

A Compact Directive Microstrip Slot Antenna for Tetra-band Applications

Hamid T. Chorsi, Ryan Jacobs, and Mark Golkowski

University of Colorado Denver, Department of Electrical Engineering, Denver,
CO, USA

Ever since the introduction of the microstrip patch antenna in 1972 (Munson, R., Proc. of Twenty-Second Symp. on USAF Antenna Research and Development), it has been extensively used in modern communication systems due to its attractive properties of low profile, low weight, compact shape and low production cost. However, the major drawback of microstrip patch antennas is narrow bandwidth. A number of techniques have been proposed to address this issue (Jackson, D.R., Overview of microstrip antennas. Department of Electrical Communication Engineering, University of Houston, 2011.). The foremost method for increasing the bandwidth is by increasing the thickness of the dielectric substrate. However, the problem with using a thicker substrate is that the impedance matching becomes progressively intricate. In addition, a thick substrate does not lend itself to effective use of coplanar microstrip lines as feeds. More recent works have proposed several kinds of microstrip slot antennas for ultra wideband applications. Various designs such as C/U/F-shaped and Koch Fractal along with a U-shaped slot on the patch have been considered to increase the bandwidth.

In this work, a compact microstrip patch antenna has been designed by embedding two symmetric H-shaped feed lines along with a split-ring resonator (SRR)-shaped stub for achieving tetra-band operation. The antenna has overall dimensions of $30 \times 20 \times 1$ mm³ which is smaller than that of multi-band antennas reported recently. The proposed antenna provides four operating frequencies in 4.3 GHz to 15.2 GHz frequency range with low VSWR level (≤ 3) and good radiation properties. By properly tuning two H-shaped feed lines along with a single unit cell of a SRR, the radiation efficiency of 85% and the gain of about 5.5 dBi have been achieved. The antenna has the properties of low profile, easy fabrication and low cost. The results prove that the proposed antenna has promise for use in UWB communication.