

California Instruments Mx Series Noise Spectrum Analysis Using Optional EMI Filter

Introduction

The following data is to outline the benefits of using an optional EMI filter to reduce the output noise of the California Instruments Mx Series Programmable AC Source.

The Mx series is a high speed (82kHz) MOSFET based switch mode AC power source. Switch mode power architecture offer greater efficiency compared to linear power sources because the switching device dissipates little power when it's outside of its active region (i.e. when the power device acts like a switch and either has a negligible voltage drop across it or a negligible current though it). Other advantages include smaller size and lighter weight and lower heat generation due to higher efficiency.

A disadvantage includes the generation of high-amplitude, high frequency energy that the low-pass filter must block to avoid electromagnetic interference (EMI), a ripple voltage at the switching frequency and the harmonic frequencies thereof. EMI can be problematic for Anechoic (EMC) Chambers applications since the source induces noise within the chamber which potentially affects test results.

Standard Mx Series Output Noise Low Voltage Range

The following noise spectrum analysis is the standard Mx Series with no EMI filter on the output. The power source is on the Low Voltage range with the output programmed to 120 volts and 60 Hz at the maximum load current. There is a 40 dB attenuator between the Spectrum Analyzer input and the measurement point.

Figure 1 is up to 1MHz and Figure 2 is up to 500kHz. The measurement marker (MKR) is set to measure the maximum noise spectrum which is 57.0kHz and measured at 48.19db μ V. The total output distortion plus noise (THD) is 0.24%.

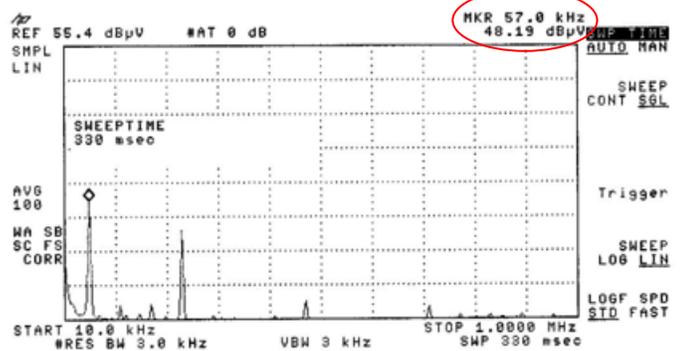


Figure 1

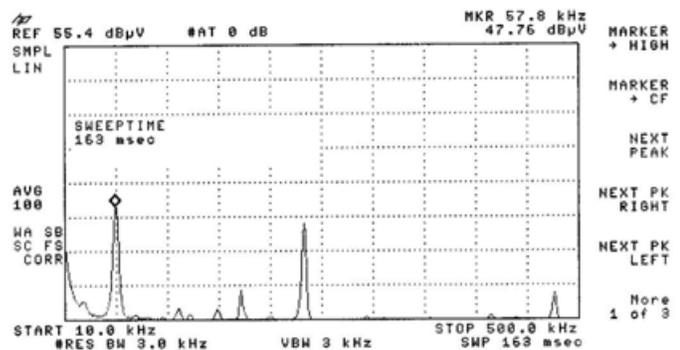


Figure 2

Standard Mx Series Output Noise High Voltage Range

The following noise spectrum analysis is the standard Mx Series with no EMI filter on the output. The power source is on the High Voltage range with the output programmed to 240 volts and 60 Hz at the maximum load current. There is a 40 dB attenuator between the Spectrum Analyzer input and the measurement point.

Figure 3 is up to 1MHz and Figure 4 is up to 500kHz. The measurement marker is set to measure the maximum noise spectrum which is 57.0kHz and measured at 48.19dbμV. The total output distortion plus noise (THD) is 0.25%.

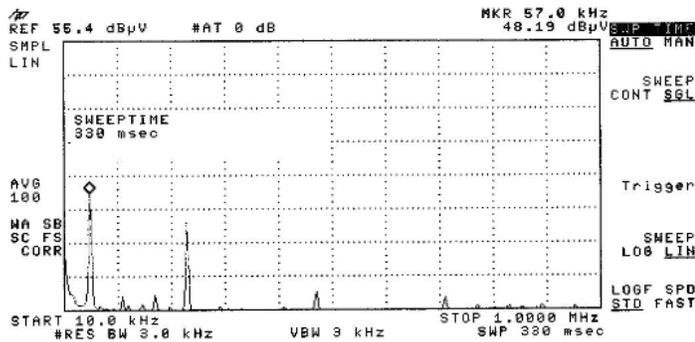


Figure 3

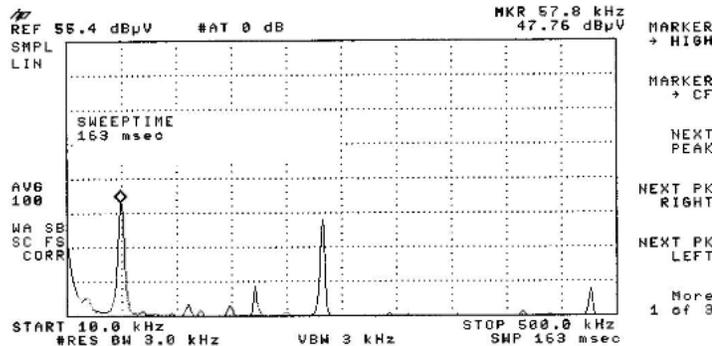


Figure 4

Mx Series Output Noise Low Voltage Range, EMI Filter Installed.

The following noise spectrum analysis is the Mx Series with EMI filter installed on the output. The power source is on the Low Voltage range with the output programmed to 120 volts and 60 Hz at the maximum load current. There is a 40 dB attenuator between the Spectrum Analyzer input and the measurement point.

Figure 5 is up to 1MHz and Figure 6 is up to 500kHz. The measurement market is set to measure the maximum noise spectrum which is 57.0kHz and measured at 44.51dbμV. The total output distortion plus noise (THD) is reduced to **0.13%**.

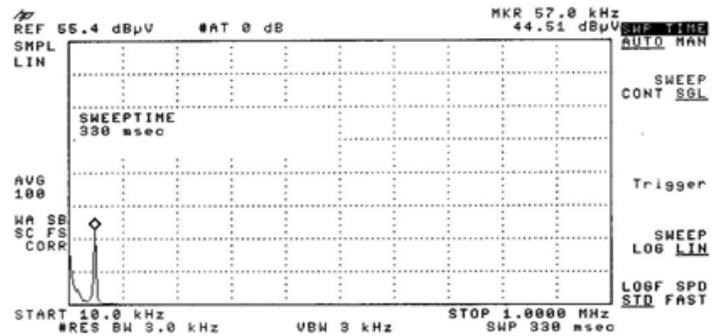


Figure 5

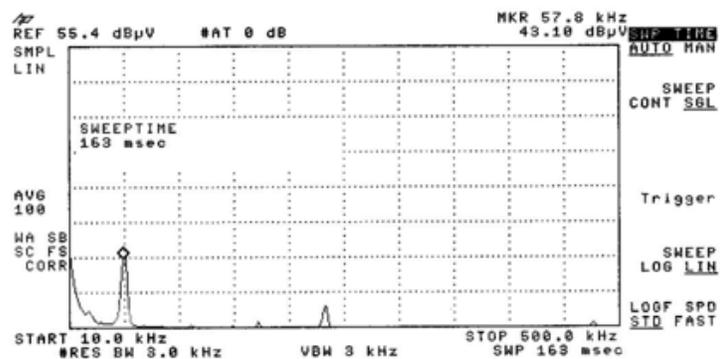


Figure 6

Mx Series Output Noise High Voltage Range, EMI Filter Installed.

The following noise spectrum analysis is the Mx Series with EMI filter installed on the output. The power source is on the Low Voltage range with the output programmed to 120 volts and 60 Hz at the maximum load current. There is a 40 dB attenuator between the Spectrum Analyzer input and the measurement point.

Figure 7 is up to 1MHz and Figure 8 is up to 500kHz. The measurement market is set to measure the maximum noise spectrum which is 57.0kHz and measured at 44.51dbμV. The total output distortion plus noise (THD) is reduced to **0.13%**.

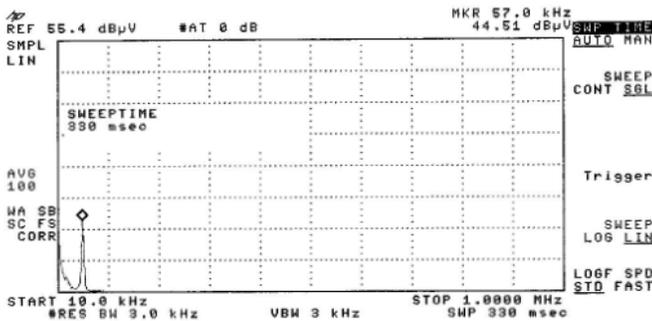


Figure 7

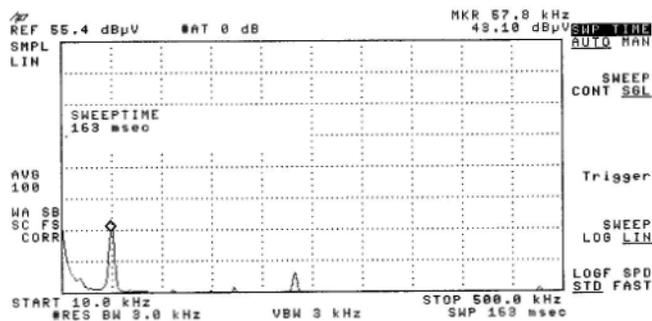


Figure 8

Summary

Installing an EMI filter results in a significant reduction of high switching noise ranging from 10kHz to 1Mhz. As a result the overall THD is reduced by almost 50%. Using an EMI filter proves to be an effective and cost effective solution for applications sensitive to switching noise.

If you are interested in ordering the optional EMI filter please reference P/N 7003-424-1 during quote request.

California Instruments Sales Support:

http://www.elgar.com/products/MX/MX_Quote.htm

California Instruments Product Support:

On-Line Request:

www.programmablepower.com/support/support_CallInst.htm

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