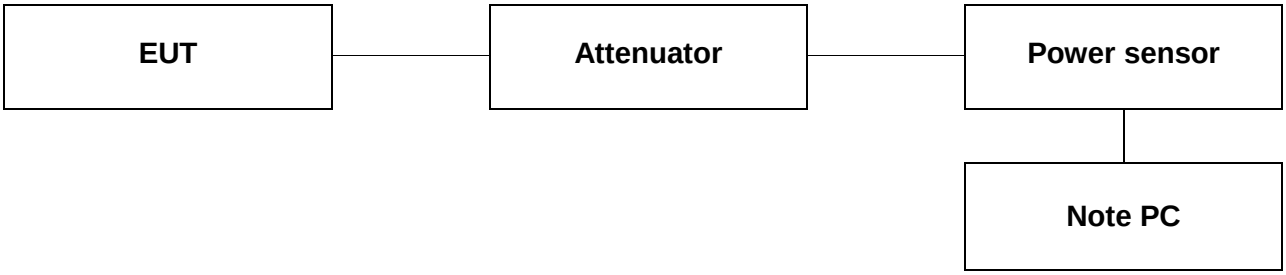
5. Maximum Conducted Output Power

5.1. Test setup



5.2. Limit

FCC 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.

(a)(2)

For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 ㏈m 10 log B, where B is the 26 ㏈ emission bandwidth in megahertz. 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.

(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.

5.3. Test procedure

1. This measurement settings are specified in section E.3.a of KDB 789033_D02 v01r02.
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 percent).
6. In case of band crossing channels 144, the measurement is complied with section E.2.d of KDB 789033_D02 v01r02 and section D of KDB 644545_D03 v01.

5.4. Test result

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

- 11a

Band	Frequency (㎒)	Conducted Power (㏈m)			
		Data Rate [Mbps]	Average Power (㏈m)	Duty Correction Factor (㏈)	Average Power Result (㏈m)
U-NII 1	5 180	6	10.18	0.04	10.22
	5 200	6	10.28	0.04	10.32
	5 240	6	10.82	0.04	**10.86**
U-NII 2A	5 260	6	11.16	0.04	11.20
	5 280	6	11.22	0.04	11.26
	5 320	6	11.48	0.04	**11.52**
U-NII 2C	5 500	6	11.02	0.04	**11.06**
	5 580	6	10.53	0.04	10.57
	5 720	6	9.62	0.04	9.66
U-NII 3	5 745	6	9.52	0.04	**9.56**
	5 785	6	8.93	0.04	8.97
	5 825	6	8.63	0.04	8.67

Band	Conducted Power Limit (㏈m)					
	Frequency (㎒)	Fixed Limit (㏈m)	26 ㏈ BW (㎒)	11+10LogB (㏈m)	Antenna gain (㏈i)	Limit (㏈m)
U-NII 1	5 180	23.98				
	5 200	23.98				
	5 240	23.98				
U-NII 2A	5 260	23.98	20.40	24.10	3.50	23.98
	5 280	23.98	20.30	24.07	3.50	23.98
	5 320	23.98	20.34	24.08	3.50	23.98
U-NII 2C	5 500	23.98	20.34	24.08	3.34	23.98
	5 580	23.98	20.38	24.09	3.34	23.98
	5 720	23.98	20.30	24.07	3.34	23.98
U-NII 3	5 745	30				
	5 785	30				
	5 825	30				

- 11n_HT20

Band	Frequency (㎒)	Conducted Power (dB m)			
		Data Rate [Mbps]	Average Power (dB m)	Duty Correction Factor (dB)	Average Power Result (dB m)
U-NII 1	5 180	MCS0	9.58	0.04	9.62
	5 200	MCS0	9.76	0.04	9.80
	5 240	MCS0	10.01	0.04	**10.05**
U-NII 2A	5 260	MCS0	10.29	0.04	10.33
	5 280	MCS0	10.36	0.04	10.40
	5 320	MCS0	10.61	0.04	**10.65**
U-NII 2C	5 500	MCS0	10.11	0.04	**10.15**
	5 580	MCS0	9.72	0.04	9.76
	5 720	MCS0	9.65	0.04	9.69
U-NII 3	5 745	MCS0	8.63	0.04	**8.67**
	5 785	MCS0	8.00	0.04	8.04
	5 825	MCS0	7.87	0.04	7.91

Band	Conducted Power Limit (dB m)					
	Frequency (㎒)	Fixed Limit (dB m)	26 dB BW (㎒)	11+10LogB (dB m)	Antenna gain (dB i)	Limit (dB m)
U-NII 1	5 180	23.98				
	5 200	23.98				
	5 240	23.98				
U-NII 2A	5 260	23.98	20.48	24.11	3.50	23.98
	5 280	23.98	20.50	24.12	3.50	23.98
	5 320	23.98	20.46	24.11	3.50	23.98
U-NII 2C	5 500	23.98	20.50	24.12	3.34	23.98
	5 580	23.98	20.46	24.11	3.34	23.98
	5 720	23.98	20.50	24.12	3.34	23.98
U-NII 3	5 745	30				
	5 785	30				
	5 825	30				

-Band-crossing channels

Band	Mode	Frequency (㎒)	Mea. Average (㏈m)	Duty Correction Factor (㏈)	Result (㏈m)	Limit (㏈m)
U-NII 2C	11a	5 720	4.63	0.04	4.67	22.82
U-NII 3			-1.96	0.04	-1.92	30
U-NII 2C	11n_HT20	5 720	4.62	0.04	4.66	22.83
U-NII 3			-1.46	0.04	-1.42	30

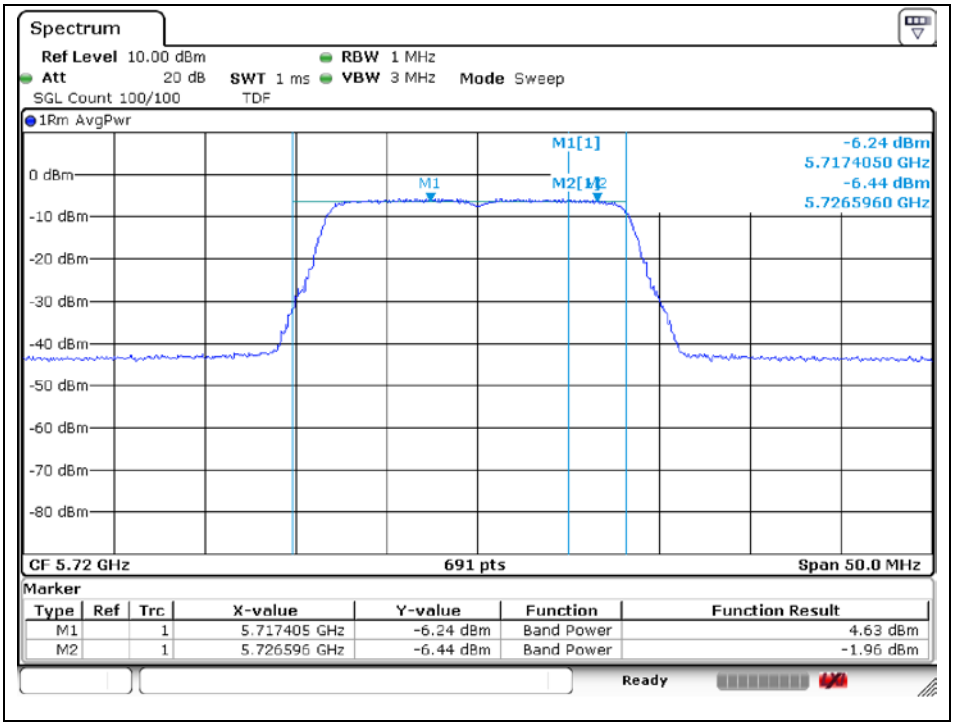
Band	Mode	Conducted Power Limit (㏈m)					
		Frequency (㎒)	Fixed Limit (㏈m)	26 ㏈ BW (㎒)	11+10LogB (㏈m)	Antenna gain (㏈i)	Limit (㏈m)
U-NII 2C	11a	5 720	23.98	15.19	22.82	3.34	22.82
U-NII 3							30
U-NII 2C	11n_HT20	5 720	23.98	15.23	22.83	3.34	22.83
U-NII 3							30

Remark:

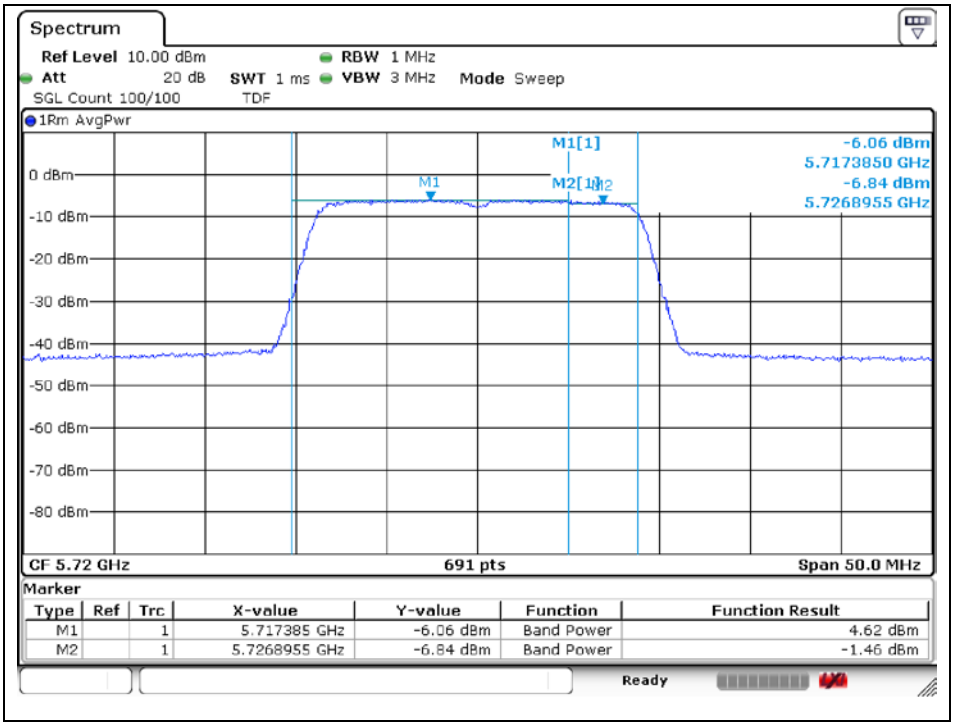
1. Result (㏈m) = Average Power(㏈m) + Correction factor (㏈)

Band-crossing channels

802.11a (5 720 ㎒)

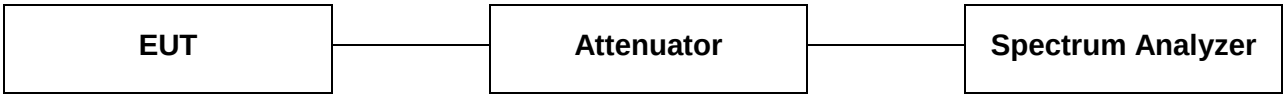


802.11n_HT20 (5 720 ㎒)



6. Peak Power Spectral Density

6.1. Test setup



6.2. Limit

FCC 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.

(a)(2)

For the 5.25-5.35 ㎓ and 5.47-5.725 ㎓ bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 ㎽ or 11 ㏈m + 10 log B, where B is the 26 ㏈ emission bandwidth in megahertz. 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.

(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.

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 v01r02.
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 ㏈ to the final result to compensate for the difference between linear averaging and power averaging.

5. The result is the Maximum PSD over 1 ㎒ reference bandwidth.
6. For devices operating in the bands 5.15-5.25 ㎓, 5.25-5.35 ㎓, and 5.47-5.725 ㎓, the above procedures make use of 1 ㎒ RBW to satisfy directly the 1 ㎒ reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 ㎓, the rules specify a measurement bandwidth of 500 ㎑. Many spectrum analyzers do not have 500 ㎑ RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 ㎒, or 500 ㎑, “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 ㎒, or 500 ㎑). If measurements are performed using a reduced resolution bandwidth (< 1 ㎒, or < 500 ㎑) and integrated over 1 ㎒, or 500 ㎑ bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/*T*, where *T* is defined in section II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 ㎑, add 10log(500 ㎑/RBW) to the measured result, whereas RBW (< 500 ㎑) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 ㎒, add 10log(1 ㎒/RBW) to the measured result, whereas RBW (< 1 ㎒) 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.

Note: As a practical matter, it is recommended to use reduced RBW of 100 ㎑ for the sections 5.c) and 5.d) above, since RBW = 100 ㎑ is available on nearly all spectrum analyzers.

7. In case of band crossing channels 144, the measurement is complied with section D of KDB 644545_D03 v01.

6.4. Test result

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

Band	Mode	Frequency (㎒)	Ch.	Data Rate	Measured PPSD (㏈ m)	Duty Factor (㏈)	Final PPSD (㏈ m)	Limit (㏈ m/1 ㎒)
U-NII 1	11a	5 180	36	6 Mbps	-4.55	0.04	-4.51	11
		5 200	44	6 Mbps	-3.56	0.04	-3.52	11
		5 240	48	6 Mbps	-4.31	0.04	-4.27	11
	11n_HT20	5 180	36	MCS0	-3.96	0.04	-3.92	11
		5 200	44	MCS0	-3.82	0.04	-3.78	11
		5 240	48	MCS0	-4.30	0.04	-4.26	11
U-NII 2A	11a	5 260	52	6 Mbps	-3.89	0.04	-3.85	11
		5 280	60	6 Mbps	-3.93	0.04	-3.89	11
		5 320	64	6 Mbps	-3.45	0.04	-3.41	11
	11n_HT20	5 260	52	MCS0	-4.59	0.04	-4.55	11
		5 280	60	MCS0	-3.66	0.04	-3.62	11
		5 320	64	MCS0	-3.66	0.04	-3.62	11
U-NII 2C	11a	5 500	134	6 Mbps	-4.55	0.04	-4.51	11
		5 580	106	6 Mbps	-4.05	0.04	-4.01	11
		5 720	144	6 Mbps	-6.32	0.04	-6.28	11
	11n_HT20	5 500	100	MCS0	-4.03	0.04	-3.99	11
		5 580	116	MCS0	-4.34	0.04	-4.30	11
		5 720	144	MCS0	-5.62	0.04	-5.58	11

Band	Mode	Frequency (㎒)	Ch.	Data Rate	Measured PPSD (㏈ m)	Duty Factor (㏈)	Final PPSD (㏈ m)	Limit (㏈ m/500 ㎑)
U-NII 3	11a	5 745	149	6 Mbps	-8.71	0.04	-8.67	30
		5 785	157	6 Mbps	-7.74	0.04	-7.70	30
		5 825	165	6 Mbps	-7.32	0.04	-7.28	30
	11n_HT20	5 745	149	MCS0	-8.54	0.04	-8.50	30
		5 785	157	MCS0	-7.99	0.04	-7.95	30
		5 825	165	MCS0	-7.92	0.04	-7.88	30

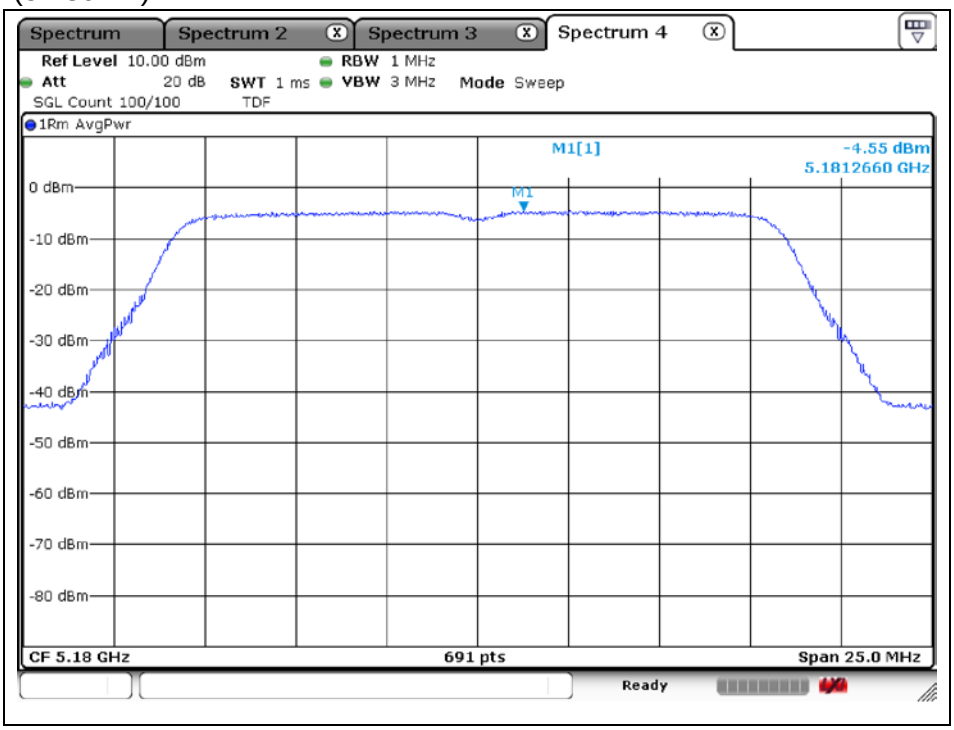
- Band-crossing channels.

Band	Mode	Frequency (㎒)	Ch.	Data Rate	Measured PPSD (㏈ m)	Duty Factor (㏈)	Final PPSD (㏈ m)	Limit (㏈m/500㎑)
U-NII 3 (Band-crossing channel)	11a	5 720	144	6 Mbps	-8.23	0.04	-8.19	30
	11n_HT20	5 720	144	MCS0	-8.94	0.04	-8.90	30

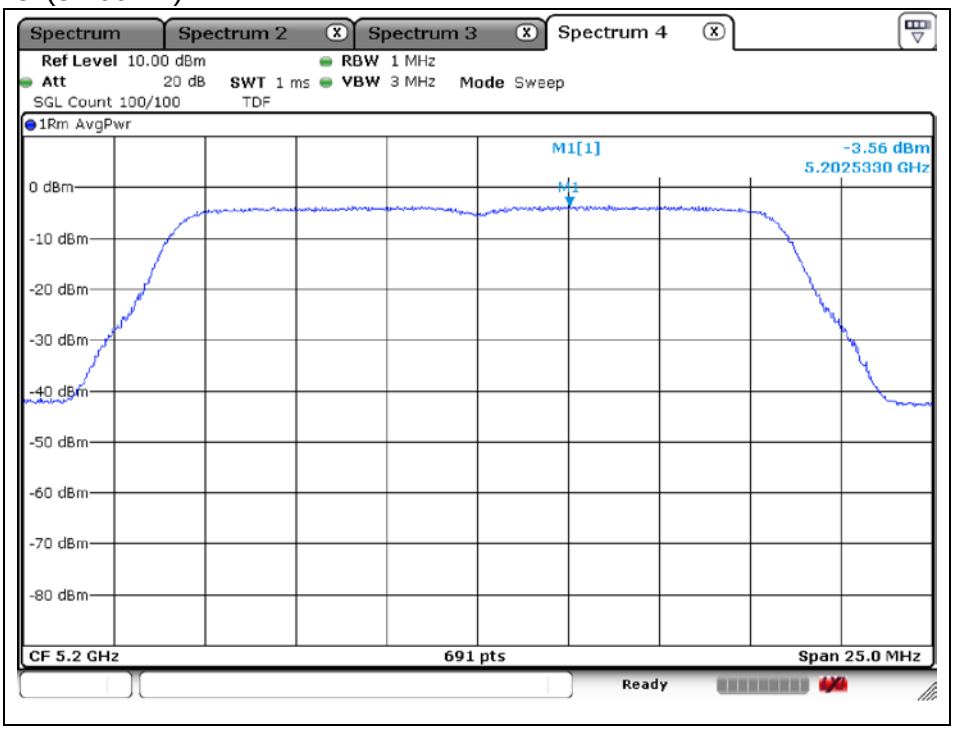
Note : Final PPSD (㏈ m) = Measured PPSD (㏈ m) + Duty Factor (㏈)

802.11a (Band 1)

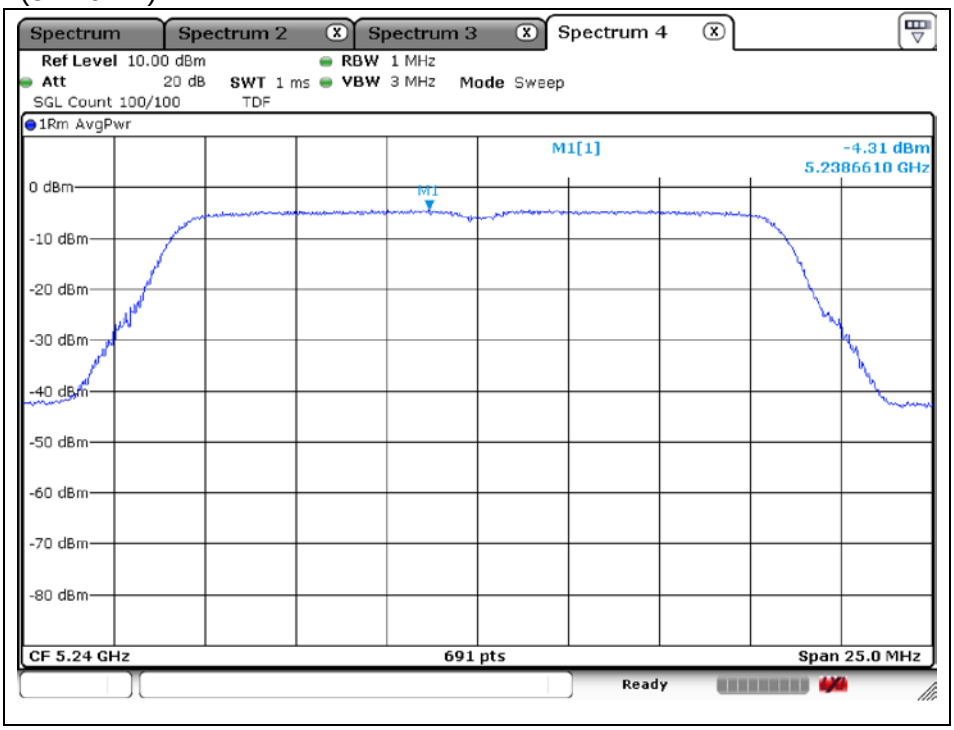
Low Channel (5 180 ㎒)



Middle Channel (5 200 ㎒)

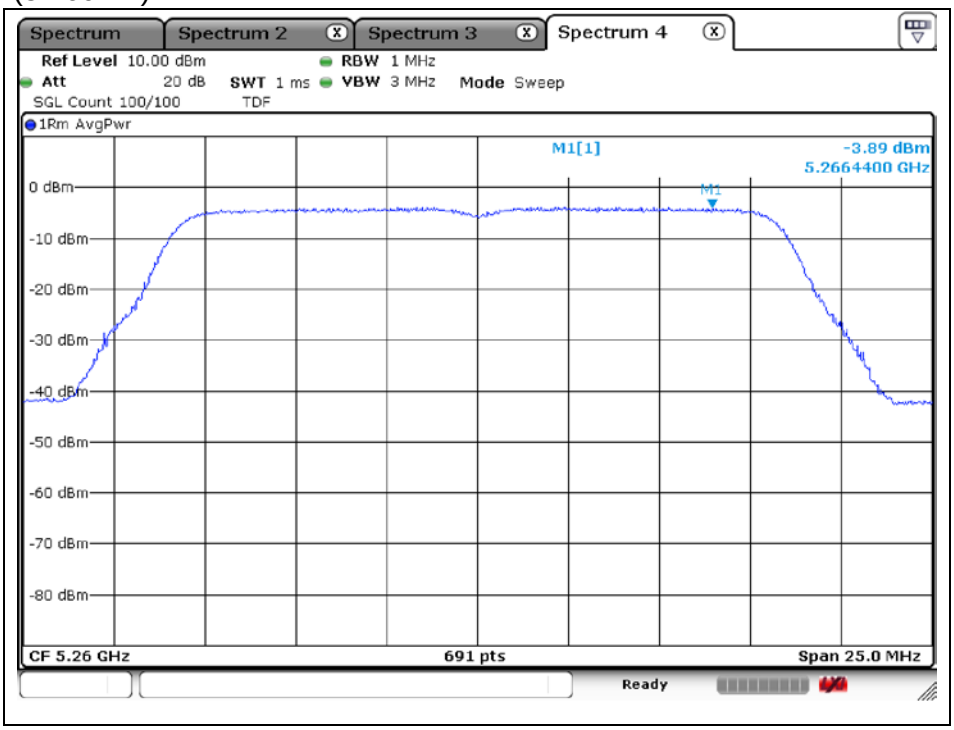


High Channel (5 240 ㎒)

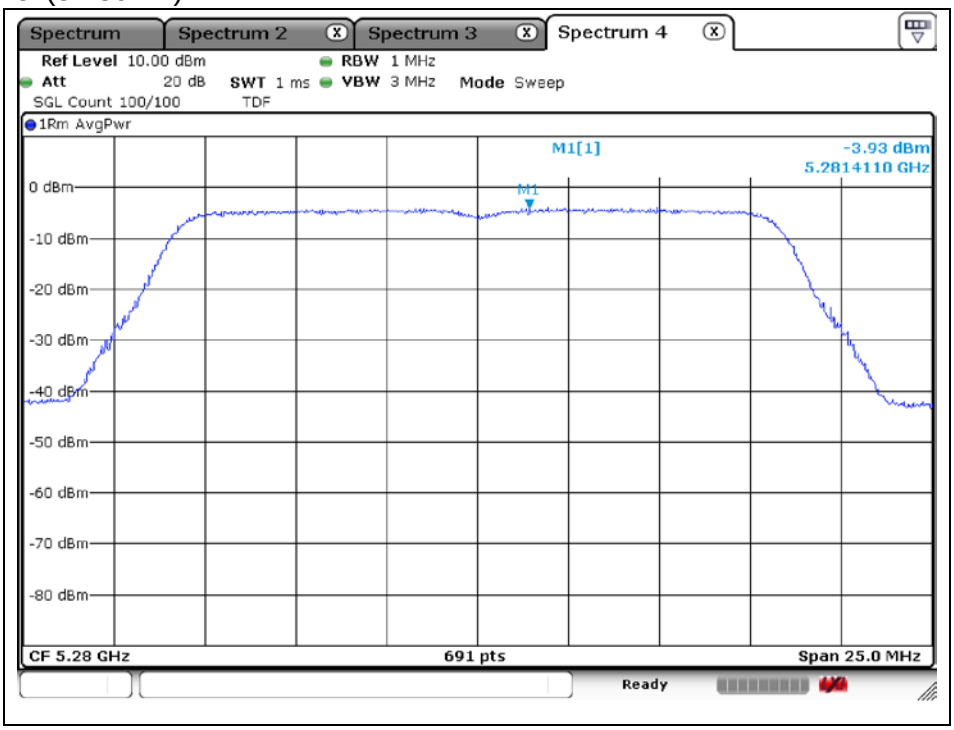


802.11a (Band 2A)

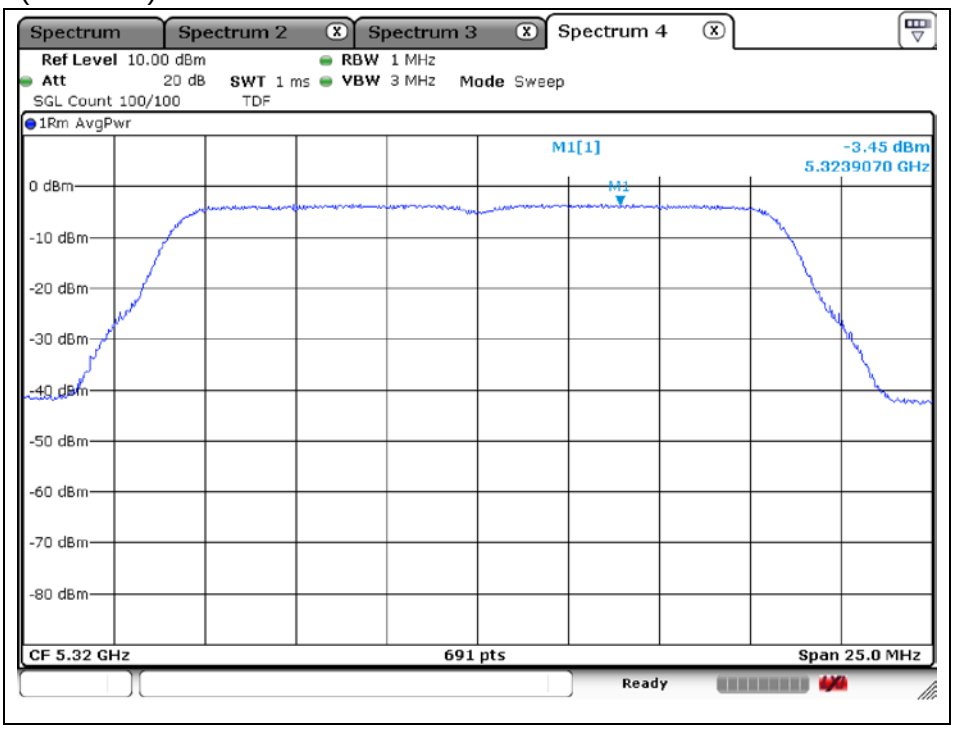
Low Channel (5 260 ㎒)



Middle Channel (5 280 ㎒)

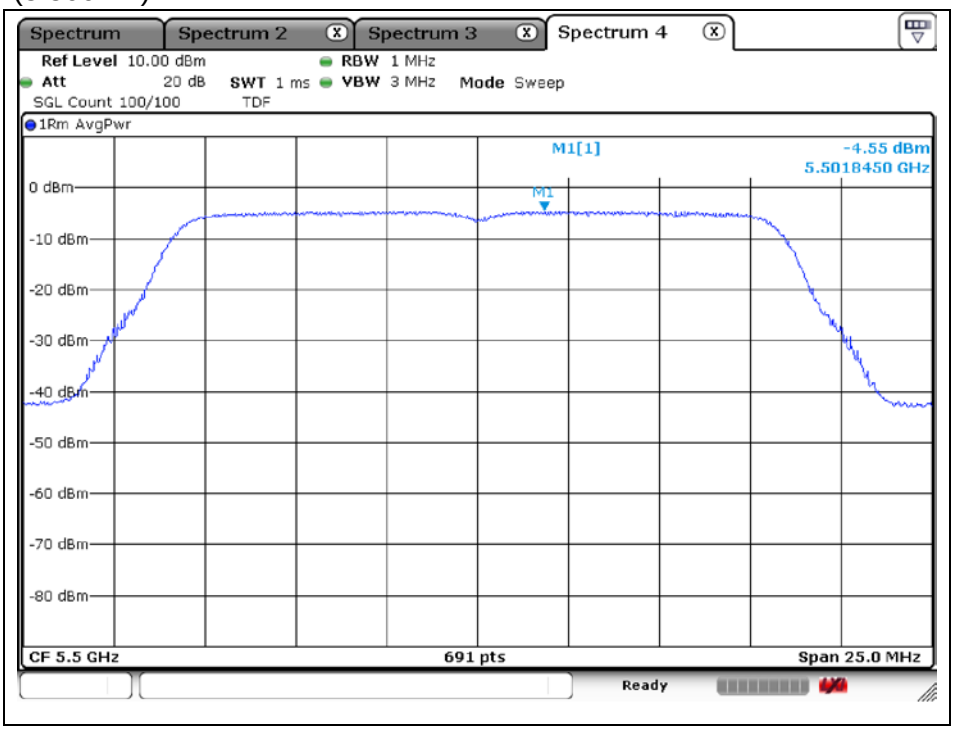


High Channel (5 320 ㎒)

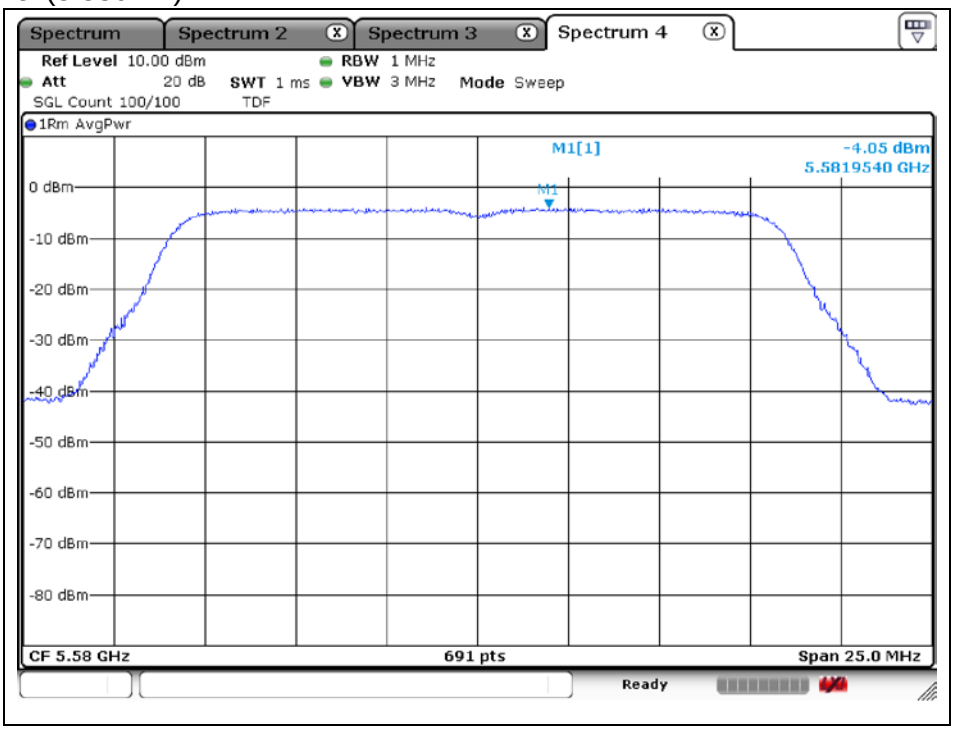


802.11a (Band 2C)

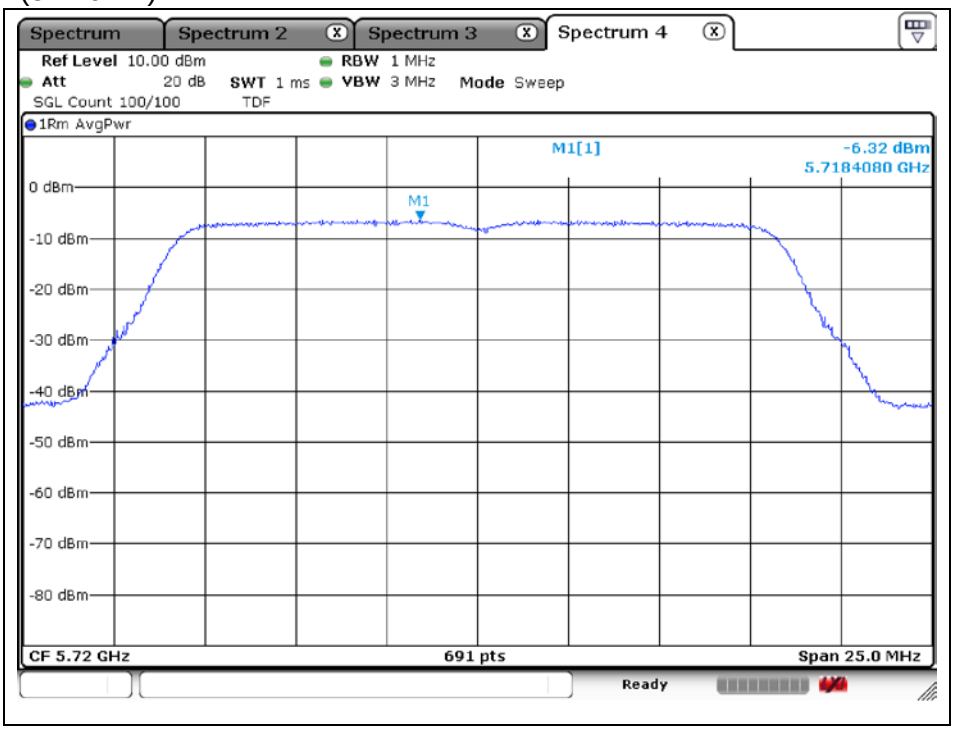
Low Channel (5 500 ㎒)



Middle Channel (5 580 ㎒)

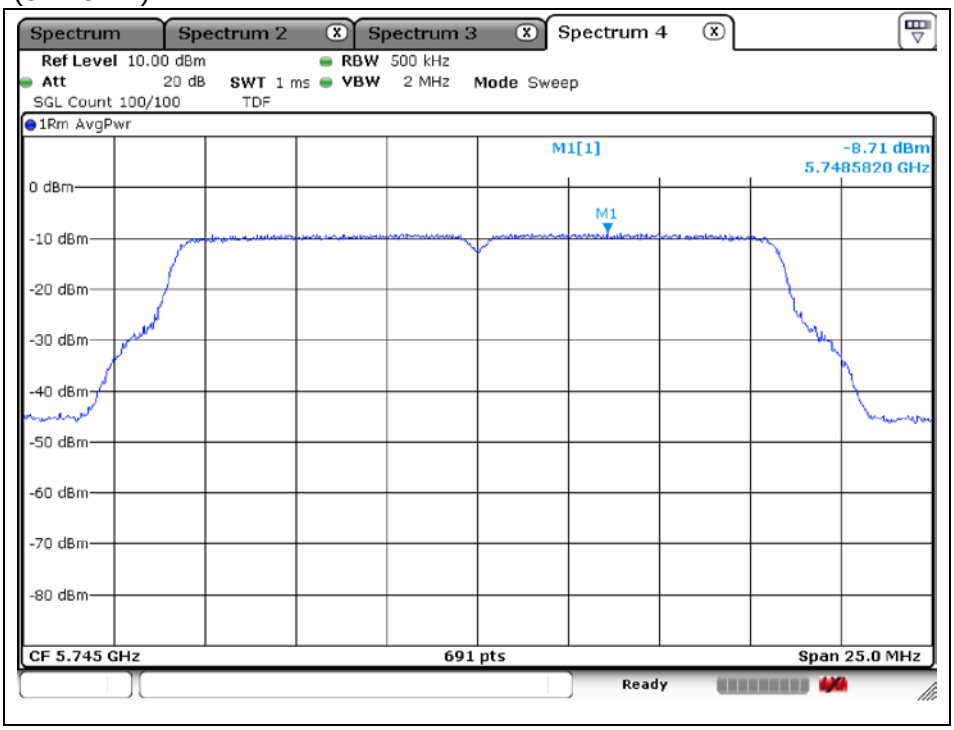


High Channel (5 720 ㎒)

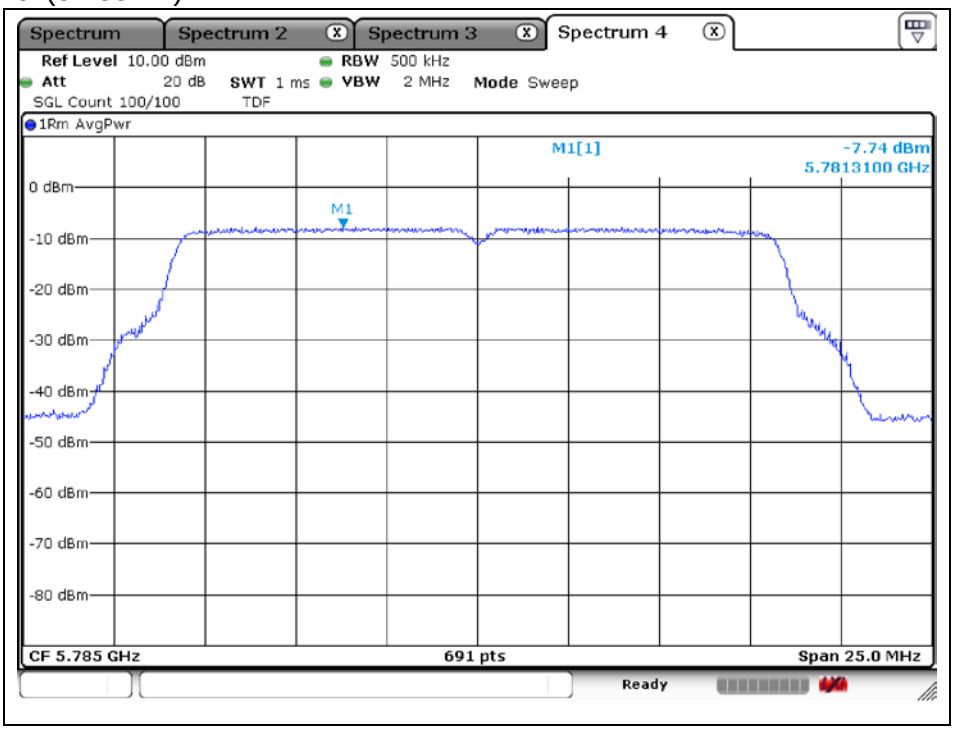


802.11a (Band 3)

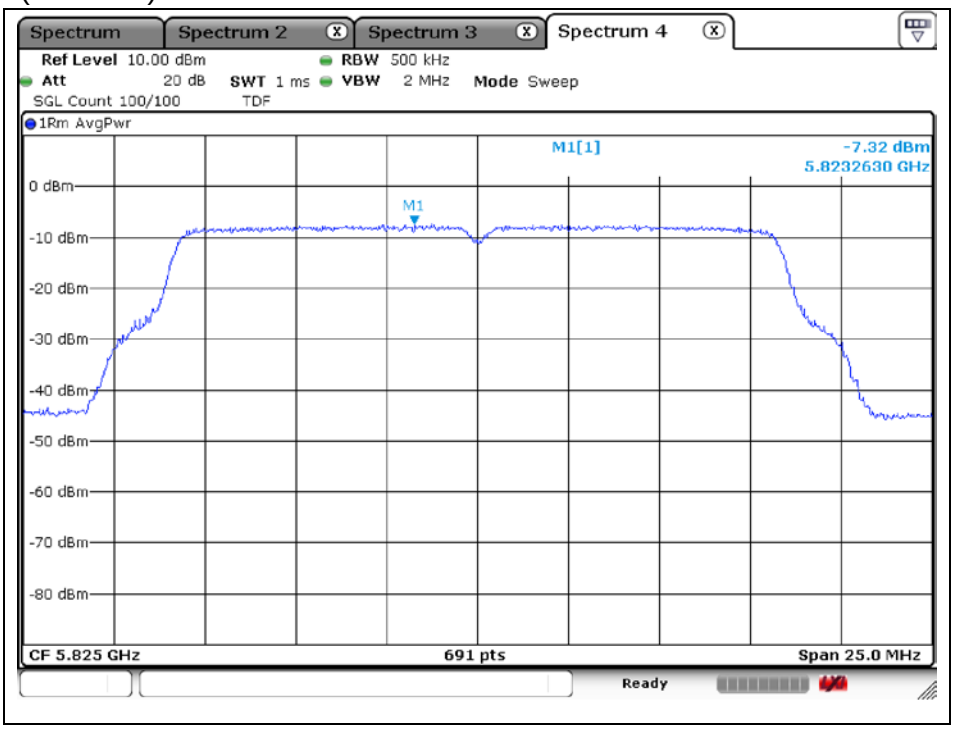
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

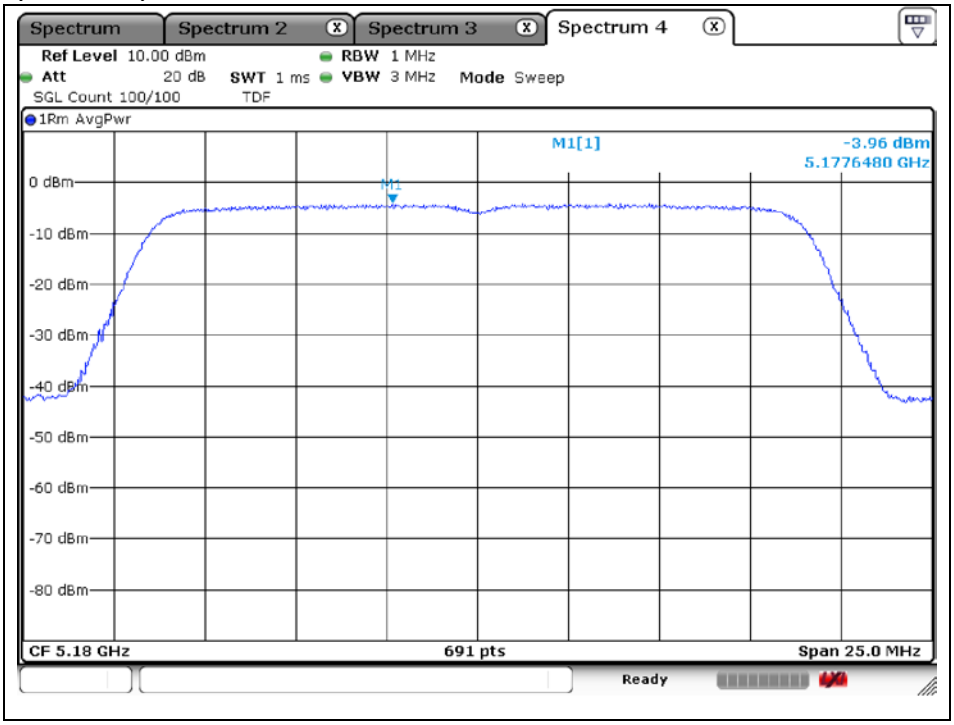


High Channel (5 825 ㎒)

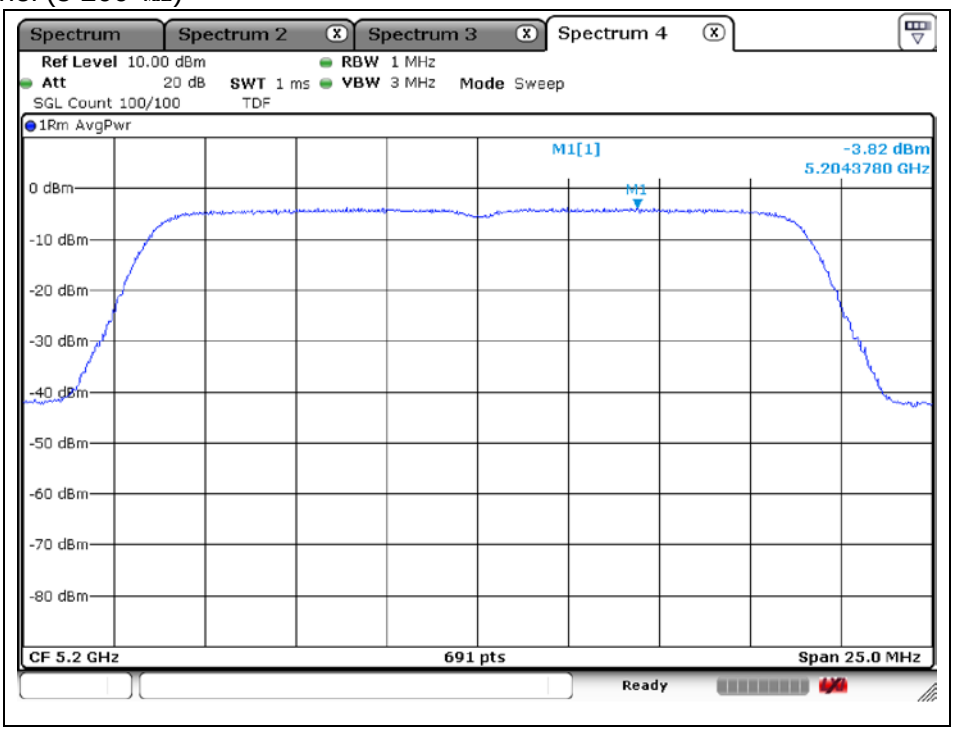


802.11n_HT20 (Band 1)

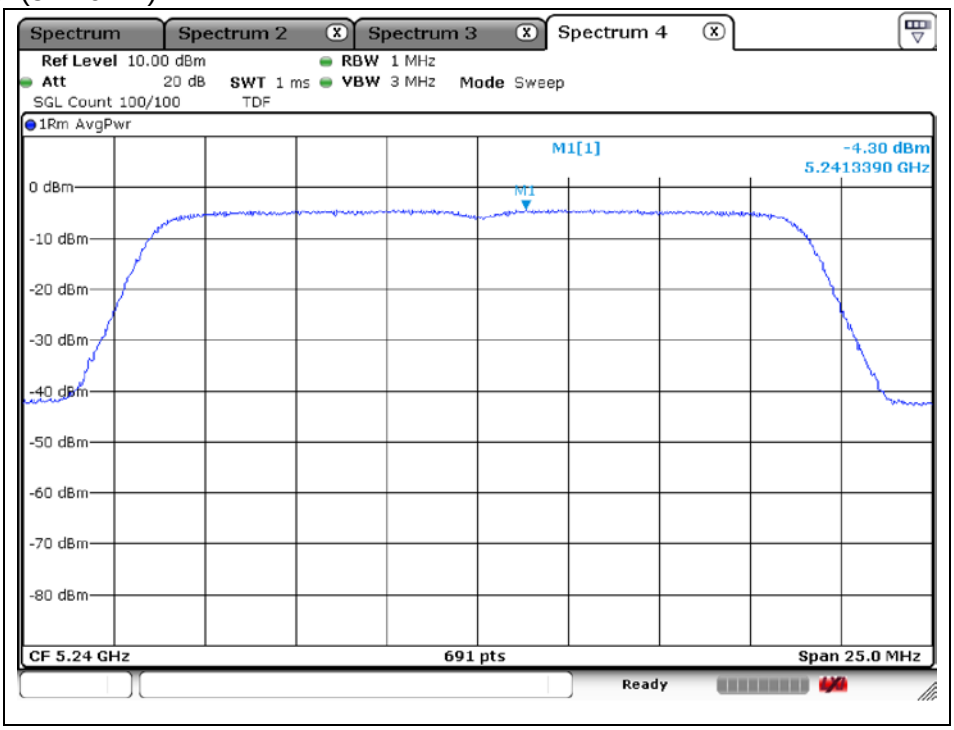
Low Channel (5 180 ㎒)



Middle Channel (5 200 ㎒)

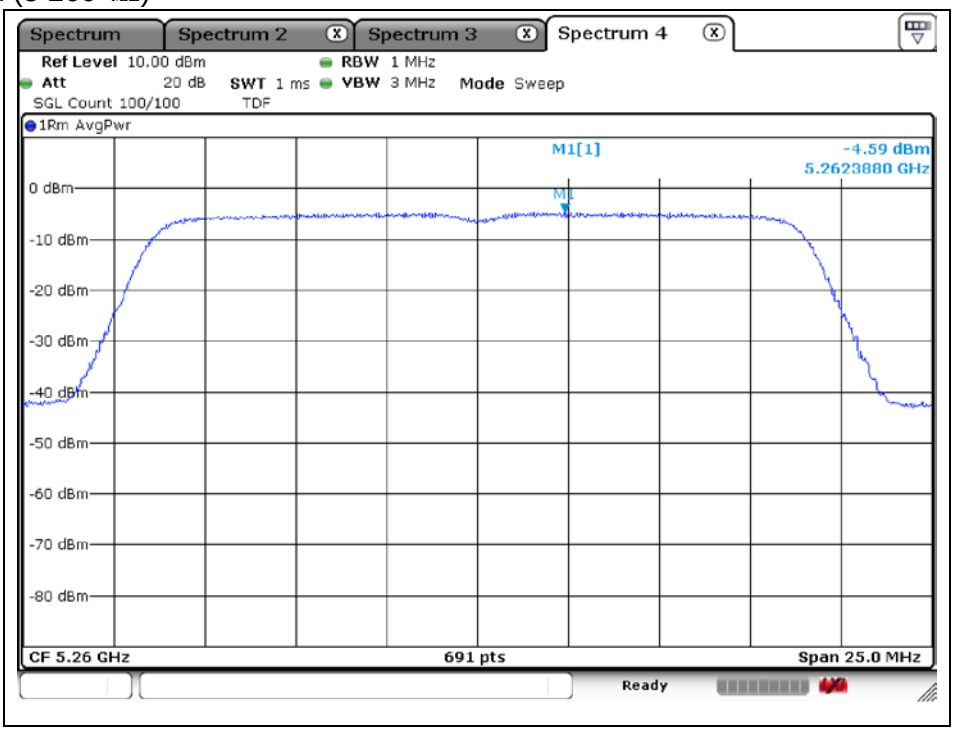


High Channel (5 240 ㎒)

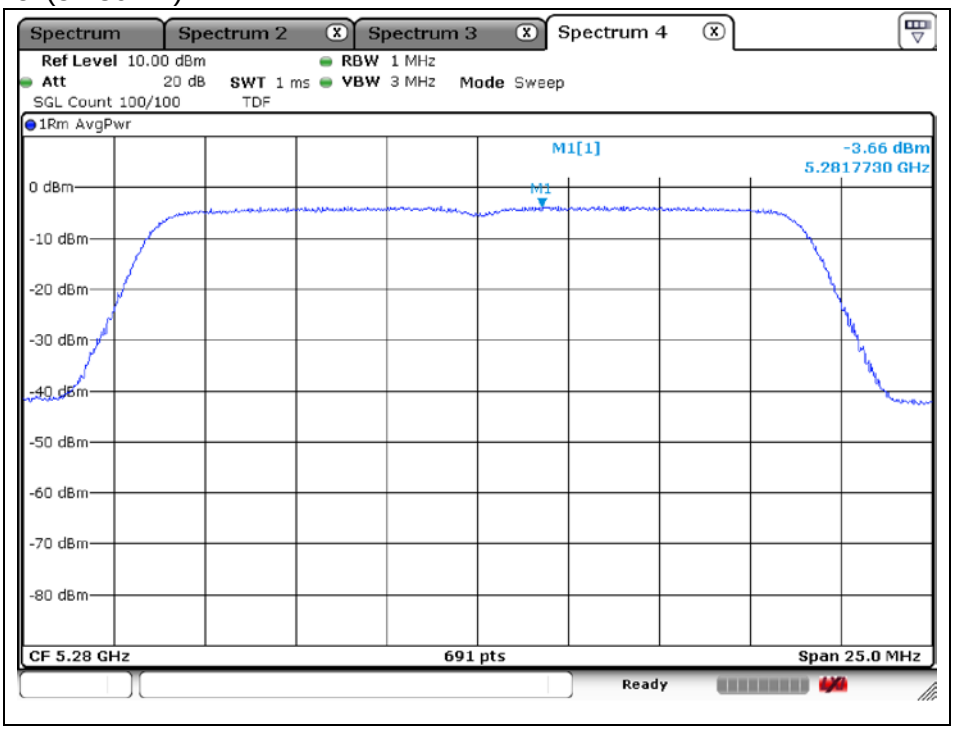


802.11n_HT20 (Band 2A)

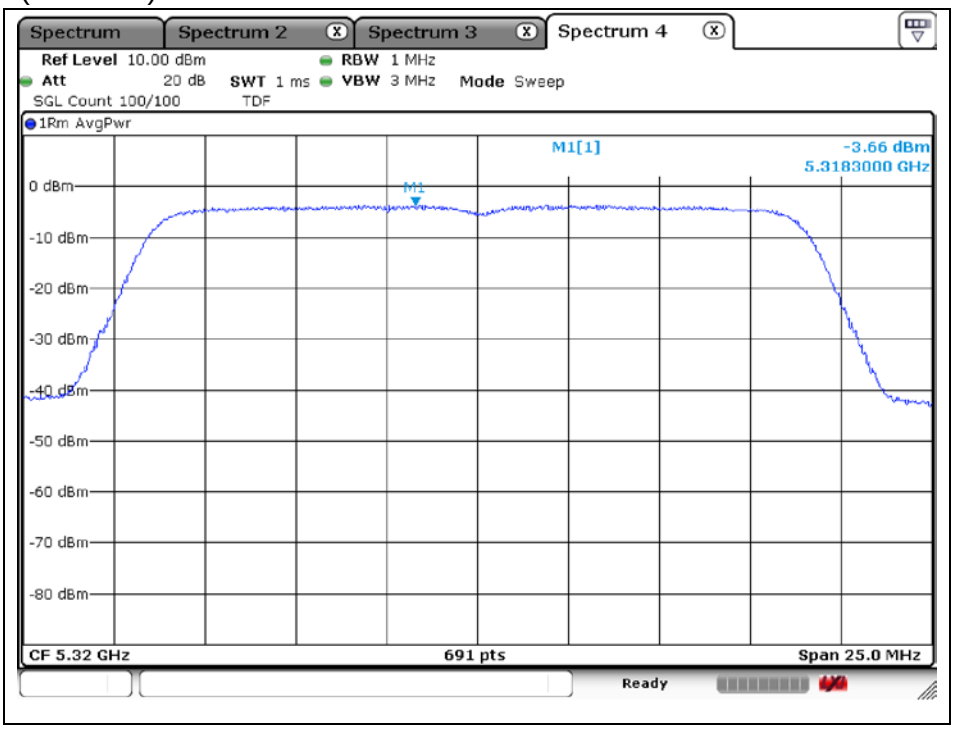
Low Channel (5 260 ㎒)



Middle Channel (5 280 ㎒)

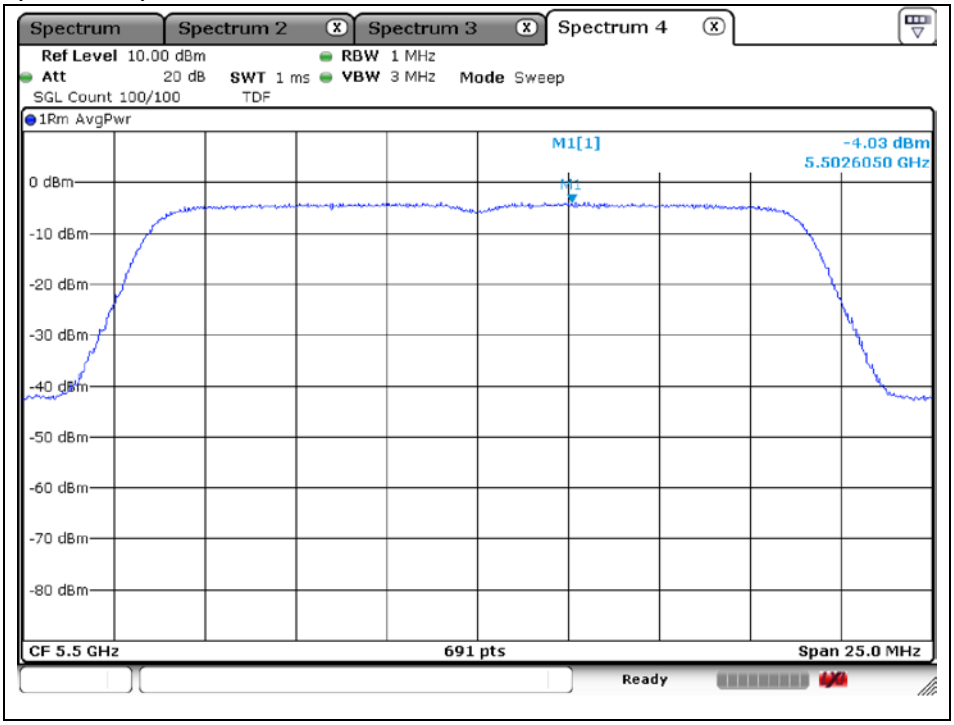


High Channel (5 320 ㎒)

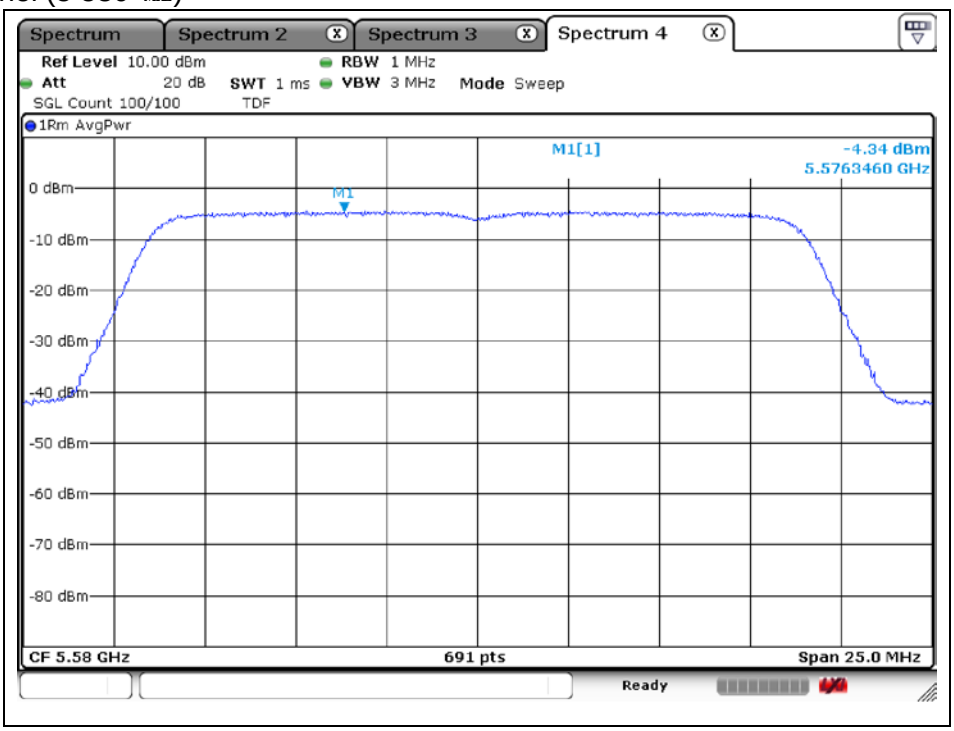


802.11n_HT20 (Band 2C)

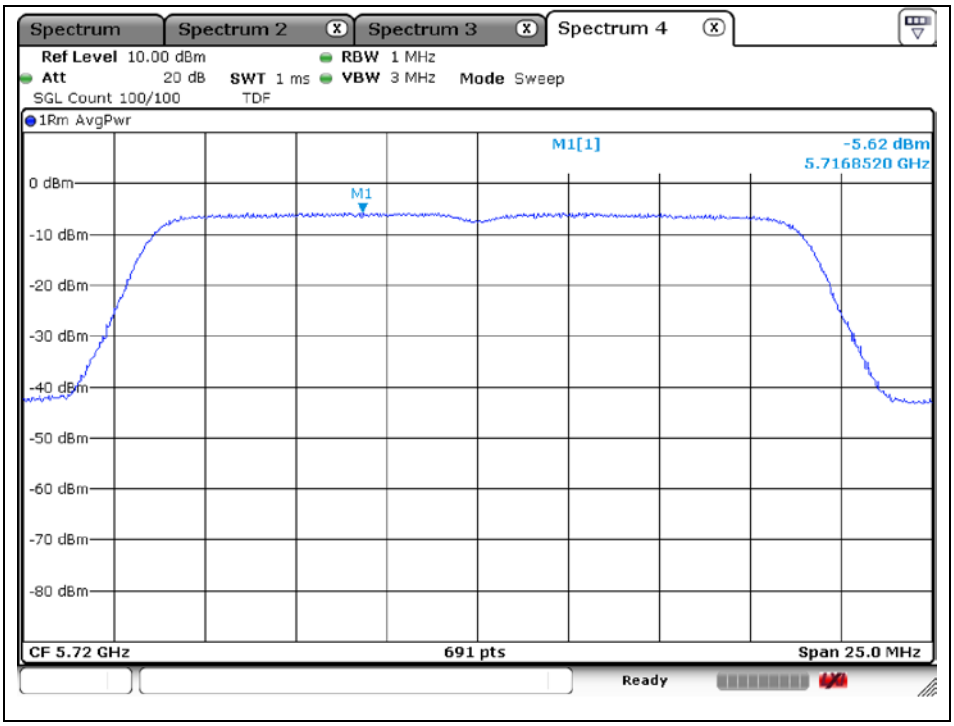
Low Channel (5 500 ㎒)



Middle Channel (5 580 ㎒)

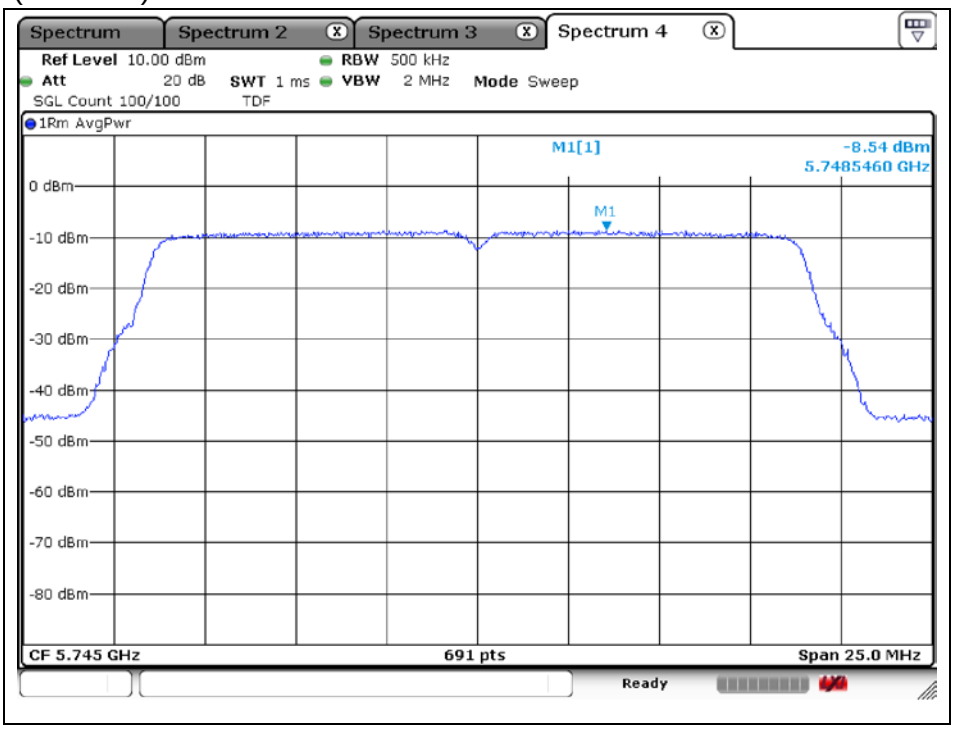


High Channel (5 720 ㎒)

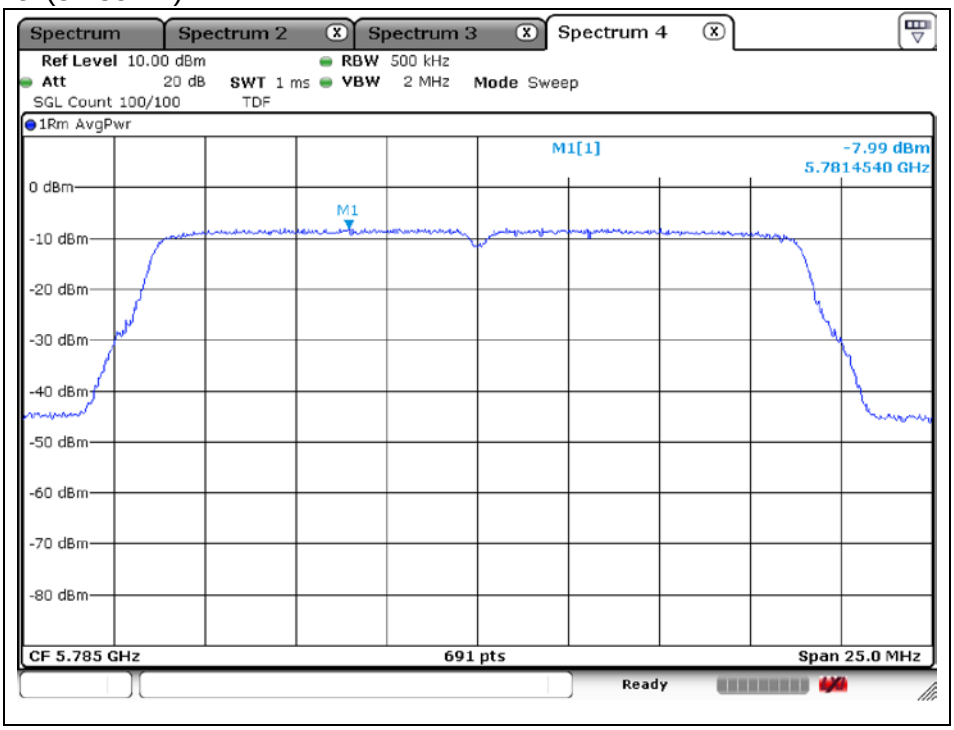


802.11n_HT20 (Band 3)

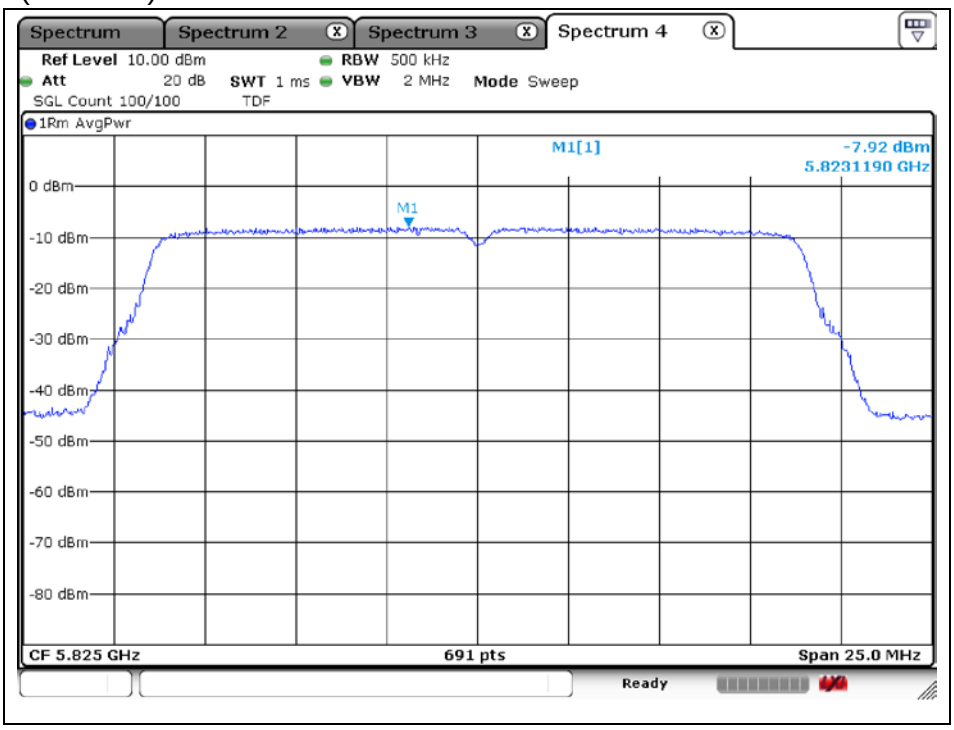
Low Channel (5 745 ㎒)



Middle Channel (5 785 ㎒)

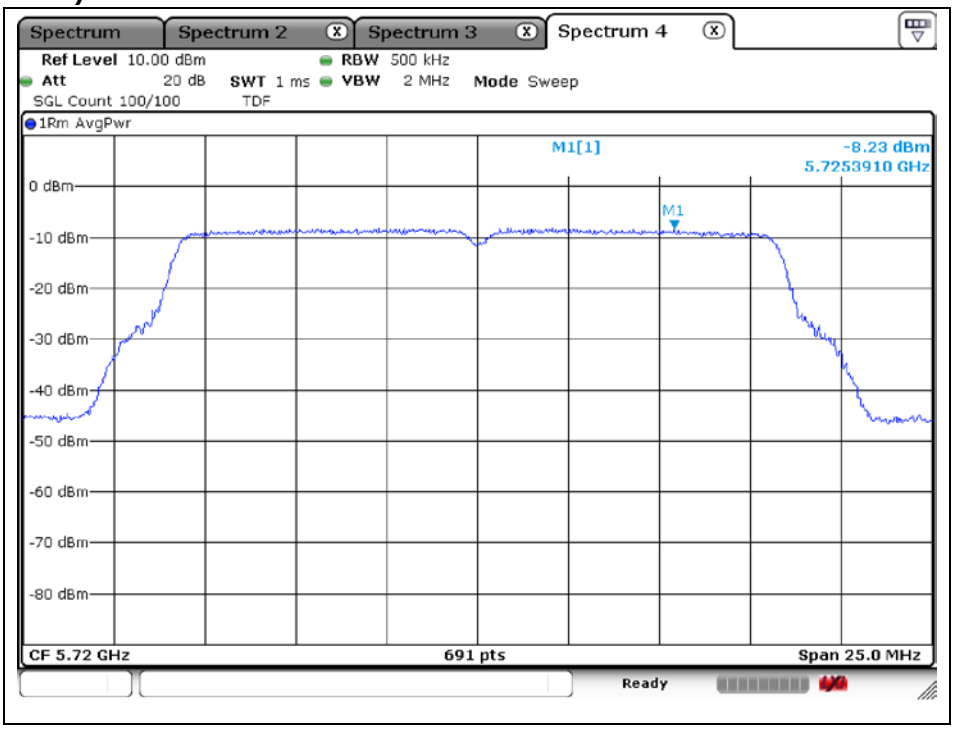


High Channel (5 825 ㎒)

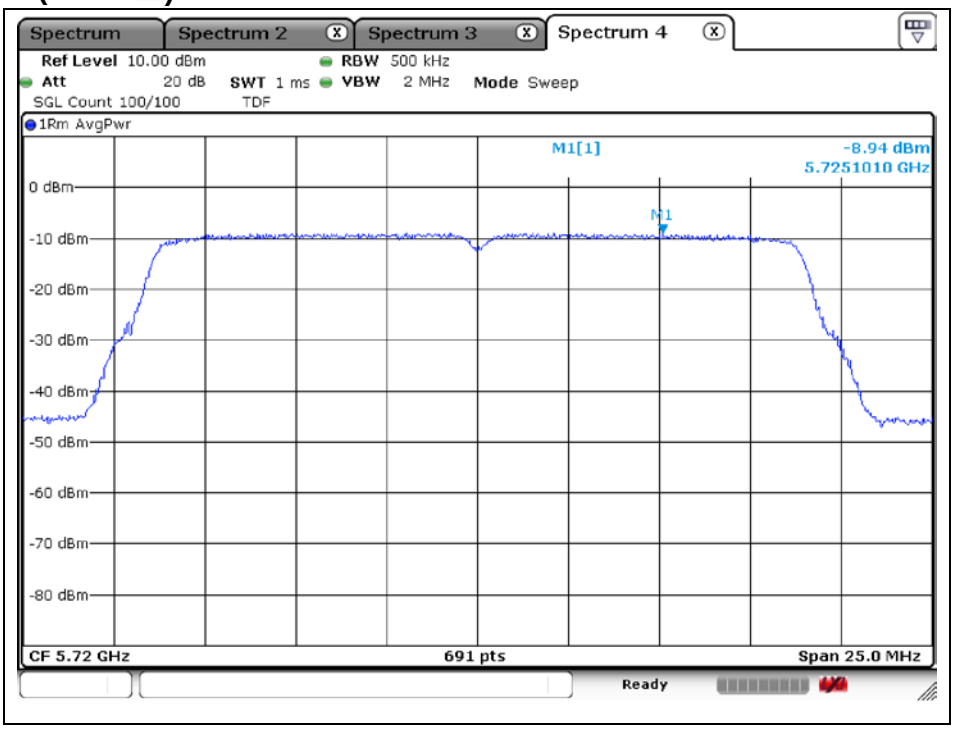


Band-crossing channels

802.11a (5 720 ㎒)

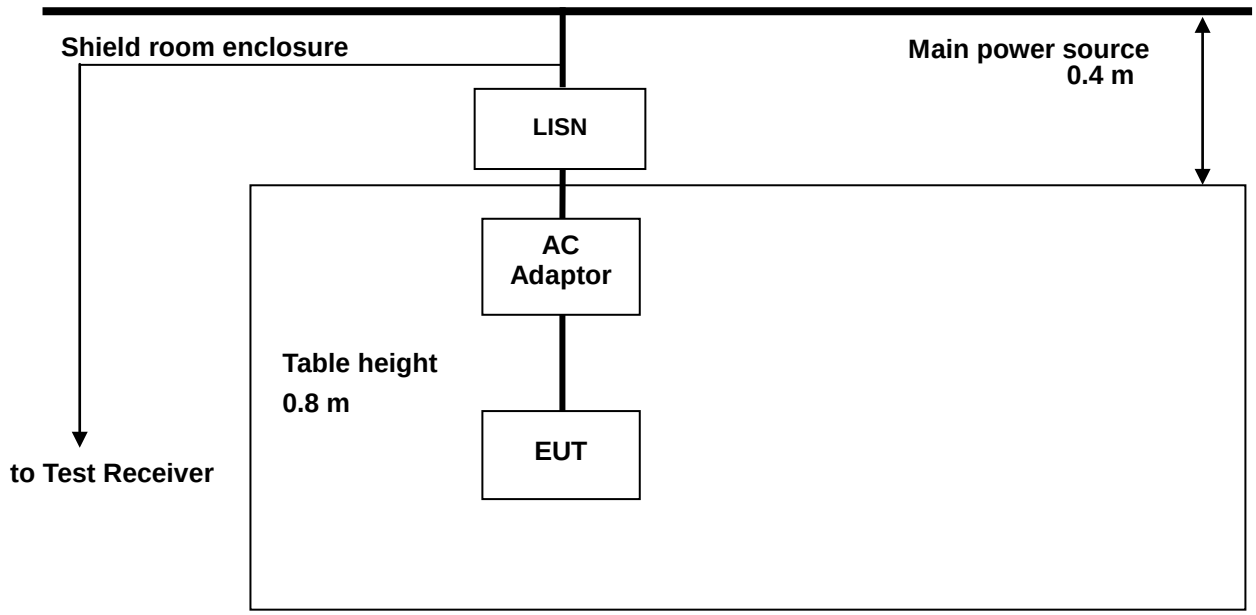


802.11n_HT20 (5 720 ㎒)



7. AC Power Line Conducted Emissions

7.1. Test Setup



7.2. Limit

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 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 ㎌ /50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (dB㎶)	
	Quasi-peak	Average
0.15 – 0.50	66 - 56*	56 - 46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

7.3. Test Procedures

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

AC line 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 × 3.6 m × 3.6 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. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT 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) ℃
Relative humidity : 47 % R.H.

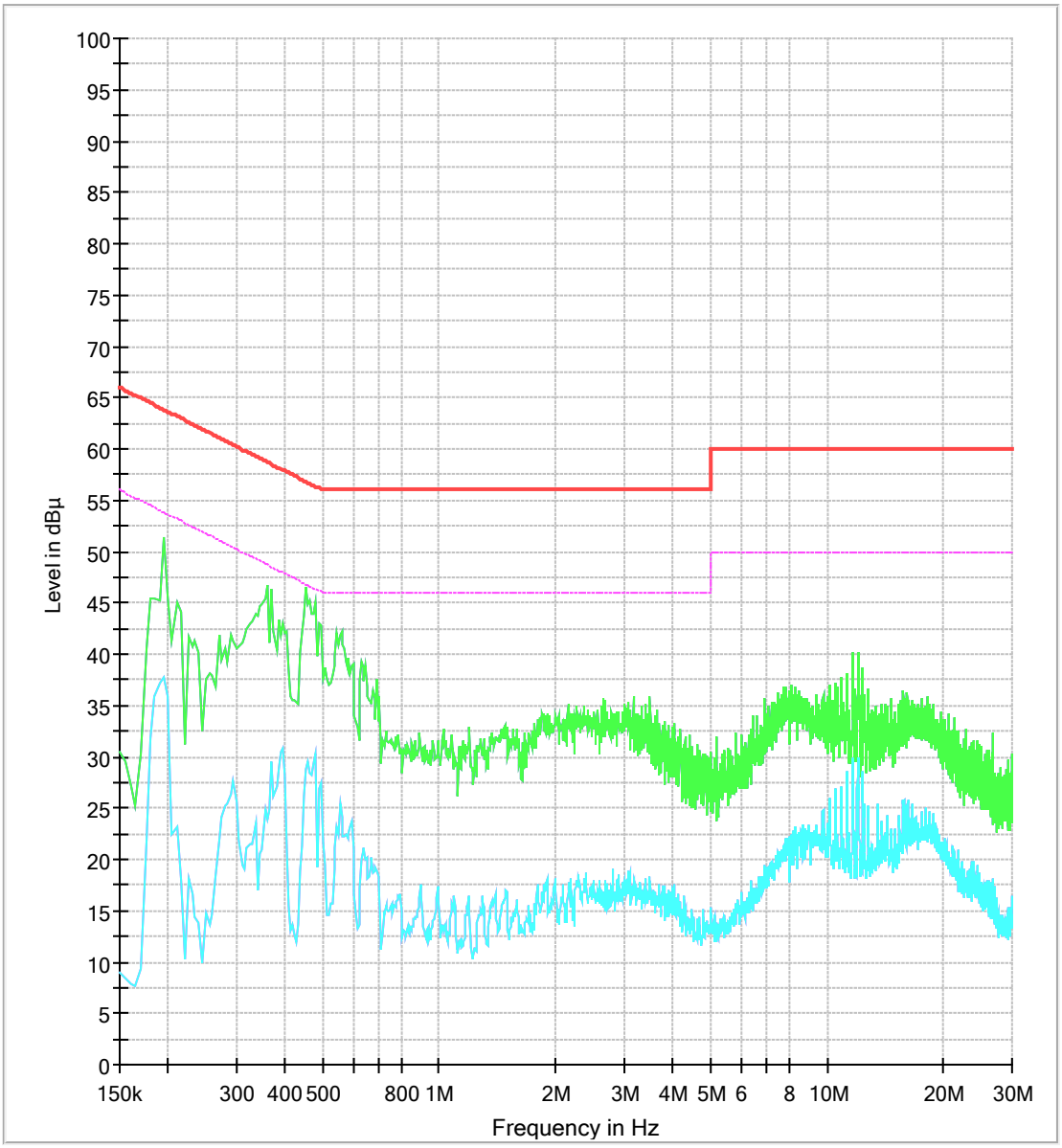
Frequency range : 0.15 ㎒ – 30 ㎒
Measured Bandwidth : 9 ㎑

FREQ.	LEVEL(dBμV)		LINE	LIMIT(dBμV)		MARGIN(dB)	
(㎒)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.46	42.20	24.60	Neutral	56.69	46.69	14.49	22.09
1.19	26.50	15.70	Neutral	56.00	46.00	29.50	30.30
2.65	29.10	16.30	Neutral	56.00	46.00	26.90	29.70
7.78	29.90	20.60	Neutral	60.00	50.00	30.10	29.40
11.70	30.00	24.40	Neutral	60.00	50.00	30.00	25.60
18.10	29.20	23.50	Neutral	60.00	50.00	30.80	26.50
0.40	43.00	30.60	Hot	57.85	47.85	14.85	17.25
1.26	30.70	16.30	Hot	56.00	46.00	25.30	29.70
3.04	30.70	16.30	Hot	56.00	46.00	25.30	29.70
6.51	22.90	15.00	Hot	60.00	50.00	37.10	35.00
12.02	36.80	31.50	Hot	60.00	50.00	23.20	18.50
23.92	31.20	25.30	Hot	60.00	50.00	28.80	24.70

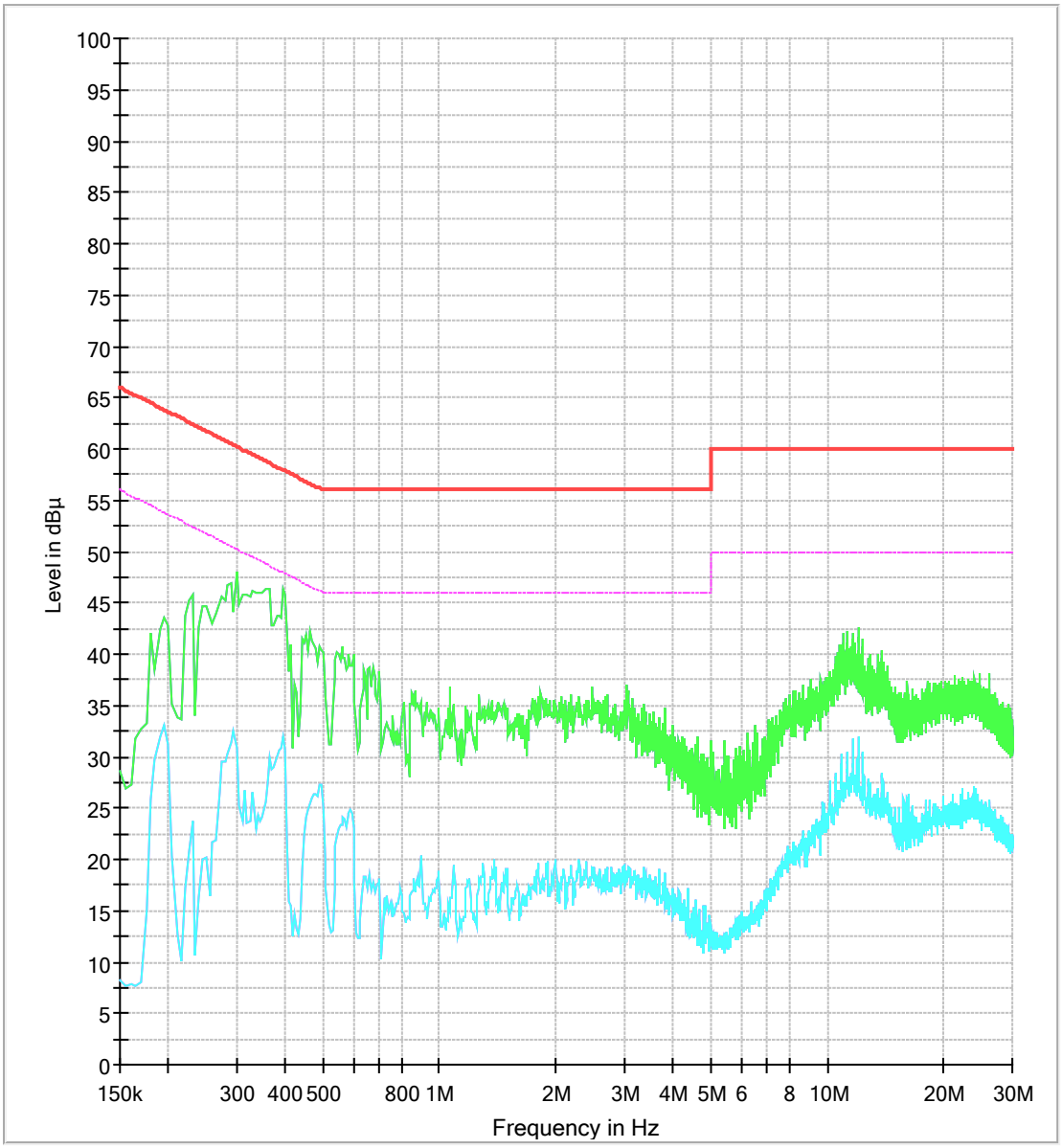
Remark;

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

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 dBi are used, the power shall be reduced by the amount in dB that the gain of the antenna exceeds 6 dBi.

8.2. Antenna Connected Construction

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

Band	5 180 ㎒ – 5 320 ㎒	5 500 ㎒ – 5 720 ㎒	5 745 ㎒ – 5 825 ㎒
Mode	11a/n_HT20		
Gain	3.50 dBi	3.34 dBi	3.01 dBi