UWB SAW-tags?

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Abstract

In this paper we discuss the feasibility of surface acoustic wave (SAW) radio-frequency identification (RFID) tags using ultra-wide band (UWB) technology. UWB technology is now emerging and enables short-range communications with high speed and low power levels. The use of wide-band (spread spectrum) and UWB signals in surface acoustic wave (SAW) identification tags has been recently addressed [1]. This possibility is very attractive because for SAW tags the number of different codes that can be obtained is determined by the product ***B*T***, where ***T*** is the pulse duration, limited in SAW devices to 2 to 4 μs.

Using UWB signals allows for much wider passbands and the same informational capacity ***B*T*** can be achieved with significantly smaller delays. For example, at frequencies higher than 1.99 GHz, we can use, according to US regulations [FCC], signals with >20% relative band and with –41.3 dBm power level. Using a band B of 500 MHz from 2.0 GHz to 2.5 GHz would satisfy such criteria for some applications. SAW technology is perfectly mature for manufacturing such devices at low cost and in big volumes.

Using an ultra-wide frequency band gives significant advantages:

- We can use a short coding time. Total length of SAW chip can be close to 1 mm.
- Performing signal processing inside a SAW tag using a chirp transducer will allow matched to signal deciphering of reflected signals . The signal coming from SAW tag will be unique resulting in a significant reduction of the initial delay necessary for decaying of environmental echoes.
- Short total delay ***T ≈ 0.4 μs*** corresponds to only about 2 dB to 3 dB of propagation loss, contrary to 18 dB - 20 dB we have in ordinary tag with 1 μs initial delay and 2 μs of coding time.
- Finally, the total power radiated by a reader in this example will be below **40 μW**, which is undeniably an attractive level, despite the fact that the reading range is expected to be limited to about 1 m. This signal will be radiated in total less than 0.1 ms for one reading, which puts average power level in the nanoWatt level with 1 reading of tag per second sufficient for many applications.

[1] Härmä S., Plessky V.P., Li X., Hartogh P., *"Feasibility of ultra-wideband SAW RFID tags meeting FCC rules."* IEEE Trans. UFFC. 2009 Apr; 6(4) pp. 812-20.