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Identification cards — Test methods — Part 6: Proximity cards

AMENDMENT 4

Additional test methods for PCD RF interface and PICC alternating field exposure

Cartes d'identification — Méthodes d'essai — Partie 6: Cartes de proximité

AMENDEMENT 4

Méthodes de test additionnelles pour l'interface RF des PCD et l'exposition des PICC au champ alternatif

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Amendment 4 to ISO/IEC 10373-6:2001 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

Identification cards — Test methods — Part 6: Proximity cards

AMENDMENT 4:

Additional test methods for PCD RF interface and PICC alternating field exposure

Page 2, Clause 3.1.2

Delete the entire subclause and the associated footnote.

Page 3 and 4, Clause 5

Replace 5, 5.1, 5.2 and 5.3 with the following:

5 Physical characteristics tests

5.1 Alternating magnetic field test

The purpose of this test is to check the behaviour of the PICC in relation to alternating magnetic field exposure. Alternating magnetic field shall be tested only at 13,56 MHz. No test is required at other frequencies.

5.1.1 Apparatus

The test PCD assembly shall be used to produce the alternating magnetic field.

5.1.2 Test procedure

The procedure is:

- a) Adjust the RF power delivered by the signal generator to the test PCD antenna to a field strength of 10 A/m rms as measured by the calibration coil.
- b) Place the PICC under test in the DUT position and readjust immediately the RF drive into the test PCD antenna to the required field strength.
- c) After 5 minutes, remove the PICC from the DUT position for at least 5 s.
- d) Adjust the RF power delivered by the signal generator to the test PCD antenna to a field strength of 12 A/m rms as measured by the calibration coil.
- e) Place the PICC under test in the DUT position and readjust immediately the RF drive into the test PCD antenna to the required field strength.
- f) Apply for 5 minutes an ASK 100% modulation to this field with the following duty cycle:
 - 5 s at 0 A/m rms;

— 25 s at 12 A/m rms.

g) Check that the PICC operates as intended.

5.1.3 Test report

The test report shall state whether or not the PICC operates as intended.

5.2 Alternating electric field test

No test is required.

5.3 Static electricity test

The purpose of this test is to check the behaviour of the card IC in relation to electrostatic discharge (ESD) exposure in the test sample. The PICC under test is exposed to a simulated electrostatic discharge (ESD, human body model) and its basic operation checked following the exposure.

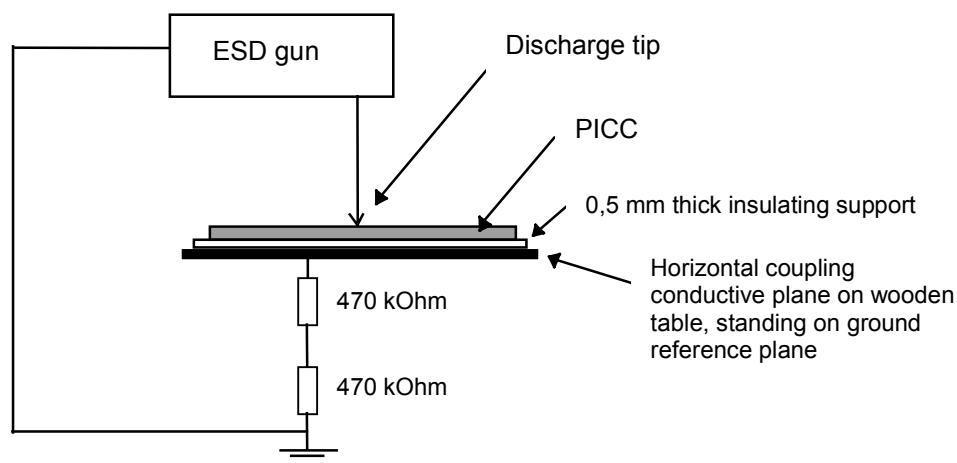


Figure 1 — ESD test circuit

5.3.1 Apparatus

Refer to IEC 61000-4-2:1995.

a) Main specifications of the ESD generator

- energy storage capacitance: 150 pF \pm 10 %
- discharge resistance: 330 Ohm \pm 10 %
- charging resistance: between 50 MOhm and 100 MOhm
- rise time: 0,7 to 1 ns

b) Selected specifications from the optional items

- type of equipment: table top equipment
- discharge method: direct application of air discharge to the equipment under test
- discharge electrodes of the ESD generator: Round tip probe of 8 mm diameter.

5.3.2 Test procedure

Connect the ground pin of the apparatus to the conductive plate upon which the PICC is placed.

Apply the discharge successively in normal polarity to each of the 20 test zones shown in figure 2. Then repeat the same procedure with reversed polarity. Allow a cool-down period between successive pulses of at least 10 s.

WARNING - If the PICC includes contacts, the contacts should face up and the zone which includes contacts should not be exposed to this discharge.

Check that the PICC operates as intended at the end of the test.

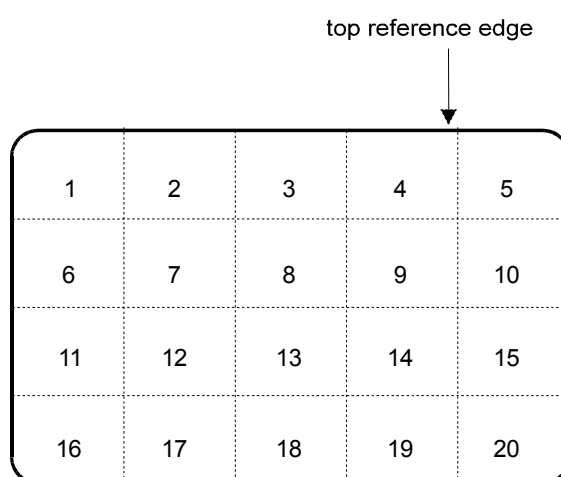


Figure 2 — Test zones on PICC for ESD test

5.3.3 Test report

The test report shall state whether or not the PICC operates as intended.

5.4 Static magnetic field test

No test is required.

Page 7, 6.3

Add a new clause 6.3.2 and renumber all subsequent clauses:

"6.3.2 Reference PICC for modulation index and waveform test

The schematic of this Reference PICC is shown in annex I. This Reference PICC includes a pick up coil with low coupling with the main coil. The pick up coil shall be connected to a high impedance oscilloscope probe. The main coil shall be calibrated with the following procedure:

- a) Calibrate the Test PCD assembly to produce the H_{\max} operating condition on the calibration coil.
- b) Tune the Reference PICC (Annex I) to 19 MHz:
 - 1) Set jumper J1 to position a;
 - 2) Drive the calibration coil directly from a signal generator set at 19 MHz;

- 3) Locate the calibration coil and the Reference PICC as close as possible with the axes of the two coils (calibration coil and Reference PICC main coil) being congruent;
 - 4) Adjust the Reference PICC capacitor C2 to maximum dc voltage at C4;
 - 5) Assure final reading of about 6 Volts (dc) at C4 of the Reference PICC by adjusting the generator drive level;
 - 6) Re-adjust the Reference PICC capacitor C2 to maximum dc voltage at C4, if necessary.
- c) Place the Reference PICC into the DUT position on the Test PCD assembly. Set jumper J1 to position b and adjust R2 to obtain 6 V (dc) at C4 measured with a high impedance voltmeter. Verify the operating field condition by monitoring the voltage on the calibration coil.

WARNING R2 value should be between 140 and 180 Ohm.

NOTE 1 The high impedance voltmeter wires should be twisted.

NOTE 2 The high impedance oscilloscope probe ground connection should be as short as possible, less than 20 mm or coaxial connection.

NOTE 3 When the PCD operating volume is large enough this tool may be replaced by the association of an independent calibration coil located as close as possible to the PCD antenna and a Reference PICC (Annex D) tuned and calibrated like the Reference PICC for modulation index and waveform test."

Page 3 of ISO/IEC 10373-6:2001/Amd.2:2003, 7.1.2

Add a warning before step 2:

"WARNING The PICC load modulation amplitude test should be done by increasing the field strength from 0 A/m, thus finding the minimum PICC operating field."

Page 5 of ISO/IEC 10373-6:2001/Amd.2:2003, 7.3.1

Add a warning at the end of the clause:

"WARNING The resonance frequency may depend on the field strength used during the measurement."

Page 5 of ISO/IEC 10373-6:2001/Amd.2:2003, Clause 7

Add a new clause 7.4:

"7.4 "Class 1" PICC maximum loading effect

7.4.1 Purpose

The following additional PICC test is necessary for interoperability between Class 1 PICCs and Class 1 PCDs.

NOTE This test improves interoperability only if the "Class 1" PICCs antenna size and location is very similar to the Reference PICC (Annex D) antenna size and location. For PICCs with different antenna size and/or location other classes may be created with, for each class, a corresponding reference PICC. Next revision of ISO/IEC 14443-1 will include the class(es) definition.

7.4.2 Test procedure

The PICC loading effect at H_{min} shall be measured using the test PCD assembly. It shall not exceed the loading effect of the reference PICC (Annex D) tuned to 13,56 MHz and calibrated to obtain 6 V (dc) at H_{min} . The procedure of this substitution method is:

- a) Calibrate the Test PCD assembly to produce the H_{min} operating condition on the calibration coil.

- b) Tune the Reference PICC (Annex D) to 13,56 MHz:
- 1) Set jumper J1 to position a;
 - 2) Drive the calibration coil directly from a signal generator set at 13,56 MHz;
 - 3) Locate the calibration coil and the Reference PICC as close as possible with the axes of the two coils being congruent;
 - 4) Adjust the Reference PICC capacitor C2 to maximum dc voltage at R1;
 - 5) Assure final reading of about 6 Volts (dc) at R1 of the Reference PICC by adjusting the generator drive level;
 - 6) Re-adjust the Reference PICC capacitor C2 to maximum dc voltage at R1, if necessary."
- c) Place the Reference PICC into the DUT position on the Test PCD assembly. Switch the jumper to R2 and adjust R2 to obtain 6 V (dc) across it measured with a high impedance voltmeter. Verify the operating field condition by monitoring the voltage on the calibration coil and readjust H_{\min} if necessary.

WARNING R2 value should be between 900 and 1000 Ohm.

NOTE The high impedance voltmeter wires should be twisted.

- d) Measure the field strength H_R monitored by the calibration coil when the Reference PICC is taken out.
- e) Place the PICC under test into the DUT position on the Test PCD assembly and readjust H_{\min} if necessary.
- f) Measure the field strength H_P monitored by the calibration coil when the PICC under test is taken out.

The field strength H_P shall be less than the field strength H_R .

7.4.3 Test report

The test report shall give the values H_R and H_P ."

Page 9, 8.1.2

Add a warning after step 3 of procedure for H_{\max} test:

"WARNING R2 value should be between 75 and 85 Ohm."

Page 10, 8.1.2

Add a warning after step 3 of procedure for H_{\min} test:

"WARNING R2 value should be between 400 and 550 Ohm."

Page 10, 8.3.2

Add the following paragraph and note after the note (in Amd.2):

"Repeat the test with the Reference PICC for modulation index and waveform test (annex I) located at various locations in the operating volume. Determine the worst case deviations of the modulation index and waveform characteristics.

NOTE The load does not represent the worst case loading effect of a PICC. Higher loading effects may be achieved with higher values of R2 and/or resonance frequency closer to carrier frequency."

Page 11, subclause 8.4.2

Replace the paragraph with the following:

"Annex E describes a Reference PICC and calibration procedure which allows the sensitivity of a PCD to load modulation to be assessed. This Reference PICC does not emulate the shunt action of all types of PICC, therefore it shall be calibrated at a given field strength H in the Test PCD assembly. It shall be used in the PCD field at a position where the field has the same value of H . The measurement of C3 (dc) voltage shall be exactly the same for both Reference PICC calibration and PCD load modulation test. The test procedure is:

- a) Place the Reference PICC at a particular position in the PCD operating volume.
- b) Adjust the Reference PICC components to produce the minimum load modulation detected by the PCD.
- c) Measure the voltage (dc) at C3.
- d) Place the Reference PICC in the DUT position on the Test PCD assembly.
- e) Adjust the Test PCD assembly to produce a field strength H which gives the same voltage (dc) at C3 and note the corresponding field strength by reading the calibration coil voltage.
- f) Measure the Reference PICC load modulation as described in 7.1 and compare it with the standard limit associated with the noted field strength.

WARNING The value of R6 and D5 should not be too low to avoid a strong clamping of the voltage at C3.

This procedure shall be repeated in various positions in the operating volume. Any position in which the PCD sensitivity is above the standard limit shall be considered out of the operating volume.

NOTE 1 The test coverage may be expanded by using different resonance frequencies such as 12, 13,56 and 15 MHz.

NOTE 2 The PCD sensitivity should be below the standard limit to ensure good reception of the PICC load modulation.

NOTE 3 This test does not check that the PCD reception is independent of the phase of the PICC load modulation. Consequently, it cannot guarantee the correct reception of any PICC compliant with 14443-2."

Page 11, Clause 8

Add a new clause 8.5:

"8.5 Field strength of PCDs supporting operation with "Class 1" PICCs

8.5.1 Purpose

The following additional PCD test is necessary for interoperability between PCDs and "Class 1" PICCs. This test is similar to PCD field strength test described in 8.1 but uses a Reference PICC with higher loading effect.

NOTE The loading effect of "Class 1" PICCs is lower than the loading effect of the Reference PICC used in this test (see "Class 1" PICC maximum loading effect test in 7.4). This guarantees that H_{\min} is supplied in the "Class 1" PCD operating volume if additionally the "Class 1" PICCs antenna size and location is very similar to the Reference PICC (Annex D) antenna size and location. For PICCs with different antenna size and/or location other classes may be created with, for each class, a corresponding reference PICC. Next revision of ISO/IEC 14443-1 will include the class(es) definition.

8.5.2 Test procedure

The PCD field strength test defined in 8.1.2, procedure for H_{\min} test, shall be repeated with the Reference PICC (Annex D) calibrated to obtain 6 V (dc) across R2 instead of 3 V (dc).

NOTE The Reference PICC calibration used in this test is the same as the calibration defined in step c) of 7.4.2.

8.5.3 Test report

The test report shall give the dc voltage measured across R2 at H_{\min} under the conditions applied.

NOTE The volume in which the dc voltage exceeds 6 V (dc) defines the “Class 1” operating volume.”

At the end of the document

Add the following annex to the standard:

Annex I (normative)

Reference PICC for modulation index and waveform test

I.1 Antenna layout

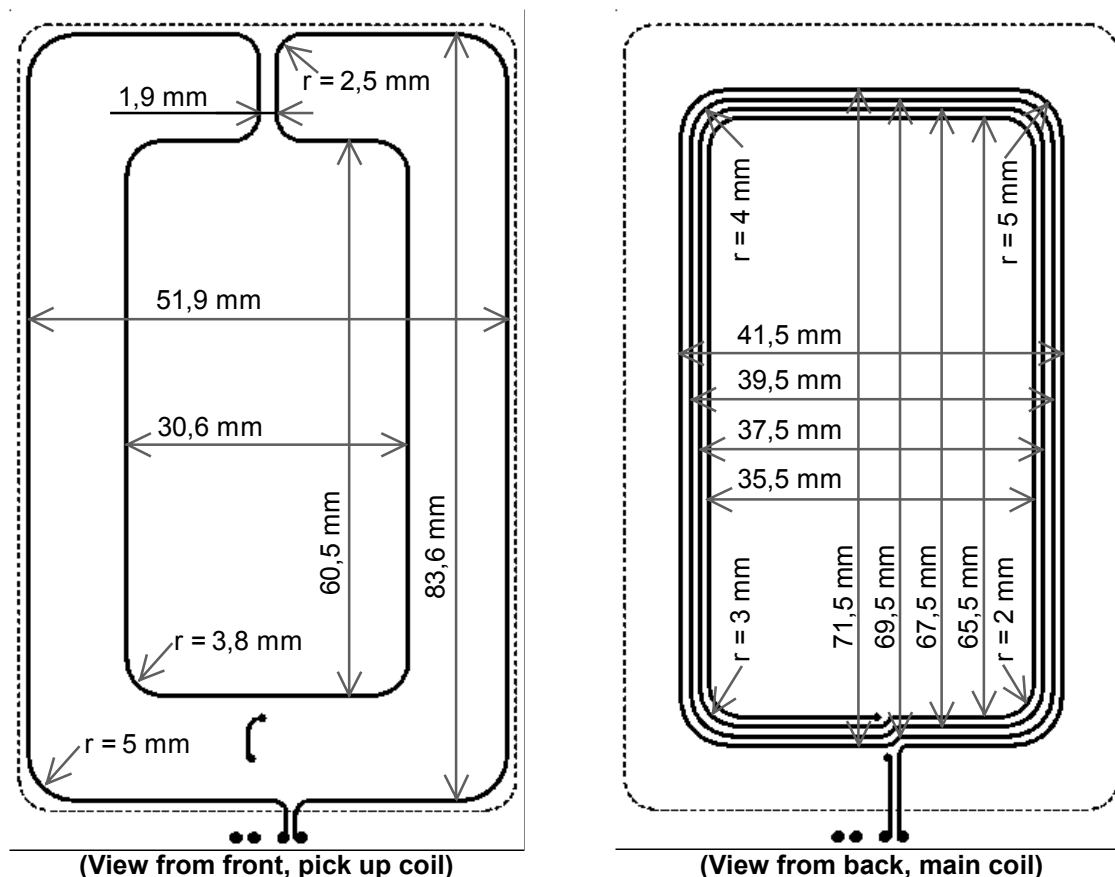


Figure I.1 — Antenna Layout

Dimensions in millimetres to track centre (drawings are not to scale).

The pick up coil and the main coil shall be concentric.

The two coils track width and spacing shall be 0,5 mm with a relative tolerance of $\pm 20\%$.

PCB: FR4 material thickness 0,76 mm with a relative tolerance of $\pm 10\%$, double sided with 35 μ m copper.

NOTE 1 The main coil printed on the back side is the same coil used for the reference PICC, defined in 6.3.5 (i.e. 4 concentric turns wound within an outer size of 72 mm x 42 mm).

NOTE 2 PCBs and finished tools may be made available by:

arsenal research

RFID Testlaboratory

Faradaygasse 3

A-1030 Vienna

Austria

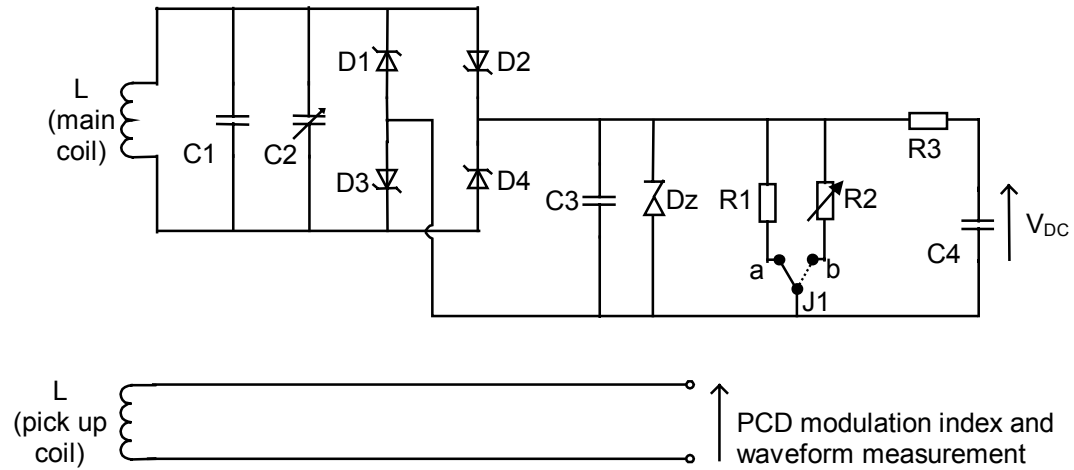
Phone: +43 50 550-6559

Fax: +43 50 550-6660

www.arsenal.ac.at/rfid

email: mci@arsenal.ac.at

I.2 Circuit diagram



| Component | Value |
|------------------|---|
| L (main coil) | see I.1 |
| L (pick up coil) | see I.1 |
| C1 | Stray capacitance < 5 pF |
| C2 | Variable (e.g. 3 – 20 pF) |
| D1, D2, D3, D4 | see characteristics in table D.1 (BAR 43 or equivalent) |
| C3 | 1 nF |
| R1 | 1,8 kOhm |
| R2 | 0 – 200 Ohm |
| Dz | Zener diode 15V (BZX84C15 or equivalent) |
| R3 | 10 kOhm |
| C4 | 1 nF |

Figure I.1 — Circuit diagram for Reference PICC for modulation index and waveform test