

4. 6 dB Bandwidth

4.1. Test Setup



4.2. Limit

4.2.1. FCC

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

4.2.2. IC

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

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 kHz.
3. Set the video bandwidth (VBW) $\geq 3 \times$ 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 dB relative to the maximum level measured in the fundamental emission.

4.4. Test result

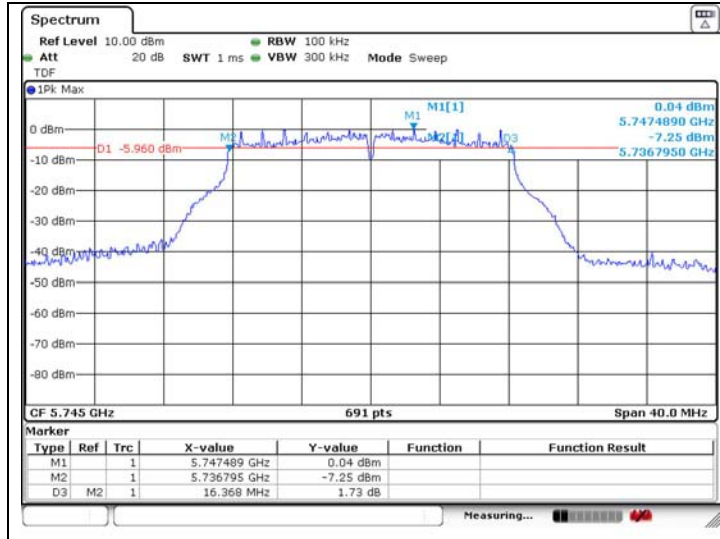
Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Band	Mode	Frequency (MHz)	Ch.	Data Rate (Mbps)	6 dB Bandwidth (MHz)		Minimum Bandwidth (kHz)
					ANT 1	ANT 2	
U-NII 3	11a	5 745	149	6	16.368	16.440	500
		5 785	157		16.324	16.440	
		5 825	165		16.382	16.440	
	11n_HT20	5 745	149	MCS8	17.598	17.714	
		5 785	157		17.540	17.714	
		5 825	165		17.598	17.714	
	11n_HT40	5 755	151	MCS8	35.890	36.006	
		5 795	159		35.770	36.006	
	11ac_VHT80	5 775	155	MCS0	75.716	75.445	

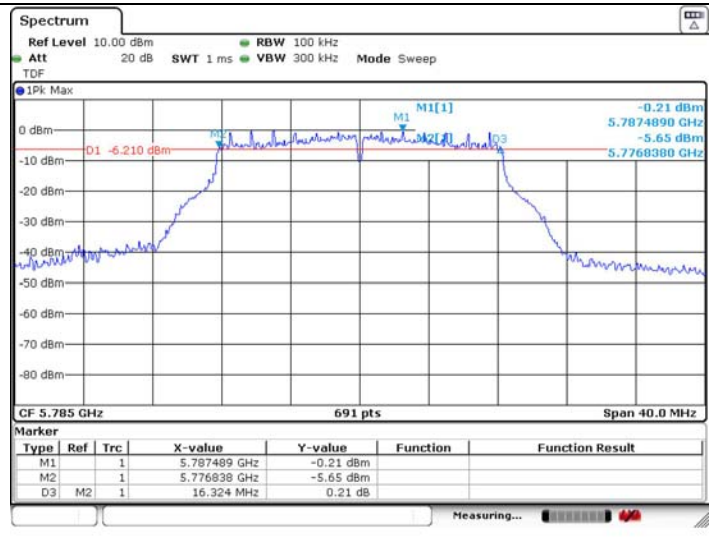
- Test plots

802.11a (Band 3)_ANT 1

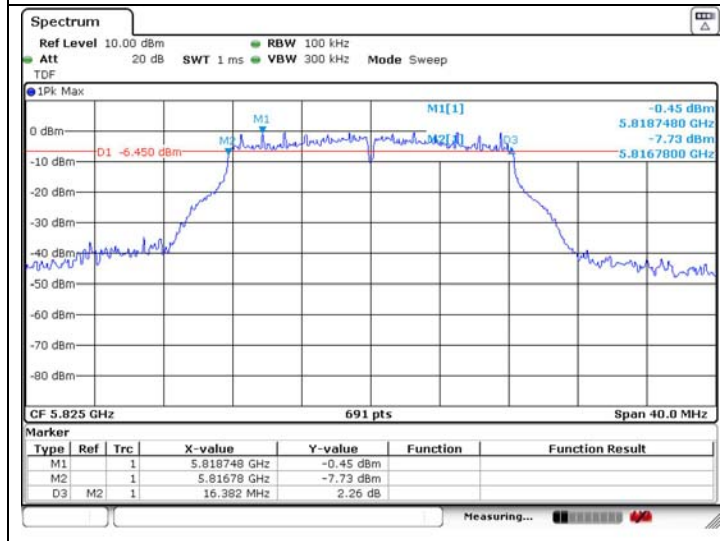
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

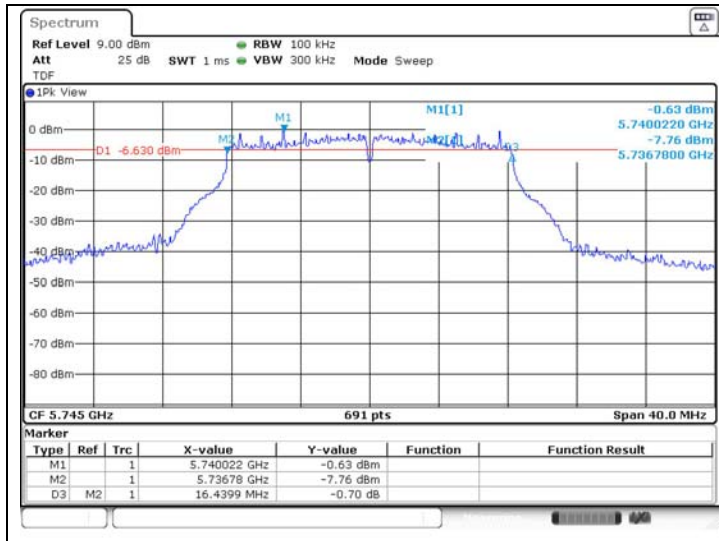


High Channel
(5 825 MHz)

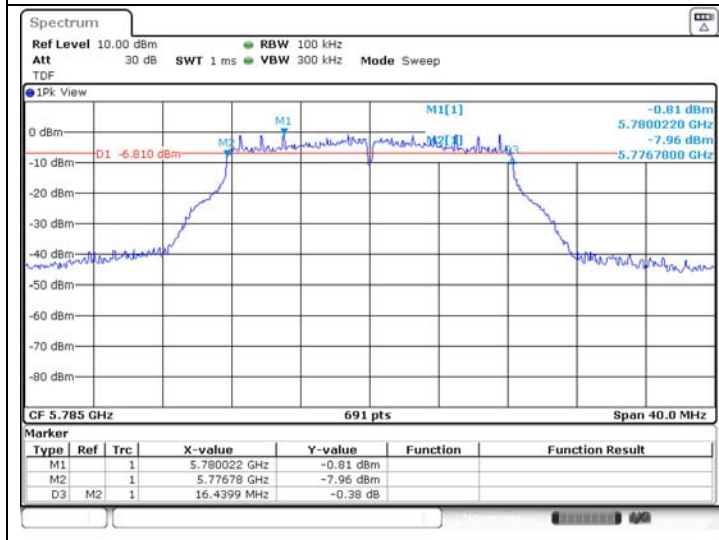


802.11a (Band 3)_ANT 2

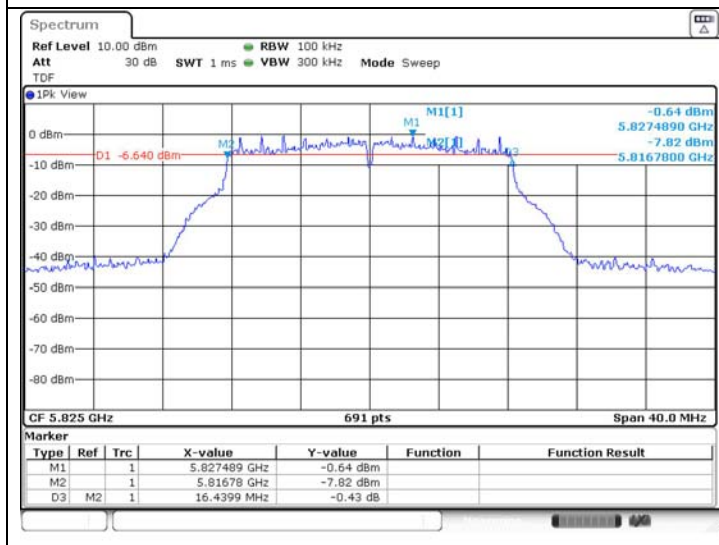
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

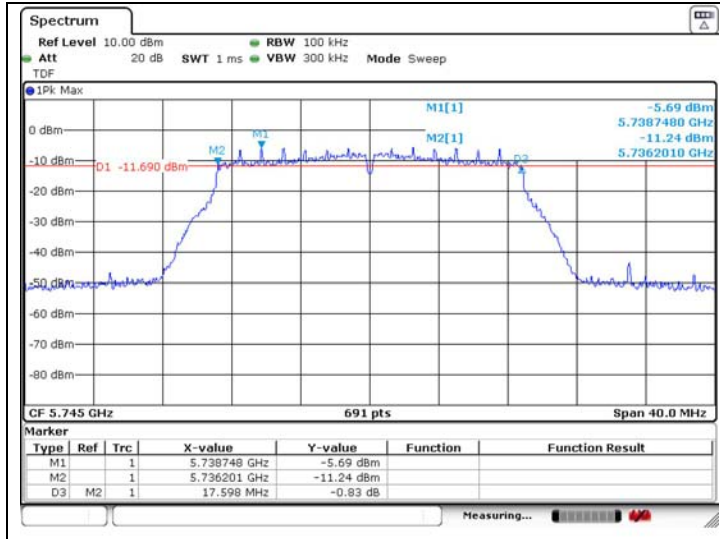


High Channel
(5 825 MHz)

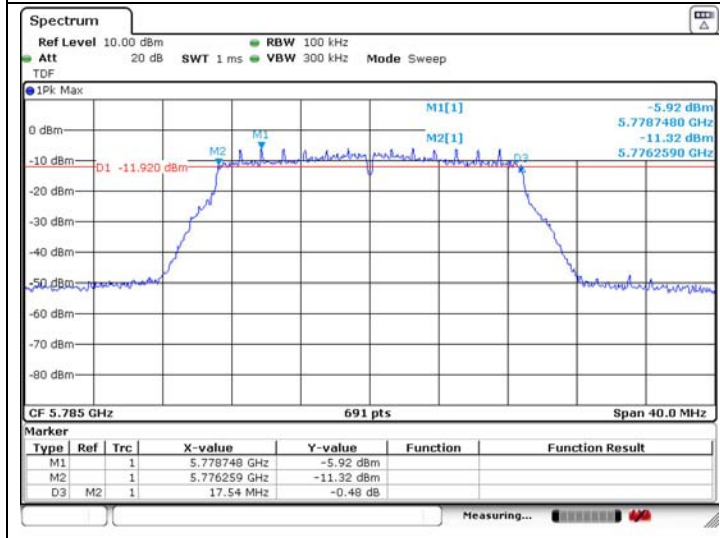


802.11n_HT20 (Band 3)_ANT 1

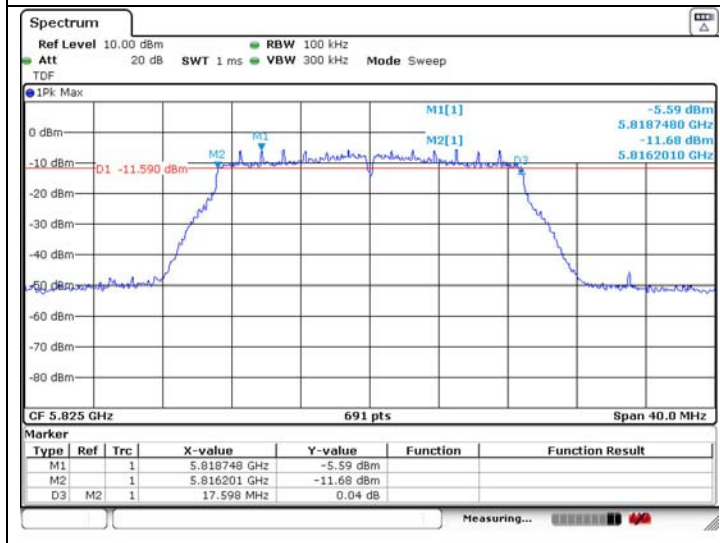
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

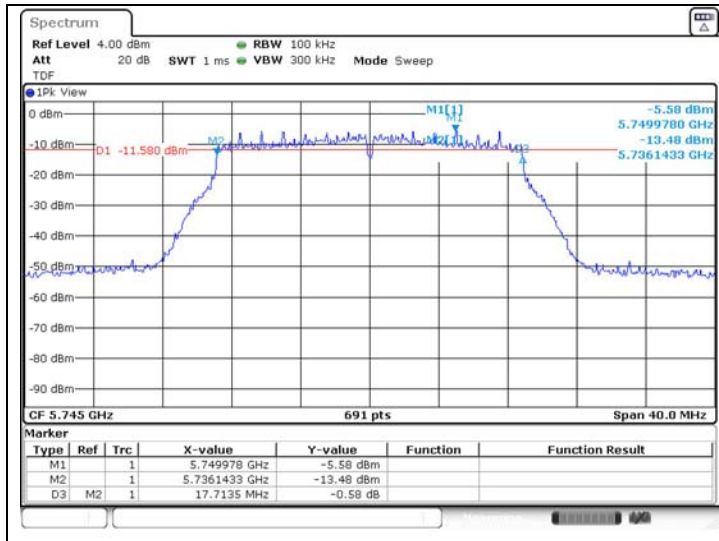


High Channel
(5 825 MHz)

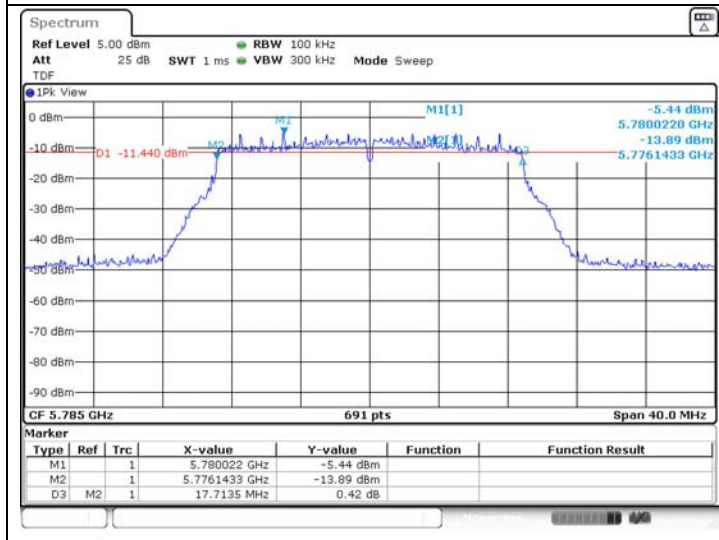


802.11n_HT20 (Band 3)_ANT 2

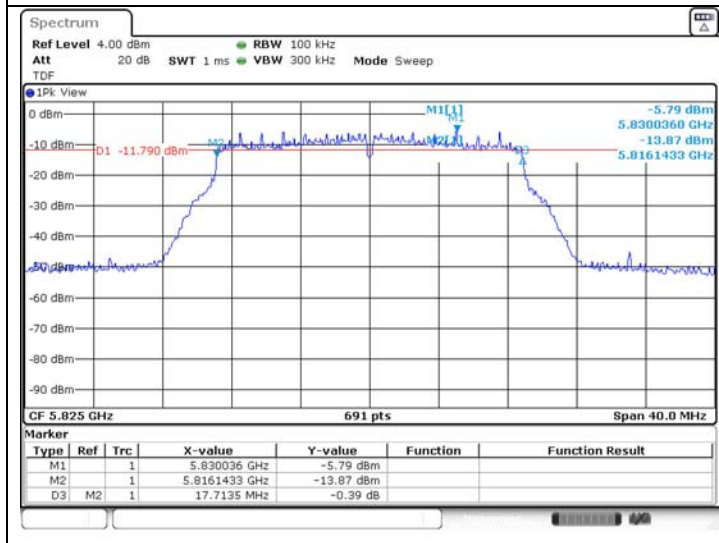
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

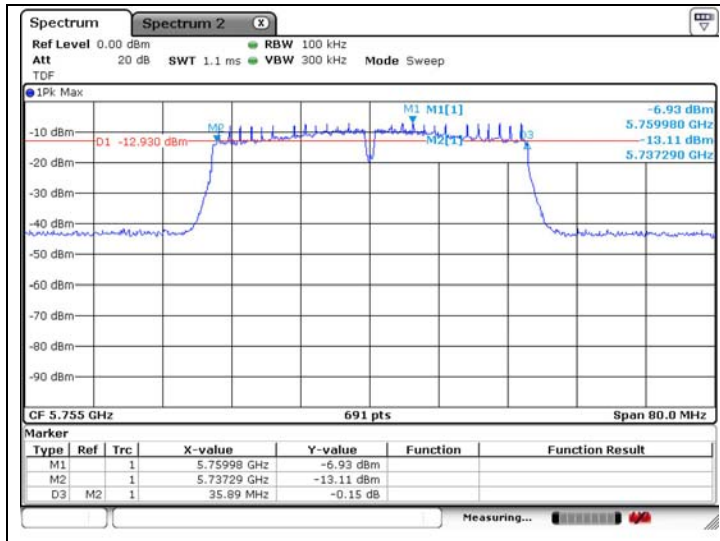


High Channel
(5 825 MHz)

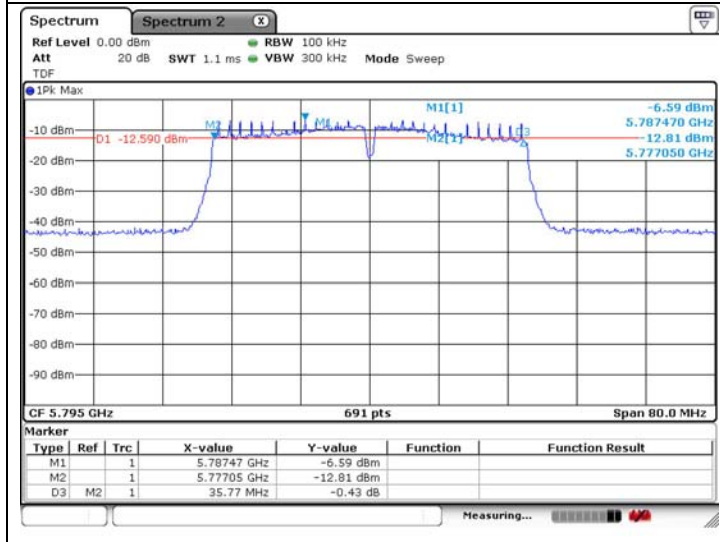


802.11n_HT40 (Band 3)_ANT 1

Low Channel
 (5 755 MHz)

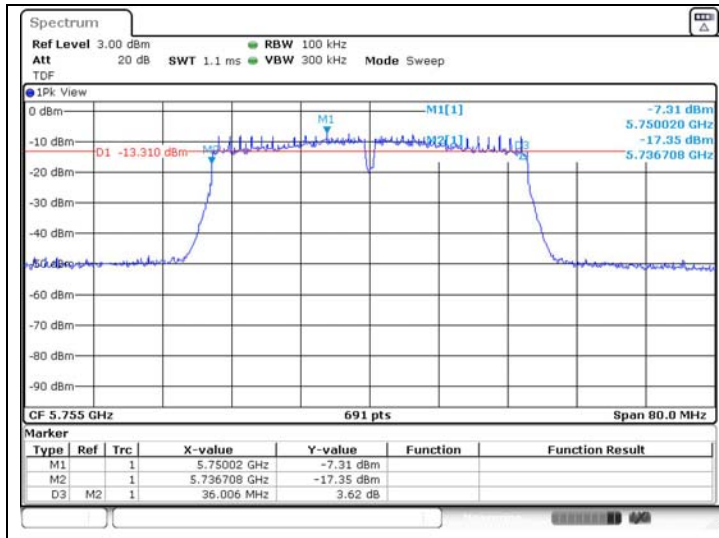


High Channel
 (5 795 MHz)

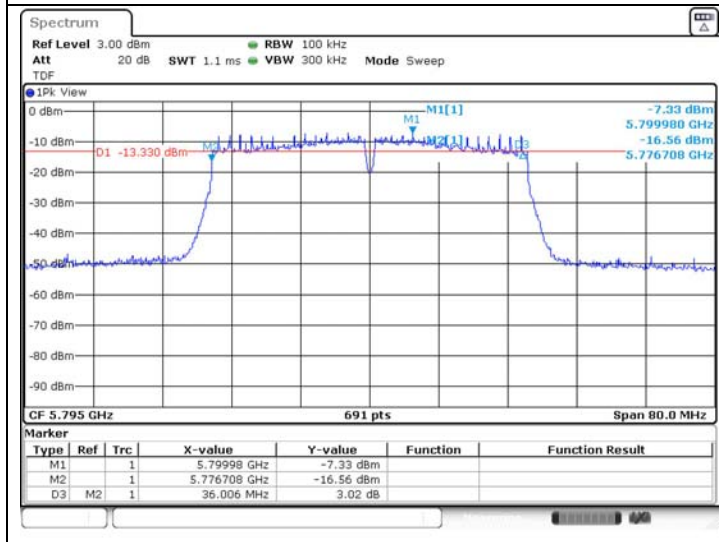


802.11n_HT40 (Band 3)_ANT 2

Low Channel
(5 755 MHz)

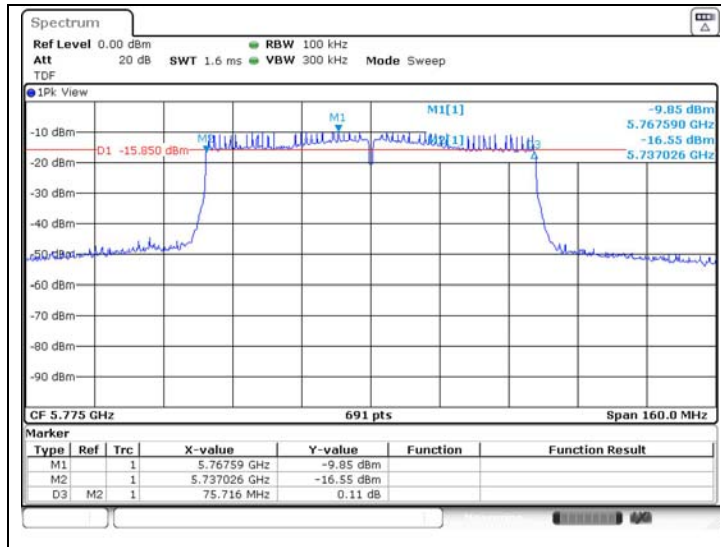


High Channel
(5 795 MHz)



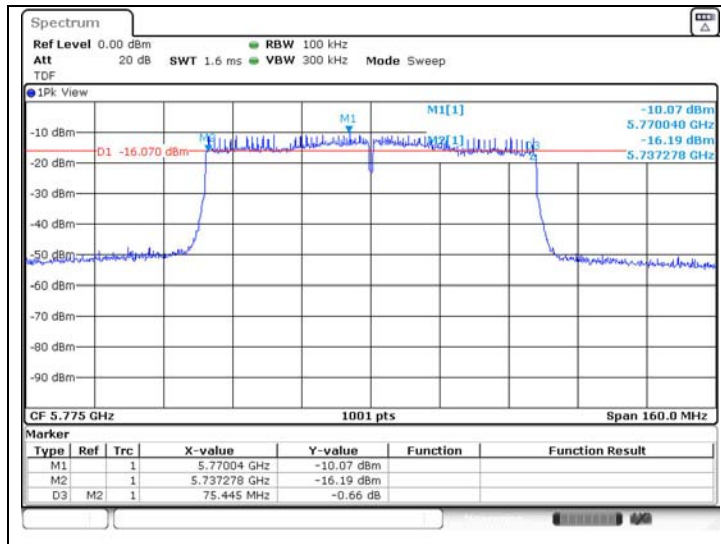
802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
 (5 775 MHz)



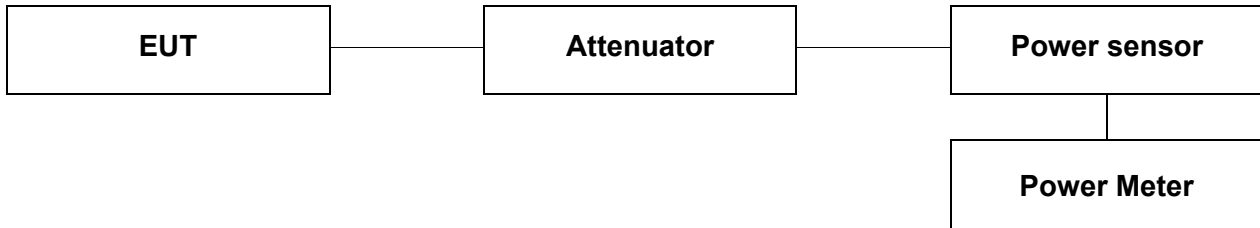
802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
 (5 775 MHz)



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

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, 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 dB m in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB 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 colocated 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 MHz

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

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

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ 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) °C
Relative humidity : 47 % R.H.

Test mode: 11a_ANT1

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 180	6	9.22	0.28	9.50
	5 220		8.93		9.21
	5 240		8.84		9.12
U-NII 3	5 745		11.21		11.49
	5 785		11.06		11.34
	5 825		11.01		11.29

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 180	6	9.50	2.84	12.34
	5 220		9.21		12.05
	5 240		9.12		11.96

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	99 % BW (MHz)	1.76+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 180	14.77	17.019	14.07	2.84	14.07
	5 220		17.077	14.08		14.08
	5 240		17.077	14.08		14.08

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

Test mode: 11a ANT2

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power (dB m)	Duty Cycle Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 180	6	9.13	0.28	9.41
	5 220		8.15		8.43
	5 240		8.82		9.10
U-NII 3	5 745		10.87		11.15
	5 785		10.96		11.24
	5 825		10.72		11.00

Band	Frequency (MHz)	Data Rate (Mbps)	Average Power Result (dB m)	Antenna Gain (dB i)	E.I.R.P. (dB m)
U-NII 1	5 180	6	9.41	2.54	11.95
	5 220		8.43		10.97
	5 240		9.10		11.64

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB 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 (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	1.76+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 180	14.77	17.019	14.07	2.54	14.07
	5 220		17.077	14.08		14.08
	5 240		17.077	14.08		14.08

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

Test mode: 11n HT20

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 Average Power (dB m)	ANT 2 Average Power (dB m)	ANT 1+ANT 2 Average Power (dB m)
U-NII 1	5 180	MCS8	1.35	2.66	5.06
	5 220		1.80	1.84	4.83
	5 240		2.09	2.18	5.15
U-NII 3	5 745		4.93	5.22	8.09
	5 785		5.01	5.05	8.04
	5 825		5.28	4.98	8.14

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dB m)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dB m)
U-NII 1	5 180	MCS8	5.06	0.61	5.67
	5 220		4.83		5.44
	5 240		5.15		5.76
U-NII 3	5 745		8.09		8.70
	5 785		8.04		8.65
	5 825		8.14		8.75

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dB m)	Antenna Gain (dB i)	ANT 1 + ANT 2 E.I.R.P. (dB m)
U-NII 1	5 180	MCS8	5.67	5.70	11.37
	5 220		5.44		11.14
	5 240		5.76		11.46

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	99 % BW (MHz)	1.76+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 180	14.77	17.887	14.29	5.70	14.29
	5 220		17.829	14.27		14.27
	5 240		17.829	14.27		14.27

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	ANT 2 Average Power (dB m)	ANT 1+ANT 2 Average Power (dB m)
U-NII 1	5 190	MCS8	3.30	3.21	6.27
	5 230		3.77	3.17	6.49
U-NII 3	5 755		5.53	5.18	8.37
	5 795		5.53	5.26	8.41

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dB m)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dB m)
U-NII 1	5 190	MCS8	6.27	1.08	7.35
	5 230		6.49		7.57
U-NII 3	5 755		8.37		9.45
	5 795		8.41		9.49

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dB m)	Antenna Gain (dB i)	ANT 1 + ANT 2 E.I.R.P. (dB m)
U-NII 1	5 190	MCS8	7.35	5.70	13.05
	5 230		7.57		13.27

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	99 % BW (MHz)	1.76+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 755	14.77	36.237	17.35	5.70	14.77
	5 795		36.122	17.34		14.77

Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	ANT 2 Average Power (dB m)	ANT 1+ANT 2 Average Power (dB m)
U-NII 1	5 210	MCS0	3.83	3.35	6.61
U-NII 3	5 775		5.29	4.75	8.04

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1+ANT 2 Average Power (dB m)	Duty Cycle Correction Factor (dB)	ANT 1 + ANT 2 Average Power Result (dB m)
U-NII 1	5 210	MCS0	6.61	1.16	7.77
U-NII 3	5 775		8.04		9.20

Band	Frequency (MHz)	Data Rate (Mbps)	ANT 1 + ANT 2 Average Power Result (dB m)	Antenna Gain (dB i)	ANT 1 + ANT 2 E.I.R.P. (dB m)
U-NII 1	5 210	MCS0	7.77	5.70	13.47

Band	FCC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	26 dB BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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 (dB m)	99 % BW (MHz)	1.76+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
U-NII 1	5 775	14.77	75.485	20.54	5.70	14.77
Band	IC Limit					
	Frequency (MHz)	Fixed Limit (dB m)	99 % BW (MHz)	11+10LogB (dB m)	Antenna Gain (dB i)	Limit (dB m)
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: $10 \log \{10^{(\text{ANT 1 power} / 10)} + 10^{(\text{ANT 2 power} / 10)}\}$

Antenna gain: $10 \log \{[10^{(\text{ANT 1 gain} / 20)} + 10^{(\text{ANT 2 gain} / 20)}]^{2 / 2}\}$

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

6. Peak Power Spectral Density

6.1. Test Setup



6.2. Limit

6.2.1. FCC

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

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

According to 15.407(a)(3)

For the band 5.725-5.85 GHz, 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 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi 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.

6.2.2. IC

According to RSS-247 Issue 2,

6.2.1.1 Frequency band 5 150-5 250 MHz

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

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

6.2.4.1 Frequency band 5 725-5 850 MHz

For equipment operating in the band 5 725-5 850 MHz, the minimum 6 dB bandwidth shall be at least 500 kHz. The maximum conducted output power shall not exceed 1 W. The output power spectral density shall not exceed 30 dB m in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dB i are used, both the maximum conducted output power and the output power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB i. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dB i without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint³ systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

6.3. 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 F of KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
2. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, "Compute power...". (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
3. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
4. Make the following adjustments to the peak value of the spectrum, if applicable:
 - a) **If Method SA-2 or SA-2 Alternative was used, add $10 \log(1/x)$, where x is the duty cycle, to the peak of the spectrum.**
 - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
5. The result is the Maximum PSD over 1 MHz reference bandwidth.
6. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, "provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
 - a) Set $RBW \geq 1/T$, where T is defined in section II.B.1.a).
 - b) Set $VBW \geq 3$ RBW.
 - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10\log(500 \text{ kHz}/RBW)$ to the measured result, whereas $RBW (< 500 \text{ kHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
 - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10\log(1 \text{ MHz}/RBW)$ to the measured result, whereas $RBW (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
 - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

6.4. Test result

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

Test mode: 11a_ANT1

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-1.75	0.28	-1.47	11
	5 220	44		-1.53		-1.25	
	5 240	48		-1.71		-1.43	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	149	6	-1.54	0.28	-1.26	30
	5 785	157		-1.90		-1.62	
	5 825	165		-1.83		-1.55	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-1.47	2.84	1.37	10
	5 220	44		-1.25		1.59	
	5 240	48		-1.43		1.41	

Test mode: 11a_ANT2

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-2.23	0.28	-1.95	11
	5 220	44		-2.17		-1.89	
	5 240	48		-1.93		-1.65	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Measured PPSD (dB m)	Duty Cycle Correction Factor (dB)	Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	149	6	-1.96	0.28	-1.68	30
	5 785	157		-1.90		-1.62	
	5 825	165		-2.06		-1.78	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	Final PPSD (dB m)	Antenna Gain (dB i)	E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 180	36	6	-1.95	2.54	0.59	10
	5 220	44		-1.89		0.65	
	5 240	48		-1.65		0.89	

Test mode: 11n_HT20

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1 Measured PPSD (dB m)	ANT 2 Measured PPSD (dB m)	ANT 1+ANT 2 PPSD (dB m)
U-NII 1	5 180	36	MCS8	-8.20	-6.97	-4.53
	5 220	44		-8.31	-7.07	-4.64
	5 240	48		-8.31	-7.32	-4.78
U-NII 3	5 745	149		-7.48	-7.84	-4.65
	5 785	157		-7.82	-8.09	-4.94
	5 825	165		-8.25	-7.86	-5.04

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 180	36	MCS8	-4.53	0.61	-3.92	11
	5 220	44		-4.64		-4.03	
	5 240	48		-4.78		-4.17	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 745	149	MCS8	-4.65	0.61	-4.04	30
	5 785	157		-4.94		-4.33	
	5 825	165		-5.04		-4.43	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 Final PPSD (dB m)	Antenna Gain (dB i)	ANT 1+ANT 2 E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 180	36	MCS8	-3.92	5.70	1.78	10
	5 220	44		-4.03		1.67	
	5 240	48		-4.17		1.53	

Test mode: 11n_HT40

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1 Measured PPSD (dB m)	ANT 2 Measured PPSD (dB m)	ANT 1+ANT 2 PPSD (dB m)
U-NII 1	5 190	38	MCS8	-7.81	-8.05	-4.92
	5 230	46		-7.68	-8.49	-5.06
U-NII 3	5 755	151		-7.28	-11.39	-5.86
	5 795	159		-7.44	-11.31	-5.95

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 190	38	MCS8	-4.92	1.08	-3.84	11
	5 230	46		-5.06		-3.98	
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 755	151	MCS8	-5.86	1.08	-4.78	30
	5 795	159		-5.95		-4.87	

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 Final PPSD (dB m)	Antenna Gain (dB i)	ANT 1+ANT 2 E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 190	38	MCS8	-3.84	5.70	1.86	10
	5 230	46		-3.98		1.72	

Test mode: 11ac_VHT80

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1 Measured PPSD (dB m)	ANT 2 Measured PPSD (dB m)	ANT 1+ANT 2 PPSD (dB m)
U-NII 1	5 210	42	MCS0	-14.02	-14.84	-11.40
U-NII 3	5 775	155		-13.57	-14.44	-10.97

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/1 MHz)
U-NII 1	5 210	42	MCS0	-11.40	1.16	-10.24	11
Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 PPSD (dB m)	Duty Cycle Correction Factor (dB)	ANT 1+ANT 2 Final PPSD (dB m)	Limit (dB m/500 kHz)
U-NII 3	5 775	155	MCS0	-10.97	1.16	-9.81	30

Band	Frequency (MHz)	Ch.	Data Rate (Mbps)	ANT 1+ANT 2 Final PPSD (dB m)	Antenna Gain (dB i)	ANT 1+ANT 2 E.I.R.P. PPSD (dB m)	IC Limit (dB m/1 MHz)
U-NII 1	5 210	42	MCS0	-10.24	5.70	-4.54	10

Remark;

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

PPSD: $10 \log \{10^{(ANT\ 1\ PSD / 10)} + 10^{(ANT\ 2\ PSD / 10)}\}$

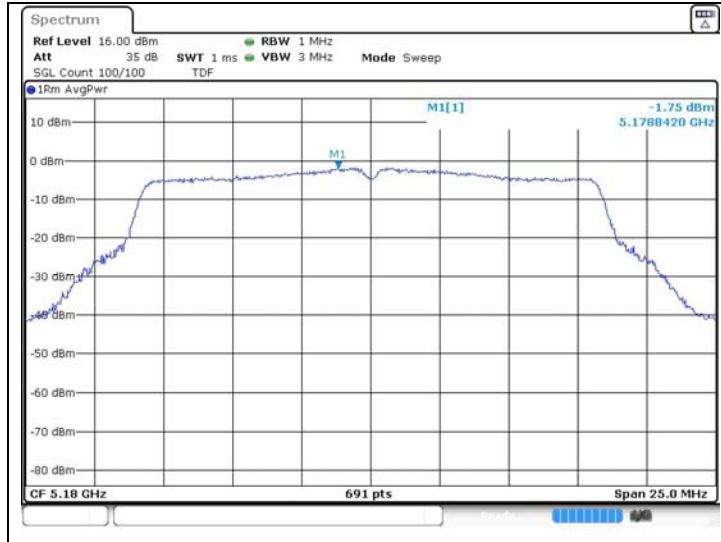
Antenna Gain: $10 \log \{[10^{(ANT\ 1\ gain / 20)} + 10^{(ANT\ 2\ gain / 20)}]^{2 / 2}\}$

Final PPSD (dB m) = PPSD (dB m) + Duty Correction Correction Factor (dB)

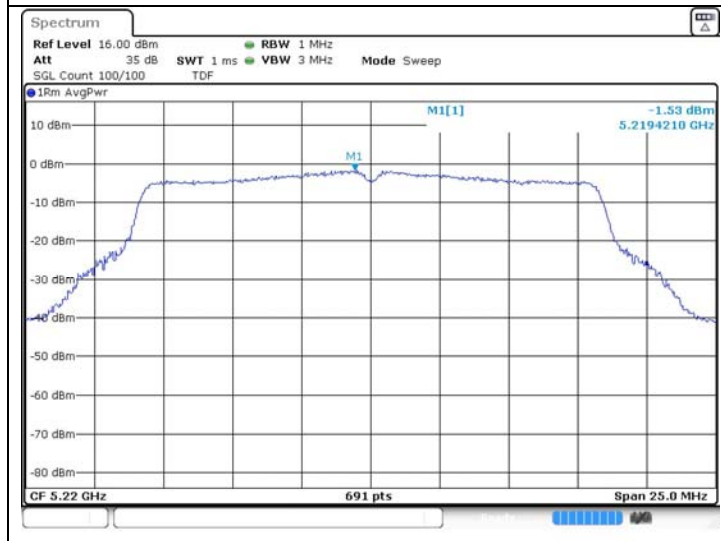
- Test plots

OFDM: 802.11a (Band 1)_ANT 1

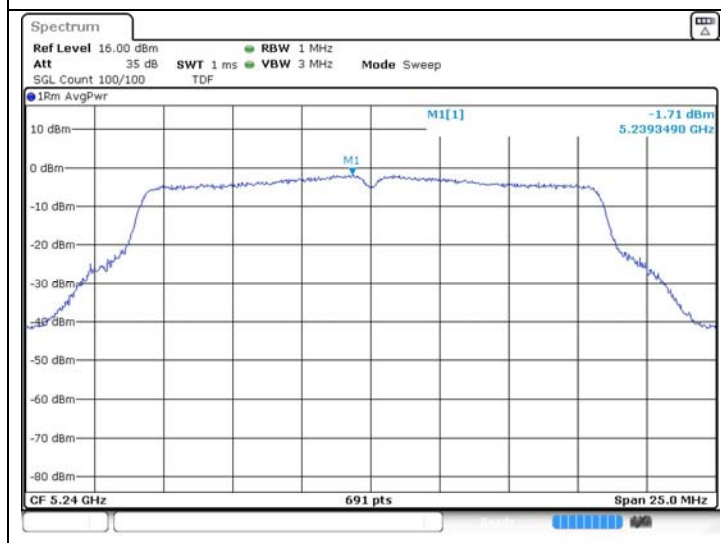
Low Channel
(5 180 MHz)



Middle Channel
(5 220 MHz)

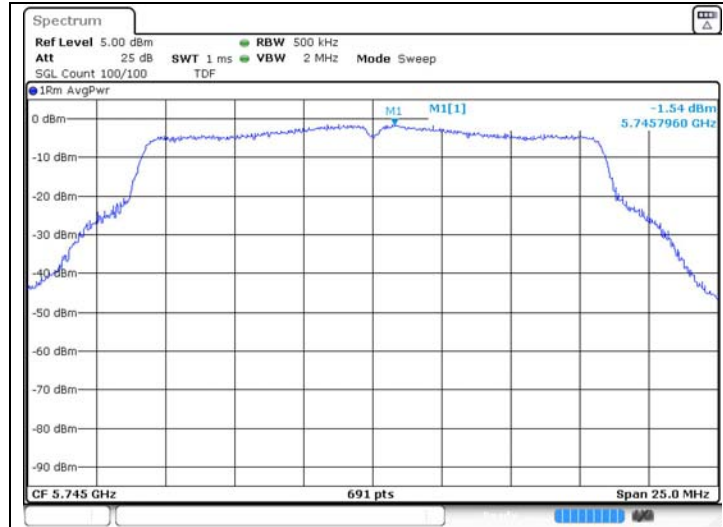


High Channel
(5 240 MHz)

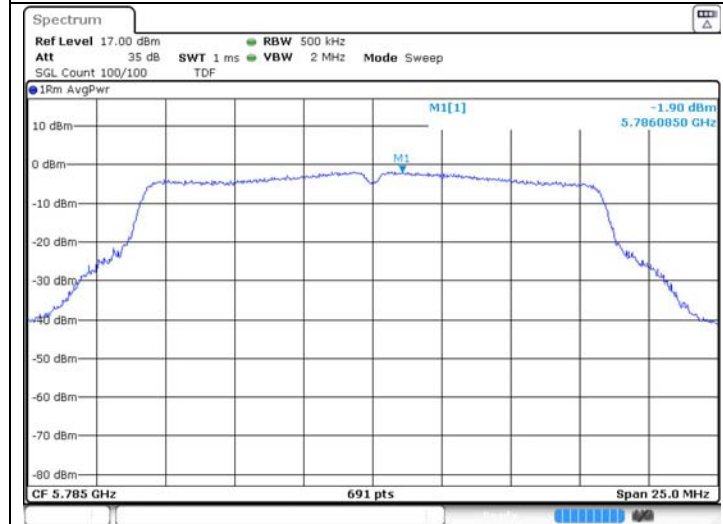


OFDM: 802.11a (Band 3)_ANT 1

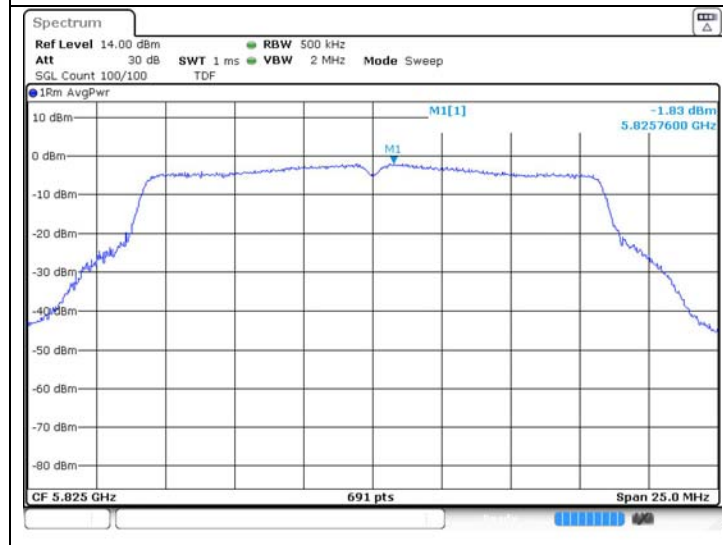
Low Channel
 (5 745 MHz)



Middle Channel
 (5 785 MHz)

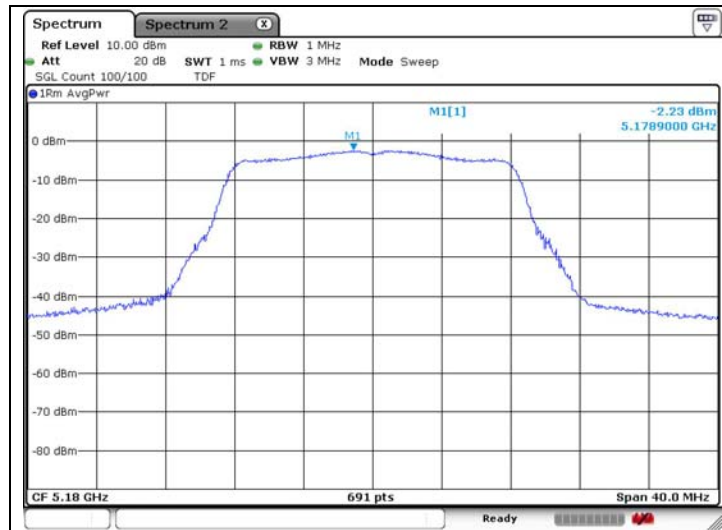


High Channel
 (5 825 MHz)



OFDM: 802.11a (Band 1)_ANT 2

Low Channel
 (5 180 MHz)



Middle Channel
 (5 220 MHz)

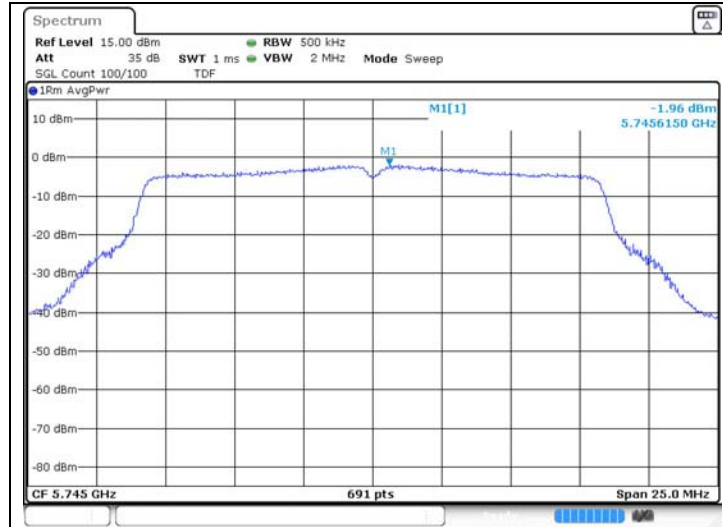


High Channel
 (5 240 MHz)



OFDM: 802.11a (Band 3)_ANT 2

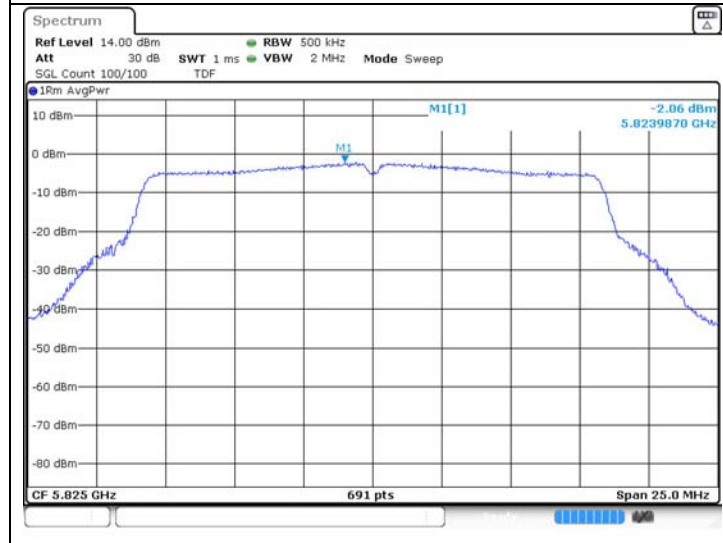
Low Channel
 (5 745 MHz)



Middle Channel
 (5 785 MHz)

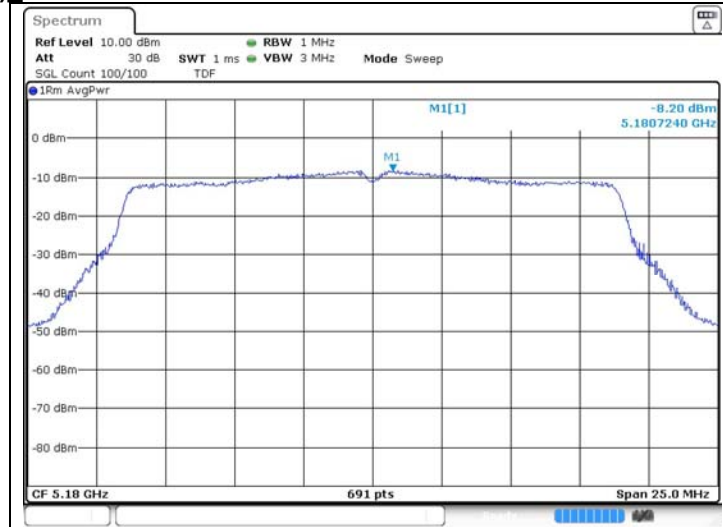


High Channel
 (5 825 MHz)

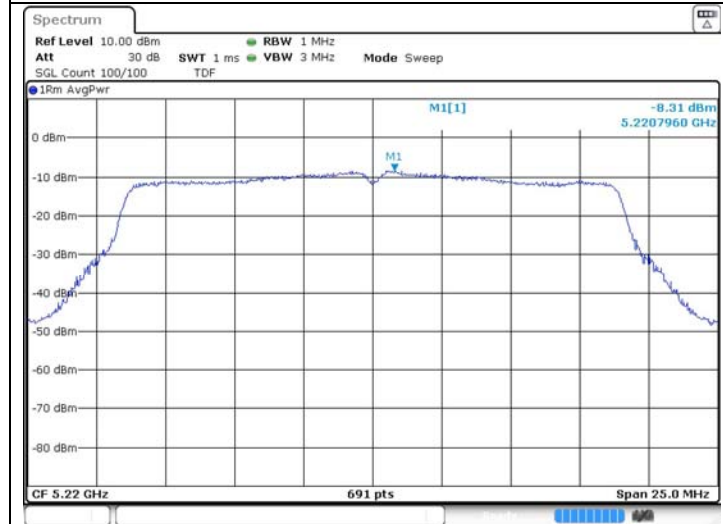


OFDM: 802.11n_HT20 (Band 1) ANT 1

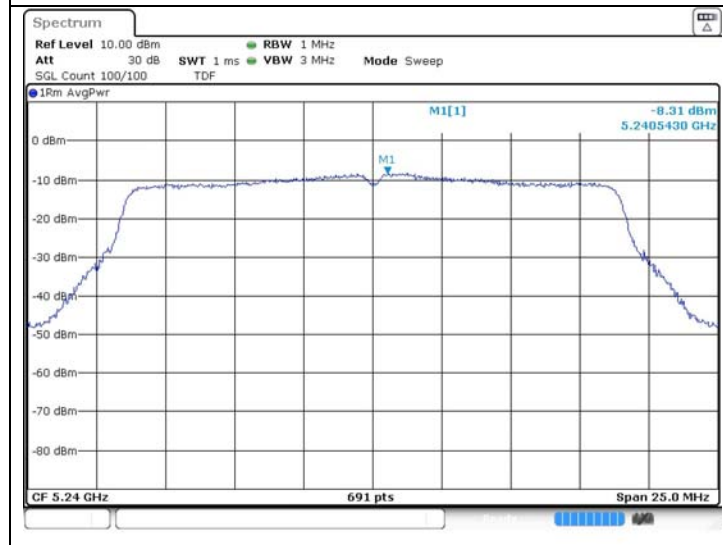
Low Channel
(5 180 MHz)



Middle Channel
(5 220 MHz)

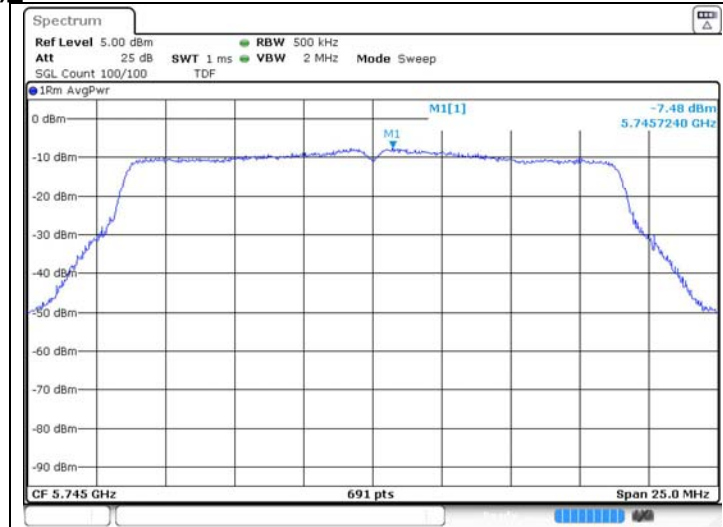


High Channel
(5 240 MHz)



OFDM: 802.11n_HT20 (Band 3) ANT 1

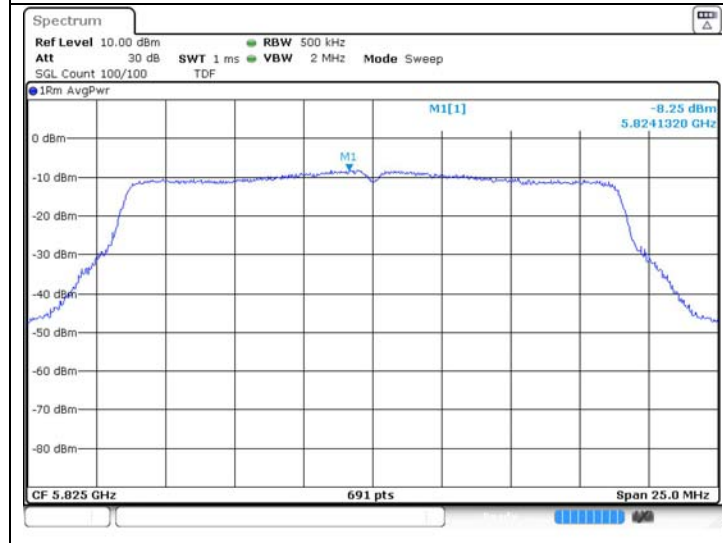
Low Channel
 (5 745 MHz)



Middle Channel
 (5 785 MHz)



High Channel
 (5 825 MHz)



OFDM: 802.11n_HT20 (Band 1) ANT 2

Low Channel
 (5 180 MHz)



Middle Channel
 (5 220 MHz)



High Channel
 (5 240 MHz)



OFDM: 802.11n_HT20 (Band 3) ANT 2

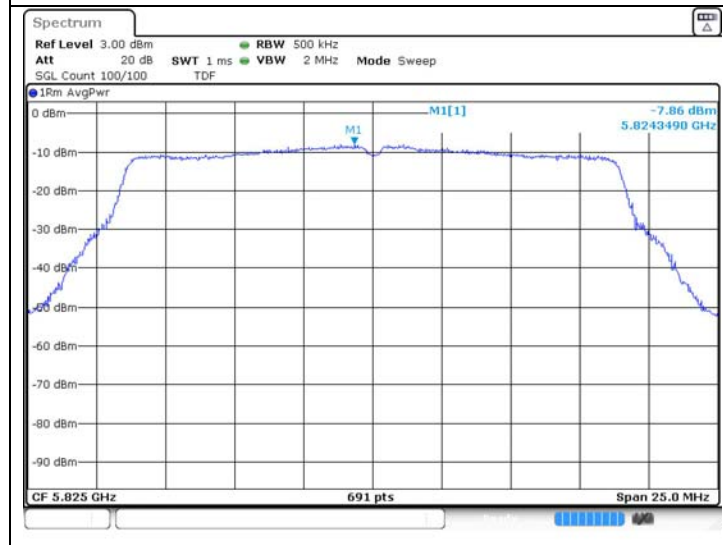
Low Channel
(5 745 MHz)



Middle Channel
(5 785 MHz)

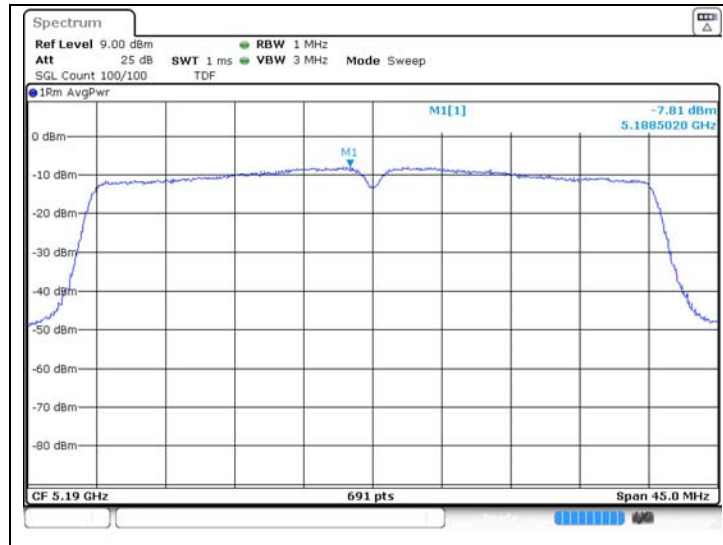


High Channel
(5 825 MHz)

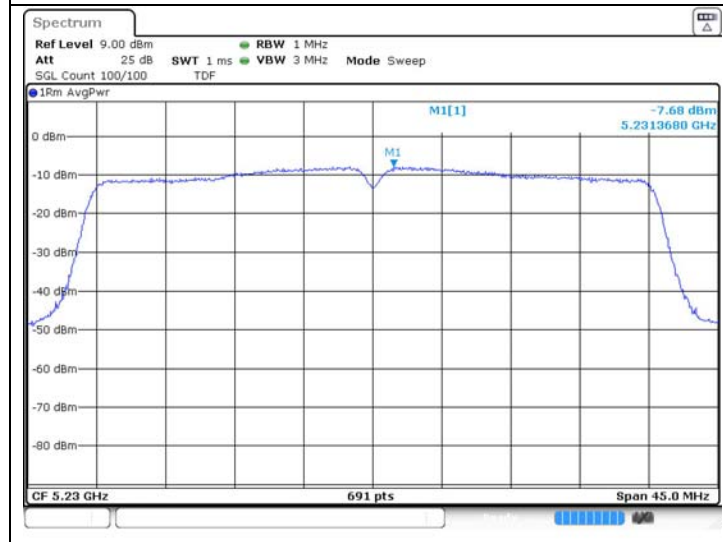


OFDM: 802.11n_HT40 (Band 1)_ANT 1

Low Channel
(5 190 MHz)

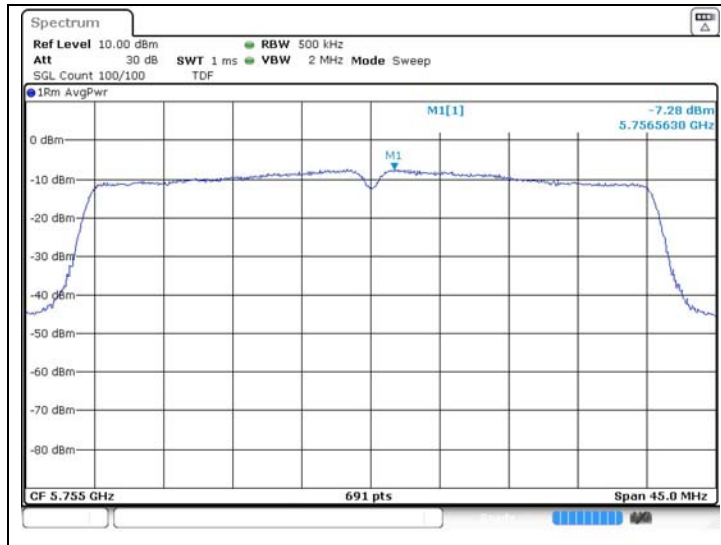


High Channel
(5 230 MHz)

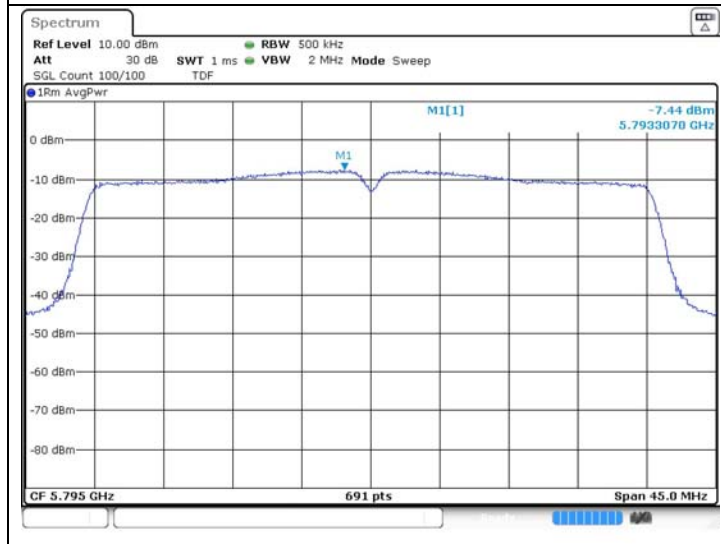


OFDM: 802.11n_HT40 (Band 3)_ANT 1

Low Channel
 (5 755 MHz)

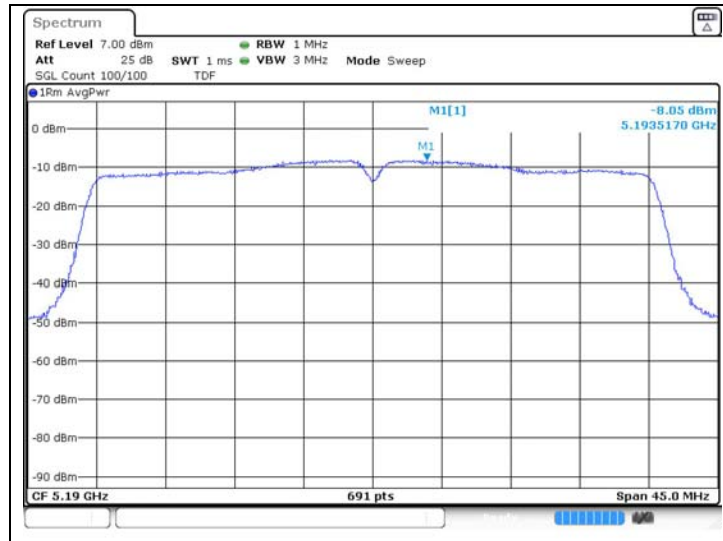


High Channel
 (5 795 MHz)

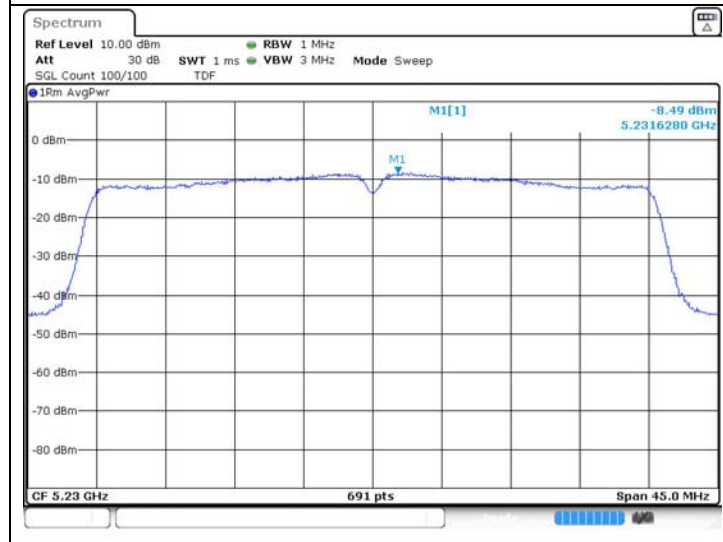


OFDM: 802.11n_HT40 (Band 1)_ANT 2

Low Channel
(5 190 MHz)

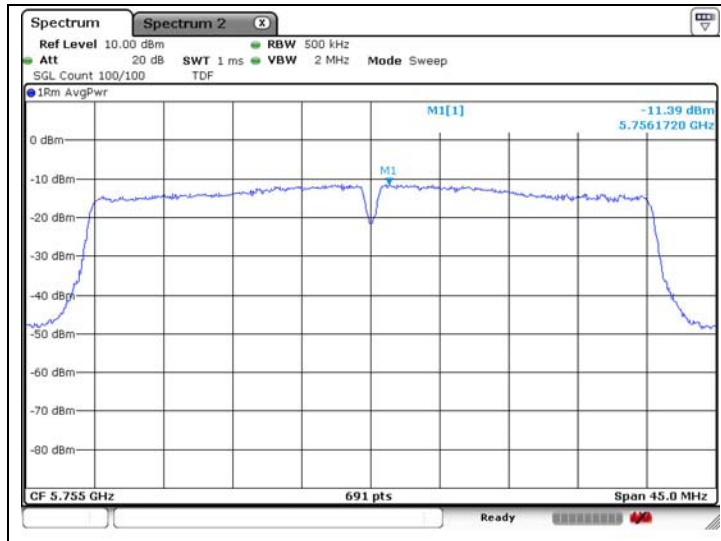


High Channel
(5 230 MHz)

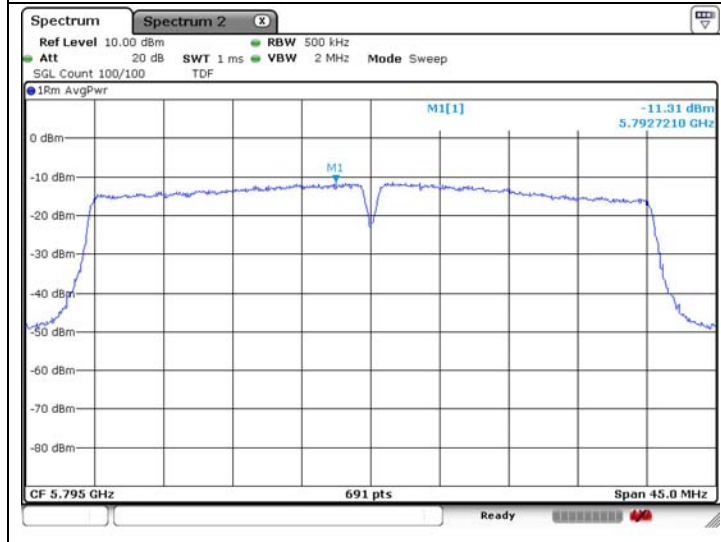


OFDM: 802.11n_HT40 (Band 3)_ANT 2

Low Channel
 (5 755 MHz)

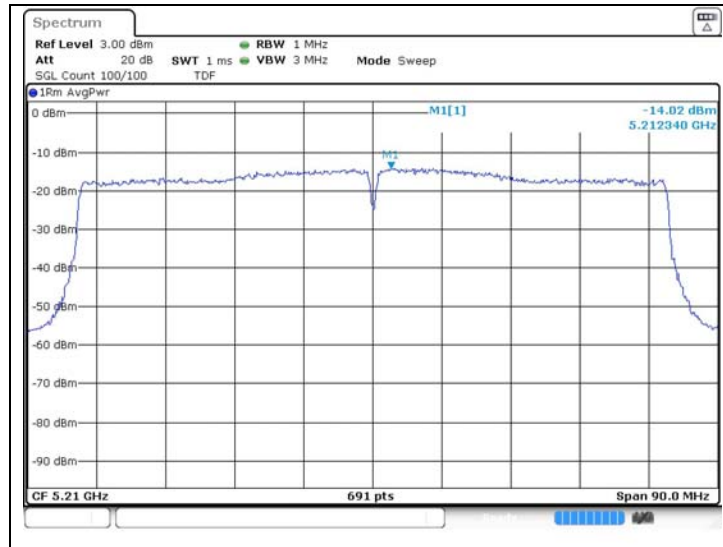


High Channel
 (5 795 MHz)



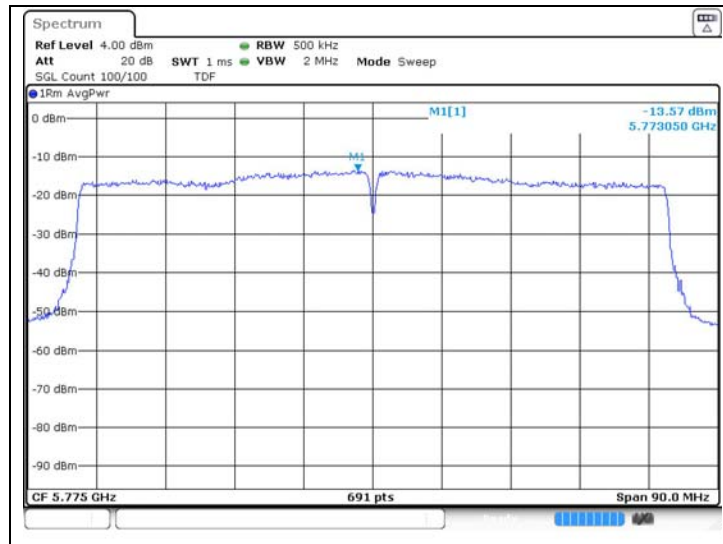
OFDM: 802.11ac_VHT80 (Band 1)_ANT 1

Middle Channel
 (5 210 MHz)



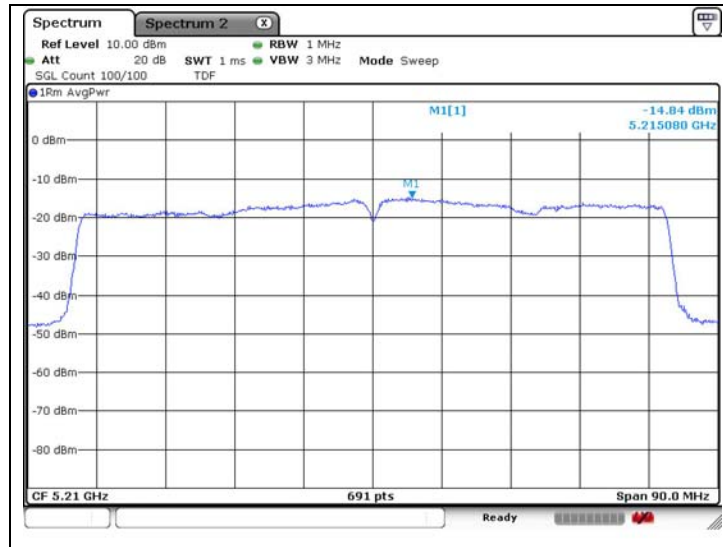
OFDM: 802.11ac_VHT80 (Band 3)_ANT 1

Middle Channel
 (5 290 MHz)



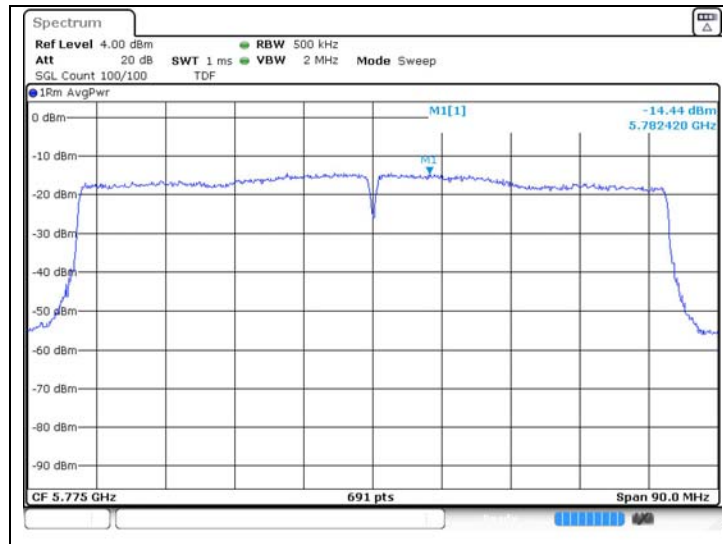
OFDM: 802.11ac_VHT80 (Band 1)_ANT 2

Middle Channel
 (5 210 MHz)



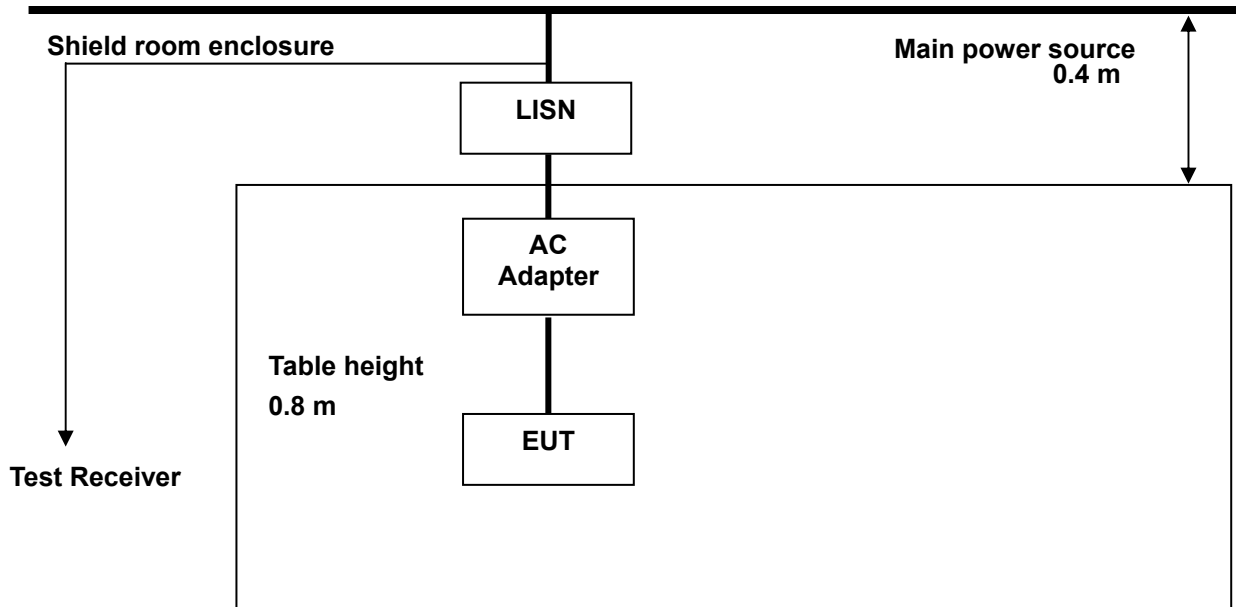
OFDM: 802.11ac_VHT80 (Band 3)_ANT 2

Middle Channel
 (5 290 MHz)



7. AC Power Line Conducted Emission

7.1. Test Setup



7.2. Limit

7.2.1. FCC

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H / 50 ohms line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

7.2.2. IC

RSS-Gen Issue 5, 8.8, Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 μ H / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 4 - AC power-line conducted emissions limits

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 ¹	56 to 46 ¹
0.5-5	56	46
5-30	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

For an EUT with a permanent or detachable antenna operating between 150 kHz and 30 MHz, the AC power-line conducted emissions must be measured using the following configurations:

- (a) Perform the AC power-line conducted emissions test with the antenna connected to determine compliance with the limits of table 4 outside the transmitter's fundamental emission band.
- (b) Retest with a dummy load instead of the antenna to determine compliance with the limits of table 4 within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network that simulates the antenna in the fundamental frequency band.

7.3. Test Procedures

AC conducted emissions from the EUT were measured according to the dictates of ANSI C63.10-2013

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

7.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

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

Frequency range : 0.15 MHz - 30 MHz
Measured Bandwidth : 9 kHz

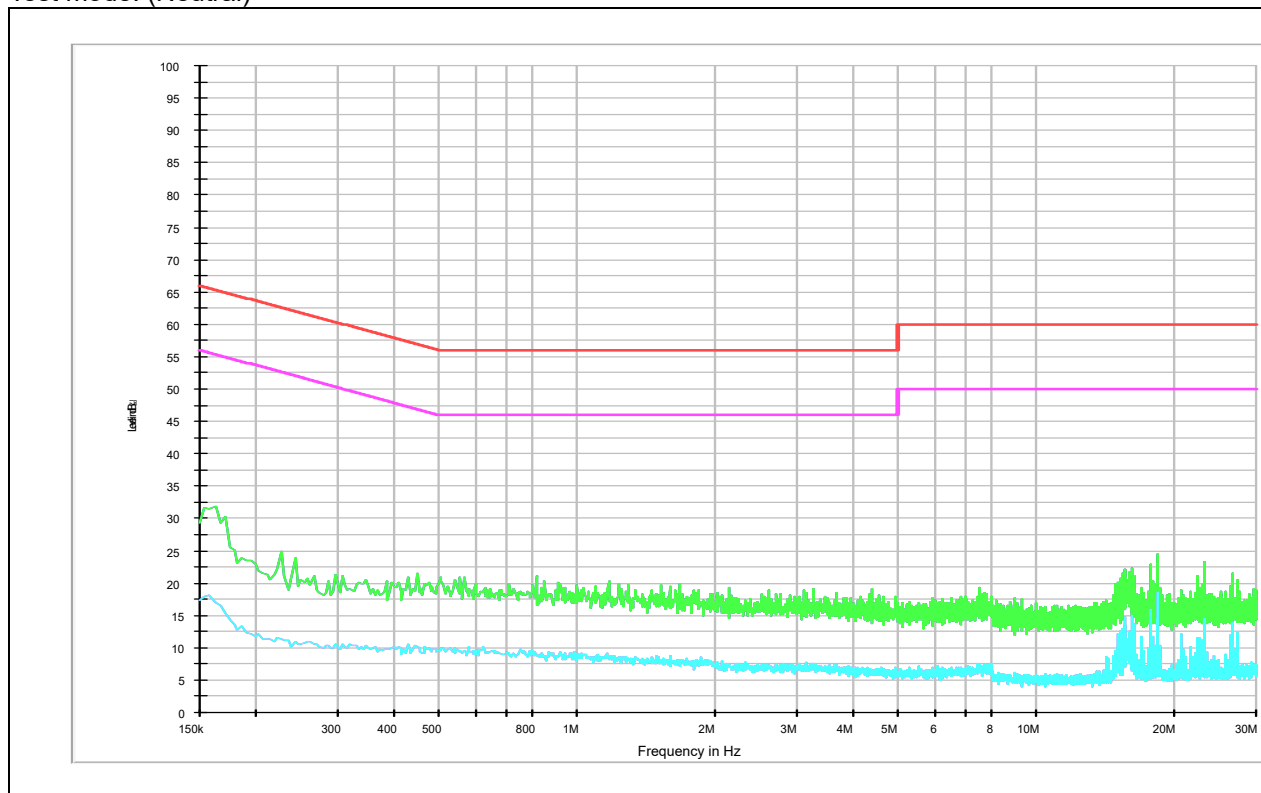
FREQ. (MHz)	LEVEL (dBμV)		LINE	LIMIT (dBμV)		MARGIN (dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.16	24.50	17.30	N	65.46	55.46	40.96	38.16
0.23	16.80	11.20	N	62.45	52.45	45.65	41.25
0.81	14.70	9.20	N	56.00	46.00	41.30	36.80
15.56	19.10	13.50	N	60.00	50.00	40.90	36.50
18.24	22.40	18.00	N	60.00	50.00	37.60	32.00
23.13	20.60	16.10	N	60.00	50.00	39.40	33.90
0.16	25.00	17.70	H	65.46	55.46	40.46	37.76
0.19	19.00	12.90	H	64.04	54.04	45.04	41.14
0.24	16.60	10.70	H	62.10	52.10	45.50	41.40
15.62	21.40	16.40	H	60.00	50.00	38.60	33.60
18.30	19.70	15.20	H	60.00	50.00	40.30	34.80
26.61	20.40	15.50	H	60.00	50.00	39.60	34.50

Remark;

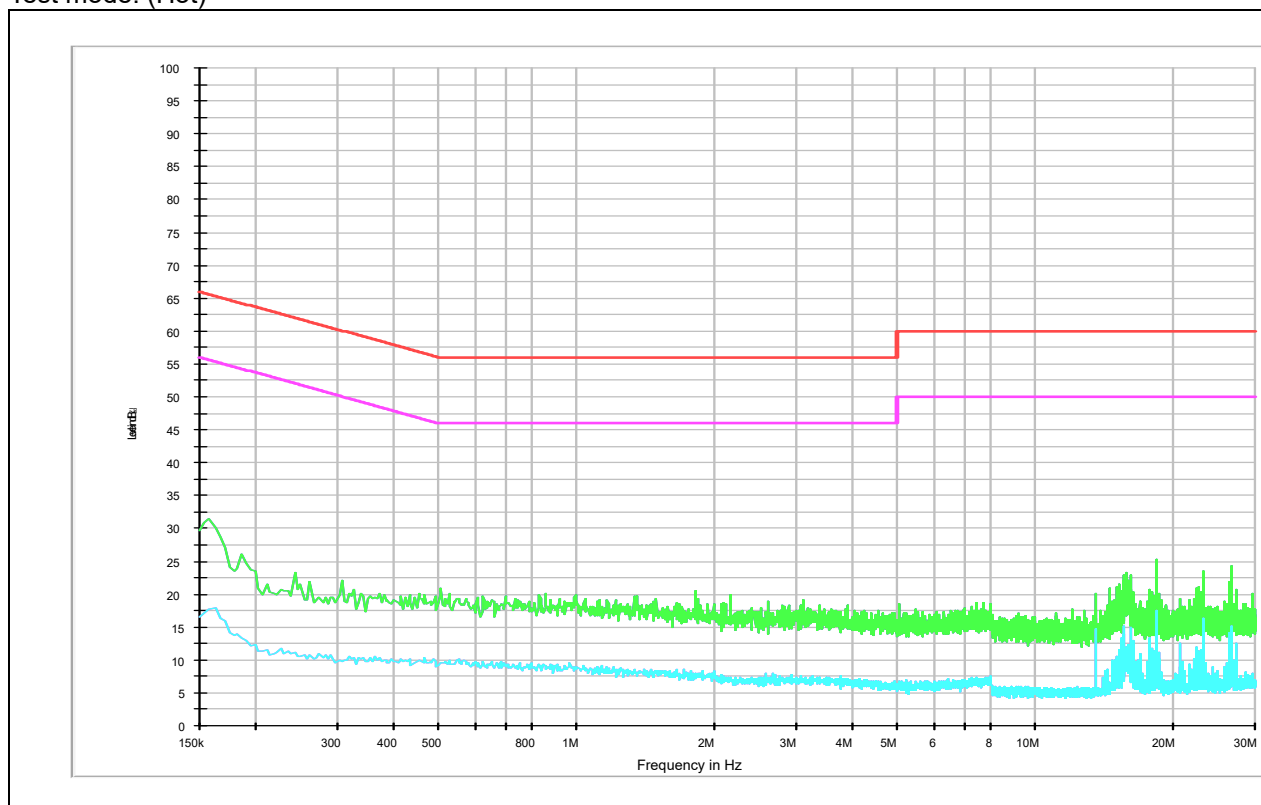
1. Line (H): Hot, Line (N): Neutral.
2. All modes of operation were investigated and the worst-case emissions were reported using **11a ANT1 (Band 3) / 6 Mbps / Low channel.**
3. The limit for Class B device(s) from 150 kHz to 30 MHz are specified in Section of the Title 47 CFR.
4. Traces shown in plot were made by using a peak detector and average detector.
5. Deviations to the Specifications: None.

- Test plots

Test mode: (Neutral)



Test mode: (Hot)



8. Antenna Requirement

8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section §15.407 (a) if transmitting antennas of directional gain greater than 6 dB i are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dB i.

8.2. Antenna Connected Construction

Antenna used in this product is PCB & Cable Assembly antenna and peak max gain of antenna as below.

Band	5 150 MHz – 5 250 MHz	5 725 MHz – 5 850 MHz
Mode	11a/n_HT20, HT40, 11ac_VHT20, VHT40, VHT80	
ANT1 Gain	2.84 dB i	2.73 dB i
ANT2 Gain	2.54 dB i	2.45 dB i
ANT1+ANT2 Gain	5.70 dB i	5.60 dB i

Unequal antenna gains, with equal transmit powers. For antenna gains given by $G_1, G_2, \dots, G_N$ dB i

(i) If transmit signals are correlated, then

Directional gain = $10 \log[(10^{G_1/20} + 10^{G_2/20} + \dots + 10^{G_N/20})^2 / N_{ANT}]$ dB i [Note the “20”s in the denominator of each exponent and the square of the sum of terms; the object is to combine the signal levels coherently.]

- End of the Test Report -