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# Novel energy harvesting microstrip Lowpass-Bandpass diplexer with an Ultra- Compact size for GSM and 5G communication systems

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## Abstract

A new microstrip layout is proposed to design an ultra-compact lowpass-bandpass diplexer. This structure includes a basic bandpass resonator (BPR) in which, a lowpass filter (LPF) is embedded. Accordingly, it occupies an area of  $0.008 \lambda g^2$  that is the smallest compared to earlier reported lowpass-bandpass diplexers mentioned in this work. Moreover, at the lower and upper passbands, it has low insertion losses of 0.006dB and 0.1 dB respectively. Meanwhile, the return loss at both channels reaches 30dB. Having low losses makes it suitable for energy harvesting applications. The cut-off frequency of its lowpass channel is located at 0.93GHz, while the bandpass section resonates at 2.05GHz. Therefore, it can be used for GSM and 5G applications. Another advantage of this diplexer is its suppressed harmonics from the 1st to the 4th. To design this diplexer, a comprehensive mathematical analysis is performed on the basic structure. Our designed diplexer is fabricated and measured. The simulated scattering parameters and extracted data through direct testing are close to each other with good accuracy.