

**“Advanced integrated RF front-end solutions for low-power and UWB wireless systems”**, pp. 272 - 280

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**Abstract** – In this paper, we present novel low-power RF front end circuits (Low Noise Amplifier [LNA], mixer, Voltage Controlled Oscillator [VCO]) and easy-to-design antenna solutions for the integration to compact wireless front-end systems for L-band and UWB applications. First, new low-power circuit architectures (LNA and mixer) have been demonstrated in CMOS process for L-band applications. The subthreshold LNA shows a measured peak gain of 13.6 dB at 980 MHz with a 3 dB bandwidth of 160 MHz. The noise figure of the LNA is 4.6 dB at 980 MHz. The input P1dB of the LNA is -0.2 dBm and the IIP3 is 7.2 dBm. Then the active anti-parallel diode pair (APDP) mixer developed exhibits a measured LO isolation above 20 dB for both 1X and 2X mixers at 2.5 GHz. The input 1 dB compression points of the two mixers are measured to be -9.5 dBm for 1X mixing and -6.5 dBm for 2X mixing. With the emerging demands of wider bandwidth and higher data rate for multimedia applications, RF front-end circuits (LNA, VCO) have been designed for UWB frequency ranges and fabricated in 0.18  $\mu\text{m}$  SiGe BiCMOS process. The designed LNA shows a measured gain of 13 dB with 3dB bandwidth of 10 GHz. The noise figure of the LNA is between 2.9 dB and 3.3 dB from 2 GHz to 10 GHz. The measured input P1dB and IIP3 at 3 GHz are -14.5 dBm and -6.5 dBm, respectively. The VCO implemented achieves a fundamental frequency between 1.7 GHz and 5.2 GHz while consuming only 3.7 mW from 1.8 V supply. The measured phase noise of the fundamental frequency varies between -94 and -103 dBc/Hz at 1 MHz offset. A phase noise degradation of around 3 to 6 dBc/Hz is observed in the consequent harmonics. Finally, a double exponentially tapered slot antenna (DE TSA) on flexible organic material (LCP), suitable for conformal packaging and integration with above circuits has been investigated as a candidate for UWB communication systems. The measured return loss remains below -10 dB and the shape of the measured radiation pattern agrees well with the simulation. Index terms – LNA, mixer, VCO, UWB, L-band, Liquid Crystal Polymer (LCP), conformal antenna, Double Exponentially Slot Antenna (DESTA), SiGe, BiCMOS, CMOS, P1dB, IIP3.