

BioCTS for ISO/IEC

Binary and XML Encoded Records

User Guide

(Alpha Release)

**NIST/ITL CSD Biometric Conformance Test Software for
ISO/IEC Binary and XML Encoded Records**

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1. Disclaimer

NIST/ITL BioCTS

For ISO/IEC Binary and XML Encoded Records

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2. Overview

This document describes the features of biometric conformance test software developed by NIST/ITL Computer Security Division (CSD).

This alpha release currently supports only the Conformance Test Suite (CTS) designed to test implementations of a biometric data interchange format for XML encoded finger image data¹. Other CTSs for other biometric modalities will be later on released. Aspects of the CTS are subject to change based upon the ongoing development of the XML encoded specification until it's completed as well as improvements made to the CTS itself.

2.1. Requirements

- Supported Microsoft[®] Operating Systems:
 - Windows[®] XP[™] Service Pack 3
 - Windows[®] Vista[™] Service Pack 2
 - Windows[®] 7[™] Service Pack 1
- Microsoft[®] .NET 4.0 Framework:
 - Microsoft[®] .NET 4.0 Web Installer (<http://www.microsoft.com/en-us/download/details.aspx?id=17851>)*
 - Microsoft[®] .NET 4.0 Stand Alone Installer (<http://www.microsoft.com/en-us/download/details.aspx?id=17718>)*

(*) Links working as of 7/16/2013

¹ Draft Amendment 2 of ISO/IEC 19794-4:2011, Biometric data interchange formats – Part 4: Finger image data: XML encoding

3. Relevant Standards, Standards Requirements and Additional Test Assertions

3.1. Relevant Standards and Specifications

The relevant standards for this initial release of the BioCTS for ISO/IEC Binary and XML Encoded Records test tool are:

- ISO/IEC 19794-1:2011 Information technology -- Biometric data interchange formats -- Part 1: Framework
 - ISO/IEC JTC 1/SC 37 N 5913 – Text of 2nd 19794-1 DAM 2, Biometric data interchange formats – Part 1: Framework – Amendment 2: XML encoding (daft amendment under development)
- ISO/IEC 19794-4:2011 Information technology -- Biometric data interchange formats -- Part 4: Finger image data
 - ISO/IEC 19794-4:2011/Amd 1:2013 Conformance testing methodology and clarification of defects
 - ISO/IEC JTC 1/SC 37 N 5911 - Text of ISO/IEC 19794-4 DAM 2, Biometric data interchange formats – Part 4: Finger image data – Amendment 2: XML encoding (daft amendment under development)

In addition to the above listed standards and specifications, the CTS for ISO/IEC 19794-4:2011 XML Encoding implements additional test assertions that have been proposed by the CTS code developer for inclusion in ISO/IEC 19794-4:2011 Amd 2.

3.2. Test Limitations of this Alpha CTS Release

This CTS is not complete; it parses, refines and tests the majority of available Elements for this data format. It currently does not perform these operations for elements that are part of “Extended Data”. These elements are displayed as “Undefined Elements” and are merely reported as present. These fields will be supported in a future release.

4. Testing Phases

The BioCTS for ISO/IEC Binary and XML Encoded Records conformance test suite (CTS) design was a result of careful analysis of the base requirements in the ISO/IEC standards, the XML Encoding specific requirements, and the XML Schema definitions. The schemas are able to verify that the Data Interchange Package data is formatted and ordered correctly, but it does not ensure conformance to all of the base requirements. As shown in Fig. 1 this approach is reflected in the BioCTS for ISO/IEC Binary and XML Encoded Records design, which validates against the schema, reports the validation as a single result, and continues testing all of the required test assertions.

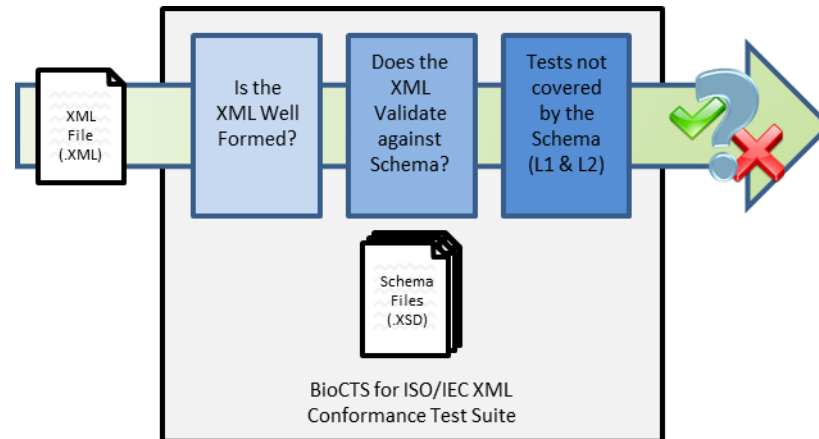


Figure 1 - High Level CTS Program Flow

The CTS has three test phases:

1. **Determination of whether the XML file is Well-Formed.**

An XML file is Well-Formed when it is syntactically correct, and follows the rules of XML documents [1] [2]. Without a Well-Formed XML file, further testing would yield potentially unusable results.

*If the XML file fails this phase of testing, the CTS **will not continue** to the next phase.*

2. **Validating the XML file against the specified schema file.**

BioCTS for ISO/IEC Binary and XML Encoded Records will attempt to validate the XML file against the specified schema file for the specified Data Interchange Format and will report as many errors as possible.

*The CTS, regardless of whether the XML file passes or fails this phase of testing, **will continue** to the next phase.*

3. **Assertion testing for ISO/IEC base requirements.**

The final phase is testing against the base requirements of the Data Interchange Format that are not covered by the XML Schema file validation. These tests include, but are not limited to:

- a. Valid Value tests
- b. Relationship tests between XML elements
- c. Basic Image Validation

After all three phases of testing is complete for the XML file, the test results are aggregated and an overall result (Pass or Fail) is determined. For the overall result of an XML file to be reported as “Pass” there must be no result of “Error” or “Critical” in any of the XML file’s results.

5. Guide

5.1. Download and Installation

Download the installer from the website

http://www.nist.gov/itl/csd/biometrics/biocta_download.cfm .

This alpha release is packaged in a zip file, and can be extracted to any location. The zip file contains the following files and folders:

- BioCTS for ISO IEC XML Alpha/
 - Modules/
 - GOV.CSD.ITL.NIST.Library.dll
 - GOV.CSD.ITL.NIST.CTS.XML.ISO_IEC_19794_4.dll
 - Schemas/
 - 19794-1.xsd
 - 19794-4.xsd
 - ISO IEC 19794-4 2011 XML Samples/
 - Fail_00_Two_Representations_Bad_NumberDistinctPositions.xml
 - Fail_00_Two_Representations_MissingEndTagForImage.xml
 - Fail_00_Two_Representations_No_NumberDistinctPositions.xml
 - Pass_00.xml
 - Pass_00_Two_Representations.xml
 - Sample Provided.xml
 - BioCTS_ISO_IEC.exe
 - GOV.CSD.ITL.NIST.Binary.dll
 - GOV.CSD.ITL.NIST.Library.dll
 - GOV.CSD.ITL.NIST.XML.dll
 - BioCTS_for_ISO_IEC_XML.pdf

5.2. Running the Conformance Test Architecture

After extracting the files from within the zip file, run the **BioCTS_ISO_IEC.exe** program to start BioCTS for ISO/IEC Binary and XML Encoding.

The CTS for ISO/IEC 19794-4:2011 XML Encoding must be selected in the Options tab of the program. Once selected, multiple files may be tested in the XML File Batch Test tab as described in section 5.3 below.

5.3. Conformance Test Architecture Features

5.3.1. Batch Testing

The “Batch Test” tab allows multiple transactions (files) to be tested in groups, and displays the overall results for each transaction in the “Files Under Test” pane.

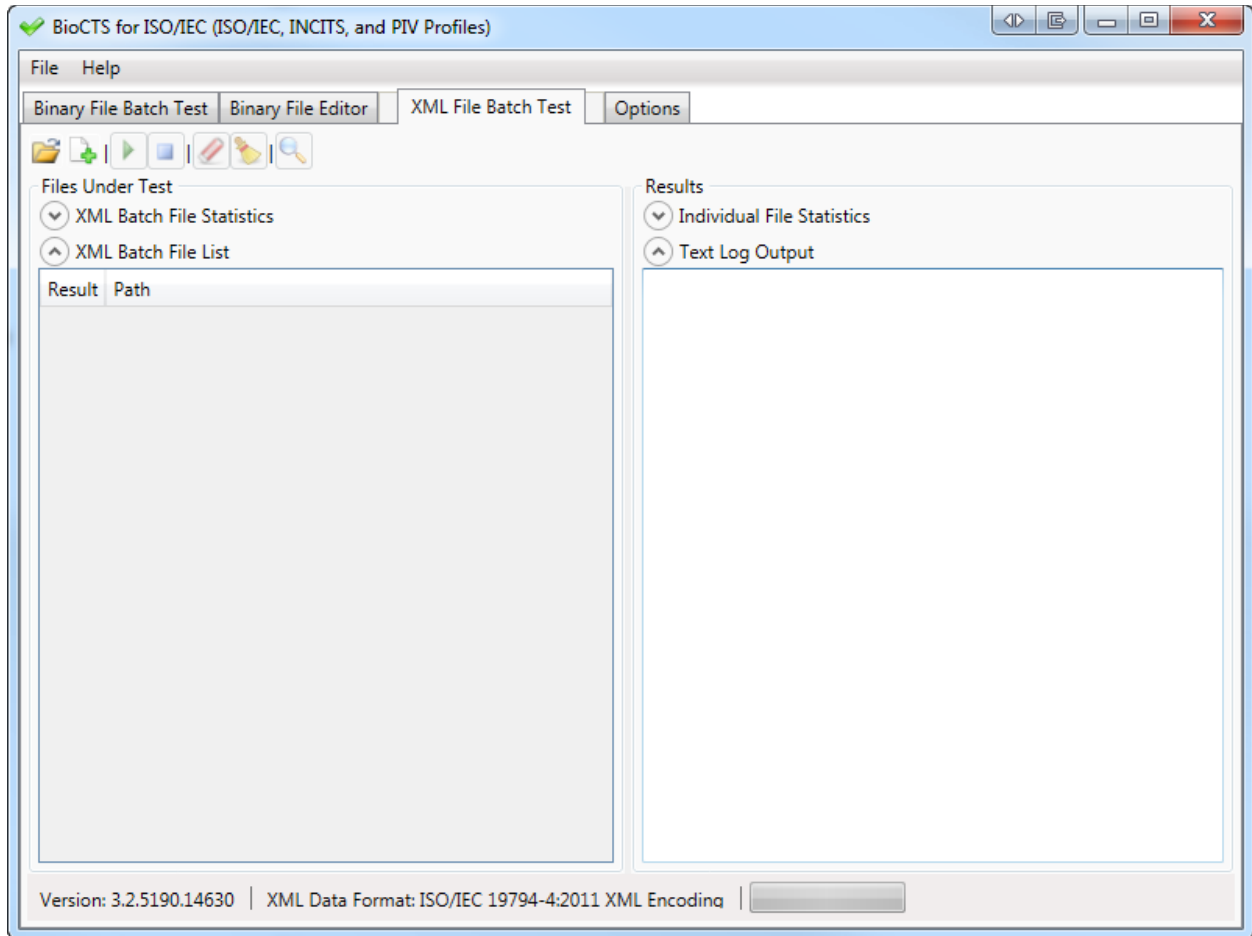


Figure 2 - BioCTS Initial XML Batch Test Tab

Several files can be loaded at once.

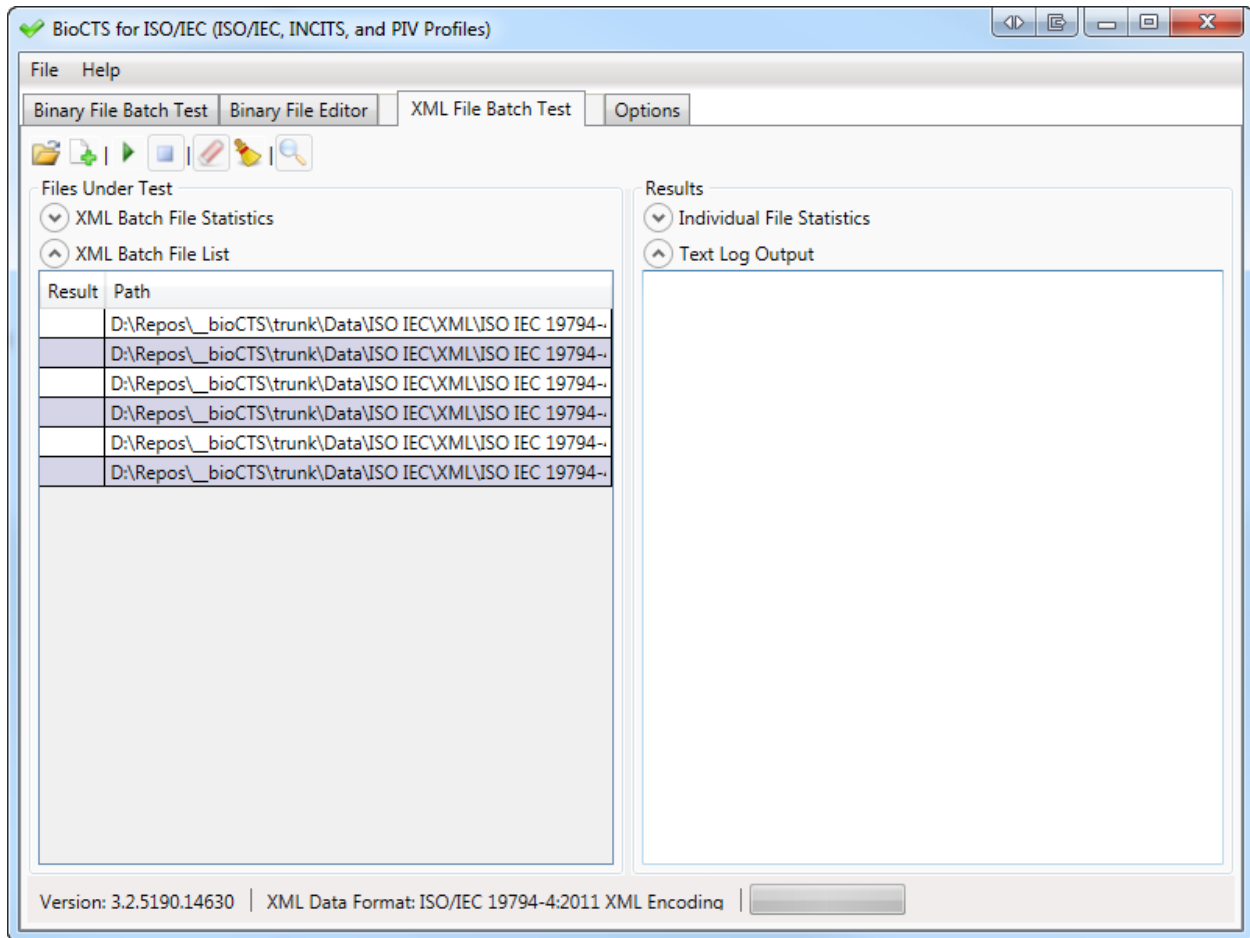




Figure 3 - BioCTS with several files loaded

The “Xml File Batch Test” tab will display the transaction’s overall result with either:

-  - Overall Result of Fail
-  - Overall Result of Pass

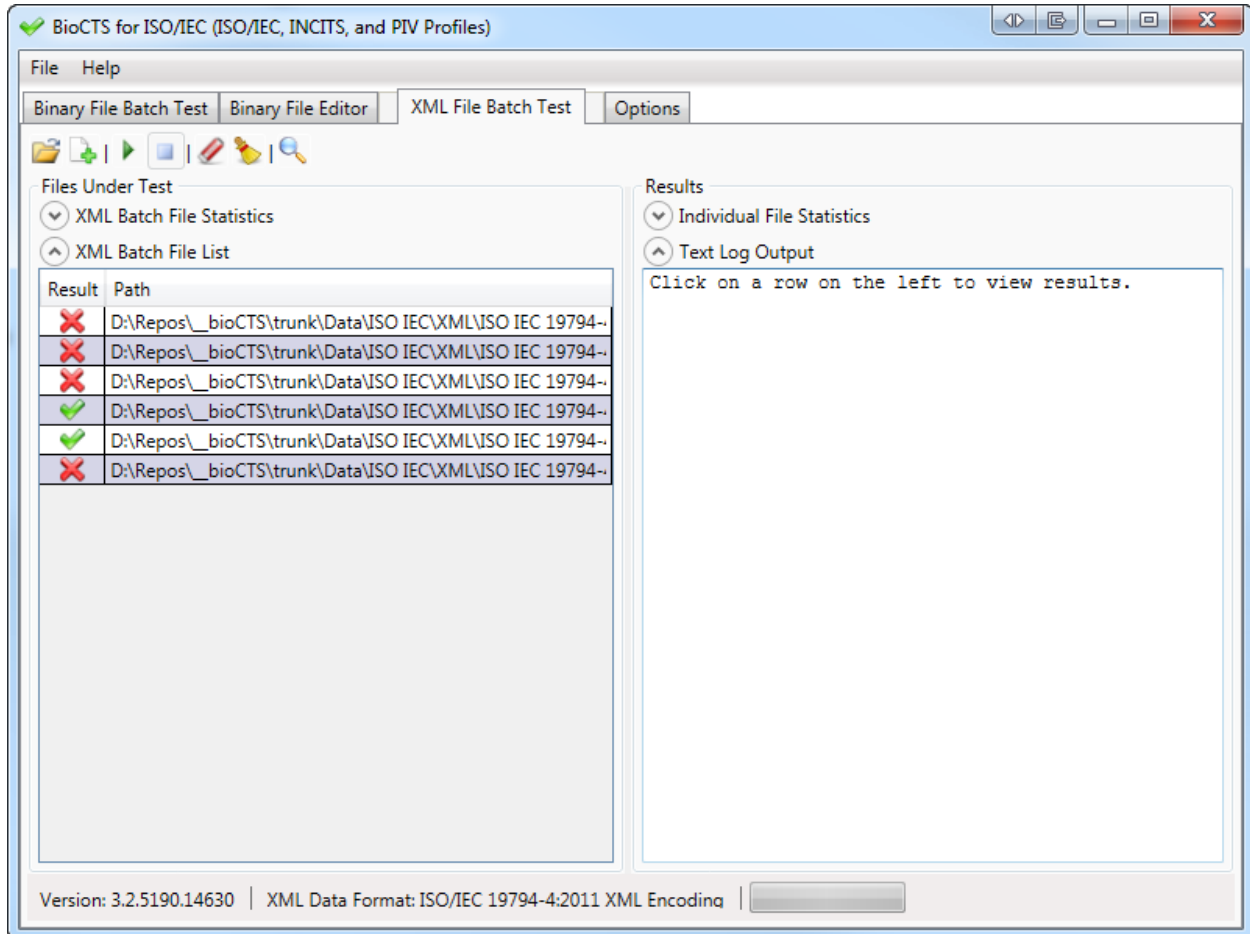


Figure 4 - BioCTS with several files loaded, displaying their overall results

Textual output results for each transaction can be viewed by clicking on the desired filename in the “File Under Test” pane. The complete textual results are displayed in the pane to the right.

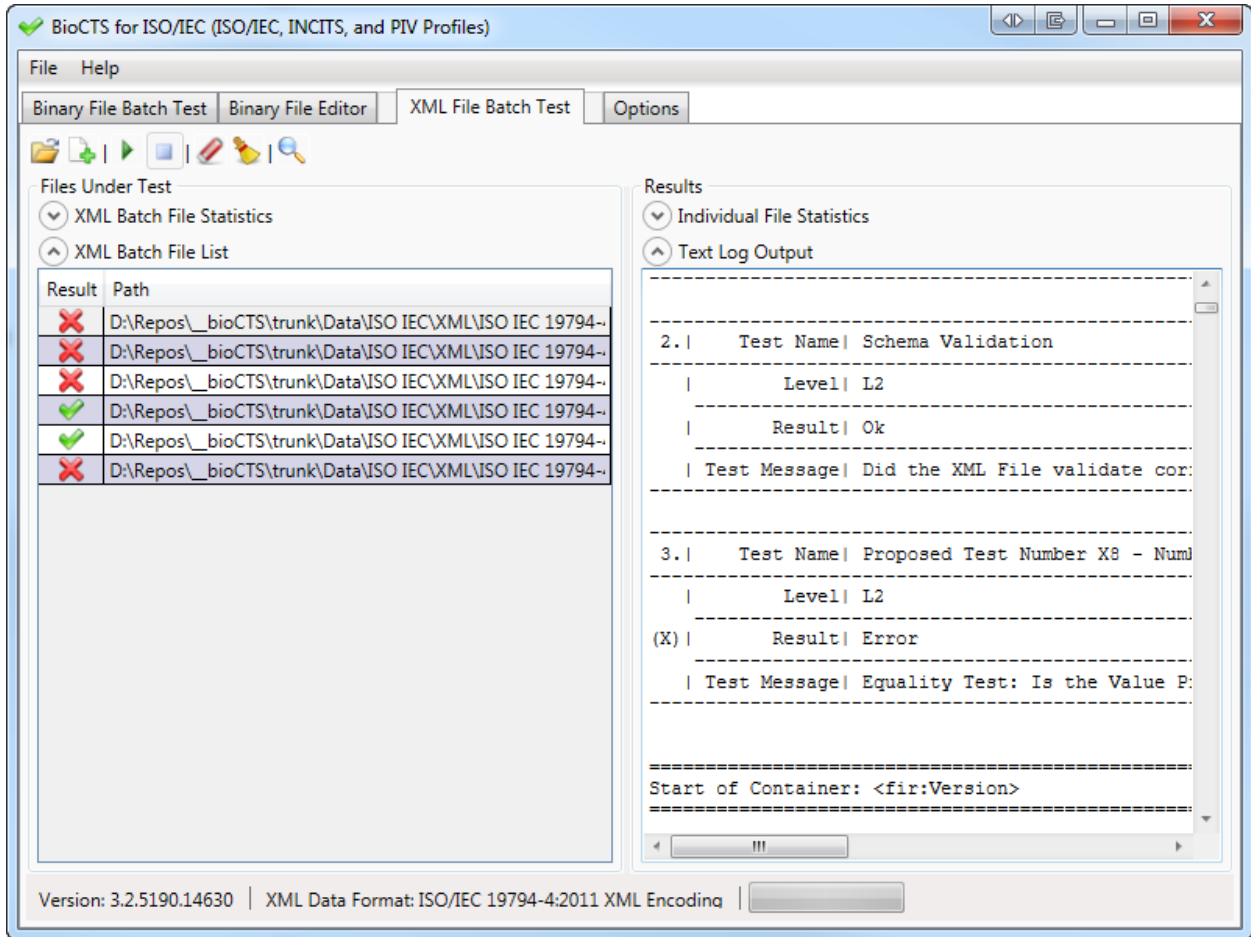


Figure 5 - BioCTS displaying the Text Log Output of a file that has been tested

5.3.2. Editor

There are many tools (both freely and commercially available) that allow for editing of the Text-based XML files. Currently, BioCTS for ISO/IEC Binary and XML Encoded Records does not include an editor specifically for the XML Records.

5.3.3. Options

The “Options” tab provides options for output file type, constraint schema path and Text and XML Log Output save location.

BioCTS for ISO/IEC Binary and XML Encoded Records is able to provide two types of output; first is the Text Log Output, which is always generated during batch testing. The second is an optional XML Output, which will generate an XML Output log that includes the same information found in the Text Log, but in a machine-readable format. **Currently the XML Output is not enabled for XML CTSs.**

Please note that because of the amount of details provided in the Log Outputs, the size of these logs can be large.

Output is generated in a Time-stamped folder located in the output directory. The time-stamped folder format:

- yyyy – 4 digit year (e.g. 2012)
- MM – 2 digit month (e.g. 10)
- dd – 2 digit day (e.g. 31)
- HH – 2 digit hour in 24-hour scale (e.g. 13)
- mm – 2 digit minutes (e.g. 59)
- ss – 2 digit seconds (e.g. 22)

Examples:

- Text Output will be generated in the directory:
C:\Users\dyaga\Desktop\BioCTS for ISO IEC Output\2012.10.31.13.59.22\Text Output
- XML Output will be generated in the directory:
C:\Users\dyaga\Desktop\BioCTS for ISO IEC Output\2012.10.31.13.59.22\xml Output

6. Result Details

Every test performed in BioCTS for ISO/IEC Binary and XML Encoded Records generates a Result – passing or failing. In an effort to enhance the readability and clarity of the Results, the textual output formatting has been modified since the initial release of BioCTS for ISO/IEC Binary and XML Encoded Records.

The Text Log Output Result formatting is:

```
-----  
3. | Test Name | Proposed Test Number X8 - NumberOfDistinctPositions vs. Count of Distinct Positions Across all Representations  
-----  
 | Level | L2  
-----  
(X) | Result | Error  
-----  
 | Test Message | Equality Test: Is the Value Present (2) Equal to the Expected Value (1)?  
-----
```

Figure 6 - A Text Log Result

The XML Log Output Result format:

```
<Result>  
  <Level>L1</Level>  
  <Message>Equality Test: Is the Value Present (0x464D5200) Equal to the Expected Value (0x464D5200)?</Message>  
  <Results>Ok</Results>  
  <Test>Value</Test>  
</Result>
```

Figure 7 - An XML Log Result

A Result consists of, and clearly identifies:

- Test Name – A Name that describes the Test
- Test Level
 - Parse – A parse level test deals with any test that relates to parsing of the information; tests with this level happen before the data is inspected during L1, L2 and L3 testing.
 - L1 – A Level 1 test, which tests for values, lengths, and character counts of the data.
 - L2 – A Level 2 test, which tests for relationships between Fields, Subfields, Information Items and Records.
 - L3 – A Level 3 test, which tests to see if the data specified is consistent with the biometric sample presented.
- Test Result
 - Ok – The test was unable to find an error. This does not necessarily mean that this portion of data was without error; just that the tests could not find error.
 - Message – The test was unable to find an error; however the test found it necessary to convey an additional message.
 - Warning – The test was unable to find an error; however there may be an aspect that warrants further investigation.
 - Error – The test was able to find an error.
 - Critical – The test was able to find an error; this error was critical enough that it may impede further testing.

- Test Message – The message can contain any additional information to clarify the test.

7. References

1. “Well-formed document” *Wikipedia: The Free Encyclopedia*. Wikimedia Foundation, Inc., 23 April 2013. Web. 30 May 2013.
<http://en.wikipedia.org/wiki/Well-formed_document>
2. “Extensible Markup Language (XML) 1.0” World Wide Web Consortium (W3C), 10 February 1998. Web. 30 May 2013
<<http://www.w3.org/TR/1998/REC-xml-19980210#dt-wellformed>>