FIT FOR PURPOSE;

One criteria of success for UHF RFID in Livestock

Presented by:

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Whilst the term "Fit for Purpose" has become a somewhat hackneyed expression, I believe that the expected success of UHF RFID technology within the livestock sector will be entirely dependent upon whether the technology is indeed Fit for Purpose.

In the livestock sector there are a number of people who will suggest that UHF is not a suited technology. Being Fit for Purpose is the single biggest challenge in bringing the UHF technology to market in the livestock sector.

It is my contention that we, as an RFID community with an interest in UHF technology to be used in the livestock sector, need to play a major role in bringing the technology forward, so that it is Fit for Purpose. It is my desire that this presentation will motivate you to lobby the designers and manufacturers of UHF RFID technology to be aware of what is required for UHF RFID to be successful in the livestock environment.

I also contend that, at this point in time, we need to always emphasise that the UHF RFID technology we are interested in is focused on LIVESTOCK and on EAR TAGS. It has often been pointed out to me that UHF is not suited to Animal Identification. I agree, it is not suited to all animals, hence my emphasis that it is suited to livestock i.e. those animals that are raised to provide meat for human consumption. Whilst some may argue that horses and dogs can be consumed by humans and recent events in this part of the world show that horse meat may have been a little more prevalent than

previously considered, I maintain that horse and dog are not considered livestock. Clearly UHF RFID is not suited to subcutaneous implanting of RFID transponders into companion animals, horses, laboratory mice etc because of the inherent properties of UHF communication. Similarly, UHF may not be Fit for Purpose for bolus transponders applications that can be used in some livestock species, although I am aware of some UHF transponders that have been encased in ceramic and operate well. As you may be aware, most of the currently available livestock bolus tags are ceramic with a LF ferrite tube tag inserted in the ceramic tube. To my knowledge no testing or trials have been done on UHF bolus for livestock, so I cannot say whether they would work or not. There is certainly a body of work that some enterprising organisation can undertake and prove conclusively if UHF in bolus is Fit for Purpose. However I wish to reiterate that at this moment in time, UHF RFID technology is Fit for Purpose to ear tag application on livestock. That is one message we must make clear to all.

I believe that the best way that we can promote the idea that UHF RFID is Fit for Purpose for use in livestock is to refuse to accept what many UHF tag and UHF reader manufacturers would like us to accept - a 'one size fits all' approach. If we are serious about promoting a technology that potentially offers a wider range of functions and features than current RFID offerings provide, then first and foremost it must be Fit for Purpose. No matter how good the technology promises to be, it the tag cannot stay on the ear, if the reader cannot stand a splash of rain, if the reader cannot read a tag in a

certain environment, then it is not Fit for Purpose. To compromise to a 'one size fits all' approach is unacceptable. The notion that a user need accept generic solutions to specific challenges, and that the user should change their operations to fit the technology, needs to be culled from the outset.

In late November I invited a senior representative of the Department of Primary Industries in Australia to come to this Conference. He responded by saying that he could not come, but commented:

> *"There needs to be a time when people quit trying to bash square pegs through round holes. I think UHF technology is fantastic, but not within the livestock industry. I'm becoming increasingly frustrated with this UHF debate as it seems that very few (if any) people are viewing this technology throughout the entire livestock chain. In many instances, it will work on-farm, but an abattoir environment is another matter entirely, especially with reflectance, where a number of manufacturers have just walked away from the whole project at this point. I have attended a number of lectures by UHF manufacturers and scientists and I have seen nothing that gives me any reason to believe this technology is suitable for the livestock industry - as a whole, from paddock to processor".* [personal communication 18 Jan 2013].

He was clearly saying that UHF as a technology was not Fit for Purpose. He was not referring to the mechanical aspects of the ear tag or readers, but

stating that the UHF RFID portion of the tag may not be read when it was in an abattoir.

Earlier today Mark Rance from ANZCO presented his paper showing photographic images and providing a verbal account of how ANZCO read UHF RFID tags on deer in their processing plant. Immediately after this presentation you will hear from Niels Peter Baadsgaard of Denmark regarding how they used both handheld and stationary readers to read pigs in the abattoir. So why is this person from DPI Australia condemning UHF as a technology not suited to operating in an abattoir? And why have two presenters at this conference been able to attest to the reading of UHF RFID tags in abattoirs that were slaughtering UHF tagged livestock? The answer is ostensibly simple. The readers that were successful were suited to that physical environment whereas the reader(s) that he witnessed in Australia were not. Further to this he referred to "a number of manufacturers walking away from the projects". Whilst it is always dangerous to make a presumption, I would guess that they used generic UHF stationary readers. While the generic UHF reader may not be Fit for Purpose in their particular trial sites that is no fitting rationale to condemn the technology as a whole because of this failure. In Denmark they use generic UHF stationary readers, and at ANZCO they used generic handheld UHF readers. It may be that some generic UHF stationary readers operate satisfactorily in some abattoir environments. Of course, abattoirs differ from site to site, so what may not operate to the users requirements in one site may work well in another. Or maybe the UHF stationary reader manufacturers need to take a leaf out of the

LF reader manufacturers' book and design readers that are suited to the environment in which they need to operate. Harking back to an earlier comment, a 'one size fits all' mentality is unwise unless you are willing to accept a less than optimal implementation.

While during this presentation it is not possible to dissect and analyse all possible areas where UHF tag and reader technology is not Fit for Purpose, I want to zero in on a couple of specific areas as examples.

Up until a year or so ago the predominant UHF tag was a flag tag. Those involved in pig farming know very well that one of the behavioural aspects of swine is that they like to chew on the ears of other pigs, although this is not to say it is prevalent in all pig farming environments. If a flag tag is damaged by chewing, then the potential for the UHF transponders aerial to be damaged is extremely high, resulting in the tag failing to operate. A tag rendered useless by what is considered typical animal behaviour cannot be considered as being Fit for Purpose. Already we have seen three UHF RFID tag manufacturers rising to the challenge and developing a UHF RFID ear tag suited to this farming environment. The UHF button tag is ideal for this species, and those involved in their development should be congratulated for their foresight to design and manufacture a product that is very Fit for Purpose. To look at this from the ear tag manufacturers viewpoint, if they all stayed with a "take it or leave it" approach, some pig farmers would quickly realise that the flag tag was not Fit for Purpose for their method of farming

and they would not buy such tags. Therefore the manufacturer would lose the opportunity to sell products. Those that listened and developed a tag that was Fit for Purpose will succeed in providing the user with a tag that is suited to the environment and the species.

It should go without saying, that if an ear tag is applied to an animal's ear it is expected to survive in-situ for the life of the animal.

- Ear tag retention is always high on the list of performance criteria set out by Regulatory Authorities of any country.
- The legibility of the inked/lasered numbers on the tag also needs to survive for the life of the animal.
- The survivability of the ear tag's plastic to the atmospheric and weather elements is equally important.

UHF ear tag manufacturers need to be aware of the different farming environments that are encountered throughout the world. It is my belief that ear tags should be designed and manufactured solely to survive the farming process. After all, livestock are in the farm environment for 98-99% of their lives with only short spells on trucks, in sales markets or waiting for slaughter. The ear tag should always be designed to survive the farming environment whether pastoral, feedlot or barn, etc.

Essentially an ear tag manufacturer is a plastic moulder. They take a RFID transponder and mould that into an ear tag which is then applied to the ear of a livestock animal by the keeper. What does a plastic moulder know about

the farming environment in which their tag is expected to survive? In Scotland, for example, you have a lot of Rylock mesh fencing, whereas in Australia and New Zealand five strand wire fencing is predominant on sheep and cattle farms. When an animal tries to pull its head back after the ear tag has been caught on the wire, the mesh fencing will react differently to that of a wire strand fence. If the UHF RFID tag is a flag tag, should the flag part be flexible or rigid? The greater the rigidity the more likely the plastic will crack and therefore damage the internal aerial. Conversely, the more flexible flag may bend and curve when under stress when being withdrawn from being caught on wire. What physical size should the flag tag be where mesh fencing is encountered? Or is a button tag more appropriate where there is mesh fencing? What I am saying is that I do not believe that a 'one size fits all' approach to ear tags will provide the best solutions. Every farming environment needs to be catered for in order to obtain the maximum benefit of the technology.

Having said that, from a manufacturer's perspective, it is not possible to cater for all potential possibilities. As most of us would have found from time to time, when dining at a restaurant that has an extensive menu selection, selecting what we wish to eat is difficult when we are overwhelmed with too many possibilities. The same would occur if each ear tag manufacturer offered twenty different ear tag possibilities for a farmer to select from. Not only would the decision of which tag to buy be difficult, but the tags would be more expensive than a 'one size fits all' model due to the size of the

manufacturer's production runs. Instead, the tag manufacturer needs to be encouraged to cater for typical farm type within a geographical area and at the same time take into account the species it will be targeting.

Hand in hand with the geographical area, the farming environment and the species of animal being tagged, we also need to consider the atmospheric and weather environments. In New Zealand and Australia for example, we have extremely high amounts of UV compared to say most of Europe. The New Zealand and Australian livestock also remain outdoors all year around. While I am not a plastics engineer, I would assume that the composition of the plastic used to manufacture the ear tag that would withstand the amount of radiation they need to absorb in New Zealand and Australia would be vastly different to the UV shielding needed in ear tags manufactured for many parts of Europe. A 'one size fits all' policy would either see the plastic disintegrating (if UV protection was not added to the plastic composition for the Down Under tags) or more expensive for the some Europeans (if UV protection was added to all tags).

Similarly the tag manufacturers need to be aware of climatic conditions and how they would impact on the tag. I cannot think of too many locations in New Zealand where livestock would be located in temperatures of less than say 0C in winter, whereas in Canada most livestock would have to tolerate sub zero temperatures. During summer in New Zealand temperatures can be in the low 30's, whereas in most of Canada for example those temperatures

would not be reached. A tag manufacturer therefore needs to be aware of these temperature extremes and differences so that in their design of the locking mechanism the plastic selected can compensate for the expected amount of contraction and expansion, otherwise tag retention will be questionable.

Unless farming groups make ear tag manufacturers aware of the farming environments that are specific to their country, the ear tag manufacturer will continue to pump out the same tag regardless of its environment affected failure rate. If the ear tag manufacturer does not listen to the buyer, then the farmers will stop buying their tags simply because they are not Fit for Purpose. Farming groups need to get their Regulatory Authorities involved so that they can demand a tag that is suitable within their jurisdiction. I am aware that in the UK farmers face cross compliance penalties due to tags falling off ears and tags not being able to be read. Engineering that takes into account the environment as well as the animal species the ear tag is to be used in, should almost eliminate the likelihood that tags cannot be read or tags not being retained in the ear for the life of the animal.

In an attempt to seamlessly cross from speaking about ear tags to reader technology I want to briefly make a few points on the tag numbering system. I believe that to even contemplate a numbering system that does not provide for the compliance with ISO 11784 is unwise.

We are all aware that there are tens of millions of RFID tagged livestock in the EU, many millions of RFID tagged livestock in Australia, millions of tagged livestock in Canada, several million tagged livestock in Latin American countries and several million RFID tagged cattle in New Zealand, all of whom are recorded on databases in their home countries primarily for the purposes of traceability. All these databases have been designed to record the 15 digit identifier of the ISO 11784 numbering plan. In my opinion it would be foolish for the UHF RFID community to disregard this numbering plan and come up with a unique plan and with complete disregard of the ISO 11784 plan. Memory chip manufacturers for UHF RFID have designed their chips to provide for more memory than just sufficient room for the 15 digit ISO number. The quantity of available memory varies from chip to chip, manufacturer to manufacturer. There are many UHF transponders that could contain a 96 bit EPC number and a 64 bit ISO number (locked) on the same silicon. Anything with more than 64 bits of User Memory can do that (Impinj , Higgs, NXP, Fujitsu and so on).

From the UHF RFID reader's viewpoint, you can read either EPC or locked User Memory or both, providing the reader has the software/firmware to decode it. The determination of the memory content, whether it is ISO number or EPC number or both, is entirely a software/firmware function of the reader.

How much user memory a UHF RFID ear tag actually requires is really up to the user and that should be decided upon in conjunction with their applications software provider and maybe their Regulatory Authority. For example, in EU countries the Regulatory Authority may decide that a UHF tag should have sufficient storage to record the details of the animal's passport. In New Zealand, we do not export sufficient quantity of live animals to EU countries to enforce that requirement on the user, so a lesser amount of memory is sufficient. Some applications software providers may use the memory on the UHF ear tag to store quick-to-access information (e.g. the withholding date for medications that have been administered). Whatever the intended usage of the UHF ear tags memory is, the user needs to be aware of what their software supplier requires in order that they purchase the correctly configured tags from the ear tag provider.

Of course after the livestock has been tagged with UHF RFID ear tags, there comes a time when they need to be read. They may need to be read by the farmer, the sales auction facility, the slaughterhouse, the compliance authorities etc. While there appears to be a number of stationary and handheld UHF readers on the market, I wonder how many are mechanically Fit for Purpose by being suited to the rugged environment that they must operate in. Again, the user of this technology will be subjected to the "this is as good as it can get" myth from reader manufacturers. Although I do acknowledge that at some point a limit will be reached that cannot be surpassed. I am reminded that when I first became involved in RFID within

the livestock sector, way back in 1999, as a company we made the decision to venture into the development of RFID reader technology based on a client's request, availability of funding to satisfy those requests etc. At that time the requirement was for us to develop a Low Frequency RFID reader, suited to the livestock environment. The client envisaged that we would initially compete in the soon to be RFID mandated Australian cattle market, and by the time we had developed products for that market other markets would be ready. Some of you will recall that in 2000 or 2001, NLIS (National Livestock Identification Scheme) of Australia demanded that the RFID tags must be able to be read across a 1.2 meter wide race. A number of FDX tag manufacturers were keen to compete in the Australian marketplace as were reader manufacturers who could read FDX and HDX tags. The stumbling block in 2001 was that most readers could only read FDX tags at a distance of approximately 400mm, a long way short of the NLIS expectation. Some reader manufacturers took a "this is as good as we can get this technology" attitude. Other reader manufacturers accepted the challenge to design a better performing reader and over the next few years did so. Now, reading FDX tags in a 1.2 meter wide race using a single panel antenna is achievable, and with the use of twin antennas you can easily span a 1.8 metre wide race. My point here is that Users and Interest Groups can make demands of manufacturers and if the manufacturer wishes to compete in that market they will spend time and effort to create a niche for themselves. Harking back to the Australian Department of Primary Industries statement that readers will not work in an abattoir environment especially through reflectance, this may

very well be the case if standard generic readers are being used. But what if a reader manufacturer designed and manufactured a reader specifically to take into account the environment present in a typical abattoir? We did exactly that with Low Frequency readers when we found that our standard generic reader did not perform to expectations in an abattoir. Again, the group(s) interested in reading UHF tags in abattoirs need to lobby UHF reader manufacturers to develop a reader that would be suited to reading UHF RFID tags in their environments.

If the stationary reader is to be Fit for Purpose in the abattoir, it needs to be waterproof and be able to withstand high pressure hose downs, be resistant to a variety of cleaning chemicals; and it may need to be able to be operated in a stun box. The antenna needs to be able to withstand impact (especially in a beef and venison slaughterhouse when a carcass of 500+kgs is swinging on a hook), and to be able to identify a single carcass that is hanging from a hook. In a practical sense, the UHF RFID tags need only be read in the first few stages of the slaughter process. It may be read as the animal is led to the stun box, in the stun box, immediately after slaughter, and up until the time the head is removed. After that stage there is no tag to be read, so the notion of having UHF readers spread throughout the entire processing chain of the plant is invalid.

In Europe in particular I have visited a number of smaller abattoirs, (compared to what I am used to) and the use of handsfree readers is

unnecessary and overly expensive for what they need. These abattoirs would be well suited to using handheld type readers although they will need to have some level of protection against wash down, drops on to concrete, etc.
A final word on abattoirs and readers. An abattoir will require either RS232, RS485 or Ethernet communications from the reader(s) to their computer system. For a reader to not have the whole stack of communication protocols could disadvantage the reader provider.

This Conference is being conducted in the Dingwall Sales Market and it is appropriate that my concluding remarks are focused on the use of UHF in livestock sales markets. It is my opinion that regardless of whether the sales market is ring sales oriented or pen sales oriented, UHF RFID is a great medium for identifying, tallying and accounting for all the animals that have been bought and sold. Most national traceability systems rely heavily on the accuracy of the data coming from these Critical Control Points. To accurately identify each livestock animal at the speed of commerce of each sales market is critical. If the sales market has to slow down their auctioneering process to achieve compliance, then they will be less than enthusiastic with such legislation. Using the inherent speed and anti-collision properties of UHF technology I feel sure that sales markets will not be disadvantaged by the introduction of this technology. Here in the Dingwall Sales Market the use of standard, generic UHF readers have been proven to successfully read UHF tagged livestock. However, I would suggest that it behoves the management of auctioneering companies involved in livestock to discuss with UHF RFID

reader manufacturers about what can be and should be expected at other establishments. It would not be sensible to say "it worked at Dingwall so it should work everywhere".

In conclusion: My subject was Fit for Purpose and I am convinced that UHF RFID in livestock will only be successfully introduced if we, as an RFID community interested in this technology being used in Livestock, can prove that it is indeed Fit for Purpose. Comparisons are always going to be made between the technology that is being proposed and that which is currently in place. The comparative critique will always include the suitability of the new over the old. As a community we must 'walk the walk and talk the talk". UHF RFID tag manufacturers and the UHF RFID reader manufacturers must demonstrate to the world that their offerings are Fit for Purpose for the positive identification of livestock.

Fit for Purpose is not just a hackneyed expression. Fit for Purpose is a vital cog in the wheel of acceptance of UHF RFID as a technology in the livestock sector that will help ensure food safety through traceability of livestock.