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A RADIOENGINEERING SYSTEM WITH A MOISTURE CONTENT MEASUREMENT CHANNEL

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It is shown that appropriate organization of a single-frequency structure with a channel for moisture content measurement in a PC-aided radioengineering system makes it possible to eliminate the impact of destabilizing factors and frequency errors, and to improve sensitivity and accuracy of moisture measurements of materials processed by a microwave electromagnetic field.

Microwave technologies are used to resolve a wide range of practical tasks in industry, agriculture, medicine and biology [1]. The need for development of specialized systems of automatic control of microwave engineering processes has long been substantiated [2]. However, up to now one could hardly find any information in the literature on practical realization of systems in which the high-power channel is also used as the information one.

Consider the block diagram (Fig. 1) of one realization of a computerized radioengineering system. The system is an embodiment of the idea of simultaneous use of a two-frequency power microwave channel for transmission of information about composition of substances and materials treated by the electromagnetic field (these materials will be called object of treatment — OT), particularly about moisture content of the materials in the process of drying. As noted in [1], the two-frequency engineering conditions assure existence of several oscillations in the engineering compartment (EC) with OT inside, permitting improved EMF uniformity. In addition, at different depths of EMF penetration, several mechanisms of effective heat transfer work simultaneously, resulting in acceleration of the engineering process and in improvement of quality of the specimen treated: dried wood, for example, has no heat stresses, deformations, stratification, or cracks.

The energy channel (Fig. 1) consists of two cascades of microwave amplifiers including preamplifiers A1, A3 and boosters A2, A4. They are built in transit-type (resonator) klystrons tuned to frequencies $\omega^{up} = 2450 \pm 25$ MHz and $\omega^{low} = 915 \pm 13$ MHz, approved by the International Electrotechnical Commission for industrial applications.

The channel of shaping signals (CSS) includes two low-power driving generators G1, G2, a balanced mixer BM1, and LPF and HPF, whose output signals are amplified by the two-frequency energy channel. The frequency ω_1 and ω_2 of each generator G1 or G2 is checked by digital frequency meters FM1 and FM2, and undergoes correction in control devices CD1, CD2 from the personal computer side. Here we can also use two computer-controlled frequency synthesizers, where each frequency must meet the condition $\omega_1 = (\omega^{up} + \omega^{low})/2$ and $\omega_2 = (\omega^{up} - \omega^{low})/2$.

The automatic power control (APC) channel is intended to equalize incident waves' powers in the paths of each of klystrons A2 and A4. The channel includes a directed coupler W7, a balanced mixer BM3, a narrow-band microwave amplifier A5, a detection circuit VD1, a low-frequency amplifier A6, a phase-sensitive rectifier PSR1, a low-pass filter, and a *p*-*i*-*n*-attenuator WU1.

The measurement channel (MC), designed for measurement of moisture content in the material treated in the EC, includes a directed coupler W6, a balanced mixer BM4, a narrow-band microwave amplifier A7, a detection circuit VD2, a

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