Software-Defined Ultra-wideband Radio Communications: A New RF Technology for Emergency Response Applications

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INTRODUCTION

Reliable wireless communication links for local-area (short-range) and regional (long-range) reach capabilities are crucial for emergency response to disasters. Lack of a dependable communication system can result in disruptions in the situational awareness between the local responders in the field and the emergency command and control centers. To date, all wireless communications systems such as cell phones and walkie-talkies use narrowband radio frequency (RF) signaling for data communication. However, the hostile radio propagation environment caused by collapsed structures and rubble in various disaster sites results in significant degradation and attenuation of narrowband RF signals, which ends up in frequent communication breakdowns.

To address the challenges of reliable radio communication in disaster fields, we propose an approach to use ultra-wideband (UWB) or wideband RF waveforms for implementation on Software Defined Radio (SDR) platforms. Ultra-wideband communications has been proven by many research groups to be effective in addressing many of the limitations faced by conventional narrowband radio technologies. In addition, LLNL's radio and wireless team have shown significant success in field deployment of various UWB communications system for harsh environments based on LLNL's patented UWB modulation and equalization techniques. Furthermore, using software defined radio platform for UWB communications offers a great deal of flexibility in operational parameters and helps the radio system to dynamically adapt itself to its environment for optimal performance.

In this position paper, we discuss LLNL's approach for long-range reliable radio communications for emergency responders.

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