

UHF RFID's Key Constraints

Twelve vital points to ponder prior to implementing a UHF RFID system.

May 8, 2006—Before deploying a UHF passive RFID solution, there are a number of critical parameters to consider. Listed below are a dozen essential ones to bear in mind.

1. Make sure the materials being tracked at a particular portal are of similar type. For example, cartons, trolleys, pallets, glass materials, documents and metal or plastic bins cannot be tracked simultaneously using a single portal. Since the RF energy level backscattered (reflected) by passive tags placed on different materials varies greatly, it is virtually impossible to have a single reader power level give a 100 percent read rate for all materials.
2. Make sure the tagged materials or objects travel in a defined pattern, and that they are not being moved by multiple modes of transport such as forklift, people and metal or plastic trolleys. There needs to be just one transportation mode—or perhaps two, at most—well tested for a 100 percent read rate.
3. When using tags based on different standards—EPC Gen 1 and EPC Gen 2, ISO or other vendor-based tags, for instance—make sure to test all of them, as performance can differ significantly. You'll find it difficult to configure the reader power level at such an optimum level that it supports all types of tags with a 100 percent read rate. Ideally, try to use a single standard and single vendor in one portal.
4. Orientation is one of the biggest factors for providing good read rates, even if you are using dual dipole tags, which perform better in all orientations.
5. Different tag sizes, shapes and encapsulation provide varying RF energy levels. Hence, I recommend utilizing a single size and shape unless it is not possible to do so. Define a proper document on the encapsulation standards and materials used, so that the same specifications can be followed whenever more tags need to be manufactured.
6. The positioning of interrogator antennas is very critical, so make sure all antennas are placed scientifically, based on polarization and tag orientation. Conceal all antenna wires properly using insulation, making sure they don't overlap each other. Otherwise, this may lead to power loss and impact the read range.
7. In some cases, RFID passive tags received from vendors can be damaged during manufacture, in transit or when encapsulated. Thus, it would be wise to test each and every tag before placing them on objects. This way, you can avoid a reduced read rate due to damaged tags.
8. When performing a test for read rates, make a point to understand the radiation pattern of the interrogator antenna rather than just doing a trial-and-error test with the tags. An optimum combination of tag orientation, antenna direction and radiation pattern provides the best-read rates.
9. Keeping the UHF RFID tags in close physical proximity to each other can render some tags ineffective. Nevertheless, a more complex signaling algorithm, such as frequency hopping, can actually help increase

performance levels.

10. If you plan to apply UHF RFID tags to liquid-based items, such as bottles of juice or water, understand that the effective read range of these tags would be drastically reduced as shorter-wave tags are more susceptible to absorption by liquids. Nevertheless, read range can be improved marginally by having a spacer between the tag and the object.

11. An RFID tag's lifespan can vary, depending on the application, business processes and other environmental factors involved. For example, in the supply chain, tag life may end once a product reaches the consumer; in cases of assembly line tracking, the end-point may be when the finished good is produced; and in asset-tracking scenarios, a tag's lifespan may be most subject to wear and tear. Whatever the lifespan, RFID solution providers need to simulate the various internal and external factors that can impact tag performance over a period of time. For example, what are the minimum and maximum temperatures that a tag can withstand, and for how long? And what would the impact be if the tag were physically handled—that is, removed from one object and reused on another—a thousand times per year? Answering these questions can help determine the kind of tag and encapsulation required.

12. Finally, when using a handheld UHF RFID reader for discrete item-level stock taking, make sure to set an optimum attenuation so the handheld interrogator doesn't read superfluous tags. In such situations, a reader fitted with a circularly polarized antenna and set for high attenuation (low signal strength) would be ideal. In applications involving a search for out-of-sight objects, however, a linear polarized antenna with high power would be a preferable choice.

There are, of course, other parameters to consider when implementing a UHF passive RFID solution. Still, with these 12 critical constraints in mind, the process becomes that much smoother.

Vinod Kankaria is an RFID consultant based in Chennai, India.

Copyright ©2005 RFID Journal, Inc. All Rights Reserved