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P4.014 The 3.7GHz LHCD system on HL-2M tokamak

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A 3.7GHz lower hybrid current drive (LHCD) system was built on HL-2M in 2017. A Full-Active Multijunction (PAM) launcher is installed. The peak parallel refractive index is 2.25 with a range from 2.1 to 2.4. ALOHA code predicts a low Reflection Coefficient (RC) within a large range of the HL-2M plasma density. TE₁₀ to TE₃₀ mode converters are designed for the antenna to divide the power in three parts equally in poloidal direction while the power is divided to 8 equal parts in toroidal direction. As a result, There are 192 active grills (6×32) facing to the plasma, with passive ones at each side. The antenna is fed by four high power pulsed klystrons TH2103C1. The klystrons are protected from the reflected power by high power circulators. The RF power is transmitted to the launcher in TE₁₀ propagation mode through the rectangular waveguide (WR284) transmission lines. The transmission line is pressurized with 2 bar of nitrogen to prevent arcing. The 4 klystrons are fed by a pulse step modulation (PSM) high voltage power supply (HVPS). The fast switch-off time is less than 10 microseconds.

With the help of the power recombiner, the power capacity of each transmission lines reaches 500kW. The recombiner is based on the microwave power coherent synthesis principle. It consists of two rectangular waveguides with the shared height wall removed. Simulation and optimization is performed by finite element method. The measured results agree with the simulated ones within the error range. The power combining efficiency reaches 98.1% and is extended when the input power is not balanced.

The transmitter was commissioned. The total output power exceeds 2.02MW with a 3s duration after the main parameters were optimized. The output characteristic of the transmitter is also studied.

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