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Modeling and measuring dielectric constants for very thin materials using a coaxial probe

ABSTRACT

This paper is focused on the non-destructive measurement of the dielectric constants (relative permittivities) of thin dielectric material (0.1-0.5 mm) using an open-ended coaxial probe with an outer diameter of 4.1 mm. Normalized de-embedding and network error calibration procedures were applied to the coaxial probe. The measured reflection coefficients for the thin samples were taken with a vector network analyzer up to 7 GHz, and the calibrated reflection coefficients were converted to relative dielectric constants using an empirical reflection coefficient model. The empirical model was created using the regression method and expressed as a polynomial model, and the coefficients of the model were obtained by fitting the data using the Finite Element Method (FEM).

Keyword: Relative effective permittivity; One-port calibration; Measured reflection coefficient; Open-ended coaxial probe; Thin dielectric substrate