

Chapter 13

Design of a Waveguide Bandpass Filter for Satellite Applications

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ABSTRACT

The design of microwave filters is a critical issue in the modernistic sphere of microwave engineering, especially waveguide technology. It has known an up growth in the last few decades for its significant addition in many distinct microwave applications, especially in the implementation phase of RF and microwave filters, despite the fact that this technology is not suitable for operations at low frequencies due to its expanded dimensions, that it is not fitting by reason of size, cost, and flexibility. In this chapter, the authors present a brief state of the art about RF and microwave filters, considering the types, the characteristics of these devices, and the presentation of results of two conceptions and simulations results of a bandpass filter dedicated for a satellite application and a waveguide with resonators and tuning screws for a mobile communication application to show and present the effect of tuning screws on the response of a microwave filter.

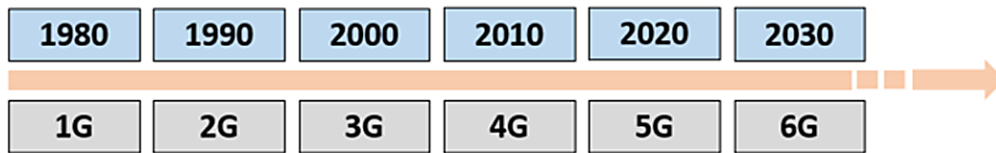
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INTRODUCTION

Due to the fast exponential raise in microwave applications, the frequency spectrum has known severe saturation and overloading due to the limitation of the allowed frequency bands. This has caused the intervention of microwave and Rf researchers to optimize this source and to limit the interferences between the different microwave applications (Miraftab & Mansour, 2005).

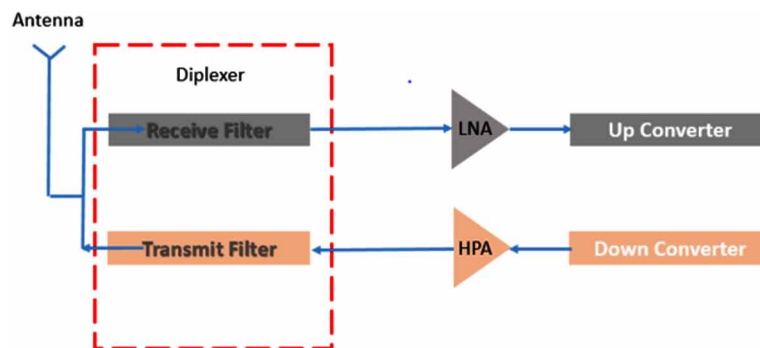
At this point, the development of microwave filters was the solution to remedy this and has become a key challenge for microwave experts, but with the diversity of RF and microwave applications, it was necessary to develop adequate filters and compatible structures with microwave applications in which they will be embedded (Cameron et al., 2018). Primarily, these devices are widely used in different domains, such as commercial applications using Bluetooth, Wi-Fi, and GPS (Pozar, 2011). Mobile and wireless communication is an application where using microwave filters is very important for their role in supporting the high demand of data traffic (Khan et al., 2012). This type of filter is used for 4G, 5G, and the following generation, according to Edholm's law, where the bandwidth of new wireless devices doubles every 18 months, as illustrated in Figure.1 (AbuHussain & Hasar, 2020).

Figure 1. Evolution of Wireless Standards



More than that, filters used at base stations are an essential device in their composition since they consist of two filters as shown in Figure.2, a receive filter aims to reject the out-of-band interference before the low-noise amplification and down-conversion (Mansour, 2004). While the transmit filter is used to minimize and limit the out-of-band caused by the transmit section of the base station. Generally, base station filters have to accomplish outstanding performances such as having a high rejection at the boundaries of the bandwidth and a low loss amount within the passband (Jarry & Beneat, 2009).

Figure 2. Front-end block in Base stations



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