Experimental Validation of Slow-Wave Phenomena in Curved Ring-Bar Slow-Wave Structure

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***Abstract*— Curved ring-bar (CRB) slow-wave structure (SWS) has been presented before in order to design an SWS for high-power and wideband traveling-wave tube in S-band. It was analyzed using the coupled transmission line theory and predicted to deliver 1-MW output power across 1.8–2.4-GHz bandwidth. However, the slow-wave characteristics were not experimentally validated through measurements. In this paper, we present $\omega - \beta$ measurement results to experimentally demonstrate that the CRB structure is providing the predicted slow-wave characteristics at the S-band. A novel synthetic technique is used to determine the $\omega - \beta$ relation using a six-period fabricated CRB structure. The measurement results exhibit a phase velocity of $0.7c$–$0.75c$ across 2–2.5 GHz with a maximum error of less than 5%. In addition, the measured on-axis interaction impedance was >43 Ω across the specified frequencies implying satisfactory agreement with theoretical predictions.**

***Index Terms*— Coupled transmission lines (TLs), curved ring-bar (CRB), slow-wave structures (SWSs), traveling-wave tubes (TWTs).**

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