Conformance Test Architecture and Test Suite for Selected Record Types of ANSI/NIST-ITL 1-2007

Beta Version 0.4

Overview and User Guide

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Disclaimer

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

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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

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. 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

Other record types will be supported as needed in the future. 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. In addition to parsing tests which are initially performed, over five-hundred Level 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.

[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.

A brief description of Level 1 to 3 testing is included below[2]. Table C-1 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 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 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 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.

[2] The concepts addressed in sections 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.

1.6 Target Audience

Although the 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.

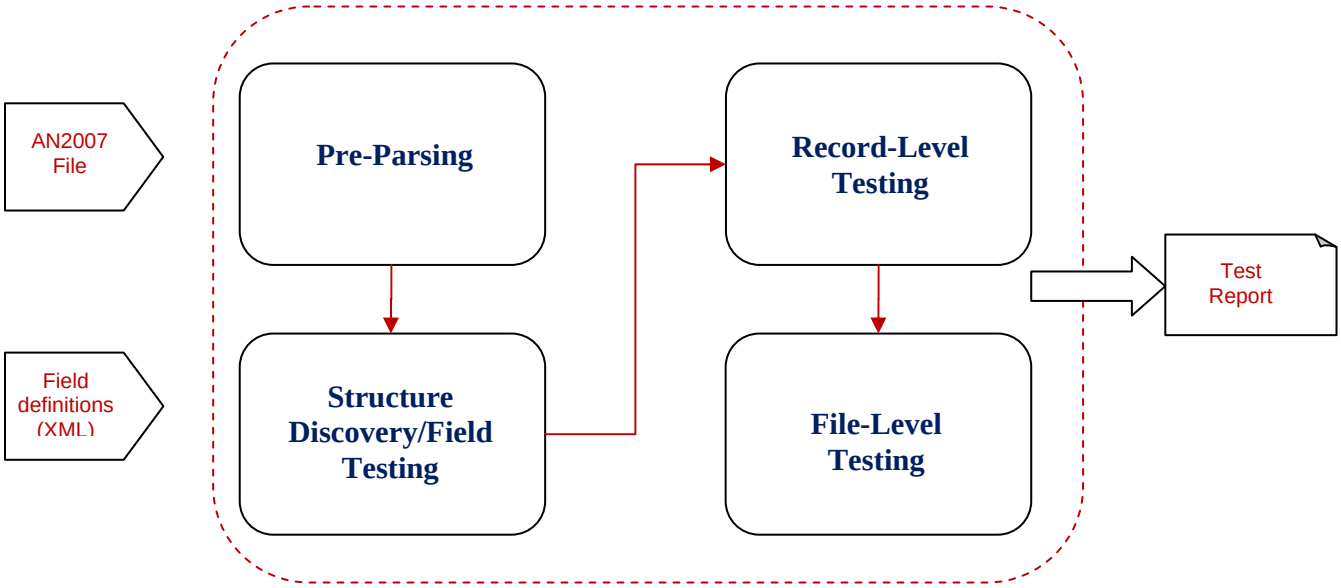

Figure 2-1: CTA/CTS High-Level Architecture

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 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:

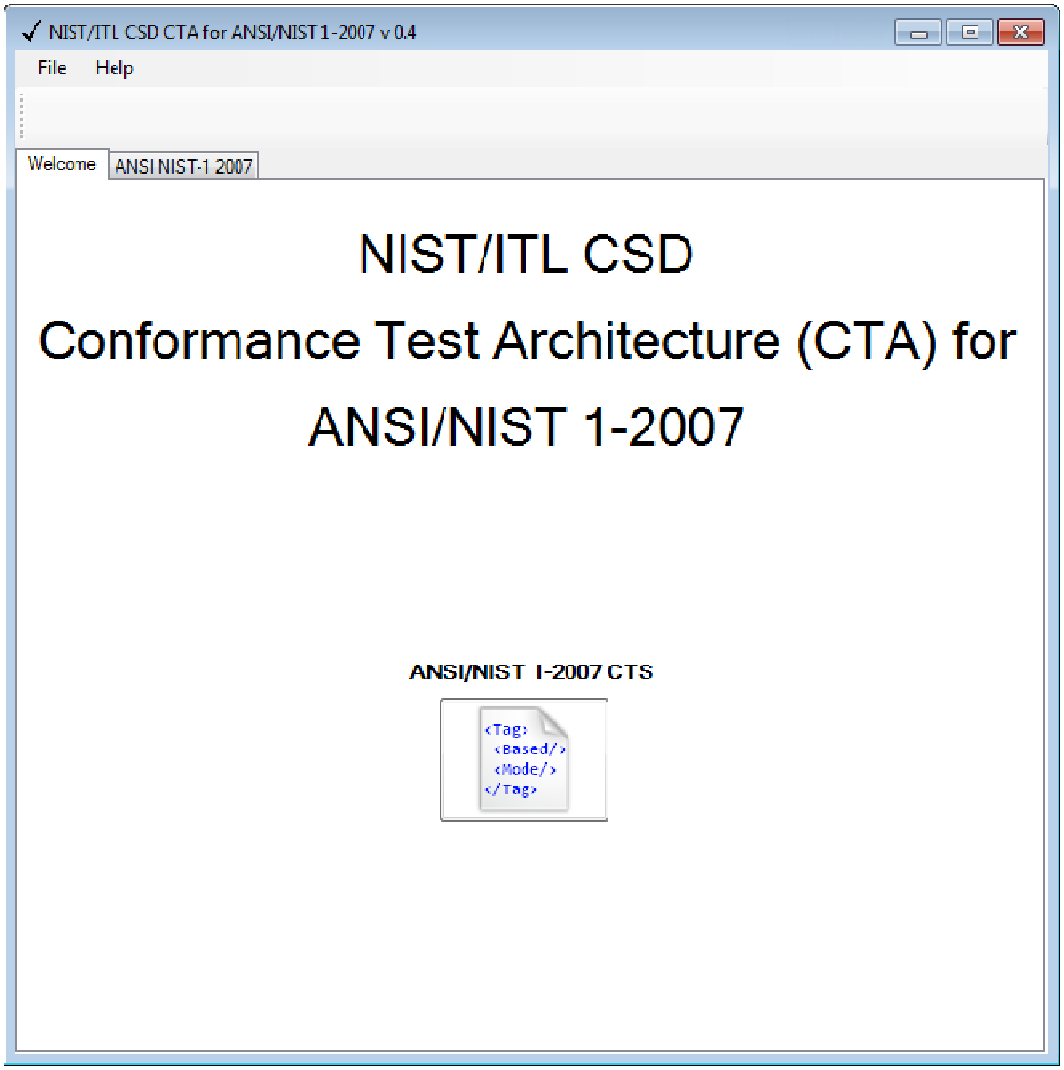

Figure 3-1: CTA/CTS Welcome

3.2 Loading and Running Implementations

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

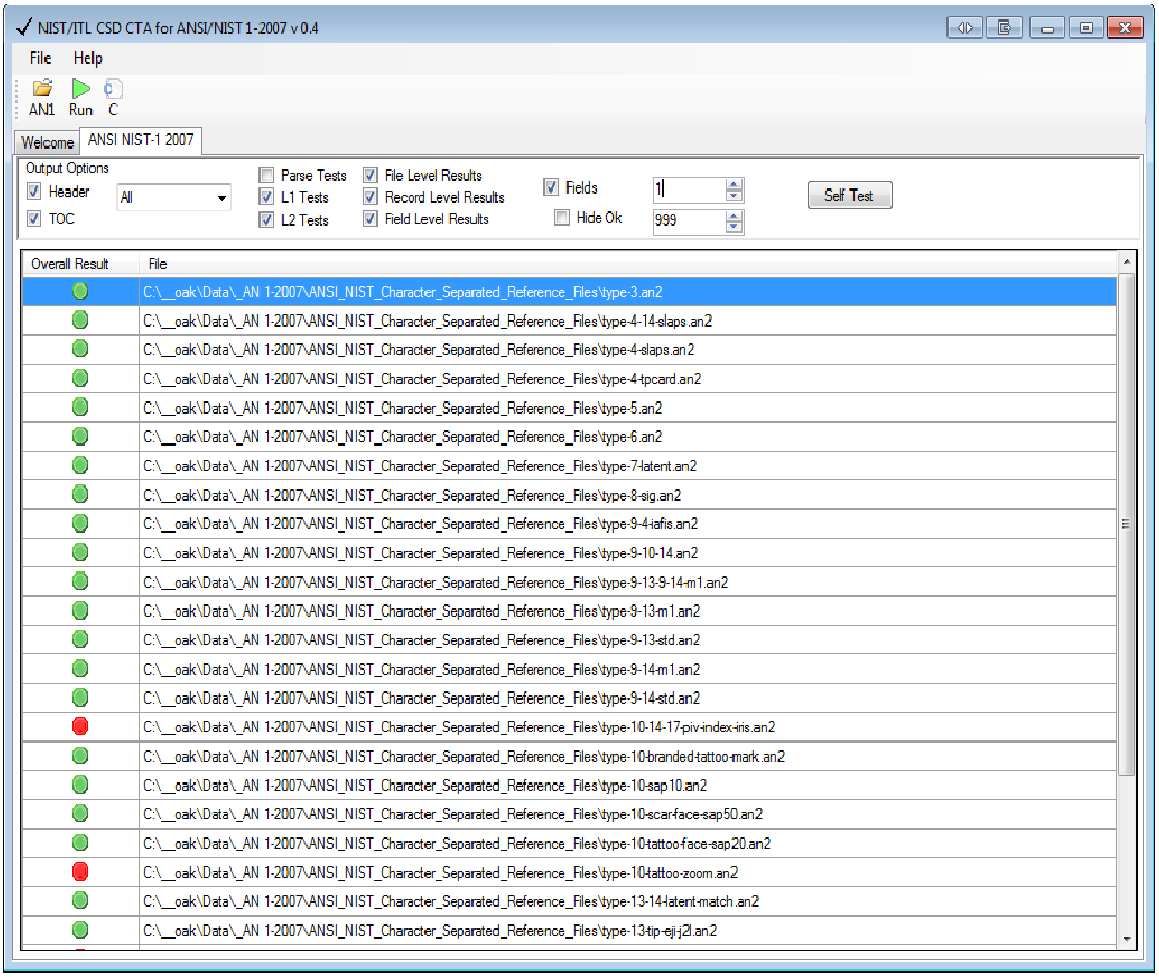

Figure 3-2: ANSI NIST - 1 2007 Test Window

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 1-2007 Sample Files
- Vista: C:\Users\Public\Documents\ANSI NIST 1-2007 Sample Files
- 7: C:\Users\Public\Documents\ANSI NIST 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 - 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 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.

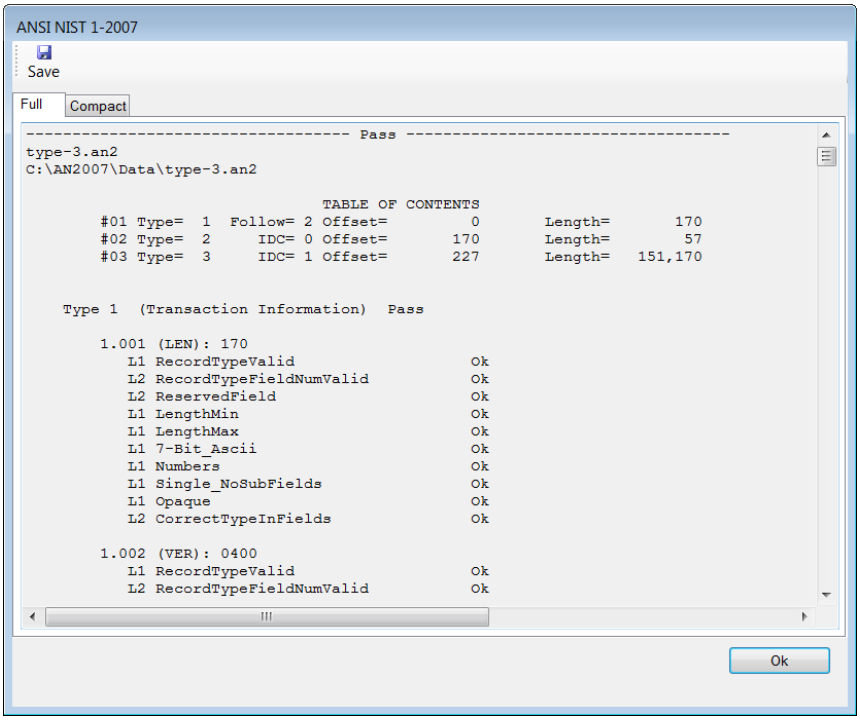

Figure 4-2: ANSI NIST 1-2007 Detailed Results

The "Save" button, shown in Figure 4-2 below the "ANSI NIST 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-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.

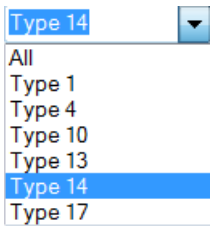

Figure 4-6: Type Selection Menu

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.

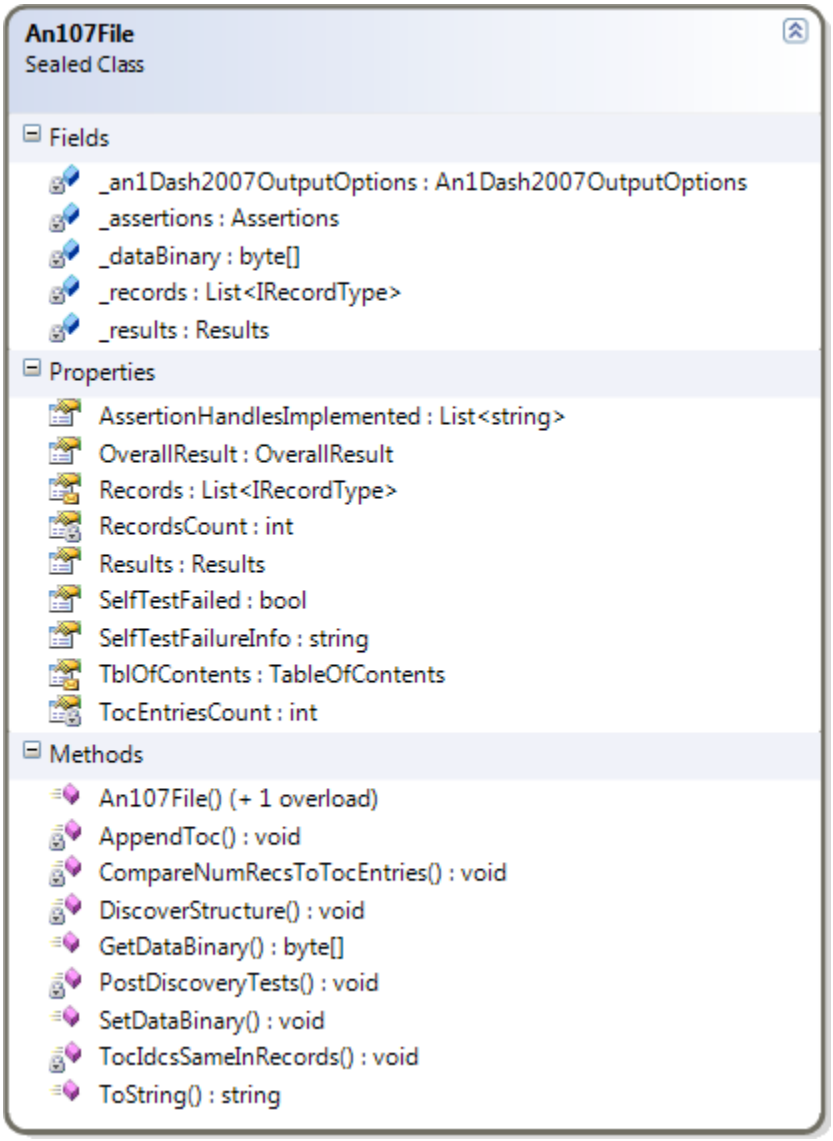

Figure A-1: Class Diagram for the An107 File Class

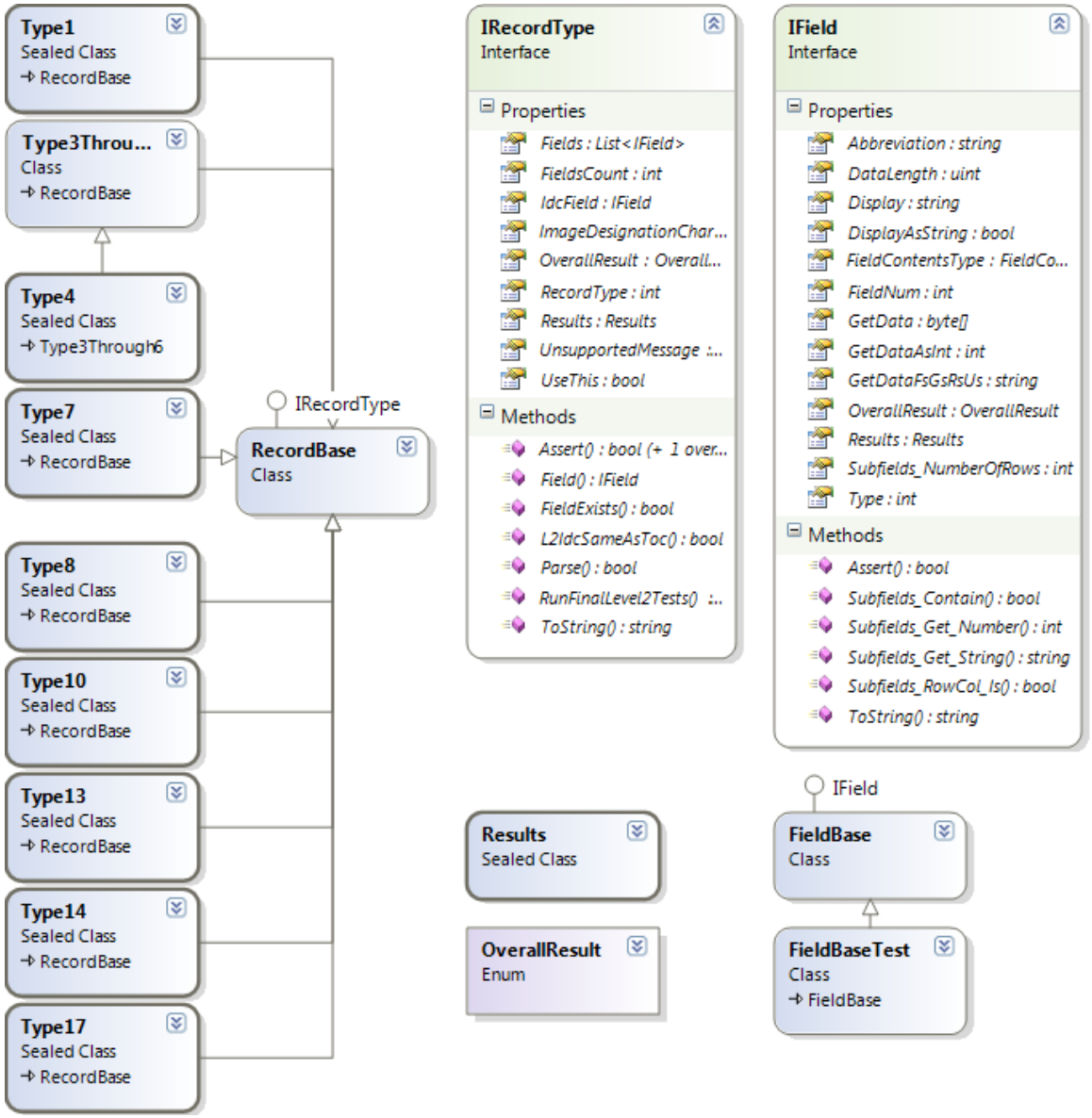

Figure A-2: Class Diagram for the Data Types

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/NISTITL 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

Table C-1 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. The table 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 below 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.

- 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.

[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 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 procedure 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.

Test assertions are expressed according to the operators and operands found below the table, except for those instances where the assertion cannot be clearly or easily represented in a mathematical format. 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 - 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 to 17.026	{17.001 to 17.026} LT 128				
			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. Within each logical record, entries shall be provided in nine ordered and unnumbered fields 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	2	M	4.002-HasIdc	Present(4.002)				
			2	M	10.002-HasIdc	Present(10.002)				
			2	M	13.002-HasIdc	Present(13.002)				

		separate field containing the Image Designation Character (IDC).	2	M	14.002-HasIdc	Present(14.002)				
			2	M	17.002-HasIdc	Present(17.002)				
Valid IDC	7.4	The IDC shall be used to relate information items in the file content field of the Type-1 record to each logical record.	2	M	See Below 1.003-CNT_ListsRecs	The test assertion is addressed for each individual supported Record Type below				
002-IDC_-Sequence	7.4	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).	2	M	002-IDC_ZeroFirst	{First(Field in Transaction) ST FieldNumber(Field) EQ 2} EQ 0				
			2	M	002-IDC_Zero_Min-_Value	{#.002} GTE 0				
			2	M	002-IDC_255_Max-_Value	{#.002} LTE 255				
			2	M	002-IDC_IncByOne	Each new IDC is one greater than the previous maximum IDC value.				
002-RelatedIDCs	7.4	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.	2	M	IDC_Entity_-Supported_Types_Only	Type(Record) MO [1,4,10,13,14, 17]				
			2	M	IDC_Entity_Has_IDC	Type(Record) MO [4, 10,13,14,17]				
			2	M	IDC_Entity_-Choose_-Biometric_And_-Comparison_Id	Record Type / Field 10.003 / Bio-metric / Field For Com-parison ID 4 / NA / FINGER / Byte 1 of 4.004 10 / FACE / FACE / NA 10 / SCAR / SCAR / (1,1) of 10.040 10 / MARK / MARK / (1,1) of 10.040 10 / TATTOO / TATTOO / (1,1) of 10.040 13 / NA / FINGER / (1,1) of 13.013 14 / NA / FINGER / (1,1) of 14.013 17 / NA / IRIS / 17.003 IF 17.003 = 1 Or 2				
			2	M	IDC_Entity_-Compare_Records_With_The_Same_-IDC_Value	First Record / Second Record / Comparison IDs / Result FINGER / FINGER / Same / Ok FINGER / FINGER / Different / Error FINGER / NEQFINGER / NA / Error FACE / FACE / NA / Ok FACE / NEQ FACE / NA / Error IRIS / IRIS / Both = 1 Or Both = 2 / Ok IRIS / IRIS / Not (Both = 1 Or Both =				

						2)				
						IRIS	NEQ IRIS	NA	Error	
						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: 1.001, 1.002, 1.004 to 1.012, 1.014 10.001 to 10.013, 10.016, 10.017, 10.020, 10.021, 10.027, 10.030 13.001 to 13.012, 13.016, 13.017 13.020 14.001 to 14.012, 14.016, 14.017,	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				

		14.020, 14.030 17.001 to 17.015, 17.017, 17.018, 17.020 to 17.023, 17.025, 17.026, 17.030	1	M	Single_NoSubFields::13.001 to 13.012	Count(Subfields in 13.001 to 13.012) EQ 0				
			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::1	IF Type(Record) EQ 14 THEN				

					4.999	Type(14.999) EQ 14				
			1	M	RecordTypeValid::17.001 to 17.026	IF Type(Record) EQ 17 THEN 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 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 The last byte, ASCII FS, is included in the Record Length				
			2	M	13-LenInclEndFs	Length(Record) EQ Sum(Field Lengths) + 1 The last byte, ASCII FS, is included in the Record Length				
			2	M	14-LenInclEndFs	Length(Record) EQ Sum(Field Lengths)				

						+ 1 The last byte, ASCII FS, is included in the Record Length				
			2	M	17-LenInclEndFs	Length(Record) EQ Sum(Field Lengths) + 1 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,	This requirement is inferred from the Tables describing the Char type for each	1	M	CharType_Numbers ::1.001, 1.002	Bytes(1.001,1.002) MO [0 to 9]				

	Table 31, Table 33, Table 37	record type. The following fields shall contain only numbers (ASCII 0x30 through 0x39): 1.001,1.002,1.005,1.006 10.001,10.002,10.005 to 10.009,10.013,10.016,10.017 13.001 to 13.003, 13.005 to 13.010, 13.012,13.013,13.016,13.017 14.001 to 14.003, 14.005 to 14.010, 14.012, 14.016,14.017 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 ::1.005, 1.006	Bytes(1.005,1.006) MO [0 to 9]				
			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	2	M	1.002-Second	IF Type(Record) EQ 1 THEN FieldNumber(Second(Field in Record)) EQ 2				

		record are ordered. 1.002 must be the second field.								
1.xxx-Mandatory	9.1 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 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): 1.003 10.024, 10.025, 10.041 13.024 14.013, 14.021 to 14.025 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:
		
		13.014, 14.018, 14.022
		
		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
						AND
						ForEach(RS_Subfield in 1.003)
						{
						Count(US_Subfields) EQ 2
						}
							2			

			1	M	Nx2::13.014	Count(RS_Subfields in 13.014) GTE 1
						AND
						ForEach(RS_Subfield in 13.014)
						{
						Count(US_Subfields) EQ 2
						}
							2			

			1	M	Nx2::14.018	Count(RS_Subfields in 14.018) GTE 1
						AND
						ForEach(RS_Subfield in 14.018)
						{
						Count(US_Subfields) EQ 2
						}
							2			

			1	M	Nx2::14.022	Count(RS_Subfields in 14.022) GTE 1 AND ForEach(RS_Subfield in 14.022) { Count(US_Subfields) EQ 2	2			

						}				
1.003-CNT_ListsRecs	9.1.3	Field 1.003, File Content (CNT) shall list 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. 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.	2	M	1.003-CNT_ListsRecs	Field 1.003, File Content (CNT) shall list 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. 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: 1.001, 1.004, 1.007 to 1.013 4.001, 4.002, 4.006, 4.007, 4.009 10.001, 10.002, 10.004, 10.006, 10.007, 10.009, 10.010, 10.016, 10.017, 10.025, 10.026, 10.041	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				

		13.001, 13.002, 13.004, 13.006 to 13.010, 13.016, 13.017 13.020 14.001, 14.002, 14.004, 14.006, 14.007, 14.009, 14.010, 14.016, 14.017, 14.020 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::10.016, 10.017	True				
			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]				
			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,	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]				

	15.1.26, 15.1.30, 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::10.028, 10.029	Bytes(10.028,10.029) MO [0x20 to 0x7E, ASCII US, ASCII RS]				
			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	2	M	See Above 1-FsAtEnd	Last(Byte in Record) EQ ASCII FS				

		information fields.								
Type 4 Requirements and Assertions										
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	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			

		recommended.								
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}				
			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) 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) This mandatory ASCII field shall be used to identify the facial or SMT image data	2	M	10.002::IDC=CNT_-IDC	{10.002} EQ {1.003}				

		contained in the record. This IDC shall match the IDC found in the file content (CNT) field of the Type-1 record.								
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	3			

						{10.009} EQ {Horizontal Density} * 0.01 (meters/cm)				
			2	M	10.009-JPEGB-JPEGL-HorzAspect	IF {13.008} NEQ “1” OR “2”, THEN {13.009} EQ {Horizontal Density} / {Vertical Density}	3			
			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_	15.1.13	Field 10:013, the Subject Acquisition	2	M	10.003::IMT=FACE_	Field 10:013, the Subject Acquisition				

SAP_Mandatory		Profile (SAP), is mandatory when field 10.003 contains "FACE".			SAP_Mandatory	Profile (SAP), is mandatory when field 10.003 contains "FACE".				
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	1	O	Photo_Descriptors::10.022	{10.022} MO Table 20				

		subfield. The first is OTHER followed by the ASCII US separator, followed by the 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 OR 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){ Count(items) EQ 3}				
			1	O	SubFields_Nx3::17.024	ForEach(Subfield in 17.024){ 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.
		
		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.
		
		2. The second information item shall
			1	O	Subject_Quality_Score::10.024	ForEach(RS_Subfield in 14.024)
						{
						Count(US_Subfield) EQ 3
						
						AND
						
						{US_Subfield:1} GTE 0 AND
						{US_Subfield:1} LTE 100 OR
						{US_Subfield:1} MO [254,255]
						
						AND
						
						{US_Subfield:2} MO [IBIA Vendor Registry]
						AND
						
						{US_Subfield:3} GTE 1 AND
						{US_Subfield:3} LTE 65535 OR
						
						}
							2			

		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. 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) This optional ASCII field shall specify quality score data for facial images stored in this record. … 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. ….	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	1	O	AlphaNumeric_RS::	Bytes(10.026) MO [0x20-0x7E, ASCII				

		characters (ASCII 0x20 through 0x7E) and ASCII RS (0x1E).			10.026	RS]				
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::10.02 8	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_C olor	15.1.26	Field 10.028: Subject hair color (SHC) 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” (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	1	O	Subject_Feature_Po ints::10.029	ForEach(RS_Subfield in 10.029) { US_Subfield:1 EQ 1 AND	2			

		item feature point block as described in Table 25. The first information item is 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.				US_Subfield:2 EQ A.B ST A.B MO Figure 5 AND A.B NOT MO [Prior A.B] AND {US_Subfield:3} > 0 AND Length(US_Subfield:3) MO [1,2,3,4] AND {US_Subfield:4} > 0 AND Length(US_Subfield:4) MO [1,2,3,4] }				
10.029::No_-Duplicate_-Feature_Points	15.1.27	Field 10.029: Facial feature points (FFP) 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) 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	1	O	NCIC_Designation_Code::10.040	{10.040} MO [NCIC Designation Codes]	5			

		can encompass an area larger than that 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, 19.1.14	The field shall have two subfields separated by ASCII US.	1	O	1x2::10.041	Count(Subfields in 10.041) EQ 2				
			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	1	O	SMT_Descriptors::10.042	ForEach(RS_Subfield in 10.042)
						{
						US_Subfield:1 MO ['SCAR', 'MARK', 'TATTOO', 'CHEMICAL', 'BRANDED', 'CUT']
						
						AND
						
						IF US_Subfield:1 MO ['SCAR','MARK']
						THEN
						{
						US_Subfield:2 EQ 'OTHER' AND
						US_Subfield:3 EQ 'MISC'
						}
						ELSE
						{
						US_Subfield:2 MO Table 28 AND
						US_Subfield:3 MO Table 29 a to h
						}
						}
							2			

10.042::SCAR_-MARK_OTHER_-MISC_Text	15.1.32	Field 10.042: SMT descriptors (SMD) 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" …	2	O	10.042::SCAR_-MARK_OTHER_-MISC_Text	IF (N,1) = “SCAR” (N,2) = “OTHER” (N,3) = “MISC” (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” Row N is (N,4)				
10.042::TATTOO	15.1.32	Field 10.042: SMT descriptors (SMD) This optional field is used to describe the content of the SMT image… The first information item of each	2	O	10.042::TATTOO	IF(N,1) In {“TATTOO”, “CHEMICAL”, “BRANDED”, “CUT”} (N,2) In {Table 28} (N,3) In {Table 29} (N,4) In {NULL, Text}				

		subfield shall identify the source of the image as being a scar, a mark, or a tattoo. It shall contain “SCAR” … 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. 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. 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) This optional field is used to describe the content of the SMT 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” … For deliberately applied or drawn images, the first information item will contain "TATTOO" to indicate a …	2	O	10.042::TATTOO_-(1x3)_Or_(1x4)	IF (N,1) In {“TATTOO”, “CHEMICAL”, “BRANDED”, “CUT”} (N,2) Is Not NULL (N,3) Is Not NULL (N,4) Is NULL Or Not NULL (Optional)				

		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.								
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) 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) 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)				
10::FsAtEnd	15.2	End of Type-10 logical record 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) 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) 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	2	M	13.007-JPEGL-VLL	{13.007} EQ {Image Height}	3			

		horizontal lines contained in the transmitted image.	2	M	13.007-JP2L-VLL	{13.007} EQ {Image Height}	3			
			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 Table 1. Lossy algorithms are not valid.	1	M	Table_1_No_Lossy:: 13.011	{13.011} MO [“NONE”, “JPEGL”, “JP2L”, “PNG”]	3			
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. 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::1 3.012	{13.012} MO [8-16]				
			1	M	Table_BPX_ASCII::1 4.012	{14.012} MO [8-16]				
			1	M	Table_BPX_ASCII::1 7.012	{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	2	M	13.013::Finger_-Palm_Position	ForEach(RS_Subfield in 13.013)
						{
						{RS_Subfield} MO [Table12, Table35]
						}				

		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.								
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 US_SubField:1 LTE 10 AND US_SubField:2 MO Table 32	2,5			
13.014::Search_-Position_-Descriptors_-Present	18.1.14	Field 13.014: Search Position Descriptors (SPD) 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	1	O	Print_Position_Coordinates::13.015	Count(US_Subfields in 13.015) EQ 6 AND	5			

		offsets to the locations for the bounding 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.				US_Subfield:1 MO ['FV1','FV2','FV3','FV4'] AND US_Subfield:2 MO ['NA','PRX','DST','MED']				
			1	O	Print_Position_Coordinates::14.015	Count(US_Subfields in 14.015) EQ 6 AND US_Subfield:1 MO ['FV1','FV2','FV3','FV4'] AND US_Subfield:2 MO ['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) 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) 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_Me	18.1.21	This optional ASCII field is used to	1	O	Latent_Quality_Met	ForEach(RS_Subfield in 13.024)	2			

tric		specify one or more different metrics of 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.
		
		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.
		
		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 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.
		
		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
					ric::13.024	{
						Count(US_Subfield) EQ 4
						
						AND
						
						US_Subfield:1 MO Table12 or Table 35
						
						AND
						
						US_Subfield:2 GTE 0 AND
						US_Subfield:2 LTE 100 OR
						US_Subfield:2 MO [254,255]
						
						AND
						
						US_Subfield:3 MO [IBIA Vendor Registry]
						
						AND
						
						US_Subfield:4 GTE 1 AND
						US_Subfield:4 LTE 65535
						}				

		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 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) 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. … 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) 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)				
			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 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) 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) 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	2	M	14.006-JPEGB-	{14.006} EQ { Image Width}	3			

		pixels contained on a single horizontal line of the transmitted image.			JPEGL-HLL					
			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 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 IF {14.008} EQ 1 OR 2 THEN {Sampling Units} EQ 1, ELSE IF {14.008} EQ 0 THEN {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 IF Present(JFIF Header) THEN {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 IF {14.008} EQ “1”, THEN {14.009} EQ {Horizontal Density} * 0.0254 (meters/inch) ELSE IF {14.008} EQ “2”, THEN {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 {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 IF {14.008} NEQ “1” OR “2”, THEN {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	2	M	14.010-JPEGB-JPEGL-VPS	IF {14.008} EQ “1” OR “2”, THEN IF Present(JFIF Header) THEN {14.010} EQ {Vertical Density}	3			
			2	M	14.010-JP2-JP2L-VPS	No Implementation	4			

		pixel aspect ratio.	2	M	14.010-PNG-VPS	IF Present(PHYS Chunk) THEN
						IF {14.008} EQ "1", THEN
						{14.010} EQ {Vertical Density} * 0.0254 (meters/inch)
						ELSE IF {14.008} EQ "2", THEN
						{14.010} EQ {Vertical Density} * 0.01 (meters/cm)
							3			

			2	M	14.010-WSQ-VPS	No Implementation	4			
			2	M	14.010-JPEGB-JPEGL-VerAspect	IF {14.008} NEQ "1" OR "2", THEN {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
						IF {14.008} NEQ "1" OR "2", THEN
						{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) 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	1	O	Print_Position_Descriptors::14.014	{US_Subfield:1} GTE 0 AND {US_Subfield:1} LTE 10 AND {US_Subfield:2} MO Table 32	2,5			

		Table 12. The second information item is 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) 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) 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.	1	O	Finger_Segment_Positions::14.021	ForEach(RS_Subfield in 14.021)
						{
						Count(US_Subfield) EQ 5
						
						AND
						
						{US_Subfield:1} MO Table 12
						
						AND
						
						{US_Subfield:2 to 5} GTE 0
						}
							2			

		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){ {US_Subfield:1} GTE 1 AND {US_Subfield:1} LTE 10 AND {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	1	O	Segmentation_Quality_Metric::14.023	ForEach(RS_Subfield in 14.023) { Count(US_Subfield) EQ 4 AND {US_Subfield:1} GTE 1 AND {US_Subfield:1} LTE 10 AND {US_Subfield:2} GTE 0 AND {US_Subfield:2} LTE 100 OR {US_Subfield:2} MO [254,255] AND {US_Subfield:3} MO [IBIA Vendor Registry] AND {US_Subfield:4} GTE 1 AND	2			

		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. 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.				{US_Subfield:4} LTE 65535 OR }				
IBIA_Quality_-Vendor	19.1.23	Field 14.023: Segmentation quality metric (SQM) 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	2	O	14.023::IBIA_-Quality_Vendor	The code exists in the IBIA Vendor Registry of CBEFF Biometric Organizations.				

		Organizations that will map the value in 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)
						{
						Count(US_Subfield) EQ 4
						
						AND
						
						{US_Subfield:1} GTE 1 AND
						{US_Subfield:1} LTE 10
						
						AND
						
						{US_Subfield:2} GTE 0 AND
						{US_Subfield:2} LTE 100 OR
						{US_Subfield:2} MO [254,255]
						
						AND
						
						{US_Subfield:3} MO [IBIA Vendor Registry]
						
						AND
						
						{US_Subfield:4} GTE 1 AND
						{US_Subfield:4} LTE 65535 OR
						
						}
							2			

IBIA_Quality_-Vendor	19.1.24	Field 14.024: Fingerprint quality metric (FQM) 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)
						{
						First(US_Subfield in RS_Subfield) MO [1 to 10]
						}				

ASEG_Order	19.1.25	The order of the vertices must be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise.	1	O	ASEG_Consecutive_ Order::14.025	Angle.Direction.First EQ ((X,Y).1 To (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)) 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. 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) X GTE 0 AND 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 character.	2	O	14.025-RS	Character separator between subfields representing each finger EQ ASCII RS				
RESERVED_FIELDS	19.1.26	Field 14.026-029: Reserved for future definition (RSV) 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) 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 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	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-	Count(17.xxx) LTE				

		"O"…and occurrence limits.			MaxOccurrences	MaxOccurrences(17.xxx)				
			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) 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) 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 {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
						
						IF Present(JFIF Header) THEN
						
						{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			

			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
						
						IF Present(JFIF Header) THEN
						
						{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				

		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) … 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.

Operators:

- 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.

Terms

- NULL = control character with no value.
- NA = Not Applicable

Operand

- Present(Value) = Determines if Value is present
- Present(X in Y) = Determines if X is present in YSum(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