A Planar Dual-Band Reduced-Surface-Wave GPS Antenna

Lorena I. Basilio, Richard L. Chen, Jeffery T. Williams, and David R. Jackson

Applied Electromagnetics Laboratory
Department of Electrical Engineering
University of Houston
Houston, Texas 77204-4005

A significant contributor to positioning errors in GPS systems is the interference caused by multipath reflections. Particularly problematic are multipath signals that impinge on the antenna at low elevation angles and those that are a result of ground reflections or scattering from the supporting structure of the antenna. Attempts to reduce these effects by using "choke-ring" ground planes, coating the ground plane with resistive or absorbing materials, and using sophisticated signal-processing techniques have proved to be only moderately successful and often introduce significant cost or weight.

Recently, a single-band GPS microstrip antenna design, based on the Reduced-Surface-Wave (RSW) concept, was introduced. This RSW-GPS antenna *significantly* reduces the deleterious effects of low-angle and ground-bounce multipath signals. In addition to having the advantages common to microstrip antennas, this GPS antenna design provides performance comparable to or better than most commonly used high-precision GPS antennas, including choke-ring and pinwheel designs.

For many high-precision GPS applications it is necessary to simultaneously receive the coded GPS signals at both the L1 and L2 frequency bands. In addition, with the emergence of other GPS bands and the Galileo global positioning system, dual-system/band receivers and, hence, suitable dual-band antennas are required. Unfortunately, the narrow bandwidth of the single-band RSW-GPS antenna is not sufficient to cover the multiple bands. In this presentation a planar dual-band RSW GPS microstrip patch design is introduced for high-precision dual-system/band applications. This antenna integrates two RSW elements, each operating at different bands, to realize dual-band performance.

The integration is achieved by the development of a new inverted RSW element (IRSW) that is complimentary in geometry to the original RSW structure (the radiating edge of the IRSW is the inner edge, and a short-circuit boundary is used at the outer edge). As with the original RSW design, this new IRSW element is based upon the reduced surface wave principle. The RSW antenna is placed inside the IRSW antenna, allowing for a completely planar design that can be fed by a single feed network. Due to the inherent reduced surface wave properties of both elements, the impedance and radiation properties of the individual elements are largely unaffected by the presence of the other. In this presentation, the RSW design principles will be reviewed and specifically applied to the new IRSW element, for which impedance and radiation properties will be shown. The integrated dual-band RSW GPS antenna will then be introduced and characterized.