Optimization of Load Impedance and Bias Voltage for Power-Added Efficiency, Delivered Power, and Adjacent-Channel Power Ratio Using the Bias Smith Tube

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Increasing radio spectrum usage and new spectrum coexistence techniques such as dynamic spectrum allocation will require systems to be capable of changing their operating frequency and spectral output bandwidth in real time. These new requirements can be met by using reconfigurable power amplifiers that allow transmitters to manage their spectral regrowth to meet the dynamically changing requirements on adjacent-channel power ratio (ACPR), maintain an acceptable level of delivered power (P_d), and maximize power-added efficiency (PAE). This presentation discusses an algorithm to quickly optimize the power amplifier device's load impedance Γ_L and bias voltage V_{DS} to maximize PAE while meeting constraints on ACPR and P_d.

The algorithm discussed in this presentation uses the Bias Smith Tube, which is a method for visualizing amplifier parameters based on load impedance and amplifier bias voltage (Fellows *et al*., 2016 IEEE Radio and Wireless Symposium). The constrained optimum point in the Bias Smith Tube will lie on the edge of a surface which bounds the region of the Bias Smith Tube that provides acceptable values for both ACPR and P_d. The previous work in the Bias Smith Tube required full load-pulls in order to find the constrained optimum point. For this presentation a vector-based search based on gradient estimations is used to find the optimum point using substantially fewer measurement points than the multiple load-pulls required to fill out the Bias Smith Tube. This presentation examines simulation and measurement applications for that search algorithm. This work is expected to be usefully applied in future reconfigurable radar and communication transmitter designs.