Wireless Implantable EMG Sensing Microsystem

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Abstract

A subfascially implantable wireless electromyogram (EMG) sensing microsystem is developed for intelligent myoelectic control of powered prostheses. The microsystem consists of EMG sensing electrodes, low power interface electronics, remote RF powering and data telemetry unit enabling real-time wireless operation. The EMG signal is sensed by two 6.5 mm diameter epimysial Pt-Ir electrodes, which are interfaced with a low noise, low power, and capacitively coupled differential amplifier with 1 kHz bandwidth. The front-end electronics are designed with an input referred noise power spectral density of 60 nV/rtHz while consuming 3 μA from a 2 V supply. The amplified EMG signal is then digitized by an 11-bit algorithmic ADC before data telemetry. Remote RF powering is achieved through inductively coupled coils driven by an external Class-E power amplifier operating at 7 MHz. The RF power is received transcutaneously by a 30-turn 8 mm-diameter spiral coil and then converted to a stable 2 V supply. The digitized EMG data is Manchester-coded and transmitted to the external transceiver by passive phase-shift keying (PSK) on the same inductive link as the RF powering system. The custom designed electronics are fabricated in the AMI 1.5 μm CMOS process occupying an area of 2mm x 2mm and consume approximately 30 μA from a 2 V supply. The overall implantable system will be packaged in a Dacron mesh and encapsulated in silicone for biocompatibility and implant performance evaluation.