

**ISO/IEC JTC 1/SC29/WG1  
(ITU-T SG16)**

**Coding of Still Pictures**

**JBIG**

Joint Bi-level Image  
Experts Group

**JPEG**

Joint Photographic  
Experts Group

**TITLE:** Draft CfP for a JPEG Reference Software

**SOURCE:** Thomas Richter

**PROJECT:** JPEG

**STATUS:** Proposal

**REQUESTED  
ACTION:** For distribution

**DISTRIBUTION:** Public

**Contacts:**

ISO/IEC JTC 1/SC29/WG1 Convener – Prof. Touradj Ebrahimi  
EPFL/STI/IEL/GR-EB, Station 11, CH-1015 Lausanne, Switzerland  
Tel: +41 21 693 2606, Fax: +41 21 693 7600, E-mail: Touradj.Ebrahimi@epfl.ch

## JPEG Reference Software Call for Proposals

### Introduction

While JPEG (Rec. ITU T.81 | ISO/IEC 10918) is still the most dominant still image format around, it may seem surprising that ISO/IEC never provided a reference software demonstrating a proper implementation of the standard, and as such, has given rise to third party implementations of ISO/IEC 10918 that, however, often implement the JPEG standard only incompletely, or sometimes even deviate from it. Given the market dominance of ISO/IEC 10918, it seems desirable to guide implementations to the correct implementation of this Recommendation | International Standard and to provide reference as how to reach conformance to it.

JPEG has a long tradition of providing open source software based only on license-fee-free and royalty-free technology, and it is the goal of this call to identify a software that is available under such licenses, e.g. BSD or a GPL license.

### Desired Features

The JPEG standard is designed as a “toolbox” approach, consisting of several orthogonal coding modes and features, only some of which have found wide market adoption.

The JPEG standard only defines a codestream format, i.e. mechanisms how to encode raw sample values, but it did not provide means to interpret these samples. In particular, color spaces and sample positions remained undefined, and JFIF as (non-ISO, living) de-facto standard specified such processes later on. Only recently JFIF has been standardized by ISO. As such, WG1 considers it useful to include such additional features in a potential reference software, even though they are formally not part of ISO/IEC 10918-1.

Other tools that are part of ISO/IEC 10918-1 have not found much market adoption, and WG1 may consider not to include them in a reference implementation as they are less relevant in practical applications.

This paragraph provides a prioritized list of features a potential reference software should provide. It is in addition necessary for the purpose of a software to act as a reference to ISO standards that all the codestreams it is able to generate are compliant to such standards.

Feature	Comments	Priority
Baseline sequential DCT process		high
Extended sequential Huffman DCT based process with 8 bit sample precision		high
Conformance to the error bounds specified in 10918-2		high
Inclusion of an encoder in addition to a decoder		high
YCbCr to RGB (ITU.T 601) conversion	Not formally part of 10918-1, specified in 10918-5 and 18477-1	high
Upsampling and downsampling for 422 and 420	The upsampling and downsampling algorithm is not formally part of 10918-1, specified in 10918-5 and 18477-1, the signaling of the downsampling factors is, however, specified in 10918-1.	high
Extended progressive Huffman DCT process		high
Conformance to the (tighter) error bounds specified in 18477-4		high
Support for the restart markers RST <sub>m</sub>		high
Adobe “RGB” marker	Not formally part of 10918-1, specified in 10918-5 and 18477-1	high
Lossless (predictive) Huffman coding process with 2-16 bit sample precision		high
Extended sequential Huffman DCT based process		high

with 12 bit sample precision		
Placement of chroma components (centered or co-sited)	Not formally part of 10918-1, specified in 10918-5 and selectable by an APP marker specified there.	
Improved coding performance through advanced techniques with constrained complexity overhead	Non-normative addition an encoder may want to provide, not specified anywhere	
Support for ICC color spaces, inclusion of a color management module supporting matrix-based V2 ICC profiles	Not formally part of ISO/IEC 10918-1, but specified in ISO/IEC 10918-5 by an APP marker.	
Support for the DNL marker		
Hardened implementation, i.e. robustness against several attack vectors, tested through a “fuzzing” test		
Extended sequential arithmetic coding DCT based process with 8 bit sample precision		
Extended sequential arithmetic coding DCT based process with 12 bit sample precision		
Extended progressive arithmetic coding DCT based process with 8 bit sample precision		
Extended progressive arithmetic coding DCT based process with 12 bit sample precision		
Lossless (predictive) arithmetic coding process		
Additional integer upsampling and downsampling factors between 3 and 4		
Hierarchical process combined with the baseline or extended DCT process		
Hierarchical process combined with the lossless process		
Support for ICC color spaces, inclusion of a color management module supporting generic ICC profiles	Not formally part of ISO/IEC 10918-1, but specified in ISO/IEC 10918-5 by an APP marker.	
Fractional (generic) upsampling and downsampling factors	The codestream format also allows signaling of fractional sampling factors.	

**Submission requirements**

Proponents are expected to deliver a JPEG encoder and decoder implementation in source code, along with instructions how to compile and run the provided sources. Ideally, the software should run on both Linux and Windows operating systems. Proponents are further asked to provide a table similar to the above that lists the JPEG tools and additional features their software implements.

**Evaluation of proposals**

Proposed software will be tested according to the test procedures defined in ISO/IEC 10918-2, in particular error bounds of the software will be tested against the bounds defined in the above standard. In addition, the decoder will be tested against the error bounds for ISO/IEC 18477-1 (JPEG XT Part 1) with the codestreams provided for this part in ISO/IEC 18477-4. Note that ISO/IEC 18477-1 (JPEG XT Part 1) is a subset of the JPEG standard that does not introduce additional coding tools, though enforces stricter error bounds on compliant decoders. Furthermore, proposed software will be tested against the requested features listed in the above table in order to evaluate the completeness of the support of the JPEG standard.



75th Meeting, Sydney, Australia 27-31 March 2017

## **Timeline**

The following schedule is planned for the development of the JPEG Reference software from the CfP to publication of the standard.

03/2017	Draft CfP
07/2017	Final CfP
Sept. 26 2017	Submission deadline for response to CfP
Oct. 23-27 2017	Evaluation and Working draft (WD) at the 77 <sup>th</sup> meeting of the WG1 committee
01/2018	CD
04/2018	DIS
07/2018	IS

## **IPR Conditions (ISO/IEC Directives)**

Proponents are advised that this call is being made in the framework and subject to the common patent policy of ITU-T/ITU-R/ISO/IEC and other established policies of these standardization organizations. The persons named below as contacts can assist potential submitters in identifying the relevant policy information. It is, however, the goal of this project to provide the Reference Software under a Royalty Free (RF) license condition.

## **Contribution to Standardization**

Proponents are informed that a standard specification will be created. If they submit a proposal and the proposed software is accepted for inclusion in the standard, they will hence have to attend subsequent WG1 meetings and contribute to the creation of various standard documents. Within this process, evolution and changes are possible.

## **Further Information**

The JPEG Reference Software Ad Hoc Group has been established between 73<sup>th</sup> and 75<sup>th</sup> JPEG meetings in order to continue activities and progress within the planned work. All interested parties are requested to register to the email reflector of the AHG.

E-mail reflector: [jpeg-reference@listserv.uni-stuttgart.de](mailto:jpeg-reference@listserv.uni-stuttgart.de)

In order to subscribe to the mailing list, please follow the link:

<https://listserv.uni-stuttgart.de/mailman/listinfo/jpeg-reference> and follow the steps of the e-mail being received.

## **Contacts**

Touradj Ebrahimi (JPEG Convener)

Email: [Touradj.Ebrahimi@epfl.ch](mailto:Touradj.Ebrahimi@epfl.ch)

Thomas Richter (JPEG Reference AhG chair)

Email: [richter@tik.uni-stuttgart.de](mailto:richter@tik.uni-stuttgart.de)