

Planar Antenna with Diffraction Radiation for Radar Complex of Millimeter Band¹

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Abstract—Design principles of diffraction-type planar antennas which can be successfully used for building antennas systems with required parameters including formation of radiation pattern (RP) with special shape are presented. All main characteristics of the studied planar antenna with open electro-dynamic structure of millimeter band on the example of antenna system used in the modern radar complex are obtained.

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Antenna systems being a vital part of radio engineering communications, radar, navigation and control complexes, aided landing systems, etc., in a significant degree determine their tactical-technical and exploitation characteristics. During their development creation of principally new classes of antenna systems allows widening application areas of radio engineering complexes and their functionality.

One of the relatively new directions in antenna technique of millimeter (mm) band is design and creation of antenna arrays called antennas of diffraction radiation. Operation of such antennas in the reception and transmission modes is based on the effect of mutual transformation of homogeneous and heterogeneous planar waves during diffraction on periodic structures. The experience of calculating, designing and making such antennas accumulated by now in the Institute of radio physics and electronics by A. Ya. Usikov NAS of Ukraine has determined the possibilities of their practical application in specialized radio engineering complexes [1–3]. Increasing number of problems solved by scientific research and development radio engineering complexes of mm band with the help of such antennas, and diversity of elementary components determine the present interest to studying electro-magnetic fields which are created during interaction of heterogeneous waves with periodic obstacles [4, 5]. Recently attention has been paid to studying excitation of dielectric waveguide of reflecting diffraction array with finite number of elements by heterogeneous wave in the combined statement considering their mutual influence [6–8].

The existing classification of antennas by the way of feeding the radiating elements [9] relates the studied antennas to the class of antenna arrays with transversal radiation in the travelling wave mode. This class includes structures containing hollow metal waveguides with slots or strip lines with serial feeding of radiators. We should note that in foreign literature similar radiating systems are called leaking wave antennas.

In the mm band under dimensions of the radiating aperture around hundreds of wavelengths the use of waveguide slot arrays or microstrip arrays is connected with significant technical and technological difficulties. In this work approaches to design and engineering of planar antennas of mm band, which are based on the effect of transformation of heterogeneous (surface) wave of planar dielectric waveguide (PDW) into body wave by means of diffraction array, are described by giving an example of specific sample of a diffraction antenna.

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