DEVELOMENT AND QUALIFICATION OF THE THALES TH1509U EUROPEAN 170 GHZ 1 MW CW INDUSTRIAL GYROTRON

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ABSTRACT

High power gyrotrons produced by THALES Microwave & Imaging Sub-Systems (MIS) have shown particular reliability and graceful aging during decades [1]. Thales gyrotrons are developed in the frame of a strong collaboration with European research institutions where each partner provides its best expertise whose confrontation allows for an efficient risk assessment and decision making. In order to respond to the ECH&CD power needs of ITER and DTT [2], the TH1509U is based on a diode-type magnetron injection gun, a single-stage depressed collector and a $TE_{32,9}$ cavity mode with an axial magnetic field of 6.77 T to provide 1 MW CW output at 170 GHz. A Gaussian TEM_{00} beam is generated by a quasi-optical system including a launcher antenna, phase correcting mirrors and a CVD diamond window. The design has been optimized by integrating last generation subassemblies, including the cathode structure, the high-voltage feedthroughs and the body insulation as well as the beam tunnel and the interaction cavity, with particular care to maximize the power output while suppressing the excitation of parasitic modes [3]. The cooling circuits have been upgraded to further enhance the power load handling capability and a dedicated filament control system has been introduced to improve stability. The TH1509U gyrotron has undergone a scan of the body voltage from 20 to 26 kV with beam current ranging from 40 to 46 A showing the complete absence of parasitic modes and efficiency variation from 22% to 40% [4]. The unit has demonstrated a power of 1.03 MW at the output window with efficiency in excess of 40% during 5 consecutive 100 s stable pulses. The tests are progressing to optimize the gyrotron performance.

References

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