GVR Trade SA

Passive wireless microphone

(project proposal)

V.Plessky, 24.02.14

There are different types of microphones produced worldwide in huge quantities, around 1 Bln. pieces per year. A microphone is an acoustic-to-electric transducer that converts sound in air into an electrical signal.
Most of microphones are connected by wires with amplifiers and other devices for processing of signals corresponding to the sounds registered by a microphone. There are wireless microphones, which transmit the audio as a radio or optical signal, rather than via a cable but they need a battery as energy source for the transmitter sending the electric signal from the microphone to receiver equipment for amplification, registration, recording, etc...

In many application such microphones are not really convenient and there is a great need of wireless truly passive microphone with zero energy consumption, having no battery on board, no energy harvesting, really no source of energy of whatever kind.

Proposed project solves this problem:

– **we propose truly passive wireless microphone**.

Such microphones are needed for communication with computes, for voice communication with on-board computers in auto and in many other applications, where the use of wires or battery is impossible or not desirable.

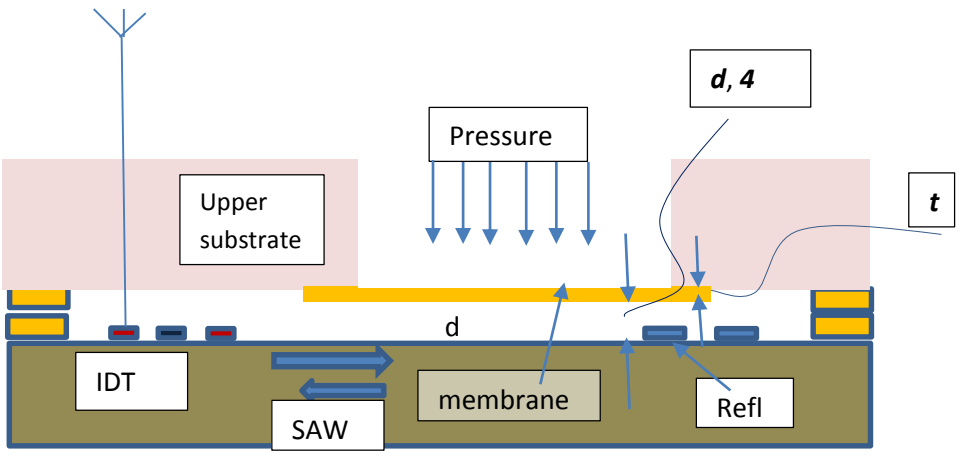

Fig.1 Passive wireless microphone, schematically

The remotely controlled passive SAW sensors of deformation are well known.

Their measurement data can be “read” from a few meter distance. Meanwhile the sensitivity of these devices is not sufficient for the sound registration. We propose here the combination of SAW sensor with MEMs technology, schematically illustrated below (see Fig.1).

The device works in the same way as the SAW-tag. The interrogation signal received by antenna is transformed by the IDT into SAW, with propagates to the reflector and is reflected back. After being received by the same IDT, the signal is returned to the interrogator device (the “reader”) through the radio channel. The conductive membrane is suspended over path of SAW and its mechanical vertical displacements, caused by the sound pressure, influence the propagation of SAW through the mechanism of the short-circuiting of the electric fields near the piezoelectric substrate.

Two “amplification effects” are used here. The first is the cantilever effect, which results in the membrane displacements many orders stronger than just a deformation of any 3D bulk solid by a weak sound pressure. The second effect is the SAW velocity change due to short-circuiting of the electric fields ($\Delta V/V$ effect), which can be of the order of 10^{-2}, while the mechanical deformation related values are usually smaller than 10^{-4}.

More precise estimations, not presented here, has shown that we can have sufficient sensitivity to achieve easily measurable variation of phase of the reflected SAW. Moreover, the sensitivity of this device, which can be used also as a pressure sensor, can be varied in large scale by using adjusted membrane thickness ***t***. The main difficulty we see is to produce a controllable gap ***d***, with dimensions depending on many factors, but, typically of the order of 0.1 μm to 1.0 μm.

In proposed project GVR, which applied for corresponding patent, would develop the theoretical model of this device and design a prototype. The above Fig.1 illustrates only the basic idea. The numerous variation of this device are possible – for example, the structure can be of a SAW resonator type, not a delay line. All such versions are included in the patent.

We need a partner, which has three basic technology (one of them could be sub-contracted):

1. SAW technology,
2. MEMs technology for manufacturing the membrane and the upper cover
3. Wafer-to-wafer bonding technology

The system will include relatively simple reader, say, compared to a mobile phone. It may work in one of ISM bands. Ag the first, feasibility, stage GVR can be responsible for the “reader” too (we could use a reader for SAW-tags).

B. Tree

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