Ferrite loaded volumetric spiral antenna

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Wideband antenna miniaturization has been demonstrated using inductive loading embedded within dielectric/ceramic materials [1.Kramer et al., AP Trans., 2005, 2. Kramer et al., submitted to AWPL Trans., 3. Kramer et al., submitted to AP Trans.]. Distributed lumped loads (capacitors/inductors) have also been employed [4. Lee et al., AP Trans., 2007] to realize wave slow-down. In both case, the goal is to realize the wave slow down while the input impedance is concurrently kept nearly constant over the entire bandwidth.

Magnetic materials have the ease of concurrent impedance matching and wave slow down. However, inherent losses with magnetic materials have limited their use. In this paper, we begin with a characterization of various commercial magnetic materials to identify composites that have sufficient low loss tangent below 300-400MHz. Specifically, ferrite-polymer composites, such as Co_2Z-LSR (liquid silicone rubber) are pursued and fabricated to exhibit equal permeability and permittivity ($\varepsilon_r'=\mu_r'$) for impedance matching. Once the material properties are verified for antenna miniaturization, we proceed with ferrite and dielectric loading strategic placement and composite design to maximize loading effects. Concurrently, excessive loading is avoided to minimize weight without sacrificing performance.

At the meeting we will present (a) material performance, (b) performance of ferrite loading within a volumetric spiral coiling, (c) strategic incorporation of ceramic and ferrite materials for best miniaturization while weight is kept to a minimum, and (d) measurements to verify ferrite loading.