Digital Predistortion with Low-Precision ADCs

Chance Tarver and Joseph R. Cavallaro

Rice University

Motivation

- **Spectrum Scarcity → Frequency Agile Standards**
  - Non-contiguous Transmission
  - Carrier Aggregation (CA) in LTE-Advanced
  - Cognitive Radio
  - 5G New Radio (NR) Cellular
- **Non-contiguous carriers intermodulate**
  - Caused by nonlinearities in power amplifiers (PAs)
  - Undesired spurious emissions (spurs)
  - Could interfere with nearby channels
  - Self-interference to own receiver when using FDD
- ***Need efficient way to linearize for this scenario***
- ***DPD requires extra hardware***
  - Extra RX chains
  - Larger area
  - More Power

Main Idea

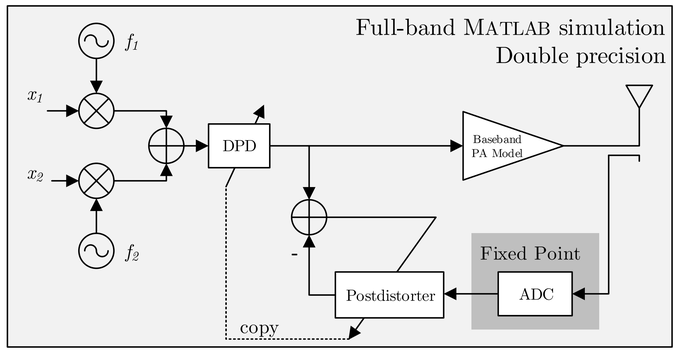
- ***Use a lower precision ADC for DPD on a UE device***
  - Reduce the necessary area
  - Reduce the power
  - Reduce the cost

MATLAB Simulation

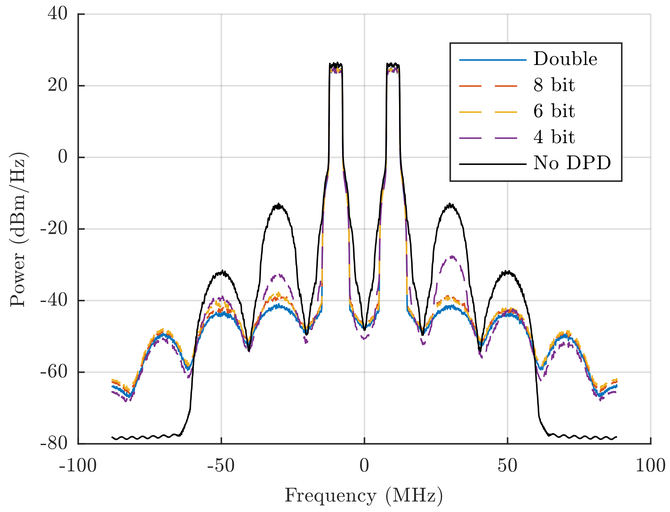
- **LTE-Advanced CA Scenario**
  - Two, 5 MHz component carriers
  - 9th order, parallel Hammerstein PA model
  - Fixed point toolbox to emulate ADC

Full-band DPD Simulations

- **Simulation Architecture**



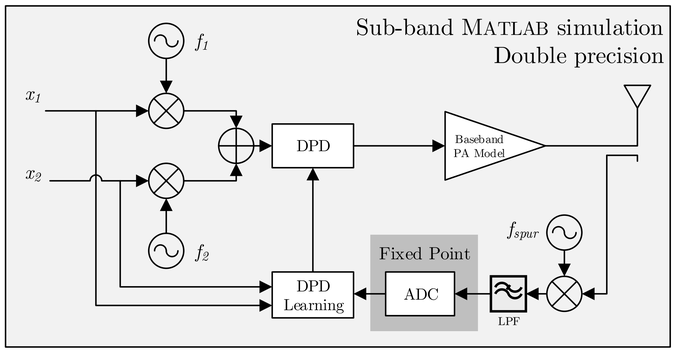
  - Traditional, indirect-learning DPD
- **Suppression Results:**



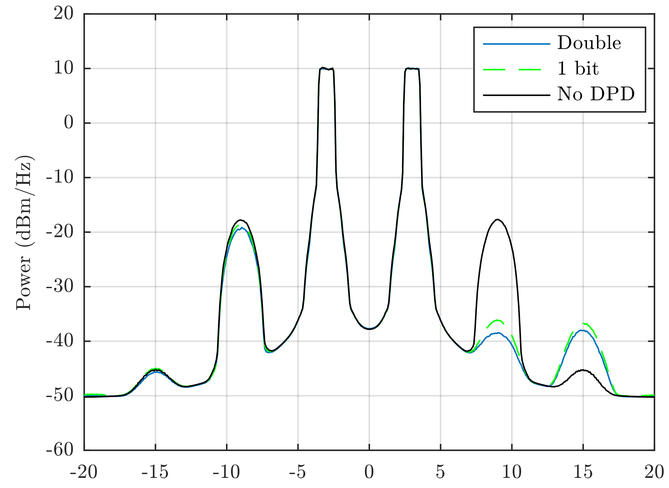
  - Near ideal performance for as low as 6 bits

Sub-band DPD Simulations

- **Simulation Architecture**



  - MATLAB simulation
- **Suppression Results:**



  - Near ideal performance for as low as 1 bit

Future Work

- **Main carrier linearization**
- **Hardware testing with a real PA using the WARP SDR platform**