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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

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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.

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

ISO/IEC 22536:2013 was prepared jointly by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 6, *Telecommunications and information exchange between systems.*

This second edition cancels and replaces the first edition (ISO/IEC 22536:2005), which has been technically revised.

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 NFCIP-1 devices with antennas fitting within the rectangular area of 50 mm by 40 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 ISO/IEC 23917 specifies protocol tests for ISO/IEC 18092.

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:—[1], *Information technology — Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1)*

ISO/IEC 10373-6:2011, *Identification cards — Test methods — Part 6: Proximity cards*

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 single quotes represent numbers in hexadecimal notation.

— The value of a bit is denoted by (0)b or (1)b.

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

[1] To be published.

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 A.

5 Abbreviations and acronyms

In addition to the abbreviations and acronyms in ISO/IEC 18092, the following apply.

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_m	Maximum external field strength for not preventing the Initiator to switch on its RF field
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
PCB	Printed Circuit Board
RF	Radio Frequency

6 Default items applicable to the test methods

6.1 Test environment

See 4.1 of ISO/IEC 10373-6.

6.2 Default tolerance

See 4.3 of ISO/IEC 10373-6.

6.3 Spurious Inductance

See 4.4 of ISO/IEC 10373-6.

6.4 Total measurement uncertainty

See 4.5 of ISO/IEC 10373-6.

6.5 Antenna class

Tests shall be executed for class 3 antenna as specified in ISO/IEC 10373-6:2010/Amd.1.

NOTE When the antenna size used for NFCIP-1 device is larger than “Class 3” antenna, “Class 1” antenna as specified in ISO/IEC 10373-6:2011/Amd.1 may be used in addition to “Class 3” antenna.

7 Test Set-up and test circuits

The test set-up includes:

— Digital sampling oscilloscope;

— Calibration coil;

— Test assembly;

— Reference Device.

These are described in the following clauses.

7.1 Digital sampling oscilloscope

See ISO/IEC 10373-6, 5.1.1.

7.2 Calibration coil

See ISO/IEC 10373-6, 5.2.

7.3 Test assembly

See ISO/IEC 10373-6, 5.3.

7.4 Reference Device

The Reference Device is used to test the ability of an Initiator to:

— generate a field strength of at least H_{min} and not exceeding H_{max};

— transmit a modulated signal to a Target;

— receive a load modulation signal from the Target in passive communication mode

in its operating volume.

The Reference Device is used to test the ability of a Target to:

— generate a field strength of at least H_{min} and not exceeding H_{max} in active communication mode;

— transmit a modulated signal to an Initiator

in its operating volume.

7.4.1 Dimensions of the Reference Device

See ISO/IEC 10373-6, 5.4.1.

7.4.2 Reference Device construction

See ISO/IEC 10373-6, 5.4.2. The Reference Device coils layouts shall be as defined in ISO/IEC 10373-6:2010 Amd.1, Annex D.3.

NOTE When the antenna larger than “Class 3”, the Reference Device 1 coils as defined in ISO/IEC 10373-6:2011/ Amd.1 Annex D.1 may be used in addition to the Reference Device 3.

7.4.3 Reference Device resonance frequency tuning

See ISO/IEC 10373-6, 5.4.3.

8 Functional Test – Initiator

8.1 Initiator RF field detection

8.1.1 Purpose

The purpose of this test is to verify that the Initiator detects an external RF field with a field strength higher than $H_{Threshold}$ as specified in 8.4 of ISO/IEC 18092.

8.1.2 Test procedure

The test assembly as specified in 7.3 is used.

Step 1:

The RF power delivered by the signal generator to the Test PCD antenna shall be adjusted to the required field strength in the range of 0 up to H_{max} as measured by the calibration coil without any NFCIP-1 device.

The output of the test circuit is connected to a digital sampling oscilloscope. The potentiometer P1 shall be trimmed to minimize the residual carrier. This signal shall be at least 40 dB lower than the signal obtained by shorting one sense coil so that it can be used to detect if the DUT switches on the RF field.

Step 2:

The NFCIP-1 device under test shall be placed in the DUT position, concentric with sense coil a. The DUT shall be set into Initiator mode.

The signal generator shall start to generate a non-modulated RF-field at the frequency *fc*. The field strength shall be increased linearly in the range from 0 up to maximum field strength H_m which can be applied, not preventing the Initiator to switch on its RF field.

The test shall verify if the Initiator correctly handles its RF-field:

The DUT passes this test if H_m is below $H_{Threshold.}$

8.1.3 Test report

The test report shall indicate whether the Initiator behaves correctly according to the procedure described in 8.1.2.

8.2 Initiator field strength in active and passive communication mode

8.2.1 Purpose

The purpose of this test is to verify that the field strength produced by an Initiator in its operating volume as specified in 8.2 of ISO/IEC 18092.

8.2.2 Test procedure

See ISO/IEC 10373-6, 7.1.1.2.

8.2.3 Test report

See ISO/IEC 10373-6, 7.1.1.3.

8.3 Initiator modulation index and waveform transmission in active and passive communication mode

8.3.1 Purpose

The purpose of this test is to verify that the modulation index of the Initiator field as well as the rise and fall times and the overshoot values for all bit rates are as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092 within the defined operating volume.

8.3.2 Test procedure

See ISO/IEC 10373-6, 7.1.4.2.

8.3.3 Test report

The test report shall give the measured modulation index of the Initiator field, the rise and fall times and overshoot values, within the defined operating volume in unloaded and loaded conditions.

8.4 Initiator load modulation reception in passive communication mode

8.4.1 Purpose

The purpose of this test is to verify that the Initiator detects the load modulation of a Target as specified in 9.3.2.2 and 9.3.3.2 of ISO/IEC 18092.

8.4.2 Test procedure

See ISO/IEC 10373-6, 7.1.5.2.

8.4.3 Test report

The test report shall give the Initiator load modulation for the tested positions.

8.5 Initiator modulation index and waveform reception in active communication mode

8.5.1 Purpose

The purpose of this test is used to verify that the Initiator detects the modulation waveforms of a Target in active communication mode as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092.

8.5.2 Bit rate of 106 kbit/s

8.5.2.1 Test condition

See ISO/IEC 10373-6, 7.2.2.2.1.

8.5.2.2 Test procedure

The test assembly as defined in 7.3 is used.

Under the conditions defined in 8.5.2.1 the Initiator shall detect the modulation waveform sent by the test assembly and continue normal operation.

8.5.2.3 Test report

The test report shall confirm the intended operation of the Initiator. Used test conditions shall be mentioned in the test report.

8.5.3 Bit rates of 212 kbit/s and 424 kbit/s

8.5.3.1 Test condition

See ISO/IEC 10373-6 7.2.2.3.1.

8.5.3.2 Test procedure

The test assembly as defined in 7.3 is used.

Under the conditions defined in 8.5.3.1 the Initiator shall detect the modulation waveform sent by the test assembly and continue normal operation.

8.5.3.3 Test report

The test report shall confirm the intended operation of the Initiator. Used test conditions shall be mentioned in the test report.

8.6 Initiator maximum loading effect test in active communication mode (Optional)

8.6.1 Purpose

The purpose of this test is to understand that the loading effect of the Initiator during reception in active communication mode is whether less or more than that of the Reference Device.

8.6.2 Test procedure

As defined for the Class 3 PICC in ISO/IEC 10373-6:2010/Amd.1, 7.2.4.2 and a DC voltage at CON3 of 4,5 V.

8.6.3 Test report

See ISO/IEC 10373-6, 7.2.4.3.

9 Functional Test – Target

9.1 Target load modulation transmission in passive communication mode

9.1.1 Purpose

The purpose of these tests is to verify that the amplitude of the Target's load modulation signal is as specified in 9.3.2.2 and 9.3.3.2 of ISO/IEC 18092.

9.1.2 Test procedure

ISO/IEC 18092 specifies 3 different bit rates for the passive communication mode. The test for the Target in the passive communication mode shall be performed at 106 kbit/s, 212 kbit/s and 424 kbit/s.

9.1.2.1 Test procedure for 106 kbit/s

As defined for the PICC in ISO/IEC 10373-6, 7.2.1.2.

9.1.2.2 Test report at 106 kbit/s

If the amplitudes of the upper sideband *fc+fs* and the lower sideband *fc-fs* respectively are above the values specified in ISO/IEC 18092 then this test passes.

9.1.2.3 Test procedure for 212 kbit/s and 424 kbit/s

As specified for the PICC in ISO/IEC 10373-6, 7.2.1.2, but replace “subcarrier” by “carrier.

A REQA or REQB command sequence shall be replaced by a Polling Request command specified in ISO/IEC 18092, and a signal or load modulation response shall be replaced by a Polling Response command specified in ISO/IEC 18092.

9.1.2.4 Test report at 212 kbit/s and 424 kbit/s

If the amplitudes of the modulated data are above the values specified in ISO/IEC 18092 then this test passes.

9.2 Target field strength in active communication mode

Execute 8.2 for Target.

9.3 Target modulation index and waveform transmission in active communication mode

Execute 8.3 for Target.

9.4 Target modulation index and waveform reception in active and passive communication mode

Execute 8.5 by exchanging Target and Initiator.

9.5 Target maximum loading effect test in Passive communication mode (Optional)

See 8.6 for Target.

Annex A
(informative)

Test report template example

Supplier:

Product:

Legend:

passed tests = number tests that have been successfully performed

tests = total number of performed tests

samples = number of different DUTs

of tested positions = number of different positions in the operating volume

No	**Testname**		**Purpose**			
8.1	Initiator RF Level Detection		The purpose of this test is to verify that the Initiator detects an external RF field with a field strength higher than $H_{Threshold}$ as specified in 8.4 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests**	**# samples**	**Date**
	$H < H_{Threshold}$	DUT switches its RF field on				
	$H_{Threshold} = < H < H_{max}$	DUT does not switch its RF field on				

No	**Testname**		**Purpose**			
8.2	Initiator field strength in active and passive communication mode.		The purpose of this test is to verify that the field strength produced by an Initiator in its operating volume as specified in 8.2 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	Different positions in the operating volume	$H_{min} \leq H \leq H_{max}$				

No	**Testname**		**Purpose**			
8.3	Initiator modulation index and waveform transmission in active and passive communication mode.		The purpose of this test is to verify that the modulation index of the Initiator field as well as the rise and fall times and the overshoot values for all bit rates are as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092 within the defined operating volume.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	Different positions in the operating volume	Waveform parameters within requirements as defined in ISO/IEC 18092.				

No	**Testname**		**Purpose**			
8.4	Initiator load modulation reception in passive communication mode		The purpose of this test is to verify that the Initiator detects the load modulation of a Target as specified in 9.3.2.2 and 9.3.3.2 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	Different positions in the operating volume 106 kbit/s, 212 kbit/s, 424 kbit/s	Load modulation amplitude sensitivity below requirements as defined in ISO/IEC 18092.				

No	Testname		Purpose			
8.5	Initiator modulation index and waveform reception in active communication mode.		The purpose of this test is used to verify that the Initiator detects the modulation waveforms of a Target in active communication mode as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests**	**# samples**	**Date**
	H_{min}, H_{max} 106 kbit/s	If the Initiator correctly detects the applied modulation waveforms and continues normal operation then this test passes.				
	H_{min}, H_{max} 212 kbit/s	If the Initiator correctly detects the applied modulation waveforms and continues normal operation then this test passes.				
	H_{min}, H_{max} 424 kbit/s	If the Initiator correctly detects the applied modulation waveforms and continues normal operation then this test passes.				

No	Testname		Purpose			
8.6	Initiator maximum loading effect test in active communication mode (Optional)		The purpose of this test is to verify that the loading effect of the Initiator during reception in active communication mode is less than that of the Reference Device.			
	Conditions	**Expected Result**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	H_{min}	Loading effect less than that of Reference Device.				

No	Testname		Purpose			
9.1	Target load modulation transmission in passive communication mode		The purpose of these tests is to verify that the amplitude of the Target's load modulation signal is as specified in 9.3.2.2 and 9.3.3.2 of ISO/IEC 18092.			
	Condition	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests**	**# samples**	**Date**
	106 kbit/s	If the amplitudes of the upper sideband *fc+fs* and the lower sideband *fc-fs* respectively are above the values specified in ISO/IEC 18092 then this test passes.				
	212 kbit/s	If the amplitudes of the modulated data are above the values specified in ISO/IEC 18092 then this test passes.				
	424 kbit/s	If the amplitudes of the modulated data are above the values specified in ISO/IEC 18092 then this test passes.				

No	Testname		Purpose			
9.2	Target field strength in active communication mode.		The purpose of this test is to verify that the field strength produced by a Target in its operating volume as specified in 8.2 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	Different positions in the operating volume	$H_{min} \leq H \leq H_{max}$				

No	**Testname**		**Purpose**			
9.3	Target modulation index and waveform transmission in active communication mode.		The purpose of this test is to verify that the modulation index of the Target field as well as the rise and fall times and the overshoot values for all bit rates are as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092 within the defined operating volume.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	Different positions in the operating volume	Waveform parameters within requirements as defined in ISO/IEC 18092.				

No	**Testname**		**Purpose**			
9.4	Target modulation index and waveform reception in active and passive communication mode.		The purpose of this test is used to verify that the Target detects the modulation waveforms of an Initiator in active communication mode as specified in 9.2.1.2 and 9.2.2.2 of ISO/IEC 18092.			
	Conditions	**Expected Result according ISO/IEC 18092**	**# passed tests**	**# tests**	**# samples**	**Date**
	H_{min}, H_{max} 106 kbit/s	If the Target correctly detects the applied modulation waveforms and continues normal operation then this test passes.				
	H_{min}, H_{max} 212 kbit/s	If the Target correctly detects the applied modulation waveforms and continues normal operation then this test passes.				
	H_{min}, H_{max} 424 kbit/s	If the Target correctly detects the applied modulation waveforms and continues normal operation then this test passes.				

No	**Testname**		**Purpose**			
9.5	Target maximum loading effect test in passive communication mode (Optional)		The purpose of this test is to verify that the loading effect of the Target during reception in passive communication mode is less than that of the Reference Device.			
	Conditions	**Expected Result**	**# passed tests**	**# tests & # of tested positions**	**# samples**	**Date**
	H_{min}	Loading effect less than that of Reference Device.				

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