ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

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

OF

FCC Applicant:	Murata Manufacturing Co., Ltd. 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
IC 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.:	LBEQ6ZZ1PN
Model Difference:	N/A
FCC ID:	VPYLB1PN
IC:	772C-LB1PN
Report Number:	ER/2018/80101
FCC Rule Part:	§15.407, Cat:NII
IC Rule:	RSS-247 issue 2 Feb. 2017
Issue Date:	Oct. 18, 2018
Date of Test:	Aug. 28, 2018 ~ Oct. 01, 2018
Date of EUT Received:	Aug. 22, 2018

We hereby certify that:

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

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

Tested By: CHUN-CHIEH, CHEN

CHUN CHIEH CHEN / Asst. Supervisor

Approved By: Jim Chang

Jim Chang / Manager

Testing Laboratory
0513

Revision History

Report Number	Revision	Description	Effected Page	Issue Date	Revised By
ER/2018/80101	Rev.00	Initial creation of document	All	Oct. 18, 2018	Elle Chang

Contents

1 GENERAL INFORMATION

1.1 Product Description

General:

Product Name:	Communication Module
Brand Name:	MURATA
Model No.:	LBEQ6ZZ1PN
Model Difference:	N/A
Hardware version:	N/A
Software version:	N/A
Power Supply:	Typ. 3.3V, Min 3.0V, Max 3.6V from DC power supply

FCC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. Power (dBm)	Modulation Technology
11a_20	5150~5250	4	12.48	OFDM
	5250~5350	4	12.51	
	5470~5725	12	12.35	
	5725-5850	5	12.42	
11n_HT / ac_VHT 20M	5150~5250	4	HT: 15.83	OFDM
	5250~5350	4	HT: 15.63	
	5470~5725	12	HT: 15.40	
	5725-5850	5	HT: 15.32	
11n_HT / ac_VHT 40M	5150~5250	2	HT: 15.64	OFDM
	5250~5350	2	HT: 15.49	
	5470~5725	6	HT: 15.63	
	5725-5850	2	HT: 15.30	
11ac VHT80M	5150~5250	1	10.38	OFDM
	5250~5350	1	10.56	
	5470~5725	2	12.44	
	5725-5850	1	12.26	
Antenna Designation:	Dipole Antenna, Supplier: Taoglas Model No.: GW.59.3153 5150~5250MHz Peak Gain: 2.93dBi 5250~5350MHz Peak Gain: 2.93dBi 5470~5725MHz Peak Gain: 2.93dBi 5725~5850MHz Peak Gain: 2.93dBi			

IC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. or EIRP	Rated Power(dBm) (Worst Case)	Modulation Technology
11a	5150~5250	4	EIRP	15.41	OFDM
	5250~5350	4	Avg.	12.51	
	5470~5725	12	Avg.	12.35	
	5725-5850	5	Avg.	12.42	
11n_HT / ac_VHT 20M	5150~5250	4	EIRP	HT: 21.77	OFDM
	5250~5350	4	Avg.	HT: 15.63	
	5470~5725	12	Avg.	HT: 15.40	
	5725-5850	5	Avg.	HT: 15.32	
11n_HT / ac_VHT 40M	5150~5250	2	EIRP	HT: 21.58	OFDM
	5250~5350	2	Avg.	HT: 15.49	
	5470~5725	6	Avg.	HT: 15.63	
	5725-5850	2	Avg.	HT: 15.30	
11ac VHT80M	5150~5250	1	EIRP	16.32	OFDM
	5250~5350	1	Avg.	10.56	
	5470~5725	2	Avg.	12.44	
	5725-5850	1	Avg.	12.26	
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 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 Apr. 2018

ANSI C63.10:2013

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

1.3 Test Facility

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

FCC Registration Numbers are: 509634 / TW0001

Canada Registration Number: 4620A-4

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.

2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

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

2.3 Test Procedure

2.3.1 Conducted Emissions

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

2.3.2 Radiated Emissions

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

2.4 Measurement Results Explanation

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 Emission Configuration

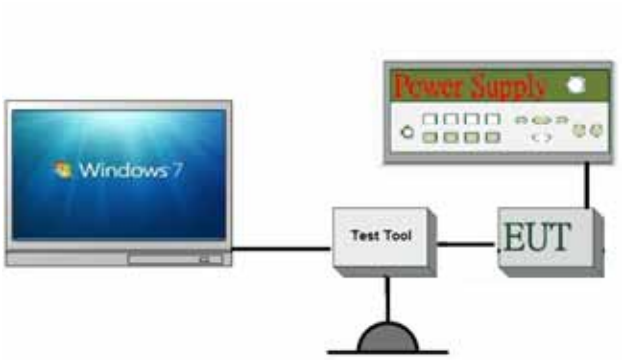


Fig.2-3 Conducted Emission (Antenna Port) Configuration

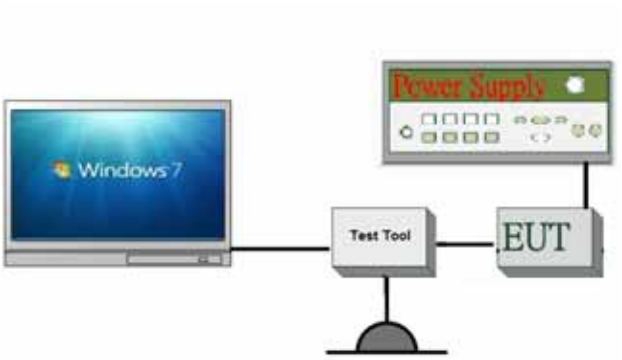


Fig. 2-2 Conducted Emission (AC Power Line) Configuration

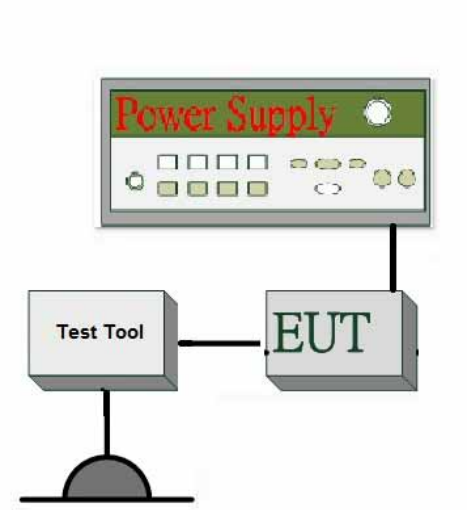


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	WLAN Test Software	N/A	N/A	N/A	N/A	N/A
2	Notebook	Lenovo	L440	R9-007LAZ	Shielded	Unshielded
3	DC power supply	Agilent	E3634A	MY53180030	N/A	Unshielded
4	Test tool kit	N/A	N/A	N/A	N/A	N/A

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 §6.6	26 dB & 6dB & 99% Emission Bandwidth	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Maximum Conducted Output Power	Compliant
§15.407(a)	RSS-247 §6.2.1~ 4 (1)	Power Spectral Density	Compliant
§15.407(b)	RSS-247 §6.2.1~ 4 (2)	Undesirable Radiated Emissions	Compliant
§15.407(c)	RSS-247 §6.4	Transmission in case of Absence of Information	Compliant
§15.407(g)	RSS-Gen §6.11	Frequency Stability	Compliant
§15.203 §15.407(a)	RSS- Gen §6.7 RSS- Gen §8.3	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

4.1 Operated in U-NII Bands

Operated band in 5150 MHz ~5250 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
Channel	Frequency
36	5180
40	5200
44	5220
48	5240

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
38	5190
46	5230

802.11ac VHT80 Mode	
channel	Frequency
42	5210

Operated band in 5250 MHz ~5350 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
channel	Frequency
52	5260
56	5280
60	5300
64	5320

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
54	5270
62	5310

802.11ac VHT80 Mode	
Channel	Frequency
58	5290

Operated band in 5470 MHz ~5725 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
Channel	Frequency
100	5500
104	5520
108	5540
112	5560
116	5580
120	5600
124	5620
128	5640
132	5660
136	5680
140	5700
144	5720

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
102	5510
110	5550
118	5590
126	5630
134	5670
142	5710

802.11ac VHT80 Mode	
channel	Frequency
106	5530
122	5610
138	5690

Operated band in 5745 MHz ~5850 MHz:

802.11a / n HT20 Mode, 802.11ac VHT20 Mode	
Channel	Frequency
149	5745
153	5765
157	5785
161	5805

802.11 n HT40 Mode, 802.11ac VHT40 Mode	
channel	Frequency
151	5755
159	5795

802.11ac VHT80 Mode	
channel	Frequency
155	5775

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 802.11ac yields the highest reading that generates the highest emission.

RADIATED EMISSION TEST:

SISO

RADIATED EMISSION TEST (ABOVE 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS0	Ch0
802.11ac_VHT80	5210	42	42	OFDM	MCS0	Ch0
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS0	Ch0

MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11ac_VHT20	5500~5720	100 to 144	140	OFDM	MCS0	Ch0
802.11ac_VHT40	5510~5710	102 to 142	102	OFDM	MCS0	Ch0
802.11ac_VHT80	5530~5690	106 to 138	106	OFDM	MCS0	Ch0

MIMO

RADIATED EMISSION TEST (BELOW 1 GHz)						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11a	5180~5240	36 to 48	44	OFDM	6	Ch0
802.11a	5260~5320	52 to 64	60	OFDM	6	Ch0
802.11a	5500~5720	100 to 144	116	OFDM	6	Ch0
802.11a	5745~5825	149 to 165	157	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	MCS8	MIMO
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT80	5290	58	58	OFDM	MCS0	MIMO

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	MCS8	MIMO
802.11n_HT40	5510~5710	102 to 142	102,110,134	OFDM	MCS8	MIMO
802.11ac_VHT80	5530~5610	106 to 122	106,122	OFDM	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS8	MIMO
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT80	5775	155	155	OFDM	MCS0	MIMO

Note:
The field strength of radiation emission was measured as EUT stand-up position (H 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.

ANTENNA PORT CONDUCTED MEASUREMENT:
SISO

CONDUCTED TEST						
MODE	FREQUENCY BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	DATA RATE (Mbps)	ANTENNA PORT
802.11n_HT40 802.11ac_VHT40	5190~5230	38 to 46	38	OFDM	MCS0	Ch0
802.11ac_VHT80	5210	42	42	OFDM	MCS0	Ch0
802.11n_HT40 802.11ac_VHT40	5270~5310	54 to 62	62	OFDM	MCS0	Ch0
802.11n_HT20 802.11ac_VHT20	5500~5700	100 to 140	140	OFDM	MCS0	Ch0
802.11n_HT40 802.11ac_VHT40	5510~5710	102 to 142	102	OFDM	MCS0	Ch0
802.11ac_VHT80	5530~5610	106 to 122	106	OFDM	MCS0	Ch0

MIMO

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	MCS8	MIMO
802.11ac_VHT20					MCS0	
802.11n_HT40	5190~5230	38 to 46	38,46	OFDM	MCS8	MIMO
802.11ac_VHT40					MCS0	
802.11ac_VHT80	5210	42	42	OFDM	MCS0	MIMO
802.11a	5260~5320	52 to 64	52,60,64	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS8	MIMO
802.11ac_VHT20					MCS0	
802.11n_HT40	5270~5310	54 to 62	54,62	OFDM	MCS8	MIMO
802.11ac_VHT40					MCS0	
802.11ac_VHT80	5290	58	58	OFDM	MCS0	MIMO
802.11a	5500~5700	100 to 140	100,116,140	OFDM	6	CH0
802.11n_HT20				OFDM	MCS8	MIMO
802.11ac_VHT20					MCS0	
802.11n_HT40	5510~5670	102 to 134	102,110,134	OFDM	MCS8	MIMO
802.11ac_VHT40					MCS0	
802.11ac_VHT80	5530~5610	106 to 122	106,122	OFDM	MCS0	MIMO
802.11a	5745~5825	149 to 165	149,157,165	OFDM	6	Ch0
802.11n_HT20				OFDM	MCS8	MIMO
802.11ac_VHT20					MCS0	
802.11n_HT40	5755~5795	151 to 159	151,159	OFDM	MCS8	MIMO
802.11ac_VHT40					MCS0	
802.11ac_VHT80	5775	155	155	OFDM	MCS0	MIMO

5 MEASUREMENT UNCERTAINTY

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

Radiated Spurious Emission:

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

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

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

6 CONDUCTED EMISSION TEST

6.1 Standard Applicable

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

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

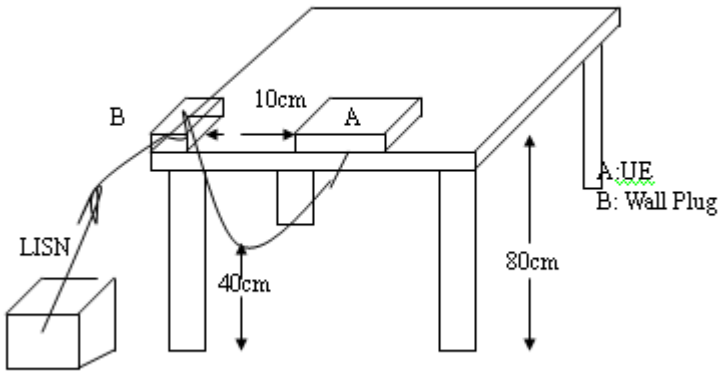
6.2 Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
EMI Test Receiver	R&S	ESCI7	100335	2018/02/02	2019/02/01
DC Power Supply	Anritsu	E3640A	KR93300208	2018/08/15	2019/08/14
LISN	SCHWARZ-BECK	NSLK 8127	8127-649	2018/05/18	2019/05/17

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.

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

AC POWER LINE CONDUCTED EMISSION TEST DATA

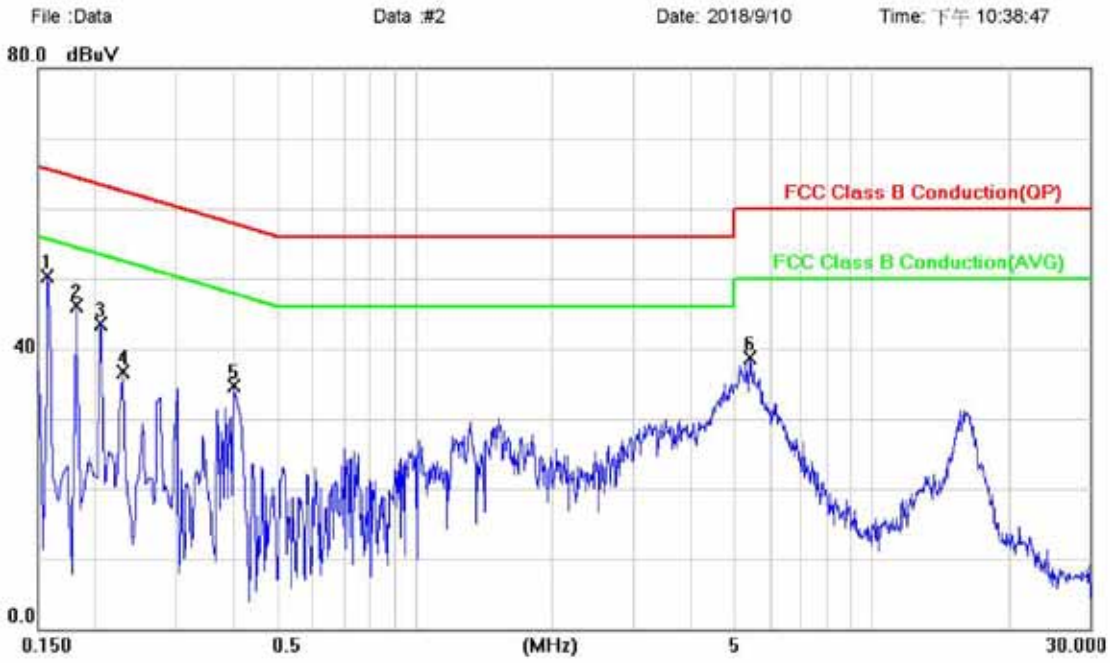
Operation Mode:	Operation mode	Test By:	Jerry

Site Conduction Room
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note: Adapter:DA-65C19

Phase: L1
Power: AC 120V/60Hz

Temperature: 25 ℃
Humidity: 85 %

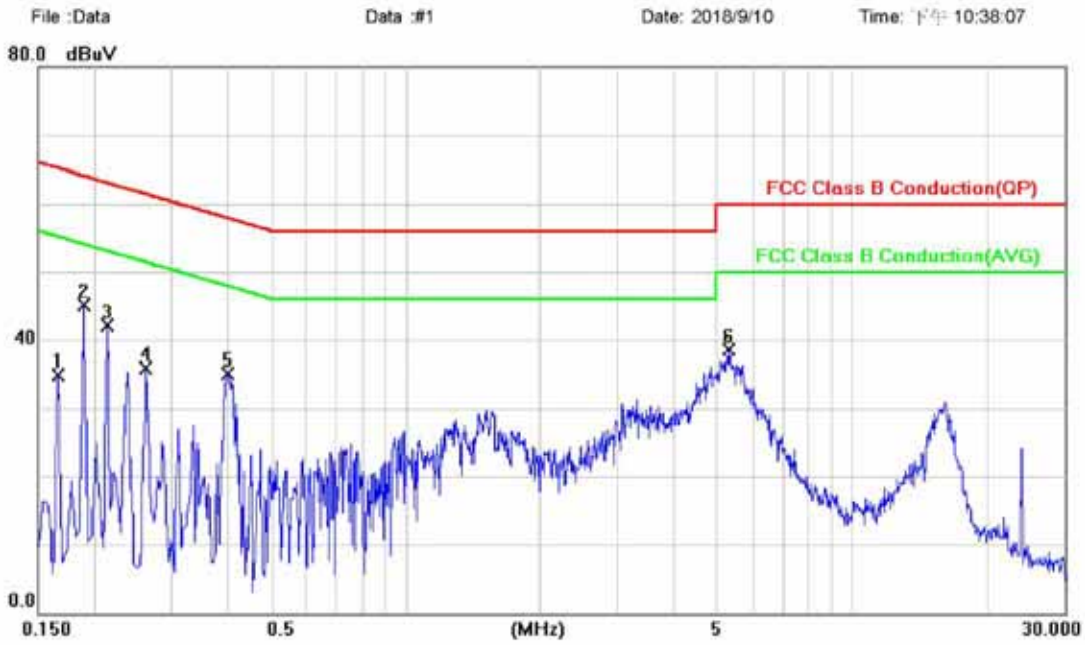
Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	50.18	0.04	50.22	65.57	-15.35	peak	
2		0.1820	46.09	0.04	46.13	64.39	-18.26	peak	
3		0.2060	43.43	0.04	43.47	63.37	-19.90	peak	
4		0.2300	36.64	0.04	36.68	62.45	-25.77	peak	
5		0.4020	34.59	0.04	34.63	57.81	-23.18	peak	
6		5.4460	38.41	0.22	38.63	60.00	-21.37	peak	

Site Conduction Room	Phase:	N	Temperature: 25 ℃
Limit: FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity: 85 %
Mode: Operation			
Note: Adapter:DA-65C19			

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1660	34.78	0.04	34.82	65.16	-30.34	peak	
2	*	0.1900	44.99	0.04	45.03	64.04	-19.01	peak	
3		0.2140	42.09	0.04	42.13	63.05	-20.92	peak	
4		0.2620	35.77	0.04	35.81	61.37	-25.56	peak	
5		0.3980	35.15	0.04	35.19	57.90	-22.71	peak	
6		5.3100	38.30	0.21	38.51	60.00	-21.49	peak	

7 DUTY CYCLE TEST SIGNAL

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

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

Formula:

Duty Cycle = Ton / (Ton+Toff)

Measurement Procedure:

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

Duty Cycle:

Mode	Duty Cycle (%)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
802.11a	98.99	0.04	0.48	1.00
802.11n_20	97.81	0.10	1.02	2.00
802.11ac_20	98.97	0.04	0.52	1.00
802.11n_40	95.75	0.19	2.02	3.00
802.11ac_40	97.61	0.11	1.05	2.00
802.11ac_80	95.56	0.20	2.16	3.00

Duty Cycle Factor: 10 * log(1/0.9899) = 0.04
Duty Cycle Factor: 10 * log(1/0.9781) = 0.1
Duty Cycle Factor: 10 * log(1/0.9897) = 0.04
Duty Cycle Factor: 10 * log(1/0.9575) = 0.19
Duty Cycle Factor: 10 * log(1/0.9761) = 0.11
Duty Cycle Factor: 10 * log(1/0.9556) = 0.2

DUTY CYCLE TEST SIGNAL Measurement Result

802.11a

802.11n HT20

802.11ac VHT 20

802.11n HT 40

802.11 ac VHT 40

802.11 ac VHT 80

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

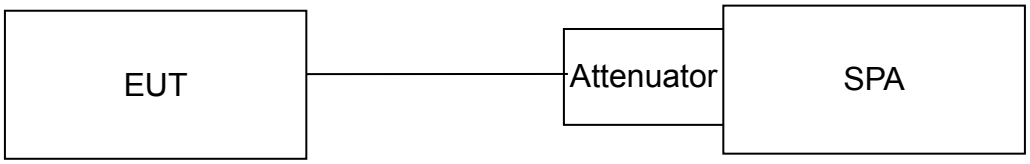
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
   a. 26dB Band width Measurement: 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. 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.

8.3 Measurement Equipment Used

SGS Conducted Room					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	R&S	FSV-30	101398	2017/10/19	2018/10/18
DC Power Supply	Anritsu	E3640A	MY52410006	2017/11/28	2018/11/27
Temperature Chamber	TERCHY	MHG-120LF	911009	2018/05/18	2019/05/17
Attenuator	Mini-Circuit	BW-S10W2+	2	2018/01/02	2019/01/01
DC Block	Mini-Circuits	BLK-18-S+	1	2018/01/02	2019/01/01
Coaxial Cables	N/A	WK CE Cable	N/A	2018/01/02	2019/01/01
Notebook	Lenovo	L430	R9-WGNK5	N/A	N/A

8.4 Test Set-up



8.5 Measurement Result

26dB and 6dB Bandwidth

SISO

802.11n_HT20_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5700	19.27	12.849

802.11n _HT40_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	38.03	15.801
5310	38.12	15.812
5510	38.23	15.824

802.11ac _VHT80_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	79.16	18.985
5290	79.15	18.985

MIMO

802.11a_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	18.63	12.701
5220	18.51	12.674
5240	18.58	12.690
5260	18.69	12.716
5300	18.65	12.707
5320	18.51	12.674
5500	18.61	12.697
5580	18.53	12.679
5700	18.46	12.662
5720(U-NII 2C)	14.76	11.691
5720 (U-NII 3)	4.80	6.812

802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.35	12.134
5785	16.35	12.134
5825	16.37	12.139

802.11n_HT20_Ch0 **802.11n_HT20_Ch1**

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5180	19.84	12.975	5180	19.83	12.973
5220	19.90	12.988	5220	19.64	12.932
5240	20.15	13.043	5240	19.94	12.997
5260	20.00	13.011	5260	19.98	13.006
5300	19.83	12.972	5300	19.88	12.984
5320	19.31	12.858	5320	19.82	12.971
5500	20.05	13.022	5500	19.56	12.914
5580	19.77	12.961	5580	19.72	12.949
5700	19.92	12.992	5700	19.82	12.971
5720(U-NII 2C)	14.80	11.703	5720(U-NII 2C)	14.96	11.749
5720 (U-NII 3)	4.76	6.776	5720 (U-NII 3)	4.96	6.955

802.11n_HT20_Ch0 **802.11n_HT20_Ch1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.95	12.292	5745	17.58	12.451
5785	17.56	12.445	5785	17.54	12.440
5825	17.59	12.452	5825	17.57	12.448

802.11n _HT40_Ch0 **802.11n _HT40_Ch1**

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5190	40.02	16.023	5190	40.51	16.075
5230	40.40	16.064	5230	40.20	16.042
5270	40.07	16.028	5270	40.32	16.055
5310	40.10	16.032	5310	40.16	16.038
5510	39.99	16.019	5510	39.94	16.014
5550	**39.91**	16.010	5550	**40.27**	16.050
5670	39.90	16.010	5670	40.80	16.107
5710 (U-NII 2C)	**35.00**	15.441	5710 (U-NII 2C)	**34.84**	15.421
5710 (U-NII 3)	5.00	6.990	5710 (U-NII 3)	5.08	7.059

802.11n_HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.59	15.513
5795	34.55	15.385

802.11n_HT40_Ch1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	35.06	15.448
5795	35.24	15.470

802.11ac _VHT80_Ch0

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	81.64	19.119
5290	81.30	19.101
5530	81.14	19.092
5610	82.31	19.155
5690 (U-NII 2C)	75.64	18.788
5690 (U-NII 3)	5.00	6.990

802.11ac _VHT80_Ch1

Frequency (MHz)	26dB BW (MHz)	10 Log (B) (dB)
5210	81.36	19.104
5290	81.09	19.090
5530	81.05	19.087
5610	81.73	19.124
5690 (U-NII 2C)	75.32	18.769
5690 (U-NII 3)	5.80	7.634

802.11ac _VHT80_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	76.38	18.830

802.11ac _VHT80_Ch1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	76.37	18.829

99% Bandwidth

SISO

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5700	17.671	12.473

802.11n _HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.051	15.569
5310	36.048	15.569
5510	36.029	15.567

802.11ac _VHT80_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.862	18.800
5290	75.896	18.802

MIMO

802.11a_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	16.660	12.217
5220	16.712	12.230
5240	16.672	12.220
5260	16.680	12.222
5300	16.709	12.230
5320	16.621	12.207
5500	16.685	12.223
5580	16.694	12.226
5700	16.588	12.198
5720(U-NII 2C)	12.600	11.004
5720 (U-NII 3)	4.054	6.079

802.11a_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	16.46	12.163
5785	16.34	12.132
5825	16.42	12.154

802.11n_HT20_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.664	12.471
5220	17.648	12.467
5240	17.667	12.472
5260	17.672	12.473
5300	17.666	12.471
5320	17.687	12.477
5500	17.635	12.464
5580	17.696	12.479
5700	17.661	12.470
5720(U-NII 2C)	13.370	11.261
5720 (U-NII 3)	4.300	6.335

802.11n_HT20_Ch1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5180	17.667	12.472
5220	17.656	12.469
5240	17.674	12.473
5260	17.650	12.467
5300	17.647	12.467
5320	17.675	12.474
5500	17.661	12.470
5580	17.652	12.468
5700	17.660	12.470
5720(U-NII 2C)	13.360	11.258
5720 (U-NII 3)	4.297	6.332

802.11n_HT20_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.63	12.461
5785	17.60	12.455
5825	17.57	12.449

802.11n_HT20_Ch1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5745	17.49	12.429
5785	17.58	12.451
5825	17.55	12.442

802.11n _HT40_Ch0

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.025	15.566
5230	36.002	15.563
5270	36.047	15.569
5310	35.985	15.561
5510	36.028	15.566
5550	36.027	15.566
5670	36.033	15.567
5710(U-NII 2C)	31.497	14.983
5710 (U-NII 3)	4.499	6.531

802.11n _HT40_Ch1

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5190	36.057	15.570
5230	36.085	15.573
5270	36.007	15.564
5310	36.072	15.572
5510	36.040	15.568
5550	36.044	15.568
5670	36.042	15.568
5710(U-NII 2C)	31.533	14.988
5710 (U-NII 3)	4.500	6.532

802.11n _HT40_Ch0

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.01	15.565
5795	36.20	15.587

802.11n _HT40_Ch1

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5755	36.16	15.583
5795	36.23	15.590

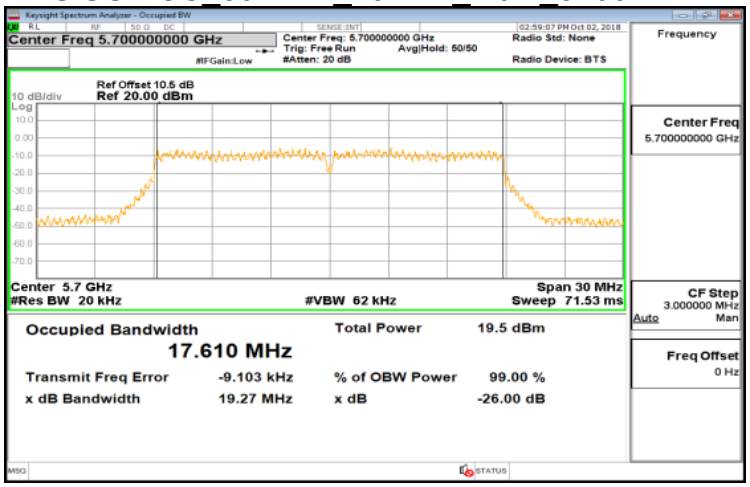
802.11ac _VHT80_Ch0 **802.11ac _VHT80_Ch1**

Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	99% BW (MHz)	10 Log (B) (dB)
5210	75.835	18.799	5210	75.870	18.801
5290	75.923	18.804	5290	75.898	18.802
5530	75.848	18.799	5530	75.744	18.793
5610	75.742	18.793	5610	75.927	18.804
5690(U-NII 2C)	71.057	18.516	5690(U-NII 2C)	71.079	18.517
5690 (U-NII 3)	4.700	6.721	5690 (U-NII 3)	4.706	6.727

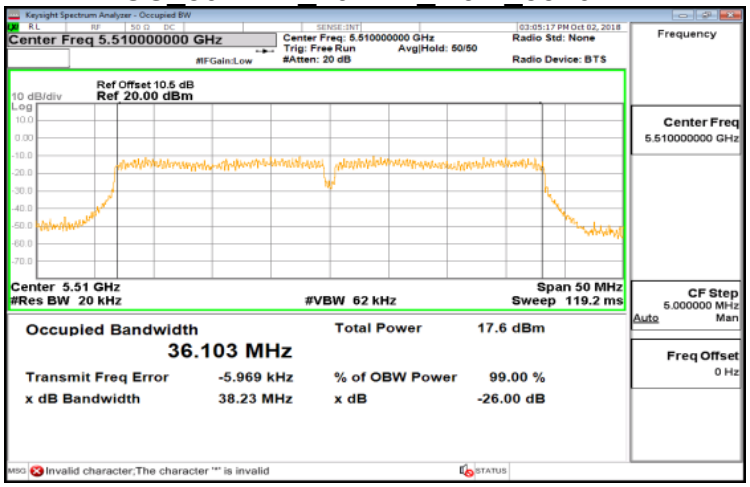
802.11ac _VHT80_Ch0 **802.11ac _VHT80_Ch1**

Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)	Frequency (MHz)	6dB BW (MHz)	10 Log (B) (dB)
5775	76.56	18.840	5775	76.51	18.837

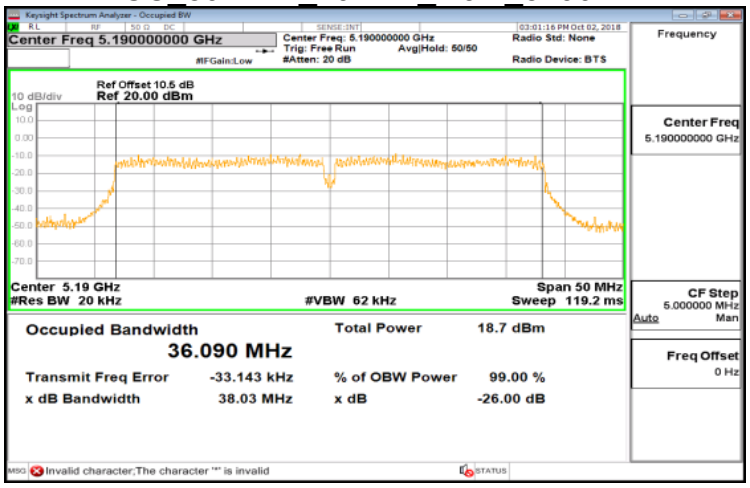
SISO FCC_802.11n_20MHz_Main_5700MHz



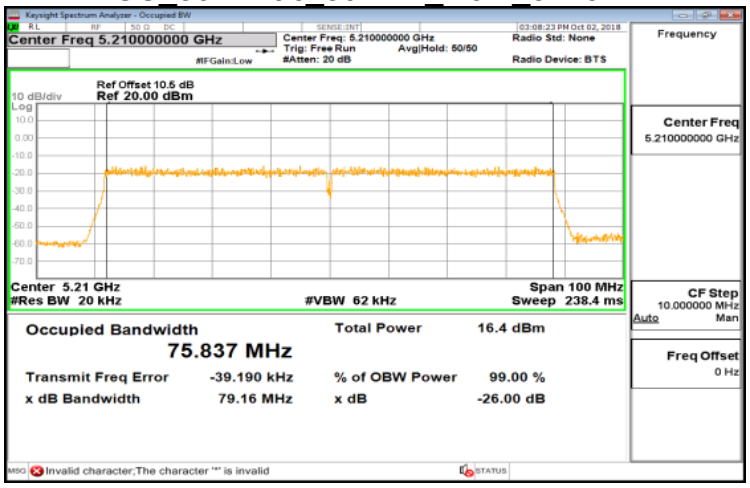
FCC_802.11n_40MHz_Main_5510MHz



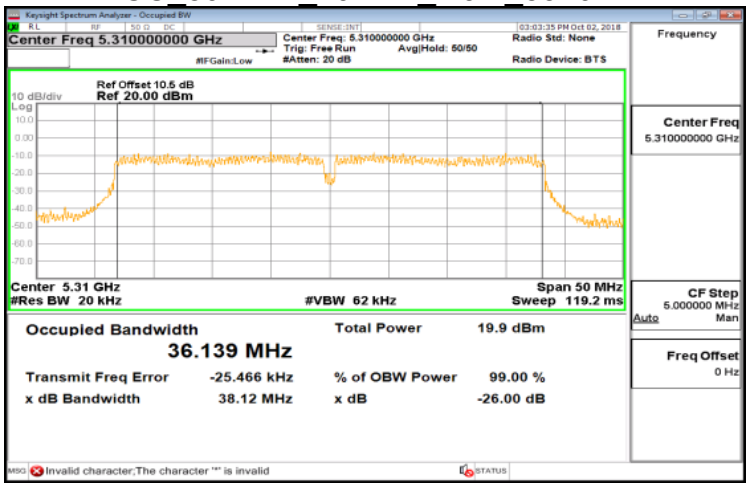
FCC_802.11n_40MHz_Main_5190MHz



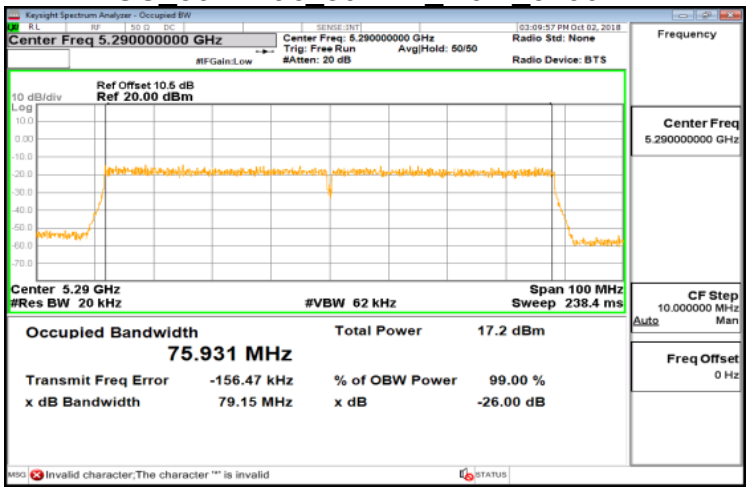
FCC_802.11ac_80MHz_Main_5210MHz



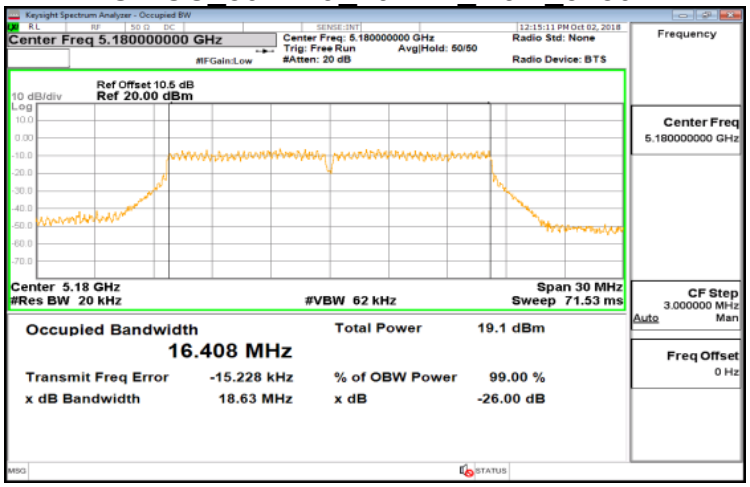
FCC_802.11n_40MHz_Main_5310MHz



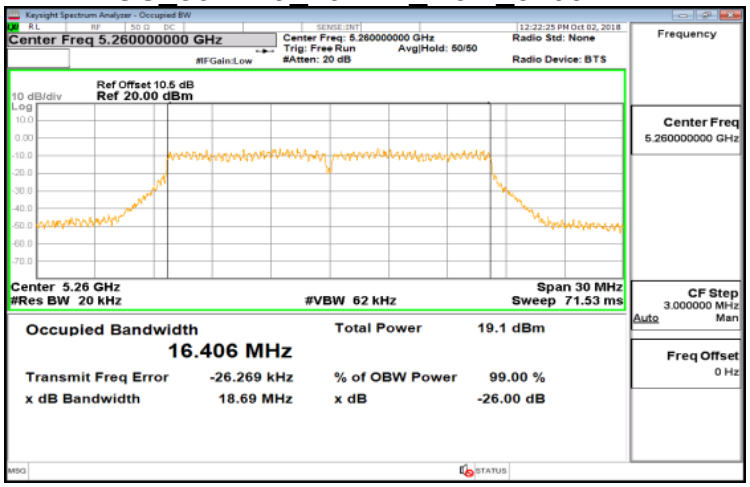
FCC_802.11ac_80MHz_Main_5290MHz



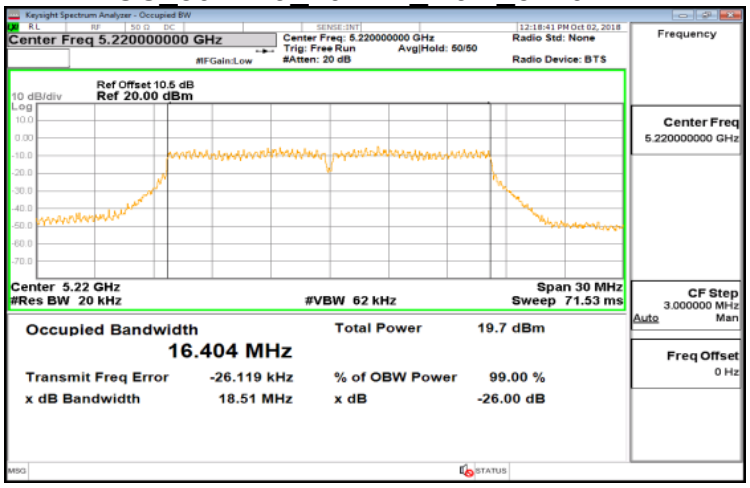
MIMO FCC_802.11a_20MHz_Main_5180MHz



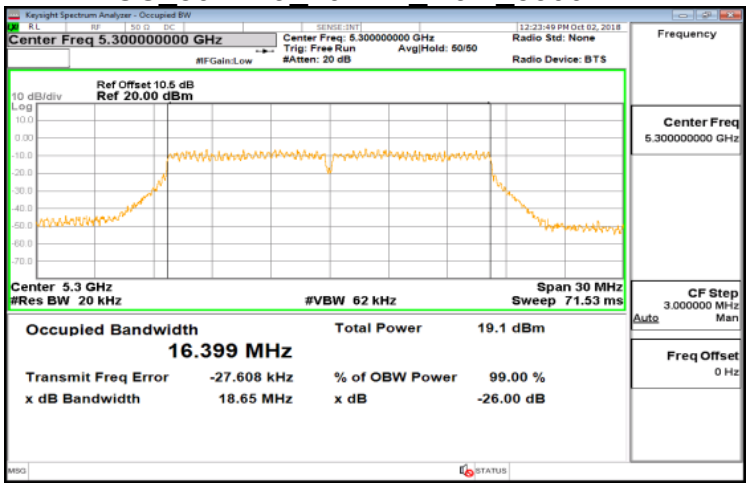
FCC_802.11a_20MHz_Main_5260MHz



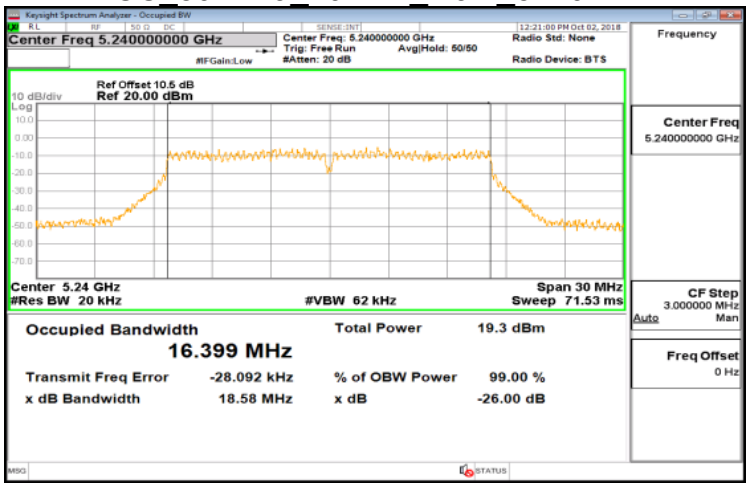
FCC_802.11a_20MHz_Main_5220MHz



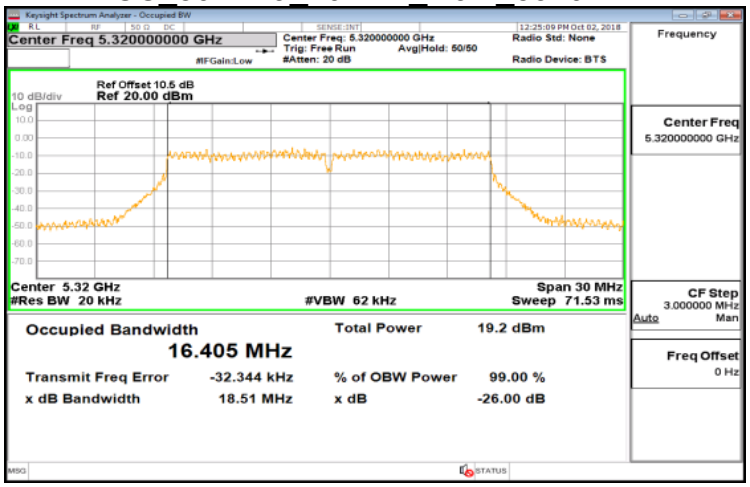
FCC_802.11a_20MHz_Main_5300MHz



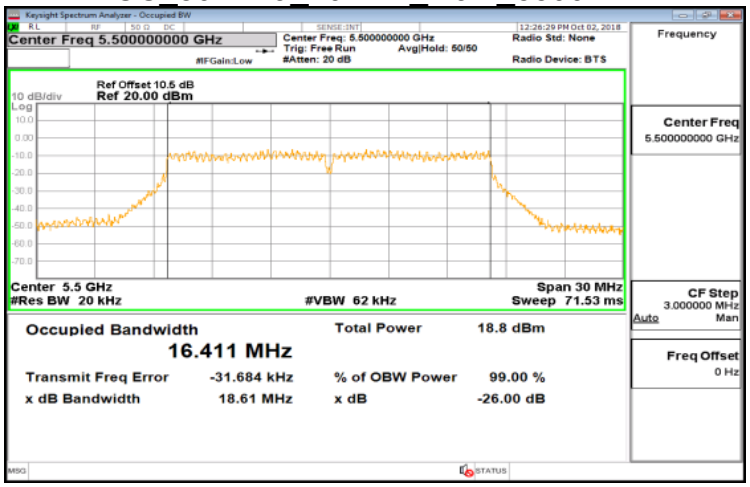
FCC_802.11a_20MHz_Main_5240MHz



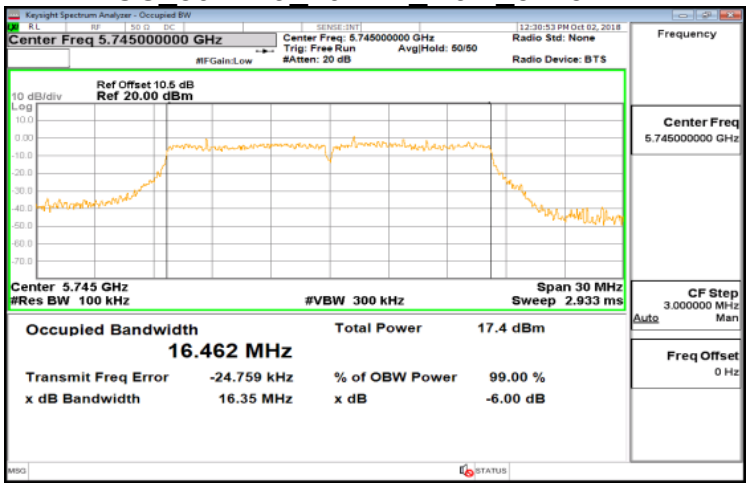
FCC_802.11a_20MHz_Main_5320MHz



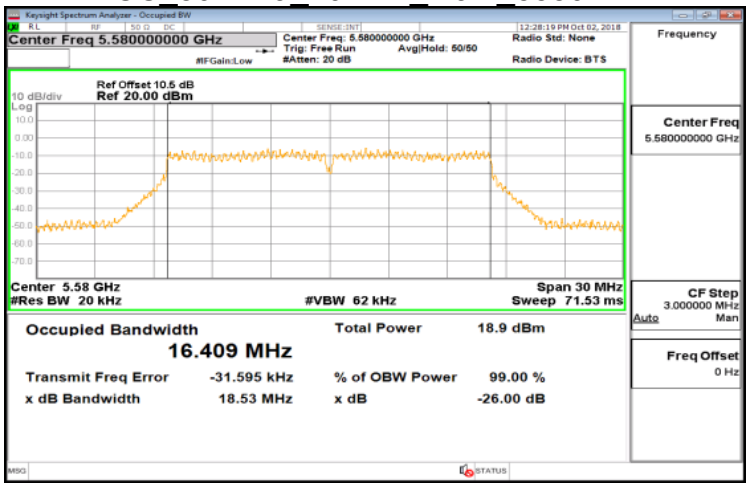
FCC_802.11a_20MHz_Main_5500MHz



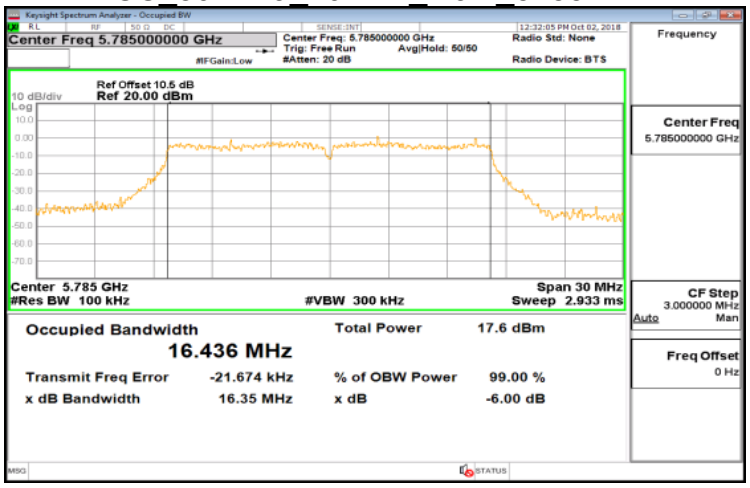
FCC_802.11a_20MHz_Main_5745MHz



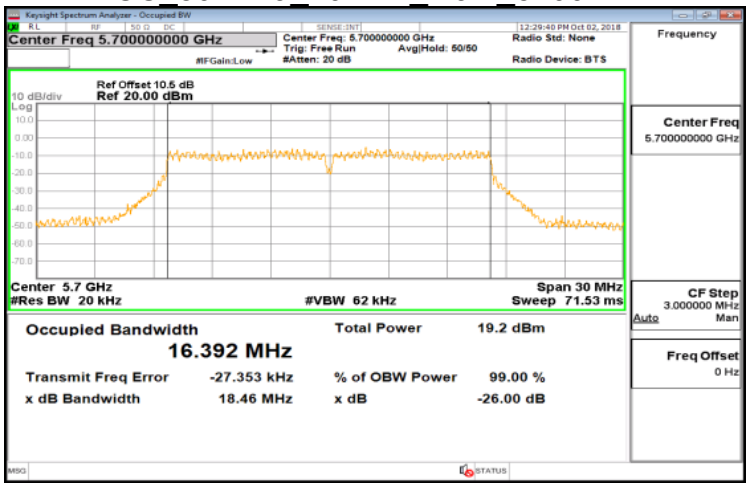
FCC_802.11a_20MHz_Main_5580MHz



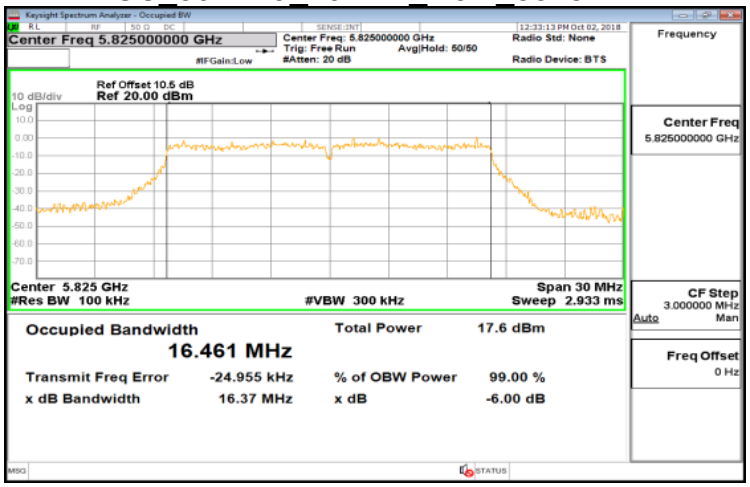
FCC_802.11a_20MHz_Main_5785MHz



FCC_802.11a_20MHz_Main_5700MHz

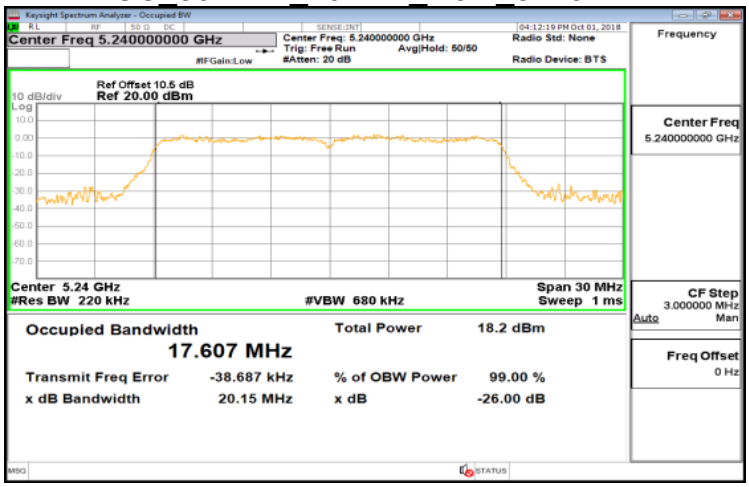


FCC_802.11a_20MHz_Main_5825MHz

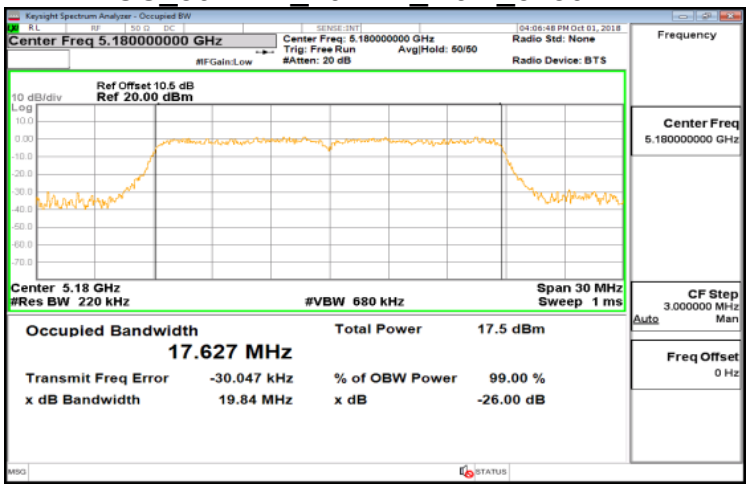


FCC_802.11a_20MHz_Chain0_5720MHz

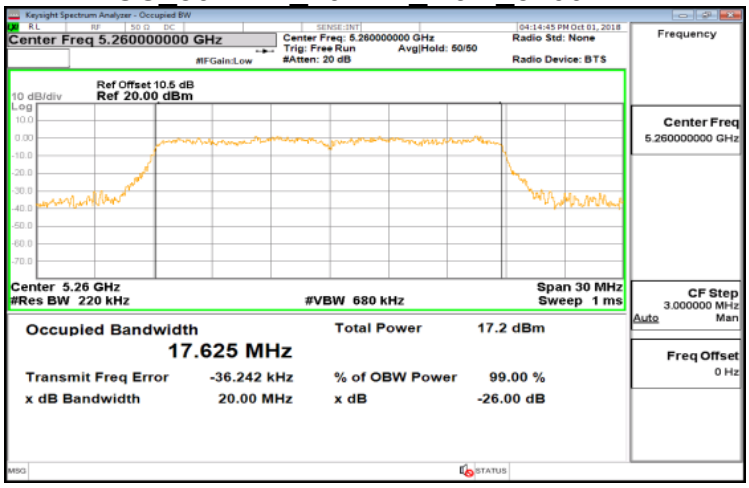
FCC_802.11n_20MHz_Main_5240MHz



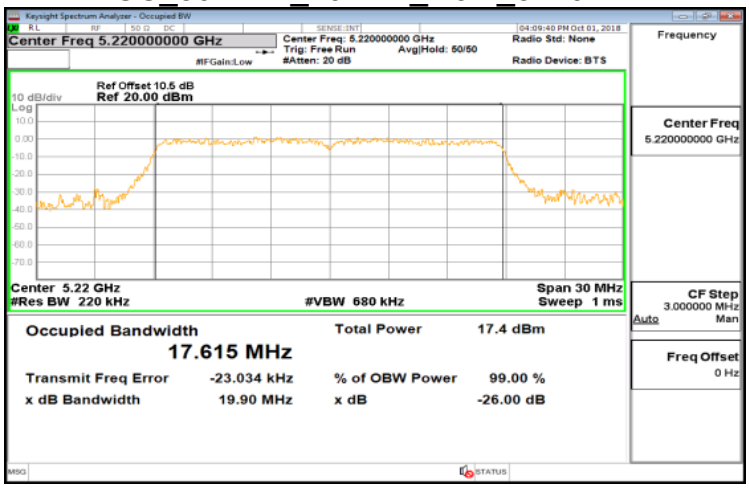
FCC_802.11n_20MHz_Main_5180MHz



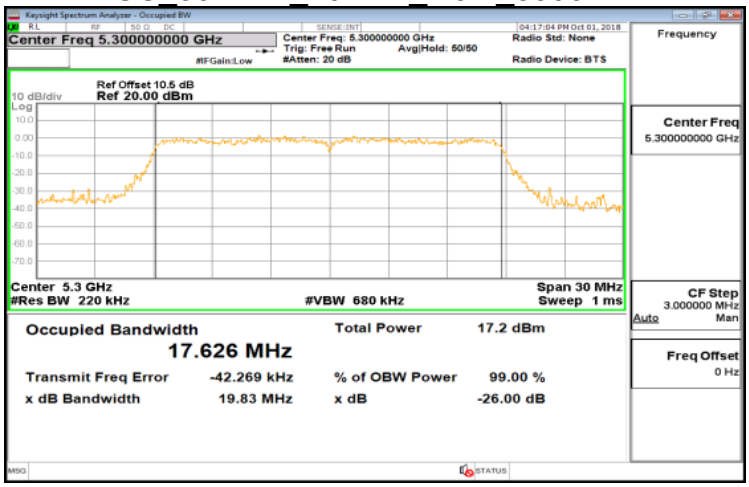
FCC_802.11n_20MHz_Main_5260MHz



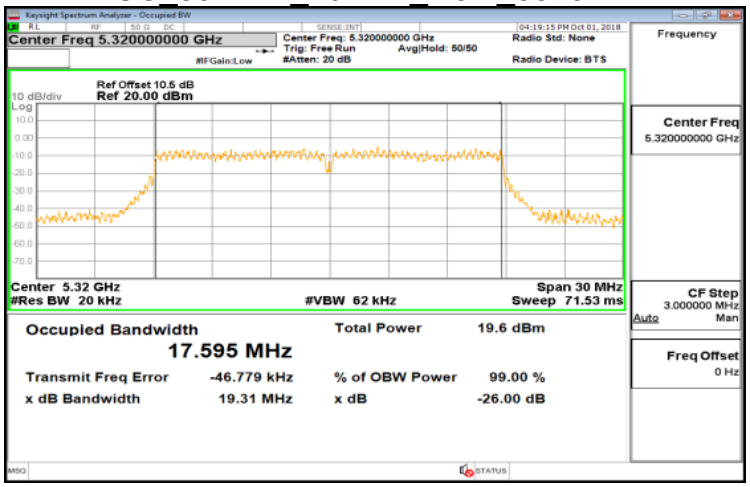
FCC_802.11n_20MHz_Main_5220MHz



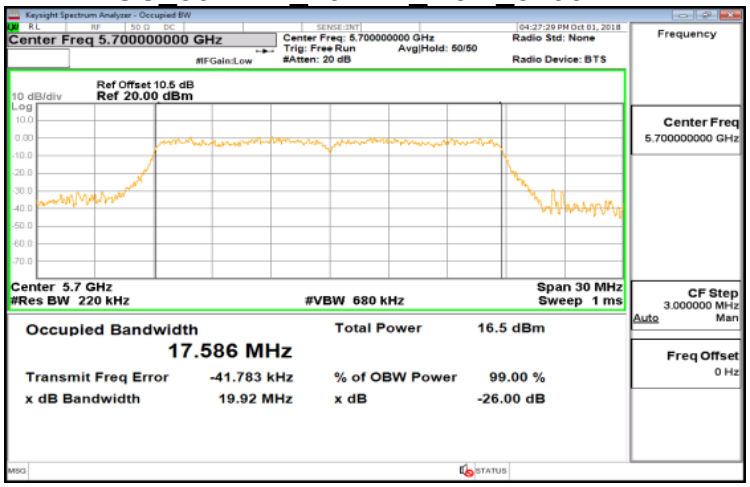
FCC_802.11n_20MHz_Main_5300MHz



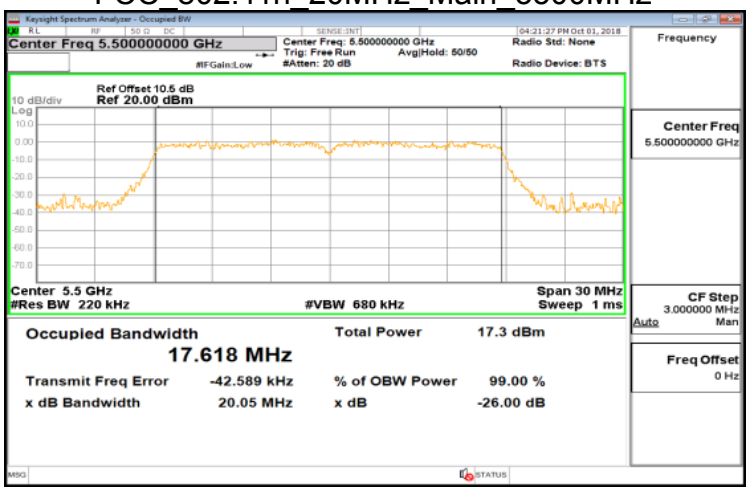
FCC_802.11n_20MHz_Main_5320MHz



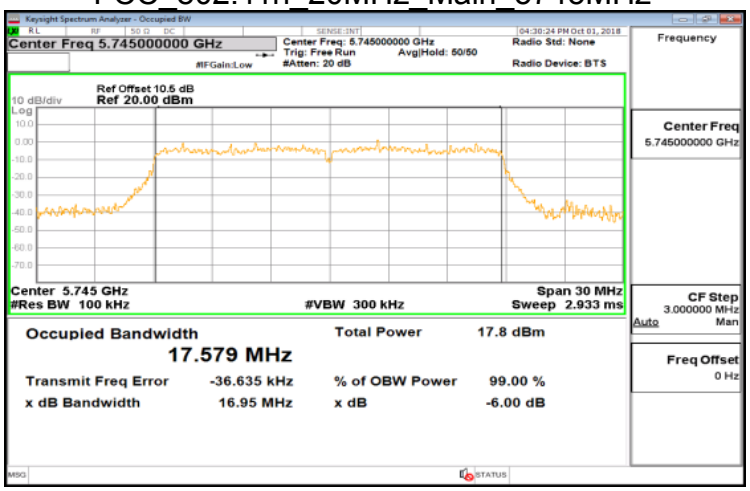
FCC_802.11n_20MHz_Main_5700MHz



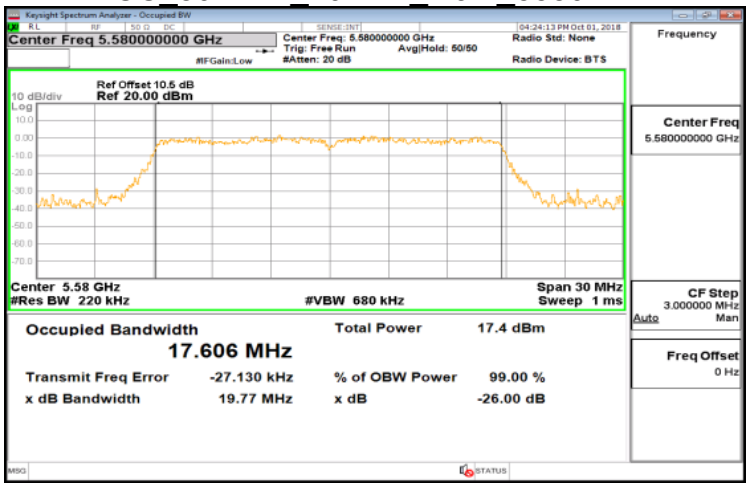
FCC_802.11n_20MHz_Main_5500MHz



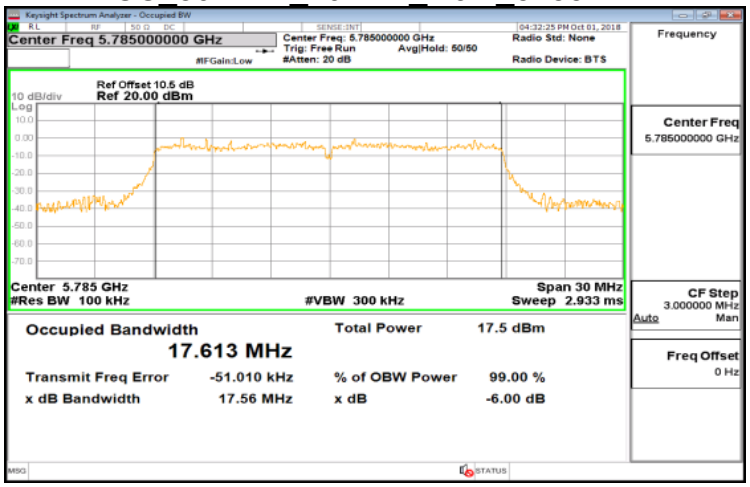
FCC_802.11n_20MHz_Main_5745MHz



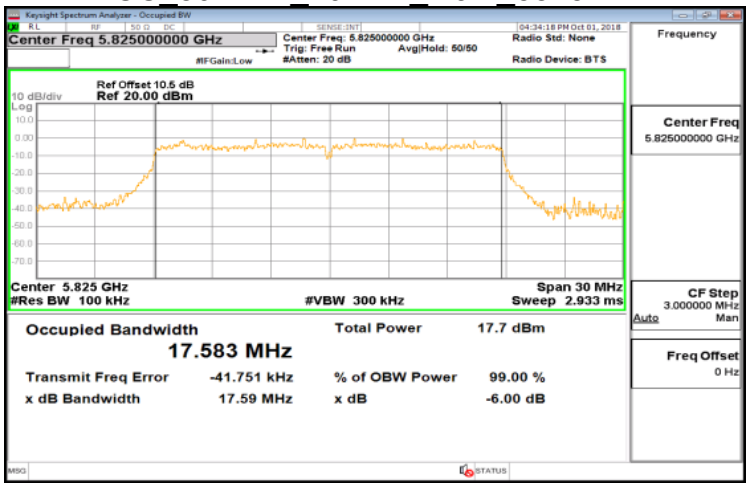
FCC_802.11n_20MHz_Main_5580MHz



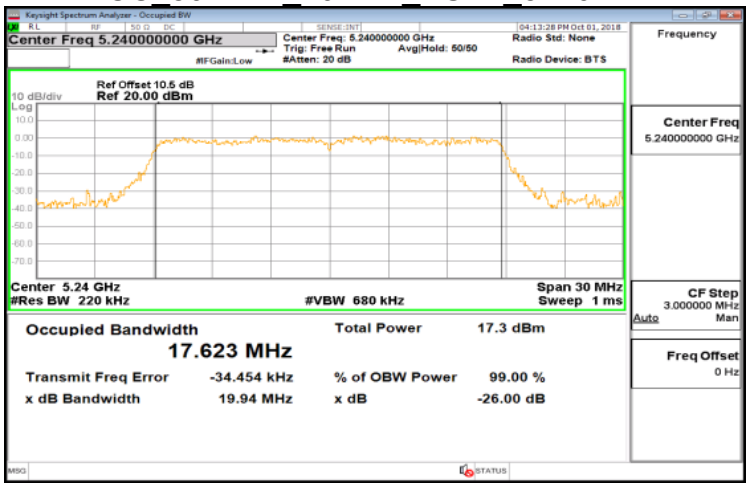
FCC_802.11n_20MHz_Main_5785MHz



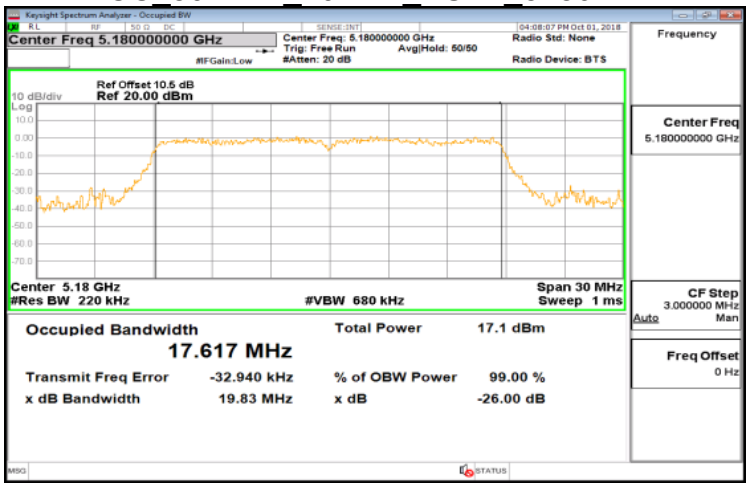
FCC_802.11n_20MHz_Main_5825MHz



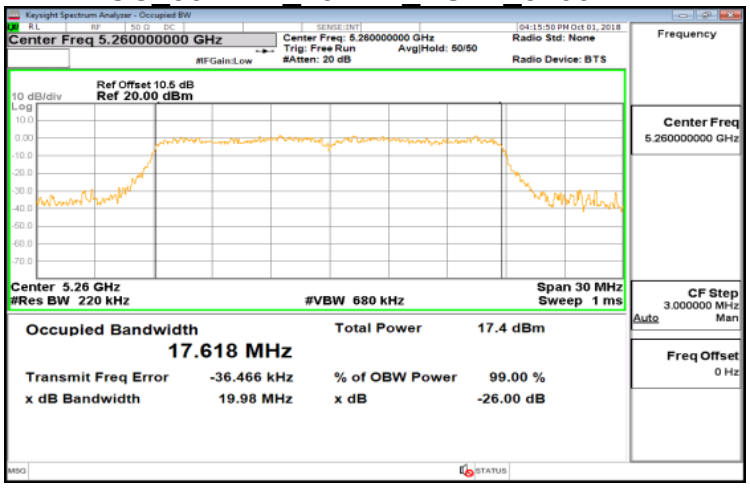
FCC_802.11n_20MHz_AUX1_5240MHz



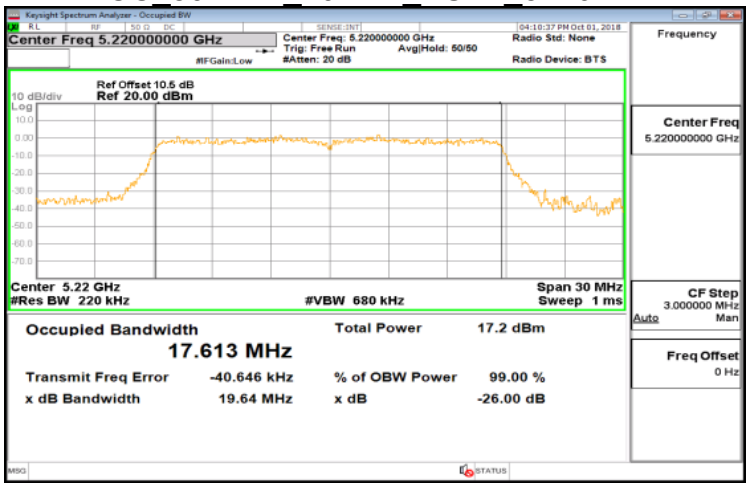
FCC_802.11n_20MHz_AUX1_5180MHz



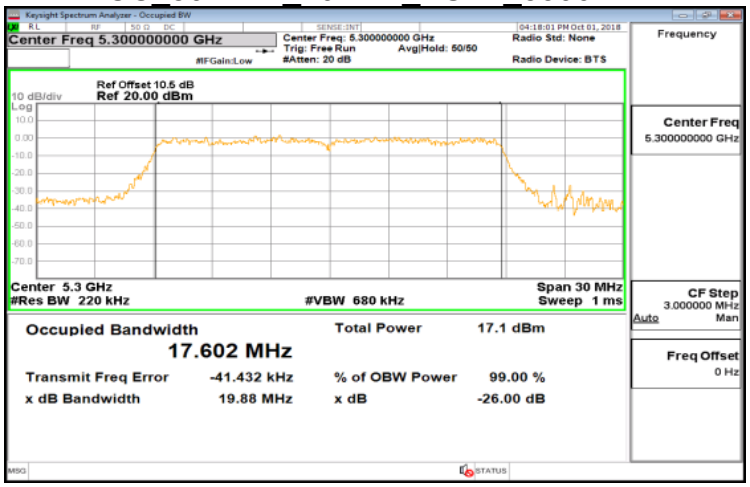
FCC_802.11n_20MHz_AUX1_5260MHz



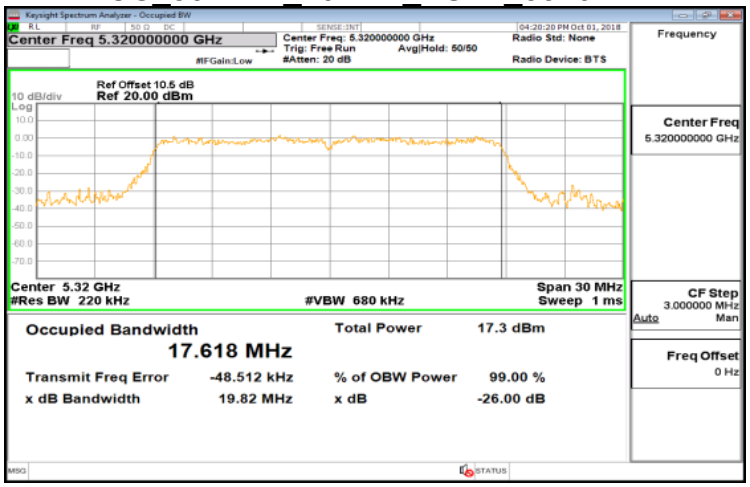
FCC_802.11n_20MHz_AUX1_5220MHz



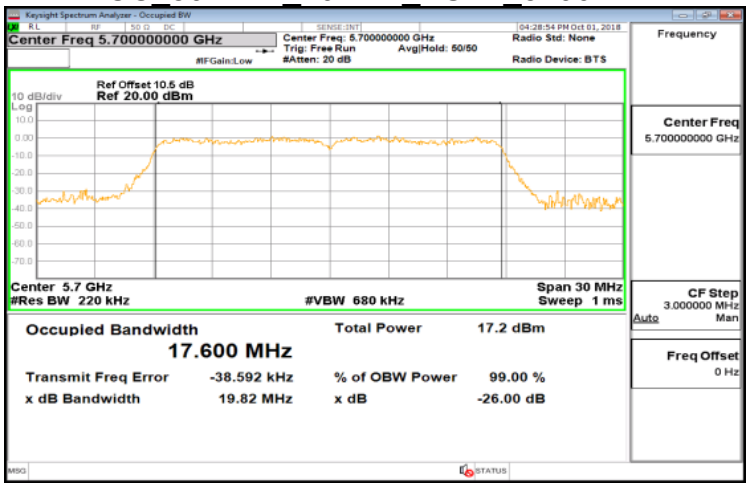
FCC_802.11n_20MHz_AUX1_5300MHz



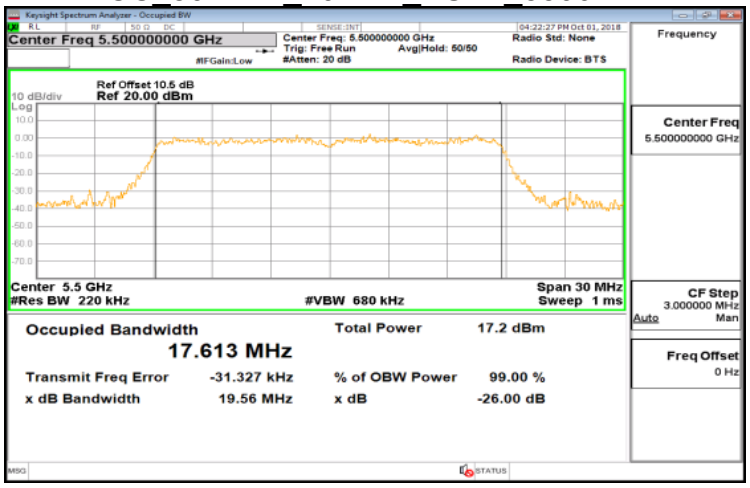
FCC_802.11n_20MHz_AUX1_5320MHz



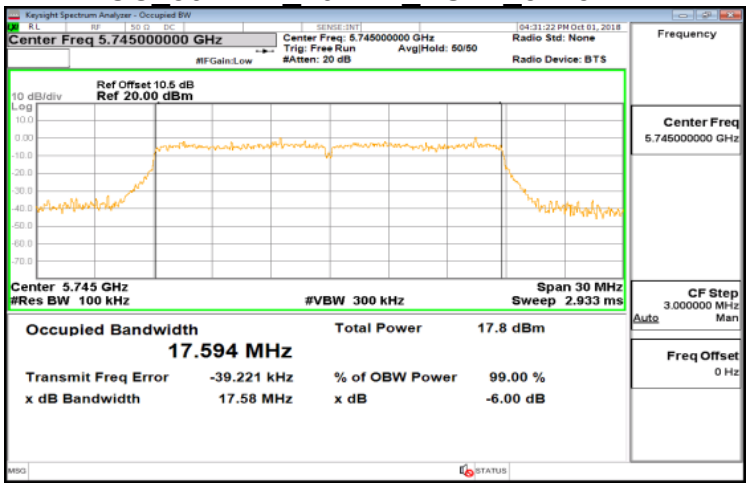
FCC_802.11n_20MHz_AUX1_5700MHz



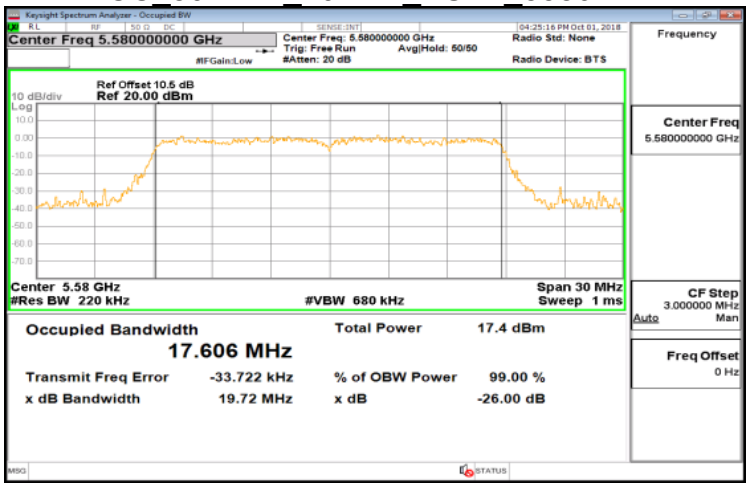
FCC_802.11n_20MHz_AUX1_5500MHz



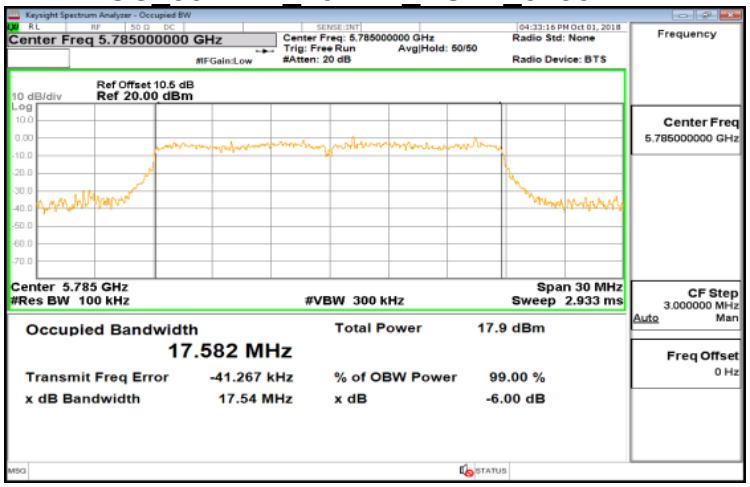
FCC_802.11n_20MHz_AUX1_5745MHz



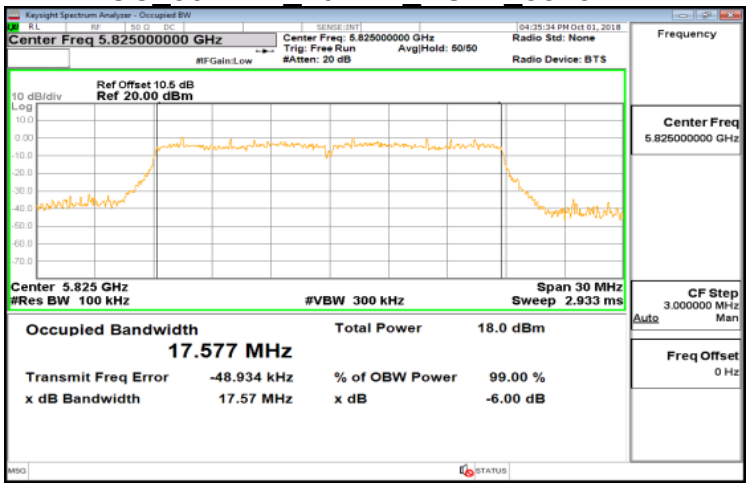
FCC_802.11n_20MHz_AUX1_5580MHz



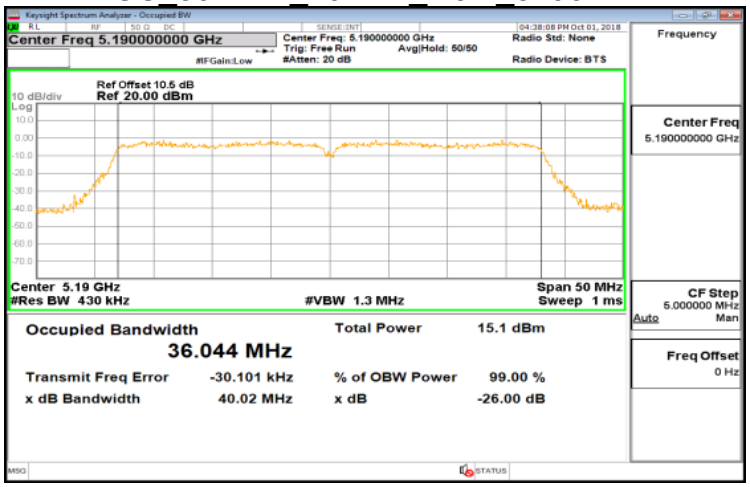
FCC_802.11n_20MHz_AUX1_5785MHz



FCC_802.11n_20MHz_AUX1_5825MHz

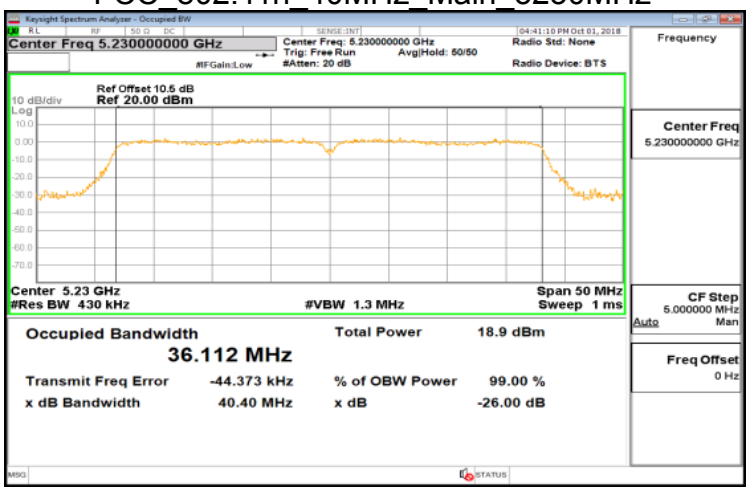


FCC_802.11n_40MHz_Main_5190MHz



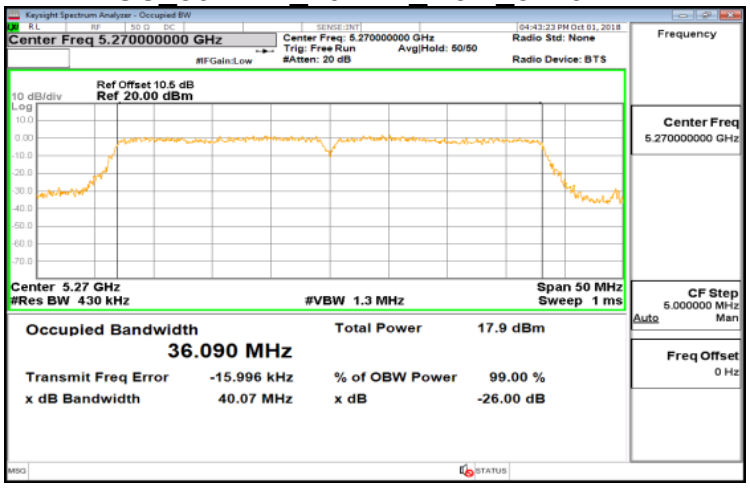
FCC_802.11n_20MHz_Chain0_5720MHz

FCC_802.11n_40MHz_Main_5230MHz

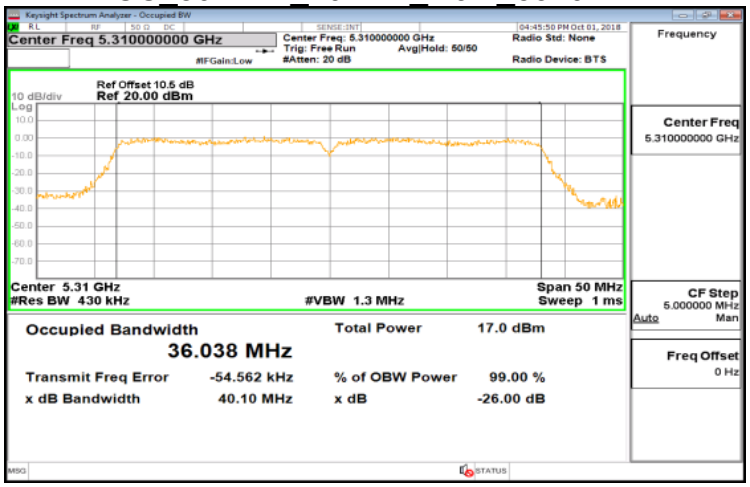


FCC_802.11n_20MHz_Chain1_5720MHz

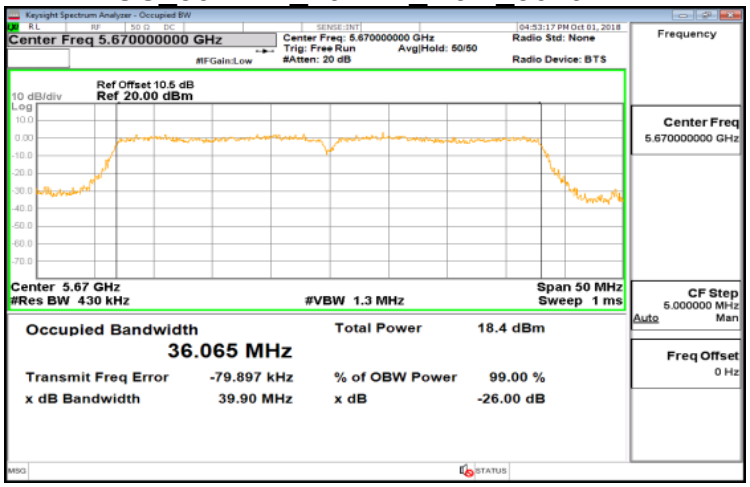
FCC_802.11n_40MHz_Main_5270MHz



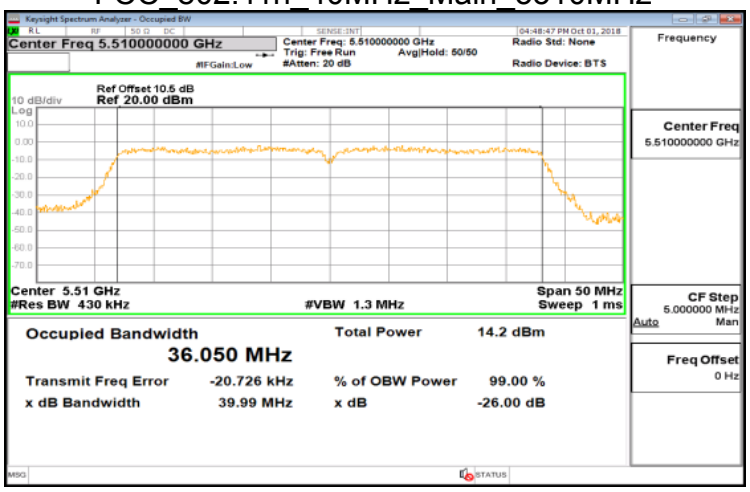
FCC_802.11n_40MHz_Main_5310MHz



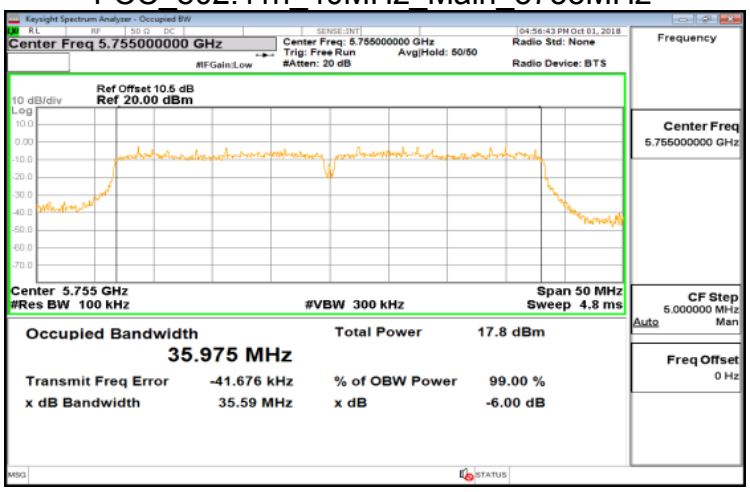
FCC_802.11n_40MHz_Main_5670MHz



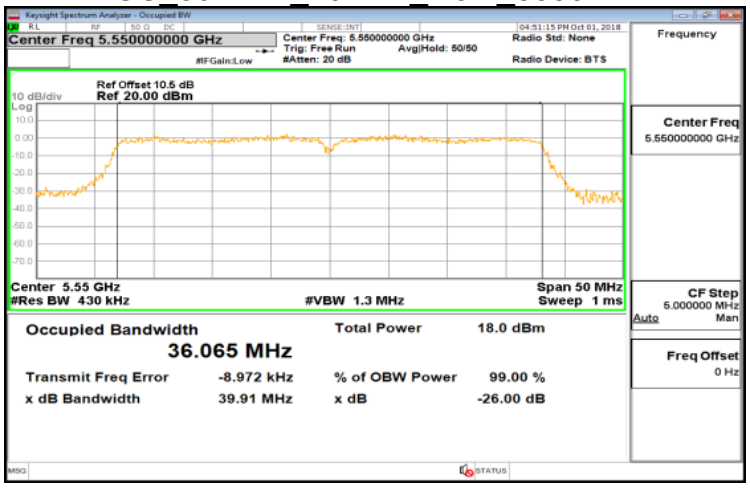
FCC_802.11n_40MHz_Main_5510MHz



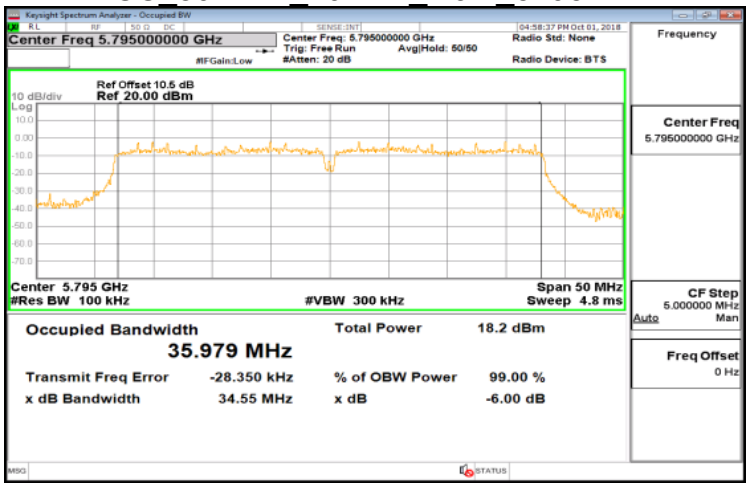
FCC_802.11n_40MHz_Main_5755MHz



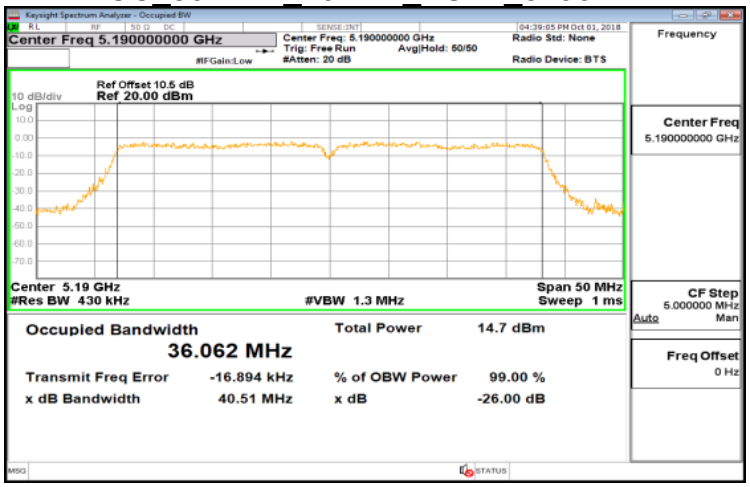
FCC_802.11n_40MHz_Main_5550MHz



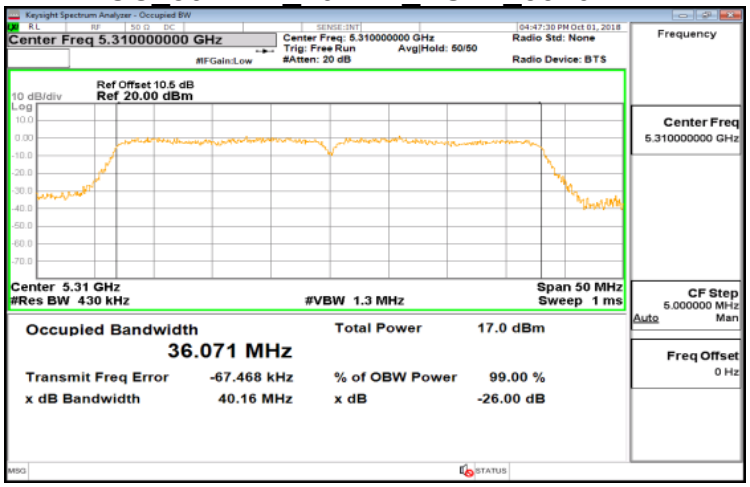
FCC_802.11n_40MHz_Main_5795MHz



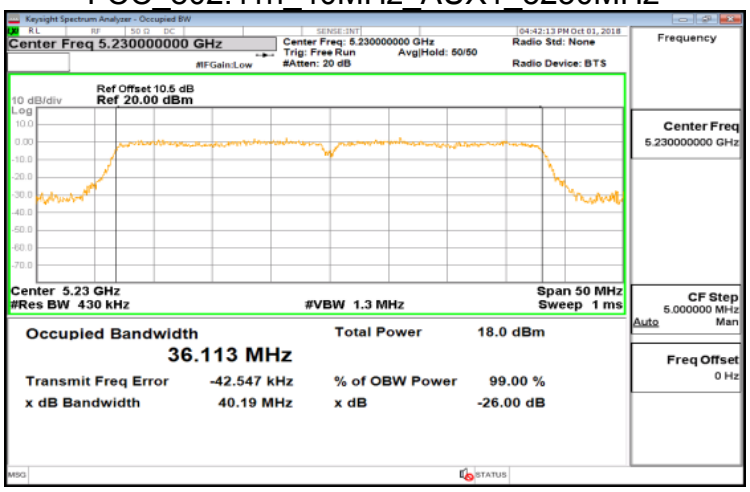
FCC_802.11n_40MHz_AUX1_5190MHz



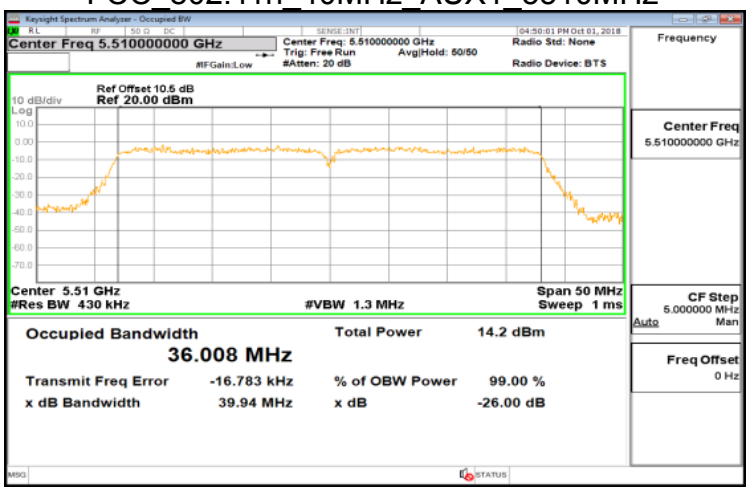
FCC_802.11n_40MHz_AUX1_5310MHz



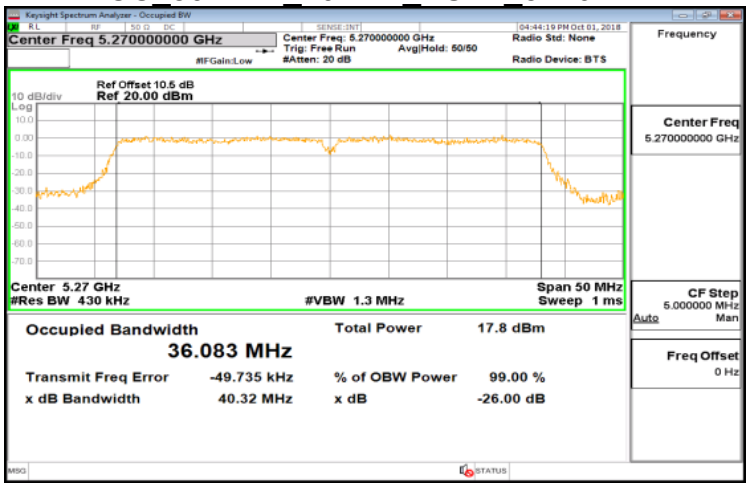
FCC_802.11n_40MHz_AUX1_5230MHz



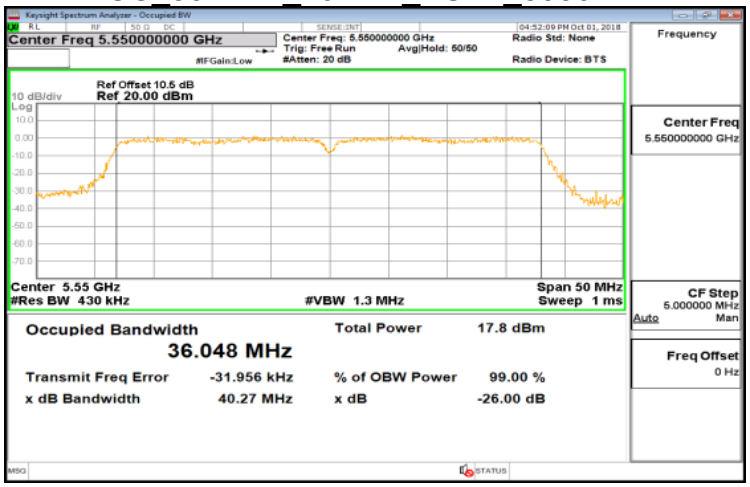
FCC_802.11n_40MHz_AUX1_5510MHz



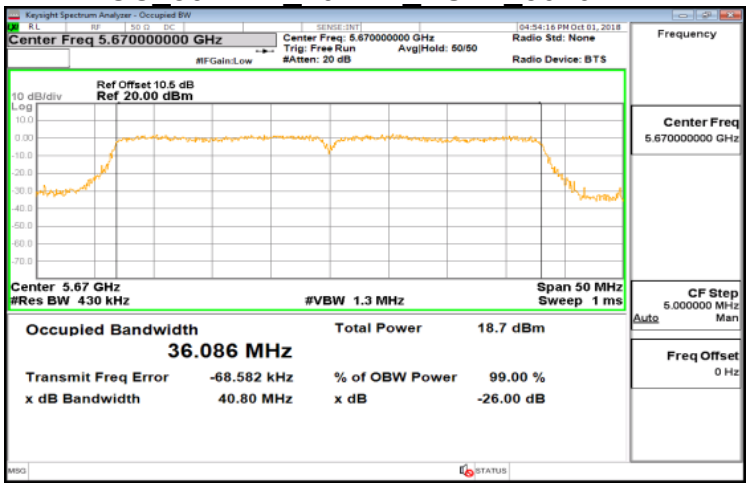
FCC_802.11n_40MHz_AUX1_5270MHz



FCC_802.11n_40MHz_AUX1_5550MHz

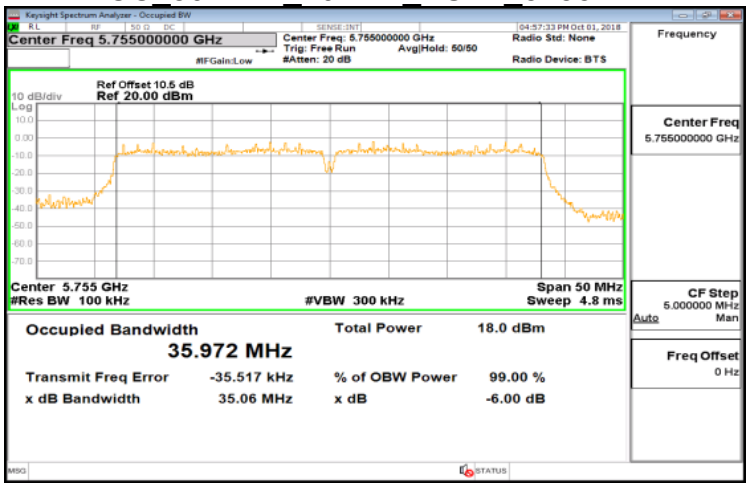


FCC_802.11n_40MHz_AUX1_5670MHz



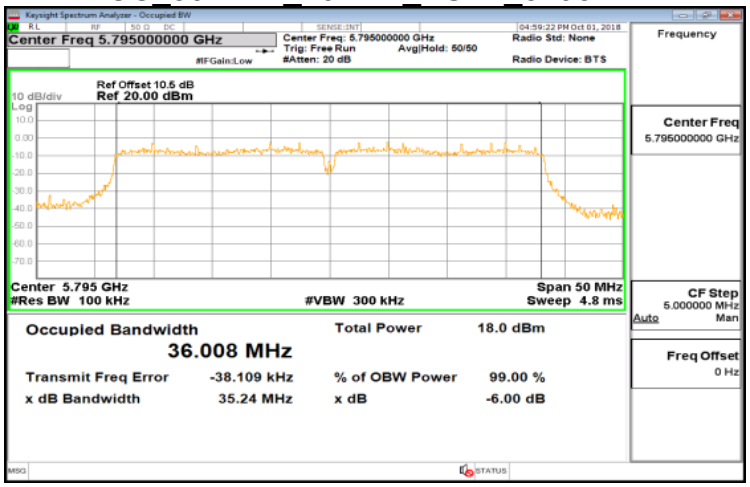
FCC_802.11n_40MHz_Chain0_5710MHz

FCC_802.11n_40MHz_AUX1_5755MHz

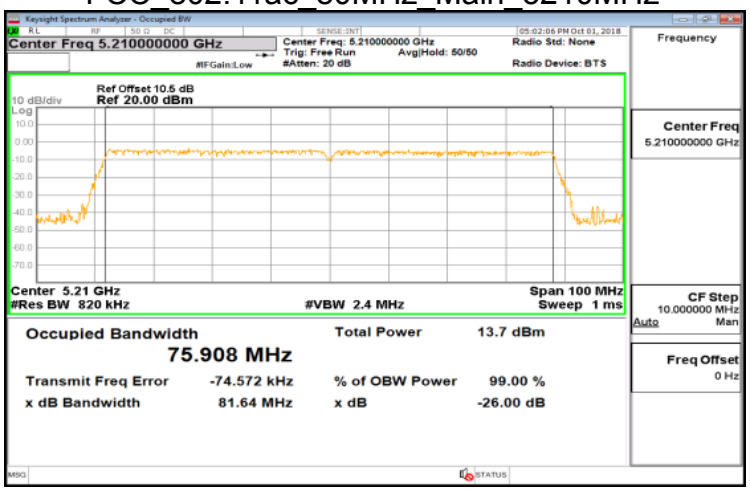


FCC_802.11n_40MHz_Chain1_5710MHz

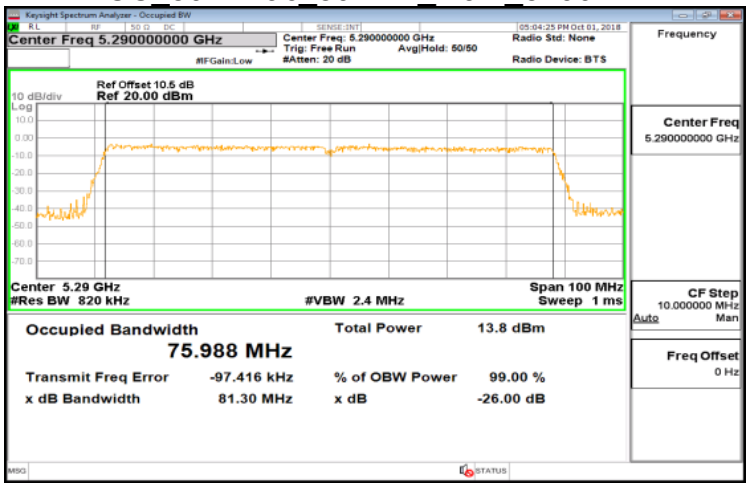
FCC_802.11n_40MHz_AUX1_5795MHz



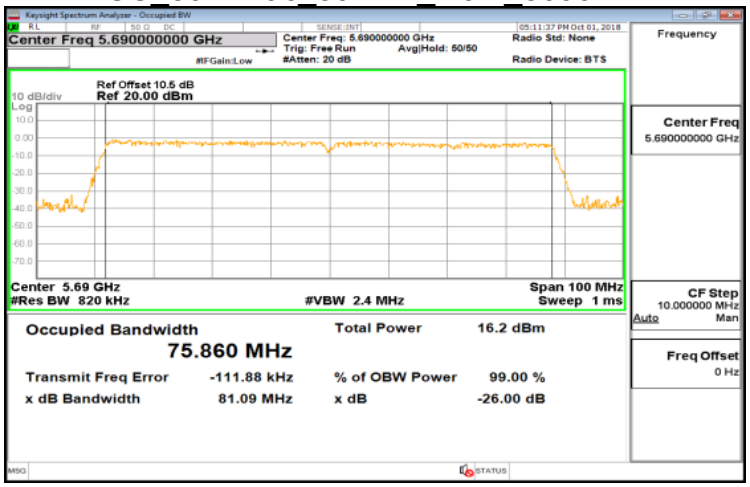
FCC_802.11ac_80MHz_Main_5210MHz



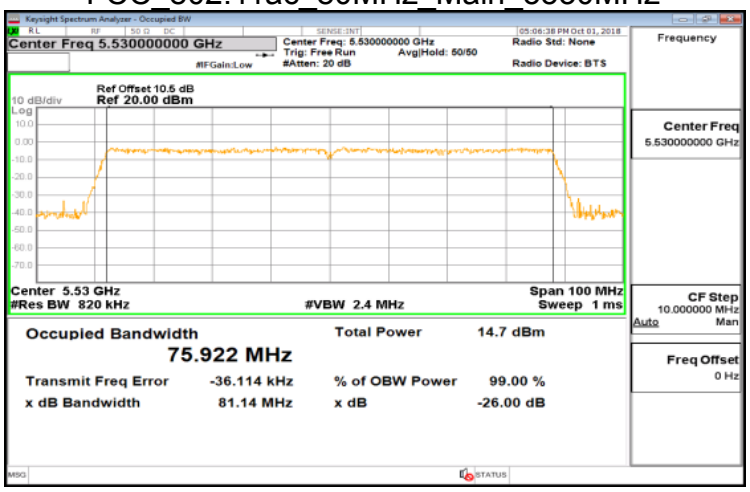
FCC_802.11ac_80MHz_Main_5290MHz



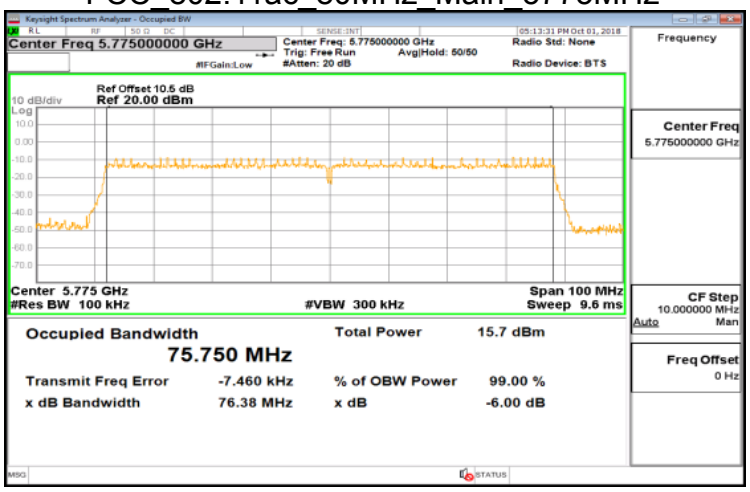
FCC_802.11ac_80MHz_Main_5690MHz



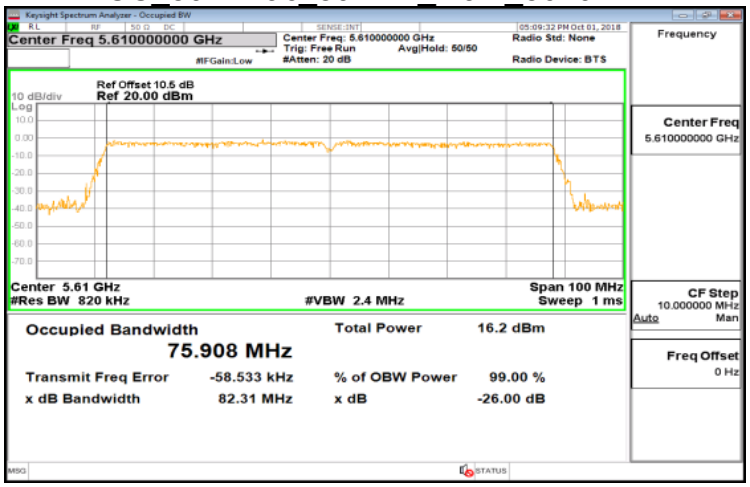
FCC_802.11ac_80MHz_Main_5530MHz



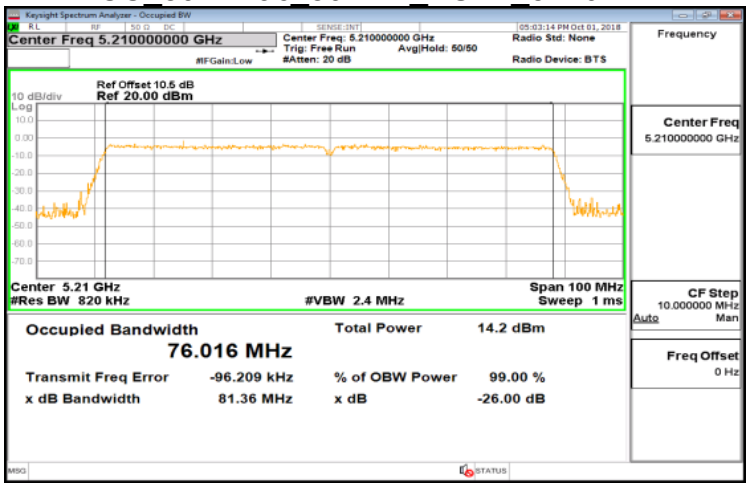
FCC_802.11ac_80MHz_Main_5775MHz



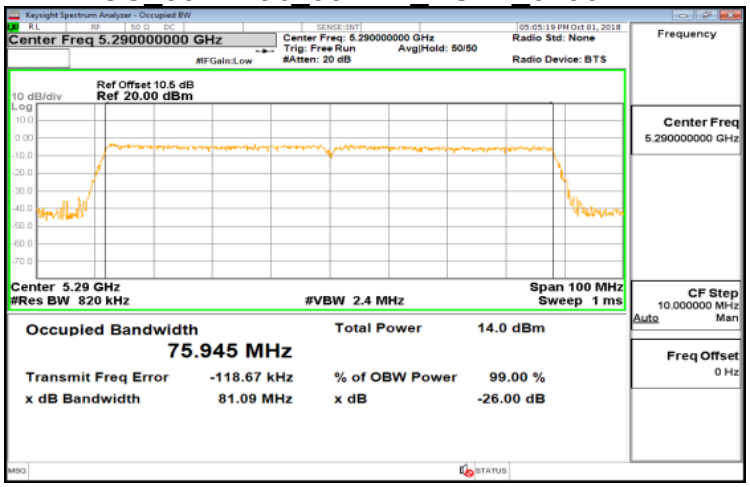
FCC_802.11ac_80MHz_Main_5610MHz



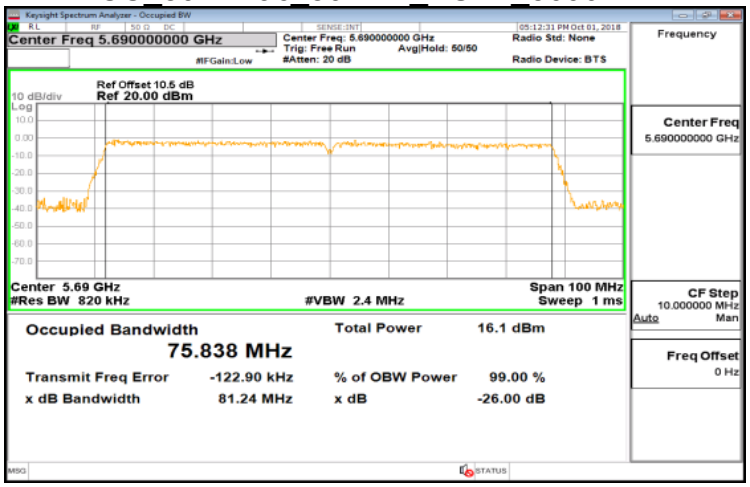
FCC_802.11ac_80MHz_AUX1_5210MHz



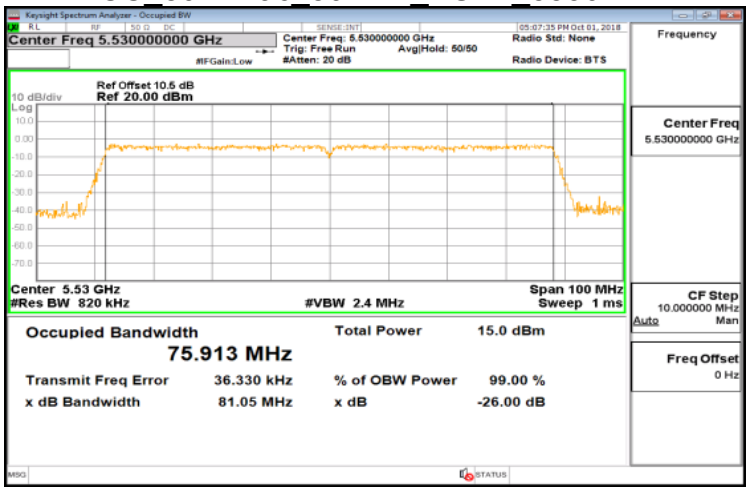
FCC_802.11ac_80MHz_AUX1_5290MHz



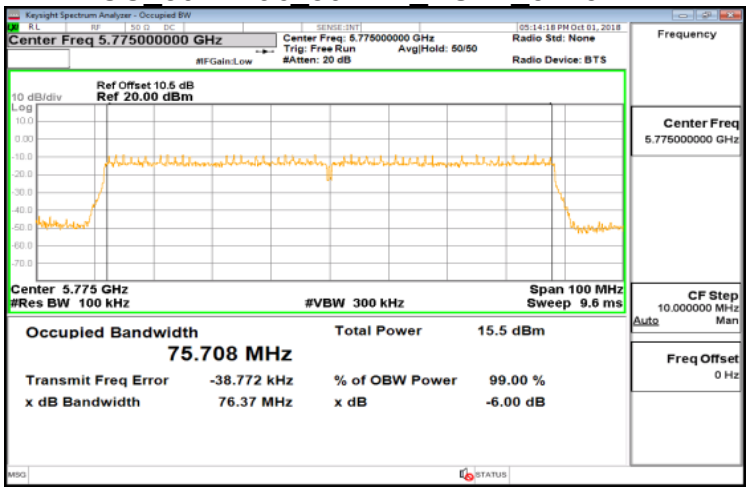
FCC_802.11ac_80MHz_AUX1_5690MHz



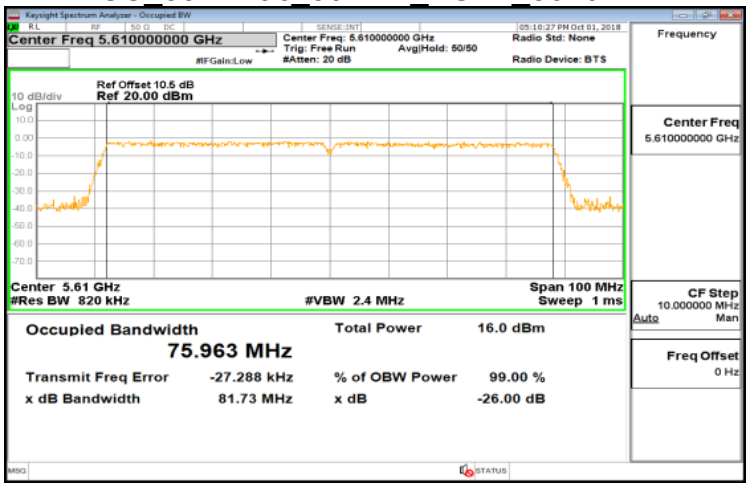
FCC_802.11ac_80MHz_AUX1_5530MHz



FCC_802.11ac_80MHz_AUX1_5775MHz



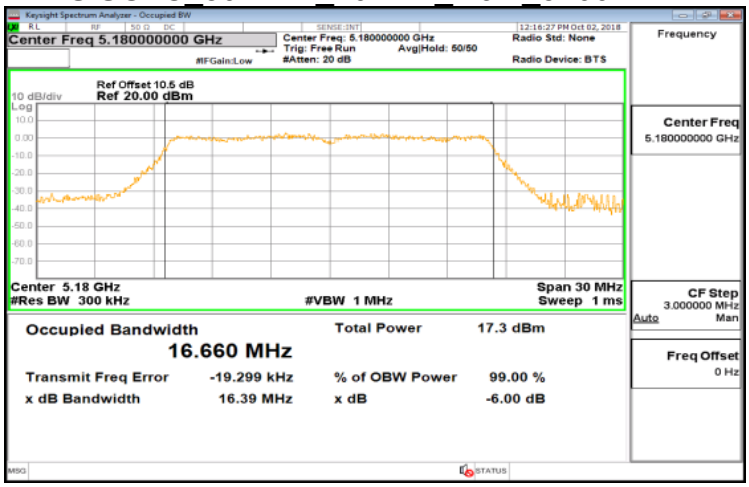
FCC_802.11ac_80MHz_AUX1_5610MHz



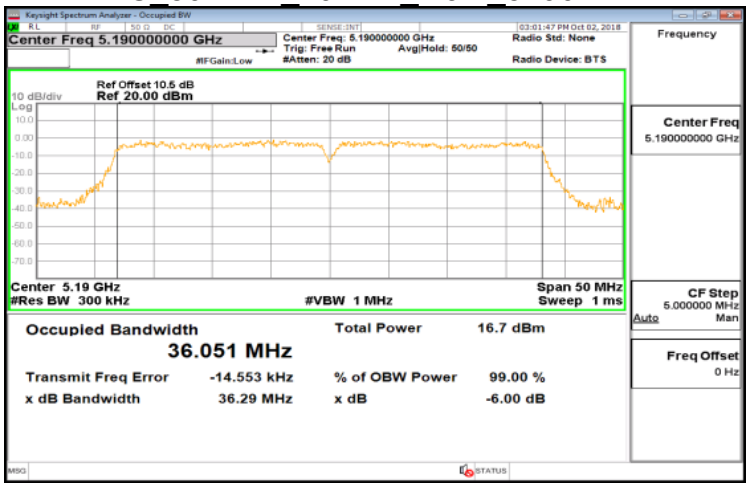
FCC_802.11ac_80MHz_Chain0_5690MHz

FCC_802.11ac_80MHz_Chain1_5690MHz

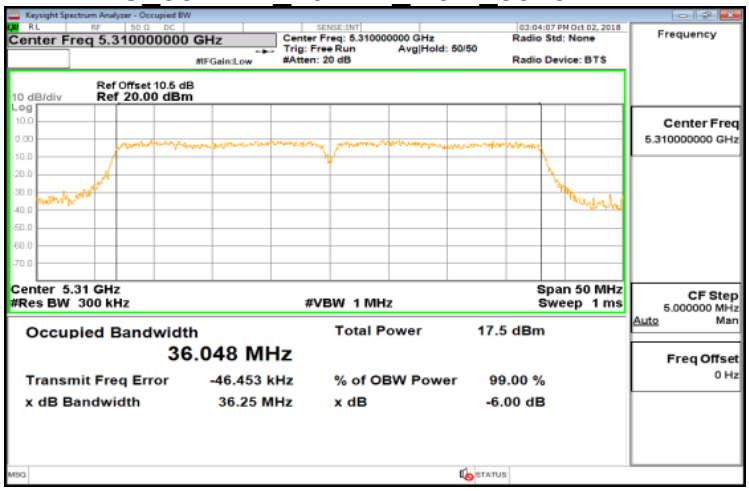
SISO IC_802.11n_20MHz_Main_5700MHz



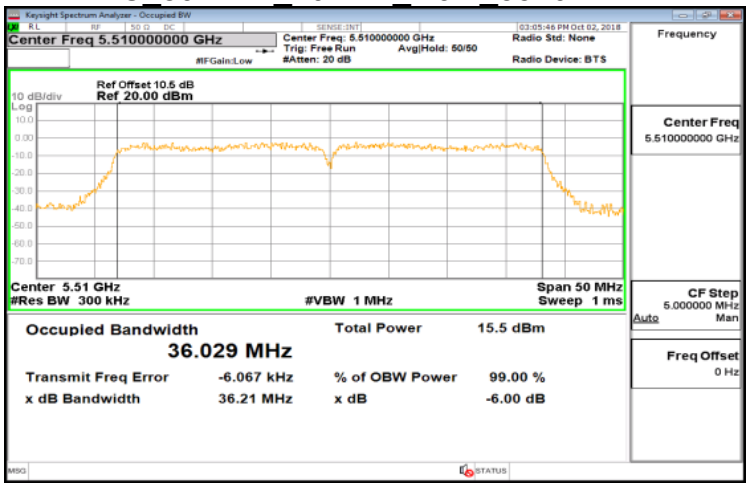
IC_802.11n_40MHz_Main_5190MHz



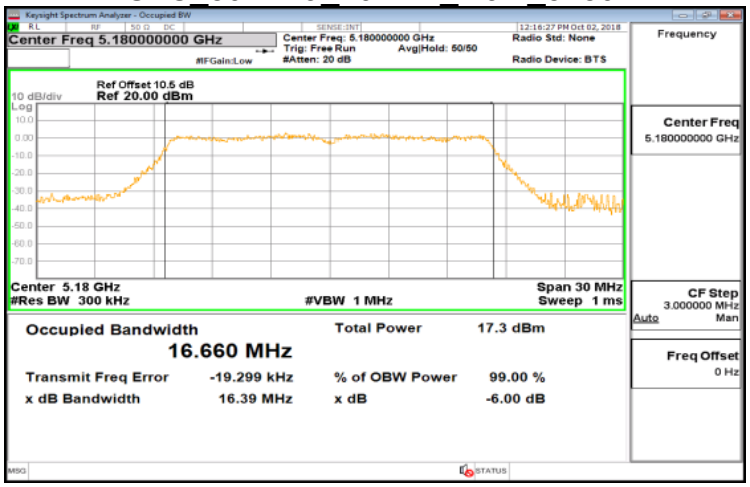
IC_802.11n_40MHz_Main_5310MHz



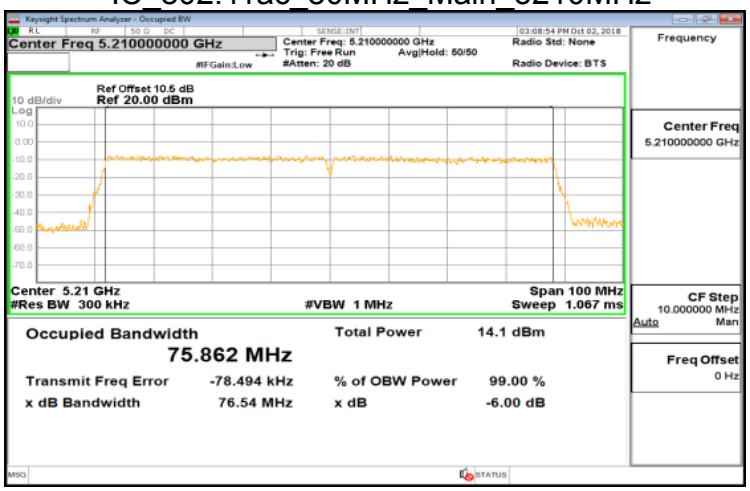
IC_802.11n_40MHz_Main_5510MHz



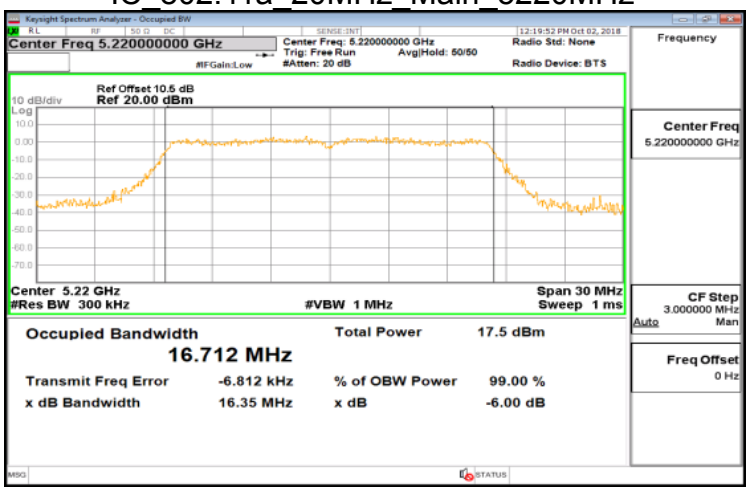
MIMO IC_802.11a_20MHz_Main_5180MHz



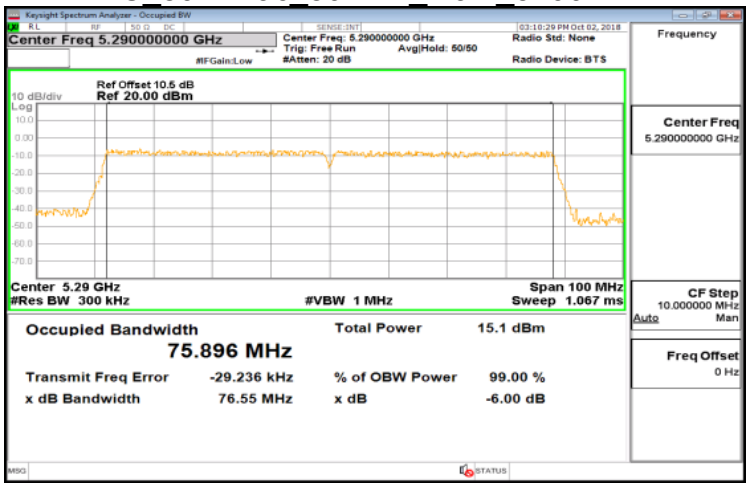
IC_802.11ac_80MHz_Main_5210MHz



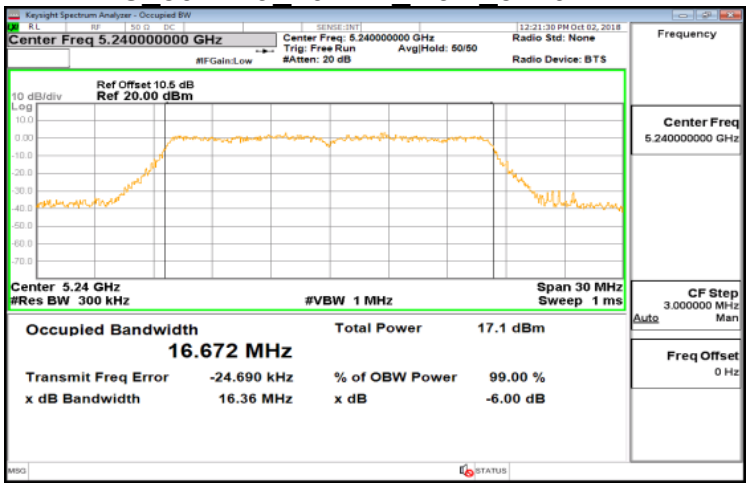
IC_802.11a_20MHz_Main_5220MHz



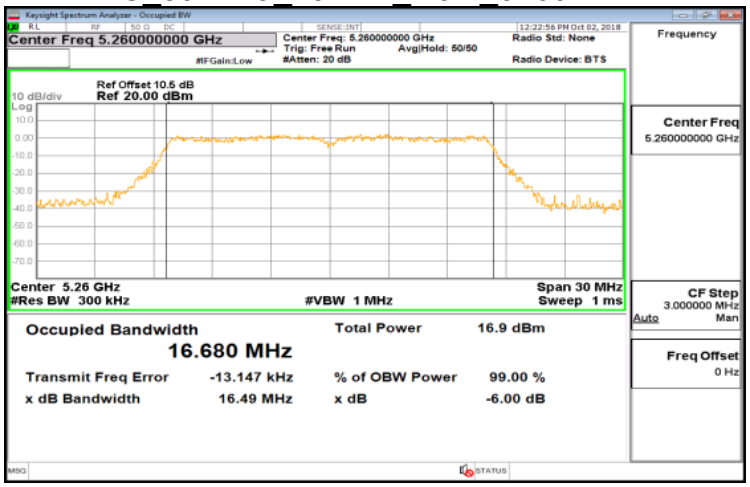
IC_802.11ac_80MHz_Main_5290MHz



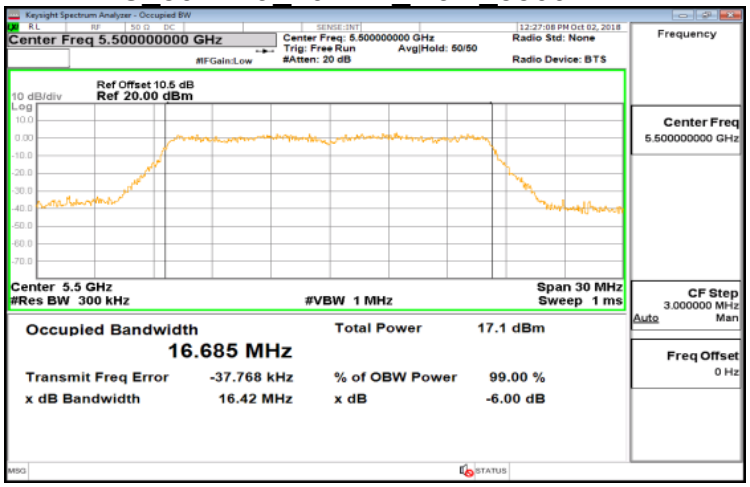
IC_802.11a_20MHz_Main_5240MHz



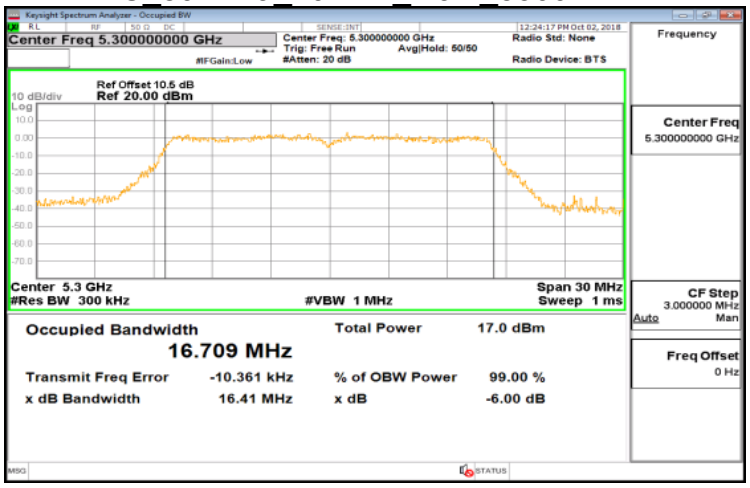
IC_802.11a_20MHz_Main_5260MHz



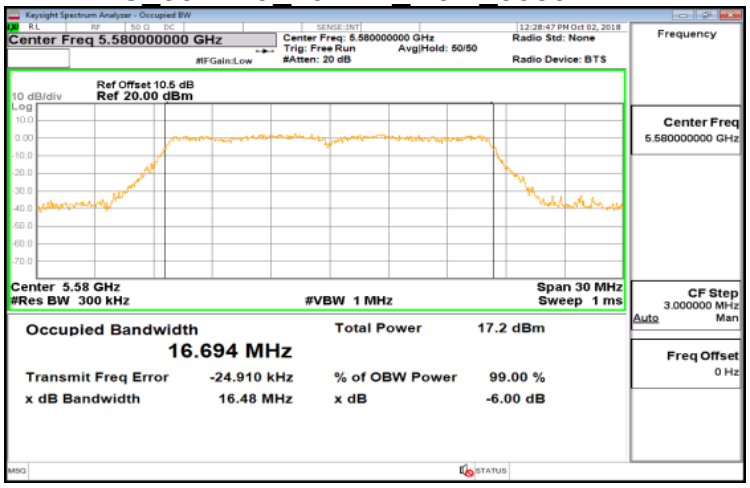
IC_802.11a_20MHz_Main_5500MHz



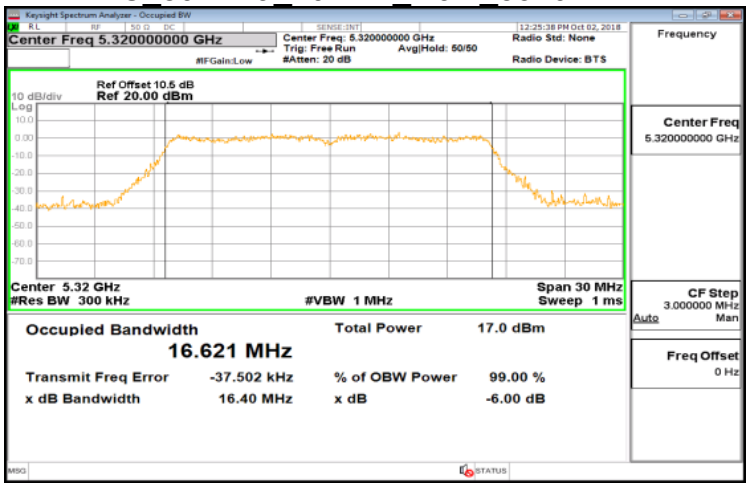
IC_802.11a_20MHz_Main_5300MHz



IC_802.11a_20MHz_Main_5580MHz



IC_802.11a_20MHz_Main_5320MHz



IC_802.11a_20MHz_Main_5700MHz