Ultra Wideband Signal Detection with a Schottky Diode Based Envelope Detector - DTU Orbit (17/12/2018)

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This paper presents an experimental demonstration of 2.5 Gbit/s real-time ultrawideband (uwb) transmission using a Schottky diode based envelope detector. The envelope detector is designed and fabricated ad-hoc on a Rogers 6002 substrate using microstrip technology and surface-mount components. The receiver is able to detect an ultra-wideband signal compliant with the Federal Communications Commission (fcc) regulations for uwb transmission and consisting of a 2.5 Gbit/s non-return-to-zero (nrz) data signal on a 6.9 GHz carrier after 20 cm wireless transmission. Bit error rates (ber) below the forward error correction threshold are achieved for wireless distances of 20 cm and 50 cm at respective data rates of 2.5 Gbit/s and 1.25 Gbit/s. uwb transmission is one of the most attractive alternatives for low-power high-speed wireless communication systems over short distances, its popularity stemming from its interoperability with existing wireless services and its license free operation. The latter is conditioned on meeting a number of standards and regulations for maximum radiated powers, designed to ensure the former by defining uwb signals as signals with large bandwidths in the frequency range of 2.85 GHz to 10.6 GHz and low power spectral density radio frequency (rf) emission. The use of such low power levels ensures non-problematic coexistence with other already deployed wireless technologies – e.g. WiFi, GPS and mobile services – and allows deployment in environments sensitive to rf interference – such as aircraft cabins and hospitals – by ensuring that a traditional narrowband receiver will only see negligible interference power within its own system bandwidth. The designed envelope detector was fabricated using microstrip lines on a Rogers 6002 substrate and a surface-mount Schottky diode. By careful design the detector is able to detect a 4 GHz wide communication signal centered around a 6.9 GHz carrier and transporting 2.5 Gbit/s of nrz data. It is thus ideally suited for detection of uwb signals and an experimental demonstration of a real-time data transmission is performed, achieving a ber below the limit of 3.8×10⁻³ for a standard 7 % overhead forward error correction (fec) limit over wireless distances of 20 cm and 50 cm at respective data rates of 2.5 Gbit/s and 1.25 Gbit/s. Demonstrating real-time transmission of gigabit-class signals under the restrictions of the fcc spectral emission mask for uwb systems highlights the possibilities of uwb transmission for short distance communications. It further confirms the potential of the designed envelope detector and the suitability of Schottky diode based envelope detectors for uwb communications.

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