Miniaturised microstrip dipexers for WiMAX application

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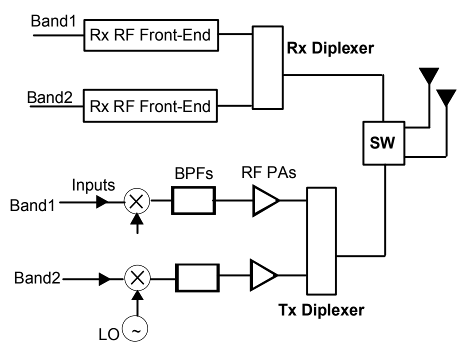
Introduction

Wireless RF and microwave communication systems are a rapidly expanding market. Such systems commonly employ filters and diplexers in RF and microwave transceivers as channel separators. Hence there is an increasing demand for low cost, low loss, small size and light weight bandpass filters and diplexers [1]. At present most microstrip diplexers at RF and microwave frequencies are produced in planar technologies such as microstrip, suspended substrate stripline and coplanar waveguide. Several approaches of design of microstrip diplexers were proposed [2]-[5].

This paper demonstrates the use of the microstrip ring resonator properties in order to achieve miniaturization of microstrip bandpass filters for diplexer and multiplexer applications. A compact microstrip diplexer for WiMAX applications (Fig. 1.) that incorporates these two filters and microstrip T-junction is presented. The proposed filters and diplexers have advantages of simplicity and compactness. Simulation results for microstrip filters and analysis and design of the proposed diplexer are presented.



Fg. 1. Traitional structure of WiMAX RF Front-End

Proposed Filter and Diplexer Structures

The geometry of a bandpass filter using microstrip ring resonator is illustrated in Fig. 2. The microstrip ring resonator is fed by a pair of perpendicular 50 Ω feed lines and each feed line is coupled with the ring by a coupled-line structure with a coupling gap of 0.4 mm. The proposed filter structure has a 1.51mm thick dielectric substrate Rogers RT/Duroid 5880 with a relative dielectric constant of

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2.2. ($\varepsilon_r = 2.2$). The filter uses a single loop resonator with a size 17.5 mm x 17.5 mm.

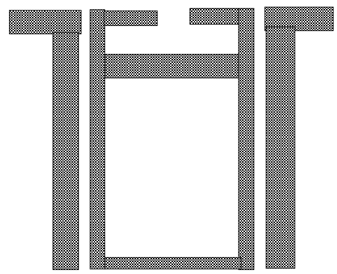

Fig. 2. Layout of the proposed microstrip filter using ring resonator

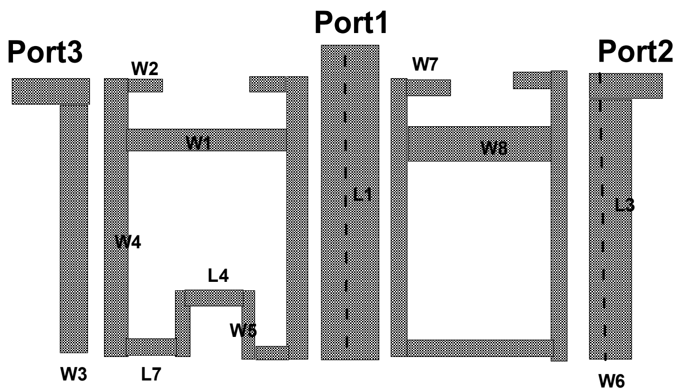

Fig. 3. Layout of proposed microstrip diplexer

The filter is designed to produce two transmission zeros, one at the upper stopband and one at the lower stopband. Fig. 3. illustrates the layout of the proposed diplexer.

Simulation Results

In order to validate the argument made the proosed bandpass filter and diplexer structures have been designed and simulated. The bandpass filters and diplexer were simulated by using Agilent ADS *Momentum* simulator [8]. Fig. 4. shows the simulated insertion losses (S21-parameters) of the lower channel and upper channel proposed filters. The simulated insertion loss and return loss of the diplexer are shown in Fig. 5.

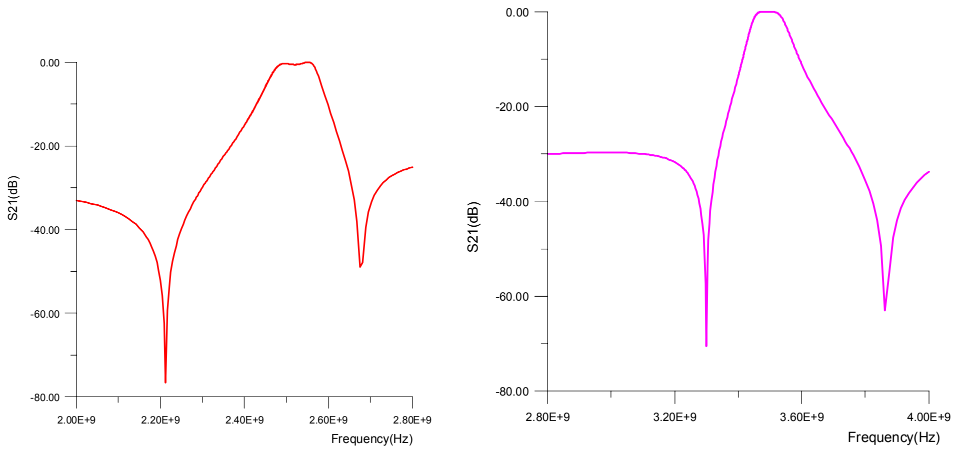

Fig. 4. Insertion Losses of (a) lower channel filter and (b) upper channel filter

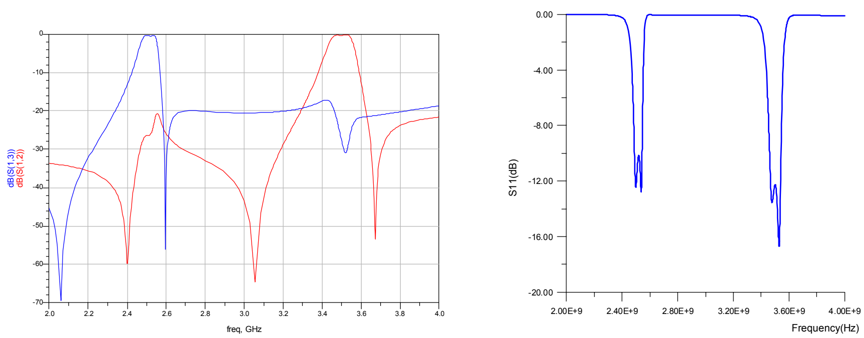

Fig. 5. Simulated insertion and return losses of the proposed diplexer

The lower channel filter (channel 1) was designed to have pass band centered at 2.5 GHz and the upper channel filter (channel 2) with pass band at 3.5 GHz. According the simulation diplexer has very good transmission and reflection characteristics on both channels. The isolation between channels is very high.

Conclusion

Miniaturised microstrip diplexer and bandpass filters using single ring resonators with good transmission and reflection characteristics on each channel for WiMAX applications have been presented. The size of the proposed diplexer is reduced. The diplexer is easy to manufacture and the results are easily reproducible. The improvement of the performance of diplexer through introduction of additional transmission zeros is under investigation.

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