Digital Predistortion with Low-Precision ADCs

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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

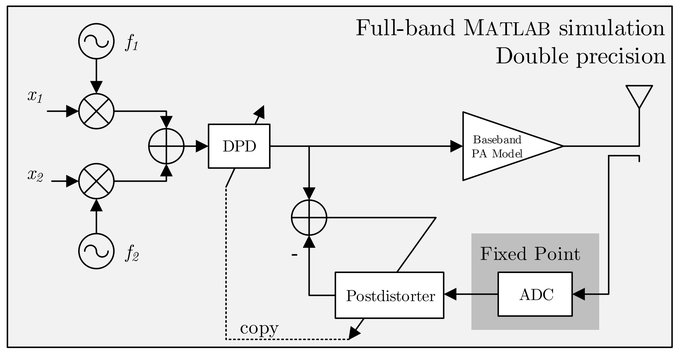
- **Use a lower precision ADC to reduce the area and cost for applying DPD on a UE device**
  - Iteratively learn coefficients as necessary using adaptive, LMS algorithm.
  - Apply them as in Equation 5 to reduce spurious emissions.

MATLAB Simulation

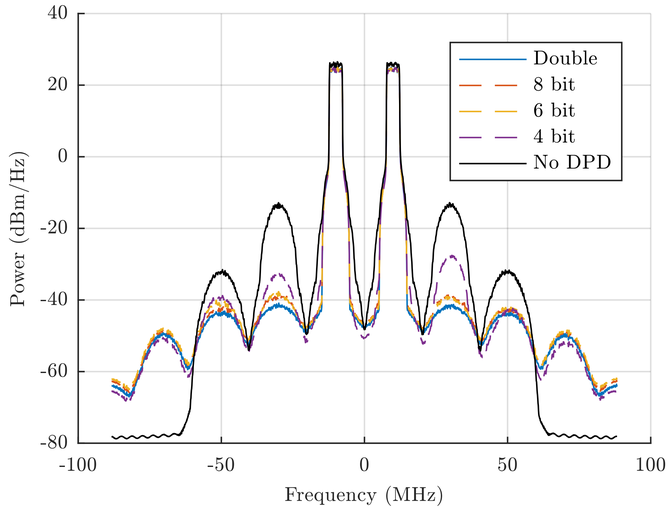
- **LTE-Advanced CA Scenario**
  - Two, 5 MHz component carriers
  - 9th order, parallel Hammerstein PA model
  - Fixed point toolbox to emulate ADC

Full-band DPD Simulations

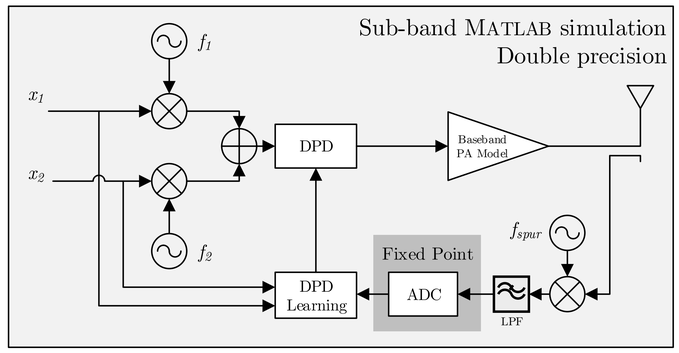
- **Simulation Architecture**

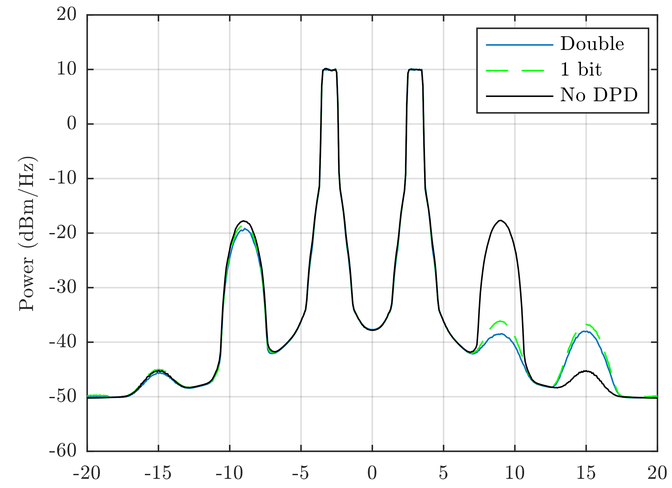


  - MATLAB simulation
  - 9th order Parallel Hammerstein PA model



Sub-band DPD Simulations





GNURadio Simulator

Future Work

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