Ultra-Wideband Ring-Cavity Power Combiner

V. Foroutan[(1)], O. Manoochehri*[(1)], A. Darvazehban [(2)], F. Farzami[(1)]
and D. Erricolo[(1)]
(1) University of Illinois at Chicago
Department of Electrical and Computer Engineering,
851 South Morgan Street, Chicago, IL 606067, USA
(2) Amirkabir University of Technology
Department of Electrical and Computer Engineering,
No. 424, Hafez Ave, Tehran, Iran

An ultra-wideband ring-cavity power combiner with a tapered cylindrical cavity is proposed. Its operation frequency goes from 6 GHz to 12 GHz, its return loss is under -15 dB, and its directivity is about -9 dB. This combiner was simulated with HFSS software, and then fabricated. An excellent agreement between the measured and simulated results was observed. Some possible applications for this power combiner include phased array antenna feeding systems; and, connect together many solid-state power amplifier devices to obtain high output power levels. Power combiners have been a research topic receiving extensive attention in recent years (e.g., R. D. Beyers and D. I. L. de Villiers, "Compact Conical-Line Power Combiner Design Using Circuit Models," *IEEE Transactions on Microwave Theory and Techniques*, vol. 62, no. 11, pp. 2650-2658, Nov. 2014.)

Among all the existing power combiners, the radial combiner is one of the most promising structures because it has very good amplitude and phase balance due to its axially symmetric structure. This design is based on a classic eight-port radial shape to combine output power in microwave systems, especially for direction finding or radar system applications. This design is based on the use of waveguides, which is necessary because high power signals are involved and microstrip power combiners cannot handle high power signals.

An effective method to design a wideband high power combiner with low loss is proposed. One feature of this design is that the connectors are attached with holders and are mechanically stable. Another feature is that this power combiner contains a cavity to create a wideband match between the connector pin and the waveguide. In addition, the tapered walls provide also wider bandwidth behavior. The coupler losses are low in 1 octave (from 6 GHz to 12 GHz). Since the minimum insertion loss is about -9 dB (1/8), it can handle high microwave power easily.