A Novel Symmetrical Coupled-Line Bandpass Filter Structure with Improved Stop-Band Performance.

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The microstrip parallel coupled filter by Cohn (S.B.Cohn, IRE Trans. MTT -6, no.4, 223-231) has been one of the most commonly used band-pass configurations to achieve narrow fractional bandwidth. Unfortunately there are certain disadvantages associated with the conventional structure. The rejection of the upper stop-band is worse than the lower stop-band. A parasitic second harmonic degrade the upper band properties. The filter response is also asymmetric with lesser roll-off at the upper stop-band. Several researchers have incorporated wiggly lines, fractal shaped coupled lines, Split Ring Resonator, defective ground structures, dielectric overlays etc. to counter the problem of spurious responses.

In this paper, we introduce a new design of coupled-line structure as shown in Fig.1. Compared with the traditional parallel-coupled filter, the modified filter shows considerable improvements of the upper stop band rejection (Fig.2 ,3), with steeper roll-off and considerably better symmetry. Various other spurious are also suppressed. The filter configuration has an added advantage of low cost fabrication and easy integration compared with the other strategies as mentioned above to suppress the spurious responses.

A filter was designed at the center frequency of 2.4 GHz. on a substrate with relative dielectric constant of 3.38 and the height of the substrate being 1.5mm. The other relevant dimensions of the filter are L2/L1 = 1.2, L3/L1 = 0.25, L4/L1 =0.15 ,W2/W1 = 1.05, Gap2/Gap1 = 2.75, W3 = 40 mm. The filter was simulated with Method of Moment based solver (B.M.Kolundzija, J.S.Ognjanovic and T.K.Sarkar WIPL-D, Artech House, Norwood, Mass 2000). The spurious at second harmonic was -30 dB lower than the pass band compared to -10 dB obtained in conventional case. The Roll-off in the upper stop band is steeper than the conventional case thus improving the stop band characteristics.

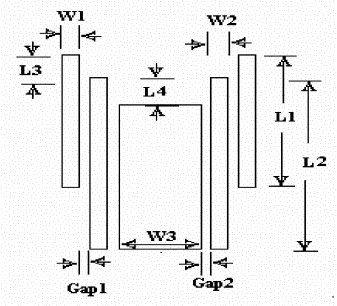

Fig.1 Filter structure

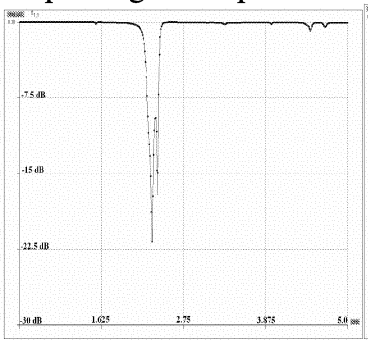

Fig.2 s-11 Parameters

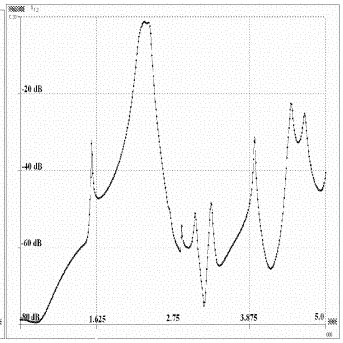

Fig.3 s-21 parameters