Abstracts

Filters using a new type of resonator: the partially-metallized dielectric slug

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In this paper, we show that a composite of a conducting metal and a dielectric material can be used to provide resonant frequencies lower than can be obtained through the use of the same volume of metal or dielectric alone. Because dielectric is both desirable in the formation of filter resonators and expensive, application in the wireless business requires prudent use of the dielectric, particularly in the frequency range below 2 GHz. We propose the application of an inexpensive metal (such as an aluminum ring or a sputtered copper-gold coating), to the circumference of a dielectric puck, leaving the top and bottom open. The ratio of puck dielectric constant to the dielectric constant of the surrounding environment (typically air) causes almost total reflection at the open ends. The fields are confined, resulting in resonance at frequencies almost the same as those of a totally enclosed dielectrically loaded waveguide of the same cross section (such as a metal cylinder closed on both ends, filled with dielectric). As compared to totally enclosed cavities, the open ends facilitate coupling to other resonators. The resonance frequency is essentially independent of the enclosure housing the resonator. It will be shown that for the same resonant frequency, metallization can substitute for more than half of the dielectric. The resulting resonator displays substantially equivalent resonance properties (lower, but still very high Q), but is smaller, possesses a wider spurious-free region, and is less expensive to manufacture. A finite-element package (HFSS) is used essentially as an experimental tool to validate a simple MATHCAD perturbation based method for computation of resonator properties.

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