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

**Part 6:
Iris image data**

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

Partie 6: Données d'image d'iris



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Foreword

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

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

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ISO/IEC 29109-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 37, *Biometrics*.

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

- *Part 1: Generalized conformance testing methodology*
- *Part 2: Finger minutiae data*
- *Part 4: Finger image data*
- *Part 5: Face image data*
- *Part 6: Iris image data*
- *Part 7: Signature/sign time series data*
- *Part 8: Finger pattern skeletal data*
- *Part 9: Vascular image data*
- *Part 10: Hand geometry silhouette data*

Finger pattern spectral data, signature/sign processed dynamic data, voice data, and DNA data will form the subjects of future parts.

Introduction

ISO/IEC 19794-6:2005 specifies a data record interchange format for recording, storing, and transmitting one or more iris images within a Common Biometric Exchange Formats Framework (CBEFF) data structure. Each image is accompanied by image-specific metadata contained in a header record. This part of ISO/IEC 29109 establishes tests for checking the correctness of the binary record.

The objective of ISO/IEC 19794-6:2005 cannot be completely achieved until biometric products can be tested to determine whether they conform to those specifications. Conforming implementations are a necessary prerequisite for achieving interoperability among implementations; therefore there is a need for a standardized conformance testing methodology, test assertions, and test procedures as applicable to specific modalities addressed by each part of ISO/IEC 19794. The test assertions will cover as much as practical of the ISO/IEC 19794-6:2005 requirements (covering the most critical features), so that the conformity results produced by the test suites will reflect the real degree of conformity of the implementations to ISO/IEC 19794-6:2005 data interchange format records. This is the motivation for the development of this conformance testing methodology.

This part of ISO/IEC 29109 supports those applications that require use of iris image data according to ISO/IEC 19794-6:2005. It defines a testing methodology to assure conformance of a vendor's application or service to the base ISO/IEC 19794-6:2005 specification. Thus, this part of ISO/IEC 29109 is intended to:

- establish elements of the conformance testing methodology framework that are specific to the iris image-based data record requirements of ISO/IEC 19794-6:2005 conformance testing,
- define requirements and guidelines for specifying conformance test suites and related test methods for measuring conformity of products and services to the iris image data record requirements of ISO/IEC 19794-6:2005, and
- define testing and reporting procedures to be followed before, during, and after conformance testing.

This part of ISO/IEC 29109 is applicable to the development and use of conformity test method specifications, conformity test suites for ISO/IEC 19794-6:2005 records, and conformance testing programs for ISO/IEC 19794-6:2005 conformant products. It is intended primarily for use by testing organizations, but may be applied by developers and users of test method specifications and test method implementations.

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

Part 6: Iris image data

1 Scope

This part of ISO/IEC 29109 specifies elements of conformance testing methodology, test assertions, and test procedures as applicable to ISO/IEC 19794-6:2005.

This part of ISO/IEC 29109 establishes

- test assertions of the structure of the iris image data format as specified in ISO/IEC 19794-6:2005 (Type A Level 1 as defined in ISO/IEC 29109-1:2009),
- 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 29109-1:2009).

This part of ISO/IEC 29109 does not establish tests of

- conformance of CBEFF structures required by ISO/IEC 19794-6:2005,
- semantic assertions (Type A Level 3 as defined in ISO/IEC 29109-1:2009),
- other characteristics of biometric products or other types of testing of biometric products (e.g. acceptance, performance, robustness, security),
- tests of conformance of systems that do not produce ISO/IEC 19794-6:2005 records.

2 Conformance

Biometric data interchange format Conformance Test Suites (CTS) conform to this part of ISO/IEC 29109 if they satisfy all of the normative requirements related to Clause 6 for one of the subformats defined in the base standard. Specifically, they shall use the test methodology specified in Clauses 6, 7 and 8 of ISO/IEC 29109-1:2009, and all Level 1 and Level 2 tests shall use the assertions defined in Table 2 or Table 3 of Clause 6 in this part of ISO/IEC 29109.

Implementations of ISO/IEC 19794-6:2005 tested according to the methodology specified shall be able to claim conformance only to those Biometric Data Record (BDR) requirements specified in ISO/IEC 19794-6:2005 that are tested by the test methods established by this methodology.

Implementations of ISO/IEC 19794-2:2005 do not necessarily need to conform to all possible aspects of ISO/IEC 19794-6:2005, but only to those ISO/IEC 19794-6:2005 requirements that are claimed to be supported by the implementation in an Implementation Conformance Statement, filled out in accordance with Clause 8 of ISO/IEC 29109-1:2009 and Table 1 of Clause 6 in this part of ISO/IEC 29109.

NOTE See that Level 3 and higher are not tested.

3 Normative references

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

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

ISO/IEC 19794-6:2005, *Information technology — Biometric data interchange formats — Part 6: Iris image data*

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

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29109-1:2009 apply.

5 Symbols and abbreviated terms

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

6 Conformance testing methodology

6.1 General

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

6.2 Table of requirements in the base standard

The normative requirements of ISO/IEC 19794-6:2005 are listed in Table 1. The supplier of the IUT can explain which optional components of the standard are supported and the testing laboratory can note the results of the test.

**Table 1 — Requirements of the Base Standard, ISO/IEC 19794-6:2005.
Rectilinear (R) and polar (P) subformats.**

Requirement ID	Ref. in base Std.	Requirement summary	Level	Status	Subformat Applicability		IUT Support	Supported range	Test result
					R	P			
R-01	6.5.1	The Iris Record shall begin with the three ASCII characters "IIR" followed by a zero byte as a NULL string terminator	1	M	Y	Y			
R-02	6.5.1	Test that Format Identifier is a big-endian encoded value	1	M	Y	Y			
R-03	6.5.1	The version number shall consist of three ASCII numerals followed by a zero byte as a NULL string terminator. The first and second character will represent the major revision number and the third character will represent the minor revision number. The version number of this specification shall be 0x30313000; "010" – Version 1 revision 0.	1	M	Y	Y			
R-04	6.5.1	Test that version number is a big-endian encoded value	1	M	Y	Y			
R-05	6.5.1	The length in bytes for the entire record shall be recorded here.	1	M	Y	Y			
R-06	6.5.1	This count shall match the number of total bytes read.	2	M	Y	Y			
R-07	6.5.1	This count shall match the sum of the lengths of the record's biometric subtypes and images.	2	M	Y	Y			
R-08	6.5.1	The capture device type ID shall be recorded in twelve bits.	1	M	Y	Y			
R-09	6.5.2	The total number of iris views shall be recorded in bytes 2-3.	1	M	Y	Y			
R-10	6.5.2	The total number of iris views shall match the number of views contained in the record.	2	M	Y	Y			
R-11	6.5.1	The record header length in bytes shall be 45.	1	M	Y	Y			
R-12	6.5.1	The image property bit-field shall contain a valid value.	1	M	Y	Y			
R-13	6.3.2.5, 6.5.1	These two bits shall encode whether the images in the record are horizontally flipped.	1	M	Y	Y			
R-14	6.3.2.5, 6.5.1	These two bits shall encode whether the images in the record are vertically flipped.	1	M	Y	Y			
R-15	6.3.2.5, 6.5.1	These two bits shall encode the scan type for the images in this record.	1	M	Y	N			
R-16	6.3.2.4, 6.5.1	This bit shall encode whether iris occlusions are embedded in the polar images of this record.	1	M	N	Y			
R-17	6.3.2.4, 6.5.1	This bit shall indicate whether occlusions are marked using the lowest or the highest possible gray value.	1	M	N	Y			
R-18	6.3.2.2, 6.3.2.3, 6.5.1	This bit shall encode whether the inner and outer iris boundaries were extracted and used to create the polar images in this record (segmented polar image).	1	M	N	Y			
R-19	6.5.1	This field shall contain the expected iris diameter if specified.	1	M	Y	N			
R-20	6.5.1	This field shall encode the image format and compression.	1	M	Y	Y			
R-21	6.2.2, 6.2.3, 6.2.4	Start markers shall be present at the beginning of each data blob of the record unless the image format is raw.	2	M	Y	Y			
R-22	6.5.1	This field shall specify the width of the images in this record if the image format is raw.	1	M	Y	Y			
R-23	6.5.1	This field shall specify the height of the images in this record if the image format is raw.	1	M	Y	Y			
R-24	6.5.1	This field shall specify the pixel depth in bits per colour channel.	1	M	Y	Y			
R-25	6.5.1, 6.3.2.7	This field shall indicate whether the standard polar transformation described in the base standard was used to create the polar images in this record.	1	M	N	Y			
R-26	6.5.1	This field shall contain the Device Unique Identifier.	1	M	Y	Y			
R-27	6.5.2	This field shall encode the biometric subtype (left, right or undefined)	1	M	Y	Y			
R-28	6.5.2	This field shall state the number of images for the biometric subtype.	1	M	Y	Y			

Table 1 (continued)

Requirement ID	Ref. in base Std.	Requirement summary	Level	Status	Subformat Applicability		IUT Support	Supported range	Test result
					R	P			
R-29	6.5.2	The actual number of images found for this biometric subtype shall match the number in the biometric subtype header.	2	M	Y	Y			
R-30	6.5.3	This field shall contain the counter of the current image within the biometric subtype.	1	M	Y	Y			
R-31	6.5.3	It shall be in the range of valid counter values.	2	M	Y	Y			
R-32	6.5.3	This field shall contain the quality value of the iris image; it shall be in the range between 0 and 100.	1	M	Y	Y			
R-33	6.3.1.2, 6.5.3	This field shall encode the rotation angle of the iris in the rectilinear image if known.	1	M	Y	N			
R-34	6.5.3	This field shall contain the UNDEF value for the rotation angle. Polar images shall be rotationally corrected if the rotational angle was known.	1	M	N	Y			
R-35	6.3.1.3 6.5.3	This field shall contain the rotational uncertainty value if the rotational angle is specified.	1	M	Y	Y			
R-36	6.5.3	This field shall specify the length in bytes of the image data blob.	1	M	Y	Y			
R-37	6.5.3	It shall match the number of bytes read from this blob.	2	M	Y	Y			

6.3 Table of test assertions

The specific test assertions required for conformance testing of ISO/IEC 19794-6:2005 are listed in Table 2 (rectilinear subformat) and Table 3 (polar subformat).

Table 2 — ISO/IEC 19794-6:2005 Level 1 and Level 2 Conformance Test Assertions for Rectilinear Subformat

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
Record header										
1	T. 2, 6.5.1	R-01	1	Format Identifier	EQ	0x49495200				
1.1	T. 2, 6.5.1	R-02	1	Format Identifier	NEQ	0x00524949	1			
2	T. 2, 6.5.1	R-03	1	Version	NONE		2			
2.1	T. 2, 6.5.1	R-04	1	Version	NONE		1, 2			
3	T. 2, 6.5.1	R-05	1	Record Length	EQ	70 to (2 ³² - 1)	3			
3.1	T. 2, 6.5.1	R-06	2	Record Length	EQ	Total Bytes Read				
3.2	T. 2, 6.5.1	R-07	2	Record Length	EQ	Total Bytes Expected	4			
4	T. 2, 6.5.1	R-08		Capture Device ID	NONE					
5	T. 2, 6.5.1	R-09	1	No. of Iris Biometric Subtypes	EQ	1 to 2				
5.1	T. 2, 6.5.1	R-10	2	No. of Iris Biometric Subtypes	EQ	Total No. of Iris Biometric Subtypes Read	5			
6	T. 2, 6.5.1	R-11	1	Record Header Length	EQ	45				
7	T. 2, 6.5.1	R-12	1	Image Properties	EQ	0 to 458	6			
7.1	T. 2, 6.3.2.5, 6.5.1	R-13	1	Bits 1-2 Horizontal Orientation	EQ	0 to 2				
7.2	T. 2, 6.3.2.5, 6.5.1	R-14	1	Bits 3-4 Vertical Orientation	EQ	0 to 2				
7.3	T. 2, 6.3.2.5	R-15	1	Bits 5-6 Scan Type	EQ	0 to 3				
8	T. 2, 6.5.1	R-19	1	Iris Diameter	NONE					
9	T. 2, 6.5.1	R-20	1	Image Format	EQ	2, 4, 6, 8, 10, 12, 14, 16	7			
9.1	T. 2, 6.2.2, 6.2.3, 6.2.4	R-21	2	Image Markers	EQ	Operands are described in the note	8			
10	T. 2, 6.5.1	R-22	1	Raw Image Width	NONE					
11	T. 2, 6.5.1	R-23	1	Raw Image Height	NONE					
12	T. 2, 6.5.1	R-24	1	Intensity Depth	NONE					
13	T. 2, 6.5.1	R-26		Device Unique Identifier	NONE					

Table 3 (continued)

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported Range	Test result
Biometric subtype header										
14	T. 3, 6.5.2	R-27	1	Biometric Subtype	EQ	0 to 2				
15	T. 3, 6.5.2	R-28	1	Number of Images	EQ	1 to 65535				
15.1	T. 3, 6.5.2	R-29	2	Number of Images	EQ	Number of Images Read	9			
Image header										
16	T. 4, 6.5.3	R-30	1	Image Number	EQ	1 to 65535				
16.1	T. 4, 6.5.3	R-31	2	Image Number	EQ	1 to {Number of Images}				
17	T. 4, 6.5.3	R-32	1	Quality	EQ	0 to 100, 253, 254, 255	10			
18	T. 4, 6.3.1.2, 6.5.3	R-33	1	Rotation Angle	NONE					
19	T. 4, 6.3.1.3	R-35	1	Rotation Uncertainty	NONE					
20	T. 4, 6.5.3	R-36	1	Image Length	EQ	1 to (2 ³² - 1)	11			
20.1	T. 4, 6.5.3	R-37	2	Image Length	EQ	Total Data Bytes Read				

Table 4 — ISO/IEC 19794-6:2005 Level 1 and Level 2 Conformance Test Assertions for Polar Subformat

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported values	Test result
Record header										
1	T. 2, 6.5.1	R-01	1	Format Identifier	EQ	0x49495200				
1.1	T. 2, 6.5.1	R-02	1	Format Identifier	NEQ	0x00524949	1			
2	T. 2, 6.5.1	R-03	1	Version	NONE		2			
2.1	T. 2, 6.5.1	R-04	1	Version	NONE		1, 2			
3	T. 2, 6.5.1	R-05	1	Record Length	EQ	70 to (2 ³² - 1)	3			
3.1	T. 2, 6.5.1	R-06	2	Record Length	EQ	Total Bytes Read				
3.2	T. 2, 6.5.1	R-07	2	Record Length	EQ	Total Bytes Expected	4			
4	T. 2, 6.5.1	R-08		Capture Device ID	NONE					
5	T. 2, 6.5.1	R-09	1	No. of Iris Biometric Subtypes	EQ	1 to 2				
5.1	T. 2, 6.5.1	R-10	2	No. of Iris Biometric Subtypes	EQ	Total No. of Iris Biometric Subtypes Read	5			

Table 4 (continued)

Test Number	References	Requirement ID	Level	Field name	Operator	Operand	Test Note	IUT Support	Supported values	Test result
6	T. 2, 6.5.1	R-11	1	Record Header Length	EQ	45				
7	T. 2, 6.5.1	R-12	1	Image Properties	EQ	0 to 458	6			
7.1	T. 2, 6.3.2.5, 6.5.1	R-13	1	Bits 1-2 Horizontal Orientation	EQ	0 to 2				
7.2	T. 2, 6.3.2.5, 6.5.1	R-14	1	Bits 3-4 Vertical Orientation	EQ	0 to 2				
7.4	T. 2, 6.3.2.4	R-16	1	Bit 7 Iris Occlusions	EQ	0 to 1				
7.5	T. 2, 6.3.2.4	R-17	1	Bit 8 Occlusion Filling	EQ	0 to 1				
7.6	T. 2, 6.3.2.2, 6.3.2.3	R-18	1	Bit 9 Boundary Extraction	EQ	0 to 1				
8	T. 2, 6.5.1	R-20	1	Image Format	EQ	2, 4, 6, 8, 10, 12, 14, 16	7			
8.1	T. 2, 6.2.2, 6.2.3, 6.2.4	R-21	2	Image Markers	EQ	See note	8			
9	T. 2, 6.5.1	R-22	1	Raw Image Width	NONE					
10	T. 2, 6.5.1	R-23	1	Raw Image Height	NONE					
11	T. 2, 6.5.1	R-24	1	Intensity Depth	NONE					
12	T. 2, 6.5.1	R-25	1	Image Transformation	EQ	0 to 1				
13	T. 2, 6.5.1	R-26		Device Unique Identifier	NONE					
Biometric subtype header										
14	T. 3, 6.5.2	R-27	1	Biometric Subtype	EQ	0 to 2				
15	T. 3, 6.5.2	R-28	1	Number of Images	EQ	1 to 65535				
15.1	T. 3, 6.5.2	R-29	2	Number of Images	EQ	Number of Images Read	9			
Image header										
16	T. 4, 6.5.3	R-30	1	Image Number	EQ	1 to 65535				
16.1	T. 4, 6.5.3	R-31	2	Image Number	EQ	1 to {Number of Images}				
17	T. 4, 6.5.3	R-32	1	Quality	EQ	0 to 100, 253, 254, 255	10			
18	T. 4, 6.5.3	R-34	1	Rotation Angle	EQ	65535				
19	T. 4, 6.3.1.3	R-35	1	Rotation Uncertainty	NONE					
20	T. 4, 6.5.3	R-36	1	Image Length	EQ	1 to (2 ³² - 1)	11			
20.1	T. 4, 6.5.3	R-37	2	Image Length	EQ	Total Data Bytes Read				

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) Test 1.1 and Test 2.1 checks 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 Test 1, 1.1, 2 and 2.1, it should be simple to determine whether or not the implementation under test is using the correct Big-endian encoding.
- 2) No {Version Number} defined in ISO/IEC 19794-6 standard. This should be noted in an erratum to the standard. Hence, no test will be performed until it defines. Test 2.1 (Big-endian) needs to be added when {Version Number} is available.
- 3) Raw monochrome image owns the least image data size.

Minimum Image data = Raw image Width x Raw image Height x (Intensity depth / 8) = 1 x 1 x 8 / 8 = 1 byte

Therefore, Minimum {Image Data} Block Length = 1 byte

Minimum {Record Length} = {Iris Record Header} Block + {Iris Biometric-subtype Header} Block

+ {Iris Image Header} Block + Minimum {Image Data} = 45 + 3 + 11 + 1 = 70

Maximum {Record Length} = $2^{32} - 1$ (record length has 4 bytes)

- 4) The {Total Bytes Expected} is calculated as follows. Note that 45 is the length of the record header, 3 the length of each subtype header header and 11 the length of each image header.

SUM = 45

For M = 1 TO {Number of Iris Biometric Subtypes}

SUM = SUM + 3

FOR N = 1 TO {Number of Images}

SUM = SUM + 11 + Image Length

END

END

{Total Bytes Expected} = SUM

- 5) This test ensures that {No. of Iris Biometric Subtypes} EQ {Subtypes Read}, where {Subtypes Read} is the number of iris biometric subtypes records read in the entire iris image interchange format record.
- 6) {Image Properties} is a bit mask of 2 bytes, with 9 possible bits. Valid values depend on whether the image is polar or rectilinear, but the largest possible value occurs with a polar image and is 111001010 or 0x1CA or 458. The following table describes the bit-field contents.

Table 5 — Iris Image Properties Bit-field

Field Description	Bits	Image Property	Bit-field Value
Horizontal Orientation	1-2	Orientation Undefined	0000 000x xxxx xx00
		Orientation Base	0000 000x xxxx xx01
		Orientation Flipped	0000 000x xxxx xx10
Vertical Orientation	3-4	Orientation Undefined	0000 000x xxxx 00xx
		Orientation Base	0000 000x xxxx 01xx
		Orientation Flipped	0000 000x xxxx 10xx
Scan Type (Rectilinear Only)	5-6	Scan Type Corrected	0000 000x xx00 xxxx
		Scan Type Progressive	0000 000x xx01 xxxx
		Scan Type Interlaced by Frame	0000 000x xx10 xxxx
		Scan Type Interlaced by Field	0000 000x xx11 xxxx
Iris Occlusions (Polar Only)	7	Occlusions Undefined	0000 000x x0xx xxxx
		Occlusions Processed	0000 000x x1xx xxxx
Occlusion Filling (Polar Only)	8	Occlusions Filled With Zero Value	0000 000x 0xxx xxxx
		Occlusions Filled with Maximum Value	0000 000x 1xxx xxxx
Boundary Extraction (Polar Only)	9	Iris Boundaries Undefined	0000 0000 xxxx xxxx
		Iris Boundaries Processed	0000 0001 xxxx xxxx

- 7) The primary assertion should be {Image Format} EQ {2, 4, 6, 8, 10, 12, 14, or 16}. The secondary assertions should be accompanied by notes explaining how to do that for the various image types. The following table describes codes for the allowed image formats in primary assertion.

Table 6 — Image Format

Image Format	Field Value
RAW format, Monochrome	0x0002
RAW format, RGB	0x0004
JPEG format, Monochrome	0x0006
JPEG format, RGB	0x0008
JPEG-LS format, Monochrome	0x000A
JPEG-LS format, RGB	0x000C
JPEG2000 format, Monochrome	0x000E
JPEG2000 format, RGB	0x0010

- 8) Because “RAW” images contain no header, there is no marker check on “RAW” images.

IF {Image Format} EQ 0x0006 OR

IF {Image Format} EQ 0x0008 OR

IF {Image Format} EQ 0x000A OR

IF {Image Format} EQ 0x000C THEN

Start of Image Marker = 0xFFD8 (JPEG)

IF {Image Format} EQ 0x000E OR

IF {Image Format} EQ 0x0010 THEN

Start of Image Marker = 0x0000 000C 6A50 2020 0D0A 870A (JPEG2000)

- 9) This test to ensure that {Number of Images} EQ {Images Read}, where {Images Read} is the number of iris images read associated with the current iris feature.

- 10) Values 253, 254, 255 are added.

253 = No Value Available

254 = Quality Not Supported

255 = Quality Not Recorded

- 11) Allowed Image length values in standard are 0 – 4294967295 (ISO/IEC 19794-6:2005, Table 4). In this assertion the allowed values are 1 – 4294967295 as proposed in the revision to ISO/IEC 19794-6:2005.

