Miniaturized Planar Split-Ring Resonator Antenna

A miniaturized planar antenna based on a broadside-coupled split ring resonator excited by an arc-shaped dipole is presented. The excitation dipole acts as a small tuning capacitor in series with a parallel RLC circuit represented by the SRR. The antenna resonance frequency and dimensions are essentially determined by the SRR, while by varying the dipole arm length the input resistance is changed in a wide range, thus matching the antenna to a feed line and compensating for simulation and manufacturing inaccuracies. No additional matching network is required. Theoretically, there is no limit on how small this antenna can be. In practice, the lower bound is set by losses in utilized materials and manufacturing inaccuracies. As an example, an antenna of $k_0 = 0.09$ was designed, fabricated and tested. Although the initially fabricated antenna prototype had the input impedance of 43 ohms, it was subsequently tuned to 50 ohms simply by cutting out the excessive arm length. This tuning technique is especially useful in practical applications, since it allows the antenna to be tuned in-place and thereby compensate for various inaccuracies as well as for an antenna environment.