The use of UHF transponders as a potential replacement for cattle passports

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Abstract: Commercially available UHF RFID tags and interrogators (readers) are surveyed with a view to assessing their suitability as a replacement for cattle passports and preliminary laboratory trials for the tag read/write range are presented.

Ultra-high frequency (UHF) transponders are potential candidates for the replacement of cattle passports. This work addresses the technical feasibility of using UHF ear tag transponders throughout the livestock industry to improve the management and traceability of cattle.

Currently, EPC UHF Class-1 Generation-2 (EPC UHF Gen-2) is the latest standard to be widely adopted by RFID manufacturers. It defines the physical and logical requirements radio identification (RFID) systems based on passive backscatter communication links. Such links consists of an interrogator and one or more tag(s). The tag reader sends information to a tag by modulating an RF carrier using double-sideband amplitude shift keying (DSB-ASK), single-sideband amplitude shift keying (SSB-ASK) or phase-reversal amplitude shift keying (PR-ASK) with pulse-interval encoding (PIE). The tag itself is passive; it has no onboard power source and receives energy from the carrier for its operation. To receive information from a tag, the reader transmits an un-modulated carrier and listens to the backscattered signal.

A preliminary assessment of the read range of a selection of RFID tags using two different interrogators has been undertaken. A key requirement with respect to the implementation of RFID based cattle passports is the ability to write to the tag. As with the read range, the write ranges that are provided by manufacturers are both generic and typical. The actual ranges are strongly dependent upon the type of tag, the tag orientation and the environment. One particular reader-tag system, Impinj SpeedwayR-420, has been characterised experimentally using a linearly polarised tag antenna and circularly polarised reader antenna to reduce the probability of range reduction due to polarisation mismatch.

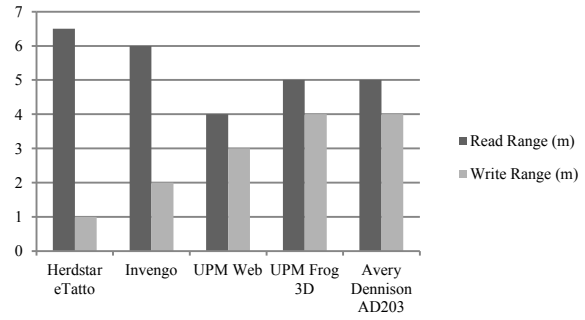

Figure 1 Impinj SpeedwayR-420 interrogator with tags in horizontal orientation

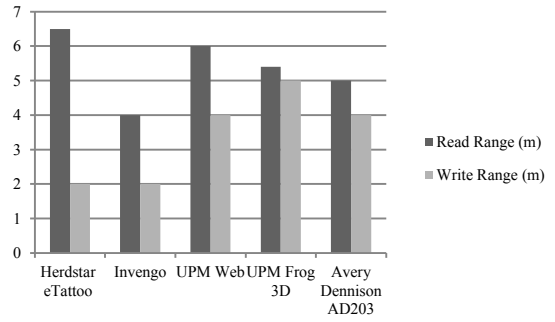

Figure 2 Impinj SpeedwayR-420 interrogator with tags in vertical orientation

The Impinj SpeedwayR-420 is easy to configure and use and maintains good network connectivity during operation. Write ranges are notably shorter than the read ranges. In the case of the two tags recommended for cattle applications (the Invengo and eTattoo), write range in the laboratory is between 1 m and 2 m. This range is likely to decrease further in a more realistic environment. Write failures at the edge of the write range, can lead to data corruption. For both the Invengo and eTatto tags, it was noted that, at the edge of write range, the reader can partially complete the write operation. Whilst the reader software can give an alert indicating an incomplete operation no mechanism currently exists to undo or complete the incomplete write operation automatically. This may be addressable by implementing a new write protocol but is presently a concern with both types of tags.

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References

[1] EPCglobal Standard, “Class-1 Generation-2 UHF RFID Protocol for Communications at 860 MHz – 960MHz”, Jan. 2005.