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FCC UNII REPORT

Certification

Applicant Name:
SAMSUNG Electronics Co., Ltd.

Address:
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Date of Issue:
June 14, 2021

Test Site/Location:
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA

Report No.: HCT-RF-2106-FC022

FCC ID:	**A3LSMG990B**
APPLICANT:	**SAMSUNG Electronics Co., Ltd.**

Model:	SM-G990B/DS
Additional Model:	SM-G990B
EUT Type:	Mobile Phone
Modulation type	OFDM
FCC Classification:	Unlicensed National Information Infrastructure(NII)
FCC Rule Part(s):	Part 15.407

Engineering Statement:

The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of the FCC Rules under normal use and maintenance.

REVIEWED BY

Report prepared by : Woong Jin Kim
Engineer of Telecommunication Testing Center

Report approved by : Kwon Jeong
Manager of Telecommunication Testing Center

This test results were applied only to the test methods required by the standard.

This laboratory is not accredited for the test results marked *.
The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA. (HCT Accreditation No.: KT197)

Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-2106-FC022	June 14, 2021	- First Approval Report

Table of Contents

1. GENERAL INFORMATION

EUT DESCRIPTION

Model	SM-G990B/DS	
Additional Model	SM-G990B	
EUT Type	Mobile Phone	
Power Supply	DC 4.20 V	
Modulation Type	OFDM : 802.11a, 802.11n, 802.11ac	
Frequency Range (MHz)	U-NII-1	20MHz BW : 5180 - 5240 40MHz BW : 5190 - 5230 80MHz BW : 5210
	U-NII-2A	20MHz BW : 5260 - 5320 40MHz BW : 5270 - 5310 80MHz BW : 5290
	U-NII-2C	20MHz BW : 5500 - 5720 40MHz BW : 5510 - 5710 80MHz BW : 5530 – 5690
	U-NII-3	20MHz BW : 5745 - 5825 40MHz BW : 5755 - 5795 80MHz BW : 5775
Straddle channel	Supported	
TDWR Band	Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	April 24, 2021~ June 10, 2021	
Serial number	Radiated: 544a5f8570207ece Conducted: 524d0f145f1e7ece	

ANTENNA CONFIGURATIONS

1. The device employs MIMO technology. Below are the possible configurations

Configurations	SISO		SDM	CDD
	Ant.1	Ant.2	Ant.1 + Ant.2	Ant.1 + Ant.2
802.11a	X	X	X	O
802.11n	X	X	O	O
802.11ac	X	X	O	O

Note:

(1) O = Support, X = Not Support

(2) SISO = Single Input Single Output

(3) SDM = Spatial Diversity Multiplexing

(4) CDD = Cyclic Delay Diversity

2.This device supports simultaneous transmission operation, which allows for two channels to operate independent of one another in the 2.4GHz and 5GHz bands simultaneously on each antenna.

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2
2.4 GHz WiFi + 5GHz WiFi MIMO	On		On	On
2.4 GHz WiFi + 5GHz WiFi MIMO		On	On	On
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO	On	On	On	On

Non-DBS	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO + Bluetooth	On	On	On

3. Directional Gain Calculation

According to KDB 662911 D01 Multiple Transmitter Output v02r01 F) 2) f) (ii)

Directional gain =

- $$DirectionalGain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

Band	Ant Gain (dBi)		N_{ANT}/ N_{ss}	Directional Gain (dBi)
U-NII	ANT.1	-1.80	2 / 2	-0.32
	ANT.2	-5.20		

2. MAXIMUM OUTPUT POWER

The transmitter has a maximum total conducted average output power as follows:

Band	Mode	Ant.1 Power		Ant.2 Power		MIMO Ant.1 + Ant.2 Power	
		(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
UNII1	802.11a	16.24	0.042	15.91	0.039	18.99	0.079
	802.11n (HT20)	16.23	0.042	15.84	0.038	18.97	0.079
	802.11n (HT40)	15.50	0.036	15.27	0.034	18.40	0.069
	802.11ac (VHT20)	16.23	0.042	15.87	0.039	18.98	0.079
	802.11ac (VHT40)	15.48	0.035	15.15	0.033	18.32	0.068
	802.11ac (VHT80)	11.98	0.016	11.83	0.015	14.92	0.031
UNII2A	802.11a	16.45	0.044	15.99	0.040	19.10	0.081
	802.11n (HT20)	16.42	0.044	16.00	0.040	19.10	0.081
	802.11n (HT40)	15.50	0.036	15.29	0.034	18.41	0.069
	802.11ac (VHT20)	16.43	0.044	15.96	0.039	19.16	0.082
	802.11ac (VHT40)	15.48	0.035	15.19	0.033	18.35	0.068
	802.11ac (VHT80)	12.01	0.016	11.69	0.015	14.87	0.031
UNII2C	802.11a	16.33	0.043	15.80	0.038	19.08	0.081
	802.11n (HT20)	16.30	0.043	15.80	0.038	19.07	0.081
	802.11n (HT40)	15.71	0.037	15.22	0.033	18.48	0.070
	802.11ac (VHT20)	16.41	0.044	15.82	0.038	19.13	0.082
	802.11ac (VHT40)	15.67	0.037	15.13	0.033	18.41	0.069
	802.11ac (VHT80)	14.89	0.031	14.05	0.025	17.50	0.056
UNII3	802.11a	16.21	0.042	15.58	0.036	18.90	0.078
	802.11n (HT20)	16.19	0.042	15.56	0.036	18.90	0.078
	802.11n (HT40)	15.44	0.035	14.74	0.030	18.11	0.065
	802.11ac (VHT20)	16.22	0.042	15.57	0.036	18.90	0.078
	802.11ac (VHT40)	15.41	0.035	14.68	0.029	18.07	0.064
	802.11ac (VHT80)	14.41	0.028	13.40	0.022	16.95	0.050

3. TEST METHODOLOGY

The measurement procedure described in FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 dated December 14, 2017 entitled “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part15, Subpart E” and ANSI C63.10(Version : 2013) ‘the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices’ were used in the measurement.

EUT CONFIGURATION

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

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart E.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m 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 hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.

Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA. The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.

Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203, §15.407:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

(1) The antennas of this E.U.T are permanently attached.

(2) The E.U.T Complies with the requirement of §15.203, §15.407

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

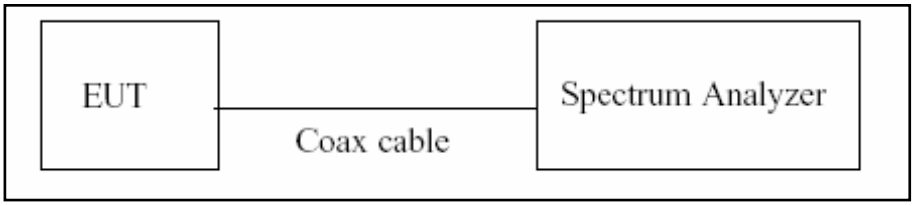
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty (dB)
Conducted Disturbance (150 kHz ~ 30 MHz)	1.82
Radiated Disturbance (9 kHz ~ 30 MHz)	3.40
Radiated Disturbance (30 MHz ~ 1 GHz)	4.80
Radiated Disturbance (1 GHz ~ 18 GHz)	5.70
Radiated Disturbance (18 GHz ~ 40 GHz)	5.05

8. DESCRIPTION OF TESTS

8.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure B.2 in KDB 789033 D02 v02r01.

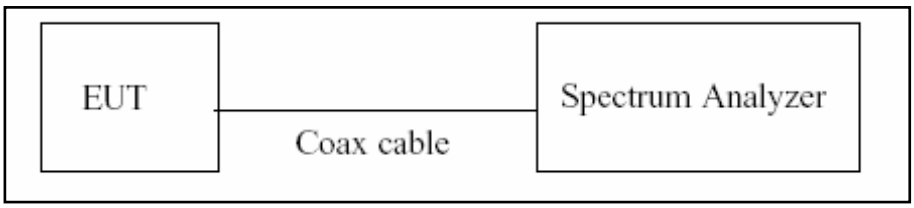
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

8.2. 6dB Bandwidth & 26dB Bandwidth

Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Configuration



Test Procedure(26dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.1 in KDB 789033 D02 v02r01.

1. RBW = approximately 1 % of the emission bandwidth
2. VBW > RBW
3. Detector = Peak
4. Trace mode = max hold
5. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1 %.

Test Procedure (6dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

We tested according to Procedure C.2 in KDB 789033 D02 v02r01.

1. RBW = 100 kHz
2. VBW ≥ 3 x RBW
3. Detector = Peak
4. Trace mode = max hold
5. Allow the trace to stabilize
6. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points(upper and lower frequencies) that are attenuated by 6 dB relative to the maximum lever measured in the fundamental emission.

Note:

1. We tested X dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.
2. DFS test channels should be defined. So, We performed the OBW test to prove that no part of the fundamental emissions of any channels belong to UNII1 and UNII3 band for DFS.
3. The 26 dB bandwidth is used to determine the conducted power limits.

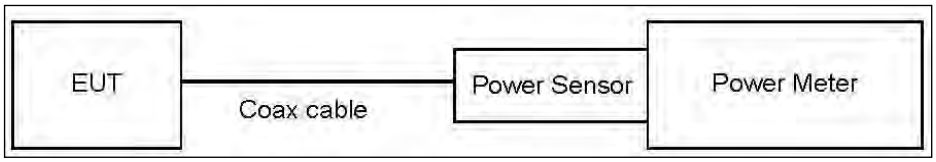
8.3. Output Power Measurement

Limit

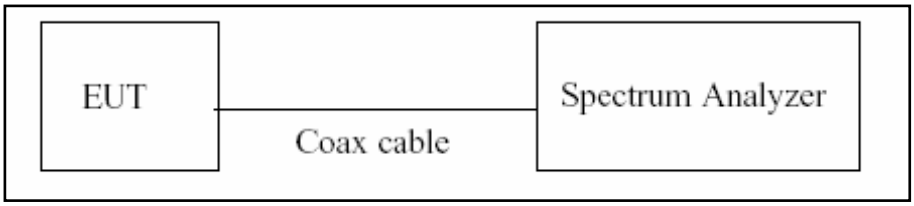
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

Test Configuration

Power Meter



Spectrum Analyzer(Only Straddle Channel)



Test Procedure(Power Meter)

We tested according to Procedure E.3.a in KDB 789033 D02 v02r01.

1. Measure the duty cycle.
2. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
3. Add 10 log (1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Test Procedure(Spectrum Analyzer)

The transmitter output is connected to the Spectrum Analyzer.

We use the spectrum analyzer's integrated band power measurement function.

We tested according to Procedure E.2.d) in KDB 789033 D02 v02r01.

1. Measure the duty cycle.
2. Set span to encompass the 26 dB EBW of the signal.
3. RBW = 1 MHz.
4. VBW ≥ 3 MHz.
5. Number of points in sweep ≥ 2 x span/RBW.
6. Sweep time = auto.
7. Detector = RMS.
8. Do not use sweep triggering. Allow the sweep to "free run".
9. Trace average at least 100 traces in power averaging(RMS) mode
10. Integrated bandwidth = OBW
11. Add 10log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

Sample Calculation

Total Power(dBm) = Reading Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

Note

1. Spectrum reading values are not plot data.
   The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset
   Ant1 Loss = Attenuator loss(10 dB) + Cable loss + EUT Cable loss
   Ant2 Loss = Attenuator loss(10 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Ant1 Loss(dB)	Ant2 Loss(dB)
UNII 1	11.55	10.73
UNII 2A	11.55	10.73
UNII 2C	11.55	10.73
UNII 3	11.55	10.73

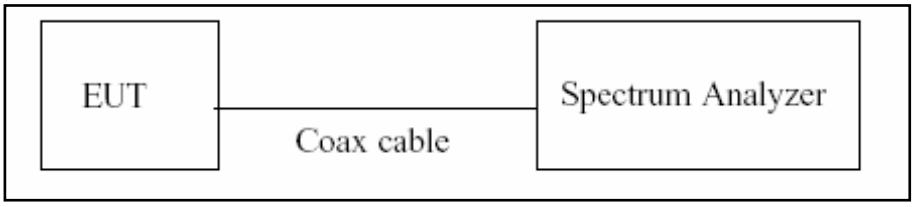
(Actual value of loss for the attenuator and cable combination)

8.4. Power Spectral Density

Limit

Band	Limit
UNII 1	11 dBm/MHz
UNII 2A, 2C	11 dBm/MHz
UNII 3	30 dBm/500 kHz

Test Configuration



Test Procedure

We tested according to Procedure F in KDB 789033 D02 v02r01.

1. Set span to encompass the entire emission bandwidth(EBW) of the signal.
2. RBW = 1 MHz(510 kHz for UNII 3)
3. VBW ≥ 3 MHz
4. Number of points in sweep ≥ 2 x span/RBW.
5. Sweep time = auto.
6. Detector = RMS(i.e., power averaging), if available. Otherwise, use sample detector mode.
7. Do not use sweep triggering. Allow the sweep to “free run”.
8. Trace average at least 100 traces in power averaging(RMS) mode
9. Use the peak search function on the spectrum analyzer to find the peak of the spectrum.
10. If Method SA-2 was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

Sample Calculation

Total PSD(dBm) = Reading Value(dBm) + ATT loss(dB) + Cable loss(dB) + Duty Cycle Factor(dB)

Note

1. Spectrum reading values are not plot data.
   The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset
   Ant1 Loss = Attenuator loss(10 dB) + Cable loss + EUT Cable loss
   Ant2 Loss = Attenuator loss(10 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Ant1 Loss(dB)	Ant2 Loss(dB)
UNII 1	11.55	10.73
UNII 2A	11.55	10.73
UNII 2C	11.55	10.73
UNII 3	11.55	10.73

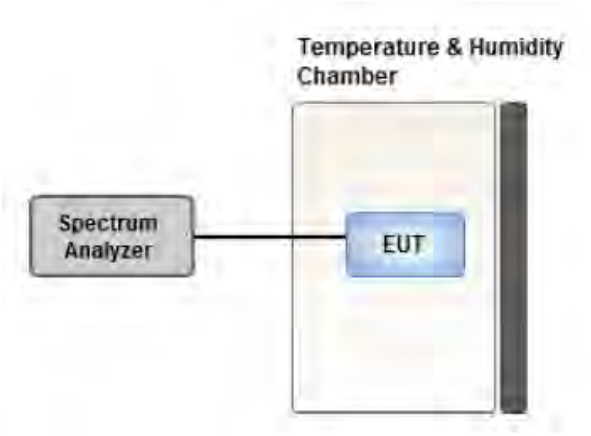
(Actual value of loss for the attenuator and cable combination)

8.5. Frequency Stability

Limit

Maintained within the band

Test Configuration



Test Procedure

1. The EUT was placed inside an environmental chamber as the temperature in the chamber was varied between -30 ℃ and 50 ℃.
2. The temperature was incremented by 10 ℃ intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.
3. The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battety operating end point which shall be specified by the manufacturer.
4. While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

8.6. AC Power line Conducted Emissions

Limit

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56[a]	56 to 46[a]
0.50 to 5	56	46
5 to 30	60	50

[a]Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

Test Procedure

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

8.7. Radiated Test

Limit

1. UNII 1: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of −27 dBm/MHz.

2. UNII 2A, 2C: All emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

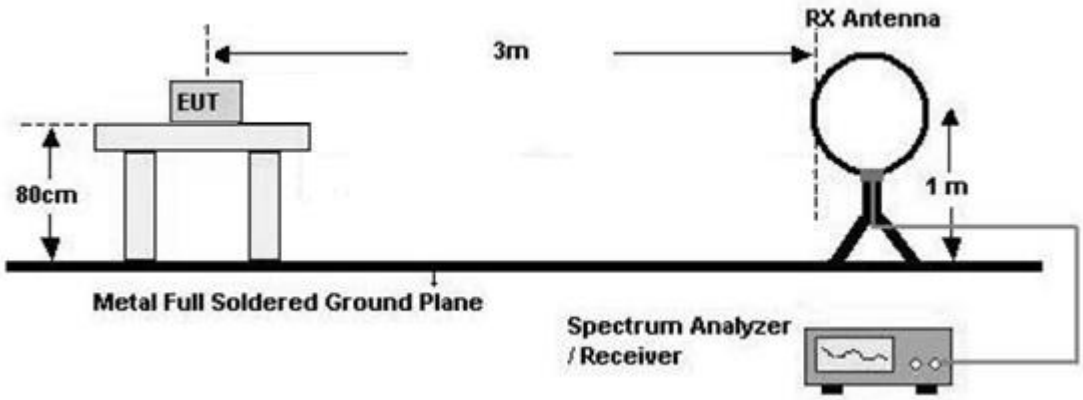
3. UNII 3: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

4. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Section 15.209.

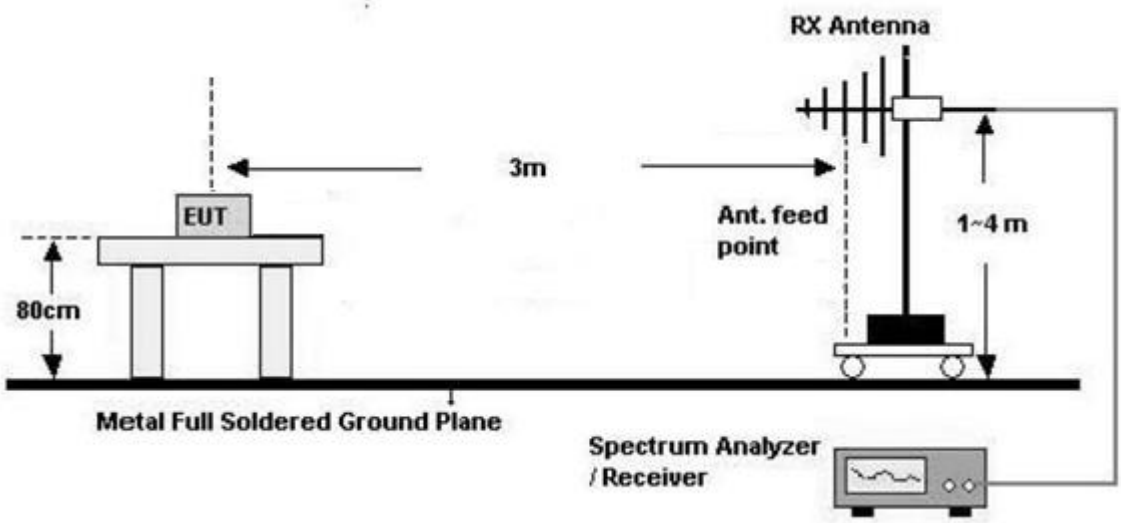
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

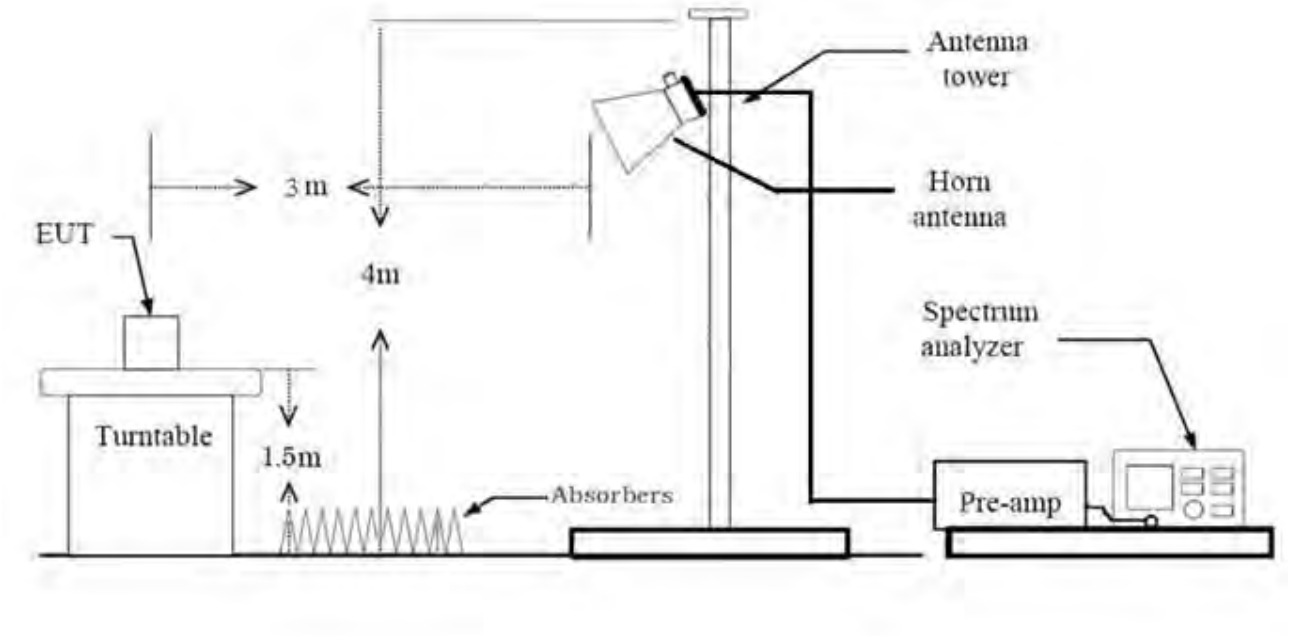
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions(Below 30 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. .We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor(0.009 MHz – 0.490 MHz) = 40log(3 m/300 m) = - 80 dB
   Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = 40log(3 m/30 m) = - 40 dB
   Measurement Distance : 3 m
8. Spectrum Setting
   - Frequency Range = 9 kHz ~ 30 MHz
   - Detector = Peak
   - Trace = Maxhold
   - RBW = 9 kHz
   - VBW ≥ 3 x RBW
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)
10. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

KDB 414788 OFS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.
OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Test Procedure of Radiated spurious emissions(Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 100 kHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz
   ※ In general, (1) is used mainly
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
8. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor.

Test Procedure of Radiated spurious emissions (Above 1 GHz)

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type (Peak, G.5 in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = max hold
- Allow sweeps to continue until the trace stabilizes.

Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

(2) Measurement Type (Average, G.6.d in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW(Duty cycle ≥ 98 percent) = VBW ≤ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW ≥ 1/T, where T is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimym number of traces by a factor of 1/x, where x is the duty cycle.

9. Measurement value only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20 dB from the applicable limit) and considered that's already beyond the background noise floor
10. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency
11. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
12. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G) + Distance Factor(D.F)

Test Procedure of Radiated Restricted Band Edge

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting

(1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = max hold
- Allow sweeps to continue until the trace stabilizes.

Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

(2) Measurement Type(Average, G.6.d in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW(Duty cycle ≥ 98 percent) = VBW ≤ RBW/100(i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = VBW ≥ 1/T, where T is the minimum transmission duration.
- The analyzer is set to linear detector mode.
- Detector = Peak.
- Sweep time = auto.
- Trace mode = max hold.
- Allow max hold to run for at least 50 traces if the transmitted signal is continuous or has at least 98 percent duty cycle. For lower duty cycles, increase the minimym number of traces by a factor of 1/x, where x is the duty cycle.

9. Measured Frequency Range :
   - 4 500 MHz ~ 5 150 MHz
   - 5 350 MHz ~ 5 460 MHz
   - 5 460 MHz ~ 5 470 MHz
   - (75 MHz or more below the 5 725 MHz) ~ 5 725 MHz
   - 5 850 MHz ~ (75 MHz or more above the 5 850 MHz)
10. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
11. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(A.G) + Attenuator(ATT) + Distance Factor(D.F)

The actual setting value of VBW

Mode	Worst Data rate (Mbps)	Duty Cycle	Duty Cycle Factor (dB)	The actual setting value of VBW (Hz)
802.11a	6	0.937	0.283	1000
802.11n(HT20)	MCS0	0.930	0.317	1000
802.11n(HT40)	MCS0	0.873	0.588	3000
802.11ac(VHT20)	MCS0	0.930	0.316	1000
802.11ac(VHT40)	MCS0	0.868	0.613	3000
802.11ac(VHT80)	MCS0	0.776	1.099	10000

8.8. Worst case configuration and mode

Radiated test

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
   - Worstcase : Stand alone
2. EUT Axis
   - Radiated Spurious Emissions : Z
   - Radiated Restricted Band Edge : X
3. All datarate of operation were investigated and the worst case datarate results are reported.
   - Mode : Ant.1(SISO), Ant.2(SISO), Ant.1+Ant.2(SDM), Ant.1+Ant.2(CDD)
   - Worstcase : Ant.1+Ant.2(CDD)
   - 802.11a : 6 Mbps
   - 802.11n_HT20 : MCS0
   - 802.11n_HT40 : MCS0
   - 802.11ac_VHT20 : MCS0
   - 802.11ac_VHT40 : MCS0
   - 802.11ac_VHT80 : MCS0
4. Radiated Spurious Emission
   - All modulation of operation were investigated and the worst case modulation results are reported.
     (Worstcase : 802.11a_6 Mbps)
5. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
   - Position : Horizontal, Vertical, Parallel to the ground plane
6. We were performed the RSE test in condition of co-location. There has no significant emission raised.
   - WWAN+WLAN 5GHz+BT
7. SM-G990B/DS, SM-G990B were tested and the worst case results are reported.
   (Worst case : SM-G990B/DS)

Radiated test(DBS)

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone, Stand alone + External accessories(Earphone, etc)
   - Worstcase : Stand alone
2. EUT Axis
   - Radiated Spurious Emissions : X, Z
3. Test case

RSDB Scenario	2.4 GHz WiFi Ant.1	2.4 GHz WiFi Ant.2	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Test case
2.4 GHz WiFi + 5GHz WiFi MIMO	On		On	On	Case 1
2.4 GHz WiFi + 5GHz WiFi MIMO		On	On	On	-
2.4 GHz WiFi MIMO + 5GHz WiFi MIMO	On	On	On	On	Case 2

Non-DBS	5GHz WiFi Ant.1	5GHz WiFi Ant.2	Bluetooth Ant.1	Test case
5GHz WiFi MIMO + Bluetooth	On	On	On	Case 3

4. The following tables show the worst case configurations determined during testing.
   (Worst case: The lowest margin condition the channels and modes were selected for test.)

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
1	Antenna	Ant 1	Ant All	-
	Channel	1	36	-
	Data Rate	1 Mbps	6 Mbps	-
	Mode	802.11b	802.11a	-

Test case	Description	2.4 GHz Emission	5 GHz Emission	Bluetooth Emission
2	Antenna	Ant All	Ant All	-
	Channel	1	36	-
	Data Rate	MCS0	6 Mbps	-
	Mode	802.11n(HT20)	802.11a	-

Test case	Description	5 GHz Emission	Bluetooth Emission
3	Antenna	Ant All	Ant 1
	Channel	36	0
	Data Rate	6 Mbps	3 Mbps
	Mode	802.11a	8DPSK

5. SM-G990B/DS, SM-G990B were tested and the worst case results are reported.
   (Worst case : SM-G990B/DS)

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone + External accessories(Earphone, etc) + Travel Adapter, Stand alone + Travel Adapter
   - Worstcase : Stand alone + Travel Adapter
2. SM-G990B/DS, SM-G990B were tested and the worst case results are reported.
   (Worst case : SM-G990B/DS)

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported.
2. SM-G990B/DS, SM-G990B were tested and the worst case results are reported.
   (Worst case : SM-G990B/DS)

9. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407 (for Power Measurement)	N/A	Conducted	PASS
6 dB Bandwidth	§15.407(e)	>500 kHz (5725-5850 MHz)		PASS
Maximum Conducted Output Power	§15.407(a)(1),(2),(3)	< 250 mW(5150-5250 MHz) < 250 mW or 11+10log$_{10}$ (BW) dBm (5250-5350 MHz) < 250 mW or 11+10log$_{10}$ (BW) dBm (5470-5725 MHz) <1 W(5725-5850 MHz)		PASS
Maximum Power Spectral Density	§15.407(a)(1),(2),(3)	<11 dBm/ MHz (5150-5250 MHz) <11 dBm/ MHz (5250-5350 MHz) <11 dBm/ MHz (5470-5725 MHz) <30 dBm/500 kHz(5725-5850 MHz)		PASS
Frequency Stability	§15.407(g) §2.1055	Maintained within the band		PASS
AC Conducted Emissions 150 kHz-30 MHz	15.207 15.407(b)(8)	<FCC 15.207 limits		PASS
Undesirable Emissions	§15.407(b) (1),(2),(3),(4)	<-27 dBm/MHz EIRP (UNII1, 2A, 2C) cf. Section 8.7 (UNII 3)	Radiated	PASS
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	15.205, 15.407(b)(9),(10)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS

10. TEST RESULT

10.1 DUTY CYCLE

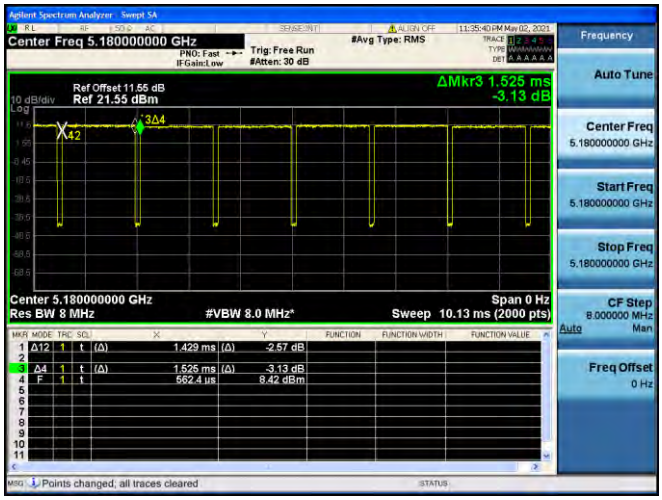
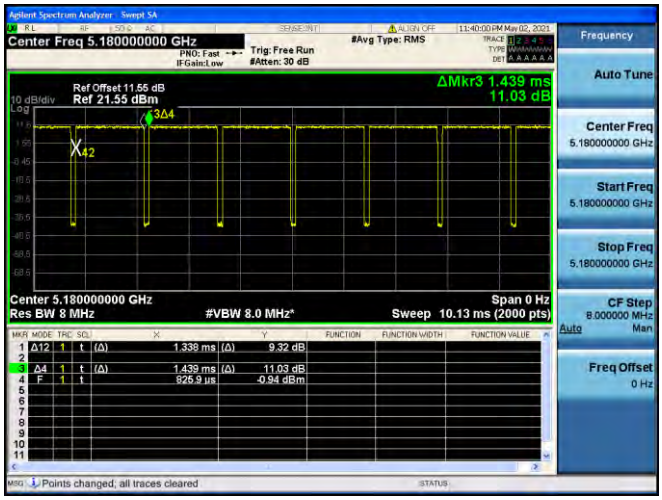
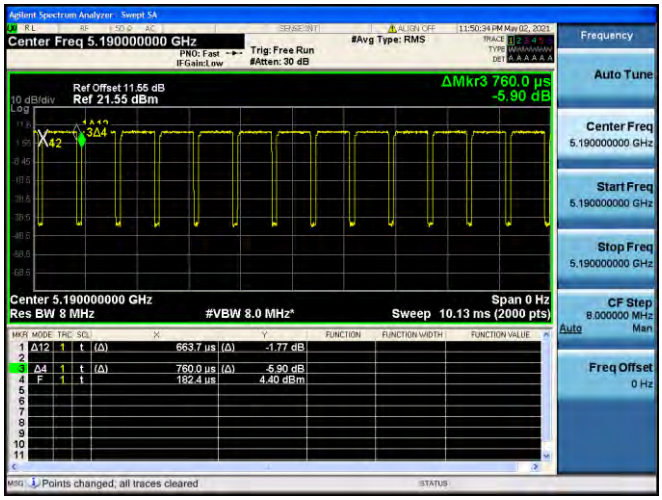
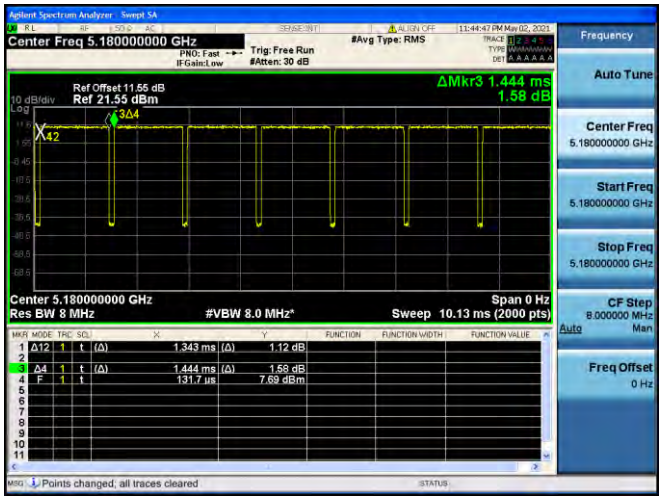
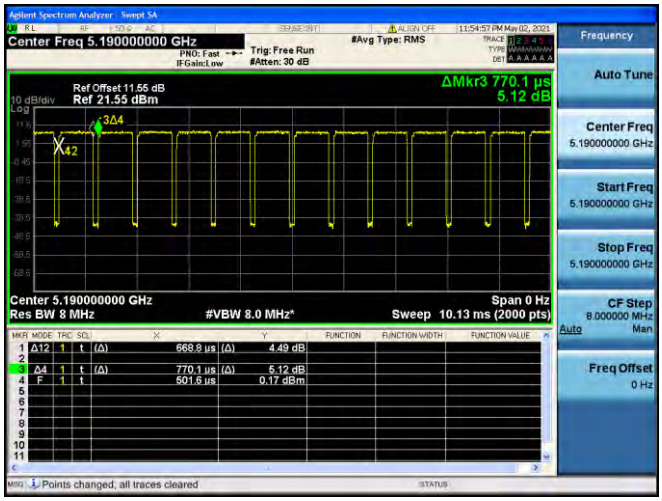
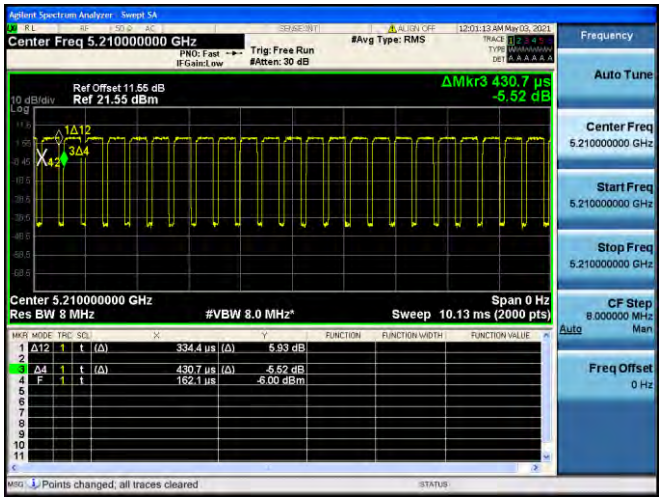
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11a	6	1.429	1.525	0.937	0.283
	9	0.958	1.059	0.904	0.437
	12	0.725	0.821	0.883	0.542
	18	0.491	0.588	0.836	0.777
	24	0.375	0.471	0.796	0.993
	36	0.253	0.355	0.714	1.461
	48	0.198	0.294	0.672	1.724
	54	0.177	0.279	0.636	1.963

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11n (HT20)	0	1.338	1.439	0.930	0.317
	1	0.689	0.785	0.877	0.568
	2	0.471	0.567	0.830	0.807
	3	0.365	0.466	0.783	1.065
	4	0.253	0.355	0.714	1.461
	5	0.198	0.299	0.661	1.798
	6	0.182	0.284	0.643	1.919
	7	0.167	0.269	0.623	2.058
802.11n (HT40)	0	0.664	0.760	0.873	0.588
	1	0.350	0.451	0.775	1.105
	2	0.248	0.345	0.721	1.423
	3	0.198	0.294	0.672	1.724
	4	0.142	0.243	0.583	2.341
	5	0.117	0.213	0.548	2.615
	6	0.106	0.208	0.512	2.906
	7	0.096	0.198	0.487	3.123

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11ac (VHT20)	0	1.343	1.444	0.930	0.316
	1	0.694	0.790	0.878	0.564
	2	0.476	0.573	0.832	0.800
	3	0.370	0.466	0.793	1.005
	4	0.263	0.360	0.732	1.353
	5	0.203	0.299	0.678	1.688
	6	0.187	0.289	0.649	1.877
	7	0.172	0.274	0.630	2.009
	8	0.152	0.248	0.612	2.131
802.11ac (VHT40)	0	0.669	0.770	0.868	0.613
	1	0.360	0.456	0.789	1.030
	2	0.253	0.350	0.725	1.399
	3	0.198	0.299	0.661	1.798
	4	0.147	0.243	0.604	2.188
	5	0.122	0.223	0.545	2.632
	6	0.111	0.213	0.524	2.808
	7	0.106	0.208	0.512	2.906
	8	0.101	0.203	0.500	3.010
	9	0.091	0.193	0.474	3.245
802.11ac (VHT80)	0	0.334	0.431	0.776	1.099
	1	0.187	0.289	0.649	1.877
	2	0.142	0.243	0.583	2.341
	3	0.111	0.213	0.524	2.808
	4	0.096	0.193	0.500	3.010
	5	0.076	0.177	0.429	3.680
	6	0.076	0.172	0.441	3.554
	7	0.076	0.172	0.441	3.554
	8	0.066	0.167	0.394	4.046
	9	0.066	0.162	0.406	3.912

Note:

In order to simplify the report, attached plots were only lowest datarate.

802.11a	802.11n(HT20)
	
802.11n(HT40)	**802.11ac(VHT20)**
	
802.11ac(VHT40)	**802.11ac(VHT80)**
	

10.2 26 dB Bandwidth

Straddle channel data in the table below are for reporting purposes only.

Straddle channel data were added in section 10.7.1.

[Ant.1]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.24	16.770
5200	40	21.21	16.735
5240	48	21.24	16.727
5260	52	21.41	16.761
5300	60	21.30	16.766
5320	64	21.27	16.721
5500	100	21.11	16.754
5600	120	21.22	16.717
5720	144	21.32	16.740
5745	149	21.24	16.743
5785	157	21.27	16.759
5825	165	21.16	16.721

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.64	17.894
5200	40	21.51	17.891
5240	48	21.48	17.890
5260	52	21.56	17.892
5300	60	21.65	17.877
5320	64	21.49	17.874
5500	100	21.34	17.869
5600	120	21.47	17.924
5720	144	21.54	17.912
5745	149	21.64	17.893
5785	157	21.50	17.896
5825	165	21.40	17.872

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.21	36.286
5230	46	39.96	36.295
5270	54	39.88	36.320
5310	62	39.95	36.284
5510	102	39.86	36.348
5590	118	39.91	36.304
5710	142	39.89	36.293
5755	151	40.14	36.350
5795	159	39.41	36.261

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.33	17.876
5200	40	21.73	17.896
5240	48	21.38	17.909
5260	52	21.50	17.897
5300	60	21.39	17.896
5320	64	21.46	17.886
5500	100	21.38	17.920
5600	120	21.64	17.893
5720	144	21.70	17.893
5745	149	21.60	17.888
5785	157	21.59	17.874
5825	165	21.78	17.889

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.08	36.318
5230	46	39.91	36.317
5270	54	40.10	36.240
5310	62	39.73	36.323
5510	102	39.74	36.357
5590	118	40.08	36.350
5710	142	39.88	36.326
5755	151	40.14	36.295
5795	159	39.70	36.289

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	81.91	75.728
5290	58	81.75	75.751
5530	106	80.74	75.685
5610	122	81.49	75.733
5690	138	81.36	75.808
5775	155	81.75	75.684

[Ant.2]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.22	16.746
5200	40	21.21	16.765
5240	48	21.17	16.744
5260	52	21.11	16.792
5300	60	21.39	16.760
5320	64	21.30	16.735
5500	100	21.21	16.786
5600	120	21.19	16.766
5720	144	21.35	16.749
5745	149	20.93	16.780
5785	157	21.38	16.774
5825	165	21.61	16.812

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.44	17.894
5200	40	21.44	17.891
5240	48	21.38	17.899
5260	52	21.53	17.885
5300	60	21.54	17.898
5320	64	21.52	17.906
5500	100	21.57	17.898
5600	120	21.31	17.904
5720	144	21.60	17.900
5745	149	21.58	17.933
5785	157	21.58	17.926
5825	165	21.44	17.914

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.25	36.409
5230	46	39.98	36.379
5270	54	39.96	36.346
5310	62	39.89	36.360
5510	102	40.01	36.346
5590	118	39.77	36.355
5710	142	43.56	36.362
5755	151	39.70	36.388
5795	159	39.94	36.319

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.64	17.867
5200	40	21.67	17.863
5240	48	21.45	17.902
5260	52	21.41	17.919
5300	60	21.75	17.910
5320	64	21.91	17.907
5500	100	21.60	17.878
5600	120	21.76	17.893
5720	144	21.69	17.914
5745	149	21.57	17.938
5785	157	21.79	17.922
5825	165	21.70	17.954

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.01	36.308
5230	46	40.18	36.371
5270	54	39.94	36.422
5310	62	39.93	36.328
5510	102	39.87	36.301
5590	118	39.88	36.345
5710	142	40.03	36.336
5755	151	39.92	36.297
5795	159	39.68	36.330

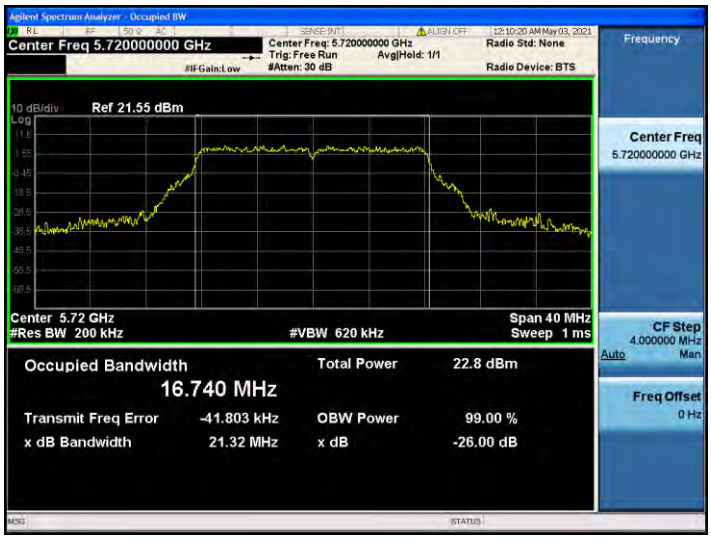
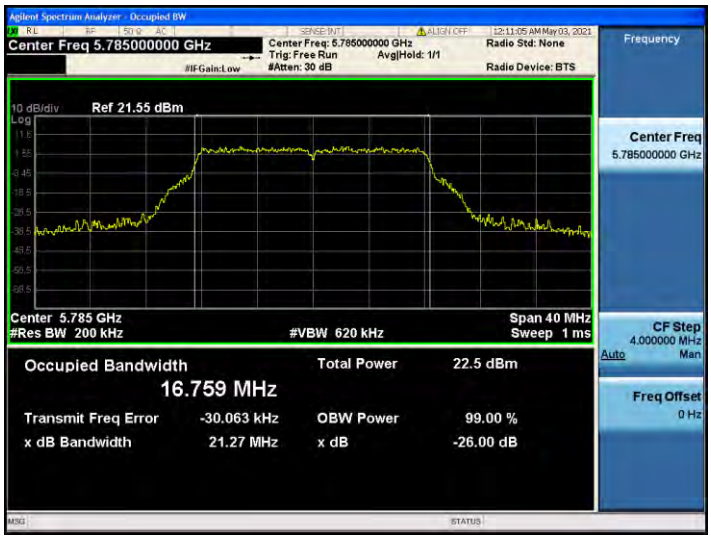
802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	81.37	75.722
5290	58	81.52	75.713
5530	106	81.43	75.769
5610	122	81.24	75.764
5690	138	81.42	75.692
5775	155	82.21	75.771

[Ant.1]

▣ Test Plots(802.11a)

Note:

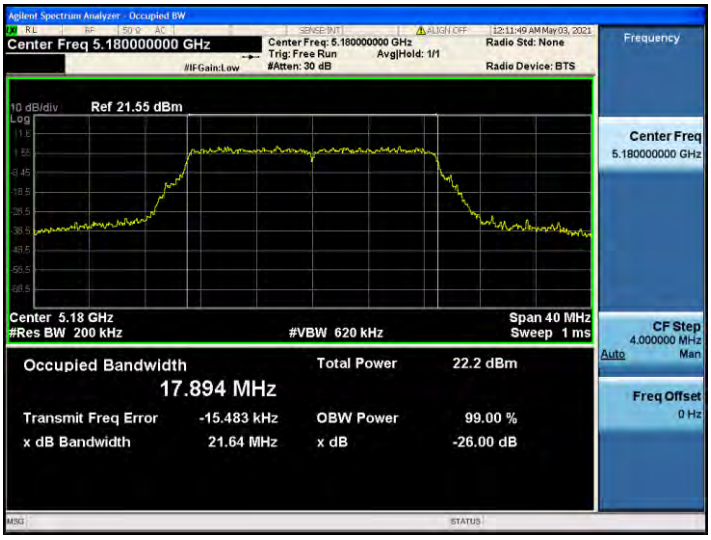
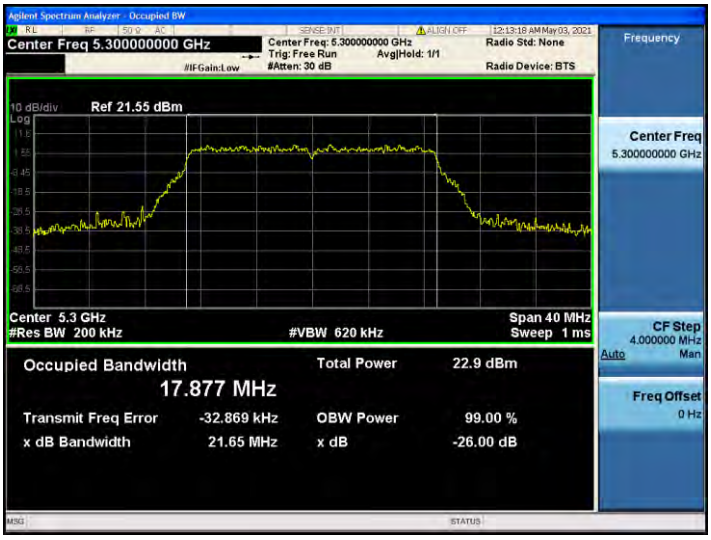
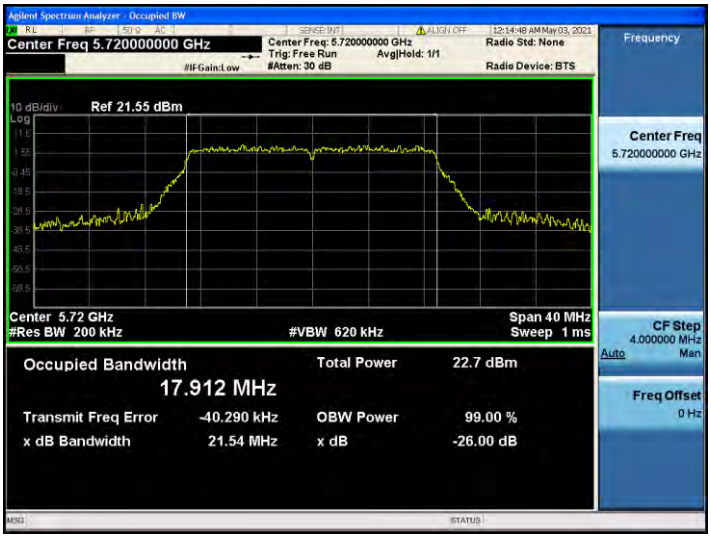
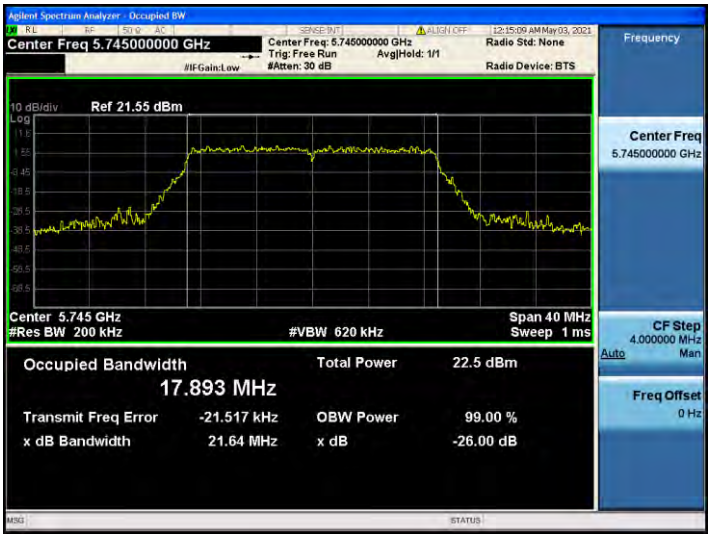
In order to simplify the report, attached plots were only the most wide channel.

802.11a UNII 1 BAND 26dB Bandwidth (CH 36)	802.11a UNII 2A BAND 26dB Bandwidth (CH 52)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 157)**
	

▣ Test Plots(802.11n(HT20))

Note:

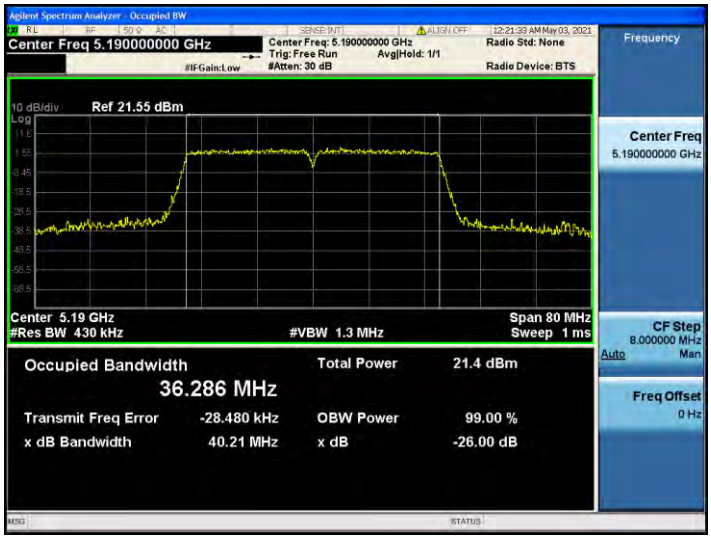
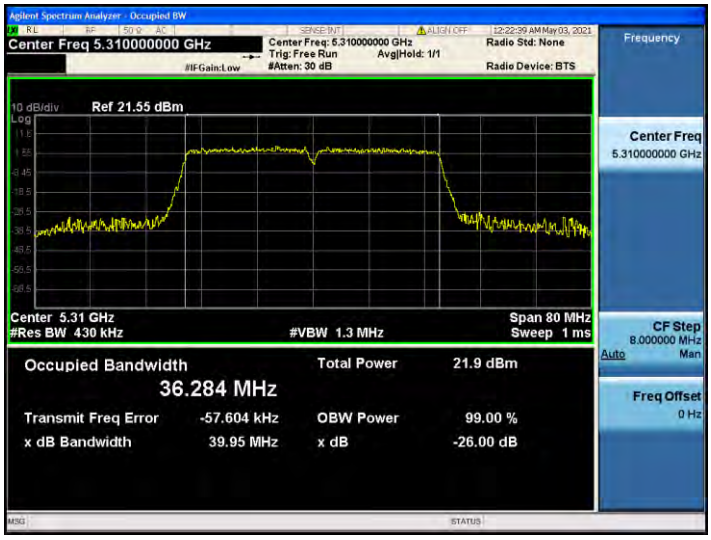
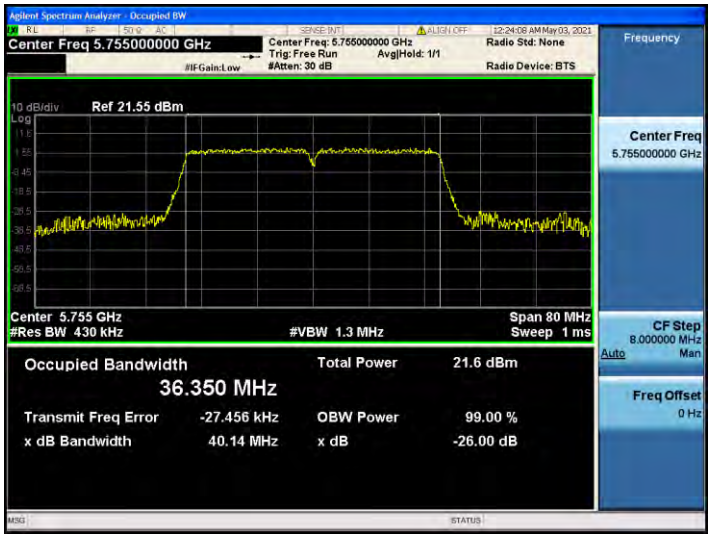
In order to simplify the report, attached plots were only the most wide channel.

802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 36)	802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 60)
	
802.11n_HT20 UNII 2C BAND 26dB Bandwidth(CH 144)	**802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 149)**
	

▣ Test Plots(802.11n(HT40))

Note:

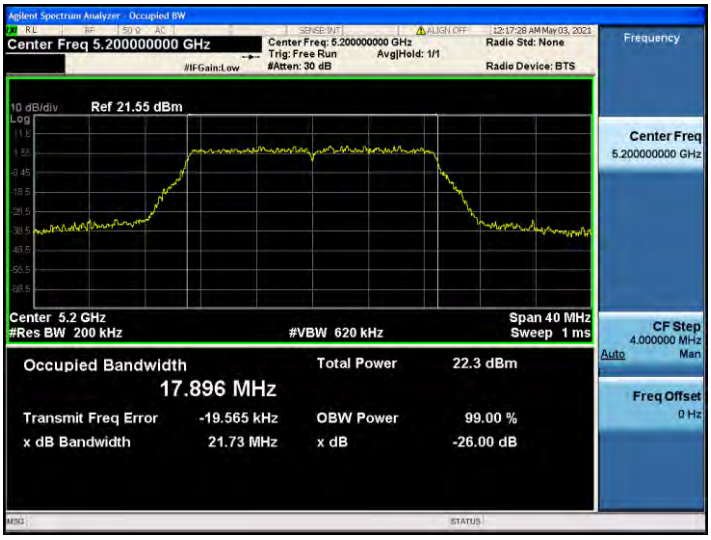
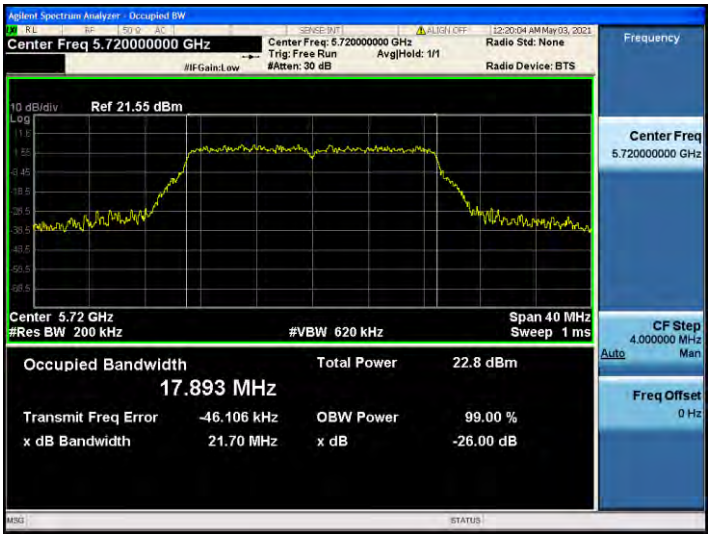
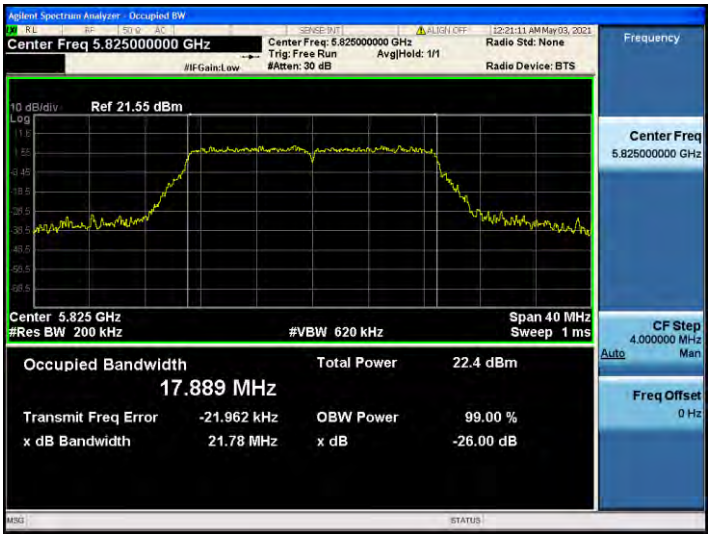
In order to simplify the report, attached plots were only the most wide channel.

802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 38)	802.11n_HT40 UNII 2A BAND 26dB Bandwidth (CH 62)
	
802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 118)	**802.11n_HT40 UNII 3 BAND 26dB Bandwidth (CH 151)**
	

▣ Test Plots(802.11ac(VHT20))

Note:

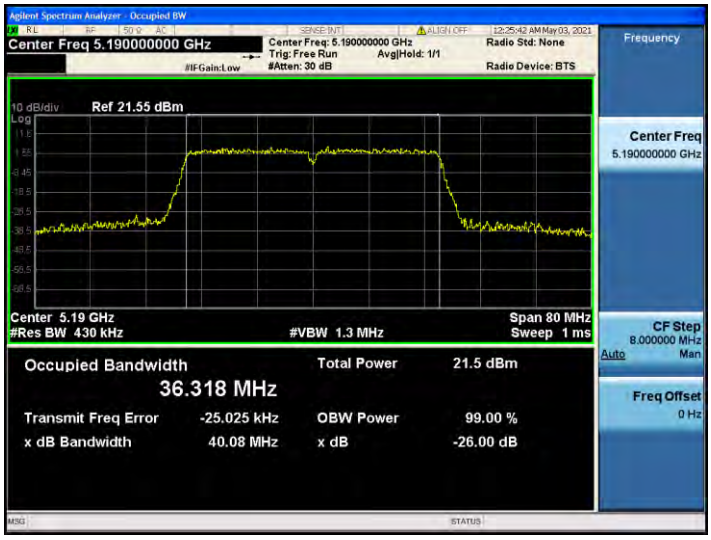
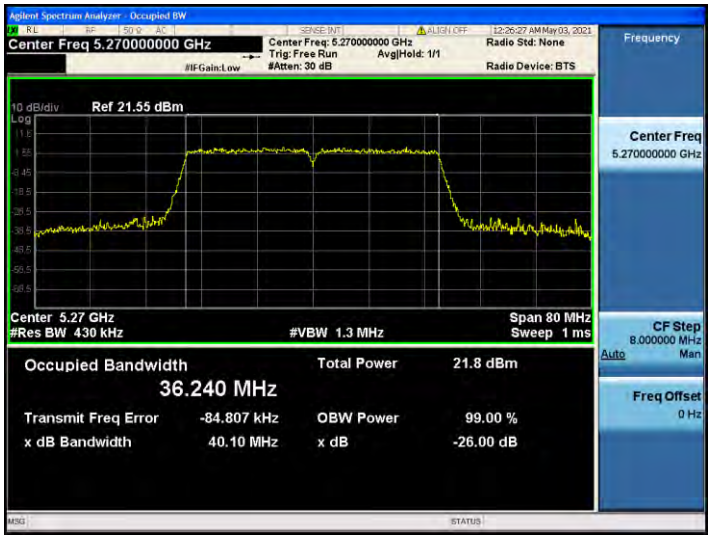
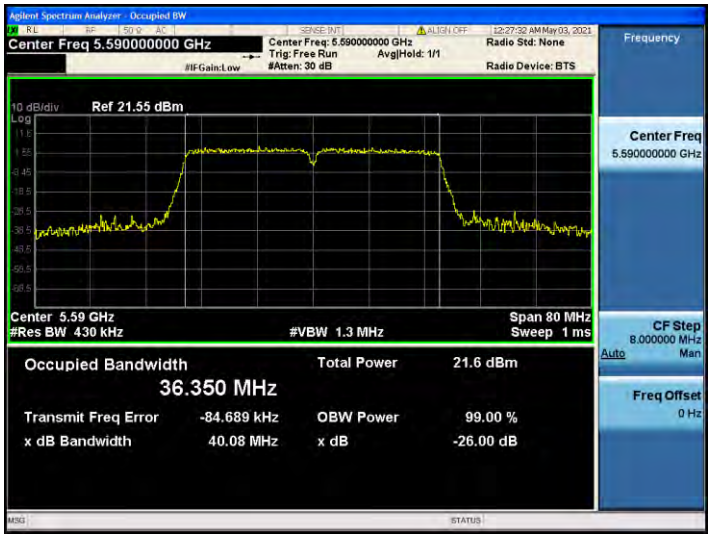
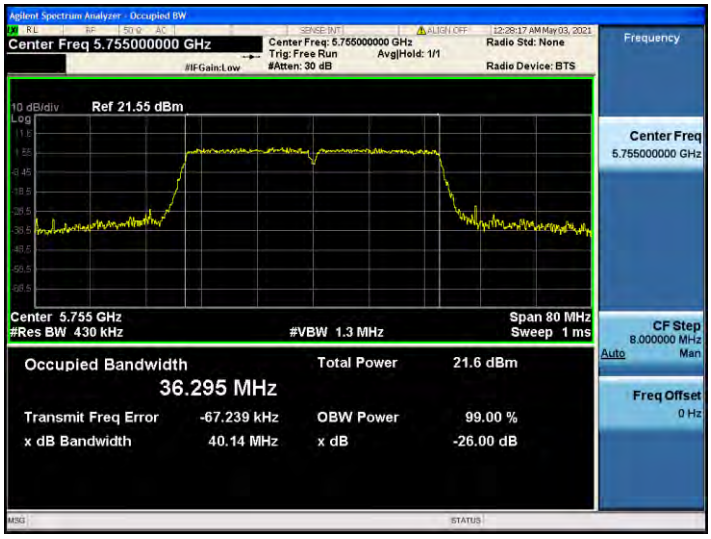
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT20 UNII 1 BAND 26dB Bandwidth(CH 40)	802.11ac_VHT20 UNII 2A BAND 26dB Bandwidth(CH 52)
	
802.11ac_VHT20 UNII 2C BAND 26dB Bandwidth(CH 144)	**802.11ac_VHT20 UNII 3 BAND 26dB Bandwidth(CH 165)**
	

▣ Test Plots(802.11ac(VHT40))

Note:

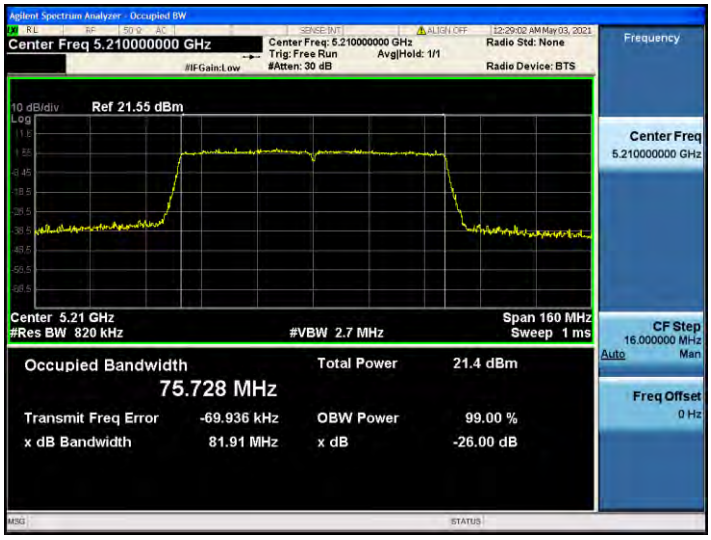
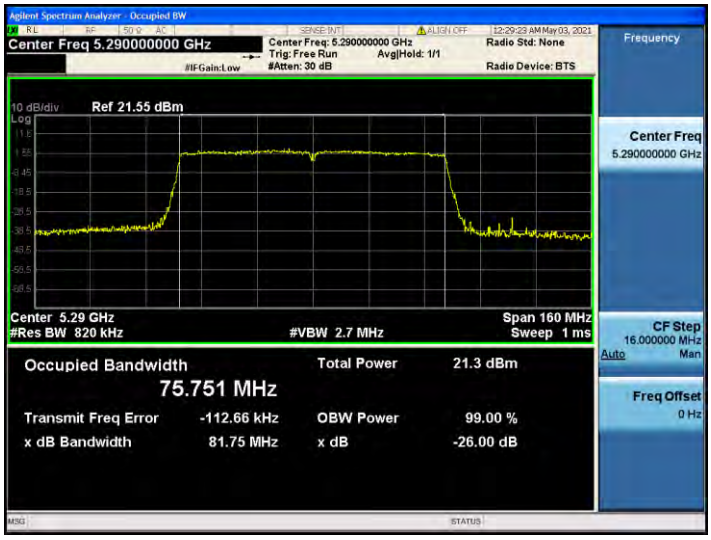
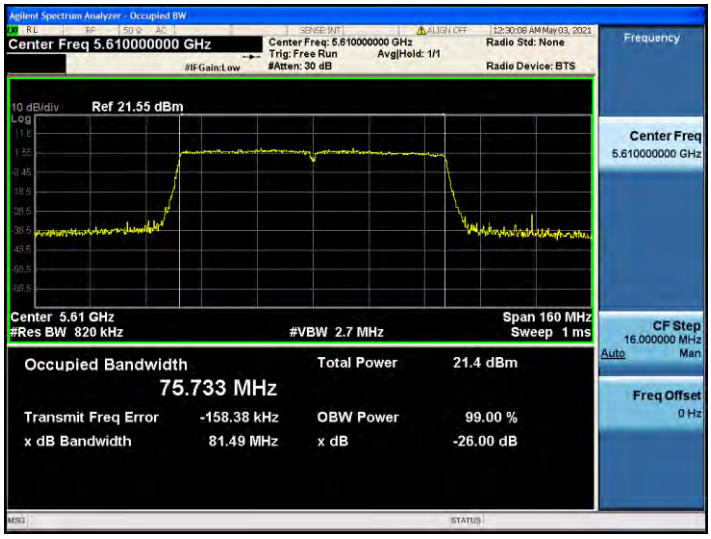
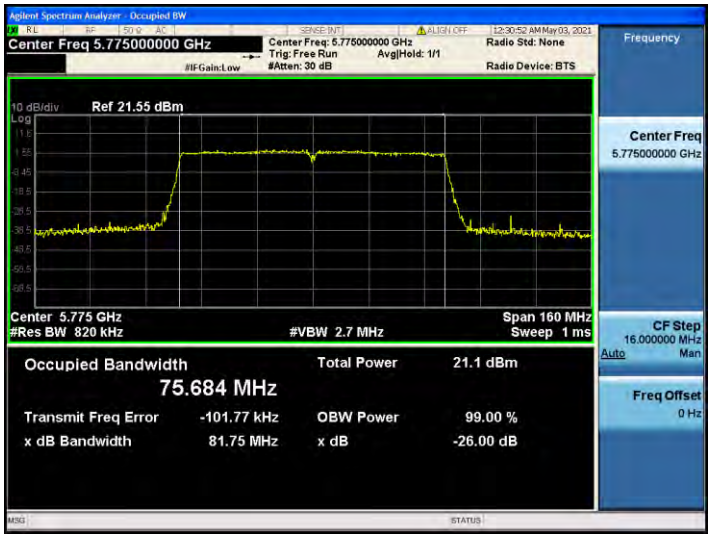
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT40 UNII 1 BAND 26dB Bandwidth(CH 38)	802.11ac_VHT40 UNII 2A BAND 26dB Bandwidth (CH 54)
	
802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 118)	**802.11ac_VHT40 UNII 3 BAND 26dB Bandwidth (CH 151)**
	

▣ Test Plots(802.11ac(VHT80))

Note:

In order to simplify the report, attached plots were only the most wide channel.

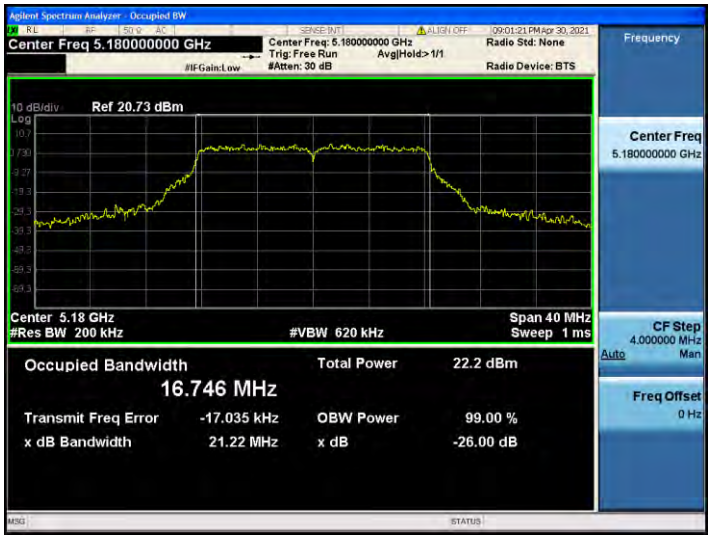
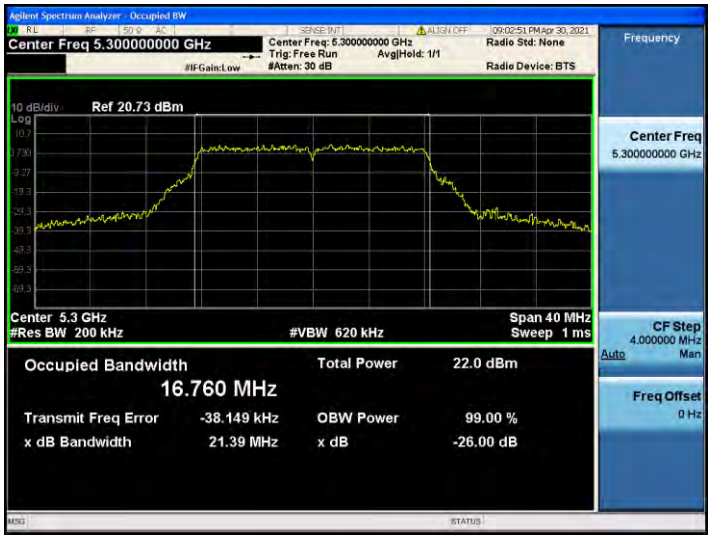
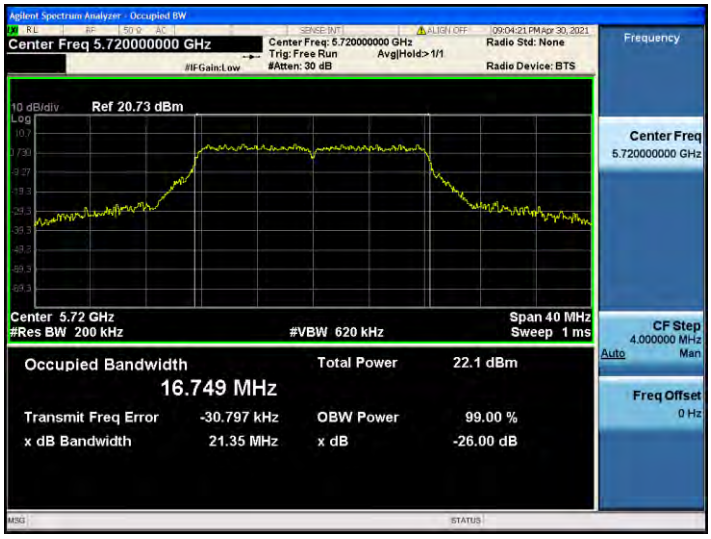
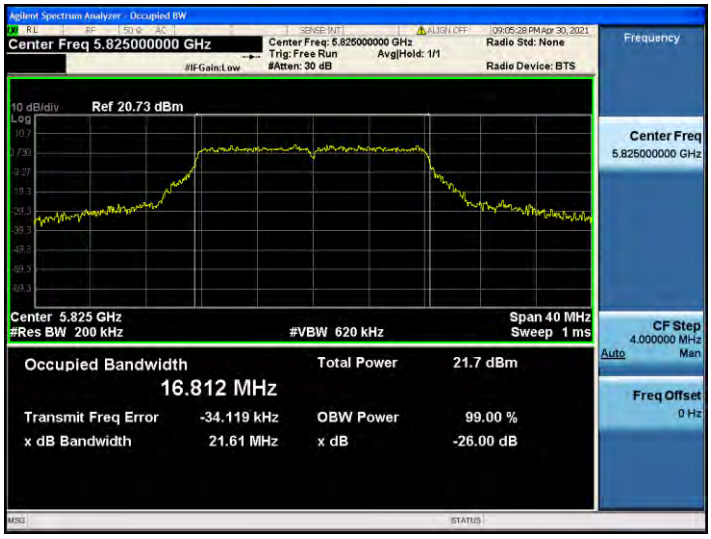
802.11ac_VHT80 UNII 1 BAND 26dB Bandwidth(CH 42)	802.11ac_VHT80 UNII 2A BAND 26dB Bandwidth (CH 58)
	
802.11ac_VHT80 UNII 2C BAND 26dB Bandwidth(CH 122)	**802.11ac_VHT80 UNII 3 BAND 26dB Bandwidth (CH 155)**
	

[Ant.2]

▣ Test Plots(802.11a)

Note:

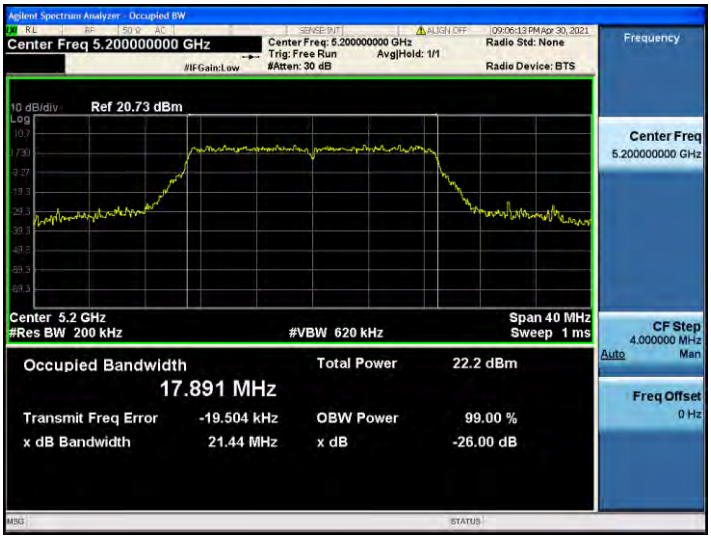
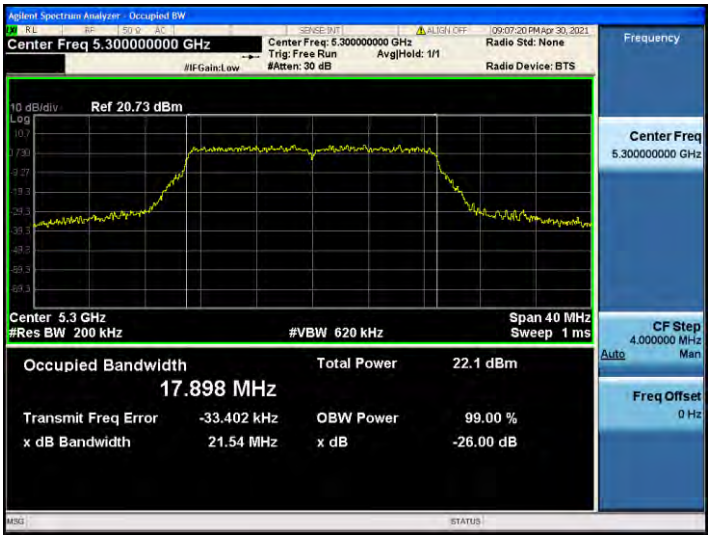
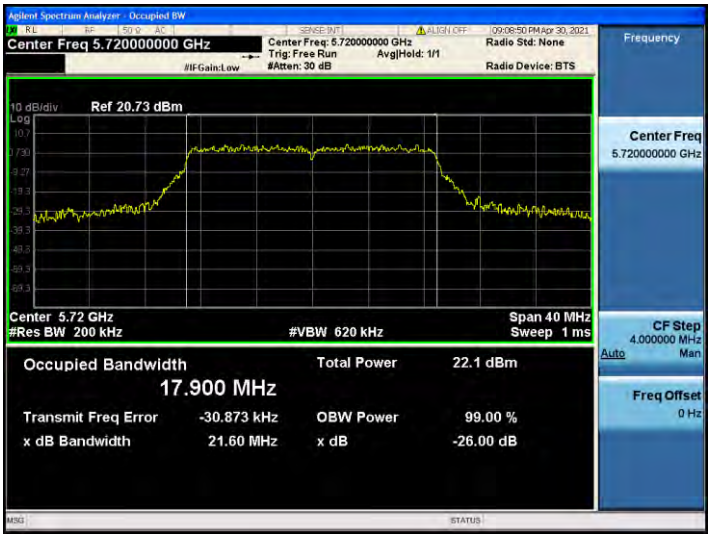
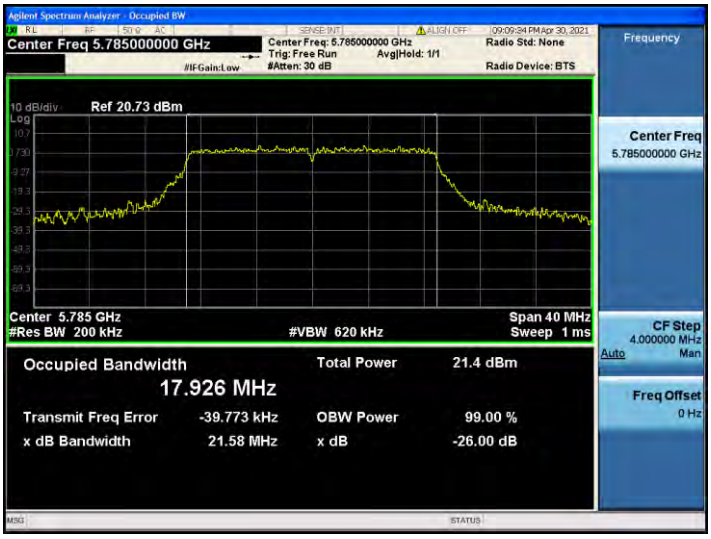
In order to simplify the report, attached plots were only the most wide channel.

802.11a UNII 1 BAND 26dB Bandwidth (CH 36)	802.11a UNII 2A BAND 26dB Bandwidth (CH 60)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**
	

▣ Test Plots(802.11n(HT20))

Note:

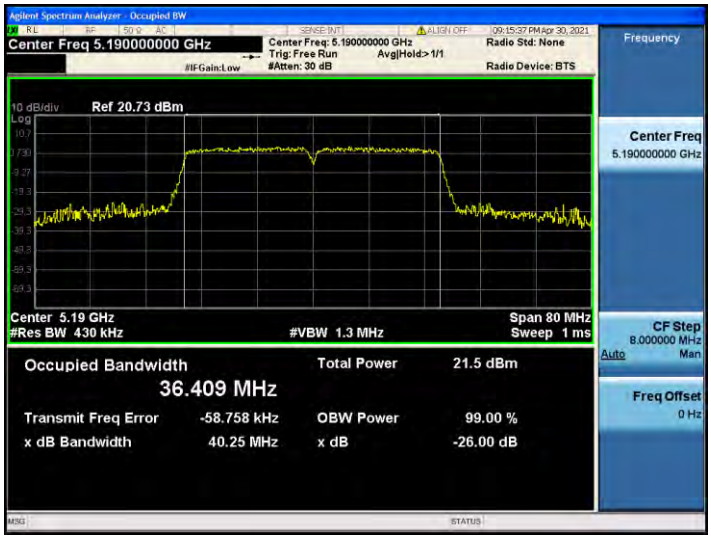
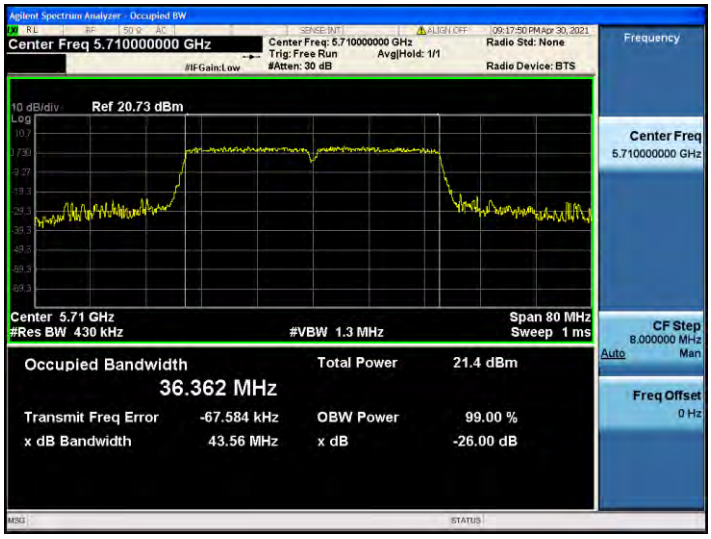
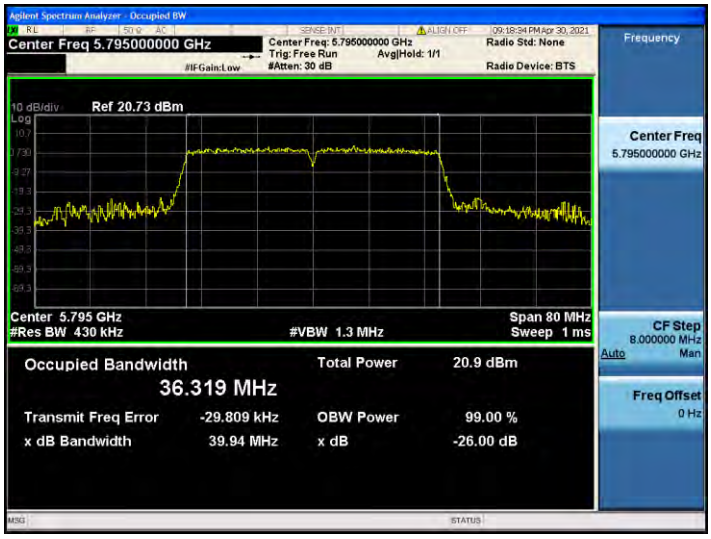
In order to simplify the report, attached plots were only the most wide channel.

802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 40)	802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 60)
	
802.11n_HT20 UNII 2C BAND 26dB Bandwidth(CH 144)	**802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 157)**
	

▣ Test Plots(802.11n(HT40))

Note:

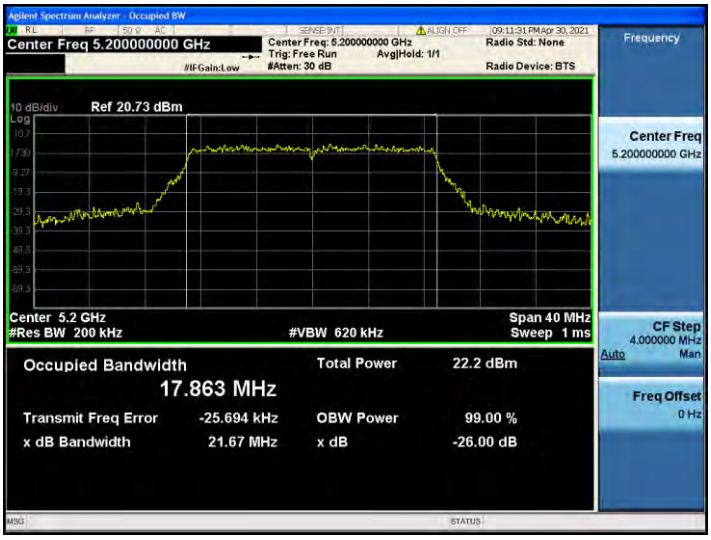
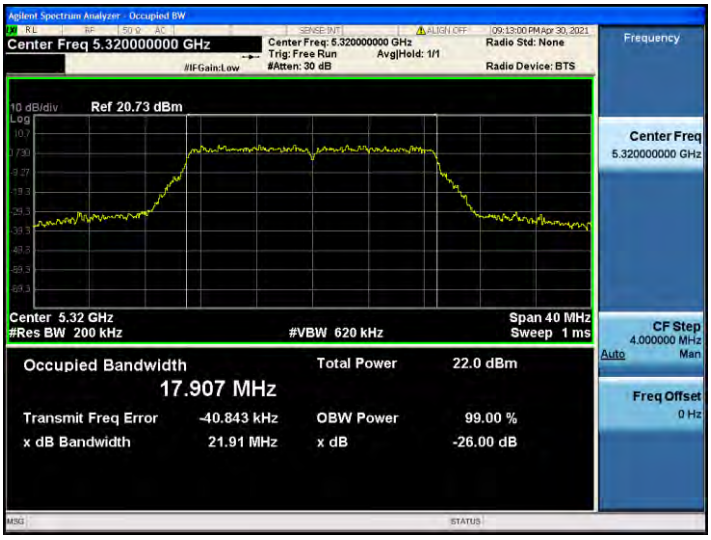
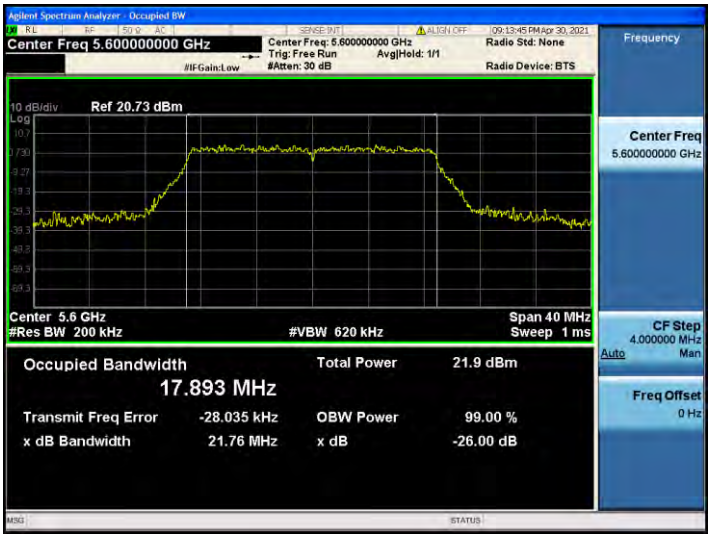
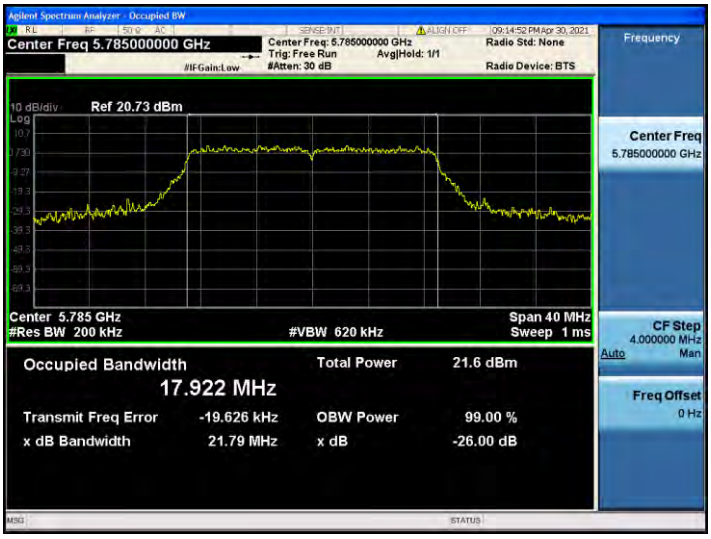
In order to simplify the report, attached plots were only the most wide channel.

802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 38)	802.11n_HT40 UNII 2A BAND 26dB Bandwidth (CH 54)
	
802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 142)	**802.11n_HT40 UNII 3 BAND 26dB Bandwidth (CH 159)**
	

▣ Test Plots(802.11ac(VHT20))

Note:

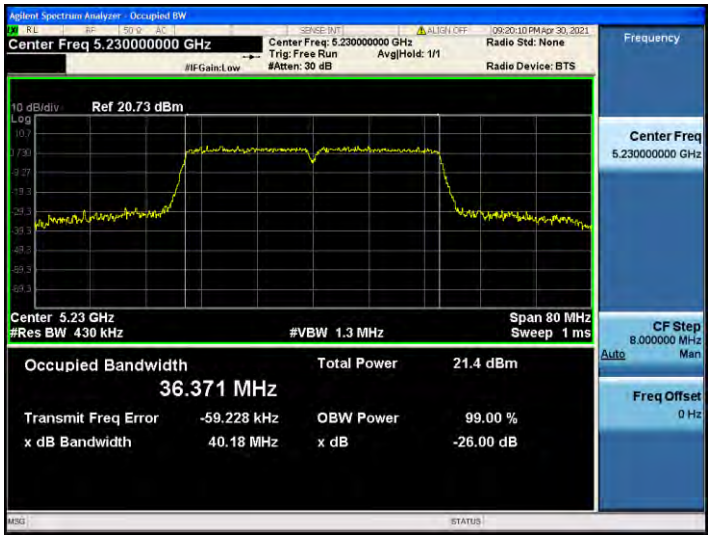
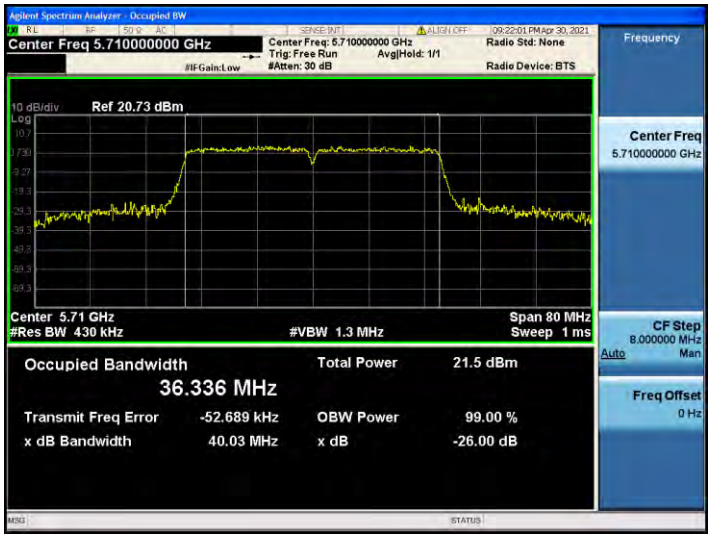
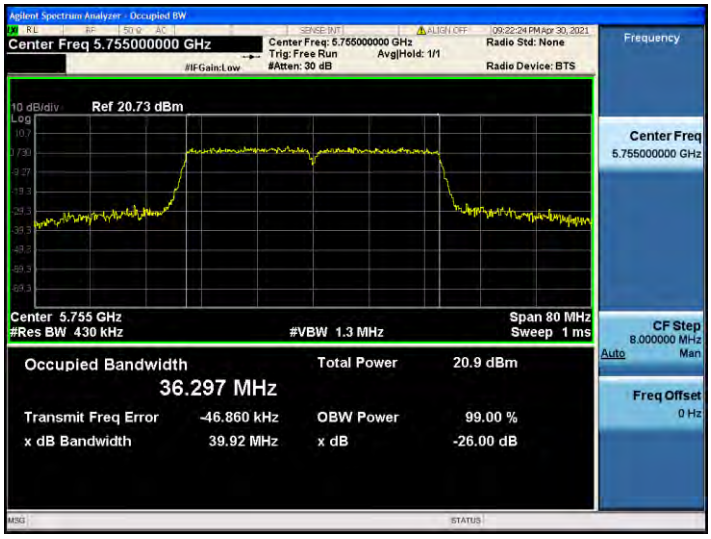
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT20 UNII 1 BAND 26dB Bandwidth(CH 40)	802.11ac_VHT20 UNII 2A BAND 26dB Bandwidth(CH 64)
	
802.11ac_VHT20 UNII 2C BAND 26dB Bandwidth(CH 120)	**802.11ac_VHT20 UNII 3 BAND 26dB Bandwidth(CH 157)**
	

▣ Test Plots(802.11ac(VHT40))

Note:

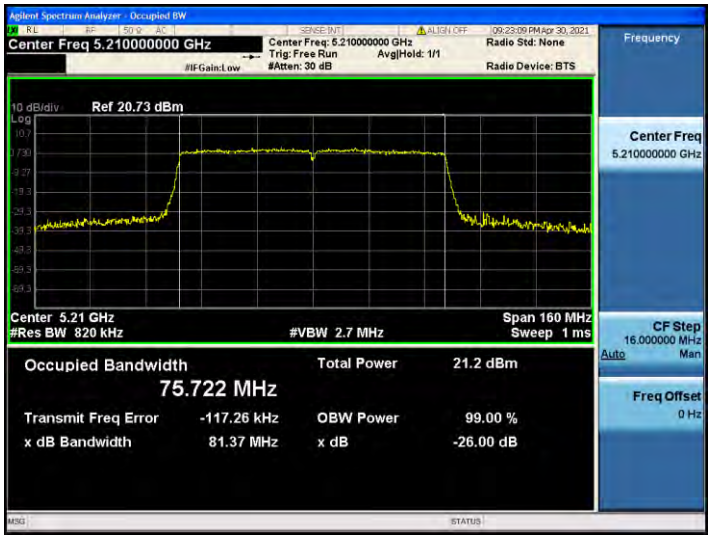
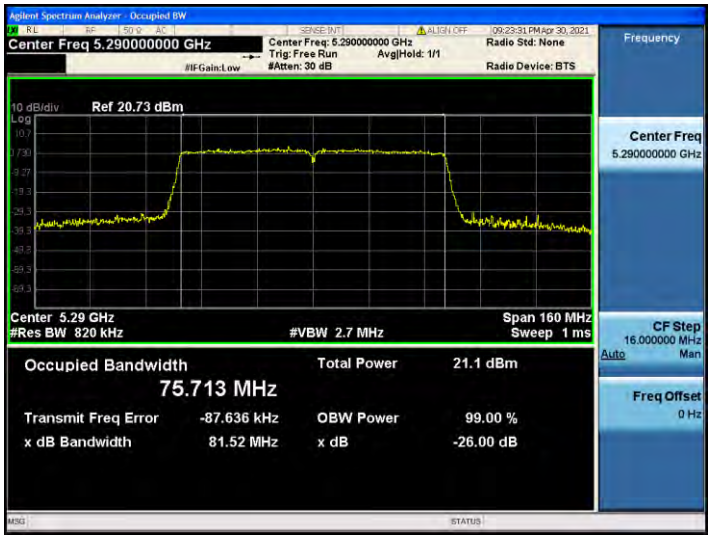
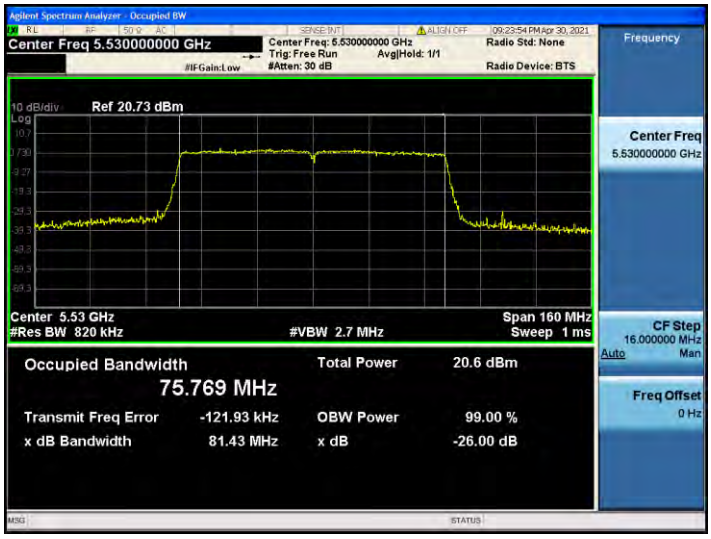
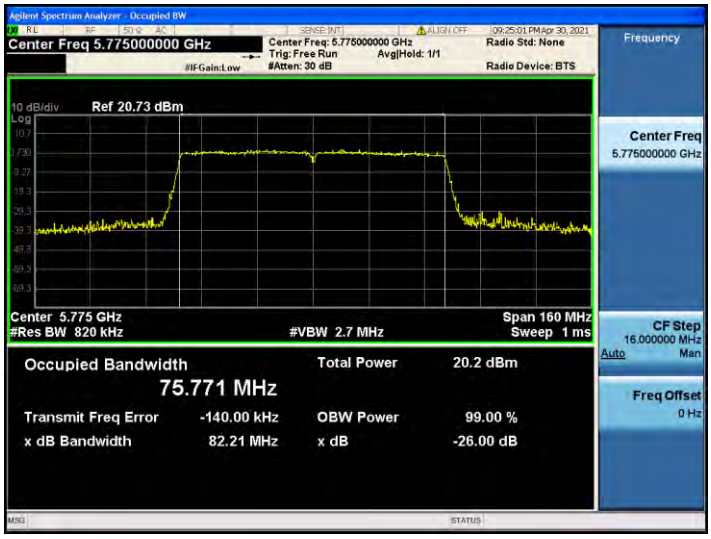
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT40 UNII 1 BAND 26dB Bandwidth(CH 46)	802.11ac_VHT40 UNII 2A BAND 26dB Bandwidth (CH 54)
	
802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 142)	**802.11ac_VHT40 UNII 3 BAND 26dB Bandwidth (CH 151)**
	

▣ Test Plots(802.11ac(VHT80))

Note:

In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT80 UNII 1 BAND 26dB Bandwidth(CH 42)	802.11ac_VHT80 UNII 2A BAND 26dB Bandwidth (CH 58)
	
802.11ac_VHT80 UNII 2C BAND 26dB Bandwidth(CH 106)	**802.11ac_VHT80 UNII 3 BAND 26dB Bandwidth (CH 155)**
	

10.3 6dB BANDWIDTH

[Ant.1]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.39	> 0.5	Pass
5785	157	16.42	> 0.5	Pass
5825	165	16.37	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.63	> 0.5	Pass
5785	157	17.60	> 0.5	Pass
5825	165	17.64	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.40	> 0.5	Pass
5795	159	36.31	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.63	> 0.5	Pass
5785	157	17.63	> 0.5	Pass
5825	165	17.60	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.38	> 0.5	Pass
5795	159	36.32	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.77	> 0.5	Pass

[Ant.2]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.42	> 0.5	Pass
5785	157	16.38	> 0.5	Pass
5825	165	16.38	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.65	> 0.5	Pass
5785	157	17.60	> 0.5	Pass
5825	165	17.61	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.29	> 0.5	Pass
5795	159	35.90	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.65	> 0.5	Pass
5785	157	17.60	> 0.5	Pass
5825	165	17.64	> 0.5	Pass

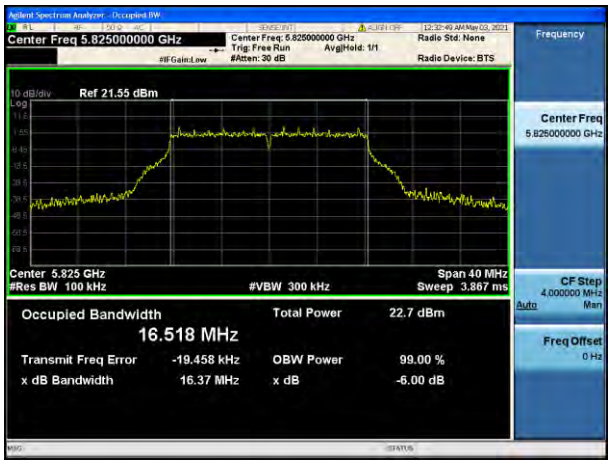
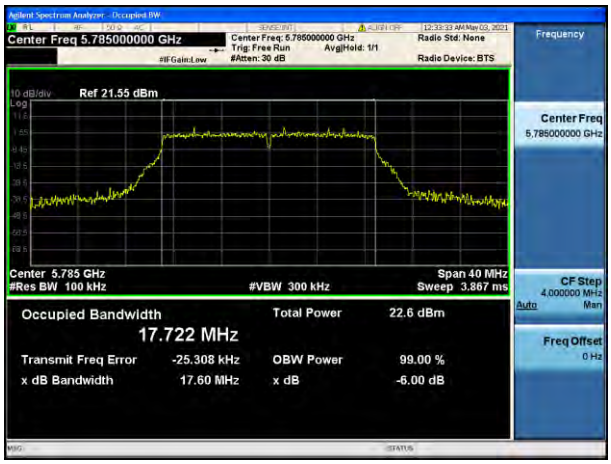
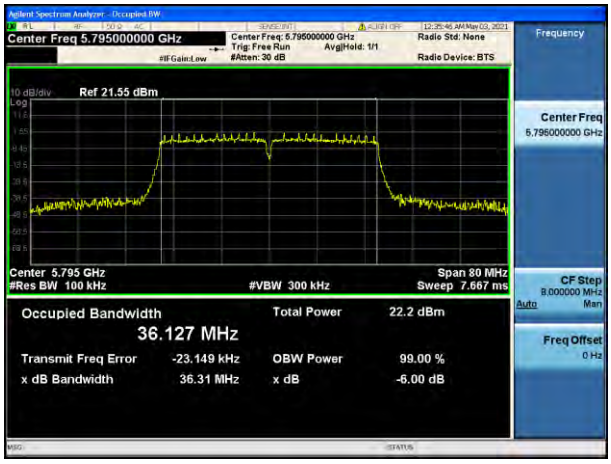
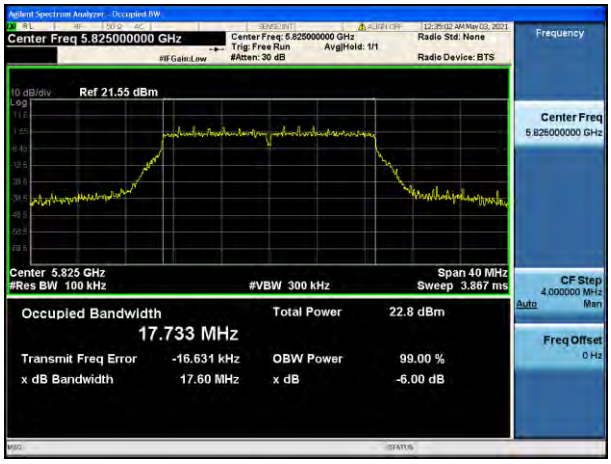
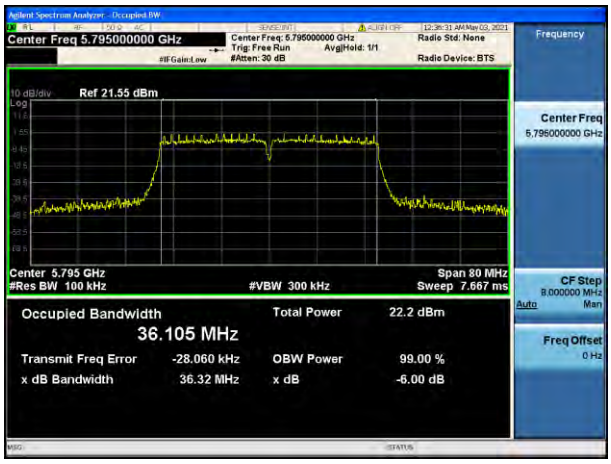
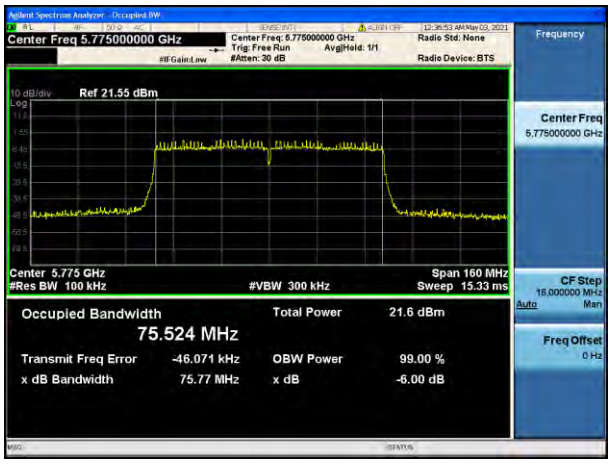
802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.35	> 0.5	Pass
5795	159	36.30	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.90	> 0.5	Pass

[Ant.1]

▣ Test Plots

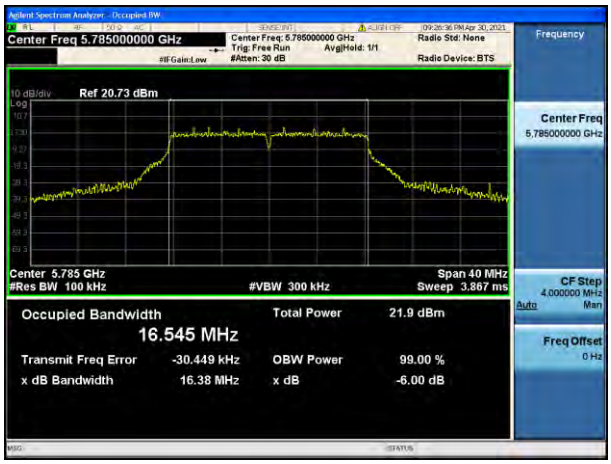
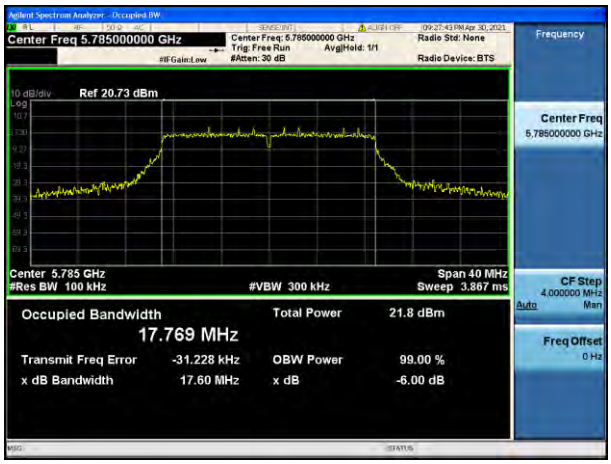
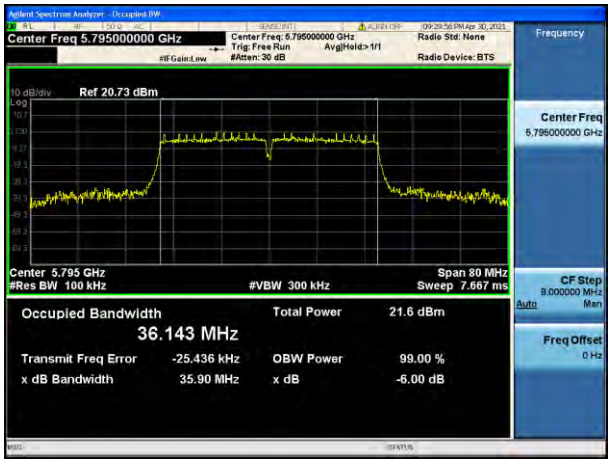
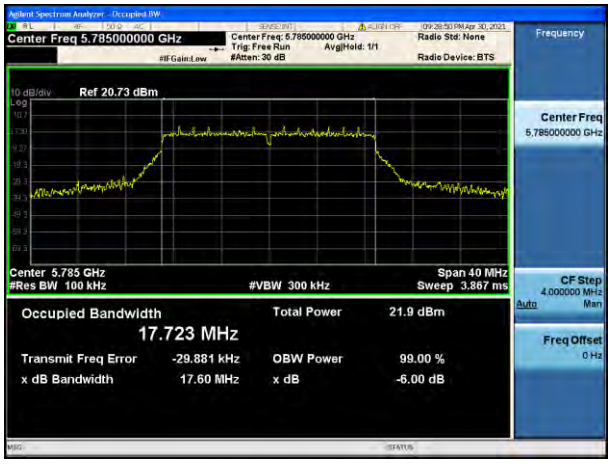
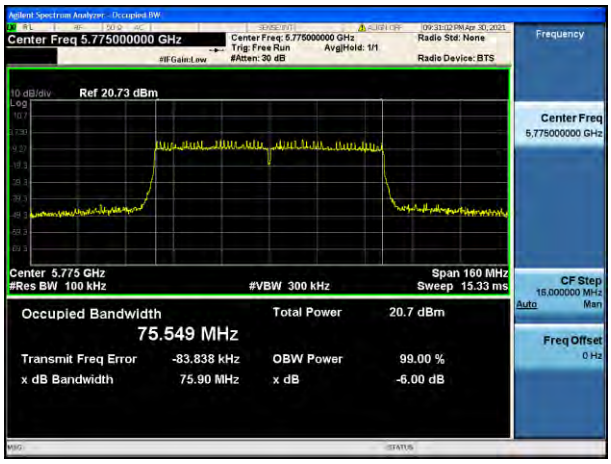
Note: In order to simplify the report, attached plots were only the most narrow channel.

802.11a (CH.165)	802.11n(HT20) (CH.157)
	
802.11n(HT40) (CH.159)	**802.11ac(VHT20) (CH.165)**
	
802.11ac(VHT40) (CH.159)	**802.11ac(VHT80) (CH.155)**
	

[Ant.2]

▣ Test Plots

Note: In order to simplify the report, attached plots were only the most narrow channel.

802.11a (CH.157)	802.11n(HT20) (CH.157)
	
802.11n(HT40) (CH.159)	**802.11ac(VHT20) (CH.157)**
	
802.11ac(VHT40) (CH.159)	**802.11ac(VHT80) (CH.155)**
	

10.4 OUTPUT POWER MEASUREMENT

Straddle channel data in the table below are for reporting purposes only.

Straddle channel data were added in section 10.7.3.

[Ant.1]

802.11a Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5180	36	16	13.92	1.963	15.88	23.98	54
5200	40	16	13.91	1.963	15.88	23.98	54
5240	48	16	14.28	1.963	16.24	23.98	54
5260	52	16	14.14	1.963	16.10	23.98	54
5300	60	16	14.38	1.963	16.34	23.98	54
5320	64	16	14.49	1.963	16.45	23.98	54
5500	100	16	13.89	1.963	15.86	23.98	54
5600	120	16	14.30	1.963	16.26	23.98	54
5720	144	16	14.37	1.963	16.33	23.98	54
5745	149	16	14.15	1.963	16.11	30.00	54
5785	157	16	14.24	1.963	16.21	30.00	54
5825	165	16	14.21	1.963	16.17	30.00	54

802.11n(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5180	36	16	13.92	1.919	15.84	23.98	MCS6
5200	40	16	13.97	1.919	15.89	23.98	MCS6
5240	48	16	14.31	1.919	16.23	23.98	MCS6
5260	52	16	14.25	1.919	16.17	23.98	MCS6
5300	60	16	14.42	1.919	16.34	23.98	MCS6
5320	64	16	14.50	1.919	16.42	23.98	MCS6
5500	100	16	13.93	1.919	15.85	23.98	MCS6
5600	120	16	14.36	1.919	16.28	23.98	MCS6
5720	144	16	14.39	1.919	16.30	23.98	MCS6
5745	149	16	14.12	1.919	16.04	30.00	MCS6
5785	157	16	14.24	1.919	16.16	30.00	MCS6
5825	165	16	14.27	1.919	16.19	30.00	MCS6

802.11n(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5190	38	13	9.72	3.123	12.84	23.98	MCS7
5230	46	15	12.38	3.123	15.50	23.98	MCS7
5270	54	15	12.38	3.123	15.50	23.98	MCS7
5310	62	12	8.85	3.123	11.98	23.98	MCS7
5510	102	11	7.58	3.123	10.70	23.98	MCS7
5590	118	15	12.37	3.123	15.50	23.98	MCS7
5710	142	15	12.58	3.123	15.71	23.98	MCS7
5755	151	15	12.32	3.123	15.44	30.00	MCS7
5795	159	15	12.31	3.123	15.43	30.00	MCS7

802.11ac(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5180	36	16	13.90	2.009	15.91	23.98	MCS7
5200	40	16	13.93	2.009	15.94	23.98	MCS7
5240	48	16	14.22	2.009	16.23	23.98	MCS7
5260	52	16	14.18	2.009	16.19	23.98	MCS7
5300	60	16	14.38	2.009	16.39	23.98	MCS7
5320	64	16	14.43	2.009	16.43	23.98	MCS7
5500	100	16	13.84	2.009	15.85	23.98	MCS7
5600	120	16	14.32	2.009	16.33	23.98	MCS7
5720	144	16	14.40	2.009	16.41	23.98	MCS7
5745	149	16	14.11	2.009	16.12	30.00	MCS7
5785	157	16	14.21	2.009	16.22	30.00	MCS7
5825	165	16	14.18	2.009	16.19	30.00	MCS7

802.11ac(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5190	38	14	10.47	3.245	13.72	23.98	MCS9
5230	46	15	12.23	3.245	15.48	23.98	MCS9
5270	54	15	12.23	3.245	15.48	23.98	MCS9
5310	62	13	9.99	3.245	13.24	23.98	MCS9
5510	102	12	8.61	3.245	11.85	23.98	MCS9
5590	118	15	12.11	3.245	15.36	23.98	MCS9
5710	142	15	12.42	3.245	15.67	23.98	MCS9
5755	151	15	12.17	3.245	15.41	30.00	MCS9
5795	159	15	12.10	3.245	15.35	30.00	MCS9

802.11ac(80MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5210	42	12	8.30	3.680	11.98	23.98	MCS5
5290	58	12	8.33	3.680	12.01	23.98	MCS5
5530	106	12	8.37	3.680	12.05	23.98	MCS5
5610	122	14	10.91	3.680	14.59	23.98	MCS5
5690	138	14	11.21	3.680	14.89	23.98	MCS5
5775	155	14	10.73	3.680	14.41	30.00	MCS5

[Ant.2]

802.11a Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5180	36	16	13.94	1.963	15.91	23.98	54
5200	40	16	13.83	1.963	15.79	23.98	54
5240	48	16	13.74	1.963	15.71	23.98	54
5260	52	16	14.03	1.963	15.99	23.98	54
5300	60	16	13.86	1.963	15.82	23.98	54
5320	64	16	13.72	1.963	15.68	23.98	54
5500	100	16	13.43	1.963	15.39	23.98	54
5600	120	16	13.55	1.963	15.51	23.98	54
5720	144	16	13.83	1.963	15.80	23.98	54
5745	149	16	13.22	1.963	15.19	30.00	54
5785	157	16	13.37	1.963	15.33	30.00	54
5825	165	16	13.62	1.963	15.58	30.00	54

802.11n(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5180	36	16	13.92	1.919	15.84	23.98	MCS6
5200	40	16	13.83	1.919	15.75	23.98	MCS6
5240	48	16	13.75	1.919	15.66	23.98	MCS6
5260	52	16	14.08	1.919	16.00	23.98	MCS6
5300	60	16	13.89	1.919	15.81	23.98	MCS6
5320	64	16	13.78	1.919	15.70	23.98	MCS6
5500	100	16	13.44	1.919	15.36	23.98	MCS6
5600	120	16	13.58	1.919	15.50	23.98	MCS6
5720	144	16	13.88	1.919	15.80	23.98	MCS6
5745	149	16	13.25	1.919	15.17	30.00	MCS6
5785	157	16	13.39	1.919	15.31	30.00	MCS6
5825	165	16	13.64	1.919	15.56	30.00	MCS6

802.11n(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5190	38	13	9.79	3.123	12.91	23.98	MCS7
5230	46	15	12.15	3.123	15.27	23.98	MCS7
5270	54	15	12.17	3.123	15.29	23.98	MCS7
5310	62	12	8.23	3.123	11.35	23.98	MCS7
5510	102	11	6.65	3.123	9.78	23.98	MCS7
5590	118	15	11.75	3.123	14.88	23.98	MCS7
5710	142	15	12.09	3.123	15.22	23.98	MCS7
5755	151	15	11.62	3.123	14.74	30.00	MCS7
5795	159	15	11.62	3.123	14.74	30.00	MCS7

802.11ac(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5180	36	16	13.86	2.009	15.87	23.98	MCS7
5200	40	16	13.77	2.009	15.78	23.98	MCS7
5240	48	16	13.68	2.009	15.69	23.98	MCS7
5260	52	16	13.95	2.009	15.96	23.98	MCS7
5300	60	16	13.89	2.009	15.90	23.98	MCS7
5320	64	16	13.71	2.009	15.72	23.98	MCS7
5500	100	16	13.37	2.009	15.38	23.98	MCS7
5600	120	16	13.50	2.009	15.51	23.98	MCS7
5720	144	16	13.81	2.009	15.82	23.98	MCS7
5745	149	16	13.19	2.009	15.20	30.00	MCS7
5785	157	16	13.31	2.009	15.32	30.00	MCS7
5825	165	16	13.56	2.009	15.57	30.00	MCS7

802.11ac(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5190	38	14	10.59	3.245	13.84	23.98	MCS9
5230	46	15	11.90	3.245	15.15	23.98	MCS9
5270	54	15	11.95	3.245	15.19	23.98	MCS9
5310	62	13	9.32	3.245	12.57	23.98	MCS9
5510	102	12	7.67	3.245	10.92	23.98	MCS9
5590	118	15	11.49	3.245	14.74	23.98	MCS9
5710	142	15	11.88	3.245	15.13	23.98	MCS9
5755	151	15	11.43	3.245	14.68	30.00	MCS9
5795	159	15	11.41	3.245	14.66	30.00	MCS9

802.11ac(80MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)	Worstcase MCS Index
Frequency [MHz]	Channel No.						
5210	42	12	8.15	3.680	11.83	23.98	MCS5
5290	58	12	8.01	3.680	11.69	23.98	MCS5
5530	106	12	7.27	3.680	10.95	23.98	MCS5
5610	122	14	10.10	3.680	13.78	23.98	MCS5
5690	138	14	10.37	3.680	14.05	23.98	MCS5
5775	155	14	9.72	3.680	13.40	30.00	MCS5

[MIMO]

802.11a Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5180	36	16	15.88	15.91	18.90	23.98	54
5200	40	16	15.88	15.79	18.85	23.98	54
5240	48	16	16.24	15.71	18.99	23.98	54
5260	52	16	16.10	15.99	19.06	23.98	54
5300	60	16	16.34	15.82	19.10	23.98	54
5320	64	16	16.45	15.68	19.10	23.98	54
5500	100	16	15.86	15.39	18.64	23.98	54
5600	120	16	16.26	15.51	18.91	23.98	54
5720	144	16	16.33	15.80	19.08	23.98	54
5745	149	16	16.11	15.19	18.68	30.00	54
5785	157	16	16.21	15.33	18.80	30.00	54
5825	165	16	16.17	15.58	18.90	30.00	54

802.11n(20MHz) Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5180	36	16	15.84	15.84	18.85	23.98	MCS6
5200	40	16	15.89	15.75	18.83	23.98	MCS6
5240	48	16	16.23	15.66	18.97	23.98	MCS6
5260	52	16	16.17	16.00	19.09	23.98	MCS6
5300	60	16	16.34	15.81	19.10	23.98	MCS6
5320	64	16	16.42	15.70	19.09	23.98	MCS6
5500	100	16	15.85	15.36	18.62	23.98	MCS6
5600	120	16	16.28	15.50	18.92	23.98	MCS6
5720	144	16	16.30	15.80	19.07	23.98	MCS6
5745	149	16	16.04	15.17	18.64	30.00	MCS6
5785	157	16	16.16	15.31	18.76	30.00	MCS6
5825	165	16	16.19	15.56	18.90	30.00	MCS6

802.11n(40MHz) Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5190	38	13	12.84	12.91	15.89	23.98	MCS7
5230	46	15	15.50	15.27	18.40	23.98	MCS7
5270	54	15	15.50	15.29	18.41	23.98	MCS7
5310	62	12	11.98	11.35	14.69	23.98	MCS7
5510	102	11	10.70	9.78	13.27	23.98	MCS7
5590	118	15	15.50	14.88	18.21	23.98	MCS7
5710	142	15	15.71	15.22	18.48	23.98	MCS7
5755	151	15	15.44	14.74	18.11	30.00	MCS7
5795	159	15	15.43	14.74	18.11	30.00	MCS7

802.11ac(20MHz) Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5180	36	16	15.91	15.87	18.90	23.98	MCS7
5200	40	16	15.94	15.78	18.87	23.98	MCS7
5240	48	16	16.23	15.69	18.98	23.98	MCS7
5260	52	16	16.19	15.96	19.09	23.98	MCS7
5300	60	16	16.39	15.90	19.16	23.98	MCS7
5320	64	16	16.43	15.72	19.10	23.98	MCS7
5500	100	16	15.85	15.38	18.63	23.98	MCS7
5600	120	16	16.33	15.51	18.95	23.98	MCS7
5720	144	16	16.41	15.82	19.13	23.98	MCS7
5745	149	16	16.12	15.20	18.70	30.00	MCS7
5785	157	16	16.22	15.32	18.81	30.00	MCS7
5825	165	16	16.19	15.57	18.90	30.00	MCS7

802.11ac(40MHz) Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5190	38	14	13.72	13.84	16.79	23.98	MCS9
5230	46	15	15.48	15.15	18.32	23.98	MCS9
5270	54	15	15.48	15.19	18.35	23.98	MCS9
5310	62	13	13.24	12.57	15.92	23.98	MCS9
5510	102	12	11.85	10.92	14.42	23.98	MCS9
5590	118	15	15.36	14.74	18.07	23.98	MCS9
5710	142	15	15.67	15.13	18.41	23.98	MCS9
5755	151	15	15.41	14.68	18.07	30.00	MCS9
5795	159	15	15.35	14.66	18.03	30.00	MCS9

802.11ac(80MHz) Mode		Power Level Setting	Ant.1 Measured Power (dBm) + Duty Cycle Factor	Ant.2 Measured Power (dBm) + Duty Cycle Factor	MIMO Total Power [dBm]	Limit (dBm)	Worstcase Datarate (Mbps)
Frequency [MHz]	Channel No.						
5210	42	12	11.98	11.83	14.92	23.98	MCS5
5290	58	12	12.01	11.69	14.87	23.98	MCS5
5530	106	12	12.05	10.95	14.54	23.98	MCS5
5610	122	14	14.59	13.78	17.22	23.98	MCS5
5690	138	14	14.89	14.05	17.50	23.98	MCS5
5775	155	14	14.41	13.40	16.95	30.00	MCS5

10.5 POWER SPECTRAL DENSITY

[Ant.1]

802.11a Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase Datarate (Mbps)	Limit
Frequency [MHz]	Channel No.					
5180	36	3.432	1.963	5.395	54	11 dBm/MHz
5200	40	3.060	1.963	5.023	54	
5240	48	3.271	1.963	5.234	54	
5260	52	3.691	1.963	5.654	54	
5300	60	3.957	1.963	5.920	54	
5320	64	3.632	1.963	5.595	54	
5500	100	3.236	1.963	5.199	54	
5600	120	3.475	1.963	5.438	54	
5720	144	3.681	1.963	5.644	54	
5745	149	0.814	1.963	2.777	54	30 dBm/500kHz
5785	157	0.719	1.963	2.682	54	
5825	165	1.093	1.963	3.056	54	

802.11n(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	2.699	1.919	4.618	MCS6	11 dBm/MHz
5200	40	2.961	1.919	4.880	MCS6	
5240	48	3.340	1.919	5.259	MCS6	
5260	52	2.883	1.919	4.802	MCS6	
5300	60	3.305	1.919	5.224	MCS6	
5320	64	3.593	1.919	5.512	MCS6	
5500	100	2.958	1.919	4.877	MCS6	
5600	120	3.129	1.919	5.048	MCS6	
5720	144	3.185	1.919	5.104	MCS6	
5745	149	0.292	1.919	2.211	MCS6	30 dBm/500kHz
5785	157	0.913	1.919	2.832	MCS6	
5825	165	0.469	1.919	2.388	MCS6	

802.11n(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	-3.831	3.123	-0.708	MCS7	11 dBm/MHz
5230	46	-1.386	3.123	1.737	MCS7	
5270	54	-1.088	3.123	2.035	MCS7	
5310	62	-4.262	3.123	-1.139	MCS7	
5510	102	-5.797	3.123	-2.674	MCS7	
5590	118	-1.216	3.123	1.907	MCS7	
5710	142	-0.970	3.123	2.153	MCS7	
5755	151	-3.046	3.123	0.077	MCS7	30 dBm /500kHz
5795	159	-4.000	3.123	-0.877	MCS7	

802.11ac(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	3.159	2.009	5.168	MCS7	11 dBm/MHz
5200	40	2.907	2.009	4.916	MCS7	
5240	48	3.389	2.009	5.398	MCS7	
5260	52	2.856	2.009	4.865	MCS7	
5300	60	3.422	2.009	5.431	MCS7	
5320	64	3.383	2.009	5.392	MCS7	
5500	100	3.083	2.009	5.092	MCS7	
5600	120	3.223	2.009	5.232	MCS7	
5720	144	3.495	2.009	5.504	MCS7	
5745	149	0.330	2.009	2.339	MCS7	30 dBm/500kHz
5785	157	0.534	2.009	2.543	MCS7	
5825	165	0.838	2.009	2.847	MCS7	

802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	-3.083	3.245	0.162	MCS9	11 dBm/MHz
5230	46	-0.946	3.245	2.299	MCS9	
5270	54	-1.455	3.245	1.790	MCS9	
5310	62	-3.806	3.245	-0.561	MCS9	
5510	102	-4.459	3.245	-1.214	MCS9	
5590	118	-1.563	3.245	1.682	MCS9	
5710	142	-1.034	3.245	2.211	MCS9	
5755	151	-3.827	3.245	-0.582	MCS9	30 dBm/500kHz
5795	159	-3.680	3.245	-0.435	MCS9	

802.11ac(80MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5210	42	-8.036	3.680	-4.356	MCS5	11 dBm/MHz
5290	58	-8.207	3.680	-4.527	MCS5	
5530	106	-7.897	3.680	-4.217	MCS5	
5610	122	-5.538	3.680	-1.858	MCS5	
5690	138	-5.632	3.680	-1.952	MCS5	
5775	155	-8.002	3.680	-4.322	MCS5	30 dBm/500kHz

[Ant.2]

802.11a Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase Datarate (Mbps)	Limit
Frequency [MHz]	Channel No.					
5180	36	2.935	1.963	4.898	54	11 dBm/MHz
5200	40	2.992	1.963	4.955	54	
5240	48	2.803	1.963	4.766	54	
5260	52	3.057	1.963	5.020	54	
5300	60	3.042	1.963	5.005	54	
5320	64	2.802	1.963	4.765	54	
5500	100	1.978	1.963	3.941	54	
5600	120	2.101	1.963	4.064	54	
5720	144	2.402	1.963	4.365	54	
5745	149	-0.028	1.963	1.935	54	30 dBm/500kHz
5785	157	-0.355	1.963	1.608	54	
5825	165	-0.003	1.963	1.960	54	

802.11n(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	3.136	1.919	5.055	MCS6	11 dBm/MHz
5200	40	3.284	1.919	5.203	MCS6	
5240	48	2.536	1.919	4.455	MCS6	
5260	52	2.728	1.919	4.647	MCS6	
5300	60	3.166	1.919	5.085	MCS6	
5320	64	2.589	1.919	4.508	MCS6	
5500	100	1.753	1.919	3.672	MCS6	
5600	120	1.836	1.919	3.755	MCS6	
5720	144	2.109	1.919	4.028	MCS6	
5745	149	-0.696	1.919	1.223	MCS6	30 dBm/500kHz
5785	157	-0.205	1.919	1.714	MCS6	
5825	165	-0.046	1.919	1.873	MCS6	

802.11n(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	-3.497	3.123	-0.374	MCS7	11 dBm/MHz
5230	46	-1.905	3.123	1.218	MCS7	
5270	54	-1.743	3.123	1.380	MCS7	
5310	62	-5.142	3.123	-2.019	MCS7	
5510	102	-7.075	3.123	-3.952	MCS7	
5590	118	-2.644	3.123	0.479	MCS7	
5710	142	-2.214	3.123	0.909	MCS7	
5755	151	-4.558	3.123	-1.435	MCS7	30 dBm /500kHz
5795	159	-4.609	3.123	-1.486	MCS7	

802.11ac(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	3.029	2.009	5.038	MCS7	11 dBm/MHz
5200	40	2.679	2.009	4.688	MCS7	
5240	48	2.518	2.009	4.527	MCS7	
5260	52	3.006	2.009	5.015	MCS7	
5300	60	2.735	2.009	4.744	MCS7	
5320	64	3.019	2.009	5.028	MCS7	
5500	100	2.106	2.009	4.115	MCS7	
5600	120	2.329	2.009	4.338	MCS7	
5720	144	2.117	2.009	4.126	MCS7	
5745	149	-0.406	2.009	1.603	MCS7	30 dBm/500kHz
5785	157	-0.388	2.009	1.621	MCS7	
5825	165	-0.010	2.009	1.999	MCS7	

802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	-2.550	3.245	0.695	MCS9	11 dBm/MHz
5230	46	-2.106	3.245	1.139	MCS9	
5270	54	-1.713	3.245	1.532	MCS9	
5310	62	-4.073	3.245	-0.828	MCS9	
5510	102	-5.428	3.245	-2.183	MCS9	
5590	118	-2.790	3.245	0.455	MCS9	
5710	142	-2.449	3.245	0.796	MCS9	
5755	151	-4.682	3.245	-1.437	MCS9	30 dBm/500kHz
5795	159	-3.825	3.245	-0.580	MCS9	

802.11ac(80MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5210	42	-7.756	3.680	-4.076	MCS5	11 dBm/MHz
5290	58	-8.608	3.680	-4.928	MCS5	
5530	106	-8.449	3.680	-4.769	MCS5	
5610	122	-6.812	3.680	-3.132	MCS5	
5690	138	-5.947	3.680	-2.267	MCS5	
5775	155	-9.234	3.680	-5.554	MCS5	30 dBm/500kHz

[MIMO]

802.11a Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase Datarate (Mbps)	Limit
Frequency [MHz]	Channel No.					
5180	36	5.395	4.898	8.164	54	11 dBm/MHz
5200	40	5.023	4.955	7.999	54	
5240	48	5.234	4.766	8.017	54	
5260	52	5.654	5.020	8.359	54	
5300	60	5.920	5.005	8.497	54	
5320	64	5.595	4.765	8.210	54	
5500	100	5.199	3.941	7.626	54	
5600	120	5.438	4.064	7.815	54	
5720	144	5.644	4.365	8.062	54	
5745	149	2.777	1.935	5.387	54	30 dBm/500kHz
5785	157	2.682	1.608	5.188	54	
5825	165	3.056	1.960	5.553	54	

802.11n(20MHz) Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	4.618	5.055	7.852	MCS6	11 dBm/MHz
5200	40	4.880	5.203	8.055	MCS6	
5240	48	5.259	4.455	7.886	MCS6	
5260	52	4.802	4.647	7.735	MCS6	
5300	60	5.224	5.085	8.165	MCS6	
5320	64	5.512	4.508	8.049	MCS6	
5500	100	4.877	3.672	7.326	MCS6	
5600	120	5.048	3.755	7.460	MCS6	
5720	144	5.104	4.028	7.609	MCS6	
5745	149	2.211	1.223	4.755	MCS6	30 dBm/500kHz
5785	157	2.832	1.714	5.319	MCS6	
5825	165	2.388	1.873	5.148	MCS6	

802.11n(40MHz) Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	-0.708	-0.374	2.473	MCS7	11 dBm/MHz
5230	46	1.737	1.218	4.496	MCS7	
5270	54	2.035	1.380	4.730	MCS7	
5310	62	-1.139	-2.019	1.454	MCS7	
5510	102	-2.674	-3.952	-0.256	MCS7	
5590	118	1.907	0.479	4.262	MCS7	
5710	142	2.153	0.909	4.586	MCS7	
5755	151	0.077	-1.435	2.397	MCS7	30 dBm /500kHz
5795	159	-0.877	-1.486	1.840	MCS7	

802.11ac(20MHz) Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5180	36	5.168	5.038	8.114	MCS7	11 dBm/MHz
5200	40	4.916	4.688	7.814	MCS7	
5240	48	5.398	4.527	7.995	MCS7	
5260	52	4.865	5.015	7.951	MCS7	
5300	60	5.431	4.744	8.112	MCS7	
5320	64	5.392	5.028	8.224	MCS7	
5500	100	5.092	4.115	7.641	MCS7	
5600	120	5.232	4.338	7.818	MCS7	
5720	144	5.504	4.126	7.880	MCS7	
5745	149	2.339	1.603	4.997	MCS7	30 dBm/500kHz
5785	157	2.543	1.621	5.117	MCS7	
5825	165	2.847	1.999	5.454	MCS7	

802.11ac(40MHz) Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5190	38	0.162	0.695	3.447	MCS9	11 dBm/MHz
5230	46	2.299	1.139	4.768	MCS9	
5270	54	1.790	1.532	4.673	MCS9	
5310	62	-0.561	-0.828	2.318	MCS9	
5510	102	-1.214	-2.183	1.339	MCS9	
5590	118	1.682	0.455	4.122	MCS9	
5710	142	2.211	0.796	4.571	MCS9	
5755	151	-0.582	-1.437	2.022	MCS9	30 dBm/500kHz
5795	159	-0.435	-0.580	2.504	MCS9	

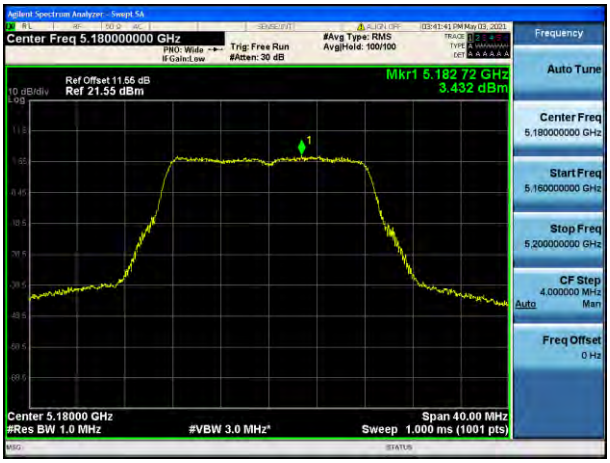
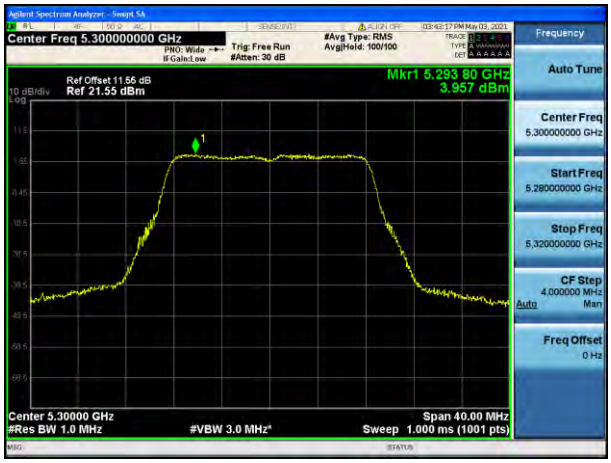
802.11ac(80MHz) Mode		ANT.1 Measured Power(dBm) + Duty Cycle Factor (dB)	ANT.2 Measured Power(dBm) + Duty Cycle Factor (dB)	MIMO Result (dBm)	Worstcase MCS Index	Limit
Frequency [MHz]	Channel No.					
5210	42	-4.356	-4.076	-1.204	MCS5	11 dBm/MHz
5290	58	-4.527	-4.928	-1.713	MCS5	
5530	106	-4.217	-4.769	-1.474	MCS5	
5610	122	-1.858	-3.132	0.562	MCS5	
5690	138	-1.952	-2.267	0.903	MCS5	
5775	155	-4.322	-5.554	-1.884	MCS5	30 dBm/500kHz

[Ant.1]

▣ Test Plots(802.11a)

Note:

In order to simplify the report, attached plots were only channel of highest power.

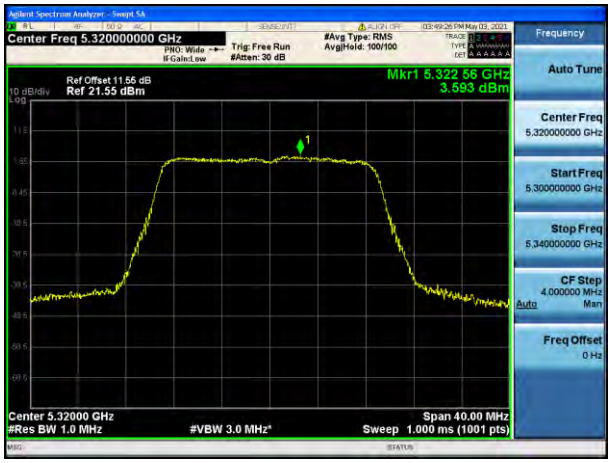
UNII 1 (Ch. 36)	UNII 2A (Ch. 60)
	

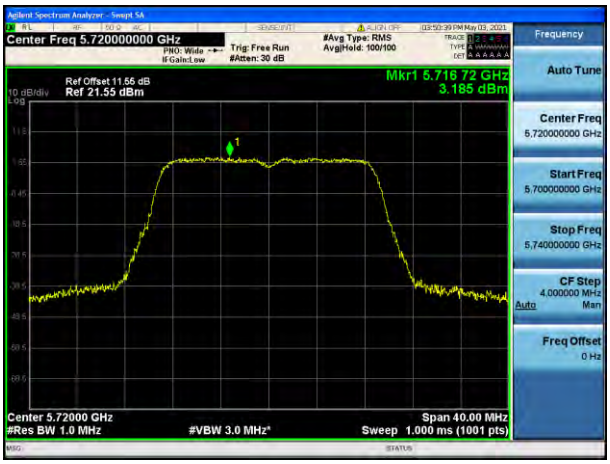
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT20))

Note:

In order to simplify the report, attached plots were only channel of highest power.

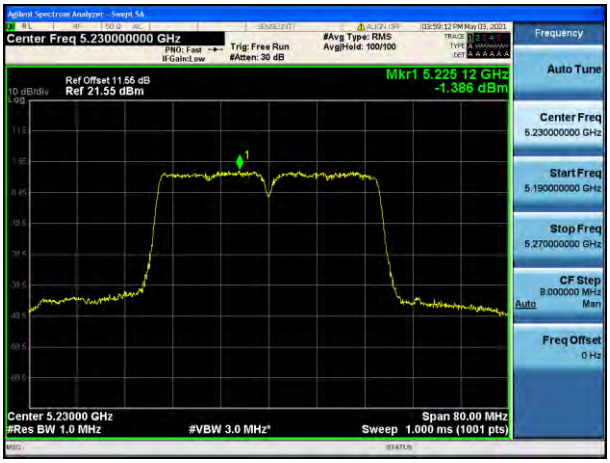
UNII 1 (Ch. 48)	UNII 2A (Ch. 64)
	

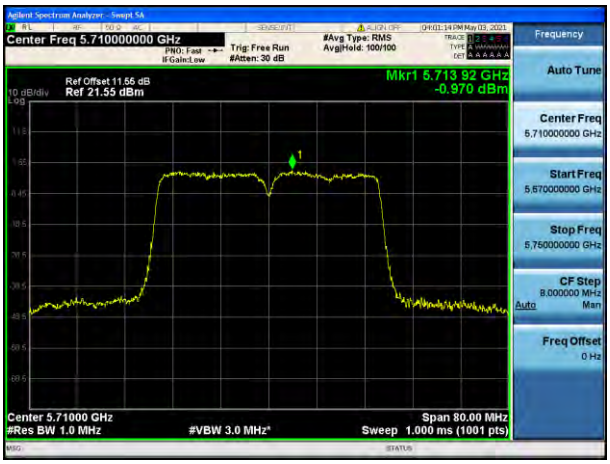
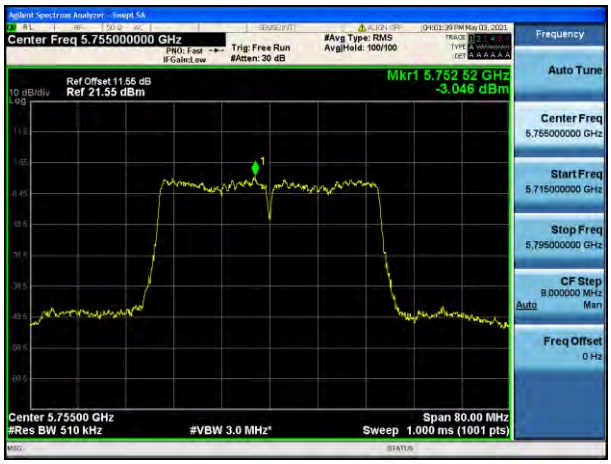
UNII 2C (Ch. 144)	UNII 3 (Ch. 157)
	

▣ Test Plots(802.11n(HT40))

Note:

In order to simplify the report, attached plots were only channel of highest power.

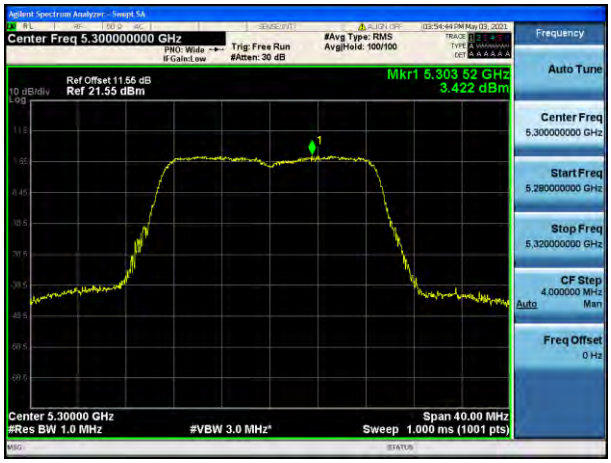
UNII 1 (Ch. 46)	UNII 2A (Ch. 54)
	

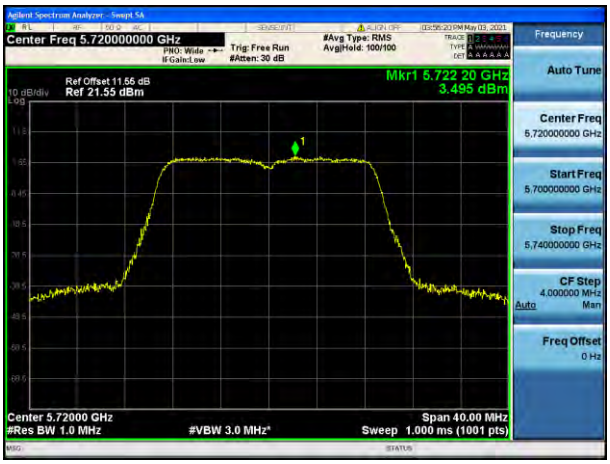
UNII 2C (Ch. 142)	UNII 3 (Ch. 151)
	

▣ Test Plots(802.11ac(VHT20))

Note:

In order to simplify the report, attached plots were only channel of highest power.

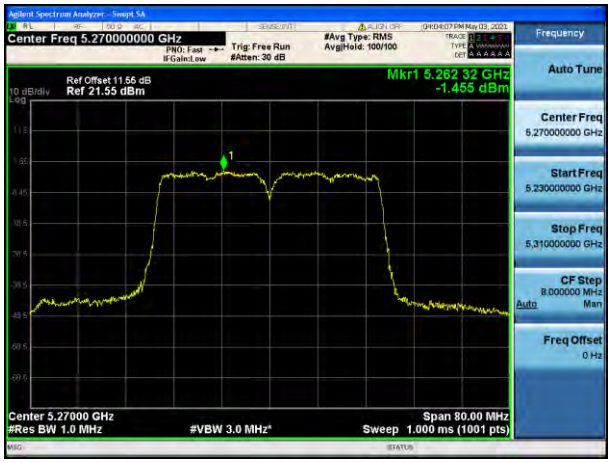
UNII 1 (Ch. 48)	UNII 2A (Ch. 60)
	

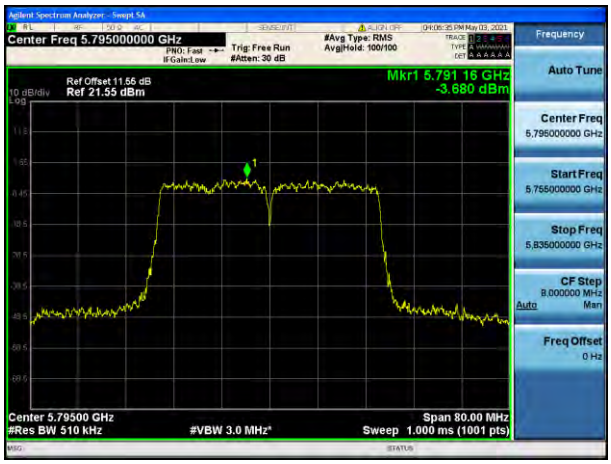
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11ac(VHT40))

Note:

In order to simplify the report, attached plots were only channel of highest power.

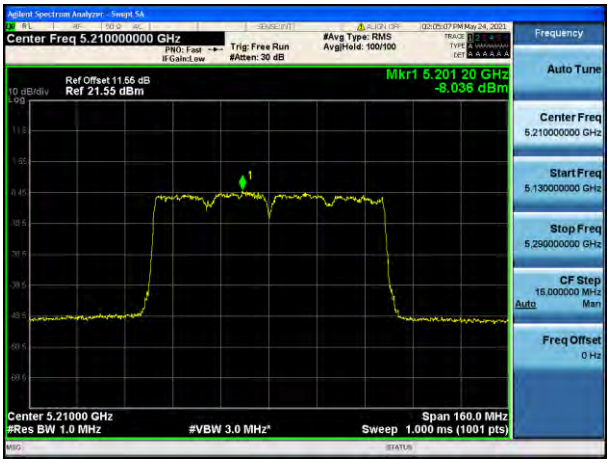
UNII 1 (Ch. 46)	UNII 2A (Ch. 54)
	

UNII 2C (Ch. 142)	UNII 3 (Ch. 159)
	

▣ Test Plots(802.11ac(VHT80))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 42)	UNII 2A (Ch. 58)
	

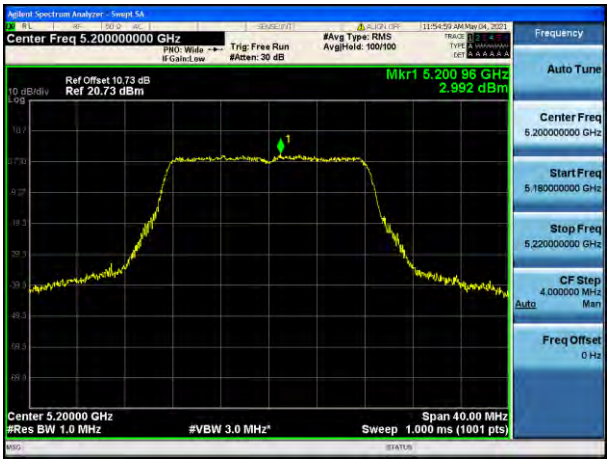
UNII 2C (Ch. 122)	UNII 3 (Ch. 155)
	

[Ant.2]

▣ Test Plots(802.11a)

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 40)	UNII 2A (Ch. 52)
	

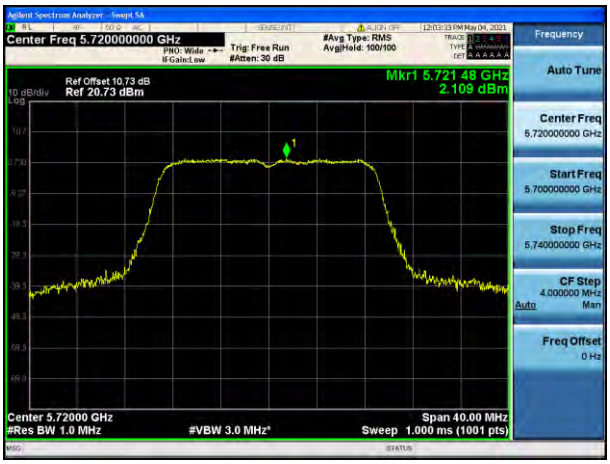
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT20))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 40)	UNII 2A (Ch. 60)
	

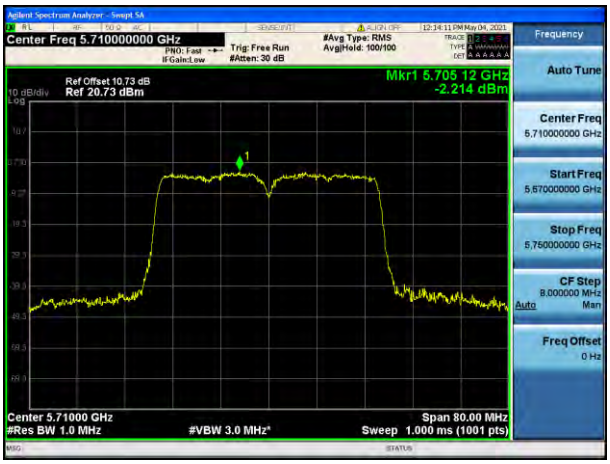
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT40))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 46)	UNII 2A (Ch. 54)
	

UNII 2C (Ch. 142)	UNII 3 (Ch. 151)
	

▣ Test Plots(802.11ac(VHT20))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 36)	UNII 2A (Ch. 64)
	

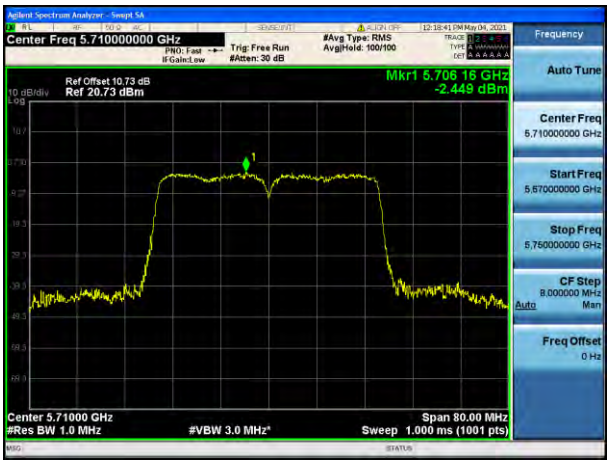
UNII 2C (Ch. 120)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11ac(VHT40))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 46)	UNII 2A (Ch. 54)
	

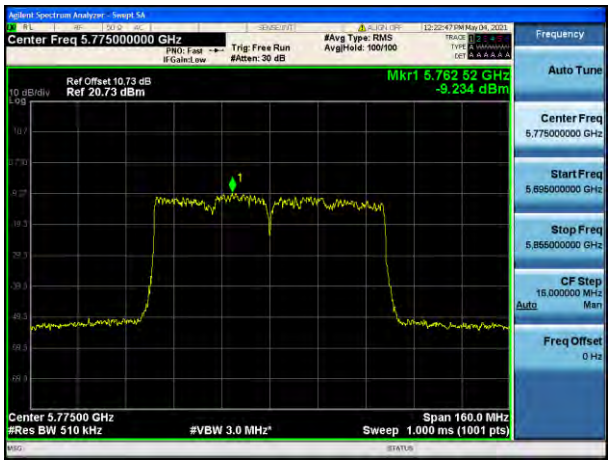
UNII 2C (Ch. 142)	UNII 3 (Ch. 159)
	

▣ Test Plots(802.11ac(VHT80))

Note:

In order to simplify the report, attached plots were only channel of highest power.

UNII 1 (Ch. 42)	UNII 2A (Ch. 58)
	

UNII 2C (Ch. 138)	UNII 3 (Ch. 155)
	

10.6 FREQUENCY STABILITY.

10.6.1 80MHz BW

Startup after the EUT is energized

[Ant.1]

OPERATING BAND:	UNII Band 1
OPERATING FREQUENCY:	5,210,000,000 Hz
CHANNEL:	42
REFERENCE VOLTAGE:	4.20 VDC

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (kHz)	Frequency Error (kHz)
100%	4.20	+20(Ref)	5210033.28	33.28
100%		-30	5210006.87	6.87
100%		-20	5210010.53	10.53
100%		-10	5210019.60	19.60
100%		0	5210023.80	23.80
100%		+10	5210027.14	27.14
100%		+30	5210039.48	39.48
100%		+40	5210044.76	44.76
100%		+50	5210060.90	60.90
Batt. Endpoint	3.65	+20	5210034.24	34.24

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

OPERATING BAND:	UNII Band 2A
OPERATING FREQUENCY:	5,290,000,000 Hz
CHANNEL:	58
REFERENCE VOLTAGE:	4.20 VDC

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (kHz)	Frequency Error (kHz)
100%	4.20	+20(Ref)	5290033.68	33.68
100%		-30	5290009.92	9.92
100%		-20	5290010.54	10.54
100%		-10	5290019.19	19.19
100%		0	5290021.17	21.17
100%		+10	5290025.75	25.75
100%		+30	5290035.63	35.63
100%		+40	5290044.71	44.71
100%		+50	5290051.22	51.22
Batt. Endpoint	3.65	+20	5290034.40	34.4

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

OPERATING BAND:	UNII Band 2C
OPERATING FREQUENCY:	5,530,000,000 Hz
CHANNEL:	106
REFERENCE VOLTAGE:	4.20 VDC

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (kHz)	Frequency Error (kHz)
100%	4.20	+20(Ref)	5530032.54	32.54
100%		-30	5530008.70	8.70
100%		-20	5530010.06	10.06
100%		-10	5530019.30	19.3
100%		0	5530020.68	20.68
100%		+10	5530026.10	26.1
100%		+30	5530039.90	39.9
100%		+40	5530045.92	45.92
100%		+50	5530056.43	56.43
Batt. Endpoint	3.65	+20	5530031.66	31.66

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

OPERATING BAND:	UNII Band 3
OPERATING FREQUENCY:	5,775,000,000 Hz
CHANNEL:	155
REFERENCE VOLTAGE:	4.20 VDC

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (kHz)	Frequency Error (kHz)
100%	4.20	+20(Ref)	5775035.04	35.04
100%		-30	5775008.69	8.69
100%		-20	5775011.59	11.59
100%		-10	5775017.74	17.74
100%		0	5775021.95	21.95
100%		+10	5775027.03	27.03
100%		+30	5775040.90	40.9
100%		+40	5775040.44	40.44
100%		+50	5775052.11	52.11
Batt. Endpoint	3.65	+20	5775031.12	31.12

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.

2 minutes after the EUT is energized

OPERATING BAND:	UNII Band 1
OPERATING FREQUENCY:	5,210,000,000 Hz
CHANNEL:	42
REFERENCE VOLTAGE:	4.20 VDC

Voltage (%)	Power (VDC)	Temp. (℃)	Frequency (kHz)	Frequency Error (kHz)
100%	4.20	+20(Ref)	5210034.65	34.65
100%		-30	5210006.95	6.95
100%		-20	5210015.85	15.85
100%		-10	5210020.56	20.56
100%		0	5210025.66	25.66
100%		+10	5210029.63	29.63
100%		+30	5210040.21	40.21
100%		+40	5210043.42	43.42
100%		+50	5210059.02	59.02
Batt. Endpoint	3.65	+20	5210034.68	34.68

Note:

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency error noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature and voltage range as tested.