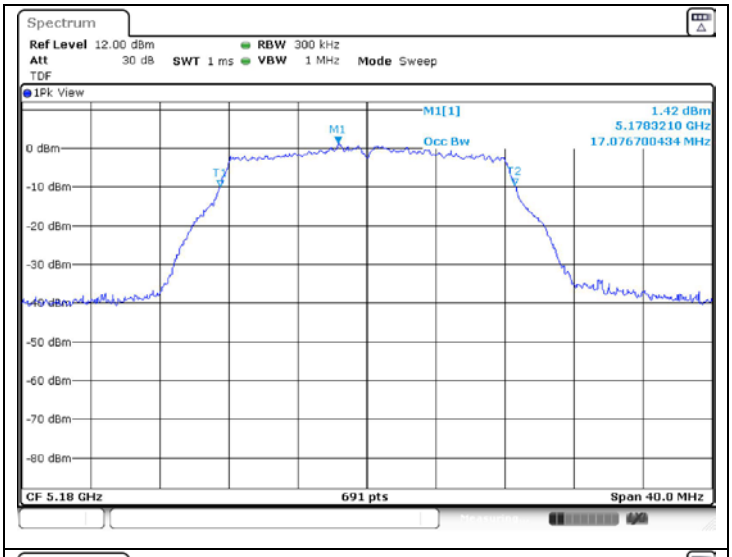
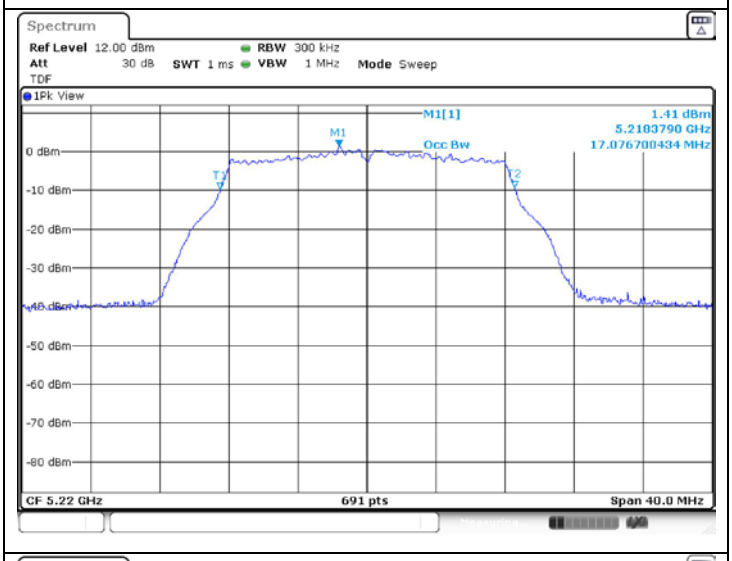
99 % Bandwidth

802.11a (Band 1)_ANT 1

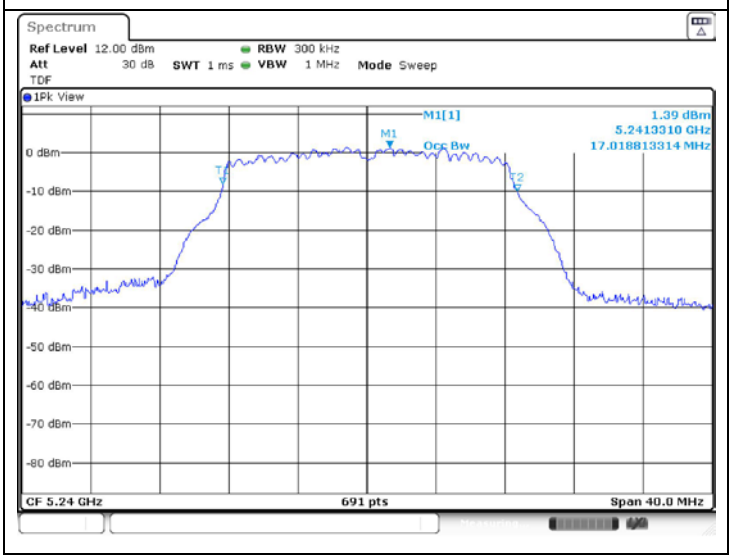
Low Channel
(5 180 ㎒)



Middle Channel
(5 220 ㎒)

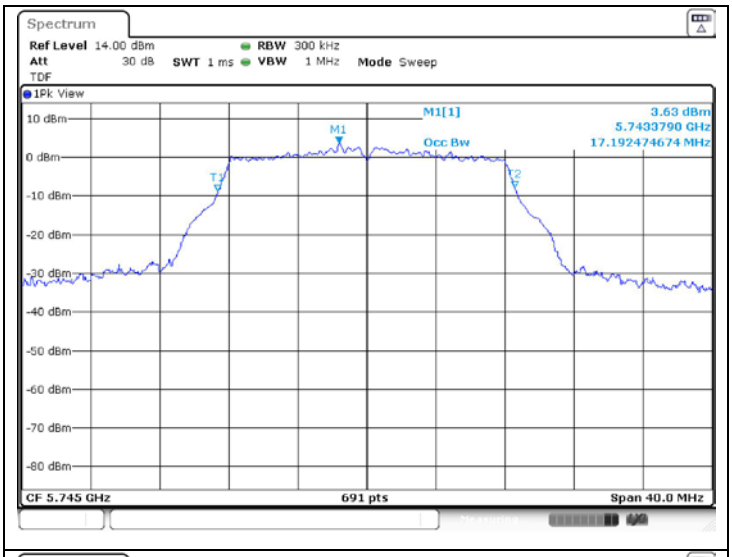


High Channel
(5 240 ㎒)

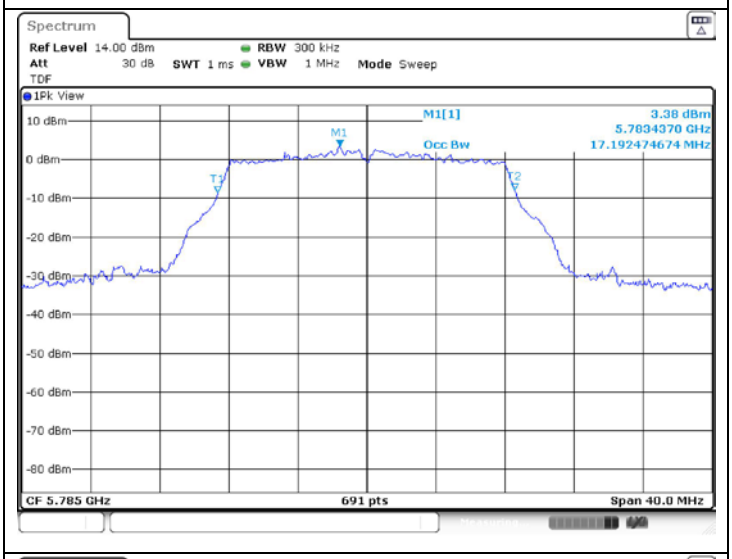


802.11a (Band 3)_ANT 1

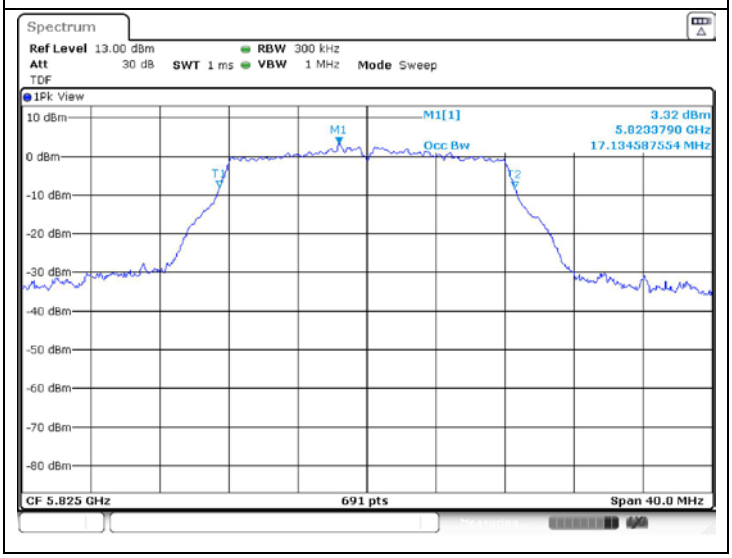
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

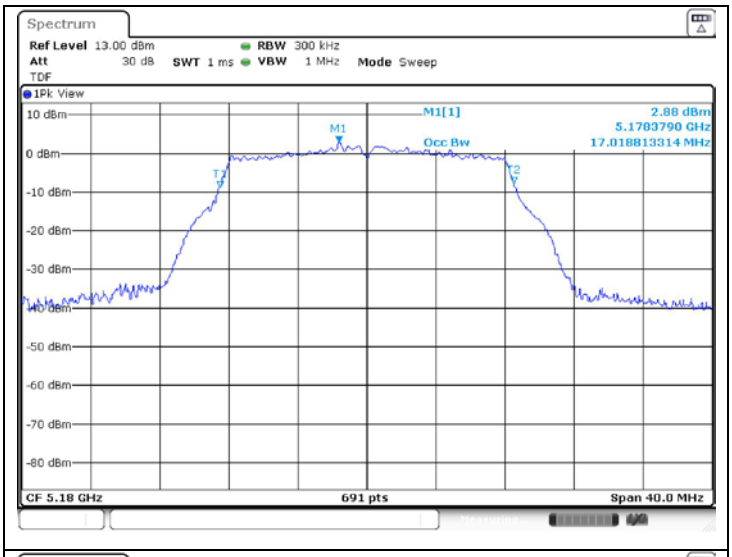


High Channel
(5 825 ㎒)

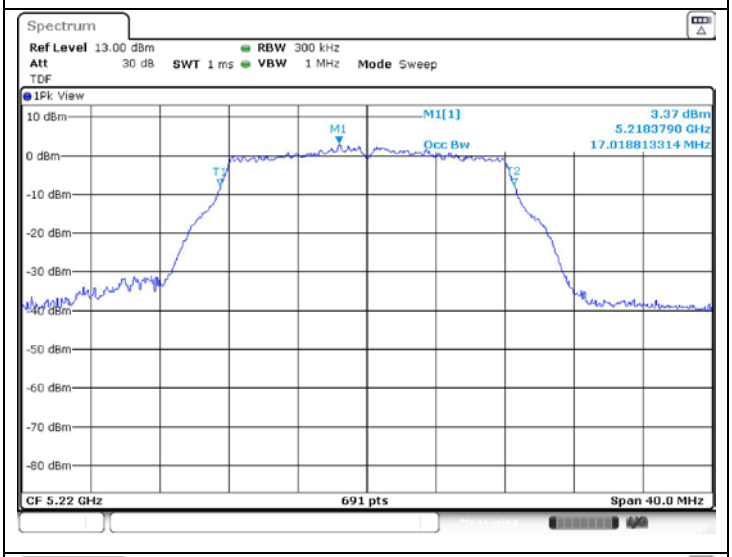


802.11a (Band 1)_ANT 2

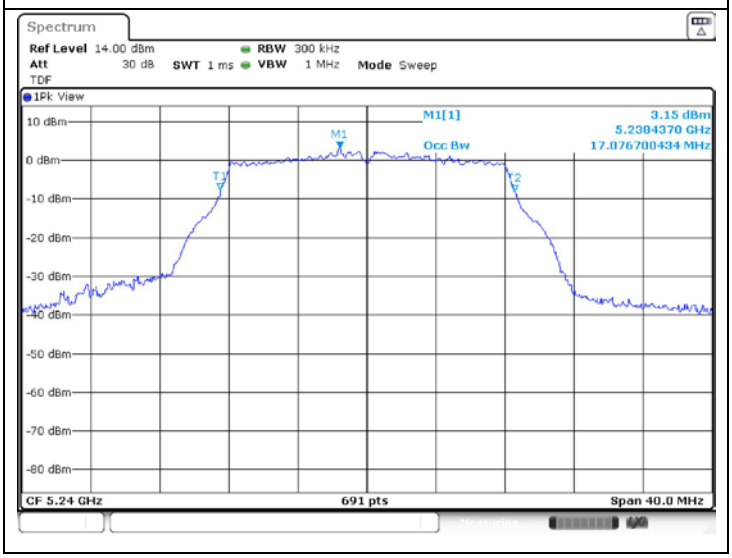
Low Channel
(5 180 ㎒)



Middle Channel
(5 220 ㎒)

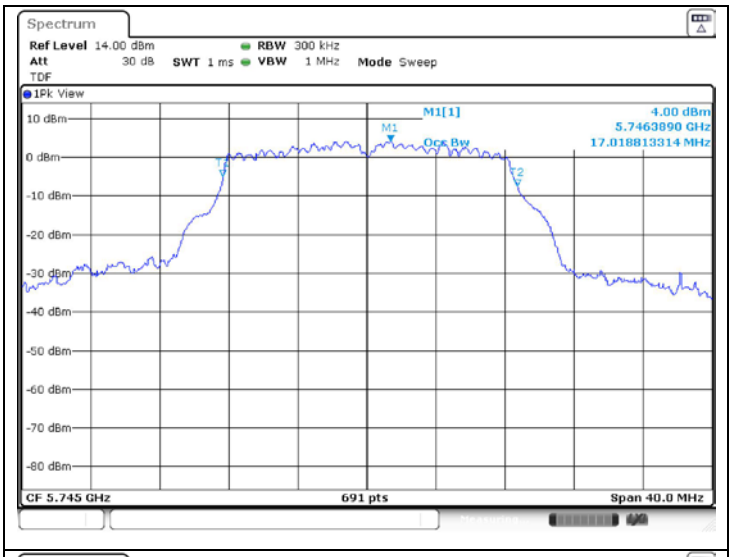


High Channel
(5 240 ㎒)

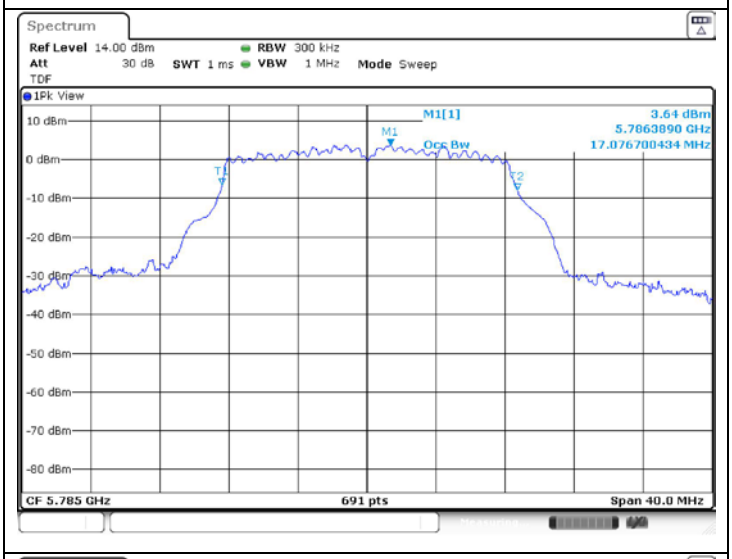


802.11a (Band 3)_ANT 2

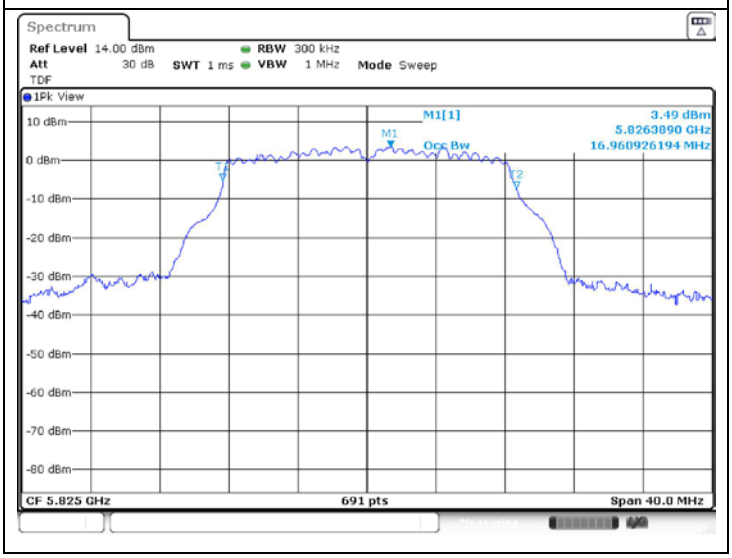
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

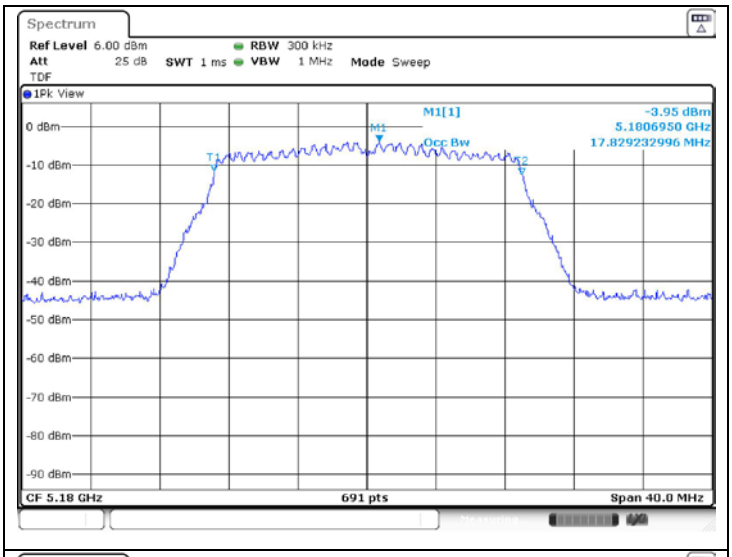


High Channel
(5 825 ㎒)

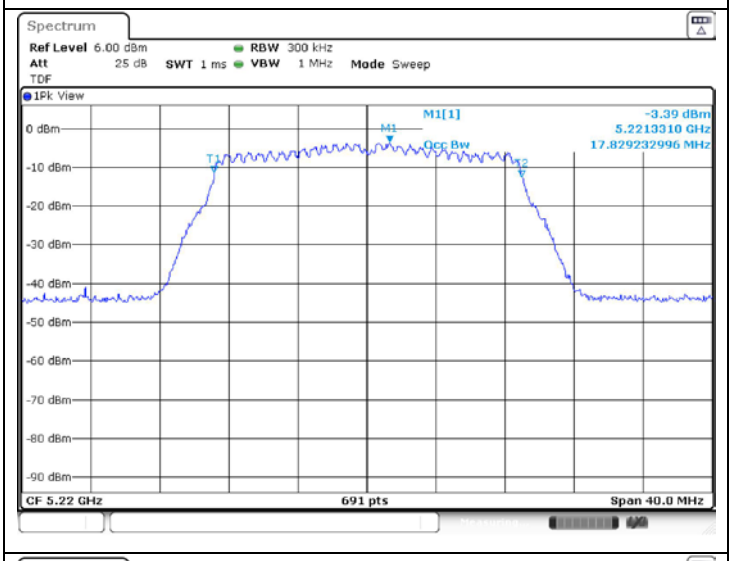


802.11n_HT20 (Band 1)_ANT 1

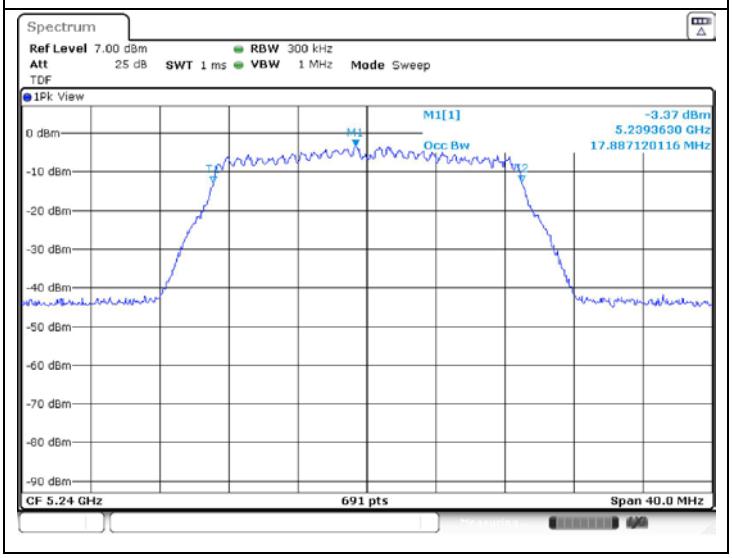
Low Channel
(5 180 ㎒)



Middle Channel
(5 220 ㎒)

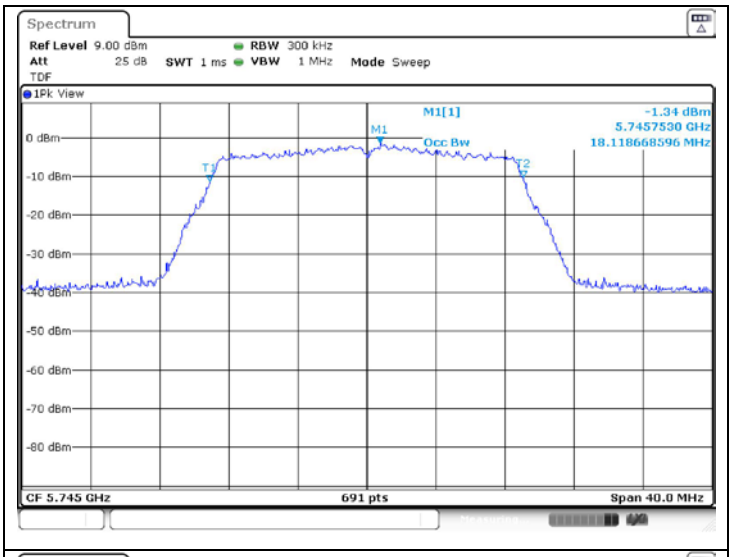


High Channel
(5 240 ㎒)

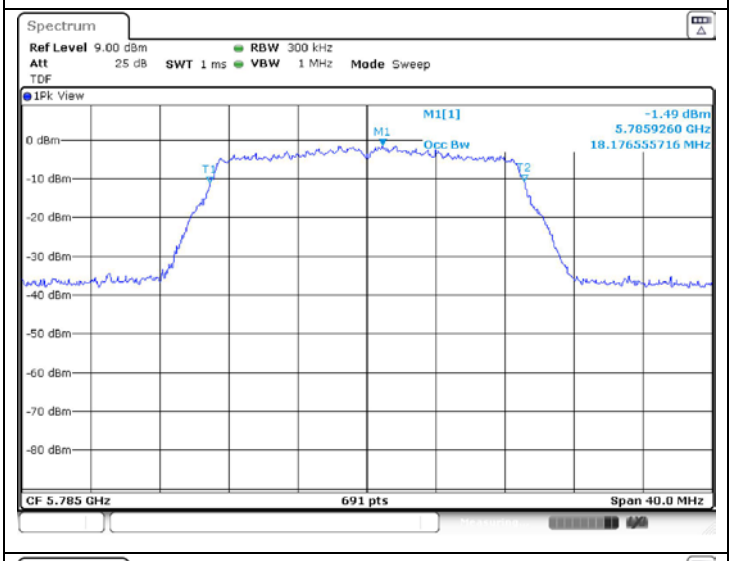


802.11n_HT20 (Band 3)_ANT 1

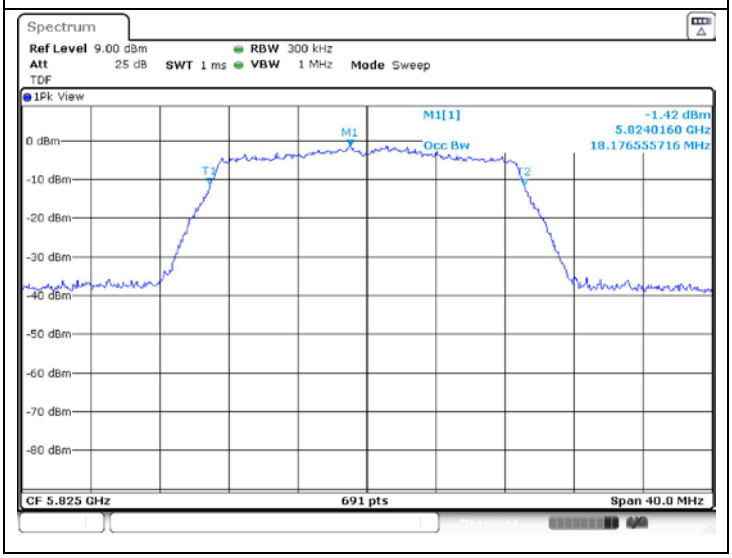
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

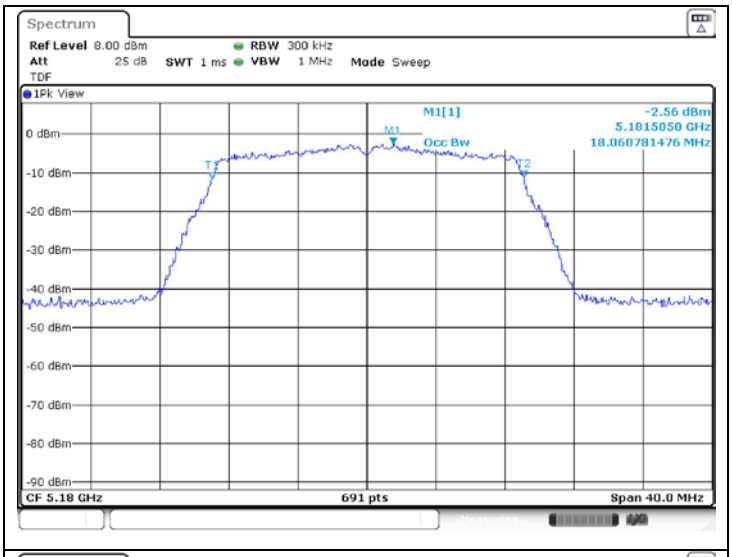


High Channel
(5 825 ㎒)

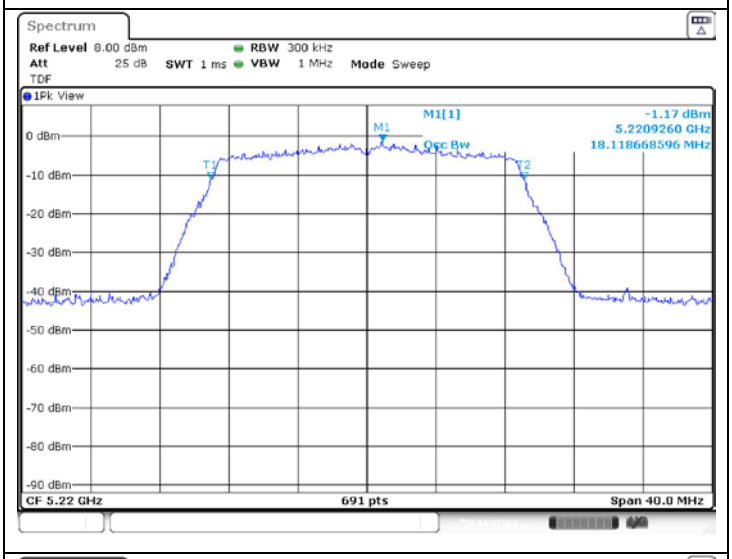


802.11n_HT20 (Band 1)_ANT 2

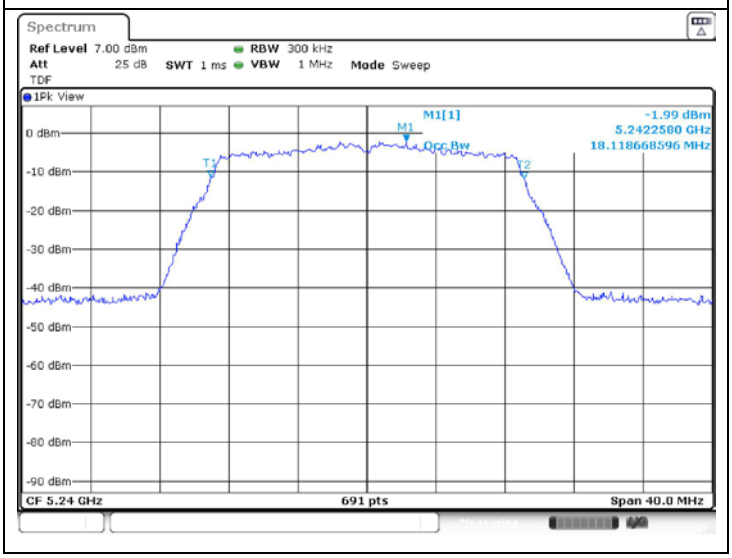
Low Channel
(5 180 ㎒)



Middle Channel
(5 220 ㎒)

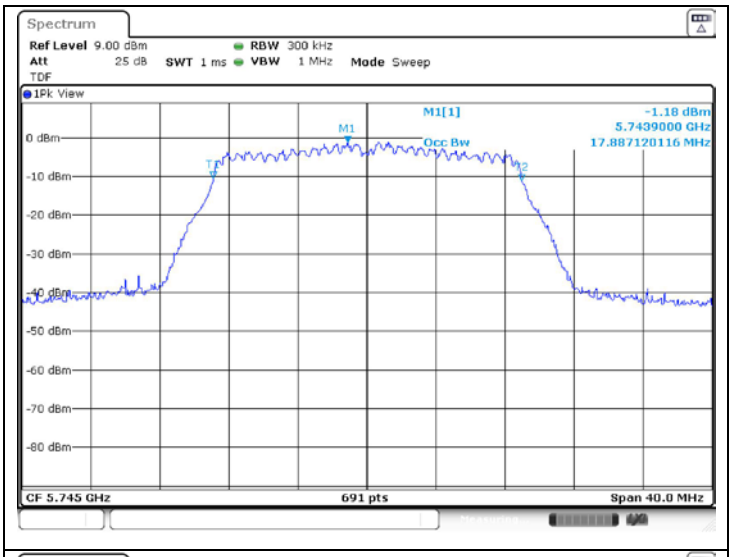


High Channel
(5 240 ㎒)

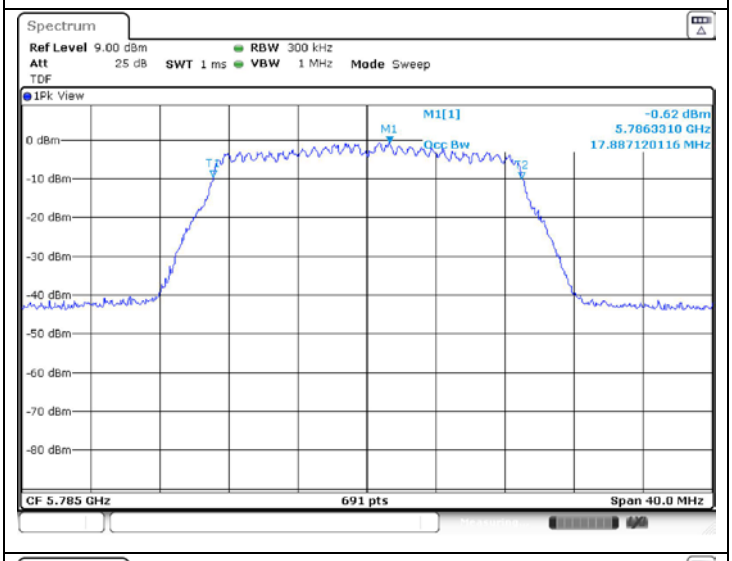


802.11n_HT20 (Band 3)_ANT 2

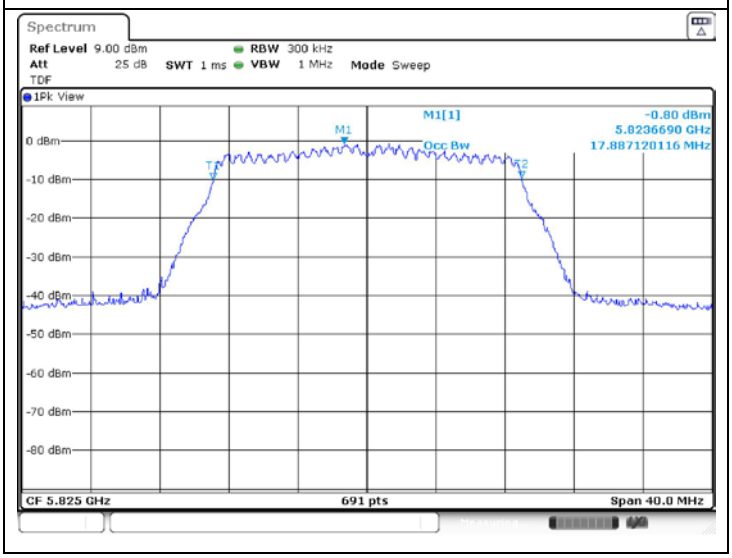
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

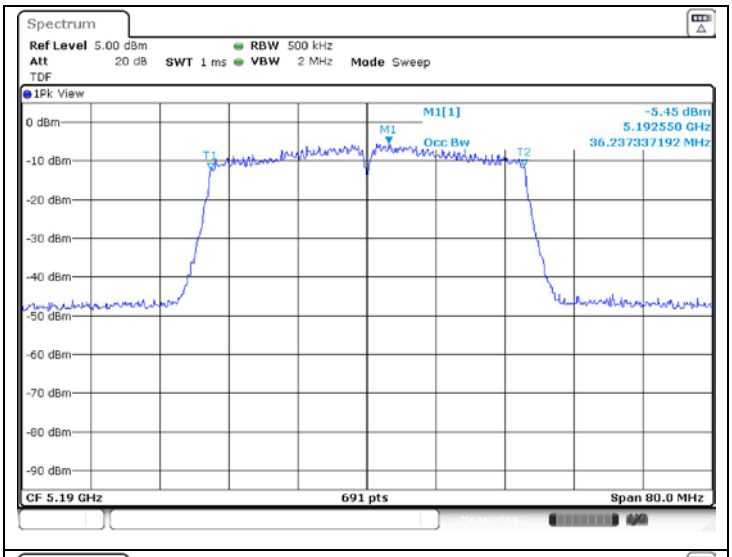


High Channel
(5 825 ㎒)

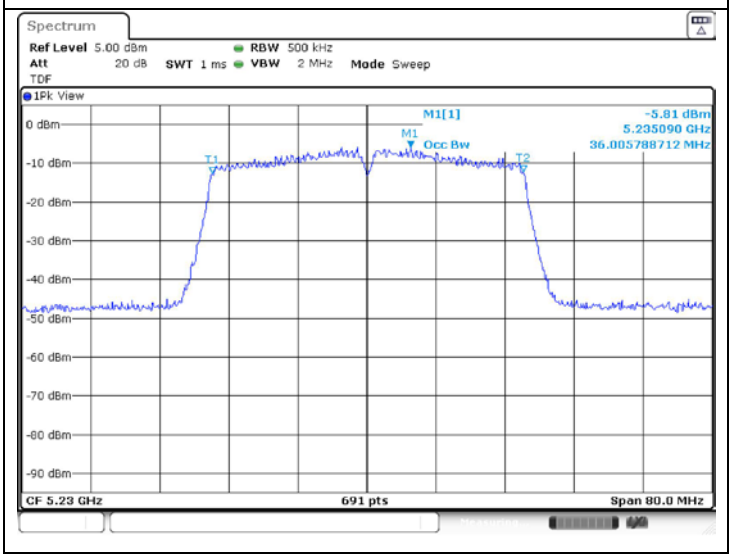


802.11n_HT40 (Band 1)_ANT 1

Low Channel
(5 190 ㎒)

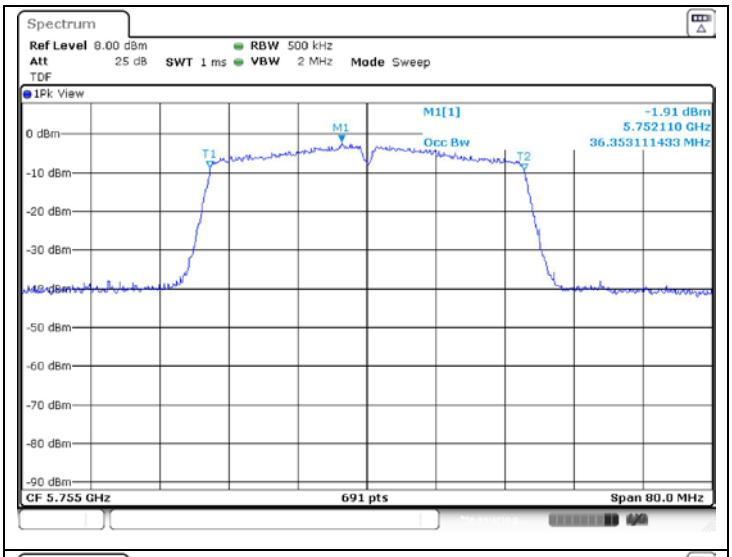


High Channel
(5 230 ㎒)

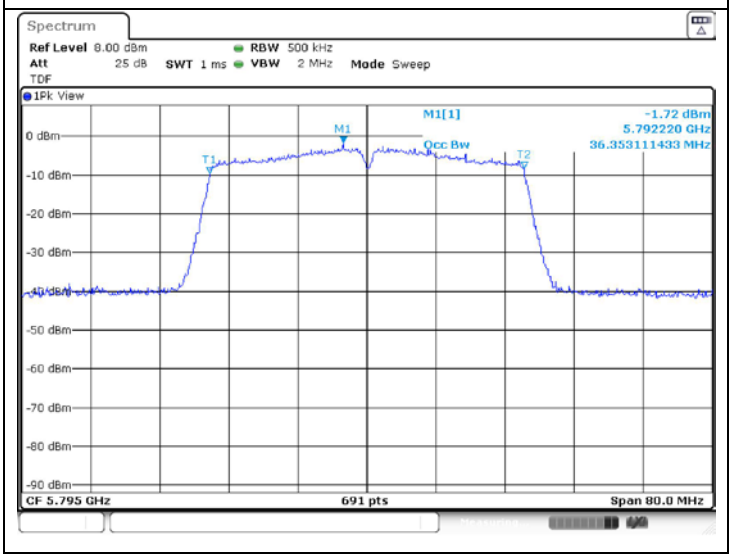


802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 ㎒)

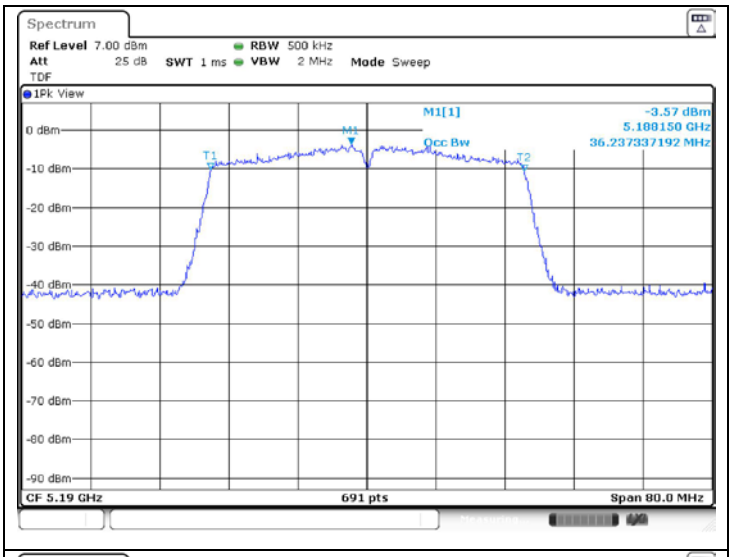


High Channel
(5 795 ㎒)

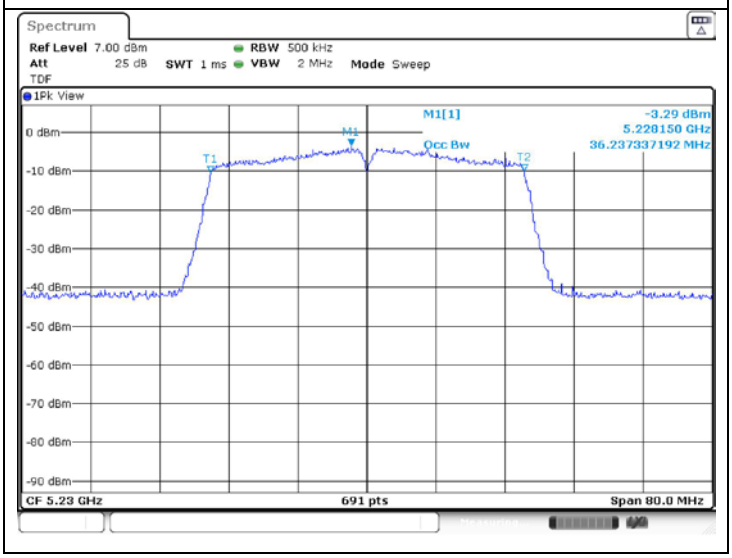


802.11n_HT40 (Band 1)_ANT 2

Low Channel
(5 190 ㎒)

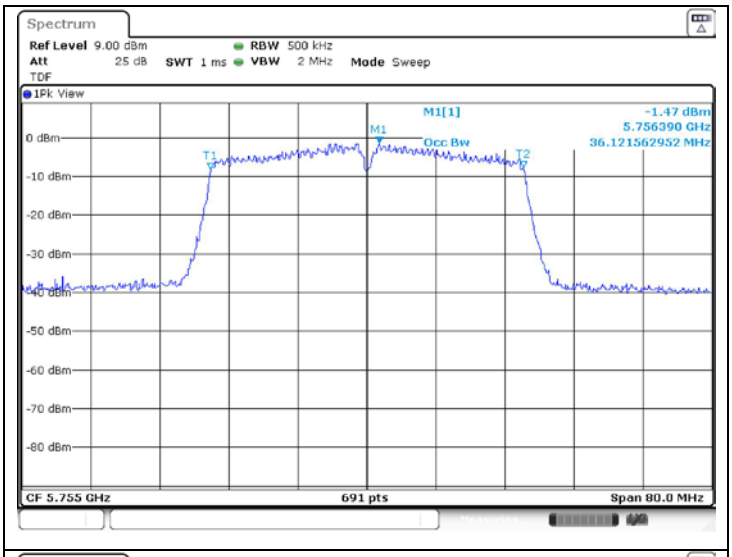


High Channel
(5 230 ㎒)

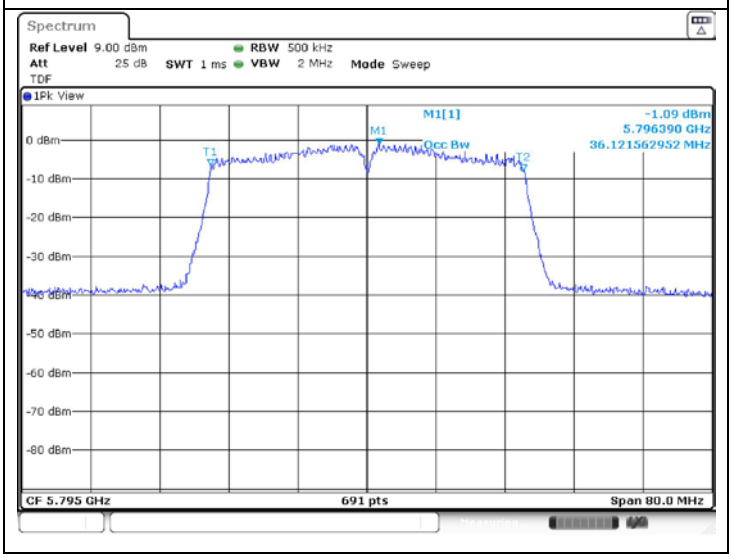


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 ㎒)

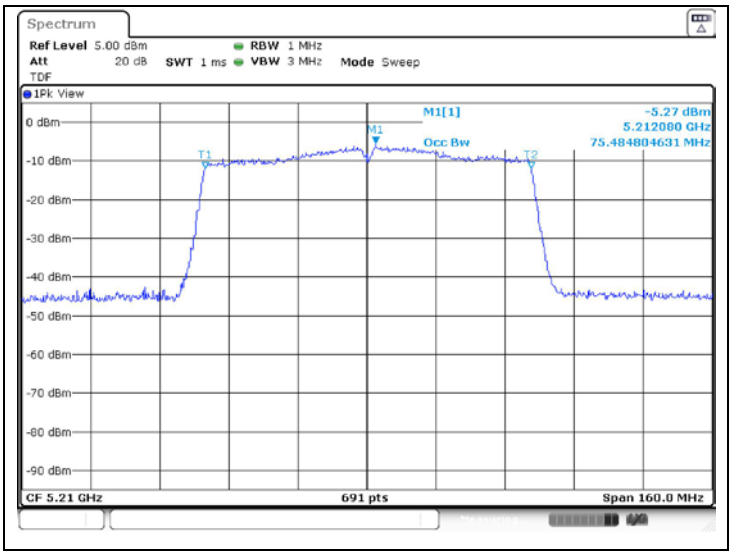


High Channel
(5 795 ㎒)



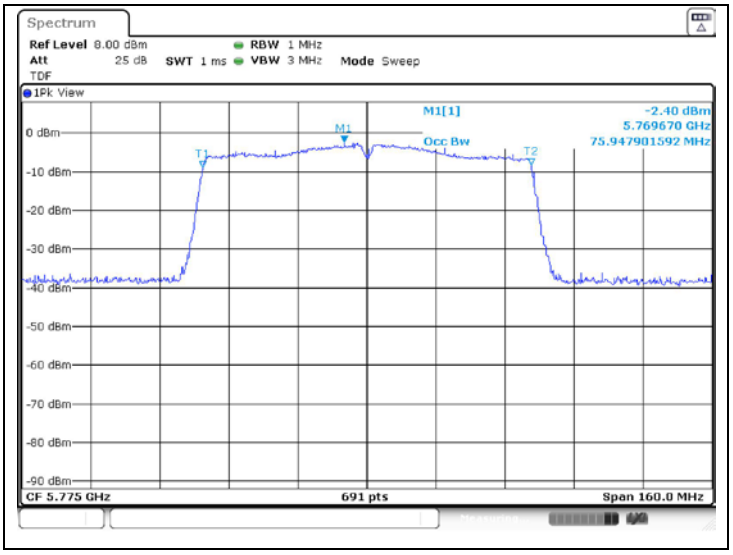
802.11ac_VHT80 (Band 1)_ANT 1

Middle Channel
(5 210 ㎒)



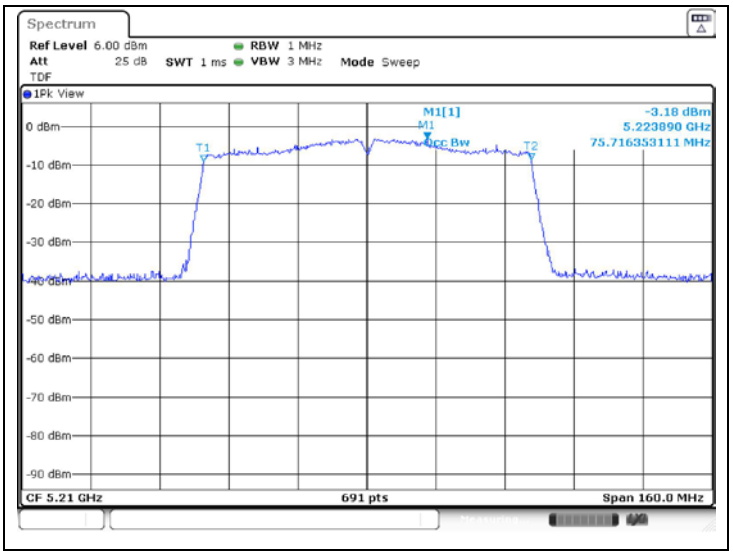
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 ㎒)



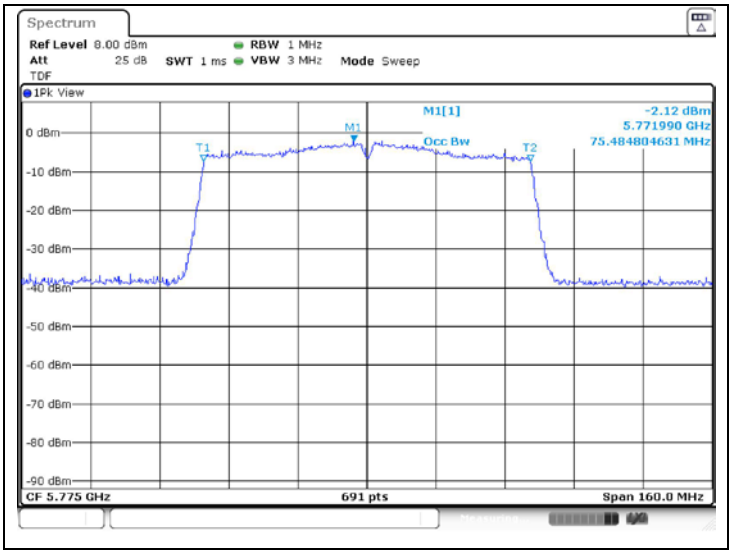
802.11ac_VHT80 (Band 1)_ANT 2

Middle Channel
(5 210 ㎒)



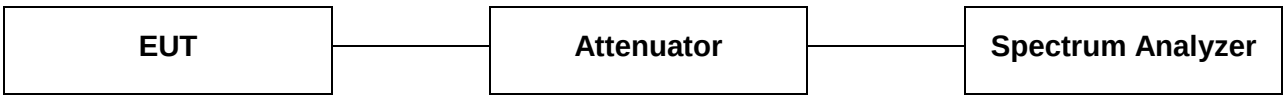
802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
(5 775 ㎒)



4. 6 ㏈ Bandwidth

4.1. Test Setup



4.2. Limit

4.2.1. FCC

According to §15.407(e), within the 5.725-5.85 ㎓ band, the minimum 6 ㏈ bandwidth of U-NII devices shall be at least 500 ㎑.

4.2.2. IC

According to RSS-247 Issue 2, 6.2.4.1, the minimum -6 ㏈ Bandwidth shall be at least 500 ㎑.

4.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section C.2 of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Set RBW = 100 ㎑.
3. Set the video bandwidth (VBW) ≥ 3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold.
6. Sweep = auto couple.
7. Allow the trace to stabilize.
8. 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 ㏈ relative to the maximum level measured in the fundamental emission.

4.4. Test result

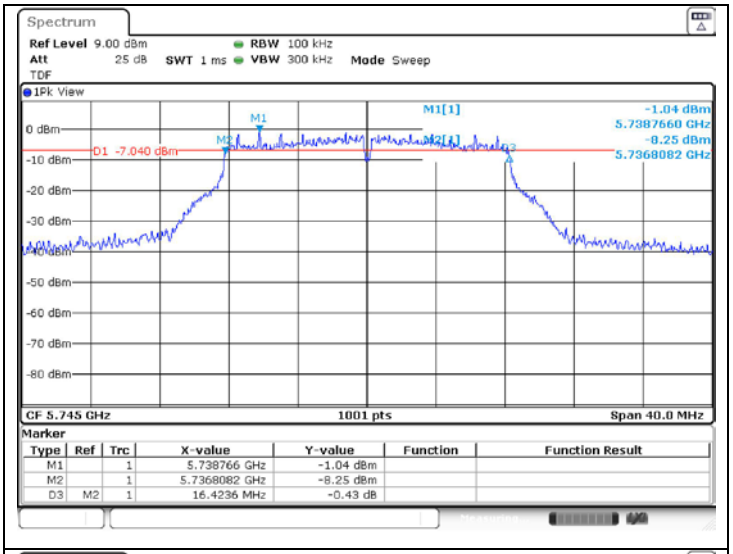
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Band	Mode	Frequency (㎒)	Ch.	Data Rate (Mbps)	6 ㏈ Bandwidth (㎒)		Minimum Bandwidth (㎑)
					ANT 1	ANT 2	
U-NII 3	11a	5 745	149	6	16.424	16.424	500
		5 785	157		16.344	16.344	
		5 825	165		16.384	16.384	
	11n_HT20	5 745	149	MCS8	17.622	17.622	
		5 785	157		17.622	17.622	
		5 825	165		17.622	17.622	
	11n_HT40	5 755	151	MCS8	35.564	35.564	
		5 795	159		35.644	35.964	
	11ac_VHT80	5 775	155	MCS0	75.764	75.764	

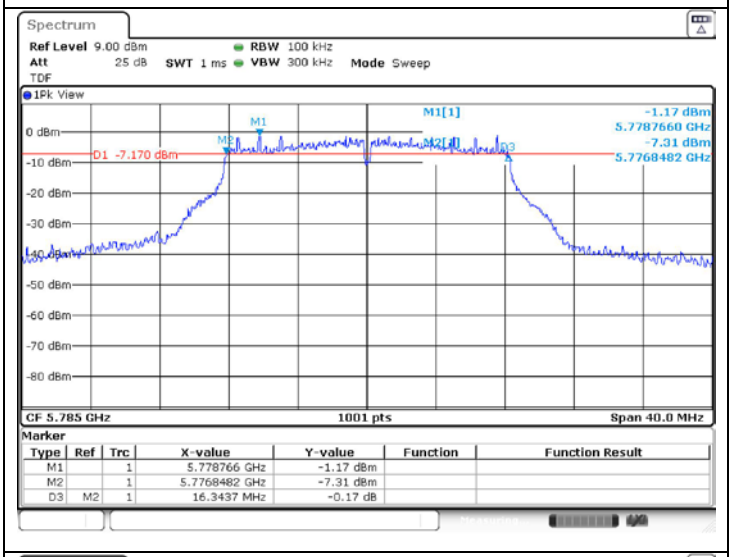
- Test plots

802.11a (Band 3)_ANT 1

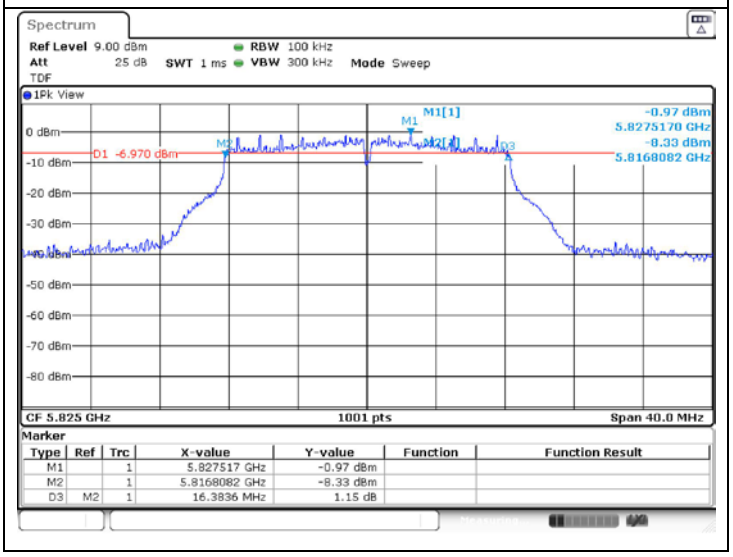
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

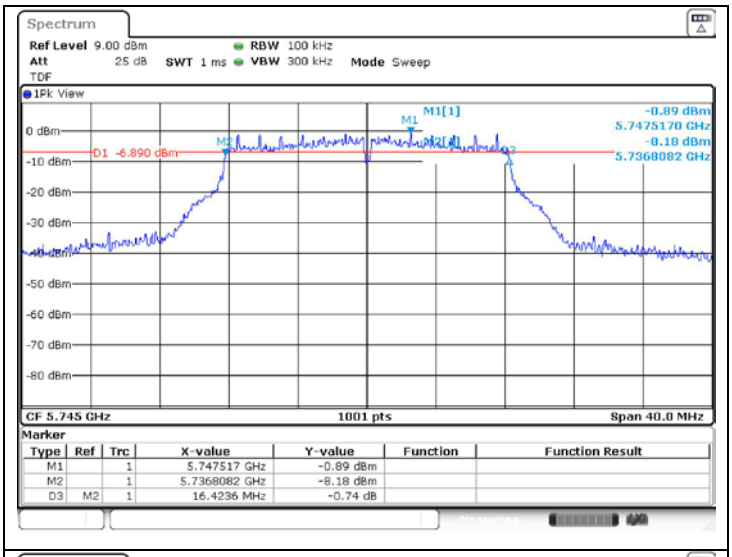


High Channel
(5 825 ㎒)

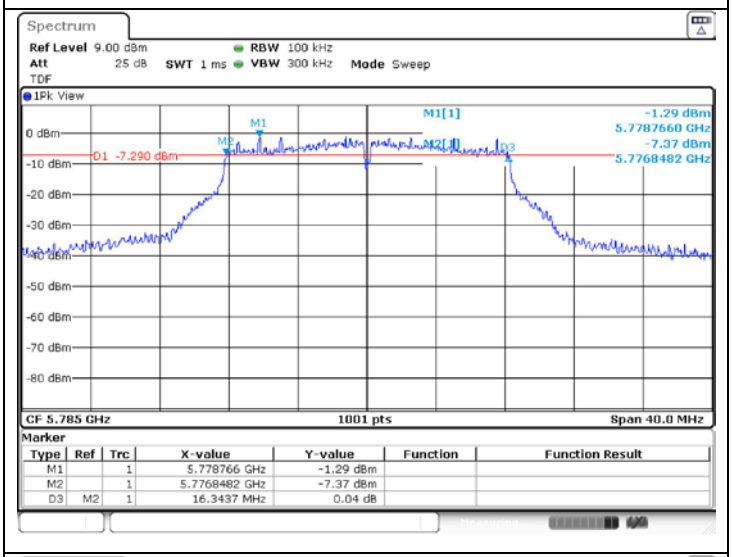


802.11a (Band 3)_ANT 2

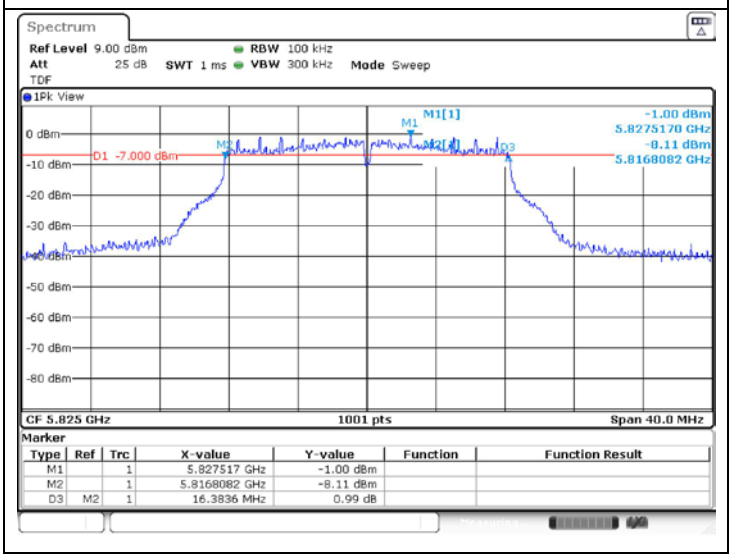
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

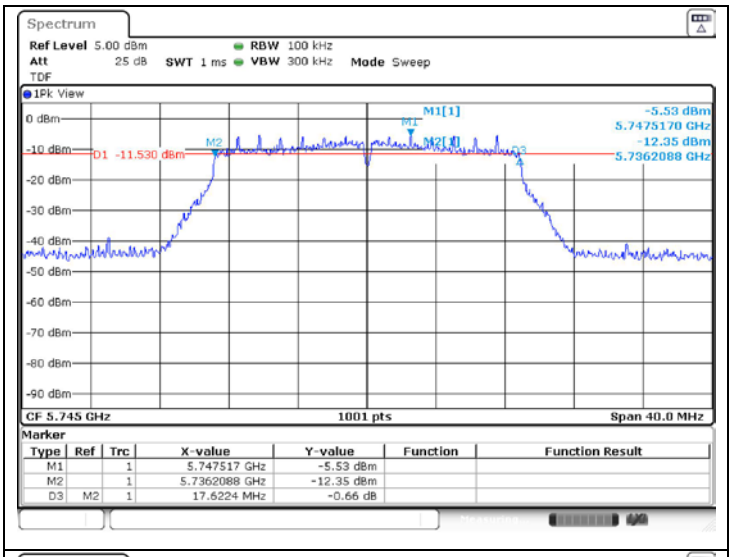


High Channel
(5 825 ㎒)

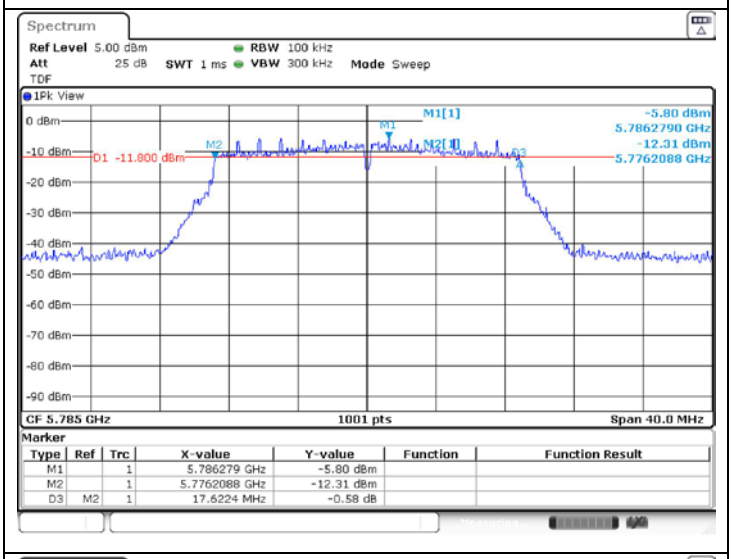


802.11n_HT20 (Band 3)_ANT 1

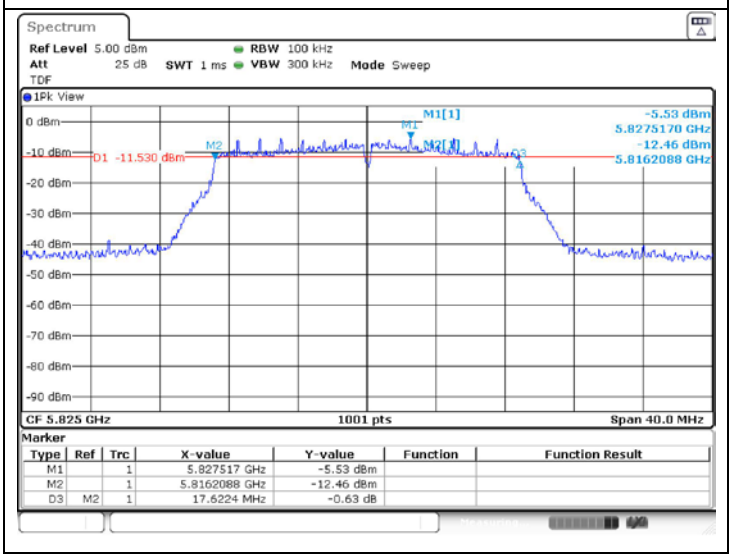
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

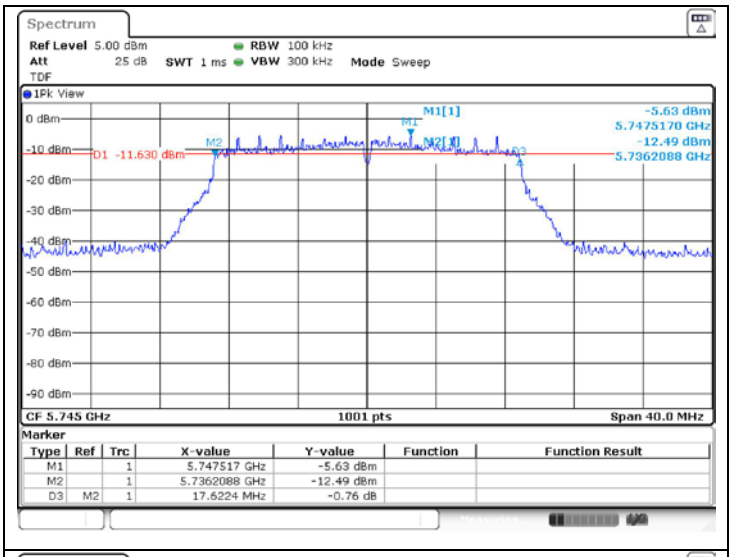


High Channel
(5 825 ㎒)

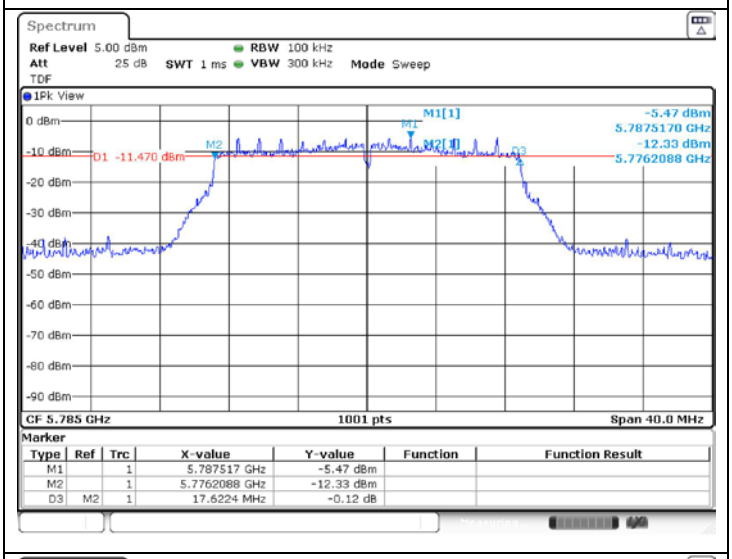


802.11n_HT20 (Band 3)_ANT 2

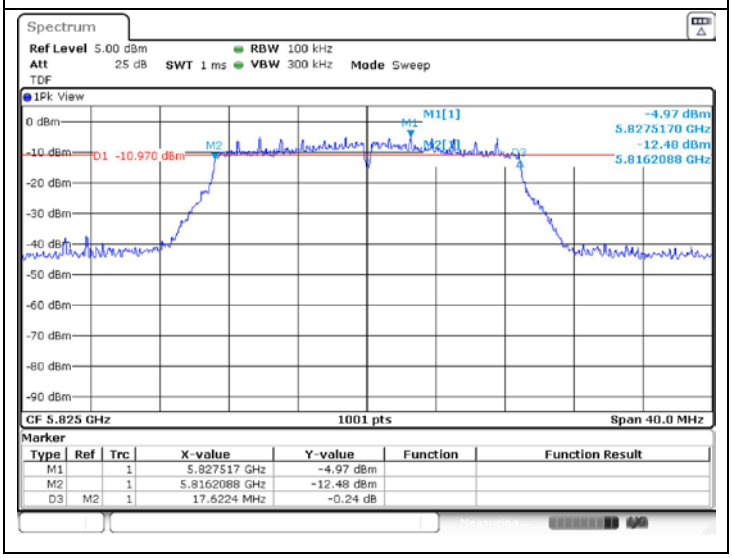
Low Channel
(5 745 ㎒)



Middle Channel
(5 785 ㎒)

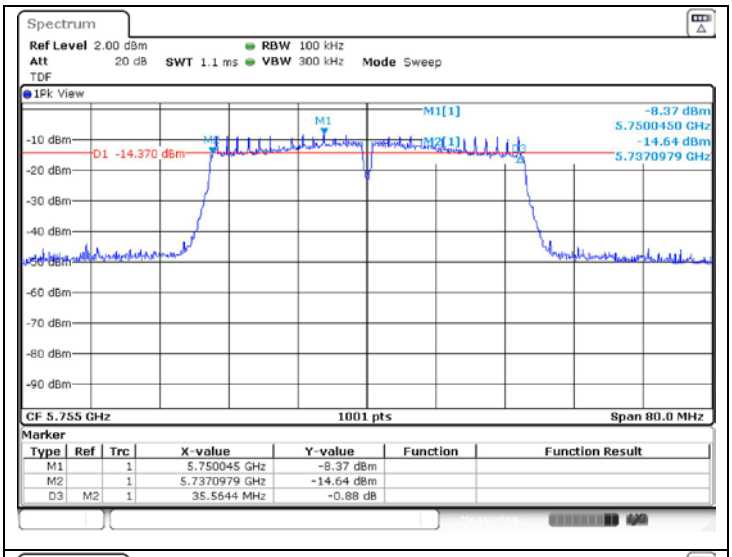


High Channel
(5 825 ㎒)

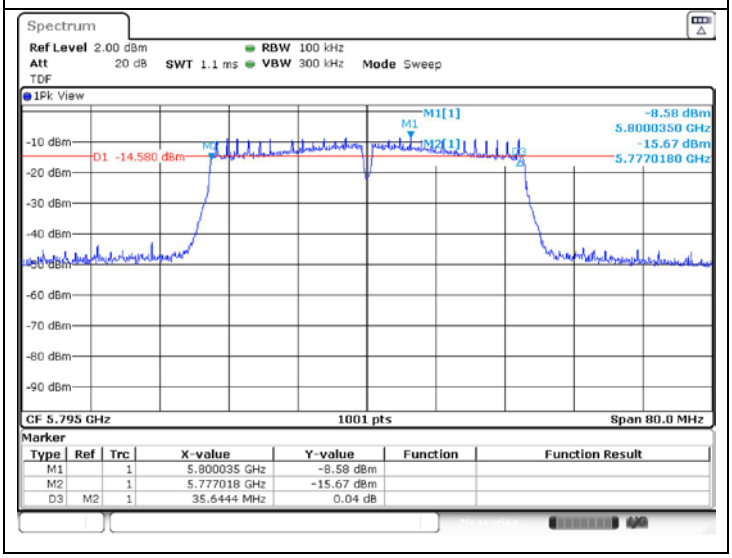


802.11n_HT40 (Band 3)_ANT 1

Low Channel
(5 755 ㎒)

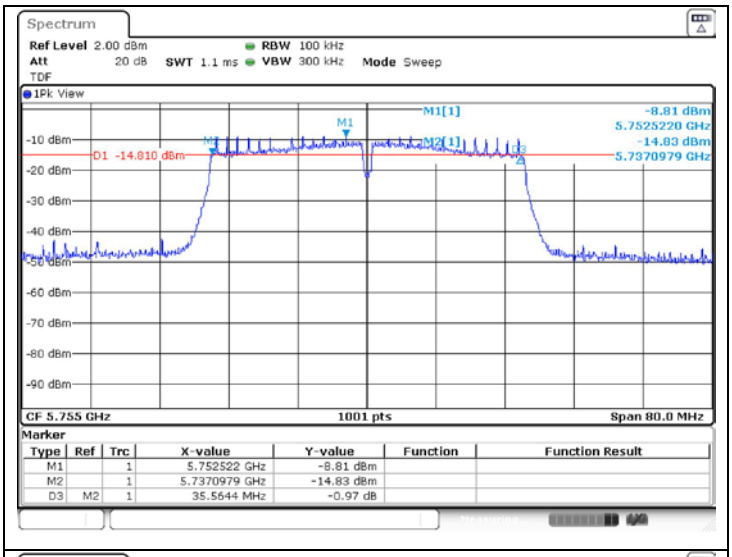


High Channel
(5 795 ㎒)

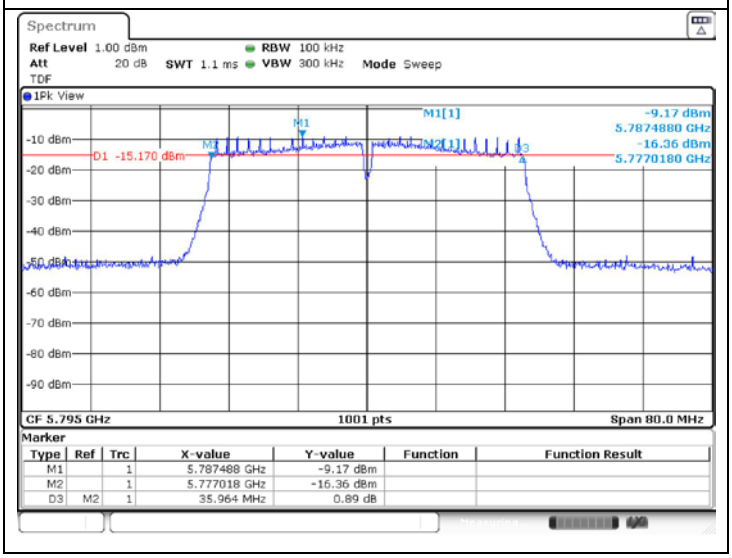


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 ㎒)

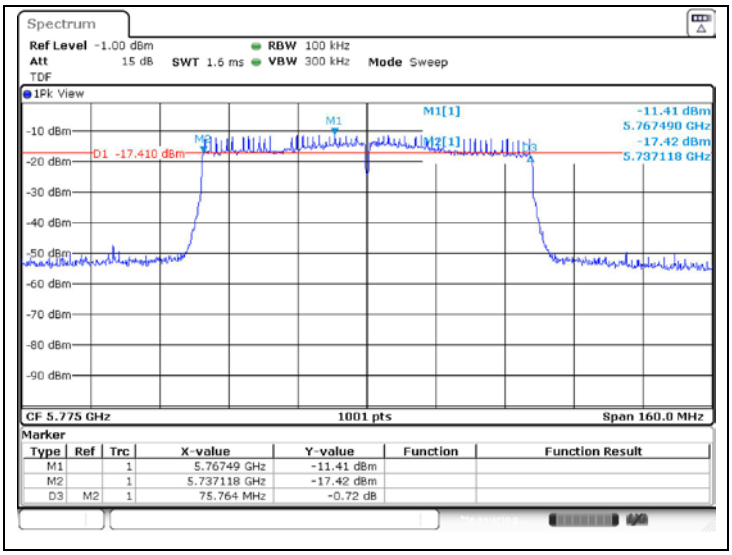


High Channel
(5 795 ㎒)



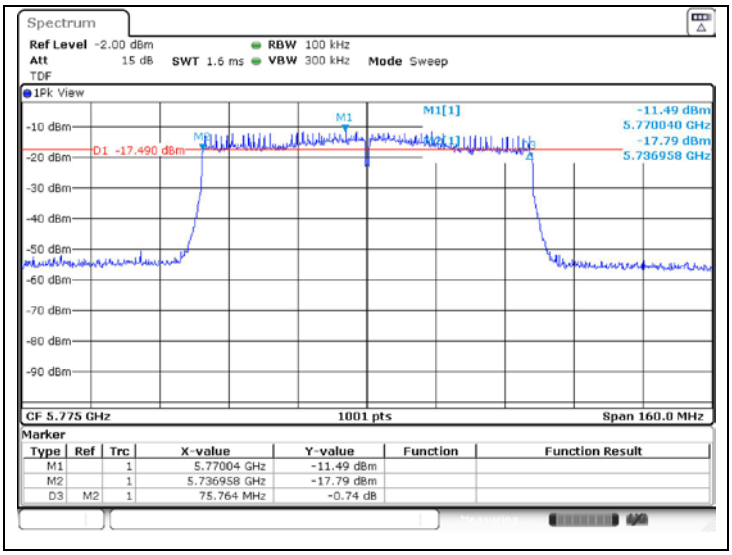
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
(5 775 ㎒)



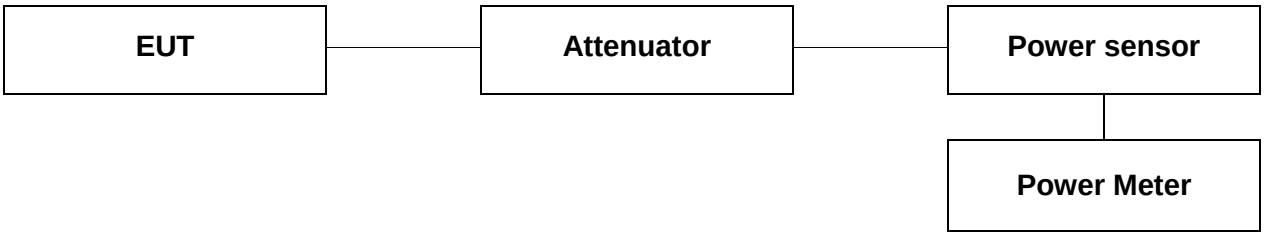
802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
(5 775 ㎒)



5. Maximum Conducted Output Power

5.1. Test Setup



5.2. Limit

5.2.1. FCC

According to 15.407(a)(1)(iv)

For client devices in the 5.15-5.25 ㎓ band, the maximum conducted output power over the frequency band of operation shall not exceed 250 ㎽ provided the maximum antenna gain does not exceed 6 ㏈ i. In addition, the maximum power spectral density shall not exceed 11 ㏈ m in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i.

According to 15.407(a)(3)

For the band 5.725-5.85 ㎓, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 ㏈m in any 500-㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈ i without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

5.2.2. IC

According to RSS-247 Issue 2,

6.2.1.1 Frequency band 5 150-5 250 ㎒

For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 ㎽ or 1.76 + 10 $\log_{10}$B, ㏈ m, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 ㏈ below the maximum permitted e.i.r.p. of 30 ㎽.

For other devices, the maximum e.i.r.p. shall not exceed 200 ㎽ or 10 + 10 $\log_{10}$B, ㏈m, whichever power is less. B is the 99 % emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 ㏈m in any 1.0 ㎒ band.

6.2.4.1 Frequency band 5 725-5 850 ㎒

For equipment operating in the band 5 725-5 850 ㎒, the minimum 6 ㏈ bandwidth shall be at least 500 ㎑. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 ㏈m in any 500 ㎑ band. If transmitting antennas of directional gain greater than 6 ㏈i are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in ㏈ that the directional gain of the antenna exceeds 6 ㏈i. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 ㏈i without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint[3] systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

5.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

1. This measurement settings are specified in section E.3.a of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied:
   - The EUT is configured to transmit continuously or to transmit with a consistent duty cycle.
   - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
   - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.
3. If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
4. Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
5. Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25 %).

5.4. Test result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Test mode: 11a_ANT1

Band	Frequency (㎒)	Data Rate (Mbps)	Average Power (㏈m)	Duty Cycle Correction Factor (㏈)	Average Power Result (㏈m)
U-NII 1	5 180	6	10.34	0.29	10.63
	5 220		10.27		10.56
	5 240		10.32		10.61
U-NII 3	5 745		10.69		10.98
	5 785		10.64		10.93
	5 825		10.65		10.94

Band	Frequency (㎒)	Data Rate (Mbps)	Average Power Result (㏈m)	Antenna Gain (㏈i)	E.I.R.P. (㏈m)
U-NII 1	5 180	6	10.63	2.54	13.17
	5 220		10.56		13.10
	5 240		10.61		13.15

Band	FCC Limit					
	Frequency (㎒)	Fixed Limit (㏈m)	26 ㏈ BW (㎒)	11+10LogB (㏈m)	Antenna Gain (㏈i)	Limit (㏈m)
U-NII 1	5 180	23.98			2.54	23.98
	5 220					
	5 240					
U-NII 3	5 745	30			2.45	30
	5 785					
	5 825					

Band	IC Limit					
	Frequency (㎒)	Fixed Limit (㏈m)	99 % BW (㎒)	1.76+10LogB (㏈m)	Antenna Gain (㏈i)	Limit (㏈m)
U-NII 1	5 180	14.77	17.077	14.08	2.54	14.08
	5 220		17.077	14.08		14.08
	5 240		17.019	14.07		14.07

Band	IC Limit					
	Frequency (㎒)	Fixed Limit (㏈m)	99 % BW (㎒)	11+10LogB (㏈m)	Antenna Gain (㏈i)	Limit (㏈m)
U-NII 3	5 745	30			2.45	30
	5 785					
	5 825					

Test mode: 11a_ANT2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Duty Cycle Correction Factor (dB)	Average Power Result (dBm)
U-NII 1	5 180	6	8.38	0.29	8.67
	5 220		8.44		8.73
	5 240		8.23		8.52
U-NII 3	5 745		10.52		10.81
	5 785		10.56		10.85
	5 825		10.40		10.69

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dBm)	Antenna Gain (dBi)	E.I.R.P. (dBm)
U-NII 1	5 180	6	8.67	2.84	11.51
	5 220		8.73		11.57
	5 240		8.52		11.36

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	26 dB BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 180	23.98			2.84	23.98
	5 220					
	5 240					
U-NII 3	5 745	30			2.73	30
	5 785					
	5 825					

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	1.76+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 180	14.77	17.019	14.07	2.84	14.07
	5 220		17.019	14.07		14.07
	5 240		17.077	14.08		14.08

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 3	5 745	30			2.73	30
	5 785					
	5 825					

Test mode: 11n_HT20

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 Average Power (dBm)	ANT 2 Average Power (dBm)	ANT 1+ANT 2 Average Power (dBm)
U-NII 1	5 180	MCS8	4.71	1.94	6.55
	5 220		4.93	2.25	6.80
	5 240		4.63	2.08	6.55
U-NII 3	5 745		5.77	4.77	8.31
	5 785		5.75	4.77	8.30
	5 825		5.75	4.60	8.22

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dBm)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dBm)
U-NII 1	5 180	MCS8	6.55	0.59	7.14
	5 220		6.80		7.39
	5 240		6.55		7.14
U-NII 3	5 745		8.31		8.90
	5 785		8.30		8.89
	5 825		8.22		8.81

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dBm)	Antenna Gain (dBi)	ANT 1 + ANT 2 E.I.R.P. (dBm)
U-NII 1	5 180	MCS8	7.14	5.70	12.84
	5 220		7.39		13.09
	5 240		7.14		12.84

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	26 dB BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 180	23.98			5.70	23.98
	5 220					
	5 240					
U-NII 3	5 745	30			5.60	30
	5 785					
	5 825					

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	1.76+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 180	14.77	17.829	14.27	5.70	14.27
	5 220		17.829	14.27		14.27
	5 240		17.887	14.29		14.29

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 3	5 745	30			5.60	30
	5 785					
	5 825					

Test mode: 11n_HT40

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 Average Power (dBm)	ANT 2 Average Power (dBm)	ANT 1+ANT 2 Average Power (dBm)
U-NII 1	5 190	MCS8	3.39	-0.86	4.78
	5 230		3.51	-0.46	4.97
U-NII 3	5 755		4.60	3.51	7.10
	5 795		4.76	3.56	7.21

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dBm)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dBm)
U-NII 1	5 190	MCS8	4.78	1.08	5.86
	5 230		4.97		6.05
U-NII 3	5 755		7.10		8.18
	5 795		7.21		8.29

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dBm)	Antenna Gain (dBi)	ANT 1 + ANT 2 E.I.R.P. (dBm)
U-NII 1	5 190	MCS8	5.86	5.70	11.56
	5 230		6.05		11.75

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	26 dB BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 190	23.98			5.70	23.98
	5 230					
U-NII 3	5 755	30			5.60	30
	5 795					

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	1.76+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 755	14.77	36.237	17.35	5.70	14.77
	5 795		36.006	17.32		14.77

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 3	5 755	30			5.60	30
	5 795					

Test mode: 11ac_VHT80

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 Average Power (dBm)	ANT 2 Average Power (dBm)	ANT 1+ANT 2 Average Power (dBm)
U-NII 1	5 210	MCS0	2.82	-1.21	4.27
U-NII 3	5 775		3.57	2.44	6.05

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dBm)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dBm)
U-NII 1	5 210	MCS0	4.27	1.84	6.11
U-NII 3	5 775		6.05		7.89

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dBm)	Antenna Gain (dBi)	ANT 1 + ANT 2 E.I.R.P. (dBm)
U-NII 1	5 210	MCS0	6.11	5.70	11.81

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	26 dB BW (MHz)	11+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 210	23.98			5.70	23.98
U-NII 3	5 775	30			5.60	30

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dBm)	99 % BW (MHz)	1.76+10LogB (dBm)	Antenna Gain (dBi)	Limit (dBm)
U-NII 1	5 775	14.77	75.485	20.54	5.70	14.77
Band	**IC Limit**					
	Frequency (MHz)	**Fixed Limit (dBm)**	**99 % BW (MHz)**	**11+10LogB (dBm)**	**Antenna Gain (dBi)**	**Limit (dBm)**
U-NII 3	5 775	30			5.60	30

Remark;

Attenuator and cable offset was compensated in test program (R&S Power Viewer) before measuring.

According to KDB 662911 D01 v02r01, average power of each port (ANT 1+ANT 2) and antenna gain was combined by using below calculation.

Average power: 10 log {10^(ANT 1 power / 10)+10^(ANT 2 power / 10)}
Antenna gain: 10 log [{10^(ANT 1 gain / 20)+10^(ANT 2 gain / 20)}^2 / 2]

Average Power Result (dBm) = Average Power (dBm) + Duty Cycle Correction Factor (dB)