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Design and development of wideband patch antenna for UHF RFID metal mountable tag

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ABSTRACT

In this research, two low profile metal mountable patch antenna designs for passive ultra-high frequency (UHF) radio frequency identification (RFID) tag are proposed. The complex impedance matching between the antenna and the referenced microchip, Alien-Higgs 3 whose impedance $Z_{\text{chip}} = 31 - j212\Omega$, is realized through an inductively coupled loop feed structure where it provides the needed reactance for the tag antenna. To enhance the bandwidth of the antenna, multiple co-planar radiating patches are employed to excite several resonant modes for worldwide use. The wide impedance bandwidth also compensates for fabrication inaccuracy which could shift the operating frequency of the final antenna design. The final dimensions of the antennas are 87 × 45 × 1.6 mm^3 and 130 × 63 × 1.6 mm^3. The measured impedance bandwidths of the proposed antennas when mounted on a metal plate are 155 MHz (RL ≥ 3 dB), which is from 830 to 985 MHz, and 117 MHz (RL ≥ 6 dB), which is from 850 to 967 MHz, respectively. The maximum simulated gains are −7 and −11 dB at the operating frequency of 915 MHz. Based on the measurement results, it is expected that the proposed antenna would be able to provide a reasonable read range of at least 2 m throughout the entire UHF RFID band when being attached on metal objects.

KEYWORDS: Complex impedance matching, patch antenna, radio frequency identification (RFID), metal object