INTERNATIONAL STANDARD

ISO/IEC 15938-7

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Information technology — Multimedia content description interface —

Part 7: Conformance testing

Technologies de l'information — Description de l'interface du contenu multimédia —

Partie 7: Essais de conformité

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 member bodies casting a vote.

ISO/IEC 15938-7 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of auto, picture, multimedia and hypermedia information*.

ISO/IEC 15938 consists of the following parts, under the general title *Information technology — Multimedia content description interface*:

— *Part 1: Systems*

— *Part 2: Description definition language*

— *Part 3: Visual*

— *Part 4: Audio*

— *Part 5: Multimedia description schemes*

— *Part 6: Reference software*

— *Part 7: Conformance testing*

— *Part 8: Extraction and use of MPEG-7 descriptions*

Introduction

ISO/IEC 15938, also known as "Multimedia Content Description Interface," provides a standardized set of technologies for describing multimedia content. It addresses a broad spectrum of multimedia applications and requirements by providing a metadata system for describing the features of multimedia content.

The following are specified in ISO/IEC 15938:

- **Description Schemes (DS)** describe entities or relationships pertaining to multimedia content. Description Schemes specify the structure and semantics of their components, which may be Description Schemes, Descriptors, or datatypes.
- **Descriptors (D)** describe features, attributes, or groups of attributes of multimedia content.
- **Datatypes** are the basic reusable datatypes employed by Description Schemes and Descriptors.
- **Systems tools** support delivery of descriptions, multiplexing of descriptions with multimedia content, synchronization, file format, and so forth.

ISO/IEC 15938 is subdivided into eight parts:

Part 1 — Systems: specifies the tools for preparing descriptions for efficient transport and storage, compressing descriptions, and allowing synchronization between content and descriptions.

Part 2 — Description Definition Language: specifies the language for defining the standard set of description tools (DSs, Ds, and datatypes) and for defining new description tools.

Part 3 — Visual: specifies the description tools pertaining to visual content.

Part 4 — Audio: specifies the description tools pertaining to audio content.

Part 5 — Multimedia Description Schemes: specifies the generic description tools pertaining to multimedia including audio and visual content.

Part 6 — Reference Software: provides a software implementation of ISO/IEC 15938.

Part 7 — Conformance testing: specifies the guidelines and procedures for testing conformance of implementations of the standard.

Part 8 — Extraction and Use: provides guidelines and examples of the extraction and use of descriptions.

This part of ISO/IEC 15938 specifies the conformance part of the ISO/IEC 15938 standard by specifying the guidelines and procedures for testing conformance of implementations of the standard.

Information technology — Multimedia content description interface —

Part 7: Conformance testing

1 Scope

1.1 Organization of the document

ISO/IEC 15938 specifies a metadata system for describing multimedia content. This part of ISO/IEC 15938 specifies how tests can be designed to verify whether descriptions and description consuming terminals meet the specifications of parts 1, 2, 3, 4 and 5 of ISO/IEC 15938. In this part of ISO/IEC 15938, the creation or extraction of descriptions from multimedia content is not addressed specifically. A system producing descriptions may be said to be an ISO/IEC 15938 compatible description production system if it produces descriptions (binary or textual) that conform to the specifications of parts 1, 2, 3, 4 and 5 of ISO/IEC 15938.

The characteristics of descriptions and the terminals consuming descriptions are defined for parts 1, 2, 3, 4 and 5 of ISO/IEC 15938 as follows.

— **Descriptions**: the characteristics of a specific description are defined according to syntax and semantics of elements from ISO/IEC 15938 that are used in the description.

— **Terminals**: the characteristics of a terminal consuming a description are defined according to the required description decoding process for the elements used in the description. An example of a description decoding property is the arithmetic accuracy in which the value of element are represented. The capabilities of a description consuming terminal are determined by the domain of descriptions and elements that the terminal is capable of decoding. A description can be decoded by a terminal if the elements of the description are within the subset of ISO/IEC 15938 specified for a given definition of decoder capabilities.

In this document, procedures are described for testing conformance of descriptions and terminals according to the specifications of parts 1, 2, 3, 4 and 5 of ISO/IEC 15938. Given a set of claimed characteristics (descriptions and terminals), the requirements for conformance are fully determined by parts 1, 2, 3, 4 and 5 of ISO/IEC 15938. This part of ISO/IEC 15938 summarizes the requirements and defines how conformance can be tested. Guidelines are given on constructing tests to verify conformance of descriptions and terminals. This document provides additional guidelines on how to construct test suites for checking conformance of terminals. In addition, some test descriptions are provided.

2 Normative references

The following referenced documents are indispensable for the application 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 8601, *Data elements and interchange formats — Information interchange — Representation of dates and times*

ISO 639 (all parts), *Code for the representation of names of languages*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 3166-2, *Codes for the representation of names of countries and their subdivisions — Part 2: Country subdivision code*

NOTE The current list of valid ISO 3166-1 country and ISO 3166-2 region codes is maintained by the official maintenance authority Deutsches Institut für Normung. Information on the current list of valid region and country codes can be found at http://www.din.de/gremien/nas/nabd/iso3166ma/index.html.

ISO 4217, *Codes for the representation of currencies and funds*

NOTE The current list of valid ISO 4217 currency codes is maintained by the official maintenance authority British Standards Institution (http://www.bsi-global.com/iso4217currency).

XML, Extensible Markup Language (XML) 1.0, October 2000

XML Schema, W3C Recommendation, 2 May 2001

XML Schema Part 0: Primer, W3C Recommendation, 2 May 2001

XML Schema Part 1: Structures, W3C Recommendation, 2 May 2001

XML Schema Part 2: Datatypes, W3C Recommendation, 2 May 200

xPath, XML Path Language, W3C Recommendation, 16 November 1999

NOTE These documents are maintained by the W3C (http://www.w3.org). The relevant documents can be obtained as follows:

Extensible Markup Language (XML) 1.0 (Second Edition), 6 October 2000,
http://www.w3.org/TR/2000/REC-xml-20001006

XML Schema: W3C Recommendation, 2 May 2001, http://www.w3.org/XML/Schema

XML Schema Part 0: Primer, W3C Recommendation, 2 May 2001, http://www.w3.org/TR/xmlschema-0/

XML Schema Part 1: Structures, W3C Recommendation, 2 May 2001, http://www.w3.org/TR/xmlschema-1/

XML Schema Part 2: Datatypes, W3C Recommendation 2 May 2001, http://www.w3.org/TR/xmlschema-2/

xPath, XML Path Language, W3C Recommendation, 16 November 1999,
http://www.w3.org/TR/1999/REC-xpath-19991116.

Canonical XML Version 1.0, W3C Recommendation 15 March 2001,
http://www.w3.org/TR/2001/REC-xml-c14n-20010315

RFC 2045 *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*

RFC 2046 *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*

RFC 2048, *Multipurpose Internet Mail Extensions (MIME) Part Four: Registration Procedures*

RFC 2045-CHARSETS, *Registered Character set codes of RFC2045*

RFC2046-MIMETYPES, *Registered Mimetypes of RFC2046*

NOTE The relevant lists can be obtained as follows:

MIMETYPES. The current list of registered mimetypes, as defined in RFC2046, RFC2048, is maintained by IANA (Internet Assigned Numbers Authority). It is available from ftp://ftp.isi.edu/in-notes/iana/assignments/media-types/media-types/

CHARSETS. The current list of registered character set codes, as defined in RFC2045 and RFC2048 is maintained by IANA (Internet Assigned Numbers Authority). It is available from ftp://ftp.isi.edu/in-notes/iana/assignments/character-sets.

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the following terms, definitions, symbols and abbreviated terms apply.

3.1 Conventions

3.1.1 Description tools

This part of ISO/IEC 15938 specifies conformance for descriptions and bitstreams complying with ISO/IEC 15938. Descriptions are instances of description tools defined in ISO/IEC 15938. The important concepts are defined as follows.

— **Description Tool (or tool)**: refers to a Description Scheme, Descriptor, or Datatype.

— **Description Scheme (DS)**: a description tool that describes entities or relationships pertaining to multimedia content. DSs specify the structure and semantics of their components, which may be Description Schemes, Descriptors, or datatypes.

— **Descriptor (D)**: a description tool that describes a feature, attribute, or group of attributes of multimedia content.

— **Datatype**: a basic reusable datatype employed by Description Schemes and Descriptors.

3.1.2 Naming convention

In order to specify the description tools, constructs provided by the Description Definition Language (DDL) specified in ISO/IEC 15938-2 are used, such as "element," "attribute," "simpleType" and "complexType." The names associated to these constructs are created on the basis of the following conventions.

— If the name is composed of multiple words, the first letter of each word is capitalized, with the exception that the capitalization of the first word depends on the type of construct as follows.

— Element naming: the first letter of the first word is capitalized (e.g. `TimePoint` element of `TimeType`).

— Attribute naming: the first letter of the first word is not capitalized (e.g. `timeUnit` attribute of `IncrDurationType`).

— complexType naming: the first letter of the first word is capitalized, and the suffix "Type" is used at the end of the name (e.g. `PersonType`).

— simpleType naming: the first letter of the first word is not capitalized, the suffix "Type" may be used at the end of the name (e.g. `timePointType`).

NOTE When referencing a complexType or simpleType in the definition of a description tool, the "Type" suffix is not used. For instance, the text refers to the "`Time datatype`" (instead of "`TimeType` datatype"), to the "`MediaLocator D`" (instead of "`MediaLocatorType D`") and to the "`Person DS`" (instead of `PersonType DS`).

3.1.3 Documentation convention

The syntax of each description tool is specified using the constructs provided by the DDL specified in ISO/IEC 15938-2, and is presented in this document using a specific font and background as shown in the following example:

```
<complexType name="ExampleType">
   <sequence>
      <element name="Element1" type="string"/>
   </sequence>
   <attribute name="attribute1" type="string" default="attrvalue1"/>
</complexType>
```

The semantics of each description tool is specified in text using a table format, where each row contains the name and a definition of a type, element or attribute as shown in the following example:

Name	*Definition*
`ExampleType`	Specifies an ...
`element1`	Describes the …
`attribute1`	Describes the …

Diagrammatic notation is sometimes used to depict overviews of the description tools. Such overview diagrams generally depict aggregation and generalization relationships between description tools or the entities being described. In these diagrams, rectangular shapes containing a name denote description tools (DSs or Ds) that are used to describe entities. In some diagrams, multiple description tools are listed in a single rectangle. Large diamond shapes containing a name denote description tools (DSs or Ds) that are used to describe relationships. Furthermore, paths between rectangles or diamonds denote association, generalization or aggregation relationships. Generalization relationships are indicated by a solid path with a filled triangle pointing at the more general entity. Aggregation (composition) relationships are indicated by a solid path with a (filled) diamond at the aggregating (composing) entity. Aggregation relationship paths may be accompanied by an indication of the multiplicity (minOccurs, maxOccurs) of the relation in text form.

The informative examples are included in separate subclauses, and are presented in this document using a separate font and background as shown in the following example:

```
<Example attribute1="example attribute value">
  <Element1>example element content</Element1>
</Example>
```

Moreover, the schema or set of description tools defined in this document follows a type-centric approach. The description tools are specified by defining the complexType or simpleType for each tool, but not declaring an element of this type at the global scope with the exception of the root element. However, in order to illustrate informative example descriptions in this document, the examples assume that an element of the example type (complexType or simpleType) has been declared, such as a member of another complexType or simpleType. For example, the description above assumes that the following declaration has been made:

```
<element name="Example" type="mpeg7:ExampleType">
```

The term "reserved" is used in specifying the semantics of some description tools. The term "reserved" indicates that particular values are reserved for use in future extensions of ISO/IEC 15938.

3.2 Terminology

3.2.1 General terminology

3.2.1.1
MPEG-7 Terminal
An entity that consumes an MPEG-7 description and provides it to further processing. An MPEG-7 terminal can be composed of a Systems decoder, a MPEG-7 validating parser or both of them

3.2.1.2
MPEG-7 validating terminal
An MPEG-7 Terminal which validates MPEG-7 descriptions against their definitions expressed using the DDL and provides them to further processing

3.2.1.3
MPEG-7 systems terminal
An MPEG-7 Terminal which receives description stream and provides reconstructed description to further processing

3.2.2 Schema-related terminology

3.2.2.1
Attribute
A field of a **description tool** which is of simple type

3.2.2.2
Base type
A **type** that serves as the root **type** of a derivation hierarchy for other **types**

3.2.2.3
Datatype
A primitive reusable **type** employed by **Description Schemes** and **Descriptors**

3.2.2.4
Derived type
A **type** that is defined in terms of extension or restriction of other **types**

3.2.2.5
Description
An instantiation of one or more **description tools**

3.2.2.6
Description Scheme
A **description tool** that describes entities or relationships pertaining to **multimedia content**. **Description Schemes** specify the structure and semantics of their components, which may be **Description Schemes**, **Descriptors**, or **datatypes**

3.2.2.7
Description Tool
A **Description Scheme**, **Descriptor**, or **datatype**

3.2.2.8
Descriptor
A **description tool** that describes a feature, attribute, or group of attributes of multimedia content

3.2.2.9
Instantiation
Assignment of values to the fields (elements, attributes) of one or more **description tools**

3.2.2.10
Element
A field of a **description tool** which is of complex type

3.2.2.11
Schema
The set of related **description tools**, for example, those specified in ISO/IEC 15938

3.2.2.12
Type
The format used for collection of letters, digits, and/or symbols, to depict values of an element or attribute of **description tool**. A **type** consists of a set of distinct values, a set of lexical representations, and a set of facets that characterize properties of the value space, individual values, or lexical items

3.2.2.13
Canonical XML
A canonical form of an XML document. If the canonical forms of two XML documents are strictly identical, the two XML documents are considered logically equivalent within the context of this specification. Canonicalization takes into account all syntactic changes physical permitted by XML 1.0 and Namespaces in XML

3.2.2.14
XML canonicalization
A method that generates the canonical form of an XML document. The term XML canonicalization refers to the process of applying the XML canonicalization method to an XML document

3.2.2.15
Information set, or **infoset**
An XML document's information set consists of a number of information items. An information item is an abstract description of some part of an XML document: each information item has a set of associated named properties

3.2.2.16
Post schema validation infoset (PSVI)
An infoset which supports information items and properties as defined in XML Schema — Part 1 — Annex D

3.2.3 Systems-related terminology

3.2.3.1
Access Unit
An entity within a description stream that is atomic in time, i.e., to which a composition time can be attached

3.2.3.2
Current description tree
The description tree that represents the current description in an MPEG-7 Systems decoder

3.2.3.3
Description stream
The ordered concatenation of either binary or textual access units conveying a single, possibly time-variant, multimedia content description

3.2.3.4
Description tree
A model of the description handled by MPEG-7 Systems decoder. A description tree consists of nodes, which represent elements or attributes of a description

3.3 Symbols and abbreviated terms

AV: Audio-visual

BiM: Binary format for MPEG-7

CS: Classification Scheme

D: Descriptor

Ds: Descriptors

DCT: Discrete Cosine Transform

DDL: Description Definition Language

DS: Description Scheme

DSs: Description Schemes

IANA: Internet Assigned Numbers Authority

IETF: Internet Engineering Task Force

IPMP: Intellectual Property Management and Protection

ISO: International Organization for Standardization

JPEG: Joint Photographic Experts Group

MDS: Multimedia Description Schemes

MPEG: Moving Picture Experts Group

MPEG-2: Generic coding of moving pictures and associated audio information (see ISO/IEC 13818)

MPEG-4: Coding of audio-visual objects (see ISO/IEC 14496)

MPEG-7: Multimedia Content Description Interface Standard (see ISO/IEC 15938)

MP3: MPEG-2 layer 3 audio coding

PSVI: Post schema validation infoset

QCIF: Quarter Common Intermediate Format

SMPTE: Society of Motion Picture and Television Engineers

TeM: Textual format for MPEG-7

TZ: Time Zone

TZD: Time Zone Difference

URI: Uniform Resource Identifier (see RFC 2396)

URL: Uniform Resource Locator (see RFC 2396)

W3C: World Wide Web Consortium

XML: Extensible Markup Language

4 Overview of conformance testing

4.1 Introduction

This clause provides an overview of conformance testing of descriptions and terminals.

4.2 Conformance testing

4.2.1 Conformance testing of descriptions

Figure 1 shows an overview of conformance testing of descriptions. The conformance testing consists of two stages: Systems testing and DDL testing. The Systems conformance testing involves decoding the description stream, which may be in binary or textual access unit form, and checking that after the decoding of each access unit the current description tree maintained by the terminal is DDL conformant. In the case that the input description to the Systems processor is an XML file, the conformance is directly performed by the DDL testing. The DDL conformance testing involves parsing the textual XML description and checking that the description is well-formed and valid according to the schema comprised from the MDS, Visual, Audio, Systems, and DDL parts of the standard.

The objective of the conformance testing of descriptions is to check the syntactic compliance with ISO/IEC 15938 Parts 1 – 5. As a result, the conformance testing of descriptions does not involve checking the semantics of the descriptions. For example, conformance testing of descriptions does not check whether the "name" field of a description actually contains the "true name" of an individual. However, the conformance testing of the description does determine whether the description is syntactically well-formed in the sense of XML processing and syntactically valid in the sense of conforming to the schema.

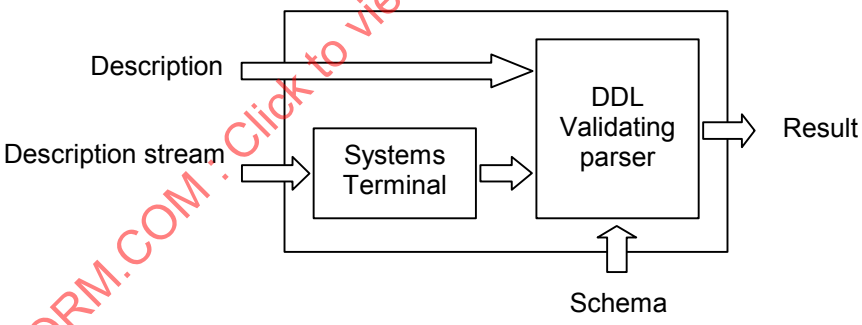

Figure 1 — Overview of conformance testing of descriptions

4.2.2 Conformance testing of terminals

The conformance testing involves the comparison of the result of processing a description using a reference terminal against the result using the test terminal. The reference terminal processes the description in terms of reference Systems and/or reference validation. Likewise, the test terminal processes the description in terms of the test Systems and/or test validation. Figure 2 shows an overview of conformance testing of ISO/15938 terminals only composed of a validating parser. Figure 3 shows an overview of conformance testing of ISO 15938 terminals only composed of a Systems decoder. Figure 4 shows an overview of conformance testing of ISO 15938 terminals composed both of a Systems decoder and a validating parser. The conformance testing of the terminal checks two things:

1) Does the test terminal provide the same results for the reconstructed XML document representation as the reference terminal, and

2) Does the test terminal provide correct response of description validity.

In the case of an input description that is in the form of textual or binary access units, the Systems processing must first convert the description into a textual XML form. In the case of an input description that is already in textual XML form, the Systems processor passes the input description on for the validating parser. In either case, the textual XML form of the description is then operated on by the validating parser, which checks the description for well-formedness and validity. The validating parser takes as input the schema composed from the MDS, visual, audio, and other parts in order to allow the checking of the syntax of the textual XML description against the specifications of ISO/IEC 15938 Parts 1-5.

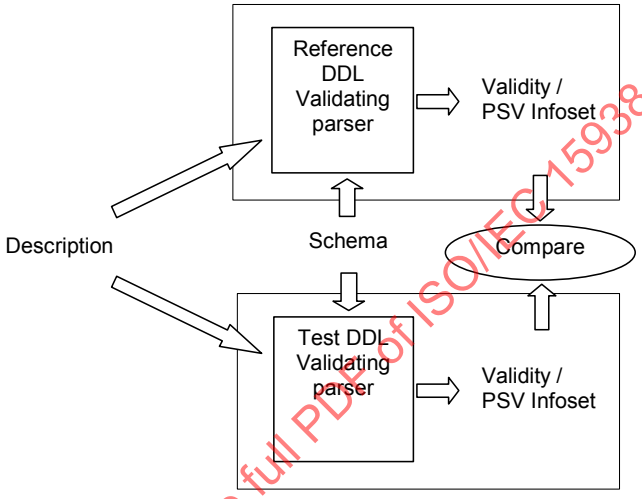

Figure 2 — Overview of conformance testing of validating terminals

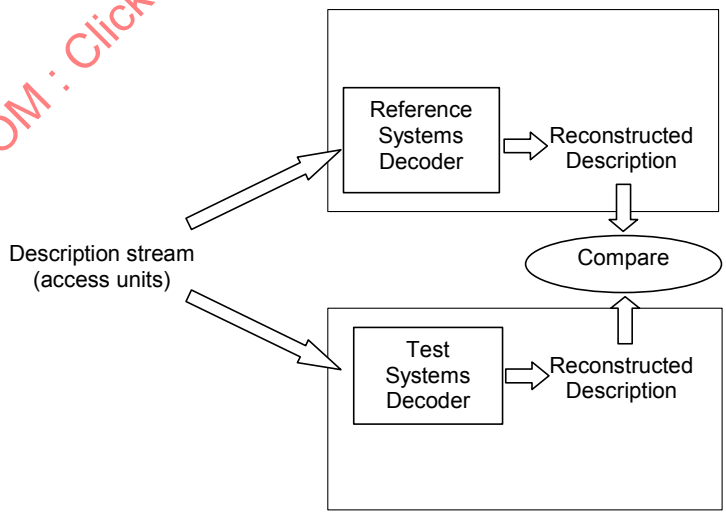

Figure 3 — Overview of conformance testing of systems based terminals

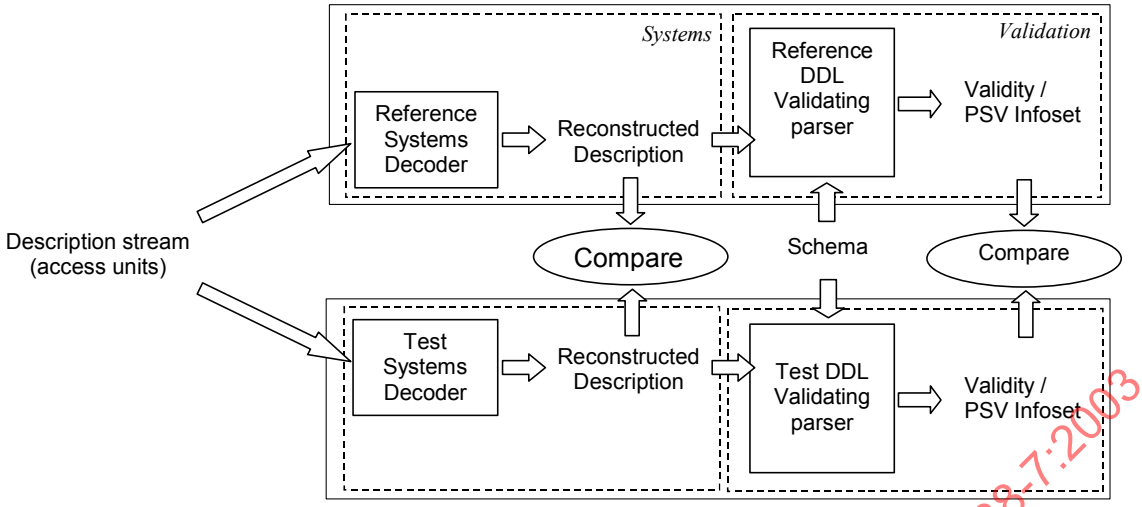

Figure 4 — Overview of conformance testing of systems based validating terminals

4.3 Interoperability points

Given the conformance testing procedures described above, the interoperability point in the standard corresponds to the reconstruction of a canonical XML representation of the description at the terminal. This allows for different possible implementations at the terminal in which different internal representations are used as long as the terminal is able to produce a conforming canonical XML representation of the description.

5 Conformance testing with respect to Systems processing

5.1 Introduction

This clause describes conformance testing with respect to Systems processing.

NOTE The reference software implementation used for conformance testing with respect to Systems processing is equivalent to ISO/IEC 15938-6.

5.2 Systems processing

The Systems processing involves operating on descriptions in binary or textual access unit form and producing an XML description output. The objective of Systems processing is to allow the unambiguous exchange of descriptions in binary or textual access unit form such that a reconstructed description is the same for all conformant terminals. The conformance and test procedures for Systems are defined for both textual and binary forms of descriptions. As a result, this conformance and testing applies for Textual and BIM bitstreams in access unit form as well as Textual and BIM decoders, respectively, as will be described in this clause.

5.3 Systems interfaces

The Systems processing of descriptions involves the two interfaces for processing descriptions in textual access unit form and binary access unit form, respectively, as shown in Figure 5.

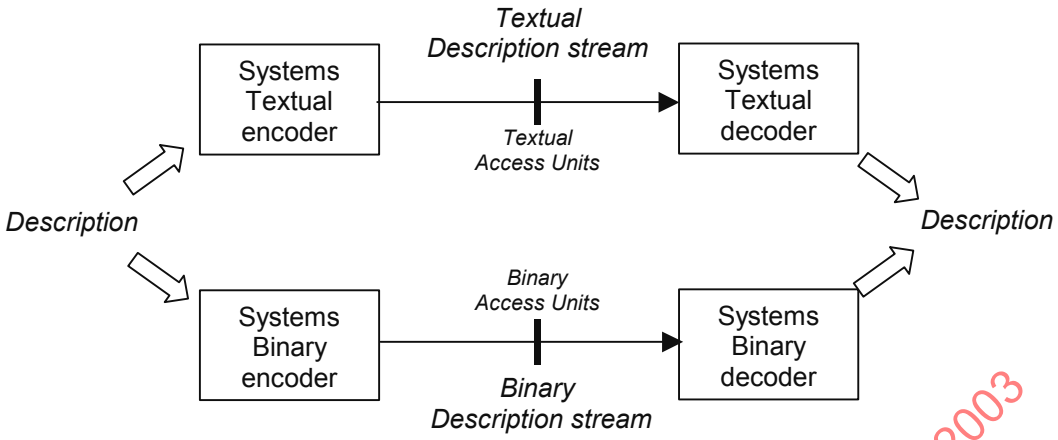

Figure 5 — Systems interfaces for descriptions in textual access unit form and binary access unit form

The Systems components illustrated in Figure 5, are defined as follows.

— **Description**: Textual XML form of description with syntax conforming to ISO/IEC 15938 Parts 1-5.

— **Systems Textual Encoder**: Transforms the textual XML form description to textual access unit form as described in ISO/IEC 15938 Part 1.

— **Systems Textual Decoder**: Transforms the textual access unit form of the description to textual XML form as described in ISO/IEC 15938 Part 1.

— **Systems Binary (BiM) Encoder**: Transforms the textual XML form description to binary access unit form as described in ISO/IEC 15938 Part 1.

— **Systems Binary (BiM) Decoder**: Transforms the binary access unit form of the description to textual XML form as described in ISO/IEC 15938 Part 1.

— **Textual Format interface**: Describes the format of the textual access units.

— **Binary Format Interface**: Describes the format of the binary access units.

Conformance with respect to Systems processing is defined with respect to the Systems textual decoder and Systems binary decoder. The conformance testing of the Systems decoders involves checking the output of decoders compared to Systems reference decoders. Conformance with respect to Systems encoders is not provided in order to allow different possible implementations of the Systems encoders. Instead the bitstreams in access unit form are tested for conformance. This is done by feeding the bitstream under test to the textual and binary reference decoders, respectively, and verifying the decodability and the correct output.

5.4 Systems Textual Encoder

The Systems Textual Encoder consumes a textual XML description and produces a description in textual access unit form. Conformance testing of the Systems Textual Encoder is not provided.

5.5 Systems Textual Bitstream in Access Unit Form

The textual bitstream in access unit form (together with its associated textual DecoderInit) is fed to the textual reference systems decoders. The decoded information is used to reconstruct a description after each access unit. Each resulting description is tested for validity against the schema declared in the associated textual DecoderInit.

The following conditions must be fulfilled as a necessary condition for each textual bitstream in access unit form.

1) The syntax of each textual access unit as well as the syntax of the textual DecoderInit must be valid against the TeM schema defined in clause 6 of ISO/IEC 15938-1.

2) Decoding the description fragment conveyed in the textual InitialDescription together with the description fragment conveyed in the first textual access unit must result in a description that is valid against the schema declared in the textual DecoderInit.

3) After the decoding of each textual access unit the decoded description must be valid against the schema declared in the textual DecoderInit.

4) Each textual fragment update context must point to an instantiated node in the current description tree.

5) Each decoded textual fragment payload must be wellformed XML

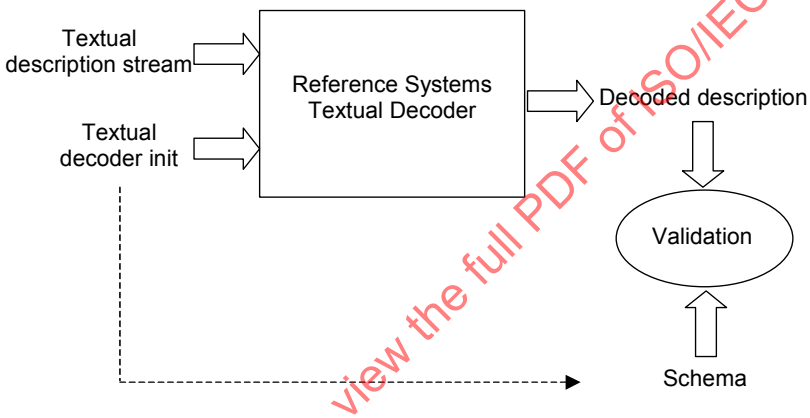

Figure 6 — Conformance testing of Systems Textual Bitstream in Access Unit Form

5.6 Systems Textual Decoder

5.6.1 Overview

The Systems Textual Decoder consumes a description in textual access unit form and produces a textual XML description as described in ISO/IEC 15938-1. Conformance testing of the Systems Textual Decoder involves checking whether the output of the Systems Textual Decoder is equivalent to that produced by a reference Systems Textual Decoder, as shown in Figure 7. The Test Systems Textual Decoder is said to be compliant if it produces a textual XML description output that is equivalent to that produced by a Reference Systems Textual Decoder.

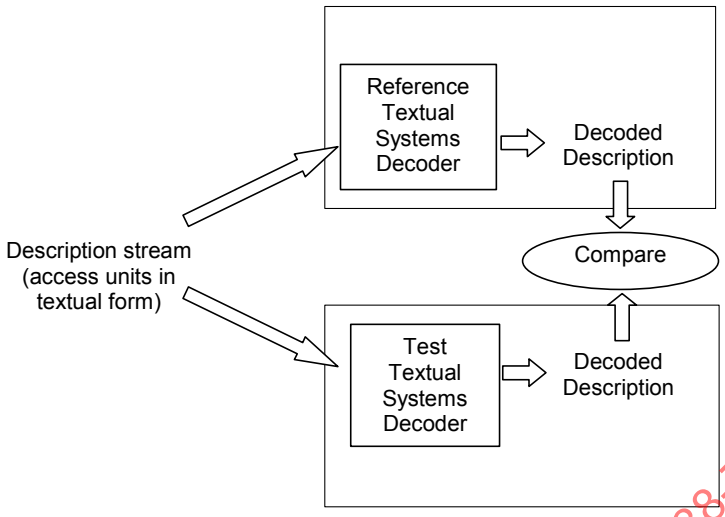

Figure 7 — Conformance testing of Systems Textual Decoder

5.6.2 Definition of Reference Textual Access Unit Form Descriptions

The reference textual access unit descriptions are designed to test the following features:

— DecoderInit: Single and multiple SchemaReferences with and without locationHint;

— DecoderInit with and without InitialDescription;

— Access Units with single and multiple FUUs;

— FU commands: addNode, updateNode, deleteNode, reset;

— FU context: relative and absolute Xpath in combination with the FU commands above;

— FU context: addressing elements and attributes;

— FU payload: with and without deferred nodes.

5.7 Systems Binary (BiM) Encoder

The Systems Binary (BiM) Encoder consumes a textual XML description and produces a description in binary access unit form. Conformance testing of the Systems Binary (BiM) Encoder is not provided.

5.8 Systems Binary (BiM) Bitstream in Access Unit Form

The binary bitstream in access unit form (together with its associated binary DecoderInit) is fed to the binary reference systems decoders. The decoded information is used to reconstruct a description after each access unit. Each resulting description is tested for validity against the schema declared in the associated binary DecoderInit.

The following conditions must be fulfilled as a necessary condition for each binary bitstream in access unit form:

1) The syntax of each binary access unit as well as the syntax of the binary DecoderInit must have correct syntax wrt. the BiM syntax as defined in Clauses 7 and 8 of ISO/IEC 15938-1.

2) Decoding the description fragment conveyed in the binary InitialDescription together with the description fragment conveyed in the first binary access unit must result in a description that is valid against the schema declared in the binary DecoderInit.

3) After each binary access unit the decoded description must be valid against the schema declared in the binary DecoderInit

4) In any FUU, when the FU command is “add” then the FU context must not point to an instantiated node in the current description tree.

5) In any FUU, when the FU command is “update” or “delete” then the FU context must point to an instantiated node in the current description tree.

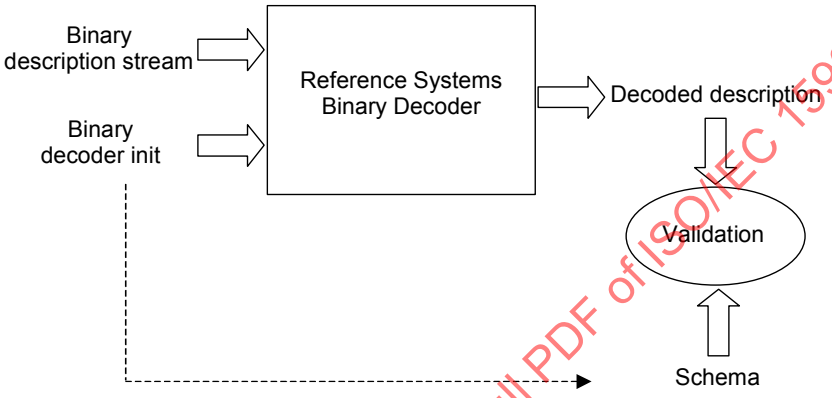

Figure 8 — Conformance testing of Systems Binary Bitstream in Access Unit Form

5.9 Systems Binary (BiM) Decoder

5.9.1 Overview

The Systems Binary (BiM) Decoder consumes a description in binary access unit form and produces a textual XML description description as described in ISO/IEC 15938-1. Conformance testing of the Systems Binary Decoder involves checking whether the output of the Systems Binary Decoder is equivalent to that produced by a reference Systems Binary Decoder, as shown in Figure 7. The Test Systems Binary Decoder is said to be compliant if it produces a textual XML description output that is equivalent to that produced by a Reference Systems Binary Decoder.

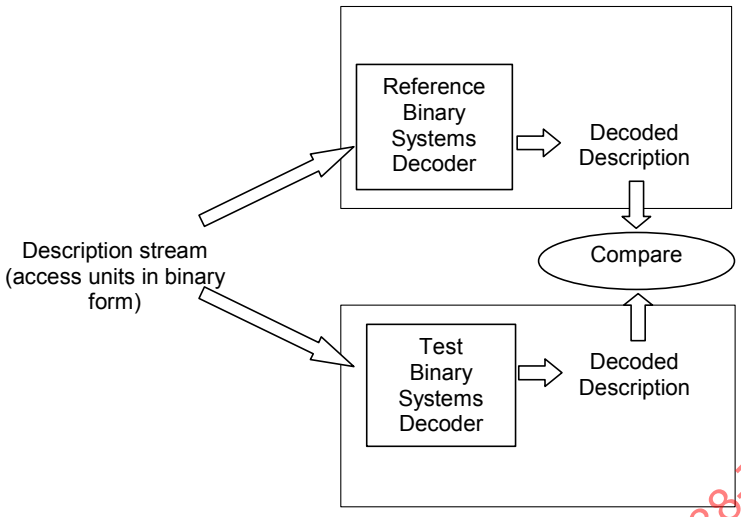

Figure 9 — Conformance testing of Systems Binary Decoder

5.9.2 Definition of Reference Binary Access Unit Form Descriptions

The reference binary access unit descriptions are designed to test the following features:

— DecoderInit: Single and multiple SchemaReferences with and without locationHint;

— DecoderInit with and without InitialDescription;

— Access Units with single and multiple FUUs;

— FU commands: addContent, updateContent, deleteContent, reset;

— FU context: relative and absolute context path in combination with the FU commands above;

— FU context: multiple payload mode;

— FU context: addressing elements and attributes;

— FU context: using "User Data Extension Code";

— FU context: use schemas including a variety of type definitions including SEQ, CHOICE, ALL content models (also in hierarchical definitions of SEQ and CHOICE) as well as simple content in a complex type;

— FU context: using type codes as well as substitution codes;

— FU context: using MPCs, no PC, SPCs as well as implicit asignment of MPCs and SPCs;

— FU payload: with and without use of "unit size" (declared in DecoderInit);

— FU payload: with and without deferred nodes;

— FU payload: use the different length coding modes;

— FU payload: with and without specific type codecs (e.g. from Visual part of the standard);

— FU payload: using type codes as well as substitution codes;

— FU payload: use schemas including a variety of type definitions including SEQ, CHOICE, ALL content models (also in hierarchical definitions of SEQ and CHOICE) as well as simple content in a complex type.

6 Conformance testing with respect to DDL processing

6.1 Introduction

Some ISO/IEC 15938 terminals can include a validating parser. This clause describes conformance testing with respect to ISO/IEC 15938-2 (DDL) processing.

6.2 DDL Schema validity assessment

As specified in XML Schema specification, a schema validity assessment is about determining local schema-validity, that is whether an element or attribute information item satisfies the constraints embodied in the relevant components of an XML Schema; and synthesizing an overall validation outcome for the item, combining local schema-validity with the results of schema-validity assessments of its descendants, if any, and adding appropriate augmentations to the infoset to record this outcome. The validating terminal shall provide the infoset contributions to the application using it as it is required by XML Schema Specification and described in Annex D of XML Schema recommendation — Part 1.

The conformance and test procedures for DDL processors are defined for the textual XML form of descriptions.

6.2.1 The validation and infoset augmentation (informative)

The DDL allows expression of structured and typed descriptions in a formal way. Thus, formal rules can be defined for processing descriptions to achieve certain functionalities in an application. The role of the DDL parser is first, to process a structured description and check its conformance. This conformance checking consists of three processes:

1) **Well-formedness**: checking that the description is well-formed XML;

2) **Validation**: checking that the description conforms to the schema and synthetizing an overall validation outcome for the description;

3) **Infoset augmentation**: checking that the terminal provides an enhanced representation of the carried ISO/IEC 15938 description. This enhanced representation explicitely augments the infoset to record the validation outcome.

The first two processes, well-formedness and validation, apply to the description itself. The second process generates an higher level interface called post schema validation infoset (PSVI). It is composed of a set of properties associated to each information item of the description as described in XML information recommendations. In general, a compliant application will rely on a terminal with conformant DDL processing capabilities for providing this higher-level interface of the description.

6.2.2 DDL processing by a terminal

If a terminal require a DDL processor not only to check the conformance of descriptions, but also provides a higher semantic-level view on the description in the sense that the description consists initially of strings of XML elements as input to the DDL processor, but provides a data model to the end-application for accessing structures at the higher level as defined in the schema.

The overall DDL processing of a terminal involves several steps as shown in Figure 10. The steps are described as follows.

1) The input description is received in XML textual form.

2) The description is parsed and wellformedness is checked.

3) The document is validated against the ISO/IEC 15938 schema.

4) The Post Schema Validation Infoset (PSVI) is generated and provided with the description to further processing.

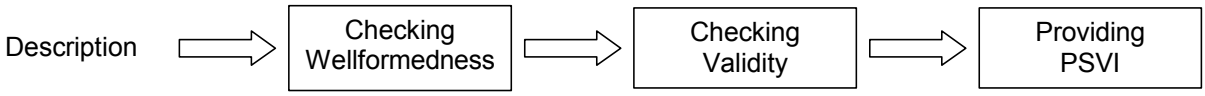

Figure 10 — Summary of DDL processing of description by a terminal

6.2.3 Extensions

The DDL is the language used for specifying the syntax of descriptions by defining a schema. The DDL can also be used to extend the standard by extending, restricting or redefining new description schemes in the ISO/IEC 15938 schema. Therefore an ISO/IEC 15938 terminal shall be able to handle schemas deriving from ISO/IEC 15938 as well as new independent schemas.

6.3 DDL conformance points

Overall, the DDL processing involves three conformance points as follows:

— Validation of the description;

— Interface to the application;

— Extensions to schema.

6.4 DDL processor

Figure 11 shows the complete conformance framework for the DDL processor. A set of normative valid and invalid descriptions are presented to the system. The output of the Reference DDL processor is compared to the output of the Test DDL processor. Each of the DDL processors checks the descriptions against the provided schema. If the Test DDL processor produces a set of equivalent results, then the Test DDL processor is said to be conformant with respect to ISO/IEC 15938. Given that the schema is composed from multiple parts of the standard, conformance with respect to those individual parts is determined from the DDL processor conformance testing using the schema composed from those parts (for example, ISO/IEC 15938 parts 2 – 5).

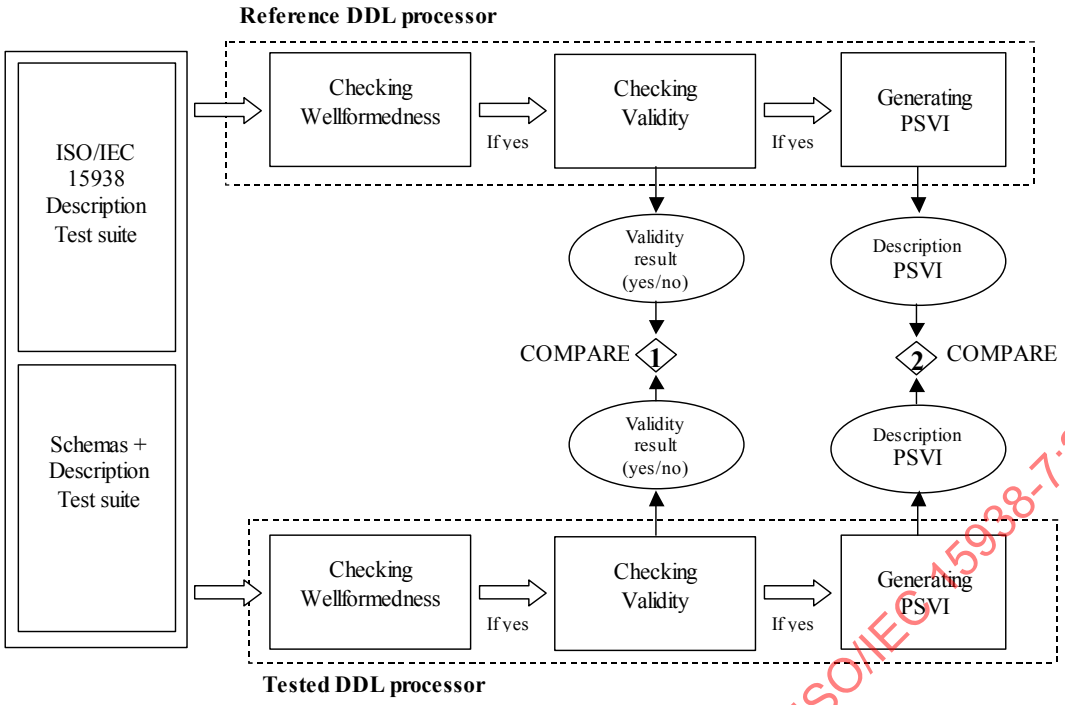

Figure 11 — Overview of conformance framework for DDL processor.

The following is checked in the conformance framework for DDL processor as shown in Figure 11.

1) Evaluate the validation

   — In that case the compared ouput is the “valid/invalid” response given by the tested DDL parser;

2) Evaluate the infoset augmentation (PSVI)

   — In that case the compared output is the PSVI produced by the reference DDL parser;

3) Evalute the extensibility capabilities

   — In that case the test 1 and 2 are performed on other schema than the ISO/IEC 15938 schema.

6.5 Systems Conformance Bitstreams

6.5.1 Introduction

The Systems Conformance Bitstreams consist of streams for BiM conformance and TeM conformance. Table 1 and Table 2 summarize the Systems Conformance Bitstreams. The Tables are organized as follows: the first column gives the name of the conformance bitstreams and the subsequent columns give additional information on the aspects of conformance testing.

6.5.1.1 Systems BiM Conformance Bitstreams

Table 1 summarizes the Systems BiM conformance bitstreams.

Table 1 — Systems BiM Conformance Bitstreams

Conformance Stream	Decoder Init			Fragment Updates	Context Path		Commands				Payload
	Initial Descr	Multiple Fragments	Schema References	Fragment Updates	Type	Address	Add	Delete	Replace	Reset	Deferred Nodes
singleAU/autop001.bin … singleAU/autop168.bin			✓	Single	Absolute	root	✓				
multipleAUs/output000			✓	Multiple	Absolute	elements	✓		✓		
multipleAUs/output019	✓		✓	Single	Absolute	elements			✓		
multipleAUs/output036			✓	Single	Absolute	elements	✓	✓			
multipleAUs/output094			✓	Multiple	Absolute	elements	✓				
multipleAUs/output094-2			✓	Multiple	Absolute	elements	✓			✓	
multipleAUs/output102			✓	Multiple	Absolute	elements	✓				
multipleAUs/output102-2			✓	Multiple	Absolute	elements	✓			✓	
multipleAUs/output153			✓	Single	Absolute	elements	✓	✓			

6.5.1.2 Systems TeM Conformance Bitstreams

Table 2 summarizes the Systems TeM conformance bitstreams.

Table 2 — Systems TeM Conformance Bitstreams

Conformance Stream	Decoder Init			Fragment Updates	Context Path		Commands				Payload
	Initial Descr	Multiple Fragments	Schema References	Fragment Updates	Type	Address	Add	Delete	Replace	Reset	Deferred Nodes
description098–attribute-systems.xml	✓		✓	Single	Both	Both	✓	✓	✓	✓	✓
description098–base-systems.xml	✓		✓	Single	Absolute	Elements	✓				
description098-commands-relative-systems.xml	✓		✓	Single	Both	Elements	✓	✓	✓	✓	
description098-commands-systems.xml	✓		✓	Single	Absolute	Elements	✓	✓	✓	✓	
description098-mutiple-systems.xml	✓		✓	Mutiple	Both	Elements	✓	✓	✓	✓	
description098-noinitial-systems.xml				Single	Absolute	Elements	✓				
description098-partial-systems.xml	✓		✓	Single	Both	Elements	✓	✓	✓		✓
description098-relative-systems.xml	✓		✓	Single	Relative	Elements	✓				
description098-commands-relativeA-systems.xml	✓		✓	Single	Both	Elements	✓	✓	✓	✓	
monsterJrH-ard-au.xml	✓		✓	Mutiple	Absolute	Elements	✓		✓		✓
monsterJrH-ardc-au.xml	✓		✓	Mutiple	Absolute	Elements	✓		✓		✓
monsterJrH-ardd-au.xml	✓		✓	Mutiple	Absolute	Elements	✓	✓	✓		✓

7 Conformance Testing with respect to ISO/IEC 15938 Schema

7.1 Introduction

Given that the ISO/IEC 15938 schema is composed from multiple parts of the standard, conformance with respect to those individual parts is determined from the DDL processor conformance testing using a schema composed from those parts (for example, ISO/IEC 15938 Parts 2 – 5).

7.2 Conformance Testing with respect to 15938-2 (DDL)

7.2.1 Introduction

This clause defines conformance with respect to ISO/IEC 15938-2 (DDL) and conformance testing procedures.

7.2.2 DDL Schema conformance

ISO/IEC 15938-2 defines structures that comprise the DDL parts of the schema. Conformance testing with respect to the schema elements defined in ISO/IEC 15938-2 involves testing conformance of the DDL processor using the ISO/IEC 15938 schema that includes the structures defined in ISO/IEC 15938-2.

7.3 Conformance Testing with respect to 15938-3 (Visual)

7.3.1 Introduction

This clause defines conformance with respect to ISO/IEC 15938-3 (Visual) and conformance testing procedures. The normative components of ISO/IEC 15938-3 (Visual) schema correspond to the syntactic and semantic definitions of descriptors and descriptions schemes in ISO/IEC 15938-3. The syntactic aspects of the definitions may also include additional constraints like limits on the dynamic range of a descriptor's value or limits on the number of elements in a vector.

7.3.2 Components of Conformance

- ISO/IEC 15938-3 (Video) conformance shall concern only syntactic conformance, which is the conformance testing of normative instantiations of meta-data descriptors and descriptions schemes. ISO/IEC 15938-3 conformance testing of extraction methods and of use methods is not required.

7.3.3 Visual Schema conformance

ISO/IEC 15938-3 defines structures that comprise the Visual parts of the schema. Conformance testing with respect to the schema elements defined in ISO/IEC 15938-3 involves testing conformance of the DDL processor using the ISO/IEC 15938 schema that includes the structures defined in ISO/IEC 15938-3.

Conformance testing for the textual and binary forms of visual descriptions is given in the following subclauses.

7.3.3.1.1 Textual Visual descriptions

The textual XML format visual descriptions shall be syntactically and semantically correct as specified by ISO/IEC 15938-3. The syntactic conformance test is performed by validating the textual XML format visual description using a validating reference ISO/IEC 15938-2 parser.

7.3.3.1.2 Binary Visual descriptions

Binary visual descriptions shall be converted to textual XML format using the Systems binary (BiM) decoder. Then, the syntactic conformance test specified in section 7.3.3.1.1 shall be performed by validating the textual XML format description using a DDL conformant parser.

7.3.4 Naming Scheme for Visual Conformance Descriptions

For each descriptor and description scheme a base name (*basename*) is defined as shown in table below. The file containing the textual conformance descriptions shall be named as

basename.xml

and the file containing the binary conformance descriptions shall be named as

basename.bim

Any additional information that may be required, for example, information associated with the media file, the conformance extraction process and parameters, or the conformance descriptions shall be contained in a file named as

basename.inf

This file is optional.

All files shall be archived together into a single archive named

basename.zip

Table 3 — Naming Scheme for Video Conformance Descriptions

Descriptor/Descriptionscheme	Basename
Grid layout D	GridLayout
Visual time series	VisualTimeSeries
2D-3D multiple view	Multiple view
Spatial 2D coordinates	Spatial2DCoordinates
Temporal interpolation	TemporalInterpolation
Color space	ColorSpace
Color quantization	ColorQuantization
Dominant color	DominantColor
Scalable color	ScalableColor
Color layout	ColorLayout
Color structure	ColorStructure
GoF/GoP color	GoFColor
Homogeneous texture	HomogeneousTexture
Texture browsing	TextureBrowsing
Edge histogram	EdgeHistogram
Region-based shape	RegionBasedShape
Contour-based shape	ContourBasedShape
Shape 3D	Shape3D
Camera motion	CameraMotion
Motion trajectory	MotionTrajectory
Parametric motion	ParametricMotion
Motion activity	MotionActivity
Region locator	RegionLocator
Spatio-temporal locator	SpatioTemporalLocator
Face recognition	FaceRecognition

7.4 Conformance Testing with respect to 15938-4 (Audio)

7.4.1 Introduction

The normative components of ISO/IEC 15938-4 are the definitions of descriptions and descriptions schemes. Definitions consist primarily of syntactic definitions, although there may be additional normative restrictions to the definitions (for example, limits on the dynamic range of a descriptor's value or limits on the number of elements in a vector).

7.4.2 Components of Conformance

ISO/IEC 15938-4 (Audio) conformance shall concern only syntactic conformance, which is the conformance testing of normative instantiations of meta-data descriptors and descriptions schemes. ISO/IEC 15938-4 conformance testing of extraction methods and of use methods is not required.

7.4.2.1 Syntactic Conformance

7.4.2.1.1 Textual Descriptions

Conformant meta-data can consist of any number of syntactically correct instantiations of ISO/IEC 15938-4 descriptors or description schemes.

7.4.2.1.2 Measure of Normative Behavior

Syntactic conformance testing consists of checking the correctness of the instantiations of individual audio descriptors. The meta-data descriptions shall be syntactically correct, as specified by ISO/IEC 15938-4 and consistent with any restrictions imposed by the specific descriptors or description schemes. This test will be executed by a validating reference ISO/IEC 15938-2 parser by validating the instantiation against the appropriate schema.

7.4.2.1.3 Binary Descriptions

Binary descriptions shall be converted to textual descriptions using the Systems decoder. Then the test specified in section 7.4.2.1.1 shall be carried out.

7.4.3 Naming Scheme for Conformance Descriptions

For each descriptor and description scheme a base name (*basename*) is defined as shown in table below. The file containing the textual conformance descriptions shall be named as

basename.xml

and the file containing the binary conformance descriptions shall be named as

basename.bim

Information that may be desirable to include with the conformance materials, for example, information associated with the media file, the conformance extraction process, or the conformance descriptions shall be contained in a file named as

basename.txt

This file is optional.

The media signal file from which the meta-data was extracted shall be named

basename.wav

This file is optional.

These files shall be archived together into a single archive named

basename.zip

Table 4 — Naming Scheme for Audio Conformance Descriptions

Descriptor/Description scheme	Basename
AudioFundamentalFrequencyD	AudioFundamentalFrequencyD
AudioHarmonicityD	AudioHarmonicityD
AudioPowerD	AudioPowerD
AudioSignatureDS	AudioSignatureDS
AudioSpectrumBasisD	AudioSpectrumBasisD
AudioSpectrumCentroidD	AudioSpectrumCentroidD
AudioSpectrumEnvelopeD	AudioSpectrumEnvelopeD
AudioSpectrumFlatnessD	AudioSpectrumFlatnessD
AudioSpectrumProjectionD	AudioSpectrumProjectionD
AudioSpectrumSpreadD	AudioSpectrumSpreadD
AudioWaveformD	AudioWaveformD
HarmonicInstrumentTimbreDS	HarmonicInstrumentTimbreDS
HarmonicSpectralCentroidD	HarmonicSpectralCentroidD
HarmonicSpectralDeviationD	HarmonicSpectralDeviationD
HarmonicSpectralSpreadD	HarmonicSpectralSpreadD
HarmonicSpectralVariationD	HarmonicSpectralVariationD
InstrumentTimbreDS	InstrumentTimbreDS
LogAttackTimeD	LogAttackTimeD
MelodyContourDS	MelodyContourDS
MelodyDS	MelodyDS
MelodyKeyDS	MelodyKeyDS
MeterD	MeterD
PercussiveInstrumentTimreDS	PercussiveInstrumentTimreDS
SilenceD	SilenceD
SoundClassificationModelDS	SoundClassificationModelDS
SoundModelDS	SoundModelDS
SoundModelStateHistogramD	SoundModelStateHistogramD
SoundModelStatePathDS	SoundModelStatePathDS
SpectralCentroidD	SpectralCentroidD
SpokenContentLatticeDS	SpokenContentLatticeDS
TemporalCentroidD	TemporalCentroidD

7.5 Conformance Testing with respect to 15938-5 (MDS)

7.5.1 Introduction

This clause defines conformance with respect to ISO/IEC 15938-5 (MDS) and conformance testing procedures. Several types of conformance testing with respect to ISO/IEC 15938-5 are discussed in the following subclauses.

— Conformance to ISO/IEC 15938-5 (MDS) Schema is discussed in 7.5.2;

— Conformance of description extraction methods (that may be used in an encoder device) with respect to ISO/IEC 15938-5 is discussed in 7.5.3;

— Conformance of description use methods (that may be used in a terminal or decoder device) with respect to ISO/IEC 15938-5 is discussed in 7.5.4;

— Conformance of descriptions under extensions of ISO/IEC 15938-5 is discussed in 7.5.5 to 7.5.6.

7.5.2 MDS Schema conformance

ISO/IEC 15938-5 defines structures that comprise the MDS parts of the schema. Conformance testing with respect to the schema elements defined in ISO/IEC 15938-5 involves testing conformance of the DDL processor using the ISO/IEC 15938 schema that includes the structures defined in ISO/IEC 15938-5.

Conformance to ISO/IEC 15938-5 (MDS) is determined by conformance testing of the textual form of descriptions, where the descriptions contain instances of the tools defined in ISO/IEC 15938-5. MDS conformance of a description is determined by the following.

— Validation of the description by the DDL processor according to MDS schema defined in ISO/IEC 15938-5.

7.5.3 MDS extraction methods

Since extraction methods of descriptions are not explicitly specified for tools defined in ISO/IEC 15938-5, conformance testing of extraction methods is not required.

7.5.4 MDS use methods

Since processing methods for use of descriptions are not explicitly specified for tools defined in ISO/IEC 15938-5, conformance testing of description processing methods is not required.

7.5.5 MDS extensions

Tools defined in ISO/IEC 15938-5 (MDS) are extensible in that new tools can be derived from the tools defined in ISO/IEC 15938-5. The possible extension mechanisms include XML Schema "extension," in which new attributes and/or elements are added to a type definition originally specified in ISO/IEC 15938-5, or XML Schema "restriction," in which values in a type definition originally specified in ISO/IEC 15938-5 are constrained to a specified set.

For example, the following example shows the specification (in a schema other than defined by ISO/IEC 15938-5) of `MyImageRegion DS`, which extends the `StillRegion DS` defined in ISO/IEC 15938-5.

```
<!-- Definition of MyImageRegion DS -->
<complexType name="MyImageRegionType">
  <complexContent>
    <extension base="mpeg7:StillRegionType">
      <attribute name="foo" type="positiveInteger" use="optional"/>
    </extension>
  </complexContent>
</complexType>
```

MDS conformance of a description that instantiates tools that are extensions of MDS tools is determined by the following:

— Validation of MDS elements of the description by the DDL parser according to MDS schema defined in ISO/IEC 15938-5;