FCC §15.407(a)(e) –BANDWIDTH

Applicable Standard

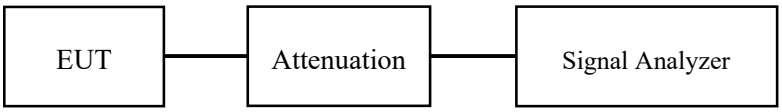
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. **Minimum Emission Bandwidth for the band 5.725-5.85 GHz**
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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.



Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0kPa

The testing was performed by Fan Yangon2021-08-11.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the Appendix.

Note: the worst case is ANT 1 was test and record in report.

FCC §15.407(a) (1)(3) –CONDUCTED TRANSMITTER OUTPUT POWER

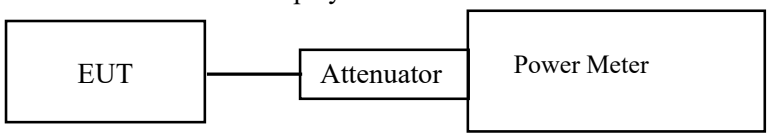
Applicable Standard

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.

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.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0kPa

The testing was performed by Fan Yang on 2021-08-11.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the Appendix.

FCC §15.407(a) (1) (3) - POWER SPECTRAL DENSITY

Applicable Standard

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.

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.

Test Procedure

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 ≥ 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 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (< 500 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 (1MHz/RBW) to the measured result, whereas RBW (< 1 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.

Test Data

Environmental Conditions

Temperature:	27 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0kPa

The testing was performed by Fan Yang on 2021-08-11.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the Appendix.

APPENDIX

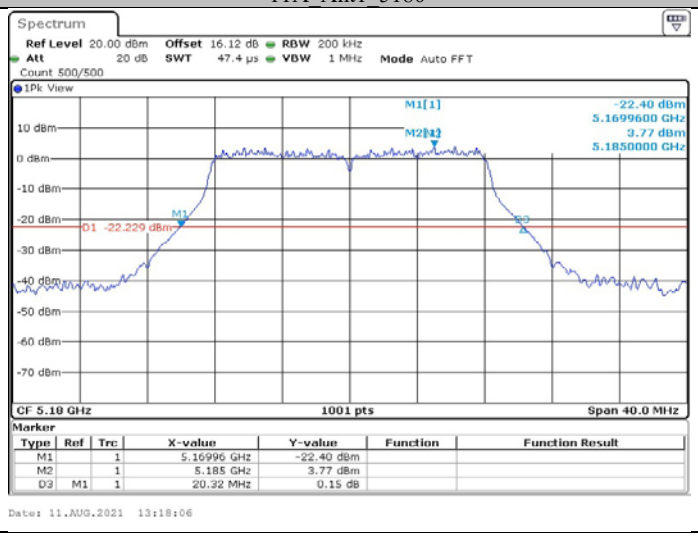
Appendix A1: Emission Bandwidth

Test Result

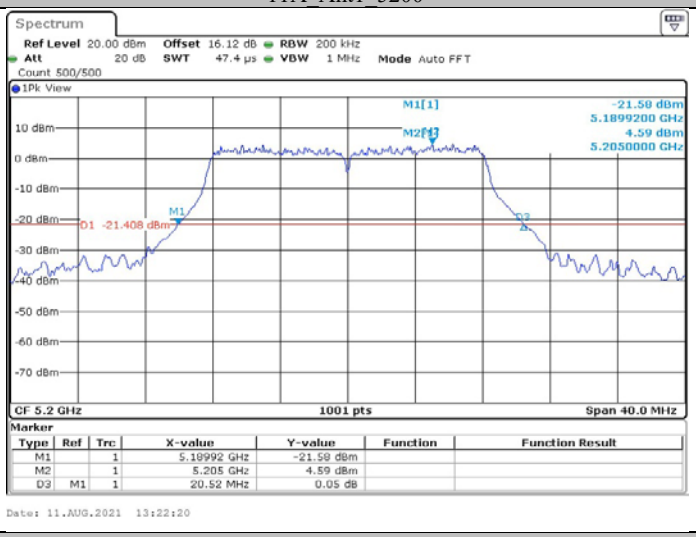
TestMode	Antenna	Channel	26db EBW [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	20.320	---	PASS
		5200	20.520	---	PASS
		5240	20.360	---	PASS
11N20MIMO	Ant1	5180	20.720	---	PASS
		5200	20.880	---	PASS
		5240	20.400	---	PASS
11N40MIMO	Ant1	5190	44.080	---	PASS
		5230	44.000	---	PASS
11AC20MIMO	Ant1	5180	20.560	---	PASS
		5200	20.520	---	PASS
		5240	20.560	---	PASS
11AC40MIMO	Ant1	5190	43.600	---	PASS
		5230	43.600	---	PASS
11AC80MIMO	Ant1	5210	82.720	---	PASS

Test Graphs

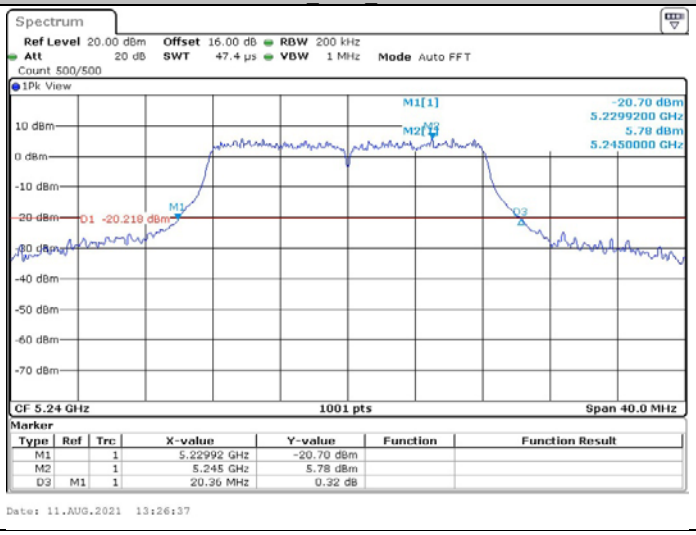
11A_Ant1_5180



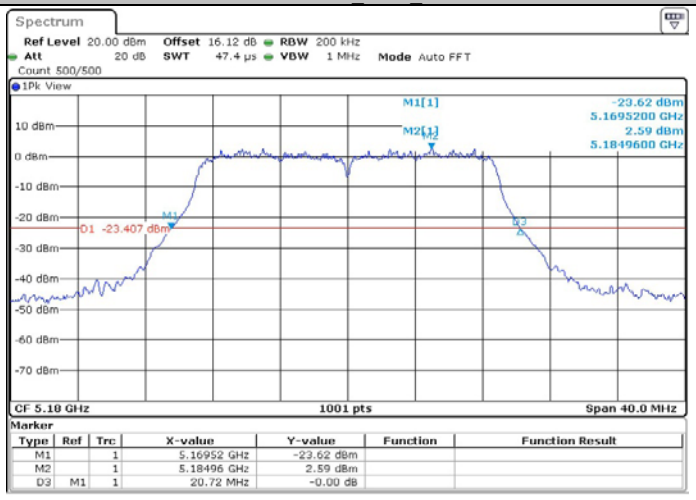
11A_Ant1_5200



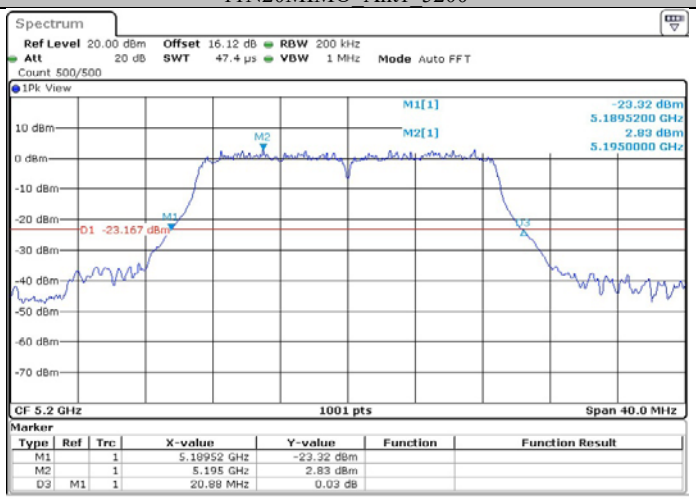
11A_Ant1_5240



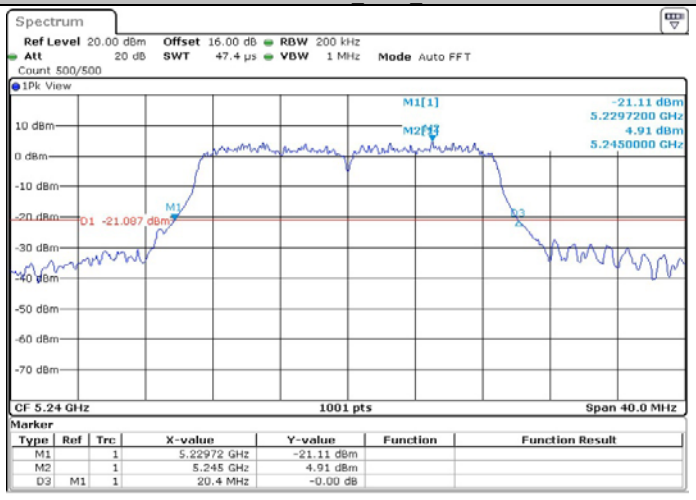
11N20MIMO_Ant1_5180



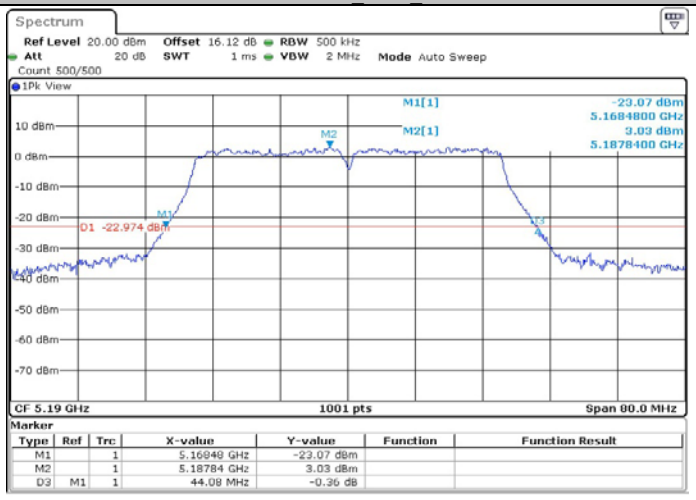
11N20MIMO_Ant1_5200



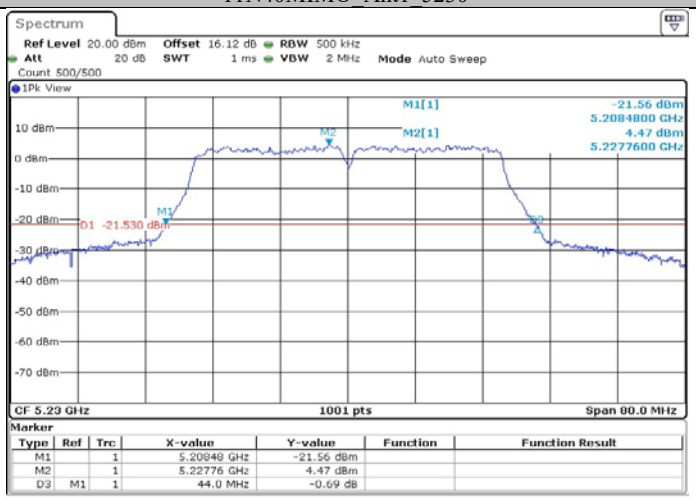
11N20MIMO_Ant1_5240



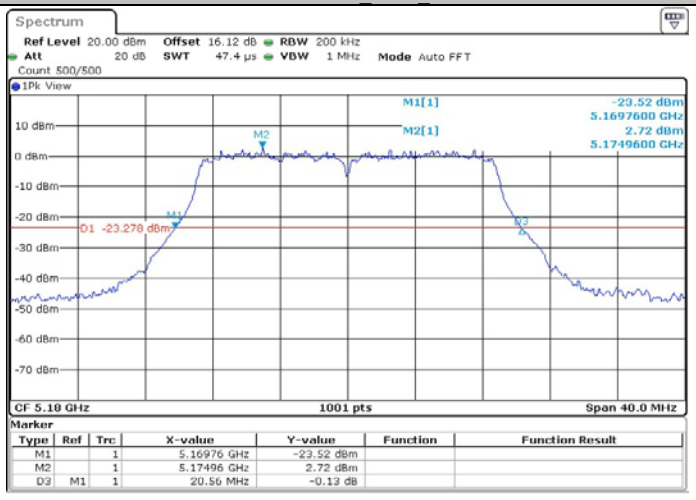
11N40MIMO_Ant1_5190



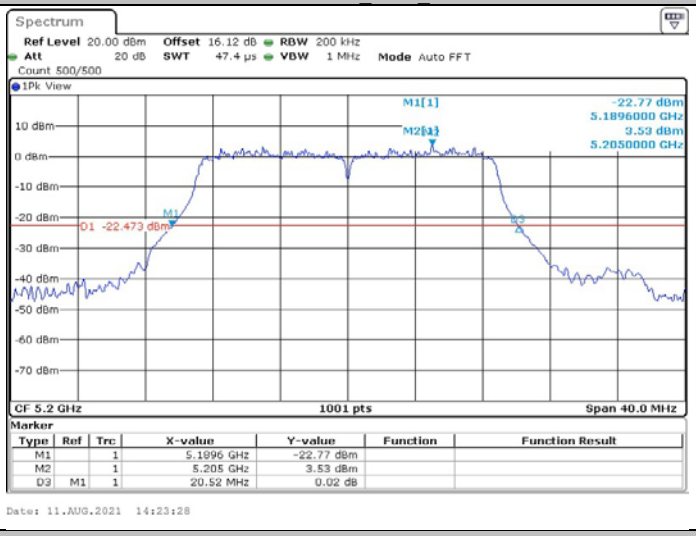
11N40MIMO_Ant1_5230



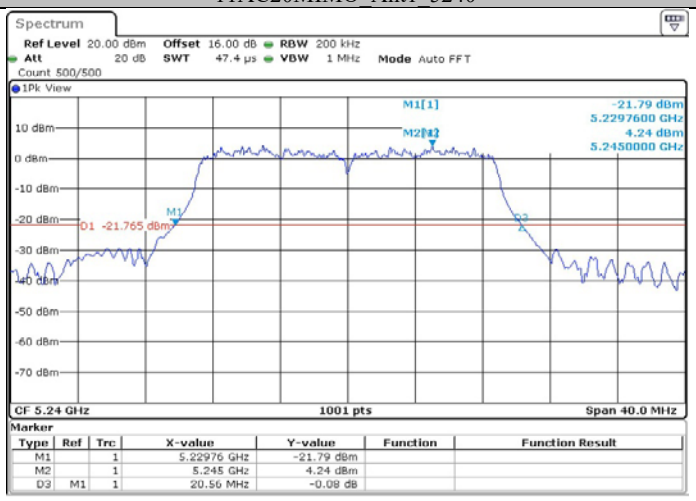
11AC20MIMO_Ant1_5180



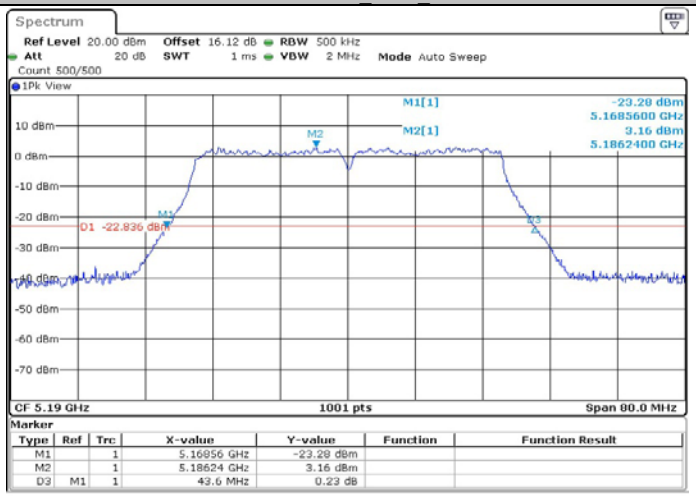
11AC20MIMO_Ant1_5200



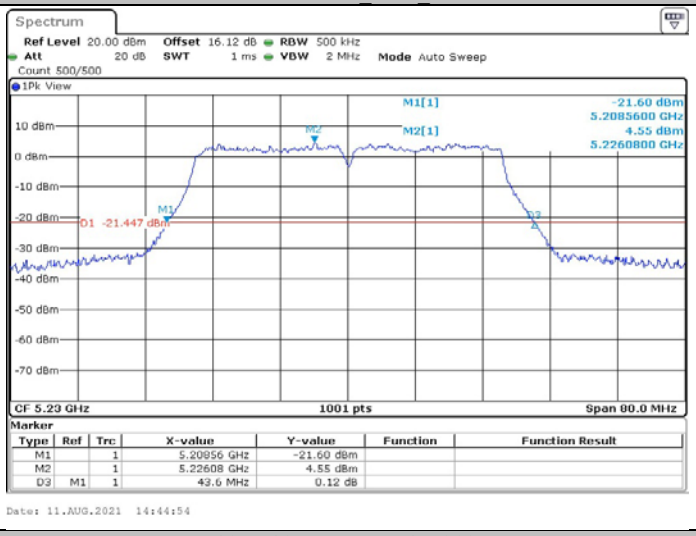
11AC20MIMO_Ant1_5240



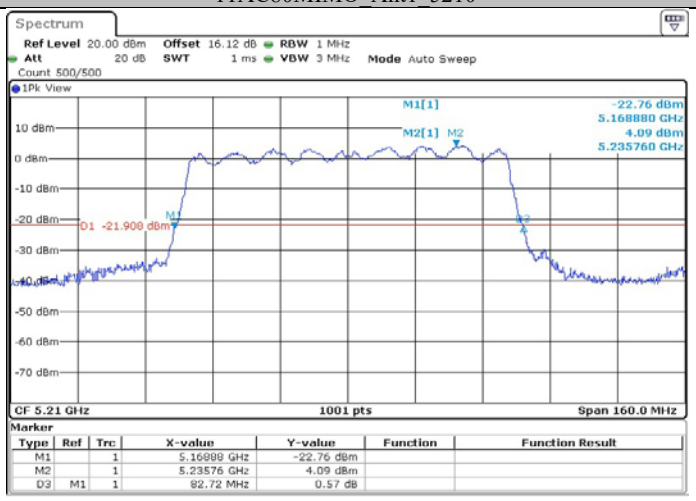
11AC40MIMO_Ant1_5190



11AC40MIMO_Ant1_5230



11AC80MIMO_Ant1_5210



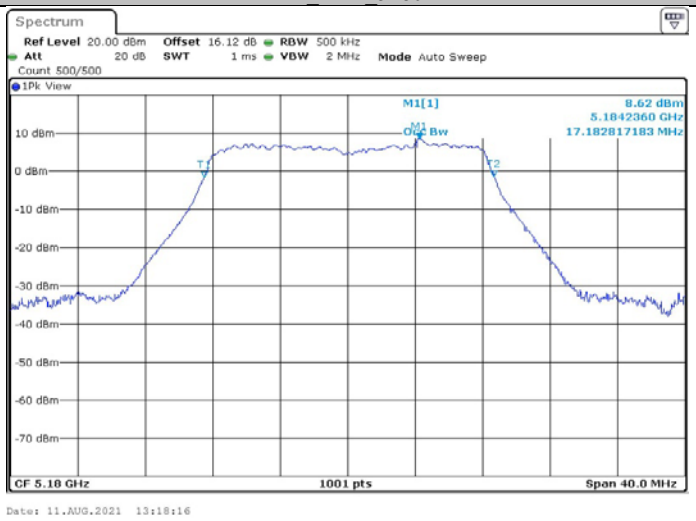
Appendix A2: Occupied channel bandwidth

Test Result

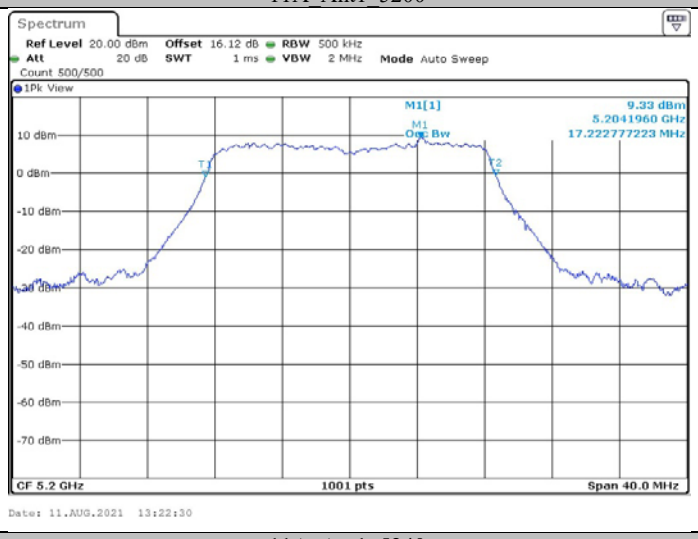
TestMode	Antenna	Channel	OCB [MHz]	Limit	Verdict
11A	Ant1	5180	17.183	The whole OBW fall within 5150-5250MHz range	PASS
		5200	17.223		PASS
		5240	17.303		PASS
11N20MIMO	Ant1	5180	18.062		PASS
		5200	18.102		PASS
		5240	18.142		PASS
11N40MIMO	Ant1	5190	37.403		PASS
		5230	37.323		PASS
11AC20MIMO	Ant1	5180	18.102		PASS
		5200	18.142		PASS
		5240	18.142		PASS
11AC40MIMO	Ant1	5190	37.323		PASS
		5230	37.243		PASS
11AC80MIMO	Ant1	5210	75.924		PASS
11A	Ant1	5745	17.662	The whole OBW fall within 5725-5850MHz range	PASS
		5785	17.902		PASS
		5825	17.862		PASS
11N20MIMO	Ant1	5745	18.262		PASS
		5785	18.302		PASS
		5825	18.262		PASS
11N40MIMO	Ant1	5755	37.642		PASS
		5795	37.642		PASS
11AC20MIMO	Ant1	5745	18.262		PASS
		5785	18.302		PASS
		5825	18.302		PASS
11AC40MIMO	Ant1	5755	37.562		PASS
		5795	37.483		PASS
11AC80MIMO	Ant1	5775	76.244		PASS

Test Graphs

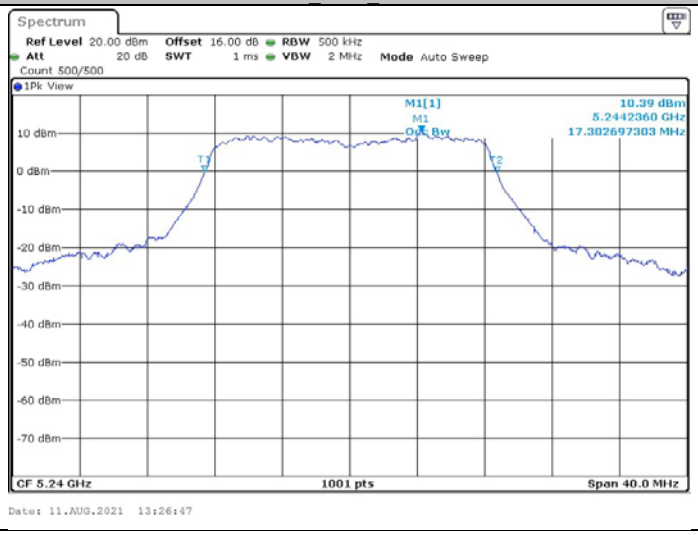
11A_Ant1_5180



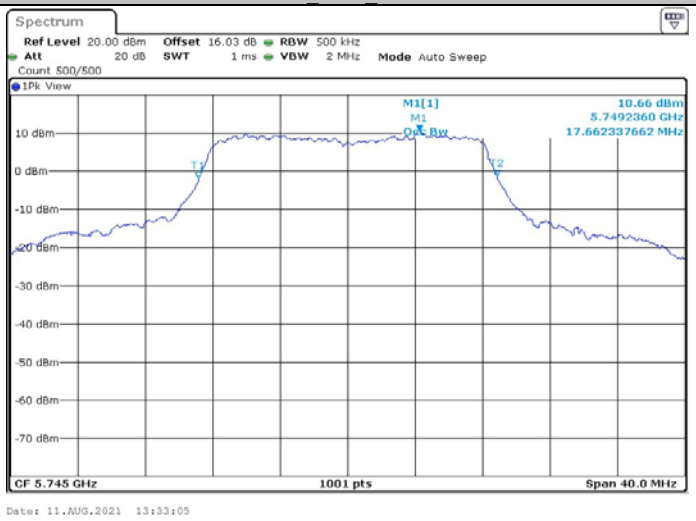
11A_Ant1_5200



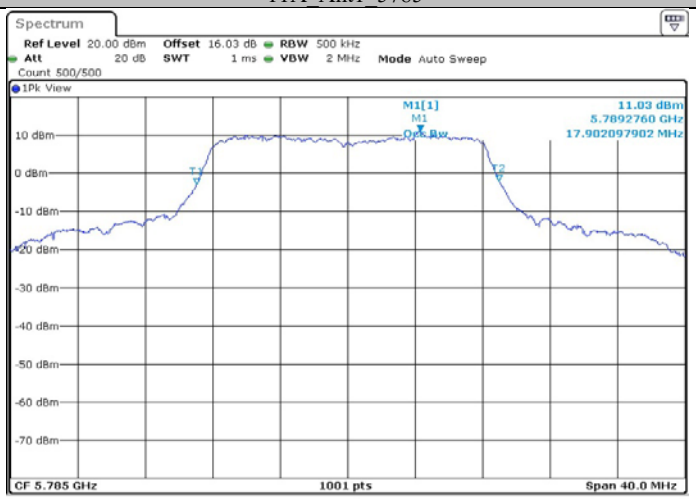
11A_Ant1_5240



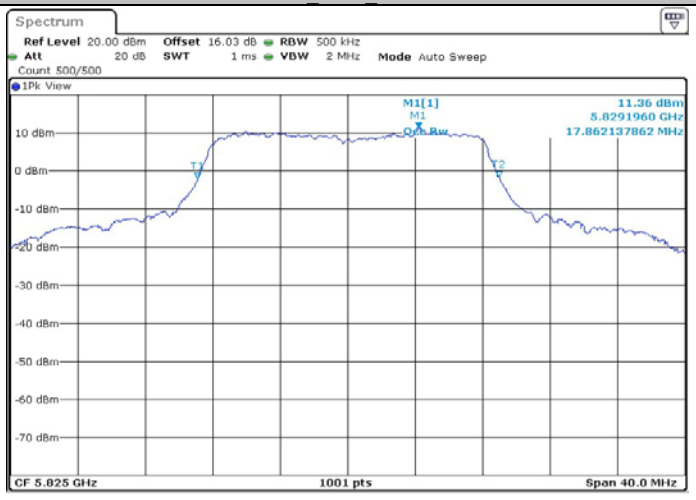
11A_Ant1_5745



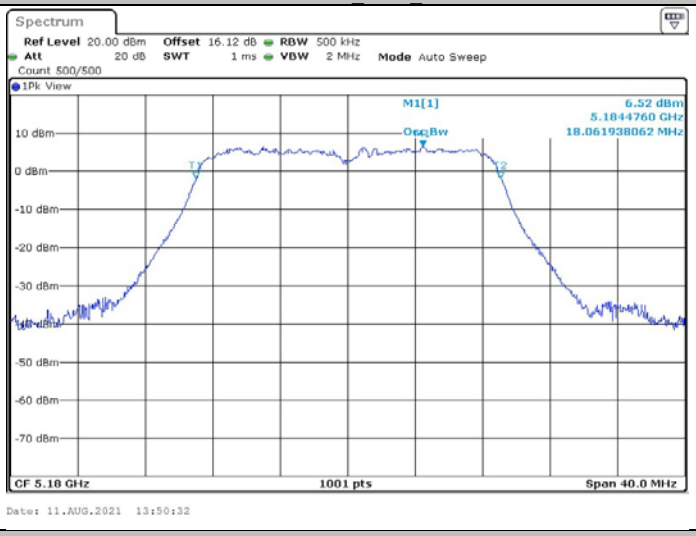
11A_Ant1_5785



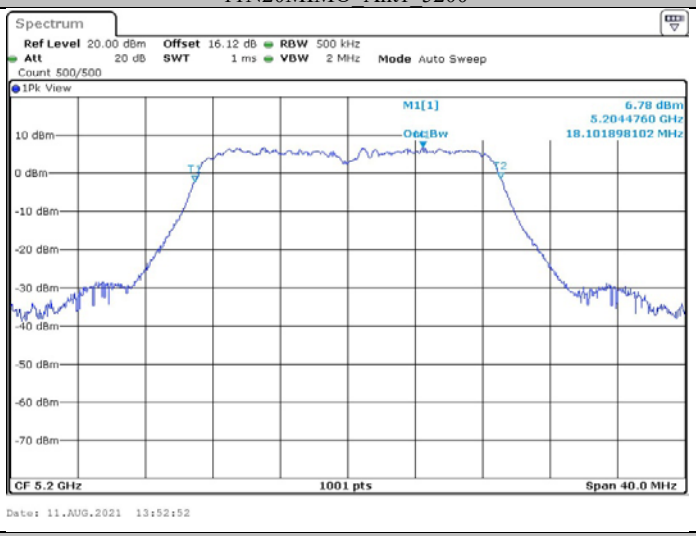
11A_Ant1_5825



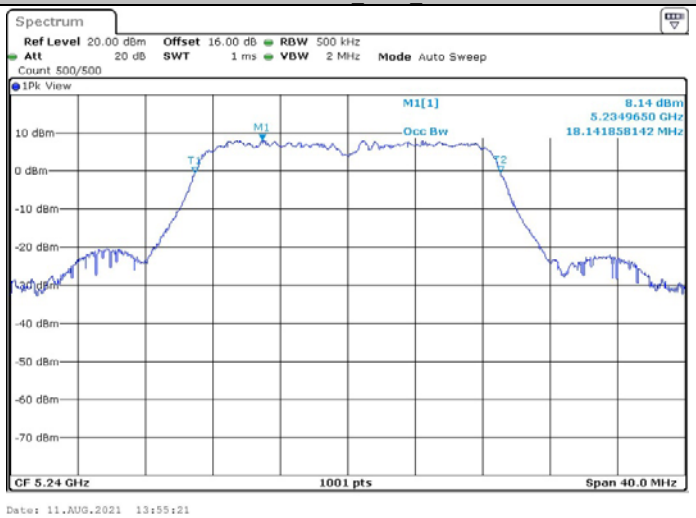
11N20MIMO_Ant1_5180



11N20MIMO_Ant1_5200



11N20MIMO_Ant1_5240



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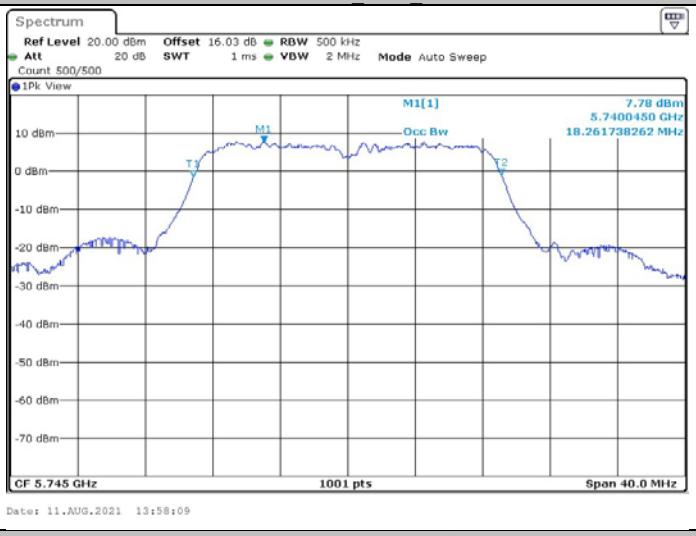
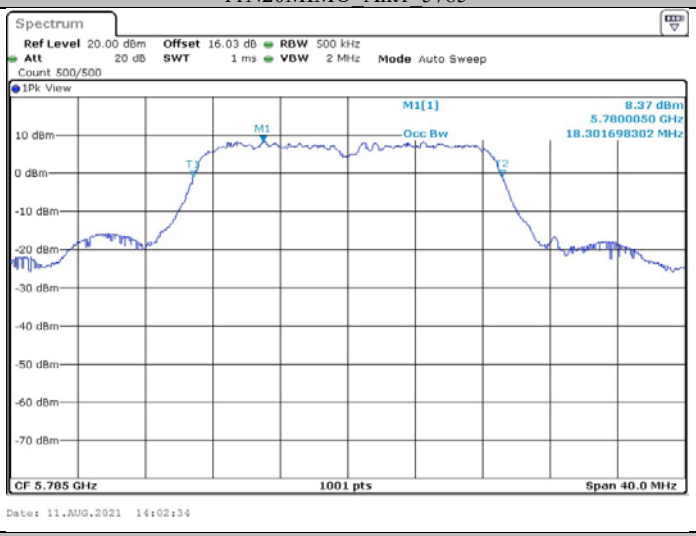
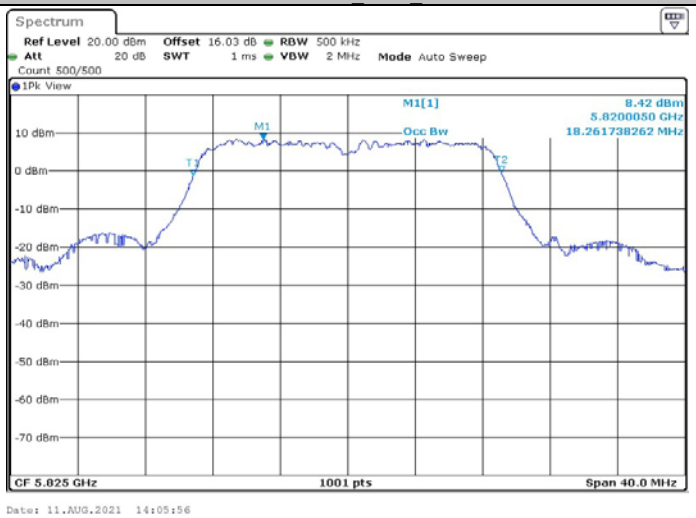


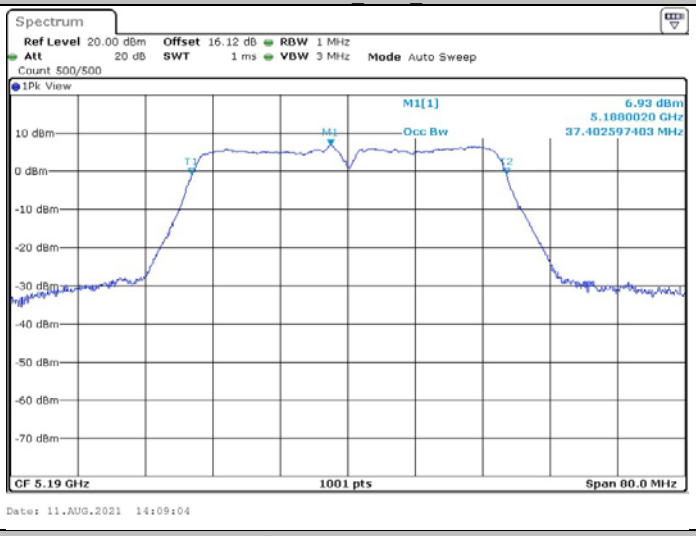
11N20MIMO_Ant1_5785



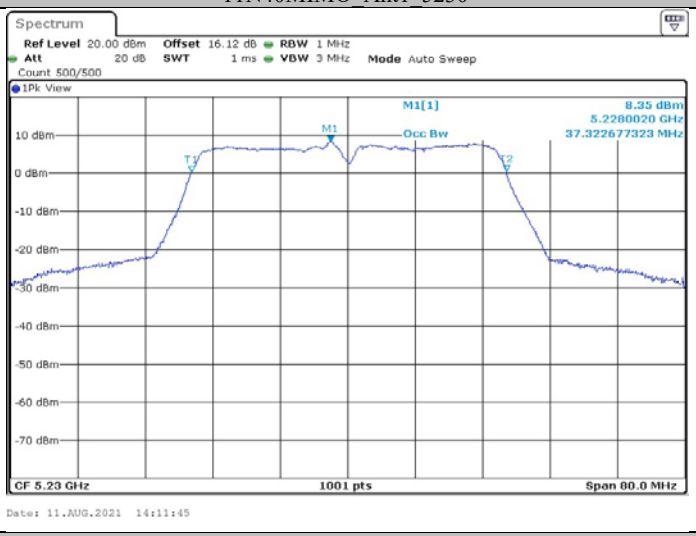
11N20MIMO_Ant1_5825



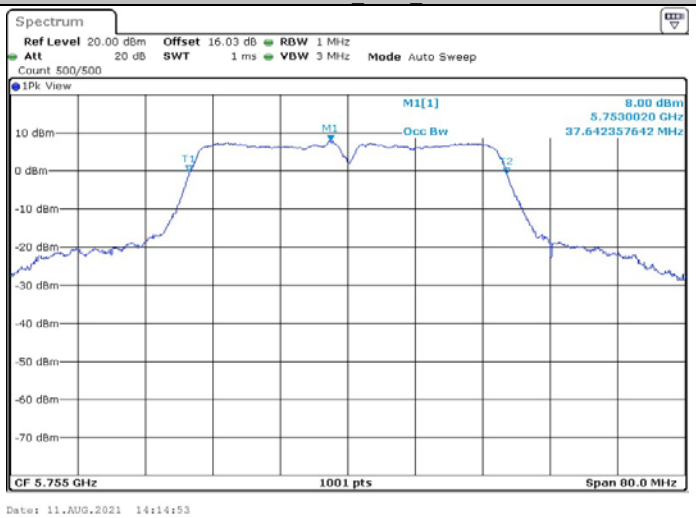
11N40MIMO_Ant1_5190



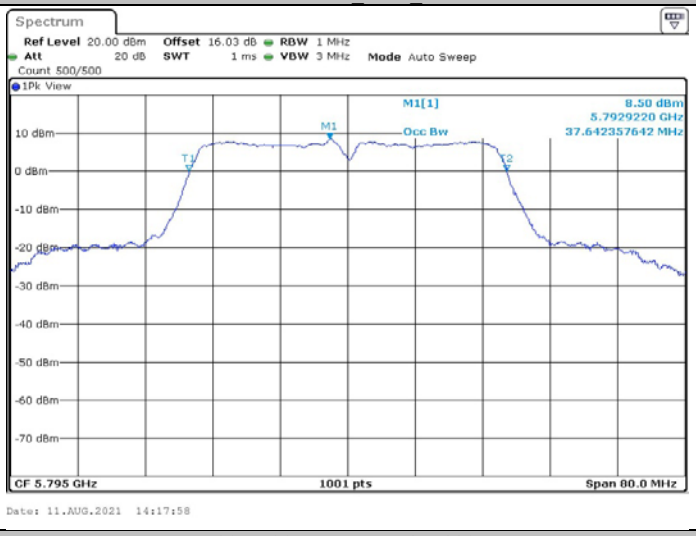
11N40MIMO_Ant1_5230



11N40MIMO_Ant1_5755



11N40MIMO_Ant1_5795



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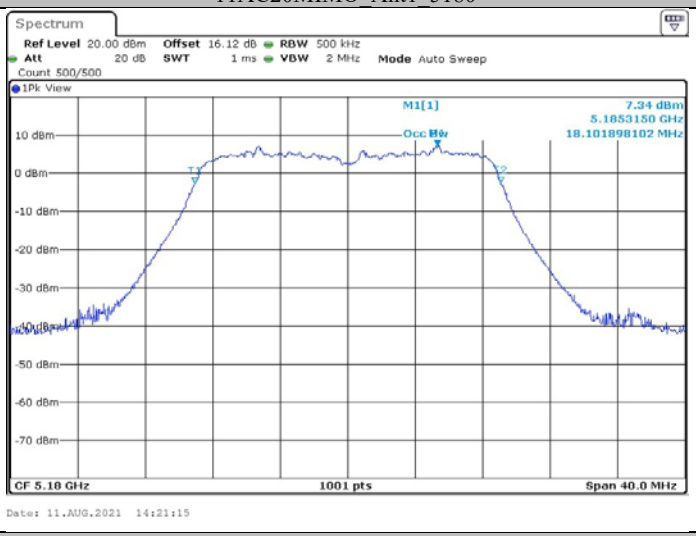

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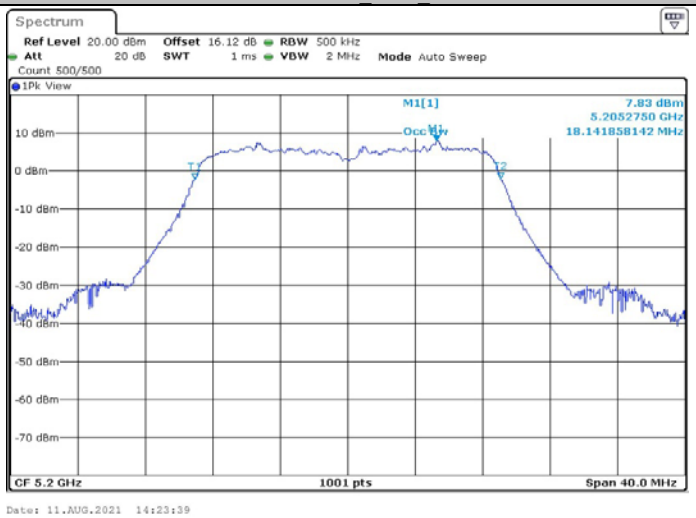
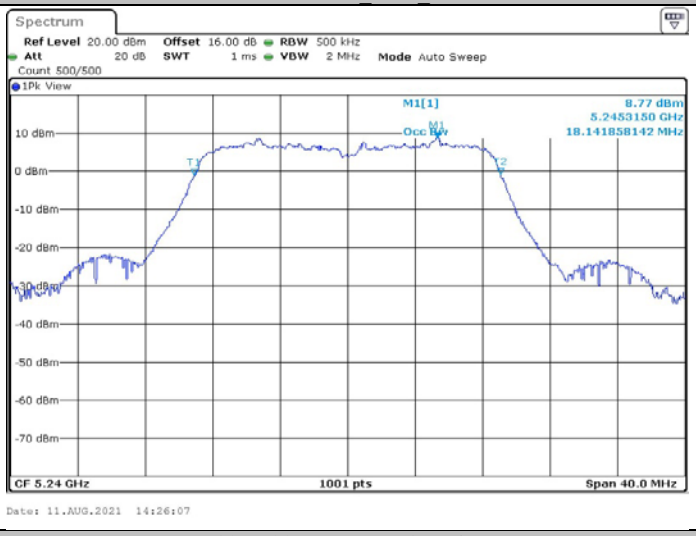
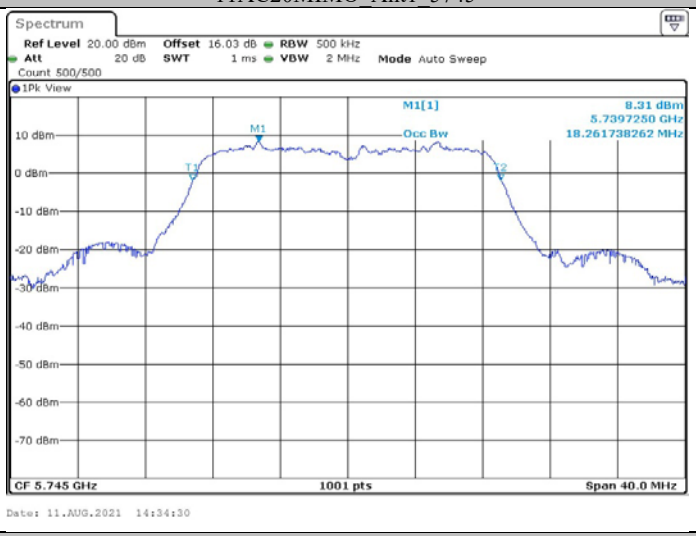


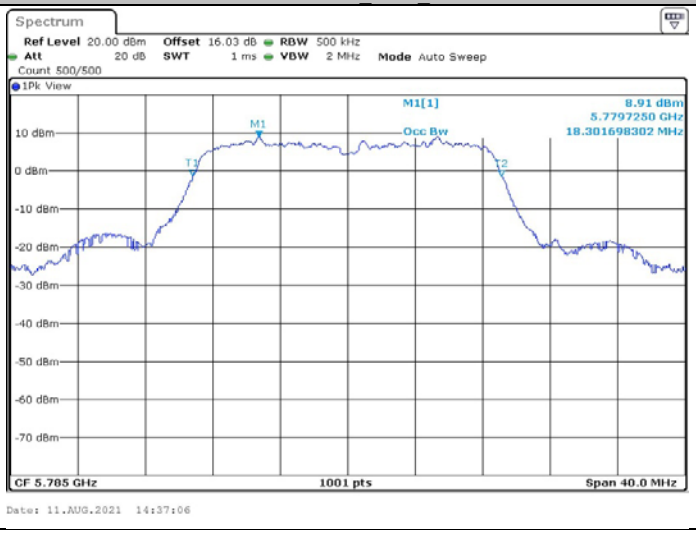
11AC20MIMO_Ant1_5240



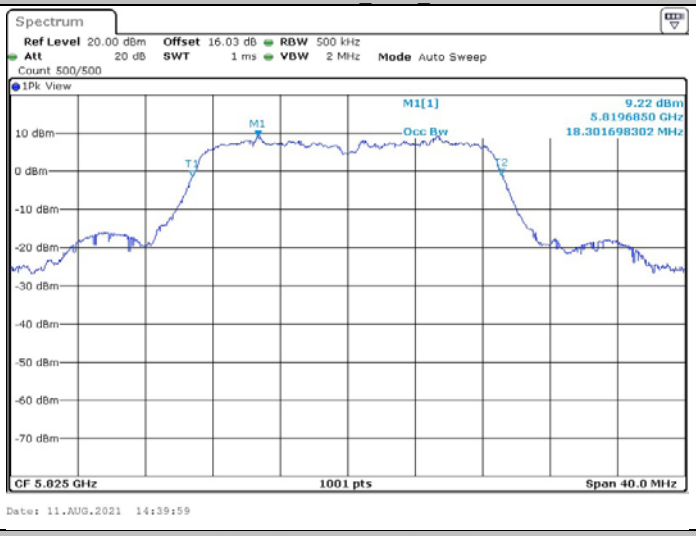
11AC20MIMO_Ant1_5745



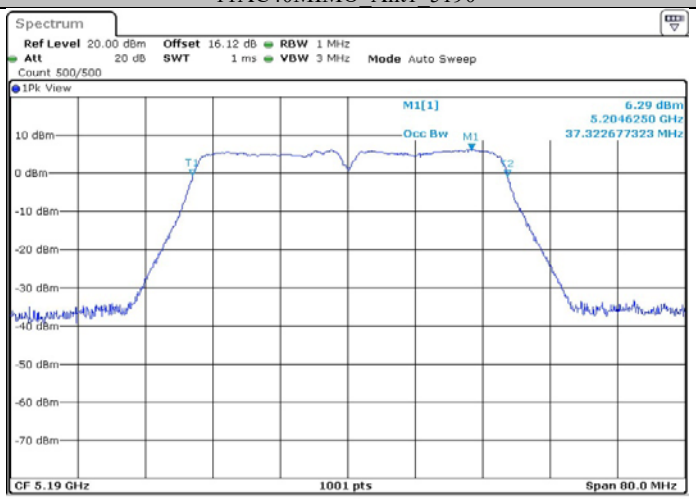
11AC20MIMO_Ant1_5785



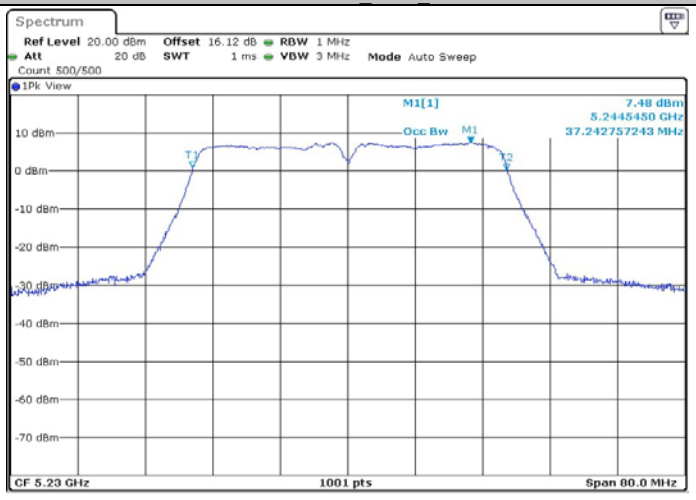
11AC20MIMO_Ant1_5825



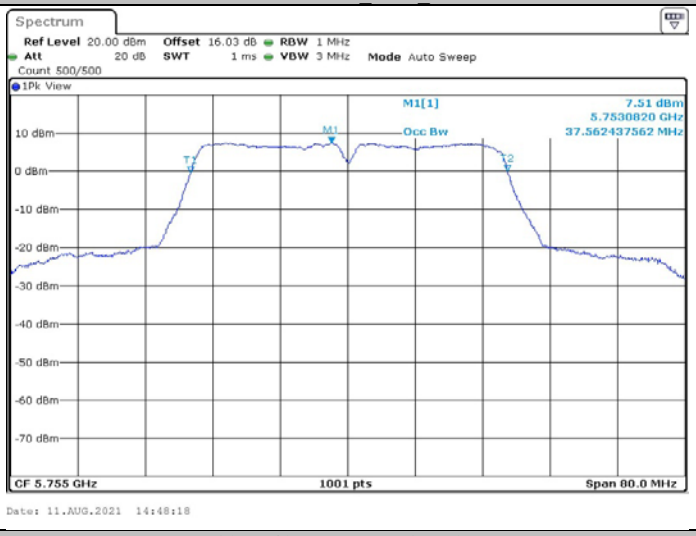
11AC40MIMO_Ant1_5190



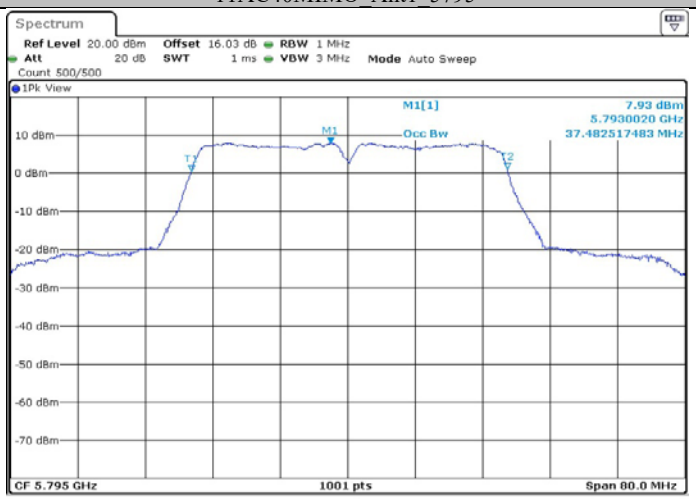
11AC40MIMO_Ant1_5230



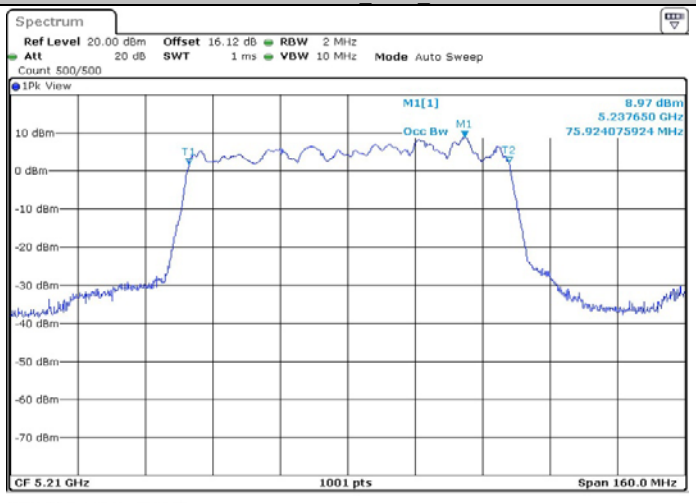
11AC40MIMO_Ant1_5755



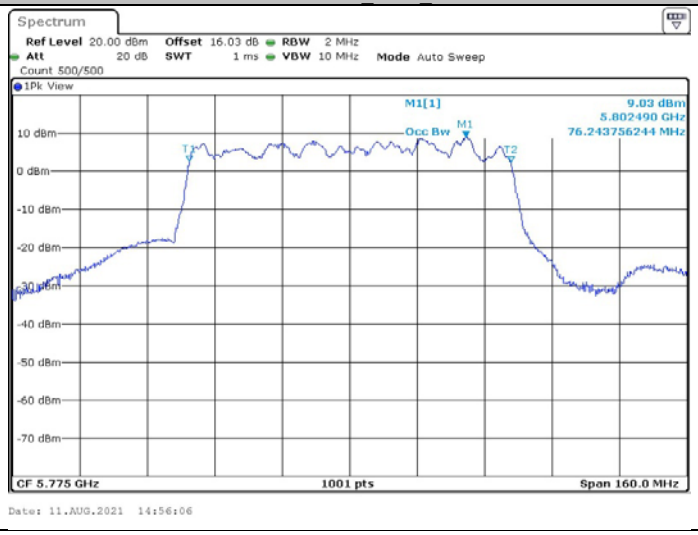
11AC40MIMO_Ant1_5795



11AC80MIMO_Ant1_5210



11AC80MIMO_Ant1_5775



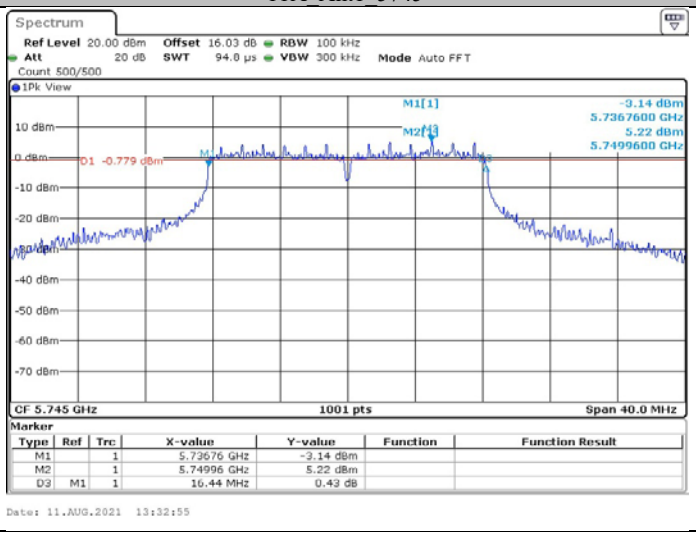
Appendix A3: Min emission bandwidth

Test Result

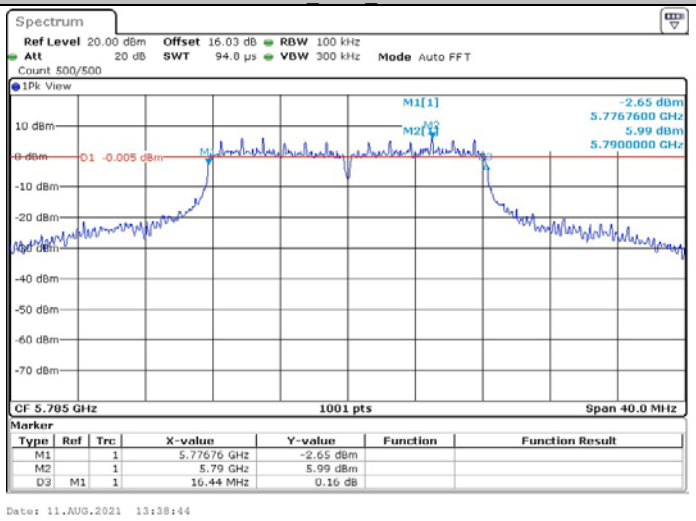
TestMode	Antenna	Channel	6db EBW [MHz]	Limit[MHz]	Verdict
11A	Ant1	5745	16.440	0.5	PASS
		5785	16.440	0.5	PASS
		5825	16.440	0.5	PASS
11N20MIMO	Ant1	5745	16.960	0.5	PASS
		5785	17.120	0.5	PASS
		5825	17.000	0.5	PASS
11N40MIMO	Ant1	5755	36.000	0.5	PASS
		5795	36.000	0.5	PASS
11AC20MIMO	Ant1	5745	17.120	0.5	PASS
		5785	17.000	0.5	PASS
		5825	17.000	0.5	PASS
11AC40MIMO	Ant1	5755	36.000	0.5	PASS
		5795	36.000	0.5	PASS
11AC80MIMO	Ant1	5775	75.520	0.5	PASS

Test Graphs

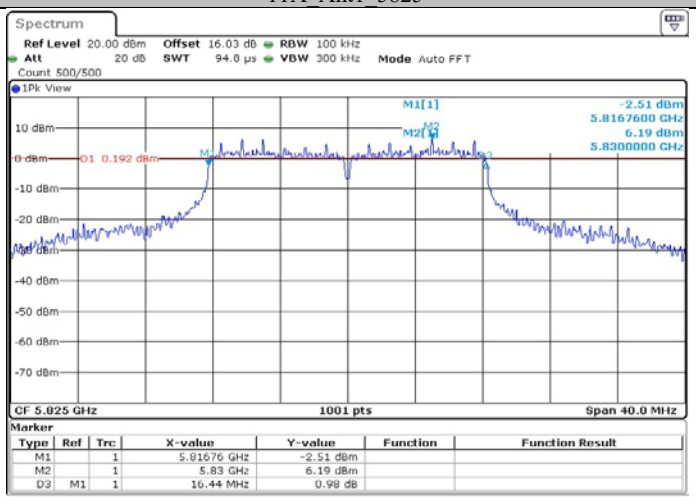
11A_Ant1_5745



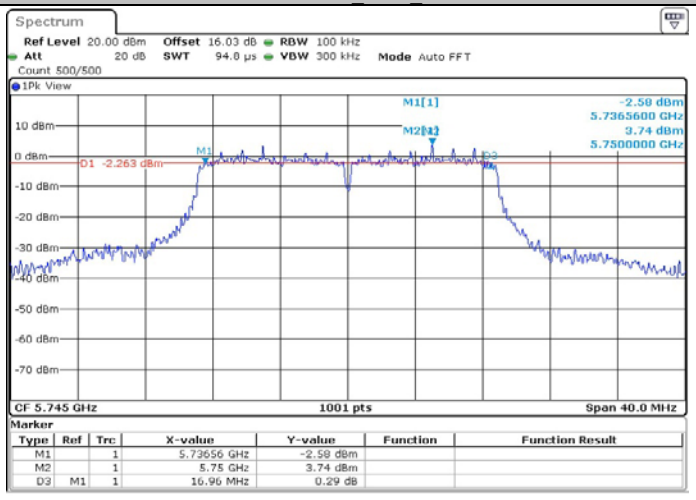
11A_Ant1_5785



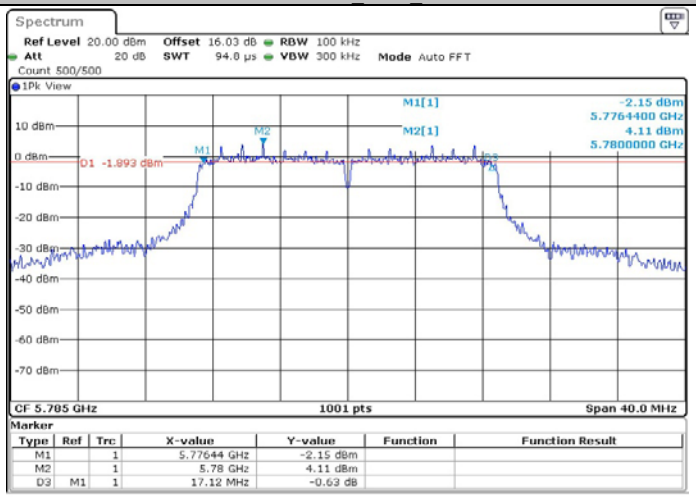
11A_Ant1_5825



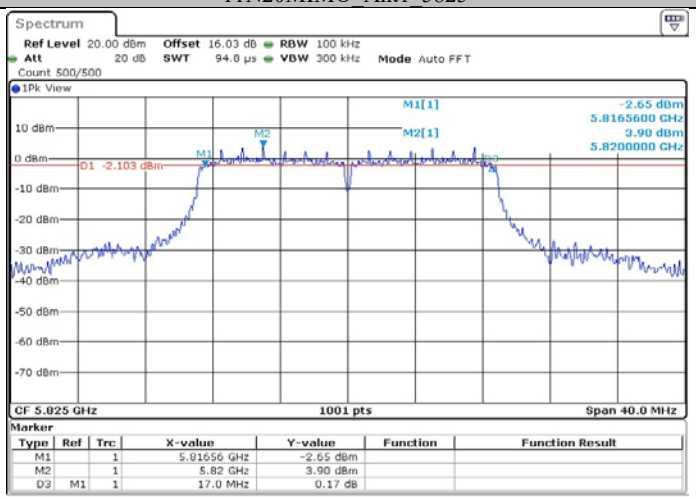
11N20MIMO_Ant1_5745



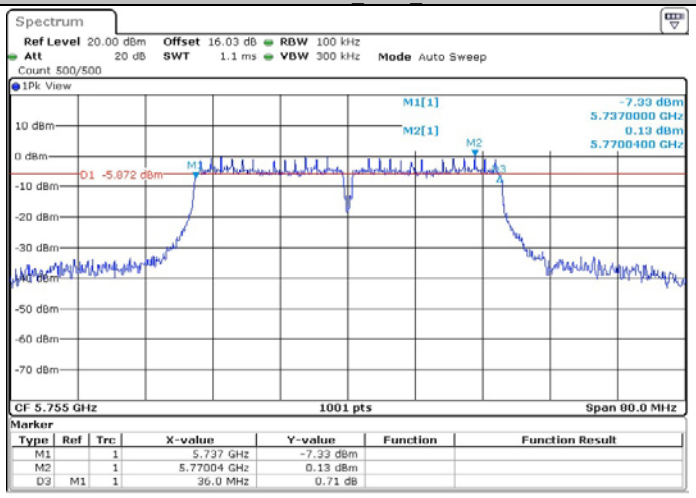
11N20MIMO_Ant1_5785



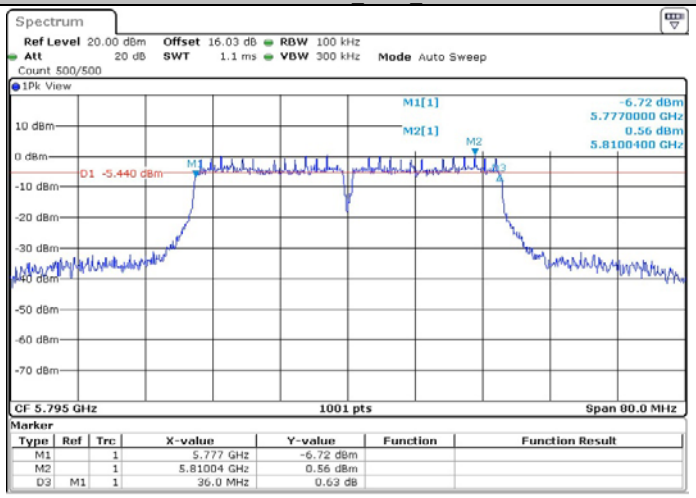
11N20MIMO_Ant1_5825



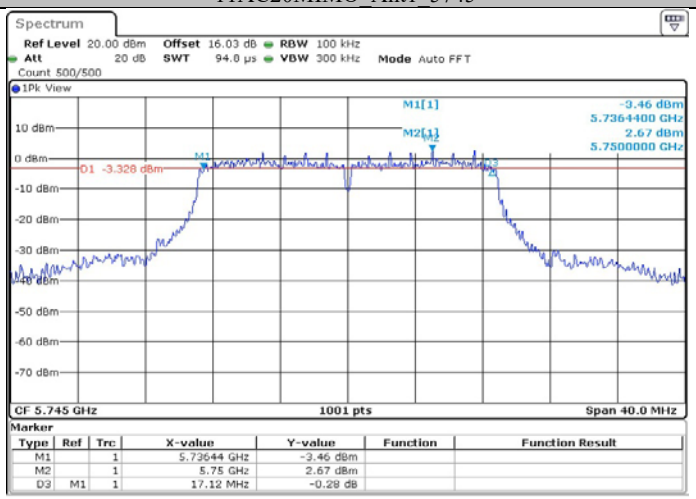
11N40MIMO_Ant1_5755



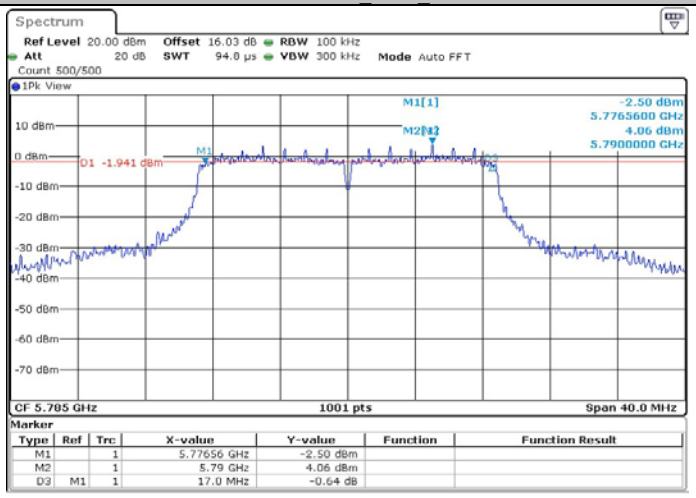
11N40MIMO_Ant1_5795



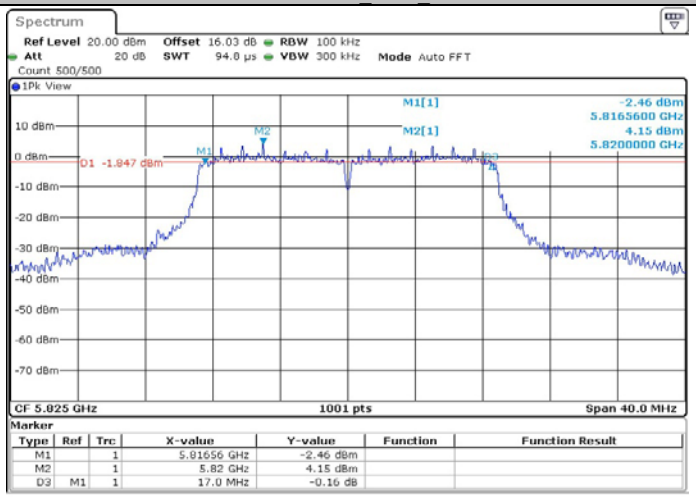
11AC20MIMO_Ant1_5745



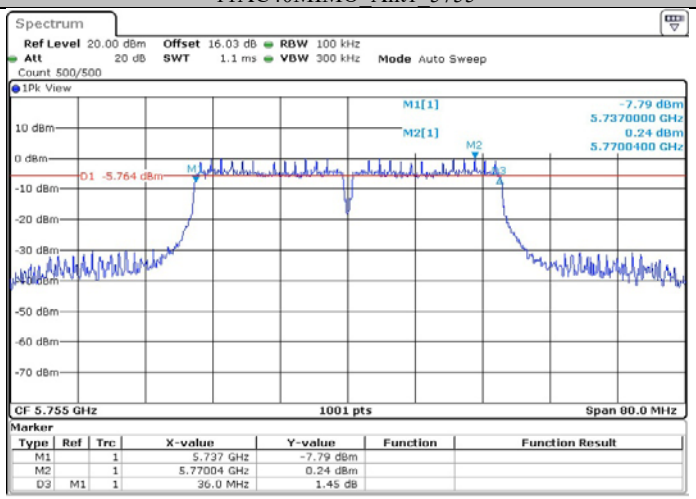
11AC20MIMO_Ant1_5785



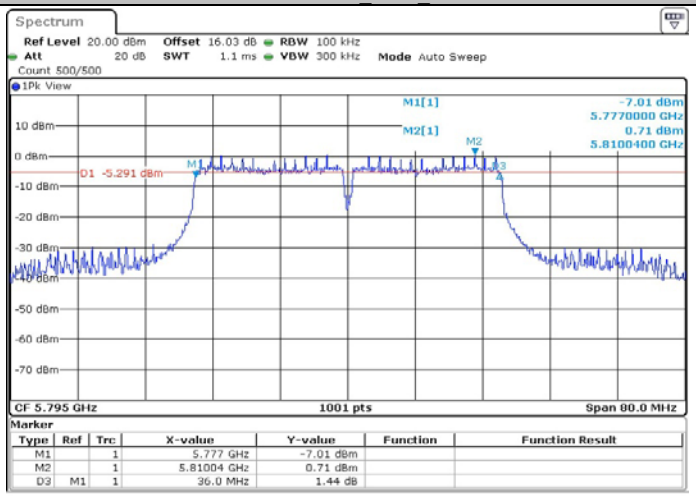
11AC20MIMO_Ant1_5825



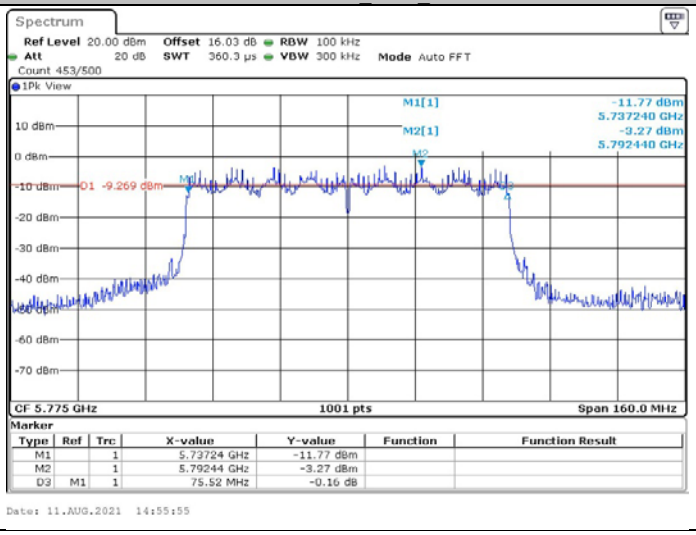
11AC40MIMO_Ant1_5755



11AC40MIMO_Ant1_5795



11AC80MIMO_Ant1_5775



Appendix B: Maximum conducted output power
Test Result

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11A	Ant1	5180	14.19	≤23.98	PASS
	Ant2	5180	14.92	≤23.98	PASS
	Ant1	5200	14.91	≤23.98	PASS
	Ant2	5200	15.60	≤23.98	PASS
	Ant1	5240	15.94	≤23.98	PASS
	Ant2	5240	16.60	≤23.98	PASS
	Ant1	5745	16.72	≤30	PASS
	Ant2	5745	16.92	≤30	PASS
	Ant1	5785	17.00	≤30	PASS
	Ant2	5785	17.40	≤30	PASS
	Ant1	5825	17.00	≤30	PASS
	Ant2	5825	17.50	≤30	PASS
11N20MIMO	Ant1	5180	12.46	≤23.98	PASS
	Ant2	5180	13.07	≤23.98	PASS
	total	5180	15.80	≤23.98	PASS
	Ant1	5200	12.71	≤23.98	PASS
	Ant2	5200	13.59	≤23.98	PASS
	total	5200	16.20	≤23.98	PASS
	Ant1	5240	14.17	≤23.98	PASS
	Ant2	5240	14.42	≤23.98	PASS
	total	5240	17.30	≤23.98	PASS
	Ant1	5745	14.45	≤30	PASS
	Ant2	5745	14.66	≤30	PASS
	total	5745	17.60	≤30	PASS
	Ant1	5785	15.09	≤30	PASS
	Ant2	5785	15.21	≤30	PASS
	total	5785	18.20	≤30	PASS
	Ant1	5825	15.01	≤30	PASS
	Ant2	5825	15.13	≤30	PASS
	total	5825	18.10	≤30	PASS
11N40MIMO	Ant1	5190	12.11	≤23.98	PASS
	Ant2	5190	12.61	≤23.98	PASS
	total	5190	15.40	≤23.98	PASS
	Ant1	5230	13.39	≤23.98	PASS
	Ant2	5230	13.72	≤23.98	PASS
	total	5230	16.60	≤23.98	PASS
	Ant1	5755	14.27	≤30	PASS
	Ant2	5755	14.41	≤30	PASS
	total	5755	17.40	≤30	PASS
	Ant1	5795	14.34	≤30	PASS
	Ant2	5795	14.93	≤30	PASS
	total	5795	17.70	≤30	PASS
11AC20MIMO	Ant1	5180	12.71	≤23.98	PASS
	Ant2	5180	12.78	≤23.98	PASS
	total	5180	15.80	≤23.98	PASS
	Ant1	5200	13.28	≤23.98	PASS
	Ant2	5200	13.35	≤23.98	PASS
	total	5200	16.30	≤23.98	PASS
	Ant1	5240	13.29	≤23.98	PASS
	Ant2	5240	13.84	≤23.98	PASS
	total	5240	16.60	≤23.98	PASS
	Ant1	5745	14.27	≤30	PASS
	Ant2	5745	14.69	≤30	PASS
	total	5745	17.50	≤30	PASS

	Ant1	5785	14.82	≤30	PASS
	Ant2	5785	15.04	≤30	PASS
	total	5785	17.90	≤30	PASS
	Ant1	5825	14.74	≤30	PASS
	Ant2	5825	15.12	≤30	PASS
	total	5825	17.90	≤30	PASS
11AC40MIMO	Ant1	5190	12.24	≤23.98	PASS
	Ant2	5190	12.62	≤23.98	PASS
	total	5190	15.40	≤23.98	PASS
	Ant1	5230	13.14	≤23.98	PASS
	Ant2	5230	13.65	≤23.98	PASS
	total	5230	16.40	≤23.98	PASS
	Ant1	5755	14.28	≤30	PASS
	Ant2	5755	14.41	≤30	PASS
	total	5755	17.40	≤30	PASS
	Ant1	5795	14.46	≤30	PASS
	Ant2	5795	14.93	≤30	PASS
	total	5795	17.70	≤30	PASS
11AC80MIMO	Ant1	5210	11.48	≤23.98	PASS
	Ant2	5210	12.09	≤23.98	PASS
	total	5210	14.80	≤23.98	PASS
	Ant1	5775	13.19	≤30	PASS
	Ant2	5775	13.40	≤30	PASS
	total	5775	16.30	≤30	PASS

Appendix C: Maximum power spectral density

Test Result

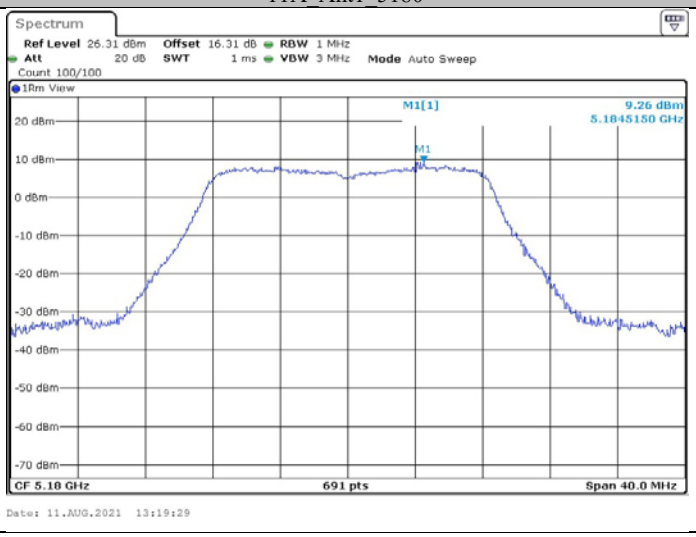
TestMode	Antenna	Channel	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	9.26	≤11	PASS
	Ant2	5180	9.14	≤11	PASS
	Ant1	5200	9.8	≤11	PASS
	Ant2	5200	9.58	≤11	PASS
	Ant1	5240	10.88	≤11	PASS
	Ant2	5240	10.58	≤11	PASS
	Ant1	5745	9.38	≤30	PASS
	Ant2	5745	8.2	≤30	PASS
	Ant1	5785	10.1	≤30	PASS
	Ant2	5785	9.28	≤30	PASS
	Ant1	5825	9.93	≤30	PASS
	Ant2	5825	9.38	≤30	PASS
11N20MIMO	Ant1	5180	6.84	≤11	PASS
	Ant2	5180	6.28	≤11	PASS
	total	5180	9.58	≤11	PASS
	Ant1	5200	7.26	≤11	PASS
	Ant2	5200	6.37	≤11	PASS
	total	5200	9.85	≤11	PASS
	Ant1	5240	8.45	≤11	PASS
	Ant2	5240	7.1	≤11	PASS
	total	5240	10.84	≤11	PASS
	Ant1	5745	6.56	≤30	PASS
	Ant2	5745	5.98	≤30	PASS
	total	5745	9.29	≤30	PASS
	Ant1	5785	7.27	≤30	PASS
	Ant2	5785	6.22	≤30	PASS
	total	5785	9.79	≤30	PASS
	Ant1	5825	7.57	≤30	PASS
	Ant2	5825	6.59	≤30	PASS
	total	5825	10.12	≤30	PASS
11N40MIMO	Ant1	5190	3.36	≤11	PASS
	Ant2	5190	2.68	≤11	PASS
	total	5190	6.04	≤11	PASS
	Ant1	5230	4.99	≤11	PASS
	Ant2	5230	3.69	≤11	PASS
	total	5230	7.40	≤11	PASS
	Ant1	5755	3.07	≤30	PASS
	Ant2	5755	2.11	≤30	PASS
	total	5755	5.63	≤30	PASS
	Ant1	5795	3.74	≤30	PASS
	Ant2	5795	2.73	≤30	PASS
	total	5795	6.27	≤30	PASS
11AC20MIMO	Ant1	5180	7.92	≤11	PASS
	Ant2	5180	5.58	≤11	PASS
	total	5180	9.92	≤11	PASS
	Ant1	5200	8.13	≤11	PASS
	Ant2	5200	5.93	≤11	PASS
	total	5200	10.18	≤11	PASS
	Ant1	5240	8.59	≤11	PASS
	Ant2	5240	6.67	≤11	PASS
	total	5240	10.75	≤11	PASS
	Ant1	5745	7.32	≤30	PASS
	Ant2	5745	5.52	≤30	PASS
	total	5745	9.52	≤30	PASS
	Ant1	5785	7.81	≤30	PASS

	Ant2	5785	6	≤30	PASS
	total	5785	10.01	≤30	PASS
	Ant1	5825	7.79	≤30	PASS
	Ant2	5825	6.24	≤30	PASS
	total	5825	10.09	≤30	PASS
11AC40MIMO	Ant1	5190	3.82	≤11	PASS
	Ant2	5190	2.86	≤11	PASS
	total	5190	6.38	≤11	PASS
	Ant1	5230	5	≤11	PASS
	Ant2	5230	4.4	≤11	PASS
	total	5230	7.72	≤11	PASS
	Ant1	5755	2.16	≤30	PASS
	Ant2	5755	2.52	≤30	PASS
	total	5755	5.35	≤30	PASS
	Ant1	5795	3.62	≤30	PASS
	Ant2	5795	2.92	≤30	PASS
	total	5795	6.29	≤30	PASS
11AC80MIMO	Ant1	5210	1.31	≤11	PASS
	Ant2	5210	0.16	≤11	PASS
	total	5210	3.78	≤11	PASS
	Ant1	5775	0.79	≤30	PASS
	Ant2	5775	0.21	≤30	PASS
	total	5775	3.52	≤30	PASS

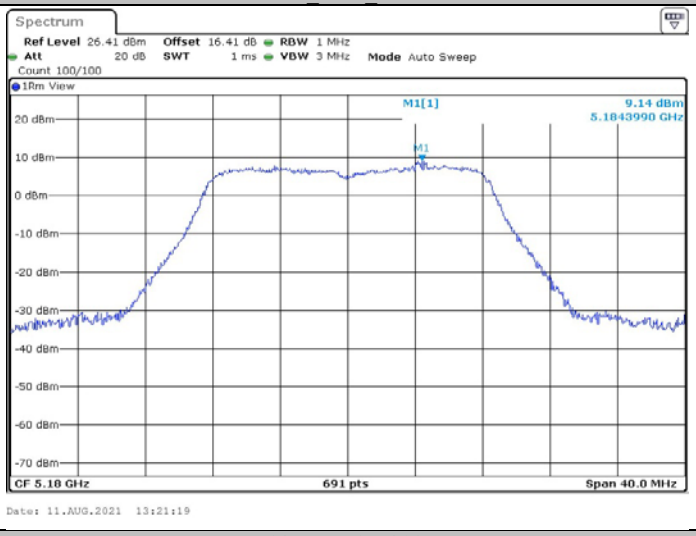
Note: TheResult and LimitUnit is dBm/500 kHz in the band 5.725−5.85 GHz.
The duty cycle factor has added into plots.

Test Graphs

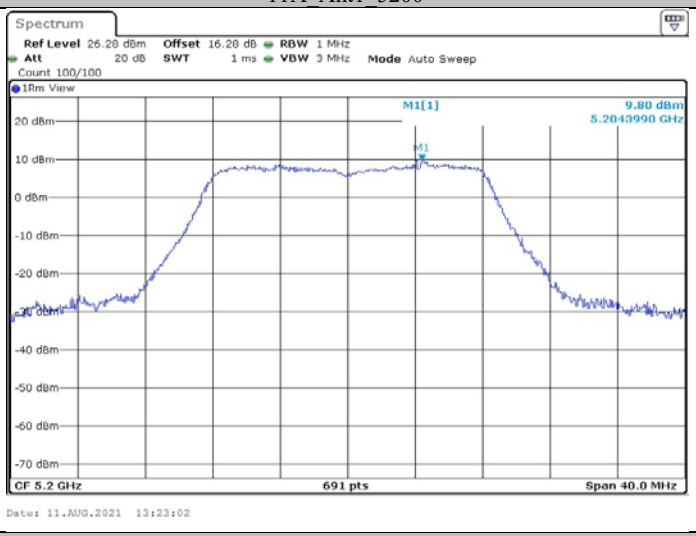
11A_Ant1_5180



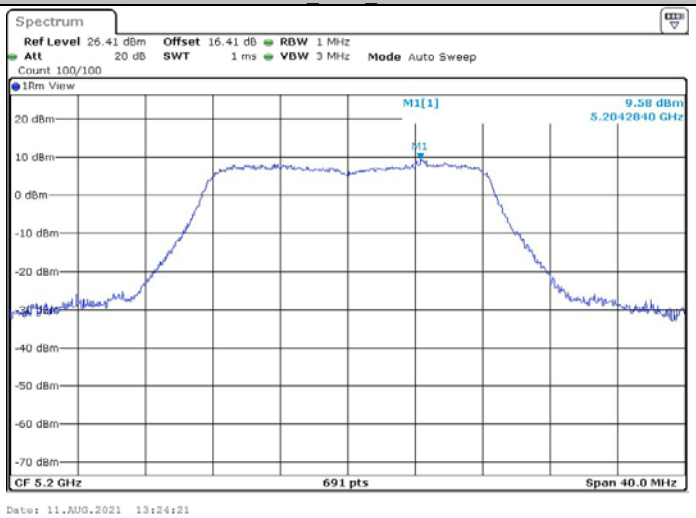
11A_Ant2_5180



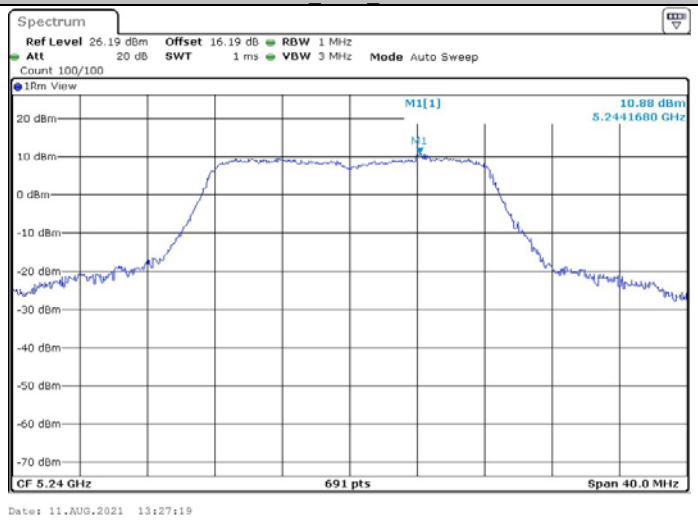
11A_Ant1_5200



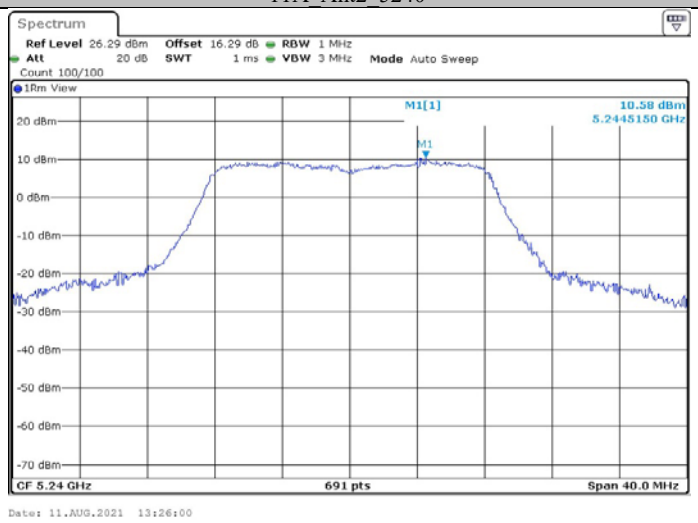
11A_Ant2_5200



11A_Ant1_5240



11A_Ant2_5240



11A_Ant1_5745