Contribution ID: **36** Type: **not specified**

A 0.18 µm CMOS Low-Power Radiation Sensor for Asynchronous Event-Driven UWB Wireless Transmission

Thursday, 3 May 2012 20:00 (1 hour)

We describe the design of a floating gate-based MOS sensor embedded in a read-out CMOS sensing element used as a radiation sensor. The read-out cell asynchronously triggers an all-digital Ultra-Wide Band (UWB) transmitter operating in a 0-5GHz band, with a repetition frequency, which dynamically depends on the radiation level. The trigger signal ranges 20 to 30MHz, with a designed sensor input range, between 0 and 2V.
The floating gate MOS sensor has been recently characterized and here emulated with a commercial radiation-sensitive FETs based on a metal-oxide-silicon p-channel structure, for a 2V variation given an equivalent absorbed dose of 100rad within 1 and 100krad. A maximum sensitivity of 1mV/rad is estimated up to 10krad. The paper shows the design of a preliminary microelectronic circuit that includes a sensor, an oscillator and modulator, which is now under submission. The prototype will be interfaced to an external power supply and to an antenna for pulse transmission, to provide a preliminary proof-of-concept validation before a complete integration. Given the small estimated area of the complete chip prototype, comprising the antenna, i.e. less than 1mm2, the IC can enable a large variety of applications for spot radiation monitoring systems (High-Energy Physics experiments might benefit of this concept). The paper shows measurements on a mini test-board equipped with the full-custom components comprising an external transmitter IC that will be integrated in the ASIC prototype (TowerJazz). First measurements, obtained at the "Istituto Italiano di Tecnologia" , Center for Space Human Robotics, demonstrate the feasibility of the proposed event-driven asynchronous Ultra-Low Power (ULP) UWB transmission. The Science and Technology Facility Council of the Rutherford Appleton Laboratory (RAL), UK, supports the entire research.

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Session Classification: Posters