INTERNATIONAL STANDARD

ISO 24631-2

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Radiofrequency identification of animals —

Part 2: Evaluation of conformance of RFID transceivers with ISO 11784 and ISO 11785

Identification des animaux par radiofréquence —

Partie 2: Évaluation de la conformité des émetteurs-récepteurs RFID à l'ISO 11784 et à l'ISO 11785

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Contents

Page

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 24631-2 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)*

— *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 [1], 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 conformance of RFID transceivers.

Radiofrequency identification of animals —

Part 2:
Evaluation of conformance of RFID transceivers with ISO 11784 and ISO 11785

1 Scope

This part of ISO 24631 provides the means of evaluating the conformance with ISO 11784 and ISO 11785 of RFID (radiofrequency identification) transceivers used in the individual identification of animals. It also specifies the procedure for applying for a transceiver test approval and the associated rights and obligations of the parties involved.

This part of ISO 24631 includes a wireless synchronization test applicable to mobile transceivers; however, it contains no provision for evaluating the wired synchronization of stationary transceivers.

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 transceiver 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 transceiver testing by completing and submitting to the RA the application form provided in Annex A. Approval of the transceiver product depends on it having passed the tests of Clause 7. An approval reference number is issued to a transceiver that is approved by the RA. The conditions attached to use of this approval by the manufacturer are laid down in Annex B.

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 11784:1996, *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)*

4 Terms and definitions

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

4.1
approval reference number
number issued to the manufacturer of an approved transceiver by the registration authority

EXAMPLE ISO 24631-2 2009-02-001

NOTE It comprises the reference of the International Standard for which approval is made, the year of issue (4 digits), the type of device tested ("02" for transceivers according to this part of ISO 24631) and the running number (3 digits) referencing the transceivers tested successfully during that year.

4.2
country code
three-digit numeric code representing a country in accordance with ISO 3166-1

4.3
ISO 11784 and ISO 11785 transceiver
transceiver that reads at least both FDX-B and HDX transponders as defined in ISO 11784 and ISO 11785

4.4
ISO 11784 and ISO 11785 transponder
radiofrequency identification (RFID) device that transmits its transponder code according to ISO 11784 and ISO 11785 when activated by a transceiver

4.5
manufacturer
company that submits an application for testing transceivers for conformance with ISO 11784 and ISO 11785

4.6
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.

4.7
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]).

4.8
RA-approved transponder
transponder approved by the registration authority

4.9
reference transponder
transponder used to test a transceiver, selected from the different RA-approved transponder types

4.10
registration authority
RA
entity that approves test laboratories and issues and registers manufacturer and product codes

4.11
transceiver
device used to communicate with the transponder

4.12
transponder
radiofrequency identification (RFID) device that transmits its stored information when activated by a transceiver and that may be able to store new information

NOTE See ISO 24631-1 for definitions of the main types.

4.13
transponder code
code programmed in the transponder, as defined in ISO 11784:1996, Table 1, and in ISO 11785

5 Abbreviated terms

CRC cyclic redundancy check

FDX-B full duplex communication protocol (conforming to ISO 11785, excepting the protocols mentioned in ISO 11785:1996, Annex A)

HDX half duplex communication protocol

MFC manufacturer code

RA registration authority

RF radio frequency

RFID radiofrequency identification

6 Application

6.1 The manufacturer may apply for a conformance test for an ISO 11784 and ISO 11785 transceiver.

6.2 The application submitted to the RA shall consist of a covering letter together with 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.

6.3 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 transceiver product.

6.5 The manufacturer shall send a transceiver and all necessary accessories to the RA-approved test centre. The manufacturer shall ensure that the equipment is able to display or store the transponder codes during testing.

6.6 The RA-approved test centre shall verify the transceivers using the test procedures specified in Clause 7. All reference transponders shall be readable by the transceiver under test. The codes read shall match the known codes of the reference transponders.

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 RA shall issue an approval reference number for each conformant transceiver type and model.

6.10 The tested transceivers shall be kept by the RA-approved test centre, under the ownership of the RA.

6.11 The RA shall make publicly available a list of conformant transceivers. A photograph of the approved transceiver shall be included in the list.

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 performed shall be the same for every synchronizing reader. The transceivers tested shall meet the technical criteria.

For documentation purposes, a photograph of the transceiver shall be taken and included in the final test report. Additionally, the mass, dimensions and the serial number of the device under test shall be noted in the test report.

7.2 Activation field frequency

The frequency of the transceiver's activation field shall be measured and shall be within the limits defined in ISO 11785.

7.3 Functional test

Ten reference transponders of the HDX type and ten reference transponders of the FDX-B type shall be read by the transceiver under test, without code errors. The displayed or stored transponder code shall be compared with the listed known codes of those reference transponders.

In addition, assess the transceiver's conformance against the following code occurrences, using special transponders that contain the following corresponding code abnormalities.

a) If bit one of the transponder code (animal bit according to ISO 11784:1996, Table 1) is equal to zero (no animal code), the transceiver shall react in a clear and unmistakable way.

b) The country code and national identification code shall be made available. In addition, retagging counter and user information field may be made available.

c) The reading of the manufacturer/country code and the identification code shall not be affected by the content of the trailer bit flag (bit 16 according to ISO 11784:1996, Table 1) and/or the content of the 24 trailer bits.

d) The reading of the manufacturer/country code and the identification code shall not be affected by the reserved bits (bits 10 to 15 according to ISO 11784:1996, Table 1).

e) When transponders with a country code above 999 are recognized by the transceiver, the transceiver shall react in a clear and unmistakable way.

f) The transceiver shall correctly perform CRC calculations.

7.4 Timing of activation field

7.4.1 Conformant transceivers shall be capable of reading both FDX-B and HDX transponders according to the dual adaptive timing protocol given in ISO 11785:1996, Clause 6. To verify this, check the activation field timings in the four different cases given in 7.4.2 to 7.4.5: the timings shown in Figure 1 shall be within the tolerance limits $^{+1}_{0}$ ms.

7.4.2 When no transponder has been placed in the activation field, the timing of the ON/OFF switching of the activation field shall be as shown in 1 in Figure 1. The periods during which the activation field is switched on shall be of a duration of 50 ms. Between these periods, the activation field shall be switched off for 3 ms. Every tenth activation cycle shall have a fixed pattern of 50 ms activation period and a fixed pause of 20 ms.

7.4.3 When an HDX transponder has been placed in the activation field, the transceiver shall switch off the field for 20 ms (see 2 in Figure 1) and read the identification code. The period during which the activation field is switched on shall remain 50 ms.

7.4.4 When an FDX-B transponder has been placed in the activation field, the period during which the activation field is switched on shall be of a duration of 50 ms, extended to a maximum duration of 100 ms if the transceiver cannot validate the FDX-B signal correctly in the first instance (see 3 in Figure 1). Both these situations shall be tested using a synchronized noise generator and loop antenna capable of generating a noise disturbance high enough to prevent the transceiver under test from reading the transponder. The noise generator shall be synchronized with the transceiver's activation field pattern and may be controlled by the operator. The start moment of the noise signal shall be such that the reading of the transmitted transponder code shall be disturbed after a part of the code is received by the transceiver under test. The period during which the noise signal is present during an activation cycle may be varied by the operator externally, but shall be such that the transceiver under test is challenged to extend the activation period to a maximum of 100 ms. The periods during which the activation field is switched off shall be 3 ms. Every tenth activation cycle shall have a fixed pattern of 50 ms activation followed by a 20 ms pause.

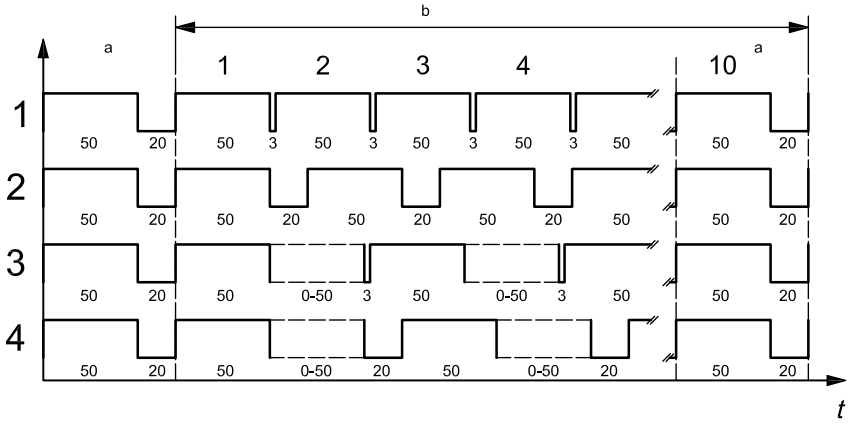
7.4.5 When both HDX and FDX-B transponders have been placed simultaneously in the activation field (see 4 in Figure 1), the duration of the activation period shall be from 50 ms to 100 ms, dependent on the receiving conditions of the FDX-B signal. The switching-off periods of the activation field shall be always 20 ms. The test using a noise generator given in 7.4.4 shall then be repeated. Every tenth activation cycle shall have a fixed pattern of 50 ms activation followed by a 20 ms pause.

7.5 Wireless synchronization test

This test is applicable only to mobile transceivers. As stated in ISO 11785:1996, Clause 6, a mobile transceiver shall be able to detect the presence of other transceivers through the reception of their activation signals. If another activation signal is present, the mobile transceiver under test shall wait for the rising edge of that next activation signal and only activate during a fixed period of 50 ms.

Using a test generator, generate an activation field of field strength 100 dBμV/m, measured at a distance of 1 m from the test antenna. The timing of the activation field shall be according to the four cases of transceiver timing shown in Figure 1. The mobile transceiver under test shall be located at a distance of 1 m from the test antenna, with both antennas in optimal orientation for maximum magnetic coupling (see Figure 4). The activation periods of the test generator shall be monitored on an oscilloscope via an auxiliary output that delivers a digital signal indicating when an activation signal is generated. An RF pick-up coil shall be connected to a second input channel of the oscilloscope. This coil shall be located in the vicinity of the mobile transceiver under test. When the test generator is switched on, check the synchronization of the mobile transceiver under test.

Times in milliseconds



Key

1 no transponder

2 HDX transponder only

3 FDX transponder only

4 HDX and FDX transponders

t time

a Fixed pattern.

b Activation cycles.

Figure 1— Transceiver timing description

The transceiver under test shall be able to detect the start of the test generator activation field (having reached 80 % of maximum), and the transceiver's activation field shall be generated within 1 ms. The field shall cease being generated within 50 ms of its activation, with decay of from −3 dB to −80 dB. It will thus be possible to prevent interference with the HDX transponder transmissions without the cessation of the test generator's field being detected. This is essential in order to prevent interference with HDX transponder transmissions.

Carry out the test by placing pick-up coils in close proximity to the test generator's antenna and the antenna of the mobile transceiver under test. From the moment the test generator's field strength falls below 40 dB, measure the time interval between this moment and the moment at which the field strength of the mobile transceiver under test also falls below 40 dB. This time interval is expected to be less than 1 ms.

7.6 Test apparatus

7.6.1 10 FDX-B reference transponders.

7.6.2 10 HDX reference transponders.

7.6.3 Test transponders, with codes necessary to perform the functional tests as described in 7.3.

7.6.4 Test set-up for activation field frequency measurement, with a maximum tolerable error of ± 1 Hz.

7.6.5 Test set-up for activation field timing measurement, with a maximum tolerable error of ± 0,01 ms.

7.6.6 Two-channel oscilloscope, with a minimum measurement bandwidth of 10 MHz.

7.6.7 Spectrum analyzer, for measuring the carrier frequency with a maximum tolerable error of ± 30 Hz.

7.6.8 Calibrated reference antenna.

7.6.9 Uncalibrated reference antenna or pick up coil.

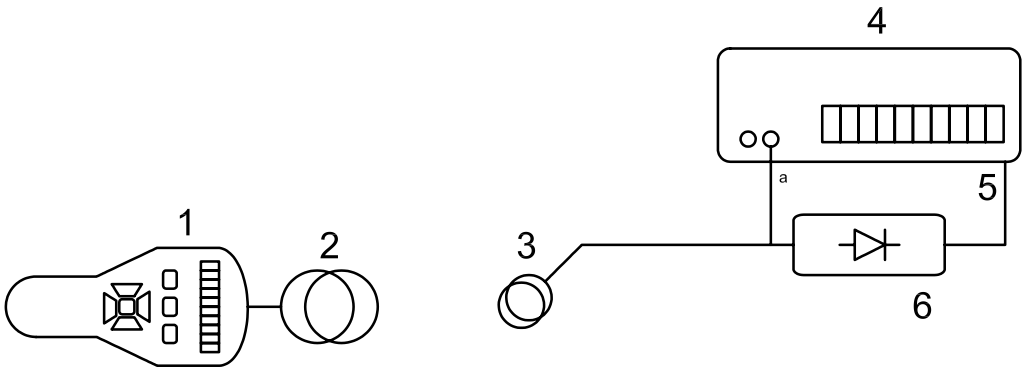
7.6.10 Activation field test generator, with a maximum tolerable noise level of −20 dB relative to the carrier.

7.6.11 Synchronized noise generator or other equipment, adequate for testing the extension of the FDX listening period by disturbing the FDX code for a short period before the complete ID code is transferred, and having a maximum tolerable noise level of −20 dB relative to the carrier.

7.7 Test set-ups

7.7.1 Frequency measurement (see Figure 2)

As the applicable transceivers produce an intermittent activation field, a frequency counter cannot be used for frequency measurement, or else the counter will need to be equipped with an external arm. Alternatively, a spectrum analyser or an EMI receiver, suitable for making high accuracy carrier frequency measurements, can be used for this test.



Key

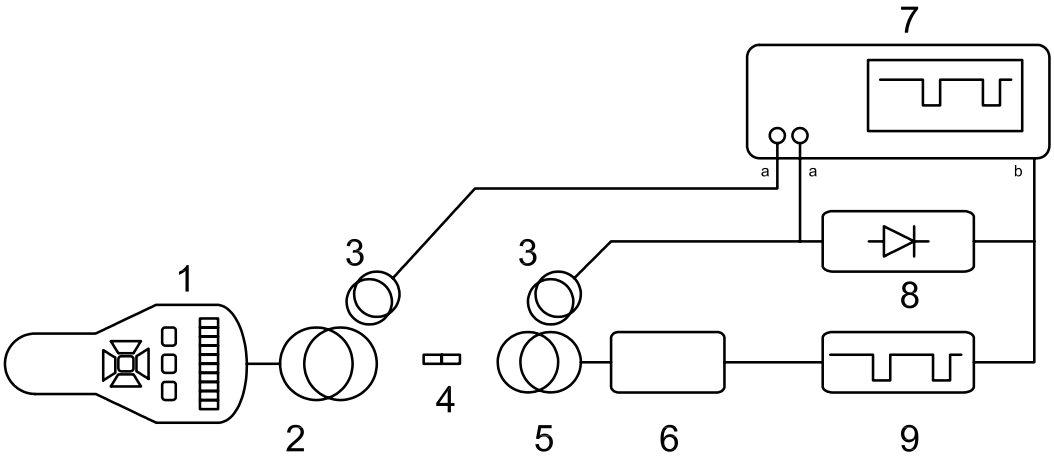
1 transceiver under test
2 antenna under test
3 pick-up antenna
4 universal counter
5 external arm
6 RF detector

[a] In.

Figure 2 — Test set-up for frequency measurement

7.7.2 Activation field timing measurement (see Figure 3)

The transceiver's activation field is sensed by a reference antenna and displayed on an oscilloscope screen. The reference antenna shall be placed close to the transceiver antenna so that the emitted RF signal is visible on the oscilloscope. By placing transponders in the activation field, the timing of changes can be observed.



Key

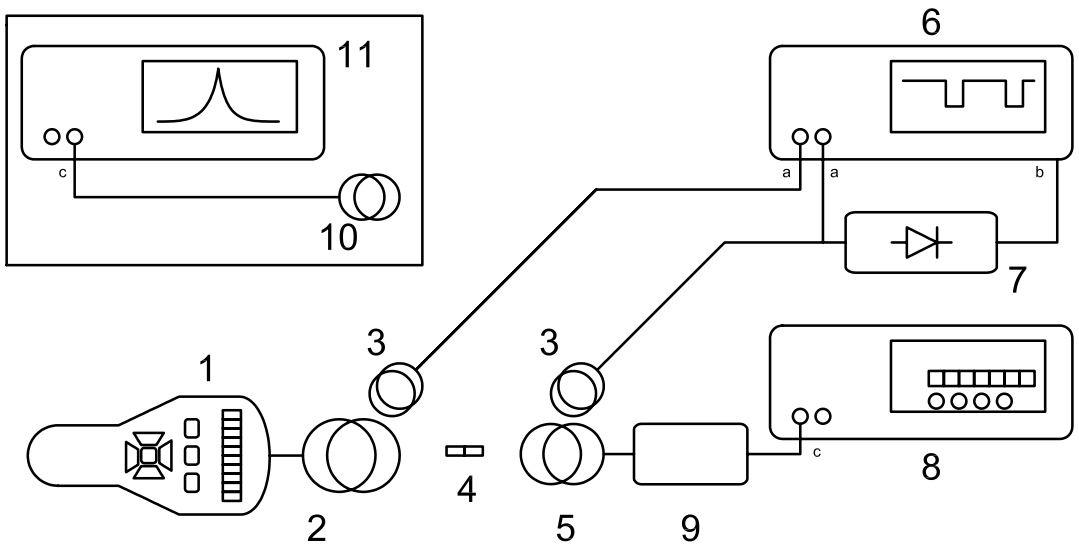
1 transceiver under test
2 antenna under test
3 pick-up antenna
4 transponder
5 antenna
6 noise generator
7 oscilloscope
8 RF detector
9 timing circuit

a In.
b External sysynchronization.

Figure 3 — Test set-up for transceiver activation field timing measurement

7.7.3 Wireless synchronization (see Figure 4)

A test generator with antenna generates a 134,2 kHz RF signal. A calibrated antenna and spectrum analyzer are used to check the field strength of this signal. Using an oscilloscope and pick-up coils, the activation of the RF field of the transceiver, which is positioned at a distance of 1 m from the test generator antenna, is compared with the activation field of the test generator.



Key

1 transceiver under test
2 antenna under test
3 pick-up antenna
4 transponder
5 antenna
6 oscilloscope
7 RF detector
8 programmable fonction generator
9 test generator (134,2 kHz)
10 calibrated antenna
11 spectrum analyzer

[a] In.
[b] External sysynchronization.
[c] Out.

Figure 4 — Test set-up for wireless synchronization test

7.8 Test conditions

The test conditions shall be as follows.

Ambient temperature:	minimum 15 °C and maximum 30 °C
Ambient humidity:	minimum 40 % rH and maximum 80 % rH
Ambient noise floor and ambient peak noise:	< 30 dBµV/m (bandwidth 2,7 kHz) 50 Hz to 1 MHz during measurements

Special attention shall be given to spurious emissions, which can be emitted, for example, by insufficiently shielded computer monitors. The electromagnetic test conditions of the measurements shall be checked by carrying out the measurements both with and without a transponder in the field.

Annex A
(normative)

Test application form

This form is also available on the RA web site: http://www.icar.org/.

RA approval date:					Date:
Company name:			**Address:**		
Manufacturer's product code:					
Mobile transceiver	☐				
Stationary transceiver	☐				
Physical characteristics:					
Dimensions ($l \times w \times h$):			Mass:		
Separate antenna:	No	☐	Yes	☐	
Communication (not to be tested):	No	☐	Yes	☐	If yes, provide specs.
Device serial number:					
Photograph of the device:					
The undersigned agrees to abide by all the provisions and conditions of ISO 24631-2.					
Date:	**Name:**				**Position:**

Annex B
(normative)

Conditions of use of transceiver approval

IMPORTANT — Approval of a transceiver confirms conformance with the code structure and technical concepts set out in ISO 11784 and ISO 11785. It does not imply approval of the transceiver's product quality and performance.

Following successful participation in a test, the RA will grant approval together with an approval reference number with the following conditions.

a) The manufacturer is allowed only to use the approval in relation to the type or model of transceiver that has been successfully tested and approved by the RA.

b) The RA reserves the right to periodically conduct an unannounced test to ascertain whether a particular manufacturer continues to meet condition a). Upon request, the manufacturer shall provide the RA with the information necessary for verifying the conditions of this annex. The right to use approval may be withdrawn if one or more conditions are not met.

c) Any disputes regarding these conditions or the use of an approval shall be addressed to ISO.

d) The RA reserves the right to distribute an advice notice regarding any manufacturer who distributes transceivers in conflict with the prescribed use described in the approval.

Bibliography

[1] *International agreement of recording practices*. ICAR Guidelines approved by the General Assembly held in Kuopio, Finland on 9 June 2006

[2] ISO/IEC 17000, *Conformity assessment — Vocabulary and general principles*

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