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Joint Radar-Communication Prototype Implementing Spectral-Spatial Agility and Index Modulation

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Introduction

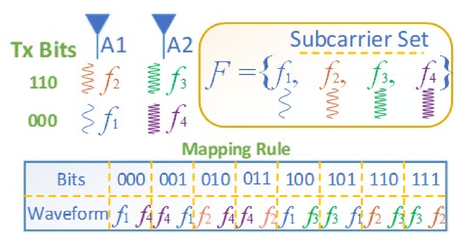
DFRC Systems for Vehicular Applications

- Future cars implement both radar and communications on the same platform
- Two implementing approaches:
  - Use individual systems
  - Jointly design a dual function radar-communications (DFRC) system
- Benefits of DFRC systems
  - Improve the spectrum efficiency
  - Reduce system size, weight and power consumption
  - Alleviate concerns for electromagnetic compatibility

Theory

Index Modulation based DFRC System

- Index modulation (IM)
  - Embed communications bits in transmission parameters
  - Possible domains: Spatial, spectral and time
- IM based DFRC techniques
  - Embed message into the combinations of radar waveform parameters
  - Have minimal degradation to radar performance



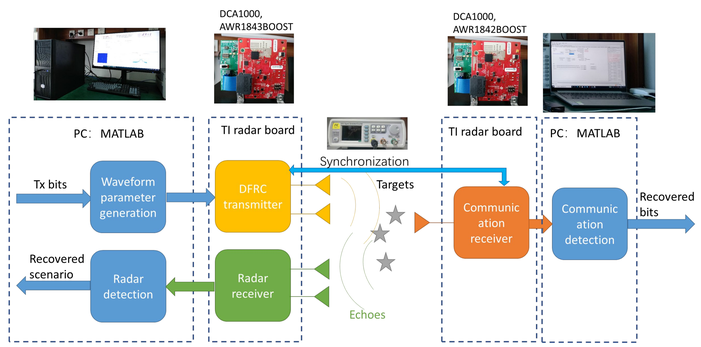
Contributions

Contribution of This Prototype

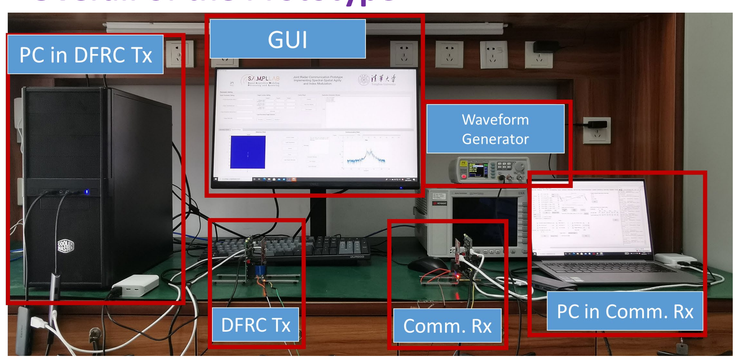
- Implementing spectral-spatial IM based DFRC system using low cost automotive radar
- The prototype realizes communication without degrading the radar performance
- This DFRC system is promising to be applied in future intelligent transportation applications

Hardware Implementation

Architecture of the Prototype

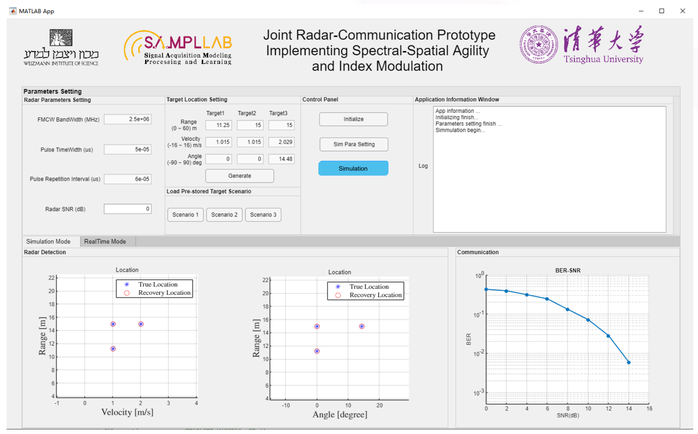


Overall of the Prototype

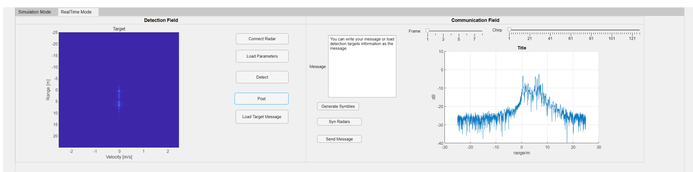


Graphical User Interface

Simulation Mode

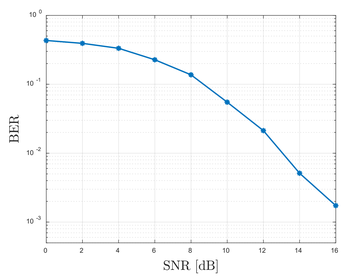


Realtime Mode



Experiment Results

Communication BER



Radar Recovery