# Usage of Effective Height Antenna Parameter for Description of Cable Susceptibility

Matthew B. Higgins* and H. Gerald Hudson
Sandia National Laboratories, Albuquerque, NM, 87106,
http://www.sandia.gov/electromagnetics

The shielding effectiveness (SE) of a cable tells little about how much voltage will be picked up by an incident electromagnetic field. The use of an antenna parameter to describe the transfer function from field to voltage gives a much more understandable quantity for design engineers to use. The Effective Height ($H_{eff}$) describes how well the cables and connector pins couple when exposed to electromagnetic radiation (EMR). $H_{eff}$ has the units of meters and coupled with an incident electric field, indicates what voltage will be induced on that specific cable for any given EMR field strength. $H_{eff}$ is simply a value which describes how well EMR is absorbed by a cable assembly. The measurements are made by exposing the cables and connectors to a known field strength ($Efield_{outside}$) inside the EM chambers while measuring the voltage coupled onto the cable pins ($V_{cable}$) with a spectrum analyzer. The equation for determining $H_{eff}$ is shown in equation (1).

$$H_{eff}(m) = \frac{V_{cable}(V)}{Efield_{outside}(V/m)} \tag{1}$$

SE of cable can be calculated if the induced pin voltage of the unshielded version of a cable is measured as a baseline and compared with the shielded version of the same cable SE is defined in equation (2). In this formulation a larger negative number indicates better shielding performance.

$$SE(dB) = 20\log\frac{V_{cable}^{shielded}}{V_{cable}^{unshielded}} \tag{2}$$

It will be shown that a cable with a poor SE does not necessarily mean the cable is unacceptable for use in a system, provided the cable has a small $H_{eff}$.

Examples of effective height measurements will be presented with a comparison to the corresponding shielding effectiveness measurements.