A Vector-Based Algorithm for Real-Time, Spectrally Sensitive Load Impedance Reconfiguration in Radar Transmitters

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New radar systems are being developed with the ability to adapt their operation characteristics in real time. These adaptive radar systems will need to adjust their frequency bands according to new spectral requirements that may change with geographic location or with time. Development of these capabilities is especially important because the National Broadband Plan will be reducing the amount of spectrum access available to radar, which will require radar systems to be more efficient with their spectrum access. This presentation shows an algorithm that will optimize the load impedance for a radar power amplifier in order to maximize the amplifier's power-added efficiency (PAE) while maintaining an acceptable adjacent-channel power ratio (ACPR) for spectral compliance.

Both PAE and ACPR are a function of the load impedance of a power amplifier. PAE is defined as the fraction of DC supply power that is converted to RF output power. Higher PAE will result in more signal power incident on radar targets, which improves the ability of the radar to correctly detect those targets. ACPR must also be considered due to the regulatory limits on spectral spreading caused by power amplifiers. The presentation will discuss the tradeoff between ACPR and PAE as a function of load impedance.

The optimization algorithm is designed to start at an arbitrary load impedance and use amplifier output measurement data in order to adjust the load impedance of the amplifier in real time. A previous URSI presentation by our group showed an indirect optimization, where the optimum load impedance was found by first finding the global PAE maximum load impedance prior to taking steps to bring the ACPR back down to an acceptable level. The presented algorithm significantly improves on the number of measurements required to complete the optimization by using a vector-based method to incorporate PAE and ACPR information at every measurement in order to approach the optimum point directly. The presentation will discuss the algorithm, show optimization results, and compare results to the previously developed algorithm.