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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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قسم

نقسم باللّه العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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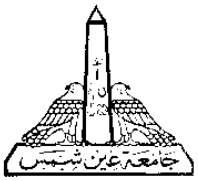

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

CAIRO - EGYPT

CMOS LTE Transmitter Front-End

A Thesis

Submitted in partial fulfilment for the requirements of the degree of

Master of Science in Electronics and Communications Engineering Department

Ain Shams University

Submitted by

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B.Sc. of Electrical Engineering

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Cairo 2020

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Statement

This thesis is submitted to Ain Shams University in partial fulfilment of the degree of Master of Science in Electrical Engineering.

The work included in this thesis was carried out by the author in the Department of Electronics and Communications Engineering, Ain Shams University.

No part of this thesis has been submitted for a degree or a qualification at any other university or institute.

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Published Papers

[1] Arafa, E., Shawkey, H., Mosalam, H., ZEZRY, A., 2017. A 1.8 GHz CMOS Power Amplifier For LTE application, 2017 Intl Conf on Advanced Control Circuits Systems (ACCS) Systems & 2017 Intl Conf on New Paradigms in Electronics & Information Technology (PEIT).

[2] Arafa, E., Zekry, A., Shawkey, H. and Ali, M., 2019, October. A CMOS RF Transmitter For LTE Applications: Implementation and Simulation. In 2019 Novel Intelligent and Leading Emerging Sciences Conference (NILES) (Vol. 1, pp. 55-58). IEEE.

CMOS LTE Transmitter Front-End

Ebtsam Arafa Abdelhamid Mohamed

Electronics and Communication Department

Supervised by

Prof. Dr. Abdelhalim Zekry and Dr. Heba Shawkey

Abstract

Recently, the necessity for low cost, low power and small size wireless transceivers has been increased expressively with the wide researches in transceiver architectures and RF circuit design techniques using CMOS technology. Long Term Evolution (LTE) is commonly identified as the fourth generation (4G) of wireless communication systems. The LTE standard takes the advantage of the multi-carrier modulation scheme Orthogonal Frequency-Division Multiplexing (OFDM) to rise the spectral efficiency, which demands high degree of linearity because of the variable signal envelope. LTE supports both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) techniques with the wide range of frequency band from 0.4GHz to 4 GHz in addition to a wide number of channel bandwidth that allocated from 1.4 MHz to 20 MHz.

This thesis presents the design and implementation of an RF front-end transmitter in UMC 130nm CMOS technology intended for LTE applications. The proposed transmitter is composed of LC voltage-controlled oscillator (VCO), up-conversion mixer, and power amplifier (PA). The LC VCO is based on differential structure with cross-coupled NMOS transistors to achieve low phase noise and low power dissipation. Gilbert-mixer is adopted in this work because of its high conversion gain, good linearity, and good isolation at the cost of a small growth in the noise figure (NF) and the power consumption. In addition, a low-power consumption PA design is introduced in this thesis. The proposed PA consists of two stages, driver stage and power stage. The power stage uses a pre-distortion linearizer to improve the linearity. The implemented transmitter provides a saturated output power of 23.1dBm with a

maximum power gain of 29.6 dB, a 21.5 dBm output 1-dB compression point, and a power dissipation of 172.5mw satisfying the requirements on LTE front end. In addition, a physical layout for the complete transmitter circuit is provided in this thesis with total area equals 0.775mm*0.7mm.

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