

SAW temperature sensors for electric power transmission lines

Vladimir.Kalinin¹, Kirill Stroganov¹, Boris Ljulin¹, Victor Plessky²

¹ SAW devices Dept., Avangard Ltd, St. Petersburg, Russia

²R&D, GVR Trade SA, Chez-le-Bart, Switzerland

Email: vl_kalinin@mail.ru

The SAW sensors have undeniable advantages such as a) ability to operate at high temperatures b) zero power consumption, c) large reading distance, d) ID function, which result in gradual recognition by the market. Here we describe a sensor system designed for monitoring the temperature of contact in high power electric equipment, transmission lines, gear boxes, etc.

In the first version of the system we use as the sensor elements our earlier developed SAW-tags¹ operating in 2.45 GHz ISM band with number of codes up to 10^7 . The basic part of the same reader, initially developed by RSSI was used. Special package for operation in severe external conditions was developed (Fig.1) Using the tags as the sensors allows automatically getting ID number of the interrogated device. The system can use up to 12 sensors and to avoid collision problem a few antennas can be used simultaneously. The range of measured temperatures is -10°C to $+125^{\circ}\text{C}$. The system consists of the reader (power output 100mW, power supply voltage – 12V...24V, power consumption 7W) with antenna (operating frequency 2.45 GHz, gain of 18 dBi) and SAW-tags. The system was tried for monitoring temperature of conductors of the electric power transmission lines, where the control points are sufficiently separated in space.

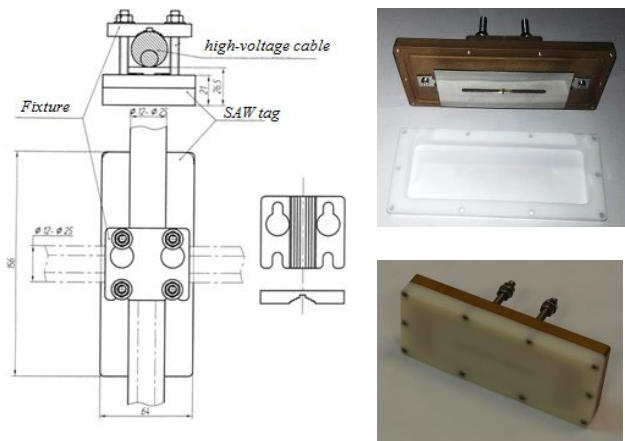


Fig. 1: SAW sensor image

In another version of this system the collision problem is solved for 12 sensors in the time domain. The SAW-tag like reflector delay lines, including 3 reflectors each are designed in a way that reflector positions do not overlap in total temperature variation of 200°C (Fig.2). Moreover, all sensors have identical combination of differences of delays, which simplifies the deciphering algorithm. These specially designed sensors have reduced level on loss of only about 25 dB to 30 dB (Fig.2) and can be “read” with the same reader as the SAW-tags. This system is currently under development and is almost doubled compared to the first version. The next step will be to show the measurement results in convenient form.

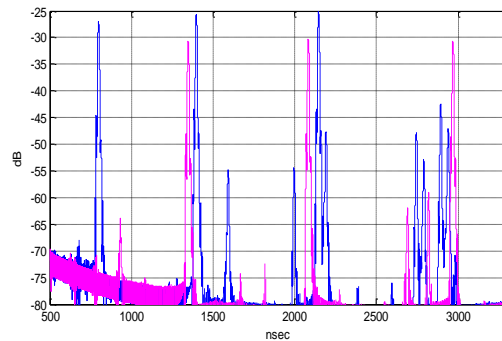


Fig.2 Blue- 1st sensor, pink- 12th sensor

¹ Plessky, V., Ostertag, T., Kalinin, V., & Lyulin, B. (2010, October). SAW-tag system with an increased reading range. In *Ultrasonics Symposium (IUS), 2010 IEEE* (pp. 531-534). IEEE.