Traveling wave ionospheric antenna formed by a HF interferometer with an arbitrary angle of inclination of the main beam

Kotik D.S., Yashnov V.A.

National Research Nizhny Novgorod State University named after N. I. Lobachevsky, Nizhny Novgorod, Russia

e-mail: dmitry.kotik@nirfi.unn.ru

It was previously shown that when using two powerful transmitters operating on two antenna arrays with a vertical radiation pattern, the phase centers of which are separated by a distance d with a carrier frequency spacing F = f1-f2, a moving source of low-frequency radiation appears in the lower ionosphere (see Kotik D.S. .,et al., On the Possibility of Forming a Superluminal Cherenkov Source Using the Getmantsev Effect, Proceedings of the II Suzdal URSI Symposium "Modification of the Ionosphere by Powerful Radio Waves", Moscow, IZMIRAN Press, 1986). The phase velocity of this traveling wave coincides with the phase velocity of the main mode of the Earth-ionosphere waveguide at the frequency F=fd/h (F is the carrier frequency difference; h is the height of the ionospheric source above the Earth's surface). At this frequency, a maximum in the radiation amplitude is observed in the experiment. The paper considers a more general case when a HF interferometer operates with an arbitrary angle of inclination of the main beam of both emitters. In this case, the emitters are also separated by a distance d, as well as in the first case, F = f1-f2 is the frequency difference of the emitters. It is shown that the frequency F strongly depends on the direction of the main beam and can vary over a wide range from units to 15 kilohertz. In this case, it is possible to match the source wave with the phase velocity of several first modes of the waveguide. We note that so far no experimental verification has been carried out in this formulation, although the technical capabilities of all modern heating facilities make it possible to perform such a series of experiments.