A modified measurement technique and nonlinear least-squares solution method is introduced for determining complex permittivity and permeability in transmission lines. In addition to a two-port S-parameter measurement, a one-port measurement of the shorted sample is employed. For low-loss samples, material property determination using the traditional method can be plagued by resonances when the sample thickness is an integer multiple of the guided half-wavelength in the sample medium. The introduction of the shorted reflectivity measurement reduces the large uncertainties inherent in the resonance effect, and increases the likelihood of determining the correct zero in the fitting of the material properties. The short-circuited sample S_{11} measurement has an increased magnitude compared with the standard two-port measurement, which greatly reduces the uncertainty of this term. The resulting complex permeability and permittivity values obtained with this method are smoother improved solutions, and have lower uncertainty. Results are presented comparing the traditional Nicolson-Ross-Weir solution and National Institute of Standards and Technology iterative method with the proposed technique for a cast epoxy and a ferrite-loaded microwave absorber sample in WR42 waveguide. We also investigate finite element simulated S-parameters of a fictional material and compare the derived material parameters obtained with the proposed method to the “true” permittivity and permeability values.