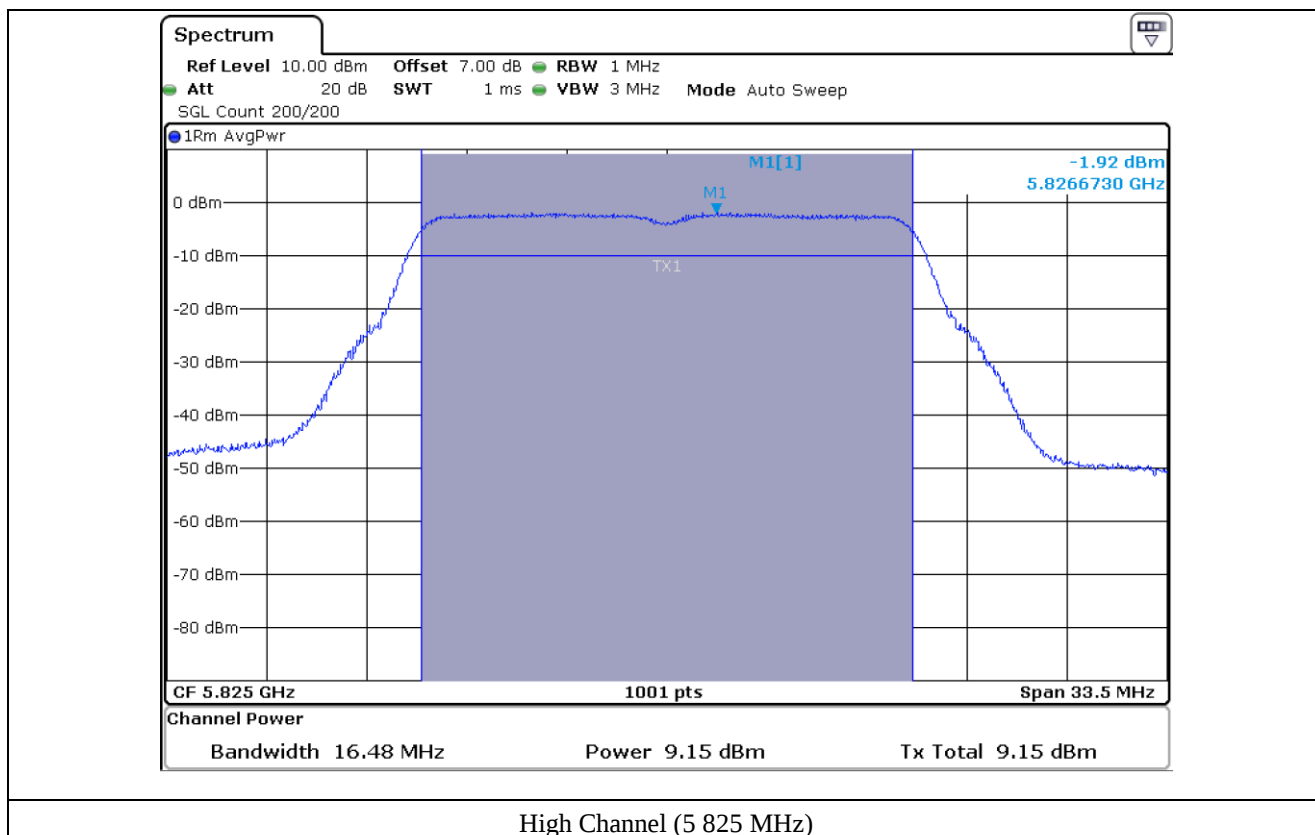




9.5 Test data for 802.11n (HT20) WLAN Mode

9.5.1 Test data for Antenna 0

-. Test Date : May 23, 2019 ~ July 09, 2019

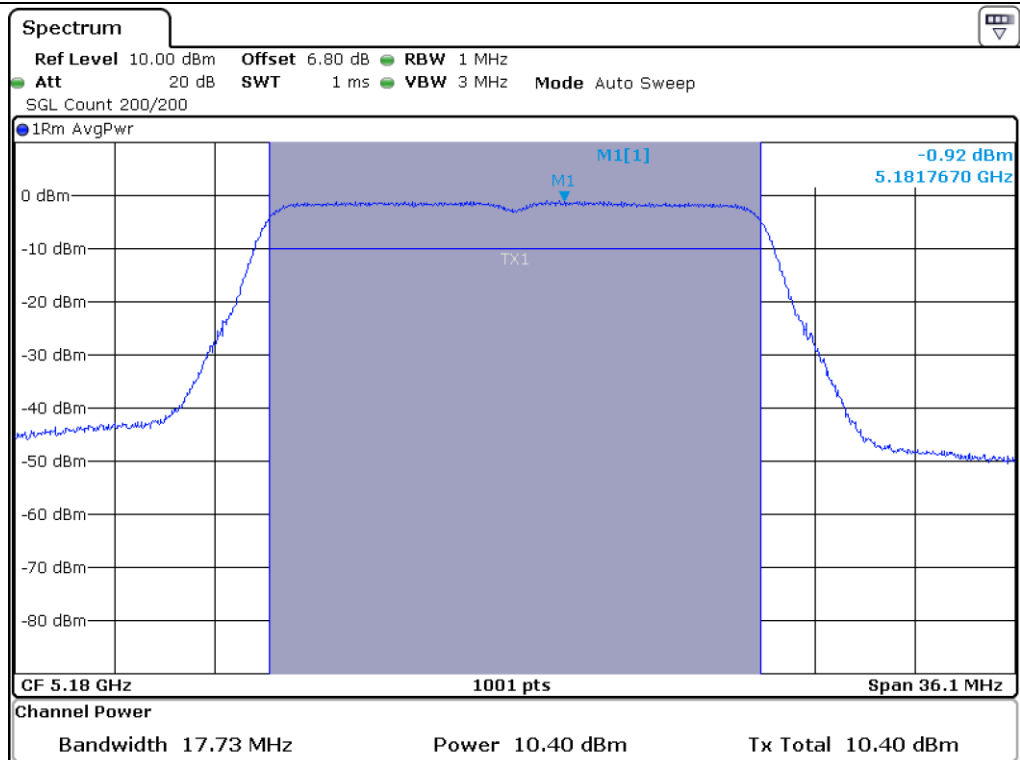
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	10.40	0.33	10.73	24.00	13.27
	Middle	5 220.00	10.53	0.33	10.86	24.00	13.14
	High	5 240.00	10.53	0.33	10.86	24.00	13.14
5 725 ~ 5 850	Low	5 745.00	10.20	0.33	10.53	30.00	19.47
	Middle	5 785.00	10.13	0.33	10.46	30.00	19.54
	High	5 825.00	9.89	0.33	10.22	30.00	19.78

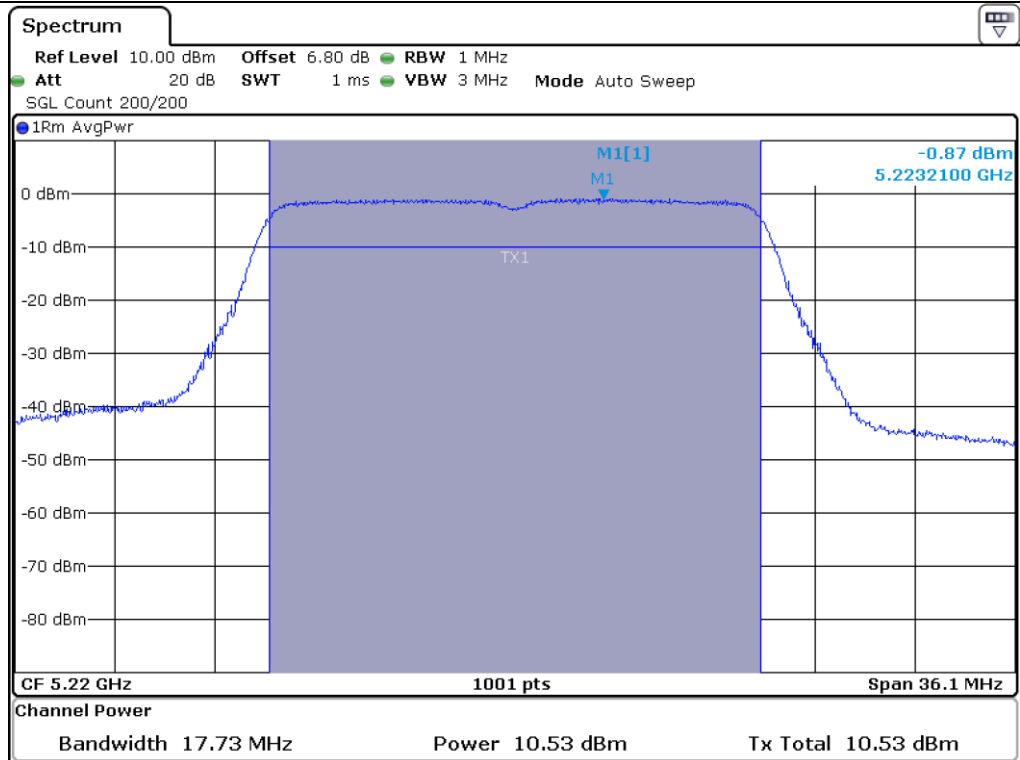
Remark : Result = Measured Value + Duty Fator



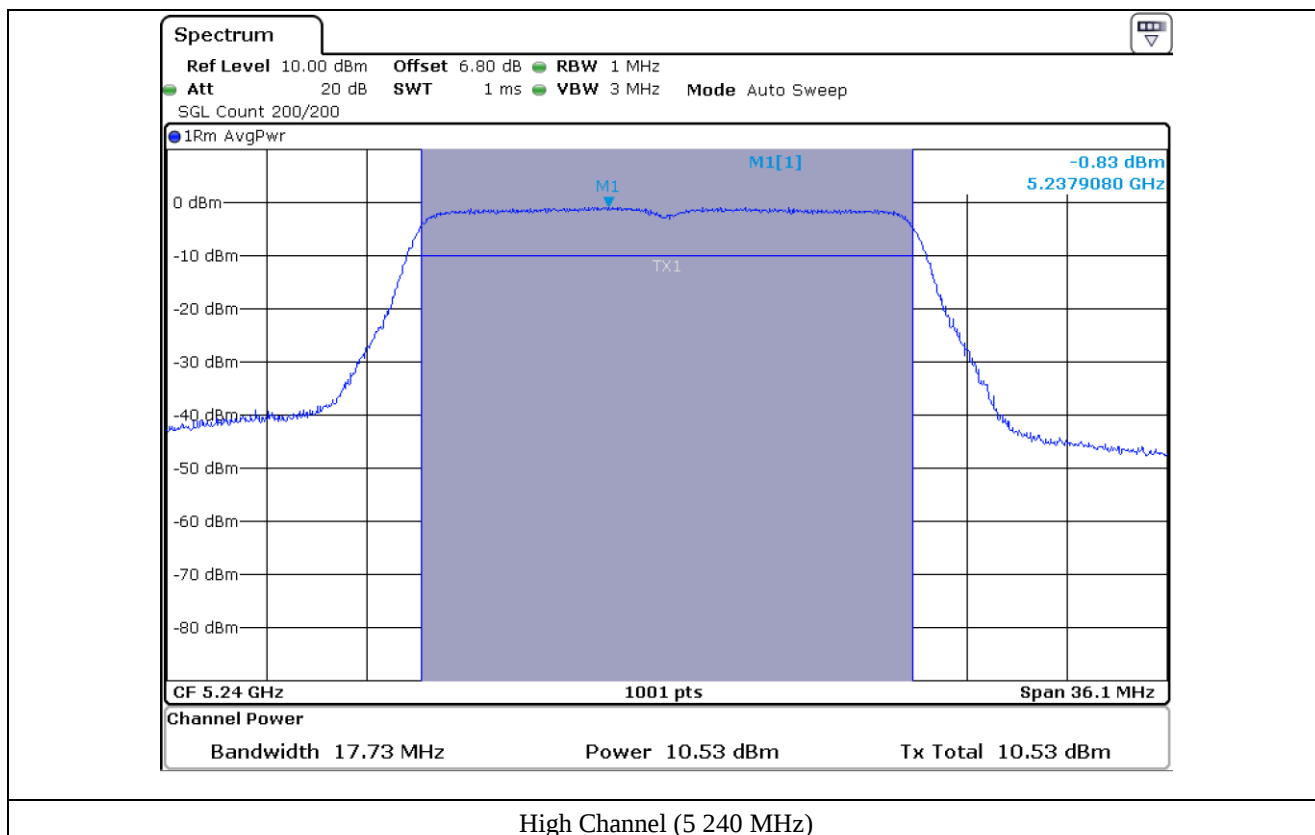
Tested by: Sieon Lee / Assistant Manager

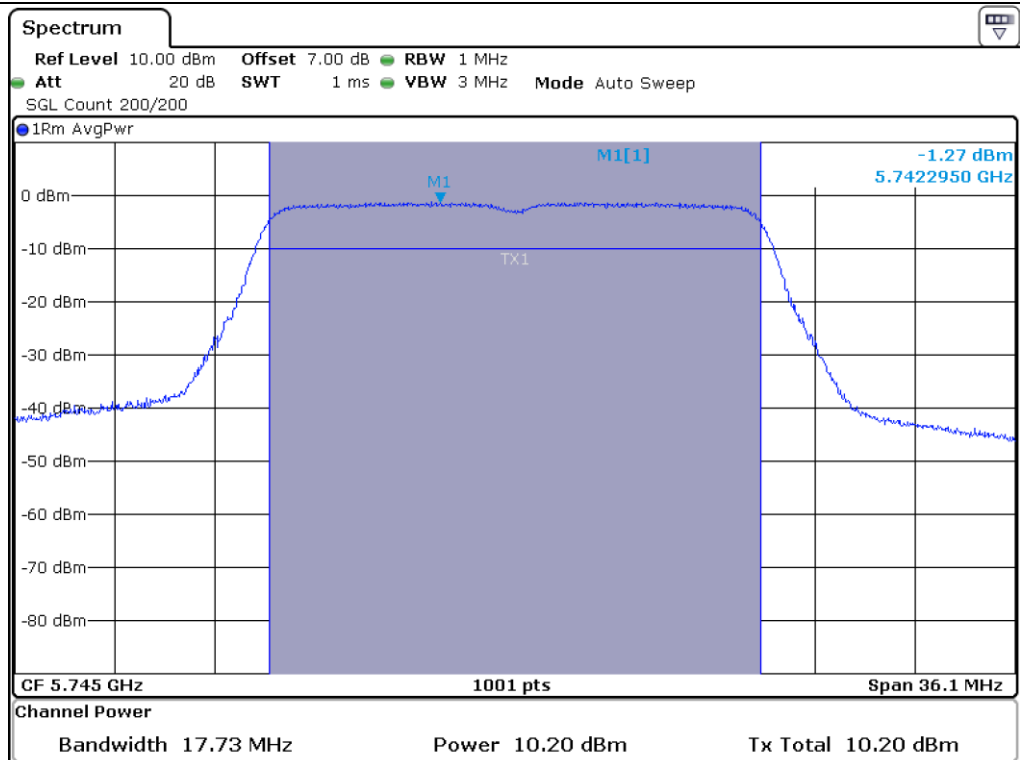


Low Channel (5 180 MHz)

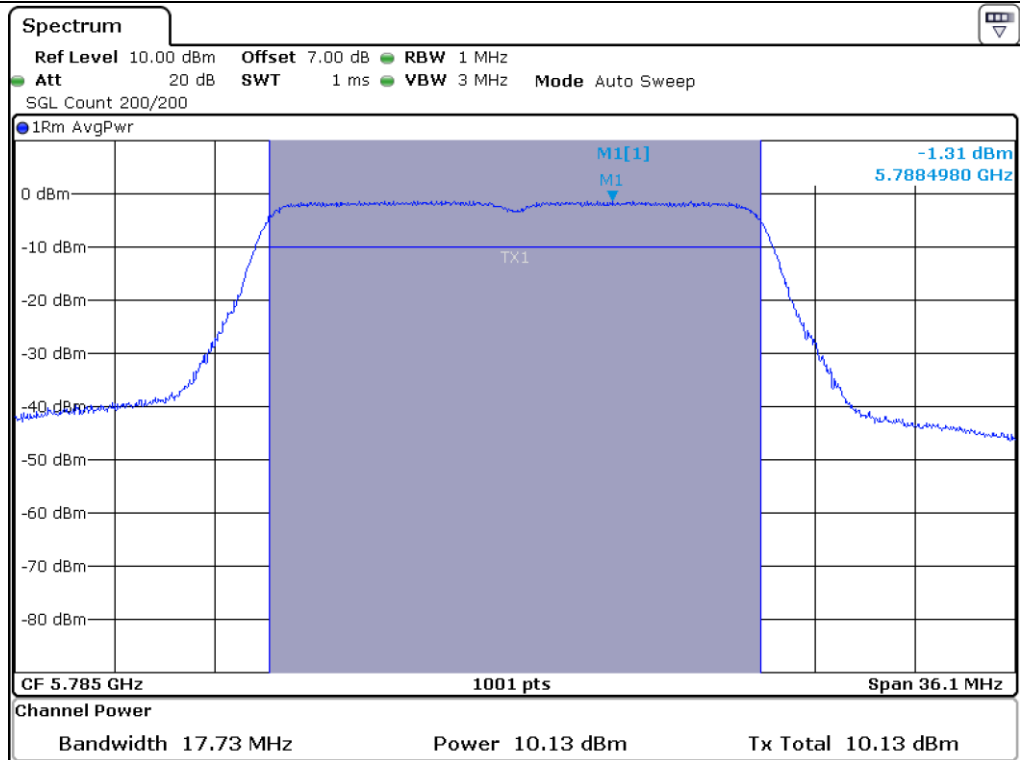


Middle Channel (5 220 MHz)

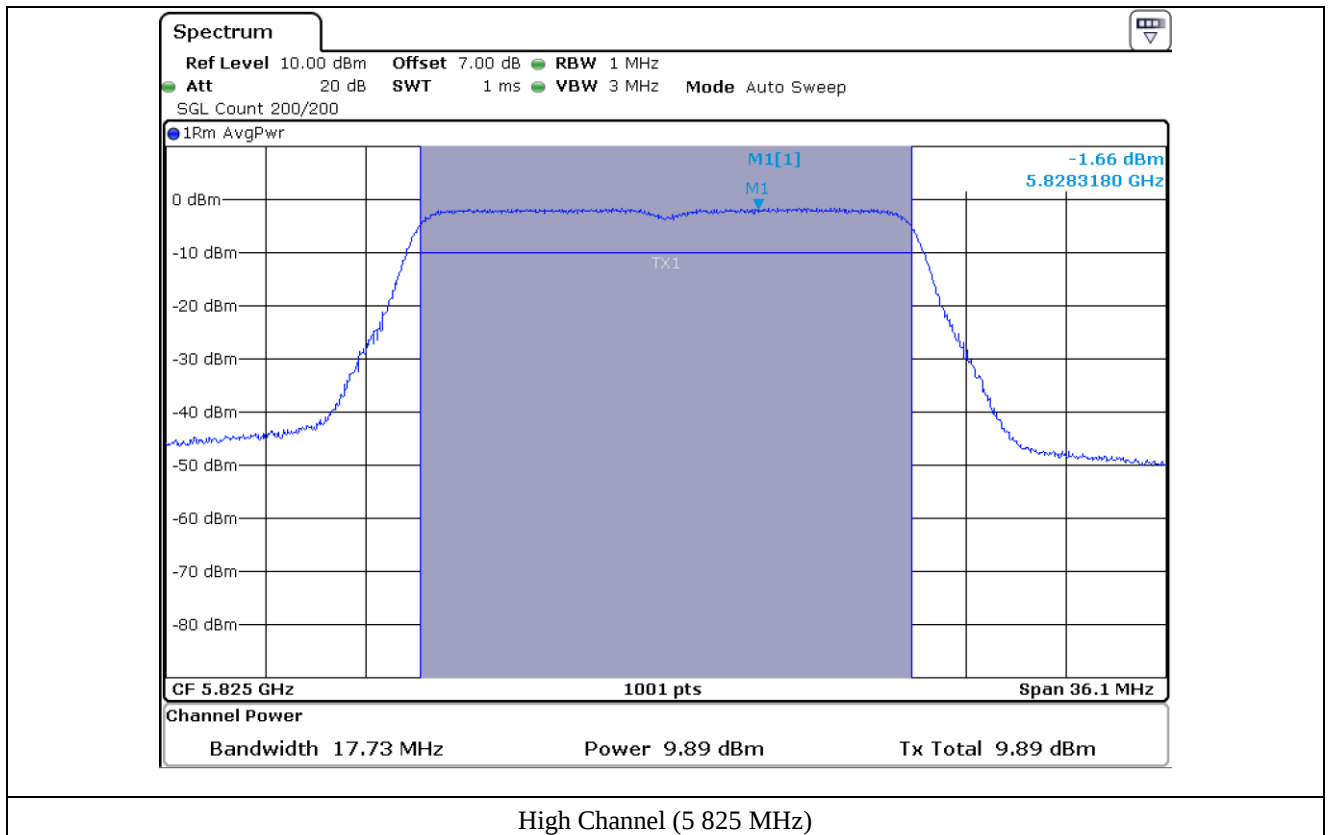




Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



9.5.2 Test data for Antenna 1

-. Test Date : May 23, 2019 ~ July 09, 2019

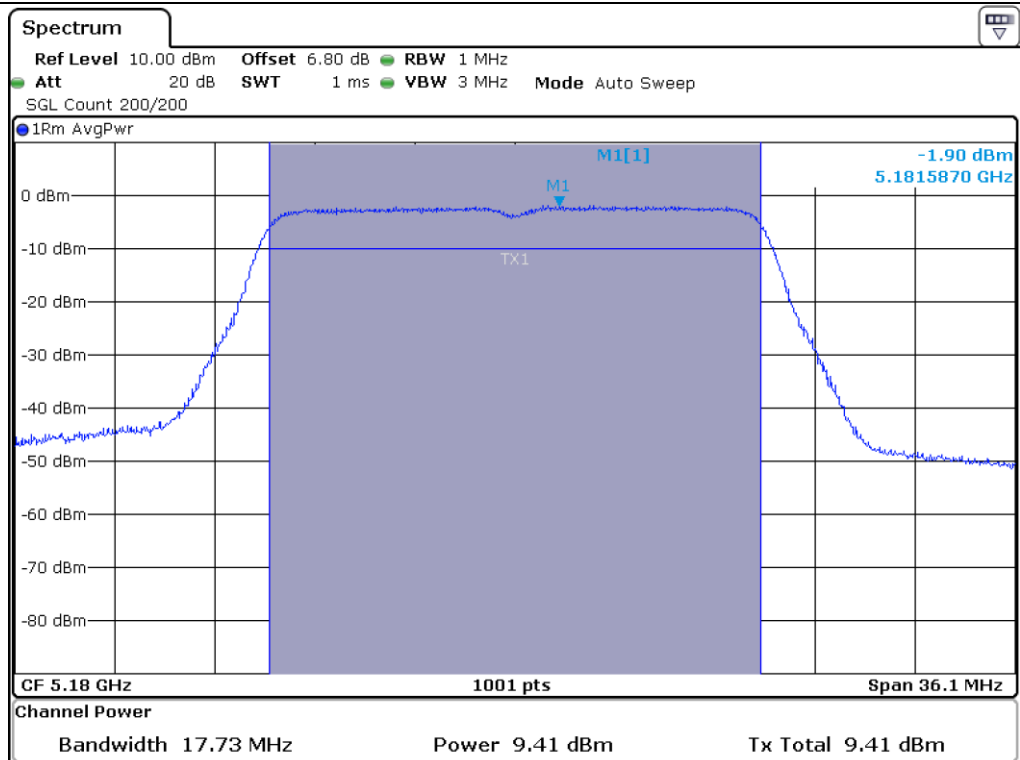
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	9.41	0.33	9.74	24.00	14.26
	Middle	5 220.00	9.39	0.33	9.72	24.00	14.28
	High	5 240.00	9.39	0.33	9.72	24.00	14.28
5 725 ~ 5 850	Low	5 745.00	9.39	0.33	9.72	30.00	20.28
	Middle	5 785.00	9.19	0.33	9.52	30.00	20.48
	High	5 825.00	9.53	0.33	9.86	30.00	20.14

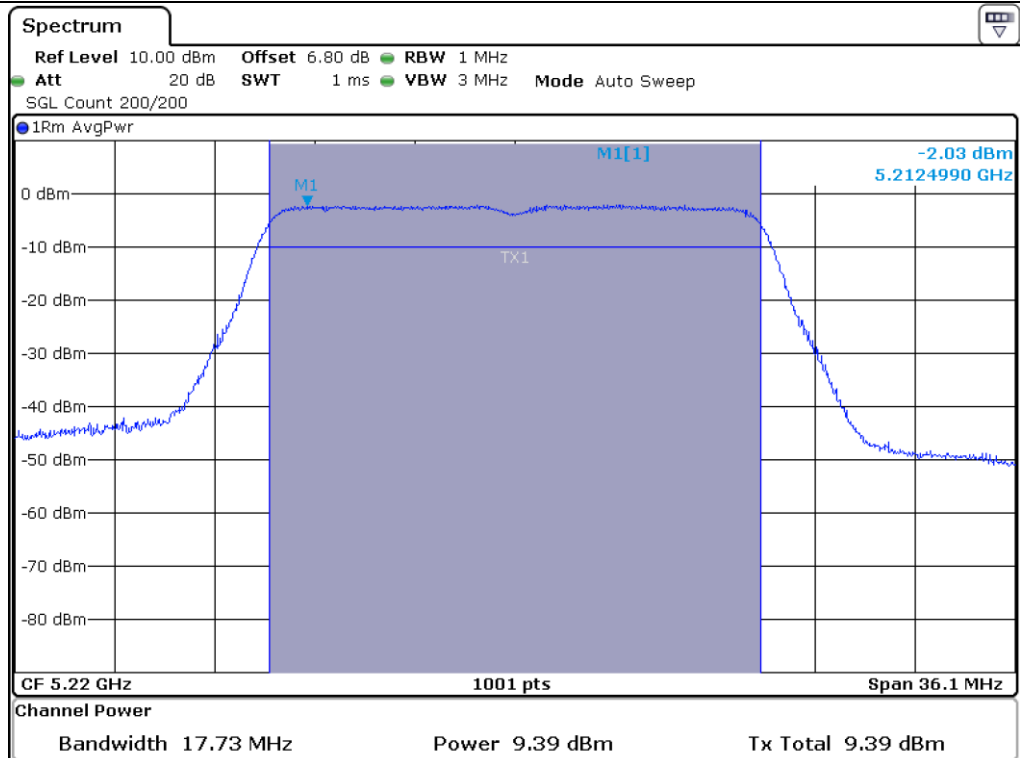
Remark : Result = Measured Value + Duty Fator



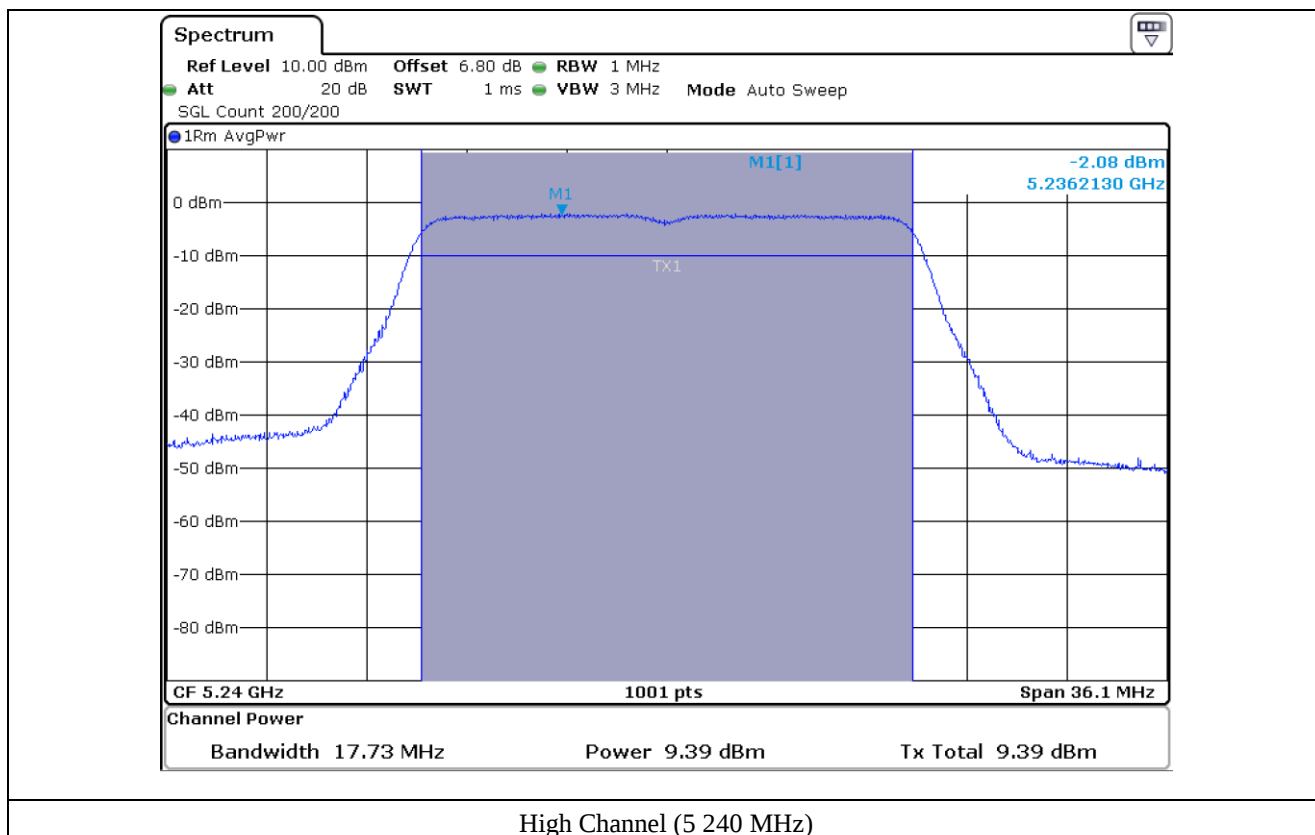
Tested by: Sieon Lee / Assistant Manager

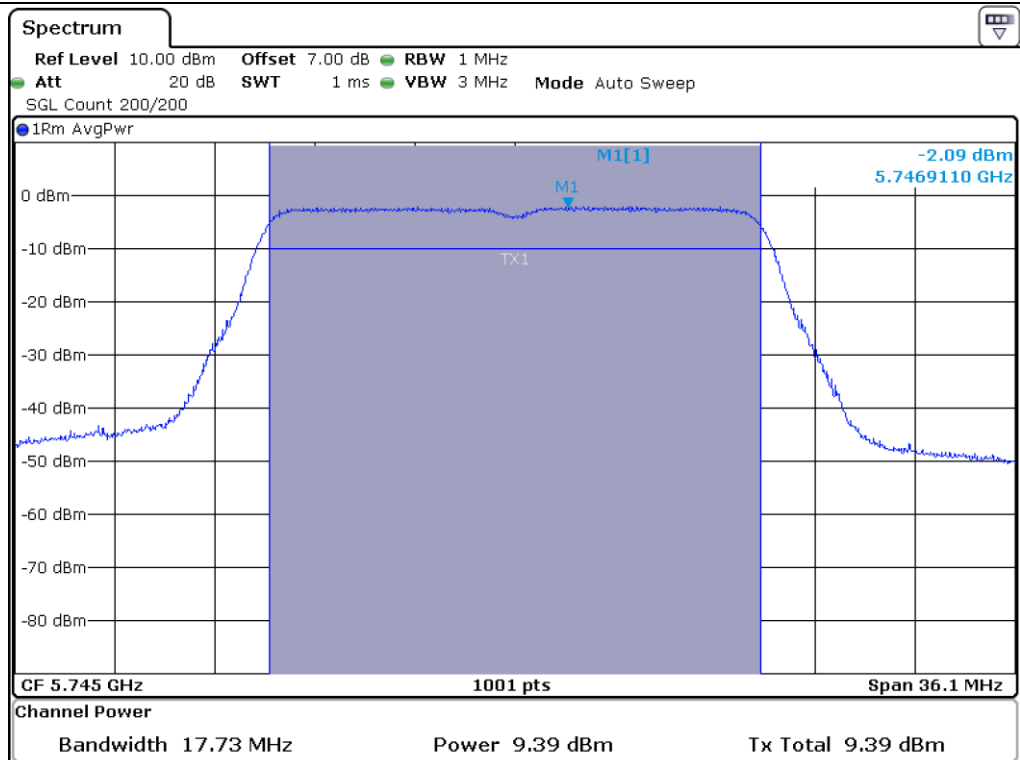


Low Channel (5 180 MHz)

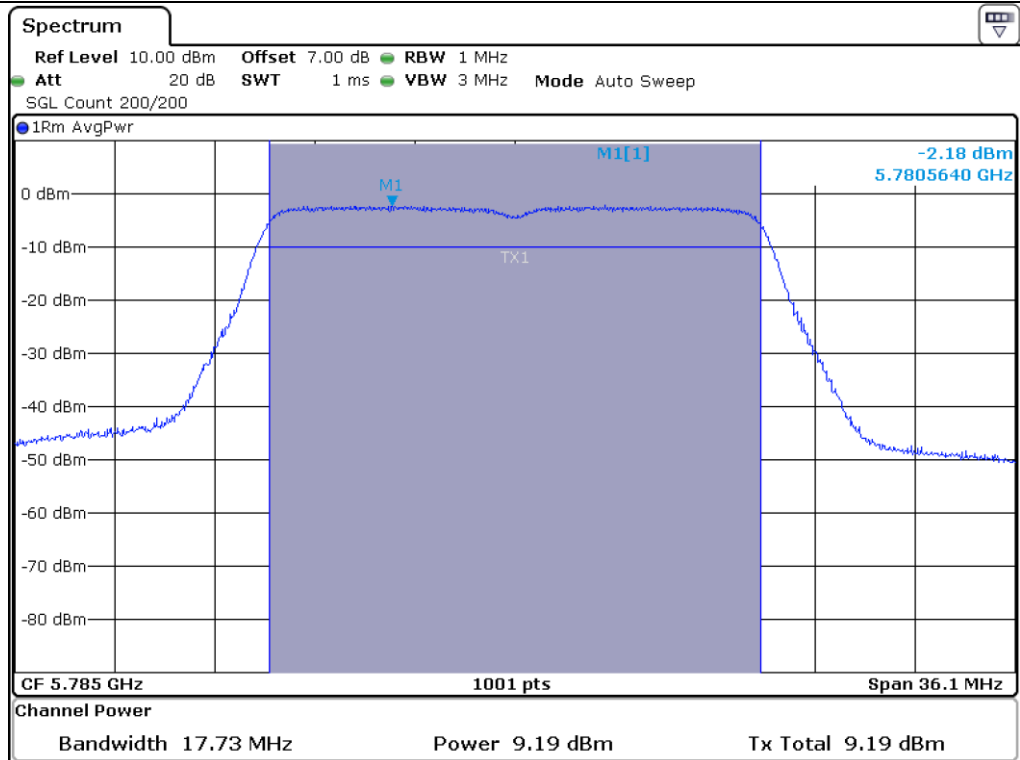


Middle Channel (5 220 MHz)

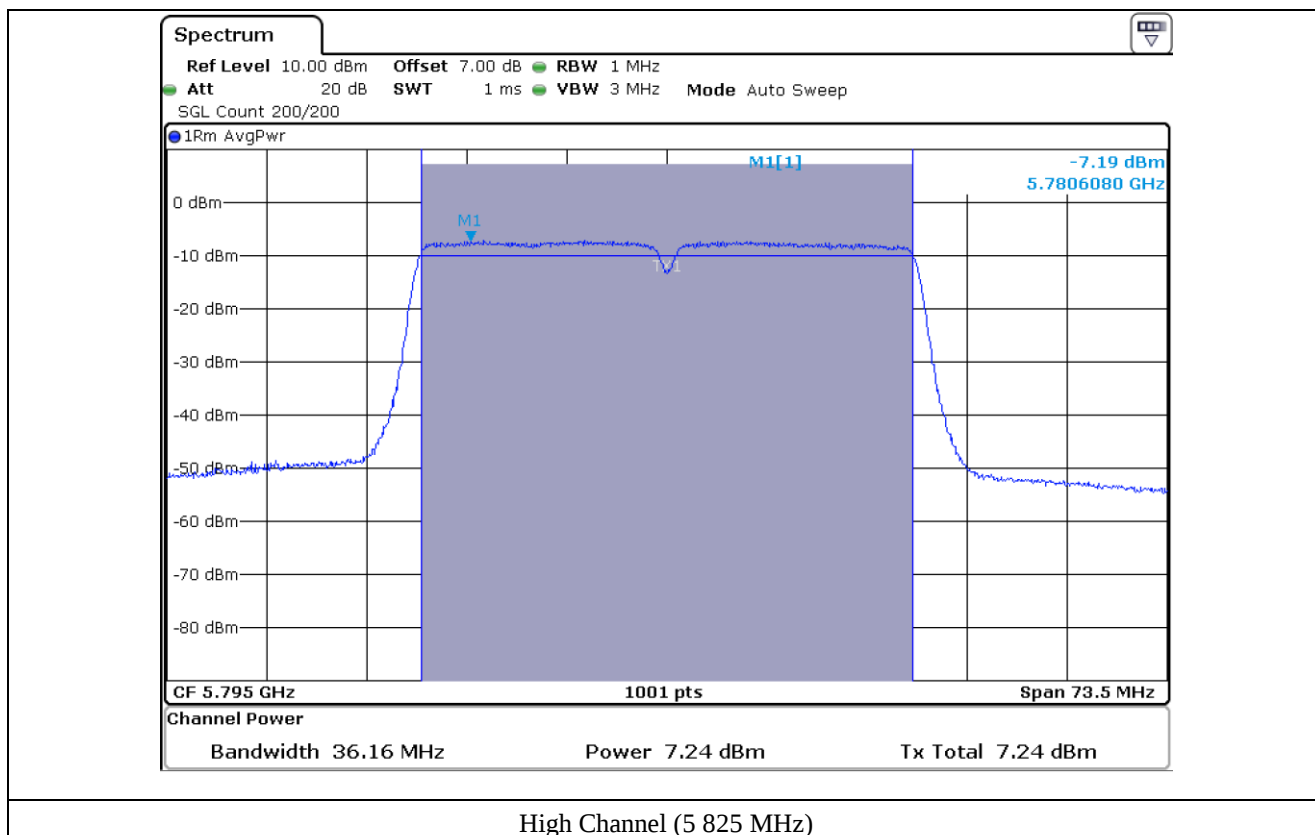




Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



9.5.3 Test data for Multiple Transmit

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Calculated Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	12.94	0.33	13.27	24.00	10.73
	Middle	5 220.00	13.01	0.33	13.34	24.00	10.66
	High	5 240.00	13.01	0.33	13.34	24.00	10.66
5 725 ~ 5 850	Low	5 745.00	12.82	0.33	13.15	28.90	15.75
	Middle	5 785.00	12.70	0.33	13.03	28.90	15.87
	High	5 825.00	12.72	0.33	13.05	28.90	15.85

Remark 1 : Result = Calculated Value + Duty Fator

Remark 2 : Calculated Peak Output Power = $10\log(10^{(\text{Antenna0 Peak Output Power}/10)} + 10^{(\text{Antenna1 Peak Output Power}/10)})$

Remark 3 : Maximum Conducted Output Power shall be reduced by the amount in dB that the directional gain of the anteenaa exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

9.6 Test data for 802.11n (HT40) WLAN Mode

9.6.1 Test data for Antenna 0

-. Test Date : May 23, 2019 ~ July 09, 2019

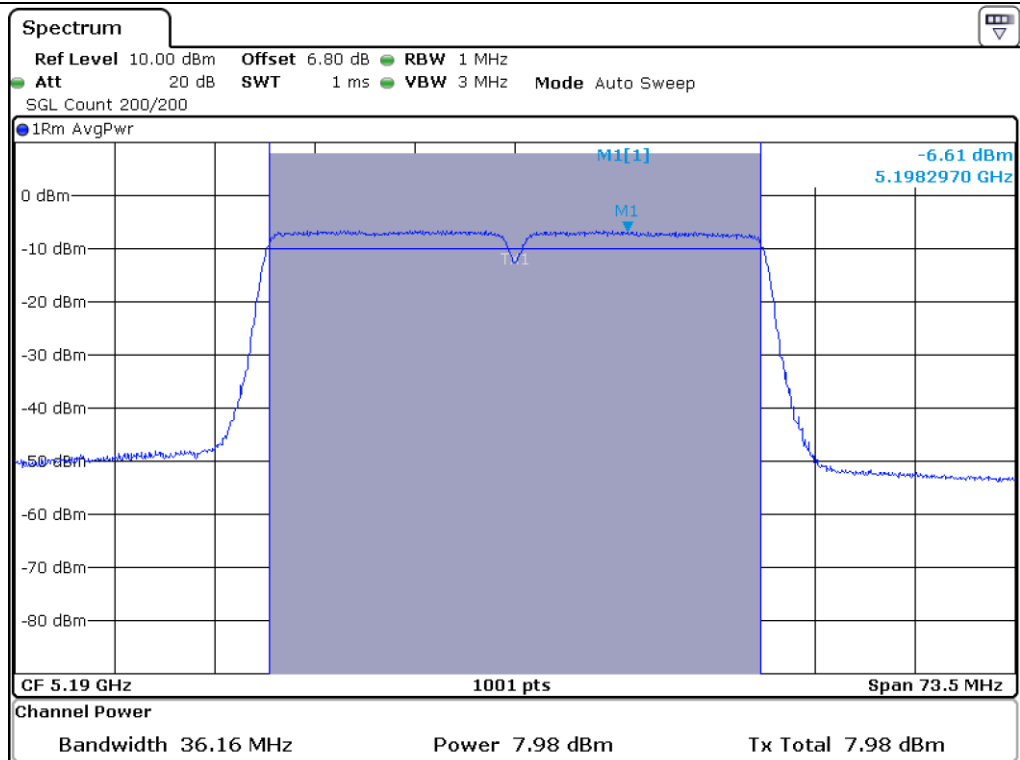
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	7.98	0.66	8.64	24.00	15.36
	High	5 230.00	7.93	0.66	8.59	24.00	15.41
5 725 ~ 5 850	Low	5 755.00	7.65	0.66	8.31	30.00	21.69
	High	5 795.00	7.62	0.66	8.28	30.00	21.72

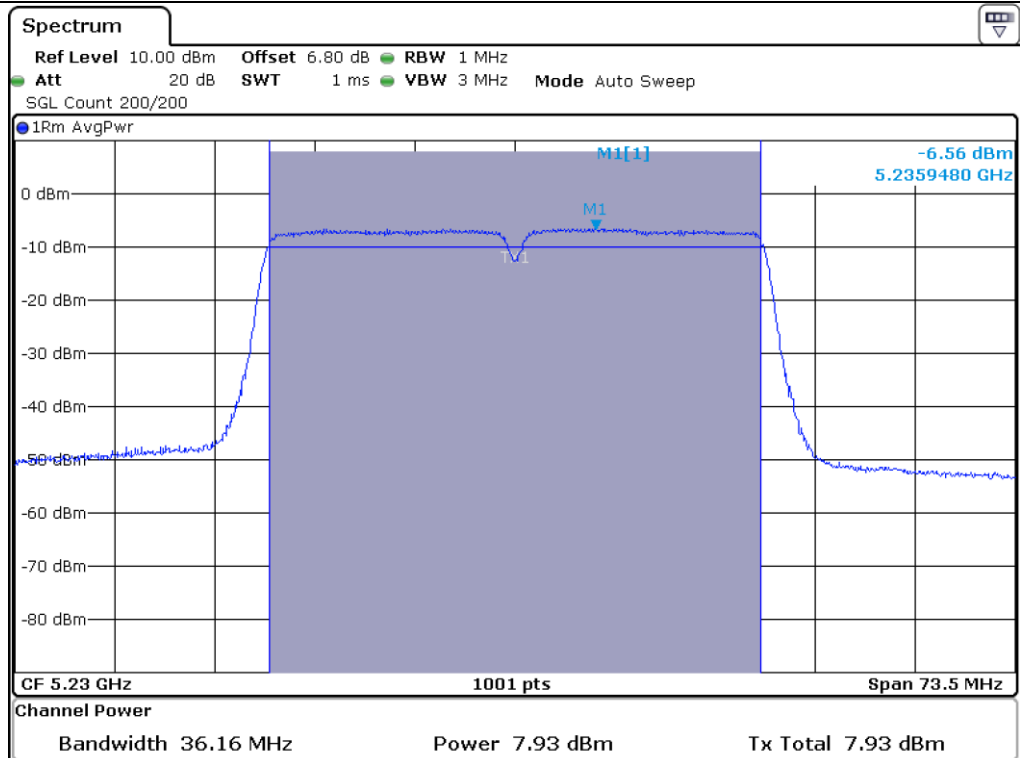
Remark : Result = Measured Value + Duty Fator



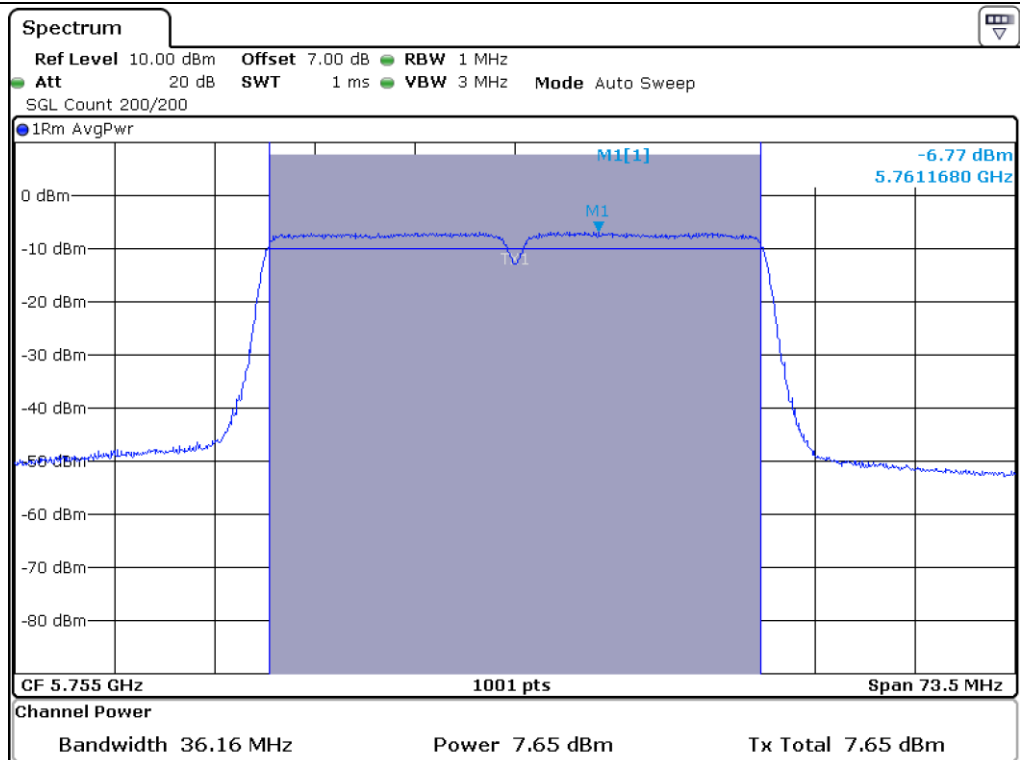
Tested by: Sieon Lee / Assistant Manager



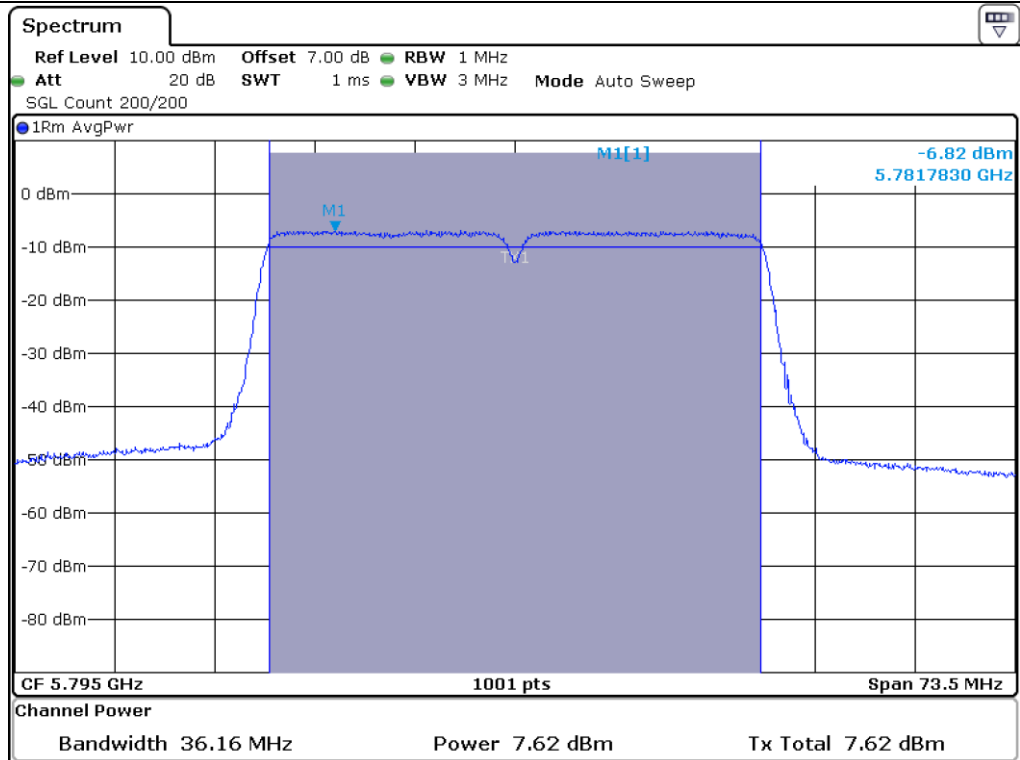
Low Channel (5 190 MHz)



High Channel (5 230 MHz)



Low Channel (5 755 MHz)



High Channel (5 795 MHz)

9.6.2 Test data for Antenna 1

-. Test Date : May 23, 2019 ~ July 09, 2019

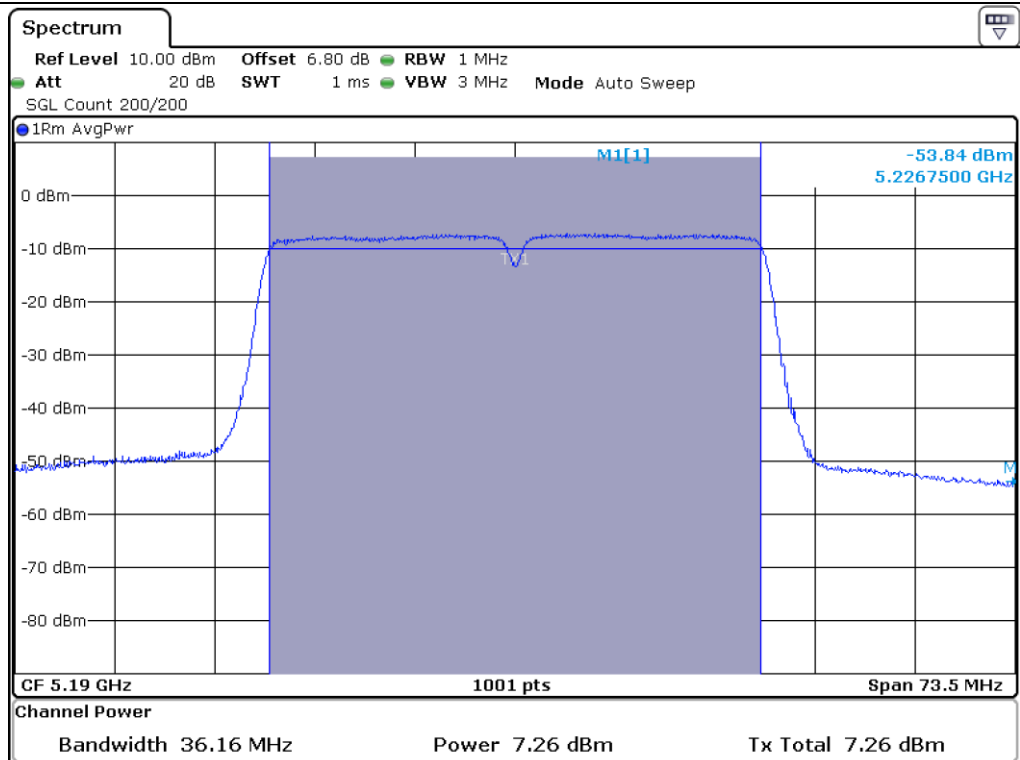
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	7.26	0.66	7.92	24.00	16.08
	High	5 230.00	7.19	0.66	7.85	24.00	16.15
5 725 ~ 5 850	Low	5 755.00	7.41	0.66	8.07	30.00	21.93
	High	5 795.00	7.24	0.66	7.90	30.00	22.10

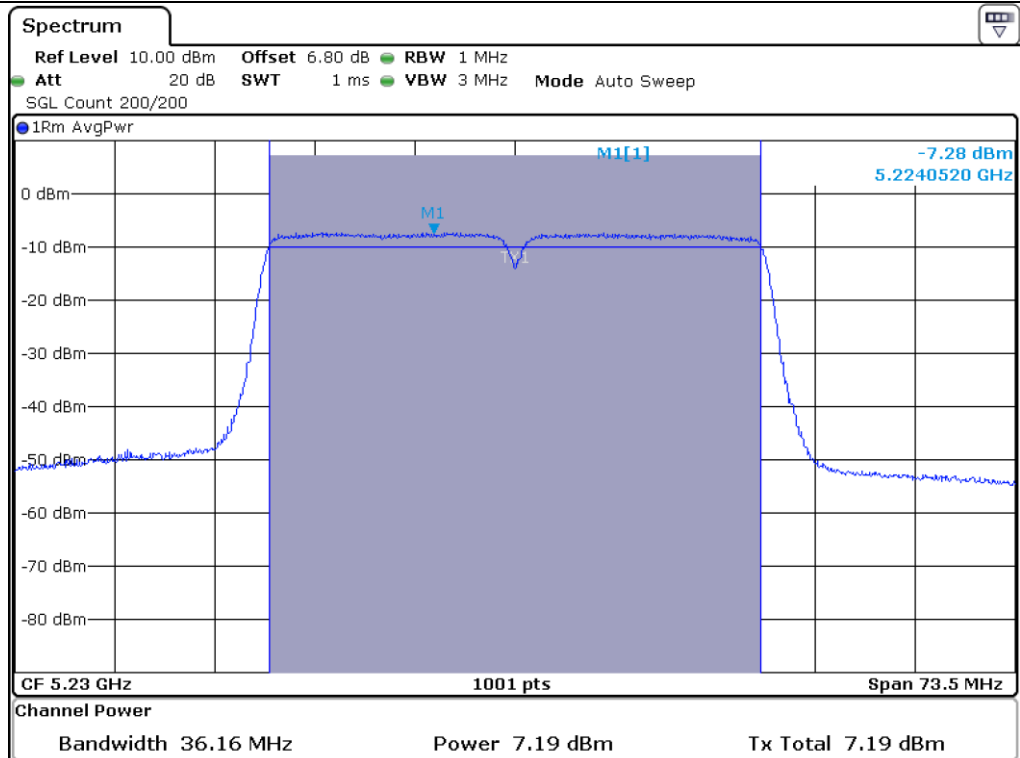
Remark : Result = Measured Value + Duty Fator



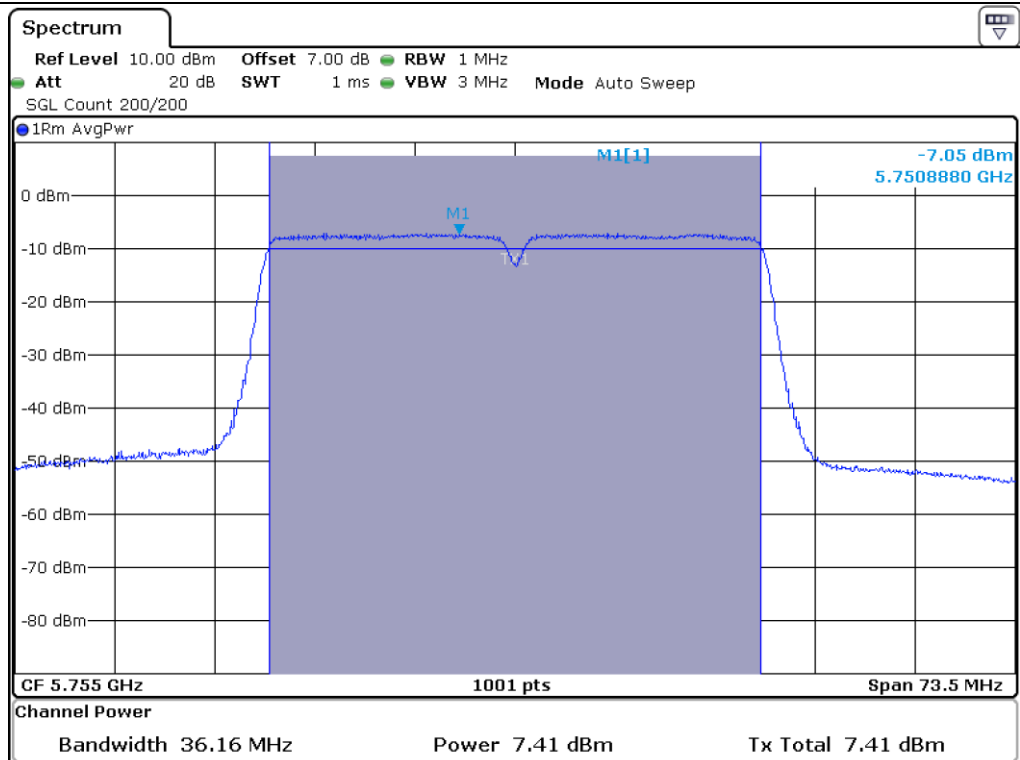
Tested by: Sieon Lee / Assistant Manager



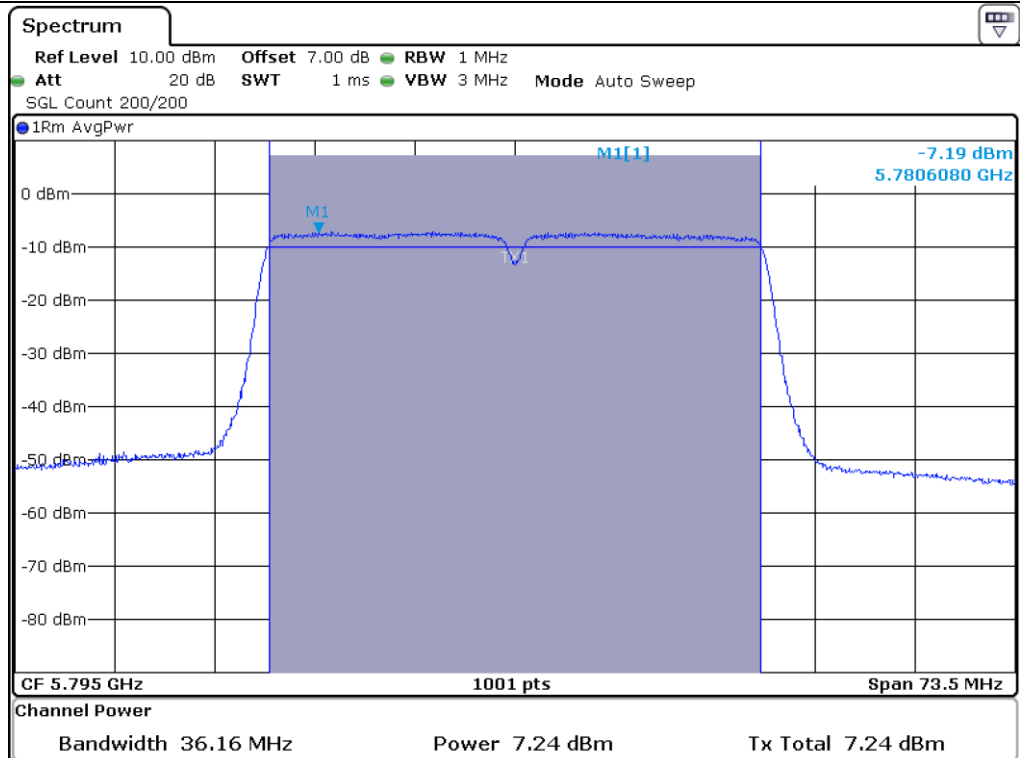
Low Channel (5 190 MHz)



High Channel (5 230 MHz)



Low Channel (5.755 MHz)



High Channel (5.795 MHz)

9.6.3 Test data for Multiple Transmit

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Calculated Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	10.65	0.66	11.31	24.00	12.69
	High	5 230.00	10.59	0.66	11.25	24.00	12.75
5 725 ~ 5 850	Low	5 755.00	10.54	0.66	11.20	28.90	17.70
	High	5 795.00	10.44	0.66	11.10	28.90	17.80

Remark 1 : Result = Calculated Value + Duty Fator

Remark 2 : Calculated Peak Output Power = $10\log(10^{(\text{Antenna0 Peak Output Power}/10)} + 10^{(\text{Antenna1 Peak Output Power}/10)})$

Remark 3 : Maximum Conducted Output Power shall be reduced by the amount in dB that the directional gain of the anteenaa exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

9.7 Test data for 802.11ac (HT80) WLAN Mode

9.7.1 Test data for Antenna 0

-. Test Date : May 23, 2019 ~ July 09, 2019

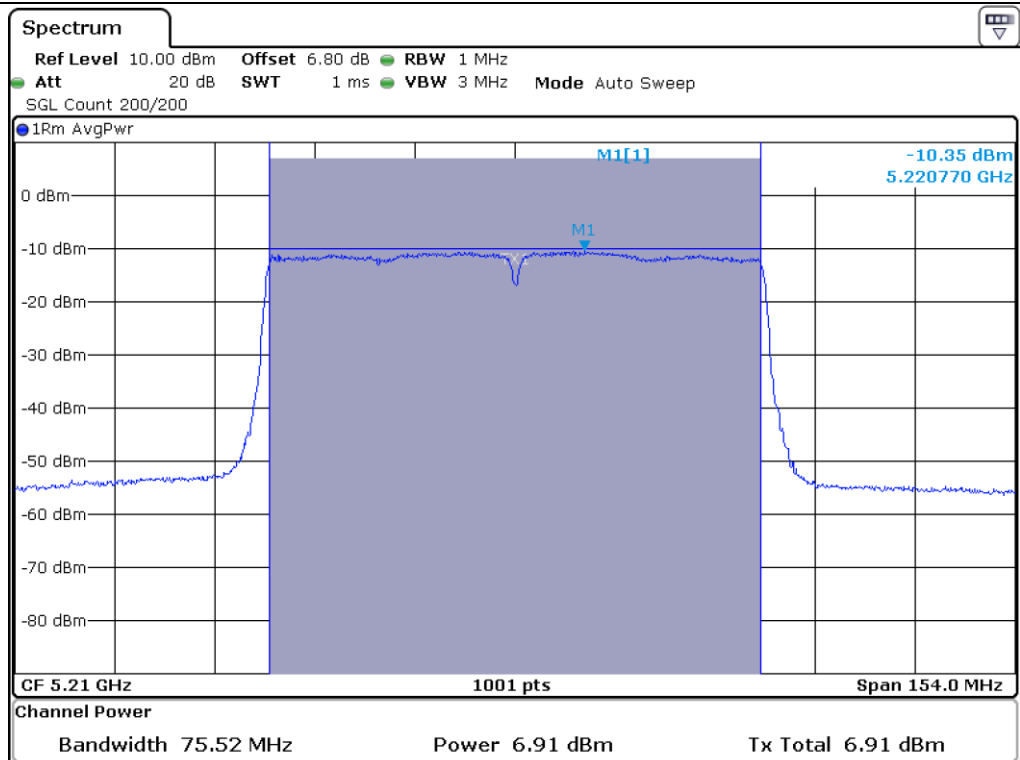
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	6.91	1.14	8.05	24.00	15.95
5 725 ~ 5 850	Low	5 775.00	6.49	1.14	7.63	30.00	22.37

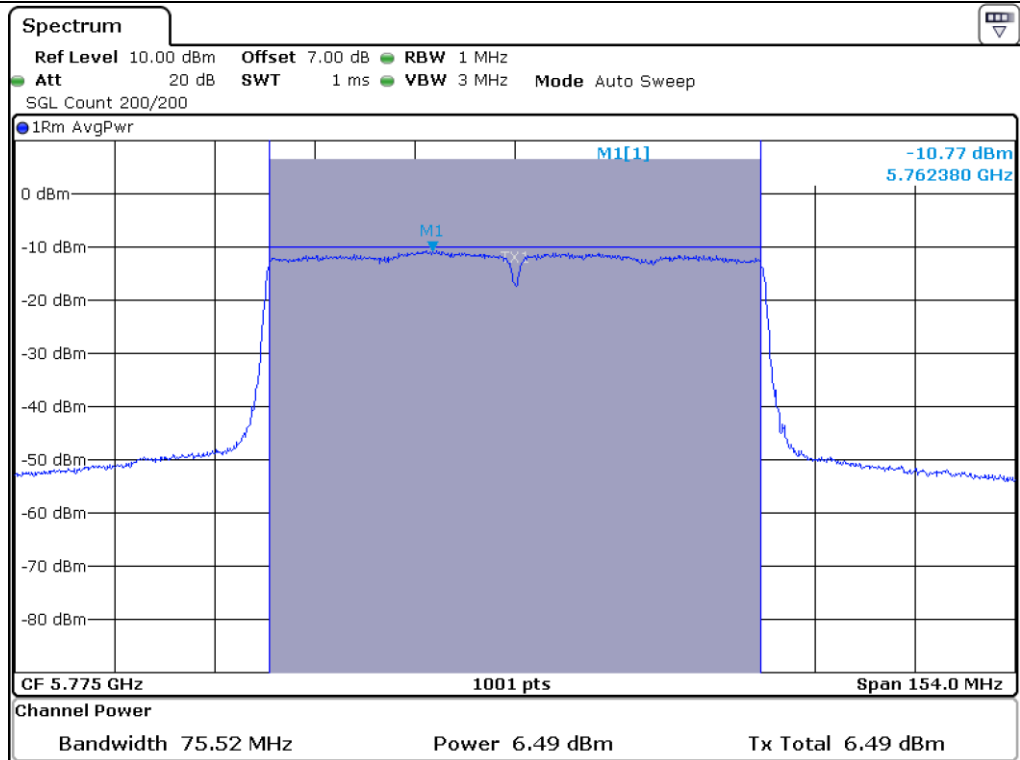
Remark : Result = Measured Value + Duty Fator



Tested by: Sieon Lee / Assistant Manager



Low Channel (5 210 MHz)



Low Channel (5 775 MHz)

9.7.2 Test data for Antenna 1

-. Test Date : May 23, 2019 ~ July 09, 2019

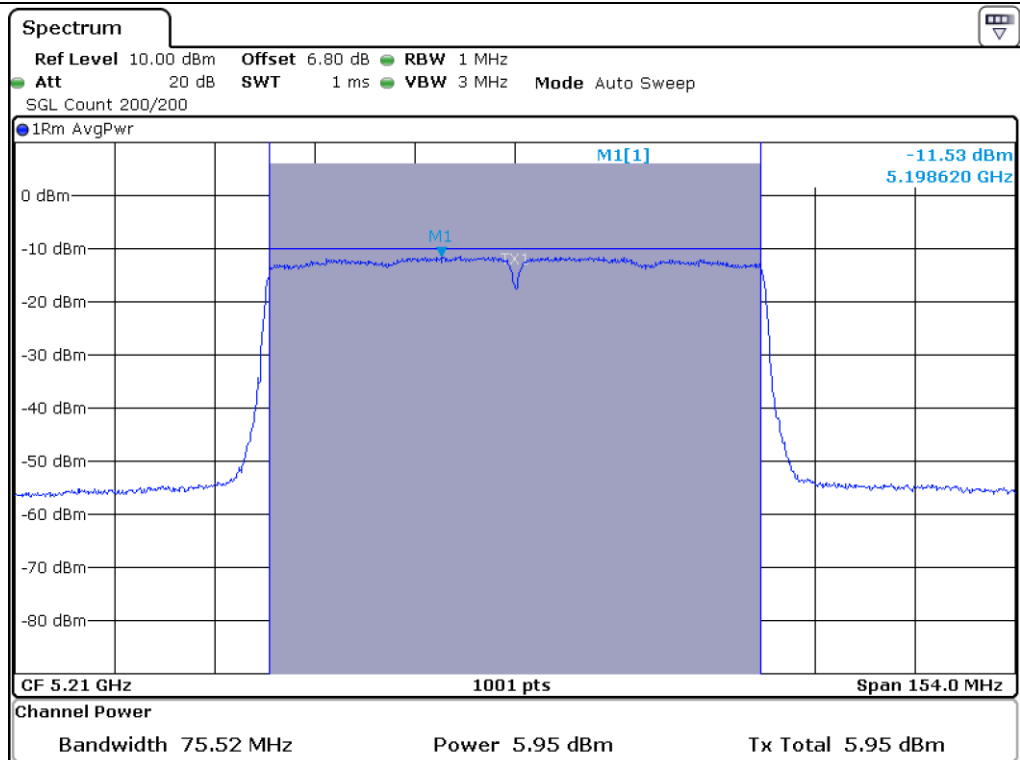
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	5.95	1.14	7.09	24.00	16.91
5 725 ~ 5 850	Low	5 775.00	5.85	1.14	6.99	30.00	23.01

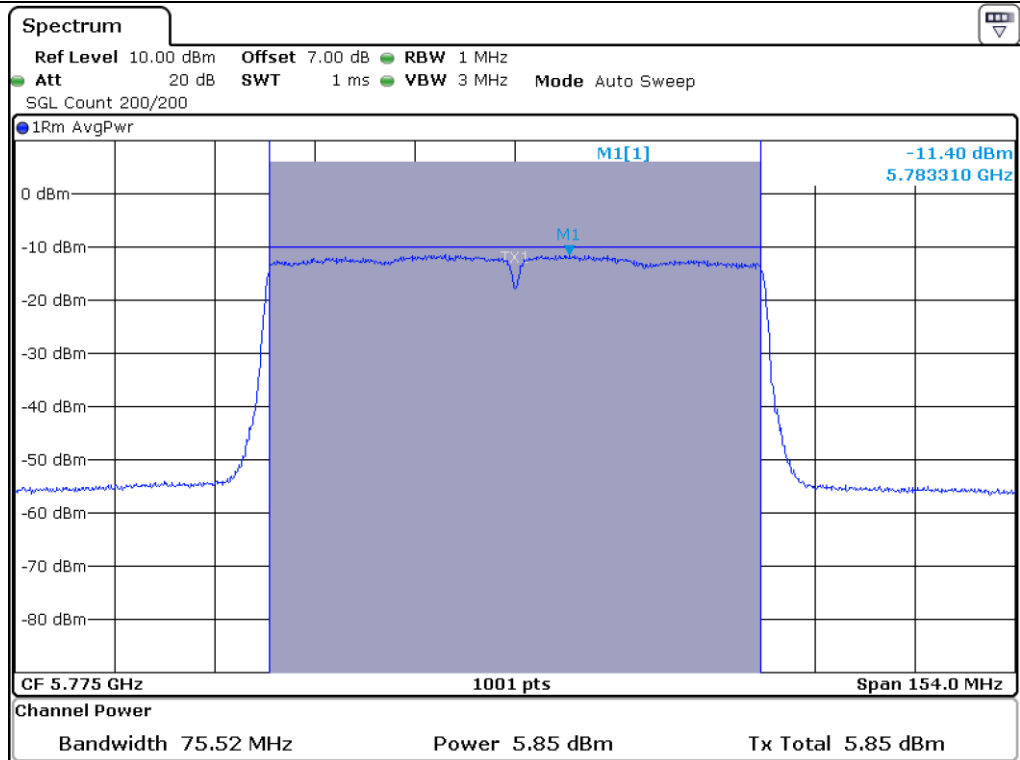
Remark : Result = Measured Value + Duty Fator



Tested by: Sieon Lee / Assistant Manager



Low Channel (5 210 MHz)



Low Channel (5 775 MHz)

9.7.3 Test data for Multiple Transmit

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Calculated Value (dBm)	Duty Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	9.47	1.14	10.61	24.00	13.39
5 725 ~ 5 850	Low	5 775.00	9.19	1.14	10.33	28.90	18.57

Remark 1 : Result = Calculated Value + Duty Fator

Remark 2 : Calculated Peak Output Power = $10\log(10^{(\text{Antenna0 Peak Output Power}/10)} + 10^{(\text{Antenna1 Peak Output Power}/10)})$

Remark 3 : Maximum Conducted Output Power shall be reduced by the amount in dB that the directional gain of the antena exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

10. PEAK POWER SPECTRAL DENSITY

10.1 Operating environment

Temperature : 24 °C

Relative humidity : 48 % R.H.

10.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level from the EUT in 1 MHz bandwidth was measured with above condition.



10.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV30	Rohde & Schwarz	Signal Analyzer	101200	Aug. 23, 2018 (1Y)

All test equipment used is calibrated on a regular basis.

10.4 Test data for 802.11a WLAN Mode

10.4.1 Test data for Antenna 0

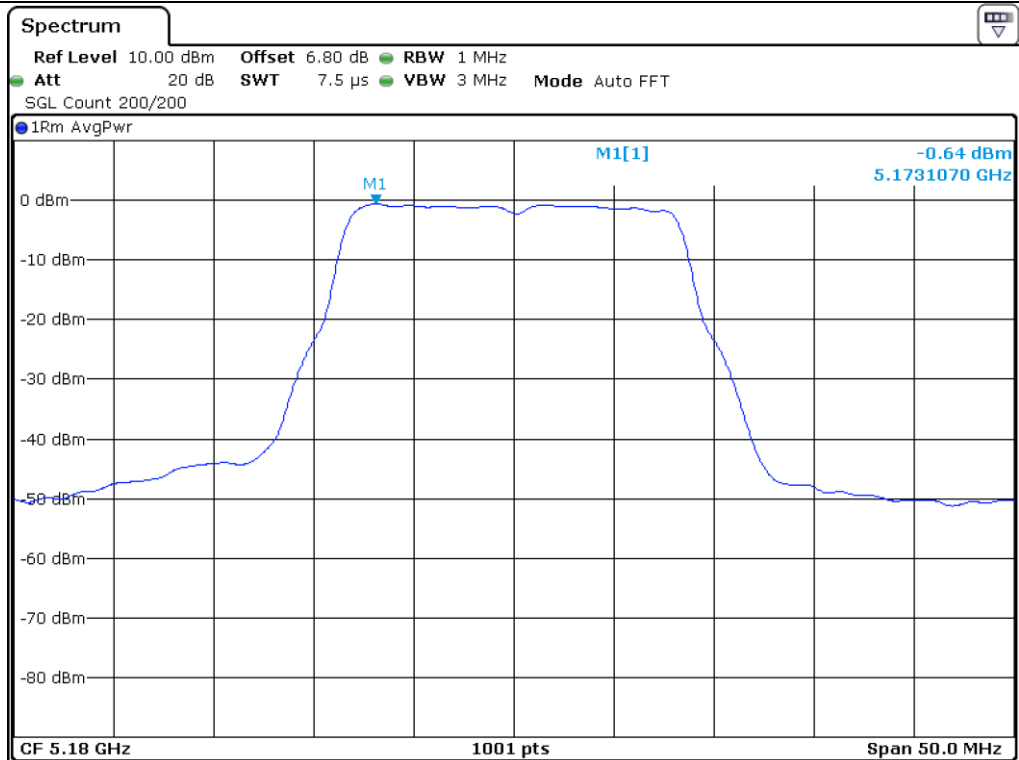
- . Test Date : May 23, 2019 ~ July 09, 2019
 -. Operating condition : Highest Output Power Transmitting Mode
 -. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	-0.64	11.00	11.31
	Middle	5 220.00	-0.55	11.00	11.22
	High	5 240.00	-0.73	11.00	11.40
5 725 ~ 5 850	Low	5 745.00	-4.47	30.00	34.14
	Middle	5 785.00	-4.37	30.00	34.04
	High	5 825.00	-4.39	30.00	34.06

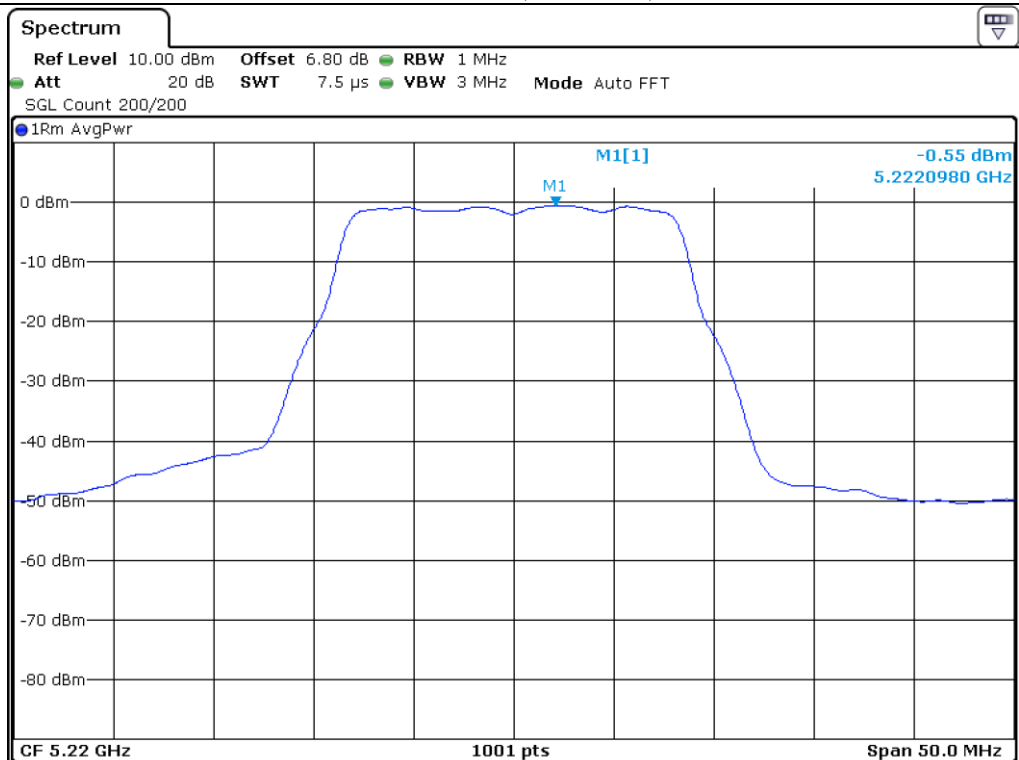
Remark: See next page for measurement data.



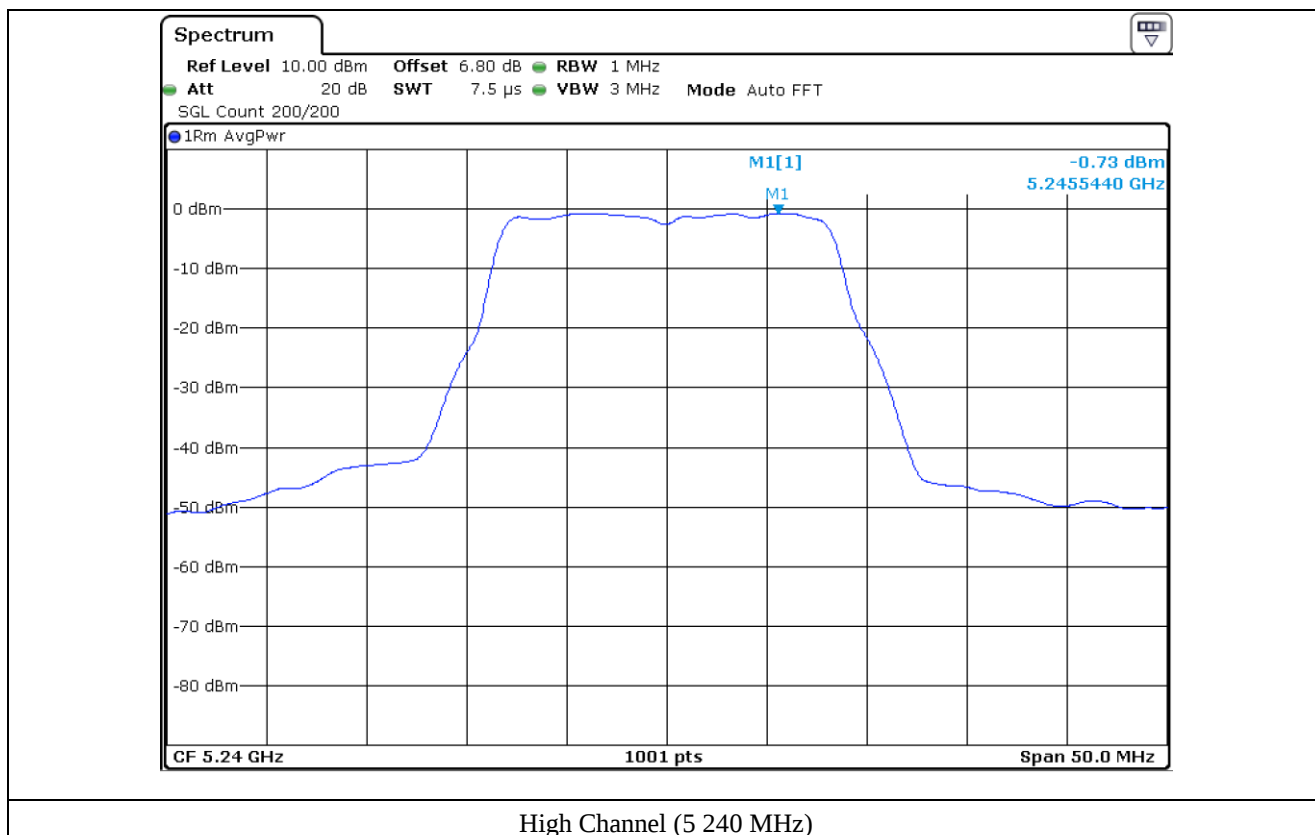
Tested by: Sieon Lee / Assistant Manager

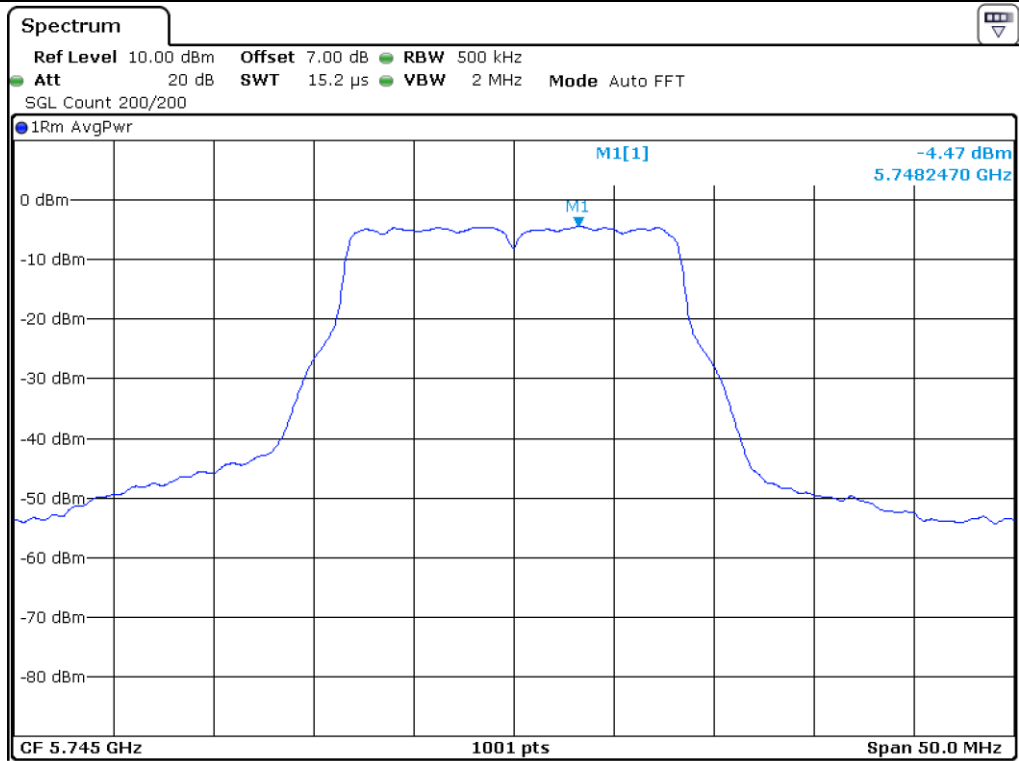


Low Channel (5 180 MHz)

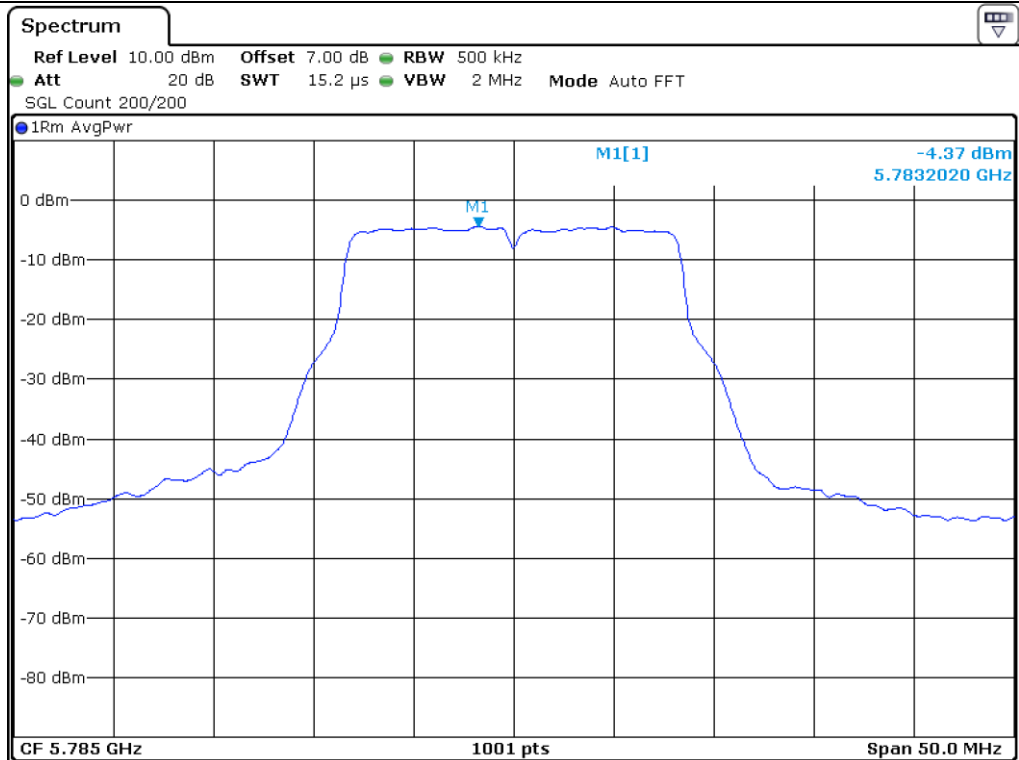


Middle Channel (5 220 MHz)

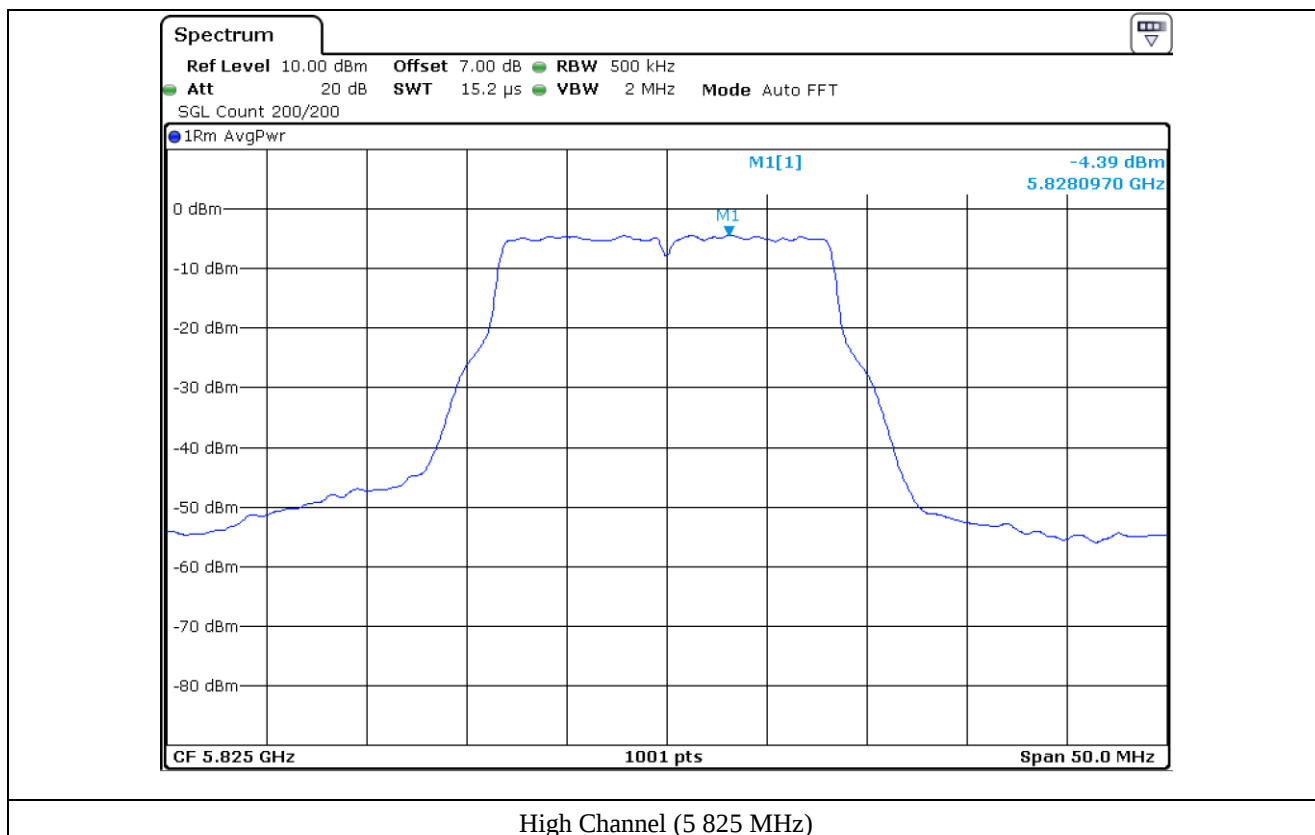




Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



10.4.2 Test data for Antenna 1

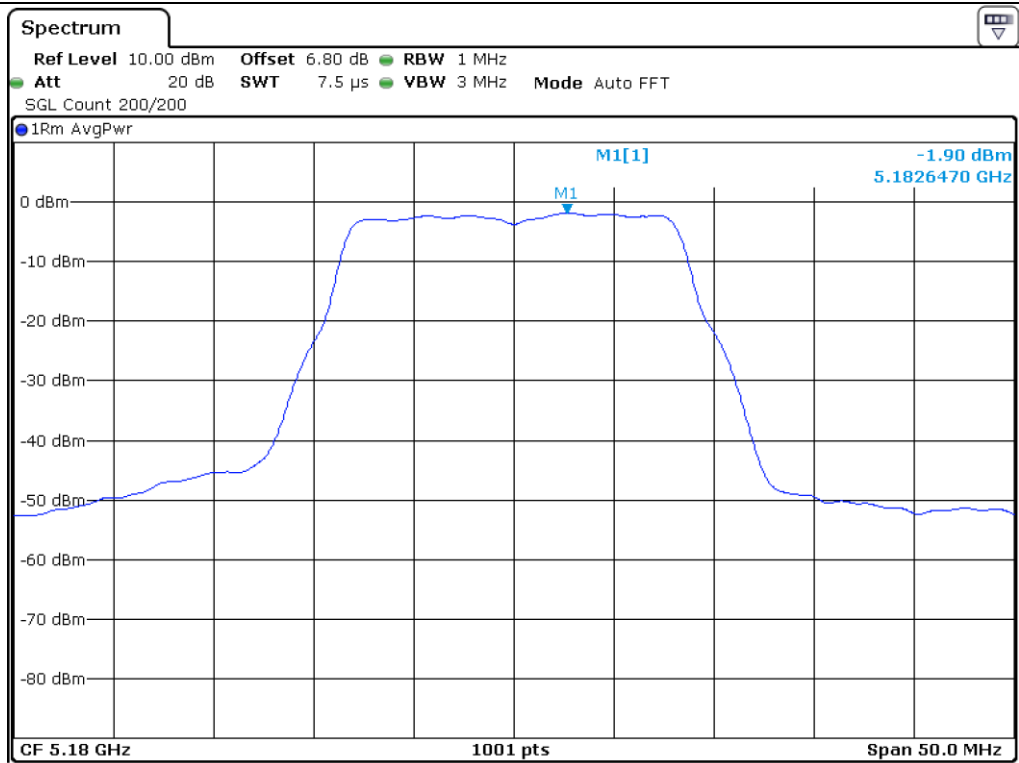
- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	-1.90	11.00	12.57
	Middle	5 220.00	-1.75	11.00	12.42
	High	5 240.00	-1.76	11.00	12.43
5 725 ~ 5 850	Low	5 745.00	-4.25	30.00	33.92
	Middle	5 785.00	-4.10	30.00	33.77
	High	5 825.00	-4.31	30.00	33.98

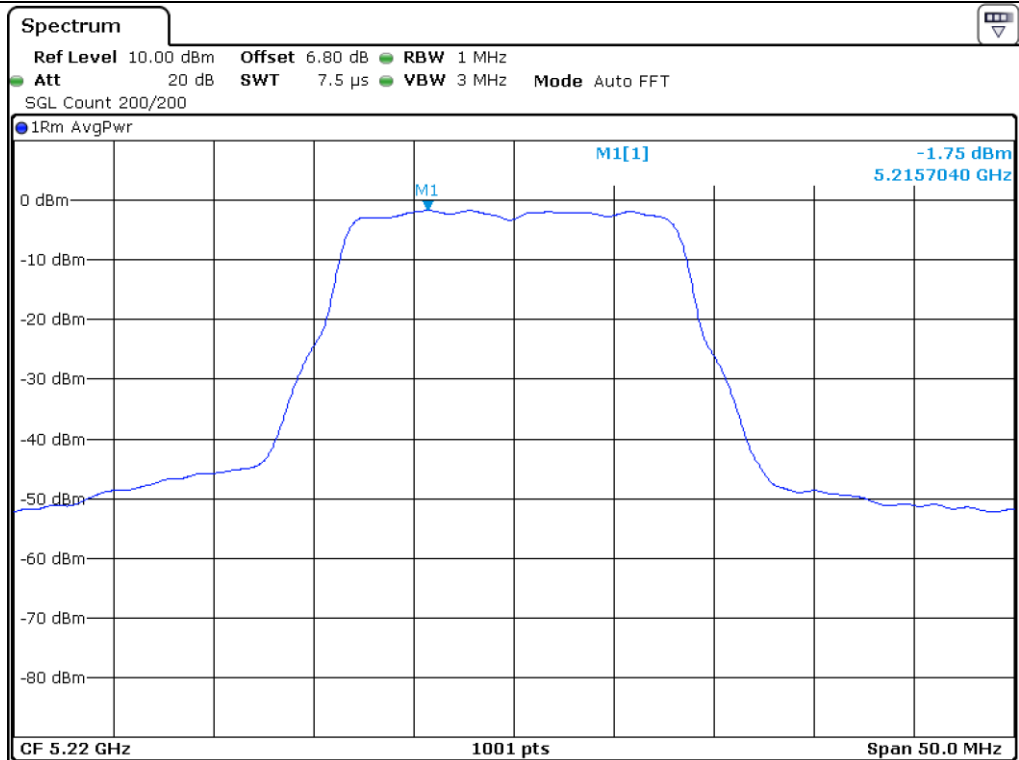
Remark: See next page for measurement data.



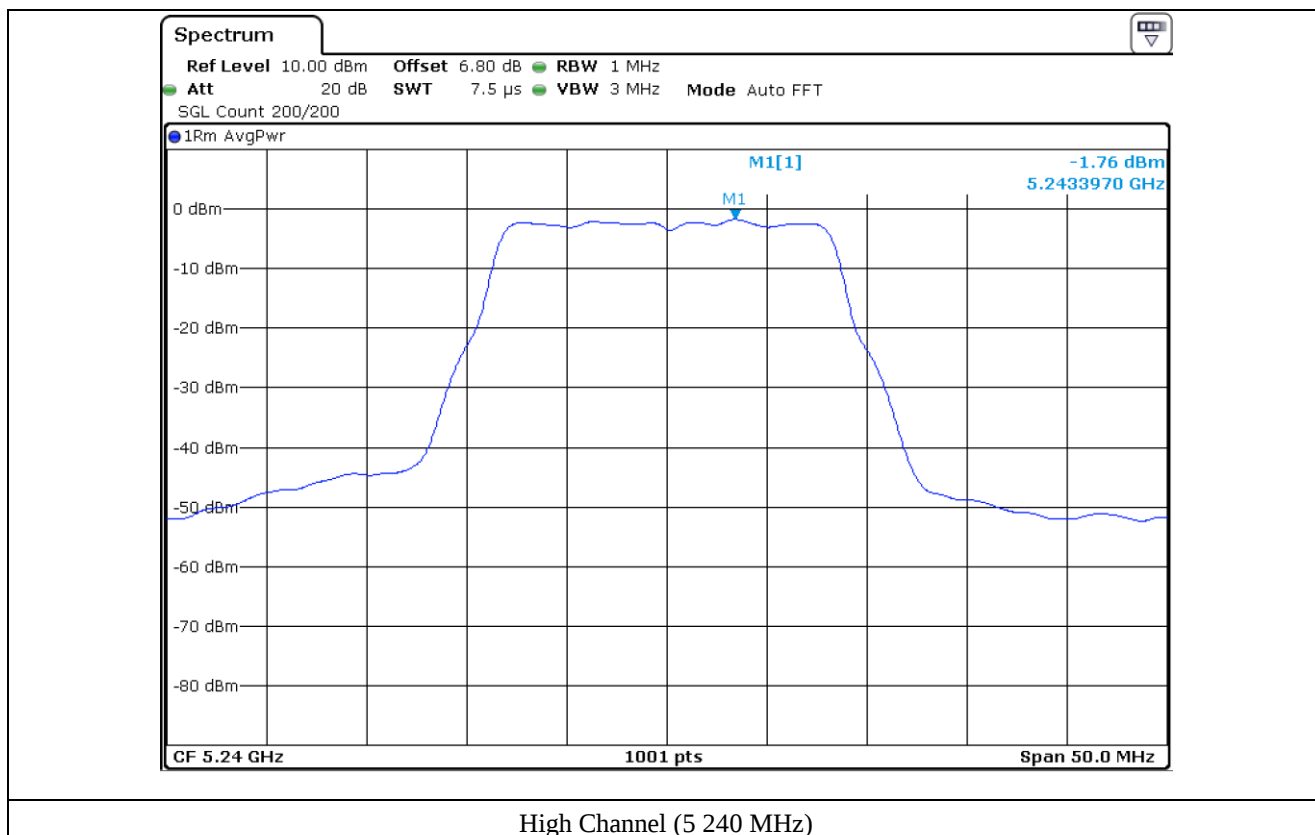
Tested by: Sieon Lee / Assistant Manager

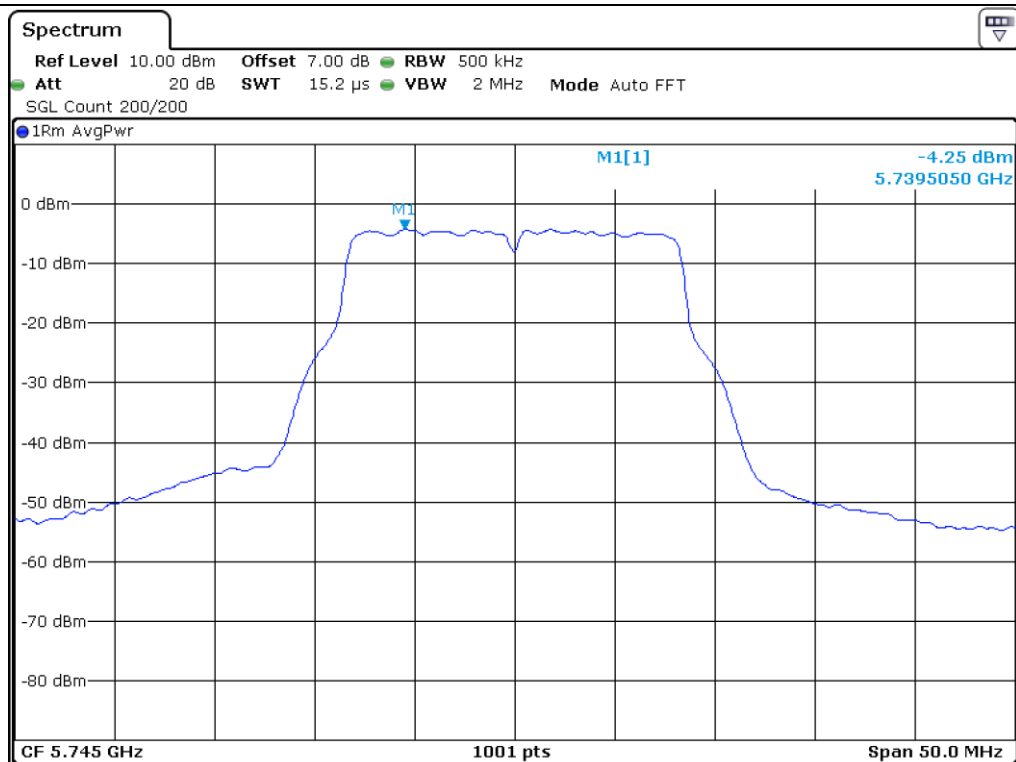


Low Channel (5 180 MHz)

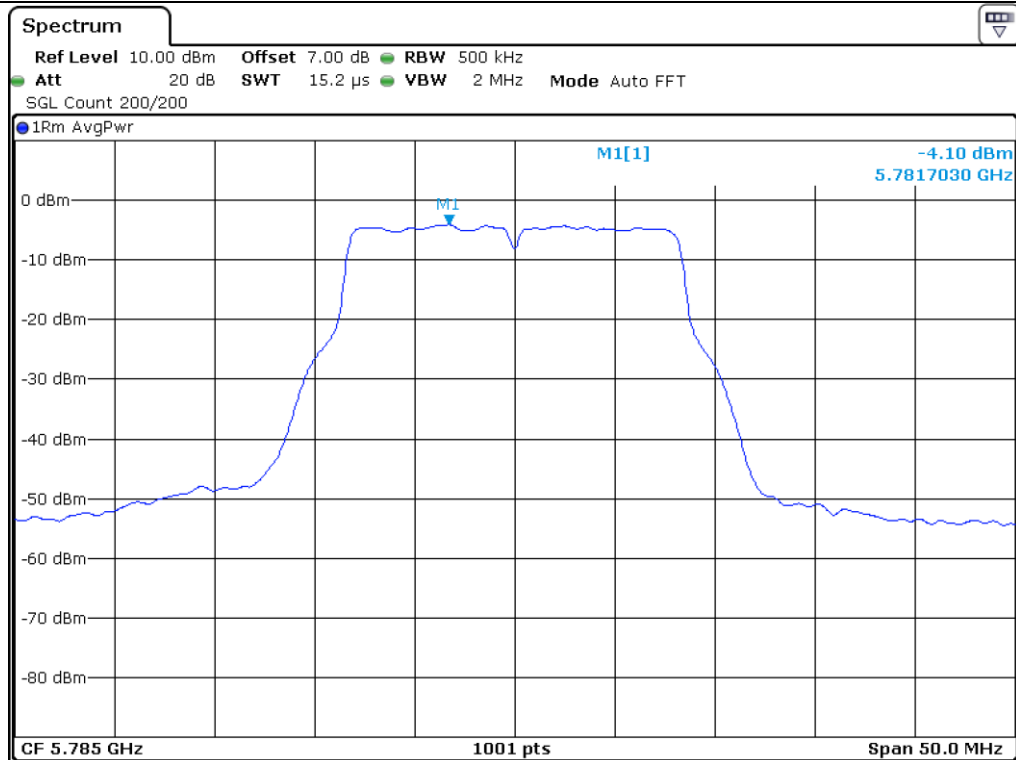


Middle Channel (5 220 MHz)

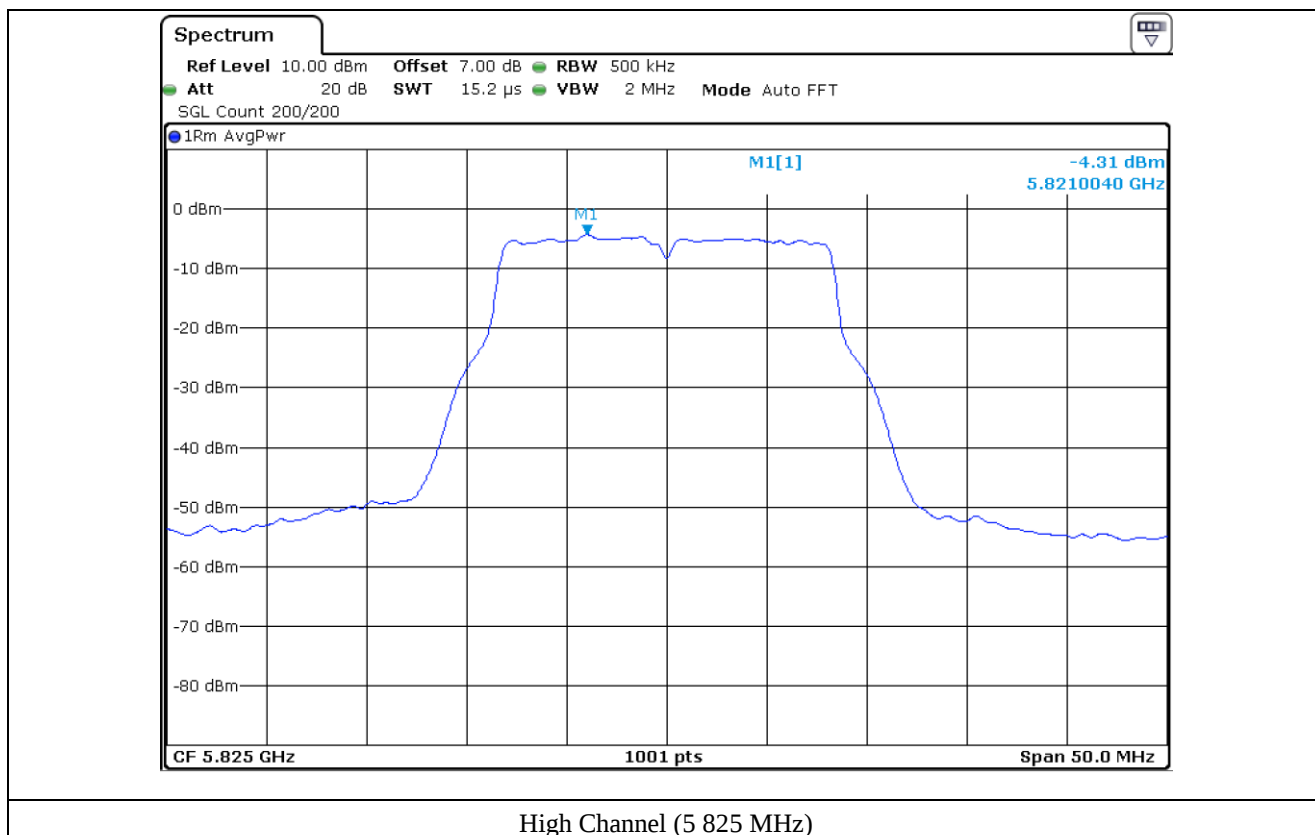




Low Chanel (5 745 MHz)



Middle Channel (5 785 MHz)



10.5 Test data for 802.11n_HT20 WLAN Mode

10.5.1 Test data for Antenna 0

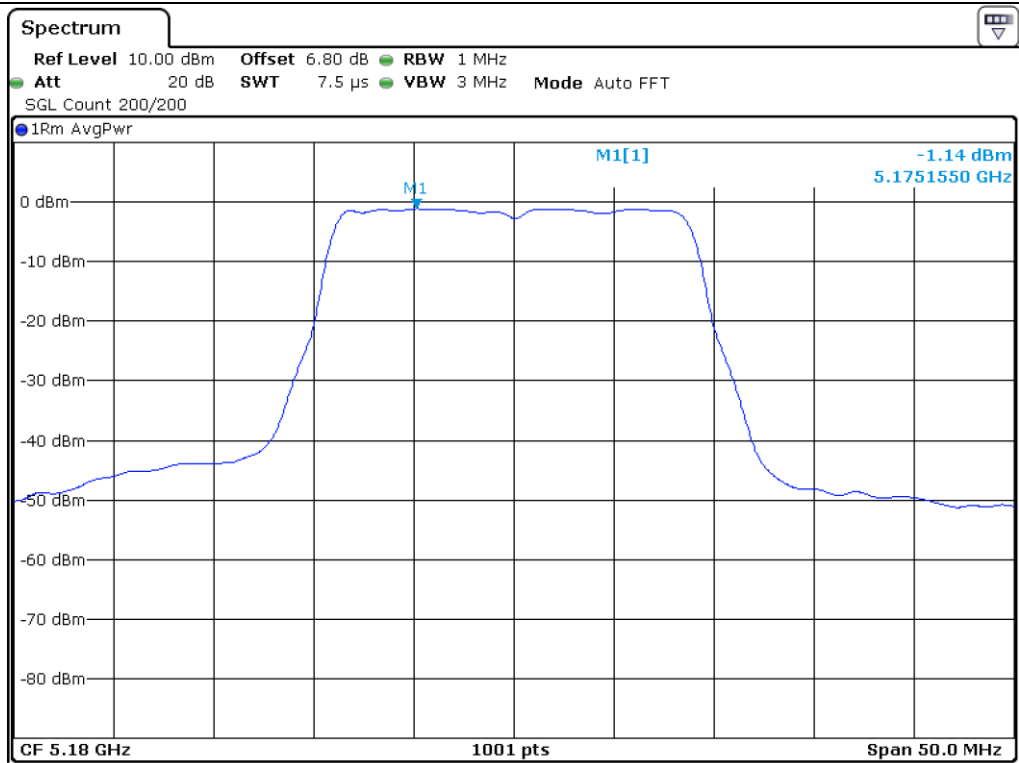
- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	-1.14	11.00	11.81
	Middle	5 220.00	-1.10	11.00	11.77
	High	5 240.00	-0.86	11.00	11.53
5 725 ~ 5 850	Low	5 745.00	-4.71	30.00	34.38
	Middle	5 785.00	-4.95	30.00	34.62
	High	5 825.00	-4.85	30.00	34.52

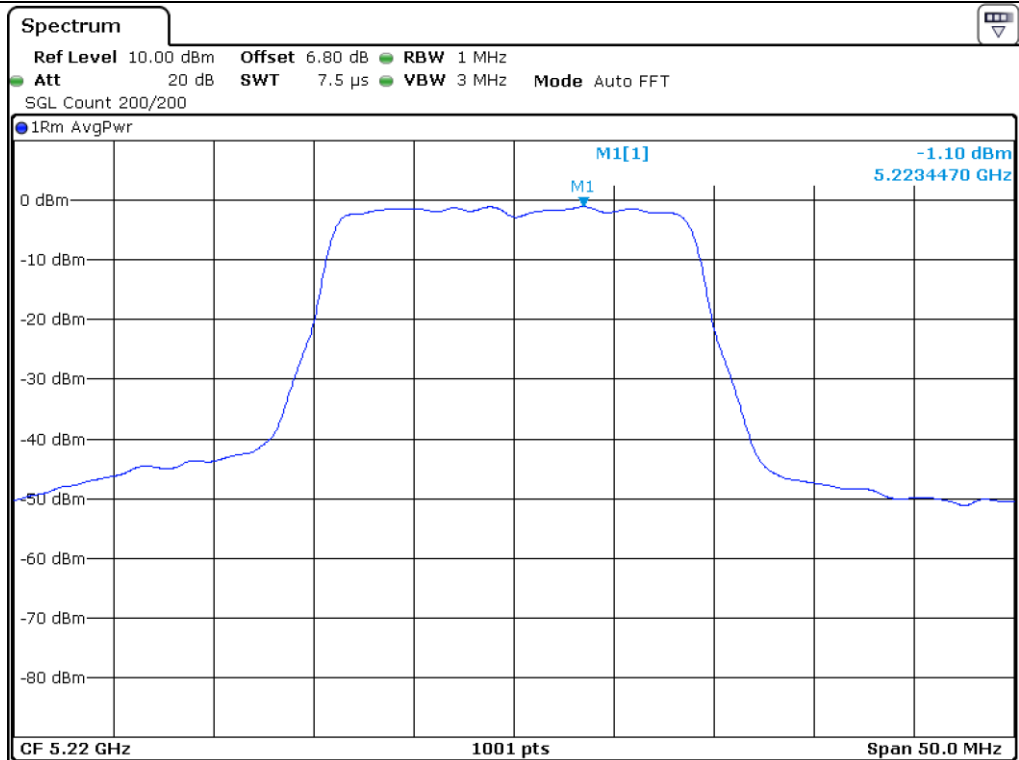
Remark: See next page for measurement data.



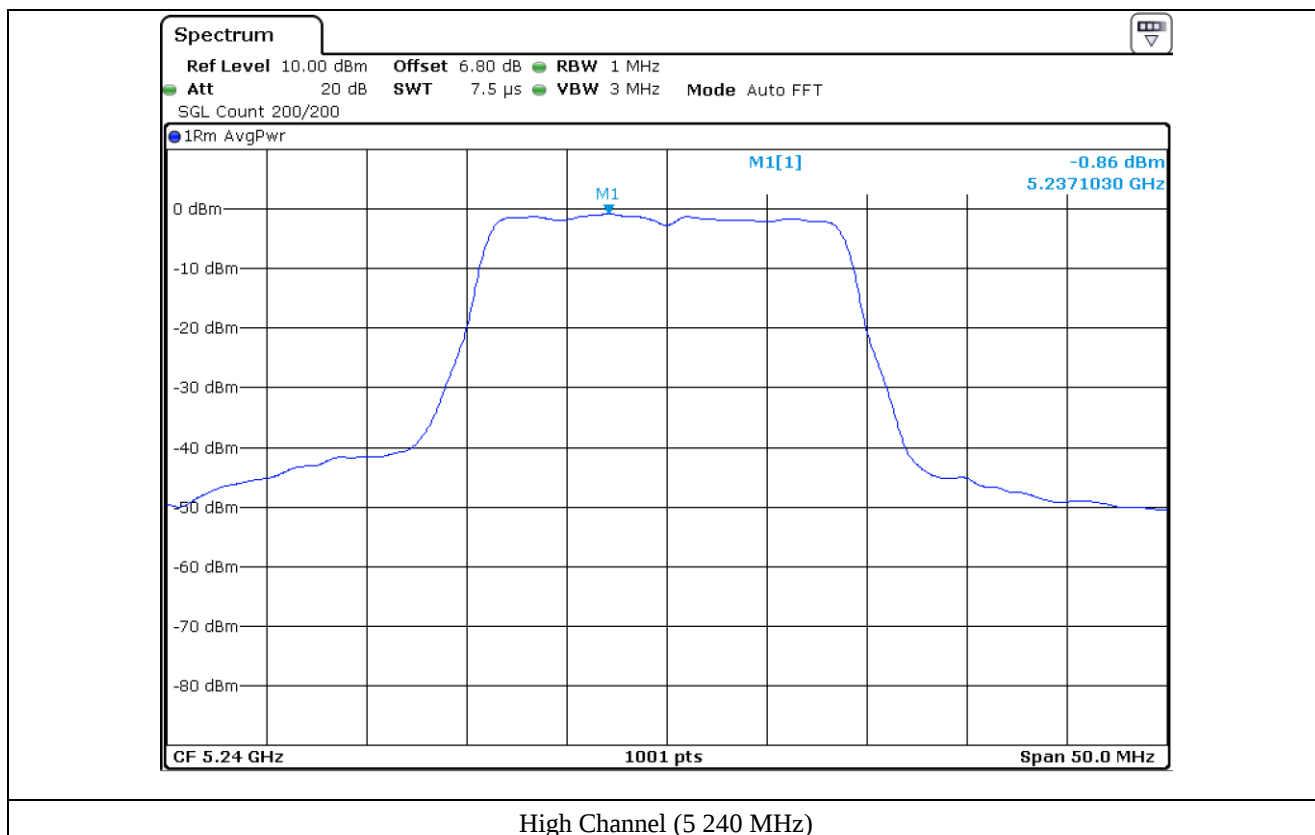
Tested by: Sieon Lee / Assistant Manager

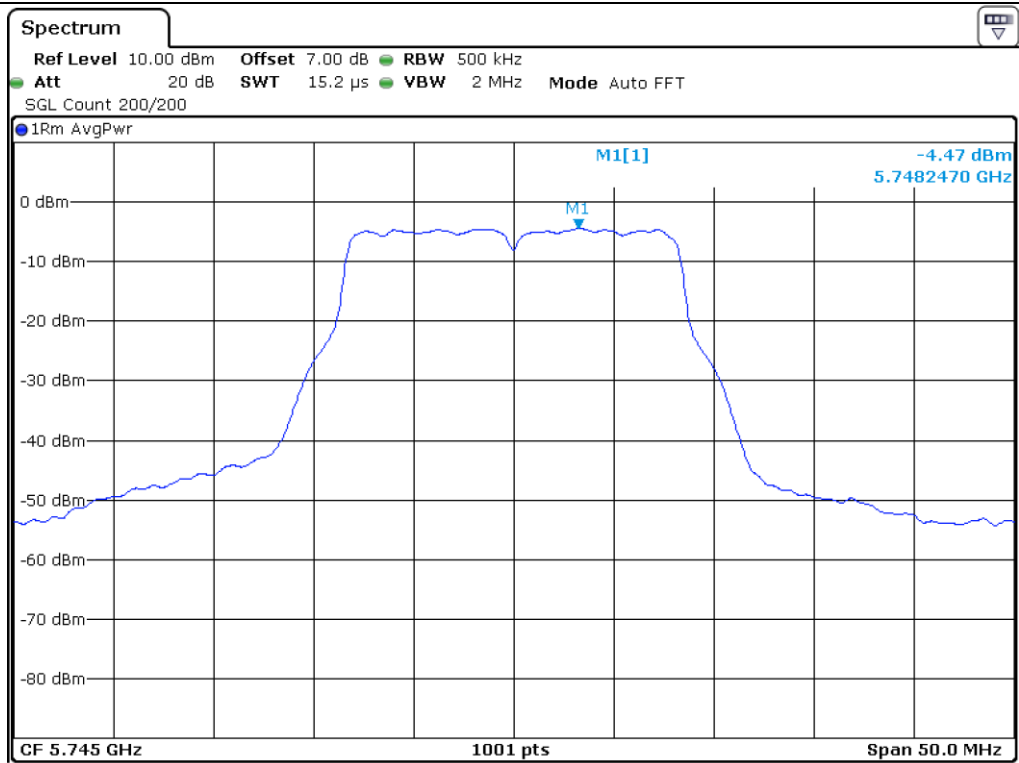


Low Channel (5 180 MHz)

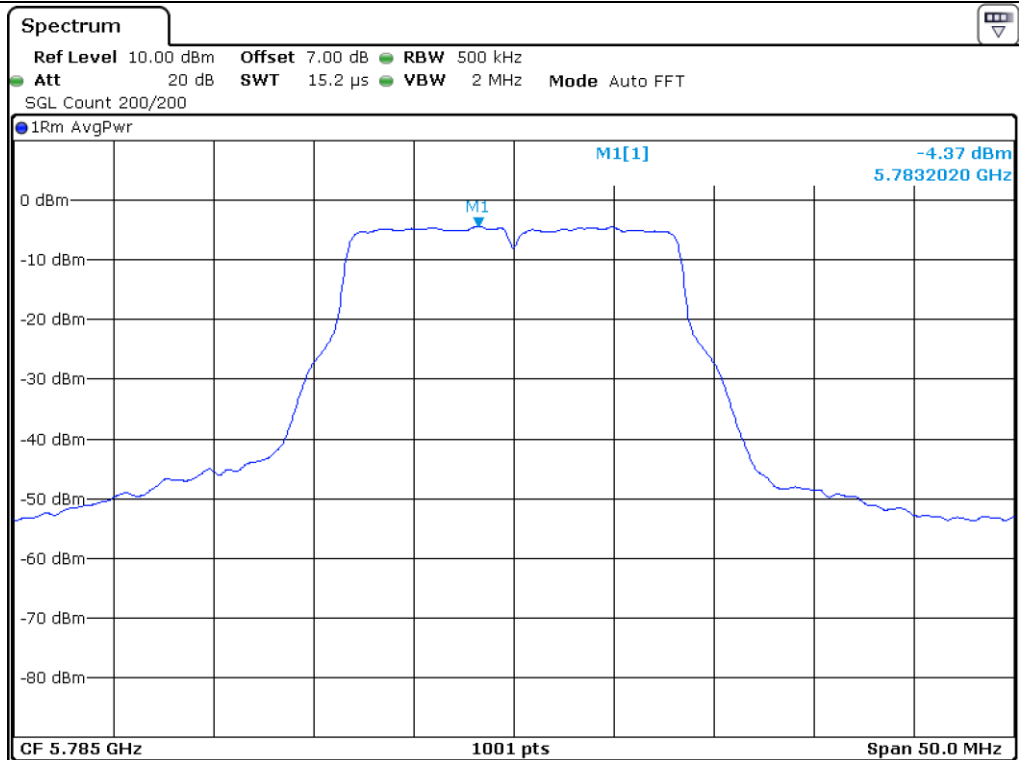


Middle Channel (5 220 MHz)

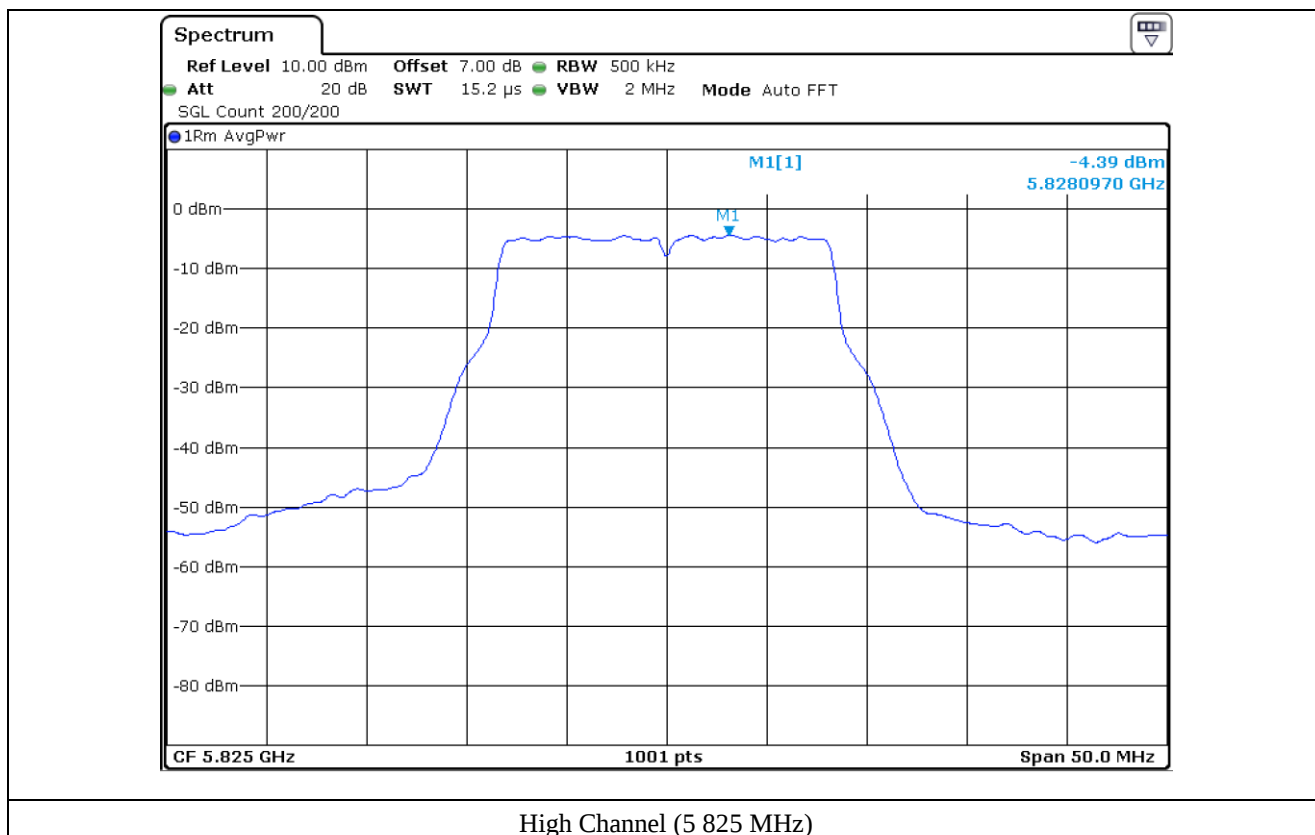




Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



10.5.2 Test data for Antenna 1

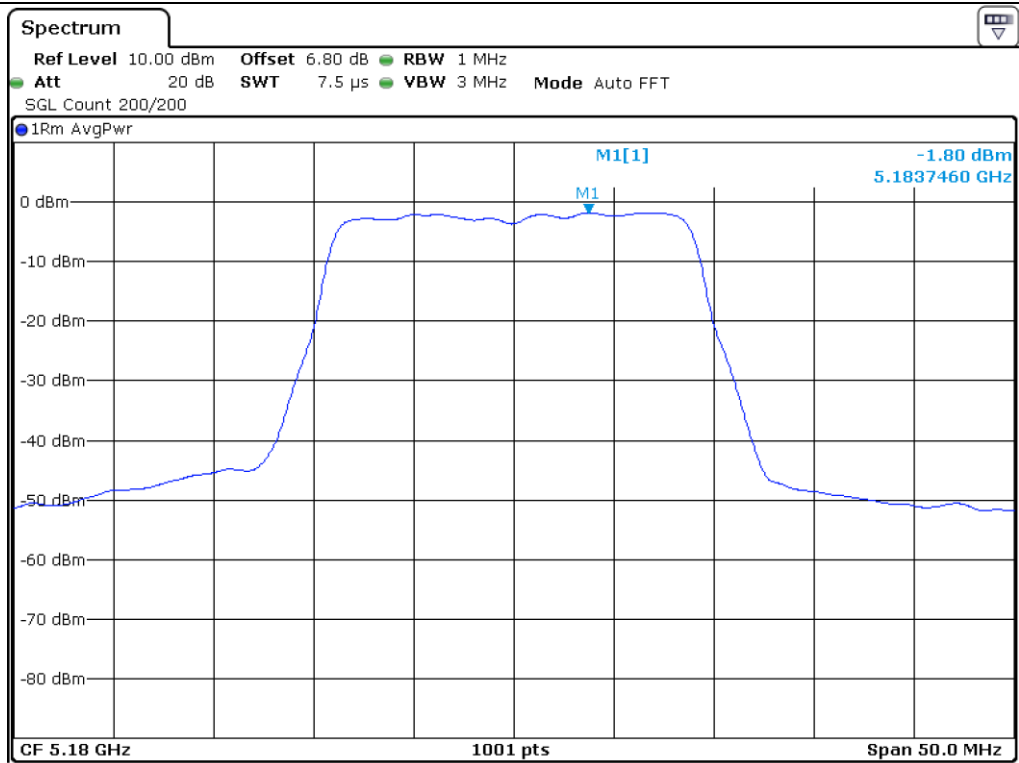
- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	-1.80	11.00	12.47
	Middle	5 220.00	-1.86	11.00	12.53
	High	5 240.00	-2.21	11.00	12.88
5 725 ~ 5 850	Low	5 745.00	-4.97	30.00	34.64
	Middle	5 785.00	-4.79	30.00	34.46
	High	5 825.00	-5.22	30.00	34.89

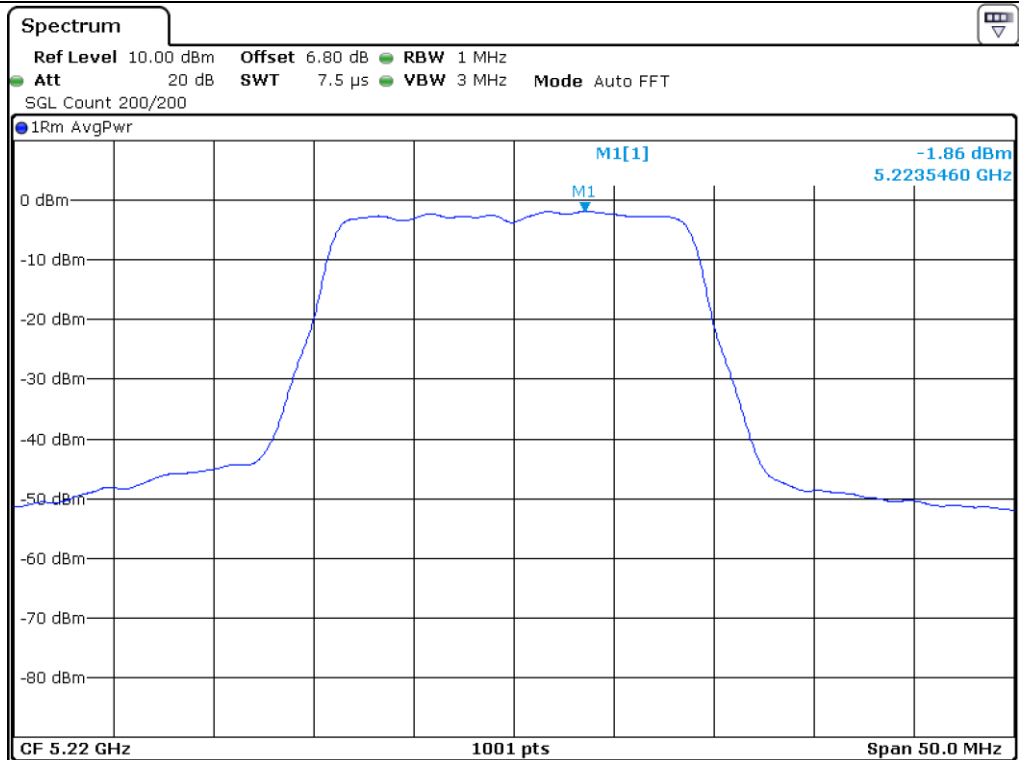
Remark: See next page for measurement data.



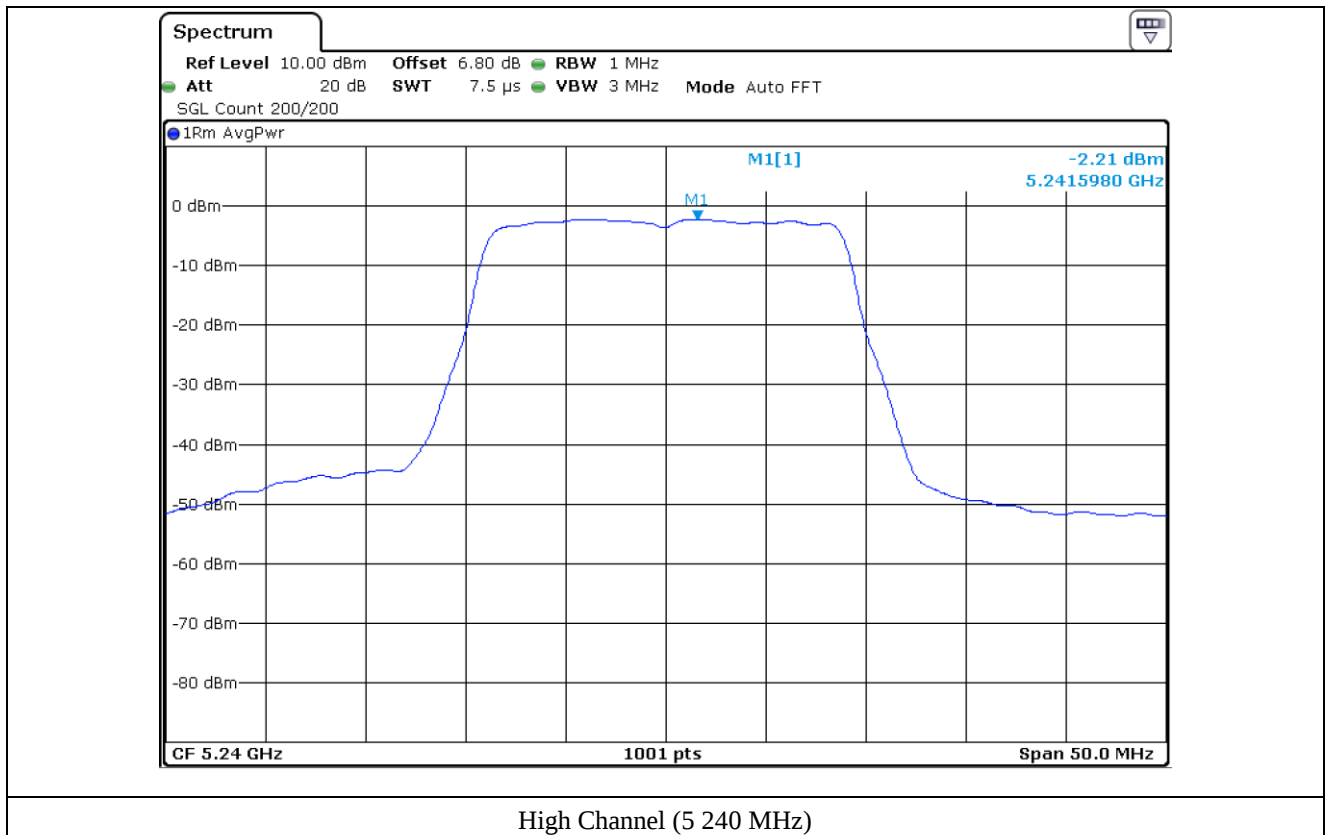
Tested by: Sieon Lee / Assistant Manager

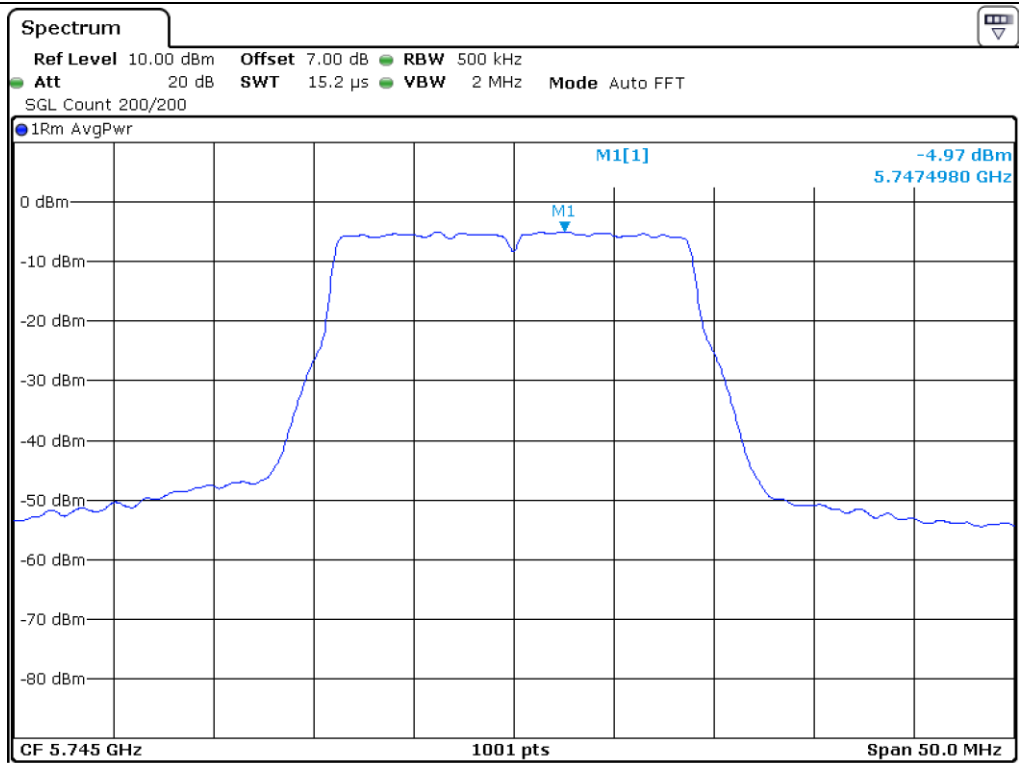


Low Channel (5 180 MHz)

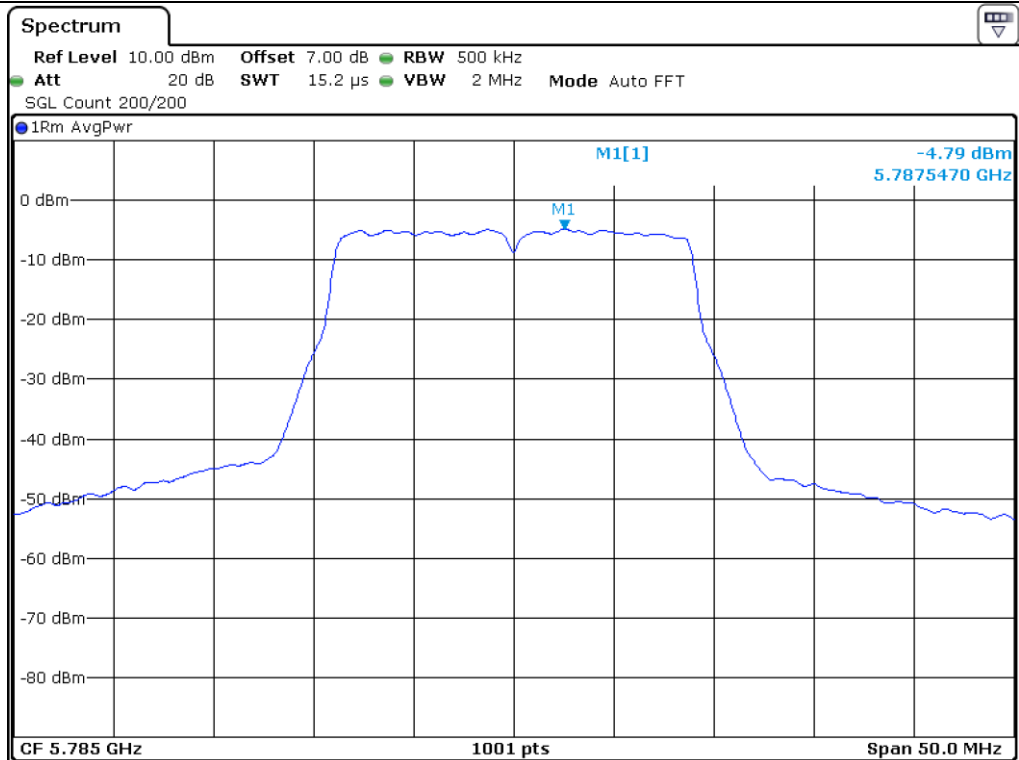


Middle Channel (5 220 MHz)

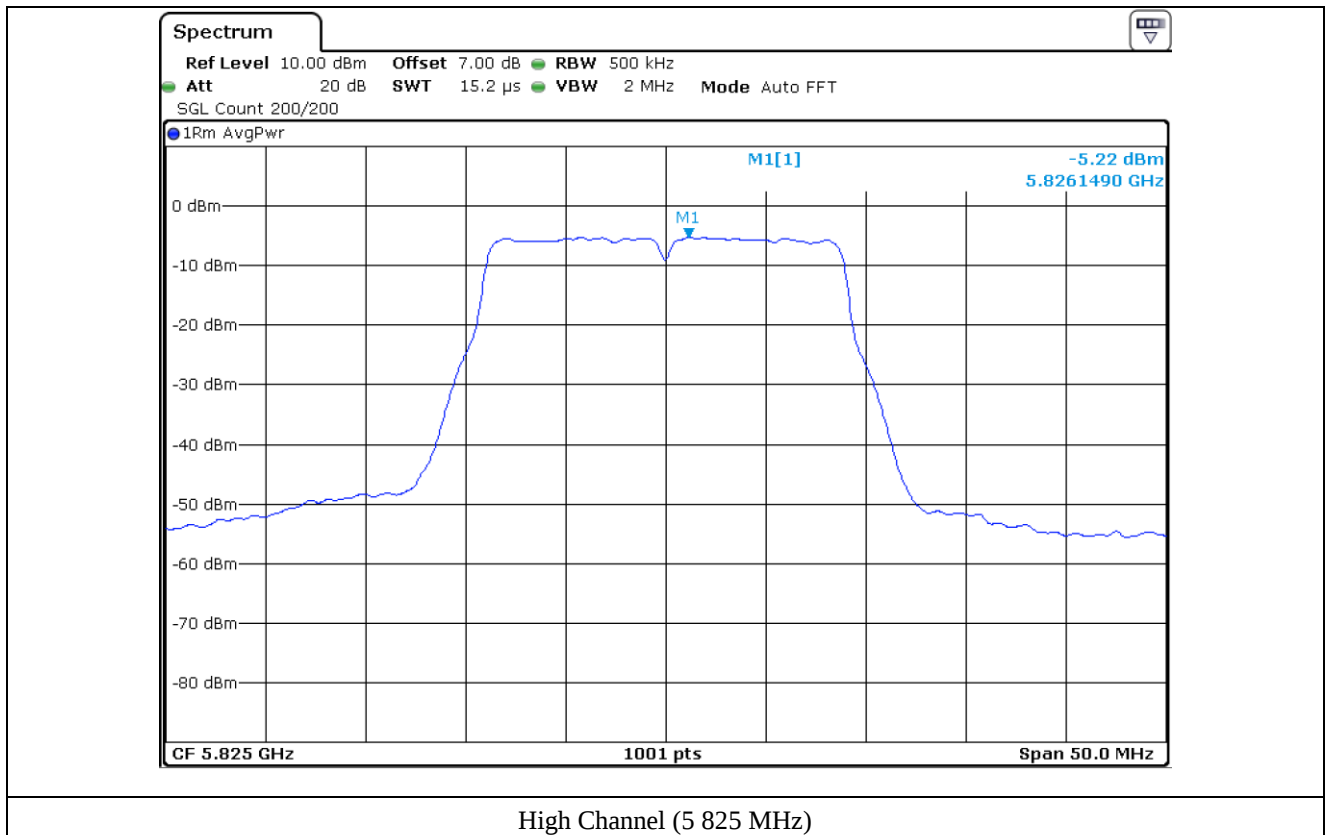




Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



10.5.3 Test data for Multiple Transmit

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Calculated Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 180.00	1.55	11.00	9.12
	Middle	5 220.00	1.55	11.00	9.12
	High	5 240.00	1.53	11.00	9.14
5 725 ~ 5 850	Low	5 745.00	-1.83	28.90	30.40
	Middle	5 785.00	-1.86	28.90	30.43
	High	5 825.00	-2.02	28.90	30.59

Remark 1 : See next page for measurement data.

Remark 2 : Calculated Power Density = $10\log(10^{(\text{Antenna0 Power Density}/10)} + 10^{(\text{Antenna1 Power Density}/10)})$

Remark 3 : Peak Power Spectral Density shall be reduced by the amount in dB that the directional gain of the antena exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

10.6 Test data for 802.11n_HT40 WLAN Mode

10.6.1 Test data for Antenna 0

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Operating condition : Highest Output Power Transmitting Mode

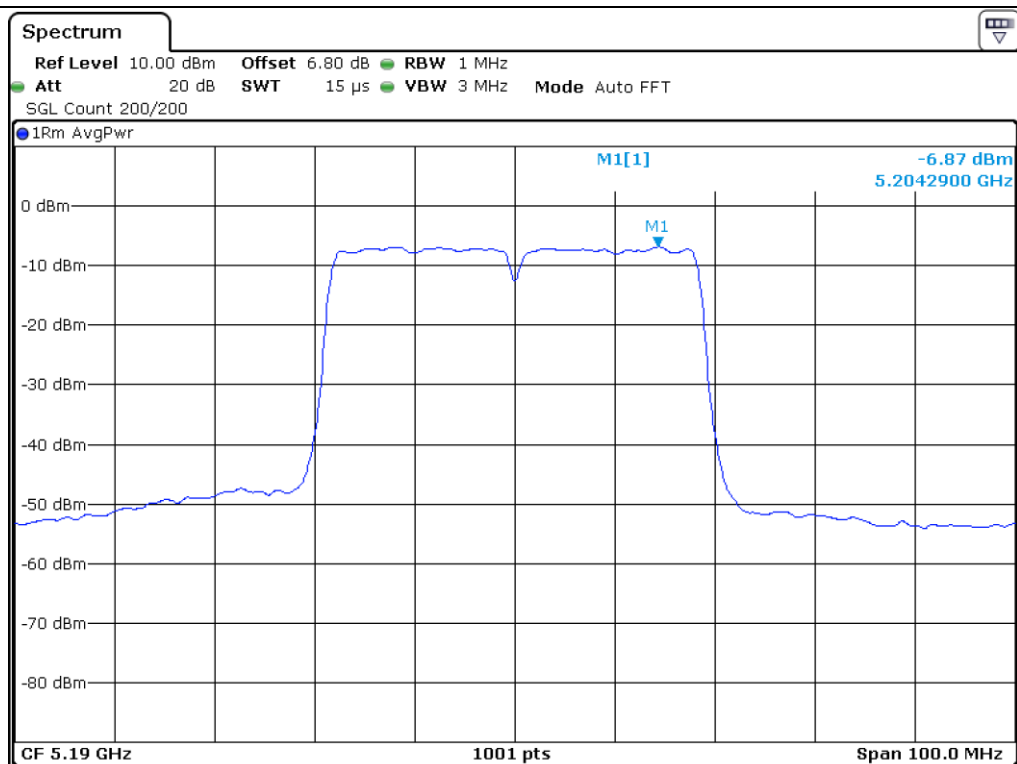
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	-6.87	11.00	17.21
	High	5 230.00	-6.24	11.00	16.58
5 725 ~ 5 850	Low	5 755.00	-10.10	30.00	39.44
	High	5 795.00	-10.25	30.00	39.59

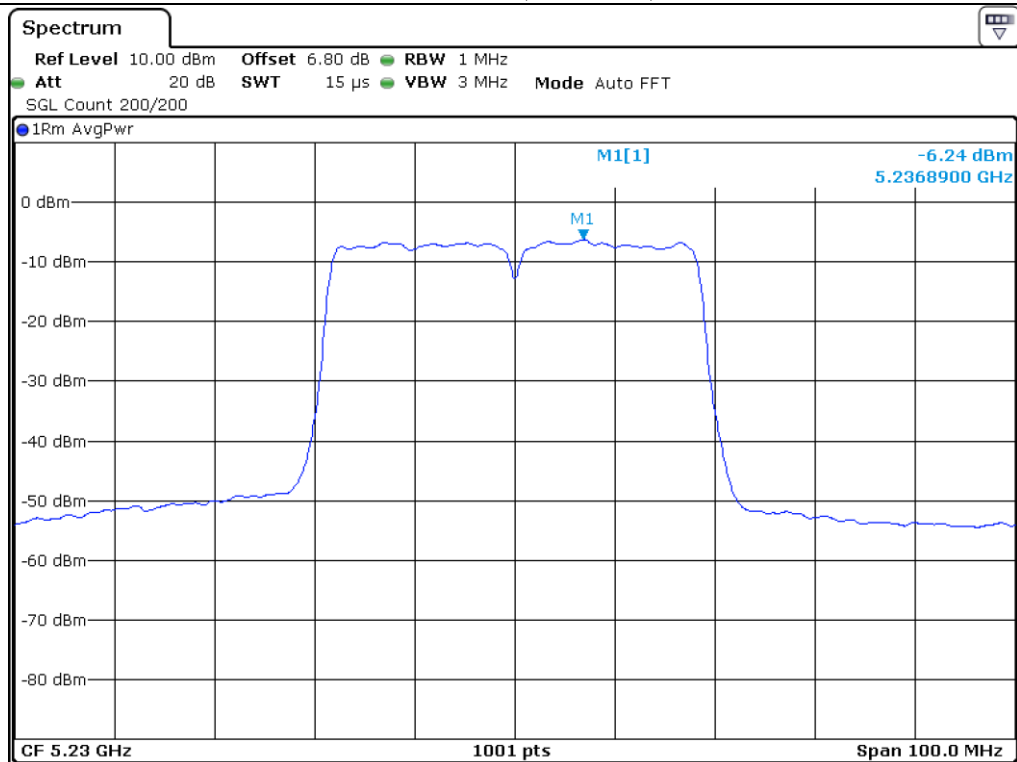
Remark: See next page for measurement data.



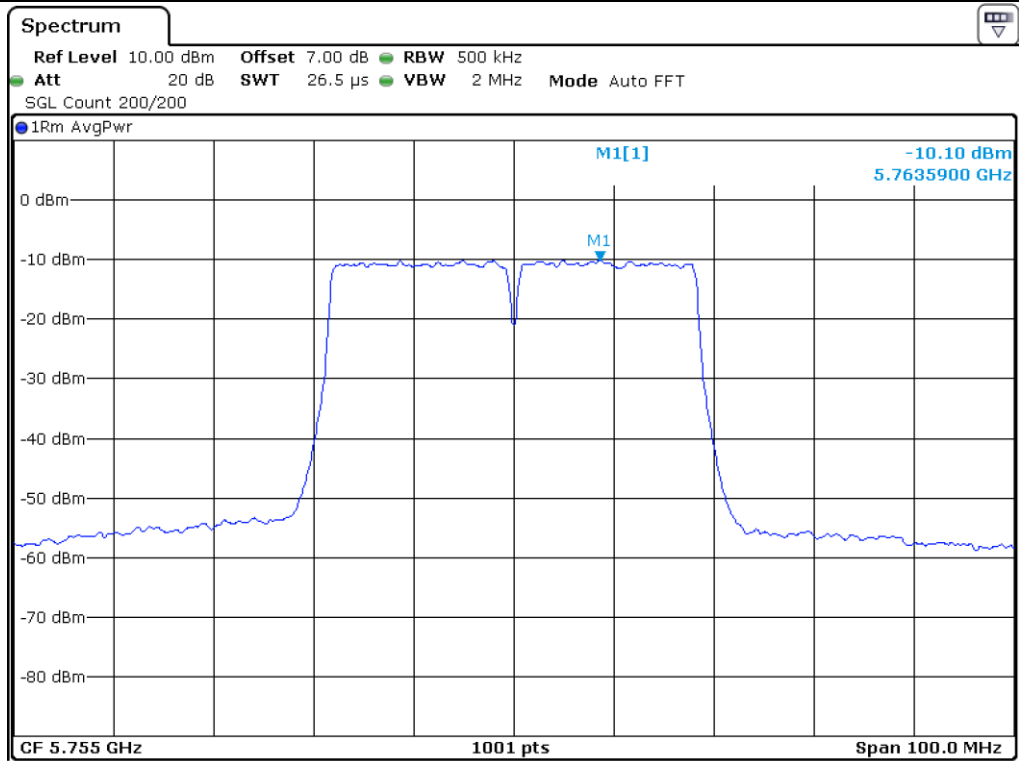
Tested by: Sieon Lee / Assistant Manager



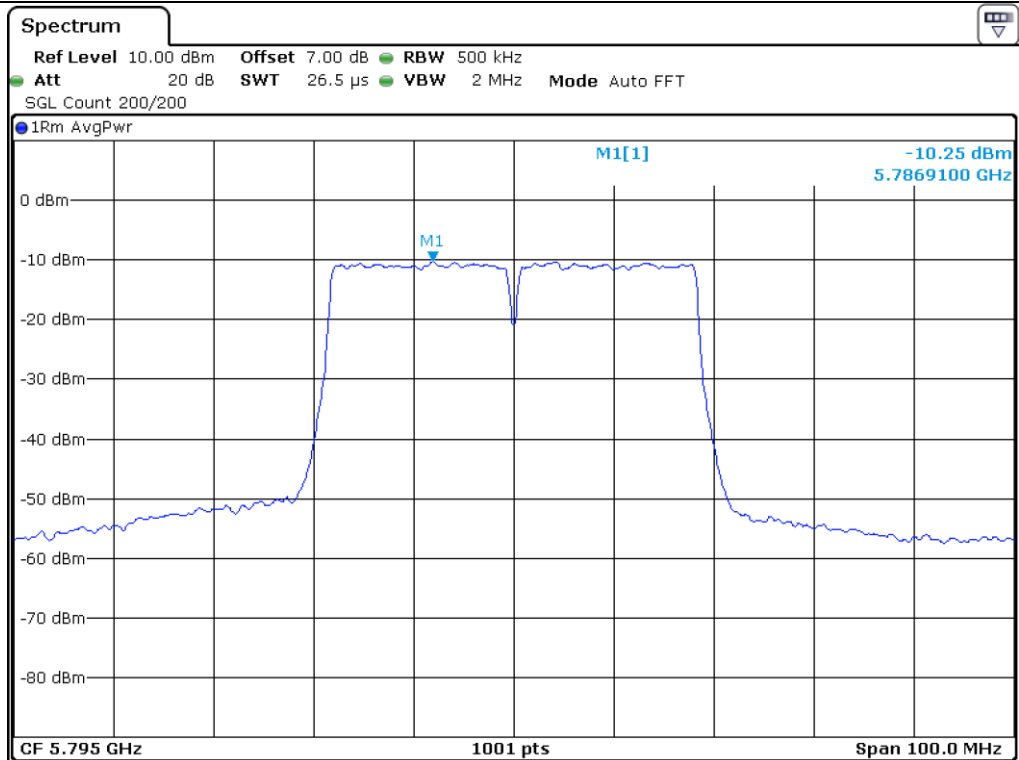
Low Channel (5 190 MHz)



High Channel (5 230 MHz)



Low Channel (5 755 MHz)



High Channel (5 795 MHz)

10.6.2 Test data for Antenna 1

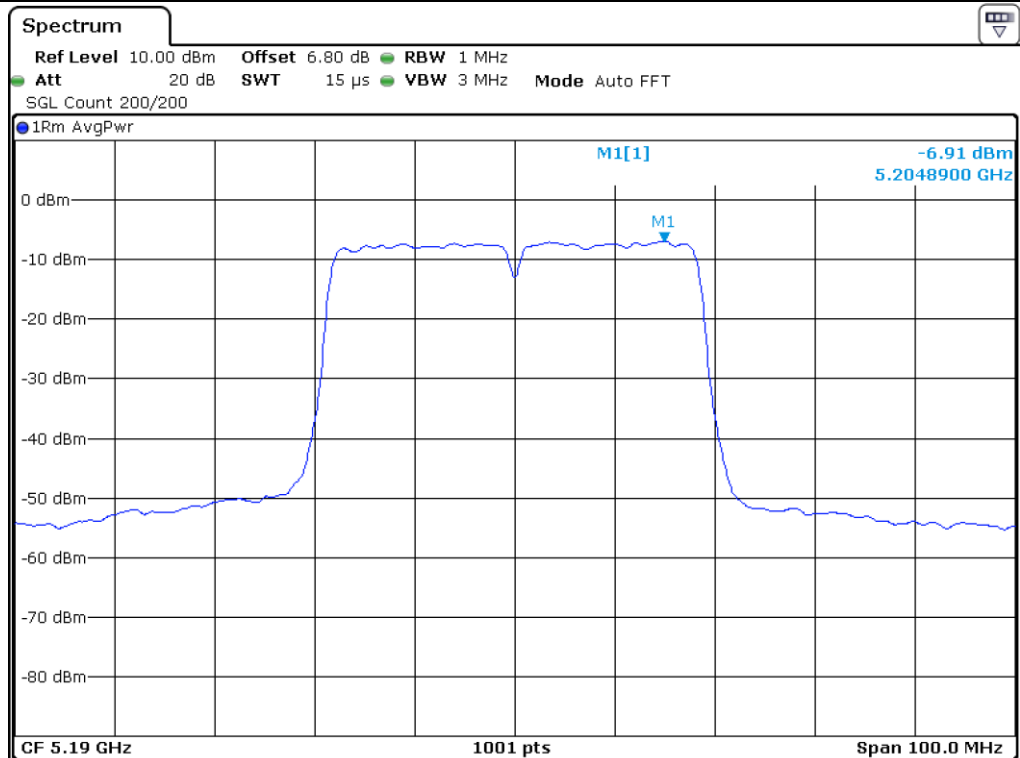
- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	-6.91	11.00	17.25
	High	5 230.00	-7.03	11.00	17.37
5 725 ~ 5 850	Low	5 755.00	-9.62	30.00	38.96
	High	5 795.00	-9.82	30.00	39.16

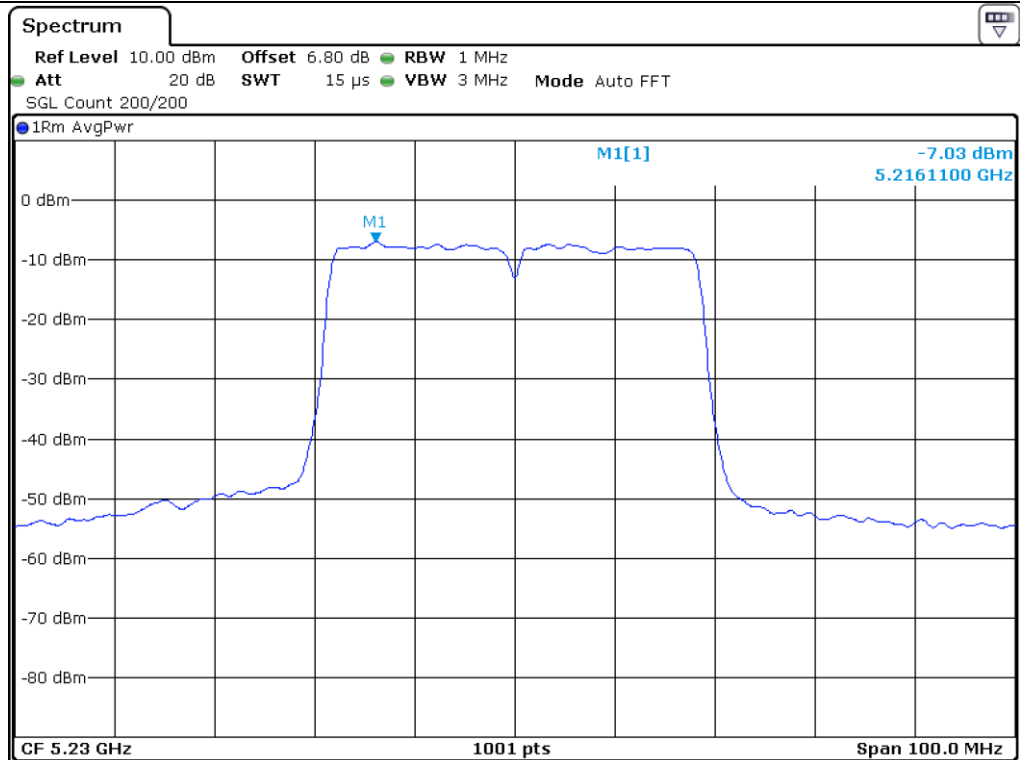
Remark: See next page for measurement data.



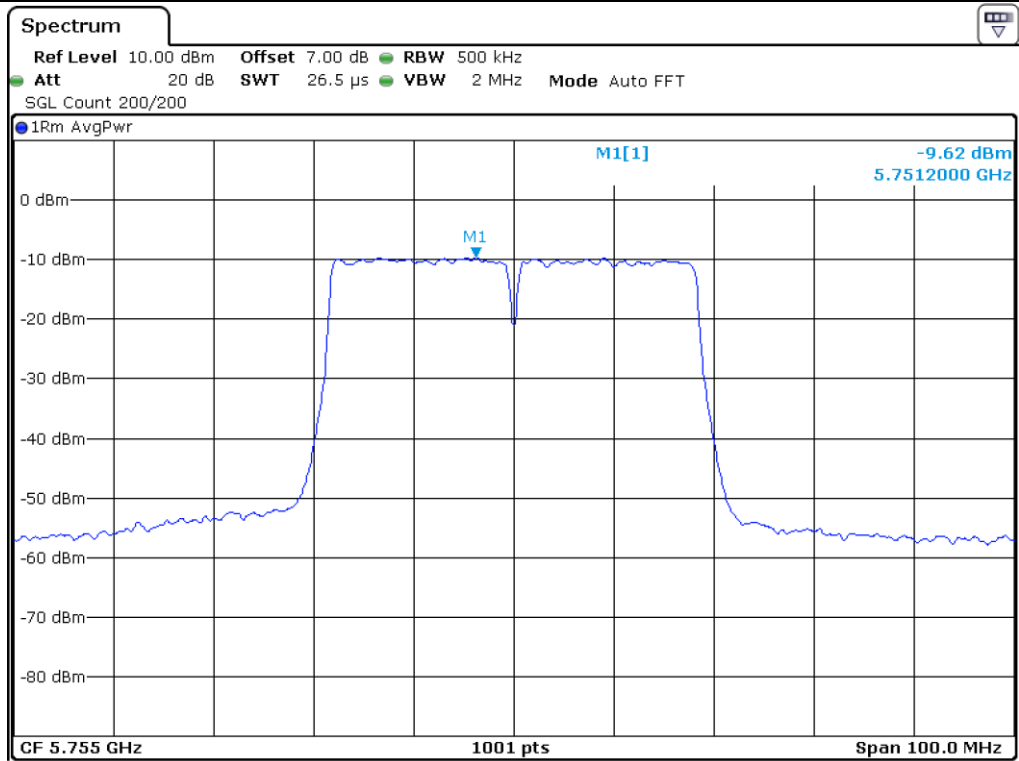
Tested by: Sieon Lee / Assistant Manager



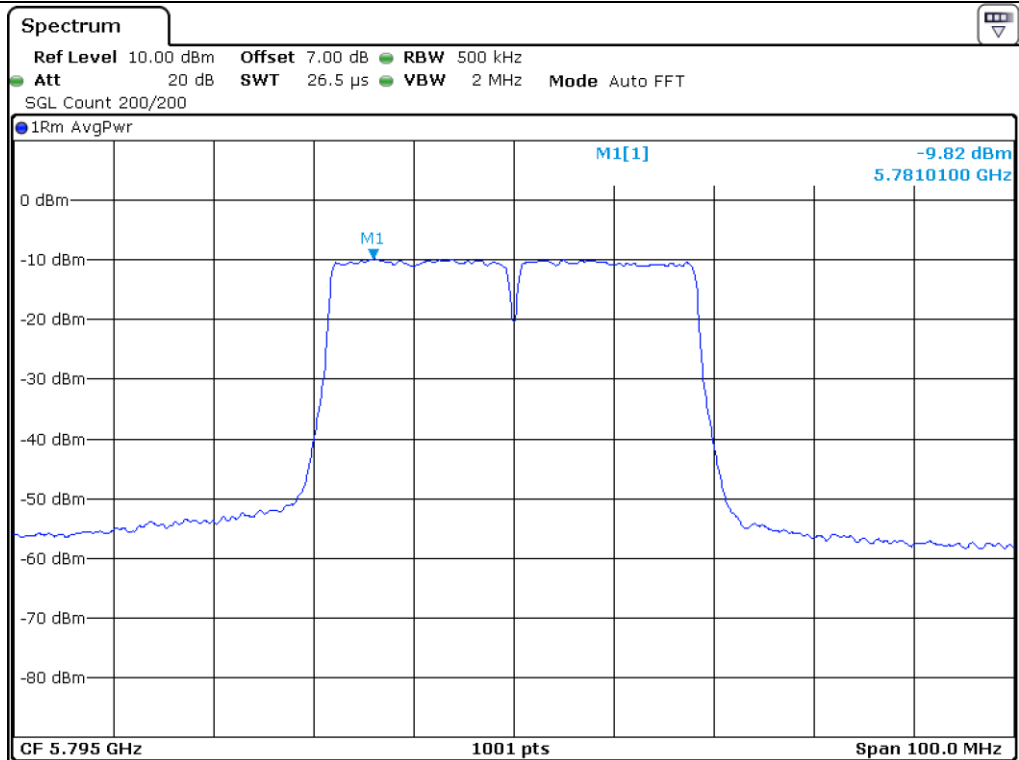
Low Channel (5 190 MHz)



High Channel (5 230 MHz)



Low Channel (5 755 MHz)



High Channel (5 795 MHz)

10.6.3 Test data for Multiple Transmit

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 190.00	-3.88	11.00	14.22
	High	5 230.00	-3.61	11.00	13.95
5 725 ~ 5 850	Low	5 755.00	-6.84	28.90	35.08
	High	5 795.00	-7.02	28.90	35.26

Remark 1 : See next page for measurement data.

Remark 2 : Calculated Power Density = $10\log(10^{(\text{Antenna0 Power Density}/10)} + 10^{(\text{Antenna1 Power Density}/10)})$

Remark 3 : Peak Power Spectral Density shall be reduced by the amount in dB that the directional gain of the antena exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

10.7 Test data for 802.11ac_HT80 WLAN Mode

10.7.1 Test data for Antenna 0

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Operating condition : Highest Output Power Transmitting Mode

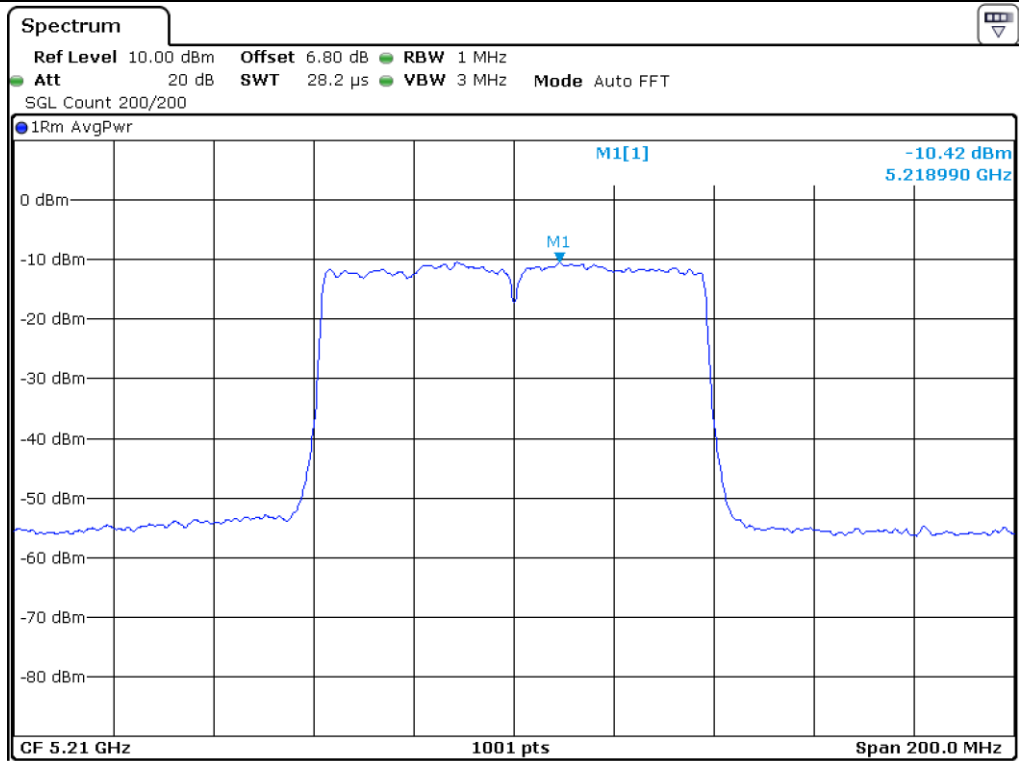
-. Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	-10.42	11.00	20.28
5 725 ~ 5 850	Low	5 775.00	-14.38	30.00	43.24

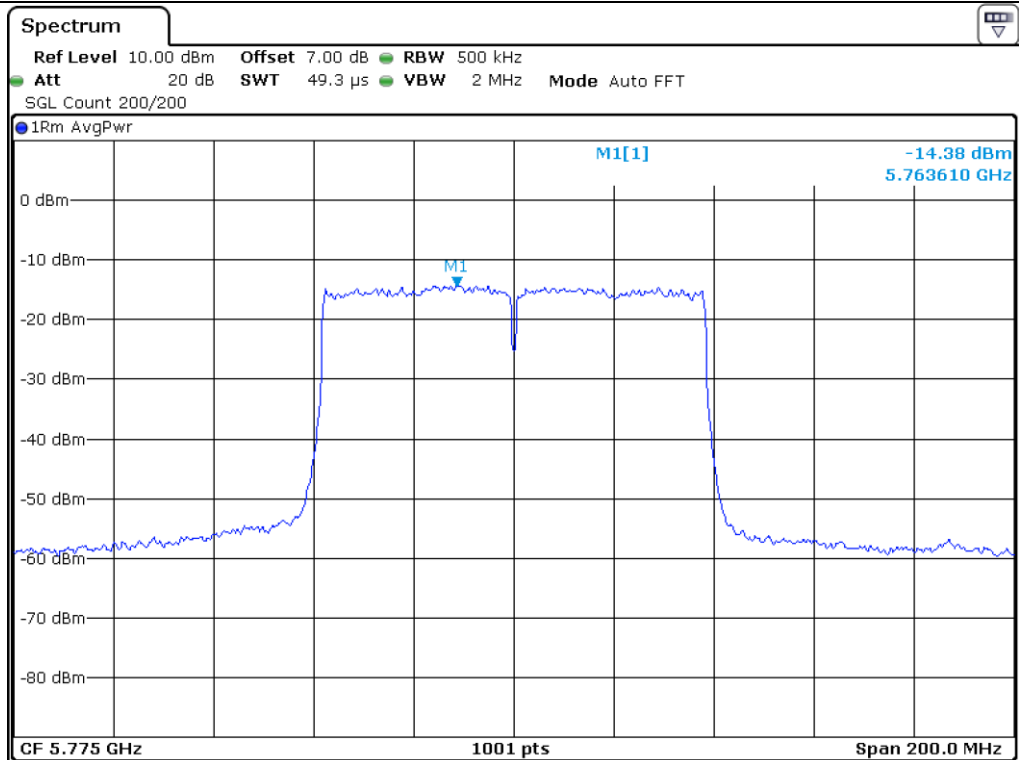
Remark: See next page for measurement data.



Tested by: Sieon Lee / Assistant Manager



Low Channel (5 210 MHz)



Low Channel (5 775 MHz)

10.7.2 Test data for Antenna 1

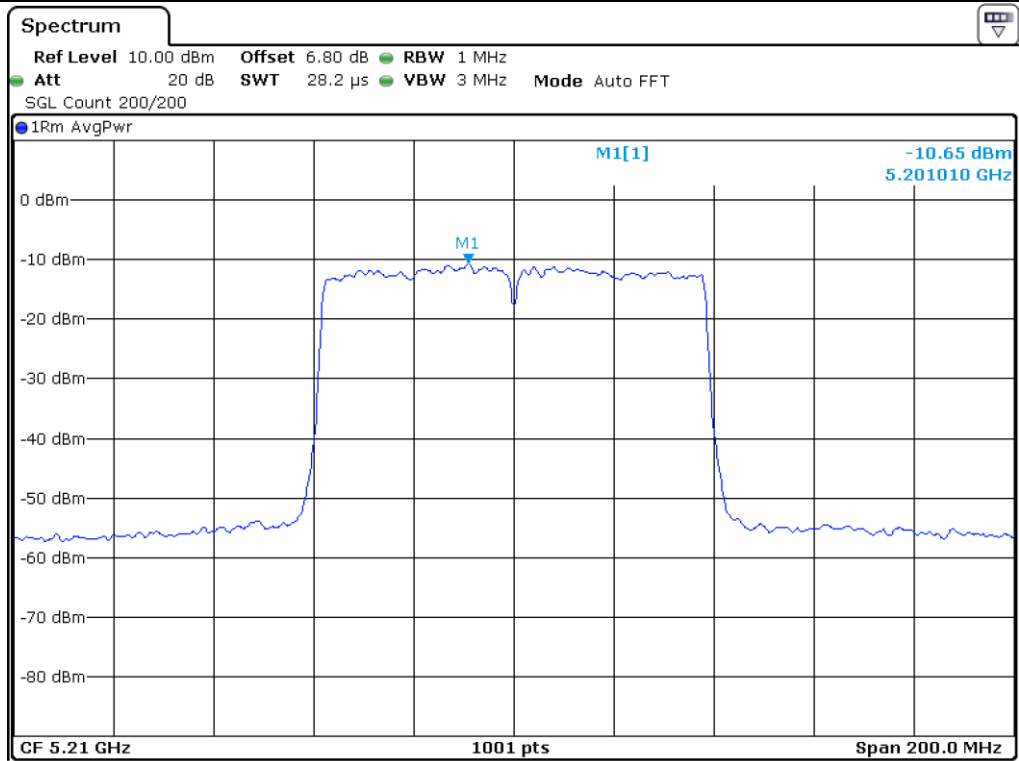
- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	-10.65	11.00	20.51
5 725 ~ 5 850	Low	5 775.00	-13.96	30.00	42.82

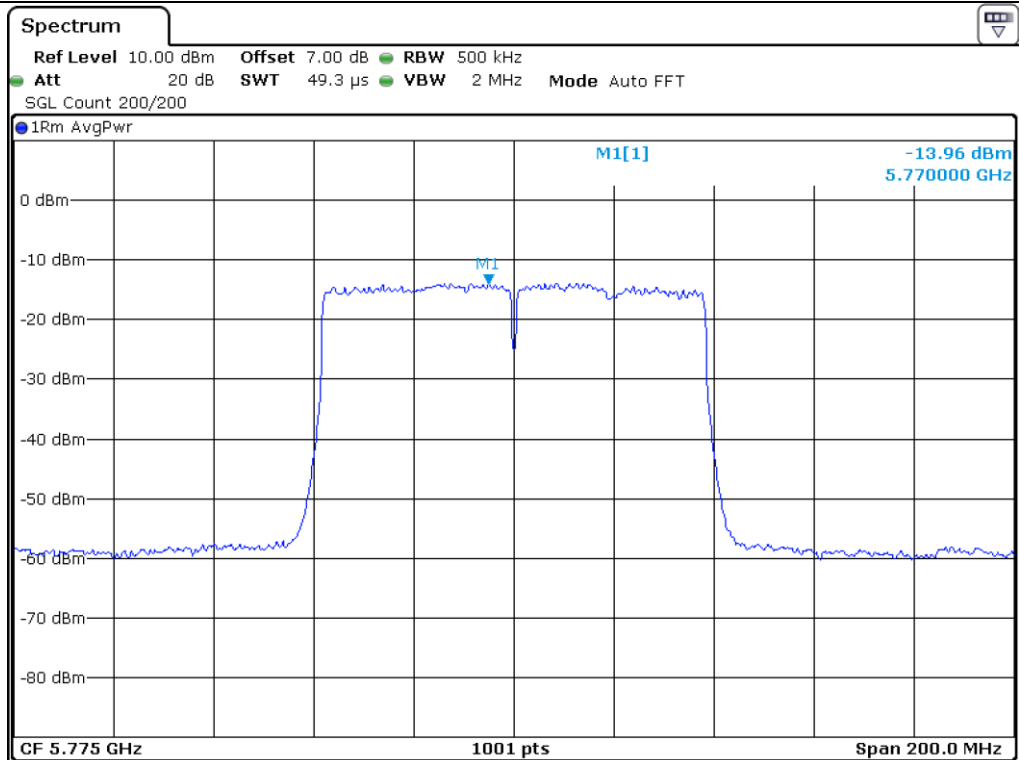
Remark: See next page for measurement data.



Tested by: Sieon Lee / Assistant Manager



Middle Channel (5 210 MHz)



Middle Channel (5 775 MHz)

10.7.3 Test data for Multiple Transmit

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Operating condition : Highest Output Power Transmitting Mode
- . Test Result : Pass

Frequency Range (MHz)	Channel	Frequency (MHz)	Calculated Value (dBm)	Limit (dBm)	Margin (dB)
5 150 ~ 5 250	Low	5 210.00	-7.52	11.00	17.38
5 725 ~ 5 850	Low	5 775.00	-11.15	28.90	38.91

Remark 1 : See next page for measurement data.

Remark 2 : Calculated Power Density = $10\log(10^{(\text{Antenna0 Power Density}/10)} + 10^{(\text{Antenna1 Power Density}/10)})$

Remark 3 : Peak Power Spectral Density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



Tested by: Sieon Lee / Assistant Manager

11. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

11.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

11.2 Test set-up

Turn EUT off and set chamber temperature to -20 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from -20 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.



11.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Aug. 23, 2018 (1Y)
■ -	PSL-2KP	ESPEC	Humidity Chamber	14009407	Feb. 22, 2019 (1Y)
■ -	H-3005D	FinePower	DC Power supply	FP09092008	Mar. 13, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test Data

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Result : Pass

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 180 000 000	5 179 978 625	-21.375
-10		5 179 977 416	-22.584
0		5 179 976 832	-23.168
10		5 179 976 542	-23.458
20		5 179 975 922	-24.078
30		5 179 975 631	-24.369
40		5179 975 013	-24.987
50		5 179 974 326	-25.674
-20	5 220 000 000	5 219 978 626	-21.374
-10		5 219 977 418	-22.582
0		5 219 976 552	-23.448
10		5 219 976 338	-23.662
20		5 219 975 463	-24.537
30		5 219 975 429	-24.571
40		5 219 975 010	-24.990
50		5 219 974 548	-25.452
-20	5 240 000 000	5 239 970 463	-29.537
-10		5 239 969 426	-30.574
0		5 239 968 662	-31.338
10		5 239 968 438	-31.562
20		5 239 967 651	-32.349
30		5 239 967 442	-32.558
40		5 239 966 948	-33.052
50		5 239 967 071	-32.929

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
-20	5 745 000 000	5 744 968 716	-31.284
-10		5 744 967 693	-32.307
0		5 744 967 083	-32.917
10		5 744 966 648	-33.352
20		5 744 966 232	-33.768
30		5 744 965 749	-34.251
40		5 744 965 422	-34.578
50		5 744 965 405	-34.595
-20	5 785 000 000	5 784 968 195	-31.805
-10		5 784 967 162	-32.838
0		5 784 966 656	-33.344
10		5 784 965 948	-34.052
20		5 784 966 529	-33.471
30		5 784 965 345	-34.655
40		5 784 964 466	-35.534
50		5 784 964 271	-35.729
-20	5 825 000 000	5 824 968 433	-31.567
-10		5 824 967 375	-32.625
0		5 824 966 729	-33.271
10		5 824 966 318	-33.682
20		5 824 965 923	-34.077
30		5 824 965 519	-34.481
40		5 824 965 128	-34.872
50		5 824 965 033	-34.967

Note : While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.
Four measurements in total are made.(ANSI C63.10-2013)



Tested by: Sieon Lee / Assistant Manager

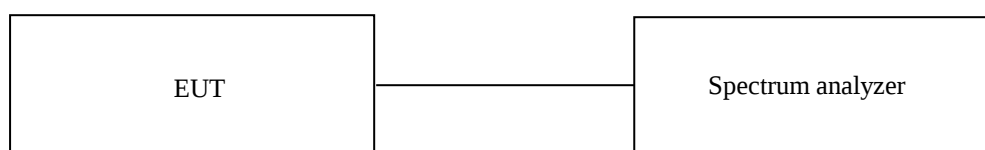
12. FREQUENCY STABILITY WITH VOLTAGE VARIATION

12.1 Operating environment

Temperature : 24 °C
Relative humidity : 48 % R.H.

12.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Aug. 23, 2018 (1Y)
■ -	H-3005D	FinePower	DC Power supply	FP09092008	Mar. 13, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

12.4 Test Data

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Result : Pass

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Freequency Error (kHz)
13.80	5 180 000 000	5 179 976 683	-23.317
12.00		5 179 976 767	-23.233
10.20		5 179 976 868	-23.132
13.80	5 220 000 000	5 219 976 473	-23.527
12.00		5 219 976 547	-23.453
10.20		5 219 976 588	-23.412
13.80	5 240 000 000	5 239 978 555	-21.445
12.00		5 239 979 320	-20.680
10.20		5 239 979 734	-20.266
13.80	5 745 000 000	5 744 977 824	-22.176
12.00		5 744 977 874	-22.126
10.20		5 744 977 033	-22.967
13.80	5 785 000 000	5 784 976 235	-23.765
12.00		5 784 976 222	-23.778
10.20		5 784 976 743	-23.257
13.80	5 825 000 000	5 824 975 534	-24.466
12.00		5 824 975 575	-24.425
10.20		5 824 975 430	-24.570



Tested by: Sieon Lee / Assistant Manager

13. RADIATED SPURIOUS EMISSIONS

13.1 Operating environment

Temperature : 24 °C
Relative humidity : 52 % R.H.

13.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

13.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
□ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2018 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2018 (1Y)
□ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Aug. 23, 2018 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Aug. 23, 2018 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Pre-Amplifier	009	Mar. 20, 2019 (1Y)
■ -	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
□ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
□ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Aug. 09, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
■ -	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

13.4 Test data for 5.2 GHz

13.4.1 Test data for 30 MHz ~ 1 GHz

Humidity Level : 52 % R.H.

Temperature: 24 °C

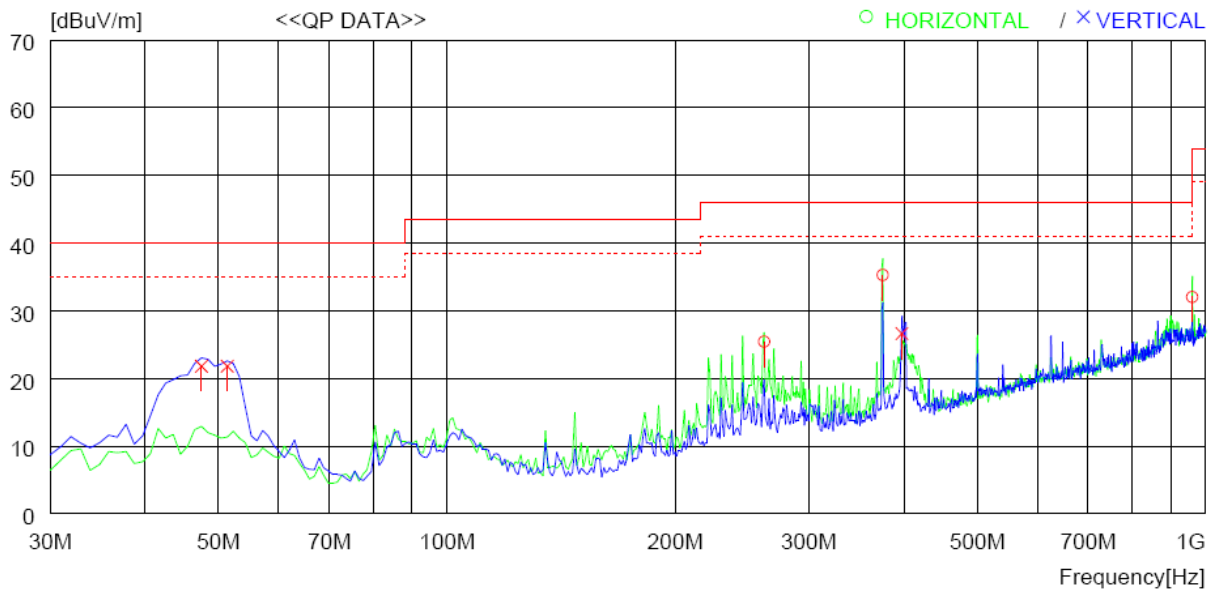
Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Date: May 23, 2019 ~ July 09, 2019

Note : 5 GHz operating mode were tested, (802.11ac WLAN Mode)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR [dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	261.830	41.8	12.8	3.8	33.0	25.4	46.0	20.6	100	359
2	375.320	48.5	15.3	4.5	33.0	35.3	46.0	10.7	100	246
3	960.217	33.2	23.3	7.3	31.8	32.0	54.0	22.0	100	359
----- Vertical -----										
4	47.460	39.0	14.3	1.6	33.1	21.8	40.0	18.2	100	130
5	51.340	39.2	14.0	1.7	33.1	21.8	40.0	18.2	100	0
6	397.630	39.3	15.8	4.6	33.1	26.6	46.0	19.4	100	0

Tested by: Sieon Lee / Assistant Manager

13.4.2 Test data for Below 30 MHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									



Tested by: Sieon Lee / Assistant Manager

13.4.3 Test data for above 1 GHz

13.4.3.1 Test data for 802.11a WLAN Mode (Ant 0)

-. Test Date : May 23, 2019 ~ July 09, 2019

-. Resolution bandwidth : 1 MHz for Peak Mode

-. Video bandwidth : 1 MHz for Peak Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-. Duty Cycle : 93 %

-. Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10 360.00	14.09	Peak	H	37.66	8.60	0.00	60.35	68.20	7.85
10 360.00	13.40	Peak	V				59.66	68.20	8.54
Middle Channel									
10 440.00	13.12	Peak	H	37.84	8.63	0.00	59.59	68.20	8.61
10 440.00	13.85	Peak	V				60.32	68.20	7.88
High Channel									
10 480.00	12.30	Peak	H	38.02	8.66	0.00	58.98	68.20	9.22
10 480.00	13.25	Peak	V				59.93	68.20	8.27

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.4.3.2 Test data for 802.11a WLAN Mode (Ant 1)

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak Mode
- Video bandwidth : 1 MHz for Peak Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 93 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10 360.00	12.56	Peak	H	37.66	8.60	0.00	58.82	68.20	9.38
10 360.00	11.97	Peak	V				58.23	68.20	9.97
Middle Channel									
10 440.00	13.62	Peak	H	37.84	8.63	0.00	60.09	68.20	8.11
10 440.00	12.18	Peak	V				58.65	68.20	9.55
High Channel									
10 480.00	13.87	Peak	H	38.02	8.66	0.00	60.55	68.20	7.65
10 480.00	12.51	Peak	V				59.19	68.20	9.01

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.4.3.3 Test data for 802.11n (HT 20) WLAN Mode

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak Mode
- Video bandwidth : 1 MHz for Peak Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 93 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10 360.00	12.65	Peak	H	37.66	8.60	0.00	58.91	68.20	9.29
10 360.00	12.76	Peak	V				59.02	68.20	9.18
Middle Channel									
10 440.00	11.79	Peak	H	37.84	8.63	0.00	58.26	68.20	9.94
10 440.00	12.46	Peak	V				58.93	68.20	9.27
High Channel									
10 480.00	12.14	Peak	H	38.02	8.66	0.00	58.82	68.20	9.38
10 480.00	13.11	Peak	V				59.79	68.20	8.41

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.4.3.4 Test data for 802.11n (HT 40) WLAN Mode

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak Mode
- Video bandwidth : 1 MHz for Peak Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 86 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10380.00	12.73	Peak	H	37.93	8.60	0.00	59.26	68.20	8.94
10380.00	12.65	Peak	V				59.18	68.20	9.02
High Channel									
10460.00	12.26	Peak	H	38.02	8.65	0.00	58.93	68.20	9.27
10460.00	11.39	Peak	V				58.06	68.20	10.14

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.4.3.5 Test data for 802.11ac (HT 80) WLAN Mode

-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak Mode
 -. Video bandwidth : 1 MHz for Peak Mode
 -. Frequency range : 1 GHz ~ 40 GHz
 -. Measurement distance : 3 m
 -. Duty Cycle : 77 %
 -. Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
10420.00	11.63	Peak	H	37.98	8.63	0.00	58.24	68.20	9.96
10420.00	11.74	Peak	V				58.35	68.20	9.85

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.5 Test data for Co-location(BT + WLAN 5.2 GHz)

13.5.1 Test data for 30 MHz ~ 1 GHz

Humidity Level : 52 % R.H.

Temperature: 24 °C

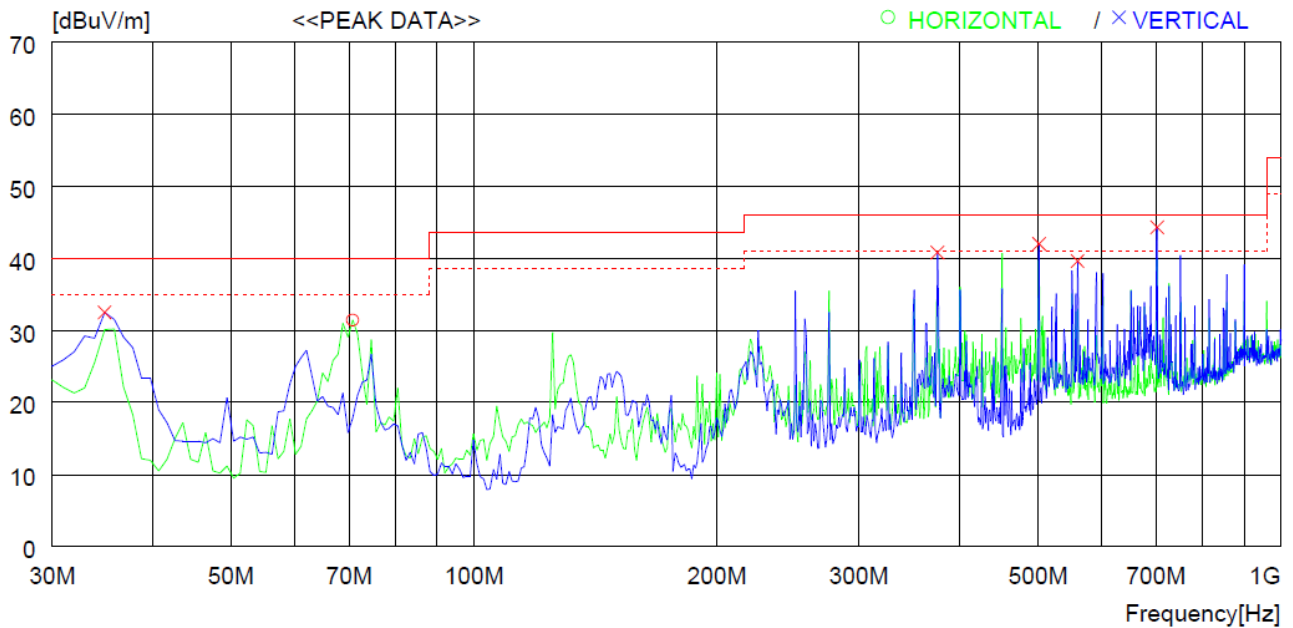
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247 & SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Date: May 23, 2019 ~ July 09, 2019

Note : Co-location(BT +WLAN 5.2 GHz) operating mode were tested



No.	FREQ [MHz]	READING [dBuV]	ANT PEAK FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	70.740	53.3	9.2	2.0	33.1	31.4	40.0	8.6	200	355
----- Vertical -----										
2	34.850	50.9	13.3	1.4	33.1	32.5	40.0	7.5	100	0
3	375.320	54.0	15.3	4.5	33.0	40.8	46.0	5.2	100	36
4	501.421	52.4	17.6	5.2	33.2	42.0	46.0	4	100	0
5	559.619	48.8	18.7	5.4	33.3	39.6	46.0	6.4	100	43
6	702.205	51.5	20.0	6.1	33.3	44.3	46.0	1.7	100	0

Tested by: Sieon Lee / Assistant Manager

13.5.2 Test data for Below 30 MHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Emissions observed were 20dB below the limit and thus not reported									



Tested by: Sieon Lee / Assistant Manager

13.5.3 Test data for above 1 GHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 40 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 93 %
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
Emissions observed were 20dB below the limit and thus not reported									



Tested by: Sieon Lee / Assistant Manager

13.6 Test data for 5.8 GHz

13.6.1 Test data for 30 MHz ~ 1 GHz

Humidity Level : 52 % R.H.

Temperature: 24 °C

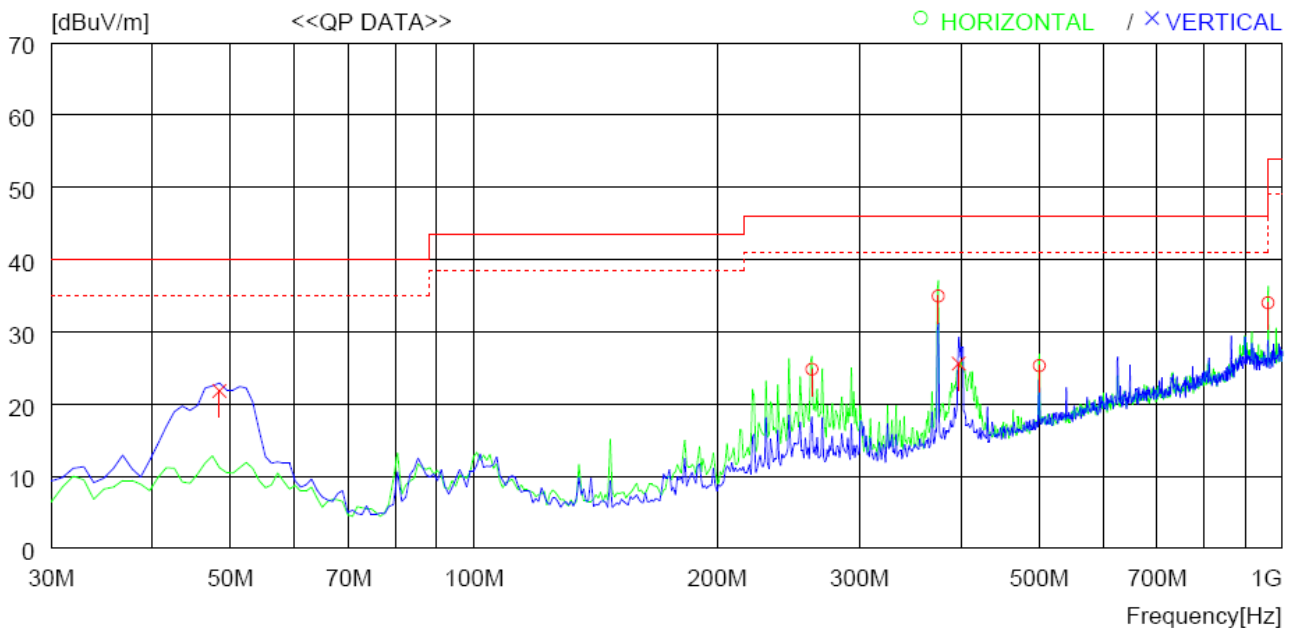
Limits apply to : FCC CFR 47, PART 15, SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Date: May 23, 2019 ~ July 09, 2019

Note : 5 GHz operating mode were tested, (802.11ac WLAN Mode)



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	QP	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	261.830	41.2	12.8	3.8	33.0	24.8	46.0	21.2	100	359
2	375.320	48.1	15.3	4.5	33.0	34.9	46.0	11.1	100	359
3	500.451	35.7	17.6	5.2	33.2	25.3	46.0	20.7	100	71
4	960.217	35.2	23.3	7.3	31.8	34.0	54.0	20.0	100	359
----- Vertical -----										
5	48.430	39.1	14.2	1.6	33.1	21.8	40.0	18.2	100	0
6	397.630	38.3	15.8	4.6	33.1	25.6	46.0	20.4	100	0

Tested by: Sieon Lee / Assistant Manager

13.6.2 Test data for Below 30 MHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
All emissions observed were 20dB below the limit and thus not reported.									



Tested by: Sieon Lee / Assistant Manager

13.6.3 Test data for above 1 GHz

13.6.3.1 Test data for 802.11a WLAN Mode (Ant 0)

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 93 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11490.00	13.74	Peak	H	38.07	8.87	0.00	60.68	74.00	13.32
11490.00	4.48	Average	H				51.42	54.00	2.58
11490.00	12.14	Peak	V				59.08	74.00	14.92
11490.00	3.88	Average	V				50.82	54.00	3.18
Middle Channel									
11570.00	13.50	Peak	H	37.78	8.80	0.00	60.08	74.00	13.92
11570.00	4.86	Average	H				51.44	54.00	2.56
11570.00	12.50	Peak	V				59.08	74.00	14.92
11570.00	4.44	Average	V				51.02	54.00	2.98
High Channel									
11650.00	12.24	Peak	H	37.49	8.71	0.00	58.44	74.00	15.56
11650.00	4.36	Average	H				50.56	54.00	3.44
11650.00	12.51	Peak	V				58.71	74.00	15.29
11650.00	4.10	Average	V				50.30	54.00	3.70

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.6.3.2 Test data for 802.11a WLAN Mode (Ant 1)

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 93 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11490.00	12.99	Peak	H	38.07	8.87	0.00	59.93	74.00	14.07
11490.00	4.03	Average	H				50.97	54.00	3.03
11490.00	12.37	Peak	V				59.31	74.00	14.69
11490.00	3.76	Average	V				50.70	54.00	3.30
Middle Channel									
11570.00	12.47	Peak	H	37.78	8.80	0.00	59.05	74.00	14.95
11570.00	3.79	Average	H				50.37	54.00	3.63
11570.00	12.90	Peak	V				59.48	74.00	14.52
11570.00	3.47	Average	V				50.05	54.00	3.95
High Channel									
11650.00	12.37	Peak	H	37.49	8.71	0.00	58.57	74.00	15.43
11650.00	3.73	Average	H				49.93	54.00	4.07
11650.00	12.76	Peak	V				58.96	74.00	15.04
11650.00	3.26	Average	V				49.46	54.00	4.54

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.6.3.3 Test data for 802.11n (HT 20) WLAN Mode

- Test Date : May 23, 2019 ~ July 09, 2019
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Duty Cycle : 93 %
- Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11490.00	15.25	Peak	H	38.07	8.87	0.00	62.19	74.00	11.81
11490.00	6.25	Average	H				53.19	54.00	0.81
11490.00	12.89	Peak	V				59.83	74.00	14.17
11490.00	3.73	Average	V				50.67	54.00	3.33
Middle Channel									
11570.00	14.65	Peak	H	37.78	8.80	0.00	61.23	74.00	12.77
11570.00	5.81	Average	H				52.39	54.00	1.61
11570.00	13.23	Peak	V				59.81	74.00	14.19
11570.00	4.35	Average	V				50.93	54.00	3.07
High Channel									
11650.00	13.93	Peak	H	37.49	8.71	0.00	60.13	74.00	13.87
11650.00	5.04	Average	H				51.24	54.00	2.76
11650.00	13.05	Peak	V				59.25	74.00	14.75
11650.00	3.60	Average	V				49.80	54.00	4.20

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.6.3.4 Test data for 802.11n (HT 40) WLAN Mode

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 40 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 86 %
- . Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11510.00	12.16	Peak	H	37.78	8.85	0.00	58.79	74.00	15.21
11510.00	4.68	Average	H				51.31	54.00	2.69
11510.00	12.34	Peak	V				58.97	74.00	15.03
11510.00	3.62	Average	V				50.25	54.00	3.75
High Channel									
11590.00	13.94	Peak	H	37.66	8.73	0.00	60.33	74.00	13.67
11590.00	4.22	Average	H				50.61	54.00	3.39
11590.00	12.08	Peak	V				58.47	74.00	15.53
11590.00	3.46	Average	V				49.85	54.00	4.15

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.6.3.5 Test data for 802.11ac (HT 80) WLAN Mode

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 40 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 77 %
- . Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
11550.00	11.95	Peak	H	37.70	8.80	0.00	58.45	74.00	15.55
11550.00	3.90	Average	H				50.40	54.00	3.60
11550.00	12.99	Peak	V				59.49	74.00	14.51
11550.00	4.09	Average	V				50.59	54.00	3.41

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

13.7 Test data for Co-location(BT + WLAN 5.8 GHz)

13.7.1 Test data for 30 MHz ~ 1 GHz

Humidity Level : 52 % R.H.

Temperature: 24 °C

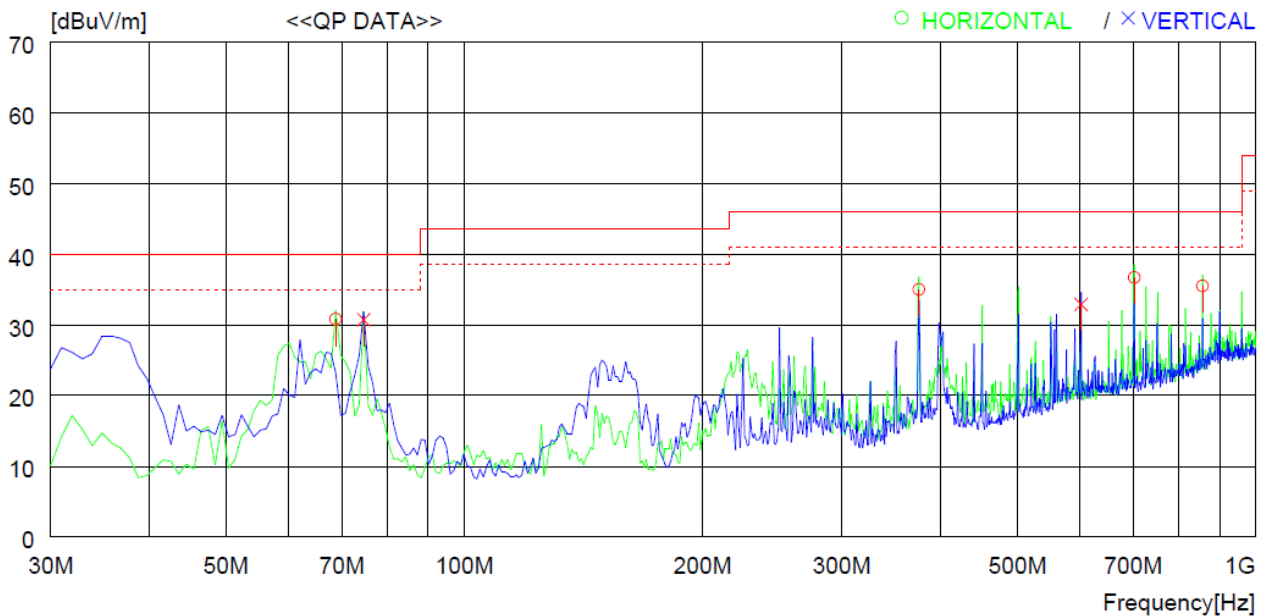
Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247 & SUBPART E, SECTION 15.407

Result : PASSED

Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

Date: May 23, 2019 ~ July 09, 2019

Note : Co-location(BT + WLAN 5.8 GHz) operating mode were tested



No.	FREQ	READING	ANT	LOSS	GAIN	RESULT	LIMIT	MARGIN	ANTENNA	TABLE
	[MHz]	[dBuV]	FACTOR	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[cm]	[DEG]
----- Horizontal -----										
1	68.800	52.1	9.8	2.0	33.1	30.8	40.0	9.2	300	203
2	375.320	48.2	15.3	4.5	33.0	35.0	46.0	11.0	100	255
3	702.205	43.9	20.0	6.1	33.3	36.7	46.0	9.3	300	94
4	856.430	39.6	21.7	6.9	32.7	35.5	46.0	10.5	300	359
----- Vertical -----										
5	74.620	53.4	8.5	1.9	33.1	30.7	40.0	9.3	200	0
6	601.328	41.1	19.5	5.6	33.3	32.9	46.0	13.1	100	359

Tested by: Sieon Lee / Assistant Manager

13.7.2 Test data for Below 30 MHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- . Frequency range : 9 kHz ~ 30 MHz
- . Measurement distance : 3 m
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Emissions observed were 20dB below the limit and thus not reported									



Tested by: Sieon Lee / Assistant Manager

13.7.3 Test data for above 1 GHz

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- . Frequency range : 1 GHz ~ 40 GHz
- . Measurement distance : 3 m
- . Duty Cycle : 93 %
- . Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
Emissions observed were 20dB below the limit and thus not reported									



Tested by: Sieon Lee / Assistant Manager

14. RADIATED RESTRICTED BAND EDGE MEASUREMENTS

14.1 Operating environment

Temperature : 24 °C
Relative humidity : 52 % R.H.

14.2 Test set-up

The radiated emissions measurements were performed on the 3 m semi anechoic chamber. The EUT was placed on turntable approximately 1.5 m above the ground plane.

The frequency spectrum from 30 MHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

14.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
□ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2018 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2018 (1Y)
□ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Aug. 23, 2018 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	312544	Mar. 18, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Aug. 23, 2018 (1Y)
■ -	BBV 9718 B	Schwarzbeck	Pre-Amplifier	009	Mar. 20, 2019 (1Y)
■ -	MA-4000XPET	Innco Systems GmbH	Antenna Master	MA4000/509	N/A
□ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT3000-3t	Innco Systems GmbH	Turn Table	N/A	N/A
□ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Aug. 09, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D295	Aug. 16, 2017 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jul. 28, 2017 (2Y)
■ -	SCU40A	Rohde & Schwarz	Pre-Amplifier	100436	Mar. 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

14.4 Test data for Restricted Band (5.2 GHz)

14.4.1 Test data for 802.11a WLAN Mode (Ant 0)

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Duty Cycle : 93 %
- . Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5113.31	16.64	Peak	H	31.28	7.84	0.00	55.76	74.00	18.24
4895.78	5.87	Average	H				44.99	54.00	9.01
4981.49	17.39	Peak	V				56.51	74.00	17.49
4966.56	5.82	Average	V				44.94	54.00	9.06

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

14.4.2 Test data for 802.11a WLAN Mode (Ant 1)

-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Detector : Peak Mode(Peak), Average Mode(RMS)
 -. Measurement distance : 3 m
 -. Duty Cycle : 93 %
 -. Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5113.31	16.64	Peak	H	31.28	7.84	0.00	55.76	74.00	18.24
4895.78	5.87	Average	H				44.99	54.00	9.01
4981.49	17.39	Peak	V				56.51	74.00	17.49
4966.56	5.82	Average	V				44.94	54.00	9.06

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

14.4.3 Test data for 802.11n (HT 20) WLAN Mode

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Duty Cycle : 93 %
- . Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
4967.21	17.96	Peak	H	31.28	7.84	0.00	57.08	74.00	16.92
4966.56	5.57	Average	H				44.69	54.00	9.31
5080.19	17.21	Peak	V				56.33	74.00	17.67
5023.05	6.13	Average	V				45.25	54.00	8.75

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

14.4.4 Test data for 802.11n (HT 40) WLAN Mode

-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak and Average Mode
 -. Video bandwidth : 3 MHz for Peak and Average Mode
 -. Detector : Peak Mode(Peak), Average Mode(RMS)
 -. Measurement distance : 3 m
 -. Duty Cycle : 86 %
 -. Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5030.84	17.39	Peak	H	31.28	7.84	0.00	56.51	74.00	17.49
4899.03	5.95	Average	H				45.07	54.00	8.93
4959.42	16.21	Peak	V				55.33	74.00	18.67
5023.05	5.77	Average	V				44.89	54.00	9.11

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

14.4.5 Test data for 802.11ac (HT 80) WLAN Mode

- . Test Date : May 23, 2019 ~ July 09, 2019
- . Resolution bandwidth : 1 MHz for Peak and Average Mode
- . Video bandwidth : 3 MHz for Peak and Average Mode
- . Detector : Peak Mode(Peak), Average Mode(RMS)
- . Measurement distance : 3 m
- . Duty Cycle : 77 %
- . Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
4668.51	17.02	Peak	H	31.28	7.84	0.00	56.14	74.00	17.86
4900.42	5.76	Average	H				44.88	54.00	9.12
4975.65	16.91	Peak	V				56.03	74.00	17.97
4966.56	5.78	Average	V				44.90	54.00	9.10

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Sieon Lee / Assistant Manager

14.5 Test data for Restricted Band (5.8 GHz)

14.5.1 Test data for 802.11a WLAN Mode (Ant 0)

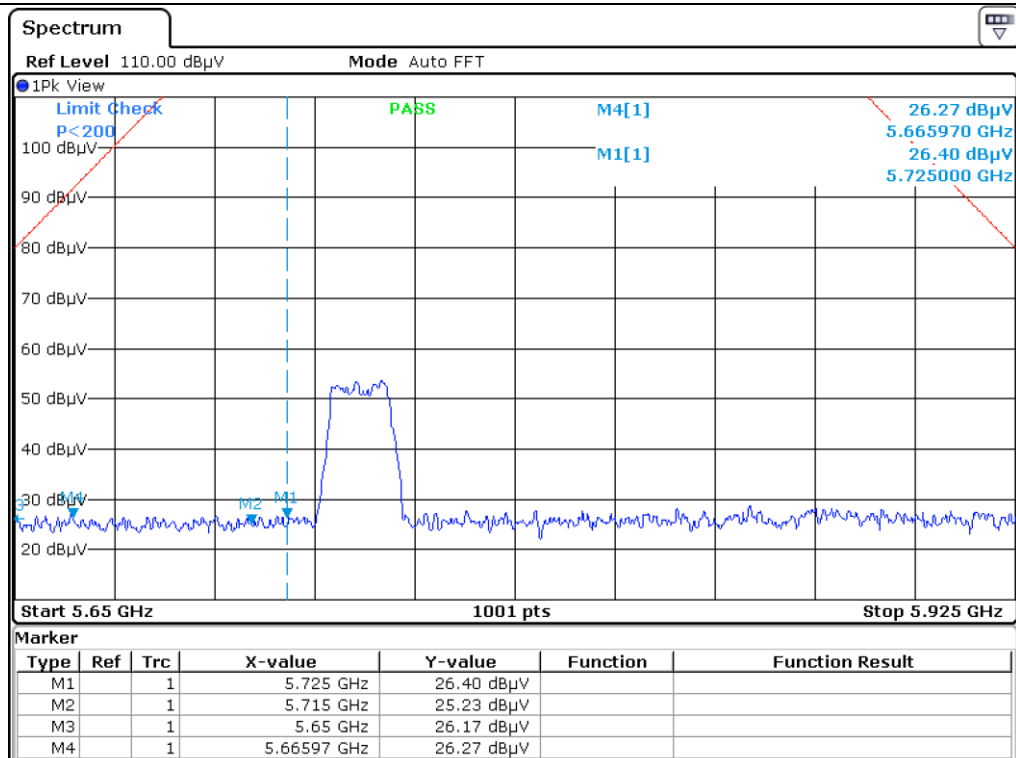
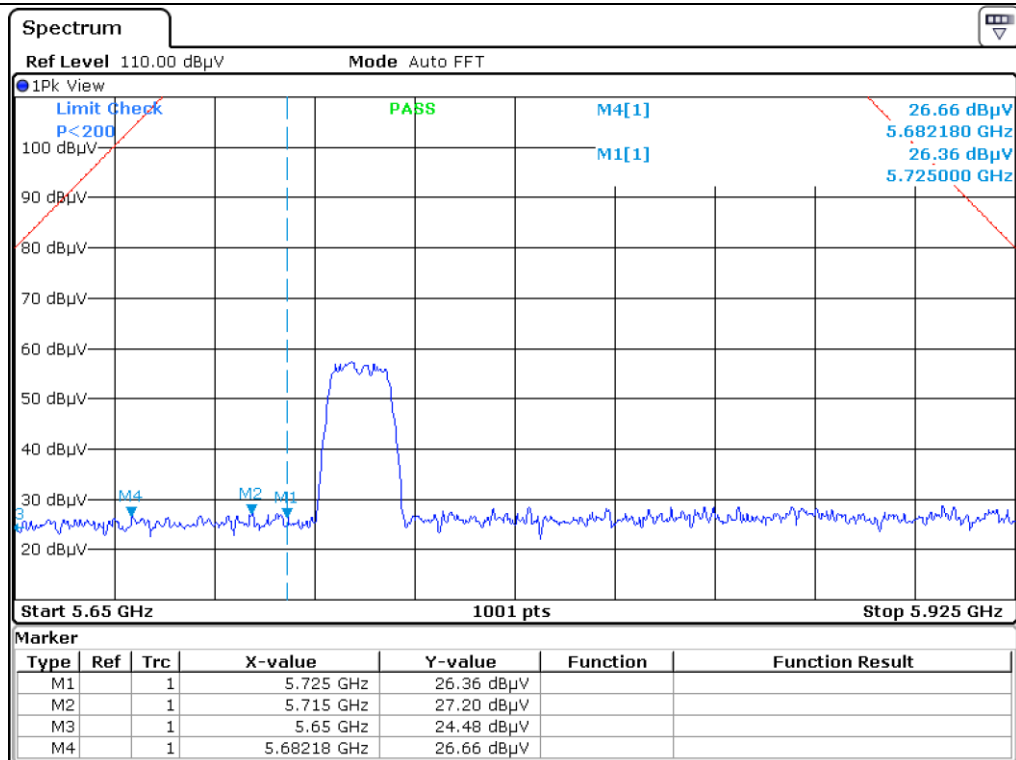
-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak Mode
 -. Video bandwidth : 3 MHz for Peak Mode
 -. Detector : Peak Mode(Peak)
 -. Measurement distance : 3 m
 -. Duty Cycle : 93 %
 -. Result : Pass

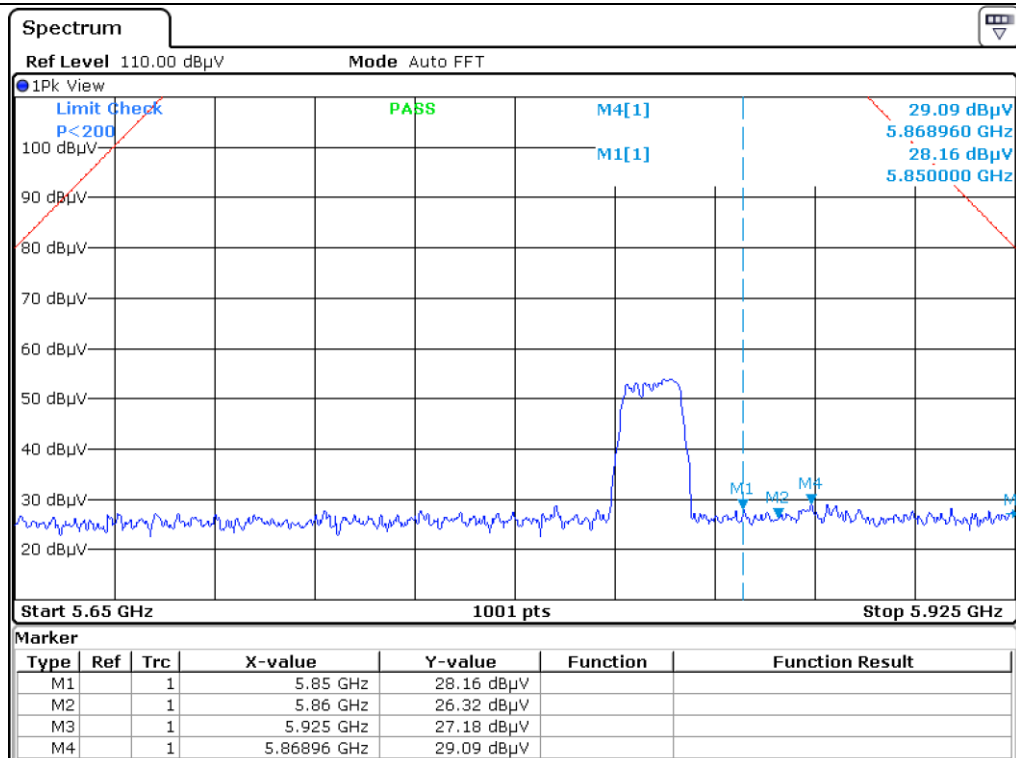
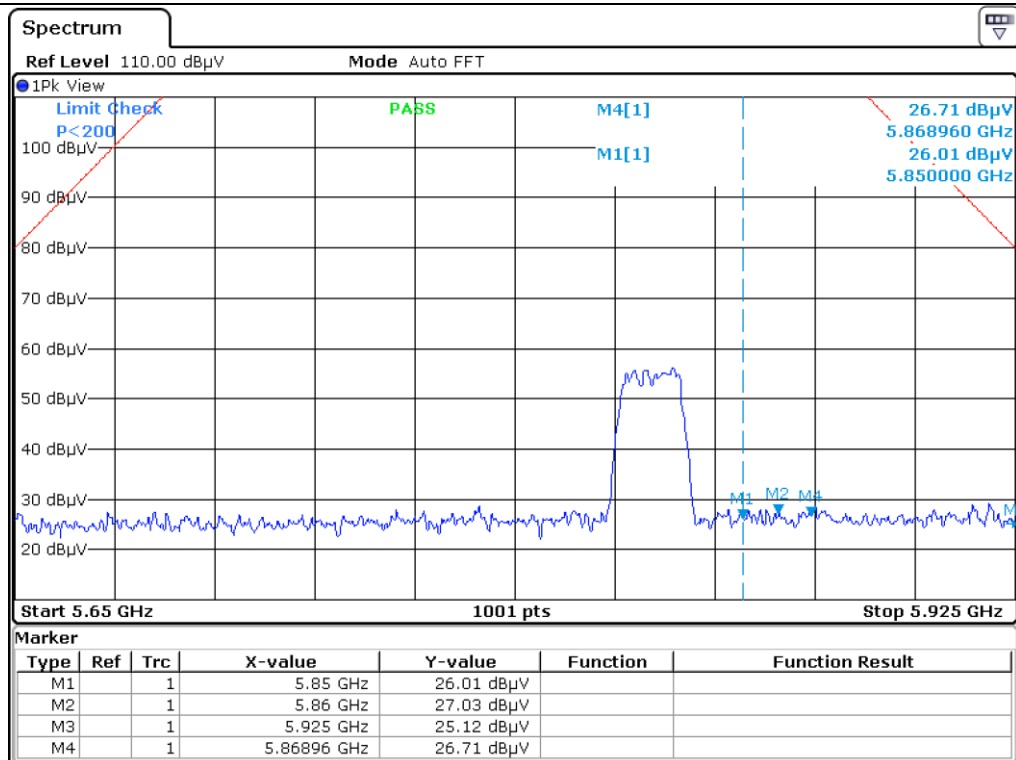
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5650.00	24.48	Peak	H	32.17	7.74	0.00	64.39	80.00	15.61
5715.00	27.20	Peak	H				67.11	121.20	54.09
5725.00	26.36	Peak	H				66.27	134.00	67.73
5682.18	26.66	Peak	H				66.57	103.81	37.24
5650.00	26.17	Peak	V				66.08	80.00	13.92
5715.00	25.23	Peak	V				65.14	121.20	56.06
5725.00	26.40	Peak	V				66.31	134.00	67.69
5665.97	26.27	Peak	V				66.18	91.82	25.64
High Channel									
5850.00	26.01	Peak	H	32.17	7.74	0.00	65.92	134.00	68.08
5860.00	27.03	Peak	H				66.94	121.20	54.26
5925.00	25.12	Peak	H				65.03	80.00	14.97
5868.96	26.71	Peak	H				66.62	118.69	52.07
5850.00	28.16	Peak	V				68.07	134.00	65.93
5860.00	26.32	Peak	V				66.23	121.20	54.97
5925.00	27.18	Peak	V				67.09	80.00	12.91
5868.96	29.09	Peak	V				69.00	118.69	49.69

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)





[Signature]

Tested by: Sieon Lee / Assistant Manager

14.5.2 Test data for 802.11a WLAN Mode (Ant 1)

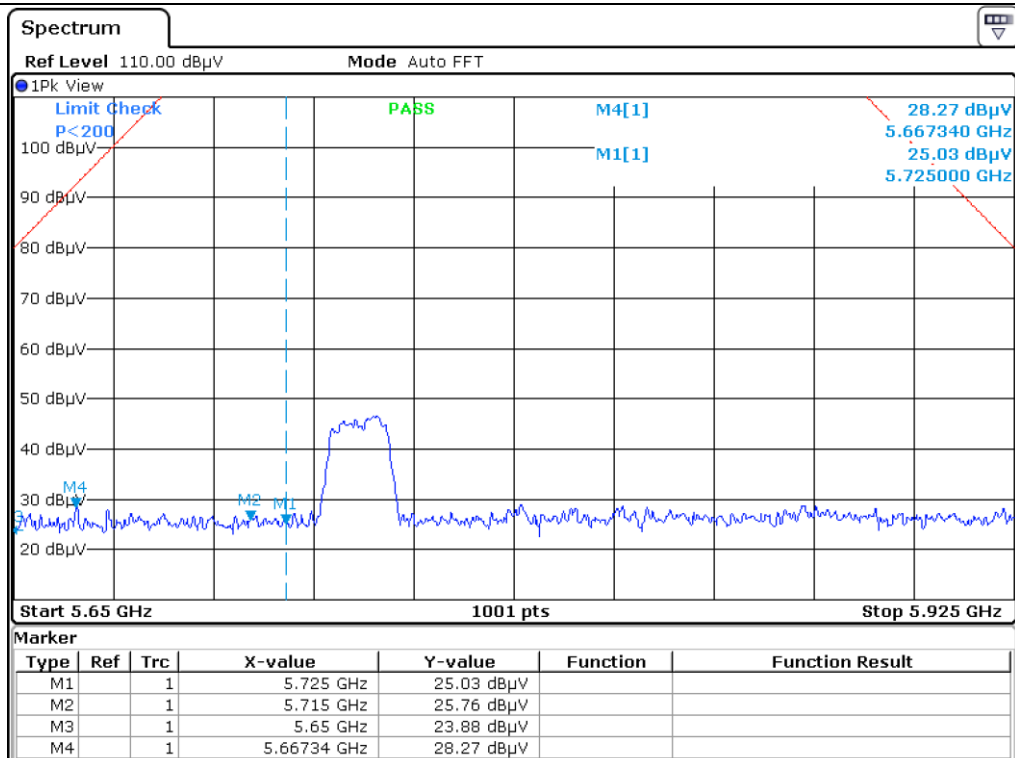
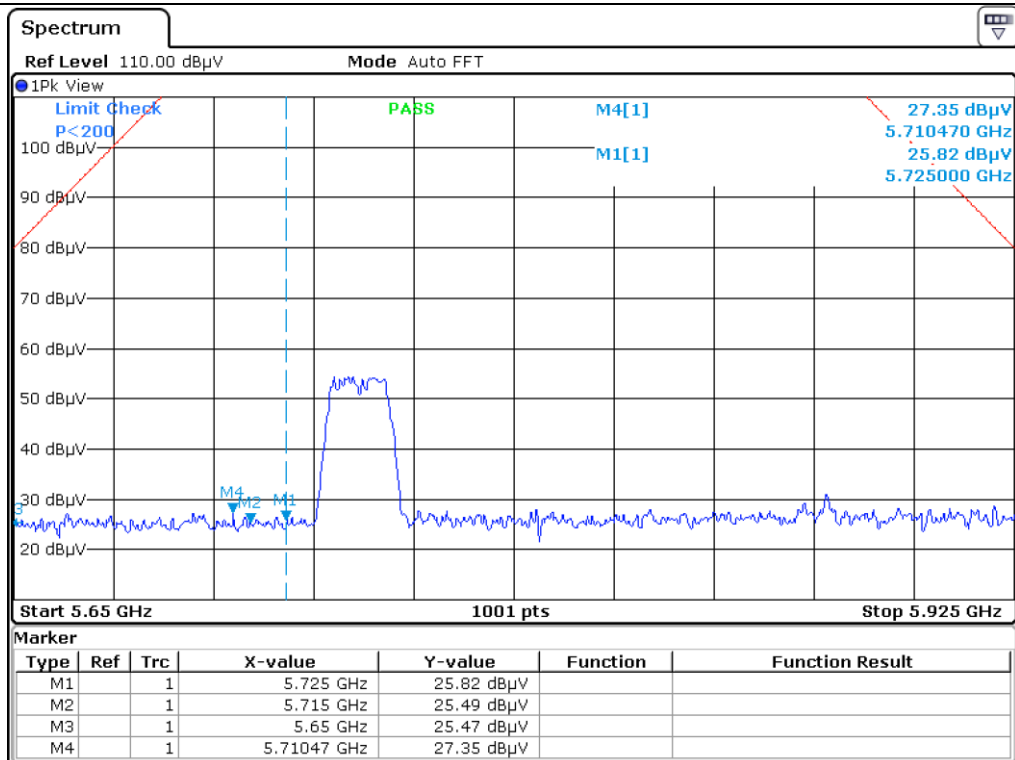
-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak Mode
 -. Video bandwidth : 3 MHz for Peak Mode
 -. Detector : Peak Mode(Peak)
 -. Measurement distance : 3 m
 -. Duty Cycle : 93 %
 -. Result : Pass

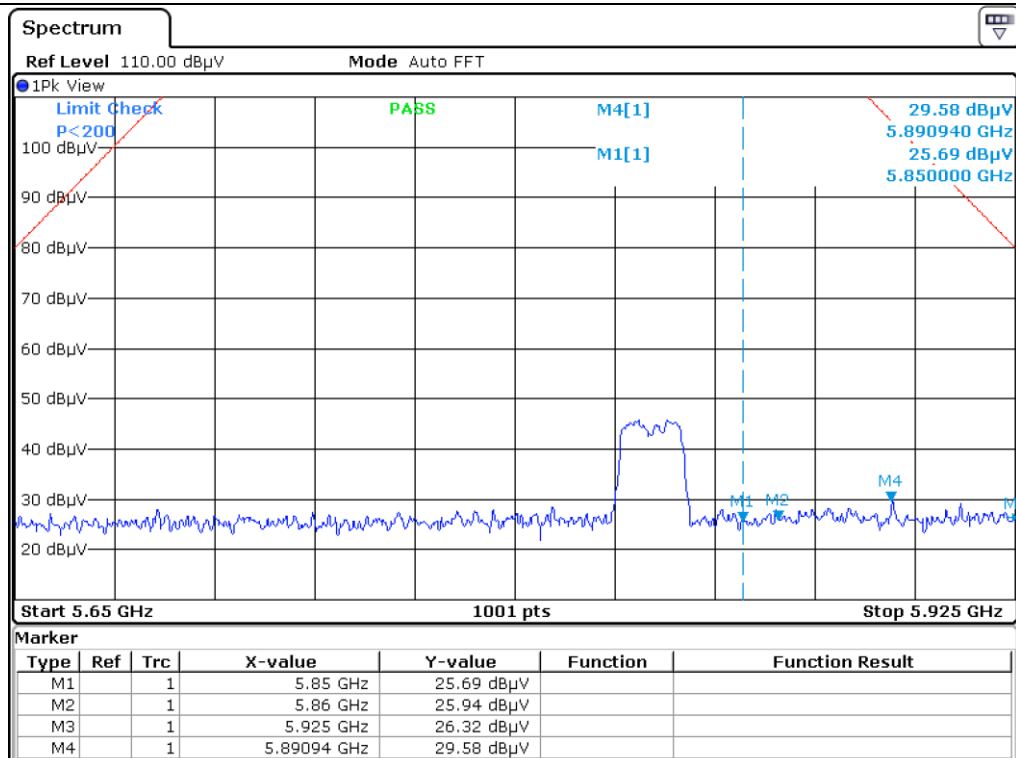
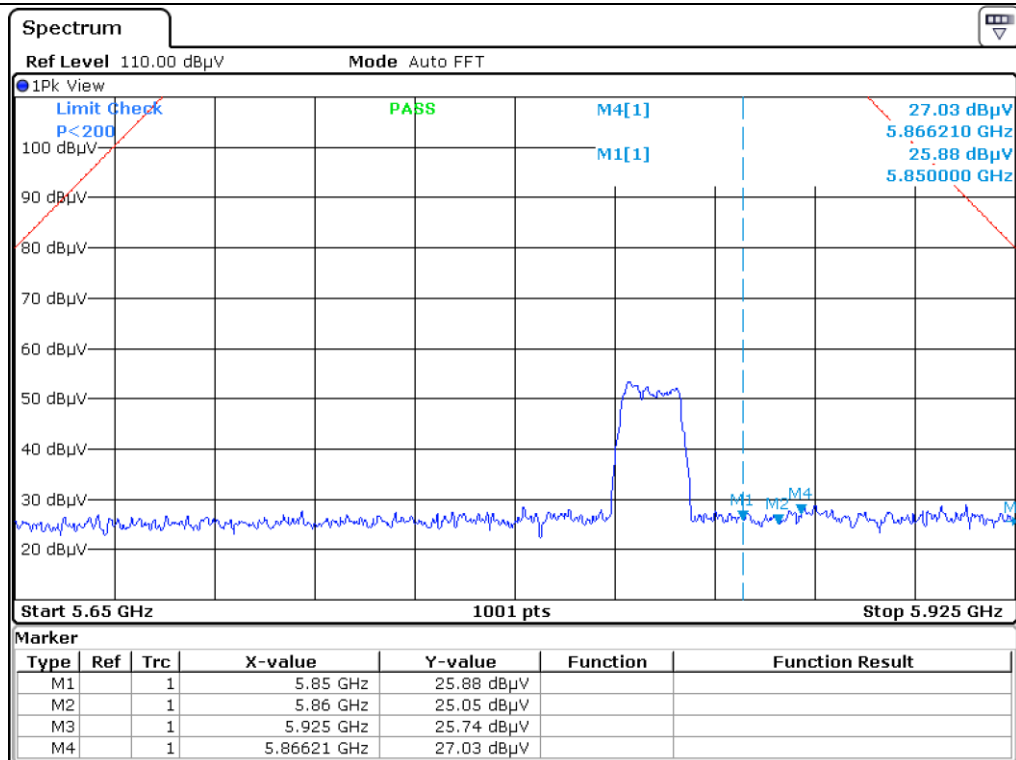
Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5650.00	25.47	Peak	H	32.17	7.74	0.00	65.38	80.00	14.62
5715.00	25.49	Peak	H				65.40	121.20	55.80
5725.00	25.82	Peak	H				65.73	134.00	68.27
5682.18	27.35	Peak	H				67.26	119.93	52.67
5650.00	23.88	Peak	V				63.79	80.00	16.21
5715.00	25.76	Peak	V				65.67	121.20	55.53
5725.00	25.03	Peak	V				64.94	134.00	69.06
5665.97	28.27	Peak	V				68.18	92.83	24.65
High Channel									
5850.00	25.88	Peak	H	32.17	7.74	0.00	65.79	134.00	68.21
5860.00	25.05	Peak	H				64.96	121.20	56.24
5925.00	25.74	Peak	H				65.65	80.00	14.35
5868.96	27.03	Peak	H				66.94	105.20	38.26
5850.00	25.69	Peak	V				65.60	134.00	68.40
5860.00	25.94	Peak	V				65.85	121.20	55.35
5925.00	26.32	Peak	V				66.23	80.00	13.77
5868.96	29.58	Peak	V				69.49	105.20	35.71

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)





[Signature]

Tested by: Sieon Lee / Assistant Manager

14.5.3 Test data for 802.11n (HT 20) WLAN Mode

-. Test Date : May 23, 2019 ~ July 09, 2019
 -. Resolution bandwidth : 1 MHz for Peak Mode
 -. Video bandwidth : 3 MHz for Peak Mode
 -. Detector : Peak Mode(Peak)
 -. Measurement distance : 3 m
 -. Duty Cycle : 93 %
 -. Result : Pass

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 650.00	27.00	Peak	H	32.17	7.74	0.00	66.91	80.00	13.09
5 715.00	25.62	Peak	H				65.53	121.20	55.67
5 725.00	27.60	Peak	H				67.51	134.00	66.49
5 681.63	26.67	Peak	H				66.58	103.41	36.83
5 650.00	24.36	Peak	V				64.27	80.00	15.73
5 715.00	24.15	Peak	V				64.06	121.20	57.14
5 725.00	25.75	Peak	V				65.66	134.00	68.34
5 706.90	27.36	Peak	V				67.27	118.93	51.66
High Channel									
5 850.00	26.50	Peak	H	32.17	7.74	0.00	66.41	134.00	67.59
5 860.00	26.02	Peak	H				65.93	121.20	55.27
5 925.00	26.61	Peak	H				66.52	80.00	13.48
5 866.21	27.50	Peak	H				67.41	119.46	52.05
5 850.00	26.63	Peak	V				66.54	134.00	67.46
5 860.00	28.35	Peak	V				68.26	121.20	52.94
5 925.00	27.93	Peak	V				67.84	80.00	12.16
5 866.21	28.06	Peak	V				67.97	119.46	51.49

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)