

# Mil-Std-461

## EMI Filter Installation

### **MIL-STD-461 Conducted Emissions:**

This MIL-STD is intended to verify that the electrical noise emitted on the cables of a system are kept within acceptable limits.

### **Power Lines**

#### **CE101: Frequency range is 30 Hz to 10 kHz.**

The noise signals in this range are usually caused by rectification of the AC Line and are composed of harmonics of the line frequency. It is generally not a good idea to try to control these harmonics with a filter. The filter size, to do so, would be quite large and costly. It is better to use active harmonic attenuation circuitry. This circuitry is much smaller and economical to use than a passive filter.

The noise emitted by a harmonic attenuator is much higher in frequency and easier to filter than the lower power line harmonics.

#### **CE102: Frequency range is 10 kHz to 30 MHz**

The noise signals in this range are due to switching frequencies of power converters and other system parts.

Every system is different depending on its mission so the emissions of systems are always different from one design to the next. One way to solve the emission issue is to use a filter that has a minimum of 60db common mode and differential mode insertion loss over the frequency range 10 kHz to 30 MHz. This approach will generally take care of all the conducted emissions however, the size of the filter could be large. With the need to keep system size down, large components are not acceptable.

The most economical approach is to test the power converter and develop or use a standard filter with the correct insertion loss to suppress any unwanted conducted emissions from the converter. Generally, a chassis mount filter will suffice to take care of emissions in this frequency range. If tested early enough in the design phase a standard filter can be selected and space can be allocated for that filter.

If frequencies will be present that are in excess of 30 MHz then some care must be taken with the filter enclosure. The problem is not the conducted emissions. The problem will be the radiated emissions. Radiated emissions have requirements that extend out to 1 GHz.

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Electrical energy in the 30 MHz to 1 GHz frequency range can easily by-pass a "chassis mount" filter and exit the system on the power leads. The power leads then become antennas and radiate the signals.

In order to overcome this problem an RF barrier must exist between the line side of the filter and the load side. One way to do this is to mount the input connector on the filter so that the input side of the filter fits snugly against the wall of the system.

Figure 1 demonstrates a possible installation and of course there are many different connectors and as many ways to accomplish this input to output isolation.

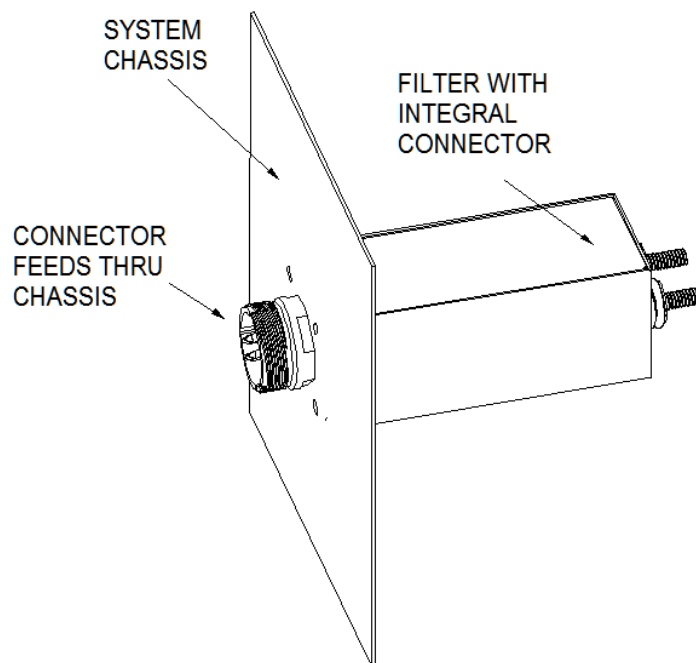


FIGURE 1

Most of JMK, Inc.'s filters that begin with "Z" will provide this type of mounting. Another method is to put a shield over the cables from the power input terminals of the system to the input terminals of the filter. Various methods can be used to accomplish this using "Doghouses" etc. An example of a different installation is shown in Figure 2.

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In Figure 2, the input terminals are shielded from the output terminals with a connector cover and shield of the wires from the connector to the filter.

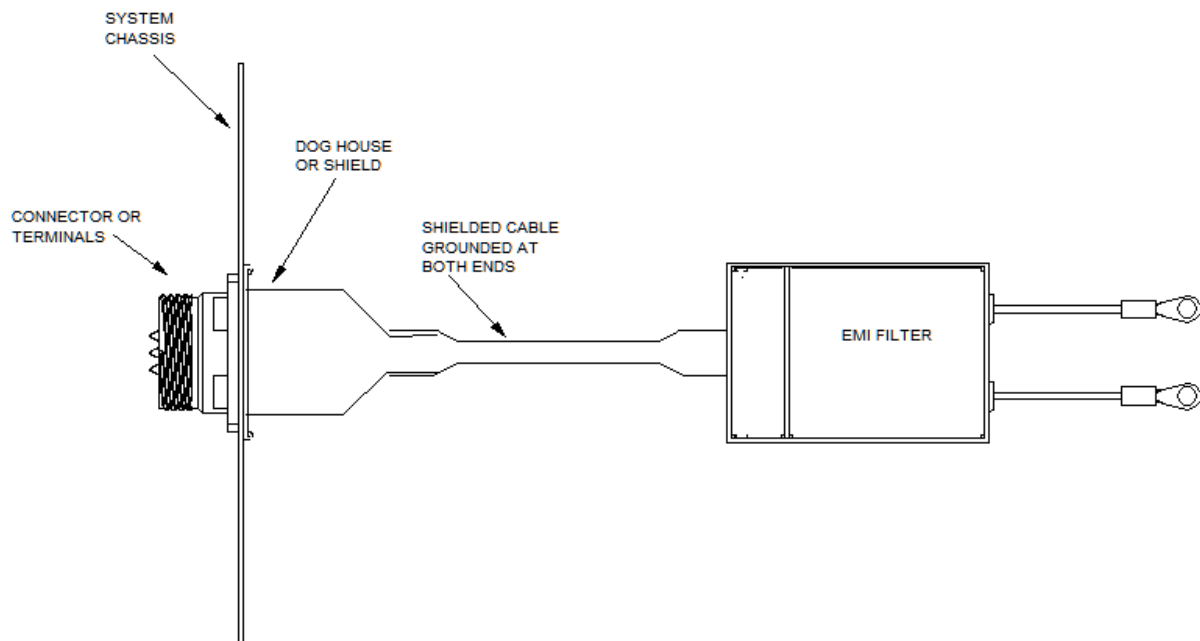


FIGURE 2

MIL-STD-461 is not a difficult spec to meet if care is taken in the early stages of a design to contain the conducted and radiated emissions. If testing facilities are not readily available JMK will provide assistance for the conducted emission testing.

We do provide engineering level testing to scan a system early in a design in order to determine the filtering required. Bread Board testing will normally suffice with 1 or 2 days needed for the test.

Please contact us at 603-886-4100 if you have any questions.