# ALIDMA: EID tag reading study

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Submitted to:
ALIDMA

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## Executive Summary

Since the introduction of Regulation 21/2004 on the 31st December 2009, EID tags have been under fire from many quarters with accusations that the 'technology does not work'. However these negative comments have not been backed up by independent technical reports.

The aim of this study was to conduct an investigation into EID tag readability to inform the industry and DEFRA, but also to allow manufacturers and industry to address any problems that may be identified.

There were three stages to the work:

- Baseline read of newly purchased tags to establish whether the tags meet the requirements of Council Regulation 21/2004 at the point of sale;
- Evaluation of EID tags retrieved from finished lambs passing through abattoirs during spring 2012; and
- Evaluation of EID tags in ewe lambs, shearling ewes and/or store lambs on farms.

### Baseline read

In total 12 different tag types (50 tags of each) were ordered anonymously in February/March 2012 from seven tag suppliers. All tags were subjected to a simple transponder response test that measured the read distance with three commercially available handheld readers. In addition 25 tags of each type were submitted to the EC Joint Research Centre (JRC) in Italy for activation field strength (AFS) testing. Results demonstrated that all the tags read with the handheld readers and those submitted to JRC passed the AFS test thus meeting the requirements of the regulation. All tags were deemed fit for purpose at the point of sale.

### Abattoir reading of slaughter lambs

Over six test days (between February and April 2012), EID tags of all lambs passing through two large Welsh abattoirs were read with handheld readers in the lairage and by the abattoir panel/race reader. All tags believed to be EID tags were retrieved from lambs on the slaughter line to allow further investigation of suspected faulty tags. In total the readability of 7633 tags was investigated. The focus of this study was investigating EID tags but it was noted that both the use and installation of readers (handheld and panel readers) affected the overall read rate achieved. Particular issues were identified with one panel reader that was not ISO compliant resulting in the exclusion of HDX tags from the analysis on two test days whilst the other had not been fully commissioned on the test dates leading to higher than expected race non-reads.

In this study 98.5% of the tags (n=7518) were considered to have met the requirements of the regulation either because they read with a panel reader at the abattoir or passed further (AFS) tests carried out by JRC. The remaining

1.5% (n=115) were considered to be not fully functional because they were total non-reads (n=98), could not be tested (n=3) or exceeded the 1.2A/m AFS standard (n=14). Reasons for total non-reads were split between loss of the transponder from the tags (55) or other problems (43) (fracture of glass, ferrite or the coil). Of the 7578 EID tags that held transponders (i.e. those that had not lost the transponder) 0.57% failed to read due to failure of glass, ferrite or coil.

**On-farm reading of breeding ewes and store lambs**

In total 2913 EID tags (in 647 shearling ewes, 715 ewe lambs and 1551 store lambs) across four farms were read (between February and June 2012) with handheld and panel/race readers. Overall, on the test days, 2898 tags (99.5%) were read with handheld readers and 2879 (98.8%) with race readers. JRC carried out AFS tests on 15 tags from this phase of the study and all were found to meet the requirements of the regulation. An additional fourteen tags were found to be total non-reads and were split equally between loss of the transponder (n=7) and other problems (n=7).

Overall 2899 (99.5%) of tags were found to meet the requirements of the regulation. There was no evidence to suggest that tags in shearling ewes read differently to those in ewe lambs or store lambs, indicating no tag deterioration over time.

Tag readability was found to be good in all aspects of this project but the work has highlighted the importance of the accurate installation, set up and maintenance of reading equipment.

# 1.0 EID tag monitoring on farm and in abattoirs

## 1.1 Brief

ADAS were contracted by ALIDMA (Approved Livestock ID Manufacturers Association) to undertake an assessment of commercially available sheep EID tags in the UK in respect of their ability to be read by ISO compliant race and handheld readers. ALIDMA members represent over 90% of tag supplies in the UK.

## 1.2 ALIDMA Members

Allflex
Cox Agri
Fearing International
Ketchum
Markrite
NMR/Nordic Star
QuickTag
Ritchey
Shearwell Data
Symtag

## 1.3 The aims of ALIDMA:

- To promote the Livestock Identification Industry (both EID and visual) and to provide a forum for the exchange of non-competitive information.
- To put the views of the Livestock Identification Industry to Government departments and agencies.
- To provide technical guidance and advice of relevance on Livestock Identification to members, Government and the livestock industry.
- To facilitate the smooth implementation of changes which affect the livestock industry, including the introduction of RFID and other major schemes.
- To be fully inclusive, promoting membership to as many companies as possible involved in livestock identification
- To promote ALIDMA and establish it as a recognised organisation

## 1.4 Background

Since the introduction of Regulation 21/2004 on the 31st December 2009, EID tags have been under fire from many quarters with accusations that the ‘technology does not work’. These negative comments have not been backed up with independent technical reports.

- Negative feedback on tag reads from the Scot EID trials and from markets suggests that a proportion of EID tags are not reading and that the number of miss-reads tends to increase over time.

- It is not known how many of the non reads in the Scot EID trial may have related to animals originating in England or Wales where the use of EID tags for slaughter animals is not compulsory.

It is in the interests of all concerned (Government, Industry and manufacturers) that an independent technical report is produced to fully understand why some tags do not read. A good deal of understanding is needed from all involved to eliminate problems at all stages of the chain.

The aim of this study was to conduct an independent investigation and provide an objective report that will not only inform the industry and DEFRA, but also allow manufacturers and industry to address any problems that are identified.

Radio frequency identification (RFID) readers have also been blamed for low read rates (both race and handheld) and while readers were obviously used in the execution of this tag trial, the aims of the trial focus on tags and performance issues surrounding them and not reader performance.

Readers have to be fully ISO compliant which means compliant with ISO 11785 standard and read both FDXB and HDX in a balanced way.

## 1.5 Project Team

The ADAS team working on the project comprised of the following:
Kate Phillips
Karen Wheeler
Nerys Wright
Emily Phelps
Alice Willett
Bernard Griffiths

Mark Tereszczak acted as technical adviser for the project. Mark participates in the work of the ISO Technical Committee 23 as part of the subcommittee (SC19) concerned with agricultural electronics, a specific working group (WG3) concerned with the electronic identification of animals. He also participates in the committee of industry representatives who provide technical advice to WG3. Under BSI there is a committee (AGE6) that mirrors the work of SC19. Mark is currently the chairman of sub committee AGE 6/1 and attends the above committees as a UK principal expert.

## 1.6 Objectives

The study was split into three distinct phases:

- Baseline read of purchased tags to establish whether the tags meet the requirements of Council Regulation 21/2004 at the point of sale.

- Evaluation of EID tags retrieved from finished lambs passing through abattoirs during spring 2012, with the following detailed objectives:
  - Read EID tags with handheld and panel/race readers
  - Retrieve all tags believed to be EID tags
  - Record the throughput of lambs on each day
  - Record the number of lambs with EID tags
  - Assess readability of different types of tags
  - Identify tags that fail to read (with either handheld reader or race reader or both.)
  - Identify the possible cause of failure
  - Independently test tags for failure, inconsistency and inadequate reads

- Evaluation of EID tags in ewe lambs, shearling ewes and/or store lambs on farms, with the following detailed objectives:

  - Assess and record the performance of the tags
  - Record retention rates
  - Record non reads (both handheld and race/panel reads)
  - Compare on farm reads to market reads when animals were purchased
  - Independently test tags for failure, inconsistency and inadequate reads

# 2.0 Phase 1 - Baseline read of new tags

## 2.1 Methodology

To provide an analysis of how well new tags meet Council Regulation 21/2004 at the point of sale, tags were ordered anonymously (by farmers) from major tag manufacturers. A total of 12 different tag types (50 tags of each type) were ordered from seven different manufacturers, each with more than 2% of UK market share. Eleven of the tags purchased used FDX technology and one HDX.

To clearly measure the read distance of the 600 baseline tags a standard operating procedure (SOP) was followed. To ensure reliability of the results a simple transponder response test procedure was followed. A copy of the procedure can be found in Appendix 1 of this report.

Three different handheld readers (currently commercially available) used for the baseline tag reads were tested on a small batch of test tags in an electro magnetic interference (EMI) free environment. The tag orientation was taken into consideration when reading the tags. Results were also collected for the same tags tested on a metal free platform. The read distances in the two environments were compared. There did not appear to be any differences between the readings in different environments.

Prior to starting the baseline reads for each batch of 50 tags, the readers were checked for battery life and a new group was created on each reader. All of the readers were charged or their battery changed after reading 4 batches of tags to ensure that battery life was not affecting the readability of tags.

A wooden table was used to carry out the testing; a ruler was fastened to the table along which the tags were moved towards the reader. At one end of the ruler the tag reader was fastened to the table at 0cm. The tags were moved from a distance greater than 30cm towards the reader along a straight line from the transmitter antenna. The tag was slowly moved towards the reader and was stopped when the transponder (tag) was identified by the reader and the distance was recorded in cm.

All tags were read with each of the 3 readers provided.

Once all tests were complete a random selection of tags from each batch was sent to JRC for testing to establish whether they met the requirements of Council Regulation 21/2004.

## 2.2 Results

All tags read with all three handheld readers.

The tag types tested are shown in Table 1.

**Table 1: Tag types tested**

| Supplier | Tag Type |
|---|---|
| Allflex | Bubblegum |
| Allflex | Electromatic |
| Allflex | FDX lwt Button |
| Cox-Agri | Qwik-EID |
| QuickTag | EID Button Tag Sheep |
| Ritchey | Button EID |
| Ritchey | RD2000 |
| Ritchey | Snapp EID |
| Roxan | Tagfaster Twin EID |
| Shearwell | Combi E23 |
| Shearwell | EID set tag |
| Symtag | EID tag |

## 2.3 JRC testing of baseline tags

The objective of the test was to establish whether tags collected at the end of the supply chain were fit for the purposes of Council Regulation 21/2004. The objective was met by measurement of the tag activation field strength, according to the method defined in ISO 24631-3, (approved after July 2010) required to produce the modulation amplitude value of 10mV mandated by Council Regulation 21/2004 and its amendments.

## 2.4 Tag performance measurement procedure

Each tag in the test sample was:

- Visually inspected to confirm its integrity and the absence of damage. Visual inspections to be conducted under a level of illumination not less than 1000 lux.
- Identified and weighed.
- Functionally checked using an ISO 11785 reader.
- Subjected to ISO 24631-3 measurement of the activation field strength required to produce 10mV modulation amplitude (applies to tags approved after July 2010).
- Electronic identification codes recorded and representative samples photographed for documentation purposes

From each batch of 50 tags that were ordered from ALIDMA member manufacturers, 25 were chosen at random and sent to JRC for testing. All the tags met the requirements of the regulation with activation field strengths below the threshold of 1.2 A/m.

## 3.0 Phase 2 - Reading EID tags in abattoirs

Two high throughput abattoirs in Wales (abattoir A and B) were each visited on three separate dates between 13 February and 2 April 2012. On each occasion three ADAS staff attended. One member of staff read the ear tags of all lambs in the lairage and two retrieved EID tags from ears of lambs on the slaughter line.

The member of staff reading ear tags in the lairage was provided with at least three ISO compliant handheld stick readers from two different manufacturers. Readers were supplied fully charged on each day and were swapped during the day to ensure battery performance did not compromise tag readability. At each site, ear tags were read with the handheld stick readers as lambs entered the race before the conveyor on the way to the stun point.

The panel reader for abattoir A was located at the stun table and picked up the ear tag as the animal was shackled immediately post-stunning. In abattoir B the panel reader was located in the conveyor race immediately pre-stunning. Panel readers and their operation were the responsibility of the host abattoir and were used 'as found' on the test days.

Ear tag retrieval took place post-bleeding but before head removal in both abattoirs. Care was taken during retrieval to prevent damage to the tags. In many cases the whole ear was removed with the tag being extracted separately. Yellow and red tags were initially assumed to be EID tags (in accordance with the prevailing English and Welsh legislation) and were retrieved automatically whilst other colours were assumed to be visual tags. However it is important to note that in Scotland the EID tag does not have to be yellow (although yellow is recommended to match requirements of England and Wales) and this resulted in some EID tags being missed on the slaughter line. It also became apparent during the tag retrieval process that some sheep producers were continuing to use old stocks of non-electronic, yellow tags and where this was evident at the time of collection these were discarded. A number of non-electronic tags were however retrieved and these were screened out following further visual checks (approx. 120) and, where necessary, by cross checking with tag suppliers' records (n=10). The following data analysis is restricted to tags verified as electronic tags.

At the outset of the project it was assumed (based on processor information) that around 25% of lambs arriving at the abattoir would have EID tags as opposed to non-electronic slaughter tags. On a high throughput day of 4000 lambs, this would yield approximately 1000 EID tags providing a total of 6000 tags during the six visits. In reality, throughput of lambs on test days at the abattoirs was lower due to the time of year but this was offset by the higher proportion of lambs with EID tags. A summary of lamb throughput and number of lambs with EID tags is shown in Table 2.

**Table 2: Abattoir throughput and proportion of lambs with EID tags**

| | | Total throughput (no. of lambs) | Number of EID tags retrieved | EID tags as % of lamb throughput |
|---|---|---|---|---|
| Abattoir A | Feb 13 | 2739 | 1621 | 59% |
| | Feb 20 | 2440 | 1236 | 51% |
| | Apr 2 | 3377 | 2391 | 71% |
| **Total Abattoir A** | | **8556** | **5248** | **61%** |
| | | | | |
| Abattoir B | Mar 27 | 2509 | 950 | 38% |
| | Mar 28 | 2816 | 1778 | 63% |
| | Mar 30 | 2202 | 894 | 41% |
| **Total Abattoir B** | | **7527** | **3622** | **48%** |
| | | | | |
| **Total (all days)** | | **16083** | **8870** | **55%** |

Operational issues that affected tag reading in abattoirs are summarised below:

### 3.1 Handheld (stick) readers

- On the first day at abattoir A, one of the handheld readers stopped working during operation. This was in the middle of a large batch of EID tagged lambs and resulted in a number of lambs being missed.

### 3.2 Panel readers

- Although the panel reader at abattoir A was believed to be fully functional at the time of the tests the single plate panel reader was not set up to read HDX technology on the first two dates and therefore was not ISO compliant. This resulted in an artificially high proportion of race non-reads. These tags have been excluded from the analysis. This was rectified by the date of the final read.
- On the final day at abattoir A the computer connected to the race reader was not working during the first session of the day because there had been a power cut. The computer was located remotely in an office away from the panel reader which meant this was not identified and rectified until the breakfast break. Therefore, although the panel reader was reading EID tags, the tag numbers were not saved onto the abattoir computer system. Electronic ear tags collected during this period were included in the total reported in Table 2 but excluded from all further analysis.

Tags collected at the abattoirs were transported in plastic bags to an ADAS site. On arrival, all tags were cleaned by rinsing under running water and were laid out to dry over night. The following day the tags were sorted into separate groups by tag type, counted and labelled with the abattoir name and date of collection. To enable accurate identification of tag type, reference samples were provided by the majority of suppliers.

Data collected by ADAS staff in the lairage and panel read data provided by the abattoir were downloaded into an Excel spreadsheet to create a combined abattoir dataset. On the first two dates, additional lairage data collected on another handheld reader by abattoir staff were also available for inclusion.

At a later date all tags retrieved in the abattoirs were read in an ADAS office with a handheld reader by date of collection and tag type and the data uploaded to an Excel spreadsheet. By comparing the combined abattoir data set with the data collected in the office, tags could be categorised by 'readability' ranging from reads with all equipment, reads with handheld reader and not panel or vice versa to 'total non-read with all equipment'. Table 3 below summarises this information for the six test dates combined. In total 20 different tag models were retrieved over the six test days and these are listed in the table as tags 1 to 20 inclusive. For each tag model the number and percentage falling into each of the four read classes are reported. The total number of each tag model retrieved is also reported as a percentage of all tags (n=7633) indicating their overall contribution to the sample. Additional tables showing the breakdown for the individual days can be found in Appendix 2 (Tables A1 to A6).

**Table 3: Summary of all read days in both abattoirs. Number and percentage of electronic tags by readability classification and tag type**

| | Readability classification | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | | Yes (panel) | | No (panel) | | No (panel) | | Total number EID tags collected | |
| Readability (handheld) | Yes (handheld) | | No (handheld) | | Yes (handheld) | | No (handheld) | | | |
| | No. | % | No. | % | No. | % | No. | % | No. | % share |
| Tag 1 | 1 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.01 |
| Tag 2 | 332 | 93.0 | 2 | 0.6 | 23 | 6.4 | 0 | 0.0 | 357 | 4.7 |
| Tag 3 | 9 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 9 | 0.1 |
| Tag 4 | 398 | 91.7 | 3 | 0.7 | 7 | 1.6 | 26 | 6.0 | 434 | 5.7 |
| Tag 5 | 19 | 95.0 | 0 | 0.0 | 1 | 5.0 | 0 | 0.0 | 20 | 0.3 |
| Tag 6 | 1072 | 95.5 | 7 | 0.6 | 26 | 2.3 | 17 | 1.5 | 1122 | 14.7 |
| Tag 7 | 2 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 0.03 |
| Tag 8 | 19 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 19 | 0.2 |
| Tag 9 | 514 | 97.9 | 2 | 0.4 | 8 | 1.5 | 1 | 0.2 | 525 | 6.9 |
| Tag 10 | 190 | 93.6 | 2 | 1.0 | 11 | 5.4 | 0 | 0.0 | 203 | 2.7 |
| Tag 11 | 17 | 89.5 | 2 | 10.5 | 0 | 0.0 | 0 | 0.0 | 19 | 0.2 |
| Tag 12 | 1 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.01 |
| Tag 13 | 250 | 96.2 | 2 | 0.8 | 7 | 2.7 | 1 | 0.4 | 260 | 3.4 |
| Tag 14 | 52 | 100.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 52 | 0.7 |
| Tag 15 | 105 | 77.7 | 1 | 0.7 | 10 | 7.4 | 19 | 14.1 | 135 | 1.8 |
| Tag 16 | 164 | 88.2 | 3 | 1.6 | 5 | 2.7 | 14 | 7.5 | 186 | 2.4 |
| Tag 17 | 446 | 92.7 | 7 | 1.5 | 26 | 5.4 | 2 | 0.4 | 481 | 6.3 |
| Tag 18 | 140 | 97.9 | 1 | 0.7 | 2 | 1.4 | 0 | 0.0 | 143 | 1.9 |
| Tag 19 | 2327 | 89.2 | 90 | 3.5 | *155 | 5.9 | *36 | 1.4 | 2608 | 34.2 |
| Tag 20 | 929 | 87.9 | 45 | 4.3 | 60 | 5.7 | 22 | 2.1 | 1056 | 13.8 |
| | | | | | | | | | | |
| Total | 6987 | 91.5 | 167 | 2.2 | 341 | 4.5 | 138 | 1.8 | **7633** | |

* A non-ISO compliant panel reader (which was not configured to read HDX technology) was incapable of reading an additional 170 HDX tags (of Tag 19) that were retrieved on the first two days. These have been excluded from the table above.

- 93.7% of EID tags (n=7154) were read by abattoir panel readers on the test days.
    - 91.5% of EID tags read with both abattoir panel reader and handheld stick reader, ranging from 77.7% to 100% for the different tag types.
    - 2.2% of EID tags were read by the abattoir panel reader but not the handheld reader (range 0% to 10.5% for different tag types).
- 96.0% of EID tags (n=7328) were read by handheld stick readers on the test days.

    - 4.5% of EID tags were read in the lairage with a handheld reader but were not read by the abattoir panel reader (range 0% to 7.4% for different tag types).
- 1.8% of EID tags (n=138) failed to read on the test days with either a handheld or panel reader (range 0% to 14.1% for different tag types).

Tags that did not read on the test days with either a handheld reader or a panel reader (n=138) were investigated further. Some of these tags read successfully with a handheld reader at a later date in an ADAS office (n=41) but others did not read at all and were designated as total non-reads (n=97). Following a visual examination of these tags the reason for the non-read was classed as either loss of the EID chip (n=55) or another issue (n=42). Loss of the EID chip was a feature of four of the tag types and accounted for just over half of the 'total non-reads'. A total of 42 tags from 4 suppliers were found to have 'other' problems. Of these 41 were returned to the ALIDMA members who had supplied them for further investigation. The remaining tag (non-ALIDMA member) was not sent for investigation. Although most flock marks contained only one or two examples of non-read tags, evidence of potentially faulty batches of tags were identified in two cases. Table 4 below summarises the information for the abattoir non-read tags and, where known, the other problem identified.

**Table 4: Investigation of abattoir non-read EID tags**

| | Read with handheld reader in office (number) | Total non-read tags (n=97) | | | |
|---|---|---|---|---|---|
| Tag type | | Chip fallen out (number) | Other problem (number) | Other problem identified | Total number of tags |
| Tag 4 | 2 | 24 | 0 | | 26 |
| Tag 6 | 1 | 16 | 0 | | 17 |
| Tag 9 | 1 | 0 | 0 | | 1 |
| Tag 13 | 0 | 1 | 0 | | 1 |
| Tag 15 | 6 | 0 | 13 | 13 fractured | 19 |
| Tag 16 | 0 | 14 | 0 | | 14 |
| Tag 17 | 1 | 0 | 1 | (non-ALIDMA) | 2 |
| Tag 19 | 29 | 0 | 7 | 5 fractured 2 broken coil | 36 |
| Tag 20 | 1 | 0 | 21 | 21 suspect damaged coil | 22 |
| | | | | | |
| **Total** | **41** | **55** | **42** | | **138** |

Abattoir non-read tags (n=138) as a percentage of the total number of tags collected (n=7633) are summarised below:

- 41 tags (0.5%) read with a hand-held stick reader in the office
- 97 tags (1.3%) were designated as total non-reads and can be broken down further as below;
    - 55 tags (0.7%) had no chip
    - 42 tags (0.6%) had another problem. Of these 18 have been confirmed as having fractured ferrite or glass, 2, broken coil and the remaining 21 suspected damaged coils.

Tags that did not read with an abattoir panel reader but did read with a stick reader (either in the lairage (n=341) see Table 3 or in the ADAS office (n=41) see Table 4) were submitted for testing by JRC (total = 382). An additional 6 tags of tag 19 were also submitted for testing but have been excluded from the table above as they were later found to be HDX tags that could not be read by the panel reader in abattoir A. In total 388 tags were sent to JRC for testing. The 164 HDX tags that were not sent to JRC all read successfully during a subsequent test in a full ISO compliant race reader. As detailed earlier, tags designated as 'total non-reads' were returned to the supplier for investigation rather than sent for testing by JRC. JRC would have only been able to report that tags were non-functional and would not have diagnosed the cause.

### 3.3 JRC testing of used abattoir tags

The objective of this test was to determine the condition of used tags retrieved at end-of-life or because deemed suspect. For tags which could be read by an ISO 11785 reader (i.e. functioning tags) this objective was met by measurement of the tag activation field strength, as carried out above for the new baseline tags. For tags which could not be read reliably by an ISO 11785 reader (i.e. suspect tags) diagnostic information could be obtained from the resonance frequency measurement defined in ISO 24631-1.

### 3.4 Tag evaluation procedure for used tags

Each tag in the test sample was:

- Visually inspected to confirm its integrity and the absence of damage. Visual inspections to be conducted under a level of illumination not less than 1000 lux.
- Identified and weighed.
- Functionally checked using an ISO 11785 reader.
- If readable: subjected to ISO 24631-3 measurement of the activation field strength required to produce 10mV modulation amplitude.
- If unreadable; subjected to ISO 24631-1 measurement of tag resonance frequency.
- Electronic identification code recorded and representative samples photographed for documentation purposes

### 3.5 Tags retrieved in the abattoir

A total of 388 tags collected from abattoirs across the six test days were submitted for testing at JRC.

On arrival all tags were tested with an ISO reader:

- 1 tag failed to read at all with a handheld reader – this FDX-B tag (tag type 15) would have read with a handheld reader in the ADAS office before

sending to JRC. This tag was excluded from further tests but is included in Table 5 below for completeness.

- Activation field strength tests were carried out on 310 FDX-B tags and 77 HDX tags (ISO 24631 part3). The results of these tests are reported below.

### 3.6 FDX-B tags

A total of 310 FDX-B tags were subjected to the activation field strength test. Seventeen tags exceeded the 1.2A/m maximum permissible activation field strength or the EID code could not be read. The test system used by JRC generated field strengths of up to 8 A/m and with this limit in place EID codes from three tags could not be read. Further tests on these three tags confirmed that their resonance frequencies had drifted out of the 134.2 kHz +/- 3kHz band. The remaining 14 tags had activation field strengths in the range 1.249 to 7.292 A/m.

**Table 5: Summary of FDX-B tag performance at JRC**

| Group | Number tags submitted for testing | Number meeting requirements | Number non-read tags | Number where AFS could not be measured | Number exceeding AFS limit of 1.2 A/m |
|---|---|---|---|---|---|
| A 13 Feb | 38 | 30 | 0 | 2 | 6 |
| B 20 Feb | 15 | 15 | 0 | 0 | 0 |
| C 27 Mar | 83 | 78 | 0 | 1 | 4 |
| D 28 Mar | 126 | 122 | 1 | 0 | 3 |
| E 30 Mar | 28 | 27 | 0 | 0 | 1 |
| F 2 Apr | 21 | 21 | 0 | 0 | 0 |
| | | | | | |
| Total | 311 | 293 | 1 | 3 | 14 |

Overall 94.2% of FDX-B tags submitted to JRC for testing met the requirements of the regulations with the remaining 5.8% either exceeding the 1.2 A/m AFS limit, having incorrect resonance frequencies or were non-functional. Following testing by JRC, potentially faulty tags were returned to the suppliers. Two of the suppliers reported that their tags (n=3) appeared to meet the previous test criteria relating to read distance (12cm for a handheld and 50cm for a panel reader).

### 3.7 HDX tags

A total of 77 HDX tags were subjected to the activation field strength test. Initially, 48 of these tags returned an activation field strength value in excess of 1.2 A/m. Further investigation revealed that 38 of these tags contained transponders that had been certified prior to the 1.2A/m limit coming into force (1 July 2010). As these tags are not subject to the 1.2 A/m AFS limit they can be considered to be ‘fit for purpose’ and meet the requirements of the regulation. These transponders would have had to pass a read distance test (50cm for a panel reader, 12 cm for a handheld reader) when they were

certified. The equivalent read distance test was not performed on these tags by JRC.

The remaining 10 tags were of the newer HDX+ technology and were certified after 1 July 2010 and therefore subject to the AFS test limit of 1.2 A/m. Initial test results at JRC suggested that these tags had values of greater than or equal to 1.2 A/m (average 1.26 A/m +/- 0.10). However following investigation by the manufacturers of the tags a discrepancy in test procedures was identified. The original procedure operated by JRC relied on a single activation field pulse. However the modified transponder design allows the HDX+ transponder to operate after absorbing power from two weak activation field pulses rather than one strong pulse. When the tags were tested by JRC using a double pulse the mean AFS values fell to 0.73 A/m (+/-0.07). As a result all HDX and HDX+ tags submitted to JRC can be considered to have passed. The modified procedure will be used for all testing in future by JRC

**Table 6: Summary of HDX tag performance at JRC**

| Group | Number tags submitted for testing | Number exceeding AFS of 1.2 A/m at original testing | Number tags found to be faulty following investigation |
|---|---|---|---|
| A 13 Feb | 0* | - | - |
| B 20 Feb | 6* | 3 | 0 |
| C 27 Mar | 12 | 8 | 0 |
| D 28 Mar | 38 | 27 | 0 |
| E 30 Mar | 11 | 4 | 0 |
| F 2 Apr | 10 | 6 | 0 |
| | | | |
| Total | 77 | 48 | 0 |

* 6 HDX tags from Group B were submitted to JRC for testing but were collected from an abattoir with a non-ISO compliant panel reader that was incapable of reading HDX technology. These tags are included in the JRC tests but excluded from the abattoir summary.

### 3.8 Overall summary of performance.

- 7633 tags collected in abattoirs were assessed for readability (excludes 170 HDX tags collected on 13 and 20 February).
    - 91.5% of EID tags (6987) read with both abattoir panel reader and handheld stick reader on the test days
    - 2.2% of EID tags (167) were read by the abattoir panel reader but not the handheld reader
    - 4.5% of EID tags (341) were read by a handheld reader but were not read by the abattoir panel reader
    - 1.8% of EID tags (138) failed to read on the test days with either a handheld or panel reader.
- 382 tags (excluding 6 HDX tags collected on 20 February) were tested by JRC.
    - 364 tags were found to meet the requirements of the regulation
    - 1 tag was designated as a total non-read by JRC

    - 3 tags could not be tested for AFS (as their resonance frequencies had slipped out of the expected range) but did read with a handheld reader
    - 14 tags had AFS of >1.2A/m.
- 97 tags were designated as total non-reads by ADAS and were not submitted for further testing.
- Overall 7518 tags (98.5%) were considered to have met the requirements of the regulation either because they read with a panel reader at the abattoir or passed further tests carried out by JRC.
- 115 tags (1.5%) were considered to be not fully functional. Of these 98 (1.3%) were total non-reads and 17 (0.2%) had AFS >1.2A/m or could not be tested.

# 4.0 Phase 3 - Reading EID tags on farm

Four farms were visited between February and June 2012.

## 4.1 Farm 1 – Breeding sheep

A farm in Buckingham with approximately 700 North Country Mule and Suffolk cross Mule ewes was visited on 23rd February and 7th June 2012 by ADAS staff and a technical advisor from an EID company to set up the race reader.

### 4.1.1 Tag reading

### 4.1.2 Day 1 – Ewe lambs

The flock had a range of tag types as the ewe lambs had been purchased from at least 14 different farms (all through northern England livestock markets) during the autumn of 2011.

A total of 433 sheep were read on the day in two lots (200 and 233 respectively). There were 432 EID tags present (one tag has been lost). Tag reading took place at the same time as pregnancy scanning. The ewe lambs were being put through the pens at the rate required to keep up with the scanner.

It was not possible to identify all the different tag types on the day as they had all been mixed since they were purchased in the autumn. Visually, it was clear that the majority of the tags were loop or two piece tags (no button tags).

There were 3 handheld readers available on the day and a race reader (portal antenna) which was set up by the manufacturer.

Three tags failed to read with one handheld reader but read with another. This could have been due to human error because of the speed at which the ewe lambs were being put through the pens.

The reading took place outside in a handling system that was provided by the farmer. The race reader was placed at the first ‘squeeze’ of the handling pens. The sheep all walked through the race reader and into the unit where they were scanned. There was a minimum of 3 metres form the edge of the race reader to where ADAS staff read with a handheld reader. See picture below:


The tags were not read by the handheld stick readers when ewes were in close proximity to the race reader or the sheep scanning equipment in case this caused issues with interference.

- Lot 1 of 200 ewe lambs – no tags were missing (200 EID tags)
- Lot 2 of 233 ewe lambs – 1 EID tag had ripped out of the ear (232 EID tags)
- Total of 432 tags read from 433 ewes

### 4.1.3 Day 2 - Shearlings

The day started cool and dry but turned very wet, windy and cold as the day progressed. The work was undertaken outside because the ewes were away on summer keep and there were no buildings available to house the ewes and their lambs.

Ewes were collected into pens ahead of the race reader (portal antenna) and ADAS staff used handheld stick readers to read the ear tags at this stage. If any non reads had been identified at this point, they would have been removed. Ewes were then moved through into another pen where the lambs were wormed and crutched (by the farmer). The ewes then ran through the race reader (individually where possible but on some occasions two or three went though in close succession). ADAS staff counted the ewes going through the race and the technical adviser ensured the race reader count

corresponded with the number of ewes. Any tags that did not register going through the race were removed from the sheep's ear.

The race reader used on the day was set up by the manufacturer. A total of two non reads were collected on the day. Part way through the day the race reading equipment suffered a power surge. This was caused by rain water entering a part of the equipment. The equipment was rebooted but still failed to work. ADAS staff and farm staff provided plastic bags and towels to cover parts of the equipment to protect it from the rain. Once dried out, the equipment started to work again. However sheep continued to pass through the equipment whilst it was not fully operational. This was because the farmer was anxious to get on.

A total of 258 tags were read on the day using two handheld readers. One tag failed to read through the race reader and another failed to read with a handheld stick reader or the race reader.

### 4.1.4 Summary

There were several tag types visually identified on both occasions from several different holdings. However, as the sheep had been purchased in many different lots and were all mixed together it was not possible to identify how many of each type of tag there were present when reading. Tag types could be identified from the ETAS database if this is required. Overall tag retention was good on this farm with only 1 EID tag missing from 691 animals (0.1%).

A total of 690 ear tags were read on this farm, 689 tags read with at least one handheld reader (the majority read with two) and 3 tags failed to read through the race readers.

**Table 7: Summary of tag readings from farm 1**

| | Handheld reads | % of total tags read | Race reader reads | % of total tags read |
|---|---|---|---|---|
| Ewe lambs (432 animals) | 432 | 100% | 430 | 99.5% |
| Shearlings (258 animals) | 257 | 99.6% | 256* | 99.2% |
| Total (690 animals ) | 689 | 99.8% | 686 | 99.4% |

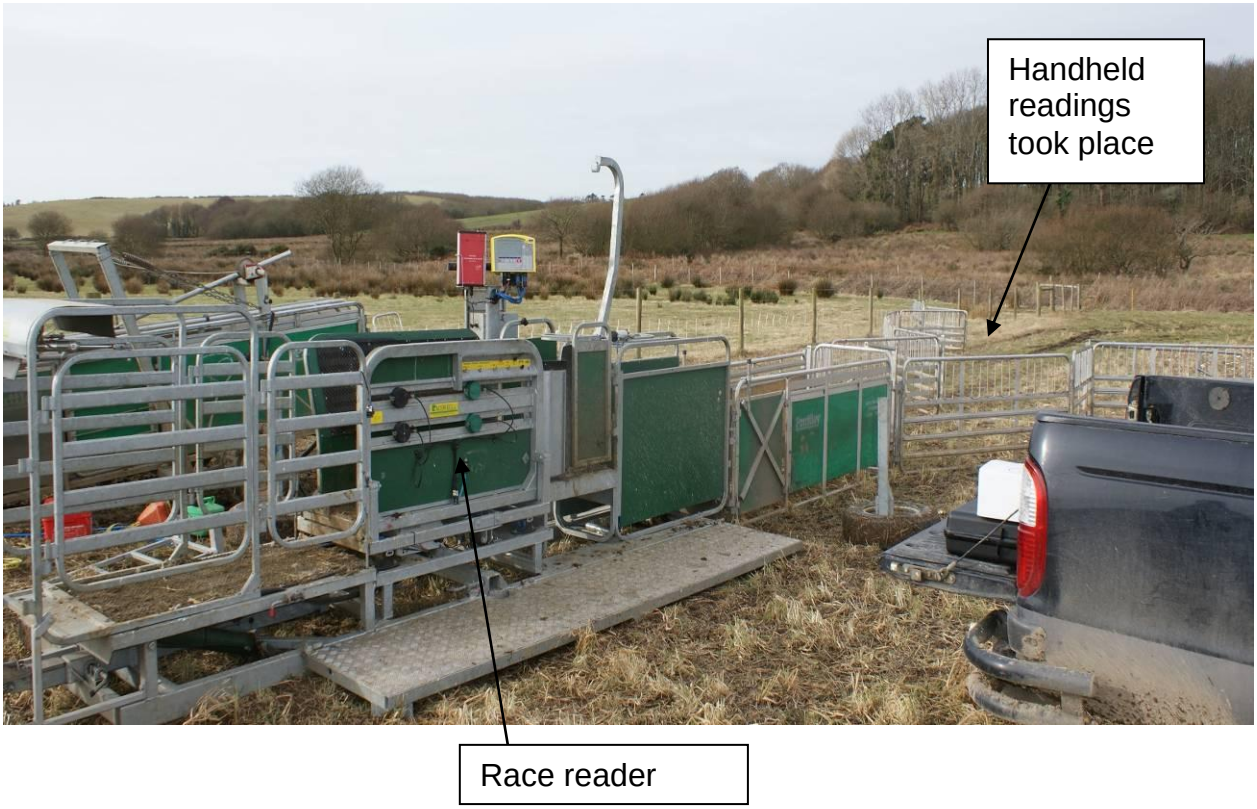
* 256 when we exclude both race read and handheld read failures

## 4.2 Farm 2 – Breeding sheep

Farm 2 was located on the Isle of Wight and was visited on 14th February 2012. The farmer used his own single plate antenna race reader and ADAS staff operated the handheld readers.

### 4.2.1 Tag reading

EID tags were present on the day of reading in 283 ewe lambs and 389 shearling ewes i.e. a total of 672 ear tags. There was a mixture of ewe breeds on the farm (Romney, Suffolk cross Mule, Easycare, Scotch Half-bred and Suffolk) which were managed separately, each group having a different tag type, with some groups having non-ALIDMA member tag types.




The farmers had a race reader (single plate antenna) on site which was used to read the tags. All the electronic tags read through the race. There was a problem with readings when the tags had been inserted into the right ear of the sheep rather than the left. This caused problems because the panel was on the left hand side of the race. The delay in the squeeze crush allowed time to identify the failure of the read before the ewes left the race. It was noticed that if the operator tilted the ewe's head slightly the tag would read.

ADAS staff attempted to read all tags with a handheld stick reader. Two tags failed to read with one handheld reader but read with the other and vice versa. Any tags that would not read with both stick readers were checked with the

third stick reader to ensure that each tag did read with at least two readers on the day.

Handheld stick reading of tags took place at least 3 metres away from the race reader. All tags read with more than one handheld reader.

Reading of tags went well but some other issues were apparent, such as loss of tags (both visual and EID). These are summarised below:

- Lot 1 of 75 Suffolk cross ewes – no tags were missing
- Lot 2 of 101 Romney ewes (100 EID tags present) – 1 EID tag had ripped out of an ear
- Lot 3 of 387 Easycare ewes (375 EID tags present) – A total of 14 tags had been lost, of which 2 were visual tags and 12 EID tags.
- Lot 4 of 124 Scotch Half bred ewes (122 EID tags present) - out of 30 ewes purchased with EID tags, 11 had been lost at the time of reading. 10 of the 11 tags had effectively fallen out as they had not left a tear in the ear - only a hole as evidence that the ewe had been tagged. One had ripped the ear. Out of the 11 tags lost, 2 were EID tags and 9 were visual tags.
- 25 of the 26 lost tags were from non ALIDMA manufacturers. Overall EID tag loss on this farm was 2.2% (15 from 687 ewes) on the test date.

### 4.2.2 Summary

100% of the 672 tags read with both handheld readers and the panel reader (single panel antenna) on all ewe lambs and shearling ewes that had an EID tag present on the day of testing.

### 4.3 Farm 3 – Store lambs

Store lamb finisher in Bury St Edmunds visited on 24th February 2012 by ADAS staff and a technical advisor for setting up the race reader.

## 4.3.1 Tag reading

A total of 966 tags were read on the day. There was a wide range of ear tag types as large numbers of store lambs are bought from several holdings. ADAS staff used two handheld stick readers and a race reader (portal antenna).

The race reader was a wide race type usually used at livestock markets and was a large piece of equipment. Several lambs were able to pass through the reader quickly to ensure a large number of tags read at any one time.

The lambs were gathered especially for the trial so there were no time constraints. The readings all took place inside. The animals were gathered from the collecting yard, into the shed and into a pen where ADAS staff read the ear tags with a handheld stick reader. Any non functioning tags were removed at this stage. Lambs were then let out of the pen into the collecting yard outside. As they left the shed they went through the race reader. There was a minimum of 3 metres from the end of the pen where ear tags were read with handheld readers to the race reader. See picture below.

4 tags did not read on the day with handheld stick readers and were removed from the ear of the lambs. Later analysis of the handheld readings versus the race reader found that 1 tag did not read by either handheld device but did read through the race reader. Despite every effort, this is likely to have been human error. 3 tags that did read with the handheld readers failed to read with the race reader.

### 4.3.2 Summary

Of a total of 966 EID tags, 961 tags read with at least one handheld reader (the majority read with two) and 3 tags failed to read through the race reader.

**Table 8: Summary of tag readings from farm 3**

| | Handheld reads | % read of total | Race reader reads | % read of total |
|---|---|---|---|---|
| Total (966 animals ) | 961 | 99.5% | 958* | 99.1% |

* 958 when we exclude both race read and handheld read failures

## 4.4 Farm 4 – Store lambs

A second store lamb finisher located in Worcestershire was visited on 17th April 2012 by ADAS staff and a technical operator from the race reader manufacturer.

### 4.4.1 Tag reading

The farmer purchases several hundred lambs every year from a number of sources. A range of ear tag types was visually identified during the course of the day.

ADAS staff used two handheld stick readers to read the ear tags. A third reader was available if required. The battery on one of the readers went low two thirds of the way through the day and the decision was made to switch to the back up reader. There is a danger of miss-reads if the battery is allowed to go too low, therefore the operator made the decision to switch readers.

A tag manufacturer (ALIDMA member) provided technical support to set up the race reader and operate it during the course of the day. The equipment was set up so that lambs were coming down the race individually, through the race reader and were then stopped in the weigh crate at the end of the handling setup. This enabled the farmer to weigh the animals and then separate them according to weight (in order to sell or put back onto grass keep) and provided ADAS staff with time to read tags with a handheld reader and remove tags if required. This proved to be a very effective, but slow method. See picture below.


A total of 585 EID tags were present on the day, 576 tags read successfully and 9 tags did not read. Due to the layout and slow pace of reading no tags were missed by the handheld reader. A total of 9 tags failed to read with the race reader or handheld reader and these were subsequently removed for further investigation. An additional 13 tags failed to read through the race reader but did read with the handheld. These were also removed for further analysis. Interestingly, one of the lambs whose tag failed to read with the race reader the first time it went through escaped from the weigh crate and was put back into the handling system. When the lamb came through the race reader the second time, the tag number registered. This tag was also removed for further testing.

### 4.4.2 Summary

**Table 9: Summary of tag readings from farm 4**

| | Handheld reads | % of total read | Race reader reads | % of total read |
|---|---|---|---|---|
| Store lambs (585 animals) | 576 | 98.5% | 563 | 96.4% |

## 4.5 Total summary of all on-farm reads

Table 10 summarises the EID tag readings over the four farms.

**Table 10: Summary of all farm readings**

| | Handheld reads | % of total read | Race reader reads | % of total read |
|---|---|---|---|---|
| 2,913 animals | 2898 | 99.5% | 2879 | 98.8% |

## 4.6 Examination of non-read tags from on-farm tests

Tags that did not read with the equipment on-farm were classed as total non-reads. These were not sent to JRC but retained to return to the tag suppliers. A total of 14 tags (across the 4 farms) were identified as potential non-reads and the suppliers were asked to check their records to confirm that these tags had been issued as EID tags. All tags were confirmed to have been issued as EID tags. Two of the tags that had not read on-farm did subsequently read at a later date in an ADAS office.

**Table 11: Reason for non-read tags following visual examination**

| | Chip fallen out (number) | Other problem (number) | Total number of tags | Number of unique flock marks |
|---|---|---|---|---|
| Tag 4 | 5 | 1 (read OK later) | 6 | 4 |
| Tag 6 | 2 | 0 | 2 | 2 |
| Tag 17 | 0 | 1 (read OK later) | 1 | 1 |
| Tag 19 | 0 | 1 | 1 | 1 |
| Tag 20 | 0 | 4 | 4 | 1 |
| | | | | |
| Total | 7 (50%) | 7 (50%) | 14 | |

## 4.7 JRC testing of tags retrieved on farm

A total of 15 tags that did not read through race readers on farm were submitted for testing at JRC. The procedure followed was the same as that used for the abattoir tags.

Testing revealed that all 15 tags met the requirements of the regulation with activation field strengths below the threshold of 1.2 A/m. A mean of 0.802 A/m +/- 0.32 (range 0.621 – 1.022) was reported across all tags.

## 4.8 Potential reasons for non-reads at abattoirs, markets and on-farm

### 4.8.1 Handheld readers and operators:

- Colour of tags – yellow and red tags are reserved for EID tags in England and Wales but this is not the case for Scotland so this can contribute to non-read rates in rapid throughput systems, although this should not be an issue for panel/race readers
- Use of old stocks of non-EID yellow tags – particularly relevant in England and Wales where yellow tags would be expected to be EID tags
- Uncertainty about whether animals actually carry EID devices
- Reader shuts down or turns off whilst reading ear tags
- Low battery life of handheld readers can be overlooked by the operator
- Reader may not provide enough energy to activate the device
- High levels of electro-magnetic interference can affect transponder response
- Human error cannot be ruled out when large batches of sheep are being read

### 4.8.2 Panel readers and associated computer systems

- Non-ISO compliant panel reader – not configured to read both FDX-B and HDX tags
- Panel reader not officially commissioned at the time of testing – led to higher than expected race non-reads
- Remote computer not operational so EID tag numbers not saved
- Single plate panel readers in race systems – readability may be affected if ear tags are not all in the ear nearest the panel reader
- Reader may not provide enough energy to activate the device
- High levels of electro-magnetic interference can affect transponder response

### 4.8.3 Ear tags and transponders

- Loss of the ear tag
- Loss of the transponder from the tag whilst in the sheep's ear
- Poor quality construction – although tags are subject to rigorous testing, certification and QA to minimise the likelihood of this
- Fracture of the ferrite, glass transponder, or damage to the coil

### 4.8.4 Other factors

- Change in certification requirements for transponders may over-report faulty tags
- System or administrative errors have been identified in markets where the head count may not match the number of EID reads. Examples include: a ewe with two lambs at foot, all three carrying an EID device recorded at market as one animal yet three identities resulting in 300% read rate; animals tagged with one tag each from matched EID and visual tags, 100 animals giving 50% read rate.

## 4.9 Conclusions

### 4.9.1 Baseline tags

EID Tags were ordered anonymously (by farmers) from tag suppliers through the usual channels. A total of 12 tag types (50 tags of each) were sourced.

All tags read in the ADAS office environment with all of the handheld readers available. Half of the tags were sent to JRC for testing where it was found that all tags met the requirements of the regulation.

Testing confirms that tags were fit for purpose at the time of sale

### 4.9.2 Abattoir phase

7633 tags were retrieved and assessed for readability from lambs slaughtered at two abattoirs over six test days.

- Overall 7518 tags (98.5%) were considered to have met the requirements of the regulation either because they read with a panel reader at the abattoir or passed further tests carried out by JRC.
- 115 tags (1.5%) were not fully functional. Of these 98 (1.3%) were total non-reads and 17 (0.2%) had AFS >1.2A/m or could not be tested.

Reasons for total non-reads included:

- Loss of the transponder
- Fractured glass
- Fractured ferrite
- Damaged coil

### 4.9.3 On-farm phase

In total EID tags of 2913 animals (breeding ewes and store lambs) on four farms were read with handheld and panel/race readers:

- 2898 tags (99.5%) were read by handheld readers
- 2879 tags (98.8%) were read by panel/race readers

14 tags were identified as total non-reads (0.5%) on the test days and 15 potentially faulty tags were submitted for testing by JRC. All tags submitted to JRC for testing met the requirements of the regulation.

Overall 2899 tags (99.5%) were considered to have met the requirements of the regulation.

# APPENDIX 1

**Guidelines for simple transponder response test procedure:**

- Prepare clear stable metal free platform to work on.

- Ensure there is a minimum risk of EMI (electro magnetic interference)

Example sources are PC's, monitors, power supplies including plug top, fluorescent strip lights.

Two metres distance from any of these sources should be sufficient to have insignificant effect when using portable transceivers.

- Define a bench mark transponder operating in HDX and FDX mode.

To do this; ensure the transceiver batteries are fully charged measure and record the read distance from the transmitting antenna to the tip of the transponder.

Repeat this exercise in a known EMI free environment (middle of a field or equivalent). Compare and if they are the same use as bench mark to qualify continued transceiver performance.

- To define read range:

It is presumed all test transceivers are of the type using a ferrite core as opposed to an air core.

Place transceiver on platform and mark the end of the transmitter antenna.

Approach the transmitting antenna from a distance greater than 250mm in line with the axis of the antenna.

When the transceiver shows it has decoded the transponder on a display or by audible warning, record the distance.

If the transponder is of the ferrite core type, hold the transponder in the same plane as the transceiver antenna and on the same axis.

If the transponder is of the air core type, hold the transponder in the same plane with the transceiver antenna aimed through the centre of the air coil and on the same axis.

When taking measurements, use a non metallic tool i.e. a plastic ruler.

N.B. The actual distance between the transceiver antenna and the transponder could be greater due to the housing of the transceiver.

Below shows image of air core and ferrite core transponders positioning relative to transmitter antenna.


N.B. only the target transponder should be within a one metre radius of the test transceiver antenna during testing.

# APPENDIX 2

## Individual test day reports for abattoirs follow:

**Table A1. Abattoir A, 13 February, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 1 | 0 | 0 | 0 | 1 |
| Tag 2 | 41 | 0 | 1 | 0 | 42 |
| Tag 3 | 1 | 0 | 0 | 0 | 1 |
| Tag 4 | 45 | 0 | 0 | 4 | 49 |
| Tag 5 | 0 | 0 | 0 | 0 | 0 |
| Tag 6 | 148 | 1 | 3 | 1 | 153 |
| Tag 7 | 0 | 0 | 0 | 0 | 0 |
| Tag 8 | 0 | 0 | 0 | 0 | 0 |
| Tag 9 | 442 | 1 | 1 | 0 | 444 |
| Tag 10 | 78 | 0 | 3 | 0 | 81 |
| Tag 11 | 1 | 0 | 0 | 0 | 1 |
| Tag 12 | 0 | 0 | 0 | 0 | 0 |
| Tag 13 | 26 | 0 | 1 | 0 | 27 |
| Tag 14 | 1 | 0 | 0 | 0 | 1 |
| Tag 15 | 51 | 1 | 3 | 15 | 70 |
| Tag 16 | 3 | 0 | 0 | 0 | 3 |
| Tag 17 | 104 | 2 | 10 | 1 | 117 |
| Tag 18 | 4 | 0 | 0 | 0 | 4 |
| Tag 19 | 340 | 0 | *2 | *2 | 344 |
| Tag 20 | 176 | 24 | 4 | 1 | 205 |
| | | | | | |
| Total | 1462 (94.8%) | 29 (1.9%) | 28 (1.8%) | 24 (1.6%) | **1543** |

* A non-ISO compliant panel reader (which was not configured to read HDX technology) was incapable of reading an additional 78 HDX tags (of Tag 19) that were retrieved on the day. These have been excluded from the table above.

**Table A2. Abattoir A, 20 February, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 0 | 0 | 0 | 0 | 0 |
| Tag 2 | 62 | 1 | 0 | 0 | 63 |
| Tag 3 | 2 | 0 | 0 | 0 | 2 |
| Tag 4 | 59 | 1 | 0 | 1 | 61 |
| Tag 5 | 2 | 0 | 0 | 0 | 2 |
| Tag 6 | 216 | 1 | 3 | 2 | 222 |
| Tag 7 | 0 | 0 | 0 | 0 | 0 |
| Tag 8 | 0 | 0 | 0 | 0 | 0 |
| Tag 9 | 25 | 1 | 1 | 0 | 27 |
| Tag 10 | 30 | 0 | 0 | 0 | 30 |
| Tag 11 | 5 | 0 | 0 | 0 | 5 |
| Tag 12 | 0 | 0 | 0 | 0 | 0 |
| Tag 13 | 28 | 0 | 0 | 0 | 28 |
| Tag 14 | 25 | 0 | 0 | 0 | 25 |
| Tag 15 | 6 | 0 | 0 | 0 | 6 |
| Tag 16 | 18 | 1 | 0 | 0 | 19 |
| Tag 17 | 65 | 0 | 4 | 0 | 69 |
| Tag 18 | 43 | 1 | 1 | 0 | 45 |
| Tag 19 | 451 | 7 | *3 | *1 | 462 |
| Tag 20 | 73 | 2 | 3 | 0 | 78 |
| | | | | | |
| Total | 1110 (97.0 %) | 15 (1.3%) | 15 (1.3%) | 4 (0.3%) | **1144** |

* A non-ISO compliant panel reader (which was not configured to read HDX technology) was incapable of reading an additional 92 HDX tags (of Tag 19) that were retrieved on the day. These have been excluded from the table above.

**Table A3. Abattoir A, 2 April, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 0 | 0 | 0 | 0 | 0 |
| Tag 2 | 53 | 0 | 1 | 0 | 54 |
| Tag 3 | 3 | 0 | 0 | 0 | 3 |
| Tag 4 | 84 | 1 | 3 | 6 | 94 |
| Tag 5 | 14 | 0 | 0 | 0 | 14 |
| Tag 6 | 209 | 2 | 1 | 6 | 218 |
| Tag 7 | 1 | 0 | 0 | 0 | 1 |
| Tag 8 | 3 | 0 | 0 | 0 | 3 |
| Tag 9 | 18 | 0 | 0 | 0 | 18 |
| Tag 10 | 21 | 0 | 0 | 0 | 21 |
| Tag 11 | 1 | 0 | 0 | 0 | 1 |
| Tag 12 | 0 | 0 | 0 | 0 | 0 |
| Tag 13 | 21 | 0 | 1 | 0 | 22 |
| Tag 14 | 1 | 0 | 0 | 0 | 1 |
| Tag 15 | 1 | 0 | 0 | 0 | 1 |
| Tag 16 | 5 | 0 | 0 | 0 | 5 |
| Tag 17 | 242 | 3 | 5 | 0 | 250 |
| Tag 18 | 39 | 0 | 0 | 0 | 39 |
| Tag 19 | 530 | 6 | 15 | 2 | 553 |
| Tag 20 | 66 | 1 | 2 | 2 | 71 |
| | | | | | |
| Total | 1312 (95.8%) | 13 (0.9%) | 28 (2.0%) | 16 (1.2%) | **1369** |

**Table A4. Abattoir B, 27 March, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 0 | 0 | 0 | 0 | 0 |
| Tag 2 | 11 | 0 | 1 | 0 | 12 |
| Tag 3 | 0 | 0 | 0 | 0 | 0 |
| Tag 4 | 28 | 0 | 0 | 0 | 28 |
| Tag 5 | 0 | 0 | 0 | 0 | 0 |
| Tag 6 | 170 | 1 | 8 | 0 | 179 |
| Tag 7 | 1 | 0 | 0 | 0 | 1 |
| Tag 8 | 14 | 0 | 0 | 0 | 14 |
| Tag 9 | 8 | 0 | 4 | 0 | 12 |
| Tag 10 | 11 | 1 | 1 | 0 | 13 |
| Tag 11 | 2 | 1 | 0 | 0 | 3 |
| Tag 12 | 0 | 0 | 0 | 0 | 0 |
| Tag 13 | 20 | 0 | 1 | 0 | 21 |
| Tag 14 | 3 | 0 | 0 | 0 | 3 |
| Tag 15 | 12 | 0 | 6 | 3 | 21 |
| Tag 16 | 27 | 0 | 2 | 2 | 31 |
| Tag 17 | 19 | 1 | 3 | 0 | 23 |
| Tag 18 | 0 | 0 | 0 | 0 | 0 |
| Tag 19 | 283 | 22 | 47 | 12 | 364 |
| Tag 20 | 158 | 4 | 14 | 4 | 180 |
| | | | | | |
| Total | 767 (84.8%) | 30 (3.3%) | 87 (9.6%) | 21 (2.3%) | **905** |

**Table A5. Abattoir B, 28 March, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 0 | 0 | 0 | 0 | 0 |
| Tag 2 | 139 | 1 | 17 | 0 | 157 |
| Tag 3 | 1 | 0 | 0 | 0 | 1 |
| Tag 4 | 78 | 0 | 3 | 10 | 91 |
| Tag 5 | 2 | 0 | 1 | 0 | 3 |
| Tag 6 | 239 | 2 | 8 | 8 | 257 |
| Tag 7 | 0 | 0 | 0 | 0 | 0 |
| Tag 8 | 2 | 0 | 0 | 0 | 2 |
| Tag 9 | 8 | 0 | 2 | 1 | 11 |
| Tag 10 | 38 | 1 | 6 | 0 | 45 |
| Tag 11 | 4 | 1 | 0 | 0 | 5 |
| Tag 12 | 1 | 0 | 0 | 0 | 1 |
| Tag 13 | 128 | 2 | 4 | 1 | 135 |
| Tag 14 | 19 | 0 | 0 | 0 | 19 |
| Tag 15 | 31 | 0 | 1 | 1 | 33 |
| Tag 16 | 76 | 1 | 2 | 9 | 88 |
| Tag 17 | 8 | 1 | 0 | 1 | 10 |
| Tag 18 | 40 | 0 | 0 | 0 | 40 |
| Tag 19 | 430 | 38 | 75 | 17 | 560 |
| Tag 20 | 277 | 13 | 27 | 3 | 320 |
| | | | | | |
| Total | 1521 (85.5%) | 60 (3.4%) | 146 (8.2%) | 51 (2.9%) | **1778** |

**Table A6. Abattoir B, 30 March, number of electronic tags by readability class and tag type**

| | Readability classification | | | | |
|---|---|---|---|---|---|
| Readability (panel) | Yes (panel) | Yes (panel) | No (panel) | No (panel) | Total number of EID tags collected |
| Readability (handheld) | Yes (handheld) | No (handheld) | Yes (handheld) | No (handheld) | |
| Tag 1 | 0 | 0 | 0 | 0 | 0 |
| Tag 2 | 26 | 0 | 3 | 0 | 29 |
| Tag 3 | 2 | 0 | 0 | 0 | 2 |
| Tag 4 | 104 | 1 | 1 | 5 | 111 |
| Tag 5 | 1 | 0 | 0 | 0 | 1 |
| Tag 6 | 90 | 0 | 3 | 0 | 93 |
| Tag 7 | 0 | 0 | 0 | 0 | 0 |
| Tag 8 | 0 | 0 | 0 | 0 | 0 |
| Tag 9 | 13 | 0 | 0 | 0 | 13 |
| Tag 10 | 12 | 0 | 1 | 0 | 13 |
| Tag 11 | 4 | 0 | 0 | 0 | 4 |
| Tag 12 | 0 | 0 | 0 | 0 | 0 |
| Tag 13 | 27 | 0 | 0 | 0 | 27 |
| Tag 14 | 3 | 0 | 0 | 0 | 3 |
| Tag 15 | 4 | 0 | 0 | 0 | 4 |
| Tag 16 | 35 | 1 | 1 | 3 | 40 |
| Tag 17 | 8 | 0 | 4 | 0 | 12 |
| Tag 18 | 14 | 0 | 1 | 0 | 15 |
| Tag 19 | 293 | 17 | 13 | 2 | 325 |
| Tag 20 | 179 | 1 | 10 | 12 | 202 |
| | | | | | |
| Total | 815 (91.2%) | 20 (2.2%) | 37 (4.1%) | 22 (2.5%) | **894** |