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FCC UNII REPORT

FCC Certification

Applicant Name:
KAONMEDIA Co., Ltd.

Address:
KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea

Date of Issue:
May 17, 2018

Test Site/Location:
HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majang-myeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-RF-1805-FC028-R1

FCC ID : WQTAR4520

APPLICANT : KAONMEDIA Co., Ltd.

Model: AR4520

EUT Type: AP Router

Modulation type OFDM

FCC Classification: Unlicensed National Information Infrastructure(UNII)

FCC Rule Part(s): Part 15.407

Band	Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	Ant.0 Power (dBm)	Ant.1 Power (dBm)	Ant.2 Power (dBm)	Ant.3 Power (dBm)	Ant. 0 & 1 & 2 & 3 Power (dBm)
UNII1	802.11a	20	5180 – 5240	13.52	13.85	14.16	14.08	19.93
	802.11n	20	5180 – 5240	13.30	13.53	14.06	13.98	19.74
	802.11n	40	5190 - 5230	11.13	11.64	11.81	12.17	17.72
	802.11ac	20	5180 – 5240	13.34	13.72	14.08	14.15	19.85
	802.11ac	40	5190 - 5230	10.43	10.89	11.17	11.70	17.08
	802.11ac	80	5210	9.91	10.20	10.81	10.69	16.43
UNII2A	802.11a	20	5260 – 5320	9.37	9.26	9.76	10.00	15.62
	802.11n	20	5260 – 5320	9.87	9.68	10.07	10.35	16.02
	802.11n	40	5270 – 5310	9.31	9.42	9.64	10.02	15.62
	802.11ac	20	5260 – 5320	9.42	9.14	9.70	9.91	15.57
	802.11ac	40	5270 – 5310	9.33	9.09	9.67	9.93	15.53
	802.11ac	80	5290	9.36	9.05	9.81	9.89	15.55
UNII2C	802.11a	20	5500 – 5720	8.47	7.47	8.32	7.91	14.07
	802.11n	20	5500 – 5720	8.44	7.43	8.24	7.82	14.01
	802.11n	40	5510 – 5710	8.65	8.28	8.72	7.84	14.40
	802.11ac	20	5500 – 5720	8.57	7.65	8.45	7.81	14.15
	802.11ac	40	5510 – 5710	9.07	8.01	9.10	8.42	14.68
	802.11ac	80	5530 – 5690	8.92	8.71	9.11	7.96	14.71
UNII3	802.11a	20	5745 – 5825	14.98	13.90	14.73	14.44	20.54
	802.11n	20	5745 – 5825	14.68	13.85	14.46	14.54	20.41
	802.11n	40	5755 – 5795	14.79	13.98	15.10	14.90	20.72
	802.11ac	20	5745 – 5825	14.69	13.82	14.50	14.53	20.41
	802.11ac	40	5755 – 5795	14.79	13.98	14.76	14.88	20.63
	802.11ac	80	5775	14.97	14.26	15.18	15.04	20.89

Mode	Channel Bandwidth (MHz)	Frequency Range (MHz)	Ant.0 + Ant.2 Power (dBm)	Ant.1 + Ant.3 Power (dBm)	Ant. 0 & 1 & 2 & 3 Power (dBm)
802.11ac	160	5210 + 5290	9.25	9.53	12.40
802.11ac	160	5530 + 5610	9.21	8.21	11.73

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.

HCT CO., LTD. Certifies that no party to this application has subject to a denial of Fede ral benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Se Wook Park
Engineer of Telecommunication testing center

Approved by : Kwon Jeong
Manager of Telecommunication testing center

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Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-RF-1805-FC028	May 15, 2018	- First Approval Report
HCT-RF-1805-FC028-R1	May 17, 2018	- Modify antenna gain and MIMO gain on Pages 9, 103 and 257

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1. GENERAL INFORMATION

Applicant: KAONMEDIA Co., Ltd.

Address: KAONMEDIA Building, 884-3, Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, South Korea

FCC ID: WQTAR4520

EUT Type: AP Router

Model: AR4520

Date(s) of Tests: April 10, 2018 ~ May 08, 2018

Place of Tests: HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea

2. EUT DESCRIPTION

Model	AR4520	
EUT Type	AP Router	
Power Supply	DC 12 V	
Frequency Range	TX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A)/ 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A)/ 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A)/ 5530 - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
	160 MHz BW:	5210MHz + 5290MHz / 5530MHz + 5610MHz
	RX_20 MHz BW:	5180 MHz - 5240 MHz (UNII 1) / 5260 MHz - 5320 MHz (UNII 2A)/ 5500 MHz - 5720 MHz (UNII 2C) / 5745 MHz - 5825 MHz (UNII 3)
	40 MHz BW:	5190 MHz - 5230 MHz (UNII 1) / 5270 MHz - 5310 MHz (UNII 2A)/ 5510 MHz - 5710 MHz (UNII 2C) / 5755 MHz - 5795 MHz (UNII 3)
	80 MHz BW:	5210 MHz (UNII 1) / 5290 MHz (UNII 2A)/ 5530 - 5690 MHz (UNII 2C) / 5775 MHz (UNII 3)
	160 MHz BW:	5210MHz + 5290MHz / 5530MHz + 5610MHz
Modulation Type	OFDM(802.11a, 802.11n, 802.11ac)	
Antenna Specification	Antenna type: Ext Antenna Peak Gain : cf. Section 6	

2.1 EUT OPERATING MODE

▣ Operating mode

Mode	Operating Mode	Operating Ant.
802.11a/n/ac	SISO	Ant 0
		Ant 1
		Ant 2
		Ant 3
	MIMO(CDD)	Ant 0 & 1 & 2 & 3

Note : In case of radiation test, we have done all test case. Worst case is MIMO (Ant 0 & 1 & 2 & 3).

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.

3.1 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.

3.2 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.

3.3 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 8 of ANSI C63.10. (Version: 2013)

Conducted Antenna Terminal

See Section from 8.1 to 8.4.(KDB 789033 D02 v02r01)

3.4 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.
Channel low, mid and high with highest data rate (worst case) is chosen for full testing.

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 equipments, which is traceable to recognized national standards.
Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2006).

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, 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 July 07, 2015 (Registration Number: 90661)

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203, §15.407

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

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

* The E.U.T Complies with the requirement of §15.203, §15.407

▣ Directional Gain Calculations

▪ According to KDB662911 D01 Multiple Transmitter Output v02r01;

Cyclic Delay Diversity (N_{ANT} =2, 3, 4/ Nss=1)

If all antennas have the same gain, G_{ANT}

- Directional gain(dBi) = G_{ANT} + Array Gain
- Array Gain(PSD) = 10 log(N_{ANT}/Nss) dB.
- Array Gain(Power) = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$ (Without Beamforming)
- Array Gain(Power) = 10 log(N_{ANT}/Nss) dB (Include Beamforming).

Spatial Multiplexing (N_{ANT} =2, 3, 4/ Nss=2, 3, 4)

If all antennas have the same gain, G_{ANT}

- Directional gain(dBi) = G_{ANT} + Array Gain
- Array Gain = 10 log(N_{ANT}/Nss) dB.

▣ Antenna Gain

5GHz Band

Antenna Gain(SISO)	Ant 0	6.486 dBi
	Ant 1	6.80 dBi
	Ant 2	6.482 dBi
	Ant 3	6.478 dBi

▣ Directional Gain

Band	Test Description	N_{ANT}/ Nss	Array Gain Calculation (dB)	Directional Gain (= G_{ANT} + Array Gain) (dBi)
UNII 1	Power (Include Beamforming)	4 / 1	10 log(N_{ANT}/Nss)	12.51
	Power (Without Beamforming)	4 / 1	0	6.486
	PSD	4 / 1	10 log(N_{ANT}/Nss)	12.51
UNII 2A	Power (Include Beamforming)	4 / 1	10 log(N_{ANT}/Nss)	12.82
	Power (Without Beamforming)	4 / 1	0	6.80
	PSD	4 / 1	10 log(N_{ANT}/Nss)	12.82
UNII 2C	Power (Include Beamforming)	4 / 1	10 log(N_{ANT}/Nss)	12.50
	Power (Without Beamforming)	4 / 1	0	6.482
	PSD	4 / 1	10 log(N_{ANT}/Nss)	12.50
UNII 3	Power (Include Beamforming)	4 / 1	10 log(N_{ANT}/Nss)	12.50
	Power (Without Beamforming)	4 / 1	0	6.478
	PSD	4 / 1	10 log(N_{ANT}/Nss)	12.50

Note:

1. The antennas have the same gain for each band.
2. Beamforming is only supported 802.11ac.
3. All modes of operation were investigated and the worst case configuration results are reported in report.

   Worst case : Cyclic Delay Diversity (N_{ANT}=4, Nss=1, Include Beamforming)

7. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.4:2014.

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

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

8. SUMMARY OF TEST RESULTS

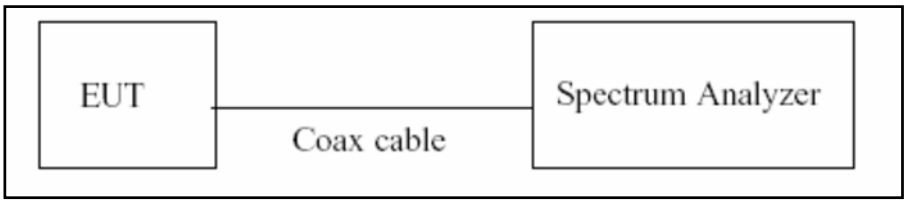
Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
26dB Bandwidth	§15.407 (for Power Measurement)	N/A	CONDUCTED	PASS
6 dB Bandwidth	§15.407(e)	>500 kHz (5725-5850 MHz)		PASS
Maximum Conducted Output Power	§15.407(a)	< 1 W (5150-5250 MHz) < 250 mW or 11+10 log $\log_{10}$ (BW) 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)	<17 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)	NA		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) <-17 dBm/MHz EIRP within 5715-5725 MHz and 5850-5860 MHz (UNII3) <-27 dBm/MHz EIRP outside 5715-5860 MHz (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

9. TEST RESULT

9.1 DUTY CYCLE

The zero-span mode on a spectrum analyzer or EMI receiver ,if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/*T*, where *T* is defined in section B)1)a), and the number of sweep points across duration *T* exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

▣ TEST CONFIGURATION



▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, (B.2 in KDB 789033 D02 v02r01)

The largest availble value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if T ≤ 6.25 microseconds. (50/6.25 = 8)

The zero-span method was used becaure all measured T data are > 6.25 microseconds and both RBW and VBW are > 50/*T*.

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

▣ Duty Cycle Factor

Mode	Data Rate (Mbps)	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11a	6	2.064	2.171	95.062	0.220
	9	1.385	1.455	95.171	0.215
	12	1.043	1.093	95.436	0.203
	18	0.704	0.739	95.228	0.212
	24	0.532	0.558	95.330	0.208
	36	0.364	0.387	94.008	0.268
	48	0.276	0.300	92.092	0.358
	54	0.249	0.272	91.455	0.388
Mode	**MCS INDEX**	**T_{on} (ms)**	**T_{total} (ms)**	**Duty Cycle**	**Duty Cycle Factor (dB)**
802.11n_HT20	MCS 0	1.919	2.017	95.161	0.215
	MCS 1	0.980	1.029	95.231	0.212
	MCS 2	0.664	0.696	95.374	0.206
	MCS 3	0.508	0.531	95.582	0.196
	MCS 4	0.352	0.375	93.750	0.280
	MCS 5	0.273	0.296	92.202	0.353
	MCS 6	0.248	0.272	91.348	0.393
	MCS 7	0.228	0.251	90.827	0.418
802.11n_HT40	MCS 0	0.943	1.043	90.434	0.437
	MCS 1	0.492	0.541	90.985	0.410
	MCS 2	0.340	0.373	91.202	0.400
	MCS 3	0.264	0.288	91.924	0.366
	MCS 4	0.188	0.212	89.018	0.505
	MCS 5	0.152	0.175	86.842	0.613
	MCS 6	0.140	0.163	85.859	0.662
	MCS 7	0.128	0.151	84.750	0.719

Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_VHT20	MCS 0	1.928	1.956	98.545	0.064
	MCS 1	0.984	1.013	97.143	0.126
	MCS 2	0.672	0.700	96.000	0.177
	MCS 3	0.511	0.539	94.810	0.231
	MCS 4	0.356	0.384	92.701	0.329
	MCS 5	0.276	0.304	90.643	0.427
	MCS 6	0.252	0.281	89.852	0.465
	MCS 7	0.233	0.261	89.091	0.502
	MCS 8	0.200	0.229	87.543	0.578
802.11ac_ VHT40	MCS 0	0.952	0.981	97.044	0.130
	MCS 1	0.496	0.523	94.837	0.230
	MCS 2	0.344	0.372	92.473	0.340
	MCS 3	0.267	0.296	90.203	0.448
	MCS 4	0.192	0.220	87.273	0.591
	MCS 5	0.156	0.184	84.783	0.717
	MCS 6	0.143	0.172	83.140	0.802
	MCS 7	0.132	0.160	82.500	0.835
	MCS 8	0.116	0.144	80.556	0.939
	MCS 9	0.111	0.139	79.856	0.977
802.11ac_ VHT80	MCS 0	0.460	0.488	94.262	0.257
	MCS 1	0.252	0.280	90.000	0.458
	MCS 2	0.179	0.208	86.058	0.652
	MCS 3	0.148	0.176	84.091	0.753
	MCS 4	0.112	0.140	80.000	0.969
	MCS 5	0.096	0.124	77.419	1.112
	MCS 6	0.088	0.116	75.862	1.200
	MCS 7	0.084	0.112	75.000	1.249
	MCS 8	0.076	0.104	73.077	1.362
	MCS 9	0.072	0.100	72.000	1.427

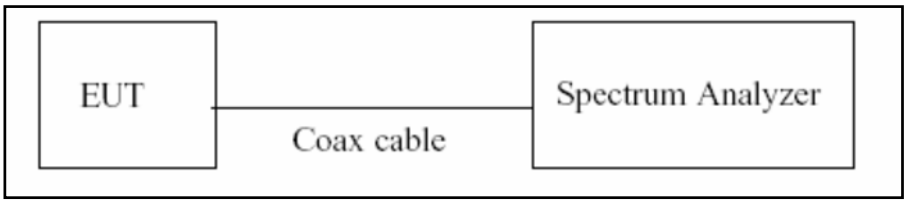
Mode	MCS INDEX	T_{on} (ms)	T_{total} (ms)	Duty Cycle	Duty Cycle Factor (dB)
802.11ac_ VHT160	MCS 0	0.252	0.280	89.881	0.463
	MCS 1	0.148	0.176	83.964	0.759
	MCS 2	0.112	0.140	79.910	0.974
	MCS 3	0.096	0.124	77.419	1.112
	MCS 4	0.075	0.103	72.816	1.378
	MCS 5	0.068	0.096	70.833	1.498
	MCS 6	0.064	0.092	69.565	1.576
	MCS 7	0.063	0.092	68.478	1.644
	MCS 8	0.060	0.088	68.182	1.663
	MCS 9	0.056	0.084	66.667	1.761

9.2 EMISSION BANDWIDTH AND MINIMUM EMISSION BANDWIDTH MEASUREMENT

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating at its maximum power control level, as defined in KDB 789033 D02 v02r01, at the appropriate frequencies. The spectrum analyzer's bandwidth measurement function is configured to measure the 26 dB bandwidth.

The 26 dB bandwidth is used to determine the conducted power limits.

▣ TEST CONFIGURATION



▣ TEST PROCEDURE (26dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.
The Spectrum Analyzer is set to(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 %.

Note : We tested 26 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 26 dB.

▣ TEST PROCEDURE (for the band 5.725-5.85 GHz, 6 dB Bandwidth)

The transmitter output is connected to the Spectrum Analyzer.

The Spectrum Analyzer is set to(C.2 in KDB 789033 D02 v02r01)

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

Note : We tested 6 dB bandwidth using the automatic bandwidth measurement capability of a spectrum analyzer. X dB is set 6 dB.

▣ TEST RESULTS for Ant.0_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.14	N/A	Pass
5200	40	21.14	N/A	Pass
5240	48	21.18	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.36	N/A	Pass
5300	60	21.34	N/A	Pass
5320	64	21.18	N/A	Pass

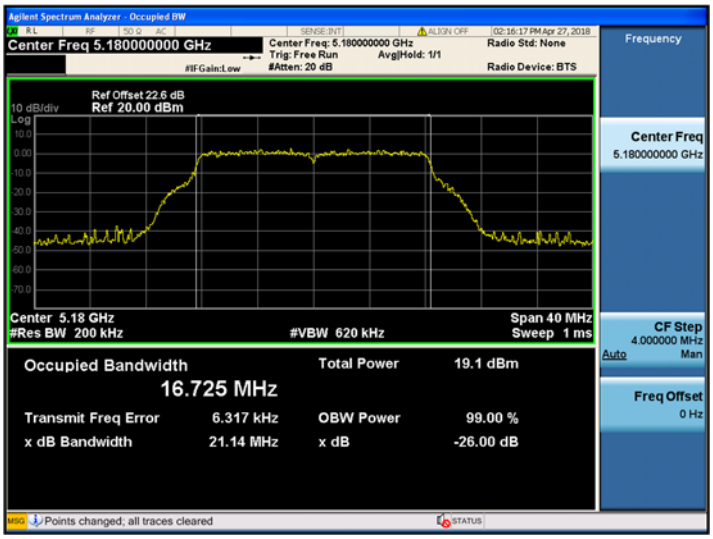
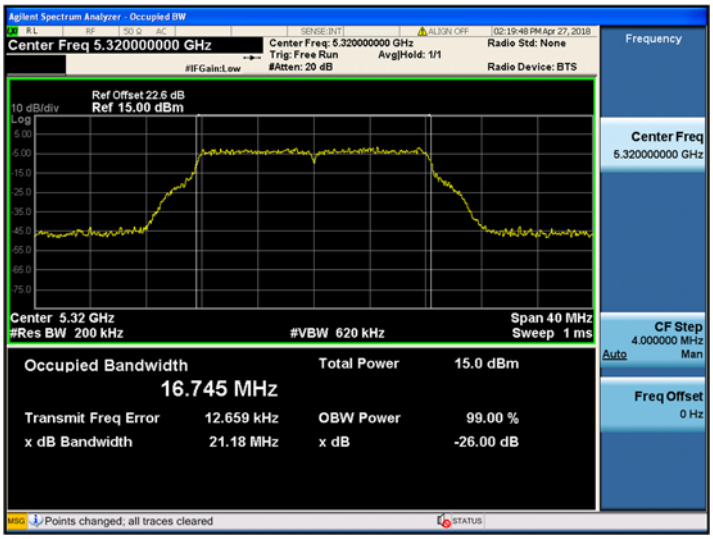
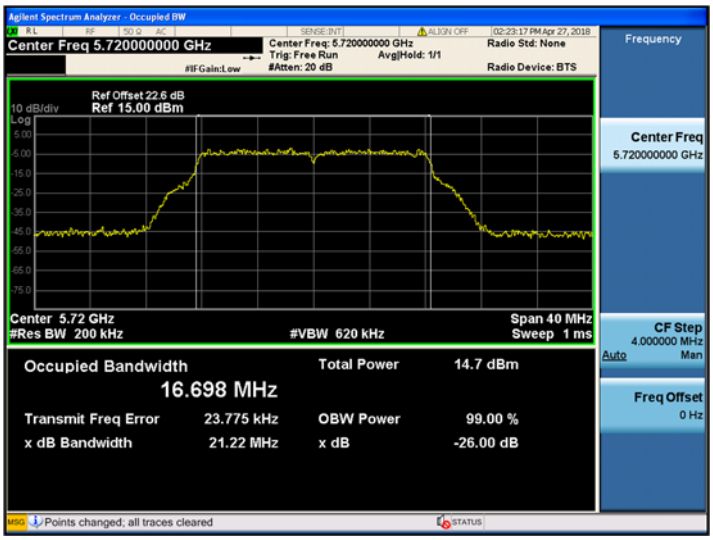
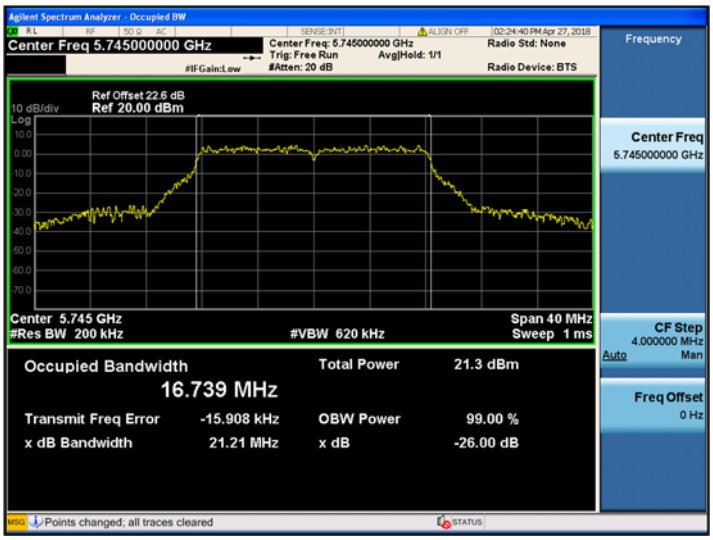
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.31	N/A	Pass
5600	120	21.32	N/A	Pass
5720	144	21.22	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.21	N/A	Pass
5785	157	21.22	N/A	Pass
5825	165	21.33	N/A	Pass

▣ TEST Plot for Ant.0_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 36)	802.11a UNII 2A BAND 26dB Bandwidth (CH 64)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 149)**
	

▣ TEST RESULTS for Ant.1_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.02	N/A	Pass
5200	40	21.28	N/A	Pass
5240	48	21.21	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.26	N/A	Pass
5300	60	21.10	N/A	Pass
5320	64	21.14	N/A	Pass

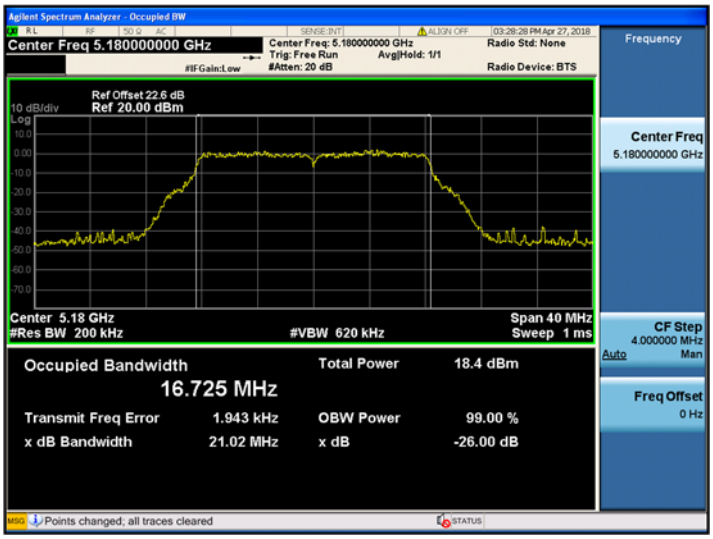
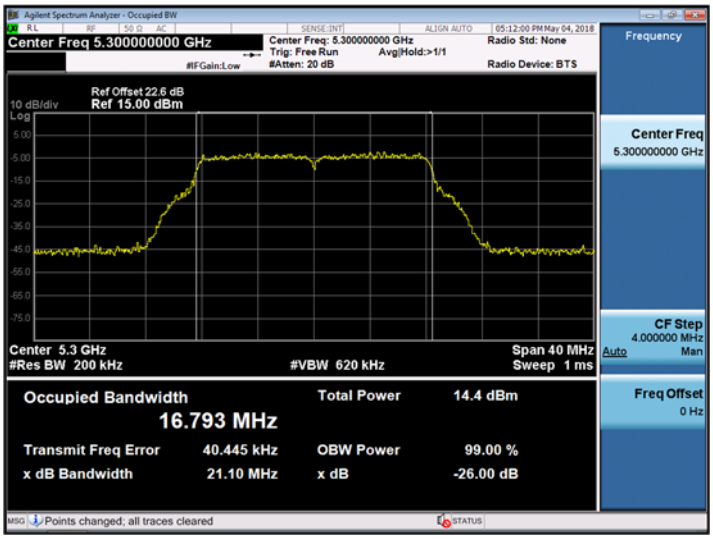
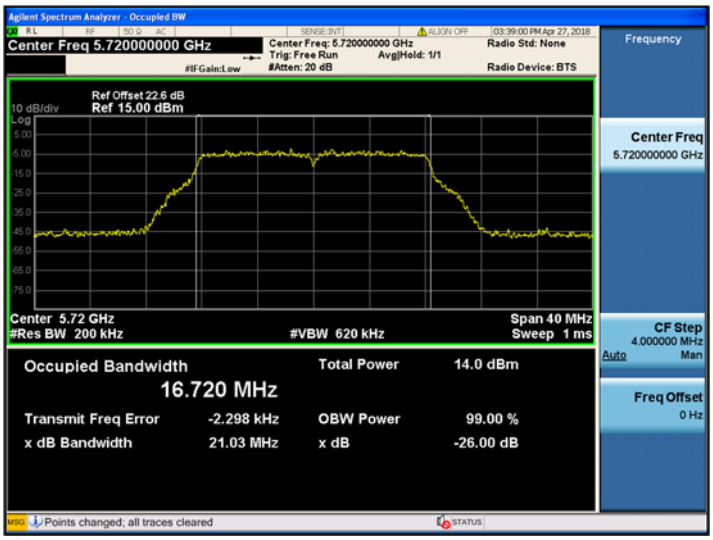
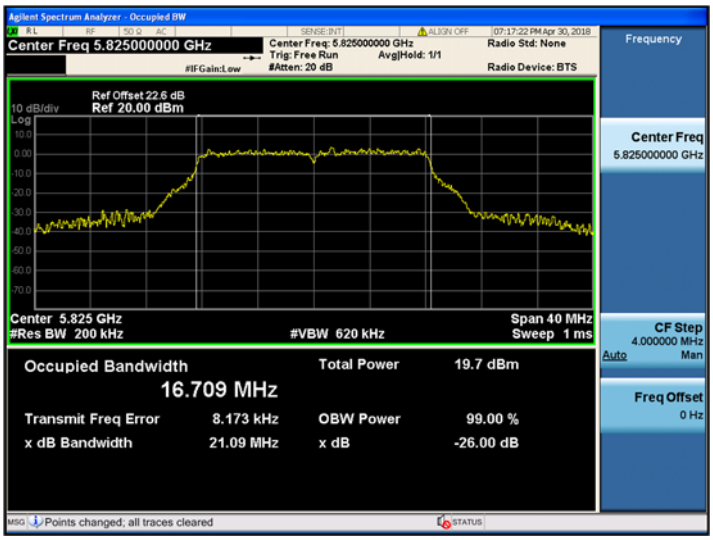
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.05	N/A	Pass
5600	120	21.08	N/A	Pass
5720	144	21.03	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.22	N/A	Pass
5785	157	21.17	N/A	Pass
5825	165	21.09	N/A	Pass

▣ TEST Plot for Ant.1_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 36)	802.11a UNII 2A BAND 26dB Bandwidth (CH 60)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**
	

▣ TEST RESULTS for Ant.2_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.19	N/A	Pass
5200	40	21.29	N/A	Pass
5240	48	21.11	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.09	N/A	Pass
5300	60	21.17	N/A	Pass
5320	64	20.89	N/A	Pass

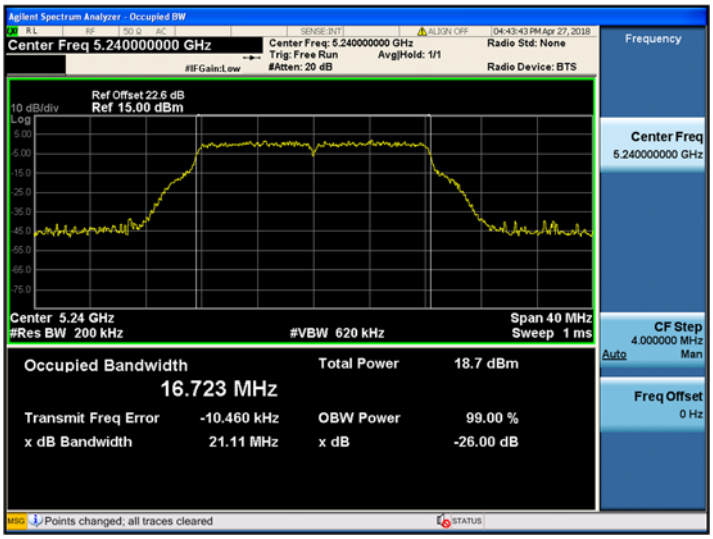
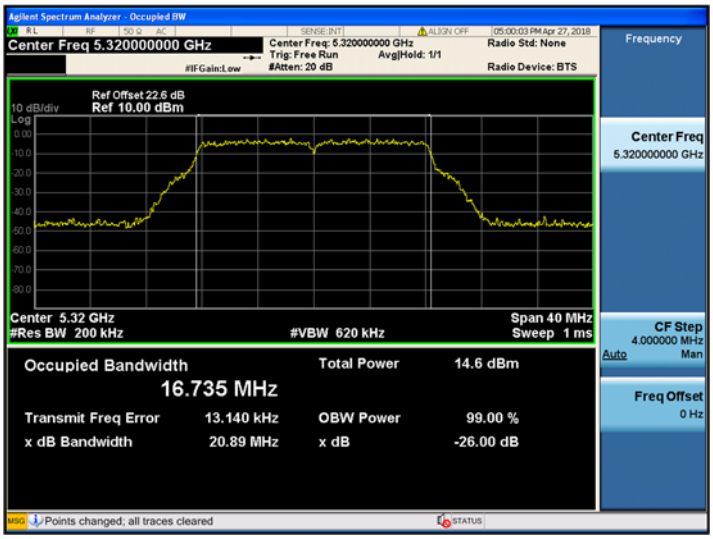
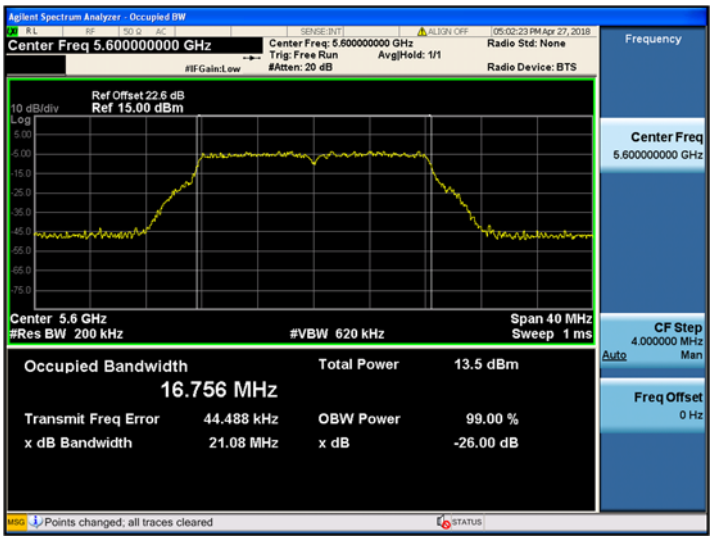
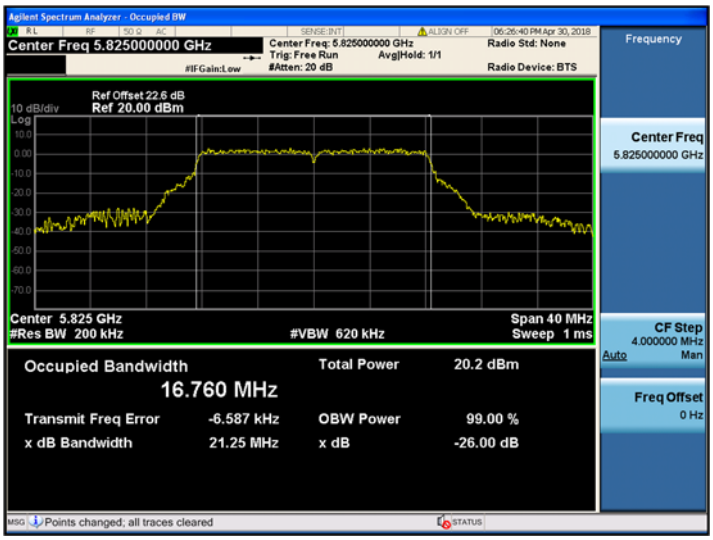
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.26	N/A	Pass
5600	120	21.08	N/A	Pass
5720	144	21.42	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.36	N/A	Pass
5785	157	21.34	N/A	Pass
5825	165	21.25	N/A	Pass

▣ TEST Plot for Ant.2_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 48)	802.11a UNII 2A BAND 26dB Bandwidth (CH 64)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 120)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 165)**
	

▣ TEST RESULTS for Ant.3_802.11a

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.21	N/A	Pass
5200	40	21.35	N/A	Pass
5240	48	21.24	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.35	N/A	Pass
5300	60	21.19	N/A	Pass
5320	64	21.24	N/A	Pass

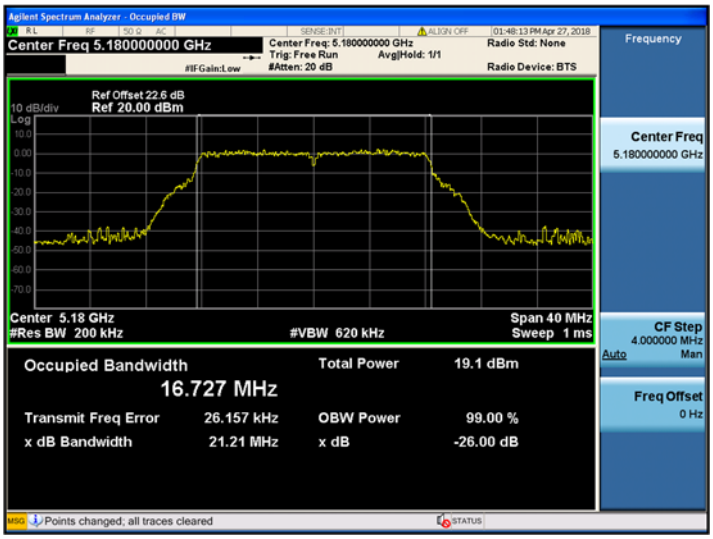
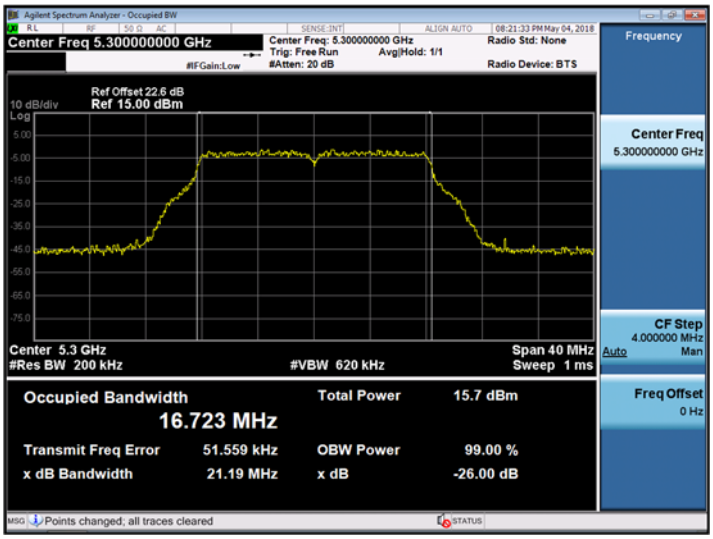
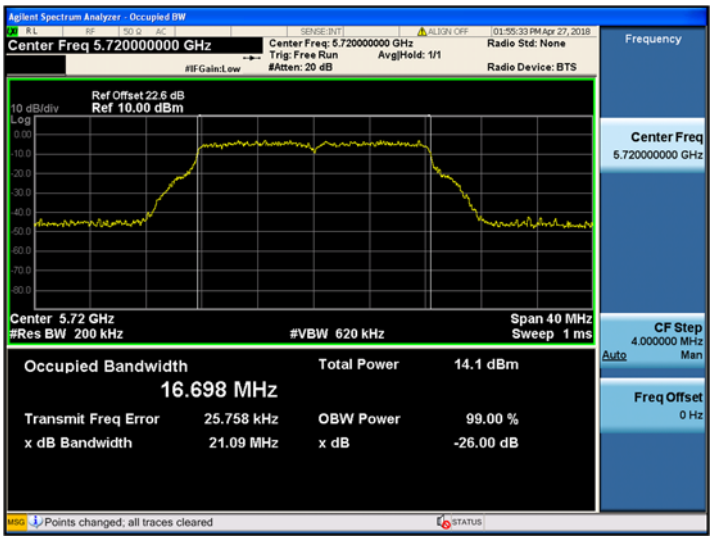
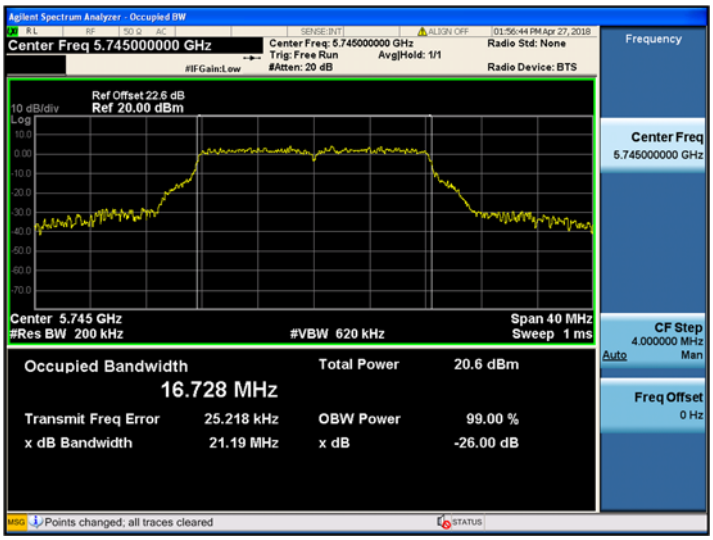
Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.24	N/A	Pass
5600	120	21.23	N/A	Pass
5720	144	21.09	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11a

802.11a Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.19	N/A	Pass
5785	157	21.26	N/A	Pass
5825	165	21.37	N/A	Pass

▣ TEST Plot for Ant.3_802.11a

802.11a UNII 1 BAND 26dB Bandwidth (CH 36)	802.11a UNII 2A BAND 26dB Bandwidth (CH 60)
	
802.11a UNII 2C BAND 26dB Bandwidth (CH 144)	**802.11a UNII 3 BAND 26dB Bandwidth (CH 149)**
	

▣ TEST RESULTS for Ant.0_802.11n_HT20

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.87	N/A	Pass
5200	40	21.58	N/A	Pass
5240	48	21.24	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.59	N/A	Pass
5300	60	21.60	N/A	Pass
5320	64	21.42	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

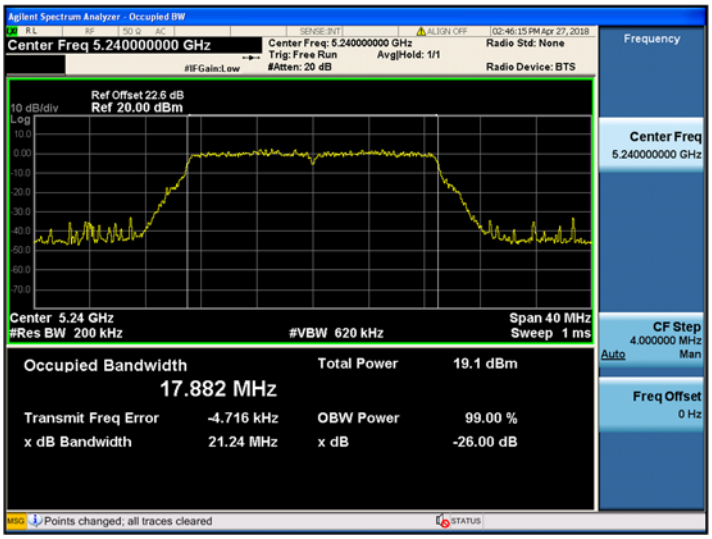
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.47	N/A	Pass
5600	120	21.65	N/A	Pass
5720	144	21.48	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

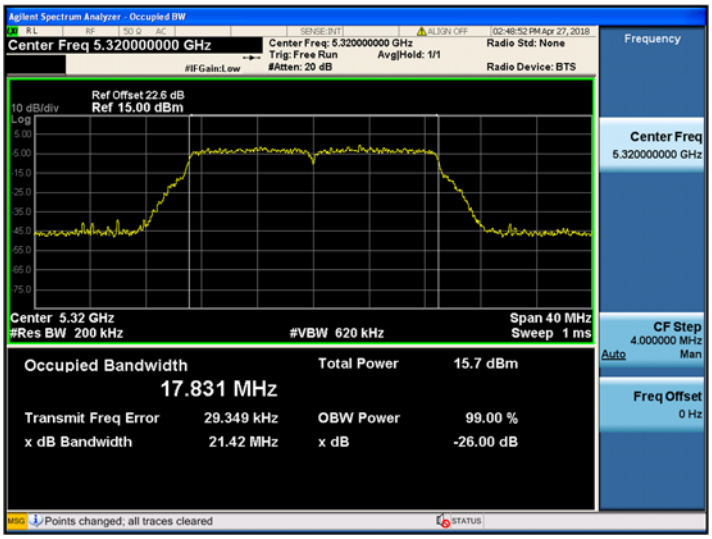
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.77	N/A	Pass
5785	157	21.47	N/A	Pass
5825	165	21.56	N/A	Pass

▣ TEST Plot for Ant.0_802.11n_HT20

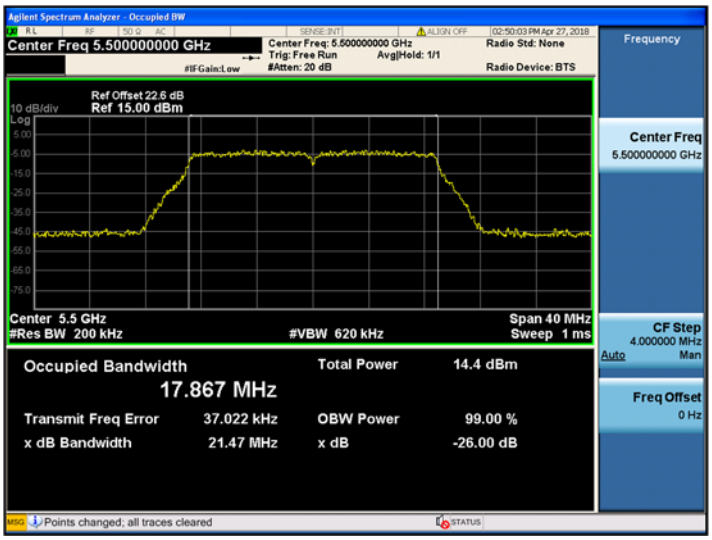
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 48)



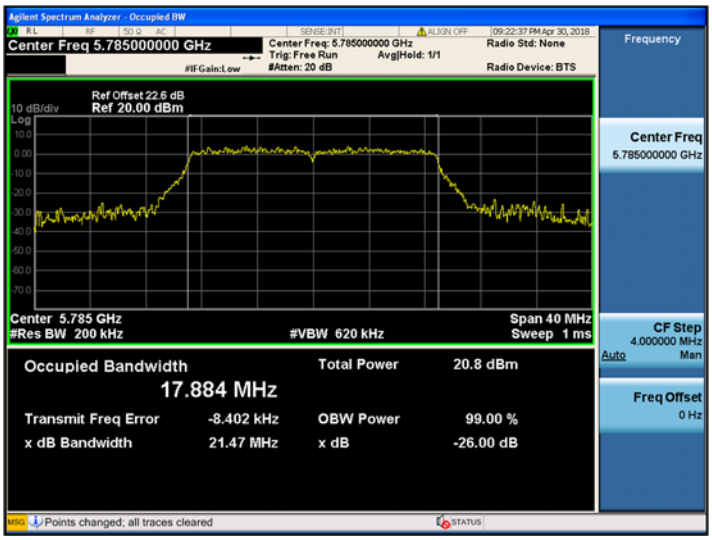
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 64)



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



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



▣ TEST RESULTS for Ant.1_802.11n_HT20

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.41	N/A	Pass
5200	40	21.46	N/A	Pass
5240	48	21.52	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.52	N/A	Pass
5300	60	21.67	N/A	Pass
5320	64	21.42	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

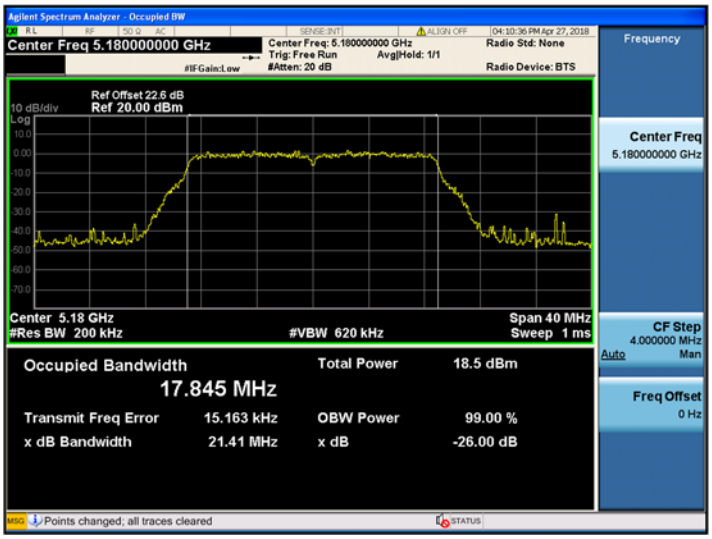
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.34	N/A	Pass
5600	120	21.50	N/A	Pass
5720	144	21.53	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

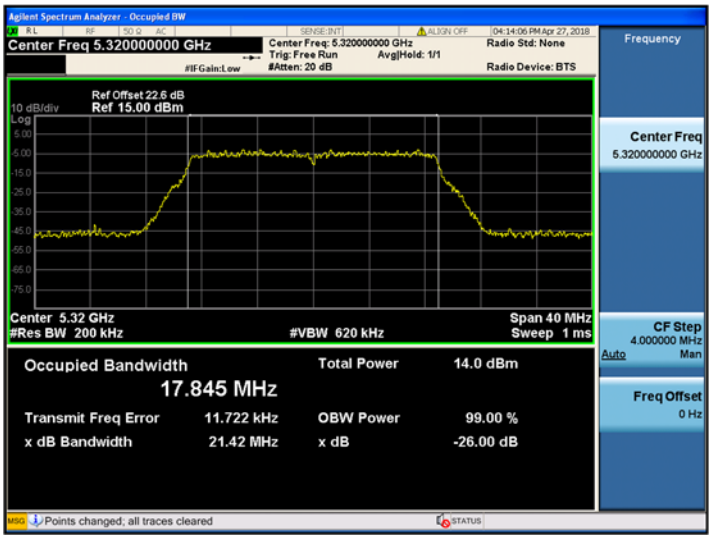
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.46	N/A	Pass
5785	157	21.44	N/A	Pass
5825	165	21.66	N/A	Pass

▣ TEST Plot for Ant.1_802.11n_HT20

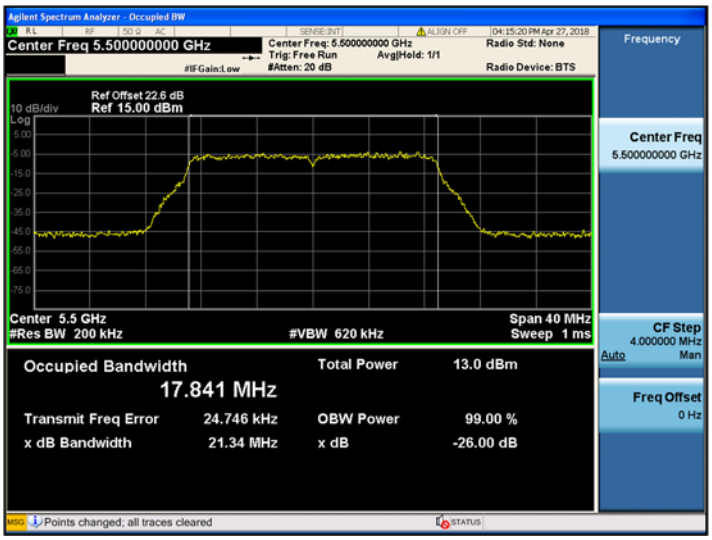
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 36)



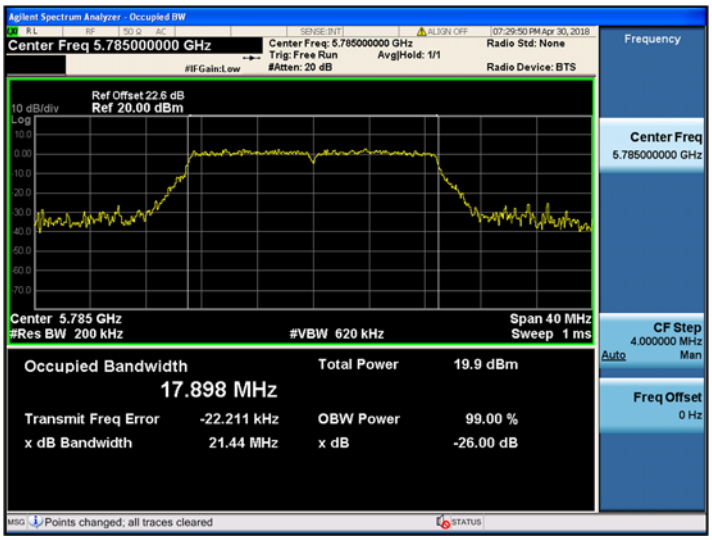
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 64)



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



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



▣ TEST RESULTS for Ant.2_802.11n_HT20

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.41	N/A	Pass
5200	40	21.71	N/A	Pass
5240	48	21.66	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.27	N/A	Pass
5300	60	21.50	N/A	Pass
5320	64	21.48	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

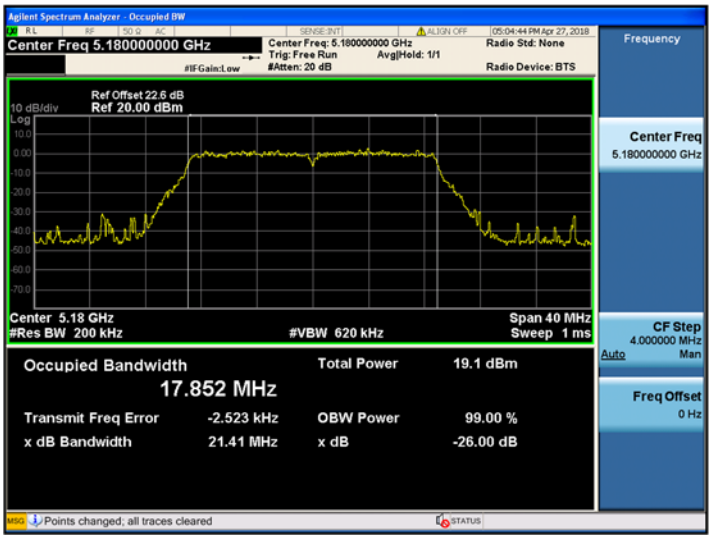
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.67	N/A	Pass
5600	120	21.68	N/A	Pass
5720	144	21.28	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

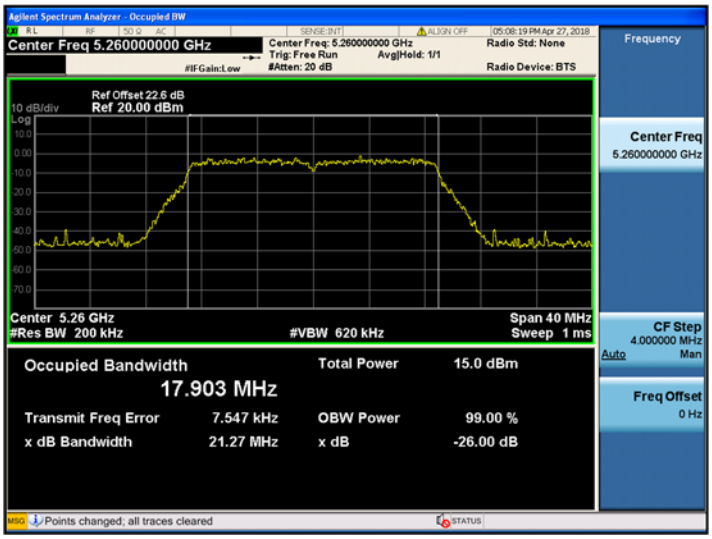
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.41	N/A	Pass
5785	157	21.69	N/A	Pass
5825	165	21.61	N/A	Pass

▣ TEST Plot for Ant.2_802.11n_HT20

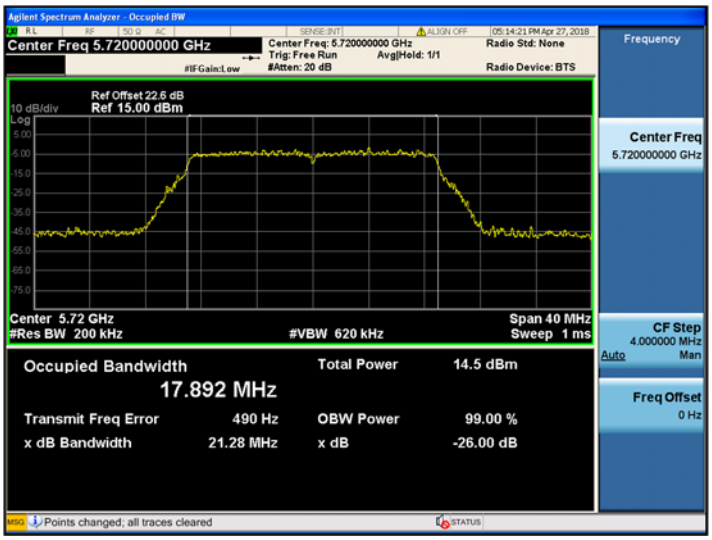
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 36)



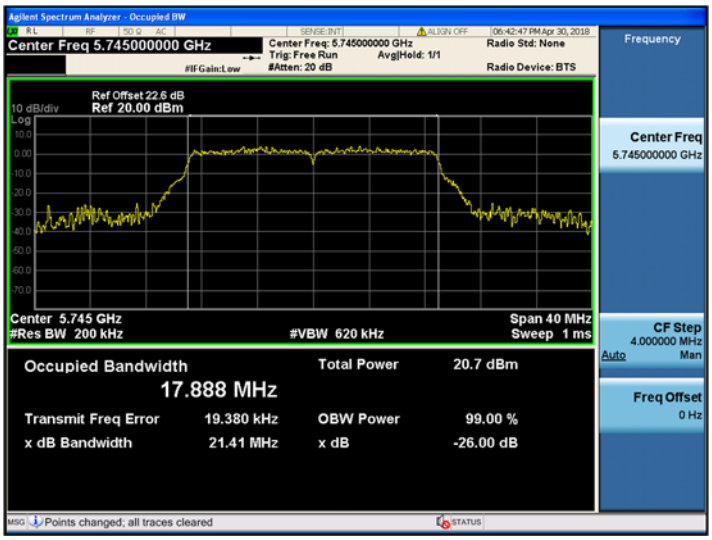
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 52)



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



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



▣ TEST RESULTS for Ant.3_802.11n_HT20

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.37	N/A	Pass
5200	40	21.63	N/A	Pass
5240	48	21.35	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.56	N/A	Pass
5300	60	21.34	N/A	Pass
5320	64	21.47	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

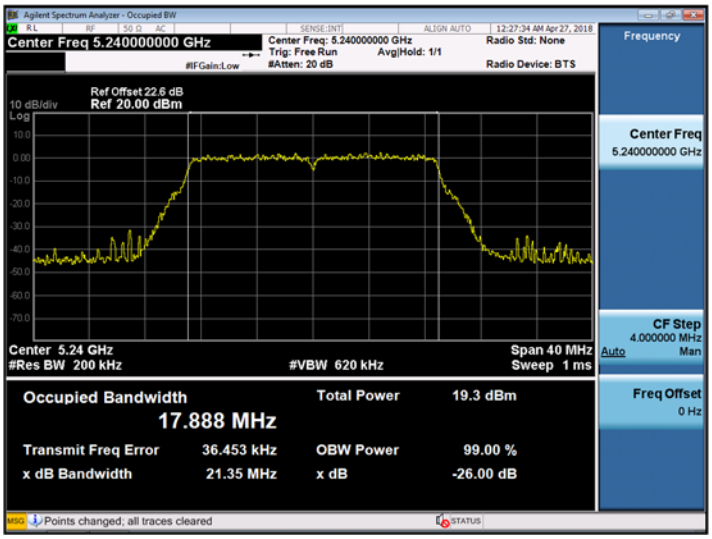
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.49	N/A	Pass
5600	120	21.55	N/A	Pass
5720	144	21.42	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11n_HT20

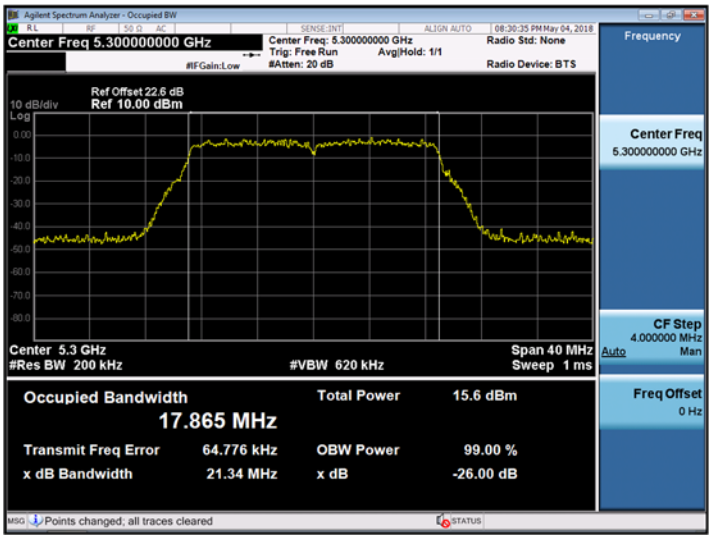
802.11n_HT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.48	N/A	Pass
5785	157	21.57	N/A	Pass
5825	165	21.37	N/A	Pass

▣ TEST Plot for Ant.3_802.11n_HT20

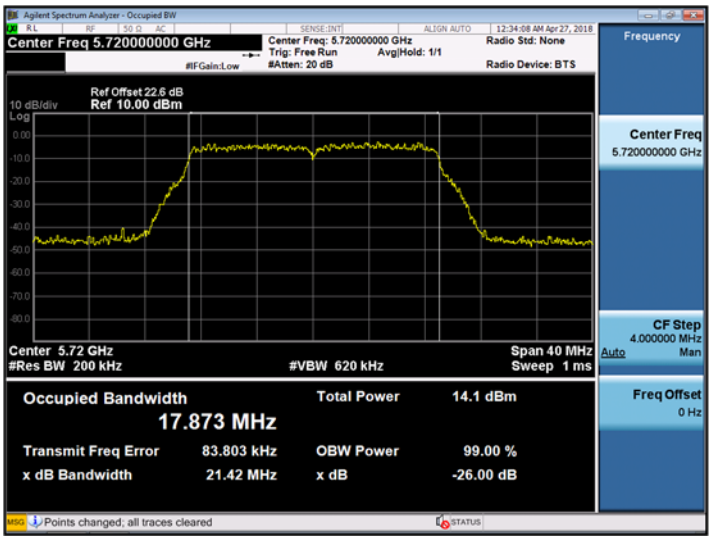
802.11n_HT20 UNII 1 BAND 26dB Bandwidth(CH 48)



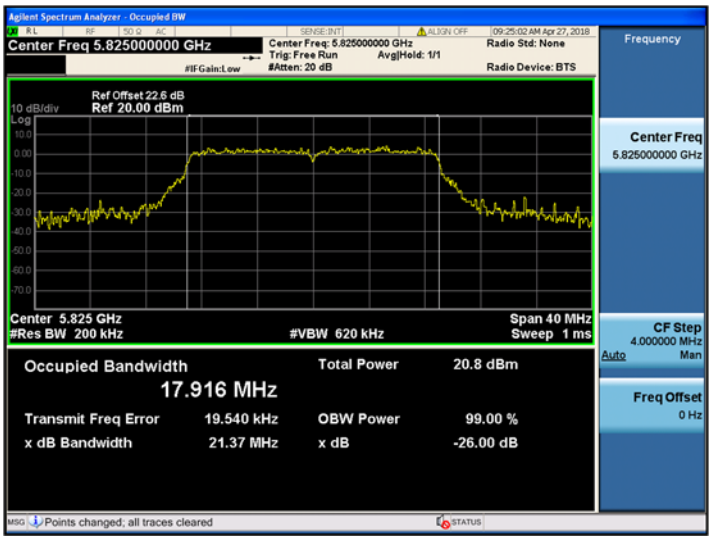
802.11n_HT20 UNII 2A BAND 26dB Bandwidth(CH 60)



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



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



▣ TEST RESULTS for Ant.0_ 802.11ac_VHT20

Conducted 26 dB Bandwidth Measurements for 802.11ac_VHT20

802.11ac_VHT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5180	36	21.47	N/A	Pass
5200	40	21.45	N/A	Pass
5240	48	21.51	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11ac_VHT20

802.11ac_VHT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5260	52	21.47	N/A	Pass
5300	60	21.43	N/A	Pass
5320	64	21.56	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11ac_VHT20

802.11ac_VHT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5500	100	21.56	N/A	Pass
5600	120	21.56	N/A	Pass
5720	144	21.34	N/A	Pass

Conducted 26 dB Bandwidth Measurements for 802.11ac_VHT20

802.11ac_VHT20 Mode		Measured Bandwidth [MHz]	Minimum Bandwidth [MHz]	Pass / Fail
Frequency [MHz]	Channel No.			
5745	149	21.87	N/A	Pass
5785	157	21.60	N/A	Pass
5825	165	21.62	N/A	Pass