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HCT

TEST REPORT

FCC UNII Test for SM-T725 Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-1906-FC013-R1

DATE OF ISSUE
June 17, 2019

HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383 KOREA
Tel. +82 31 634 6300 F ax. +82 31 645 6401

HCT Co., Ltd.
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TEST REPORT

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HCT-RF-1906-FC013-R1

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Other Model
SM-T725N, SM-T727

Applicant	**SAMSUNG Electronics Co., Ltd.** 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea
Eut Type Model Name	Tablet SM-T725
FCC ID	A3LSMT725U
Modulation type	OFDM
FCC Classification	Unlicensed National Information Infrastructure(UNII)
FCC Rule Part(s)	Part 15.407

Tested by
Jeong Ho Kim (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	June 05, 2019	Initial Release
1	June 17, 2019	On page 20 &25 Revised

The result shown in this test report refer only to the sample(s) tested unless otherwise stated.

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.

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	SM-T725	
Additional Model	SM-T725N, SM-T727	
EUT Type	Tablet	
Power Supply	DC 3.85 V	
Battery Information	Model: EB-BT725ABU Type: Li-ion Battery	
Travel Adapter Information	Model : EP-TA200 Manufacture: SOLUM	
Keyboard Information	Model : EJ-FT720 Manufacture: SAMSUNG	
Charging Doc Information	Model : EE-D3200 Manufacture: SAMSUNG	
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 Specification	Antenna type: Metal Peak Gain : -6.4 dBi(UNII 1, 2A) / -6.5 dBi(UNII 2C)/ -6.3 dBi(UNII 3)	
Straddle channel	Supported	
TDWR Band	Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	May 10, 2019~ June 05, 2019	

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)
U-NII-1	802.11a	17.29	0.054
	802.11n (HT20)	17.97	0.063
	802.11n (HT40)	17.08	0.051
	802.11ac (VHT20)	17.23	0.053
	802.11ac (VHT40)	16.90	0.049
	802.11ac (VHT80)	15.88	0.039
U-NII-2A	802.11a	17.82	0.061
	802.11n (HT20)	17.77	0.060
	802.11n (HT40)	17.24	0.053
	802.11ac (VHT20)	17.11	0.051
	802.11ac (VHT40)	17.09	0.051
	802.11ac (VHT80)	15.69	0.037
U-NII-2C	802.11a	18.14	0.065
	802.11n (HT20)	18.22	0.066
	802.11n (HT40)	17.57	0.057
	802.11ac (VHT20)	17.60	0.058
	802.11ac (VHT40)	17.40	0.055
	802.11ac (VHT80)	17.09	0.051
U-NII-3	802.11a	18.41	0.069
	802.11n (HT20)	18.36	0.069
	802.11n (HT40)	17.22	0.053
	802.11ac (VHT20)	17.62	0.058
	802.11ac (VHT40)	17.19	0.052
	802.11ac (VHT80)	17.02	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 3.75 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."

* The antennas of this E.U.T are permanently attached.
* 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.

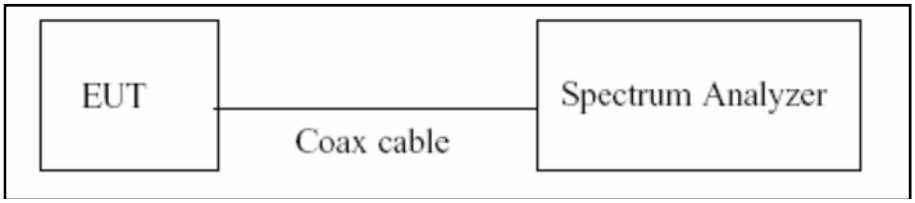
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

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)	5.71

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.

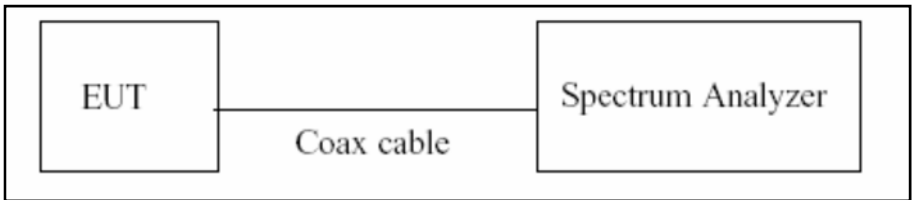
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10*log(1/Duty Cycle)

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*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.

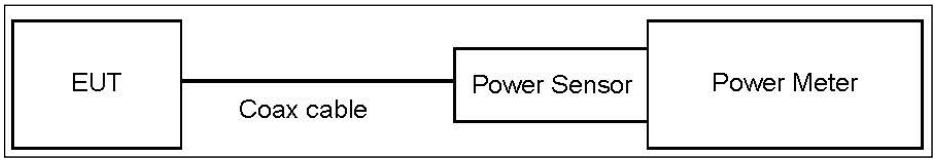
8.3. Output Power Measurement

Limit

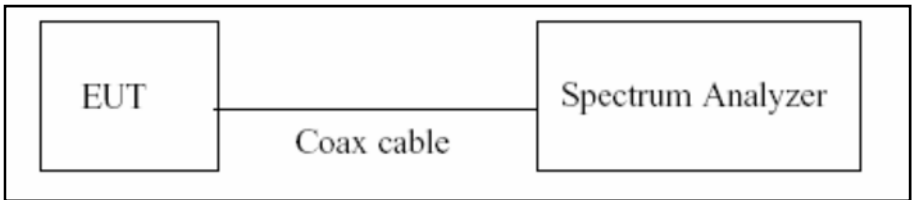
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

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*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	20.63
UNII 2A	20.63
UNII 2C	20.63
UNII 3	20.63

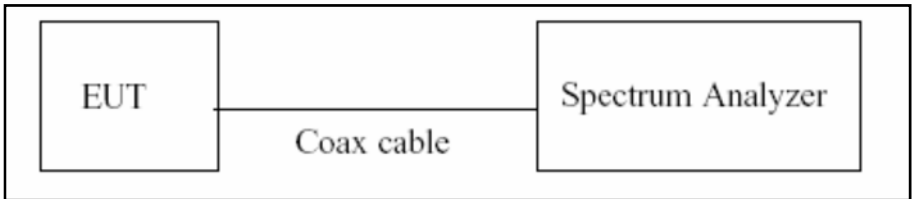
(Actual value of loss for the attenuator and cable combination)

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*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	20.63
UNII 2A	20.63
UNII 2C	20.63
UNII 3	20.63

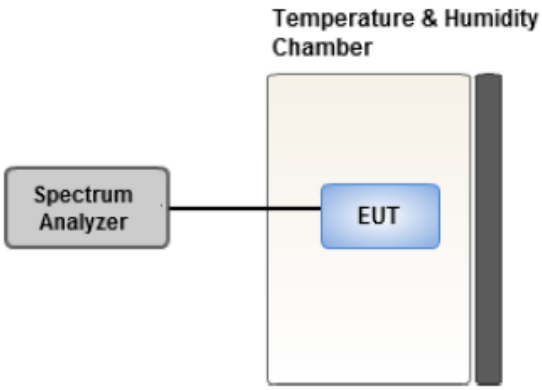
(Actual value of loss for the attenuator and cable combination)

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 °C and 50 °C.
2. The temperature was incremented by 10 °C 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*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*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.

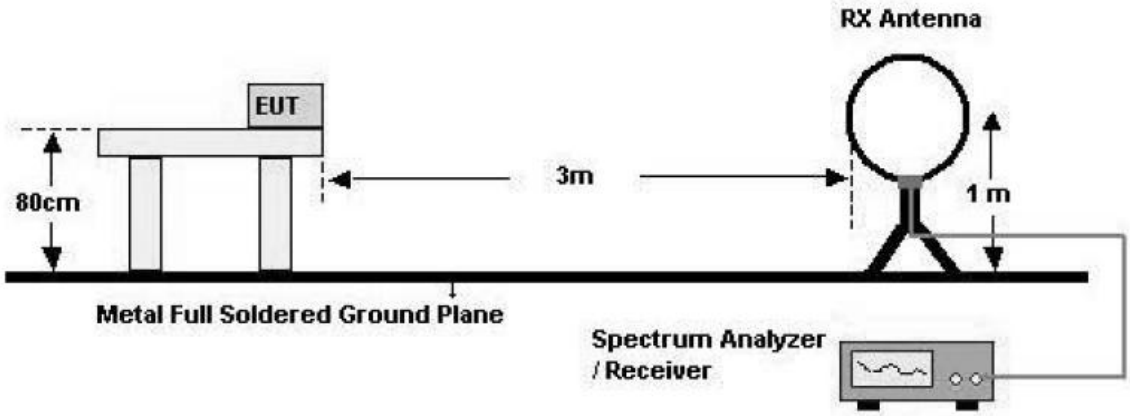
3. UNII 3: All emissions shall be limited to a level of －27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below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

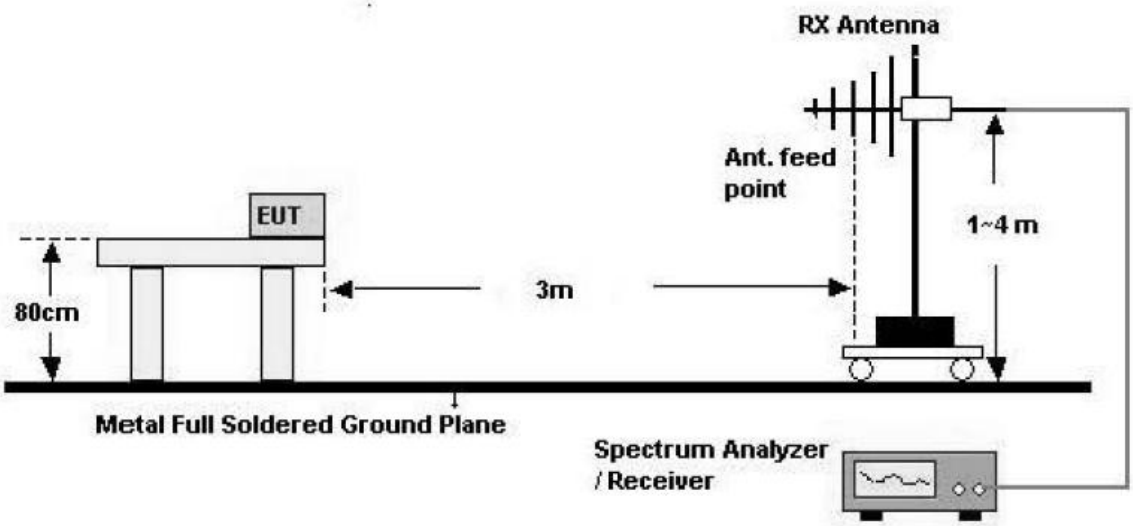
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

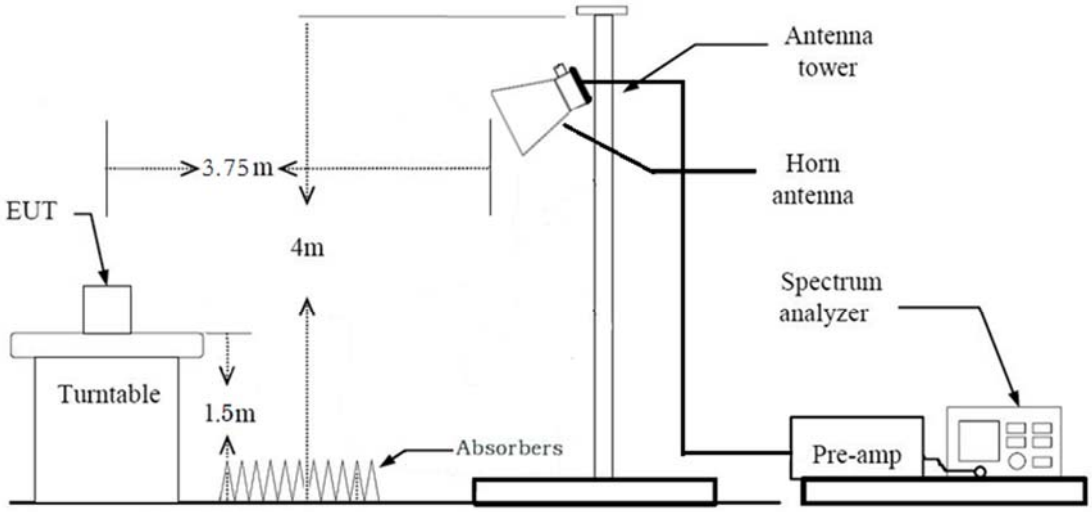
Below 30 MHz



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) = 40*log(3 m/300 m) = - 80 dB
   Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = 40*log(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*RBW
9. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) + Distance Factor(D.F)

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*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)

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 = 20*log (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 = 20*log (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	0.975	0.110	1000
802.11n(HT20)	MCS 0	0.972	0.124	1000
802.11n(HT40)	MCS 0	0.949	0.226	3000
802.11ac(VHT20)	MCS 0	0.974	0.117	1000
802.11ac(VHT40)	MCS 0	0.949	0.227	3000
802.11ac(VHT80)	MCS 0	0.901	0.452	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(Keyboard, Charging Doc, Earphone, etc)
   - Worstcase : Stand alone
2. EUT Axis
   - Radiated Spurious Emissions : Y
   - Radiated Restricted Band Edge : Z
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. SM-T725, SM-T725N, SM-T727 were tested and the worst case results are reported.
   (Worst case : SM-T725)

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(Keyboard, Charging Doc, Earphone, etc)+Travel Adapter, Stand alone + Travel Adapter
   - Worstcase : Stand alone + Travel Adapter
2. SM-T725, SM-T725N, SM-T727 were tested and the worst case results are reported.
   (Worst case : SM-T725)

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported
2. SM-T725, SM-T725N, SM-T727 were tested and the worst case results are reported.
   (Worst case : SM-T725)

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		PASS
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

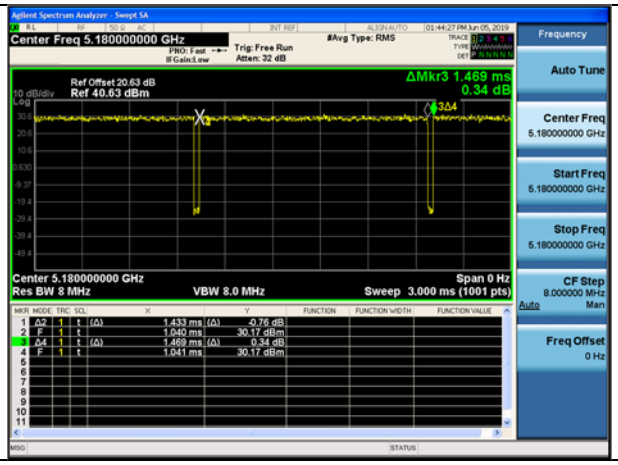
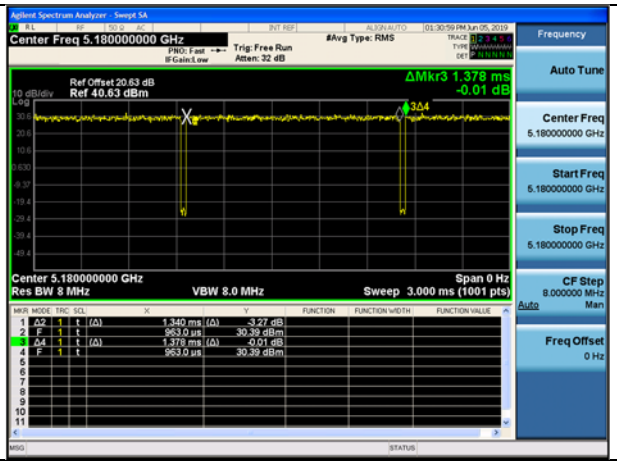
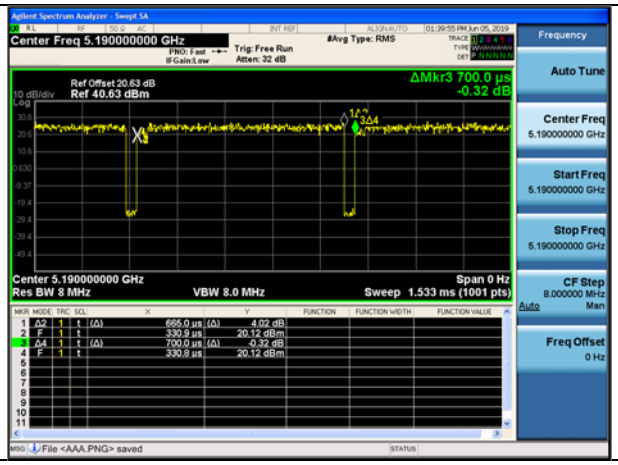
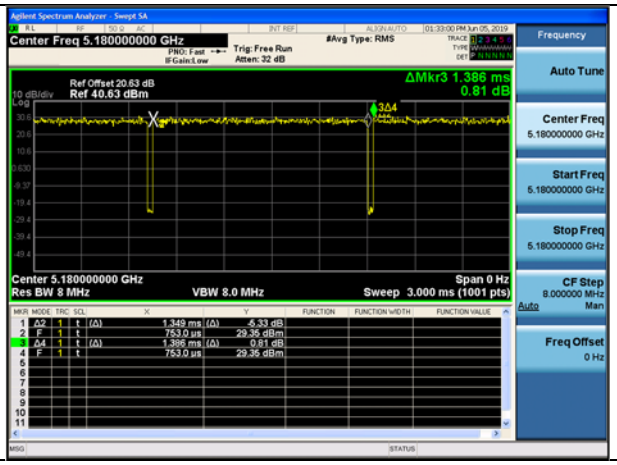
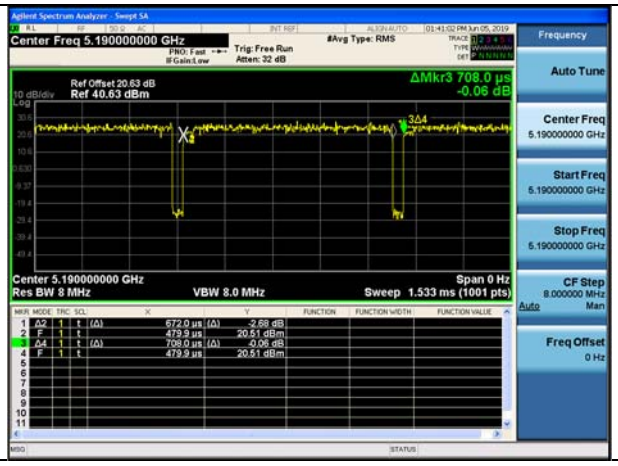
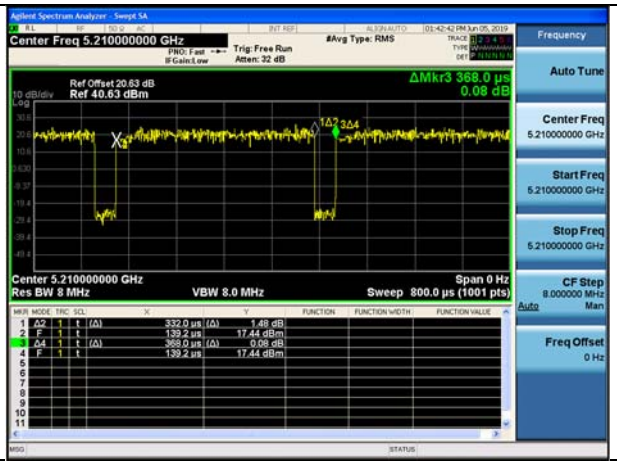
Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11a	6	1.433	1.469	0.975	0.110
	9	0.960	0.997	0.963	0.166
	12	0.728	0.765	0.951	0.217
	18	0.492	0.529	0.930	0.313
	24	0.376	0.413	0.911	0.406
	36	0.256	0.292	0.877	0.570
	48	0.200	0.236	0.847	0.719
	54	0.180	0.216	0.833	0.793

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11n (HT20)	0	1.340	1.378	0.972	0.124
	1	0.688	0.725	0.949	0.227
	2	0.472	0.509	0.927	0.328
	3	0.365	0.402	0.908	0.418
	4	0.256	0.292	0.877	0.570
	5	0.200	0.236	0.847	0.719
	6	0.184	0.220	0.836	0.777
	7	0.168	0.204	0.823	0.845
802.11n (HT40)	0	0.665	0.700	0.949	0.226
	1	0.352	0.388	0.907	0.423
	2	0.248	0.284	0.873	0.589
	3	0.196	0.232	0.845	0.729
	4	0.144	0.180	0.801	0.966
	5	0.116	0.152	0.763	1.174
	6	0.108	0.144	0.752	1.239
	7	0.100	0.136	0.734	1.342

Mode	MCS Index	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11ac (VHT20)	0	1.349	1.386	0.974	0.117
	1	0.696	0.733	0.950	0.225
	2	0.476	0.513	0.927	0.329
	3	0.369	0.405	0.909	0.414
	4	0.260	0.296	0.878	0.563
	5	0.204	0.240	0.850	0.705
	6	0.188	0.224	0.839	0.763
	7	0.172	0.208	0.826	0.829
	8	0.152	0.188	0.808	0.927
802.11ac (VHT40)	0	0.672	0.708	0.949	0.227
	1	0.356	0.392	0.909	0.415
	2	0.252	0.288	0.874	0.583
	3	0.200	0.236	0.848	0.716
	4	0.148	0.184	0.805	0.941
	5	0.120	0.156	0.769	1.139
	6	0.112	0.148	0.756	1.216
	7	0.104	0.140	0.743	1.289
	8	0.096	0.132	0.726	1.390
	9	0.088	0.124	0.710	1.487
802.11ac (VHT80)	0	0.332	0.368	0.901	0.452
	1	0.188	0.224	0.840	0.758
	2	0.140	0.176	0.796	0.991
	3	0.116	0.152	0.763	1.174
	4	0.092	0.128	0.720	1.429
	5	0.080	0.117	0.686	1.637
	6	0.076	0.112	0.679	1.681
	7	0.072	0.108	0.667	1.756
	8	0.068	0.104	0.657	1.827
	9	0.064	0.100	0.641	1.933

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

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	26.69	17.041
5200	40	26.90	17.075
5240	48	24.62	16.782
5260	52	24.12	16.663
5300	60	21.58	16.608
5320	64	23.33	16.627
5500	100	21.38	16.556
5600	120	21.85	16.561
5720	144	21.70	16.534
5745	149	22.13	16.582
5785	157	23.43	16.662
5825	165	24.05	16.702

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	25.00	17.959
5200	40	27.60	18.042
5240	48	25.26	17.944
5260	52	23.22	17.800
5300	60	22.90	17.769
5320	64	23.72	17.802
5500	100	22.21	17.756
5600	120	21.86	17.749
5720	144	22.12	17.746
5745	149	22.27	17.755
5785	157	23.34	17.806
5825	165	24.52	17.879

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	41.72	36.328
5230	46	41.23	36.203
5270	54	41.60	36.234
5310	62	41.51	36.217
5510	102	40.84	36.183
5590	118	41.49	36.230
5710	142	41.45	36.179
5755	151	41.18	36.218
5795	159	41.10	36.208

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	24.31	17.799
5200	40	24.16	17.861
5240	48	23.13	17.818
5260	52	22.74	17.734
5300	60	22.58	17.751
5320	64	22.57	17.720
5500	100	22.45	17.684
5600	120	22.16	17.742
5720	144	23.16	17.761
5745	149	22.59	17.723
5785	157	22.01	17.759
5825	165	22.75	17.755

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	41.79	36.300
5230	46	41.31	36.208
5270	54	41.41	36.235
5310	62	41.68	36.260
5510	102	41.22	36.195
5590	118	41.09	36.184
5710	142	41.28	36.191
5755	151	40.90	36.183
5795	159	40.71	36.230

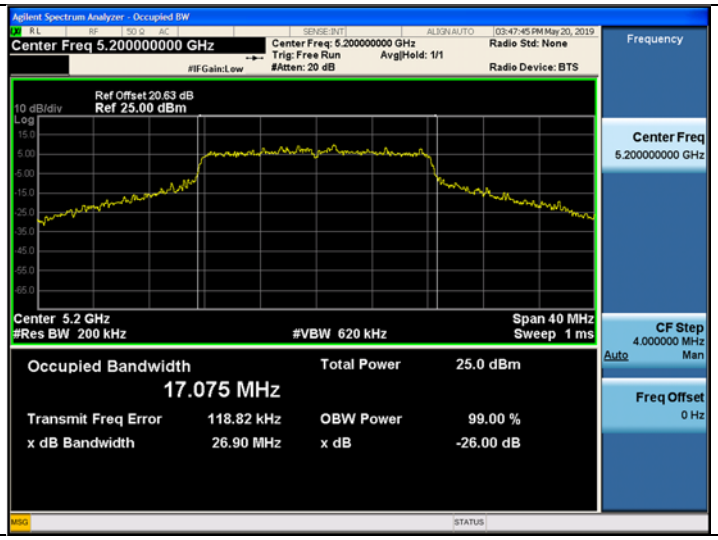
802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	87.83	75.778
5290	58	82.88	75.643
5530	106	84.22	75.600
5610	122	83.64	75.646
5690	138	83.43	75.711
5775	155	83.79	75.739

▣ Test Plots(802.11a)

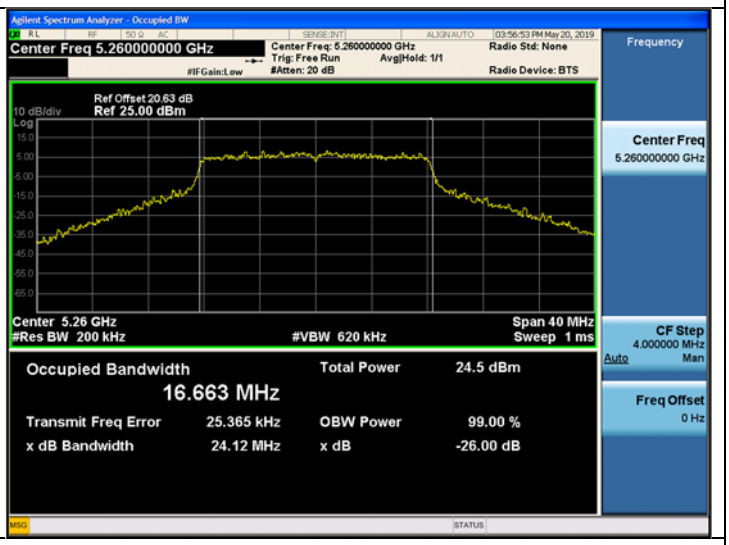
Note:

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

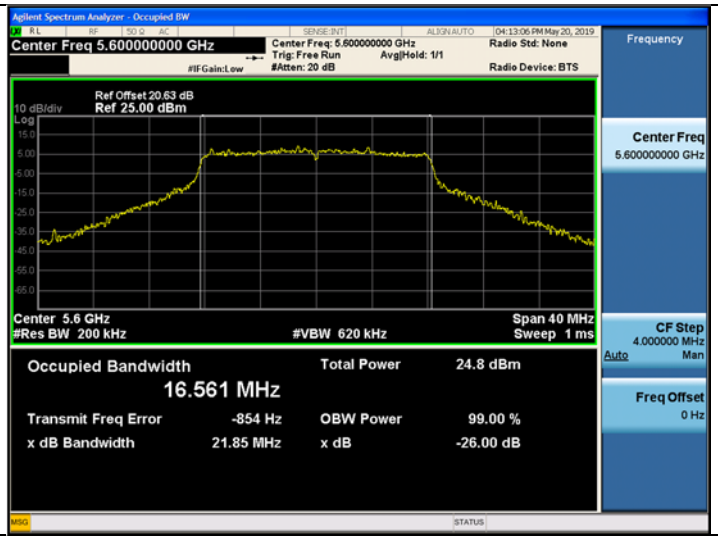
802.11a UNII 1 BAND 26dB Bandwidth (CH 40)



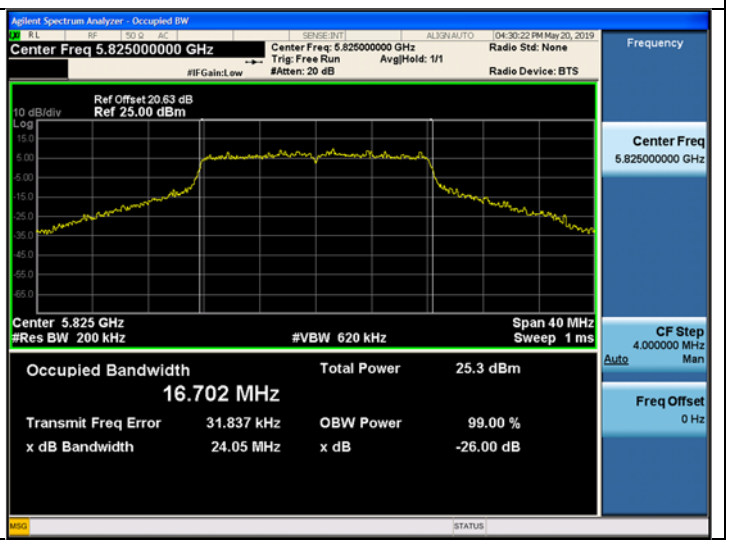
802.11a UNII 2A BAND 26dB Bandwidth (CH 52)



802.11a UNII 2C BAND 26dB Bandwidth (CH120)



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 64)

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 38)

802.11n_HT40 UNII 2A BAND 26dB Bandwidth (CH 54)

802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 118)

802.11n_HT40 UNII 3 BAND 26dB Bandwidth (CH 151)

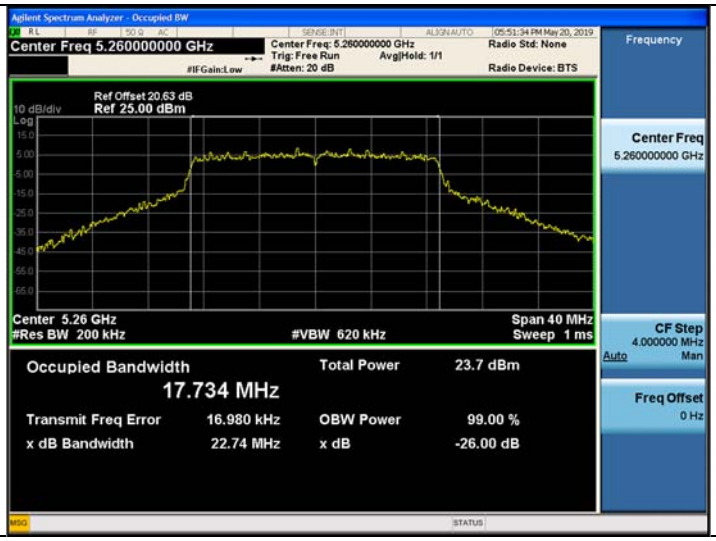
▣ Test Plots(802.11ac(VHT20))

Note:

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

802.11ac_VHT20 UNII 1 BAND 26dB Bandwidth(CH 36)

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 62)

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

802.11a Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5745	149	15.05	> 0.5	Pass
5785	157	15.18	> 0.5	Pass
5825	165	15.18	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5745	149	15.48	> 0.5	Pass
5785	157	16.55	> 0.5	Pass
5825	165	15.43	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5755	151	35.60	> 0.5	Pass
5795	159	35.41	> 0.5	Pass

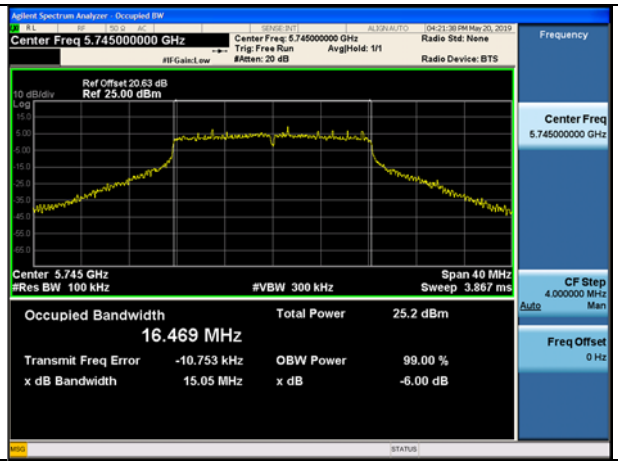
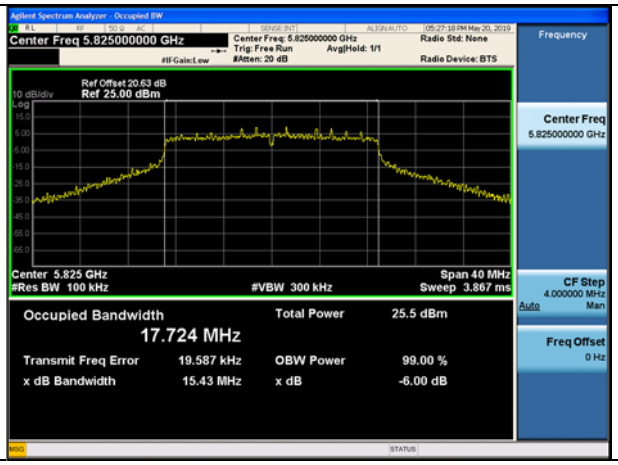
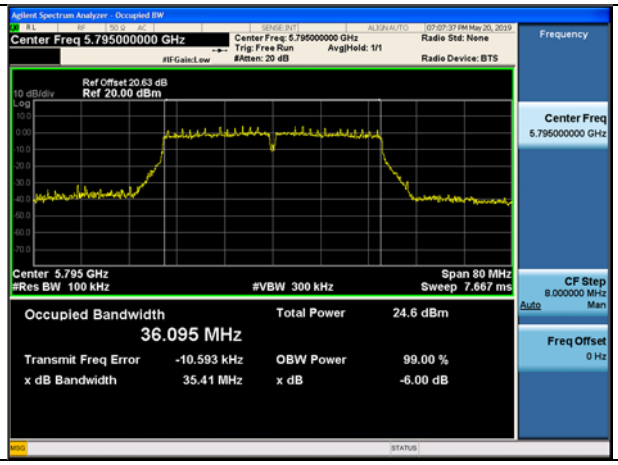
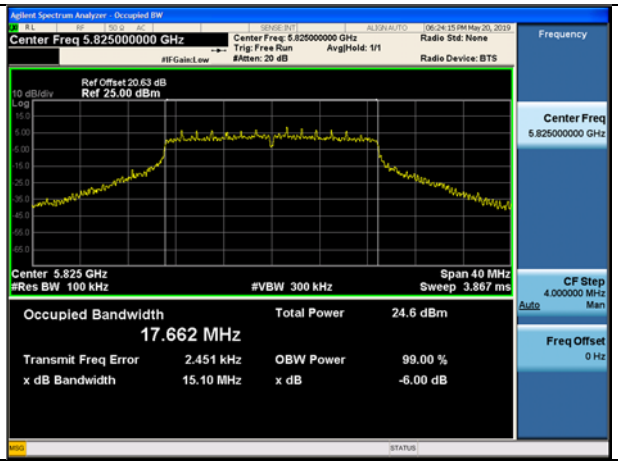
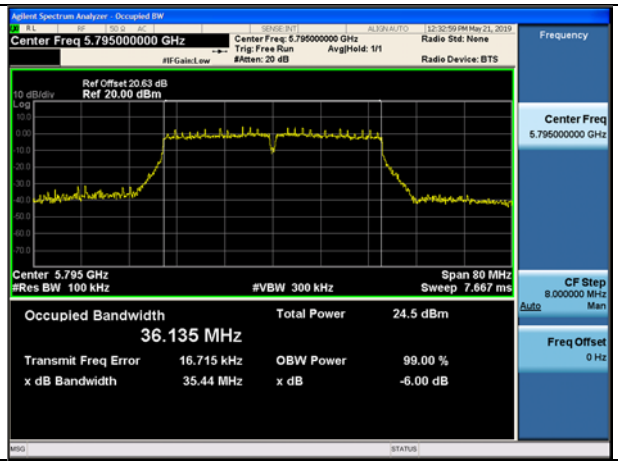
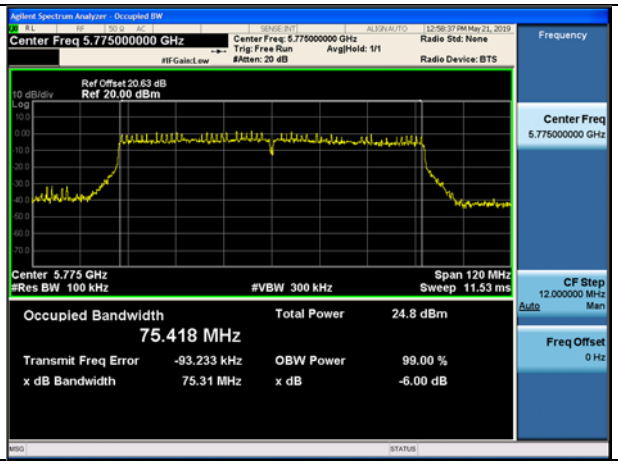
802.11ac(VHT20) Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5745	149	15.66	> 0.5	Pass
5785	157	16.01	> 0.5	Pass
5825	165	15.10	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5755	151	35.61	> 0.5	Pass
5795	159	35.44	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth	Limit	Pass / Fail
Frequency [MHz]	Channel No.	[MHz]	[MHz]	
5775	155	75.31	> 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.165)
	
802.11n(HT40) (CH.159)	**802.11ac(VHT20) (CH.165)**
	
802.11ac(VHT40) (CH.159)	**802.11ac(VHT80) (CH.155)**
	

10.4 OUTPUT POWER MEASUREMENT

802.11a Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5180	36	17.00	17.16	0.110	17.27	23.98
5200	40	17.00	17.18	0.110	17.29	23.98
5240	48	17.00	16.83	0.217	17.05	23.98
5260	52	17.00	16.74	0.110	16.85	23.98
5300	60	18.00	17.51	0.217	17.73	23.98
5320	64	18.00	17.61	0.217	17.82	23.98
5500	100	18.00	17.38	0.719	18.10	23.98
5600	120	18.00	17.30	0.793	18.09	23.98
5720	144	18.00	17.42	0.719	18.14	23.98
5745	149	18.00	17.42	0.793	18.21	30.00
5785	157	18.00	18.02	0.110	18.13	30.00
5825	165	18.00	18.30	0.110	18.41	30.00

802.11n(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5180	36	18.00	17.83	0.124	17.95	23.98
5200	40	18.00	17.84	0.124	17.97	23.98
5240	48	18.00	17.64	0.124	17.77	23.98
5260	52	18.00	16.83	0.845	17.67	23.98
5300	60	18.00	16.90	0.845	17.75	23.98
5320	64	18.00	16.99	0.777	17.77	23.98
5500	100	18.00	17.37	0.777	18.15	23.98
5600	120	18.00	17.47	0.719	18.19	23.98
5720	144	18.00	17.50	0.719	18.22	23.98
5745	149	18.00	17.56	0.777	18.34	30.00
5785	157	18.00	17.31	0.845	18.15	30.00
5825	165	18.00	18.24	0.124	18.36	30.00

802.11n(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5190	38	15.50	15.60	0.423	16.03	23.98
5230	46	17.00	16.66	0.423	17.08	23.98
5270	54	17.00	16.81	0.423	17.24	23.98
5310	62	16.00	14.90	1.239	16.14	23.98
5510	102	17.00	16.23	1.342	17.57	23.98
5590	118	17.00	16.23	1.174	17.40	23.98
5710	142	17.00	16.33	0.966	17.30	23.98
5755	151	17.00	15.91	1.239	17.15	30.00
5795	159	17.00	16.80	0.423	17.22	30.00

802.11ac(20MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5180	36	17.00	16.47	0.763	17.23	23.98
5200	40	17.00	16.28	0.927	17.20	23.98
5240	48	17.00	16.35	0.705	17.06	23.98
5260	52	17.00	16.10	0.829	16.93	23.98
5300	60	17.00	16.28	0.829	17.11	23.98
5320	64	17.00	16.31	0.705	17.01	23.98
5500	100	17.00	16.76	0.763	17.53	23.98
5600	120	17.00	16.69	0.829	17.52	23.98
5720	144	17.00	16.77	0.829	17.60	23.98
5745	149	17.00	16.77	0.763	17.53	30.00
5785	157	17.00	16.47	0.927	17.39	30.00
5825	165	17.00	16.86	0.763	17.62	30.00

802.11ac(40MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5190	38	15.50	14.66	1.390	16.05	23.98
5230	46	17.00	16.49	0.415	16.90	23.98
5270	54	17.00	16.67	0.415	17.09	23.98
5310	62	16.00	14.95	1.216	16.16	23.98
5510	102	17.00	16.01	1.390	17.40	23.98
5590	118	17.00	16.02	1.289	17.31	23.98
5710	142	17.00	15.99	1.216	17.21	23.98
5755	151	17.00	15.98	1.216	17.19	30.00
5795	159	17.00	16.70	0.415	17.11	30.00

802.11ac(80MHz) Mode		Power Level Setting	Measured Power [dBm]	Duty Cycle Factor (dB)	Total Power [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.					
5210	42	15.50	14.13	1.756	15.88	23.98
5290	58	15.50	13.75	1.933	15.69	23.98
5530	106	15.50	14.23	1.681	15.91	23.98
5610	122	17.00	15.45	1.637	17.09	23.98
5690	138	17.00	14.66	1.933	16.59	23.98
5775	155	17.00	15.27	1.756	17.02	30.00

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	6.636	0.110	6.746	11
5200	40	6.676	0.110	6.786	11
5240	48	6.221	0.217	6.438	11
5260	52	6.007	0.110	6.117	11
5300	60	6.721	0.217	6.938	11
5320	64	6.833	0.217	7.050	11
5500	100	6.485	0.719	7.204	11
5600	120	6.138	0.793	6.931	11
5720	144	6.491	0.719	7.210	11
5745	149	3.751	0.793	4.544	30
5785	157	4.781	0.110	4.891	30
5825	165	5.162	0.110	5.272	30

802.11n(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	7.013	0.124	7.137	11
5200	40	7.175	0.124	7.299	11
5240	48	6.901	0.124	7.025	11
5260	52	5.471	0.845	6.316	11
5300	60	5.511	0.845	6.356	11
5320	64	5.620	0.777	6.397	11
5500	100	5.893	0.777	6.670	11
5600	120	5.898	0.719	6.617	11
5720	144	6.082	0.719	6.801	11
5745	149	3.365	0.777	4.142	30
5785	157	3.388	0.845	4.233	30
5825	165	4.639	0.124	4.763	30

802.11n(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	1.923	0.423	2.346	11
5230	46	2.755	0.423	3.178	11
5270	54	2.974	0.423	3.397	11
5310	62	0.851	1.239	2.090	11
5510	102	1.758	1.342	3.100	11
5590	118	1.907	1.174	3.081	11
5710	142	1.716	0.966	2.682	11
5755	151	-0.578	1.239	0.661	30
5795	159	0.460	0.423	0.883	30

802.11ac(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	5.173	0.763	5.936	11
5200	40	4.926	0.927	5.853	11
5240	48	4.924	0.705	5.629	11
5260	52	4.742	0.829	5.571	11
5300	60	5.020	0.829	5.849	11
5320	64	5.083	0.705	5.788	11
5500	100	5.222	0.763	5.985	11
5600	120	5.431	0.829	6.260	11
5720	144	5.361	0.829	6.190	11
5745	149	2.527	0.763	3.290	30
5785	157	2.686	0.927	3.613	30
5825	165	2.934	0.763	3.697	30

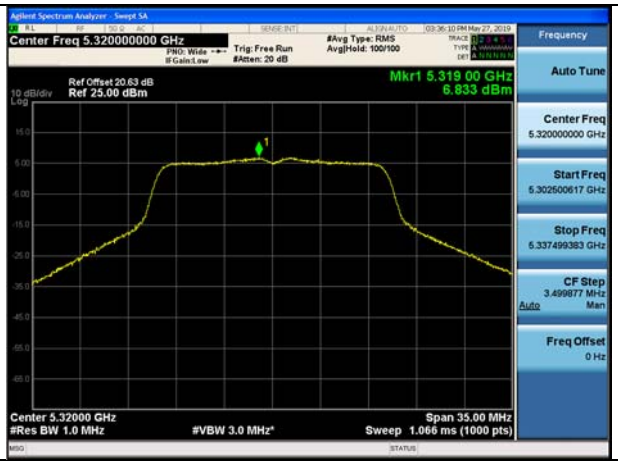
802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	1.440	1.390	2.830	11
5230	46	2.825	0.415	3.240	11
5270	54	3.228	0.415	3.643	11
5310	62	0.884	1.216	2.100	11
5510	102	2.101	1.390	3.491	11
5590	118	1.959	1.289	3.248	11
5710	142	1.726	1.216	2.942	11
5755	151	-0.583	1.216	0.633	30
5795	159	0.348	0.415	0.763	30

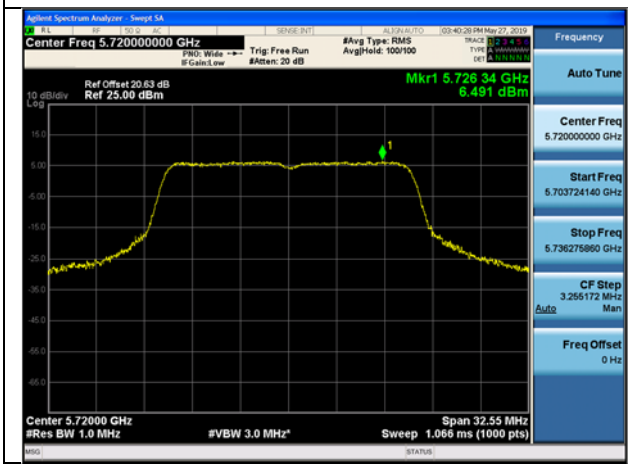
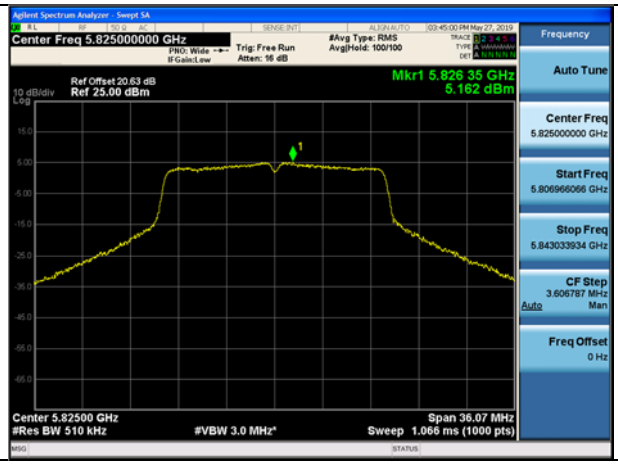
802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5210	42	-2.232	1.756	-0.476	11
5290	58	-2.542	1.933	-0.609	11
5530	106	-2.760	1.681	-1.079	11
5610	122	-1.655	1.637	-0.018	11
5690	138	-2.604	1.933	-0.671	11
5775	155	-3.798	1.756	-2.042	30

▣ Test Plots(802.11a)

Note:

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

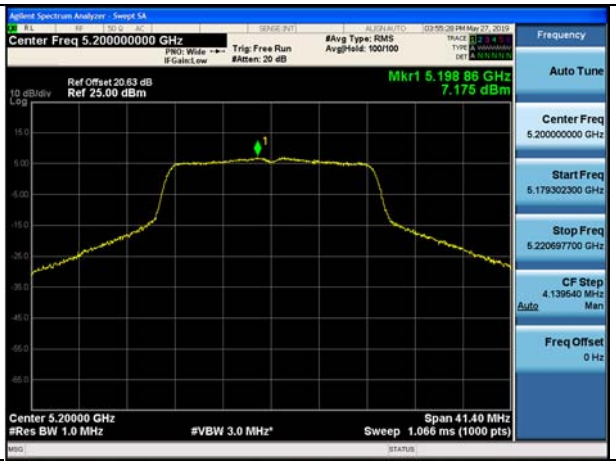
UNII 1 (Ch. 40)	UNII 2A (Ch. 64)
	

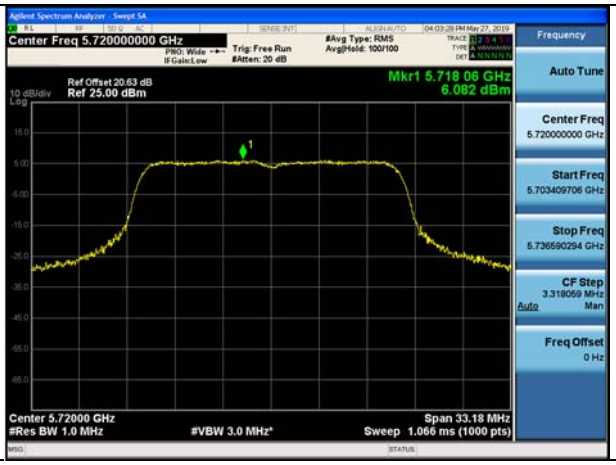
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT20))

Note:

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

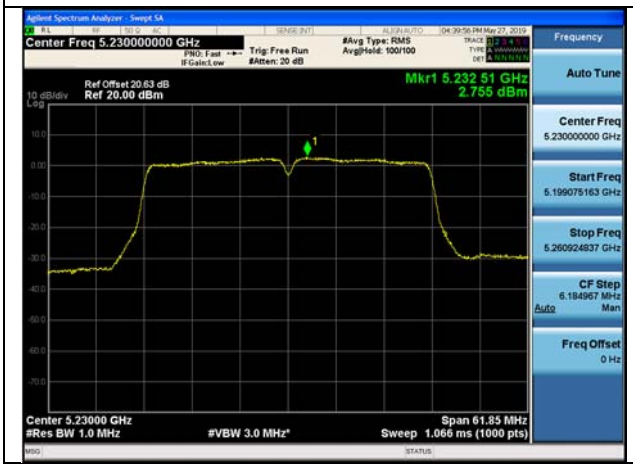
UNII 1 (Ch. 40)	UNII 2A (Ch. 64)
	

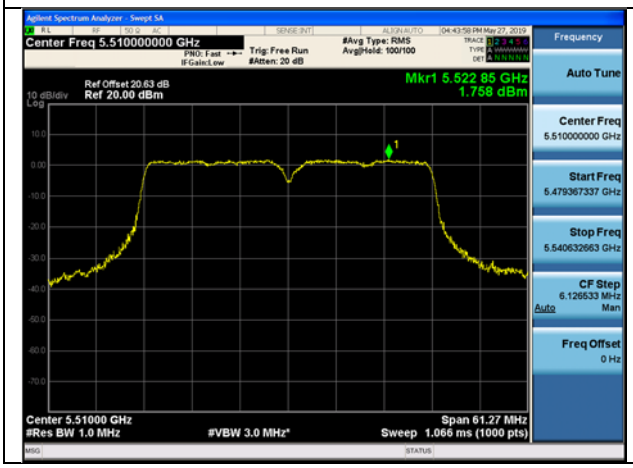
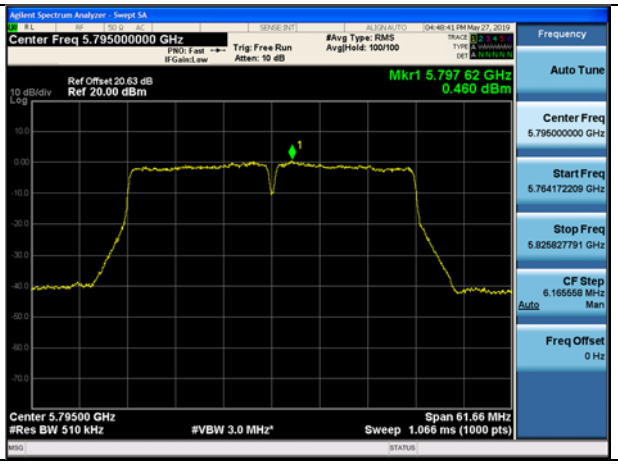
UNII 2C (Ch. 144)	UNII 3 (Ch. 165)
	

▣ Test Plots(802.11n(HT40))

Note:

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

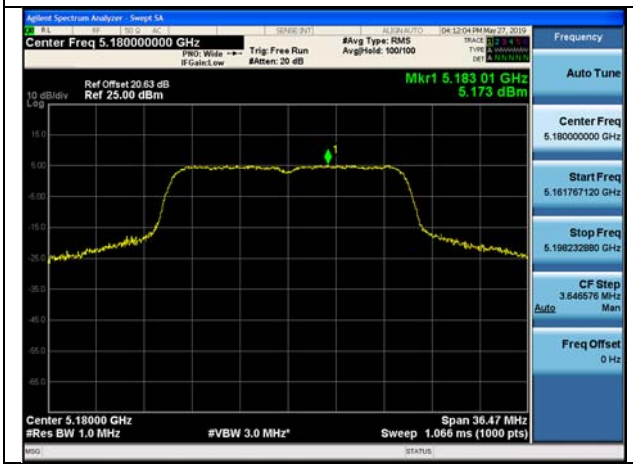
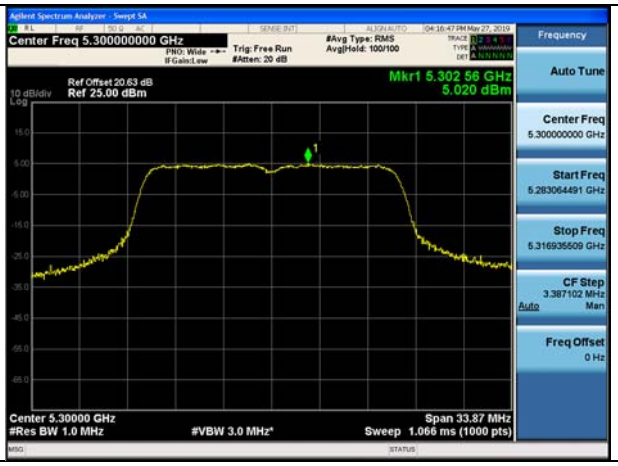
UNII 1 (Ch. 46)	UNII 2A (Ch. 54)
	

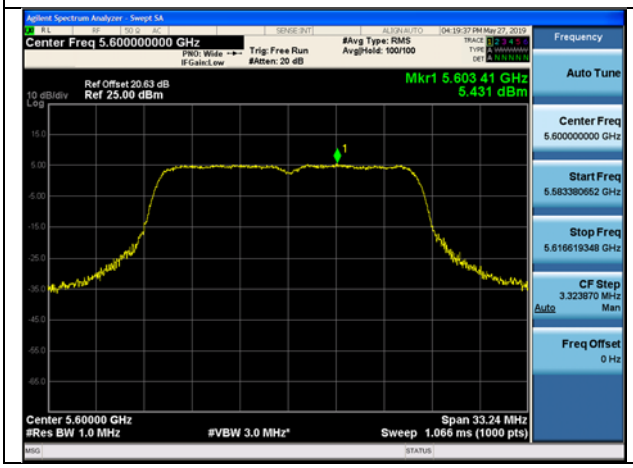
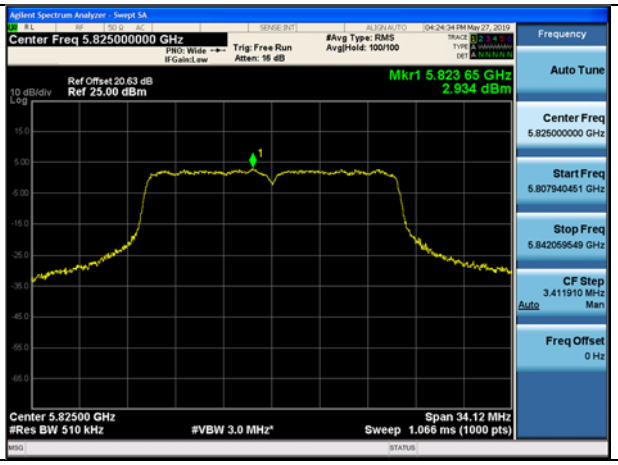
UNII 2C (Ch. 102)	UNII 3 (Ch. 159)
	

▣ Test Plots(802.11ac(VHT20))

Note:

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

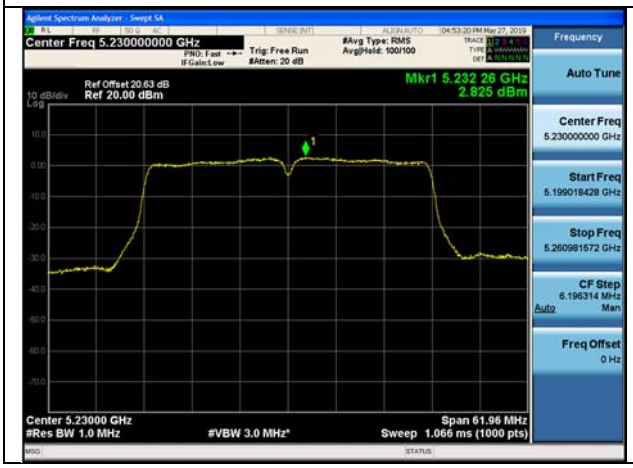
UNII 1 (Ch. 36)	UNII 2A (Ch. 60)
	

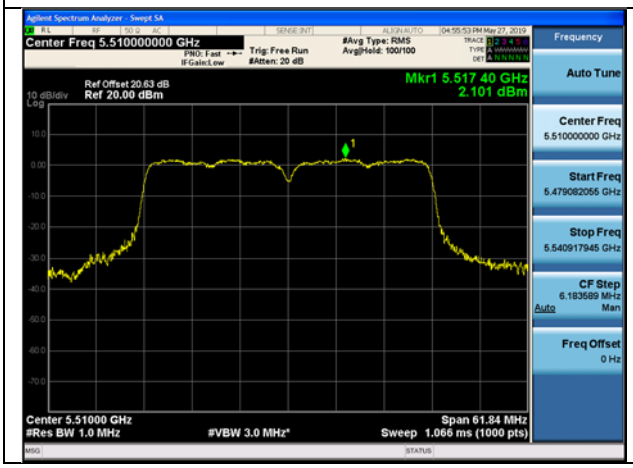
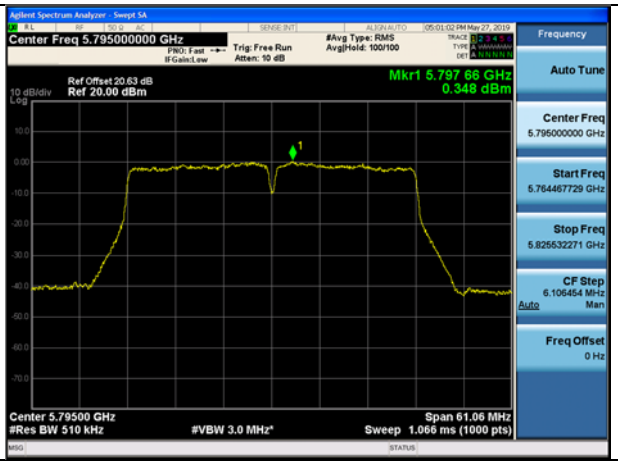
UNII 2C (Ch. 120)	UNII 3 (Ch. 165)
	

▣ 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)
	

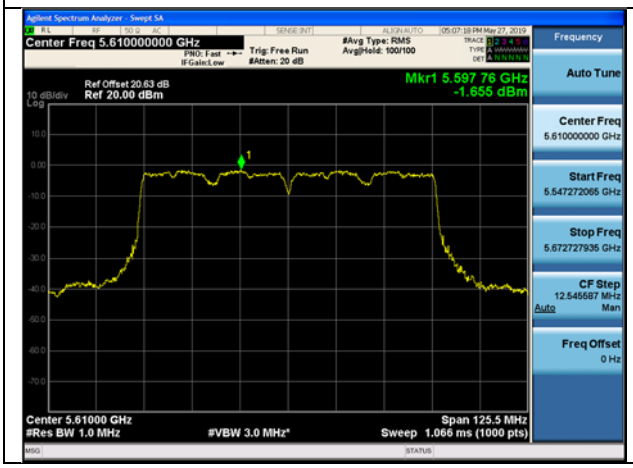
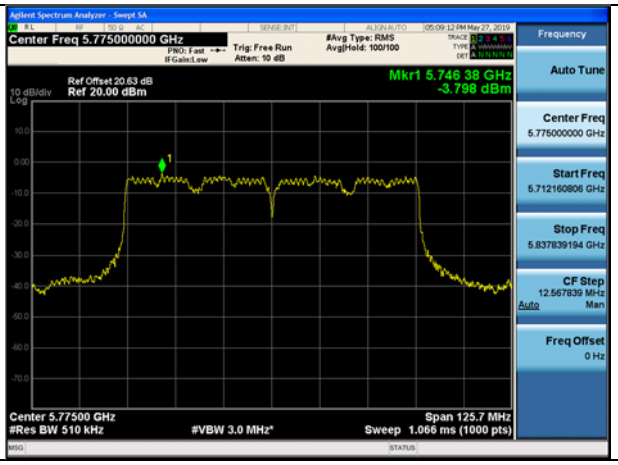
UNII 2C (Ch. 102)	UNII 3 (Ch. 159)
	

▣ 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)
	

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5210019.83	19.83
100%		-30	5210046.34	46.34
100%		-20	5210042.65	42.65
100%		-10	5210039.47	39.47
100%		0	5210034.80	34.80
100%		+10	5210030.90	30.90
100%		+30	5210030.43	30.43
100%		+40	5210033.77	33.77
100%		+50	5210037.76	37.76
115%	4.43	+20	5210037.28	37.28
End. Point	3.27	+20	5210041.89	41.89

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5290023.16	23.16
100%		-30	5290047.45	47.45
100%		-20	5290044.27	44.27
100%		-10	5290039.94	39.94
100%		0	5290035.52	35.52
100%		+10	5290031.07	31.07
100%		+30	5290031.41	31.41
100%		+40	5290035.26	35.26
100%		+50	5290038.45	38.45
115%	4.43	+20	5290039.88	39.88
End. Point	3.27	+20	5290044.24	44.24

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 2C
OPERATING FREQUENCY: 5,530,000,000 Hz
CHANNEL: 106
REFERENCE VOLTAGE: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5530031.47	31.47
100%		-30	5530045.82	45.82
100%		-20	5530042.68	42.68
100%		-10	5530039.20	39.20
100%		0	5530035.95	35.95
100%		+10	5530031.18	31.18
100%		+30	5530030.20	30.20
100%		+40	5530035.04	35.04
100%		+50	5530039.16	39.16
115%	4.43	+20	5530038.00	38.00
End. Point	3.27	+20	5530043.21	43.21

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5775029.22	29.22
100%		-30	5775047.24	47.24
100%		-20	5775043.07	43.07
100%		-10	5775038.45	38.45
100%		0	5775034.72	34.72
100%		+10	5775030.26	30.26
100%		+30	5775030.34	30.34
100%		+40	5775034.27	34.27
100%		+50	5775038.90	38.90
115%	4.43	+20	5775039.72	39.72
End. Point	3.27	+20	5775042.67	42.67

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5210044.61	44.61
100%		-30	5210065.64	65.64
100%		-20	5210061.14	61.14
100%		-10	5210057.47	57.47
100%		0	5210053.25	53.25
100%		+10	5210049.31	49.31
100%		+30	5210048.86	48.86
100%		+40	5210053.32	53.32
100%		+50	5210058.36	58.36
115%	4.43	+20	5210056.76	56.76
End. Point	3.27	+20	5210061.28	61.28

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5290037.74	37.74
100%		-30	5290059.83	59.83
100%		-20	5290054.96	54.96
100%		-10	5290050.54	50.54
100%		0	5290045.64	45.64
100%		+10	5290041.44	41.44
100%		+30	5290042.35	42.35
100%		+40	5290046.55	46.55
100%		+50	5290049.79	49.79
115%	4.43	+20	5290050.26	50.26
End. Point	3.27	+20	5290054.91	54.91

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5530056.18	56.18
100%		-30	5530076.14	76.14
100%		-20	5530072.18	72.18
100%		-10	5530068.45	68.45
100%		0	5530063.97	63.97
100%		+10	5530060.59	60.59
100%		+30	5530060.02	60.02
100%		+40	5530063.89	63.89
100%		+50	5530068.48	68.48
115%	4.43	+20	5530069.19	69.19
End. Point	3.27	+20	5530072.26	72.26

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5775047.92	47.92
100%		-30	5775066.90	66.90
100%		-20	5775063.62	63.62
100%		-10	5775060.25	60.25
100%		0	5775056.27	56.27
100%		+10	5775052.12	52.12
100%		+30	5775052.30	52.30
100%		+40	5775055.82	55.82
100%		+50	5775060.10	60.10
115%	4.43	+20	5775059.77	59.77
End. Point	3.27	+20	5775064.99	64.99

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5210055.11	55.11
100%		-30	5210074.75	74.75
100%		-20	5210070.38	70.38
100%		-10	5210065.91	65.91
100%		0	5210062.69	62.69
100%		+10	5210059.18	59.18
100%		+30	5210058.75	58.75
100%		+40	5210063.00	63.00
100%		+50	5210066.24	66.24
115%	4.43	+20	5210067.45	67.45
End. Point	3.27	+20	5210070.20	70.20

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5290042.96	42.96
100%		-30	5290066.84	66.84
100%		-20	5290061.79	61.79
100%		-10	5290056.86	56.86
100%		0	5290051.83	51.83
100%		+10	5290047.04	47.04
100%		+30	5290047.99	47.99
100%		+40	5290052.72	52.72
100%		+50	5290057.38	57.38
115%	4.43	+20	5290056.51	56.51
End. Point	3.27	+20	5290060.65	60.65

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5530061.46	61.46
100%		-30	5530081.12	81.12
100%		-20	5530077.09	77.09
100%		-10	5530072.91	72.91
100%		0	5530068.97	68.97
100%		+10	5530065.26	65.26
100%		+30	5530065.70	65.70
100%		+40	5530069.17	69.17
100%		+50	5530072.41	72.41
115%	4.43	+20	5530073.96	73.96
End. Point	3.27	+20	5530077.98	77.98

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5775054.72	54.72
100%		-30	5775076.13	76.13
100%		-20	5775071.36	71.36
100%		-10	5775067.76	67.76
100%		0	5775063.15	63.15
100%		+10	5775058.55	58.55
100%		+30	5775059.74	59.74
100%		+40	5775063.79	63.79
100%		+50	5775067.20	67.20
115%	4.43	+20	5775068.07	68.07
End. Point	3.27	+20	5775072.37	72.37

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5210054.49	54.49
100%		-30	5210073.91	73.91
100%		-20	5210069.03	69.03
100%		-10	5210065.64	65.64
100%		0	5210062.29	62.29
100%		+10	5210058.36	58.36
100%		+30	5210058.71	58.71
100%		+40	5210062.69	62.69
100%		+50	5210067.17	67.17
115%	4.43	+20	5210067.11	67.11
End. Point	3.27	+20	5210070.16	70.16

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5290062.84	62.84
100%		-30	5290082.54	82.54
100%		-20	5290078.96	78.96
100%		-10	5290074.76	74.76
100%		0	5290069.73	69.73
100%		+10	5290066.29	66.29
100%		+30	5290066.14	66.14
100%		+40	5290070.48	70.48
100%		+50	5290074.06	74.06
115%	4.43	+20	5290075.13	75.13
End. Point	3.27	+20	5290078.11	78.11

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5530060.13	60.13
100%		-30	5530078.08	78.08
100%		-20	5530074.56	74.56
100%		-10	5530071.35	71.35
100%		0	5530067.01	67.01
100%		+10	5530063.73	63.73
100%		+30	5530063.95	63.95
100%		+40	5530067.16	67.16
100%		+50	5530071.58	71.58
115%	4.43	+20	5530070.83	70.83
End. Point	3.27	+20	5530074.49	74.49

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: 3.85 VDC

Voltage (%)	Power (VDC)	Temp. (°C)	Frequency (kHz)	Frequency Error (kHz)
100%	3.85	+20(Ref)	5775056.53	56.53
100%		-30	5775076.68	76.68
100%		-20	5775072.32	72.32
100%		-10	5775067.68	67.68
100%		0	5775064.08	64.08
100%		+10	5775060.28	60.28
100%		+30	5775061.48	61.48
100%		+40	5775065.12	65.12
100%		+50	5775068.95	68.95
115%	4.43	+20	5775069.26	69.26
End. Point	3.27	+20	5775072.32	72.32

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	5710.08	14.92
802.11n(HT20)				5709.40	15.60
802.11ac(VHT20)				5709.84	15.16
802.11a	UNII 3	5720	144	5730.24	5.24
802.11n(HT20)				5731.12	6.12
802.11ac(VHT20)				5731.00	6.00

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11n(HT40)	UNII 2C	5710	142	5689.76	35.24
802.11ac(VHT40)				5689.60	35.40
802.11n(HT40)	UNII 3	5710	142	5730.80	5.80
802.11ac(VHT40)				5730.72	5.72

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11ac(VHT80)	UNII 2C	5690	138	5648.48	76.52
	UNII 3	5690	138	5731.40	6.40

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	5728.24	3.24	> 0.5
802.11n(HT20)				5728.88	3.88	> 0.5
802.11ac(VHT20)				5728.88	3.88	> 0.5

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT40)	UNII 3	5710	142	5728.26	3.26	> 0.5
802.11ac(VHT40)				5728.26	3.26	> 0.5

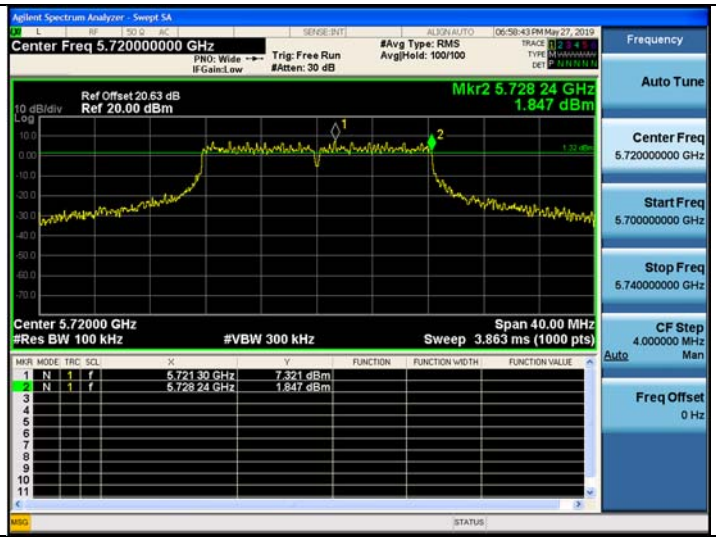
Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11ac(VHT80)	UNII 3	5690	138	5728.31	3.31	> 0.5

Note:

6dB Bandwidth = Measured Frequency[MHz] – 5725MHz

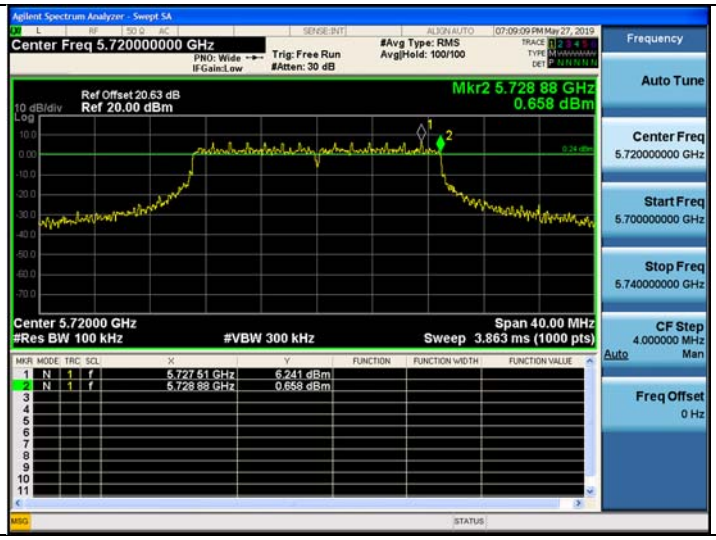
▣ Test Plots(UNII 3 Band 6dB Bandwidth)

802.11a CH.144

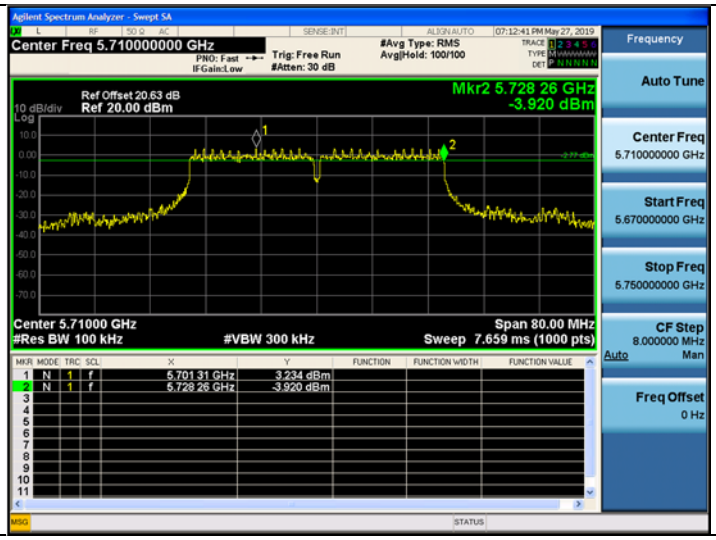


802.11n_HT20 CH.144

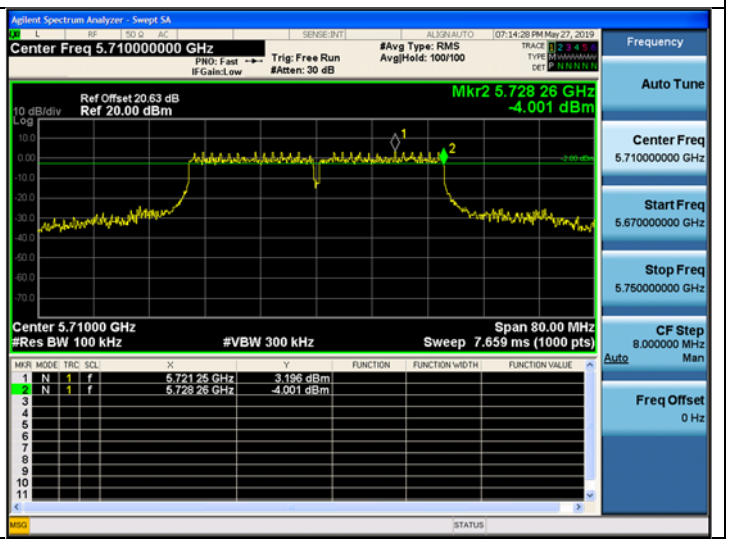
802.11ac_VHT20 CH.144



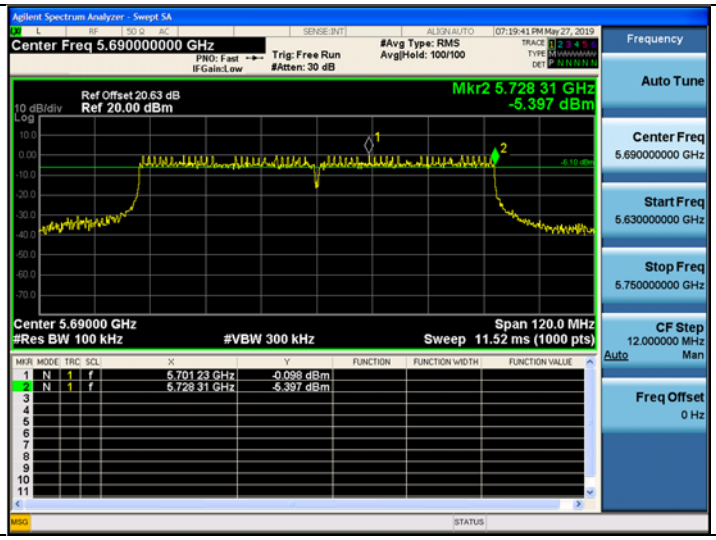
802.11n_HT40 CH.142



802.11ac_VHT40 CH.142



802.11ac_VHT80 CH.138



10.7.3 Output Power

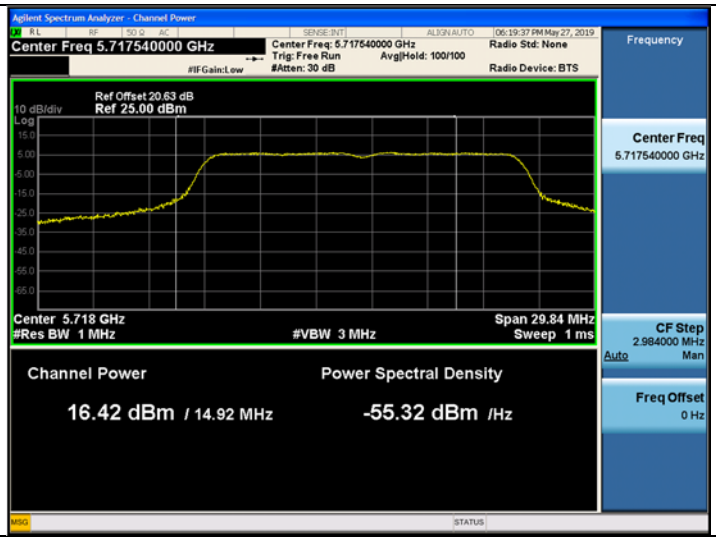
Mode	Frequency [MHz]	Channel	Measured Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Limit (dBm)
802.11a	5720 (UNII 2C Band)	144	16.42	0.719	17.14	22.74
802.11n(HT20)			16.33	0.719	17.05	22.93
802.11ac(VHT20)			15.57	0.829	16.40	22.81
802.11a	5720 (UNII 3 Band)	144	10.51	0.719	11.23	30.00
802.11n(HT20)			10.85	0.719	11.57	30.00
802.11ac(VHT20)			10.16	0.829	10.99	30.00

Mode	Frequency [MHz]	Channel	Measured Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Limit (dBm)
802.11n(HT40)	5710 (UNII 2C Band)	142	15.70	0.966	16.67	23.98
802.11ac(VHT40)			15.45	1.216	16.67	23.98
802.11n(HT40)	5710 (UNII 3 Band)	142	6.16	0.966	7.13	30.00
802.11ac(VHT40)			5.92	1.216	7.14	30.00

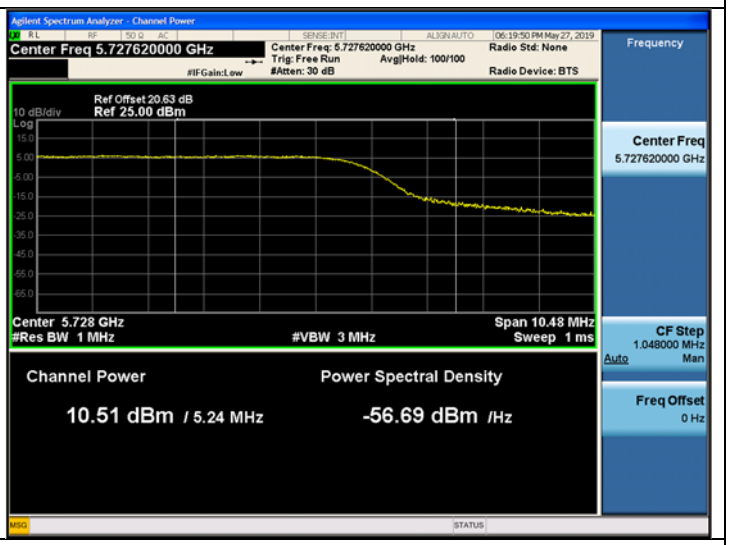
Mode	Frequency [MHz]	Channel	Measured Power (dBm)	Duty Cycle Factor (dB)	Total Power (dBm)	Limit (dBm)
802.11ac(VHT80)	5690 (UNII 2C Band)	138	14.16	1.933	16.09	23.98
	5690 (UNII 3 Band)	138	2.03	1.933	3.96	30.00

▣ Test Plots

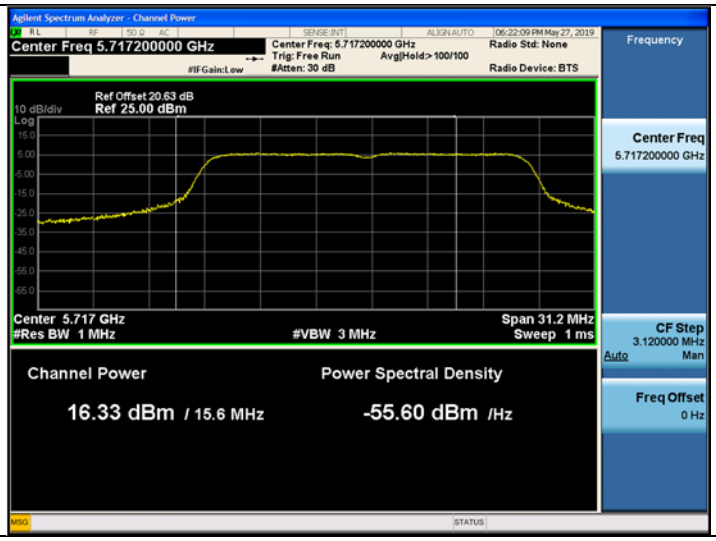
802.11a UNII 2C Band



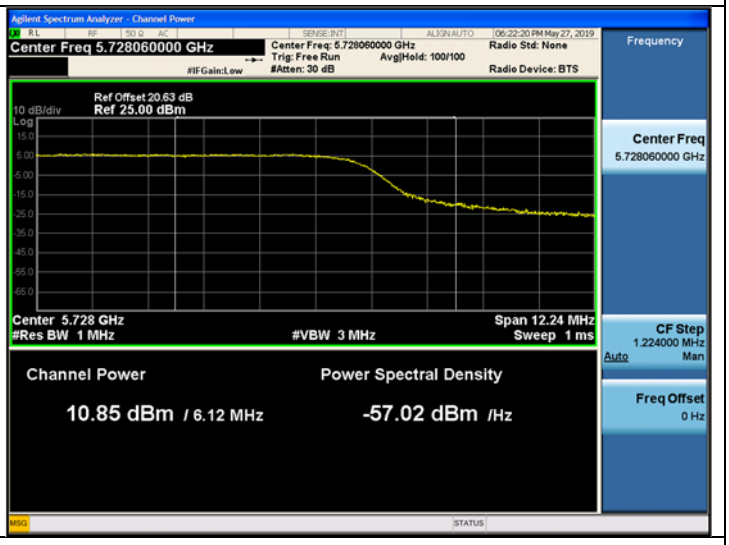
802.11a UNII 3 Band



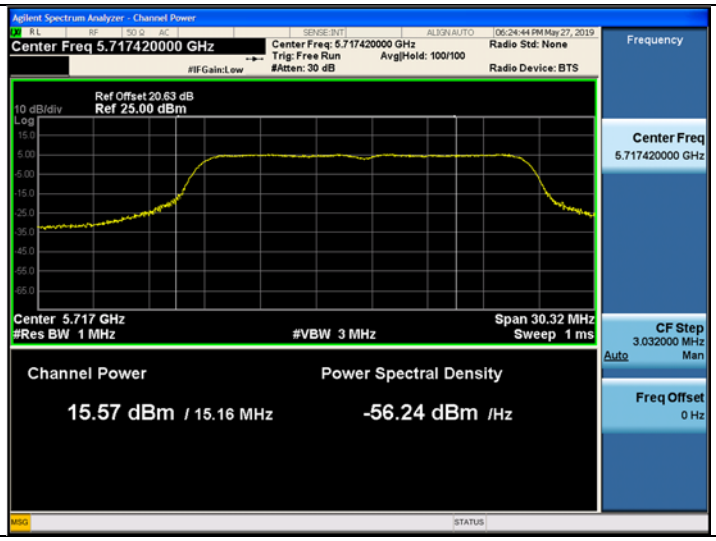
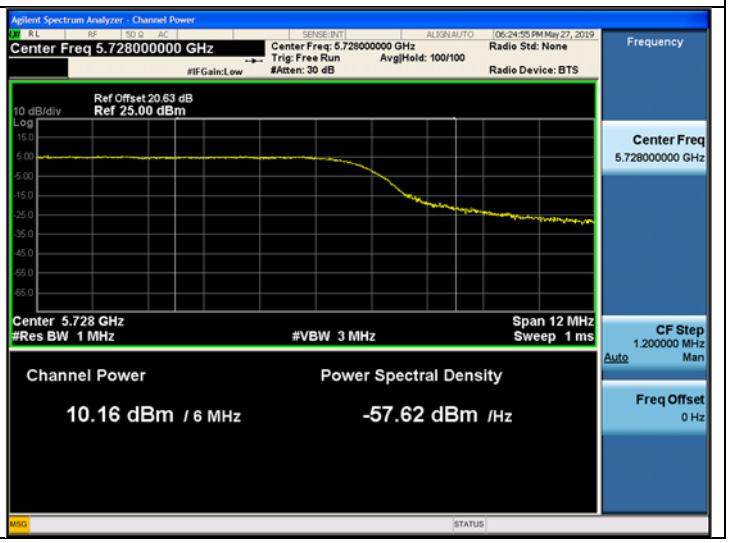
802.11n(HT20) UNII 2C Band



802.11n(HT20) UNII 3 Band



802.11ac(VHT20) UNII 2C Band



802.11ac(VHT20) UNII 3 Band