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P3.030 Optimization of TE11/TE04 Mode Converters for the Cold Test of a 250 GHz CARM Source

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Electron Cyclotron Resonance Frequency (ECRF) systems in future fusion devices, like the DEMO-nstration reactor, foresee an operational frequency in the range 230-280 GHz to match the plasma characteristics. The Cyclotron Auto Resonance Masers (CARM) characterized by a high value of a frequency Doppler up-shift, could represent an alternative to gyrotrons and the design of a 250 GHz, 0.5 MW CARM device has been undertaken by ENEA. A mode conversion from the fundamental TE10 mode in WR-3 rectangular waveguide to the TE53 operational mode in an oversized circular waveguide is required to perform the cold test of the two Bragg reflectors delimiting the CARM resonant cavity. An improved structure for the TE11 to TE04 conversion, using only two transitions with profile and radius optimized in order to obtain high efficiencies and sufficient bandwidth, has been designed and presented in this paper. The first transition is a TE11/TE01 serpentine mode converter in circular waveguide with average radius of 1.48 mm and an appropriate number of geometrical periods. The second one is a TE01/TE04 rippled wall mode converter with an average radius of 3 mm. It consists of a single conversion section with sixteen sinusoidal periods instead of three conversion sections (TE01/TE02, TE02/TE03, TE03/TE04) in cascade, thus reducing the complexity and the length of the full transition chain. The last conversion (TE04 to TE53), a rippled-wall mode converter, made by a helically corrugated waveguide, has been described in a previous paper. The analysis with HFSS and CST- MWS (S-parameters, efficiency and electric field) of each single converter will be reported; for the TE01/TE04 transition, results obtained by in-house codes will be shown too. A first validation of the simulation tools at 250 GHz will be carried out through the construction of a short Bragg reflector during the current year.

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