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**Radiofrequency identification  
of animals —**

Part 3:

**Evaluation of performance of RFID  
transponders conforming with ISO 11784  
and ISO 11785**

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*Identification des animaux par radiofréquence —*

*Partie 3: Évaluation de la performance des transpondeurs RFID  
conformes à l'ISO 11784 et à l'ISO 11785*

ISO 24631-3:2009

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 24631-3 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

ISO 24631 consists of the following parts, under the general title *Radiofrequency identification of animals*:

- *Part 1: Evaluation of conformance of RFID transponders with ISO 11784 and ISO 11785 (including granting and use of a manufacturer code)* [ISO 24631-3:2009](https://standards.iteh.ai/catalog/standards/sist/b1efcda1-407d-4f7b-ba47-265c84e51bcc/iso-24631-3-2009)
- *Part 2: Evaluation of conformance of RFID transceivers with ISO 11784 and ISO 11785*
- *Part 3: Evaluation of performance of RFID transponders conforming with ISO 11784 and ISO 11785*
- *Part 4: Evaluation of performance of RFID transceivers conforming with ISO 11784 and ISO 11785*

## Introduction

ISO has appointed ICAR (International Committee for Animal Recording) as the registration authority (RA) competent to register manufacturer codes used in the radiofrequency identification (RFID) of animals in accordance with ISO 11784 and ISO 11785.

ISO 24631 defines means, based upon ICAR test procedures<sup>[1]</sup>, for evaluating and verifying both the conformance and performance of RFID devices in respect of ISO 11784 and ISO 11785. Only those results emanating from RA-approved test centres are recognized.

This part of ISO 24631 deals with the performance of RFID transponders, of which the four main types used for animal identification are

- injectable transponders,
- electronic ear tag transponders,
- electronic ruminal bolus transponders, and
- tag attachments.

This part of ISO 24631 permits the characterization of the two RFID communication paths: the energy transfer from transceiver to transponder, and the data transfer from transponder to transceiver. This characterization can be obtained from the results of two measurements — the first determining the minimal activating magnetic field strength needed for transmitting the information and the second the transponder modulation amplitude. Both measurements use a reference measurement antenna configuration under conditions allowing the absolute values to be obtained for comparison of data between the tested transponders. Additional measurements that contribute to the performance assessment of the transponders are the bit length stability in the case of FDX-B transponders and the frequency stability in the case of HDX transponders. These parameters can be measured using the same measurement antenna configuration.

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# Radiofrequency identification of animals —

## Part 3: Evaluation of performance of RFID transponders conforming with ISO 11784 and ISO 11785

### 1 Scope

This part of ISO 24631 provides the means of evaluating the performance of ISO 11784- and ISO 11785-conformant RFID (radiofrequency identification) transponders used in the individual identification of animals.

The test procedures specified in this part of ISO 24631 are recognized by the FECAVA (Federation of European Companion Animals Veterinary Association) and WSAVA (World Small Animal Veterinarian Association) and as such can be applied also to companion animals.

### 2 Conformance

Test centres approved by the registration authority (RA) shall perform transponder testing using the procedures specified in Clause 7 and shall report the test results to the RA. These tests are in accordance with the technical requirements of ISO 11784 and ISO 11785. The manufacturer shall apply for transponder testing by completing and submitting to the RA the application form provided in Annex A. Only transponders with a product code issued by the RA (see ISO 24631-1) shall be tested. A transponder test report shall be accorded to a manufacturer whose transponder product has been tested as per Clause 7.

### 3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 11784, *Radio frequency identification of animals — Code structure*

ISO 11785:1996, *Radio frequency identification of animals — Technical concept*

ISO 24631-1:2009, *Radiofrequency identification of animals — Part 1: Evaluation of conformance of RFID transponders with ISO 11784 and ISO 11785 (including granting and use of a manufacturer code)*

ERC recommendation 70-03, *Relating to the Use of Short Range Devices (SRD)*<sup>1)</sup>

1) CEPT (Conférence Européenne des Administrations des Postes et des Télécommunications) publication.

## 4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 4.1

#### **bit length stability**

stability of an FDX-B transponder expressed by the standard deviation of the duration of one-bit information

### 4.2

#### **country code**

three-digit numeric code representing a country in accordance with ISO 3166-1

### 4.3

#### **frequency stability**

stability of an HDX transponder expressed by the standard deviation of the two frequencies representing the low and high bit of an FSK modulated signal

### 4.4

#### **identification code**

code used to identify the animal individually, at the national and, in combination with a country code, international levels

NOTE It is a national responsibility to ensure the uniqueness of national ID codes.

### 4.5

#### **laboratory activation field**

electromagnetic field with a frequency of 134,2 kHz and a magnetic field strength according to ERC Recommendation 70-03

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### 4.6

#### **laboratory reference transceiver**

transceiver used to test the transponders generating the laboratory activation field, able to read FDX-B and HDX transponders

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### 4.7

#### **manufacturer**

company that submits an application for conformance testing or for the granting and use of a manufacturer code for transponders in conformance with ISO 11784 and ISO 11785 while accepting the conditions set forth in ISO 24631-1:2009, Annexes B, C and E

### 4.8

#### **manufacturer code**

##### **MFC**

three-digit number granted by the RA to a manufacturer under the conditions set forth in ISO 24631-1:2009, Annex E, whose range and placement within the code structure are in accordance with ISO 11784

NOTE Only one manufacturer code is granted to the same manufacturer.

### 4.9

#### **product code**

six-digit number granted by the registration authority to a manufacturer for a certain type of transponder, formatted such that its first part is the manufacturer code and second part a three-digit serial number

### 4.10

#### **RA-approved test centre**

accredited test centre meeting the criteria of the registration authority

NOTE Accreditation: third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks (see Reference [2]).



**4.11****RA-approved transponder**

transponder approved by the registration authority

**4.12****RA-registered manufacturer**

manufacturer with one or more RA-approved transponders

**4.13****registration authority****RA**

entity that approves test laboratories and issues and registers manufacturer and product codes

**4.14****retagging**

process that assigns to a new transponder the same identification number as a transponder that has been lost or that is no longer readable

**4.15****retagging counter**

three-bit field for counting the number of retagging

**4.16****transceiver**

device used to communicate with the transponder

**4.17****transponder**

radio frequency identification (RFID) device that transmits its stored information when activated by a transceiver and that may be able to store new information

NOTE A transponder can be characterized according to its components (chip, coil, capacitor, etc.), communication protocol, size, shape and packaging, or any additional characteristics that could change its properties. The main types are defined in 4.17.1 to 4.17.4 below.

**4.17.1****injectable transponder**

small transponder able to be injected into an animal's body and encapsulated in a biocompatible and non-porous material such as glass

**4.17.2****electronic ear tag transponder**

plastic-covered transponder able to be fixed to the ear of the animal using a locking mechanism or to be attached to an ear tag such that it cannot be removed from the tag without damaging it

**4.17.3****electronic ruminal bolus transponder**

transponder placed into a high specific gravity container able to be orally administered to a ruminant, which remains permanently in its fore stomach

**4.17.4****tag attachment**

transponder components covered by a primary protection layer and meant for producing one or more of the three other main transponder types or other types of animal transponder

**4.18****transponder modulation amplitude**

characterization of the transponder signal strength sent back to the transceiver

NOTE For FDX-B it corresponds to the modulation depth; for HDX to the average voltage depth.

#### 4.19

##### **transponder minimal activating magnetic field strength**

minimal value of magnetic field strength needed to obtain full activity of the transponder

NOTE The transponder is activated after having been placed in a magnetic field whose strength depends on the antenna, chip and packaging design. Full activity is obtained when the transponder is supplied with energy sufficient to transmit the complete data according to ISO 11785.

#### 4.20

##### **user information field**

five-bit field for additional user information, used only in conjunction with the country code

## 5 Abbreviated terms

CN	compensating network
CRC	cyclic redundancy check
FDX-B	full duplex communication protocol (conforming to ISO 11785, excluding protocols mentioned in ISO 11785:1996, Annex A)
FSK	frequency shift keying
HDX	half duplex communication protocol
HSC	Helmholtz sensing coil
HTA	Helmholtz transmitting antenna
IEEE	Institute of Electrical and Electronics Engineers
MFC	manufacturer code
MN	matching network
RA	registration authority
RFID	radiofrequency identification
SC	sensing coil
TUT	transponder under test

## 6 Application

**6.1** The application submitted to the RA for testing the performance of a transponder shall consist of a covering letter and the application form presented in Annex A. The RA shall confirm receipt of the application to the manufacturer within two weeks. By signing the application form, the manufacturer agrees to fulfil the provisions of this part of ISO 24631.

**6.2** Approval in accordance with ISO 24631-1 is a prerequisite for approval for testing in accordance with the present part of ISO 24631.

**6.3** The test centre shall be approved by the RA.

**6.4** The RA maintains a list of approved test centres, from which the manufacturer may choose the centre that will test his transponder product.

**6.5** The manufacturer shall provide the RA-approved test centre with 50 transponders of the same type and model for testing. If the RA-approved test centre selected already has this number of the same transponders, they may be used. The transponders shall carry the country code “999” (indicating a test transponder) or the manufacturer’s code if existent. The manufacturer may freely choose the identification codes, but duplicated numbers are not allowed. The manufacturer shall provide a list of the transponder codes in decimal representation.

**6.6** The RA-approved test centre shall verify the transponders using the test procedures specified in Clause 7. All tested transponders shall be readable by the configuration also specified in Clause 7. The codes read shall match the codes provided by the manufacturer.

**6.7** The RA-approved test centre shall prepare a confidential report of the results and shall send two copies (and an electronic version) of the report to the chairman of the RA.

**6.8** The RA chairman shall inform the manufacturer of the test results in a letter together with a copy of the report.

**6.9** The tested transponders shall be kept by the RA-approved test centre, under the ownership of the RA.

**6.10** The RA shall make publicly available a photograph of the approved transponder.

**6.11** The RA shall make publicly available the main results of the test. A manufacturer shall have the right to refuse that the results be made publicly available or to request their withdrawal from public availability. In the first case, the manufacturer shall send a request to the RA not to publish, within two weeks of having received the test report. In the second, the manufacturer shall send a request to the RA and the RA shall remove the results from public availability within four weeks of receipt of this request.

**6.12** The RA shall do everything (within its power) to protect the integrity of this procedure with regard to ISO 11784 and ISO 11785.

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## 7 Test procedures

### 7.1 General

The test centre shall test five transponders randomly picked from the 50 transponders provided by the manufacturer, in accordance with the following procedures. During the measurements, the transponder shall be positioned in a Helmholtz configuration producing an adjustable uniform magnetic field.

### 7.2 Helmholtz configuration

#### 7.2.1 Transponder parameter test set-up

The Helmholtz transmitting antennas (HTA) produce a homogeneous, cylindrically shaped field. A functional diagram of the Helmholtz configuration and corresponding test set-up is shown in Figure 1. The transponder under test (TUT) shall be positioned on the central axis, midway between the transmitter coils of the test configuration.<sup>2)</sup> The matching network (MN) shall be used to match the setup of the two HTA to 50 Ω output resistance of the amplifier.

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2) The maximum size of the transponder is limited by the Helmholtz configuration's dimensions — in length by the distance between the HTA, and in diameter by the HSC diameter. The signal emitted by small transponders could require smaller sensing coil dimensions. If that is the case, the ISO/TC 23/SC 19 animal identification working group will develop a special setup for those devices.

**7.2.2 Field strength calculation**

A very accurate relation exists between the magnetic field and the current in the Helmholtz coils. By measuring the current through the HTA, the magnetic field strength,  $H_{rms}$  (root mean square, 35,8 mA/m – 35,8 A/m) can be calculated from Equation (1):

$$H_{rms} = \frac{N_{HTA} \times U_{HTA\_pp}}{1,976\ 4 \times D_{HTA} \times R_{HTA}} \tag{1}$$

where

$N_{HTA}$  is the number of turns on HTA coil (= 5);

$U_{HTA\_pp}$  is the peak-to-peak voltage at  $R_{HTA}$ ;

$D_{HTA}$  is the diameter of HTA coil;

$R_{HTA}$  is the resistor in series with HTA coils.

**7.2.3 Helmholtz transmitting antenna (HTA) coils**

The dimensions and characteristics of the HTA coils shall be as shown in Figure 2.

Two HTA coils are used in the Helmholtz configuration.

Owing to the low number of turns (five), the best way to manufacture the HTA is by winding onto a core element.

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**7.2.4 Helmholtz sensing coils (HSC) and sensing coils (SC)**

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HSC shall be used for both FDX-B and HDX. Two HSC shall be connected in series.

The HSC and the SC shall be made in accordance with Figure 3 and shall be connected by means of the compensation network (CN) (see Figure 1).