A finger on the pulse

MPE Ltd's Paul Currie outlines the measures being taken to safeguard important electronics against both man-made and natural pulse threats...

For general commercial use, the performance of electromagnetic pulse (EMP) filters has traditionally been accepted as 60dB at 10kHz, rising to 80dB from 100kHz to 1GHz. All lines in these multi-line systems feature high-energy transient suppressors – such as varistors, spark gaps or silicon avalanche diodes – at the input end. Each transient suppressor has to give an ultra high-speed response to arrest the incoming pulse.

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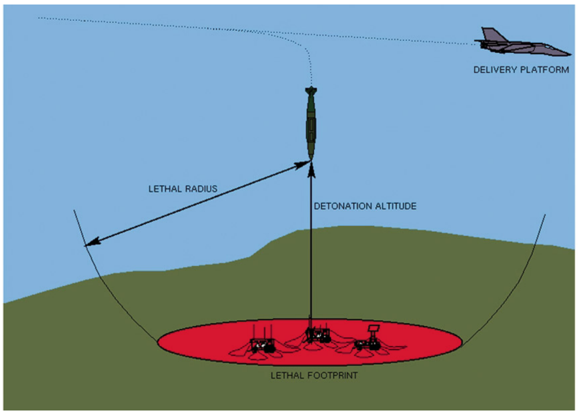
The purpose of this front-end transient suppressor (primary protector) is to shunt the bulk of the pulse energy to earth. Secondary and tertiary protection may be provided by further transient suppressors fitted at later stages of the filter to help to reduce the remaining pulse voltage to a safe level. To provide delay to the incoming pulse, filtering components are either mounted at a distance from the primary protector or separated by a discrete inductor.

For uses in war zones, national defence and homeland security, a subcategory of EMP – the high-altitude electromagnetic pulse (HEMP) filters – serve to safeguard equipment systems against the devastating effects of nuclear blasts high in the atmosphere. The EMP caused by such an event could knock out military computer and communication networks, as well as civil and commercial infrastructures.

For example, the intense EMP created by a HEMP event more than 30km up could disable, damage or destroy electrical power supply networks, unprotected items of electrical equipment and electrical controls for key service industries over a wide area. Any equipment containing microchips would be particularly vulnerable and would be damaged or destroyed in a fraction of a second. A solar flare or geomagnetic storm, over which we have no control but will inevitably happen from time to time, could produce a similar catastrophic result. An historical example of this was the Carrington super-flare of September 1859, when semiconductor electronics lay far in the future, so effects will depend on what vulnerable technology may be in existence at the time of the event.



Lethal footprint of low frequency e-bomb in relation to altitude

Tests show that purpose-designed HEMP filters to protect the cable entry points of AC mains power lines are far more effective than adapted EMI catalogue filters in terms of performance, size and weight. The latest HEMP specifications, MIL-STD 188-125 Parts 1 and 2 and DEF STAN 59-188, have no stated insertion loss requirement, but it is accepted that the value should be 20dB at 10kHz rising to 80dB in the frequency range 10MHz to 1GHz, in order to not compromise the required shielding effectiveness.

Three different threat levels are defined in the MIL-STD – an early-time E1, intermediate-time E2 and late-time E3 pulse – with the objective of protecting critical infrastructure against a HEMP bomb. Moreover, the first Electric Infrastructure Security (EIS) Summit on 20th September 2010 in London and the second one on 11th April 2011 in Washington were aimed at defining a new international security framework to address HEMP threats.

For further information on the Electric Infrastructure Security Summits see: www.empcoalition.org.

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