

Turnstile/Cone Antenna Design and Analysis for UHF SATCOM Communications

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Abstract:

Inexpensive, lightweight antennas are needed to provide omni directional, circularly polarized radiation patterns for UHF SATCOM applications. A turnstile/cone antenna was designed to meet UHF SATCOM requirements. The basic antenna concept consists of a canted turnstile, fed by a split-tube balun and is positioned over a truncated, slotted conical ground plane. This combination produces a broad beam, circularly polarized radiation pattern. Another design feature of this antenna concept is the opportunity to include a radial choke flange to attenuate the back lobe radiation. This antenna concept has a unique heritage. NASA used a similar design concept for the landing radar altimeter on the Viking Mars Lander Spacecraft that soft-landed on the Planet Mars in 1976. This antenna was redesigned and optimized for UHF SATCOM applications using very unique conductive coatings (www.unishield.com). Unishield is a water-based, highly conductive coating is used to reduce the weight of the antenna. Commercial EM analysis software, FEKO is used for this antenna design and optimization. The field computation is based on Method of Moments (MoM) formulation. The geometry of the turnstile/cone antenna was defined using FEKO's parametric geometry cards. With this capability, FEKO provided a 3D visualization of the surface currents on the antenna and resulting 3D radiation patterns. Optimization feature in FEKO (optFEKO) is applied extensively to optimize the design of the turnstile/cone antenna for UHF SATCOM communication applications. Input impedance and radiation pattern measurements are conducted to validate the design. Results of this analysis along with experimental measurement results are presented in this paper.