

基于 EMSIW 的多零点小型化滤波器设计

梁 青¹ , 王 超¹ , 张国鹏¹ , 熊 伟²

(¹ 西安邮电大学 电子工程学院, 陕西 西安 710121; ² 西京学院 理学院, 陕西 西安 710199)

摘 要: 为改善基片集成波导(Substrate Integrated Waveguide, SIW)滤波器的有效尺寸和插入损耗, 提出了一种新型的八分之一模基片集成波导 (Eighth-Mode Substrate Integrated Waveguide, EMSIW) 带通滤波器. 采用八分之一模基片集成波导作为腔体, 并使用双层 PCB 结构, 可使滤波器较原始尺寸减少 90% 以上; 利用其边缘效应, 以缝隙耦合的方式实现电磁能量传输, 改善插入损耗; 通过设计腔体间的交叉耦合结构, 使通带两侧处各引入一个传输零点, 提高其选择性和带外抑制水平. 仿真结果表明, 滤波器的中心频率为 3.9 GHz, 插入损耗为 1.06 dB, 且有效尺寸仅为 9 mm × 9 mm, 在 0~8 GHz 的频谱范围内带外抑制均大于 40 dB.

关键词: 八分之一模基片集成波导; 小型化; 交叉耦合; 传输零点; 带外抑制

Design of multi-zero miniaturization filter based on EMSIW

LIANG Qing¹ , WANG Chao¹ , ZHANG Guo-peng¹ , XIONG Wei²

(¹ School of Electronic Engineering, Xi'an University of Posts and Telecommunications, Xi'an 710121, China;

² Xijing University School of Science, Xi'an 710199, China)

Abstract: In order to improve the effective size and insertion loss of the substrate integrated waveguide (Substrate Integrated Waveguide, SIW) filter, a novel 1/8 mode substrate integrated waveguide (Eighth-Mode Substrate Integrated Waveguide, EMSIW) band-pass filter is proposed. Using 1/8 mode substrate integrated waveguide as cavity and using double-layer PCB structure, the filter can be reduced by more than 90% compared with the original size, and the edge effect of the filter is realized by slot coupling. Electromagnetic energy transmission can improve the insertion loss, and by designing the cross-coupling structure between cavities, a transmission zero is introduced at each side of the passband to improve its selectivity and out-of-band suppression level. The simulation results show that the center frequency of the filter is 3.9 GHz, the insertion loss is 1.06 dB, the effective size is only 9 mm × 9 mm, and the out-of-band suppression is more than 40 dB in the range of 0~8 GHz spectrum. Physical processing is carried out to verify the conclusion, and the test results are in good agreement with the simulation.

Key words: eighth-mode substrate integrated waveguide; miniaturization; cross-coupling; transmission zero; out-of-band suppression

作者简介:

梁 青 女, (1966-), 硕士, 教授. 研究方向为无人机自组网技术.

王 超(通信作者) 男, (1995-), 硕士研究生. 研究方向为射频电路设计与天线理论.

E-mail: chao_7584285@163.com

张国鹏 男, (1994-), 硕士研究生. 研究方向为射频与微波器件.

熊 伟 男, (1965-), 博士, 教授. 研究方向为无线传感器网络.