Chapter 13
Impact of Number of Slots and Permittivity on EMI Shielding Effectiveness

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ABSTRACT

All electronics equipment and devices emit electromagnetic energy. The emitted energy creates electromagnetic interference to the nearby electronic equipment. Shielding is the only effective method of reducing this type of interference without disturbing and reducing the performance of complex electronic systems. Shielding cages usually have openings or slots to provide ventilation and enable access to electronic components placed inside the cage. In this chapter, the impact of dimension of the shielding cage and the number of slots in the shielding cage are investigated. Relative permittivity reflects the electrical characteristics. Its impact on shielding effectiveness is also analyzed in this chapter. Simulation results shows decrease in the shielding effectiveness with the increase in number of slots as well as increase in relative permittivity. In addition, the shielding effectiveness decreases with the increase in frequency.

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INTRODUCTION

Electromagnetic interference (EMI) is a common and wide source of disturbance that can interrupt electronic operations and include electronic bias to malfunction. All electronics equipment and devices emit electromagnetic energy. Similar emitted if interacts with near device and causes it to malfunction, also it is considered as interference. Radios, televisions, motors, lightning are some of the common sources creating interference to other devices like computers, measuring instruments and navigation systems. Most of the electronic equipment and systems are nowadays placed or fitted inside a plastic housing. Due to the insulator property of the plastics, the electromagnetic waves can easily pass through the plastic housings and therefore a provision for EMI shielding is necessary in such cases. One way to achieve this is to cover the plastic casing with a conductive layer. Else the casing has to be make with a conductive material (Enbo Liu., Ping-An Du., and Baolin Nie (2014).

An especially shaped conducting material can be used to form a shield against such EMI by incompletely or fully. Such shielding reduces the measure of EMI radiation that can pass from the external surround into the shielded circuit. They also help in shielding the EMI radiation generated by the circuit inside the housing to escape out. Shielding is the only effective method of reducing EMI things without disturbing and reducing the performance of complex electronic systems. Utmost of the EMI shielding systems follow the same introductory set of principles.

Faraday EMI cage principle shows that an enclosed conductive casing will result in a zero electrical field, therefore suppressing the things of interference. Based on this, EMI cage is developed and it reflects interference into the ground. The conductive cage has electric charges of varying opposition along its surface that produce a separate electric field to cancel the effects of the original field. Still, an EMI shields generally have openings or orifices to give ventilation and enable access to shielded factors that enable attachment to cables or other assemblies. The Effectiveness of an EMI shield is dropped due to the presence of orifices. Any place or opening in the shell will attract the current and affect it to pass through the defensive surface, no matter how small the opening (Angelo Gifuni., Antonio Sorrentino., Alessandro Fanti., Giuseppe Ferrara., Maurizio Migliaccio.,Giuseppe Mazzarella and Federico Corona, 2012).

The EMI shielding considerations are kindly different when a field is designated according to the electric field intensity (E -filed) or magnetic field intensity (H-field). In addition to that, operating frequency is also plays an important role. Lower frequency H-field shielding is supplied by closure fabricated from a thick, soft magnetic material with a high level of permeability and at high H-field frequencies, a thin conductive enclosure with low permeability is required. Utmost EMI is caused by frequencies that fall between 1 kilohertz and 10 gigahertz, and this range is known