The Study of Measurement and Analysis in Dielectric Materials of Microwave and The Application to Antenna Design

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ABSTRACT

Since microwave dielectric materials may greatly influence the performance of high-frequency devices, accurate characterization of microwave dielectric materials becomes very important in high-frequency circuit design. Although many methods have been proposed for measuring the constitutive parameters of a dielectric in the literature, they usually have some limitations. Among those methods, the procedure that employs an open-ended coaxial probe (referred to as the OECP method) is usually favorable, for it is relatively easy to use, simple, nondestructive, and of broad band in nature. In this study, the author will use an HP coaxial probe to measure the reflection coefficients of a material under test (MUT). From these coefficients, the frequency-dependent dielectric constants of a MUT can be computed using the formulas derived in this thesis. The computed dielectric constants are compared with those using the HP 85070D dielectric measurement system to validate the derived formulas. Moreover, with the help of these formulas, measured dielectric constants using a standard HP coaxial probe and those using a simplified laboratory-made open-ended coaxial probe are compared and studied. It is found that the low-cost dielectric measurement system established here can replace the expensive HP 85050D system. Finally, a microwave substrate with its high dielectric constant measured using this low-cost system is applied to design a chip antenna.

Keywords : microwave base plate, dielectric parameters measurement, open-ended coaxial probe, chip antenna

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In all these applications microwave materials have been used. The development of these materials and the study of their properties at microwave frequencies are very active areas in materials science, solid-state physics and electrical and electronic engineering. The development of high-frequency circuits require complete understanding of the properties of materials operating at microwave frequencies [Waser 2003]. Therefore a very important area in microwave electronics for many industries and scientists is the characterization of materials properties [Chen, Ong, Neo, Varadan, Varadan 2004, p. ... Even that the studied antenna contains two T-shaped slots which are responsible for internal coupling, accuracy of the modal analysis is sufficient, with the average error 10.7 %. Better results (see Tab. 2) could be achieved by further decreasing of the height h, with the average error 6.9 % in resonant fre-quency estimation.Â Feeding microstrip line is at the bottom of dielectric. substrate (GML 1000, Îµr = 3.2, tanÎ´ ~ 0.003) placed below the ground plane.Â A proper modeling of microwave circuits strongly depends on correct characterization of transmission lines, namely impedance and effective permittivity. The impedance evaluation is mainly influenced by discretization of a port cross-section and a size of its sur-face. 18. Measurement of the Dielectric Properties of Materials at RF and Microwave Frequencies. 18.1 Introduction. 18.2 Dielectrics - Basic Parameters.Â While the authors and the publishers believe that the information and guidance given in this work are correct, all parties must rely upon their own skill and judgement when making use of them. Neither the authors nor the publishers assume any liability to anyone for any loss or damage caused by any error or omission in the work, whether such error or omission is the result of negligence or any other cause. Any and all such liability is disclaimed. The moral rights of the author to be identied as author of this work have been asserted by him in accordance with the Copyright, Designs and Patents...