6GHz SAW-tags and sensors

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SAW-tags usually are designed to operate in the 2.42 GHz ISM band in Europe. However, going to much higher frequencies can be attractive: the devices become smaller, especially antenna dimensions can be strongly reduced, and more directional antennas can be easily handled. It has been shown recently[1] that despite a strong increase of SAW propagation losses at 6 GHz frequency range, the final loss increase of the signal reflected by a SAW tag back to the "reader" is only about 10dB. That can be achieved due to shorter SAW pulses and shorter total delays. At this frequency range even for the ultra-wide-band devices (UWB, B > 500MHz) the IDT remains relatively narrow-band which also leads to a reduction of the device losses.

The 6 GHz range SAW devices can be produced either using E-beam lithography or nano-imprint lithography (NIL), where we have demonstrated both. The advantage of NIL is that hundreds of SAW devices can be imprinted at once, increasing the throughput by a factor of 50 at least compared to E-beam lithography. In E-beam lithography the devices are written serially, thus the problem of individual coding of SAW-tags does not exist. By combining NIL and E-beam the by using NIL technology for manufacturing the transducer and calibration (CAL) reflectors (identical in all devices) and then using E-beam to write unique reflector lines corresponding to individual coding of each particular device, one could increase the substantially.

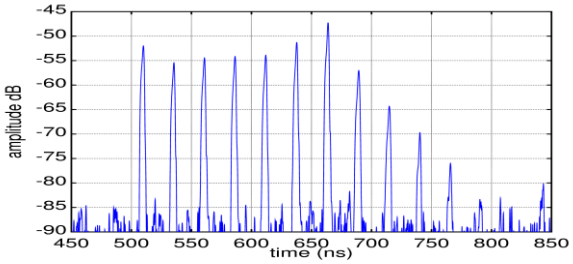

Fig. 1: On-wafer probed 6 GHz SAW-tag.

Fig.1 shows the response of a probed on wafer 6-GHz SAW-tag. One can see that the response is very strong compared to the noise level. It is also very close to the simulation results[1]. The CAL reflectors (the first and the last) were designed to give approximately 3 dB stronger responses compared to the code reflectors situated in-between. Recently we have received first wafers with 3GHz-6GHz SAW tags and sensors manufactured by NIL technology. Fig.2 shows the pulse response of one of these sensors. The data will be reported in detail in this paper.

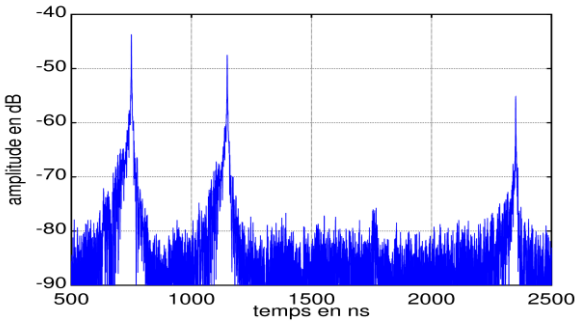

Fig.2 UWB (2-3 GHz) SAW sensor; fabricated using NIL technology

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[1] Sveshnikov, B. V., et al. "State University, Saratov, Russia." *Ultrasonics Symposium (IUS), 2013 IEEE International*. IEEE, 2013.