



# High Efficiency Pulse Modulated Power Amplifiers

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## SUMMARY

UCLA Researchers in the Electrical Engineering Department have developed a novel amplifier for efficient amplification of RF signals in non-constant envelope modulation, without compromising the fidelity of the modulation information.

## BACKGROUND

The power efficiency of conventional linear power amplifiers can degrade severely when driven by non-constant envelope signals. Doherty amplifiers, outphasing, Kahn techniques, and delta-sigma modulation can provide improved efficiency, but at the cost of limited linearity performance and operating bandwidth, or other implementation difficulties.

## INNOVATION

The novel amplifier provides maximum efficiency for a wide range of output power levels, without compromising linearity performance. Control is simple and linearity is robust. The amplifier is easy to implement without requiring any specialized high speed devices.

## APPLICATIONS

- ▶ RF transmitters
- ▶ Wireless base stations
- ▶ Power amplification in wireless or wired RF systems
- ▶ Non-constant envelope modulation

## ADVANTAGES

- ▶ Maintains maximum efficiency and linearity performance over a wide range of output power fluctuations
- ▶ Avoids the middle-range efficiency dip associated with traditional Doherty amplifiers
- ▶ Provides robust linearity performance
- ▶ Simplifies bias control conditions, gain characteristics, and peripheral sizes of the devices to achieve linear amplification
- ▶ Suitable for an envelope delta-sigma modulation (EDSM) approach
- ▶ Addresses the efficiency problems associated with non-constant envelope modulations

## STATE OF DEVELOPMENT

The device has been validated in simulations, fabricated, and successfully tested in experiments

## PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	8,254,854	08/28/2012	2006-330

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## OTHER INFORMATION

### KEYWORDS

power amplifier, non-constant envelope modulation, pulse switched amplifier, Kahn technique, polar amplifier, Delta-Sigma modulation, High-Q filter, switched resonator, Doherty amplifier

### CATEGORIZED AS

- ▶ [Communications](#)
- ▶ [Wireless](#)

### RELATED CASES

2006-330-0

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