Frequency-Agile Reconfiguration for a High-Power Resonant Cavity Tuner Using Previous Search Results

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As the wireless radio spectrum becomes increasingly congested, there is an ever-growing need for spectrally sensitive radar transmitters. In wireless bands, such as the S-band, where recent discussion has focused on spectrum sharing, radar transmitters are required to sense and respond to the surrounding spectral use. This requires tunable devices capable of fast reconfiguration while maintaining output power and efficiency.

This work presents the fast reconfiguration of a tunable power-amplifier matching circuit for use in radar transmitters to enable spectrum sharing. A 90-W evanescent-mode cavity tuner is used as the reconfigurable load impedance of an amplifier device and is controlled with a modified gradient search algorithm that maximizes the Power-Added Efficiency (PAE) while maintaining spectral mask compliance. Measurement results illustrating the tuner adjusting to different operating frequencies within the S-band radar allocation are presented. If the transmitter is reconfigured to a new operating frequency, then the circuit is re-matched to achieve the highest possible PAE within spectral compliance by adjusting the positions of piezoelectric discs positioned above the tuner's cavities.

Improvements to reconfiguration time can be achieved on re-visits to operating frequencies by using a look-up table which stores the optimum resonant cavity position numbers and realized PAE at each visited frequency. Comparisons between the results of searches utilizing the look-up table versus not utilizing a look-up table are discussed. Reductions in the number of measurements needed to reconfigure is validated for many operating frequencies by comparing results of searches using the look-up table to searches performed without a look-up table. Finally, the impact of tuner frequency-dependent loss on PAE as well as developments and improvements in tuning technology are discussed.