

Filtering of a large band wavelength signal by a microstub cavity grafted on a straight guide

Y. Pennec, B. Djafari-Rouhani, M. Beaugeois, A. Akjouj, J.O. Vasseur, L. Dobrzynski,
M. Bouazaoui, J.P. Vigneron, R. Fikri
Y. Pennec / iemn, CNRS 8520, Université Lille 1, 59655 Villeneuve d'Ascq, France

The aim of this work is to discuss, using finite difference time domain simulations, the filtering efficiency of a resonator device constituted by a straight dielectric waveguide coupled to a rectangular cavity disposed on each side of the guide, forming a cross. Such a cavity is called a stub. Owing to their very small size, microstubs could serve in future complex and highly integrated structures. We search to realize the filtering of some specific wavelength, as telecom frequency, from a large band input signal.

We show that the coating of the dielectric stub with a metallic material is necessary to reinforce the interaction between the waveguide and the resonance modes of the stub and thus filtering several narrow frequencies. We show how the dips in the transmission spectrum evolve as functions of the length and the width of the stub. The above trends are explained in the frame of a simple analytical model considering the electromagnetic modes of a finite rectangular cavity. To give a deeper insight about the above comparison, we present maps of the magnetic field obtained from the FDTD calculation for several monochromatic incident waves corresponding to the frequencies of the zeros of transmission. Finally, we examine the effect of a small thickness air gap between the stub and the waveguide on the quality factor.