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Information technology — Biometric data interchange formats —

Part 8:
Finger pattern skeletal data

AMENDMENT 1: Conformance testing methodology

Technologies de l'information — Formats d'échange de données biométriques —

Partie 8: Données des structures du squelette de l'empreinte

AMENDEMENT 1: Méthodologie d'essai de conformité

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Foreword

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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.

Amendment 1 to ISO/IEC 19794-8:2011 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

Information technology — Biometric data interchange formats —

Part 8:
Finger pattern skeletal data

AMENDMENT 1: Conformance testing methodology

1. The following text is to be added to the "Introduction" clause of ISO/IEC 19794-8:

Annex A to document addresses the conformance testing to be used for interchange format defined in this part of ISO/IEC 19794. This Annex A is distinct from the ISO/IEC 29109-8, which addressed conformance testing only of the first, 2007, edition of the ISO/IEC 19794-8 standard.

2. The following text is to be added to the "Scope" clause of ISO/IEC 19794-8:

This part of ISO/IEC 19794 also specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to this part of ISO/IEC 19794. Specifically, it establishes

⸺ test assertions of the structure of the finger pattern skeletal data format as specified in Clauses 7 and 8 of this part of ISO/IEC 19794 (Type A Level 1 as defined in ISO/IEC 19794-1:2011 AMD 1),

⸺ test 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 19794-1:2011 AMD 1),

⸺ tests of semantic assertions (Type A Level 3 as defined in ISO/IEC 19794-1:2011 AMD 1).

The conformance testing methodology specified in this part of ISO/IEC 19794 does not establish

⸺ 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 data records conforming to the requirements of this part of ISO/IEC 19794.

3. The following text is to be added to the "Conformance" clause of ISO/IEC 19794-8:

Biometric data interchange format conformance tests conform to this part of ISO/IEC 19794 if they satisfy all of the normative requirements set forth in clauses 6, 7, and 8. Specifically, they shall use the test methodology specified in ISO/IEC 19794-1:2011 AMD 1, and all Level 1, Level 2 and Level 3 tests shall use the assertions defined in Table A.1 of Clause A.2 in this part of ISO/IEC 19794.

Implementations of this part of ISO/IEC 19794 tested according to the specified methodology shall be able to claim conformance only to those biometric data record (BDB) requirements specified in this part of ISO/IEC 19794 that are tested by the test methods established by this methodology.

In consideration of the semantic specifics in different parts of 19794, all level 1, level 2, and level 3 tests shall use the assertions defined in Table A.2 of clause A.3 of this part of 19794 in conformity with the concept and rules set in 19794-1 Annex A.

4. Replace 3rd paragraph of Clause 6.2.3 "Constructing direction elements" with the following:

In order to minimize integration of digitalisation error, each starting point must be computed with relatively high accuracy, i.e. its resolution shall be at least 100 times finer than the spatial resolution of the minutiae.

5. Replace the normative annex in ISO/IEC 19794-8:2011 with the following one:

Annex A
(normative)

Conformance Testing Methodology

A.1 Introduction

The testing methodology specified in ISO/IEC 19794-1:2011 AMD 1 shall apply. The content of the tables below is based on the conformance testing methodology outlined in ISO/IEC 19794-1:2011 AMD 1 and shall only be used in the context of that testing methodology.

A.2 Table of requirements in the base standard

The normative requirements of this part of ISO/IEC 19794 are listed in Table A.1. The supplier of the IUT should explain which optional components of the standard are supported and the testing laboratory should note the results of the test.

Table A.1 — Requirements of the Base Standard

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-1	6.1.1	Minutiae are points located at the places in the fingerprint image where friction ridges end or split into two ridges. Each minutia point has a "type" associated with it. There are two major types of minutia: a "ridge ending" represented by the 2-bit value 01 and a "ridge bifurcation" or split point represented by 2-bit value 10.	1	M	Y	Y	Y		N/A	
R-2	6.1.2	The coordinate system used to express the position of the minutiae points of a fingerprint shall be a Cartesian coordinate system. For the skeletal pattern card format, the resolution of the x and y coordinates of the minutia shall be in metric units. The position of the minutia for a ridge ending shall be defined as the coordinates of the skeleton point with only one neighbour pixel belonging to the skeleton. The position of the minutia for a ridge bifurcation shall be defined as the point of forking of the skeleton of the ridge. The position of a virtual ending shall be defined like the position of a real ridge ending.	3C	O-1	Y	Y	Y		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-3	6.1.3	The direction of the lines starting or ending at a point with more than three arms (trifurcation, etc.) shall be defined like the direction of a real ridge ending. The direction of a virtual ending shall be defined like the direction of a real ridge ending.	3C	O-1	Y	Y	Y		N/A	N/A
R-4	6.2.2	To keep the encoding size small a line shall start with a real minutia (type 01 or 10) if possible. No assumption shall be made about the order of the line encodings in the record. The skeleton shall be encoded only for image areas where the ridge lines are displayed with a sufficient quality. The reconstructed ridge lines shall describe the fingerprint image in ridge position and structure. The reconstructed skeleton line polygon element shall be inside the area of the ridge it is describing for most part of its length. The reconstructed skeleton line shall never be inside the area of any other ridge but the one it is describing. The reconstructed skeleton line shall preserve the topology of the ridges.	3C	O-1	Y	Y	Y		N/A	N/A
R-5	6.2.3	In order to minimize integration of digitalisation error, each starting point must be computed with relatively high accuracy, i.e. its resolution shall be at least 100 times finer than the spatial resolution of the minutiae.	3C	O-1	Y	Y	Y		N/A	N/A
R-6	6.2.3	If the direction change of the skeleton line cannot be described by a direction element, the line encoding shall be interrupted by a "virtual continuation" and a new line encoding shall begin with the same point without repeating the minutia data.	3C	O-1	Y	Y	Y		N/A	N/A
R-7	6.3.2	It is not usefull to list a neighourhood relation twice, any of the other indices shall be different i.e. Ai-1>Ai.	3A	M	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-8	7.3, Table 1	There shall be one and only one record header for the finger pattern skeletal data record. The record header will contain information describing the identity and characteristics of the device that generated the data.	3A	M	Y	N	N			
R-9	7.3.1, Table 1	The finger pattern skeletal data record shall begin with a format identifier to be recorded in four bytes. For this part of ISO/IEC 19794, it shall consist of the three ASCII characters "FSK", followed by a zero byte as a NULL string terminator.	1	M	Y	N	N			
R-10	7.3.2, Table 1	The version number for the version of this part of ISO/IEC 19794 used in constructing the record shall be placed in four bytes.	1	M	Y	N	N			
R-11	7.3.2, Table 1	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. Upon approval of this specification, the version number shall be "020" (an ASCII '0'followed by an ASCII '2' and an ASCII '0').	1	M	Y	N	N			
R-12	7.3.3, Table 1	The length of the entire BDIR shall be recorded in four bytes.	1	M	Y	N	N			
R-13	7.3.3, Table 1	This count shall be the total length of the BDIR including the general record header and one or more representation records.	1	M	Y	N	N			
R-14	7.3.4	The total number of representation records contained in the BDIR shall be recorded in two bytes. A minimum of one representation is required.	1	M	Y	N	N			
R-15	7.3.5	The one-byte certification flag shall indicate whether each Representation Header includes a certification block. A value of 00HEX shall indicate that no representation contains a certification block. A value of 01HEX shall indicate that all representations contain a certification block.	1	M	Y	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-16	7.4.1	A finger pattern skeletal representation header shall start each area of finger data providing information for that finger. There shall be one finger pattern skeletal representation header for each finger contained in the finger pattern skeletal data record. The finger pattern skeletal representation header will occupy at least 31 bytes as described below. Note that it is permissible for more than one single finger record to represent the same finger, with (presumably) different data.	1	M	Y	Y	Y			
R17	7.4.1.1	The representation-length field denotes the length in bytes of the representation including the representation header fields	1	M	Y	Y	Y			
R-18	7.4.1.2	The capture date and time field shall indicate when the capture of this representation started in Coordinated Universal Time (UTC). The capture date and time field shall consist of 9 bytes. Its value shall be encoded in the form given in ISO/IEC 19794-1.This field shall indicate the date and time the representation was captured. This field is not intended encode the time the record was instantiated.	1	M	Y	Y	Y			
R-19	7.4.1.3	The capture device technology ID shall be encoded in one byte. This field shall indicate the class of capture device technology used to acquire the captured biometric sample.	1	M	Y	Y	Y			
R-20	7.4.1.3	A value of 00HEX indicates unknown or unspecified technology. See Table 2 for the list of possible values.	1	M	Y	Y	Y			
R-21	7.4.1.4	The capture device vendor identifier shall be recorded in two bytes. It shall identify the biometric organisation that owns the product that created the BDB and shall be registered with the IBIA or other approved registration authority.	1	M	Y	Y	Y			
R-22	7.4.1.4	A value of all zeros shall indicate that the capture device vendor is unreported.	1	M	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-23	7.4.1.5	This capture device type identifier shall be recorded in two bytes. It shall identify the product type that created the BDB and shall be assigned by the registered BDB product owner or other approved registration authority. A value of all zeros shall indicate that the capture device type is unreported.	1	M	Y	Y	Y			
R-24	7.4.1.6.1	The quality information of the overall finger minutiae data shall be recorded in five bytes.	1	M	Y	Y	Y			
R-25	7.4.1.6.2	The first byte is mandatory and shall contain the number of blocks of quality information of the overall finger pattern skeletal data.	1	M	Y	Y	Y			
R-26	7.4.1.6.2	Subsequent 5-byte blocks shall contain the specific quality/vendor/algorithm information for each quality/vendor/algorithm evaluation.	1	M	Y	Y	Y			
R-27	7.4.1.6.2	A value of zero (0) means that no attempt was made to assign a quality score. In this case, no Quality Blocks are present.	1	M	Y	Y	Y			
R-28	7.4.1.6.3	Quality score, as defined in ISO/IEC 29794-1, shall be a quantitative expression of the predicted verification performance of the biometric sample. Valid values for Quality Score are integers between 0 and 100, where higher values indicate better quality.	1	M	Y	Y	Y			
R-29	7.4.1.6.3	A value of 255 is to handle a special case. An entry of 255 shall indicate a failed attempt to calculate a quality score. Multiple quality scores calculated by the same algorithm (same vendor identifier and Quality Algorithm identifier) shall not be present in a single representation.	1	M	Y	Y	Y			
R-30	7.4.1.6.4	To enable the recipient of the quality score to differentiate between quality scores generated by different algorithms, the provider of quality scores shall be uniquely identified by the next two bytes. This Vendor identifier shall be registered with the International Biometrics Industry Association (IBIA).	1	M	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-31	7.4.1.6.5	The remaining two bytes shall specify an integer product code assigned by the vendor of the Quality Algorithm ID. It indicates which of the vendor's algorithms (and version) was used in the calculation of the quality score and must be within the range of 1 to 65535.	1	M	Y	Y	Y			
R-32	7.4.1.7.1	This multi-byte block contains information to indicate the compliant certification procedures that were used to test the biometric capture equipment used. If the device certification block flag in the general header has a value of 00 HEX, no capture device certification information shall be present in any of the representation header records for that finger pattern skeletal record.	1	M	Y	Y	Y			
R-33	7.4.1.7.2	The first byte is mandatory and shall contain the number of successful certifications for the capture device. This byte is followed by 3-byte sub-blocks containing certification information. A value of 00 HEX in this first byte shall indicate that this capture device has not been certified and no certification information sub-blocks follow.	1	M	Y	Y	Y			
R-34	7.4.1.7.3	Certification authority identifier shall be encoded in two bytes. Certification Authority is the agency that certifies a device according to a particular capture device quality specification. Certification authority identifier shall be registered by the IBIA or other approved registration authority.	1	O	Y	Y	Y			
R-35	7.4.1.7.4	This last byte of the sub-block shall identify a certification scheme used to certify the capture device. A list of current certification scheme identifiers is contained in Table 3.	1	O	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-36	7.4.1.8	The finger position code shown on Table 4 shall be recorded in one byte. The codes for this byte shall be as defined in Table 5 of ANSI/NIST-ITL 1-2007, "Data format for the interchange of fingerprint information". This table is reproduced here in Table 2 for convenience. Only codes 0 through 10 shall be used, the "plain" codes included in Table 5 of ANSI/NIST ITL 1-2007 are not relevant for this part of ISO/IEC 19794.	1	M	Y	Y	Y			
R-37	7.4.1.9	If more than one finger pattern record in a general record is from the same finger, each pattern record shall have a unique representation number. The combination of finger location and representation number shall uniquely identify a particular pattern record within a general record. Multiple finger pattern records from the same finger shall be numbered with increasing representation numbers, beginning with zero. Where only one finger pattern record is taken from each finger, this field shall be set to 0. The representation number shall be recorded in one byte.	2	M	Y	Y	Y			
R-38	7.4.1.10	The resolution (in ppcm) of the scaled finger image(s) shall be uniform in the x and y-directions and shall be stored in 1 byte.	1	M	Y	N	N			
R-39	7.4.1.11	The impression type of the finger images that the finger pattern skeletal data was derived from shall be recorded in one byte. The codes for this byte are shown in Table 5. These codes are derived from Table 11 of ANSI/NIST-ITL 1-2007, "Data Format for the Interchange of Fingerprint Facial, & Other Biometric Information". The "swipe" type identifies data records derived from image streams generated by sliding the finger across a small sensor. Only codes 0 through 3, 8, 24 and 28 through 29 shall be used; the "latent" and "palm" codes are not relevant for this part of ISO/IEC 19794.	1	M	Y	Y	Y			
R-40	7.4.1.12	The size of the skeleton image in pixels in the x direction shall be contained in 2 bytes.	1	M	Y	Y	Y			
R-41	7.4.1.13	The size of the skeleton image in pixels in the y direction shall be contained in 2 bytes.	1	M	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-42	7.4.1.14	The bit-depth used to represent the x and y-coordinate of the starting and ending point in the direction code description of the skeleton shall be recorded in 1 byte.	1	M	Y	N	N			
R-43	7.4.1.15	The bit-depth used to represent the direction of the starting and ending point in the direction code description of the skeleton shall be recorded in 1 byte.	1	M	Y	N	N			
R-44	7.4.1.16	The bit-depth used to represent the direction in the direction code shall be recorded in 1 byte.	1	M	Y	N	N			
R-45	7.4.1.17	The maximal step size Ss in the current direction of each direction code step shall be recorded in 1 byte.	1	M	Y	N	N			
R-46	7.4.1.18	The relative perpendicular step size floor($256 \times Sp/Ss$) of the direction code shall be recorded in 1 byte.	1	M	Y	N	N			
R-47	7.4.1.19	The angular resolution of the direction code is stored as the number N of directions on 180° and shall be recorded in 1 byte.	1	M	Y	N	N			
R-48	7.4.1.20	The length (in bytes) of the finger pattern skeletal data block recorded for the finger shall be recorded in two bytes. The length provided includes any padding bits necessary to complete the last byte of finger pattern skeletal data.	1	M	Y	Y	Y			
R-49	7.4.2.1	The length (in bytes) of the finger pattern skeletal data shall be recorded in two bytes. The length provided includes any padding bits necessary to complete the last byte of finger pattern skeletal data.	1	M	Y	Y	Y			
R-50	7.4.2.2	The finger pattern skeletal data for a single finger shall be recorded as defined in Clauses 6.1 and 6.2.	3C	O-1	Y	Y	Y		N/A	N/A
R-51	7.4.2.3	The length (in bytes) of the skeleton line neighborhood index data shall be recorded in two bytes. The length provided includes any padding bits necessary to complete the last byte of finger pattern skeletal data.	2	M	Y	Y	Y			
R-52	7.4.2.4	The skeleton line neighborhood index data for a single finger shall be recorded as defined in Clause 6.3.	3C	O-1	Y	Y	Y		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-53	7.5	The size of this area shall be kept as small as possible, augmenting the data stored in the standard pattern skeletal data area. The extended data for each finger view shall immediately follow the standard pattern skeletal data for that finger view and shall begin with the extended data block length.	3C	O-1	Y	Y	Y		N/A	N/A
R-54	7.5	In particular, ridge count data, core and delta data, zonal quality information or sweat pore positions shall not be represented in proprietary manner to the exclusion of the publicly defined formats in this part of ISO/IEC 19794.	3C	O-1	Y	Y	Y		N/A	N/A
R-55	7.5.1.1	All pattern skeletal data records shall contain the extended data block length. This field will signify the existence of extended data, and shall be recorded in 2 bytes.	1	M	Y	Y	Y			
R-56	7.5.1.1	A value of all zeros (0x0000 hexadecimal) will indicate that there is no extended data and that the file will end or continue with the next finger view. A nonzero value will indicate the length of all extended data starting with the next byte.	2	M	Y	Y	Y			
R-57	7.5.1.2	The extended data area type 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 CBEFF_BDB_product_owner and CBEFF_BDB_product_type in the CBEFF header.	1	M	Y	N	N			
R-58	7.5.1.2	A non-zero value in the first byte shall indicate a vendor specified format, with a code maintained by the vendor.	1	M	Y	Y	Y			
R-59	7.5.1.3	The length of the extended data area, including the extended data area type code and length of data fields, shall be recorded in two bytes.	1	M	Y	Y	Y			
R-60	7.5.1.3	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.	2	M	Y	Y	Y			
R-61	7.5.1.4	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.	2	M	Y	Y	Y			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-62	7.5.2	If the extended data area type code is 0x0001, the extended data area contains ridge count information. This format is provided to contain optional information	1	O	Y	N	N			
R-63	7.5.2	Ridge counts shall not include the ridges represented by either of the associated minutiae points.	3C	O-1	Y	N	N		N/A	N/A
R-64	7.5.2.1	The ridge count data area shall begin with a single byte indicating the ridge count extraction method.	1	O	Y	N	N			
R-65	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	Y	N	N			
R-66	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	Y	N	N			
R-67	7.5.2.1	all ridge counts for a particular center minutia shall be listed together;	2	O	Y	N	N			
R-68	7.5.2.1	the center minutia shall be the first minutia references in the three-byte ridge count data;	2	O	Y	N	N			
R-69	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	Y	N	N			
R-70	7.5.2.1	no assumption shall be made regarding the order of the neighboring minutiae.	2	O	Y	N	N			
R-71	7.5.2.2	The ridge count data shall be represented by a list of threebyte elements.	1	O	Y	N	N			
R-72	7.5.2.2	no assumption shall be made about the geometric relationships of the various ridge count items.	2	O	Y	N	N			
R-73	7.5.3	If the extended data area type code is 0x0002, the extended data area contains core and delta information.	2	O	Y	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-74	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	Y	N	N			
R-75	7.5.3.2	The core information type shall be recorded in the two most significant bits of the two bytes 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 field shall not be present for this core.	3C	O-1	Y	N	N		N/A	N/A
R-76	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	Y	N	N			
R-77	7.5.3.3	The Y coordinate shall be placed in the lower fourteen bits of the following two bytes.	1	O	Y	N	N			
R-78	7.5.3.3	The coordinates shall be expressed in pixels at the resolution indicated in the record header.	3C	O-1	Y	N	N		N/A	N/A
R-79	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 non-negative value between 0 and 255, inclusive.	1	O	Y	N	N			
R-80	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	Y	N	N			
R-81	7.5.3.6	The delta information type shall be recorded in the two most significant bits of the two bytes 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 this delta.	3C	O-1	Y	N	N		N/A	N/A
R-82	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	Y	N	N			
R-83	7.5.3.7	The Y coordinate shall be placed in the lower fourteen bits of the following two bytes.	1	O	Y	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-84	7.5.3.7	The coordinates shall be expressed in pixels at the resolution indicated in the representation header.	3C	O-1	Y	N	N		N/A	N/A
R-85	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	Y	N	N			
R-86	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	Y	N	N		N/A	N/A
R-87	7.5.4	If the extended data area type code is 0x0003, the extended data area contains zonal quality data.	2	O	Y	N	N			
R-88	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	Y	N	N			
R-89	7.5.4.2	The bit depth of the cell quality information shall be contained in one byte.	1	O	Y	N	N			
R-90	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	Y	N	N			
R-91	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	Y	N	N		N/A	N/A
R-92	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	Y	N	N		N/A	N/A
R-93	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	Y	N	N			

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-94	7.5.4.4	The zonal quality data format shall be as follows:	1	O	Y	N	N			
R-95	7.5.5.3	The final byte in the sweat pore position data shall be packed with bit values of zero ('0') for the least significant bits as required to complete the last byte.	2	O	Y	N	N			
R-96	7.5.5.4	The sweat pore position data format shall be as follows:	1	O	Y	N	N			
R-97	7.5.6.1	The finger pattern skeleton structural data format shall be as follows:	2	O	Y	N	N			
R-98	8.1	Resolution of direction code start and stop point	3C	O-1	N	Y	N		N/A	N/A
R-99	8.1	Bit-depth of direction code start and stop point in x	3C	O-1	N	Y	N		N/A	N/A
R-100	8.1	Bit-depth of direction code start and stop point in y	3C	O-1	N	Y	N		N/A	N/A
R-101	8.1	Bit-depth of direction code start and stop direction	3C	O-1	N	Y	N		N/A	N/A
R-102	8.1	Bit-depth of direction in direction code	3C	O-1	N	Y	N		N/A	N/A
R-103	8.1	Step size Ss of direction code	3C	O-1	N	Y	N		N/A	N/A
R-104	8.1	Relative perpendicular step size $256 \times Sp/Ss$	3C	O-1	N	Y	N		N/A	N/A
R-105	8.1	Number $N\pi$ of directions on 180°	3C	O-1	N	Y	N		N/A	N/A
R-106	8.2	Resolution of direction code start and stop point	3C	O-1	N	N	Y		N/A	N/A
R-107	8.2	Bit-depth of direction code start and stop point in x	3C	O-1	N	N	Y		N/A	N/A
R-108	8.2	Bit-depth of direction code start and stop point in y	3C	O-1	N	N	Y		N/A	N/A
R-109	8.2	Bit-depth of direction code start and stop direction	3C	O-1	N	N	Y		N/A	N/A
R-110	8.2	Bit-depth of direction in direction code	3C	O-1	N	N	Y		N/A	N/A
R-111	8.2	Step size Ss of direction code	3C	O-1	N	N	Y		N/A	N/A
R-112	8.2	Relative perpendicular step size $256 \times Sp/Ss$	3C	O-1	N	N	Y		N/A	N/A
R-113	8.2	Number $N\pi$ of directions on 180°	3C	O-1	N	N	Y		N/A	N/A
R-114	8.3.1	The skeleton image size in pixels in x is stored in 2 bytes at a resolution of 100 ppcm for the compact and 200 ppcm for the normal format.	3C	O-1	N	Y	Y		N/A	N/A

Requirement Identifier	Reference in Base Standard	Requirement Summary	Level	Status	Sub-format / Format Type Applicability			IUT Support	Supported Range	Test Result
					R	N	C			
R-115	8.3.1	The skeleton image size in pixels in y is stored in 2 bytes at a resolution of 100 ppcm for the compact and 200 ppcm for the normal format.	3C	O-1	N	Y	Y		N/A	N/A
R-116	8.3.2	The length (in bytes) of the finger pattern skeletal data shall be recorded in two bytes.	1	M	N	Y	Y			
R-117	8.3.3	The finger pattern skeletal data for a single finger shall be encoded as defined in Clauses 6.1 and 6.2 with the definitions of 8.1 respectively. 8.2.	3C	O-1	N	Y	Y		N/A	N/A
R-118	8.3.4	The length (in bytes) of the skeleton line neighbourhood index data shall be recorded in two bytes.	1	M	N	Y	Y			
R-119	8.3.5	The skeleton line neighbourhood index data for a single finger shall be recorded as defined in Clause 6.3.	3C	O	N	Y	Y			
R-120	8.4	Only the x or the y-image size, not both, shall exceed the range of 255.	3A	M	N	Y	Y			
R-121	8.5	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'.	2	O	N	Y	Y			
R-122	8.6.1	The maximal data size accepted is therefore an implementation dependent value and shall be indicated using the DO 'Maximal data size' (tag '81', value field 2 bytes). The nesting of this DO in the DO 'Biometric algorithm parameters' is shown in Table 7.	2	O	N	Y	Y			
R-123	8.6.1	If still the data length is too large, then truncation shall be made by peeling off skeleton segments from the convex hull of the described area.	2	O	N	Y	Y			
R-124	8.6.1	For the indication of the maximal data size expected by the card the DO Maximal data size as shown in Table 7 shall be used.	2	O	N	Y	Y			
R-125	8.6.1	If a card with on-card comparison supports one or more of the additional features, then the capabilities shall be indicated using the DO 'Feature handling indicator' (tag '83', value field 1 byte).	2	O	N	Y	Y			

Status Notes:

1. Level 3C difficulty

   The requirement is mandatory in the base standard but has been declared optional for purposes of a declaration of conformance because it 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.

A.3 Table of Conformance Test Assertions

The specific test assertions required for conformance testing to this part of ISO/IEC 19794 are listed in Table A.2. The normative requirements of this part of ISO/IEC 19794 described in Table A.1 are referenced in Table A.2.

The conformance test assertions are listed in the order in which the corresponding fields are required to appear, if present, in a conforming record.

Table A.2 – Conformance Test Assertions for Finger pattern skeletal data record format

Test Number	Section	Requirement ID	Level	Field Name	Operator	Operand	Test Note	Status	IUT Support	Supported Range	Test Result
1	General Record Header	R-9	1	Format Identifier	EQ	0x 46534b00	1	M			
1.1	General Record Header	R-9	1	Format Identifier	NEQ	0x004b5346	1	M			
2	General Record Header	R-10, R-11	1	Version	EQ	0x30323000		M			
2.1	General Record Header	R-10, R-11	1	Version	NEQ	0x0030323	1	M			
3	General Record Header	R-12, R-13	1	Record Length	EQ	57 to 4294967295	2	M			
3.1	General Record Header	R-12, R-13	2	Record Length	EQ	Total Bytes Read	2	M			
3.2	General Record Header	R-12, R-13	2	Record Length	EQ	Total Bytes Expected	2	M			
4	General Record Header	R-14	1	Number of finger representations in record	EQ	1 to 255	4,5	M			
5	General Record Header	R-15	1	Certification flag	EQ	0 to 1		M			
6	Representation header	R-17	1	Representation length	EQ	0 to 4294967295					
7	Representation header	R-16	1	Representation length	EQ	39 to 4294967295		M			
7.1	Representation header	R-16	2	Representation length	EQ	39+ Skeltale Data Bytes Read	3,6	M			

8.1	Representation header	R-18	1	Capture date and time (Byte 1 to 2)	EQ	1 to 65534, FFFF HEX		M			
8.2	Representation header	R-18	1	Capture date and time (Byte 3)	EQ	1 to 12, FF Hex		M			
8.3	Representation header	R-18	1	Capture date and time (Byte 4)	EQ	1 to 31, FF Hex		M			
8.4	Representation header	R-18	1	Capture date and time (Byte 5)	EQ	0 to 23, FF Hex		M			
8.5	Representation header	R-18	1	Capture date and time (Byte 6)	EQ	0 to 59, FF Hex		M			
8.6	Representation header	R-18	1	Capture date and time (Byte 7)	EQ	0 to 59, FF Hex		M			
8.7	Representation header	R-18	1	Capture date and time (Byte 8 to 9)	EQ	0 to 999, FFFF Hex		M			
9	Representation header	R-19, R-20	1	Capture device technology ID	EQ	0 to 20	7	M			
10	Representation header	R-21, R-22	1	Capture device vendor ID	EQ	0 to 65535	7	M			
11	Representation header	R-23	1	Capture device type ID	EQ	0 to 65535	7	M			
12	Representation header	R-24, R-25, R-26, R-27	1	Number of quality blocks	EQ	0 to 255		M			
12.1	Representation header	R-24, R-25, R-26, R-27	2	Number of quality blocks	EQ	0		M			
13	Representation header	R-28	1	Quality score	EQ	0 to 255		M			
14	Representation header	R-30	1	Quality algorithm vendor ID	EQ	0 to 65535		M			
15	Representation header	R-31	1	Quality algorithm ID	EQ	0 to 65535		M			
16	Representation header	R-32, R-33	1	Number of certification	EQ	0 to 3		M			
17	Representation header	R-34	1	Certification authority ID	EQ	0000 Hex to FFFF Hex		M			
18	Representation header	R-35	1	Certification scheme ID	EQ	01 Hex to 03 Hex		M			
19	Representation header	R-36	1	Finger position	EQ	0 to 10		M			

20	Representation header	R-37	1	Representation number	EQ	0 to 15		M			
21	Representation header	R-38	1	Resolution of finger pattern [ppcm]	EQ	1 to 255		M			
22	Representation header	R-39	1	Impression type	EQ	0 to3 or 8 to 9		M			
23	Representation header	R-40	1	Size of skeleton image in x direction	EQ	0 to 65535		M			
24	Representation header	R-41	1	Size of skeleton image in y direction	EQ	0 to 65535		M			
25	Representation header	R-42	1	Bit-depth of direction code start and stop point coordinates	EQ	8 to 16		M			
26	Representation header	R-43	1	Bit-depth of direction code start and stop direction	EQ	4 to 8		M			
27	Representation header	R-44	1	Bit-depth of direction in direction code	EQ	3 to 8		M			
28	Representation header	R-45	2	Step size of direction code	EQ	1 to 255		M			
29	Representation header	R-46	1	Relative perpendicular step size of direction code	EQ	0 to 255		M			
30	Representation header	R-47	1	Number of directions on 180°	EQ	1 to 255		M			
31	Representation header	R-48, R-49	1	Length of finger pattern skeletal data	EQ	0 to 65535		M			
32	Representation header	R-51, R-52	1	Length of skeleton line neighbourhood index data	EQ	0 to 65535		M			
33.1	Extended Data	R-53, R-54, R-55, R-56	1	Extended Data Block Length	EQ	0 to 65535	8	M			
33.2	Extended Data	R-53, R-54, R-55, R-56, R-61	2	Extended Data Block Length	EQ	Bytes Read	8	M			

33.3	Extended Data	R-53, R-54, R-55, R-56, R-61	2	Extended Data Block Length	EQ	Expected 8	8	M		
34	Extended Data	R-57, R-58	1	Extended Data Area Type Code	EQ	1 to 3, 0x0100 to 0xFFFF	8	M		
35.1	Extended Data	R-59, R-60	1	Extended Data Area Length	EQ	4 to 65535	8	M		
35.2	Extended Data	R-59, R-60	2	Extended Data Area Length	EQ	Bytes Read	8	M		
36	Ridge Count	R-64, R-65, R-66, R-67, R-68, R-69, R-70	1	Ridge Extraction Method	EQ	0 to 2	10	M		
37	Ridge Count	R-71	2	Ridge Index 1	C		9	M		
38	Ridge Count	R-71	2	Ridge Index 2	C		9, 11, 12	M		
39	Ridge Count	R-71	2	Ridge Index 3	C		9	M		
40	Ridge Count	R-71, R-72	1	Ridge Count	EQ	0	9	M		
41.1	Core	R-73, R-74	1	Number of Cores	EQ	0 to 15	13	M		
41.2	Core	R-73, R-74	2	Number of Cores	C	Cores Read	13	M		
42	Core	R-75	1	Core Information Type	EQ	0 to 1	13	M		
43	Core	R-76, R-78	2	Core Location X	EQ	0 to 16383	13	M		
44	Core	R-77, R-78	2	Core Location Y	EQ	0 to 16383	13	M		
45	Core	R-79	1	Core Angle	EQ	0 to 255	13	M		
46.1	Delta	R-80	1	Number of Delta	EQ	0 to 15	13	M		
46.2	Delta	R-80	2	Number of Delta	C	Delta Read	13	M		
47	Delta	R-81	1	Delta Information Type	EQ	0 to 1	13	M		
48	Delta	R-82, R-84	2	Delta Location X	EQ	0 to 16383	13	M		

49	Delta	R-83, R-84	2	Delta Location Y	EQ	0 to 16383	13	M			
50	Delta	R-85, R-86	1	Delta Angle 1	EQ	0 to 255	13	M			
51	Delta	R-85, R-86	1	Delta Angle 2	EQ	0 to 255	13	M			
52	Delta	R-85, R-86	1	Delta Angle 3	EQ	0 to 255	13	M			
62	Zone Quality	R-87, R-88	1	Cell Width	EQ	1 to 255		M			
63	Zone Quality	R-87, R-88	1	Cell Height	EQ	1 to 255		M			
64	Zone Quality	R-89	1	Cell Bit Depth	EQ	1 to 255		M			
65	Zone Quality	R-90, R-91, R-92, R-93	2	Cell Quality Bits	C	Cell Bits Read		M			

Table A.3 – Conformance Test Assertions for Finger pattern skeletal data card format – normal size

Test Number	Section	Requirement ID	Level	Field Name	Operator	Operand	Test Note	Status	IUT Support	Supported Range	Test Result
1	Representation header	R-17	1	Representation length	EQ	0 to 4294967295					
2	Representation header	R-16	1	Representation length	EQ	39 to 4294967295		M			
2.1	Representation header	R-16	2	Representation length	EQ	39+ Skeltale Data Bytes Read	3,6	M			
3.1	Representation header	R-18	1	Capture date and time (Byte 1 to 2)	EQ	1 to 65534, FFFF $_{HEX}$		M			
3.2	Representation header	R-18	1	Capture date and time (Byte 3)	EQ	1 to 12, FF $_{Hex}$		M			
3.3	Representation header	R-18	1	Capture date and time (Byte 4)	EQ	1 to 31, FF $_{Hex}$		M			
3.4	Representation header	R-18	1	Capture date and time (Byte 5)	EQ	0 to 23, FF $_{Hex}$		M			
3.5	Representation header	R-18	1	Capture date and time (Byte 6)	EQ	0 to 59, FF $_{Hex}$		M			
3.6	Representation header	R-18	1	Capture date and time (Byte 7)	EQ	0 to 59, FF $_{Hex}$		M			
3.7	Representation header	R-18	1	Capture date and time (Byte 8 to 9)	EQ	0 to 999, FFFF $_{Hex}$		M			
4	Representation header	R-19, R-20	1	Capture device technology ID	EQ	0 to 20	7	M			
5	Representation header	R-21, R-22	1	Capture device vendor ID	EQ	0 to 65535	7	M			
6	Representation header	R-23	1	Capture device type ID	EQ	0 to 65535	7	M			
7	Representation header	R-24, R-25, R-26, R-27	1	Number of quality blocks	EQ	0 to 255		M			
8.1	Representation header	R-24, R-25, R-26, R-27	2	Number of quality blocks	EQ	0		M			
9	Representation header	R-28	1	Quality score	EQ	0 to 255		M			

10	Representation header	R-30	1	Quality algorithm vendor ID	EQ	0 to 65535		M			
11	Representation header	R-31	1	Quality algorithm ID	EQ	0 to 65535		M			
12	Representation header	R-32, R-33	1	Number of certification	EQ	0 to 3		M			
13	Representation header	R-34	1	Certification authority ID	EQ	0000Hex to FFFF Hex		M			
14	Representation header	R-35	1	Certification scheme ID	EQ	01Hex to 03 Hex		M			
15	Representation header	R-36	1	Finger position	EQ	0 to 10		M			
16	Representation header	R-37	1	Representation number	EQ	0 to 15		M			
17	Representation header	R-39	1	Impression type	EQ	0 to3 or 8 to 9		M			
18	Representation header	R-40	1	Size of skeleton image in x direction	EQ	0 to 65535		M			
19	Representation header	R-41	1	Size of skeleton image in y direction	EQ	0 to 65535		M			
20	Representation header	R-48, R-49	1	Length of finger pattern skeletal data	EQ	0 to 65535		M			
21	Representation header	R-51, R-52	1	Length of skeleton line neighbourhood index data	EQ	0 to 65535		M			
22	Extended Data	R-53, R-54, R-55, R-56	1	Extended Data Block Length	EQ	0	8	M			