

## Design of a Frequency Agile Rat Race Coupler, Biswajit Dwivedy, Santanu Kumar Behera, Department of Electronics and Communication Engineering

A frequency reconfigurable  $180^\circ$  hybrid ring having wide tunability within 1.7 GHz - 3.2 GHz range is presented. Equivalent low-pass structures of transmission lines are used for circuit transformation and later capacitors are replaced by varactor diodes for continuous frequency tuning purpose. The proposed circuit can provide equal power division with  $0^\circ$ ,  $180^\circ$  phase difference at diverse operating frequencies by simultaneously tuning six varactors at different voltage levels. The performance of frequency agile rat-race coupler at different frequencies is verified using both circuit and finite element method (FEM) based full wave analysis. It is verified that the proposed device operates at different frequencies of 3.0 GHz, 2.4 GHz, 1.9 GHz depending upon various reverse bias voltage of 19V(0.3pF), 5V(0.66pF) 1.5V(1.33pF) applied to varactor diodes. Very less amplitude and phase imbalance ( $\pm 0.1$  dB,  $\pm 2^\circ$ ), reflection coefficient less than -10dB along with isolation more than 25dB are observed between the output ports at all achieved frequencies within the intended range. The circuit is designed on commercially available FR-4 substrate and has also compact dimension ( $0.17\lambda \times 0.27\lambda \times 0.127\lambda$ ) at 2.5 GHz, 50% less than conventional configuration. Due to uniqueness of frequency agility, compactness and low fabrication cost the device may be considered as a suitable candidate for being used in MMICs. More in: <http://ieeexplore.ieee.org/document/7509194/> (DOI: [10.1109/AEMC.2015.7509194](https://doi.org/10.1109/AEMC.2015.7509194))

