DOI: 10.34854/ICPAF.52.2025.1.1.204

THE SPECTRAL DISTRIBUTION OF THE MILLIMETER RADIATION FLUX GENERATED BY A KILOAMPERE RIBBON REB UNDER CONDITIONS OF TWO-DIMENSIONAL CORRUGATION OF ONE OF THE WALLS OF A PLANAR CAVITY *)

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The creation of high-power (10–100 MW) sources of coherent electromagnetic radiation in the millimeter range is a key task of vacuum electronics of the present time. One of the approaches to its solution is the use of high-current ribbon relativistic electron beams (REB) for pumping oscillations in a planar electrodynamic system [1]. With a planar geometry of the generating device, one of its transverse dimensions can reach a large value (two orders of magnitude greater than the wavelength of the radiation), which allows a beam with a current of up to tens of kiloamperes to pass through such a generator and, as a result, achieve the specified power level in it. Systematic experimental studies in this direction are being carried out at the BINP SB RAS at the ELMI facility [2]. The planar electrodynamic system of this facility, installed in a slit vacuum channel with a guiding magnetic field (0.8-1.5 T), has the following geometric dimensions: width – 180 mm, length – 1.5 m, gap between planes – 9.5 mm. One of the planes of this system contains a surface section with a sinusoidal corrugation along both orthogonal coordinates. The corrugation period is 3.76 mm, its depth is 1.4 mm, and the length of the corrugated section is 200 mm. The ribbon beam injected into this electrodynamic system from the U-3 accelerator has the following parameters: beam thickness – 3-4 mm, width – 170 mm, total current in the beam – about 5 kA, electron energy – 0.8-0.9 MeV, pulse duration – 3-5 μs. During the experiments, the following parameters are recorded: beam currents in different parts of the facility, plasma glow arising in different sections of the electrodynamic system, intensity and frequency characteristics of the generated radiation flux.

The report presents the results of one of the experimental series, during which the guiding magnetic field was varied at different thicknesses of the ribbon REB and positions of its cross-section in the gap between the planes of the electrodynamic system. The dynamics of the frequency spectrum behavior in the region of 70 GHz was recorded with its time reference to the oscillograms of the beam current and plasma glow in different parts of the facility. The experimental results are discussed within the framework of the existing model concepts of possible generation mechanisms in a planar electrodynamic system.

The work was supported by the Russian Science Foundation (project No. 23-19-00370).

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*) abstracts of this report in Russian