

## **Efforts Toward a Board Level Holistic Thermal and EMI Solution for Mobile Electronic Devices**

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### **Abstract**

Thermal and EMI management in electronic devices is an increasing challenge for device manufacturers. Several trends such as increasing device density, both at the chip and board level, coupled with the reduction in overall device thickness influence device manufacturers' approach these challenges. In most electronic devices, these thermal and EMI challenges are addressed separately through the use of individual board level shields, thermal interface materials, and heat spreaders. These products typically provide only one solution and in mobile electronic devices may unintentionally influence each other's performance in the device after their implementation. In this presentation we will discuss work that we have performed at Laird to design an integrated solution for thermal and EMI management at the board level.

Our integrated solution has been evaluated in several mobile electronic devices. Two case studies will be presented demonstrating its effectiveness in smartphones. The first case study utilizes a mid-range smartphone and the second a flagship smartphone. The goal of the evaluations was to quantify improvements in both CPU performance and device skin temperature provided by our integrated solution. Full device functionality was maintained with our solution in both cases. Device performance was measured by the increase in clock speed of the CPU. Increases of CPU clock speed by as much as 40% were observed in the mid-range smartphone. Reductions of skin temperature were obtained in the flagship smartphone of up to 4°C with modest increases of the CPU clock speed. The design of the integrated solution includes a heat spreader and specific thermal interface materials selected to manage heat flow at the board level. Several alternatives to board level shields such as synthetic graphite and conductive fabric were evaluated to provide EMI shielding while reducing thickness and promoting integration.