Mitigation of PCB Radiation through Novel Mesh Fencing Techniques

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In printed circuit boards (PCB), as the frequency increases, the PCB dimension becomes electrically long, and the clock harmonics can lead to resonances, which in turn makes the PCB an efficient radiator. Essentially, the multi-layer PCB structure behaves in a manner identical to that of a microstrip patch antenna, where the radiation is a result of the field accumulation at the edges of the board. The radiated emission occurs at the microstrip line or strip lines under fast switching, which becomes one of the primary electromagnetic interference (EMI) sources. Moreover, the transient currents associated with fast switching produce simultaneous switching noise (SSN), which can significantly compromise the power distribution integrity on the boards, leading to crosstalk and false logic.

Via fencing, an edge treatment that consists of adding a string of vias around the periphery of the PCB effectively shorting out common voltage reference planes, was proposed in previous works to reduce the electromagnetic radiation. It has been demonstrated that closely spaced fencing vias can reduce the radiation from the board edge effectively. However, the energy radiated is partially reflected back into the PCB by fencing vias, therefore enhancing the power plane resonance with consequential adverse signal integrity implications.

In this work, we review via fencing techniques. We then present a quantitative study to determine via fencing effects on enhancing power plane resonance. It is known that RC termination is an effective method to dampen the power plane resonances. In this work, we suggest the addition of “equivalent capacitance” through the use of strip lines (open-ended on both ends). These strips will be perpendicular to the propagating electric field and will act as a capacitive load. With this mesh fencing approach, i.e., a combination of the via fencing and capacitive strip lines, we expect to reduce the radiated emission from PCB while dampen enhanced resonances.