INTERNATIONAL STANDARD

ISO/IEC 10373-5

Third edition
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Identification cards — Test methods —

Part 5:
Optical memory cards

Cartes d'identification — Méthodes d'essai —

Partie 5: Cartes à mémoire optique

Reference number
ISO/IEC 10373:2014(E)

Contents

Page

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 10373-5 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and Personal Identification.*

This third edition cancels and replaces the second edition (ISO/IEC 10373-5:2006), which has been technically revised.

ISO/IEC 10373 consists of the following parts, under the general title *Identification cards — Test methods*:

— *Part 1: General characteristics tests*

— *Part 2: Cards with magnetic stripes*

— *Part 3: Integrated circuit cards with contacts and related interface devices*

— *Part 5: Optical memory cards*

— *Part 6: Proximity cards*

— *Part 7: Vicinity cards*

— *Part 8: USB-ICC*

— *Part 9: Optical memory cards — Holographic recording method*

Identification cards — Test methods —

Part 5:
Optical memory cards

1 Scope

This International Standard defines test methods for characteristics of identification cards according to the definition given in ISO/IEC 7810. Each test method is cross-referenced to one or more base standards, which can be ISO/IEC 7810 or one or more of the supplementary standards that define the information storage technologies employed in identification cards applications.

NOTE 1 Criteria for acceptability do not form part of this International Standard but will be found in the International Standards mentioned above.

NOTE 2 Test methods described in this International Standard are intended to be performed separately. A given card is not required to pass through all the tests sequentially.

This part of ISO/IEC 10373 deals with test methods which are specific to optical memory card technology. ISO/IEC 10373-1 deals with test methods which are common to one or more card technologies and other parts deal with other technology-specific tests.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 11694-4, *Identification cards — Optical memory cards — Linear recording method — Part 4: Logical data structures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
test method
method for testing characteristics of identification cards for the purpose of confirming their compliance with International Standards

3.2
testably functional
surviving the action of some potentially destructive influence to the extent of the following:

a) any magnetic stripe present on the card shows a relationship between signal amplitudes before and after exposure that is in accordance with the base standard;

b) any integrated circuit(s) present in the card continues to show an answer to reset response which conforms to the base standard;

Note 1 to entry This International Standard does not define any test to establish the complete functioning of integrated circuit(s) cards. The test methods require only that the minimum functionality (testably functional) be verified. This may, in appropriate circumstances, be supplemented by further application specific functionality criteria, which are not available in the general case.

c) any contacts associated with any integrated circuit(s) present in the card continue to show electrical resistance and impedance which conform to the base standard;

d) any optical memory present in the card continues to show optical characteristics which conform to the base standard

3.3
normal use
use as an identification card, involving equipment processes appropriate to the card technology and storage as a personal document between equipment processes

Note 1 to entry: See ISO/IEC 7810, Clause 4.

4 Default items applicable to the test methods

4.1 Test environment

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

4.2 Pre-conditioning

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

4.3 Selection of test methods

Unless otherwise specified, the tests in this part of ISO/IEC 10373 shall be applied exclusively to optical memory cards defined in ISO/IEC 11693 and ISO/IEC 11694.

4.4 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).

4.5 Total measurement uncertainty

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

5 Test methods

5.1 Location of accessible optical area and reference track

The purpose of this test is to measure the location of the accessible optical area and the reference track in the card (see ISO/IEC 11694-2).

5.1.1 Procedure

Construct two perpendicular axes of reference x and y intersecting at O. Mark three reference points on the axes, points P2 and P3, measured 11,25 mm and 71,25 mm from O are marked on the x axis and point P1, 27,00 mm from O, on the y axis. Place the card to be tested, accessible optical area side up, on a flat hard surface. The card shall be held down by a load of 2,2 ± 0,2 N.

Apply force F_1 (1 N to 2 N) and F_2 (2 N to 4 N) so that the reference edge of the card touches points P2 and P3 and the left edge touches at P1 (see Figure 1).

Measure dimensions X_a, X_b, Y, C and D, with equipment having an accuracy of 0,05 mm.

Dimensions in millimetres

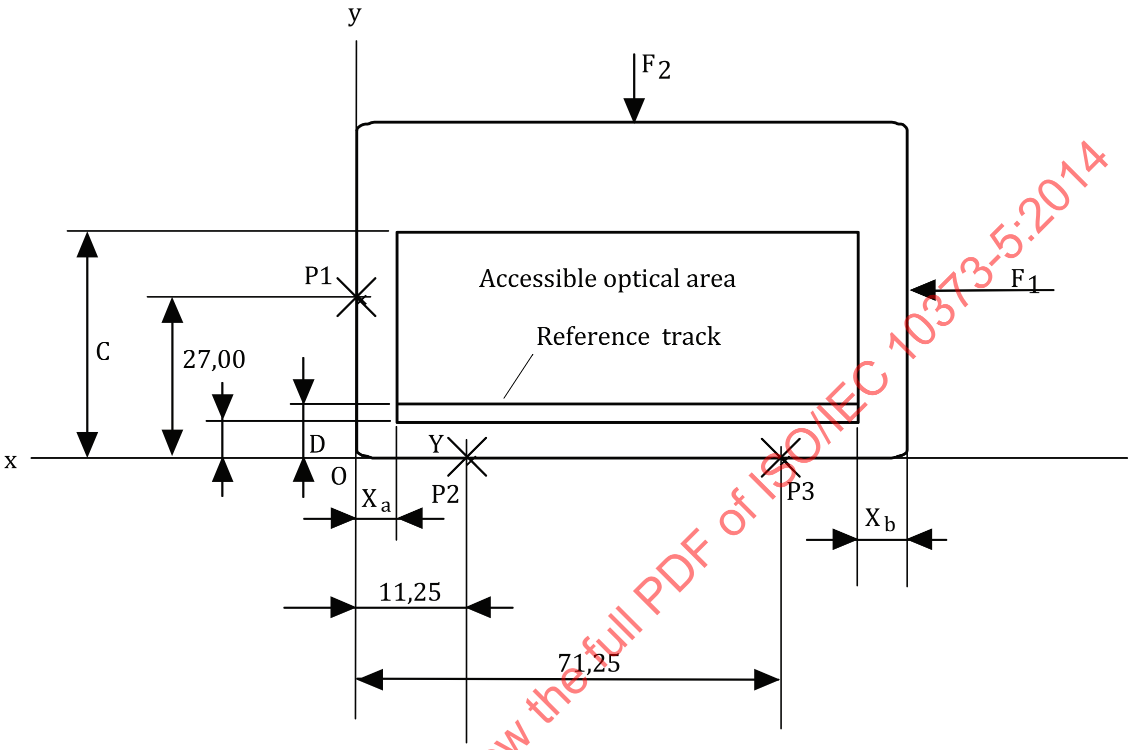


Figure 1 — Location of accessible optical area and reference track

5.1.2 Test report

The test report shall give the values of the dimensions measured.

5.2 Skew

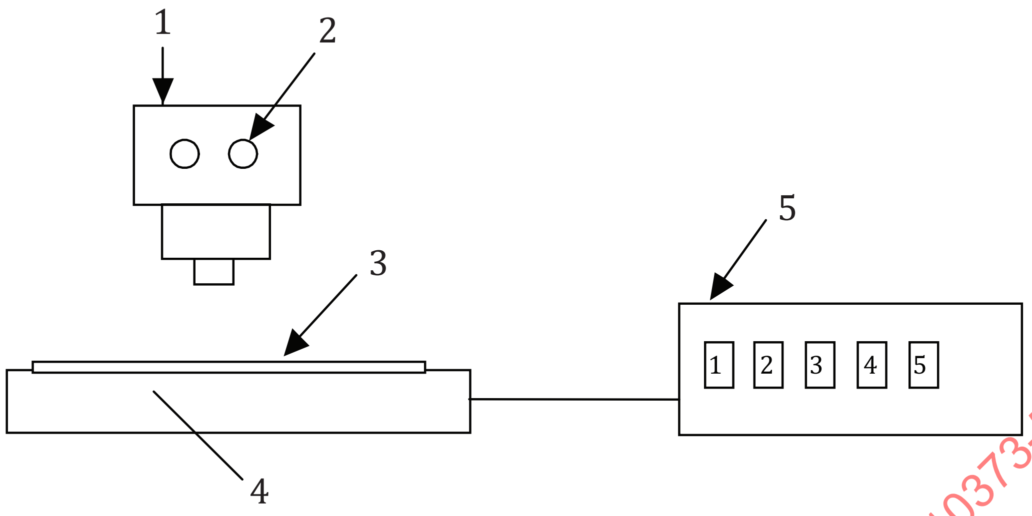
The purpose of this test is to measure the skew of the reference track to the bottom edge of the optical memory card (see ISO/IEC 11694-2:2000).

5.2.1 Apparatus for skew measurement

The apparatus is shown in Figure 2. It comprises

— an xy stage with an xy position indicator, and

— an optical microscope.



Key

1 microscope

2 eyepiece

3 card

4 xy stage

5 XY position indicator

Figure 2 — Apparatus for the skew measurement

5.2.2 Procedure for skew measurement

Place the sample card to be tested, flat, accessible optical area side up, on the xy stage.

Look into the eyepiece of the microscope, move the xy stage so that the reference track on the left side of the card can be seen. (see figure 3), and adjust the xy stage so that the xy cross-point in the eyepiece is on the reference track. Then record the xy coordinate value(X_0,Y_0).

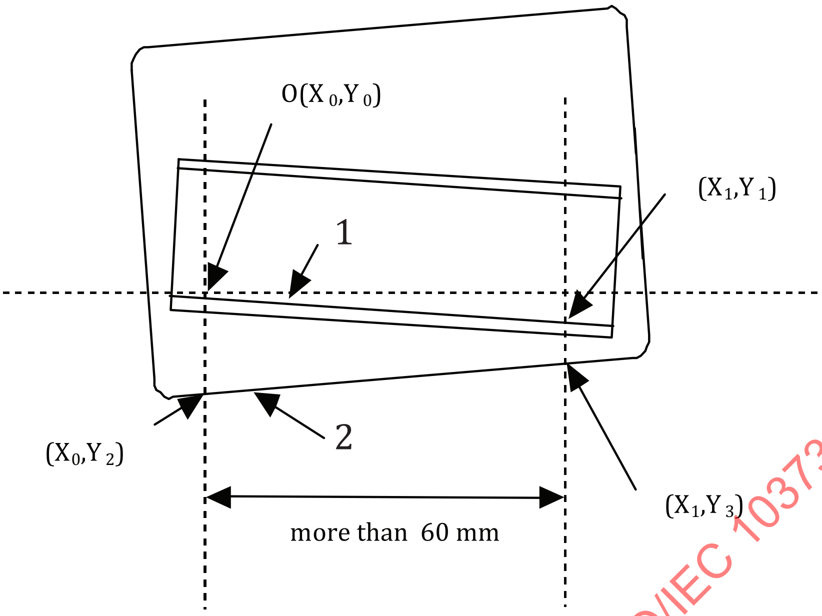
Next, move the stage in the y direction so that the bottom edge of the card can be seen, adjust the stage and record the value (X_0,Y_2) similarly.

Then move the stage so that the reference track in the right part of the card can be seen, adjust the stage and record the coordinate value (X_1,Y_1). However the value of $|X_0\text{-}X_1|$ shall be not less than 60 mm.

Lastly move the stage in the y direction so that the bottom edge of the card can be seen, and record the value (X_1,Y_3) in the same way.

The skew is calculated by the expression as:

$$\text{Skew} = \text{ABS}\left[\arctan\left\{\left(Y_1 - Y_0\right)/\left(X_1 - X_0\right)\right\} - \arctan\left\{\left(Y_3 - Y_2\right)/\left(X_1 - X_0\right)\right\}\right] \quad (1)$$



Key

1 reference track

2 bottom edge

Figure 3 — Procedure for the skew measurement

5.2.3 Test report

The test report shall give the value of the angle measured.

5.3 Defects

The purpose of this test is to measure defects of a card test sample (see ISO/IEC 11694-3).

5.3.1 Apparatus for defect measurement

Defects at the accessible optical area shall be measured by optical microscope.

5.3.2 Procedure for defect measurement

Count the number of defects whose cross-section exceeds 2.5 µm at the optical layer of accessible optical area and calculate the total defect area of these defects. Divide the total defect area by the total area of the accessible optical area to obtain the density of the raw uncorrected defect ratio within the accessible optical area.

At the transparent layer of the accessible optical area, the presence of defects whose cross-section exceeds 100 µm shall be noted.

5.3.3 Test report

The test report shall give the density of defects at the optical layer of the accessible optical area and the existence of defects at the transparent layer.

5.4 Optical properties of the media

5.4.1 Apparatus for testing optical cards conforming to ISO/IEC 11694-4

The production media tester (PMT) is based upon a commercially available optical card drive modified for the purpose[1]. The illumination source of the card tester shall be a semiconductor laser diode having a wavelength of 780±15nm and shall deliver a focussed elliptic spot of 1.8µ ±2% X 2.25µ ±2% $(1/e^2)$ at the surface of the optical layer. The major axis of the beam shall be 90 degrees±30 minutes of arc to the track direction. When not writing, the beam power (read power) is 200µW at the card surface and is controlled via detector external to the laser. A data bit is written with a write pulse of 13mW power and 2µsec±0.2µsec duration at a 1meter/second±10% scan rate. This results in a circular data bit of 3.35µ±0.05µ diameter on the calibration card[2]. A pattern of data bits are written across a track of the calibration card. The diameters of the ~ 8500 bits are measured by the optical head and the tester computer calculates the average diameter across the card track. The dimensions of the bit are set through the laser power and pulse length controls. Calibration cards shall conform to ISO/IEC 11694-4.

An additional computer board and connector are installed as a modification to the commercial drive to provide trigger signals and an analog signal back from the read photoreceptor of the laser optical head. The main board of the commercial drive is also modified to route the optical head signals to the additional computer board in the optical card drive. The additional computer board is the major departure of the test drive from a standard commercial drive. The drive is controlled via the normal SCSI cable and an interface card in the computer. The optical head trigger signals are routed to the serial port on the computer through an interface box. The interface box provides RF protection and conditions the signals from the optical card drive. The signal waveforms from the detector in the optical head are also routed to the interface box and then to a high speed data acquisition board in the computer (NI DAQ 5102 or equivalent). Three shielded coaxial cables are used to connect the interface box to the data acquisition board; see Figure 4. The high speed data acquisition board is used to capture and digitize the signal waveforms from the optical head for processing in the computer program. A signal scan from a card track will typically comprise a million data points or more.

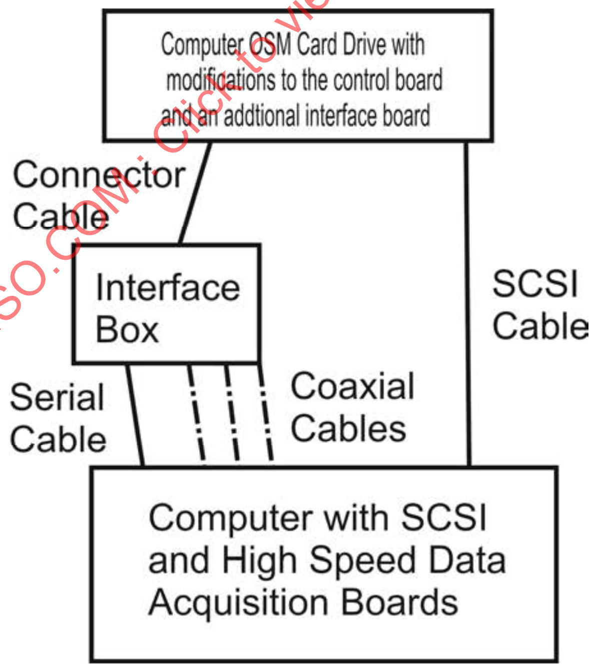


Figure 4 — Card tester (PMT) block diagram

Note 1 A suitable optical card tester can be ordered from HID Global, 1875 North Shoreline Boulevard, Mountain View, CA 94043 USA. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO/IEC of the product named.

Note 2 Calibration cards can be ordered from HID Global, 1875 North Shoreline Boulevard, Mountain View, CA 94043 USA. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO/IEC of the product named.

5.4.1.1 Calibration of PMT

The PMT reflectance value is calibrated using standard calibration cards (Silver Standard Cards). The Silver cards are tested and calibrated for reflectance versus a coated metal card called a Gold Standard. The Gold Standard cards are calibrated using a reflective coated aluminium metal standard. The metal standard is NRC or NIST traceable. The reflectance of the metal standard is checked against a NIST or NRC certified standard every five years. The calibration of the Gold standard is checked every year. The reflectance of the Silver standard card is checked every 120 days. The PMT reflectance is calibrated to the Silver cards after every four hours of use. The electronic calibration correction value for the read gain power on the instrument is adjusted to match the reflectance value given the Silver card in testing. If the calibration correction value for the PMT varies by more than 1% then the PMT shall be checked and recalibrated.

The bit size written by each PMT is checked using a standard calibration card every two weeks. If the bit size is out of specification then the write power or timing shall be adjusted.

The electronic read power of the PMT is tested against a Gold standard card. The read power check is completed every 120 days at the time of the Silver card calibrations. The read power shall not deviate by more than plus or minus 1% from the standard value.

5.4.2 Optical properties measurement methods

The PMT measures the performance of the non-written tracks, the preformatted bit tracks and written bit tracks. The bits shall be written in an alternating high and low frequency bit pattern across a track. The bit size shall be determined from the low frequency segments and the ultimate performance of the media shall be determined with the high frequency segment.

The PMT takes the voltage signal from the photo-detector in the optical read head and converts it into a digitized plot of a single sweep of the head down a card's optical track. Trigger signals fed from the optical drive start and stop and start the fast data acquisition. Normally more than a million data points are collected along the sweep of a track. A voltage waveform form from a single bit on the track has more than 50 data points digitized.

The fast data acquisition card in the computer performs the same function as a digital oscilloscope. Head voltage data from an individual sweep down the track of a card can be captured and displayed as a graph. Algorithms in the PMT program process this data across the whole track to determine the required values. For clarity the collected values are described here using the digitized graphs like those collected on a test oscilloscope.

Figure 5 shows the structure of the card. The top and bottom edges of the card contain the unformatted regions which are used to focus the optical head on the card tester. The PMT only modifies the normal function of the standard card tester to allow the photo-detector's wave signal to be sent to the computer. The PMT uses the standard control board in the tester to read the card format, find the unformatted blank reference area on that card format and adjust the focus of the optical head when each card is loaded.

The displayed full written track waveform in Figure 6 shows the data region for the blank unwritten formatted area. The data is recorded in mV versus distance. The higher reflective areas return a greater portion of the laser light to the photo-detector and therefore have higher voltages. A portion of these regions at either end of the card are used to determine the unwritten average reflectance value for the preformatted tracks.

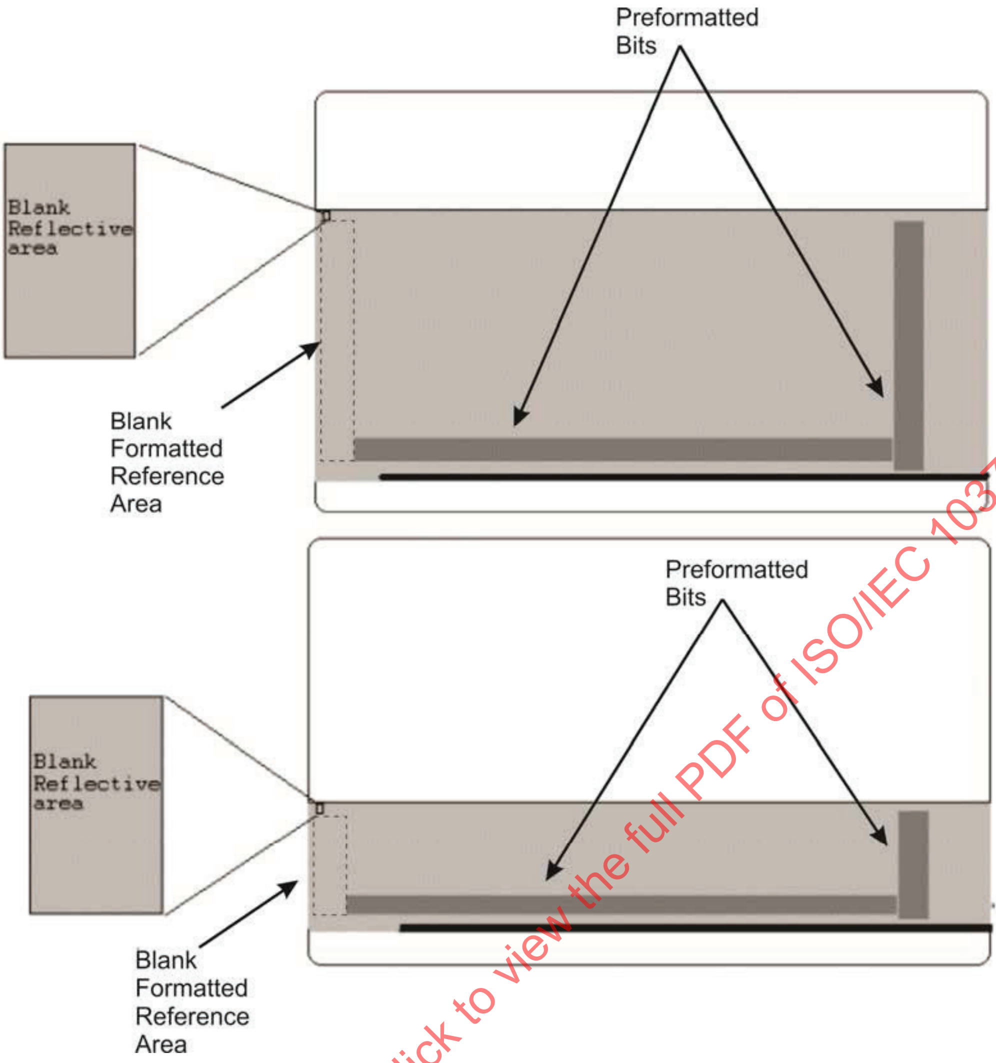


Figure 5 — Diagram of optical media on card. Top 35mm and bottom 16mm optical memory media

The figures below, which illustrate the measurement algorithms all show the analog optical photo-detector signal level with the same oscilloscope gain and offset. The PMT digitizes these signals across a full track on the optical media.

All measurements are based on the processing of the read signal. It is assumed that the amplitude of the signal is linearly proportional to the power of the laser light reflected off the card and transmitted to the read photo-detector and a gain and offset factor can be applied to the RF voltage level to give a reflectance value. The offset factor shall be determined by measuring the RF level with the laser turned off (**RF_off**) and the gain factor.

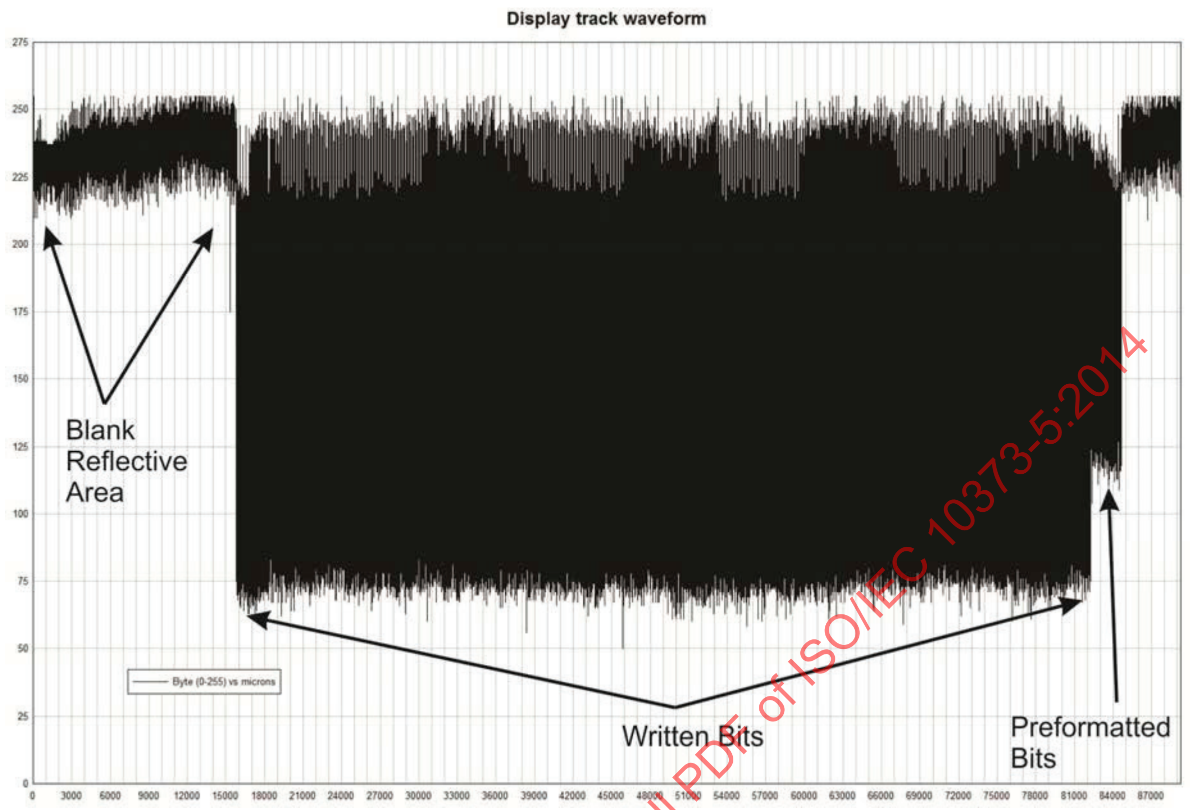


Figure 6 — Full wave scan of written card

(**RF_gain**) shall be determined by measuring the RF level when focused on a calibration card in the unformatted test region of the card (see Figure 5). The calibration card has a known reflectance in this region.

Specifically:

RF_gain = calibration card reflectance (%) / (RF level focused on calibration card - RF_off)

The reflectance values used in the formulas which follow (**Ref xxx**) shall be derived from the RF signal level and the gain and offset factors.

Ref xxx = RF_gain * (RF level xxx - RF_off)

5.4.2.1 Focus sweep (card surface reflectance)

This test shall be performed by positioning the head over the unformatted test region, sweeping the objective lens in the focus direction and capturing the RF and focus error (FES) signals. Figure 7 shows the two signals. The FES signal shows sharp transitions at times Tsurface and Tmedia. This corresponds to the objective lens being at the best focus positions for the card surface and media plane respectively. The RF signal level shall be measured at these times to provide a measure of card surface reflectance and media unformatted reflectance.

Surface reflectance = RF_gain * (Vsurface - RF_off)

Unformatted media reflectance = RF_gain * (Vmedia - RF_off)

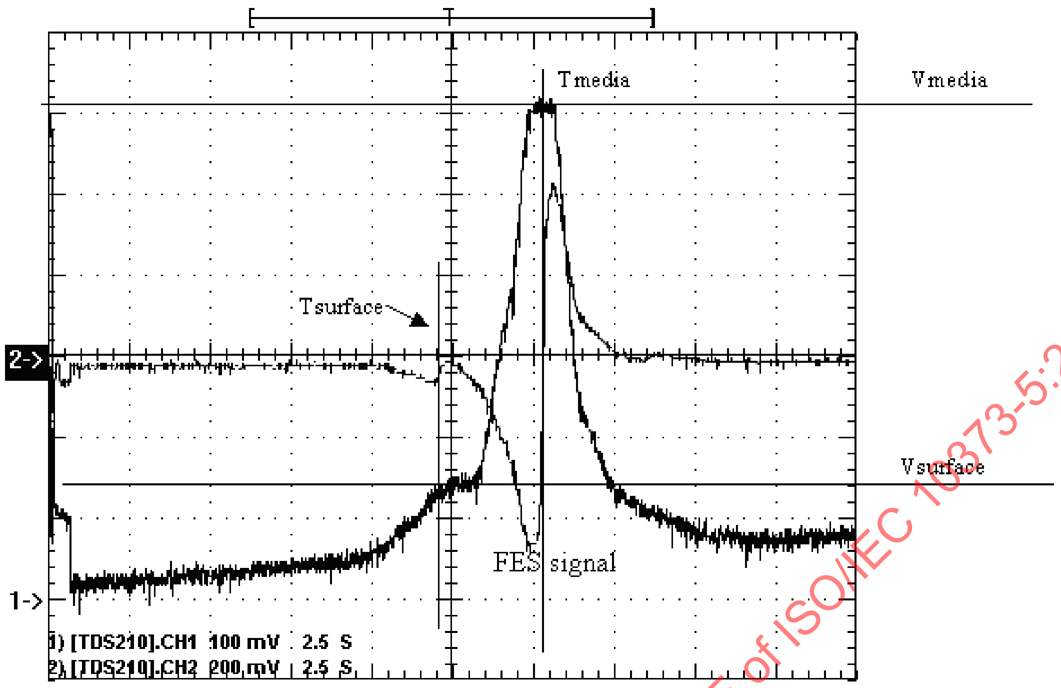


Figure 7 — Focus sweep waveform

5.4.2.2 Background reflectance measurement

This test shall be performed by sweeping the length of an unrecorded track. The RF signal waveform is shown in Figure 8. Also shown is the laser-off RF level.

Background reflectance = RF_gain * (Vunrecorded - RF_off)

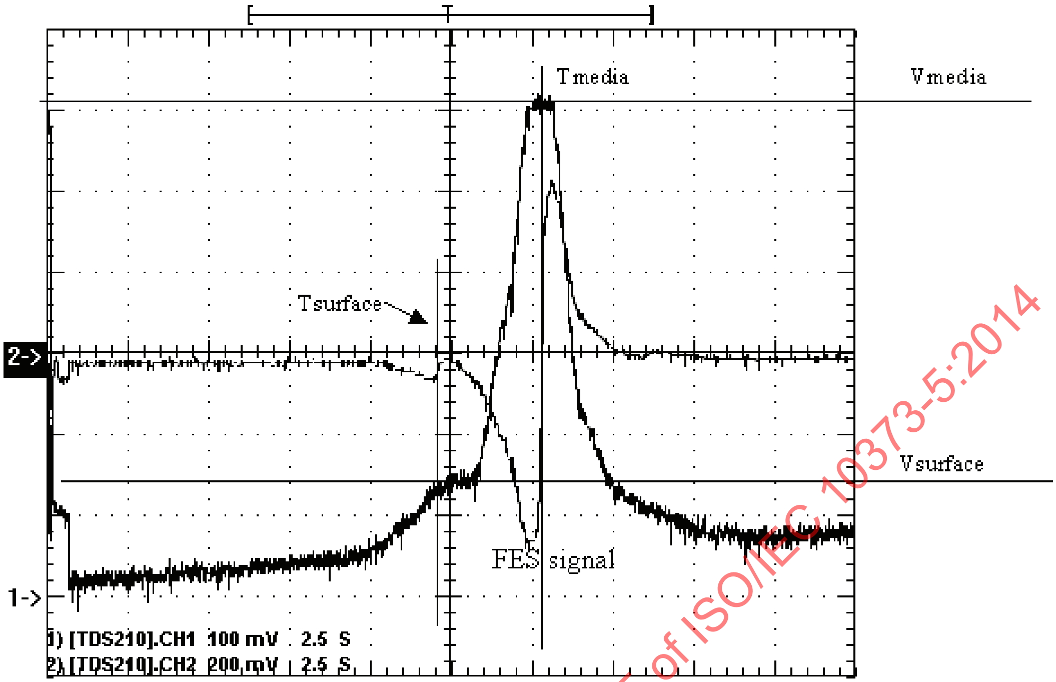


Figure 8 — Unrecorded and laser-off RF levels

5.4.2.3 Track guide contrast

This test shall be performed by focusing on a card and sweeping the optical head rapidly across tracks in an unrecorded region of the card. The RF signal waveform is shown in Figure 9.

Track guide contrast = (Vbase - Vgroove) / (Vbase - RF_off)

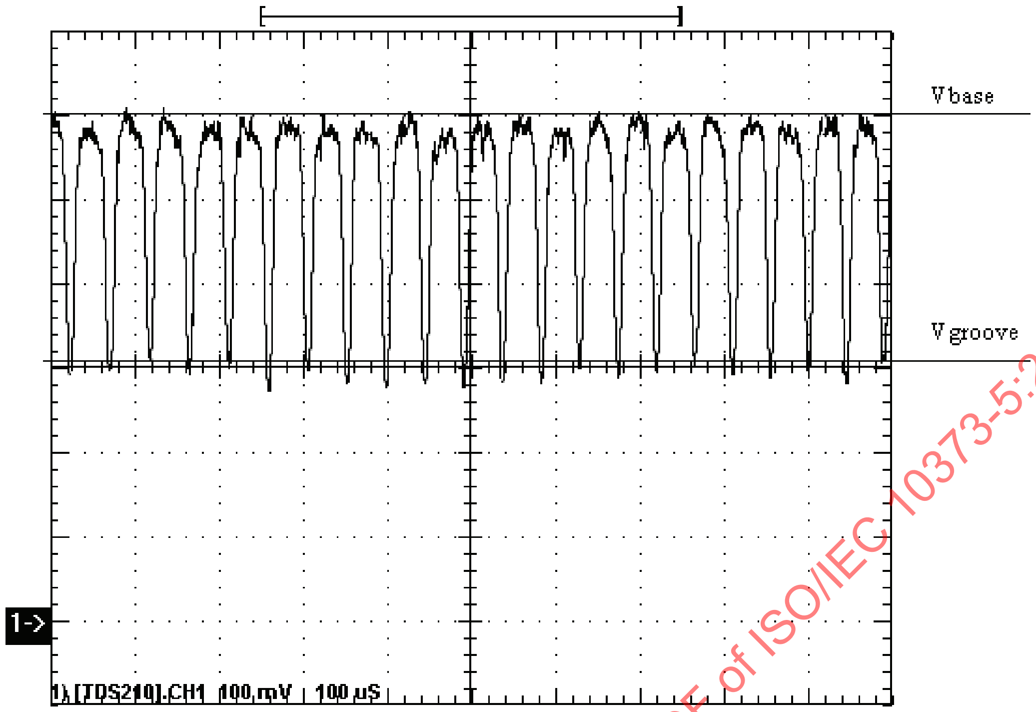


Figure 9 — Track guide contrast

5.4.2.4 Preformatted and written contrast parameters

The preformatted contrast test shall be performed by sweeping the pre-format region of a track. A portion of RF signal waveform is shown in Figure 10. The lines show the approximate level of the average of the positive and negative peaks for high and low frequency pulse trains. These average values shall be determined by processing the waveform for each individual peak level and selecting those in consecutive low frequency (2T) and high frequency (1T) sequences. The two pulses at the end of each sequence shall be rejected. The amplitude of the remaining pulses shall be averaged to provide the four average levels shown.

The recorded contrast test is essentially the same. In this case a waveform shall be recorded with a laser pulse with an amplitude and duration as described in 5.4.1.1, and then captured and processed as described above.

