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A Low Power High-Performance Area Efficient RF Front-end exploiting Body Effect for 2.4GHz IEEE 802.15.4 Applications

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***Abstract*—**The rising internet-of-things applications in home automation, smart wearables, healthcare monitoring demand small, area efficient, high-performance and low power radio frequency (RF) blocks for effective short-range communication. This growing market demand is addressed in this paper by proposing a fully CMOS radio frequency front-end (RFE) exploiting bulk effect. Apart from the primary function of frequency translation, proper circuit performance concerning the linearity, conversion gain, and noise figure is required for low-cost densely integrated transceivers operating in the 2.4GHz ISM band. The proposed RFE at 2.4GHz is designed and implemented in UMC 180nm CMOS process technology with two modes of operation. In high gain mode (Mode-I), the post-layout simulation with SpectreRF shows a peak gain of 30.06dB, IIP2 at 64.52dBm, IIP3 at -2.74dBm and a DSB-NF of 7.68dB while consuming only 9.24mW from the 1.8V supply. In the high linear mode (Mode-II), the RFE achieves a higher IIP3 of 10.78dBm, IIP2 of 91.56dBm, the conversion gain of 23.5dB, DSB-NF of 9.46dB while consuming a low power of 3.6mW. The fully CMOS circuit occupies a core area of only 0.0021mm^2. The proposed front-end exhibits a spurious free dynamic range (SFDR) of 81.18dB ensuring the high dynamic operation of the wireless system.

***Keywords*— CMOS, IoT, RF, LNA, Mixer, Down-conversion, Conversion Gain, Linearity, IIP3, Dynamic range, Noise figure, Inductorless, Zigbee, WPAN, Wireless, Communication systems**