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Circularly polarized microstrip antenna array

A microstrip antenna has a very thin small metallic patch or patches on a dielectric substrate, which is a small fraction of wavelength above a ground plane. The radiating elements and the feed lines are photo etched on the dielectric substrate. It is a low weight, low profile antenna. It can be also made non-planer. It is easy to manufacture and is inexpensive. These patch antennas have certain limitations such as the restricted bandwidth of operation and therefore they can be used in narrow band applications. These types of antennas are very popular for use in the microwave and millimeter wave regions particularly in air applications.

A circularly polarized square patch antenna array with patches was designed. It can be easily mounted on an aircraft ski where the geometry and the weight of an antenna are subject to constraints. The thickness of the antenna is 1.6 mm and has an area of 6.4 cm x 9 cm. Resonance cavity model was used to analyze the antenna radiation pattern and transmission line model resonates at a frequency slightly above the resonance frequency of the patch antenna is (f1+f2)/2. Matlab was used to obtain the necessary design parameters. Matlab was also used to obtain the theoretical radiation patterns. Ensemble was used for 2D modeling. A microstrip transmission line feed network was used to feed the antenna array therefore the resultant antenna unit is fully integrated.

The design criteria and the results of a “four square patch antenna array” that was constructed to radiate or receive electromagnetic waves with right hand circular polarization are also presented. The antenna was designed to operate at a frequency of 9.4 GHz. It was etched on an epoxy glass fiber substrate, which has a relative permittivity of 2.91. The antenna far-field radiation patterns in the E and H planes were measured and compared with the theoretical patterns. They both showed an almost hemispherical radiation pattern in both planes. The antenna has a gain of 4.5 dBi at the design frequency and it has an axial ratio of 1.4. Thus with a slightly higher gain it would be a promising antenna for an application such as for aircraft to satellite communication.