International

ISO/IEC 15444-4

Information technology — JPEG 2000 image coding system —

Part 4: Conformance testing

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

Partie 4: Tests de conformité

Fourth edition
2024-05

Reference number
ISO/IEC 15444-4:2024(en)

COPYRIGHT PROTECTED DOCUMENT

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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.

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.

ISO and IEC draw attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO and IEC take no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO and IEC had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents and https://patents.iec.ch. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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 fourth edition cancels and replaces the third edition (ISO/IEC 15444-4:2021), which has been technically revised.

The main changes are as follows:

— the maximum allowable errors associated with compliance Class 1, for both Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.814 | ISO/IEC 15444-15 codestreams, have been relaxed in a few cases to ensure that well designed 16-bit fixed-point implementations of the inverse discrete wavelet transform should be able to pass all compliance tests for Class 1;

— two additional test codestreams have been added along with conformance bounds, to facilitate testing of inverse wavelet and component decorrelating transform accuracy;

— a number of codestreams and files conforming to Rec. ITU-T T.801 | ISO/IEC 15444-2 have been included for informative purposes only, to facilitate the development of decoders and file format readers that are able to support features beyond the core capabilities found in Rec. ITU-T T.800 | ISO/IEC 15444-1 and 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.

committees.

1 Scope 1
2 References 1
3 Definitions 1
4 Abbreviations and symbols 4
4.1 Abbreviations 4
4.2 Symbols 5
5 Conventions 6
6 General description 6
6.1 Profiles, derived sets and compliance classes 7
6.2 Decoders 8
6.3 Encoders and codestreams 8
6.4 Implementation compliance statement 8
6.5 Abstract test suites 8
6.6 Encoder compliance testing procedure 9
6.7 Decoder compliance testing procedure 9
6.8 Procedures for testing file format readers 9
6.9 Additional test codestreams and files 9
7 Copyright 9
8 Compliance files availability and updates 9
Annex A Decoder compliance classes 10
A.1 Compliance class parameter definitions 10
A.1.1 Profile: codestream guarantees 10
A.1.2 *H*, *W*, *C*: Image size guarantees 10
A.1.3 N_{cb}: Code-block parsing guarantee 11
A.1.4 N_{comp}: Component parsing guarantee 11
A.1.5 L_{body}: Coded data buffering guarantee 11
A.1.6 *M*: Decoded bit-plane guarantee 12
A.1.7 *P*: 9-7I precision guarantee 12
A.1.8 *B*: 5-3R precision guarantee 12
A.1.9 T_L: Transform level guarantee 12
A.1.10 *L*: Layer guarantee 12
A.1.11 Progressions 12
A.1.12 Tile-parts 12
A.1.13 Precincts 13
A.1.14 M_{MAGB}: Magnitude bound guarantee 13
A.2 Compliance class definitions 13
A.3 Lossless encoding and decoding 14
Annex B Decoder compliance testing procedures 15
B.1 General 15
B.2 Decoder test procedure 15
B.2.1 Files for testing 16
B.2.2 Decoder settings 16
B.2.3 Output file format conversion 16
B.2.4 Compare decoded and formatted components with reference components 18
B.2.5 Compare error metrics with specification 18
B.2.6 Reference components file format 18
Annex C Compliance tests 20
C.1 Abstract test suite (informative) 20
C.1.1 Syntax and compressed data order 20
C.1.2 Arithmetic entropy encoding 20
C.1.3 Coefficient bit modelling 21
C.1.4 Quantization 21
C.1.5 Discrete wavelet transform 21
C.1.6 DC level shift and multiple component transform 21

C.1.9 High throughput cleanup pass coding 22
C.1.10 HT refinement pass coding 22
C.1.11 Placeholder passes 22
C.1.12 Mixing of HT and J2K code-blocks within HTJ2K codestreams 22
C.1.13 JPH File format 22
C.2 Executable test suite 22
C.2.1 Class 0 Profile-0 23
C.2.2 Class 0 Profile-1 27
C.2.3 Class 1 Profile-0 28
C.2.4 Class 1 Profile-1 30
C.2.5 Class 1HF Profile 1 30
Annex D Encoder compliance test procedure 32
D.1 General 32
D.2 Reference decoder 32
D.3 Compliance requirement and acceptance 32
D.4 Encoding compliance test procedure 32
Annex E Decoder implementation compliance statement 34
E.1 General 34
E.2 Decoder implementation compliance statement 34
E.3 Extended support 34
Annex F Encoder implementation compliance statement 37
F.1 General 37
F.2 Encoder description 37
Annex G JP2 and JPH file format reader compliance testing procedures 39
G.1 General 39
G.2 JP2 file compliance requirement and acceptance 39
G.3 Reading a JP2 file compliance test procedure 39
G.4 JP2 file format test codestreams and images 40
G.4.1 Test files 40
G.4.2 Reference decoded images 40
G.4.3 Tolerances 40
G.4.4 Additional information regarding the JP2 test files 41
G.5 JPH file format test codestreams and images 42
G.5.1 Test files 42
G.5.2 Relationship between the JP2 and JPH test files 42
Annex H Test codestreams and files conforming to Rec. ITU-T T.801 | ISO/IEC 15444-2 43
H.1 General 43
H.2 Extended test codestreams 43
H.3 JPX test files 44
Bibliography 45

Electronic attachment: Codestreams used in the application of the procedures described in this Specification.

List of Tables

Page

Table 1 – HTJ2K derived sets employed in this Recommendation | International Standard 8
Table A.1 – Definitions of compliance classes (Cclass) for J2K decoders 13
Table A.2 – Definitions of derived compliance classes (Cclass) for HTJ2K decoders 13
Table A.3 – Definitions of HiFi compliance classes 14
Table C.1 – Class 0 Profile-0 reference images and allowable errors 23
Table C.1bis – Additional allowable errors for HTJ2K TCSs belonging to derived set 0 24
Table C.2 – Items tested by Profile-0 codestreams 24
Table C.2bis – Items tested by derived set 0 HTJ2K codestreams 25

Table C.4bis – Additional allowable errors for HTJ2K TCSs belonging to derived set 1 27
Table C.5 – Items tested by Profile-1 codestreams 28
Table C.5bis – Items tested by derived set 1 HTJ2K codestreams 28
Table C.6 – Class 1 Profile-0 reference files and maximum error 29
Table C.7 – Class 1 Profile-1 reference images and allowable error 30
Table C.8 – Class 1HF Profile 1 reference images and allowable error 31
Table E.1 – ICS for defined Cclasses, profiles and derived sets 34
Table E.2 – Extended capabilities for Cclass 0 35
Table E.3 – Extended capabilities for Cclass 1 35
Table E.4 – Extended capabilities for Cclass 2 35
Table E.5 – Extended capabilities for derived Cclass 0h 36
Table E.6 – Extended capabilities for derived Cclass 1h 36
Table E.7 – Extended capabilities for derived Cclass 2h 36
Table F.1 – Encoder implementation marker usage 37
Table G.1 – JP2 reference images and allowable error 41
Table H.1 – Properties of each extended codestream 43
Table H.2 – Properties of each JPX test file 44

List of Figures

Figure B.1 – Decoder compliance test flow chart 15
Figure D.1 – Encoder compliance test block diagram 33
Figure G.1 – JP2 file format reader compliance test block diagram 40

Information technology – JPEG 2000 image coding system: Conformance testing

1 Scope

This Recommendation | International Standard[1] specifies the framework, concepts, methodology for testing, and criteria to be achieved to claim compliance to Rec. ITU-T T.800 | ISO/IEC 15444-1 or Rec. ITU-T T.814 | ISO/IEC 15444-15. It provides a framework for specifying abstract test suites (ATSs) and for defining the procedures to be followed during compliance testing.

This Recommendation | International Standard:

- specifies compliance testing procedures for encoding and decoding using Rec. ITU-T T.800 | ISO/IEC 15444-1 and Rec. ITU-T T.814 | ISO/IEC 15444-15;
- specifies codestreams, decoded images, and error metrics to be used with the testing procedures;
- specifies ATSs;
- provides guidance for creating an encoder compliance test

This Recommendation | International Standard does not include the following tests:

Acceptance testing: the process of determining whether an implementation satisfies acceptance criteria and enables the user to determine whether or not to accept the implementation. This includes the planning and execution of several kinds of tests (e.g., functionality, quality, and speed performance testing) that demonstrate that the implementation satisfies the user requirements.

Performance testing: measures the performance characteristics of an implementation under test (IUT) such as its throughput and responsiveness, under various conditions.

Robustness testing: the process of determining how well an implementation processes data which contains errors.

2 References

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated 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.

- 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: High-throughput JPEG 2000*.

3 Definitions

For the purposes of this Recommendation | International Standard, the terms and definitions given in Rec. ITU-T T.800 | ISO/IEC 15444-1, Rec. ITU-T T.814 | ISO/IEC 15444-15 and the following apply.

3.1 **abstract test suite (ATS)**: Generic compliance testing concepts and procedures for a given requirement.

3.2 **arithmetic coder**: Entropy coder that converts variable length strings to variable length codes (encoding) and vice versa (decoding).

---

[1] This Recommendation | International Standard includes an electronic attachment with the codestreams used in the application of the procedures described the Specification.