Title: Passive Wireless Saw Sensors with New and Noval Reflector Structures: Design and Applications

Surface acoustic wave (SAW) devices are a solution for today's ever growing need for passive wireless sensors. Orthogonal frequency coding (OFC) together with time division multiplexing (TDM) provides a large number of codes and coding algorithms producing devices that have excellent collision properties. Novel SAW noise-like reflector (NLR) structures with pulse position modulation (PPM) are shown to exhibit good auto- and cross-correlation, and anti-collision properties.

Multi-track, multi-transducer approaches yield devices with adjustable input impedances and enhanced collision properties for OFC TDM SAW sensor devices. Each track-transducer is designed for optimum performance for loss, coding, and chip reflectivity. Experimental results and theoretical predictions confirm a constant Q for SAW transducers for a given operational bandwidth, independent of transducer and device configuration.

Results on these new NLR SAW structures and devices along with a new novel 915 MHz transceiver based on a software radio approach was designed, built, and analyzed. Passive wireless SAW temperature sensors were interrogated and demodulated in a spread spectrum correlator system using a new adaptive filter. The first-ever SAW OFC four-sensor operation was demonstrated at a distance of 1 meter and a single sensor was shown to operate up to 3 meters. Comments on future work and directions are also presented.

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Approved for distribution by Arthur Weeks, Committee Chair, on February 3, 2011.

The public is welcome to attend.