Abstracts

A Graphical Method for Measuring Dielectric Constants at Microwave Frequencies

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This paper describes a graphical method for measuring the real and imaginary parts of the dielectric constant epsilon/epsilon/sub 0/ = epsilon' - j epsilon" of materials at microwave frequencies. The method is based on the network approach to dielectric measurements proposed by Oliner and Altschuler in which the dielectric sample fills a section of transmission line or waveguide. In contrast to their method, the network representing the dielectric sample is analyzed in terms of the bilinear transformation Gamma'=(aGamma+b)/(cGamma+d); ad-bc=4. The analysis proceeds from the geometric properties of the image circle in the r plane obtained by terminating the output line in a calibrated sliding short. The technique described retains the desirable features of the network approach but avoids the necessity of measuring both scattering coefficients. As a result the procedure is more direct and, in the case of the TEM configuration, leads to an entirely graphical solution in which the complex dielectric constant can be read from a Smith chart overlay.

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