STTR Phase I: Reconfigurable Wireless Platforms for Spectrally Agile Coexistence

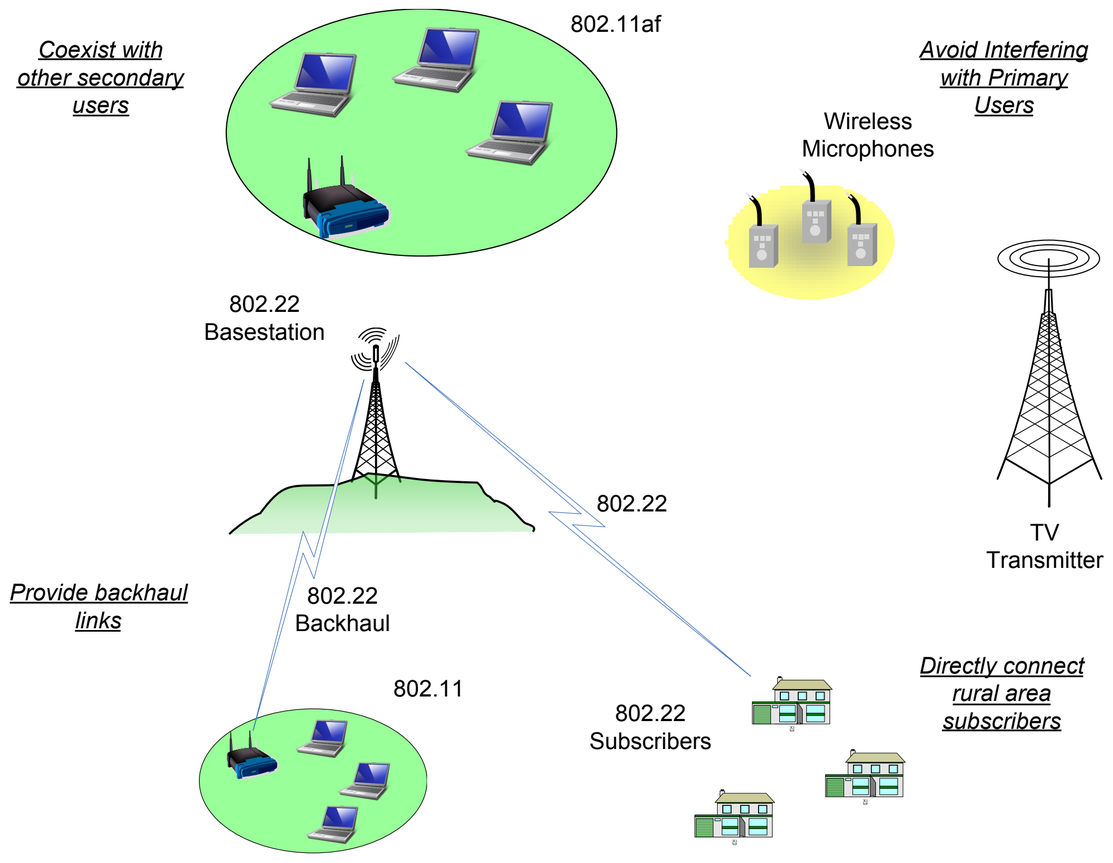
Samuel J. MacMullan, ORB Analytics Inc.
Alexander M. Wyglinski, Worcester Polytechnic Institute

Goal

- Enable broadband wireless data access in geographical areas lacking existing information infrastructure, such as rural regions or locations possessing significant terrain challenges

Objective

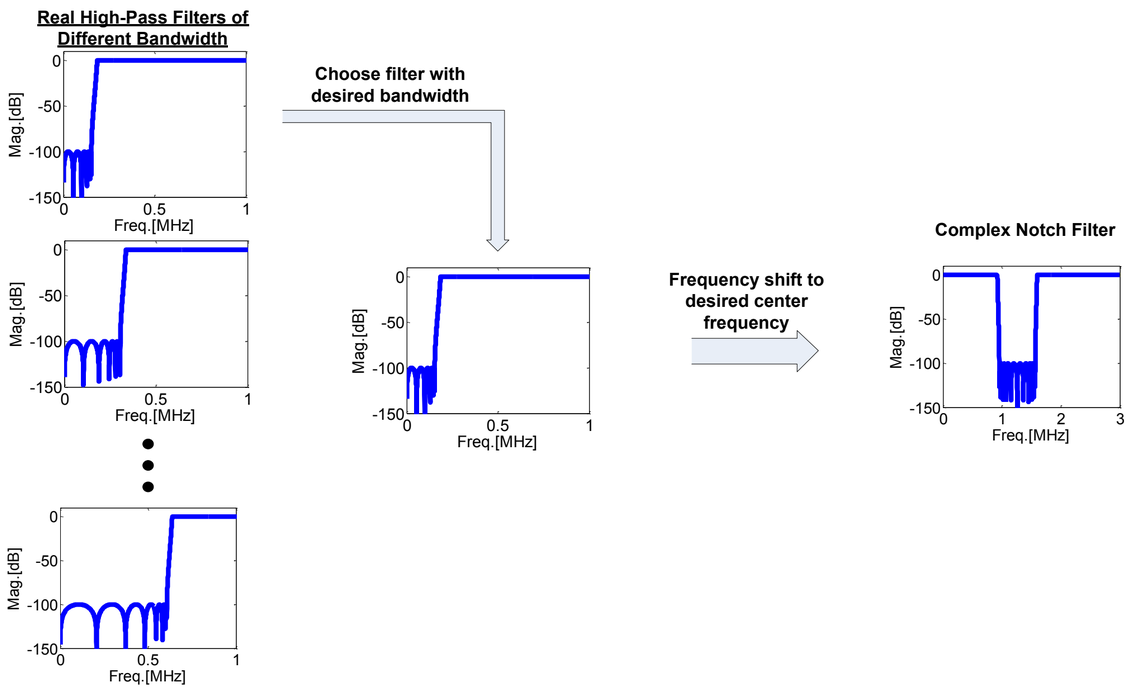
- Devise proof-of-concept spectrally agile wireless transceiver system capable of accessing electromagnetic spectrum in secondary manner without interfering with legacy transmissions, i.e., primary users



Proposed Phase II 802.22 Design

Proposed Approach

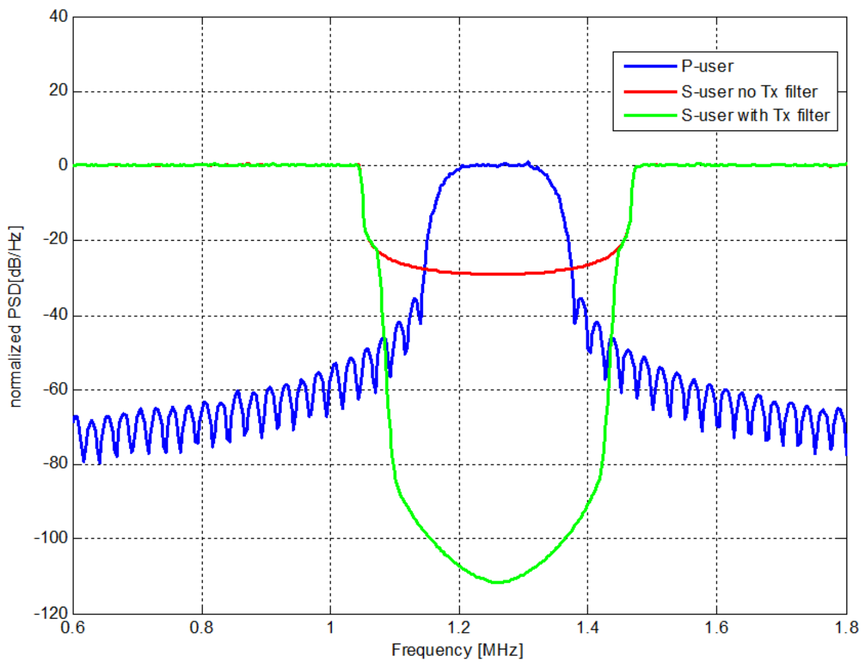
- Create "quiver" of infinite impulse response (IIR) filters to be employed by orthogonal frequency division (OFDM)-based spectrally agile transceiver to sufficiently minimize out-of-band (OOB) emissions
- Implement prototype system using field programmable gate array (FPGA) technology in order to enable real-time performance for spectrally agile wireless data transmissions
- Combine IIR filter quiver with real-time spectrum sensing module in order to minimize potential interference with primary user signals



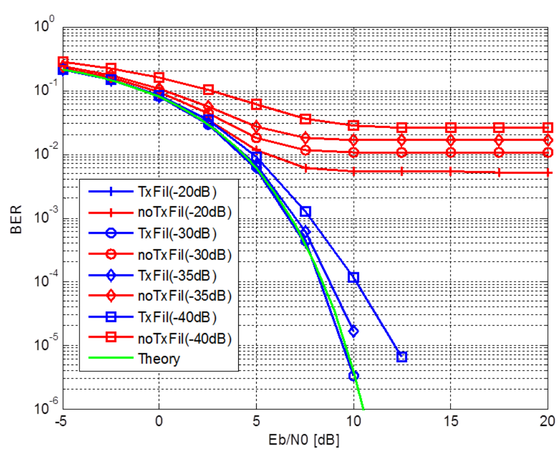
The "Quiver": Frequency- and Bandwidth-Programmable IIR Notch Digital Filters

Phase I Experimental Results

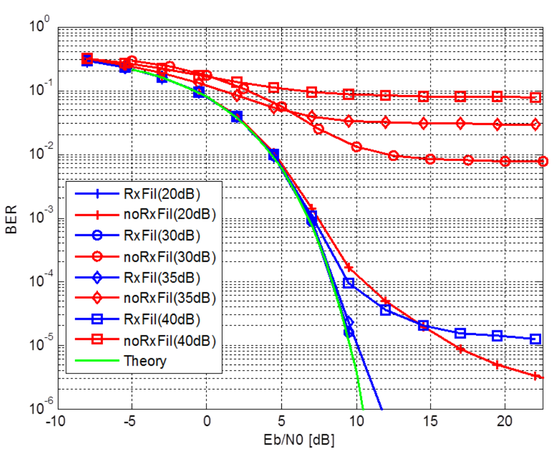
- Prototype IIR quiver created for spectrally agile transceiver
  - Initially designed using floating-point design tools
  - Converted to fixed-point and implemented on FPGA
- OFDM-based spectrally agile transceiver system evaluated entirely in hardware within emulated environment
  - OOB emissions and BER performance assessed



Primary and Secondary User PSD, Secondary User With and Without Transmitter Notch Filtering



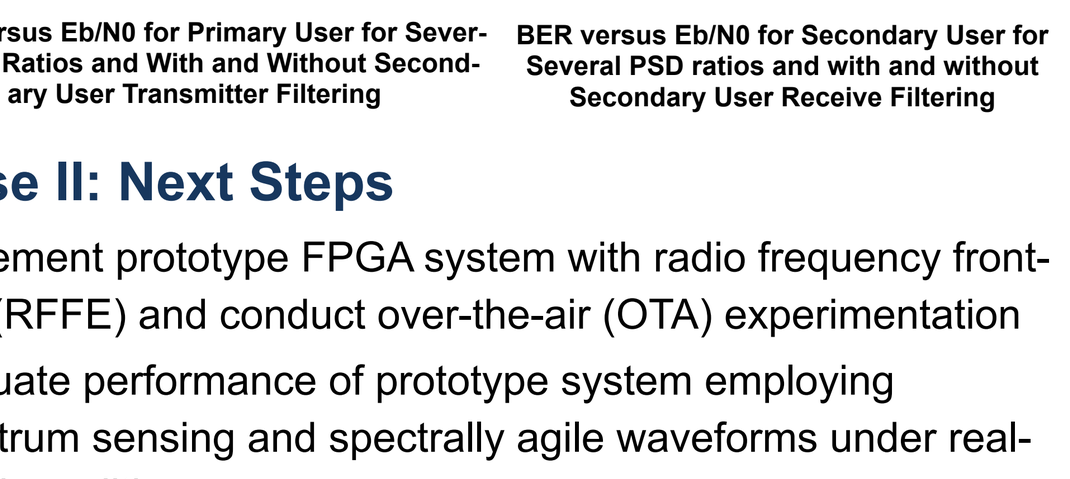
BER versus Eb/N0 for Primary User for Several PSD Ratios and With and Without Secondary User Transmitter Filtering



BER versus Eb/N0 for Secondary User for Several PSD ratios and with and without Secondary User Receive Filtering

Phase II: Next Steps

- Implement prototype FPGA system with radio frequency front-end (RFFE) and conduct over-the-air (OTA) experimentation
- Evaluate performance of prototype system employing spectrum sensing and spectrally agile waveforms under real-world conditions
- Conduct field tests with prototype system delivering broadband wireless to rural or wirelessly challenged area



Proposed Notch Filter and Spectrum Sensing Architecture

The work was sponsored by the National Science Foundation via award number 1212340.

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