

Design and Realization of a High-Voltage Adapter for the Testing of Surge Protective Devices against Intentional Electromagnetic Interferences

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Abstract—We report on the design, realization and experimental test of an adapter for testing of surge protection devices against very fast transients.

Keywords—intentional electromagnetic interference (IEMI); high voltage; surge protective device (SPD)

I. INTRODUCTION

One option for the mitigation of sensitive electronic systems against intentional electromagnetic interference (IEMI) is the use of surge protective devices (SPDs). Testing the response of surge protection devices to IEMI threats is a challenging task (e.g., [1-4]). The expected disturbances can have significant variations in terms of their waveshape and spectral content [5]. They are also often characterized by very high frequency components and amplitudes. Finally, SPDs are generally available for protection against traditional disturbances due to lightning and EMP.

Another practical difficulty in testing SPDs against IEMI pulses stems from the fact that semiconductor-based fast transient generators require a quasi-matched load at their output, a condition hardly realizable when testing SPDs. To cope with this problem, different solutions can be envisioned, such as the use of attenuators [2]. In this paper, we propose the use of a specially-designed coaxial tapered transmission line to adapt a 50-Ohm fast transient generator to the low impedance of a conducting SPD.

II. DESIGN OF AN ADAPTER

A cross-section of the designed adapter along its length is shown in Fig. 1. It is characterized by a tapered coaxial structure designed in such a way that the characteristic impedance decreases linearly from 50 Ohm to a low impedance. To ensure a good matching also at low frequencies, for which the adapter is electrically small, the internal conductor was made of ten 4.7-Ohm Allen-Bradley resistors.

The design was validated with numerical simulations carried out using CST microwave studio[®] and the performance

of the prototype was tested in the time domain (TDR) and in the frequency domain (VNA).

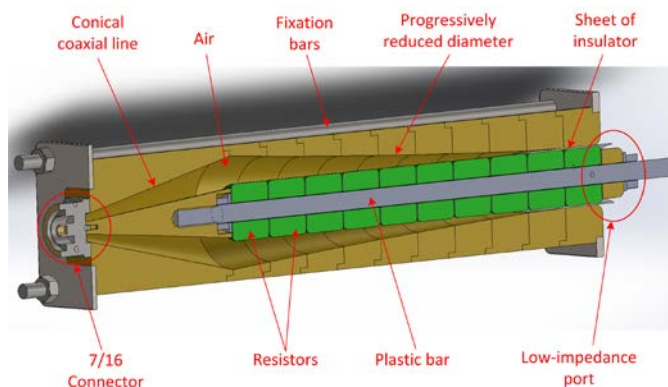


Fig. 1. Cross-section view of the adapter, from the CAD drawings.

The adapter was used to test a few commercially available SPDs.

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