

## Mutual Coupling Reduction between Two Closely Spaced Inverted-F Antennas

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Recent demands for miniaturized, lightweight, high data rate, and reliable wireless devices motivated researches and designers of wireless systems to adopt the use of multiple input-multiple output MIMO antenna arrays with close proximity of each other. One of the difficulties is to overcome the problems associated with the low isolation between any two closely spaced antennas. The low profile, small size, ease of fabrication, and simplicity of design encourage the use of the IFA/PIFA antennas. In this paper, two vertical IFA antennas with close separation of  $\lambda_0/15$  ( $\ll \lambda_0/2$ ) fed by coaxial lines are combined in an array operating at the frequency of 2.5 GHz. The two antennas are deployed on a ground backed substrate of 50 mm  $\times$  50 mm in length and width respectively and a thickness of 1.524 mm with a relative permittivity,  $\epsilon_r$  of 10.2. Each IFA consists of a monopole as the main radiator with a length of 38 mm and a diameter of 1.22 mm placed 11 mm above the ground plane. The separation between the feeding point and the grounded end of the radiating element is 10 mm. The consequence of positioning the antenna in the proximity of each other is the high mutual coupling. To decrease the resulted effects, a new Defected Ground Structure (DGS) has been proposed. A rectangular slot of 32 mm and width of 1.5 mm with a strip line of 29 mm in length and a width of 1 mm have been introduced to the ground plane. The final proposed array with the DGS is shown in the attached figure. The Defected Ground Structure (DGS) has the effect of reducing the interaction between the antennas, main radiators, by restricting the current flow in the ground plane. A parametric study has been carried out to obtain the optimum dimensions of the structure using Ansys High Frequency Structure Simulator (HFSS). The S-Parameters of the design are shown in the enclosed figure. The antenna has an operating frequency of 2.5 GHz. A total isolation level of -22 dB has been achieved by the proposed structure at the operating frequency. The array with the proposed ground structure provides a gain of 3.9 dB at 2.5 GHz when the two ports are excited. This structure is a good candidate for reducing the mutual coupling between two vertical IFA for application utilizing MIMO techniques.

