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A Synthesis for the ICAR Certification of Animal Identification Devices and Transceivers

Introduction

The purpose of this Synthesis is three fold:

1. To demonstrate the necessity for animal identification devices to be ICAR certified.
2. To explain the testing ICAR certified devices are subjected to.
3. To assist in the establishment and validation of animal identification device selection criteria.

In recent years, the demand for traceability of animals for reasons ranging from animal health and welfare to food product safety has highlighted two imperative necessities:

1. For animal identification devices to be of a global uniform high quality in both composition and performance to facilitate movement of identified animals across national borders and participation and integration in multiple animal identification databases;
2. The evolution of animal identification responsibilities moving into the hands of governmental authorities, which shall be hereafter referred to as Competent Authorities (CA).

For the above points to be adequately addressed, testing protocols and guidelines for animal identification devices are required to assure Competent Authorities that devices selected for the identification of animals meet necessary and relevant standards which will include criteria such as animal welfare, product composition, transponder performance, etc. Such testing protocols and guidelines have been designed and implemented by the International Committee for Animal Recording (ICAR).

Who is ICAR?

ICAR is the world-wide organisation for the standardisation of animal recording and productivity evaluation. Its aim is to promote improvement of farm animal recording and evaluation through the formulation of definitions and standards for the measurement of traits of economic importance.

ICAR's mission is to provide benefits to its member organisations through the following actions:

1. Providing information and services which help member organisations to develop, operate and manage their business.



2. Providing information and services which promote benefits of recording and evaluation, thereby increasing the demand for the services provided by ICAR member organisations.
3. Providing guidelines and standards which facilitate the provision of services and the exchange of information by member organisations both nationally and internationally; and
4. Providing a body through which member organisations can work together to achieve shared objectives.

The present structure of ICAR as a registered, non-profit International Non-governmental Organisation (INGO) provides for full participation of its members in developing - among other things - guidelines and recommendations on the basis of sound scientific evidence. Guidelines represent a minimum of the requirements set up to ensure a satisfactory degree of uniformity of recording among member countries, and a maximum flexibility in the choice of methods.

ICAR operates in conjunction with ISO/TC23/SC19/WG3 and its technical Working Group to monitor, maintain and continue the development of the respective ISO standards. Since 2007, ICAR has served as the Registration Authority for International Standards Organisation (ISO) in specific respect to Radio Frequency Identification (RFID) devices conforming to ISO Standards 11784 and 11785. ICAR and ISO have developed independent test procedures, protocols and guidelines through which compliance of RFID systems with the aforementioned ISO standards can be verified.

Why choose ICAR certified products?

ICAR certification can only be obtained through independent testing by stringently selected ICAR approved laboratories. This testing reviews and reports on:

1. conformance to ISO standards, i.e. ISO 11784 and 11785;
2. product performance against clearly defined parameters specified in published ISO standards and detailed ICAR specifications written in conjunction with ISO; and
3. product composition to ensure both animal and human welfare is not adversely affected nor suffers increased risk and that the product is suitable for real-world environments.

Standardisation of devices and procedures is necessary to guarantee accuracy of individual animal data in any recording or tracing operations. Through the ICAR certification process, a Competent Authority can choose identification devices that have been independently tested and certified to ensure both performance and composition consistency which will then allow that authority to utilise an identification method appropriate for their relevant legislation. The ICAR certification also reduces the requirement for individual jurisdictions to outlay significant financial resources to conduct additional testing for device selection criteria or for the expertise required to both conduct and interpret the test results.



ICAR provides the competent authorities with reliable basic information to assist their decision making process regarding the selection and approval of animal identification methods through:

1. A wide range of requirements for a variety of identification devices, e.g. conventional ear tags, RFID devices etc.; and
2. A certification system which ensures that:
 - a. RFID devices can be read by any ISO reader and return to that reader specific standardised data. *Conformance* tests ensure a transponder responds correctly to the transmission from a transceiver (sometimes known as a reader or a scanner). This is important as it ensures all devices give exactly the same response to appropriate transceivers.
 - b. RFID devices can be read under real world conditions. *Performance* tests measure the response characteristics of a transponder when receiving a transmission from a transceiver. This is important for determining key decision making factors, such as read distance and read speed.
 - c. Conventional ear tags and external RFID devices have the necessary characteristics to remain attached to an animal for its lifetime. Composition and environmental performance tests of conventional ear tags and external RFID devices, i.e. this test reviews the composition of the tag or device and the physical strength and durability of tag or device against varying environmental factors. This is important for discovering expected retention rates, UV stability and animal and human safety in product composition.

Eliminato: Visual ear tags
(with or without RFID devices)

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Competent authorities can trust in the ICAR certificate for the following reasons:

- ICAR specifications are established in conjunction with ISO;
- ICAR specifications are established and regularly updated by independent experts with current, leading technical knowledge;
- Tests are conducted by independent laboratories accredited by ICAR; and
- ICAR certificates are monitored, and where there is evidence a certified product no longer complies with its requirements, ICAR reserves the right to withdraw the certificate for that product.

It is in recognition of the above examples ICAR, in conjunction with ISO, has developed and implemented the protocols and procedures currently in place. A brief overview of these procedures and protocols will now be discussed and a more detailed and technical explanation can be read in Section 10 of the *ICAR International Agreement of Recording Practices; Guidelines Approved by the General Assembly*.

ICAR testing and certification of identification devices

ICAR testing of identification devices can be divided into the following categories:

1. RFID Conformance (ISO 24631-1)



2. RFID Performance (ISO 24631-3)
3. Device Composition and Environmental Performance (ICAR Test Procedure)

The latest version of ISO Standards will always apply and these Standards can be downloaded from the ISO website (www.iso.org).

The ICAR tests are recognised by the Federation of European Companion Animals Veterinary Association (FECAVA) and WSAVA (World Small Animal Veterinarian Association) and thus can be applied to companion animal identification also.

RFID Conformance Test

Conformance testing is required to demonstrate transponders meet the specifications and standards outlined in ISO 11784 and ISO 11785. To briefly summarise these standards:

1. ISO 11784 is the ISO Standard that specifies the structure of the identification code encoded in and transmitted by the transponder to ensure it is correctly interpreted by an ISO compliant transceiver.
2. ISO 11785 is the ISO Standard that specifies how a transponder is activated and how its data is transmitted to the transceiver, i.e. the communication protocol between a transponder and a transceiver.

These ISO standards cover these principle forms of RFID devices:

1. **Injectable:** a small transponder able to be injected into an animal's body. The transponder is encapsulated in a biocompatible and non-porous material, e.g. glass.
2. **Ear tag:** a plastic covered transponder able to be fixed to an animal's ear using a locking mechanism which prevents the device from being removed without damaging the tag and rendering it unusable.
3. **Ruminal bolus:** a transponder placed into a high specific gravity container and orally administered to a ruminant animal where the device remains in the stomach of the recipient without passing through the animal's digestive system due to the device's high specific gravity.
4. **Leg Tag:** an external device able to be permanently fastened to an animal's lower leg using a locking mechanism which prevents the device from being removed without damaging the tag and rendering it unusable.
5. **Tag attachment:** a transponder covered by a primary protection layer but without its own locking system and is used only as an attachment to a **visual** ear tag or to another means of external animal identification, e.g. collar.

Conformance testing of RFID devices should be obligatory before they can be used in the official identification of animals. Only those results emanating from accredited and ICAR approved test centres are recognised. If the transponder passes the Conformance Test and the manufacturer of the transponder signs the ISO Code of Conduct, then the transponder receives a perpetual ICAR registration and is certified for five years. In addition to this, the



manufacturer receives a Certificate of Conformance for that device along with a registration code from ICAR acting as the registration authority on behalf of ISO.

The Conformance test is conducted against the procedures outlined in ISO 24631-1.

RFID Performance test

Performance testing is an evaluation of the following characteristics of an RFID device:

1. modulation amplitude
2. bit length stability
3. minimum activation field strength
4. resonance frequency
5. amplitude voltage response (Vss).

These RFID performance test results are not subject to pass or fail criteria but provide useful additional information on device behaviour when communicating with a transceiver. These results are made available to the submitting manufacturer and Competent Authorities should request these results when selecting devices for their relevant jurisdictions and identification programs.

Performance testing of RFID devices should also be obligatory before they can be used in the official identification of animals. It has been noted by jurisdictions who have implemented national identification systems that RFID devices which have poor performance cause the end users much frustration. These measurements can assist Competent Authorities select product(s) appropriate to their country's requirements, especially regarding parameters such as read distance and read speed.

The Performance Test is conducted against the procedures outlined in ISO 24631-3.

Device Composition and Environmental Performance Test (ICAR)

ICAR has recognised the critical need of Competent Authorities to select identification devices which will have both performance in the following characteristics:

1. Ease of application and use
2. Read efficiency (both visual and electronic)
3. Durability and retention
4. Animal care and human health

This particular ICAR test focuses on testing the ear tag design (including the locking mechanism), the tag durability, the print quality, and, if requested, the ear tag machine readability, i.e. barcoded product.



The Composition and Environmental Performance Test provides extensive information on both conventional plastic and RFID ear tags. Such information includes:

1. Composition analysis to both characterise the basic components of the plastic raw material and to also detect any harmful substances in the plastic
2. Resistance to sunlight (UV stability)
3. Resistance to tensile loading
4. Resistance to cold
5. Resistance to damp heat
6. Resistance to rapid temperature changes
7. Resistance to free-fall impacts
8. Resistance to abrasive forces
9. Typography readability
10. Colour stability

The performance assessments are summarised in the following table:

	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)*	×	×	×	×

Readability tests are performed after every environmental test.

Upon completion of the testing, ICAR issues an evaluation report and an ICAR certificate for tested devices in accordance with the ICAR standards described in Sections 10.7 and 10.8 of the *ICAR International Agreement of Recording Practices; Guidelines Approved by the General Assembly*.



ICAR Test Centres

Test procedures must be conducted by ICAR approved test centres. Each test is contracted by Service-ICAR to a specific test centre. The test centre is obliged to act according to the procedures laid down within the appropriate test protocols. Test centres are regularly monitored by the ICAR Sub-Committee for Animal Identification.

Publication of information

ICAR certifications and advice of successful and / or completed tests will be published on the ICAR website (www.icar.org). The full test reports are the property of the manufacturers and are not published by ICAR. It is recommended that Competent Authorities selecting identification devices for their jurisdictions request the full test reports from the manufacturers submitting devices for consideration.

Conditions for the use of ICAR certificates

The certificates issued by ICAR are valid for 5 years and commit the manufacturer to a list of validation conditions given in Section 10 of the ICAR Guidelines. If a device is certified by ICAR, the manufacturer may publish the certification of its device. ICAR certification does not guarantee the device is suitable for all environments and ICAR strongly endorses careful and prudent review of devices by Competent Authorities for suitability to their relevant requirements and legislation.

While an ICAR certificate is valid for 5 years, the registration of an RFID device is unlimited and all registered RFID devices will be listed on the ICAR website; however, should a manufacturer fail to maintain compliance to the ISO Code of Conduct, then the registration of its product(s) may be cancelled.

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Glossary

Note

The following terms are not technically defined but rather explained in a user-friendly manner to assist in the understanding of animal identification.

Animal Code

a signalling or flag code in the data structure of a transponder that denotes that the transponder is used for animal identification. 1 = animal identification while 0 = non-animal identification.

Bit Length Stability

a value which determines the stability of an individual bit length and is expressed as the standard deviation of time needed to transmit 1 bit of information. This measurement is important for determining the quality of read required for an application.

Climatic chamber

a laboratory chamber designed to emulate certain environmental conditions with the ability to expedite the effect of those conditions on the product(s) within that chamber. For example, a climatic chamber can be setup to emulate seven years of UV radiation and display those effects on an ear tag.

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Code of Conduct

a manufacturer's declaration of compliance to the ISO 11784 and ISO 11785 standards and the related ICAR conditions.

Conformance Test

an ICAR test which evaluates the conformance of RFID transponders with ISO 11784 and ISO 11785 standards. Transponders successfully illustrating conformance to these standards are listed as both ICAR registered and ICAR certified and a manufacturer's code is granted accordingly.

Composition and Environmental Performance Test

an ICAR test for both conventional plastic ear tags and external RFID devices to obtain extensive information on device durability and performance in diverse animal management conditions.



Conventional ear tag

a plastic ear tag used for the identification of an animal that, as opposed to an electronic ear tag, does not include an RFID transponder.

Country code

a three-digit numerical code representing a country in accordance with ISO Standard 3166-1. This code can prefix the unique identification code encoded into a transponder so that any transponder allocated within a country is individually unique to both that specific animal and that respective country.

Device Change Notification

a procedure which gives manufacturers a mechanism to officially notify ICAR of certified product changes, either for conventional ear tags or RFID tags certified for material composition and environmental performance.

Electronic ear tag

a plastic covered transponder able to be fixed to an animal's ear using a locking mechanism which cannot be removed without damaging the ear tag and making it unusable.

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Electronic ruminal bolus

a transponder placed into a specific gravity container which is orally administered to a ruminant animal where it remains in the animal's stomach.

External RFID device

an ear tag, leg tag, tag attachment etc which contains a transponder for the use of identification and remains outside of but attached to an animal. An electronic ruminal bolus and an injectable transponder are not external but internal RFID devices.

Frequencies (LF, HF, and UHF)

a transceiver and transponder communicate with each other via electromagnetic waves otherwise known as frequencies. These frequencies are broken up into specific ranges such as: low frequency (LF), high frequency (HF) and ultra-high frequency (UHF).

Full duplex

electronic transmission technology. For RFID transponders, this technology is where the response signal from the transponder is sent at the same time the signal from the reader is sent. An example of a similar technology would be a telephone conversation where two people can talk at the same time.



Half duplex

electronic transmission technology. For RFID transponders, this technology is where the response signal from the transponder is sent after the signal from the reader is sent. An example of a similar technology would be a two-way radio (CB) transmission where only one person can transmit at a time.

Heavy metals

toxic metals which while sometimes essential for a product's composition must be monitored to ensure the toxicity level remains at an acceptable safe level where there are not any negative health effects on the animal or human. Some heavy metals should never be used for the composition of any product used in or on a food-producing animal.

Helmholtz coil

a device for producing a region of pristine magnetic field. This device is used in the test setup for RFID conformance and performance tests.

ICAR Certification

a certificate issued to all successfully tested devices for a period of five years. The tests providing ICAR certification are the Conformance Test and the Composition and Environmental Performance Test.

ICAR Re-certification

a certificate issued to a device that is successfully tested upon expiry of its previous certification. The device is certified with its original certification code for further five years.

ICAR Registration

a registry of all RFID devices which passed the Conformance Test irrespective of current ICAR certification.

ICAR Validation Service

a voluntary service for National Competent Authorities and other field service users. Consists in testing samples of external identification devices from local market stocks in order to verify that they meet the original certification criteria of ICAR.

Injectable transponder

a transponder encapsulated in a biocompatible and non-porous material and injected into an animal's body, usually under the surface of the skin.

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Locking mechanism

the mechanism where the male part of an ear tag is locked to the female part of that ear tag and thus permanently affixes the ear tag to the animal. For ICAR certification, the locking mechanism of an ear tag must not be opened and/or removed without the device becoming unusable.

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Machine readability

the capability of a printed barcode on an ear tag to be successfully read by a barcode scanner / reader of the appropriate technology relevant to the barcode type used, e.g. 2D, EAN, etc.

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Magnetic field strength

an electronic parameter measured in the RFID performance Test. This measurement describes the strength of the response signal from the RFID transponder. This measurement is important for determining the level of read distance required for an application.

Manufacturer code (shared and unshared)

an unshared manufacturer code can be granted to a manufacturer providing proof to ICAR that during two consecutive years the company has sold a minimum of one million registered/certified transponders per year. The granted code will be exclusive to that manufacturer.

a shared manufacturer code of 900 is granted to a manufacturer after the first successful RFID transponder conformance test is completed. With the shared code ICAR allocates a set of one million codes restricted for the exclusive use of the respective manufacturer.

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Minimum activation field strength

an electronic parameter measured in the RFID performance Test. This measurement describes the minimal electronic activation field required for the transponder to respond with a valid message. This measurement is important for determining the level of read speed required for an application.

Modulation amplitude

an electronic parameter measured in the RFID performance Test. This measurement describes the modulation quality of the response signals from the RFID-transponder. This measurement is important for determining the quality of read required for an application.



RFID Performance Test

an RFID performance testing is an optional test for the evaluation of various characteristics of a transponder including: bit length stability, minimum activation field strength, resonance frequency etc.

Polymer spectrum

a spectra of common polymers. These are measured to obtain a 'fingerprint' of the ear tag and thus check for potentially harmful substances within the ear tag.

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Product code

a six-digit number granted by ICAR to a manufacturer for a certain type of transponder. This number is formatted with the first three digits being the manufacturer code and the last three digits being a serial number unique to that transponder type.

Resonance frequency

the frequency required to activate a transponder. According to ISO 11785, this frequency should be 134.2 +/- 3 kHz for ICAR certified devices.

Residual noise

environmental electronic noise at the same frequency bandwidth as the transponder operational frequency. This can be caused by a myriad of factors, e.g. cathode ray tubes, large speakers, etc and must always be monitored when testing devices.

Tag attachment

a transponder covered by a primary protection layer but without its own locking system, e.g. in some leg tags, collars etc. A tag attachment can be removed and reused.

Thermal characteristics

the way an ear tag, and more specifically, the polymer composition of an ear tag, responds to the application of heat. Like the polymer spectra, a "fingerprint" of an ear tag can be determined by its unique response to the application of certain levels of heat.

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Transceiver

a device used to communicate with a transponder and is sometimes known as a reader or scanner. The transceiver must operate on the same frequency as the transponder, i.e. LF transceivers can only read LF transponders, etc.



Transponder

a radio frequency identification (RFID) device that transmits its stored information when activated by the electromagnetic waves transmitted by a transceiver. Some transponders may also be able to store new information. Transponders that can only transmit data are known as 'Read Only' transponders while transponders that can both transmit data and store new data are known as 'Read write' transponders.