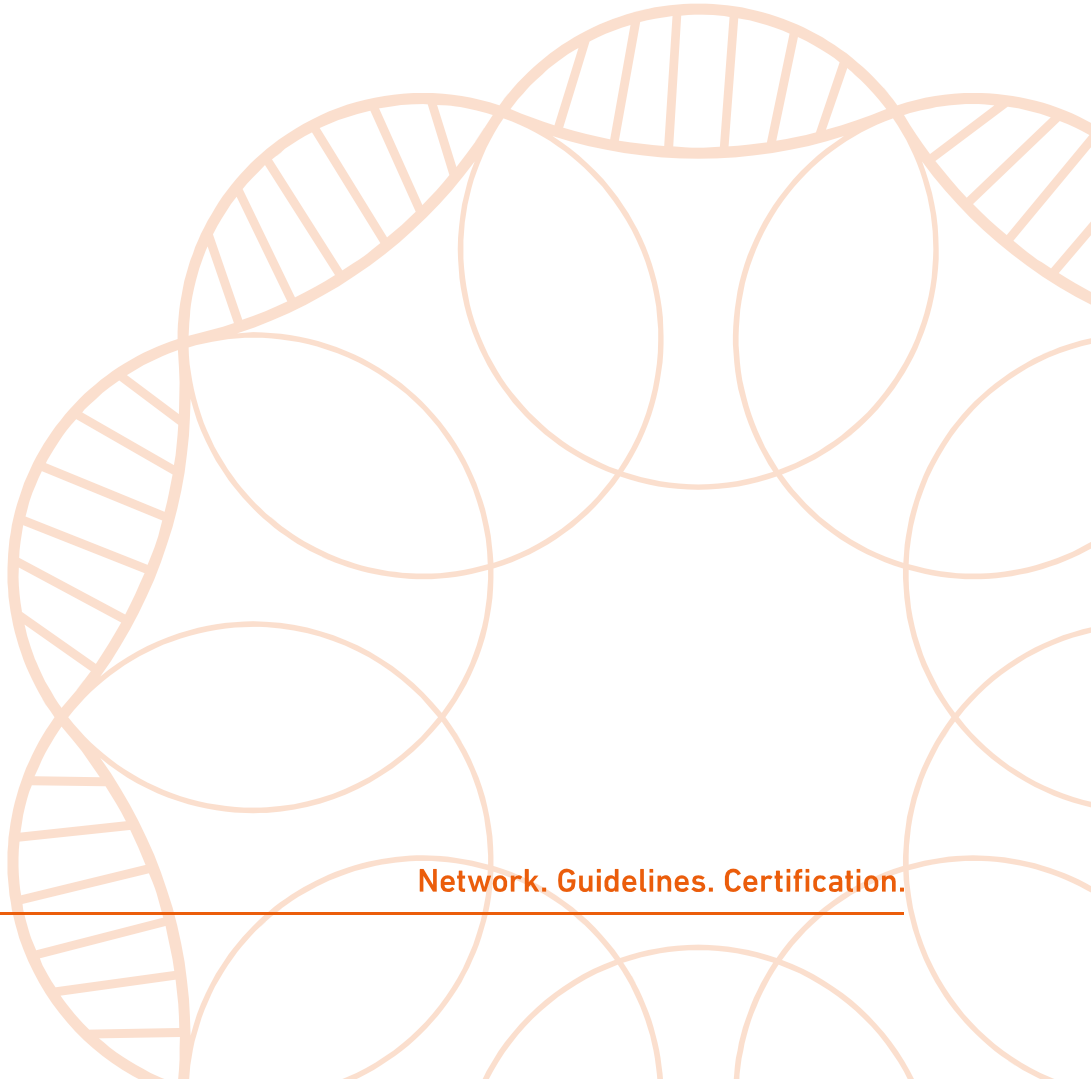
THE GLOBAL STANDARD
FOR LIVESTOCK DATA

# Appendix C4 of Section 10 of ICAR Guidelines – Laboratory Test for External RFID Devices

**Laboratory Test for External RFID Devices**

Version February, 2018



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# Change Summary

| Date of Change | Nature of Change |
|---|---|
| August 2017 | Removed the reference 'Chromium: 10 mg/kg' (section 1.2.2) |
| August 2017 | Replaced 'Every RFID device will be read before starting any environmental test' with '20 randomly selected RFID devices will be read before starting any environmental test' (section 2.1) |
| August 2017 | Replaced 'The measured values are compared to those of the initial test' with 'The measured values are compared to those of the reference devices' (section 2 in several places). |

| Date of Change | Nature of Change |
|---|---|
| August 2017 | Added 'On cattle and on sheep and goat ear tags as well the test is performed at -25°C (± 2°), 21°C (± 2°C) and 55°C (± 2°C) combined with 50% RH (when the temperature is greater than 0°C) with 10 ear tags from the three treatment variations.<br><br>On pig ear tags the test is performed at -10 °C (± 2°), 21 °C (± 2°) and 55 °C (± 2°) combined with 50% RH (when the temperature is greater than 0°C) with 10 ear tags from the three treatment variations.'<br><br>Removed the phrase 'Broken or unfastened tags must not be re-usable' and replaced with 'None of the ear tags – neither male nor female part – must be re-usable. Male pin tips must break off and remain within the female caps (locking gap).'<br><br>Added the requirement 'At ambient conditions (21°C ± 2°), ear tags designed to be used in pigs shall not break with the application of a force lower than 200 Newton.'<br><br>(Section 2.3) |
| August 2017 | Replaced 'The measured values are compared to those of the initial test' with 'The measured values are compared to those of the reference (sections 2 in several places). |
| August 2017 | Replaced ISO 7724 with ISO 11664-4<br><br>Replaced 10 with 15 CIELAB units (section 2.9) |
| September 2017 | Template added and styles applied. |
| October 2017 | Version updated to October. Cross references corrected. Weight and dimension measure included in 1.1. |
| February 2018 | On Saturday 10th February, changes approved by the ICAR General Assembly in Auckland, New Zealand. |

# 1 Assessment of descriptive parameters

The parameters describing the RFID device will be assessed and compared to the information provided in the Application Form and, if applicable, the Preliminary Assessment report to ensure accuracy of description.

## 1.1 Weight and dimensions

The following measurements will be taken from five of the submitted RFID devices:

a. For RFID ear tags the following are observed and measured:

- Ear tags shall have smooth, rounded corners and no sharp edges or protrusions specifically on the shaft of the piercing pin.
- The weight of the complete locked ear tag.
- The dimensions of the front and rear plate (height, width and thickness).
- The pin (length and diameter).
- The entrance hole of the cap.
- Values and observations potentially impacting on animal welfare will be reported.

b. RFID leg tags the the following are observed and measured:

- RFID leg tags shall have smooth, rounded corners and no sharp edges or protrusions.
- The weight of the leg tag.
- The dimensions of the leg tag (length, width and thickness).
- The adjustable diameter.
- Values and observations potentially impacting on animal welfare will be reported.

## 1.2 Composition

Because external RFID devices are attached to "food producing" animals, they must meet specific requirements set down by international laws and regulations. In addition to these requirements, substances affecting animal, human or environmental health need to be detected.

This evaluation will involve 20 RFID devices.

### 1.2.1 Characteristics of the plastic of the ear or leg tag

To characterise the basic component of the plastic raw material, one device is submitted to an Attenuated Total Reflectance-Fourier Transform Infrared (ATR-FTIR) spectroscopy analysis. If the RFID ear tag contains a flag (an extended plate), the ear tag plate is pressed directly against the ATR-crystal. With leg tags or ear tags without a flag, the laboratory will determine if sample preparation is necessary. After analysis, the resulting ATR spectrum will be compared with characteristic spectra stored in specific databases.

Following this analysis, a material sample is submitted to a Differential Scanning calorimetry (DSC) analysis to analyse the thermal characteristics of the material as per according to ISO 11357. This analysis allows the detection of overlapping IR curves, e.g. if an additional component of minor quality was used to stretch the main component. The test is performed in two heat-up phases:

a. Phase 1: 30°C - 200°C to obtain information about post cross linking of the plastic material to detect processing effects

b. Phase 2: 30°C - 400°C to analyse the thermal parameters.

Melting point and glass transition temperatures are recorded to indicate the specific thermal characteristics of the plastic material.

### 1.2.2 Harmful substances

Pigmented plastics may contain critical heavy metals which must be recorded. These metals are: Cadmium (Cd), lead (Pb), mercury (Hg) and chromium (Cr). If chromium is detected, an additional analysis of carcinogenic hexavalent chromium will be done. The following limit values must not be exceeded:

a. Cadmium: 100 mg/kg

b. Lead: 10 mg/kg

c. Mercury: 1 mg/kg

d. Chromate (Cr VI): < 1 mg/kg

## 2 Performance assessment

The tests described in this section are designed to determine the stability and endurance of the RFID devices.

The performance assessments are summarized in Table 1.

*Table 1. Performance assessments.*

| | Electronic ear tags | | | Electronic leg tags |
|---|---|---|---|---|
| | **New** | **Artificially aged** | **Damp heat treated** | **New** |
| Artificial ageing (ISO 4892-2, A/1) | × | | | × |
| Free fall (IEC 60068-2-32) | × | × | | × |
| Cold (IEC 60068-2-1) | × | | | × |
| Dry heat (IEC 60068-2-2) | × | | | × |
| Damp heat (ISO 4611) | × | | | × |
| Tensile test of the locking system | × | × | × | |
| Visual readability | | | | |
| Typography (flag tags only) | × | × | | |
| Colour contrast change | × | × | | |
| Electronic readability (ISO 24631-1, ISO 24631-3)* | × | × | × | × |

A readability test is performed after every environmental test

### 2.1 Initial readability test

20 randomly selected RFID devices will be read before starting any environmental test. The readability test is done according to ISO 24631-1 and 24631-3. Identification number (ID

code), resonance frequency, minimum activation field strength and all relevant performance parameters are measured and recorded. The recorded values will be used as the reference for every following read test.

### 2.2 Resistance to artificial ageing

In accordance with EN ISO 4892-2, procedure A/cycle 1, 40 ear tags are tested against resistance to sunlight. The exposure chamber will be fitted with xenon-arc lamps according to EN ISO 4892-2 and operated continuously for 1,000 hours. These 1000 hours will consist of repeated cycles of 102 minutes of radiant exposure followed by 18 minutes of combined irradiation and rain simulation. The irradiance level of the xenon-arc lamps will be 60 W/m² (at 300-400 nm).

Upon completion of the artificial aging treatment, a readability test is performed according to ISO 24631-1 and ISO 24631-3 on 20 randomly chosen devices to ensure every tag, as a whole, has survived the procedure with the transponder in situ and remains compliant with ISO 11784 and ISO 11785. The measured values are compared to those of the reference devices.

### 2.3 Resistance to tensile loading

This test applies to RFID ear tags only.

This test is done using 30 new ear tags, 30 artificially aged tags and 30 tags submitted to damp heat treatment.

On cattle and on sheep and goat ear tags as well the test is performed at -25°C (± 2°), 21°C (± 2°C) and 55°C (± 2°C) combined with 50% RH[1] (when the temperature is higher than 0°C) with 10 ear tags from the three treatment variations.

On pig ear tags the test is performed at -10 °C (± 2°), 21 °C (± 2°) and 55 °C (± 2°) combined with 50% RH (when the temperature is higher than 0°C) with 10 ear tags from the three treatment variations.

For tags which are used for both sheep/goat and pigs, the test is performed at -25°C (± 2°), -10 °C (± 2°), 21°C (± 2°C), and 55°C (± 2°C).

To test the tensile strength of the locking mechanism the ear tag is affixed to a test jig simulating its application and attempts are made to remove the ear tag by subjecting it to increasing forces. The class 1 tensile test machine shall operate at a speed rate of 500 mm/min and be capable of generating loads of up to 1,000 N.

An increasing load will be applied in axial direction. The maximum load and the effect(s) of the tensile force on the appearance and/or efficacy of the ear tags will be recorded.

#### Requirements

a. None of the ear tags – neither male nor female part – must be re-usable. Male pin tips must break off and remain within the female caps (locking gap).

b. At ambient conditions (21°C ± 2°), ear tags designed to be used in cattle shall not break with application of a force lower than 280 Newton.

[1] For ear tags made of moisture-sensitive material like PA (polyamide), the test must be carried out at the same laboratory humidity (50 % ± 10 %) like used during the preconditioning.

c. At ambient conditions (21°C ± 2°), ear tags designed to be used in sheep and / or goats shall not break with the application of a force lower than 200 Newton.

d. At ambient conditions (21°C ± 2°), ear tags designed to be used in pigs shall not break with the application of a force lower than 200 Newton.

e. The minimum breaking force applies to devices irrespective of treatments (artificial aging, damp heat, etc.)

### 2.4 Resistance to impact of free fall

When tested in accordance with IEC 60068-2-32 the RFID device shall not split or crack after falling 1000 mm onto a concrete surface. The test conditions are as follows:

a. The tag component containing the transponder is levelled in 3 attitudes (horizontally, vertically top and bottom) and dropped twice in each attitude.

b. The above test is carried out on three new and three artificially aged devices.

c. The test shall be carried out at a temperature of 21°C (± 3°) and at ambient humidity. The test is repeated again after an hour's storage at -20°C (± 2°) immediately after removing off the climatic chamber.

After the free fall test, a readability test is performed according to ISO 24631-1 and ISO 24631-3 on the tested RFID devices to ensure every device has survived the procedure with the transponder in situ and remains compliant with ISO 11784 and ISO 11785. The measured values are compared to those of the reference devices.

### 2.5 Resistance to cold

In accordance with IEC 60068-2-1, 10 new tags are exposed to a constant climate of -25°C (± 2°) for 24 hours.

Directly after removing the samples from the climatic chamber a readability test is performed according to ISO 24631-1 and ISO 24631-3 on the tested RFID devices to ensure every device has survived the procedure with the transponder in situ with no change in performance. The measured values are compared to those of the reference devices.

### 2.6 Resistance to dry heat

In accordance with IEC 60068-2-2, 10 new tags are exposed to a constant climate of 55°C (± 3°) for 24 hours.

Directly after removing the samples from the climatic chamber a readability test is performed according to ISO 24631-1 and ISO 24631-3 on the tested RFID devices to ensure every device has survived the procedure with the transponder in situ with no change in performance. The measured values are compared to those of the reference devices.

### 2.7 Resistance to damp heat and cold

In accordance with ISO 4611, 40 ear tags are placed into alternating cycles of 12 hours damp heat (40°C ± 2° / 95% RH) and 12 hours cold (-25°C ± 2°) for a duration of 3 weeks in a climatic chamber.

Upon completion of this test, a readability test is performed on 10 ear tags according to ISO 24631-1 and ISO 24631-3 on the tested RFID devices to ensure every device has survived the procedure with the transponder in situ with no change in performance. The measured values are compared to those of the initial test.

## 2.8 Typography readability

This test applies to RFID ear tags classified as flag tags only.

Five new ear tags and five artificially aged tags will be selected for assessment.

Five randomly chosen numbers as given in Appendix B3 will be printed on five white pages of paper. The font size, print style and character spacing will replicate that used for the ear tags.

The test tags and the pages with the printed numbers will be placed on a vertical surface (viewing surface) at head height in an appropriately lit laboratory room. Five assessors will stand 15 metres from the viewing surface and then commence walking towards it. Each assessor will attempt to read the numbers on the different ear tags and pages and the distance at which each device (ear tag or page) can be read without error will be recorded on the evaluation sheet.

The mean reading distance for both the pages and the ear tags will be separately calculated for each assessor and for the average of the assessors.

The following requirements must be met:

a. New, untreated tags: The mean distance at which the reference printing is read on the ear tags must be at least 80% of the mean distance at which the pages are read.

b. Artificially aged tags: The mean distance at which the reference printing is read for the ear tags must be at least 65% of the mean distance at which the pages are read.

## 2.9 Evaluation of colour contrast change

The colour difference of the ear tag plates and of the laser printing is measured and compared between three new ear tags and three artificially aged ear tags by use of spectral photometric measuring equipment according to ISO 11664-4.

After artificial ageing, the change in colour must be less than delta E* of 15 CIELAB units.