PA Linearization Overview

- General principles
- Overview/Block Diagram of DPD and RFPD
- RFPAL System architecture & Implementation
Predistortion Principle

No predistortion

With predistortion

5-10 x BW expansion
Digital Pre-Distortion (DPD)

Without PA/DUC/CFR:
Power consumption ~5.4W

Semiconductors for Wireless Communications
RFPAL (RF PA Linearization)

Without PA/DUC/CFR
Power consumption ~1.4W
RFPAL System Architecture & Implementation
Scintera Advantages

- Single chip CMOS linearization solution
- Easy to evaluate and design in
- Simplifies TX chain
- High system efficiency
- Very low power consumption
- Low system cost
- Small footprint
- Future proof
  - In-system & in-field reprogrammable
  - RFin/RFout supports stand-alone PAs
- Waveform & modulation independent
- Power Amp Independent
  - Linearize even lowest power PAs
- Robust & field-proven solution
More Complete Information on Theory of Operation and Datasheets Available on Line at www.scintera.com or Richardson RFPD website

Please Visit Us at Booth # 208
Additional Slides
Analog Volterra Series

\[ V_{\text{OUT}}(t) = \sim \sum_{p=1}^{4} \sum_{m=1}^{5} c_{p,2.m} r^{2.m}(t - \tau_p) \]

\[ V_{\text{IN}}(t) = r^2(t) \]
RFPAL Key Architectural Attributes

- Analog (RF & BB), Digital (high & low-speed) and SW partitioning minimize power & area
  - Computation of correction terms in digital (software and hardware) domain
  - Application of correction in the analog domain

- RF and most of baseband analog circuitry is *unclocked*
  - enables robustness and flexibility for various modulation schemes & carrier frequencies.

Flexible Work Function

- Synthesizes wide range of PA AM/AM and AM/PM compensation and memory compensation (1ns - 300ns)
- Enables robust adaptation (orthogonal basis terms of work function)

Robust performance with process, voltage, aging and temperature variations

- Extensive digital/analog compensation loops for analog cells, with process/temp sensing, calibration routines, etc.
- Optimized calibration algorithms using a low-power, on-chip spectral estimator.
- *Software-driven* analog circuit design that can be conveniently tuned /optimized.

Software-driven correction enables flexibility

- With respect to waveforms, PA, power consumption (duty-cycle), etc.
- Allows customization of solutions by application and customer
RFPAL Reference PCB

- **Output coupler**
- **Ceramic resonator**
- **RFPAL Linearizer SoC**
  - \(9 \times 9 \times 0.9\) mm standard QFN package
- **Input coupler**
- **Other: Decoupling + matching networks**