INTERNATIONAL STANDARD

ISO 14223-1

First edition
2003-07-01

Radiofrequency identification of animals — Advanced transponders —

Part 1: Air interface

Identification des animaux par radiofréquence — Transpondeurs évolués —

Partie 1: Interface hertzienne

Reference number
ISO 14223-1:2003(E)

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Published in Switzerland

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Foreword

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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.

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ISO 14223-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

ISO 14223 consists of the following parts, under the general title *Radiofrequency identification of animals — Advanced transponders*:

— *Part 1: Air interface*

Code and command structure, and applications, will form the subjects of future parts 2 and 3.

Introduction

ISO 14223 specifies the structure of the radio frequency (RF) code for advanced transponders for animals. The technical concept of advanced transponders for animal identification described is based on the principle of radio frequency identification (RFID) and is thus an extension of ISO 11784 and ISO 11785. Apart from the transmission of this (unique) identification code, application of advanced technologies facilitates the storage and retrieval of additional information (integrated database), the implementation of authentication methods and the reading of the data of integrated sensors, as well as presenting other advantages.

Radiofrequency identification of animals — Advanced transponders —

Part 1: Air interface

1 Scope

This part of ISO 14223 specifies the air interface between the transceiver and the advanced transponder used in the radiofrequency identification of animals, this specification being fully backwards-compatible with those of ISO 11784 and ISO 11785. As a direct extension of ISO 11785, it is to be used in conjunction with that International Standard. Transponders are in conformance with this part of ISO 14223 provided they meet the requirements of Clause 5 and of Clause 6 or 7 or 8. Transceivers are in conformance provided they meet the requirements of Clauses 5, 6, 7 and 8.

2 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 11784, *Radio frequency identification of animals — Code structure*

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

3 Terms and definitions

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

3.1
advanced transponder
transponder, backwards compatible with the specifications of ISO 11784 and ISO 11785, with facilities for storage and retrieving additional data, implemented authentication methods, integrated sensors etc.

3.2
advanced mode
working principle of the advanced transponder after the switching command

3.3
basic time unit
time of one period of interrogation frequency

3.4
binary pulse length encoding
method of encoding in which differentiation between data bits 0 and 1 is done by difference in length of the high phase of the signal, the high phase being defined as 0 to 10 % modulation depth and the low phase (100 % modulation) having a constant length

3.5
bit rate
number of bits transmitted per second

3.6
differential bi-phase encoding
method of encoding in which data bit 0 is represented by a mid-bit transition, data bit 1 is represented by no transition and there is always a transition between two bits

3.7
down-link
transmission of data or commands from transceiver to transponder

3.8
encoding
one-to-one relationship between basic information elements and modulation patterns

3.9
error detection code
bits that contain information which can be used to detect errors

3.10
FDX-B20
air interface for FDX-B advanced transponders with low modulation depth

3.11
FDX-B100
air interface for FDX-B advanced transponders with high modulation depth

3.12
frequency shift keying
means whereby binary information is superimposed onto a carrier electromagnetic field by shifting between discrete frequencies of the field

cf. **phase shift keying** (3.25)

3.13
full duplex
method of information exchange in which the information is communicated while the transceiver transmits the interrogation field

3.14
half duplex
method of information exchange in which the information is communicated after the transceiver has stopped transmitting the interrogation field

3.15
HDX-ADV
air Interface for HDX advanced transponders

3.16
header
bits transmitted before the useful information, uniquely identifying the start of a page, which may also be used for synchronization of the transponder and the transceiver

3.17
interrogation field
magnetic field transmitted by a transceiver to energize and/or activate a transponder and to transfer data to an advanced transponder

3.18
interrogation frequency
frequency of the interrogation field

3.19
interrogation period
time duration of the interrogation signal

3.20
instruction
command
bit pattern downloaded to the advanced transponder to modify its status

3.21
ISO 11785 frame
total identification message (header, identification code, error detection code and trailer), possibly repeatedly transmitted by the transponder upon activation

3.22
mobile transceiver
transceiver, usually hand-held, not synchronized by wire to other transceivers

3.23
modulation
method of superimposing information onto an interrogation field by means of varying a specific parameter of the field

3.24
non-return to zero encoding
method of encoding in which data bit 1 is a high signal and data bit 0 is a low signal.

3.25
phase shift keying
means whereby binary information is superimposed onto a carrier magnetic field by introducing discrete phase shifts of the field

cf. **frequency shift keying** (3.12)

3.26
stationary transceiver
non-mobile transceiver that can be connected to a host computer and which can also be connected to other transceivers to synchronize activation periods and pauses

3.27
switch code
bit pattern used to switch an advanced transponder to the advanced mode

3.28
switch off time
time interval wherein the interrogation field is switched off

3.29
switch window
time interval wherein a FDX-B100 transponder can be switched into the advanced mode

3.30
trailer
bits transmitted after the error detection code

NOTE The content of the trailer is dependent upon the value of the flag for an additional data block (see ISO 11784).

3.31
transceiver
device used to communicate with a transponder

3.32
transponder
electronic device which is activated by a transceiver and communicates with it

3.33
type code
bit pattern which specifies the used down-link mode

3.34
up-link
transmission of data from transponder to transceiver

4 Symbols and abbreviated terms

ASK Amplitude shift keying

CRC Cyclic redundancy check

FDX Full duplex

HDX Half duplex

LSB Least significant bit

MSB Most significant bit

RFID Radio frequency identification

PWM Pulse width modulation

btu Basic time unit (1 period of interrogation frequency)

5 General requirements

The advanced ISO transponders described in this document shall be fully backwards-compatible with the specifications of ISO 11784 and ISO 11785. After the advanced transponder is placed in the interrogation field, it shall perform in a manner identical to transponders in accordance with ISO 11785. The advanced transponder shall send type information in the reserved bit field to the transceiver. To bring the advanced transponder into the advanced mode, the transceiver shall modulate the interrogation field. The details of this procedure for every protocol are given in the relevant clauses of this part of ISO 14223. When the advanced transponder has detected this modulation of the interrogation field, it shall switch to the advanced mode. In this advanced mode, the advanced transponder shall respond only when instructed by the transceiver. The transponder shall switch back to the ISO 11785 mode when

a) the transponder is no longer in the interrogation field,

b) the advanced transponder operations have been terminated.

The off-time shall be extended up to 20 ms, depending on the presence of a HDX transponder.

All data telegrams from transceiver to transponder and vice versa shall be in accordance with ISO 11785. The identification code, all data telegrams from transceiver to transponder and vice versa and the CRC error detection bits (if applicable) shall be transmitted starting with the LSB and ending with the MSB.

Bit 16 of the ISO 11785 frame (additional data flag) shall be set to “1”, indicating that the transponder contains additional data. The transmission parameters of the up-link in advanced mode are the same as those defined in ISO 11785.

6 FDX-B20 transponder — Down-link

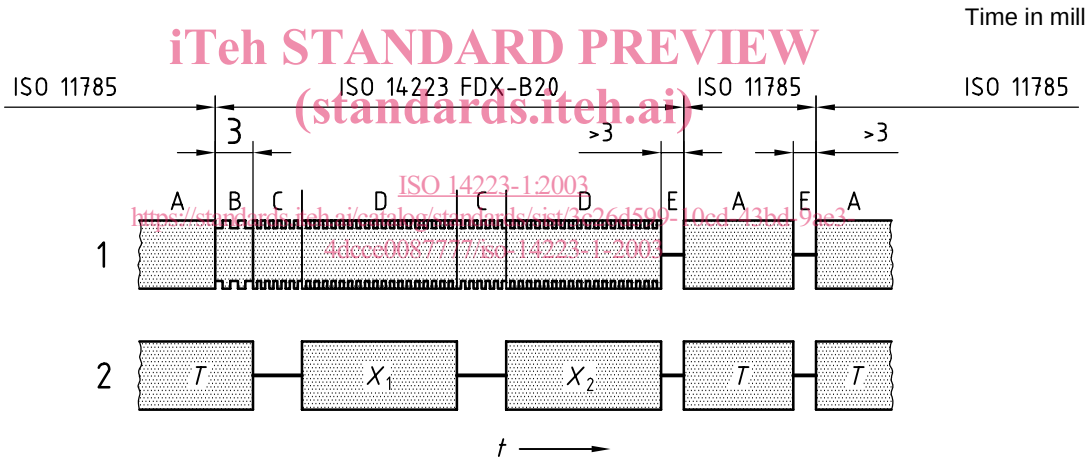
6.1 Description

See Figure 1. After receiving and decoding the ISO 11785 frame (T), the transceiver shall detect the presence of an advanced transponder in the interrogation field.

In order to bring the FDX-B20 transponder into the advanced mode, the transceiver modulates the interrogation field while the ISO 11785 header is transmitted (B).

After receiving the correct mode switching pattern from the transceiver, the FDX-B20 transponder shall stop transmitting its ISO 11785 transponder code (T), switch to the advanced mode and wait for instructions from the transceiver (C).

The down-link communication takes place in periods C and D. The example in Figure 1 shows two data blocks (X_1 and X_2) being selected by the transceiver, which then are transmitted by the transponder.



Key

1	interrogation field
2	transponder response
3	header
A to E	cycles/periods
T	transponder code
X_1, X_2	data blocks
t	time

Figure 1 — Interrogation sequence of an FDX-B20 transponder — Example

The FDX-B20 transponder shall return to the ISO 11785 FDX-B mode after the switching off of the interrogation field (E) for at least 3 ms, identical to that of ISO 11785. The cycles are as follows.

— **Cycle A:** the transceiver reads the ISO 11785 frame. The bits in the reserved field of the ISO 11785 code indicate to the transceiver that an advanced FDX-B20 transponder is in the interrogation field.

— **Cycle B:** mode switching. The transceiver modulates the interrogation field while the transponder transmits the ISO 11785 header.