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Radiofrequency identification of animals —

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

Identification des animaux par radiofréquence —
Partie 3: Évaluation de la performance des transpondeurs RFID conformes à l'ISO 11784 et à l'ISO 11785

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 24631-3:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— quality of the figures has been improved (see Clause 7).

A list of all parts in the ISO 24631 series can be found on the ISO website.

Introduction

ISO has appointed a registration authority (RA) competent to register manufacturer codes used in the radiofrequency identification (RFID) of animals in accordance with ISO 11784 and ISO 11785.

The registration authority for ISO 11784 and ISO 11785 can found under http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/maintenance_agencies.htm.

This document deals with the performance of RFID transponders, of which the main types used for animal identification are

— injectable transponders,

— electronic ear tag transponders,

— electronic ruminal bolus transponders,

— leg tag transponders, and

— tag attachments.

This document 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.

Radiofrequency identification of animals —

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

1 Scope

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

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 11784, *Radio frequency identification of animals — Code structure*

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

ISO 24631-1, *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)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
accreditation
third-party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks

[SOURCE: ISO/IEC 17000:2004, 5.6]

3.2
activation field
electromagnetic field with a frequency of 134,2 kHz

3.3
bit length stability
stability of an FDX-B *transponder* (3.18) expressed by the standard deviation of the duration of one-bit information

3.4
country code
three-digit numeric code representing a country in accordance with ISO 3166-1

3.5
frequency stability
stability of an HDX *transponder* (3.18) expressed by the standard deviation of the two frequencies representing the low and high bit of an FSK-modulated signal

3.6
identification code
code used to identify the animal individually, at the national and, in combination with a *country code* (3.4), international levels

Note 1 to entry: It is a national responsibility to ensure the uniqueness of national ID codes.

3.7
laboratory reference transceiver
transceiver (3.17) used to test the *transponders* (3.18) generating the *activation field* (3.2), able to read FDX-B and HDX transponders

3.8
manufacturer
company that submits an application for conformance testing or for the granting and use of a *manufacturer code* (3.9) for *transponders* (3.18) in conformance with ISO 11784 and ISO 11785 while accepting the conditions set forth in ISO 24631-1:2017, Annexes B, C and E

3.9
manufacturer code
MFC
three-digit number granted by the RA to a *manufacturer* (3.8) under the conditions set forth in ISO 24631-1:2017, Annex E, whose range and placement within the code structure are in accordance with ISO 11784

Note 1 to entry: Only one manufacturer code is granted to the same manufacturer.

3.10
product code
six-digit number granted (and registered) by the *registration authority* (3.14) to a *manufacturer* (3.8) for a certain type of *transponder* (3.18), formatted such that its first part is the *manufacturer code* (3.9) and second part a three-digit serial number

3.11
RA-recognized test centre
accredited test centre meeting the criteria of the *registration authority* (3.14)

3.12
RA-registered transponder
transponder (3.18) registered by the *registration authority* (3.14)

3.13
RA-registered manufacturer
manufacturer (3.8) with one or more *RA-registered transponders* (3.12)

3.14
registration authority
RA
entity that approves test laboratories and issues and registers *manufacturer* (3.8) and *product codes* (3.10)

3.15
retagging
process that assigns to a new *transponder* (3.18) the same identification number as a transponder that has been lost or that is no longer readable

3.16
retagging counter
three-bit field for counting the number of *retagging* (3.15)

3.17
transceiver
device used to communicate with the transponder

3.18
transponder
radio frequency identification (RFID) device that transmits its stored information when activated by a *transceiver* (3.17) and that may be able to store new information

Note 1 to entry: See ISO 24631-1 for definitions of the main types.

3.19
transponder modulation amplitude
characterization of the transponder signal strength sent back to the *transceiver* (3.17)

Note 1 to entry: For FDX-B it corresponds to the modulation depth; for HDX to the average voltage depth.

3.20
transponder minimal activating magnetic field strength
minimal value of magnetic field strength needed to obtain full activity of the transponder

Note 1 to entry: 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.

3.21
user information field
five-bit field for additional user information, used only in conjunction with the *country code* (3.4)

4 Conformance

Test centres recognized 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.

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 2 weeks. By signing the application form, the manufacturer agrees to fulfil the provisions of this document.

6.2 Approval in accordance with ISO 24631-1 is a prerequisite for approval for testing in accordance with this document.

6.3 Test centres that are ISO/IEC 17025 accredited for the measurements defined in this document can be recognized by the RA.

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

6.5 The manufacturer shall provide the RA-recognized test centre with 50 transponders of the same type and model for testing. If the RA-recognized 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-recognized 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-recognized test centre shall prepare a confidential report of the results and shall send two copies (or 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-recognized test centre, under the ownership of the RA.

6.10 The RA shall make publicly available a photograph of the registered 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.

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 setup is shown in Figure 1. The transponder under test (TUT) shall be positioned on the central axis, centred between the transmitter coils of the test configuration.[1] The matching network (MN) shall be used to match the setup of the two HTA to 50 Ω output resistance of the amplifier.

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 to 35,8 A/m) can be calculated from Formula (1):

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

where

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

$U_{\mathrm{HTA\_pp}}$ 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.

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1) The maximum size of the transponder is limited by the Helmholtz configuration's dimensions — in length by the distance between the HTA coils, 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.

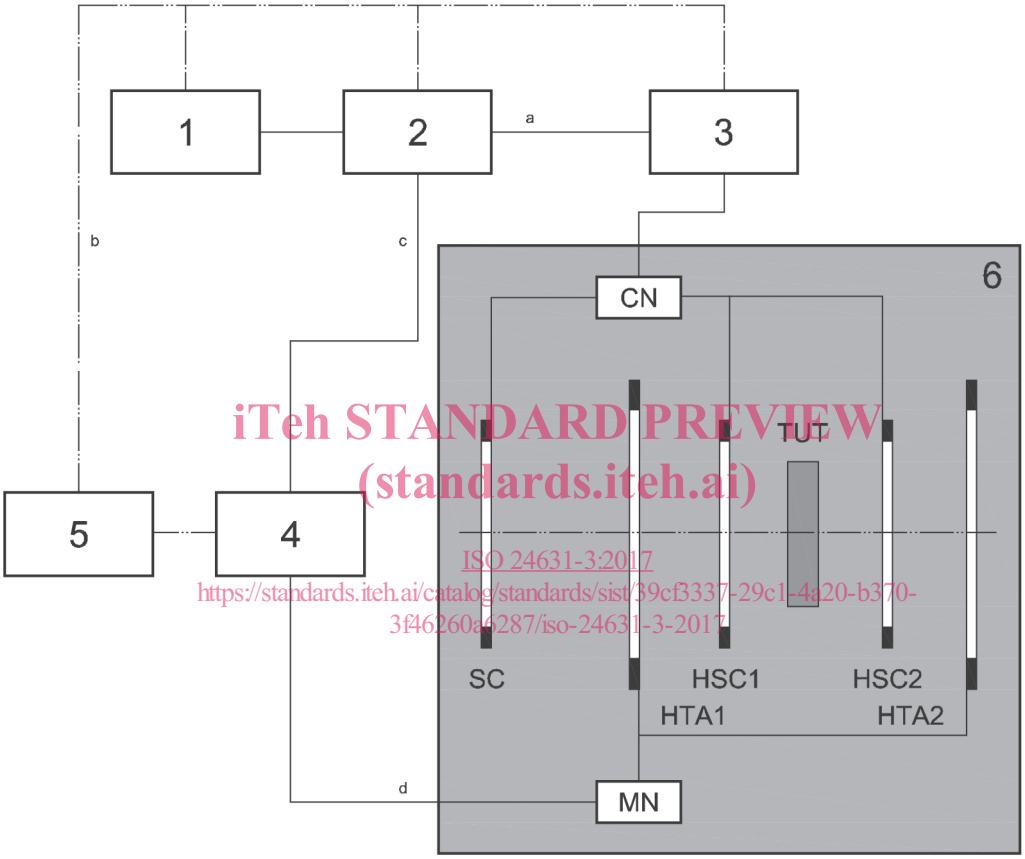
Two HTA coils are used in the Helmholtz configuration.

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

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

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).



Key

1	code generator	CN	compensation network
2	function waveform or arbitrary waveform generator	HSC1	first Helmholtz sensing coil[e]
3	oscilloscope	HSC2	second Helmholtz sensing coil[e]
4	amplifier	HTA1	first Helmholtz transmitting antenna[e]
5	personal computer (PC) with IEEE card	HTA2	second Helmholtz transmitting antenna[e]
6	measurement antenna configuration	MN	matching network
		SC	sensing coil
		TUT	transponder under test

a Trigger.
b IEEE interface.
c Output signal.
d 50 Ω.
e Serial and in phase.

Figure 1 — Test setup and Helmholtz configuration