TEST REPORT

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Report No.:
CTK-2020-04554

1. Client

◦ Name : Samsung Electronics Co Ltd

◦ Address : 19 Chapin Rd, Building D. Pine Brook, New Jersey, United States

◦ Date of Receipt : 2020-10-26

2. Manufacturer

◦ Name : Samsung Electronics Co., Ltd.

◦ Address : 129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea

3. Use of Report : For FCC Conformance

4. Test Sample / Model: Wi-Fi/BT Transceiver / WCA943M

5. Date of Test : 2020-11-05 to 2020-11-20

6. Test Standard(method) used : FCC 47 CFR part 15 subpart C 15.407

7. Testing Environment: Temp.: (23 ± 1) ℃, Humidity: (49 ± 3) % R.H

8. Test Results : Compliance

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This Test Report cannot be reproduced, except in full.

Affirmation	Tested by Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)

2020-11-20

Republic of KOREA **CTK Co., Ltd.**

REPORT REVISION HISTORY

Date	Revision	Page No
2020-11-20	Issued (CTK-2020-04554)	all

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1. General Product Description

1.1 Client Information

Company	Samsung Electronics Co., Ltd.
Contact Point	129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Contact Person	Name : Youngjoong Noh E-mail : monk.noh@samsung.com Tel : +82-277-0598 Fax : -

1.2 Product Information

FCC ID	A3LWCA942M
ISED	649E-WCA942M
Product Description	Wi-Fi/BT Transceiver
Model name	WCA943M
Variant Model name	-
Operating Frequency	UNII 1 : 5 180 MHz – 5 240 MHz (20 MHz_BW) 5 190 MHz – 5 230 MHz (40 MHz_BW) 5 210 MHz (80 MHz_BW) UNII 2A : 5 260 MHz – 5 320 MHz (20 MHz_BW) 5 270 MHz – 5 310 MHz (40 MHz_BW) 5 290 MHz (80 MHz_BW) UNII 2C : 5 500 MHz – 5 720 MHz (20 MHz_BW) 5 510 MHz – 5 710 MHz (40 MHz_BW) 5 530 MHz – 5 690 MHz (80 MHz_BW) UNII 3 : 5 745 MHz – 5 825 MHz (20 MHz_BW) 5 755 MHz – 5 795 MHz (40 MHz_BW) 5 775 MHz (80 MHz)
RF Output Power	802.11a : 18.82 dBm (76.16 mW) 802.11n_HT20 : 18.79 dBm (75.60 mW) 802.11n_HT40 : 21.27 dBm (134.04 mW) 802.11ac_VHT20 : 18.60 dBm (72.42 mW) 802.11ac_VHT40 : 21.21 dBm (132.00 mW) 802.11ac_VHT80 : 17.93 dBm (62.15 mW) 802.11ax_HE20 : 18.81 dBm (76.00 mW) 802.11ax_HE40 : 21.51 dBm (141.61 mW) 802.11ax_HE80 : 18.27 dBm (67.15 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : 0.95 dBi (ANT1), -1.37 dBi (ANT2)
Type of Modulation	OFDM, OFDMA
Data Rate	802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 300 Mbps 802.11ac : up to 867 Mbps 802.11ax : up to 1 200 Mbps
Power Source	DC 5 V
Hardware Rev	V4.0
Software Rev	FC2

1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253QPR
AC/DC Adapter	HP	HSTNN-LA40	-

1.4 Model Differences

Not applicable

2. Facility and Accreditations

2.1 Test Facility

The measurement facility is located at (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea.

2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A-2
KOREA	NRRA	KR0025

2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

3. Test Specifications

3.1 Standards

FCC Part Section(s)	Requirement(s)	Limit	Status (Note 1)	Test Condition
15.407(e)	6 dB Bandwidth	> 500 kHz	C	Conducted
15.407(a)	26 dB Bandwidth and 99% Bandwidth	NA	C	
15.407(a)(1)	Conducted Output Power	< 250 mW (5 150 – 5 250 MHz) < 250 mW (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 1 W (5 725 – 5 850 MHz)	C	
15.407(a)(1)	Power Spectral Density	< 11 dBm/MHz (5 150 – 5 250 MHz) < 11 dBm/MHz (5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < 30 dBm/500 KHz (5 725 – 5 850 MHz)	C	
15.407(g)	Frequency Stability	NA	C	
15.407 (b)	Undesirable emission	< -27 dBm/MHz EIRP (5 150 – 5 250 MHz, 5250 – 5350 MHz, 5470 – 5725 MHz) < -17 dBm/MHz EIRP (5715 – 5725 MHz, 5 850 – 5 860 MHz) < -27 dBm/MHz EIRP outside (5 715 – 5 850 MHz)	C	Radiated
15.205, 15.407 (b)(5),(6)	Radiated Spurious Emission	15.209(a)	C	
15.207	AC Conducted Emissions	15.207(a)	C	Line Conducted
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
Note 2: The data in this test report are traceable to the national or international standards.				
Note 3: The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013				
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.789033.				

3.2 Mode of operation during the test

The EUT is operated in a manner representative of the typical of the equipments.
During at testing, system components were manipulated within the confines of typical usage to maximize each emission.
For WLAN function, the engineering test program was provided and enabled to make EUT continuous transmit.
All modulation modes were tests. The results are only attached worst cases.

Test Frequency

- 802.11a, 802.11n_HT20, 802.11ac_VHT20, 802.11ax_HE20

	Lowest channel	Middle channel	Highest channel
UNII 1	5 180 MHz	5 200 MHz	5 240 MHz
UNII 2A	5 260 MHz	5 300 MHz	5 320 MHz
UNII 2C	5 500 MHz	5 600 MHz	5 720 MHz
UNII 3	5 745 MHz	5 785 MHz	5 825 MHz

- 802.11n_HT40, 802.11ac_VHT40, 802.11ax_HE40

	Lowest channel	Middle channel	Highest channel
UNII 1	5 190 MHz	-	5 230 MHz
UNII 2A	5 270 MHz	-	5 310 MHz
UNII 2C	5 510 MHz	5 590 MHz	5 710 MHz
UNII 3	5 755 MHz	-	5 795 MHz

- 802.11ac_VHT80, 802.11ax_HE80

	Lowest channel	Middle channel	Highest channel
UNII 1	5 210 MHz	-	-
UNII 2A	5 290 MHz	-	-
UNII 2C	5 530 MHz	-	5 690 MHz
UNII 3	5 775 MHz	-	-

Test mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11a	DSSS	1 Mbps	97.1 %	0.13 dB
802.11n_HT20	OFDM	MCS 0	96.9 %	0.14 dB
802.11n_HT40	OFDM	MCS 0	94.0 %	0.27 dB
802.11ac_VHT20	OFDM	MNSS 0	94.2 %	0.26 dB
802.11ac_VHT40	OFDM	MNSS 0	89.4 %	0.49 dB
802.11ac_VHT80	OFDM	MNSS 0	81.5 %	0.89 dB
802.11ax_HE20	OFDMA	MCS 0	93.2 %	0.31 dB
802.11ax_HE40	OFDMA	MCS 0	88.5 %	0.53 dB
802.11ax_HE80	OFDMA	MCS 0	82.3 %	0.85 dB

3.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

3.4 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.
Coverage factor *k* = 2, Confidence levels of 95 %

Description	Uncertainty
Conducted RF Output Power	± 1.5 dB
Power Spectral Density	± 1.5 dB
Occupied Bandwidth	± 0.1 MHz
Unwanted Emission(conducted)	± 3.0 dB
Radiated Emissions (f ≤ 1 GHz)	± 4.0 dB
Radiated Emissions (f > 1 GHz)	± 5.0 dB

3.5 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 6.0.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0

4. Technical Characteristic Test

4.1 6dB Bandwidth

Test Procedures

KDB 789033 – Section C.2
ANSI C63.10-2013 - Section 6.9.2

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.

Test Settings :

Center frequency = the highest, middle and the lowest channels

a) RBW = 100 kHz
b) VBW ≥ 3 x RBW
c) Detector = peak
d) Trace mode = Max hold
e) Sweep = auto couple
f) Allow trace to fully stabilize
g) 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.

Minimum Standard:

6 dB Bandwidth	>	500 kHz

Test Data:

ANT1

	6 dB Bandwidth (MHz)			
Mode / Frequency	802.11a	802.11n_HT20	802.11ac_VHT20	802.11ax_HE20
5 745 MHz	16.35	17.60	17.55	17.43
5 785 MHz	16.32	17.58	17.59	17.53
5 825 MHz	16.38	17.60	17.60	18.27
Measurement uncertainty	± 0.1 MHz			

	6 dB Bandwidth (MHz)		
Mode / Frequency	802.11n_HT40	802.11ac_VHT40	802.11ax_HE40
5 755 MHz	35.07	35.06	35.35
5 795 MHz	35.07	35.08	36.03
Measurement uncertainty	± 0.1 MHz		

	6 dB Bandwidth (MHz)	
Mode / Frequency	802.11ac_VHT80	802.11ax_HE80
5 775 MHz	75.11	75.12
Measurement uncertainty	± 0.1 MHz	

ANT2

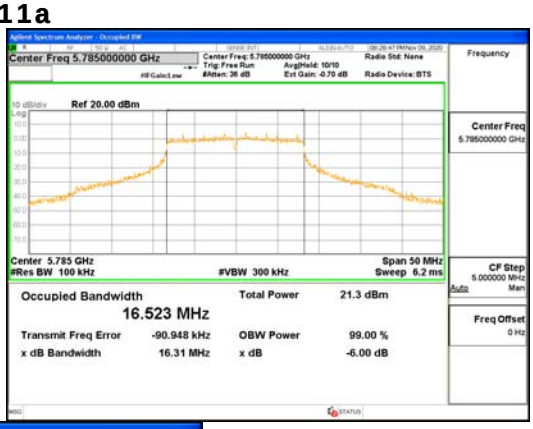
	6 dB Bandwidth (MHz)			
Mode / Frequency	802.11a	802.11n_HT20	802.11ac_VHT20	802.11ax_HE20
5 745 MHz	16.30	17.55	17.58	18.28
5 785 MHz	16.31	17.56	17.52	17.74
5 825 MHz	16.35	17.54	17.52	18.22
Measurement uncertainty	± 0.1 MHz			

	6 dB Bandwidth (MHz)		
Mode / Frequency	802.11n_HT40	802.11ac_VHT40	802.11ax_HE40
5 755 MHz	33.81	33.81	36.06
5 795 MHz	35.06	35.05	35.11
Measurement uncertainty	± 0.1 MHz		

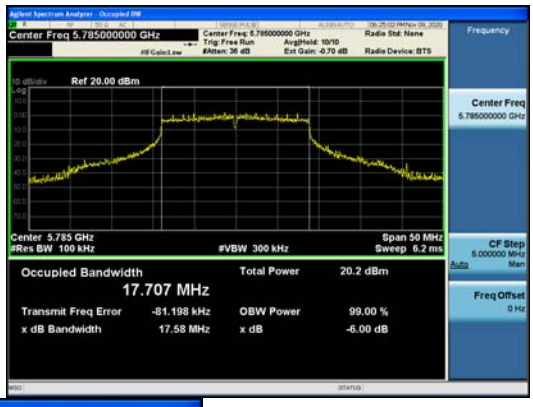
	6 dB Bandwidth (MHz)	
Mode / Frequency	802.11ac_VHT80	802.11ax_HE80
5 775 MHz	75.05	75.11
Measurement uncertainty	± 0.1 MHz	

See next pages for actual measured spectrum plots.

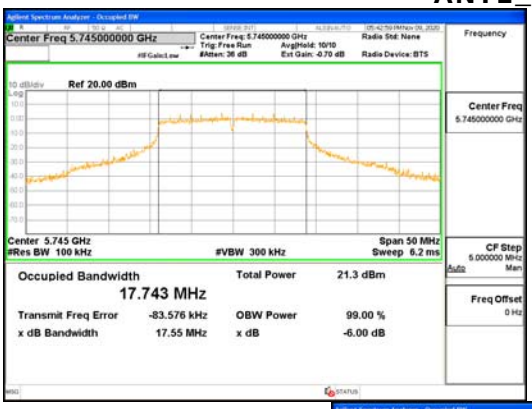
ANT1_802.11a

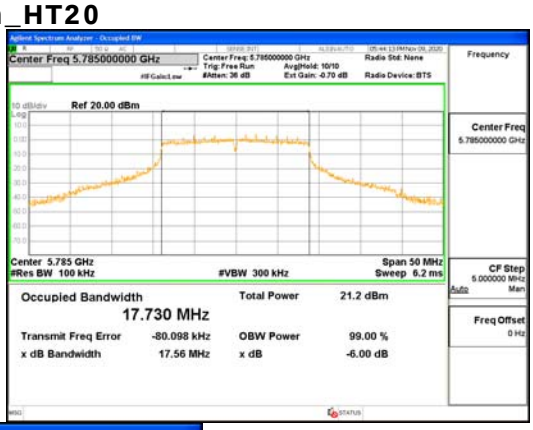


ANT2_802.11a



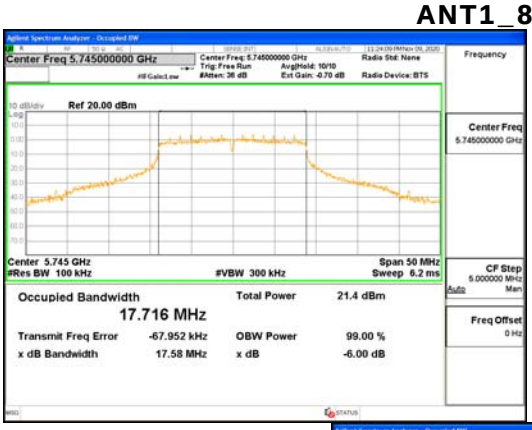
ANT1_802.11n_HT20

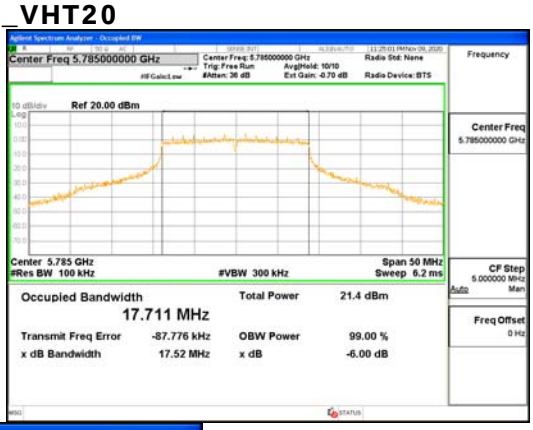




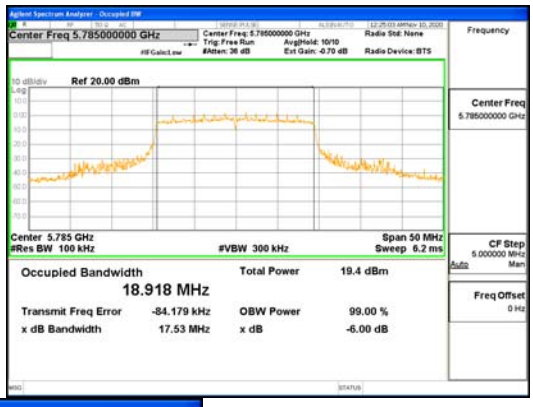
ANT2_802.11n_HT20

ANT1_802.11ac_VHT20

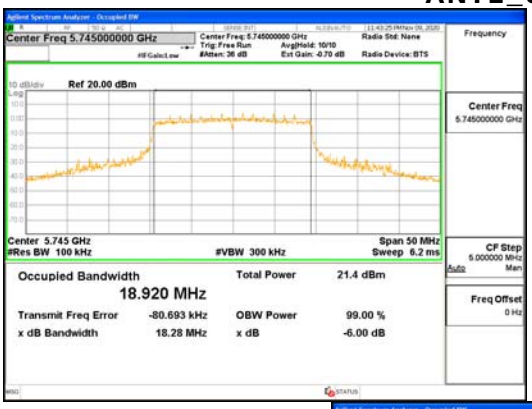


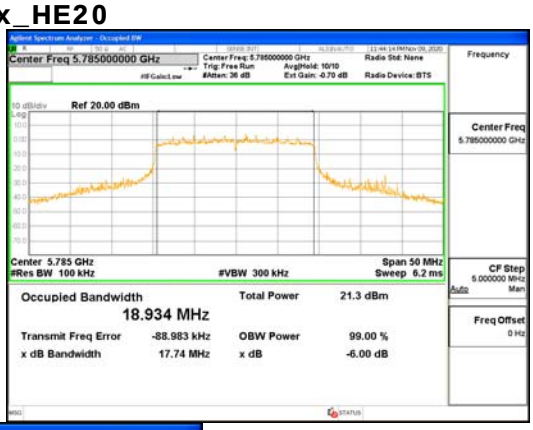


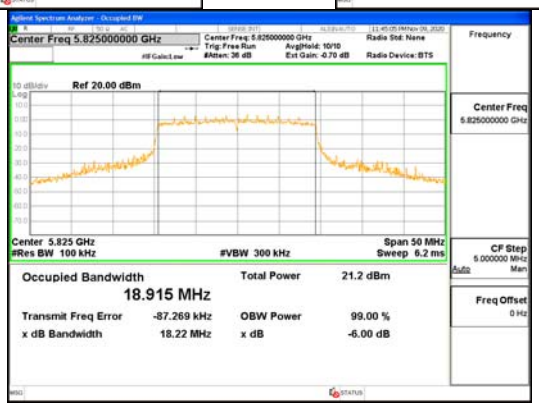
ANT2_802.11ac_VHT20



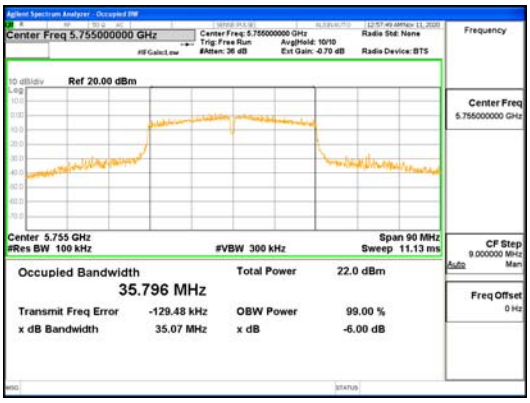
ANT1_802.11ax_HE20



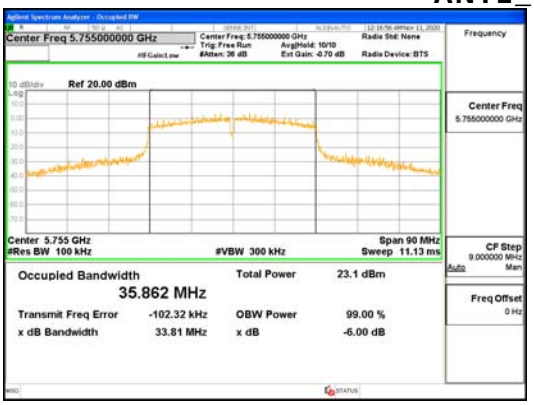


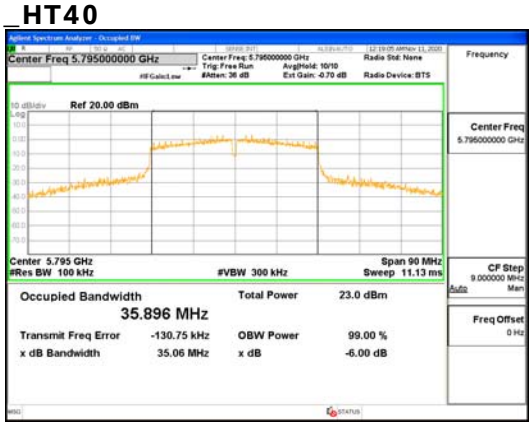


ANT2_802.11ax_HE20

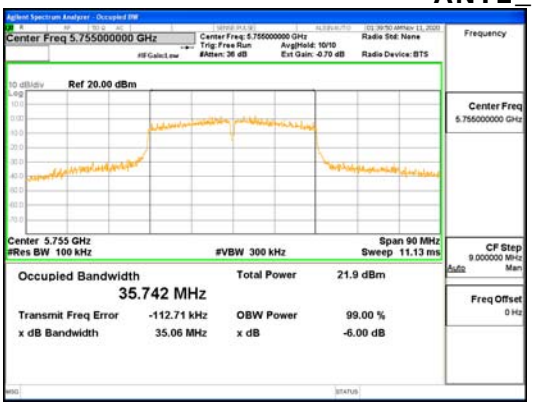


ANT1_802.11n_HT40

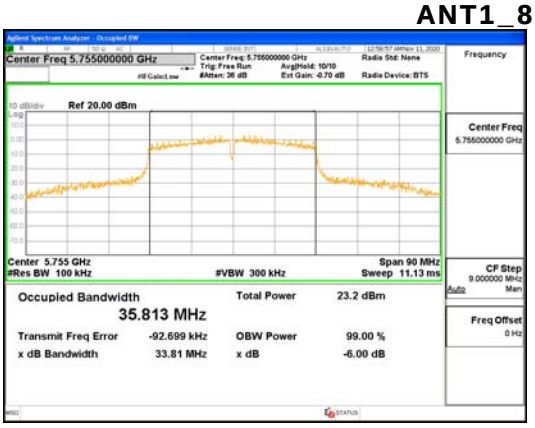


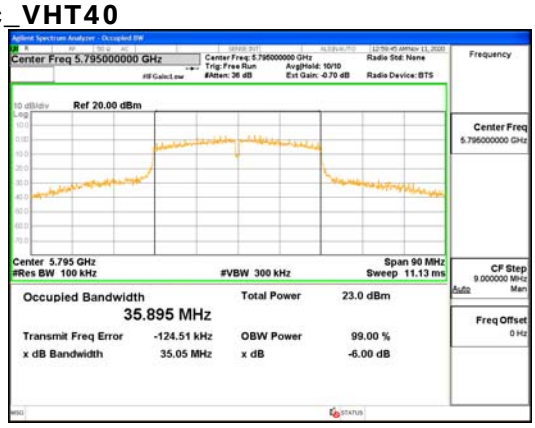


ANT2_802.11n_HT40



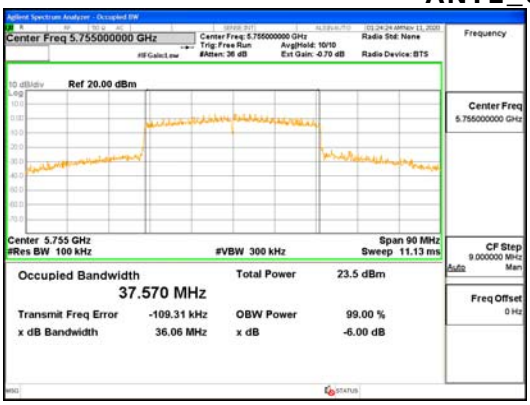
ANT1_802.11ac_VHT40

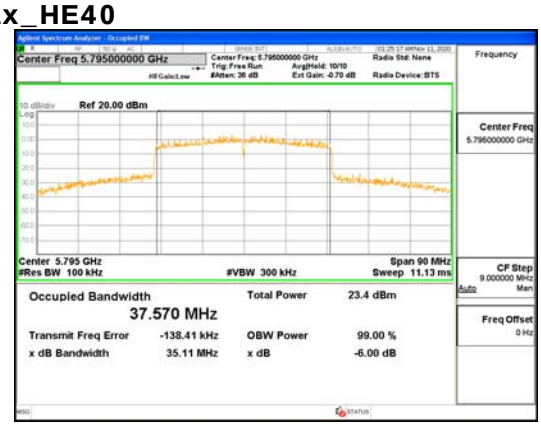




ANT2_802.11ac_VHT40

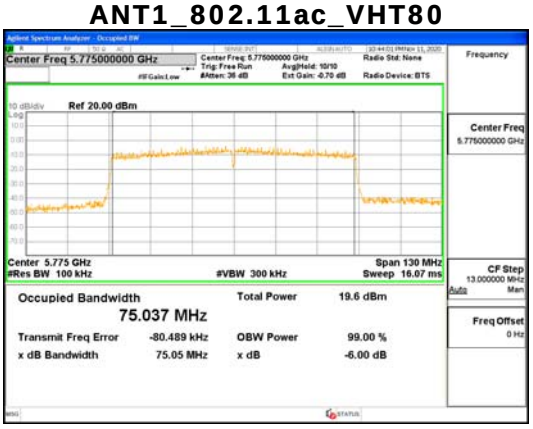
ANT1_802.11ax_HE40





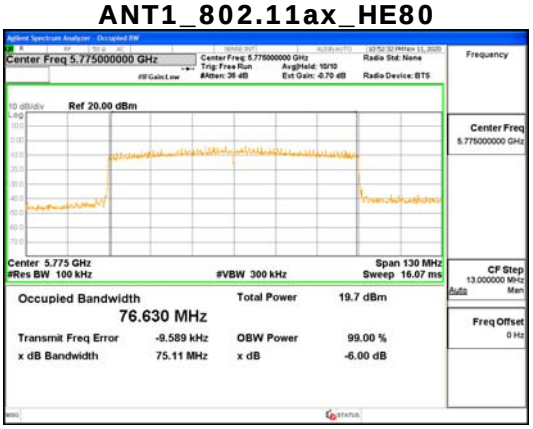
ANT2_802.11ax_HE40

ANT1_802.11ac_VHT80



ANT2_802.11ac_VHT80

ANT1_802.11ax_HE80



ANT2_802.11ax_HE80

4.2 26 dB Bandwidth and 99% Bandwidth

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 6.9.2

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 26 dB relative to the maximum level measured in the fundamental emission.

Test Procedures

KDB 789033 – Section C.1
ANSI C63.10-2013 - Section 6.9.3

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.
Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

Test Settings :

Center frequency = the highest, middle and the lowest channels

a) RBW = approximately 1 % of the emission bandwidth

b) VBW ≥ RBW

c) Detector = peak

d) Trace mode = Max hold

e) 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%.

Minimum Standard:

NA

Test Data:

ANT1

	26 dB Bandwidth and 99 % Bandwidth (MHz)							
Mode	802.11a		802.11n_HT20		802.11ac_VHT20		802.11ax_HE20	
Frequency	26 dB	99 %	26 dB	99 %	26 dB	99 %	26 dB	99 %
5 180 MHz	24.28	16.69	23.59	17.86	22.61	17.81	23.37	18.98
5 200 MHz	22.93	16.62	23.85	17.82	23.15	17.84	22.01	18.98
5 240 MHz	19.51	16.37	19.92	17.57	20.02	17.56	19.83	18.85
5 260 MHz	23.13	16.67	24.23	17.89	23.81	17.85	22.22	18.99
5 300 MHz	22.74	16.69	24.10	17.84	23.25	17.83	23.47	19.02
5 320 MHz	22.49	16.69	23.10	17.85	23.72	17.81	24.04	19.00
5 500 MHz	22.07	16.68	24.57	17.85	23.65	17.84	22.07	19.02
5 600 MHz	22.93	16.68	23.78	17.87	24.03	17.83	24.54	19.04
5 720 MHz	24.16	16.69	23.55	17.86	23.54	17.82	21.56	19.00
5 745 MHz	24.89	17.57	26.59	18.39	27.32	18.36	25.65	19.25
5 785 MHz	25.88	17.45	26.46	18.39	26.17	18.48	23.01	19.23
5 825 MHz	25.63	17.53	26.10	18.42	27.22	18.35	35.28	19.23
Measurement uncertainty	± 0.1 MHz							

	26 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11n_HT40		802.11ac_VHT40		802.11ax_HE40	
Frequency	26 dB	99 %	26 dB	99 %	26 dB	99 %
5 190 MHz	39.58	35.75	39.49	35.80	39.41	37.50
5 230 MHz	39.72	35.82	40.11	35.82	39.44	37.58
5 270 MHz	39.57	35.81	39.48	35.77	39.41	37.53
5 310 MHz	39.43	35.78	39.18	35.88	39.47	37.54
5 510 MHz	39.82	35.89	39.20	35.81	39.34	37.60
5 590 MHz	39.75	35.94	39.81	35.95	39.35	37.57
5 710 MHz	39.93	35.98	39.67	35.95	39.56	37.53
5 755 MHz	39.56	36.02	39.68	35.96	39.36	37.71
5 795 MHz	44.88	36.00	40.44	36.02	41.32	37.66
Measurement uncertainty	± 0.1 MHz					

	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11ac_VHT80		802.11ax_HE80	
Frequency	26 dB	99 %	26 dB	99 %
5 210 MHz	78.88	75.09	80.03	76.69
5 290 MHz	78.99	75.12	79.98	76.75
5 530 MHz	79.12	75.04	79.92	76.80
5 690 MHz	79.16	75.06	79.95	76.61
5 775 MHz	78.47	75.04	79.59	76.64
Measurement uncertainty	± 0.1 MHz			

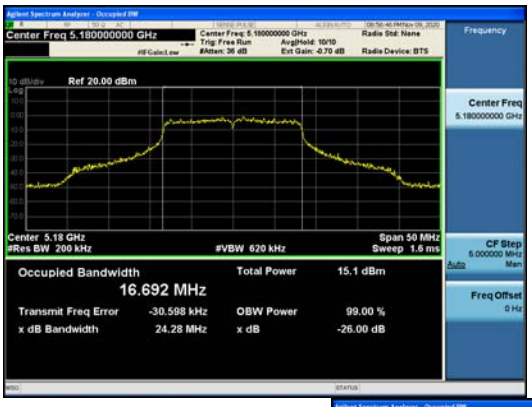
ANT2

	26 dB Bandwidth and 99 % Bandwidth (MHz)							
Mode	802.11a		802.11n_HT20		802.11ac_VHT20		802.11ax_HE20	
Frequency	26 dB	99 %	26 dB	99 %	26 dB	99 %	26 dB	99 %
5 180 MHz	23.47	16.75	24.85	17.94	23.65	17.93	22.26	19.00
5 200 MHz	23.83	16.79	23.81	17.92	23.90	17.92	25.01	18.98
5 240 MHz	19.71	16.43	20.19	17.56	20.07	17.54	19.87	18.81
5 260 MHz	23.27	16.79	24.08	17.94	23.79	17.91	23.34	19.01
5 300 MHz	23.21	16.72	24.43	17.96	24.64	17.95	24.41	19.02
5 320 MHz	23.24	16.80	25.62	17.96	24.12	17.93	23.99	18.99
5 500 MHz	23.58	16.78	24.73	17.93	25.08	17.94	25.07	19.04
5 600 MHz	23.29	16.75	24.91	17.93	25.02	17.94	23.41	19.01
5 720 MHz	23.38	16.79	25.30	17.94	24.87	17.94	22.81	19.00
5 745 MHz	26.33	18.13	29.26	19.15	29.21	19.02	30.89	19.29
5 785 MHz	27.78	18.19	29.14	19.08	30.15	19.04	30.67	19.24
5 825 MHz	27.97	18.03	29.22	19.06	29.12	18.98	27.10	19.24
Measurement uncertainty	± 0.1 MHz							

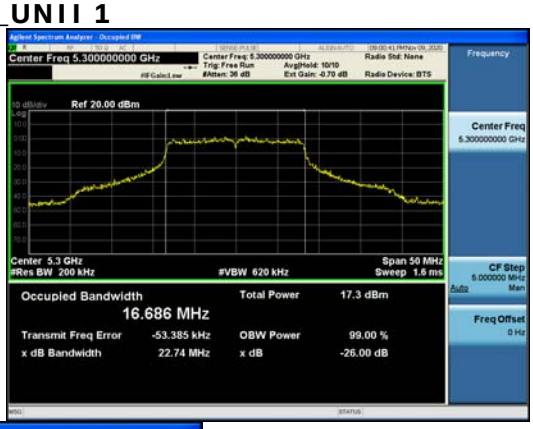
	26 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11n_HT40		802.11ac_VHT40		802.11ax_HE40	
Frequency	26 dB	99 %	26 dB	99 %	26 dB	99 %
5 190 MHz	40.11	35.83	39.80	35.81	39.53	37.50
5 230 MHz	40.12	35.88	39.83	35.82	39.54	37.55
5 270 MHz	39.90	35.83	40.25	35.83	39.44	37.49
5 310 MHz	39.81	35.86	39.91	35.90	39.34	37.47
5 510 MHz	42.26	36.08	40.43	36.03	47.05	37.61
5 590 MHz	53.78	36.18	59.13	36.16	45.34	37.76
5 710 MHz	49.63	36.11	49.00	36.09	39.47	37.70
5 755 MHz	46.75	36.15	48.47	36.19	44.10	37.73
5 795 MHz	53.97	36.24	53.83	36.19	47.83	37.80
Measurement uncertainty	± 0.1 MHz					

	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11ac_VHT80		802.11ax_HE80	
Frequency	26 dB	99 %	26 dB	99 %
5 210 MHz	79.48	75.21	80.01	76.89
5 290 MHz	79.50	75.24	80.03	76.80
5 530 MHz	79.36	75.29	80.00	76.90
5 690 MHz	79.34	75.21	79.92	76.87
5 775 MHz	79.08	75.09	79.44	76.72
Measurement uncertainty	± 0.1 MHz			

See next pages for actual measured spectrum plots.

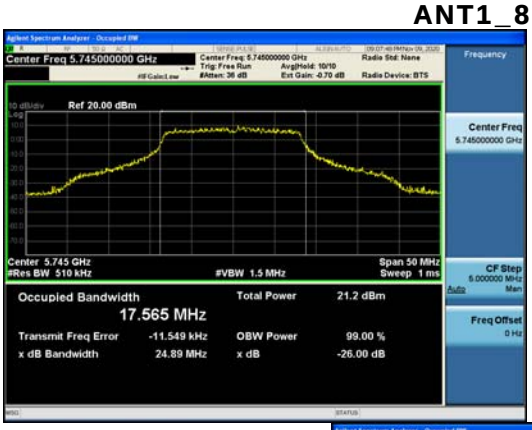


ANT1_802.11a_UNII 1

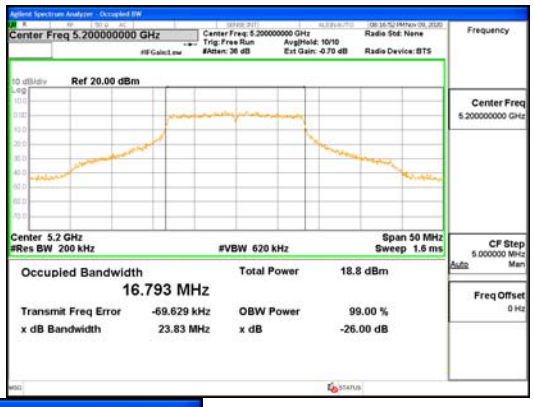


ANT1_802.11a_UNII 2A

ANT1_802.11a_UNII 2C



ANT1_802.11a_UNII 3



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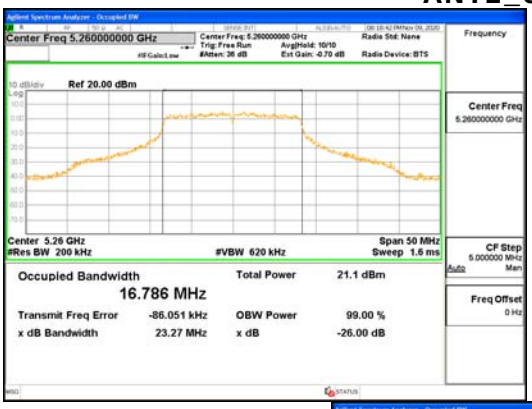
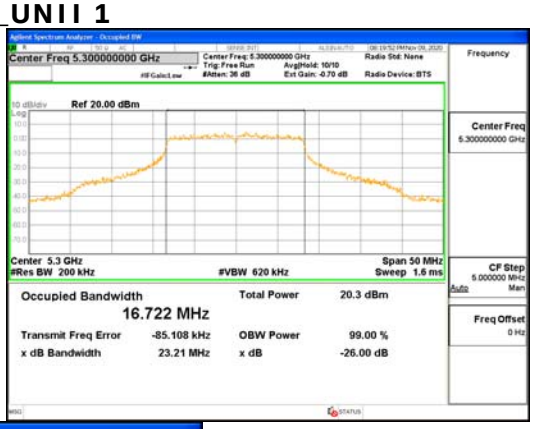
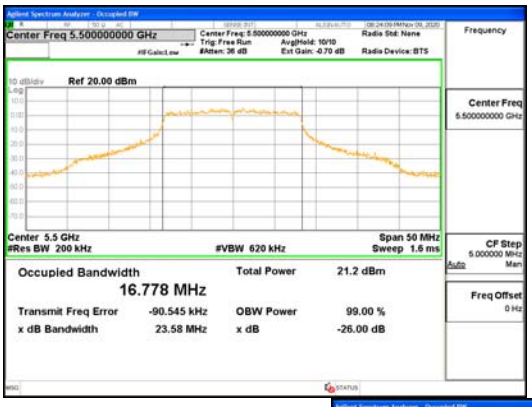
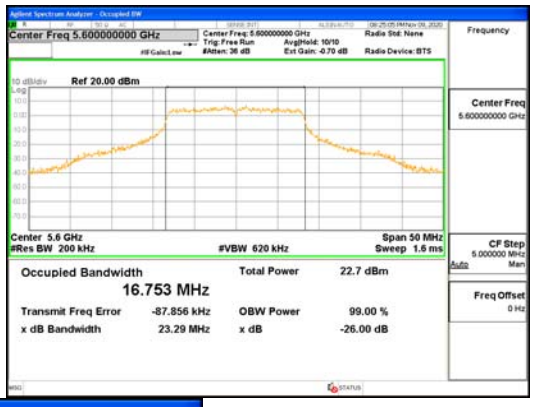
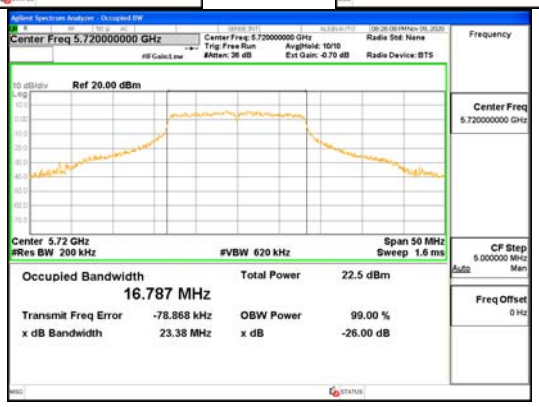




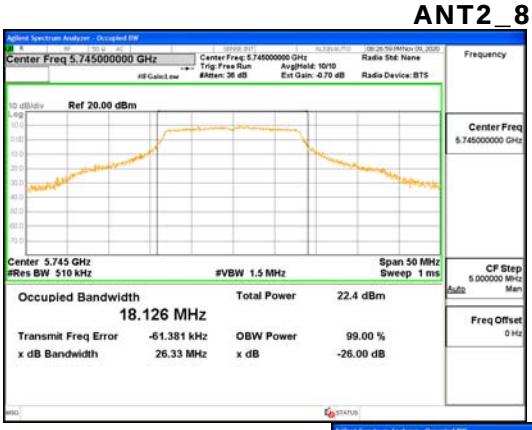
ANT2_802.11a_UNII 2A

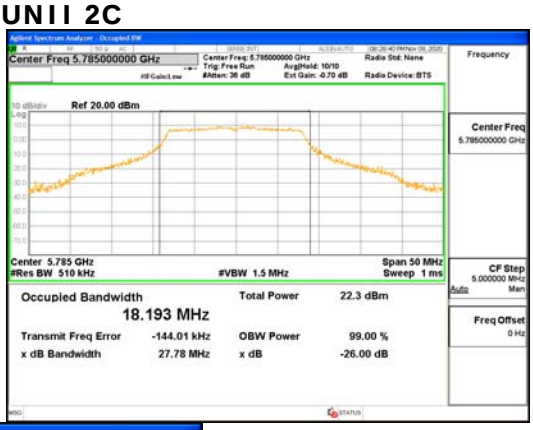


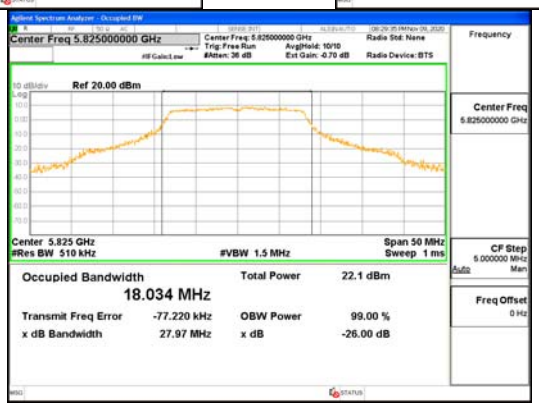




ANT2_802.11a_UNII 2C

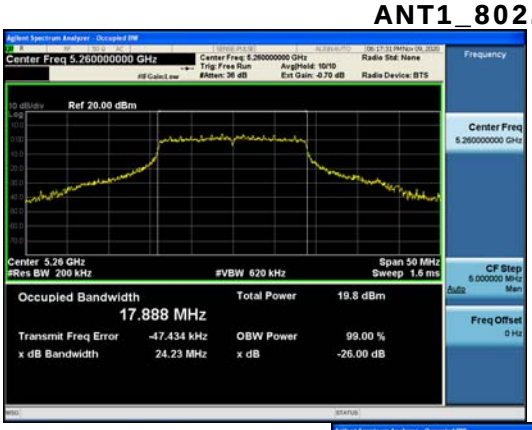


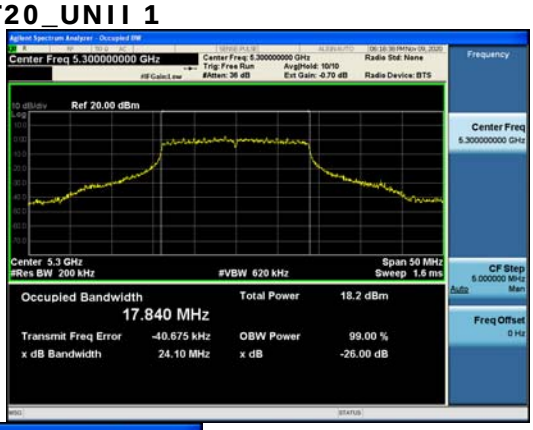




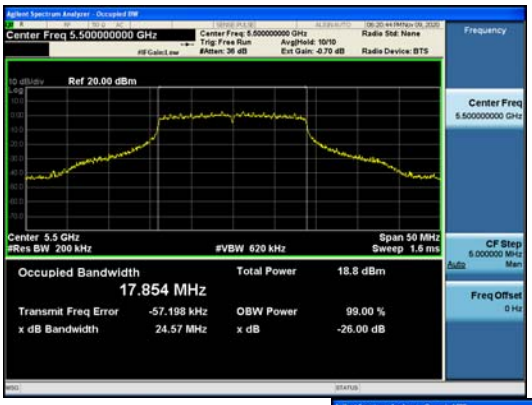
ANT2_802.11a_UNII 3

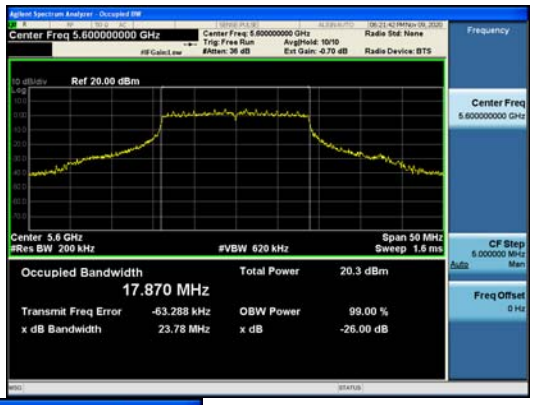
ANT1_802.11n_HT20_UNII 1



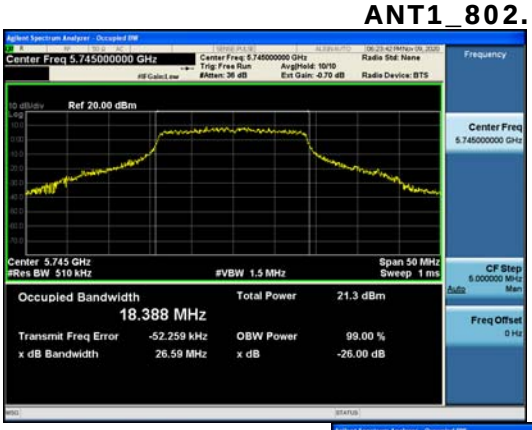


ANT1_802.11n_HT20_UNII 2A

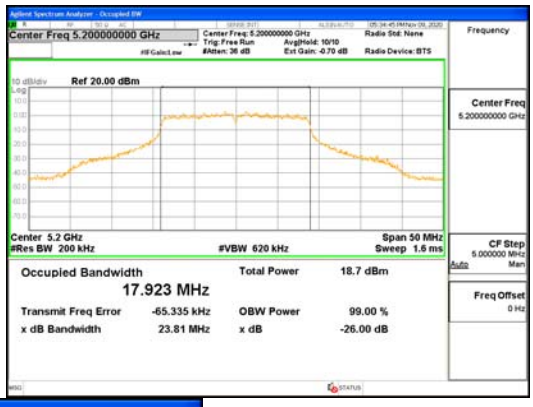




ANT1_802.11n_HT20_UNII 2C



ANT1_802.11n_HT20_UNII 3



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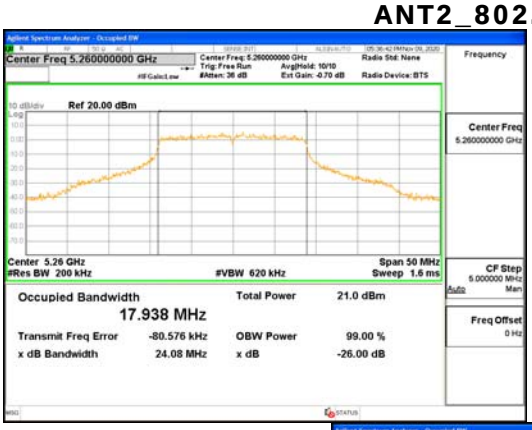
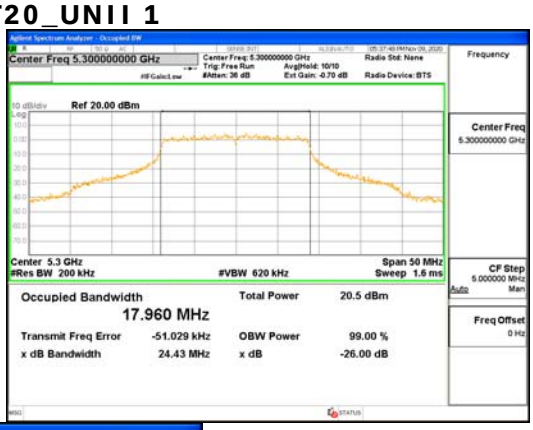
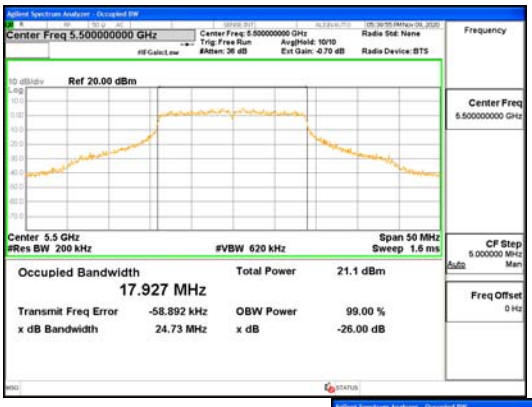
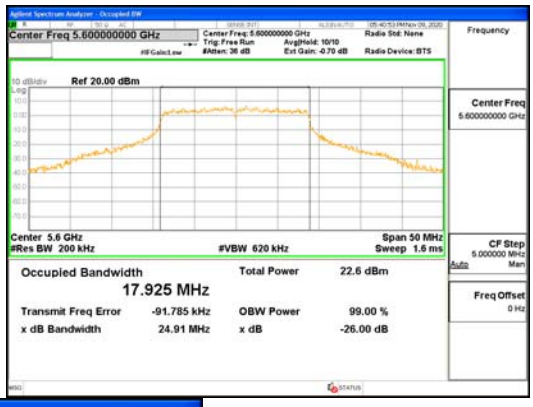
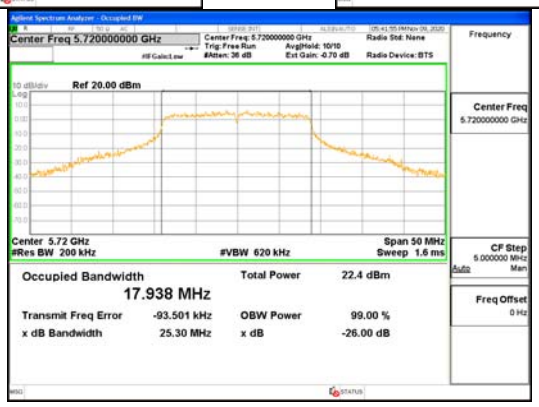




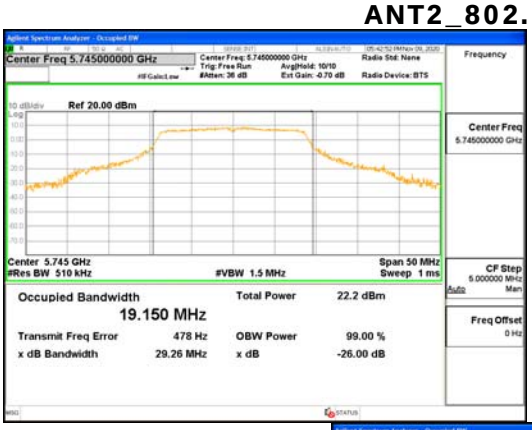
ANT2_802.11n_HT20_UNII 2A

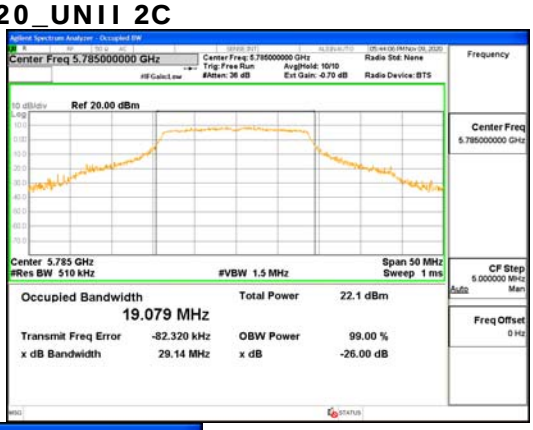






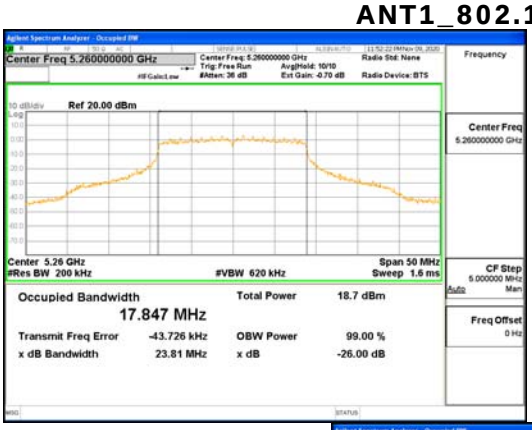
ANT2_802.11n_HT20_UNII 2C

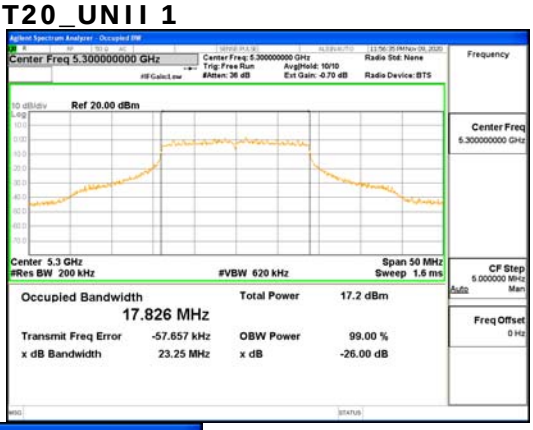




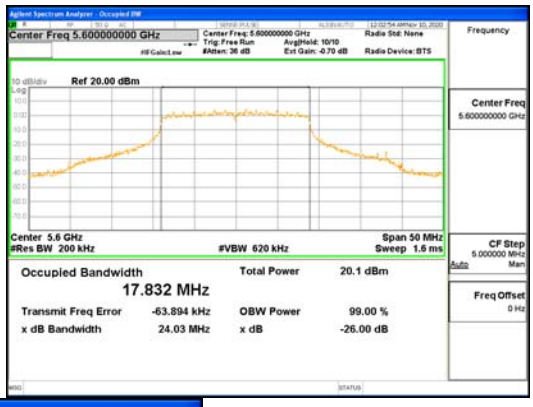
ANT2_802.11n_HT20_UNII 3

ANT1_802.11ac_VHT20_UNII 1

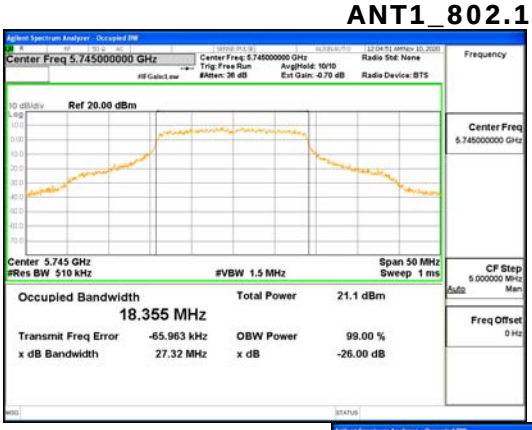


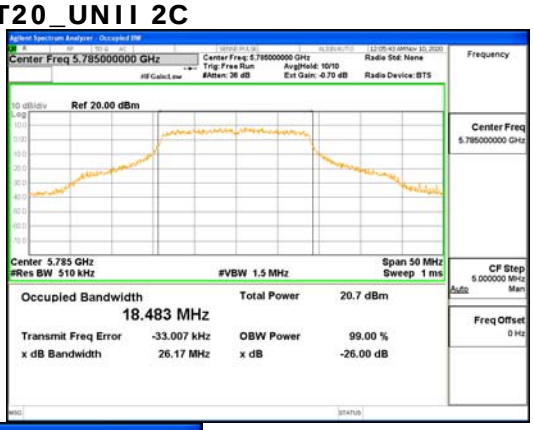


ANT1_802.11ac_VHT20_UNII 2A



ANT1_802.11ac_VHT20_UNII 2C





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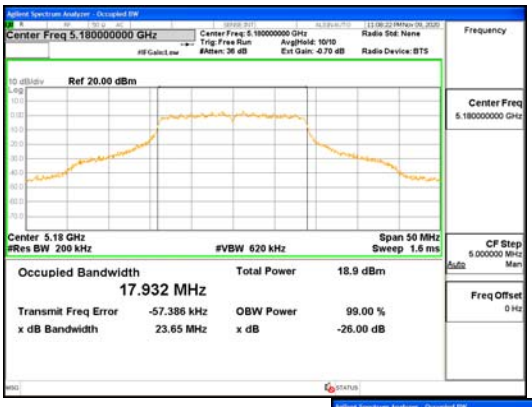

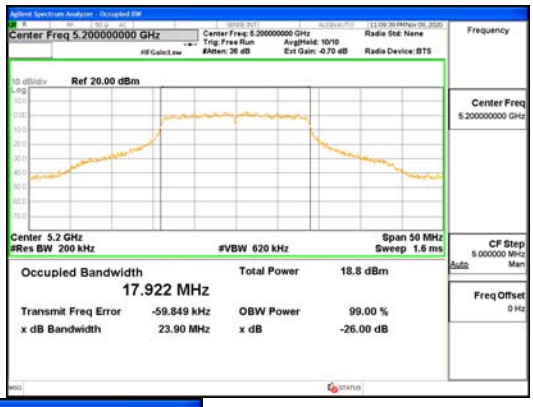

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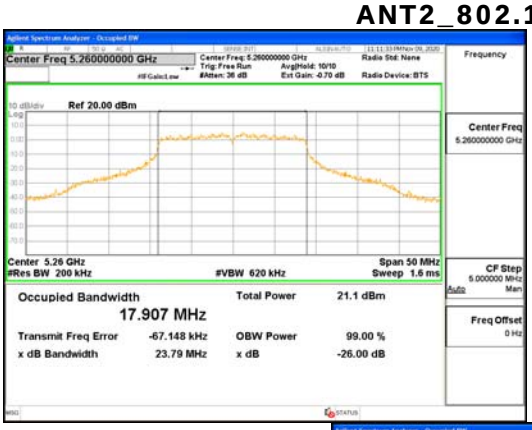
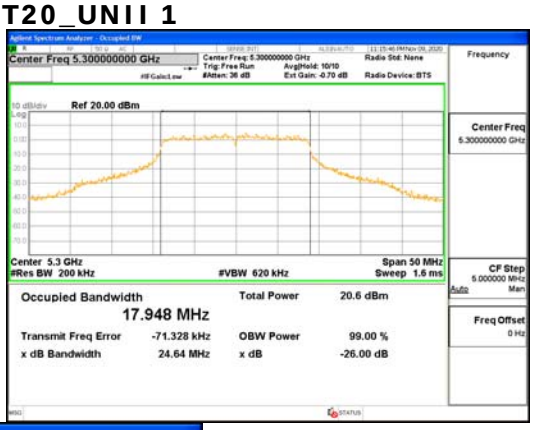
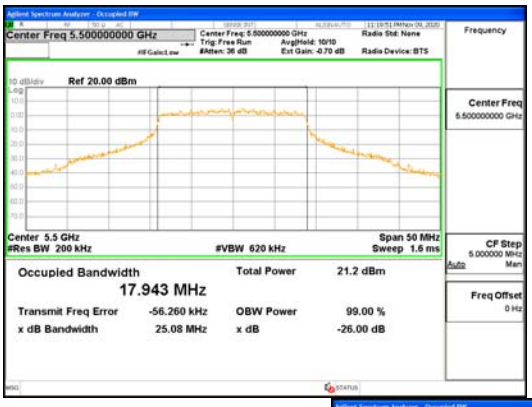
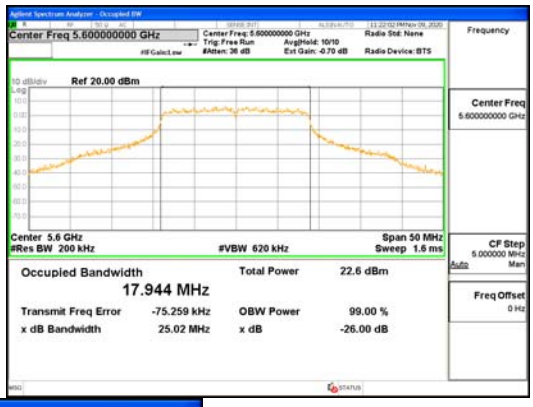
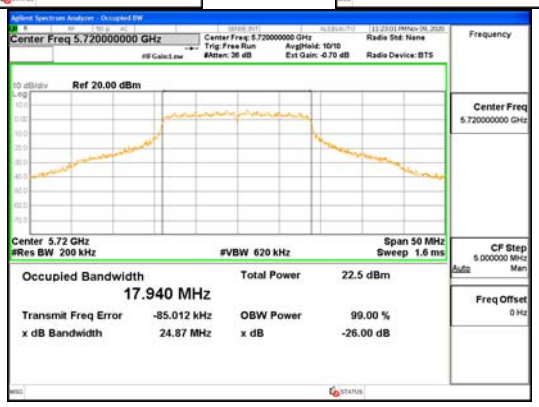




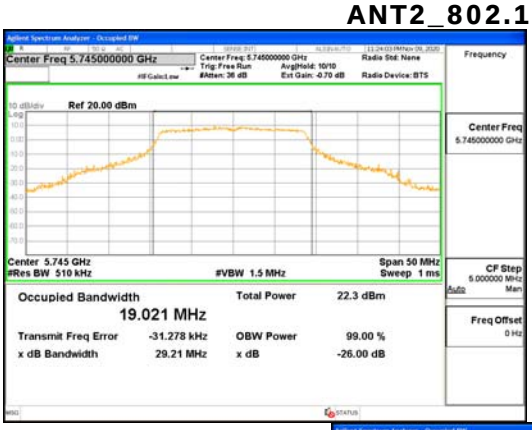
ANT2_802.11ac_VHT20_UNII 2A

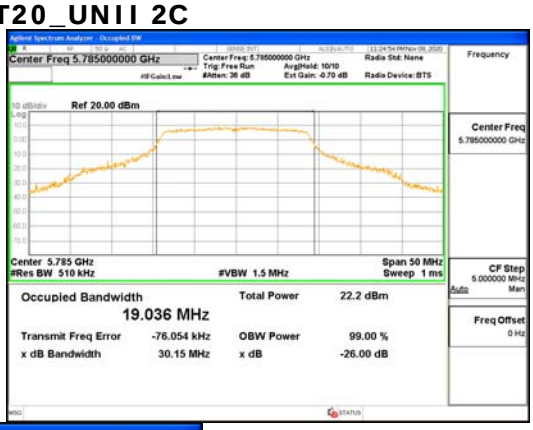




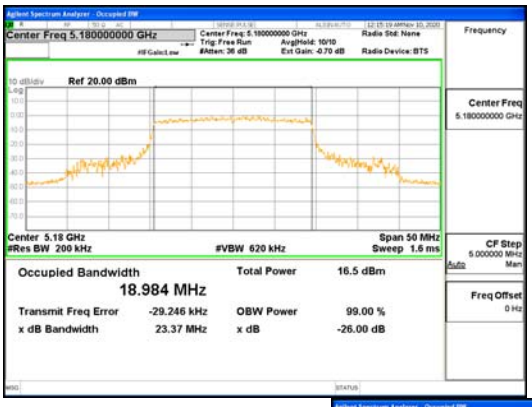


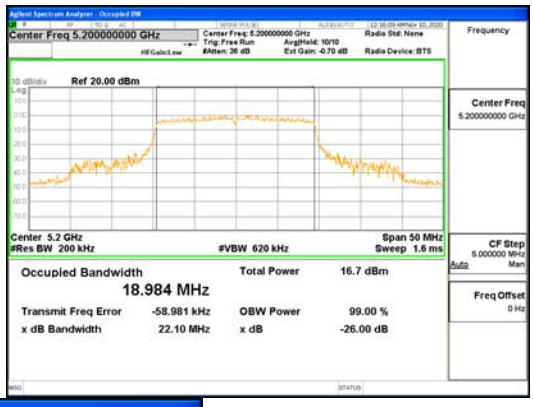
ANT2_802.11ac_VHT20_UNII 2C





ANT2_802.11ac_VHT20_UNII 3





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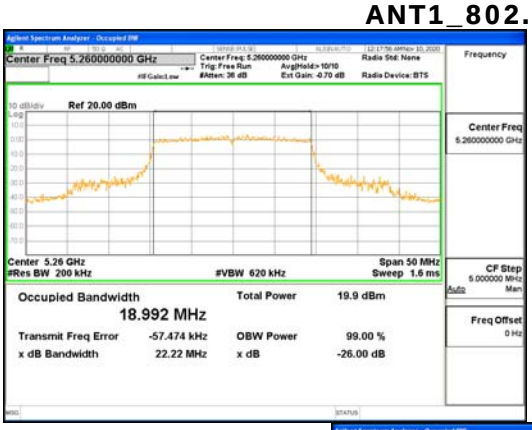
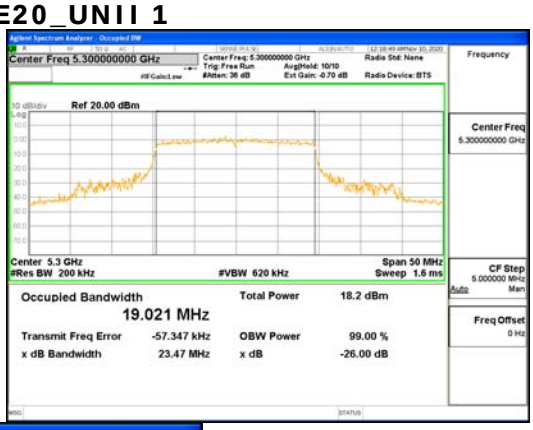
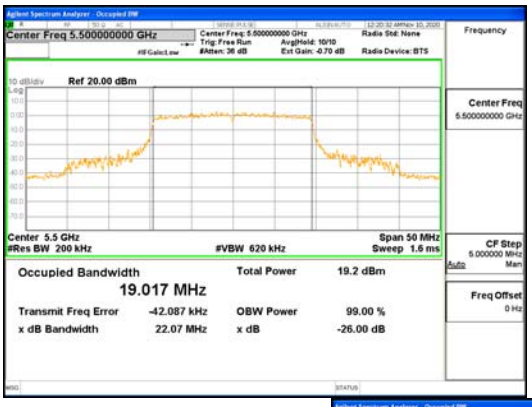
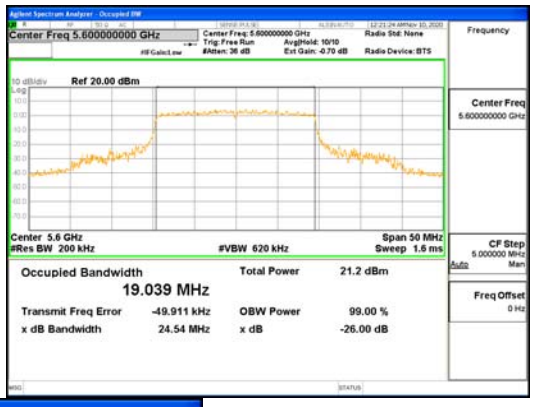
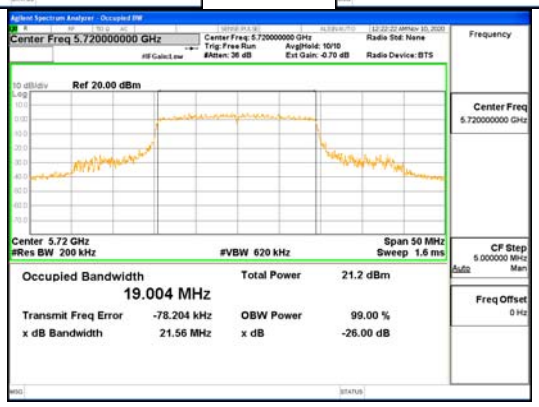




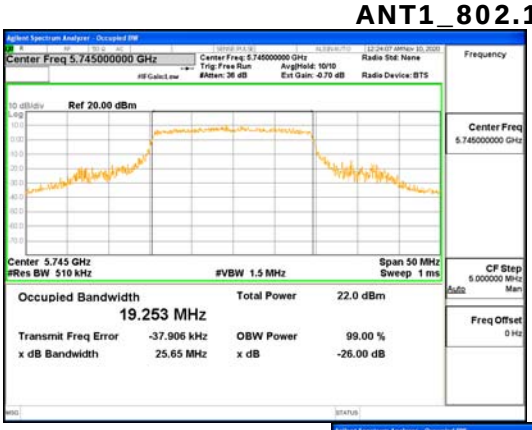
ANT1_802.11ax_HE20_UNII 2A

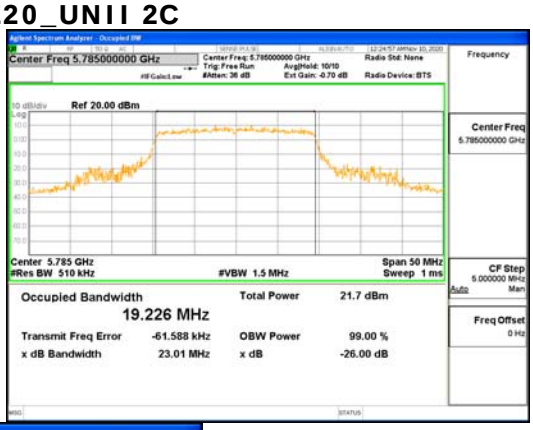




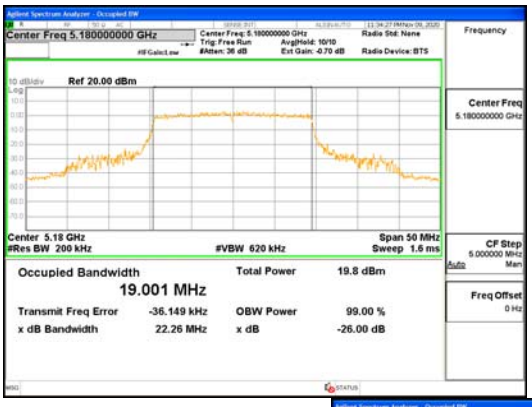


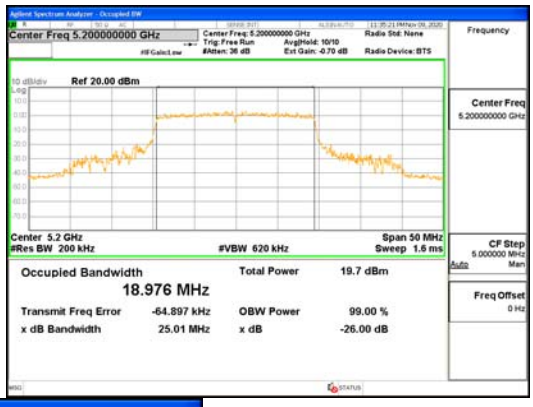
ANT1_802.11ax_HE20_UNII 2C





ANT1_802.11ax_HE20_UNII 3





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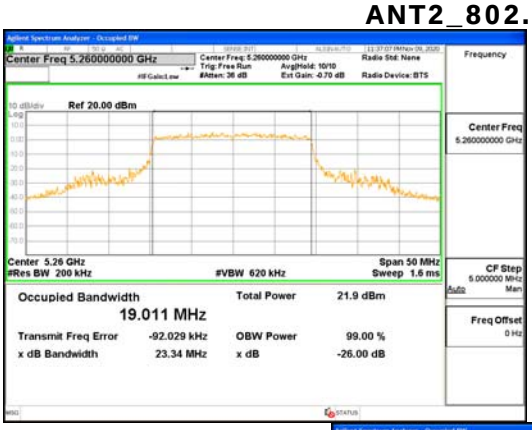
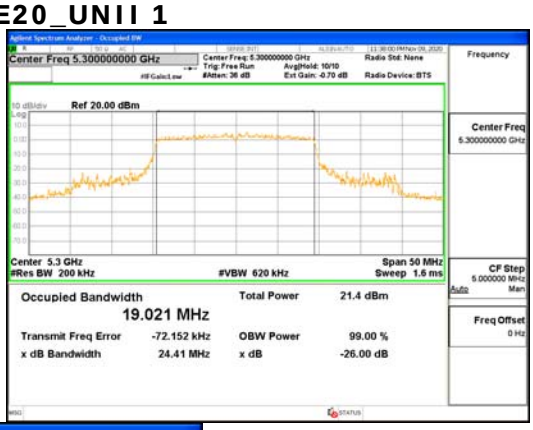
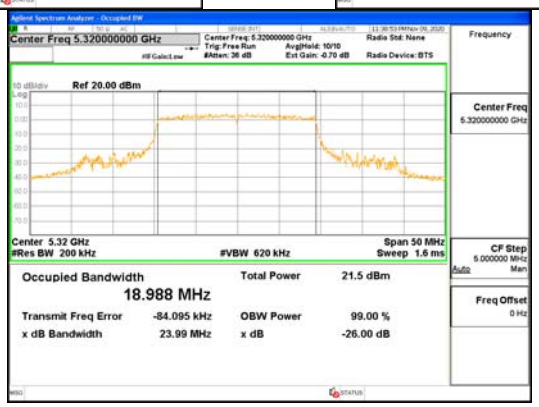
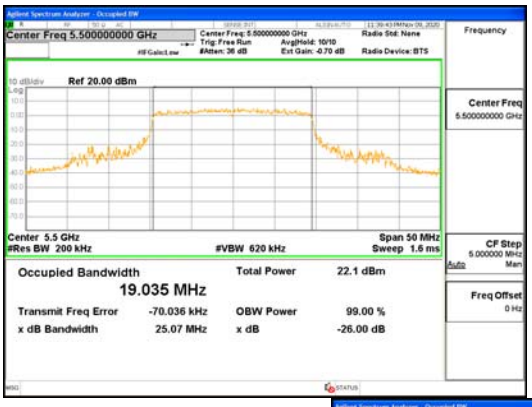
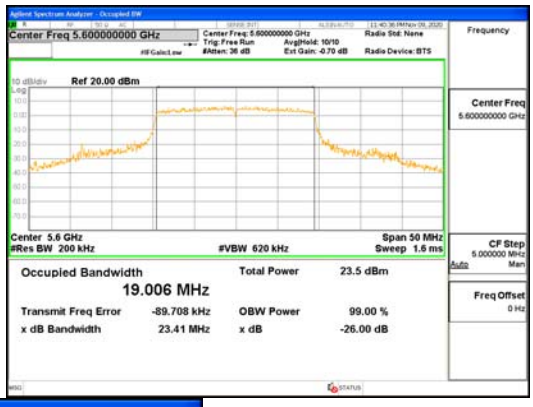


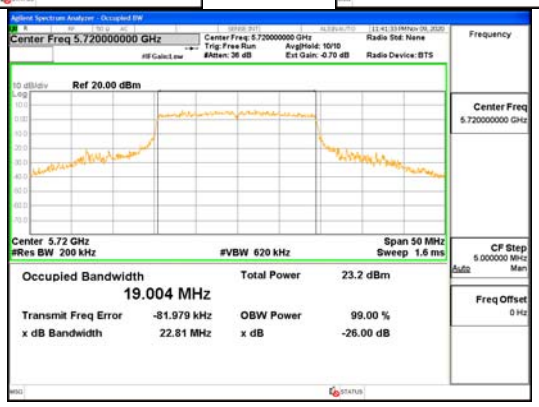




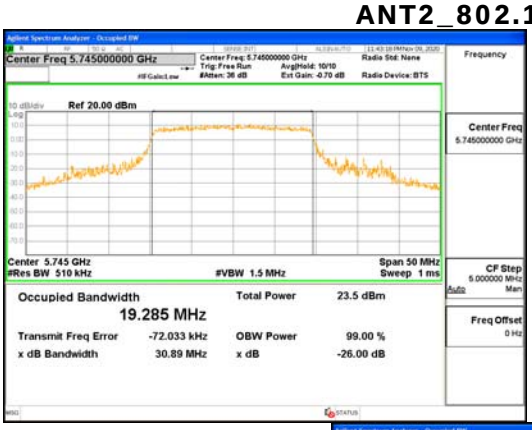
ANT2_802.11ax_HE20_UNII 2A

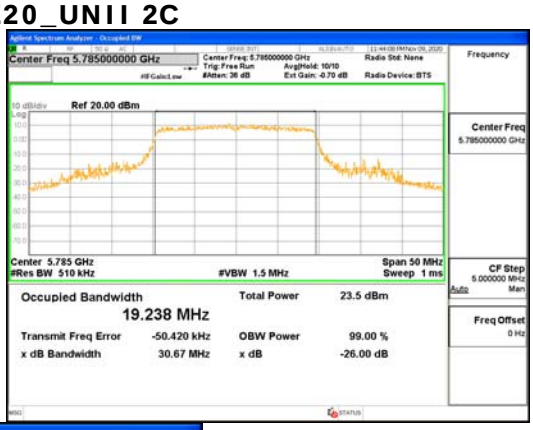






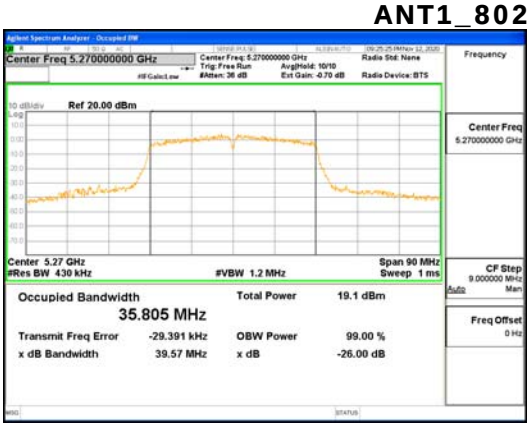
ANT2_802.11ax_HE20_UNII 2C

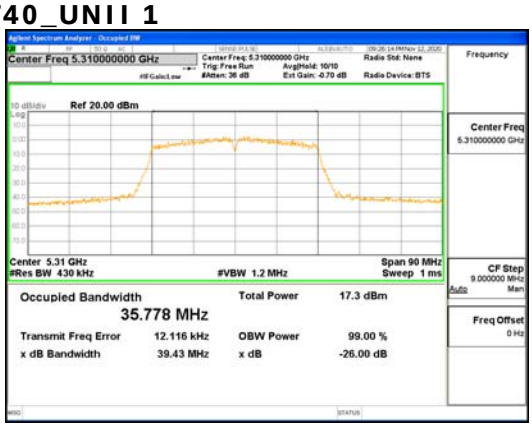




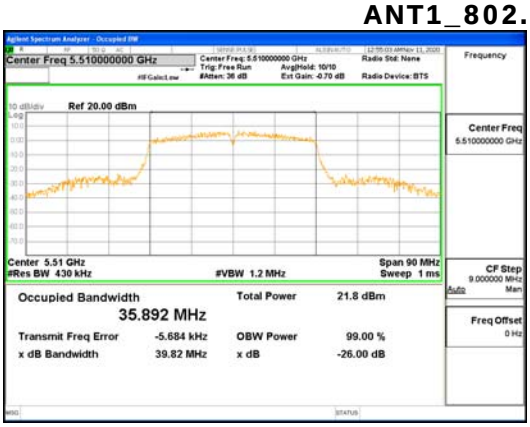
ANT2_802.11ax_HE20_UNII 3

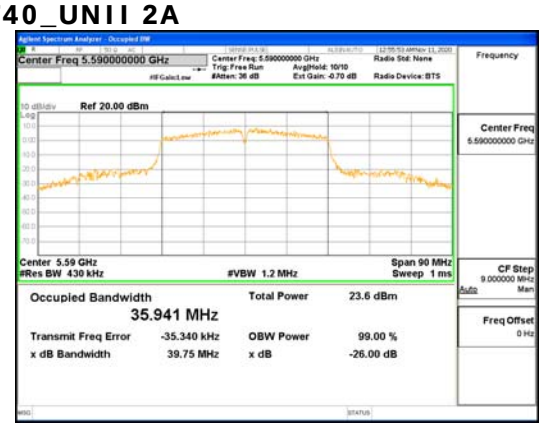
ANT1_802.11n_HT40_UNII 1

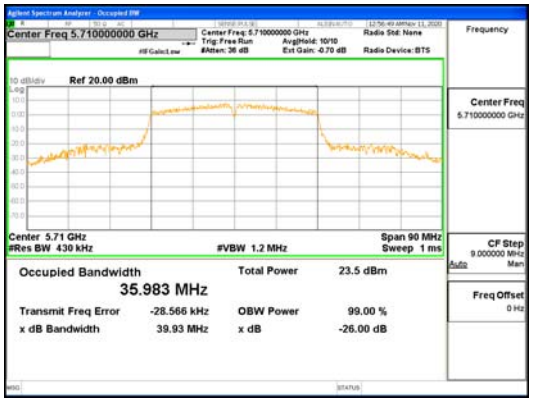




ANT1_802.11n_HT40_UNII 2A

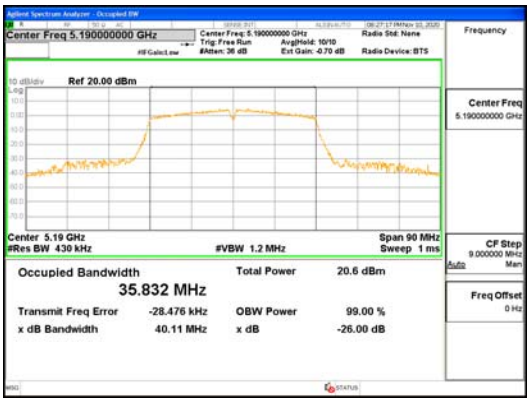


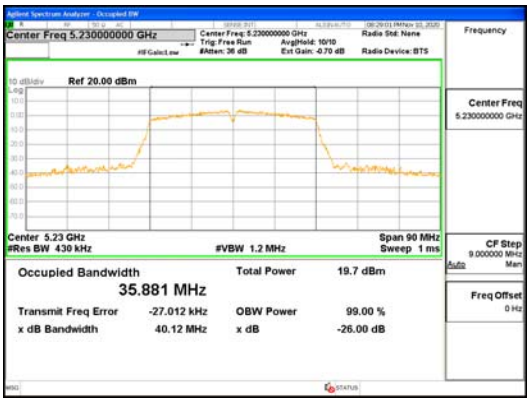




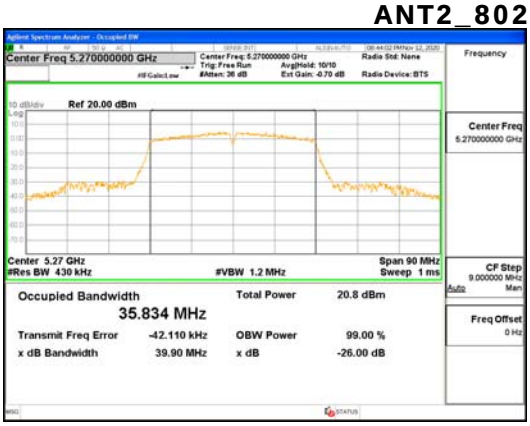
ANT1_802.11n_HT40_UNII 2C

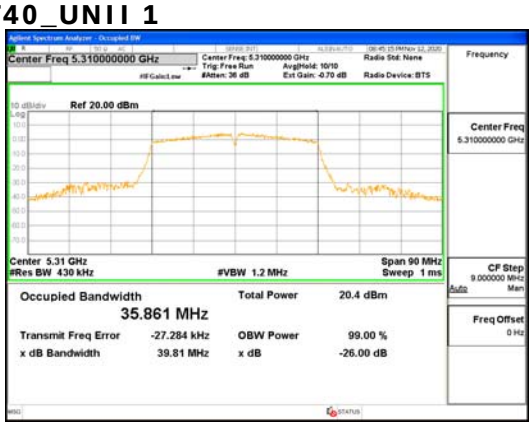
ANT1_802.11n_HT40_UNII 3



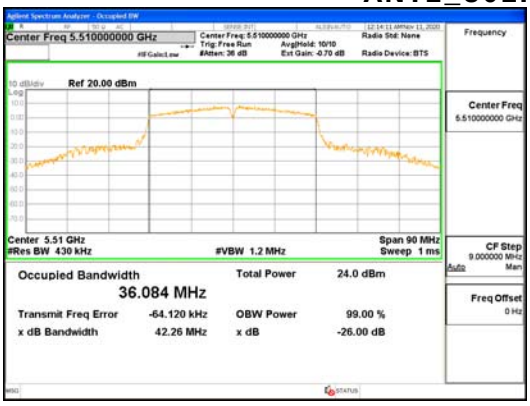


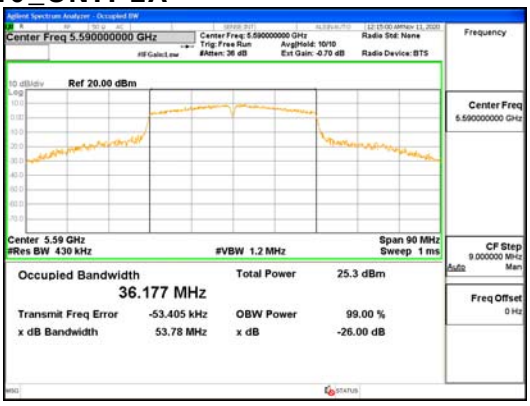
ANT2_802.11n_HT40_UNII 1

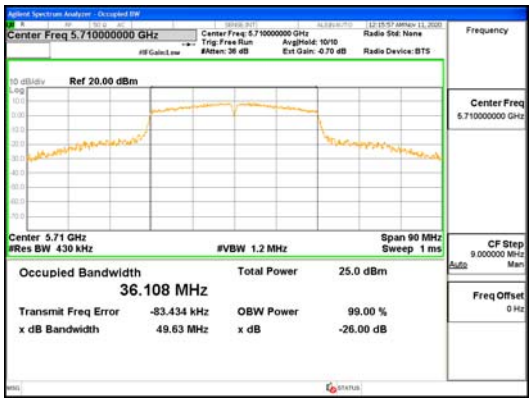




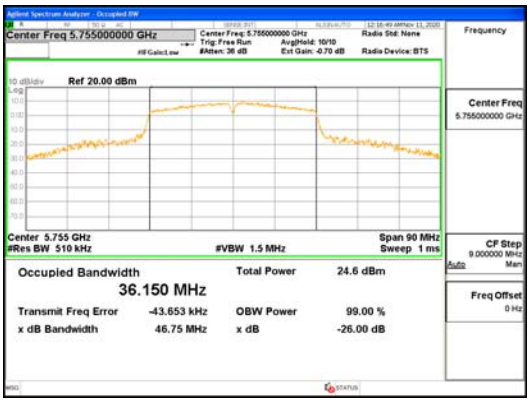
ANT2_802.11n_HT40_UNII 2A

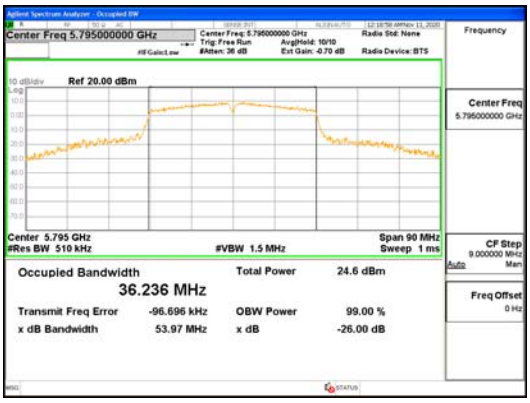






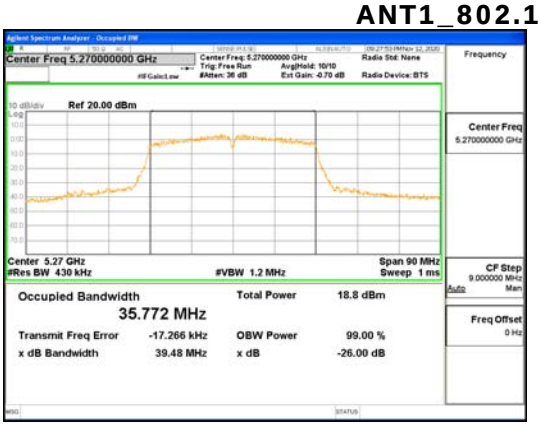
ANT2_802.11n_HT40_UNII 2C

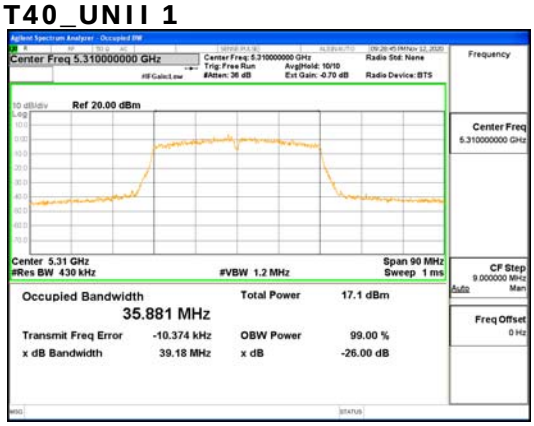




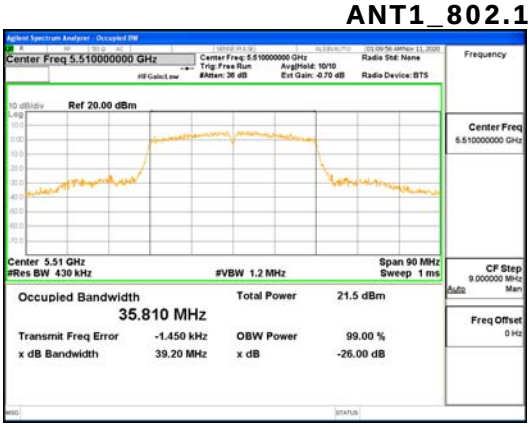
ANT2_802.11n_HT40_UNII 3

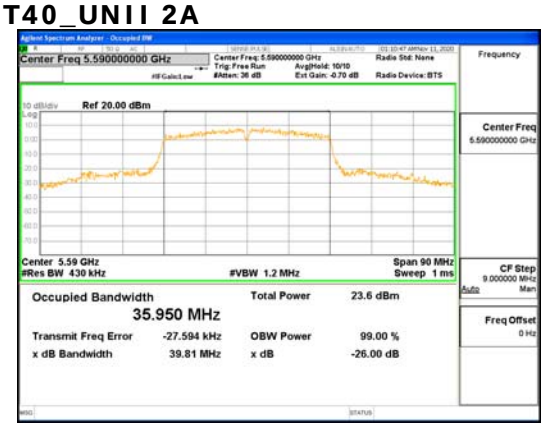
ANT1_802.11ac_VHT40_UNII 1





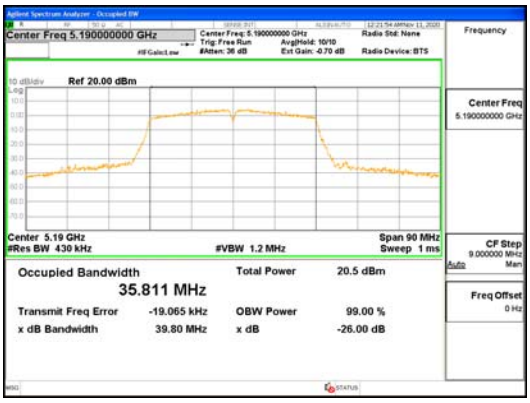
ANT1_802.11ac_VHT40_UNII 2A

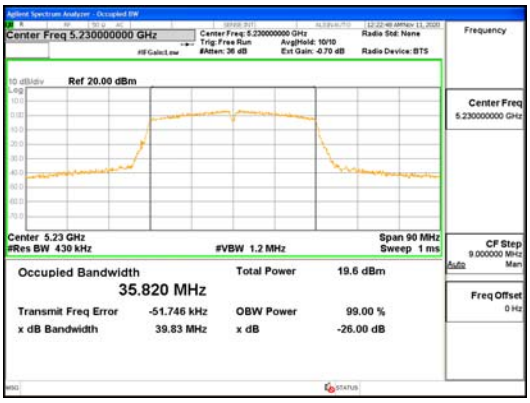




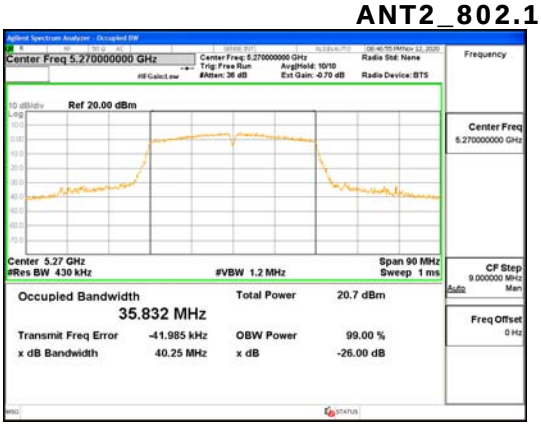
ANT1_802.11ac_VHT40_UNII 2C

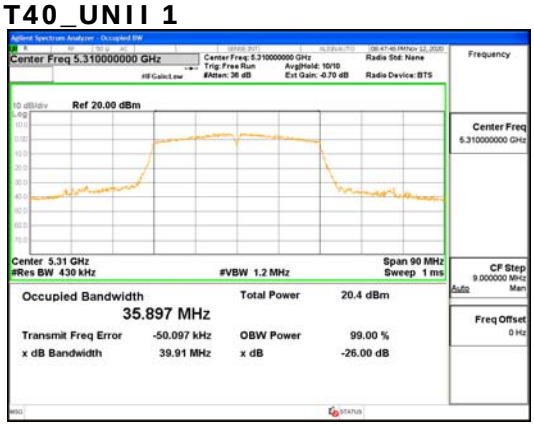
ANT1_802.11ac_VHT40_UNII 3



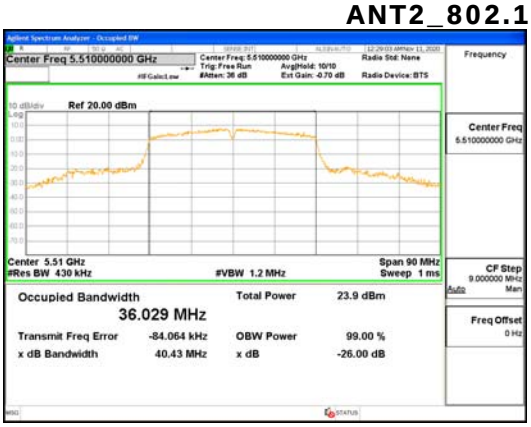


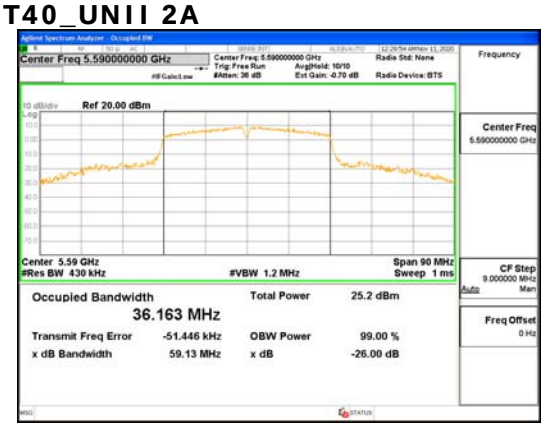
ANT2_802.11ac_VHT40_UNII 1

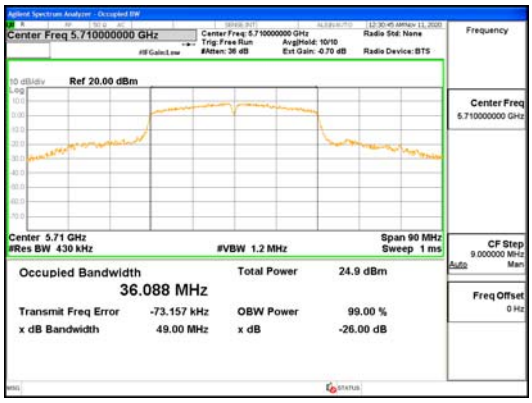




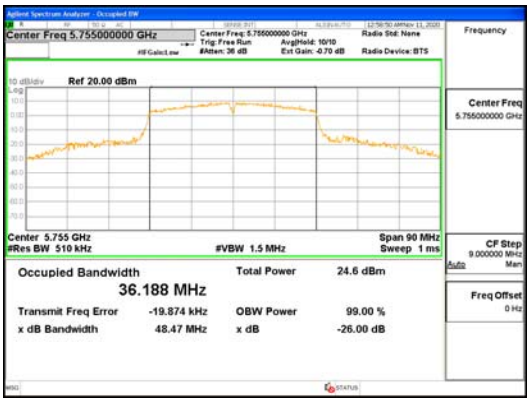
ANT2_802.11ac_VHT40_UNII 2A

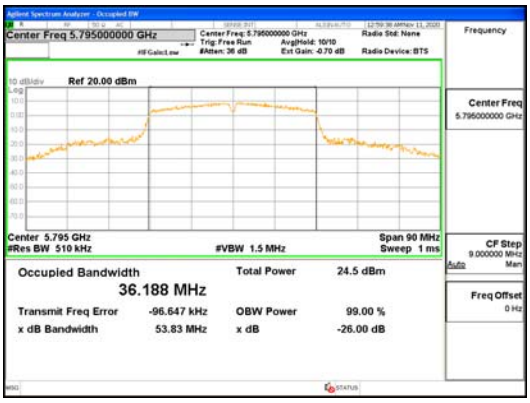






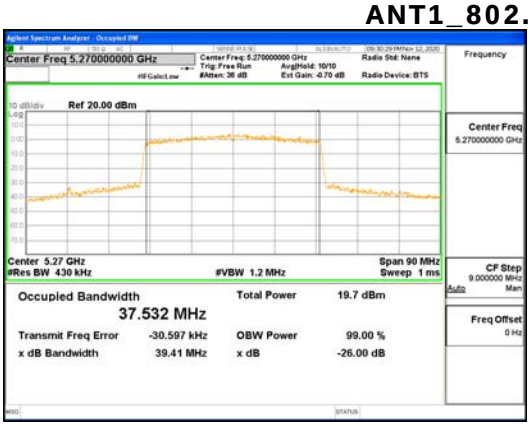
ANT2_802.11ac_VHT40_UNII 2C

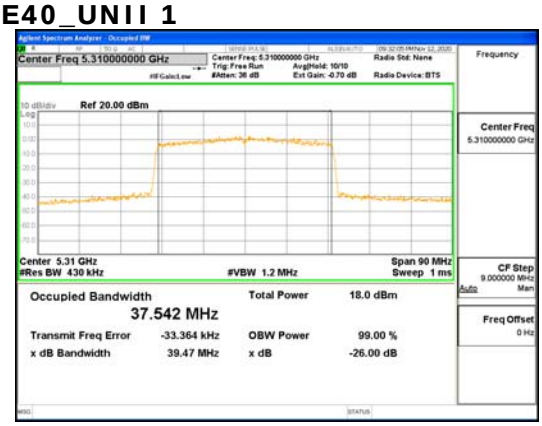




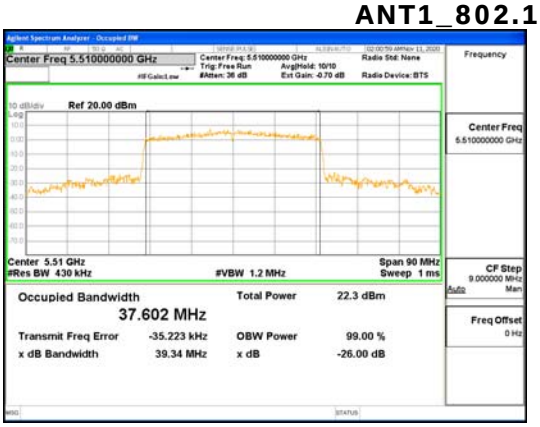
ANT2_802.11ac_VHT40_UNII 3

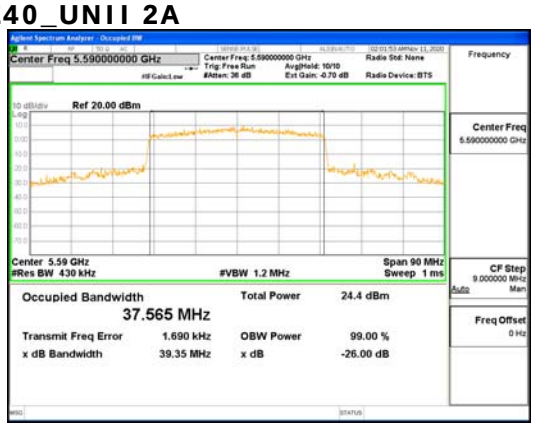
ANT1_802.11ax_HE40_UNII 1





ANT1_802.11ax_HE40_UNII 2A





ANT1_802.11ax_HE40_UNII 2C

ANT1_802.11ax_HE40_UNII 3