شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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قسم

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

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A LOW-POWER MULTI-BAND NB-IOT RECEIVER WITH HIGHLY LINEAR RF FRONT END

By

Hassan Ali Hassan Ali

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
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Title of Thesis:

A Low-Power Multi-band NB-IoT Receiver with Highly Linear RF Front End

Key Words:
NB-IoT; sensitivity; Noise Figure; linearity; blocker

Summary:
This Thesis presents the system and circuit level design of a NB-IoT receiver (RX) based on 3GPP Technical Specification (TS) 36.101. Required sensitivity is -108dBm in 200kHz bandwidth, while expected blocker level is -15dBm at ±85MHz offset from required signal. This places a restriction on both gain and filtration such that gain shall be large to be able to receive low level wanted signal while filtration shall be large such that all RX chain blocks operate linearly. This design targets serving many NB-IoT operation bands, namely from 400MHz to 2.3GHz. So no off-chip filter is used. This dictates large linearity specification on the RF front end to avoid desensitization by -15dBm out-of-band blockers (OOBs). Large linearity specification leads to large power consumption. A solution is proposed to reduce power consumption of the RF front end, while achieving high gain and high linearity. The proposed RF front end provides 29.5dB gain and -10.9dBm IIP3 while consuming 2mW from a single 1.1V power supply. The solution includes adding gain programmability to conventional resistive feedback LNA to relax the trade-off between linearity and power consumption. The RF front end is designed using a 40nm CMOS technology and occupies an area of 0.2mm^2.

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.

Name: Hassan Ali Hassan Ali Date:

Signature:

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