DRAFT INTERNATIONAL STANDARD
ISO/IEC DIS 21122-5

ISO/IEC JTC **1**/SC **29**

Secretariat: **JISC**

Voting begins on:
2019-10-28

Voting terminates on:
2020-01-20

Information technology — JPEG XS low-latency lightweight image coding system —

Part 5:
Reference software

Technologies de l'information — Système de codage d'images léger à faible latence JPEG XS —

Partie 5: Logiciel de référence

ICS: 35.040.40

This document is circulated as received from the committee secretariat.

Reference number
ISO/IEC DIS 21122-5:2019(E)

© ISO/IEC 2019

COPYRIGHT PROTECTED DOCUMENT

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.

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).

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).

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/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 21122 series can be found on the ISO website.

Introduction

This International Standard is part of a series of standards for a low-latency lightweight image coding system, denoted JPEG XS.

In many use cases during production or transmission of a movie, limiting the latency and the recompression loss is a more important aspect than the compression efficiency. The JPEG XS coding system offers compression and recompression of image sequences with very moderate computational resources while remaining robust under multiple compression and decompression cycles and mixing of content sources, e.g. embedding of subtitles, overlays or logos. Typical target compression ratios ensuring visually lossless quality are in the range of 2:1 to 10:1, depending on the nature of the source material. The end-to-end latency can be confined to a fraction of a frame, typically between a small number of lines down to below a single line.

This document provides the reference software of the JPEG XS standard.

Information technology — JPEG XS low-latency lightweight image coding system —

Part 5:
Reference software

1. Scope

The ISO/IEC 21122 standard, also known under the term JPEG XS, specifies a low-latency, lightweight image compression system offering compression tools for high-speed, ultra-low online compression of images and image sequences.

This document contains the reference software of JPEG XS. Its purpose is to act as a guideline for implementations and as a reference for conformance testing. It has been successfully compiled and tested on Linux and Windows™ operating systems at the time of writing.

2. Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this document. 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 document are encouraged to investigate the possibility of applying the most recent edition of the Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 21122-1: *Information Technology – JPEG XS Low-latency lightweight image coding system – Part 1: Core coding system*

ISO/IEC 21122-2: *Information Technology – JPEG XS Low-latency lightweight image coding system – Part 2: Profiles and Buffer Models*

ISO/IEC 21122-4: *Information Technology – JPEG XS Low-latency lightweight image coding system – Part 4: Conformance testing.*

3. Definitions, abbreviations and symbols

3.1. Definitions

For the purposes of this Recommendation | International Standard, the terms, definitions and abbreviated terms given in ISO/IEC 21122-1, ISO/IEC 21122-2, ISO/IEC 21122-4 and the following apply.

3.1.1.
reference software decoder

software decoder provided as an electronic attachment to this document.

3.1.2.
testing

process of evaluating conformance

3.2. Abbreviations

For the purposes of this document, the following abbreviations apply.

MSE   Mean Square Error

PSNR   Peak Signal to Noise Ratio

4. Conventions

4.1. Operators

NOTE – Many of the operators used in this document are similar to those used in the C programming language.

4.1.1. Arithmetic operators

+	Addition
−	Subtraction (as a binary operator) or negation (as a unary prefix operator)
×	Multiplication
/	Division without truncation or rounding.

4.2. Typesetting

Regular face fonts as this text describe informative text that provides instructions, comments or details for the reader.

```
Monospaced text as this paragraph indicates program input or output as necessary
to either run the software, or as generated by the software on the console.
```

5. Reference software

5.1. Purpose

The purpose of this document is to provide the following:

- Provide a reference decoder software capable of decoding codestreams that conform to ISO/IEC 21122-1, or to ISO/IEC 21122-1 and ISO/IEC 21122-2.

- Provide a sample encoder software capable of producing codestreams that conform to ISO/IEC 21122-1 and ISO/IEC 21122-2.

The use of the reference software is not required for making an implementation of an encoder or decoder in conformance to any of the parts of the ISO/IEC 21122 standard. Requirements established in ISO/IEC 21122-1 and ISO/IEC 21122-2 take precedence over the behaviour of the reference software.

The reference software is normative in the sense that the output its decoder generates is the normative output of the decoding process specified by ISO/IEC 21122-1. ISO/IEC 21122-4 therefore defines conformance testing by means of comparing the output of a candidate implementation by that of the reference software specified in this document. It is also normative in the sense that it allows validation of the codestream syntax by attempting to decode a candidate codestream with the reference software decoder. A candidate codestream that is not decodable by the reference software decoder is not conforming to the syntax specified in ISO/IEC 21122-1.

5.2. Examples of use

Some examples of use for the reference decoder software implementations are as follows:

- As an illustration of how to perform the decoding processes specified in ISO/IEC 21122-1.

- As the starting basis for the implementation of a decoder that conforms to ISO/IEC 21122-1.

- For testing the conformance of a decoder implementation to ISO/IEC 21122-1 with the procedures specified in ISO/IEC 21122-4 (Conformance Testing). Details on reference testing can be found in ISO/IEC 21122-4.

- For (non-exhaustive) testing of the conformance of a codestream (or file) to the constraints specified in ISO/IEC 21122-1.

The lack of detection of any conformance violation by any reference software implementation should not be considered as a definite proof that the codestream under testing conforms to all constraints required for it be conforming to ISO/IEC 21122-1. In fact, ISO/IEC 21122-4 defines additional testing procedures that can be used to test a codestream for

conformance to ISO/IEC 21122-1 and ISO/IEC 21122-2, such as for example testing the conformance to the buffer models specified there.

Some examples of use for a sample encoder software are as follows:

- As an illustration of how to implement an encoding process that produces codestreams that are conforming to ISO/IEC 21122-1 and ISO/IEC 21122-2.

- As starting point for an implementation of an encoder that conforms to ISO/IEC 21122-1 and ISO/IEC 21122-2.

- As a means of generating codestreams conforming to ISO/IEC 21122-1 and ISO/IEC 21122-2 for testing purposes.

- As a means of demonstrating and evaluating examples of the quality that can be achieved by an encoding process that conforms to ISO/IEC 21122-1 and ISO/IEC 21122-2.

However, no guarantee of the quality that will be achieved by an encoder is provided by its conformance to ISO/IEC 21122-1 as the conformance is only defined in terms of specific constraints imposed on the syntax of the generated codestream. In particular, while sample encoder software implementations may suffice to provide some illustrative examples of which quality can be achieved within the ISO/IEC 21122 standard, they provide neither an assurance of minimum guaranteed image encoding quality nor maximum achievable image encoding quality.

Similarly, the computation resource characteristics in terms of program or data memory usage, execution speed, etc. of sample software encoder or decoder implementations should not be construed as a representative of the typical, minimal or maximal computational resource characteristics to be exhibited by implementations of ISO/IEC 21122-1.

5.3. Layout of this document

This document is structured in three Annexes, Annex A, Annex B and Annex C. Annex A describes unpacking, configuration and compiling the reference software. Annex B describes the file formats in which the sample encoder accepts images and into which the reference decoder reconstructs images. Annex C describes its use as encoder or decoder. In addition to the main text, the reference software is available as an electronic attachment to this document.

6. Copyright, licensing and intellectual property

These software modules were originally developed by the parties indicated in the file LICENCE within the package forming a part of this document, in the course of development of ISO/IEC 21122-5. ISO/IEC draws the attention of the users of these software modules to the license terms and conditions specified in the same LICENSE file. Those intending to use these software modules in hardware or software products are advised that their use may infringe existing patents. In particular, the original developers of these software modules and their respective companies, the editors and their companies, and ISO/IEC have disclaimed liability for any proposed use of these software modules or modifications thereof.