

Design of circular corrugated waveguides to transmit millimeter waves at ITER

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Abstract. Low-loss circular waveguides will be needed for a large number of millimeter-wave transmission lines on ITER, including those transmitting electron cyclotron heating (ECH) power and diagnostic signals. In order to provide low-loss transmission, the waveguides need to be several wavelengths in diameter. Corrugating the walls reduces the loss further not only in straight runs but also at bends, and makes the waveguide robust against small deformations. We present results of theoretical calculations showing that these properties can be maintained over very wide bandwidths suitable for ITER applications. The computer code used to make these calculations is based on a space harmonic analysis of the fields. Measurements on waveguides are described that validate the theory for corrugated waveguides semi-quantitatively. Tolerances on the corrugation geometry, waveguide bore, waveguide junctions, input Gaussian beam alignment and waveguide support alignment are discussed. Finally, some fabrication considerations are presented.