

Cattle EID FAQ

The following is a list of frequently asked questions relating to the use of Low Frequency (LF), Ultra High Frequency (UHF) and dual LF-UHF technology for electronic identification (EID) of cattle ("control-click" on a question, or simply scroll-down). The answers given draw on ScotEID's experience of the current sheep EID system and testing UHF equipment in cattle and sheep plus findings reported by other researchers.

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Q1. What is EID?

Electronic Identification (EID) is one use of Radio Frequency Identification (RFID) technology. RFID is already used for EID in sheep plus some companion animals such as cats and dogs. It is also widely used in retail and logistics applications. In all cases, an electronic transponder encoded with an ID number is attached to the item (e.g. animal, pallet, vehicle) of interest and the ID is read wirelessly using an electronic reader. RFID offers advantages over more traditional forms of visual identification (e.g. written labels or barcodes) through reading and recording IDs more quickly and accurately.

Q2. Who are ScotEID?

On behalf of a joint Scottish Government/Industry Working Group, the Scottish Agricultural Organisation Society (SAOS) co-ordinates research funded by Scottish Government into the feasibility of multi species tracing systems and livestock EID within Scotland. The research commenced in 2008 and has developed a multi species tracing system incorporating sheep, cattle, pigs and goats, including working EID systems for sheep in accordance with regulatory requirements. Current research extends to cattle in terms of recording test results for Bovine Viral Diarrhoea (BVD) and field-testing of bovine EID. The research and development under the name of ScotEID is managed by SAOS in trust for the Scottish livestock industry. Unlike some other EID research projects, a large number of partner farms, marts and abattoirs have been involved throughout in order to test and develop hardware, software and procedures under a variety of challenging conditions. ScotEID has no commercial interests in the manufacture or distribution of EID equipment and is motivated solely by seeking workable EID solutions to support the Scottish agricultural sector.

Q3. Why is EID being introduced for cattle?

As an integral part of livestock traceability for disease control and food safety, the existing cattle passport system already obliges farmers and others in the supply chain to read and record cattle IDs. EID offers an opportunity to reduce the time and paperwork involved with this. It may also offer opportunities for improving the use of on-farm management information. Sheep EID is already mandatory, but cattle EID will be voluntary (at least in the first instance).

Q4. Are there different forms of EID?

All forms of EID share the same basic principles of encoding unique IDs onto transponders which are then read using an electronic reader. Readers can be handheld, stick-like devices or fixed panels installed on (e.g.) walls or entrances. Transponders can be embedded in a variety of forms, including tags for ears, collars for necks, pasterns for legs, boluses for ingestion and phials for subcutaneous injection. However, different EID applications can differ in technical characteristics. In particular, different radio frequencies can be used. Low Frequency (LF) EID has already been mandated for sheep and seems likely to be favoured by the European Commission (EC), but Ultra High Frequency (UHF) offers an alternative. ScotEID has developed dual LF-UHF technology to potentially satisfy the EC's likely preference for LF whilst retaining some flexibility to meet the preferences of users across the Scottish supply chain.

Q5. What forms of EID are in use?

LF is a mature technology that is already familiar to many parts of the Scottish agricultural sector through its use for sheep EID and, in some cases, for management purposes on dairy farms. Moreover, international standards have long been established for animal-specific LF applications, most notably the way that IDs are encoded and read. By contrast, UHF is a newer technology with no animal-specific standards and relatively few animal applications. However, UHF has developed rapidly over the past decade through its wide-spread adoption in logistics and retailing and there is increasing interest in its potential for livestock EID. In particular, it is in use or being tested in Canada, Brazil, Denmark, Germany, New Zealand and the USA. Dual LF-UHF technology is a more recent development seeking to combine the capabilities of both LF and UHF.

Q6. If the European Commission opts for LF, can UHF still be used?

Provided that the UHF is not explicitly prohibited, it could still potentially be used alongside LF. The development of dual LF-UHF technology is an attempt to retain flexibility, allowing users needing or wishing to use LF to do whilst also retaining freedom of choice for users wishing to use UHF. Tags containing dual LF-UHF transponders have been developed, as have dual LF-UHF readers. The co-existence of different forms of identification is nothing new with, for example, the use of alphanumeric and barcode representations of the same ID on conventional ear tags.

Q7. Why is UHF of interest?

UHF offers a number of advantages over LF. In particular, it is able to read IDs at a greater distance and more rapidly than LF is. For example, UHF has been shown to reliably read IDs at a distance of several metres and at the commercial speeds experienced in auction marts whilst LF is typically used to read cattle one-at-a-time at close range. In addition, UHF transponders have the potential for storing more information beyond simply the ID.

Q8. Why do reading distances matter?

Cattle are large animals and can be unpredictable when being handled or restrained, both of which are typically required for LF reading (as with visual and barcode reading too). Being able to read IDs with UHF without having to get physically close reduces the risk of injury to staff and animals. Avoiding the need to restrain animals or to use handheld readers in close proximity to animals' heads and eyes also lowers their stress levels. Although dairy cattle may be used to being handled and/or restrained, beef cattle (especially from suckler herds) are less so and represent a significant proportion of cattle in Scotland (and some other parts of the UK). UHF thus offers the potential to improve staff Health & Safety and animal welfare, both on farms and at other points in the supply chain such as auction marts. Of all farm fatalities, 12% are related to cattle.

Q9. Can the reading distance of LF be improved?

The reading distance of LF can be improved moderately through increasing the output power of reading equipment and/or optimising it for a specific transponder type. For example, in Australia, more powerful reading equipment is used in conjunction with only HDX format tags. However, current EU regulations restrict output power and require all reading equipment to work with both HDX and FDX formats. Moreover, UHF still achieves a superior reading distance due to its shorter wavelength and directional signal, which LF cannot emulate.

Q10. Why not let users with Health & Safety or animal welfare concerns simply not adopt EID?

EID is being promoted as a means of reducing the regulatory burden associated with cattle passports and of improving farm management for all parts of the cattle sector – a sector that does not solely comprise docile dairy animals, particularly in Scotland and other upland parts of the UK. Denying potential EID gains to (e.g.) farms with beef suckler herds or auction marts handling large numbers of beef cattle does not seem consistent with the stated policy aims.

Q11. Why does reading speed matter?

Reading and recording cattle IDs is an administrative task that diverts attention away from more productive uses of staff time, whether on farms, at marts or in abattoirs. By avoiding the need to manually read and write-down IDs, EID offers the potential to speed up the process and thus release staff time. Both LF and UHF can do this, but UHF achieves it faster and more consistently first-time relative to LF which is slower and can often entail re-reading some IDs missed at the first attempt. The time savings may be individually small, but cumulatively large given the numbers of cattle across the sector. Auction marts anticipate significant time savings relative to the manual processing of cattle passports, but individual farmers also report time savings for operations such as weighing or routine veterinary treatments.

Q12. Can the reading speed of LF be improved?

UHF is able to read IDs at a faster rate than LF due to a combination of its higher radio frequency and its anti-collision properties. The latter means that multiple IDs can be read simultaneously whilst the higher frequency means that a transponder does not have to remain within reading range for as long. Commercial LF does not currently possess anti-collision properties, but these can be incorporated and international standards are being revised to acknowledge this. Since the speed of data transfer between a transponder and a reader is proportional to the radio frequency, even with anti-collision properties LF can never match the reading speed of UHF. Importantly, LF readers cannot simultaneously read a mix of anti-collision and non-anti-collision transponders, implying that any existing LF tags would have to be withdrawn from use – a problem that does not apply to UHF since all transponders have the anti-collision property.

Q13. What evidence is there for the comparative performance of LF, UHF and dual-technology?

ScotEID has conducted and reported (see www.scoteid.com) on various tests of LF, UHF and dual-technology. Some tests have been under controlled conditions, largely to compare different brands and configurations of available equipment, but field testing with partner farms, marts and abattoirs is key to developing workable solutions under commercial conditions. Field-testing of dual-technology is largely completed. A public demonstration of UHF capabilities was given at an international conference held at Dingwall mart in March 2013. In addition, the Scottish Government commissioned separate laboratory testing of UHF transponders whilst the academic and grey literature also reports international experience with laboratory tests and field trials.

Q14. Are UHF signals blocked by animals' body tissue?

All RFID signals are prone to interference of various types. UHF signals can be impaired by dense body tissue. However, this effect has not been an issue during ScotEID tests due to positioning of readers above the heads of cattle – as demonstrated at the Dingwall conference. Conversely, it is far harder to counter electromagnetic interference that adversely affects the performance of LF. Electromagnetic interference arises from metal infrastructure commonly found in marts and various electrical equipment in abattoirs.

Q15. Is UHF performance impaired by wet or humid conditions?

UHF signals actually comprise a 'near field' magnetic component and a 'far-field' electric component. Although the far-field signal is affected by the presence of water, the near-field signal is not. Consequently UHF performance is not impaired unduly by wet or humid conditions – and this was demonstrated very clearly at the Dingwall conference, and has also been reported elsewhere for livestock, forestry and horticultural applications. LF signals are entirely near-field.

Q16. If UHF has a long reading distance, how can it tell which animal is being read amongst a group?

Unlike LF, it is possible to vary the effective range of any UHF reader and, more importantly, UHF signals are directional. Hence, when it is necessary to read animals individually, it is relatively easy to see which animal's EID is being read at a given time.

Q17. If LF is already used for sheep, would using it for cattle offer consistency?

Superficially, given LF is already in use for sheep, capital costs would be reduced and greater consistency achieved by also adopting it for cattle. However, this argument is flawed since cattle and sheep do not share a common ID numbering system and hence existing readers would not be usable anyway (unless reprogrammed). Moreover, in the case of fixed (rather than handheld) readers, the limited read range combined with the difference in head height between sheep and cattle limits the potential for using existing LF reader installations for cattle. Hence new investment will be required for cattle EID, regardless of which technology is adopted.

Q18. If UHF offers so many advantages, why would the European Commission favour LF?

This is a matter for the European Commission, but it appears that there is some misunderstanding and/or lack of awareness of how UHF technical capabilities have developed over the past decade. There are also differences of opinion regarding the scope and interpretation of various existing regulations in terms of how they should apply to UHF and dual LF-UHF technology. In particular, whether transponders are permissible in primary tags and whether dual-technology is compatible with existing international standards.

Q19. What is the issue with EID and primary tags?

Tagging regulations drafted prior to the advent of EID make no mention of internal EID transponders within a primary tag, only of IDs marked externally as barcodes and alpha-numeric symbols. This could be interpreted as precluding transponders within a primary tag. However, an alternative interpretation is that, to maintain ease of reading, restrictions on what can be marked externally on a primary tag were originally created to avoid unnecessary visual cluttering of the limited space available. Since internal transponders have no impact on external markings, it is difficult to argue that they should be the target of such restrictions. A slightly different interpretation of the marking

restrictions limits the permissible information on a primary tag to be only the animal ID, regardless of whether it is held internally or externally. Since internal transponders can contain more than just an ID (e.g. manufacturer code, management information) transponders would not be permitted in a primary tag under this interpretation. Yet if the limit on permissible information reflects the limited space available externally rather than any deliberate intention to preclude other information, then transponders should arguably be acceptable. Indeed, given that the potential for holding additional information is one of the perceived advantages of EID, it would might seem odd to seek to exclude transponders on the basis that they hold too much information.

Q20. Why not simply use EID in secondary tags?

Unlike usage in primary tags, there are no inferred objections to the use of transponders in secondary tags which are subject to less explicit limitations under existing regulations. However, in Scotland, many farmers choose to use metal fold-over secondary tags since these are perceived to have superior retention rates relative to plastic flag or button tags. Since transponders do not work if embedded in metal rather than plastic, precluding transponders from primary tags means that farmers wishing to use UHF or dual-technology would have to abandon metal fold-over secondary tags or use a third plastic management tag. It seems unlikely that the tagging regulations were drafted with the intention of constraining farmers' choices in this manner. Indeed, given that EID is promoted as making animal identification easier, permitting transponders in the primary tag is arguably compatible with the original intention of using primary tags as the primary means of identification.

Q21. Is dual-technology permissible under existing international standards?

International ISO standards state that each animal ID can only be encoded onto one transponder, to avoid the same number being issued to different animals. As such, tags containing two transponders – one LF, one UHF – with the same ID encoded on them would not be permissible. However, since the LF and UHF transponders are embedded together in the same tag, it is not possible for two animals to have the same EID. Moreover, the official distribution of tags via (e.g.) ETAS ensures that only unique IDs are issued. Hence compatibility with existing standards depends on the degree to which interpretations can take account of technological developments that have occurred since the standards were agreed.

Q22. Does it matter that, unlike LF, UHF lacks animal-specific standards?

The animal-specific standards for LF (ISO11784 & ISO11785) do not relate to technical performance, only to how IDs are encoded onto transponders and read by reading equipment. Although these standards impose some undesirable restrictions (e.g. with respect to WYSIWYG numbering), for consistency the UHF elements of the dual-technology developed by ScotEID has been designed to emulate them. Hence the lack of animal-specific UHF standards is not problematic. As with LF, the technical performance of UHF is governed by international standards.

Q23. What's the issue with retaining existing cattle IDs?

Information, such as an alpha-numeric code used to identify an individual animal, is stored on a transponder in binary form, as a series of ones and zeros (1,0). Under the prevailing ISO11784 and ISO11785 standards, the physical storage space available for an ID is limited to 10 "bits" for the

country code and a further 38 bits for the number (with each bit taking a value of one or zero). EU cattle numbering currently takes the format of a two-letter country code followed by a 12-digit number, with the latter comprising a six-digit herd number, a single check-digit (to help spot transcription errors) and a five-digit animal number. In Scotland, all herd numbers and thus all numerical IDs start with a "5". Unfortunately, 38 binary bits are insufficient to represent decimal numbers this big: the largest decimal number that can be represented by a 38 bit binary code is only 27487790693. Consequently, either a new system of cattle numbering will be required and/or the existing standards dictating how IDs are encoded will need to change. Any new numbering system is likely to cause considerable confusion and to be expensive to implement. In principle, a less disruptive possibility would be to omit the check-digit from the transponder (thereby freeing sufficient space for any current ID) and to rely instead on software in the reading equipment to re-insert it when reporting – which is not such a radical idea since readers already decode information into the expected format (e.g. the country-code "UK" is actually stored as the binary version of "826"). An arguably more sensible approach would be to accept that the storage constraints imposed by ISO11784 & ISO11785 reflect historical rather than current technological limits, and to update the standards to match the storage capacity offered by modern transponders. That is, both LF and UHF transponders now have more than 10+38 bits of storage and thus could relatively easily accommodate existing cattle IDs if it was permitted to utilise the additional bits. Moreover, such a change would also facilitate true WYSIWYG, with external visual IDs matching internal IDs without the need for cross-referencing.

Q24. Can regulations and standards be updated?

Standards and regulations can be updated. Indeed LF standards are likely to be revised to acknowledge technical possibilities for greater data storage and anti-collision properties. However, revisions inevitably take time and can entail protracted negotiations. A more pragmatic approach is to allow for some interpretive flexibility to accommodate new technological possibilities whilst respecting the overarching purpose of the standard or regulation.

Q25. Who manufactures EID equipment?

Transponders and reading equipment are available from a number of manufacturers and distributors. Some manufacturers are also distributors, but some distributors are only re-sellers. Many firms are global, some with different brand names in different countries. The pursuit of economies of scale has led to consolidation with several mergers/take-overs in recent years.

Q26. What are the relative costs of LF, UHF and dual-technology?

Costs vary slightly across different brands and configurations, but in general UHF is less expensive than LF. Dual-technology is the most expensive option, but offers greater flexibility.