SYNCHRONIZATION FOR BROADBAND OFDM MOBILE AD HOC NETWORKING

John E. Kleider and Steve Gifford
General Dynamics Decision Systems
Scottsdale, Arizona, USA
Brian Sadler, Army Research Laboratory
steve.gifford@gd-decisionsystems.com

ABSTRACT

Broadband wireless services are currently addressing the operation of limited mobility configurations (fixed access or at pedestrian speeds). The Army has recognized the importance of high data rate (HDR) systems and is defining new waveforms that will support video and imagery applications. These new HDR waveforms are required to operate in mobile terrestrial environments associated with OTM operation and rapid deployment scenarios. In this paper, we present a method for time and frequency synchronization of broadband OFDM for mobile networking systems, where each node randomly and rapidly changes location.

The proposed method is robust in Rayleigh fading and is computationally tractable for low-power digital signal processor (DSP) implementations. Future Combat System (FCS) robotic nodes will depend on HDR systems that overcome the dynamic channel environment and battery power constraints. For efficient operation in the FCS and WIN-T ad hoc network applications, waveform signals must support high network capacity by reducing the ratio of acquisition time-to-message payload and provide improved link margin through proper peak power control strategies.

To achieve these waveform and network performance goals, a synchronization method is developed that uses a pseudo-noise (PN) preamble sequence to provides low probability of false detection, low probability of missed detection, and exhibits a low peak-to-average power ratio (PAPR). We show that the power spectral density (PSD) of the PN-based preamble, after the digital up-converter shaping filter, fits into a spectral mask similar to that of the OFDM traffic signal's PSD. Efficient implementation is demonstrated using frequency-domain equivalent processing on a fixed-point Texas Instruments DSP and a floating-point Motorola G4 PowerPC with Altivec.