

TEST REPORT

FCC UNII Test for SM-A507FN/DS
Certification

APPLICANT
SAMSUNG Electronics Co., Ltd.

REPORT NO.
HCT-RF-1908-FC006-R1

DATE OF ISSUE
August 29, 2019

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FCC ID
A3LSMA507FN

Applicant

SAMSUNG Electronics Co., Ltd.
129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Rep. of Korea

Eut Type
Model Name

Mobile Phone
SM-A507FN/DS

Modulation type

OFDM

FCC Classification

Unlicensed National Information Infrastructure(UNII)

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
Jung Ki Lim

(Signature)

Technical Manager
Jong Seok Lee

(Signature)

HCT CO., LTD.

Soo Chan Lee

SooChan Lee / CEO
Accredited by KOLAS, Republic of KOREA

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

Revision No.	Date of Issue	Description
0	August 05, 2019	Initial Release
1	August 29, 2019	Added the ISO 17025 KOLAS logo.

This laboratory is not accredited for the test results marked *.

The above Test Report is the accredited test result by KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.

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-A507FN/DS	
EUT Type	Mobile Phone	
Power Supply	DC 3.85 V	
Battery Information	Model: EB-BA505ABU Type: Li-ion Battery	
Travel Adapter Information	Model : EP-TA200 Manufacture: SOLUM	
Data Cable Information	Model : EP-DR140ABE Manufacture: KSD	
Ear-jack Information	Model : EHS61ASFBE Manufacture: FOSTER	
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: INTERNAL Peak Gain : -6.4 dBi(UNII 1, 2A) / -6.5 dBi(UNII 2C)/ -7.2 dBi(UNII 3)	
Straddle channel	Supported	
TDWR Band	Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	July 12, 2019 ~ August 01, 2019	

2. MAXIMUM OUTPUT POWER

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

Band	Mode	Power	
		(dBm)	(W)
UNII1	802.11a	17.90	0.062
	802.11n (HT20)	17.83	0.061
	802.11n (HT40)	16.68	0.047
	802.11ac (VHT20)	17.79	0.060
	802.11ac (VHT40)	16.61	0.046
	802.11ac (VHT80)	13.63	0.023
UNII2A	802.11a	17.26	0.053
	802.11n (HT20)	17.13	0.052
	802.11n (HT40)	16.03	0.040
	802.11ac (VHT20)	17.12	0.052
	802.11ac (VHT40)	16.07	0.040
	802.11ac (VHT80)	13.73	0.024
UNII2C	802.11a	17.32	0.054
	802.11n (HT20)	17.38	0.055
	802.11n (HT40)	16.58	0.046
	802.11ac (VHT20)	17.50	0.056
	802.11ac (VHT40)	16.45	0.044
	802.11ac (VHT80)	14.16	0.026
UNII3	802.11a	17.21	0.053
	802.11n (HT20)	17.46	0.056
	802.11n (HT40)	16.45	0.044
	802.11ac (VHT20)	17.29	0.054
	802.11ac (VHT40)	16.39	0.044
	802.11ac (VHT80)	14.03	0.025

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.

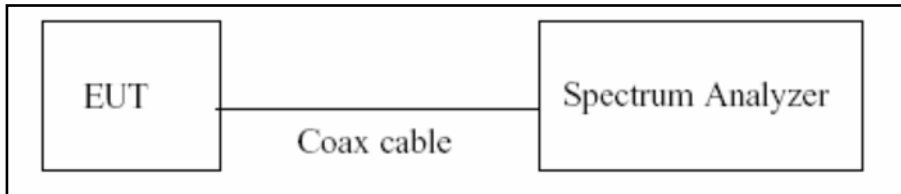
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty ($\pm$ 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.

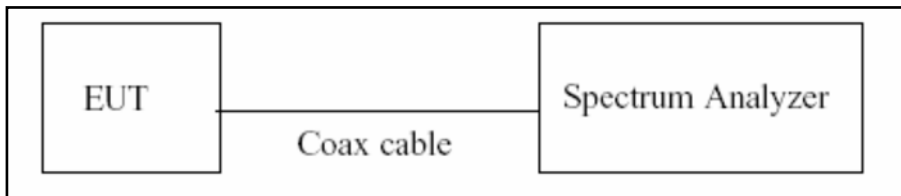
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = $T_{\text{on}} / T_{\text{total}}$ and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty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

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. $VBW \geq 3 \cdot RBW$
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 level 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.

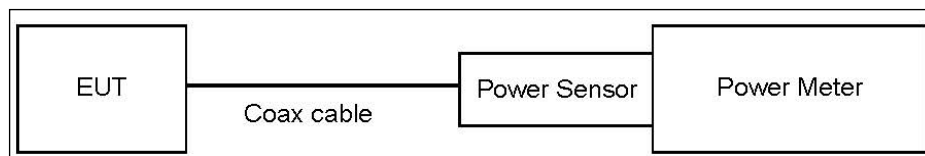
8.3. Output Power Measurement

Limit

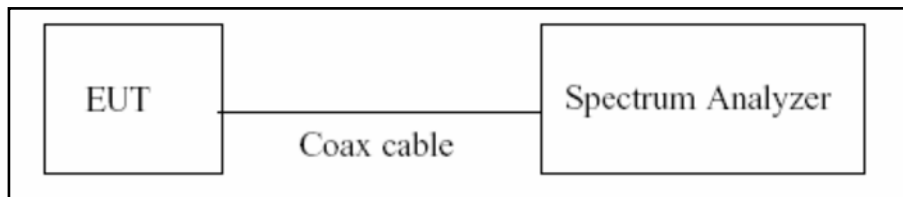
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

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 $\geq$ 3 MHz.
5. Number of points in sweep $\geq 2 \times \text{span} / \text{RBW}$.
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 $10\log(1/x)$, where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times.

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

Band	Loss(dB)
UNII 1	11.1
UNII 2A	11.1
UNII 2C	11.1
UNII 3	11.1

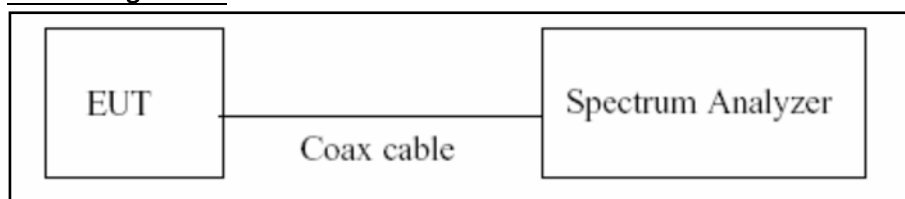
(Actual value of loss for the attenuator and cable combination)

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 $\geq$ 3 MHz
4. Number of points in sweep $\geq$ 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(10 dB) + Cable loss

3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	11.1
UNII 2A	11.1
UNII 2C	11.1
UNII 3	11.1

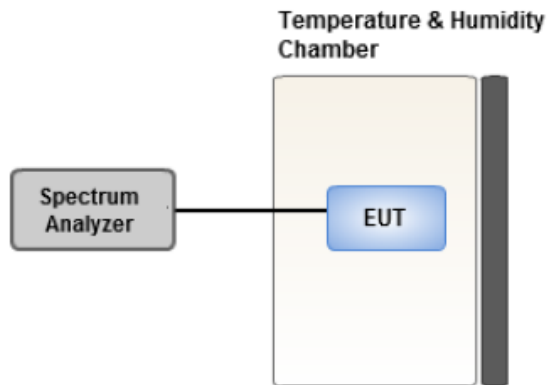
(Actual value of loss for the attenuator and cable combination)

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 battery 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 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	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

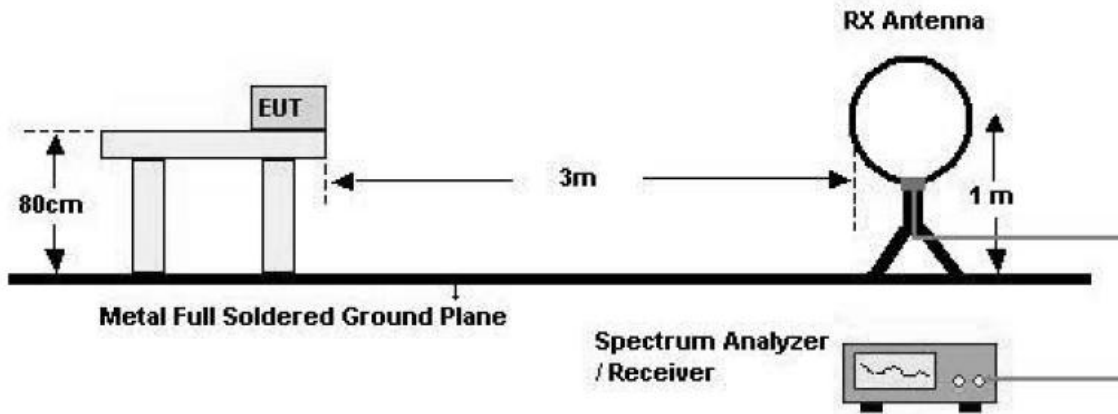
Limit

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.

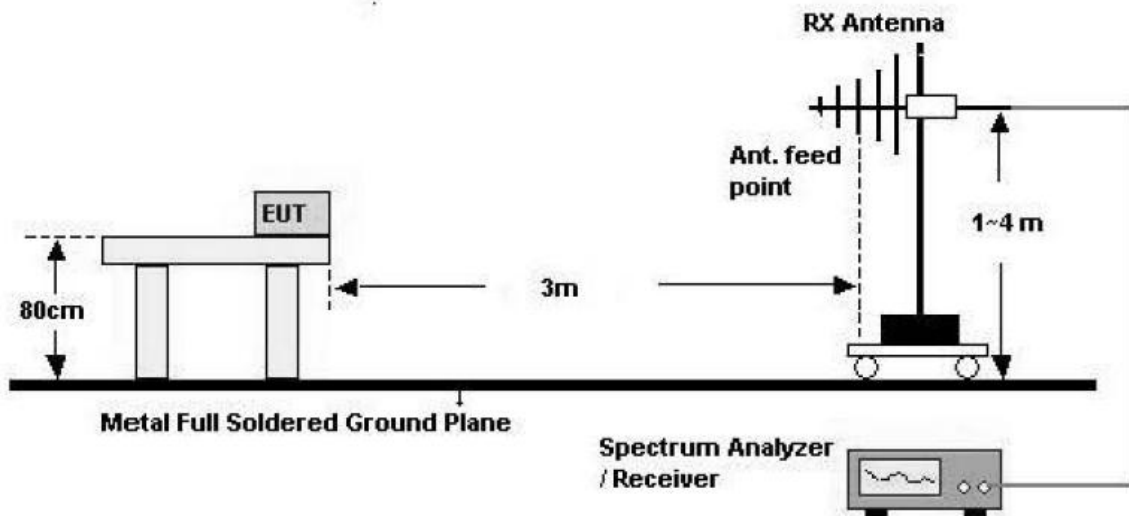
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

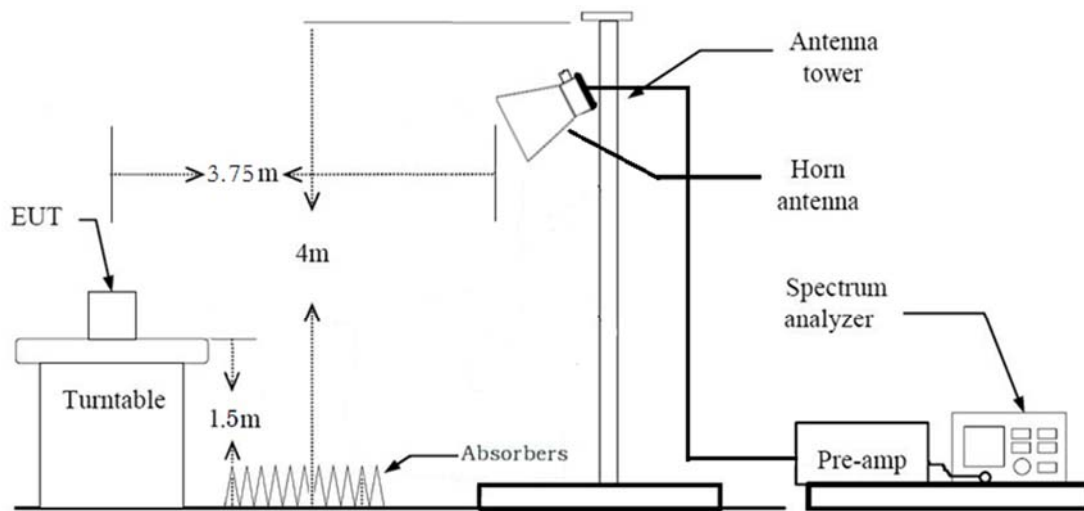
Below 30 MHz



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) = $40 \cdot \log(3 \text{ m}/300 \text{ m}) = -80 \text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40 \cdot \log(3 \text{ m}/30 \text{ m}) = -40 \text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW $\geq 3 \cdot \text{RBW}$
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 $\geq 3 \times$ 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 = $20 \cdot \log(\text{test distance} / \text{specific distance})$ (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 $\geq$ 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 $\geq$ 98 percent) = $\text{VBW} \leq \text{RBW}/100$ (i.e., 10 kHz) but not less than 10 Hz.
- VBW(Duty cycle is < 98 percent) = $\text{VBW} \geq 1/T$, 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 minimum 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 = $20 \cdot \log (\text{test distance} / \text{specific distance})$ (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 $\geq$ 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 $\geq$ 98 percent) = $\text{VBW} \leq \text{RBW}/100$ (i.e., 10 kHz) but not less than 10 Hz.

- VBW(Duty cycle is < 98 percent) = $\text{VBW} \geq 1/T$, 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 minimum 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	0.933	0.300	1000
802.11n(HT20)	MCS 0	0.925	0.340	1000
802.11n(HT40)	MCS 0	0.859	0.659	3000
802.11ac(VHT20)	MCS 0	0.930	0.313	1000
802.11ac(VHT40)	MCS 0	0.869	0.611	3000
802.11ac(VHT80)	MCS 0	0.753	1.234	10000

8.8. Worst case configuration and mode

Radiated test

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

AC Power line Conducted Emissions

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

Conducted test

1. All datarate of operation were investigated and the worst case datarate results are reported

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	1.428	1.530	0.933	0.300
	9	0.961	1.069	0.899	0.464
	12	0.725	0.843	0.860	0.655
	18	0.492	0.601	0.818	0.870
	24	0.373	0.482	0.773	1.116
	36	0.256	0.366	0.699	1.555
	48	0.196	0.314	0.624	2.046
	54	0.180	0.290	0.622	2.063

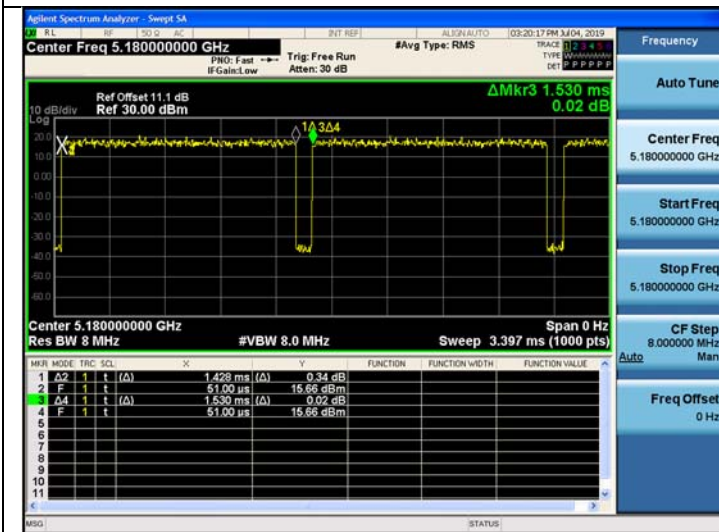
Mode	MCS Index	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11n (HT20)	0	1.336	1.445	0.925	0.340
	1	0.688	0.798	0.862	0.644
	2	0.472	0.582	0.811	0.909
	3	0.364	0.474	0.768	1.147
	4	0.256	0.365	0.701	1.541
	5	0.200	0.319	0.628	2.023
	6	0.184	0.294	0.627	2.028
	7	0.168	0.286	0.587	2.316
802.11n (HT40)	0	0.664	0.773	0.859	0.659
	1	0.352	0.454	0.776	1.103
	2	0.248	0.349	0.711	1.482
	3	0.196	0.297	0.660	1.804
	4	0.144	0.253	0.567	2.463
	5	0.116	0.226	0.515	2.884
	6	0.108	0.218	0.496	3.049
	7	0.100	0.210	0.478	3.209

Mode	MCS Index	T _{on} (ms)	T _{total} (ms)	Duty Cycle	Duty Cycle Factor(dB)
802.11ac (VHT20)	0	1.342	1.442	0.930	0.313
	1	0.692	0.802	0.863	0.641
	2	0.476	0.584	0.815	0.888
	3	0.368	0.477	0.772	1.124
	4	0.260	0.369	0.706	1.515
	5	0.205	0.314	0.652	1.858
	6	0.188	0.297	0.632	1.992
	7	0.172	0.282	0.612	2.133
	8	0.151	0.261	0.579	2.377
802.11ac (VHT40)	0	0.667	0.768	0.869	0.611
	1	0.356	0.466	0.765	1.166
	2	0.252	0.362	0.697	1.568
	3	0.200	0.301	0.665	1.772
	4	0.148	0.258	0.576	2.398
	5	0.121	0.230	0.525	2.802
	6	0.112	0.222	0.507	2.950
	7	0.103	0.222	0.464	3.335
	8	0.095	0.205	0.463	3.347
802.11ac (VHT80)	9	0.088	0.198	0.447	3.499
	0	0.332	0.441	0.753	1.234
	1	0.189	0.298	0.633	1.988
	2	0.140	0.241	0.583	2.346
	3	0.116	0.226	0.515	2.878
	4	0.092	0.202	0.456	3.414
	5	0.080	0.190	0.423	3.741
	6	0.076	0.186	0.410	3.870
	7	0.072	0.182	0.397	4.011
	8	0.068	0.178	0.382	4.174
	9	0.064	0.174	0.368	4.338

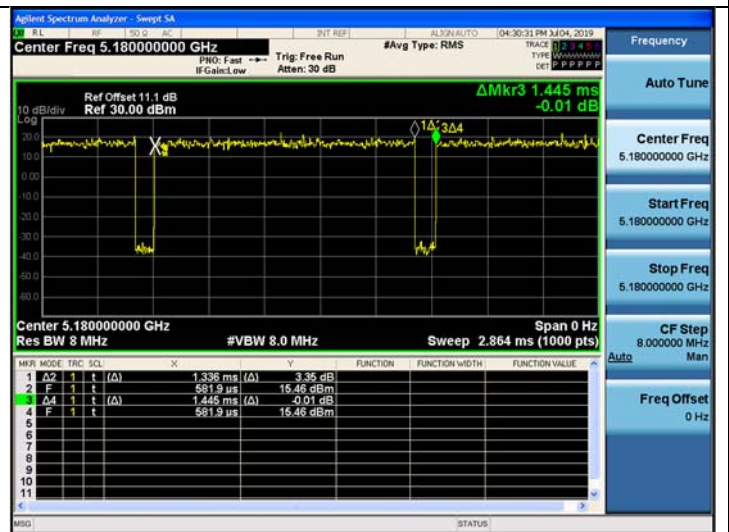
Note:

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

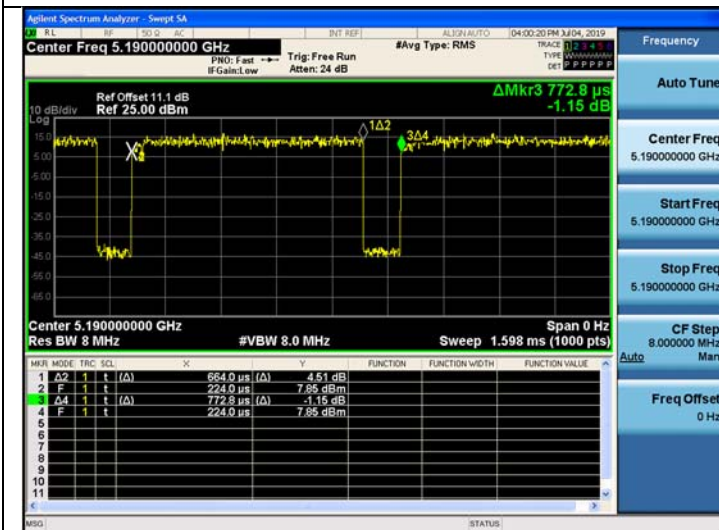
802.11a



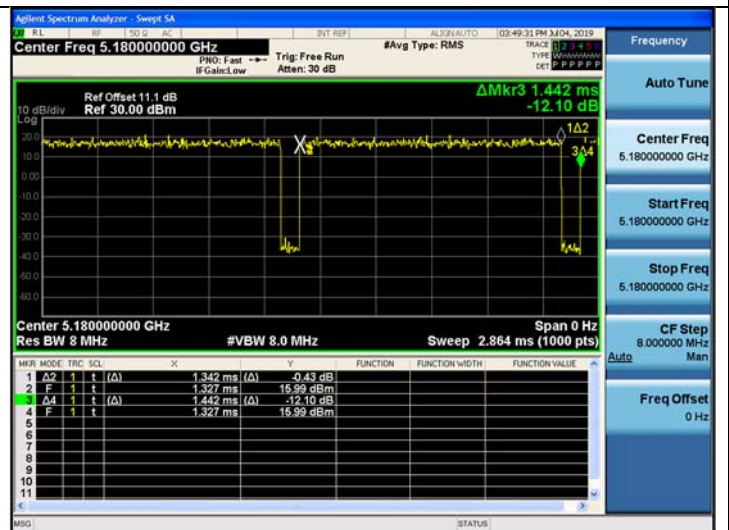
802.11n(HT20)



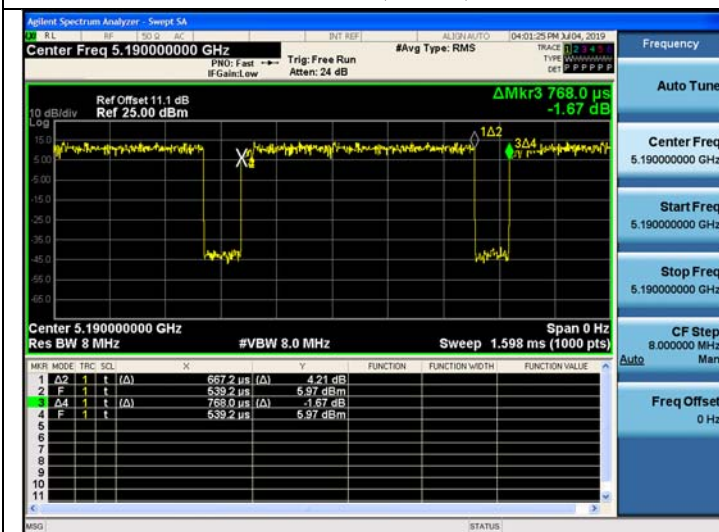
802.11n(HT40)



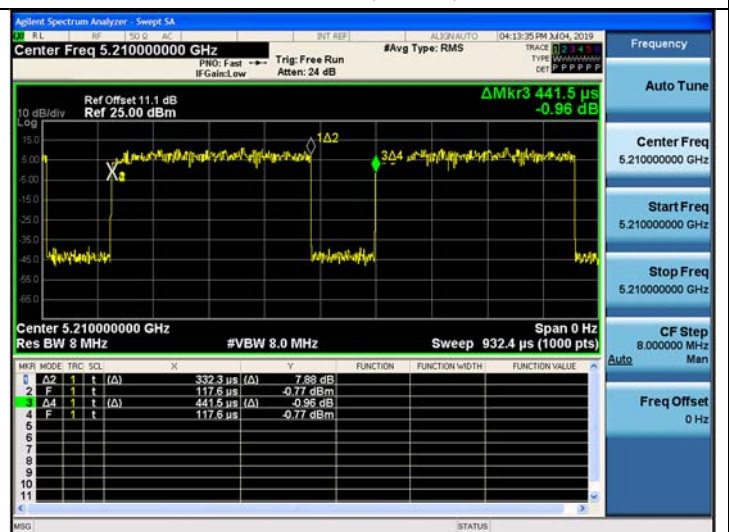
802.11ac(VHT20)



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	22.93	17.925
5200	40	22.75	17.829
5240	48	22.76	17.763
5260	52	22.28	17.815
5300	60	22.68	17.737
5320	64	22.91	17.791
5500	100	24.36	17.880
5600	120	26.74	18.070
5720	144	25.46	17.857
5745	149	22.20	17.738
5785	157	27.18	18.035
5825	165	25.92	18.037

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	22.85	18.342
5200	40	24.75	18.429
5240	48	25.87	18.647
5260	52	25.05	18.402
5300	60	25.71	18.646
5320	64	23.83	18.357
5500	100	22.77	18.370
5600	120	24.24	18.473
5720	144	25.29	18.500
5745	149	25.33	18.146
5785	157	26.92	18.752
5825	165	25.06	18.601

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	43.08	38.543
5230	46	43.33	38.432
5270	54	43.49	38.735
5310	62	43.42	38.469
5510	102	45.97	38.675
5590	118	43.40	38.594
5710	142	45.55	38.581
5755	151	47.94	38.754
5795	159	45.15	38.399

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	27.24	18.822
5200	40	23.18	18.634
5240	48	24.24	18.715
5260	52	24.45	18.706
5300	60	22.82	18.662
5320	64	24.27	18.736
5500	100	24.23	18.792
5600	120	25.17	18.740
5720	144	23.38	18.861
5745	149	28.21	18.974
5785	157	26.61	18.886
5825	165	26.19	18.649

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	43.16	38.233
5230	46	44.46	38.451
5270	54	43.10	38.317
5310	62	46.04	38.249
5510	102	45.71	38.353
5590	118	45.86	38.488
5710	142	45.46	38.357
5755	151	45.47	38.349
5795	159	46.02	38.425

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	80.87	77.818
5290	58	80.85	77.960
5530	106	81.28	77.951
5610	122	80.86	77.750
5690	138	80.83	77.782
5775	155	80.17	77.614

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 64)



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



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



Test Plots(802.11n(HT20))

Note:

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

802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 48)



802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 60)



802.11n_HT20 UNII 2C BAND 26dB Bandwidth(CH 144)



802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 157)



Test Plots(802.11n(HT40))

Note:

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

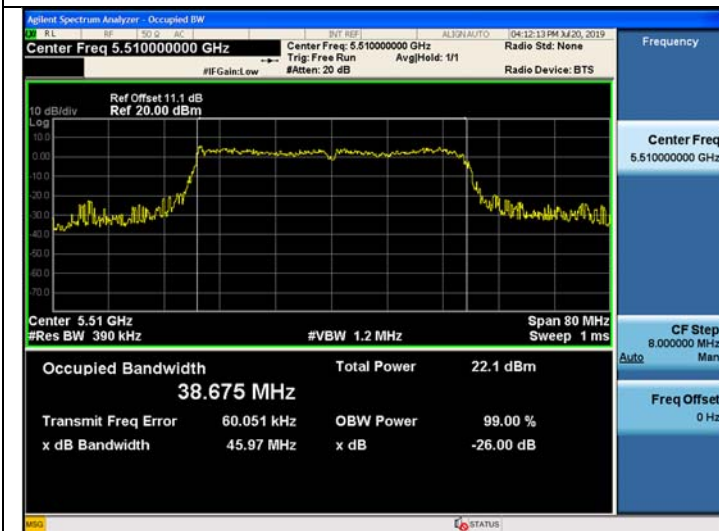
802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 46)



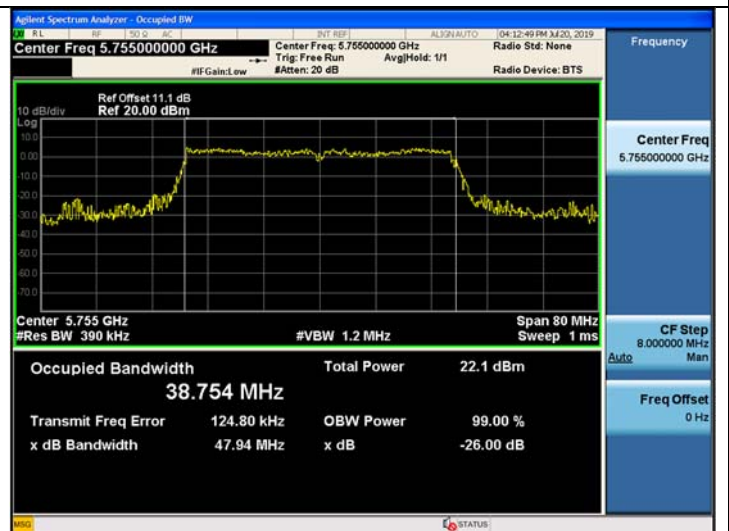
802.11n_HT40 UNII 2A BAND 26dB Bandwidth (CH 54)



802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 102)



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 120)



802.11ac_VHT20 UNII 3 BAND 26dB Bandwidth(CH 149)



Test Plots(802.11ac(VHT40))

Note:

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

802.11ac_VHT40 UNII 1 BAND 26dB Bandwidth(CH 46)



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



802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 118)



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

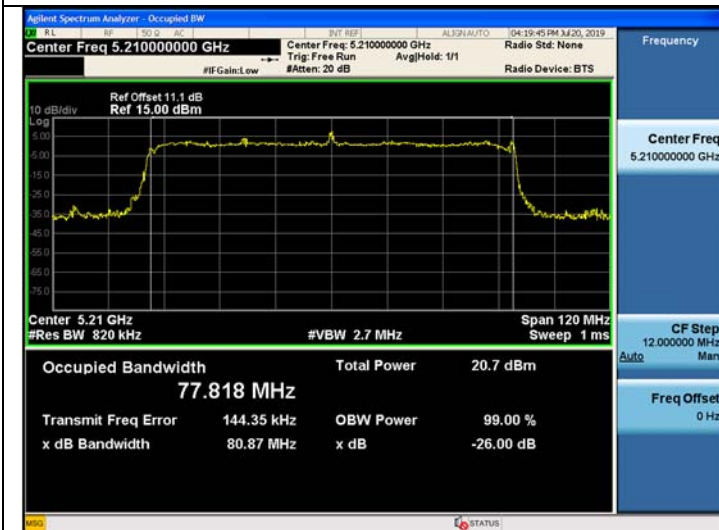


Test Plots(802.11ac(VHT80))

Note:

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

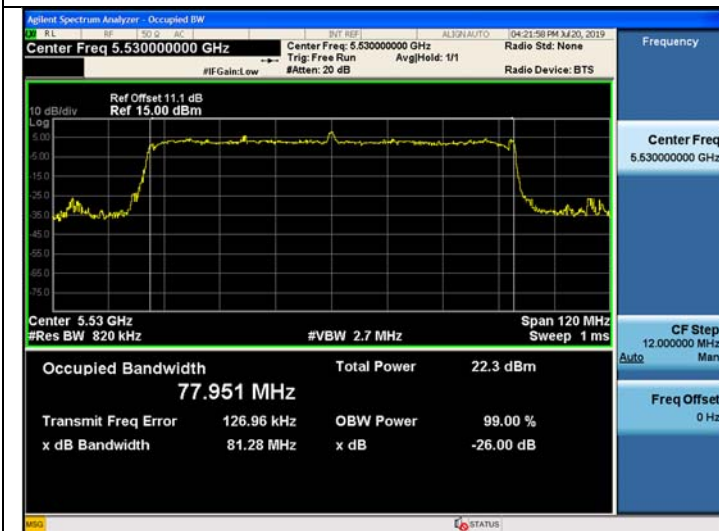
802.11ac_VHT80 UNII 1 BAND 26dB Bandwidth(CH 42)



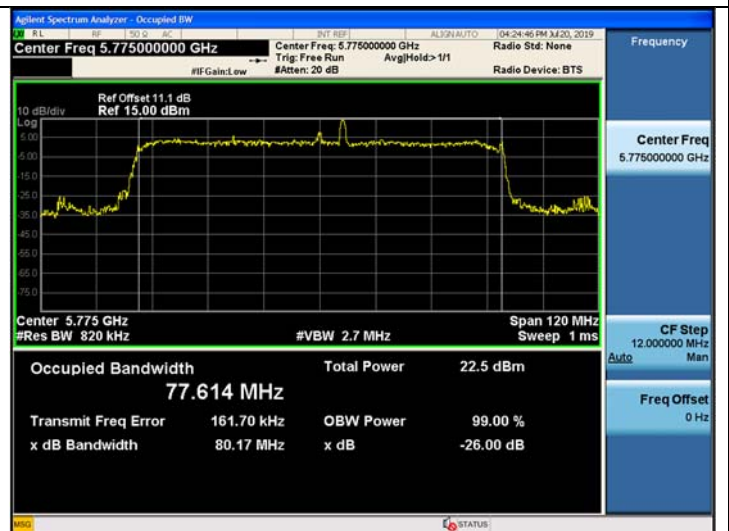
802.11ac_VHT80 UNII 2A BAND 26dB Bandwidth (CH 58)



802.11ac_VHT80 UNII 2C BAND 26dB Bandwidth(CH 106)



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	15.80	> 0.5	Pass
5785	157	15.61	> 0.5	Pass
5825	165	15.45	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	15.13	> 0.5	Pass
5785	157	15.55	> 0.5	Pass
5825	165	16.11	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	37.60	> 0.5	Pass
5795	159	37.67	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.43	> 0.5	Pass
5785	157	15.15	> 0.5	Pass
5825	165	15.12	> 0.5	Pass

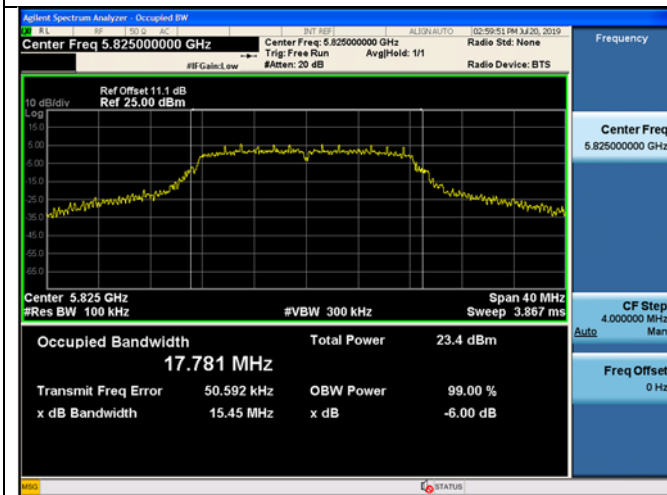
802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	37.81	> 0.5	Pass
5795	159	37.77	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	76.29	> 0.5	Pass

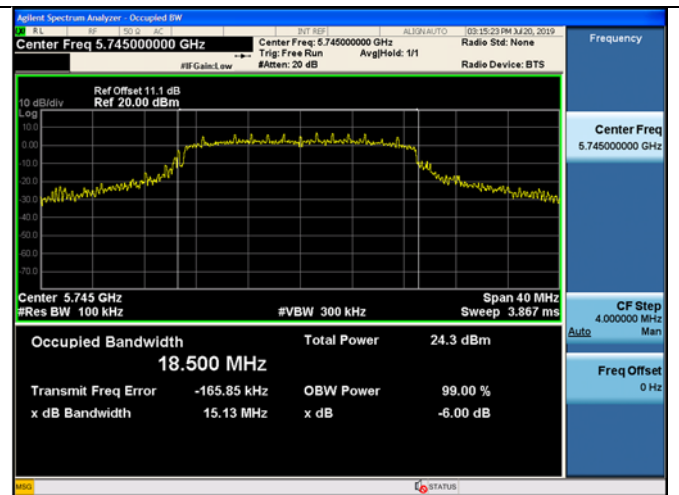
Test Plots

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

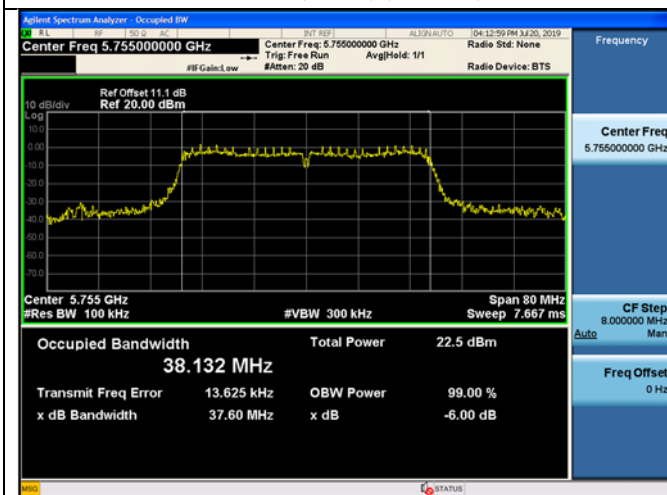
802.11a (CH.165)



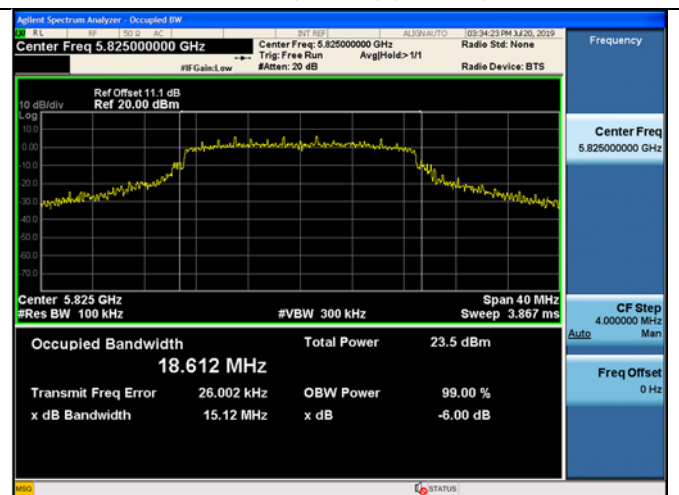
802.11n(HT20) (CH.149)



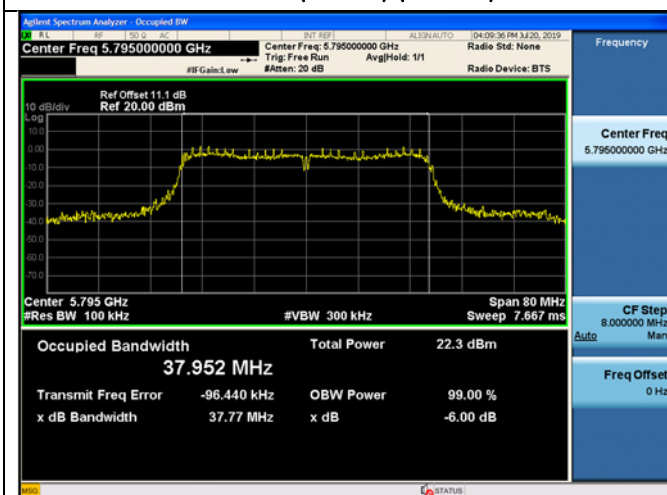
802.11n(HT40) (CH.151)



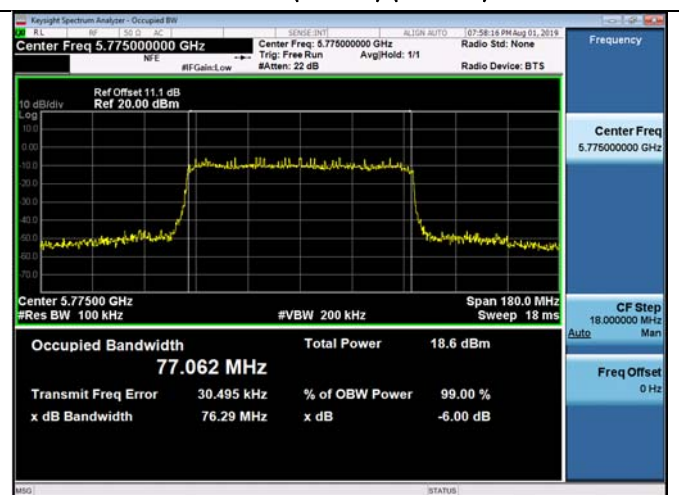
802.11ac(VHT20) (CH.165)



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	18	15.74	1.555	17.29	23.98
5200	40		15.67	1.555	17.22	
5240	48		16.35	1.555	17.90	
5260	52	17	15.41	1.555	16.96	
5300	60		15.71	1.555	17.26	
5320	64		15.62	1.555	17.17	
5500	100		15.55	1.555	17.10	
5600	120		15.64	1.555	17.19	
5720	144		15.77	1.555	17.32	
5745	149		16.04	1.116	17.16	30
5785	157		15.66	1.555	17.21	
5825	165		15.66	1.555	17.21	

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	15.48	1.541	17.02	23.98
5200	40		15.48	1.541	17.02	
5240	48		16.29	1.541	17.83	
5260	52	17	15.22	1.541	16.76	
5300	60		15.59	1.541	17.13	
5320	64		15.55	1.541	17.09	
5500	100		15.68	1.541	17.22	
5600	120		15.84	1.541	17.38	
5720	144		15.81	1.541	17.35	
5745	149		15.92	1.541	17.46	30
5785	157		15.88	1.541	17.42	
5825	165		15.85	1.541	17.39	

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	17	13.74	2.463	16.20	23.98
5230	46		14.22	2.463	16.68	
5270	54	16	13.57	2.463	16.03	
5310	62	14	11.40	3.049	14.45	
5510	102	12.5	10.32	3.049	13.37	
5590	118	16	14.12	2.463	16.58	30
5710	142		14.09	2.463	16.55	
5755	151		13.99	2.463	16.45	
5795	159		13.95	2.463	16.41	

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	18	15.57	1.515	17.08	23.98
5200	40		15.63	1.515	17.14	
5240	48		16.28	1.515	17.79	
5260	52	17	15.40	1.515	16.91	
5300	60		15.51	1.515	17.02	
5320	64		15.61	1.515	17.12	
5500	100		15.74	1.515	17.25	
5600	120		15.78	1.515	17.29	
5720	144		15.99	1.515	17.50	
5745	149		15.75	1.515	17.26	30
5785	157		15.68	1.515	17.19	
5825	165		15.78	1.515	17.29	

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	17	14.05	2.398	16.45	23.98
5230	46		14.21	2.398	16.61	
5270	54	16	13.67	2.398	16.07	
5310	62	14	11.28	3.335	14.62	
5510	102	12.5	10.02	3.335	13.36	
5590	118	16	14.05	2.398	16.45	30
5710	142		13.98	2.398	16.38	
5755	151		13.99	2.398	16.39	
5795	159		13.98	2.398	16.38	

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	14	10.22	3.414	13.63	23.98
5290	58	13.5	10.32	3.414	13.73	
5530	106		10.34	3.414	13.75	
5610	122	14	10.75	3.414	14.16	
5690	138		10.75	3.414	14.16	
5775	155		10.62	3.414	14.03	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	4.954	1.555	6.509	11
5200	40	4.709	1.555	6.264	
5240	48	5.540	1.555	7.095	
5260	52	4.647	1.555	6.202	
5300	60	5.380	1.555	6.935	
5320	64	5.031	1.555	6.586	
5500	100	5.024	1.555	6.579	
5600	120	5.469	1.555	7.024	
5720	144	5.263	1.555	6.818	
5745	149	2.411	1.116	3.527	30
5785	157	2.852	1.555	4.407	
5825	165	2.814	1.555	4.369	

802.11n(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	4.695	1.541	6.236	11
5200	40	4.791	1.541	6.332	
5240	48	5.364	1.541	6.905	
5260	52	4.647	1.541	6.188	
5300	60	4.800	1.541	6.341	
5320	64	4.689	1.541	6.230	
5500	100	5.288	1.541	6.829	
5600	120	5.357	1.541	6.898	
5720	144	5.323	1.541	6.864	
5745	149	2.738	1.541	4.279	30
5785	157	2.311	1.541	3.852	
5825	165	2.315	1.541	3.856	

802.11n(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	0.825	2.463	3.288	11
5230	46	1.066	2.463	3.529	
5270	54	-0.219	2.463	2.244	
5310	62	-2.559	3.049	0.490	
5510	102	-3.741	3.049	-0.692	
5590	118	0.729	2.463	3.192	
5710	142	0.653	2.463	3.116	
5755	151	-2.129	2.463	0.334	30
5795	159	-1.671	2.463	0.792	

802.11ac(20MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5180	36	5.470	1.515	6.985	11
5200	40	5.417	1.515	6.932	
5240	48	6.037	1.515	7.552	
5260	52	4.972	1.515	6.487	
5300	60	5.058	1.515	6.573	
5320	64	5.111	1.515	6.626	
5500	100	5.508	1.515	7.023	
5600	120	5.478	1.515	6.993	
5720	144	6.141	1.515	7.656	
5745	149	2.477	1.515	3.992	30
5785	157	2.451	1.515	3.966	
5825	165	2.807	1.515	4.322	

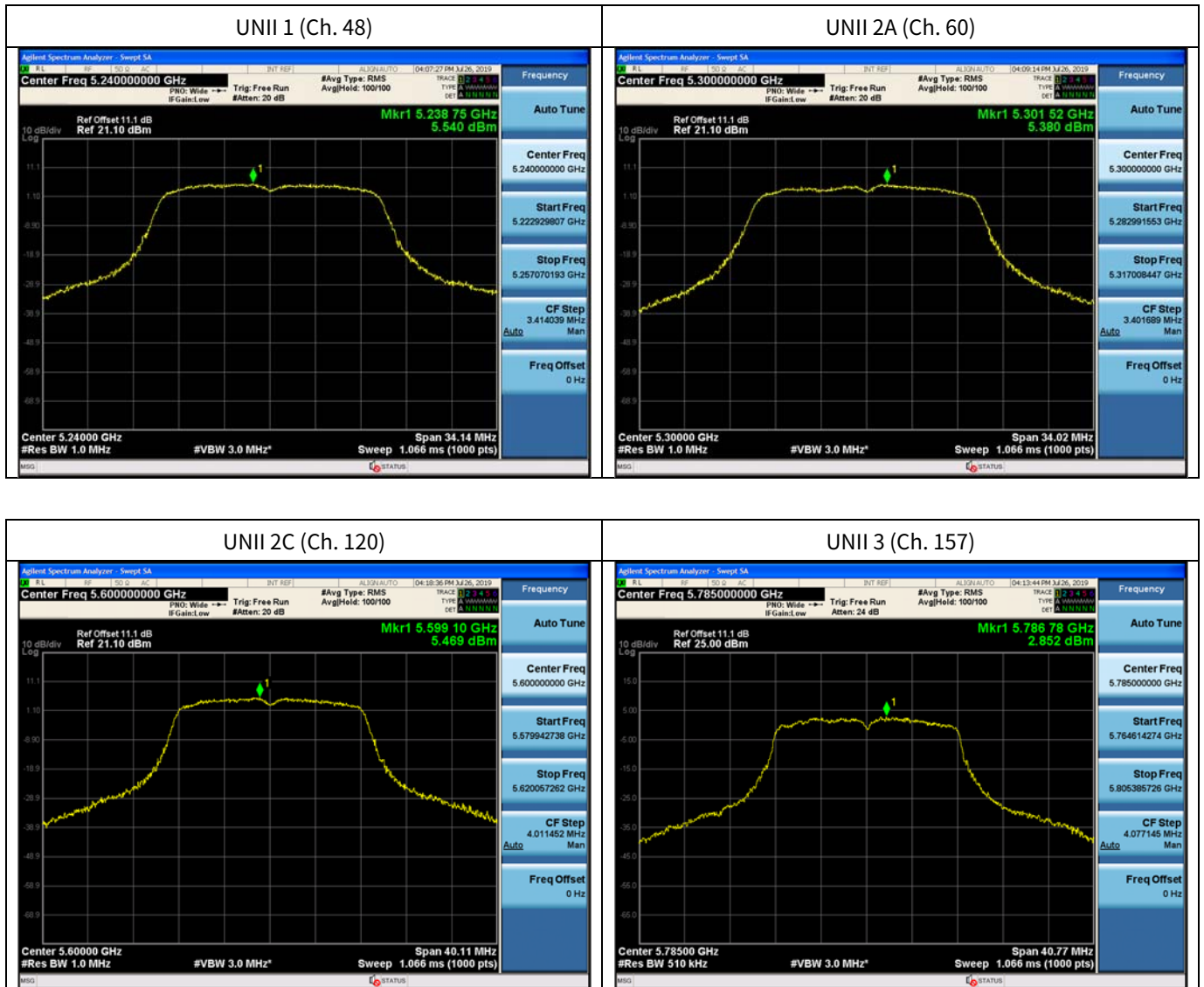
802.11ac(40MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5190	38	1.135	2.398	3.533	11
5230	46	1.295	2.398	3.693	
5270	54	0.078	2.398	2.476	
5310	62	-2.160	3.335	1.175	
5510	102	-3.046	3.335	0.289	
5590	118	0.337	2.398	2.735	
5710	142	0.900	2.398	3.298	
5755	151	-2.418	2.398	-0.020	30
5795	159	-2.286	2.398	0.112	

802.11ac(80MHz) Mode		Measured PSD [dBm]	Duty Cycle Factor (dB)	Total PSD [dBm]	Limit (dBm)
Frequency [MHz]	Channel No.				
5210	42	-6.432	3.414	-3.018	11
5290	58	-5.657	3.414	-2.243	
5530	106	-5.276	3.414	-1.862	
5610	122	-5.472	3.414	-2.058	
5690	138	-5.627	3.414	-2.213	
5775	155	-7.907	3.414	-4.493	30

Test Plots(802.11a)

Note:

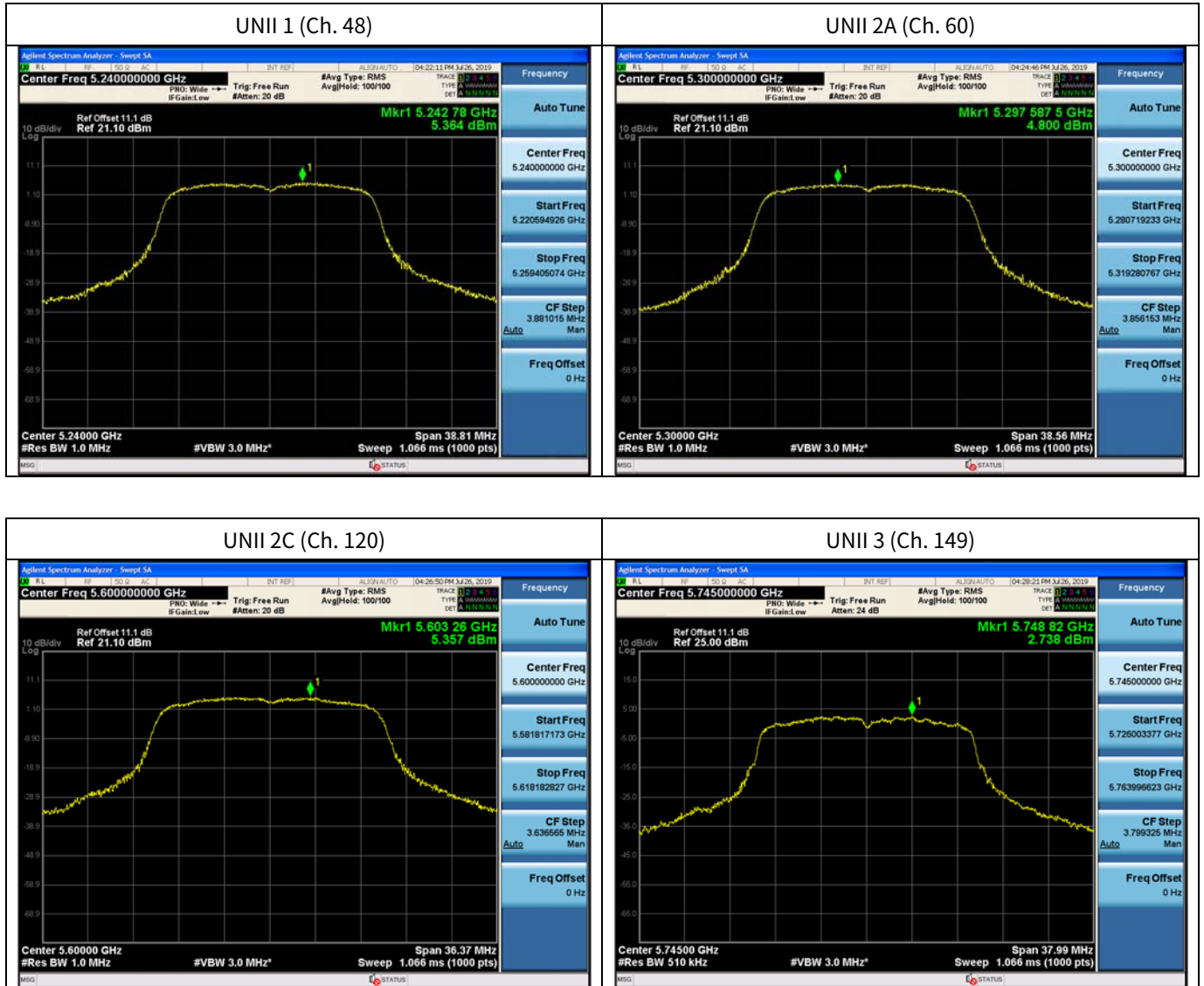
In order to simplify the report, attached plots were only channel of highest power.



Test Plots(802.11n(HT20))

Note:

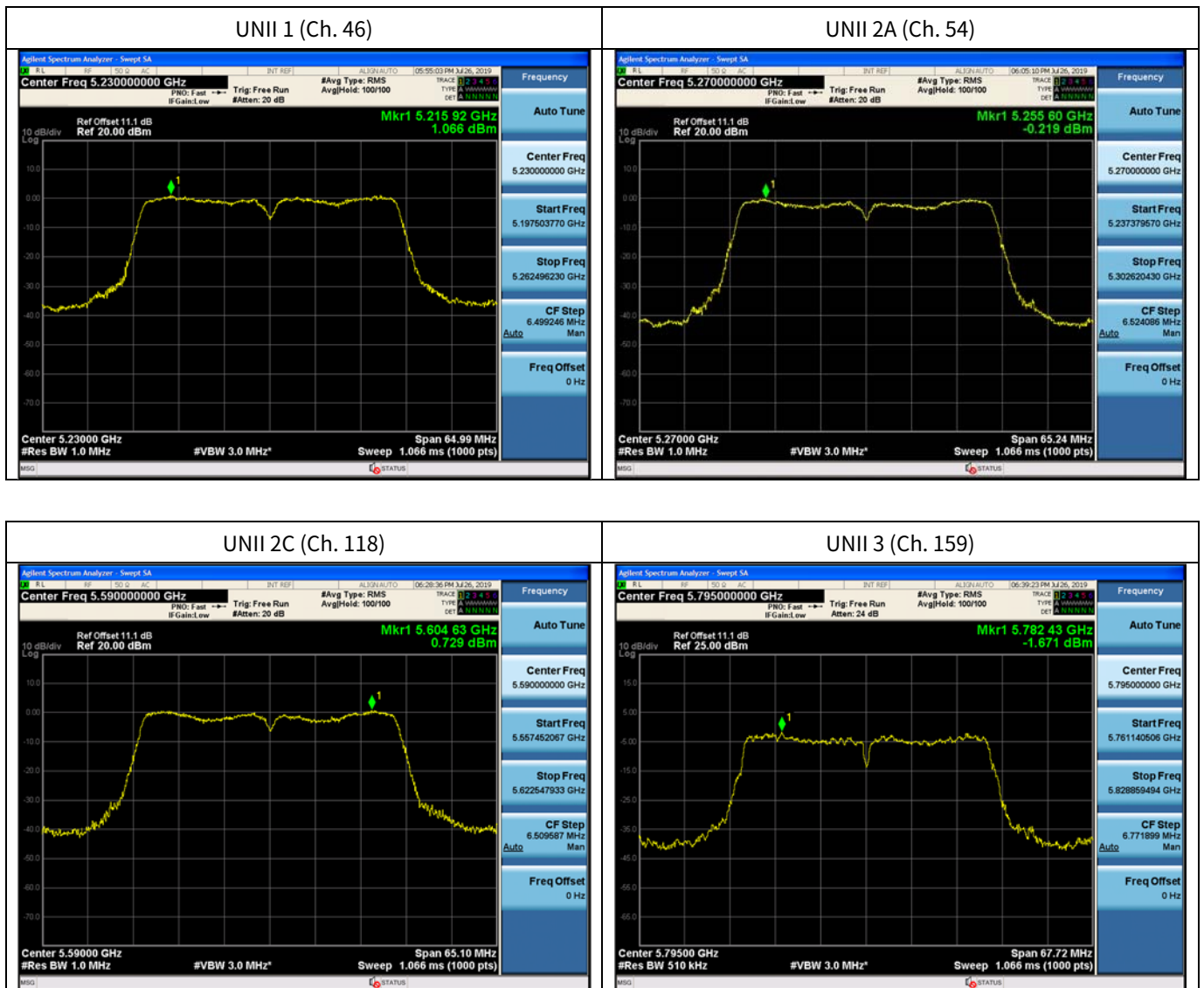
In order to simplify the report, attached plots were only channel of highest power.



Test Plots(802.11n(HT40))

Note:

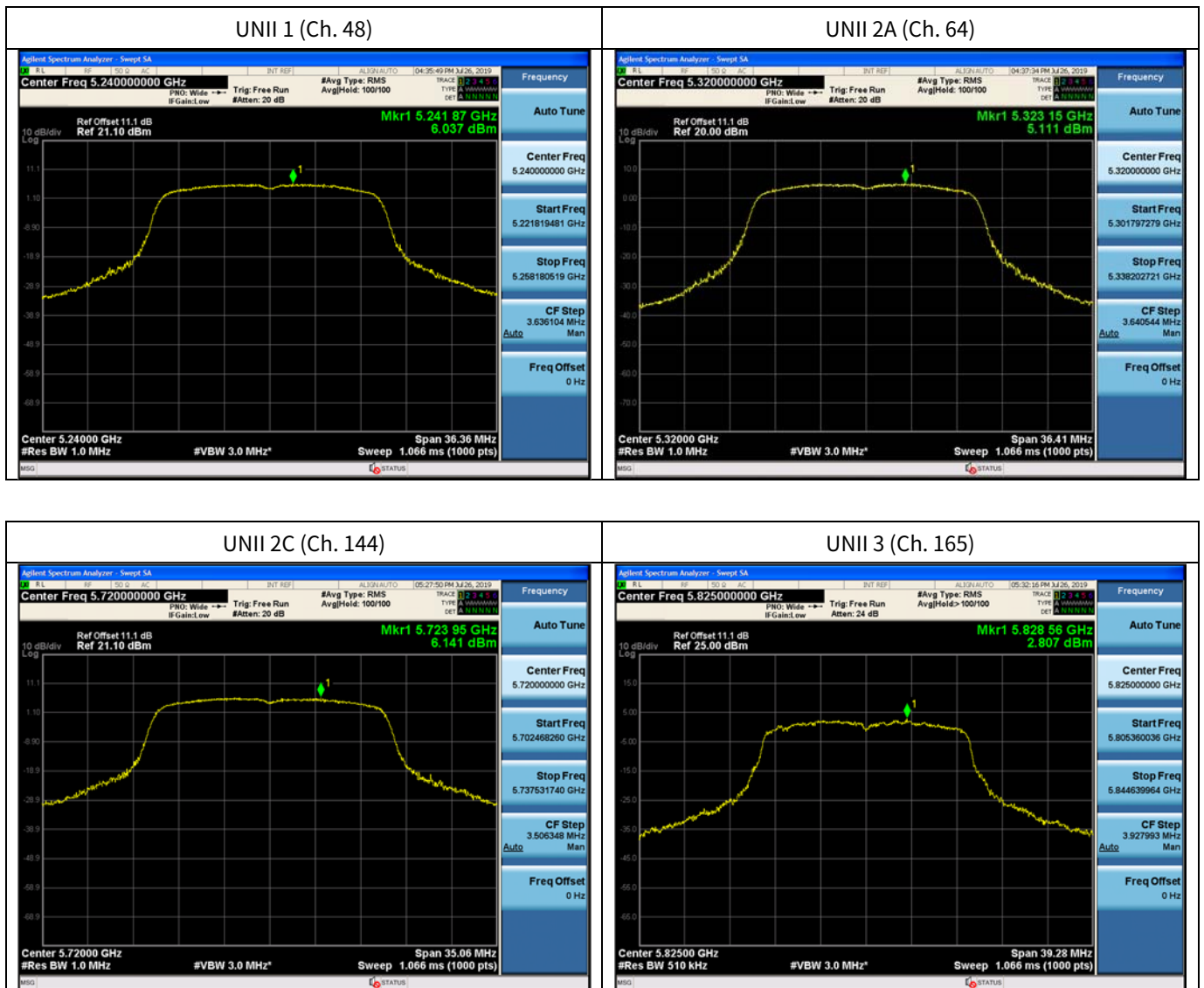
In order to simplify the report, attached plots were only channel of highest power.



Test Plots(802.11ac(VHT20))

Note:

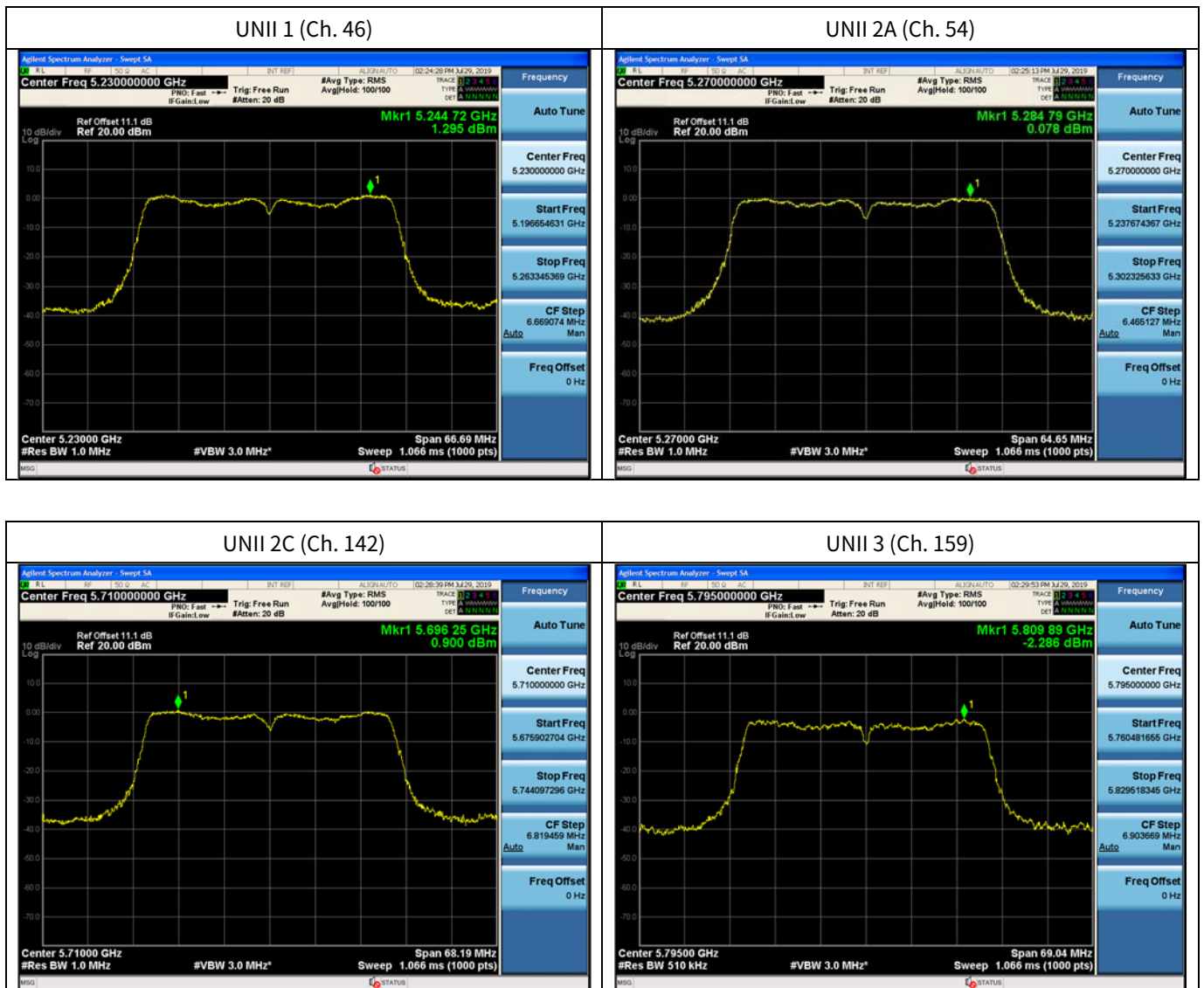
In order to simplify the report, attached plots were only channel of highest power.



Test Plots(802.11ac(VHT40))

Note:

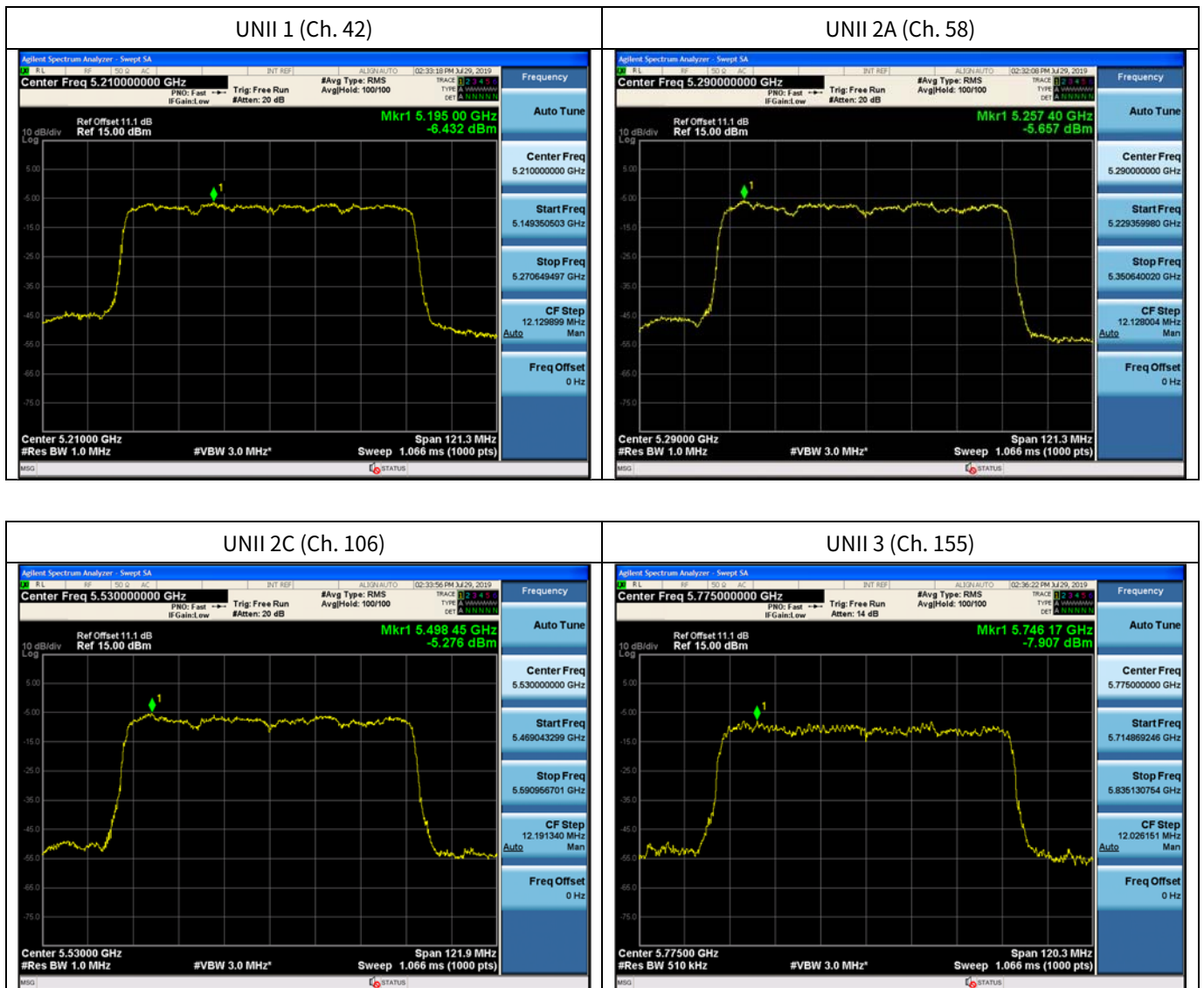
In order to simplify the report, attached plots were only channel of highest power.



Test Plots(802.11ac(VHT80))

Note:

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



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)	5210057.53	57.53
100%		-30	5210061.26	61.26
100%		-20	5210097.38	97.38
100%		-10	5210065.91	65.91
100%		0	5210037.40	37.40
100%		+10	5210011.29	11.29
100%		+30	5210038.47	38.47
100%		+40	5210042.81	42.81
100%		+50	5210076.77	76.77
End. Point		+20	5210032.62	32.62

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)	5290055.83	55.83
100%		-30	5290087.60	87.60
100%		-20	5290090.44	90.44
100%		-10	5290078.02	78.02
100%		0	5290096.87	96.87
100%		+10	5290095.52	95.52
100%		+30	5290028.36	28.36
100%		+40	5290031.98	31.98
100%		+50	5290038.98	38.98
End. Point	3.40	+20	5290039.52	39.52

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)	5530029.23	29.23
100%		-30	5530014.94	14.94
100%		-20	5530057.99	57.99
100%		-10	5530094.86	94.86
100%		0	5530085.48	85.48
100%		+10	5530009.69	9.69
100%		+30	5530070.69	70.69
100%		+40	5530041.77	41.77
100%		+50	5530097.20	97.20
End. Point		+20	5530036.94	36.94

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)	5775026.51	26.51
100%		-30	5775002.46	2.46
100%		-20	5775093.10	93.1
100%		-10	5775003.72	3.72
100%		0	5775026.67	26.67
100%		+10	5775038.87	38.87
100%		+30	5775064.75	64.75
100%		+40	5775080.09	80.09
100%		+50	5775006.22	6.22
End. Point	3.40	+20	5775042.50	42.5

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.

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)	5210009.36	9.36
100%		-30	5210090.86	90.86
100%		-20	5210076.96	76.96
100%		-10	5210094.77	94.77
100%		0	5210006.54	6.54
100%		+10	5210049.52	49.52
100%		+30	5210064.28	64.28
100%		+40	5210028.56	28.56
100%		+50	5210005.19	5.19
End. Point	3.40	+20	5210055.56	55.56

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)	5290035.38	35.38
100%		-30	5290060.96	60.96
100%		-20	5290021.82	21.82
100%		-10	5290024.67	24.67
100%		0	5290002.24	2.24
100%		+10	5290097.49	97.49
100%		+30	5290041.43	41.43
100%		+40	5290013.68	13.68
100%		+50	5290094.36	94.36
End. Point	3.40	+20	5290054.30	54.3

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)	5530014.21	14.21
100%		-30	5530092.30	92.30
100%		-20	5530033.99	33.99
100%		-10	5530086.76	86.76
100%		0	5530067.63	67.63
100%		+10	5530083.31	83.31
100%		+30	5530028.40	28.4
100%		+40	5530088.48	88.48
100%		+50	5530012.14	12.14
End. Point	3.40	+20	5530090.34	90.34

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)	5775071.74	71.74
100%		-30	5775001.45	1.45
100%		-20	5775067.44	67.44
100%		-10	5775047.28	47.28
100%		0	5775093.23	93.23
100%		+10	5775010.21	10.21
100%		+30	5775044.12	44.12
100%		+40	5775001.56	1.56
100%		+50	5775019.14	19.14
End. Point	3.40	+20	5775066.45	66.45

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)	5210025.12	25.12
100%		-30	5210026.13	26.13
100%		-20	5210046.90	46.90
100%		-10	5210027.02	27.02
100%		0	5210046.70	46.70
100%		+10	5210021.75	21.75
100%		+30	5210093.44	93.44
100%		+40	5210091.98	91.98
100%		+50	5210047.14	47.14
End. Point	3.40	+20	5210008.04	8.04

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)	5290075.40	75.40
100%		-30	5290012.42	12.42
100%		-20	5290050.78	50.78
100%		-10	5290025.24	25.24
100%		0	5290058.26	58.26
100%		+10	5290069.52	69.52
100%		+30	5290040.18	40.18
100%		+40	5290080.71	80.71
100%		+50	5290086.07	86.07
End. Point	3.40	+20	5290026.69	26.69

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)	5530019.72	19.72
100%		-30	5530077.79	77.79
100%		-20	5530060.70	60.7
100%		-10	5530032.04	32.04
100%		0	5530029.40	29.4
100%		+10	5530070.73	70.73
100%		+30	5530039.85	39.85
100%		+40	5530050.81	50.81
100%		+50	5530077.25	77.25
End. Point	3.40	+20	5530068.30	68.3

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)	5775019.60	19.60
100%		-30	5775086.09	86.09
100%		-20	5775011.56	11.56
100%		-10	5775035.03	35.03
100%		0	5775081.02	81.02
100%		+10	5775009.18	9.18
100%		+30	5775090.36	90.36
100%		+40	5775099.77	99.77
100%		+50	5775004.82	4.82
End. Point	3.40	+20	5775062.07	62.07

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)	5210052.31	52.31
100%		-30	5210096.34	96.34
100%		-20	5210005.98	5.98
100%		-10	5210091.71	91.71
100%		0	5210047.23	47.23
100%		+10	5210006.34	6.34
100%		+30	5210050.59	50.59
100%		+40	5210013.20	13.20
100%		+50	5210043.40	43.40
End. Point	3.40	+20	5210069.81	69.81

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)	5290058.07	58.07
100%		-30	5290025.63	25.63
100%		-20	5290062.98	62.98
100%		-10	5290072.04	72.04
100%		0	5290055.10	55.1
100%		+10	5290097.44	97.44
100%		+30	5290039.17	39.17
100%		+40	5290071.55	71.55
100%		+50	5290053.59	53.59
End. Point	3.40	+20	5290066.86	66.86

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)	5530005.81	5.81
100%		-30	5530084.75	84.75
100%		-20	5530063.68	63.68
100%		-10	5530002.41	2.41
100%		0	5530039.58	39.58
100%		+10	5530048.11	48.11
100%		+30	5530017.38	17.38
100%		+40	5530011.05	11.05
100%		+50	5530004.40	4.40
End. Point	3.40	+20	5530064.60	64.6

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)	5775074.07	74.07
100%		-30	5775057.30	57.30
100%		-20	5775075.80	75.8
100%		-10	5775056.53	56.53
100%		0	5775022.46	22.46
100%		+10	5775090.77	90.77
100%		+30	5775071.12	71.12
100%		+40	5775032.56	32.56
100%		+50	5775060.54	60.54
End. Point	3.40	+20	5775036.47	36.47

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	5709.24	15.76
802.11n(HT20)				5709.04	15.96
802.11ac(VHT20)				5708.84	16.16
802.11a	UNII 3	5720	144	5730.80	5.80
802.11n(HT20)				5730.92	5.92
802.11ac(VHT20)				5731.12	6.12

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11n(HT40)	UNII 2C	5710	142	5689.12	35.88
802.11ac(VHT40)				5688.56	36.44
802.11n(HT40)	UNII 3	5710	142	5730.88	5.88
802.11ac(VHT40)				5731.04	6.04

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	26dB Bandwidth [MHz]
802.11ac(VHT80)	UNII 2C	5690	138	5649.44	75.56
	UNII 3	5690	138	5730.44	5.44

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)

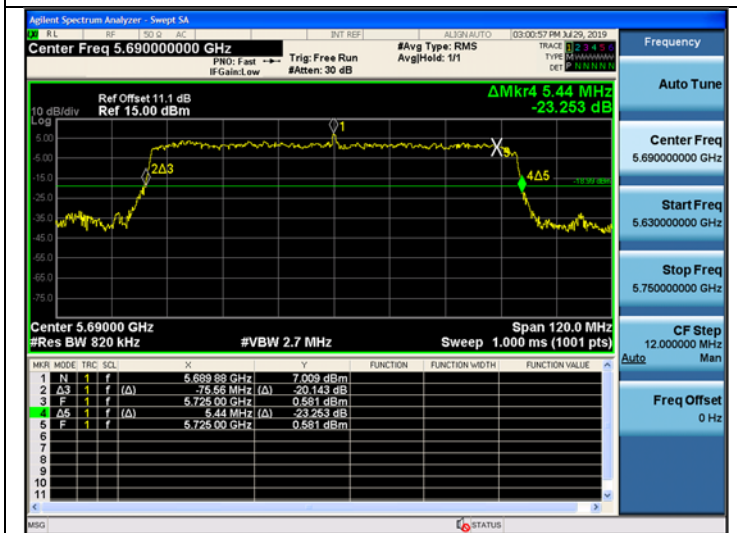
802.11n(HT40) UNII Band



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	5728.12	3.12	> 0.5
802.11n(HT20)				5727.80	2.80	> 0.5
802.11ac(VHT20)				5727.84	2.84	> 0.5

Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11n(HT40)	UNII 3	5710	142	5728.12	3.12	> 0.5
802.11ac(VHT40)				5728.12	3.12	> 0.5

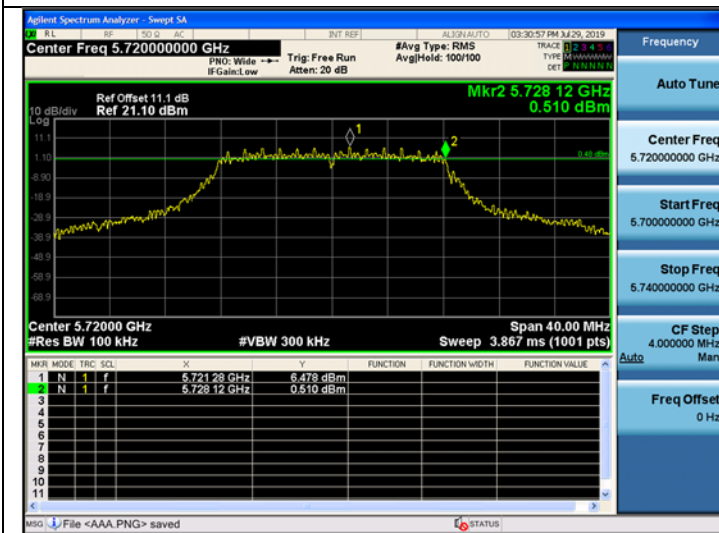
Mode	Band	Frequency [MHz]	Channel	Measured Frequency [MHz]	6dB Bandwidth [MHz]	Limit [MHz]
802.11ac(VHT80)	UNII 3	5690	138	5727.55	2.55	> 0.5

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

