

PERFORMANCE ANALYSIS AND PREDICTION USING CIRCUIT MODEL IN A MICROSTRIP PATCH ARRAY

Abstract

This work is an effort in investigating and modeling an accurate Circuit Model derived from the Transmission Line Method (CM/TLM) by simulating a rectangular microstrip patch array using two different simulation techniques, the Transmission Line Method (TLM) and Method of Moments (MoM). Each array contains two element units of rectangular patches, which is very accurately modeled. The array, which is a combination of several unit of this basic structure, is designed to resonate at 3G/UMTS frequency of 2 GHz. Both feed networks are simulated using Microwave Office™ software. Each technique will be evaluated and predicted using two sets of simulations (using CM/TLM and MoM). Both are then compared, and their level of variations in terms of bandwidth, resonant frequency (f_{res}) and S_{11} are determined. MoM-simulated structure is then fabricated and measured to determine the degree of distinction between hardware and the two simulation sets. Fabrication is done on an FR-4 board with a relative permittivity (ϵ_r) of 4.7. Antennas designed and simulated for each feeding technique achieved the best return losses at the desired frequency, which is 2 GHz, with S_{11} values lower than -10 dB. At the same time, both arrays produced relatively sufficient bandwidth for its kind which is about 2 %. CM presented in this work is observed to have less than 9% difference compared to its MoM counterpart in terms of S_{11} and resonant frequency (f_{res}), but very poor when used in predicting bandwidth's performance.