INTERNATIONAL STANDARD

ISO/IEC 22536

First edition
2005-07-15

Information technology — Telecommunications and information exchange between systems — Near Field Communication Interface and Protocol (NFCIP-1) — RF interface test methods

Technologies de l'information — Télécommunications et échange d'information entre systèmes — Interface et protocole de communication en champ proche (NFCIP-1) — Méthodes d'essai pour interface RF

Reference number
ISO/IEC 22536:2005(E)

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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.

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 22536 was prepared by Ecma International (as ECMA-356) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in parallel with its approval by national bodies of ISO and IEC.

Information technology — Telecommunications and information exchange between systems — Near Field Communication Interface and Protocol (NFCIP-1) — RF interface test methods

1 Scope

This International Standard is part of a suite of standards that specify tests for ISO/IEC 18092. It defines test methods for the RF-interface. This International Standard specifies RF-test methods for NFC devices with antennas fitting within the rectangular area of 85 mm by 54 mm.

This test standard, the first of two parts, specifies compliance tests for the RF interface of ISO/IEC 18092 devices. The companion test standard specifies protocol tests for ISO/IEC 18092.

Ecma purposefully aligned this International Standard with ISO/IEC 10373-6 to allow testing laboratories to reuse equipment and expertise.

2 Conformance

A system implementing ISO/IEC 18092 is in conformance with this International Standard if it meets all the mandatory requirements specified herein.

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/IEC 18092:2004, *Information technology — Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1)*

4 Conventions and notations

4.1 Representation of numbers

The following conventions and notations apply in this document unless otherwise stated.

— Letters and digits in parentheses represent numbers in hexadecimal notation.

— The value of a bit is denoted by ZERO or ONE.

— Numbers in binary notation and bit patterns are represented by strings of digits 0 and 1 shown with the most significant bit to the left. Within such strings, X may be used to indicate that the value of a bit is not specified within the string.

4.2 Names

The names of basic elements, e.g. specific fields, are written with a capital initial letter.

4.3 Test report

The test report Includes the number of passed tests versus the total number of tests, the number of different samples and the date of the tests, see Annex D.

5 Abbreviations and acronyms

ar	Reference device width
br	Reference device height
ch	Calibration coil height
cw	Calibration coil width
cr	Calibration coil corner radius
dis	Distance between field generating antenna and sense coils
DFT	Discrete Fourier Transformation
DUT	Device under test
fc	Frequency of the operating field
fs	Frequency of subcarrier at 106 kbit/s in passive communication mode
H_{max}	Maximum field strength of the Initiator antenna field
H_{min}	Minimum field strength of the Initiator antenna field
$H_{Threshold}$	Minimum field strength for the RF level detector
$L_{Calcoil}$	Inductance of the calibration coil
$L_{Refcoil}$	Inductance of the reference device
lx	Length of test assembly connection cable
lya	Field generating and sense coil PCB width
lyb	Field generating and sense coil PCB height
lyd	Field generating coil diameter
lyw	Field generating coil track width
NFC	Near Field Communication
nr	Number of turns of reference device
oh	Calibration coil outline height
ow	Calibration coil outline width
PCB	Printed Circuit Board
RF	Radio Frequency
$R_{Calcoil}$	Resistance of the calibration coil
$R_{Refcoil}$	Resistance of the reference device
rs	Sense coil corner radius
sa	Sense coil width

sb	Sense coil height
sr	Reference device track spacing
wr	Reference device track width

6 Default items applicable to the test methods

6.1 Test environment

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

6.2 Default tolerance

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

6.3 Spurious Inductance

Resistors and capacitors shall have negligible inductance.

6.4 Total measurement uncertainty

The measurement uncertainty shall be recorded.

NOTE Basic information is given in “ISO Guide to the Expression of Uncertainty in Measurement“, ISBN 92-67-10188-9, 1993.

7 Test Set-up and test circuits

The test set-up includes:

- Calibration coil
- Test assembly
- Reference devices
- Digital sampling oscilloscope

These are described in the following clauses.

This test set-up applies to NFCIP-1 devices with antennas fitting within the rectangular area of 85 mm by 54 mm.

7.1 Calibration coil

This clause defines the size, thickness and other characteristics of the calibration coil.

7.1.1 Size of the calibration coil

The calibration coil shall be integrated in a PCB that consists of an area, which has the height and width defined in Table 1 containing a single turn coil concentric with the calibration coil outline. Figure 1 illustrates the calibration coil.

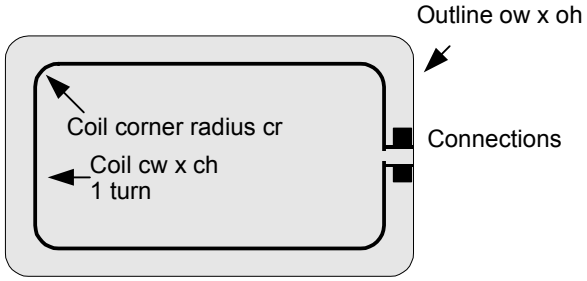

Figure 1 — Calibration coil

7.1.2 Thickness and material of the calibration coil PCB

The thickness of the calibration coil PCB shall be 0,76 mm ±10 %. It shall be constructed of a suitable insulating material.

7.1.3 Coil characteristics

The coil shall have one turn. The outer size of the coil shall have a corner radius cr as defined in Table 1.

The coil is made as a printed coil on a PCB plated with 35 µm copper. Track width shall be 500 µm ± 20 %. The size of the connection pads shall be 1,5 mm by 1,5 mm.

Table 1 — Definition of calibration coil

Name	Symbol	Value
Outline width	ow	85 mm (+/-2 %)
Outline height	oh	54 mm (+/-2 %)
Coil width	cw	72 mm (+/-2 %)
Coil height	ch	42 mm (+/-2 %)
Coil corner radius	cr	5 mm (+/-2 %)

NOTE At 13,56 MHz the approximate inductance $L_{Calcoil}$ is 250 nH and the approximate resistance is $R_{Calcoil}$ 0,4 Ohm.

A high impedance oscilloscope probe (e.g. >1 MOhm, <14 pF) shall be used to measure the (open circuit) voltage in the coil. The resonant frequency of the whole set (calibration coil, connecting leads and probe) shall be above 60 MHz.

The open circuit calibration factor for this coil is 0,32 Volts (rms) per A/m (rms) [Equivalent to 900 mV (peak-to-peak) per A/m (rms)].

NOTE A parasitic capacitance of the probe assembly of less than 35 pF normally ensures a resonant frequency for the whole set of greater than 60 MHz.

NOTE The high impedance oscilloscope probe ground connection should be as short as possible, less than 20 mm or alternatively use a coaxial connection.

7.2 Test assembly

The test assembly for load modulation consists of a field generating antenna and two parallel sense coils: sense coil a and sense coil b. The test assembly set-up is shown in Figure 2. The sense coils are connected such that the signal from one coil is in opposite phase to the other. The potentiometer P1 serves to fine adjust the balance point when the sense coils are not loaded by a Target or any magnetically coupled circuit. The capacitive load of the probe including its parasitic capacitance shall be less than 14 pF.

NOTE The capacitance of the connections and oscilloscope probe should be kept to a minimum for reproducibility.

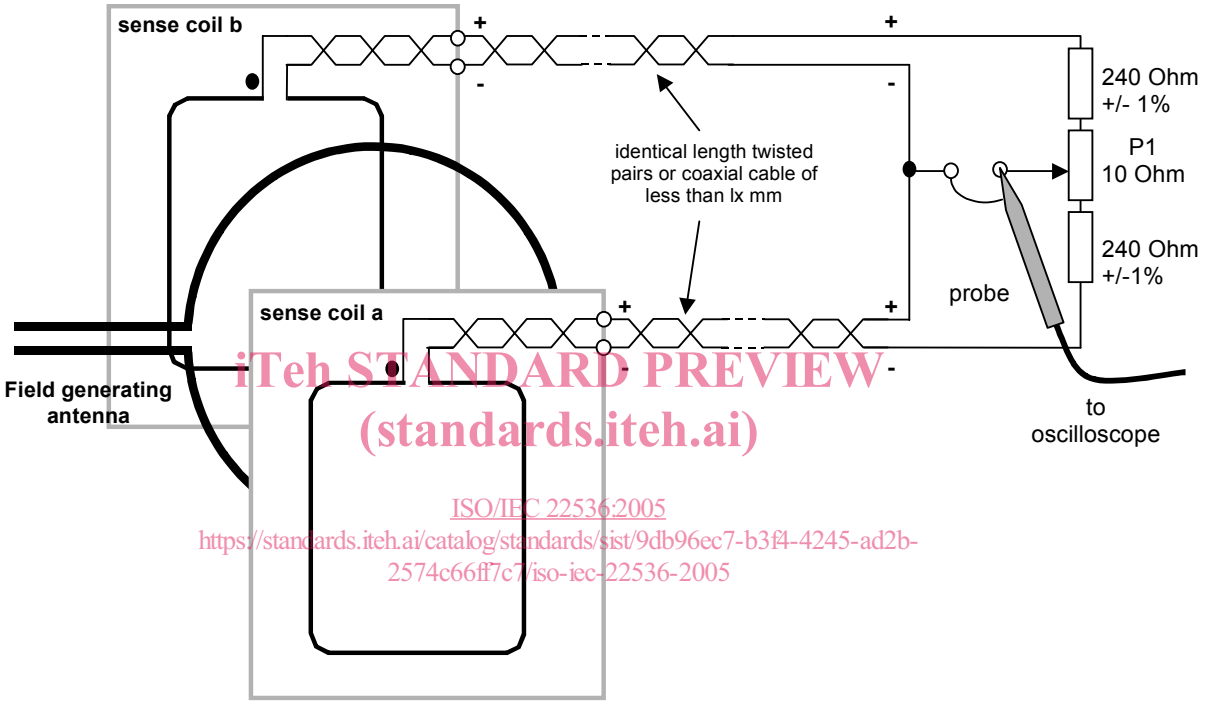

Figure 2 — Test assembly set-up (principle)

NOTE In order to avoid any unintended misalignment in case of an unsymmetrical set-up, the tuning range of the potentiometer P1 is only 10 Ohms. If the set-up cannot be compensated by the potentiometer P1 the symmetry of the set-up should be checked.

NOTE The high impedance oscilloscope probe ground connection should be as short as possible, less than 20 mm or alternatively use a coaxial connection.

7.2.1 Field generating antenna

The field generating antenna shall have a diameter and a construction as specified in Annex A. To match the impedance of the antenna to the antenna output driver a matching circuit as defined in Annex A2 shall be used. The antenna shall be tuned to 50 Ohm by the matching circuit using suitable measurement equipment such as an impedance analyser or a measurement bridge.

7.2.2 Sense coils

The size and the sense coil layout and assembly are specified in Annex B.

7.2.3 Arrangement of the test assembly

The sense coils and field generating antenna are assembled parallel and with the sense and antenna coils coaxial and such that the distance between the active conductors has the value dis in Table 2. The distance between the coil in the DUT and the calibration coil shall be equal with respect to the coil of the field generating antenna. There shall be a 3 mm air space between the DUT and sense coil a in order to avoid parasitic effects such as detuning by closer spacing or ambiguous results due to noise and other environmental effects. The antenna of the DUT shall be placed in parallel to the sense coils.

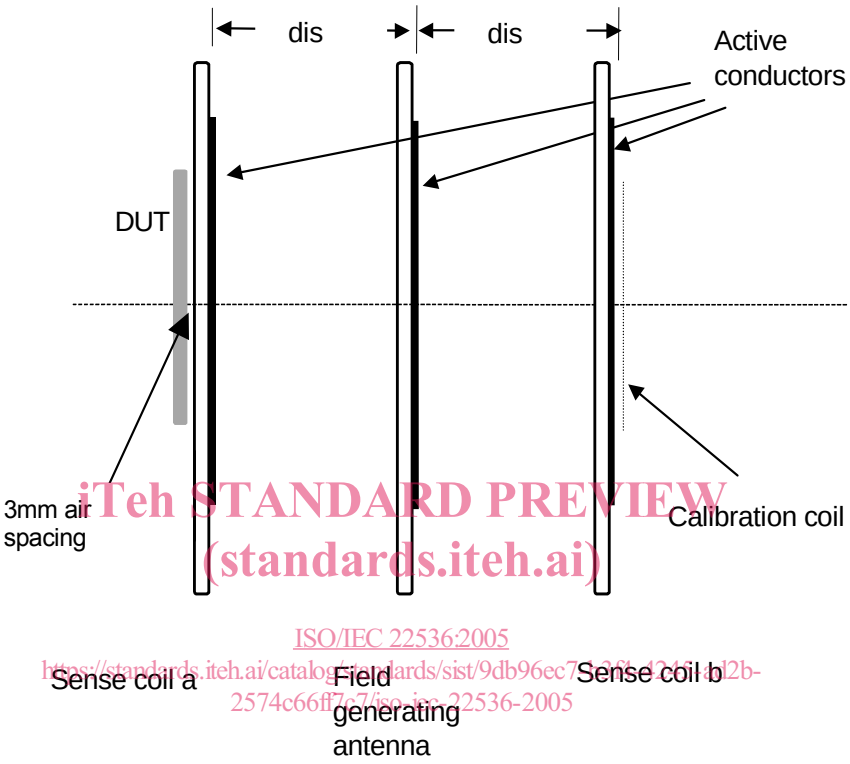

Figure 3 — Test assembly

Table 2 — Definition of test assembly

Name	Symbol	Value
Distance	dis	37,5 mm
Sense coil connection cable length (max.)	lx	100 mm

7.3 Reference devices

Reference devices are used to measure:

— The Initiator power: to verify that the Initiator generates a field with a field strength within the range of H_{min} and H_{max} (under conditions of loading by a Target).

— The load modulation: to verify that the Target exerts at least the minimum load modulation.