

Near Field UHF vs. HF for Item Level Tagging

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Everyone agrees that item level tagging is going to be the biggest market for RFID in terms of both spend and number of tags sold. Everyone agrees that item level tagging has its own, special requirements making it different from other categories of RFID such as the tagging of people, animals, pallets, cases and vehicles or RFID in passports, tickets, smart cards and so on. But there the agreement ends.

The potentially highest volume item level RFID will involve such things as books, consumer packaged goods, drugs and letters. Many of these items are very small. Water and metal are frequently in, on or near these items. Smart shelves, often made of metal, need to distinguish one from another, however small they are, and yet groups of these items may also need to be read together. Exceptionally accurate reading and lack of false reads is required with drugs, aircraft and medical parts and jewellery, for example but some other applications such as anti-counterfeiting on 100 billion cigarette packets yearly may be met with cruder cheaper technology.

The transition from case to item level is far from distinct. For example, a single bicycle in a case may even be larger than a case of 200 tins of sardines and involve even more metal. Indeed, Robert Ulrich of Wal-Mart has pointed out that 15% of his general merchandise is "case pack one-of-one". Some retailers may therefore view with distress the preference of leading drug companies for HF RFID because the tags are small enough for the smallest packs of drugs and are tolerant of the metal in shelving and handling equipment, water in medicines and any necessary tag bending around an item.

These drug manufacturers were only following long established practice with items such as books in libraries (50 million items yearly), rented textiles/ laundry and many other items not involving retailing. For example, for US deliveries, Pfizer has been tagging all US Viagra and GlaxoSmithKline has placed orders to tag US deliveries of Trizivir both at HF. Perhaps 20 million drug items will be delivered with HF tags in 2006 and 10 million with UHF. 99.95% successful reads and no ghost reads seem to have been factors in the choice of HF, as well as the fact that it is a long proven reality. Conventional UHF was often found wanting in these respects although it is not a unanimous view in the pharmaceutical industry. Indeed, by Spring 2006, over two million drug items had been delivered to Wal-Mart under its mandate requiring the UHF RFID tagging of Type 2 drugs and some drug companies have said that they have yet to decide if UHF or HF is best for them.

Nevertheless, today, there is a rapidly declining number of suppliers recommending conventional Far Field "FF" UHF tagging of items if only because many of the UHF proponents have switched to recommending what they see as a "best of both worlds" option called Near Field UHF "NF". Technically, NF UHF means that the standard UHF Gen 2 chip is used but instead of the antennas of tag and reader communicating by Far Field (electric E field), they are designed to communicate by Near Field, including in just the same way that an HF antenna communicates (magnetic H field). This calls for a different antenna on both tag and interrogator.

Ian Forster of Avery Dennison points out that NF UHF is not a new idea. Only the intention to use it in mass markets is new. He says, "Nobody should be surprised by this, as we use near field couplers in our production systems to allow us to test tags in roll format adjacent to each other, and RFID printers use a near field coupler to read and program RFID labels. We have been using UHF near field technology for at least three years, and I think it has a lot to offer in comparison to the HF technology, and will offer a viable alternative for item level applications; I think one factor which may concern people at the moment is that UHF readers are more expensive, but I think this is going to change very rapidly, making the reader infrastructure for item level highly competitive to HF." For example, a primitive HF reader costs \$15 but the UHF equivalent is \$150.

Many companies endorse NF UHF even though it has yet to be tested in millions in real world environments. Wal-Mart is keen to use UHF for everything even if reader and tag antennas must come in many shapes and sizes.

It is probably indisputable that NF UHF gives the same tolerance of water and metal as an HF system and that it does so with a tag antenna that is currently easier to make. By contrast, the requirements of high conductance and fine definition for the seven or so turns of an HF tag have so far prevented high speed printing in one pass although companies such as Trierenburg Holdings are working on this. Indeed, Hyan Label in China is already printing HF antennas directly onto label feedstock, avoiding the need for an inlet, so HF costs are coming down too.

A UHF chip and label may both be cheaper to make than HF ones. There is too much loss making pricing at UHF to be clear – we have to await the shakeout of UHF suppliers to be sure. HF chips are often designed with more features than UHF ones, confusing any comparison.

Ian Forster notes that, “To be 'near field' the range is usually going to be less than 30cm (to be exact, the radiating near field, but the boundary between reactive near field, radiating near field and far field can be complex to calculate); however, if you use a 'normal' UHF tag, still very small, like our Gen 2 Pharma tag, 1" square, it works very well in the near field but with a far field system up to 2m, so you can tailor the read field to get what you want, control or range.” However, HF tags give relative tolerance to metal and water up to many meters depending on tag and reader antenna size.

So what are we to make of all this? NF UHF is an old idea, newly being considered for mass markets, notably highest volume item level applications. It may provide the lowest cost of system ownership for many such applications and perform as well as HF but how much HF market share it will take is uncertain at this early stage. HF interrogators are the cheapest at present but interrogator cost will not be a major component of total cost of ownership of most of the highest volume item level schemes.

No supplier is ceasing its activity in HF RFID and some UHF RFID suppliers are broadening their capability to HF. Hedging of bets may be in order and the likely outcome is that there will be a place for both solutions even at item level but rarely on the same product. Here, HF or UHF will win, not both, with drugs being a prime example of where there simply is not the space for two tags and having two infrastructures would be a nonsense anyway.

The biggest limitation to UHF is that it is not global and there may never be one frequency, bandwidth, signaling protocol under radio regulations or even power level allowed globally for UHF. It is a busy frequency: both causing and suffering from interference are concerns. Although we think fears of UHF heating drugs and damaging them are unfounded, particularly at near field, studies continue. Meanwhile, HF is being standardized for blood banks and various other applications where users call for proven performance. The train is leaving the station.

This article has only covered a few of the aspects of this complex matter. A full comparison, including the views of many more experts and pictures of many products on offer, is given in “Near Field UHF vs HF for Item Level RFID” www.idtechex.com. Also read “Item Level RFID Volume 1 Forecasts 2006-2016, Technology, Standards” and “Item Level RFID Volume 2 100 Case studies, Paybacks, Lessons Learned” www.idtechex.com. Enthusiast Dr Richard Fletcher of TagSense will demonstrate the NF UHF technology and Ian Forster of Avery Dennison will fully discuss it at the IDTechEx conference “RFID Smart Labels Europe” London www.smartlabelsEurope.com September 19-20. See www.smartlabelsEurope.com