(SD2019-364) Method For Enhancing Power Amplifier Efficiency And Linearity

Tech ID: 32021 / UC Case 2019-364-0

TECHNOLOGY DESCRIPTION

Electrical engineers from UC San Diego (Drs. Seyed Bagher Rabet and Peter Asbeck) have invented a patent-pending method for simultaneously improving the back-off efficiency and linearity of Power Amplifiers (PAs). The topology, which is named Single Input Linear Chireix (SILC) PA, employs a combination of Chireix outphasing and Doherty architectures, and requires a single RF input with no predistortion. The circuit consists of a dual-input high-efficiency outphasing PA and a simple input network which serves as a power splitter and feeds the inputs of the main and auxiliary PA cells that are biased in class-AB and class-C regions respectively, similar to the Doherty architecture. The operation of the PA cells together with the Chireix combiner result in back-off efficiency enhancement plus systematic AM-AM and AM-PM variations which are used to correct the distortions caused by transistors, resulting in a linear response.

APPLICATIONS

5G transmitters

Orthogonal frequency-division multiplexing OFDM

ADVANTAGES

There is no need for explicit predistortion like DPD. This invention not only improves back-off efficiency while requiring a single RF input, but also corrects the nonlinearity of the PA cells, eliminating the need for predistortion. It relies on use of the Chireix combiner and is termed here the Single Input Linear Chireix (SILC) PA

This technology exhibits among the highest PAE reported to date for an OFDM signal without DPD (or other forms of digital enhancement) at power levels of interest for 5G transmitters.

The implemented PA demonstrates 19 dBm saturation power (Psat) with 34.4% peak power-added efficiency (PAE) and 6 dB back-off PAE of >23% at 27.5 GHz.

The modulated signal performance using a 100 MHz 64QAM OFDM signal shows an average output power of 11.9 dBm with PAE >20%, EVM <5%, and ACLR <-33 dBc without using predistortion.

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OTHER INFORMATION

KEYWORDS

5G mobile communication, 5G, mobile communication, BiCMOS, BiCMOS integrated circuits, millimeter wave (mm-wave), integrated circuit, millimeter wave (mm-wave) integrated circuits, power amplifiers, PA, Orthogonal frequency-division multiplexing, OFDM, Predistortion, Modulation, Linearity, Impedance, Radio frequency

CATEGORIZED AS

- Communications
  - Wireless

RELATED CASES

2019-364-0

STATE OF DEVELOPMENT

SILC, a new method for simultaneously improving back-off efficiency and linearity of PAs is presented. The circuit consists of a Chireix outphasing topology with asymmetric biases for the PA cells and a simple input signal splitter creating a phase shift between them. The implemented mm-wave integrated circuit achieves an average PAE greater than 20% while modulating a 64QAM OFDM signal with 100 MHz bandwidth and 11.9 dBm average output power at 27.5 GHz. Without using DPD, EVM less than 5% and ACLR better than −33 dBc are obtained, demonstrating the potential for emerging 5G applications.

INTELLECTUAL PROPERTY INFO

UC San Diego is seeking partners for commercial development.

RELATED MATERIALS

- B. Rabet and P. M. Asbeck, "A 28 GHz Single-Input Linear Chireix (SILC) Power Amplifier in 130 nm SiGe Technology," in IEEE Journal of Solid-State Circuits, doi: 10.1109/JSSC.2020.2967542. - 03/12/2020

PATENT STATUS

Patent Pending

IMAGES

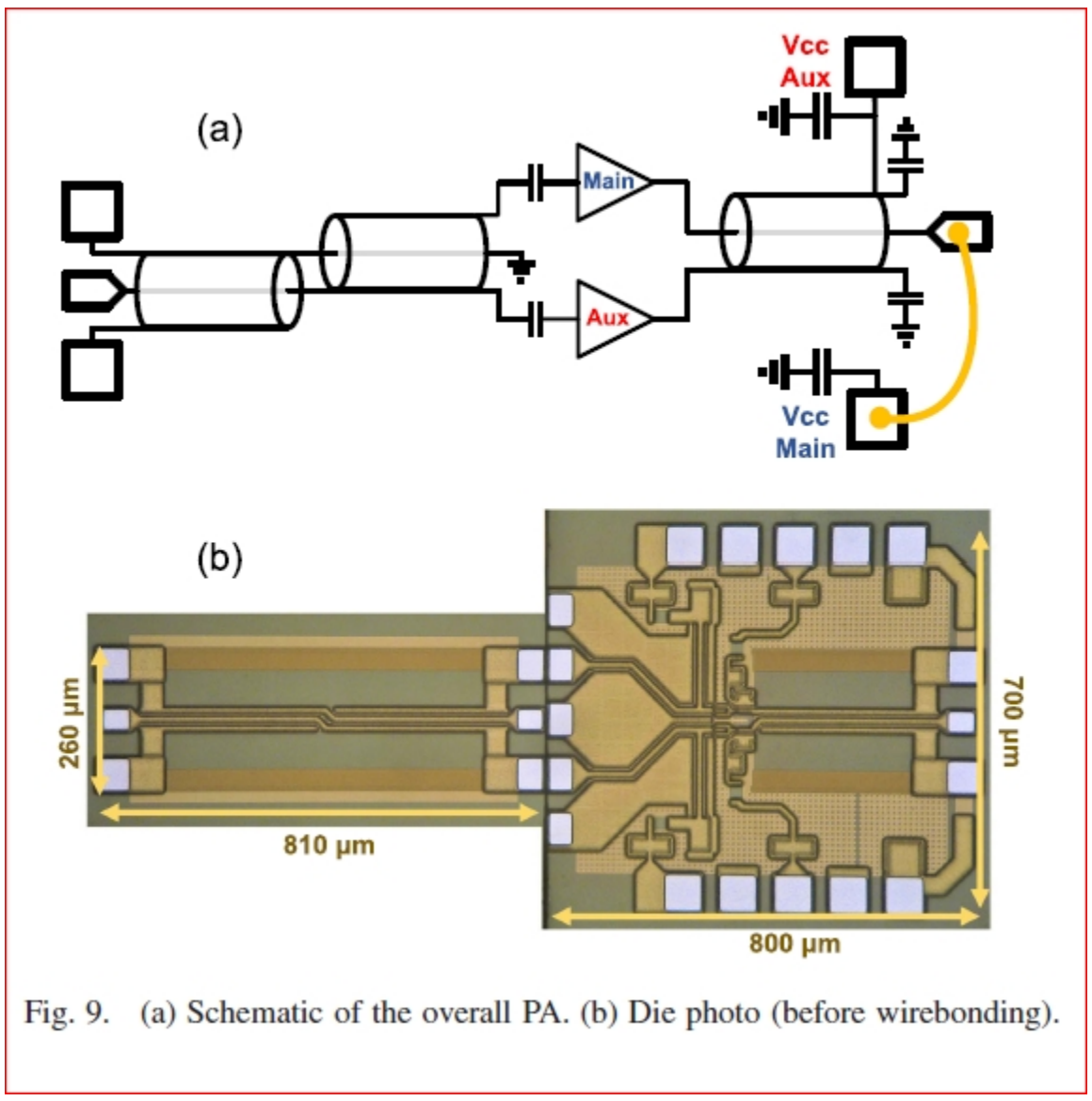

Fig. 9. (a) Schematic of the overall PA. (b) Die photo (before wirebonding).

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