Thesis

# Introduction

## The need for TTE:

### NIOSH

### Robot, rescue, first responders…

### Manufacturers: Ultra (Rock Phone), Lockheed- Martin (),,…

### Approaches:

* + - 1. E-field: https://www.cdc.gov/niosh/mining/researchprogram/contracts/contract\_200-2008-26818.html
      2. B-field
      3. Alertek, Lockheed, Stolar, E-spectrum, Ultra

## Electromagnetic analysis of VLF band

## Magnetic devices- Coils

## Channel model: Brazil figure 14

## The choice of OFDM

### Analog or FSK ( Brazil, p. 166)

### MSK (Brazil [2])

### impulsive noise (Brazil); frequency selective?

### No good model. (Brazil p.170 left)

### OFDM is flexible both on Tx and on Rx

### CSIT is of advantage

1. System, Magnetic and Analog Devices

## System requirements

### Throughput

### Range

### Antenna

### Frequency domain characteristics

### Direction sensitivity

## SIMO 1x3

### Ordinary use of SIMO: small scale fading

### Proposed use of SIMO: Large scale fading

## SDR concept

## Magnetic devices

### Tx

### Rx

## Analog devices

### D/A

### A/D

### Reconstruction & Anti-aliasing filters (Maxim)

## Link budget

### Calculation

### Simulation

1. OFDM- general

## Need: Rx & Tx Selectivity

## Evolution

## Mathematical representation

### Tx

### Rx: matched filtering as FFT

## CP:

### General: Frequency domain equalization- Linear into cyclic convolution

### OFDM frequency domain equalization: flatness per subcarrier (channel=complex scalar)

### Preservation of orthogonality

### ISI (Guard time)

## Time synchronization problems: effect on signal (Prasad)

## Frequency synchronization problems: effect on signal (Prasad, NPTEL, my summary)

## Pilots

## Guard bands:

### The need to D/A

### the DC sc

## Preambles

### Long:

* + - 1. PN sequence

### Short:

* + - 1. Channel estimation
      2. SNR estimation

1. OFDM- parameters calculations

## CP

## N FFT

## Length of preambles

1. Transmitter:

## Preambles enhancement

## PAPR reduction

## Analog HW compensation: inverse sinc, differentiator

1. Receiver:

## Equalizer types

## Timing synchronization

## Frequency& phase synchronization

## MRC MIMO

1. Data Converters integration:

## Setting the Fs, Frec

## Synchronization

## Frequency error effect on signal integrity. My analysis (summary) and results

1. Results- Simulations
2. Results- Field experiments