

Analysis and design of a novel low-loss hollow substrate integrated waveguide

Abstract

In this paper, a novel hollow substrate integrated waveguide (HSIW) is presented for realizing low-loss millimeter-wave (mm-wave) transmission lines embedded in multi-chip modules. A new analysis method for the HSIW is proposed by treating it as a combination of a two-dielectric loaded rectangular waveguide (RWG) and standard substrate integrated waveguide, where an effective dielectric constant, ϵ_{eff} , is introduced. An HSIW prototype in the Ka-band is fabricated using a progressive-lamination low-temperature co-fired ceramic technique. The measured results agree well with theoretical calculations and simulations. An average of 0.009-dB/mm loss is achieved in Ka-band, which is comparable to an air-filled RWG. This shows that the technique has great potential for further development to realize highly integrated mm-wave modules.