INTERNATIONAL STANDARD

ISO/IEC 19794-4

Second edition
2011-12-15

AMENDMENT 2
2015-12-01

Information technology — Biometric data interchange formats —

Part 4: Finger image data

AMENDMENT 2: XML encoding and clarification of defects

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

Partie 4: Données d'image du doigt

AMENDEMENT 2: Codage XML et précisions concernant les défauts

Reference number
ISO/IEC 19794-4:2011/Amd.2:2015(E)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

Amendment 2 to ISO/IEC 19794-4:2011 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

Information technology — Biometric data interchange format — Part 4: Finger image data

Amendment 2: XML encoding and clarification of defects

1. *Append the following paragraph into introduction*

Additionally, this part of the ISO/IEC standard supports both binary and XML encoding, to support a spectrum of user requirement. With XML, this part will meet the requirements modern IT architectures. With binary encoding this part will also be able to be used in bandwitdth or storage constrained environments. Annex F specifies the schema that XML encoded finger image records must conform to, and Annex G provides an example of a valid XML encoded finger image record.

2. *Replace the existing text in clause "2– Conformance" wth the following*

A binary data record conforms to this part of ISO/IEC 19794 if it satisfies all the format requirements with respect to its structure, data values, relationships among its fields, and with respect to relations between its fields and the underlying input that are specified throughout clause 8 of this part of ISO/IEC 19794.

An XML document conforms to this part of ISO/IEC 19794 if it satisfies the format requirements with respect to its structure, with respect to relations among its fields, and with respect to relations between its fields and the underlying input that are specified within Annex F of this part of ISO/IEC 19794.

A system that produces biometric data records is conformant to this part of ISO/IEC 19794 if all biometric data records that it outputs conform to this part of ISO/IEC 19794 (as defined above) as claimed in the Implementation Conformance Statement associated with that system. A system does not need to be capable of producing biometric data records that cover all possible aspects of this part of ISO/IEC 19794, but only those that are claimed to be supported by the system in the Implementation Conformance Statement (ICS).

A system that uses biometric data records is conformant to this part of ISO/IEC 19794 if it can read, and use for the purpose intended by that system, all biometric data records that conform to this part of ISO/IEC 19794 (as defined above) as claimed in the Implementation Conformance Statement associated with that system. A system does not need to be capable of using biometric data records that cover all possible aspects of this part of ISO/IEC 19794, but only those that are claimed to be supported by the system in an Implementation Conformance Statement (ICS).

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 Annex A. Specifically, all Level-1,

Level-2 and Level-3 tests shall use the assertions defined in Table A.2 and Table A.3 of clause A.3 in conformity with the concept and rules set in ISO/IEC 19794-1:2011 AMD 1.

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.

Implementations of this part of ISO/IEC 19794 do not necessarily need to conform to all possible aspects of this part of ISO/IEC 19794, but only to those requirements that are claimed to be supported by the implementation in an implementation conformance statement (ICS), filled out in accordance with Annex A of ISO/IEC 19794-1:2011 AMD 1 and Table A.1 of clause A.2 of this part of ISO/IEC 19794.

3. Insert the following text in the appropriate alphabetical order of Clause 3:

— http://www.w3.org/XML/Schema

4. Add the following Note in clause 8.4.1

NOTE: The total length of the extended data is obtained by: Length_extended_data = Representation_length - Representation_header_length (41/42 bytes) -Image_Data_Length. In order to detect whether additional extended data blocks are available, the number of bytes read from the representation have to be subtracted from the representation length, and if the result is positive, there is, at least, an additional extended data block.

5. Replace Clause A.2 with the following text

A.2 Table of requirements

The normative requirements specified in this Part of ISO/IEC 19794 are listed in Table A.1, which extends over multiple pages. The supplier of the IUT should explain which optional components of the standard are supported and the testing laboratory shall note the results of the test.

35 (0023_{Hex})	XML-finger-image	{iso(1) registration-authority(1) cbeff(19785) biometric-organization(0) jtc1-sc37(257) bdbs(0) XML-finger-image(35)}

Table A.1 – Table of requirements

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
Finger image general header									
R-1.	8.1	Each record shall pertain to a single subject.	3C	O-1	Y	Y		N/A	N/A
R-2.	8.1	Each record shall contain at least one representation for each of one or more fingers, multiple fingers (single image records), or palms	3C	O-1	Y	Y		N/A	N/A
R-3.	8.2.1	Information shall be included for each field	1	M	Y	Y			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		within the header.							
R-4.	8.2.2 Table 1	The format identifier shall be recorded in four bytes.	1	M	Y	N			
R-5.	8.2.2 Table 1	The format identifier shall consist of three characters "FIR" (0x464952) followed by a zero byte as a NULL string terminator. Therefore, the format identifier shall be 0x46495200.	1	M	Y	N		N/A	
R-6.	8.2.3 Table 1	The Version Number shall be recorded in four bytes.	1	M	Y	N		N/A	
R-7.	8.2.3 Table 1	This version number shall consist of three ASCII numerals “020” (0x30323000) followed by zero byte as a NULL string terminator.	1	M	Y	N		N/A	
R-8.	8.2.4 Table 1	The length (in bytes) of the entire image data record shall be recorded in four bytes. Valid values are 57 to (2^{32} -1)	2	M	Y	N			
R-9.	8.2.4	This length of entire record shall be total length of the general record header and one or more representation records.	2	M	Y	N			
R-10.	8.2.5 Table 1	The total number of finger image representations contained in the finger image data record shall be recorded in two bytes. Valid values are 1 to 672.	1,2	M	Y	N			
R-11.	8.2.5	A minimum of one representation is required.	1	M	Y	Y			
R-12.	8.2.6 Table 1	The one-byte certification flag shall indicate whether each representation header includes a certification record. Valid values are 00_{Hex} and 01_{Hex}.	1	M	Y	N			
R-13.	8.2.6	A value of 00_{Hex} shall indicate that none of the representations contains a certification record.	2	M	Y	N			
R-14.	8.2.6	A value of 01_{Hex} shall indicate that all representations contain a certification record.	2	M	Y	N			
R-15.	8.2.7	The number of finger or palm images included in the	1	M	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
	Table 1	record shall be recorded in one byte. Valid values are 1 to FF_{HEX}.							
Finger image representation header									
R-16.	8.3.1	A finger or palm representation header shall start each section of finger data providing information for that representation of a single finger image, multi-finger image or palm image.	3C	O-1	Y	N		N/A	N/A
R-17.	8.3.1	For each such image there shall be one finger header record accompanying the representation of the image data.	2	M	Y	N		N/A	
R-18.	8.3.1	The representaion header shall occupy a minimum of 41 bytes (assuming no certification blocks and no quality blocks are present). Otherwise, it shall be 42+ 5*num_quality_block+ 3*num_certification_block	2	M	Y	N			
R-19.	8.3.1	The compressed or uncompressed image data for that image representation shall immediately follow the image representation header.	3C	O-1	Y	N		N/A	N/A
R-20.	8.3.1	Subsequent image representations (including the image representation header) will be concatenated to the end of the previous image representation.	3C	O-1	Y	N		N/A	N/A
R-21.	8.3.2 Table 2	The four-byte representation length field shall contain the length in bytes of the finger representation including the representation header fields. The minimum length is 41.	2	M	Y	N			
R-22.	8.3.3 Table 2	Capture date-time field shall indicate the date and time the representation was captured. This field is not intended to encode the time the record was instantiated.	3C	O-1	Y	Y			
R-23.	8.3.3 Table 2	Capture time field shall be encoded in accordance to the requirements given in	1	M	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		Part 1 of this standard. Parts of the capture date and time that are unknown shall be filled with FF_{Hex}, or $FFFF_{Hex}$ for two-byte components and all subsequent components shall be unknown.							
R-24.	8.3.4 Table 4	The one-byte capture device technology ID shall contain the entry chosen from Table 4 to indicate the technology type used by the capture device. Valid values are 0 to 20.	1	M	Y	N			
R-25.	8.3.5 Table 2	The capture device vendor ID shall be recorded in two bytes.	1	M	Y	N			
R-26.	8.3.5 Table 2	The capture device vendor ID shall identify the biometric organisation that owns the product that created the biometric record (BDIR) and shall be registered with the IBIA or other approved registration authority. A value of all zeros shall indicate that the capture device vendor is unreported.	3B	M	Y	Y			
R-27.	8.3.6 Table 2	This capture device type ID shall be recorded in two bytes.	1	M	Y	N			
R-28.	8.3.6 Table 2	This capture device type ID shall identify the product type that created the biometric record and shall be assigned by the registered biometric record product owner or other approved registration authority. A value of all zeros shall indicate that the capture device type is unreported.	3C	O-1	Y	Y			N/A
R-29.	8.3.7.1	The quality information of the overall finger image data shall be recorded in one or more five-byte blocks.	1	M	Y	N			
R-30.	8.3.7.1	Each of these blocks shall pertain to a specific quality/vendor/algorithm evaluation.	2	M	Y	Y			
R-31.	8.3.7.2	The first byte of the quality	2	M	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
	Table 2	record is mandatory and shall contain the number of subsequent quality blocks. Valid values are 0 to 255.							
R-32.	8.3.7.2 Table 2	Subsequent 5-byte blocks shall contain the specific quality/vendor/algorithm information for each quality/vendor/algorithm evaluation.	1,3B	M	Y	N			
R-33.	8.3.7.2 Table 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	2	M	Y	N			
R-34.	8.3.7.3 Table 2	The quality score shall be recorded in the first byte of each of the five-byte quality blocks. Valid values for quality score are integers between 0 and 100, and 255.	1	M	Y	N			
R-35.	8.3.7.3 Table 2	The quality score shall be the quantitative expression of the predicted verification performance of the biometric sample, per ISO/IEC 29794-1. For valid values 0 to 100, higher values shall indicate better quality.	3C	O-1	Y	Y			N/A
R-36.	8.3.7.3 Table 2	An entry of "255" shall indicate a failed attempt to calculate a quality score.	3C	O-1	Y	N			N/A
R-37.	8.3.7.4 Table 2	The provider of quality scores shall be uniquely identified by bytes 2 and 3 of the 5-byte quality block.	1	M	Y	N			
R-38.	8.3.7.4 Table 2	This Vendor ID shall be registered with the International Biometrics Industry Association (IBIA).	3B	M	Y	Y			
R-39.	8.3.7.5 Table 2	Bytes 4 and 5 of the 5-byte quality block 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 shall be within the range of 0 to 65535.	1	M	Y	N			
R-40.	8.3.7.5 Table 2	Multiple quality scores calculated by the same	2	M	Y	Y			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		algorithm (same vendor ID and algorithm ID) shall not be present in a single representation.							
R-41.	8.3.8.1 Table 2	The certification record shall consist of a length field followed by zero or more 3-byte certification blocks. Each certification block shall consist of a certification authority identifier and a certification scheme identifier.	2	M	Y	N			
R-42.	8.3.8.1 Table 2	If the 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 image record.	2	M	Y	N			
R-43.	8.3.8.2 Table 2	The first byte of the certification record is mandatory and shall contain the number of 3-byte certification blocks for the capture device. Valid values are 0 to 255.	1,2	M	Y	N			
R-44.	8.3.8.3	The first two bytes of each 3-byte certification block shall contain the certification authority identifier agency or organization that certified the device according to a particular capture device quality specification.	1	M	Y	N			
R-45.	8.3.8.3	The Certification Authority Identifier shall be registered by the IBIA or other approved registration authority.	3C	O-1	Y	Y			N/A
R-46.	8.3.8.4 Table 5	The 3rd and last byte of certification block shall identify a certification scheme identifier used to certify the capture device as listed in Table 5.	1	M	Y	N			
R-47.	8.3.9 Table 2 Tables 6-8	The one-byte finger or palm position field shall contain the finger or palm position code. Valid values are 0-10, 13-15, 20-36, and 40-50.	1	M	Y	N			
R-48.	8.3.10 Table 2	The one-byte representation number shall contain the specific image	2	M	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		representation number associated with the image data (or finger, multi finger or palm image data).							
R-49.	8.3.11 Table 2	Scale units field shall specify the units used to describe the scanning and image spatial sampling rate of the image.	3C	O-1	Y	Y			
R-50.	8.3.11 Table 2	Valid values (for scale units) are 01_{Hex} (indicating pixels per inch), or 02_{Hex} (indicating pixels per centimetre).	1	M	Y	N			
R-51.	8.3.12 Table 2	The two-byte capture device spatial sampling rate (horizontal) shall specify the rounded scanning spatial sampling rate used in the horizontal direction.	3C	O-1	Y	Y			
R-52.	8.3.13 Table 2	The two-byte capture device spatial sampling rate (vertical) shall specify the rounded spatial sampling rate used in the vertical direction.	3C	O-1	Y	Y			
R-53.	8.3.14 Table 2	The two-byte image spatial sampling rate (horizontal) shall specify the rounded image spatial sampling rate used in the horizontal direction. Valid values are values smaller or equal to device spatial sampling rate (horizontal).	2	M	Y	Y			
R-54.	8.3.15 Table 2	The two-byte image spatial sampling rate (vertical) shall specify the rounded image spatial sampling rate used in the vertical direction. Valid values are values smaller or equal to device spatial sampling rate (vertical).	2	M	Y	Y			
R-55.	8.3.16 Table 2	The one-byte bit-depth field shall contain the number of bits used to represent a pixel. This field shall contain an entry of 01_{Hex}(=1) to 10_{Hex}(=16).	1	M	Y	Y			
R-56.	8.3.17 Table 9	The one-byte image compression algorithm field shall specify the method used to record the uncompressed or	1,2	M	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		compressed grayscale images. Valid values are 0 to 6 as listed in Table 9.							
R-57.	8.3.17 Table 9	If compression algorithm code is 0, for grayscale pixels greater than eight bits, each pixel shall be recorded in a pair of bytes right justified.	3C	O-1	Y	Y			
R-58.	8.3.17 Table 9	When the compression algorithm code is 2, a certified version of the Wavelet Scalar Quantization (WSQ) algorithm as described in Annex E shall be used	3C	O-1	Y	Y			
R-59.	8.3.17 Table 9	WSQ compression for 8-bit, 197 ppcm (500 ppi) grayscale images.shall be limited to a 15:1 compression ratio.	2	M	Y	Y			
R-60.	8.3.17	WSQ shall not be used to compress images scanned at 394 ppcm (1000 ppi).	2	M	Y	Y			
R-61.	8.3.17	JPEG shall not be used for new applications.	2	M	Y	Y			
R-62.	8.3.17	Fingerprint/palm print images scanned at 394 ppcm (1000 ppi), if compressed, shall be compressed using the JPEG 2000 algorithm as described in the ISO Standard 15444.	2	M	Y	Y			
R-63.	8.3.17	When JPEG 2000 is used, the JPEG 2000 profile settings as specified in the "Profile for 1000ppi Fingerprint Compression" normative reference are required to be incorporated.	3C	O-1	Y	Y			N/A
R-64.	8.3.17	If compression algorithm is 5, the ISO/IEC 15948 PNG algorithm shall be used.	2	M	Y	Y			
R-65.	8.3.18 Table 10	The impression type code of the finger or palm image shall be recorded in one byte. Valid values are 0 to 15, and 20 to 29.	1 3C	M O-1	Y	N			
R-66.	8.3.19	The two-byte horizontal line length field shall be used to specify the number of pixels contained on a single horizontal line of the transmitted image.	2	M-2	Y	Y			
R-67.	8.3.20	The two-byte vertical line	2	M-2	Y	Y			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		length field shall be used to specify the number of horizontal lines contained in the transmitted image.							
R-68.	8.3.21 Table 2	The 4-byte image data length field shall contain the length (expressed as the number of bytes) of the compressed or uncompressed image data contained in this representation. Valid values are 0 to (2^{32}-58).	1	M	Y	N			
R-69.	8.3.22	The finger or palm image data field shall contain the grayscale image data formatted and recorded in accordance with the image compression algorithm.	2	M	Y	Y			
Extended data									
R-70.	8.4.1	The size of extended data block shall be kept as small as possible, augmenting the image data stored in the standard image data section.	3C	O-1	Y	Y			N/A
R-71.	8.4.1	Any extended data associated with a finger representation shall immediately follow the standard image data for that finger representation.	1	M	Y	N			
R-72.	8.4.1	The extended data is not intended to allow for alternate representations of data that can be represented in open manner as defined in this standard. The intention of this standard is to provide interoperability.	3C	O-1	Y	Y			N/A
R-73.	8.4.2.1 Table 11	Extended data block type identification code shall have a length of two bytes. Valid values: 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; currently, only	2	M	Y	Y			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		segmentation, annotation, and comment formats are specified (refer to clauses 8.4.3, 8.4.4, and 8.4.5). A non-zero value in the first byte shall indicate a vendor-specified format with a code maintained by the vendor.							
R-74.	8.4.2.2	The length of the extended data section shall be recorded in two bytes. This length field includes the count of the length and type identification fields (four bytes total).	2	M	Y	N			
R-75.	8.4.3	If the extended data type identification code is 0x0001, the extended data section contains segmentation and image quality data for each segment of the flat fingerprint image.	2	M	Y	N			
R-76.	8.4.3.1 Table 12	The segmentation quality assessment algorithm owner's ID is encoded in the first two bytes of the segmentation data block. The 16-bit format owner value is assigned by the IBIA. A value of 0x00 indicates that segmentation algorithm and vendor ID is unreported.	1	M	Y	N			
R-77.	8.4.3.1 Table 12	Bytes 3 and 4 of the segmentaion block shall contain a specific identifier for the segmentation quality assessment algorithm. This field contains the binary representation of the integer product code and should be within the range 1 to 65535. This value is assigned by the organization, and may be registered with the IBIA.	1	M	Y	N			
R-78.	8.4.3.2 Table 12	The one-byte segmentation quality score shall be a measure of estimated correctness regarding the accuracy of the location of the segmented finger. Valid values: 0-100 quality score, 254: no attempt to calculate a segmentation quality	1 3C	M O-1	Y	N			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		score and 255 for a failed attempt to calculate a segmentation quality score.							
R-79.	8.4.3.3 Table 12	The quality assessment algorithm's supplier (owner) is contained in the 6th and 7th bytes of a segmentation data block. This field contains the binary representation of the integer product code and should be within the range 1 to 65535. This value is assigned by the organization, and may be registered with the IBIA. A value of 00_{Hex} indicates that the vendor ID is unreported.	1	M	Y	N			
R-80.	8.4.3.3 Table 12	Bytes 8-9 of a segmentation block shall contain a specific identifier for the quality assessment algorithm. Valid values: 1 to 65535.	1	M	Y	N			
R-81.	8.4.3.4 Table 12	The number of Finger Data Segment blocks shall be equal to the number stated in the Number of Segments field.	2	M	Y	N			
R-82.	8.4.3.4 Table 12	Valid values for number of segments field are 0 to 4, and 255.	1	M	Y	N			
R-83.	8.4.3.4	If an image is multi-finger impression then the number of segments shall be 0.	2	M	Y	Y			
R-84.	8.4.3.4	If the segmentation attempt fails then the number of segments shall be 255.	2	M	Y	N			
R-85.	8.4.3.5.1 Table 12	Each finger segment shall be defined by finger position, image quality, the number of points used to define the segment and the coordinates of each point.	2	M	Y	Y			
R-86.	8.4.3.5.2 Table 12, Table 6	Finger position of segmented finger in one byte. Valid values: 0 to 10, and 13 to 15.	1	M	Y	N			
R-87.	8.4.3.5.3 Table 12	Finger image quality is encoded in the 2nd byte of finger segmant data shall be a quantitative expression of the predicted verification performance of the biometric sample.	3C	O-1	Y	N			N/A

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
R-88.	8.4.3.5.3 Table 12	The finger image quality of a segmentation block is calculated by the algorithm identified by finger quality owner ID.	3C	O-1	Y	N			N/A
R-89.	8.4.3.5.3 Table 12	Valid values for finger image quality of a segmentation block are: 0 to 100, 254(not reported) and 255(failed attempt)	2	M	Y	N			
R-90.	8.4.3.5.4 Table 12	The third byte in a finger segment data block shall specify the number of points or vertexes used to enclose the segmented image.	3C	O-1	Y	N			N/A
R-91.	8.4.3.5.4	For a finger segment enclosed by an n-sided polygon, this byte shall contain a value between 4 and 99.	1	M	Y	N			
R-92.	8.4.3.5.4	The order of the vertices shall be in their consecutive order around the perimeter of the polygon, either clockwise or counterclockwise. The polygon side defined by the last subfield and the first subfield shall complete the polygon. The polygon shall be a simple, plane figure with no sides crossing and no interior holes. Each vertex of the rectangle or polygon shall be represented by a pair of coordinates.	3C	O-1	Y	Y			N/A
R-93.	8.4.3.5.4	No two vertices may occupy the same location.	2	M	Y	Y			
R-94.	8.4.3.5.4.1	Two bytes shall be used to contain the horizontal pixel offset to the right relative to the origin positioned in the upper left corner of the image.	1	M	Y	Y			
R-95.	8.4.3.5.4.2	Two bytes shall be used to contain the vertical pixel offset down relative to the origin positioned in the upper left corner of the image..	1	M	Y	Y			
R-96.	8.4.3.5.5	This one byte field shall encode the angle between the longitudinal axis of the finger and the horizontal	1	M	Y	Y			

Requirement Identifier	Governing section	Requirement Summary	Level	Status	Binary Format Applicability	XML Format Applicability	IUT Support	Supported Range	Test Result
		axis to the right.							
R-97.	8.4.3.5.5	The integer value encoded shall be the physical estimate of the angle in degrees divided by 1.40625	3A	O	Y	Y			
R-98.	8.4.4	If the extended data type identification code is 0x0002, the extended data section contains annotation information.	2	M	Y	N			
R-99.	8.4.4.1 Table 13	The one-byte number of annotations shall contain the number of annotations that follow. Each annotation will consists of two information items.	2	M	Y	N			
R-100.	8.4.4.1 Table 13	The valid values for the number of annotations are 1 to 4.	2	M	Y	Y			
R-101.	8.4.4.2 Table 13	Finger position shall be encoded in byte 2 of annotation block. Valid values are 0 to 10, 13 to 15, 20 to 36, and 40 to 50.	1	M	Y	N			
R-102.	8.4.4.3 Table 13	Annotation code shall be encoded in byte 3 of annotation block. Valid values are 01_{Hex} for an amputated finger and 02_{Hex} for a bandaged or otherwise unable to print finger.	1	M	Y	N			
R-103.	8.4.5	If the extended data type identification code is 0003_{Hex}, the extended data section contains ASCII text information associated with the captured image or subject supplying the image. The comment is inputted by the individual generating the fingerprint or palmprint record. A null terminator for the ASCII string is not necessary, as the length is provided.	2	M	Y	N			

Status Notes:

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

O-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.

M-2. No level 1 test is associated with this requirement, because the test will always pass

6. ***Replace the header of A.3 with the following***

A.3 Table of test assertions for binary encoded records

The specific test assertions required for conformance testing for binary records to this Part of ISO/IEC 19794 are listed in Table A.2, which extends over multiple pages. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record. The normative requirements of this part of ISO/IEC 19794 as summarized in Table A.1 are referenced in the Table.

7. ***Rename Table A.2 as Test assertions for binary encoded records***

8. **Add new section A.4**

A.4 Table of test assertions for xml encoded records

The specific test assertions required for conformance testing for xml encoded records to this Part of ISO/IEC 19794 are listed in Table A.3, which may extend over multiple pages. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record. The normative requirements of this part of ISO/IEC 19794 as summarized in Table A.1 are referenced in Table.

Table A.3. Test assertions for xml encoded records

Test Num	Rqt ID	Level	Element Name	Operator	Opd	Test Note	Status	IUT Spt	Spt Range	Test Result
X1	R6-R7	1	FingerImage.Version.Major	EQ	2		M			
X2	R6-R7	1	FingerImage.Version.Minor	EQ	0		M			
X3	R-53	2	FingerImage.RepresentationList.Representation.ImageXSpatialSamplingRate	LTE	FingerImage.RepresentationList.Representation.ScannerXSpatialSamplingRate	1	M			
X4	R-54	2	FingerImage.RepresentationList.Representation.ImageYSpatialSamplingRate	LTE	FingerImage.RepresentationList.Representation.ScannerYSpatialSamplingRate	1	M			
X5	R-56	2	FingerImage.RepresentationList.Representation.ImageCompressionAlgorithmName	EQ	Compression Algorithm of decoded base64 FingerImage.RepresentationList.Representation.FingerImageData	1	M			
X6	R-66	2	FingerImage.RepresentationList.Representation.Width	EQ	Width Value found within decoded base64 FingerImage.RepresentationList.Representation.FingerImageData	1	M			
X7	R-67	2	FingerImage.RepresentationList.Representation.Height	EQ	Height Value found within decoded	1	M			

					base64 FingerImage. RepresentationList. Representation. FingerImageData					
X8		2	FingerImage. NumberOfDistinctPositions	EQ	Count Of Distinct Values of FingerImage. RepresentationList. Representation. Position	2	M			
X9	R-93	2	FingerImage. RepresentationList. Representation. FingerSegmentationList. FingerSegmentation. FingerSegmentList. FingerSegment. EnclosingCoordinates	C	All coordinates have a unique X,Y position	1	M			
X10	R-83	2	Count of FingerImage. RepresentationList. Representation. FingerSegmentationList	EQ	0	3	M			

Test Notes:

1. For values within the same Representation
2. For values across all Representations within the RepresentationList
3. If FingerImage.RepresentationList.Representation.Position is not any of the following:

```
        UnknownFinger, RightThumb, RightIndex, RightMiddle, RightRing,
        RightLittle,
        LeftThumb, LeftIndex, LeftMiddle, LeftRing, LeftLittle
```

```
THEN Count of
FingerImage.RepresentationList.Representation.FingerSegmentationList == 0
```

9. Insert the following text as a new Annex F normative clause

Annex F (normative) XML schema definition

This annex defines the schema that shall be used to validate xml finger image records encoded in an XML format. Additionally, this annex provides mappings from binary values to XML values

F.1 Finger Image Schema

```
<?xml version="1.0" encoding="utf-8" ?>
<!--Permission is hereby granted, free of charge in perpetuity, to any person obtaining a copy of the
Schema, to use, copy, modify, merge and distribute free of charge, copies of the Schema for the purposes
of developing, implementing, installing and using software based on the Schema, and to permit persons to
whom the Schema is furnished to do so, subject to the following conditions:
THE SCHEMA IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT
LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO
EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER
IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SCHEMA OR THE
USE OR OTHER DEALINGS IN THE SCHEMA. In addition, any modified copy of the Schema shall include the
following notice: THIS SCHEMA HAS BEEN MODIFIED FROM THE SCHEMA DEFINED IN ISO/IEC 19794-4, AND SHOULD NOT
BE INTERPRETED AS COMPLYING WITH THAT STANDARD-->
```

```
<xs:schema xmlns="http://standards.iso.org/iso-iec/19794/-4/ed-2/amd/2"
xmlns:cmn="http://standards.iso.org/iso-iec/19794/-1/ed-2/amd/2" attributeFormDefault="unqualified"
elementFormDefault="qualified" targetNamespace="http://standards.iso.org/iso-iec/19794/-4/ed-2/amd/2"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
    <xs:import schemaLocation="19794-1_ed2_amd2.xsd" namespace="http://standards.iso.org/iso-iec/19794/-
1/ed-2/amd/2" />
```

```
    <xs:simpleType name="AnnotationReasonType">
        <xs:restriction base="xs:string">
            <xs:enumeration value="Amputated" />
            <xs:enumeration value="UnableToPrint" />
            <xs:enumeration value="Bandaged" />
        </xs:restriction>
    </xs:simpleType>
```

```
    <xs:simpleType name="PositionType">
        <xs:restriction base="xs:string">
            <xs:enumeration value="UnknownFinger" />
            <xs:enumeration value="RightThumb" />
            <xs:enumeration value="RightIndex" />
            <xs:enumeration value="RightMiddle" />
            <xs:enumeration value="RightRing" />
            <xs:enumeration value="RightLittle" />
            <xs:enumeration value="LeftThumb" />
            <xs:enumeration value="LeftIndex" />
            <xs:enumeration value="LeftMiddle" />
            <xs:enumeration value="LeftRing" />
            <xs:enumeration value="LeftLittle" />
            <xs:enumeration value="RightSlap" />
            <xs:enumeration value="LeftSlap" />
            <xs:enumeration value="BothThumbs" />
            <xs:enumeration value="UnknownPalm" />
            <xs:enumeration value="RightFullPalm" />
            <xs:enumeration value="RightWritersPalm" />
            <xs:enumeration value="RightLowerPalm" />
            <xs:enumeration value="RightUpperPalm" />
            <xs:enumeration value="RightOtherPalm" />
            <xs:enumeration value="RightInterdigital" />
            <xs:enumeration value="RightThenar" />
            <xs:enumeration value="RightHypothenar" />
            <xs:enumeration value="LeftFullPalm" />
            <xs:enumeration value="LeftWritersPalm" />
            <xs:enumeration value="LeftLowerPalm" />
            <xs:enumeration value="LeftUpperPalm" />
            <xs:enumeration value="LeftOtherPalm" />
            <xs:enumeration value="LeftInterdigital" />
            <xs:enumeration value="LeftThenar" />
            <xs:enumeration value="LeftHypothenar" />
            <xs:enumeration value="RightIndexMiddle" />
            <xs:enumeration value="RightMiddleRing" />
            <xs:enumeration value="RightRingLittle" />
            <xs:enumeration value="LeftIndexMiddle" />
            <xs:enumeration value="LeftMiddleRing" />
            <xs:enumeration value="LeftRingLittle" />
            <xs:enumeration value="RightIndexLeftIndex" />
            <xs:enumeration value="RightIndexMiddleAndRing" />
            <xs:enumeration value="RightMiddleRingAndLittle" />
            <xs:enumeration value="LeftIndexMiddleAndRing" />
            <xs:enumeration value="LeftMiddleRingAndLittle" />
        </xs:restriction>
    </xs:simpleType>
```

```
    <xs:simpleType name="ImpressionType">
        <xs:restriction base="xs:string">
            <xs:enumeration value="LiveScanPlain" />
            <xs:enumeration value="LiveScanRolled" />
            <xs:enumeration value="NonLiveScanPlain" />
            <xs:enumeration value="NonLiveScanRolled" />
            <xs:enumeration value="LatentImpression" />
            <xs:enumeration value="LatentTracing" />
            <xs:enumeration value="LatentPhoto" />
            <xs:enumeration value="LatentLift" />
            <xs:enumeration value="LiveScanVerticalSwipe" />
            <xs:enumeration value="LiveScanVerticalRolled" />
            <xs:enumeration value="LiveScanPalm" />
            <xs:enumeration value="NonLiveScanPalm" />
            <xs:enumeration value="LatentPalmImpression" />
            <xs:enumeration value="LatentPalmTracing" />
            <xs:enumeration value="LatentPalmPhoto" />
            <xs:enumeration value="LatentPalmLift" />
            <xs:enumeration value="LiveScanOpticalContactPlain" />
            <xs:enumeration value="LiveScanOpticalContactRolled" />
            <xs:enumeration value="LiveScanNonOpticalContactPlain" />
            <xs:enumeration value="LiveScanNonOpticalContactRolled" />
            <xs:enumeration value="LiveScanOpticalContactlessPlain" />
            <xs:enumeration value="LiveScanOpticalContactlessRolled" />
```

```
            <xs:enumeration value="LiveScanNonOpticalContactlessPlain" />
            <xs:enumeration value="LiveScanNonOpticalContactlessRolled" />
            <xs:enumeration value="Other" />
            <xs:enumeration value="Unknown" />
        </xs:restriction>
    </xs:simpleType>

    <xs:complexType name="SegmentType">
        <xs:sequence>
            <xs:element name="Position" type="PositionType" />
            <xs:element name="QualityList" type="cmn:QualityListType" minOccurs="0" />
            <xs:element name="EnclosingCoordinates">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="Coordinate" type="cmn:CoordinateCartesian2DUnsignedShortType"
minOccurs="2" maxOccurs="unbounded" />
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element name="Orientation" type="xs:unsignedByte" />
        </xs:sequence>
    </xs:complexType>
    <xs:complexType name="SegmentationType">
        <xs:sequence>
            <xs:element name="Algorithm" type="cmn:RegistryIDType" />
            <xs:element name="SegmentList">
                <xs:complexType>
                    <xs:sequence>
                        <xs:element name="Segment" type="SegmentType" maxOccurs="4" />
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>

    <xs:simpleType name="ImageCompressionType">
        <xs:restriction base="xs:string">
            <xs:enumeration value="None" />
            <xs:enumeration value="BitPacked" />
            <xs:enumeration value="JPG" />
            <xs:enumeration value="WSQ" />
            <xs:enumeration value="JP2" />
            <xs:enumeration value="JP2_LS" />
            <xs:enumeration value="PNG" />
        </xs:restriction>
    </xs:simpleType>

    <xs:complexType name="AnnotationType">
        <xs:sequence>
            <xs:element name="Position" type="PositionType" />
            <xs:element name="Reason" type="AnnotationReasonType" />
        </xs:sequence>
    </xs:complexType>

    <xs:simpleType name="UnitDimensionType">
        <xs:restriction base="xs:string">
            <xs:whiteSpace value="collapse" />
            <xs:enumeration value="Inch" />
            <xs:enumeration value="Cm" />
        </xs:restriction>
    </xs:simpleType>

    <xs:complexType name="SpatialSamplingRateType">
        <xs:sequence>
            <xs:element name="SamplesPerUnit" type="xs:unsignedShort" />
            <xs:element name="UnitDimension" type="UnitDimensionType" />
        </xs:sequence>
    </xs:complexType>

    <xs:simpleType name="CaptureDeviceTechnologyType">
        <xs:restriction base="xs:string">
            <xs:whiteSpace value="collapse" />
            <xs:enumeration value="Unknown" />
            <xs:enumeration value="WhiteLightOpticalTIR" />
            <xs:enumeration value="WhiteLightOpticalDirectPlatenView" />
            <xs:enumeration value="WhiteLightOpticalTouchless" />
            <xs:enumeration value="MonochromaticVisibleOpticalTIR" />
            <xs:enumeration value="MonochromaticVisibleOpticalDirectPlatenView" />
            <xs:enumeration value="MonochromaticVisibleOpticalTouchless" />
            <xs:enumeration value="MonochromaticIROpticalTIR" />
            <xs:enumeration value="MonochromaticIROpticalDirectPlatenView" />
            <xs:enumeration value="MonochromaticIROpticalTouchless" />
            <xs:enumeration value="MultispectralOpticalTIR" />
            <xs:enumeration value="MultispectralOpticalDirectPlatenView" />
            <xs:enumeration value="MultispectralOpticalTouchless" />
            <xs:enumeration value="ElectroLuminescent" />
```