

TEST REPORT

FCC/IC UNII Test for LGSBWAX12
Certification

APPLICANT
LG Electronics Inc.

REPORT NO.
HCT-RF-2009-FI003-R1

DATE OF ISSUE
14 September 2020

Tested by
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Accredited by KOLAS, Republic of KOREA

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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
LGSBWAX12

FCC ID IC

BEJLGSBWAX12
2703H-LGSBWAX12

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	September 10, 2020	Initial Release
1	September 14, 2020	Typo correction (Page 34)

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.

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



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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	LGSBWAX12	
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	July 02, 2020 ~ August 31, 2020	
PMN (Product Marketing Number)	LGSBWAX12	
HVIN (Hardware Version Identification Number)	ETWCHMBC01	
FVIN (Firmware Version Identification Number)	MT7921_V1.0	
HMN (Host Marketing Name)	N/A	
EUT serial numbers	ETWCHMBC01-01, ETWCHMBC01-02, ETWCHMBC01-03, ETWCHMBC01-04	
EUT Cable Type.	Basic Cable Type, FFC Cable Type	

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 = $10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N]$ dBi

Band	Ant Gain (dBi)		Directional Gain = $10 \cdot \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N]$ 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	13.03	0.020	12.82	0.019	15.92	0.039
	802.11n (HT20)	13.02	0.020	12.83	0.019	15.94	0.039
	802.11n (HT40)	13.10	0.020	13.20	0.021	16.16	0.041
	802.11ac (VHT20)	13.37	0.022	12.84	0.019	16.11	0.041
	802.11ac (VHT40)	13.32	0.021	13.01	0.020	16.18	0.041
	802.11ac (VHT80)	11.78	0.015	11.86	0.015	14.83	0.030
UNII2A	802.11a	12.92	0.020	12.80	0.019	15.87	0.039
	802.11n (HT20)	13.49	0.022	13.63	0.023	16.42	0.044
	802.11n (HT40)	13.96	0.025	13.84	0.024	16.56	0.045
	802.11ac (VHT20)	13.93	0.025	13.77	0.024	16.44	0.044
	802.11ac (VHT40)	13.22	0.021	13.22	0.021	16.23	0.042
	802.11ac (VHT80)	13.44	0.022	12.64	0.018	16.06	0.040
UNII2C	802.11a	13.14	0.021	12.44	0.018	15.80	0.038
	802.11n (HT20)	13.37	0.022	12.95	0.020	16.18	0.041
	802.11n (HT40)	12.81	0.019	12.59	0.018	15.57	0.036
	802.11ac (VHT20)	13.27	0.021	12.43	0.017	15.88	0.039
	802.11ac (VHT40)	13.83	0.024	12.56	0.018	16.22	0.042
	802.11ac (VHT80)	13.15	0.021	12.84	0.019	15.93	0.039
UNII3	802.11a	13.50	0.022	12.49	0.018	16.03	0.040
	802.11n (HT20)	13.44	0.022	12.30	0.017	15.90	0.039
	802.11n (HT40)	13.50	0.022	12.16	0.016	15.89	0.039
	802.11ac (VHT20)	13.22	0.021	12.01	0.016	15.67	0.037
	802.11ac (VHT40)	13.41	0.022	12.04	0.016	15.79	0.038
	802.11ac (VHT80)	13.25	0.021	12.14	0.016	15.74	0.038

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.

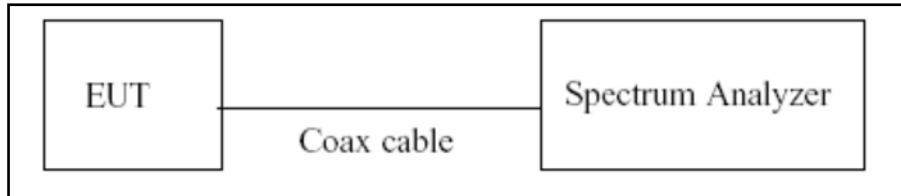
The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance

Parameter	Expanded Uncertainty ($\pm$ 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.

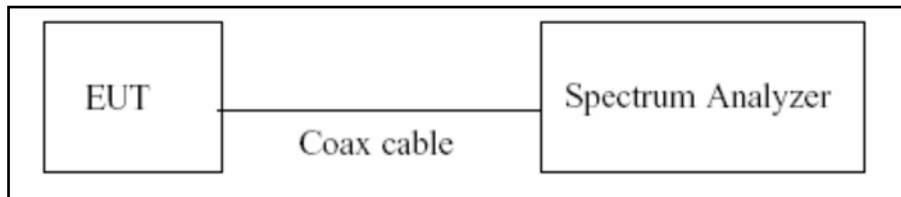
1. RBW = 8 MHz (the largest available value)
2. VBW = 8 MHz ($\geq$ RBW)
3. SPAN = 0 Hz
4. Detector = Peak
5. Number of points in sweep > 100
6. Trace mode = Clear write
7. Measure T_{total} and T_{on}
8. Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10\log(1/\text{Duty Cycle})$

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 $\geq 3 \times$ 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.

Test Procedure (99 % Bandwidth for IC)

The transmitter output is connected to the spectrum analyzer.

RBW = 1% ~ 5% of the occupied bandwidth

VBW $\approx$ 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.

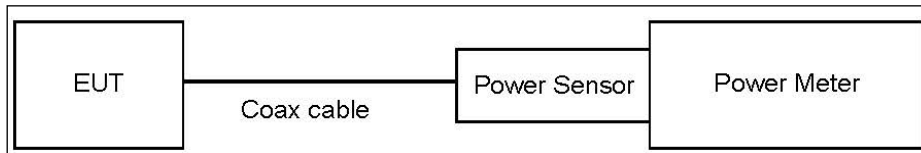
8.3. Output Power Measurement

Limit

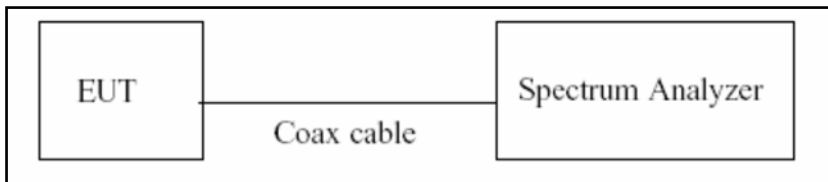
Band	Limit
UNII 1	- Master : Not exceed 1 W(=30dBm) - Slave : Not exceed 250 mW(=23.98 dBm)
UNII 2A, 2C	Not exceed the lesser of 250 mW or 11 dBm + 10 log B, (where B is the 26 dB emission bandwidth in megahertz.)
UNII 3	Not exceed 1 W(=30dBm)

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 $\geq$ 3 MHz.
5. Number of points in sweep $\geq 2 \times \text{span/RBW}$.
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 $10\log(1/x)$, 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(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	22.36	23.98
			Ant 2(Main)	1.42	22.40	23.98
	UNII 2A		Ant 1(Aux)	0.98	29.46	23.46
			Ant 2(Main)	1.45	29.39	23.39
	UNII 2C		Ant 1(Aux)	1.41	29.45	23.45
			Ant 2(Main)	1.37	29.41	23.41
	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	22.36	23.98
	UNII 2A			4.23	29.39	23.39
	UNII 2C			4.40	29.41	23.41
	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

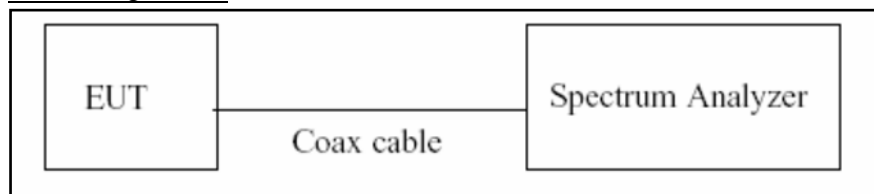
Note: IC Limit

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 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

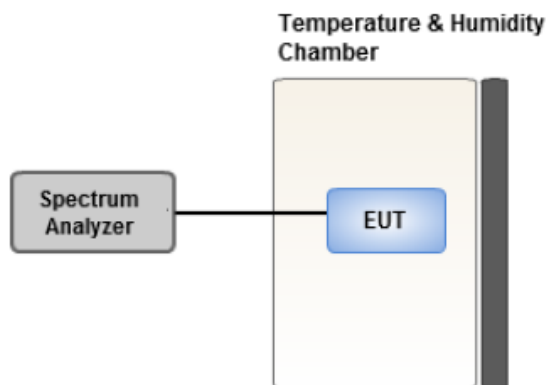
(Actual value of loss for the attenuator and cable combination)

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 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 ^(a)	56 to 46 ^(a)
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	$2400/F(\text{kHz})$	300
0.490 – 1.705	$24000/F(\text{kHz})$	30
1.705 – 30	30	30

IC

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

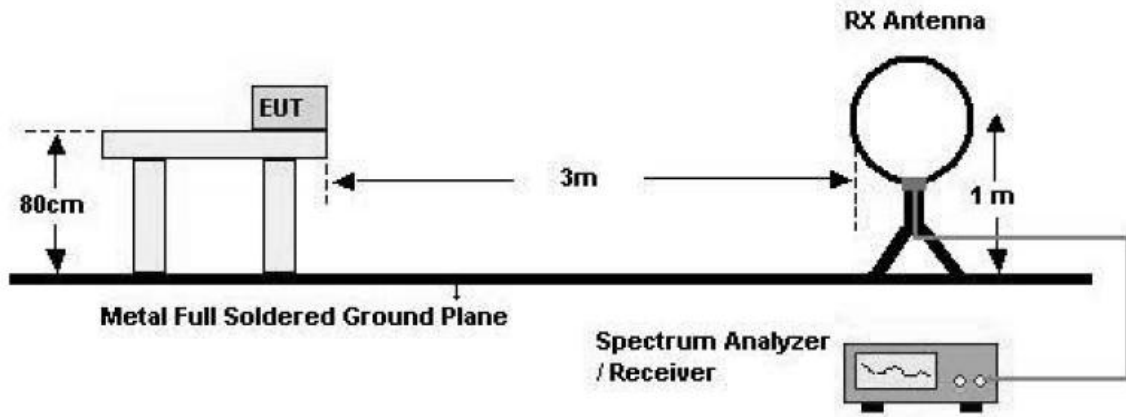


FCC&IC

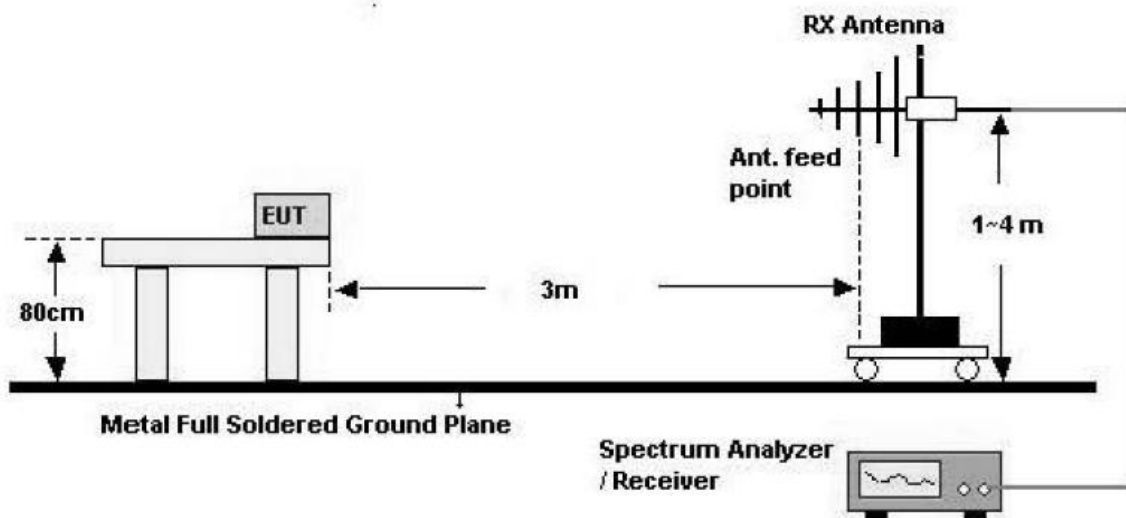
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Test Configuration

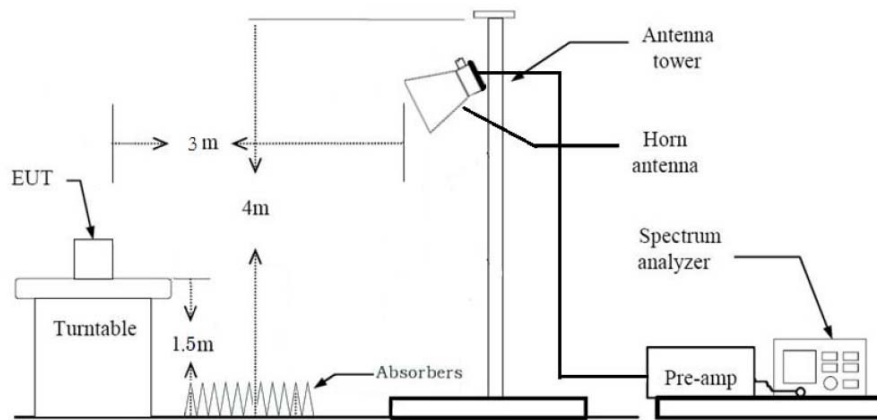
Below 30 MHz



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) = $40\log(3\text{ m}/300\text{ m}) = -80\text{ dB}$
Measurement Distance : 3 m
7. Distance Correction Factor(0.490 MHz – 30 MHz) = $40\log(3\text{ m}/30\text{ m}) = -40\text{ dB}$
Measurement Distance : 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Maxhold
 - RBW = 9 kHz
 - VBW $\geq 3 \times$ 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 $\geq$ 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 $\geq$ 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.c in KDB 789033 v02r01):

- RBW = 1 MHz
- VBW $\geq$ 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 = $20\log(\text{test distance} / \text{specific distance})$ (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 $\geq$ 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.c in KDB 789033 v02r01):
 - RBW = 1 MHz
 - VBW $\geq$ 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 = $20\log(\text{test distance} / \text{specific distance})$ (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

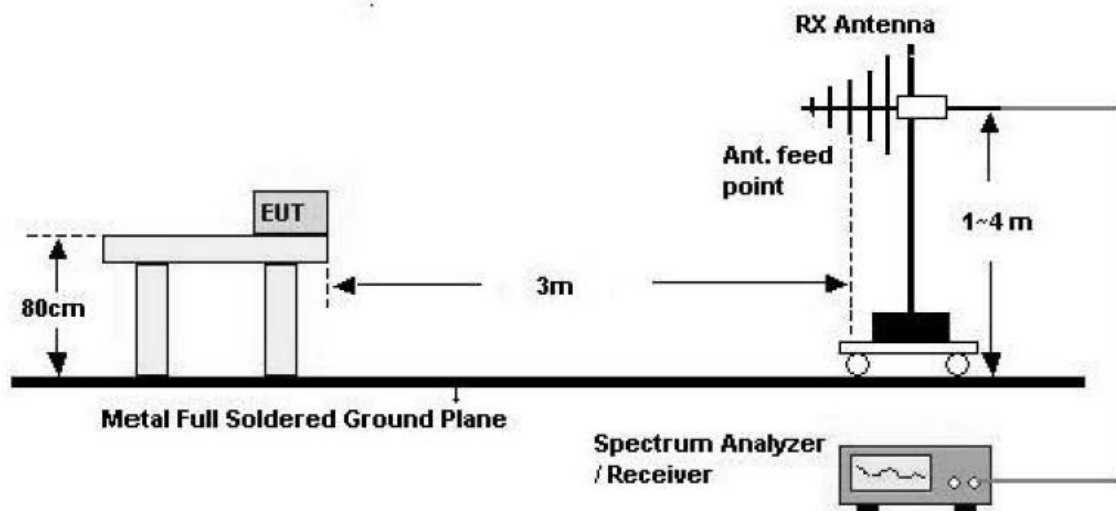
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

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):

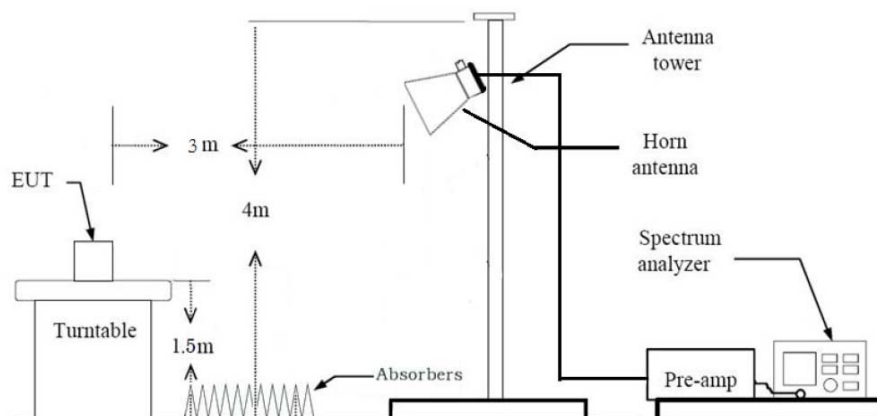
- Measured Frequency Range : 30 MHz – 1 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 100 kHz
- VBW $\geq 3 \times$ RBW

(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



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):

- Measured Frequency Range : 1 GHz – 25 GHz
- Detector = Peak
- Trace = Maxhold
- RBW = 1 MHz
- VBW $\geq 3 \times$ 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 $\geq 1/\tau$ 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 = $20\log(\text{test distance} / \text{specific distance})$ (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

Radiated test(DBS)

1. All modes of operation were investigated and the worst case configuration results are reported.
 - Mode : Stand alone + Notebook
 - Worstcase : Stand alone + Notebook
2. EUT Axis
 - Radiated Spurious Emissions : Z
3. Test case

RSDB	5GHz WIFI		2.4GHz WIFI		Test case
	Ant1	Ant2	Ant1	Ant2	
2.4 GHz + 5 GHz RSDB Only	A			B	Case1

Not RSDB	5GHz WIFI		2.4GHz Bluetooth	Test case
	Ant1	Ant2	Ant1	
Bluetooth + 5 GHz	A		B	-
		A	B	-
	A	A	B	Case2

4. . The following tables show the worst case configurations determined during testing.

(Worst case: The lowest margin condition the channels and modes were selected for test.)

Test case	Description	2.4 GHz Emission	5 GHz Emission
1	Antenna	Ant 2	Ant 1
	Channel	11	52
	Data Rate	1Mbps	MCS0
	Mode	802.11b	802.11ax(HE20)(26 Tone)(RU 8)

Test case	Description	Bluetooth Emission	5 GHz Emission
2	Antenna	Ant 1	Ant 1
	Channel	78	52
	Data Rate	1 Mbps	MCS 0
	Mode	8DPSK : 3-DH5	802.11ax(HE20)(26 Tone)(RU 8)

5. LGSBWAX12 were tested and the worst case results are reported.

6. Please refer to the LGSBWAX12 [UNII] 802.11ax Test Report.

AC Power line Conducted Emissions

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

- Mode : Stand alone + Notebook

- Worstcase : 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)		PASS
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		
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	23.52	16.856
5200	40	24.03	16.893
5240	48	22.59	16.590
5260	52	24.46	16.823
5300	60	24.58	16.875
5320	64	25.37	16.828
5500	100	24.75	16.866
5580	116	24.19	16.832
5720	144	25.47	16.816
5745	149	24.14	16.818
5785	157	24.98	16.794
5825	165	24.86	16.834

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	25.60	17.987
5200	40	24.35	17.998
5240	48	24.43	17.951
5260	52	25.14	17.983
5300	60	23.44	17.832
5320	64	25.65	17.984
5500	100	25.24	18.013
5580	116	24.25	17.947
5720	144	25.65	17.963
5745	149	25.41	17.996
5785	157	24.88	17.998
5825	165	25.43	17.966

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	40.00	35.810
5230	46	39.67	35.882
5270	54	39.97	35.823
5310	62	39.47	35.847
5510	102	39.73	35.816
5550	110	39.74	35.826
5710	142	39.84	35.823
5755	151	39.89	35.817
5795	159	40.05	35.807

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	25.59	18.006
5200	40	25.03	18.013
5240	48	25.60	18.008
5260	52	25.11	17.975
5300	60	25.77	18.005
5320	64	25.05	18.021
5500	100	24.65	17.975
5580	116	24.92	17.982
5720	144	24.37	17.954
5745	149	25.29	17.977
5785	157	26.04	18.022
5825	165	25.50	17.996

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.80	35.852
5230	46	39.63	35.835
5270	54	39.87	35.790
5310	62	39.76	35.811
5510	102	39.69	35.825
5550	110	40.71	36.271
5710	142	39.85	35.761
5755	151	39.95	35.784
5795	159	40.12	35.810

802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	79.97	74.957
5290	58	79.74	75.715
5530	106	79.59	75.049
5690	138	79.55	74.921
5775	155	79.70	74.950

[ANT2]

802.11a Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	23.84	16.722
5200	40	23.24	16.741
5240	48	24.09	16.741
5260	52	22.92	16.765
5300	60	23.27	16.778
5320	64	23.01	16.742
5500	100	23.00	16.777
5580	116	25.07	16.765
5720	144	24.99	16.766
5745	149	24.01	16.737
5785	157	23.84	16.739
5825	165	23.41	16.752

802.11n(HT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	23.99	17.917
5200	40	25.05	17.902
5240	48	24.79	17.886
5260	52	25.05	17.900
5300	60	24.62	17.899
5320	64	24.16	17.917
5500	100	24.52	17.896
5580	116	25.00	17.892
5720	144	23.95	17.870
5745	149	24.48	17.884
5785	157	24.09	17.951
5825	165	23.75	17.899

802.11n(HT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.40	35.858
5230	46	39.27	35.850
5270	54	39.31	35.679
5310	62	39.89	35.791
5510	102	39.14	35.766
5550	110	39.55	35.871
5710	142	39.38	35.691
5755	151	38.95	35.845
5795	159	39.54	35.739

802.11ac(VHT20) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5180	36	25.13	17.905
5200	40	24.53	17.902
5240	48	25.13	17.883
5260	52	23.91	17.904
5300	60	24.08	17.910
5320	64	24.75	17.879
5500	100	24.58	17.900
5580	116	25.22	17.872
5720	144	24.83	17.866
5745	149	24.65	17.926
5785	157	24.73	17.907
5825	165	24.39	17.896

802.11ac(VHT40) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5190	38	39.55	35.805
5230	46	39.25	35.818
5270	54	39.08	35.755
5310	62	39.60	35.693
5510	102	39.54	35.753
5550	110	39.39	35.803
5710	142	39.51	35.796
5755	151	39.32	35.718
5795	159	39.42	35.794

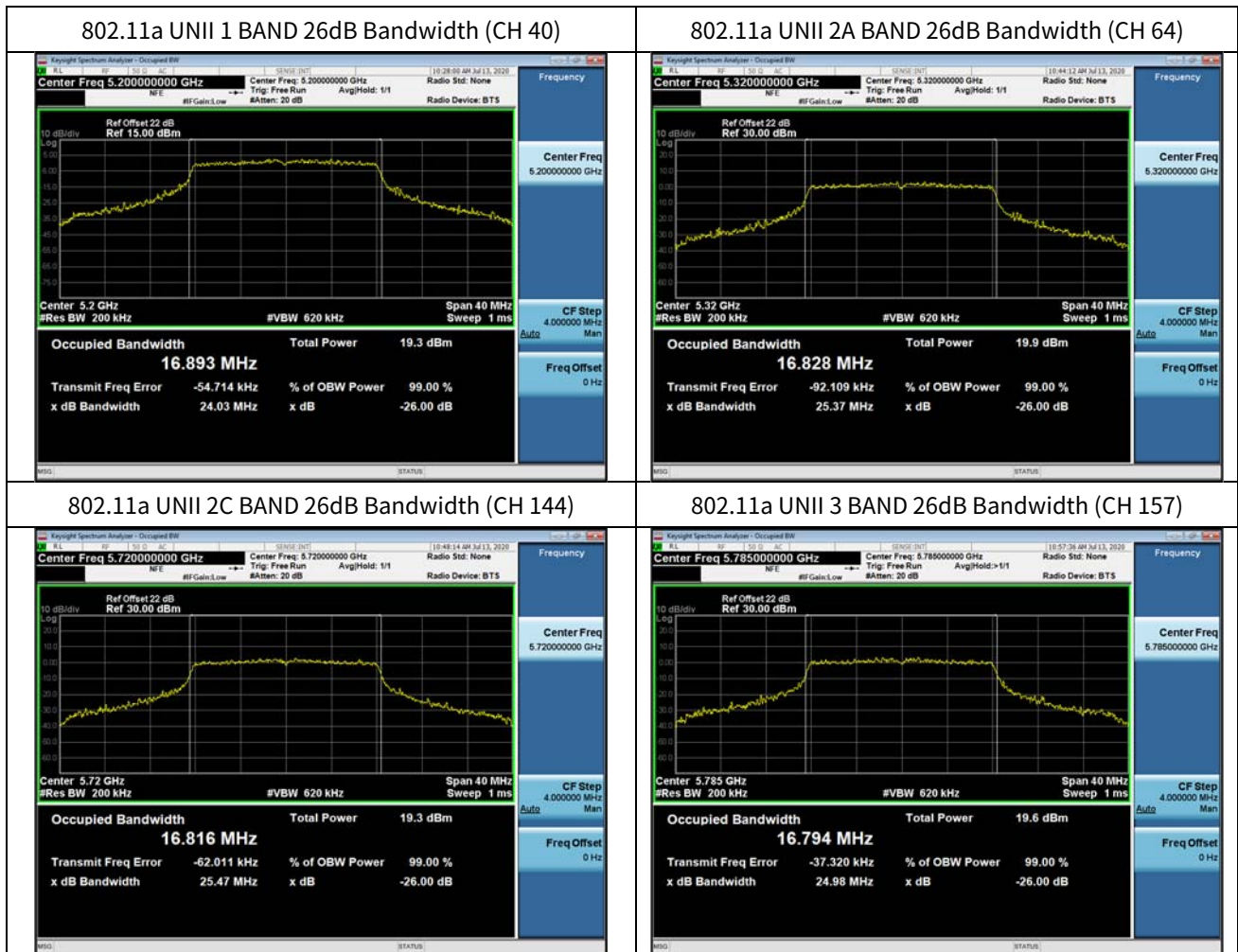
802.11ac(VHT80) Mode		26dB Bandwidth [MHz]	99% bandwidth [MHz]
Frequency [MHz]	Channel No.		
5210	42	79.18	74.999
5290	58	79.29	74.864
5530	106	79.43	74.983
5690	138	79.21	75.059
5775	155	79.09	74.944

[ANT1]

▣ Test Plots(802.11a)

Note:

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



□ Test Plots(802.11n(HT20))

Note:

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

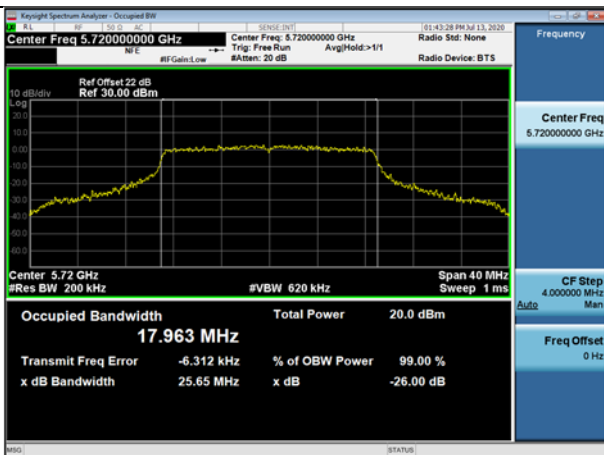
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 36)



802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 64)



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



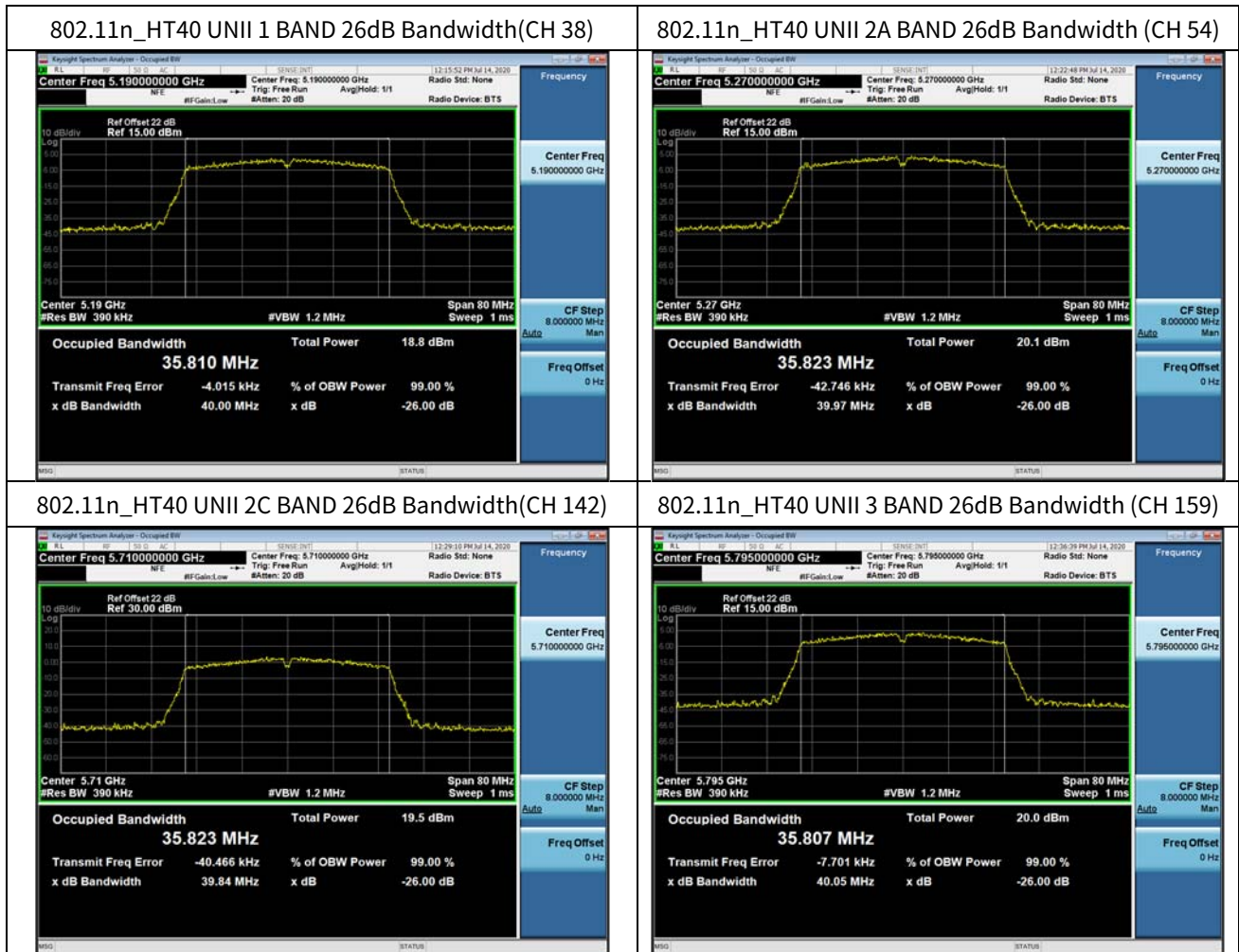
802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 165)



□ Test Plots(802.11n(HT40))

Note:

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



■ Test Plots(802.11ac(VHT20))

Note:

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



□ Test Plots(802.11ac(VHT40))

Note:

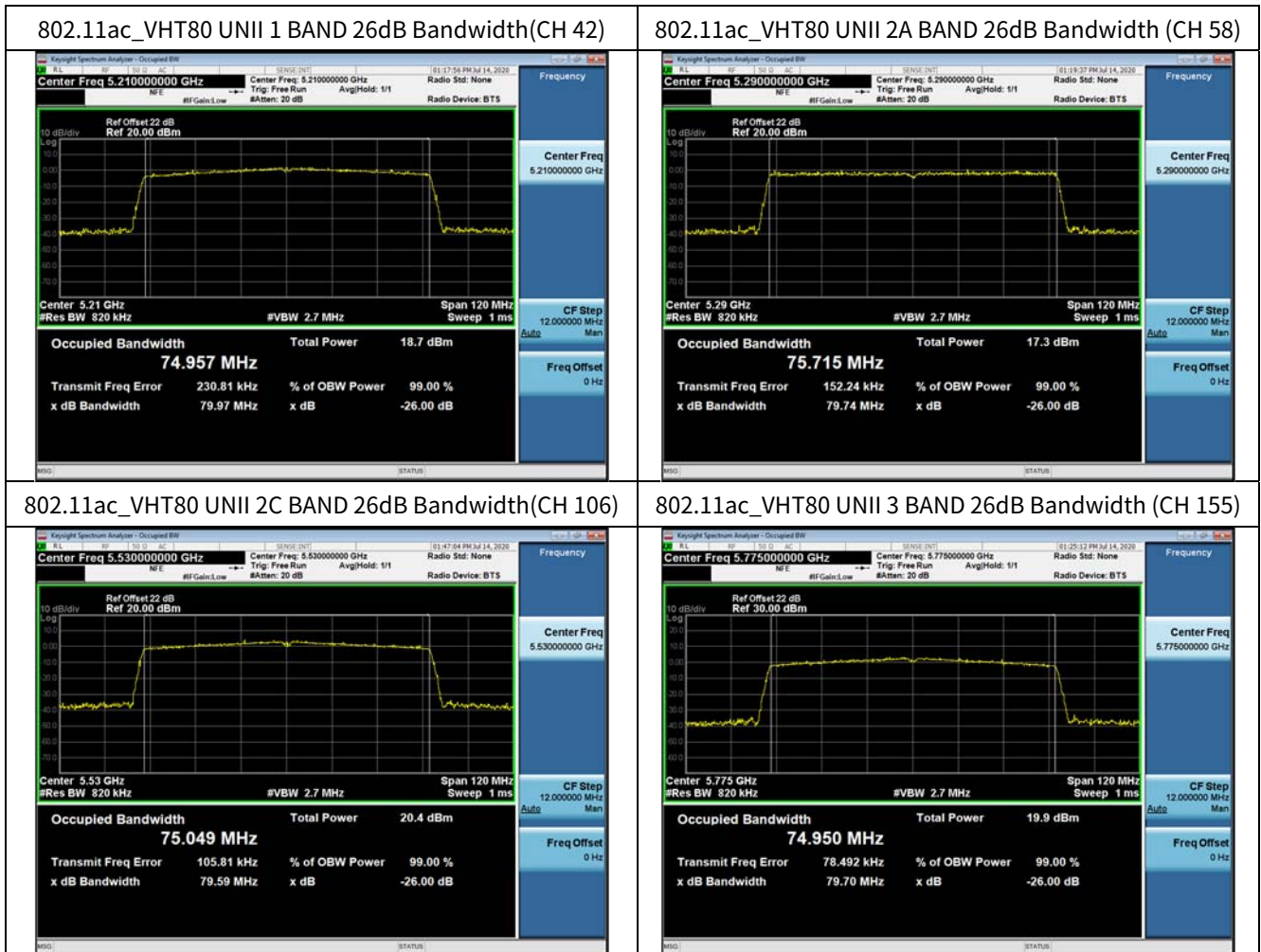
In order to simplify the report, attached plots were only the most wide channel.



□ Test Plots(802.11ac(VHT80))

Note:

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

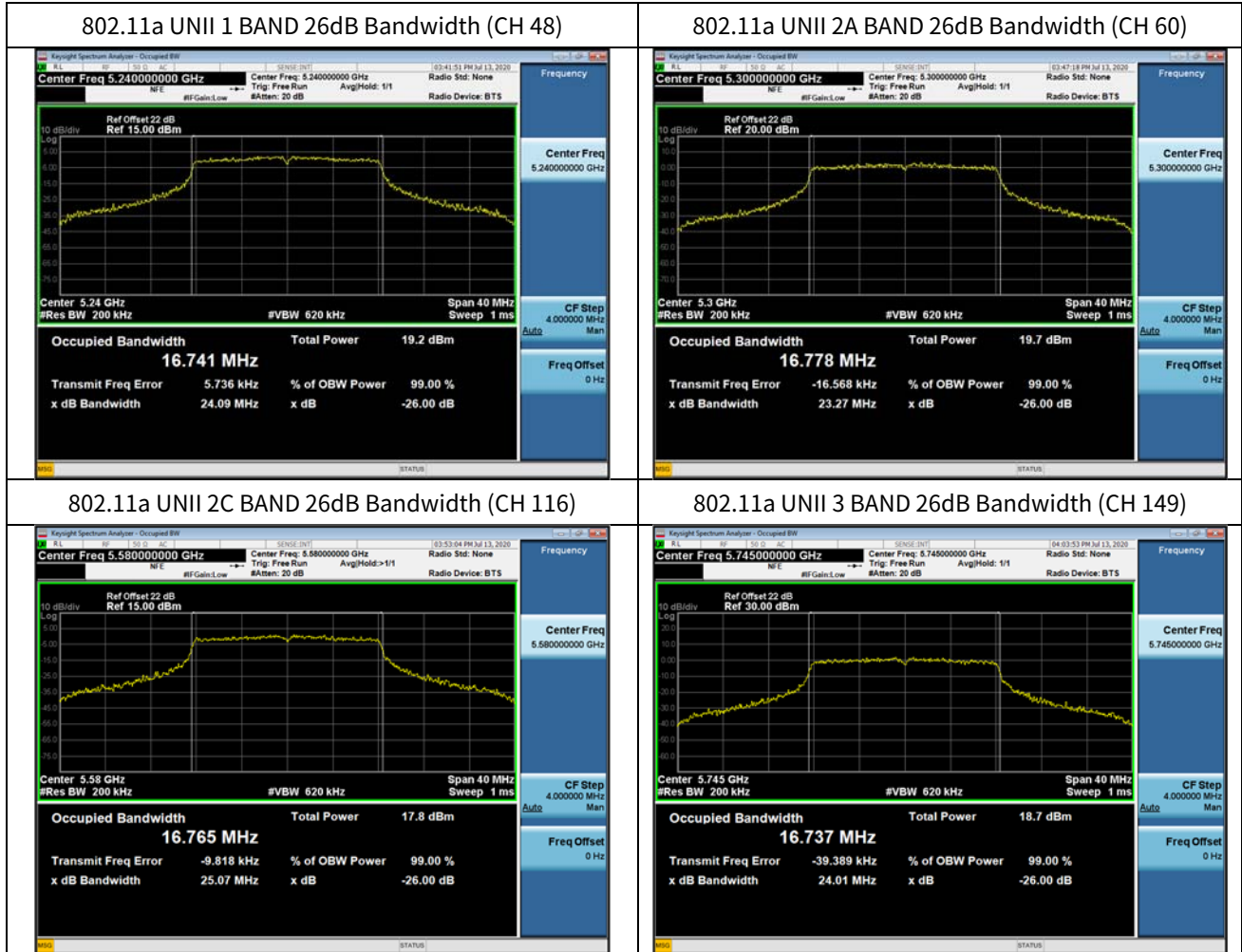


[ANT2]

▣ Test Plots(802.11a)

Note:

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



□ Test Plots(802.11n(HT20))

Note:

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

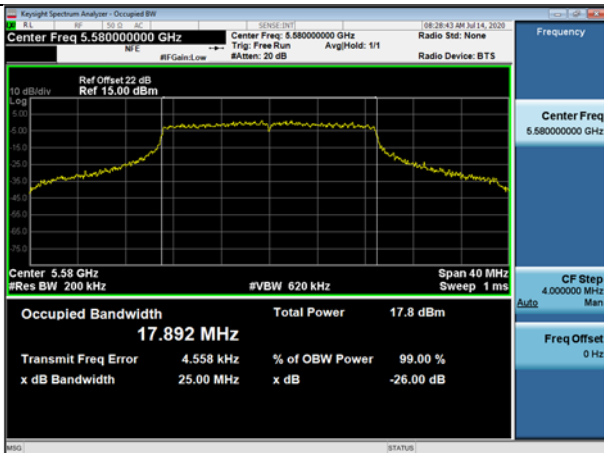
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 40)



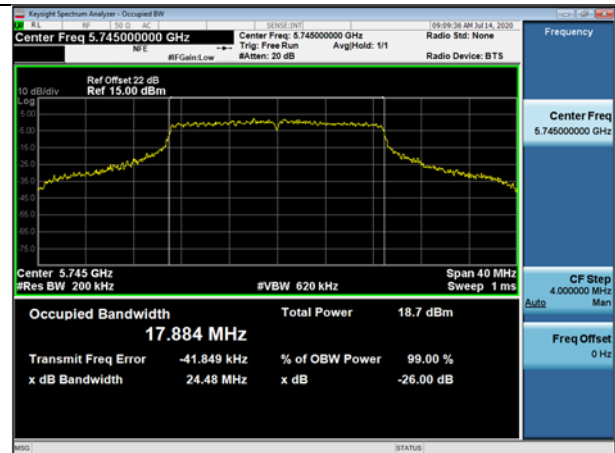
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 52)



802.11n_HT20 UNII 2C BAND 26dB Bandwidth(CH 116)



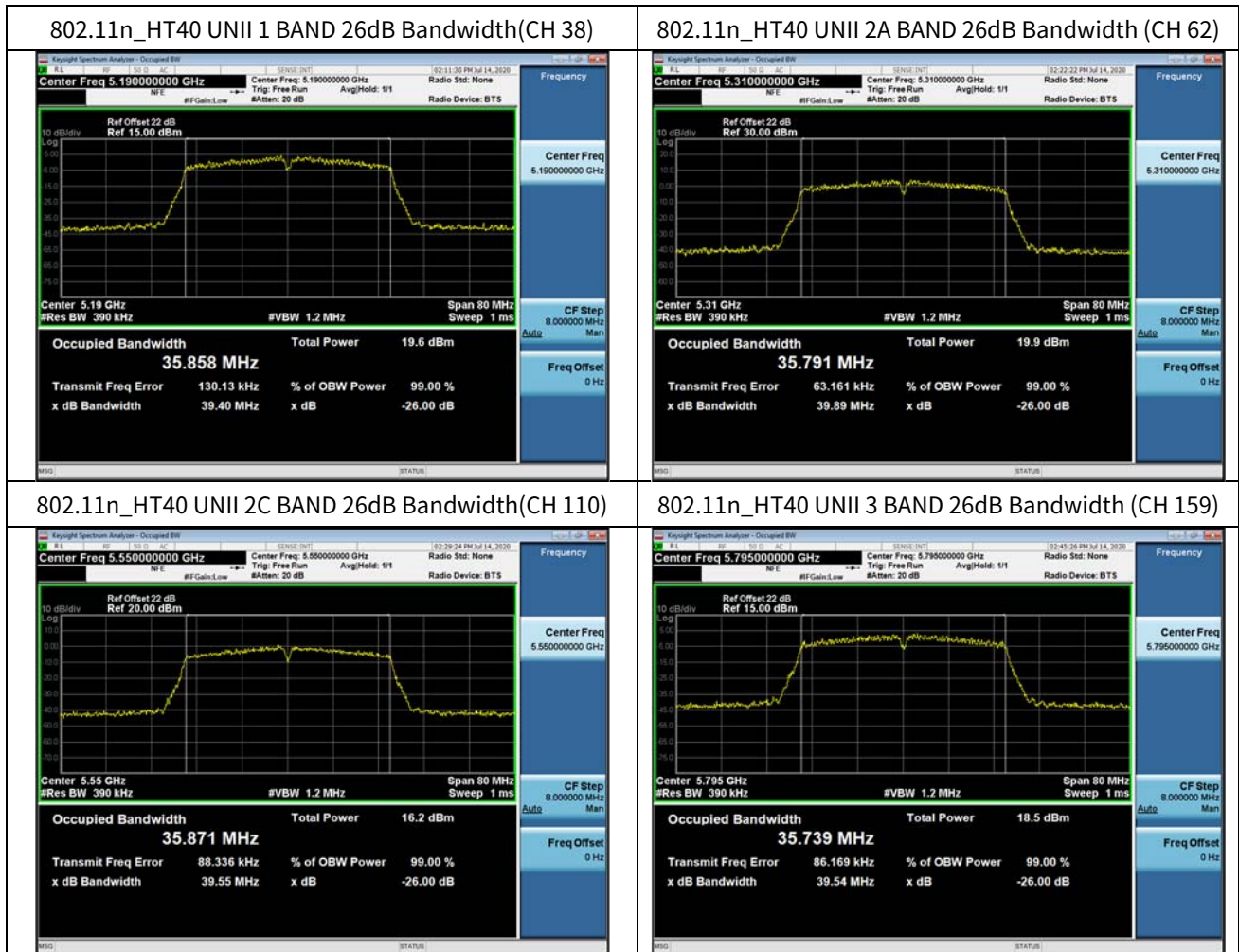
802.11n_HT20 UNII 3 BAND 26dB Bandwidth(CH 149)



□ Test Plots(802.11n(HT40))

Note:

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



■ Test Plots(802.11ac(VHT20))

Note:

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



□ Test Plots(802.11ac(VHT40))

Note:

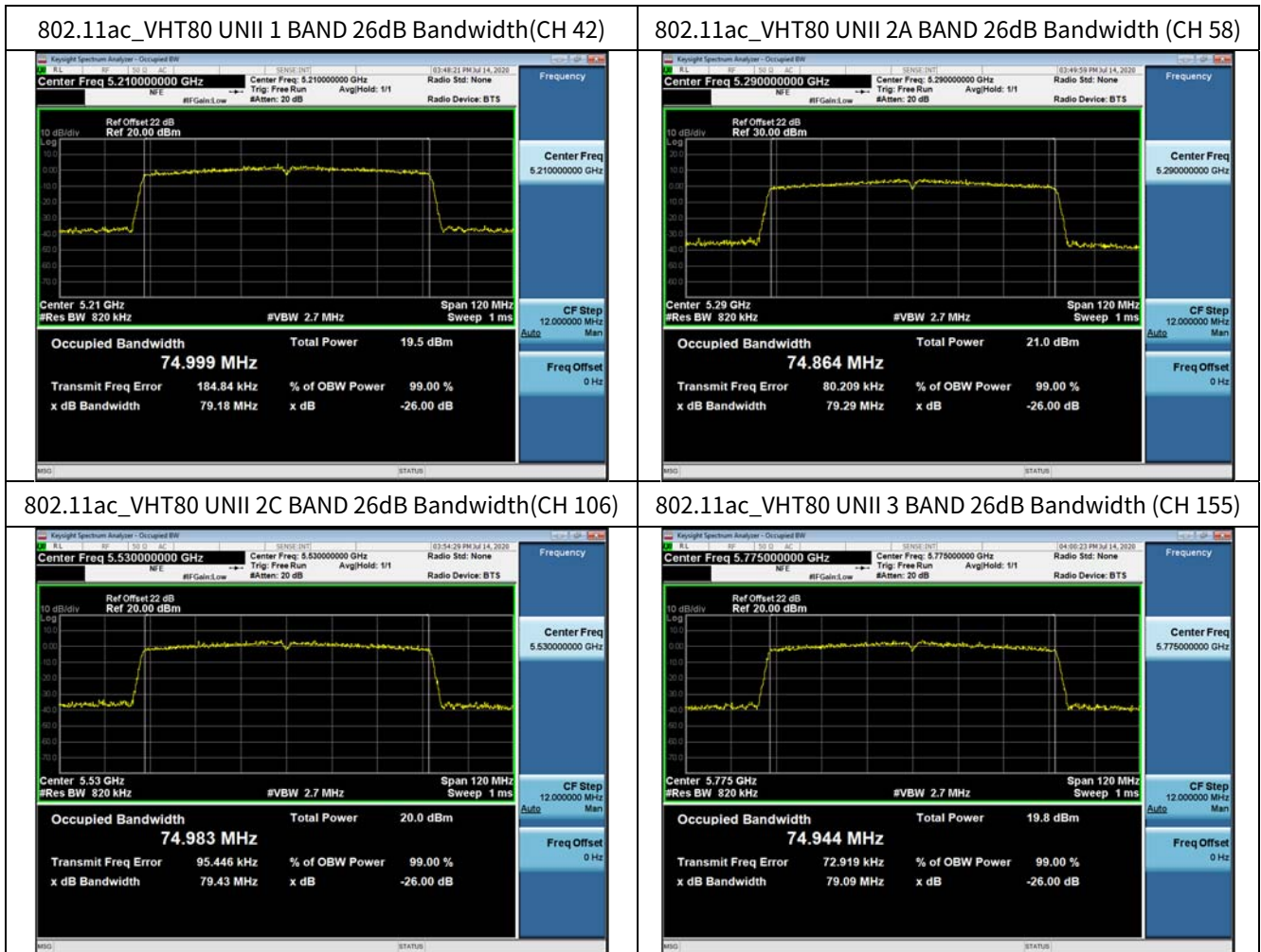
In order to simplify the report, attached plots were only the most wide channel.



□ Test Plots(802.11ac(VHT80))

Note:

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



10.2 6DB BANDWIDTH & 99 % Bandwidth

[ANT1]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.45	> 0.5	Pass
5785	157	16.44	> 0.5	Pass
5825	165	16.48	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.73	> 0.5	Pass
5785	157	17.73	> 0.5	Pass
5825	165	17.74	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	35.54	> 0.5	Pass
5795	159	35.73	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.70	> 0.5	Pass
5785	157	17.73	> 0.5	Pass
5825	165	17.78	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	35.32	> 0.5	Pass
5795	159	34.50	> 0.5	Pass



802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.71	> 0.5	Pass

[ANT2]

802.11a Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	16.55	> 0.5	Pass
5785	157	16.51	> 0.5	Pass
5825	165	16.49	> 0.5	Pass

802.11n(HT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.75	> 0.5	Pass
5785	157	17.70	> 0.5	Pass
5825	165	17.69	> 0.5	Pass

802.11n(HT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	35.46	> 0.5	Pass
5795	159	34.45	> 0.5	Pass

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	17.68	> 0.5	Pass
5785	157	17.78	> 0.5	Pass
5825	165	17.77	> 0.5	Pass

802.11ac(VHT40) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5755	151	35.15	> 0.5	Pass
5795	159	34.66	> 0.5	Pass



802.11ac(VHT80) Mode		Measured Bandwidth [MHz]	Limit [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5775	155	75.79	> 0.5	Pass

[ANT1]

Test Plots

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

802.11a (CH.157)



802.11n(HT20) (CH.149)



802.11n(HT40) (CH.151)



802.11ac(VHT20) (CH.149)



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.

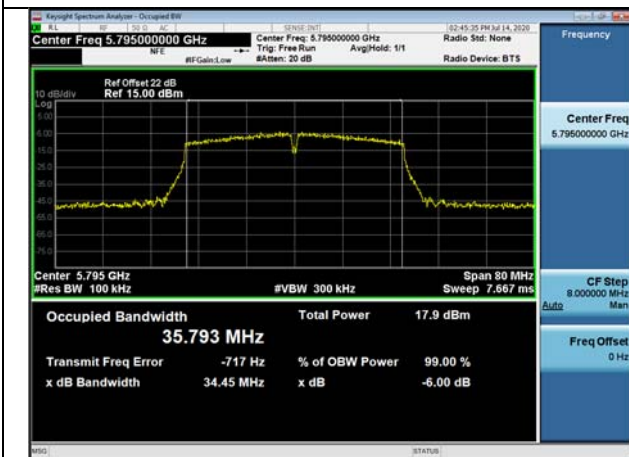
802.11a (CH.165)



802.11n(HT20) (CH.165)



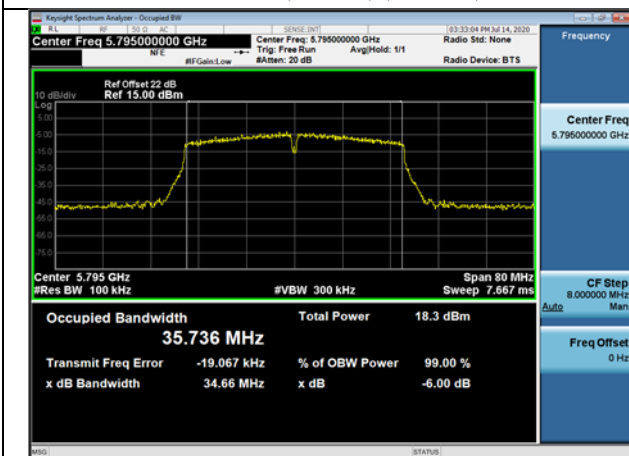
802.11n(HT40) (CH.159)



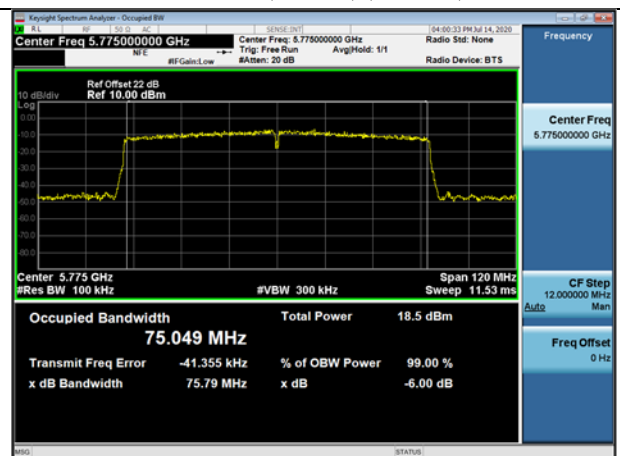
802.11ac(VHT20) (CH.149)



802.11ac(VHT40) (CH.159)



802.11ac(VHT80) (CH.155)



99 % Bandwidth measurement(IC)

[ANT1]

802.11a Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.707
5200	40	17.649
5240	48	17.222
5260	52	17.696
5300	60	17.698
5320	64	17.624
5500	100	17.570
5580	116	17.588
5720	144	17.703
5745	149	17.549
5785	157	17.671
5825	165	17.560

802.11n(HT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	18.666
5200	40	18.737
5240	48	18.700
5260	52	18.637
5300	60	18.296
5320	64	18.669
5500	100	18.672
5580	116	18.701
5720	144	18.538
5745	149	18.537
5785	157	18.700
5825	165	18.743

802.11n(HT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.030
5230	46	35.906
5270	54	35.937
5310	62	35.936
5510	102	36.031
5550	110	35.979
5710	142	35.864
5755	151	35.936
5795	159	35.989

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	18.758
5200	40	18.784
5240	48	18.708
5260	52	18.743
5300	60	18.661
5320	64	18.797
5500	100	18.728
5580	116	18.713
5720	144	18.648
5745	149	18.688
5785	157	18.593
5825	165	18.659



802.11ac(VHT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	36.030
5230	46	35.980
5270	54	35.903
5310	62	35.864
5510	102	35.998
5550	110	36.504
5710	142	35.879
5755	151	36.071
5795	159	35.942

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5210	42	75.193
5290	58	75.118
5530	106	75.155
5690	138	75.167
5775	155	75.122

[ANT2]

802.11a Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	17.520
5200	40	17.438
5240	48	17.373
5260	52	17.354
5300	60	17.512
5320	64	17.430
5500	100	17.413
5580	116	17.476
5720	144	17.469
5745	149	17.351
5785	157	17.344
5825	165	17.363

802.11n(HT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	18.294
5200	40	18.278
5240	48	18.243
5260	52	18.241
5300	60	18.279
5320	64	18.236
5500	100	18.234
5580	116	18.245
5720	144	18.282
5745	149	18.237
5785	157	18.269
5825	165	18.283

802.11n(HT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	35.855
5230	46	35.816
5270	54	35.979
5310	62	35.831
5510	102	35.987
5550	110	35.973
5710	142	35.769
5755	151	35.917
5795	159	35.920

802.11ac(VHT20) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5180	36	18.255
5200	40	18.292
5240	48	18.257
5260	52	18.283
5300	60	18.206
5320	64	18.282
5500	100	18.226
5580	116	18.230
5720	144	18.209
5745	149	18.256
5785	157	18.274
5825	165	18.274



802.11ac(VHT40) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5190	38	35.894
5230	46	35.922
5270	54	35.844
5310	62	35.918
5510	102	35.826
5550	110	35.828
5710	142	36.010
5755	151	35.931
5795	159	35.914

802.11ac(VHT80) Mode		Measured Bandwidth [MHz]
Frequency [MHz]	Channel No.	
5210	42	75.120
5290	58	75.112
5530	106	75.193
5690	138	75.130
5775	155	75.127

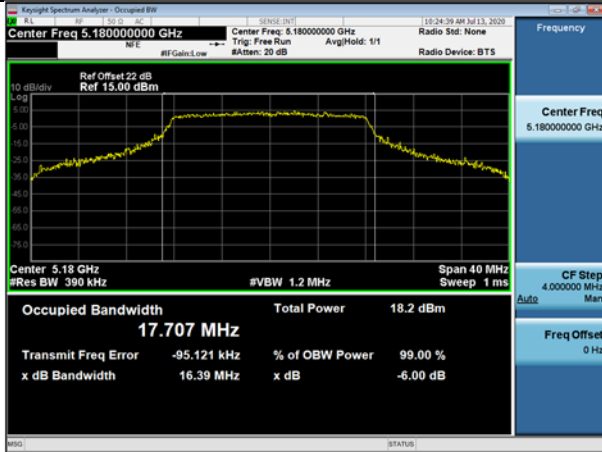
Test Plots(802.11a)

[ANT1]

Note:

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

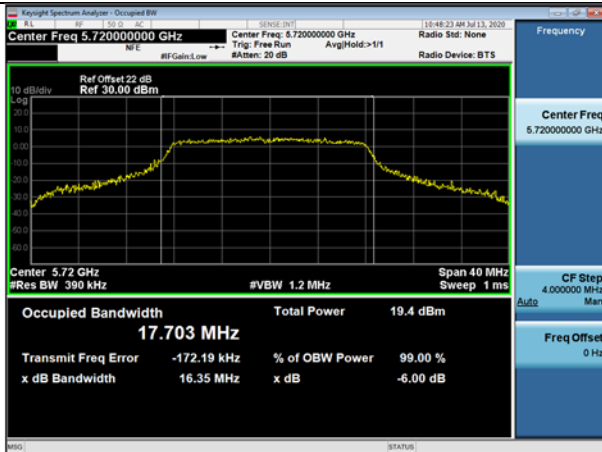
802.11a UNII 1 (CH 36)



802.11a UNII 2A (CH 60)



802.11a UNII 2C (CH 144)



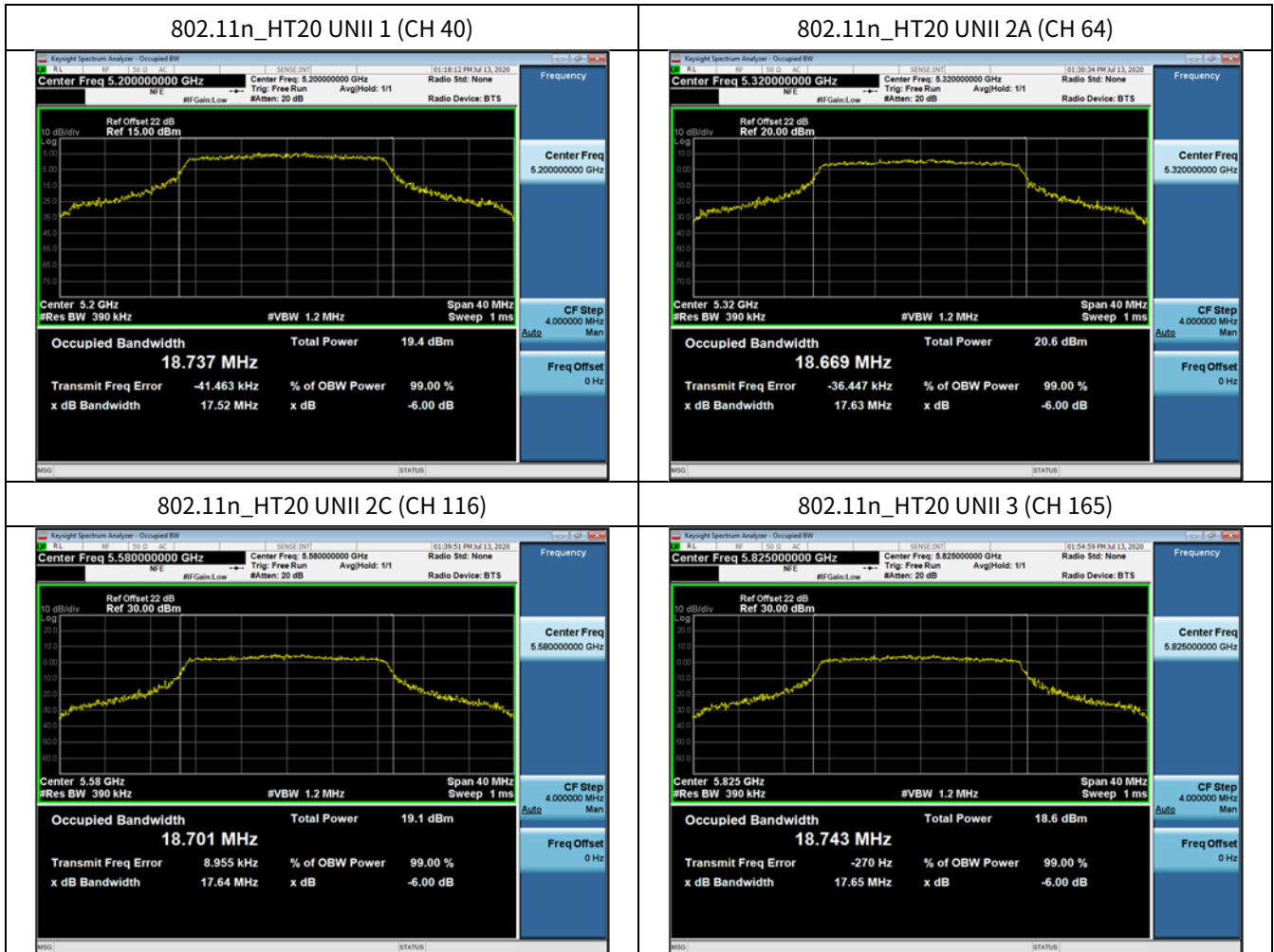
802.11a UNII 3 (CH 157)



■ Test Plots(802.11n(HT20))

Note:

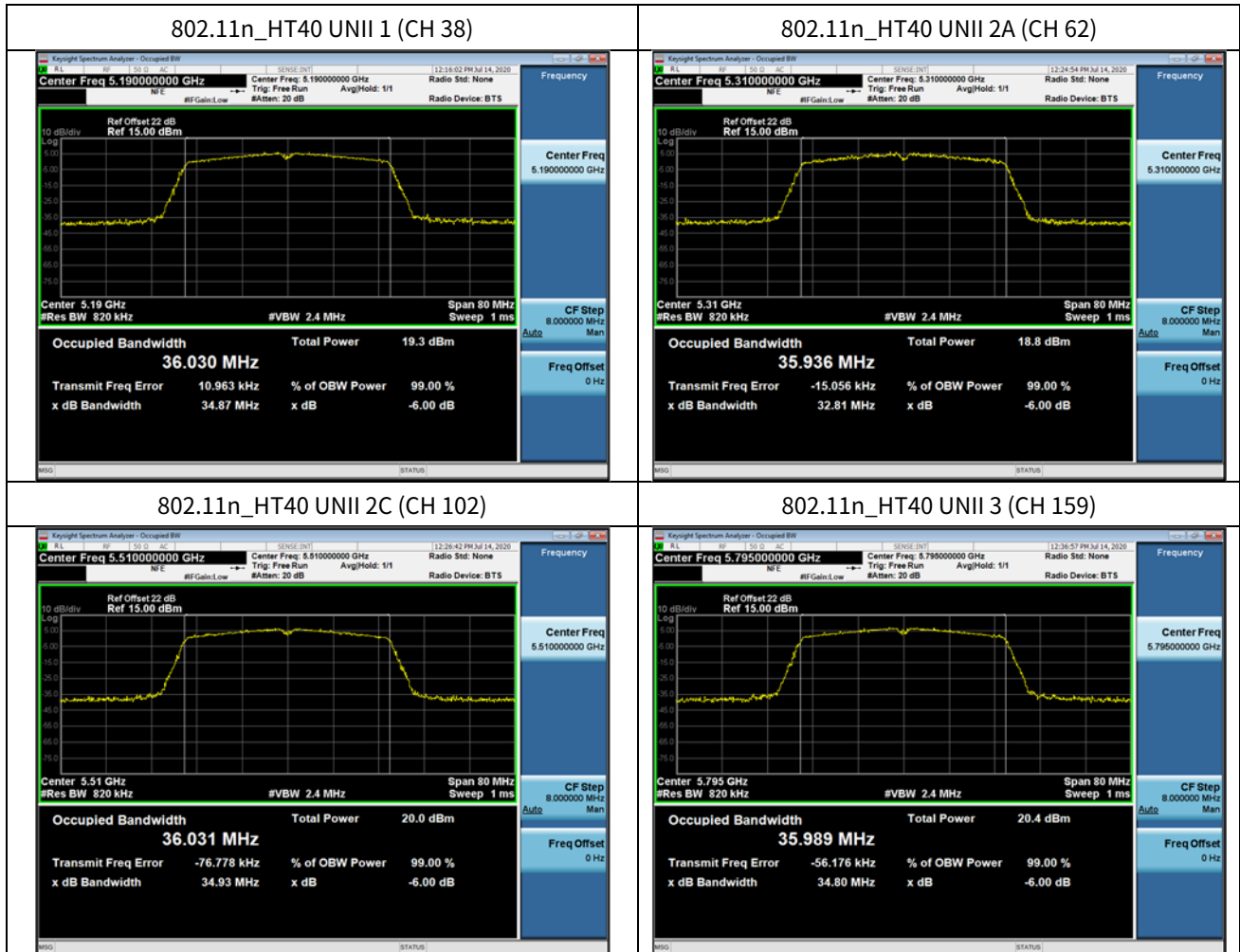
In order to simplify the report, attached plots were only the most narrow channel.



■ Test Plots(802.11n(HT40))

Note:

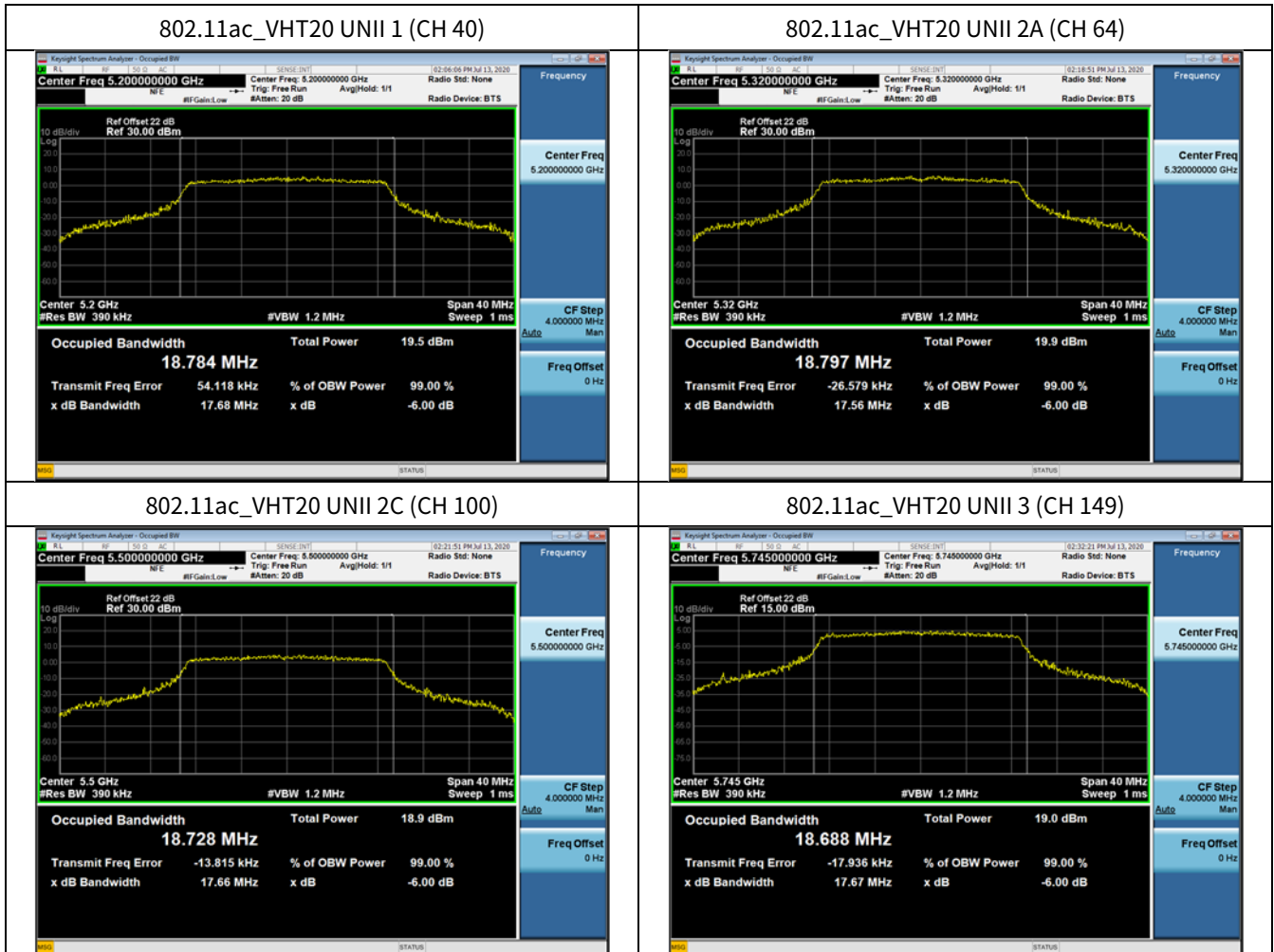
In order to simplify the report, attached plots were only the most narrow channel.



■ Test Plots(802.11ac(VHT20))

Note:

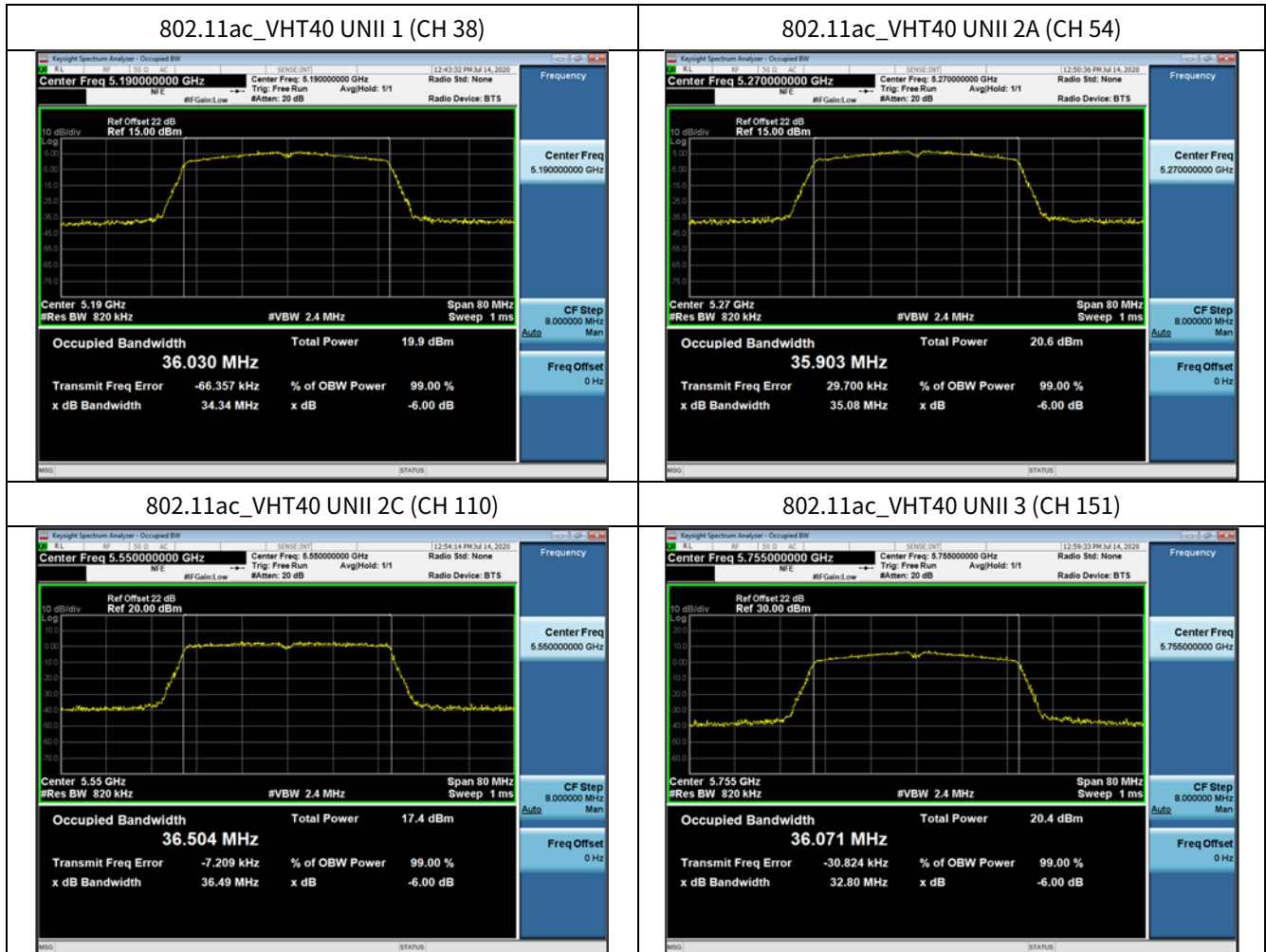
In order to simplify the report, attached plots were only the most narrow channel.



■ Test Plots(802.11ac(VHT40))

Note:

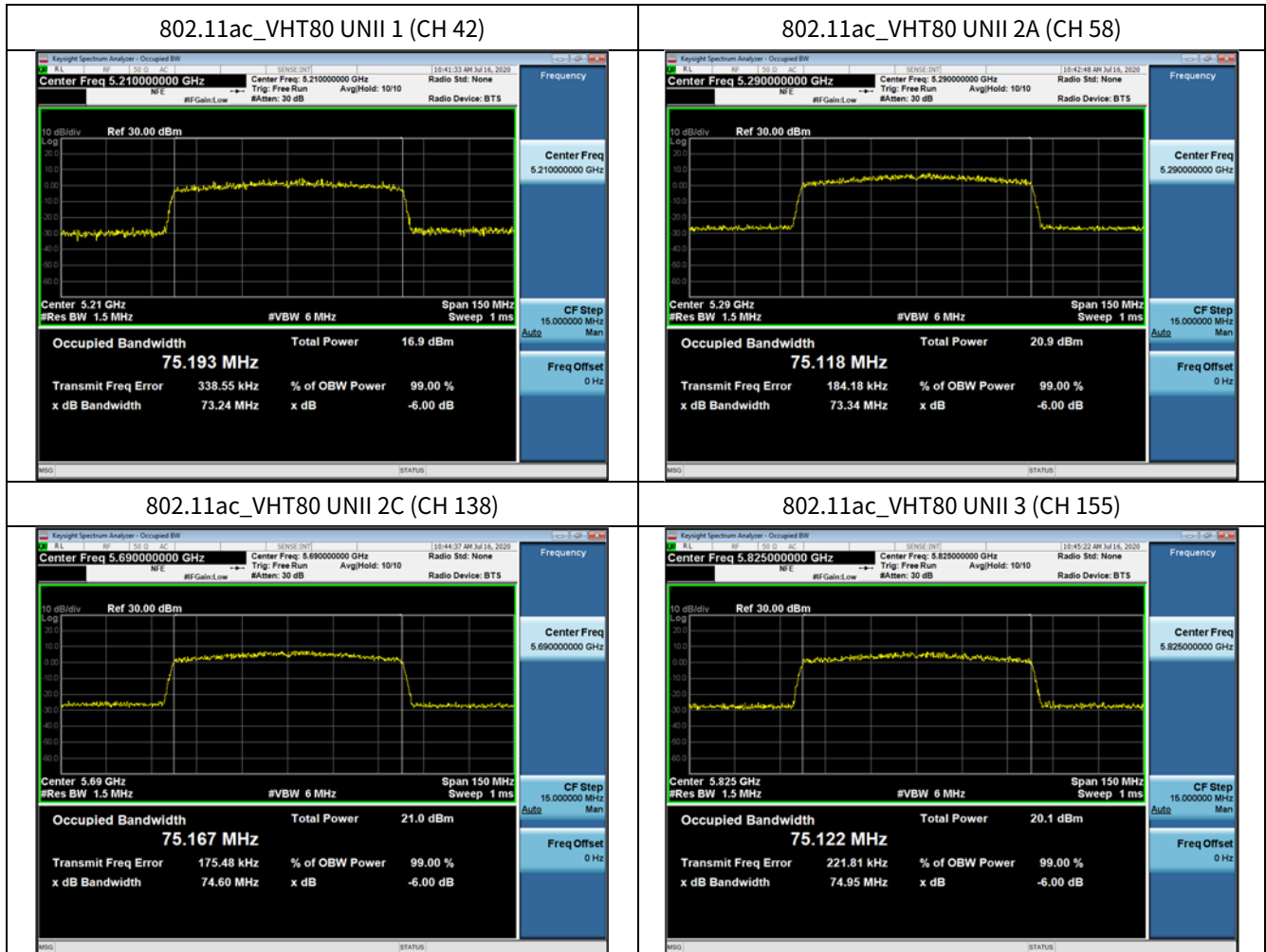
In order to simplify the report, attached plots were only the most narrow channel.



■ Test Plots(802.11ac(VHT80))

Note:

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

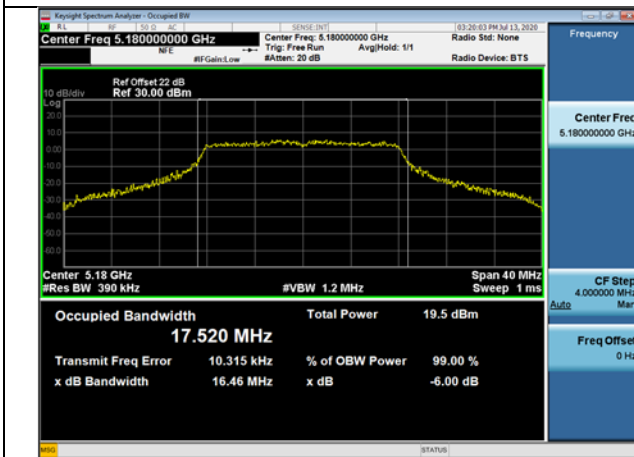


[ANT2]

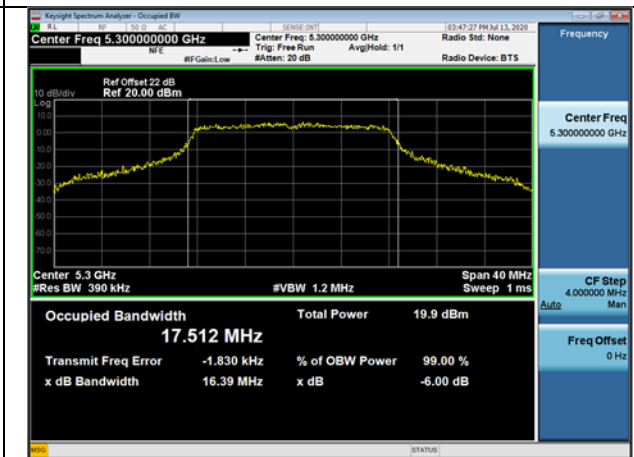
Note:

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

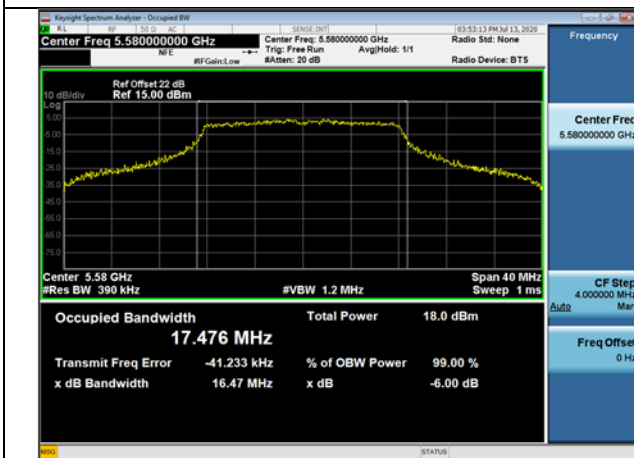
802.11a UNII 1 (CH 36)



802.11a UNII 2A (CH 60)



802.11a UNII 2C (CH 116)



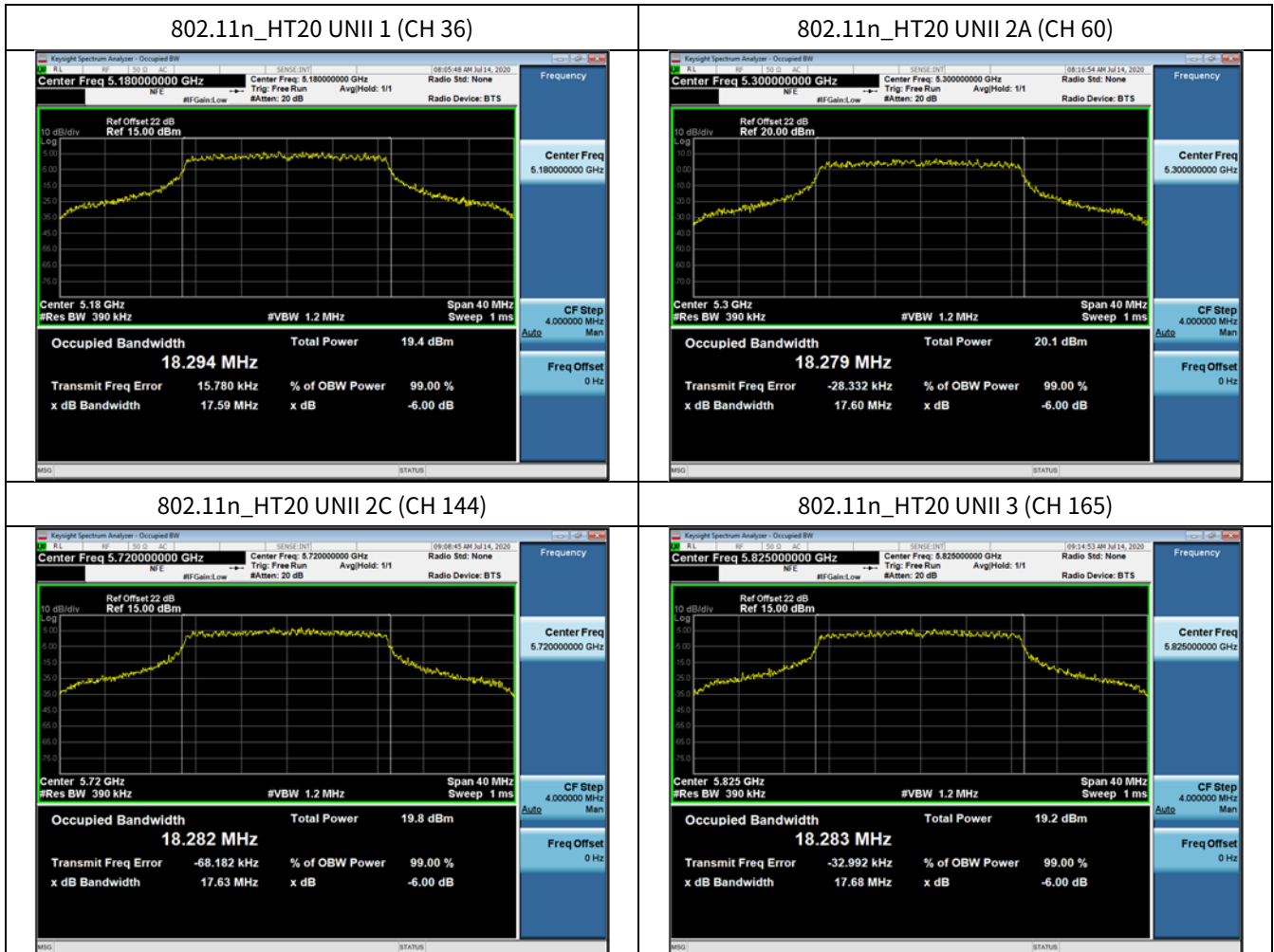
802.11a UNII 3 (CH 165)



■ Test Plots(802.11n(HT20))

Note:

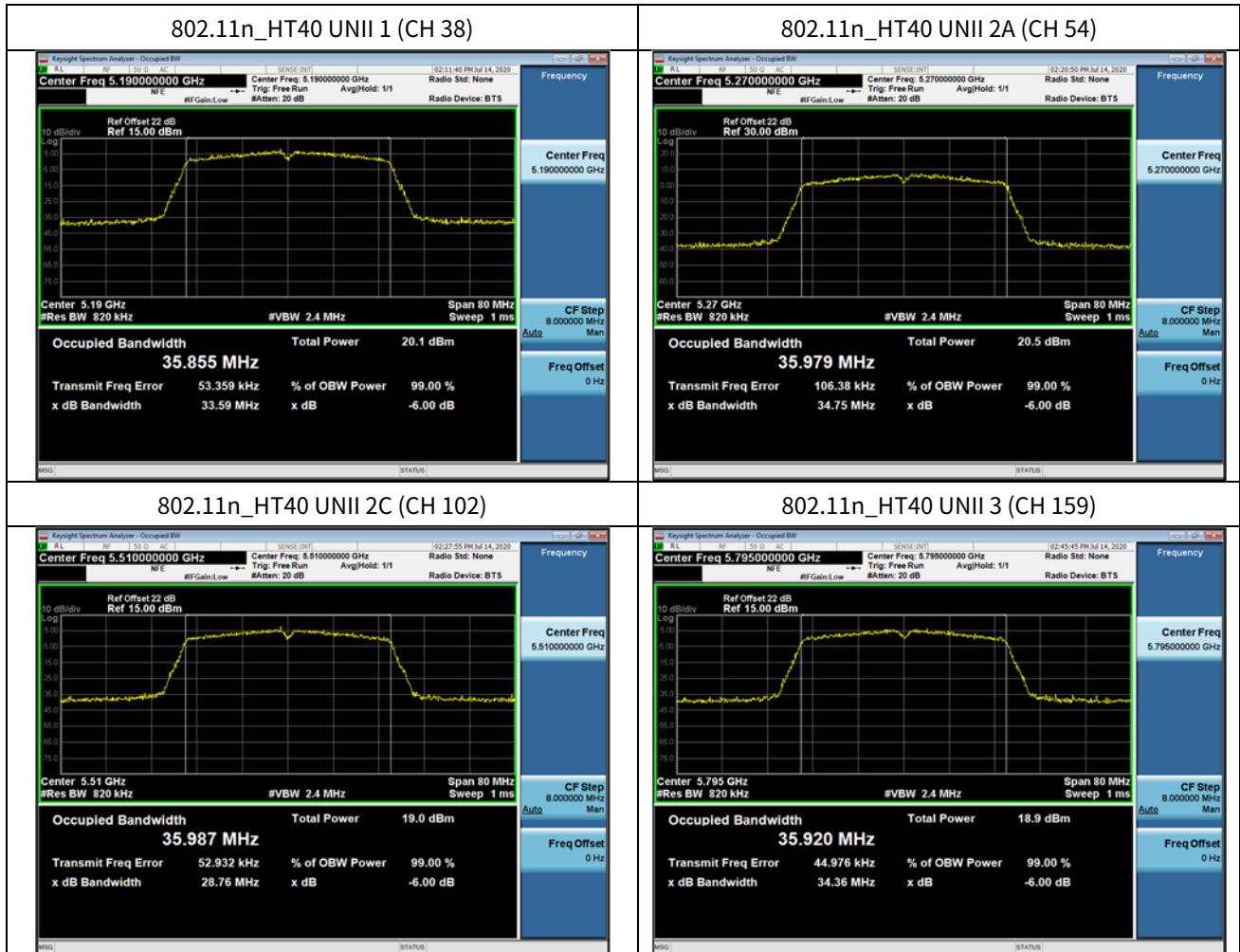
In order to simplify the report, attached plots were only the most narrow channel.



■ Test Plots(802.11n(HT40))

Note:

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



■ Test Plots(802.11ac(VHT20))

Note:

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

