The Study of Measurement and Analysis in Dielectric Materials of Microwave and 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