

Cold Test Validation of Novel Slow Wave Structure for High-Power Backward-Wave Oscillators

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Abstract—Previous work presented the concepts of mode dominance reversal using a novel slow wave structure (SWS). An example application of this mode reversal was a backward-wave oscillator operating in the K_a band. However, the concepts have not yet been experimentally validated. In this paper, we use a scaled version of the SWS to experimentally demonstrate mode dominance reversal in the S band. Using the detected resonances of the six SWS cells, a highly accurate synthetic technique is used to derive the dispersion curve. Simulations based on a commercial particle-in-cell code using this SWS design show peak output powers of 5.94 MW at 2.64 GHz with a 35% peak power electronic efficiency.

Index Terms—Backward-wave oscillator (BWO), interaction impedance, mode control, slow wave structure (SWS).