A Research Path for the Design of Future Spectrally Compliant, Flexible Radar Transmitters

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In 2009, Federal Communications Commission (FCC) chairman Julius Genachowski warned of a "looming spectrum crisis." The continued surge in wireless broadband applications foreshadows the need for new methods of sharing, such as dynamic spectrum access. Radar systems are spectrum users that will be significantly affected, both through the shortage of spectrum and through new protocols that require dynamic spectrum allocation. This presentation discusses the way forward in research that will design a next-generation, adaptive radar transmitter that will fit within a cognitive radar technology (described by Haykin 2006, Guerci 2010) and a dynamic spectrum access protocol.

Some features of a prospective future radar are discussed. First, the future radar must be capable of reducing its nonlinearities to be a "good neighbor" to wireless devices in surrounding frequencies. As such, amplifier linearization techniques, such as envelope tracking, envelope elimination and restoration, the Doherty configuration, push-pull amplifiers, and other approaches, must be applied to radar amplifiers. Second, future radars, capable of adjusting their operating frequencies, must include reconfigurable load matching networks. Third, the spectral spreading of the radar's emissions should be developed and controlled dynamically to match the environment in which the radar will be placed. A decision-making process involving the allowable emissions of the radar, based on environment sensing, must be designed.

The presentation examines several upcoming research steps toward implementing the adaptive transmitter. The design of real-time, joint circuit and waveform optimization is a starting step; it may also be useful to incorporate nonlinear network parameters and other useful information to speed the adjustments. Dynamic spectrum radar spectral mask construction, based on the relative locations of the radar transmitter and nearby communication nodes, should be investigated. Third, it will be necessary to construct and evaluate a prototype reconfigurable transmitter amplifier from a software-defined radio platform. This effort will require collaboration between the government, industry, and university researchers. Finally, it will be necessary to engage the global community in understanding spectrum issues. The use of NATO research task groups on spectrum engineering and waveform diversity, as well as informing the next generation through educational outreach, are some of the ongoing engagement efforts that will be briefly described in this presentation.