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# Investigation of a Novel Dual Band Microstrip/Waveguide Hybrid Antenna Element

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**Abstract :** Microstrip antennas are low in profile, light in weight, conformable in structure and are now developed for many applications. The main difficulty of the microstrip antenna is its narrow bandwidth. Several modern applications like satellite communications, remote sensing, and multi-function radar systems will find it useful if there is dual-band antenna operating from a single aperture. Some applications require covering both transmitting and receiving frequency bands which are spaced apart. Providing multiple antennas to handle multiple frequencies and polarizations becomes especially difficult if the available space is limited as with airborne platforms and submarine periscopes. Dual band operation can be realized from a single feed using slot loaded or stacked microstrip antenna or two separately fed antennas sharing a common aperture. The former design, when used in arrays, has certain limitations like complicated beam forming or diplexing network and difficulty to realize good radiation patterns at both the bands. The second technique provides more flexibility with separate feed system as beams in each frequency band can be controlled independently. Another desirable feature of a dual band antenna is easy adjustability of upper and lower frequency bands. This thesis presents investigation of a new dual-band antenna, which is a hybrid of microstrip and waveguide radiating elements. The low band radiator is a Shorted Annular Ring (SAR) microstrip antenna and the high band radiator is an aperture antenna. The hybrid antenna is realized by forming a waveguide radiator in the shorted region of the SAR microstrip antenna. It is shown that the upper to lower frequency ratio can be controlled by the proper choice of various dimensions and dielectric material. Operation in both linear and circular polarization is possible in either band. Moreover, both broadside and conical beams can be generated in either band from this antenna element. Finite Element Method based software, HFSS and Method of Moments based software, FEKO were employed to perform parametric studies of the proposed dual-band antenna. The antenna was not tested physically. Therefore, in most cases, both HFSS and FEKO were employed to corroborate the simulation results.

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