Performance of Biomark's IS1001 transceiver by antenna wire and tag duplex type

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Introduction:

Biomark's new IS1001 multiplexing PIT tag transceiver system offers a number of potential advantages over earlier-generation systems. They can read both half-duplex (HDX) and full-duplex (HDX) PIT tags and potentially support the deployment of larger flexible antennas with smaller air gaps. However, the IS1001 has not yet been widely deployed in field settings, so practical information about optimal antenna design and performance under different field conditions is scarce.

Objectives

To reduce the amount of trial-and-error testing by field biologists and provide some practical rules of thumb for antenna design, we conducted a series of tests to examine the performance of the IS1001 antenna control node (ACN) based on variation in wire type, tag type, and tag size.

Methods:

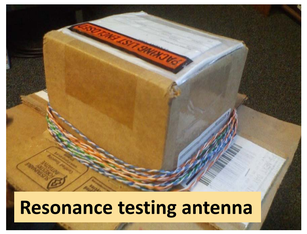
1. **First, we investigated the how to properly tune an antenna by generating a series of resonance curves for a small antenna, measuring 6"× 6". This involved:**

   a) **Determining the values of the fixed, selectable, and switched capacitors that can be configured in series with the antenna connected to the ACN.**

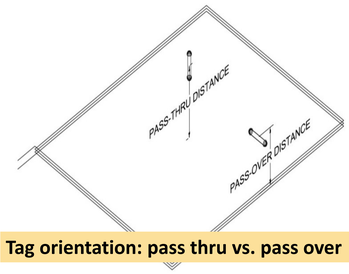
   a) **Adding successive turns (1-23 turns) to the antenna, tuning the antenna, and comparing the antenna current to the capacitor number**

2. **Second, pass-over and pass-through detection distances for an antenna measuring 8' x 10' and with 3 turns were measured for 5 different wire types for both half-duplex (HDX) and full-duplex (FDX) PIT tags of various sizes**

Methods:



Resonance testing antenna



Tag orientation: pass thru vs. pass over

Test antenna – 8' x 10 ' with three turns and five wire types

Results: Full-duplex tags

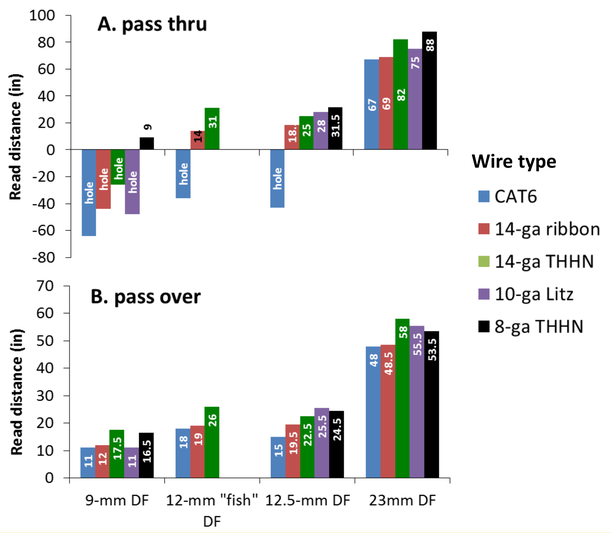


Figure 1. *Pass-thru (A) and pass-over (B) read distances for full duplex (FDX) tags manufactured by Destron Fearing (DF). Negative measurements for pass-through denote where the tag was not read at the center of the antenna and the distance value indicates the size of the "hole" in the center of the antenna where the tag was not detected.*

Results: Half-duplex tags

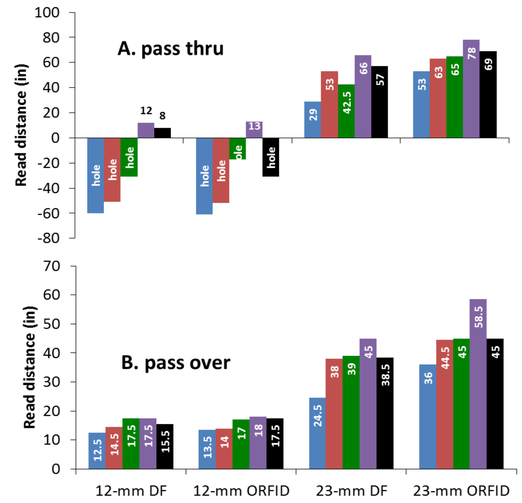


Figure 2. *Pass-thru (A) and pass-over (B) read distances for half-duplex (HDX) tags supplied by Destron Fearing (DF) or OregonRFID (ORFID). Negative measurements for pass-through denote where the tag was not read at the center of the antenna and the distance value indicates the size of the "hole" in the center of the antenna where the tag was not detected.*

Conclusions:

1. **Resonance testing with the small (6" × 6") antenna indicated that the higher the inductance, the less variation in the series antenna capacitance the system can tolerate.**

2. **Antenna performance testing was not exhaustive, but with the large (8' × 10') antenna we found the best wire type varied by duplex type.**

3. **For FDX tags, the 8-ga THHN wire outperformed the others (Figure 1). For HDX, 10-ga Litz wire was best (Figure 2).**

4. **In theory, there should be a single optimal wire type for HDX and FDX based on their operating frequency. We are conducting additional testing with wire designed to operate at this frequency, and also examining the influence of wire jacket composition.**

Acknowledgements:

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