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**Information technology — Office  
equipment — Test pages and methods  
for measuring monochrome printer  
resolution**

*Technologies de l'information — Équipement de bureau —  
Diagrammes et méthodes pour mesurer la résolution des imprimantes  
monochromes*





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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 JTC1.

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](http://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](http://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/forward.html](http://www.iso.org/iso/forward.html).

This document was prepared by Technical Committee ISO/IEC JTC1, *Information technology*, Subcommittee SC 28, *Office equipment*.

This first edition cancels and replaces ISO/IEC TS 29112:2012.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The purpose of this document is to provide a process for the objective measurement of print quality characteristics that contribute to perceived resolution in pages printed on paper or similar opaque materials using monochrome electro-photographic printing processes.

This document prescribes the following:

- Definitions of print quality characteristics that contribute to perceived resolution.
- Definitions of conformance methods to qualify a reflection scanner for use as a measuring device.
- A testing procedure based upon:
  - a) a well-documented printer and printing environment setup,
  - b) well-controlled printing of specified test pages, and
  - c) subsequent measurement of print quality characteristics using reflection scans of test pattern elements on the printed test pages.
- Definitions of methods for measuring the contributing print quality characteristics using printed test pattern elements of the specified test pages and analysing the resulting data to derive an assessment of printer resolution.
- Requirements for the report of a printer resolution assessment that define the context of the assessment and describe the results of the assessment.

Printer resolution, a quantification of the ability of a digital printing system to depict fine spatial detail, is a perceptually complex entity with no single, simple, objective measure. Five print quality characteristics that meaningfully contribute to resolution are described in this document. These print quality characteristics are: native addressability, effective addressability, edge blurriness, edge raggedness and the printing system spatial frequency response characteristic (SFR).

- Native or physical addressability refers to the imaging framework in a digital printing process, usually a rectangular grid of printable spots, which enables depiction of fine spatial detail. Native addressability specifies only one facet of the perceived resolution of a printing system. The common unit for native addressability is DPI (dots per inch).
- Effective addressability is a measure of the minimum pitch by which the centre of a printed object (e.g. line segment) can be displaced and evaluates the effects of imaged spot position modulation, size modulation or exposure modulation.
- Edge blurriness provides an optical measure of the geometric transition width of an edge between an unprinted substrate region and a printed solid area region.
- Edge raggedness provides an optical measure of the geometric deviations of a printed edge from a requested straight line.
- The spatial frequency response characteristic (SFR) describes the ability of a linear imaging system to depict fine spatial detail. This is the spatial analogue of frequency response used to characterize sound reproduction. A common synonym of the SFR characteristic is the modulation transfer function (MTF). The ability to depict fine spatial detail is affected by edge blurriness and edge raggedness as well as the spot size and shape of the printer's marking technology and any adjacency effects that can occur in the reproduction of fine detail. Two measurement methods are described that provide estimates of the printing system's spatial frequency response including contributions from edge blurriness, edge raggedness, spot-size, spot shape and adjacency effects.

An essential part of the development of this document was verification that the specified measurement methods correlate well with perceived printer resolution (the ability of a digital printing system to depict fine spatial detail) and that the measurements are reproducible across laboratories and instruments.

The steps in and results of this process to verify the utility of the measurement methods specified in this document are presented in more detail in [Annex F](#). The applicability of the measurement methods specified in this document could be expanded by undertaking similar verification processes with other printing technologies.





# Information technology — Office equipment — Test pages and methods for measuring monochrome printer resolution

## 1 Scope

This document defines methods for the objective measurement of the print quality characteristics that contribute to the perceived resolution of reflection mode monochrome printed pages produced by digital electro-photographic printers. The measurement methods of this document are derived from several existing techniques for the assessment of an imaging system's resolution characteristics. Each of these measurement methods is intended for the engineering evaluation of a printing system's perceived resolution and is not intended to be used for purposes of advertising claims.

The methods of this document are applicable only to monochrome prints produced in reflection mode by electro-photographic printing technology. This document is intended for monochrome printers utilizing PostScript®<sup>1)</sup> interpreters capable of accepting PostScript and encapsulated PostScript (EPS) jobs.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 12233, *Photography — Electronic still picture imaging — Resolution and spatial frequency responses*

ISO 14524, *Photography — Electronic still-picture cameras — Methods for measuring opto-electronic conversion functions (OECFs)*

ISO 16067-1, *Photography: Spatial resolution measurements of electronic scanners for photographic images — Part 1: Scanners for reflective media*

ISO/IEC 24790, *Information technology — Office equipment — Measurement of image quality attributes for hardcopy output — Monochrome text and graphic images*

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