

## Design and Optimization of a Compact Parallel-Coupled Microstrip Bandpass Filter for 12-14 Ghz Wireless Applications

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**Abstract :** This paper presents a compact bandpass filter design for wireless communication systems using coupled microstrip lines operating over 12–14 GHz. A Butterworth prototype ensures a flat passband and steep stopband roll-off. The filter, implemented on an FR4 substrate ( $\epsilon_r = 4.4$ ,  $H = 1.27$  mm), targets an insertion loss greater than -8 dB and a return loss below -10 dB. Key design parameters, including the width, length, and spacing of the coupled lines, are determined through calculations and simulations. The schematic circuit design is converted into a layout and optimized using electromagnetic simulations in ADS software. The final design meets performance goals for insertion loss, return loss, selectivity, and stopband rejection, proving its suitability for high-frequency wireless applications.

**Keywords :** bandpass filter, Butterworth filter, coupled microstrip lines, FR4 substrate

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