

ANTENNA

SYSTEMS & TECHNOLOGY

Simulation Helps Sarantel Design World's Smallest Quadrifilar Helix Antenna

Sarantel specializes in developing internal antennas for small electronic devices such as global positioning systems (GPS) and smart phones. The quadrifilar helix antenna (QHA) has dominated this space by balancing a pair of filars against a quadrature-related second opposing pair to achieve the circular polarized pattern need for GPS receivers and other smart devices. As these devices become ever smaller, the company faces the challenge of continually reducing the size of their antennas without reducing their performance level. Dielectric loading is used to maintain the electrical size of the antennas while their physical size is reduced. However, this reduces the antenna's radiation characteristics which are limited by the conductivity of the metal that is printed onto the dielectric material.



3-D model of the octafilar antenna in the MicroStripes build module. The dielectric core medium has been removed to reveal the entire metallized surface.

"Having made a few million QHA antennas, we realized that we needed to improve upon their design to support the next generation of devices," said Oliver Leisten, chief technology officer for Sarantel. A critical challenge in making QHA antennas smaller is integrating the single-ended currents on the microstrip line on the circuit board with the balanced currents in the ground plane. Phasing on these antennas is normally done with couplers and phase shifters, the same approach as is used in much larger air-loaded structures.

Leisten previously developed the 360° resonant ring sleeve balun which fills a dual purpose in quadrifilar antennas. As the current flows around the rim of the balun clockwise it shoots current in the correct phases down each of the helices. The balun also



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traces the transition between single-ended and balanced. He used MicroStripes, Flomerics 3D electromagnetic simulation and analysis solution software, to evaluate alternative design concepts and optimize the design. This work led to Sarantel's GeoHelix P2 quadrifilar helix antenna which is 30 percent smaller than the previous generation of quadrifilar helix antennas and has already achieved

design wins on the Benefon Twiq Discovery smart phone, Flextrack Lommy GPS, SkyHawke SkyCaddie SG2 GPS and Tomtom Mobile 5 GPS.

"Over my last Christmas vacation I had the idea of using this concept on hexafilar and octafilar antennas and beyond," Leisten said. "The question was how much time and money should I invest in this idea. I didn't know whether surface waves or other physical phenomena might make it unworkable. Fortunately, I had confidence in MicroStripe's ability to predict the performance of our antenna designs accurately. I set up verification models on two 64-bit dual-processor PCs. To my delight, they demonstrated that the idea not only works but that it provides a bit of a windfall. Increasing the number of helices creates more powerful circular polarization resonances in the balun so hexafilar and octafilar antennas are even easier to match than quadrifilar antennas."

Sarantel is currently finalizing the design of hexafilar and octafilar antennas that will provide similar levels of performance in even smaller packages. "MicroStripes is an important tool that has helped Sarantel become a leader in the design of antennas for personal devices such as mobile phones and satellite navigation systems," Leisten concluded. Sarantel recently put its money where its mouth is by investing \$620,000 over three years for multiple licenses of MicroStripes.

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