

A new cavity-based method to measure the complex permittivity of dielectric materials is presented here. The method uses a double-ridged waveguide for the cavity instead of the widely used rectangular waveguides, thus enhancing the operational frequency bandwidth by twofold. The bandwidth enhancement is advantageous when measuring the permittivities of frequency dispersive specimens. Building on the perturbation theory, this paper develops the measurement equations required for permittivity extraction. The measurement errors induced by the approximations in the perturbation theory are evaluated using numerical simulations, and the errors are quantified for different specimen sizes and dielectric constants. The experimental results are also presented. The complex permittivities of three common plastic specimens are measured at frequencies of around 3, 5, and 8 GHz using one double-ridged cavity. For comparison purposes, the same samples are also measured using two rectangular cavities operating in the S- and X-bands. Good agreement in the measured permittivity values is observed.