An Implementation of a Sub-nanosecond UWB Pulse Generator

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The ultra-wideband (UWB) technology offers promises for high accuracy (in the cm range) localization at distances of up to 10-20m in challenging indoor environments with multipath. One of the ways of generating UWB signals is based on short pulses that occupy a very wide swath of the radio frequency spectrum. However, research results on practical approaches to validations of the performance of simple architecture UWB generators that are able to generate narrow (200-300ps range) UWB pulses of high amplitude (6-9V) and with relatively low power consumption (below 300mW) are limited.

In this paper, we present an implementation of a UWB pulse generator based on a step recovery diode. The principle of operation and the architecture of the developed pulse generator are explained. Moreover, the hardware implementation issues and the parameters of the generated UWB pulse including its peak voltage equal to 8.9 V, its full width at half maximum equal to 240 ps, and frequency spectrum are provided. The carried out practical measurements with the UWB pulse generator are in line with the theoretical analysis performed with the help of the Agilent Advance Design System (ADS) simulation tool. The UWB pulse generator incorporates not only the high frequency part, but also a trigger signal part that is based on a low-power MSP430F2121 microcontroller. The averaged total power consumption of the complete UWB pulse generator is 185mW @ 3.3V supply voltage.

Such a pulse generator constitutes a vital part of a transmitter in a UWB localization system. The presented in this paper work represents the next step in the development of our UWB localization platform shown at the last edition of the IPIN conference in Portugal.