Abstracts

A new approach to estimate complex permittivity of dielectric materials at microwave frequencies using waveguide measurements

M.D. Deshpande, C.J. Reddy, P.I. Tiemsin and R. Cravey. "A new approach to estimate complex permittivity of dielectric materials at microwave frequencies using waveguide measurements." 1997 Transactions on Microwave Theory and Techniques 45.3 (Mar. 1997 [T-MTT]): 359-366.

In this paper, a simple waveguide measurement technique is presented to determine the complex dielectric constant of a dielectric material. The dielectric sample is loaded in a short-circuited rectangular waveguide. Using a network analyzer, the reflection coefficient of the waveguide is measured. Using the finite-element method (FEM) the exact reflection coefficient of this configuration is determined as a function of the dielectric constant. The measured and calculated values of the reflection coefficient are then matched using the Newton-Raphson method to estimate the dielectric constant of a material. A comparison of estimated values of the dielectric constant obtained from simple waveguide modal theory and the FEM approach is presented. Numerical results for dielectric constants of Teflon and Plexiglas measured at the X- and Ku-bands are presented. Numerical inaccuracies in the estimate of the dielectric constant due to: 1) the presence of airgaps between sample and sample holder waveguide surfaces and 2) inaccuracy in the sample dimensions are also discussed.

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