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Prototype Development of the ITER EC System with 170GHz Gyrotron

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To study the operational performance of ITER EC heating and current drive system (H&CD), a mock-up of the ITER mm wave system has been assembled using the high power long gyrotron test stand in JAEA. The prototype system is composed of the primary parts of the EC H&CD system, including: 170GHz gyrotron, power supply, transmission line (TL) and mock-up of equatorial launcher (EL) and control system. The gyrotron power was transmitted via the precise aligned TL (40m) with 7 miter bends to the EL achieving a 91% of HE₁₁ mode purity. The experiments were realized using a mock-up of the conceptual EC control system based on the ITER Plant Control Design Handbook (PCDH). The system has achieved CW 5 kHz power switching, which demonstrates the compatibility for MHD control of ITER plasma. The modulation was achieved using a novel configuration of the electron beam acceleration power supply. In the experiment, stable 5 kHz of power modulation was demonstrated with minimized spurious frequency excitation at the ramp-up phase of each pulse., which satisfied the ITER criteria. The JAEA test stand is a flexible system with its center piece a frequency-step-tunable gyrotron at 170GHz/137GHz/104GHz. The output beam is radiated to the identical direction from the output window for each frequency, consequently the power was transmitted to the end of the TL at these three frequencies.

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