Substrate Integrated Waveguide (SIW) inductive window band-pass filter based on post-wall irises

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Received : 1 September 2009
Published online :

Abstract. In this article, we demonstrate a new inductive-window 5.245-GHz-band-pass filter based on post-wall irises by standard PcB process on Epoxy FR4 substrate. A new and easy to build microstrip-to-waveguide transition that consists of three tapers is also designed to connect the filter to standard measurement system. Both simulated results and measurements have shown insertion-loss lower than 5 dB within 14% bandwidth around 5.245 GHz and input return loss better than 25 dB over the frequency range.

PACS. 41.20.-q Applied classical electromagnetism - 41.20.Jb Electromagnetic wave propagation; radiowave propagation.

1 Introduction

Filters are widely used in satellite and modern communication systems. General requirements for these filters are low insertion loss, high power capacity, small size and high rejection with low cost realization [1]-[2].
Rectangular waveguide components have advantages over other planar transmission structures for microwave and millimeter-wave band applications because of their low loss and high Q-factor. But their high cost and difficult integration to planar circuits prevent these components from being used in low-cost high-volume applications. Recently, a new concept of substrate integrated waveguide (SIW) technique has been proposed [3].
Many components such as antennas, power dividers, filters and diplexers, based on SIW technology have been reported [4]-[6]. This technology offers a good option for the design of microwave and millimeter-wave filters. It provides a low profile, low cost standard printed circuit boards (PCB) and low weight scheme while maintaining high performance [7]-[9].
SIW structures are realized by two bilateral walls of periodic metallic via-hole arrays in substrate and grounded planes which can be easily interconnected with other elements of the system on a single substrate platform without tuning. This system can be miniaturised into small package (called the system in package - SIP) with small size and low cost [10].
This paper presents the design and performance of a new inductive-window filter using post-wall irises operating around 5.245 GHz. We begin with a brief analysis of C-band SIW-microstrip lines. Then, a new stepped transition is proposed to connect SIW circuits to microstrip ones. The filter is designed and fabricated by using low cost printed circuit board (PCB) technology. The measurements are performed by means of a vector network analyzer (HP8720C). Electromagnetic simulations and measured responses of the filter are presented to validate the proposed approach. Compared to previous studies related to SIW filters using post-wall irises, a wide bandwidth operation of about 14% and return loss better than 25 dB are achieved by the proposed filter associated to stepped transitions [11]-[13].