

Determination of transmission coefficients and energy density of an overlay microstrip patch antenna for microwave filters and feeds designs using microwave methods

ABSTRACT

In designing filters and antenna feeds at microwave frequency, the energy density and stop bands are of vital importance. To this development, this work is set out to determine the transmission coefficients behavior of substrates along with their energy density for a microstrip structure using finite element method (FEM) and Vector network analyzer (VNA). In this work, a 15, 30 and 50 mm PTFE samples were used as an overlay substrate material on a patch microstrip antenna. Simulations and measurement were then carried using FEM and VNA, respectively. Transmission coefficient obtained via FEM and VNA were compared and the behavior of the substrates at 10 GHz were noted which is the area of broad stop band. Results from simulation and measurement showed that the energy density of the 50 mm thick substrates was 1.67×10^{-5} J/m³ while the attenuated power for the 15, 30 and 50 mm thick substrates at 10 GHz were 6.8, 8.0 and 14.6 dB, respectively. Based on these findings, it is concluded that the 50 mm thick PTFE substrates has the deepest stopband at 10 GHz and more suitable for filter designs and antenna feeds.

Keyword: Microstrip antenna; Filter; Energy density; Stopband; Transmission coefficients