
**Information technology — Scalable
compression and coding of
continuous-tone still images —**

**Part 7:
HDR Floating-Point Coding**

*Technologies de l'information — Compression échelonnable et codage
d'images plates en ton continu —*

Partie 7: Codage de la virgule flottante en HDR





COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

| | Page |
|---|-----------|
| Foreword | iv |
| Introduction | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms, definitions, symbols and abbreviated terms | 1 |
| 4 Conventions | 9 |
| 4.1 Conformance language | 9 |
| 4.2 Operators | 9 |
| 4.2.1 Arithmetic operators | 10 |
| 4.2.2 Logical operators | 10 |
| 4.2.3 Relational operators | 10 |
| 4.2.4 Precedence order of operators | 10 |
| 4.2.5 Mathematical functions | 11 |
| 5 General | 11 |
| 5.1 Overview | 11 |
| 5.2 High-level overview on JPEG XT ISO/IEC 18477-7 (informative) | 11 |
| 5.3 Profiles | 13 |
| 5.4 Encoder requirements | 13 |
| 5.5 Decoder requirements | 13 |
| Annex A (normative) Encoding and decoding process | 14 |
| Annex B (normative) Boxes | 19 |
| Annex C (normative) Multi-component decorrelation | 31 |
| Annex D (normative) Half-exponential output transformation | 32 |
| Annex E (normative) Profiles | 33 |
| Annex F (informative) Implementation guidelines | 43 |
| Bibliography | 49 |

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*, SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This second edition cancels and replaces the first edition (ISO 18477-7:2016), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

- a definition has been added for the term “horizontal subsampling factor” as [3.1.31](#);
- notes to entry have been added to terms throughout [Clause 3](#);
- text in [F.3](#) and [F.4.2](#) has been modified;
- minor editorial changes.

A list of all the parts in the ISO/IEC 18477 series can be found on the ISO website.

Introduction

This document specifies a coded codestream format for storage of continuous-tone high and low dynamic range photographic content. JPEG XT part 7 is a scalable image coding system supporting multiple component images consisting of floating-point samples. It is by itself an extension of the coding tools defined in ISO/IEC 18477-1 and the box-based format defined in ISO/IEC 18477-3; the codestream is composed in such a way that legacy applications conforming to Rec. ITU-T T.81 | ISO/IEC 10918-1 are able to reconstruct a lower quality, low dynamic range, eight bits per sample version of the image. This standard low dynamic range image is typically constructed at the encoder side by tone mapping from the high dynamic image; while the LDR image is always present, this document does not define a process that generates this image.

Today, the most widely used digital photography format, a minimal implementation of JPEG (specified in Rec. ITU-T T.81 | ISO/IEC 10918-1), uses a bit depth of 8; each of the three channels that together compose an image pixel is represented by eight bits, providing 256 representable values per channel. If the dynamic range of the input scene is too large, however, an integer sample representation is no longer applicable and sample values need to be specified in floating-point. These values typically are, or are proportional to physical radiance values of three primaries. These primaries may be device specific physical colours, or may be the basis of the CIE XYZ colour space.

JPEG XT is primarily designed to provide coded data containing high dynamic range and wide colour gamut content while simultaneously providing eight bits per pixel low dynamic range images using tools defined in ISO/IEC 18477-1. The goal is to provide a backwards compatible coding specification that allows legacy applications and existing tool chains to continue to operate on codestreams conforming to this document.

JPEG XT has been designed to be backwards compatible to legacy applications while at the same time having a small coding complexity; JPEG XT uses, whenever possible, functional blocks of Rec. ITU-T T.81 | ISO/IEC 10918-1 to extend the functionality of the legacy JPEG Coding System. It is optimized for storage and transmission of high dynamic range and wide colour gamut floating-point images while also enabling low-complexity encoder and decoder implementations.

This document is an extension of ISO/IEC 18477-1, a compression system for continuous-tone digital still images which is backwards compatible with Rec. ITU-T T.81 | ISO/IEC 10918-1. That is, legacy applications conforming to Rec. ITU-T T.81 | ISO/IEC 10918-1 will be able to reconstruct streams generated by an encoder conforming to this document, though will possibly not be able to reconstruct such streams in full dynamic range, full quality or other features defined in this document.

This document is itself based on ISO/IEC 18477-3, which defines a box-based file format similar to other JPEG standards. The aim of this document is to provide a migration path for legacy applications to support, potentially in a limited way, lossless coding and coding of high dynamic range images consisting of samples represented in floating-point. Existing tools depending on the existing standards will continue to work, but will only be able to reconstruct a lossy and/or a low dynamic range version of the image contained in the codestream. This document specifies a coded file format, referred to as JPEG XT, which is designed primarily for storage and interchange of continuous-tone photographic content

Information technology — Scalable compression and coding of continuous-tone still images —

Part 7: HDR Floating-Point Coding

1 Scope

This document specifies a coding format, referred to as JPEG XT, which is designed primarily for continuous-tone photographic content.

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/IEC 18477-1:2015, *Information technology — Scalable compression and coding of continuous-tone still images — Part 1: Scalable compression and coding of continuous-tone still images*

ISO/IEC 18477-2, *Information technology — Scalable compression and coding of continuous-tone still images — Part 2: Coding of high dynamic range images*

ISO/IEC 18477-3:2015, *Information technology — Scalable compression and coding of continuous-tone still images — Part 3: Box file format*

ISO/IEC 18477-6:2016, *Information technology — Scalable compression and coding of continuous-tone still images — Part 6: IDR Integer Coding*

ISO/IEC/IEEE 60559, *Information technology — Microprocessor Systems — Floating-Point arithmetic*

Rec. ITU-T T.81 | ISO/IEC 10918-1:1994, *Information technology — Digital compression and coding of continuous-tone still images — Requirements and guidelines*

Rec. ITU-T BT.601, *Studio encoding parameters of digital television for standard 4:3 and wide screen 16:9 aspect ratios*