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OPERATIONAL LIMITS OF THE CORRELATION REFLECTOMETER ON THE TOKAMAK T-15MD *)

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The study of turbulence and processes of nondiffusive transport of particles and heat in the discharge is important when studying the behavior of high-temperature plasma in a tokamak. One of the methods of diagnostics of small-scale density fluctuations is correlation reflectometry [1, 2]. The method is based on probing a plasma column with an electromagnetic wave in the frequency range from 10 to 100 GHz. One can assess the parameters of electron density perturbations in the vicinity of the cutoff surface by analysis of the fluctuations of the reflected wave phase.

This work is devoted to analysis of the limitations of ordinary-wave reflectometry at the T-15MD device. The first limitation is related to the absorption of the wave when passing the regions of electron cyclotron resonance. The second is the limitation of the maximum measured amplitude of density fluctuations associated with the limited perturbation of the reflected wave phase [2].

A code has been developed to determine the limiting amplitude of the measured fluctuations and the availability of the regions inside the plasma for reflectometer observations for arbitrary antenna position in the vacuum vessel and probing direction. The algorithm is applicable to any magnetic configuration. In particular, the cases of probing in the direction of the magnetic axis from equatorial, vertical, and inclined ports from the low field side are obtained and analyzed for typical discharge scenarios with toroidal fields of 1.0, 1.5, and 2.0 T. It is shown that when probing from equatorial and inclined ports there are extensive regions of inaccessibility in the plasma, but in certain scenarios there is a region of transparency up to the plasma core. When measuring from the vertical port, there are no significant limitations of the observation region. The maximum measured amplitude of fluctuations in the central and gradient parts is 0.2 - 0.6 %, and in the periphery it reaches 1 - 2 %.

In addition, the paper will present the results of antenna coupling and signal-to-noise ratio evaluations.

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