CHAPTER-VII

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Microstrip antenna is a short of planar radiating structure having application in several systems like mobile communications, satellite communications, radar, and other many types of equipment. However, the single antenna has limitation that they can be utilized for single application. In this endeavor an attempt has been made to provide dual band operation for the different radiating structures and their theoretical analysis along with simulated and experimental results are compared. Although various aspects of the antenna have been broadly discussed in above chapters but for the sake of convenience the entire investigations are summarized in this chapter.

The investigation of dissimilar structures of semi-circular disk antennas along with MSA loaded with two symmetrical vertical notches and shorting pin has been carried. The MSA loaded with two symmetrical vertical notches and shorting pin depends on the size of the notch, shorting pin and height of the substrate as well as on dielectric constant. The theoretical and simulated results are in close agreement with reported experimental results of MSA loaded with two symmetrical vertical notches and shorting pin. On inserting the shorting pin and loading of notches on semi circular disk patch, the dualband is achieved at 2.84/6.33 GHz. The proposed antennas can be utilized in various S and C bands applications.

Analyses of two different radiating structures of L-strip antennas with and without shorting pin are investigated for dualband operation and discussed. The variation of reflection coefficient with frequency on increasing the width of the L-strip higher resonance frequency shifts towards lower side whereas lower resonance frequency remains almost constant. The bandwidth of lower and upper resonance frequencies of simulated result are 6.61% and 6.02 %, whereas theoretical values are 10.64 % and 9.06 % respectively. The L-strip fed with shorting pin
antenna has two different resonant frequencies which offers 1.3/6.13 GHz dualband operation. The theoretical and simulated results are in close agreement with experimental results of the antenna. As the antenna covers two different frequency bands i.e. L and S bands, it can be utilized for wireless and satellite communications systems.

An analysis of different structures of microstrip line fed antennas and F-shape antenna has been discussed. The F-shape antenna parameters depend on length of microstrip line, on increasing the length from 15 mm to 15.5 mm, lower and higher resonance frequencies shift towards lower side while on further increasing length up to 16.5 mm, multi-band is obtained as well as it also depends on width of microstrip line, height of the dielectric substrate and dielectric constant of the substrate. The theoretical and simulated results are in close agreement with reported experimental results of F-shape antenna. With two different resonant lengths the F-shape antenna offers 2.4/5.2 GHz dualband operation. With sufficient bandwidth and moderate gain, these antennas can be utilized in various wireless communication systems.

Analysis of compact slots loaded patch antenna has been presented and discussed. It is observed that an antenna characteristic depends on length of slots thickness $S_1$, $S_2$ and $S_3$ i.e. on decreasing the thickness of slots from 1.0 mm to 0.5 mm lower and higher resonance frequencies shift towards higher side, while on increasing the thickness of slot from 1.0 mm to 2.0 mm, lower and higher resonance frequencies shifts towards lower side whereas on varying the length of slot $S_i$ and $S_3$ from 24 mm to 12 mm, lower and higher resonance frequencies shift towards lower side while frequency ratio of the antenna remains unchanged. The bandwidth of the L-strip fed slot loaded compact rectangular microstrip patch antenna at lower resonance frequency is 1.16% (simulated) and 10.16% (theoretical) whereas at upper resonance frequency, it is 1.5% (simulated) and 2.51% (theoretical) and frequency ratio of the antenna is obtained as 2.03. The theoretical results are compared with IE3D and AWR simulation results and they are in agreement with measured results.
However, there are still many options open to carry on the investigations such as using aperture coupling, proximity coupling, L-probe etc. as a feeding technique instead of coaxial feeding which has been used throughout the analysis in the thesis. The effect of fractal shape patch, angular ring, sector and shorting wall may be useful to obtain compact and reduced size of the antennas. The integration of active devices such as Gunn diode, Tunnel diode and IMPATT diode with the patch can provide an additional tool in terms of its bias voltage that optimizes the various antenna parameters.

It is envisaged that the presented investigations may lead to design an antenna with improved performance.