

Abstract

UWB technology has attracted the attention of researchers from academia and industry after the legalization of 7.5 GHz (3.1-10.6 GHz) bandwidth by FCC for UWB wireless communication system in 2002. The design and analysis of UWB filters are more challenging compared to narrowband filters due to two main reasons. Firstly, it should have a wide operational bandwidth as specified by FCC. Secondly, it has to be small in size with the desired filter characteristics for ease integration with UWB systems. The objective of this work is to design and investigate several compact UWB filters in order to understand the various design aspects of wideband filter design.

A number of novel UWB/wideband filters are designed and their characteristics are investigated. These filters are designed using multimode resonators (MMR). To improve the selectivity and good out-of-band performance of UWB filters two stages of multimode resonators are employed. This is achieved with the use of fish spear shaped MMR. To overcome the in-band interfering signals, single/dual band notch UWB bandpass filters are designed. The band notch characteristic is obtained with the split ring resonator (SRR) and shorted stepped impedance resonator (SSIR). This is following by introducing reconfigurability in the filter design in order to utilize the spectrum efficiently. Reconfigurability in the context of band rejection using two capacitors in the UWB filter design is demonstrated. Finally, several compact differential UWB filters are designed in order to overcome issue of environmental noise and electromagnetic interferences.

Keywords: Ultra Wideband Band (UWB), Microstrip Filter, Multi Mode Resonator (MMR), Bandpass Filter (BPF), Band notch, Reconfigurable, Differential filter, Differential Mode (DM), Common Mode (CM), Slotline Resonator.