

Advances 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-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 basic theory and fundamental limitations of small antennas. The presentation focuses on providing an understanding of small antenna performance in terms of impedance, radiation patterns, bandwidth, efficiency, and quality factor (Q). Techniques used to design self-resonant electrically small antennas are described and compared. The relationship between the antenna's performance characteristics and its physical properties is 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 PIFA and RFID antennas in the UHF band. These discussions include an understanding of the basic theory of these designs, equivalent circuit analysis, and ground plane effects. Antenna miniaturization techniques are also discussed using the definition of the antenna's electrical volume. In addition, determination of the small antenna's radiation efficiency is discussed by several measurement methods.