FILTRATION SYSTEM of GYROTRON RADIATION FOR DIAGNOSTICS OF DOPPLER REFLECTOMETRY on L-2M STELLARATOR

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During the experimental session stellarator L-2M it has been found that an increase in power ECR heating gyrotron radiation plasma above 400 kW Drive Doppler reflectometry diagnostic system [1] to become unstable. It is known that the plasma absorbs gyrotron not completely, you also need some time to create a plasma in the installation (1-2ms). The instability of the system Doppler reflectometry was conditioned noisy foster detectors during the beginning of the pulse heating ECR and teamwork two gyrotron complex MiG-3 [2].

To filter gyrotron radiation at a frequency close to 75 GHz, used two types of notch filters: waveguide filters and notch filter based on Fabry-Perot cavity of mica plates. The article [3] previously described method of manufacturing a Fabry-Perot filter on the frequency of 75 GHz, copper plane-parallel grids on textolite basis, but due to the inability of their manufacture in our laboratory, it was applied a different approach. The CAD system Electro-Magnetic Professional (CAD EMPro) from the company Keysight Technologies (formerly Agilent Technologies) in a three-dimensional geometry of band-stop filter was represented as a few pairs of contiguous mica plates arranged successively at a distance from each other. Plates were provisionally placed in the coaxial waveguide perpendicular to its axis in order to ensure the dissemination of TEM (transverse electromagnetic wave) wave. The calculation was performed using finite element method (FEM, Finite Element Method, FEM) in Agilent FEM Simulator block. Computer simulations allowed resonator filter to determine at what distance were positioned available laboratory mica plate 120 microns thick to provide microwave attenuation peak at a frequency of 75 GHz. Since the diagnosis has a single receiving and transmitting path (sensing and reception is carried out on a single antenna) important technical condition of containers for graphical notch filter to the minimum attenuation electromagnetic waves at a frequency of operation dopller reflectometry.

First test measurements showed an improvement in signal / noise ratio, requiring optimization of algorithms for data analysis and the development of new software.

The filter characteristics were measured by AB Millimetre MVNA 8–350 GHz Millimeter vector network analyzer. At a frequency of 75 GHz attenuation for three pluggable filter level was 30 dB, and in the filter cavity was close to the calculated - about 21,8dB.

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References

1. Pshenichnikov A.A., Tereshchenko M.A., Harchev N.K. et al. The use of Doppler reflectometry in the L-2M stellarator // Plasma Physics, 2005, v. 31, №7, p. 604-611.
2. Batanov G.M., Belousov V.I., Bondar Y.F., Stepahin V.D. et al., New gyrotron complex MiG-3 for creating and plasma heating in the L-2M stellarator and the results of the first experiments // Applied Physics, 2012. number 6, p. 79-87.
3. Arzhannikov A.V., Ginzburg N.S., Zaslavsky V.Yu. et al., Study of generating millimeter waves in a planar maser free electron combined Bragg resonator // Vestnik NGU. Series: Physics. 2006.Volume 1, Issue 2, p.71-81.