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A NEW BEAM WIDE-ANGLE SCANNING BELL LENS ANTENNA FOR INTERPLANETARY COMMUNICATIONS

Abstract

A new two refraction beam wide-angle scanning bell lens antenna at millimeter-wave frequencies is designed for interplanetary communications using geometrical optics techniques. The bell lens antenna consists of the bell lens partially filled with low cost polystyrene material (εr= 2.53) and a horn feed. By means of twirling the lens around the focal point where places a fixed horn feed, The lens allows beam steering mechanically in elevation at about-45deg\+ 45deg(3dBi scan loss as the limit), and the deflexion angle of the beam is consistent with the deflecxion angle of the lens ,at the same time, the lens also can increases gain substantially. A ray-tracing method and FEKO are used to analyze and design this two refraction beam wide-angle scanning bell lens antenna in Ka band. Measurements show good agreement with the simulations. When the deflecxion angle is 0 deg, the aperture efficiency is about 50%. When the deflecxion angle of the lens is 45 deg, the deflecxion angle of the beam is also 45deg and the Gain loss is 2.5dBi.