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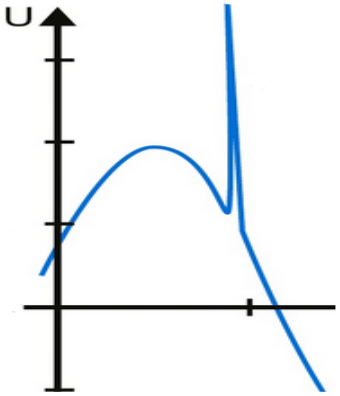
EFT Solutions for Sensitive Electronics



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During EMC testing at the compliance lab, complex customer systems are exposed to several different forms of electromagnetic energy, both wire conducted and thru the air. The most prevalent problem we have noted during the immunity test suite of the customer system is EFT failure.

EFT is a low energy test, a 50 ohms series impedance is used during the test. Though it is non-destructive due to the 50 ohms source impedance, none-the-less it tends to have a wide spectral frequency content, which can cause havoc with sensitive electronic sensors and microprocessors.

During the EFT test, a repetitive voltage transient event is induced into the AC mains thru a LISN (*line impedance stabilization network*), this induces both a differential and a common mode current into the AC mains port of the power adapter. However the differential mode current flow, does not typically result in any system type problem, the common mode current flow induced can and does result in havoc for the sensitive components in the customer apparatus. EFT induced common mode current will flow from the power adapter AC input to the output cable. The common mode current in the output cable of the power adapter can then flow thru the electronics appliance core equipment, and then flow out to any sensors. The high gain amplifiers used for the sensors may amplify the EFT induced common mode currents, overdriving and saturating local circuitry, resulting in severe distortion of the critical physical phenomenon the sensor is measuring.

Since the common mode current path is injection from the AC mains, the power adapter provides a logical point of control, where attenuation of the EFT injected common mode event is possible.

The EFT test methodology is defined in IEC 61000-4-4. The test protocol calls for testing of the AC line, Neutral and Earth connections independently and in combination with each other. With a Class I AC input power adapter, this presents 7 uniquely different AC line EFT injection possibilities, as follows:

1. Inject Line
2. Inject Neutral
3. Inject Earth
4. Inject Line and Neutral together
5. Inject Line and Earth together
6. Inject Neutral and Earth together
7. Inject Line, Neutral and Earth together

When injecting EFT, in order to control the repeatability of the injected pulse, a separate LISN channel is used for each of the 3 wires. (*Three LISN channels are used for testing Class I equipment; all are symmetrical with respect to one another.*)

A typical power adapter uses SMPS (Switched Mode Power Supply) technology, to convert the AC input power into low voltage (3V to 60V) DC power. An integral part of practically all SMPS is an input common mode choke (AKA CMC). This input filter component, although designed to prevent the common mode noise from the switching action of the SMPS Mosfet from flowing back to the AC mains, can also block common mode EMI moving in the opposite direction such as during the EFT test.

Therefore, a common observation of a Class I input product which fails the EFT test, is that the Line and Neutral wires *(which pass thru the common mode choke*) can comply with the EFT test pulse sequence, but the Earth wire input will fail the EFT test sequence. The reason for the failure on the earth wire is that common mode current flow blocking typically does not occur on this wire, since the most common Class I internal construction configuration, is that the earth wire passes directly from the AC input earth terminal to the negative output terminal without any limiting impedance.
Accordingly, the addition of adequately high series impedance on the earth wire can often resolve an EFT system issue.

Furthermore, when sensor or transducer sensitivity levels are extremely problematic, it is possible to add more blocking impedance directly to the output cord, in the form of a multi-turn ferrite bead. In this situation, obtaining adequate inductance on the multi-turn ferrite bead is necessary in order to provide additional blocking impedance in the 20MHz to 200MHz frequency range.

Following these measures to improve EFT immunity, can typically provide for a 2X to 3X increase in EFT immunity performance of the customer system. GlobTek can provide enhanced EFT common mode attenuation power adapter products for your sensitive electronic OEM equipment. Please contact our sales department, should you require help with your system, and we will provide engineering support with customized prototypes which can precisely target your specific system EMC problem.

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