ABSTRACT

With ever-increasing demand for reliable wireless communications, the need for compact and efficient antenna array is on the rise. In this research two methods of enhancing the performance of microstrip patch antenna arrays using Electromagnetic BandGap (EBG) structures and Frequency Selective Surface (FSS) are investigated. The effect of EBG structures and FSS in reducing mutual coupling between the patches is also studied.

In the first method, inset feed microstrip patch antenna array with EBG cells on either side of the feedline is studied. The proposed antenna array is designed to operate at dual band resonant frequencies of 3.12 GHz and 4.8 GHz, which is suitable for WLAN applications. Using suspended strip line method and dispersion diagram, band gap frequencies of EBG cells are found. Optimal positioning of EBG cells near the inset feedline is obtained by a parametric study. Placing EBG cells at the inset feedline reduces the patch antenna array size by 32%, when compared to the antenna array with conventional placement of EBG cells around the patch antenna array. Placing EBG cells on both side of the inset feedline also reduces spurious radiation and feed network losses. The parameters analyzed are return loss, bandwidth, radiation pattern, VSWR and mutual coupling between the patch elements. The simulated values and measured values are in good agreement with each other.
In the second method, the same microstrip antenna array with aperture coupled feed is studied using FSS as a superstrate layer. This design uses a multilayer antenna design approach. In aperture coupled antenna array the slot is designed as an U-shaped aperture. The U shaped slot resonates at frequencies of 3.12 GHz and 4.8 GHz. The enhanced performance of the microstrip patch antenna array is obtained when placing FSS as a superstrate layer. The aperture coupled microstrip patch antenna array is designed for two and four elements with and without FSS. The FSS is characterized for specified band of operation. The dimension of these metal patches and the height at which the FSS is placed from the radiating patch are obtained from parametric study. Here again the performance of the aperture coupled microstrip patch antenna array is studied for various parameters such as return loss, radiation pattern, VSWR, bandwidth and mutual coupling between patches. Analytical results obtained using CST simulations are presented. Experimental results are also presented and compared with the simulated results.