Abstracts

Radio-requestable passive SAW water-content sensor

L. Reindl, C.C.W. Ruppel, A. Kirmayr, N. Stockhausen, M.A. Hilhorst and J. Balendonck. "Radio-requestable passive SAW water-content sensor." 2001 Transactions on Microwave Theory and Techniques 49.4 (Apr. 2001, Part II [T-MTT] (Special Issue on Microwave Acoustic Wave Devices for Wireless Communications and Sensing)): 803-808.

A new passive sensor for remote measurement of water content in sandy soil was designed, using a surface acoustic wave (SAW) reflective delay line. Information from this sensor can be obtained by an interrogation device via a radio link operating in the European 434-MHz industrial-scientific-medical band. The SAW device, manufactured on the YZ cut of LiNbO/sub 3/, is mounted and sealed in a standard dual inline 16 package and contains four electroacoustic transducers. One transducer is connected to an external antenna to pick up an RF request signal from the interrogation device and to send back an RF response. The second transducer operates as a reflector. The bus bars of this transducer are connected with two measuring rods through an electrical transmission line. These rods can be inserted into sandy soil. The final two transducers operate as reflectors and are included for reference purposes. The transmission line and the two rods spanning the sand-water mixture have a characteristic impedance Z/sub load/, which loads the second transducer. Changes in the soil water content are observed as a change of the total permittivity due to the high permittivity of free water, which, in turn, affects Z/sub load/, as well. The amplitude and phase of the acoustic reflection at the second transducer changes due to a variation of the terminating Z/sub load/. This then results in a difference in attenuation and phase of the corresponding peak in the time domain. Thus, the RF response of the sensor carries information about the water content between the rods, which, therefore, can be detected by and evaluated in the interrogation unit.

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