
**Information technology — Radio
frequency identification device
conformance test methods —**

**Part 2:
Test methods for air interface
communications below 135 kHz**

*Technologies de l'information — Méthodes d'essai de conformité du
dispositif d'identification de radiofréquence —*

*Partie 2: Méthodes d'essai pour des communications d'une interface
d'air à moins de 135 kHz*



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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

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

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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

ISO/IEC TR 18047-2, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

ISO/IEC TR 18047 consists of the following parts, under the general title *Information technology — Radio frequency identification device conformance test methods*:

- *Part 2: Test methods for air interface communications below 135 kHz*
- *Part 3: Test methods for air interface communications at 13,56 MHz*
- *Part 4: Test methods for air interface communications at 2,45 GHz*
- *Part 6: Test methods for air interface communications at 860 MHz to 960 MHz*
- *Part 7: Test methods for active air interface communications at 433 MHz*

Introduction

ISO/IEC 18000 defines the air interfaces for radio frequency identification (RFID) devices used in item management applications. ISO/IEC 18000-2 defines the air interface for these devices operating in frequencies below 135 kHz.

The purpose of ISO/IEC TR 18047 is to provide test methods for conformance with the various parts of ISO/IEC 18000.

Each part of ISO/IEC TR 18047 contains all measurements required to be made on a product in order to establish whether it conforms with the corresponding part of ISO/IEC 18000. For this part of ISO/IEC TR 18047, each interrogator needs to be assessed with tags of both type A (FDX) and type B (HDX), while each tag needs to be assessed either with type A (FDX) or type B (HDX).

It should be noted that measurement of tag and interrogator performance is covered by ISO/IEC TR 18046.

Information technology — Radio frequency identification device conformance test methods —

Part 2: Test methods for air interface communications below 135 kHz

1 Scope

This part of ISO/IEC TR 18047 defines test methods for determining the conformance of radio frequency identification devices (tags and interrogators) for item management with the specifications given in ISO/IEC 18000-2, but does not apply to the testing of conformity with regulatory or similar requirements.

The test methods require only that the mandatory functions, and any optional functions which are implemented, be verified. This may, in appropriate circumstances, be supplemented by further, application-specific functionality criteria that are not available in the general case.

The interrogator and tag conformance parameters in this part of ISO/IEC TR 18047 are the following:

- mode-specific conformance parameters including nominal values and tolerances;
- parameters that apply directly affecting system functionality and inter-operability.

The following are not included in this part of ISO/IEC TR 18047:

- parameters that are already included in regulatory test requirements;
- high-level data encoding conformance test parameters (these are specified in ISO/IEC 15962).

Unless otherwise specified, the tests in this part of ISO/IEC TR 18047 are to be applied exclusively to RFID tags and interrogators defined in ISO/IEC 18000-2.

Clause 4 describes all necessary conformance tests.

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/IEC 18000-2, *Information technology — Radio frequency identification for item management — Part 2: Parameters for air interface communications below 135 kHz*

ISO/IEC 19762 (all parts), *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISBN 92-67-10188-9, 1993, *ISO Guide to the expression of uncertainty in measurement*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762 and the following apply.

3.1.1

air-cored tag

tag having an antenna which uses no material to modify the antenna inductance

3.1.2

ferrite-cored tag

tag having an antenna which uses ferrite to increase antenna inductance

3.1.3

level of tag response

ability of the tag to send the information to the interrogator station

3.1.4

noise floor

measure, usually in decibels, of the constant level of ambient environmental energy level present within the frequency band of interest

3.2 Symbols

For the purposes of this document, the symbols given in ISO/IEC 19762 apply.

3.3 Abbreviated terms

For the purposes of this document, the abbreviated terms given in ISO/IEC 19762 and the following apply.

AWG arbitrary waveform generator

CRC cyclic redundancy check

FDX full duplex

FSK frequency shift keying

HDX half duplex

HSC Helmholtz sense coil

HTA Helmholtz transmitting antenna

NRZ non return to zero

PC computer suitable for the conformance testing requirements, e.g., personal computer

RF radio frequency

SC sense coil

DUT device under test

4 Conformance tests for ISO/IEC 18000-2 — below 135 kHz

4.1 General

This part of ISO/IEC TR 18047 specifies a series of tests to determine the conformance of interrogators and tags. The results of these tests shall be compared with the values of the parameters specified in ISO/IEC 18000-2 to determine whether the interrogator or tag under test conforms. ISO/IEC 18000-1 provides a general description of air interface parameters.

A tag compliant to ISO/IEC 18000-2 shall support either type A (FDX) or type B (HDX).

An interrogator compliant to ISO/IEC 18000-2 shall support both type A (FDX) and type B (HDX).

NOTE In case an interrogator or tags does not comply to the series of tests specified in this part of ISO/IEC TR 18047 due to the form factors of the antennas, it is recommended to amend this document to accommodate these new application requirements by providing new geometries for the measurement setups.

4.2 Default conditions applicable to the test methods

4.2.1 Test environment

Unless otherwise specified, testing shall take place in an environment of temperature $23\text{ °C} \pm 3\text{ °C}$ ($73\text{ °F} \pm 5\text{ °F}$) and of non-condensing relative humidity from 40 % to 60 %.

4.2.2 Pre-conditioning

Where pre-conditioning is required by the test method, the identification tags to be tested shall be conditioned to the test environment for a period of 24 hours before testing.

4.2.3 Default tolerance

Unless otherwise specified, a default tolerance of $\pm 5\%$ shall be applied to the measured values specifying the characteristics of the test equipment (e.g. linear dimensions) and the test method procedures (e.g. test equipment adjustments).

4.2.4 Spurious inductance

In order to ensure consistent results, resistors and capacitors in the test equipment should have negligible inductance.

4.2.5 Noise floor at test location

It shall be 20 dB less than signal from the DUT within the frequency band of the test when measured according the applicable regulatory requirement for that band.

Special attention has to be given to spurious emissions, e.g., insufficiently shielded computer monitors. The electromagnetic test conditions of the measurements can be checked by performing the measurements with and without a tag in the field.

4.2.6 Total measurement uncertainty

The total measurement uncertainty for each quantity determined by these test methods shall be stated in the test report.

NOTE Basic information is given in "ISO Guide to the expression of uncertainty in measurement", ISBN 92-67-10188-9, 1993.

4.3 Setup of test equipment for tag tests

4.3.1 Parameter definition

4.3.1.1 Minimum tag activation magnetic field strength

It should be noted that this value shall be determined in order to perform the following test measurements and the recorded value is not a conformance criterion.

Once placed in a magnetic field strength and depending on antenna, chip and packaging design, each tag will be activated. Full functionality is obtained when the tag is supplied with enough energy to transmit correctly the information stored in the chip memory. This measurement will determine the minimum value of the magnetic field strength required to obtain the full functionality of the tag.

4.3.1.2 Level of tag response

For FDX mode: The level of tag response is defined by the difference of the level of tag response values measured for the bit 1 and the bit 0. These values of the level of tag response depend on the magnetic field strength in which the tag is placed. To get the appropriate characterisation, the level of tag response shall be monitored over different magnetic field strengths and presented as the modulation characteristic.

For HDX mode: The level of tag response is defined by the average value of the level of tag response values measured for the bit 1 and the bit 0.

4.3.2 Test equipment configuration

4.3.2.1 Functional diagram

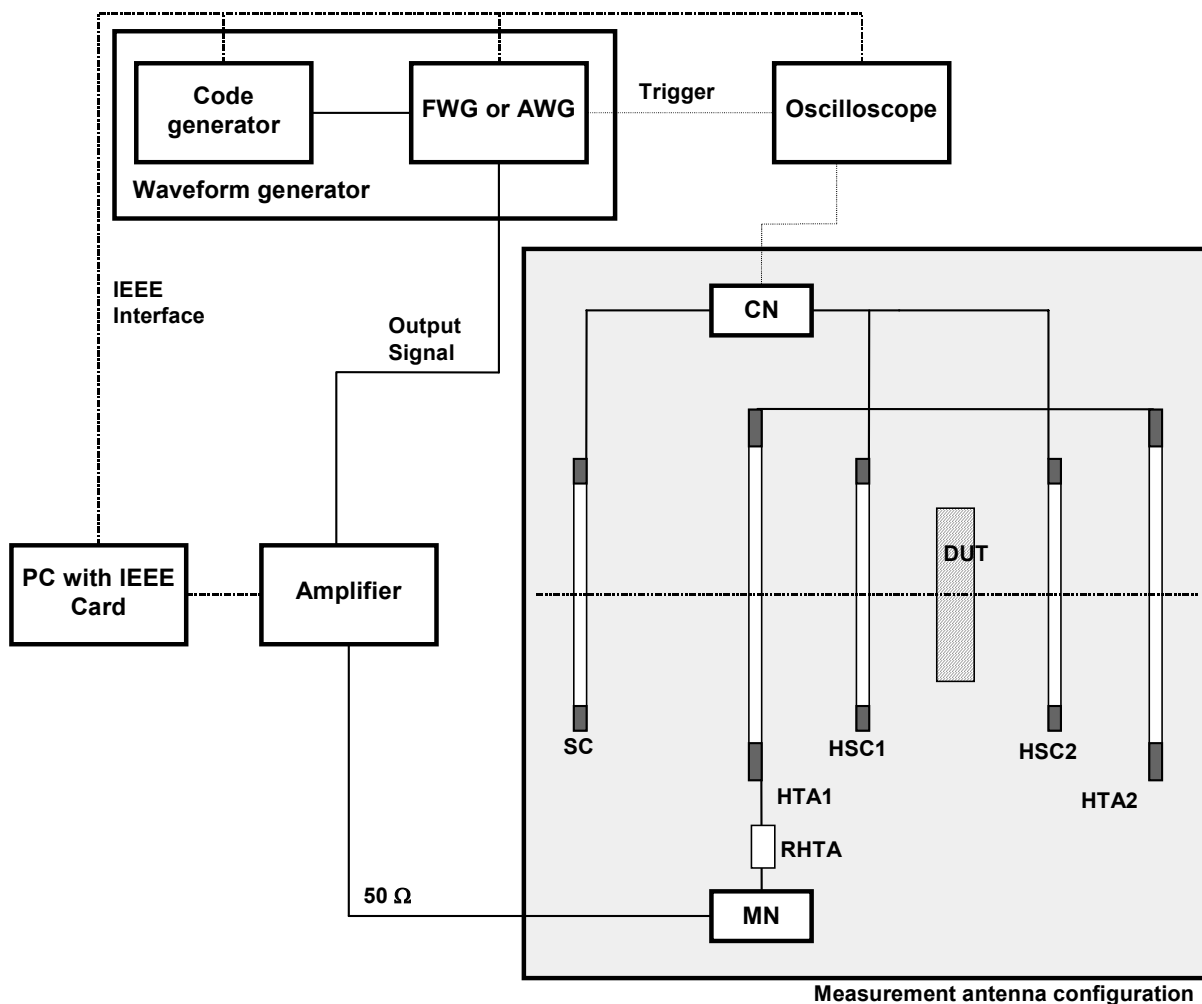


Figure 1 — Functional diagram

Amplifier: Amplifier with an output resistance of 50 Ω. (e.g. Amplifier Research 25A250A, 10 kHz – 250 MHz)

FWG: function waveform generator

AWG: arbitrary waveform generator

CN: compensation network

MN: matching network

HSC1: Helmholtz Sense Coil 1

HSC2: Helmholtz Sense Coil 2

HTA1: Helmholtz Transmitting Antenna 1

HTA2: Helmholtz Transmitting Antenna 2

RHTA: Serial measurement resistor with 4,7 Ω