بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

جامعة عين شمس

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DESIGN OF MM-WAVE PHASE INVARIANT VARIABLE GAIN AMPLIFIER AND LOW PHASE NOISE VOLTAGE CONTROLLED OSCILLATOR FOR 5G TRANSCEIVERS

By

Yahia Zakaria Mohamed Ibrahim

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electronics and Communications Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
GIZA, EGYPT
2021

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Title of Thesis:

Design of mm-wave phase invariant Variable Gain Amplifier and low phase noise Voltage Controlled Oscillator for 5G transceivers

Key Words:
5G transceivers – VGA – current steering – wideband – VCO

Summary:
This Thesis presents the design and implementation of two important building blocks for phased arrays used in 5G transceivers; namely Variable Gain Amplifier (VGA) and Voltage Controlled Oscillator (VCO). It proposes the design and implementation of a current steering VGA where novel techniques are adopted to achieve very low phase and gain errors across the entire gain range. The proposed current steering VGA achieves a wideband response and shows an excellent correlation between the measurements and the simulations. A Novel VGA architecture is also introduced in this thesis which is based on the concept of ac currents addition and subtraction to achieve inherently wideband phase invariant response without any .trade-off with the other VGA parameters such as gain, bandwidth, linearity and noise
In addition, this thesis proposes the design and implementation of an LC cross-coupled VCO and a novel transmission line based VCO. Coarse and fine tuning are used together with a fixed capacitor technique to achieve wide tuning range for the LC based VCO. The transmission line based VCO provides a square wave at the output of the VCO with very low power consumption, this can be used in high speed digital applications. Varactor is added at the middle of the transmission line in order to add tuning to the VCO by changing the electrical length of the transmission line.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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