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TEST REPORT

FCC/IC UNII Test for LGSBWAC03
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2007-FI003-R1

DATE OF ISSUE
13 July 2020

Tested by
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Additional Model
-

Applicant	**LG Electronics Inc.** 222, LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 451-713, Korea
Eut Type Model Name	RF Module LGSBWAC03
FCC ID IC	BEJLGSBWAC03 2703H-LGSBWAC03
Modulation type	GFSK
FCC Classification	Unlicensed National Information Infrastructure(NII)
FCC Rule Part(s)	Part 15.407
IC Rule Part(s)	RSS-247 Issue 2 (February 2017) RSS-Gen Issue 5_Amendment 1 (March 2019)

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.

REVISION HISTORY

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

Revision No.	Date of Issue	Description
0	July 08, 2020	Initial Release
1	July 13, 2020	A2LA mark removed & Typo revised (Page 1, 2, 3)

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 / IC Rules under normal use and maintenance.

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

The above Test Report is the accredited test result by (KS Q) ISO/IEC 17025 AND KOLAS(Korea Laboratory Accreditation Scheme), which signed the ILAC-MRA.(HCT Accreditation No.: KT197)

* The report shall not be reproduced except in full(only partly) without approval of the laboratory.

CONTENTS

1. GENERAL INFORMATION 5
EUT DESCRIPTION 5
ANTENNA CONFIGURATIONS 6
2. MAXIMUM OUTPUT POWER 7
3. TEST METHODOLOGY 8
EUT CONFIGURATION 8
EUT EXERCISE 8
GENERAL TEST PROCEDURES 8
DESCRIPTION OF TEST MODES 9
4. INSTRUMENT CALIBRATION 9
5. FACILITIES AND ACCREDITATIONS 9
5.1 FACILITIES 9
5.2 EQUIPMENT 9
6. ANTENNA REQUIREMENTS 10
7. MEASUREMENT UNCERTAINTY 10
8. DESCRIPTION OF TESTS 11
9. SUMMARY OF TEST RESULTS 34
10. TEST RESULT 36
10.1 26DB BANDWIDTH & 99 % BANDWIDTH 36
10.2 6DB BANDWIDTH 54
10.3 OUTPUT POWER MEASUREMENT 78
10.4 POWER SPECTRAL DENSITY 143
10.5 FREQUENCY STABILITY. 160
10.5.1 80MHz BW 160
10.6 STRADDLE CHANNEL 192
10.6.1 26dB Bandwidth 192
10.6.2 6dB Bandwidth 198
10.6.3 Output Power 204
10.6.4 Power Spectral Density 210
10.7 RADIATED SPURIOUS EMISSIONS 216
10.8 RADIATED RESTRICTED BAND EDGE 250
10.9 RECEIVER SPURIOUS EMISSIONS 268
10.10 POWERLINE CONDUCTED EMISSIONS 269
11. LIST OF TEST EQUIPMENT 273
12. ANNEX A_ TEST SETUP PHOTO 275

1. GENERAL INFORMATION

EUT DESCRIPTION

Model	LGSBWAC03	
Additional Model	-	
EUT Type	RF Module	
Power Supply	DC 3.30 V	
Modulation Type	OFDM : 802.11a, 802.11n, 802.11ac	
Frequency Range (MHz)	U-NII-1	20MHz BW : 5180 - 5240 40MHz BW : 5190 - 5230 80MHz BW : 5210
	U-NII-2A	20MHz BW : 5260 - 5320 40MHz BW : 5270 - 5310 80MHz BW : 5290
	U-NII-2C	20MHz BW : 5500 - 5720 40MHz BW : 5510 - 5710 80MHz BW : 5530 – 5690
	U-NII-3	20MHz BW : 5745 - 5825 40MHz BW : 5755 - 5795 80MHz BW : 5775
Antenna type	Metal press Ant	
Antenna Peak Gain	Ant.1: 0.05 dBi(UNII 1), 0.98 dBi(UNII 2A)/ 1.41 dBi(UNII 2C)/ 1.44 dBi(UNII 3) Ant.2: 1.42 dBi(UNII 1), 1.45 dBi(UNII 2A)/ 1.37 dBi(UNII 2C)/ 1.42 dBi(UNII 3)	
Straddle channel	Supported	
TDWR Band	Not Supported	
Dynamic Frequency Selection	Slave without radar detection	
Date(s) of Tests	June 01, 2020 ~ June 24, 2020	
PMN (Product Marketing Number)	LGSBWAC03	
HVIN (Hardware Version Identification Number)	ETWCFMBC02	
FVIN (Firmware Version Identification Number)	MT7663_V1.0	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	ETWCFMBC02–01, ETWCFMBC02-02, ETWCFMBC02-03, ETWCFMBC02-04	

ANTENNA CONFIGURATIONS

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

Configurations	SISO		SDM	CDD
	Ant1	Ant2	Ant1 + Ant2	Ant1 + Ant2
802.11a	O	O	X	O
802.11n(HT20)	O	O	O	O
802.11n(HT40)	O	O	O	O
802.11ac(VHT20)	O	O	O	O
802.11ac(VHT40)	O	O	O	O
802.11ac(VHT80)	O	O	O	O

Note:

1. O = Support, X = Not Support
2. SISO = Single Input Single Output
3. SDM = Spatial Diversity Multiplexing
4. CDD = Cyclic Delay Diversity

2. Directional Gain Calculation

According to KDB 662911 D01 Multiple Transmitter Output v02r01

Directional gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N]$ dBi

Band	Ant Gain (dBi)		Directional Gain = $10*\log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2/N]$ dBi
UNII 1	Ant1(Aux)	0.05	3.77
	Ant2(Main)	1.42	
UNII 2A	Ant1(Aux)	0.98	4.23
	Ant2(Main)	1.45	
UNII 2C	Ant1(Aux)	1.41	4.40
	Ant2(Main)	1.37	
UNII 3	Ant1(Aux)	1.44	4.44
	Ant2(Main)	1.42	

2. MAXIMUM OUTPUT POWER

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

Band	Mode	SISO				MIMO	
		Ant1 Power		Ant2 Power		Ant 1 + Ant 2 Power	
		(dBm)	(W)	(dBm)	(W)	(dBm)	(W)
UNII1	802.11a	13.86	0.024	12.51	0.018	16.25	0.042
	802.11n (HT20)	13.43	0.022	12.39	0.017	15.94	0.039
	802.11n (HT40)	14.88	0.031	13.88	0.024	17.40	0.055
	802.11ac (VHT20)	13.43	0.022	12.85	0.019	16.16	0.041
	802.11ac (VHT40)	14.53	0.028	13.03	0.020	16.75	0.047
	802.11ac (VHT80)	13.76	0.024	13.21	0.021	16.50	0.045
UNII2A	802.11a	13.82	0.024	12.88	0.019	16.36	0.043
	802.11n (HT20)	14.20	0.026	13.39	0.022	16.83	0.048
	802.11n (HT40)	14.66	0.029	14.35	0.027	17.52	0.056
	802.11ac (VHT20)	15.95	0.039	15.60	0.036	18.78	0.075
	802.11ac (VHT40)	14.85	0.031	13.31	0.021	17.04	0.051
	802.11ac (VHT80)	12.58	0.018	11.27	0.013	14.99	0.032
UNII2C	802.11a	14.19	0.026	12.92	0.020	16.59	0.046
	802.11n (HT20)	15.67	0.037	13.91	0.025	17.89	0.062
	802.11n (HT40)	13.52	0.022	13.30	0.021	16.42	0.044
	802.11ac (VHT20)	14.81	0.030	14.48	0.028	17.66	0.058
	802.11ac (VHT40)	13.37	0.022	12.28	0.017	15.87	0.039
	802.11ac (VHT80)	14.57	0.029	13.61	0.023	17.05	0.051
UNII3	802.11a	14.68	0.029	13.86	0.024	17.30	0.054
	802.11n (HT20)	13.53	0.023	13.33	0.022	16.22	0.042
	802.11n (HT40)	14.75	0.030	14.14	0.026	17.47	0.056
	802.11ac (VHT20)	13.17	0.021	13.08	0.020	16.12	0.041
	802.11ac (VHT40)	14.44	0.028	13.91	0.025	17.19	0.052
	802.11ac (VHT80)	15.60	0.036	15.02	0.032	18.33	0.068

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. / RSS-Gen issue 5, RSS-247 issue 2.

GENERAL TEST PROCEDURES

Conducted Emissions

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

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 6.6.5 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

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

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The SAC(Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil,
Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA.
The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.
Detailed description of test facility was submitted to the Commission and accepted dated April 02, 2018 (Registration Number: KR0032).
For ISED, test facility was accepted dated February 14, 2019 (CAB identifier: 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 / RSS-Gen (Issue 5) Section 8:

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

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

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

7. MEASUREMENT UNCERTAINTY

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

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

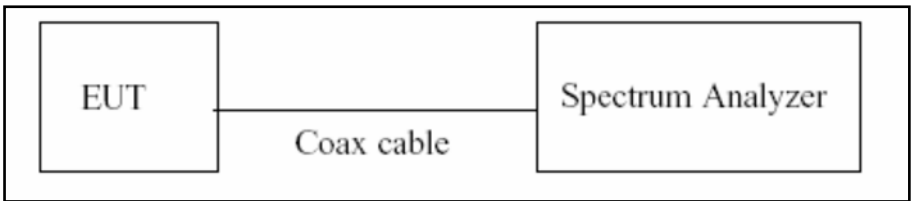
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance

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

8. DESCRIPTION OF TESTS

8.1. Duty Cycle

Test Configuration



Test Procedure

The transmitter output is connected to the Spectrum Analyzer.

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

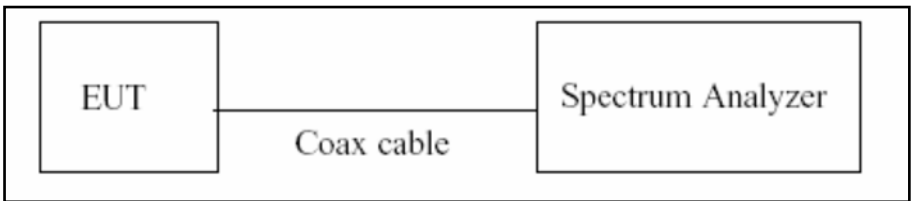
1. RBW = 8 MHz (the largest availble value)
2. VBW = 8 MHz (≥ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on}/ T_{total} and Duty Cycle Factor = 10log(1/Duty Cycle)

8.2. 6dB Bandwidth & 26dB Bandwidth & 99 % Bandwidth

Limit

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

Test Configuration



Test Procedure(26dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

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

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

Test Procedure (6dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

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

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

Note:

1. We tested X dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer.

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

Test Procedure (99 % Bandwidth for IC)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW ≒ 3 x RBW

Detector = Peak

Trace mode = max hold

Sweep = auto couple

Allow the trace to stabilize

Note : We tested OBW using the automatic bandwidth measurement capability of a spectrum analyzer.

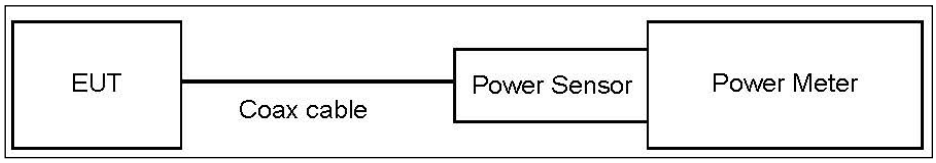
8.3. Output Power Measurement

Limit

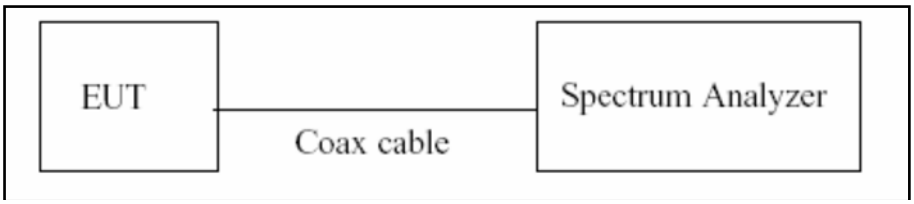
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

Test Configuration

Power Meter



Spectrum Analyzer(Only Straddle Channel)



Test Procedure(Power Meter)

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

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

Test Procedure(Spectrum Analyzer)

The transmitter output is connected to the Spectrum Analyzer.

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

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

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

Sample Calculation

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

Note

1. Spectrum reading values are not plot data.
   The power results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss(20 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	22.00
UNII 2A	22.00
UNII 2C	22.00
UNII 3	22.00

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

Limit & Ant Gain Calculation (FCC&IC)

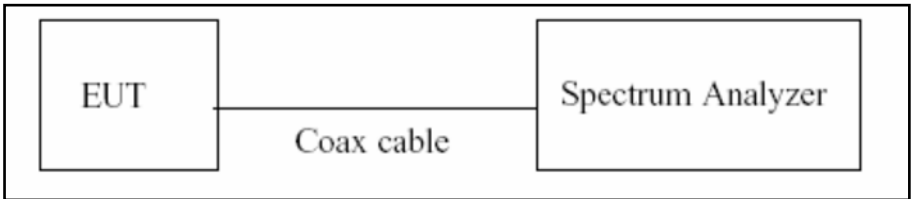
Operating Mode	Band	Mode	Operating Ant.	Ant. Gain (dBi)	E.I.R.P Limit (dBm)	Conducted Limit (dBm)
SISO	UNII 1	802.11a/ 802.11n20/ 802.11ac20	Ant 1(Aux)	0.05	22.24	23.98
			Ant 2(Main)	1.42	22.25	23.98
	UNII 2A		Ant 1(Aux)	0.98	29.25	23.25
			Ant 2(Main)	1.45	29.22	23.22
	UNII 2C		Ant 1(Aux)	1.41	29.24	23.24
			Ant 2(Main)	1.37	29.24	23.24
	UNII 3		Ant 1(Aux)	1.44	N/A	30.00
			Ant 2(Main)	1.42	N/A	30.00
MIMO	UNII 1	802.11a/ 802.11n20/ 802.11ac20	Ant 1(Aux) & Ant 2(Main)	3.77	22.24	23.98
	UNII 2A			4.23	29.22	23.22
	UNII 2C			4.40	29.24	23.24
	UNII 3			4.44	N/A	30.00
SISO	UNII 1	802.11n40/ 802.11ac40/ 802.11ac80	Ant 1(Aux)	0.05	23.01	23.98
			Ant 2(Main)	1.42	23.01	23.98
	UNII 2A		Ant 1(Aux)	0.98	30.00	23.98
			Ant 2(Main)	1.45	30.00	23.98
	UNII 2C		Ant 1(Aux)	1.41	30.00	23.98
			Ant 2(Main)	1.37	30.00	23.98
	UNII 3		Ant 1(Aux)	1.44	N/A	30.00
			Ant 2(Main)	1.42	N/A	30.00
MIMO	UNII 1	802.11n40/ 802.11ac40/ 802.11ac80	Ant 1(Aux) & Ant 2(Main)	3.77	23.01	23.98
	UNII 2A			4.23	30.00	23.98
	UNII 2C			4.40	30.00	23.98
	UNII 3			4.44	N/A	30.00

8.4. Power Spectral Density

Limit

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

Test Configuration



Test Procedure

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

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

Sample Calculation

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

Note

1. Spectrum reading values are not plot data.
   The PSD results in plot is already including the actual values of loss for the attenuator and cable combination.
2. Spectrum offset = Attenuator loss(20 dB) + Cable loss
3. Actual value of loss for the attenuator and cable combination is below table.

Band	Loss(dB)
UNII 1	22.00
UNII 2A	22.00
UNII 2C	22.00
UNII 3	22.00

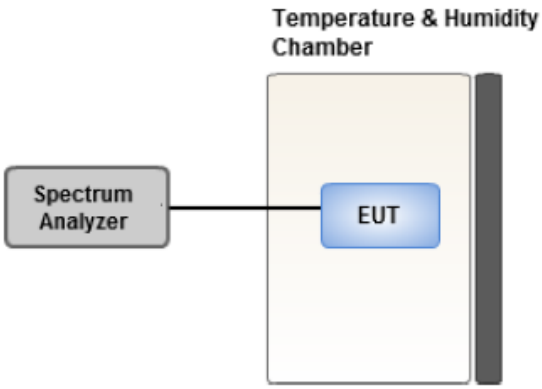
(Actual value of loss for the attenuator and cable combination)

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
5 to 30	60	50

[a]Decreases with the logarithm of the frequency.

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

Test Configuration

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

Test Procedure

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

Sample Calculation

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

8.7. Radiated Test

Limit

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

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

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

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

FCC

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

IC

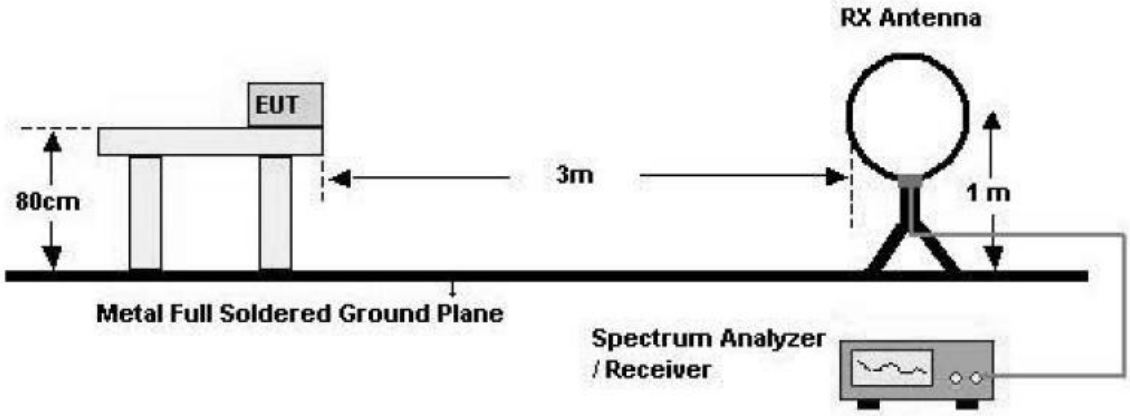
Frequency (MHz)	Field Strength (uA/m)	Measurement Distance (m)
0.009 – 0.490	6.37/F(kHz)	300
0.490 – 1.705	63.7/F(kHz)	30
1.705 – 30	0.08	30

FCC&IC

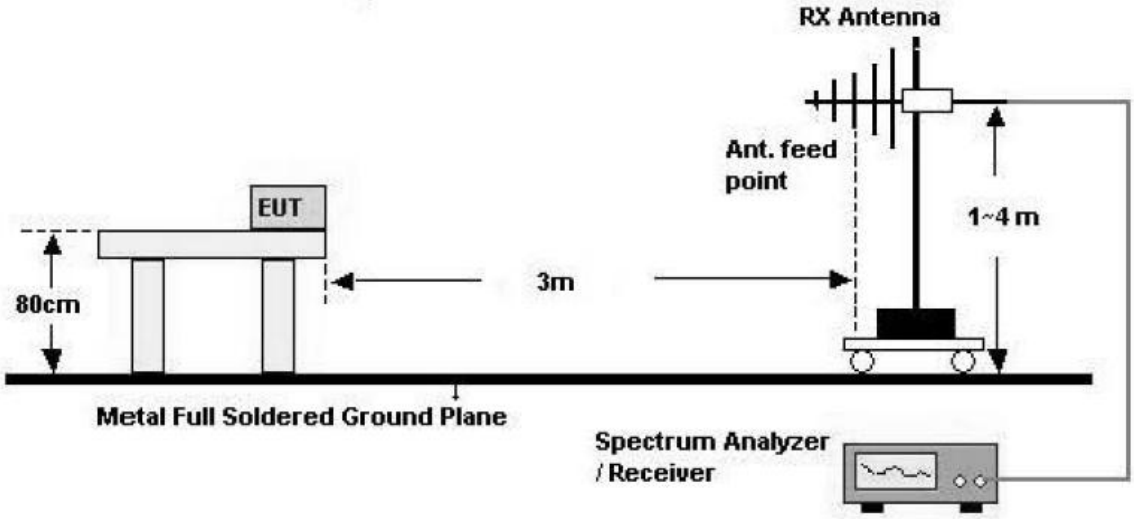
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

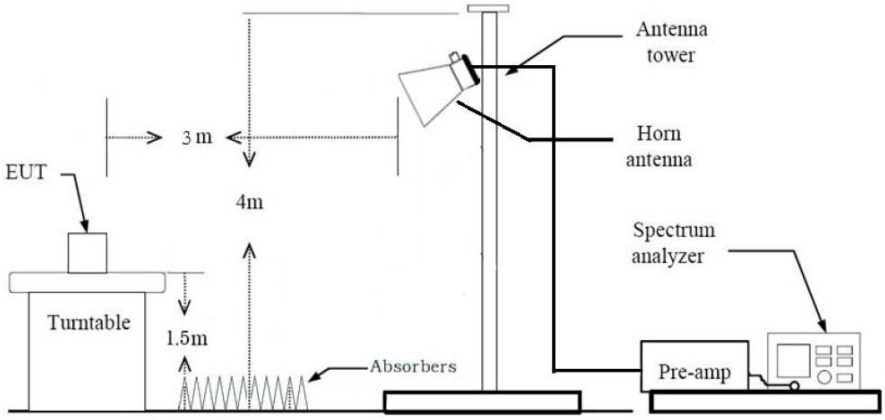
Below 30 MHz



30 MHz - 1 GHz



Above 1 GHz



Test Procedure of Radiated spurious emissions(Below 30 MHz)

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

KDB 414788 OFS and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

Test Procedure of Radiated spurious emissions(Below 1GHz)

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

Test Procedure of Radiated spurious emissions (Above 1 GHz)

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

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

- RBW = 1 MHz
- VBW ≥ 3 MHz
- Detector = Peak
- Sweep Time = auto
- Trace mode = max hold
- Allow sweeps to continue until the trace stabilizes.
  Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

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

- RBW = 1 MHz
- VBW ≥ 3 MHz
- The analyzer is set to linear detector mode.
- Averaging type = power (*i.e.*, RMS)
- Sweep time = auto.
- Trace mode = average (at least 100 traces).
- If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

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

Test Procedure of Radiated Restricted Band Edge

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting
   (1) Measurement Type(Peak, G.5 in KDB 789033 v02r01):
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep Time = auto
   - Trace mode = max hold
   - Allow sweeps to continue until the trace stabilizes.
     Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle.

   (2) Measurement Type (Average, G.6.c in KDB 789033 v02r01):
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - The analyzer is set to linear detector mode.
   - Averaging type = power (*i.e.*, RMS)
   - Sweep time = auto.
   - Trace mode = average (at least 100 traces).
   - If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.
9. 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)

10. Distance extrapolation factor = 20log (test distance / specific distance) (dB)
11. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L) - Amp Gain(G) + Attenuator + Distance Factor(D.F)

8.8. Receiver Spurious Emissions

Limit

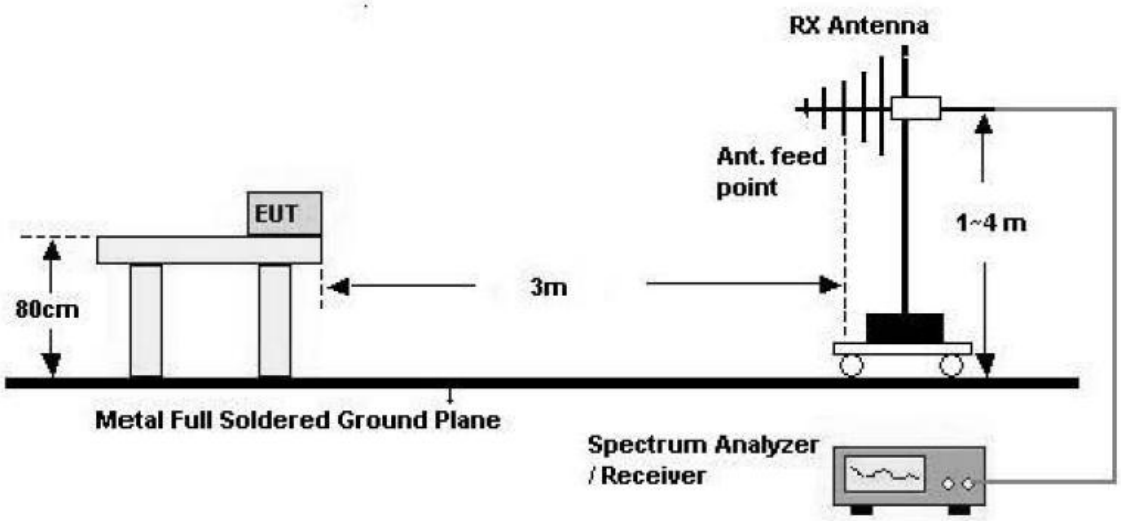
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

Measurements for compliance with the limits in table may be performed at distances other than 3 metres.

Test Configuration

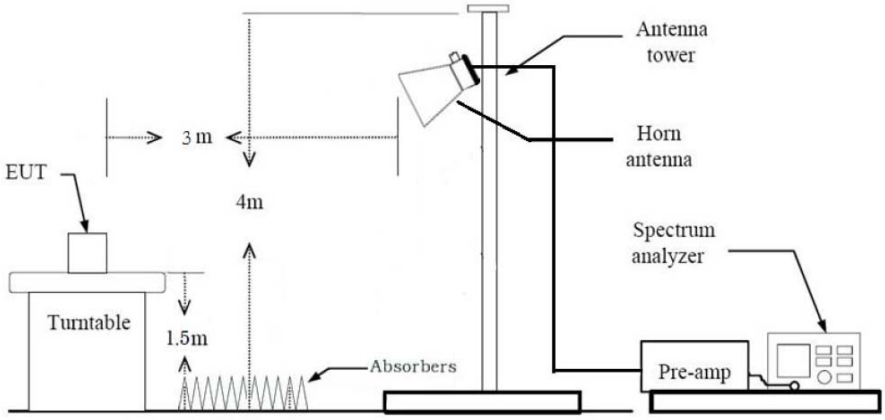
30 MHz - 1 GHz



Test Procedure of Receiver Spurious Emissions (Below 1GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8m above ground plane.
3. The Hybrid antenna was placed at a location 3m from the EUT, which is varied from 1m to 4m to find out the highest emissions.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 100 kHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Quasi-peak):
      - Measured Frequency Range : 30 MHz – 1 GHz
      - Detector = Quasi-Peak
      - RBW = 120 kHz
7. Total = Reading Value + Antenna Factor(A.F) + Cable Loss(C.L)

Above 1 GHz



<u>Test Procedure of Radiated spurious emissions (Above 1 GHz)</u>

1. The EUT is placed on a turntable, which is 1.5 m above ground plane.
2. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
3. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
4. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. Each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. The unit was tested with its standard battery.
8. Spectrum Setting
   (1) Measurement Type(Peak):
      - Measured Frequency Range : 1 GHz – 25 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 1 MHz
      - VBW ≥ 3 x RBW
   (2) Measurement Type(Average):
      - We performed using a reduced video BW method was done with the analyzer in linear mode
      - Measured Frequency Range : 1 GHz – 25 GHz
      - Detector = Peak
      - Trace = Maxhold
      - RBW = 1 MHz
      - VBW ≥ 1/τ Hz, where τ = pulse width in seconds

The actual setting value of VBW = 1 kHz

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

8.9. Worst case configuration and mode

Radiated test

1. All modes of operation were investigated and the worst case configuration results are reported.
2. All configurations of antenna were investigated and the worst case configuration results are reported.
   - Mode : Ant1(SISO), Ant2(SISO), Ant1+Ant2(CDD,SDM)
   - Worstcase : Ant1+Ant2(CDD)
3. EUT Axis
   - Radiated Spurious Emissions : Y
   - Radiated Restricted Band Edge : X
4. All datarate of operation were investigated and the worst case datarate results are reported
   - 802.11a : 6Mbps
   - 802.11n : MCS0
   - 802.11ac : MCS0
5. All position of loop antenna were investigated and the test result is a no critical peak found at all positions.
   - Position : Horizontal, Vertical, Parallel to the ground plane

AC Power line Conducted Emissions

1. All modes of operation were investigated and the worst case configuration results are reported.
   - Mode : Stand alone + Notebook

Conducted test

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

2. SISO & MIMO were tested and the all case results are reported.
   - Mode : Ant1(SISO), Ant2(SISO), Ant1+Ant2(CDD)

9. SUMMARY OF TEST RESULTS

FCC

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

IC

Test Description	IC Part Section(s)	Test Limit	Test Condition	Test Result
99% Bandwidth	RSS-GEN, 6.7	N/A	CONDUCTED	PASS
6 dB Bandwidth	RSS-247, 6.2.4.1	> 500 kHz (5725~5850 MHz)		PASS
Maximum Conducted Output Power,	RSS-247, 6.2	< 250 mW or 11+10 log $_{10}$ (BW) dBm (5470-5600, 5650-5725 MHz) Whichever power is less		PASS
	RSS-247, 6.2.4 1	<1 W (5725-5850 MHz)		
Maximum e.i.r.p	RSS-247, 6.2	< 200 mW or 10+10 log $_{10}$ (BW) dBm (5150-5250 MHz) < 1 W or 17+10 log $_{10}$ (BW) dBm (5250-5350 MHz) < 1 W or 17+10 log $_{10}$ (BW) dBm (5470-5725 MHz) Whichever power is less		PASS
Power Spectral Density	RSS-247 6.2	<10 dBm/ MHz(e.i.r.p.) (5150-5250 MHz) <11 dBm/MHz(Conducted) (5250-5350 MHz, 5470-5600 MHz, 5650-5725 MHz)		PASS
	RSS-247, 6.2.4 1	<30 dBm/500 kHz(Conducted) (5725-5850 MHz)		
Frequency Stability	RSS-GEN 8.11	should be kept within at least the central 80% of its permitted operating frequency band in order to minimize the possibility of out-of-band operation.		PASS
AC Conducted Emissions 150 kHz-30 MHz	RSS-GEN, 8.8	RSS-GEN section 8.8 table 4		PASS
Undesirable Emissions	RSS-247, 6.2.1 2	26 dBc at 5250~5350 MHz (5150~5350 MHz)		PASS
	RSS-247, 6.2	<-27 dBm/ MHz EIRP (5150-5350 MHz, 5470-5725 MHz)	RADIATED	PASS
	RSS-247, 6.2.4 2	cf. Section 9.8.1 (UNII 3)		
General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	RSS-Gen, 8.9 RSS-Gen, 8.10	RSS-Gen section 8.9 table 5, 6 section 8.10 table 7		PASS
Receiver Spurious Emissions	RSS-GEN, 5 RSS-GEN, 7.3	RSS-GEN section 7.3 table 3		PASS

10. TEST RESULT

10.1 26DB BANDWIDTH & 99 % BANDWIDTH

[ANT1]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	19.83	16.500
5200	40	19.80	16.510
5240	48	19.91	16.495
5260	52	20.05	16.526
5300	60	19.54	16.447
5320	64	19.77	16.515
5500	100	19.75	16.480
5580	116	20.10	16.504
5720	144	20.19	16.514
5745	149	20.01	16.478
5785	157	20.00	16.505
5825	165	19.97	16.515

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	20.11	17.583
5200	40	20.27	17.578
5240	48	20.18	17.602
5260	52	20.31	17.616
5300	60	20.17	17.646
5320	64	20.30	17.597
5500	100	20.14	17.576
5580	116	20.22	17.594
5720	144	20.29	17.609
5745	149	20.14	17.614
5785	157	20.38	17.617
5825	165	20.07	17.608

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.38	36.006
5230	46	40.27	36.005
5270	54	40.54	36.065
5310	62	40.41	36.045
5510	102	40.61	35.999
5550	110	40.55	36.025
5710	142	40.14	36.076
5755	151	40.59	36.084
5795	159	40.38	36.045

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	20.26	17.582
5200	40	20.14	17.591
5240	48	19.98	17.595
5260	52	20.09	17.570
5300	60	20.25	17.618
5320	64	20.17	17.583
5500	100	20.18	17.615
5580	116	20.18	17.600
5720	144	20.31	17.610
5745	149	20.15	17.559
5785	157	20.18	17.597
5825	165	20.21	17.586

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.34	35.982
5230	46	40.24	36.049
5270	54	40.47	35.995
5310	62	40.45	36.027
5510	102	40.86	36.031
5550	110	41.08	36.048
5710	142	40.42	36.030
5755	151	40.45	36.012
5795	159	40.48	36.056

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	80.77	75.336
5290	58	81.03	75.307
5530	106	81.14	75.416
5690	138	80.83	75.294
5775	155	80.99	75.396

[ANT2]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	20.15	16.496
5200	40	20.12	16.506
5240	48	19.75	16.471
5260	52	20.10	16.491
5300	60	20.05	16.437
5320	64	19.74	16.489
5500	100	19.96	16.526
5580	116	20.00	16.526
5720	144	20.08	16.483
5745	149	19.79	16.486
5785	157	20.04	16.468
5825	165	20.04	16.495

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	20.21	17.623
5200	40	20.10	17.566
5240	48	20.22	17.602
5260	52	20.31	17.605
5300	60	20.40	17.613
5320	64	20.18	17.587
5500	100	20.01	17.609
5580	116	20.27	17.608
5720	144	20.44	17.591
5745	149	20.21	17.605
5785	157	20.19	17.612
5825	165	20.11	17.589

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.53	36.033
5230	46	40.68	36.013
5270	54	40.07	36.021
5310	62	40.08	36.024
5510	102	40.60	36.022
5550	110	40.58	36.042
5710	142	40.46	36.022
5755	151	40.47	36.033
5795	159	40.82	36.015

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	20.31	17.599
5200	40	20.42	17.615
5240	48	19.95	17.583
5260	52	20.29	17.594
5300	60	20.31	17.581
5320	64	20.20	17.602
5500	100	20.09	17.616
5580	116	20.27	17.602
5720	144	20.22	17.606
5745	149	20.33	17.596
5785	157	20.11	17.580
5825	165	20.33	17.613

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.73	36.056
5230	46	40.17	36.026
5270	54	40.34	36.057
5310	62	40.39	36.003
5510	102	40.21	36.038
5550	110	40.39	36.006
5710	142	40.22	35.971
5755	151	40.36	36.007
5795	159	40.57	36.087

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	80.66	75.350
5290	58	80.93	75.277
5530	106	81.12	75.367
5690	138	80.80	75.289
5775	155	80.68	75.417

[ANT1]

▣ 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 48)

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

802.11a UNII 2C BAND 26dB Bandwidth (CH144)

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

▣ Test Plots(802.11n(HT20))

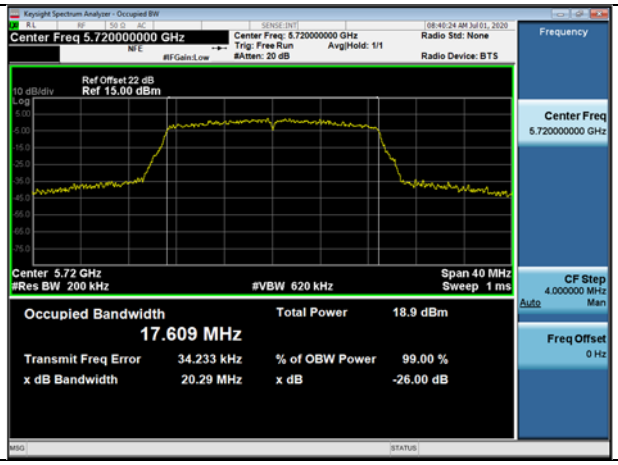
Note:

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

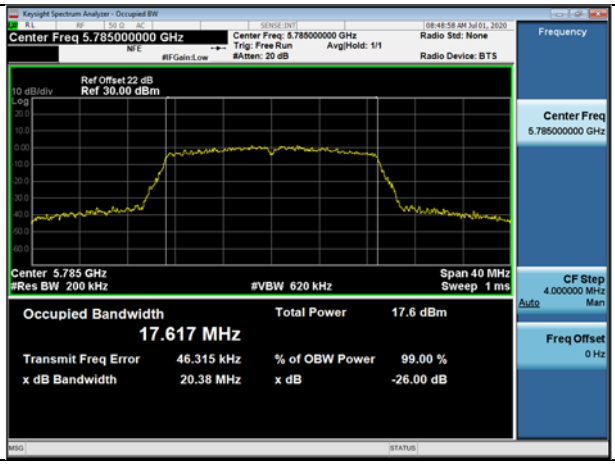
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 40)

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

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



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



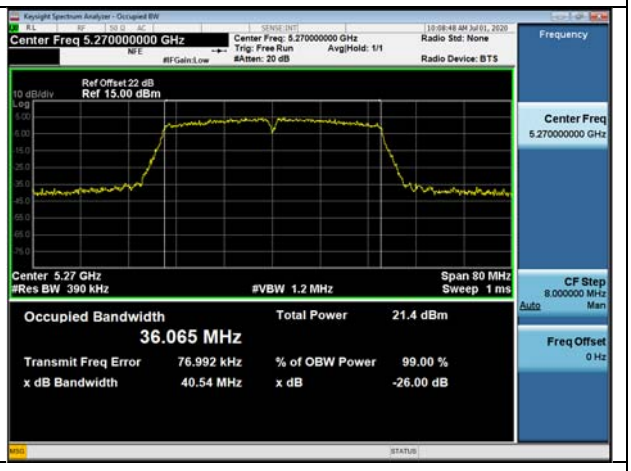
▣ Test Plots(802.11n(HT40))

Note:

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

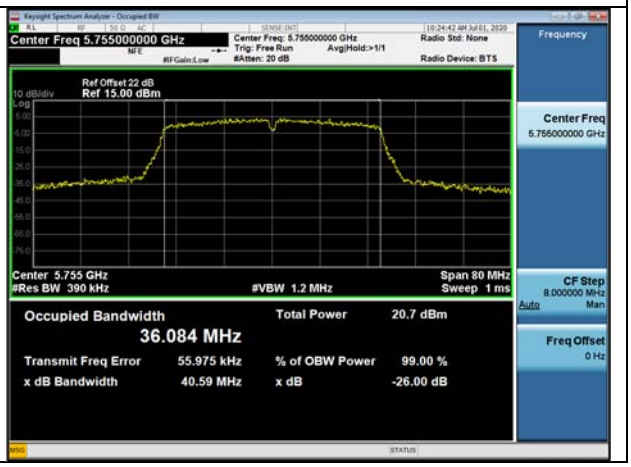
802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 38)

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



802.11n_HT40 UNII 2C BAND 26dB Bandwidth(CH 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 60)
802.11ac_VHT20 UNII 2C BAND 26dB Bandwidth(CH 144)	802.11ac_VHT20 UNII 3 BAND 26dB Bandwidth(CH 165)

▣ Test Plots(802.11ac(VHT40))

Note:

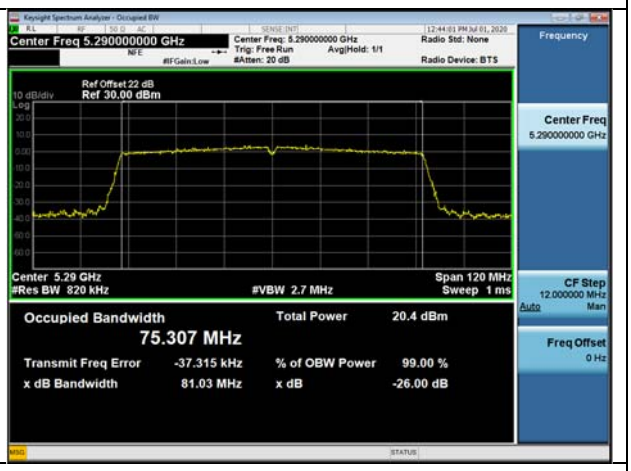
In order to simplify the report, attached plots were only the most wide channel.

802.11ac_VHT40 UNII 1 BAND 26dB Bandwidth(CH 38)	802.11ac_VHT40 UNII 2A BAND 26dB Bandwidth (CH 54)
802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 110)	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)

[ANT2]

▣ Test Plots(802.11a)

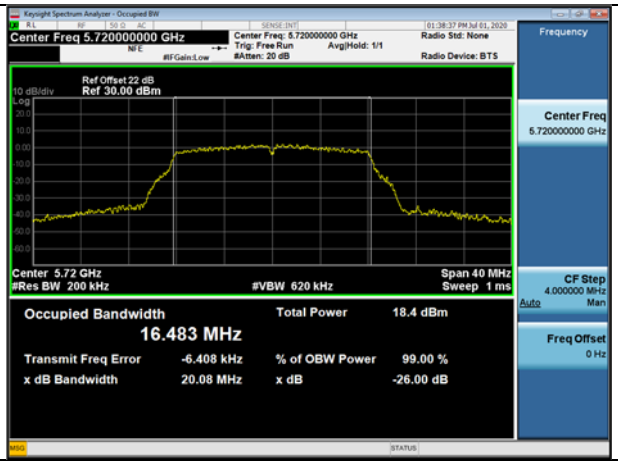
Note:

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

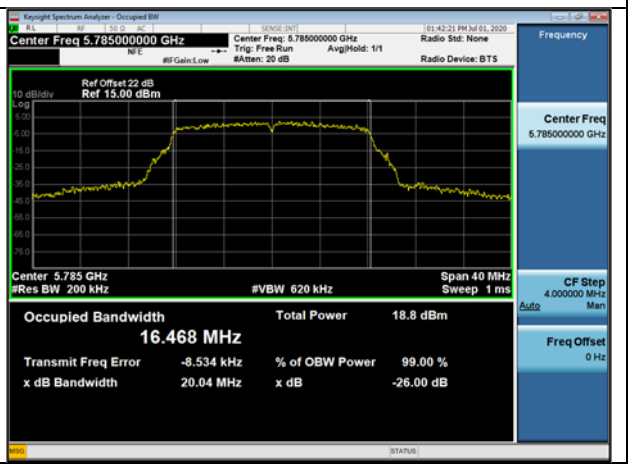
802.11a UNII 1 BAND 26dB Bandwidth (CH 36)

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

802.11a UNII 2C BAND 26dB Bandwidth (CH144)



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



▣ Test Plots(802.11n(HT20))

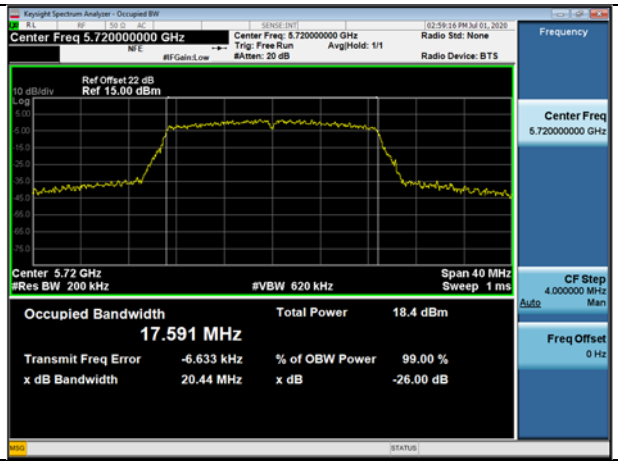
Note:

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

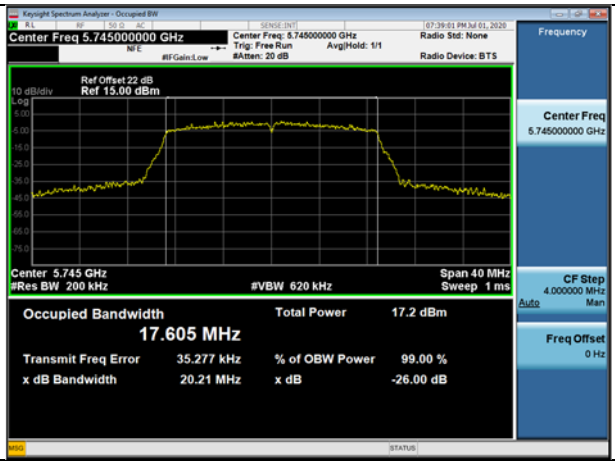
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 48)

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 149)



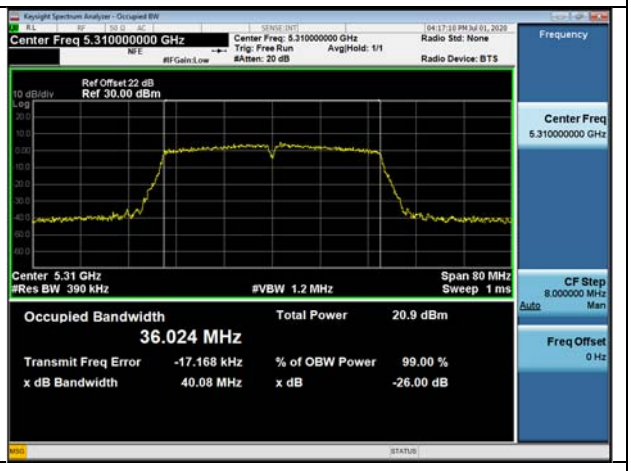
▣ Test Plots(802.11n(HT40))

Note:

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

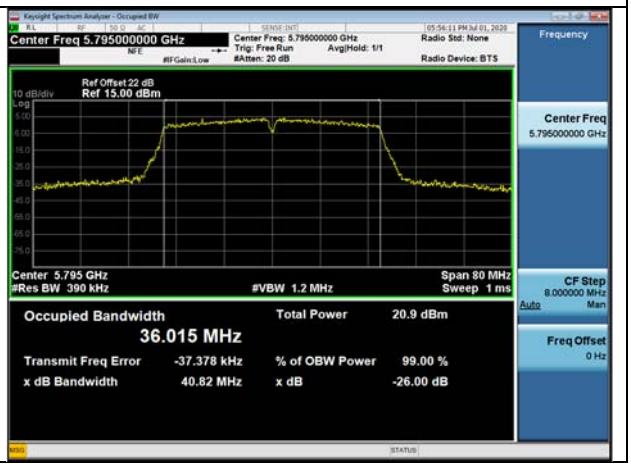
802.11n_HT40 UNII 1 BAND 26dB Bandwidth(CH 46)

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



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

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



▣ Test Plots(802.11ac(VHT20))

Note:

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

802.11ac_VHT20 UNII 1 BAND 26dB Bandwidth(CH 40)

802.11ac_VHT20 UNII 2A BAND 26dB Bandwidth(CH 60)

802.11ac_VHT20 UNII 2C BAND 26dB Bandwidth(CH 116)

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 38)	802.11ac_VHT40 UNII 2A BAND 26dB Bandwidth (CH 62)
802.11ac_VHT40 UNII 2C BAND 26dB Bandwidth(CH 110)	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)

10.2 6DB BANDWIDTH

[ANT1]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.38	> 0.5	Pass
5785	157	16.40	> 0.5	Pass
5825	165	16.38	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.64	> 0.5	Pass
5785	157	17.66	> 0.5	Pass
5825	165	17.58	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.15	> 0.5	Pass
5795	159	36.39	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.61	> 0.5	Pass
5785	157	17.64	> 0.5	Pass
5825	165	17.59	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.39	> 0.5	Pass
5795	159	36.38	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	76.44	> 0.5	Pass

[ANT2]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.34	> 0.5	Pass
5785	157	16.35	> 0.5	Pass
5825	165	16.41	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.64	> 0.5	Pass
5785	157	17.53	> 0.5	Pass
5825	165	17.61	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.38	> 0.5	Pass
5795	159	36.37	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.60	> 0.5	Pass
5785	157	17.59	> 0.5	Pass
5825	165	17.62	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	36.36	> 0.5	Pass
5795	159	36.36	> 0.5	Pass

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	76.42	> 0.5	Pass

[ANT1]

▣ 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.151)

802.11ac(VHT20) (CH.165)

802.11ac(VHT40) (CH.159)

802.11ac(VHT80) (CH.155)

[ANT2]

▣ Test Plots

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

802.11a (CH.149)

802.11n(HT20) (CH.157)

802.11n(HT40) (CH.159)

802.11ac(VHT20) (CH.157)

802.11ac(VHT40) (CH.151)

802.11ac(VHT80) (CH.155)

99 % Bandwidth measurement(IC)

[ANT1]

802.11a Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	16.752
5200	40	16.779
5240	48	16.867
5260	52	16.770
5300	60	16.823
5320	64	16.787
5500	100	16.854
5580	116	16.744
5720	144	16.819
5745	149	16.813
5785	157	16.808
5825	165	16.811

802.11n(HT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.757
5200	40	17.762
5240	48	17.776
5260	52	17.774
5300	60	17.797
5320	64	17.748
5500	100	17.791
5580	116	17.788
5720	144	17.772
5745	149	17.810
5785	157	17.835
5825	165	17.829

802.11n(HT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.133
5230	46	36.167
5270	54	36.258
5310	62	36.327
5510	102	36.310
5550	110	36.310
5710	142	36.175
5755	151	36.280
5795	159	36.135

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.705
5200	40	17.768
5240	48	17.756
5260	52	17.768
5300	60	17.800
5320	64	17.758
5500	100	17.736
5580	116	17.737
5720	144	17.763
5745	149	17.770
5785	157	17.773
5825	165	17.800

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.210
5230	46	36.181
5270	54	36.168
5310	62	36.178
5510	102	36.214
5550	110	36.276
5710	142	36.262
5755	151	36.274
5795	159	36.246

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5210	42	75.374
5290	58	75.572
5530	106	75.494
5690	138	75.295
5775	155	75.443

[ANT2]

802.11a Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	16.771
5200	40	16.833
5240	48	16.845
5260	52	16.795
5300	60	16.686
5320	64	16.796
5500	100	16.750
5580	116	16.819
5720	144	16.832
5745	149	16.839
5785	157	16.785
5825	165	16.765

802.11n(HT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.757
5200	40	17.722
5240	48	17.810
5260	52	17.800
5300	60	17.760
5320	64	17.736
5500	100	17.761
5580	116	17.794
5720	144	17.797
5745	149	17.744
5785	157	17.801
5825	165	17.753

802.11n(HT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.197
5230	46	36.313
5270	54	36.199
5310	62	36.258
5510	102	36.190
5550	110	36.249
5710	142	36.185
5755	151	36.206
5795	159	36.260

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.756
5200	40	17.757
5240	48	17.793
5260	52	17.759
5300	60	17.789
5320	64	17.772
5500	100	17.776
5580	116	17.772
5720	144	17.764
5745	149	17.748
5785	157	17.768
5825	165	17.777

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.217
5230	46	36.231
5270	54	36.279
5310	62	36.239
5510	102	36.283
5550	110	36.200
5710	142	36.196
5755	151	36.255
5795	159	36.229

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5210	42	75.389
5290	58	75.322
5530	106	75.389
5690	138	75.446
5775	155	75.416

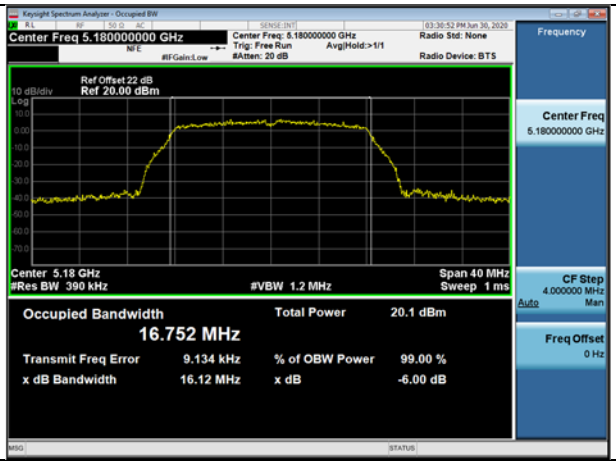
▣ Test Plots(802.11a)

[ANT1]

Note:

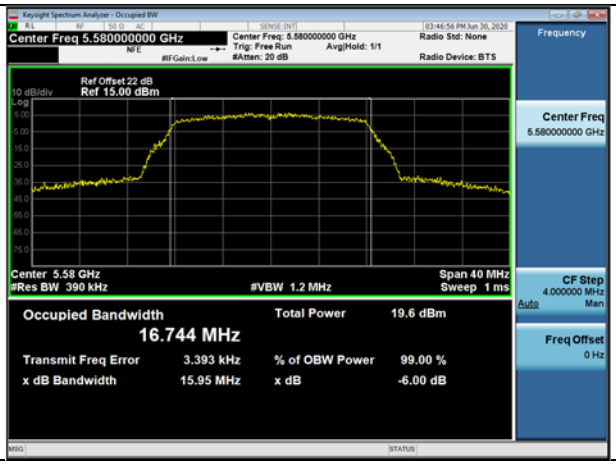
In order to simplify the report, attached plots were only the most narrow channel.

802.11a UNII 1 (CH 36)



802.11a UNII 2A (CH 52)

802.11a UNII 2C (CH 116)



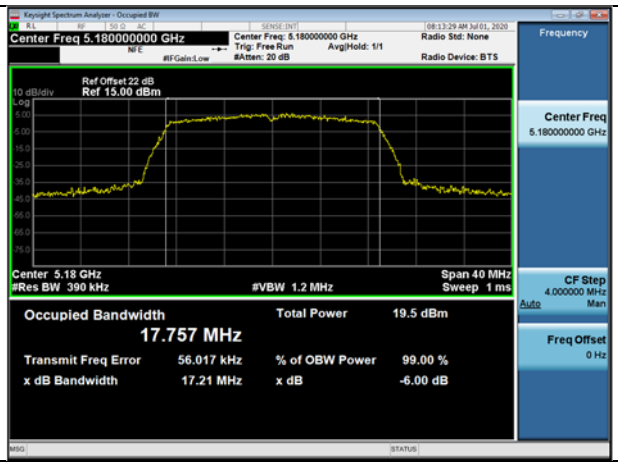
802.11a UNII 3 (CH 157)

▣ Test Plots(802.11n(HT20))

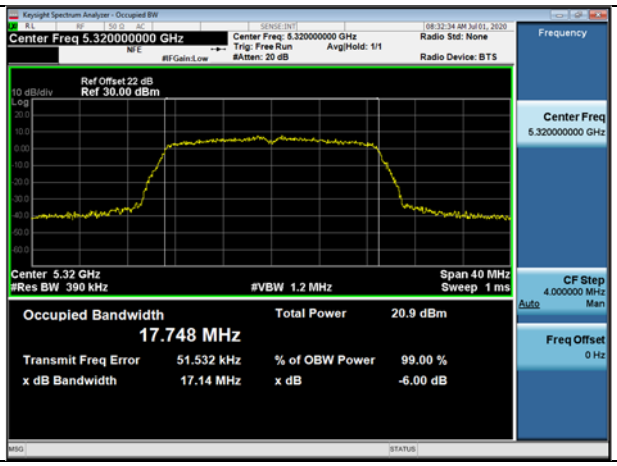
Note:

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

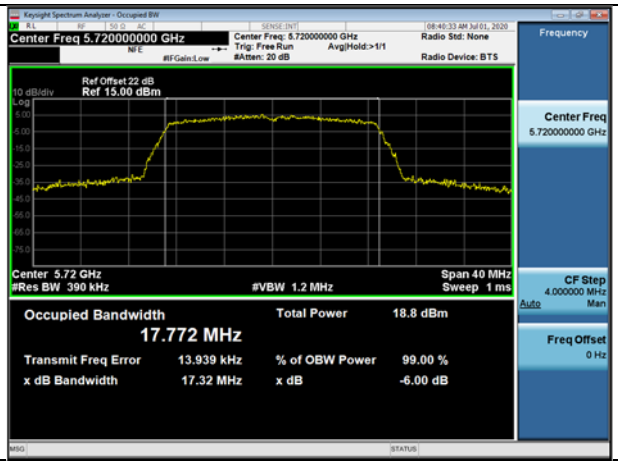
802.11n_HT20 UNII 1 (CH 36)



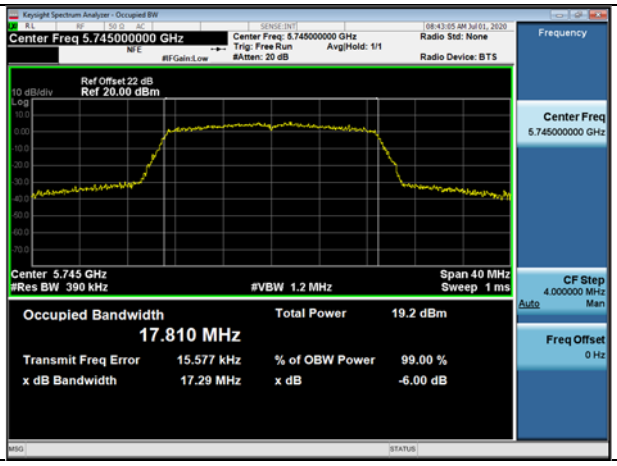
802.11n_HT20 UNII 2A (CH 64)



802.11n_HT20 UNII 2C (CH 144)



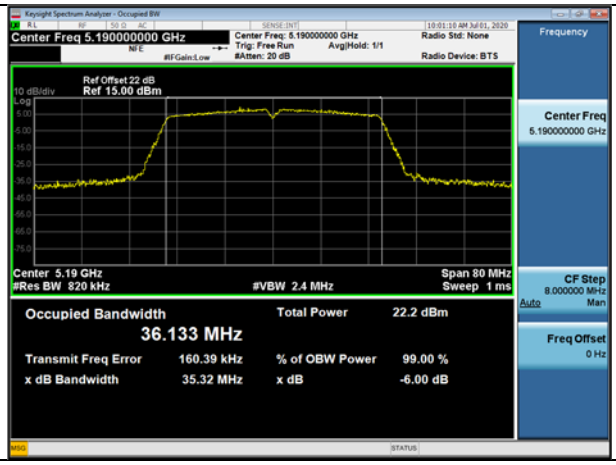
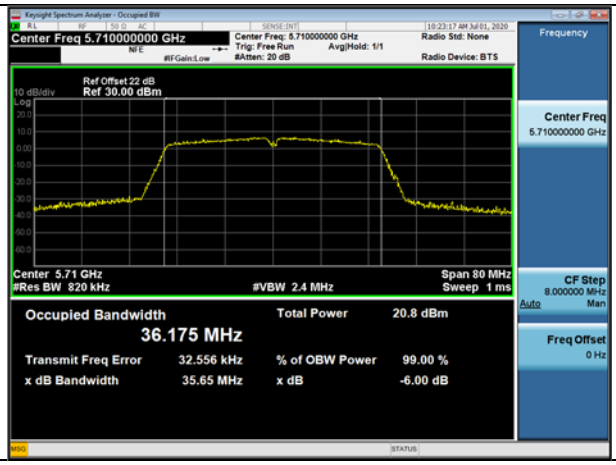
802.11n_HT20 UNII 3 (CH 149)



▣ Test Plots(802.11n(HT40))

Note:

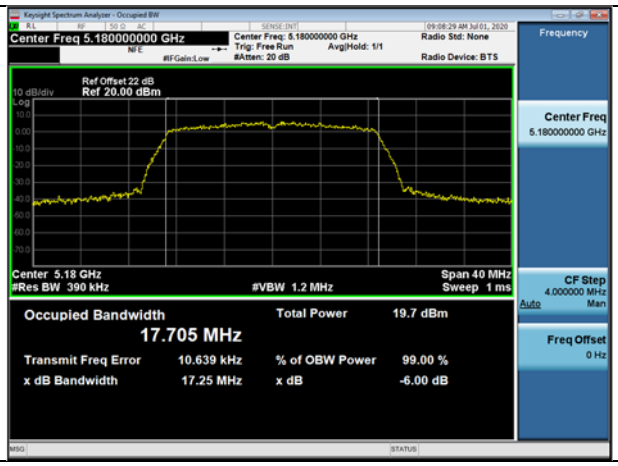
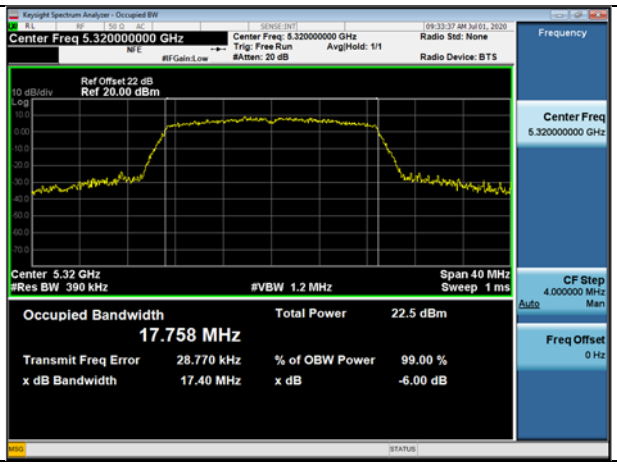
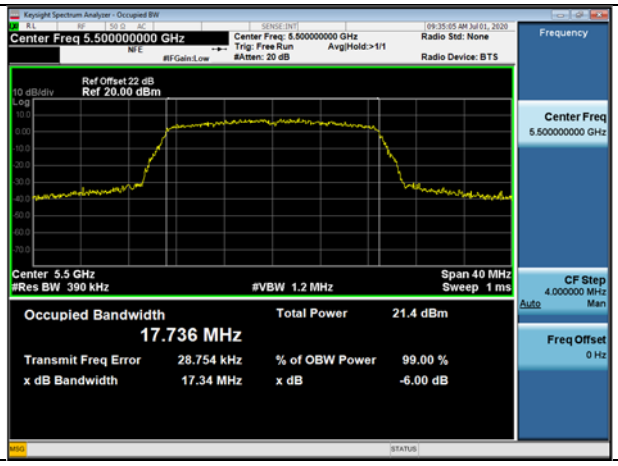
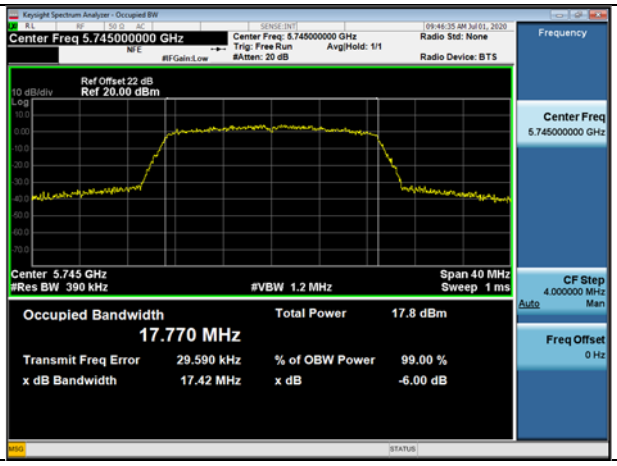
In order to simplify the report, attached plots were only the most narrow channel.

802.11n_HT40 UNII 1 (CH 38)	802.11n_HT40 UNII 2A (CH 54)
	
802.11n_HT40 UNII 2C (CH 142)	802.11n_HT40 UNII 3 (CH 159)
	

▣ Test Plots(802.11ac(VHT20))

Note:

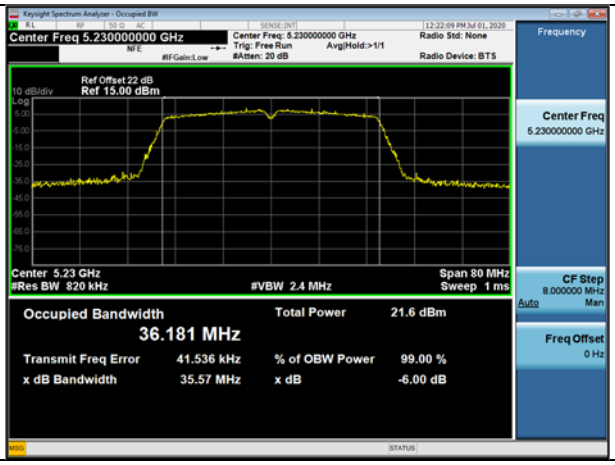
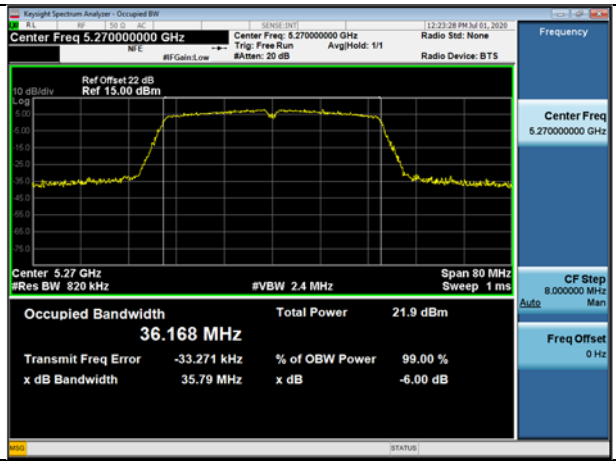
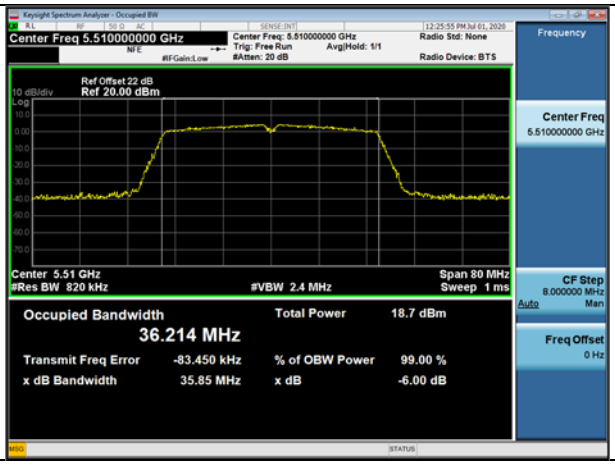
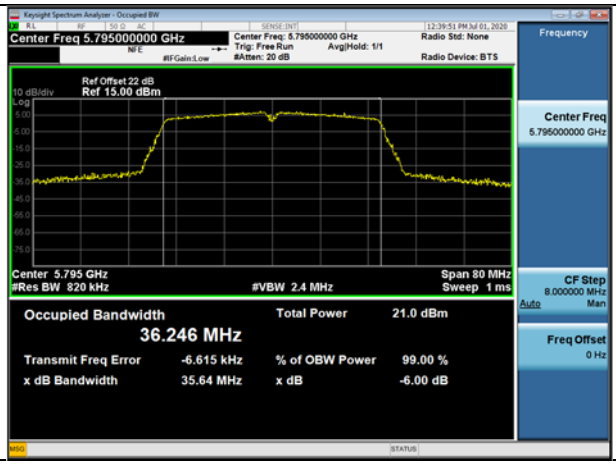
In order to simplify the report, attached plots were only the most narrow channel.

802.11ac_VHT20 UNII 1 (CH 36)	802.11ac_VHT20 UNII 2A (CH 64)
	
802.11ac_VHT20 UNII 2C (CH 100)	802.11ac_VHT20 UNII 3 (CH 149)
	

▣ Test Plots(802.11ac(VHT40))

Note:

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

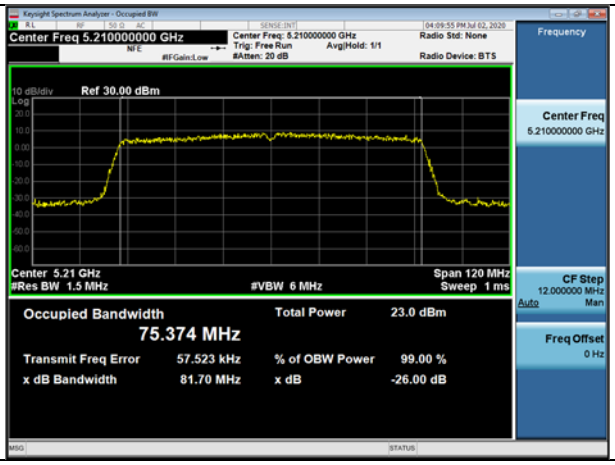
802.11ac_VHT40 UNII 1 (CH 46)	802.11ac_VHT40 UNII 2A (CH 54)
	
802.11ac_VHT40 UNII 2C (CH 102)	802.11ac_VHT40 UNII 3 (CH 159)
	

▣ Test Plots(802.11ac(VHT80))

Note:

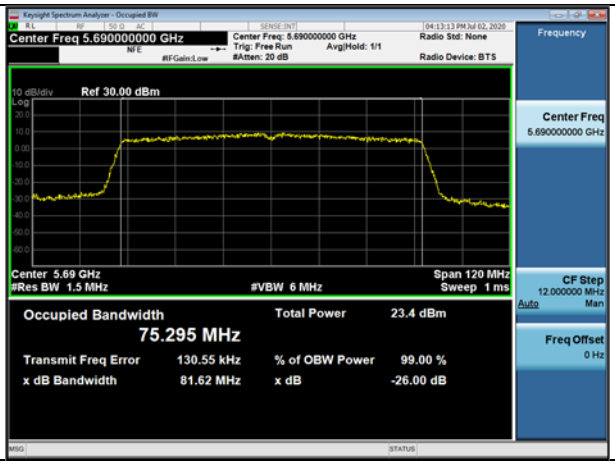
In order to simplify the report, attached plots were only the most narrow channel.

802.11ac_VHT80 UNII 1 (CH 42)



802.11ac_VHT80 UNII 2A (CH 58)

802.11ac_VHT80 UNII 2C (CH 138)

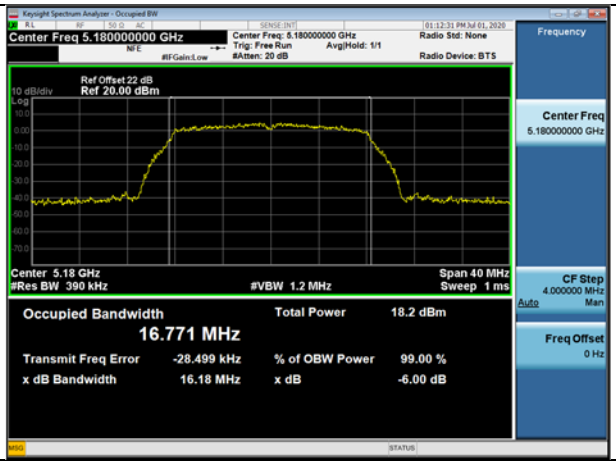
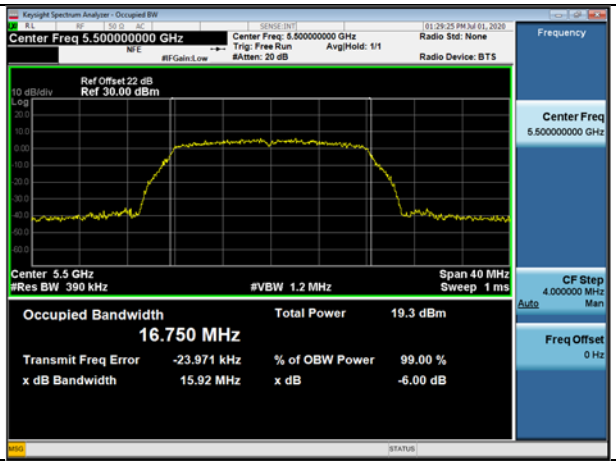


802.11ac_VHT80 UNII 3 (CH 155)

[ANT2]

Note:

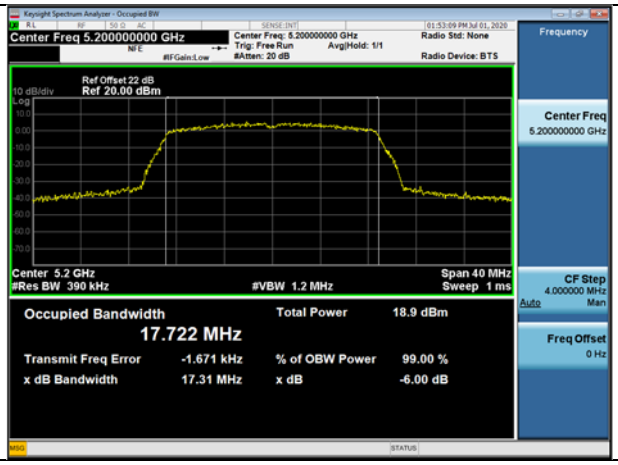
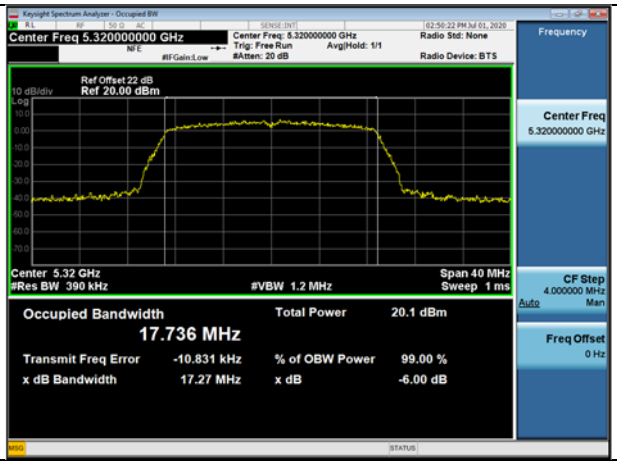
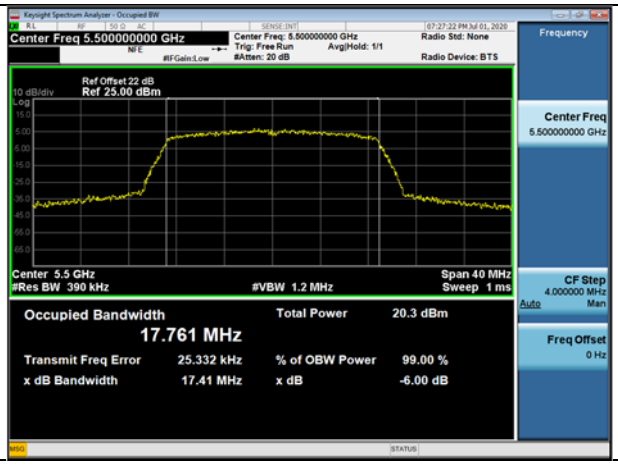
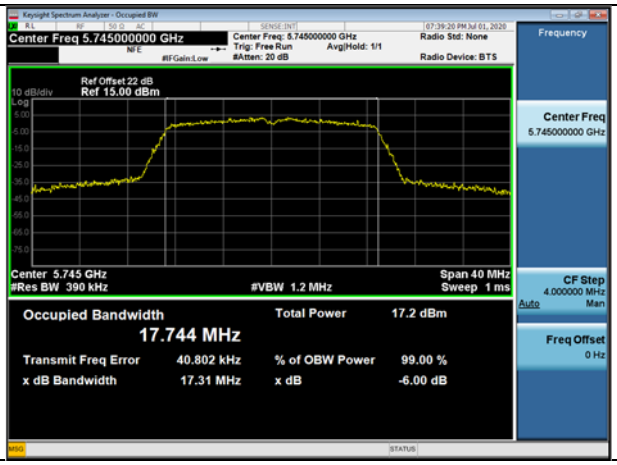
In order to simplify the report, attached plots were only the most narrow channel.

802.11a UNII 1 (CH 36)	802.11a UNII 2A (CH 52)
	
802.11a UNII 2C (CH 100)	802.11a UNII 3 (CH 165)
	

▣ Test Plots(802.11n(HT20))

Note:

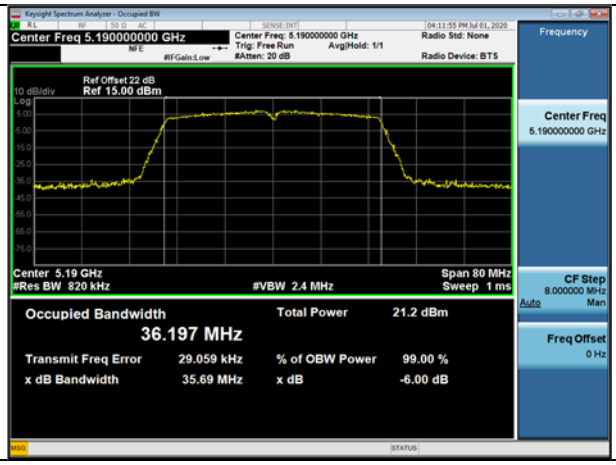
In order to simplify the report, attached plots were only the most narrow channel.

802.11n_HT20 UNII 1 (CH 40)	802.11n_HT20 UNII 2A (CH 64)
	
802.11n_HT20 UNII 2C (CH 100)	802.11n_HT20 UNII 3 (CH 149)
	

▣ Test Plots(802.11n(HT40))

Note:

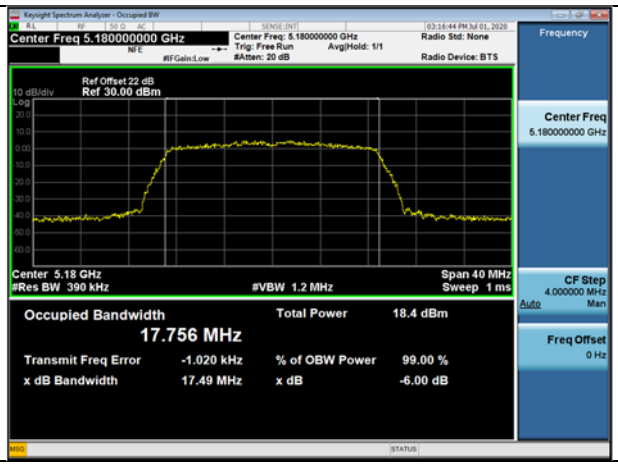
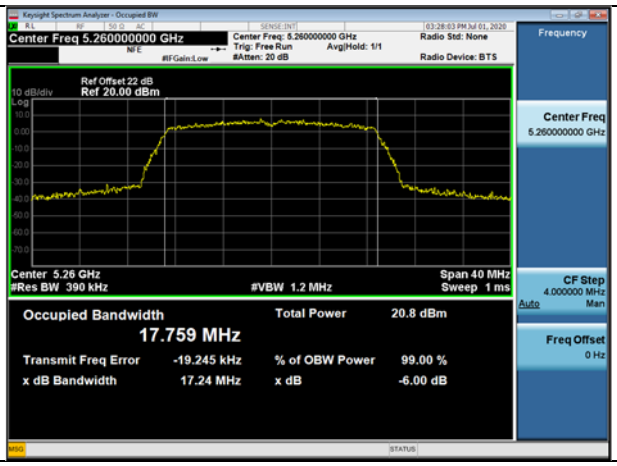
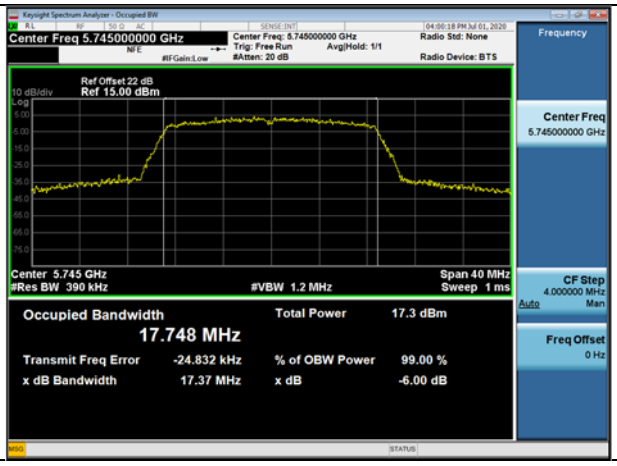
In order to simplify the report, attached plots were only the most narrow channel.

802.11n_HT40 UNII 1 (CH 38)	802.11n_HT40 UNII 2A (CH 54)
	
802.11n_HT40 UNII 2C (CH 142)	802.11n_HT40 UNII 3 (CH 151)

▣ Test Plots(802.11ac(VHT20))

Note:

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

802.11ac_VHT20 UNII 1 (CH 36)	802.11ac_VHT20 UNII 2A (CH 52)
	
802.11ac_VHT20 UNII 2C (CH 144)	802.11ac_VHT20 UNII 3 (CH 149)