THE GLOBAL STANDARD
FOR LIVESTOCK DATA

Section 10 - Appendix C4: Laboratory Test for External RFID Devices

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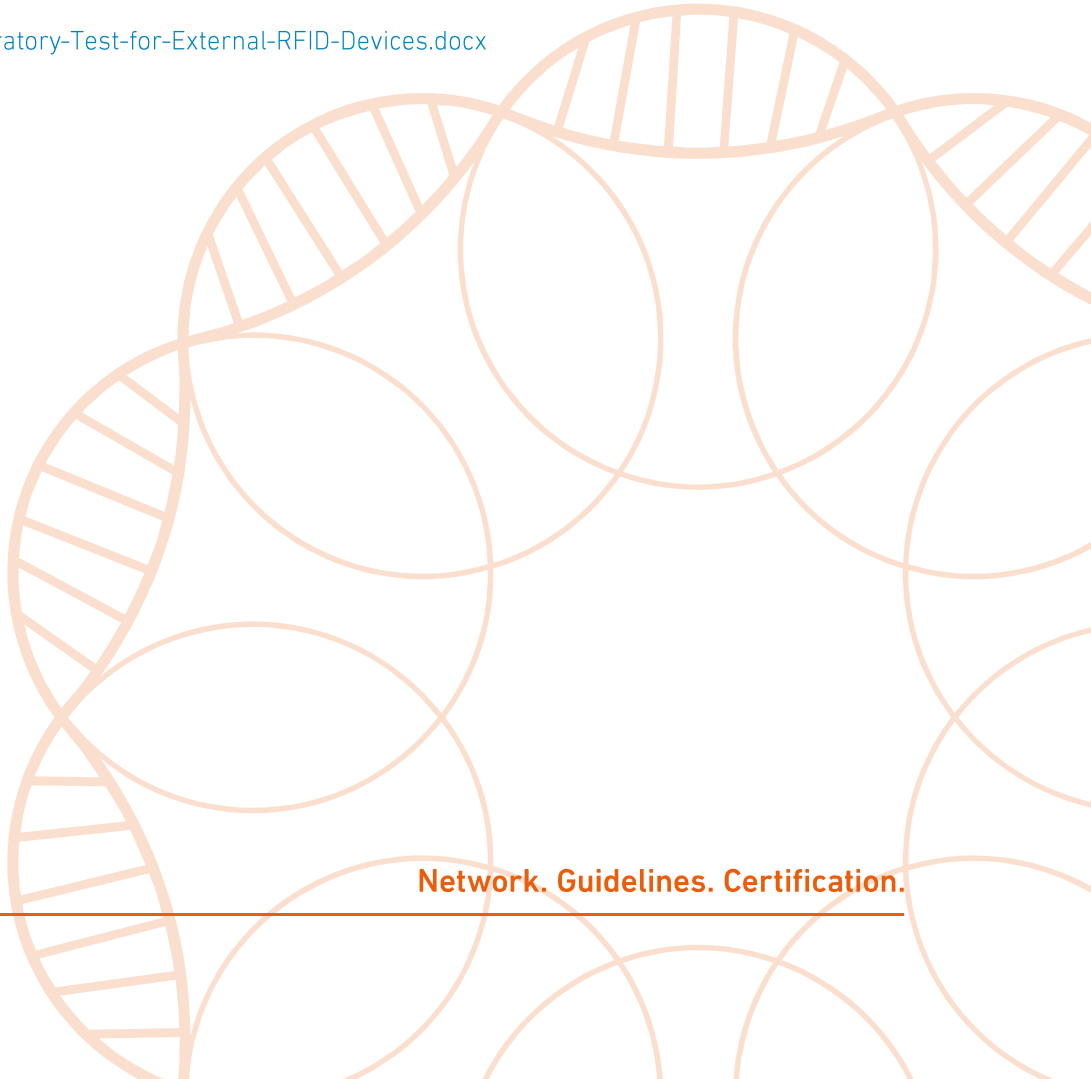

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Change Summary

Date of Change	Nature of Change
August 2017	Updated Sections 1.2.2, 2, 3.1, 3.5, and 3.12 Replaced ISO 7724 with ISO 11664-4
September 2017	Updated styles and format into uniform template
October 2017	Updated Section 1.1 Cross-referenced corrected
February 2018	Changes approved by the ICAR General Assembly
September 2020	Added Section 3.2 Colour staining test Added Section 3.1 Introduction of samples into climatic chamber Updated Sections 3.3, 3.4, 3.5, and 3.11
June 2021	Grammatical clarification updates
May 2023	Added Section 2 Pre-conditioning of tag applicator. Added Section 3.13 Evaluation of contrast change for ear tags with combined laser and inkjet printing Updated Section 3.2, 3.3, 3.4, 3.5, 3.6 and 3.12 Cross-references corrected
August 2024	Updated title page format

1 Assessment of descriptive parameters

The parameters describing the RFID device will be assessed and compared to the information provided in the Application Form to ensure accuracy of description.

1.1 Weight and dimensions

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

a. Ear tags shall have smooth, rounded corners and no sharp edges or protrusions especially on the shaft of the piercing pin. The following measurements will be taken:
   - The dimensions of the front and rear plate (height, width and thickness)
   - The pin (length and diameter)
   - The weight of the complete locked ear tag
   - The entrance hole of the cap
   - The distance between the base of the pin and the base of the plate, i.e., the maximum possible distance between the inner side of the male and female components when the device is coupled, measured at the pin, with the two tag plates parallel with each other.

b. Leg tags shall have smooth, rounded corners and no sharp edges or protrusions. The following measurements will be taken:
   - The weight of the leg tag.
   - The dimensions of the leg tag (length, width and thickness).
   - The adjustable diameter.

The results of these measurements will be compared to the Preliminary Assessment test report to ensure the accuracy of the samples.

1.2 Composition

Because 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. As such, certain chemical and physical composition traits of the RFID device will be evaluated. 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.

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:

c. Cadmium: 100 mg/kg
d. Lead: 10 mg/kg
e. Mercury: 1 mg/kg
f. Chromate (Cr VI): < 1 mg/kg

2 Pre-conditioning of tag applicator

Devices requiring coupling for various testing procedures will be coupled in an environment of 21°C ± 2° and a relative humidity (RH) of 50% ± 10%. Before coupling, the supplied applicator and the devices will be preconditioned to this environment for a minimum period of 24 hours.

3 Performance Assessments

The tests described in this section are designed to determine the stability and endurance of the RFID devices. The performance assessments are summarized in the following table.

Note: Acid and alkaline treatments are mandatory in ear tags where the tip and inner ring of the locking mechanism contain metal parts.

	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 mechanism	×	×	×	
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.

3.1 Initial readability test

20 randomly selected RFID devices will be read before commencing 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.

3.2 Acid and alkaline bath treatment

Three coupled ear tags are immersed for 3 weeks in a 21°C acid liquid (acetic acid, pH = 3) and another three coupled ear tags are immersed for 3 weeks in a 21°C alkaline liquid (sodium hydroxide, pH = 12). Both these treatments are to ensure compliance with ISO 175 for thermoplastics and ISO 1817 for vulcanized elastomers. As a reference, another three coupled ear tags are immersed in demineralized water for the same time period as the acid and alkaline baths.

These tests will only be done on ear tags where the tip and inner ring of the locking mechanism contain metal parts to ensure there is no susceptibility to galvanic corrosion.

After treatment, the samples are rinsed with demineralized water and dried for assessment of obvious deformation or material loss. Samples are also weighed before and after tests to detect material loss.

3.3 Resistance to artificial ageing

In accordance with EN ISO 4892-2, procedure A/cycle 1, 40 coupled 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. Due to the normal movement of animals' ears, both sides of a coupled ear tag are affected by the sun and other climatic elements. To simulate this process in the laboratory, ear tags undergoing an artificial aging testing within the climatic chamber are turned over after 500 hours. This ensures both sides of the coupled ear tag undergo 500 hours of exposure which has proven to be a sufficient time to assess aging behavior and to measure impacts on the material adequately. These 1,000 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).

3.4 Resistance to tensile loading

This test only applies to RFID ear tags (not applicable for leg tags).

The ear tags are pre-conditioned for at least 2 hours before testing at the respective temperature. Testing must occur within 10 seconds after the ear tag is removed from the climatic chamber.

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

[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 %) as used during preconditioning.

For 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 cap).

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.

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.)

3.5 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 after an hour's storage at -20°C (± 2°) immediately after the device is removed from 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.

3.6 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.

3.7 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.

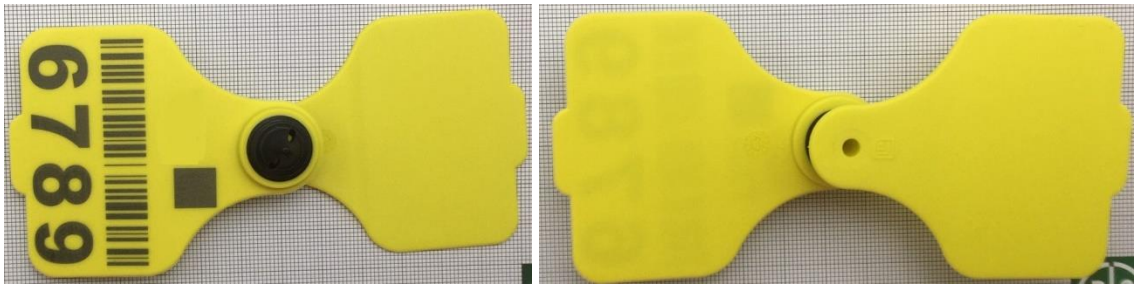
3.8 Resistance to damp heat and cold

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.

3.9 Introduction of samples into the climatic chamber

To avoid irradiation of the stem and pin, the samples must be closed (coupled) with the manufacturer-supplied applicator, then spread apart and turned around so that male faces upwards and the female downwards, or vice versa. See pictures below:



3.10 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:

d. 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.

e. 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.

3.11 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.

3.12 Evaluation of contrast change for ear tags with combined laser and inkjet printing

Combined laser and inkjet printed tags can be tested as an additional option. If the option is chosen, then they will be tested in addition and parallel to laser printed tags only. If combined laser and inkjet printed tags will be tested, then ten tags with combined laser and inkjet printing shall be delivered in addition to the standard required quantity of laser printed tags for laboratory testing.

The tags printed with combined laser and inkjet printing will be subjected to the colour contrast change evaluation test before and after an abrasive treatment (see Appendix B5 Paragraph 3.5). The comparative evaluation will be against a new tag printed with laser only. The change in colour must not fade beyond a maximum colour change of delta E* ≤ 15 CIELAB units.