Plasma Maser IN PULSE-PERIODIC NOISE AMPLIFICATION MODE [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.156

1Asanina S.G., 1,2Buleyko A.B., 1Bakhtin V.P., 1,2Loza O.T., 1Ravaev A.A.

1JSC “SRC RF TRINITI”, asanina\_sg@triniti.ru
2RUDN University

A plasma maser is a source of powerful microwave radiation based on the Cherenkov interaction of a high-current relativistic electron beam (REB) and a slow plasma wave. Plasma is used as a decelerating structure, and a rapid change in its density allows you to quickly change the frequency of the generated radiation.

In this paper, a plasma maser in the noise amplification mode was studied. The current of the tubular REB 2 kA was provided by voltage pulses with an amplitude of 250 kV, a duration of 2 ns and a frequency of formation up to 100 Hz. Plasma with a concentration of 1012...1013 cm-3 was created within 100 microseconds by ionization of gas by a separate electron beam. REB transportation and plasma formation were carried out in a magnetic field with an induction of 1 T created by a solenoid. As a result of the interaction of the plasma wave with the electron beam, broadband noise in the microwave range was amplified and the subsequent output of microwave radiation through a conical horn antenna. Such a maser in the mode of formation of single pulses [1] demonstrated a maximum radiation power of up to 400 MW per pulse with a pulse energy efficiency of up to 26%.

 In this experimental study, the operation mode was implemented in a frequency mode with a repetition rate of microwave pulses up to 100 Hz. Earlier in [2] it was shown that the periodic deposition of a REB current with a duration of 80 ns on the plasma maser collector entails abundant desorption of gases and significant changes in the plasma concentration profile and the maser operating mode in the following pulses.

The figure shows the spectra of microwave radiation of a plasma maser with a current duration of 2 ns, obtained sequentially in different pulses, followed by a frequency of 100 Hz. From pulse to pulse there is a shift of the radiation spectrum towards high frequencies and its expansion, and at the same time a decrease in power was observed. On average, by the 30th pulse, the changes accumulated to the maximum value, as a result of which the spectrum stabilized in the frequency band ~ 2... 20 GHz. The control of the radiation spectra in each pulse during the periodic mode of their formation was the task of this work.

Литература

1. Alla B. Buleyko, Anatoly V. Ponomarev, Oleg T. Loza, et al. (2021) *Physics of Plasmas* **28:** 023304.
2. Andreev S.E., Bogdankevich I.L., Gusein-zade N.G., Loza O.T. (2021) *Plasma Phys. Rep.* 47, 257–268.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Pt/ru/GI-Asanina.docx) [↑](#footnote-ref-1)