Re: high voltage discharge emi problem..

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- *From*: Jeroen Belleman <jeroen@xxxxxxxxxxxxx>
- *Date*: Thu, 30 Nov 2006 11:55:28 +0100

booth wrote:

> Dear All,
> I'm designing a medical device which generates shockwaves. I'm facing serious EMI problems. The device generates the shockwaves by discharging a high voltage capacitor through a Spark Gap, a triggering transformer is used. The triggering transformer is triggered using a circuit. The trigger circuit is fully isolated using an isolated supply and optocouplers.
> A seperate microcontroller controls the triggering process by sending signals to the opto isolated triggering circuit.
> Despite all the isolation measures taken, whenever a HV discharge occurs the microcontroller circuit resets. I look at the supply voltage of the uC board and see large spikes.
> What I am doing wrong? Is it the layout in the HV section?
> Please Help...

Electromagnetic compatibility must be designed in right from the start. Adding it later is much harder. If you make medical devices you should be very aware of that. Be especially vigilant when you are making sparks, because that usually implies the presence of wideband powerful magnetic and electrical interference.

Anyway, there are three main paths by which interference may mess up your circuits:

− Magnetic coupling. To reduce this, keep loop areas of closed circuits as small as possible. Keep bus bars close together. Twist wires. Output and associated return leads should follow the same path. Keep loops with low−level sensitive signals away from loops with high−power signals. If the field is high frequency, a conductive shield can divert or contain the flux, depending on geometry. Low frequency and constant fields may be channeled around sensitive spots using soft iron.

− Electrostatic or capacitive coupling. Separate nodes with rapidly changing voltages from nodes with high−impedance low−level nodes. Lower victim node impedances, if you can. Keep nodes compact. Put grounded or guarded shielding between them. Use metal boxes.

− Common impedance coupling. This is what you get when currents from more than one separate circuit flow through a common wire or trace. Even solid conductors can have a significant impedance, especially when one of the circuits carries a large current and the other a sensitive low−level signal. This is even more true if high frequency signals are involved. Give every circuit its own return lead. Make sure you *know* where return currents flow.

Decoupling or bypass capacitors are a way to reduce loop area and confine RF currents to small loops. Filters on input and output leads can divert or impede undesirable currents, if signal and interference bands do not overlap. Coaxial cable works as a shield for both electrical and magnetic fields at sufficiently high frequencies. PCB ground planes reduce common impedance coupling and offer shielding as well. Signal transformers, opto−couplers or differential signalling can be used to open unavoidable loops at a well defined place.

I probably just missed a nice consulting job...

Regards,
Jeroen Belleman
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