TEST REPORT

CTK Co., Ltd.
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Report No.: CTK-2024-02547

1. Applicant

◦ Name : Haier US Appliance Solutions, Inc.

◦ Address : Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225

◦ Date of Receipt : 2024-07-19

2. Manufacturer

◦ Name : Haier US Appliance Solutions, Inc.

◦ Address : Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225

3. Use of Report : For FCC Conformance

4. Test Sample / Model : Android Board for GEA LCD products / SBC001

5. Date of Test : 2022-08-02 to 2024-09-06

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

7. Testing Environment : refer to 8 page

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing

(Address : (Unhak-Dong) 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yong-in-si, Gyeonggi-do, Korea)

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
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Approval	Tested by Ji-Hye, Kim: (Signature)	Technical Manager Won-Jae, Hwang: (Signature)

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2024-09-10

CTK Co., Ltd.

REPORT REVISION HISTORY

Date	Revision	Page No
2024-09-10	Issued (CTK-2024-02547)	all

CONTENTS

1. General Product Description

1.1 Applicant Information

Company	Haier US Appliance Solutions, Inc.
Contact Point	Appliance Park AP5-2N-65, Louisville, Kentucky, United States, 40225
Contact Person	Name : Park, Hansung E-mail : hansung.park@geappliances.com Tel : +82-31-8094-6732 Fax : +82-31-8094-6888

1.2 Product Information

FCC ID	ZKJ-SBC001
ISED	10229A-SBC001
Product Description	Android Board for GEA LCD products
Model name	SBC001
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 : 17.53 dBm (56.62 mW) 802.11n_HT20 : 18.49 dBm (70.63 mW) 802.11n_HT40 : 19.53 dBm (89.74 mW) 802.11ac_VHT20 : 17.93 dBm (62.09 mW) 802.11ac_VHT40 : 19.30 dBm (85.11 mW) 802.11ac_VHT80 : 19.02 dBm (79.80 mW)
Antenna Specification	Antenna type : Chip Antenna Peak Gain : 3.51 dBi (ANT1, ANT2)
Antenna Configurations	802.11a : SISO(ANT1, ANT2) 802.11n : SISO(ANT1, ANT2), MIMO(ANT1+ANT2) 802.11ac : SISO(ANT1, ANT2), MIMO(ANT1+ANT2)
Type of Modulation	OFDM
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
Power Source	DC 5 V
Hardware Rev	HT-PCB-240-A2302B-C-V06
Software Rev	AOSP-1.8.0.10
Dynamic Frequency Selection	Slave without radar detection

RF Power setting in Test SW

Mode	Frequency Band	Power Setting Value
802.11a	UNII 1	15.0
	UNII 2A	16.5
	UNII 2C	16.0 (5 700 MHz : 14)
	UNII 3	17.0
802.11n_HT20	UNII 1	12.0
	UNII 2A	15.5
	UNII 2C	14.5 (5 700 MHz : 13)
	UNII 3	17.0
802.11n_HT40	UNII 1	15.0
	UNII 2A	14.0
	UNII 2C	14.5
	UNII 3	17.0
802.11ac_VHT20	UNII 1	12.0
	UNII 2A	15.5
	UNII 2C	14.5 (5 700 MHz : 13)
	UNII 3	17.0
802.11ac_VHT40	UNII 1	15.0
	UNII 2A	14.0
	UNII 2C	14.5
	UNII 3	17.0
802.11ac_VHT80	UNII 1	14.5
	UNII 2A	14.0
	UNII 2C	14.5
	UNII 3	17.0

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. Accreditations

2.1 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	CN : 8737A CAB ID : KR0025
KOREA	NRRA	KR0025

2.2 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 (5 725 – 5 850 MHz)	C	Conducted
15.407(a)	26 dB Bandwidth and 99% Bandwidth	NA	C	
15.407(a)(1),(2),(3)	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),(2),(3)	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, 5 250 – 5 350 MHz, 5 470 – 5 725 MHz) < -27 dBm/MHz EIRP < 10 dBm/MHz EIRP < 15.6 dBm/MHz EIRP < 27 dBm/MHz EIRP (5 725 – 5 850 MHz)	C	Radiated
15.205, 15.407 (b)(9),(10)	Radiated Spurious Emission	15.209(a)	C	
15.407 (b)(9)	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 15.407, ANSI C63.10-2013				
Note 4: The tests were performed according to the method of measurements prescribed in KDB No.789033.				

3.2 Testing Environment

Test Item		Test Date	Temperature (℃)	Relative Humidity (%)
Carrier Frequency Separation Number of Hopping Frequencies 20 dB Bandwidth Time of occupancy (Dwell Time) Maximum peak conducted output power Unwanted emission (Conducted)		2024-08-02	23	55
Transmitter emission (Radiated)	1) 9 kHz to 30 MHz	2024-08-23	24	50
	2) 30 MHz to 1 GHz			
	3) 1 GHz to 18 GHz	2024-09-03 to 2024-09-06	23 to 25	55 to 60
	4) 18 GHz to 25 GHz			
	5) Restricted Frequency Bands			
AC Conducted Emission		2024-08-23	24	50

3.3 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

	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	5 700 MHz, 5 720 MHz
UNII 3	5 745 MHz	5 785 MHz	5 825 MHz

- 802.11n_HT40, 802.11ac_VHT40

	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	5 670 MHz, 5 710 MHz
UNII 3	5 755 MHz	-	5 795 MHz

- 802.11ac_VHT80

	Lowest channel	Middle channel	Highest channel
UNII 1	5 210 MHz	-	-
UNII 2A	5 290 MHz	-	-
UNII 2C	5 530 MHz	5 610 MHz	5 690 MHz
UNII 3	5 775 MHz	-	-

Test mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11a	OFDM	6 Mbps	96.5 %	0.15 dB
802.11n_HT20	OFDM	MCS 0	96.2 %	0.17 dB
802.11n_HT40	OFDM	MCS 0	92.9 %	0.32 dB
802.11ac_VHT20	OFDM	MNSS 0	96.3 %	0.16 dB
802.11ac_VHT40	OFDM	MNSS 0	92.9 %	0.32 dB
802.11ac_VHT80	OFDM	MNSS 0	86.8 %	0.61 dB

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 (C.L.: Approx. 95 %, k = 2)
Power Spectral Density	1.5 dB (C.L.: Approx. 95 %, k = 2)
Occupied Bandwidth	0.1 MHz (C.L.: Approx. 95 %, k = 2)
Unwanted Emission(conducted)	3.0 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f ≤ 1 GHz)	3.82 dB (C.L.: Approx. 95 %, k = 2)
Radiated Emissions (f > 1 GHz)	4.50 dB (C.L.: Approx. 95 %, k = 2)
Line Conducted Emission	2.00 dB (C.L.: Approx. 95 %, k = 2)

3.5 Test Software

Automation program

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 6.0.1.0, ES10 Ver. 10.001
Line Conducted Test	EMC32 Ver. 10.50.0

Test program

Conducted Test, Radiated Test, Line Conducted Test	cmd.exe

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
5 745 MHz	15.12	15.01	15.15
5 785 MHz	15.10	15.01	16.06
5 825 MHz	15.14	13.83	15.03
Measurement uncertainty	± 0.1 MHz		

	6 dB Bandwidth (MHz)	
Mode / Frequency	802.11n_HT40	802.11ac_VHT40
5 755 MHz	35.10	35.09
5 795 MHz	35.10	35.09
Measurement uncertainty	± 0.1 MHz	

	6 dB Bandwidth (MHz)
Mode / Frequency	802.11ac_VHT80
5 775 MHz	71.41
Measurement uncertainty	± 0.1 MHz

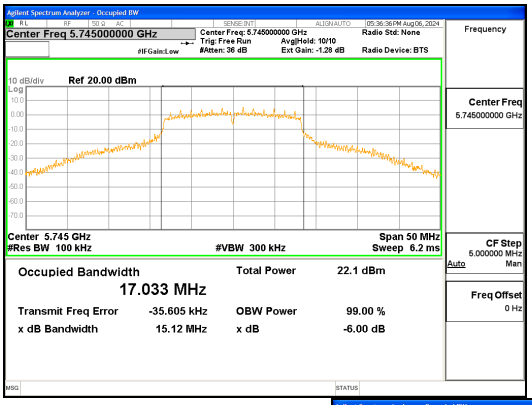
ANT2

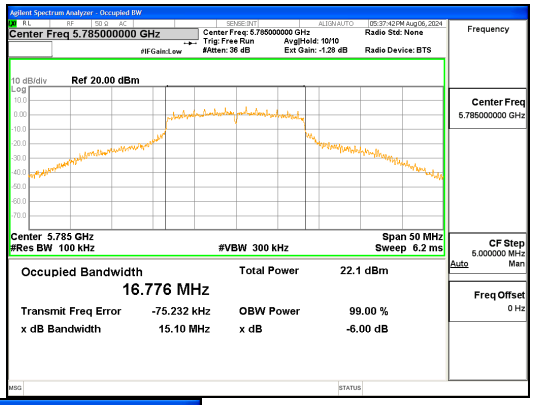
	6 dB Bandwidth (MHz)		
Mode / Frequency	802.11a	802.11n_HT20	802.11ac_VHT20
5 745 MHz	15.14	17.21	15.05
5 785 MHz	15.10	16.33	15.09
5 825 MHz	15.12	15.69	17.51
Measurement uncertainty	± 0.1 MHz		

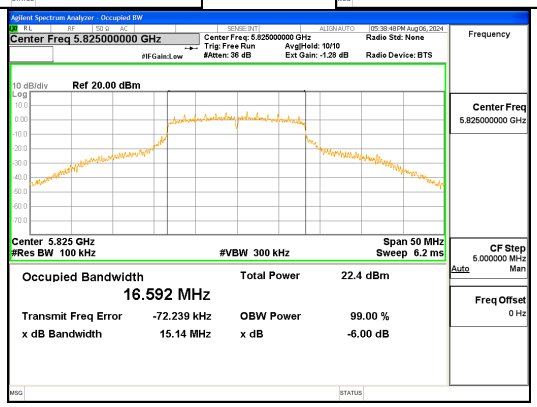
	6 dB Bandwidth (MHz)	
Mode / Frequency	802.11n_HT40	802.11ac_VHT40
5 755 MHz	35.10	32.61
5 795 MHz	35.10	32.61
Measurement uncertainty	± 0.1 MHz	

	6 dB Bandwidth (MHz)
Mode / Frequency	802.11ac_VHT80
5 775 MHz	75.15
Measurement uncertainty	± 0.1 MHz

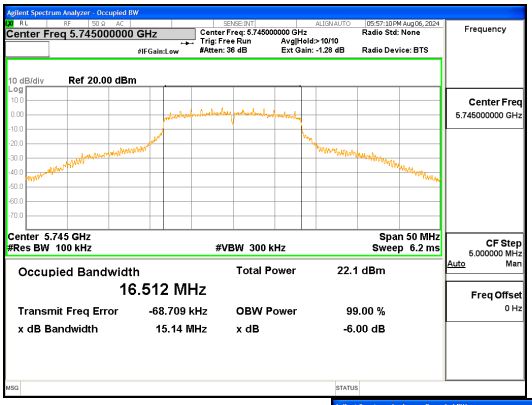
See next pages for actual measured spectrum plots.

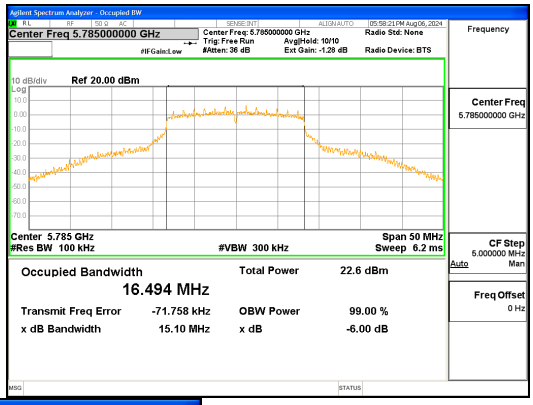


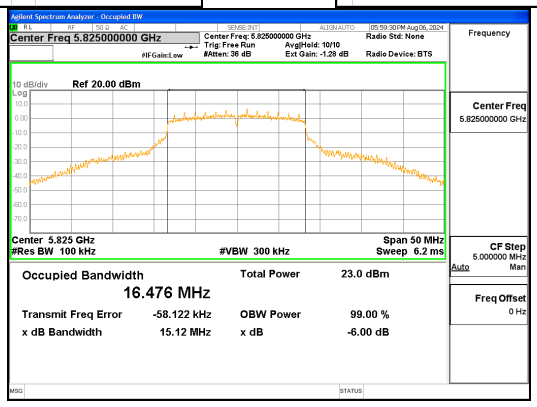




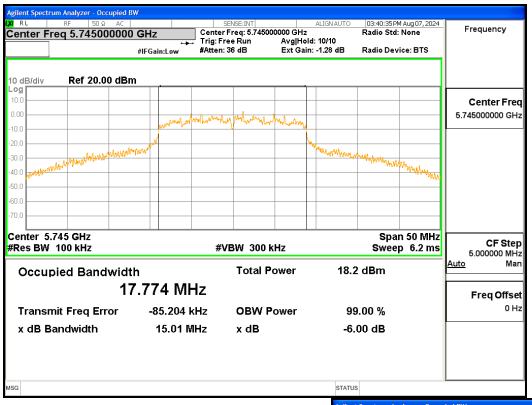
ANT1_802.11a

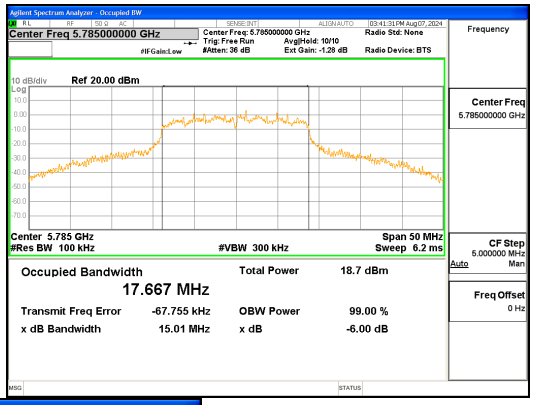


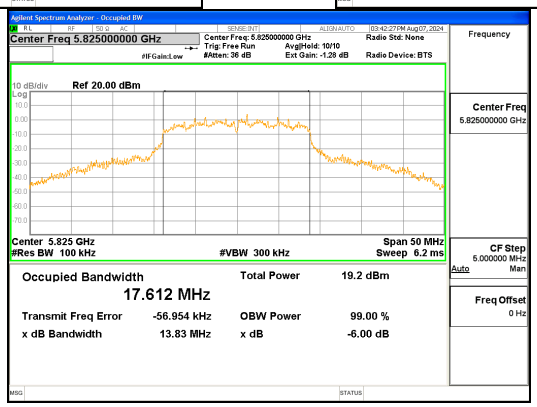




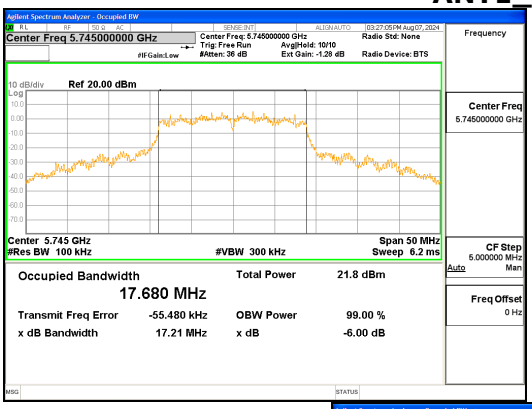
ANT2_802.11a

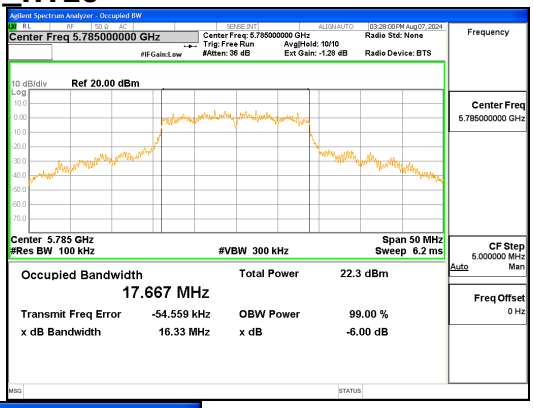


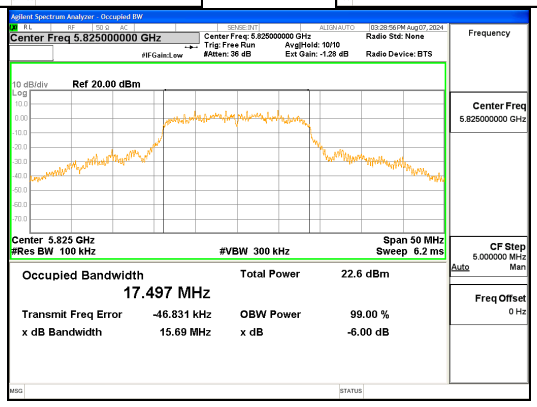




ANT1_802.11n_HT20







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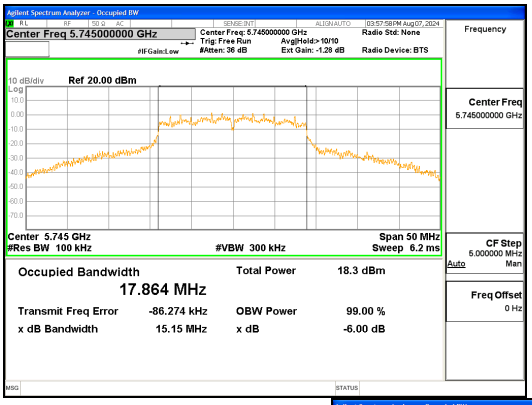
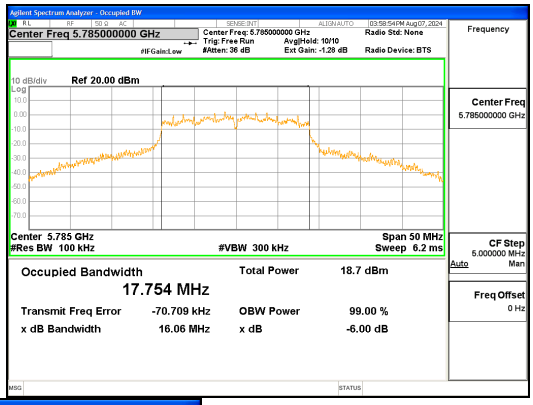
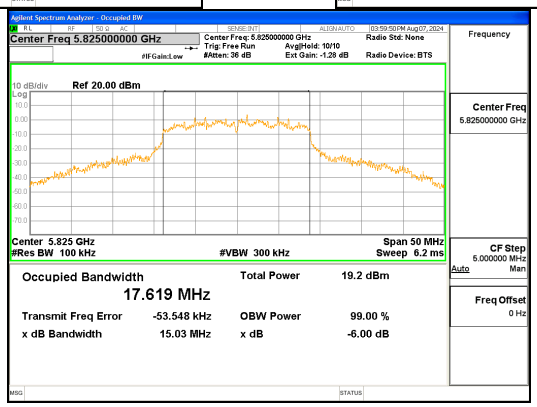
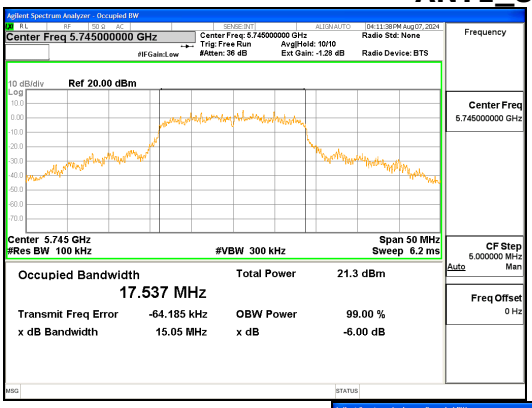
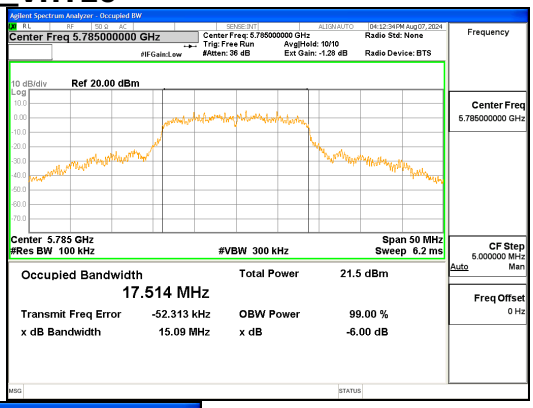


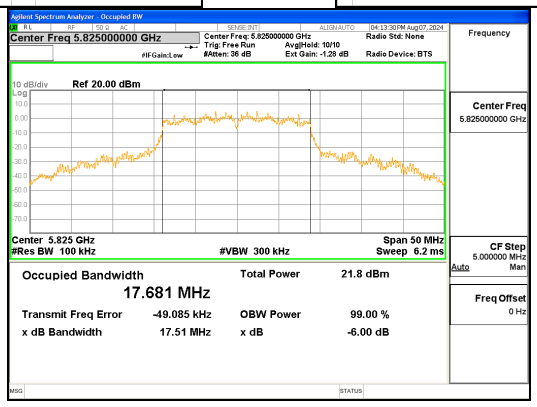




ANT1_802.11ac_VHT20







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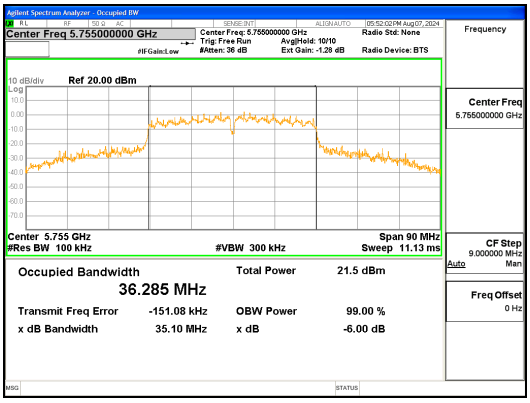

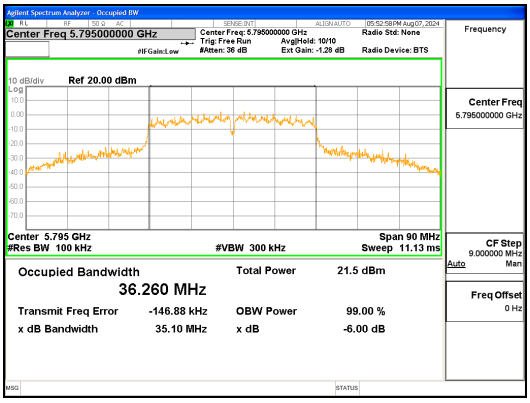

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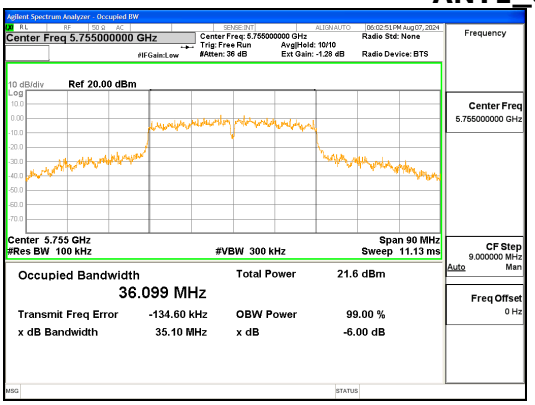

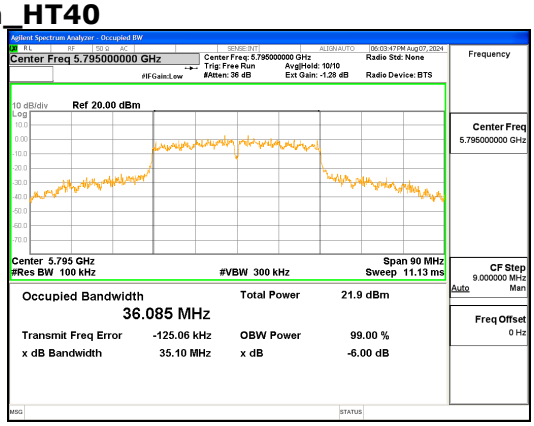

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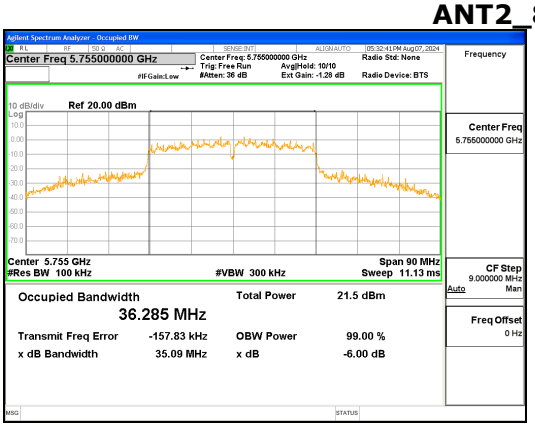

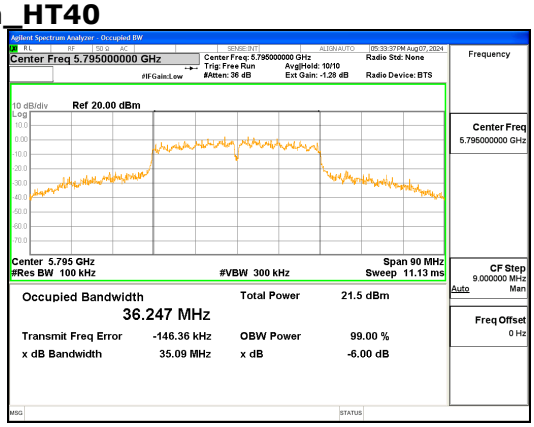

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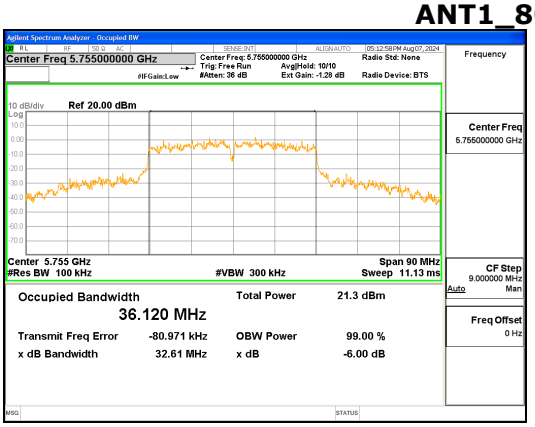

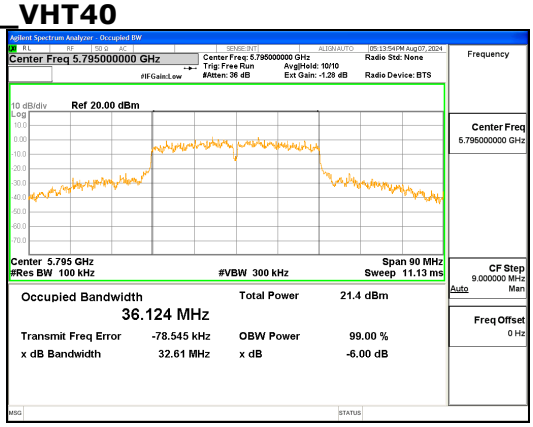

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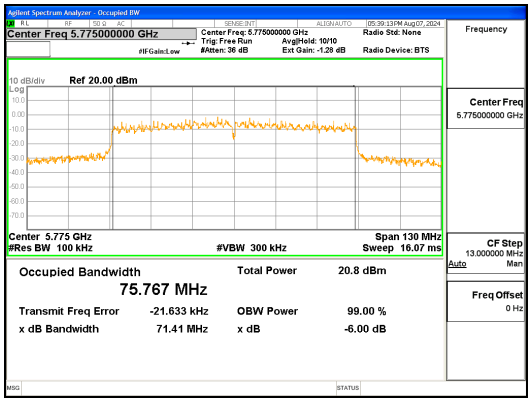

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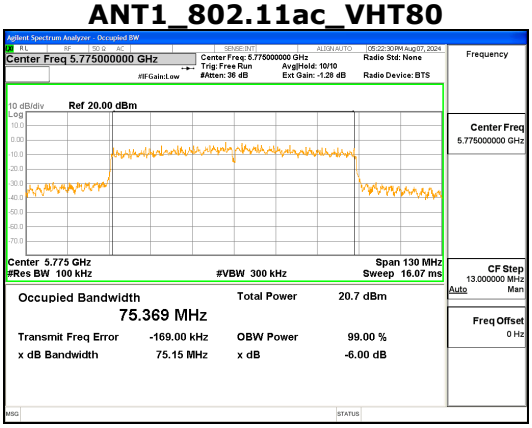


ANT2_802.11ac_VHT80

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	
Frequency	26 dB	99%	26 dB	99%	26 dB	99%
5 180 MHz	19.67	16.44	19.92	17.53	19.92	17.55
5 200 MHz	19.99	16.51	19.92	17.59	19.86	17.56
5 240 MHz	19.92	16.53	19.93	17.56	20.01	17.57
5 260 MHz	20.42	16.54	19.87	17.57	19.91	17.59
5 300 MHz	20.22	16.54	19.93	17.58	20.33	17.57
5 320 MHz	20.41	16.58	19.94	17.58	19.93	17.58
5 500 MHz	21.07	16.71	19.94	17.58	19.96	17.58
5 600 MHz	25.42	16.91	20.72	17.65	20.84	17.65
5 700 MHz	20.59	16.60	19.98	17.61	19.95	17.60
5 720 MHz	23.81	16.72	20.58	17.60	20.48	17.73
5 745 MHz	32.53	17.93	30.80	18.69	32.68	18.67
5 785 MHz	30.20	17.71	27.88	18.34	32.55	18.48
5 825 MHz	26.91	17.52	26.37	18.19	27.98	18.19
Measurement uncertainty	± 0.1 MHz					

	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	40.18	36.02	40.38	36.00
5 230 MHz	40.54	36.01	40.32	36.01
5 270 MHz	40.75	36.04	40.00	36.03
5 310 MHz	40.14	35.96	40.53	35.99
5 510 MHz	39.96	36.02	39.81	35.93
5 590 MHz	46.04	36.20	46.00	36.19
5 670 MHz	44.67	36.15	46.36	36.18
5 710 MHz	41.40	36.11	46.19	36.05
5 755 MHz	63.14	36.71	63.00	36.76
5 795 MHz	60.96	36.62	63.21	36.58
Measurement uncertainty	± 0.1 MHz			

	26 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	81.43	75.59
5 290 MHz	81.41	75.54
5 530 MHz	81.09	75.61
5 610 MHz	88.30	75.72
5 690 MHz	85.40	75.70
5 775 MHz	119.66	75.98
Measurement uncertainty	± 0.1 MHz	

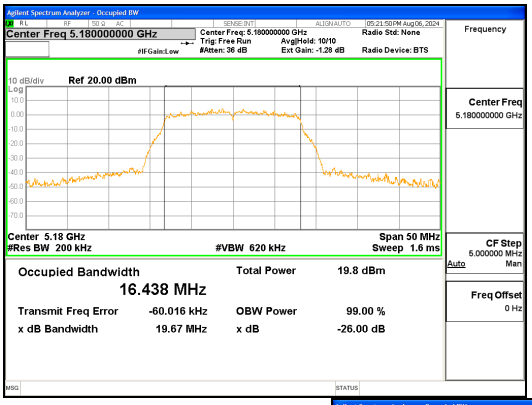
ANT2

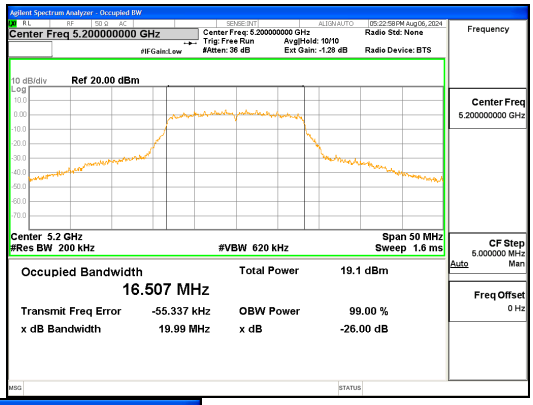
	26 dB Bandwidth and 99% Bandwidth (MHz)					
Mode	802.11a		802.11n_HT20		802.11ac_VHT20	
Frequency	26 dB	99%	26 dB	99%	26 dB	99%
5 180 MHz	19.74	16.49	20.05	17.58	19.85	17.59
5 200 MHz	20.32	16.57	20.15	17.50	19.83	17.49
5 240 MHz	20.03	16.50	20.10	17.59	19.79	17.59
5 260 MHz	20.34	16.62	19.99	17.62	20.20	17.59
5 300 MHz	20.35	16.59	20.07	17.62	19.89	17.57
5 320 MHz	20.47	16.61	20.05	17.62	19.93	17.59
5 500 MHz	23.78	16.76	19.99	17.57	19.74	17.52
5 600 MHz	20.58	16.60	19.91	17.61	19.91	17.62
5 700 MHz	19.83	16.49	20.17	17.49	19.91	17.47
5 720 MHz	20.34	16.55	20.01	17.62	19.88	17.64
5 745 MHz	25.50	17.31	29.97	18.01	25.07	17.78
5 785 MHz	23.23	17.28	24.81	17.99	25.39	17.78
5 825 MHz	23.46	17.31	25.37	17.72	24.98	18.00
Measurement uncertainty	± 0.1 MHz					

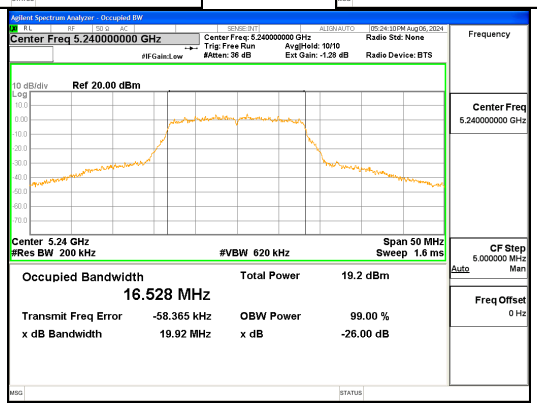
	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	39.58	36.13	39.51	35.96
5 230 MHz	39.72	36.13	39.77	36.13
5 270 MHz	39.57	35.97	39.95	36.05
5 310 MHz	40.20	36.05	39.47	35.99
5 510 MHz	39.76	36.05	39.51	35.99
5 590 MHz	40.04	36.13	39.91	36.06
5 670 MHz	39.92	36.14	39.62	36.00
5 710 MHz	39.76	36.06	39.96	36.12
5 755 MHz	46.94	36.31	54.99	36.39
5 795 MHz	47.23	36.32	55.01	36.40
Measurement uncertainty	± 0.1 MHz			

	26 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	79.88	75.24
5 290 MHz	79.44	75.22
5 530 MHz	79.65	75.29
5 610 MHz	80.09	75.39
5 690 MHz	80.61	75.45
5 775 MHz	93.26	75.51
Measurement uncertainty	± 0.1 MHz	

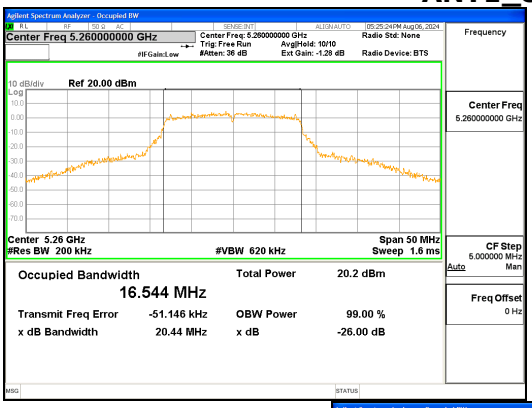
See next pages for actual measured spectrum plots.

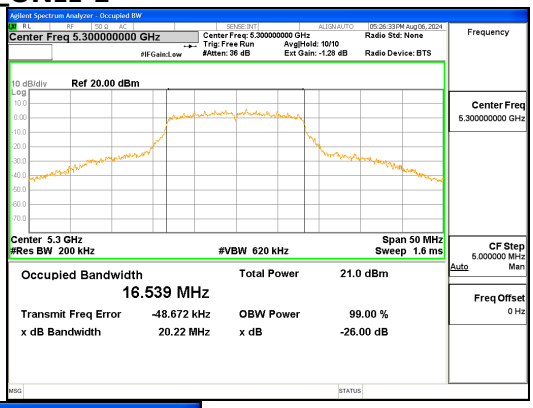


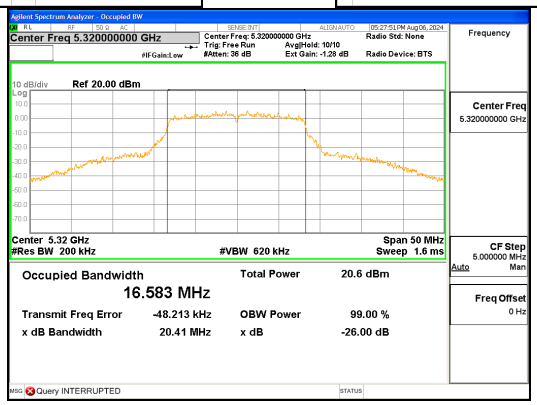




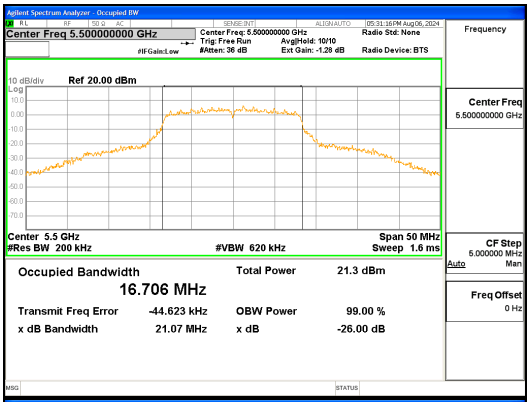
ANT1_802.11a_UNII 1

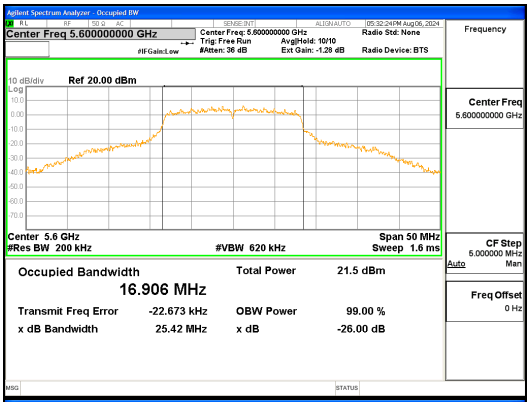


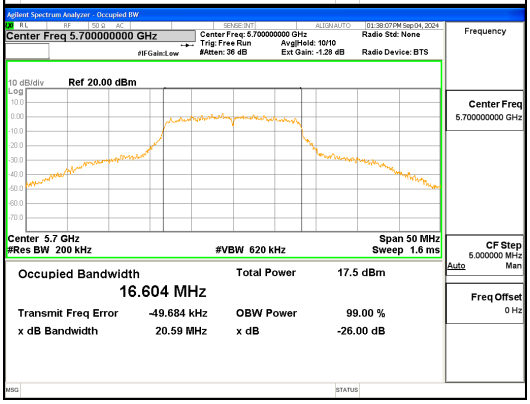


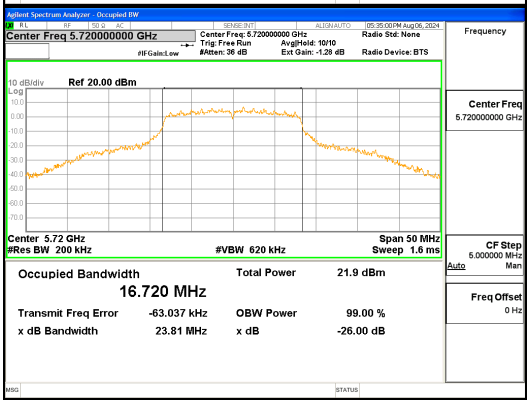


ANT1_802.11a_UNII 2A

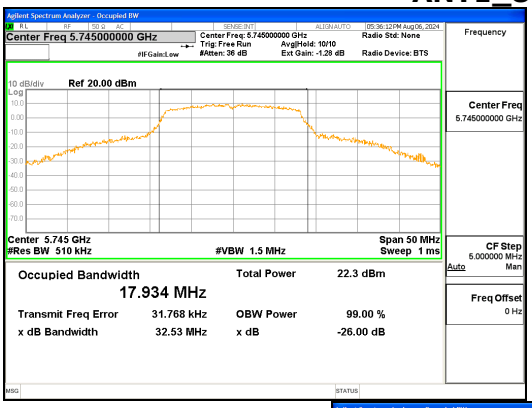


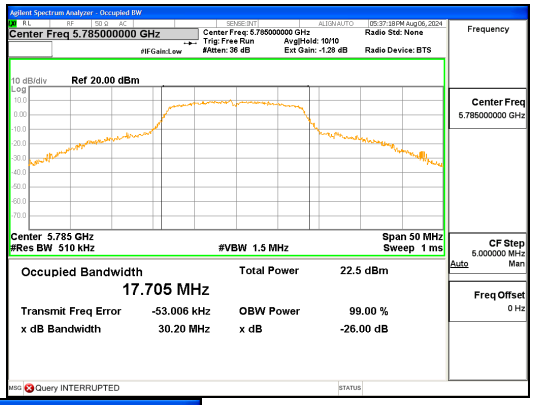


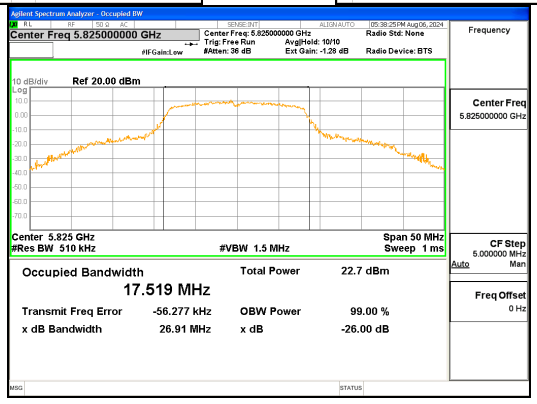




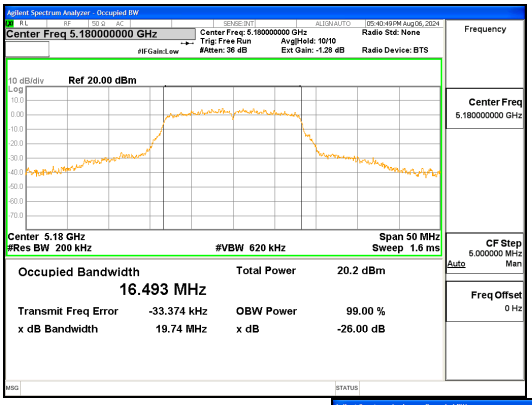
ANT1_802.11a_UNII 2C

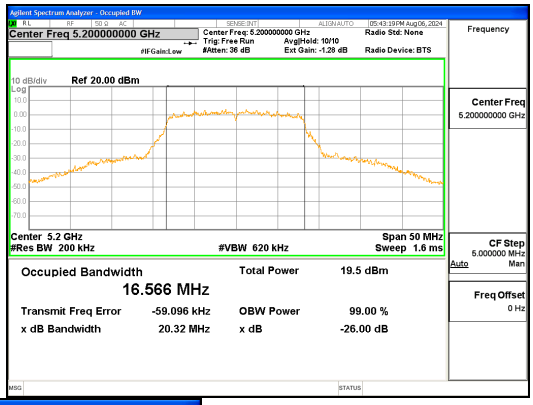


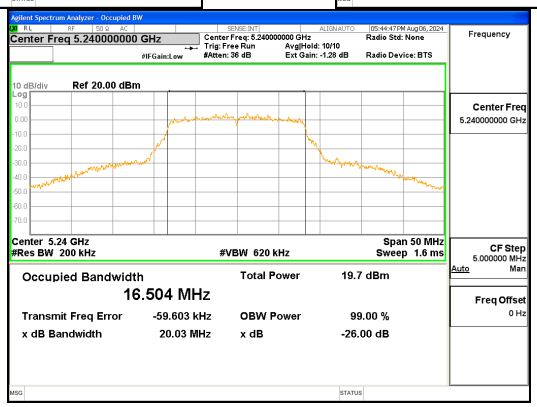




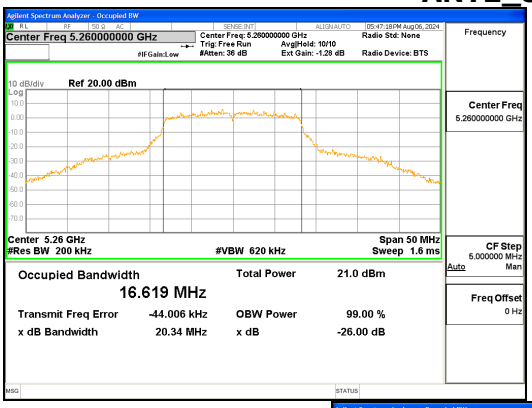
ANT1_802.11a_UNII 3

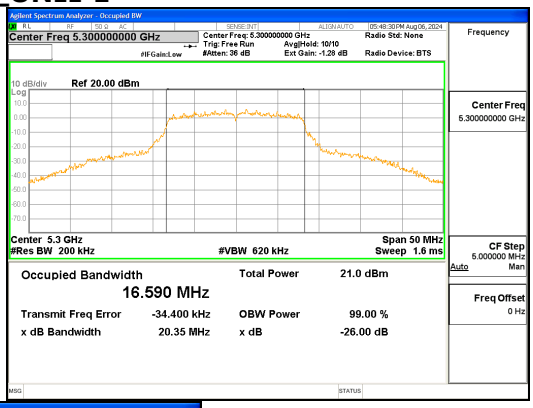


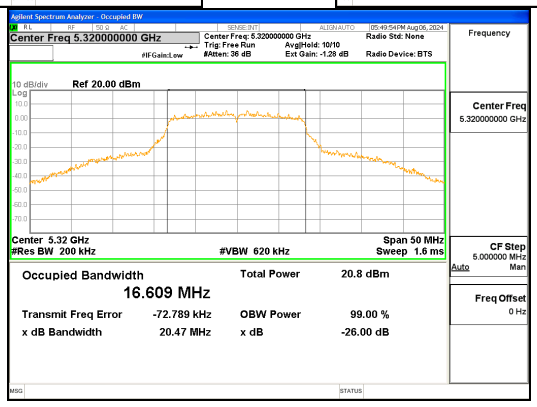




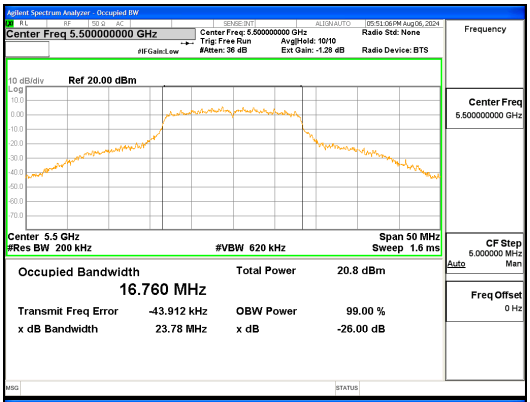
ANT2_802.11a_UNII 1

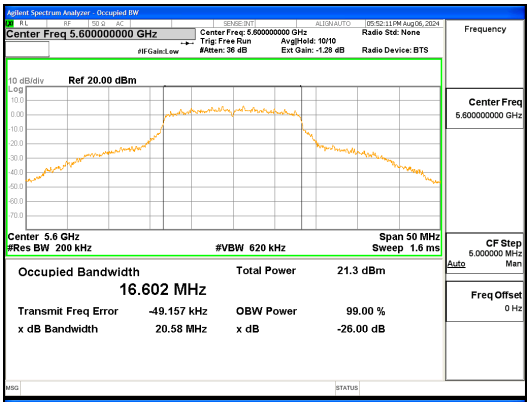


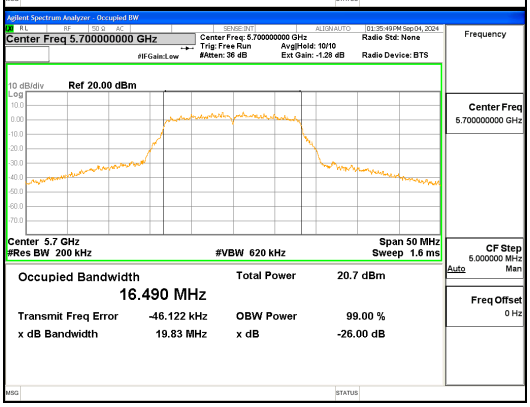


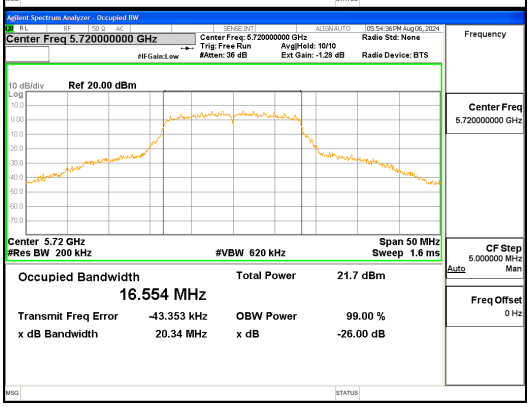


ANT2_802.11a_UNII 2A

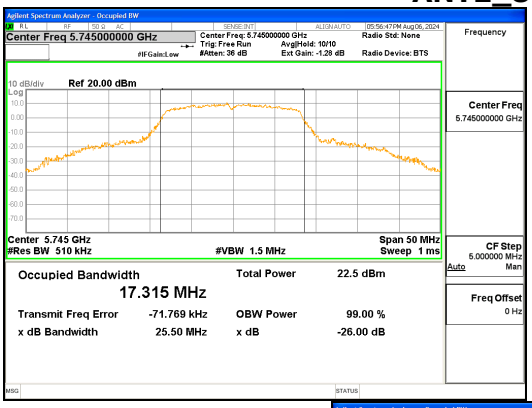


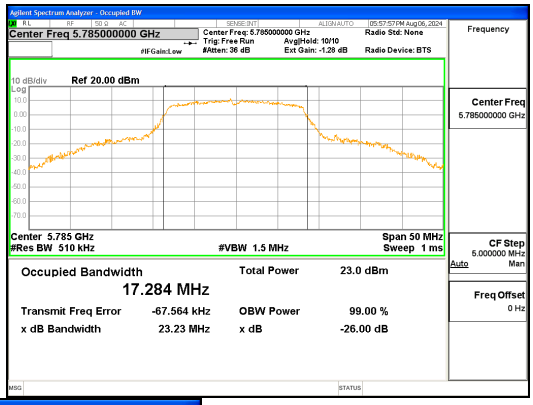


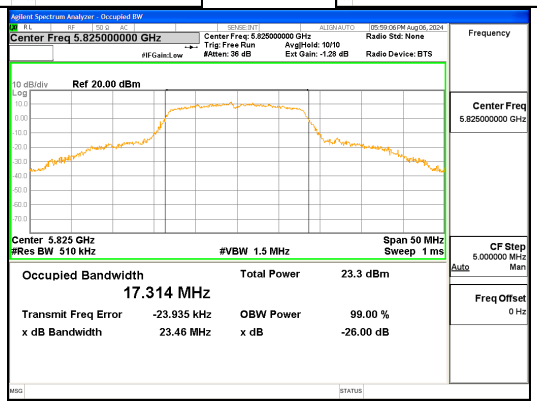




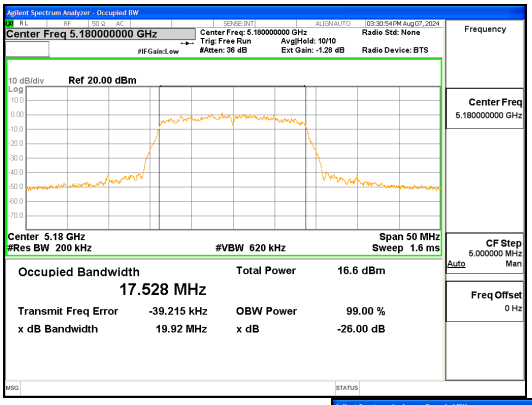
ANT2_802.11a_UNII 2C

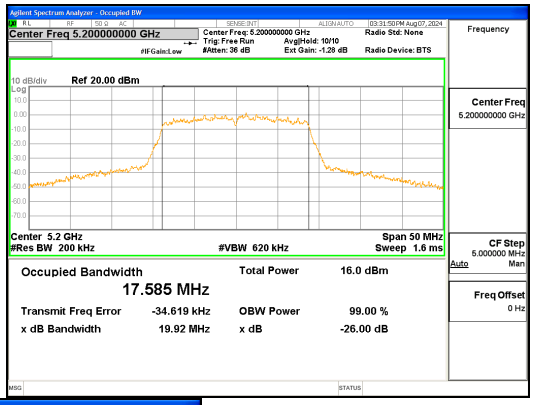


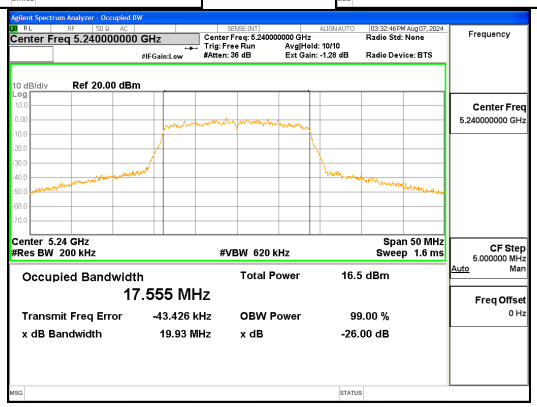




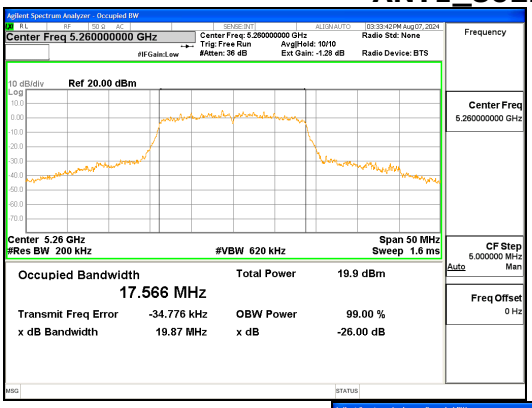
ANT2_802.11a_UNII 3

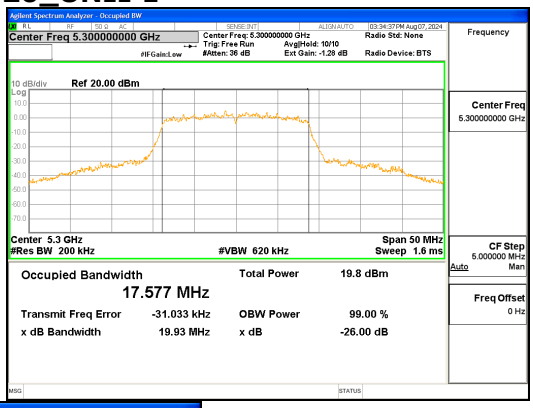


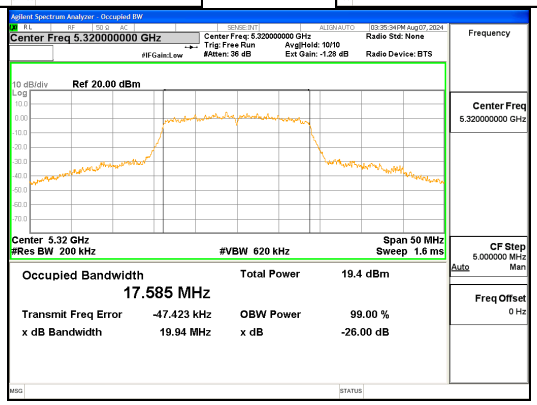




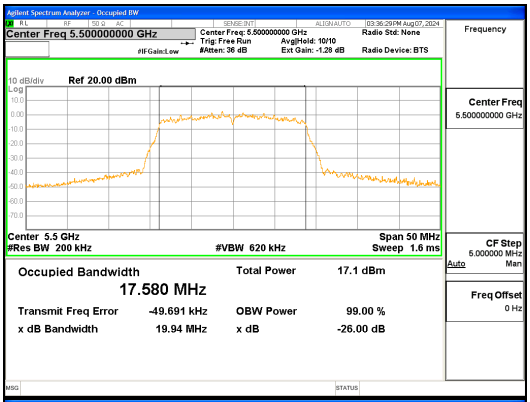
ANT1_802.11n_HT20_UNII 1

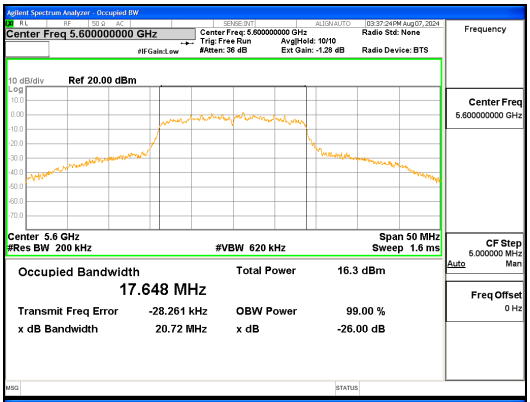


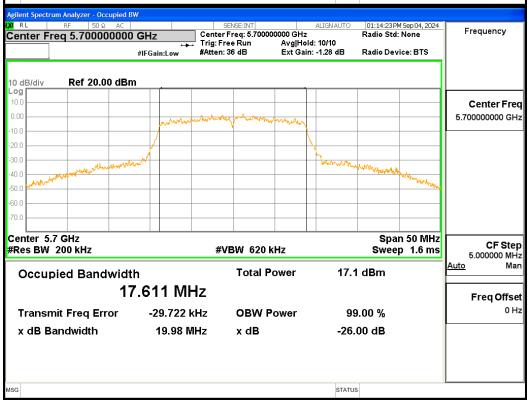


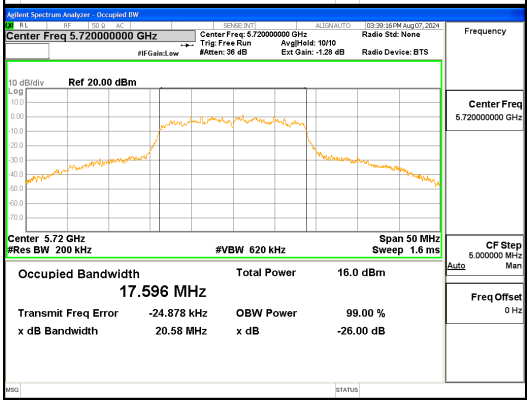


ANT1_802.11n_HT20_UNII 2A

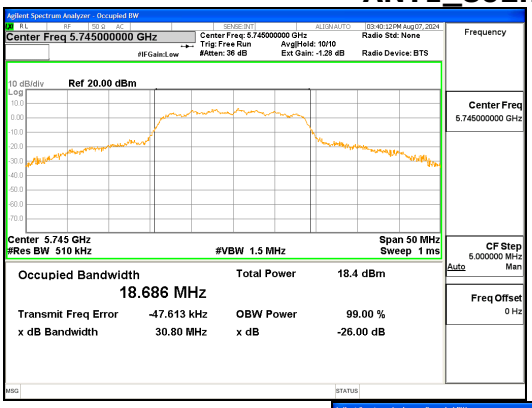


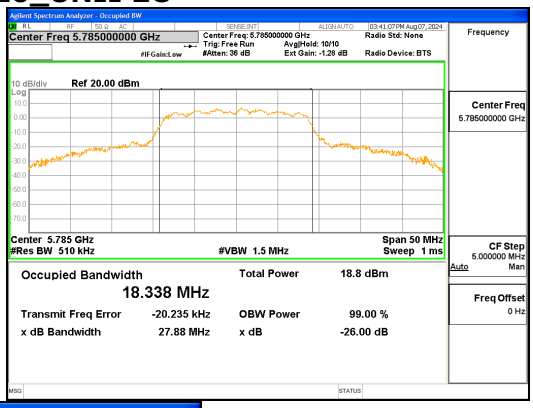


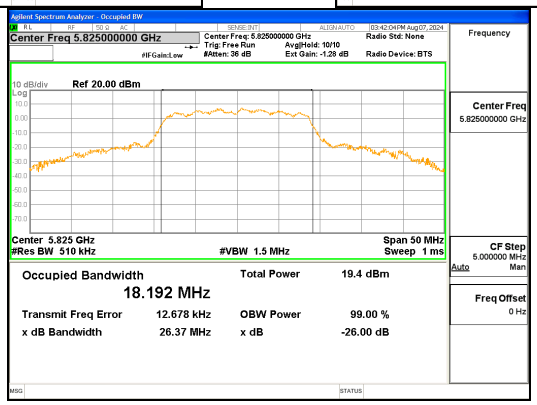




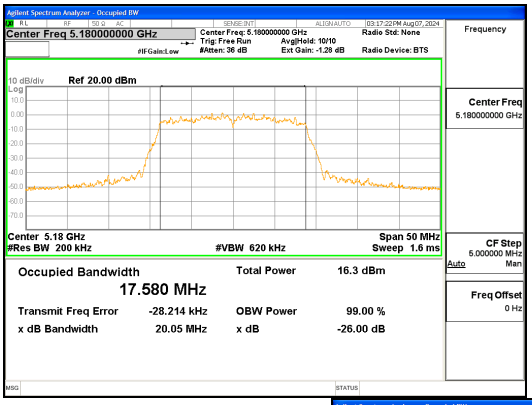
ANT1_802.11n_HT20_UNII 2C

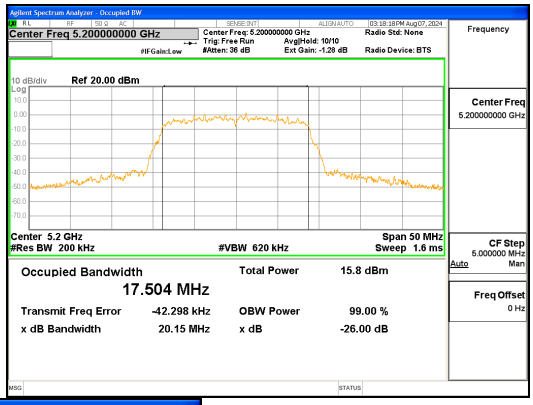


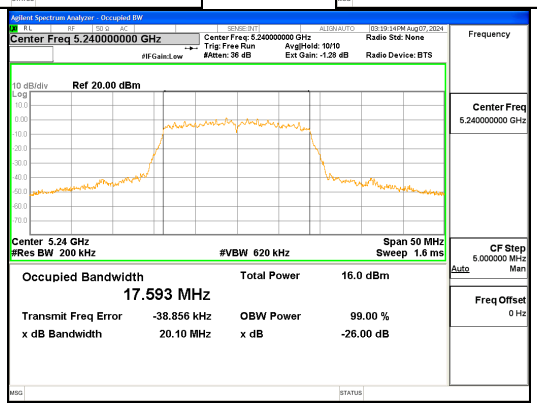




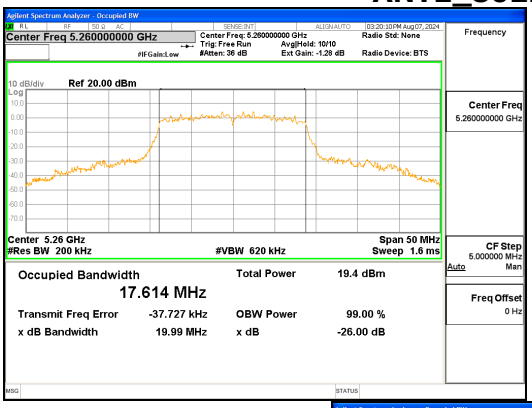
ANT1_802.11n_HT20_UNII 3

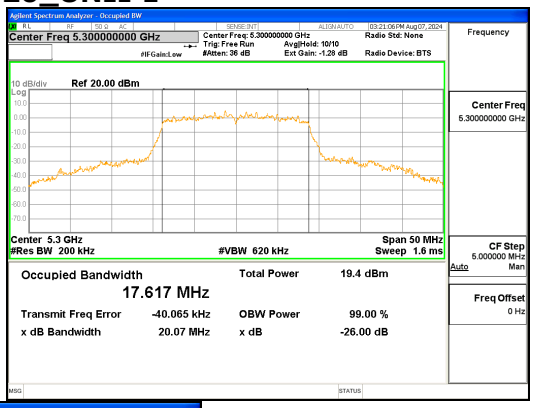


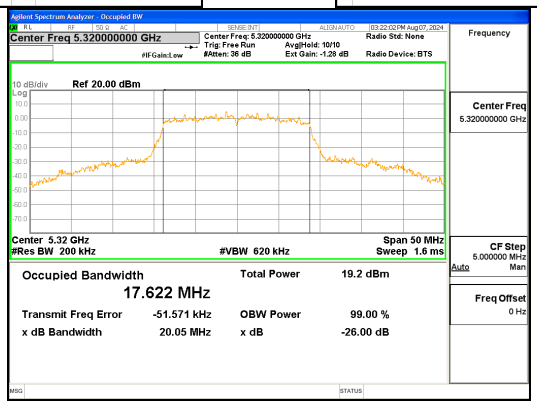




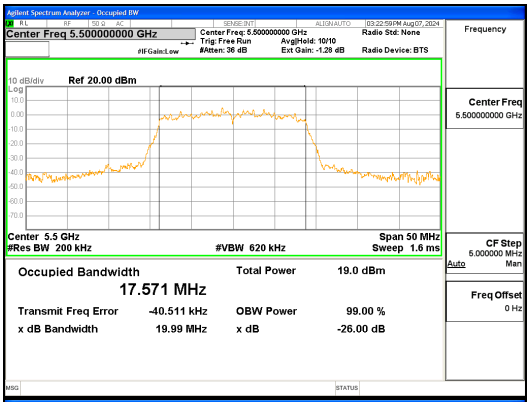
ANT2_802.11n_HT20_UNII 1

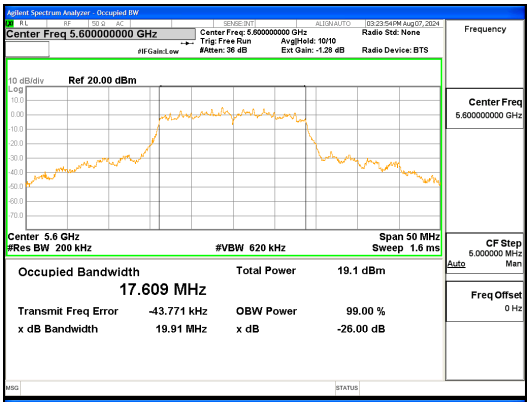


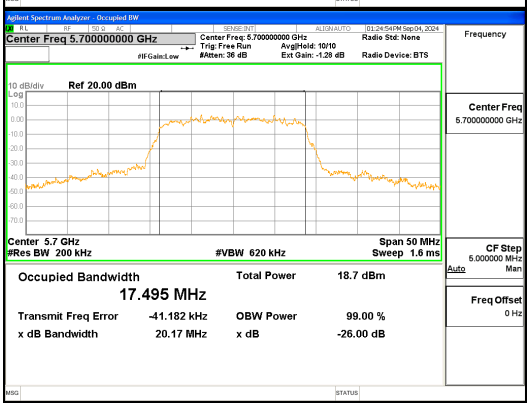


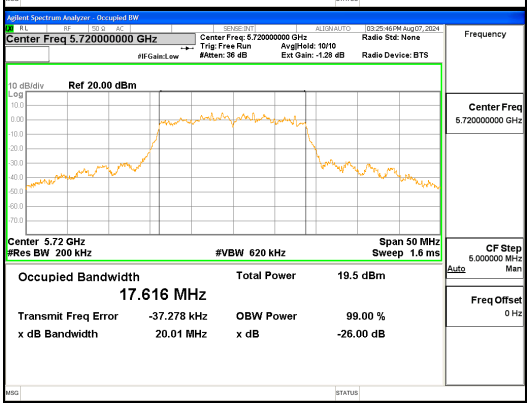


ANT2_802.11n_HT20_UNII 2A

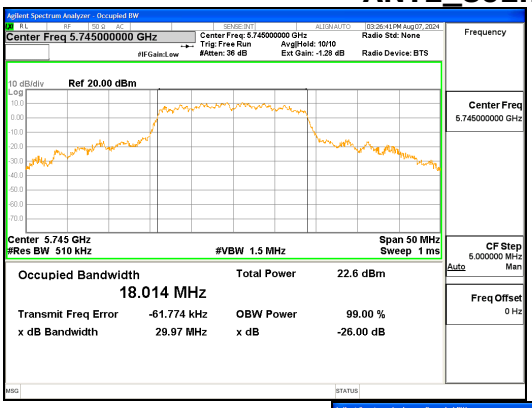


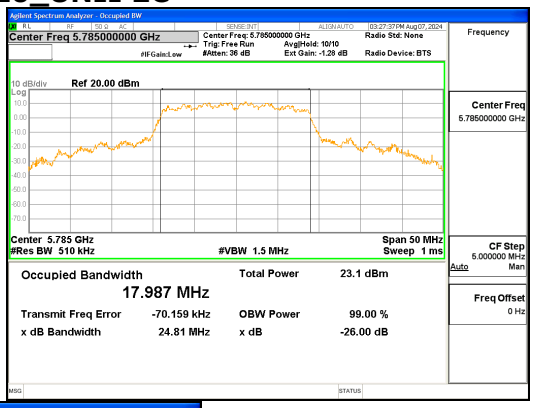


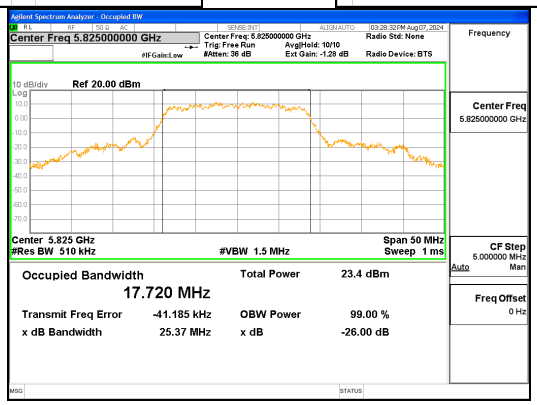




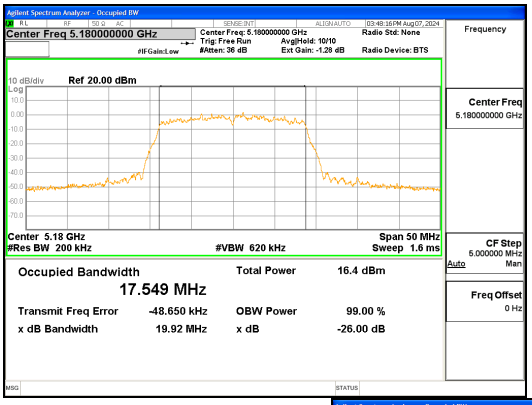
ANT2_802.11n_HT20_UNII 2C

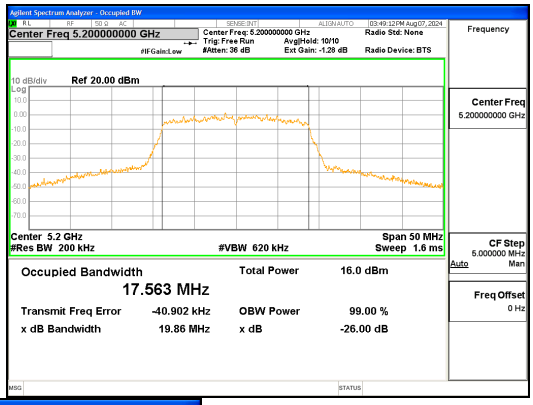


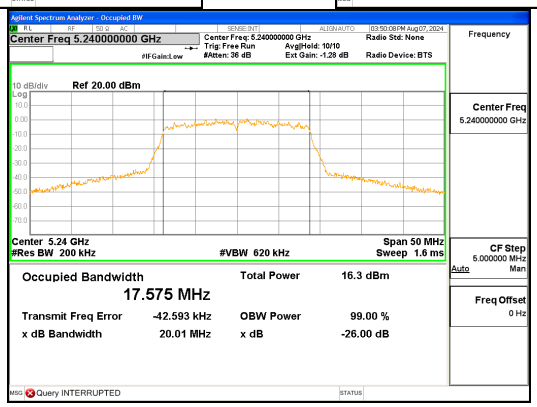




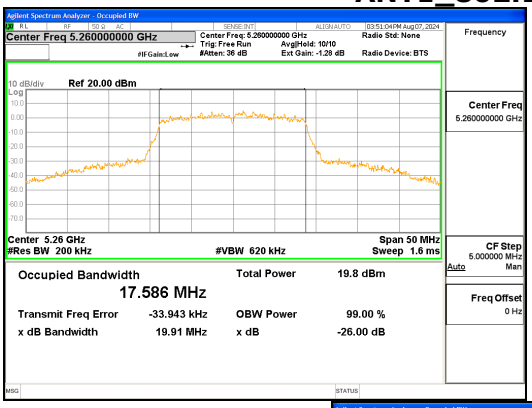
ANT2_802.11n_HT20_UNII 3

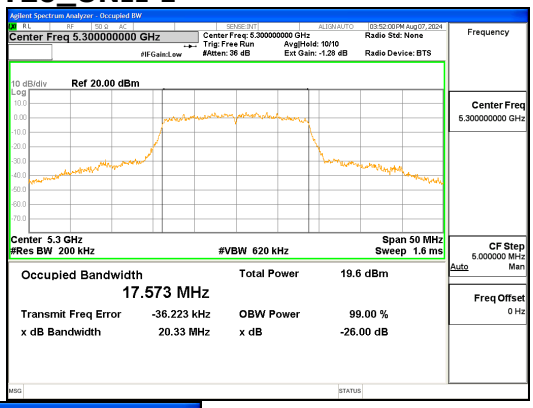


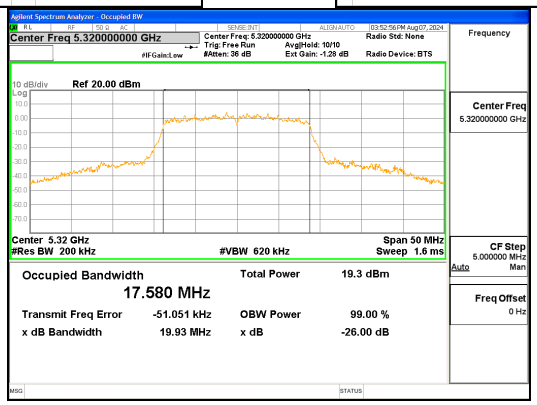




ANT1_802.11ac_VHT20_UNII 1







ANT1_802.11ac_VHT20_UNII 2A