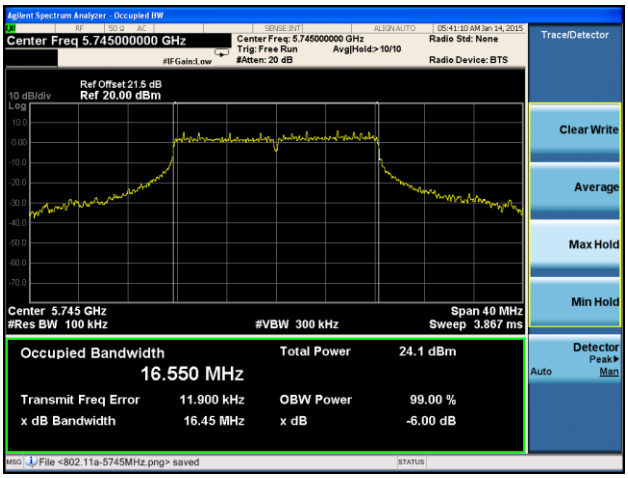
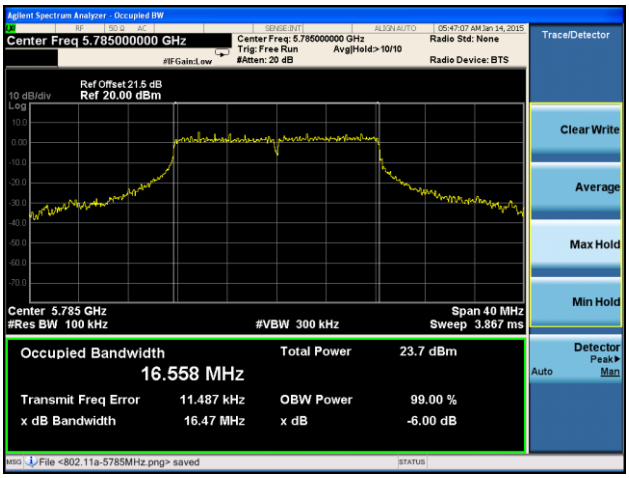
802.11a 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3

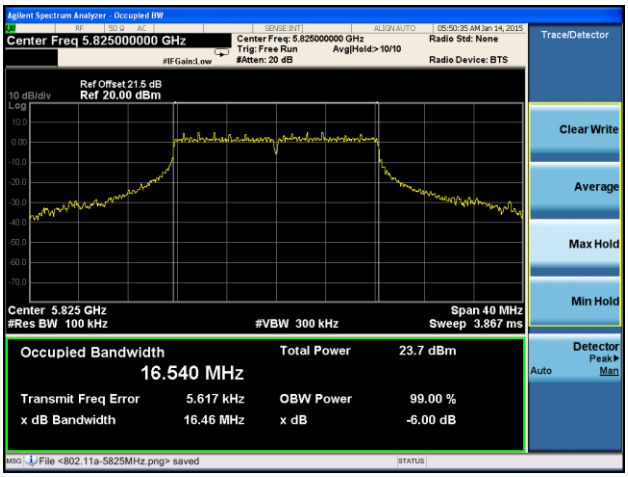
Channel 149 (5745MHz)



Channel 157 (5785MHz)

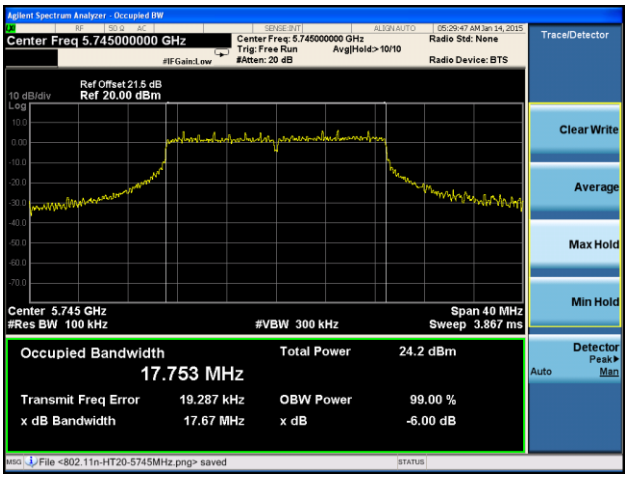


Channel 165 (5825MHz)

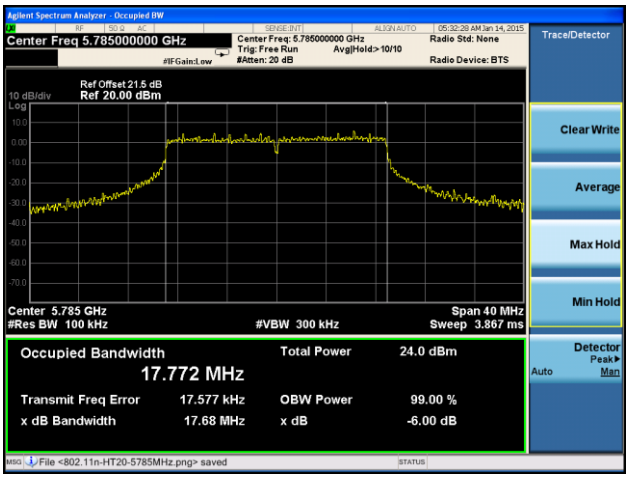


802.11n-HT20 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3

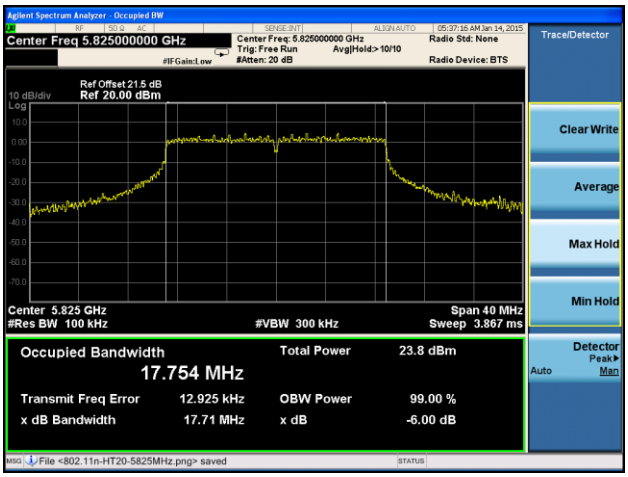
Channel 149 (5745MHz)

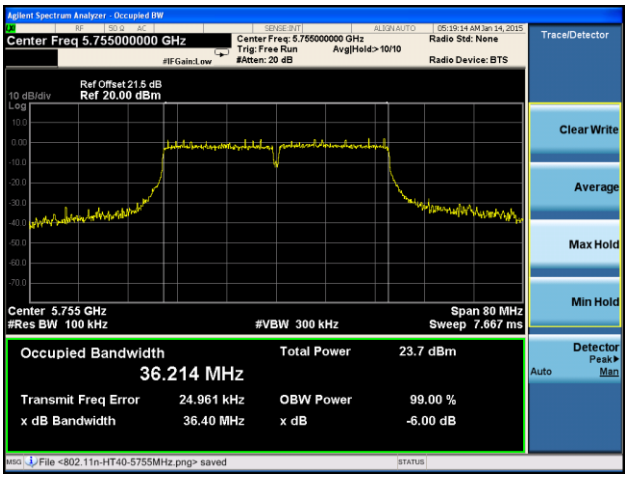
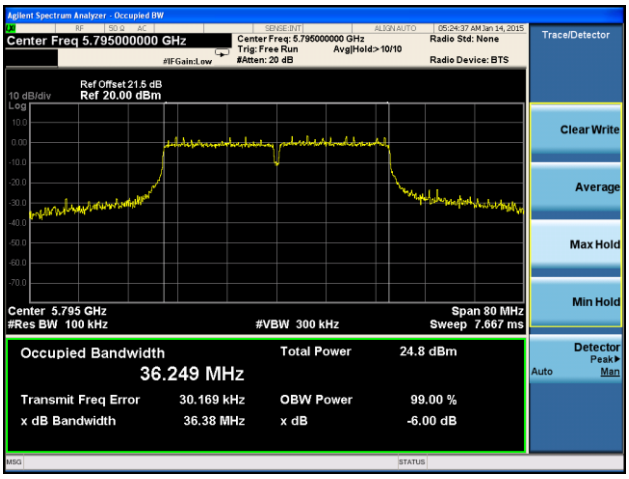


Channel 157 (5785MHz)



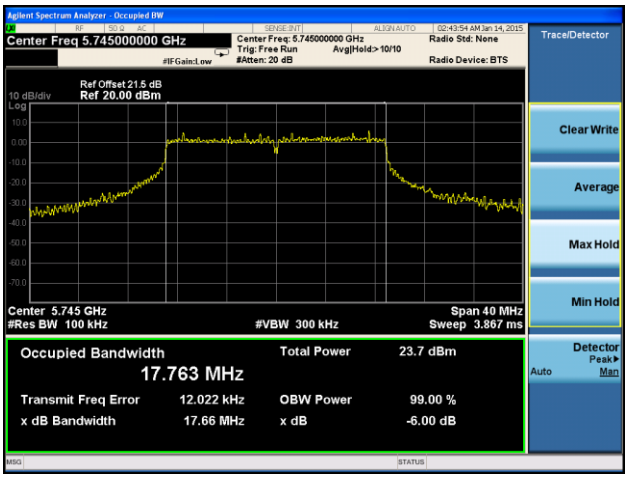
Channel 165 (5825MHz)



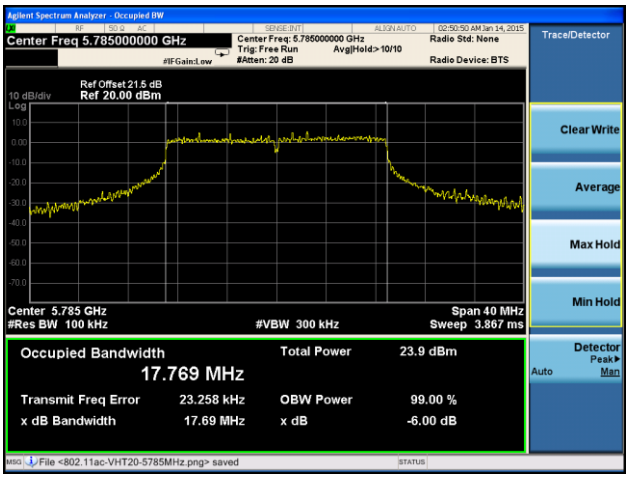
802.11n-HT40 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT20 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3

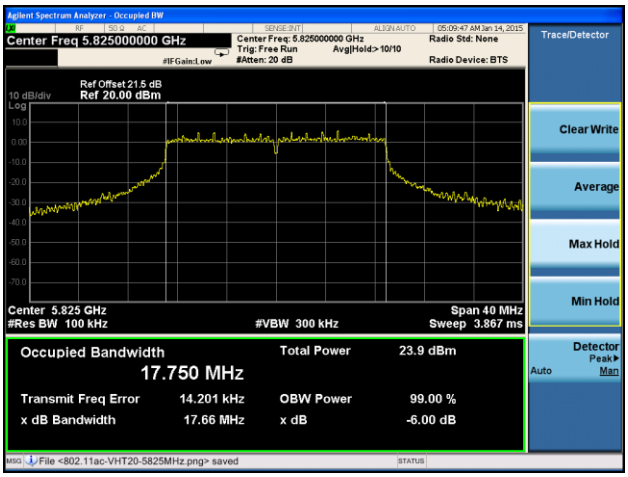
Channel 149 (5745MHz)

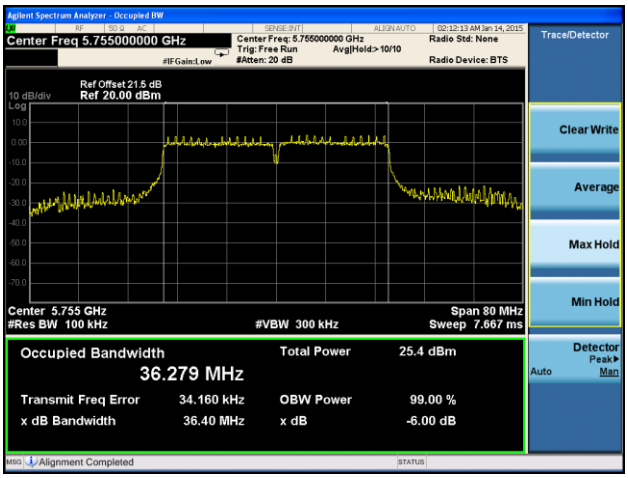
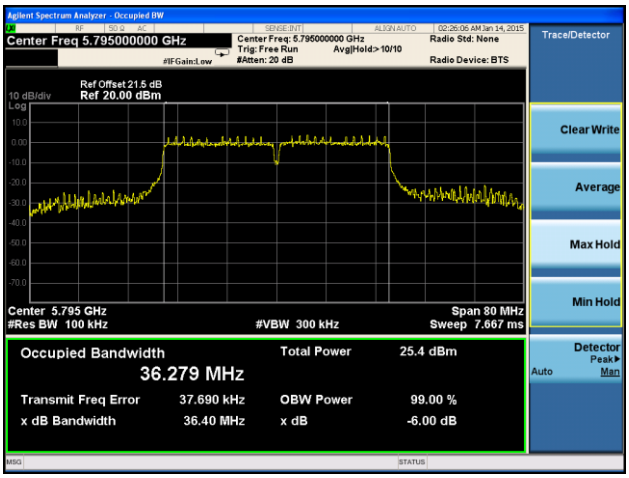


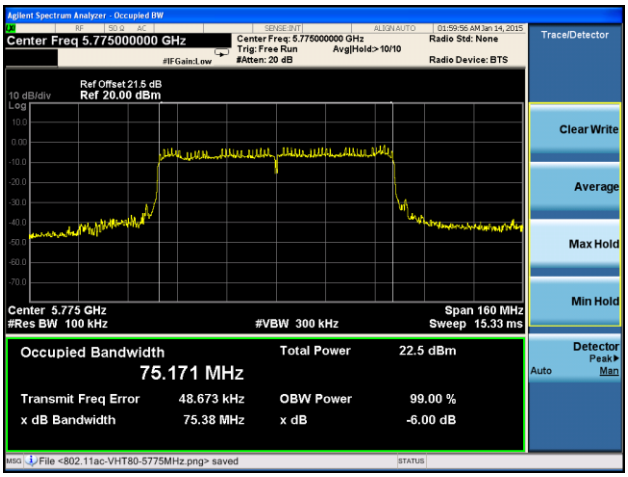
Channel 157 (5785MHz)

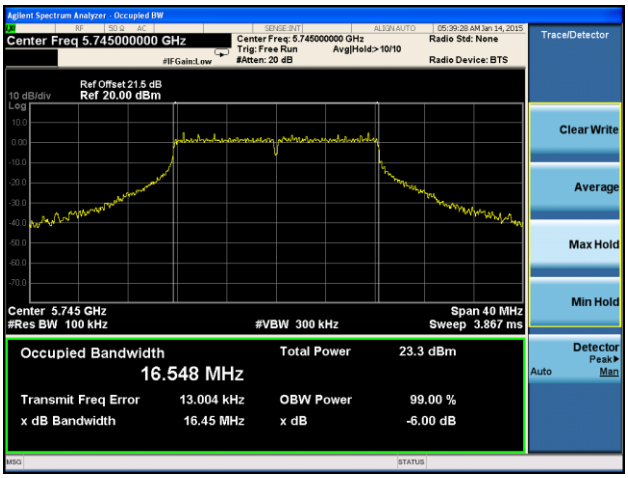
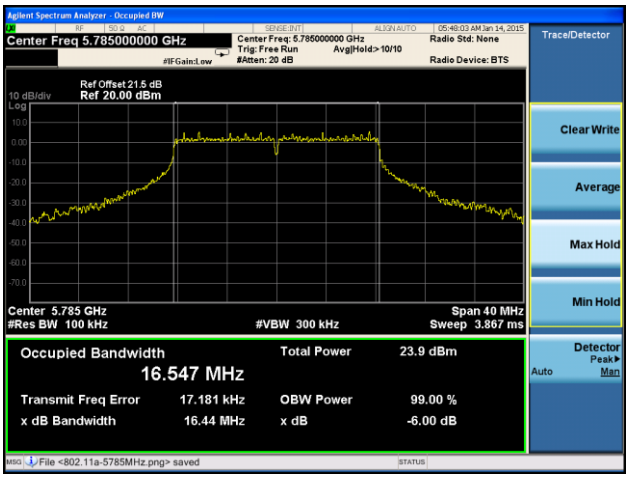
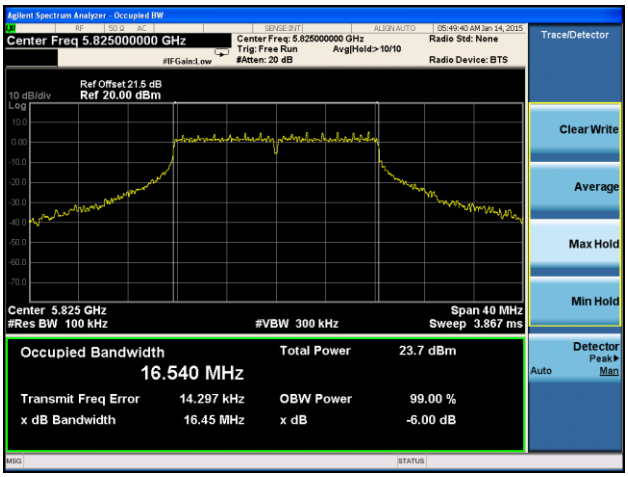


Channel 165 (5825MHz)



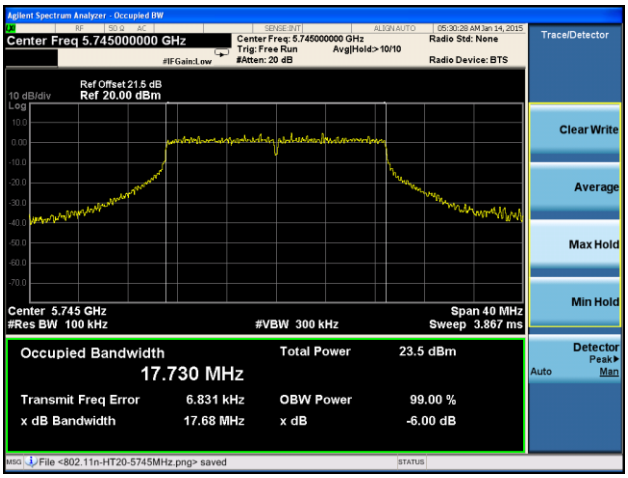
802.11ac-VHT40 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT80 6dB Bandwidth - Ant 2 / Ant 0 + 1 + 2 + 3	
Channel 155 (5775MHz)	
	

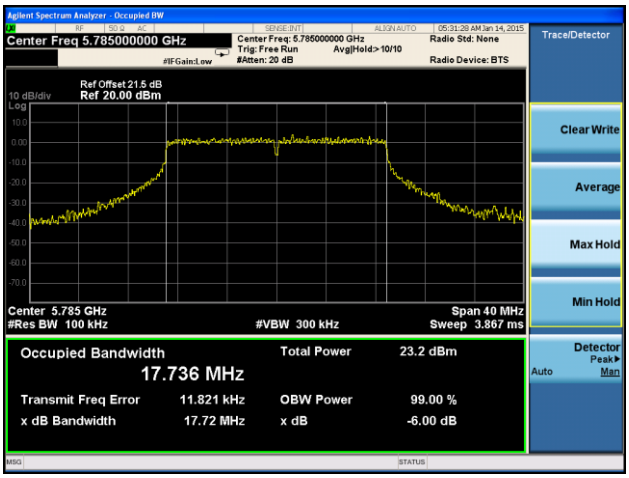
802.11a 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3	
Channel 149 (5745MHz)	**Channel 157 (5785MHz)**
	
Channel 165 (5825MHz)	
	

802.11n-HT20 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3

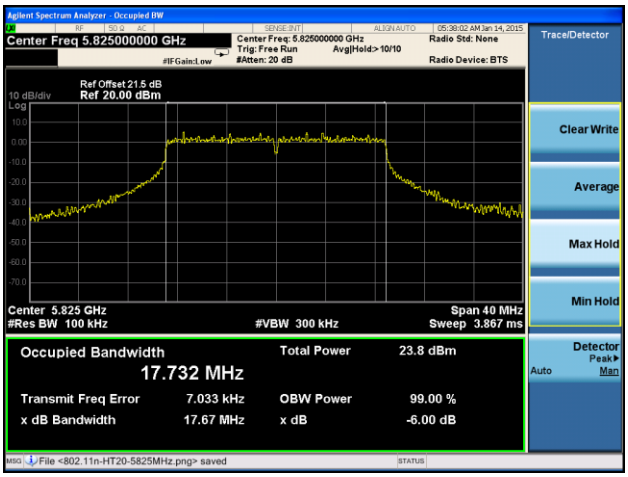
Channel 149 (5745MHz)

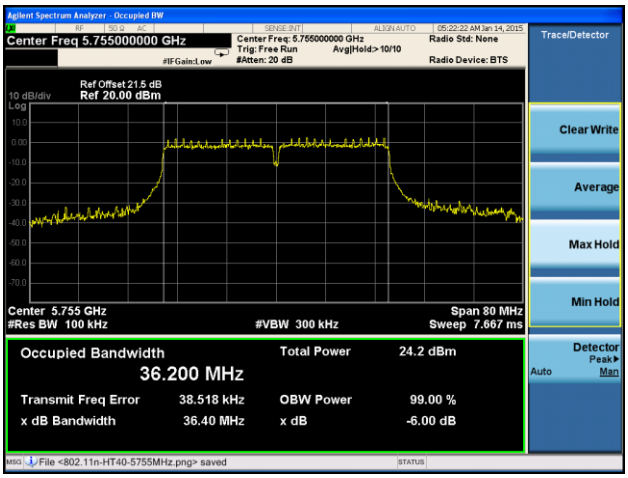
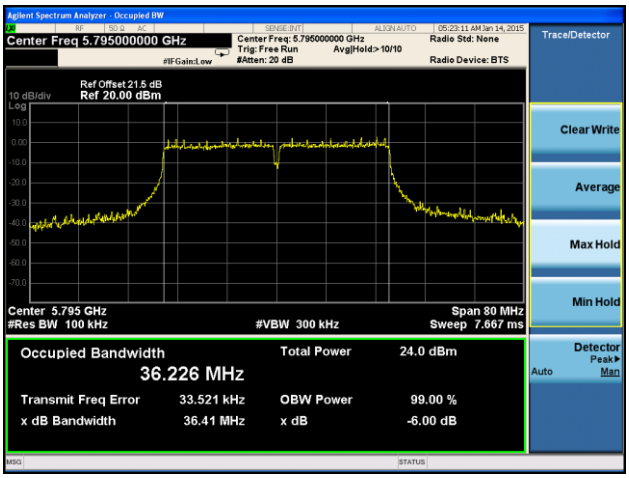


Channel 157 (5785MHz)



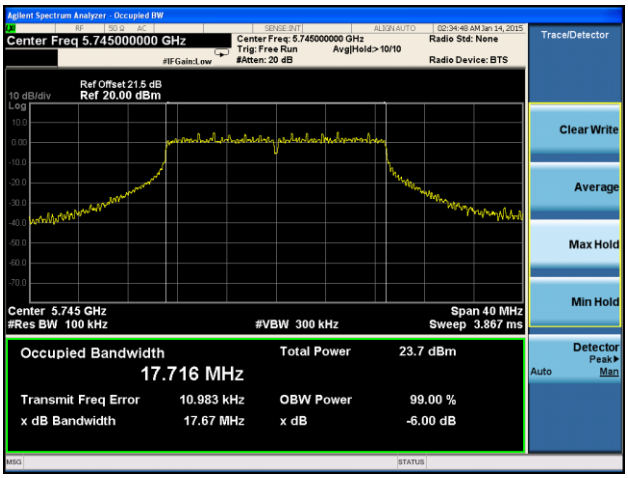
Channel 165 (5825MHz)



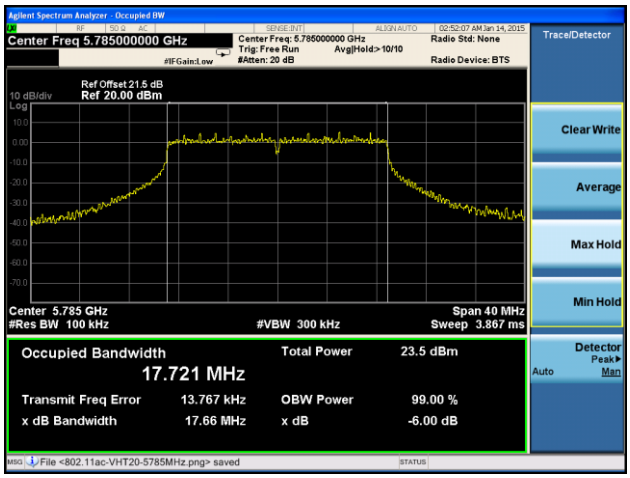
802.11n-HT40 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT20 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3

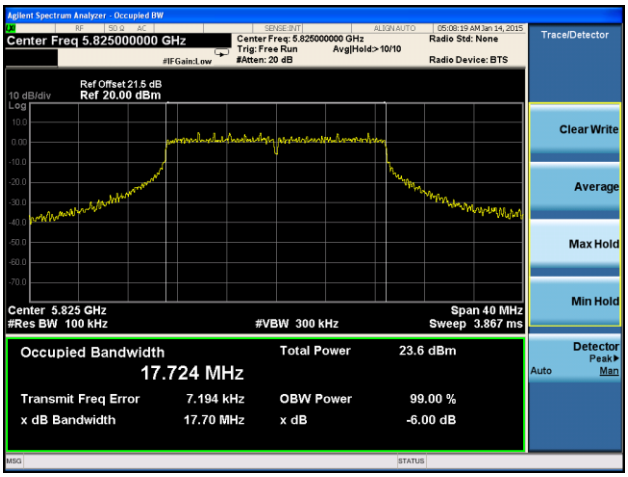
Channel 149 (5745MHz)

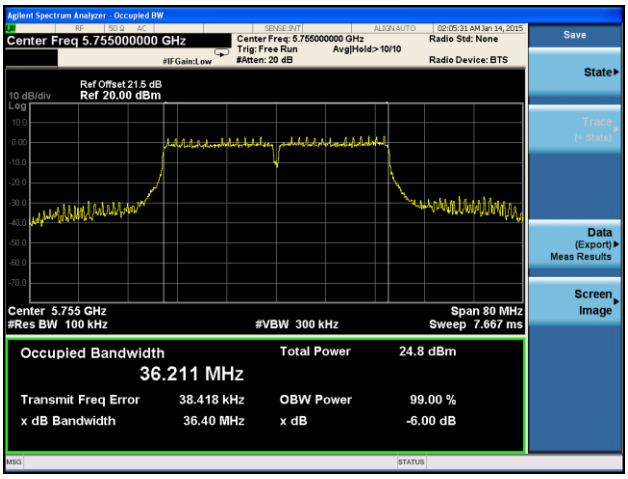
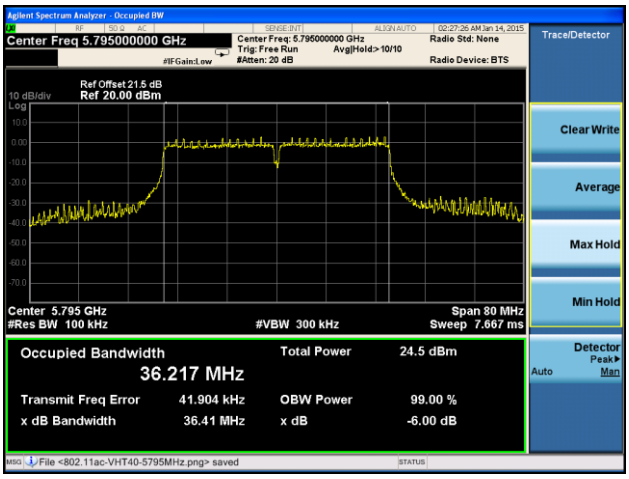


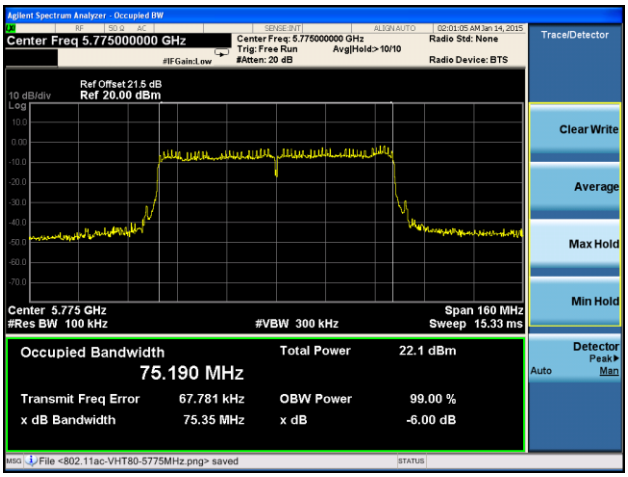
Channel 157 (5785MHz)



Channel 165 (5825MHz)



802.11ac-VHT40 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT80 6dB Bandwidth - Ant 3 / Ant 0 + 1 + 2 + 3	
Channel 155 (5775MHz)	
	

7.4. Output Power Measurement

7.4.1. Test Limit

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30dBm).

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

For 802.11n/ac:

5.15-5.25GHz: Limit (dBm) = 30dBm - (8.04dBi - 6dBi) = 27.96dBm

5.725-5.85GHz: Limit (dBm) = 30dBm - (8.70dBi - 6dBi) = 27.30dBm

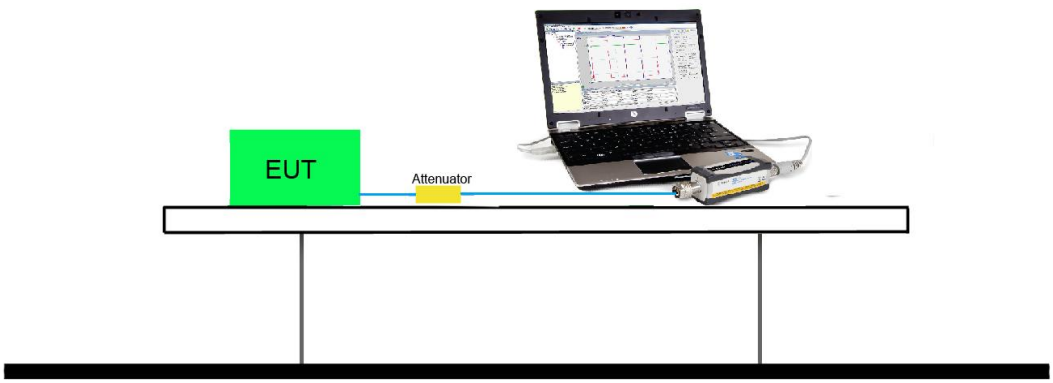
7.4.2. Test Procedure Used

KDB 789033 D02v01 - Section E) 3) b) Method PM-G

7.4.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.4.4. Test Setup



7.4.5. Test Result

Power output test was verified over all data rates of each mode shown as below, and then choose the maximum power output (yellow marker) for final test of each channel.

N_{Tx}	a	MCS Index for 802.11n	Data Rate (Mbps)			
			20MHz Bandwidth		40MHz Bandwidth	
			800ns GI	400ns GI	800ns GI	400ns GI
1	6	0	6.5	7.2	13.5	15.0
1	9	1	13.0	14.4	27.0	30.0
1	12	2	19.5	21.7	40.5	45.0
1	18	3	26.0	28.9	54.0	60.0
1	24	4	39.0	43.3	81.0	90.0
1	36	5	52.0	57.8	108.0	120.0
1	48	6	58.5	65.0	121.5	135.0
1	54	7	65.0	72.2	135.0	150.0
4	6	24	26.0	28.8	54.0	60.0
4	9	25	52.0	57.6	108.0	120.0
4	12	26	78.0	86.8	162.0	180.0
4	18	27	104.0	115.6	216.0	240.0
4	24	28	156.0	173.2	324.0	360.0
4	36	29	208.0	231.2	342.0	480.0
4	48	30	234.0	260.0	486.0	540.0
4	54	31	260.0	288.8	540.0	600.0

N_{Tx}	MCS Index for 802.11ac	Data Rate (Mbps)					
		20MHz Bandwidth		40MHz Bandwidth		80MHz Bandwidth	
		800ns GI	400ns GI	800ns GI	400ns GI	800ns GI	400ns GI
1	0	6.5	7.2	13.5	15.0	29.3	32.5
1	1	13.0	14.4	27.0	30.0	58.5	65.0
1	2	19.5	21.7	40.5	45.0	87.8	97.5
1	3	26.0	28.9	54.0	60.0	117.0	130.0
1	4	39.0	43.3	81.0	90.0	175.5	195.0
1	5	52.0	57.8	108.0	120.0	234.0	260.0
1	6	58.5	65.0	121.5	135.0	263.0	292.5
1	7	65.0	72.2	135.0	150.0	292.5	325.0
1	8	78.0	86.7	162.0	180.0	351.0	390.0
1	9	--	--	180.0	200.0	390.0	433.3
4	0	26.0	28.9	54.0	60.0	117.0	130.0
4	1	52.0	57.8	108.0	120.0	234.0	260.0
4	2	78.0	86.7	162.0	180.0	351.0	390.0
4	3	104.0	115.6	216.0	240.0	468.0	520.0
4	4	156.0	173.3	324.0	360.0	702.0	780.0
4	5	208.0	231.1	432.0	480.0	936.0	1040.0
4	6	234.0	260.0	486.0	540.0	1053.0	1170.0
4	7	260.0	288.9	540.0	600.0	1170.0	1300.0
4	8	312.0	246.7	648.0	720.0	1404.0	1560.0
4	9	--	--	720.0	800.0	1560.0	1733.3

Note: Power output test was verified over all data rates of each mode shown as above, and then choose the maximum power output (yellow marker) for final test of each channel.

Output power at various data rates for Ant 0 / Ant 0 + 1 + 2 + 3:

Test Mode	Bandwidth	Channel	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)
802.11a	20	60	5180	6	16.24
				24	16.11
				54	16.02
802.11n	20	60	5180	26	16.11
				156	16.01
				260	15.89
802.11n	40	62	5190	54	12.33
				324	12.02
				540	11.86
802.11ac	20	60	5180	26	16.41
				156	16.22
				312	15.98
802.11ac	40	62	5190	54	12.16
				324	12.01
				720	11.88
802.11ac	80	58	5210	117	10.80
				702	10.55
				1560	10.23

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 Average Power (dBm)	Ant 1 Average Power (dBm)	Ant 2 Average Power (dBm)	Ant 3 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	Result
11a	6	36	5180	16.24	15.37	15.69	16.03	21.87	≤27.96	Pass
11a	6	44	5220	17.93	17.19	17.72	17.98	23.74	≤27.96	Pass
11a	6	48	5240	18.05	17.47	17.68	17.79	23.77	≤27.96	Pass
11a	6	149	5745	20.48	21.88	21.55	20.47	27.16	≤27.30	Pass
11a	6	157	5785	20.62	21.82	20.95	20.92	27.12	≤27.30	Pass
11a	6	165	5825	20.37	21.49	20.88	20.17	26.78	≤27.30	Pass
11n-HT20	6.5	36	5180	16.11	15.38	15.46	16.18	21.82	≤27.96	Pass
11n-HT20	6.5	44	5220	17.81	17.34	17.62	17.82	23.67	≤27.96	Pass
11n-HT20	6.5	48	5240	18.06	17.12	17.41	17.92	23.66	≤27.96	Pass
11n-HT20	6.5	149	5745	20.23	21.02	21.54	20.47	26.87	≤27.30	Pass
11n-HT20	6.5	157	5785	20.49	21.19	21.25	21.20	27.06	≤27.30	Pass
11n-HT20	6.5	165	5825	20.30	21.60	21.12	20.92	27.03	≤27.30	Pass
11n-HT40	13.5	38	5190	12.33	10.70	11.86	11.79	17.73	≤27.96	Pass
11n-HT40	13.5	46	5230	18.29	17.52	18.14	18.51	24.15	≤27.96	Pass
11n-HT40	13.5	151	5755	20.92	21.18	21.03	20.71	26.98	≤27.30	Pass
11n-HT40	13.5	159	5795	21.02	21.21	21.35	20.43	27.04	≤27.30	Pass
11ac-VHT20	6.5	36	5180	16.41	15.27	15.78	16.04	21.92	≤27.96	Pass
11ac-VHT20	6.5	44	5220	17.93	17.38	17.44	17.91	23.69	≤27.96	Pass
11ac-VHT20	6.5	48	5240	17.83	17.25	17.72	17.75	23.66	≤27.96	Pass
11ac-VHT20	6.5	149	5745	20.74	21.86	21.25	20.74	27.19	≤27.30	Pass
11ac-VHT20	6.5	157	5785	21.15	21.18	21.26	20.92	27.15	≤27.30	Pass
11ac-VHT20	6.5	165	5825	20.13	21.71	21.17	20.14	26.86	≤27.30	Pass
11ac-VHT40	13.5	38	5190	12.16	10.68	11.47	11.56	17.52	≤27.96	Pass
11ac-VHT40	13.5	46	5230	18.32	17.46	18.05	18.15	24.03	≤27.96	Pass
11ac-VHT40	13.5	151	5755	20.63	21.67	21.63	20.66	27.20	≤27.30	Pass
11ac-VHT40	13.5	159	5795	20.71	21.57	21.64	20.64	27.19	≤27.30	Pass
11ac-VHT80	29.3	42	5210	10.80	9.05	10.20	9.57	15.98	≤27.96	Pass
11ac-VHT80	29.3	155	5775	18.15	19.88	19.31	18.38	25.01	≤27.30	Pass

Note: The Total Average Power (dBm) = $10*\log\{10^{(\text{Ant 0 Average Power }/10)}+10^{(\text{Ant 1 Average Power }/10)}+10^{(\text{Ant 2 Average Power }/10)}+10^{(\text{Ant 3 Average Power }/10)}\}$.

7.5. Transmit Power Control

7.5.1. Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

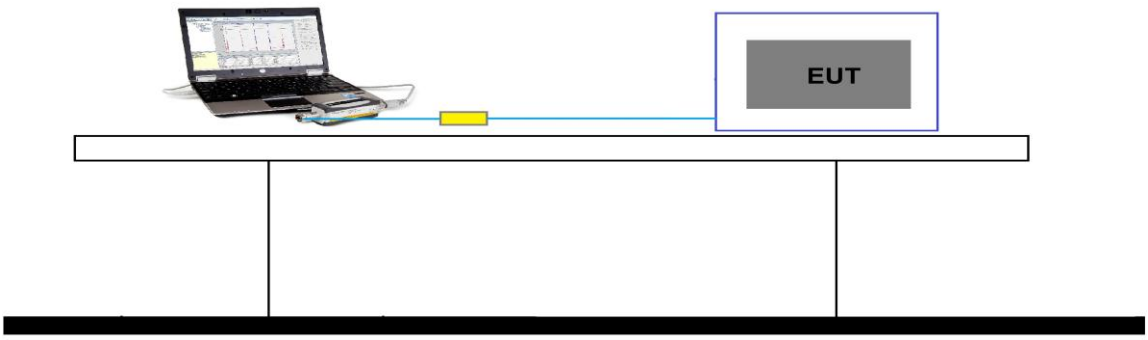
7.5.2. Test Procedure Used

KDB 789033 D02v01 - Section E) 3) b) Method PM-G

7.5.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.5.4. Test Setup



7.5.5. Test Result

TPC is not required for 5150 ~ 5250MHz & 5725 ~ 5850MHz.

7.6. Power Spectral Density Measurement

7.6.1. Test Limit

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band.

For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.15-5.25GHz: Limit (dBm/MHz) = 17dBm/MHz - (8.04dBi - 6dBi) = 14.96dBm/MHz

5.725-5.85GHz: Limit (dBm/500kHz) = 30dBm/500kHz - (8.70dBi - 6dBi) = 27.30dBm/500kHz

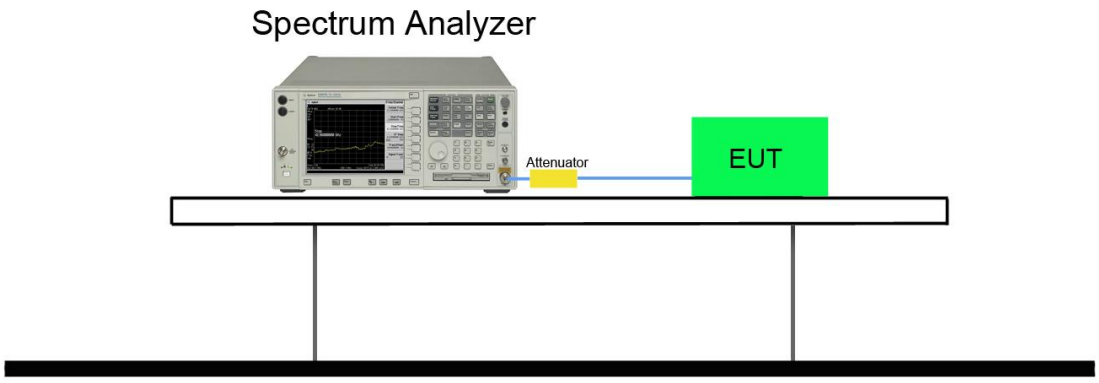
7.6.2. Test Procedure Used

KDB 789033 D02v01 - Section F

7.6.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz, if measurement bandwidth of Maximum PSD is specified in 500 kHz, RBW = 100 kHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (RMS)
7. Sweep time = auto
8. Trigger = free run
9. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
10. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.
11. When the measurement bandwidth of Maximum PSD is specified in 500 kHz, add a constant factor 10*log(500kHz/100kHz) = 7 dB to the measured result

7.6.4. Test Setup



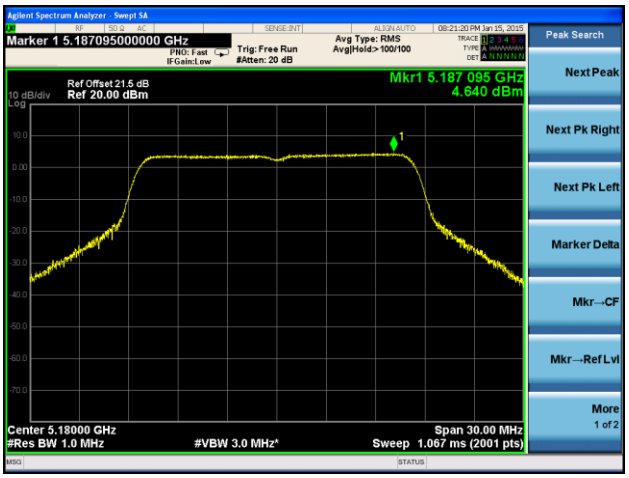
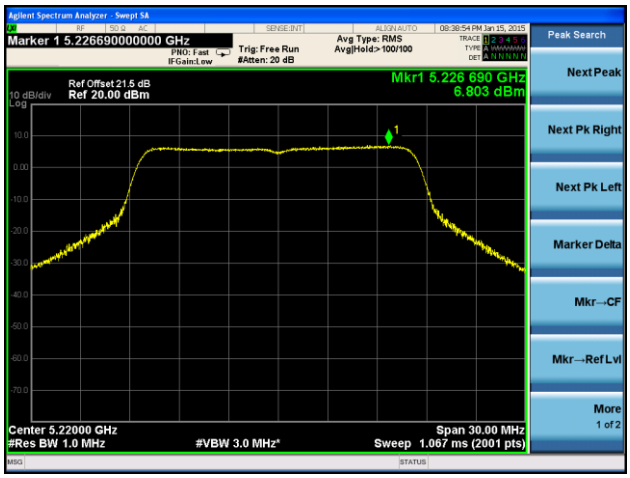
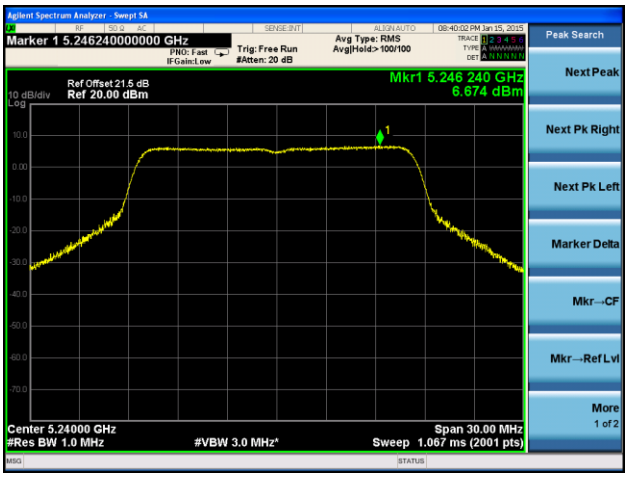
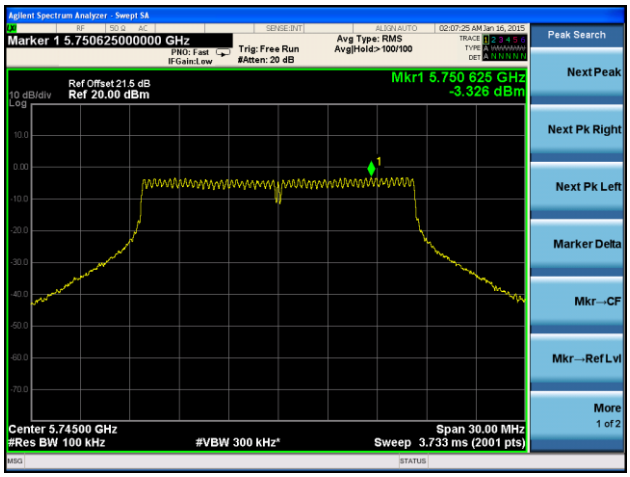
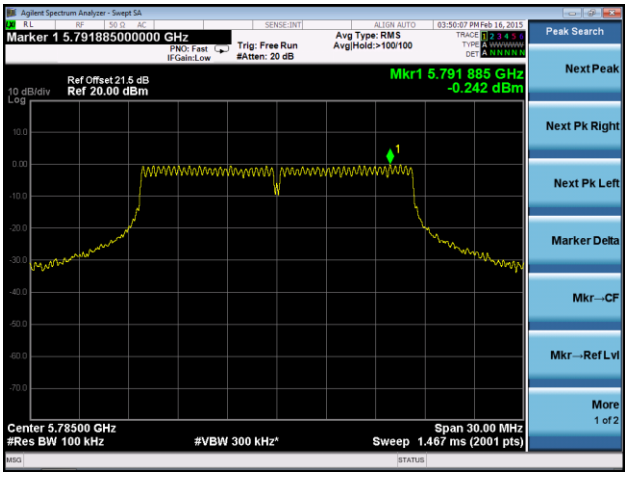
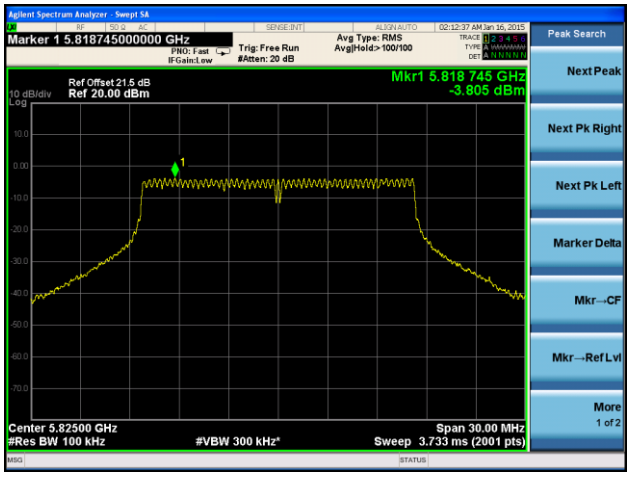
7.6.5. Test Result

Test Mode	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Ant 0 PSD (dBm/ MHz)	Ant 1 PSD (dBm/ MHz)	Ant 2 PSD (dBm/ MHz)	Ant 3 PSD (dBm/ MHz)	Duty Cycle (%)	Total PSD (dBm/ MHz)	Limit (dBm/ MHz)	Result
11a	6	36	5180	4.64	3.50	3.90	4.38	99.2	10.15	≤14.96	Pass
11a	6	44	5220	6.80	6.04	6.48	6.04	99.2	12.37	≤14.96	Pass
11a	6	48	5240	6.67	5.80	6.60	6.21	99.2	12.35	≤14.96	Pass
11n-HT20	6.5	36	5180	4.46	3.98	3.94	4.31	99.1	10.20	≤14.96	Pass
11n-HT20	6.5	44	5220	6.57	5.80	6.40	6.23	99.1	12.28	≤14.96	Pass
11n-HT20	6.5	48	5240	6.43	5.48	5.83	6.26	99.1	12.04	≤14.96	Pass
11n-HT40	13.5	38	5190	-2.65	-4.35	-3.18	-3.57	97.6	2.63	≤14.96	Pass
11n-HT40	13.5	46	5230	3.26	2.73	3.54	3.34	97.6	9.35	≤14.96	Pass
11ac-VHT20	6.5	36	5180	4.97	3.50	3.51	4.22	98.7	10.11	≤14.96	Pass
11ac-VHT20	6.5	44	5220	6.07	5.55	6.76	6.38	98.7	12.24	≤14.96	Pass
11ac-VHT20	6.5	48	5240	5.92	5.83	6.10	6.25	98.7	12.05	≤14.96	Pass
11ac-VHT40	13.5	38	5190	-3.40	-3.52	-3.04	-2.84	97.2	2.83	≤14.96	Pass
11ac-VHT40	13.5	46	5230	3.64	2.84	3.64	3.55	97.2	9.57	≤14.96	Pass
11ac-VHT80	29.3	42	5210	-6.94	-8.32	-7.46	-7.81	94.5	-1.58	≤14.96	Pass

Note: When EUT duty cycle < 98%, the total PSD = $10*\log\{10^{(\text{Ant 0 PSD}/10)}+10^{(\text{Ant 1 PSD}/10)}+10^{(\text{Ant 2 PSD}/10)}+10^{(\text{Ant 3 PSD}/10)}\}$ + 10*log(1/duty cycle)

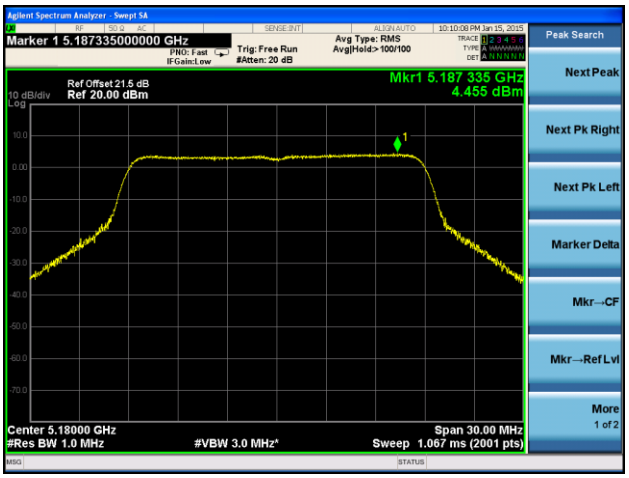
Test Mode	Data Rate (Mbps)	Freq. (MHz)	Ant 0 PSD (dBm/ 100kHz)	Ant 1 PSD (dBm/ 100kHz)	Ant 2 PSD (dBm/ 100kHz)	Ant 3 PSD (dBm/ 100kHz)	Duty Cycle (%)	Constant Factor	Total PSD (dBm/ 500kHz)	Limit (dBm/ 500kHz)	Result
11a	6	5745	-3.33	-1.19	-2.13	-2.90	99.2	7	10.71	≤27.30	Pass
11a	6	5785	-0.24	0.75	0.38	-0.36	99.2	7	13.17	≤27.30	Pass
11a	6	5825	-3.81	-1.99	-2.52	-3.26	99.2	7	10.18	≤27.30	Pass
11n-HT20	6.5	5745	-3.49	-1.98	-2.10	-3.54	99.1	7	10.30	≤27.30	Pass
11n-HT20	6.5	5785	-0.67	0.03	-0.33	-0.76	99.1	7	12.60	≤27.30	Pass
11n-HT20	6.5	5825	-5.28	-5.40	-2.44	-4.22	99.1	7	8.86	≤27.30	Pass
11n-HT40	13.5	5755	-5.54	-4.86	-4.96	-6.43	97.6	7	7.72	≤27.30	Pass
11n-HT40	13.5	5795	-5.04	-6.48	-4.89	-6.94	97.6	7	7.38	≤27.30	Pass
11ac-VHT20	6.5	5745	-3.19	-2.03	-2.43	-3.33	98.7	7	10.31	≤27.30	Pass
11ac-VHT20	6.5	5785	-1.24	-0.12	-0.58	-1.20	98.7	7	12.26	≤27.30	Pass
11ac-VHT20	6.5	5825	-4.17	-3.16	-2.69	-3.82	98.7	7	9.60	≤27.30	Pass
11ac-VHT40	13.5	5755	-5.53	-5.15	-5.03	-5.72	97.2	7	7.79	≤27.30	Pass
11ac-VHT40	13.5	5795	-4.44	-5.46	-5.57	-5.66	97.2	7	7.89	≤27.30	Pass
11ac-VHT80	29.3	5775	-6.05	-7.57	-7.65	-8.26	94.5	7	5.96	≤27.30	Pass

Note: When EUT duty cycle < 98%, the total PSD = $10*\log\{10^{(\text{Ant 0 PSD}/10)}+10^{(\text{Ant 1 PSD}/10)}+10^{(\text{Ant 2 PSD}/10)}+10^{(\text{Ant 3 PSD}/10)}\}$ + 10*log(1/duty cycle) + Constant Factor.

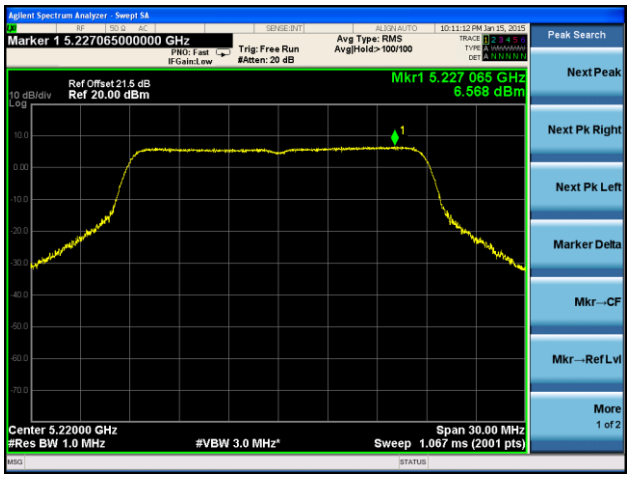
802.11a Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3	
Channel 36 (5180MHz)	**Channel 44 (5220MHz)**
	
Channel 48 (5240MHz)	**Channel 149 (5745MHz)**
	
Channel 157 (5785MHz)	**Channel 165 (5825MHz)**
	

802.11n-HT20 Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3

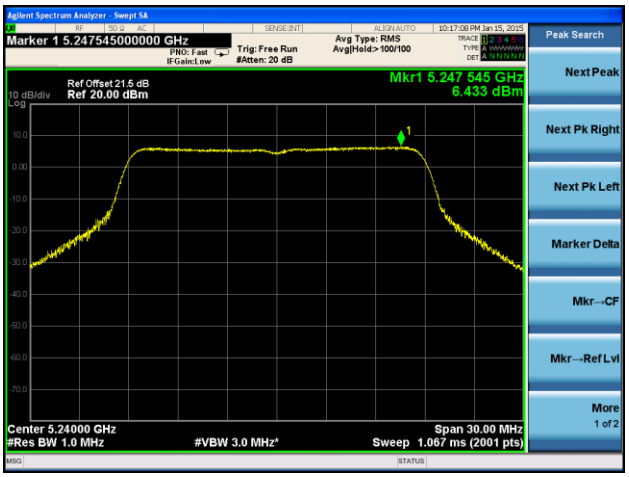
Channel 36 (5180MHz)



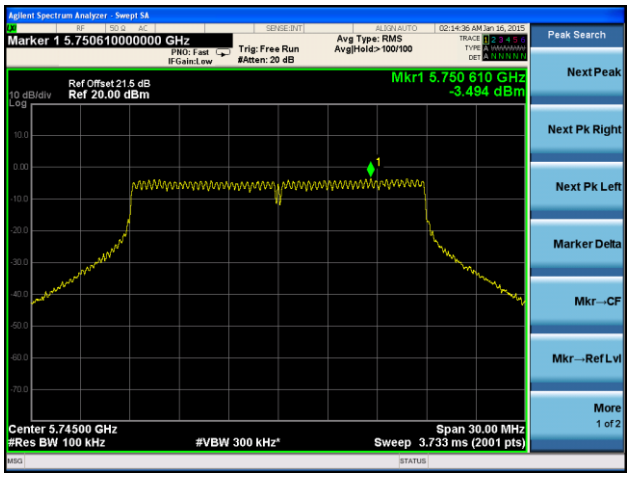
Channel 44 (5220MHz)



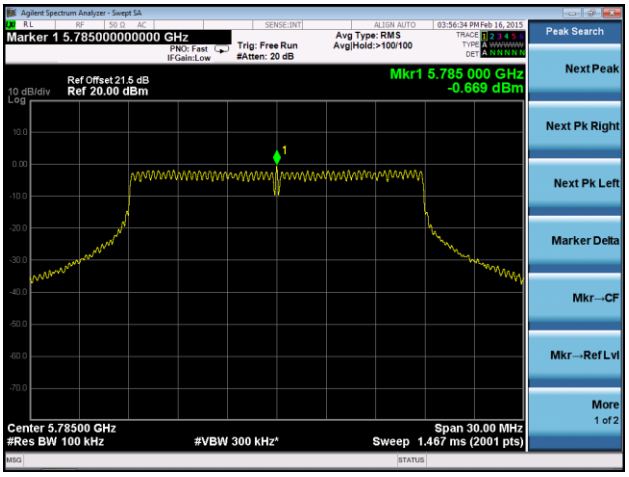
Channel 48 (5240MHz)



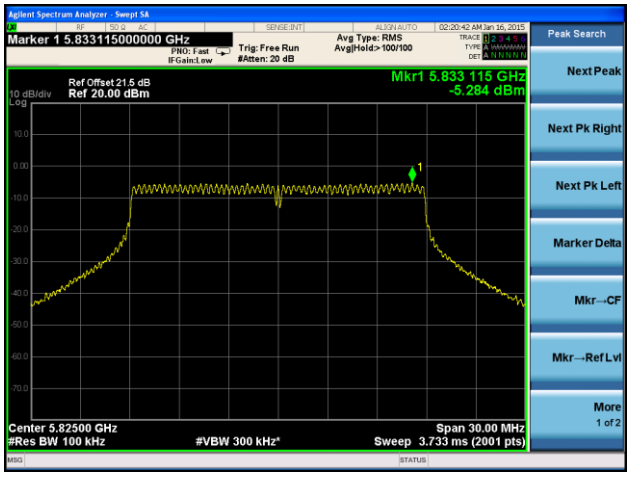
Channel 149 (5745MHz)

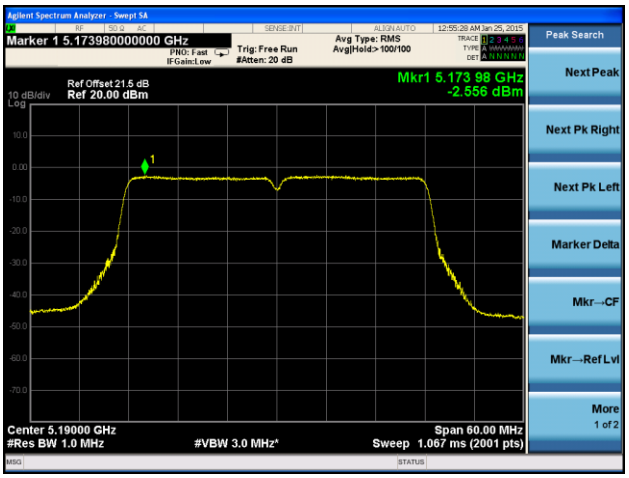
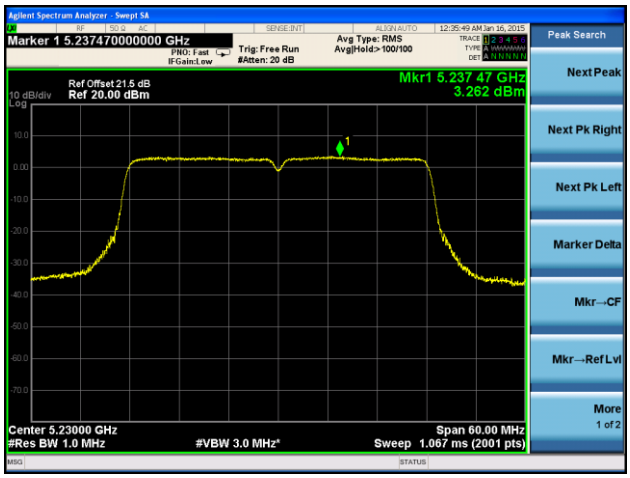
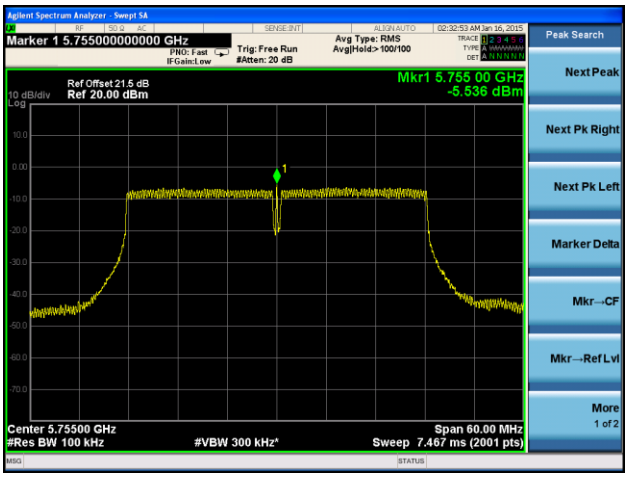
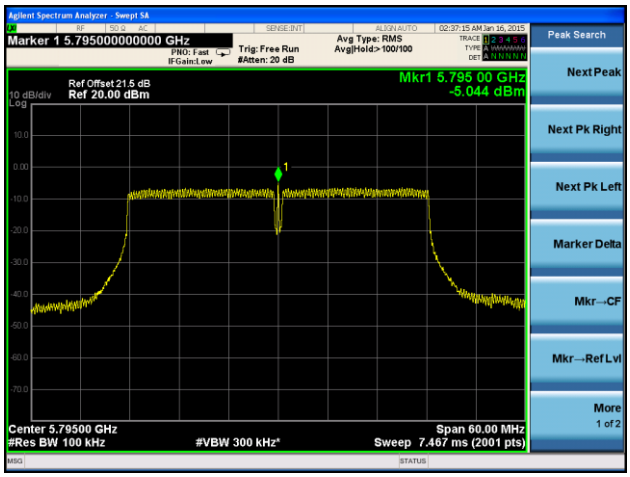


Channel 157 (5785MHz)



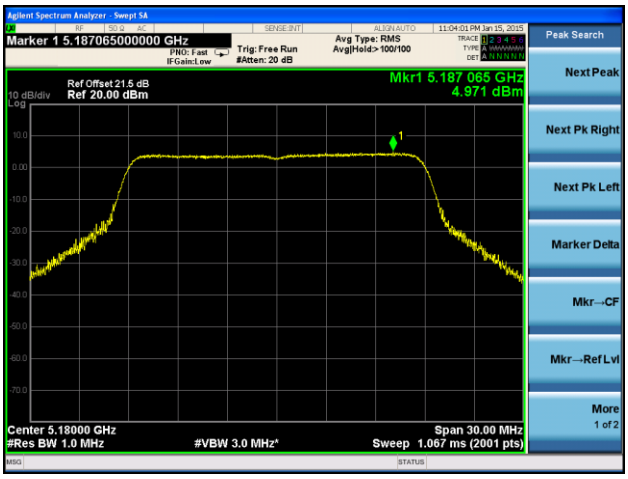
Channel 165 (5825MHz)



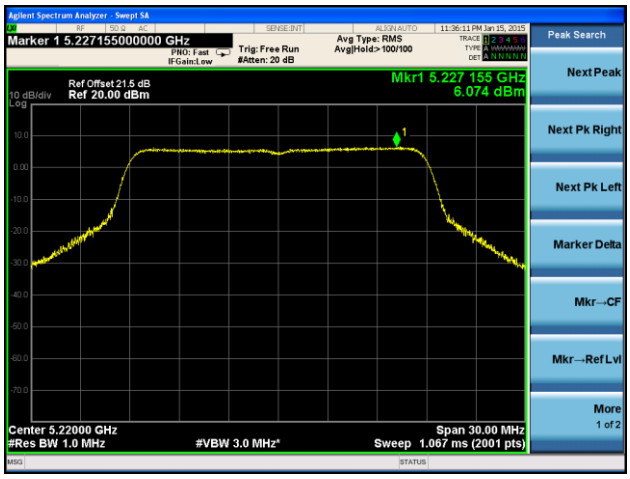
802.11n-HT40 Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3	
Channel 38 (5190MHz)	**Channel 46 (5230MHz)**
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

802.11ac-VHT20 Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3

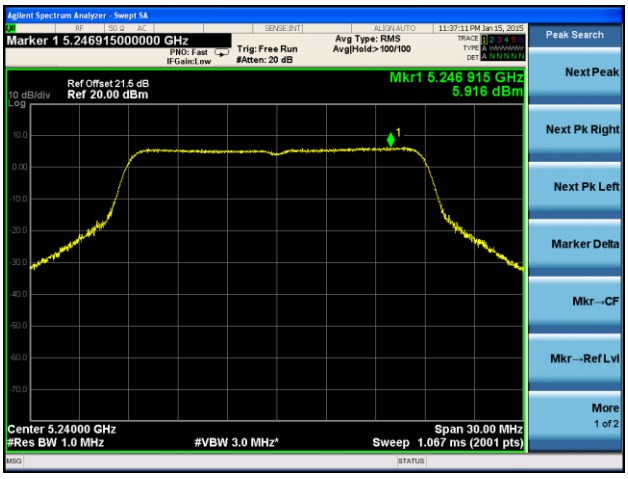
Channel 36 (5180MHz)



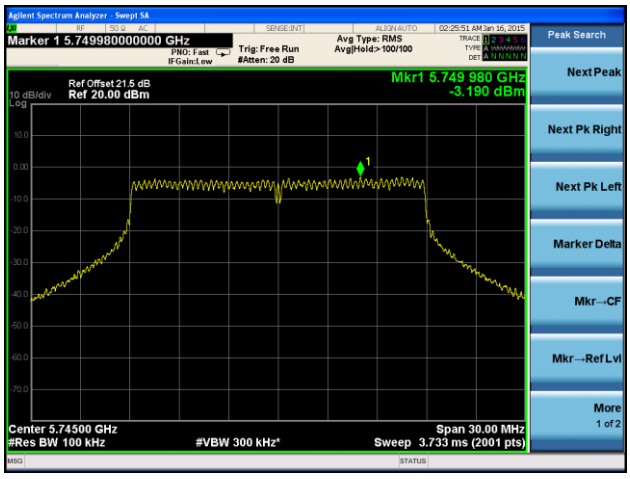
Channel 44 (5220MHz)



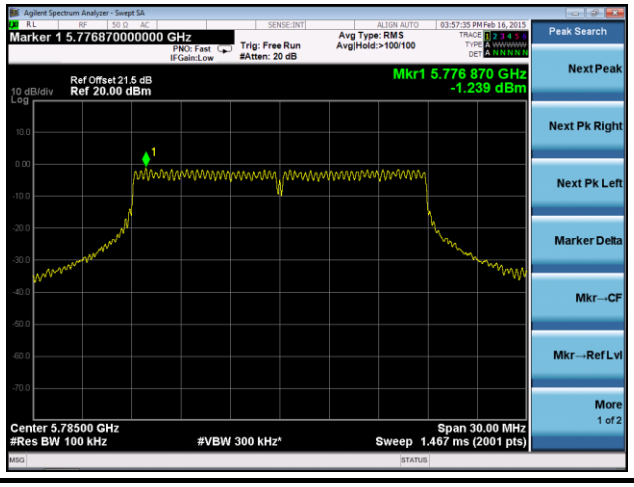
Channel 48 (5240MHz)



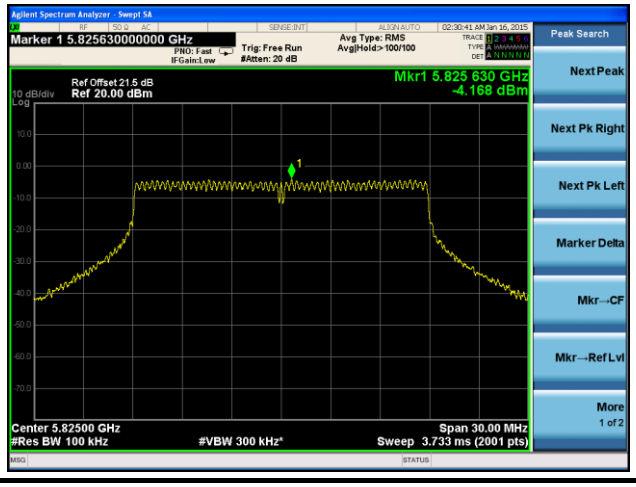
Channel 149 (5745MHz)

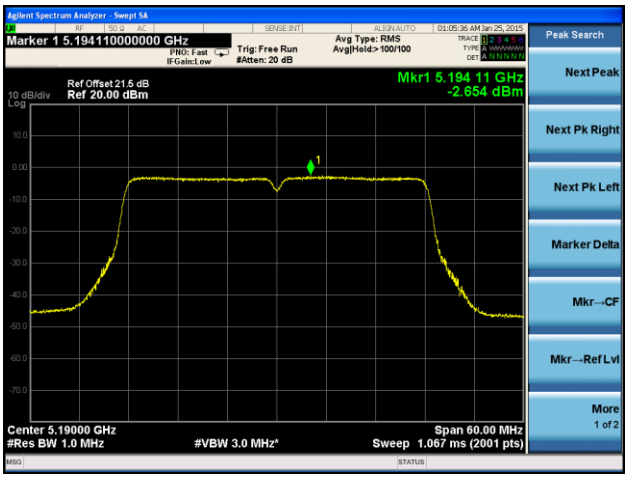
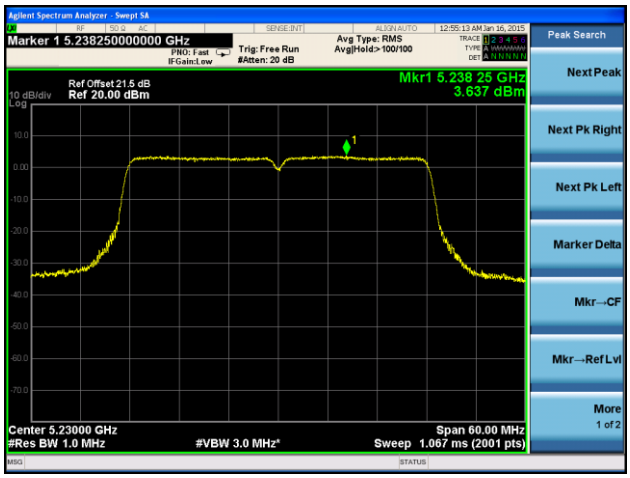
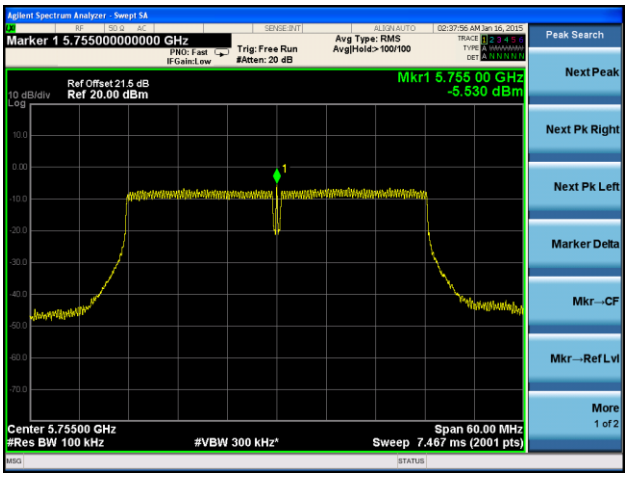
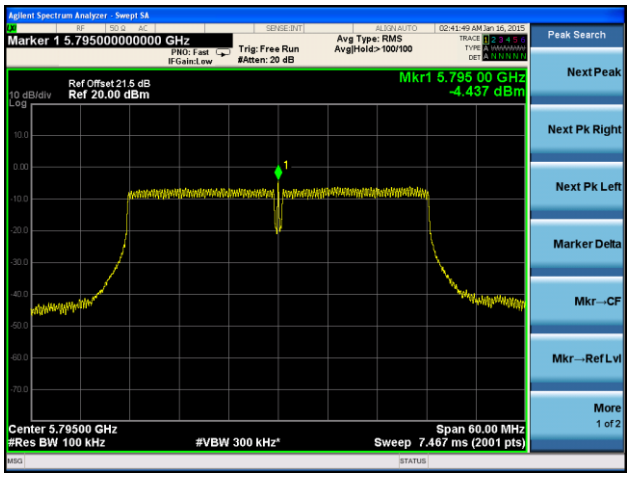


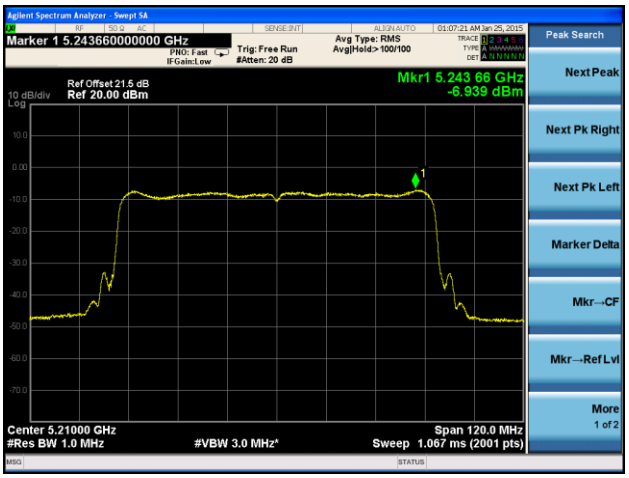
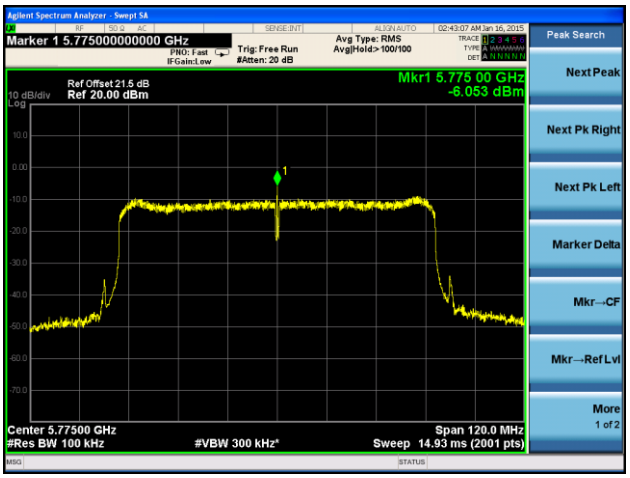
Channel 157 (5785MHz)



Channel 165 (5825MHz)

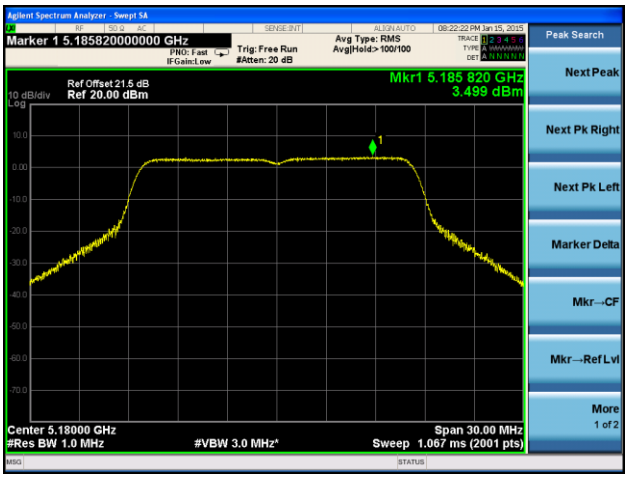


802.11ac-VHT40 Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3	
Channel 38 (5190MHz)	**Channel 46 (5230MHz)**
	
Channel 151 (5755MHz)	**Channel 159 (5795MHz)**
	

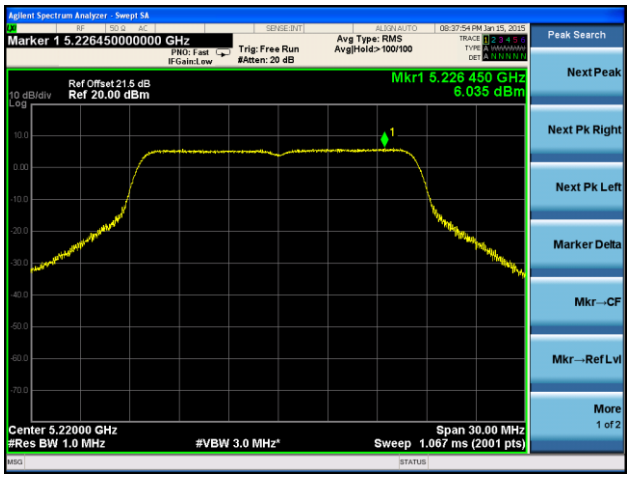
802.11ac-VHT80 Power Spectral Density - Ant 0 / Ant 0 + 1 + 2 + 3	
Channel 42 (5210MHz)	**Channel 155 (5775MHz)**
	

802.11a Power Spectral Density - Ant 1 / Ant 0 + 1 + 2 + 3

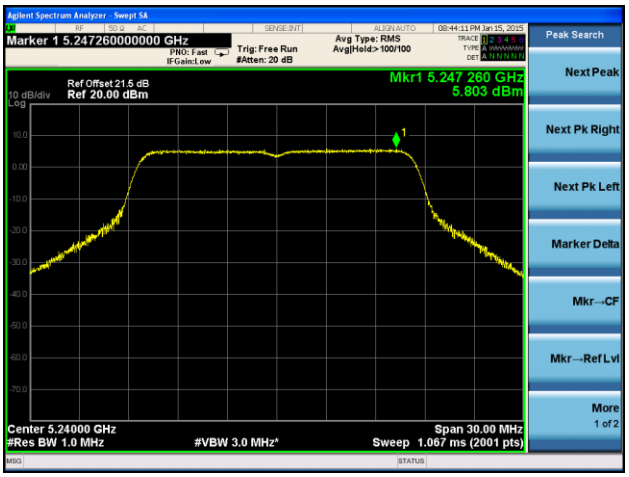
Channel 36 (5180MHz)



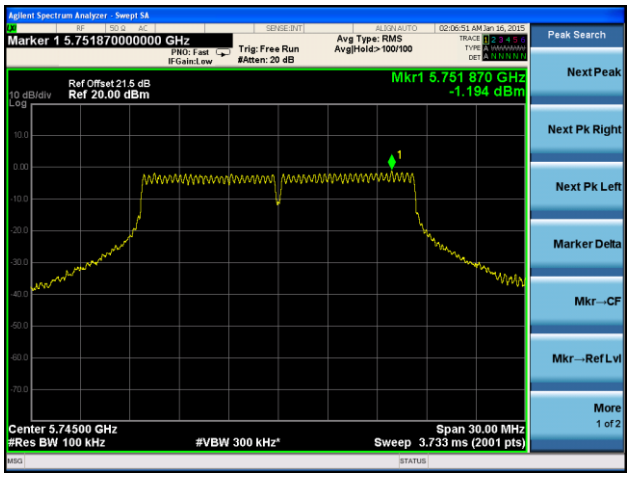
Channel 44 (5220MHz)



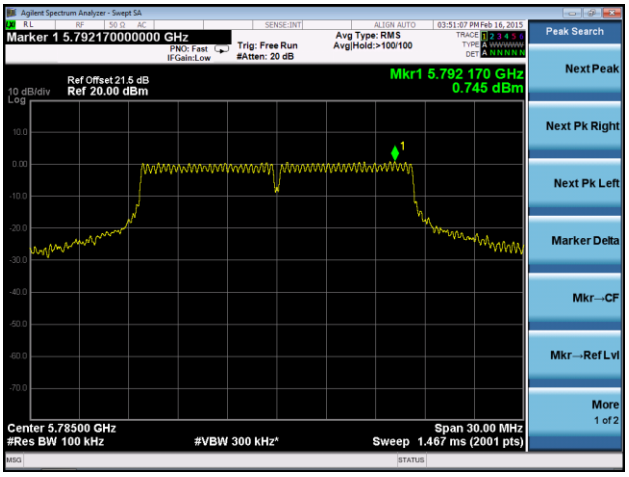
Channel 48 (5240MHz)



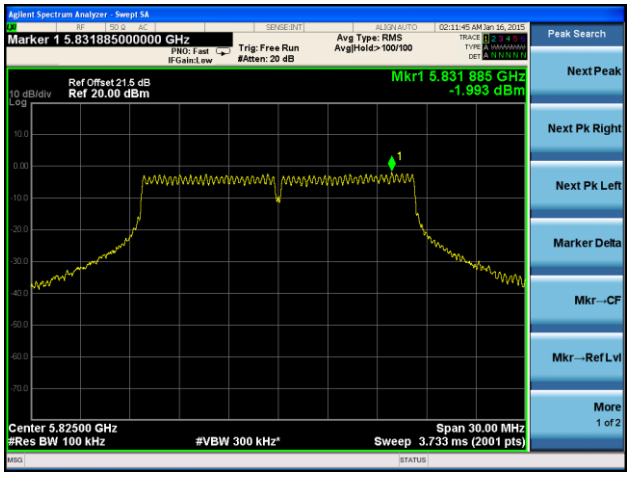
Channel 149 (5745MHz)



Channel 157 (5785MHz)

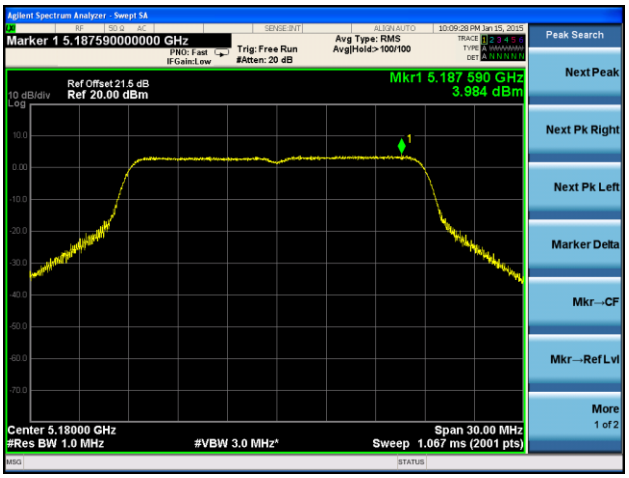


Channel 165 (5825MHz)

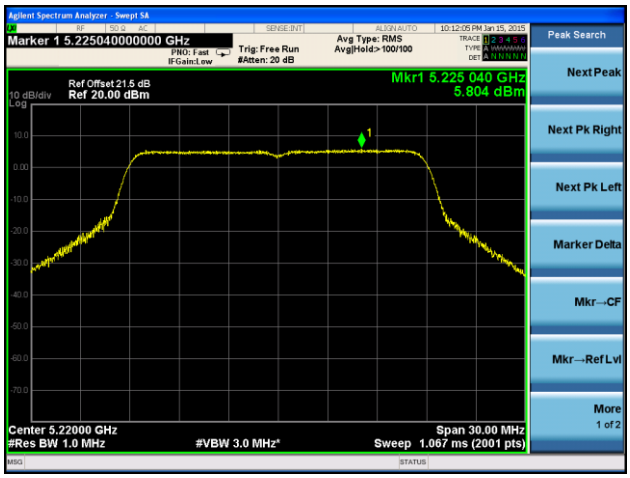


802.11n-HT20 Power Spectral Density - Ant 1 / Ant 0 + 1 + 2 + 3

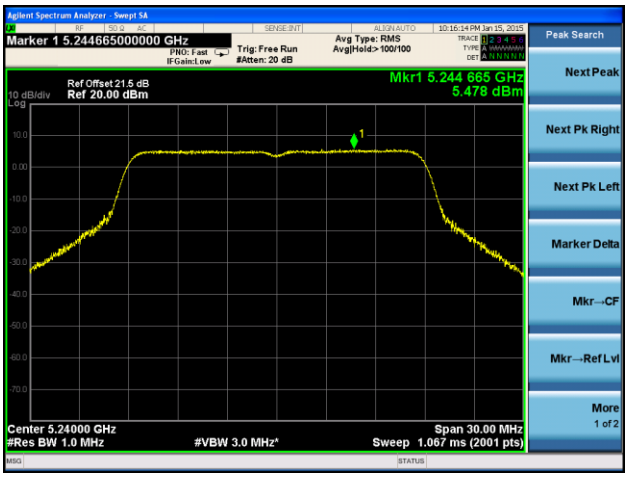
Channel 36 (5180MHz)



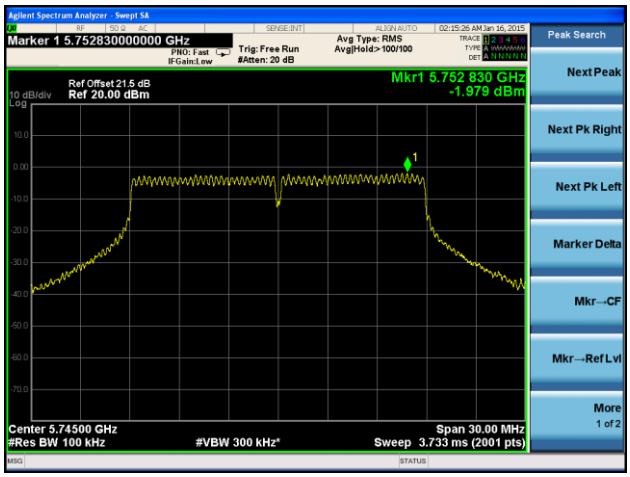
Channel 44 (5220MHz)



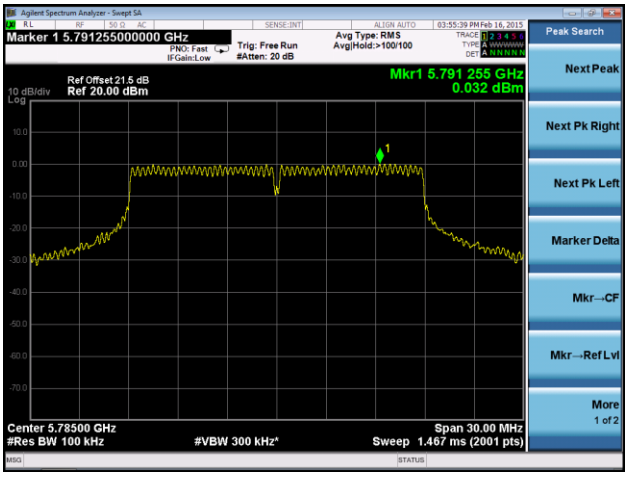
Channel 48 (5240MHz)



Channel 149 (5745MHz)



Channel 157 (5785MHz)



Channel 165 (5825MHz)