Experimental and Theoretical Assessment of UWB Secure Communication in Presence of Dynamic Interference

Md Rakibur Rahman, Satheesh Bojja Venkatakrishnan and John L. Volakis
RF Communications, Millimeter-Waves, and Terahertz Lab,
Florida International University, Miami, FL 33174 U.S.A,
http://www.rfcom.fiu.edu

Recent advancements in the state of arts high-speed ADCs and DACs allow us to design and validate unprecedented ultra-wideband secure communication links for software define radios (SDR). Wireless communication can be vulnerable due to dynamic spectrum allocation, inter-modulation effect or dynamic interference scenario. This interference could be other than static results; its mitigation is more challenging. In addition, spectrum congestion implies major challenges in accessing large contiguous bandwidths. By exploiting ultra wideband code division multiplexing (UWB-CDM) over large bandwidths, it is possible to combat dynamic interference scenarios, including spot, sweep, barrage, or base interference. With this in mind, this paper proposes a unified platform to mitigate dynamic interference scenarios by exploiting UWB-CDM spread techniques with wideband front end, a tightly coupled dipole array (TCDA) with MIMO beamforming to evaluate communication links under dynamic interference scenarios. Furthermore, we introduce a new bit error rate (BER) expression via simulations and measurements in presence of multiple interference scenarios for UWB-CDM system. The presented measurements are a sample of the extensive tests performed to assess the performance of the proposed Ultra-Wideband Code Division Multiplexed (UWB-CDM) system.

Code division multiplexing (CDM) is a well known interference mitigation approach that spread the bandwidth to provide a low probability of interception by turning the signal into a pseudo-noise (PN) like code. This inherent capabilities of spread spectrum CDM is the key feature of establishing secure communication links. Though a well-established technique for realizing secured communication links, due to hardware limitations and synchronization challenges, ultra wideband (UWB-CDM) has limited experimental validation. As part of our assessment, our UWB-CDM was implemented in the digital domain with a contiguous 1.27GHz bandwidth for hardware demonstration. The presented interference mitigation associated theoretical assessment of bit error rates and associated measurements provide for a well-studied and practical UWB-CDM systems.