Dielectric Waveguide Filter with Cross Coupling

D. S. Jun, H. Y. Lee, D. Y. Kim, S. S. Lee, E. S. Nam, and K. I. Cho
Electronics and Telecommunications Research Institute, Korea

Recently, commercial millimeter wave applications such as 60 GHz communication systems or 77 GHz autonomous cruise control highly require surface mountable planar millimeter wave bandpass filters with a narrow bandwidth for low cost and compact integration of RF (Radio Frequency) front-ends. Metallic rectangular waveguide filters result in high production costs and bulky integration to planar circuits.

In this paper, we describe newly developed three resonator dielectric waveguide filters. The reduction in the number of resonators contributes to the compact, which is smaller than the previous three resonator dielectric waveguide filters. To improve stop band rejection for filters with a smaller number of resonators, cross coupling between 1st and 3rd resonators is introduced by twodimensional arrangement of resonators, which provides an attenuation pole at the higher frequency side of the pass band. The coupling between resonators is introduced by three-dimensional arrangement of resonators, which expect low cost and compact integration of RF front-end modules.

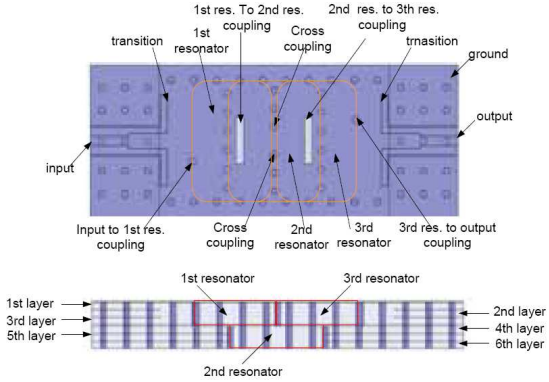

Figure 1: Schematic layout of BPF.

The waveguide structure is by forming metallized through holes in a dielectric substrate with metallized surfaces. In order to cross coupling for attenuation pole, the resonators are arranged twodimensionally. The structure facilitates realization of cross coupling by the space between though holes. T-shaped waveguide to GCPW (Ground Coplanar Waveguide) transitions lead to input/output ports, which enable flip chip bonding or external system probe connecting. The space between though holes around the input/output port must be sufficiently narrow to avoid propagation of the waveguide mode within the waveguide because a wide spacing can cause unwanted coupling. Also, the space between though holes of the waveguide structure must be sufficiently narrow to decrease radiation loss because a wide spacing can cause to increase insertion loss.

Planar dielectric waveguide filters with cross coupling were developed for 60 GHz band applications. The filters were fabricated using LTCC (Low Temperature Cofired Ceramics) for transceiver module. These filters will be applied to high-speed wireless communication systems.

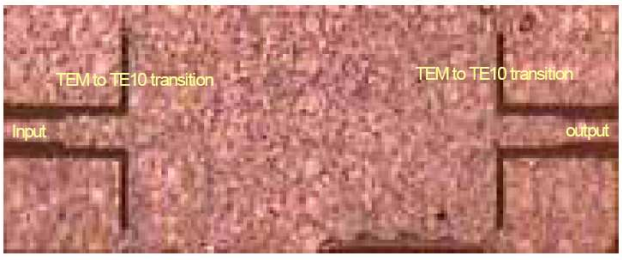

Figure 2: Photograph of a fabricated BPF.

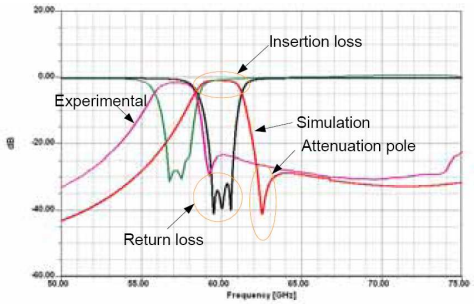

Figure 3: Experimental and simulation results of BPF.