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Information technology — Radio frequency identification device performance test methods —

Part 3:
Test methods for tag performance

Technologies de l'information — Méthodes d'essai des performances du dispositif d'identification par radiofréquence —

Partie 3: Méthodes d'essai des perfomances du tag

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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.

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 document 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 and IEC 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/IEC JTC 1, *Information technology*, Subcommittee SC ##, *[name of subcommittee]*.

This second/third/... edition cancels and replaces the first/second/... edition (ISO/IEC #####:####), which has been technically revised.

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

— Change of the frequency range to 860 – 930 MHz, as Japan (and no other country) any longer supports a frequency in the 930 – 960 MHz range

— Adaptation of test method for 860-930 MHz band based on 10 years experience of the use of this standard.

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

Introduction

RFID technology has broad applicability to the Automatic Identification and Data Capture (AIDC) industry in item management. As a wireless communication technique based on Radio Frequency technology the applications cover multiple levels of the industrial, commercial and retail supply chains. These may include:

— Freight containers

— Returnable Transport Items (RTI)

— Transport units

— Product packaging

— Product tagging

Performance tests define test methods that deliver results that allow the comparison of different RFID systems, interrogator and tags in order to select among them for use in a particular application.

The performance characteristics of devices (tags and interrogation equipment) may vary drastically due to application factors as well as the particular RFID air interface (frequency, modulation, protocol, etc.) being supported. Of key concern is the matching of the various performance characteristics to the user application. Additionally, in an open environment users of such technology demand multiple sources for these devices from technology providers. A key challenge is a method of evaluating the differences between various technology providers' products in a consistent and equitable manner.

This International Standard provides a framework for meeting the above noted concern and challenges. To this end, clear definitions of performance as relate to user application of RFID technology in the supply chain are provided. Based on such application-based definitions test methods are defined with attention to the test parameters required for a consistent evaluation of RFID devices.

Of particular significance, these tests are defined for RFID devices having one antenna. It is common practice to have products with both single and multiple antennas to define an RFID transaction zone sufficient for the application. The defined methods can easily be extended from equipment with a single antenna to apply to equipment with multiple antennas, in order to evaluate performance under conditions more closely matching those of a particular application.

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of patents.

The ISO and IEC take no position concerning the evidence, validity and scope of these patent rights.

The holder of this patent right has assured the ISO and IEC that he is prepared to grant a free license to an unrestricted number of applicants on a worldwide, non-discriminatory basis and under other reasonable terms and conditions to make, use, and sell RFID reader antenna design / patterns for implementations of this ISO/IEC International Standard, which is related to testing. In this respect, the

statements of the holder of this patent right are registered with the ISO and IEC. Information may be obtained from the following company.

Contact details	Patent number	Affected subclause(s) in this part of ISO/IEC 18046
Impinj inc 701 N. 34th Street, Suite 300 Seattle, WA 98103 Tel: 206/517-5300 Fax: 206/517-5262	Patent pending	6.3.2, 7.1.2.3, 7.3.2.3, 7.4.2.1, 7.5.2.1, 7.6.2.3

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The latest information on IP that may be applicable to this part of ISO/IEC 18046 can be found at www.iso.org/patents.

Information technology — Radio frequency identification device performance test methods —

Part 3:
Test methods for tag performance

1 Scope

This International Standard defines test methods for performance characteristics of RFID tags for item management and specifies the general requirements and test requirements for tags which are applicable to the selection of the devices for an application. The summary of the test reports forms a unified tag datasheet. It does not apply to testing in relation to regulatory or similar requirements.

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 18000-1, *Information technology — Radio-frequency identification for item management — Part1: Reference architecture and definition of parameters to be standardized*

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

ISO/IEC 18000-3, *Information technology — Radio frequency identification for item management — Part 3: Parameters for air interface communications at 13,56 MHz*

ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz General*

ISO/IEC 18000-61, *Information technology — Radio frequency identification for item management — Part 61: Parameters for air interface communications at 860 MHz to 960 MHz Type A*

ISO/IEC 18000-62, *Information technology — Radio frequency identification for item management — Part 62: Parameters for air interface communications at 860 MHz to 960 MHz Type B*

ISO/IEC 18000-63, *Information technology — Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C*

ISO/IEC 18000-64, *Information technology — Radio frequency identification for item management — Part 64: Parameters for air interface communications at 860 MHz to 960 MHz Type D*

ISO/IEC 18000-7, *Information technology — Radio frequency identification for item management — Part 7: Parameters for active air interface communications at 433 MHz*

ISO/IEC 18047-2, *Information technology — Radio frequency identification device conformance test methods — Part 2: Test methods for air interface communications below 135 kHz*

ISO/IEC/TR 18047-3, *Information technology — Radio frequency identification device conformance test methods — Part 3: Test methods for air interface communications at 13,56 MHz*

ISO/IEC/TR 18047-4, *Information technology — Radio frequency identification device conformance test methods — Part 4: Test methods for air interface communications at 2,45 GHz*

ISO/IEC 18047-6:2017, *Information technology — Radio frequency identification device conformance test methods — Part 6: Test methods for air interface communications at 860 MHz to 960 MHz*

ISO/IEC/TR 18047-7, *Information technology — Radio frequency identification device conformance test methods — Part 7: Test methods for active air interface communications at 433 MHz*

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

3 Terms and definitions

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

4 Symbols and abbreviated terms

f_{TSBR}	frequency tag side band right (frequency of the right side band of the tag spectrum)
f_{TSBL}	frequency tag side band left (frequency of the left side band of the tag spectrum)
$H_{THR\ Identification}$	Identification magnetic field threshold
$H_{THR\ Read}$	Reading magnetic field threshold
$H_{THR\ Write}$	Writing magnetic field threshold
H_{max}	Maximum operating magnetic field
$H_{Survival}$	Survival magnetic field
Lm	Load Modulation
Pmin	Minimum power operation threshold (Scientific: power received by the isotropic antenna from the E-field that is the minimum one for the tag to turn-on.)
$P_{min,identification}$	Minimum operation power to read the tag identifier
$P_{min,read}$	Minimum operation power to read from the tag memory
$P_{min,write}$	Minimum operation power to write to the tag memory
P_{back}	Backscatter power at tag position
$S_{Degradation}$	Sensitivity degradation
P_{max}	Maximum operating power of tag
$P_{survival}$	Survival power of tag
$I_{Rejection}$	Interference rejection
G	Antenna gain
D	Distance between the tag and the antenna
MPE	Maximum Permissible human Exposure
SAR	Specific Absorption Rate

5 Conditions applicable to the test methods

5.1 Number of tags to be tested

All measurements defined in this document may be performed on a single tag, but higher sampling numbers may be required for measurement campains for statistical purpose.

5.2 Test environment

Unless otherwise specified, testing shall take place in air environment of temperature 23 °C +/- 3 °C (73 °F +/-5 °F) and of relative humidity 40 % to 60 %.

5.3 RF environment

The tests shall be performed in a known RF environment.

For measurements of propagative UHF tags (ISO/IEC 18000-61, ISO/IEC 18000-62, ISO/IEC 18000-63 or ISO/IEC 18000-64) an anechoic chamber is the recommended test environment.

For measurement of inductive tags at frequencies below 30 MHz a typical laboratory environment is sufficient, where consideration is given to minimize the impact of electromagnetic sources that may influence the results.

5.4 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.

5.5 Default tolerance

Unless otherwise specified, a default tolerance of +/- 5 % shall be applied to the quantity values given to specify the characteristics of the test equipment (e.g. linear dimensions) and the test method procedures (e.g. test equipment adjustments).

For power values represented in dB or dBm the tolerance shall be +/- 0.5 dB.

NOTE +/- 0.5 dB is approximately +/- 12% of the non-logarithmics value.

5.6 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/IEC Guide 98-3:2008.

5.7 Test result reporting

Each test result shall be reported with the number of samples tested. For statistical evaluation optionally the minimum value, maximum value, mean value and standard deviation may be reported as well.

5.8 Test mounting material

For UHF tags, the tests may be performed with or without applied mounting material. When the mounting material is defined by the tag manufacturer, the tests shall be performed with the specified mounting material and in the free air.

If the dielectric parameter or other critical parameters of material are known, then they should be notified in the test report.

5.9 Test communication parameters

All the tests can be done for various communication parameters (forward and return link). The tests conditions shall be recorded in the test report.

5.10 Test equipment limits

Test equipment for survivability field maximum level shall be able to handle the maximum level declared by the product vendor. It shall be ensured that the test equipment is not limiting the performance measurement.

5.11 Human exposure to EMF

High magnetic or electromagnetic field strength may exceed the limits of maximum permissible human exposure to EMF, which should be considered accordingly.

NOTE FCC guidelines for MPE and SAR or EC 1999/519/CE are examples for relevant documents.

6 Setup of test equipment for tag test

6.1 Test apparatus and test circuits for ISO/IEC 18000-2 tags

This clause defines the test apparatus and test circuits for verifying the operation of a tag according to the base standard ISO/IEC 18000-2. The test set-ups used shall be as described in ISO/IEC 18047-2.

6.2 Test apparatus and test circuits for ISO/IEC 18000-3 tags

This clause defines the test apparatus and test circuits for verifying the operation of a tag according to the base standard ISO/IEC 18000-3. The test set-ups used shall be as described in ISO/IEC 18047-3.

As the test apparatus described in ISO/IEC 18047-3 is only designed for a magnetic field strength up to 5 A/m the test set-ups as described in Annex B shall be used for magnetic field strength >5 A/m.

6.3 Test apparatus and test circuits for ISO/IEC 18000-61, ISO/IEC 18000-62, ISO/IEC 18000-63 and ISO/IEC 18000-64 tags

6.3.1 Propagative UHF tags measurement

6.3.1.1 General

This clause defines the test apparatus and test circuits for verifying the operation of a tag according to the base standards ISO/IEC 18000-61, 62, -63 and -64. The test set-up used for measurement of propagative UHF tags shall as shown in 6.3.1.2. Alternatively, the test setup described in ISO/IEC 18047-6 may be used.

6.3.1.2 Setup of the devices

The test setup shall be according either using a bistatic test setup as in Figure 1 or a monostatic test setup as in Figure 2. It shall be ensured that the Test Equipment (TE) receiver is sensitive enough to not limit the measurements.

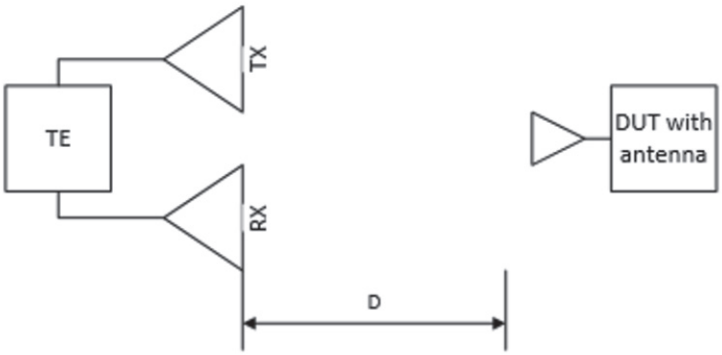

Figure 1 — Bistatic test setup

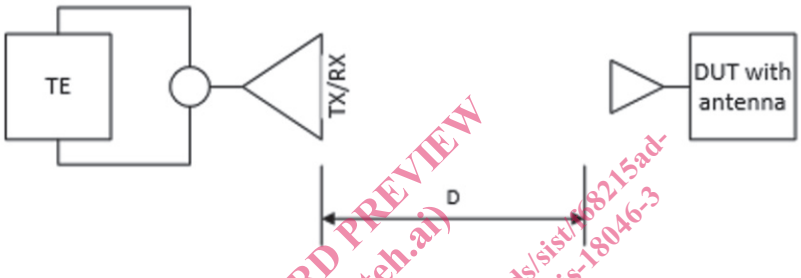

Figure 2 — Monostatic test setup

6.3.1.3 DUT placement

The DUT shall be placed in the far field according Figure 1 or Figure 2. The distance D shall be at least as in Formula (1):

$$D = \frac{2L^2}{\lambda} \tag{1}$$

where λ lamda is the wavelength and L is the maximum dimension of the test antenna.

6.3.1.4 Antenna polarization and requirements

For propagative UHF tests, a linear or circular polarized antenna shall be used, except when testing tags that have more than one antenna or for sensitivity degradation measurements, in which case a circular polarized antenna shall be used.

The circular polarized antenna shall have an axial ratio that is less than 1 dB over the frequency and orientation ranges of the testing.

Antennas used together in one measurement setup shall have the same gain with a VSWR < 1:2.

6.3.1.5 Test set-up for interference rejection measurement of propagative UHF tags

Figure 3 and Figure 4 show the test set-up arrangements for interference rejection measurement: