Susceptibility Analysis of a Cavity with an Aperture and System Effects

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Susceptibility of equipment to High Power Microwave (HPM) and Electromagnetic Pulse (EMP) attacks has been a serious issue for both military and commercial electronic systems. High-frequency HPM/EMP may cause equipment failure with disastrous consequences.

Much of the equipment of concern is housed in metal enclosures where apertures for ventilation and input/output lines are the avenues for coupling to the system. The radiated susceptibility due to the apertures and the conducted susceptibility due to the input/output penetrations are the concern here. Conducted susceptibility in this case is also due to the external field.

This paper will present analysis of a typical enclosure. Commercially available full-wave electromagnetic simulator is employed to provide data on the coupling to the system. Induced current or voltage at the system input port is determined and treated as noise to the system. System analysis based on signal-to-noise ratio provides the information of the overall effect. Radiated susceptibility will be due to an aperture and internal coupling is to electronics systems. In field modeling, the aperture size and transmission line types will be varied to analyze the HPM/EMP effect on the system. Conducted susceptibility analysis will use a single external wire penetrating the enclosure. Various lengths will be used for analysis. Finally the system effect will be analyzed to determine the worst case scenario and threshold limits for safe operation. Analysis will be shown for the effect on both analog and digital systems.

The results of this analysis will be later compared to empirical data to determine the accuracy of the model.