



Traps for beginners

Troubleshooting with trials and
demonstrations using RFID

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RFID trials – Traps for beginners

Trial or Demonstration?

Many so called “trials” of RFID equipment are often not trials and should more properly be called controlled demonstrations.

Such “demonstrations” specify criteria that a particular technology is known to be capable of passing rather than testing functionality and conformance with known user requirements and published industry standards.

The reasons for this are many and may be due to a simple lack of knowledge or to the fact that many people interested in RFID are not technical and often do not know the correct questions to ask.

Unnecessary Limitations

Too often trials are also constructed with unnecessary limitations and unwarranted restrictions built into the trial before the trial starts.

Magellan has observed such limitations in many past trials and these limitations are still being observed in present trials.

This document discusses some of the issues around these often unnecessary limitations.

Demonstration components

Environment

Range

- Fact: Writing to a tag needs much more power than it does to read from a tag.
- Look for: Tests which claim a range of 15 – 20 feet but which do not say this is the read range only and fail to say that the read range is not the same as the write range.
- Test: Clarify this point.

Weather

- Fact: UHF tags operate at frequencies that can be sensitive to wet and humid conditions.
- Look for: Tests conducted only in ideal dry conditions.
- Test: Move tags and readers out into the weather. Spray tags lightly with a misting spray to simulate condensation and/or rain and humidity. Observe reliability of read and write.

The effect of Liquids on RF

- Fact: RF energy is attenuated by the liquid found in frozen foods, pharmaceuticals, blood, oils, shampoos, vegetables meat and fruit. The affect is minor at LF and HF frequencies but is significant at UHF (e.g. microwave).
- Look for: Tests where the reader is tuned and optimised for only dry products. Also look for cased articles where the contents of cases and articles are not mixed up as they would be in the real world.
- Test: Observe how the readers and tags perform when attached to articles and cartons of mixed goods such as bottled liquids, frozen meat etc.

RFID tags and labels

Tag Order

- Fact: Very few RFID systems can establish tag order.
- Look for: Readers which need 1 – 2 feet physical separation between tags or they will read the second tag first.
- Test: Rearrange the tags on the belt so that the order of entering the reader volume is not known, and move the tags closer together.

Tag Orientation

- Fact: Tags need power and must “face” the reader antenna.
- Look for: Tests where the tag orientation is tightly controlled or pre positioned.
- Test: Move tags into various positions relative to the reader in the X, Y & Z orientation and observe what happens.

Stacked and Overlapping Tags

- Fact: Most RFID tags use tuned antenna but tuned tag antenna do not work when they touch closely or overlap yet certain tags in all applications will always overlap.
- Look for: Tests where tags are not allowed to overlap or be stacked one on top of the other.
- Test: Check what happens when tags do overlap.

Multiple Tags

Fact: In the real world, tags are not neatly separated, unstacked and presented one at a time. They come in all sorts of arrangements and numbers. Multiple tags need to be read at the same time.

Look for: Tests where tag numbers and the speed of new tags entering the reader are limited. Look for tags staying in the field too long and for software constructs.

Test: Place new tags in and out during the read sequence. Change the number of tags. Swap tags so that software cannot be pre configured to recognise known tags. Check what is actually being read.

Fact: It is possible to create the impression that multiple tags have been identified when what has really happened is that the reader has simply found multiple tags in the field and has not actually yet read anything.

Look for: Communication protocols not being used in accordance with normal operations.

Test: Change the tags by writing new data to the tags and then read this new data. Move single and then multiple tags in and out of the field at different times.

Tag Populations

Fact: Most RFID readers use a slot protocol which limits the tag population being read at the one time to the number of slots. The tag population must also not change and single tags must not lose power (e.g. switch axes) during the interrogation sequence.

Look for: Tests where the tags move only in tightly controlled batches.

Test: Add and remove a single tag from the population during the interrogating sequence and observe what happens.

Tag Size

- Fact: Larger tags and reader antennae generally provide greater range.
- Look for: Tags which are larger than the standard reference tag (ISO credit card).
- Test: Ensure when comparing claims about range that you compare tags of the same size.

Tag Memory Size

- Fact: Tags for use in dynamic (moving) applications and with a slow communication protocol (standard) will always have a very small memory. This is because the tag cannot stay in the field long enough to allow communication with a larger tag memory.
- Look for: The actual useful size of the memory and tests where tags are only read and not written. Tags presented only one at a time.
- Test: Ask to see reading and writing of multiple words to multiple tags.

Article Placement

Separation of Articles

- Fact: Very few RFID systems can read closely spaced articles.
- Look for: Articles always presented singly; articles that are widely separated; and articles too carefully positioned.
- Test: Test by moving articles closer together and speed up the presentation of the articles (speed up the conveyor belt or push the trolley more quickly past the reader).

Closely Stacked Articles

- Fact:** Very few RFID systems can read closely stacked tags or articles (this is because they use tuned tag antennas and these interfere).
- Look for:** Compromises where only a few loosely stacked tags are used, the read time is extended and/or articles are too carefully positioned.
- Test:** Test by stacking articles 20 or 50 deep.

Readers and Antennas

Reader and Antenna Arrays

- Fact:** To achieve longer range, UHF antenna tend to be focussing antennas this means they can be highly selective in their read area (the sweet spot problem).
- Look for:** Antennas or antenna arrays that need constant retuning depending on the range, nature and sizes of the articles to be read.
- Test:** Observe the robustness, stability and reliability of the antenna.

Reader Shielding and Interference

- Fact:** Unshielded RFID readers receive interference and electrical noise and also create noise and electrical interference in other readers.
- Look for:** Tests where only one reader is used. Observe if multiple readers are switched on and off to share the duty cycle as only one extra reader will half the time available to each reader.
- Test:** Place two or three unshielded operational readers close together and see what happens.

Data Rate

- Fact:** A high data rate is critical to the passage of information to and from the tag because there has to be sufficient time, particularly with multiple moving tags, to complete the read/write transaction with all tags.
- Look for:** Tags with only a small memory as this indicates a slow data rate and also look for slow conveyor belt speeds.
- Test:** Require data to be read and written to multiple moving tags; increase the number of tags; and increase the speed of the conveyor belt.

Radio Frequencies

RF Safety

Fact: It is not legal for emissions to exceed national regulations. These regulations differ around the world.

Look for: The allowed maximum emission level in the country of operation.

Test: Ask if the reader's emitted power level meets the emission regulations in all countries of application.

Ensure the reader is not over driven during the trial so it will perform one way in a trial but differently when installed in the field. (Does the antenna get warm?)

RF Interference

Fact: It is not legal to cause interference outside the permitted band width (especially in telephony bands).

Look for: Spurious emissions outside the authorised bandwidth/frequency. Check the country of use and check the telephone frequencies in that country.

Test: Ask if the equipment operates only within the allowed frequency and with the correct side bands. Note that license exemptions are allowed for certain sites.