**Simulation and Measurement of a Self-Phased Quadrifilar Helix Antenna for Enhanced On-the-Move Communications**

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Portable radios typically employ linearly polarized antennas such as the stub or whip antenna for their durability, portability and simplicity. Complementary airborne antennas for an air-to-ground communications link often include a bent monopole or blade antenna. However, during on-the-move communications between an airborne and ground-based platform, the dynamic orientation of each platform's antenna can lead to significant polarization losses as their differential orientation approaches orthogonality. At the most extreme angles of polarization misalignment, RF losses can exceed 20 dB, leading to disruption in communications. These massive losses may be mitigated by replacing one of the antennas in a linear-to-linear polarization communications link with a circularly polarized antenna. With a linear-to-circular polarization link, a uniform polarization loss of 3 dB will result at all alignment angles. By accepting a minor increase in polarization loss at all angles, the significant losses typically seen when full orthogonality exists between two linearly polarized antennas can be avoided, maximizing the stability of the communications system.

For this study, a compact self-phased quadrifilar helix antenna has been designed, simulated, fabricated and measured to serve as a circularly polarized replacement antenna in such a communications system. A standard quadrifilar helix antenna is composed of two equally spaced $\lambda/2$ long bifilar helical loops, each fed 180° out of phase in order to produce currents along the loops that are in phase quadrature (0, 90, 180, 270°). In order to achieve a single-input, self-phased quadrifilar helix, one helical loop was designed to be electrically longer compared to a multiple of $\lambda/4$, producing an inductive input impedance with +45° phase angle, and the other helical loop was designed to be electrically shorter compared to a multiple of $\lambda/4$, producing a capacitive input impedance with -45° phase angle. This results in a relative current phase of 90° between the two helices. The antenna was fabricated using 12-gauge bus wire for the helical legs and RG-402/U semi-rigid coaxial cable as the input and inner structural support. An SMA feed is located at one end of the semi-rigid coaxial cable and all four helical legs are connected to the outer conductor of the semi-rigid coaxial cable at its bottom end. At the top end, complementary legs of each helix are connected as a pair to either the inner or outer conductor to achieve self-phasing by means of an infinite balun. The resulting hemispherical radiation pattern exhibits circular polarization (axial ratio < 3 dB over 110°), ~3-4% bandwidth, and realized gain of ~5 dBiC.

The effects of the size of a metallic ground plane, representative of an aircraft fuselage, and the presence of an RF absorber material will be explored and measured prototype data will be compared with FEKO simulation results.