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Use of NexTek HPR + HCP Filters for CS116 Hardening

NexTek's HPR Series High Current Feedthrough Filters are able to help power systems survive MIL-STD-461, §CS116 testing. There are many variables that need to be considered in analyzing the effects of CS116 testing:

1. DUT [Device Under Test] impedance over Frequency
2. Control Circuit Stability
3. Attenuation or resonance of passive circuits
4. Load impedance over frequency
5. Filter grounding and shielding

C-Type Filters – Typical Attenuation

The attenuation of the HPR's over frequency, in a 50Ω system, is presented in the product specification and below in the graph. The presentation of this attenuation data in a 50 Ohm system is not quite applicable to lower impedance power system. The key insight from this chart is to note that larger capacitance HPR's do a better job of attenuating lower frequencies.

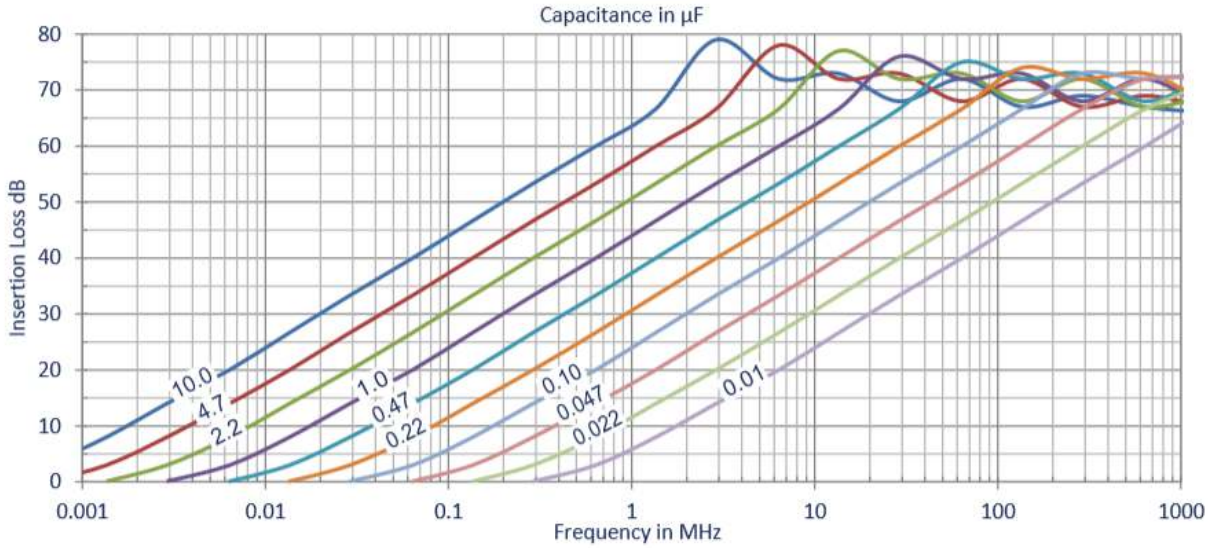

Figure 1 - Typical HPR Series Attenuation

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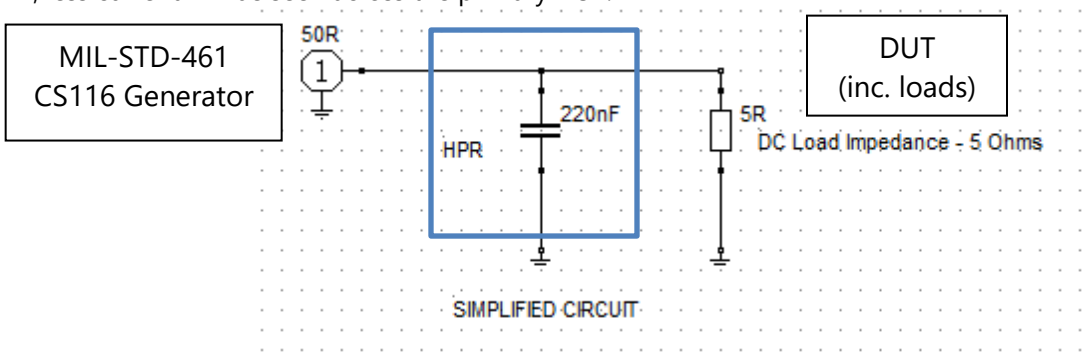
CS116 Testing – Test Setup Details

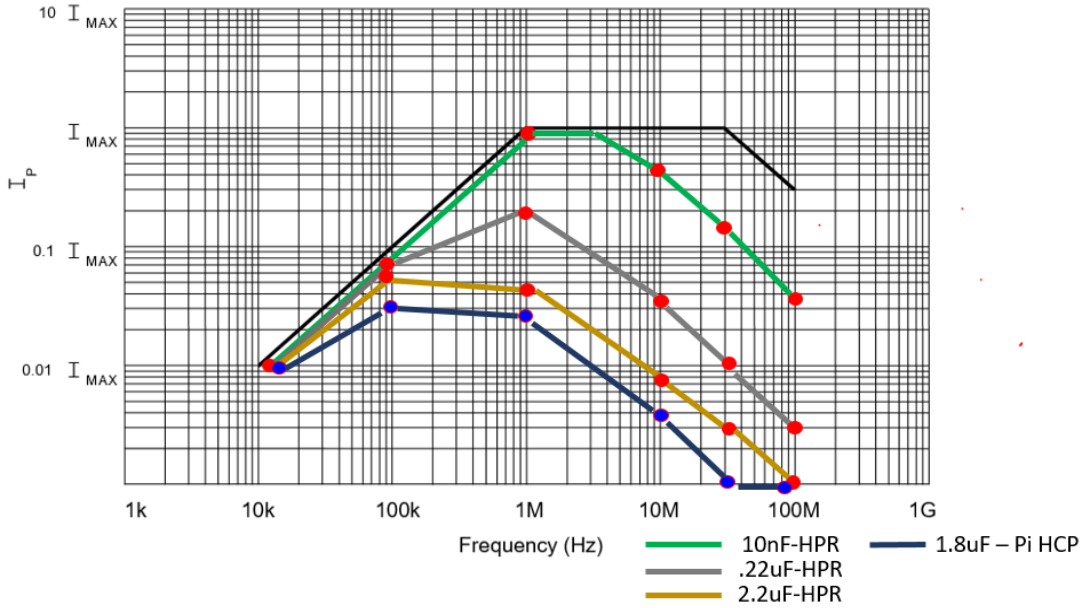
Looking at a simplified circuit where the Device Under Test (including any loads and load line) impedance is 5 Ohms and an HPR filter, it is evident that high frequency currents will be shunted to ground through the HPR (Impedance of a capacitor decreases as frequency increases). As the CS116 damped sinusoidal currents begin shunting through the HPR, less current will be seen across the primary DUT.



C-Type Filters [HPR Series] – Performance Against CS116 Input Transients

Some SPICE simulation of a similar system as shown in the schematic shows that as capacitance increases, the amount of sinusoidal current at the load can be significantly diminished. The simulated current data is overlaid against the CS116 current curve to provide an idea of the type of reduction that could be achieved with an HPR.

Ref 1



Notice that the NexTek HPR reduces the higher frequency energy to a large extent. These higher frequency disturbances are above most power system stability or control regimes, particularly for COTS products. In addition, power supply ripple filters which also have limited high frequency control, because of electrolytic or use of leaded capacitors with high ESL [Equivalent Series Inductance.] NexTek HPR filters can assist with RE [Radiated Emissions] and CE [Conducted Emissions] control at higher frequencies, too.

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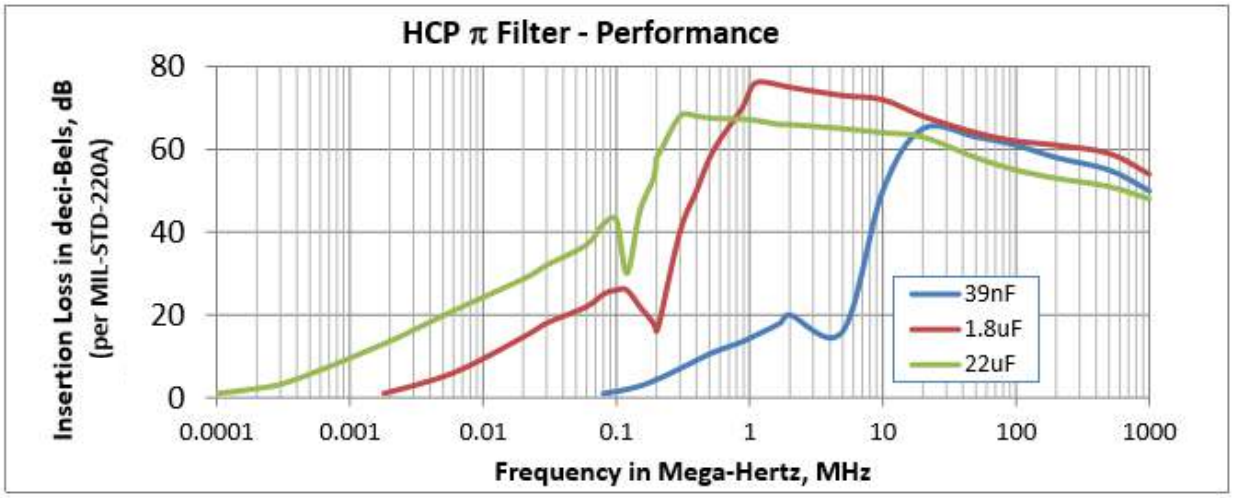
C-L-C or Pi Filter (HCP Series) – Typical Performance

A "pi" filter (capacitor-inductor-capacitor) provides even higher attenuation at higher frequencies as can be seen from the Nextek HCP data sheet (screenshot below). The 1.8uF performance (simulated in same system as above) was plotted on the CS116 Frequency curve along with the HPR's as an additional reference point.



Conclusion

NexTek Power Filters can help power systems pass CS116 testing, but there are many factors that determine the amount of hardening that HPR's can provide. It is possible for Nextek to do a rigorous analysis of the power system and provide proper guidance and recommendations related to various Mil-Std-461 test conditions.

Learn More

HPR Series EMI Filter Page

Resources Page

***Ref 1* – MIL-STD 461G @ Everyspec.com**

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