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**Information technology — Media  
context and control —**

**Part 7:  
Conformance and reference software**

*Technologies de l'information — Contrôle et contexte de supports —  
Partie 7: Conformité et logiciel de référence*

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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.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)) or the IEC list of patent declarations received (see <http://patents.iec.ch>).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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*.

This fourth edition cancels and replaces the third edition (ISO/IEC 23005-7:2017), which has been technically revised. The main changes compared to the previous edition are as follows:

- modification of introduction;
- modification of schema namespace.

A list of all parts in the ISO/IEC 23005 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The ISO/IEC 23005 series provides an architecture and specifies information representation of data flowing in and out of the real world and virtual worlds.

The data for the real world are communicated through sensors and actuators. The data for virtual worlds consist of properties of virtual objects and multi-sensorial data embedded in audio-visual content. The ISO/IEC 23005 series specifies data formats for sensors, actuators, virtual objects, and audio-visual content.

Data captured from the real world could need to be adapted for use in a virtual world and data from virtual worlds could also need to be adapted for use in the real world. The ISO/IEC 23005 series does not specify how the adaptation is carried out but only specifies the interfaces:

- data for sensors are sensor capabilities, sensed data, and sensor adaptation preferences;
- data for actuators are sensory device capabilities, sensory device commands, and sensory effect preferences;
- data for virtual objects are characteristics of avatars and virtual world objects;
- sensory effect could be needed to enrich audio-visual contents.

The conformance and reference software is available at <https://standards.iso.org/iso-iec/23005/-7/ed-4/en>.

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# Information technology — Media context and control —

## Part 7:

## Conformance and reference software

### 1 Scope

This document specifies the conformance and reference software implementing the normative clauses of all parts of the ISO/IEC 23005 series. The information provided is applicable for determining the reference software modules available for the parts of the ISO/IEC 23005 series, understanding the functionality of the available reference software modules, and utilizing the available reference software modules. The available reference software modules are specified in the form of application programming interfaces (API) according to ISO/IEC 23006-1.

Furthermore, this document provides the means for conformance testing, i.e. bitstreams – XML descriptions – that conform or do not conform to the normative clauses of the other parts of the ISO/IEC 23005 series and informative descriptions thereof.

### 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 23005-2, *Information technology — Media context and control — Part 2: Control information*

ISO/IEC 23005-3, *Information technology — Media context and control — Part 3: Sensory information*

ISO/IEC 23005-4, *Information technology — Media context and control — Part 4: Virtual world object characteristics*

ISO/IEC 23005-5, *Information technology — Media context and control — Part 5: Data formats for interaction devices*

ISO/IEC 23005-6, *Information technology — Media context and control — Part 6: Common types and tools*

ISO/IEC 23006-1, *Information technology — Multimedia service platform technologies — Part 1: Architecture*

W3C, Extensible Markup Language (XML) 1.0 (Fifth Edition) W3C Recommendation 26 November 2008. Available at <https://www.w3.org/TR/xml/>

### 3 Terms, definitions and abbreviated terms

#### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 23006-1 apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

### 3.2 Abbreviated terms

|      |                                      |
|------|--------------------------------------|
| API  | application programming interface    |
| CIM  | control information metadata         |
| MXM  | MPEG extensible middleware           |
| SEM  | sensory effect metadata              |
| VWOC | virtual world object characteristics |
| IIM  | interaction information metadata     |

## 4 Reference software for the ISO/IEC 23005 series

### 4.1 General

This clause specifies the reference software for the ISO/IEC 23005 series. The ISO/IEC 23005 series reference software is written in Java<sup>[1]</sup>, which is a general purpose programming language and adopts the following package structure:

| <b>Name</b>                      | <b>Definition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| org                              | Java package name for reference software provided by organizations such as ISO/IEC, W3C, or similar.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| org.iso                          | Java package name for reference software provided by ISO/IEC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| org.iso.mpeg                     | Java package name for reference software provided by ISO/IEC.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| org.iso.mpeg.mpegv               | Java package name for reference software provided in the course of the development of the ISO/IEC 23005 series.<br><br>NOTE 1 Subsequent packages for the individual parts of the ISO/IEC 23005 series use the uncapitalized abbreviations as defined in 3.2, e.g.,<br>— org.iso.mpeg.mpegv.cidl, org.iso.mpeg.mpegv.dcdv, org.iso.mpeg.mpegv.sapv, org.iso.mpeg.mpegv.scdv and org.iso.mpeg.mpegv.sepv for ISO/IEC 23005-2,<br>— org.iso.mpeg.mpegv.sedl and org.iso.mpeg.mpegv.sev for ISO/IEC 23005-3,<br>— org.iso.mpeg.mpegv.vwoc for ISO/IEC 23005-4, or<br>— org.iso.mpeg.mpegv.iidl, org.iso.mpeg.mpegv.dcv and org.iso.mpeg.mpegv.siv for ISO/IEC 23005-5.<br>— org.iso.mpeg.mpegv.ct for ISO/IEC 23005-6.<br>NOTE 2 Code included within these packages can be generated automatically by using tools such as JAXB (Java Architecture for XML Binding). |
| org.iso.mpeg.mpegv.{part}.binary | Java package name for binary representation of reference software provided in the course of the development of the ISO/IEC 23005 series.<br><br>the {part} placeholder is replaced by the component of each part, i.e., cidl, dcdv, sapv, scdv, sepv, sedl, sev, vwoc, iidl, dcv, siv and ct.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| org.iso.mpeg.mxm                 | Java package name for reference software provided in the course of the development of ISO/IEC 23006-1. The actual API is defined within this package.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## 4.2 ISO/IEC 23005-2 APIs

### 4.2.1 General

This subclause specifies the API to the ISO/IEC 23005-2 reference software. The API is defined in Java and adopts the following package structure.

| <i>Name</i>                                    | <i>Definition</i>                                                    |
|------------------------------------------------|----------------------------------------------------------------------|
| <code>org.iso.mpeg.mxm.engine.cimengine</code> | Java package name for API to the ISO/IEC 23005-2 reference software. |

### 4.2.2 CIM engine

The CIMEngine interface defines the methods for operating over data structures as defined within ISO/IEC 23005-2. Classes implementing the CIM engine interface act as factories creating instances of classes performing the following functionalities:

- classes to create data structures, by means of the CIM creation engine;
- classes to access data contained in data structures, by means of CIM parser engine.

### 4.2.3 CIM creation

Creating CIM structures involves the following interfaces:

- CIMCreator: an interface defining the methods to create CIM structures.

### 4.2.4 CIM access

Accessing CIM structures involves the following interfaces:

- CIMParser: an interface defining the methods to parse CIM structures.

## 4.3 ISO/IEC 23005-3 APIs

### 4.3.1 General

This subclause specifies the API to the ISO/IEC 23005-3 reference software. The API is defined in Java and adopts the following package structure.

| <i>Name</i>                                    | <i>Definition</i>                                                    |
|------------------------------------------------|----------------------------------------------------------------------|
| <code>org.iso.mpeg.mxm.engine.semengine</code> | Java package name for API to the ISO/IEC 23005-3 reference software. |

### 4.3.2 SEM engine

The SEMEngine interface defines the methods for operating over data structures as defined within ISO/IEC 23005-3. Classes implementing the SEM engine interface act as factories creating instances of classes performing the following functionalities:

- classes to create data structures, by means of the SEM creation engine;
- classes to access data contained in data structures, by means of SEM parser engine.

#### 4.3.3 SEM creation

Creating SEM structures involves the following interfaces:

- SEMCreator: an interface defining the methods to create SEM structures.

#### 4.3.4 SEM access

Accessing SEM structures involves the following interfaces:

- SEMParser: an interface defining the methods to parse SEM structures.

### 4.4 ISO/IEC 23005-4 APIs

#### 4.4.1 General

This subclause specifies the API to the ISO/IEC 23005-4 reference software. The API is defined in Java and adopts the following package structure.

| <i>Name</i>                                     | <i>Definition</i>                                                    |
|-------------------------------------------------|----------------------------------------------------------------------|
| <code>org.iso.mpeg.mxm.engine.vwocengine</code> | Java package name for API to the ISO/IEC 23005-4 reference software. |

#### 4.4.2 VWOC engine

The VWOC Engine interface defines the methods for operating over data structures as defined within ISO/IEC 23005-4. Classes implementing the VWOC engine interface act as factories creating instances of classes performing the following functionalities:

- classes to create data structures, by means of the VWOC creation engine;
- classes to access data contained in data structures, by means of VWOC parser engine.

#### 4.4.3 VWOC creation

Creating VWOC structures involves the following interfaces:

- VWOC Creator: an interface defining the methods to create VWOC structures.

#### 4.4.4 VWOC access

Accessing VWOC structures involves the following interfaces:

- VWOC Parser: an interface defining the methods to parse VWOC structures.

### 4.5 ISO/IEC 23005-5 APIs

#### 4.5.1 General

This subclause specifies the API to the ISO/IEC 23005-5 reference software. The API is defined in Java and adopts the following package structure.

| <i>Name</i>                                    | <i>Definition</i>                                                    |
|------------------------------------------------|----------------------------------------------------------------------|
| <code>org.iso.mpeg.mxm.engine.iidengine</code> | Java package name for API to the ISO/IEC 23005-5 reference software. |

#### 4.5.2 IID engine

The IIDEngine interface defines the methods for operating over data structures as defined within ISO/IEC 23005-2. Classes implementing the IID engine interface act as factories creating instances of classes performing the following functionalities:

- classes to create data structures, by means of the IID creation engine;
- classes to access data contained in data structures, by means of IID parser engine.

#### 4.5.3 IID creation

Creating IID structures involves the following interfaces:

- IIDCreator: an interface defining the methods to create IID structures.

#### 4.5.4 IID access

Accessing IID structures involves the following interfaces:

- IIDParser: an interface defining the methods to parse IID structures.

### 4.6 Binary representation APIs for the ISO/IEC 23005 series

#### 4.6.1 General

This subclause specifies the API to the ISO/IEC 23005 series reference software for binary representation. The API is defined in Java and adopts the following package structure.

| Name                           | Definition                                                                                          |
|--------------------------------|-----------------------------------------------------------------------------------------------------|
| org.iso.mpeg.mpegv.binary.core | Java package name for API to the ISO/IEC 23005 series reference software for binary representation. |

#### 4.6.2 BinaryIO

The BinaryIO interface defines the methods for operating over data structures as defined within the ISO/IEC 23005 series. Classes implementing the BinaryIO interface act as factories creating instances of classes performing the following functionalities:

- classes to generate a binary structure from a MXM object tree, by means of the construct binary structure function;
- classes to generate a binary file from a binary structure, by means of the write binary function;
- classes to generate a binary structure from a binary structure, by means of the read binary function;
- classes to restore a MXM object tree from a binary structure, by means of the create MXM object function.

#### 4.6.3 DefaultBinaryIO

DefaultBinaryIO class defines the functions “encode” and “decode”. Root elements of other parts (e.g. ISO/IEC 23005-2, ISO/IEC 23005-3, ISO/IEC 23005-4) can be extended from this DefaultBinaryIO class. DefaultBinaryIO involves the following functions:

- encode: a function defining the methods to create binary file from a MXM object tree;
- decode: a function defining the methods to restore a MXM object tree from a binary file.

## 5 Conformance for the ISO/IEC 23005 series

### 5.1 General

This clause defines conformance for the ISO/IEC 23005 series. A bitstream is compliant to the ISO/IEC 23005 series if it conforms to the conformance definitions specified in 5.2 and 5.3.

### 5.2 Rule-based conformance for the ISO/IEC 23005 series

#### 5.2.1 General

This subclause defines a validation schema based on ISO/IEC 19757-3 to check the conformance bitstreams – XML descriptions – that conform or do not conform to the normative clauses of the other parts of the ISO/IEC 23005 series and descriptions thereof. In particular, the additional validation rules as specified in the other parts of the ISO/IEC 23005 series are checked with this validation schema. The actual schema can be found in 5.2.2 and a more readable version of the rules and assertion messages is provided in 5.2.3. The actual conformance bitstreams – XML descriptions – are defined in 5.2.4. The actual conformance bitstreams and corresponding code are available at <https://standards.iso.org/iso-iec/23005-7/ed-4/en>.

For transforming the validation schema according to ISO/IEC 19757-3<sup>[2]</sup> and for validating the examples, Saxon<sup>[1]</sup> is used. Saxon is not mandatory and other tools can be used for validating the examples.

#### 5.2.2 Validation schema

```
<schema
  xmlns="http://purl.oclc.org/dsdl/schematron"
  xmlns:sedl="urn:mpeg:mpeg-v:2018:01-SEDL-NS"
  xmlns:sev="urn:mpeg:mpeg-v:2018:01-SEV-NS"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:si="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"
  xmlns:cidl="urn:mpeg:mpeg-v:2018:01-CIDL-NS"
  xmlns:dcdv="urn:mpeg:mpeg-v:2018:01-DCDV-NS"
  xmlns:scdv="urn:mpeg:mpeg-v:2018:01-SCDV-NS"
  xmlns:sepv="urn:mpeg:mpeg-v:2018:01-SEPV-NS"
  xmlns:mpegvct="urn:mpeg:mpeg-v:2018:01-CT-NS"
  xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004"
  xmlns:dia="urn:mpeg:mpeg21:2003:01-DIA-NS"
  xmlns:iidl="urn:mpeg:mpeg-v:2018:01-IIDL-NS"
  xmlns:dcv="urn:mpeg:mpeg-v:2018:01-DCV-NS"
  xmlns:siv="urn:mpeg:mpeg-v:2018:01-SIV-NS"
  queryBinding='xslt' schemaVersion='ISO19757-3'>
  <ns prefix="sedl" uri="urn:mpeg:mpeg-v:2018:01-SEDL-NS"/>
  <ns prefix="si" uri="urn:mpeg:mpeg21:2003:01-DIA-XSI-NS"/>
  <ns prefix="sev" uri="urn:mpeg:mpeg-v:2018:01-SEV-NS"/>
  <ns prefix="xsi" uri="http://www.w3.org/2001/XMLSchema-instance"/>
  <ns prefix="mpeg7" uri="urn:mpeg:mpeg7:schema:2004"/>
  <ns prefix="cidl" uri="urn:mpeg:mpeg-v:2018:01-CIDL-NS"/>
  <ns prefix="dcdv" uri="urn:mpeg:mpeg-v:2018:01-DCDV-NS"/>
  <ns prefix="scdv" uri="urn:mpeg:mpeg-v:2018:01-SCDV-NS"/>
  <ns prefix="sepv" uri="urn:mpeg:mpeg-v:2018:01-SEPV-NS"/>
  <ns prefix="mpegvct" uri="urn:mpeg:mpeg-v:2018:01-CT-NS"/>
  <ns prefix="dia" uri="urn:mpeg:mpeg21:2003:01-DIA-NS"/>
  <ns prefix="iidl" uri="urn:mpeg:mpeg-v:2018:01-IIDL-NS"/>
  <ns prefix="dcv" uri="urn:mpeg:mpeg-v:2018:01-DCV-NS"/>
  <ns prefix="siv" uri="urn:mpeg:mpeg-v:2018:01-SIV-NS"/>
  <title>Schema for validating SEDL/CIDL/IIDL descriptions</title>
  <!-- ##### -->
  <!-- Schema for validating CIDL(Part 2) descriptions -->
  <!-- ##### -->
  <pattern name="SensorDeviceCapability element">
    <!-- R1.0: Check the conformance of SensorDeviceCapability -->
    <rule context="cidl:SensorDeviceCapability">
      <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true()">
```

```

        A minValue shall be less than or equal to a maxValue.
    </assert>
</rule>
</pattern>
<pattern name="PositionCapability element">
    <!-- R1.1: Check the conformance of PositionCapability -->
    <rule context="scdv:PositionCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="OrientationCapability element">
    <!-- R1.2: Check the conformance of OrientationCapability -->
    <rule context="scdv:OrientationCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="VelocityCapability element">
    <!-- R1.3: Check the conformance of VelocityCapability -->
    <rule context="scdv:VelocityCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="AngularVelocityCapability element">
    <!-- R1.4: Check the conformance of AngularVelocityCapability -->
    <rule context="scdv:AngularVelocityCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="AccelerationCapability element">
    <!-- R1.5: Check the conformance of AccelerationCapability -->
    <rule context="scdv:AccelerationCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="AngularAccelerationCapability element">
    <!-- R1.6: Check the conformance of AngularAccelerationCapability -->
    <rule context="scdv:AngularAccelerationCapability">
        <assert test="if (@minValue and @maxValue) then if (@minValue > @maxValue) then
false() else true() else true() ">
            A minValue shall be less than or equal to a maxValue.
        </assert>
    </rule>
</pattern>
<pattern name="Range element">
    <!-- R2.*: Check the conformance of range -->
    <rule context="scdv:Range">
        <!-- R2.0 -->
        <assert test="if (child::scdv:XminValue > child::scdv:XmaxValue) then false() else
true() ">
            An XminValue shall be less than or equal to an XmaxValue.
        </assert>
        <!-- R2.1 -->
        <assert test="if (child::scdv:YminValue > child::scdv:YmaxValue) then false() else
true() ">
            An YminValue shall be less than or equal to an YmaxValue.
        </assert>
    </rule>
</pattern>

```

```

    <!-- R2.2 -->
    <assert test="if (child::scdv:ZminValue > child::scdv:ZmaxValue) then false() else
true()" ">
        A ZminValue shall be less than or equal to a ZmaxValue.
    </assert>
</rule>
</pattern>
<pattern name="OrientationRange element">
    <!-- R3.*: Check the conformance of OrientationRange -->
    <rule context="scdv:OrientationRange">
        <!-- R3.0 -->
        <assert test="if (child::scdv:YawMin > child::scdv:YawMax) then false() else
true()" ">
            An YawMin shall be less than or equal to an YawMax.
        </assert>
        <!-- R3.1 -->
        <assert test="if (child::scdv:PitchMin > child::scdv:PitchMax) then false() else
true()" ">
            A PitchMin shall be less than or equal to a PitchMax.
        </assert>
        <!-- R3.2 -->
        <assert test="if (child::scdv:RollMin > child::scdv:RollMax) then false() else
true()" ">
            A RollMin shall be less than or equal to a RollMax.
        </assert>
    </rule>
</pattern>

<!-- ##### -->
<!-- Schema for validating SEDL(Part 3) descriptions -->
<!-- ##### -->
<pattern name="SEM element">
    <!-- R1.0: Check the conformance of SEM -->
    <rule context="sedl:SEM">
        <assert test="@si:timeScale">
            The SEM element shall have a timeScale attribute.
        </assert>
    </rule>
</pattern>
<pattern name="GroupOfEffects elements">
    <!-- R2.*: Check the conformance of GroupOfEffects -->
    <rule context="sedl:GroupOfEffects">
        <!-- R2.0 -->
        <assert test="if ( not(parent::sedl:Declarations) and not(@si:pts or @si:ptsDelta or
@si:absTime) ) then false() else true()" ">
            A GroupOfEffects outside of a Declarations shall have a timestamp (i.e., pts,
ptsDelta, or absTime).
        </assert>
        <!-- R2.1 -->
        <assert test="if ( not(parent::sedl:Declarations) and (@si:pts and @si:absTime) )
then false() else true()" ">
            A GroupOfEffects outside of a Declarations shall not have both a pts and an
absTime at the same time.
        </assert>
        <!-- R2.2 -->
        <assert test="if ( parent::sedl:Declarations and (@si:pts or @si:absTime) ) then
false() else true()" ">
            A GroupOfEffects within a Declarations shall have only a ptsDelta for a timestamp.
        </assert>
    </rule>
</pattern>
<pattern name="Effect elements">
    <!-- R3.*: Check the conformance of Effects -->
    <rule context="sedl:Effect">
        <!-- R3.0 -->
        <assert test="@fade or @activate or @duration">
            At least activate, duration, or fade shall be defined.
        </assert>
        <!-- R3.1 -->
        <assert test="(not(@si:pts or @si:ptsDelta or @si:absTime) and
parent::sedl:GroupOfEffects) or @si:pts or @si:ptsDelta or @si:absTime">

```

An effect outside of a GroupOfEffects shall have a timestamp (i.e., pts, ptsDelta, or absTime).

```

</assert>
<!-- R3.2 -->
<assert test="((@si:pts or @si:ptsDelta or @si:absTime) and not(parent::sedl:GroupOfEffects)) or not(@si:pts or @si:ptsDelta or @si:absTime)">
  An effect within a GroupOfEffects shall not have a timestamp (i.e., pts, ptsDelta, or absTime).
</assert>
<!-- R3.3 -->
<assert test="if (@duration and @activate) then false() else true()">
  If duration is defined activate may not be defined.
</assert>
<!-- R3.4 -->
<assert test="if (@duration and @fade) then if (not(@activate)) then true() else false() else true()">
  If fade and duration are defined activate may not be defined.
</assert>
<!-- R3.5 -->
<assert test="if (@fade and not(@intensity-value and @intensity-range)) then false() else true()">
  If fade is defined intensity-value and intensity-range shall be defined.
</assert>
<!-- R3.6 -->
<assert test="if (some $retVal in (for $siblings in following-sibling::sedl:Effect return @xsi:type = $siblings/@xsi:type and ((@si:pts = $siblings/@si:pts or @si:ptsDelta = $siblings/@si:ptsDelta or @si:absTime = $siblings/@si:absTime) or parent::sedl:GroupOfEffects) and @location = $siblings/@location) satisfies $retVal = true()) then false() else true()">
  If two (or more) consecutive Effect elements of the same type share the same timestamp (i.e., pts, ptsDelta, or absTime) and location only the latest in their order of appearance shall be used.
</assert>
<!-- R3.7 -->
<assert test="if ((@intensity-range and not(@intensity-value)) or (@intensity-value and not(@intensity-range))) then false() else true()">
  If intensity-value is present, intensity-range shall be present and vice versa.
</assert>
<!-- R3.8 -->
<assert test="if (@intensity-value and @intensity-range) then if ((@intensity-value >= number(tokenize(@intensity-range, '\s+') [1])) and (number(tokenize(@intensity-range, '\s+') [2]) >= @intensity-value)) then true() else false() else true()">
  The intensity-value shall be within the intensity-range.
</assert>
<!-- R3.9 -->
<assert test="if(child::sev:TrajectorySamples) then if((not(@duration)) and (@timeSamples)) then true() else false() else true()">
  A number of trajectory samples at an update period shall have a timeSamples attribute, but duration attribute shall not be described.
</assert>
<!-- R3.10 -->
<assert test="if(child::sev:PassiveKinestheticForce) then if((not(@duration)) and (@timeSamples)) then true() else false() else true()">
  Passive kinesthetic force effect element shall have a timeSamples attribute in parent element, but duration attribute shall not be described.
</assert>
<!-- R3.11 -->
<assert test="if((@xsi:type = 'sev:PassiveKinestheticForceType') and (following-sibling::sedl:Effect/@xsi:type['sev:ActiveKinestheticType'])) or ((@xsi:type = 'sev:ActiveKinestheticType') and (following-sibling::sedl:Effect/@xsi:type['sev:PassiveKinestheticForceType'])) then false() else true()">
  Passive kinesthetic force effect element shall not be described with active kinesthetic effect at the same time.
</assert>
<!-- R3.12 -->
<assert test="if (@duration and @fade) then if (@fade > @duration) then false() else true() else true()">
  If fade and duration are defined fade shall be less or equal to duration.
</assert>
<!-- R3.13 -->
<assert test="if ( not(ancestor::sedl:Declarations) and (not(parent::sedl:GroupOfEff

```

```

ects) and (@si:pts and @si:absTime)) ) then false() else true() ">
    An Effect shall not have both a pts and an absTime at the same time.
</assert>
<!-- R3.14 -->
<assert test="if ( ancestor::sedl:Declarations and (@si:pts or @si:absTime) ) then
false() else true() ">
    An Effect within a Declarations shall have only a ptsDelta for a timestamp.
</assert>
</rule>
</pattern>

<pattern name="TrajectorySamples element">
    <!-- R4.0 -->
    <rule context="sev:TrajectorySamples">
        <assert test="if(tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false() ">
            A number of trajectory samples shall be in multiples of 6 since 6 samples include
            three positions and three orientations at each period Therefore number of rows are fixed
            to 6.
        </assert>
    </rule>
</pattern>

<pattern name="PassiveKinestheticForce element">
    <!-- R5.0 -->
    <rule context="sev:PassiveKinestheticForce">
        <assert test="if(tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false() ">
            Rows indicate 3 forces and 3 torques. Therefore, the number of row shall be '6'.
        </assert>
    </rule>
</pattern>

<pattern name="Wave element">
    <!-- R6.0: Check the conformance of Wave -->
    <rule context="sev:Wave">
        <assert test="parent::sedl:Effect/@duration>0">
            Wave effect element shall have duration attribute in parent element.
        </assert>
    </rule>
</pattern>

<pattern name="Shake element">
    <!-- R7.0: Check the conformance of Shake -->
    <rule context="sev:Shake">
        <assert test="parent::sedl:Effect/@duration>0">
            Shake effect element shall have duration attribute in parent element.
        </assert>
    </rule>
</pattern>

<pattern name="Spin element">
    <!-- R8.0: Check the conformance of Spin -->
    <rule context="sev:Spin">
        <assert test="parent::sedl:Effect/@duration>0">
            Spin effect element shall have duration attribute in parent element.
        </assert>
    </rule>
</pattern>

<pattern name="MoveToward element">
    <!-- R9.0: Check the conformance of MoveToward -->
    <rule context="sev:MoveToward">
        <assert test="@directionH or @directionV">
            At least directionH or directionV shall be defined.
        </assert>
    </rule>
</pattern>

<pattern name="Incline element">
    <!-- R10.*: Check the conformance of Incline -->
    <rule context="sev:Incline">
        <!-- R10.0 -->

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<assert test="@pitch or @roll or @yaw">
  At least pitch, roll, or yaw shall be defined.
</assert>
<!-- R10.1 -->
<assert test="if (@pitch) then if (@pitchSpeed or @pitchAcceleration) then true() else
false() else true()">
  If pitch is defined pitchSpeed or pitchAcceleration shall be defined.
</assert>
<!-- R10.2 -->
<assert test="if (@yaw) then if (@yawSpeed or @yawAcceleration) then true() else
false() else true()">
  If yaw is defined yawSpeed or yawAcceleration shall be defined.
</assert>
<!-- R10.3 -->
<assert test="if (@roll) then if (@rollSpeed or @rollAcceleration) then true() else
false() else true()">
  If roll is defined rollSpeed or rollAcceleration shall be defined.
</assert>
</rule>
</pattern>

<!-- R11.*: Check the conformance of Color Correction Parameter -->
<pattern name="Color correction element">
  <!-- R11.0 -->
  <rule context="mpegvct:RGB_Value">
    <assert test="if(count((tokenize(normalize-space(self::*), ' '))) = 3) then true()
else false()">
      The number of RGB_value shall be 3(red, green, blue). Therefore the length of
vector is fixed to 3.
    </assert>
  </rule>
  <!-- R11.1 -->
  <rule context="mpegvct:RGB2XYZ_LUT">
    <assert test="if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')
[2] = '3')) then true() else false()">
      The size of REG2XYZ_LUT matrix shall be 3 by 3. Therefore the number of rows is
fixed to 3 and the number of columns is fixed to 3.
    </assert>
  </rule>
  <!-- R11.2 -->
  <rule context="mpegvct:RGBScalar_Max">
    <assert test="if(count((tokenize(normalize-space(self::*), ' '))) = 3) then true()
else false()">
      The number of RGBScalar_Max shall be 3(red, green, blue). Therefore the length of
RGBScalar_Max vector is fixed to 3.
    </assert>
  </rule>
  <!-- R11.3 -->
  <rule context="mpegvct:Offset_Value">
    <assert test="if(count((tokenize(normalize-space(self::*), ' '))) = 3) then true()
else false()">
      The number of Offset_Value shall be 3(red offset, green offset, blue offset).
Therefore the length of Offset_Value vector is fixed to 3.
    </assert>
  </rule>
  <!-- R11.4 -->
  <rule context="mpegvct:Gain_Offset_Gamma">
    <assert test="if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')
[2] = '3')) then true() else false()">
      The size of Gain, Offset, and Gamma is 3, respectively. The size of matrix Gain_
Offset_Gamma is 3 by 3. Therefore the number of rows is fixed to 3 and the number of
columns is fixed to 3.
    </assert>
  </rule>
  <!-- R11.5 -->
  <rule context="mpegvct:InverseLUT">
    <assert test="if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')
[2] = '3')) then true() else false()">
      The size of Inverse_LUT matrix is 3 by 3. Therefore the number of rows is fixed to
3 and the number of columns is fixed to 3.
    </assert>
  </rule>
</pattern>

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</rule>
<!-- R11.6 -->
<rule context="mpegvct:IDCG_Value">
  <assert test="if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')
[2] = '2')) then true() else false() ">
    The size of IDCG_Value matrix is 3 by 2. Therefore the number of rows is fixed to
3 and the number of columns is fixed to 2.
  </assert>
</rule>
</pattern>

<!-- R12.*: Check the conformance of ReferenceEffect -->
<pattern name="ReferenceEffect elements">
  <rule context="sedl:ReferenceEffect">
    <!-- R12.0 -->
    <assert test="if ( not(ancestor::sedl:Declarations) and not(parent::sedl:GroupOfEffe
cts) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true() ">
      A ReferenceEffect outside of a GroupOfEffects shall have a timestamp (i.e., pts,
ptsDelta, or absTime).
    </assert>
    <!-- R12.1 -->
    <assert test="if ( not(ancestor::sedl:Declarations) and (parent::sedl:GroupOfEffects
and (@si:pts or @si:absTime)) ) then false() else true() ">
      A ReferenceEffect within a GroupOfEffects shall have only a ptsDelta for a
timestamp.
    </assert>
    <!-- R12.2 -->
    <assert test="if ( not(ancestor::sedl:Declarations) and (not(parent::sedl:GroupOfEff
ects) and (@si:pts and @si:absTime)) ) then false() else true() ">
      A ReferenceEffect shall not have both a pts and an absTime at the same time.
    </assert>
    <!-- R12.3 -->
    <assert test="if ( ancestor::sedl:Declarations and (@si:pts or @si:absTime) ) then
false() else true() ">
      A ReferenceEffect within Declarations shall have only a ptsDelta for a timestamp.
    </assert>
  </rule>
</pattern>

<!-- ##### -->
<!-- Schema for validating IIDL (Part 5) descriptions -->
<!-- ##### -->
<pattern name="SensedInfo element">
  <!-- R1.*: Check the conformance of SensedInfo -->
  <rule context="iidl:SensedInfo">
    <!-- R1.0 -->
    <assert test="if ( (@xsi:type = 'siv:MotionSensorType') and (count(child:*) = 1) )
then false() else true() ">
      A MotionSensor shall contain at least one element in addition to a timestamp
element.
    </assert>
    <!-- R1.1 -->
    <assert test="if ( (@xsi:type = 'siv:IntelligentCameraType') and (count(child:*) =
1) ) then false() else true() ">
      An IntelligentCamera shall contain at least one element in addition to a timestamp
element.
    </assert>
  </rule>
</pattern>
</schema>

```

### 5.2.3 Description

#### 5.2.3.1 Description for ISO/IEC 23005-2

Description for `SensorDeviceCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.0 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `PositionCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.1 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `OrientationCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.2 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `VelocityCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.3 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `AngularVelocityCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.4 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `AccelerationCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.5 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `AngularAccelerationCapability`:

| No.  | Rule                                                                                                  | Description                                           |
|------|-------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| R1.6 | if (@minValue and @maxValue) then if (@min-Value > @maxValue) then false() else true()<br>else true() | A minValue shall be less than or equal to a maxValue. |

Description for `Range`:

| No.  | Rule                                                                        | Description                                               |
|------|-----------------------------------------------------------------------------|-----------------------------------------------------------|
| R2.0 | if (child::scdv:XminValue > child::scdv:XmaxValue) then false() else true() | An XminValue shall be less than or equal to an XmaxValue. |

| No.  | Rule                                                                        | Description                                               |
|------|-----------------------------------------------------------------------------|-----------------------------------------------------------|
| R2.1 | if (child::scdv:YminValue > child::scdv:YmaxValue) then false() else true() | An YminValue shall be less than or equal to an YmaxValue. |
| R2.2 | if (child::scdv:ZminValue > child::scdv:ZmaxValue) then false() else true() | A ZminValue shall be less than or equal to a ZmaxValue.   |

Description for `OrientationRange`:

| No.  | Rule                                                                      | Description                                           |
|------|---------------------------------------------------------------------------|-------------------------------------------------------|
| R3.0 | if (child::scdv:YawMin > child::scdv:YawMax) then false() else true()     | An YawMin shall be less than or equal to an YawMax.   |
| R3.1 | if (child::scdv:PitchMin > child::scdv:PitchMax) then false() else true() | A PitchMin shall be less than or equal to a PitchMax. |
| R3.2 | if (child::scdv:RollMin > child::scdv:RollMax) then false() else true()   | A RollMin shall be less than or equal to a RollMax.   |

### 5.2.3.2 Description for ISO/IEC 23005-3

Description for `SEM`:

| No.  | Rule          | Description                                       |
|------|---------------|---------------------------------------------------|
| R1.0 | @si:timeScale | The SEM element shall have a timeScale attribute. |

Description for `GroupOfEffects`:

| No.  | Rule                                                                                                           | Description                                                                                           |
|------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| R2.0 | if ( not(parent::sedl:Declarations) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true() | A GroupOfEffects outside of a Declarations shall have a timestamp (i.e., pts, ptsDelta, or absTime).  |
| R2.1 | if ( not(parent::sedl:Declarations) and (@si:pts and @si:absTime) ) then false() else true()                   | A GroupOfEffects outside of a Declarations shall not have both a pts and an absTime at the same time. |
| R2.2 | if ( parent::sedl:Declarations and (@si:pts or @si:absTime) ) then false() else true()                         | A GroupOfEffects within a Declarations shall have only a ptsDelta for a timestamp.                    |

Description for `Effects`:

| No.  | Rule                                                                                                                                                  | Description                                                                                     |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| R3.0 | @fade or @activate or @duration                                                                                                                       | At least activate, duration, or fade shall be defined.                                          |
| R3.1 | if ( not(ancestor::sedl:Declarations) and not(parent::sedl:GroupOfEffects) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true() | An effect outside of a GroupOfEffects shall have a timestamp (i.e., pts, ptsDelta, or absTime). |
| R3.2 | if ( not(ancestor::sedl:Declarations) and (parent::sedl:GroupOfEffects and (@si:pts or @si:absTime)) ) then false() else true()                       | An Effect within a GroupOfEffects shall have only a ptsDelta for a timestamp.                   |
| R3.3 | if (@duration and @activate) then false() else true()                                                                                                 | If duration is defined activate may not be defined.                                             |
| R3.4 | if (@duration and @fade) then if (not(@activate)) then true() else false() else true()                                                                | If fade and duration are defined activate may not be defined.                                   |
| R3.5 | if(@fade and not(@intensity-value and @intensity-range)) then false() else true()                                                                     | If fade is defined intensity-value and intensity-range shall be defined.                        |

| No.   | Rule                                                                                                                                                                                                                                                                                                                                                             | Description                                                                                                                                                                                                                                                                   |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R3.6  | if (some \$retVal in (for \$siblings in following-sibling::sedl:Effect return @xsi:type = \$siblings/@xsi:type and ((@si:pts = \$siblings/@si:pts or @si:ptsDelta = \$siblings/@si:ptsDelta or @si:absTime = \$siblings/@si:absTime) or parent::sedl:GroupOfEffects) and @location = \$siblings/@location) satisfies \$retVal = true()) then false() else true() | If two (or more) consecutive Effect elements of the same type share the same timestamp (i.e., pts, pts-Delta, or absTime) and location only the latest in their order of appearance shall be used.<br><br>NOTE The other Effect elements can be removed from the description. |
| R3.7  | if (((@intensity-range and not(@intensity-value)) or (@intensity-value and not(@intensity-range))) then false() else true())                                                                                                                                                                                                                                     | If intensity-value is present, intensity-range shall be present and vice versa.                                                                                                                                                                                               |
| R3.8  | if (@intensity-value and @intensity-range) then if (((@intensity-value >= number(tokenize(@intensity-range,'s+')[1])) and (number(tokenize(@intensity-range,'s+')[2]) >= @intensity-value)) then true() else false() else true()                                                                                                                                 | The intensity-value shall be within the intensity-range.                                                                                                                                                                                                                      |
| R3.9  | if(child::sev:TrajectorySamples) then if-((not(@duration)) and (@timeSamples)) then true() else false() else true()                                                                                                                                                                                                                                              | A number of trajectory samples at an update period shall have a timeSamples attribute, but duration attribute shall not be described.                                                                                                                                         |
| R3.10 | if(child::sev:PassiveKinestheticForce) then if-((not(@duration)) and (@timeSamples)) then true() else false() else true()                                                                                                                                                                                                                                        | Passive kinesthetic force effect element shall have a timeSamples attribute in parent element, but duration attribute shall not be described.                                                                                                                                 |
| R3.11 | if (((@xsi:type = 'sev:PassiveKinestheticForceType') and (following-sibling::sedl:Effect/@xsi:type['sev:ActiveKinestheticType'])) or ((@xsi:type = 'sev:ActiveKinestheticType') and (following-sibling::sedl:Effect/@xsi:type['sev:PassiveKinestheticForceType']))) then false() else true()                                                                     | Passive kinesthetic force effect element shall not be described with active kinesthetic effect at the same time.                                                                                                                                                              |
| R3.12 | if (@duration and @fade) then if (@fade > @duration) then false() else true() else true()                                                                                                                                                                                                                                                                        | If fade and duration are defined fade shall be less or equal to duration.                                                                                                                                                                                                     |
| R3.13 | if ( not(ancestor::sedl:Declarations) and (not(parent::sedl:GroupOfEffects) and (@si:pts and @si:absTime)) ) then false() else true()                                                                                                                                                                                                                            | An Effect shall not have both a pts and an absTime at the same time.                                                                                                                                                                                                          |
| R3.14 | if ( ancestor::sedl:Declarations and (@si:pts or @si:absTime) ) then false() else true()                                                                                                                                                                                                                                                                         | An Effect within a Declarations shall have only a pts-Delta for a timestamp.                                                                                                                                                                                                  |

## Description for TrajectorySamples:

| No.  | Rule                                                            | Description                                                                                                                                                                      |
|------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R4.0 | if(tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false() | A number of trajectory samples shall be in multiples of 6 since 6 samples include three positions and three orientations at each period Therefore number of rows are fixed to 6. |

## Description for PassiveKinestheticForce:

| No.  | Rule                                                            | Description                                                                       |
|------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------|
| R5.0 | if(tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false() | Rows indicate 3 forces and 3 torques. Therefore, the number of rows shall be '6'. |

## Description for Wave:

| No.  | Rule                            | Description                                                          |
|------|---------------------------------|----------------------------------------------------------------------|
| R6.0 | parent::sedl:Effect/@duration>0 | Wave effect element shall have duration attribute in parent element. |

## Description for Shake:

| No.  | Rule                            | Description                                                           |
|------|---------------------------------|-----------------------------------------------------------------------|
| R7.0 | parent::sedl:Effect/@duration>0 | Shake effect element shall have duration attribute in parent element. |

## Description for Spin:

| No.  | Rule                            | Description                                                          |
|------|---------------------------------|----------------------------------------------------------------------|
| R8.0 | parent::sedl:Effect/@duration>0 | Spin effect element shall have duration attribute in parent element. |

## Description for MoveToward:

| No.  | Rule                       | Description                                         |
|------|----------------------------|-----------------------------------------------------|
| R9.0 | @directionH or @directionV | At least directionH or directionV shall be defined. |

## Description for Incline:

| No.   | Rule                                                                                                             | Description                                                           |
|-------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| R10.0 | @pitch or @roll or @yaw                                                                                          | At least pitch, roll, or yaw shall be defined.                        |
| R10.1 | if (@pitch) then if (child::sev:PitchSpeed or child::sev:PitchAcceleration) then true() else false() else true() | If pitch is defined PitchSpeed or PitchAcceleration shall be defined. |
| R10.2 | if (@yaw) then if (child::sev:YawSpeed or child::sev:YawAcceleration) then true() else false() else true()       | If yaw is defined YawSpeed or YawAcceleration shall be defined.       |
| R10.3 | if (@roll) then if (child::sev:RollSpeed or child::sev:RollAcceleration) then true() else false() else true()    | If roll is defined RollSpeed or RollAcceleration shall be defined.    |

## Description for RGB\_Value:

| No.   | Rule                                                                              | Description                                                                                         |
|-------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| R11.0 | if(count((tokenize(normalize-space(self::*), ' '))) = 3) then true() else false() | The number of RGB_value shall be 3(red, green, blue). Therefore the length of vector is fixed to 3. |

## Description for RGB2XYZ\_LUT:

| No.   | Rule                                                                                                       | Description                                                                                                                         |
|-------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| R11.1 | if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false() | The size of REG2XYZ_LUT matrix shall be 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3. |

## Description for RGBScalar\_Max:

| No.   | Rule                                                                              | Description                                                                                                           |
|-------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| R11.2 | if(count((tokenize(normalize-space(self::*), ' '))) = 3) then true() else false() | The number of RGBScalar_Max shall be 3(red, green, blue). Therefore the length of RGBScalar_Max vector is fixed to 3. |

Description for `Offset_Value`:

| No.   | Rule                                                                              | Description                                                                                                                                                         |
|-------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R11.3 | if(count((tokenize(normalize-space(self::*), ' ')) = 3) then true() else false()) | The number of <code>Offset_Value</code> shall be 3 (red offset, green offset, blue offset). Therefore the length of <code>Offset_Value</code> vector is fixed to 3. |

Description for `Gain_Offset_Gamma`:

| No.   | Rule                                                                                                       | Description                                                                                                                                                                                              |
|-------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R11.4 | if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false() | The size of Gain, Offset, and Gamma is 3, respectively. The size of matrix <code>Gain_Offset_Gamma</code> is 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3. |

Description for `InverseLUT`:

| No.   | Rule                                                                                                       | Description                                                                                                                   |
|-------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| R11.5 | if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false() | The size of Inverse LUT matrix is 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3. |

Description for `IDCG_Value`:

| No.   | Rule                                                                                                       | Description                                                                                                                  |
|-------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| R11.6 | if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '2')) then true() else false() | The size of IDCG_Value matrix is 3 by 2. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 2. |

Description for `ReferenceEffect`:

| No.   | Rule                                                                                                                                                  | Description                                                                                                                                                                 |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R12.0 | if ( not(ancestor::sedl:Declarations) and not(parent::sedl:GroupOfEffects) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true() | A <code>ReferenceEffect</code> outside of a <code>GroupOfEffects</code> shall have a timestamp (i.e., <code>pts</code> , <code>ptsDelta</code> , or <code>absTime</code> ). |
| R12.1 | if ( not(ancestor::sedl:Declarations) and (parent::sedl:GroupOfEffects and (@si:pts or @si:absTime)) ) then false() else true()                       | A <code>ReferenceEffect</code> within a <code>GroupOfEffects</code> shall have only a <code>ptsDelta</code> for a timestamp.                                                |
| R12.2 | if ( not(ancestor::sedl:Declarations) and (not(parent::sedl:GroupOfEffects) and (@si:pts and @si:absTime)) ) then false() else true()                 | A <code>ReferenceEffect</code> shall not have both a <code>pts</code> and an <code>absTime</code> at the same time.                                                         |
| R12.3 | if ( ancestor::sedl:Declarations and (@si:pts or @si:absTime) ) then false() else true()                                                              | A <code>ReferenceEffect</code> within <code>Declarations</code> shall have only a <code>ptsDelta</code> for a timestamp.                                                    |

### 5.2.3.3 Description for ISO/IEC 23005-5

Description for `SensedInfo`:

| No.  | Rule                                                                                                | Description                                                                                              |
|------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| R1.0 | if ( (@xsi:type = 'siv:MotionSensorType') and (count(child::*) = 1) ) then false() else true()      | A <code>MotionSensor</code> shall contain at least one element in addition to a timestamp element.       |
| R1.1 | if ( (@xsi:type = 'siv:IntelligentCameraType') and (count(child::*) = 1) ) then false() else true() | An <code>IntelligentCamera</code> shall contain at least one element in addition to a timestamp element. |

#### 5.2.3.4 Validation schema transformation

For transforming the validation schema the following commands are used.

**NOTE** The validation schema is called schematron.xsd.

```
java -jar saxon/saxon9.jar -versionmsg:off -s:schematron.xsd
-o:tmp/new_schema1.sch -xsl:schematron/iso_dsd1_include.xsl
java -jar saxon/saxon9.jar -versionmsg:off -s:tmp/new_schema1.sch
-o:tmp/new_schema2.sch -xsl:schematron/iso_abstract_expand.xsl
java -jar saxon/saxon9.jar -versionmsg:off -s:tmp/new_schema2.sch
-o:output/val_schema.xsl -xsl:schematron/iso_svrl_for_xslt1.xsl
```

The first two commands resolve inclusions and abstractions. The last command generates the XSLT style sheet which can then be applied to the XML description. The command generates an XSLT 1.0 description.

### 5.2.4 Conformance bitstreams

#### 5.2.4.1 General

The actual conformance bitstreams are organized as following and referred to as examples:

- 1) the conformance bitstreams – XML description;
- 2) the command to validate the example (both schematron and conformance software);
- 3) the output generated during the validation;
- 4) description of erroneous output (relevant parts).

#### 5.2.4.2 Conformance bitstreams for ISO/IEC 23005-2

##### 5.2.4.2.1 Example 1

ex01.xml shows a valid CIM description with the result in result\_ex01.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex01.xml
-o:schematron/output/cidl/result_ex01.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex01.xml
```

It is necessary to provide the input with the absolute path.

##### 5.2.4.2.2 Example 2

ex02.xml shows an invalid CIM description with the result in result\_ex02.xml. The errors occur in the SensorDeviceCapability, PositionCapability, OrientationCapability, VelocityCapability, AngularVelocityCapability, AccelerationCapability, and AngularAccelerationCapability. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex02.xml
-o:schematron/output/cidl/result_ex02.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex02.xml
```

It is necessary to provide the input with the absolute path.

The errors during the validation are shown in the lines 40 to 46, lines 47 to 53, lines 56 to 62, lines 64 to 70, lines 72 to 78, lines 80 to 86, lines 88 to 94, and lines 96 to 102. Note that all errors are the same but for different test rules. The lines 40 and 41, lines 47 and 48, lines 56 and 57, lines 64 and 65, lines 72

and 73, lines 80 and 81, lines 88 and 89, and lines 96 and 97 defined failed assertions. There is also the test which failed depicted: “if (@minValue and @maxValue) then if (@minValue > @maxValue) then false() else true() else true()”. The error message: “A minValue shall be less than or equal to a maxValue.” is defined in the lines: 44, 51, 60, 68, 76, 84, 92, and 100.

#### 5.2.4.2.3 Example 3

ex03.xml shows a valid CIM description with the result in result\_ex03.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex03.xml
-o:schematron/output/cidl/result_ex03.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex03.xml
```

It is necessary to provide the input with the absolute path.

#### 5.2.4.2.4 Example 4

ex04.xml shows an invalid CIM description with the result in result\_ex04.xml. The errors occur in the range. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex04.xml
-o:schematron/output/cidl/result_ex04.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex04.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 51 to 56. Lines 51 and 52 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:XminValue > child::scdv:XmaxValue) then false() else true()”. Line 54 defines the error message: “An XminValue shall be less than or equal to an XmaxValue”. Another error during the validation is shown in the lines 57 to 62. Lines 57 and 58 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:YminValue > child::scdv:YmaxValue) then false() else true()”. Line 60 defines the error message: “An YminValue shall be less than or equal to an YmaxValue”. Another error during the validation is shown in the lines 63 to 68. Lines 63 and 64 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:ZminValue > child::scdv:ZmaxValue) then false() else true()”. Line 66 defines the error message: “A ZminValue shall be less than or equal to a ZmaxValue”. The next error during the validation is shown in the lines 69 to 75. Lines 69 and 70 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:XminValue > child::scdv:XmaxValue) then false() else true()”. Line 73 defines the error message: “An XminValue shall be less than or equal to an XmaxValue”. Another error during the validation is shown in the lines 76 to 81. Lines 76 and 77 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:YminValue > child::scdv:YmaxValue) then false() else true()”. Line 79 defines the error message: “An YminValue shall be less than or equal to an YmaxValue”. Another error during the validation is shown in the lines 82 to 87. Lines 82 and 83 defined a failed assertion. There is also the test which failed depicted: “if (child::scdv:ZminValue > child::scdv:ZmaxValue) then false() else true()”. Line 85 defines the error message: “A ZminValue shall be less than or equal to a ZmaxValue”.

#### 5.2.4.2.5 Example 5

ex05.xml shows a valid CIM description with the result in result\_ex05.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex05.xml
-o:schematron/output/cidl/result_ex05.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex05.xml
```

It is necessary to provide the input with the absolute path.

#### 5.2.4.2.6 Example 6

ex06.xml shows an invalid CIM description with the result in result\_ex06.xml. The errors occur in the OrientationRange. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex06.xml  
-o:schematron/output/cidl/result_ex06.xml  
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex06.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 51 to 56. Lines 51 and 52 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:YawMin > child::scdv:YawMax) then false() else true()". Line 54 defines the error message: "An YawMin shall be less than or equal to an YawMax.". Another error during the validation is shown in the lines 58 to 63. Lines 58 and 59 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:PitchMin > child::scdv:PitchMax) then false() else true()". Line 61 defines the error message: "A PitchMin shall be less than or equal to a PitchMax.". Another error during the validation is shown in the lines 64 to 69. Lines 64 and 65 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:RollMin > child::scdv:RollMax) then false() else true()". Line 67 defines the error message: "A RollMin shall be less than or equal to a RollMax.". The next error during the validation is shown in the lines 70 to 76. Lines 70 and 71 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:YawMin > child::scdv:YawMax) then false() else true()". Line 74 defines the error message: "An YawMin shall be less than or equal to an YawMax.". Another error during the validation is shown in the lines 77 to 82. Lines 77 and 78 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:PitchMin > child::scdv:PitchMax) then false() else true()". Line 80 defines the error message: "A PitchMin shall be less than or equal to a PitchMax.". Another error during the validation is shown in the lines 83 to 88. Lines 83 and 84 defined a failed assertion. There is also the test which failed depicted: "if (child::scdv:RollMin > child::scdv:RollMax) then false() else true()". Line 86 defines the error message: "A RollMin shall be less than or equal to a RollMax.".

#### 5.2.4.2.7 Example 7

ex07.xml shows a valid CIM description with the result in result\_ex07.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/cidl/ex07.xml  
-o:schematron/output/cidl/result_ex07.xml  
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/cidl/ex07.xml
```

It is necessary to provide the input with the absolute path.

### 5.2.4.3 Conformance bitstreams for ISO/IEC 23005-3

#### 5.2.4.3.1 Example 1

ex01.xml shows a valid SEM description with the result in result\_ex01.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex01.xml
-o:schematron/output/sedl/result_ex01.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex01.xml
```

It is necessary to provide the input with the absolute path.

#### 5.2.4.3.2 Example 2

ex02.xml shows an invalid SEM description with the result in result\_ex02.xml. The error occurs in the GroupOfEffects. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex02.xml
-o:schematron/output/sedl/result_ex02.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex02.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 51 to 57. Lines 51 and 52 defined a failed assertion. There is also the test which failed depicted: “if ( not(parent::sedl:Declarations) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true()”. Line 55 defines the error message: “A GroupOfEffects outside of a Declarations shall have a timestamp (i.e., pts, ptsDelta, or absTime).”

#### 5.2.4.3.3 Example 3

ex03.xml shows an invalid SEM description with the result in result\_ex03.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex03.xml
-o:schematron/output/sedl/result_ex03.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex03.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 53 to 59. Lines 53 and 54 defined a failed assertion. There is also the test which failed depicted: “if ( not(ancestor::sedl:Declarations) and (parent::sedl:GroupOfEffects and (@si:pts or @si:absTime)) ) then false() else true()”. Line 57 defines the error message: “An Effect within a GroupOfEffects shall have only a ptsDelta for a timestamp.”

#### 5.2.4.3.4 Example 4

ex04.xml shows an invalid SEM description with the result in result\_ex04.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex04.xml
-o:schematron/output/sedl/result_ex04.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex04.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “@fade or @activate or @duration”. Line 57 defines the error message: “At least activate, duration, or fade shall be defined.”

#### 5.2.4.3.5 Example 5

ex05.xml shows an invalid SEM description with the result in result\_ex05.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex05.xml
-o:schematron/output/sedl/result_ex05.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex05.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “if ( not(ancestor::sedl:Declarations) and not(parent::sedl:GroupOfEffects) and not(@si:pts or @si:ptsDelta or @si:absTime) ) then false() else true()”. Line 56 defines the error message: “An Effect outside of a GroupOfEffects shall have a timestamp (i.e., pts, ptsDelta, or absTime).”

#### 5.2.4.3.6 Example 6

ex06.xml shows an invalid SEM description with the result in result\_ex06.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex06.xml
-o:schematron/output/sedl/result_ex06.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex06.xml
```

It is necessary to provide the input with the absolute path.

The two errors during the validation are shown in the lines 52 to 58 and lines 59 to 64. Lines 52 and 53 defined the first failed assertion. There is also the test which failed depicted: “if (@duration and @activate) then false() else true()”. Line 56 defines the error message: “If duration is defined activate may not be defined.” The second assert is defined in the lines 59 and 60. The test was: “if (@duration and @fade) then if (not(@activate)) then true() else false() else true()”. Line 64 defines the error message: “If fade and duration are defined activate may not be defined.”

#### 5.2.4.3.7 Example 7

ex07.xml shows an invalid SEM description with the result in result\_ex07.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex07.xml
-o:schematron/output/sedl/result_ex07.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex07.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “if (@fade and not(@intensity-value and @intensity-range)) then false() else true()”. Line 56 defines the error message: “If fade is defined intensity-value and intensity-range shall be defined.”

#### 5.2.4.3.8 Example 8

ex08.xml shows an invalid SEM description with the result in result\_ex08.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex08.xml
-o:schematron/output/sedl/result_ex08.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex08.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “if (some \$retVal in (for \$siblings in following-sibling::sedl:Effect return @xsi:type = \$siblings/@xsi:type and ((@si:pts = \$siblings/@si:pts or @si:ptsDelta = \$siblings/@si:ptsDelta or @si:absTime = \$siblings/@si:absTime) or parent::sedl:GroupOfEffects) and @location = \$siblings/@location) satisfies \$retVal = true()) then false() else true()”. Line 56 defines the error message: “If two (or more) consecutive Effect elements of the same type share the same timestamp (i.e., pts, ptsDelta, or absTime) and location only the latest in their order of appearance shall be used.”

#### 5.2.4.3.9 Example 9

ex09.xml shows an invalid SEM description with the result in result\_ex09.xml. The error occurs in the SEM. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex09.xml
-o:schematron/output/sedl/result_ex09.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex09.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 49 to 55. Lines 49 and 50 defined a failed assertion. There is also the test which failed depicted: “@si:timeScale”. Line 53 defines the error message: “The SEM element shall have a timeScale attribute.”

#### 5.2.4.3.10 Example 10

ex10.xml shows a valid SEM description with the result in result\_ex10.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex10.xml
-o:schematron/output/sedl/result_ex10.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex10.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 56 to 62. Lines 56 and 57 defined a failed assertion. There is also the test which failed depicted: “@fade or @activate or @duration”. Line 60 defines the error message: “At least activate, duration, or fade shall be defined.”

#### 5.2.4.3.11 Example 11

ex11.xml shows an invalid SEM description with the result in result\_ex11.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex11.xml
-o:schematron/output/sedl/result_ex11.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex11.xml
```

It is necessary to provide the input with the absolute path.

The two errors during the validation are shown in the lines 52 to 58 and lines 59 to 65. Lines 52 and 53 defined the first failed assertion. There is also the test which failed depicted: “if ((@intensity-range and not(@intensity-value)) or (@intensity-value and not(@intensity-range))) then false() else true()”. Line 56 defines the error message: “If intensity-value is present, intensity-range shall be present and vice versa.” The second assert is defined in the lines 59 and 60. The test was: “if ((@intensity-range and not(@intensity-value)) or (@intensity-value and not(@intensity-range))) then false() else true()”. Line 63 defines the error message: “If intensity-value is present, intensity-range shall be present and vice versa.”

#### 5.2.4.3.12 Example 12

ex12.xml shows an invalid SEM description with the result in result\_ex12.xml. The error occurs in the Effect. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex12.xml
-o:schematron/output/sedl/result_ex12.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex12.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “if (@intensity-value and @intensity-range) then if ((@intensity-value >= number(tokenize(@intensity-range, '\s+') [1])) and (number(tokenize(@intensity-range, '\s+') [2]) >= @intensity-value)) then true() else false() else true()”. Line 56 defines the error message: “The intensity-value shall be within the intensity-range.”

#### 5.2.4.3.13 Example 13

ex13.xml shows an invalid SEM description with the result in result\_ex13.xml. The error occurs in the TrajectorySamples. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex13.xml
-o:schematron/output/sedl/result_ex13.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex13.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 54 to 60. Lines 54 and 55 defined a failed assertion. There is also the test which failed depicted: “if (tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false()”. Line 58 defines the error message: “A number of trajectory samples shall be in multiples of 6 since 6 samples include three positions and three orientations at each period Therefore number of rows are fixed to 6.”

#### 5.2.4.3.14 Example 14

ex14.xml shows an invalid SEM description with the result in result\_ex14.xml. The error occurs in the TrajectorySamples. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex14.xml
-o:schematron/output/sedl/result_ex14.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex14.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 53 to 58. Lines 53 and 54 defined the failed assertion. The test was: “if(child::sev:TrajectorySamples) then if((not(@duration)) and (@timeSamples)) then true() else false() else true()”. Line 56 defines the error message: “A number

of trajectory samples at an update period shall have a timeSamples attribute, but duration attribute shall not be described."

#### 5.2.4.3.15 Example 15

ex15.xml shows an invalid SEM description with the result in result\_ex15.xml. The error occurs in the TrajectorySamples. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex15.xml
-o:schematron/output/sed1/result_ex15.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex15.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: "if(child::sev:TrajectorySamples) then if((not(@duration)) and (@timeSamples)) then true() else false() else true()". Line 56 defines the error message: "A number of trajectory samples at an update period shall have a timeSamples attribute, but duration attribute shall not be described."

#### 5.2.4.3.16 Example 16

ex16.xml shows an invalid SEM description with the result in result\_ex16.xml. The error occurs in the PassiveKinestheticForce. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex16.xml
-o:schematron/output/sed1/result_ex16.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex16.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 55 to 61. Lines 55 and 56 defined a failed assertion. There is also the test which failed depicted: "if (tokenize(@mpeg7:dim, ' ')[1] = '6') then true() else false()". Line 59 defines the error message: "Rows indicate 3 forces and 3 torques. Therefore, the number of row shall be '6'."

#### 5.2.4.3.17 Example 17

ex17.xml shows an invalid SEM description with the result in result\_ex17.xml. The error occurs in the PassiveKinestheticForce. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex17.xml
-o:schematron/output/sed1/result_ex17.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex17.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: "if(child::sev:PassiveKinestheticForce) then if((not(@duration)) and (@timeSamples)) then true() else false() else true() ". Line 56 defines the error message: "Passive kinesthetic force effect element shall have a timeSamples attribute in parent element, but duration attribute shall not be described."

#### 5.2.4.3.18 Example 18

ex18.xml shows an invalid SEM description with the result in result\_ex18.xml. The error occurs in the passivekinestheticforce and activekinesthetic. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex18.xml
-o:schematron/output/sed1/result_ex18.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex18.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: "if (((@xsi:type = 'sev:PassiveKinestheticForceType') and (following-sibling::sed1:Effect/@xsi:type['sev:ActiveKinestheticType']) or ((@xsi:type = 'sev:ActiveKinestheticType') and (following-sibling::sed1:Effect/@xsi:type['sev:PassiveKinestheticForceType']))) then false() else true()". Line 58 defines the error message: "Passive kinesthetic force effect element shall not be described with active kinesthetic effect at the same time."

#### 5.2.4.3.19 Example 19

ex19.xml shows a valid SEM description with the result in result\_ex19.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex19.xml
-o:schematron/output/sed1/result_ex19.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex19.xml
```

It is necessary to provide the input with the absolute path.

#### 5.2.4.3.20 Example 20

ex20.xml shows an invalid SEM description with the result in result\_ex20.xml. The error occurs in the MoveToward. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex20.xml
-o:schematron/output/sed1/result_ex20.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex20.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 59 to 65. Lines 59 and 60 defined a failed assertion. There is also the test which failed depicted: "@directionH or @directionV". Line 63 defines the error message: "At least directionH or directionV shall be defined."

#### 5.2.4.3.21 Example 21

ex21.xml shows an invalid SEM description with the result in result\_ex21.xml. The error occurs in the Incline. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex21.xml
-o:schematron/output/sed1/result_ex21.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex21.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 60 to 66. Lines 60 and 61 defined a failed assertion. There is also the test which failed depicted: “@pitch or @roll or @yaw”. Line 64 defines the error message: “At least pitch, roll, or yaw shall be defined.”

#### 5.2.4.3.22 Example 22

ex22.xml shows an invalid SEM description with the result in result\_ex22.xml. The error occurs in the Incline. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex22.xml
-o:schematron/output/sed1/result_ex22.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex22.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 60 to 66. Lines 60 and 61 defined a failed assertion. There is also the test which failed depicted: “if (@pitch) then if (@pitchSpeed or @pitchAcceleration) then true() else false() else true()”. Line 64 defines the error message: “If pitch is defined pitchSpeed or pitchAcceleration shall be defined.”

#### 5.2.4.3.23 Example 23

ex23.xml shows an invalid SEM description with the result in result\_ex23.xml. The error occurs in the Incline. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex23.xml
-o:schematron/output/sed1/result_ex23.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex23.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 60 to 66. Lines 60 and 61 defined a failed assertion. There is also the test which failed depicted: “if (@yaw) then if (@yawSpeed or @yawAcceleration) then true() else false() else true()”. Line 64 defines the error message: “yaw is defined yawSpeed or yawAcceleration shall be defined.”

#### 5.2.4.3.24 Example 24

ex24.xml shows an invalid SEM description with the result in result\_ex24.xml. The error occurs in the Incline. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sed1/ex24.xml
-o:schematron/output/sed1/result_ex24.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sed1/ex24.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 60 to 66. Lines 60 and 61 defined a failed assertion. There is also the test which failed depicted: “if (@roll) then if (@rollSpeed or @rollAcceleration) then true() else false() else true()”. Line 64 defines the error message: “yaw is defined rollSpeed or rollAcceleration shall be defined.”

#### 5.2.4.3.25 Example 25

ex25.xml shows an invalid SEM description with the result in result\_ex25.xml. The error occurs in the Wave. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex25.xml
-o:schematron/output/sedl/result_ex25.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex25.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 56 to 62. Lines 56 and 57 defined a failed assertion. There is also the test which failed depicted: "parent::sedl:Effect/@duration>0". Line 60 defines the error message: "Wave effect element shall have duration attribute in parent element."

#### 5.2.4.3.26 Example 26

ex26.xml shows an invalid SEM description with the result in result\_ex26.xml. The error occurs in the Shake. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex26.xml
-o:schematron/output/sedl/result_ex26.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex26.xml
```

It is necessary to provide the input with the absolute path.

The two errors during the validation are shown in the lines 52 to 58 and lines 63 to 69. Lines 52 and 53 defined the first failed assertion. There is also the test which failed depicted: "@fade or @activate or @duration". Line 56 defines the error message: "At least activate, duration, or fade shall be defined." The second assert is defined in the lines 63 and 64. The test was: "parent::sedl:Effect/@duration>0". Line 67 defines the error message: "Shake effect element shall have duration attribute in parent element."

#### 5.2.4.3.27 Example 27

ex27.xml shows an invalid SEM description with the result in result\_ex27.xml. The error occurs in the Spin. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex27.xml
-o:schematron/output/sedl/result_ex27.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex27.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 58 to 64. Lines 58 and 59 defined a failed assertion. There is also the test which failed depicted: "parent::sedl:Effect/@duration>0". Line 62 defines the error message: "Spin effect element shall have duration attribute in parent element."

#### 5.2.4.3.28 Example 28

ex28.xml shows an invalid SEM description with the result in result\_ex31.xml. The error occurs in the WindType. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex28.xml
-o:schematron/output/sedl/result_ex28.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex28.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 52 to 58. Lines 52 and 53 defined a failed assertion. There is also the test which failed depicted: “if (@duration and @fade) then if (@fade > @duration) then false() else true() else true()”. Line 56 defines the error message: “If fade and duration are defined fade shall be less or equal to duration.”

#### 5.2.4.3.29 Example 29

ex29.xml shows a valid SEM description with the result in result\_ex29.xml. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex29.xml
-o:schematron/output/sedl/result_ex29.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex29.xml
```

It is necessary to provide the input with the absolute path.

#### 5.2.4.3.30 Example 30

ex30.xml shows an invalid SEM description with the result in result\_ex30.xml. The errors occur in the RGB\_Value, RGBXYZ\_LUT, RGBScalar\_Max, Offset\_Value, Gain\_Offset\_Gamma, InverseLUT, and IDCG\_Value. The command used for that is as follows.

```
java -jar saxon9.jar -versionmsg:off -s:schematron/examples/sedl/ex30.xml
-o:schematron/output/sedl/result_ex30.xml
-xsl:schematron/output/val_schema.xsl
```

Command for the conformance software:

```
ant run -Dvalid=RULE -Dinput=schematron/examples/sedl/ex30.xml
```

It is necessary to provide the input with the absolute path.

The error during the validation is shown in the lines 66 to 72. Lines 66 and 67 defined a failed assertion. There is also the test which failed depicted: “if(count((tokenize(normalize-space(self::\*), ' '))) = 3) then true() else false()”. Line 70 defines the error message: “The number of RGB\_value shall be 3(red, green, blue). Therefore the length of vector is fixed to 3.”. Another error during the validation is shown in the lines 89 to 95. Lines 89 and 90 defined a failed assertion. There is also the test which failed depicted: “if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false()”. Line 93 defines the error message: “The size of REG2XYZ\_LUT matrix shall be 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3.”. Another error during the validation is shown in the lines 96 to 102. Lines 96 and 97 defined a failed assertion. There is also the test which failed depicted: “if(count((tokenize(normalize-space(self::\*), ' '))) = 3) then true() else false()”. Line 100 defines the error message: “The number of RGBScalar\_Max shall be 3(red, green, blue). Therefore the length of RGBScalar\_Max vector is fixed to 3.”. The next error during the validation is shown in the lines 103 to 109. Lines 103 and 104 defined a failed assertion. There is also the test which failed depicted: “if(count((tokenize(normalize-space(self::\*), ' '))) = 3) then true() else false()”. Line 107 defines the error message: “The number of Offset\_Value shall be 3(red offset, green offset, blue offset). Therefore the length of Offset\_Value vector is fixed to 3.”. Another error during the validation is shown in the lines 110 to 116. Lines 110 and 111 defined a failed assertion. There is also the test which failed depicted: “if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false()”. Line 114 defines the error message: “The size of Gain, Offset, and Gamma is 3, respectively. The size of matrix Gain\_Offset\_Gamma is 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3.”. Another error during the validation is shown in the lines 117 to 123. Lines 117 and 118 defined a failed assertion. There is also the test which failed depicted: “if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' ')[2] = '3')) then true() else false()”. Line 121 defines the error message: “The size of Inverse\_LUT matrix is 3 by 3. Therefore the number of rows is fixed to 3 and the number of columns is fixed to 3.”. The last error during the validation is shown in the lines 124 to 130. Lines 124 and 125 defined a failed assertion. There is also the test which failed depicted: “if((tokenize(@mpeg7:dim, ' ')[1] = '3') and (tokenize(@mpeg7:dim, ' '))