
**Information technology — JPEG XR
image coding system —**

**Part 4:
Conformance testing**

*Technologies de l'information — Système de codage d'image
JPEG XR —*

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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 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 29199-4 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T.

This part of ISO/IEC 29199 is technically aligned with ITU-T Rec. T.834 but is not published as identical text.

ISO/IEC 29199 consists of the following parts, under the general title *Information technology — JPEG XR image coding system*:

- *Part 2: Image coding specification*
- *Part 3: Motion JPEG XR*
- *Part 4: Conformance testing*
- *Part 5: Reference software*

The following part is under preparation:

- *Part 1: System architecture* [Technical Report]

Introduction

This part of ISO/IEC 29199 has been developed by ITU-T and ISO/IEC in a collaborative team that is referred to as the Joint Photographic Experts Group (JPEG). It is published as technically-aligned twin text by both organizations (ITU-T and ISO/IEC).

This part of ISO/IEC 29199 specifies a set of tests designed to verify whether codestreams, files, encoders, and decoders meet the normative requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 (*Information technology – JPEG XR image coding system – Image coding specification*).

- A codestream (or file) can be claimed to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2 if it meets the normative requirements for such codestreams (or files) specified in ITU-T Rec. T.832 | ISO/IEC 29199-2.
- An encoder can be claimed to have codestream (or file format) conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2 if the codestreams (or files) that it generates are conforming codestreams (or files).
- A decoder can be claimed to conform to a specified subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 capabilities (such as a combination of "profile" and "level" capabilities) if it can properly decode all codestreams (or files) obeying the constraints specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 for the specified subset of capabilities.

The tests specified in this part of ISO/IEC 29199 provide methods for (non-exhaustive) testing of whether encoders and decoders meet these requirements.

Characteristics of codestreams, files, and decoders are specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. The characteristics of a codestream (or file) indicate the subset of that standard that is exploited within the codestream (or file). Examples are the selected values of the image size and number of associated color components. Decoder characteristics specify the properties and capabilities of the applied decoding process. The capabilities of a decoder specify which codestreams (or files) the decoder can decode by specifying the subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 syntax features and values that may be exploited in the codestreams (or files) that it will decode. A codestream (or file) can be decoded by a conforming decoder if it is a conforming codestream (or file) and the characteristics of the codestream (or file) are within the subset of the standard that is specified by the decoder capabilities.

Procedures are specified in this part of ISO/IEC 29199 for testing the conformance of codestreams (or files) and decoders to the requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. Given the set of characteristics claimed, the requirements that shall be met are fully determined by ITU-T Rec. T.832 | ISO/IEC 29199-2. This part of ISO/IEC 29199 summarizes these requirements, cross references them to characteristics, and specifies how conformance to them can be tested. Particular tests to verify codestream and decoder conformance are specified.

A set of data for use in such tests is provided as an electronic attachment to this part of ISO/IEC 29199 and is considered an integral part thereof. When a decoder under test does not satisfy the requirements of the specified tests when operating on the provided data set, the decoder is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2.

The specified testing of codestreams (or files) produced by encoders employs the reference software decoder specified in ITU-T Rec. T.835 | ISO/IEC 29199-5 (with source code available in electronic format). When a codestream (or file) cannot be decoded by the reference software decoder without generating non-conformance warning messages, the codestream (or file) is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2. When an encoder produces any such codestreams (or files) that cannot be decoded without warnings by the reference software decoder, the encoder is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2.

Information technology — JPEG XR image coding system —

Part 4: Conformance testing

1 Scope

This part of ISO/IEC 29199 specifies a set of tests designed to verify whether codestreams, files, encoders, and decoders meet the normative requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 (*Information technology — JPEG XR image coding system — Image coding specification*).

2 Normative references

The following referenced documents are indispensable for the application 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.

ITU-T Rec. T.832 | ISO/IEC 29199-2, *Information technology — JPEG XR image coding system — Image coding specification*

ITU-T Rec. T.835 | ISO/IEC 29199-5, *Information technology — JPEG XR image coding system — Reference software*

[ISO/IEC 29199-4:2010](https://standards.iteh.ai/catalog/standards/sist/cd181e42-53e-4575-b844-ae7531458891/iso-iec-29199-4-2010)

3 Terms and definitions

For the purposes of this document, the terms, definitions and symbols specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 and the following apply.

3.1

codestream

sequence of bits contained in a sequence of bytes that conforms to the codestream requirements specified by ITU-T Rec. T.832 | ISO/IEC 29199-2 or is to be tested to determine whether it conforms to the codestream requirements specified by ITU-T Rec. T.832 | ISO/IEC 29199-2

3.2

decoder

embodiment of the decoding process specified by ITU-T Rec. T.832 | ISO/IEC 29199-2 or a process embodiment that is to be tested to determine whether it conforms to the decoding process specified by ITU-T Rec. T.832 | ISO/IEC 29199-2

NOTE

The decoder does not include the display process, which is outside the scope of this part of ISO/IEC 29199.

3.3

encoder

process that produces **codestreams** or **files** that conform to ITU-T Rec. T.832 | ISO/IEC 29199-2 or are to be tested to determine whether these **codestreams** or **files** conform to ITU-T Rec. T.832 | ISO/IEC 29199-2

3.4

file

(ITU-T Rec. T.832 | ISO/IEC 29199-2:2009, Annex A) finite-length sequence of bytes produced by an **encoder** that conforms to ITU-T Rec. T.832 | ISO/IEC 29199-2:2009, Annex A or is to be tested to determine whether it conforms to ITU-T Rec. T.832 | ISO/IEC 29199-2:2009, Annex A

3.5

reference output

output of the reference software decoder

3.6

reference software decoder

software decoder contained in ITU-T Rec. T.835 | ISO/IEC 29199-5

4 Abbreviations

For the purposes of this document, the abbreviations given in ITU-T Rec. T.832 | ISO/IEC 29199-2 apply.

5 Conventions

For the purposes of this document, the conventions given in ITU-T Rec. T.832 | ISO/IEC 29199-2 apply.

6 Conformance testing specification

6.1 General

The following subclauses specify normative tests designed to verify whether codestreams, files, encoders, and decoders meet the normative requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2, as follows:

- A codestream (or file) can be claimed to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2 if it meets the normative requirements for such codestreams (or file) specified in ITU-T Rec. T.832 | ISO/IEC 29199-2.
- An encoder can be claimed to have codestream (or file format) conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2 if the codestreams (or files) that it generates are conforming codestreams (or files).
- A decoder can be claimed to conform to a specified subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 capabilities (such as a combination of "profile" and "level" capabilities) if it can properly decode all codestreams (or files) obeying the constraints specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 for the specified subset of capabilities.

The tests specified in this part of ISO/IEC 29199 provide methods for (non-exhaustive) testing of whether encoders and decoders meet these requirements.

Characteristics of codestreams, files, and decoders are specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. The characteristics of a codestream (or file) indicate the subset of that standard that is exploited within the codestream (or file). Examples are the selected values of the image size and number of associated color components. Decoder characteristics specify the properties and capabilities of the applied decoding process. The capabilities of a decoder specify which codestreams (or files) the decoder can decode by specifying the subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 syntax features and values that may be exploited in the codestreams (or files) that it will decode. A codestream (or file) can be decoded by a conforming decoder if it is a conforming codestream (or file) and the characteristics of the codestream (or file) are within the subset of the standard that is specified by the decoder capabilities.

Procedures are specified in this part of ISO/IEC 29199 for testing the conformance of codestreams (or files) and decoders to the requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. Given the set of characteristics claimed, the requirements that shall be met are fully determined by ITU-T Rec. T.832 | ISO/IEC 29199-2. This part of ISO/IEC 29199 summarizes these requirements, cross references them to codestream (or file) characteristics, and specifies how conformance to the requirements can be tested. Particular tests to verify codestream and decoder conformance are specified.

A set of data for use in such tests is provided as an electronic attachment to this part of ISO/IEC 29199 and is considered an integral part thereof. When a decoder under test does not satisfy the requirements of the specified tests when operating on the provided data set, the decoder is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2.

The specified testing of codestreams (or files) produced by encoders employs the reference software decoder specified in ITU-T Rec. T.835 | ISO/IEC 29199-5 (with source code available in electronic format). When a codestream (or file) cannot be decoded by the reference software decoder without generating non-conformance warning messages, the codestream (or file) is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2. When an encoder produces any

such codestreams (or files) that cannot be decoded without warnings by the reference software decoder, the encoder is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2.

6.2 Procedure to test codestreams (or files)

A codestream (or file) that claims conformance with ITU-T Rec. T.832 | ISO/IEC 29199-2 shall pass the following normative test.

The codestream (or file) shall be decoded by processing it with the reference software decoder. When processed by the reference software decoder, the codestream (or file) shall not cause any error or non-conformance messages to be reported by the reference software decoder. The output of the reference software decoder shall be considered the reference output.

NOTE 1 – This test should not be applied to codestreams (or files) that are known to contain errors introduced by transmission, as such errors are highly likely to result in codestreams (or files) that lack conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2.

Successfully passing the reference software decoder test provides only a preliminary indication that the codestream (or file) under test is in conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2, as not all conformance requirements of ITU-T Rec. T.832 | ISO/IEC 29199-2 may be tested by the reference software decoder.

Additional tests may be necessary to more thoroughly check that the codestream (or file) properly meets all the requirements specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. These complementary tests may be performed using other codestream (or file) verifiers that perform more complete tests than those implemented by the reference software decoder.

NOTE 2 – Indications of codestream (or file) non-conformance obtained in such tests should be investigated to verify the exact characteristics of the codestream (or file) that resulted in the indication and the relationship of these characteristics to the requirements expressed in ITU-T Rec. T.832 | ISO/IEC 29199-2 for conformance to that Specification.

To check correctness of a codestream (or file), it is necessary to parse the entire codestream (or file) and to extract all the syntax elements and other values derived from those syntactic elements and used by the decoding process specified in ITU-T Rec. T.832 | ISO/IEC 29199-2. (standards.iteh.ai)

Some verifiers may not necessarily need to perform all stages of the decoding process specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 in order to verify aspects of codestream (or file) correctness. Many tests can be performed on syntax elements in a state prior to their use in some processing stages.

6.3 Procedure to test encoders

An encoder can be claimed to have codestream (or file format) conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2 if the codestreams (or files) that it generates are conforming codestreams (or files). To test an encoder for conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2, the encoder should be operated in such a manner as to maximally exercise its usage of the syntax features of ITU-T Rec. T.832 | ISO/IEC 29199-2, and sample codestreams (or files) produced from the encoder shall be checked for conformance to ITU-T Rec. T.832 | ISO/IEC 29199-2 as specified in subclause 6.2. If the encoder produces codestreams (or files) that do not conform to ITU-T Rec. T.832 | ISO/IEC 29199-2 under such sample testing operation, the encoder is indicated not to conform to ITU-T Rec. T.832 | ISO/IEC 29199-2.

6.4 Procedure to test decoders

A decoder can be claimed to conform to a specified subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 capabilities (such as a combination of "profile" and "level" capabilities) if it can properly decode all codestreams (or files) obeying the constraints specified in ITU-T Rec. T.832 | ISO/IEC 29199-2 for the specified subset of capabilities. To test a decoder for conformance to a specified subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 capabilities, the set of reference encoded files (or, in the case of codestream-level testing, the set of codestreams extracted from those files) specified below in clause 7 that are within the specified subset of ITU-T Rec. T.832 | ISO/IEC 29199-2 capabilities shall be processed by the decoder under test and by the reference software decoder. The decoder under test shall output decoded images, and the output decoded images produced by the decoder under test shall be checked for correspondence with the output of the reference software decoder. The output decoded images produced by the two decoding processes shall match exactly. When upsampling is invoked in the output formatting process specified in subclause 9.10 of ITU-T Rec. T.832 | ISO/IEC 29199-2, the upsampling process performed for purposes of conformance testing of the output of the decoder under test shall be the nominal upsampling process specified in subclause 9.10.3.1 or 9.10.3.2 of ITU-T Rec. T.832 | ISO/IEC 29199-2, as applicable. However, the actual manner of performing upsampling by a decoder for purposes other than conformance testing is outside the scope of conformance requirements to ITU-T Rec. T.832 | ISO/IEC 29199-2, as noted in subclauses 8.4.6 and 8.4.9 of ITU-T Rec. T.832 | ISO/IEC 29199-2.

7 Reference data set

7.1 General

A set of data for use in decoder conformance tests is provided as an electronic attachment to this part of ISO/IEC 29199 and is considered an integral part thereof. This set of data consists of a number of files encoded according to ITU-T Rec. T.832 | ISO/IEC 29199-2 Annex A. For purposes of codestream-only testing, the testing shall be performed by extracting the codestreams embedded within these files and performing the testing using these codestreams.

This set of files and the codestreams they contain are not intended to represent all combinations of syntax elements that are allowed in ITU-T Rec. T.832 | ISO/IEC 29199-2. Rather, the set of files (and the codestreams they contain) was developed with the intention of testing key selected aspects of the parsing and decoding processes that are required by the various syntax elements. Selected characteristics of the files in each category are described in corresponding subclauses of this part of ISO/IEC 29199.

7.2 Reference file set BasicAndOverlap_1x1Tile

This collection of 18 .jxr files has the following syntax element characteristics:

- The FREQUENCY_MODE_CODESTREAM_FLAG syntax element is set to FALSE (spatial mode) or TRUE (frequency mode)
- The OVERLAP_MODE is varied between the values 0, 1 and 2.
- The INTERNAL_CLR_FMT is set to YUV444 or YONLY.
- The QP (for all color channels and all bands) is set to 1 or 10.

For all files in the BasicAndOverlap_1x1Tile set, the syntax elements NUM_HOR_TILES_MINUS1 and NUM_VER_TILES_MINUS1 are both set to 0, resulting in each image being structured as a single tile.

The following files are included in the BasicAndOverlap_1x1Tile file set:

- Seattle_Spat_Ov0_1x1_YONLY_QP10.jxr
- Seattle_Spat_Ov0_1x1_YUV444_QP1.jxr
- Seattle_Spat_Ov0_1x1_YUV444_QP10.jxr
- Seattle_Spat_Ov1_1x1_YONLY_QP10.jxr
- Seattle_Spat_Ov1_1x1_YUV444_QP1.jxr
- Seattle_Spat_Ov1_1x1_YUV444_QP10.jxr
- Seattle_Spat_Ov2_1x1_YONLY_QP10.jxr
- Seattle_Spat_Ov2_1x1_YUV444_QP1.jxr
- Seattle_Spat_Ov2_1x1_YUV444_QP10.jxr
- Seattle_Freq_Ov0_1x1_YONLY_QP10.jxr
- Seattle_Freq_Ov0_1x1_YUV444_QP1.jxr
- Seattle_Freq_Ov0_1x1_YUV444_QP10.jxr
- Seattle_Freq_Ov1_1x1_YONLY_QP10.jxr
- Seattle_Freq_Ov1_1x1_YUV444_QP1.jxr
- Seattle_Freq_Ov1_1x1_YUV444_QP10.jxr
- Seattle_Freq_Ov2_1x1_YONLY_QP10.jxr
- Seattle_Freq_Ov2_1x1_YUV444_QP1.jxr
- Seattle_Freq_Ov2_1x1_YUV444_QP10.jxr

These files can be found in the directory BasicAndOverlap_1x1Tile.

7.3 Reference file set BasicAndOverlap_4x4Tile

This collection of 42 .jxr files has the same type of syntax element characteristics as in the BasicAndOverlap_1x1Tile file set (subclause 7.2), except that in the files in BasicAndOverlap_4x4Tile, the syntax elements NUM_HOR_TILES_MINUS1 and NUM_VER_TILES_MINUS1 are both set to 3, resulting in each image being structured as a 4×4 grid of tiles. The remaining note syntax characteristics are repeated here:

- The FREQUENCY_MODE_CODESTREAM_FLAG syntax element is set to FALSE (spatial mode) or TRUE (frequency mode).
- The OVERLAP_MODE is varied between the values 0, 1 and 2.
- The INTERNAL_CLR_FMT is set to YUV444, YUV422, YUV420, or YONLY.
- The QP (for all color channels and all bands) is set to 1 or 10.

The following files are included in the BasicAndOverlap_4x4Tile file set:

- Seattle_Spat_Ov0_4x4_YONLY_QP10.jxr
- Seattle_Spat_Ov0_4x4_YUV420_QP1.jxr
- Seattle_Spat_Ov0_4x4_YUV420_QP10.jxr
- Seattle_Spat_Ov0_4x4_YUV422_QP1.jxr
- Seattle_Spat_Ov0_4x4_YUV422_QP10.jxr
- Seattle_Spat_Ov0_4x4_YUV444_QP1.jxr
- Seattle_Spat_Ov0_4x4_YUV444_QP10.jxr
- Seattle_Spat_Ov1_4x4_YONLY_QP10.jxr
- Seattle_Spat_Ov1_4x4_YUV420_QP1.jxr
- Seattle_Spat_Ov1_4x4_YUV420_QP10.jxr
- Seattle_Spat_Ov1_4x4_YUV422_QP1.jxr
- Seattle_Spat_Ov1_4x4_YUV422_QP10.jxr
- Seattle_Spat_Ov1_4x4_YUV444_QP1.jxr
- Seattle_Spat_Ov1_4x4_YUV444_QP10.jxr
- Seattle_Spat_Ov2_4x4_YONLY_QP10.jxr
- Seattle_Spat_Ov2_4x4_YUV420_QP1.jxr
- Seattle_Spat_Ov2_4x4_YUV420_QP10.jxr
- Seattle_Spat_Ov2_4x4_YUV422_QP1.jxr
- Seattle_Spat_Ov2_4x4_YUV422_QP10.jxr
- Seattle_Spat_Ov2_4x4_YUV444_QP1.jxr
- Seattle_Spat_Ov2_4x4_YUV444_QP10.jxr
- Seattle_Freq_Ov0_4x4_YONLY_QP10.jxr
- Seattle_Freq_Ov0_4x4_YUV420_QP1.jxr
- Seattle_Freq_Ov0_4x4_YUV420_QP10.jxr
- Seattle_Freq_Ov0_4x4_YUV422_QP1.jxr
- Seattle_Freq_Ov0_4x4_YUV422_QP10.jxr
- Seattle_Freq_Ov0_4x4_YUV444_QP1.jxr
- Seattle_Freq_Ov0_4x4_YUV444_QP10.jxr
- Seattle_Freq_Ov1_4x4_YONLY_QP10.jxr
- Seattle_Freq_Ov1_4x4_YUV420_QP1.jxr
- Seattle_Freq_Ov1_4x4_YUV420_QP10.jxr
- Seattle_Freq_Ov1_4x4_YUV422_QP1.jxr
- Seattle_Freq_Ov1_4x4_YUV422_QP10.jxr