UWB Double Ridge Waveguide Coupler with low loss

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

An ultra wide band cross-guide coupler with two double-ridge waveguides is proposed. Its operation frequency goes from 6 GHz to 18 GHz, its return loss is under -15 dB, its directivity is more than 15 dB, and its coupling coefficient is about -50 dB. This coupler was simulated with both CST and HFSS software, and then fabricated. An excellent agreement between the measured and simulated results was observed. A possible application for this coupler includes the measurement of high power microwave levels because it has low loss along the forward direction.

The four-port cross-guide directional coupler is a classic component to detect the output power levels in microwave systems, especially when high power signals are involved (R. E. Collin, *Foundations for microwave engineering*, 1966. New York-McGraw-Hill). Microstrip directional couplers have acceptable frequency bandwidth, but they cannot handle high power because of their significant losses.

An effective method to design a wideband high power coupler with high directivity is proposed. One feature of this design is that it includes one coupling hole to increase the bandwidth. Another feature is that it contains a cavity to create a wideband match between the connector pin and the waveguide. In addition, the tapering of the double ridge contributes also to the wider bandwidth behavior. The coupler losses are low in 3 octaves (from 6 GHz to 18 GHz). Since the coupling coefficient is below 50 dB, it is possible to eliminate the attenuator at the coupling port when this waveguide coupler is used as a sampler in high power applications.