Abstracts

Measuring the Permittivity and Permeability of a Sample at K/sub a/ Band Using a Partially Filled Waveguide

J.M. Jarem, J.B. Johnson, Jr. and W.S. Albritton. "Measuring the Permittivity and Permeability of a Sample at K/sub a/ Band Using a Partially Filled Waveguide." 1995 Transactions on Microwave Theory and Techniques 43.12 (Dec. 1995, Part I [T-MTT]): 2654-2667.

A novel method of measuring the relative complex permittivity (epsilon = epsilon' - j epsilon") and relative complex permeability (μ = μ' - jμ") of a material at K/sub a/ Band (26.5-40 GHz) using a partially filled waveguide (PFW) (rectangular) and a vector network analyzer (VNA) is presented. The method is based on 1) placing a material sample of length L, width a (waveguide width), and height d <= b (b is the waveguide height) in a rectangular waveguide, 2) measuring the S-parameters of the sample using the VNA, and 3) inferring the epsilon', epsilon", μ', and μ" parameters by comparing the experimental S-parameters with numerically generated S-parameters. The paper presents a method of moments analysis and also a variational formulation of the scattering that occurs from a finite length sample that partially fills a waveguide. Formulas to calculate the complex Poynting power and energy in the waveguide are derived to check the degree to which the numerical solutions obey the conservation of complex power. Numerical methods to extract the material parameters from the S-parameter data are proposed. The experimental PFW S-parameters of a radar absorbing material are measured and its dielectric material parameters are inferred.

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