INTERNATIONAL STANDARD

ISO/IEC
29109-2

First edition
2010-05-01

Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 —

Part 2:
Finger minutiae data

Technologies de l'information — Méthodologie d'essai de conformité pour les formats d'interéchange de données biométriques définis dans l'ISO/CEI 19794 —

Partie 2: Données de point caractéristique de doigt

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 29109-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

ISO/IEC 29109 consists of the following parts, under the general title *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794*:

⎯ *Part 1: Generalized conformance testing methodology*

⎯ *Part 2: Finger minutiae data*

⎯ *Part 4: Finger image data*

⎯ *Part 5: Face image data*

⎯ *Part 6: Iris image data*

⎯ *Part 8: Finger pattern skeletal data*

⎯ *Part 9: Vascular image data*

⎯ *Part 10: Hand geometry silhouette data*

The following parts are under preparation:

⎯ *Part 3: Finger pattern spectral data*

⎯ *Part 7: Signature/sign time series data*

⎯ *Part 11: Signature/sign processed dynamic data*

⎯ *Part 13: Voice data*

⎯ *Part 14: DNA data*

Introduction

ISO/IEC 19794-2 specifies data interchange formats for recording, storing and transmitting one or more finger minutiae records, possibly within a Common Biometric Exchange Formats Framework (CBEFF) data structure. Each minutia may be accompanied by subject-specific metadata contained in a header record. This part of ISO/IEC 29109 defines tests for checking the correctness of the binary record.

The requirements of ISO/IEC 19794-2 cannot be completely achieved until biometric products can be tested to determine whether they conform to its specifications. Conforming implementations are a necessary prerequisite for achieving interoperability among implementations; there is therefore a need for a standardized conformance testing methodology, test assertions and test procedures, as applicable to specific modalities addressed by each part of ISO/IEC 19794. The test assertions will cover as much as is practical of the ISO/IEC 19794 requirements (covering the most critical features), so that the conformity results produced by the test suites will reflect the real degree of conformity of the implementations to ISO/IEC 19794 Data Interchange Format records. This is the motivation for the development of this conformance testing methodology.

This part of ISO/IEC 29109 supports those applications that require use of finger minutiae data according to ISO/IEC 19794-2:2005. It defines a testing methodology to assure conformance of a vendor's application or service to the base ISO/IEC 19794-2:2005 specification. Thus, it is intended to:

— establish elements of the Conformance Testing Methodology framework that are specific to the Finger Minutiae-based Data Record requirements of ISO/IEC 19794-2:2005 conformance testing,

— define requirements and guidelines for specifying conformance test suites and related test methods for measuring conformity of products and services to the Finger Minutiae-based Data Record requirements of ISO/IEC 19794-2:2005, and

— define test and reporting procedures to be followed before, during and after conformance testing.

This part of ISO/IEC 29109 is applicable to the development and use of conformity test method specifications, conformity test suites for ISO/IEC 19794-2:2005 records, and conformance testing programs for ISO/IEC 19794-2:2005 conformant products. It is intended primarily for use by testing organizations, but may be applied by developers and users of test method specifications and test method implementations.

Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 —

Part 2:
Finger minutiae data

1 Scope

This part of ISO/IEC 29109 specifies elements of conformance testing methodology, test assertions and test procedures, as applicable to the biometric data interchange format standard relating to finger minutiae data (i.e. ISO/IEC 19794-2).

It establishes

— tests of assertions of the structure of the finger minutiae data format as specified in ISO/IEC 19794-2:2005 (Type A Level 1 as defined in ISO/IEC 29109-1:2009),

— tests of assertions of internal consistency by checking the types of values that may be contained within each field (Type A Level 2 as defined in ISO/IEC 29109-1:2009), and

— tests of semantic assertions (Type A Level 3 as defined in ISO/IEC 29109-1:2009).

This part of ISO/IEC 29109 does not establish

— tests of conformance of CBEFF structures embedding ISO/IEC 19794-2:2005 biometric data blocks (BDBs),

— tests of other characteristics of biometric products or other types of testing of biometric products (e.g. acceptance, performance, robustness, security),

— tests of conformance of systems that do not produce ISO/IEC 19794-2:2005 records, or

— tests for Level 3 conformance testing.

2 Conformance

Biometric data interchange format conformance tests conform to this part of ISO/IEC 29109 if they satisfy all of the normative requirements related to Clause 6. Specifically, they shall use the test methodology specified in ISO/IEC 29109-1:2009, Clauses 6, 7 and 8, and all Level 1 and Level 2 tests shall use the assertions defined in Table 2.

Implementations of ISO/IEC 19794-2:2005 tested according to the methodology specified shall be able to claim conformance only to those Biometric Data Record (BDR) requirements specified in ISO/IEC 19794-2:2005 that are tested by the test methods established by this methodology.

Implementations of ISO/IEC 19794-2:2005 do not necessarily need to conform to all possible aspects of ISO/IEC 19794-2:2005, but only to those ISO/IEC 19794-2:2005 requirements that are claimed to be supported by the implementation in an Implementation Conformance Statement, filled out in accordance with Table 1 of this part of ISO/IEC 29109 and ISO/IEC 29109-1:2009, Clause 8.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 19794-2:2005, *Information technology — Biometric data interchange formats — Part 2: Finger minutiae data*

ISO/IEC 19794-2:2005/Cor.1:2009, *Information technology — Biometric data interchange formats — Part 2: Finger minutiae data — Technical corrigendum 1*

ISO/IEC 29109-1:2009, *Information technology — Conformance testing methodology for biometric data interchange formats defined in ISO/IEC 19794 — Part 1: Generalized conformance testing methodology*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29109-1 apply.

5 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in ISO/IEC 29109-1 apply.

6 Conformance testing methodology

6.1 General

The testing methodology specified in ISO/IEC 29109-1:2009, Clauses 6, 7 and 8 shall be used. The content of the tables below is based on the conformance testing methodology outlined in 29109-1 and shall only be used in the context of that testing methodology.

6.2 Table of requirements in the base standard

The normative requirements of ISO/IEC 19794-2:2005, are listed in Table 1. The supplier of the IUT can explain which optional components of the standard are supported and the testing laboratory can note the results of the test.

Table 1 — Requirements of the Base Standard (19794-2:2005)

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-1	6.2	Some points are neither a ridge ending nor a bifurcation. This standard therefore defines additionally a type named "other", which shall be used in such a way that the matching conditions specified in clause 6.5 apply. The "other" minutiae type shall not be used for minutiae that are ridge endings or ridge bifurcations.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	
R-2	6.3.1	The coordinate system used to express the minutiae of a fingerprint shall be a Cartesian coordinate system. Points shall be represented by their X and Y coordinates. The origin of the coordinate system shall be the upper left corner of the original image with X increasing to the right and Y increasing downward. The X and Y coordinates of the minutiae shall be in pixel units, with the spatial resolution of a pixel given in the "X Resolution" and "Y Resolution" fields of the format.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-3	6.3.2	The minutia for a ridge ending shall be defined as the point of forking of the medial skeleton of the valley area immediately in front of the ridge ending.	3C	O-1	Y	Y	Y	N	Y	N	Y	N	Y	N		N/A	N/A
R-4	6.3.3	The minutia for a ridge bifurcation shall be defined as the point of forking of the medial skeleton of the ridge. If the ridges were thinned down to a single-pixel-wide skeleton, the point where the three legs intersect is the location of the minutia.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-5	6.3.4	The minutia for a ridge skeleton endpoint shall be defined as the center point of the ending ridge.	3C	O-1	N	N	N	Y	N	Y	N	Y	N	Y		N/A	N/A
R-6	6.3.5	For minutia other than a bifurcation or ridge ending the position and angle calculations shall be done in such a way that the matching conditions in clause 6.5 apply.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-7	6.5	Core direction: If the core has a discernible angle of direction, it shall be recorded in the core information, since this characterizes the type of core.	3C	O-1	Y	N	N	N	N	N	N	N	N	N		N/A	N/A
R-8	6.5	Delta direction: For all observable divergences the angle is defined by the direction of the tangent before the pair of ridges beings to diverge. The angle shall point from divergent towards parallel ridge lines; that is, the angles shall point outwards from the delta.	3C	O-1	Y	N	N	N	N	N	N	N	N	N		N/A	N/A
R-9	6.6	In a matching process, the different minutia types shall be matched according to the following Table 1. Matchers may choose to assign lower weights (or importance) to a match of type 00 to 01 or 10, than to a match of type 00 to 00, 01 to 01, or 10 to 10.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-10	6.7	All multibyte quantities are represented in Big-Endian format; that is, the more significant bytes of any multibyte quantity are stored at lower addresses in memory than (and are transmitted before) less significant bytes. All numeric values are fixed-length integer quantities, and are unsigned quantities.	1	M	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A

ISO/IEC 29109-2:2010(E)

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-11	7.1	The minutiae record format shall be used to achieve interoperability between finger matchers providing a one-to- one verification.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-12	7.1	The minutia data shall be represented in a common format, containing both basic and extended data. With the exception of the Format Identifier and the Version number for the standard, which are null-terminated ASCII character strings, all data is represented in binary format.	1	M	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			
R-13	7.3	There shall be one and only one record header for the minutiae record, to hold information describing the type and characteristics of device that generated the minutia data.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-14	7.3.1	The Finger Minutiae Record shall begin with the three ASCII characters "FMR" followed by a zero byte as a NULL string terminator.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-15	7.3.2	The version number for the version of this standard used in constructing the minutiae record shall be placed in four bytes. This version number shall consist of three ASCII numerals followed by a zero byte as a NULL string terminator. The first and second character will represent the major revision number and the third character will represent the minor revision number. The version number is " 20" (an ASCII space followed by an ASCII '2' and an ASCII '0').	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support		Test Result
					1	2	3	4	5	6	25	26	27	28	Supported Range		
R-16	7.3.3	The length of the entire record shall be recorded in four bytes.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-17	7.3.4	If the most significant bit is '1', the original capture equipment was certified to be compliant with the specifications in Annex B, copied from the US Federal Bureau of Investigation's Image Quality Specifications, Appendix F. The least significant of the four bits is reserved for a future ISO finger image capture equipment certification. The two additional bits are reserved for future image quality certifications.	3C	O-1	Y	Y	Y	Y	Y	Y	N	N	N	N	N/A		N/A
R-18	7.3.5	The capture device type ID shall be recorded in twelve bits.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-19	7.3.6	The size of the original image in pixels in the X direction shall be contained in two bytes.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-20	7.3.7	The size of the original image in pixels in the Y direction shall be contained in two bytes.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-21	7.3.8	The resolution of the minutiae coordinate system shall be recorded in two bytes having the units of pixels per centimeter. The value of the X resolution shall not be less than 98.45 pixels per centimeter (250 pixels per inch).	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-22	7.3.9	The resolution of the minutiae coordinate system shall be recorded in two bytes having the units of pixels per centimeter. The value of the Y resolution shall not be less than 98.45 pixels per centimeter (250 pixels per inch).	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-23	7.3.10	The total number of finger views contained in the minutiae record shall be recorded in one byte.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-24	7.3.10	In cases where there is more than one view of any finger, this number will be greater than the number of fingers.	2	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-25	7.3.11	This field is reserved for future use, and to align the end of the record header on a long-word (four byte) boundary. For the current version of the standard, this field shall be set to zero.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-26	7.4.1	A finger header shall start each section of finger data providing information for that finger. There shall be one finger header for each finger contained in the finger minutiae record. The finger header will occupy a total of four bytes as described below.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-27	7.4.1.1	The finger position shall be recorded in one byte The codes for this byte shall be as defined in Table 2.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-28	7.4.1.2	The view number shall be recorded in four bits.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-29	7.4.1.2	If more than one finger minutiae record in a general record is from the same finger, each minutiae record shall have a unique view number. The combination of finger location and view number shall uniquely identify a particular minutiae record within a general record.	2	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-30	7.4.1.2	Multiple finger minutiae records from the same finger shall be numbered with increasing view numbers, beginning with zero. Where only one finger minutiae record is taken from each finger, this field shall be set to 0.	2	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-31	7.4.1.3	The impression type of the finger images that the minutiae data was derived from shall be recorded in four bits. The codes for this byte are shown in Table 3.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-32	7.4.1.4	The quality of the overall finger minutiae data shall be between 0 and 100 and recorded in one byte.	1	M	Y	Y	N	N	N	N	N	N	N	N			
R-33	7.4.1.5	The number of minutiae recorded for the finger shall be recorded in one byte.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-34	7.4.2	The finger minutiae data for a single finger shall be recorded in blocks of six bytes per minutia.	2	M	Y	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-35	7.4.2.1	The type of minutia will be recorded in the first two bits of the upper byte of the X coordinate. There will be two bits reserved at the beginning of the upper byte of the Y coordinate for future use. The bits "00" will represent a minutia of "other" type, "01" will represent a ridge ending and "10" will represent a ridge bifurcation.	1	M	Y	Y	Y	Y	N	N	Y	Y	N	N			
R-36	7.4.2.2	The X coordinate of the minutia shall be recorded in the rest of the first two bytes (fourteen bits).	1	M	Y	Y	Y	Y	N	N	Y	Y	N	N			
R-37	7.4.2.2	The Y coordinate shall be placed in the lower fourteen bits of the following two bytes.	1	M	Y	Y	Y	Y	N	N	Y	Y	N	N			
R-38	7.4.2.2	The coordinates shall be expressed in pixels at the resolution indicated in the record header.	3C	O-1	Y	Y	Y	Y	N	N	Y	Y	N	N		N/A	N/A
R-39	7.4.2.3	The angle of the minutia shall be recorded in one byte in units of 1.40625 (360/256) degrees. The value shall be a non-negative value between 0 and 255, inclusive.	1	M	Y	Y	Y	Y	N	N	Y	Y	N	N			
R-40	7.4.2.4	The quality of each minutia shall be recorded in one byte. The quality figure shall range from 100 as a maximum to 1 as a minimum.	1	M	Y	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-41	7.4.2.4	The quality of each minutia shall be recorded in one byte. The quality figure shall be set to 0 for no quality encoded.	1	M	Y	Y	N	N	N	N	N	N	N	N			
R-42	7.5	The extended data for each finger view shall immediately follow the standard minutiae data for that finger view and shall begin with the Extended Data Block Length field.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-43	7.5	In particular, ridge count data, core and delta data or zonal quality information shall not be represented in proprietary manner to the exclusion of the publicly defined formats in this standard.	3C	O-1	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-44	7.5.1.1	All minutiae records shall contain the extended data block length.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-45	7.5.1.1	A value of all zeros (0x0000 hexadecimal) will indicate that there is no extended data.	1	M	Y	Y	Y	Y	Y	Y	N	N	N	N			
R-46	7.5.1.2	The type identification code shall be recorded in two bytes, and shall distinguish the format of the extended data area (as defined by the Vendor specified by the PID code in the CBEFF header). A value of zero in both bytes is a reserved value and shall not be used. A value of zero in the first byte, followed by a non-zero value in the second byte, shall indicate that the extended data section has a format defined in this standard. A nonzero value in the first byte shall indicate a vendor specified format, with a code maintained by the vendor.	1	O	N	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-47	7.5.1.3	The length of the extended data section shall be recorded in two bytes. If the Extended Data Block Length (7.5.1.1) for the finger view is zero, indicating no extended data, this field shall not be present.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-48	7.5.2	If the extended data area type code is 0x0001, the extended data area contains ridge count information.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-49	7.5.2	Ridge counts shall not include the ridges represented by either of the associated minutiae.	3C	O-1	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-50	7.5.2.1	The ridge count data area shall begin with a single byte indicating the ridge count extraction method.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-51	7.5.2.1	In 4 Neighbor Ridge Count Method, For each center minutia used, ridge count data was extracted to the nearest neighboring minutia in four quadrants, and ridge counts for each center minutia are listed together.	2	O	N	Y	Y	Y	Y	Y	Y	Y	Y	Y			
R-52	7.5.2.1	In 8 Neighbor Ridge Count Method, For each center minutia used, ridge count data was extracted to the nearest neighboring minutia in eight octants, and ridge counts for each center minutia are listed together.	2	O	N	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-53	7.5.2.1	All ridge counts for a particular center minutia shall be listed together.	2	O	N	Y	Y	Y	Y	Y	Y	Y	Y	Y			
R-54	7.5.2.1	The center minutia shall be the first minutia references in the three-byte ridge count data.	2	O	N	Y	N	N	N	N	N	N	N	N			
R-55	7.5.2.1	If a given quadrant or octant has no neighboring minutiae in it, a ridge count field shall be recorded with both the minutia index and the ridge count fields set to zero (so that, for each center minutia, there shall always be four ridge counts recorded for the quadrant method and eight ridge counts recorded for the octant method).	2	O	N	Y	N	N	N	N	N	N	N	N			
R-56	7.5.2.1	No assumption shall be made regarding the order of the neighboring minutiae.	2	O	N	Y	N	N	N	N	N	N	N	N			
R-57	7.5.2.2	The ridge count data shall be represented by a list of three-byte elements.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-58	7.5.3	If the extended data area type code is 0x0002, the extended data area contains core and delta information.	2	O	N	Y	N	N	N	N	N	N	N	N			
R-59	7.5.3.1	The number of core points represented shall be recorded in the least significant four bits of this byte. Valid values are from 0 to 15.	1	O	N	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-60	7.5.3.2	The core information type shall be recorded in the first two bits of the upper byte of the X coordinate of the core position. The bits "01" will indicate that the core has angular information while "00" will indicate that no angular information is relevant for the core type. If this field is "00", then the angle fields shall not be present for the cores.	2	O	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-61	7.5.3.3	The X coordinate of the core shall be recorded in the lower fourteen bits of the first two bytes (fourteen bits).	1	O	N	Y	N	N	N	N	N	N	N	N			
R-62	7.5.3.3	The Y coordinate shall be placed in the lower fourteen bits of the following two bytes.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-63	7.5.3.3	The coordinates shall be expressed in pixels at the resolution indicated in the record header.	3C	O-1	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-64	7.5.3.4	The angle of the core shall be recorded in one byte in units of 1.40625 (360/256) degrees. The core angle is measured increasing counter-clockwise starting from the horizontal axis to the right. The value shall be a nonnegative value between 0 and 255, inclusive.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-65	7.5.3.5	The number of delta points represented shall be recorded in the least significant four bits of this byte. Valid values are from 0 to 15.	1	O	N	Y	N	N	N	N	N	N	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-66	7.5.3.6	The delta information type shall be recorded in the first two bits of the upper byte of the X coordinate of the delta position. The bits "01" will indicate that the delta has angular information while "00" will indicate that no angular information is relevant for the delta type. If this field is "00", then the angle fields shall not be present for the deltas.	2	O	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-67	7.5.3.7	The X coordinate of the delta shall be recorded in the lower fourteen bits of the first two bytes (fourteen bits).	1	O	N	Y	N	N	N	N	N	N	N	N			
R-68	7.5.3.7	The Y coordinate shall be placed in the lower fourteen bits of the following two bytes.	1	O	N	Y	Y	Y	Y	Y	Y	Y	Y	Y			
R-69	7.5.3.7	The coordinates shall be expressed in pixels at the resolution indicated in the record header.	3C	O-1	N	Y	N	N	N	N	N	N	N	N		N/A	N/A
R-70	7.5.3.8	The three angle attributes of the delta shall each be recorded in one byte in units of 1.40625 (360/256) degrees. The delta angle is measured increasing counter-clockwise starting from the horizontal axis to the right. The value shall be a non-negative value between 0 and 255, inclusive.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-71	7.5.3.8	If not all three angles can be extracted from the image because of noise or image cropping, the angle fields affected shall be filled by repeating any of the other angle(s) for the same delta.	3C	O-1	N	Y	N	N	N	N	N	N	N	N		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support		Test Result
					1	2	3	4	5	6	25	26	27	28	Supported Range		
R-72	7.5.4	If the extended data area type code is 0x0003, the extended data area contains zonal quality data.	2	O	N	Y	N	N	N	N	N	N	N	N			
R-73	7.5.4.1	The number of pixels in cells in the x-direction (horizontal) shall be stored in one byte. Permissible values are 1 to 255.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-74	7.5.4.1	The number of pixels in cells in the y-direction (vertical) shall be stored in one byte. Permissible values are 1 to 255.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-75	7.5.4.2	The bit depth of the cell quality information shall be contained in one byte.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-76	7.5.4.3	The quality of the fingerprint image in each cell shall be represented by one or more bits, as indicated in 7.5.4.2.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-77	7.5.4.3	Quality data for cells shall be stored in usual "raster" order – left to right, then top to bottom.	3C	O-1	N	Y	N	N	N	N	N	N	N	N	N/A	N/A	N/A
R-78	7.5.4.3	If the finger image within this cell is of good clarity and significant ridge data is present, the cell quality shall be represented by higher values (by the bit value '1' if the information depth is 1). If the cell does not contain significant ridge data, or the ridge pattern within the cell is blurred, broken or otherwise of poor quality, the cell quality shall be represented by lower values (the bit value '0' if the information depth is 1).	3C	O-1	N	Y	N	N	N	N	N	N	N	N	N/A	N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-79	7.5.4.3	The cell quality shall be packed into bytes. The final byte in the cell quality data may be packed with bit values of zero ('0') on the right as required to complete the last byte.	1	O	N	Y	N	N	N	N	N	N	N	N			
R-80	8.3.1	The maximum number of minutiae accepted is therefore an implementation dependent value and shall be indicated in the Biometric Information Template, if the default value is not used (see Annex C).	3C	O-1	N	N	N	N	N	N	Y	Y	Y	Y		N/A	N/A
R-81	8.3.1	A card may also require a special ordering of the minutiae presented in the biometric verification data. The ordering scheme shall be indicated in the Biometric Information Template (see ISO/IEC 19785 and ISO/IEC 7816-11), if default value is not used.	2	M	N	N	N	N	N	N	Y	Y	Y	Y			
R-82	8.3.1	If the number of minutiae exceeds the maximum number processable by a card, truncation is necessary. The truncation is a 2 step process. At first, finger minutiae of poor quality are eliminated. If still too many minutiae are there, then truncation shall be made by peeling off minutiae from the convex hull of the minutiae set and before sorting into the order required by the card.	3C	O-1	N	N	N	N	N	N	Y	Y	Y	Y		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-83	8.3.3	For the indication of the minimum and maximum value of minutiae expected by the card the DO Number of minutiae as shown in Table 10 shall be used.	2	M	N	N	N	N	N	N	Y	Y	Y	Y			
R-84	8.3.4	For the indication of the ordering scheme for minutiae, the DO Minutiae order as shown in Table 11 shall be used.	2	M	N	N	N	N	N	N	Y	Y	Y	Y			
R-85	8.3.4	The position of the centre of mass of the minutiae shall be computed as the point specified by the means of the coordinates in X and Y. $x_{cm} = (x_1 + x_2 + \ldots + x_n) / n$; $y_{cm} = (y_1 + y_2 + \ldots + y_n) / n$, where cm is the centre of mass and n is the number of minutiae.	2	M	N	N	N	N	N	N	Y	Y	Y	Y			
R-86	8.4.1	If proprietary data are appended, then the biometric data in standardized format (DOs with tag '90' – '93') shall be encapsulated in the DO with tag 'A1', see Table 13.	2	O	N	N	N	N	N	N	Y	Y	Y	Y			
R-87	8.4.2	If a card with of on-card matching supports one or more of the additional features, then the capabilities shall be indicated in the DO 'Biometric algorithm parameters' (tag 'B1' within the BIT, see ISO/IEC 7816-11) using the DO 'Feature handling indicator' (tag '83', value field 1 byte). The nesting of the DO 'Feature handling indicator' in the DO 'Biometric algorithm parameters' is shown in Table 14, the coding is denoted in Table 15.	2	O	N	N	N	N	N	N	Y	Y	Y	Y			

17

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Subformat Applicability										IUT Support	Supported Range	Test Result
					1	2	3	4	5	6	25	26	27	28			
R-88	B.1	Equipment shall be tested to meet the requirements in normal operating modes, e.g., scanners shall not be tested at slower than normal operating speeds to meet modulation transfer function specifications.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-89	B.2	Fingerprint Scanner Performance Characteristics.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A
R-90	B.3	Latent Print Scanner Performance Characteristics.	3C	O-1	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		N/A	N/A

Notes for Level 3 Requirements:

The following short notes provide more details about why a specific conformance test assertion is not specified for the corresponding requirement(s):

1. Level 3 Assertion is too difficult to test

No method has been defined to test the conformance of the IUT or BDIR for this mandatory requirement of the base standard. For the purposes of this international standard, this requirement is marked as Optional until an appropriate test method is established. A ground truth database is envisioned as a mechanism by which content checking associated with these level 3 tests can be used.

6.3   Tables of Test Assertions

The specific test assertions required for conformance testing of ISO/IEC 19794-2:2005 Finger Minutia Format for Data Interchange are listed in Tables 2-11.

Clause 9 defines that the CBEFF Format Owner ID is '0101' and is registered with IBIA. It also defines ten different CBEFF Format Types. Each type has its own format. Therefore, only one of the following ten Formats will be tested, as further described in Test Note 6.

The normative requirements of ISO/IEC 19794-2:2005 Biometric Data Interchange Format – Part 2-Finger Minutia Data described in Table 1 which are applicable to each CBEFF Format Type are listed in Tables 2-11.

Table 2 — Conformance Test Assertions for CBEFF Format Type 1 (no extended data)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
17	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	N/A	Reserved	NONE			M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
23	Single Finger Info	R-34, R-40, R-41	1	Minutiae Quality	EQ	0 – 100		M			
24	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 3 — Conformance Test Assertions for CBEFF Format Type 2 (including extended data)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
17	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	N/A	Reserved	NONE			M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
23	Single Finger Info	R-34, R-40, R-41	1	Minutiae Quality	EQ	0 – 100		M			
24.1	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0 - 65535		M			
24.2	Extended Data	R-44, R-45	2	Extended Data Block Length	EQ	Bytes Read		M			
24.3	Extended Data	R-44, R-45	2	Extended Data Block Length	EQ	Bytes Expected	8	M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
25	Extended Data	R-46	1	Extended Data Area Type Code	EQ	1 – 3, 0x0100 – 0xFFFF	9	M			
26	Extended Data	R-47	1	Extended Data Area Length	EQ	4 – 65535		M			
26.1	Extended Data	R-47	2	Extended Data Area Length	EQ	Bytes Read		M			
27	Ridge Count	R-48, R-50	1	Ridge Extraction Method	EQ	0 – 2		M			
28	Ridge Count	R-48, R-51, R-52, R-53, R-54, R-55, R-56, R-57	2	Ridge Index 1	C		10	M			
29	Ridge Count	R-48, R-51, R-52, R-53, R-54, R-55, R-56, R-57	2	Ridge Index 2	C		11	M			
29.1	Ridge Count	R-48, R-51, R-52, R-53, R-54, R-55, R-56	2	Ridge Index 2	C		12	M			
30	Ridge Count	R-48, R-51, R-52, R-53, R-54, R-55, R-56, R-57	1	Ridge Count	EQ	0	13	M			
31	Core	R-58, R-59	1	Number of Cores	EQ	0 – 15		M			
31.1	Core	R-58, R-59	2	Number of Cores	C	Cores Read		M			
32	Core	R-58, R-60	1	Core Information Type	EQ	0 – 1		M			
32.1	Core	R-58, R-60	2	Core Information Type	C		15	M			
33	Core	R-58, R-61	2	Core Location X	EQ	0 – 16383		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
34	Core	R-58, R-62	2	Core Location Y	EQ	0 – 16383		M			
35	Core	R-58, R-60, R-63	1	Core Angle	EQ	0 – 255		M			
36	Delta	R-58, R-65	1	Number of Delta	EQ	0 – 15		M			
36.1	Delta	R-58, R-65	2	Number of Delta	C	Delta Read		M			
37	Delta	R-58, R-66	1	Delta Information Type	EQ	0 – 1		M			
37.1	Delta	R-58, R-66	2	Delta Information Type	C		15	M			
38	Delta	R-58, R-67	2	Delta Location X	EQ	0 – 16383		M			
39	Delta	R-58, R-68	2	Delta Location Y	EQ	0 – 16383		M			
40	Delta	R-58, R-66, R-70	1	Delta Angle 1	EQ	0 – 255		M			
41	Delta	R-58, R-66, R-70	1	Delta Angle 2	EQ	0 – 255		M			
42	Delta	R-58, R-66, R-70	1	Delta Angle 3	EQ	0 – 255		M			
43	Zone Quality	R-72, R-73	1	Cell Width	EQ	1 – 255		M			
44	Zone Quality	R-72, R-74	1	Cell Height	EQ	1 – 255		M			
45	Zone Quality	R-72, R-75	1	Cell Bit Depth	EQ	1 – 255		M			
46	Zone Quality	R-72, R-75, R-76, R-79	2	Cell Quality Bits	C	Cell Bits Read		M			

Table 4 — Conformance Test Assertions for CBEFF Format Type 3 (card normal valley bifurcation with header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
17.1	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 3		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	1	Reserved	EQ	0		M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 5 — Conformance Test Assertions for CBEFF Format Type 4 (card normal ridge ending with header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
17.1	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 3		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	1	Reserved	EQ	0		M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 6 — Conformance Test Assertions for CBEFF Format Type 5 (card compact valley bifurcation without header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
18.1	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 255	14	M			
20.1	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 255		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
17.3	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
22.1	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 64		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 7 — Conformance Test Assertions for CBEFF Format Type 6 (card compact ridge ending without header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
18.1	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 255	14	M			
20.1	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 255		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
17.3	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
22.1	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 64		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 8 — Conformance Test Assertions for CBEFF Format Type 25 (card compact valley bifurcation without header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
18.1	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 255	14	M			
20.1	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 255		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
17.3	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
22.1	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 64		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 9 — Conformance Test Assertions for CBEFF Format Format Type 26 (card compact ridge ending with header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
T-1.1	Record Header	R-12, R-14	1	Format Identifier	EQ	0x464D5200		M			
1.2	Record Header	R-14	1	Format Identifier	NEQ	0x00524D46	1	M			
2.1	Record Header	R-10, R-15	1	Version	EQ	0x20323000		M			
2.2	Record Header	R-15	1	Version	NEQ	0x00303220		M			
3	Record Header	R-16	1	Record Length	EQ	24 – 4294967295		M			
3.1	Record Header	R-16	2	Record Length	EQ	Total Bytes Read		M			
3.2	Record Header	R-16	2	Record Length	EQ	Total Bytes Expected	2	M			
4	Record Header	R-17	N/A	Capture Equipment Certification	NONE			M			
5	Record Header	R-18	N/A	Capture Device Type ID	NONE			M			
6	Record Header	R-19	N/A	Image Size X	NONE			M			
7	Record Header	R-20	N/A	Image Size Y	NONE			M			
8	Record Header	R-21	1	Resolution X	GTE	98 / 1000 / 100	3	M			
9	Record Header	R-22	1	Resolution Y	GTE	98 / 1000 / 100	3	M			
10	Record Header	R-23	1	Number of Finger Views	EQ	0 – 176	4	M			
10.1	Record Header	R-24	2	Number of Finger Views	EQ	Finger View Read		M			
11	Record Header	R-25	1	Reserved	EQ	0		M			
12	Single Finger Header Record	R-26, R-27	1	Finger Position	EQ	0 – 10		M			

　　33

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
13	Single Finger Header Record	R-26, R-28, R-29	2	View Number	EQ	0 – 15	5	M			
14	Single Finger Header Record	R-26, R-31	1	Impression Type	EQ	0 – 3, 8		M			
15	Single Finger Header Record	R-26, R-32	1	Finger Quality	EQ	0 – 100		M			
16	Single Finger Header Record	R-26, R-33	1	Number of Minutiae	EQ	1 – 255		M			
16.1	Single Finger Header Record	R-26, R-30	2	Number of Minutiae	EQ	Minutiae Read		M			
18.1	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 255	14	M			
20.1	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 255		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
17.3	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 2		M			
22.1	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 64		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 10 — Conformance Test Assertions for CBEFF Format Format Type 27 (card normal valley bifurcation without header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
17.1	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 3		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	1	Reserved	EQ	0		M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Table 11 — Conformance Test Assertions for CBEFF Format Format Type 28 (card normal ridge ending without header)

Test	Section	Requirement ID	Level	Field	Operator	Operands	Note	Status	Support	Supported Values	Test Result
17.1	Single Finger Info	R-34, R-35	1	Minutiae Type	EQ	0 – 3		M			
18	Single Finger Info	R-34, R-36	2	Minutiae X coordinate	EQ	0 – 16383		M			
19	Single Finger Info	R-34, R-37	1	Reserved	EQ	0		M			
20	Single Finger Info	R-34, R-37	2	Minutiae Y coordinate	EQ	0 – 16383		M			
21	Single Finger Info	R-34	2	Minutiae Position	C		7	M			
22	Single Finger Info	R-34, R-39	1	Minutiae Angle	EQ	0 – 255		M			
24.3	Extended Data	R-42, R-44, R-45	1	Extended Data Block Length	EQ	0		M			

Test Notes:

These are short notes that provide more detail about a specific conformance test assertion or requirement. They use a combination of explanatory text and pseudo code for complex calculations. The pseudo code uses commonly used mathematical notations, rather than the specific logical operators developed for the assertion language.

1. {Format Identifier} and {Version} Little-Endian

Test 1 checks to see if these multi-byte quantities have been encoded as the Little-Endian equivalent of the correct Big-Endian value. This test fails if that is true but pass in all other cases. By reviewing the combination of the results of Tests 1, 1.1, 2, it should be simple to determine whether or not the implementation under test is using the correct Big-Endian encoding.

2. {Record Length}

The following calculation will be evaluated once the {Extended Data Block Length} field for the last finger view has been parsed successfully (not having reached an End-of-File marker prematurely). In the event that an End-of-File marker is reached prematurely this test will be marked as having failed, but no value of {Total Bytes Expected} will be produced.

The initial value of SUMBYTES below will correspond to the length of the BIR header in bytes (24).

        SUMBYTES = BIR Header Length

    IF {CBEFF Type} EQ '0001' THEN

            FOR I = 1 TO {Number of Finger Views}

                SUMBYTES = SUMBYTES + 6 + ({Number of Minutiae} * 6)

            END

    IF {CBEFF Type} EQ '0002' THEN

            FOR I = 1 TO {Number of Finger Views}

                SUMBYTES = SUMBYTES + 6 + ({Number of Minutiae} * 6)

                SUMBYTES = SUMBYTES + {Extended Data Block Length}

            END

    IF {CBEFF Type} EQ '0003' OR

    IF {CBEFF Type} EQ '0004' THEN

            FOR I = 1 TO {Number of Finger Views}

                SUMBYTES = SUMBYTES + 6 + ({Number of Minutiae} * 5)

END

IF {CBEFF Type} EQ '0005' OR

IF {CBEFF Type} EQ '0006' THEN

FOR I = 1 TO {Number of Finger Views}

SUMBYTES = SUMBYTES + 6 + ({Number of Minutiae} * 3)

END

{Total Bytes Expected} = SUMBYTES

3. {CBEFF Type Resolution}

IF {CBEFF Type} EQ '0001' OR

IF {CBEFF Type} EQ '0002' THEN

{Resolution X} GTE 98

{Resolution Y} GTE 98

IF {CBEFF Type} EQ '0003' OR

IF {CBEFF Type} EQ '0004' THEN

{Resolution X} EQ 1000

{Resolution Y} EQ 1000

IF {CBEFF Type} EQ '0005' OR

IF {CBEFF Type} EQ '0006' THEN

{Resolution X} EQ 100

{Resolution Y} EQ 100

The card formats have fixed resolution, whereas the standard format has a minimum resolution requirement.

4. {Number of Finger View Consistency}

This test will pass if the value of {Number of Finger Views} is less than or equal to the sum of all possible finger positions (11) permitted by the standard multiplied by the maximum number of views per finger (16).

Maximum {Number of Finger View} = 11 x 16 = 176.

5. {Incremental View Number Correctness}

As each finger view from the BIR is read, a counter, {Next Finger View}, for the corresponding finger position (if valid) is incremented and compared to {View Number}. The test shall pass if {Next Finger View} is equal to {View Number}.

6. {CBEFF Format Type Testing}

Clause 9 defines that the CBEFF Format Owner ID is '0101' and is registered with IBIA. It also defines six different CBEFF Format Types. Each type has its own format. Therefore, only one of the following four Formats will be tested.

> IF {CBEFF Type} EQ '0001'
>
> > Finger minutiae Record Format with no extended data

> IF {CBEFF Type} EQ '0002'
>
> > Finger minutiae Record Format with extended data

> IF {CBEFF Type} EQ '0003' OR
>
> IF {CBEFF Type} EQ '0004' THEN
>
> > Finger minutiae Normal Size Card Format

> IF {CBEFF Type} EQ '0005' OR
>
> IF {CBEFF Type} EQ '0006' THEN
>
> > Finger minutiae Compact Size Card Format

7. {Unique Minutia X-Y Points}

Though not explicitly defined in the standard, all minutiae within a finger view should have unique X/Y coordinates to avoid potential interoperability issues. This test shall pass if the {Minutiae Position} is a unique pair of minutiae X/Y coordinates within the finger view.

8. {Zero Extended Data Length for No Extended Data}

As the individual extended data areas are read, the {Length of Extended Data Area} parameter for each one will become known. The sum of these is {Bytes Expected} for the extended data block, in accordance with Section 7.5.1.1 of the base standard. The test shall pass if the length is zero for a record that has no extended data.

9. {Vendor Specific Value Disambiguity}

Note that this condition assumes the current text of 7.5.1.2 is correct and not Table 4, since Table 4 specifically disallows certain vendor specified values as Reserved, but this is incompatible with the concept of a vendor specified value.

10. {Ridge Count Indexing Consistency}

If {Minutiae Index 1} corresponds with the first ridge count in a Four-neighbor or Eight-neighbor group, or if the {Ridge Extraction Method} is zero (0), the test shall pass if the index is between 1 and {Number of Minutiae}. Otherwise, the test shall pass only if the index is the same value as {Minutiae Index 1} of the first ridge count in the same Four-neighbor or Eight-neighbor group.

11. {Ridge Count Extraction Method Checking}

If the {Ridge Extraction Method} is zero (0), the test shall pass if the index is between 1 and {Number of Minutiae}, and if the index is not equal to {Minutiae Index 1}. If the {Ridge Extraction Method} is one (1) or two (2) then the test shall pass if the index is between 0 and {Number of Minutiae}.

12. {Ridge Count Index 2 Uniqueness}

This test is only evaluated if {Minutiae Index 2} is not zero (0) and the {Ridge Extraction Method} is not zero (0). Each ridge count within the same Four-neighbor or Eight-neighbor group should refer to the same center minutiae, {Minutiae Index 1}, and neighboring minutiae, {Minutiae Index 2}, from a different quadrant or octant. Thus, this test shall pass if {Minutiae Index 2} is unique within the same Four-neighbor or Eight-neighbor group.

13. {Zero Ridge Count Index 2}

This test is only evaluated if {Minutiae Index 2} is zero (0) and {Ridge Extraction Method} is not zero (0). This test shall pass if {Ridge Count} is zero.

14. {Maximum Value for X and Y Coordinates}

As per footnote in clause 8.2, the maximum value for the X and Y coordinate is 25.5mm with the compact format. The unit for X and Y is 10^{-1} mm. The Maximum value for the X and Y coordinate is 255.

Unit = 10^{-1} mm

25.5mm = 255 x 10^{-1} mm

15. {Core and Delta Angles Present given Core Information Type of 01}

The following calculation will be evaluated once the {Extended Data Area Length} field for the core and delta data extended type has been parsed successfully (not having reached an End-of-File marker prematurely). In the event that an End-of-File marker is reached prematurely this test will be marked as having failed, but no value of {Total Bytes Expected} will be produced.

{Total Bytes Expected} = Extended Data Area Length

```
IF {Core Information Type} EQ '0001' THEN

    NUMBER of BYTES for CORE Data EQ 1 + 5 * NUMBER_OF_CORES

ELSE

    NUMBER of BYTES for CORE Data EQ 1 + 4 * NUMBER_OF_CORES


IF {Delta Information Type} EQ '0001' THEN
```

NUMBER of BYTES for DELTA Data EQ 1 + 7 * NUMBER_OF_DELTAS

ELSE

NUMBER of BYTES for DELTA Data EQ 1 + 4 * NUMBER_OF_DELTAS

Total Bytes Expected EQ NUMBER of BYTES for CORE Data + NUMBER of BYTES for DELTA Data, such that the remaining bytes parsed are valid chains of extended data block lengths to end of file marker

ICS 35.040

Price based on 40 pages