Phase-Compensated Loaded-Loop Antenna for Near Field UHF RFID

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A surge in interest in the application of Radio Frequency Identification for tracking objects at the item level has contributed to recent advancements in compact antennas. While RFID spectrum exists in several different frequency bands, systems operating in the Ultra High Frequency band under the EPC Global Gen 2 standard provide some compelling advantages in terms of throughput, economy, robustness of protocol, and overall performance. In order to realize these system advantages in item-level tracking (ILT) applications on small items, it is necessary to employ small tags with correspondingly small effective apertures. Transferring power to such tags requires relatively high field intensities, and magnetic near field coupling has emerged as one of the preferred energy transfer mechanisms. In some applications it is further desirable to limit the radiated power in order to avoid interference with other nearby systems and to minimize unintended, or "stray", reads of sensitive long-range tags that may be present in a typical mixed population.

This work presents a UHF RFID reader antenna which produces strong magnetic near field characteristics, yet limits radiated power. The design is based on a loop structure with distributed phase compensating features. Currents throughout the loop maintain nearly uniform phase, yielding magnetic field characteristics similar to an electrically small loop even though the perimeter of this loop electrically large, at approximately two-thirds wavelength. Input return loss is 16dB or better over a 120MHz bandwidth, from 840MHz to 960MHz. Measured magnetic field intensity is approximately 10dB greater than conventional antennas, while far field gain is less than -10dBi.