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THE MULTI-BAND REFLECTOR ANTENNA OF THE DOUBLE-POLARIZATION SCANNING RADIO AEROSPACE RADIOMETER

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The paper describes a 13-channel reflector antenna operating in six subbands of wavelengths from 3 mm to 4.5 cm in two orthogonal linear polarizations for the scanning aerospace radiometer.

Systems of Earth remote sounding use pencil-beam scanning reflector antennas ensuring high spatial resolution and high sensitivity in the resolution element given a wide scanning band of the underlying surface. The increase in the amount and quality of information obtained in such a way may be ensured by simultaneous construction of the profiles of the underlying surface in several bands of wavelengths. The present article provides the results of developing a multi-channel scanning reflector antenna operating on two orthogonal (vertical and horizontal) polarizations in the bands of wavelengths 3.3; 8.2; 13.5; 16.0; 28.2, and 45.5 mm designed for installation on board of the "Sich" space vehicle as part of the "Kyi" radiometer complex for solving conservation and ecological monitoring issues.

When building antenna systems of radiometer complexes, high gains and use of the large area of the reflector antenna are of great importance just as making for the minimum of side lobes of the directional pattern (DP) and, accordingly, the minimum of the antenna scattering coefficient. These requirements are contradictory [1] and the problem of optimizing the radiometer antenna system in terms of electrodynamic characteristics requires thorough design of the reflector antenna in combination with the radiator.

At present the designing of the radiation field of reflector antennas is conducted mainly by the current method, aperture method, and by the method of geometrical theory of diffraction. We will note that the current method is more precise than the aperture one since it rules out an approximate scaling from the reflector surface to the aperture using the laws of geometrical optics, and the reflector depth is taken into account in the explicit form. The observation region where the calculation of the filed by the current method yields a true quantitative result is, at least, twice as large as the respective region for the aperture method. Compared with the method of the geometrical theory of diffraction the disadvantages of the current method include the complexity of the computational process and, as a result, low speed of computational algorithms (although when using modern computational technology this drawback may not be considered as crucial). The current method makes it possible at high precision to calculate fields in the geometrical region and transitional regions adjacent to it, where the bulk power of radiation is concentrated, and where high accuracy of designing polarization characteristics of reflector antennas in this area, is secured.

Characteristics of the radiation of reflector antennas by the current method are calculated under the following assumptions: introduction of the feed in the reflector system does not change its direction and polarization characteristics; the radius of the reflector curvature is substantially larger than the wavelength. The radiation field of the reflector antenna is determined in the assumption of the reflector ideal conductivity

$$\vec{E} = i60k \frac{e^{-ikR}}{R} \int_S \left[\vec{R}^0 \left[\vec{R}^0 \left[\vec{n}^0 \vec{H}_s\right]\right]\right] e^{ik(\vec{r}_s \vec{R}^0)}\, ds, \qquad (1)$$

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