

## **X-band miniaturized wideband bandpass filter utilizing multilayered microstrip hairpin resonator.**

### **ABSTRACT**

This paper presents a new design of miniaturized wideband bandpass filter using microstrip hairpin in multilayer configuration for X-band application. The strong coupling required for wideband filter is realized by arranging five hairpin resonators in two layers on different dielectric substrates. Since adjacent resonator lines are placed at different levels, there are two possible ways to change coupling strength by varying the overlapping gap between two resonators; vertically and horizontally. In this paper, simulated and measured result for a wideband filter of 4.4 GHz bandwidth at 10.2 GHz center frequency with fifth order Chebyshev response is proposed. The filter is fabricated on 0.254 mm thickness R/T Duroid 6010 and R/T Duroid 5880 with dielectric constant 10.2 and 2.2 respectively using standard photolithography technique. Two filter configurations based on vertical (Type 1) and horizontal (Type 2) coupling variation to optimize the coupling strength are presented and compared. Both configurations produce very small and compact filter size, at 5.0 x 14.6 mm<sup>2</sup> and 3.2 x 16.1 mm<sup>2</sup> for the first and second proposed filter type respectively. The measured passband insertion losses for both filters are less than 2.3 dB and the passband return loss is better than -16 dB for filter Type 1 and -13 dB for filter Type 2. Very small and compact filter is achieved where measured results show good agreement with the simulated responses.

**Keyword:** X-band; Wideband bandpass filter; Microstrip hairpin; Multilayer.