COMPARISON OF THE PARAMETERS OF A MICROWAVE AMPLIFIER WITH OPTIMAL FEEDBACK SUPPRESSION AND WITHOUT FEEDBACK SUPPRESSION [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2023.50.2023.1.1.203

2Dias Mikhailova D.E., 1Strelkov P.S., 3Kartashov I.N.

1Prokhorov General Physics Institute of the Russian Academy of Sciences, strelkov@fpl.gpi.ru  
2National Research Centre Kurchatov Institute, [tomasrulit@mail.ru](mailto:tomasrulit@mail.ru)  
3Faculty of Physics M.V.Lomonosov Moscow State University, igorkartashov@mail.ru

An experimental study of a plasma relativistic microwave amplifier with a gain band of about 1.5 GHz and a maximum gain at a frequency of about 3 GHz has been carried out. The wide gain bandwidth of this amplifier circuit has previously allowed the demonstration of amplifier frequency tuning from 2.4 GHz to 3.1 GHz. Microwave radiation with a power of 100 ‑150 MW and a pulse duration of 300 ns was obtained using an electron beam with a current of 2 kA and an electron energy of 500 keV [1]. In this work frequency of input signal was 2.716 GHz.

The waves reflection from the elements of the amplifier output part leads to the occurrence of feedback and to the transition of the amplifier to the self-excitation mode in a wide frequency band 1.5‑3.5 GHz. The latter is due to the fact that the electron beam formed on the explosive emission cathode of the accelerator has a high noise level in the studied frequency range.

Feedback suppression was carried out by placing ceramic microwave absorbers inside the amplifier. The absorbers described in [2] were used. The optimal attenuation coefficient of the absorbing element was found by the selection method and amounted to about 20 dB.

The report presents the results of experiments on studying the parameters of an amplifier without feedback suppression (without an absorber) and with optimal feedback suppression (with an absorber).

Installing an absorber leads to an increase of the maximum energy of the amplified signal Wf0, an increase in its stability in a given range of plasma density values, and a sharp decrease in the noise energy W1. In the plasma density range 5 < n < 8.5 rel. units the proportion of noise W1 / Wf0 does not exceed 11%.

The addition of an absorber to the plasma amplifier circuit leads to stabilization of the radiation frequency, in the plasma density range 6 < n < 10 rel. units, where the maximum energy of the amplified microwave pulse is observed, the radiation frequency of the plasma microwave amplifier is equal to the frequency of the magnetron 2.716 GHz, taking into account the accuracy of its measurement ± 1.9 MHz.

References

1. Strelkov P. S. *Experimental relativistic plasma microwave electronics* // Physics Uspekhi 62 (5), 2019, P. 465 -486. DOI: 10.3367/UFNr.2018.09.038443.
2. P.S. Strelkov, V.P. Tarakanov, D.E. Dias Mikhailova, I.E. Ivanov, D.V. Shumeiko, Plasma Physics, 2019, vol. 45, no. 4, p. 345-354. DOI: 10.1134/S1063780X19030097.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Pt/ru/GK-Dias.docx) [↑](#footnote-ref-1)