INTERNATIONAL STANDARD

ISO/IEC 15444-5

Third edition
2021-10

Information technology — JPEG 2000 image coding system —

Part 5: Reference software

Technologies de l'information — Système de codage d'images JPEG 2000 —

Partie 5: Logiciel de référence

Reference number
ISO/IEC 15444-5:2021(E)

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Published in Switzerland

Foreword

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This document was prepared by ITU-T (as ITU-T REC. T.803) and drafted in accordance with its editorial rules, in collaboration with Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This third edition cancels and replaces the second edition (ISO/IEC 15444-5:2015), which has been technically revised.

The main changes are as follows:

— addition of a software reference implementation of a High Throughput (HT) block coding algorithm specified in Rec. ITU-T T.814 | ISO/IEC 15444-15; and

— addition of a software reference implementation of a JPH file format specified in Rec. ITU-T T.814 | ISO/IEC 15444-15.

A list of all parts in the ISO/IEC 15444 series can be found on the ISO and IEC websites.

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 and www.iec.ch/national-committees.

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – JPEG 2000 image coding system: Reference software

1 Scope

Rec. ITU-T T.800 | ISO/IEC 15444-1[1] defines a set of lossless and lossy compression methods for coding continuous-tone, bi-level, greyscale or colour digital still images. This Recommendation | International Standard provides three independently created software reference implementations of Rec. ITU-T T.800 | ISO/IEC 15444-1, in order to assist implementers of Rec. ITU-T T.800 | ISO/IEC 15444-1 in testing and understanding its content. The packages are JASPER, JJ2000 and OPENJPEG.

This Recommendation | International Standard also provides an independently created software reference implementation of Rec. ITU-T T.814 | ISO/IEC 15444-15, which specifies a high-throughput (HT) block coding algorithm that can be used in place of the block coding algorithm of Rec. ITU-T T.800 | ISO/IEC 15444-1, in order to assist implementers of Rec. ITU-T T.814 | ISO/IEC 15444-15 in testing and understanding its content. The package is TT.

This Recommendation | International Standard additionally provides an independently created software reference implementation for parsing of a JP2 file format specified in Rec. ITU-T T.800 | ISO/IEC 15444-1 and a JPH file format specified in Rec. ITU-T T.814 | ISO/IEC 15444-15, The package is Codestream-parser.

This Recommendation | International Standard does not define any additional part of the JPEG 2000 image coding system.

Each version of the J2K reference software contains source code, which can be compiled to provide the following functionality:

- Transcoding from selected, widely available image formats into a JPEG 2000 codestream.
- Transcoding from selected, widely available image formats into the JP2 file format.
- Selection of a wide range of JPEG 2000 encoding options (as documented in each reference software).
- Decoding from a JPEG 2000 codestream to a range of selected widely available image formats.
- Processing of a JP2 file to extract a JPEG 2000 codestream for decoding and conversion to a range of selected widely available image formats.
- The ability to extract metadata from a JP2 file, including the contents of the Image Header box and the colour space.
- The decoding of JP2 files that use the three-component matrix-based form of the restricted ICC method for the specification of colour space and the conversion of the decoded image data to the sRGB colour space for display, including limited upsampling of all decoded components to the same resolution.
- The decoding of JP2 files that use the monochrome form of the restricted ICC method for the specification of colour space and the conversion of the decoded image data to the sRGB based greyscale space as defined within the JP2 file format.
- The decoding of JP2 files that use the sYCC colour space and the conversion of the decoded image data to the sRGB colour space for display, including upsampling of all decoded components to the same resolution.
- Some additional tools to help with evaluation and testing.

The TT HTJ2K reference software contains source code, which can be compiled to provide the following functionality:

- Decoding from a HTJ2K codestream to a range of selected widely available image formats.

The codestream-parser reference software contains source code, which can provide the following functionality:

- Parsing of JP2 file format;
- Parsing of JPH file format.

The reference software is intended for use as a testing and validation tool for other implementations of JPEG 2000, and to help in the understanding of Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.814 | ISO/IEC 15444-15.

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[1] This Specification includes an electronic attachment containing the JASPER, JJ2000, OPENJPEG, TT, Codestream-parser reference packages.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. At the time of publication, the editions indicated in dated references were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- Recommendation ITU-T T.800 | ISO/IEC 15444-1, *Information technology – JPEG 2000 Image Coding System: Core coding system*.
- Recommendation ITU-T T.814 | ISO/IEC 15444-15, *Information technology – JPEG 2000 image coding system – Part 15: High Throughput JPEG 2000*.

2.2 Additional references

- ISO/IEC 9899:1999, *Programming languages – C*.
- ISO/IEC 9945-1:1996, *Information technology – Portable Operating System Interface (POSIX) – Part 1: System Application Program Interface (API) (C language)*.
- ISO/IEC 9945-2:1993, *Information technology – Portable Operating System Interface (POSIX) – Part 2: Shell and utilities*.
- ISO/IEC 14882:2011, *Programming languages – C++*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 **big endian**: The bits of a value representation occur in order from most significant to least significant.

3.2 **bit**: A contraction of the term "binary digit"; a unit of information represented by a zero or a one.

3.3 **bit-plane**: A two-dimensional array of bits. In this Recommendation | International Standard, a bit-plane refers to all the bits of the same magnitude in all coefficients or samples. This could refer to a bit-plane in a component, tile-component, code-block, region of interest, or other.

3.4 **bit stream**: The actual sequence of bits resulting from the coding of a sequence of symbols. It does not include the markers or marker segments in the main and tile-part headers or the EOC marker. It does include any packet headers and in stream markers and marker segments not found within the main or tile-part headers.

3.5 **box**: A portion of the file format defined by a length and unique box type. Boxes of some types may contain other boxes.

3.6 **box contents**: Refers to the data wrapped within the box structure. The contents of a particular box are stored within the DBox field within the Box data structure.

3.7 **byte**: Eight bits.

3.8 **channel**: One logical component of the image. A channel may be a direct representation of one component from the codestream, or may be generated by the application of a palette to a component from the codestream.

3.9 **code-block**: A rectangular grouping of coefficients from the same subband of a tile-component.

3.10 **coder**: An embodiment of either an encoding or decoding process.

3.11 **codestream**: A collection of one or more bit streams and the main header, tile-part headers, and the EOC required for their decoding and expansion into image data. This is the image data in a compressed form with all of the signalling needed to decode.

3.12 **coefficient**: The values that are the result of a transformation.

3.13 **component**: A two-dimensional array of samples. An image typically consists of several components, for instance representing red, green and blue.