

# TEST REPORT



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
Yongin-si, Gyeonggi-do, Korea  
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Report No.:  
CTK-2018-00984  
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## 1. Client

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
- Date of Receipt : 2018-02-14

## 2. Manufacturer

- Name : KAONMEDIA Co., Ltd.
- Address : KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea

**3. Use of Report** : For FCC Certification

**4. Test Sample / Model:** Layer3 TV / Client VM3000C


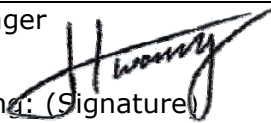
**5. Date of Test** : 2018-02-27 to 2018-04-12

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

**7. Testing Environment:** Temp.: (25 ± 5) °C, Humidity: (46 ± 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		Technical Manager	
	Ji-Hye Kim: (Signature)		Won-Jae, Hwang: (Signature)	

2018-04-13

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



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## REPORT REVISION HISTORY

Date	Revision	Page No
2018-04-13	Issued (CTK-2018-00984)	all

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## 1. General Product Description

### 1.1 Client Information

<b>Company</b>	KAONMEDIA Co., Ltd.
<b>Contact Point</b>	KAONMEDIA Building, 884-3 Seongnam-daero, Bundang-gu, Seongnam-si, Gyeonggi-do, Korea
<b>Contact Person</b>	Name : Kim tae-Sung E-mail : kkam@kaonmedia.com Tel : +82-31-724-8861

### 1.2 Product Information

<b>FCC ID</b>	WQTVM3000C
<b>Product Description</b>	Layer3 TV
<b>Model name</b>	Client VM3000C
<b>Variant Model name</b>	-
<b>Operating Frequency</b>	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 3 : 5 745 MHz – 5 825 MHz (20 MHz_BW) 5 755 MHz – 5 795 MHz (40 MHz_BW) 5 775 MHz (80 MHz)
<b>RF Output Power</b>	CDD Mode_802.11a : 24.60 dBm (288.40 mW) CDD Mode_802.11n_HT20 : 23.60 dBm (229.09 mW) CDD Mode_802.11n_HT40 : 23.41 dBm (219.28 mW) CDD Mode_802.11ac_VHT20 : 23.35 dBm (216.27 mW) CDD Mode_802.11ac_VHT40 : 23.55 dBm (226.46 mW) CDD Mode_802.11ac_VHT80 : 22.83 dBm (191.87 mW)  SDM Mode_802.11n_HT20 : 23.43 dBm (220.29 mW) SDM Mode_802.11n_HT40 : 23.30 dBm (213.80 mW) SDM Mode_802.11ac_VHT20 : 23.35 dBm (216.27 mW) SDM Mode_802.11ac_VHT40 : 23.30 dBm (213.80 mW) SDM Mode_802.11ac_VHT80 : 22.61 dBm (182.39 mW)
<b>Antenna Specification</b>	Antenna type : PCB Antenna Peak Gain : 2 dBi
<b>Type of Modulation</b>	OFDM
<b>Data Rate</b>	802.11a : 54 / 48 / 36 / 24 / 18 / 12 / 9 / 6 Mbps 802.11n : up to 600 Mbps 802.11ac : up to 1.7 Gbps
<b>Power Source</b>	DC 12 V (Adapter)
<b>Hardware Rev</b>	V0.3
<b>Software Rev</b>	V1.0



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### 1.3 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	HP	15-bs563TU	CND7253R6N
AC/DC Adapter	HP	HSTNN-CA40	-
Switching Power Adapter	I.T.E POWER SUPPLY ALSO LISTED	MSA-Z3330IC12.0-48W-P	-





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## 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	Scope of Accreditation	Registration Number	Logo
USA	FCC	FCC Part 15 & 18 EMI (Electromagnetic Interference / Emission)	805871	
CANADA	ISED	ISED EMI (3/10m test site)	8737A-2	
JAPAN	VCCI	VCCI V-3 EMI (Electromagnetic Interference / Emission)	C-986 T-1843 R-3627 G-387	
KOREA	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	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.



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### 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	< 1 W (5 150 – 5 250 MHz) < 1 W (5 725 – 5 850 MHz)	C	
15.407(a)(1)	Power Spectral Density	< 17 dBm/MHz (5 150 – 5 250 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) < -17 dBm/MHz EIRP (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
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<i>Note 2:</i> The data in this test report are traceable to the national or international standards.				
<i>Note 3:</i> The sample was tested according to the following specification: FCC Part 15.247, ANSI C63.10-2013				
<i>Note 4:</i> 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

	Lowest channel	Middle channel	Highest channel
<b>UNII 1</b>	5 180 MHz	5 200 MHz	5 240 MHz
<b>UNII 3</b>	5 745 MHz	5 785 MHz	5 825 MHz

- 802.11n\_HT40, 802.11ac\_VHT40

	Lowest channel	Middle channel	Highest channel
<b>UNII 1</b>	5 190 MHz	-	5 230 MHz
<b>UNII 3</b>	5 755 MHz	-	5 795 MHz

- 802.11ac\_VHT80

	Lowest channel	Middle channel	Highest channel
<b>UNII 1</b>	5 210 MHz	-	-
<b>UNII 3</b>	5 775 MHz	-	-

#### Test mode

- CDD mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11a	OFDM	6 Mbps	95.8%	0.19 dB
802.11n_HT20	OFDM	MCS 0	95.5%	0.20 dB
802.11n_HT40	OFDM	MCS 0	90.7%	0.42 dB
802.11ac_VHT20	OFDM	MNSS 0	95.4%	0.21 dB
802.11ac_VHT40	OFDM	MNSS 0	90.8%	0.42 dB
802.11ac_VHT80	OFDM	MNSS 0	82.6%	0.83 dB

- SDM mode

Test mode	Modulation	Data rate	Duty Cycle	Duty Cycle Factor
802.11n_HT20	OFDM	MCS 24	84.3%	0.74 dB
802.11n_HT40	OFDM	MCS 24	73.8%	1.32 dB
802.11ac_VHT20	OFDM	MNSS 0	84.4%	0.74 dB
802.11ac_VHT40	OFDM	MNSS 0	73.8%	1.32 dB
802.11ac_VHT80	OFDM	MNSS 0	62.0%	2.08 dB





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### 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	$\pm 1.5$ dB
Power Spectral Density	$\pm 1.5$ dB
Occupied Bandwidth	$\pm 0.1$ MHz
Unwanted Emission(conducted)	$\pm 3.0$ dB
Radiated Emissions ( $f \leq 1$ GHz)	$\pm 4.0$ dB
Radiated Emissions ( $f > 1$ GHz)	$\pm 5.0$ dB

### 3.5 Test Software

Conducted Test	Ics Pro Ver. 6.0.3
Radiated Test	TOYO EMI software EP5RE Ver. 5.1.0
Line Conducted Test	ESCI7, ESCI3 : EMC32 Ver. 8.50.0 ESR7 : EMC32 Ver. 8.53.0



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## 4. Technical Characteristic Test

### 4.1 6dB Bandwidth

#### Test Procedures(ANSI C63.10-2013 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:**

**CDD Mode\_ANT0**

		6 dB Bandwidth (MHz)		
Mode		802.11a	802.11n_HT20	802.11ac_VHT20
Frequency				
5 745 MHz		16.39	17.65	17.62
5 785 MHz		16.40	17.67	17.65
5 825 MHz		16.45	17.68	17.64

		6 dB Bandwidth (MHz)	
Mode		802.11n_HT40	802.11ac_VHT40
Frequency			
5 755 MHz		36.46	36.48
5 795 MHz		36.39	36.42

		6 dB Bandwidth (MHz)	
Mode		802.11ac_VHT80	
Frequency			
5 775 MHz		76.35	

**CDD Mode\_ANT1**

		6 dB Bandwidth (MHz)		
Mode		802.11a	802.11n_HT20	802.11ac_VHT20
Frequency				
5 745 MHz		16.44	17.67	17.65
5 785 MHz		16.38	17.64	17.63
5 825 MHz		16.43	17.64	17.66



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6 dB Bandwidth (MHz)		
Mode	802.11n_HT40	802.11ac_VHT40
Frequency		
5 755 MHz	36.38	36.38
5 795 MHz	36.47	36.47

6 dB Bandwidth (MHz)	
Mode	802.11ac_VHT80
Frequency	
5 775 MHz	76.30

**CDD Mode\_ANT2**

6 dB Bandwidth (MHz)			
Mode	802.11a	802.11n_HT20	802.11ac_VHT20
Frequency			
5 745 MHz	16.44	17.63	17.65
5 785 MHz	16.45	17.67	17.68
5 825 MHz	16.43	17.69	17.67

6 dB Bandwidth (MHz)		
Mode	802.11n_HT40	802.11ac_VHT40
Frequency		
5 755 MHz	36.32	36.47
5 795 MHz	36.40	36.45

6 dB Bandwidth (MHz)	
Mode	802.11ac_VHT80
Frequency	
5 775 MHz	76.33



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**CDD Mode\_ANT3**

		6 dB Bandwidth (MHz)		
Mode		802.11a	802.11n_HT20	802.11ac_VHT20
Frequency				
5 745 MHz		16.45	17.65	17.66
5 785 MHz		16.43	17.67	17.63
5 825 MHz		16.47	17.65	17.62

		6 dB Bandwidth (MHz)	
Mode		802.11n_HT40	802.11ac_VHT40
Frequency			
5 755 MHz		36.38	36.38
5 795 MHz		36.45	36.49

		6 dB Bandwidth (MHz)	
Mode		802.11ac_VHT80	
Frequency			
5 775 MHz		76.32	

See next pages for actual measured spectrum plots.

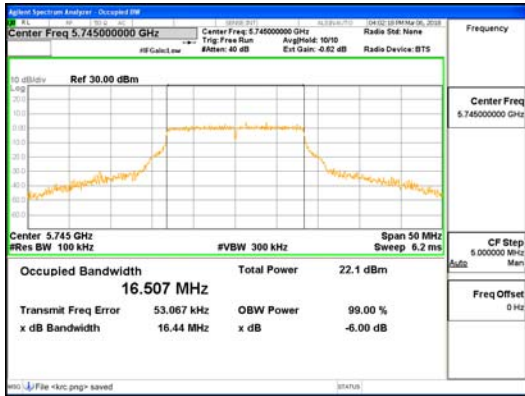


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**CDD Mode\_ANT0\_802.11a**

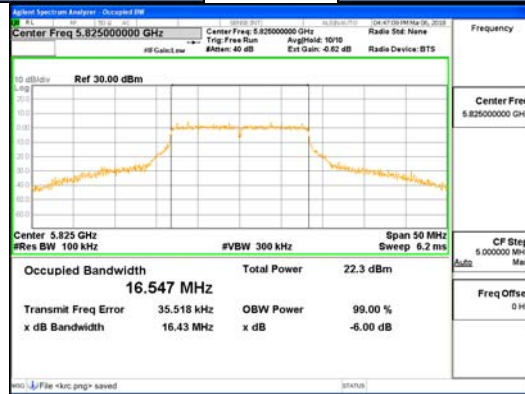


**CDD Mode\_ANT1\_802.11a**



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**CDD Mode\_ANT2\_802.11a**

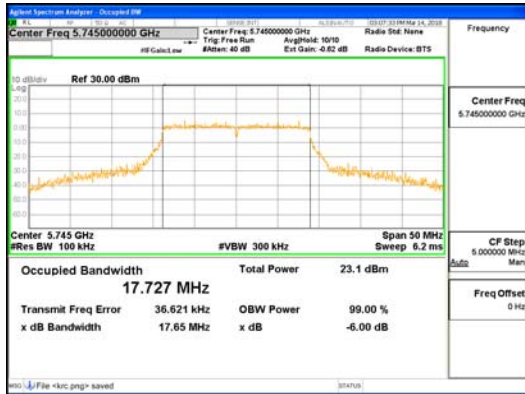


**CDD Mode\_ANT3\_802.11a**

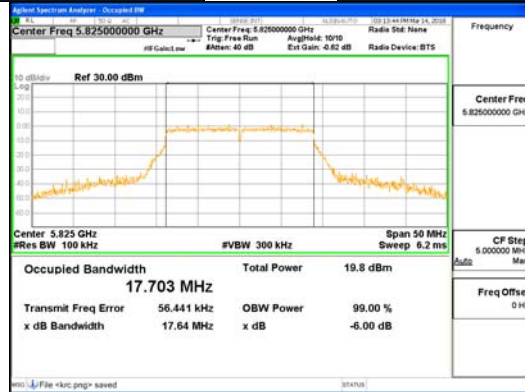
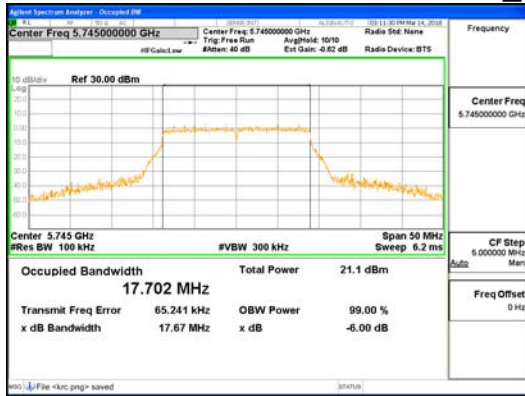


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CDD Mode\_ANT0\_802.11n\_HT20



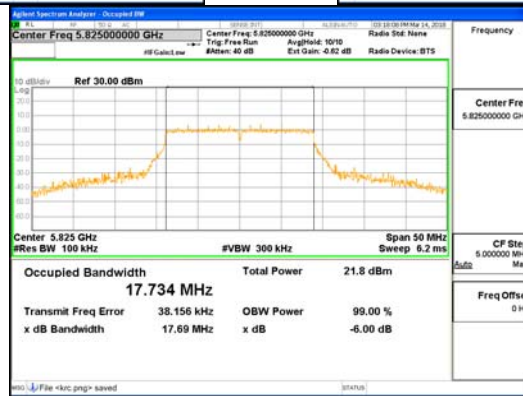
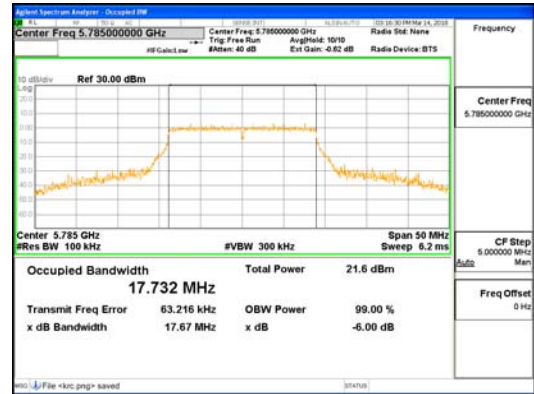
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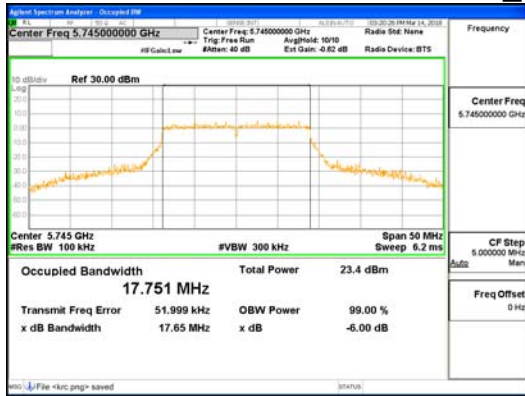


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**CDD Mode\_ANT2\_802.11n\_HT20**

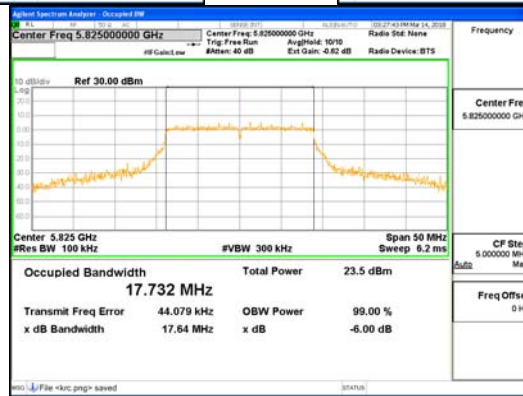
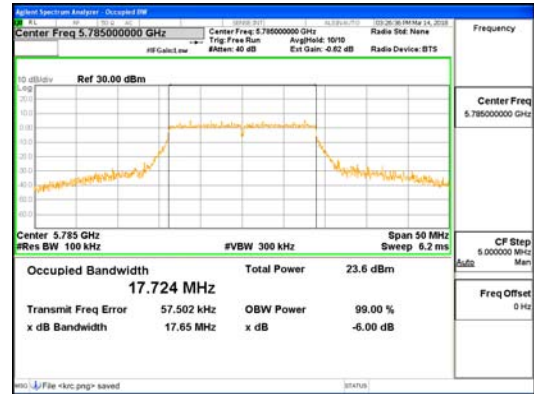


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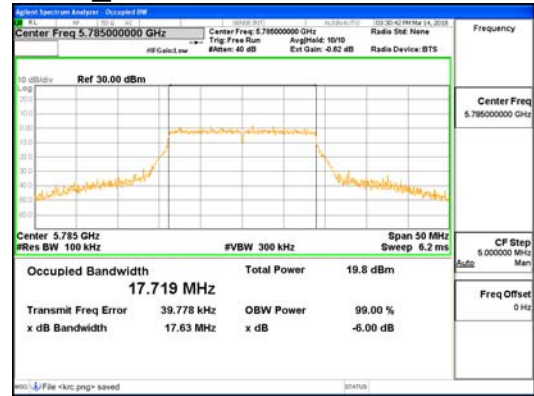


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CDD Mode\_ANT0\_802.11ac\_VHT20

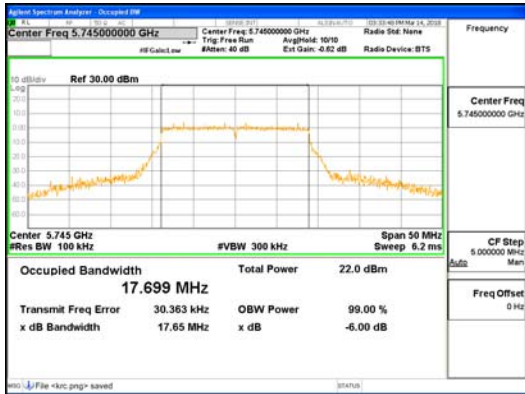


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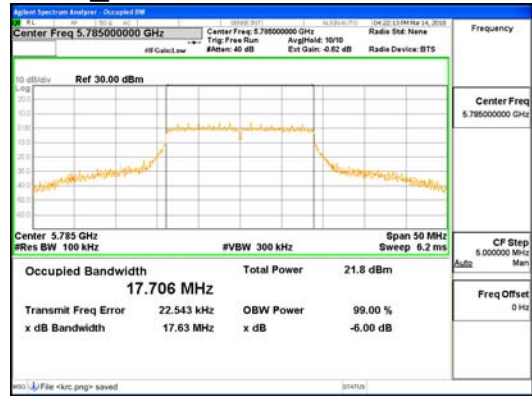
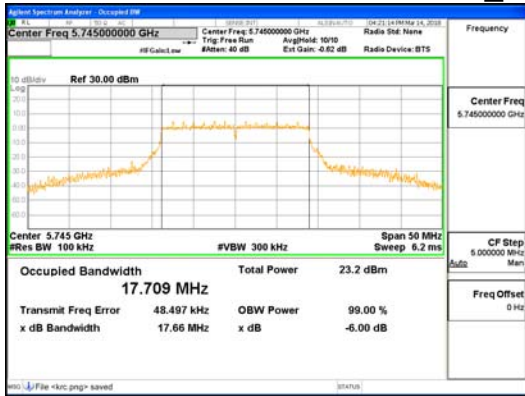


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CDD Mode\_ANT2\_802.11ac\_VHT20

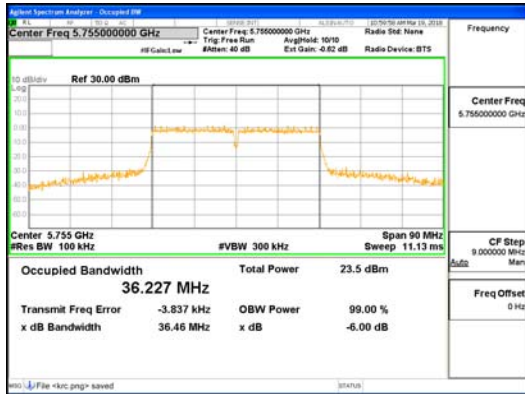


CDD Mode\_ANT3\_802.11ac\_VHT20

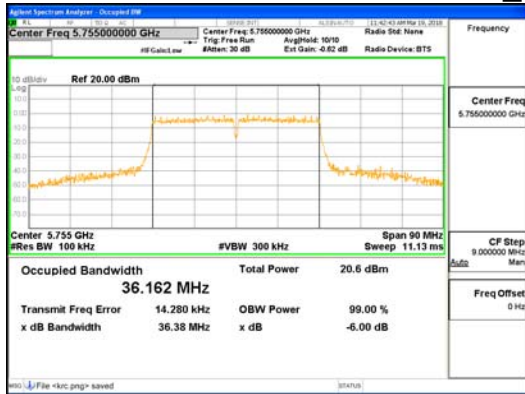


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CDD Mode\_ANT0\_802.11n\_HT40



CDD Mode\_ANT1\_802.11n\_HT40



CDD Mode\_ANT2\_802.11n\_HT40



CDD Mode\_ANT3\_802.11n\_HT40

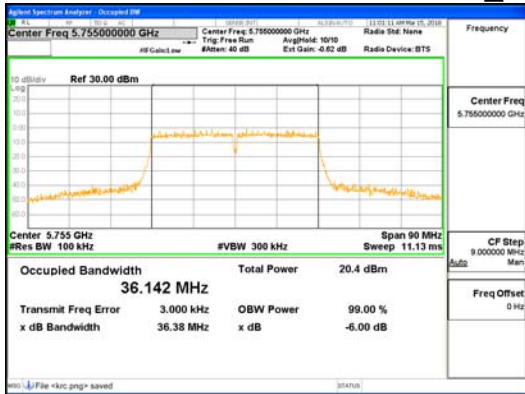


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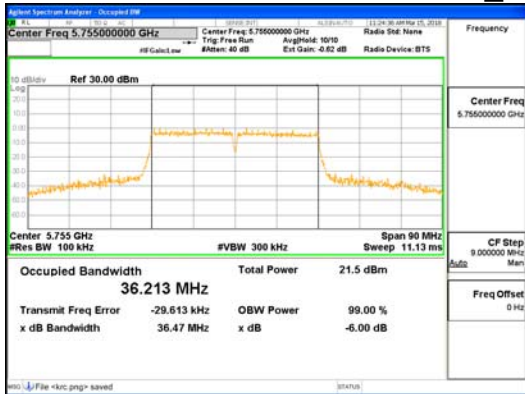
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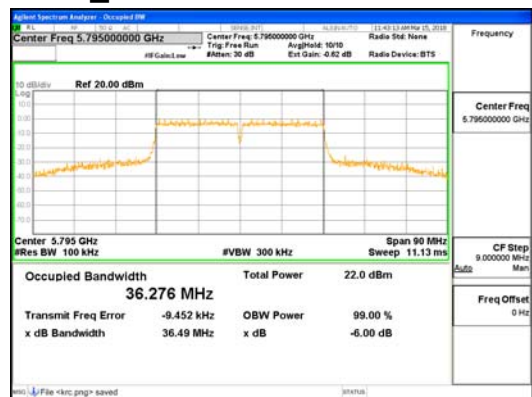
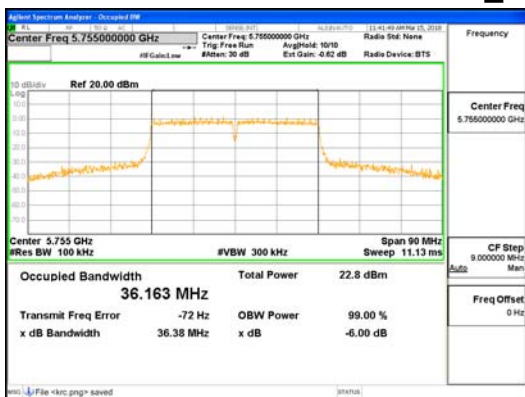
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CDD Mode\_ANT1\_802.11ac\_VHT40



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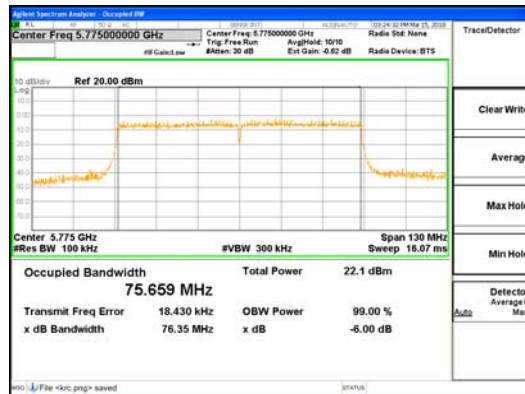


CDD Mode\_ANT3\_802.11ac\_VHT40



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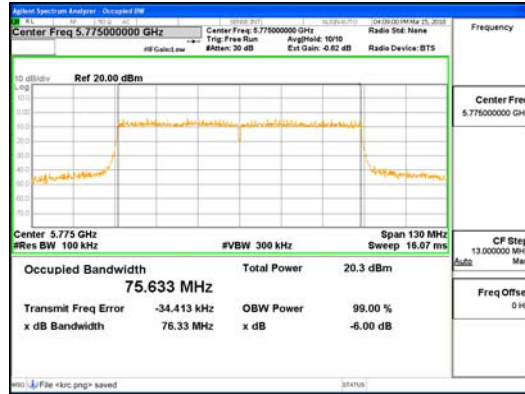
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**CDD Mode\_ANT0\_802.11ac\_VHT80**



**CDD Mode\_ANT1\_802.11ac\_VHT80**



**CDD Mode\_ANT2\_802.11ac\_VHT80**



**CDD Mode\_ANT3\_802.11ac\_VHT80**



## 4.2 26 dB Bandwidth and 99% Bandwidth

### Test Procedures(ANSI C63.10-2013 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(ANSI C63.10-2013 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:

#### CDD Mode\_ANTO

Mode	26 dB Bandwidth and 99% Bandwidth (MHz)					
	802.11a		802.11n_HT20		802.11ac_VHT20	
	26 dB	99%	26 dB	99%	26 dB	99%
5 180 MHz	22.50	18.09	22.61	19.01	22.65	18.94
5 200 MHz	22.44	18.10	22.76	19.03	22.83	19.01
5 240 MHz	22.51	18.10	22.80	19.08	22.50	19.05
5 745 MHz	29.22	17.80	29.71	18.60	28.21	18.55
5 785 MHz	27.86	17.79	28.11	18.62	26.80	18.55
5 825 MHz	31.09	17.93	34.10	18.77	29.68	18.66



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26 dB Bandwidth and 99% Bandwidth (MHz)				
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	40.74	36.67	40.51	36.70
5 230 MHz	40.75	36.74	40.66	36.71
5 755 MHz	53.36	36.53	63.20	36.52
5 795 MHz	43.51	36.40	42.89	36.43

26 dB Bandwidth and 99% Bandwidth (MHz)		
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	82.23	75.86
5 775 MHz	80.79	75.80

**CDD Mode\_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	22.59	18.14	22.61	19.08	22.90	19.03
5 200 MHz	22.64	18.23	22.67	19.04	22.81	19.15
5 240 MHz	22.69	18.19	22.82	19.06	22.60	19.07
5 745 MHz	21.70	17.53	25.32	18.48	22.62	18.46
5 785 MHz	24.00	17.64	23.99	18.54	22.05	18.52
5 825 MHz	22.13	17.59	24.50	18.56	22.15	18.51

26 dB Bandwidth and 99% Bandwidth (MHz)				
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	40.67	36.67	40.81	36.73
5 230 MHz	40.69	36.78	40.85	36.71
5 755 MHz	40.04	36.36	40.00	36.34
5 795 MHz	40.16	36.48	46.65	36.44





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26 dB Bandwidth and 99% Bandwidth (MHz)		
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	81.70	75.83
5 775 MHz	80.75	75.72

**CDD Mode\_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	22.47	18.12	22.75	19.10	22.60	19.02
5 200 MHz	22.51	18.15	22.51	18.98	22.76	19.00
5 240 MHz	22.48	18.16	22.68	19.02	22.63	19.10
5 745 MHz	22.90	17.63	22.36	18.49	22.10	18.51
5 785 MHz	28.05	17.87	30.88	18.63	26.79	18.54
5 825 MHz	28.82	17.83	31.07	18.85	26.31	18.63

26 dB Bandwidth and 99% Bandwidth (MHz)				
Mode	802.11n_HT40		802.11ac_VHT40	
Frequency	26 dB	99 %	26 dB	99 %
5 190 MHz	41.12	36.69	40.80	36.68
5 230 MHz	40.89	36.67	40.60	36.67
5 755 MHz	40.22	36.45	40.00	36.44
5 795 MHz	48.52	36.50	44.97	36.46

26 dB Bandwidth and 99% Bandwidth (MHz)		
Mode	802.11ac_VHT80	
Frequency	26 dB	99 %
5 210 MHz	81.41	75.88
5 775 MHz	81.18	75.81



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**CDD Mode\_ANT3**

Mode	26 dB Bandwidth and 99% Bandwidth (MHz)					
	802.11a		802.11n_HT20		802.11ac_VHT20	
	26 dB	99%	26 dB	99%	26 dB	99%
5 180 MHz	22.51	18.17	22.72	19.11	22.87	19.10
5 200 MHz	22.58	18.25	22.69	19.06	22.81	19.09
5 240 MHz	22.33	18.19	22.69	19.08	22.60	19.02
5 745 MHz	31.27	18.01	28.93	18.63	26.71	18.41
5 785 MHz	29.82	18.05	33.06	18.76	26.76	18.38
5 825 MHz	29.29	18.03	31.19	18.73	27.02	18.39

Mode	26 dB Bandwidth and 99% Bandwidth (MHz)			
	802.11n_HT40		802.11ac_VHT40	
	26 dB	99 %	26 dB	99 %
5 190 MHz	40.87	36.84	40.99	36.69
5 230 MHz	40.75	36.72	40.76	36.76
5 755 MHz	42.76	36.38	46.64	36.45
5 795 MHz	67.40	36.70	59.70	36.61

Mode	26 dB Bandwidth and 99% Bandwidth (MHz)	
	802.11ac_VHT80	
	26 dB	99 %
5 210 MHz	81.51	75.89
5 775 MHz	80.97	75.76

See next pages for actual measured spectrum plots.

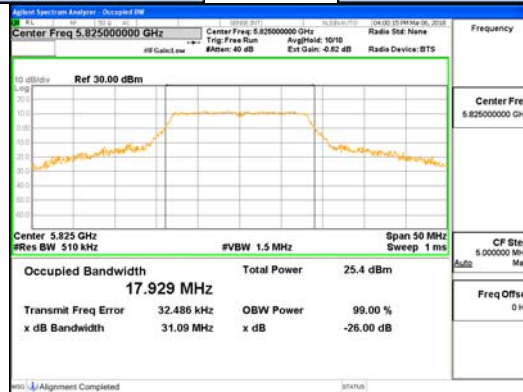
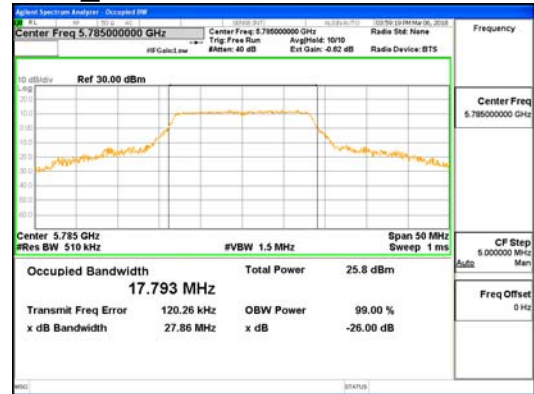
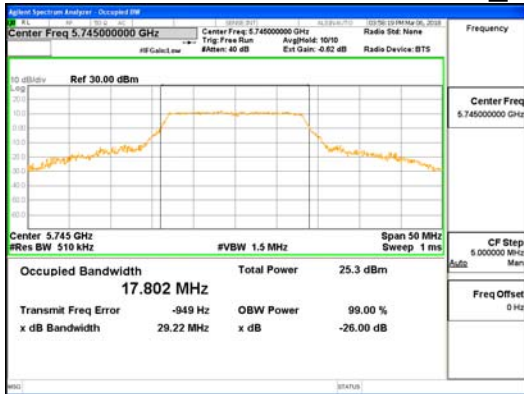


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CDD Mode\_ANTO\_802.11a\_UNII-1

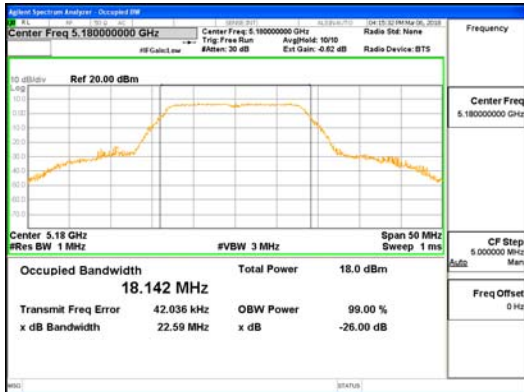


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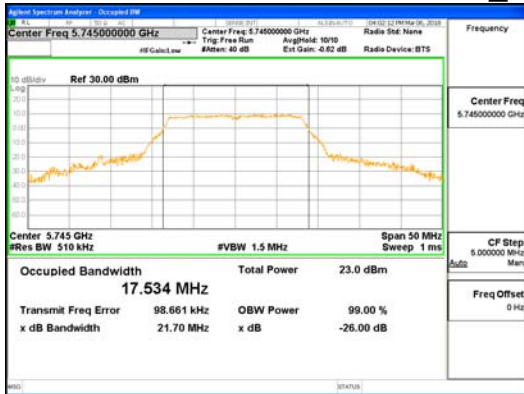


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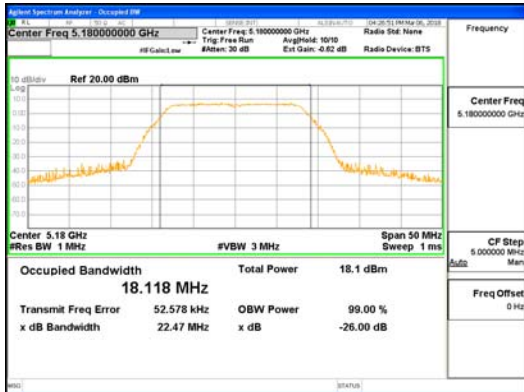
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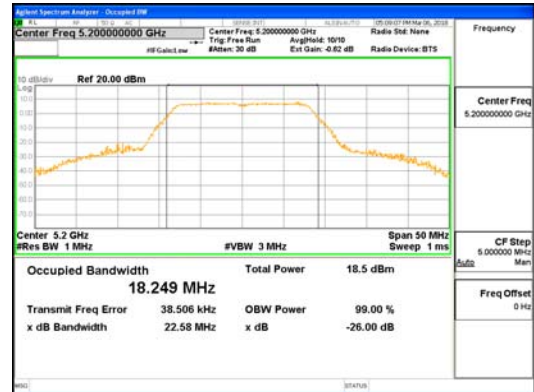
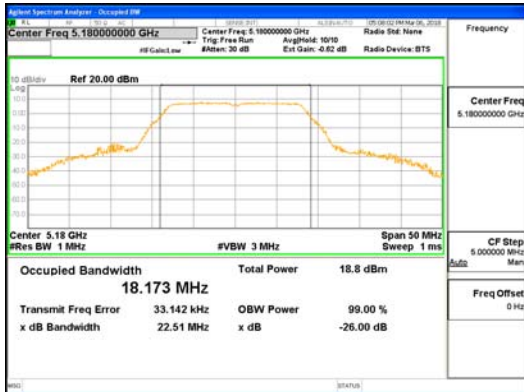


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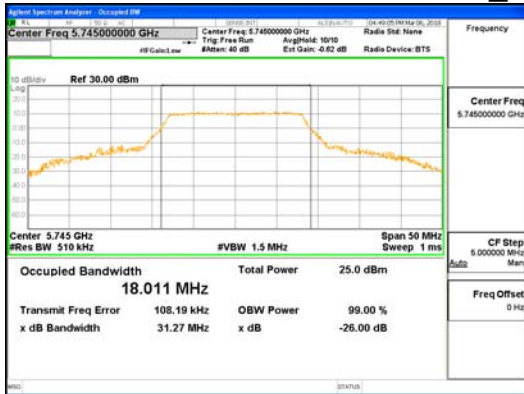


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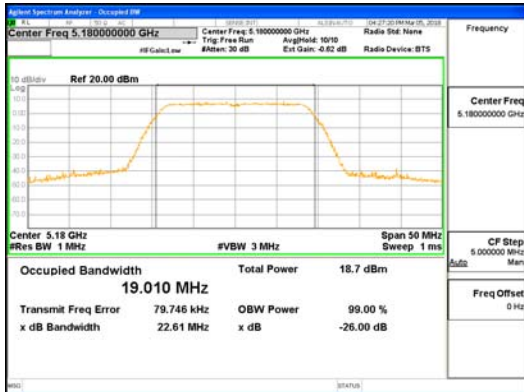


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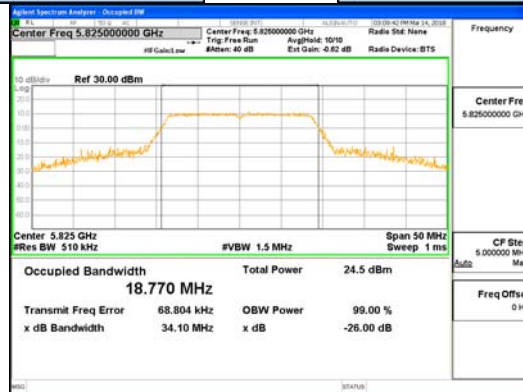
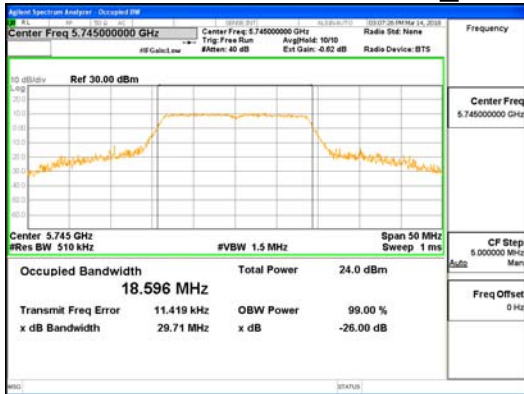


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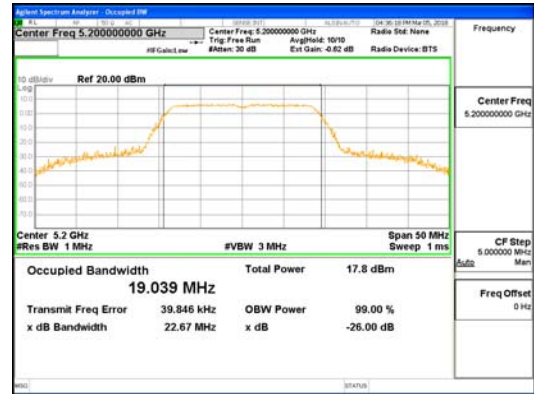
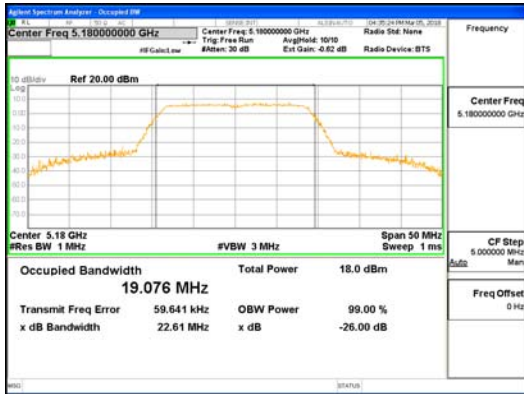


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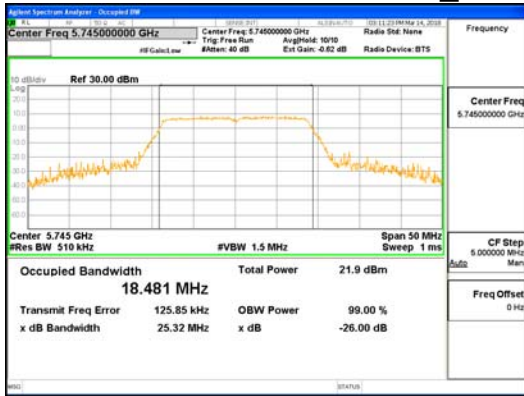


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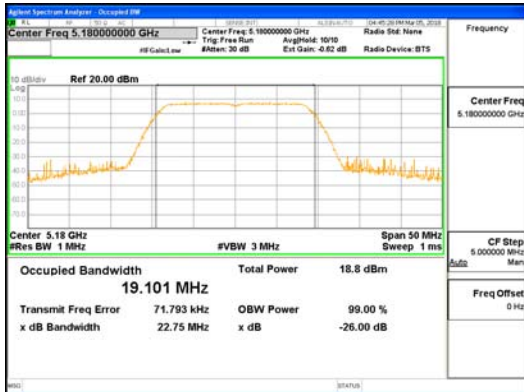


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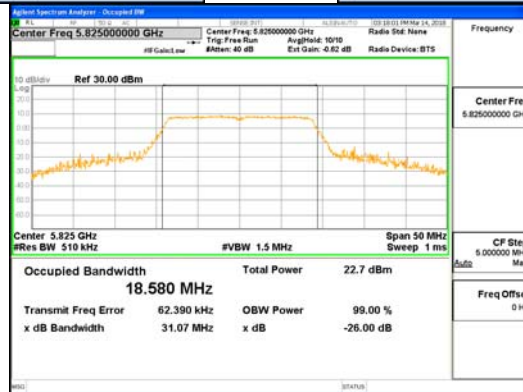
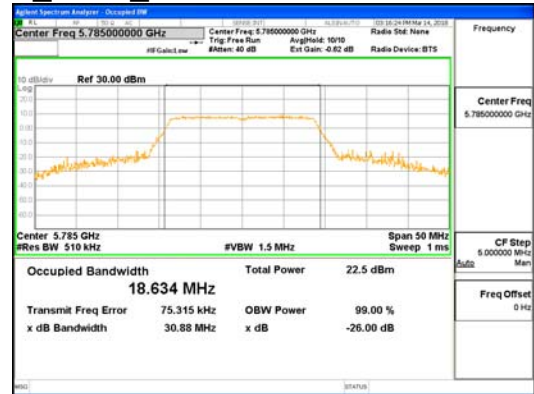
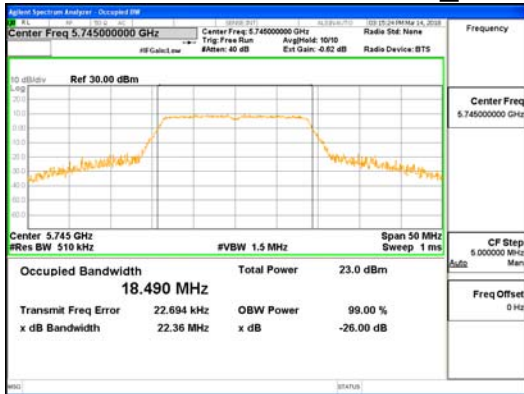


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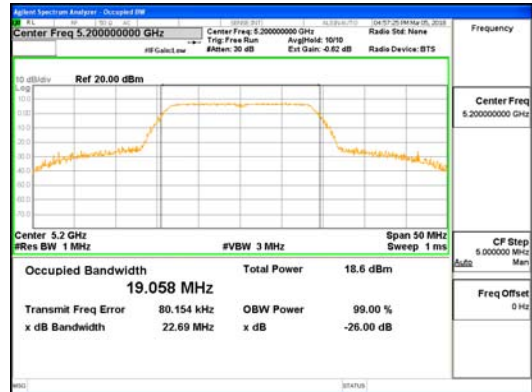
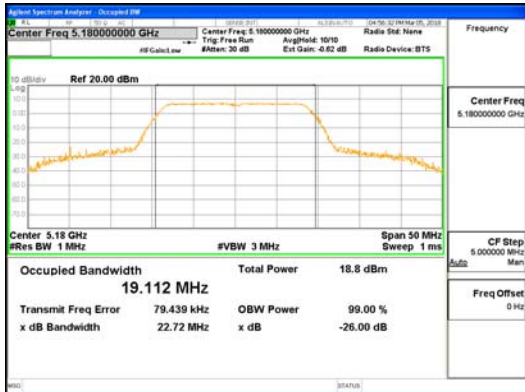


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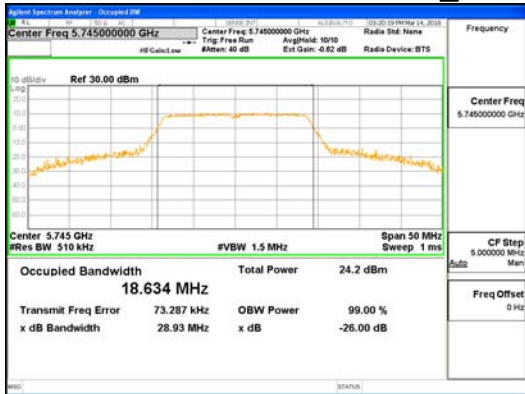


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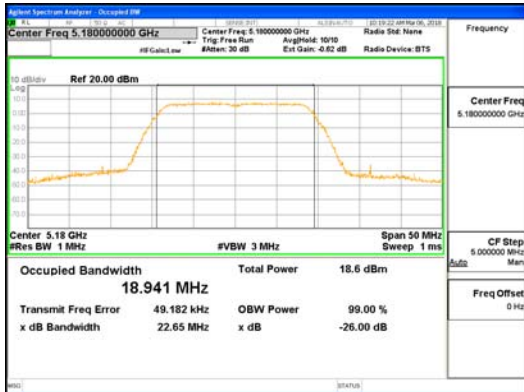
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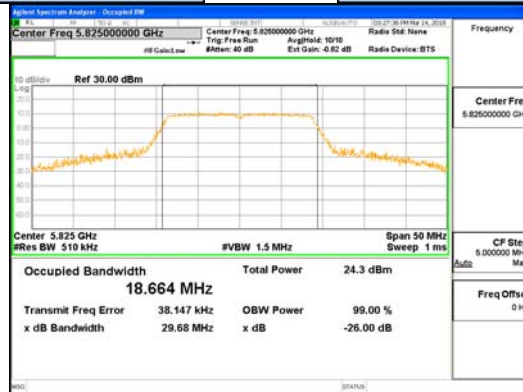
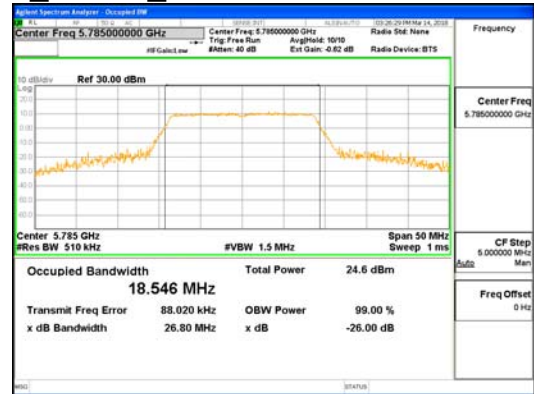
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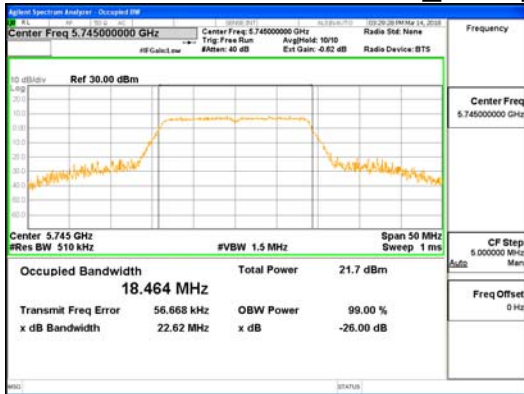
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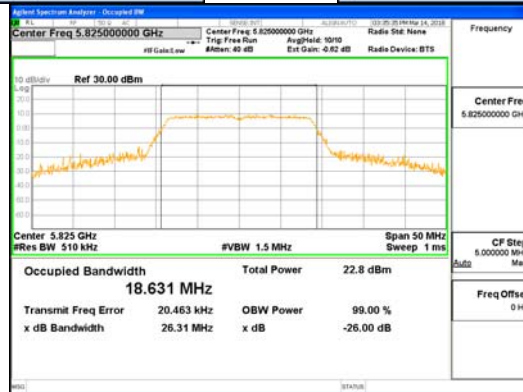
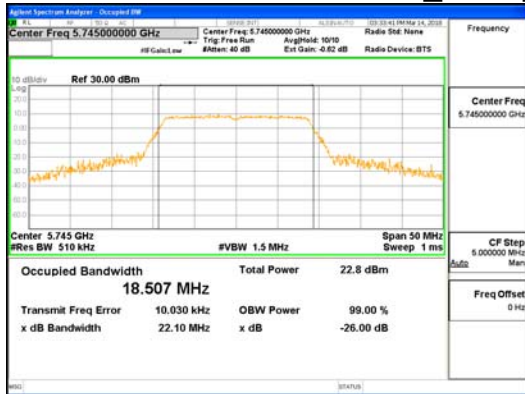


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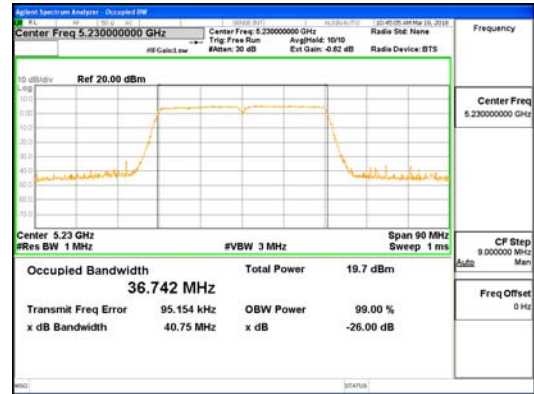
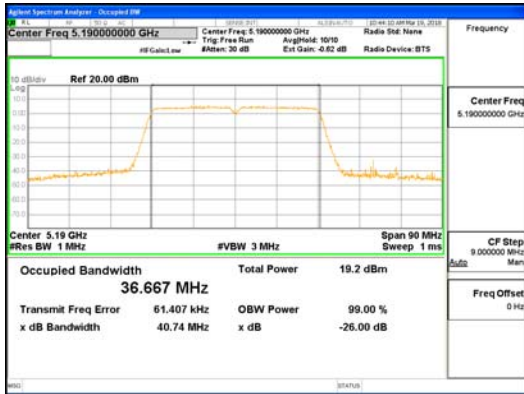


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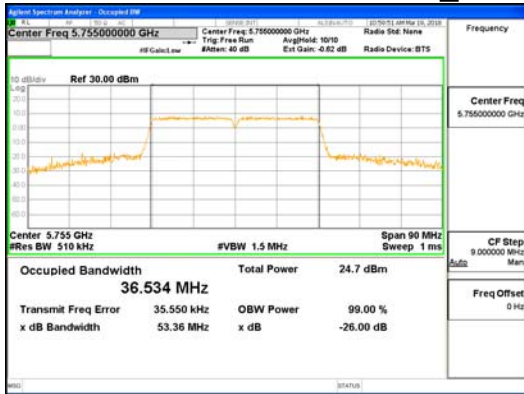


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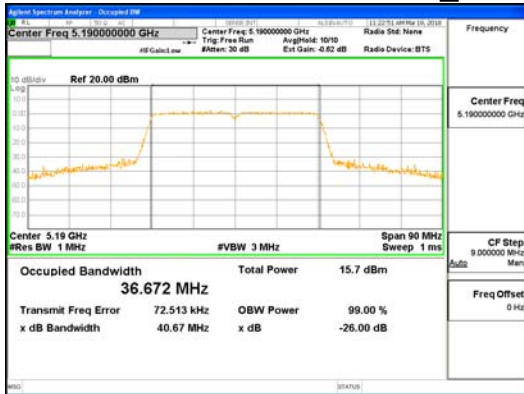
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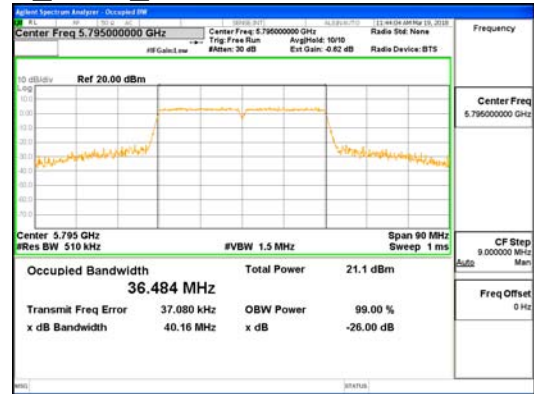
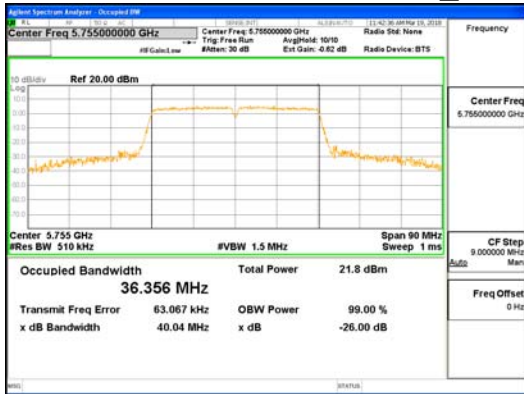
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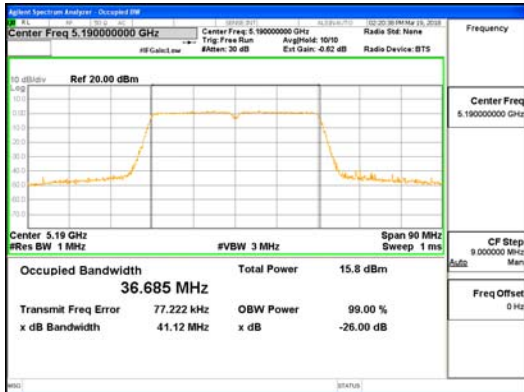


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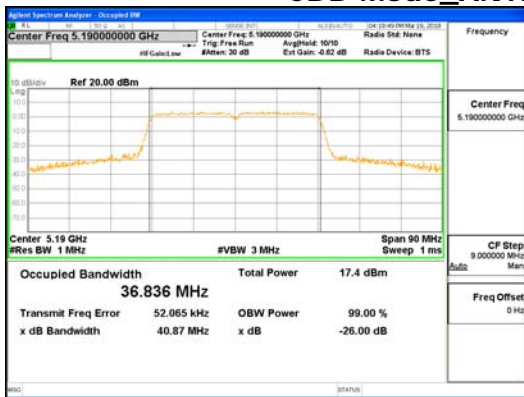
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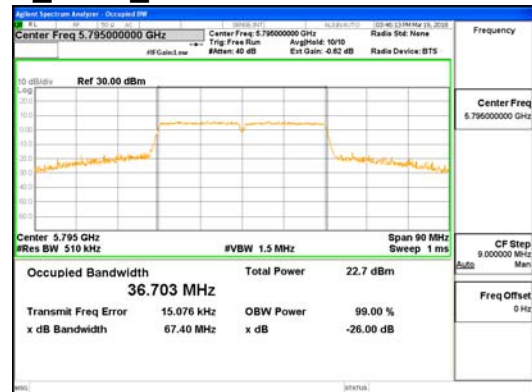
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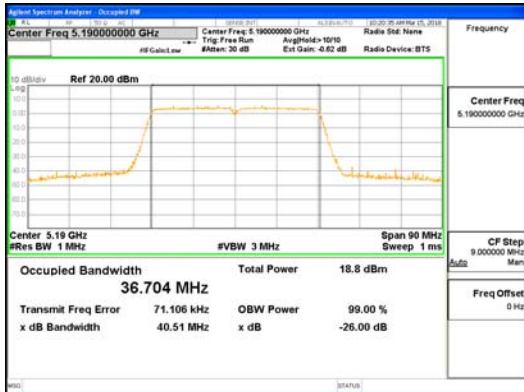
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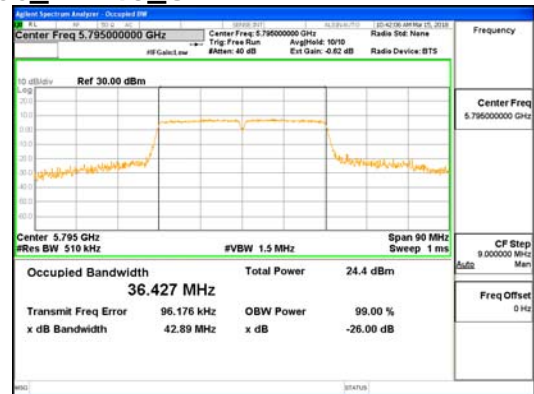


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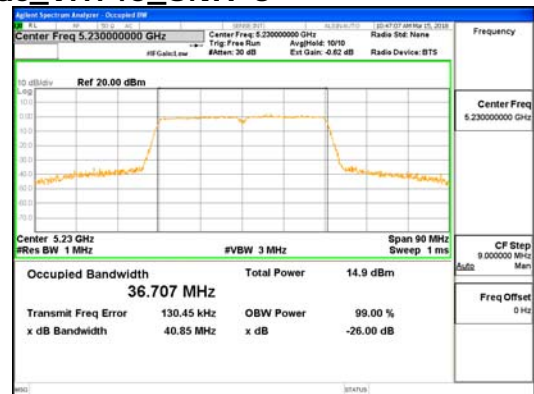
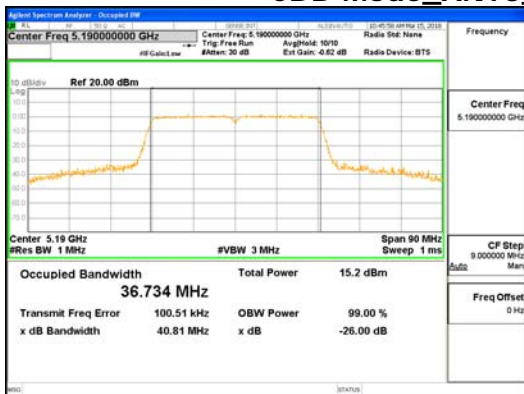
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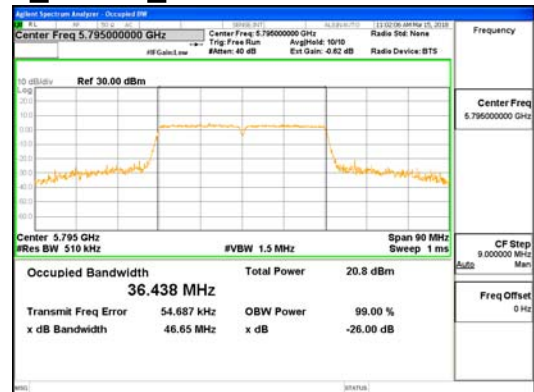
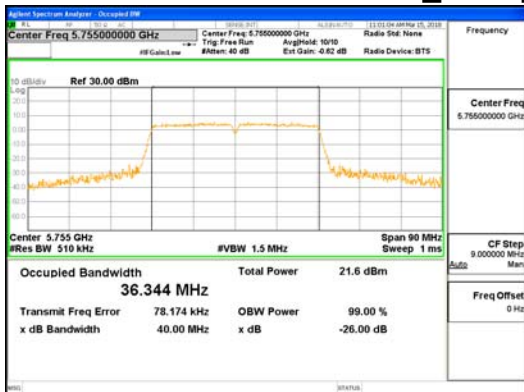
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**CDD Mode\_ANT0\_802.11ac\_VHT40\_UNII-3**



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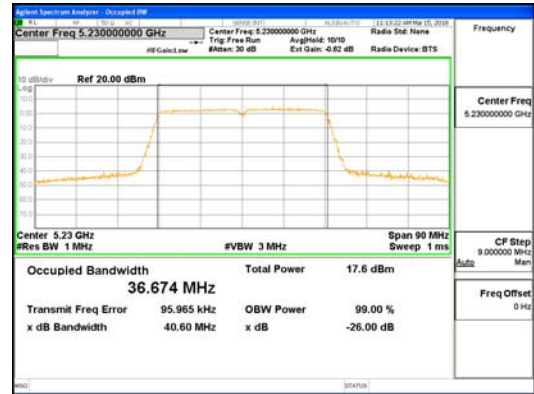


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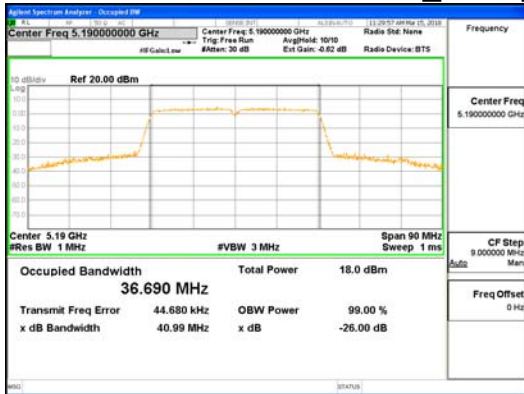
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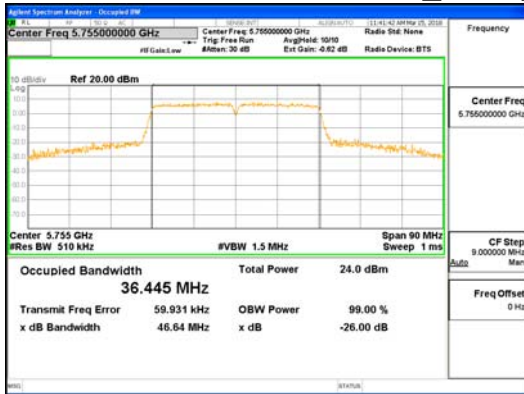
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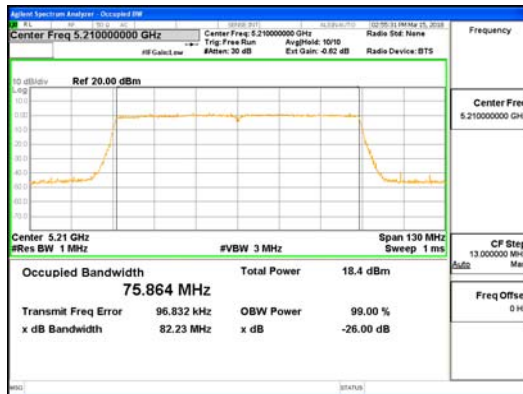
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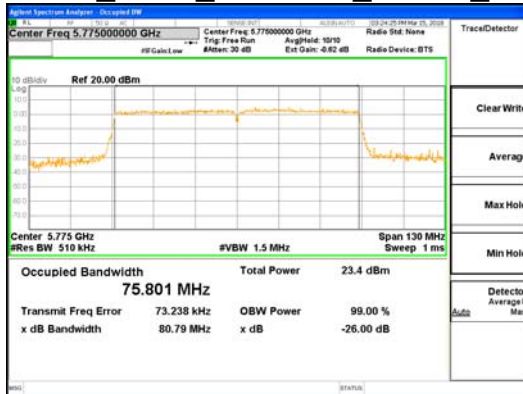
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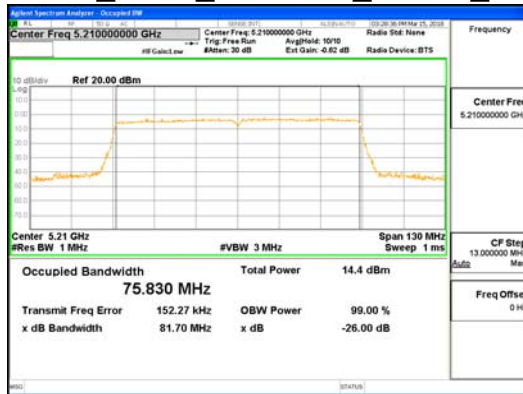
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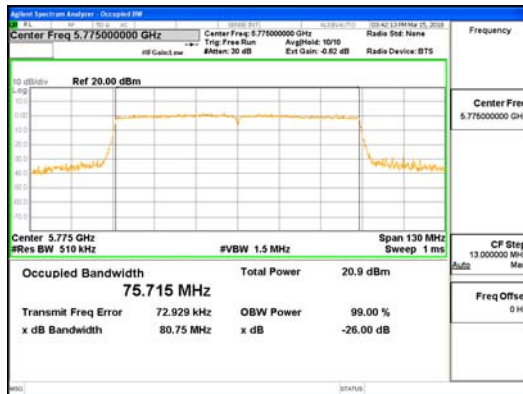
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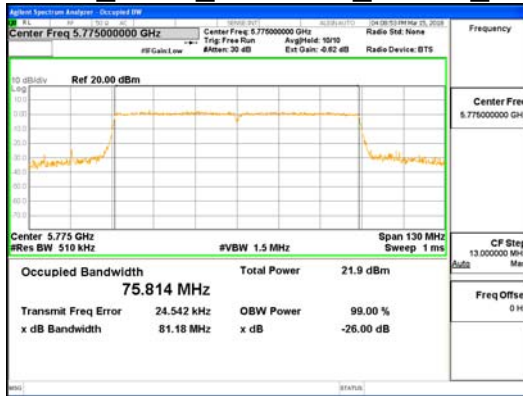
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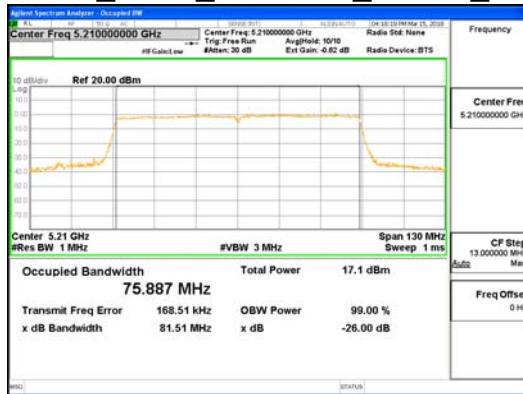
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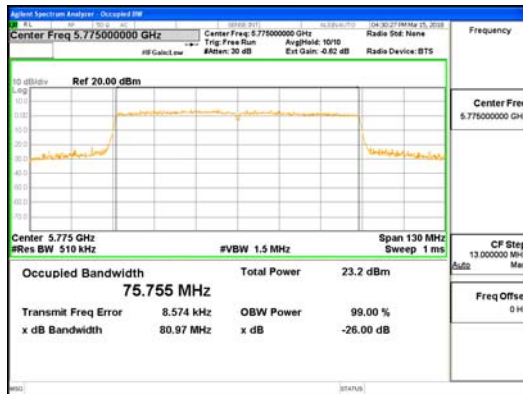
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CDD Mode\_ANT2\_802.11ac\_VHT80\_UNII-3



CDD Mode\_ANT3\_802.11ac\_VHT80\_UNII-1



CDD Mode\_ANT3\_802.11ac\_VHT80\_UNII-3