HIGH EFFICIENCY COUPLING OF GYROTRON OUTPUT WITH THE LONG DISTANCE WAVEGUIDE SYSTEM

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The high power gyrotron and the power coupling efficiency with the corrugated waveguide are discussed. The 170GHz transmission lines(TLs) for electron cyclotron heating and current drive (EC H&CD) system in the International Thermonuclear Experimental Reactor (ITER) require higher purity of HE_{11} mode to minimize a transmission loss. In addition, higher order modes will generate a stray RF in the millimeter wave launching system which is installed at the end of the transmission line.

Higher order modes in corrugated waveguide are generated by the initial coupling of the beam into the waveguide and each component in TL. In particular, the quasioptical coupling at the inlet of the corrugated waveguide could be the major source of the higher order LP modes by the tilt angle and beam offset.

In this study, mode purity was measured at ITER relevant test TL in JAEA. JAEA-TL is the 63.5 mm corrugated waveguide system which included miter bends, polarizers and a waveguide switch. A 170GHz high power gyrotron was connected to waveguide system with matching optical unit (MOU) which consists from 2 phase correcting mirrors. The distance of test TL is 40m.

First, mirror angles in MOU were optimized to reduce LP_{11} generated at the initial coupling into waveguide. The field pattern at the outlet of the 1 m waveguide from MOU was analyzed. With iterating the measurement and mirror control, 95 % HE_{11} mode purity was achieved at 1 m distance. Next, the mode purity at the outlet of 40m TL was measured. After long transmission HE_{11} mode purity was 92% and reduced power increased HE_{12} mode and LP_{11} mode. Although the RF beam was successfully coupled into waveguide minimizing high order modes, mode conversion loss occurred by transmission components. The measurement result indicates that mode conversion loss by transmission components like miter bends generates low m,n number higher order modes which transmit through the transmission line with small losses. The mode conversion loss by components is significant source of higher order modes at TL end.

The quasioptical beam coupling in MOU was also tested und er 2 frequency operation of gyrotron and its result will be als o reported.