Preface

With the continued maturation of the Internet of things (IoT) for smart cities, a huge market has been opening up for short-range wireless communications, especially for ubiquitous wireless sensor networks (WSNs). It is expected that by 2020, the IoT market will be close to hundreds of billion dollars (annually $\sim$16 billions). These WSNs consist of spatial distribution of highly autonomous short-range radios to sense and collect the environmental data. The large number of units present in the network relaxes the sensitivity of a single receiver but, at the same time, demands ultra-low-power (ULP) and ultra-low-cost (ULC) radio chips to increase the density of elements and autonomous lifetime.

This book focuses on ULP and ULC receiver circuit techniques, and attempts to alleviate the trade-off between ULP and ULC. The rapid downscaling of CMOS offers sufficiently high f_T and low V_T favoring the design of ULP wireless receivers by: (1) cascading of radio frequency (RF) and baseband (BB) circuits under an ultra-low-voltage supply; (2) cascoding of RF and BB circuits in the current domain for current reuse. Based on these observations, two receivers according to the IEEE 802.15.4 (ZigBee/WPAN) standard have been designed, suitable for the worldwide available 2.4-GHz ISM band. Although current-reuse receivers can lead to power savings, they normally demand a high supply voltage and are optimized for narrowband only. To surmount this, by processing the RF and BB signals in an orthogonal approach, the third design is a function-reuse wideband-tunable receiver for sub-GHz multiple ISM bands. This is realized elegantly by employing an N-path passive mixer as the feedback path of the low-noise amplifier (LNA) to *concurrently* amplify the RF (common mode) and BB (differential mode) signals.

The described ULP and ULC architectures constitute attractive solutions for emerging WSNs suitable for different ISM bands. We hope you will enjoy reading this book.

Macao, China
May 2015

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http://www.springer.com/978-3-319-21523-5

Ultra-Low-Power and Ultra-Low-Cost Short-Range
Wireless Receivers in Nanoscale CMOS
Lin, Z.; Mak Elvis, P.-I.; Martins, R.P.
2016, XIV, 110 p. 72 illus., 52 illus. in color., Hardcover
ISBN: 978-3-319-21523-5