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Information technology — Plenoptic image coding system (JPEG Pleno) —

Part 3: Conformance testing

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Foreword

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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 or www.iec.ch/members_experts/refdocs).

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This document was prepared by Joint 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 21794 series can be found on the ISO and IEC websites.

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Introduction

This document is part of a series of standards for a system known as JPEG Pleno. The ISO/IEC 21794 series aims to provide a standard framework for representing new imaging modalities. It facilitates the capture, representation, exchange and visualization of plenoptic imaging modalities. A plenoptic image modality can be a light field, point cloud or hologram, which are sampled representations of the plenoptic function in the form of, respectively, a vector function that represents the radiance of a discretized set of light rays, a collection of points with position and attribute information, or a complex wavefront. The plenoptic function describes the radiance in time and in space obtained by positioning a pinhole camera at every viewpoint in 3D spatial coordinates, every viewing angle and every wavelength, resulting in a 7D function.

JPEG Pleno is designed primarily to facilitate the capture, representation, exchange and visualization of point cloud, light field and holographic imaging modalities. It specifies tools for coding these modalities while providing advanced functionality at the system level, such as support for data and metadata manipulation, editing, random access and interaction, protection of privacy and ownership rights, as well as other security mechanisms.

This document provides the framework, concepts and methodology for testing codestreams and implementations, and the criteria to be achieved to claim conformance to the ISO/IEC 21794 series. The objective of this document is to promote interoperability between JPEG Pleno decoders, and to test these systems for conformance to one or multiple specifications that are part of the JPEG Pleno. Conformance testing is the testing of a candidate implementation for the existence of specific characteristics required by a standard. It involves testing the capabilities of an implementation against the conformance requirements in the relevant standard.

The purpose of this document is to define a common test methodology, to provide a framework for specific test cases and to define the procedures to be followed during conformance testing.

Any organization contemplating the use of the test methods defined in this document should carefully consider the constraints on their applicability. Conformance testing does not include robustness testing, acceptance testing or performance testing, all of which are outside the scope of this document.

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Information technology — Plenoptic image coding system (JPEG Pleno) —

Part 3: Conformance testing

1 Scope

This document provides the conformance testing of the ISO/IEC 21794 series, also known as JPEG Pleno.

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 21794-1, *Information technology — Plenoptic image coding system (JPEG Pleno) — Part 1: Framework*

ISO/IEC 21794-2:2021, *Information technology — Plenoptic image coding system (JPEG Pleno) — Part 2: Light field coding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 21794-1 and ISO/IEC 21794-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
baseline block-based profile
BBBP
4D transform mode coding tools

3.2
baseline view-based profile
BVBP
4D prediction mode coding tools

3.3
box
structured collection of data describing a portion of the file format defined by a length and unique box type

3.4
conformance
fulfilment of the specified requirements for a given profile

Note 1 to entry: The specified requirements are those defined in this document.

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3.5
conformance test procedure
steps for assessing *conformance* (3.4)

3.6
executable test suite
ETS
set of executable test cases that support the abstract test cases

3.7
file format
codestream and its additional support information encoded for storage in a computer file

3.8
header
part of the codestream that contains only markers and marker segments

3.9
image
set of all components

3.10
implementation
realization of a specification

3.11
mean squared error
MSE
average squared difference between the decoded values and the pristine value

3.12
parser
program for syntax analysis

3.13
precision
number of binary digits allocated to a given sample

3.14
prediction mode codestream
ISO/IEC 21794-2 codestream obtained using the 4DPM coding tools

3.15
peak signal-to-noise ratio
PSNR
fidelity measurement between the original and decompressed signal

3.16
test codestream
TCS
available codestream designed to test specific tools

3.17
testing
process of evaluating conformance

3.18
transform mode codestream
ISO/IEC 21794-2 codestream obtained using the 4DTM coding tools

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4 Abbreviated terms

4DPM four-dimensional prediction mode

4DTM four-dimensional transform mode

ASCII American Standard Code for Information Interchange

5 General description

5.1 Overview

JPEG Pleno encoders will possibly employ only a fraction of the features specified by ISO/IEC 21794-2. Likewise, some decoders might not implement all the features specified by ISO/IEC 21794-2. It is impossible to provide test cases for all possible configurations of tools that an encoder or decoder can implement. This document provides abstract test procedures for JPEG Pleno encoders and decoders. A developer may designate the features that have been implemented and determine a set of test cases that applies to those features. This document specifies explicit decoder test procedures that aim to ensure the greatest level of interoperability between various implementations of encoders and decoders. These test procedures are used to derive tests that are run for a particular profile. Passing the explicit tests for a given profile allows a decoder to be labelled as "conforming to a given profile".

Even with the explicit decoder tests, it is expected that some decoders will not decode all of the information that was originally incorporated into the codestream by an encoder. Since ISO/IEC 21794-2 defines many auxiliary boxes, it is desirable to allow decoders to ignore information that is not of interest to their target application.

This document describes conformance for JPEG Pleno decoders in terms of a system of assurance. These assurances serve to discourage encoders from producing codestreams that will be exceedingly difficult or impossible for a decoder to process, to encourage decoders to provide quality images from any reasonable codestream, and to encourage the use of the flexibility and scalability of JPEG Pleno codestreams.

5.2 Profiles and levels

Profiles define a subset of coding techniques, from the ISO/IEC 21794 series, that meet the needs of a given application. Levels provide information about resolution and memory constraints in conforming decoder implementations. Decoders implement the capabilities for all bitstreams encoded for a particular profile. Encoders achieve quality guarantees for particular decoders by encoding bitstreams which meet a particular profile and level definition.

If a JPEG Pleno encoder produces a codestream with certain properties, then a decoder of a certain profile and level will be able to produce an image with some defined level of quality. The tests in this document are designed to require a conforming decoder to be capable of decoding all codestreams.

Two profiles are labelled as baseline block-based profile (BBBP) and baseline view-based profile (BVBP). These two profiles describe bitstream constraints for an encoder implementing ISO/IEC 21794-1 and ISO/IEC 21794-2. BBBP corresponds to the 4DTM coding tools. Specifically, this profile considers the tools described in Annexes A and B but excludes the tools detailed in ISO/IEC 21794-2:2021, Annexes C, D and E. BVBP corresponds to the 4DPM tools and requires the implementation of all annexes but Annex B. These profiles do not define a hierarchy, and hence are not subsets of each other. In other words, they are independent of each other and no other simple relation holds between the other profiles.

Levels define the complexity of the decoding tools and serve as guidance for encoders to produce codestreams that are easily decodable by decoders conforming to a given profile and level. A lower level is a subset of a higher level. Hence, any implementation capable of decoding a higher-level test codestream (TCS) shall be capable of passing the conformance tests for a lower-level codestream of the same profile.

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5.3 Objective metrics

Maximum absolute error and peak signal-to-noise ratio (PSNR) are the objective metrics used for computing the distortions obtained from the conformance test procedure.

The maximum absolute error, $E_{\max}$, between the original component, I, and the reconstructed component, I', both with size $M \times N$ samples, is computed as follows:

$$E_{\max} = \max_{0 \le i < M,\ 0 \le j < N} (|I(i,j) - I'(i,j)|)$$

The maximum absolute error of the whole light field is the maximum value obtained for all sub-aperture images.

The PSNR between the original component, I, and the reconstructed component, I', (both n-bit) is computed as follows:

$$S_{\text{PSNR}} = 10 \times log_{10}\left(\frac{(2^n - 1)^2}{E_{\text{MSE}}}\right)$$

where E_{MSE} is the mean squared error (MSE) between the two $M \times N$ images, I and I':

$$E_{\text{MSE}} = \frac{1}{M \times N} \sum_{i=0}^{M-1} \sum_{j=0}^{N-1} (I(i,j) - I'(i,j))^2$$

Once the PSNR of the Y-channel ($S_{\text{PSNR,Y}}$), the PSNR of the Cb-channel ($S_{\text{PSNR,Cb}}$) and the PSNR of the Cr-channel ($S_{\text{PSNR,Cr}}$) are computed, the PSNR of all three channels ($S_{\text{PSNR,YCbCr}}$) should be computed as follows:

$$S_{\text{PSNR},YCbCr} = \frac{6 \times S_{\text{PSNR},Y} + S_{\text{PSNR},Cb} + S_{\text{PSNR},Cr}}{8}$$

The PSNRs for the whole light field ($S_{\text{PSNR,LF}}$) are computed by averaging the PSNRs for all sub-aperture images.

5.4 Test procedures to test decoders for conformance to ISO/IEC 21794-2

The test procedure specified in Annex A shall be used for testing whether a decoder under test conforms to a particular profile and level from ISO/IEC 21794-2. Annex B specifies the test suites and the references and tolerances allowed for each TCS.

5.5 File format syntax testing

The procedures defined in Annex C shall be used for testing JPEG Pleno files for conformity to the file format specified in ISO/IEC 21794-1 and ISO/IEC 21794-2. They depend on a codestream syntax parsing tool whose source code is available as a machine-readable file at https://standards.iso.org/iso-iec/21794/-3/ed-1/en.

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Annex A
(normative)

Decoder conformance testing procedure

A.1 General

This annex defines procedures to follow for determining whether a decoder conforms to a particular profile within a particular part.

A.2 Decoder test procedure for baseline block-based profile

The procedure defined in this clause will determine whether a decoder conforms to a given level of the BBBP. A decoder under test is said to conform to a level of BBBP if it is able to decode all TCSs for that level and the maximum absolute error $E_{\max} \leq 2$ when comparing the reconstructed views with their reference view counterparts. Figure A.1 shows the test procedure.

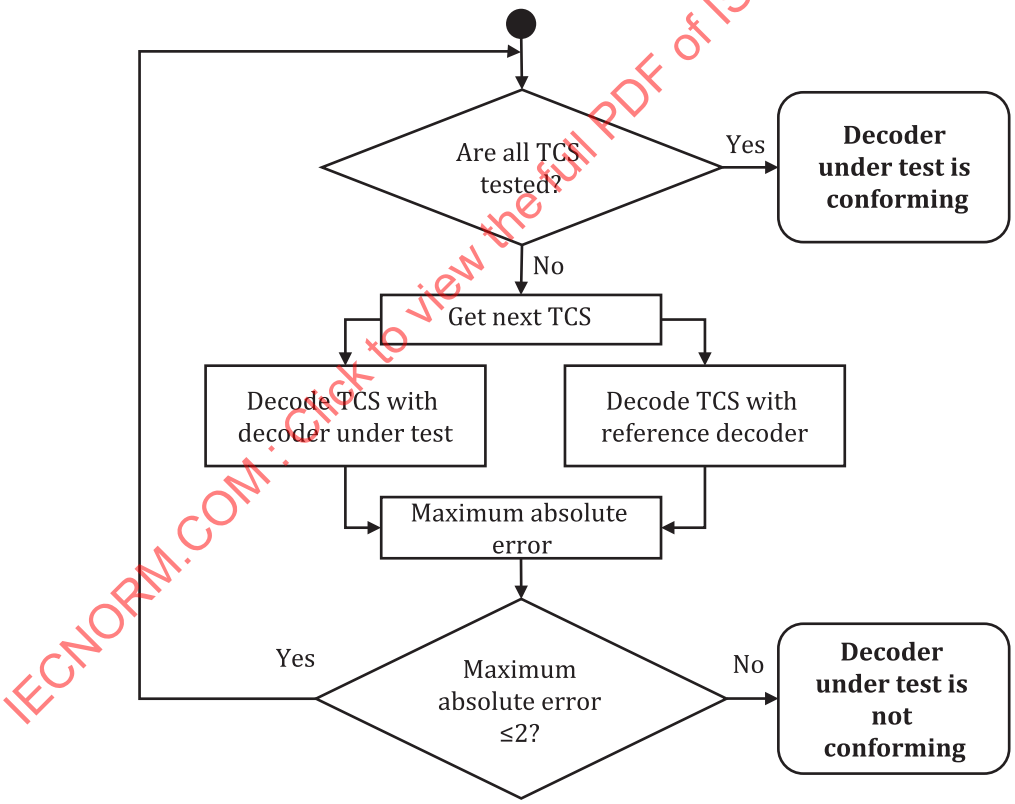

Figure A.1 — Decoder conformance test procedure for a level of the baseline block-based profile

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A.3 Decoder setting for baseline block-based profile

A.3.1 Reference software decoder settings

The reference decoder software for the BBBP, specified in ISO/IEC 21794-4[1)] along with build instructions, is used to obtain the reference views. For a given TCS, the reference decoder software shall be named as follows:

```
~/jpeg-pleno-refsw/bin$ jpl-decoder-bin --input bbbp-{###}.jpl \
   --output ./bbbp-{###}/
```

The decoded reference views will be available after the decoding process is completed in the folder ./bbbp-{###}/. in a specific file format defined in A.3.2.

A.3.2 Reference components file format

The organization or name convention of view files for the block-based profile reference decoder is specified in ISO/IEC 21794-4:—, B.2. This decoder is agnostic to any colour space specification and will decode only raw sample values. The reference decoded views are in PGX file format, specified in ISO/IEC 15444-4. Such a file format comports only one component per file, thus light fields with *n*-colour components will require the generation of *n* of such files per view. In order to compare decoded views from the DUT with these reference decoded views, it is possible that several conversions will be necessary. These conversions may be done as post-processing steps outside of the decoder solely for determining conformance. There is no requirement for a conforming decoder to perform these processes as part of its normal operation. These conversions shall not introduce a quality change (either loss or gain) except as required by the specific conversions described in the following clauses.

A.4 Decoder test procedure for baseline view-based profile

A decoder under test is said to conform to a level of the BVBP if it is able to decode all TCSs for that level and the PSNR is greater than the minimum permitted value for the given TCS. Figure A.2 shows the test procedure.

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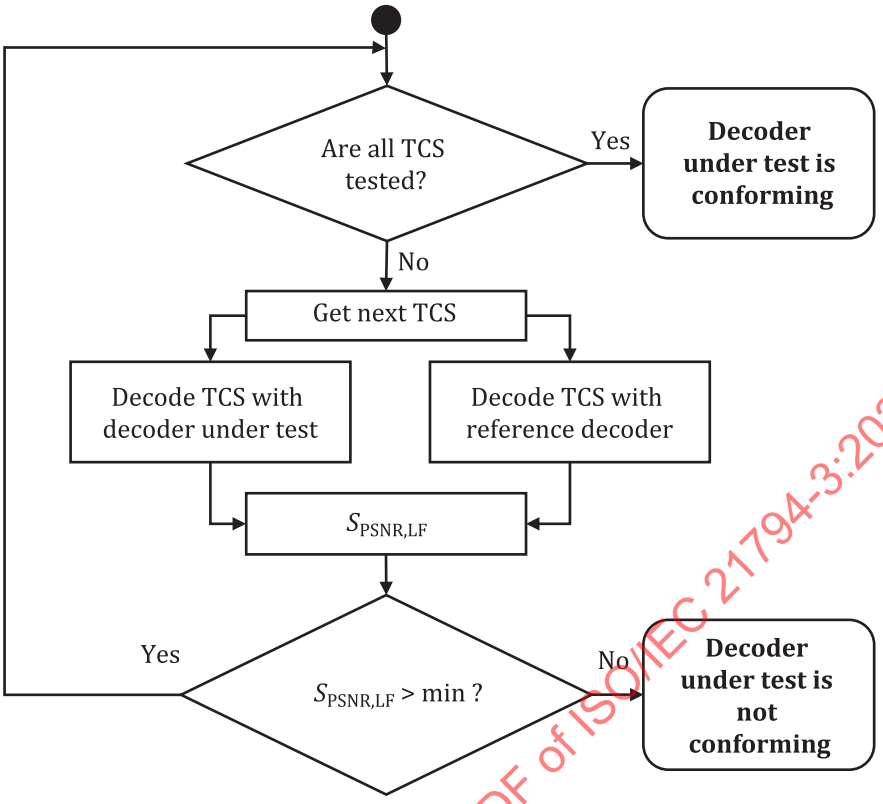

Figure A.2 — Decoder conformance test procedure for a level of the baseline view-based profile

A.5 Decoder settings for baseline view-based profile

A.5.1 Reference software decoder settings

The reference software decoder for the BVBP, specified in ISO/IEC 21794-4 along with build instructions, is used to obtain the reference images. Codestream lossless.jpl contains the lossless coding of a light field composed of 15 × 15 sub-aperture images with resolution 625 × 434 pixel, RGB colour space, 10bit per sample. The reference light field with depth information is obtained as follows:

```
~/jpeg-pleno-refsw-bvbp/bin$ jpl-bvbp-decoder --input lossless.jpl \
   --output ./referenceLF/
```

The decoded reference images will be available in ./referenceLF/PPM and the normalized disparity information will be available in ./referenceLF/PGM.

A.5.2 Reference components file format

A.5.2.1 General

This subclause describes the file format, called PNM, of the reference images used for comparison with the output of the decoder under test. The decoder under test is not required to produce this particular file format, though it is advantageous to perform a conversion to this file format for testing purposes as ISO/IEC 21794-4 provides test tools that are able to decode this format. Any necessary conversion to this format, as specified by subclause A.2.3, may be applied.

The format consists of a header and raw data, concatenated to a single file.

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A.5.2.2 Header format

The format of the header consists of:

— two identifier bytes that specify the data format and encoding, which are the ASCII codes for "P6" (hex 0x50 0x36) for three-component integer sample images, the ASCII codes "P5" (hex 0x50 0x35) for one-component (gray-scale) integer sample images, the ASCII codes "PF" (hex 0x50 0x46) for three-component floating-point sample images, the ASCII codes "Pf" (hex 0x50 0x66) for one-component floating point sample images, followed by any number of white space (ASCII 32, ASCII 8, ASCII 13 or ASCII 10, i.e. blank space, TAB, CR or LF);

— a width in pixels formatted as ASCII encoded decimal number;

— any number of white space;

— a height in pixels formatted as ASCII encoded decimal number;

— for integer sample formats:

  — any number of white space;

  — the maximum sample value, i.e $2^b - 1$, where b is the bit precision of the integer samples;

  — a single ASCII line feed (hex 0x0a);

The raw data formatted according to the following subclause follows this header immediately.

A.5.2.3 Data format

The binary data appears immediately after the line feed (hex 0x0a) byte in the header. The data is stored with the most significant byte first in binary two's complement representation for integer sample images, sign extended to either 1, 2 or 4 bytes. Components are interleaved in this format, in the order "Red, Green, Blue" or "X, Y, Z", depending on the colour space of the image

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Annex B
(informative)

Decoder conformance tests

B.1 General

This annex specifies the test suites and executable test suites (ETSs) that will be used in the conformance test procedures from Annex A.

B.2 Test suites for baseline block-based profile

The purpose of this test is to assess the ability of a decoder implementation to decode codestreams that were encoded using 4D transform mode tools, and the conformance of the DUT with ISO/IEC 21794-1 and ISO/IEC 21794-2:2021, Annexes A and B. The test method shall decode codestreams generated by the reference software with different configurations of the 4DTM tools. These configurations may be limited by the level being tested. Specific test items include:

— light field dimensions with even and odd sizes, to check the correctness of the light field division into 4D blocks;

— 4D block dimensions with even and odd sizes, to check the correctness of the 4D block partitioning into smaller 4D blocks;

— support for the largest 4D block dimension for the level being tested;

— multiple distinct 4D block partitioning;

— multiple 4D DCT sizes;

— different quantization bitplanes;

— border blocks policy, i.e. TRNC flag of LFC (truncate and padding);

— different number of colour channels;

— XML box with catalogue;

— PNT marker segment.

B.3 Test suites for baseline view-based profile

B.3.1 Syntax and compressed data order

The purpose of this test is to check the ability of a decoder to decode codestreams with optional boxes and markers, box and marker values and markers in various locations in the codestream.

The test method shall encode codestreams with varying marker locations and variations of markers that, despite varying implementation details, shall decode to identical images on the same implementation. For example, the location of a box or marker shall not have an impact on the reconstructed image, regardless of other implementation choices.

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B.3.2 External decoder

The purpose of this test is to check the conformance of the external decoder(s) to the corresponding standard (e.g. ISO/IEC 15444-1). The test method shall decode different codestream generated enabling exclusively the coding of reference view module and the coding of depth view module.

B.3.3 Common codestream payload

The purpose of this test is to check the ability of a decoder to decode codestreams conveying the header information from TCODEC encoded file (e.g headers from ISO/IEC 15444-1). The test method shall decode different codestreams using the common codestream payload and different codestreams generated without using the common codestream payload.

B.3.4 JPEG 2000 lossless mode

The purpose of this test is to check the ability of a decoder to decode codestreams where the external codec is using lossless mode in order to identify non-conformance. The test method shall decode different codestreams where the external codec is a lossless one.

B.3.5 Warped view merging

The purpose of this test is to check the ability of a decoder to decode codestreams generated with different merging modes. For this test, the conformance bitstreams are generated with the prediction error correction module disabled. The test method shall decode different codestreams generated, enabling one of the available merging modes: least-squares optimal filter (MMODEp==0), fixed filter (MMODEp=1), median filter (MMODEp=2).

B.3.6 Prediction error correction

The purpose of this test is to check the ability of a decoder to decode codestreams generated with different merging modes and to enable the prediction error correction module. The test method shall decode different codestreams generated, enabling one of the available merging modes: least-squares optimal filter (MMODEp==0), fixed filter (MMODEp=1), median filter (MMODEp=2).

B.4 Executable test suites (ETSs)

B.4.1 General

Each ETS consists of codestreams, reference decoded images, a textual description of the contents of the codestream and tolerance values for MSE or PSNR. Two additional software packages to aid testing are provided in the source code included as a machine-readable file at https://standards.iso.org/iso-iec/21794/-3/ed-1/en. A codestream parser is described in Clause C.2 and a light field quality measurement tool is described in Clause C.5.

B.4.2 References and tolerances for ISO/IEC 21794-2 baseline block-based profile

The TCSs for this ETS are in the directory light_fields/codestreams_block_based_profile. There are 598 codestreams, with names of the form bbbp-###.jpl, where '###' is the codestream number. Table B.1 defines the four ETSs for testing the conformance. Table B.2 lists a few codestreams and their respective tested parameters. The complete table that comprises all TCSs is provided as a machine-readable file at https://standards.iso.org/iso-iec/21794/-3/ed-1/en.

Table B.1 — TCSs for each level of the baseline block-based profile

ETS	Level	Test codestreams
1	Level 1	bbbp-001.jpl to bbbp-579.jpl
2	Level 2	bbbp-001.jpl to bbbp-584.jpl

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Table B.1 *(continued)*

ETS	Level	Test codestreams
3	Level 3	bbbp-001.jpl to bbbp-589.jpl
4	Level 4	bbbp-001.jpl to bbbp-598.jpl

Table B.2 — ISO/IEC 21794-3 test files and tested parameters

Filename	Light field size					Block size max.				Block size min.				Other flags		
	T	S	V	U	NC	T	S	V	U	T	S	V	U	TRNC	XML	PNT
bbbp-001.jpl	13	13	434	625	3	13	13	64	63	13	13	4	1	1	D	E
bbbp-002.jpl	13	13	434	625	1	13	10	61	64	1	1	1	3	1	E	D
bbbp-003.jpl	13	13	434	625	2	8	13	64	64	4	4	16	16	1	D	D
bbbp-004.jpl	3	3	86	124	1	3	3	30	30	3	3	4	4	1	E	D
bbbp-005.jpl	3	3	86	124	3	3	3	30	30	3	3	4	5	0	D	E
…																

B.4.3 References and tolerances for ISO/IEC 21794-2 baseline view-based profile

The TCSs for this ETS are in the directory light_fields/codestreams_view_based_profile. There are 10 codestreams, with names of the form vbp-##.jpl, where '##' is the codestream number. The same folder contains losssless.jpl, the lossless coding of the source light field used for generating these codestreams. Table B.3 lists the codestreams and tolerances for testing implementations against the ISO/IEC 21794-2 view-based profile. The error metrics to be used for these tests are specified in 5.3. The reference decoded files are 10 bit per sample (30 bit per RGB pixel). Table B.4 lists the correspondence between the ABS test objective and the corresponding TCSs for validating the conformance of the decoder under test.

Table B.3 — Test files, reference decoded files and tolerances (minimum allowed $S_{PSNR,LF}$)

TCS	Reference decoded files[a]	TCS description	Minimum allowable $S_{PSNR,LF}$	Notes
vbp-01.jpl	001_001.ppm	Mixed order of box and superboxes with XML box	inf	Testing: syntax and compressed data order; JPEG 2000 lossless; reference view module
vpb-02.jpl	001_001.ppm 001_001.pgm	JPEG 2000 coding of reference view module and the coding of depth view module	inf	Testing: reference view module and reference depth view module
vbp-03.jpl	007_007.ppm 007_007.pgm 003_003.ppm 003_011.ppm 011_003.ppm 011_011.ppm	Common codestream box enabled	inf	Testing decoding when common codestream is enabled

[a] Generated with the reference software decoder.

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Table B.3 *(continued)*

TCS	Reference decoded files[a]	TCS description	Minimum allowable $S_{PSNR,LF}$	Notes
vbp-04.jpl	007_007.ppm 007_007.pgm 003_003.ppm 003_011.ppm 011_003.ppm 011_011.ppm	Common codestream box disabled	inf	Testing decoding when common codestream is disabled
vbp-05.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode zero, with prediction error correction module disabled	29.17dB	Testing least-squares optimal filter module in warped view merging
vbp-06.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode one, with prediction error correction module disabled	12.65dB	Testing fixed filter module in warped view merging
vbp-07.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode two, with prediction error correction module disabled	28.45dB	Testing median filter filter module in warped view merging
vbp-08.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode zero, with prediction error correction module enabled	41dB	Testing prediction error correction module
vbp-09.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode one, with prediction error correction module enabled	33.3dB	Testing prediction error correction module
vbp-10.jpl	{x}_{y}.ppm x=[001:013] y=[001:013]	Warped view merging mode two, with prediction error correction module enabled	39.7dB	Testing prediction error correction module

[a] Generated with the reference software decoder.

Table B.4 — List of test objectives and corresponding TCSs for validating the conformance of the decoder under test

Test objective	TCSs
Syntax and compressed data order	vbp-01.jpl
External decoder(s)	vpb-02.jpl
Common codestream payload	vbp-03.jp, vbp-04.jp
JPEG 2000 lossless mode	vbp-01.jpl, vbp-03.jpl
Warped view merging	vpb-05.jpl, vpb-06.jpl, vpb-07.jpl
Prediction error correction	vpb-08.jpl, vpb-09.jpl, vpb-10.jpl

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Annex C
(normative)

Codestream conformance

C.1 General

This annex defines methods to test the conformance of a codestream to ISO/IEC 21794-2. Conformance to ISO/IEC 21794-2 for the 4D transform mode codestream shall be tested according to the procedure defined in subclause C.2. Conformance to ISO/IEC 21794-2 for the 4D prediction mode codestream shall be tested according to the procedure defined in subclause C.3.

C.2 Testing codestreams for conformance to boxes structure defined in ISO/IEC 21794-1 and ISO/IEC 21794-2

Conformance of codestreams to ISO/IEC 21794-1 and ISO/IEC 21794-2 shall be tested with the codestream parser utility `jpl-parser`, available as a machine-readable file at https://standards.iso.org/iso-iec/21794/-3/ed-1/en. To test a codestream for conformance, execute the codestream parser on the command line as follows:

```
jpl-parser <codestream> [less]
```

where <codestream> shall be substituted by the path to the JPEG Pleno codestream under test. The [less] is an optional constant used for generating a less verbose output displaying only the superbox and box size and type. This codestream does not conform to ISO/IEC 21794-1 if the above script reports errors or non-conformance messages.

NOTE Conformance to ISO/IEC 21794-1 is a necessary condition for conformance to ISO/IEC 21794-2.

Successfully passing the codestream parser utility provides only a preliminary indication that the codestream is syntactically correct and conforms to ISO/IEC 21794-1. This test does not indicate that the codestream is decodable to an image or is syntactically correct, as the codestream parser utility is testing only the file format and not the content of the superboxes containing the encoded light field(s) and/or hologram(s) and/or point cloud(s). Additional tests shall be conducted according to Clause B.3.

C.3 Testing baseline block-based profile codestreams for conformance to ISO/IEC 21794-2

Conformance of a codestream to ISO/IEC 21794-2 shall be tested by processing the codestream under test with the 4D transform mode reference software in ISO/IEC 21794-4. The codestream is non-conforming if the reference software reports errors or non-conformance messages.

Successfully passing the reference software decoder test provides only a preliminary indication that the codestream (or file) under test is in conformance to ISO/IEC 21794-2, as not all conformance requirements of ISO/IEC 21794-2 may be tested by the reference software decoder.

Additional tests might be necessary to more thoroughly check that the codestream (or file) properly meets all the requirements specified in ISO/IEC 21794-2. These complementary tests may be performed using other codestream (or file) verifiers that perform more complete tests than those implemented by the reference software implementations.

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