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CHARACTERISTICS OF A DIELECTRIC ANTENNA FOR THE MILLIMETER RANGE OF WAVELENGTHS

A. P. Krut'ko, V. A. Obolonskii, and B. M. Shevchuk

"Iceberg" Semiconductor Electronics Research Institute, Kiev, Ukraine

The paper presents results of an experimental investigation of radiation characteristics of rod dielectric antennas used as primary radiators for microwave reception-transmission modules. It is shown that elongation of the rods with the aid of hollow conical sections makes it possible to narrow the main lobe and to lower the side lobe levels.

One promising problem in the millimeter wave range is creation of small receiving and transmitting modules for active and passive radiolocation, radio-relay communication systems, etc., including matrix-type radio-vision receivers in the microwave range [1].

Matrix radio systems can be built based on monolithic-integral technologies [2]. However, that fact that we have to arrange a large number of micromodules, supplied with their own antennas, on a minimal area perpendicular to radiation direction (for example, in the focal plane of a lens or a parabolic mirror), necessitates reduction of aperture area of the antennas (horn-shaped as a rule), which deteriorates the antenna characteristics. In this connection, of interest is the possibility of using, in such irradiators, rod dielectric antennas (RDA), whose directional properties are dictated not by dimensions transversal with respect to the beam, but by configuration and rod length along the beam, when the rod lateral dimension does not exceed a half-wavelength [3].

For this purpose we have performed experimental investigation of RDA radiation characteristics in the millimeter range of wavelengths (8.1 to 8.6 mm). The RDA brassboard models tested (Fig. 1) were in the form of a rod [4] fabricated of microwave dielectric (FP4). One end of the rod, in the shape of a cone 6 mm in diameter *1* and cuts 3.4 mm thick, was inserted into a waveguide pyramidal joint *2* with the cross-section from 7.2×3.4 mm^2 to 6.6×3.4 mm^2 at the output face. A part of rod *3*, protruding from the end face of the waveguide joint, had the shape of a truncated cone 18 mm long terminating in a cylinder *4* 3 mm in diameter. The length of this part of the RDA was set for different specimens from 18 (the cone without cylinder) to 53 mm. The RDA specimens, with a microwave detector at the joint, were mounted on a rotating unit in a peculiar manner: the end face of the waveguide joint corresponding to the front face of the RDA radiating part was located on the rotation axis, when we performed a turn through the angles $\pm\Delta\varphi$ from the direction corresponding to the maximum of radiation pattern (RP) of the specimen under investigation.

Figure 2 shows several typical RP in the *H*-plane for a number of specimens having different shapes and lengths of the radiating part (l_r) of the rod protruding from the end face of the waveguide joint. Curve *1* (crosses) refers to RDA with l_r = 28 mm, while curves *2* (circles) and *3* (squares) correspond to RDA with l_r = 18 mm and to a pyramidal horn in the shape of truncated pyramid 10 mm high and with the aperture area 13×17 mm^2.

It follows from Fig. 2 that at a level of –3 dB the radiation pattern of the horn in the *H*-plane corresponds to the angular width of a RP of the rod with l_r = 23 mm. At the attenuation equal to –10 dB it exceeds this value for the shortest (18 mm) rod, although the level of side lobes of the horn RP, in the case of their implicit form, is lower than for these RDA

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