**State-of-the-Art in the Design of Electrically Small Antennas**

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Optimization of the performance properties of electrically small antennas represents a challenging design problem for the antenna engineer. As wireless devices decrease in size, there is an increasing demand for physically smaller antennas, yet the performance requirements are rarely relaxed. This 1/2-day short course provides a detailed discussion on the theory, challenges, performance trade-offs and design approaches associated with electrically small antennas.

The short course begins with an overview of the fundamental theory and inherent limitations of small antennas. The presentation focuses on providing an understanding of small antenna performance in terms of impedance, radiation patterns, bandwidth, radiation efficiency, matching efficiency, and quality factor (*Q*). Techniques used to design self-resonant and impedance matched electrically small antennas are described and compared. The relationships between the small antenna’s performance properties and its physical characteristics are discussed in detail. The performance of the small antenna on small finite ground planes is considered with a particular emphasis on how the antenna’s location on the ground plane affects impedance, pattern and polarization properties. This short course also presents and describes practical approaches for the design of wireless device antennas. These discussions include an understanding of the basic theory of these designs, equivalent circuit analysis, and ground plane effects.

**Learning Objective**: Participants will understand the basic challenges and limitations associated with designing small antennas for wireless communications systems and devices. Participants will also understand the basic approaches and techniques used to design a number of practical electrically small antennas.

**Presentation and Materials:** The course will be presented using PowerPoint slides. Students will be provided copies of the slides.