Design of Directive Microstrip Array Antenna with a Corporate Feed Arrangement

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Abstract

Recently, microstrip patch antennas are widely used in high performance applications where the size, cost, weight and ease of fabrication are vital factors. Our aim in this project is to design and fabricate a linear array of microstrip antenna that resonates at 10 GHz and has a directive radiation pattern.

The designed antenna contains four individual components: power divider, phase shifter, linear array of radiators along with a superstrate of frequency selective surface. The design process was conducted using theoretical equations and simulated by (HFSS). A PCB plotter was used for the fabrication process, and the performance is tested using network analyzer and (ATMS).

Design of 3-Element Array Antenna

In applications, where the further directivity is required, such as air crafting radars and speed monitoring devices, the single patch antenna is not recommended since it has large radiation angles with lower gain. However, a linear array of patches can provide a higher gain with further directivity.

Design of Corporate Feeder

The design of corporate feeder for broadside array antenna is carried on, using equations of microstrip line design, to be operated at 10GHz. Signals, that are feeding antenna elements, share identical amplitude and phase.

Fabrication and Testing

This design has been fabricated using PCB plotter and tested using network analyzer and ATMS.

Design of FSS Superstrate

To improve the directivity of the antenna, a frequency selective superstrate (FSS) is used to implement a Fabry Perot cavity (FPC) antenna. A 27X2 FSS superstrate, placed on 3-element array antenna, have been designed and simulated with considerable enhancement in directivity.

Design of Shorted Patch Array Antenna

Another technique to increase directivity is to use a reduced size patches loaded with shorting posts to maintain the radiation characteristics of original patches. An array antenna of 7-shorted patches have been designed to operate at 10GHz

Future Work

The design of 7-patches array antenna fed by corporate network is to be optimized to have a further directive radiation pattern. In addition, an FSS superstrate is to be added to enhance the directivity. Furthermore, a tunable phase shifter is recommended to be designed to enable beam scanning control.