

TEST REPORT

 CTK Co., Ltd. The Power Leader of Global Regulatory Certification	CTK Co., Ltd. (Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea Tel: +82-31-339-9970 Fax: +82-31-624-9501	Report No.: CTK-2024-00203 Page (1) / (103)	
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1. Applicant

- Name : Innopia Technologies, Inc.
- Address : (sangdaewon-dong, A-405), 215, Galmachi-ro, Jungwon-gu, Seongnam-si,
Gyeonggi-do, Republic of Korea
- Date of Receipt : 2023-07-25

2. Manufacturer

- Name : Innopia Technologies, Inc.
- Address : (sangdaewon-dong, A-405), 215, Galmachi-ro, Jungwon-gu, Seongnam-si,
Gyeonggi-do, Republic of Korea

3. Use of Report : For FCC Conformance

4. Test Sample / Model : IMT-M800 / M800A

5. Date of Test : 2023-08-21 to 2023-12-21

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

7. Testing Environment: Temp.: (23 ± 1) °C, Humidity: (36 ± 3) % R.H.

8. Test Results : Compliance

9. Location of Test : ☒ Permanent Testing Lab ☐ On Site Testing (Address : 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea)

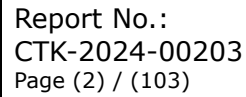
The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK

Approval	Tested by Bong-seok Kim: (Signature) 	Technical Manager Young-taek Lee: (Signature) 
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Remark. This report is not related to KOLAS accreditation and relevant regulation.

2024-01-19

CTK Co., Ltd.



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1. General Product Description

1.1 Applicant Information

Company	Innopia Technologies, Inc.
Contact Point	(sangdaewon-dong, A-405), 215, Galmachi-ro, Jungwon-gu, Seongnam-si, Gyeonggi-do, Republic of Korea
Contact Person	Name : Chonghwa Park E-mail : peter@innopiatech.com Tel : +82-10-2665-3250 Fax : -

1.2 Product Information

FCC ID	2BCR9M800A	
Product Description	IMT-M800	
Model name	M800A	
Variant Model name	TVDongle, M800, M800A, M801A, M802A, M803A, M804A, M805A, M806A, M807A, M809A (Variant models have no technical differences with each model except for the model name and color for marketing purposes.)	
Operating Frequency	UNII 1	20 MHz_BW : 5 180 MHz – 5 240 MHz 40 MHz_BW : 5 190 MHz – 5 230 MHz 80 MHz_BW : 5 210 MHz
	UNII 3	20 MHz_BW : 5 745 MHz – 5 825 MHz 40 MHz_BW : 5 755 MHz – 5 795 MHz 80 MHz_BW : 5 775 MHz
RF Output Power	802.11a : 20.70 dBm (117.49 mW) 802.11n_HT20 : 20.39 dBm (109.40 mW) 802.11n_HT40 : 20.11 dBm (102.57 mW) 802.11ac_VHT20 : 20.34 dBm (108.14 mW) 802.11ac_VHT40 : 18.93 dBm (78.16 mW) 802.11ac_VHT80 : 17.58 dBm (57.28 mW)	
Antenna Specification	Antenna type : Metal Antenna	
	UNII 1	Peak Gain : 4.628 dBi (ANT 0), 3.726 dBi (ANT 1)
	UNII 3	Peak Gain : 4.471 dBi (ANT 0), 3.559 dBi (ANT 1)
Antenna Configurations	802.11a : SISO(ANT 0, ANT 1) 802.11n : MIMO(ANT 0+ANT 1) 802.11ac : MIMO(ANT 0+ANT 1)	
Type of Modulation	802.11a/n/ac : 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	V2.1	
Software Rev	FC 3	
Dynamic Frequency Selection	-	

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1.3 Peripheral Devices

-For Conducted Measurement and Radiated Measurement

Device	Manufacturer	Model No.	Serial No.
Notebook	HP Inc.	HP Probook 455 G7	5CD0234DWM
AC Adapter	HP Inc.	PPP012D-S	677777-003

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)	Status (Note 1)	Test Condition
15.407 (e)	6 dB Bandwidth	C	Conducted
15.407 (a)	26 dB Bandwidth and 99% Bandwidth	C	
15.407 (a)(1),(2),(3)	Conducted Output Power	C	
15.407 (a)(1),(2),(3)	Power Spectral Density	C	
15.407 (g)	Frequency Stability	C	
15.407 (b)	Undesirable emission	C	Radiated
15.205, 15.407 (b)(9),(10)	Radiated Spurious Emission	C	
15.407 (b)(9)	AC Conducted Emissions	C	Line Conducted
<u>Note 1:</u> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable			
<u>Note 2:</u> The data in this test report are traceable to the national or international standards.			
<u>Note 3:</u> The sample was tested according to the following specification: FCC Part 15.407, ANSI C63.10-2013			
<u>Note 4:</u> The tests were performed according to the method of measurements prescribed in KDB No.789033, KDB No.987594			

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

	Lowest channel	Middle channel	Highest channel
UNII 1	5 180 MHz	5 220 MHz	5 240 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 3	5 755 MHz	-	5 795 MHz

- 802.11ac_VHT80

	Lowest channel	Middle channel	Highest channel
UNII 1	5 210 MHz	-	-
UNII 3	5 775 MHz	-	-

Test mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11a_ANT0	OFDM	6 Mbps	94.0 %	0.27 dB
802.11a_ANT1	OFDM	6 Mbps	93.2 %	0.31 dB
802.11n_HT20	OFDM	MCS 0	88.8 %	0.52 dB
802.11n_HT40	OFDM	MCS 0	80.0 %	0.97 dB
802.11ac_VHT20	OFDM	MNSS 0	93.3 %	0.30 dB
802.11ac_VHT40	OFDM	MNSS 0	88.1 %	0.55 dB
802.11ac_VHT80	OFDM	MNSS 0	78.2 %	1.07 dB

3.3 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 ($f \leq 1$ GHz)	3.88 dB (C.L.: Approx. 95 %, $k = 2$)
Radiated Emissions ($f > 1$ GHz)	4.50 dB (C.L.: Approx. 95 %, $k = 2$)
Line Conducted Emission	2.08 dB (C.L.: Approx. 95 %, $k = 2$)

3.4 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	EP5RE Ver. 6.0.1.0, ES10 Ver. 10.001
Line Conducted Test	EMC32 Ver. 10.50.00

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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 $\geq 3 \times$ 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:

ANT 0

	6 dB Bandwidth (MHz)		
Mode	802.11a	802.11n_HT20	802.11ac_VHT20
Frequency			
5 180 MHz	16.32	16.52	16.83
5 220 MHz	16.32	16.53	16.29
5 240 MHz	15.12	17.57	15.67
5 745 MHz	15.91	16.78	16.00
5 785 MHz	16.31	17.52	17.61
5 825 MHz	15.44	16.56	16.94

	6 dB Bandwidth (MHz)	
Mode	802.11n_HT40	802.11ac_VHT40
Frequency		
5 190 MHz	35.71	35.71
5 230 MHz	35.46	35.10
5 755 MHz	35.10	33.79
5 795 MHz	35.40	35.09

	6 dB Bandwidth (MHz)
Mode	802.11ac_VHT80
Frequency	
5 210 MHz	74.45
5 775 MHz	75.20

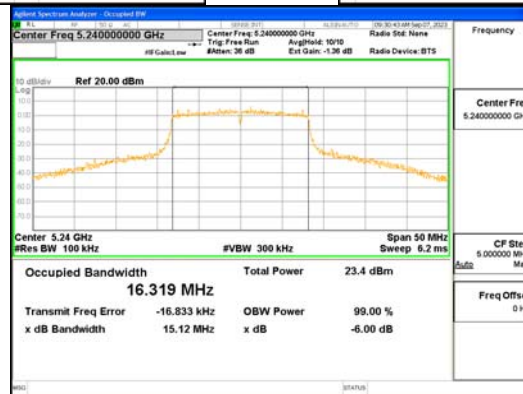
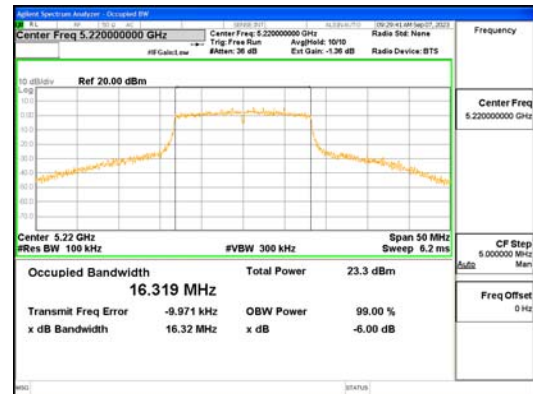
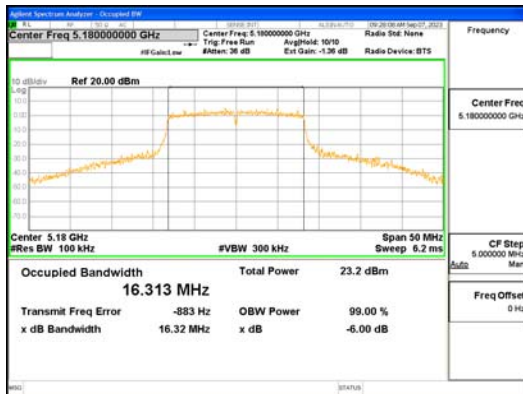
ANT 1

	6 dB Bandwidth (MHz)		
Mode	802.11a	802.11n_HT20	802.11ac_VHT20
Frequency			
5 180 MHz	16.38	15.45	17.58
5 220 MHz	16.33	16.82	17.53
5 240 MHz	16.26	17.56	17.54
5 745 MHz	16.30	16.89	17.51
5 785 MHz	15.70	17.56	17.53
5 825 MHz	14.92	16.92	17.31

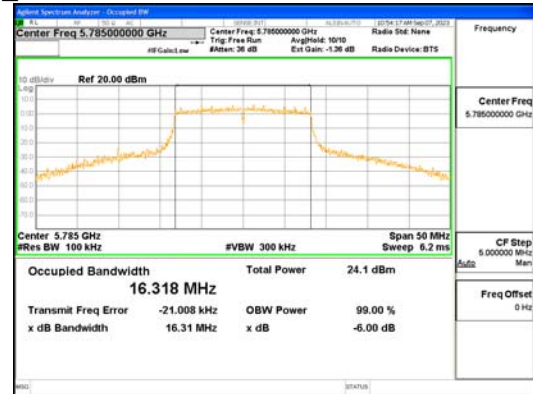
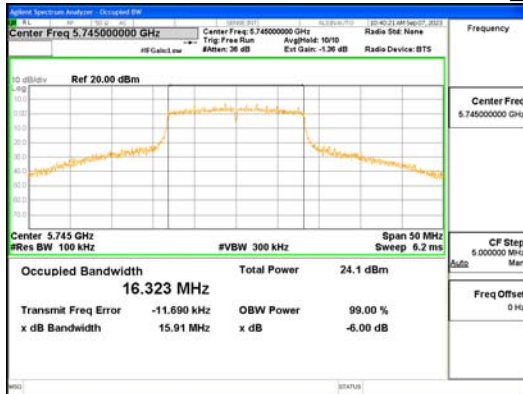
	6 dB Bandwidth (MHz)	
Mode	802.11n_HT40	802.11ac_VHT40
Frequency		
5 190 MHz	35.43	35.04
5 230 MHz	35.14	35.08
5 755 MHz	35.14	32.68
5 795 MHz	35.12	35.35

	6 dB Bandwidth (MHz)
Mode	802.11ac_VHT80
Frequency	
5 210 MHz	73.96
5 775 MHz	75.49

See next pages for actual measured spectrum plots.



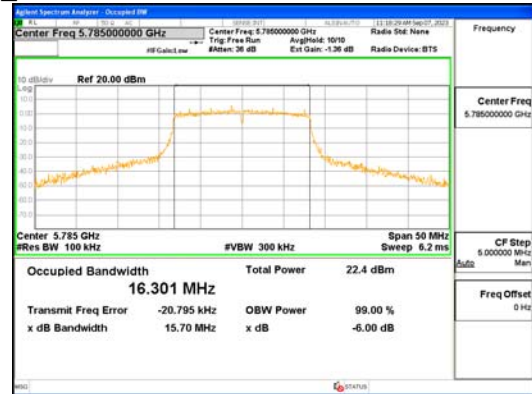
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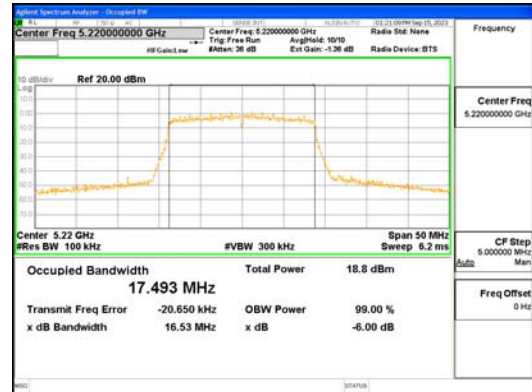
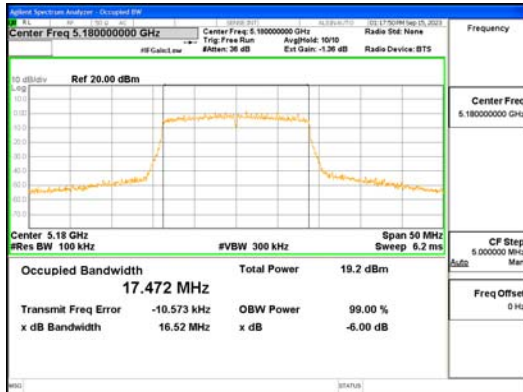
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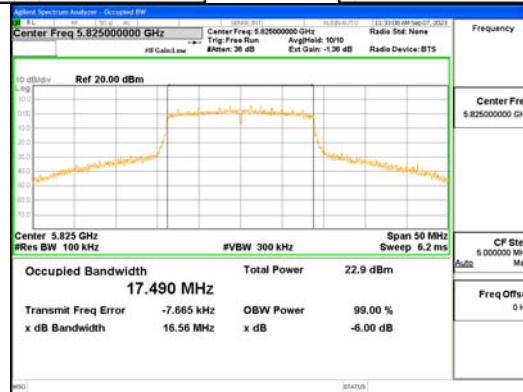
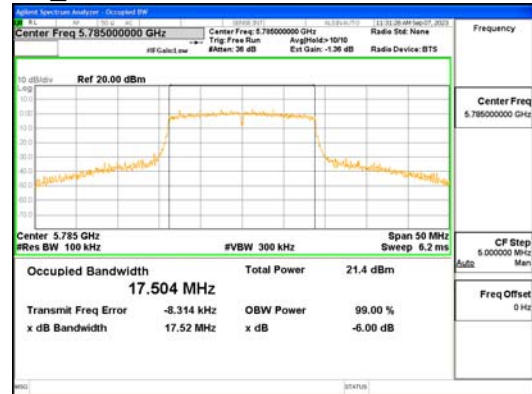
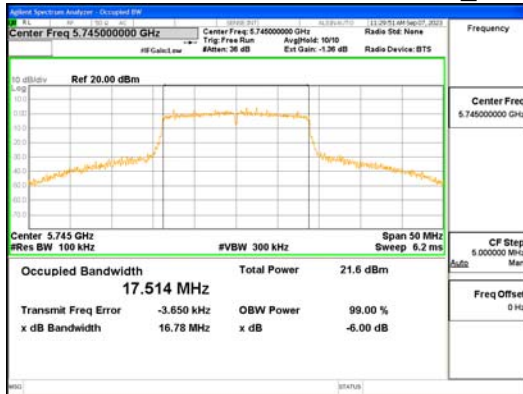
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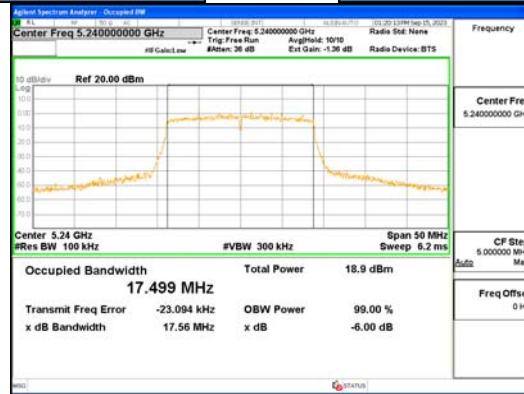
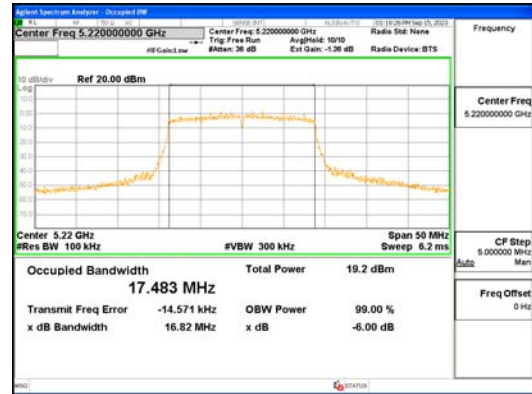
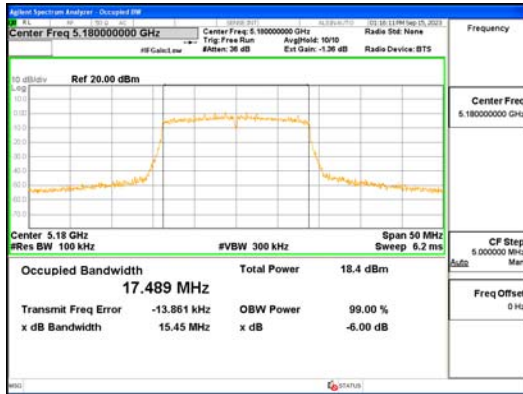
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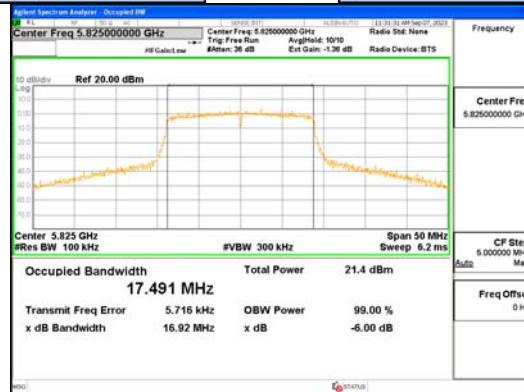
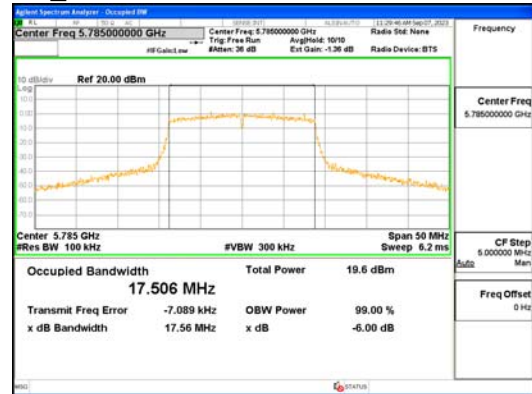
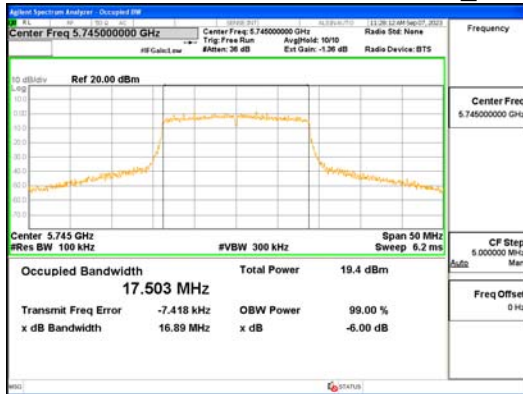
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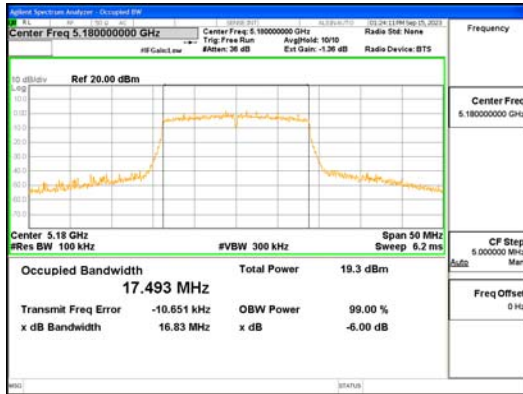
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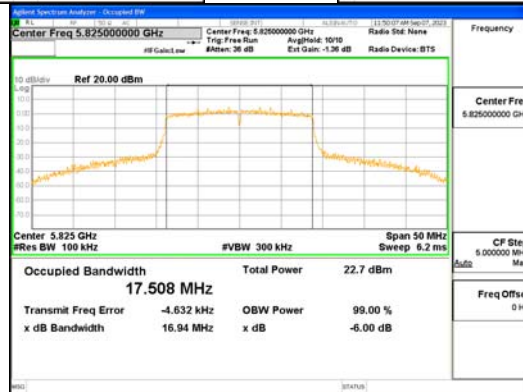
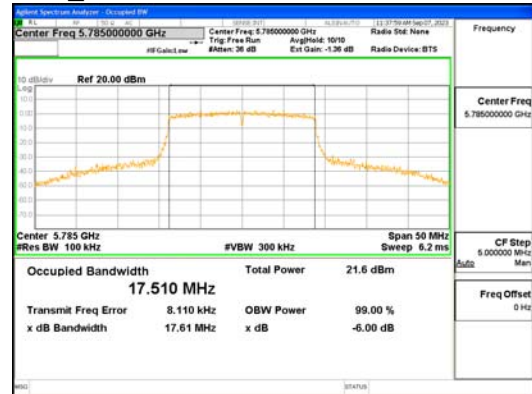
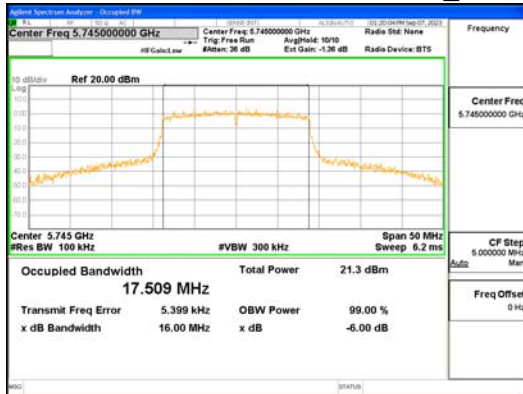
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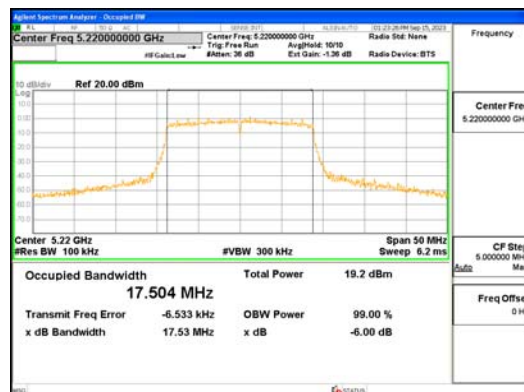
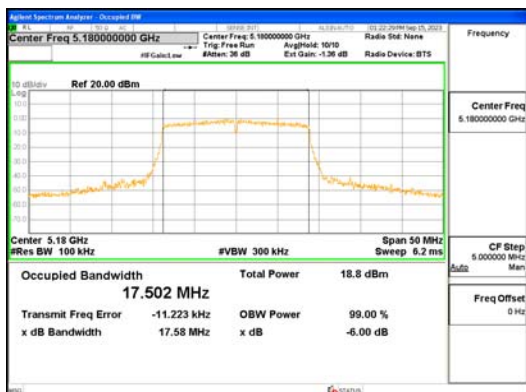
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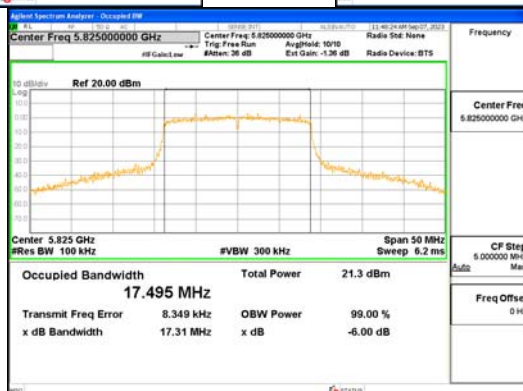
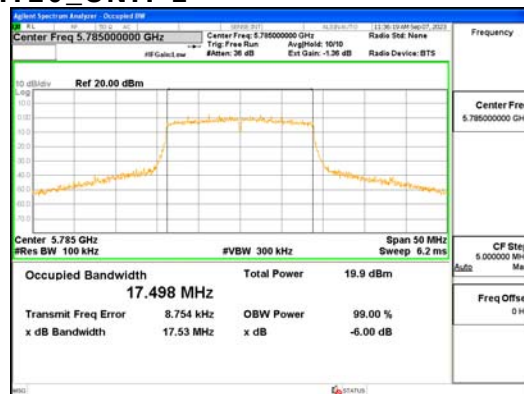
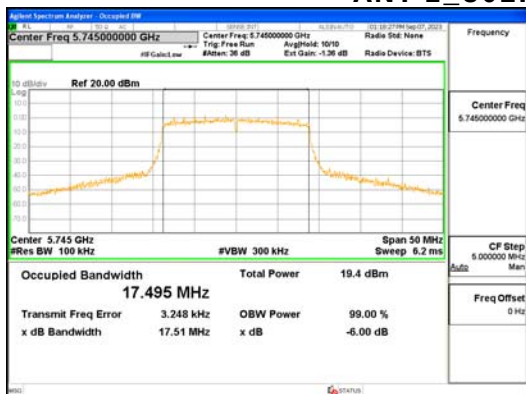
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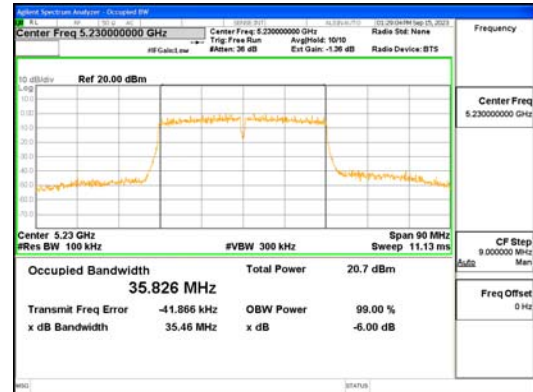
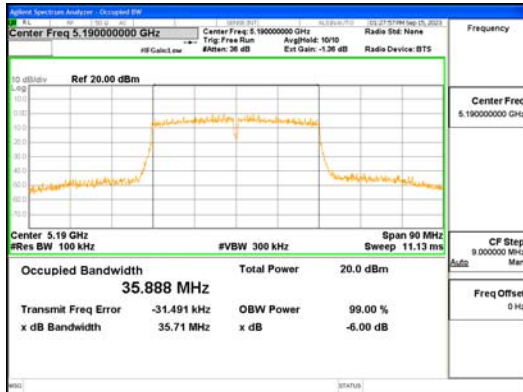
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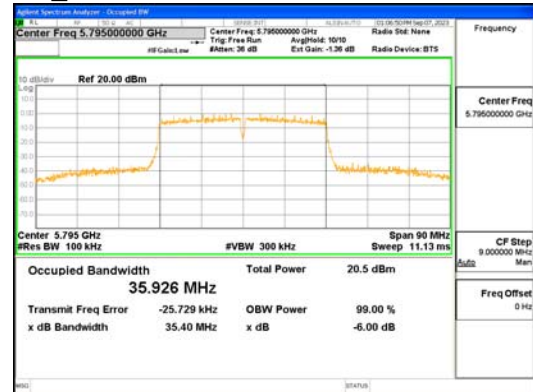
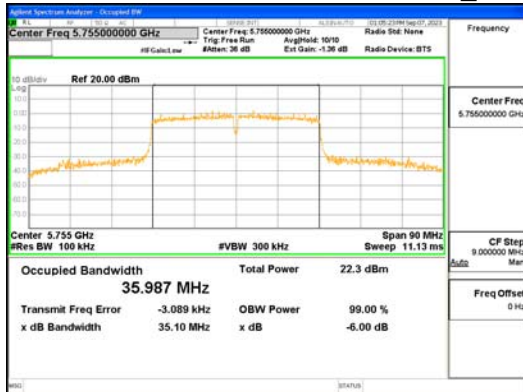
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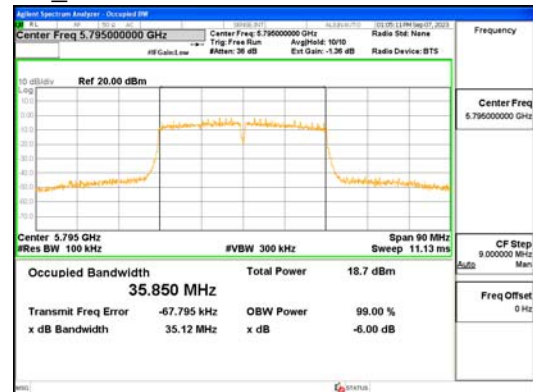
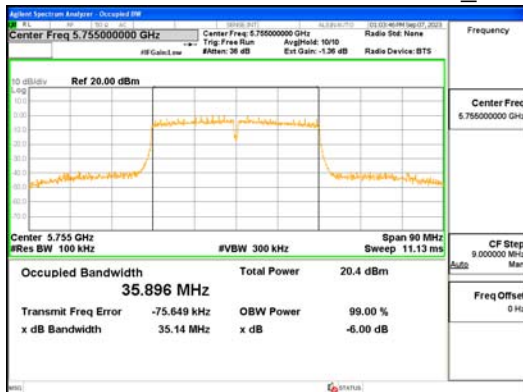
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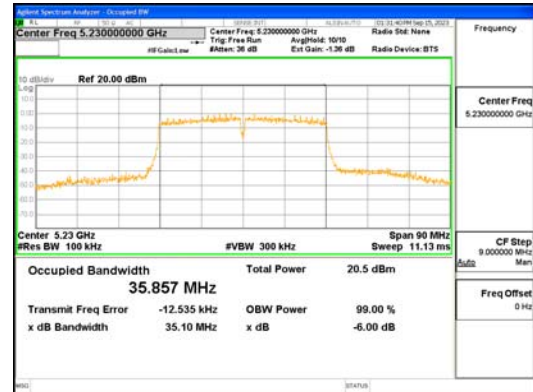
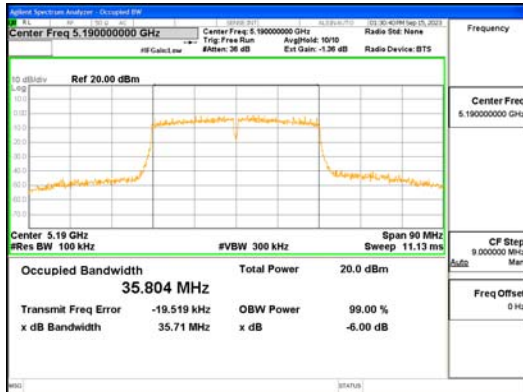
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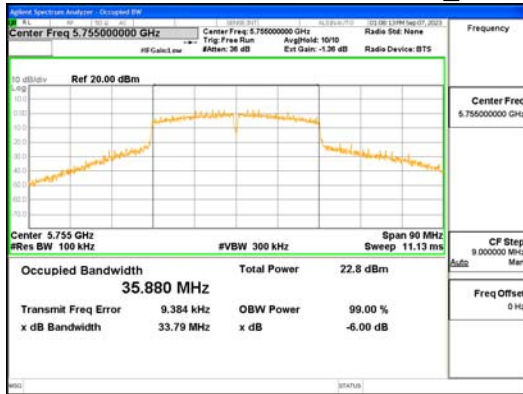
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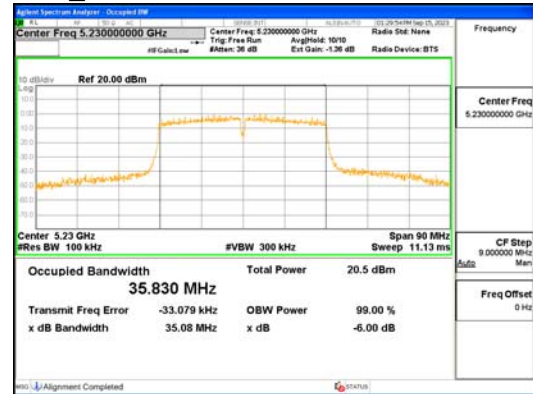
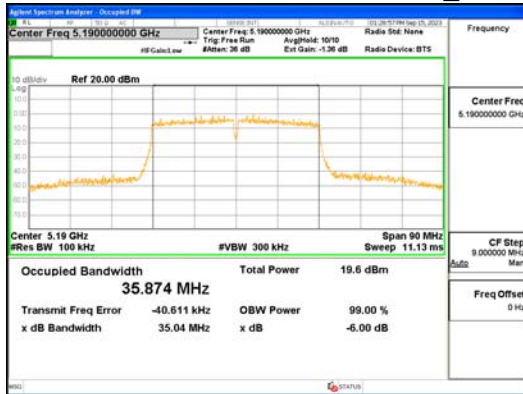
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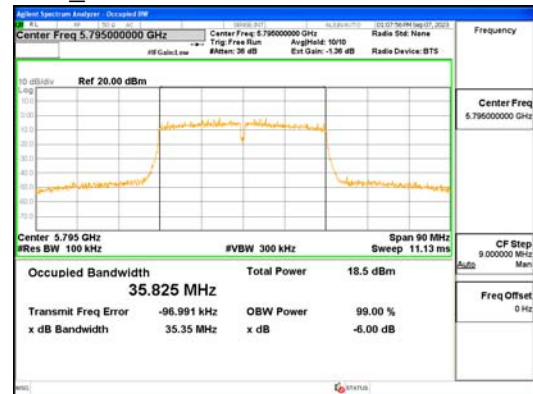
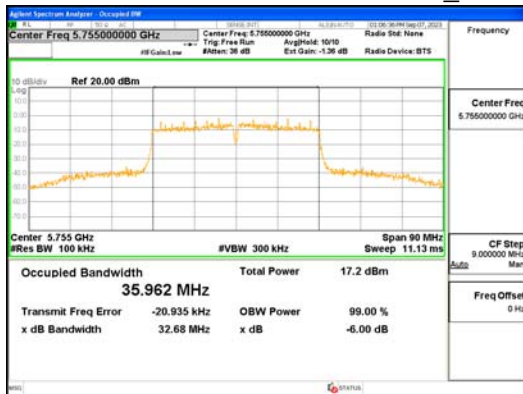
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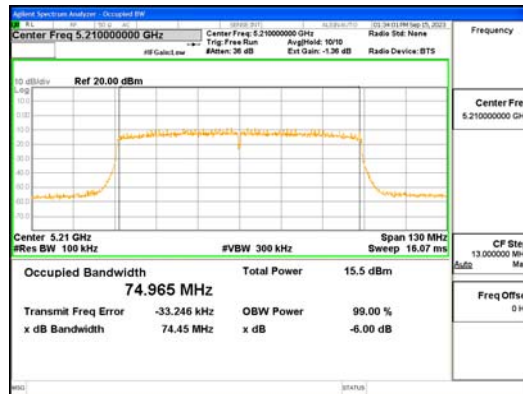
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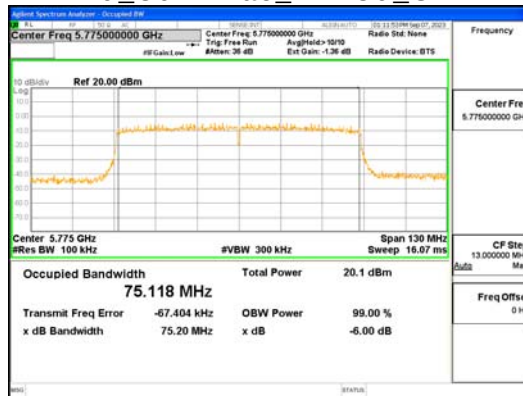
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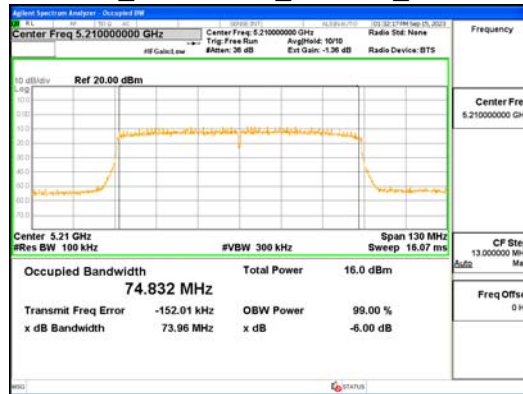
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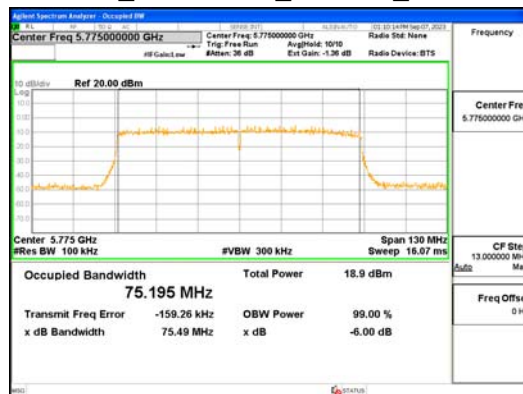
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ANT 0_802.11ac_VHT80_UNII-3



ANT 1_802.11ac_VHT80_UNII-1



ANT 1_802.11ac_VHT80_UNII-3

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 $\geq$ 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:

ANT 0

	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	18.54	16.30	18.92	17.45	19.10	17.42
5 220 MHz	18.30	16.32	18.96	17.46	19.08	17.43
5 240 MHz	18.46	16.29	18.95	17.48	19.12	17.43
5 745 MHz	18.67	16.61	19.95	17.63	19.85	17.64
5 785 MHz	15.72	16.53	19.82	17.59	19.81	17.63
5 825 MHz	18.60	16.62	19.94	17.61	19.92	17.61

	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	38.53	35.93	38.71	35.84
5 230 MHz	38.55	35.92	38.86	35.88
5 755 MHz	39.31	36.03	38.64	35.90
5 795 MHz	39.05	35.98	39.16	35.96

	26 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	81.27	75.07
5 775 MHz	80.46	75.21

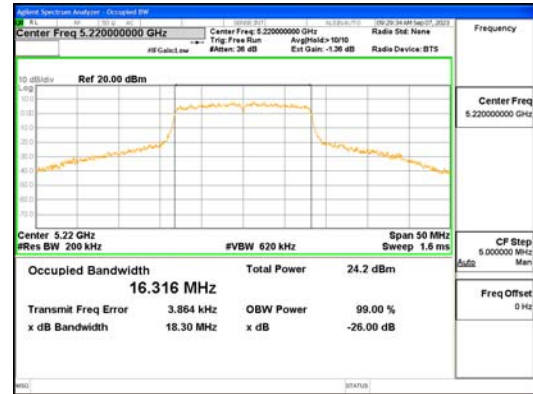
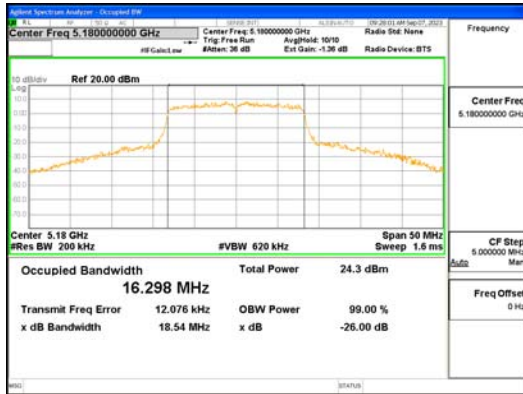
ANT 1

	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	18.18	16.28	19.03	17.43	19.02	17.42
5 220 MHz	18.28	16.28	18.96	17.42	19.05	17.42
5 240 MHz	18.42	16.26	19.17	17.47	19.10	17.45
5 745 MHz	19.04	16.49	19.66	17.59	19.72	17.59
5 785 MHz	18.98	16.47	19.74	17.58	19.92	17.57
5 825 MHz	19.02	16.49	19.84	17.59	19.74	17.59

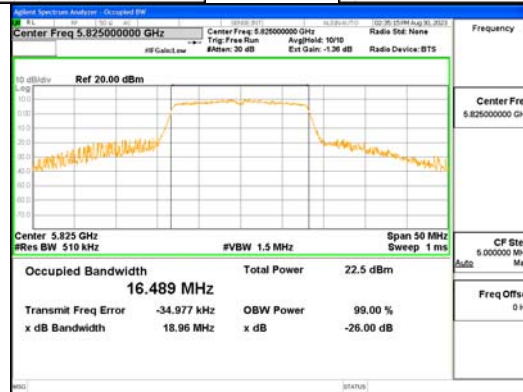
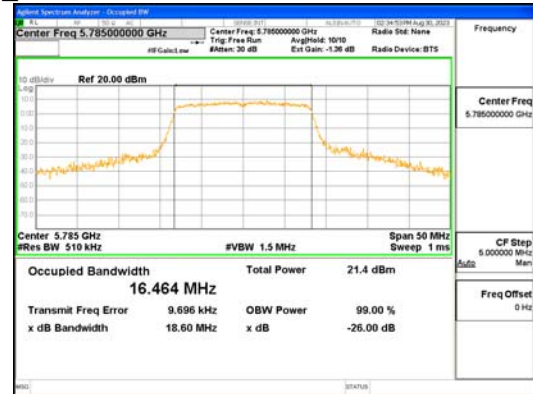
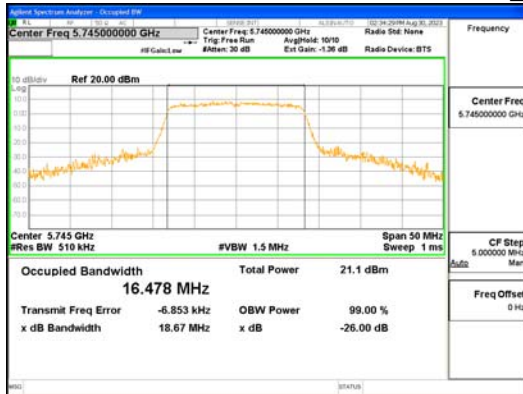
	26 dB Bandwidth and 99% Bandwidth (MHz)			
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	39.02	35.95	38.91	35.95
5 230 MHz	38.78	35.88	38.69	35.82
5 755 MHz	39.04	35.95	39.05	36.00
5 795 MHz	39.04	35.90	38.92	35.87

	26 dB Bandwidth and 99% Bandwidth (MHz)	
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	80.96	75.05
5 775 MHz	80.43	75.23

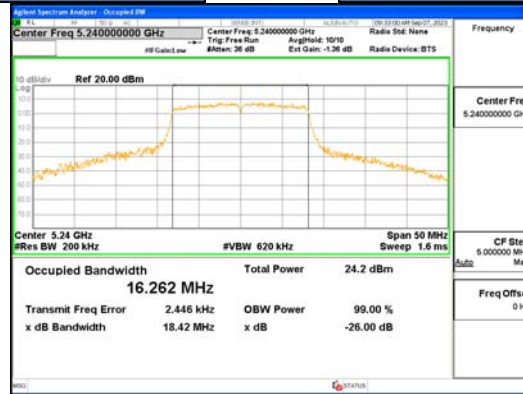
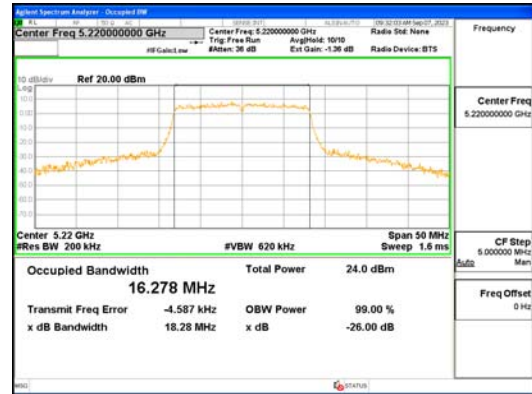
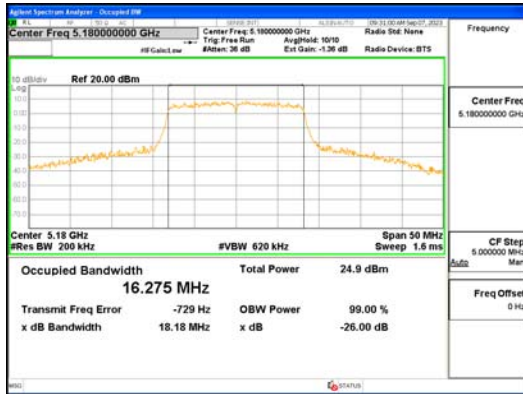
See next pages for actual measured spectrum plots.



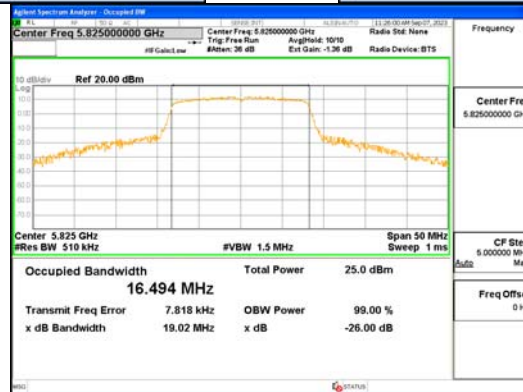
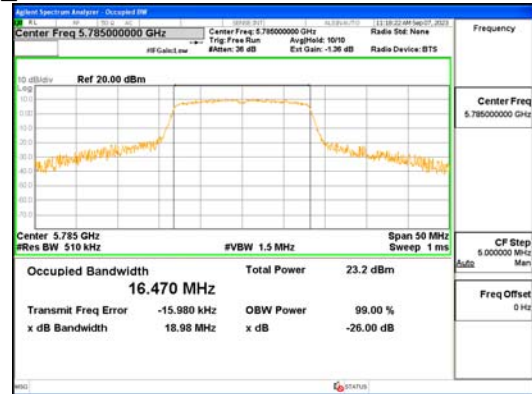
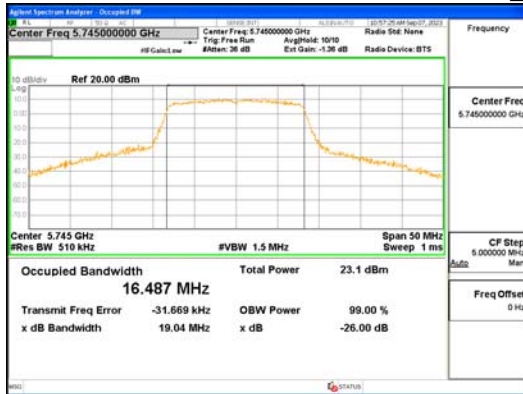
ANT 0_802.11a_UNII-1



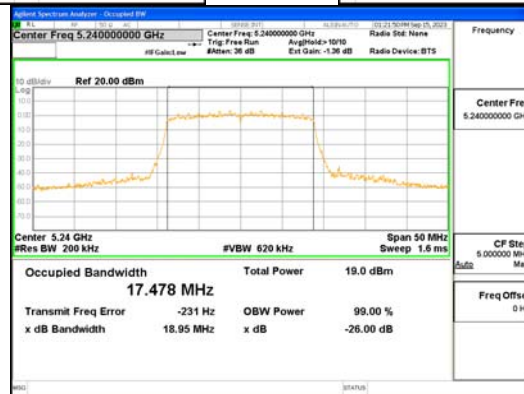
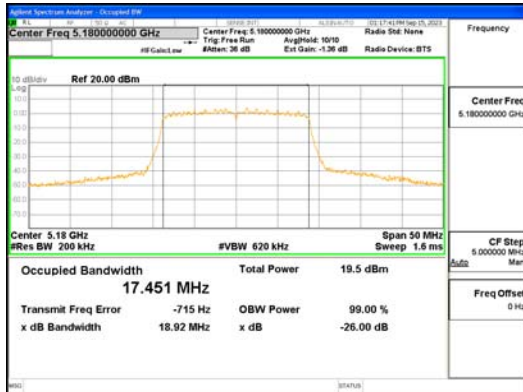
ANT 0_802.11a_UNII-3



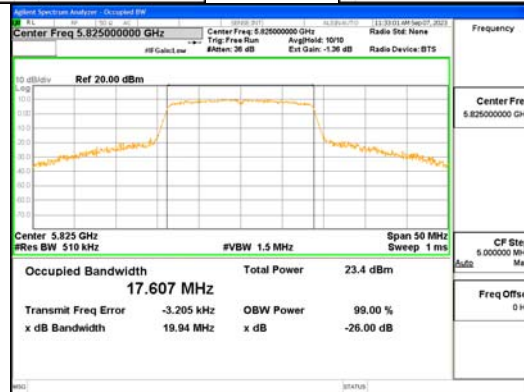
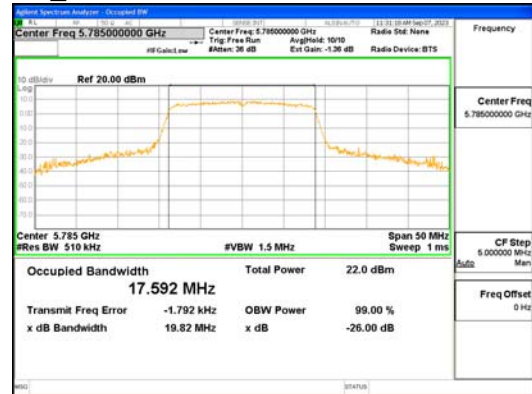
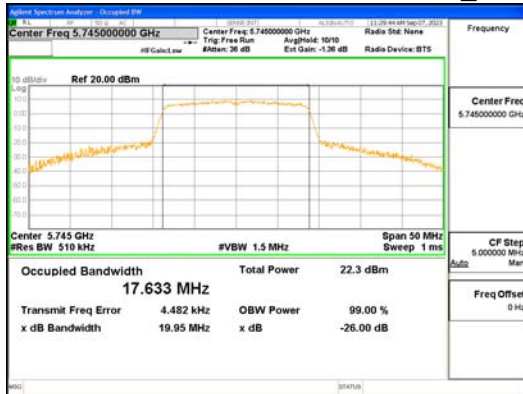
ANT 1_802.11a_UNII-1



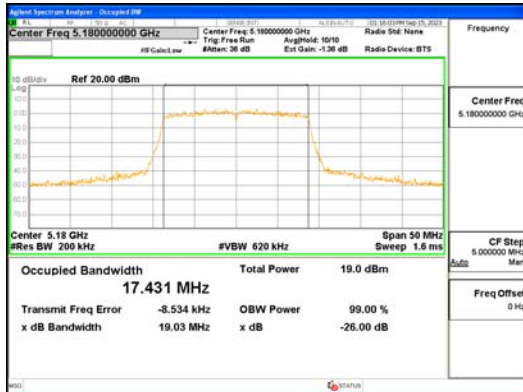
ANT 1_802.11a_UNII-3



ANT 0_802.11n_HT20_UNII-1



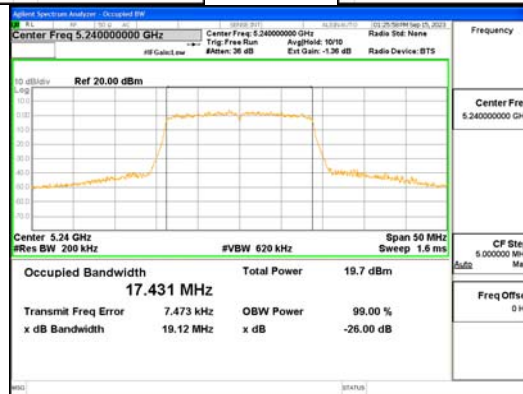
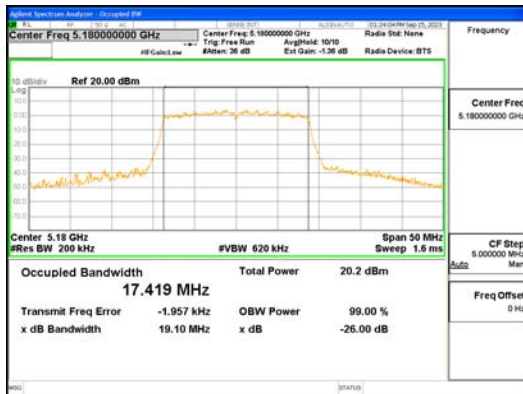
ANT 0_802.11n_HT20_UNII-3



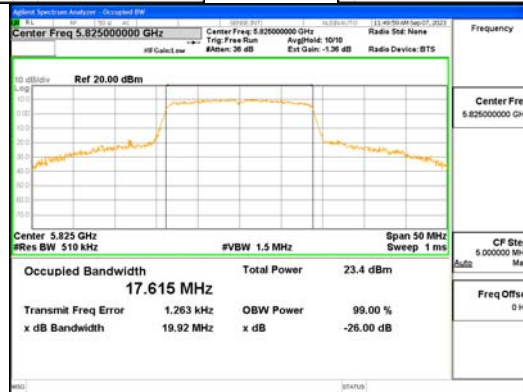
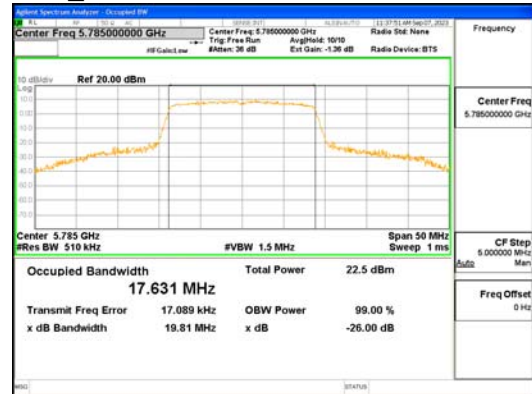
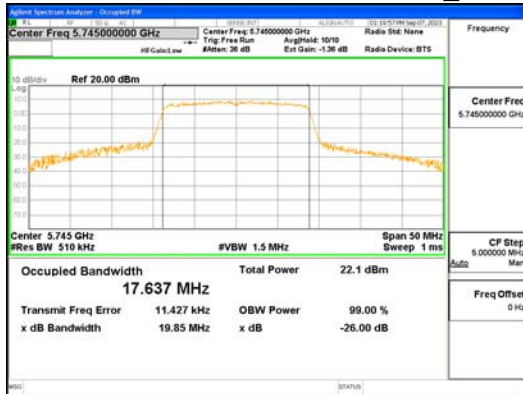
ANT 1_802.11n_HT20_UNII-1



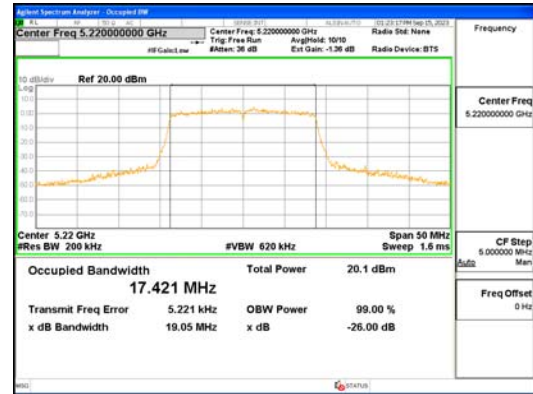
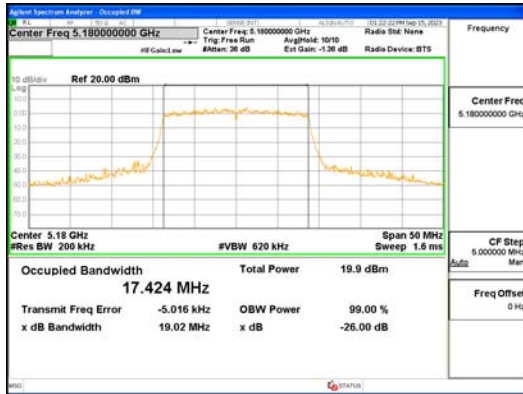
ANT 1_802.11n_HT20_UNII-3



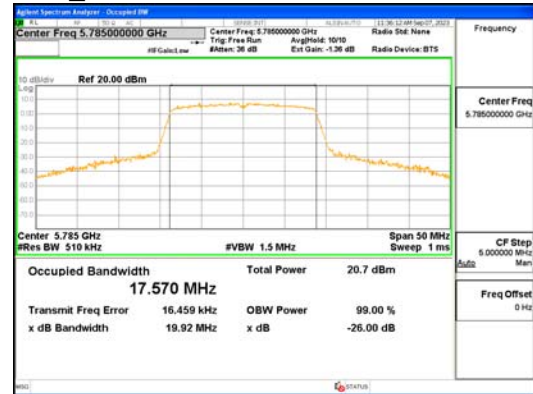
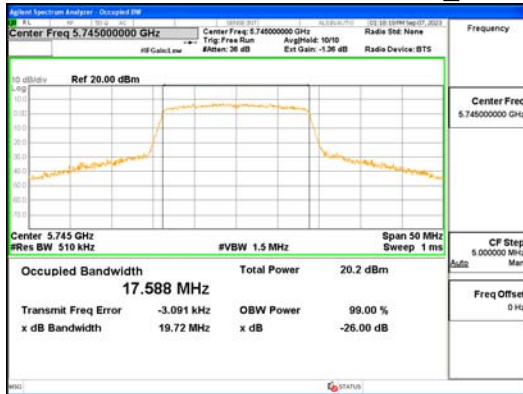
ANT 0_802.11ac_VHT20_UNII-1



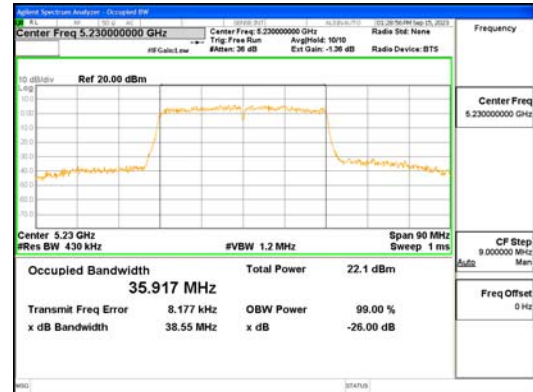
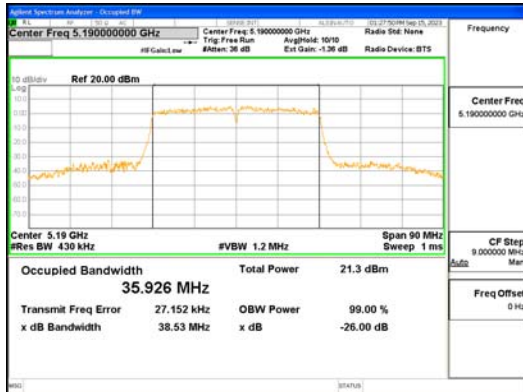
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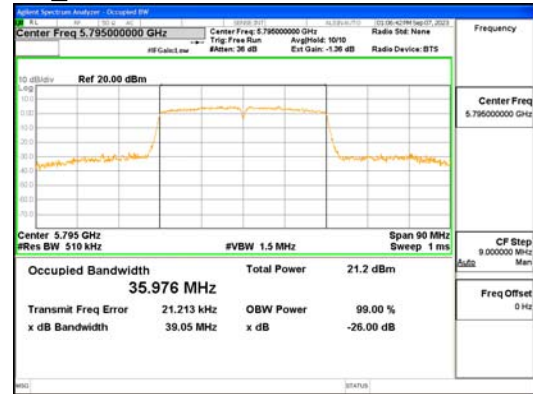
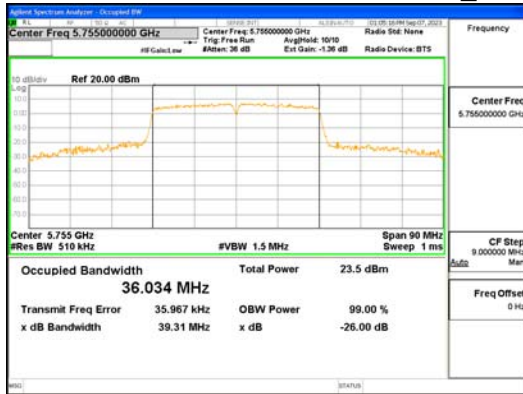
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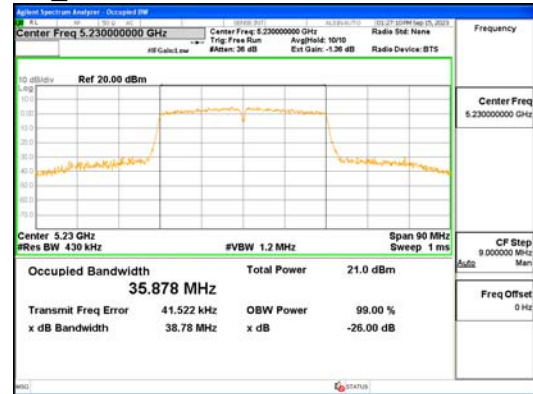
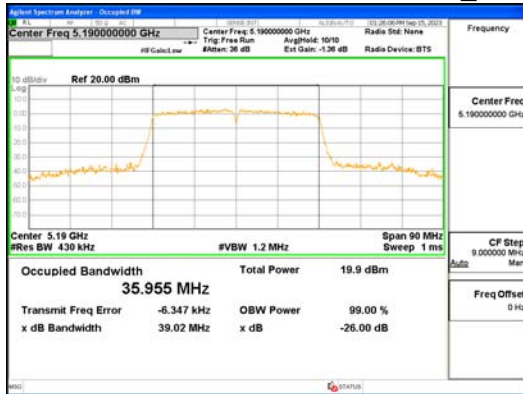
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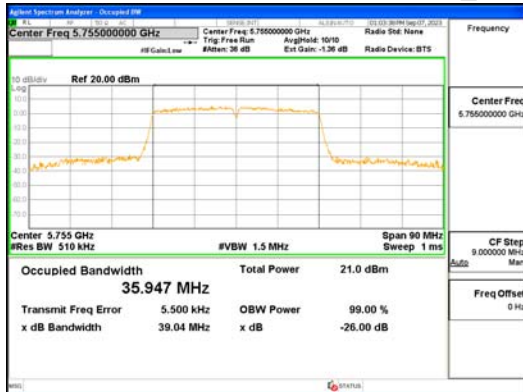
ANT 0_802.11n_HT40_UNII-1



ANT 0_802.11n_HT40_UNII-3



ANT 1_802.11n_HT40_UNII-1



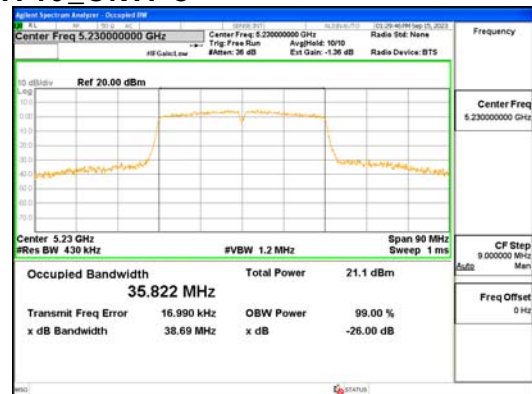
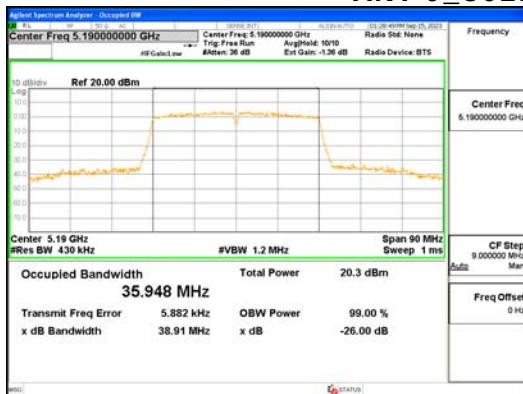
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ANT 0_802.11ac_VHT40_UNII-1



ANT 0_802.11ac_VHT40_UNII-3



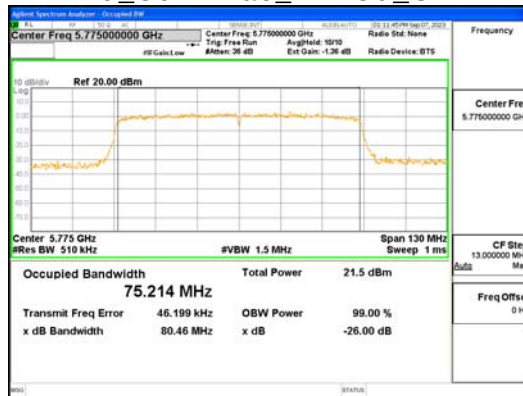
ANT 1_802.11ac_VHT40_UNII-1



ANT 1_802.11ac_VHT40_UNII-3



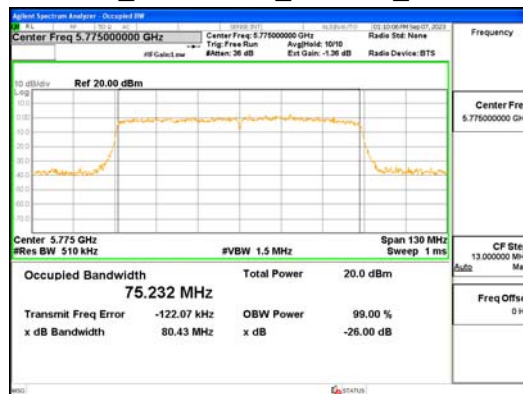
ANT 0_802.11ac_VHT80_UNII-1



ANT 0_802.11ac_VHT80_UNII-3



ANT 1_802.11ac_VHT80_UNII-1



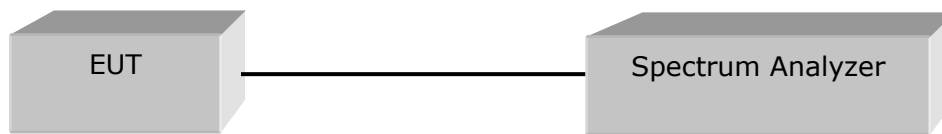
ANT 1_802.11ac_VHT80_UNII-3

4.3 OUTPUT POWER

Test Procedures

KDB 789033 – Section E.2.d (Method SA-2, Maximum Conducted Output Power)
KDB 662911 D01, D02 (Multiple Transmitter Output)

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 1 MHz
- b) VBW $\geq 3 \times$ RBW
- c) Sweep time = auto
- d) Detector = power averaging (rms)
- e) Trace mode = Average at least 100
- f) Duty cycle factor = $10\log(1/x)$

Test mode	Duty Cycle Factor (dB)
802.11a_ANT0	0.27
802.11a_ANT1	0.31
802.11n_HT20	0.52
802.11n_HT40	0.97
802.11ac_VHT20	0.30
802.11ac_VHT40	0.55
802.11ac_VHT80	1.07

Limit

Operating Mode	Band	Mode	ANT Configuration	ANT Gain (dBi)	Limit (dBm)
SISO	UNII 1	802.11a	ANT 0, ANT 1	4.63, 3.73	24.00
	UNII 3			4.47, 3.56	30.00
MIMO (2Tx)	UNII 1	802.11n/ac	ANT 0 + ANT 1	7.20	22.80
	UNII 3			7.04	29.00

Note :

Per KDB 662911, the MIMO directional gain is calculated using the following formula, Where GN is the gain of the nth antenna and NANT, the total number of antennas used.

Directional gain = 10 log[(10^{G1/20} + 10^{G2/20} + ... + 10^{GN /20})² /NANT] dBi

Test Data

SISO_ANT 0

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	17.92	0.27	18.19	22.80	4.61
	5 220	18.14	0.27	18.41	22.80	4.39
	5 240	18.16	0.27	18.43	22.80	4.37
	5 745	18.96	0.27	19.23	29.00	9.77
	5 785	18.92	0.27	19.19	29.00	9.81
	5 825	20.43	0.27	20.70	29.00	8.30

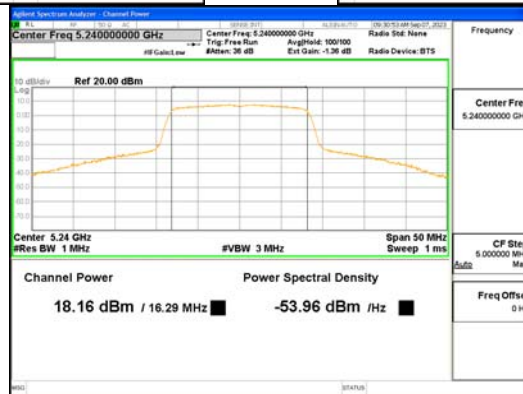
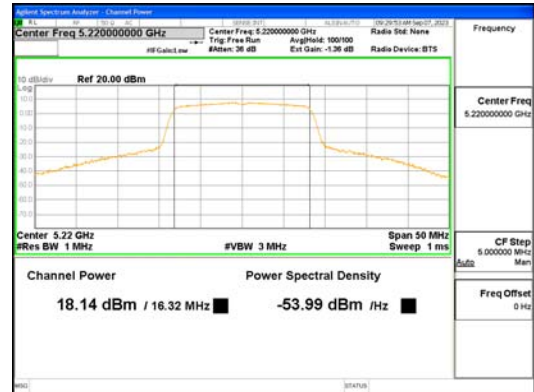
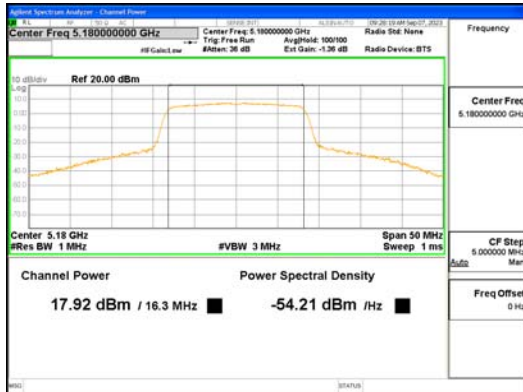
SISO_ANT 1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	18.79	0.31	19.10	22.80	3.70
	5 220	18.26	0.31	18.57	22.80	4.23
	5 240	18.10	0.31	18.41	22.80	4.39
	5 745	17.06	0.31	17.37	29.00	11.63
	5 785	17.44	0.31	17.75	29.00	11.25
	5 825	18.97	0.31	19.28	29.00	9.72

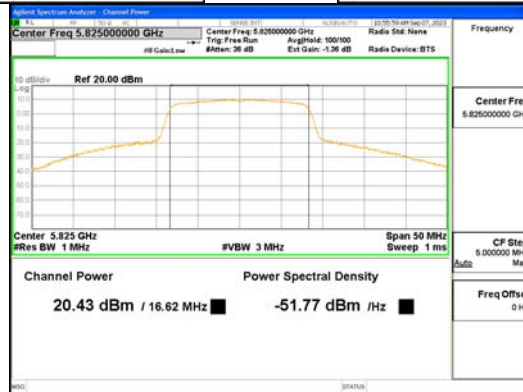
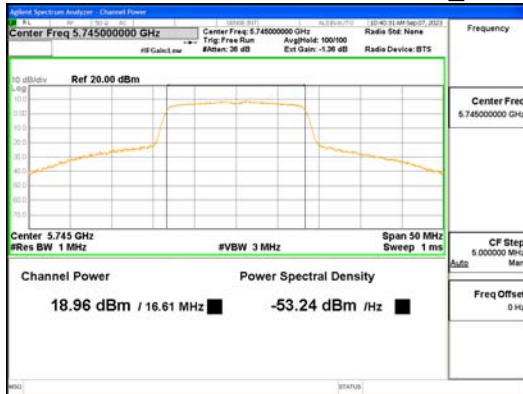
MIMO_ANT 0 + ANT 1

Test Mode	Frequency (MHz)	Measured Output Power (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n_HT20	5 180	16.03	0.52	16.55	22.80	6.25
	5 220	16.13	0.52	16.65	22.80	6.15
	5 240	16.22	0.52	16.74	22.80	6.06
	5 745	18.50	0.52	19.02	29.00	9.98
	5 785	18.46	0.52	18.98	29.00	10.02
	5 825	19.87	0.52	20.39	29.00	8.61
802.11ac_VHT20	5 180	16.67	0.30	16.97	22.80	5.83
	5 220	16.58	0.30	16.88	22.80	5.92
	5 240	16.60	0.30	16.90	22.80	5.90
	5 745	18.22	0.30	18.52	29.00	10.48
	5 785	18.64	0.30	18.94	29.00	10.06
	5 825	20.04	0.30	20.34	29.00	8.66
802.11n_HT40	5 190	16.87	0.97	17.84	22.80	4.96
	5 230	16.96	0.97	17.93	22.80	4.87
	5 755	19.14	0.97	20.11	29.00	8.89
	5 795	17.39	0.97	18.36	29.00	10.64
802.11ac_VHT40	5 190	17.54	0.55	18.09	22.80	4.71
	5 230	18.38	0.55	18.93	22.80	3.87
	5 755	18.27	0.55	18.82	29.00	10.18
	5 795	17.24	0.55	17.79	29.00	11.21
802.11ac_VHT80	5 210	12.94	1.07	14.01	22.80	8.79
	5 775	16.51	1.07	17.58	29.00	11.42

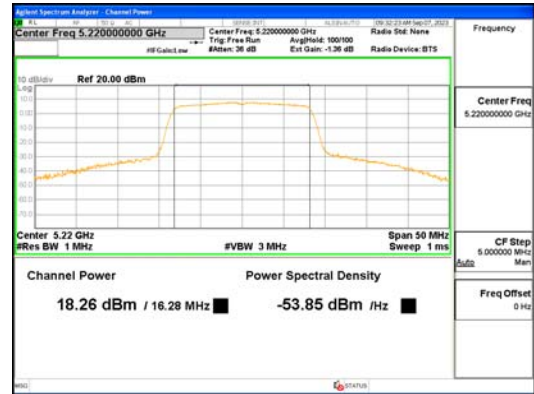
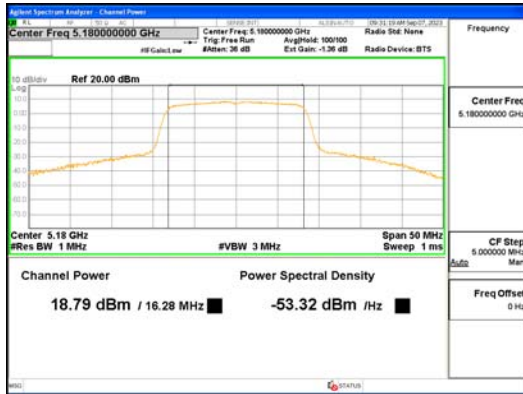
See next pages for actual measured spectrum plots.



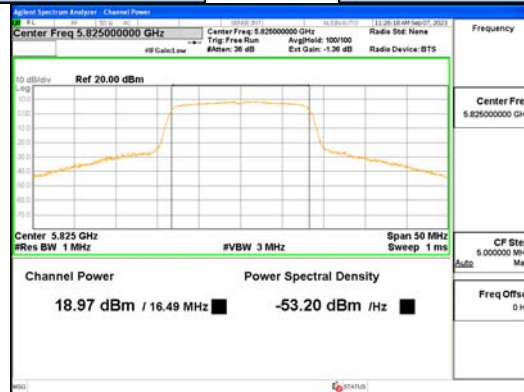
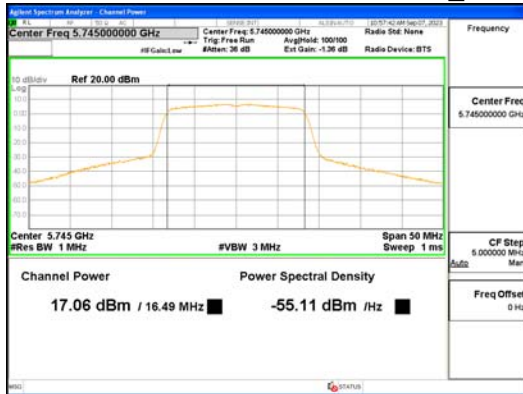
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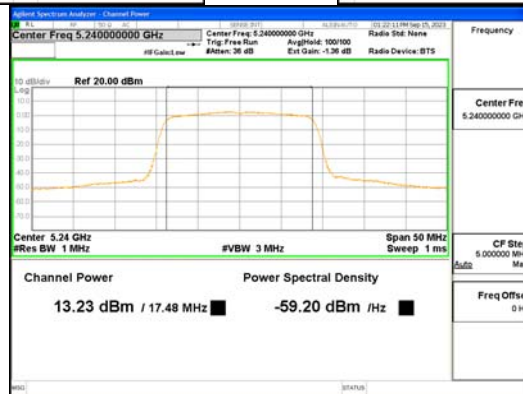
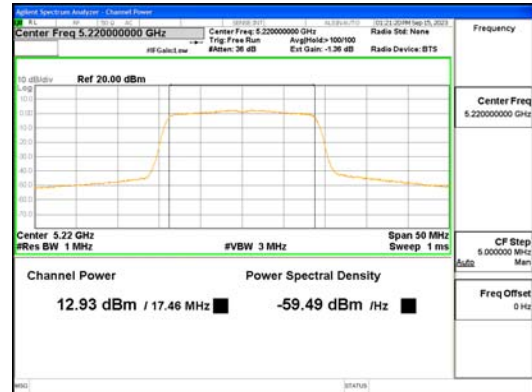
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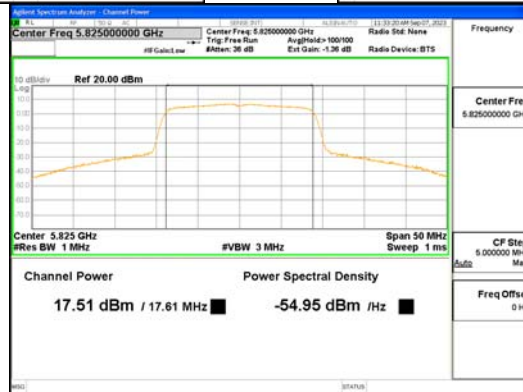
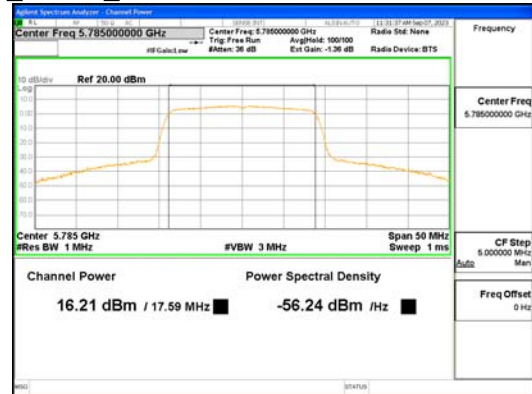
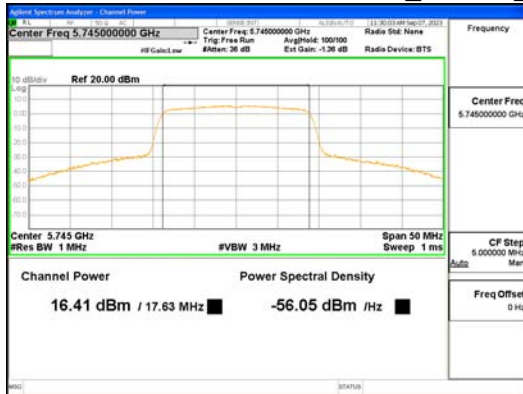
SISO_ANT 1_802.11a_UNII-1



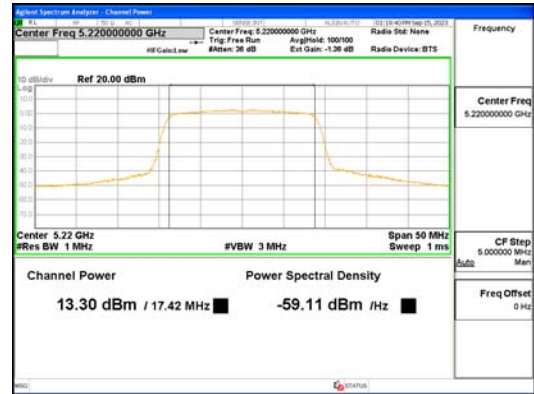
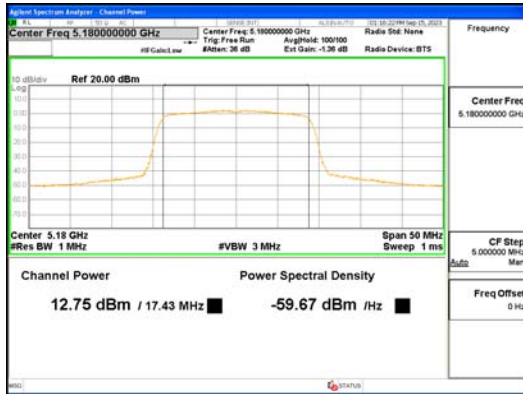
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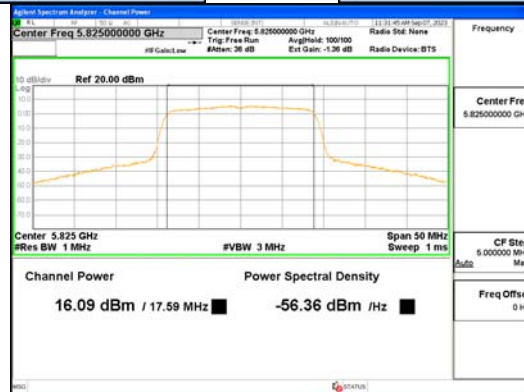
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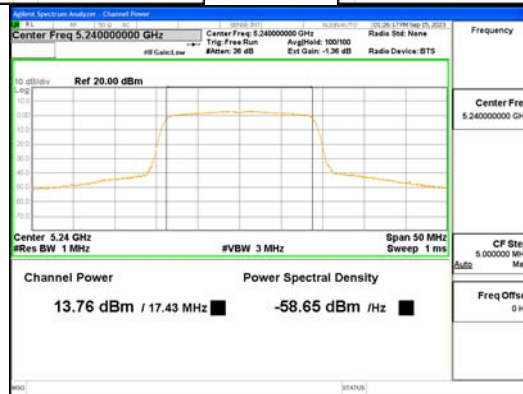
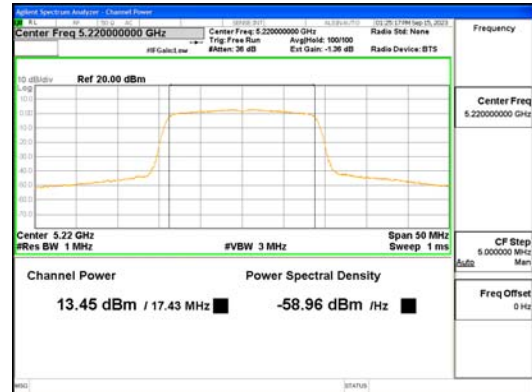
MIMO_ANT 0_802.11n_HT20_UNII-3



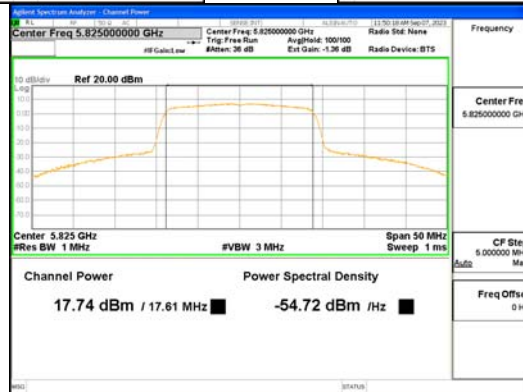
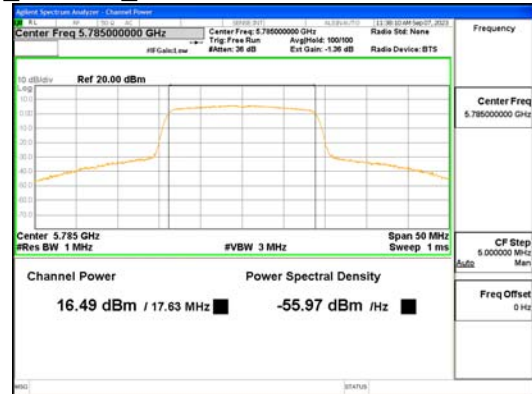
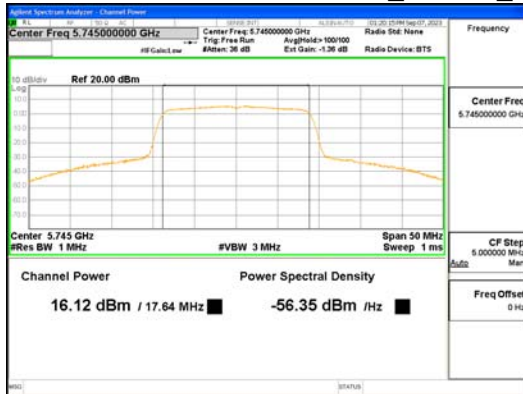
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MIMO_ANT 1_802.11n_HT20_UNII-3



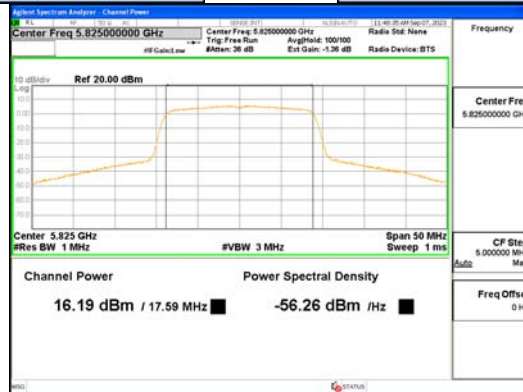
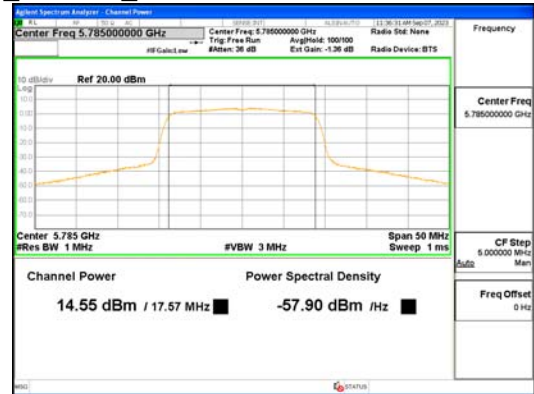
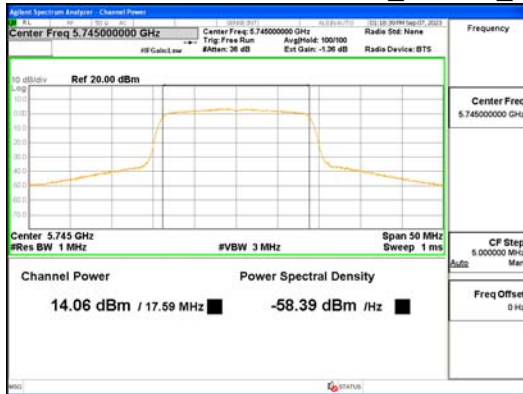
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MIMO_ANT 0_802.11ac_VHT20_UNII-3



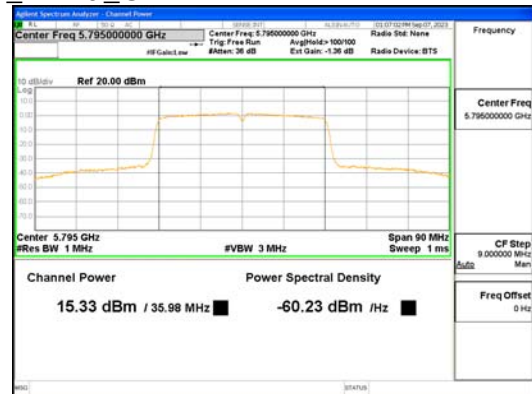
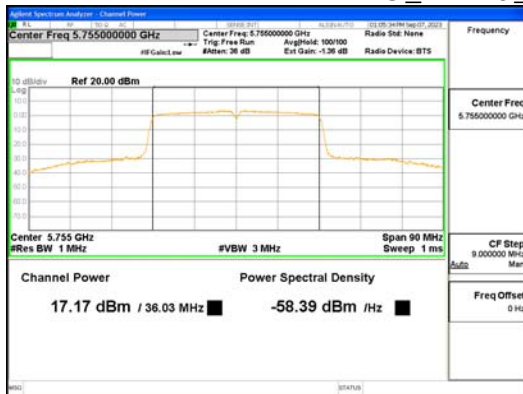
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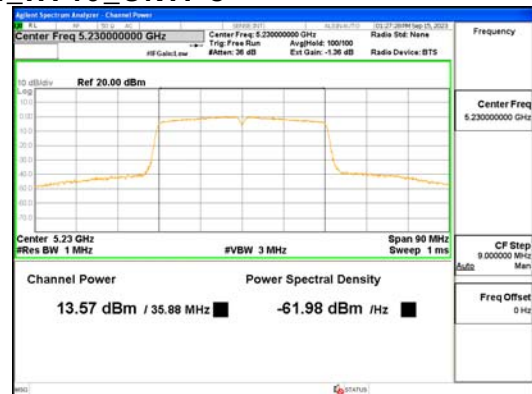
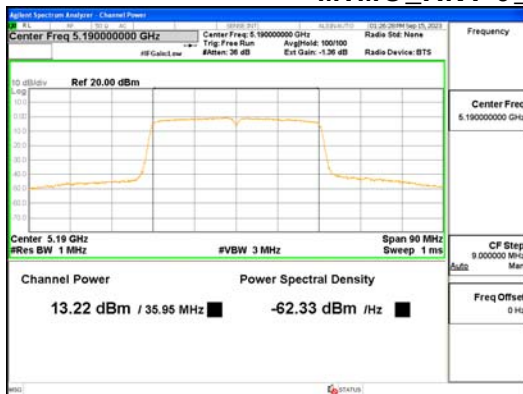
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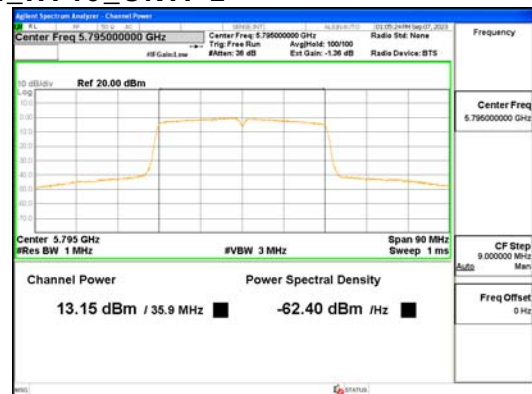
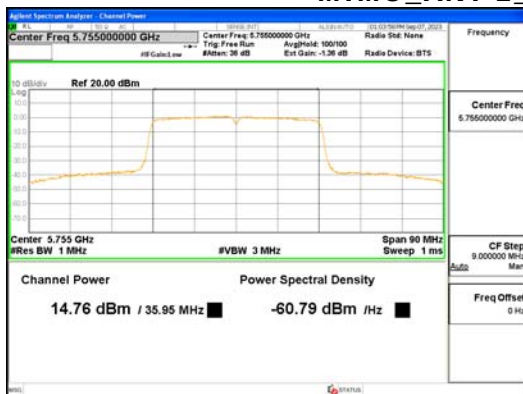
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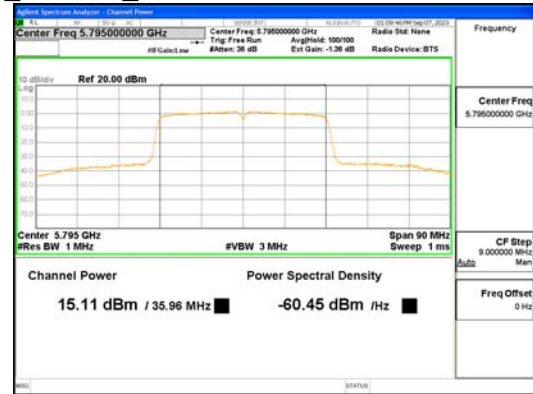
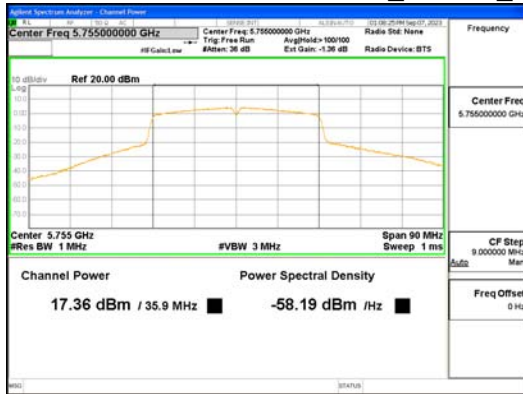
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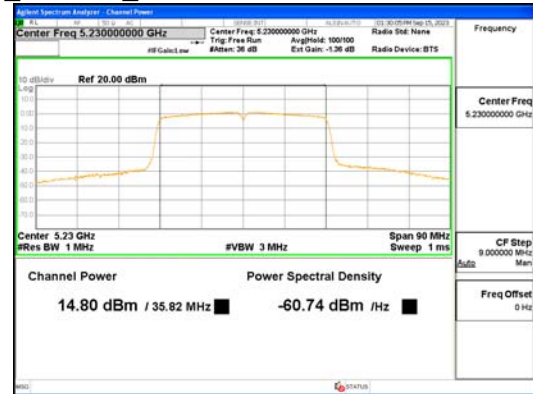
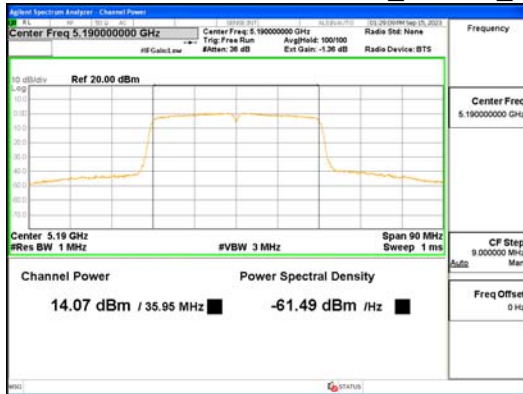
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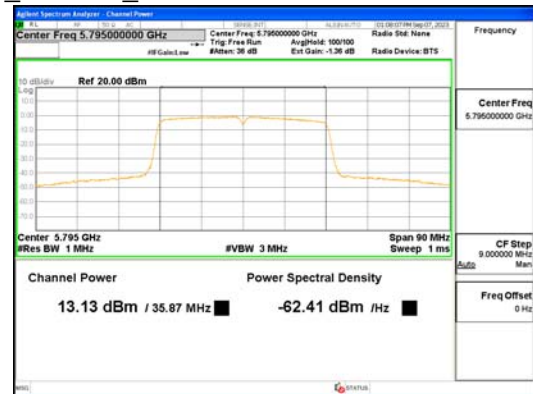
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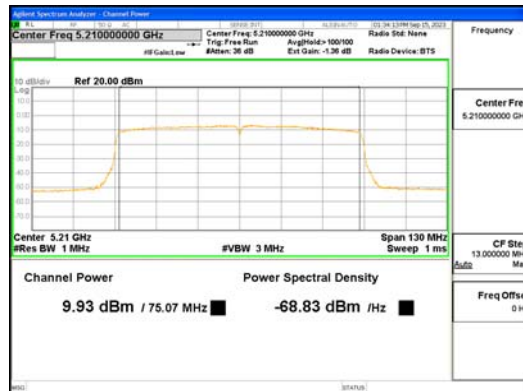
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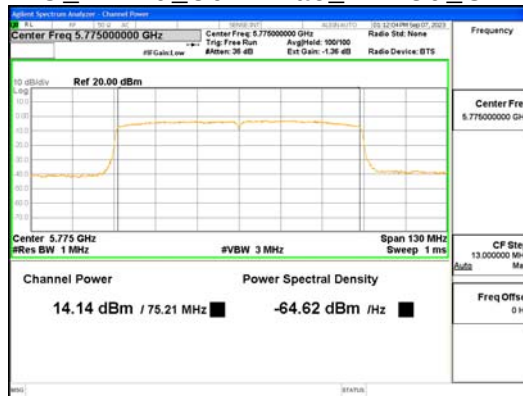
MIMO_ANT 1_802.11ac_VHT40_UNII-1



MIMO_ANT 1_802.11ac_VHT40_UNII-3



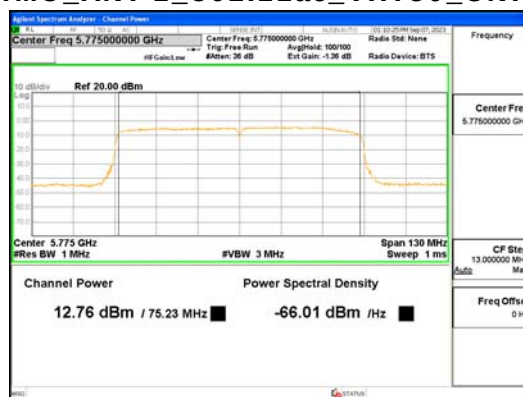
MIMO_ANT 0_802.11ac_VHT80_UNII-1



MIMO_ANT 0_802.11ac_VHT80_UNII-3



MIMO_ANT 1_802.11ac_VHT80_UNII-1



MIMO_ANT 1_802.11ac_VHT80_UNII-3

4.4 Power Spectral Density

Test Procedures

KDB 789033 – Section F (Method SA-2, Maximum Power Spectral Density)
KDB 662911 D01, D02 (Multiple Transmitter Output)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Test Settings :

Center frequency = the highest, middle and the lowest channels

- a) RBW = 1 MHz, 500 KHz (UNII 3)
- b) VBW = 3 MHz, 1.5 MHz (UNII 3)
- c) Sweep time = auto
- d) Detector = power averaging (rms)
- e) Trace mode = Average at least 100
- f) Duty cycle factor = $10\log(1/x)$

Test mode		Duty Cycle Factor (dB)
CDD Mode	802.11a_ANT0	0.27
	802.11a_ANT1	0.31
	802.11n_HT20	0.52
	802.11n_HT40	0.97
	802.11ac_VHT20	0.30
	802.11ac_VHT40	0.55
	802.11ac_VHT80	1.07

Limit

Operating Mode	Band	Mode	ANT Configuration	ANT Gain (dBi)	Limit (dBm)
SISO	UNII 1	802.11a	ANT 0, ANT 1	4.63, 3.73	11.00
	UNII 3			4.47, 3.56	30.00
MIMO (2Tx)	UNII 1	802.11n/ac	ANT 0 + ANT 1	7.20	9.80
	UNII 3			7.04	29.00

Note :

Per KDB 662911, the MIMO directional gain is calculated using the following formula, Where GN is the gain of the nth antenna and NANT, the total number of antennas used.

Directional gain = 10 log[(10^{G1/20} + 10^{G2/20} + ... + 10^{GN /20})² /NANT] dBi

Test Data

SISO_ANT 0

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	7.67	0.27	7.94	9.80	1.86
	5 220	7.86	0.27	8.13	9.80	1.67
	5 240	8.11	0.27	8.38	9.80	1.42
	5 745	5.90	0.27	6.17	29.00	22.83
	5 785	5.82	0.27	6.09	29.00	22.91
	5 825	7.46	0.27	7.73	29.00	21.27

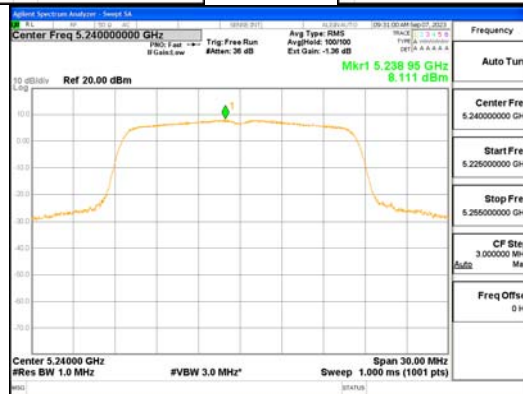
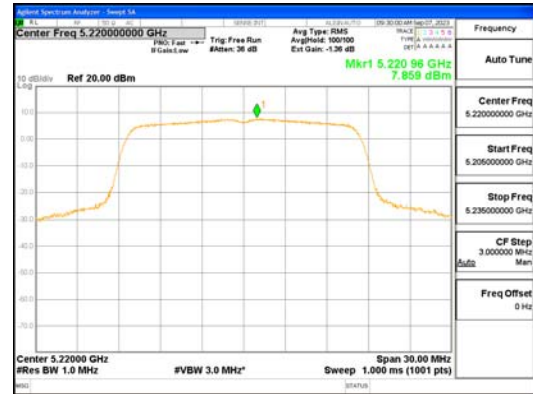
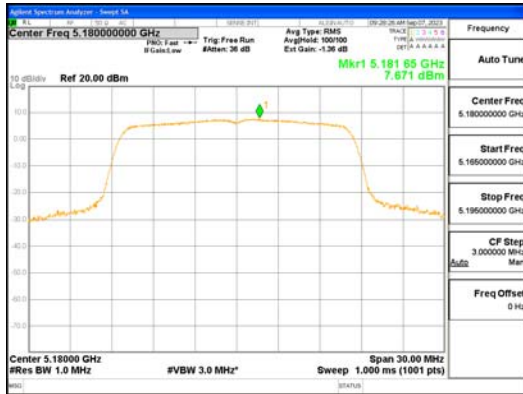
SISO_ANT 1

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11a	5 180	8.57	0.31	8.88	9.80	0.92
	5 220	8.09	0.31	8.40	9.80	1.40
	5 240	8.02	0.31	8.33	9.80	1.47
	5 745	4.20	0.31	4.51	29.00	24.49
	5 785	4.47	0.31	4.78	29.00	24.22
	5 825	5.89	0.31	6.20	29.00	22.80

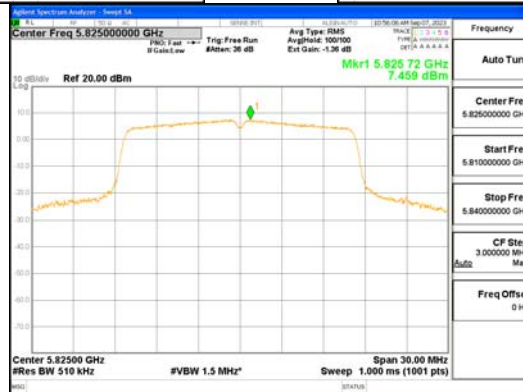
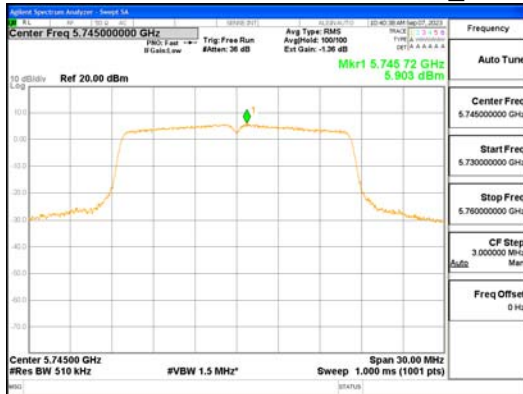
MIMO_ANT 0 + ANT 1

Test Mode	Frequency (MHz)	Measured Power Density (dBm)	Duty cycle Factor (dB)	Result Output Power (dBm)	Limit (dBm)	Margin (dB)
802.11n_HT20	5 180	5.53	0.52	6.05	9.80	3.75
	5 220	5.94	0.52	6.46	9.80	3.34
	5 240	5.92	0.52	6.44	9.80	3.36
	5 745	5.19	0.52	5.71	29.00	23.29
	5 785	5.06	0.52	5.58	29.00	23.42
	5 825	6.62	0.52	7.14	29.00	21.86
802.11ac_VHT20	5 180	6.28	0.30	6.58	9.80	3.22
	5 220	6.25	0.30	6.55	9.80	3.25
	5 240	6.11	0.30	6.41	9.80	3.39
	5 745	4.86	0.30	5.16	29.00	23.84
	5 785	5.44	0.30	5.74	29.00	23.26
	5 825	6.88	0.30	7.18	29.00	21.82
802.11n_HT40	5 190	3.48	0.97	4.45	9.80	5.35
	5 230	3.22	0.97	4.19	9.80	5.61
	5 755	2.91	0.97	3.88	29.00	25.12
	5 795	1.14	0.97	2.11	29.00	26.89
802.11ac_VHT40	5 190	4.09	0.55	4.64	9.80	5.16
	5 230	5.03	0.55	5.58	9.80	4.22
	5 755	2.27	0.55	2.82	29.00	26.18
	5 795	1.11	0.55	1.66	29.00	27.34
802.11ac_VHT80	5 210	-3.67	1.07	-2.60	9.80	12.40
	5 775	-2.93	1.07	-1.86	29.00	30.86

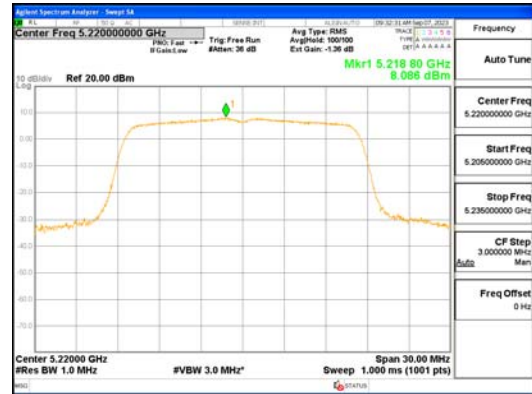
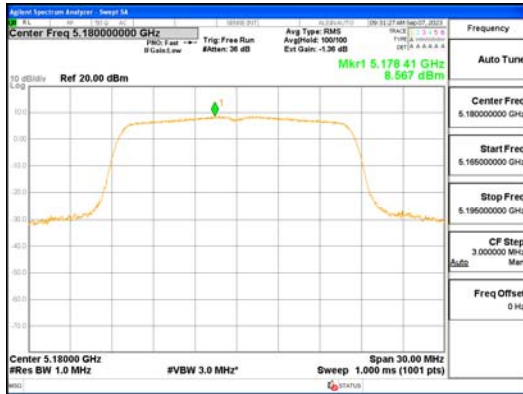
See next pages for actual measured spectrum plots.



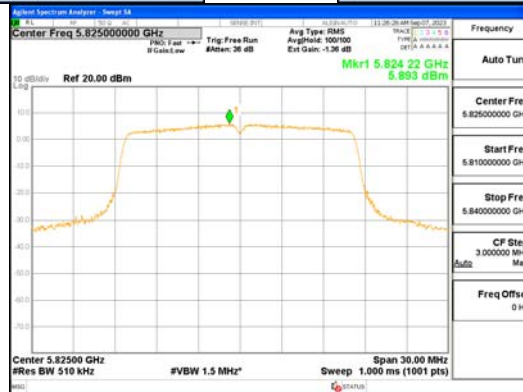
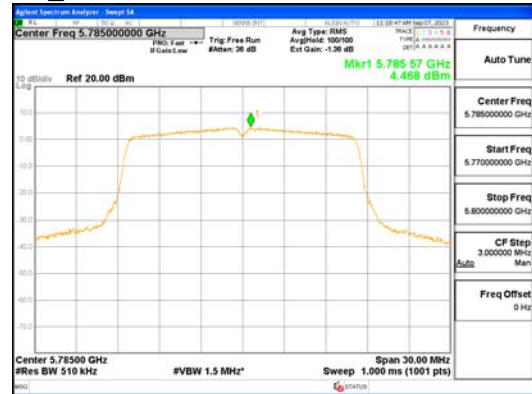
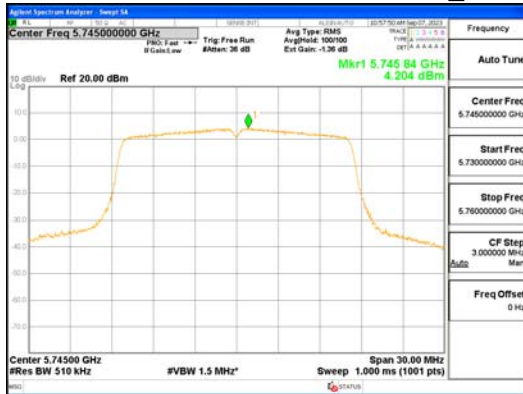
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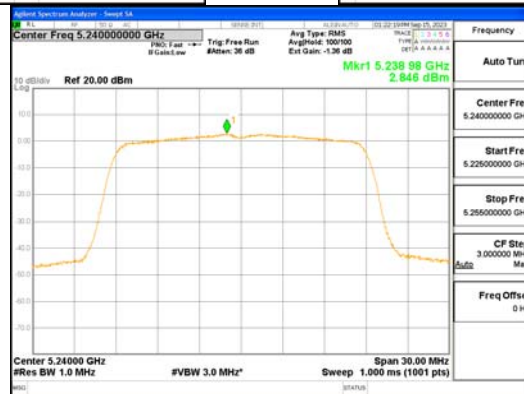
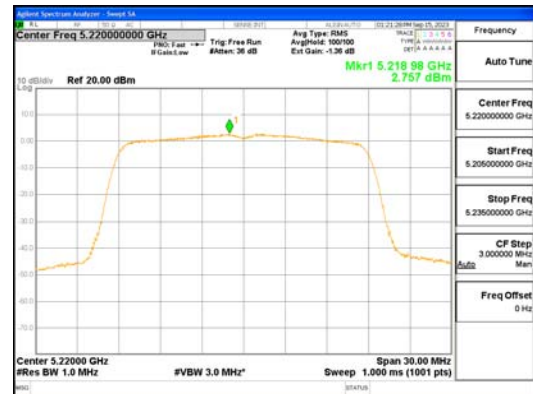
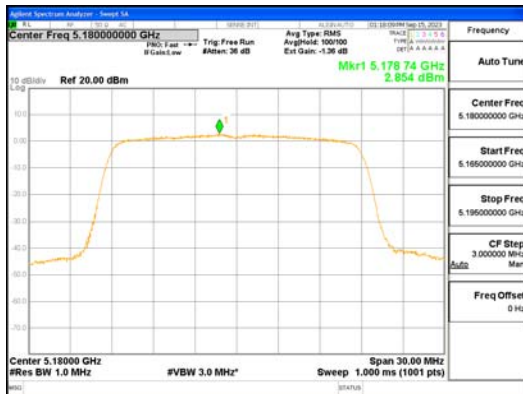
SISO_ANT 0_802.11a_UNII-3



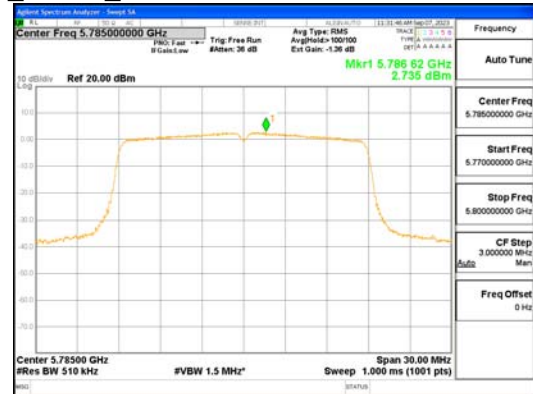
SISO_ANT 1_802.11a_UNII-1



SISO_ANT 1_802.11a_UNII-3



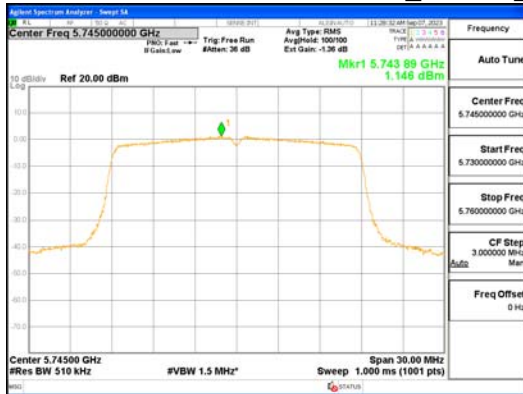
MIMO_ANT 0_802.11n_HT20_UNII-1



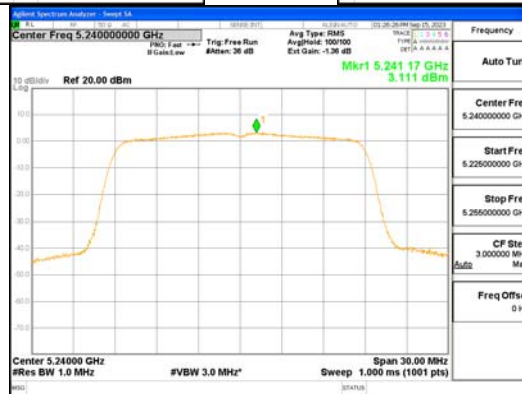
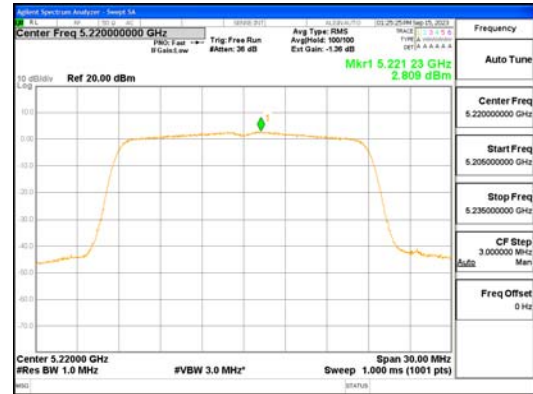
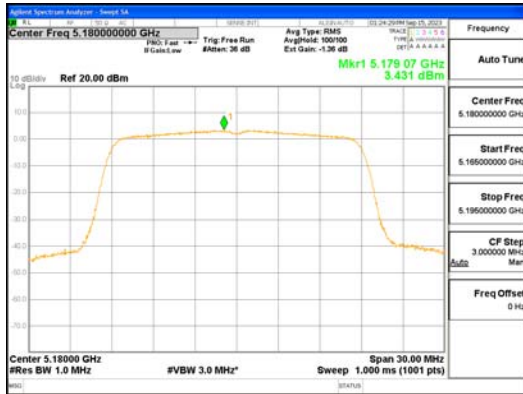
MIMO_ANT 0_802.11n_HT20_UNII-3



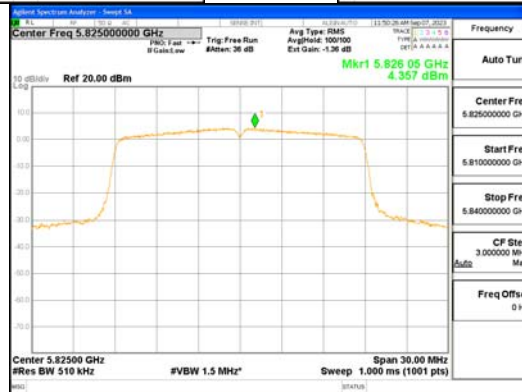
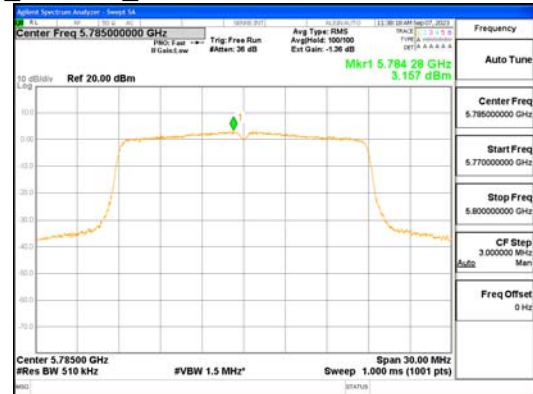
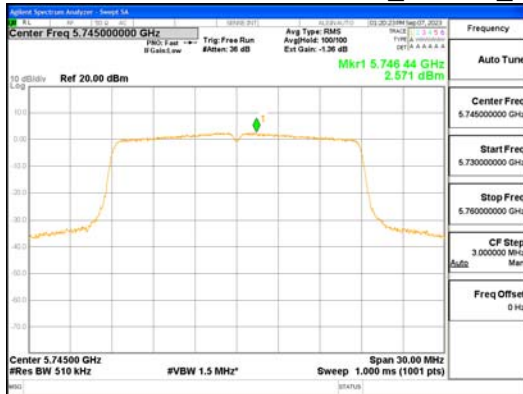
MIMO_ANT 1_802.11n_HT20_UNII-1



MIMO_ANT 1_802.11n_HT20_UNII-3



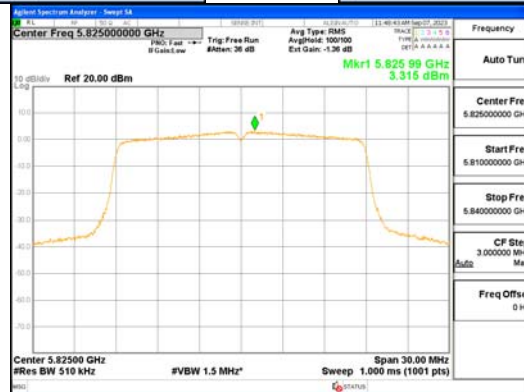
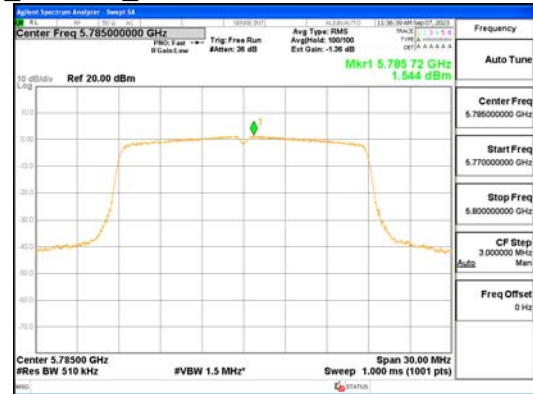
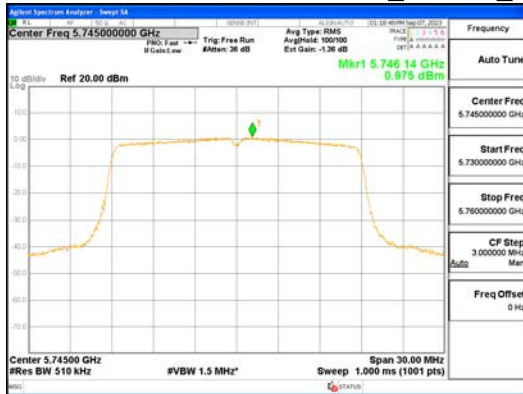
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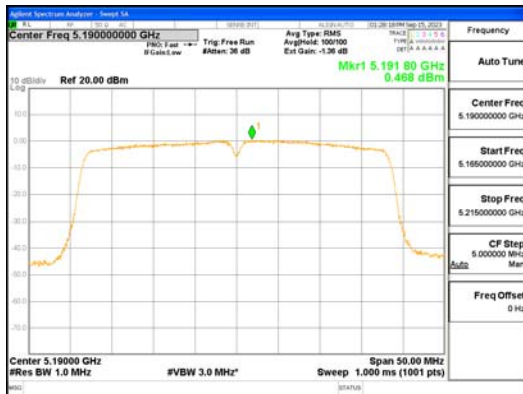
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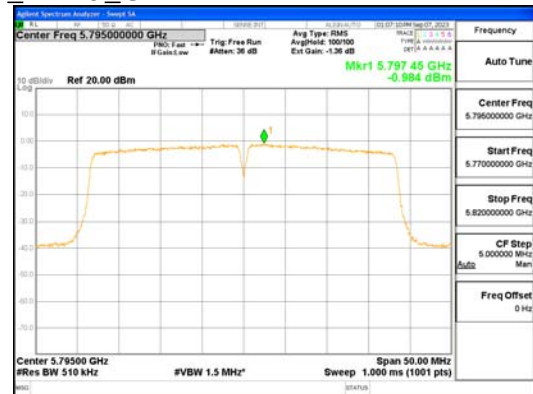
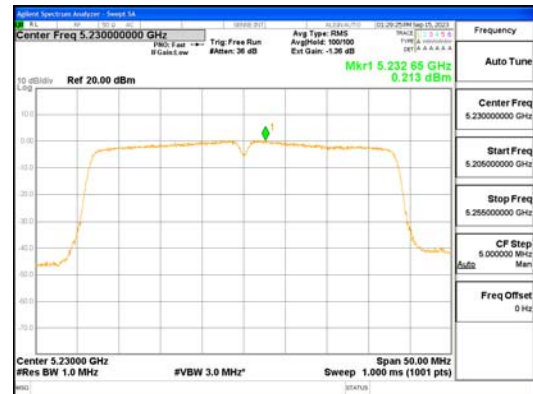
MIMO_ANT 1_802.11ac_VHT20_UNII-1



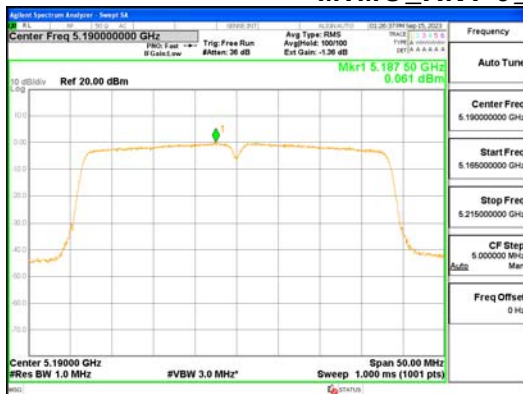
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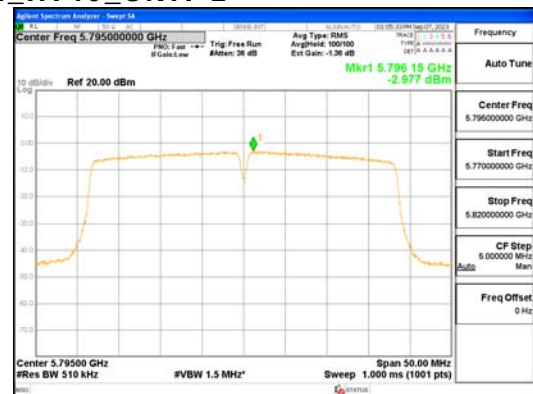
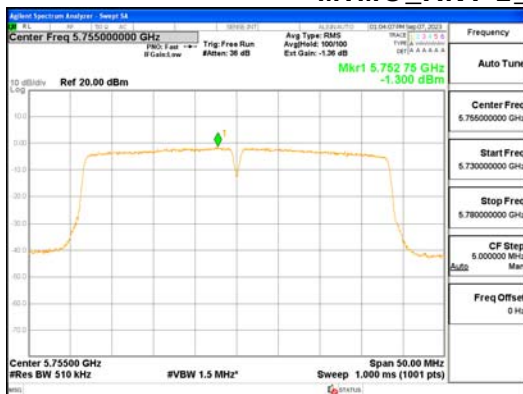
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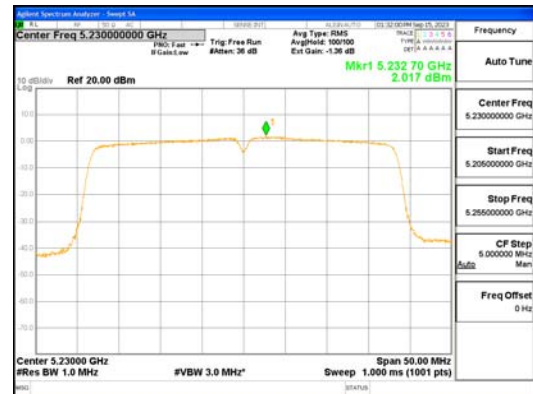
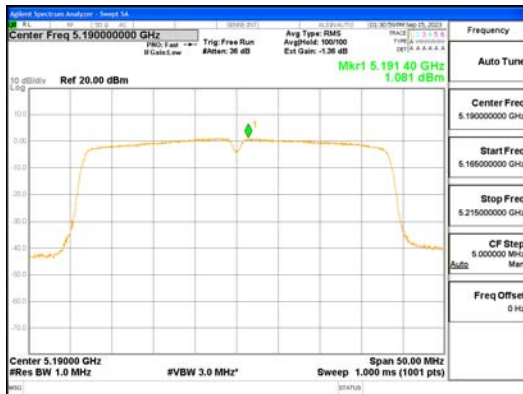
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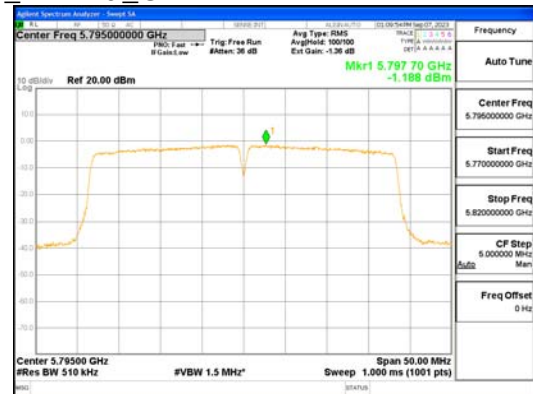
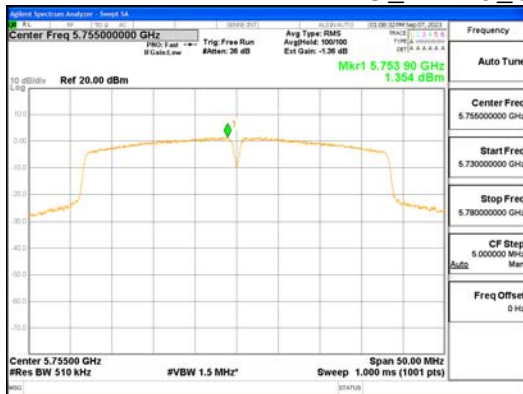
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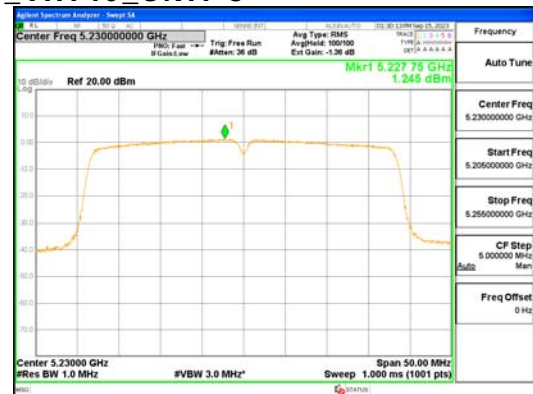
MIMO_ANT 1_802.11n_HT40_UNII-3



MIMO_ANT 0_802.11ac_VHT40_UNII-1



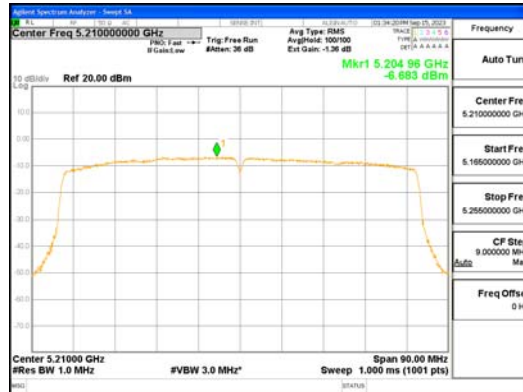
MIMO_ANT 0_802.11ac_VHT40_UNII-3



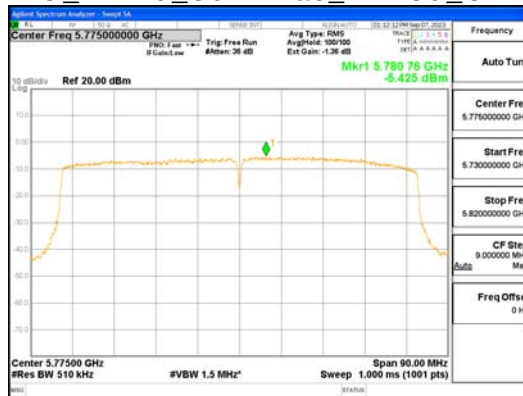
MIMO_ANT 1_802.11ac_VHT40_UNII-1



MIMO_ANT 1_802.11ac_VHT40_UNII-3



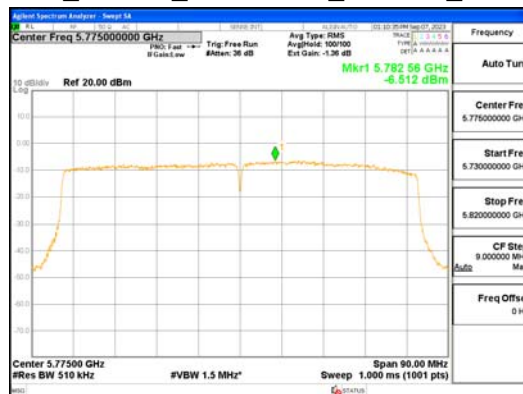
MIMO_ANT 0_802.11ac_VHT80_UNII-1



MIMO_ANT 0_802.11ac_VHT80_UNII-3



MIMO_ANT 1_802.11ac_VHT80_UNII-1



MIMO_ANT 1_802.11ac_VHT80_UNII-3

4.5 Frequency Stability

Test Procedures

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 0 °C and +70 °C (Declaration by the Manufacturer). The temperature was incremented by 10 °C (5 °C) intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

Data for the worst case channel is shown below.

Temperature (°C)	0	10	20	30	40	50	60	70
Frequency	Measured Frequency Error (kHz)							
5 180 MHz	12.937	5.744	-16.313	-13.826	-21.782	-19.555	-15.121	19.263
5 220 MHz	11.954	3.264	-17.556	-16.533	-22.251	-19.468	-13.217	21.715
5 240 MHz	11.532	2.874	-18.509	-17.003	-22.535	-19.461	-3.939	23.329
5 745 MHz	12.437	2.815	-21.788	-18.885	-24.741	-21.297	-3.892	24.620
5 785 MHz	12.072	1.087	-23.477	-19.551	-25.048	-21.021	-3.121	31.146
5 825 MHz	11.907	999	-24.185	-20.108	-25.192	-20.978	-2.646	33.176

Note :

Based on the results of the frequency stability test shown above the frequency deviation results measured are very small. As such it is determined that the channels at the band edge would remain in-band when the maximum measured frequency deviation noted during the frequency stability tests is applied. Therefore the device is determined to remain operating in band over the temperature range as tested.