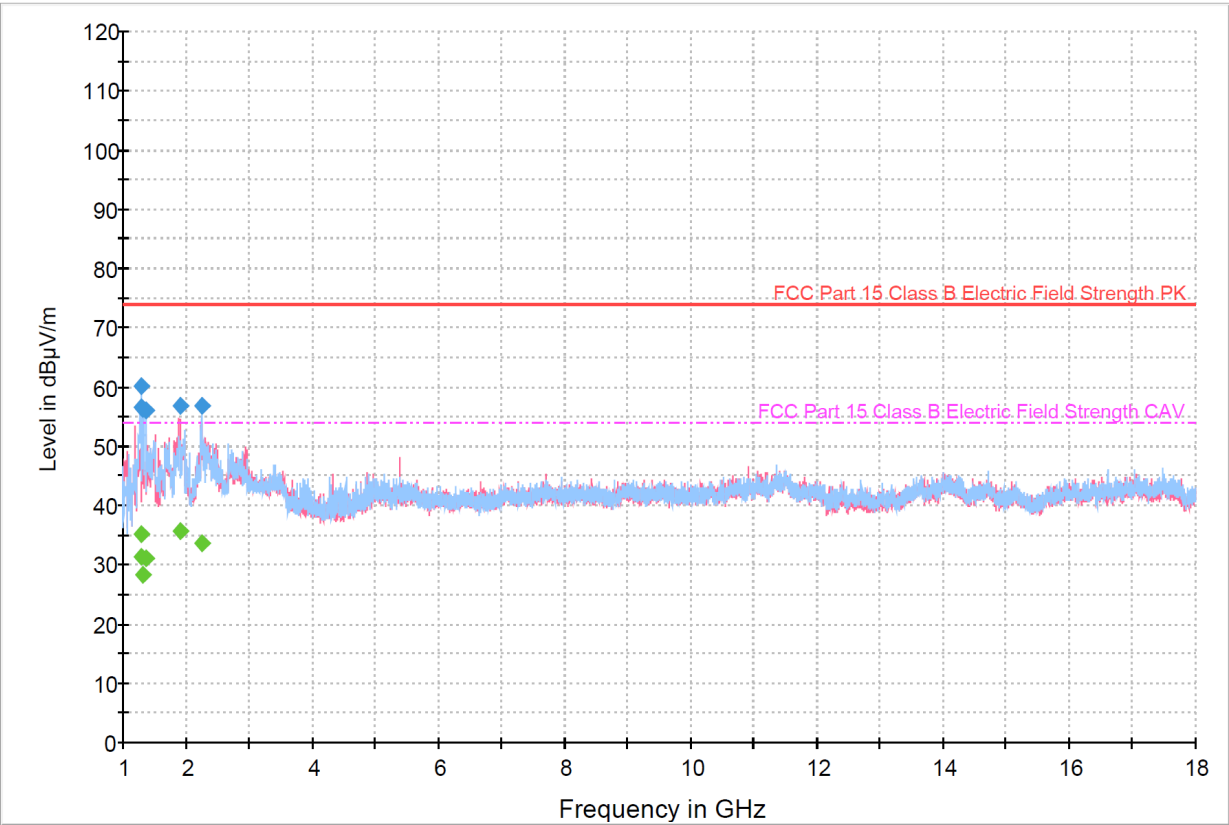


9/10/2024

Radiated Emissions Testing. Build 0.5.2.

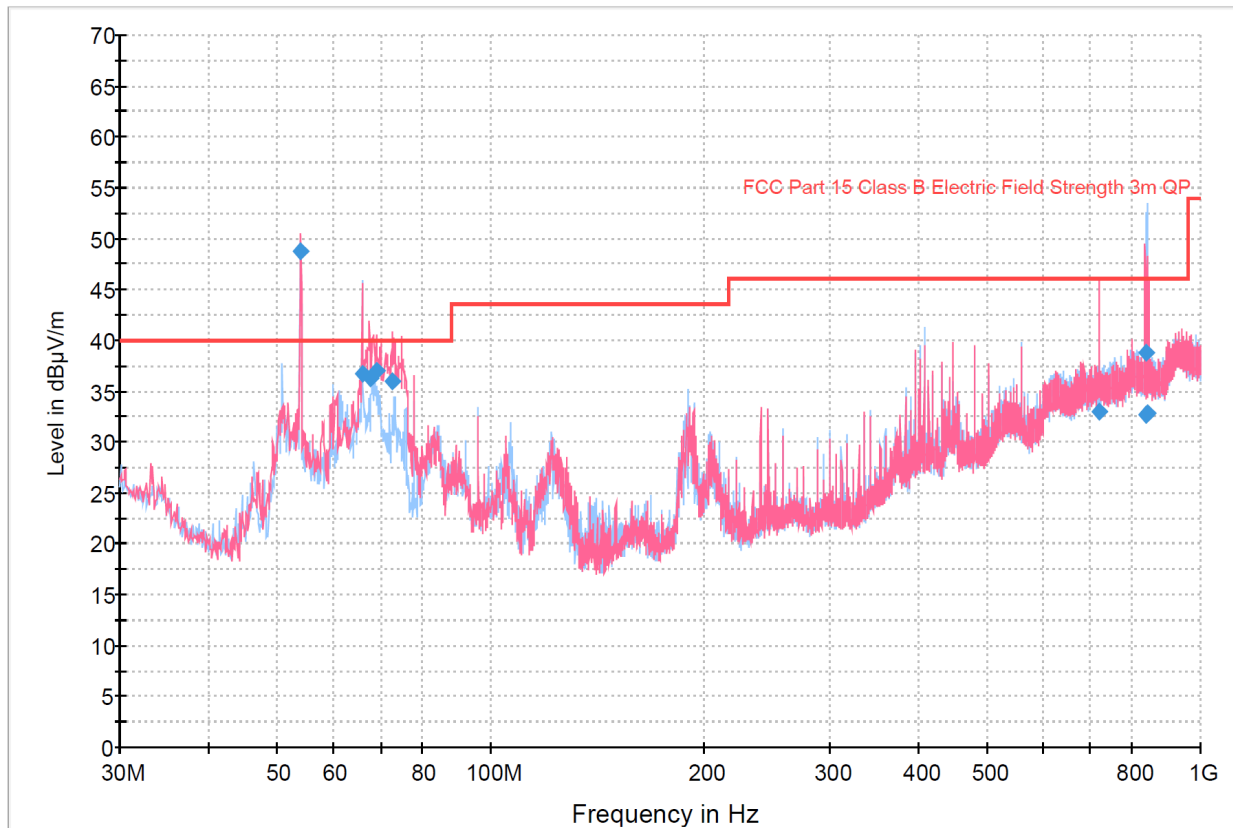
The first scan was in the high frequency range between 1 and 18 GHz. As expected, there were no frequencies with levels above the limit and all had plenty of margin. This test passed.



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
1292.600000	60.09	---	73.90	13.81	5000.0	1000.000	109.0	H	190.0	-11.1	
1292.600000	---	35.13	53.90	18.77	5000.0	1000.000	109.0	H	190.0	-11.1	
1304.100000	---	31.30	53.90	22.60	5000.0	1000.000	118.0	H	193.0	-11.1	
1304.100000	56.54	---	73.90	17.36	5000.0	1000.000	118.0	H	193.0	-11.1	
1321.750000	---	28.34	53.90	25.56	5000.0	1000.000	202.0	H	190.0	-11.1	
1321.750000	56.41	---	73.90	17.49	5000.0	1000.000	202.0	H	190.0	-11.1	
1368.650000	56.13	---	73.90	17.77	5000.0	1000.000	110.0	H	154.0	-11.2	
1368.650000	---	31.18	53.90	22.72	5000.0	1000.000	110.0	H	154.0	-11.2	
1901.050000	56.91	---	73.90	16.99	5000.0	1000.000	111.0	V	172.0	-6.4	
1901.050000	---	35.58	53.90	18.32	5000.0	1000.000	111.0	V	172.0	-6.4	
2246.300000	56.69	---	73.90	17.21	5000.0	1000.000	244.0	H	240.0	-5.8	
2246.300000	---	33.59	53.90	20.31	5000.0	1000.000	244.0	H	240.0	-5.8	

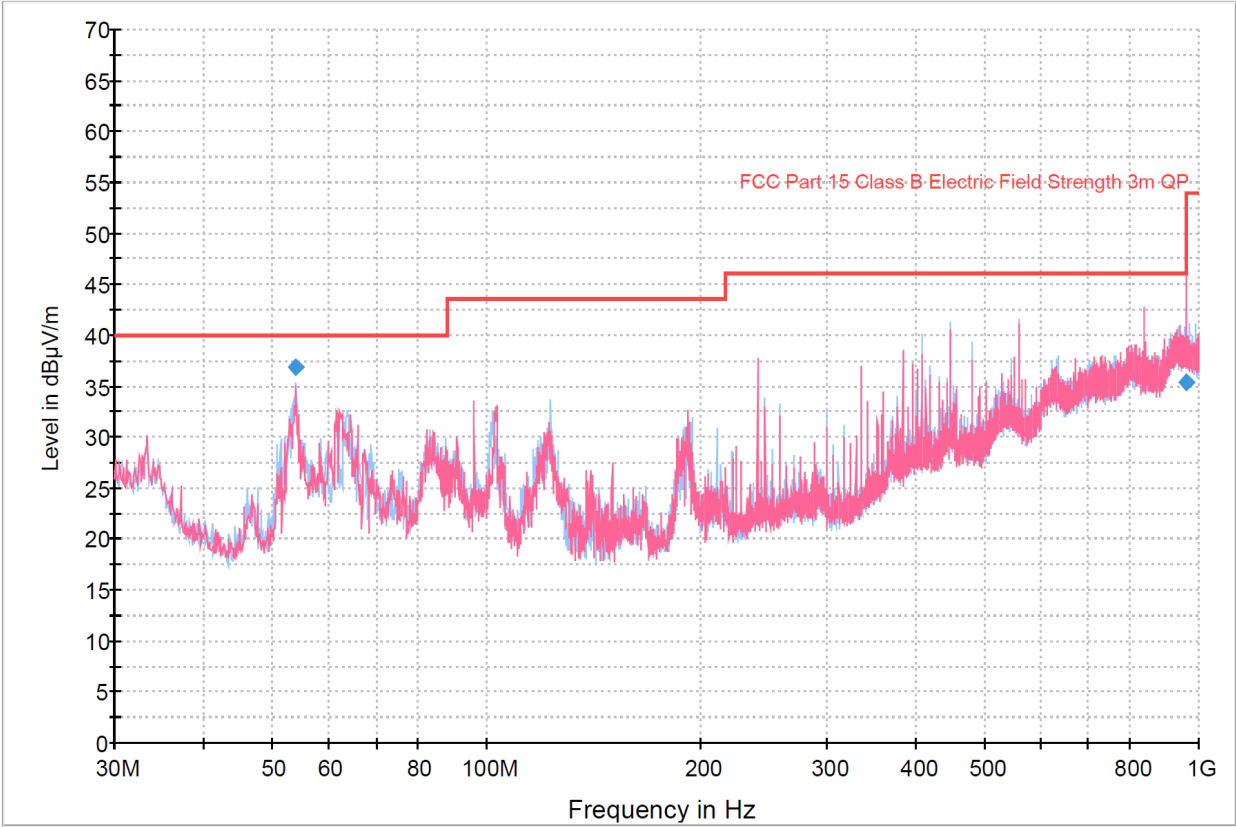
The next scan was in the 30 MHz to 1 GHz low frequency range. There were many frequencies near or above the limit, but after quasi-peak processing, only the 53.999 MHz peak was a failure. The other frequencies all have at least 3dB of margin.



## Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
53.999000	48.78	40.00	-8.78	5000.0	120.000	134.0	V	176.0	13.5	
65.987000	36.75	40.00	3.25	5000.0	120.000	402.0	H	108.0	14.1	
67.722000	36.26	40.00	3.74	5000.0	120.000	128.0	V	198.0	14.1	
69.097000	36.94	40.00	3.06	5000.0	120.000	125.0	V	212.0	14.1	
72.600000	35.99	40.00	4.01	5000.0	120.000	100.0	V	189.0	14.2	
720.618000	32.92	46.00	13.08	5000.0	120.000	161.0	V	342.0	32.3	
836.939000	32.73	46.00	13.27	5000.0	120.000	365.0	V	115.0	32.8	
837.666000	32.74	46.00	13.26	5000.0	120.000	303.0	H	265.0	32.8	
839.775000	38.74	46.00	7.26	5000.0	120.000	174.0	H	306.0	32.8	
844.014000	32.81	46.00	13.19	5000.0	120.000	146.0	H	74.0	32.9	

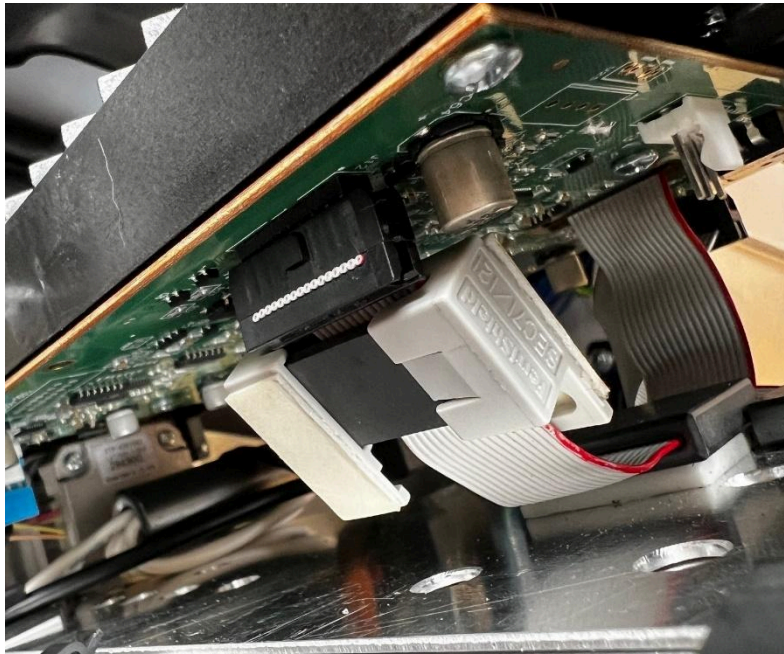
Using a near field probe to scan the MCM for 53.999 MHz emissions, the scanner was determined to be the source. A second ferrite was added to the cable that connects the controller board to the bottom half of the scanner. The final scan shows many of the frequency peaks dropping, including the 53.999 MHz peak. All frequencies passed with more than 3 dB of margin.



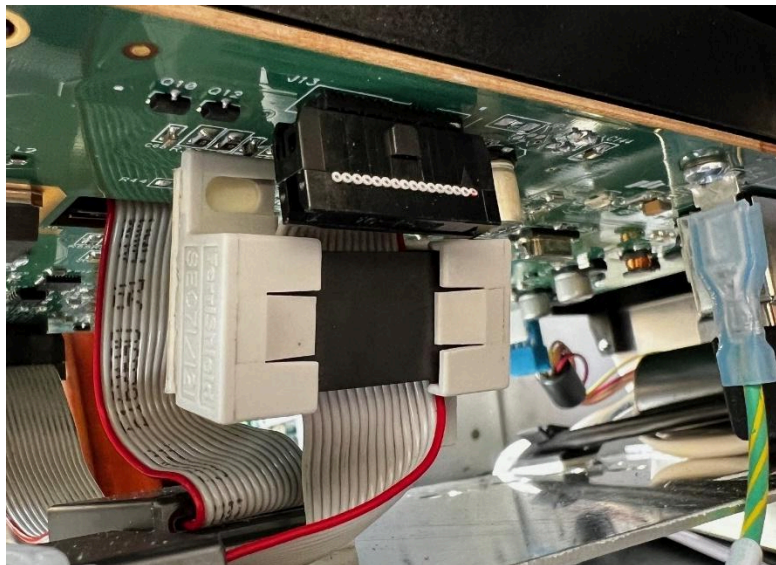
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Comment
54.039000	36.93	40.00	3.07	5000.0	120.000	120.0	H	278.0	13.5	
960.579000	35.33	53.90	18.57	5000.0	120.000	177.0	V	210.0	34.5	

This is where the ferrite was installed (near the front of the MCM). It is best to have it as close to the controller board as possible so the emissions can be absorbed before they go too far down the cable.



Although the test passed with just one added ferrite on the scanner bottom cable, it would be better to add one to the top cable as well. A second suitable ferrite was not available during testing.



The ferrite used during testing was from sample kits available at Nemko. A much less expensive but superior part is a 28S2023-0M0 from Laird Signal Integrity Products (Digi-Key 240-2104-ND).