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Compact Triple-Band Bandstop Filter Using Folded, Symmetric Stepped-Impedance Resonators

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Abstract. A compact bandstop filter composed of eight folded stepped-impedance resonator cells for triple-band stopband is presented. Based on the analysis of unit structure's characteristic and parametric analysis, it is found that the result of input output connecting lines with proposed stepped-impedance resonator cells exhibits three transmission zeros. Through tuning the geometry parameters in a small range, the design flexibility of transmission zeros is depicted. Then, the influence of different amounts of folded, symmetric resonator cells is researched for the sake of getting the characteristic of triple-band rejection. Via optimization, a compact triple-band bandstop filter adopting eight stepped-impedance resonator cells has been fabricated and measured. Three center frequencies at 3.8, 6.7 and 9.5GHz are reported corresponding to the attenuation level of 54.3, 37.4 and 27.5dB with return losses of 0.11, 0.25 and 0.71dB. Additionally, there are two transmission poles on the right and left sides of each stopbands for better selectivity. Owing to the folded shape, the totally size of the proposed structure gets reduced.

Keywords

Folded stepped-impedance resonator cell; triple-band; bandstop filter.

1. Introduction

In the era of advance microwave communications, high performance filters are required and researched [1-9]. Microstrip bandstop filters have advantages in blocking interfered signals owing to low weight and easy fabrication. So, they are widely utilized in microwave applications. In recent years, defected ground structure (DGS), defected microstrip structure (DMS), dual composite right/left-handed transmission line(D-CRLH-TL), stepped-impedance resonator (SIR) and uniplanar double spiral resonant cells (UDSRCs) are adopted in the design of bandstop filter [10-16]. In literature [10], a bandstop filter composed of uniplanar double spiral resonant cells is fabricated; it has a wide bandstop rejection. In literature [11], a dual-band bandstop filter is presented using two defected stepped impedance resonators embedded on transmission line. The structure induces two transmission zeros. The method using composite right/left handed transmission line [12-13] is adopted in dual-band bandstop filter. In literature [14], the bandstop filter with inner T-shaped defected microstrip structure is studied. Moreover, coupled-line stubs [15] and dual-mode complementary split-ring resonator [16] could also induce two stopbands. Recently, defected ground structure and stepped-impedance resonators are applied in dual-band bandstop filter[17-18], in literature [17], one defected ground structure pair is utilized to obtain one stopband and stepped impedance resonators are adopted to realize another stopband. Two meandered-line stepped-impedance resonators in literature [18] are used in the structure of dual-band bandstop filter. What's more, novel stepped-impedance resonators are also applied in the structure of dual-band bandstop filter with characteristics of miniaturized and great selectivity [19-20]. However, most of the structures in the open literature have been designed with one or two stopbands [21-24].There are a few reports about employing stepped-impedance