COLOREEL®

Coloreel File Format

Specification

Contents

List of Figures

List of Figures

List of Tables

List of Pseudocodes

List of XML Syntaxes

List of XML Syntaxes

1 General Information

1.1 Identification

The purpose of this document is to define the file formats in use in the Coloreel Instant Thread Coloring Unit (ITC-U) platform and the associated concepts needed to read/write and visualize the elements defined by the standard. File formats defined in this document:

- Coloreel Studio Embroidery (CSE)
- Coloreel Studio Library (CSL)

1.2 File Version

This document defines the CSE/CSL version 2.2

2 Referenced Documents

Description	Source
Semantic Versioning for Documents 1.0.0	https://semverdoc.org/semverdoc.html
Keep a Changelog 1.0.0	https://keepachangelog.com/en/1.0.0/

Table 1: Referenced Documents

3 Document History

This document adheres to Semantic Versioning for Documents 1.0.0
This document adheres to Keep a Changelog 1.0.0

3.1 Change Log

3. Document History

Version	Date	Changes
2.2.0	2022-11-18	**Fixed** • Thumbnail definition • Updated document template • Appendix examples corrected
		Added • Chapter Definitions • Chapter Stripe
		Removed • Removed informative section Concept and Swatch. • Removed Appedix F-I.
		Changed • Moved Swatch from abstract <Striped> to its references • Removed abstract <StripedNoise>. • Moved <NoiseStripe> to <Stripe> • InOutQuad changed to EaseInOutQuad.
2.1.2	2021-07-30	**Fixed** • Updated document template.
2.1.1	2020-12-01	**Added** • D50 as LAB white point.
2.1.0	2020-11-16	**Added** • Thread concept.
		Changed • Interpolation renamed to Easing in the DOM.
2.0.0	2020-06-04	**Added** • Versioning Information.
		Changed • Most aspect of the DOM has been changed.
		Removed • Solid colors defined in RGB. • Solid colors defined as named colors.
		Fixed • Updated document template.
1.0.0	2019-06-28	**Added** • First Version.

Table 2: Change Log

4 Container

The zip archive format is used as a container used for the Coloreel Studio Embroidery (CSE) and Coloreel Studio Library (CSL) files. Any valid CSE/CSL must contain a “Manifest.xml” entry.

4.1 CSE container

The CSE container contains all neccessary information to produce a complete Coloreel embroidery when loaded into a ITC-U connected to an embroidery machine with a corresponding stitch file.

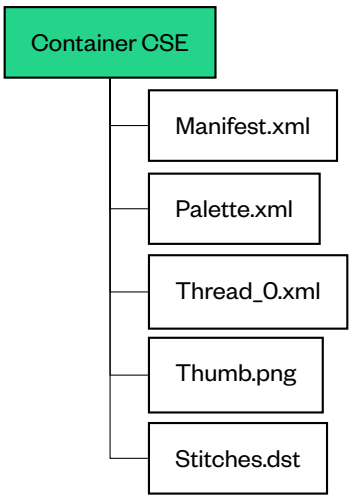

Figure 1: Recommended structure for CSE containers

4.2 CSL container

The CSL container contains a library of Colors and Color effects and contain neccessary information to directly produce colored thread or effect thread when loaded into a ITC-U without defining a specific embroidery.

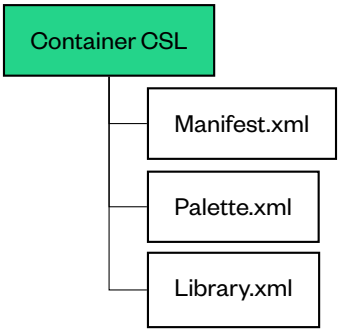

Figure 2: Recommended structure for CSL containers

4.3 Definitions

The following definitions are applicable for the specificions

4. Container

Definitions		
Element	Description	Type
<Pixel>	A minimal size of a thread color pixel that Instant Thread Coloring Unit can produce.	1.3253940 mm

Table 3: Definitions

4.4 Threads Concept

The collection of threads defines what effects to be used, a thread is defined as uninterrupted period of thread consumption.

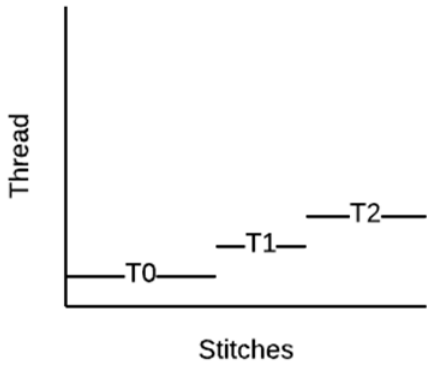

Figure 3: Thread example for mixing thread types

Figure 3 displays the threads defined when T0 and T2 is of the instant thread type and T1 being a standard thread type. See 5.2 for more information.

Every needle change in a DST file will generate a thread. The thread concept supports then multi thread definition where each thread shall be defined as its own Thread_N.xml, where N is a thread.

5 Document Object Models

The file format consists of several XML defined DOMs entries in the container.

5.1 Manifest

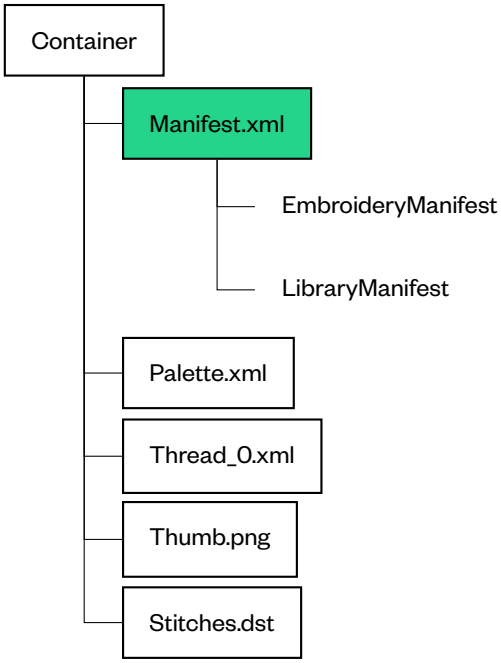

Figure 4: Manifest DOM

This is an abstract element and cannot be used directly in the Manifest file. *<Manifest>* is the base type for the manifests that describes the content of the file. See 'Manifest Syntax' on page 5, and its elements in 'Manifest Elements' on page 6.

```
<!-- abstract element; do not create -->
<!-- Manifest -->
    <MajorVersion>...</MajorVersion> <!-- int -->
    <MinorVersion >...</MinorVersion><!-- int -->
<!-- /Manifest -->
```

XMLSyntax 1: Manifest Syntax

5. Document Object Models

Manifest		
Element	Description	Type
<MajorVersion>	Major version of the file format used.	int
<MinorVersion>	Minor version of the file format used.	int

Table 4: Manifest Elements

5.1.1 Embroidery Manifest

This manifest element defines an CSE file. See 'Embroidery Manifest Syntax' on page 6, and its elements in 'Embroidery Manifest Elements' on page 6.

```
<EmbroideryManifest>
    <!-- inherited from Manifest element -->
    <MajorVersion>...</MajorVersion>    <!-- int -->
    <MinorVersion>...</MinorVersion>    <!-- int -->
    <!-- specific to EmbroideryManifest-->
    <StitchData>...<StitchData>         <!-- string -->
    <ThumbNail>...</ThumbNail>          <!-- string -->
    <Threads>                           <!-- collection of Thread -->
        <Thread>...</Thread>            <!-- string -->
    </Threads>
    <Palette>...<Palette>               <!-- string -->
<EmbroideryManifest>
```

XMLSyntax 2: Embroidery Manifest Syntax

Embroidery Manifest		
Element	Description	Type
<StitchData>	Name of the stitch data (DST).	string
<ThumbNail>	Name of the PNG image.	string
<Threads>	A collection of elements containing a Thread DOM.	'Thread' on page 7
<Palette>	Name of the Palette DOM.	string

Table 5: Embroidery Manifest Elements

5.1.2 Library Manifest

This manifest element defines a CSL file. See 'Library Manifest Syntax' on page 7, and its elements in 'Library Manifest Elements' on page 7.

```
<LibraryManifest>
    <!-- inherited from Manifest element -->
    <MajorVersion>...</MajorVersion>    <!-- int -->
    <MinorVersion>...</MinorVersion>    <!-- int -->
    <!-- specific to LibraryManifest-->
    <Palette>...<Palette>               <!-- string -->
    <Library>...<Library>               <!-- string -->
<LibraryManifest>
```

XMLSyntax 3: Library Manifest Syntax

Library Manifest		
Element	Description	Type
<Palette>	Name of the Palette DOM.	string
<Library>	Name of the Library DOM.	string

Table 6: Library Manifest Elements

5.2 Thread

This root element defines a Thread.

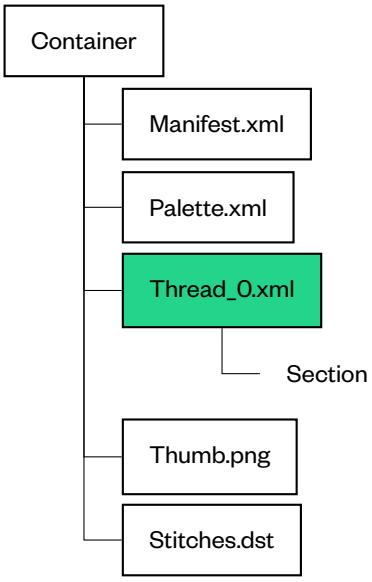

Figure 5: Thread DOM

```
<Thread>
    <ThreadId>...</ThreadId>          <!-- int -->
    <NeedleId>...</NeedleId>          <!-- int -->
    <ThreadType>...</ThreadType>      <!-- string -->
    <Sections>                        <!-- collection of Section-->
        <Section>...</Section>        <!-- Section -->
    </Sections>
<Thread>
```

XMLSyntax 4: Thread Syntax

Thread		
Element	Description	Type
<ThreadId>	The ID of the thread.	int
<NeedleId>	The ID of the needle used for this thread.	int
<ThreadType>	Valid values: • **Standard**, Standard colored thread. • **Instant**, Instantly colored thread.	string
<Sections>	A collection of elements containinng a Section DOM.	'Section' on page 8

Table 7: Thread Manifest Elements

5.2.1 Section

This element defines a section of a thread that is colored by a specific swatch. Elements are defined by stich numbers defined in the <StitchData>. The <Swatch> references a swatch defined in the <Palette>.

```
<Section>
    <StartStitch>...</StartStitch>  <!-- int -->
    <StopStitch>...</StopStitch>    <!-- int -->
    <Swatch>...</Swatch>            <!-- string -->
<Section>
```

XMLSyntax 5: Section Syntax

Section		
Element	Description	Type
<StartStitch>	Start of section in stitch number. • Note: <Startstitch> shall be equal to <Stopstitch> of previous <Section>.	int
<StopStitch>	End of the section in stitch number. • Note: Last <Stopstitch> shall be equal to stitch number in DST header number + 1.	int
<Swatch>	The ID of the swatch used in this section.	string

Table 8: Section Elements

5.3 Library

The <Library> defines a list of <Records> containing a <Name> and a references to a <Swatch> defined in <Palette>. The name elements contain the end user visible name for this library.

```
<Library>
    <Records>           <!-- Collection of Record -->
        <Record>...</Record>
    </Records>
    <Name>...</Name>    <!-- string -->
</Library>
```

XMLSyntax 6: Library Syntax

Library		
Element	Description	Type
<Records>	A collection of elements containing a Record DOM.	'Record' on page 9
<Name>	A human readable name.	string

Table 9: Library Elements

5.3.1 Record

The <Record> defines a <Swatch> references defined in <Palette> and a <Name> for the reference.

```
<Record>
    <Name>...</Name>        <!-- string -->
    <Swatch>...</Swatch>    <!-- string -->
</Record>
```

XMLSyntax 7: Record Syntax

Record		
Element	Description	Type
<Name>	A human readable name of this <Swatch> reference.	string
<Swatch>	The ID of an <Swatch> defined in the <Palette>. • Note: ID shall be unique for the applicable Manifest.	string

Table 10: Record Elements

5.4 Palette

The <Palette> defines a palette of <Swatch>.

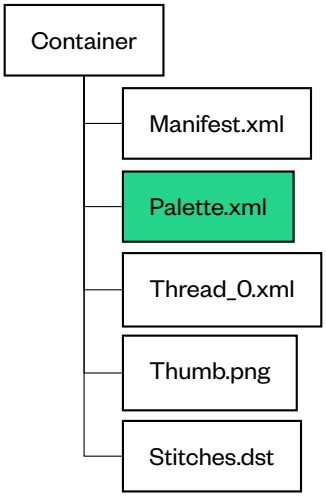

Figure 6: Manifest DOM

```
<Palette>
    <Swatches>                  <!-- Collection of Swatch -->
        <Swatch>...</Swatch>    <!-- Swatch> -->
    </Swatches>
</Palette>
```

XMLSyntax 8: Palette Syntax

Palette		
Element	Description	Type
<Swatches>	A collection of element of <Swatch>.	'Swatch' on page 11

Table 11: Palette Elements

5.5 Swatch

The abstract element <Swatch> is the base object for all swatches, it provides the Id attribute, which allows unique identification of a swatch element.

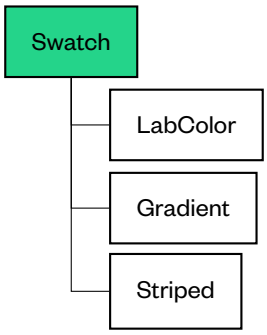

Figure 7: Swatch DOM

```
<!-- abstract element; do not create -->
<!-- <Swatch Id="..."> -->
<!-- </Swatch> -->
```

XMLSyntax 9: Swatch Syntax

5.6 Lab Color

The <LabColor> defines a swatch with static color defined in the CIELAB (LAB_{D50}) color space.

```
<LabColor Id="...">
    <!-- specific to LabColor-->
    <L>...</L>  <!-- double -->
    <A>...</A>  <!-- double -->
    <B>...</B>  <!-- double -->
</LabColor>
```

XMLSyntax 10: Lab Color Syntax

Lab Color		
Element	Description	Type
<L>	L component, valid range is [0,100]	double
<A>	A component, valid range is [-128,127]	double
<B>	B component, valid range is [-128,127]	double

Table 12: Lab Color Elements

5.7 Gradient

The <Gradient> defines a gradient between two or more <GradientStop>.

```
<Gradient Id="...">
    <!-- specific to Gradient-->
    <Stops>     <!-- collection of GradientStop -->
        <GradientStop>...</GradientStop>
    </Stops>
</Gradient>
```

XMLSyntax 11: Gradient Syntax

Gradient		
Element	Description	Type
<Stops>	A colllection of GradientStop defining the gradient. • Must contain one <GradientStop> with <Position> equal to 0.0 • Must contain one <GradientStop> with <Position> equal to 1.0	'Gradient Stop' on page 12

Table 13: Gradient Elements

5.7.1 Gradient Stop

The <GradientStop> defines the position and color of a transition point in a gradient.

```
<GradientStop>
    <Swatch>...</Swatch>                    <!-- string -->
    <Position>...</Position>                <!-- double -->
    <Easing>...</Easing>                    <!-- Easing -->
    <CoordinateSpace>...</CoordinateSpace>  <!-- CoordinateSpace -->
</GradientStop>
```

XMLSyntax 12: Gradient Stop Syntax

Gradient Stop		
Element	Description	Type
<Swatch>	The ID of the <Swatch> used in this gradient element.	string
<Position>	The position in the section the parent <Gradient> is painted on. • Valid range [0,1]	double
<Easing>	The <Easing> function used for this <Gradient>.	'Easing' on page 13
<CoordinateSpace>	The <CoordinateSpace> used for this <Gradient>.	'Coordinate Space' on page 14

Table 14: Gradient Stop Elements

5.7.2 Easing

The abstract element <Easing> is the base object for all interpolations. See 'Ease In Out Quad' on page 13 and 'Linear Easing' on page 13.

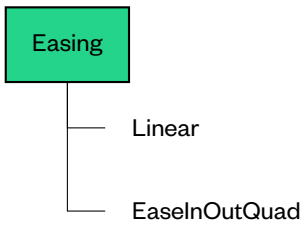

Figure 8: Easing DOM

5.7.3 Ease In Out Quad

The <EaseInOutQuad> defines that the ease in out quad easing function to be used when painting the parent <Gradient> for this <Gradient>.

```
<EaseInOutQuad>
</EaseInOutQuad>
```

XMLSyntax 13: In Out Quad Easing Syntax

5.7.4 Linear Easing

The <Linear> defines the linear easing function to be used when painting the parent <Gradient>.

```
<Linear>
</Linear>
```

XMLSyntax 14: Linear Easing Syntax

5.7.5 Coordinate Space

The abstract element <CoordinateSpace> is the base object for all coordinate spaces. See 'Cartesian Coordinate Space' on page 14 and 'Spherical Coordinate Space' on page 14.

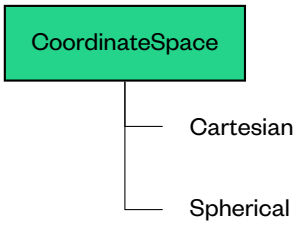

Figure 9: CoordinateSpace DOM

5.7.6 Cartesian Coordinate Space

The <Cartesian> defines that the cartesian coordinate system shall be used when painting the parent <Gradient> for this <Gradient>.

```
<Cartesian>
</Cartesian>
```

XMLSyntax 15: Cartesian Coordinate Space Syntax

5.7.7 Spherical Coordinate Space

The element defines the Spherical coordinate system.

```
<Spherical>
    <!-- specific to Spherical -->
    <Reversed>...</Reversed>    <!-- bool -->
</Spherical>
```

XMLSyntax 16: Cartesian Coordinate Space Syntax

Spherical Coordinate System		
Element	Description	Type
<Reversed>	The interpolation is reversed in the AB-plane in the LAB color space.	bool

Table 15: Spherical Coordinate System Elements

5.8 Striped

The <Striped> element swatch defines a swatch that is defined according to a collection of <Stripe>.

```
<Striped Id="...">
    <!-- specific to Striped -->
    <Stripes>       <!-- collections of one type of Stripe -->
        <Stripe>...</Stripe>
    </Stripes>
    <Seed>...></Seed> <!-- unsigned int -->
</Striped>
```

XMLSyntax 17: Striped Swatch Syntax

Striped Swatch		
Element	Description	Type
<Stripes>	A collection of <Stripe>.	'Stripe' on page 15
<Seed>	Mandatory for type <NoiseStripe> 'Noise Stripe' on page 16	Unsigned int

Table 16: Striped Swatch Elements

5.8.1 Stripe

The abstract element <Stripe> is the base object for 'Relative Stripe' on page 15, 'Absolute Stripe' on page 16 and 'Noise Stripe' on page 16

```
<Stripe>
    <!-- abstract element; do not create -->
</Stripe>
```

XMLSyntax 18: Stripe Syntax

5.8.2 Relative Stripe

The <RelativeStripe> defines a stripe with the length as percentage of the section being painted.

```
<RelativeStripe>
    <Swatch>...</Swatch>            <!-- string -->
    <Percentage>...</Percentage>    <!-- double -->
</RelativeStripe>
```

XMLSyntax 19: Relative Stripe Syntax

Relative Stripe		
Element	Description	Type
<Swatch>	ID of the <Swatch> used in this stripe element.	String
<Percentage>	Length of the stripe as a percentage of the containing section. • Valid range [0,1]	double

Table 17: Relative Stripe Elements

5.8.3 Absolute Stripe

The <AbsoluteStripe> defines a stripe in pixels.

```
<AbsoluteStripe>
    <Swatch>...</Swatch>                    <!-- string -->
    <LengthInPixels>...</LengthInPixels>    <!-- unsigned integer -->
</AbsoluteStripe>
```

XMLSyntax 20: Absolute Stripe Syntax

Absolute Stripe		
Element	Description	Type
<Swatch>	ID of the <Swatch> used in this stripe element.	String
<LengthInPixels>	Length of the stripe in pixels. • Valid range > 0	unsigned int

Table 18: Absolute Stripe Elements

5.8.4 Noise Stripe

The <NoiseStripe> defines a stripe with a random length in pixels, length being between Min and Max.

```
<NoiseStripe>
    <!-- specific to NoiseStripe -->
    <Swatch>...</Swatch>     <!-- string -->
    <Min>...</Min>           <!-- unsigned integer -->
    <Max>...</Max>           <!-- unsinged integer -->
</NoiseStripe>
```

XMLSyntax 21: NoiseStripe Syntax

Noise Stripe		
Element	Description	Type
<Min>	Minimum length in pixels. • Valid range > 0	unsigned int
<Max>	Maximum length in pixels. • Valid range > 0 && > <Min>	unsigned int

Table 19: Noise Stripe Elements

A. Sample EmbroideryManifest DOM

A Sample EmbroideryManifest DOM

```xml
<EmbroideryManifest>
    <MajorVersion>2</MajorVersion>
    <MinorVersion>0</MinorVersion>
    <StitchData>Stitches.xml</StitchData>
    <ThumbNail>Thumb.png</ThumbNail>
    <Threads>
        <Thread>Thread_0.xml</Thread>
        <Thread>Thread_1.xml</Thread>
    </Threads>
    <Palette>Palette.xml</Palette>
</EmbroideryManifest>
```

XMLSyntax 22: Sample EmbroideryManifest DOM

B Sample LibraryManifest DOM

```
<LibraryManifest>
    <MajorVersion>2</MajorVersion>
    <MinorVersion>0</MinorVersion>
    <Library>Library.xml</Library>
    <Palette>Palette.xml</Palette>
</LibraryManifest>
```

XMLSyntax 23: Sample LibraryManifest DOM Syntax

C Sample Thread DOMs

```
<Thread>
    <ThreadId>2</ThreadId>
    <NeedleId>1</NeedleId>
    <ThreadType>Instant</ThreadType>
    <Sections>
        <Section>
            <StartStitch>0</StartStitch>
            <StopStitch>50</StopStitch>
            <Swatch>LabColor_1</Swatch>
        </Section>
        <Section>
            <StartStitch>50</StartStitch>
            <StopStitch>100</StopStitch>
            <Swatch>LabColor_2</Swatch>
        </Section>
    </Sections>
</Thread>
```

XMLSyntax 24: Sample Thread DOM - Instant Thread

```
<Thread>
    <ThreadId>3</ThreadId>
    <NeedleId>2</NeedleId>
    <ThreadType>Standard</ThreadType>
    <Sections>
        <Section>
            <StartStitch>0</StartStitch>
            <StopStitch>10</StopStitch>
            <Swatch>LabColor_3</Swatch>
        </Section>
    </Sections>
</Thread>
```

XMLSyntax 25: Sample Thread DOM - Standard Thread

D Sample Library DOM

```
<Library>
    <Records>
        <Record>
            <Name>Green Lime</Name>
            <Swatch>LabColor_1</Swatch>
        </Record>
    </Records>
    <Name>Coloreel Standard Colors  v1.0.0</Name>
</Library>
```

XMLSyntax 26: Sample Library DOM

E Sample Palette DOM

```xml
<Palette>
  <Swatches>
    <LabColor Id="LabColor_1">
      <L>0</L>
      <A>0</A>
      <B>0</B>
    </LabColor>
    <LabColor Id="LabColor_2">
      <L>0</L>
      <A>50</A>
      <B>0</B>
    </LabColor>
    <LabColor Id="LabColor_3">
      <L>0</L>
      <A>0</A>
      <B>50</B>
    </LabColor>
    <Gradient Id="Gradient_1">
      <Stops>
        <GradientStop>
          <Swatch>LabColor_1</Swatch>
          <Position>0</Position>
          <Linear />
          <Spherical>
            <Reversed>false</Reversed>
          </Spherical>
        </GradientStop>
        <GradientStop>
          <Swatch>LabColor_2</Swatch>
          <Position>1</Position>
           <Linear />
          <Spherical>
            <Reversed>false</Reversed>
          </Spherical>
        </GradientStop>
      </Stops>
    </Gradient>
    [...] continues on next xml Syntax
```

XMLSyntax 27: Sample Palette DOM, 1/3

```
[...] continued
    <Gradient Id="Gradient_2">
        <Stops>
        <GradientStop>
            <Swatch>LabColor_1</Swatch>
            <Position>0</Position>
            <EaseInOutQuad />
            <Cartesian />
        </GradientStop>
        <GradientStop>
            <Swatch>LabColor_2</Swatch>
            <Position>0.5</Position>
            <EaseInOutQuad />
            <Cartesian />
        </GradientStop>
        <GradientStop>
            <Swatch>LabColor_3</Swatch>
            <Position>1</Position>
            <EaseInOutQuad />
            <Cartesian />
        </GradientStop>
        </Stops>
    </Gradient>
    <Striped Id="3">
        <Stripes>
            <AbsoluteStripe>
                <Swatch>LabColor_1</Swatch>
                <LengthInPixels>4</LengthInPixels>
            </AbsoluteStripe>
            <AbsoluteStripe>
                <Swatch>LabColor_2</Swatch>
                <LengthInPixels>15</LengthInPixels>
            </AbsoluteStripe>
        </Stripes>
    </Striped>
    [...] continues on next xml Syntax
```

XMLSyntax 28: Sample Palette DOM, 2/3

E. Sample Palette DOM

```
[...] continued
    <Striped Id="4">
        <Stripes>
            <RelativeStripe>
                <Swatch>LabColor_1</Swatch>
                <Percentage>0.35</Percentage>
            </RelativeStripe>
            <RelativeStripe>
                <Swatch>LabColor_2</Swatch>
                <Percentage>0.3</Percentage>
            </RelativeStripe>
            <RelativeStripe>
                <Swatch>LabColor_3</Swatch>
                <Percentage>0.35</Percentage>
            </RelativeStripe>
        </Stripes>
    </Striped>
    <Striped Id="5">
        <Stripes>
            <NoiseStripe>
                <Swatch>LabColor_2</Swatch>
                <Min>5</Min>
                <Max>10</Max>
            </NoiseStripe>
            <NoiseStripe>
                <Swatch>LabColor_3</Swatch>
                <Min>10</Min>
                <Max>20</Max>
            </NoiseStripe>
        </Stripes>
        <Seed>1</Seed>
    </Striped>
  </Swatches>
</Palette>
```

XMLSyntax 29: Sample Palette DOM, 3/3

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2.2.0

Unlock your potential

Coloreel® is a Swedish textile innovation brand with a groundbreaking technology that enables high-quality coloring of textile thread on demand, unlocking a world of potential.

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