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# New Compact Low-Pass Filter (LPF) Using Cascaded Square Open Loop Resonator

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**Abstract:** This article introduces a new design technique of low-pass filter using cascaded square open loop resonator (SOLR) for the multi-wireless communication system. In the design procedure, a half-wavelength SOLR is realized with 6 GHz to meet the desired LPF cut off frequency. As the resonator is fed by a direct connection of 50-ohm input/output ports, the structure is directly transferred into a second-order low-pass filter with elliptic behaviour. An equivalent circuit is extracted and its lumped elements are computed to support the proposed second-order LPF. Based on the equivalent circuit, highly selective third and fifth-order LPFs with wide rejection band are developed. To achieve this development several SOLR are cascaded by a direct connection. The designed filters are implemented on a grounded substrate which has relative permittivity of 6.15 and thickness of 0.508 mm. To verify the design concept, a third-order LPF using two cascaded SOLRs is designed, simulated, fabricated and measured. The filter responses obtained from theory, simulation, and measurement show good agreement. The filter has very small circuit area about 31 $mm^2$ excluding the input/output feeding ports.

**Keywords:** Low-pass filter, square open loop resonator, cascaded SOLR, multi-wireless communication system, equivalent circuit.