

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

Applicant: Murata Manufacturing Co., Ltd.
10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan

Product Name: Communication Module

Brand Name: muRata

Model No.: LBEE6ZZ1PY

Model Difference: N/A

Report Number: T190313W02-RP4

FCC ID: VPYLB1PY

IC: 772C-LB1PY

FCC Rule Part: §15.407, Cat:NIJ

IC Rule: RSS-247 issue 2 Feb. 2017

Issue Date: Apr. 22, 2019

Date of Test: Mar. 14, 2019 ~ Mar. 27, 2019

Date of EUT Received: Mar. 14, 2019

Issued by: Compliance Certification Services Inc. Wugu Lab.
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Note: The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

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

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory).

Tested By: _____

Peter Weng
Peter Weng / Engineer

Approved By: _____

Kevin Tsai
Kevin Tsai / Deputy Manager



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Revision History

Report Number	Revision	Description	Effectuated Page	Issue Date	Revised By
T190313W02-RP4	Rev.00	Initial creation of document	All	Apr. 22, 2019	Violetta Tang

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEE6ZZ1PY
Model Difference:	N/A
Product SW/HW version:	1.0 / 1.0
Radio SW/HW version:	1.0 / 1.0
Test SW Version:	N/A
RF power setting in TEST SW:	N/A
Power Supply:	3.3Vdc

FCC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. Power (dBm)	Modulation Technology
11a_20	5150~5250	4	10.93	OFDM
	5250~5350	4	10.90	
	5470~5725	12	11.03	
	5725~5850	5	10.93	
11n_HT / ac_VHT 20M	5150~5250	4	HT: 11.08	OFDM
	5250~5350	4	HT: 11.06	
	5470~5725	12	HT: 11.13	
	5725~5850	5	HT: 11.06	
11n_HT / ac_VHT 40M	5150~5250	2	HT: 8.09	OFDM
	5250~5350	2	HT: 8.39	
	5470~5725	6	HT: 8.27	
	5725~5850	2	HT: 8.00	
11ac VHT80M	5150~5250	1	8.55	OFDM
	5250~5350	1	8.74	
	5470~5725	3	8.77	
	5725~5850	1	8.37	
Antenna Designation:		Monopole Antenna, Antenna Gain: 5.2dBi		

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IC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. or EIRP	Rated Power(dBm)	Modulation Technology
11a	5180~5240	4	EIRP	16.13	OFDM
	5260~5320	4	Avg.	10.90	
	5500~5580	5	Avg.	11.03	
	5660~5720	4	Avg.	10.77	
	5745~5825	5	Avg.	10.93	
11n_HT / ac_VHT 20M	5180~5240	4	EIRP	HT: 16.28	OFDM
	5260~5320	4	Avg.	HT: 11.06	
	5500~5580	5	Avg.	HT: 11.13	
	5660~5720	4	Avg.	HT: 10.88	
	5745~5825	5	Avg.	HT: 11.06	
11n_HT / ac_VHT 40M	5190~5230	2	EIRP	HT: 13.29	OFDM
	5270~5310	2	Avg.	HT: 8.39	
	5510~5550	2	Avg.	HT: 8.27	
	5670~5710	2	Avg.	HT: 7.83	
	5755~5795	2	Avg.	HT: 8.00	
11ac VHT80M	5210~5210	1	EIRP	13.75	OFDM
	5290~5290	1	Avg.	8.74	
	5530~5530	1	Avg.	8.77	
	5690~5690	1	Avg.	8.59	
	5775~5775	1	Avg.	8.37	
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 – 72.2Mbps 802.11 n_40MHz: 13.5 – 150.0Mbps 802.11 ac_20MHz: 6.5 –86.7Mbps 802.11 ac_40MHz: 13.5 -200.0Mbps 802.11 ac_80MHz: 29.3 – 433.3Mbps			

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1.2 Test Methodology of Applied Standards

FCC Part 15, Subpart E §15.407

FCC KDB 789033 D02 General UNII Test Procedures New Rules

KDB 789033 D02 v01r04 General UNII Test Procedures New Rules

KDB 644545 D03 v01 Guidance for IEEE 802.11ac

RSS-247 issue 2 Feb. 2017

RSS-Gen. issue 5 Apr. 2018

ANSI C63.10:2013

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

1.3 Test Facility

Compliance Certification Services Inc. Wugong Lab. No.11, Wugong 6th Rd.,

Wugong Dist., New Taipei City 24891, Taiwan. (R.O.C.) (TAF code 1309)

FCC Designation number: TW1309

Canada Company number: 2324G

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.

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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 30MHz. The CISPR Quasi-Peak and Average detector mode is employed according to §15.207. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Conducted Test (RF)

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

2.3.3 Radiated Emissions

The EUT is 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

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.

2.5 Configuration of Tested System

Fig. 2-1 Radiated & Conducted Emission Configuration

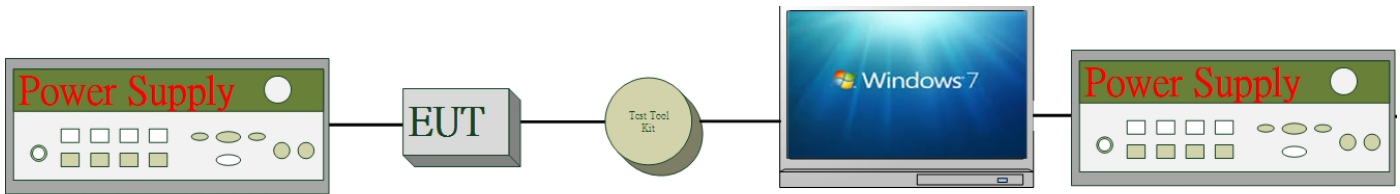


Fig 2-2 AC power line Configuration

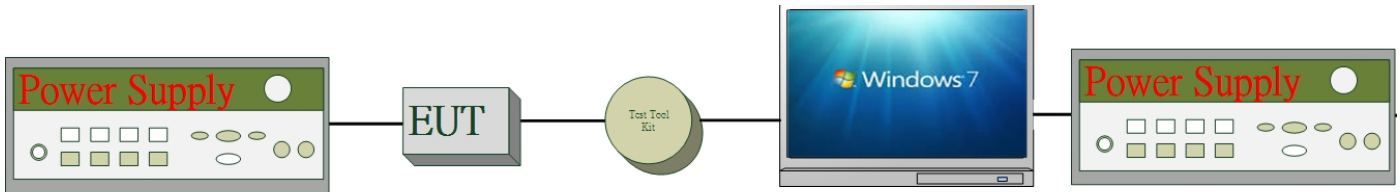


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2.	DC Power Supply	Agilent	E3640A	KR93300208	N/A	Unshielded
3.	DC Power Supply	Agilent	E3640A	MY52410006	N/A	Unshielded
4.	Notebook	Lenovo	T440P	PC-089AH5	Shielded	Unshielded

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3 SUMMARY OF TEST RESULT

FCC Rules	IC Rules	Description Of Test	Result
§15.207	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.403(i) §15.407(e)	RSS-247 §6.2.1~ 4 (1) RSS-Gen §6.7	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Power Spectral Density	Compliant
§15.205 §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 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

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

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

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
42	5210 MHz

Operated band in 5250 MHz ~5350 MHz:

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

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

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
54	5270 MHz	62	5310 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
58	5290 MHz

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Operated band in 5470 MHz ~5725 MHz:

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

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

5 channels are provided for 802.11n_HT40, 802.11ac_VHT40

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

3 channels are provided for 802.11ac_VHT80

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

Operated band in 5725 MHz ~5850 MHz:

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

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

2 channels are provided for 802.11n_HT40, 802.11ac_VHT40

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755 MHz	159	5795 MHz

1 channel is provided for 802.11ac_VHT80

CHANNEL	FREQUENCY
155	5775 MHz

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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.
4. The given UE is pre-scanned among 802.11n and ac modes, and 802.11n yields the highest reading that generates the highest emission.
5. The given UE is pre-scanned among SISO Main, SISO Aux and MIMO modes, and SISO Main mode yields the highest reading that generates the highest emission. Therefore, 802.11ac+SISO Main as the mode of radiated test configuration is chosen to carry out the relevantly mandatory test items.

AC POWER LINE CONDUCTED EMISSION TEST:

Test Condition	AC Power line conducted emission for line and neutral
Worst Case	Operation in normal mode

RADIATED EMISSION TEST:

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	Ch0
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	Ch0
802.11a	5500~5720	100 to 140	100,116,140	OFDM	6	Ch0
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	Ch0
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	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	Ch0
802.11ac_VHT80	5210	42	42	OFDM	MCS0	Ch0
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS0	Ch0
802.11ac_VHT80	5290	58	58	OFDM	MCS0	Ch0

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MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5500~5720	100 to 144	100,116,140	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5510~5710	102 to 142	102,110,134	OFDM	MCS0	Ch0
802.11ac_VHT80	5530~5690	106 to 138	106,122,138	OFDM	MCS0	Ch0
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS0	Ch0
802.11ac_VHT80	5775	155	155	OFDM	MCS0	Ch0

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 E1 position was reported.

ANTENNA PORT CONDUCTED MEASUREMENT:

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	36,44,48	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	Ch0
802.11ac_VHT80	5210	42	42	OFDM	MCS0	Ch0
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS0	Ch0
802.11ac_VHT80	5290	58	58	OFDM	MCS0	Ch0
802.11a	5500~5720	100 to 144	100,116,140,144	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5510~5710	102 to 142	102,110,134,142	OFDM	MCS0	Ch0
802.11ac_VHT80	5530~5690	106 to 138	106,122,138	OFDM	MCS0	Ch0
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS0	Ch0
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS0	Ch0
802.11ac_VHT80	5775	155	155	OFDM	MCS0	Ch0

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5 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	+/- 1.2575 dB
26dB & 6dB Emission Bandwidth	+/- 147.256 Hz
The Maximum Output Power	+/- 2.128 dB
Peak Power Spectral Density	+/- 2.878 dB
Frequency Stability	+/- 147.256 Hz
3M Semi Anechoic Chamber / 30M~200M	+/- 4.12 dB
3M Semi Anechoic Chamber / 200M~1000M	+/- 4.68 dB
3M Semi Anechoic Chamber / 1G~8G	+/- 5.18 dB
3M Semi Anechoic Chamber / 8G~18G	+/- 5.47 dB
3M Semi Anechoic Chamber / 18G~26G	+/- 3.81 dB
3M Semi Anechoic Chamber / 26G~40G	+/- 3.87 dB

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.
3. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

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

Note

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

6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
CABLE	EMCI	CFD300-NL	CERF	06/29/2018	06/28/2019
EMI Test Receiver	R&S	ESCI	100064	07/24/2018	07/23/2019
LISN	SCHWARZBECK	NSLK 8127	8127-541	01/31/2019	01/30/2020
LISN	SCHAFFNER	NNB 41	03/10013	02/13/2019	02/12/2020
Software	EZ-EMC(CCS-3A1-CE)				

6.3 EUT Setup

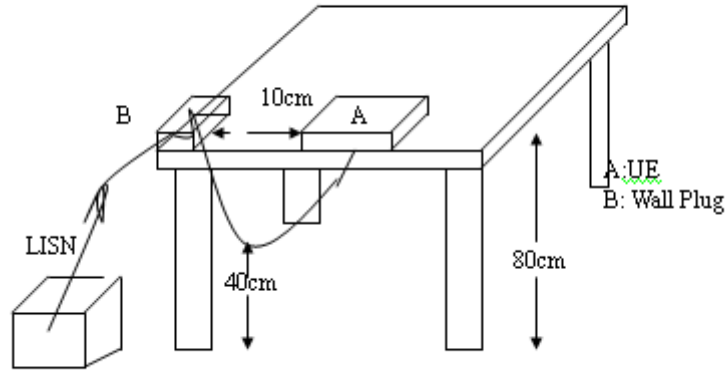
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz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

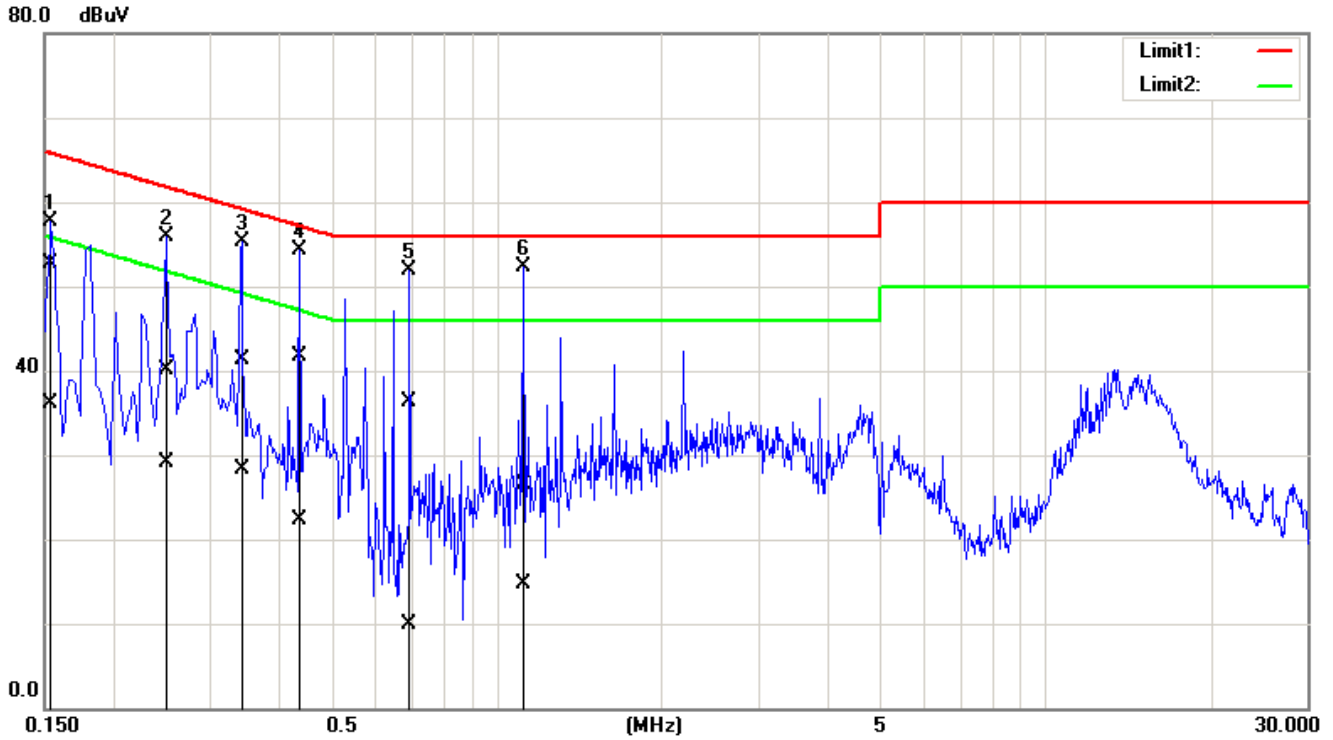
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Description:	Operation	Date:	2019/3/29
Line:	L1	Temp.(°C)/Hum.(%):	24(°C)/52%
Test Voltage:	AC 120V/60Hz	Test By:	Peter



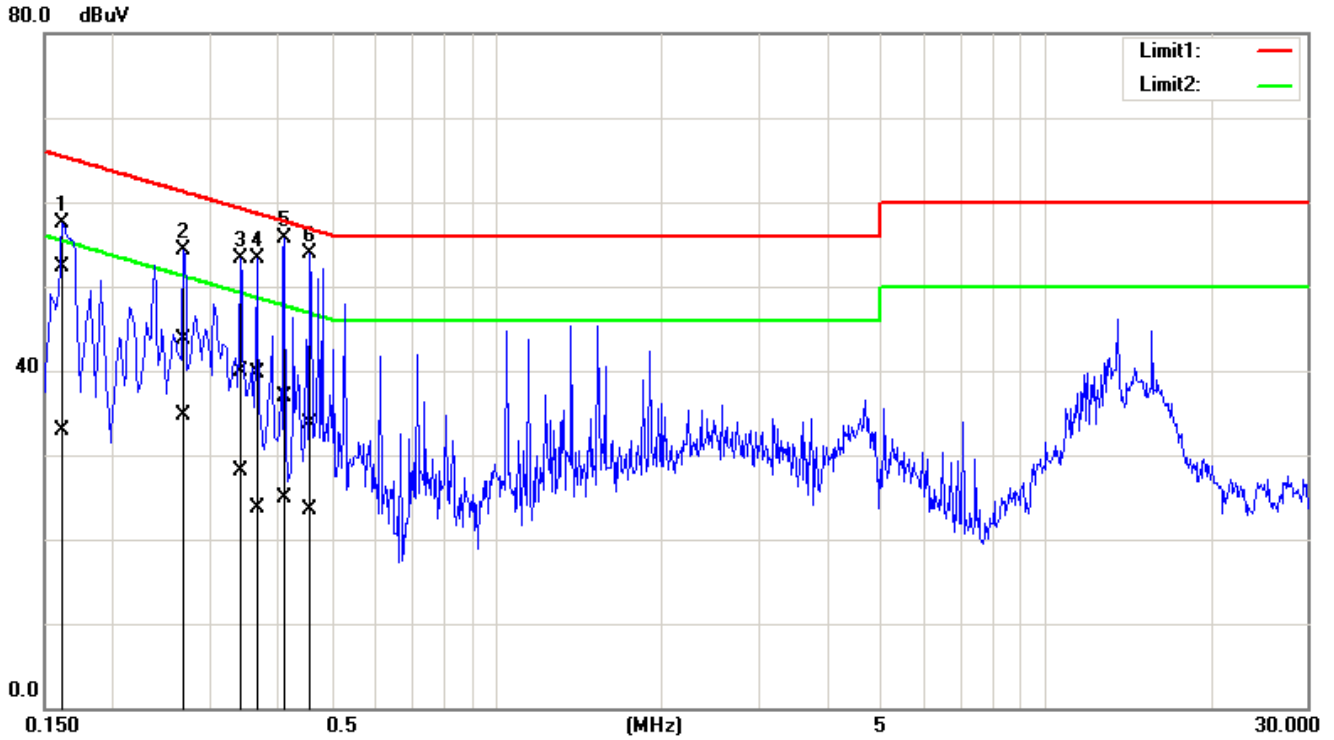
No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1539	52.63	35.96	0.16	52.79	36.12	65.78	55.79	-12.99	-19.67	Pass
2	0.2500	39.97	28.98	0.15	40.12	29.13	61.75	51.76	-21.63	-22.63	Pass
3	0.3428	41.21	28.12	0.16	41.37	28.28	59.13	49.14	-17.76	-20.86	Pass
4	0.4380	41.59	22.07	0.16	41.75	22.23	57.10	47.10	-15.35	-24.87	Pass
5	0.6940	36.18	9.78	0.16	36.34	9.94	56.00	46.00	-19.66	-36.06	Pass
6	1.1180	26.40	14.61	0.18	26.58	14.79	56.00	46.00	-29.42	-31.21	Pass

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Description:	Operation	Date:	2019/3/29
Line:	N	Temp.(°C)/Hum.(%):	24(°C)/52%
Test Voltage:	AC 120V/60Hz	Test By:	Peter



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1620	52.24	32.73	0.10	52.34	32.83	65.36	55.36	-13.02	-22.53	Pass
2	0.2700	43.60	34.58	0.10	43.70	34.68	61.12	51.12	-17.42	-16.44	Pass
3	0.3420	39.70	28.04	0.11	39.81	28.15	59.15	49.15	-19.34	-21.00	Pass
4	0.3660	39.66	23.52	0.11	39.77	23.63	58.59	48.59	-18.82	-24.96	Pass
5	0.4105	36.71	24.77	0.11	36.82	24.88	57.64	47.64	-20.82	-22.76	Pass
6	0.4580	33.61	23.33	0.11	33.72	23.44	56.73	46.73	-23.01	-23.29	Pass

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7 DUTY CYCLE TEST SIGNAL

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

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

Formula:

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

Measurement Procedure:

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

Duty Cycle:

Mode	Duty Cycle (%)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	98.90	0.05	0.49	1.00
802.11n_20	98.80	0.05	0.53	1.00
802.11n_40	97.60	0.11	1.08	2.00
802.11ac_80	95.60	0.20	2.19	3.00

$$\text{Duty Cycle Factor: } 10 * \log(1/0.989) = 0.05$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.988) = 0.05$$

$$\text{Duty Cycle Factor: } 10 * \log(1/0.976) = 0.11$$

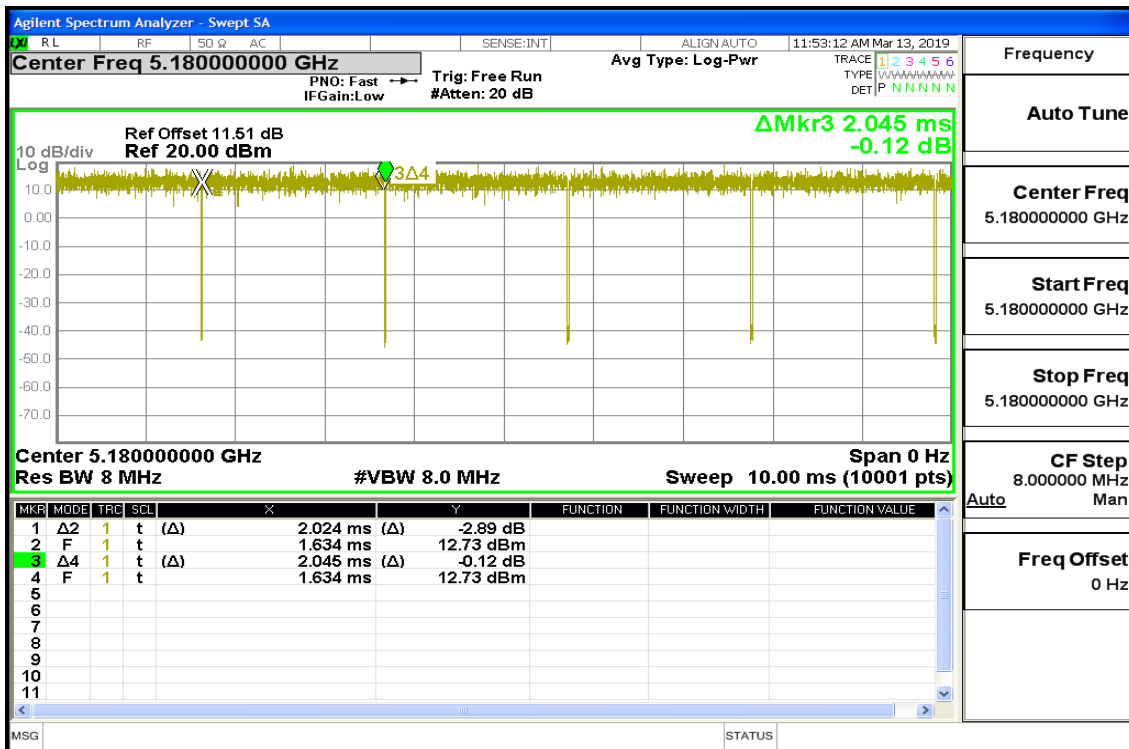
$$\text{Duty Cycle Factor: } 10 * \log(1/0.956) = 0.2$$

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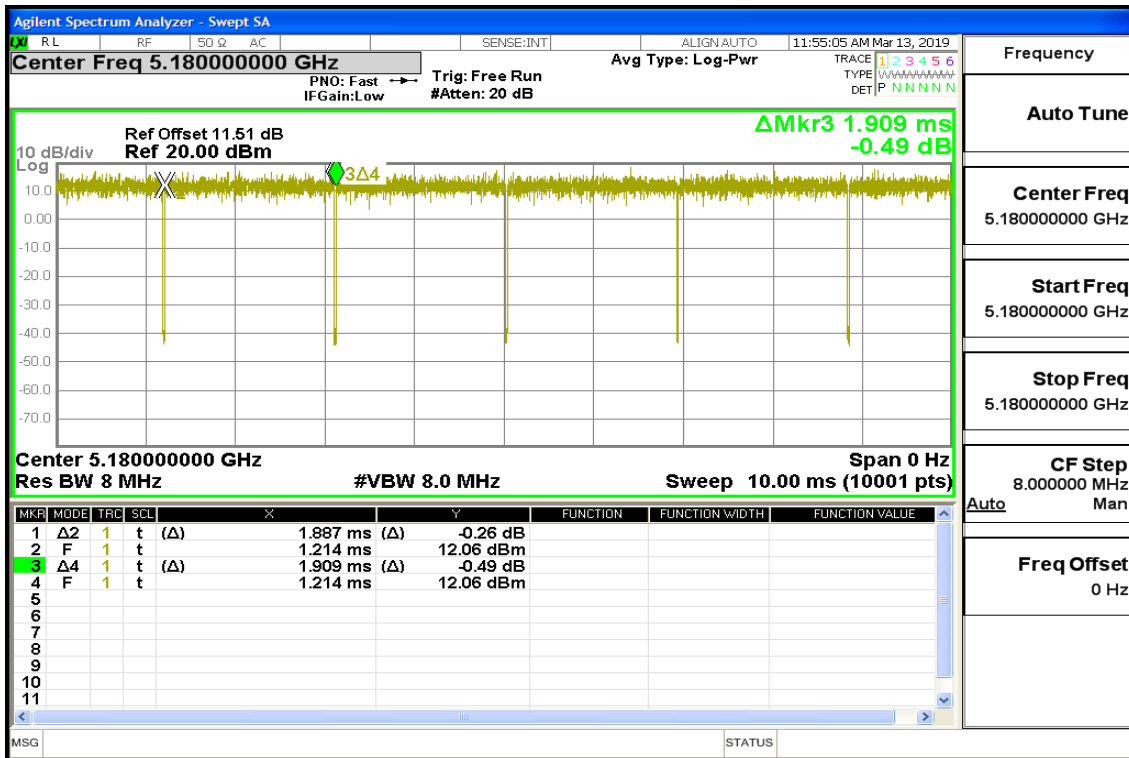
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DUTY CYCLE TEST SIGNAL Measurement Result 802.11a



802.11n HT20

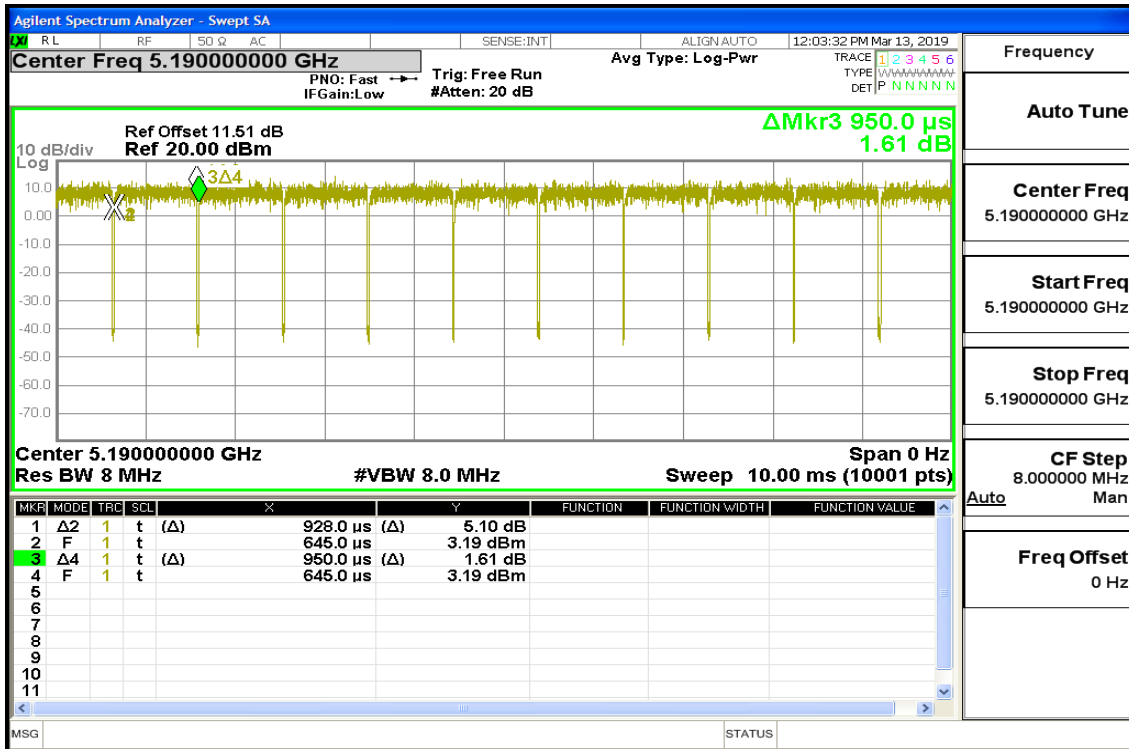


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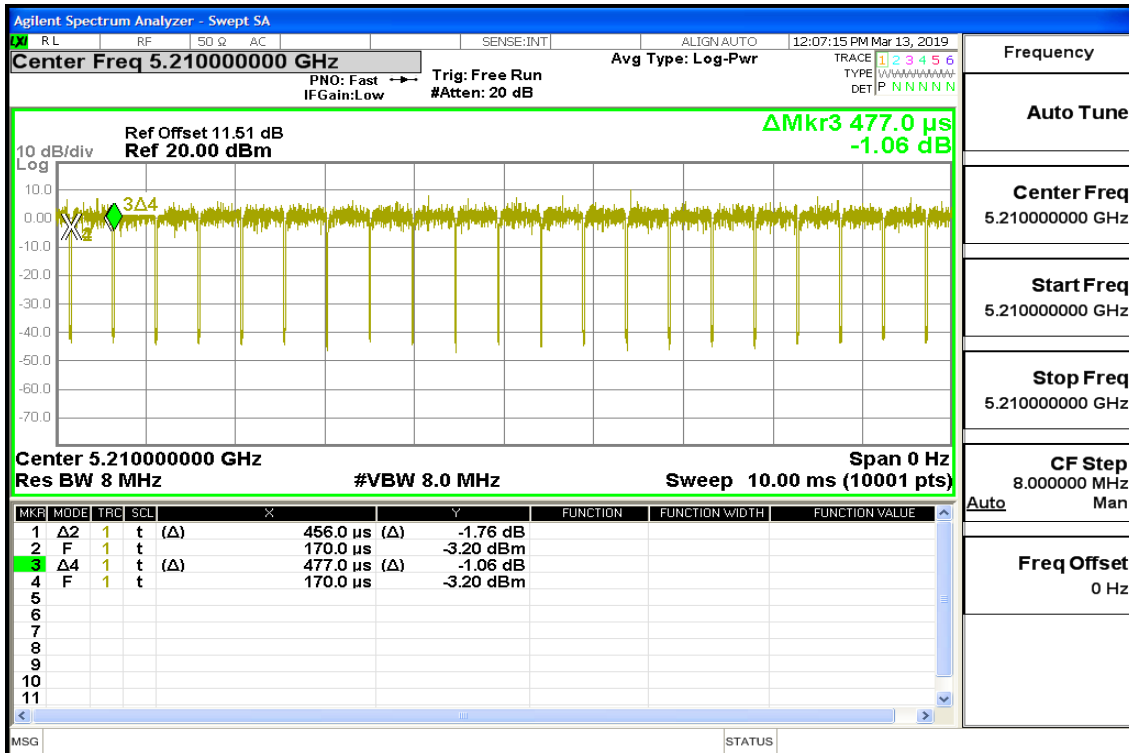
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802.11n HT 40



802.11 ac VHT 80



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8 26DB & 6DB EMISSION BANDWIDTH MEASUREMENT

8.1 Standard Applicable

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

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

8.2 Measurement Procedure

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

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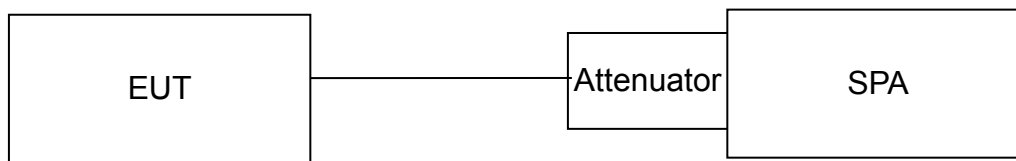
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8.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
DC Power Supply	Agilent	E3640A	MY53130054	09/03/2018	09/02/2019
PXA Spectrum Analyzer	Agilent	N9030A	MY53120760	04/09/2018	04/08/2019
DC Power Supply	Agilent	E3640A	KR93300208	08/15/2018	08/14/2019
Thermostatic/Hrgrosatic Chamber	TAICHY	MHG-150LF	930619	10/08/2018	10/07/2019
DC Block	Mini-Circuits	BLK-18-S+	31129(1)	02/26/2019	02/25/2020
Attenuator	Mini-Circuit	BW-S10W2+	1	02/26/2019	02/25/2020

8.4 Test Set-up



8.5 Measurement Result

26dB and 6dB Bandwidth

802.11a_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.59	12.921
5220	19.69	12.942
5240	19.47	12.894
5260	19.84	12.975
5300	19.64	12.931
5320	19.53	12.906
5500	19.60	12.923
5580	19.73	12.950
5700	19.45	12.889
5720(U-NII 2C)	14.72	11.679
5720 (U-NII 3)	4.60	6.628

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802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.39	12.145
5785	16.43	12.157
5825	16.40	12.148

802.11n_HT20_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	20.10	13.032
5220	19.98	13.005
5240	19.82	12.971
5260	19.98	13.005
5300	19.87	12.983
5320	19.83	12.974
5500	19.54	12.908
5580	20.07	13.025
5700	19.99	13.009
5720(U-NII 2C)	14.92	11.738
5720 (U-NII 3)	4.88	6.884

802.11n_HT20_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.61	12.457
5785	17.61	12.456
5825	17.61	12.458

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802.11n_HT40_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	40.75	16.101
5230	40.74	16.101
5270	41.29	16.158
5310	40.69	16.095
5510	40.69	16.094
5550	40.10	16.032
5670	41.17	16.145
5710 (U-NII 2C)	35.56	15.510
5710 (U-NII 3)	4.92	6.920

802.11n_HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.85	15.545
5795	36.03	15.567

802.11ac_VHT80_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	81.35	19.104
5290	82.35	19.156
5530	80.83	19.076
5610	81.43	19.108
5690 (U-NII 2C)	76.12	18.815
5690 (U-NII 3)	5.48	7.388

802.11ac_VHT80_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	75.70	18.791

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99% Bandwidth
802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.720	12.232
5220	16.722	12.233
5240	16.705	12.228
5260	16.743	12.238
5300	16.736	12.237
5320	16.756	12.242
5500	16.717	12.232
5580	16.749	12.240
5700	16.722	12.233
5720(U-NII 2C)	13.339	11.251
5720 (U-NII 3)	3.339	5.236

802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.46	12.164
5785	16.45	12.163
5825	16.42	12.154

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.701	12.480
5220	17.714	12.483
5240	17.685	12.476
5260	17.724	12.486
5300	17.684	12.476
5320	17.711	12.482
5500	16.708	12.229
5580	17.742	12.490
5700	17.727	12.486
5720(U-NII 2C)	13.853	11.415
5720 (U-NII 3)	3.852	5.857

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802.11n_HT20_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.65	12.468
5785	17.70	12.479
5825	17.68	12.476

802.11n_HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.127	15.578
5230	36.073	15.572
5270	36.101	15.575
5310	36.108	15.576
5510	36.119	15.577
5550	36.128	15.578
5670	36.091	15.574
5710(U-NII 2C)	33.072	15.195
5710 (U-NII 3)	3.072	4.874

802.11n_HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.28	15.596
5795	36.24	15.592

802.11ac_VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.819	18.798
5290	75.810	18.797
5530	75.783	18.796
5610	75.819	18.798
5690(U-NII 2C)	72.894	18.627
5690 (U-NII 3)	2.894	4.615

802.11ac_VHT80_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	76.55	18.839

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99% BW verification for DFS Function
802.11a_Ch0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.28	< 5250
5745	5736.75	> 5725

802.11n_HT20_Ch0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5240	5248.82	< 5250
5745	5736.12	> 5725

802.11n_HT40_Ch0

Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5230	5248.10	< 5250
5755	5736.90	> 5725

802.11ac_VHT80_Ch0

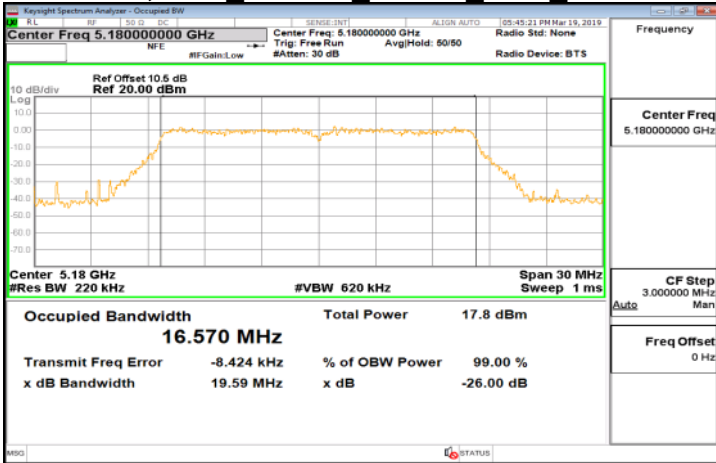
Frequency (MHz)	Measured Frequency (MHz)	Limit (MHz)
5210	5247.90	< 5250
5775	5737.00	> 5725

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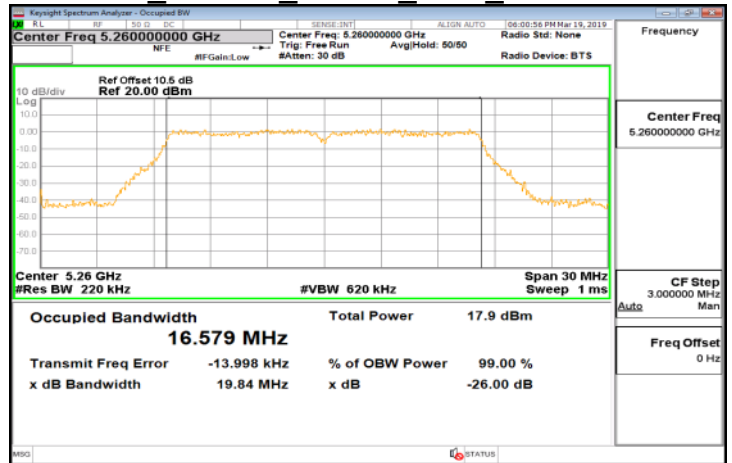
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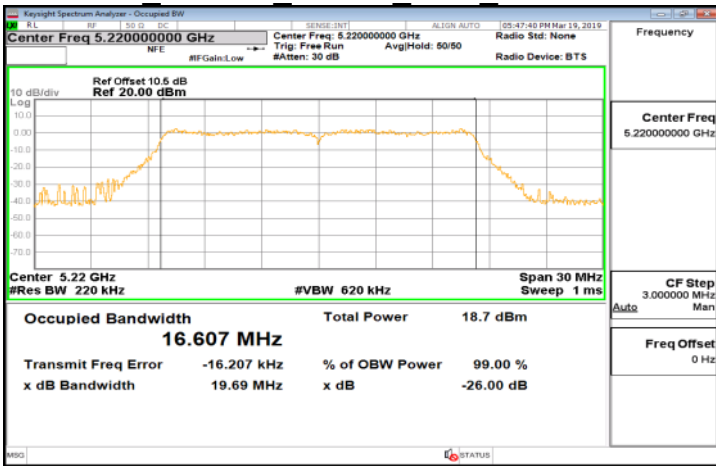
For 26dB, FCC 802.11a 20MHz Main 5180MHz



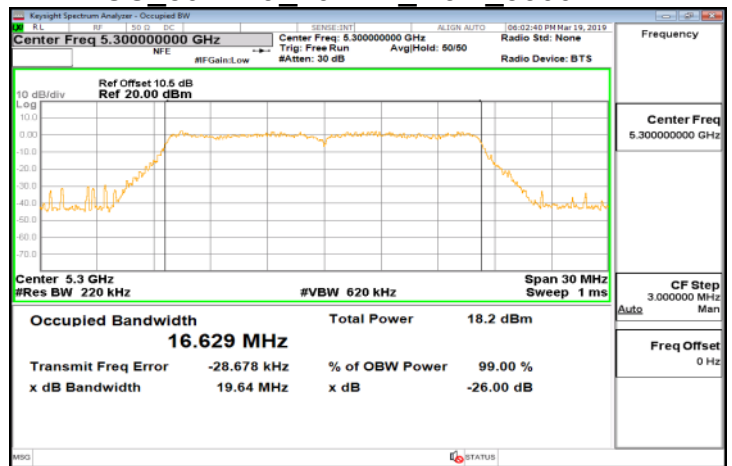
FCC 802.11a 20MHz Main 5260MHz



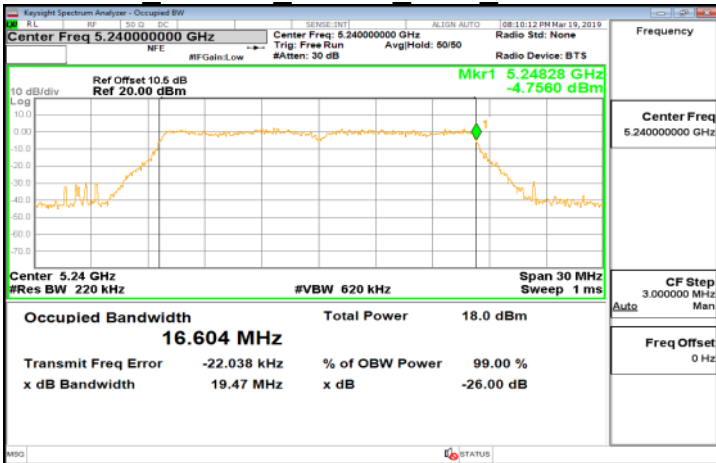
FCC 802.11a 20MHz Main 5220MHz



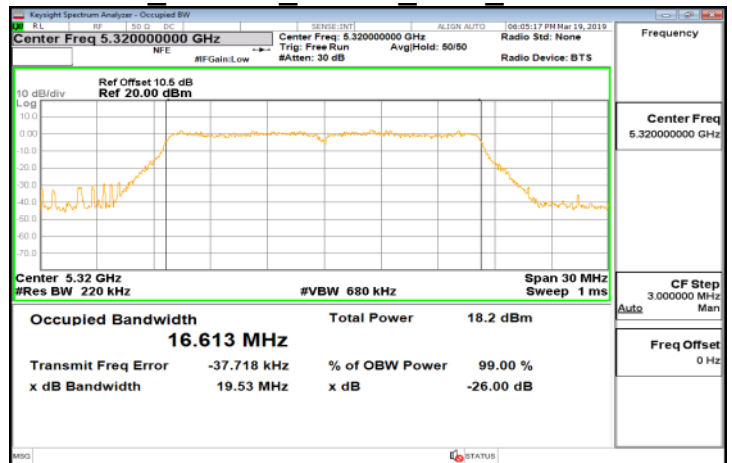
FCC 802.11a 20MHz Main 5300MHz



FCC 802.11a 20MHz Main 5240MHz



FCC 802.11a 20MHz Main 5320MHz

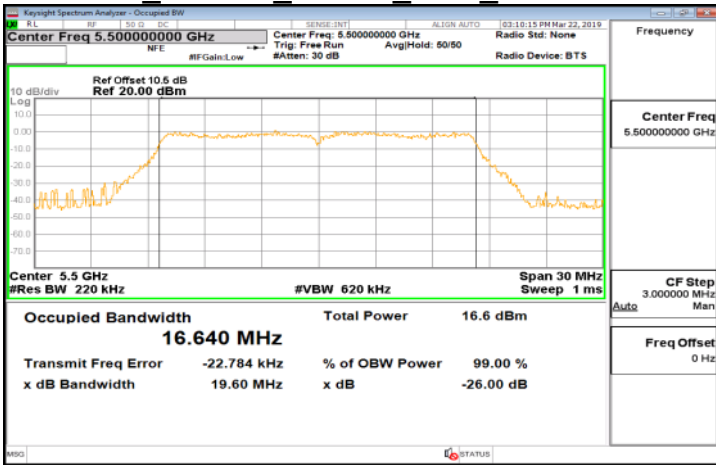


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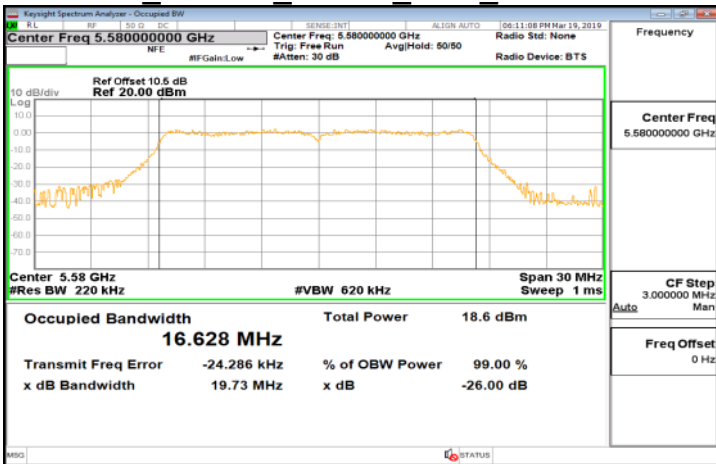
FCC 802.11a 20MHz Main 5500MHz



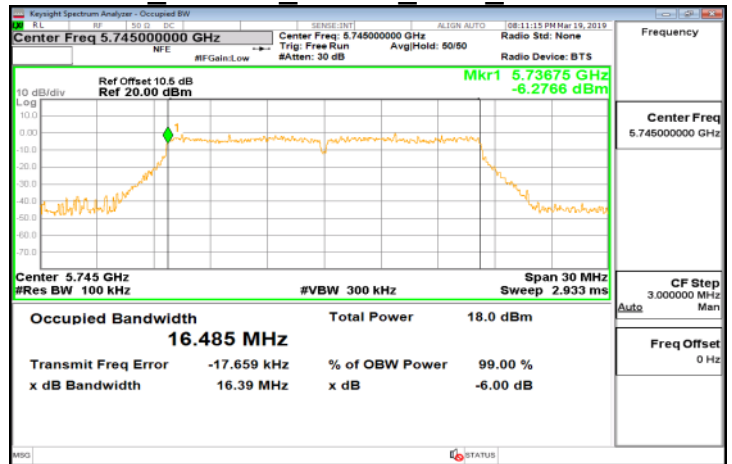
FCC 802.11a 20MHz Main 5720MHz



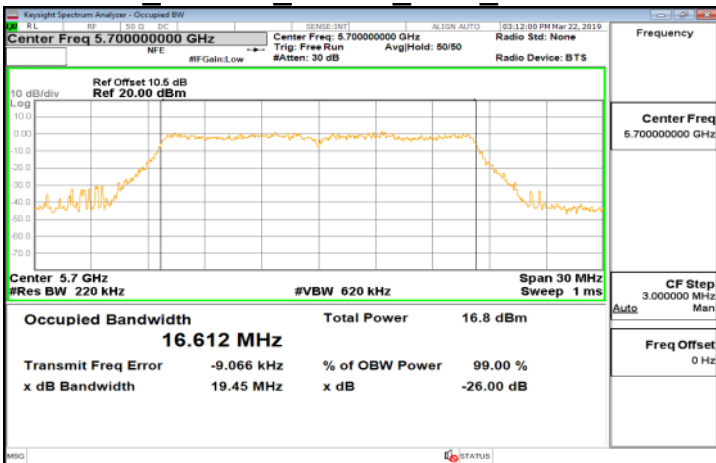
FCC 802.11a 20MHz Main 5580MHz



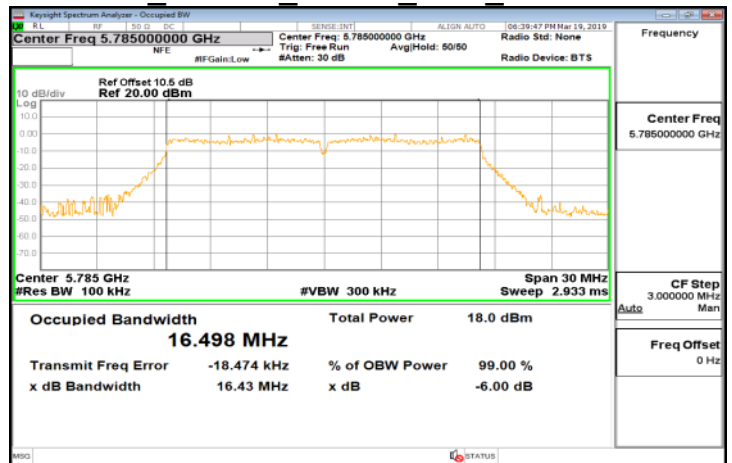
FCC 802.11a 20MHz Main 5745MHz



FCC 802.11a 20MHz Main 5700MHz



FCC 802.11a 20MHz Main 5785MHz

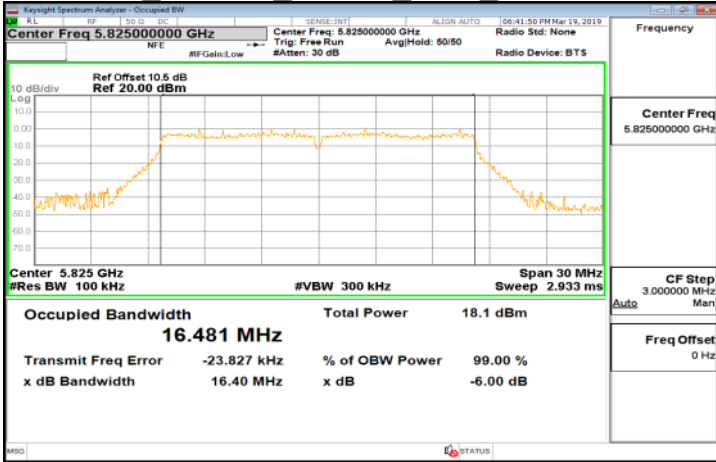


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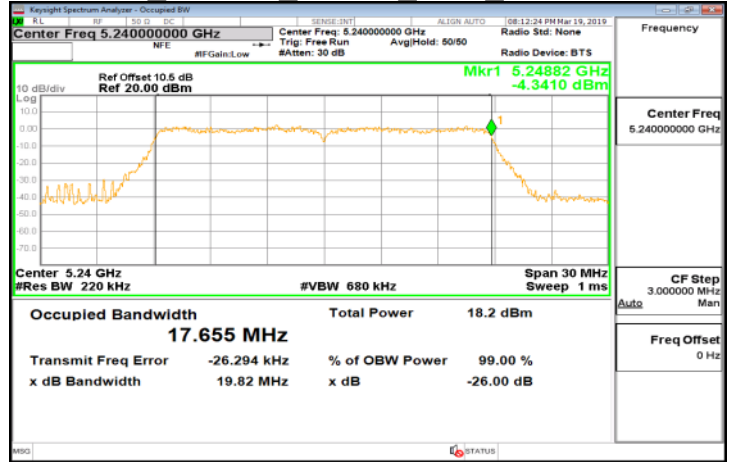
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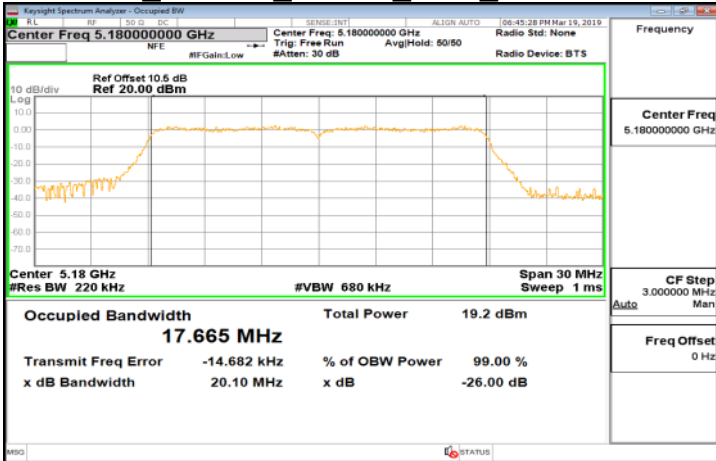
FCC 802.11a 20MHz Main 5825MHz



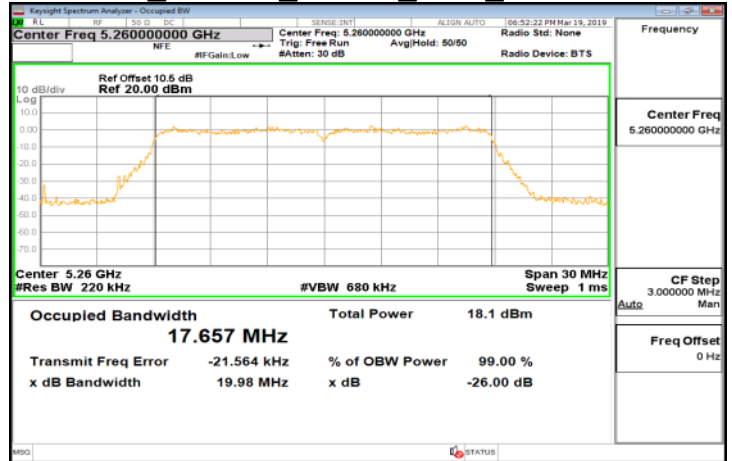
FCC 802.11n 20MHz Main 5240MHz



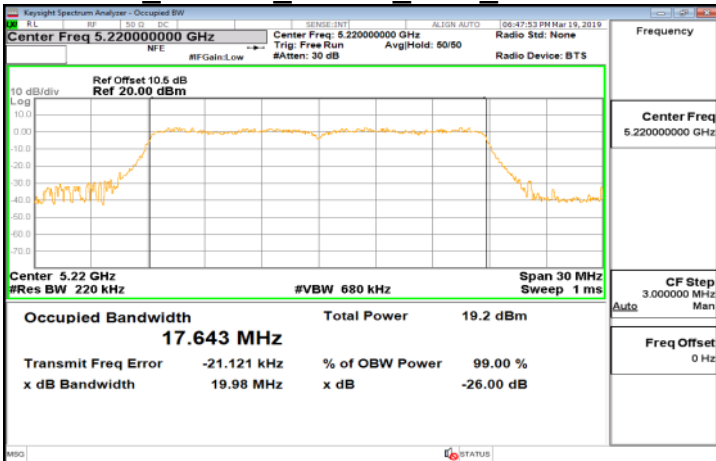
FCC 802.11n 20MHz Main 5180MHz



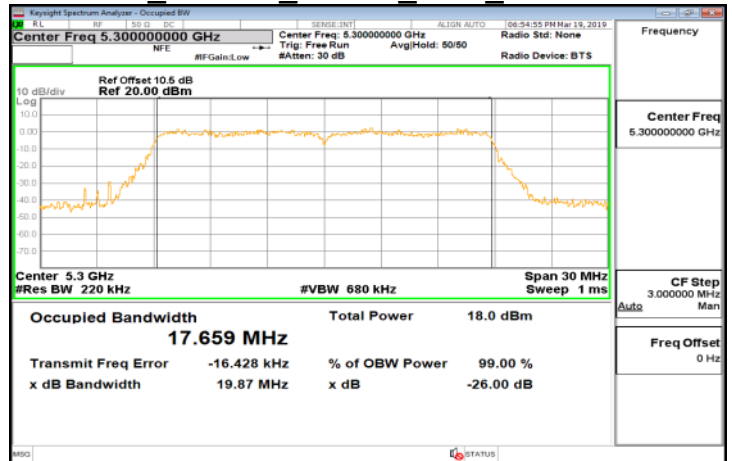
FCC 802.11n 20MHz Main 5260MHz



FCC 802.11n 20MHz Main 5220MHz



FCC 802.11n 20MHz Main 5300MHz

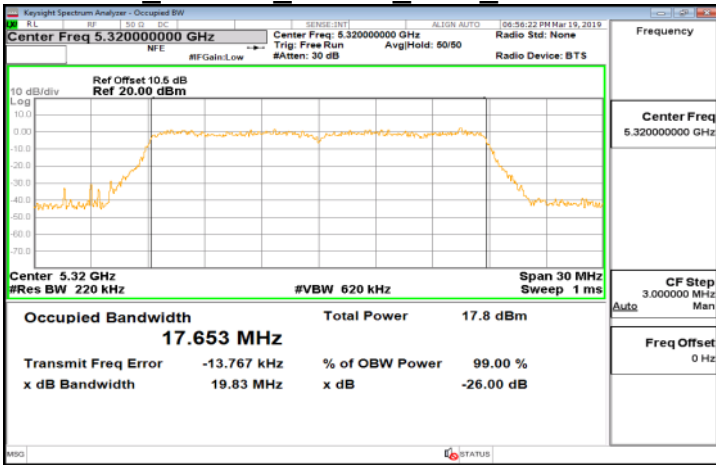


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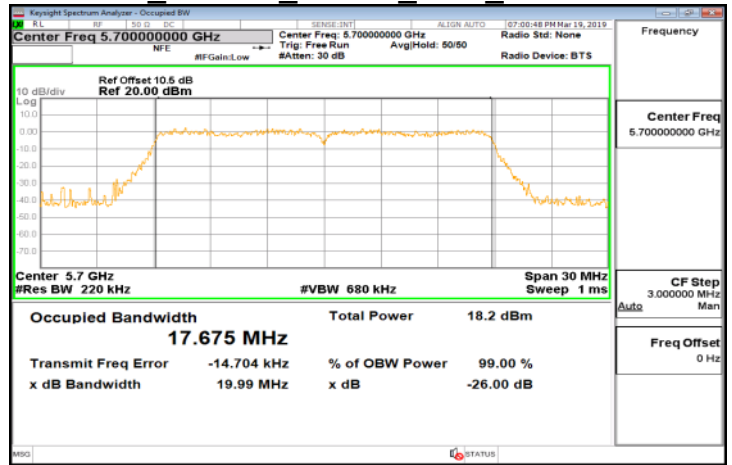
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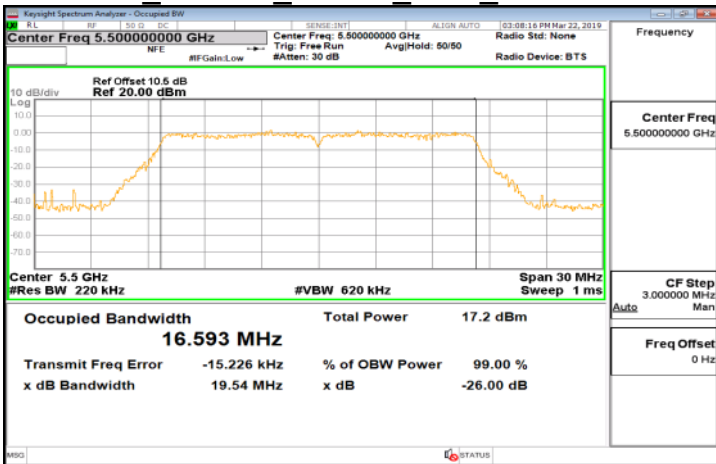
FCC 802.11n 20MHz Main 5320MHz



FCC 802.11n 20MHz Main 5700MHz



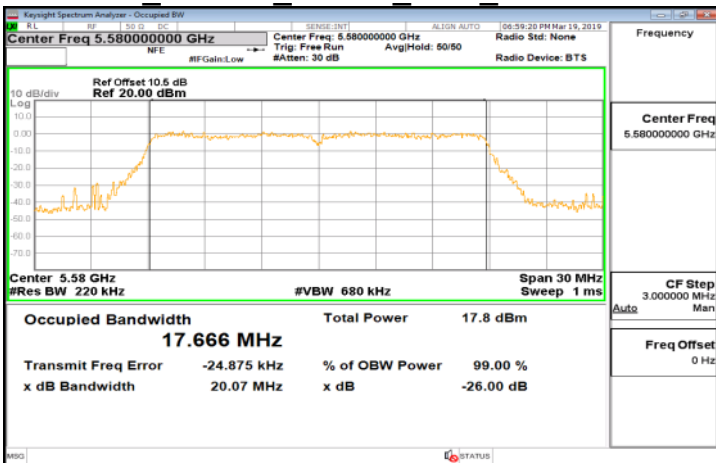
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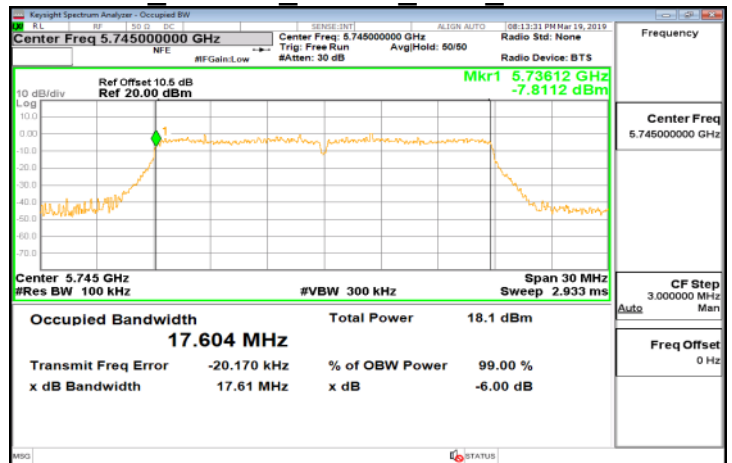
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FCC 802.11n 20MHz Main 5580MHz



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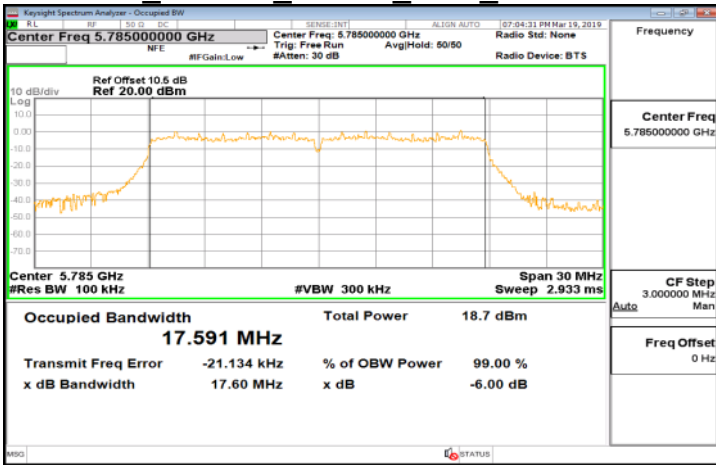


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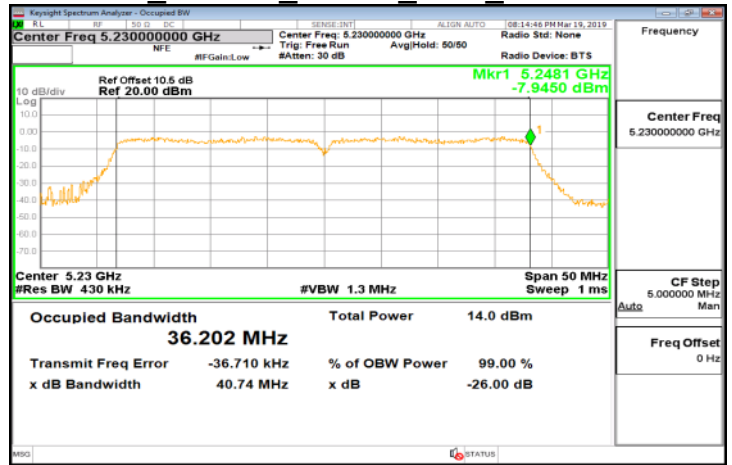
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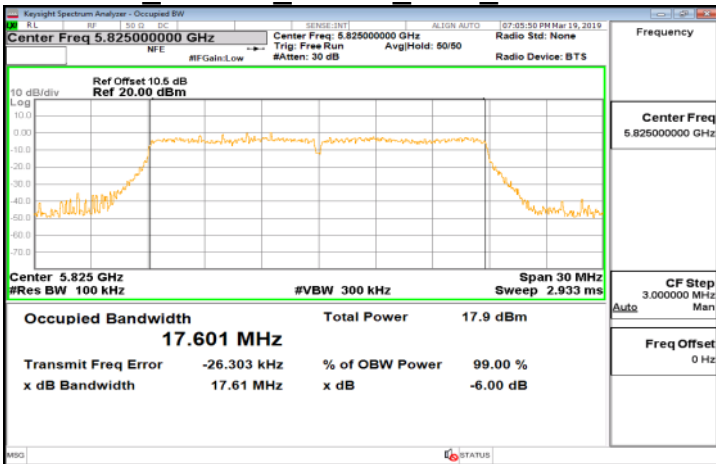
FCC 802.11n 20MHz Main 5785MHz



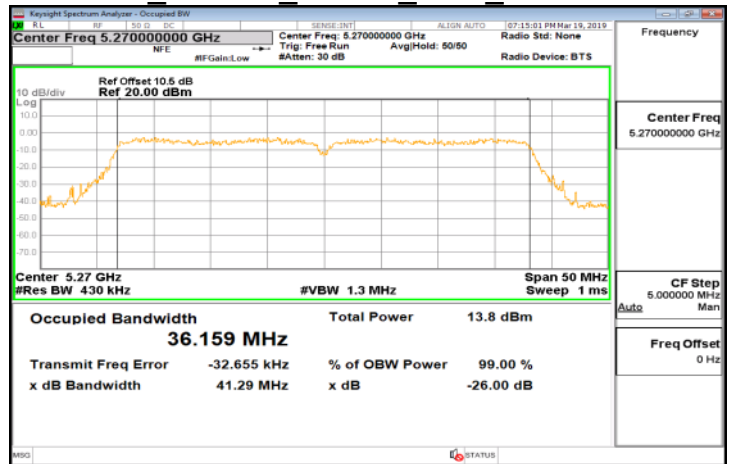
FCC 802.11n 40MHz Main 5230MHz



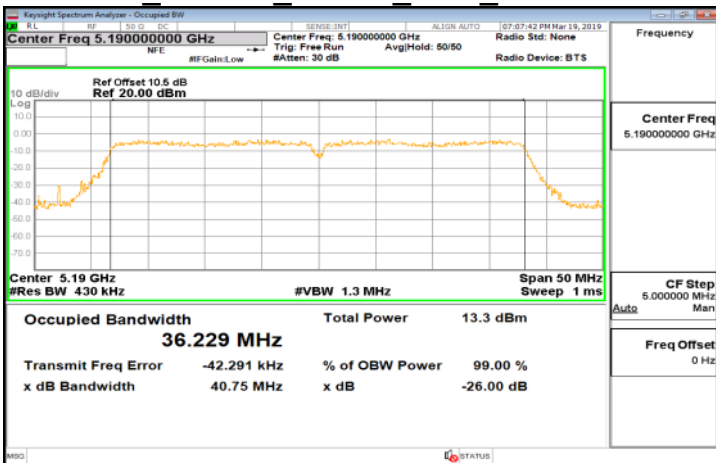
FCC 802.11n 20MHz Main 5825MHz



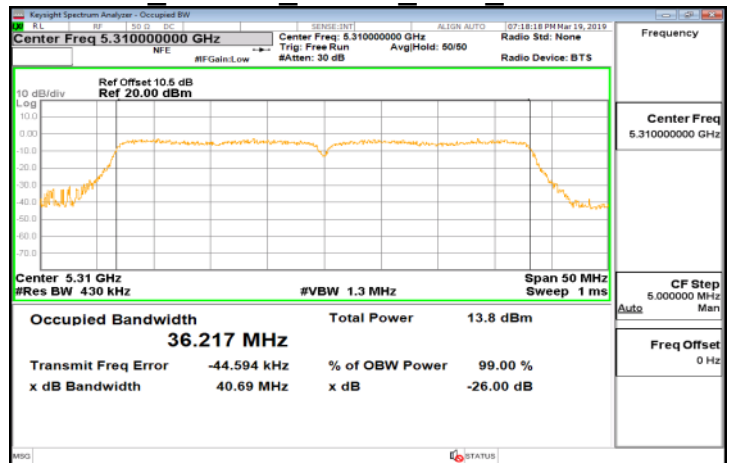
FCC 802.11n 40MHz Main 5270MHz



FCC 802.11n 40MHz Main 5190MHz



FCC 802.11n 40MHz Main 5310MHz

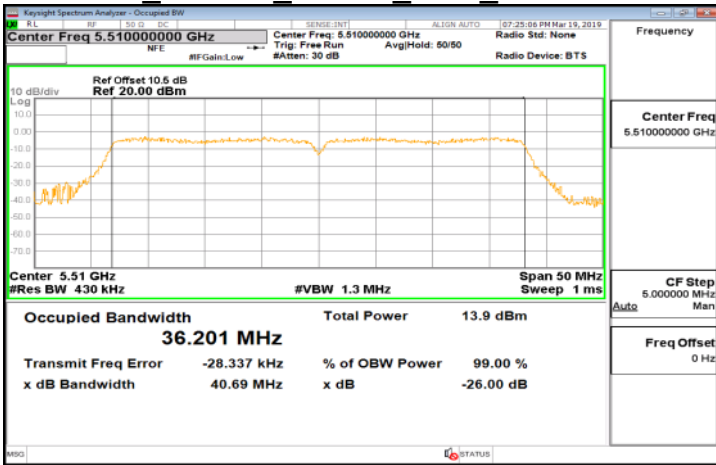


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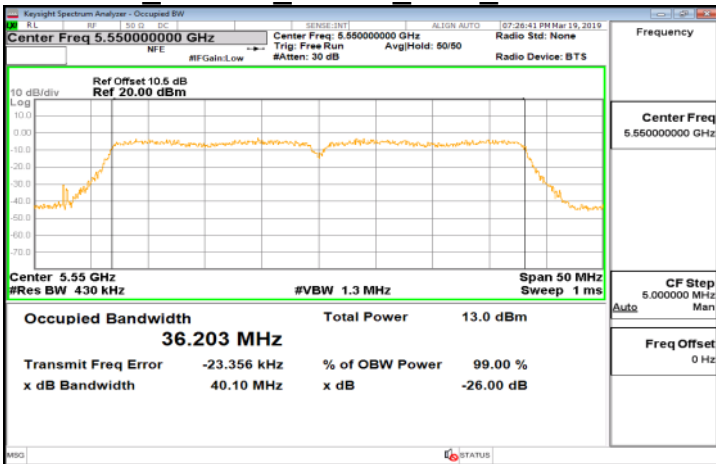
FCC 802.11n 40MHz Main 5510MHz



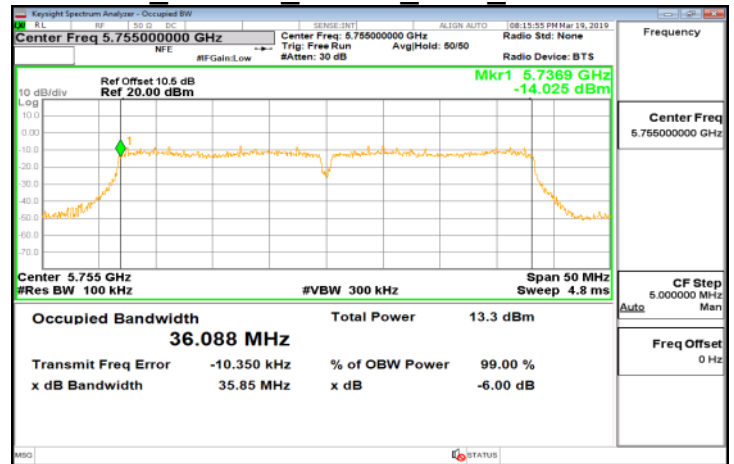
FCC 802.11n 40MHz Main 5710MHz



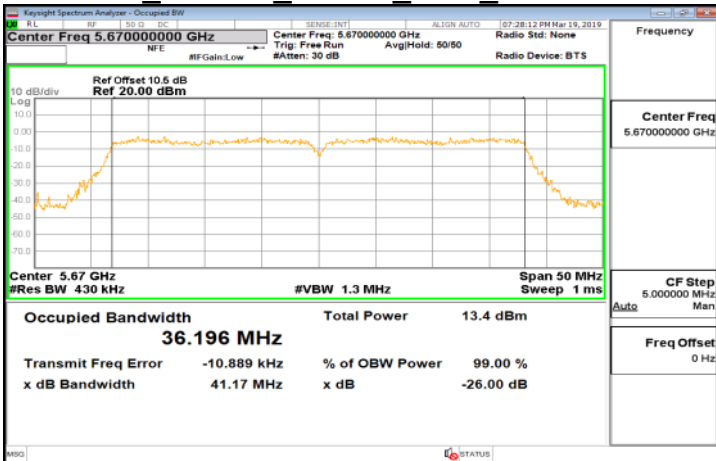
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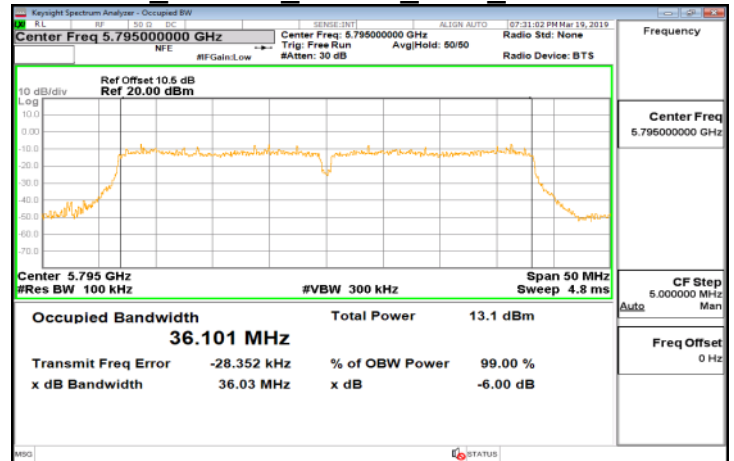
FCC 802.11n 40MHz Main 5755MHz



FCC 802.11n 40MHz Main 5670MHz



FCC 802.11n 40MHz Main 5795MHz

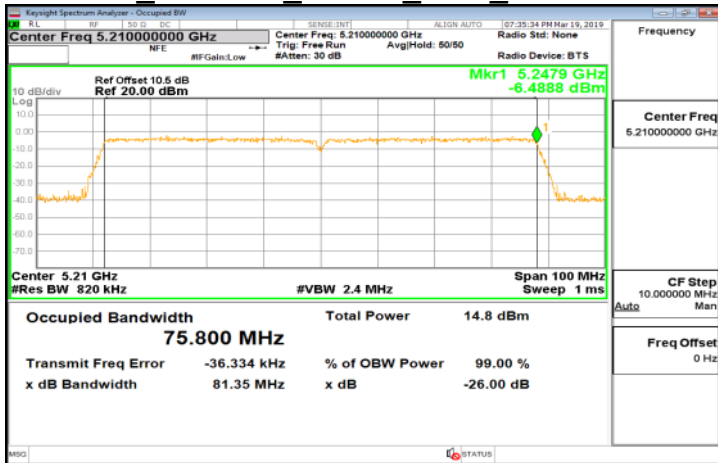


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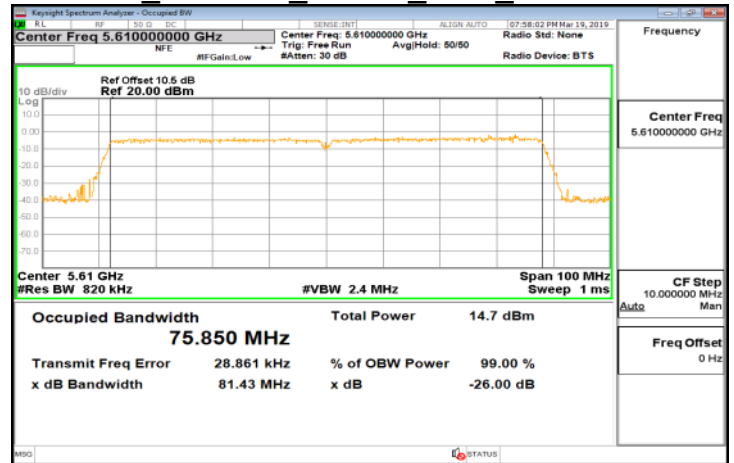
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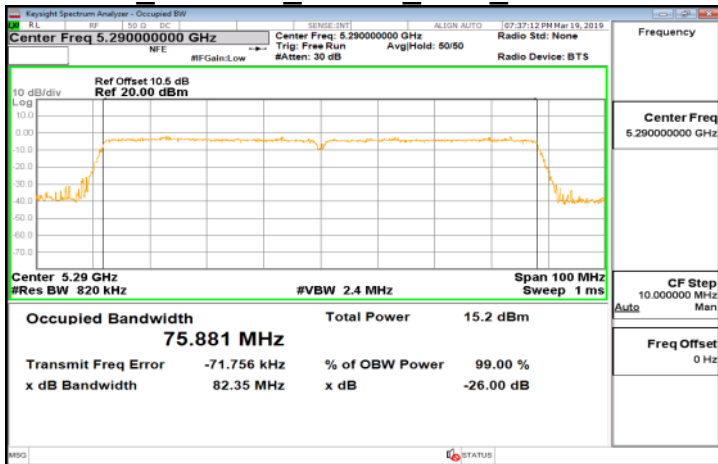
FCC 802.11ac 80MHz Main 5210MHz



FCC 802.11ac 80MHz Main 5610MHz



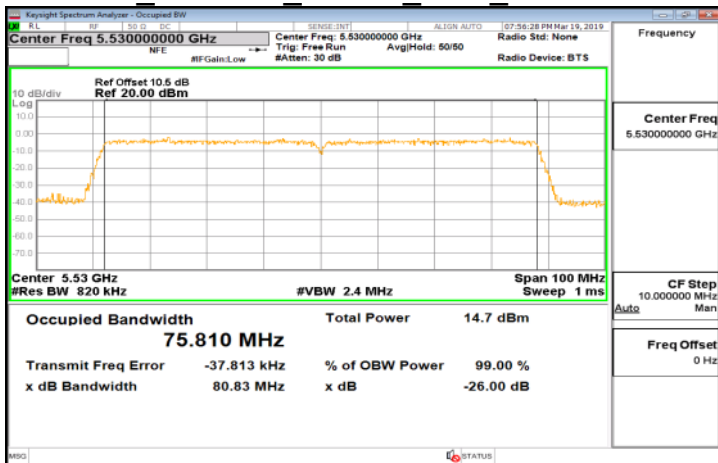
FCC 802.11ac 80MHz Main 5290MHz



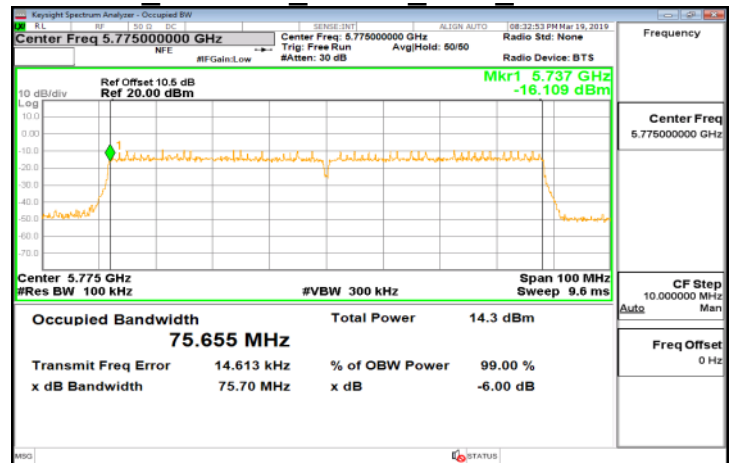
FCC 802.11ac 80MHz Main 5690MHz



FCC 802.11ac 80MHz Main 5530MHz



FCC 802.11ac 80MHz Main 5775MHz

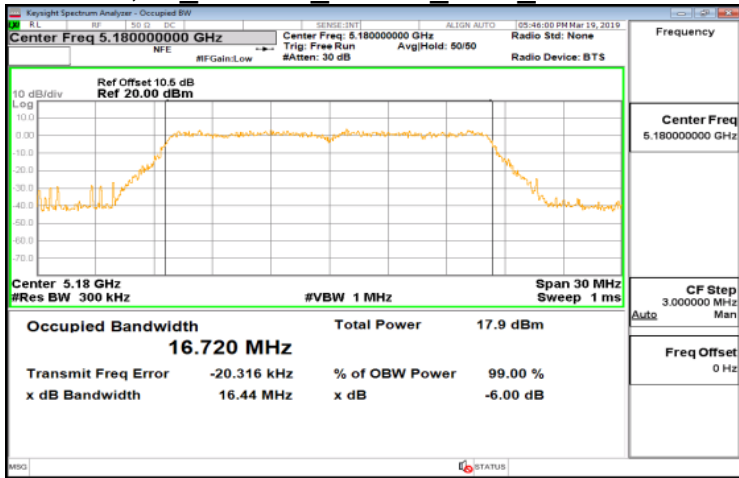


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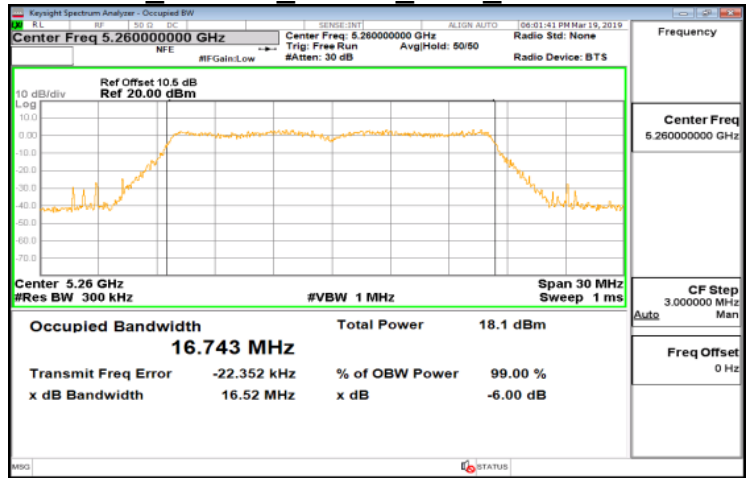
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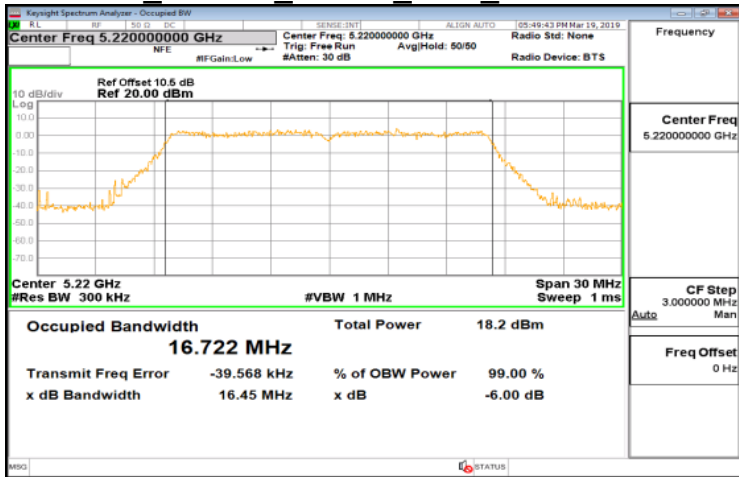
For 99%, IC 802.11a 20MHz Main 5180MHz



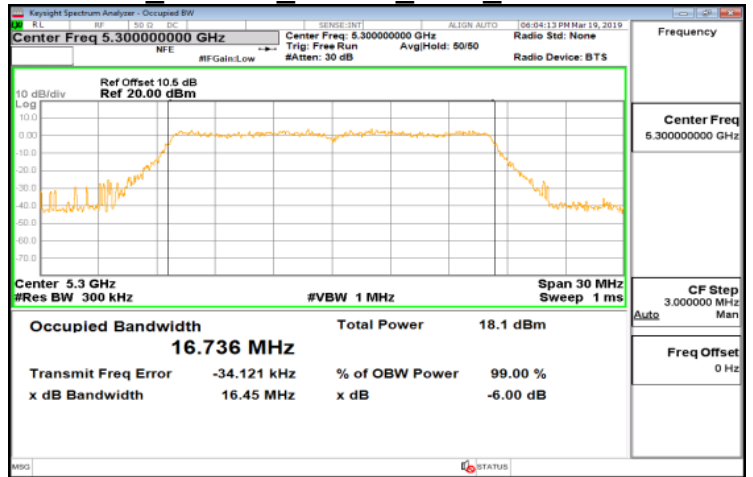
IC 802.11a 20MHz Main 5260MHz



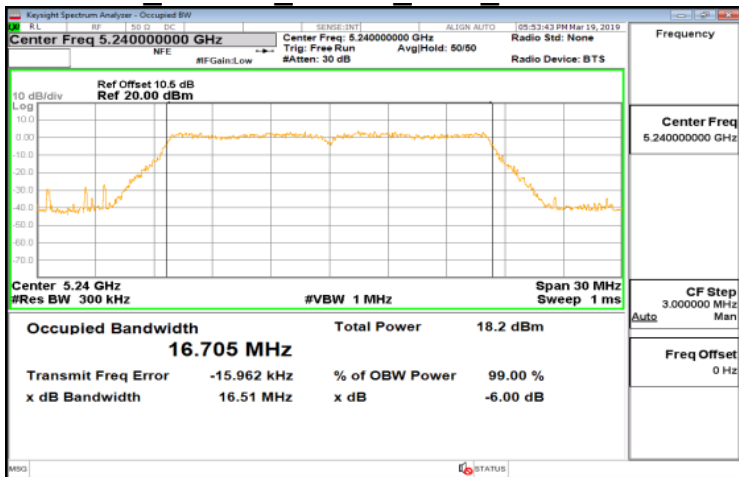
IC 802.11a 20MHz Main 5220MHz



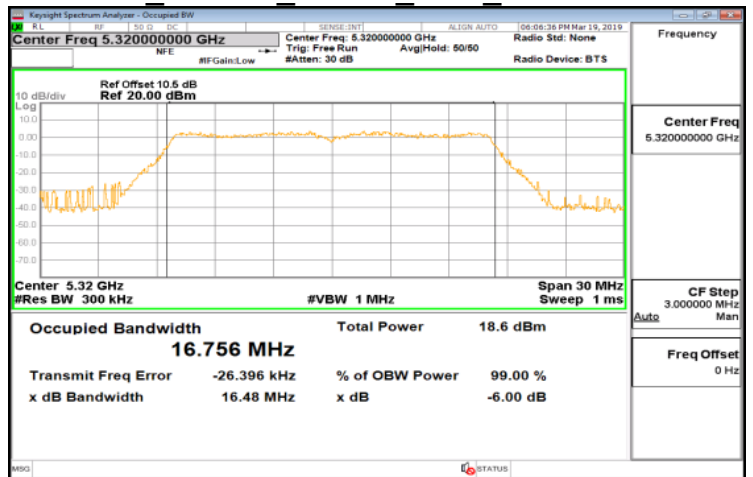
IC 802.11a 20MHz Main 5300MHz



IC 802.11a 20MHz Main 5240MHz



IC 802.11a 20MHz Main 5320MHz

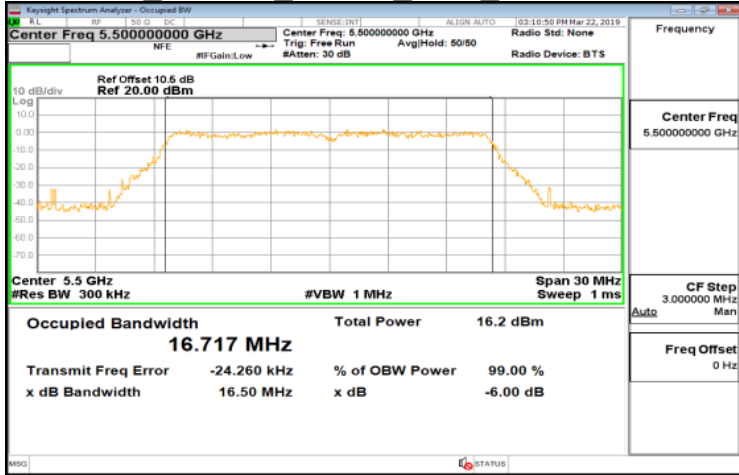


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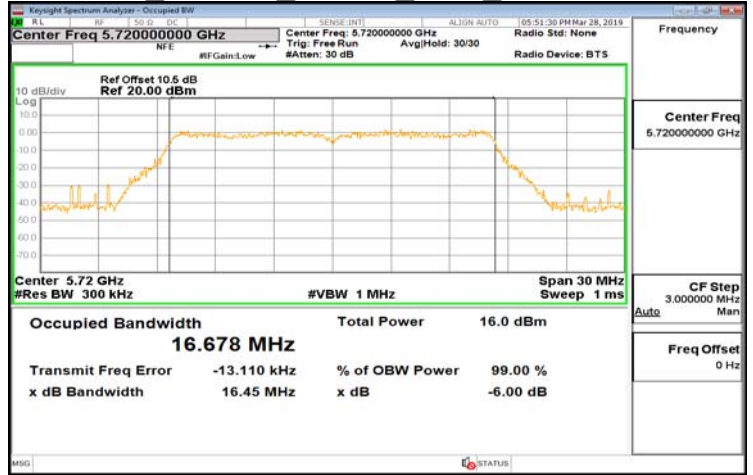
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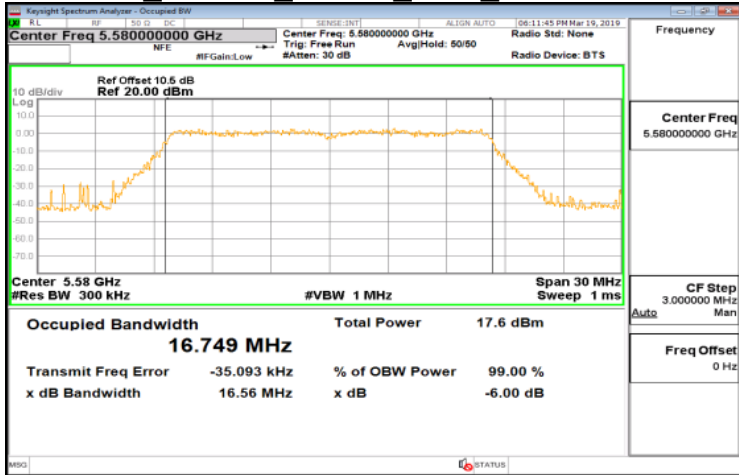
IC 802.11a 20MHz Main 5500MHz



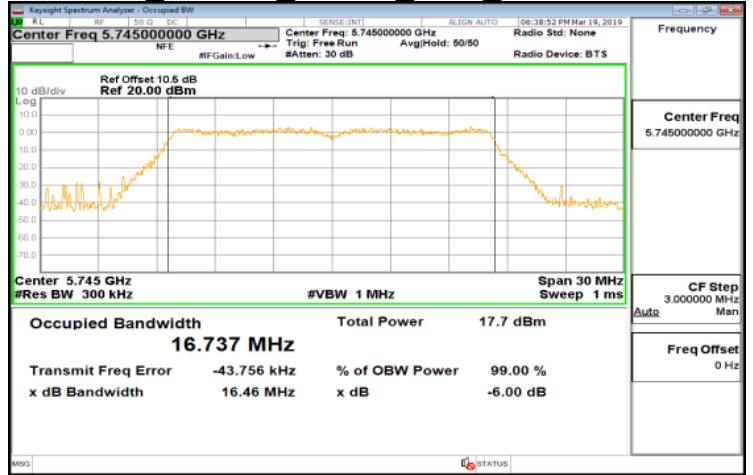
IC 802.11a 20MHz Main 5720MHz



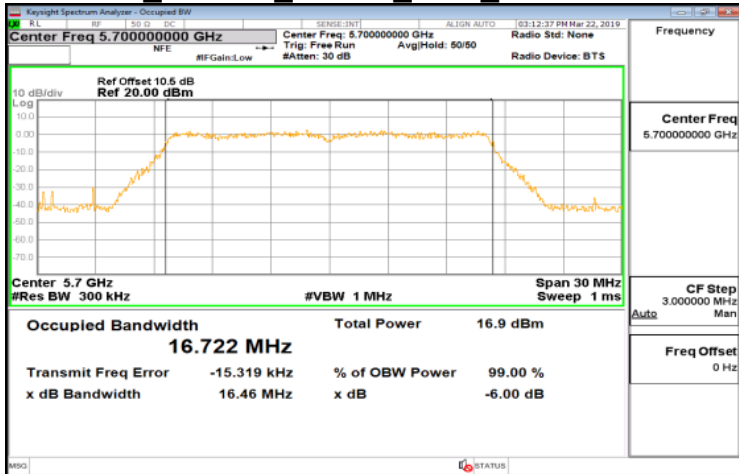
IC 802.11a 20MHz Main 5580MHz



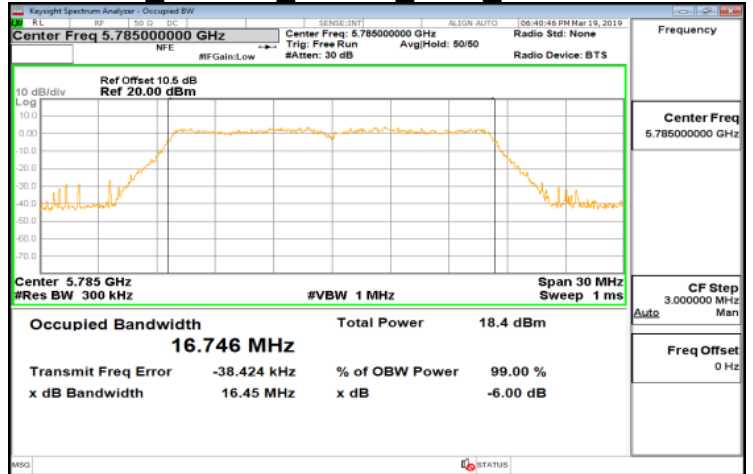
IC 802.11a 20MHz Main 5745MHz



IC 802.11a 20MHz Main 5700MHz



IC 802.11a 20MHz Main 5785MHz

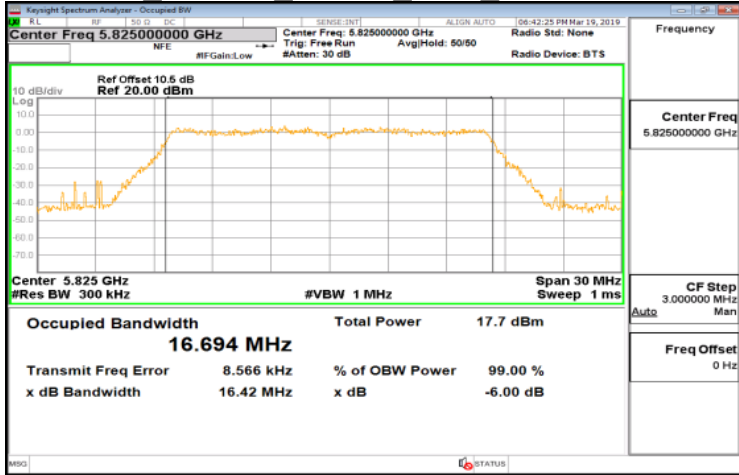


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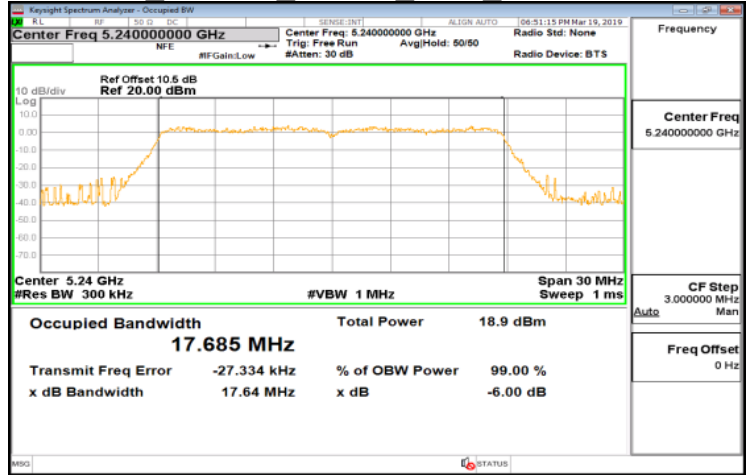
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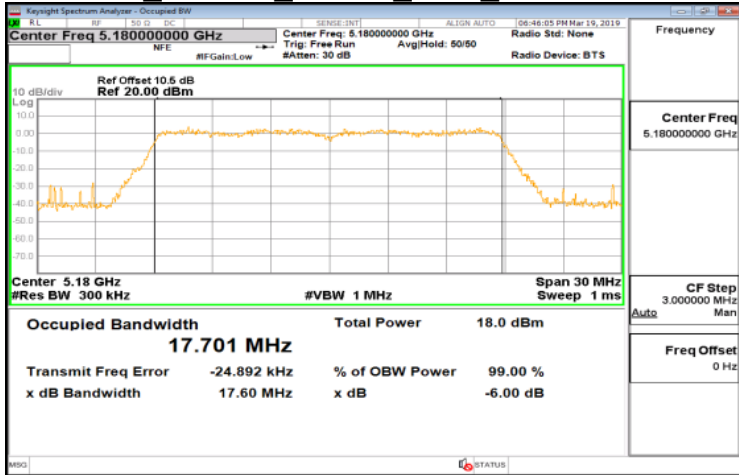
IC 802.11a 20MHz Main 5825MHz



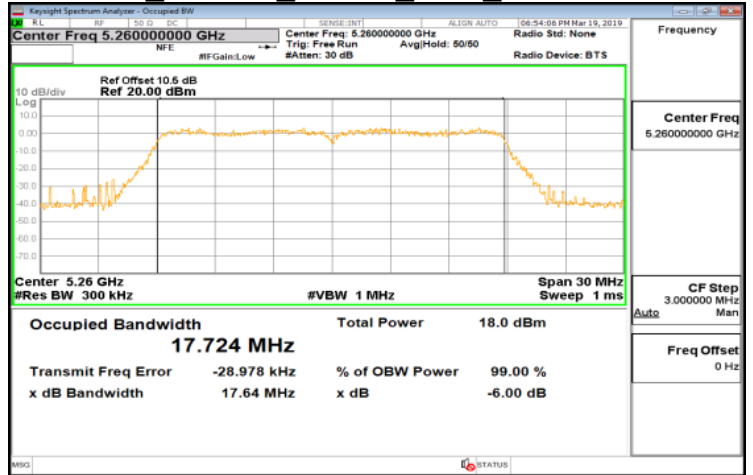
IC 802.11n 20MHz Main 5240MHz



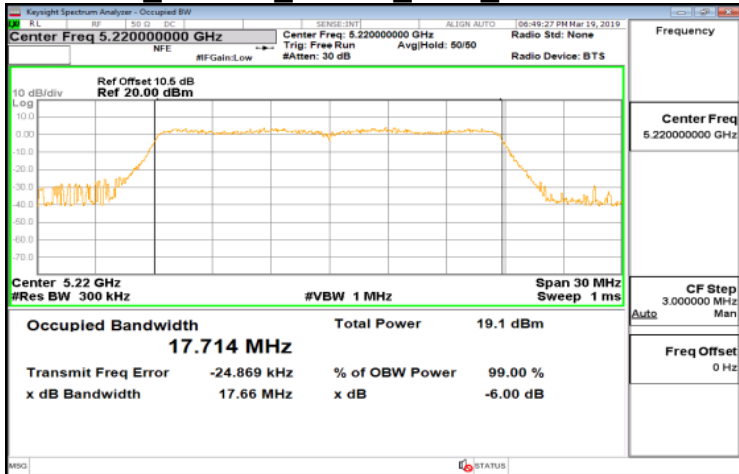
IC 802.11n 20MHz Main 5180MHz



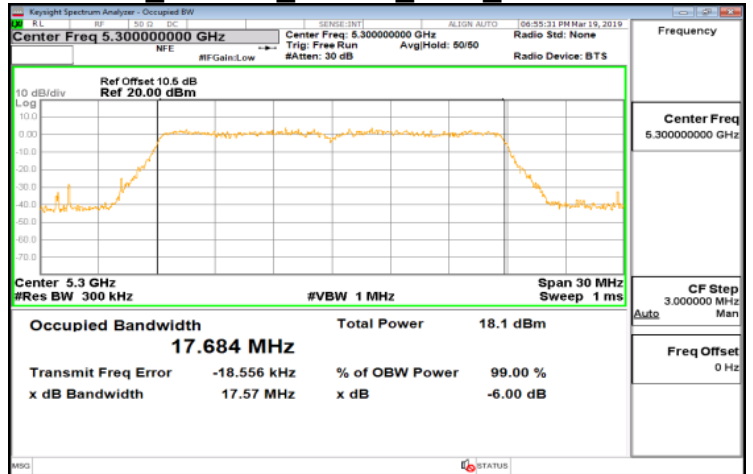
IC 802.11n 20MHz Main 5260MHz



IC 802.11n 20MHz Main 5220MHz



IC 802.11n 20MHz Main 5300MHz

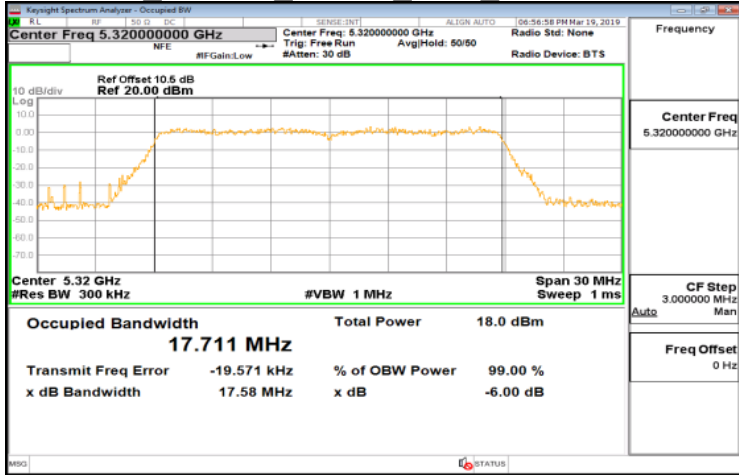


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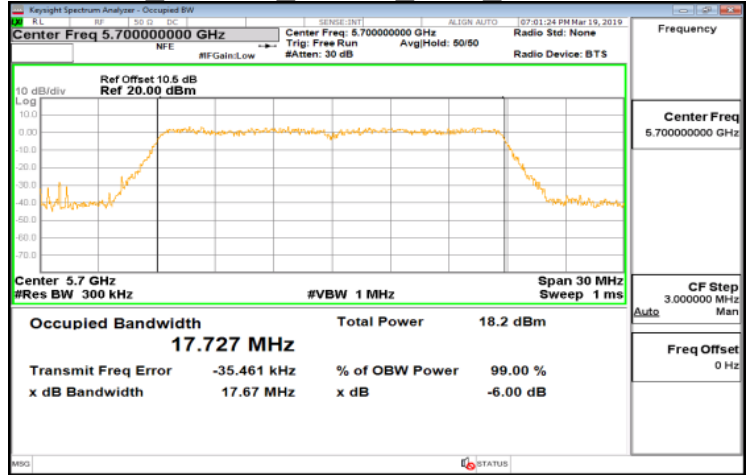
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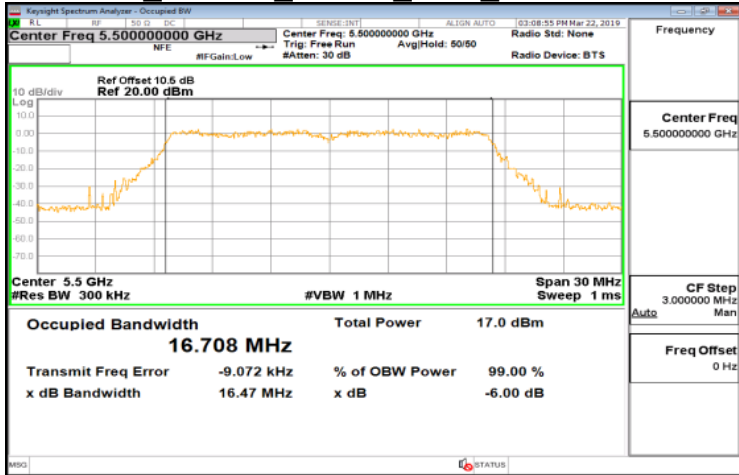
IC 802.11n 20MHz Main 5320MHz



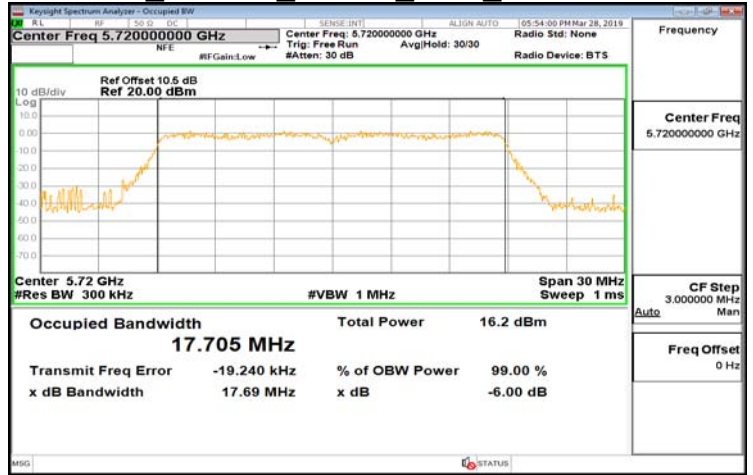
IC 802.11n 20MHz Main 5700MHz



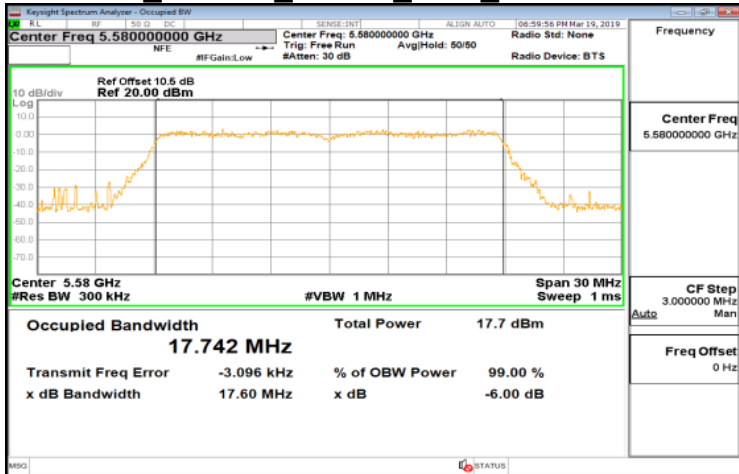
IC 802.11n 20MHz Main 5500MHz



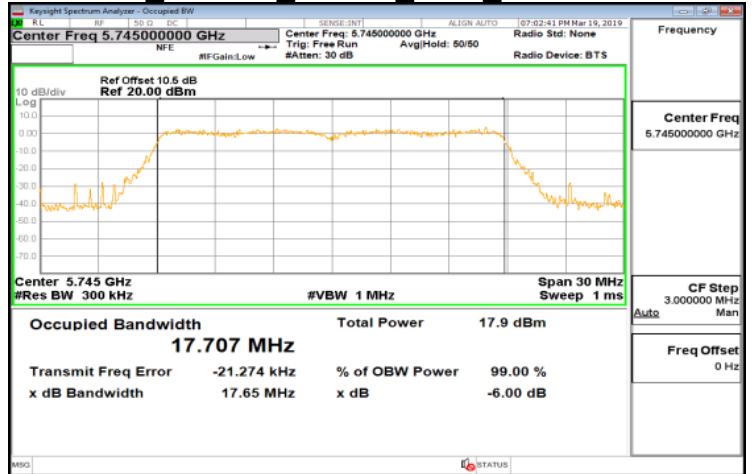
IC 802.11n 20MHz Main 5720MHz



IC 802.11n 20MHz Main 5580MHz



IC 802.11n 20MHz Main 5745MHz

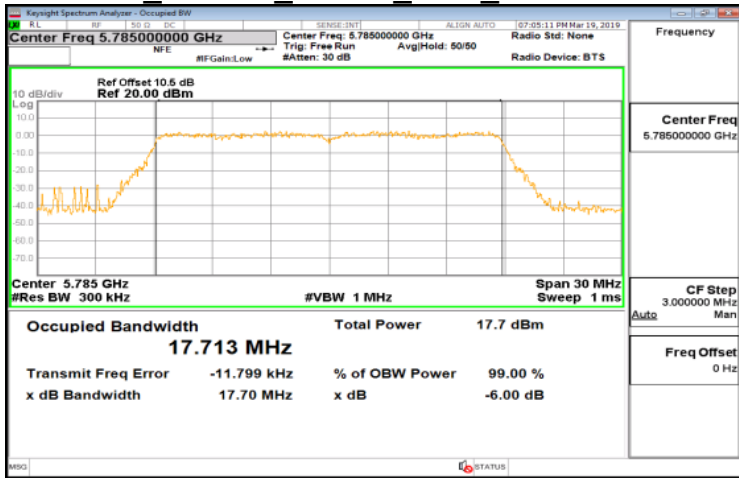


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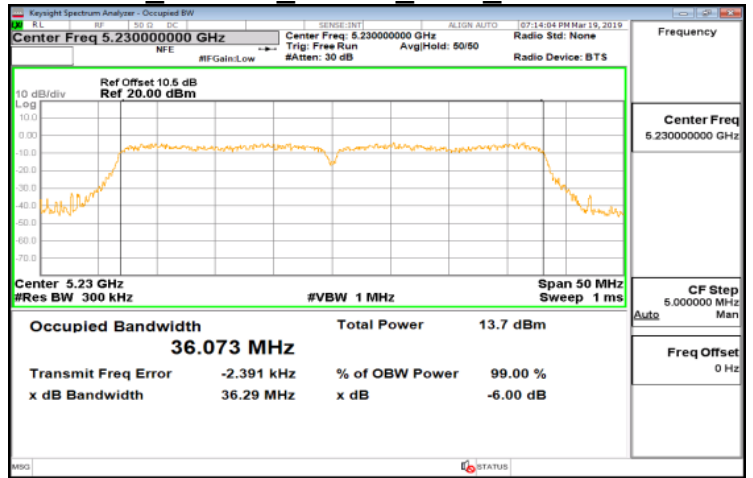
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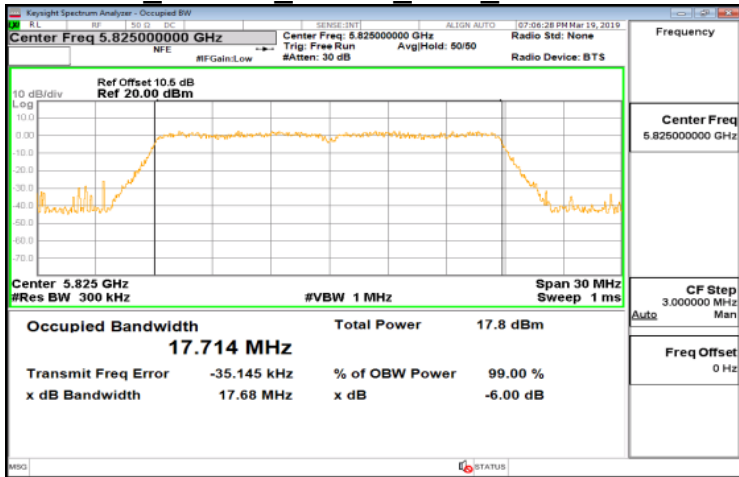
IC 802.11n 20MHz Main 5785MHz



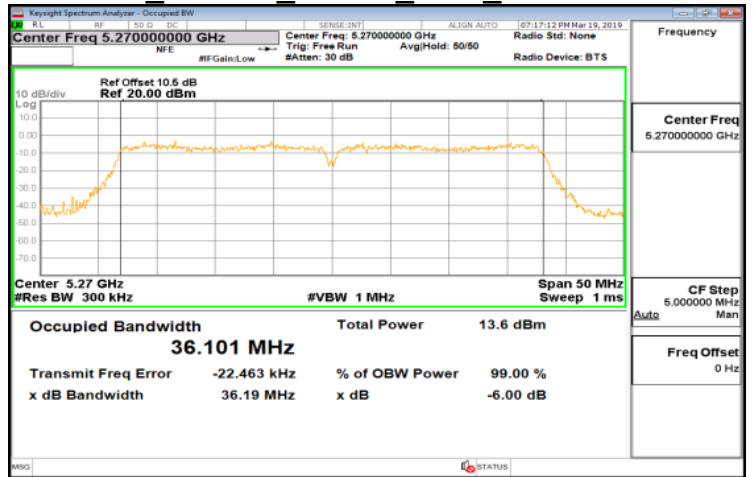
IC 802.11n 40MHz Main 5230MHz



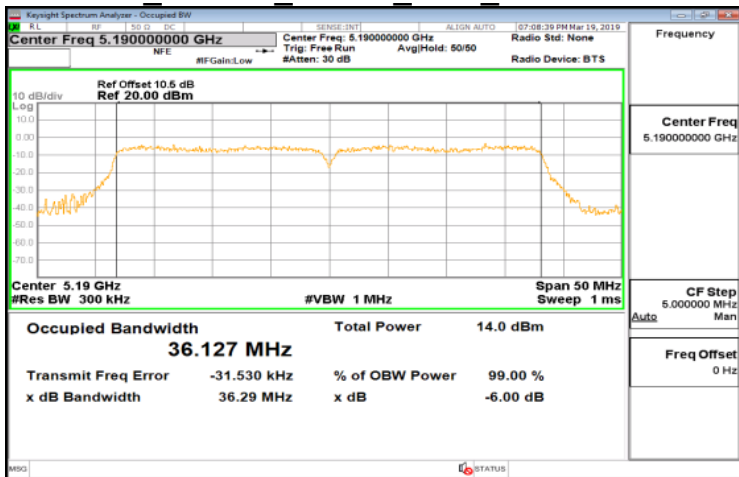
IC 802.11n 20MHz Main 5825MHz



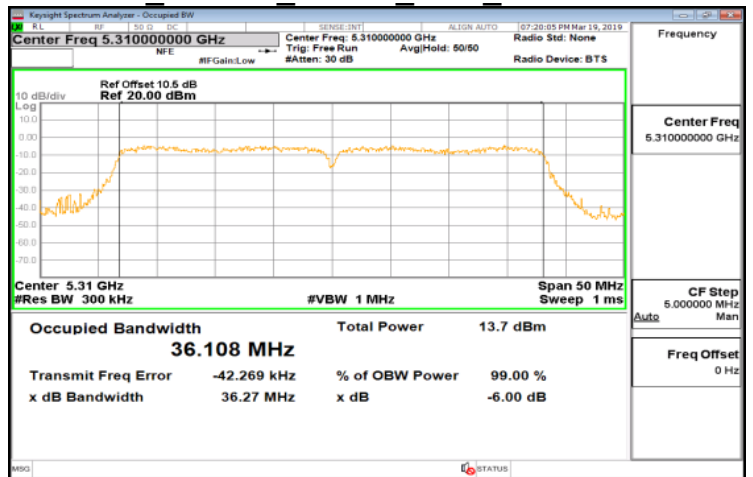
IC 802.11n 40MHz Main 5270MHz



IC 802.11n 40MHz Main 5190MHz



IC 802.11n 40MHz Main 5310MHz



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