Printed Patch Antennas Made of Non-Uniform Gridding

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Microstrip patch antennas are conventionally designed with a continuous uniform conductor. They are typically made of copper and their conductive pattern is produced using copper-removal techniques such as photolithographic chemical etching.

Recently, conductive ink printing was proposed as an alternative to traditional copper etching. This additive fabrication technique is a promising technology for antennas on demand, antennas on substrates not suitable to chemical etching process, or fast prototyping. However, conductive inks, which are usually made of silver, have a high cost. Therefore, there is a need to reduce the amount of metallization used to design these antennas.

Gridded microstrip patch antennas have been proposed as a solution to reduce the metallization (G. Clasen and R. Langley, IEEE Trans. Ant. Propagat., 52, 1412-1416, 2004). However, all the proposed designs were based on uniform gridding. In this presentation, we propose the design of square microstrip patch antennas made of non-uniform gridding. In these designs, the conductive grids are optimized to minimize the amount of ink while the location of the grid segments and the width of the conductive segments are tuned independently to obtain optimum radiation performance and bandwidth. The parametric analysis is conducted from full-wave electromagnetic simulation results obtained using the commercially available finite-difference time-domain (FDTD) software Empire XCcel™ developed by IMST. The designs are performed at the 2.45 GHz industrial, scientific and medical (ISM) band.

Preliminary analyses have revealed that optimized designs allow for additional ink minimization without compromising the radiation performance. Further research will be conducted. Simulation and experimental results will be presented at the conference.