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TEST REPORT

FCC UNII Test for DA330SNFN

Certification

APPLICANT
HYUNDAI MOBIS CO., LTD

REPORT NO.
HCT-RF-2004-FC003

DATE OF ISSUE
April 03, 2020

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Additional Model
DA330SNGG, DA331SNGG, DA332SNGG, DA330SNGN, DA330SNGL, DA330SNMG, DA330SNEP, DA331SNEP, DA333SNGG, DA334SNGG, DA331SNGN, DA333SNEP, DA330SNUA

Applicant	**HYUNDAI MOBIS CO., LTD** 203, Teheran-ro, Gangnam-gu, Seoul, 135-977, South Korea
Eut Type Model Name	Car Audio System DA330SNFN
FCC ID	TQ8-DA330SNFN
Modulation type	OFDM
FCC Classification	Unlicensed National Information Infrastructure(NII)
FCC Rule Part(s)	Part 15.407

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard.

Tested by
Jin Gwan Lee (signature)

Technical Manager
Jong Seok Lee (signature)

HCT CO., LTD.
Soo Chan Lee
SooChan Lee / CEO

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	April 03, 2020	Initial Release

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.

CONTENTS

1. GENERAL INFORMATION

EUT DESCRIPTION

Model	DA330SNFN	
Additional Model	DA330SNGG, DA331SNGG, DA332SNGG, DA330SNGN, DA330SNGL, DA330SNMG, DA330SNEP, DA331SNEP, DA333SNGG, DA334SNGG, DA331SNGN, DA333SNEP, DA330SNUA	
EUT Type	Car Audio System	
Power Supply	DC 14.4 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
Antenna type	Pattern Antenna	
Antenna Peak Gain	-0.61 dBi(UNII 1), -0.18 dBi(UNII 2A)/ -0.77 dBi(UNII 2C)/ -0.18 dBi(UNII 3)	
Straddle channel	Supported	
TDWR Band	Not Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	March 16, 2020 ~ March 27, 2020	

2. MAXIMUM OUTPUT POWER

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

Band	Mode	RF Output Power (dBm)	RF Output Power (W)
UNII1	802.11a	9.21	0.008
	802.11n (HT20)	9.17	0.008
	802.11n (HT40)	4.94	0.003
	802.11ac (VHT20)	9.16	0.008
	802.11ac (VHT40)	4.93	0.003
	802.11ac (VHT80)	5.57	0.004
UNII2A	802.11a	9.13	0.008
	802.11n (HT20)	8.91	0.008
	802.11n (HT40)	7.35	0.005
	802.11ac (VHT20)	9.03	0.008
	802.11ac (VHT40)	7.56	0.006
	802.11ac (VHT80)	7.83	0.006
UNII2C	802.11a	6.11	0.004
	802.11n (HT20)	5.90	0.004
	802.11n (HT40)	5.65	0.004
	802.11ac (VHT20)	6.15	0.004
	802.11ac (VHT40)	5.58	0.004
	802.11ac (VHT80)	5.41	0.003
UNII3	802.11a	2.97	0.002
	802.11n (HT20)	3.11	0.002
	802.11n (HT40)	2.43	0.002
	802.11ac (VHT20)	3.08	0.002
	802.11ac (VHT40)	2.18	0.002
	802.11ac (VHT80)	2.26	0.002

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 3.75 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.

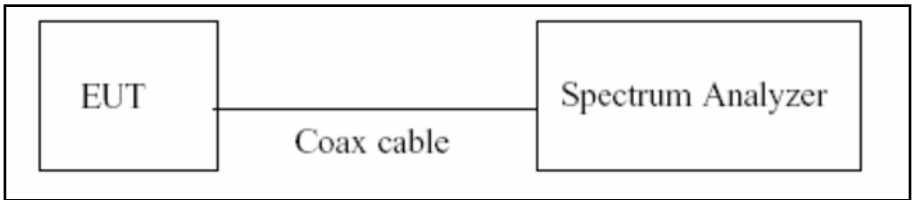
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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.

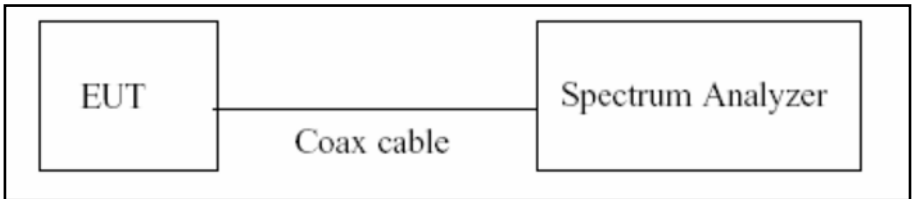
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

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.

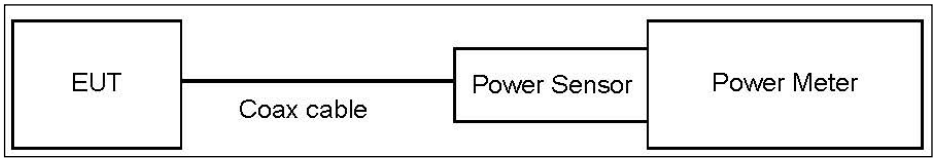
8.3. Output Power Measurement

Limit

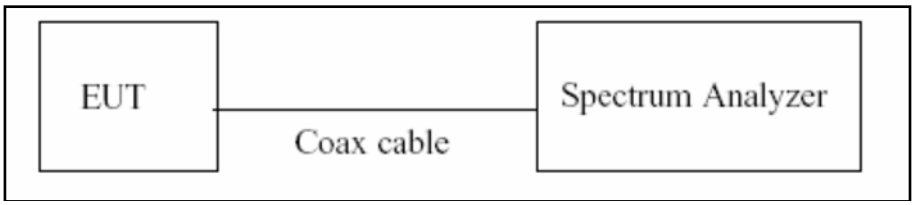
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

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 = Attenuator loss(20 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	21.87
UNII 2A	21.87
UNII 2C	21.87
UNII 3	21.87

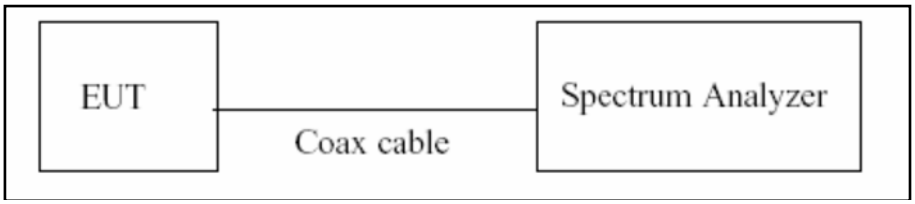
(Actual value of loss for the attenuator and cable combination)

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 = Attenuator loss(20 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	21.87
UNII 2A	21.87
UNII 2C	21.87
UNII 3	21.87

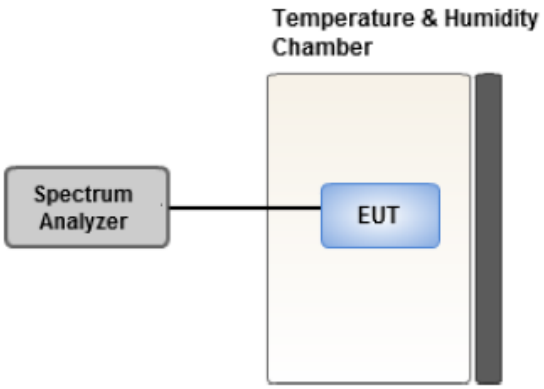
(Actual value of loss for the attenuator and cable combination)

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.

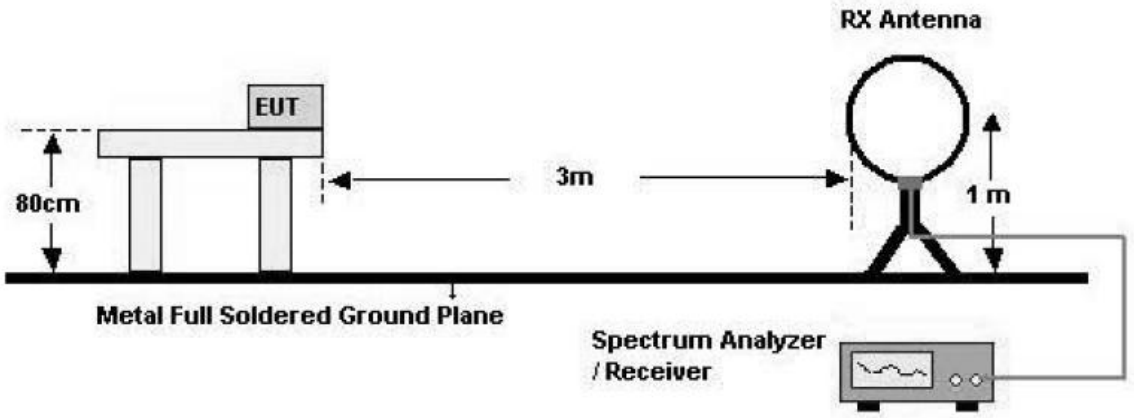
3. UNII 3: All emissions shall be limited to a level of －27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below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

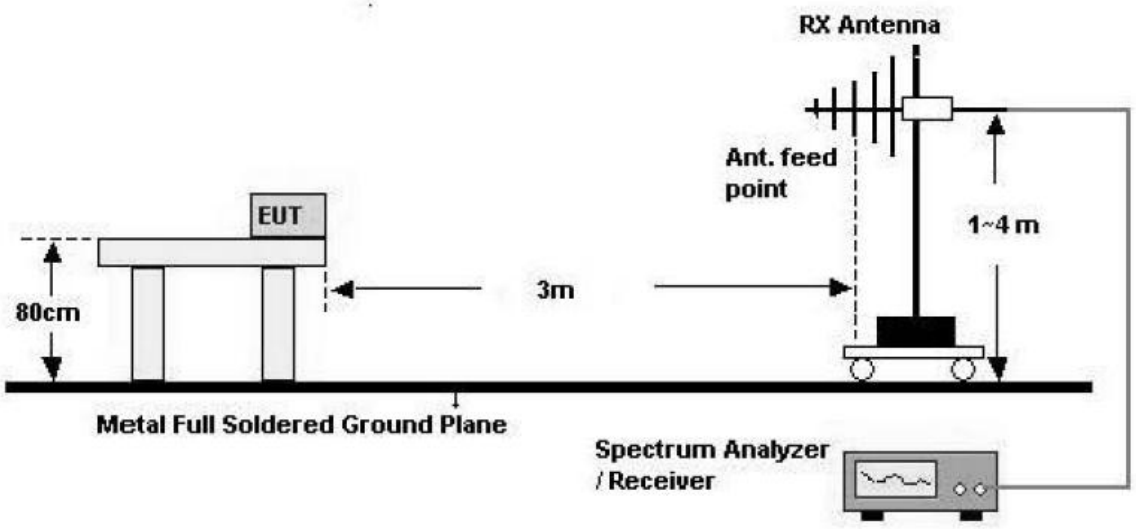
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

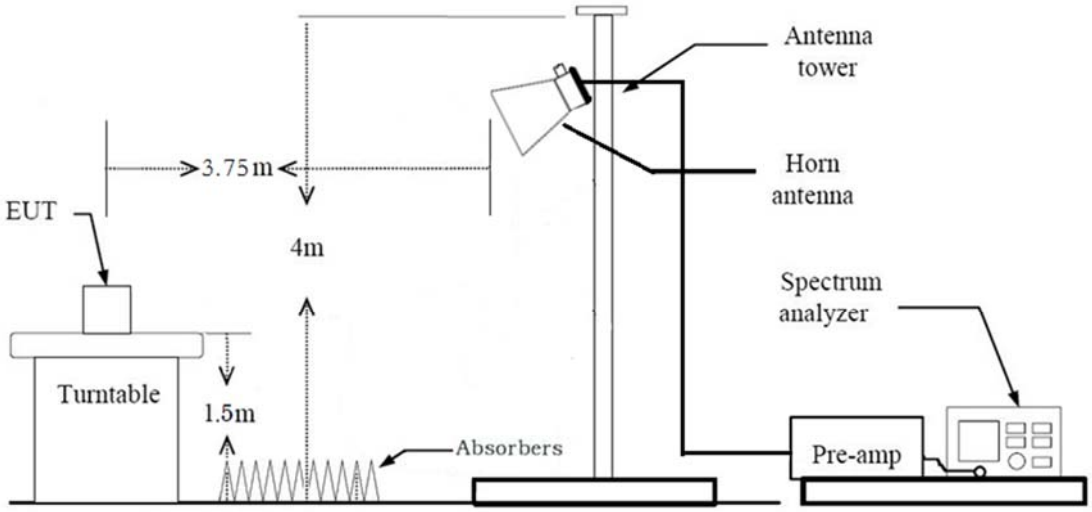
Below 30 MHz



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. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. 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
6. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)
7. 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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
   - ◆ Distance extrapolation factor = 20log (test distance / specific distance) (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. 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.
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

11. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency
12. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(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 3.75 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. According to SVSWR requirement in ANSI 63.4-2014, We performed the radiated test at 3.75 m distance from center of turn table. So, we applied the distance factor(reference distance : 3 m).
   - ◆ Distance extrapolation factor = 20log (test distance / specific distance) (dB)
6. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
7. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
8. The unit was tested with its standard battery.
9. 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.
10. Measured Frequency Range :
   - 4500MHz ~ 5150MHz
   - 5350MHz ~ 5460MHz
   - 5460MHz ~ 5470MHz
   - (75 MHz or more below the 5725MHz) ~ 5725MHz
   - 5850MHz ~ (75 MHz or more above the 5850MHz)
11. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + 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	0.955	0.200	1000
802.11n(HT20)	MCS 0	0.950	0.224	1000
802.11n(HT40)	MCS 0	0.903	0.445	3000
802.11ac(VHT20)	MCS 0	0.950	0.225	1000
802.11ac(VHT40)	MCS 0	0.904	0.439	3000
802.11ac(VHT80)	MCS 0	0.822	0.853	3000

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 + Shark Antenna
2. EUT Axis
   - Radiated Spurious Emissions : X-V
   - Radiated Restricted Band Edge : X
3. All datarate of operation were investigated and the worst case datarate results are reported
   - 802.11a : 6Mbps
   - 802.11n : MCS0
   - 802.11ac : MCS0
4. 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
5. DA330SNFN & Additional Models were tested and the worst case results are reported.

(Worst case : DA330SNFN)

AC Power line Conducted Emissions

1. We don't perform powerline conducted emission test. Because this EUT is used with vehicle.

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported
2. DA330SNFN & Additional Models were tested and the worst case results are reported.

(Worst case : DA330SNFN)

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)	< 250 mW(5150-5250 MHz) < 250 mW or 11+10 log log $_{10}$ (BW) dBm (5250-5350 MHz) < 250 mW or 11+10 log log $_{10}$ (BW) dBm (5470-5725 MHz) <1 W(5725-5850 MHz)		PASS
Peak Power Spectral Density	§ 15.407(a)(1),(5)	<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	<FCC 15.207 limits		N/A
Undesirable Emissions	§ 15.407(b)	<-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)(5), (6)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS

10. TEST RESULT

10.1 DUTY CYCLE

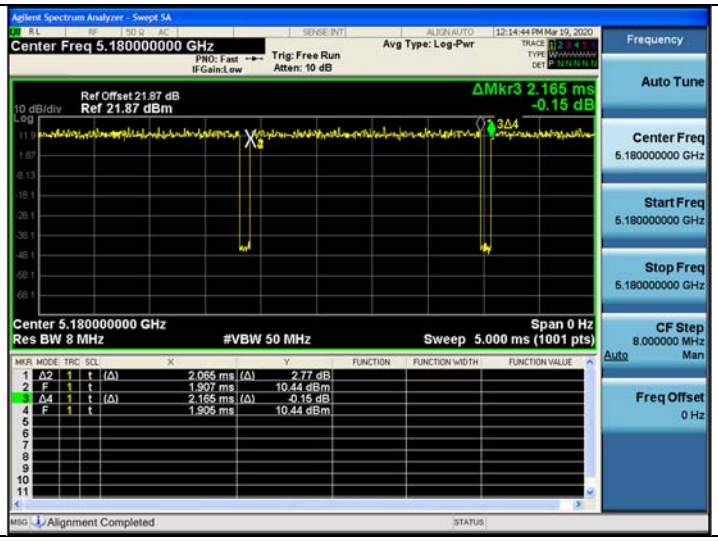
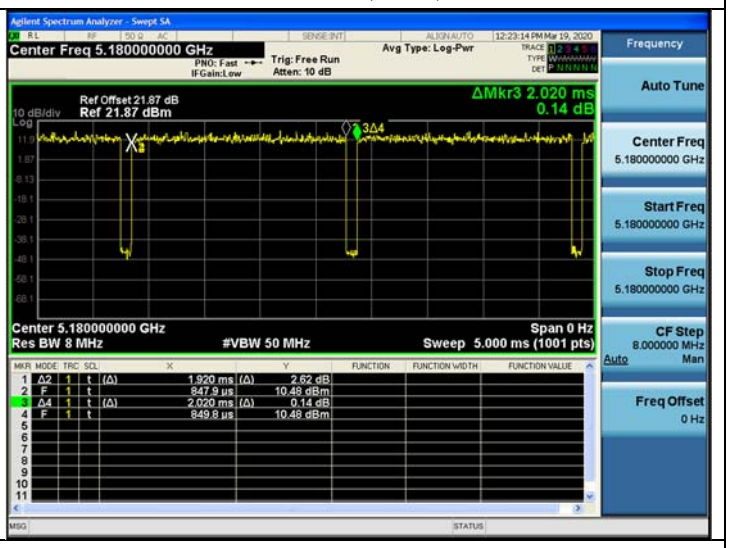
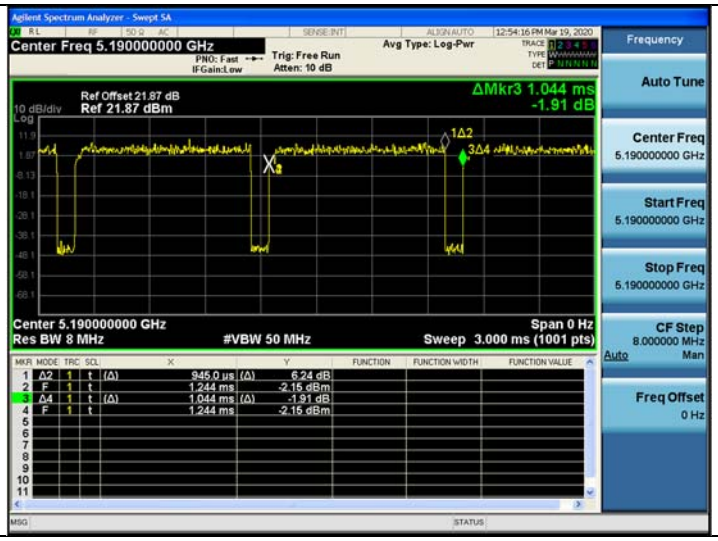
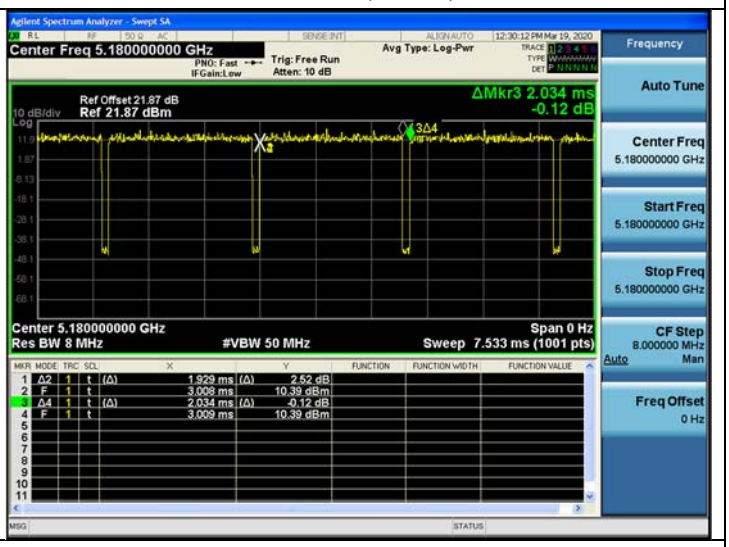
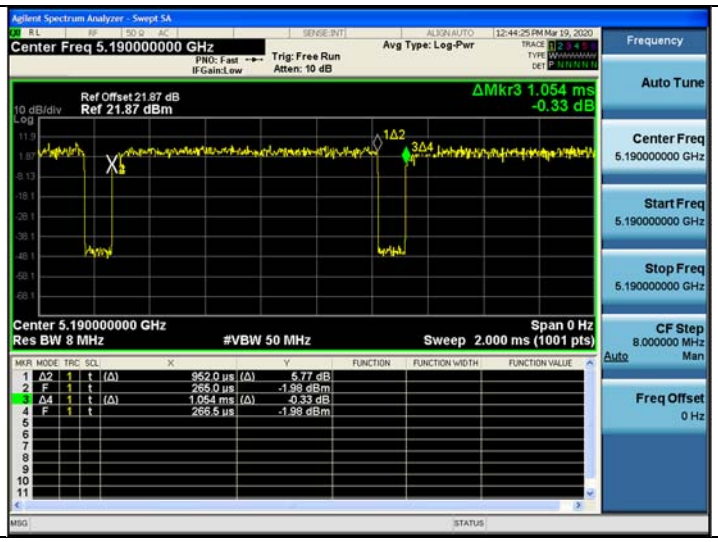
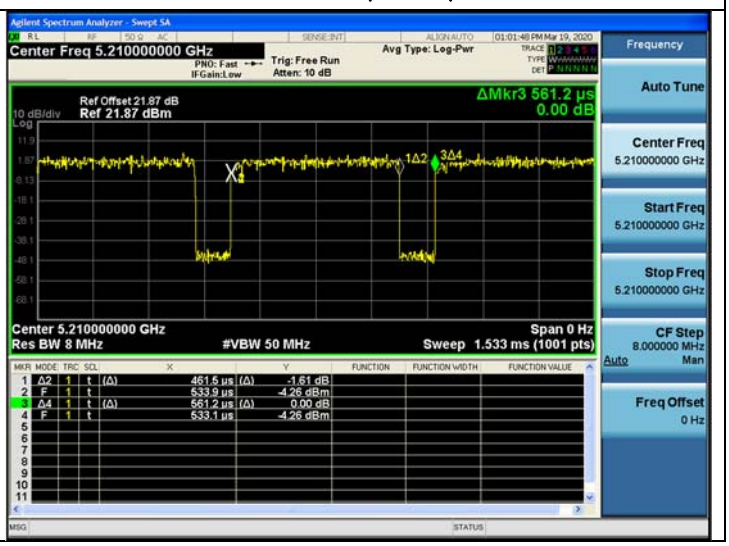
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11a	6	2.065	2.165	0.954	0.205
	9	1.380	1.485	0.929	0.318
	12	1.044	1.146	0.911	0.405
	18	0.704	0.806	0.873	0.588
	24	0.532	0.634	0.839	0.762
	36	0.363	0.465	0.782	1.067
	48	0.276	0.378	0.730	1.366
	54	0.247	0.349	0.708	1.501

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11n (HT20)	0	1.920	2.020	0.950	0.221
	1	0.981	1.080	0.908	0.418
	2	0.663	0.765	0.867	0.621
	3	0.508	0.609	0.834	0.790
	4	0.351	0.452	0.776	1.100
	5	0.272	0.374	0.727	1.383
	6	0.247	0.349	0.708	1.501
	7	0.228	0.330	0.692	1.601
802.11n (HT40)	0	0.945	1.044	0.905	0.433
	1	0.492	0.592	0.831	0.804
	2	0.340	0.442	0.771	1.130
	3	0.264	0.365	0.723	1.407
	4	0.189	0.289	0.654	1.844
	5	0.152	0.253	0.601	2.213
	6	0.140	0.241	0.581	2.359
	7	0.128	0.230	0.557	2.538

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11ac (VHT20)	0	1.929	2.034	0.948	0.230
	1	0.987	1.089	0.906	0.427
	2	0.672	0.774	0.868	0.614
	3	0.514	0.618	0.832	0.800
	4	0.356	0.459	0.776	1.103
	5	0.280	0.382	0.733	1.349
	6	0.252	0.353	0.713	1.469
	7	0.232	0.334	0.695	1.583
	8	0.200	0.302	0.662	1.790
802.11ac (VHT40)	0	0.952	1.054	0.903	0.442
	1	0.496	0.598	0.829	0.812
	2	0.344	0.446	0.770	1.136
	3	0.268	0.370	0.726	1.390
	4	0.192	0.293	0.655	1.836
	5	0.156	0.257	0.607	2.168
	6	0.145	0.245	0.592	2.278
	7	0.132	0.233	0.567	2.464
	8	0.116	0.217	0.535	2.716
	9	0.112	0.213	0.526	2.788
802.11ac (VHT80)	0	0.462	0.561	0.822	0.849
	1	0.253	0.353	0.717	1.443
	2	0.182	0.281	0.648	1.886
	3	0.150	0.249	0.601	2.209
	4	0.114	0.213	0.534	2.726
	5	0.098	0.197	0.499	3.020
	6	0.089	0.189	0.473	3.252
	7	0.086	0.186	0.463	3.349
	8	0.076	0.178	0.430	3.668
	9	0.074	0.173	0.428	3.687

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 26DB BANDWIDTH

Straddle channel data in the table below are for reporting purposes only.
Straddle channel data were added in section 10.7.1.

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.19	16.654
5200	40	20.79	16.644
5240	48	21.16	16.613
5260	52	20.96	16.601
5300	60	21.34	16.600
5320	64	20.77	16.612
5500	100	20.87	16.655
5580	116	20.85	16.602
5720	144	20.86	16.637
5745	149	21.02	16.638
5785	157	20.72	16.612
5825	165	20.89	16.640

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.37	17.812
5200	40	21.05	17.825
5240	48	21.05	17.743
5260	52	21.47	17.767
5300	60	21.30	17.764
5320	64	21.34	17.840
5500	100	21.44	17.850
5580	116	21.22	17.774
5720	144	21.03	17.798
5745	149	21.44	17.794
5785	157	21.37	17.815
5825	165	21.63	17.821

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.32	36.076
5230	46	39.45	36.211
5270	54	39.23	36.123
5310	62	39.79	36.155
5510	102	39.30	36.086
5550	110	39.34	36.103
5710	142	39.50	36.093
5755	151	39.24	36.157
5795	159	39.38	36.093

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	21.14	17.758
5200	40	21.18	17.777
5240	48	21.33	17.775
5260	52	21.27	17.767
5300	60	21.42	17.805
5320	64	21.58	17.782
5500	100	21.56	17.856
5580	116	21.46	17.790
5720	144	21.33	17.721
5745	149	21.33	17.787
5785	157	21.50	17.797
5825	165	21.40	17.811

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.56	36.095
5230	46	39.43	36.113
5270	54	39.48	36.124
5310	62	39.55	36.129
5510	102	39.67	36.099
5550	110	39.46	36.081
5710	142	39.55	36.057
5755	151	39.57	36.163
5795	159	39.58	36.130

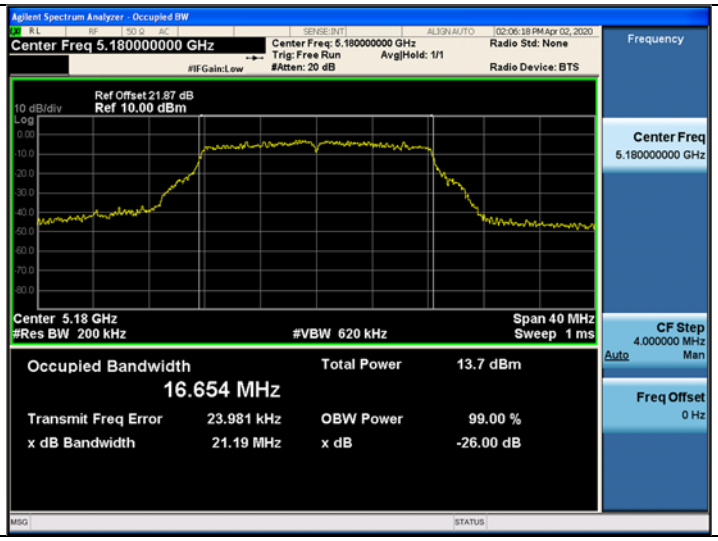
802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	81.91	75.600
5290	58	81.12	75.519
5530	106	81.07	75.404
5690	138	81.26	75.550
5775	155	81.28	75.625

▣ Test Plots(802.11a)

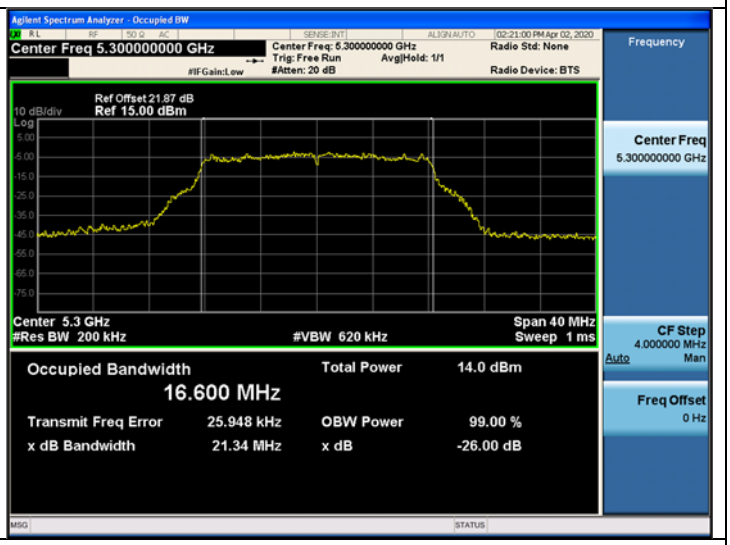
Note:

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

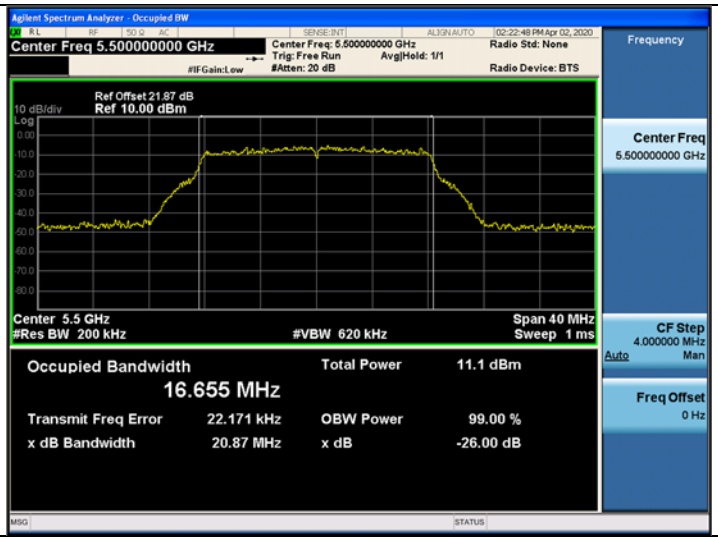
802.11a UNII 1 BAND 26dB Bandwidth (CH 36)



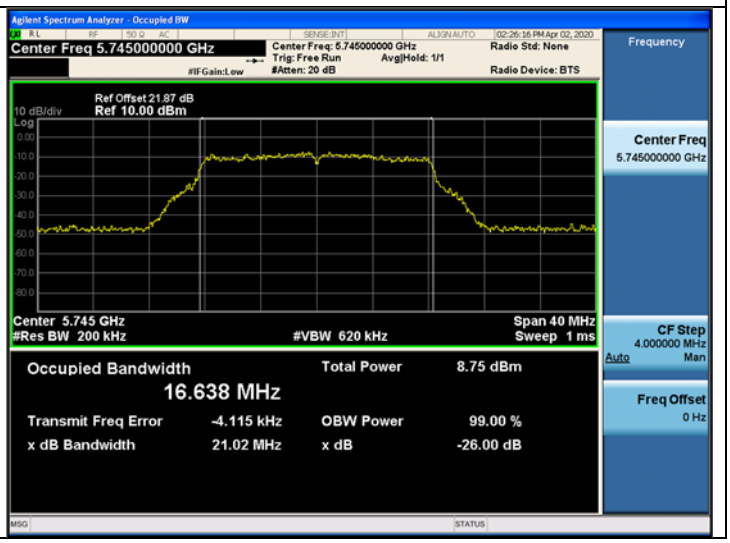
802.11a UNII 2A BAND 26dB Bandwidth (CH 60)



802.11a UNII 2C BAND 26dB Bandwidth (CH 100)



802.11a UNII 3 BAND 26dB Bandwidth (CH 149)

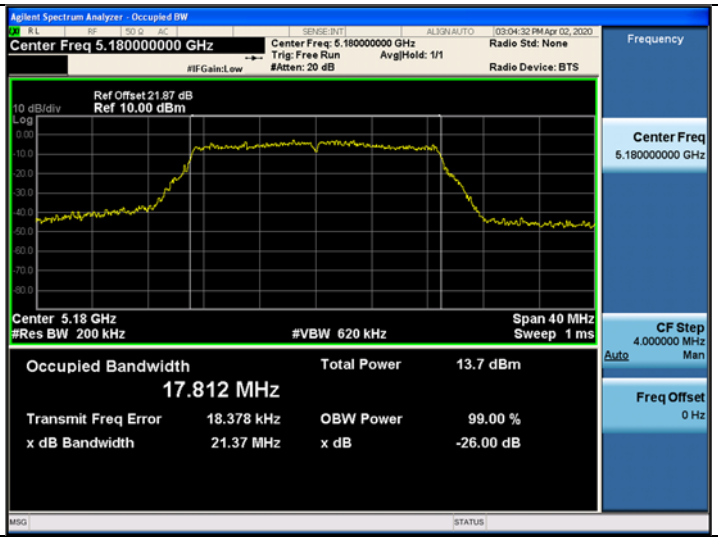


▣ Test Plots(802.11n(HT20))

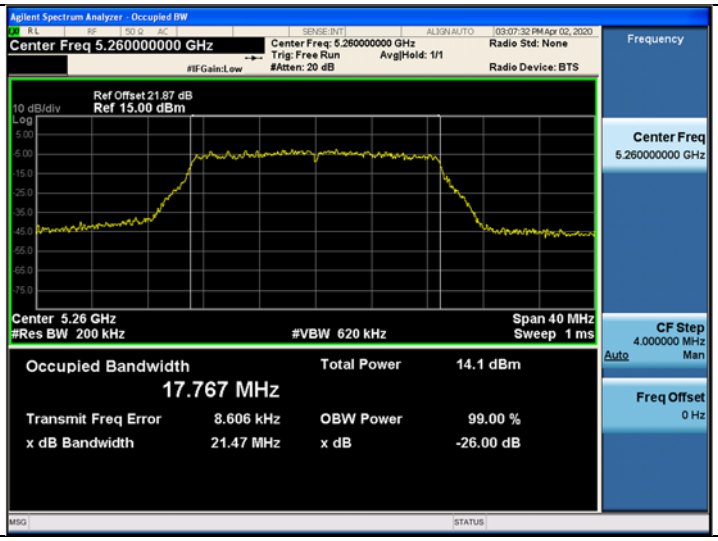
Note:

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

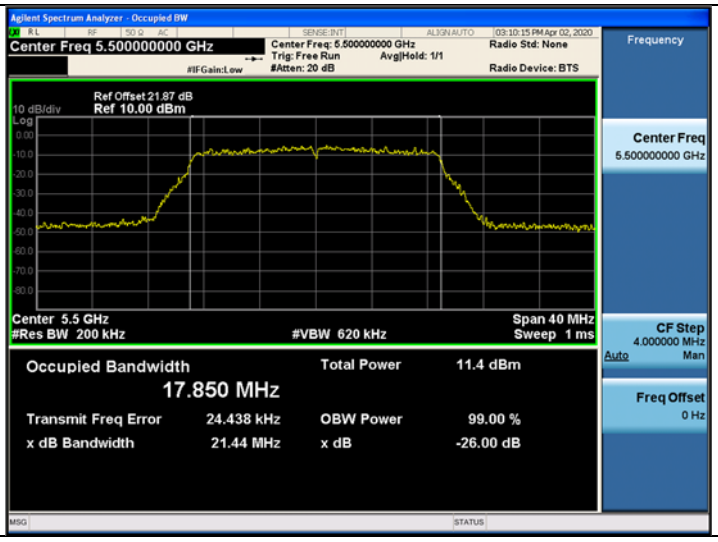
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 36)



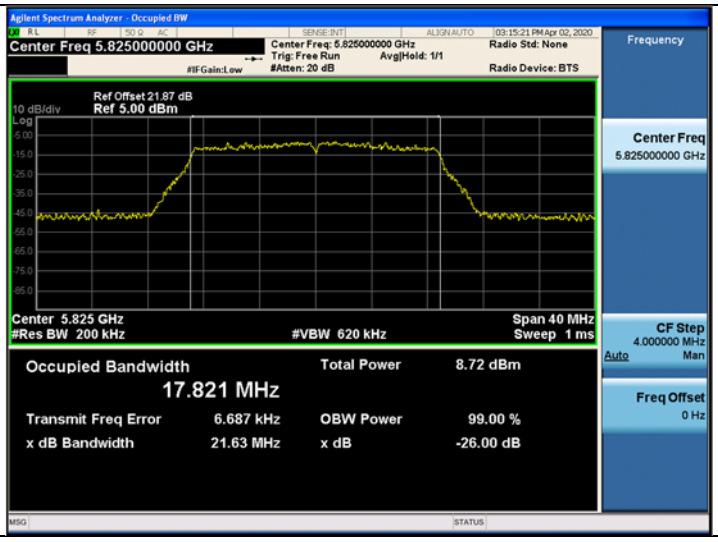
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 52)



802.11n_HT20 UNII 2C BAND 26dB Bandwidth(CH 100)



802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 165)

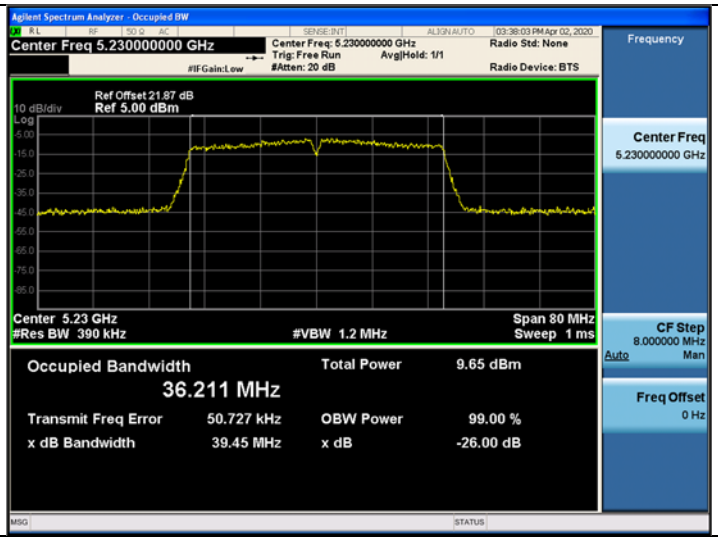


▣ Test Plots(802.11n(HT40))

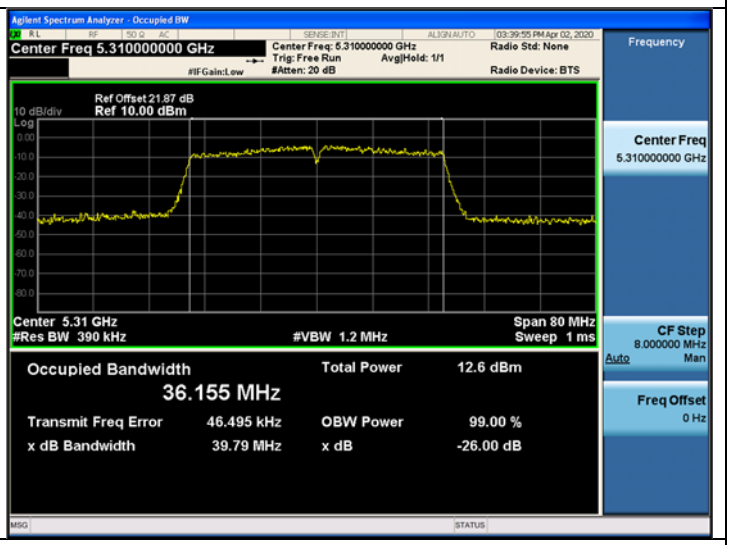
Note:

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

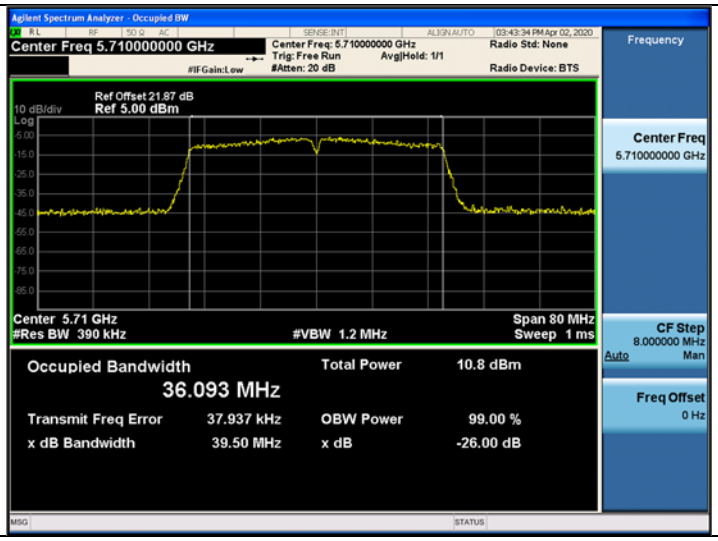
802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 46)



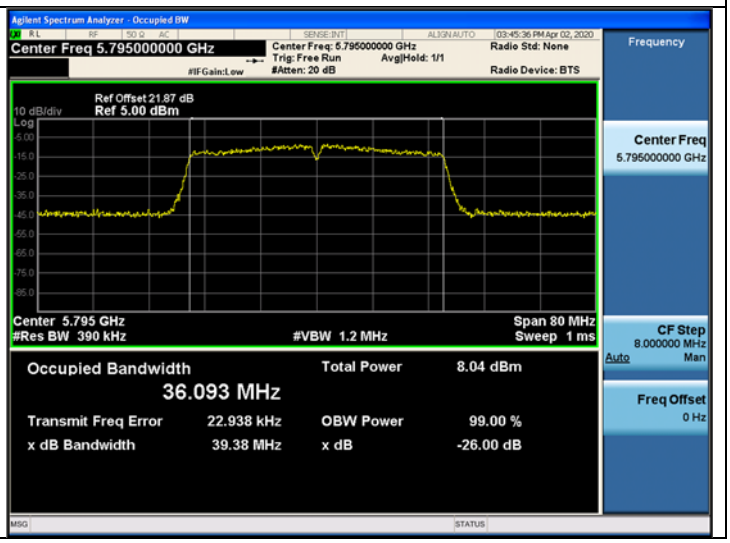
802.11n_HT40 UNII 2A BAND 26dB Bandwidth (CH 62)



802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 142)



802.11n_HT40 UNII 3 BAND 26dB Bandwidth (CH 159)

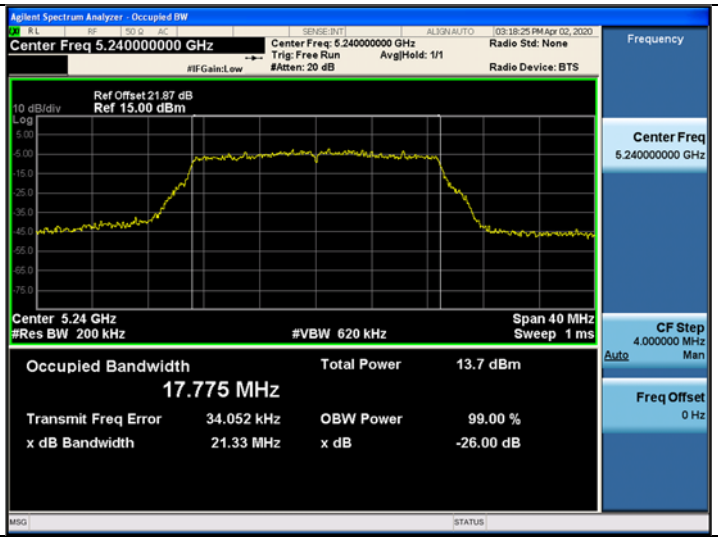


▣ Test Plots(802.11ac(VHT20))

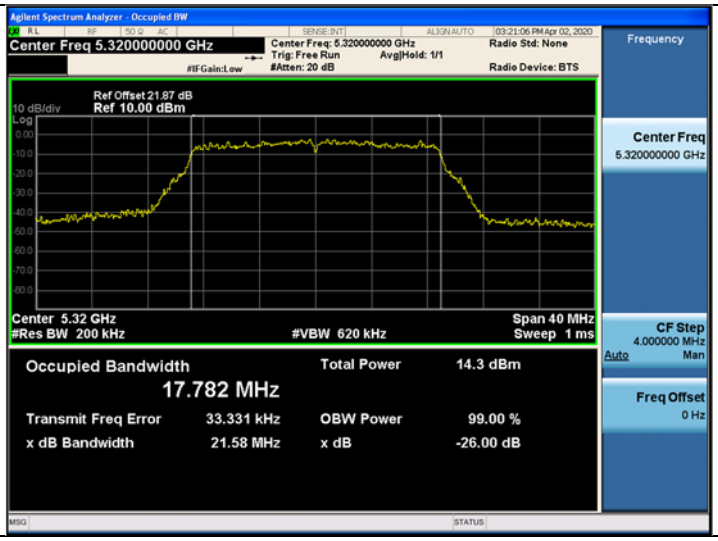
Note:

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

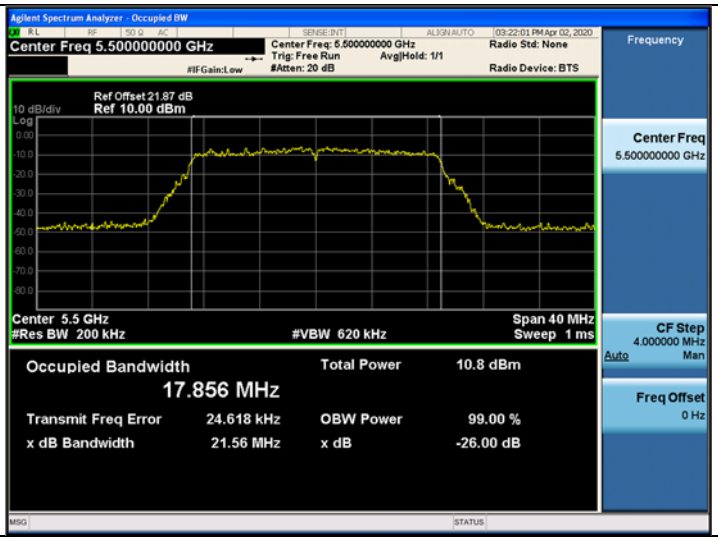
802.11ac_VHT20 UNII 1 BAND 26dB Bandwidth(CH 48)



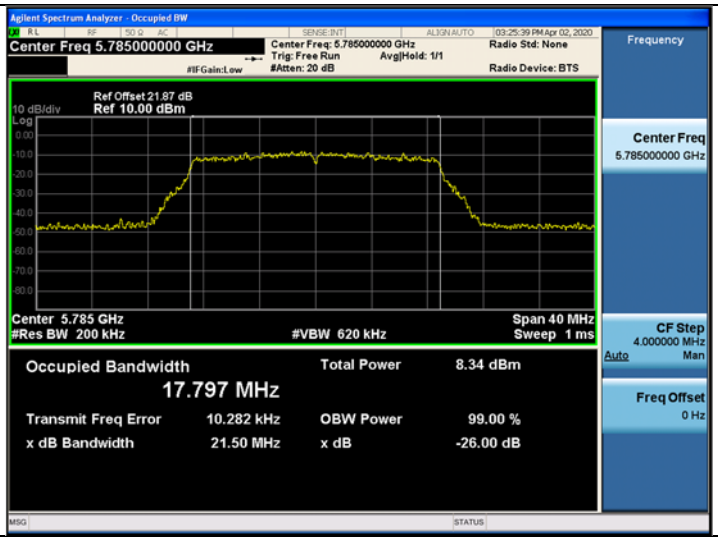
802.11ac_VHT20 UNII 2A BAND 26dB Bandwidth(CH 64)



802.11ac_VHT20 UNII 2C BAND 26dB Bandwidth(CH 100)



802.11ac_VHT20 UNII 3 BAND 26dB Bandwidth(CH 157)

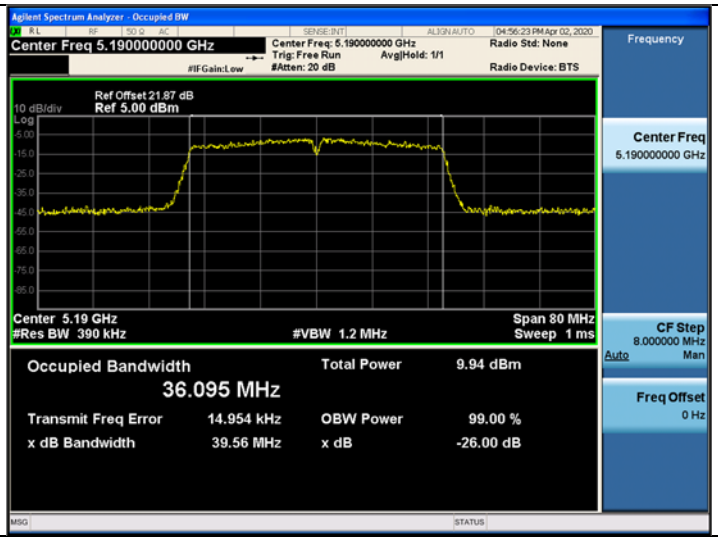


▣ Test Plots(802.11ac(VHT40))

Note:

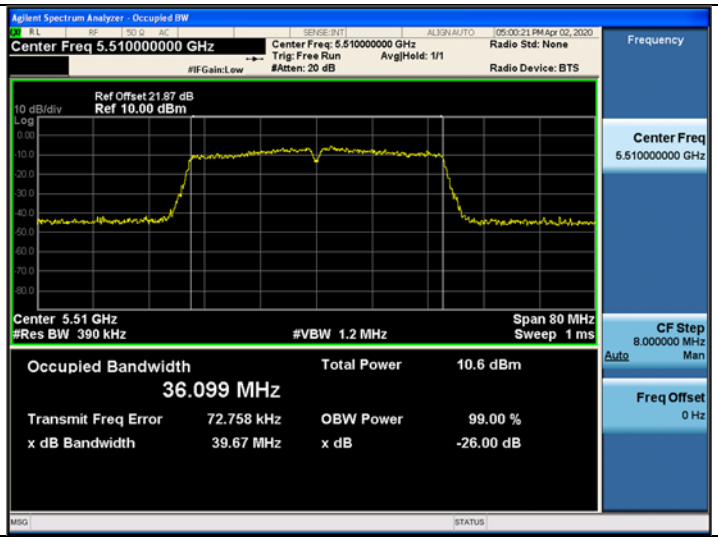
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT40 UNII 1 BAND 26dB Bandwidth(CH 38)

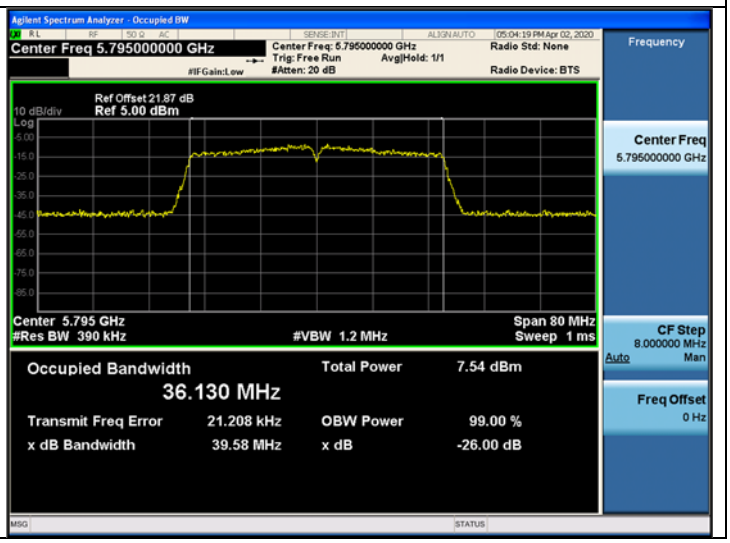


802.11ac_VHT40 UNII 2A BAND 26dB Bandwidth (CH 62)

802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 102)



802.11ac_VHT40 UNII 3 BAND 26dB Bandwidth (CH 159)

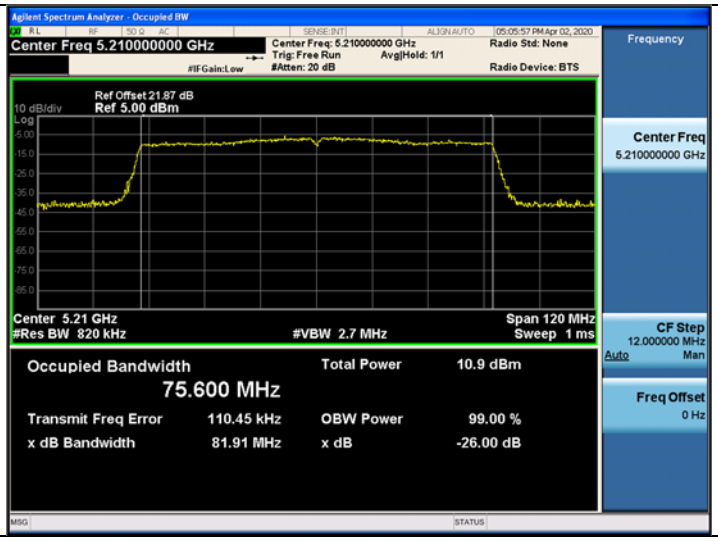


▣ Test Plots(802.11ac(VHT80))

Note:

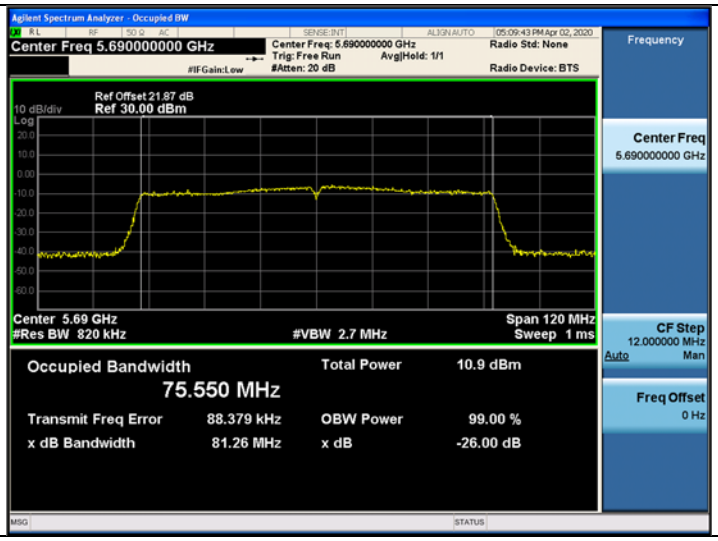
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT80 UNII 1 BAND 26dB Bandwidth(CH 42)

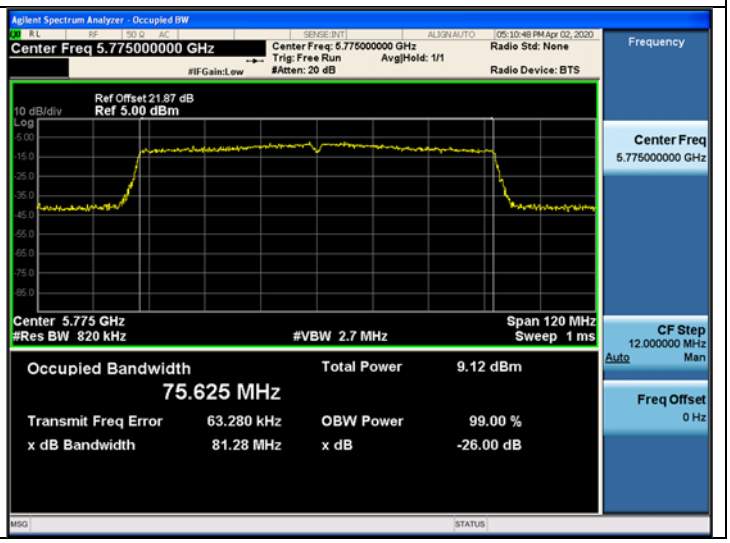


802.11ac_VHT80 UNII 2A BAND 26dB Bandwidth (CH 58)

802.11ac_VHT80 UNII 2C BAND 26dB Bandwidth(CH 138)



802.11ac_VHT80 UNII 3 BAND 26dB Bandwidth (CH 155)



10.3 6DB BANDWIDTH

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.35	> 0.5	Pass
5785	157	16.36	> 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	17.60	> 0.5	Pass
5785	157	17.31	> 0.5	Pass
5825	165	17.57	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.30	> 0.5	Pass
5795	159	35.52	> 0.5	Pass

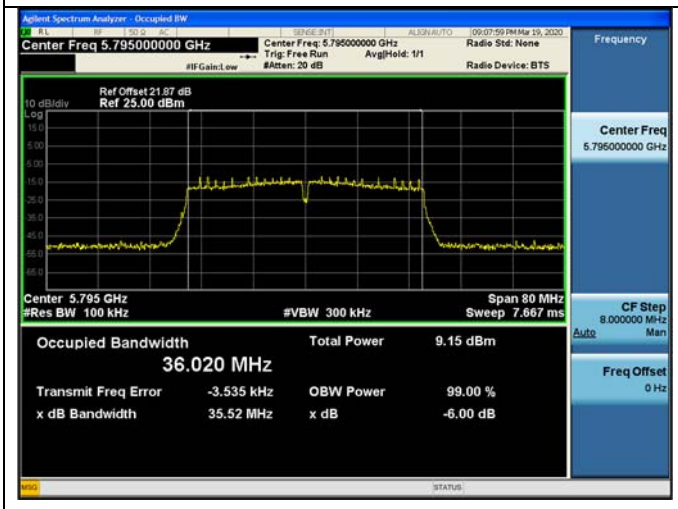
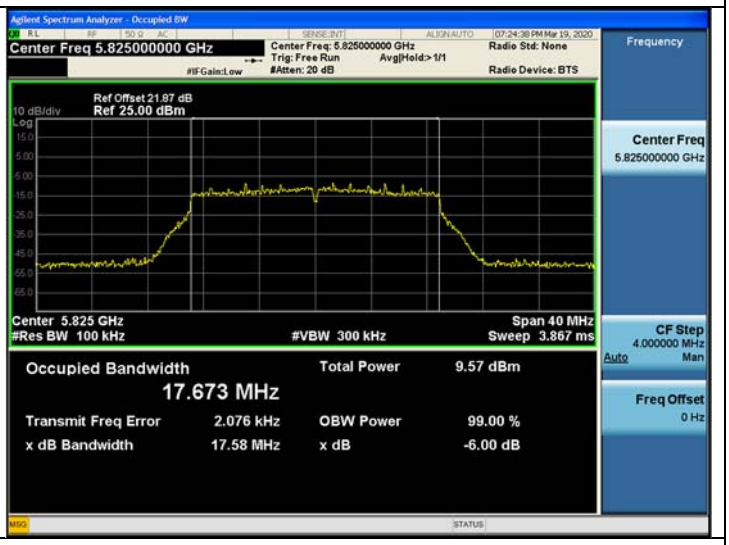
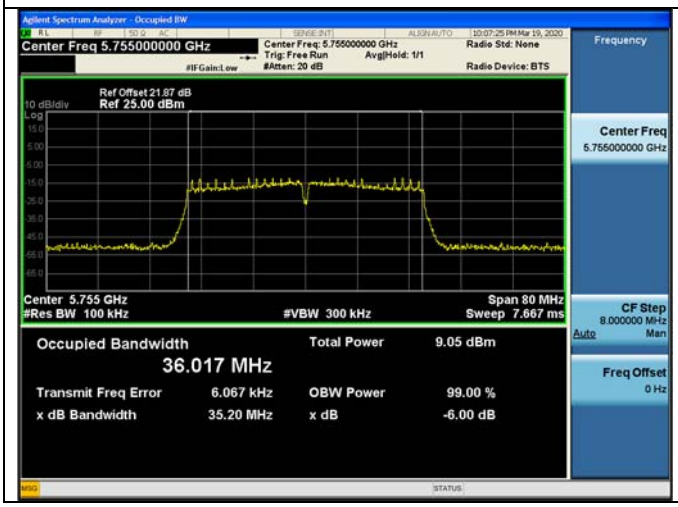
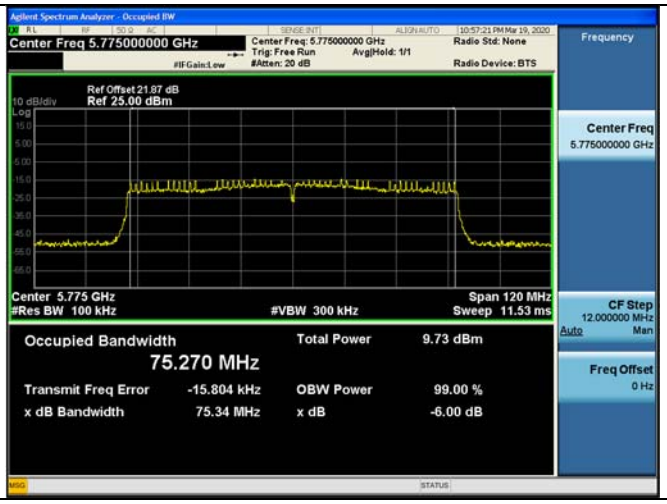
802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.60	> 0.5	Pass
5785	157	17.60	> 0.5	Pass
5825	165	17.58	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	35.20	> 0.5	Pass
5795	159	35.54	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.34	> 0.5	Pass

▣ Test Plots

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

802.11a (CH.149)	802.11n(HT20) (CH.157)
	
802.11n(HT40) (CH.159)	**802.11ac(VHT20) (CH.165)**
	
802.11ac(VHT40) (CH.151)	**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.

802.11a Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	8.90	0.32	9.21	23.98
5200	40	8.58	0.21	8.79	
5240	48	8.73	0.32	9.04	
5260	52	8.72	0.40	9.13	
5300	60	8.33	0.32	8.65	
5320	64	8.19	0.21	8.40	
5500	100	5.19	0.21	5.39	
5580	116	4.97	0.32	5.28	
5720	144	5.70	0.40	6.11	
5745	149	2.57	0.40	2.97	30
5785	157	2.43	0.40	2.83	
5825	165	1.55	1.37	2.92	

802.11n(20MHz) Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	8.55	0.62	9.17	23.98
5200	40	7.49	1.50	8.99	
5240	48	8.75	0.42	9.16	
5260	52	8.28	0.62	8.91	
5300	60	8.16	0.42	8.58	
5320	64	7.69	0.62	8.31	
5500	100	5.07	0.62	5.69	
5580	116	4.95	0.62	5.57	
5720	144	4.40	1.50	5.90	
5745	149	2.49	0.62	3.11	30
5785	157	1.62	1.10	2.72	
5825	165	2.88	0.22	3.10	

802.11n(40MHz) Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	4.51	0.43	4.94	23.98
5230	46	3.33	1.41	4.74	
5270	54	5.14	2.21	7.35	
5310	62	4.73	2.36	7.09	
5510	102	2.68	2.54	5.22	
5550	110	5.22	0.43	5.65	
5710	142	3.06	2.54	5.60	
5755	151	-0.10	2.54	2.43	30
5795	159	0.91	1.13	2.04	

802.11ac(20MHz) Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	8.06	1.10	9.16	23.98
5200	40	8.36	0.61	8.97	
5240	48	8.68	0.43	9.11	
5260	52	8.80	0.23	9.03	
5300	60	8.12	0.61	8.73	
5320	64	7.86	0.61	8.47	
5500	100	5.39	0.43	5.81	
5580	116	5.47	0.23	5.70	
5720	144	5.54	0.61	6.15	
5745	149	2.85	0.23	3.08	30
5785	157	2.31	0.61	2.93	
5825	165	1.28	1.58	2.86	

802.11ac(40MHz) Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	3.09	1.84	4.93	23.98
5230	46	3.46	1.39	4.85	
5270	54	6.75	0.81	7.56	
5310	62	6.54	0.44	6.98	
5510	102	4.24	1.14	5.37	
5550	110	4.19	1.39	5.58	
5710	142	2.61	2.79	5.40	
5755	151	-0.07	2.17	2.10	30
5795	159	-0.54	2.72	2.18	

802.11ac(80MHz) Mode		Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5210	42	1.90	3.67	5.57	23.98
5290	58	5.62	2.21	7.83	
5530	106	3.53	1.89	5.41	
5690	138	1.85	3.35	5.20	
5775	155	-1.41	3.67	2.26	30

10.5 POWER SPECTRAL DENSITY

802.11a Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	-2.861	0.318	-2.543	11 dBm/MHz
5200	40	-2.632	0.205	-2.427	
5240	48	-3.196	0.318	-2.878	
5260	52	-2.542	0.405	-2.137	
5300	60	-2.662	0.318	-2.344	
5320	64	-3.050	0.205	-2.845	
5500	100	-5.420	0.205	-5.215	
5580	116	-5.820	0.318	-5.502	
5720	144	-5.192	0.405	-4.787	
5745	149	-10.716	0.405	-10.311	30 dBm/500kHz
5785	157	-11.380	0.405	-10.975	
5825	165	-12.944	1.366	-11.578	

802.11n(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	-2.875	0.621	-2.254	11 dBm/MHz
5200	40	-5.222	1.501	-3.721	
5240	48	-3.454	0.418	-3.036	
5260	52	-3.112	0.621	-2.491	
5300	60	-3.197	0.418	-2.779	
5320	64	-3.498	0.621	-2.877	
5500	100	-6.400	0.621	-5.779	
5580	116	-6.544	0.621	-5.923	
5720	144	-5.944	1.501	-4.443	
5745	149	-11.582	0.621	-10.961	30 dBm/500kHz
5785	157	-13.302	1.100	-12.202	
5825	165	-10.855	0.221	-10.634	

802.11n(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	-10.077	0.433	-9.644	11 dBm/MHz
5230	46	-11.361	1.407	-9.954	
5270	54	-8.692	2.213	-6.479	
5310	62	-9.270	2.359	-6.911	
5510	102	-10.668	2.538	-8.130	
5550	110	-9.109	0.433	-8.676	
5710	142	-11.238	2.538	-8.700	
5755	151	-17.148	2.538	-14.610	30 dBm /500kHz
5795	159	-15.908	1.130	-14.778	

802.11ac(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	-5.062	1.103	-3.959	11 dBm/MHz
5200	40	-3.549	0.614	-2.935	
5240	48	-3.469	0.427	-3.042	
5260	52	-2.998	0.230	-2.768	
5300	60	-3.296	0.614	-2.682	
5320	64	-3.678	0.614	-3.064	
5500	100	-5.891	0.427	-5.464	
5580	116	-6.240	0.230	-6.010	
5720	144	-5.855	0.614	-5.241	
5745	149	-11.166	0.230	-10.936	30 dBm/500kHz
5785	157	-11.913	0.614	-11.299	
5825	165	-13.102	1.583	-11.519	

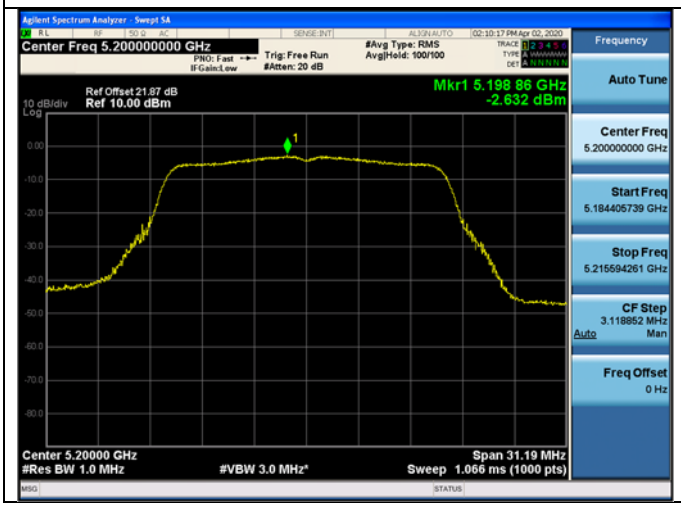
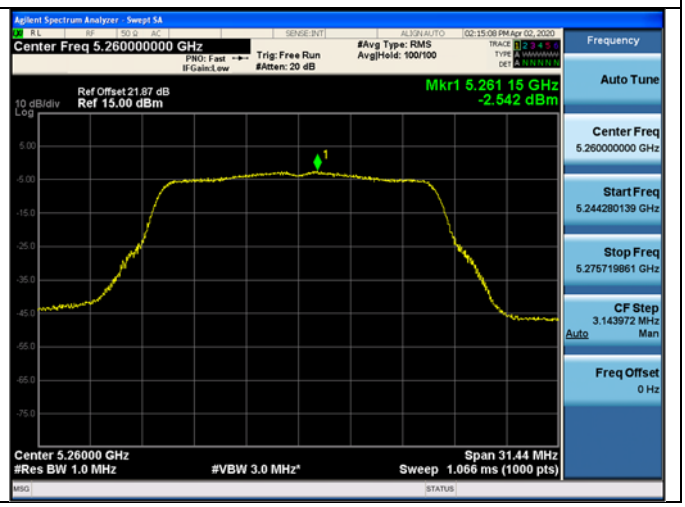
802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	-11.546	1.836	-9.710	11 dBm/MHz
5230	46	-10.900	1.390	-9.510	
5270	54	-7.668	0.812	-6.856	
5310	62	-7.407	0.442	-6.965	
5510	102	-9.536	1.136	-8.400	
5550	110	-8.963	1.390	-7.573	
5710	142	-11.476	2.788	-8.688	
5755	151	-17.041	2.168	-14.873	30 dBm/500kHz
5795	159	-16.772	2.716	-14.056	

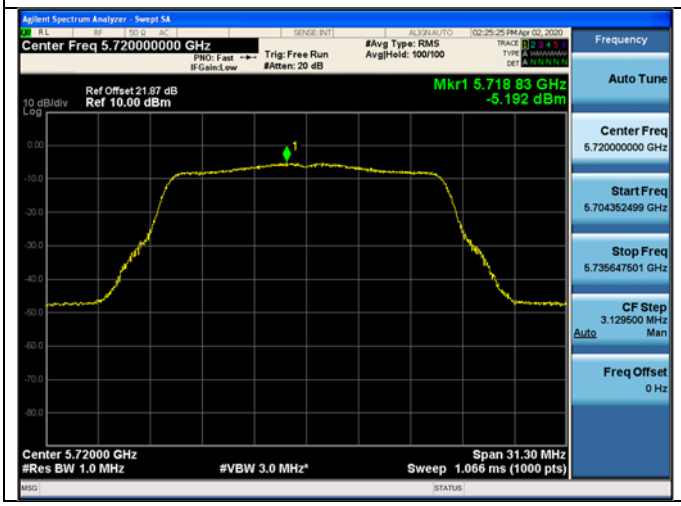
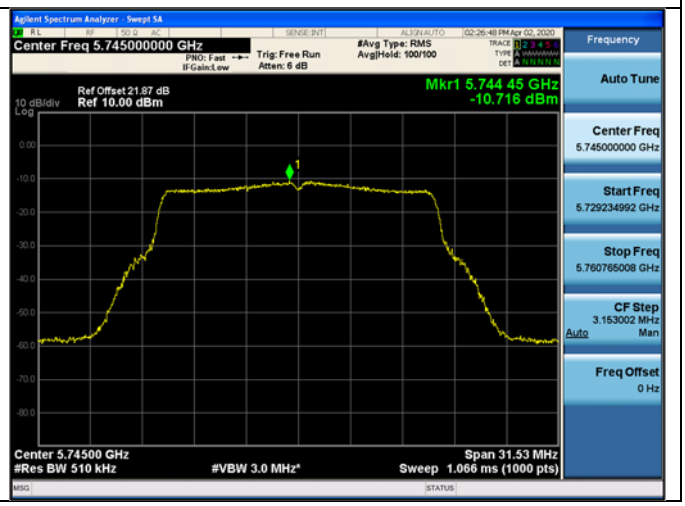
802.11ac(80MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5210	42	-15.840	3.668	-12.172	11 dBm/MHz
5290	58	-12.947	2.209	-10.738	
5530	106	-12.071	1.886	-10.185	
5690	138	-15.799	3.349	-12.450	
5775	155	-20.865	3.668	-17.197	30 dBm/500kHz

▣ Test Plots(802.11a)

Note:

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

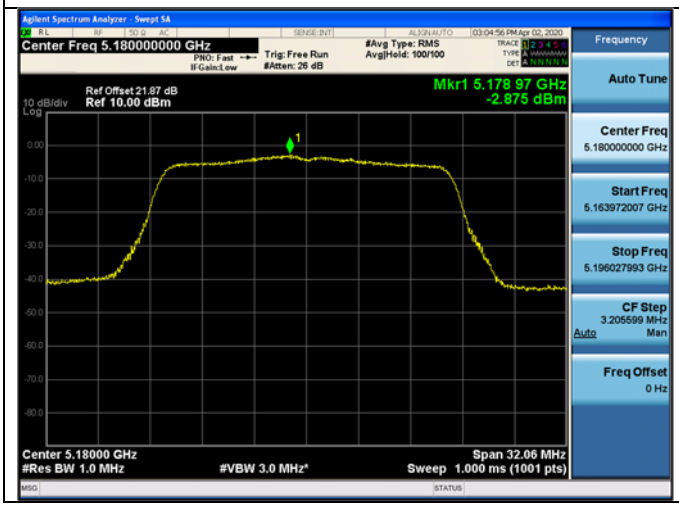
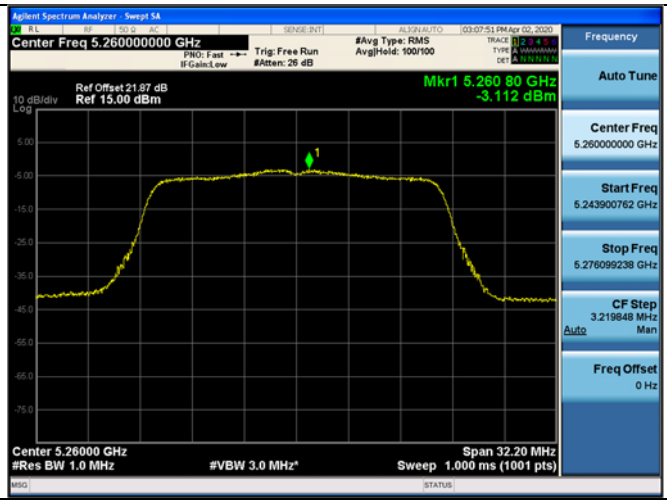
UNII 1 (Ch. 40)	UNII 2A (Ch. 52)
	

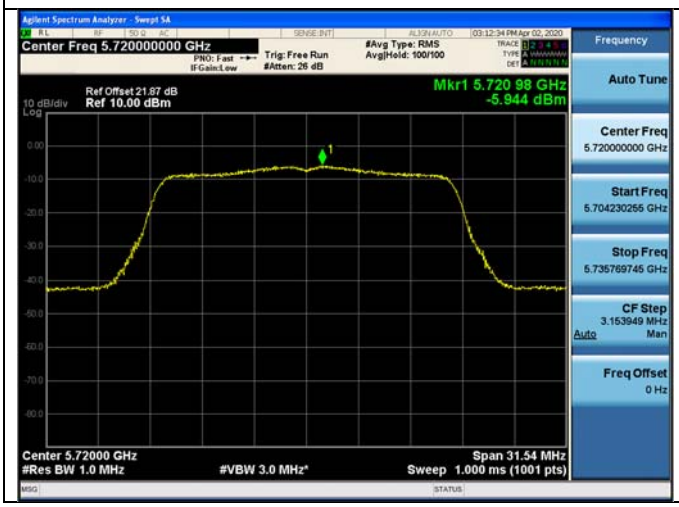
UNII 2C (Ch. 144)	UNII 3 (Ch. 149)
	

▣ Test Plots(802.11n(HT20))

Note:

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

UNII 1 (Ch. 36)	UNII 2A (Ch. 52)
	

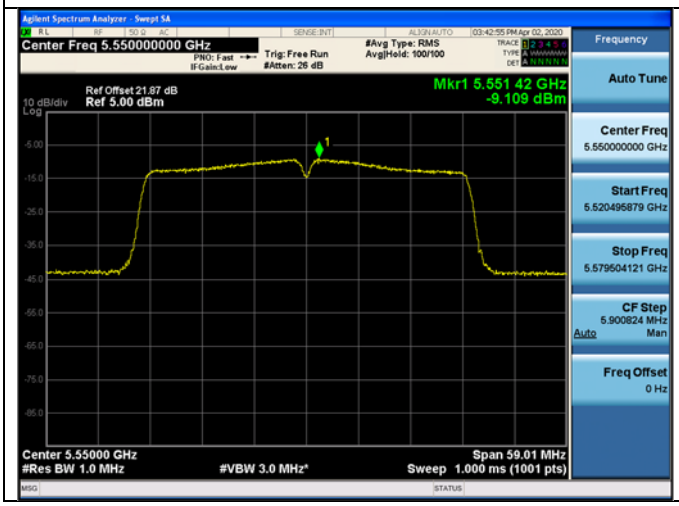
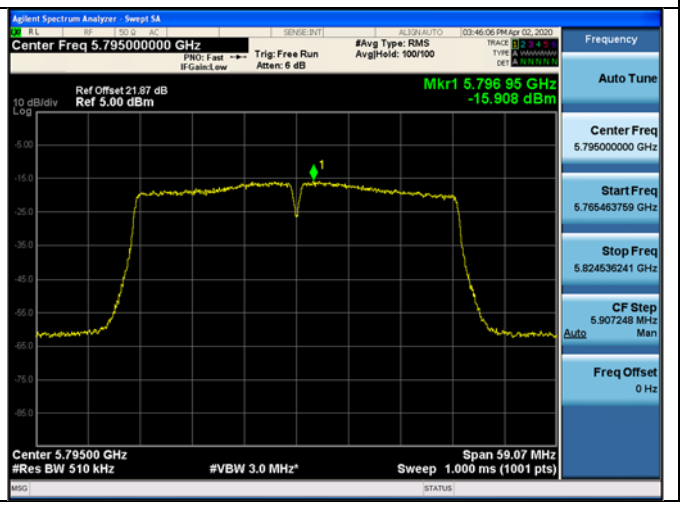
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT40))

Note:

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

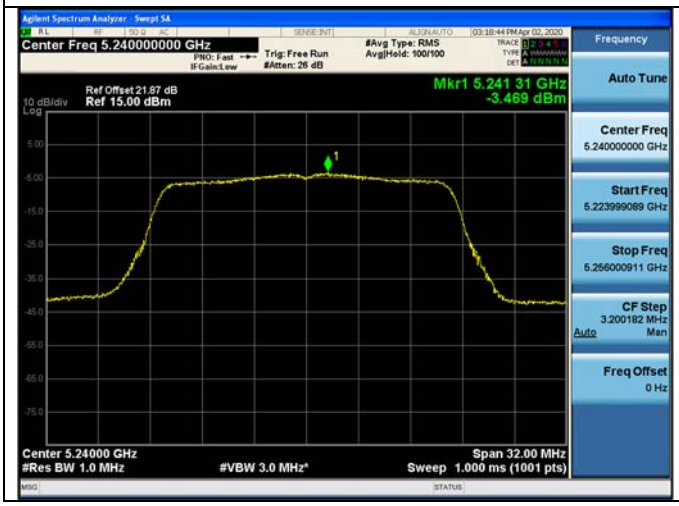
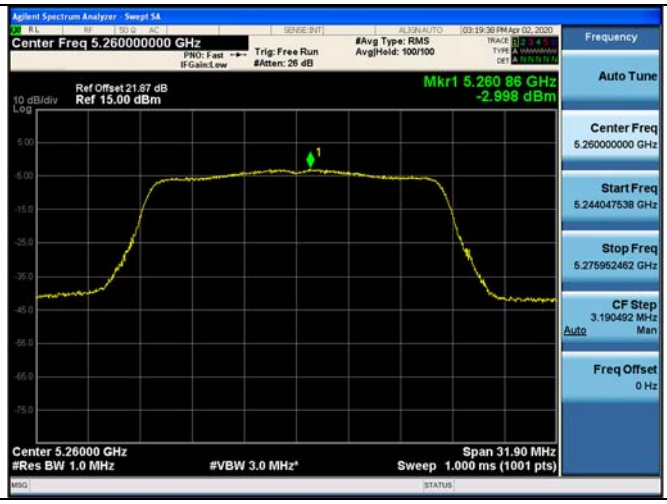
UNII 1 (Ch. 38)	UNII 2A (Ch. 54)
	

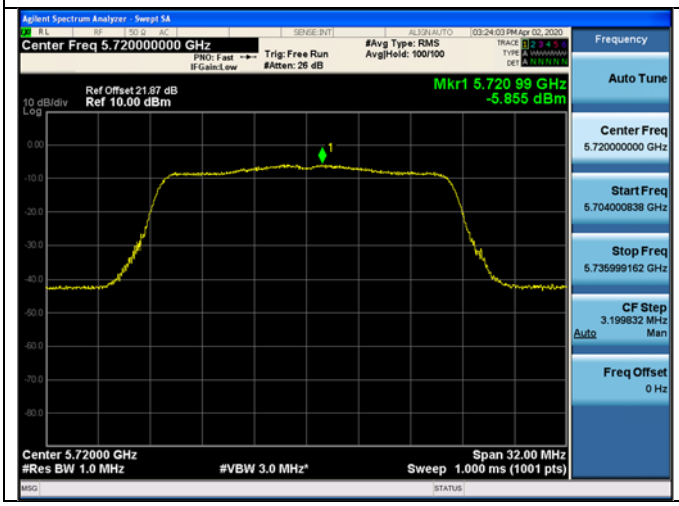
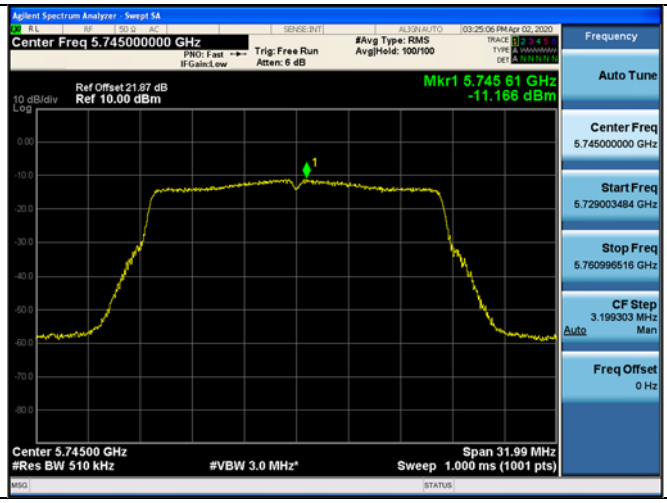
UNII 2C (Ch. 110)	UNII 3 (Ch. 159)
	

▣ Test Plots(802.11ac(VHT20))

Note:

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

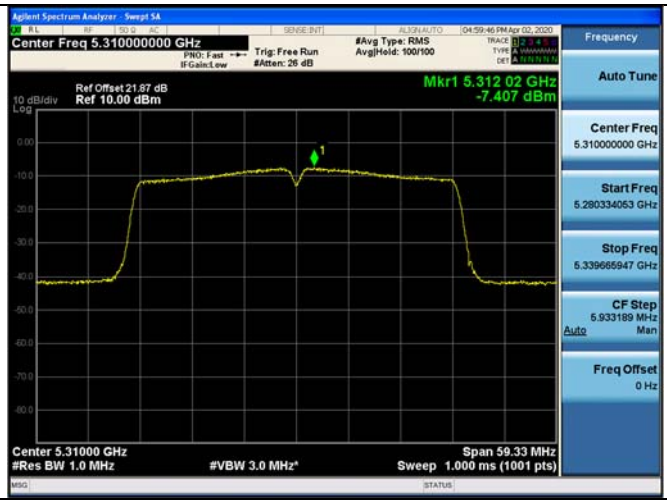
UNII 1 (Ch. 48)	UNII 2A (Ch. 52)
	

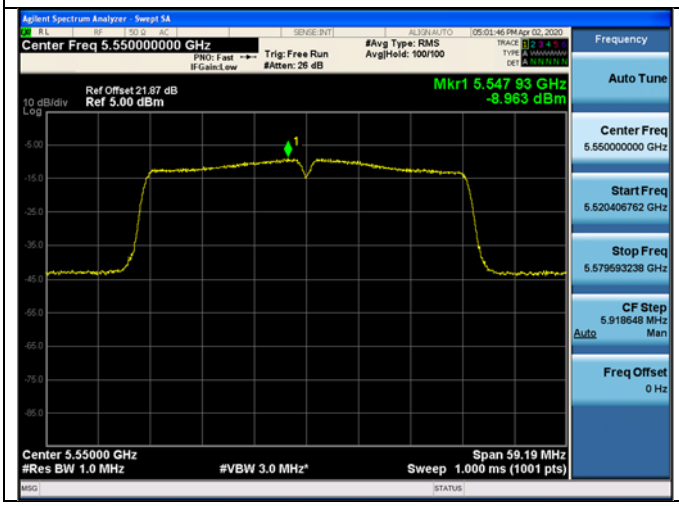
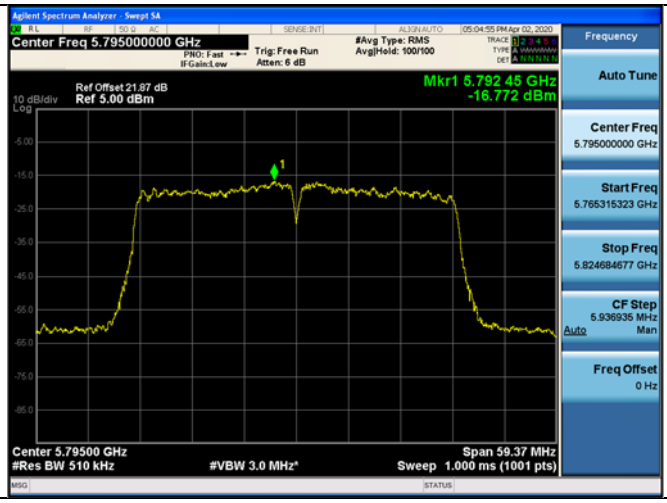
UNII 2C (Ch. 144)	UNII 3 (Ch. 149)
	

▣ 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. 62)
	

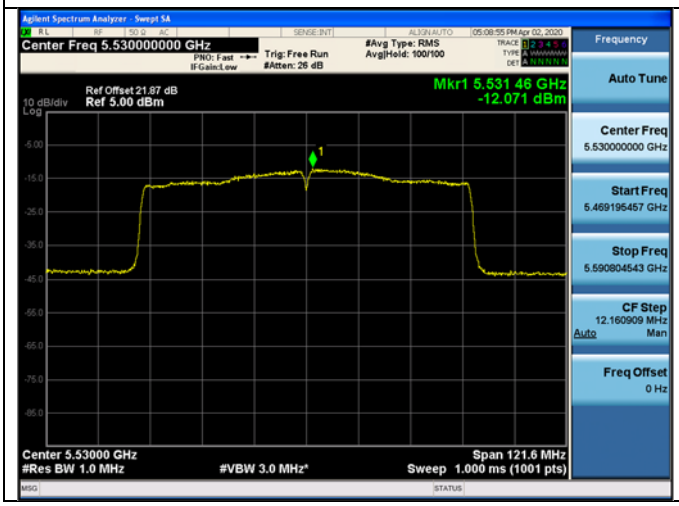
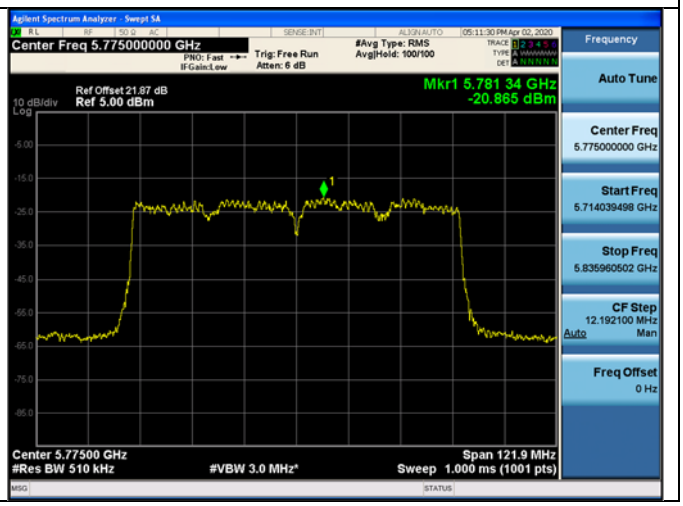
UNII 2C (Ch. 110)	UNII 3 (Ch. 159)
	

▣ 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. 106)	UNII 3 (Ch. 155)
	

10.6 FREQUENCY STABILITY.

10.6.1 80MHz BW

Startup after the EUT is energized

OPERATING BAND:	UNII Band 1
OPERATING FREQUENCY:	5,210,000,000 Hz
CHANNEL:	42
REFERENCE VOLTAGE:	14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5210001.68	1.68
100%		-30	5210031.84	31.84
100%		-20	5210068.32	68.32
100%		-10	5210073.39	73.39
100%		0	5210066.57	66.57
100%		+10	5210001.18	1.18
100%		+30	5210036.53	36.53
100%		+40	5210010.08	10.08
100%		+50	5210028.11	28.11
111%	16.00	+20	5210028.27	28.27
End. Point	9.00	+20	5210097.73	97.73

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5290001.41	1.41
100%		-30	5290029.27	29.27
100%		-20	5290068.28	68.28
100%		-10	5290056.22	56.22
100%		0	5290099.25	99.25
100%		+10	5290055.88	55.88
100%		+30	5290017.18	17.18
100%		+40	5290090.89	90.89
100%		+50	5290010.47	10.47
111%	16.00	+20	5290093.25	93.25
End. Point	9.00	+20	5290005.76	5.76

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5530082.20	82.20
100%		-30	5530023.73	23.73
100%		-20	5530059.61	59.61
100%		-10	5530086.08	86.08
100%		0	5530028.76	28.76
100%		+10	5530061.54	61.54
100%		+30	5530036.16	36.16
100%		+40	5530027.09	27.09
100%		+50	5530033.37	33.37
111%	16.00	+20	5530047.45	47.45
End. Point	9.00	+20	5530012.96	12.96

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5775010.94	10.94
100%		-30	5775071.07	71.07
100%		-20	5775077.51	77.51
100%		-10	5775010.55	10.55
100%		0	5775028.23	28.23
100%		+10	5775019.39	19.39
100%		+30	5775021.19	21.19
100%		+40	5775047.76	47.76
100%		+50	5775063.59	63.59
111%	16.00	+20	5775020.61	20.61
End. Point	9.00	+20	5775002.39	2.39

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:	14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5210021.26	21.26
100%		-30	5210006.44	6.44
100%		-20	5210052.68	52.68
100%		-10	5210094.03	94.03
100%		0	5210058.68	58.68
100%		+10	5210079.37	79.37
100%		+30	5210053.48	53.48
100%		+40	5210076.07	76.07
100%		+50	5210084.28	84.28
111%	16.00	+20	5210040.60	40.60
End. Point	9.00	+20	5210017.73	17.73

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5290065.72	65.72
100%		-30	5290094.21	94.21
100%		-20	5290010.11	10.11
100%		-10	5290008.99	8.99
100%		0	5290069.21	69.21
100%		+10	5290084.66	84.66
100%		+30	5290066.18	66.18
100%		+40	5290030.07	30.07
100%		+50	5290060.28	60.28
111%	16.00	+20	5290010.53	10.53
End. Point	9.00	+20	5290024.20	24.2

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5530099.02	99.02
100%		-30	5530097.60	97.60
100%		-20	5530092.55	92.55
100%		-10	5530012.05	12.05
100%		0	5530032.99	32.99
100%		+10	5530050.11	50.11
100%		+30	5530022.16	22.16
100%		+40	5530068.40	68.4
100%		+50	5530049.14	49.14
111%	16.00	+20	5530034.70	34.70
End. Point	9.00	+20	5530061.12	61.12

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.

OPERATING BAND: UNII Band 3
OPERATING FREQUENCY: 5,775,000,000 Hz
CHANNEL: 155
REFERENCE VOLTAGE: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5775013.61	13.61
100%		-30	5775053.71	53.71
100%		-20	5775064.85	64.85
100%		-10	5775002.67	2.67
100%		0	5775025.74	25.74
100%		+10	5775091.11	91.11
100%		+30	5775094.97	94.97
100%		+40	5775092.86	92.86
100%		+50	5775074.23	74.23
111%	16.00	+20	5775019.46	19.46
End. Point	9.00	+20	5775078.35	78.35

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.

5 minutes after the EUT is energized

OPERATING BAND:	UNII Band 1
OPERATING FREQUENCY:	5,210,000,000 Hz
CHANNEL:	42
REFERENCE VOLTAGE:	14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5210086.59	86.59
100%		-30	5210082.28	82.28
100%		-20	5210055.86	55.86
100%		-10	5210048.13	48.13
100%		0	5210001.04	1.04
100%		+10	5210011.14	11.14
100%		+30	5210095.88	95.88
100%		+40	5210014.92	14.92
100%		+50	5210061.67	61.67
111%	16.00	+20	5210042.19	42.19
End. Point	9.00	+20	5210078.12	78.12

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.

OPERATING BAND: UNII Band 2A

OPERATING FREQUENCY: 5,290,000,000 Hz

CHANNEL: 58

REFERENCE VOLTAGE: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5290054.05	54.05
100%		-30	5290043.18	43.18
100%		-20	5290033.53	33.53
100%		-10	5290077.13	77.13
100%		0	5290091.68	91.68
100%		+10	5290096.70	96.7
100%		+30	5290075.11	75.11
100%		+40	5290060.54	60.54
100%		+50	5290089.96	89.96
111%	16.00	+20	5290085.23	85.23
End. Point	9.00	+20	5290030.78	30.78

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5530082.79	82.79
100%		-30	5530032.60	32.60
100%		-20	5530068.21	68.21
100%		-10	5530032.78	32.78
100%		0	5530025.12	25.12
100%		+10	5530032.74	32.74
100%		+30	5530061.57	61.57
100%		+40	5530091.82	91.82
100%		+50	5530064.83	64.83
111%	16.00	+20	5530040.15	40.15
End. Point	9.00	+20	5530029.27	29.27

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5775039.55	39.55
100%		-30	5775032.31	32.31
100%		-20	5775088.29	88.29
100%		-10	5775013.28	13.28
100%		0	5775095.79	95.79
100%		+10	5775052.16	52.16
100%		+30	5775081.39	81.39
100%		+40	5775005.64	5.64
100%		+50	5775028.34	28.34
111%	16.00	+20	5775033.15	33.15
End. Point	9.00	+20	5775080.50	80.5

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.

10 minutes after the EUT is energized

OPERATING BAND:	UNII Band 1
OPERATING FREQUENCY:	5,210,000,000 Hz
CHANNEL:	42
REFERENCE VOLTAGE:	14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5210006.65	6.65
100%		-30	5210008.79	8.79
100%		-20	5210089.72	89.72
100%		-10	5210045.18	45.18
100%		0	5210036.90	36.90
100%		+10	5210046.47	46.47
100%		+30	5210007.52	7.52
100%		+40	5210085.85	85.85
100%		+50	5210029.53	29.53
111%	16.00	+20	5210026.38	26.38
End. Point	9.00	+20	5210070.97	70.97

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5290021.97	21.97
100%		-30	5290013.18	13.18
100%		-20	5290013.14	13.14
100%		-10	5290004.77	4.77
100%		0	5290077.34	77.34
100%		+10	5290001.89	1.89
100%		+30	5290056.12	56.12
100%		+40	5290055.56	55.56
100%		+50	5290028.81	28.81
111%	16.00	+20	5290031.60	31.60
End. Point	9.00	+20	5290002.66	2.66

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 2C
OPERATING FREQUENCY: 5,530,000,000 Hz
CHANNEL: 106
REFERENCE VOLTAGE: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5530004.59	4.59
100%		-30	5530024.49	24.49
100%		-20	5530039.06	39.06
100%		-10	5530019.35	19.35
100%		0	5530002.79	2.79
100%		+10	5530007.76	7.76
100%		+30	5530087.93	87.93
100%		+40	5530034.48	34.48
100%		+50	5530065.09	65.09
111%	16.00	+20	5530014.28	14.28
End. Point	9.00	+20	5530059.03	59.03

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: 14.4 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	14.40	+20(Ref)	5775080.80	80.80
100%		-30	5775040.67	40.67
100%		-20	5775059.39	59.39
100%		-10	5775065.36	65.36
100%		0	5775061.53	61.53
100%		+10	5775061.32	61.32
100%		+30	5775052.19	52.19
100%		+40	5775013.68	13.68
100%		+50	5775097.98	97.98
111%	16.00	+20	5775026.43	26.43
End. Point	9.00	+20	5775055.72	55.72

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.

10.7 STRADDLE CHANNEL

10.7.1 26dB Bandwidth

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11a	UNII 2C	5720	144	5709.52	15.48
802.11n(HT20)				5709.48	15.52
802.11ac(VHT20)				5709.40	15.60
802.11a	UNII 3	5720	144	5730.44	5.44
802.11n(HT20)				5730.68	5.68
802.11ac(VHT20)				5730.76	5.76

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11n(HT40)	UNII 2C	5710	142	5690.16	34.84
802.11ac(VHT40)				5690.32	34.68
802.11n(HT40)	UNII 3	5710	142	5730.00	5.00
802.11ac(VHT40)				5729.68	4.68

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11ac(VHT80)	UNII 2C	5690	138	5649.32	75.68
	UNII 3	5690	138	5730.80	5.80

Note:

[UNII 2C] 26dB Bandwidth = 5725MHz - Measured Frequency[MHz]

[UNII 3C] 26dB Bandwidth = Measured Frequency[MHz] -5725MHz

▣ Test Plots (26dB Bandwidth)

802.11a UNII Band

802.11n(HT20) UNII Band

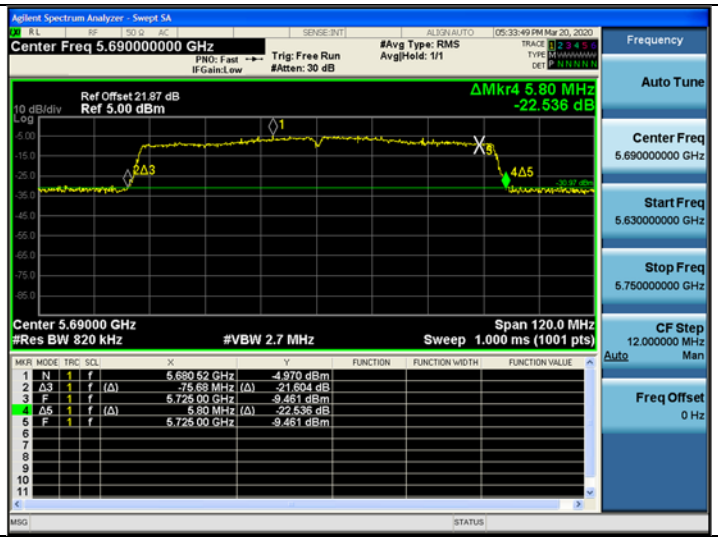
802.11ac(VHT20) UNII Band

▣ Test Plots (26dB Bandwidth)

802.11n(HT40) UNII Band

802.11ac(VHT40) UNII Band

802.11ac(VHT80) UNII Band



10.7.2 6dB Bandwidth

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11a	UNII 3	5720	144	5728.20	3.20	> 0.5
802.11n(HT20)				5728.84	3.84	> 0.5
802.11ac(VHT20)				5728.92	3.92	> 0.5

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT40)	UNII 3	5710	142	5728.20	3.20	> 0.5
802.11ac(VHT40)				5728.20	3.20	> 0.5

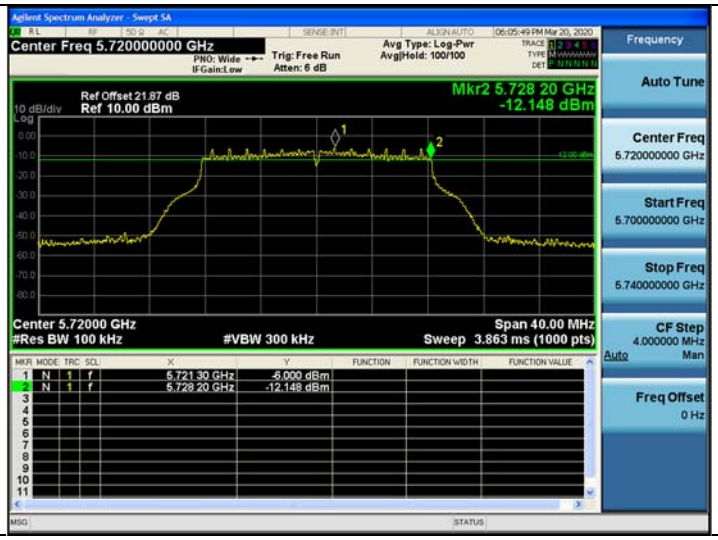
Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11ac(VHT80)	UNII 3	5690	138	5728.42	3.42	> 0.5

Note:

6dB Bandwidth = Measured Frequency[MHz] – 5 725 MHz

▣ Test Plots(UNII 3 Band 6dB Bandwidth)

802.11a CH.144



802.11n_HT20 CH.144

802.11ac_VHT20 CH. 144