Abstract

The demand of high-speed wireless communication has increased, which need the data rate of the order of Terabyte per second (Tbps) in near future. Terahertz (THz) band communication is a key wireless communication technology to satisfy this future demand. This will also reduce the spectrum scarcity and capacity limitation of current wireless systems. Micro fabricated folded waveguides are potential compact source of wide band and high-power terahertz radiation.

This study primarily focuses on machining technology for THz waveguide components requiring ultra-high precision micro machining. Rectangular waveguides especially folded waveguides are even more difficult to manufacture using conventional machining techniques due to their small size and very tight tolerances. The criticalities in micromachining of Terahertz waveguide Components staring from 100GHz to 1100 GHz been developed mechanically in this research work. Free cutting Brass IS 319-H_2 and AL Alloy IS: 736 24345 WP were used as work materials due to its electrical and mechanical properties. Waveguide size as small as 0.254x0.127 mm (254x127 μm) was micro machined within ±3-5 μm linear tolerances, surface roughness of the order of 0.045 μm Ra and flatness less than 0.3 μm (< λ/2). The split top and bottom blocks of the waveguide were aligned by dowel pins, which matched within a tolerance of ± 5 μm. The perpendicularity and parallelism were maintained within ±5 μm tolerance as per IS: 8000, 1975. This work explored and established the application of micro milling as reasonably suitable for the THz waveguides followed by ultrasonic cleaning. Waveguide above 1.1 THz having waveguide size as small as 75μmx 37.5μm were also realized using femto second LASER within nanometer level accuracies. Measurements of folded waveguide at 0.22THz waveguide losses were close to simulated values.