Selectivity Improvement in Dual-Band Band Pass Filter by Coupled Complementary Split Ring Resonators

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With the advent of modern wireless communication technologies, single transceivers operating at multiple frequency bands have become popular. However, there are challenges in the design of dual-band filter supporting high performances and compact size. In this paper we propose the design of dual-band bandpass filter for Worldwide Interoperability for Microwave Access (WiMAX) and Wireless Local Area Network (WLAN) applications, providing selectivity enhancement using complementary split ring resonators CSRRs. It consists of two-pole parallel coupled bandpass filter with null coupling gap for middle section, as shown in Fig.1. From Fig.2, it can be observed that the filter exhibits good performance in term of return loss with low insertion loss in the desired frequency bands of 3.4 GHz and 5.5 GHz. However the rejection between bands is poor. This limitation can be overcomed by etching two CSRRs in the ground plane, exactly below the 50 Ω transmission line to improve the filter response. Fig.2 shows the cases implementing the CSRRs compared to the initial design. It can be seen that by using the same CSRR radius (2.2 mm) we achieve good rejection values at 4.2 GHz, whilst introducing slight band shifting and degradation in the WLAN band. However by applying two different radius (1.5 mm and 2.2 mm), a good response is obtained with insertion loss lower than the first case for the WiMAX band and sharp rejection at 6.7 GHz. The proposed design allows the potential implementation of simple and low cost dual band filters, scalable to different systems.

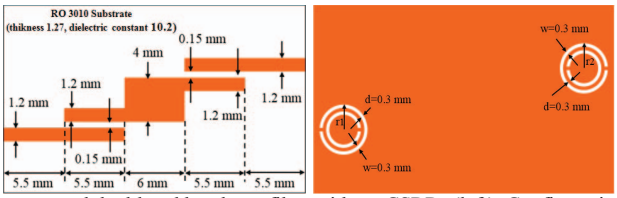

Figure 1. Layout of the proposed dual-band bandpass filter without CSRRs (left). Configuration of ground plane with embedded CSSRs (right).

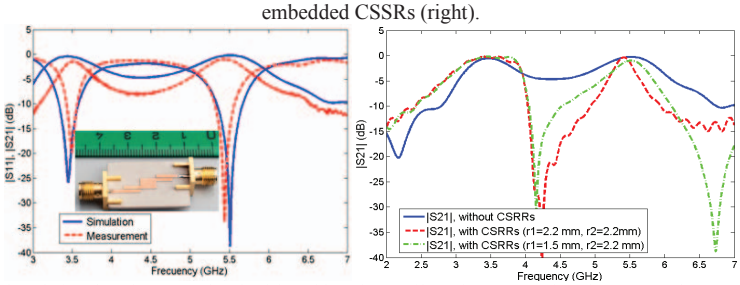

Figure 1. Measured and simulated S21 of the dual-band bandpass filter (left). Simulated insertion loss of the proposed dual-band filter for two different radius of CSRRs radius (right).