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Characterization of Mode Content and Losses in the ITER ECH Transmission Lines[1] SUDHEER JAWLA, ELIZABETH KOWALSKI, EMILIO NANNI, MICHAEL SHAPIRO, RICHARD TEMKIN, Plasma Science and Fusion Center, MIT, Cambridge, MA, USA, TIMOTHY BIGELOW, DAVID RASMUSSEN, Oak Ridge National Laboratory, Oak Ridge, TN, USA — Estimation of overall losses in the transmission line (TL) due to ohmic loss, inaccurate coupling of the quasi-Gaussian beam to the overmoded waveguide and the mode conversion becomes vital to characterize the ITER ECH system which uses 24 MW RF power at 170 GHz. Components in the TL such as 63.5-mm diameter corrugated waveguides, plane mirrors and polarizers at the miter-bends (MBs) must be characterized for these losses. Tilt and offset of the gyrotron output beam w. r. t. the TL result in excitation of higher order modes (particularly LP11 mode) and therefore additional losses. We calculate that tilting of the mirrors in two consecutive MBs in the TL can convert a significant fraction of the unwanted LP11 mode into the HE11 mode. We have observed that the estimation of mode contents in such systems, using the radiated field measurements in several planes after the waveguide end, requires an extremely high precision alignment of the scanner when measuring the field patterns. Characterizing the plane mirrors and polarizers at miter bends in cold test at low power for small length of TL becomes difficult because the losses are very small. We measured the loss of (0.022 ± 0.008) dB/ miter bend by an S11 technique for a MB with a flat mirror using a vector network analyzer. The same technique is currently being applied to measure the loss of the polarizer miter bends.

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