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AMENDMENT 21
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Information technology — Coding of audio-visual objects —

Part 4: Conformance testing

AMENDMENT 21: Geometry and shadow conformance

Technologies de l'information — Codage des objets audiovisuels —

Partie 4: Essai de conformité

AMENDEMENT 21: Conformité de géométrie et d'ombre

Reference number
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Foreword

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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.

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Amendment 21 to ISO/IEC 14496-4:2004 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

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Information technology — Coding of audio-visual objects —

Part 4:
Conformance testing

AMENDMENT 21: Geometry and shadow conformance

At the end of Table AMD 7-4 in 8.4.2.2.1, add the following table and renumber the first column:

N°	Feature	Reference of Test sequence and associated method
1	FootPrintSetNode	CityDynamic
	FootPrintNode	cityFootPrintLOD
	BuildingPartNode	CityDynamic
	RoofNode	CityDynamic
	FacadeNode	CityDynamic
2	Shadow	windmill.mp4 transparent.mp4

At the end of the Table in 8.4.2.3, add the following Table:

Name	Provider	Content	Original wrl file
cityFootPrintStatic	France Telecom	**FootPrintSetNode:**The building footprints of a city.	cityFootPrintStatic
cityFootPrintStaticBuffer	France Telecom	**FootPrintSetNode**: The building footprints of a city.	cityFootPrintStaticBuffer
cityFootPrintLOD	France Telecom	**FootPrintSetNode:** The building footprints of a city with LOD.	cityFootPrintLOD
cityFootPrintLODBuffer	France Telecom	**FootPrintSetNode:**The building footprints of a city with LOD.	cityFootPrintLODBuffer
cityFootPrintLOD_0_001	France Telecom	**FootPrintSetNode:**The building footprints of a city with LOD using the compression based on the scene accuracy.	cityFootPrintLOD_0_001
cityFootPrintLOD_0_001 Buffer	France Telecom	**FootPrintSetNode:**The building footprints of a city with LOD using the compression based on the scene accuracy.	cityFootPrintLOD_0_001Buffer
cityStatic	France Telecom	**FootPrintSetNode:**The 3D building of a city.	cityStatic
cityStaticBuffer	France Telecom	**FootPrintSetNode:**The 3D building of a city.	cityStaticBuffer
cityDynamic	France Telecom	**FootPrintSetNode:**The 3D building of a city with LOD using the compression based on the scene accuracy.	cityDynamic
cityDynamicBuffer	France Telecom	**FootPrintSetNode:**The 3D building of a city with LOD using the compression based on the scene accuracy.	cityDynamicBuffer

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House	France Telecom	**FootPrintSetNode:**The complex 3D model of a house.	House
windmill.mp4	University of Ilmenau	**Shadow:** Animated windmill, that casts shadows on the ground	windmill.wrl
transparent.mp4	University of Ilmenau	**Shadow:** Several cubes with different transparency cast shadows on the ground	transparent.wrl

After 8.5.13, add the following subclause:

8.5.14 Multiresolution footprint-based coding

8.5.14.1 Introduction

Some 3D models such as buildings can be well-compressed using a footprint-based representation. To allow an adaptive streaming of huge models, this coding is based on a multi-resolution schema well-suited for graphics on-demand transmission. For the specific case of building models, a procedural representation is available to encode complex facades and roofs. Due to its compression, the multi-resolution footprint-based coding is actually one of the best way to transmit huge city models for geo-visualization applications.

8.5.14.2 Conformance Points (Covered functionalities)

The conformance points for the multiresolution footprint based representation cover the different object type (0=footprint, 1=building), the static (with one level of detail) or dynamic scene (with several levels of detail), the compression based on the accuracy of the scene, the different fields use in the Bitwrapper node (url or BUFFER), the swap nodes used in building mode (allowing to replace the encoded building by a more complex indexedFaceSet), the facades reconstruction with textures or 3D models, the complex roofs reconstruction with simple roof superimposition.

The following subclauses specify the normative tests for verifying conformance of the multiresolution footprint based representation. Those normative tests make use of test data (bitstream test suites).

8.5.14.3 Bitstream conformance

8.5.14.3.1 Conformance Requirements

BIFS streams shall comply with the specifications in subclause 4.3.6 of ISO/IEC 14496-16:2006 and BitWrapper in ISO/IEC 14496-11.

8.5.14.3.2 Measurement procedure

BIFS streams shall comply with the specifications in subclause 4.3.6 of ISO/IEC 14496-16:2006 and BitWrapper in ISO/IEC 14496-11.

8.5.14.3.3 Tolerance

There is no tolerance for bitstream syntax checking. The diagnosis is pass or fail.

8.5.14.4 Terminal conformance

8.5.14.4.1 Conformance Requirements

A compliant decoder shall implement a decoding process that is equivalent to the one specified in ISO/IEC 14496-16 and meets all the general requirements, defined in the document, which apply for the functionalities considered. The decoder shall decode bitstreams with any options or parameters with values permitted for the functionalities. In the case of using BIFS for scene representation, the decoding process that is specified in ISO/IEC 14496-1:2004 shall also be implemented.

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8.5.14.4.2 Test Bitstreams

Files:

Test Name	Attribute	Bitstream (.mp4)	Reference file (.txt)
Standalone_URL	Use of URL field in the Bitwrapper node. Entire object coded at once.	Standalone_URL	Standalone_URL
Standalone_Buffer	Use of URL field in the Bitwrapper node. Entire object coded at once.	Standalone_Buffer	Standalone_Buffer
Partial_URL	Use of URL in the Bitwrapper node. Partially encoded object.	Partial_URL	Partial_URL
Partial_BUFFER	Use of BUFFER in the Bitwrapper node. Partially encoded object.	Partial_BUFFER	Partial_BUFFER
Progressive_URL	Use of URL in the Bitwrapper node. Refinement to Partial_URL.	Progressive_URL	Progressive_URL
Progressive_BUFFER	Use of BUFFER in the Bitwrapper node. Refinement to Partial_Buffer.	Progressive_BUFFER	Progressive_BUFFER

8.5.14.4.3 Measurement procedure

The terminal should produce a formatted output giving the reconstructed 3D object with the available refinement Elementary Streams.

8.5.14.4.4 Tolerance

The conformance is passed when the reconstructed 3D object reflects the correct 3D object, as defined in ISO/IEC 14496-16. The rendering functionality must be observed visually.

8.5.15 3DMC extension

8.5.15.1 Introduction

The 3D mesh object is a 3D polygonal model that can be represented as an IndexedFaceSet in BIFS. It is defined by the position of its vertices (geometry), by the association between each face and its sustaining vertices (connectivity), and optionally by colours, normals, and texture coordinates (properties). Properties do not affect the 3D geometry, but influence the way the model is shaded.

3D mesh coding (3DMC) extension addresses the efficient coding of 3D mesh object. It comprises a basic method and several options. The basic 3DMC extension method operates on manifold model and features incremental representation of single resolution 3D model. The model may be triangular or polygonal – the latter are triangulated for coding purposes and are fully recovered in the decoder. Options include: (a) support for error resilience; (b) vertex order and face order preserving; (c) efficient texture mapping; and (d) support for non-manifold and non-orientable model.

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8.5.15.2 Conformance Points

8.5.15.2.1 Covered functionalities

The conformance points for compression of 3DMC extension cover basic compression, backward compatibility, forward compatibility, error resilience support, backward compatibility with error resilience, forward compatibility with error resilience, vertex order and face order preserving, support of non-manifold/non-orientable model (stitch), and efficient texture mapping. These functionalities relate to the compressed representation of IndexedFaceSet node carried by BitWrapper node as described in ISO/IEC 14496-11.

As for carriage of compressed representation IndexedFaceSet node using BitWrapper node, it can be carried either in a separate stream or within the scene stream (BIFS stream). Therefore, compression of 3DMC extension also shall be tested together with this node.

The following subclauses specify the normative tests for verifying conformance of 3DMC extension compressed bitstreams and 3DMC extension decoder. Those normative tests make use of test data (bitstream test suites).

8.5.15.3 Bitstream conformance

8.5.15.3.1 Conformance Requirements

BIFS streams shall comply with the specifications for compression of 3DMC extension in ISO/IEC 14496-16 and BitWrapper in ISO/IEC 14496-11.

8.5.15.3.2 Measurement procedure

Syntax of the BIFS stream shall meet the requirements of compression of 3DMC extension in ISO/IEC 14496-16 and BitWrapper in ISO/IEC 14496-11.

8.5.15.3.3 Tolerance

There is no tolerance for bitstream syntax checking. The diagnosis is pass or fail.

8.5.15.4 Terminal conformance

8.5.15.4.1 Conformance Requirements

A compliant decoder shall implement a decoding process that is equivalent to the one specified in ISO/IEC 14496-16 and meets all the general requirements, defined in the document, which apply for the functionalities considered. The decoder shall decode bitstreams with any options or parameters with values permitted for the functionalities. In the case of using BIFS for scene representation, the decoding process that is specified in ISO/IEC 14496-1:2004 shall also be implemented.

8.5.15.4.2 Test Bitstreams

Purpose 1 (URL): Exercise the basic compression, backward compatibility, forward compatibility, error resilience support, backward compatibility with error resilience, forward compatibility with error resilience, vertex order and face order preserving, support of non-manifold/non-orientable model (stitch), and efficient texture mapping functionalities of MPEG-4 3DMC extension compression carried in a separate stream from the scene stream.

Purpose 2 (Buffer): Exercise the basic compression, backward compatibility, forward compatibility, error resilience support, backward compatibility with error resilience, forward compatibility with error resilience, vertex order and face order preserving, support of non-manifold/non-orientable model (stitch), and efficient texture mapping functionalities of MPEG-4 3DMC extension compression carried in a BIFS scene stream.

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Files:

Test Name	Attribute	Bitstream (.mp4)	Reference file (.txt)
BASIC#1-1	Use of URL field in the Bitwrapper node. Use of basic compression of polygonal 3D mesh with geometry, connectivity, color, normal, and texture coordinates.	BASIC-object #1-1	BASIC-object#1-1
BASIC#1-2	Use of URL field in the Bitwrapper node. Use of basic compression of triangle 3D mesh with geometry, connectivity, color, normal, and texture coordinates composed of 1 connected component.	BASIC-object #1-2	BASIC-object#1-2
BASIC#1-3	Use of URL field in the Bitwrapper node. Use of basic compression of triangle 3D mesh with geometry, connectivity, color, normal, and texture coordinates composed of several connected components.	BASIC-object #1-3	BASIC-object#1-3
CROSS#1-1	Use of URL field in the Bitwrapper node. Use of backward compatibility. *Use of 3DMC decoder.	CROSS-object #1-1	CROSS-object#1-1
CROSS#1-2	Use of URL field in the Bitwrapper node. Use of forward compatibility.	CROSS -object #1-2	CROSS -object#1-2
ERR_MODE#1-1	Use of URL field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0)	ERR_MODE-object#1-1	ERR_MODE -object#1-1
ERR_MODE#1-2	Use of URL field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 1)	ERR_MODE -object#1-2	ERR_MODE -object#1-2
ERR_MODE#1-3	Use of URL field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 1, packetsize: 360, boundary predicition type: 0)	ERR_MODE -object#1-3	ERR_MODE -object#1-3
ERR_MODE#1-4	Use of URL field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 1, packetsize: 360, boundary predicition type: 1)	ERR_MODE -object#1-4	ERR_MODE -object#1-4
ERR_CROSS#1-1	Use of URL field in the Bitwrapper node. Use of backward compatibility and error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0) * Use of 3DMC decoder.	ERR_CROSS-object#1-1	ERR_CROSS -object#1-1
ERR_CROSS#1-2	Use of URL field in the Bitwrapper node. Use of forward compatibility and error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0)	ERR_CROSS -object#1-2	ERR_CROSS -object#1-2
ORDER#1-1	Use of URL field in the Bitwrapper node. Use of vertex order preserving coded at the unit of IFS	ORDER-object#1-1	ORDER -object#1-1
ORDER#1-2	Use of URL field in the Bitwrapper node. Use of vertex order preserving coded at the unit of CC	ORDER -object#1-2	ORDER -object#1-2
ORDER#1-3	Use of URL field in the Bitwrapper node. Use of face order preserving coded at the unit of IFS	ORDER -object#1-3	ORDER -object#1-3
ORDER#1-4	Use of URL field in the Bitwrapper node. Use of face order preserving coded at the unit of CC	ORDER -object#1-4	ORDER -object#1-4

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ORDER#1-5	Use of URL field in the Bitwrapper node. Use of vertex order and face order preserving coded at the unit of IFS	ORDER -object#1-5	ORDER -object#1-5
ORDER#1-6	Use of URL field in the Bitwrapper node. Use of vertex order and face order preserving coded at the unit of CC	ORDER -object#1-6	ORDER -object#1-6
STITCH#1-1	Use of URL field in the Bitwrapper node. Use of support of non-manifold model.	STITCH-object#1-1	STITCH -object#1-1
STITCH#1-2	Use of URL field in the Bitwrapper node. Use of support of non-manifold and non-orientable model.	STITCH -object#1-2	STITCH -object#1-2
TC#1-1	Use of URL field in the Bitwrapper node. Use of efficient texture mapping with use of Adaptive_quant_texCoord_mode.	TC-object#1-1	TC-object#1-1
TC#1-2	Use of URL field in the Bitwrapper node. Use of efficient texture mapping with no use of Adaptive_quant_texCoord_mode.	TC-object#1-2	TC-object#1-2
BASIC#2-1	Use of buffer field in the Bitwrapper node. Use of basic compression of polygonal 3D mesh with geometry, connectivity, color, normal, and texture coordinates.	BASIC-object #2-1	BASIC-object#2-1
BASIC#2-2	Use of buffer field in the Bitwrapper node. Use of basic compression of triangle 3D mesh with geometry, connectivity, color, normal, and texture coordinates composed of 1 connected component.	BASIC-object #2-2	BASIC-object#2-2
BASIC#2-3	Use of buffer field in the Bitwrapper node. Use of basic compression of triangle 3D mesh with geometry, connectivity, color, normal, and texture coordinates composed of several connected components.	BASIC-object #2-3	BASIC-object#2-3
CROSS#2-1	Use of buffer field in the Bitwrapper node. Use of backward compatibility. *Use of 3DMC decoder.	CROSS-object #2-1	CROSS-object#2-1
CROSS#2-2	Use of buffer field in the Bitwrapper node. Use of forward compatibility.	CROSS -object #2-2	CROSS -object#2-2
ERR_MODE#2-1	Use of buffer field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0)	ERR_MODE-object#2-1	ERR_MODE -object#2-1
ERR_MODE#2-2	Use of buffer field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 1)	ERR_MODE -object#2-2	ERR_MODE -object#2-2
ERR_MODE#2-3	Use of buffer field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 1, packetsize: 360, boundary predicition type: 0)	ERR_MODE -object#2-3	ERR_MODE -object#2-3
ERR_MODE#2-4	Use of buffer field in the Bitwrapper node. Use of error resilience mode (error resilience mode: 1, packetsize: 360, boundary predicition type: 1)	ERR_MODE -object#2-4	ERR_MODE -object#2-4
ERR_CROSS#2-1	Use of buffer field in the Bitwrapper node. Use of backward compatibility and error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0) * Use of 3DMC decoder.	ERR_CROSS-object#2-1	ERR_CROSS -object#2-1

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ERR_CROSS #2-2	Use of buffer field in the Bitwrapper node. Use of forward compatibility and error resilience mode (error resilience mode: 0, packetsize: 360, boundary predicition type: 0)	ERR_CROSS - object#2-2	ERR_CROSS - object#2-2
ORDER#2-1	Use of buffer field in the Bitwrapper node. Use of vertex order preserving coded at the unit of IFS	ORDER-object#2-1	ORDER -object#2-1
ORDER#2-2	Use of buffer field in the Bitwrapper node. Use of vertex order preserving coded at the unit of CC	ORDER -object#2-2	ORDER -object#2-2
ORDER#2-3	Use of buffer field in the Bitwrapper node. Use of face order preserving coded at the unit of IFS	ORDER -object#2-3	ORDER -object#2-3
ORDER#2-4	Use of buffer field in the Bitwrapper node. Use of face order preserving coded at the unit of CC	ORDER -object#2-4	ORDER -object#2-4
ORDER#2-5	Use of buffer field in the Bitwrapper node. Use of vertex order and face order preserving coded at the unit of IFS	ORDER -object#2-5	ORDER -object#2-5
ORDER#2-6	Use of buffer field in the Bitwrapper node. Use of vertex order and face order preserving coded at the unit of CC	ORDER -object#2-6	ORDER -object#2-6
STITCH#2-1	Use of buffer field in the Bitwrapper node. Use of support of non-manifold model.	STITCH-object#2-1	STITCH -object#2-1
STITCH#2-2	Use of buffer field in the Bitwrapper node. Use of support of non-manifold and non-orientable model.	STITCH -object#2-2	STITCH -object#2-2
TC#2-1	Use of buffer field in the Bitwrapper node. Use of efficient texture mapping with use of Adaptive_quant_texCoord_mode.	TC-object#2-1	TC-object#2-1
TC#2-2	Use of buffer field in the Bitwrapper node. Use of efficient texture mapping with no use of Adaptive_quant_texCoord_mode.	TC-object#2-2	TC-object#2-2

8.5.15.4.3 Measurement Procedure

The terminal should produce a formatted output giving the reconstructed fields of IndexedFaceSet. The decoder shall be able to decode the bitstreams provided as described in subclause 8.5.12.3.2.

8.5.15.4.4 Tolerance

The diagnosis is to check whether the field data (geometry, connectivity, and properties) of IndexedFaceSet node that is decoded from ".mp4" files correspond with the node included in the provided reference ".txt" files.

8.5.16 JPEG 2000 support

8.5.16.1 Introduction

Initially, the only still image formats natively supported by the MPEG-4 specification, other than its own, VTC (Visual Texture Coding), were JPEG and PNG. More precisely, only ESs (Elementary Streams) describing still images according to those formats could be inserted in an MPEG-4 bitstream in the natural manner, i.e., by multiplexing them with the other ESs of the compound stream and having an ImageTexture node (from the BIFS-coded ES of the scene) refer to them. It was impossible to do this for textures coded according to the JPEG 2000 format, which provides in many cases great advantages over both JPEG and PNG, both in terms of compression efficiency and multi-resolution handles.

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8.5.16.2 Conformance Points (Covered functionalities)

The single conformance point of the JPEG 2000 support is to enable the use of ESs (Elementary Streams) containing textures coded according to the JPEG 2000 standard within MPEG-4 bitstreams.

8.5.16.3 Bitstream conformance

8.5.16.3.1 Conformance Requirements

MPEG-4 BIFS streams shall comply with the specifications in ISO/IEC 14496-1. JPEG 2000 ESs shall comply with the specifications in ISO/IEC 15444-1.

8.5.16.3.2 Measurement procedure

MPEG-4 BIFS streams shall comply with the specifications in ISO/IEC 14496-1. JPEG 2000 ESs shall comply with the specifications in ISO/IEC 15444-1.

8.5.16.3.3 Tolerance

There is no tolerance for bitstream syntax checking. The diagnosis is pass or fail.

8.5.16.4 Terminal conformance

8.5.16.4.1 Conformance Requirements

A compliant decoder shall implement a decoding process that is equivalent to the one specified in ISO/IEC 14496-1, as far as the decoding of the scene is concerned, and to the one specified in ISO/IEC 15444-1, as far as the texture is concerned. The decoder shall decode bitstreams with any options or parameters with values permitted for the considered functionalities.

8.5.16.4.2 Test Bitstreams

Files:

Test Name	Attribute	Bitstream (.mp4)	Reference files (.{wrl,scr})
Quad	Simple use of a JPEG 2000 ES inside an MPEG-4 bitstream, with no hints for the decoder. The scene consists of a JPEG 2000 texture mapped onto a rectangle defined by two triangles.	quad	quad
Quad with DSI (Decoder Specific Information)	Exactly as above, but with hints for the decoder, which are given through decSpecificInfo JPEG2000_DecoderConfig {} within decConfigDescr DecoderConfigDescriptor {} of the ES_Descriptor {} of the ES containing the texture.	quad_dsi	quad_dsi
Earth	Slightly more complex use of a JPEG 2000 ES inside an MPEG-4 bitstream, with no hints for the decoder. The scene consists of a JPEG 2000 texture mapped onto a sphere tesselated by many triangles.	earth	earth
Earth with DSI	Exactly as above, but with hints for the decoder, which are given through decSpecificInfo JPEG2000_DecoderConfig {} within decConfigDescr DecoderConfigDescriptor {} of the ES_Descriptor {} of the ES containing the texture.	earth_dsi	earth_dsi

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8.5.16.4.3 Measurement procedure

The terminal should produce a formatted output showing any textures contained in JPEG 2000 ESs within the MPEG-4 bitstream correctly decoded.

8.5.16.4.4 Tolerance

The terminal conformance is passed if the textures contained in JPEG 2000 ESs within the MPEG-4 bitstream are correctly rendered, which must be observed visually.

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