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Information technology — Biometric data interchange formats —

Part 6: Iris image data

AMENDMENT 1: Conformance testing methodology and clarification of defects

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

Partie 6: Données d'image de l'iris

AMENDEMENT 1: Méthodologie d'essai de conformité et clarification des défauts

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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 ISO documents 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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Amendment 1 to ISO/IEC 19794-6:2011 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information Technology*, Subcommittee SC 37, *Biometrics*.

Information Technology — Biometric data interchange formats — Part 6: Iris image format

Amendment 1: Conformance testing methodologies and clarification of defects

1. The following text is to be added to the "Introduction" clause of ISO/IEC 19794-6:

Annex A of this International Standard is distinct from the ISO/IEC 29109-6 which addressed conformance testing only of the first, 2005, edition of the ISO/IEC 19794-6. The normative Annex A of this International Standard addresses conformance testing of data formats specified in this International Standard (i.e. second edition of 19794-6).

2. The following text is to be added to the "Scope" clause of ISO/IEC 19794-6:

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. It establishes test assertions pertaining to the structure of the iris image data format as specified in Clause 6, 7 and 8 of this part of ISO/IEC 19794 (Type A Level 1 as defined in ISO/IEC 19794-1/Amd 1:2013), test assertions pertaining to 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/Amd 1:2013), and semantic test assertions (Type A Level 3 as defined in ISO/IEC 19794-1/Amd 1:2013.

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 19794-6:

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 clause 8. Specifically, they shall use the test methodology specified in Clauses A.1, A.2 and A.3 of ISO/IEC 19794-1/Amd 1:2013, and 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 ISO/IEC 19794 in conformity with the concept and rules set in 19794-1 Annex A1.

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 (BDR) 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 Clause A.3 of ISO/IEC 19794-1/Amd 1:2013 and tables of Clause A.3 of this part of ISO/IEC 19794.

4. The following referenced document is to be added to clause "Normative References" of ISO/IEC 19794-6:

— ISO/IEC 19794-1:2011 – Information Technology – Biometric data interchange formats – Part 1: Framework. Amendment 1: Generalized Conformance Testing Methodology

5. In clause 6.1 of ISO/IEC 19794-6:2011, Table 1, delete title "compression", replace "Mode" with "Compression mode", replace "method" with "Data encoding method", and replace all appearances of "n/a" with "RAW"

6. In clause 6.5.1 of ISO/IEC 19794-6:2011, remove 2nd sentence: "At least one region shall be masked."

7. In clause 6.5.1 of ISO/IEC 19794-6:2011, add to the end of the 1st paragraph the following text:

In the Cropped and Masked Iris Image type, the image regions outside of the iris itself shall be masked with uniform pixel values in order to increase compressibility and to ensure that coding bytes are allocated maximally to the iris texture itself.

Pixels in the sclera shall be replaced uniformly with the value 200.

Furthermore, when upper and/or lower eyelids are detected within the cropped image, then pixels in these eyelid regions and beyond shall be replaced with the value 128 such that normal methods for detecting and fitting such eyelid boundaries in unmasked images may continue to function with the Cropped and Masked Iris Image type. Note that none, one or both of the upper or lower eyelids may occlude the iris (see Figure 3). In all these cases, the pixels in the sclera shall be replaced uniformly with the value 200, and if eyelid regions are detected, pixels in those regions and beyond shall be replaced with the value 128.

8. In clause 6.5.2 of ISO/IEC 19794-6:2011, change "The sclera mask shall extend to the first and last columns unless the upper and lower eyelids touch there." with "The sclera mask shall extend to the first and last columns unless the extremes of the upper and lower eyelids meet inside the left or right image boundary."

9. In clause 6.5.3 of ISO/IEC 19794-6:2011, change Figure 3 with the following one:

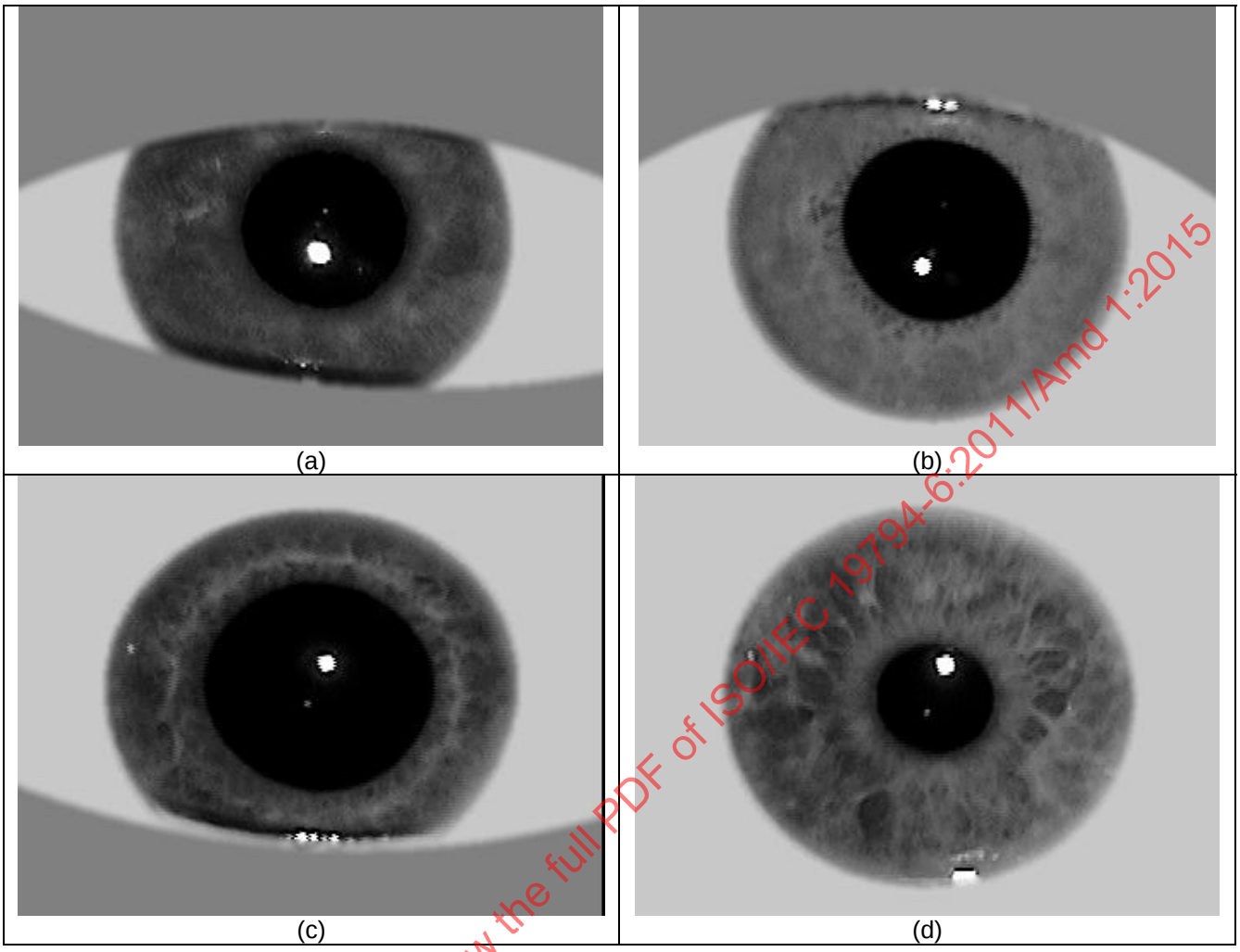

Figure 3 - Examples of Cropped and Masked iris images. (a) Iris occluded by both eyelids. (b) Iris occluded by the upper eyelid and not the lower eyelid. (c) Iris occluded by the lower eyelid and not the upper eyelid. (d) Iris is not occluded by eyelids

10. Replace Annex A of ISO/IEC 19794-6:2011 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 19794-1:2013 AMD 1 and shall only be used in the context of that testing methodology.

A.2 Table of requirements

The normative requirements of ISO/IEC 19794-6:2011 Biometric Data Interchange Formats – Part 6 - iris Image Data are listed in Table A.1 (Table A.1 extends over multiple pages). The supplier of the IUT shall explain which optional components of the standard are supported and the testing laboratory shall note the results of the test.

NOTE TO ISO EDITOR: it is required to repeat the title of all tables in this document wherever the table extends over multiple pages.

Table A.1 — Table of requirements for data formats

Requirement ID	Reference in Data Format	Requirement Summary	Level	Status	Applicable to format type				IUT Support	Supported Range	Test Result
					Type 01	Type 02	Type 03	Type 07			
R-1.	Table3 row 1	The format identifier shall be recorded in four bytes.	1	M	Y	Y	Y	Y			
R-2.	Table3 row 1	The format identifier shall consist of three characters "IIR", standing for iris image record, followed by a zero byte as a NULL string terminator.	1	M	Y	Y	Y	Y			
R-3.	Table3 row 2	The number for the version of that part of ISO/IEC 19794 used for constructing the iris image data record shall be placed in four bytes.	1	M	Y	Y	Y	Y			
R-4.	Table3 row 2	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 version number (‘0’,’2’) and the third character will represent the minor revision number (‘0’).	1	M	Y	Y	Y	Y			
R-5.	Table3 row 3	The length (in bytes) of the entire iris image data record shall be recorded in four bytes.	1	M	Y	Y	Y	Y			
R-6.	Table 3 row 3	The length of record shall be a value between 69 and $(2^{32}-1)$	1	M	Y	Y	Y	Y			
R-7.	Table3 row 3	This count shall be the total length of the data block including the iris record header and one or more representation records.	2	M	Y	Y	Y	Y			
R-8.	Table3 row 4	The total number of iris representations in the record shall be recorded in two bytes.	1	M	Y	Y	Y	Y			
R-9.	Table 3 row 4	The total number of iris representations in the record shall be a number between 1 and 65535	1	M	Y	Y	Y	Y			
R-10.	Table3 row 4	A minimum of one representation is required.	2	M	Y	Y	Y	Y			

R-11.	Table 3 row 4	The number of iris representations shall be equal to the number of representations present in the record	2	M	Y	Y	Y	Y			
R-12.	Table 3 row 5	The certification flag shall be composed of one single byte	1	M	Y	Y	Y	Y			
R-13.	Table 3 row 5	The certification flag shall be a 00_{Hex} value, as no certification blocks are expected	1	M	Y	Y	Y	Y			
R-14.	Table 3 row 5	There shall not be a certification data block within the register.	2	M	Y	Y	Y	Y			
R-15.	Table 3 row 6	The number of eyes represented shall be recorded in one byte	1	M	Y	Y	Y	Y			
R-16.	Table 3 row 6	The number of eyes represented shall be a number between 0 and 2	1	M	Y	Y	Y	Y			
R-17.	Table 3 row 6	The number of eyes represented shall be 1 if the eye label for all representations has the same value, being either 1 or 2	2	M	Y	Y	Y	Y			
R-18.	Table 3 row 6	The number of eyes represented shall be 2 if the eye label for all representations has a value of 1 or 2, and within all representations are one or some of them with the value of 1 and the rest with the value of 2	2	M	Y	Y	Y	Y			
R-19.	Table 3 row 6	The number of eyes represented shall be 0 if the eye label of any of the representations is declared to be undefined (i.e. its value is 0)	2	M	Y	Y	Y	Y			
R-20.	7.1	All data shall be stored in network byte (big-endian) order.	1	M	Y	Y	Y	Y			
R-21.	7.1	Where bit-level data definitions are specified, bit 1 shall be interpreted as the least significant bit	1	C	Y	Y	Y	Y			
R-22.	7.2	The record shall contain images from a single individual	3C	O1	Y	Y	Y	Y			
R-23.	7.2	The iris image biometric data record shall have an iris general header and at least the information about one image.	1	M	Y	Y	Y	Y			
R-24.	7.2	The record shall contain images from one or two eyes.	3C	O1	Y	Y	Y	Y			
R-25.	7.3	The iris image biometric data record shall have an iris record header that contains information about the number of images that follow, the number of eyes represented and the total length, plus other information stated in Table 3.	2	M	Y	Y	Y	Y			

R-100.	7.2	A Representation Header shall precede each representation providing information for that representation. There shall be one header for each representation contained in the BDIR.	1	M	Y	Y	Y	Y			
R-101.	Table 4 row 1	For each image representation, the representation length shall be coded as an integer value in 4 bytes	1	M	Y	Y	Y	Y			
R-102.	Table 4 row 1	Any representation length shall have a value between 53 and $((2^{32}-1)-16)$	1	M	Y	Y	Y	Y			
R-103.	Table 4 row 1	For each image representation, the representation length shall be the number of bytes between the end of the previous representation (or the general header for the first representation in the record), and the beginning of the next representation (or the end of the record for the last representation in the record)	2	M	Y	Y	Y	Y			
R-104.	Table 4 row 2	The capture date field shall be encoded in nine bytes	1	M	Y	Y	Y	Y			
R-105.	Table 4 row 2	The coding of the capture date field shall be in the format defined in ISO/IEC 19794-1	1	M	Y	Y	Y	Y			
R-106.	Table 4 row 2	The Gregorian calendar year of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-107.	Table 4 row 2	The month of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-108.	Table 4 row 2	The day of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-109.	Table 4 row 2	The hour of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-110.	Table 4 row 2	The minute of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-111.	Table 4 row 2	The second of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			
R-112.	Table 4 row 2	The millisecond of the capture date and time field shall be encoded in the form given in ISO/IEC 19794-1.	1	M	Y	Y	Y	Y			

R-113.	Table 4 row 2	The capture date and time field shall indicate when the capture of this representation started in Coordinated Universal Time (UTC).	3C	O1	Y	Y	Y	Y			
R-114.	Table 4 row 3	The capture device technology identifier shall be coded in one single byte	1	M	Y	Y	Y	Y			
R-115.	Table 4 row 3	The capture device technology identifier shall have a value of 0 or 1	1	M	Y	Y	Y	Y			
R-116.	Table 4 row 3	The capture device technology identifier shall have a value of 00_{Hex} when the capture device technology is unknown or unspecified.	3C	O1	Y	Y	Y	Y			
R-117.	Table 4 row 3	The capture device technology ID shall indicate the class of capture device technology used to acquire the captured biometric sample.	3C	O1	Y	Y	Y	Y			
R-118.	Table 4 row 4	The capture device vendor ID shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-119.	Table 4 row 4	The capture device vendor ID shall be registered with the IBIA or other approved registration authority.	2	M	Y	Y	Y	Y			
R-120.	Table 4 row 4	A value of all zeros for capture device vendor ID shall indicate that the capture device vendor is unreported.	1	M	Y	Y	Y	Y			
R-121.	Table 4 row 4	The capture device vendor ID shall identify the biometric organization that owns the product that created the record.	3C	O1	Y	Y	Y	Y			
R-122.	Table 4 row 5	The capture device type ID field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-123.	Table 4 row 5	The capture device type ID shall be registered with the IBIA or other approved registration authority.	1	M	Y	Y	Y	Y			
R-124.	Table 4 row 5	A value of all zeros for capture device type ID shall indicate that the capture device type is unreported.	1	M	Y	Y	Y	Y			
R-125.	Table 4 row 5	The capture device type ID shall identify the product type that created the record	3C	O1	Y	Y	Y	Y			
R-126.	Table 4 row 6	If no quality information is present, the quality block shall be coded in one byte	1	M	Y	Y	Y	Y			

R-127.	Table 4 row 6	If no quality information is present, the length field in the quality block shall be 0	1	M	Y	Y	Y	Y			
R-128.	Table 4 row 6	If there is quality information within the representation, the quality block shall be coded as m bytes where m = (5*N+1) bytes, and N is the number of quality scores reported	1	M	Y	Y	Y	Y			
R-129.	Table 4 row 6	If there are N quality scores reported in the quality information block, then the quality length field shall be equal to N	2	M	Y	Y	Y	Y			
R-130.	Table 4 row 6	The quality block shall consist of a length field followed by zero or more quality sub-blocks.	1	M	Y	Y	Y	Y			
R-131.	Table 4 row 6	In the quality block, the length field shall consist of one byte coded as an unsigned integer	1	M	Y	Y	Y	Y			
R-132.	Table 4 row 6	The length field in the quality block shall represent the number of quality sub-blocks.	2	M	Y	Y	Y	Y			
R-133.	Table 4 row 6	If the number of quality blocks field is 0 then the Representation number field follows immediately after the number of quality blocks field.	2	M	Y	Y	Y	Y			
R-134.	Table 4 row 6	Each quality sub-block shall consist of a quality score, a quality algorithm vendor identifier, and a quality algorithm identifier	1	C	Y	Y	Y	Y			
R-135.	Table 4 row 6	Each “Quality score” shall be encoded in one byte as an unsigned integer.	1	C	Y	Y	Y	Y			
R-136.	Table 4 row 6	The quality score shall be recorded as a number between 0 and 100, if quality has been computed, or a 255 if the quality calculation has failed.	1	C	Y	Y	Y	Y			
R-137.	7.4	The quality algorithm vendor ID shall be encoded in two bytes.	1	C	Y	Y	Y	Y			
R-138.	7.4	A value of all zeros in the quality algorithm vendor ID shall be used if the quality algorithm vendor is unreported.	1	M	Y	Y	Y	Y			
R-139.	7.4	The quality algorithm vendor ID shall be registered by IBIA or other approved registration authority.	2	C	Y	Y	Y	Y			
R-140.	7.4	The quality algorithm ID shall be encoded in two bytes.	1	C	Y	Y	Y	Y			
R-141.	7.4	A value of all zeros in the quality algorithm ID shall be used if the quality algorithm is unreported	1	M	Y	Y	Y	Y			
R-142.	7.4	The quality algorithm ID shall be registered by IBIA or other	3C	O1	Y	Y	Y	Y			

		approved registration authority.									
R-143.	Table 4 row 7	The representation number shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-144.	Table 4 row 7	The representation number shall have a value representing the representation position sequence in the iris image record	2	M	Y	Y	Y	Y			
R-145.	Table 4 row 7	The representation number shall be a number between 1 and the number of iris representations	2	M	Y	Y	Y	Y			
R-146.	Table 4 row 8	The eye label field shall be coded in 1 byte	1	M	Y	Y	Y	Y			
R-147.	Table 4 row 8	If the capture device is unable to determine which eye was presented, then the eye label shall be entered as “undefined” (i.e. 00_{Hex}).	3C	O1	Y	Y	Y	Y			
R-148.	Table 4 row 8	The one-byte eye label refers to the subject’s own eye. Valid values are SUBJECT_EYE_UNDEF = 0 (00_{Hex}) SUBJECT_EYE_RIGHT = 1 (01_{Hex}) SUBJECT_EYE_LEFT = 2 (02_{Hex})	1	M	Y	Y	Y	Y			
R-149.	Table 4 row 9	The image type field shall be coded in 1 byte	1	M	Y	Y	Y	Y			
R-150.	Table 4 row 9	The image type field shall have a value between the following list: 01_{Hex}, 02_{Hex}, 03_{Hex} or 07_{Hex}	1	M	Y	Y	Y	Y			
R-151.	Table 4 row 9 7.4.1	The Image Type field shall indicate the kind of image that follows.	3C	O1	Y	Y	Y	Y			
R-152.	Table 4 row 9 7.4.1 6.2	If the Image Type field is equal to 01_{Hex}, an Uncropped iris image shall be contained in the image data field, i.e. the image shall be a raster scan image of a single eye.	3C	O1	Y	N	N	N			
R-153.	Table 4 row 9	For an uncropped image iris radius of R, there shall be margins of image data at least 0,2R above and below the iris	2	C	Y	Y	Y	Y			

	7.4.1 6.2										
R-154.	Table 4 row 9 7.4.1 6.2	For an uncropped image an iris radius of R, there shall be margins of image data at least 0,6R to the right and left of the iris.	2	C	Y	Y	Y	Y			
R-155.	Table 4 row 9 7.4.1 6.2	For an uncropped image, image data shall either be compressed in accordance with the JPEG2000 protocol specified in ISO/IEC 15444-1 and stored in JP2 file format, or otherwise losslessly compressed in accordance with the PNG protocol specified in ISO/IEC 15948:2003.	2	C	Y	Y	N	N			
R-156.	Table 4 row 9 7.4.1 6.2	For an uncropped image, PNG shall not be used in its interlaced mode and not for images that have been compressed lossily before.	2	C	Y	Y	N	N			
R-157.	Table 4 row 9 7.4.1 6.2	For an uncropped image, PNG shall not be used in its interlaced mode and not for images that have been compressed lossily before.	3C	O1	Y	Y	N	N			
R-158.	Table 4 row 9 7.4.1 6.3	If the Image Type field is equal to 02_{Hex}, a VGA iris image shall be contained in the image data field, i.e. the image shall have a resolution of 640x480 pixels.	2	C	N	Y	N	N			
R-159.	Table 4 row 9 7.4.1 6.4	If the Image Type field is equal to 03_{Hex}, a cropped rectilinear iris image shall be contained in the image data field, i.e. the image shall have the iris centred relative to the geometric centre of the raster representation.	2	C	N	N	Y	Y			
R-160.	Table 4	If the Image Type field is equal to 03_{Hex}, a cropped rectilinear	3C	O1	N	N	Y	Y			

	row 9 7.4.1 6.4	iris image shall be contained in the image data field, i.e. the image shall have the iris centred relative to the geometric centre of the raster representation.									
R-161.	Table 4 row 9 7.4.1 6.4	For cropped rectilinear images, margin pixels shall represent actual sensor readings, not substitute values.	3C	O1	N	N	Y	N			
R-162.	Table 4 row 9 7.4.1 6.4	For cropped rectilinear images, parts of the iris estimated to have been cropped during capture (i.e. absent in the input image) shall be replaced with pixels of value 0.	3C	O1	N	N	Y	N			
R-163.	Table 4 row 9 7.4.1 6.5	If the Image Type field is equal to 07_{Hex}, a cropped and masked iris image shall be contained in the image data field, i.e. a cropped and masked iris image which conforms to the normative requirements of ISO/IEC 19794-6:2011 clause 6.5.	3C	O1	N	N	N	Y			
R-164.	Table 4 row 9 7.4.1 6.5	For cropped and masked iris images, a mask shall consist of a single grey value assigned to a four-connected region of pixels.	3C	O1	N	N	N	Y			
R-165.	Table 4 row 9 7.4.1 6.5.2	For cropped and masked iris images, the pixels in the sclera region shall be substituted with a fixed mask value of 200.	3C	O1	N	N	N	Y			
R-166.	Table 4 row 9 7.4.1 6.5.2	For cropped and masked iris images, the sclera mask shall extend to the first and last columns unless the extremes of the upper and lower eyelids meet inside the left or right image boundary.	3C	O1	N	N	N	Y			

R-167.	Table 4 row 9 7.4.1 6.5.3	For cropped and masked iris images, the pixels in the upper and lower eyelid regions, if detected, shall be substituted with a fixed mask value of 128.	3C	O1	N	N	N	Y			
R-168.	Table 4 row 9 7.4.1 6.5.3	For cropped and masked iris images, the upper eyelid mask where present shall extend to the first (top) row of the image.	3C	O1	N	N	N	Y			
R-169.	Table 4 row 9 7.4.1 6.5.3	For cropped and masked iris images, the upper eyelid mask where present shall extend to the leftmost and rightmost columns of the image.	3C	O1	N	N	N	Y			
R-170.	Table 4 row 9 7.4.1 6.5.3	For cropped and masked iris images, the lower eyelid mask where present shall extend to the last (bottom) row of the image. The lower eyelid mask shall extend to the leftmost and rightmost columns of the image.	3C	O1	N	N	N	Y			
R-171.	Table 4 row 9 7.4.1 6.5.4	For cropped and masked iris images, the transitions from iris and sclera regions to the eyelid mask regions where present, and from the iris to the sclera mask regions where present, shall be locally smoothed to minimize the boundary's impact on the compression coding budget.	3C	O1	N	N	N	Y			
R-172.	Table 4 row 9 7.4.1 6.5.4	For cropped and masked iris images, the recommended the slope of the blurred transition to or from masked regions, or between masked regions, shall not be larger than 15 grey values per pixel. (For example, the transition between the sclera mask value of 200 and the eyelid mask value of 128 may occur over an interval of 5 pixels.)	3C	O1	N	N	N	Y			
R-173.	Table 4 row 10	The Image Format field shall be coded in 1 byte	1	M	Y	Y	Y	Y			
R-174.	Table 4	The only valid values for the Image Format field are:	1	M	Y	Y	Y	Y			

	row 10	IMAGEFORMAT_MONO_RAW = 2 (0002_{Hex}) IMAGEFORMAT_MONO_JPEG2000 = 10 ($000A_{Hex}$) IMAGEFORMAT_MONO_PNG = 14 ($000E_{Hex}$)									
R-175.	Table 4 row 11	The Iris image properties bit field shall be coded in one byte	1	M	Y	Y	Y	Y			
R-176.	Table 4 row 11	Bits 1-2, i.e. least significant bits, of the Iris image properties bit field shall be coded in the following way: ORIENTATION_UNDEF = 0 HORZ_ORIENTATION_BASE = 1 HORZ_ORIENTATION_FLIPPED = 2	1	M	Y	Y	Y	Y			
R-177.	Table 4 row 11	The image coded in the image data field, shall have the horizontal orientation specified in bits 1-2 of the Iris image properties field	3C	O1	Y	Y	Y	Y			
R-178.	Table 4 row 11	Bits 3-4 of the Iris image properties bit field shall be coded in the following way: ORIENTATION_UNDEF = 0 VERT_ORIENTATION_BASE = 1 VERT_ORIENTATION_FLIPPED = 2	1	M	Y	Y	Y	Y			
R-179.	Table 4 row 11	The image coded in the image data field, shall have the vertical orientation specified in bits 3-4 of the Iris image properties field	3C	O1	Y	Y	Y	Y			
R-180.	Table 4 row 11	Bits 5-6 of the Iris image properties bit field shall be 0	1	M	Y	Y	Y	Y			
R-181.	Table 4 row 11	Bits 7-8 of the Iris image properties bit field shall be coded in the following way: PREVIOUS_COMPRESSION_UNDEF = 0 PREVIOUS_COMPRESSION_LOSSLESS_OR_NONE = 1 PREVIOUS_COMPRESSION_LOSSY = 2	1	M	Y	Y	Y	Y			
R-182.	Table 4 row 11	The image coded in the image data field, shall have be coded with the compression technique declared in bits 7-8 of the Iris image properties field	3C	O1	Y	Y	Y	Y			
R-183.	Table 4 row 12	The Image width field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-184.	Table 4 row 12	The Image width field shall contain the width in pixels.	1	M	Y	Y	Y	Y			

R-185.	Table 4 row 12	The image width shall always be a positive non-zero value.	1	M	Y	Y	Y	Y			
R-186.	Table 4 row 12	The image data contained in the representation shall present the same width in pixels as the Image width field states	2	M	Y	Y	Y	Y			
R-187.	Table 4 row 13	The Image height field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-188.	Table 4 row 13	The Image height field shall contain the height in pixels.	1	M	Y	Y	Y	Y			
R-189.	Table 4 row 13	The image height shall always be a positive non-zero value.	1	M	Y	Y	Y	Y			
R-190.	Table 4 row 13	The image data contained in the representation shall present the same height in pixels as the Image height field states	2	M	Y	Y	Y	Y			
R-191.	Table 4 row 14	The Bit depth field shall be encoded in 1 byte	1	M	Y	Y	Y	Y			
R-192.	Table 4 row 14	The bit depth field contains the bit depth in bits per pixel.	1	M	Y	Y	Y	Y			
R-193.	Table 4 row 14	The bit depth field shall always be an integer greater or equal to 8	1	M	Y	Y	Y	Y			
R-194.	Table 4 row 14	The image coded in the image data field shall represent an image with a bit depth corresponding to the one coded in this field	3C	O1	Y	Y	Y	Y			
R-195.	Table 4 row 15	The Range field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-196.	Table 4 row 15	The Range field shall specify an estimate of the distance between the optical centre of the camera lens and the subject iris, measured in mm.	3C	O1	Y	Y	Y	Y			
R-197.	Table 4 row 15	Valid values for the Range field are: 0 – for an unassigned value 1 – for a failed measurement 2 … $2^{16} – 2$ $2^{16} – 1$ for a range overflow	1	M	Y	Y	Y	Y			

R-198.	Table 4 row 16	The Roll angle of eye field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-199.	Table 4 row 16	The roll angle of eye field is obtained as (unsigned short) round (65 535* angle/360) modulo 65 535, where angle is measured counter-clockwise in degrees.	3C	O1	Y	Y	Y	Y			
R-200.	Table 4 row 16	The Roll angle of eye field shall be coded as $FFFF_{Hex}$ if the value is undefined	1	M	Y	Y	Y	Y			
R-201.	Table 4 row 16 7.4.2.1	If the relative roll angle between head and camera is measured and recorded in field 16, it shall be measured in degrees between the horizontal axis of the camera system and the line between the centres of the two eyes, with a positive value signifying counter-clockwise rotation, as seen from the camera, of the line between the eyes.	3C	O1	Y	Y	Y	Y			
R-202.	Table 4 row 17	The Roll angle uncertainty field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-203.	Table 4 row 17 7.4.2.2	The roll angle uncertainty shall be measured as a nonzero value in degrees.	1	M	Y	Y	Y	Y			
R-204.	Table 4 row 17 7.4.2.2	If roll angle information is not available then the roll angle uncertainty value 17 shall be set to $FFFF_{Hex}$.	3C	O1	Y	Y	Y	Y			
R-205.	Table 4 row 18	The Iris centre, smallest X field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-206.	Table 4 row 18	Smallest expected iris centre X coordinate is stated in pixels. If undefined, it shall be set to 0.	1	M	Y	Y	Y	Y			
R-207.	Table 4 row 18	Smallest expected iris centre X coordinate in pixels shall be lower than the image width	2	M	Y	Y	Y	Y			
R-208.	Table 4 row 19	The Iris centre, largest X field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-209.	Table 4 row 19	Largest expected iris centre X coordinate is stated in pixels. If undefined, it shall be set to 0.	1	M	Y	Y	Y	Y			

R-210.	Table 4 row 19	Largest expected iris centre X coordinate in pixels shall be lower than the image width	2	M	Y	Y	Y	Y			
R-211.	Table 4 row 20	The Iris centre, smallest Y field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-212.	Table 4 row 20	Smallest expected iris centre Y coordinate is stated in pixels. If undefined, it shall be set to 0.	1	M	Y	Y	Y	Y			
R-213.	Table 4 row 20	Smallest expected iris centre Y coordinate in pixels shall be lower than the image height	2	M	Y	Y	Y	Y			
R-214.	Table 4 row 21	The Iris centre, largest Y field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-215.	Table 4 row 21	Largest expected iris centre y coordinate is stated in pixels. If undefined, it shall be set to 0.	1	M	Y	Y	Y	Y			
R-216.	Table 4 row 21	Largest expected iris centre Y coordinate in pixels shall be lower than the image height	2	M	Y	Y	Y	Y			
R-217.	Table 4 row 22	The Iris diameter, smallest field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-218.	Table 4 row 22	Smallest expected iris diameter is stated in pixels. If undefined, it shall be set to 0.	1	M	Y	Y	Y	Y			
R-219.	Table 4 row 22	Smallest expected iris diameter in pixels shall be lower or equal to the minimum from the iris width and the iris height	2	M	Y	Y	Y	Y			
R-220.	Table 4 row 23	The Iris diameter, largest field shall be coded in 2 bytes	1	M	Y	Y	Y	Y			
R-221.	Table 4 row 23	Largest expected iris diameter is stated in pixels. If undefined, it shall be set to 0	1	M	Y	Y	Y	Y			
R-222.	Table 4 row 23	Largest expected iris diameter in pixels shall be lower or equal to the minimum from the iris width and the iris height	2	M	Y	Y	Y	Y			
R-223.	Table 4 row 24	The iris representation header shall be concluded by the length of the image data, which follow the header.	1	M	Y	Y	Y	Y			
R-224.	Table 4	The Image length field shall be encoded in 4 bytes.	1	M	Y	Y	Y	Y			

	row 24										
R-225.	Table 4 row 24	The Image length shall always be a positive non-zero value	1	M	Y	Y	Y	Y			
R-226.	Table 4 row 24	The image data field shall have the same number of bytes as the Image length field states	2	M	Y	Y	Y	Y			
R-227.	7.2	Each iris image is preceded by an iris image header that contains an image sequence number plus information about the Image Type, size, origin, quality and rotation for that image, as stated in Table 4.	3C	O1	Y	Y	Y	Y			
R-228.	7.2	Each image shall be padded with extra bits, if necessary, to end on an integral byte boundary.	1	M	Y	Y	Y	Y			

Status Notes:

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

O1 - 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.

A.3 Table of test assertions

A.3.1 Level 1 and Level 2 conformance assertions for common requirements

The specific test assertions required for conformance testing of this international standard are listed in Table A.2. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record.

Table A.2 only refers to those test assertions that are common to all data formats. In subsequent clauses, specific test assertions will be addressed for each of the data formats. Table A.2 extends over multiple pages.

NOTE TO ISO EDITOR: it is required to repeat the title of all tables in this document wherever the table extends over multiple pages.

Table A.2 — Level 1 and Level 2 Conformance Binary Encoded Test Assertions for Common Requirements

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
General header										
T-1	T. 3 row 1, 7.1	R-1, R-2, R-20	1	Format Identifier	EQ	49495200_{Hex}				
T-2	T. 3 row 1, 7.1	R-1, R-2, R-20	1	Format Identifier	NEQ	00524949_{Hex}	1			
T-3	T. 3 row 2, 7.1	R-3, R-4, R-20	1	Version number	EQ	30323000_{Hex}				
T-4	T. 3 row 2, 7.1	R-3, R-4, R-20	1	Version number	NEQ	00303230_{Hex}	1			
T-5	T. 3 row 3	R-5, R-6	1	Length of Record	EQ	69 to $(2^{32} - 1)$	2			
T-6	T. 3 row 3	R-5, R-6	2	Length of Record	EQ	Total Bytes Read	2			
T-7	T. 3 row 3	R-5, R-6	2	Length of Record	EQ	Total Bytes Expected	2			
T-8	T. 3 row 4	R-8 to R-11	1	Number of Iris Representations	EQ	1 to 65535				
T-9	T. 3 row 4	R-8 to R-11	2	Number of Iris Representations	EQ	Number of Images Read	3			
T-10	T. 3 row 5	R-12 to R-14	1	Certification flag	EQ	0				
T-11	T. 3 row 6	R-15, R-16	1	Number of eyes represented	EQ	0 to 2				
T-12	T. 3 row 6	R-17, R-19	2	Number of eyes represented	EQ	NUMBER_EYES_REPRESENTED	4			
T-13	7.1, 7.2 and 7.3	R-24, R-25, R-100	1	Structure of the biometric data record			5			
Representation header										
T-100	T. 4 row 1	R-101, R-102	1	Representation Length	EQ	53 to $((2^{32} – 1) – 16)$				
T-101	T. 4 row 1	R-103	2	Representation Length	EQ	Total Bytes Expected	6			
T-102	T. 4 row 2	R-104, R-105, R-106	1	Gregorian calendar year of the capture date	EQ	0001_{Hex} to $FFFF_{Hex}$	7			
T-103	T. 4 row 2	R-104, R-105, R-107	1	Month of the capture date	EQ	01_{Hex} to $0C_{Hex}$ or FF_{Hex}	7			
T-104	T. 4 row 2	R-104, R-105, R-108	1	Day of the capture date	EQ	01_{Hex} to $1F_{Hex}$ or FF_{Hex}	7			
T-105	T. 4 row 2	R-104, R-105, R-109	1	Hour of the capture time	EQ	00_{Hex} to 17_{Hex} or FF_{Hex}	7			
T-106	T. 4 row 2	R-104, R-105, R-110	1	Minute of the capture time	EQ	00_{Hex} to $3B_{Hex}$ or FF_{Hex}	7			
T-107	T. 4 row 2	R-104, R-105, R-111	1	Second of the capture time	EQ	00_{Hex} to $3B_{Hex}$ or FF_{Hex}	7			
T-108	T. 4 row 2	R-104, R-105, R-112	1	Millisecond of the capture time	EQ	0000_{Hex} to $03E7_{Hex}$ or $FFFF_{Hex}$	7			
T-109	T. 4 row 3	R-114, R-115	1	Capture device technology identifier	EQ	0 to 1				
T-110	T. 4 row 4	R-118 to R-120	1	Capture device vendor ID	EQ	0000_{Hex} to $FFFF_{Hex}$, being the value either 0 for unreported, or a value previously approved by a registration authority (e.g. IBIA)				

T-111	T. 4 row 5	R-122 to R-124	1	Capture device type ID	EQ	0000_{Hex} to $FFFF_{Hex}$, being the value either 0 for unreported, or a value previously approved by a registration authority (e.g. IBIA)				
T-112	T. 4 row 6	R-125 to R-133	1, 2	Number of quality subblocks	EQ	00_{Hex} to FF_{Hex}	7			
T-113	T. 4 row 6	R-134 to R-136	1	Quality score	EQ	00_{Hex} to 64_{Hex} or FF_{Hex} if present	7			
T-114	T. 4 row 6	R-134, R-137 to R-138	1	Quality algorithm vendor ID	EQ	0000_{Hex} to $FFFF_{Hex}$ if present	7			
T-115	T. 4 row 6	R-134, R-140 to R-141		Quality algorithm ID	EQ	0000_{Hex} to $FFFF_{Hex}$ if present	7			
T-116	T. 4 row 7	R-143	1	Representation number	EQ	1 to 65535				
T-117	T.4 row 7	R-144	2	Representation number	EQ	1 if it is the first representation in the record {Representation number from the previous representation} +1 in any other case				
T-118	T. 4 row 7	R-145	2	Representation number	LTE	Number of Representations				
T-119	T. 4 row 8	R-146, R-148	1	Eye label	EQ	0 to 2				
T-120	T. 4 row 9	R-149, R-150	1	Image Type	EQ	1, 2, 3 or 7				
T-121	T. 4 row 10	R-173, R-174	1	Image format	EQ	2, 10 or 14				
T-122	T.4 row 10	R-173, R-174	2	Image Format	C		8			
T-123	T. 4 row 11	R-21, R-175, R-176	1	Iris image properties bit field Bits 1-2 (i.e. least significant bits) (Horizontal orientation)	EQ	0 to 2				
T-124	T. 4 row 11	R-21, R-175, R-178	1	Iris image properties bit field Bits 3-4 (Vertical orientation)	EQ	0 to 2				
T-125	T. 4 row 11	R-21, R-175, R-180	1	Iris image properties bit field Bits 5-6	EQ	0				
T-126	T. 4 row 11	R-21, R-175, R-181	1	Iris image properties bit field Bits 7-8 (Compression history)	EQ	0 to 2				
T-127	T. 4 row 12	R-183 to R-185	1	Image width	EQ	1 to 65535				
T-128	T. 4 Row 12	R-186	2	Image width	EQ	Value in the coded image	9			
T-129	T. 4 row 13	R-187 to R-189	1	Image height	EQ	1 to 65535				
T-130	T. 4 Row 13	R-190	2	Image height	EQ	Value in the coded image	9			
T-131	T. 4 row 14	R-191 to R-193	1	Bit-depth	EQ	8 to 16				
T-132	T. 4 row 15	R-195, R-197	1	Range	EQ	0 to 65535				
T-133	T. 4 row 16	R-198, R-200	1	Roll angle of eye	EQ	0 to 65535				
T-134	T. 4 row 17	R-202, R-203	1	Roll angle uncertainty	EQ	0 to 65535				

T-135	T. 4 row 18	R-205, R-206	1	Iris centre, lowest X	EQ	0 to 65535				
T-136	T. 4 row 18	R-207	2	Iris centre, lowest X	LESS THAN	Image width				
T-137	T. 4 row 19	R-208, R-209	1	Iris centre, highest X	EQ	0 to 65535				
T-138	T. 4 row 19	R-210	2	Iris centre, highest X	LESS THAN	Image width				
T-139	T. 4 row 20	R-211, R-212	1	Iris centre, lowest Y	EQ	0 to 65535				
T-140	T. 4 row 20	R-213	2	Iris centre, lowest Y	LESS THAN	Image height				
T-141	T. 4 row 21	R-214, R-215	1	Iris centre, highest Y	EQ	0 to 65535				
T-142	T. 4 row 21	R-216	2	Iris centre, highest Y	LESS THAN	Image height				
T-143	T. 4 row 22	R-217, R-218	1	Iris diameter, lowest	EQ	0 to 65535				
T-144	T. 4 row 22	R-219	2	Iris diameter, lowest	LESS or EQ THAN	Minimum({Image width},{Image height})				
T-145	T. 4 row 23	R-220, R-221	1	Iris diameter, highest	EQ	0 to 65535				
T-146	T. 4 row 23	R-222	2	Iris diameter, highest	LESS or EQ THAN	Minimum({Image width},{Image height})				
T-147	T. 4 row 24	R-223 to R-225	1	Image Length	EQ	1 to $((2^{32} - 1) - 69)$				
T-148	T. 4 row 24	R-226	2	Image Length	EQ	Total Data Bytes Read				

A.3.2 Level 1 and Level 2 specific conformance assertions for Type 01 data format

The specific test assertions required for conformance testing of this international standard are listed in Table A.3. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record.

Table A.3 only refers to those test assertions that are specific to Type 01 data format. In addition to these test assertions, the common ones (i.e. clause A.3.1) are applicable.

Table A.3 — Level 1 and Level 2 Specific Conformance Binary Encoded Test Assertions for Type 01 data format

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
T-200	7.4.1 6.2	R-153	2	Image Data, Iris centres, Iris height, Iris diameters	C		10			
T-201	7.4.1 6.2	R-154	2	Image Data, Iris centres, Iris width, Iris diameters	C		11			
T-202	7.4.1 6.2	R-155	2	Image Format and Iris image properties bit field	C		12			
T-203	7.4.1 6.2	R-157	2	Image Format and Image data	C		12			

A.3.3 Level 1 and Level 2 specific conformance assertions for Type 02 data format

The specific test assertions required for conformance testing of this international standard are listed in Table A.4. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record.

Table A.4 only refers to those test assertions that are specific to Type 02 data format. In addition to these test assertions, the common ones (i.e. clause A.3.1) are applicable.

Table A.4 —Level 1 and Level 2 Conformance Binary Encoded Test Assertions for Type 02 data format

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
T-300	7.4.1 6.3	R-153	2	Image Data, Iris centres, Iris height, Iris diameters	C		10			
T-301	7.4.1 6.3	R-154	2	Image Data, Iris centres, Iris width, Iris diameters	C		11			
T-302	7.4.1 6.3	R-155	2	Image Format and Iris image properties bit field	C		12			
T-303	7.4.1 6.3	R-157	2	Image Format and Image data	C		12			
T-304	7.4.1 6.3	R-158	2	Image width	EQ	640				
T-305	7.4.1 6.3	R-158	2	Image height	EQ	480				

A.3.4 Level 1 and Level 2 specific conformance assertions for Type 03 data format

The specific test assertions required for conformance testing of this international standard are listed in Table A.5. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record.

Table A.5 only refers to those test assertions that are specific to Type 03 data format. In addition to these test assertions, the common ones (i.e. clause A.3.1) are applicable.

Table A.5 —Level 1 and Level 2 Conformance Binary Encoded Test Assertions for Type 03 data format

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test Result
T-400	7.4.1 6.4	R-159	2	Iris centre	C		13			
T-401	7.4.1 6.4	R-153	2	Image Data, Iris centres, Iris height, Iris diameters	C		10			
T-402	7.4.1 6.4	R-154	2	Image Data, Iris centres, Iris width, Iris diameters	C		11			
T-403	7.4.1 6.4	R-155	2	Image Format and Iris image properties bit field	C		12			
T-404	7.4.1 6.4	R-157	2	Image Format and Image data	C		12			

A.3.5 Level 1 and Level 2 specific conformance assertions for Type 07 data format

The specific test assertions required for conformance testing of this international standard are listed in Table A.6. The conformance test assertions are listed in the order in that the corresponding fields are required to appear, if present, in a conforming record.

Table A.6 only refers to those test assertions that are specific to Type 07 data format. In addition to these test assertions, the common ones (i.e. clause A.3.1) are applicable.

Table A.6 —Level 1 and Level 2 Conformance Binary Encoded Test Assertions for Type 07 data format

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
T-500	7.4.1 6.5	R-159	2	Iris centre	C		13			
T-501	7.4.1 6.5	R-153	2	Image Data, Iris centres, Iris height, Iris diameters	C		10			
T-502	7.4.1 6.5	R-154	2	Image Data, Iris centres, Iris width, Iris diameters	C		11			
T-503	7.4.1 6.5	R-155	2	Image Format and Iris image properties bit field	C		12			
T-504	7.4.1 6.5	R-157	2	Image Format and Image data	C		12			

A.3.6 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

Tests T-2 and T-4 check to see if these multi-byte quantities have been encoded as the Little-endian equivalent of the correct Big-endian value. These tests fail if that is true but pass in all other cases. By reviewing the combination of the results of these tests, it should be simple to determine whether or not the implementation under test is using the correct Big-endian encoding.

2) {record length}

The minimum length of the record is given by an image of a single byte. As the general header is 16 bytes long and the minimum representation header (no quality blocks) is 52 bytes long, by adding the minimum 1 byte image, it makes a total of 69 bytes.

If the record is stored in a single file, the total of bytes read will be the total of bytes from the beginning of the record till the End-of-File marker is found.

The following calculation will be evaluated once the {Image Data Block Length} field for the last iris 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. Note that the calculation shown below shows a counter being incremented over each representation of irises. In an actual data record, the representations for a given iris do not have to be contiguous, but SUMBYTES must be incremented across the total count of all representations for all eyes.

```
SUMBYTES = 16                                   # i.e. length of General Header
For M = 1 to {Number of iris representations}
   SUMBYTES = SUMBYTES + 52                     # i.e. length of minimum representation header
   SUMBYTES = SUMBYTES + (5 * {Number of Quality Blocks for representation M} + {Image data length
   for representation M}
END
{Total Bytes Expected} = SUMBYTES
```

3) {Number of iris representations}

The following calculation checks if there are as many iris data as the {number of representations} field specifies. The four-byte {representation length} contains the length in bytes of the iris representation.

```
NUMBER_IMAGES_READ = 0;
WHILE (NUMBER_IMAGES_READ <= {number of representations})
   M = {representation length}
   skip M bytes
   IF (End-Of-File)
        RETURN(ERROR)
   END IF
   NUMBER_IMAGES_READ++
END
```

4) {Number of eyes represented}