6.7 Restricted Band

Test Requirement : FCC Part15 E Section 15.407(b)

Test site : Measurement Distance: 3m

Test Limit :

Frequency	Limit (dBuV/m @3m)	Remark
Above 1GHz	68.23	Peak Value
	54	Average Value

Test Procedure:

1. The EUT was placed on a styrofoam table which is 1.5m above ground plane.

2. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.

5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

6. Repeat above procedures until the measurements for all frequencies are complete.

7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8. The test above 1GHz must be use the fully anechoic room, and the test below 1GHz use the half anechoic room

Test Result:

Worst case mode:		Ant1_802.11a(6Mbps)		Test channel:		36		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5150	50.43	6.53	56.96	68.23	11.27	H	Peak
2	5150	40.03	6.53	46.56	54	7.44	H	Average
3	5150	49.42	6.53	55.95	68.23	12.28	V	Peak
4	5150	38.15	6.53	44.68	54	9.32	V	Average

Worst case mode:		Ant1_802.11a(6Mbps)		Test channel:		48		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5350	50.82	6.56	57.38	68.23	10.85	H	Peak
2	5350	39.9	6.56	46.46	54	7.54	H	Average
3	5350	49.56	6.56	56.12	68.23	12.11	V	Peak
4	5350	38.5	6.56	45.06	54	8.94	V	Average

Worst case mode:		Ant2_802.11a(6Mbps)		Test channel:		165		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5850	50.51	6.53	57.04	68.23	11.19	H	Peak
2	5850	40	6.53	46.53	54	7.47	H	Average
3	5850	49.66	6.53	56.19	68.23	12.04	V	Peak
4	5850	38.21	6.53	44.74	54	9.26	V	Average

Worst case mode:		Ant2_802.11a(6Mbps)		Test channel:		36		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5150	50.13	6.56	56.69	68.23	11.54	H	Peak
2	5150	40.07	6.56	46.63	54	7.37	H	Average
3	5150	49.53	6.56	56.09	68.23	12.14	V	Peak
4	5150	38.48	6.56	45.04	54	8.96	V	Average

Worst case mode:		Ant3_802.11a(6Mbps)		Test channel:		48		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5350	49.97	6.64	56.61	68.23	11.62	H	Peak
2	5350	40.05	6.64	46.69	54	7.31	H	Average
3	5350	49.04	6.64	55.68	68.23	12.55	V	Peak
4	5350	37.89	6.64	44.53	54	9.47	V	Average

Worst case mode:		Ant2_802.11a(6Mbps)		Test channel:		165		
NO.	Freq. [MHz]	level [dBμV/m]	Factor [dB]	Emission level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Polarity	Detector Type
1	5850	50.11	6.64	56.75	68.23	11.48	H	Peak
2	5850	40.03	6.64	46.67	54	7.33	H	Average
3	5850	48.71	6.64	55.35	68.23	12.88	V	Peak
4	5850	38.48	6.64	45.12	54	8.88	V	Average

Note: Only recorded the worst case in the report.

7 Emission Bandwidth and Occupied Bandwidth

Test Requirement	:	FCC CFR47 Part 15 Section 15.407(a)(e)
Test Method	:	ANSI C63.10:2013
Test Limit		According to FCC §15.407(a), 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. As per FCC §15.407(e): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

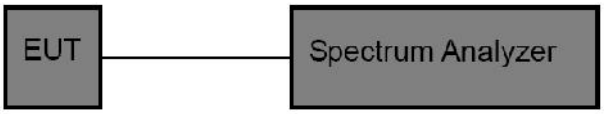
7.1 Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01,
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%;99% Occupied Bandwidth
The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ⩾ 3 • RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise,
peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency.

The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

7.2 Test setup



7.3 Test Result

PASS

Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations / data rates and antenna ports.
Following channel was selected for the final test as listed below.

26 dB emission bandwidth:

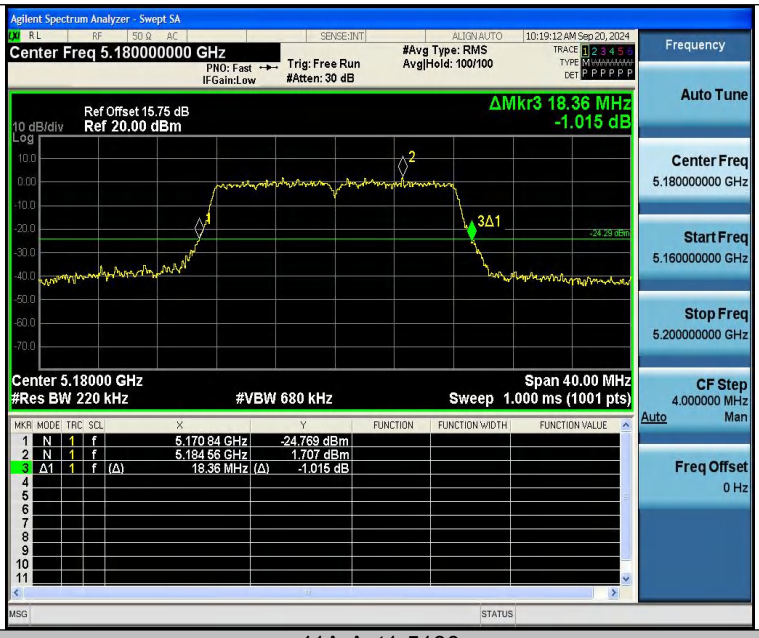
TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	18.360	5170.840	5189.200	---	---
11A	Ant1	5200	18.240	5190.920	5209.160	---	---
11A	Ant1	5240	18.520	5230.760	5249.280	---	---
11N20SISO	Ant1	5180	19.600	5170.240	5189.840	---	---
11N20SISO	Ant1	5200	19.280	5190.280	5209.560	---	---
11N20SISO	Ant1	5240	19.400	5230.360	5249.760	---	---
11N40SISO	Ant1	5190	41.040	5169.360	5210.400	---	---
11N40SISO	Ant1	5230	40.480	5209.680	5250.160	---	---
11AC20SISO	Ant1	5180	19.440	5170.320	5189.760	---	---
11AC20SISO	Ant1	5200	19.360	5190.280	5209.640	---	---
11AC20SISO	Ant1	5240	19.320	5230.400	5249.720	---	---
11AC40SISO	Ant1	5190	40.560	5169.760	5210.320	---	---
11AC40SISO	Ant1	5230	40.480	5210.000	5250.480	---	---
11AC80SISO	Ant1	5210	80.000	5170.160	5250.160	---	---
11A	Ant1	5745	18.320	5735.800	5754.120	---	---
11A	Ant1	5785	18.440	5775.760	5794.200	---	---
11A	Ant1	5825	18.360	5815.840	5834.200	---	---
11N20SISO	Ant1	5745	19.480	5735.200	5754.680	---	---
11N20SISO	Ant1	5785	19.320	5775.360	5794.680	---	---
11N20SISO	Ant1	5825	19.440	5815.280	5834.720	---	---
11N40SISO	Ant1	5755	41.360	5734.440	5775.800	---	---
11N40SISO	Ant1	5795	41.040	5774.280	5815.320	---	---
11AC20SISO	Ant1	5745	19.480	5735.280	5754.760	---	---
11AC20SISO	Ant1	5785	19.320	5775.400	5794.720	---	---
11AC20SISO	Ant1	5825	19.280	5815.440	5834.720	---	---
11AC40SISO	Ant1	5755	41.200	5734.920	5776.120	---	---
11AC40SISO	Ant1	5795	40.720	5774.760	5815.480	---	---
11AC80SISO	Ant1	5775	80.000	5735.160	5815.160	---	---
11A	Ant2	5745	18.360	5735.840	5754.200	---	---
11A	Ant2	5785	18.440	5775.800	5794.240	---	---
11A	Ant2	5825	18.400	5815.880	5834.280	---	---
11N20SISO	Ant2	5745	19.480	5735.240	5754.720	---	---
11N20SISO	Ant2	5785	19.400	5775.280	5794.680	---	---

11N20SISO	Ant2	5825	19.440	5815.280	5834.720	---	---
11N40SISO	Ant2	5755	42.720	5734.920	5777.640	---	---
11N40SISO	Ant2	5795	40.400	5774.760	5815.160	---	---
11AC20SISO	Ant2	5745	19.400	5735.240	5754.640	---	---
11AC20SISO	Ant2	5785	19.280	5775.320	5794.600	---	---
11AC20SISO	Ant2	5825	19.440	5815.240	5834.680	---	---
11AC40SISO	Ant2	5755	40.800	5734.680	5775.480	---	---
11AC40SISO	Ant2	5795	40.480	5774.520	5815.000	---	---
11AC80SISO	Ant2	5775	80.320	5735.160	5815.480	---	---
11A	Ant2	5180	18.600	5170.800	5189.400	---	---
11A	Ant2	5200	18.360	5190.800	5209.160	---	---
11A	Ant2	5240	18.440	5230.760	5249.200	---	---
11N20SISO	Ant2	5180	19.520	5170.280	5189.800	---	---
11N20SISO	Ant2	5200	19.240	5190.320	5209.560	---	---
11N20SISO	Ant2	5240	19.400	5230.240	5249.640	---	---
11N40SISO	Ant2	5190	40.400	5170.160	5210.560	---	---
11N40SISO	Ant2	5230	40.400	5209.760	5250.160	---	---
11AC20SISO	Ant2	5180	19.560	5170.200	5189.760	---	---
11AC20SISO	Ant2	5200	19.480	5190.280	5209.760	---	---
11AC20SISO	Ant2	5240	19.360	5230.360	5249.720	---	---
11AC40SISO	Ant2	5190	40.320	5169.840	5210.160	---	---
11AC40SISO	Ant2	5230	40.160	5210.080	5250.240	---	---
11AC80SISO	Ant2	5210	80.800	5170.000	5250.800	---	---

minimum 6 dB bandwidth:

TestMode	Antenna	Frequency[MHz]	6db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A	Ant1	5745	16.360	5736.800	5753.160	0.5	PASS
11A	Ant1	5785	16.320	5776.840	5793.160	0.5	PASS
11A	Ant1	5825	16.320	5816.840	5833.160	0.5	PASS
11N20SISO	Ant1	5745	17.520	5736.240	5753.760	0.5	PASS
11N20SISO	Ant1	5785	17.520	5776.240	5793.760	0.5	PASS
11N20SISO	Ant1	5825	17.520	5816.240	5833.760	0.5	PASS
11N40SISO	Ant1	5755	35.120	5737.400	5772.520	0.5	PASS
11N40SISO	Ant1	5795	35.040	5777.480	5812.520	0.5	PASS
11AC20SISO	Ant1	5745	16.880	5736.600	5753.480	0.5	PASS
11AC20SISO	Ant1	5785	17.560	5776.200	5793.760	0.5	PASS
11AC20SISO	Ant1	5825	17.160	5816.240	5833.400	0.5	PASS
11AC40SISO	Ant1	5755	35.120	5737.400	5772.520	0.5	PASS
11AC40SISO	Ant1	5795	35.120	5777.400	5812.520	0.5	PASS
11AC80SISO	Ant1	5775	73.920	5738.680	5812.600	0.5	PASS
11A	Ant2	5745	16.320	5736.840	5753.160	0.5	PASS
11A	Ant2	5785	16.280	5776.840	5793.120	0.5	PASS
11A	Ant2	5825	16.280	5816.840	5833.120	0.5	PASS
11N20SISO	Ant2	5745	17.320	5736.440	5753.760	0.5	PASS
11N20SISO	Ant2	5785	17.560	5776.200	5793.760	0.5	PASS
11N20SISO	Ant2	5825	17.560	5816.200	5833.760	0.5	PASS
11N40SISO	Ant2	5755	34.400	5738.360	5772.760	0.5	PASS
11N40SISO	Ant2	5795	35.040	5777.480	5812.520	0.5	PASS
11AC20SISO	Ant2	5745	17.280	5736.480	5753.760	0.5	PASS
11AC20SISO	Ant2	5785	16.920	5776.560	5793.480	0.5	PASS
11AC20SISO	Ant2	5825	17.560	5816.200	5833.760	0.5	PASS
11AC40SISO	Ant2	5755	33.840	5738.680	5772.520	0.5	PASS
11AC40SISO	Ant2	5795	33.760	5777.480	5811.240	0.5	PASS
11AC80SISO	Ant2	5775	72.640	5738.680	5811.320	0.5	PASS

Test Graphs：



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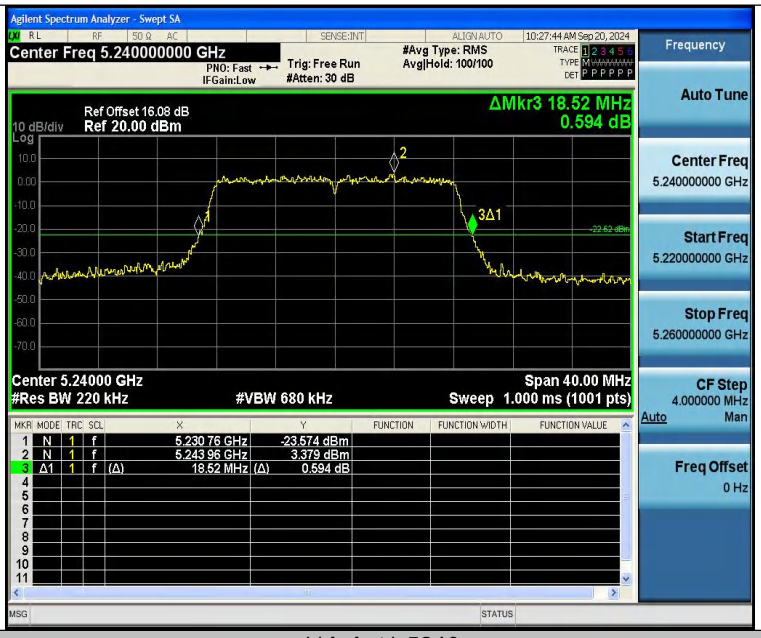
11A-Ant1-5200



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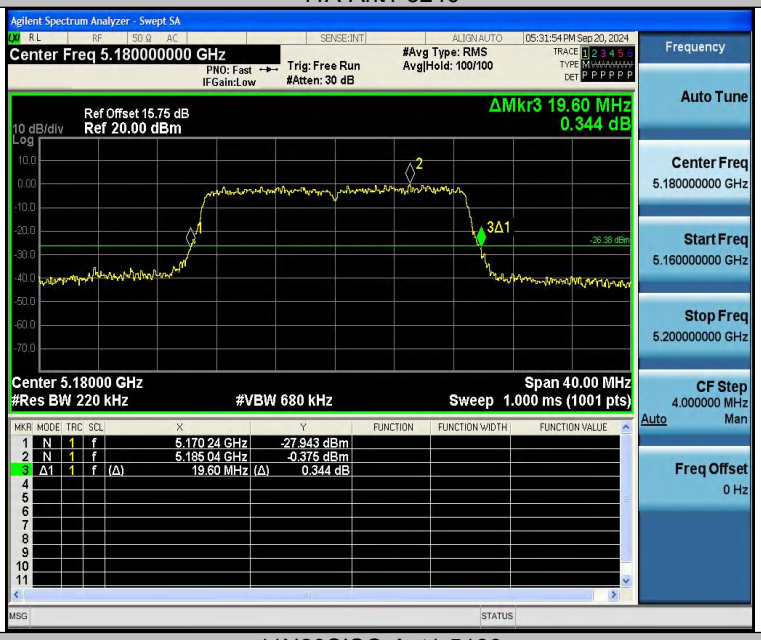

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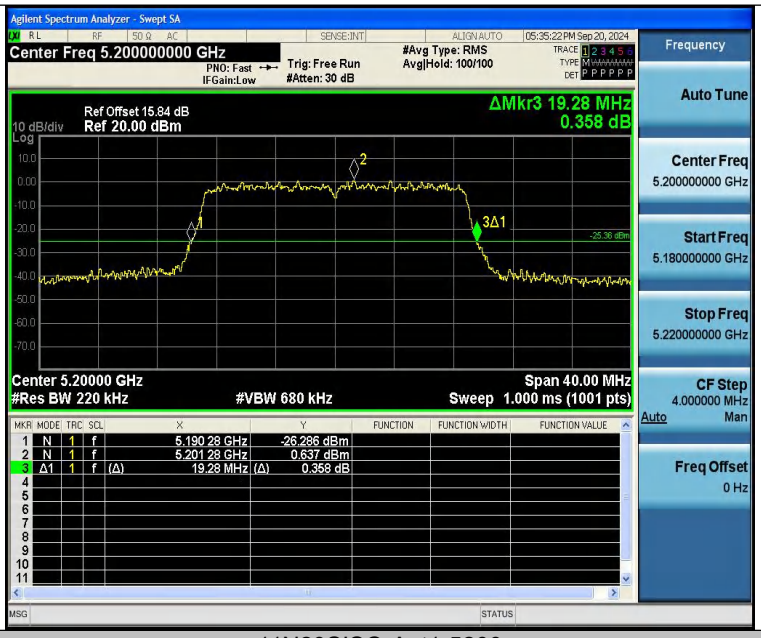

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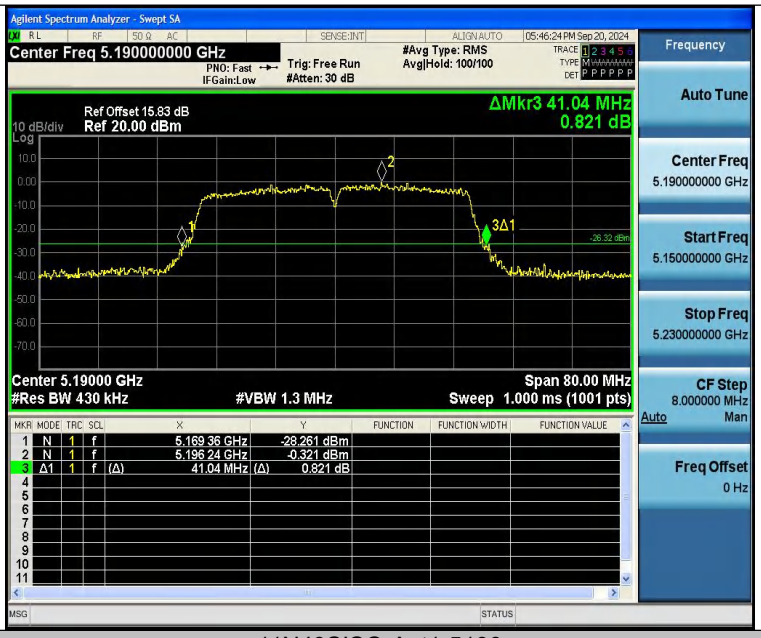

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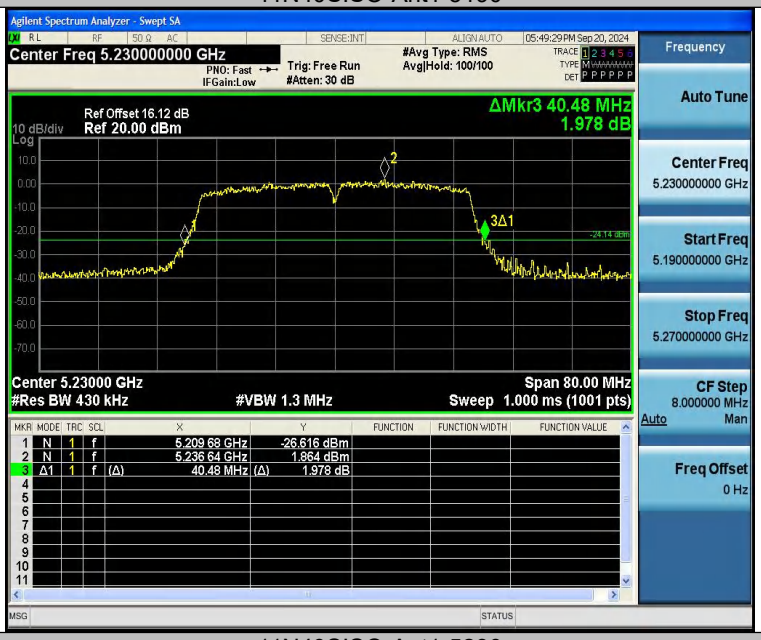

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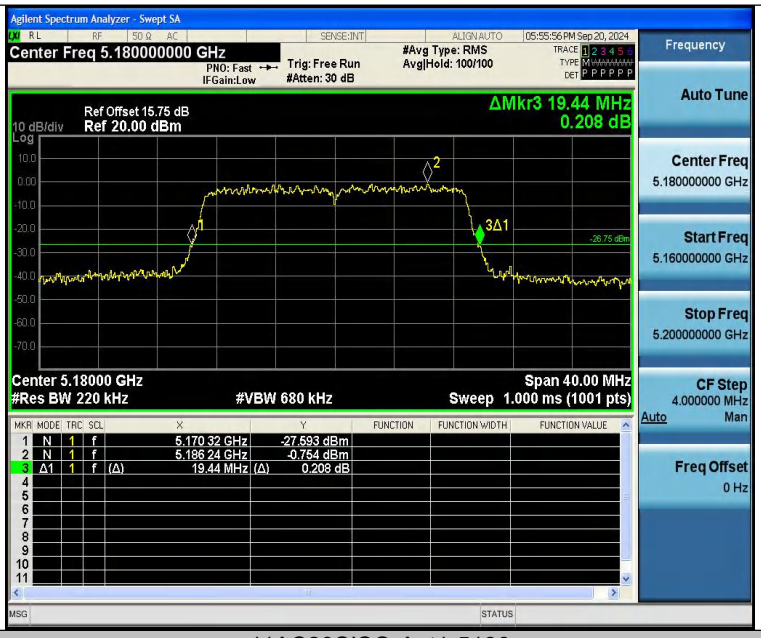

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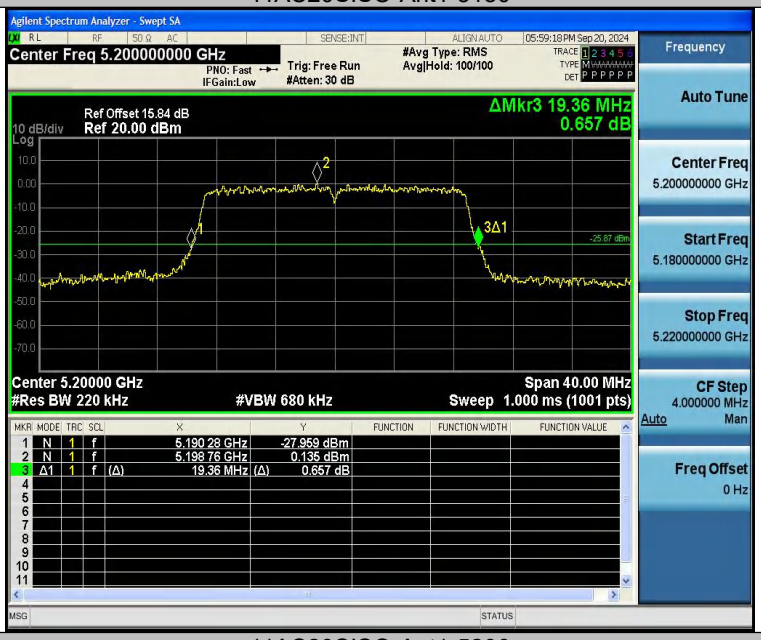

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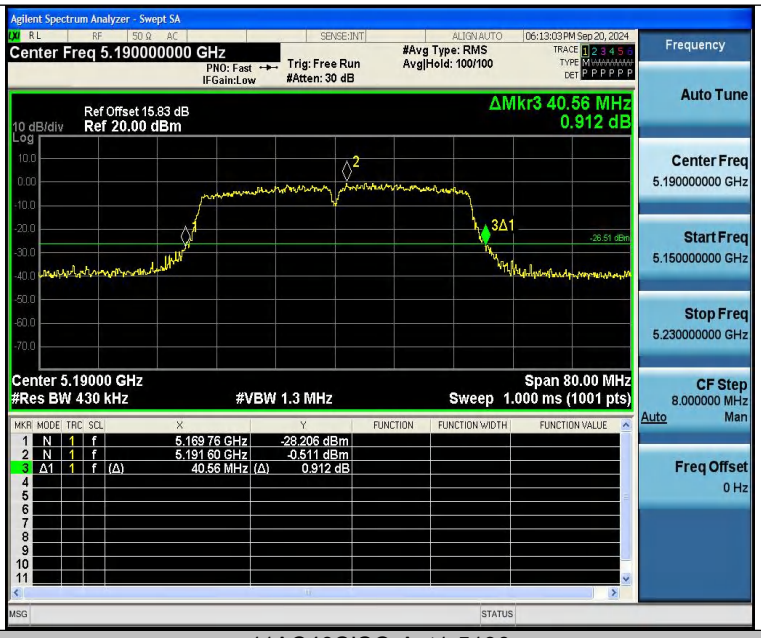

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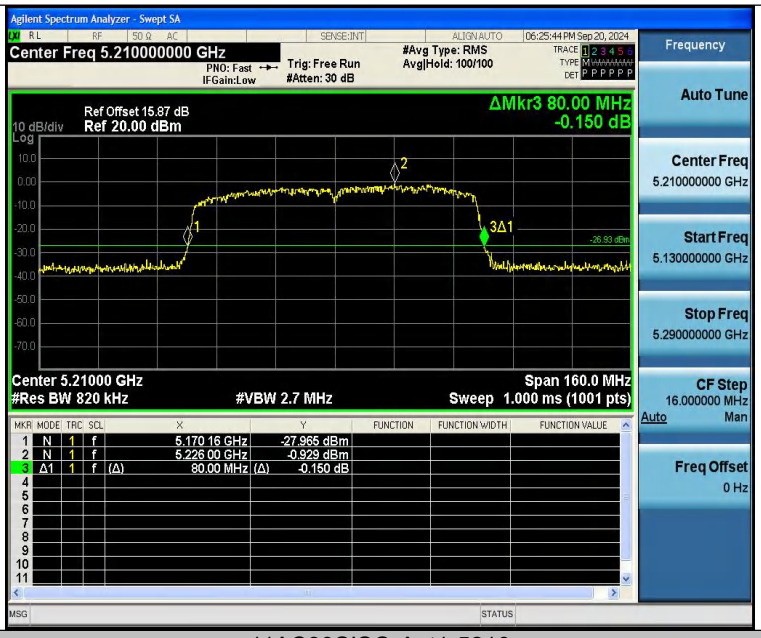

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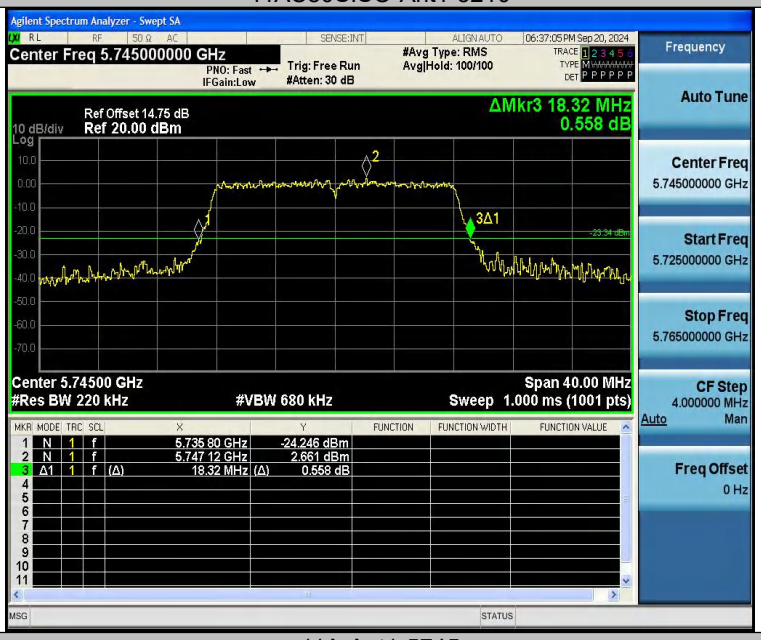

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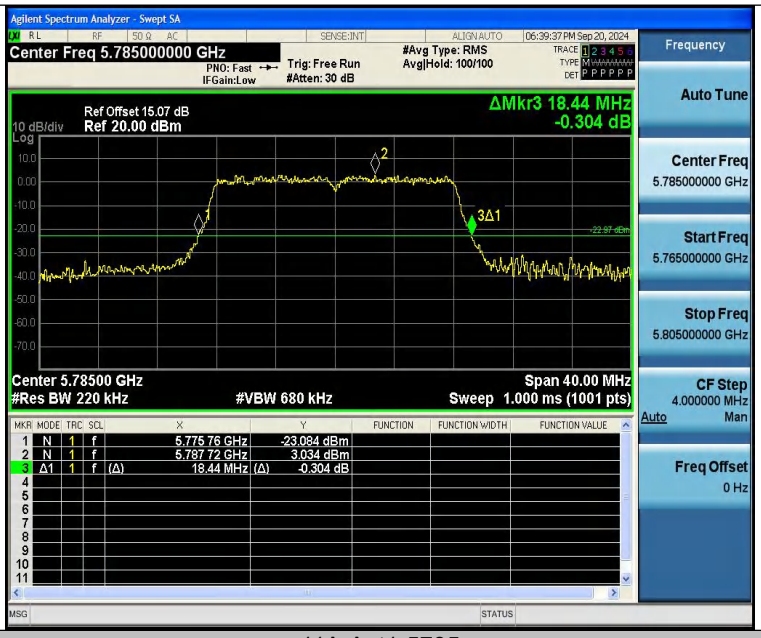

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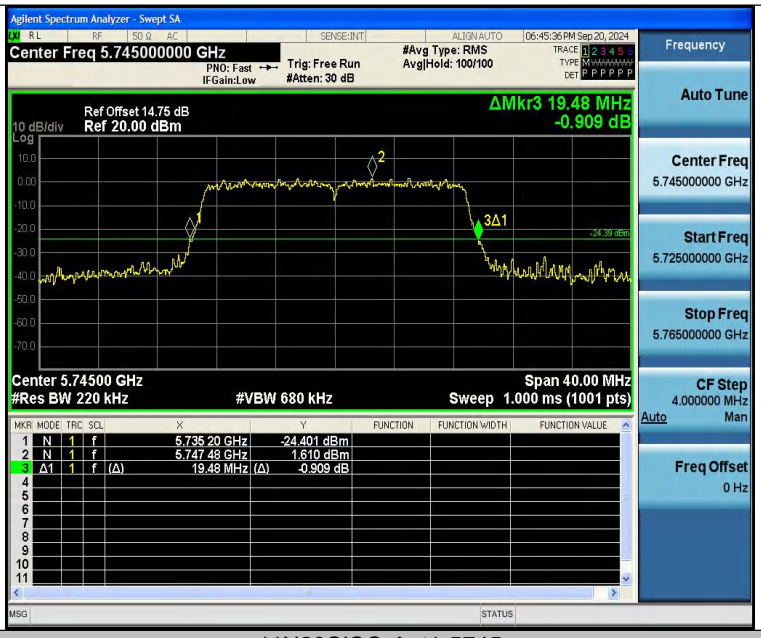

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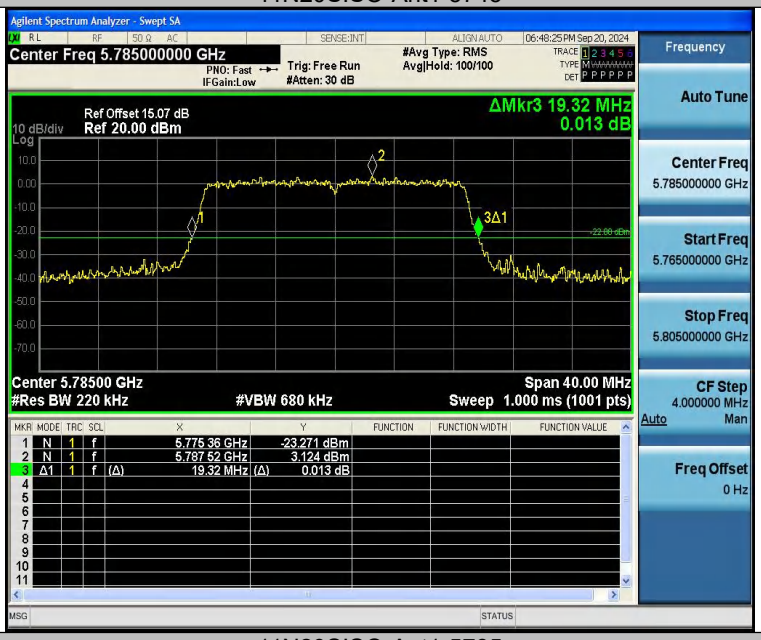

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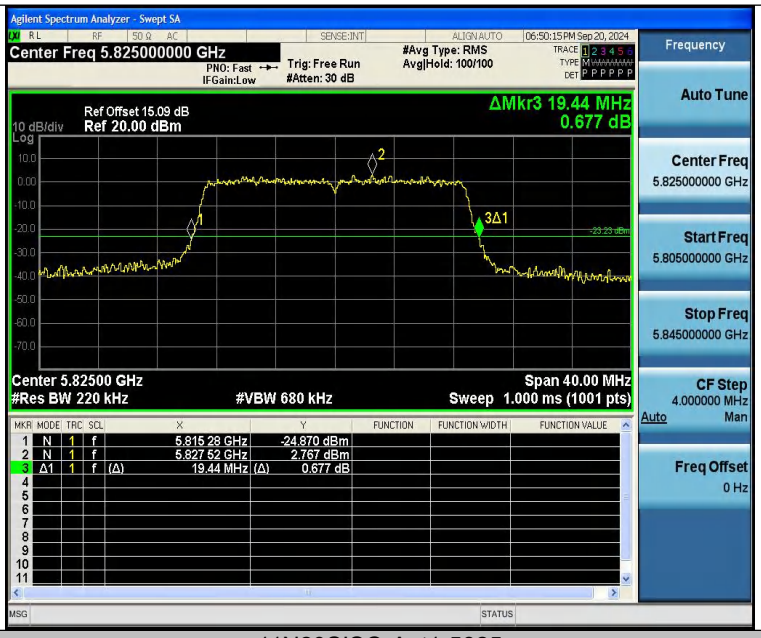

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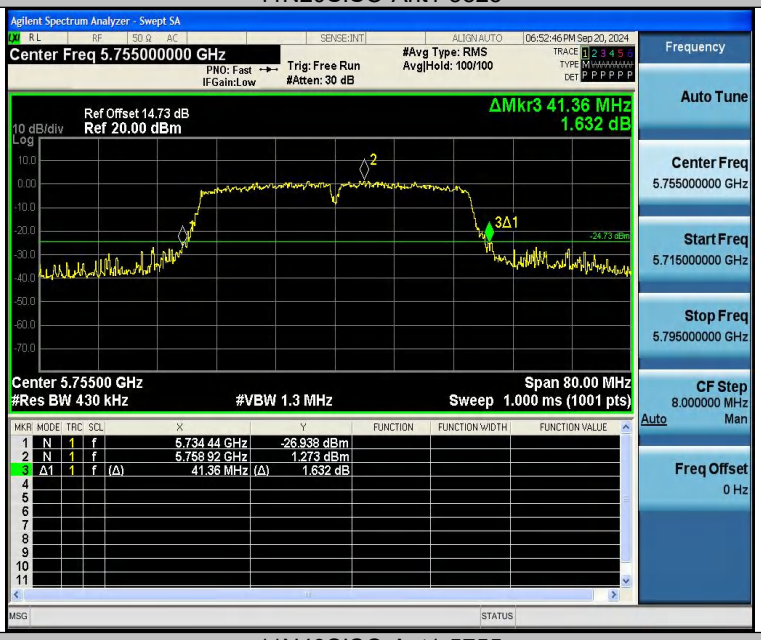

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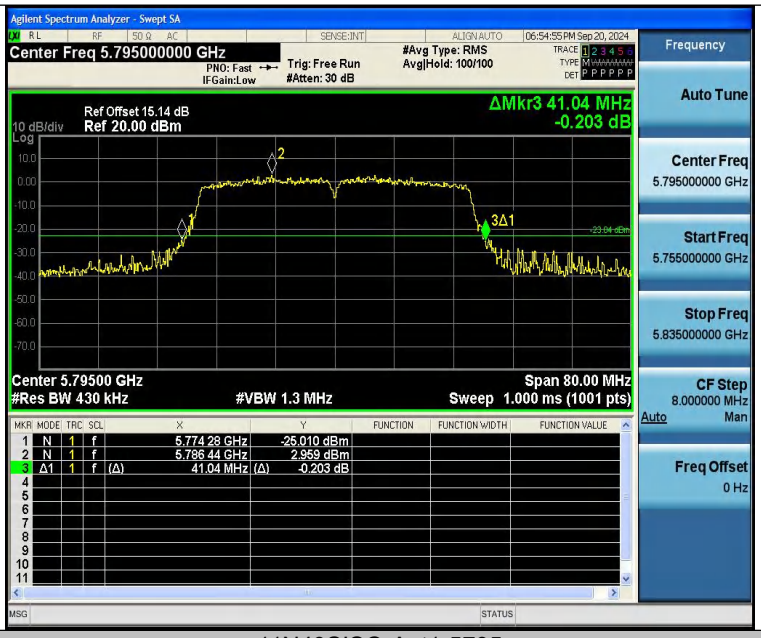

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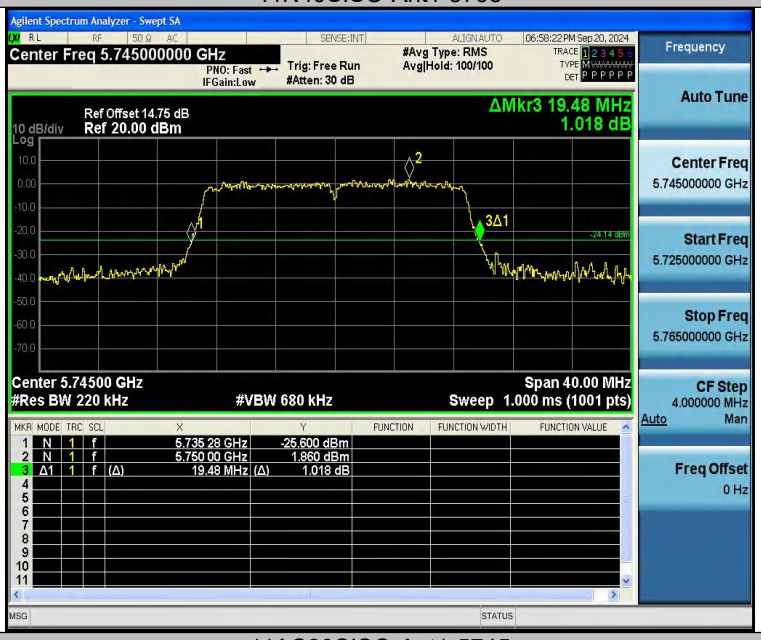

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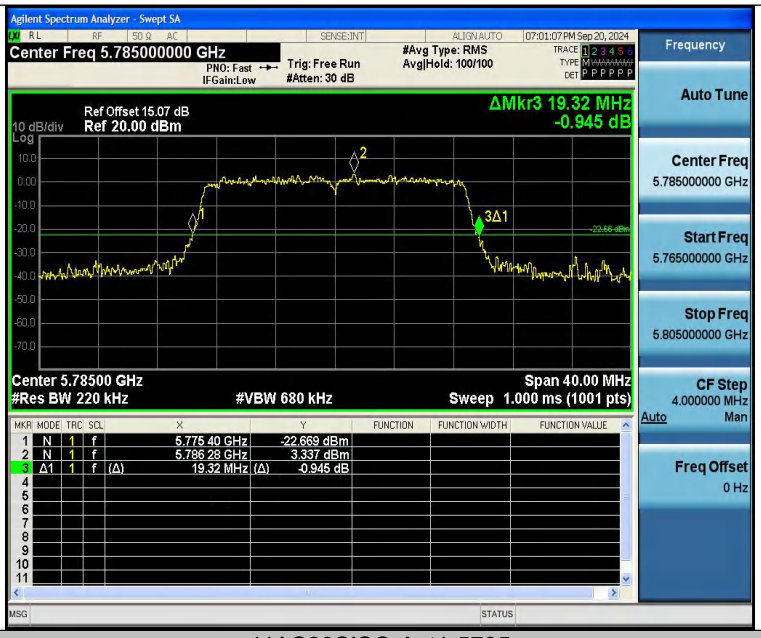
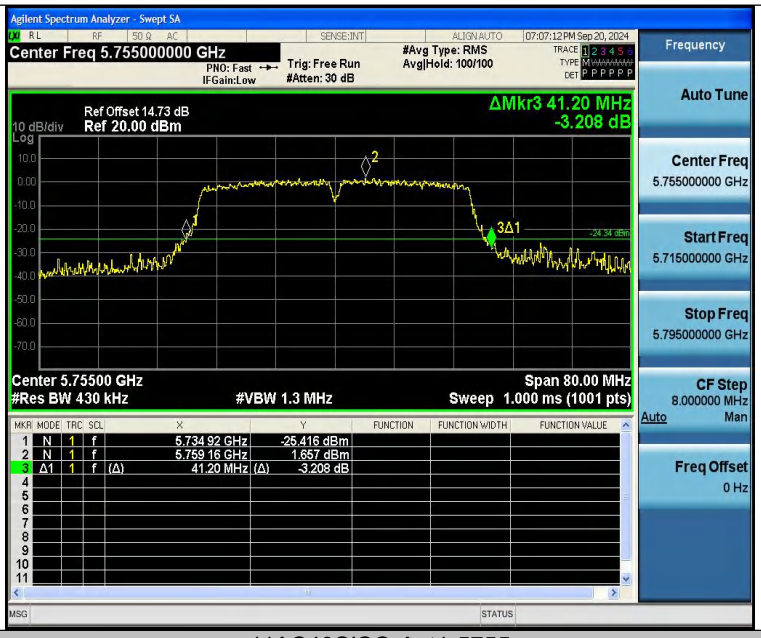
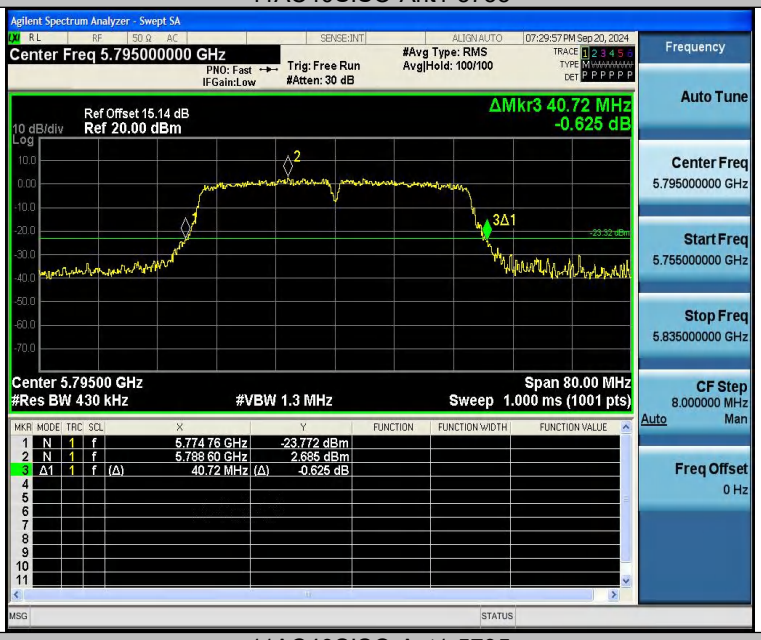


11AC20SISO-Ant1-5785

11AC20SISO-Ant1-5825



11AC40SISO-Ant1-5755



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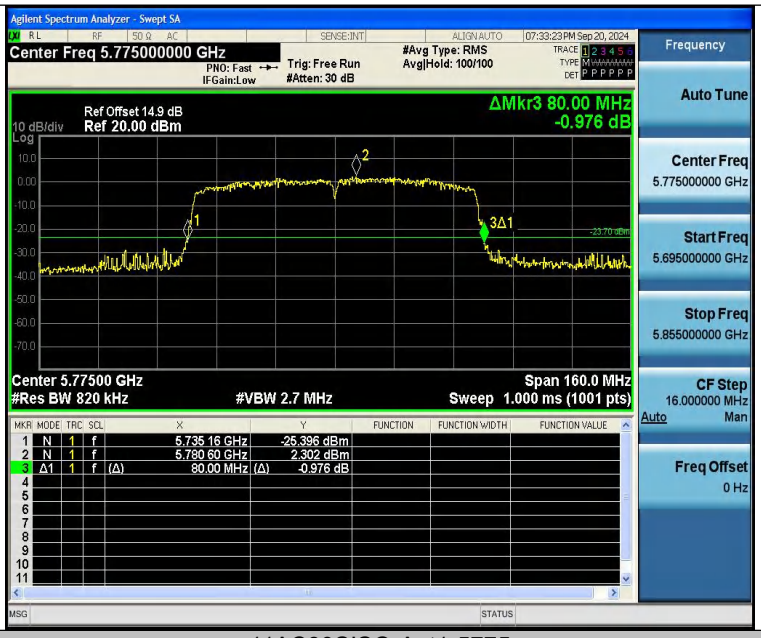
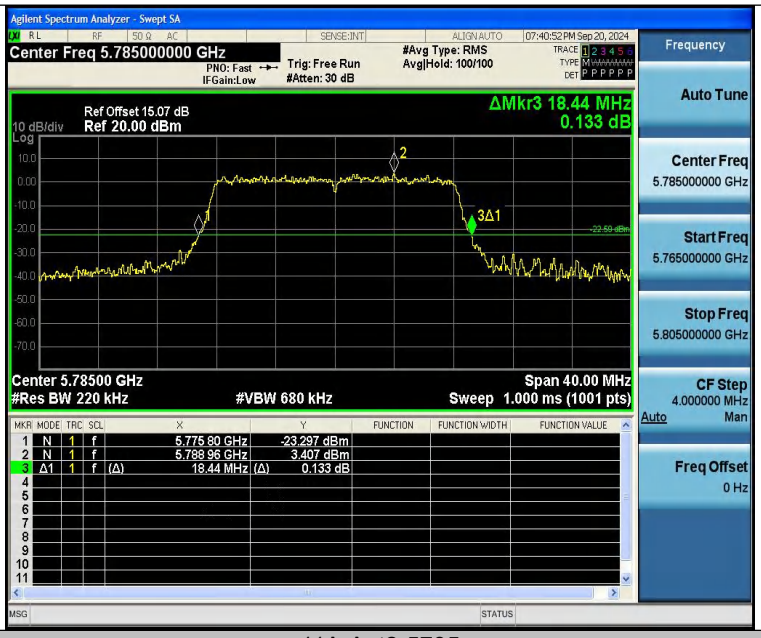


11AC80SISO-Ant1-5775

11A-Ant2-5745



11A-Ant2-5785

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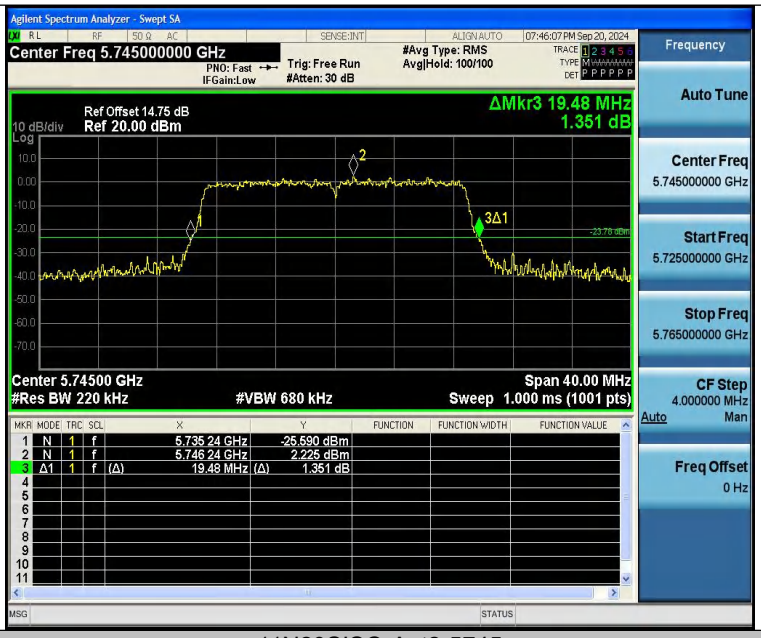

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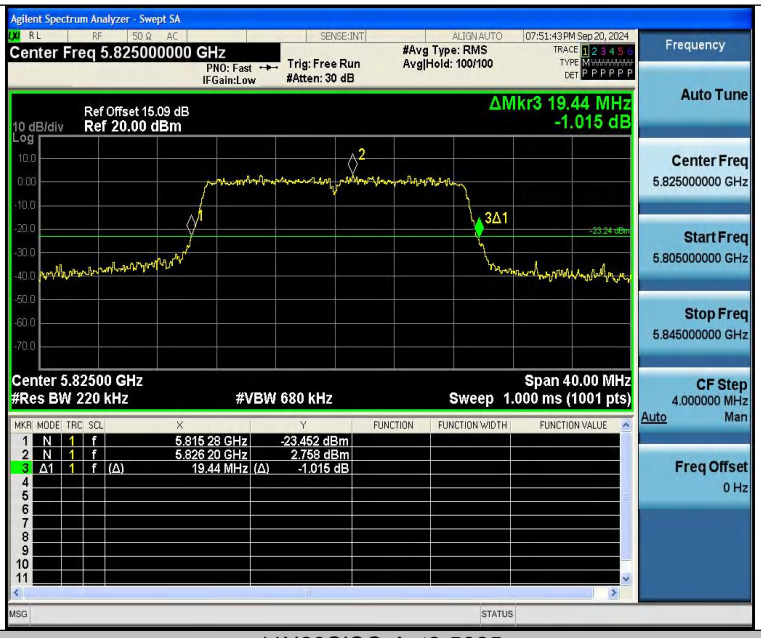

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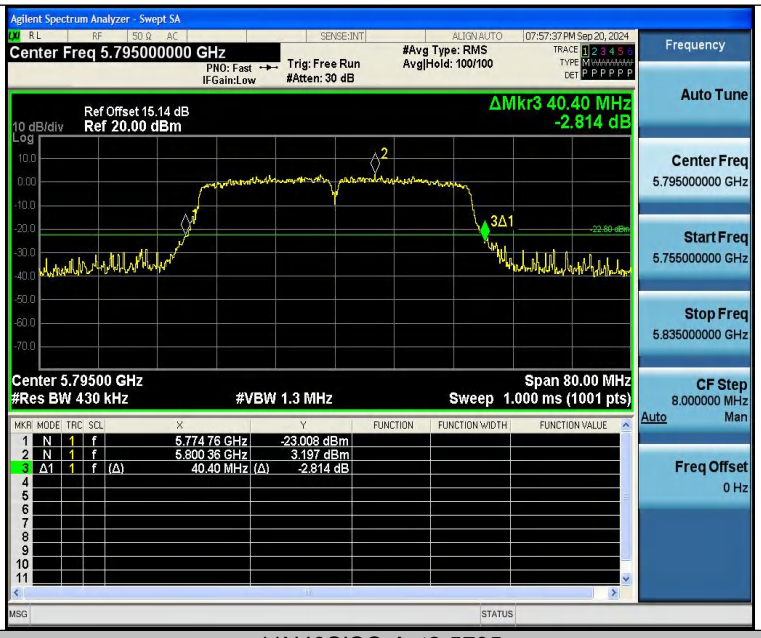

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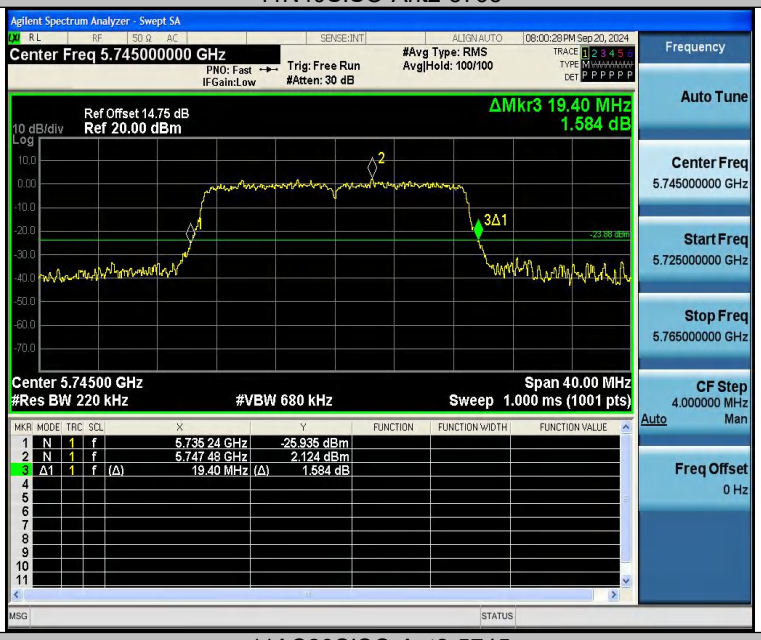

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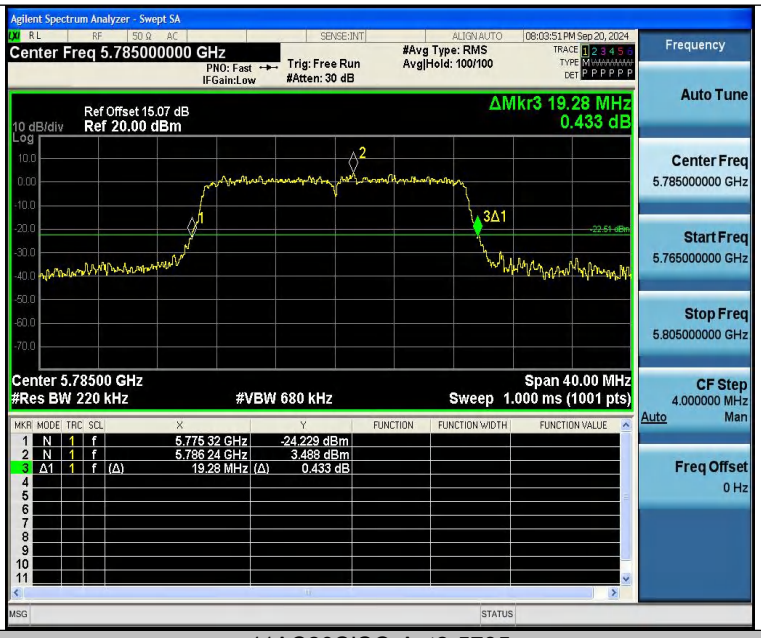

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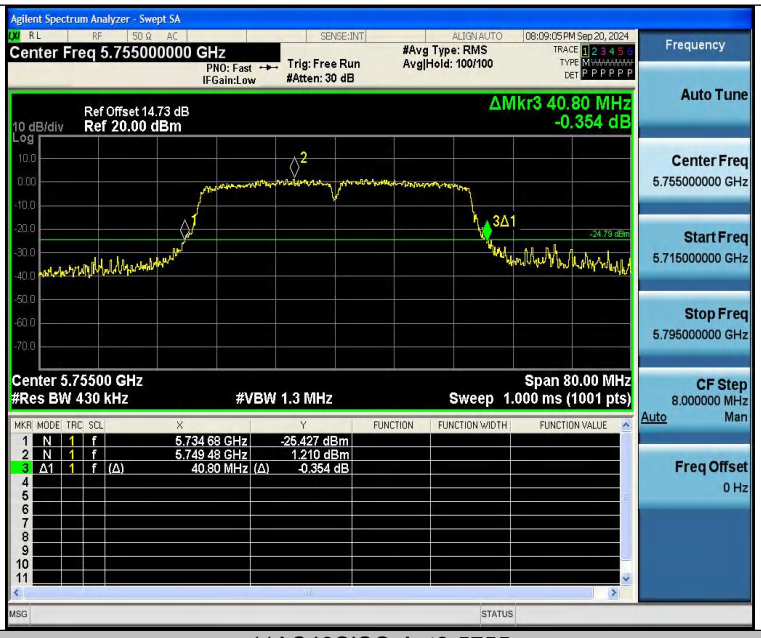

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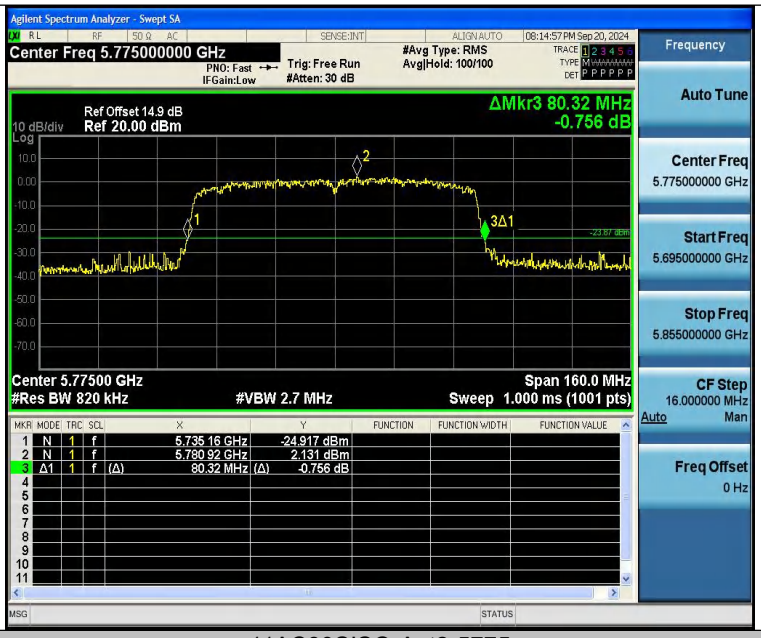

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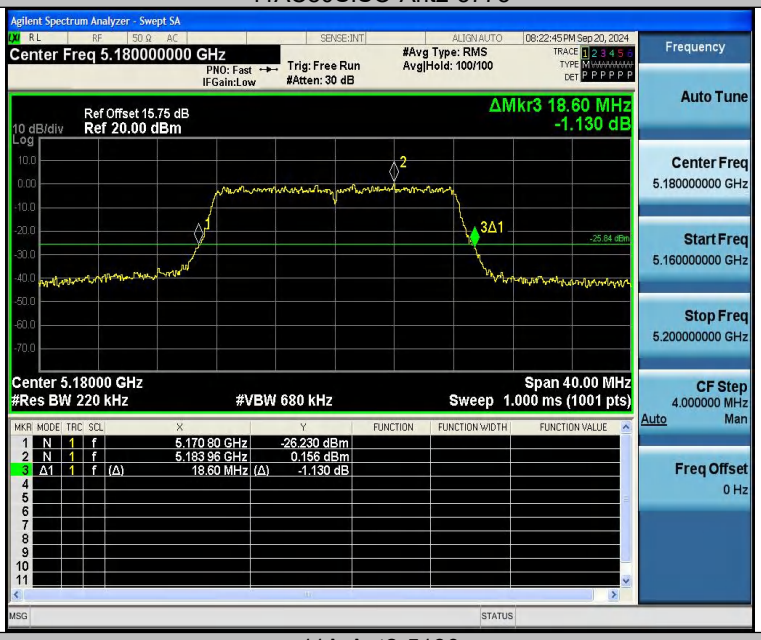
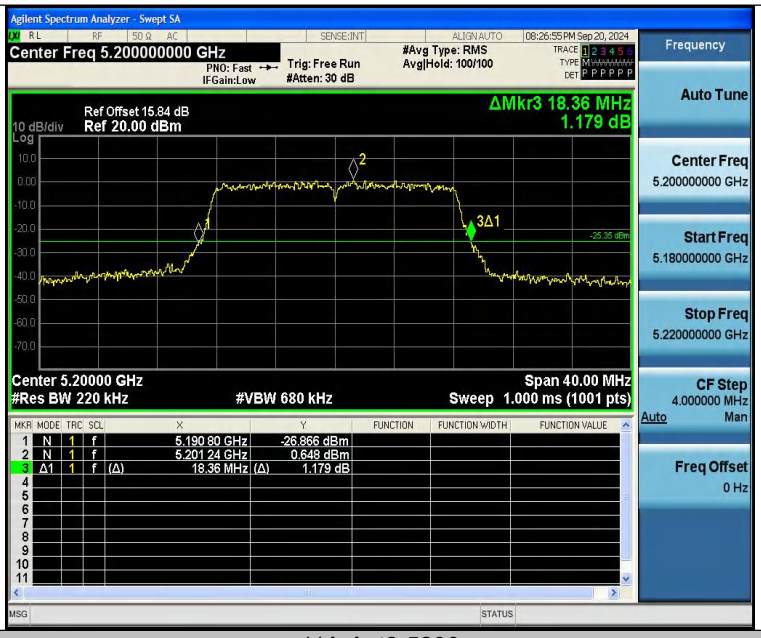
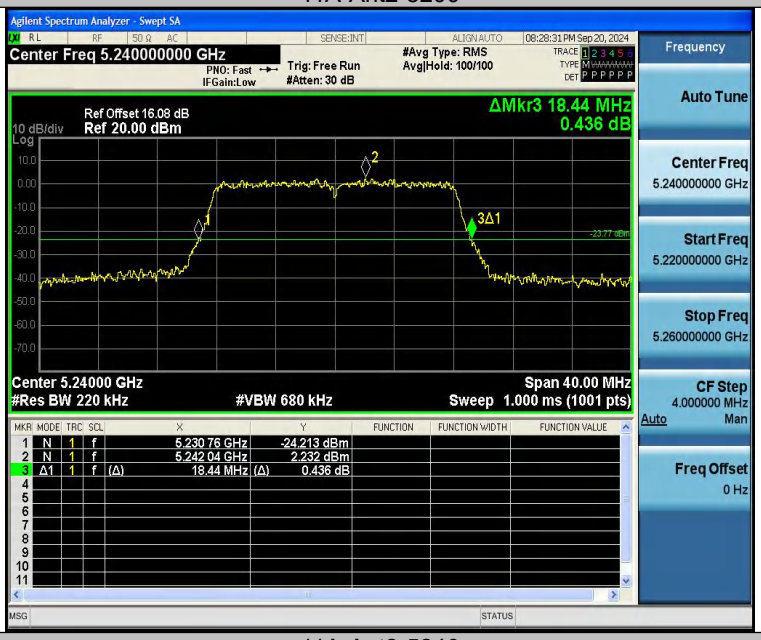


11A-Ant2-5180



11A-Ant2-5200



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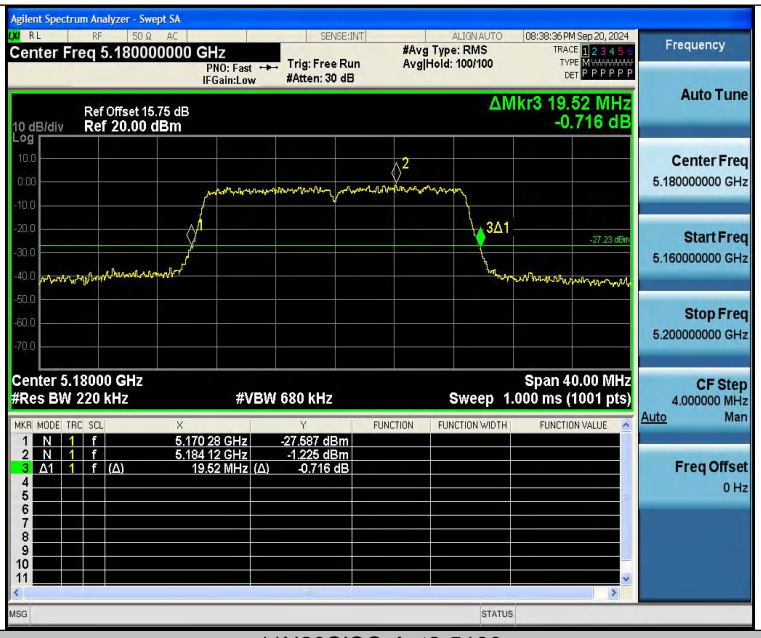

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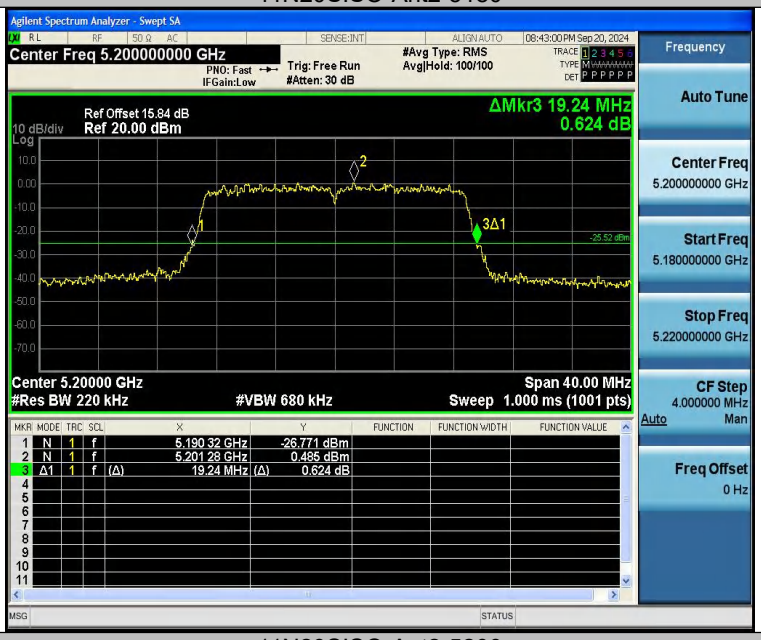

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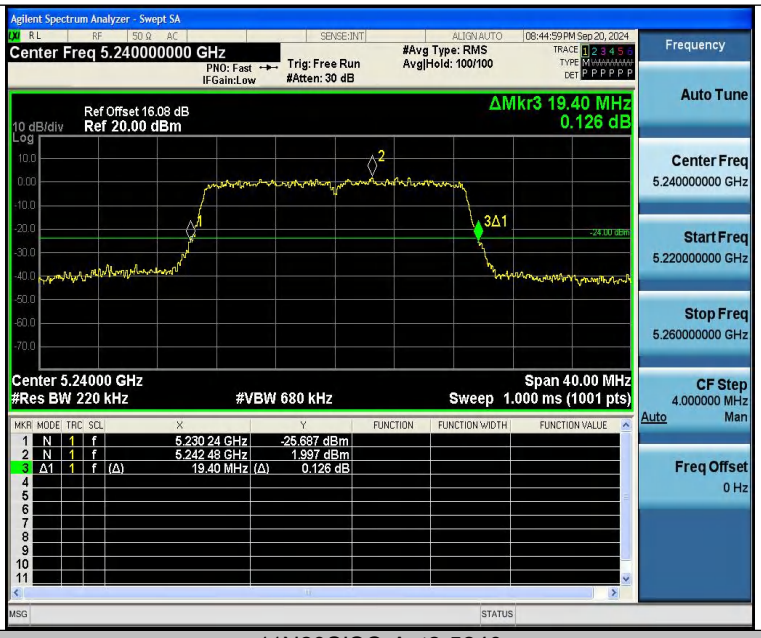

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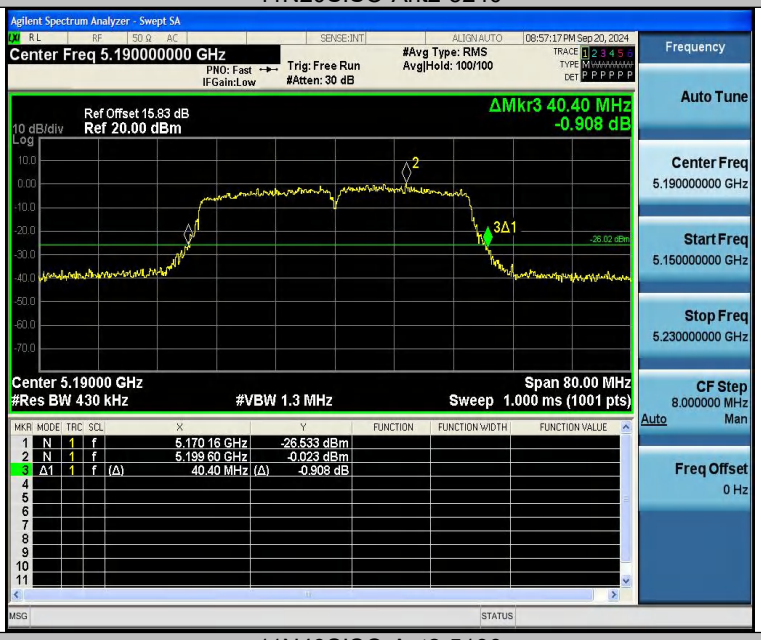

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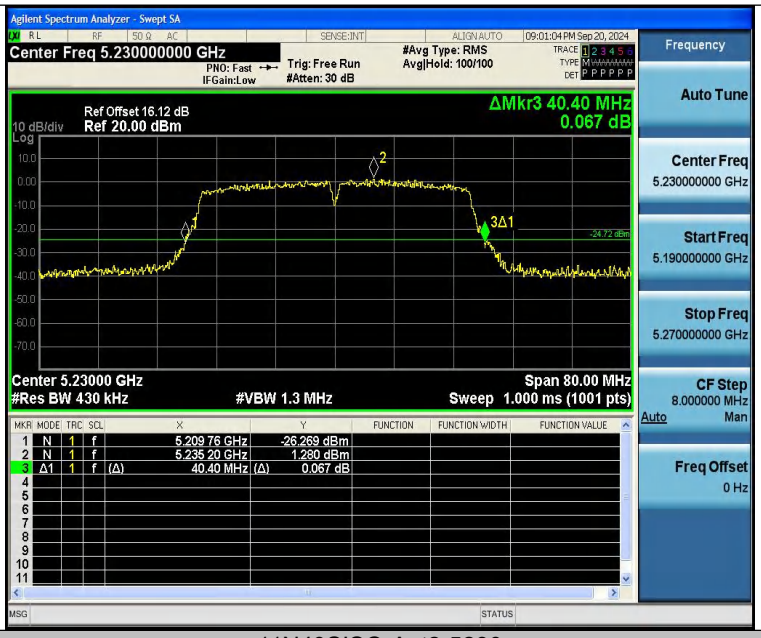

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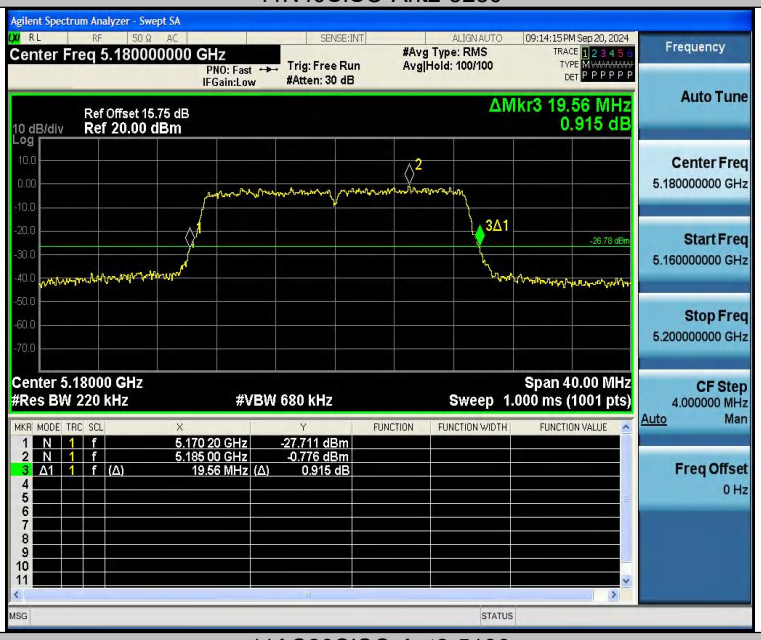

11AC20SISO-Ant2-5180