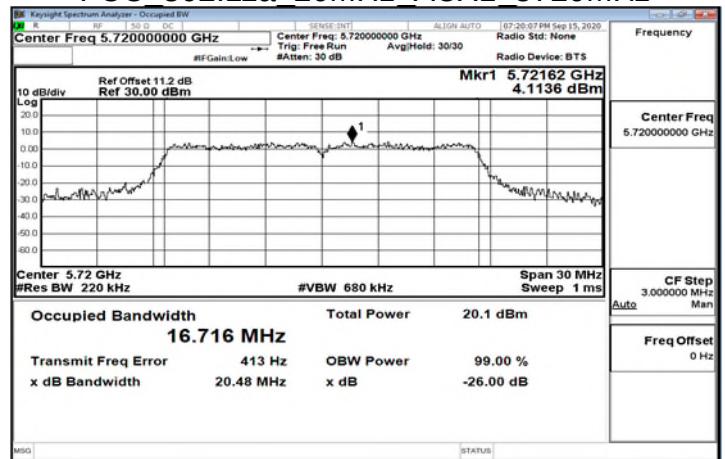
FCC 802.11a 20MHz_AUX1_5700MHz



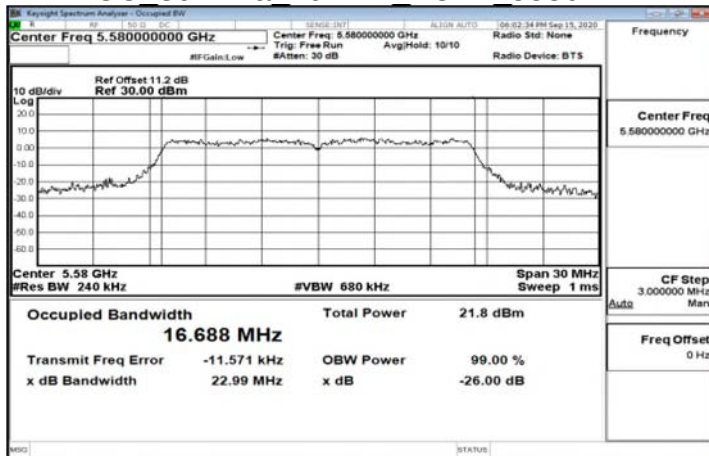
FCC 802.11a 20MHz_AUX1_5500MHz



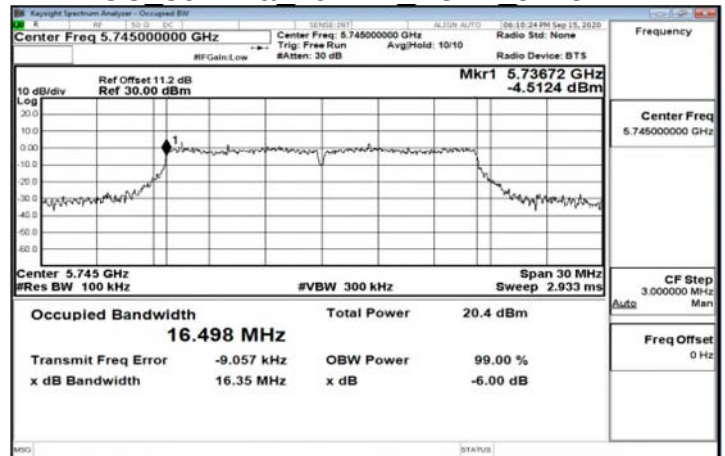
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FCC 802.11a 20MHz_AUX1_5580MHz



FCC 802.11a 20MHz_AUX1_5745MHz

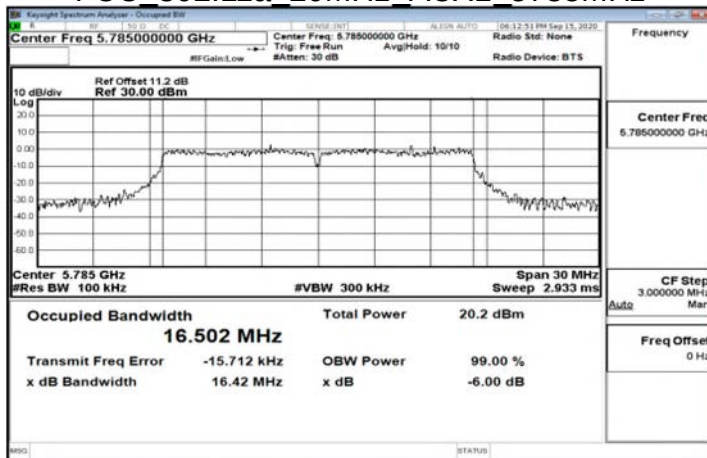


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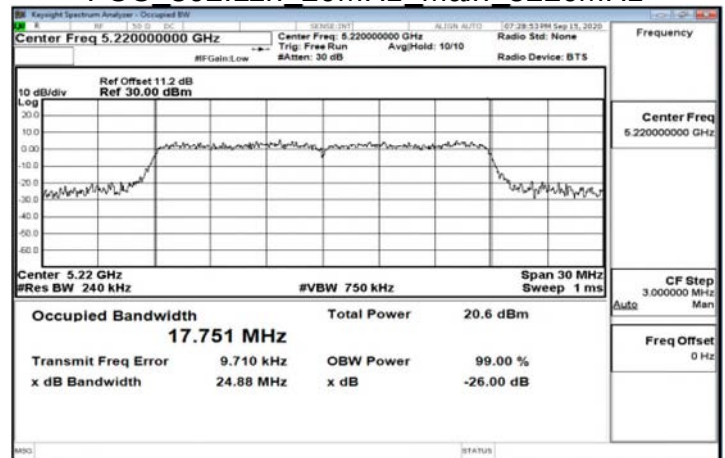
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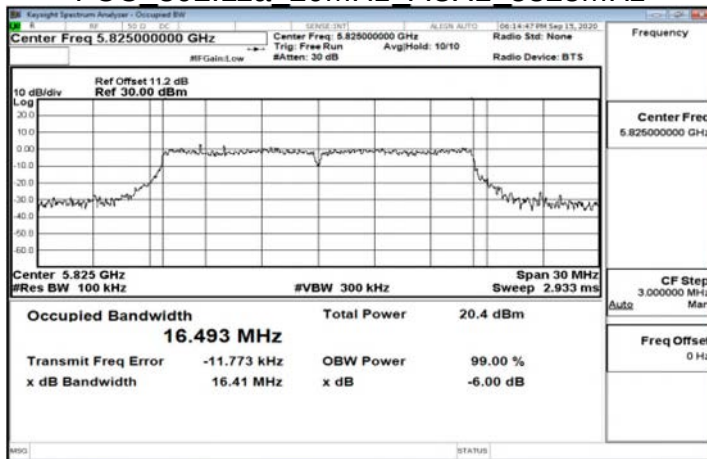
FCC 802.11a 20MHz_AUX1 5785MHz



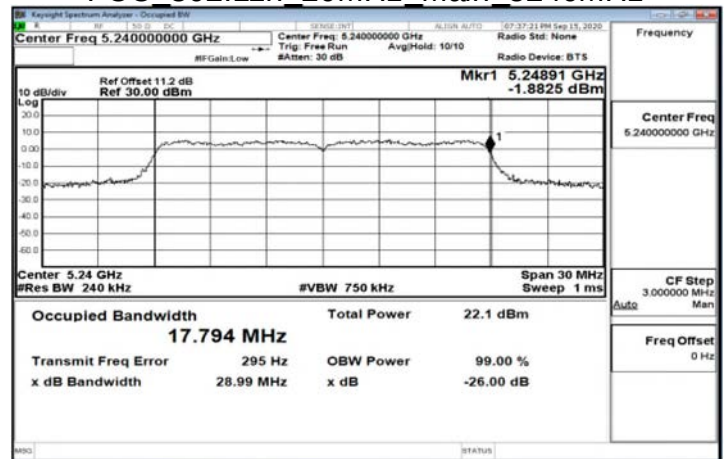
FCC 802.11n 20MHz_Main 5220MHz



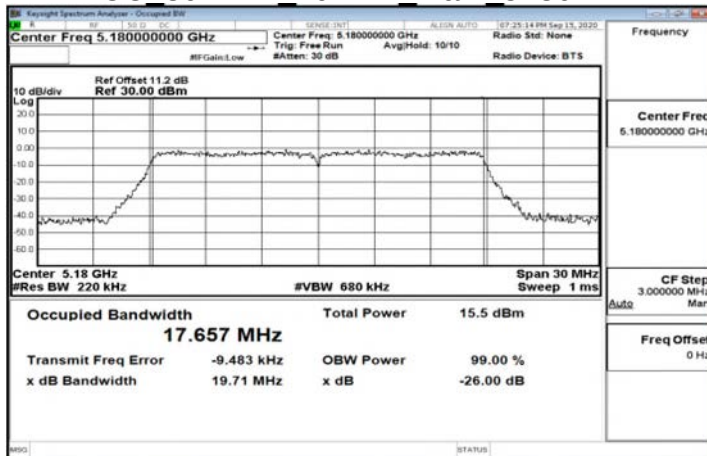
FCC 802.11a 20MHz_AUX1 5825MHz



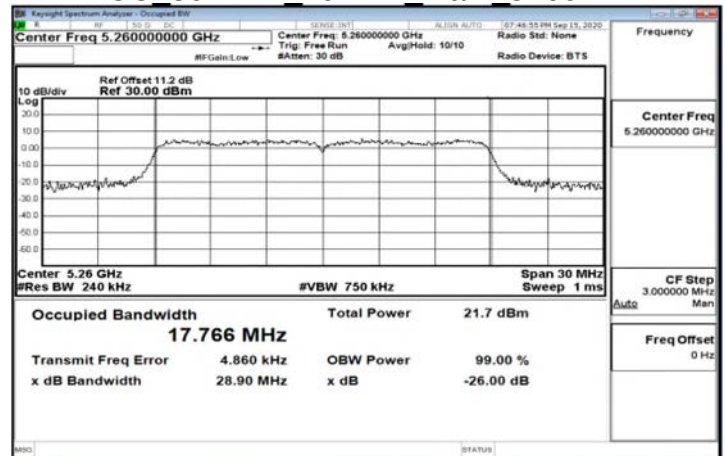
FCC 802.11n 20MHz_Main 5240MHz



FCC 802.11n 20MHz_Main 5180MHz



FCC 802.11n 20MHz_Main 5260MHz

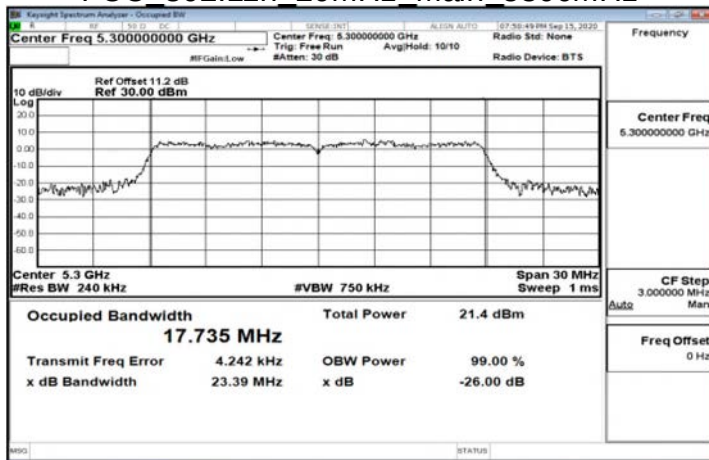


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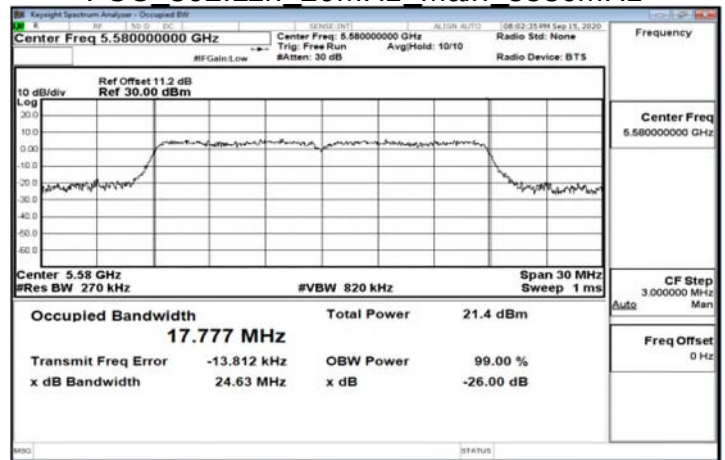
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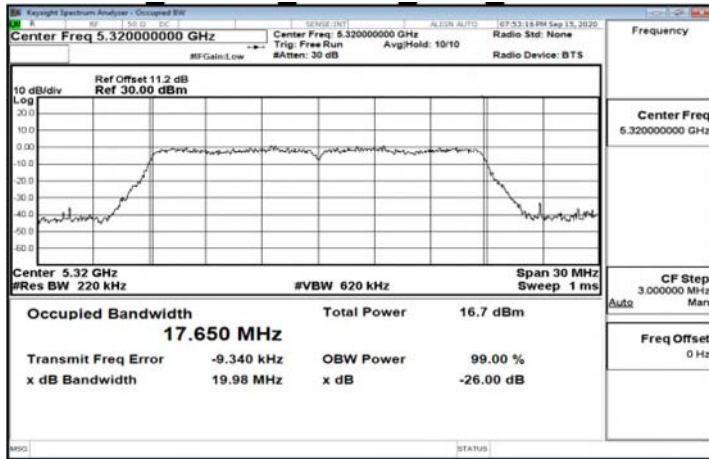
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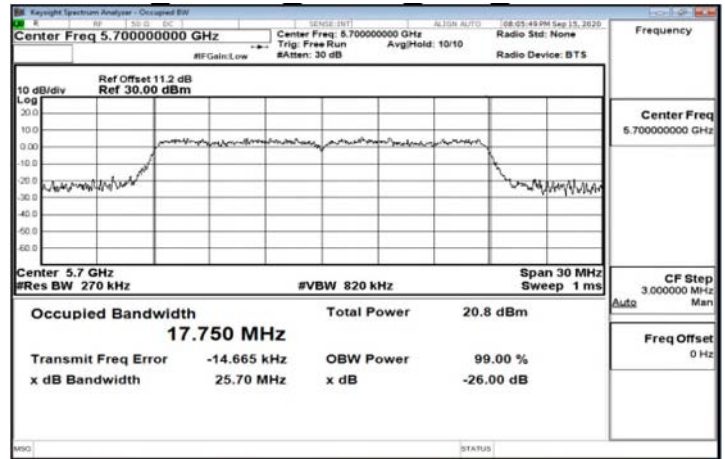
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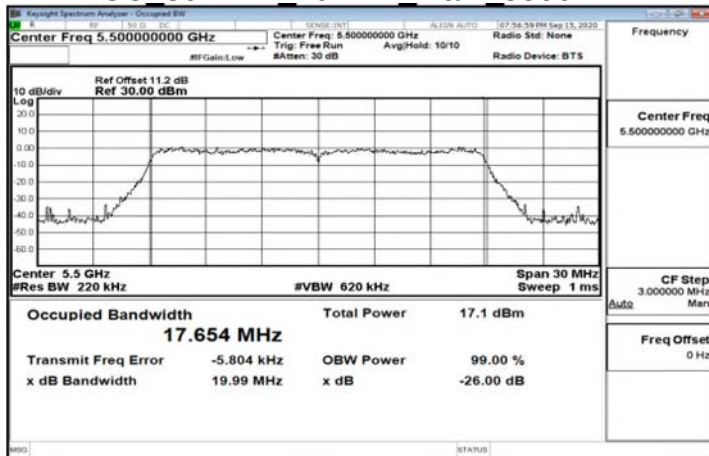
FCC 802.11n 20MHz Main 5320MHz



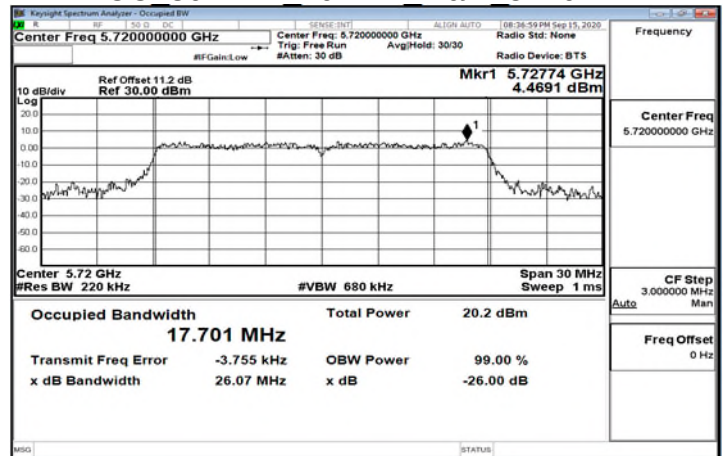
FCC 802.11n 20MHz Main 5700MHz



FCC 802.11n 20MHz Main 5500MHz



FCC 802.11n 20MHz Main 5720MHz

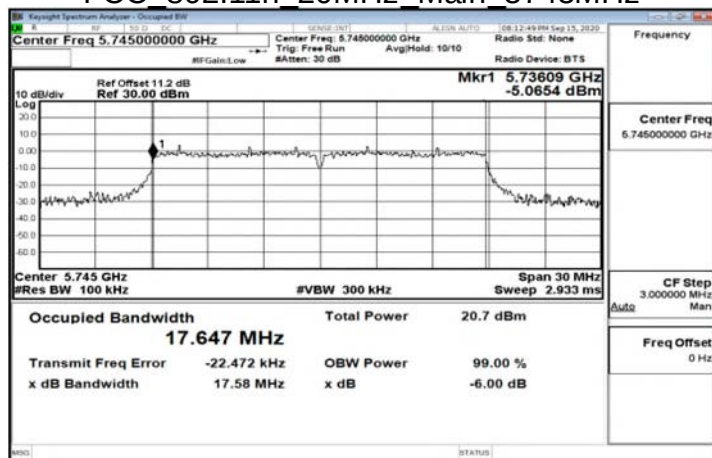


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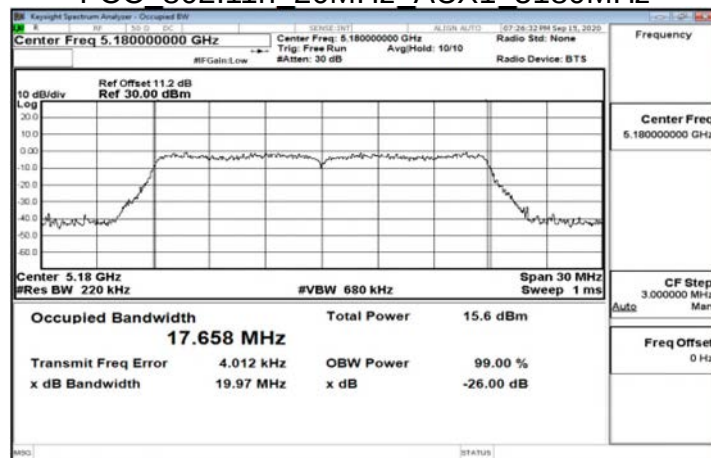
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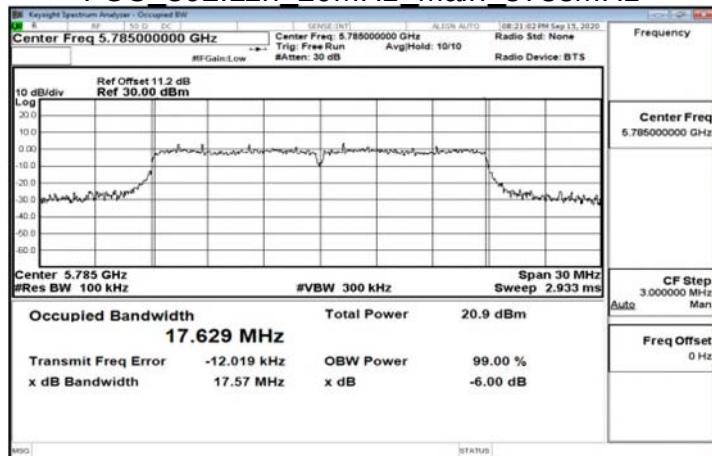
FCC 802.11n 20MHz Main 5745MHz



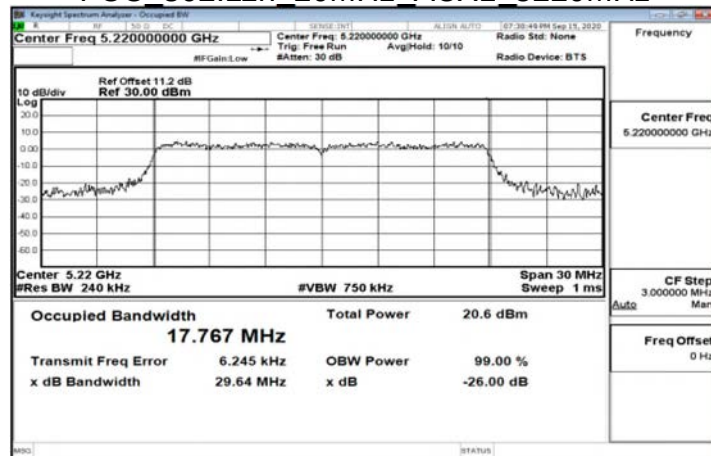
FCC 802.11n 20MHz AUX1 5180MHz



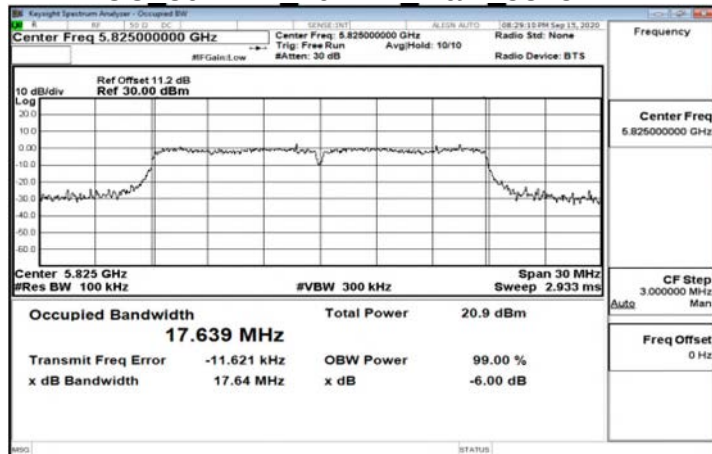
FCC 802.11n 20MHz Main 5785MHz



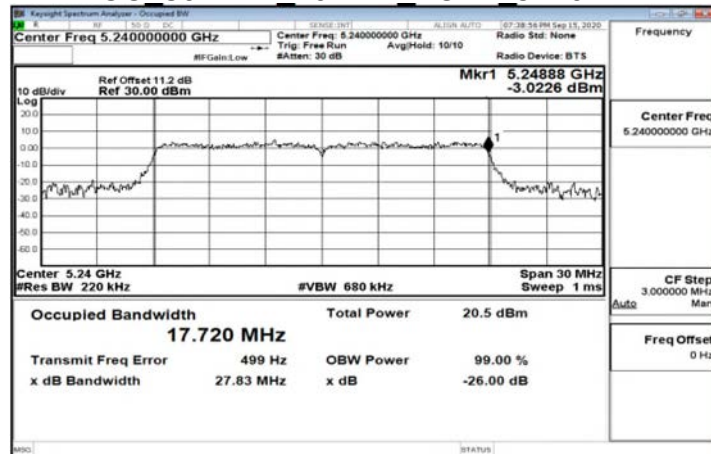
FCC 802.11n 20MHz AUX1 5220MHz



FCC 802.11n 20MHz Main 5825MHz



FCC 802.11n 20MHz AUX1 5240MHz

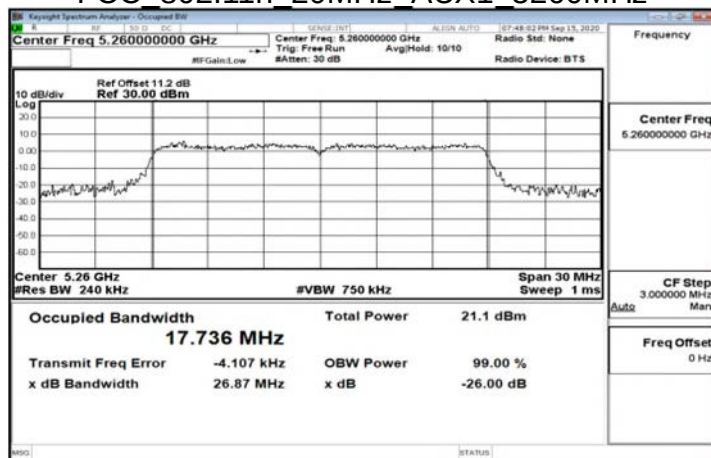


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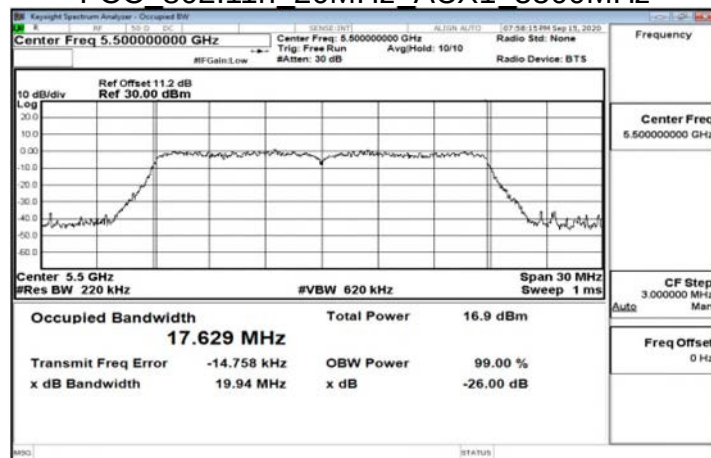
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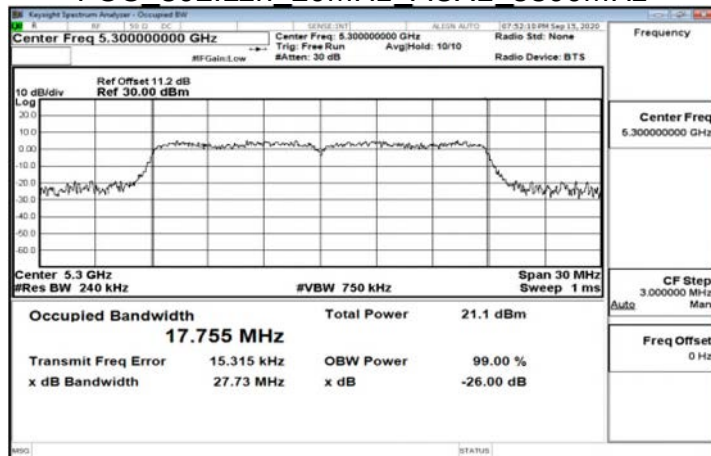
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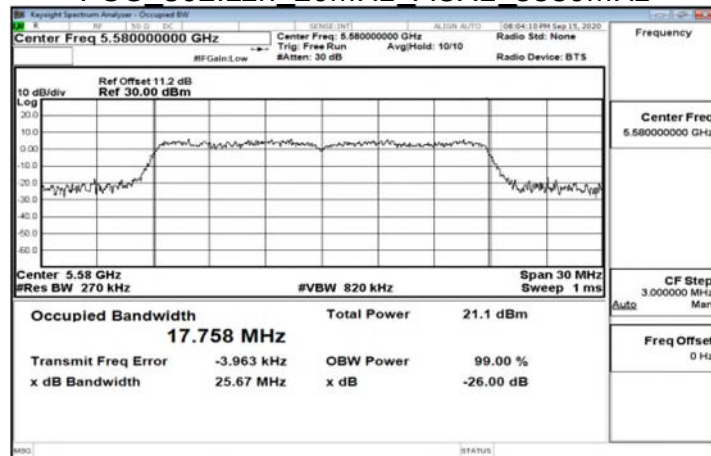
FCC 802.11n 20MHz_AUX1_5500MHz



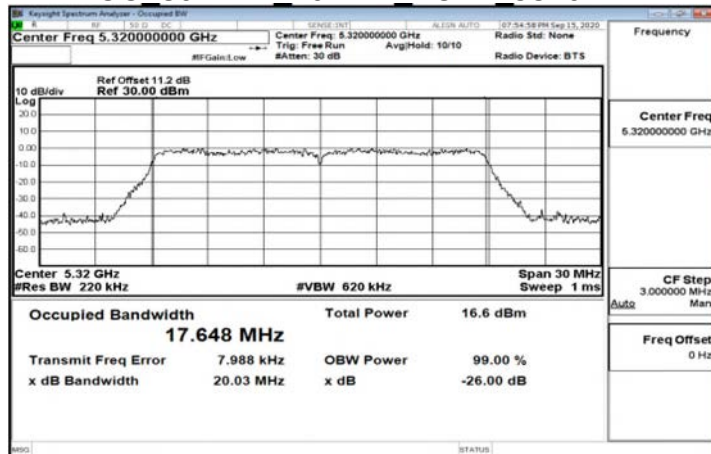
FCC 802.11n 20MHz_AUX1_5300MHz



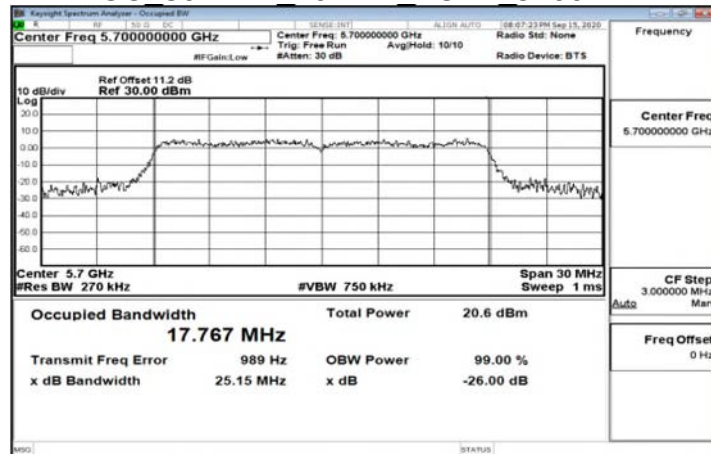
FCC 802.11n 20MHz_AUX1_5580MHz



FCC 802.11n 20MHz_AUX1_5320MHz



FCC 802.11n 20MHz_AUX1_5700MHz

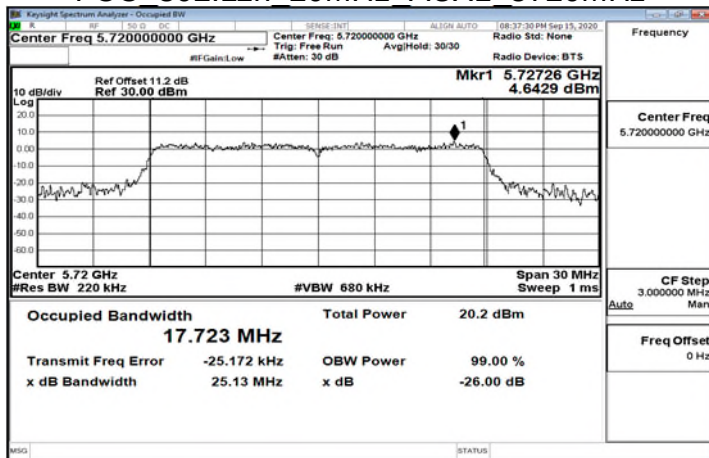


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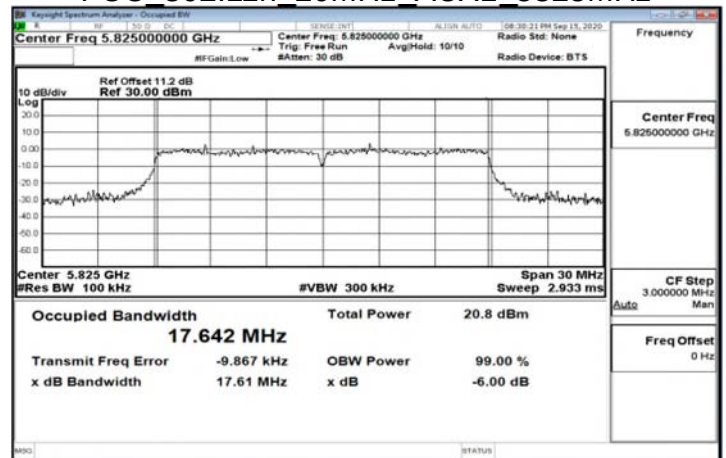
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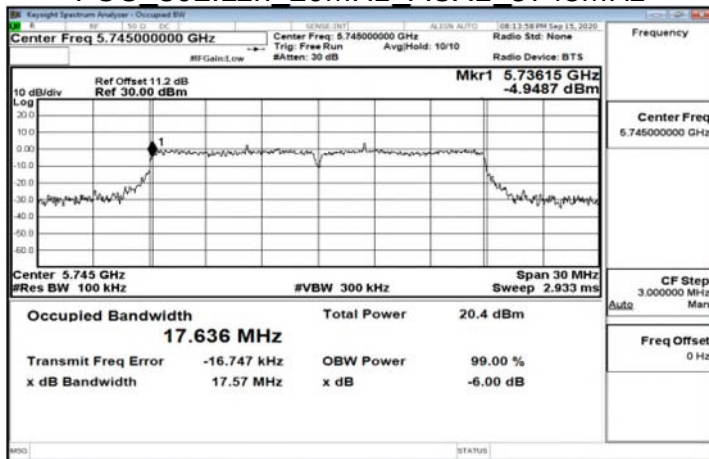
FCC 802.11n 20MHz AUX1 5720MHz



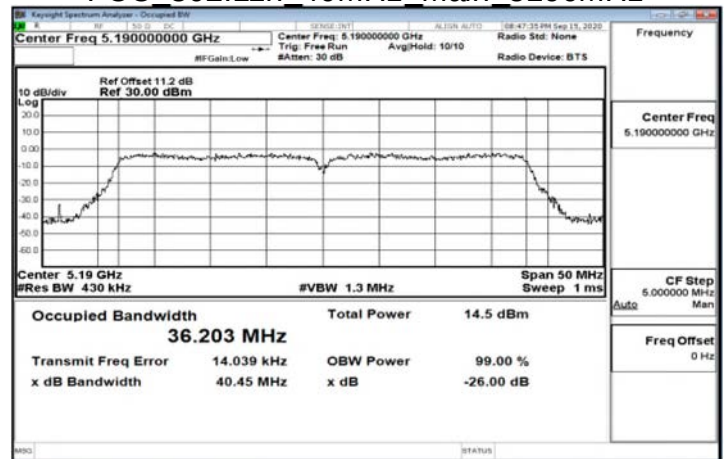
FCC_802.11n_20MHz_AUX1_5825MHz



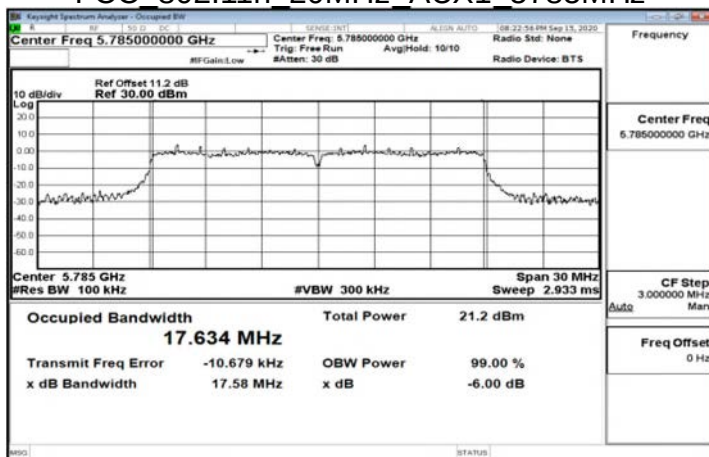
FCC 802.11n 20MHz AUX1 5745MHz



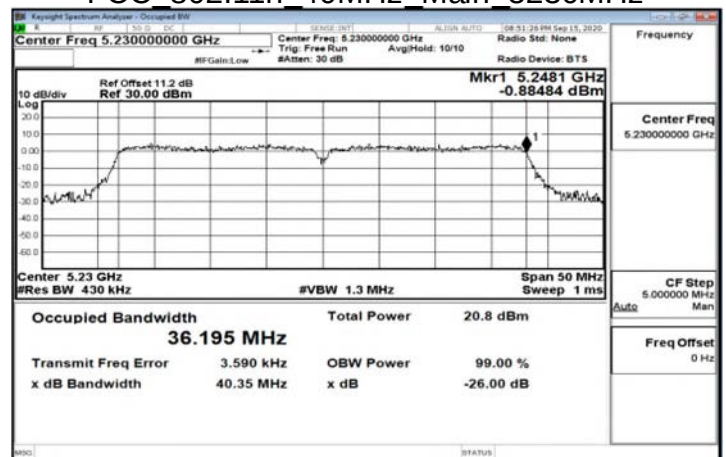
FCC 802.11n 40MHz Main 5190MHz



FCC 802.11n 20MHz AUX1 5785MHz



FCC 802.11n 40MHz Main 5230MHz

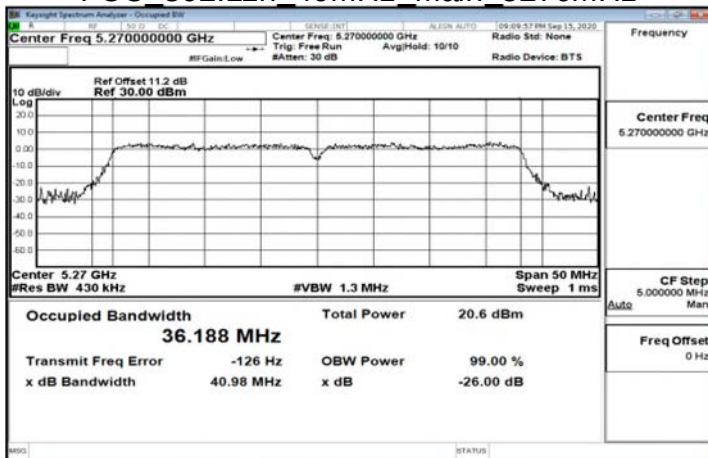


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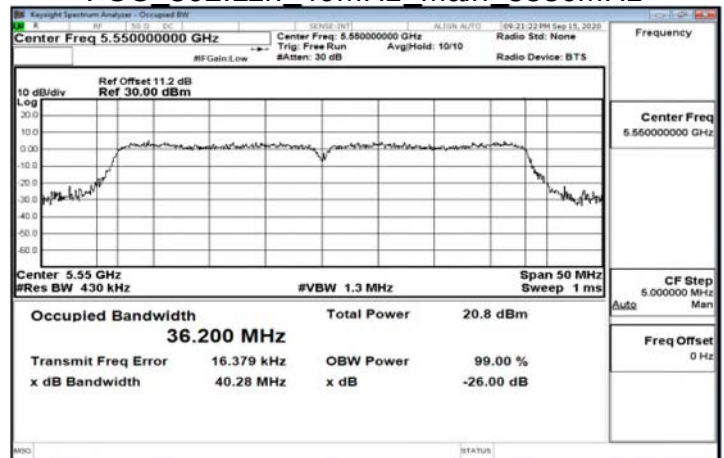
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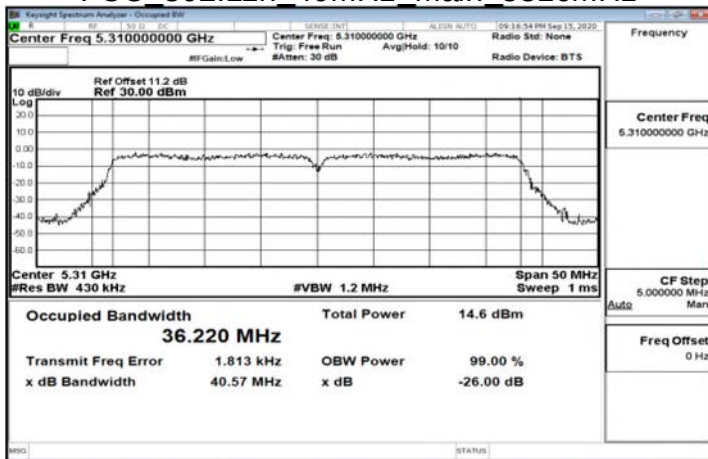
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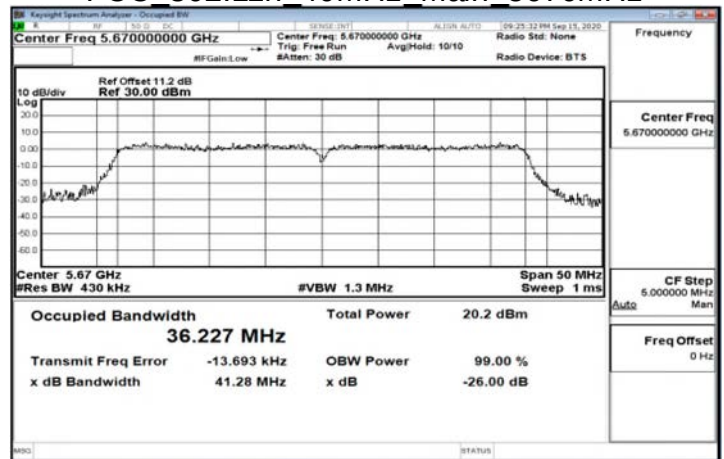
FCC 802.11n 40MHz Main 5550MHz



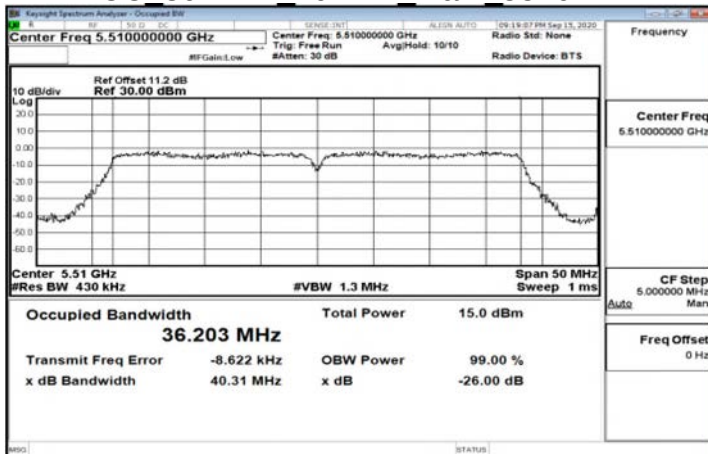
FCC 802.11n 40MHz Main 5310MHz



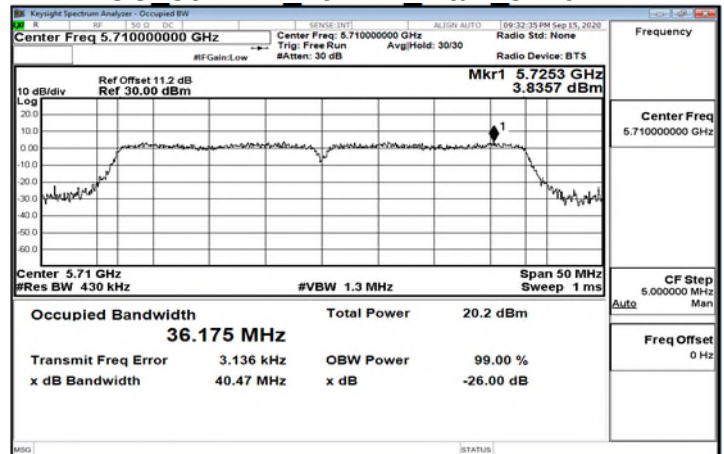
FCC 802.11n 40MHz Main 5670MHz



FCC 802.11n 40MHz Main 5510MHz



FCC 802.11n 40MHz Main 5710MHz

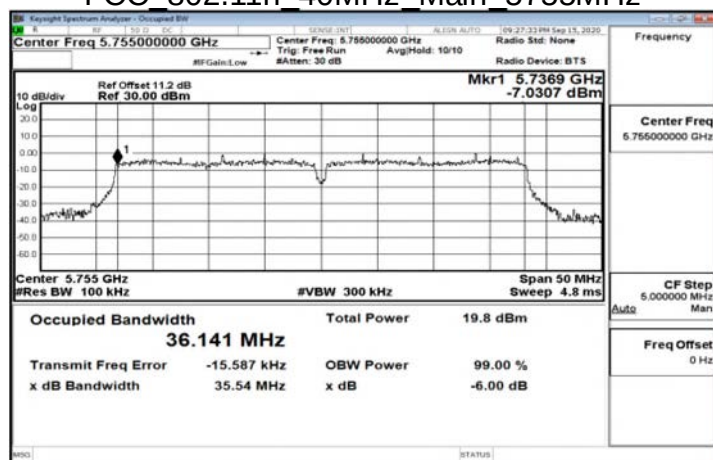


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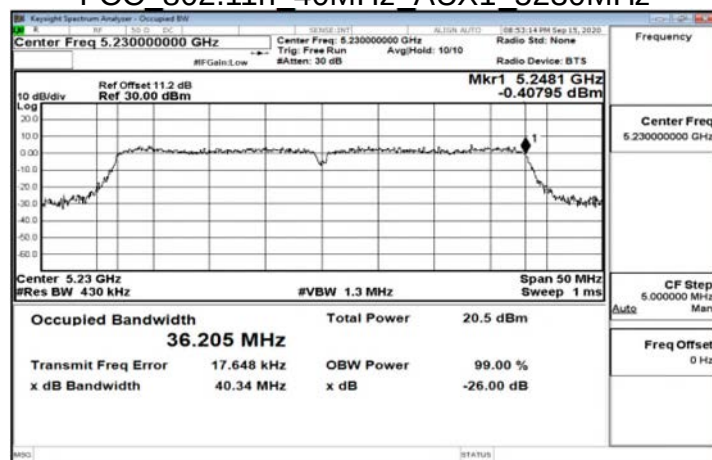
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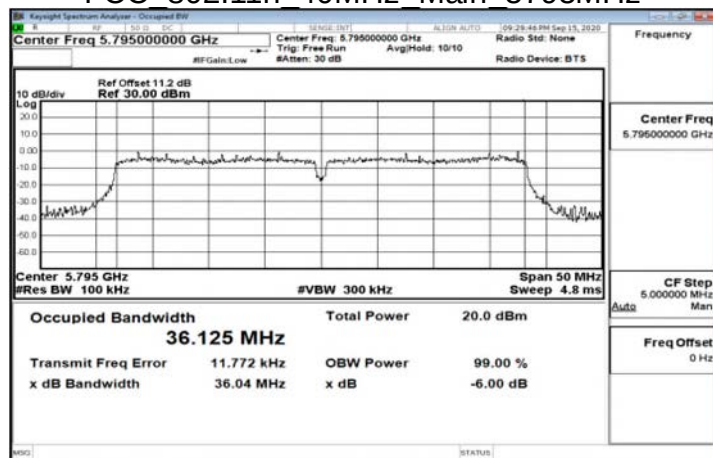
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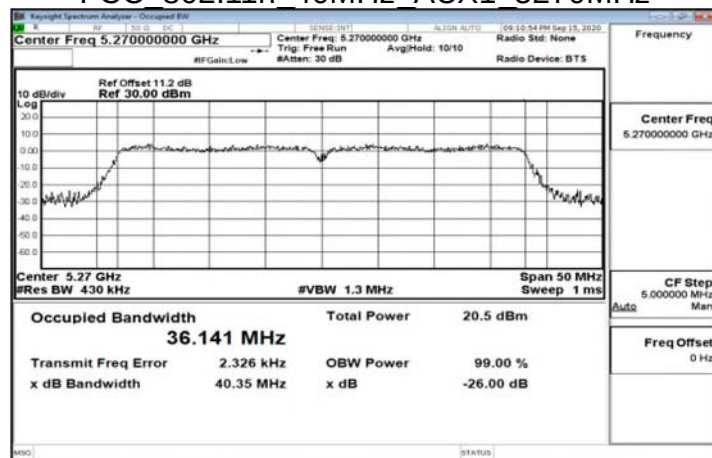
FCC 802.11n 40MHz AUX1 5230MHz



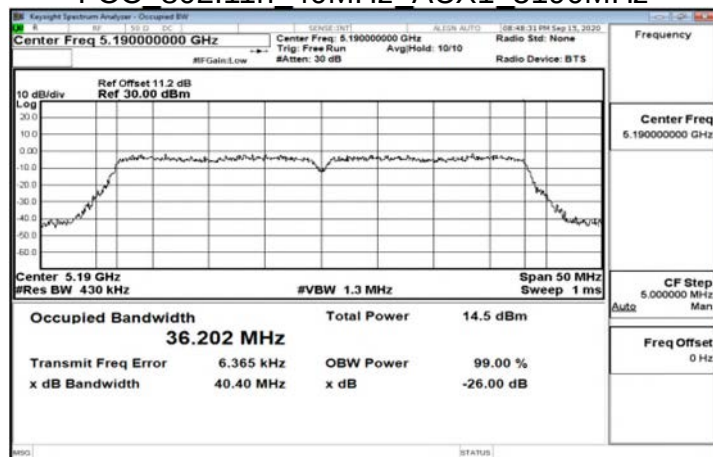
FCC 802.11n 40MHz Main 5795MHz



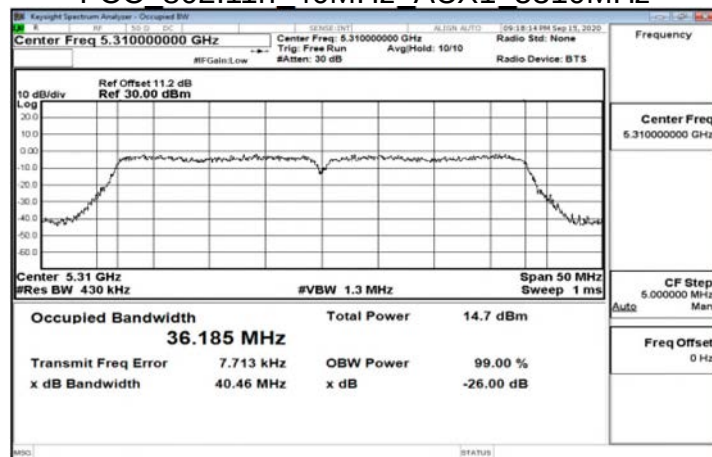
FCC 802.11n 40MHz AUX1 5270MHz



FCC 802.11n 40MHz AUX1 5190MHz



FCC 802.11n 40MHz AUX1 5310MHz

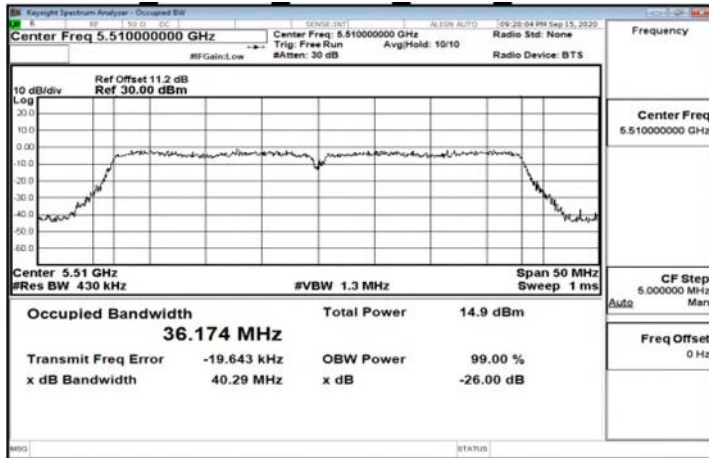


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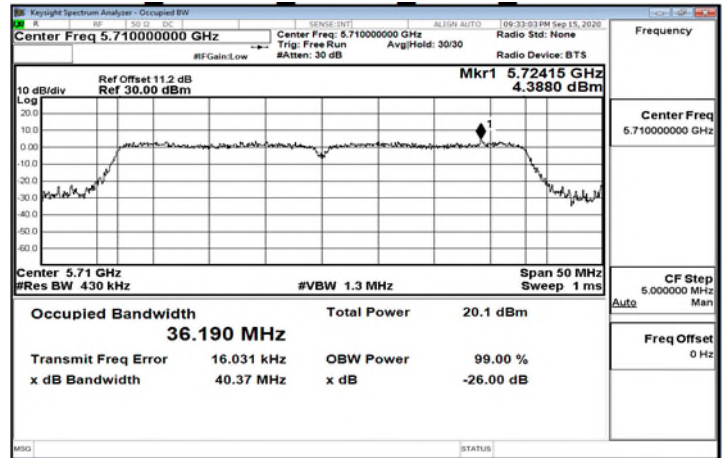
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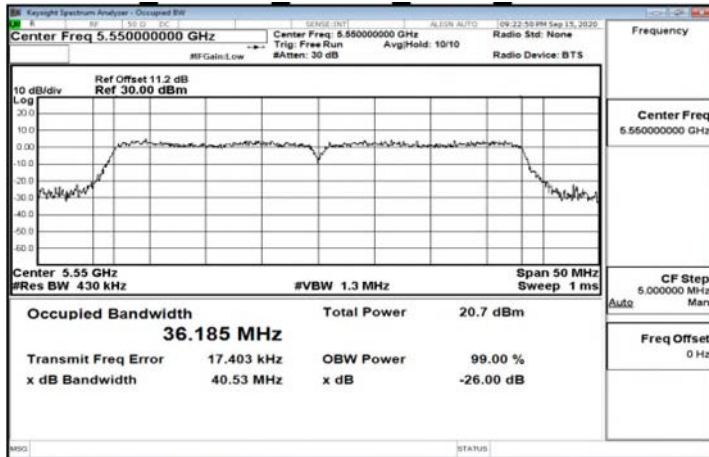
FCC 802.11n 40MHz_AUX1_5510MHz



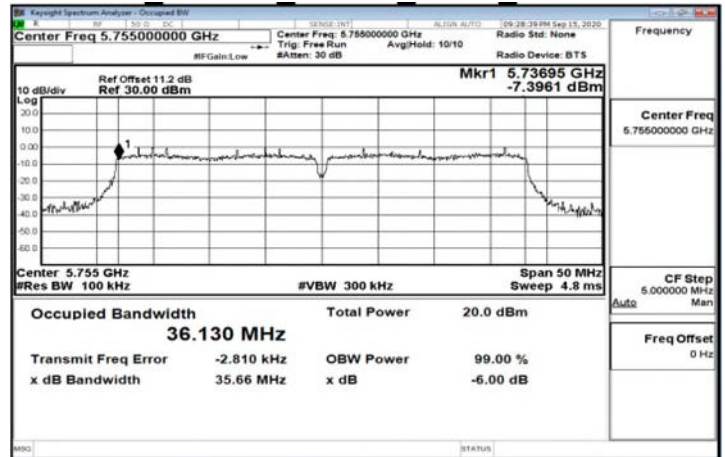
FCC 802.11n 40MHz_AUX1_5710MHz



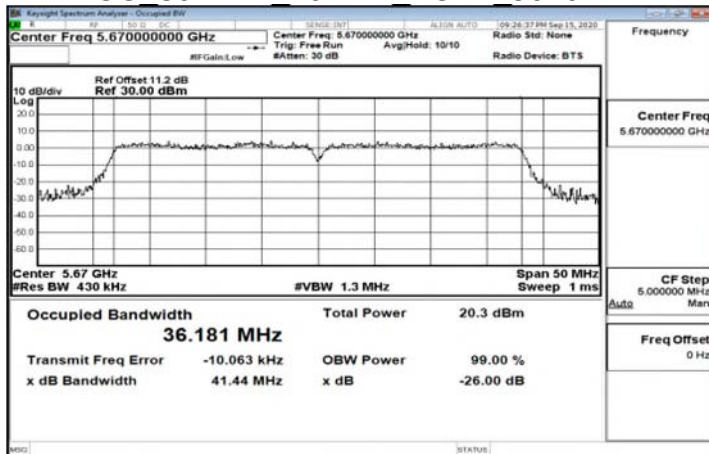
FCC 802.11n 40MHz_AUX1_5550MHz



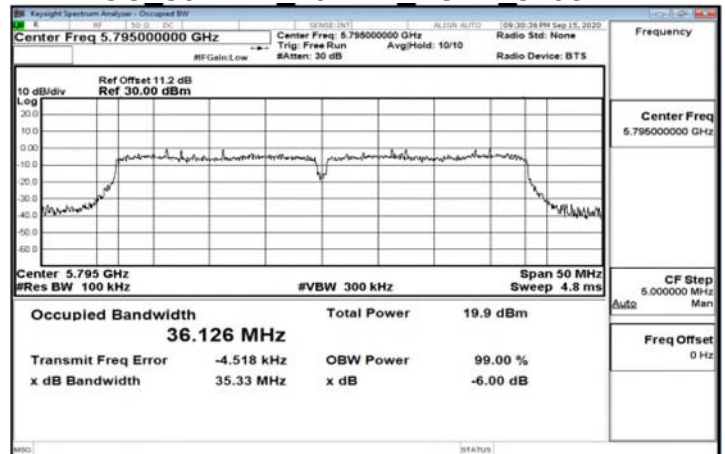
FCC 802.11n 40MHz_AUX1_5755MHz



FCC 802.11n 40MHz_AUX1_5670MHz



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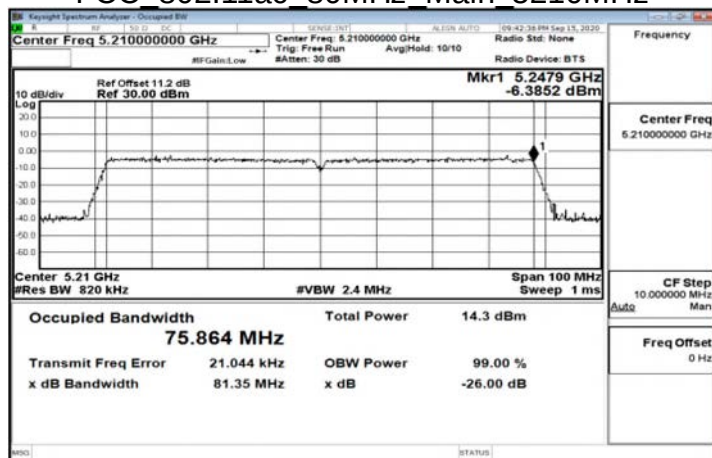


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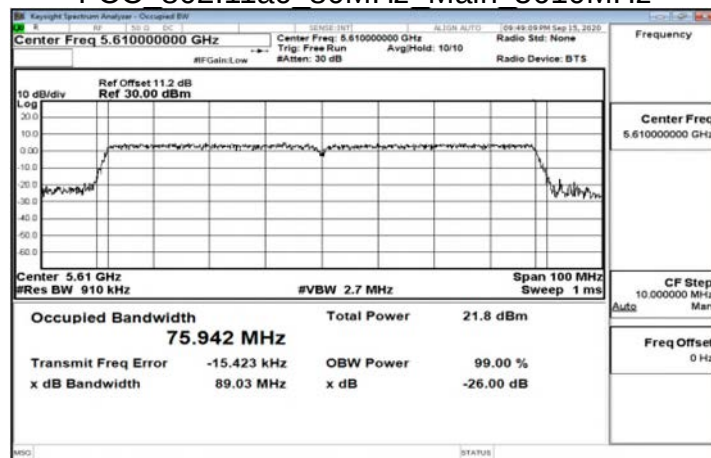
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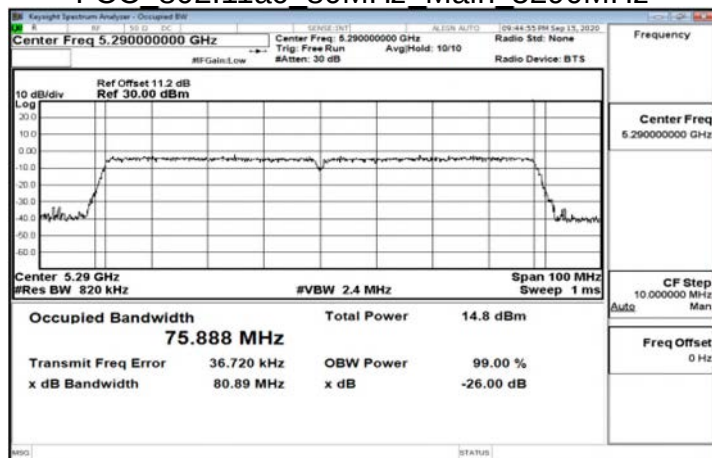
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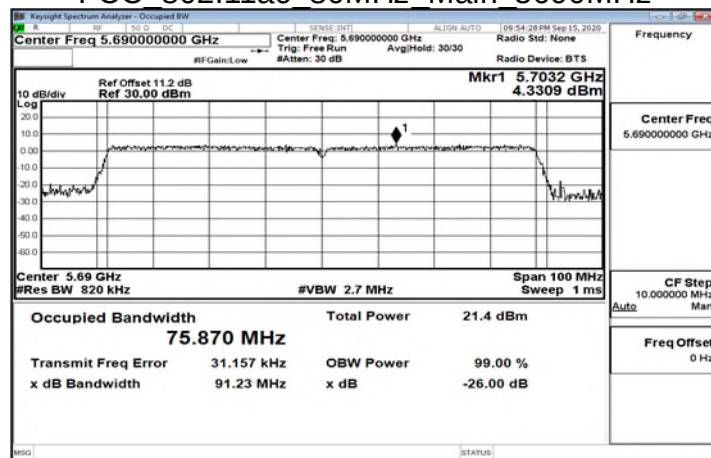
FCC 802.11ac 80MHz Main 5610MHz



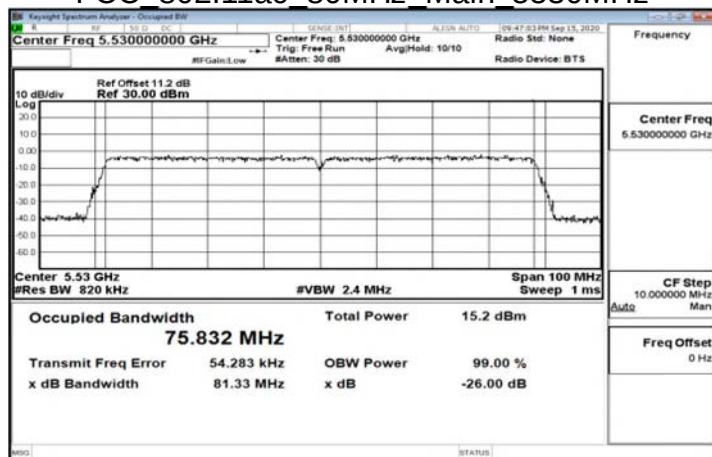
FCC 802.11ac 80MHz Main 5290MHz



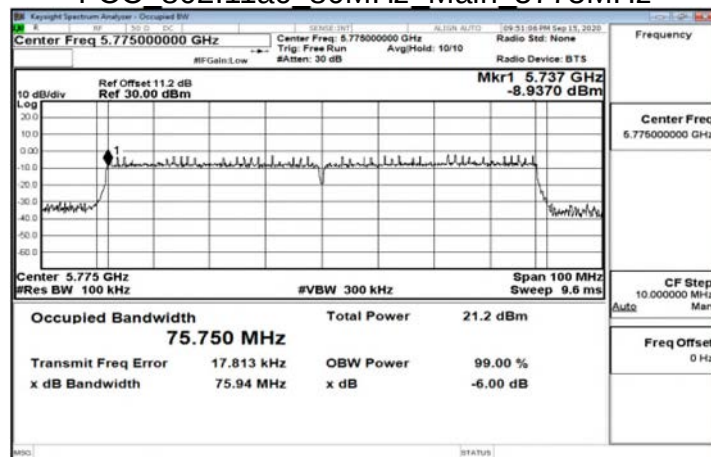
FCC 802.11ac 80MHz Main 5690MHz



FCC 802.11ac 80MHz Main 5530MHz



FCC 802.11ac 80MHz Main 5775MHz

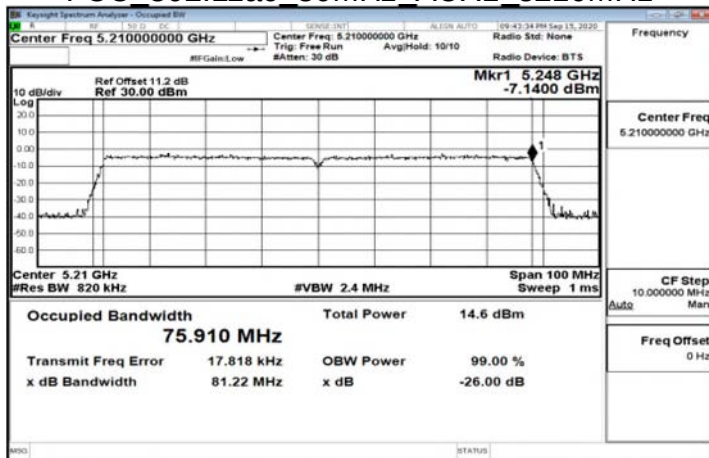


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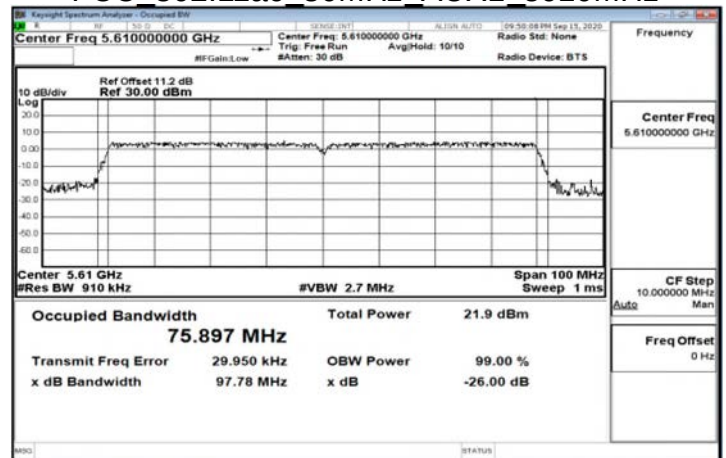
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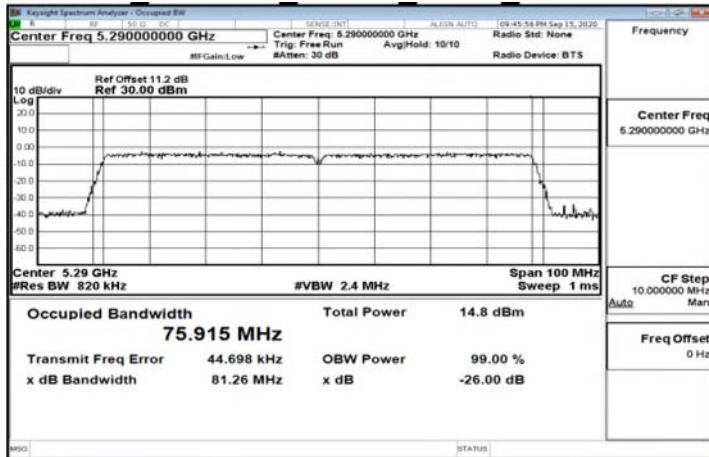
FCC 802.11ac 80MHz AUX1 5210MHz



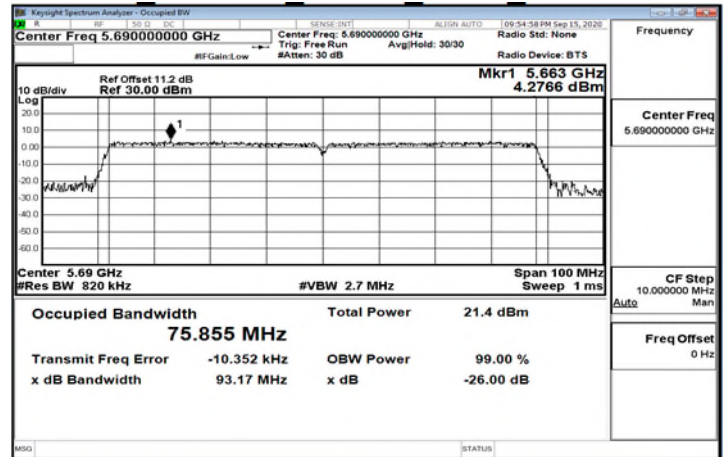
FCC 802.11ac 80MHz AUX1 5610MHz



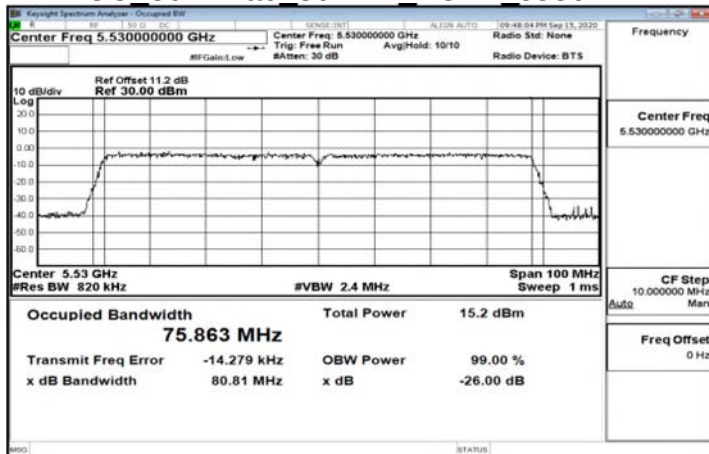
FCC 802.11ac 80MHz AUX1 5290MHz



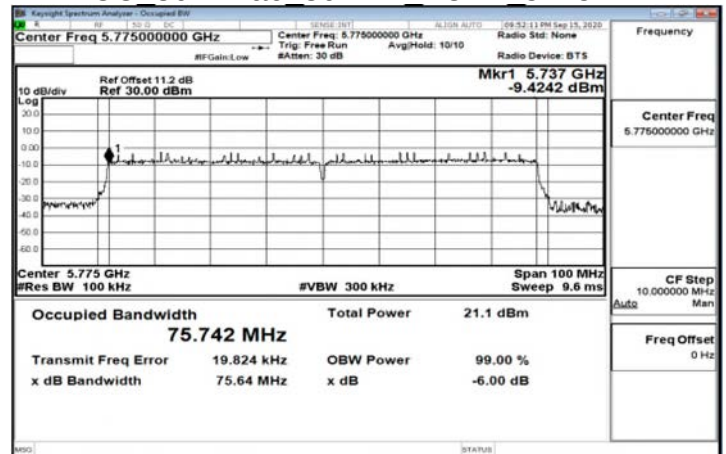
FCC 802.11ac 80MHz AUX1 5690MHz



FCC 802.11ac 80MHz AUX1 5530MHz



FCC 802.11ac 80MHz AUX1 5775MHz



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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	16.735	12.236	5180	16.769	12.245
5220	16.793	12.251	5220	16.833	12.262
5240	16.774	12.246	5240	16.765	12.244
5260	16.911	12.282	5260	16.757	12.242
5300	16.846	12.265	5300	16.847	12.265
5320	16.806	12.255	5320	16.829	12.261
5500	16.772	12.246	5500	16.729	12.235
5580	16.871	12.271	5580	16.799	12.253
5700	16.814	12.257	5700	16.813	12.256
5720	16.767	12.245	5720	16.824	12.259

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	17.711	12.482	5180	17.692	12.478
5220	17.833	12.512	5220	17.777	12.499
5240	17.813	12.507	5240	17.792	12.502
5260	17.797	12.503	5260	17.802	12.505
5300	17.855	12.518	5300	17.772	12.497
5320	17.688	12.477	5320	17.712	12.483
5500	17.706	12.481	5500	17.707	12.481
5580	17.813	12.507	5580	17.807	12.506
5700	17.808	12.506	5700	17.824	12.510
5720	17.78	12.499	5720	17.766	12.496

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	36.174	15.584	5190	36.212	15.589
5230	36.163	15.583	5230	36.191	15.586
5270	36.216	15.589	5270	36.21	15.588
5310	36.211	15.588	5310	36.195	15.586
5510	36.202	15.587	5510	36.204	15.588
5550	36.201	15.587	5550	36.21	15.588
5670	36.191	15.586	5670	36.205	15.588
5710	36.235	15.591	5710	36.204	15.588

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	75.935	18.804	5210	75.904	18.803
5290	75.893	18.802	5290	75.979	18.807
5530	75.91	18.803	5530	75.886	18.802
5690	75.836	18.799	5690	75.944	18.805

802.11ac_VHT80_Ch1

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

802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.813	12.256	5745	16.776	12.247
5785	16.782	12.248	5785	16.775	12.247
5825	16.778	12.247	5825	16.753	12.241

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	17.783	12.500	5745	17.79	12.502
5785	17.8	12.504	5785	17.787	12.501
5825	17.771	12.497	5825	17.785	12.501

802.11n_HT20_Ch1

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802.11n _HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.199	15.587
5795	36.262	15.595

802.11n _HT40_Ch1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.171	15.584
5795	36.302	15.599

802.11ac _VHT80_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.993	18.808

802.11ac _VHT80_Ch1

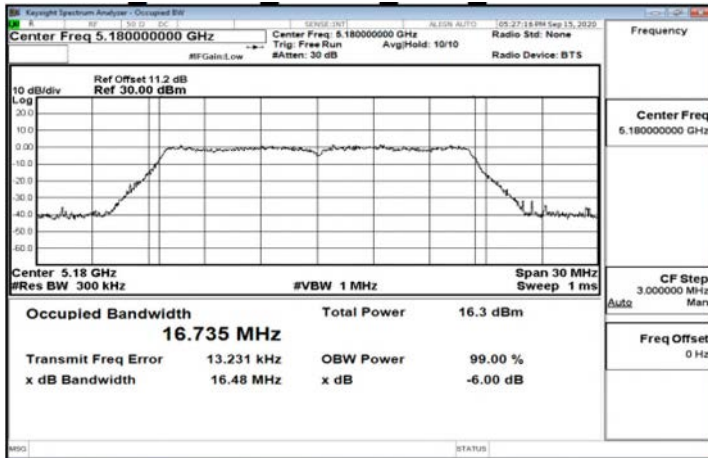
Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	76.526	18.838

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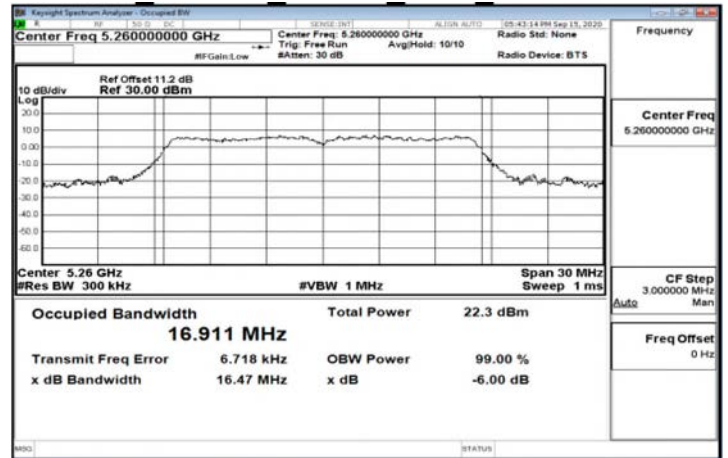
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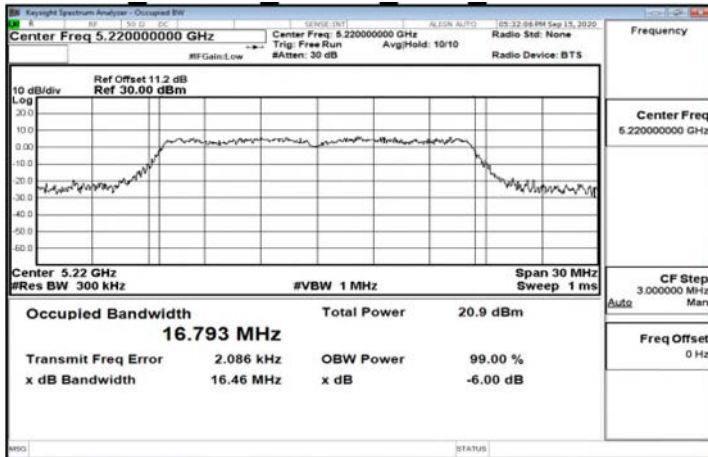
IC 802.11a 20MHz Main 5180MHz



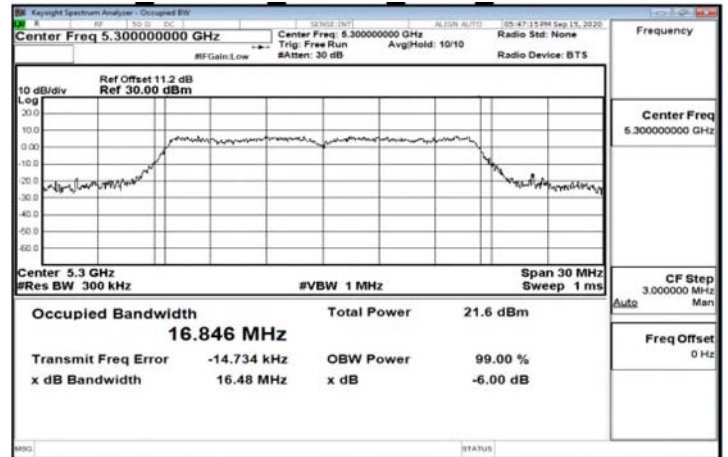
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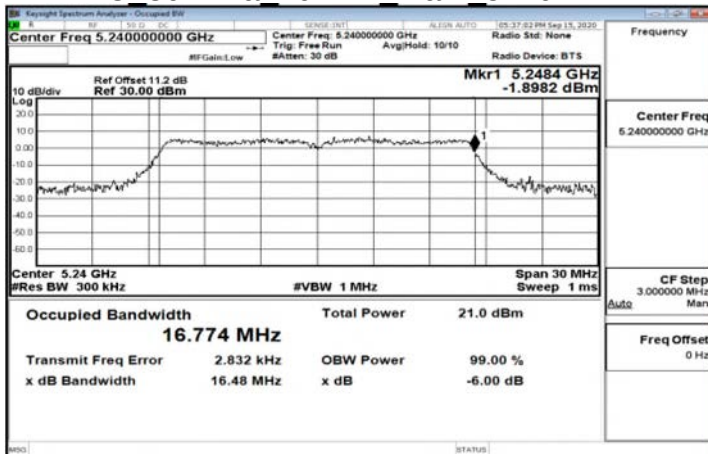
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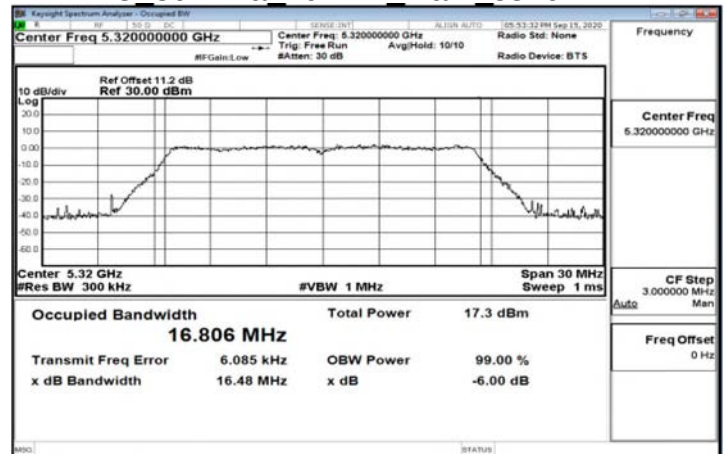
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IC 802.11a 20MHz Main 5240MHz



IC 802.11a 20MHz Main 5320MHz

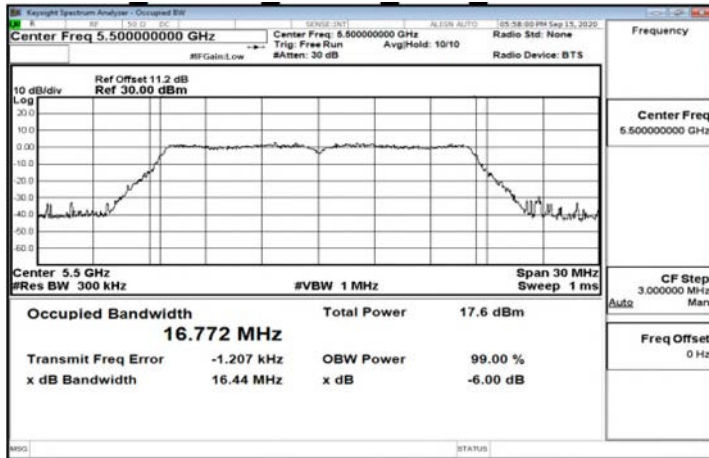


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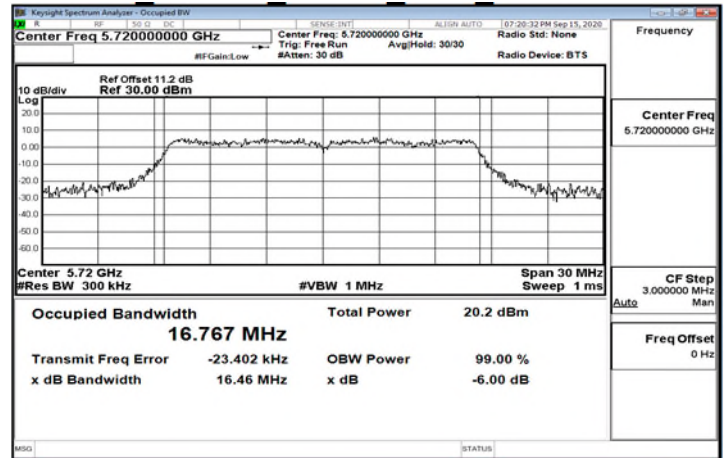
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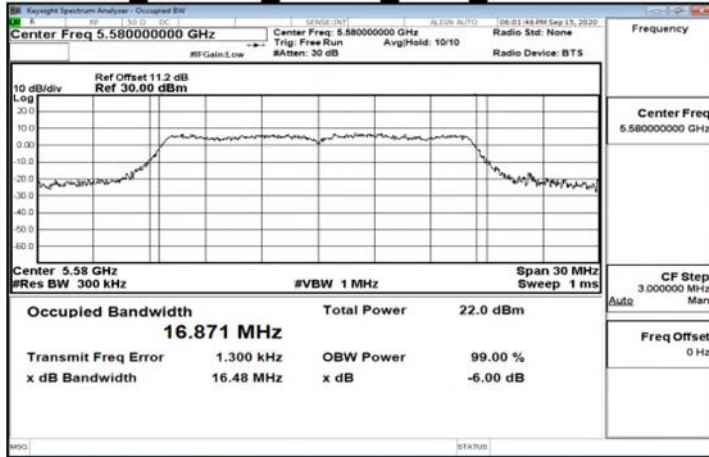
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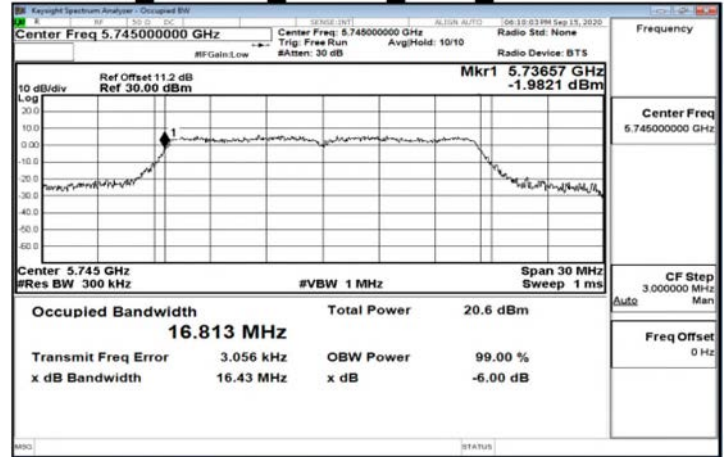
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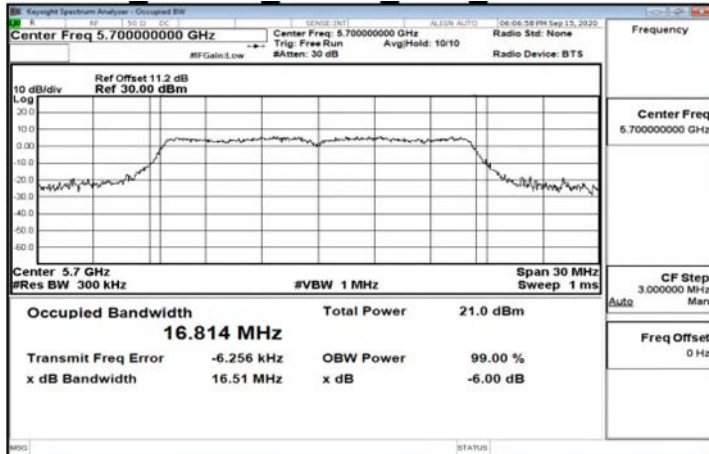
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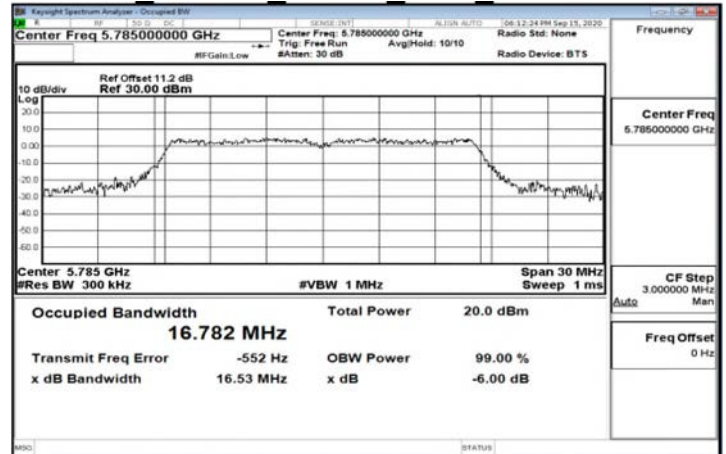
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IC 802.11a 20MHz Main 5700MHz



IC 802.11a 20MHz Main 5785MHz

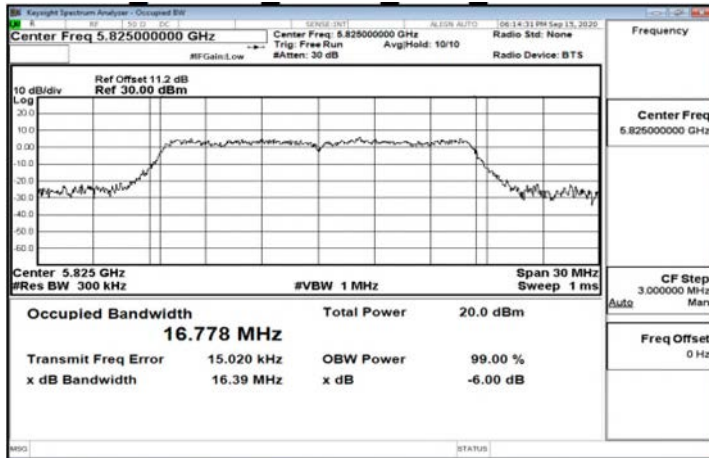


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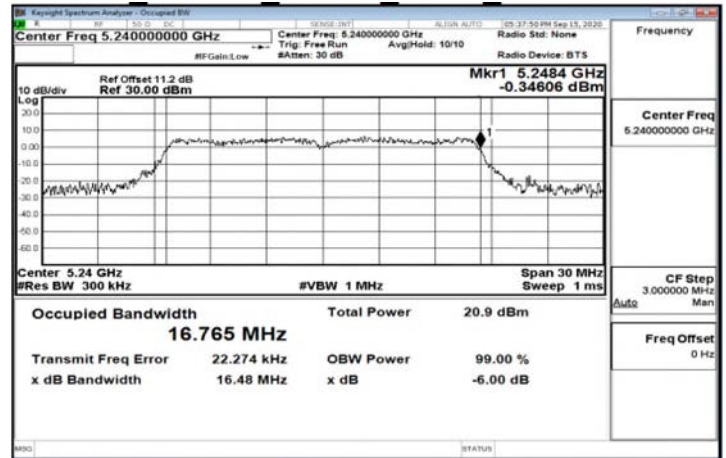
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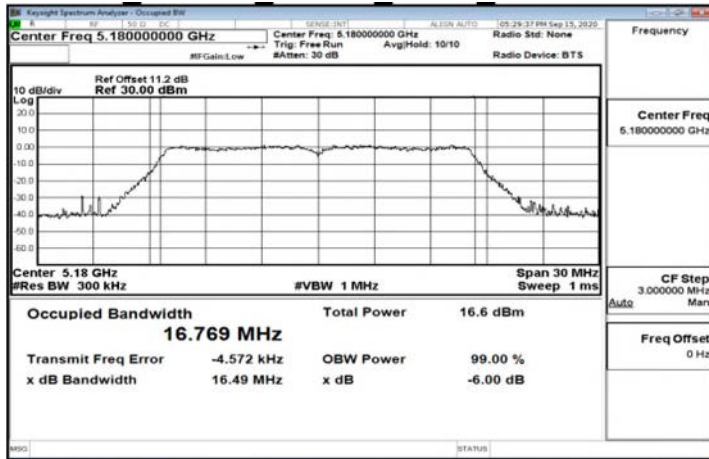
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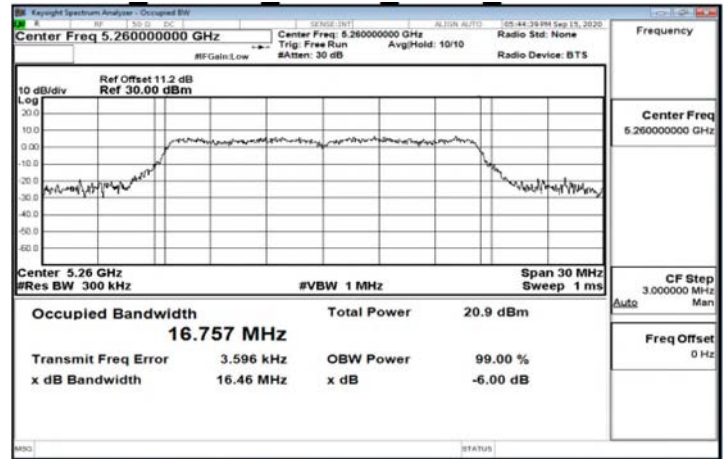
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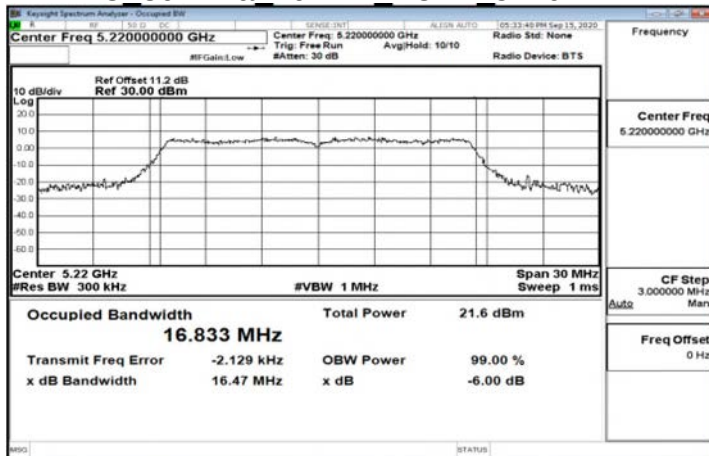
IC 802.11a 20MHz AUX1 5180MHz



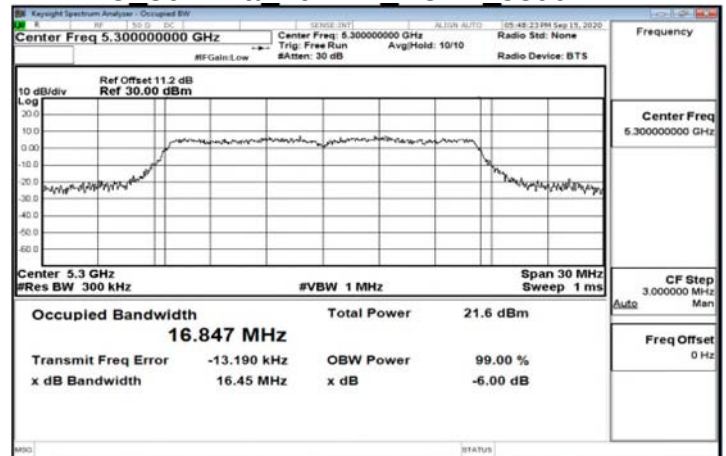
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IC 802.11a 20MHz AUX1 5220MHz



IC 802.11a 20MHz AUX1 5300MHz

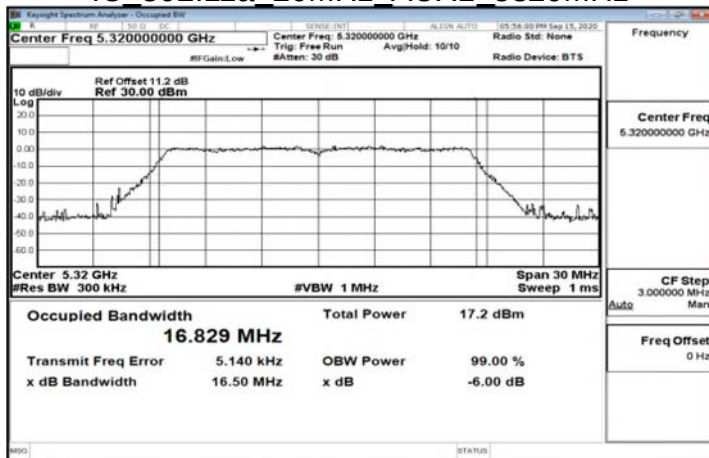


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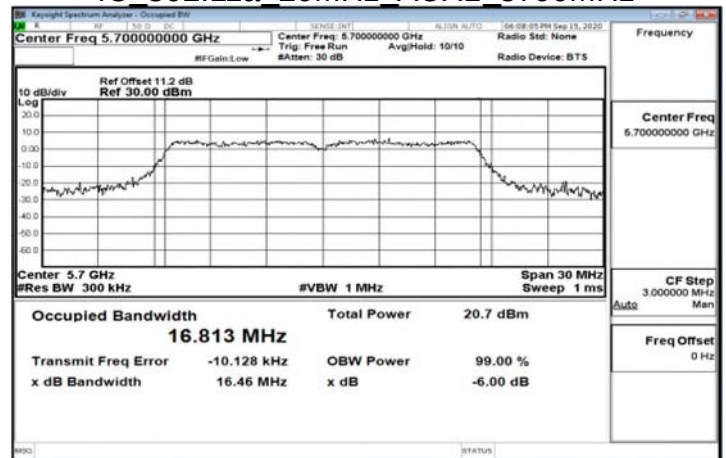
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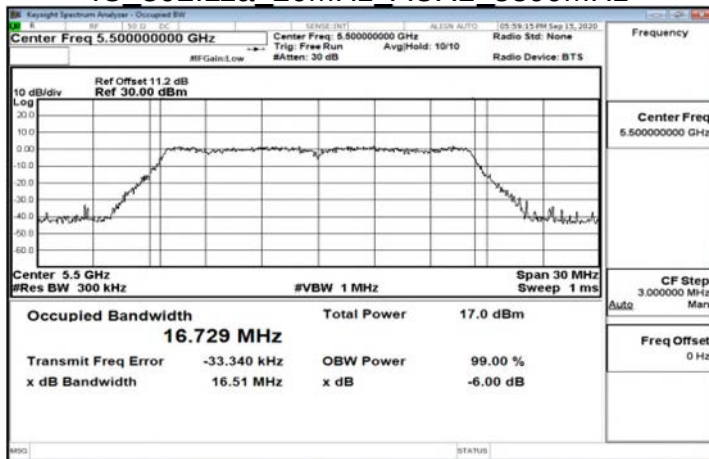
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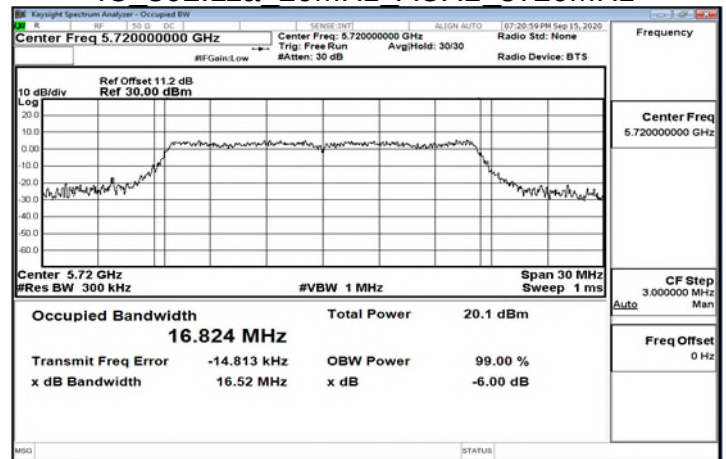
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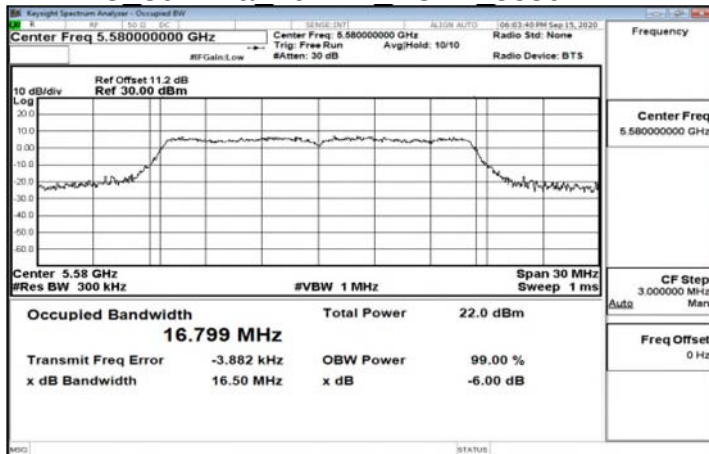
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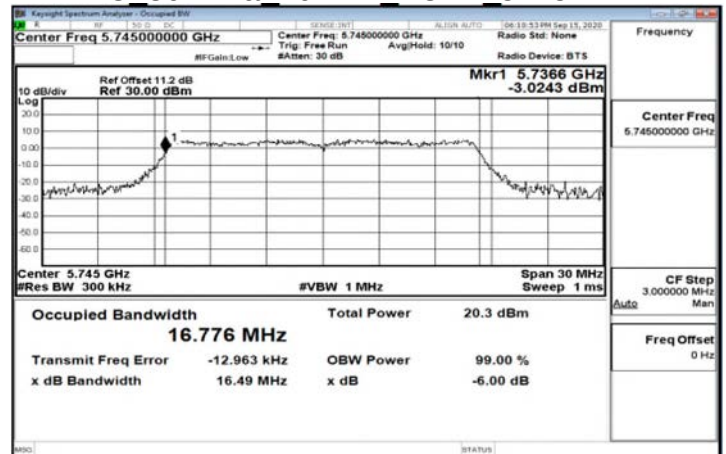
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IC 802.11a 20MHz AUX1 5580MHz



IC 802.11a 20MHz AUX1 5745MHz

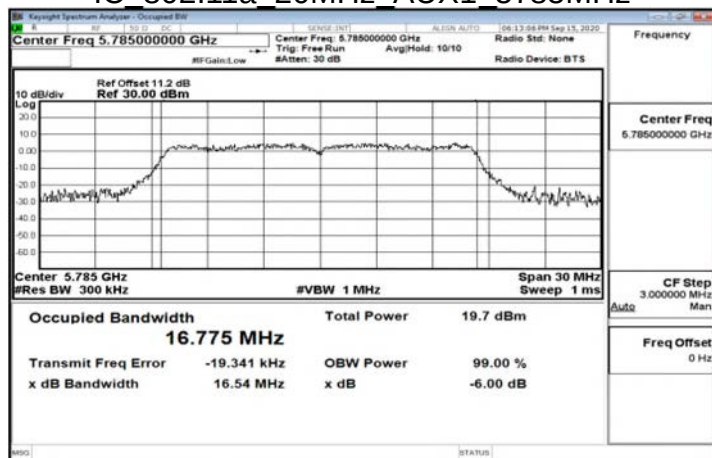


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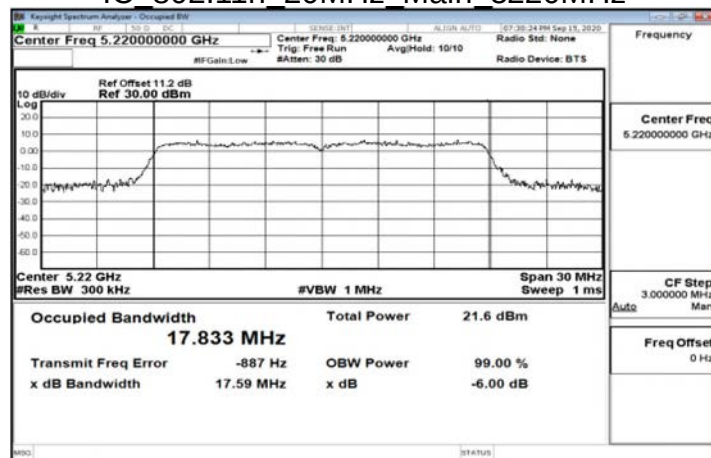
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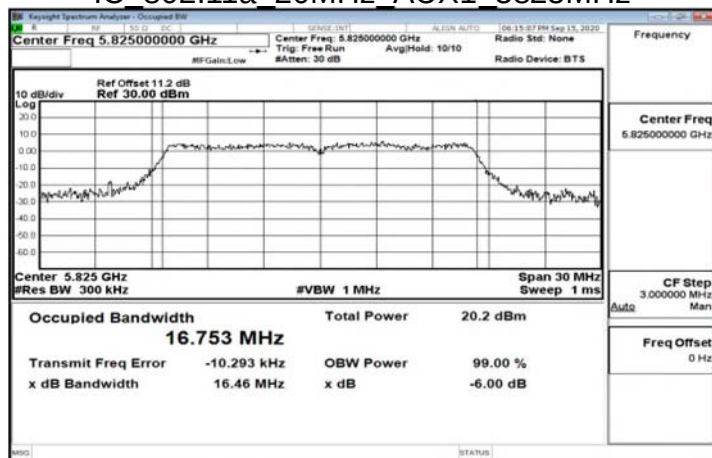
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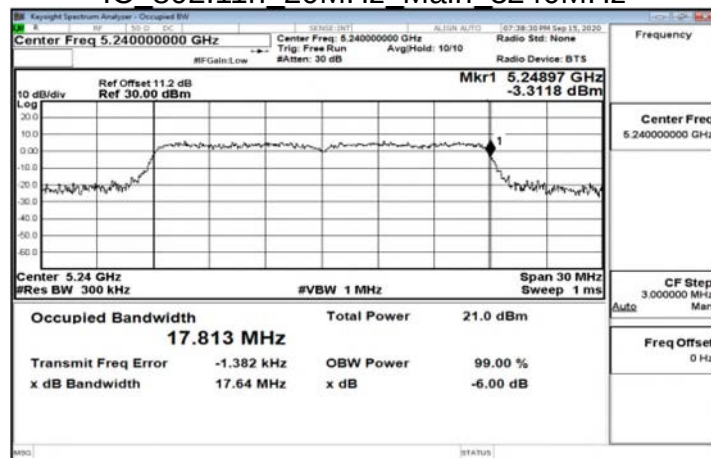
IC 802.11n 20MHz Main 5220MHz



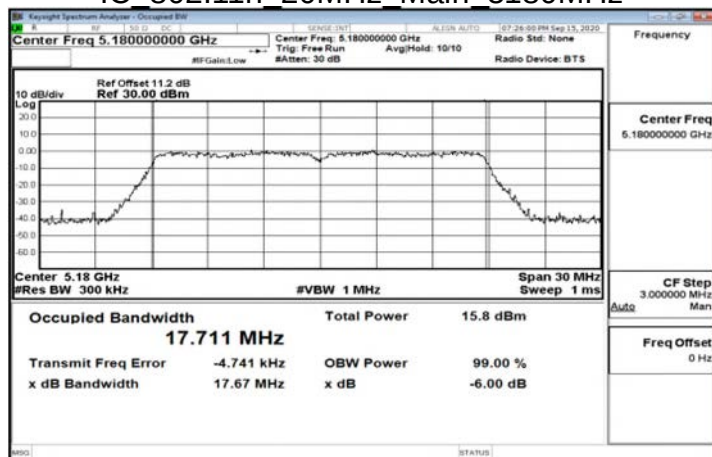
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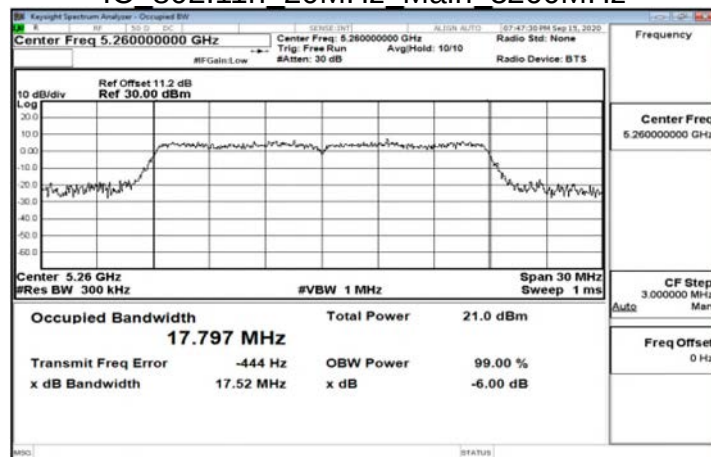
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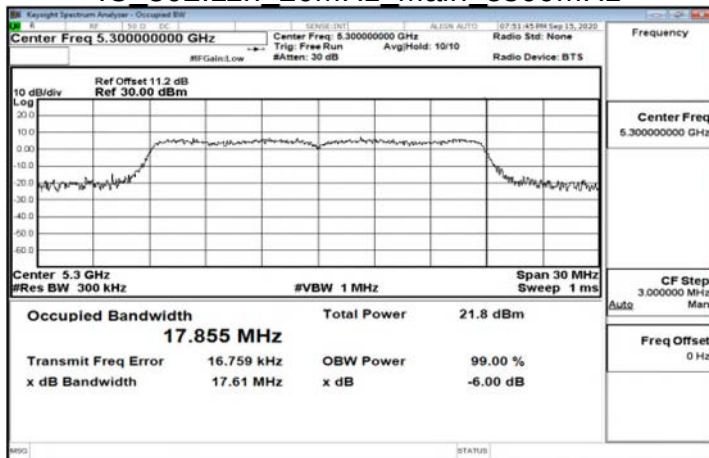


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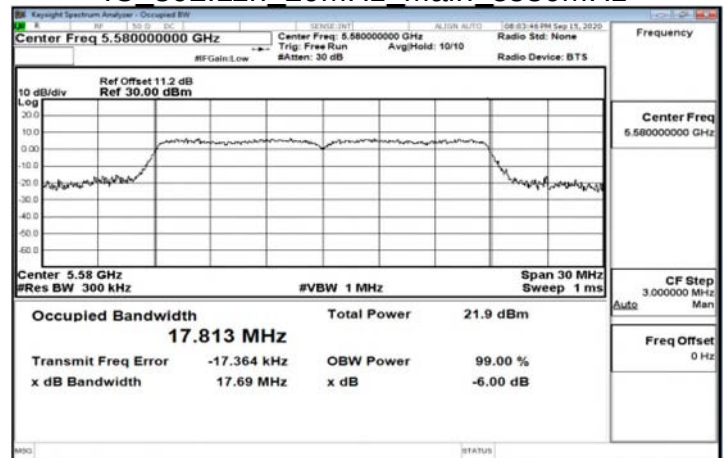
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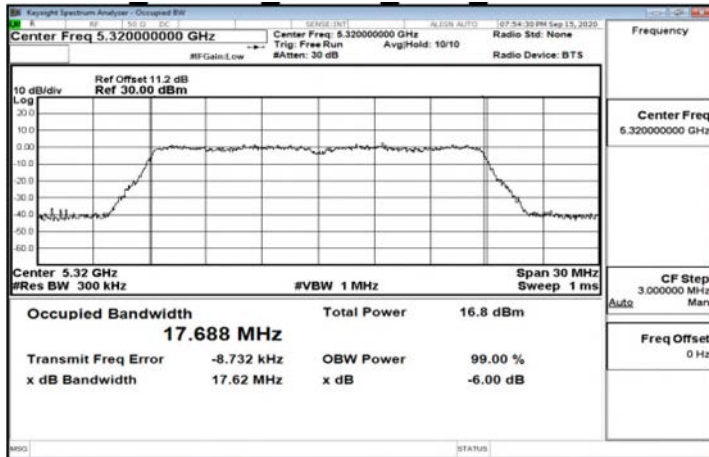
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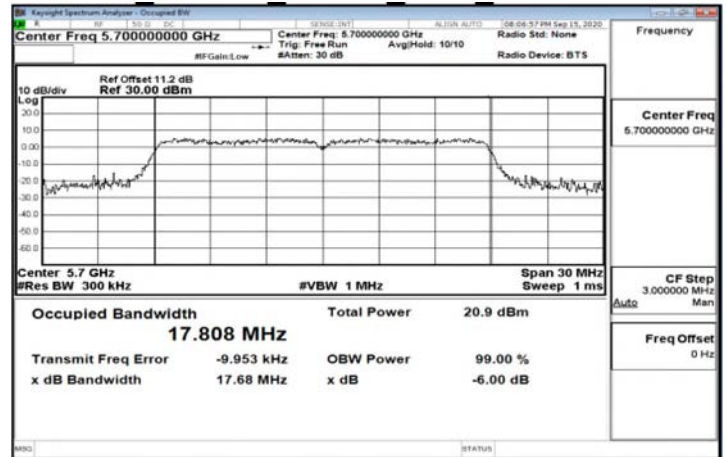
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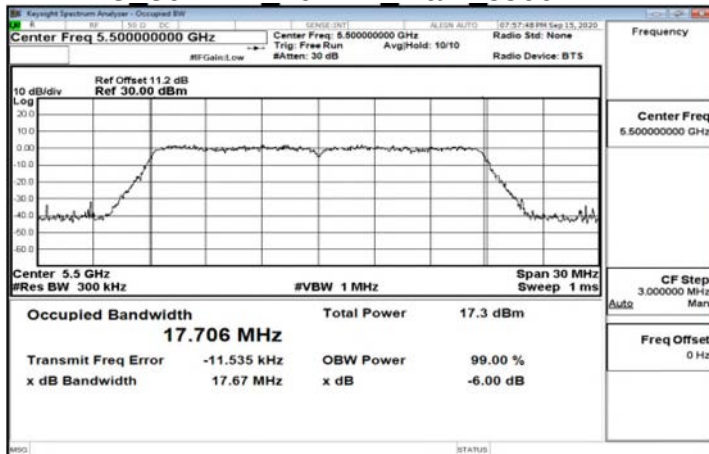
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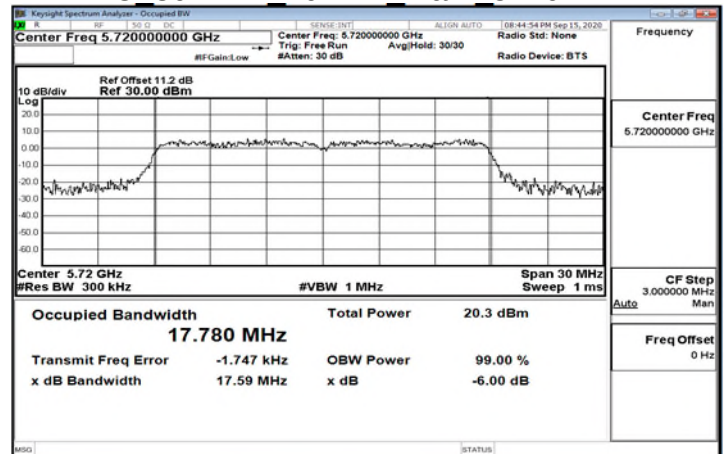
IC 802.11n 20MHz Main 5700MHz



IC 802.11n 20MHz Main 5500MHz



IC 802.11n 20MHz Main 5720MHz

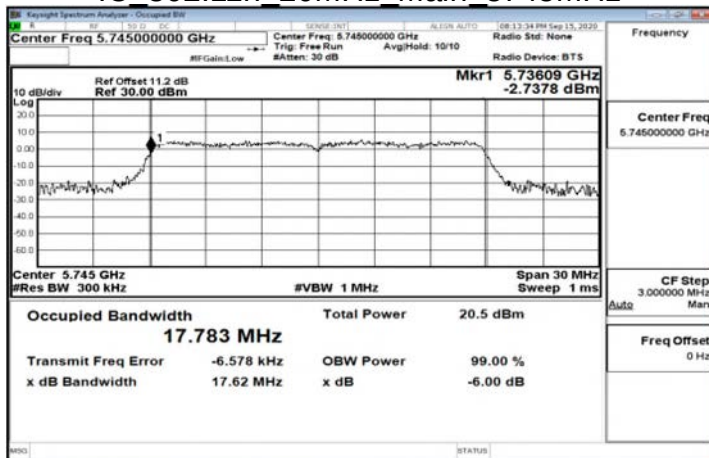


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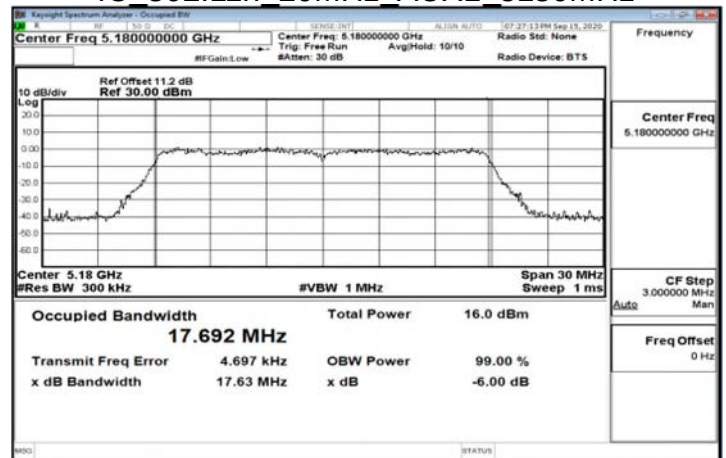
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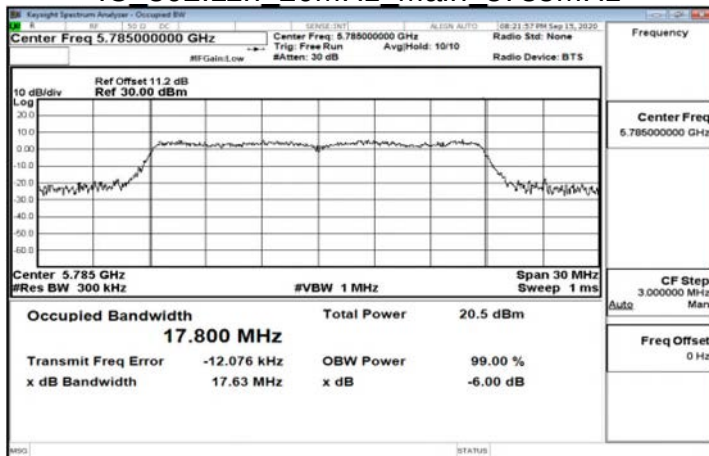
IC 802.11n 20MHz Main 5745MHz



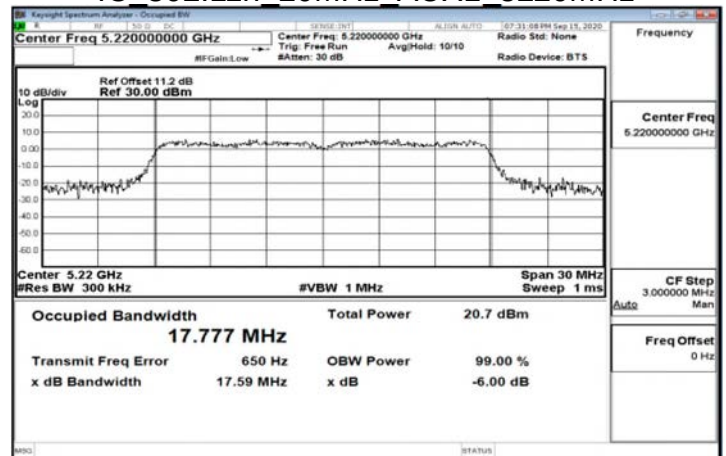
IC 802.11n 20MHz AUX1 5180MHz



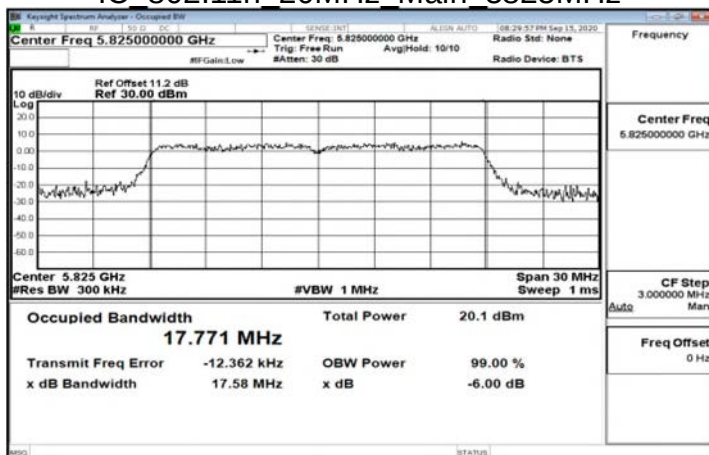
IC 802.11n 20MHz Main 5785MHz



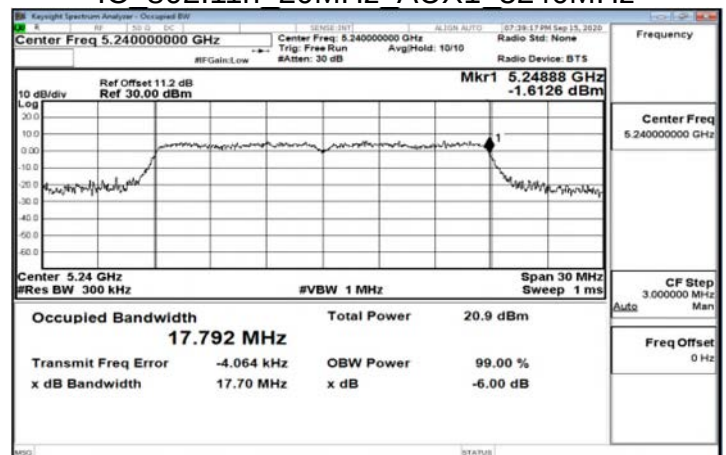
IC 802.11n 20MHz AUX1 5220MHz



IC 802.11n 20MHz Main 5825MHz



IC 802.11n 20MHz AUX1 5240MHz



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