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# Conformance Test Architecture and Test Suite for ANSI/NIST-ITL 1-2007

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## Reports on Computer Systems Technology

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## Abstract

The Computer Security Division of NIST/ITL supports the development of biometric conformance testing methodology standards and other conformity assessment efforts through active technical participation in the development of these standards and the associated conformance test architectures and test suites. The ANSI/NIST-ITL standard "Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information" is used by law enforcement, intelligence, military, and homeland security organizations throughout the world. The current version specified in its Traditional Format, is Part 1: ANSI/NIST-ITL 1-2007. Although a revised and augmented version of the standard is under development, the 2007 version is still widely used. The Conformance Test Architecture and Test Suite described in this publication are designed to test implementations of ANSI/NIST ITL 1-2007. The code (Beta 0.4) is currently designed to support testing of selected record types of the standard but can be extended to support other record types as required. A high-level overview of the architecture and test suite as well as software details and the code structure are provided. A quick start user guide and a comprehensive table of the standard's requirements and the associated implemented conformance test assertions (over five-hundred and thirty) are included.

## Disclaimer

Statements made in this paper should not be interpreted as standards, guidelines, best practices, or recommendations for specific changes to any other NIST publications.

## Acknowledgment

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## Sponsor

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## Feedback

The Conformance Test Architecture (CTA)/Test Suite (CTS), sample data and documentation can be downloaded from the following web site:
http://www.nist.gov/itl/csd/biometrics/biocta_download.cfm.

Feedback on the CTA/CTS, the sample data and documentation are welcome. Please send comments to csdbiomcta@nist.gov.

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# 1 Introduction

## 1.1 Background

The ANSI/NIST-ITL standard "Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information" is used by law enforcement, intelligence, military, and homeland security organizations throughout the world. The first version of the standard dates to 1986. Over the years, it has been updated and expanded to cover more biometric modalities beyond the original record type of fingerprint minutiae. Current modalities are:

- Fingerprint minutiae
- Fingerprint image (flat/plain, rolled and latent)
- Scars, marks and tattoos
- Facial image
- Iris image
- Palmprint image

The current version of the ANSI/NIST-ITL standard is:

Part 1 – (ANSI/NIST-ITL 1-2007) in Traditional Format [1]
Part 2 – (ANSI/NIST-ITL 2-2008) in NIEM-conformant XML format [2]

In addition, there is an extension to the table of finger position codes in both parts of the standard to handle multiple-finger captures: ANSI/NIST-ITL 1a-2009 [3].

The standard is now in the process of being revised. A workshop was held July 27-29, 2010 at NIST to determine what new biometric modalities and associated data should be included in a new version of the standard. Working groups established at this workshop provided input for the updated standard. Two drafts were developed (the first draft incorporated the output of the working groups). The second draft incorporated changes based on comments received after the first draft was issued. A second workshop, to discuss this draft was held on March 1-3, 2011 at NIST in Gaithersburg, MD., USA. A third draft was developed after the second workshop. At the time of this writing a new draft (fourth draft) was made available for review and comment. The fourth draft can be downloaded from the ANSI/NIST-ITL Standard Homepage [4].

## 1.2 Need for Conformance Testing to Biometric Standards

The existence of biometric standards alone is not enough to demonstrate that products meet the technical requirements specified in the standards. Conformance testing captures the technical description of a specification and measures whether an implementation faithfully implements the specification. The Computer Security Division (CSD) of NIST/ITL supports the development of biometric conformance testing methodology standards and other conformity assessment efforts through active technical participation in the development of biometric standards and the development of associated conformance test architectures and test suites. NIST/ITL CSD develops these conformance test tools to support users that require conformance to selected biometric standards and to also support product developers interested in conforming to biometric standards by using the same testing tools available to users. These efforts support the possible establishment of conformity

assessment programs to validate conformance to biometric standards. Conformance testing provides developers, users, and purchasers with increased levels of confidence in product quality and increases the probability of successful interoperability. A Conformance Test Architecture (CTA) as well as Conformance Test Suites (CTS) designed to test implementations of selected biometric data interchange formats developed by Technical Committee M1- Biometrics [5] of the InterNational Committee for Information Technology Standards (INCITS) and Subcommittee 37 (SC 37) – Biometrics of the Joint Technical Committee 1 (JTC 1) of ISO and IEC [6] are available for download at a NIST/ITL CSD web page [7].

## 1.3 Support for the ANSI/NIST- ITL 1-2007 Standard

Although a revised and augmented version of the standard is under development, the 2007 version is still widely used. NIST/ITL CSD developed a CTA/CTS (Beta version 0.4) designed to test implementations of selected Record Types of ANSI/NIST-ITL 1-2007, Data Format for the Interchange of Fingerprint, Facial, & Other Biometric Information – Part 1. These Record Types were considered the first-priority tier. In addition to testing Record Type 1, "Transaction Information Record", the selected records supported by the CTA/CTS are:

- Type 4, High-resolution grayscale fingerprint image
- Type 10, Facial and SMT image
- Type 13, Variable-resolution latent image
- Type 14, Variable-resolution fingerprint image
- Type 17, Iris image

Over five-hundred and thirty test assertions were implemented. The software code can be extended to support other record types as required. The tool is designed to detail a transaction's level of conformance to the standard. The granularity of the output information in the test results is provided in section 4. The CTA/CTS can also be used as an analysis tool for determining which parts of the transaction (e.g., non-conformant fields, records) do not conform to the standard and to analyze the reason for their nonconformance. For unsupported Record Types only the length of the record is reported during testing, and no determination of conformance is made for these records. In addition to stating whether a file passes or fails, the messages provided include warnings and notes.

## 1.4 Requirements in the Standard and Conformance Test Assertions

The CTA/CTS code implements the assertions required to test all of the mandatory, conditional and optional requirements for Record Type 1 and the other supported Record Types[1]. One or more assertions are required to adequately test conformance for a given requirement. Section 1.5, below, briefly describes Levels 1, 2 and 3 test assertions; more detail is available in the standards identified in the footnote 2[2]. In addition to parsing tests which are initially performed, over five-hundred Level

[1] Although the standard specifies the Record Type fields as either being Mandatory or Optional, many of the Optional fields are conditional to the content of other fields/requirements.

[2] The concepts addressed in sections 1.4 and 1.5 are based on definitions and discussions included in the following standards: ISO/IEC 29109-1:2009, Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 – Biometric Data Format Standard - Part 1: Generalized conformance testing methodology and the 7th draft of Conformance testing methodology for ANSI/NIST- ITL 1- 2011 developed by the ANSI/NIST-ITL Conformance Working Group, February 22, 2011.

1 and 2 assertions were implemented in the code. The assertions also apply to a particular scope, with the scope being "File", "Record" or "Field.". Level 3 assertions were not implemented.

Table C-3 of Appendix C documents the requirements and test assertions for the selected Record Types. Requirements in the standard that are not tested in the current CTA/CTS release version (Beta Version 0.4) are noted in the table. They include: (a) requirements related to International Character Sets; (b) image-based requirements where the image metadata required to implement the assertion is not defined in the image standard; and (c) four assertions related to the alternate finger segment position(s) (ASEG) specified in field 14.025. The required algorithms to implement these assertions are under research.

## 1.5 Hierarchy of Conformance Tests

Three levels of conformance testing are defined below:

***Level 1 – Checking internal content***

In Level 1 testing, an ANSI/NIST-ITL 1-2007 transaction(s) is checked for field-by-field, subfield-by-subfield and information item–by information item conformance with the specification of the standard, both in terms of ranges, character types, and cardinality. Since Level 1 testing can be performed by a simple field-by-field, subfield-by-subfield and information item–by information item reading of the standard and comparison to known values, and their encoding, performing this level of conformance testing only requires a transaction or a set of ANSI/NIST transactions (as opposed to a computer algorithm or a set of hardware and software). Therefore, any hardware or software components of the implementation being tested do not have to come into the possession of the testing lab. Only ANSI/NIST-ITL 1-2007 transactions created with those components need to be available.

***Level 2 – Internal consistency checking***

In Level 2 testing, an ANSI/NIST-ITL 1-2007 transaction(s) is checked to determine if it is internally consistent. This is achieved by relating values from one or more fields, subfields, or information items within a transaction to other values within the same transaction. Level 2 tests involve interactions between multiple values from different parts of the ANSI/NIST-ITL 1-2007 standard and sometimes from implicit assumptions that are not explicitly stated in the base standard. Thus, Level 2 tests require more complex validation than Level 1. Similar to Level 1 testing, Level 2 conformance testing only requires an ANSI/NIST-ITL 1-2007 transaction(s). To ensure that all (or almost all) possible internal consistency checks are tested, tests are performed whenever possible with a large number of transactions representing as many as possible different structural variants.

***Level 3 – Content checking***

A Level 3 test is intended to test whether an ANSI/NIST-ITL 1-2007 transaction under test is a faithful representation of the original biometric data and that it satisfies those requirements of the standard that are not simply a matter of syntax and format. This level of conformance testing for some requirements might be significantly difficult or even impossible to test.

## 1.6 Target Audience

Although this publication is written for users of the Architecture/Conformance Test Suite, technical details of the architecture, operations, and the code structure are provided for more technically-inclined readers.

# 2 CTA/CTS Overview

## 2.1 High-Level Architecture

The high-level architecture implemented for the CTA/CTS can be described using four key components. As depicted in Figure 2-1, each of these components addresses different testing levels. These components are identified as Pre-Parse testing and Field, Record and File-level testing.

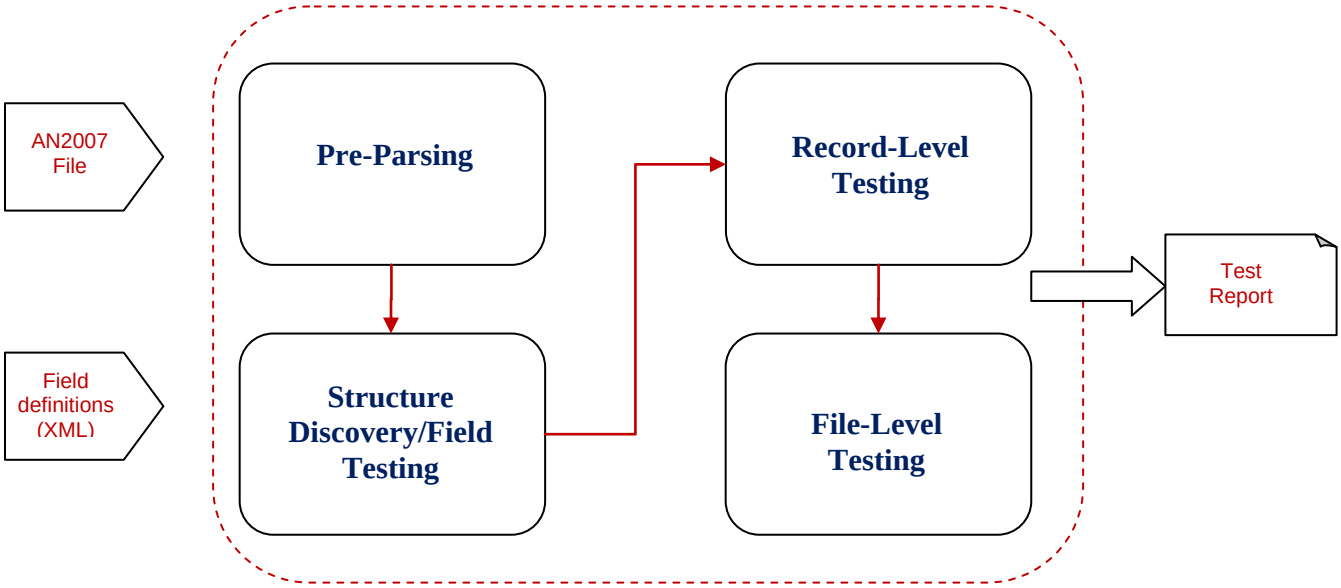



**Figure 2-1: CTA/CTS High-Level Architecture**

***Pre-Parsing Operations***

This operation verifies that the file exists (e.g., it's not NULL) and that the proper arguments are sent to the software. In addition, the file is opened and tests are performed to verify that the first two characters in the file are "1." since every ANSI/NIST-ITL 1-2007 transaction must start with Record Type 1.

***Structure Discovery/Field Testing***

During structure discovery, the Table of Contents (TOC) in Record Type 1 is read and the file is parsed based on the TOC. As the software parses the file, it builds an array containing all fields that are found in each of the records in the transaction. Level 1 testing is then performed for these fields, using the Field definitions (XML file) shown in Figure 2-1. The field definitions file includes metadata on each field such as:

- Type/fields number
- Length min and max
- Min and max occurrences
- Required Level 1 tests

Level 1 test messages (errors, warning, notes, etc.) are maintained with the corresponding fields within the structure data in memory.

Once this operation is performed and the structure is built, record-level testing is ready to be performed as detailed below. The structure discovery module is designed to allow the parsing method to change based on the type of data present (e.g., binary, ASCII, ASCII/binary). This flexible approach allows also for future revisions of the test tool to allow additional data types to be parsed. The structure discovery/fields testing module includes information on all Level 1 assertions, messages, and message types that will be included in a test report.

***Record-Level Testing***

In this module, initial Level 2 tests are performed such as:

- Does the record length equal the number of bytes read?
- Are the correct Record types included in each record?
- For each record, is field 1 first, field 2 second and field 999 last?

Final record Level 2 tests are performed such as checking whether all mandatory and conditional fields are present and whether the field occurrences are correct.

***File-Level Testing***

Level 2 tests that include fields of more than one record are performed within this module, such as the requirements associated with the Image Designation Character (IDC) values for each record.

## 2.2 Software Details

The code is developed in C# under the Microsoft® .NET 4.0 Framework. The code structure uses interfaces that allow the CTS to treat every Record Type in the same manner while testing. This allows the high-level structure in the code that pertains to all Record Types to be expanded to other Record Types (not supported in this CTA/CTS version) without having redundant code for this level of testing. Derived classes from these interfaces can implement specific tests required for each supported Record Type. Annex A provides a description and class diagram for the code structure, and is oriented towards readers interested in technical details of the code structure.

# 3 Quick Start

## 3.1 Installation

Run the installation program `NIST ITL CSD CTA Beta 0.4.exe`, and follow the on screen prompts. The CTA/CTS runs in a Windows environment. It is developed under .NET v 4.0.

After installation, the loaded application should resemble the image below:

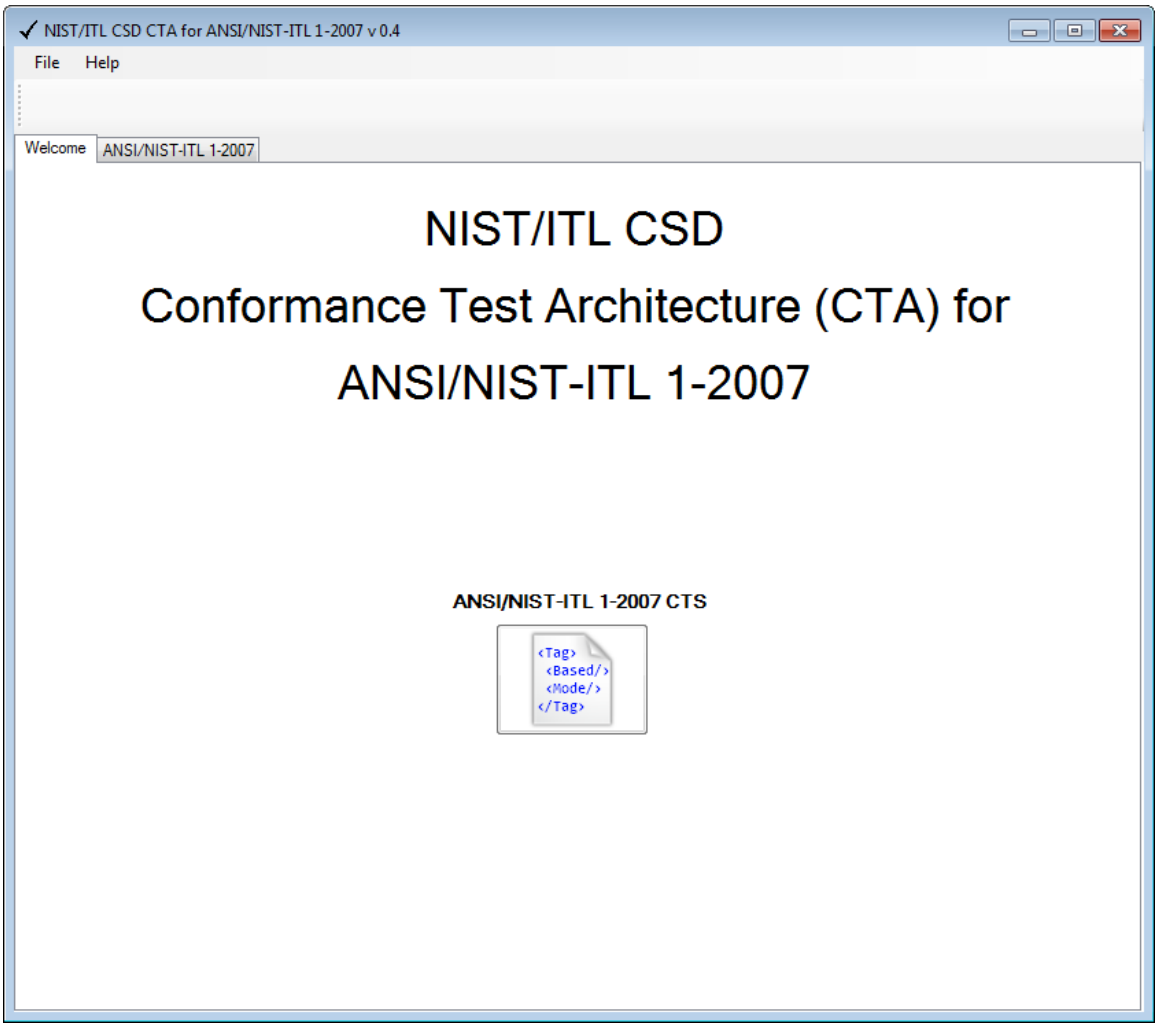



**Figure 3-1: CTA/CTS Welcome**

## 3.2 Loading and Running Implementations

The "ANSI/NIST-ITL 1-2007" tab must be selected before files can be loaded. An image of the test window is shown in Figure 3-2.

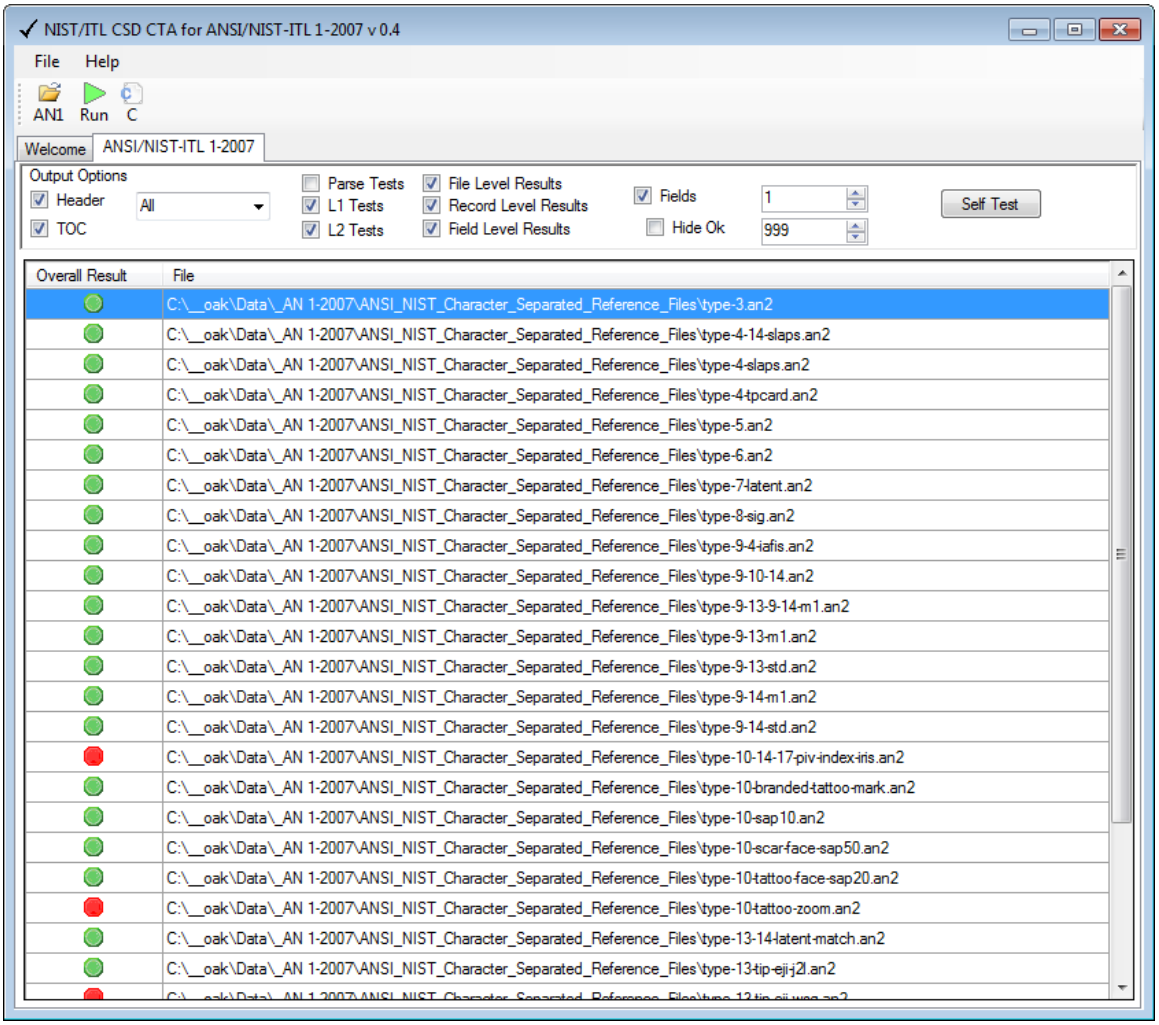



**Figure 3-2: ANSI/NIST-ITL 1-2007 Test Window**

### *Loading Files*

There are two options for loading files:

1. Click the "AN1" button 

to specify the file path. If this option is used, the selected files will be loaded but the tests will not run until the "Run" button is selected.

2. Drag and drop one or many files into the window. If this method is chosen, the tests will automatically run and display as passed or failed.

If necessary, click the “C” (Clear) button  to remove the loaded files.

***Running Tests***

Click the “Run” button  to run the tests. The files loaded in the window will display as passed or failed, indicated by a green or red circle respectively.

***Sample Data Location***

The sample data is available from the following locations for these versions of Microsoft® Windows®:

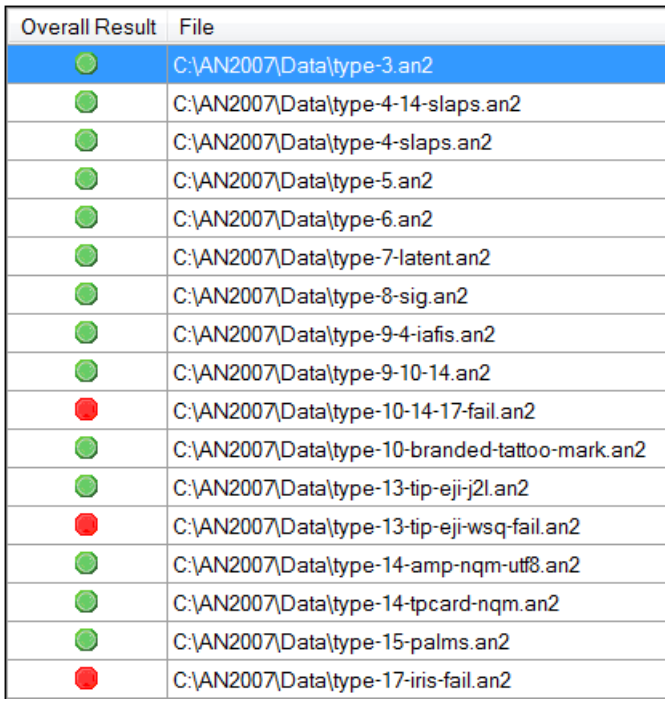
- XP: C:\Documents and Settings\All Users\Documents\ ANSI NIST-ITL 1-2007 Sample Files
- Vista: C:\Users\Public\Documents\ANSI NIST-ITL 1-2007 Sample Files
- 7: C:\Users\Public\Documents\ANSI NIST-ITL 1-2007 Sample Files

# 4 Test Results

To generate the test results, specify the file path using the "AN1" button and click the "Run" button to run the tests. Alternatively, drag and drop the files into the GUI and the tests will run automatically.

## 4.1 Overall Results

After running the tests using one of the methods mentioned previously, the overall pass/fail results of the tests will be displayed in the "ANSI/NIST-ITL 1-2007" window. An example of the pass/fail results is shown below, with red (darker) circles representing failures and green circles representing successes.



| Overall Result | File |
|---|---|
| ● | C:\AN2007\Data\type-3.an2 |
| ● | C:\AN2007\Data\type-4-14-slaps.an2 |
| ● | C:\AN2007\Data\type-4-slaps.an2 |
| ● | C:\AN2007\Data\type-5.an2 |
| ● | C:\AN2007\Data\type-6.an2 |
| ● | C:\AN2007\Data\type-7-latent.an2 |
| ● | C:\AN2007\Data\type-8-sig.an2 |
| ● | C:\AN2007\Data\type-9-4-iafis.an2 |
| ● | C:\AN2007\Data\type-9-10-14.an2 |
| ● | C:\AN2007\Data\type-10-14-17-fail.an2 |
| ● | C:\AN2007\Data\type-10-branded-tattoo-mark.an2 |
| ● | C:\AN2007\Data\type-13-tip-eji-j2l.an2 |
| ● | C:\AN2007\Data\type-13-tip-eji-wsq-fail.an2 |
| ● | C:\AN2007\Data\type-14-amp-nqm-utf8.an2 |
| ● | C:\AN2007\Data\type-14-tpcard-nqm.an2 |
| ● | C:\AN2007\Data\type-15-palms.an2 |
| ● | C:\AN2007\Data\type-17-iris-fail.an2 |

**Figure 4-1: Pass/Fail Results**

The complete file path to the implementation is also listed for reference. In addition to these overall results, a detailed summary is also displayed in a separate window. The detailed summary is discussed in the next section.

## 4.2 Detailed Results

The detailed results are displayed in a new window titled "ANSI/NIST-ITL 1-2007", with the tab titled "Full". The contents of this window are defined by the "Output Options" that are selected before running the tests. These options may also be selected after running the tests to update the detailed results dynamically. The image below depicts the detailed summary window with sample results.

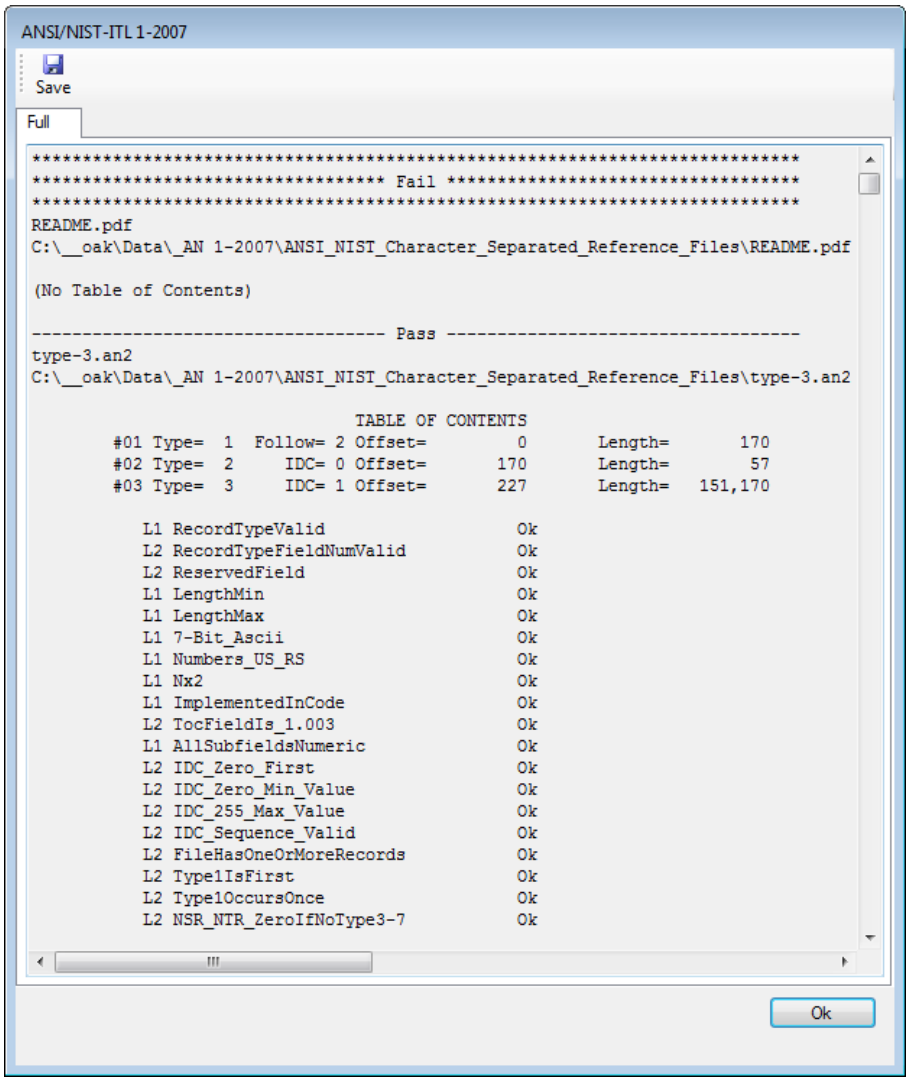



**Figure 4-2: ANSI/NIST-ITL 1-2007 Detailed Results**

The "Save" button, shown in Figure 4-2 below the "ANSI/NIST-ITL 1-2007" tile bar, may be clicked to save the test results to a text file. After clicking the "Save" button, a Windows Explorer browser window will open to allow a file location and name to be selected.

### *Output Options*

On the "ANSI/NIST-ITL 1-2007" tab depicted in Figure 3-2, several options are available for formatting the test results detailed output as shown in Figure 4-3 below.


**Figure 4-3: Output Options**

- **Header**

The “Header” option displays general information about the implementation including the pass/fail status and the file path. A sample header is shown below for a passing implementation.

```
---------------------------------- Pass ----------------------------------
type-10-branded-tattoo-mark.an2
C:\AN2007\Data\type-10-branded-tattoo-mark.an2
```

**Figure 4-4: Header Sample**

- **TOC**

The “TOC” option displays a table of contents describing all of the content for a given implementation, including Type, IDC, Offset, and Length. The number preceding each line in the TOC (such as #01 shown in Figure 4-5) is an identifier assigned to each record found inside of the file as it is sequentially parsed. This identifier clarifies the ordering of record types found within each file.

```
                        TABLE OF CONTENTS
#01 Type=  1  Follow= 3 Offset=          0       Length=       185
#02 Type=  2     IDC= 0 Offset=        185       Length=        57
#03 Type= 10     IDC= 1 Offset=        242       Length=    12,373
#04 Type= 10     IDC= 2 Offset=     12,615       Length=     8,016
```

**Figure 4-5: TOC Sample**

- **Type Selection**

The type selection window allows the user to select which Record Types should be displayed, including Record Types 1, 4, 10, 13, 14, and 17 (or all record types included in the file). Only the option selected will be displayed in the results. For the unsupported Record Types (any type other than those shown in Figure 4-6), only the name and length of the record will be displayed in the results.

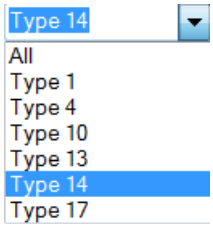



**Figure 4-6: Type Selection Menu**

For example, the implementation below contains multiple types as shown in the TOC, but only the selected type (14) is shown in the results.

```
type-4-14-slaps.an2
C:\AN2007\Data\type-4-14-slaps.an2

                              TABLE OF CONTENTS
        #01 Type=  1  Follow= 4 Offset=          0       Length=       195
        #02 Type=  2      IDC= 0 Offset=        195       Length=        57
        #03 Type=  4      IDC= 1 Offset=        252       Length=   104,277
        #04 Type=  4      IDC= 2 Offset=    104,529       Length=   112,535
        #05 Type= 14      IDC= 3 Offset=    217,064       Length=    50,415


    Type 14  (Variable-Resolution Fingerprint Image)  Pass

        14.001 (LEN): 50415
           L1 RecordTypeValid                    Ok
           L2 RecordTypeFieldNumValid            Ok
           L2 ReservedField                      Ok
           L1 LengthMin                          Ok
```

**Figure 4-7: Type Selection Menu**

- **Parse Tests**

The “Parse Tests” option displays parse test results (i.e., tests that are executed during parsing of the file, before the testing of L1 and L2 assertions). The “File Level Results” checkbox must be selected to view the parse tests. See Figure 4-8 for an example of parse tests in the file level results.

```
Parse FileExists (C:\AN2007\Data\type-3.an2) Ok
Parse FileMinimumLength              Ok
Parse FileBeginning                  Ok
Parse TocField1.001First             Ok
Parse TocField1.002Second            Ok
Parse TocSeekField1.003              Ok
Parse GetRecordLength (1)            Ok
Parse GetRecordLength (2)            Ok
Parse GetRecordLength (3)            Ok
Parse GetRecordData (# 1)            Ok
Parse RecordFactory.GetRecord (Type 1)       Ok
Parse GetRecordData (# 2)            Ok
Parse RecordFactory.GetRecord (Type 2)       Ok
Parse GetRecordData (# 3)            Ok
Parse RecordFactory.GetRecord (Type 3)       Ok
```

**Figure 4-8: Field-Level Parse Test Sample**

- **L1 Tests/ L2 Tests**

The “L1 Tests” and “L2 Tests” options display L1 and/or L2 test results at the File, Record, and Field levels. The "Fields" checkbox and at least one of the File, Record, or Field Level checkboxes must be selected to view these results.

```
L1 RecordTypeValid
L2 RecordTypeFieldNumValid
L2 ReservedField
L1 LengthMin
L1 LengthMax
L1 7-Bit_Ascii
L1 Numbers
L1 Single_NoSubFields
L1 Opaque
L2 CorrectTypeInFields
```

**Figure 4-9: L1, L2 Tests Sample**

- **File Level Results**

The "File Level Results" option displays results related to the file contents.

```
L1 RecordTypeValid                    Ok
L2 RecordTypeFieldNumValid            Ok
L2 ReservedField                      Ok
L1 LengthMin                          Ok
L1 LengthMax                          Ok
L1 7-Bit_Ascii                        Ok
L1 Numbers_US_RS                      Ok
L1 Nx2                                Ok
L1 ImplementedInCode                  Ok
L2 TocFieldIs_1.003                   Ok
L1 AllSubfieldsNumeric                Ok
L2 IDC_Zero_First                     Ok
L2 IDC_Zero_Min_Value                 Ok
L2 IDC_255_Max_Value                  Ok
L2 IDC_Sequence_Valid                 Ok
L2 FileHasOneOrMoreRecords            Ok
```

**Figure 4-10: File-Level Results Sample**

- **Record Level Results**

The "Record Level Results" option displays a summary of test results for the record.

```
L2 LastByteIsFS                       Ok
L2 RecLenEqualsNumBytes               Ok      x.001 Used For Parse
L2 Field001First                      Ok
L2 Field002Second                     Ok
L2 CorrectTypeInFields                Ok
L2 MandatoryFields                    Ok      2 Optional Fields: 1.013 1.014
L2 DuplicateFields                    Ok
L2 NSR_NTR_ZeroIfNoType3-7            Ok
```

**Figure 4-11: Record-Level Results Sample**

Since some Record Types are not supported, the presence of these Records in a file or transaction is noted but no action on the content of the record is taken. The Record length is stated in the test result.

- **Field Level Results**

The “Field Level Results” option displays all test results for each field. Figure 4-12 depicts a sample of the Field Level Results.

```
**      17.011 (CGA): PNG
           L1 RecordTypeValid                 Ok
           L2 RecordTypeFieldNumValid         Ok
           L2 ReservedField                   Ok
           L1 LengthMin                       Ok
           L1 LengthMax                       Ok
           L1 7-Bit_Ascii                     Ok
           L1 AlphaNumeric                    Ok
           L1 Single_NoSubFields              Ok
        *  L1 Table_1_No_WSQ_PNG              Error   The Value Is Not In Table 1 (WSQ, PNG Are Not Valid Values)
           L2 CorrectTypeInFields             Ok
           L2 CompressionAlg                  Ok
```

**Figure 4-12: Field-Level Results Sample**

- **Fields**

The “Fields” option displays the fields within each test. If this option is not selected, “Field Level Results” will not be displayed. The image below shows the output when the “Fields” option is not selected, and thus no fields are displayed.

```
Type 1   (Transaction Information)   Pass

Type 2   (User-Defined Descriptive Text)   Length = 57

Type 4   (High-Resolution Grayscale Fingerprint Image)   Pass

Type 4   (High-Resolution Grayscale Fingerprint Image)   Pass

Type 14   (Variable-Resolution Fingerprint Image)   Pass
```

**Figure 4-13: Fields Option Not Selected**

- **Hide Ok**

The “Hide Ok” option removes all tests results that return the status "Ok" from the detailed summary with the exception of Records/Fields in error.

- **Field Range**

Specifies which fields of the existing Record Types are displayed by the selected lower and upper bounds in these windows.

## Annex A - Code Structure

This Annex discusses the elements of the code structure depicted in Figures A-1 and A-2 below.

The `An107File` Class is the entry point into the CTA/CTS module. It contains a list of all the Record Types encountered in a given transaction (file). After determining that the file exists, the parsing operation begins. As each Record in the file is parsed, it is added to the list of Records within the `An107File` Class.

`IRecordType` is an interface that defines required methods and attributes. There is a base Class that derives from this interface called "`RecordBase`" that performs all common Level 1 and Level 2 assertions for each Record. From `RecordBase` specific implementations for each Record Type to perform Record Type-specific parsing/testing can be derived. Parsing at this level could, as required, override the general parsing performed at the `RecordBase` level.

`IField` is the interface for fields which describes the content of fields in the file under test. `IRecordType` contains a list of `IFields`. `FieldBase` is a specific implementation of IField.

After each test is performed the code updates the list of results at every testing level (File, Record, Field, Subfield, and Subfield data). Possible results, listed in order of increasing severity are: (a) "Ok"; (b) "Note"; (c) "Warning"; (d) "Error"; and "Critical Error[3]". There is also an overall result, once all tests have been completed. A Transaction is determined to be "passing" or "failing" in the `OverallResult`.

[3] The module tries to run all assertions on all applicable data. That is, processing continues after results of *Ok*, *Note*, *Warning* and *Error*. But the result *Critical Error* means processing cannot continue because the next valid data element (field or record) could not be parsed successfully.

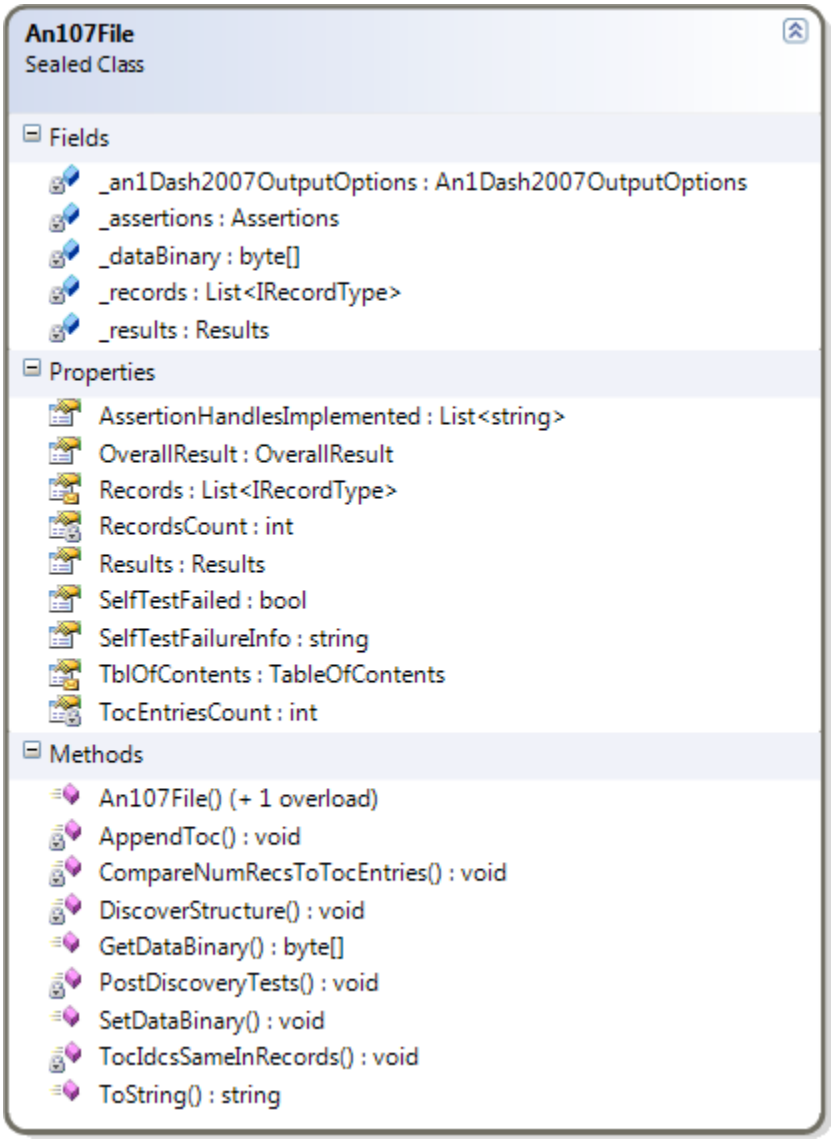



**Figure A-1: Class Diagram for the An107 File Class**

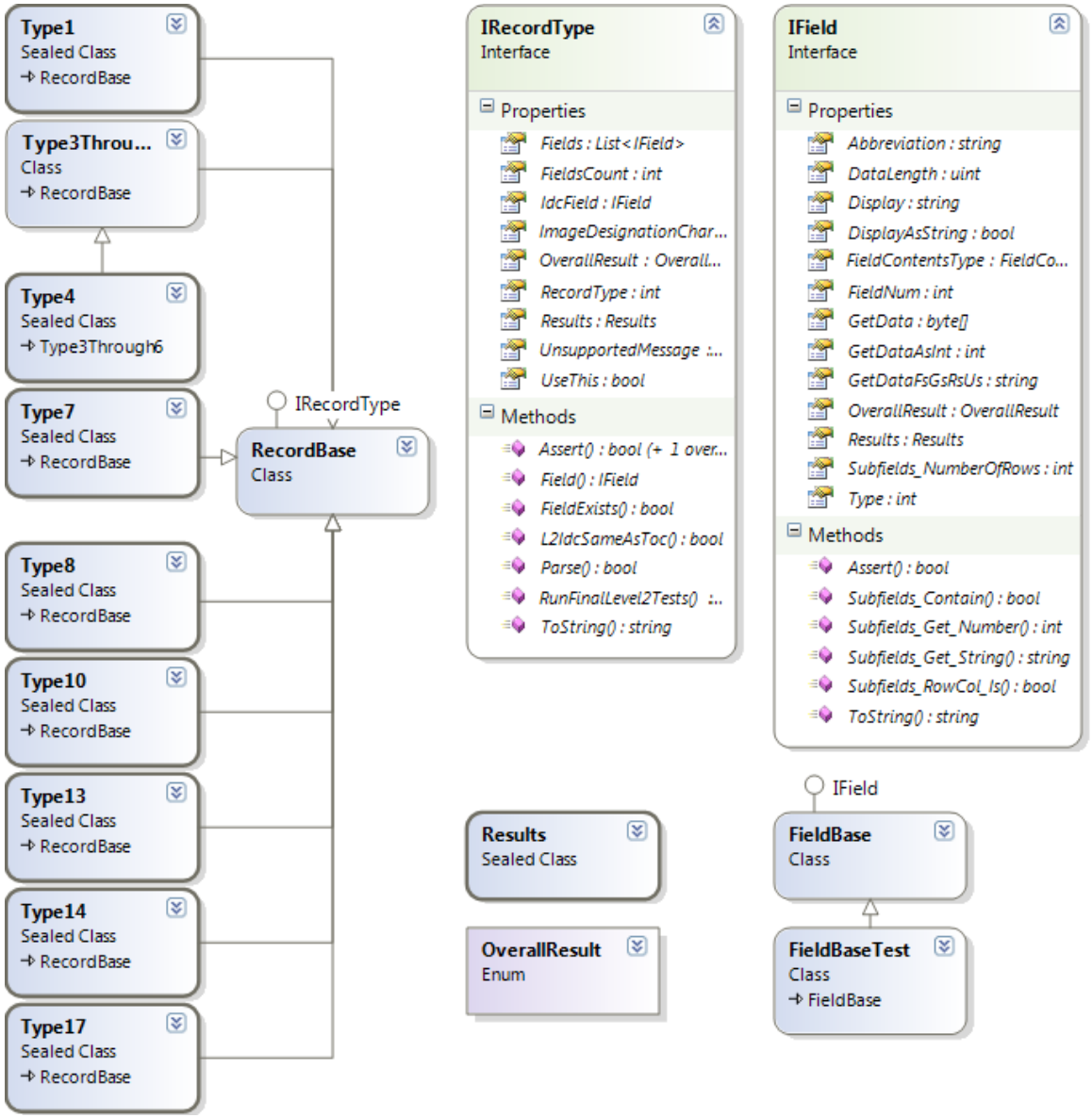



**Figure A-2: Class Diagram for the Data Types**

## Annex B - References


[1] NIST Special Publication 500-271, ANSI/NIST-ITL 1-2007 (Revision of ANSI/NIST-ITL 1-2000), American National Standard for Information Systems — Data Format for the Interchange of Fingerprint Facial, & Other Biometric Information – Part 1

[2] NIST Special Publication 500-275, ANSI/NIST-ITL 2-2008 (XML Version of ANSI/NIST-ITL 1-2007), American National Standard for Information Systems — Data Format for the Interchange of Fingerprint Facial, & Other Biometric Information – Part 2: XML Version

[3] Update to "Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information" for multiple finger capture designations ANSI/NIST ITL 1a-2009

[4] ANSI/NIST Standard Homepage - http://www.nist.gov/itl/iad/ig/ansi_standard.cfm

[5] INCITS M1 – *Biometrics* Public Homepage - http://standards.incits.org/a/public/group/m1

[6] ISO/IEC JTC1/SC 37 – *Biometrics* Public Homepage - http://www.iso.org/iso/jtc1_sc37_home

[7] NIST/ITL CSD Biometric Conformance Test Architectures and Test Suites Downloads Web Page: http://www.nist.gov/itl/csd/biometrics/biocta_download.cfm

## Annex C - Standard Requirements and Conformance Test Assertions

Test assertions documented in Table C-4 below are expressed according to the operators and operands included in Tables C-1 and C-2 respectively, except for those instances where the assertion cannot be clearly or easily represented in a mathematical format. Table C-3 includes terms used throughout the assertions table. In the tool implementation all image-related assertions associated with compressed image types are tested against the image metadata only and not against the image itself. Even though Logical Record types 3 to 6 are not ASCII data, and are not represented in implementations as a tagged-field (e.g. 4.001), they are represented as such in this table to make it easier to understand. For assertions formulated from several sections of the AN Standard, the assertion is listed once on the first requirement encountered.

**Table C-1 – Operators Use in Table C-4 Test Assertions**

| Operator | Description |
|---|---|
| **EQ** | Equal. Tests for equality between two values. |
| **NEQ** | Not Equal. Tests for non-equality between two values. |
| **GTE** | Greater Than or Equal To. Tests if the first value is greater than or equal to the second value. |
| **LTE** | Less Than or Equal To. Tests if the first value is less than or equal to the second value. |
| **GT** | Greater Than. Tests if the first value is greater than the second value. |
| **LT** | Less Than. Tests if the first value is less than the second value. |
| **MO** | Member Of. Tests if the value is a contained within the set. |
| **AND** | Logical And. Tests if both values are true. |
| **OR** | Logical OR. Tests if any values are true. |
| **NOT** | Negate. Negates any operator or calculation that follows. |
| **ST** | Such That. For example, (X,Y) ST X GTE 0 AND Y LTE 10 |
| **IF** | Logical IF. Tests if the condition is true. |
| **IFF** | IF and Only IF. Tests that the condition guarantees another. |
| **MOD** | The modulo operator. X MOD Y = the remainder of a X divided by Y |
| **#** | All. Represents all legal values. |
| **:** | Data Element Selector. X:N selects the Nth data element in X. |
| **in** | The selector operator. X in Y selects only those X found in Y. |
| **to** | Range Selector. X to Y provides set of values Z ST Z GTE X AND Z LTE Y |
| **,** | Range concatenation. X,Y provides the set of values X AND Y. |

**Table C-2 - Description of the Operands Used in Table C-4 Test Assertions**

| Operand | Description |
|---|---|
| **Present(Value)** | Determines if Value is present. |
| **Present(X in Y)** | Determines if X is present in Y. |
| **Sum(Values)** | The summation of Values. |
| **Count(Value)** | The number of occurrences of Value. |
| **Count(X in Y)** | The number of X found in Y. |
| **{X}** | Value of X. |
| **Bytes(Value)** | All of the byte data contained within Value. |
| **MinOccurrences(Value)** | The minimum number of occurrences allowed. |
| **MaxOccurrences(Value)** | The maximum number of occurrences allowed. |
| **MinSize(Value)** | The minimum size allowed per occurrence. |
| **MaxSize(Value)** | The maximum size allowed per occurrence. |
| **Min(Value)=** | The minimum of the set represented by Value. |
| **Length(Value)** | The length of the Value. |
| **First(X in Y)** | The first X found in Y. |
| **Second(X in Y)** | The second X found in Y. |
| **Last(X in Y)** | The last X found in Y. |
| **Type(Value)** | The type of Record represented by Value. |
| **FieldNumber(Value)** | The value of the field number for the field represented by Value. |
| **ForEach(X in Y) {Expression(s)}** | Evaluate Expression for every X in Y. |
| **Valid(X)** | A set of all valid values for X as defined by the requirement. |

Note: When a data range is used in a calculation, the calculation is applied independently for each data element in the range. As an example, the expression:

Count(Subfields in 1.001,1.002) EQ 0

is equivalent to:

Count(Subfields in 1.001) EQ 0 AND Count(Subfields in 1.002) EQ 0

**Table C-3 Terms Used in Table C-4 Test Assertions**

| Term | Description |
|---|---|
| **NULL** | Control character with no value. |
| **NA** | Not Applicable |

Table C-4 includes the requirements (or a summary of the requirements) specified in ANSI/NIST-ITL 1-2007 standard and associated required conformance test assertions. Although references are included for all Record Types when appropriate (for example when a requirement detailed for "tagged-filed records"), the table focuses on requirements and assertions for the Record Types of interest: Record Type 1 and Record Types 4, 10, 13, 14, and 17. Explanations of the heading for each column in the table are included below.

Table C-4 can be used for conformance test tool developers, implementers of the standard, and end-users as well as testing laboratories File, Record and Field-level requirements and assertions are included.

The table includes the following headings[4]:

- Requirement ID: Defines a unique identifier for the requirement and associated assertion or set of assertions. It provides reference to the type of requirement (e.g., file, record, and field). It could refer to more than one Record Type.

- Reference in the standard: Identifies the clause where the requirement is included in the standard. In some cases the reference includes additional information such as a Table number.

- Requirement Summary: Provides a summary of the requirement detailed as textual information or an interpretation of the requirement in the standard. It carries the essentials of the requirement but may not provide all the text necessary to understand it.

- Level: Indicates whether Level 1 or Level 2 conformance testing is required to address the requirement in the previous column. Assertions for Level 3 conformance test are not included. A single cell is included for each assertion.

- Status: Reflects the status specified in the standard (Mandatory (M) or Optional (O)) for each field. It might also indicate whether the requirement in the standard (e.g., field content, presence of field) is considered Mandatory or Optional. Conditional requirements (e.g., conditional to other information items) are tested according to the requirements but are not indicated as such in this column.

- Assertion ID: Defines an identifier of a specific test assertion within the set of test assertions associated with a requirement.

[4] The table headings are derived from the tables of requirements and conformance test assertions specified in ISO/IEC 29109-1:2009, Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 – Biometric Data Format Standard - Part 1: Generalized conformance testing methodology and the 7th draft of the Conformance testing methodology for ANSI/NIST- ITL 1-2011 developed by the ANSI/NIST-ITL Conformance Working Group, February 22, 2011.

- Test assertion: Provides, whenever possible, a mathematical equation or a procedure. Plain text is included whenever a mathematical formula or simple procedure cannot be detailed.

- Test Note: Contains a number of a note included below the table. The test note may include a test procedure when the complexity of the test assertion does not allow this procedur**e** to be included in the test assertion column. It could also include an explanatory note related to the assertion's implementation.

- Implementation support: Denotes a supplier's implementation support of a particular requirement ("Y"/"N"). A note can follow the table when providing more details of implementation support (or the lack of it) is required.

- Supported Range: Indicates a range of values supported, especially when it is different than the full range of values specified in the standard. When an information item is specified as a single value, or does not address a range of values, a N/A should be used.

- Test Result: This column is used to denote the test results. For file and record-level results the results are either "Pass" or "Fail". The field-level results should be indicated as "Ok""Error", "Warning" and "Note". Explanatory notes can be added below the table.

**Table C-4 - Requirements and Conformance Test Assertions**

| Requirement ID | Reference in Base Standard | Requirement Summary | Level | Status | Assertion ID | Test Assertion | Test Note | Implemen-tation Support | Suppor-ted Range | Test Result |
|---|---|---|---|---|---|---|---|---|---|---|
| **File-Level Requirements and Assertions** | | | | | | | | | | |
| 7_Bit_ASCII | 7, Table 4 7.1 | The standard defines logical records, some of which include ASCII tagged textual fields. The data in the Type-1 record shall always be recorded in variable length fields using 7-bit ASCII. Text data in the Type-2, Type-9 and tagged-field records will normally use 7-bit ASCII encoding. Mechanisms for using character sets other than 7-bit ASCII are given in section 8.2.3, International Character Sets. | 1 | M | 7-Bit_Ascii::1.001 to 1.015 | { 1.001 to 1.015} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::10.001 to 10.013 | {10.001 to 10.013} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::10.016, 10.017 | {10.016, 10.017} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::10.020 to 10.030 | {10.020 to 10.030} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::10.040 to 10.043 | {10.040 to 10.043} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::13.001 to 13.017 | {13.001 to 13.017} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::13.020, 13.024 | {13.020, 13.024} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::14.001 to 14.018 | {14.001 to 14.018} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::14.020 to 14.025 | {14.020 to 14.025} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::14.030 | {14.030} LT 128 | | | | |
| | | | 1 | M | 7-Bit_Ascii::17.001 | {17.001 to 17.026} LT 128 | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | to 17.026 | | | | | |
| | | | 1 | M | 7-Bit_Ascii::17.030 | {17.030} LT 128 | | | | |
| **(1,2,9).001-Fld1First** | 7.1 | The first field in all tagged-field records (Types 1, 2 and 9) shall be labeled as field "1". | 2 | M | 1,2,9.001-Fld1First | See 1.001-First (handled in Record Type assertions) | | | | |
| **(1,2,9).002-Fld2Second** | 7.1 | The second field in all tagged-field records (Types 1, 2 and 9) shall be labeled as field "2". | 2 | M | 1.002-Fld2Second | See 1.002-Second (handled in Record Type assertions) | | | | |
| **(1,2,9).001-RecBytes** | 7.1 | The first field in all tagged-field records shall contain the length in bytes of the record. | 2 | M | 1.001-RecBytes | {1.001} EQ Length(Record) | | | | |
| **(3-6, 8).Contents** | 7.1 | For the binary image Type-3, Type-4, Type-5, Type-6, and Type-8 logical records, the content and order of the recorded fields are specified by this standard. With the exception of the first two fields, the remaining fields of the Type-7 logical image record are all user-defined. All fields and data in these record types shall be recorded as binary information. | 2 | M | *3-6,8.#-Contents* | The test assertions are included below under field testing for Record Type 4 | | | | |
| **(3-6, 8).Field_Order** | 7.1, 11.1 | For the binary image Type-3, Type-4, Type-5, Type-6, and Type-8 logical records, the content and order of the recorded fields are specified by this standard. With the exception of the first two fields, the remaining fields of the Type-7 logical image record are all user-defined. All fields and data in these record types shall be recorded as binary information.<br><br>Within each logical record, entries shall be provided in nine ordered and unnumbered fields<br>Table 10 lists the contents of each of the nine fields (for Type-3 through Type-6). | 2 | M | Type-4.-Fields_In_Order | IF Type(Record) EQ 4 THEN Count(Fields) EQ 9 AND Fields:1 to Fields: 9 must be ordered. | | | | |
| **File-OneType-1** | 7.2 | Files to be exchanged are required to contain one and only one Type-1 logical record per transaction. | 2 | M | File-OneType-1 | Count(Records ST Type(Records) EQ 1) EQ 1 | | | | |
| **File-Type-1_First** | 7.2 | The Type-1 logical record shall always be the first logical record within the file. | 2 | M | File-Type-1_First | Type(First(Record in Transaction)) EQ 1 | | | | |
| **XX(-1).002-IDCRqd** | 7.4 | With the exception of the Type-1 logical record, each of the remaining logical records present in a file shall include a separate field containing the Image | 2 | M | 4.002-HasIdc | Present(4.002) | | | | |
| | | | 2 | M | 10.002-HasIdc | Present(10.002) | | | | |
| | | | 2 | M | 13.002-HasIdc | Present(13.002) | | | | |
| | | | 2 | M | 14.002-HasIdc | Present(14.002) | | | | |

<table>
<tr><td></td><td></td><td>Designation Character (IDC).</td><td>2</td><td>M</td><td>17.002-HasIdc</td><td>Present(17.002)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Valid IDC</td><td>7.4</td><td>The IDC shall be used to relate information items in the file content field of the Type-1 record to each logical record.</td><td>2</td><td>M</td><td>See Below 1.003-CNT_ListsRecs</td><td>The test assertion is addressed for each individual supported Record Type below</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">002-IDC_-Sequence</td><td rowspan="4">7.4</td><td rowspan="4">The value of the IDC shall be a sequentially assigned positive integer starting from zero and incremented by one (up to a maximum of 255).</td><td>2</td><td>M</td><td>002-IDC_ZeroFirst</td><td>{First(Field in Transaction) ST FieldNumber(Field) EQ 2} EQ 0</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>002-IDC_Zero_Min-_Value</td><td>{#.002} GTE 0</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>002-IDC_255_Max-_Value</td><td>{#.002} LTE 255</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>002-IDC_IncByOne</td><td>Each new IDC is one greater than the previous maximum IDC value.</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">002-RelatedIDCs</td><td rowspan="4">7.4</td><td rowspan="4">The IDC shall be used to properly identify and link together logical records that pertain to the same entity such as a particular finger or face.</td><td>2</td><td>M</td><td>IDC_Entity_-Supported_Types_Only</td><td>Type(Record) MO [1,4,10,13,14, 17]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>IDC_Entity_Has_IDC</td><td>Type(Record) MO [4, 10,13,14,17]</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>IDC_Entity_-Choose_-Biometric_And_-Comparison_Id</td><td>
<table>
<tr><th>Record Type</th><th>Field 10.003</th><th>Bio-metric</th><th>Field For Com-parison ID</th></tr>
<tr><td>4</td><td>NA</td><td>FINGER</td><td>Byte 1 of 4.004</td></tr>
<tr><td>10</td><td>FACE</td><td>FACE</td><td>NA</td></tr>
<tr><td>10</td><td>SCAR</td><td>SCAR</td><td>(1,1) of 10.040</td></tr>
<tr><td>10</td><td>MARK</td><td>MARK</td><td>(1,1) of 10.040</td></tr>
<tr><td>10</td><td>TATTOO</td><td>TATTOO</td><td>(1,1) of 10.040</td></tr>
<tr><td>13</td><td>NA</td><td>FINGER</td><td>(1,1) of 13.013</td></tr>
<tr><td>14</td><td>NA</td><td>FINGER</td><td>(1,1) of 14.013</td></tr>
<tr><td>17</td><td>NA</td><td>IRIS</td><td>17.003 IF 17.003 = 1 Or 2</td></tr>
</table>
</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>M</td><td>IDC_Entity_-Compare_Records_With_The_Same_-IDC_Value</td><td>
<table>
<tr><th>First Record</th><th>Second Record</th><th>Comparison IDs</th><th>Result</th></tr>
<tr><td>FINGER</td><td>FINGER</td><td>Same</td><td>Ok</td></tr>
<tr><td>FINGER</td><td>FINGER</td><td>Different</td><td>Error</td></tr>
<tr><td>FINGER</td><td>NEQFINGER</td><td>NA</td><td>Error</td></tr>
<tr><td>FACE</td><td>FACE</td><td>NA</td><td>Ok</td></tr>
<tr><td>FACE</td><td>NEQ FACE</td><td>NA</td><td>Error</td></tr>
<tr><td>IRIS</td><td>IRIS</td><td>Both = 1 Or Both = 2</td><td>Ok</td></tr>
<tr><td>IRIS</td><td>IRIS</td><td>Not (Both = 1 Or Both = 2)</td><td>Error</td></tr>
<tr><td>IRIS</td><td>NEQ</td><td>NA</td><td>Error</td></tr>
</table>
</td><td></td><td></td><td></td><td></td></tr>
</table>

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | IRIS | | | | |
| | | | | | | SCAR | SCAR | Same | Ok | |
| | | | | | | SCAR | SCAR | Different | Warning | |
| | | | | | | SCAR | MARK Or TATTOO | Same or Different | Warning | |
| | | | | | | SCAR | FINGER, FACE Or IRIS | NA | Error | |
| | | | | | | MARK | MARK | Same | Ok | |
| | | | | | | MARK | MARK | Different | Warning | |
| | | | | | | MARK | SCAR Or TATTOO | Same or Different | Warning | |
| | | | | | | MARK | FINGER, FACE Or IRIS | NA | Error | |
| | | | | | | TATTOO | TATTOO | Same | Ok | |
| | | | | | | TATTOO | TATTOO | Different | Warning | |
| | | | | | | TATTOO | SCAR Or MARK | Same or Different | Warning | |
| | | | | | | TATTOO | FINGER, FACE Or IRIS | NA | Error | |
| **Record-Level Requirements and Assertions** | | | | | | | | | | |
| **File::OneOrMoreRecs** | 8.2 | A transaction file shall consist of one or more logical records. | 2 | M | File::One-OrMoreRecs | Count(Records in Transaction) GTE 1 | ??? | | | |
| **AppropriateFields-PerRecord** | 8.2 | For each logical record contained in the file, several information fields appropriate to that record type shall be present. | 2 | M | *AppropriateFields* | These test assertions are included in the tests for the supported Record Types below. | | | | |
| **No_Subfields** | 8.2, 8.2.1, Various sub-sections of 9.1, 15.1, 18.1, 19.1, 22.2 | Sections 8.2 and 8.2.1 describe the mechanism that enables a field to contain multiple information items known as subfields. The following fields are defined to have a single information field and contain no subfields:<br><br>1.001, 1.002, 1.004 to 1.012, 1.014<br><br>10.001 to 10.013, 10.016, 10.017, 10.020, 10.021, 10.027, 10.030<br><br>13.001 to 13.012, 13.016, 13.017 13.020<br><br>14.001 to 14.012, 14.016, 14.017, 14.020, 14.030 | 1 | M | Single_NoSubFields: :1.001, 1.002 | Count(Subfields in 1.001, 1.002 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :1.004 to 1.012 | Count(1.Subfields in 004 to 1.012 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :1.014 | Count(Subfields in 1.014 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :10.001 to 10.013 | Count(Subfields in 10.001 to 10.013 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :10.016, 10.017 | Count(Subfields in 10.016, 10.017 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :10.020, 10.021 | Count(Subfields in 10.020, 10.021 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :10.027 | Count(Subfields in 10.027 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :10.030 | Count(Subfields in 10.030 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :13.001 to 13.012 | Count(Subfields in 13.001 to 13.012 ) EQ 0 | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 17.001 to 17.015, 17.017, 17.018, 17.020 to 17.023, 17.025, 17.026, 17.030 | 1 | M | Single_NoSubFields: :13.016, 13.017 | Count(Subfields in 13.016, 13.017 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :13.020 | Count(Subfields in 13.020 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :14.001 to 14.012 | Count(Subfields in 14.001 to 14.012 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :14.016, 14.017 | Count(Subfields in 14.016, 14.017 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :14.020, 14.030 | Count(Subfields in 14.020, 14.030 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :17.001 to 17.015 | Count(Subfields in 17.001 to 17.015 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :17.017, 17.018 | Count(Subfields in 17.017, 17.018 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :17.020 to 17.023 | Count(Subfields in 17.020 to 17.023 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :17.025, 17.026 | Count(Subfields in 17.025, 17.026 ) EQ 0 | | | | |
| | | | 1 | M | Single_NoSubFields: :17.030 | Count(Subfields in 17.030 ) EQ 0 | | | | |
| **Valid_Record_Type** | 8.2.2 | For tagged-field logical records each field shall begin with the logical record type number chosen from Table 4. | 1 | M | RecordTypeValid::1.001 to 1.015 | IF Type(Record) EQ 1 THEN Type(1.001 to 1.015) EQ 1 | | | | |
| | | | 1 | M | RecordTypeValid::10.001 to 10.013 | IF Type(Record) EQ 10 THEN Type(10.001 to 10.013) EQ 10 | | | | |
| | | | 1 | M | RecordTypeValid::10.016, 10.017 | IF Type(Record) EQ 10 THEN Type(10.016,10.017) EQ 10 | | | | |
| | | | 1 | M | RecordTypeValid::10.020 to 10.030 | IF Type(Record) EQ 10 THEN Type(10.020 to 10.030) EQ 10 | | | | |
| | | | 1 | M | RecordTypeValid::10.040 to 10.043 | IF Type(Record) EQ 10 THEN Type(10.040 to 10.043) EQ 10 | | | | |
| | | | 1 | M | RecordTypeValid::10.999 | IF Type(Record) EQ 10 THEN Type(10.999) EQ 10 | | | | |
| | | | 1 | M | RecordTypeValid::13.001 to 13.017 | IF Type(Record) EQ 13 THEN Type(13.001 to 13.017) EQ 13 | | | | |
| | | | 1 | M | RecordTypeValid::13.020, 13.024 | IF Type(Record) EQ 13 THEN Type(13.020, 13.024) EQ 13 | | | | |
| | | | 1 | M | RecordTypeValid::13.999 | IF Type(Record) EQ 13 THEN Type(13.999) EQ 13 | | | | |
| | | | 1 | M | RecordTypeValid::14.001 to 14.018 | IF Type(Record) EQ 14 THEN Type(14.001 to 14.018) EQ 14 | | | | |
| | | | 1 | M | RecordTypeValid::14.020 to 14.025 | IF Type(Record) EQ 14 THEN Type(14.020 to 14.025) EQ 14 | | | | |
| | | | 1 | M | RecordTypeValid::14.030 | IF Type(Record) EQ 14 THEN Type(14.030) EQ 14 | | | | |
| | | | 1 | M | RecordTypeValid::14.999 | IF Type(Record) EQ 14 THEN Type(14.999) EQ 14 | | | | |
| | | | 1 | M | RecordTypeValid::1 | IF Type(Record) EQ 17 THEN | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 7.001 to 17.026 | Type(17.001 to 17.026) EQ 17 | | | | |
| | | | 1 | M | RecordTypeValid::17.030 | IF Type(Record) EQ 17 THEN Type(17.030) EQ 17 | | | | |
| | | | 1 | M | RecordTypeValid::17.999 | IF Type(Record) EQ 17 THEN Type(17.999) EQ 17 | | | | |
| **(1,2,9)-FsAtEnd** | 8.2.2 | The ASCII File Separator ASCII FS control character (signifying the end of the logical record or transaction) shall follow the last byte of ASCII information for each Type-1, Type-2, and Type-9 record. | 2 | M | 1-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| **(1,2,9)-LenInclEndFs** | 8.2.2 | The ASCII File Separator ASCII FS control character (signifying the end of the logical record or transaction) shall follow the last byte of ASCII information and shall be included in the length of the record for each Type-1, Type-2, and Type-9 record. | 2 | M | 1-LenInclEndFs | Length(Record) EQ Sum(Field Lengths) + 1<br>The last byte, ASCII FS, is included in the Record Length | | | | |
| **(3-8).001-Length** | 8.2.2 | The entire length of the record shall be recorded in the first four-byte binary field of each Type-3 through Type-8 record. | 2 | M | 4.001-Length | {4.001} EQ Length(Record) | | | | |
| **(10,13-17,99).999Last** | 8.2.2 | The last physical field in a tagged-field image record (Types 10, 13, 14, 15, 16, 17 & 99) shall always be numbered "999". | 2 | M | 10.999Last | FieldNumber(Last (Field in Record)) EQ 999 | | | | |
| | | | 2 | M | 13.999Last | FieldNumber (Last (Field in Record)) EQ 999 | | | | |
| | | | 2 | M | 14.999Last | FieldNumber (Last (Field in Record)) EQ 999 | | | | |
| | | | 2 | M | 17.999Last | FieldNumber (Last (Field in Record)) EQ 999 | | | | |
| **(10,13-17,99)-FsAtEnd** | 8.2.2 | The ASCII File Separator ASCII FS control character shall follow the last byte of the compressed or uncompressed image data in a tagged-field image record (Types 10, 13, 14, 15, 16, 17 & 99). | 2 | M | 10-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| | | | 2 | M | 13-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| | | | 2 | M | 14-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| | | | 2 | M | 17-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| **(10,13-17,99)-LenInclEndFs** | 8.2.2 | The ASCII FS character shall signify the end of the logical record or transaction and shall be included as part of the record length of a tagged-field image record (Types 10, 13, 14, 15, 16, 17 & 99). | 2 | M | 10-LenInclEndFs | Length(Record) EQ Sum(Field Lengths) + 1<br>The last byte, ASCII FS, is included in the Record Length | | | | |
| | | | 2 | M | 13-LenInclEndFs | Length(Record) EQ Sum(Field Lengths) + 1<br>The last byte, ASCII FS, is included in the Record Length | | | | |
| | | | 2 | M | 14-LenInclEndFs | Length(Record) EQ Sum(Field Lengths) + 1<br>The last byte, ASCII FS, is included in | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | the Record Length | | | | |
| | | | 2 | M | 17-LenInclEndFs | Length(Record) EQ Sum(Field Lengths) + 1<br>The last byte, ASCII FS, is included in the Record Length | | | | |
| **Intn'l Char Sets** | 8.2.3 | NA | NA | NA | NA | Not supported in this version | 1 | | | |
| **Type 1 Requirements and Assertions** | | | | | | | | | | |
| **Length_Minimum_ Tagged_Field** | 9.1 (Table 8), 15.1 (Table 17), 18.1 (Table 31), 19.1 (Table 33), 22.1 (Table 37) | This requirement is inferred from the Tables describing the Minimum Field size per occurrence and Minimum Occur count values for each record type. The length of the data shall be greater than or equal to the field's min size per occurrence times the min Occur count. | 1 | M | LengthMin::1.001 to 1.015 | Length(1.001 to 1.015) GTE MinSize(1.001 to 1.015) * MinOccurrences(1.001 to 1.015) | | | | |
| | | | 1 | M | LengthMin::10.001 to 10.013 | Length(10.001 to 10.013) GTE MinSize(10.001 to 10.013) * MinOccurrences(10.001 to 1.013) | | | | |
| | | | 1 | M | LengthMin::10.016, 10.017 | Length(10.016,10.017) GTE MinSize(10.016, 10.017) * MinOccurrences(10.016, 10.017) | | | | |
| | | | 1 | M | LengthMin::10.020 to 10.030 | Length(10.020 to 10.030) GTE MinSize(10.020 to 10.030) * MinOccurrences(10.020, 10.030) | | | | |
| | | | 1 | M | LengthMin::10.040 to 10.043 | Length(10.040 to 10.043) GTE MinSize(10.040, to 10.043) * MinOccurrences(10.040 to 10.043) | | | | |
| | | | 1 | M | LengthMin::10.999 | Length(10.999) GTE MinSize(10.999) * MinOccurrences(10.999) | | | | |
| | | | 1 | M | LengthMin::13.001 to 13.017 | Length(13.001 to 13.017) GTE MinSize(13.001 to 13.017) * MinOccurrences(13.001 to 13.017) | | | | |
| | | | 1 | M | LengthMin::13.020 | Length(13.020) GTE MinSize(13.020) * MinOccurrences(13.020) | | | | |
| | | | 1 | M | LengthMin::13.024 | Length(13.024) GTE MinSize(13.024) * MinOccurrences(13.024) | | | | |
| | | | 1 | M | LengthMin::13.999 | Length(13.999) GTE MinSize(13.999) * MinOccurrences(13.9999) | | | | |
| | | | 1 | M | LengthMin::14.001 to 14.018 | Length(14.001 to 14.018) GTE MinSize(14.001 to 14.018) * MinOccurrences(14.001 to 14.018) | | | | |
| | | | 1 | M | LengthMin::14.020 to 14.025 | Length(14.020 to 14.025) GTE MinSize(14.020 to 14.025) * MinOccurrences(14.020 to 14.025) | | | | |
| | | | 1 | M | LengthMin::14.030 | Length(14.030) GTE MinSize(14.030) * MinOccurrences(14.030) | | | | |
| | | | 1 | M | LengthMin::14.999 | Length(14.999) GTE MinSize(14.999) * MinOccurrences(14.999) | | | | |
| | | | 1 | M | LengthMin::17.001 to 17.026 | Length(17.001 to 17.026) GTE MinSize(17.001 to 17.026) * MinOccurrences(17.001 to 17.026) | | | | |
| | | | 1 | M | LengthMin::17.030 | Length(17.030) GTE MinSize(17.030) * | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MinOccurrences(17.030) | | | | |
| | | | 1 | M | LengthMin::17.999 | Length(17.999) GTE MinSize(17.999) * MinOccurrences(17.999) | | | | |
| **Length_Maximum_ Tagged _Field** | 9.1 (Table 8), 15.1 (Table 17), 18.1 (Table 31), 19.1 (Table 33), 22.1 (Table 37) | This requirement is inferred from the Tables describing the Maximum Field size per occurrence and Maximum Occur count values for each record type. The length of the data shall be less than or equal to the field's max size per occurrence times the max Occur count. | 1 | M | LengthMax::1.001 to 1.015 | Length(1.001 to 1.015) LTE MaxSize(1.001 to 1.015) * MaxOccurrences(1.001 to 1.015) | | | | |
| | | | 1 | M | LengthMax::10.001 to 10.013 | Length(10.001 to 10.013) LTE MaxSize(10.001 to 10.013) * MaxOccurrences(10.001 to 1.013) | | | | |
| | | | 1 | M | LengthMax::10.016, 10.017 | Length(10.016,10.017) LTE MaxSize(10.016, 10.017) * MaxOccurrences(10.016, 10.017) | | | | |
| | | | 1 | M | LengthMax::10.020 to 10.030 | Length(10.020 to 10.030) LTE MaxSize(10.020 to 10.030) * MaxOccurrences(10.020, 10.030) | | | | |
| | | | 1 | M | LengthMax::10.040 TO 10.043 | Length(10.040 to 10.043) LTE MaxSize(10.040, to 10.043) * MaxOccurrences(10.040 to 10.043) | | | | |
| | | | 1 | M | LengthMax::10.999 | Length(10.999) LTE MaxSize(10.999) * MaxOccurrences(10.999) | | | | |
| | | | 1 | M | LengthMax::13.001 TO 13.017 | Length(13.001 to 13.017) LTE MaxSize(13.001 to 13.017) * MaxOccurrences(13.001 to 13.017) | | | | |
| | | | 1 | M | LengthMax::13.020 | Length(13.020) LTE MaxSize(13.020) * MaxOccurrences(13.020) | | | | |
| | | | 1 | M | LengthMax::13.024 | Length(13.024) LTE MaxSize(13.024) * MaxOccurrences(13.024) | | | | |
| | | | 1 | M | LengthMax::13.999 | Length(13.999) LTE MaxSize(13.999) * MaxOccurrences(13.9999) | | | | |
| | | | 1 | M | LengthMax::14.001 TO 14.018 | Length(14.001 to 14.018) LTE MaxSize(14.001 to 14.018) * MaxOccurrences(14.001 to 14.018) | | | | |
| | | | 1 | M | LengthMax::14.020 TO 14.025 | Length(14.020 to 14.025) LTE MaxSize(14.020 to 14.025) * MaxOccurrences(14.020 to 14.025) | | | | |
| | | | 1 | M | LengthMax::14.030 | Length(14.030) LTE MaxSize(14.030) * MaxOccurrences(14.030) | | | | |
| | | | 1 | M | LengthMax::14.999 | Length(14.999) LTE MaxSize(14.999) * MaxOccurrences(14.999) | | | | |
| | | | 1 | M | LengthMax::17.001 TO 17.026 | Length(17.001 to 17.026) LTE MaxSize(17.001 to 17.026) * MaxOccurrences(17.001 to 17.026) | | | | |
| | | | 1 | M | LengthMax::17.030 | Length(17.030) LTE MaxSize(17.030) * MaxOccurrences(17.030) | | | | |
| | | | 1 | M | LengthMax::17.999 | Length(17.999) LTE MaxSize(17.999) * MaxOccurrences(17.999) | | | | |
| **CharType_Numbers** | Table 8, Table 17, Table 31, Table 33, | This requirement is inferred from the Tables describing the Char type for each record type. The following fields shall contain only numbers (ASCII 0x30 | 1 | M | CharType_Numbers ::1.001, 1.002 | Bytes(1.001,1.002) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::1.005, 1.006 | Bytes(1.005,1.006) MO [0 to 9] | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | Table 37 | through 0x39):<br><br>1.001,1.002,1.005,1.006<br><br>10.001,10.002,10.005 to 10.009,10.013,10.016,10.017<br><br>13.001 to 13.003, 13.005 to 13.010, 13.012,13.013,13.016,13.017<br><br>14.001 to 14.003, 14.005 to 14.010, 14.012, 14.016,14.017<br><br>17.001 to 17.003, 17.005 to 17.010, 17.012, 17.020, 17.022, 17.023, 17.025, 17.026 | 1 | M | CharType_Numbers ::10.001, 10.002 | Bytes(10.001,10.002) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::10.005 to 10.009 | Bytes(10.005 to 10.009) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::10.013 | Bytes(10.013) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::10.016,10.017 | Bytes(10.016,10.017) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::10.017 | Bytes(10.017) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::13.001 to 13.003 | Bytes(13.001 to 13.003)MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::13.005 to 13.010 | Bytes(13.005 to 13.010) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::13.012, 13.013 | Bytes(13.012, 13.013) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::13.016, 13.017 | Bytes(13.016,13.017) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::14.001 to 14.003 | Bytes(14.001 to 14.003) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::14.005 to 14.010 | Bytes(14.005 to 14.010) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::14.012 | Bytes(14.012) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::14.016, 14.017 | Bytes(14.016,14.017) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.001 to 17.003 | Bytes(17.001 to 17003) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.005 to 17.010 | Bytes(17.005 to 17.010) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.012 | Bytes(17.012) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.020 | Bytes(17.020) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.022, 17.023 | Bytes(17.022, 17.023) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.025, 17.026 | Bytes(17.025, 17.026) MO [0 to 9] | | | | |
| | | | 1 | M | CharType_Numbers ::17.030 | Bytes(17.030) MO [0 to 9] | | | | |
| **1.001-First** | 9.1 | Within a Type-1 logical record, entries shall be provided in numbered fields. It is required that the first two fields of the record are ordered.1.001 must be the first field. | 2 | M | 1.001-First | IF Type(Record) EQ 1 THEN FieldNumber (First(Field in Record)) EQ 1 | | | | |
| **1.002-Second** | 9.1 | Within a Type-1 logical record, entries shall be provided in numbered fields. It is required that the first two fields of the record are ordered. 1.002 must be the second field. | 2 | M | 1.002-Second | IF Type(Record) EQ 1 THEN FieldNumber(Second(Field in Record)) EQ 2 | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **1.xxx-Mandatory** | 9.1<br>Table 8 | Table 8 lists the “condition code” as being mandatory “M” or optional “O” | 2 | M | 1.xxx-Mandatory | Present(Mandatory Fields) | | | | |
| **1.xxx-MaxOccurances** | 9.1<br>Table 8 | The “Occur count Max” column of Table 8 lists the maximum number of times a field can occur in a Type-1 record. | 2 | M | 1.xxx-MaxOccurances | Count(1.xxx) LTE MaxOccurrences(1.xxx) | | | | |
| **Version=0400** | 9.1.2 | The entry for this 2007 version of the approved standard shall be '0400'. | 1 | M | Value_0400::1.002 | {1.002} EQ 0400 | | | | |
| **CharType_Numbers_Subfields** | 9.1.3, 15.1.22, 15.1.23, 15.1.31, 18.1.21, 19.1.13, 19.1.21 to 19.1.25, 22.2.16, 22.2.24 | The following fields shall only contain numbers (ASCII 0x30 through 0x39), ASCII US (0x1F) and ASCII RS (0x1E):<br><br>1.003<br><br>10.024, 10.025, 10.041<br><br>13.024<br><br>14.013, 14.021 to 14.025<br><br>17.016, 17.024 | 1 | M | CharType_Numbers_US_RS::1.003 | Bytes(1.003) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::10.024, 10.025 | Bytes(10.024,10.025) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::10.041 | Bytes(10.041) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::13.024 | Bytes(13.024) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::14.013 | Bytes(14.013) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::14.021 to 14.025 | Bytes(14.021 to 14.025) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::17.016 | Bytes(17.016) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | CharType_Numbers_US_RS::17.024 | Bytes(17.024) MO [0 to 9, ASCII US, ASCII RS] | | | | |
| **Subfields_Nx2** | 9.1.3, 18.1.14, 19.1.18, 19.1.22 | The following fields shall contain one or more RS_Subfields, which each contain two US_Subfields:<br><br>13.014, 14.018, 14.022<br><br>Field 1.003 shall contain two or more RS_Subfields, which each contain two US_Subfields | 1 | M | Nx2::1.003 | Count(RS_Subfields in 1.003 ) GTE 2<br>AND<br>ForEach(RS_Subfield in 1.003 )<br>{<br>Count(US_Subfields) EQ 2<br>} | 2 | | | |
| | | | 1 | M | Nx2::13.014 | Count(RS_Subfields in 13.014 ) GTE 1<br>AND<br>ForEach(RS_Subfield in 13.014 )<br>{<br>Count(US_Subfields) EQ 2<br>} | 2 | | | |
| | | | 1 | M | Nx2::14.018 | Count(RS_Subfields in 14.018 ) GTE 1<br>AND<br>ForEach(RS_Subfield in 14.018 )<br>{<br>Count(US_Subfields) EQ 2<br>} | 2 | | | |
| | | | 1 | M | Nx2::14.022 | Count(RS_Subfields in 14.022 ) GTE 1<br>AND<br>ForEach(RS_Subfield in 14.022 )<br>{<br>Count(US_Subfields) EQ 2<br>} | 2 | | | |
| **1.003-** | 9.1.3 | Field 1.003, File Content (CNT) shall list | 2 | M | 1.003- | Field 1.003, File Content (CNT) shall list | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **CNT_ListsRecs** | | and identify each of the logical records in the file by record type. It also specifies the order in which the remaining logical records shall appear in the file.<br><br>Each of the subfields after the first subfield of Field 1.003 relate to a single Type-2 through Type-99 logical record contained in the file. Two information items shall comprise each subfield. The first information item shall be the record identifier character(s) chosen from Table 4 that identifies the record type. This identifier must match the record type of the corresponding record in the field. | | | CNT_ListsRecs | and identify each of the logical records in the file by record type. It also specifies the order in which the remaining logical records shall appear in the file.<br><br>Each of the subfields after the first subfield of Field 1.003 relate to a single Type-2 through Type-99 logical record contained in the file. Two information items shall comprise each subfield. The first information item shall be the record identifier character(s) chosen from Table 4 that identifies the record type. This identifier must match the record type of the corresponding record in the field. | | | | |
| **1.003-Num-Following-Recs=Num-FollowingSubfields** | 9.1.3 | The second information item of the first subfield of Field 1.003 (CNT) shall be the sum of the Type-2 through Type-99 logical records contained in this file. This number is also the number of remaining subfields in the CNT field. | 2 | M | 1.003-Num-Following-Recs=Num-FollowingSubfields | The second information item of the first subfield of Field 1.003 (CNT) shall be the sum of the Type-2 through Type-99 logical records contained in this file. This number is also the number of remaining subfields in the CNT field. | | | | |
| **1.003-CNT_IDCsMatchRecs** | 9.1.3 | Each of the subfields after the first subfield of Field 1.003 relate to a single Type-2 through Type-99 logical record contained in the file. Two information items shall comprise each subfield. The second item shall be the IDC associated with the logical record pertaining to that subfield. | 2 | M | 1.003-CNT_IDCs-MatchRecs | Each of the subfields after the first subfield of Field 1.003 relate to a single Type-2 through Type-99 logical record contained in the file. Two information items shall comprise each subfield. The second item shall be the IDC associated with the logical record pertaining to that subfield. | | | | |
| **Unspecified Data** | 9.1.1, Various sub-sections of 9.1, 11.2, 15.1, 18.1 19.1, 22.2 | This requirement is not explicitly stated, but instead is a generalization for all fields where the content cannot be checked against any known value. For all such fields that allow unspecified data, the content of the field is always accepted. These fields include:<br><br>1.001, 1.004, 1.007 to 1.013<br><br>4.001, 4.002, 4.006, 4.007, 4.009<br><br>10.001, 10.002, 10.004, 10.006, 10.007, 10.009, 10.010, 10.016, 10.017, 10.025, 10.026, 10.041<br><br>13.001, 13.002, 13.004, 13.006 to 13.010, 13.016, 13.017 13.020 | 1 | M | Opaque::1.001 | True | | | | |
| | | | 1 | M | Opaque::1.004 | True | | | | |
| | | | 1 | M | Opaque::1.007 to 1.013 | True | | | | |
| | | | 1 | M | Opaque::4.001, 4.002 | True | | | | |
| | | | 1 | M | Opaque::4.006, 4.007 | True | | | | |
| | | | 1 | M | Opaque::4.009 | True | | | | |
| | | | 1 | M | Opaque::10.001, 10.002 | True | | | | |
| | | | 1 | M | Opaque::10.004 | True | | | | |
| | | | 1 | M | Opaque::10.006, 10.007 | True | | | | |
| | | | 1 | M | Opaque::10.009, 10.010 | True | | | | |
| | | | 1 | M | Opaque::10.016, 10.017 | True | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 14.001, 14.002, 14.004, 14.006, 14.007, 14.009, 14.010, 14.016, 14.017, 14.020<br><br>17.001, 17.002, 17.004, 17.006, 17.007, 17.009, 17.010, 17.014, 17.015, 17.018, 17.019, 17.021 to 17.024, 17.026 | 1 | M | Opaque::10.025, 10.026 | True | | | | |
| | | | 1 | M | Opaque::10.041 | True | | | | |
| | | | 1 | M | Opaque::13.001, 13.002 | True | | | | |
| | | | 1 | M | Opaque::13.004 | True | | | | |
| | | | 1 | M | Opaque::13.006 to 13.010 | True | | | | |
| | | | 1 | M | Opaque::13.016, 13.017 | True | | | | |
| | | | 1 | M | Opaque::13.020 | True | | | | |
| | | | 1 | M | Opaque::14.001, 14.002 | True | | | | |
| | | | 1 | M | Opaque::14.004 | True | | | | |
| | | | 1 | M | Opaque::14.006, 14.007 | True | | | | |
| | | | 1 | M | Opaque::14.009, 14.010 | True | | | | |
| | | | 1 | M | Opaque::14.016, 14.017 | True | | | | |
| | | | 1 | M | Opaque::14.020 | True | | | | |
| | | | 1 | M | Opaque::17.001, 17.002 | True | | | | |
| | | | 1 | M | Opaque::17.004 | True | | | | |
| | | | 1 | M | Opaque::17.006, 17.007 | True | | | | |
| | | | 1 | M | Opaque::17.009, 17.010 | True | | | | |
| | | | 1 | M | Opaque::17.014, 17.015 | True | | | | |
| | | | 1 | M | Opaque::17.018, 17.019 | True | | | | |
| | | | 1 | M | Opaque::17.021 to 17.024 | True | | | | |
| | | | 1 | M | Opaque::17.026 | True | | | | |
| **AlphaNumeric** | 9.1 (Table 8), 15.1 (Table 17), 18.1 (Table 31), 19.1 (Table 33), 22.1 (Table 37) | The field shall only contain alphanumeric characters (ASCII 0x20 through 0x7E). | 1 | M | AlphaNumeric::1.004 | Bytes(1.004) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::1.007 to 1.010 | Bytes(1.007 to 1.010) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::1.014 | Bytes(1.014) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::10.003, 10.004 | Bytes(10.003, 10.004) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::10.010 to 10.012 | Bytes(10.010 to 10.012) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::10.020 | Bytes(10.020) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::10.027 | Bytes(10.027) MO [0x20 to 0x7E] | | | | |

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| | | | 1 | M | AlphaNumeric::10.030 | Bytes(10.030) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::13.004 | Bytes(13.004) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::13.011 | Bytes(13.011) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::13.020 | Bytes(13.020) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::14.004 | Bytes(14.004) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::14.011 | Bytes(14.011) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::14.020 | Bytes(14.020) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::14.030 | Bytes(14.030) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::17.004 | Bytes(17.004) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::17.011 | Bytes(17.011) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::17.013 to 17.015 | Bytes(17.013 to 17.015) MO [0x20 to 0x7E] | | | | |
| | | | 1 | M | AlphaNumeric::17.017, 17.018 | Bytes(17.017, 17.018) MO [0x20 to 0x7E] | | | | |
| **YYYYMMDD_Valid** | 9.1.5, 15.1.5, 18.1.5, 19.1.5, 22.2.5 | The date shall appear as eight digits in the format YYYYMMDD. | 1 | M | YYYYMMDD_Valid::1.005 | {1.005} MO Valid(YYYYMMDD) | | | | |
| | | | 1 | M | YYYYMMDD_Valid::10.005 | {10.005} MO Valid(YYYYMMDD) | | | | |
| | | | 1 | M | YYYYMMDD_Valid::13.005 | {13.005} MO Valid(YYYYMMDD) | | | | |
| | | | 1 | M | YYYYMMDD_Valid::14.005 | {14.005} MO Valid(YYYYMMDD) | | | | |
| | | | 1 | M | YYYYMMDD_Valid::17.005 | {17.005} MO Valid(YYYYMMDD) | | | | |
| **YYYYMMDD_NotFuture** | 9.1.5 | The transaction date shall not be future. | 1 | M | YYYYMMDD_NotFuture::1.005 | {1.005} LTE Date.Today | | | | |
| **Values_1To9** | 9.1.6 | The value shall be in the range 1 to 9. | 1 | O | Values_1To9::1.006 | {1.006} MO [1 to 9] | | | | |
| **1.011-NSR_-ZeroIfNoBinaryRecs** | 9.1.11 | For transactions that do not contain Type-3 through Type-7 fingerprint image records, field 1.011 (NSR) shall be set to "00.00". | 2 | M | 1.011-NSR_-ZeroIfNoBinaryRecs | If NOT Present(Type 3 to Type 7) Then {1.011} EQ "00.00" | | | | |
| **AlphaNumeric_Subfields** | 9.1 (Table 8), 9.1.13, 9.1.15, 15.1.20, 15.1.21, 15.1.26, 15.1.30, | The field shall only contain alphanumeric characters (ASCII 0x20 through 0x7E), ASCII US (0x1F) and ASCII RS (0x1E). | 1 | M | AlphaNumeric_US_RS::1.013 | Bytes(1.013) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::1.015 | Bytes(1.015) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::10.022, 10.023 | Bytes(10.022,10.023) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::10.028, 10.029 | Bytes(10.028,10.029) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |

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| | 15.1.32, 15.1.33, 18.1.14, 18.1.15, 19.1.14, 19.1.15, 19.1.18, 22.2.19 | | 1 | M | AlphaNumeric_US_RS::10.040 | Bytes(10.040) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::10.042, 10.043 | Bytes(10.042,10.043) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::13.014, 13.015 | Bytes(13.014,13015) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::14.014,14.015 | Bytes(14.014,14.015) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::14.018 | Bytes(14.018) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| | | | 1 | M | AlphaNumeric_US_RS::17.019 | Bytes(17.019) MO [0x20 to 0x7E, ASCII US, ASCII RS] | | | | |
| **Numbers2Dot2** | 9.1.11, 9.1.12 | The field shall consist of two numbers followed by a period followed by two numbers. | 1 | M | Numbers2Dot2::1.011, 1.012 | {1.011, 1.012} MO '##.##' | | | | |
| **1.012-NTR_-ZeroIfNoBinaryRecs** | 9.1.12 | For transactions that do not contain Type-3 through Type-7 fingerprint image records, field 1.012 (NTR) shall be set to "00.00". | 2 | M | 1.012-NTR_-ZeroIfNoBinaryRecs | If NOT Present(Type 3 to Type 7) Then {1.012} EQ "00.00" | | | | |
| **GMT** | 9.1.14 | The GMT is represented as YYYYMMDDHHMMSSZ, a 15-character string that is the concatenation of the date with the GMT and concludes with a Z. | 1 | O | GMT_Valid::1.014 | {1.014} Valid(YYYYMMDDHHMMSSZ) | | | | |
| **GMT_NotFuture** | 9.1.14 | The GMT shall not exceed the current date. | 1 | O | GMT_NotFuture::1.014 | {1.014} LTE {Date Today} | | | | |
| **1.014-GMT_NotFuture** | 9.1.14 | The complete GMT date shall not exceed the current date. | 2 | M | 1.014-GMT_NotFuture | {1.014} LTE {Current DateTime} | | | | |
| **SubFields** | 9.1.13, 9.1.15, 15.1.27, 15.1.32, 19.1.25 | The field shall contain subfields. | 1 | O | SubFields Expected::1.013 | Present( Subfield in 1.013) | | | | |
| | | | 1 | O | SubFields Expected::1.015 | Present(Subfield in 1.015 ) | | | | |
| | | | 1 | O | SubFields Expected::10.029 | Present(Subfield in 10.029 ) | | | | |
| | | | 1 | O | SubFields Expected::10.042 | Present(Subfield in 10.042 ) | | | | |
| | | | 1 | O | SubFields Expected::14.025 | Present(Subfield in 14.025 ) | | | | |
| **NotSupported** | 9.1.15 | The field is not supported. | 1 | O | NotSupported::1.015 | True | | | | |
| **1.015-DCS** | 9.1.15 | | | | | Not supported in this version | 1 | | | |
| **(Not Needed)** | 9.2 | Immediately following the last information field in the Type-1 logical record, an ASCII FS separator character shall be used to separate it from the next logical record. This ASCII FS character shall replace the "GS" character that is normally used between information fields. | 2 | M | See Above 1-FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |

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| **4::MandatoryFields** | 11.1 | In a Type 4 record, entries shall be provided in nine ordered and unnumbered fields. The data recorded is in binary form – no ASCII data. The first eight fields are fixed length and total eighteen bytes. These fields precede the image data contained in field nine. Table 10 lists the contents of each of the nine fields. | 2 | M | 4::MandatoryFields | In a Type 4 record, entries shall be provided in nine ordered and unnumbered fields. The data recorded is in binary form – no ASCII data. The first eight fields are fixed length and total eighteen bytes. These fields precede the image data contained in field nine. Table 10 lists the contents of each of the nine fields. | | | | |
| **4::LenData=LEN-18** | 11.1 | In a Type-4 record the size of the ninth field is eighteen bytes less than the value specified in the LEN field. | 2 | M | 4::LenData=LEN-18 | Length(4.009) EQ Length(Record) - 18 | | | | |
| **Length_Maximum_ Binary _Field** | 11.2 (Table 10) | The field length shall be as specified. | 1 | M | LengthMax::4.001 to 4.009 | Length(4.001 to 4.009) LTE {Length.Max} | | | | |
| **Length_Minimum_ Binary_Field** | 11.2 (Table 10) | The field length shall be as specified. | 1 | M | LengthMin::4.001 | Length(4.001 to 4.009) GTE {Length.Min} | | | | |
| **4.001::RecBytes** | 11.2.1 | The mandatory four-byte binary LEN field shall occupy bytes one through four of each record type. It shall contain the length of the logical record specifying the total number of bytes, including every byte of all nine fields contained in the record. | 2 | M | 4.001::RecBytes | Length(Record) EQ {4.001} | | | | |
| **4.002-CNT_IDCsMatchRecs** | 11.2.2 | The mandatory one-byte binary IDC field shall be a binary representation of the IDC found in the file content (CNT) field of the Type-1 record. | 2 | M | 4.003-CNT_IDCsMatchRecs | See Above 1.003-CNT_IDCsMatchRecs | | | | |
| **Table_11_Finger** | 11.2.3 | The field value shall be selected from Table 11. | 1 | M | Table_11_Finger::4.003 | {4.003} MO Table 11 | | | | |
| **Table_12_0To14** | 11.2.4 | The field value shall be selected from Table 12. | 1 | M | Table_12_0-14_Binary::4.004 | {4.004} MO [0 to 14] | | | | |
| **Values_0To1** | 11.2.5 | The value shall be 0 or 1. | 1 | M | 0-1_Binary::4.005 | {4.005} MO [0, 1] | | | | |
| **4.006-HLL** | 11.2.6 | Field 4.006 shall be used to specify the number of pixels contained on a single horizontal line of the transmitted image. | 2 | M | 4.006-JPEGB-JPEGL-HLL | {4.006} EQ {Image Width} | 3 | | | |
| | | | 2 | M | 4.006-WSQ-HLL | {4.006} EQ {Image Width} | 3 | | | |
| **4.007-VLL** | 11.2.7 | Field 4.007 shall be used to specify the number of horizontal lines contained in the transmitted image. | 2 | M | 4.007-JPEGB-JPEGL-VLL | {4.007} EQ {Image Height} | 3 | | | |
| | | | 2 | M | 4.007-WSQ-VLL | {4.007} EQ {Image Height} | 3 | | | |
| **Table_1_No_4-6** | 11.2.8 | The field value shall be selected from Table 1. Values 4 through 6 are not valid. | 1 | M | Table_1_No_4-6::4.008 | {4.008} NOT MO [4-6] AND {4.008} MO Table 1 | | | | |
| **4.008-ConfirmedCGA** | 11.2.8 | Field 4.008 shall be used to specify the type of compression used (if any). For the Type-4 logical record, the WSQ or the JPEG standard algorithms are recommended. | 2 | M | 4.011-JPEGB-JPEGL | {4.008} corresponds to {SOF marker} | 3 | | | |
| | | | 2 | M | 4.011-WSQ | Present(SOF, Image Height, Image Width) | 3 | | | |
| **4.009-ValidImage** | 11.2.9 | Field 4.009 shall contain the image data. | 2 | M | 4.009-Valid-Uncomp | Length(4.009) EQ {4.006} * {4.007} | | | | |

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| | | | 2 | M | 4.009-Valid-JPEGB-JPEGL | Present(SOI, SOF, EOI) | 3 | | | |
| | | | 2 | M | 4.009-Valid-WSQ | Present(SOI, SOF, SOB, EOI) | 3 | | | |
| **Type 10 Requirements and Assertions** | | | | | | | | | | |
| **10::FixedPositionFields** | 15.1 | It is required that the first two fields of the Type-10 record are ordered, and the field containing the image data shall be the last physical field in the record. | 2 | M | 10:001::LEN_First | First(Field in Record) ST Type(Record) EQ 10 AND Field EQ 10.001 | | | | |
| | | | 2 | M | 10:002::IDC_Second | Second(Field in Record) ST Type(Record) EQ 10 AND Field EQ 10.002 | | | | |
| | | | 2 | M | 10:999::DATA_Last | Last(Field in Record) ST Type(Record) EQ 10 AND Field EQ 10.999 in a Type-10 record. | | | | |
| **10::MandatoryFields** | 15.1, (Table 17) | For each field of the Type-10 record, Table 17 lists the "condition code" as being mandatory "M" or optional "O"…and occurrence limits. | 2 | M | 10::CondCode_M | IF "Cond code" EQ "M" in Table 17, Present(Field in Record) | | | | |
| | | | 2 | M | 10.xxx-MaxOccurances | Count(10.xxx) LTE MaxOccurrences(10.xxx) | | | | |
| | | | 2 | M | 10.xxx-MinOccurances | Count(10.xxx) GTE MinOccurrences(10.xxx) | | | | |
| **10::IMG=FAC_Fields** | 15.1 | Fields with “FAC” in the “IMG” column of Table 17 apply to mugshot or facial image Type-10 records. | 2 | M | 10::IMG=FAC_FaceOK | Fields with “FAC” in the “IMG” column of Table 17 apply to mugshot or facial image Type-10 records. | | | | |
| | | | 2 | M | 10::IMG=FAC_SmtBad | Fields with “SMT” in the “IMG” column of Table 17 do not apply to mugshot or facial image Type-10 records. | | | | |
| **10::IMG=SMT_Fields** | 15.1 | Fields with “SMT” in the “IMG” column of Table 17 apply to scar, mark or tattoo image Type-10 records | 2 | M | 10::IMG=SMT_-SmtOk | Fields with “SMT” in the “IMG” column of Table 17 apply to scar, mark or tattoo image Type-10 records. | | | | |
| | | | 2 | M | 10::IMG=SMT_-FaceBad | Fields with “FAC” in the “IMG” column of Table 17 do not apply to scar, mark or tattoo image Type-10 records. | | | | |
| **10::Len=Bytes** | 15.1.1 | Field 10.001: Logical record length (LEN)<br><br>This mandatory ASCII field shall contain the total count of the number of bytes in the Type-10 logical record. Field 10.001 shall specify the length of the record including every character of every field contained in the record and the information separators. | 2 | M | 10.001::Len=Bytes | {10.001} EQ Length(Record) | | | | |
| **10::IDC=CNT_IDC** | 15.1.2 | Field 10.002: Image designation character (IDC)<br><br>This mandatory ASCII field shall be used to identify the facial or SMT image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record. | 2 | M | 10.002::IDC=CNT_-IDC | {10.002} EQ {1.003} | | | | |

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| **FaceScarMarkTattoo** | 15.1.3 | The value shall be FACE, SCAR, MARK or TATTOO. | 1 | M | FaceScarMarkTattoo::10.003 | {10.003} MO ['FACE', 'SCAR', 'MARK', 'TATTOO'] | | | | |
| **10.006-HLL** | 15.1.6 | Field 10.006 shall contain the number of pixels contained on a single horizontal line of the transmitted image. | 2 | M | 10.006-JPEGB-JPEGL-HLL | {10.006} EQ {Image Width} | | | | |
| | | | 2 | M | 10.006-JP2-JP2L-HLL | {10.006} EQ {Image Width} | | | | |
| | | | 2 | M | 10.006-PNG-HLL | {10.006} EQ {Image Width} | | | | |
| **NotifyOnZero** | 15.1.6, 15.1.7, 18.1.6, 18.1.7, 19.1.6, 19.1.7, 22.2.6, 22.2.7 | If the field value is zero note this fact in the output. | 1 | M | NotifyOnZero::10.006, 10.007 | {10.006,10.007} NEQ 0 | | | | |
| | | | 1 | M | NotifyOnZero::13.006, 13.007 | {13.006, 13.007} NEQ 0 | | | | |
| | | | 1 | M | NotifyOnZero::14.006, 14.007 | {14.006, 14.007} NEQ 0 | | | | |
| | | | 1 | M | NotifyOnZero::17.006, 17.007 | {17.006,17.007} NEQ 0 | | | | |
| **10.007-VLL** | 15.1.7 | Field 10.007 shall contain the number of horizontal lines contained in the transmitted image. | 2 | M | 10.007-JPEGB-JPEGL-VLL | {10.007} EQ {Image Height} | | | | |
| | | | 2 | M | 10.007-JP2-JP2L-VLL | {10.007} EQ {Image Height} | | | | |
| | | | 2 | M | 10.007-PNG-VLL | {10.007} EQ {Image Height} | | | | |
| **Values_0To2** | 15.1.8, 19.1.8, 22.2.3, 22.2.8 | The value shall be 0, 1 or 2. | 1 | M | Values_0To2::10.008 | {10.008} MO [0-2] | | | | |
| | | | 1 | M | Values_0To2::14.008 | {14.008} MO [0-2] | | | | |
| | | | 1 | M | Values_0To2::17.003 | {17.003} MO [0-2] | | | | |
| | | | 1 | M | Values_0To2::17.008 | {17.008} MO [0-2] | | | | |
| **10.008-SLC** | 15.1.8 | Field 10.008 shall specify the units used to describe the image sampling frequency (pixel density). | 2 | M | 10.008-JPEGB-JPEGL-SLC | IF Present(JFIF Header) THEN {10.008} EQ {Sampling Units} | 3 | | | |
| | | | 2 | M | 10.008-JP2-JP2L-SLC | Not Implemented | 4 | | | |
| | | | 2 | M | 10.008-PNG-SLC | IF Present(PHYS chunk) THEN IF {10.008} EQ “1” OR “2” THEN {Sampling Units} EQ 1, ELSE IF {10.008} EQ 0 THEN{Sampling Units} EQ 0 | 3 | | | |
| **10.009-HPS** | 15.1.9 | Field 10.010 shall specify the integer pixel density used in the horizontal direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the horizontal component of the pixel aspect ratio. | 2 | M | 10.009-JPEGB-JPEGL | IF {10.008} EQ “1” OR “2”, THEN IF Present(JFIF Header) THEN {10.009} EQ {Horizontal Density} | 3 | | | |
| | | | 2 | M | 10.009-JP2-JP2L-HPS | No Implementation | 4 | | | |
| | | | 2 | M | 10.009-PNG-HPS | IF Present(PHYS Chunk) THEN IF {10.008} EQ “1”, THEN {10.009} EQ {Horizontal Density} * 0.0254 (meters/inch) ELSE IF {10.008} EQ “2”, THEN {10.009} EQ {Horizontal Density} * 0.01 (meters/cm) | 3 | | | |
| | | | 2 | M | 10.009-JPEGB- | IF {13.008} NEQ “1” OR “2”, THEN | 3 | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JPEGL-HorzAspect | {13.009} EQ {Horizontal Density} / {Vertical Density} | | | | |
| | | | 2 | M | 10.009-JP2-JP2L-HorzAspect | No Implementation | 4 | | | |
| | | | 2 | M | 10.009-PNG-HorzAspect | IF Present(PHYS Chunk), THEN IF {10.008} NEQ "1" OR "2", THEN {10.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| **10.010-VPS** | 15.1.10 | Field 10.010 shall specify the integer pixel density used in the vertical direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the vertical component of the pixel aspect ratio. | 2 | M | 10.010-JPEGB-JPEGL-VPS | IF {10.008} EQ "1" OR "2", THEN IF Present(JFIF Header) THEN {10.010} EQ {Vertical Density} | 3 | | | |
| | | | 2 | M | 10.010-JP2-JP2L-VPS | No Implementation | 4 | | | |
| | | | 2 | M | 10.010-PNG-VPS | IF Present(PHYS Chunk) THEN IF {10.008} EQ "1", THEN {10.010} EQ {Vertical Density} * 0.0254 (meters/inch) ELSE IF {10.008} EQ "2", THEN {10.010} EQ {Vertical Density} * 0.01 (meters/cm) | 3 | | | |
| | | | 2 | M | 10.010-JPEGB-JPEGL-VerAspect | IF {10.008} NEQ "1" OR "2", THEN {10.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 10.010-JP2-JP2L-VerAspect | No Implementation | 4 | | | |
| | | | 2 | M | 10.010-PNG-VerAspect | IF Present(PHYS Chunk), THEN IF {10.008} NEQ "1" OR "2", THEN {10.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| **Table_1_No_WSQ** | 15.1.11 | The field value shall be selected from Table 1. WSQ is not valid. | 1 | M | Table_1_No_WSQ::10.011 | {10.011} NOT WSQ AND {10.011} MO Table 1 | | | | |
| **10.011-ConfirmedCGA** | 15.1.11 | Field 10.011 shall contain an entry from Table 1 (other than WSQ) to specify the algorithm used to compress the transmitted grayscale images. | 2 | M | 10.011-JPEGB-JPEGL-CGA | {10.011} corresponds to {SOF marker} | 3 | | | |
| | | | 2 | M | 10.011-JP2-JP2L-CGA | {5th parameter of ImgBox} EQ "7" | 3 | | | |
| | | | 2 | M | 10.011-PNG-CGA | Present(IHDR) | 3 | | | |
| **Table_3** | 15.1.12, 22.2.13 | The field value shall be selected from Table 3. | 1 | M | Table_3::10.012 | {10.012} MO Table 3 | | | | |
| | | | 1 | M | Table_3::17.013 | {17.013} MO Table 3 | | | | |
| **10.012-CSP** | 15.1.12 | Field 15.012 shall contain an entry from Table 3 to identify the color space used. If the color space for an RGB image cannot be determined, an entry of "RGB" shall be entered. | 2 | M | 10.012-JPEGB-JPEGL-CSP | No Implementation | 4 | | | |
| | | | 2 | M | 10.012-JP2-JP2L-CSP | IF Present(Colour Specification box), THEN {10.012} corresponds to {CSP} | 3 | | | |
| | | | 2 | M | 10.012-PNG-CSP | {10.012} corresponds to {CSP} | 3 | | | |
| **Table_18** | 15.1.13 | The field value shall be selected from Table 18. | 1 | M | Table_18::10.013 | {10.013} MO [0, 1, 10, 11, 12, 13, 14, 15, 20, 30, 40, 50, 51] | 5 | | | |
| **10.003::IMT=FACE_SAP_Mandatory** | 15.1.13 | Field 10:013, the Subject Acquisition Profile (SAP), is mandatory when field 10.003 contains "FACE". | 2 | M | 10.003::IMT=FACE_SAP_Mandatory | Field 10:013, the Subject Acquisition Profile (SAP), is mandatory when field 10.003 contains "FACE". | | | | |

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| **RESERVED_FIELDS** | 15.1.14 | Fields 10.014 and 10.015 are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 10.014::Reserved | Present(10.014) | | | | |
| | | | - | - | 10.015::Reserved | Present(10.015) | | | | |
| **RESERVED_FIELDS** | 15.1.17 | Fields 10.018 and 10.019 are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 10.018::Reserved | Present(10.018) | | | | |
| | | | - | - | 10.019::Reserved | Present(10.019) | | | | |
| **SubjectPose_Table_19** | 15.1.18 | The value shall be selected from Table 19. | 1 | O | SubjectPose::10.020 | {10.020} MO ['F', 'R', 'L', 'A', 'D'] | | | | |
| **-180_To_180** | 15.1.19 | The offset angle shall be measured from the full-face pose position and have a range of values from -180 degrees to +180 degrees. | 1 | O | -180_To_180::10.021 | {10.021} LTE 180 AND {10.021} GTE -180 | 5 | | | |
| **10.021::POS=A_-POA_Mandatory** | 15.1.19 | Field 10.021, Pose offset angle (POA), shall only be used for the exchange of facial image data if Field 10.020 (POS) contains an "A" to indicate an angled pose of the subject. This field should be omitted for a full face or a profile. If the entry in the POS field is an "F", "L", or "R", the contents of this field are ignored. | 2 | O | 10.021::POS=A_-POA_Mandatory | IF{10.020} EQ “A” THEN Present(10.021) | | | | |
| **Photo_Description** | 15.1.20 | This optional ASCII field, retained for legacy systems, is used for the exchange of facial image data. When present, it shall consist of one or more subfields and shall describe special attributes of the captured facial image. Attributes associated with the facial image may be selected from Table 20 and entered in this field as one or more subfields separated by the ASCII RS separator character between the items. Physical characteristics, such as FRECKLES may be entered as a subfield consisting of two information items. The first is PHYSICAL followed by the ASCII US separator, followed by the characteristic as listed in the Ninth (or current) Edition of the NCIC Code Manual, December, 2000. The OTHER category is used to enter unlisted or miscellaneous attributes of the facial image. This information shall be entered as a two-information item subfield. The first is OTHER followed by the ASCII US separator, followed by the | 1 | O | Photo_Descriptors::10.022 | {10.022} MO Table 20 | | | | |

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| | | unformatted text used to describe the attribute. Multiple attributes and subfields may be listed but must be separated by the ASCII RS character. | | | | | | | | |
| **Table_21** | 15.1.21 | The field value shall be selected from Table 21. | 1 | O | 10.023_Table_21::10.023 | {10.023} MO Table 21 | | | | |
| **Subfields_1x[1,2]** | 15.1.21 | The field shall be single or have two subfields. The subfields shall be separated by ASCII US. | 1 | O | 1x1_Or_1x2::10.023 | Count(US_Subfields in 10.023 ) EQ 0<br>OR<br>Count(US_Subfields in 10.023 ) EQ 2 | 2 | | | |
| **10.023::SAP>=40_-PAS_Mandatory** | 15.1.21 | Field 10.023, Photo acquisition source (PAS), is mandatory if the SAP entry (Field 10.013) is "40" or greater. | 2 | O | 10.023::SAP>=40_-PAS_Mandatory | IF {10.013} GTE 40 THEN Present(10.023) | | | | |
| **SubFields_Nx3** | 15.1.22, 22.2.24 | Each subfield shall contain three information items separated by the ASCII US separator character. The field shall contain one or more rows of subfields. | 1 | O | SubFields_Nx3::10.024 | ForEach(Subfield in 10.024 ){<br>Count(items) EQ 3} | | | | |
| | | | 1 | O | SubFields_Nx3::17.024 | ForEach(Subfield in 17.024 ){<br>Count(items) EQ 3} | | | | |
| **Subject_Quality_Score** | 15.1.22 | This optional ASCII field shall specify quality score data for facial images stored in this record. Each subfield shall contain three information items separated by the ASCII US separator character. They identify a quality score and the algorithm used to create the quality score. This information is useful to enable the recipient of the quality score to differentiate between quality scores generated by different algorithms and adjust for any differences in processing or analysis as necessary.<br><br>1. The first information item shall be a quantitative expression of the predicted matching performance of the biometric sample. This item contains the ASCII representation of the integer image quality score between 0 and 100 assigned to the image data by a quality algorithm. Higher values indicate better quality. An entry of 255 shall indicate a failed attempt to calculate a quality score. An entry of 254 shall indicate that no attempt to calculate a quality score was made. The use of additional values to convey other information should be harmonized with ISO/IEC 19794 standards.<br><br>2. The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the | 1 | O | Subject_Quality_Score::10.024 | ForEach(RS_Subfield in 14.024)<br>{<br>Count(US_Subfield) EQ 3<br><br>AND<br><br>{US_Subfield:1} GTE 0 AND<br>{US_Subfield:1} LTE 100 OR<br>{US_Subfield:1} MO [254,255]<br><br>AND<br><br>{US_Subfield:2} MO [IBIA Vendor Registry]<br>AND<br><br>{US_Subfield:3} GTE 1 AND<br>{US_Subfield:3} LTE 65535 OR<br><br>} | 2 | | | |

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| | | quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization.<br><br>3. The third information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with the IBIA, but it is not required to be registered. It indicates which of the vendor's algorithms was used in the calculation of the quality score. This field contains the ASCII representation of the integer product code and should be within the range 1 to 65,535. | | | | | | | | |
| **IBIA_Quality_-Vendor** | 15.1.22 | Field 10.024: Subject quality score (SQS)<br><br>This optional ASCII field shall specify quality score data for facial images stored in this record. …<br><br>2. The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization.<br><br>…. | 2 | O | 10.024::IBIA_-Quality_Vendor | The code exists in the IBIA Vendor Registry of CBEFF Biometric Organizations. | | | | |
| **10.025::POS=D_-SPA_Mandatory** | 15.1.23 | Field 10.025, Subject pose angles (SPA), is mandatory when Field 10.020 (POS) contains a "D". | 2 | O | 10.025::POS=D_-SPA_Mandatory | IF{10.020} EQ "D" THEN Present(10.025) | | | | |
| **Single_Or_SubFields** | 15.1.20, 15.1.24, 15.1.30, 15.1.33 | The field can have one or more subfields. | 1 | O | SingleOrSubFields:: 10.022 | True | | | | |
| | | | 1 | O | SingleOrSubFields:: 10.026 | True | | | | |
| | | | 1 | O | SingleOrSubFields:: 10.040 | True | | | | |
| | | | 1 | O | SingleOrSubFields:: 10.043 | True | | | | |
| **AlphaNumeric_RS** | 15.1.24 | The field shall only contain alphanumeric characters (ASCII 0x20 through 0x7E) and ASCII RS (0x1E). | 1 | O | AlphaNumeric_RS:: 10.026 | Bytes(10.026) MO [0x20-0x7E, ASCII RS] | | | | |

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| **10.026::SAP_>=_40 _Mandatory** | 15.1.24 | Field 10.026, Subject facial description (SXS), is mandatory if the SAP entry (Field 10.013) is "40" or greater. | 2 | O | 10.026::SAP_>=_40 _Mandatory | IF {10.013} GTE “40” THEN Present(10.026) | | | | |
| **EyeColor** | 15.1.25 | The field value shall be selected from Table 23. | 1 | O | EyeColor::10.027 | {10.027} MO Table 30 | | | | |
| | | | 1 | O | EyeColor::17.020 | {17.020} MO Table 30 | | | | |
| **10.027::SAP_>=_40 _Mandatory** | 15.1.25 | Field 10.027, Subject eye color (SEC), is mandatory if the SAP entry (Field 10.013) is "40" or greater. | 2 | O | 10.027::SAP_>=_40 _Mandatory | IF{10.013} GTE “40” THEN Present(10.027) | | | | |
| **Subfields_[1,2]x1** | 15.1.26 | The field shall be single or have two subfields. The subfields shall be separated by ASCII RS. | 1 | O | 1x1_Or_2x1::10.028 | Count(Subfields in 10.028 ) EQ 0 OR Count(Subfields in 10.028 ) EQ 2 | | | | |
| **Subject_Hair_Color** | 15.1.26 | This optional ASCII field shall be used for the exchange of facial image data. This field is mandatory if the SAP entry (Field 10.013) is 40 or greater. When present, it shall contain an entry form Table 24 that describes the hair color of the subject as seen in the photograph. For unusual or unnatural colors not listed in the table, or the real color cannot be ascertained, the hair color should be labeled as XXX. If the subject is completely bald, or has a completely shaved head, then the hair color shall be labeled as BAL. When the subject is predominantly bald, but hair color is discernable, then the appropriate hair color attribute code shall follow BAL (separated by the ASCII RS character). | 1 | O | Subject_Hair_Color::10.028 | {10.028} MO Table 24 | | | | |
| **10.028::SAP_>=_40 _Mandatory** | 15.1.26 | Field 10.028, Subject hair color (SHC), is mandatory if the SAP entry (Field 10.013) is "40" or greater. | 2 | O | 10.028::SAP_>=_40 _Mandatory | IF {10.013} GTE “40” THEN Present(10.028) | | | | |
| **10.028::Bald_2nd_Color** | 15.1.26 | Field 10.028: Subject hair color (SHC)<br><br>If the subject is completely bald, or has a completely shaved head, then the hair color shall be labeled as “BAL”. When the subject is predominantly bald, but hair color is discernable, then the appropriate hair color attribute code shall follow “BAL” (separated by the ASCII RS). | 2 | O | 10.028::Bald_2nd_-Color | IF (1,1) = “BAL”<br>(2,1) = {NULL Or {All Color Attributes Except “BAL”}} | | | | |
| **FeaturePoint** | 15.1.27 | The optional ASCII field shall be used for the exchange of facial image data. When present, it shall describe special attributes of manually or automatically detected facial feature points of the captured facial image. This information shall be entered as a four-information item feature point block as described in Table 25. The first information item is | 1 | O | Subject_Feature_Points::10.029 | ForEach(RS_Subfield in 10.029)<br>{<br>US_Subfield:1 EQ 1<br><br>AND<br><br>US_Subfield:2 EQ A.B ST A.B MO Figure 5 AND A.B NOT MO [Prior A.B] | 2 | | | |

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| | | feature point type. For this version of the standard the only allowable value is1 which is followed by the ASCII US separator character. The second is feature point code, followed by the ASCII US separator character. The third is the X coordinate of a feature point, followed by the ASCII US separator character. The fourth and final item is the Y coordinate of a feature point in the facial image. Multiple facial points may be listed using these four information items. But each feature block must be separated by the ASCII RS separator character. The maximum number of feature points shall be 88, with the use of 84 MPEG4 feature points and 4 additional eye and nostril center feature points. | | | | AND<br>{US_Subfield:3} > 0 AND<br>Length(US_Subfield:3) MO [1,2,3,4]<br><br>AND<br><br>{US_Subfield:4} > 0 AND<br>Length(US_Subfield:4) MO [1,2,3,4]<br><br>} | | | | |
| **10.029::No_-Duplicate_-Feature_Points** | 15.1.27 | Field 10.029: Facial feature points (FFP)<br><br>The optional ASCII field shall be used for the exchange of facial image data. … The maximum number of feature points shall be 88, with the use of 84 MPEG4 feature points and 4 additional eye and nostril center feature points. | 2 | O | 10.029::No_-Duplicate_-Feature_Points | All Facial Feature Points (FPP) (X,Y) are unique. | | | | |
| **Table_27** | 15.1.28, 19.1.27, 22.2.28, Table 27 | The field value shall be selected from Table 27. | 1 | O | Table_27::10.030 | {10.030} MO Table 27 | | | | |
| | | | 1 | O | Table_27::14.030 | {14.030} MO Table 27 | | | | |
| | | | 1 | O | Table_27::17.030 | {17.030} MO Table 27 | | | | |
| **RESERVED_FIELDS** | 15.1.29 | Field 10.031-039: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 10.031-039::-Reserved | Present(10.031 to 10.039) | | | | |
| **NCIC_Designation_Code** | 15.1.30 | This field is mandatory for a Type-10 record containing SMT image data. It is used to identify a general location of the captured scar, mark, tattoo, or other characteristic (including piercings) in an image. The contents of this field will be an entry chosen from the December, 2000 ninth (or current) edition of the NCIC Code Manual. The captured image can encompass an area larger than that | 1 | O | NCIC_Designation_Code::10.040 | {10.040} MO [NCIC Designation Codes] | 5 | | | |

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| | | specified by a single NCIC body part code for the particular image type. This situation can be accommodated by listing multiple NCIC codes separated by the ASCII RS separator character. In this case the primary code is listed first. For the marks category, the NCIC manual lists the common locations for needle track marks. For other body part locations not listed under the marks category, use the body location codes listed for scars. | | | | | | | | |
| **10.040::SMT_-Image_Data_-SMT_Field_-Mandatory** | 15.1.30 | Field 10.040, NCIC designation code (SMT), is mandatory for a Type-10 record containing SMT image data. | 2 | O | 10.040::SMT_-Image_Data_-SMT_Field_-Mandatory | Field 10.040, NCIC designation code (SMT), is mandatory for a Type-10 record containing SMT image data. | | | | |
| **Subfields_1x2** | 15.1.31, | The field shall have two subfields separated by ASCII US. | 1 | O | 1x2::10.041 | Count(Subfields in 10.041 ) EQ 2 | | | | |
| | 19.1.14 | | 1 | O | 1x2::14.014 | Count(Subfields in 14.014 ) EQ 2 | | | | |
| **SMT_Descriptors** | 15.1.32 | This optional field is used to describe the content of the SMT image. It shall consist of one or more subfields. Each subfield shall contain three or four information items that provide progressively detailed information describing the total image or a portion of the image. The first information item of each subfield shall identify the source of the image as being a scar, a mark, or a tattoo. It shall contain SCAR to indicate healed scar tissue that was the result an accident or medical procedure. An entry of MARK shall be used for the pattern resulting from needle or track marks. For either case the second and third information items shall contain OTHER and MISC and the fourth information item shall contain a textual description or other information concerning the scar or mark pattern. For deliberately applied or drawn images, the first information item will contain TATTOO to indicate a common tattoo or indelible image resulting from the pricking of the skin with a coloring matter; CHEMICAL if the image was created by the use of chemicals to burn the image into the skin; BRANDED if the image was burned into the skin using a branding iron or other form of heat; or CUT if the image was caused by incision of the skin. | 1 | O | SMT_Descriptors::10.042 | ForEach(RS_Subfield in 10.042)<br>{<br>US_Subfield:1 MO ['SCAR', 'MARK', 'TATTOO', 'CHEMICAL', 'BRANDED', 'CUT']<br><br>AND<br><br>IF US_Subfield:1 MO ['SCAR','MARK'] THEN<br>{<br>US_Subfield:2 EQ 'OTHER' AND<br>US_Subfield:3 EQ 'MISC'<br>}<br>ELSE<br>{<br>US_Subfield:2 MO Table 28 AND<br>US_Subfield:3 MO Table 29 a to h<br>}<br>} | 2 | | | |
| | 15.1.32 | Field 10.042: SMT descriptors (SMD) | 2 | O | 10.042::SCAR_- | IF (N,1) = "SCAR" | | | | |

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| **10.042::SCAR_-MARK_OTHER_-MISC_Text** | | This optional field is used to describe the content of the SMT image. It shall consist of one or more subfields. Each subfield shall contain three or four information items that provide progressively detailed information describing the total image or a portion of the image.<br><br>The first information item of each subfield shall identify the source of the image as being a scar, a mark, or a tattoo. It shall contain “SCAR” to indicate healed scar tissue that was the result an accident or medical procedure. An entry of “MARK” shall be used for the pattern resulting from needle or track marks. For either case the second and third information items shall contain “OTHER” and “MISC” and the fourth information item shall contain a textual description or other information concerning the scar or mark pattern.<br><br>For deliberately applied or drawn images, the first information item will contain "TATTOO" … | | | MARK_OTHER_-MISC_Text | (N,2) = “OTHER”<br>(N,3) = “MISC”<br>(N,4) = Text | | | | |
| **10.042::SCAR_-MARK_(1x4)** | 15.1.32 | The first information item of each subfield shall identify the source of the image as being a scar, a mark, or a tattoo. It shall contain “SCAR” to indicate healed scar tissue that was the result an accident or medical procedure. An entry of “MARK” shall be used for the pattern resulting from needle or track marks. For either case the second and third information items shall contain “OTHER” and “MISC” and the fourth information item shall contain a textual description or other information concerning the scar or mark pattern. | 2 | O | 10.042::SCAR_-MARK_(1x4) | IF(N,1) = “SCAR”<br>Row N is (N,4) | | | | |
| **10.042::TATTOO** | 15.1.32 | Field 10.042: SMT descriptors (SMD)<br><br>This optional field is used to describe the content of the SMT image…<br><br>The first information item of each subfield shall identify the source of the image as being a scar, a mark, or a | 2 | O | 10.042::TATTOO | IF(N,1) In {“TATTOO”, “CHEMICAL”, “BRANDED”, “CUT”}<br>(N,2) In {Table 28}<br>(N,3) In {Table 29}<br>(N,4) In {NULL, Text} | | | | |

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| | | tattoo. It shall contain “SCAR” …<br><br>For deliberately applied or drawn images, the first information item will contain "TATTOO" to indicate a common tattoo or indelible image resulting from the pricking of the skin with a coloring matter; "CHEMICAL" if the image was created by the use of chemicals to burn the image into the skin; "BRANDED" if the image was burned into the skin using a branding iron or other form of heat; or “CUT” if the image was caused by incision of the skin.<br><br>The second information item shall be the general class code of tattoo chosen from Table 28. For each general class of tattoo, there are several defined subclasses. The third information item of the subfield shall be the appropriate subclass code selected from Table 29 a-h which lists the various subclasses of tattoos for each of the general classes.<br><br>The final and optional information item in this subfield shall be an ASCII text string that provides additional qualifiers to describe the image or portion of the image. For example, to fully describe a tattoo, there may be a class description of "ANIMAL", with a subclass description of "DOG", and qualified by "golden retriever with an overbite". The ASCII US separator character will be used between information items. | | | | | | | | |
| **10.042::TATTOO_-(1x3)_Or_(1x4)** | 15.1.32 | Field 10.042: SMT descriptors (SMD)<br><br>This optional field is used to describe the content of the SMT image…<br><br>The first information item of each subfield shall identify the source of the image as being a scar, a mark, or a tattoo. It shall contain “SCAR” …<br><br>For deliberately applied or drawn images, the first information item will contain "TATTOO" to indicate a …<br><br>The final and optional information | 2 | O | 10.042::TATTOO_-(1x3)_Or_(1x4) | IF (N,1) In {“TATTOO”, “CHEMICAL”, “BRANDED”, “CUT”}<br>(N,2) Is Not NULL<br>(N,3) Is Not NULL<br>(N,4) Is NULL Or Not NULL<br>(Optional) | | | | |

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| | | item in this subfield shall be an ASCII text string that provides additional qualifiers to describe the image or portion of the image. For example, to fully describe a tattoo, there may be a class description of "ANIMAL", with a subclass description of "DOG", and qualified by "golden retriever with an overbite". The ASCII US separator character will be used between information items. | | | | | | | | |
| **Color_Tattoo** | 15.1.33 | This optional field shall contain one subfield corresponding to each subfield contained in Field 10.042. Each subfield shall contain one or more information items that list the color(s) of the tattoo or part of the tattoo. For each subfield, the first information item in the subfield shall be the predominant color chosen from Table 30. Additional colors for the sub-field shall be entered as information items in the subfield separated by the ASCII US separator character. | 1 | O | Color::10.043 | {10.043} MO Table 30 | | | | |
| **10.043::Num-Subfields** | 15.1.33 | Field 10.043: Color (COL)<br><br>This optional field shall contain one subfield corresponding to each subfield contained in Field 10.042. | 2 | O | 10.043::Num-Subfields | IF Present(10.043) THEN Count(Subfields in10.043) EQ Count(Subfields in 10.042) | | | | |
| **RESERVED_FIELDS** | 15.1.34 | Field 10.044-199: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 10:044-199::-Reserved | Present(10.044 to 10.199) | | | | |
| **Binary_Tagged_Field** | 15.1.36, | Binary data is opaque. | 1 | M | BinaryData::10.999 | True | | | | |
| | | | 1 | M | BinaryData::13.999 | True | | | | |
| | | | 1 | M | BinaryData::14.999 | True | | | | |
| | | | 1 | M | BinaryData::17.999 | True | | | | |
| **10.999-ValidImage** | 15.1.36 | Field 10.999 shall contain all of the grayscale or color image data from a face, scar, mark, tattoo, or other image. | 2 | M | 10.999-Valid-Uncomp | Length(10.999) EQ {10.006} * {10.007} | | | | |
| | | | 2 | M | 10.999-Valid-JPEGB-JPEGL | Present(SOI, SOF, EOI) | | | | |
| | | | 2 | M | 10.999-Valid-JP2-JP2L | Present(SigBox, HeadBox, ImgBox) | | | | |
| | | | 2 | M | 10.999-Valid-PNG | Present(PNGSIG, IHDR, IDAT, IEND) | | | | |

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| **10::FsAtEnd** | 15.2 | End of Type-10 logical record<br><br>For the sake of consistency, immediately following the last byte of data from field 10.999 an ASCII FS separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-10 record. | 2 | M | 10::FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| **Type 13 Requirements and Assertions** | | | | | | | | | | |
| **13::MandatoryFields** | 18.1, Table 31 | For each field of the Type-13 record, Table 31 lists the "condition code" as being mandatory "M" or optional "O"…and occurrence limits. | 2 | M | 13::CondCode_M | IF "Cond code" EQ "M" in Table 31, the Field must be present in the record. | | | | |
| | | | 2 | M | 13.xxx-MaxOccurrences | Count(13.xxx) LTE MaxOccurrences(13.xxx) | | | | |
| | | | 2 | M | 13.xxx-MinOccurrences | Count(13.xxx) GTE MinOccurrences(13.xxx) | | | | |
| **13::FixedPosition-Fields** | 18.1 | It is required that the first two fields of the record are ordered, and the field containing the image data shall be the last physical field in the record. | 2 | M | 13.001::LEN_First | First(Field in Record) ST Type(Record) EQ 13 AND Field EQ 13.001 | | | | |
| | | | 2 | M | 13.002::IDC_Second | Second(Field in Record) ST Type(Record) EQ 13 AND Field EQ 13.002 | | | | |
| | | | 2 | M | 13.999::DATA_Last | Last(Field in Record) ST Type(Record) EQ 13 AND Field EQ 13.999 | | | | |
| **13::Len=Bytes** | 18.1.1 | Field 13.001: Logical record length (LEN)<br><br>This mandatory ASCII field shall contain the total count of the number of bytes in the Type-13 logical record. Field 13.001 shall specify the length of the record including every character of every field contained in the record and the information separators. | 2 | M | 13:001::Len=Bytes | {13.001} EQ Length(Record) | | | | |
| **13::IDC=CNT_IDC** | 18.1.2 | Field 13.002: Image designation character (IDC)<br><br>This mandatory ASCII field shall be used to identify the latent image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record. | 2 | M | 13.002::IDC=CNT_-IDC | The IDC matches the value of the corresponding CNT field of the Type-1 record. | | | | |
| **Table_11_LatentFngrPlm** | 18.1.3 | The field value shall be selected from Table 11. | 1 | M | Table_11_LatentFingerPalm::13.003 | {13.003} MO [4-7, 12-15] | | | | |
| **13.006-HLL** | 18.1.6 | Field 13.006 shall contain the number of pixels contained on a single horizontal line of the transmitted image. | 2 | M | 13.006-JPEGL-HLL | {13.006} EQ {Image Width} | 3 | | | |
| | | | 2 | M | 13.006-JP2L-HLL | {13.006} EQ {Image Width} | 3 | | | |
| | | | 2 | M | 13.006-PNG-HLL | {13.006} EQ {Image Width} | 3 | | | |
| **13.007-VLL** | 18.1.7 | Field 13.007 shall contain the number of horizontal lines contained in the | 2 | M | 13.007-JPEGL-VLL | {13.007} EQ {Image Height} | 3 | | | |
| | | | 2 | M | 13.007-JP2L-VLL | {13.007} EQ {Image Height} | 3 | | | |

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| | | transmitted image. | 2 | M | 13.007-PNG-VLL | {13.007} EQ {Image Height} | 3 | | | |
| **13.008-SLC** | 18.1.8 | Field 13.008 shall specify the units used to describe the image sampling frequency (pixel density). | 2 | M | 13.008-JPEGL-SLC | IF Present(JFIF Header) THEN {13.008} EQ {Sampling Units} | | | | |
| | | | 2 | M | 13.008-JP2L-SLC | No Implementation | 4 | | | |
| | | | 2 | M | 13.008-PNG-SLC | IF Present(PHYS Chunk) THEN IF {13.008} EQ 1 OR 2 THEN {Sampling Units} EQ 1, ELSE IF {13.008} EQ 0 THEN {Sampling Units} EQ 0 | 3 | | | |
| **13.009-HPS** | 18.1.9 | Field 13.010 shall specify the integer pixel density used in the horizontal direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the horizontal component of the pixel aspect ratio. | 2 | M | 13.009-JPEGL-HPS | IF {13.008} EQ "1" OR "2", THEN IF Present(JFIF Header) THEN {13.009} EQ {Horizontal Density} | 3 | | | |
| | | | 2 | M | 13.009-JP2L-HPS | No Implementation | 4 | | | |
| | | | 2 | M | 13.009-PNG-HPS | IF Present(PHYS Chunk) THEN IF {13.008} EQ "1", THEN {13.009} EQ {Horizontal Density} * 0.0254 (meters/inch) ELSE IF {13.008} EQ "2", THEN {13.009} EQ {Horizontal Density} * 0.01 (meters/cm) | 3 | | | |
| | | | 2 | M | 13.009-JPEGL-HorzAspect | IF {13.008} NEQ "1" OR "2", THEN {13.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 13.009-JP2L-HorzAspect | No Implementation | 4 | | | |
| | | | 2 | M | 13.009-PNG-HorzAspect | IF Present(PHYS Chunk), THEN IF {13.008} NEQ "1" OR "2", THEN {13.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| **13.010-VPS** | 18.1.10 | Field 13.010 shall specify the integer pixel density used in the vertical direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the vertical component of the pixel aspect ratio. | 2 | M | 13.010-JPEGL-VPS | IF {13.008} EQ "1" OR "2", THEN IF Present(JFIF Header) THEN {13.010} EQ {Vertical Density} | 3 | | | |
| | | | 2 | M | 13.010-JP2L-VPS | No Implementation | 4 | | | |
| | | | 2 | M | 13.010-PNG-VPS | IF Present(PHYS Chunk) THEN IF {13.008} EQ "1", THEN {13.010} EQ {Vertical Density} * 0.0254 (meters/inch) ELSE IF {13.008} EQ "2", THEN {13.010} EQ {Vertical Density} * 0.01 (meters/cm) | 3 | | | |
| | | | 2 | M | 13.010-JPEGL-VerAspect | IF {13.008} NEQ "1" OR "2", THEN {13.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 13.010-JP2L-VerAspect | No Implementation | 4 | | | |
| | | | 2 | M | 13.010-PNG-VerAspect | IF Present(PHYS Chunk), THEN IF {13.008} NEQ "1" OR "2", THEN {13.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| **Table_1_No_Lossy** | 18.1.11 | The field value shall be selected from | 1 | M | Table_1_No_Lossy:: | {13.011} MO ["NONE", "JPEGL", "JP2L", | 3 | | | |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | Table 1. Lossy algorithms are not valid. | | | 13.011 | "PNG"] | | | | |
| **13.011-ConfirmedCGA** | 8.1.10, 18.1.11 | The variable-resolution latent image data contained in the Type-13 logical record shall be uncompressed or may be the output from a lossless compression algorithm.<br>Field 13.011 shall specify the algorithm used to compress the transmitted grayscale images. | 2 | M | 13.011-JPEGL-CGA | {13.011} corresponds to {SOF } | | | | |
| | | | 2 | M | 13.011-JP2L-CGA | {5th parameter of Image Header box} EQ "7" | 3 | | | |
| | | | 2 | M | 13.011-PNG-CGA | Present(IHDR) | 3 | | | |
| **Bits_Per_Pixel** | 18.1.12, 19.1.12, 22.2.12 | This mandatory ASCII field shall contain the number of bits used to represent a pixel. This field shall contain an entry of 8 for normal grayscale values of 0 to 255. Any entry in this field greater than 8 shall represent a grayscale pixel with increased precision. | 1 | M | Table_BPX_ASCII::13.012 | {13.012} MO [8-16] | | | | |
| | | | 1 | M | Table_BPX_ASCII::14.012 | {14.012} MO [8-16] | | | | |
| | | | 1 | M | Table_BPX_ASCII::17.012 | {17.012} MO [8-16] | | | | |
| **13.012-ConfirmedBPX** | 18.1.12 | Field 13.012 shall contain the number of bits used to represent a pixel. | 2 | M | 13.012-JPEGL-CBPX | {13.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 13.012-JP2L-CBPX | IF {4th parameter of Image Header box} NEQ "255", THEN {13.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 13.012-PNG-CBPX | {13.012} EQ {BPX} | 3 | | | |
| **Finger_Palm_Position** | 18.1.13 | This mandatory tagged field shall contain one or more possible finger or palm positions that may match the latent image. The decimal code number corresponding to the known or most probable finger position shall be taken from Table 12 or the most probable palm position from Table 35 and entered as a one- or two-character ASCII subfield. Additional finger and/or palm positions may be referenced by entering the alternate position codes as subfields separated by the ASCII RS separator character. The code 0, for 'Unknown Finger', shall be used to reference every finger position from one through ten. The code 20, for 'Unknown Palm', shall be used to reference every listed palmprint position. Code 19 shall be used to reference one or more parts of an EJI or tip. | 1 | M | Finger_Palm_Position::13.013 | {13.013} MO Table 12 OR {13.013} MO Table 35 | | | | |
| **Subfields_Nx1** | 18.1.13, 19.1.13 | The field shall contain one or more subfields. Subfields are separated by ASCII RS. | 1 | M | Nx1::13.013 | Count(RS_Subfields in 13.013 ) GTE 1 | 2 | | | |
| | | | 1 | M | Nx1::14.013 | Count(RS_Subfields in 14.013 ) GTE 1 | 2 | | | |
| **13.013::Finger_-Palm_Position** | 18.1.13 | This mandatory tagged field shall contain one or more possible finger or palm positions that may match the latent image. The decimal code number corresponding to the known or most probable finger position shall be taken | 2 | M | 13.013::Finger_-Palm_Position | ForEach(RS_Subfield in 13.013)<br>{<br>{RS_Subfield} MO [Table12, Table35]<br>} | | | | |

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| | | from Table 12 or the most probable palm position from Table 35 and entered as a one- or two-character ASCII subfield. Additional finger and/or palm positions may be referenced by entering the alternate position codes as subfields separated by the ASCII RS separator character. | | | | | | | | |
| **Search_Position_Descriptors** | 18.1.14 | This ASCII field shall be present if and only if the finger position code 19 appears in Field 13.013. It is used to narrow the search of the latent image in this record against a database. This field shall consist of two mandatory information items. The first is the probable decimal finger position code (0-10) taken from Table 12. A "0" indicates that all the fingers of a possible candidate should be searched. The second information item is the code taken from Table 32 to indicate the portion of the EJI or tip image in the database to search. Latent images of full-length fingers use codes FV1 through FV4 as defined in Table 32. Figure 7 is an illustration of the Entire Joint Image for a middle finger with each of the full finger views and constituent parts identified. The EJI code is used for the case where all four finger images are to be considered. For the case where the latent is to be compared to proximal, distal, or medial segments of a finger, this information item will contain the appropriate finger segment character. Multiple portions of the EJI can be listed and separated by the ASCII RS separator character. | 1 | O | Search_Position_Descriptors::13.014 | US_SubField:1 GTE 0 AND<br>US_SubField:1 LTE 10<br>AND<br>US_SubField:2 MO Table 32 | 2,5 | | | |
| **13.014::Search_-Position_-Descriptors_-Present** | 18.1.14 | Field 13.014: Search Position Descriptors (SPD)<br><br>This ASCII field shall be present if and only if the finger position code "19" appears in Field 13.013. | 2 | O | 13.014::Search_-Position_-Descriptors_-Present | IF {13.013} EQ "19" THEN Present(13.014) | | | | |
| **Subfields_Nx6** | 18.1.15, 19.1.15 | The field shall contain one or more rows of six subfields. | 1 | O | Nx6::13.015 | Count(Subfields in 13.015 ) MOD 6 EQ 0 AND Count(Subfields in 13.015 ) GT 0 | 5 | | | |
| | | | 1 | O | Nx6::14.015 | Count(Subfields in 14.015 ) MOD 6 EQ 0 AND Count(Subfields in 14.015 ) GT 0 | 5 | | | |
| **PPC** | 18.1.15, 19.1.15 | If finger position code 19 appears in field 13.013 or 14.013, this field contains offsets to the locations for the bounding | 1 | O | Print_Position_Coordinates::13.015 | Count(US_Subfields in 13.015 ) EQ 6<br>AND<br>US_Subfield:1 MO | 5 | | | |

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| | | box of the EJI, each of the full finger views, or segments within the EJI. When used, this field shall consist of six (6) mandatory information items to describe the type or portion of the latent image contained in this record and its location within an entire joint image. The first information item is the number of the full finger view with values of FV1 through FV4. Values of FV1 to FV4 specify the bounding coordinates for each full finger view. The second information item is used to identify the location of a segment within a full finger view. It will contain the not applicable code NA if the image portion refers to a full finger view or to the entire joint image locations. It shall contain PRX, DST, MED for a proximal, distal, or medial segment. | | | | ['FV1','FV2','FV3','FV4']<br>AND<br>US_Subfield:2 MO<br>['NA','PRX','DST','MED'] | | | | |
| | | | 1 | O | Print_Position_Coordinates::14.015 | Count(US_Subfields in 14.015 ) EQ 6<br>AND<br>US_Subfield:1 MO<br>['FV1','FV2','FV3','FV4']<br>AND<br>US_Subfield:2 MO<br>['NA','PRX','DST','MED'] | 2,5 | | | |
| **PPC_Numbers** | 18.1.15, 19.1.15 | The next four information items are the horizontal and vertical offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the pixel counts down. The location of the image portion is defined by the sequence of X coordinates (LEFT, RIGHT) and the Y coordinates (TOP, BOTTOM), of its bounding box. | 1 | O | PPC_Numbers::13.015 | {US_Subfield:3 to 6 in 13.015} GTE 0 | 5 | | | |
| | | | 1 | O | PPC_Numbers::14.015 | {US_Subfield:3 to 6 in 14.015} GTE 0 | 5 | | | |
| **RESERVED_FIELDS** | 18.1.18 | Field 13.018-019: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 13.018-019::-Reserved | Present(13.018 to 13.019) | | | | |
| **RESERVED_FIELDS** | 18.1.20 | Field 13.021-023: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 13.021-023::-Reserved | Present(13.021 to 13.023) | | | | |
| **Latent_Quality_Metric** | 18.1.21 | This optional ASCII field is used to specify one or more different metrics of | 1 | O | Latent_Quality_Metric::13.024 | ForEach(RS_Subfield in 13.024)<br>{ | 2 | | | |

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| | | latent image quality score data for the image stored in this record. The meaning attributed to this metric must be defined and interpreted by the producer of the scoring algorithm or by the person or system used to assign the metric to the latent image. The metric may be a predictor of AFIS matcher accuracy performance or a different metric to indicate a value associated with the quality of the latent image for a particular function.<br><br>This field may contain one or more subfields, each consisting of four information items separated by the "US" separator character. The first information item is the code as chosen from Table 12 or Table 35.<br><br>The other three items identify a quality score and the algorithm used to create the quality score. This information is useful to enable the recipient of the quality score to differentiate between quality scores generated by different algorithms and adjust for any differences in processing or analysis as necessary.<br><br>The second information item shall be a quantitative expression of the predicted matching performance of the biometric sample. This item contains the ASCII representation of the integer image quality score between 0 and 100 assigned to the image data by a quality algorithm. Higher values indicate better quality. An entry of “255” shall indicate a failed attempt to calculate a quality score. An entry of “254” shall indicate that no attempt to calculate a quality score was made. The use of additional values to convey other information should be harmonized with ISO/IEC 19794 standards.<br><br>The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII | | | | Count(US_Subfield) EQ 4<br><br>AND<br><br>US_Subfield:1 MO Table12 or Table 35<br><br>AND<br><br>US_Subfield:2 GTE 0 AND<br>US_Subfield:2 LTE 100 OR<br>US_Subfield:2 MO [254,255]<br><br>AND<br><br>US_Subfield:3 MO [IBIA Vendor Registry]<br><br>AND<br><br>US_Subfield:4 GTE 1 AND<br>US_Subfield:4 LTE 65535<br>} | | | | |

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| | | characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization.<br><br>The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with the IBIA, but registration is not required. It indicates which of the vendor's algorithms was used in the calculation of the quality score. This field contains the ASCII representation of the integer product code and should be within the range 1 to 65,535. | | | | | | | | |
| **Subfields_Nx4** | 18.1.21, 19.1.23, 19.1.24 | The field shall contain one or more rows of four subfields. | 1 | O | Nx4::13.024 | Count(Subfields in 13.024 ) MOD 4 EQ 0 AND Count(Subfields in 13.024 ) GT 0 | | | | |
| | | | 1 | O | Nx4::14.023 | Count(Subfields in 14.023 ) MOD 4 EQ 0 AND Count(Subfields in 14.023 ) GT 0 | | | | |
| | | | 1 | O | Nx4::14.024 | Count(Subfields in 14.024 ) MOD 4 EQ 0 AND Count(Subfields in 14.024 ) GT 0 | | | | |
| **IBIA_Quality_-Vendor** | 18.1.21 | Field 13.024: Latent quality metric (LQM)<br><br>This optional ASCII field is used to specify one or more different metrics of latent image quality score data for the image stored in this record. …<br><br>The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization. | 2 | O | 13.024::IBIA_-Quality_Vendor | The code exists in the IBIA Vendor Registry of CBEFF Biometric Organizations. | | | | |
| **RESERVED_FIELDS** | 18.1.22 | Field 13.025-199: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 13.025-199::-Reserved | Present(13.025 to 13.199) | | | | |
| **13.999-ValidImage** | 18.1.24 | Field 13.999 shall contain all of the data from a captured latent image. | 2 | M | 13.999-Valid-Uncomp | Length(Field 13.999) EQ {13.006} * {13.007} | | | | |
| | | | 2 | M | 13.999-Valid-JPEGL | Present(SOI, SOF, EOI) | | | | |

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| | | | 2 | M | 13.999-Valid-JP2L | Present(SigBox, HeadBox, Image Header box) | | | | |
| | | | 2 | M | 13.999-Valid-PNG | Present(PNGSIG, IHDR, IDAT, IEND) | | | | |
| **13::FsAtEnd** | 18.2 | End of Type-13 variable-resolution latent image record<br><br>For the sake of consistency, immediately following the last byte of data from field 13.999 an ASCII FS separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-13 record. | 2 | M | 13::FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| **Type 14 Requirements and Assertions** | | | | | | | | | | |
| **14::MandatoryFields** | 19.1, Table 33 | For each field of the Type-14 record, Table 33 lists the "condition code" as being mandatory "M" or optional "O"…and occurrence limits. | 2 | M | 14::CondCode_M | IF "Cond code" EQ "M" in Table 33, the Field must be present in the record. | | | | |
| | | | 2 | M | 14.xxx-MaxOccurrences | Count(14.xxx) LTE MaxOccurrences(14.xxx) | | | | |
| | | | 2 | M | 14.xxx-MinOccurrences | Count(14.xxx) GTE MinOccurrence(14.xxx) | | | | |
| **14::FixedPositionFields** | 19.1 | It is required that the first two fields of the record are ordered, and the field containing the image data shall be the last physical field in the record. | 2 | M | 14.001::LEN_First | First(Field in Record) ST Type(Record) EQ 14 AND Field EQ 14.001 | | | | |
| | | | 2 | M | 14.002::IDC_Second | Second(Field in Record) ST Type(Record) EQ 14 AND Field EQ 14.002 | | | | |
| | | | 2 | M | 14.999::DATA_Last | Last(Field in Record) ST Type(Record) EQ 14 AND Field EQ 14.999 | | | | |
| **14::Len=Bytes** | 19.1.1 | Field 14.001: Logical record length (LEN)<br><br>This mandatory ASCII field shall contain the total count of the number of bytes in the Type-14 logical record. Field 14.001 shall specify the length of the record including every character of every field contained in the record and the information separators. | 2 | M | 14.001::Len=Bytes | {14.001} EQ Length(Record) | | | | |
| **14::IDC=CNT_IDC** | 19.1.2 | Field 14.002: Image designation character (IDC)<br><br>This mandatory ASCII field shall be used to identify the fingerprint image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record. | 2 | M | 14.002::IDC=CNT_-IDC | The IDC matches the value of the corresponding CNT field of the Type-1 record. | | | | |
| **Table_11_Finger_TagFld** | 19.1.3 | The field value shall be selected from Table 11. | 1 | M | Table_11_Finger::14.003 | {14.003} MO Table 11 | | | | |
| **14.006-HLL** | 19.1.6 | Field 14.006 shall contain the number of pixels contained on a single horizontal | 2 | M | 14.006-JPEGB-JPEGL-HLL | {14.006} EQ { Image Width} | 3 | | | |

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| | | line of the transmitted image. | 2 | M | 14.006-JP2-JP2L-HLL | {14.006} EQ { Image Width} | 3 | | | |
| | | | 2 | M | 14.006-PNG-HLL | {14.006} EQ { Image Width} | 3 | | | |
| | | | 2 | M | 14.006-WSQ-HLL | {14.006} EQ { Image Width} | 3 | | | |
| **14.007-VLL** | 19.1.7 | Field 14.007 shall contain the number of horizontal lines contained in the transmitted image. | 2 | M | 14.007-JPEGB-JPEGL-VLL | {14.007} EQ { Image Height } | 3 | | | |
| | | | 2 | M | 14.007-JP2-JP2L-VLL | {14.007} EQ { Image Height } | 3 | | | |
| | | | 2 | M | 14.007-PNG-VLL | {14.007} EQ { Image Height } | 3 | | | |
| | | | 2 | M | 14.007-WSQ-VLL | {14.007} EQ { Image Height } | 3 | | | |
| **14.008-SLC** | 19.1.8 | Field 14.008 shall specify the units used to describe the image sampling frequency (pixel density). | 2 | M | 14.008-JPEGB-JPEGL-SLC | IF Present(JFIF Header) THEN<br>Field 14.008 EQ {Sampling Units} | 3 | | | |
| | | | 2 | M | 14.008-JP2-JP2L-SLC | No Implementation | 4 | | | |
| | | | 2 | M | 14.008-PNG-SLC | IF Present(PHYS Chunk) THEN<br>IF {14.008} EQ 1 OR 2 THEN<br>{Sampling Units} EQ 1, ELSE IF {14.008} EQ 0 THEN<br>{Sampling Units} EQ 0 | 3 | | | |
| | | | 2 | M | 14.008-WSQ-SLC | No Implementation | 4 | | | |
| **14.009-HPS** | 19.1.9 | Field 14.009 shall specify the integer pixel density used in the horizontal direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the horizontal component of the pixel aspect ratio. | 2 | M | 14.009-JPEGB-JPEGL-HPS | IF {14.008} EQ “1” OR “2”, THEN<br>IF Present(JFIF Header) THEN<br>{14.009} EQ {Horizontal Density} | 3 | | | |
| | | | 2 | M | 14.009-JP2-JP2L-HPS | No Implementation | 4 | | | |
| | | | 2 | M | 14.009-PNG-HPS | IF Present(PHYS Chunk) THEN<br>IF {14.008} EQ “1”, THEN<br>{14.009} EQ {Horizontal Density} * 0.0254 (meters/inch)<br>ELSE IF {14.008} EQ “2”, THEN<br>{14.009} EQ {Horizontal Density} * 0.01 (meters/cm) | 3 | | | |
| | | | 2 | M | 14.009-WSQ-HPS | No Implementation | 4 | | | |
| | | | 2 | M | 14.009-JPEGB-JPEGL-HorzAspect | IF {14.008} NEQ “1” OR “2”, THEN<br>{14.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 14.009-JP2-JP2L-HorzAspect | No Implementation | 4 | | | |
| | | | 2 | M | 14.009-PNG-HorzAspect | IF Present(PHYS Chunk), THEN<br>IF {14.008} NEQ “1” OR “2”, THEN<br>{14.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 14.009-WSQ-HorzAspect | No Implementation | 4 | | | |
| **14.010-VPS** | 19.1.10 | Field 14.010 shall specify the integer pixel density used in the vertical direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the vertical component of the pixel aspect ratio. | 2 | M | 14.010-JPEGB-JPEGL-VPS | IF {14.008} EQ “1” OR “2”, THEN<br>IF Present(JFIF Header) THEN<br>{14.010} EQ {Vertical Density} | 3 | | | |
| | | | 2 | M | 14.010-JP2-JP2L-VPS | No Implementation | 4 | | | |
| | | | 2 | M | 14.010-PNG-VPS | IF Present(PHYS Chunk) THEN | 3 | | | |

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| | | | | | | IF {14.008} EQ “1”, THEN<br>{14.010} EQ {Vertical Density} * 0.0254 (meters/inch)<br>ELSE IF {14.008} EQ “2”, THEN<br>{14.010} EQ {Vertical Density} * 0.01 (meters/cm) | | | | |
| | | | 2 | M | 14.010-WSQ-VPS | No Implementation | 4 | | | |
| | | | 2 | M | 14.010-JPEGB-JPEGL-VerAspect | IF {14.008} NEQ “1” OR “2”, THEN<br>{14.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 14.010-JP2-JP2L-VerAspect | No Implementation | 4 | | | |
| | | | 2 | M | 14.010-PNG-VerAspect | IF Present(PHYS Chunk), THEN<br>IF {14.008} NEQ “1” OR “2”, THEN<br>{14.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 14.010-WSQ-VerAspect | No Implementation | 4 | | | |
| **Table_1_ASCII** | 19.1.11 | The field value shall be selected from Table 1. | 1 | M | Table_1_ASCII::14.011 | {14.011} MO Table 1 | | | | |
| **14.011-ConfirmedCGA** | 19.1.11 | Field 14.011 shall specify the algorithm used to compress the color or grayscale image. | 2 | M | 14.011-JPEGB-JPEGL-CGA | {14.011} corresponds to {SOF} | 3 | | | |
| | | | 2 | M | 14.011-JP2-JP2L-CGA | {5th parameter of Image Header box} EQ “7” | | | | |
| | | | 2 | M | 14.011-PNG-CGA | Present(IHDR) | 3 | | | |
| | | | 2 | M | 14.011-WSQ-CGA | Present(SOF) AND Present(4th and 5th parameters not counting the SOF marker) | 3 | | | |
| **14.012-ConfirmedBPX** | 19.1.12 | Field 14.012 shall contain the number of bits used to represent a pixel. | 2 | M | 14.012-JPEGB-JPEGL-CBPX | {14.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 14.012-JP2-JP2L-CBPX | IF {4th parameter of Image Header box} NEQ “255”, THEN {14.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 14.012-PNG-CBPX | {14.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 14.012-WSQ-CBPX | No Implementation | 4 | | | |
| **Table_12_Subfields** | 19.1.13 | The field value shall be selected from Table 12. | 1 | M | Table_12_Subfields::14.013 | {14.013} MO Table 12 | | | | |
| **14.013::FGP++** | 19.1.13 | Field 14.013: Finger position (FGP)<br><br>Additional finger positions may be referenced in the transaction by entering the alternate finger positions as subfields separated by the ASCII RS separator character. | 2 | M | 14.013::FGP++ | Additional finger positions may be referenced in the transaction by entering the alternate finger positions as subfields separated by the ASCII RS separator character. | | | | |
| **Print_Position_Descriptors** | 19.1.14 | This ASCII field shall be present if and only if the finger position code 19 appears in Field 14.013. This field shall consist of two mandatory information items. The first is the probable decimal finger position code (0-10) taken from Table 12. The second information item is | 1 | O | Print_Position_Descriptors::14.014 | {US_Subfield:1} GTE 0 AND<br>{US_Subfield:1} LTE 10<br>AND<br>{US_Subfield:2} MO Table 32 | 2,5 | | | |

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| | | the code taken from Table 32 to indicate the portion of the EJI or tip image that is stored as a single image in the database. There may be up to 17 such images for a single finger. Images of full-length fingers use codes FV1 through FV4 as defined in Table 32. Figure 7 is an illustration of the Entire Joint Image for a middle finger with each of the full finger views and constituent parts identified. | | | | | | | | |
| **14.014::Print_-Position_-Descriptors_-Present** | 19.1.14 | Field 14.014: Print Position Descriptors (PPD)<br><br>This ASCII field shall be present if and only if the finger position code "19" appears in Field 14.013. | 2 | O | 14.014::Print_-Position_-Descriptors_-Present | IF {14.013} EQ “19” THEN Present(14.014) | | | | |
| **Amputated_Or_Bandaged** | 19.1.18 | The value shall be XX or UP. | 1 | O | Amputated_Or_Damaged::14.018 | {14.018} MO [XX, UP] | | | | |
| **RESERVED_FIELDS** | 19.1.19 | Field 14.019: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 14.019::Reserved | Present(14.019) | | | | |
| **Subfields_Nx5** | 19.1.21 | The field shall contain one or more rows of five subfields. | 1 | O | Nx5::14.021 | Count(Subfields in 14.021 ) MOD 5 EQ 0 AND Count(Subfields in 14.021 ) GT 0 | | | | |
| **Finger_Segment_Positions** | 19.1.21 | This optional ASCII field shall contain offsets to the locations of image segments containing the individual fingers within the flat images of the four simultaneous fingers from each hand or the two simultaneous thumbs. The offsets are relative to the origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the pixel counts down. A finger segment is defined by the FINGER NUMBER, the X coordinates (LEFT, RIGHT) and the Y coordinates (TOP, BOTTOM), of its bounding box. The five information items within a finger segment definition are separated by the ASCII US separator character. Individual finger segment definitions are | 1 | O | Finger_Segment_Positions::14.021 | ForEach(RS_Subfield in 14.021)<br>{<br>Count(US_Subfield) EQ 5<br><br>AND<br><br>{US_Subfield:1} MO Table 12<br><br>AND<br><br>{US_Subfield:2 to 5} GTE 0<br>} | 2 | | | |

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| | | separated by the ASCII RS separator character.. If more than one algorithm is used to segment the image, successive sets finger segmentation positions shall be formatted as above and immediately follow the previous set. | | | | | | | | |
| **NIST_Quality_Metric** | 19.1.22 | This optional ASCII field shall contain the NIST Fingerprint Image Quality (NFIQ) scores for the individual finger(s) derived from the slap impressions or individual rolled fingerprints. It consists of two information items. The first item is the finger number between one and ten as chosen from Table 12. The second item is the quality score which is a quantitative expression of the predicted AFIS matcher accuracy performance of the fingerprint image. The scores range from 1 for the best quality image, to 5 for the worst quality image. A 254 indicates that no score was ever computed while an entry of 255 shall indicate a failed attempt to calculate the image quality metric. These two information items are separated by the ASCII US separator character. Individual finger quality definitions are separated by the ASCII RS separator character. | 1 | O | NIST_Quality_Metric::14.022 | ForEach(RS_Subfield in 14.022){<br>{US_Subfield:1} GTE 1 AND<br>{US_Subfield:1} LTE 10 AND<br>{US_Subfield:2} MO [1,2,3,4,5,254,255]} | 2 | | | |
| **Segmentation_Quality_Metric** | 19.1.23 | This optional ASCII field provides a measure of estimated correctness regarding the accuracy of the location of the segmented finger within the right or left four finger or two thumbs slap image. For each segmented finger, this field shall contain four information items separated by the ASCII US separator character. The first information item is the finger number between one and ten as chosen from Table 12. The other three items identify a quality score and the algorithm used to create the quality score. This information is useful to enable the recipient of the quality score to differentiate between quality scores generated by different algorithms and adjust for any differences in processing or analysis as necessary. The second information item shall be a measure of estimated correctness regarding the accuracy of the location of the segmented finger. This item contains the ASCII representation of the integer | 1 | O | Segmentation_Quality_Metric::14.023 | ForEach(RS_Subfield in 14.023)<br>{<br>Count(US_Subfield) EQ 4<br><br>AND<br><br>{US_Subfield:1} GTE 1 AND<br>{US_Subfield:1} LTE 10<br><br>AND<br><br>{US_Subfield:2} GTE 0 AND<br>{US_Subfield:2} LTE 100 OR<br>{US_Subfield:2} MO [254,255]<br><br>AND<br><br>{US_Subfield:3} MO [IBIA Vendor Registry]<br><br>AND<br><br>{US_Subfield:4} GTE 1 AND<br>{US_Subfield:4} LTE 65535 OR | 2 | | | |

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| | | image quality score between 0 and 100 assigned to the image data by a quality algorithm. Higher values indicate better quality. An entry of 255 shall indicate a failed attempt to calculate a quality score. An entry of 254 shall indicate that no attempt to calculate a quality score was made. The use of additional values to convey other information should be harmonized with ISO/IEC 19794 standards. The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization. The fourth information item shall specify a numeric product code assigned by the vendor of the quality algorithm, which may be registered with the IBIA, but registration is not required. It indicates which of the vendor's algorithms was used in the calculation of the quality score. This field contains the ASCII representation of the integer product code and should be within the range 1 to 65535. This subfield is repeated for each segmented finger whose coordinates appear in field 14.021. The ASCII RS separator character, separates each set of four information items. For the case where more than one segmentation algorithm is applied to a multi-finger plain image, the set of segmentation information items for each finger shall be ordered corresponding to the entries in field 14.021. | | | | } | | | | |
| **IBIA_Quality_-Vendor** | 19.1.23 | Field 14.023: Segmentation quality metric (SQM)<br><br>The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in | 2 | O | 14.023::IBIA_-Quality_Vendor | The code exists in the IBIA Vendor Registry of CBEFF Biometric Organizations. | | | | |

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| | | this field to a registered organization. | | | | | | | | |
| **Fingerprint_Quality_Metric** | 19.1.24 | This optional ASCII field is used to specify one or more different metrics of fingerprint image quality score data for the image stored in this record. The meaning attributed to this metric must be defined and interpreted by the producer of the scoring algorithm or by the person or system used to assign the metric to the fingerprint image. The metric may be a predictor of AFIS matcher accuracy performance or a different metric to indicate a value associated with the quality of the fingerprint image for a particular function. | 1 | O | Fingerprint_Quality_Metric::14.024 | ForEach(RS_Subfield in 14.024)<br>{<br>Count(US_Subfield) EQ 4<br><br>AND<br><br>{US_Subfield:1} GTE 1 AND<br>{US_Subfield:1} LTE 10<br><br>AND<br><br>{US_Subfield:2} GTE 0 AND<br>{US_Subfield:2} LTE 100 OR<br>{US_Subfield:2} MO [254,255]<br><br>AND<br><br>{US_Subfield:3} MO [IBIA Vendor Registry]<br><br>AND<br><br>{US_Subfield:4} GTE 1 AND<br>{US_Subfield:4} LTE 65535 OR<br><br>} | 2 | | | |
| **IBIA_Quality_-Vendor** | 19.1.24 | Field 14.024: Fingerprint quality metric (FQM)<br><br>The third information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization. | 2 | O | 14.024::IBIA_-Quality_Vendor | The code exists in the IBIA Vendor Registry of CBEFF Biometric Organizations. | | | | |
| **ASEG_1-4_Subfields** | 19.1.25 | The field shall consist of 1 to 4 subfields. | 1 | O | ASEG_1_To_4_Subfields::14.025 | Count(Subfields in 14.025 ) MO [1-4] | | | | |
| **ASEG_3To99** | 19.1.25 | This field uses an n-vertex polygon to encompass each finger image segment, where 'n' is between 3 and 99. | 1 | O | ASEG_3_To_99_Segments::14.025 | Count(Subfield Vertices in 14.025 ) MO [3 to 99] | | | | |
| **ASEG_FingerNum** | 19.1.25 | Each subfield shall consist of a finger number between 1 and 10, the total number of vertices of the polygon encompassing the finger, and the set of consecutive vertices. | 1 | O | ASEG_Finger_Number_1-10::14.025 | ForEach(ASCII RS_Subfield in Record)<br>{<br>First(US_Subfield in RS_Subfield) MO [1 to 10]<br>} | | | | |
| **ASEG_Order** | 19.1.25 | The order of the vertices must be in | 1 | O | ASEG_Consecutive_ | Angle.Direction.First EQ ((X,Y).1 To | | | | |

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| | | their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. | | | Order::14.025 | (X,Y).2).Angle.Direction; ((X,Y).2 To N-1 to (X,Y).3 To N).Angle.Direction EQ Angle.Direction.First; ((X,Y).N To (X,Y).1).Angle.Direction EQ Angle.Direction.First | | | | |
| **ASEG_XY_GE_Zero** | 19.1.25 | Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image. The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the pixel counts down from the origin. | 1 | O | ASEG_XY_GE_Zero:: 14.025 | (X,Y) ST X GTE 0 AND Y GTE 0 | | | | |
| **14.025 ASEG** | 19.1.25 | The order of the vertices must be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. | 2 | O | ASEG_Consecutive_ Order | Not supported in this version | 6 | | | |
| **14.025 ASEG** | 19.1.25 | No two vertices may occupy the same location. | 2 | O | ASEG_No_Duplicate _Vertices | Each Vertex (X, Y) is unique | | | | |
| **14.025 ASEG** | 19.1.25 | The polygon must be a simple, plane figure with no sides crossing and no interior holes. | 2 | O | ASEG_Simple_Plane _Figure | No implementation | 6 | | | |
| **14.025 ASEG** | 19.1.25 | | 2 | O | ASEG_No_Sides_- Crossing | No implementation | 6 | | | |
| **14.025 ASEG** | 19.1.25 | | 2 | O | ASEQ_No_- Interior_Holes | No implementation | 6 | | | |
| **14.025 ASEG** | 19.1.25 | This field shall consist of one to four subfields. | 2 | O | ASEG_Num_Sub- fields | 1 LTE Count( Subfields) LTE 4 | | | | |
| **14.025 ASEG** | 19.1.25 | Each subfield shall consist of a finger number between 1 and 10, the total number of vertices of the polygon encompassing the finger, and the set of consecutive vertices. A minimum of three points is required to describe a finger location. | 1 | O | ASEG_Finger- Number | 1 LTE Finger Number LTE 10 | | | | |
| | | | 1 | O | ASEG_3_To_99_- Segments | 3 LTE Segments LTE 99 | | | | |
| | | | 2 | O | ASEG_Expected_- Information_Items | Expected Cols EQ 1 (Finger #) + 1 (# Vertices) + (2 * # Vertices ((x, y) pairs))<br><br>ExpectedCols = 2 + 2 * # Vertices | | | | |
| **14.025 ASEG** | 19.1.25 | Each vertex shall be represented as horizontal and vertical pixel offsets relative to the origin positioned in the upper left corner of the image.<br>The horizontal offsets (X) are the pixel counts to the right, and the vertical offsets (Y) are the pixel counts down from the origin. | 2 | O | ASEG_XY_Offsets_G E_Zero | For Each (X, Y)<br>X GTE 0 AND<br>Y GTE0 | | | | |
| **14.025 ASEG** | 19.1.25 | An ASCII US separator character shall be used to separate the finger number, the number of vertices, each X coordinate, and each Y coordinate. | 2 | O | 14.025-US | Character separator between finger number, the number of vertices, each X coordinate, and each Y coordinate EQ "US" | | | | |
| **14.025 ASEG** | 19.1.25 | Subfields representing each finger are delimited by the ASCII RS separator | 2 | O | 14.025-RS | Character separator between subfields representing each finger EQ ASCII RS | | | | |

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| | | character. | | | | | | | | |
| **RESERVED_FIELDS** | 19.1.26 | Field 14.026-029: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 14.026-029::-Reserved | Present(14.026 to 14.029) | | | | |
| **RESERVED_FIELDS** | 19.1.28 | Field 14.031-199: Reserved for future definition (RSV)<br><br>These fields are reserved for definition and inclusion in future revisions of this standard. None of these fields are to be used at this revision level. If any of these fields are present, they are to be ignored. | - | - | 14.031-199::-Reserved | Present(14.031 to 14.199) | | | | |
| **14.999-ValidImage** | 19.1.30 | Field 14.999 shall contain all of the data from a captured tenprint image. | 2 | M | 14.999-Valid-Uncomp | Length(Field 14.999) EQ {14.006} * {14.007} | | | | |
| | | | 2 | M | 14.999-Valid-JPEGB-JPEGL | Present(SOI, SOF, EOI) | 3 | | | |
| | | | 2 | M | 14.999-Valid-JP2-JP2L | Present(SigBox, HeadBox, Image Header box) | 3 | | | |
| | | | 2 | M | 14.999-Valid-PNG | Present(PNGSIG, IHDR, IDAT, IEND) | 3 | | | |
| | | | 2 | M | 14.999-Valid-WSQ | Present(SOI, SOF, SOB, EOI) | 3 | | | |
| **14::FsAtEnd** | 19.2 | End of Type-14 variable-resolution fingerprint image record<br><br>For the sake of consistency, immediately following the last byte of data from field 14.999 an ASCII FS separator shall be used to separate it from the next logical record. This separator must be included in the length field of the Type-14 record. | 1 | M | 14::FsAtEnd | Last(Byte in Record) EQ ASCII FS | | | | |
| **Type 17 Requirements and Assertions** | | | | | | | | | | |
| **17::FixedPositionFields** | 22.2 | It is required that the first two fields of the record are ordered, and the field containing the iris binary data shall be the last physical field in the record. | 2 | M | 17.001::LEN_First | First(Field in Record) ST Type(Record) EQ 17 AND Field EQ 17.001 | | | | |
| | | | 2 | M | 17.002::IDC_Second | Second(Field in Record) ST Type(Record) EQ 17 AND Field EQ 17.002 | | | | |
| | | | 2 | M | 17.999::DATA_Last | Last(Field in Record) ST Type(Record) EQ 17 AND Field EQ 17.999 | | | | |
| **17::MandatoryFields** | 22.2, Table 37 | For each field of the Type-17 record, Table 37 lists the "condition code" as being mandatory "M" or optional "O"…and occurrence limits. | 2 | M | 17::CondCode_M | IF "Cond code" EQ "M" in Table 37, the Field must be present in the record. | | | | |
| | | | 2 | M | 17.xxx-MaxOccurrences | Count(17.xxx) LTE MaxOccurrences(17.xxx) | | | | |

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| | | | 2 | M | 17.xxx-MinOccurrences | Count(17.xxx) GTE MinOccurrences(17.xxx) | | | | |
| **17::Len=Bytes** | 22.2.1 | Field 17.001: Logical record length (LEN)<br><br>This mandatory ASCII field shall contain the total count of the number of bytes in the Type-17 logical record. Field 17.001 shall specify the length of the record including every character of every field contained in the record and the information separators. | 2 | M | 17.001::-Value=Bytes | {17.001} EQ Length(Record) | | | | |
| **17::IDC=TOC_IDC** | 22.2.2 | Field 17.002: Image designation character (IDC)<br><br>This mandatory ASCII field shall be used to identify the iris image data contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record. | 2 | M | 17.002::IDC=TOC_-IDC | The IDC value matches the corresponding IDC value in the content (CNT) field in the Type-1 record. | | | | |
| **17.006-HLL** | 22.2.6 | Field 17.006 shall contain the number of pixels contained on a single horizontal line of the transmitted image. | 2 | M | 17.006-JPEGB-JPEGL-HLL | {17.006} EQ {Image Width} | 3 | | | |
| | | | 2 | M | 17.006-JP2-JP2L-HLL | {17.006} EQ {Image Width} | 3 | | | |
| **17.007-VLL** | 22.2.7 | Field 17.007 shall contain the number of horizontal lines contained in the transmitted image. | 2 | M | 17.007-JPEGB-JPEGL-VLL | {17.007} EQ {Image Height} | 3 | | | |
| | | | 2 | M | 17.007-JP2-JP2L-VLL | {17.007} EQ {Image Height} | 3 | | | |
| **17.008-SLC** | 22.2.8 | Field 17.008 shall specify the units used to describe the image sampling frequency (pixel density). | 2 | M | 17.008-JPEGB-JPEGL-SLC | IF Present(JFIF Header) THEN<br><br>{17.008} EQ {Sampling Units} | 3 | | | |
| | | | 2 | M | 17.008-JP2-JP2L-SLC | No Implementation | 4 | | | |
| **17.009-HPS** | 22.2.9 | Field 17.009 shall specify the integer pixel density used in the horizontal direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the horizontal component of the pixel aspect ratio. | 2 | M | 17.009-JPEGB-JPEGL-HPS | IF {17.008} EQ “1” OR “2”, THEN<br><br>IF Present(JFIF Header) THEN<br><br>{17.009} EQ {Horizontal Density} | 3 | | | |
| | | | 2 | M | 17.009-JP2-JP2L-HPS | No Implementation | 4 | | | |
| | | | 2 | M | 17.009-JPEGB-JPEGL-HorzAspect | IF {17.008} NEQ “1” OR “2”, THEN {17.009} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |

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| | | | 2 | M | 17.009-JP2-JP2L-HorzAspect | No Implementation | 4 | | | |
| **17.010-VPS** | 22.2.10 | Field 17.010 shall specify the integer pixel density used in the vertical direction of the transmitted image if the SLC field contains a 1 or 2. Otherwise, it indicates the vertical component of the pixel aspect ratio. | 2 | M | 17.010-JPEGB-JPEGL-VPS | IF {17.008} EQ "1" OR "2", THEN<br><br>IF Present(JFIF Header) THEN<br><br>{17.010} EQ {Vertical Density} | 3 | | | |
| | | | 2 | M | 17.010-JP2-JP2L-VPS | No Implementation | 4 | | | |
| | | | 2 | M | 17.010-JPEGB-JPEGL-VerAspect | IF {17.008} NEQ "1" OR "2", THEN {17.010} EQ {Horizontal Density} / {Vertical Density} | 3 | | | |
| | | | 2 | M | 17.010-JP2-JP2L-VerAspect | No Implementation | 4 | | | |
| **Table_1_No_WSQ_PNG** | 22.2.11 | The field value shall be selected from Table 1. WSQ and PNG are not valid. | 1 | M | Table_1_No_WSQ_PNG::17.011 | {17.011} NOT MO ['WSQ', 'PNG'] AND {17.011} MO Table 1 | | | | |
| **17.011-ConfirmedCGA** | 22.2.11 | Field 17.011 shall specify the algorithm used to compress the color or grayscale image. | 2 | M | 17.011-JPEGB-JPEGL-CGA | {17.011} corresponds to {SOF} | 3 | | | |
| | | | 2 | M | 17.011-JP2-JP2L-CGA | {5th parameter of Image Header box} EQ "7" | 3 | | | |
| **17.012-ConfirmedBPX** | 22.2.12 | Field 17.012 shall contain the number of bits used to represent a pixel. | 2 | M | 17.012-JPEGB-JPEGL-CBPX | {17.012} EQ {BPX} | 3 | | | |
| | | | 2 | M | 17.012-JP2-JP2L-CBPX | IF {4th parameter of Image Header box} NEQ "255", THEN {17.012} EQ {BPX} | 4 | | | |
| **17.013-CSP** | 22.2.13 | Field 17.013 shall contain an entry from Table 3 to identify the color space used. | 2 | M | 17.013-JPEGB-JPEGL-CSP | No Implementation | 3 | | | |
| | | | 2 | M | 17.013-JP2-JP2L-CSP | IF Present(Colour Specification box), THEN {17.013} corresponds to {CSP} | 3 | | | |
| **SubFields_1x3** | 22.2.16, 22.2.19 | The field shall contain three subfields separated by an ASCII US separator character. | 1 | O | SubFields_1x3::17.016 | (Rows, Cols) ST Rows EQ 1 AND Cols EQ 3 | | | | |
| | | | 1 | O | SubFields_1x3::17.019 | Count(Subfields in 17.019 ) EQ 3 | | | | |
| **DeviceUniqueID** | 22.2.17 | This optional field shall contain a | 1 | O | DeviceUniqueID::17 | First(Byte in 17.017) MO [D, M, P] OR | | | | |

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| | | sixteen-byte string uniquely identifying the device or source of the data. This data can be one of: (1) Device Serial number, identified by the first character "D", (2) Host PC Mac address, identified by the first character "M", (3) Host PC processor ID, identified by the first character "P", and (4) No serial number, identified by all zero's. | | | .017 | Sum(Bytes(17.017)) EQ 0 | | | | |
| **IBIA_Quality_-Vendor** | 22.2.24 | Field 17.024: Image Quality Score (IQS)<br><br>… The second information item shall specify the ID of the vendor of the quality algorithm used to calculate the quality score. This 4-digit hex value is assigned by IBIA and expressed as four ASCII characters. The IBIA shall maintain the Vendor Registry of CBEFF Biometric Organizations that will map the value in this field to a registered organization. | 2 | O | 17.024::IBIA_-Quality_Vendor | The value is in the IBIA Vendor Registry of CBEFF Biometric Organizations. | | | | |
| **NirVisOther** | 22.2.25 | This optional field indicates the lighting spectrum used in capturing the iris image. Values shall be one of the following: NIR for near-infrared illumination (~700-850nm), VIS for visible full spectrum illumination (~380-740nm), or OTHER for other illumination. | 1 | O | NIR_VIS_OTHER::17.025 | {17.025} MO ['NIR', 'VIS', 'OTHER'] | | | | |
| **17.026-IRD** | 22.2.26, Table 37 | Field 17.026 shall specify the expected iris diameter in pixels. | 2 | O | 17.026-IRD | {17.026} LTE Min({17.006},{17.007}) | | | | |
| **17.999-ValidImage** | 22.2.31 | Field 17.999 shall contain the iris image. | 2 | M | 17.999-Valid-Uncomp | Length(F13.999) EQ {13.006} * {13.007} | | | | |
| | | | 2 | M | 17.999-Valid-JPEGB-JPEGL | Present(SOI, SOF, EOI) | | | | |
| | | | 2 | M | 17.999-Valid-JP2-JP2L | Present(SigBox, HeadBox, ImgBox) | | | | |

**Test Notes:**

1. Requirements related to International Character Sets are not tested in this version of the CTS.

2. Subfields are defined as follows:

- RS_Subfield:N= Any subfield that uses the ASCII RS separator character. If N is specified, N represents the Nth such subfield in the field
- US_Subfield:N = Any subfield that uses the ASCII US separator character. If N is specified, N represents the Nth such subfield in the field
- Subfield(s) = If a prefix is not specified (US or RS), then the type of subfield should be clear from the context of the requirement.

3. The table lists assertions for multiple image format types, however, based upon the compression algorithm specified in the record, specific image formats are to be tested in different ways. Features of the image metadata are defined as follows:

- Image Width
  - JPEG, JPEGL: 4th parameter of the Frame Header not counting the SOF marker
  - JP2,JP2L: 2nd parameter of Image Header box
  - PNG: 1st parameter of IHDR chunk
  - WSQ: 5th parameter of SOF not counting the SOF marker
- Image Height
  - JPEG, JPEGL: 3rd parameter of the Frame Header not counting the SOF marker
  - JP2,JP2L: 1st parameter of Image Header box
  - PNG: 2nd parameter of IHDR chunk
  - WSQ: 4th parameter of SOF not counting the SOF marker
- Image metadata markers
  - JPEG, JPEGL: SOI – Start of Image, SOF – Start of Frame, EOI – End of Image
  - JP2, JP2L: SigBox – JP2 Signature box, HeadBox – JP2 Header box, ImgBox – Image Header box
  - PNG: PNGSig – PNG Signature, IHDR – IHDR Chunk, IDAT – IDAT Chunk, IEND – IEND Chunk
  - WSQ: SOI – Start of Image, SOF – Start of Frame , SOB – Start of Block, EOI – End of Image
- Sampling Units
  - JPEG, JPEGL: 4th parameter in JFIF Header not counting the APP0 Marker
  - JP2, JP2L: Undefined
  - PNG: 3rd parameter of PHYS chunk
  - WSQ: Undefined
- Horizontal Density
  - JPEG, JPEGL: 5th parameter in JFIF Header not counting the APP0 Marker
  - JP2, JP2L: Undefined
  - PNG: 1st parameter in PHYS Chunk
  - WSQ: Undefined
- Vertical Density
  - JPEG, JPEGL: 6th parameter in JFIF Header not counting the APP0 Marker
  - JP2, JP2L: Undefined
  - PNG: 2nd parameter in PHYS Chunk
  - WSQ: Undefined
- BPX

- JPEG, JPEGL: 2nd parameter of the Frame Header not counting the SOF marker
- JP2, JP2L: 7 LSB of 4th parameter of Image Header box + 1
- PNG: 3rd parameter of IHDR chunk
- WSQ: Undefined

- CSP
  - JPEG,JPEGL: Undefined
  - JP2, JP2L: 4th parameter of Colour Specification box
  - PNG: 4th parameter of IHDR chunk
  - WSQ: Undefined

4. The image metadata required to implement the assertion is not defined in the image standard documentation.

5. While the ANSI/NIST-ITL 1-2007 standard defines only the “M” and “O” statuses for each field, this field is conditional upon the content of the other field(s).

6. The required algorithm for this assertion is under research.