INTEGRATION DESIGN OF 2.4 GHZ MICROSTRIP PATCH WITH SIW ANTENNA STRUCTURE

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Abstract

In this paper, the integration design of the microstrip patch antenna with SIW antenna structure was proposed. SIW technology represents an emerging for the development of circuit and components operating in the microwave and millimeter-wave region. The proposed rectangular microstrip antenna by adding SIW technique is stimulated at 2.4 GHz operating frequency with Teflon dielectric constant 2.1 and loss tangent equal to 0.0002 to analyze the antenna performance. For the simulation, antennas are numerically investigated using High-Frequency Structure Simulator (HFSS) software. The simulation result shows that with the integration of the SIW design, the antenna gain can be significantly improved. Moreover, a very significant improvement of thereturn loss of -22.63 dB comparing to the original patch antenna which only reported to obtained return loss of -10.36dB.

1 Introduction

Antenna is a sensor and transducer that converts electrical signals into electromagnetic waves and electromagnetic waves into electrical signals. Microstrip antenna was first introduced in the 1950s. However, the technology of Printed Circuit Board (PCB) was later introduced in 1970s.In its most basic form, a microstrip patch antenna consists of a radiating patch on one side of a dielectric substrate which has a ground plane on the other side. In recent years there is a need for more compact antennas due to rapid decrease in size of personal communication devices [1]. A rectangular patch is used as the main radiator. Substrate integrated waveguide implement on a piece of printed circuit board by emulating the side walls of a waveguide using two rows of metal posts or vias [2].

There are several advantages of this type of patch antenna, such as being planar, small in size, simple in structure, light weight, low in cost, compatibility with printed circuits and easy to be fabricated. The study and the design of rectangular patch antenna by adding SIW technique is presented in this research paper. We begin first with schematic model of the rectangular patch antenna. After, the different simulations of circuit conceived are studied and we finish by conclude our work. results in a demand for similar reductions in antenna size and return loss. In addition to this, low profile antenna designs are also important for fixed wireless application. The microstrip antennas used in a wide range of applications from communication systems to satellite and mobile applications.

In order to simplify analysis and performance prediction, the patch is generally rectangular shape. The rectangular microstrip patch antenna is the widely used of all the types of microstrip antennas that are present. The substrate material, dimension of antenna, feeding technique will determines the performance of microstrip antenna. To enhance the gain, the array of patch elements is used instead of single patch. Hence among different feeding techniques, edge fed technique is used for the design of rectangular microstrip patch antenna at 2.4 GHz. The substrate material mainly used for design technique is Teflon with low dielectric constant 2.1and the loss tangent is 0.0002 with SIW addition.

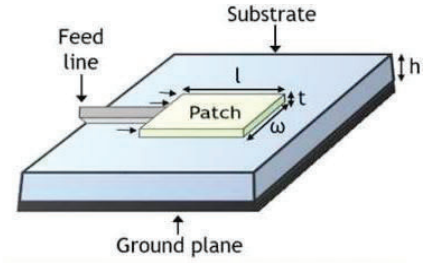

Fig.1 Rectangular microstrip patch antenna.

2 Gap Analysis

Based on the gap analysis in Table 1, most of the researchers used High Frequency Simulation Software to design antenna because its automatic adaptive meshing techniques, which require you to specify only geometry, material properties and the desired output. Teflon which have low dielectric constant. FR4 epoxy glass substrates are the material of choice for most PCB applications. The material is very low cost and has excellent mechanical properties, making it ideal for a wide range of electronic component applications while Rogers RT/Duroid 5880 high frequency laminates are PTFE composites reinforced with glass microfibers. RT/Duroid 5880 laminates has low