

Abstract

A rigorous method of moments (MoM) analysis of rectangular waveguide slot coupled hemispherical dielectric resonator antenna (HDRA) is the subject matter of this thesis. Basically two types of waveguide-fed HDRAs are analyzed using MoM: HDRA kept at the waveguide shorted-end and at the broad wall. In the first case of waveguide shorted-end, the HDRA is kept just above the slot on the thick ground plane with and without centered capacitive waveguide junction (CWJ). In the second case, HDRA is kept on longitudinal/transverse broad wall slot. The problems are formulated using the Green's function approach, where the unknown slot currents are solved using the MoM. The HDRA is modeled using exact magnetic field Green's function due to the equivalent magnetic current in the slot. The field inside the waveguide is expressed in terms of modal vectors and modal functions. Thickness of the slot is analyzed using a rectangular cavity dyadic Green's function. For the analysis of HDRA part, the modal series is represented as a sum of particular and homogeneous solutions. The particular solution is computed efficiently using spectral domain approach. Matching increases from 34% to 98% by using the CWJ. The slot when given an offset along its length and relative to the CWJ leads to dual band and wide band operations of the HDRA. For the broad wall slot coupled HDRA case, the performance in terms of radiation obtained for a single slot was enhanced by using an array of slot coupled HDRAs. In order to determine the effects of varying design parameters on the bandwidth and matching, parametric analysis is carried out using the MATLAB code developed for all the above cases of the antennas. Matching of waveguide-fed rectangular and cylindrical DRAs has also been improved by using CWJ. Theoretical results obtained for HDRAs and simulation results for the other DRAs have been experimentally verified.

Key Words

Broad wall Slot, Capacitive Waveguide Junction, Dielectric Resonator Antenna, Entire Domain Basis Function, Fourier Transform, Green's Function, Galerkin's Technique, Hemispherical DRA, Longitudinal Slot, Method of Moments, Modal Expansion, Spectral Domain, Slot Coupled DRA, Transverse Slot, Vector Potential Approach, Waveguide slot, Waveguide Shorted-End.