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# TRANSISTORIZED GENERATORS WITH QUASIOPTICAL RESONANT SYSTEMS

R. V. Antipenko, Ye. A. Machusskii, and N. A. Pershin

*Kiev Polytechnic Institute, Ukraine*

**The paper describes several designs of transistorized quasioptical generators using a slot antenna for exciting an open resonator. Equivalent networks of the devices are developed, and results of experimental tests of the generators are presented.**

Owing to recent advances in technology and in improvement of characteristics of transistors, diodes are gradually being superseded by transistors in generators of the millimeter and submillimeter range of wavelengths. For example, at the present time the maximum frequency of generation in bipolar transistors with heterojunctions exceeds 100 GHz [1].

In order to decrease the working wavelength, we have to reduce the physical size of single-mode metal waveguides and of cavity resonators, which in turn leads to an increase in loss and decrease in quality. Moreover, the requirements for accuracy of mechanical working of some assemblies and wiring elements are becoming more stringent. All this results in technological limitations and in additional production expenditures. Because of this, for devices of extremely high frequency range quasioptical resonant systems such as open resonators (OR) are preferable. The quality factor of OR is several orders higher than that of cavity resonators, which significantly improves spectral characteristics of the generators. In addition, the use of OR facilitates the summing of power of individual active elements mounted on one of the OR mirrors [2]. And, the transition to integrated technology for manufacture of parts for oscillation elements of generator systems becomes quite natural.

The main difficulty in designing quasioptical generators is the development of the coupling and matching elements between the transistor and the resonator field. Note also that placement of an active element inside an OR results in additional spurious effects between the network elements, modification of the field structure in the resonator, and deterioration of its quality. For example, after mounting the diodes and matching elements in a resonator, its quality factor fell from 10000 to 3000–4000 [2].

To reduce the impact of a transistor's components and wiring, in quasioptical generator design we propose to employ a transverse-planar transistor module described in [3]. In this structure the role of coupling of the active element to the OR is played by a slot antenna (SA) on a dielectric base (Fig. 1). Here the metallized surface of the substrate is also the surface of one of the resonator mirrors. The transistor, with its feeding and coupling elements, is located at the back side of the substrate. The slot antenna is connected to the transistor by the matching segments of a microstrip line. The wiring elements for feeding the active element are not shown in the picture. The coupling of the active element to the OR is performed only via the slot antenna, whose parameters are easily controllable.

The positive feedback of the generators is realized through SA elements. The antenna is Π-shaped. Since the fields of the vertical segments of the slot compensate one another, the coupling to the resonator is defined by the length of the slot horizontal part. The antenna yields two-directional radiation permitting realization of various patterns of generator design. Here two variants of OR connection are possible: "for reflection" and "for re-entrance".

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