PREFACE

In the low-profile multi-element antenna systems, the performance of the antenna elements is severely affected due to the mutual coupling between them. A number of isolation enhancement techniques were utilized in the past. The isolation enhancement techniques based on metamaterial are emerging nowadays to overcome the limitation of the existing techniques. The potential of metamaterial absorber as an isolator is explored in the present thesis.

In the present thesis, the endeavor has been made to develop the multiband metamaterial absorber to mitigate the difficulty of achieving absorption in multiple frequency bands due to the strict resonance conditions of the resonator. This is achieved by a combination of closed ring resonator and square patch in a single unit cell. The proposed structure is a three-layered structure in which top and bottom metallic layers are separated by the dielectric substrate. Polarization-insensitive behavior is realized by the symmetrical structure of the unit cell. Simulation study of the presented absorber is carried out using CST Microwave Studio. The parametric variations are studied to understand the dependence of absorption frequencies on the design parameters. The absorption mechanism is explained with the help of *E*-field and surface current distribution plots at the peak absorption frequencies. Constitutive electromagnetic parameters of the presented structures are retrieved. A sample of the proposed absorber is fabricated and free space measurement method is used to obtain the measured results. The measured and simulated results are in close agreement. It is observed that the proposed structure works well up to an angle of incidence of 60^0 and hence, shows wide-angle performance. Further, the variant of the presented resonator is used to mitigate the mutual coupling between four-elements MIMO antenna. The details of which are given in various chapters that embody the present thesis.

The brief introduction of the effect of coupling in multi-element antenna systems is presented in chapter one. The state-of-the-art review of various isolation enhancement techniques along with the motivation, scope, and structure of the thesis is also presented.

A compact and ultrathin metamaterial absorber with dual-band absorption characteristics in C- and X- frequency bands is presented in chapter two.

To get the good physical insight of the resonance behavior of the structure presented in chapter two, an equivalent circuit model based on transmission line method is proposed in chapter three.

A quad-band compact and ultrathin absorber structure with absorption in C- and X-frequency bands is proposed in chapter four. The proposed unit cell geometry utilizes a 2 x 2 array of the variant of electrical resonator presented in chapter 2 in a single unit cell to achieve quad-band absorption. All four resonators are oriented perpendicular to each other in a unit cell to achieve symmetrical structure.

A variant of the resonator presented in previous chapters is employed in chapter five to decouple antenna elements of a four-element MIMO antenna array suitable for indoor 5 GHz WLAN access point applications. An array of asymmetric metasurface unit cell is employed as an isolator between the antenna elements.

Finally, the summary and conclusion along with the key findings are presented in chapter six. The scope for the further work on the presented topic is also briefly discussed in this chapter.