Digital Predistortion Linearizer for a Realization of Automatic Calibration Unit

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Background

- Digitization and Processing of RF signal is still not possible because of the lack of ADC & DAC resolution
- The requisite analog RF components

SDR architecture:
Motivation

Problems:

- Imperfection concern of analog RF components
  - Nonlinear distortion, Power efficiency
- Compliance concern when changing the operating mode
  - The emission of energy

Our Motivation:

Providing more efficiency of RF components while protecting the public from harmful interference of SDR

ACU: Automatic Calibration & Certification Unit
What is ACU?

ACU is a hardware embedded module

- Digitally aided Adaptive RF (DARF):
  - to control and adjust RF components:
    (Predistortion, Power Amplifier bias control, ...)
- Digitally aided Secure RF (DSRF):
  - to ensure the compliance of the combination of HW & SW by run-time check
Digitally aided Adaptive RF

Example: Digital Predistorter

ACU

Predistorter

Adaptive Controller

Feedback Analyzer

Programmable Processor(s)

Cont.

D/A

Bias Cont.

VCO Cont.

A/D

PA
Digitally aided Secure RF

Programmable Processor(s)

Radio Law

DB

ACU

Regulation check

MASK

FFT

Spectrum Analyzer

D/A

PA

A/D
ACU Simulink Model

W-CDMA system with ACU module (Simulink model)
ACU Demonstration

- Without Predistorter:

- With Predistorter:
Features of ACU

• DARF :
  • Better efficiency of RF components

• DSRF :
  • More secure SDR architecture with run-time regulation check

• Providing a new authorization procedure that can approve HW and SW separately

AMAP: ACU eMployed Authorization Procedure
How does AMAP work?

AMAP: ACU employed Authorization Procedure

AMAP: to approve HW & SW separately

HW Approval

Authorize HW only (with ACU)

SW Approval

Authorize SW only

HW+SW

ACU checks run-time parameters when HW & SW are functioning together
Summary and Future Work

• ACU
  - Digitally aided Adaptive RF
  - Digitally aided Secure RF

• AMAP
  - Separating HW & SW Authorization Procedure
  - Improving SDR Flexibility

• Future Work:
  - Prototype ACU implementation
  - More detail structure of AMAP