End-fed RFID Tag Antenna Design

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As item-level-tagging (ILT) Radio Frequency Identification (RFID) is drawing more interest, the system requirements are also becoming more complex. One of the complex requirements is the antenna design. The reader or interrogator and the tag or the transponder both require antennas. One of the biggest issues the tag designer faces is impedance matching and radiation efficiency for small tag. The tags of interest need to be small and interact with a small ASIC (integrated circuit) that provides both power scavenging and communications.

Some applications require end-fed tag antennas. Potential antennas include variations on the J-pole antenna. A standard J-pole is ¾λ long. An alternative antenna is the folder dipole fed from the end of one of the transmission line sections of the antenna. Similar to the J-pole, the standard size would be much longer than acceptable for most tag applications.

For a small tag, a reduced size is required to meet most applications. The impedance typically provides a small series resistance and a large capacitive reactance. By shunt tuning the antenna, the resistance of the tag can be substantially increased to meet the needs of providing voltage to the ASIC power scavenging function. The antenna may be slightly mistuned to account for the reactance of the ASIC. The paper will consider the size reduction of both the J-pole and folded-dipole configurations. Zig-zag or meander concepts will be used to obtain a small size.

The antennas are investigated to meet the needs of size, impedance, pattern, and ASIC interaction. Results of simulations for the antennas will be presented to demonstrate the potential operation. Consideration will also be given to the fundamental limits of the antennas in terms of size and the related bandwidth that may be expected, giving evaluation of the potential use of such tags in the international arena.